Clinical and Economic Evaluation of Inpatient and Daypatient Care for Active Rheumatoid Arthritis

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Doctor of Medicine
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Declaration

I declare that this thesis has been composed by myself and that the research reported herein has been conducted by myself or under my direct supervision. I declare that the research and the composition of this thesis has been carried out while working as a member of staff in the Rheumatic Diseases Unit, University of Edinburgh. The contribution that others have made to this work is specified in the acknowledgements.


C Michael Lambert
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I wish to thank the various members of staff of the Rheumatic Diseases Unit, University of Edinburgh and others who have collaborated in this research and contributed in different ways to this thesis.

This research would not have been possible without the methodical and careful metrology and data management performed by Mrs Alison Lochhead and Mrs Mary Macleod.

My other co authors, Dr Nigel Hurst, Professor George Nuki, Rheumatic Diseases Unit, and Dr John Forbes, Department of Public Health Sciences, University of Edinburgh contributed to the original concept of the research and together with myself were co-applicants on the grant proposals.

Dr John Forbes has advised on the methodology for the economic analysis and performed the bootstrapping analysis.

Drs Robert Elton and Julie Ives have advised on statistical analysis.

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To my family
Abstract

Inpatient multidisciplinary care of patients with active rheumatoid arthritis has been shown to be clinically effective in a number of studies in both the UK and North America, but it is unfortunately expensive because of high fixed costs such as hospital overheads and ward running costs. Multidisciplinary care comprises several elements including bed rest, withdrawal from domestic pressures, medication, education and physical therapy, but the individual contribution of each element to the overall clinical benefit remains uncertain. Day care, by eliminating some of the high fixed costs and overheads yet preserving all of the clinical elements of inpatient care, may be a more efficient method of managing patients with active rheumatoid arthritis. The original work described in this thesis addresses this issue.

A pilot study of day-patient versus inpatient care was performed on twenty patients. This confirmed the acceptability of day-patient care and the practicality of the trial design. It also provided some preliminary economic data which suggested that day care may be substantially cheaper (40%) than conventional inpatient care.

The pilot study was not powered to address the question of whether clinical outcome of day-patient therapy was equivalent to inpatient care. A larger prospective randomised clinical and economic evaluation of 118 patients was therefore undertaken. The aim of this study was to test the hypothesis that the clinical outcome of inpatient and day-patient management of patients with uncomplicated active rheumatoid arthritis is equivalent and that there is no difference in the use of resources.

This study demonstrated that the day-patient and inpatient care are clinically equivalent for patients with active rheumatoid arthritis. The overall resource costs of day-patient care are slightly lower than those of inpatient care. Day-patient care is associated with lower hospital costs but higher transport costs. Clinical benefit from either form of management is short lived. The background to this work and the implications of the results are discussed.
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Introduction.

Rheumatoid arthritis is the most common chronic inflammatory joint disease and is a world-wide human affliction which may affect any race or ethnic group at any age and of either gender. Aside from the adverse physical and psychological effects borne by the individual patient, rheumatoid arthritis has far wider social and economic implications; for families and carers, for those funding and delivering healthcare and ultimately for society in general in terms of the cost of long term care and lost productivity. In purely financial terms, the impact of rheumatoid arthritis is enormous; the estimated total cost of rheumatoid arthritis in England in 1992 was £1256 million.

Rheumatoid arthritis remains an incurable disease and therapeutic goals continue to be centred on controlling disease activity, alleviating pain, maintaining function and optimising the quality of life. For patients with active rheumatoid arthritis, hospital based multidisciplinary team rehabilitation, which was developed in the 1960s, continues to be widely regarded as the optimal model for delivering care but it is also the most expensive due to high fixed costs and hospital overheads. Constraints on healthcare expenditure have led to, amongst other things, shrinking inpatient facilities with shorter duration of inpatient stay and contracting access to paramedical services. Alongside this there is now greater emphasis on providing community, rather than hospital based, care with a further shift in resources away from hospitals. As a result of these changes, confirmation that medical intervention is effective must now be supported with additional evidence that it is also economically efficient.
The Rheumatic Diseases Unit in the University of Edinburgh includes in patient and outpatient facilities alongside a professorial academic unit which, in the 1960s, was responsible for some of the early research on hospital based multidisciplinary care of rheumatoid arthritis. Partly because of this interest, and partly because until 1992 the Rheumatic Diseases Unit occupied a small specialist hospital with less pressure on inpatient facilities, today's unit retains a dedicated inpatient facility. Inpatient multidisciplinary care therefore remains a practical option for the management of active rheumatoid arthritis in our unit, whereas in many other rheumatology units access to inpatient facilities is restricted to emergency admissions.

An opportunity therefore existed to examine whether a novel day care programme, which retained all of the clinical aspects of in patient care but saved on the high fixed costs, was a more efficient strategy for managing active rheumatoid arthritis. The new work presented in this thesis addresses this issue. The work is set in historical and scientific context in the first two chapters. Chapter I describes the relevant clinical and economic aspects of rheumatoid arthritis while Chapter II discusses outcome assessment in rheumatoid arthritis and the broad principles of health economics. Chapter III describes a pilot study of the economic cost and clinical outcome of day patient versus inpatient care of active rheumatoid arthritis. This was performed to examine the feasibility of the protocol design and suitability of the selected outcome instruments. Chapter IV describes the methods, results and conclusions of the second, larger randomised controlled clinical and economic evaluation of day care versus in patient care for active rheumatoid arthritis. Finally,
Chapter V is a general discussion of the results and concludes with a summary and some suggestions for future research in this field.
CHAPTER 1
Clinical and economic aspects of rheumatoid arthritis

1.1 Historical review.
The name rheumatoid arthritis was coined by Alfred Baring Garrod (Garrod, 1859) to describe a number of conditions that we now recognise as distinct entities. These included non-inflammatory conditions such as polyarticular osteoarthritis. By the early twentieth century the use of the term had been narrowed to include only inflammatory polyarthritis and this was refined further in 1972 and 1988 by the exclusion of the seronegative polyarthritides (Arnet et al, 1988). Today, the term rheumatoid arthritis describes a systemic inflammatory disease with involvement of the locomotor system usually dominating the clinical picture. Although there are readily recognisable clinical and laboratory features, the heterogeneity of presentation, course and outcome raises the possibility that the term, as currently used, still includes more than one disease entity.

Although Sydenham had described a patient with chronic joint deformities which were compatible with rheumatoid arthritis in 1676, the first convincing description of rheumatoid arthritis appeared in 1800 when Landre-Beauvais described 'la goutte
asthenique primative’ (Snorrason 1952). This physician distinguished the polyarticular onset of rheumatoid arthritis from the better recognised monoarticular presentation of gout and he drew attention to the asthenia that accompanies systemic inflammatory disease. There is still controversy as to the origin of rheumatoid arthritis. Some consider it, along with syphilis, to be a relatively recent import from the New World (Rothschild and Woods, 1990) others, that its origins are much earlier as suggested by some paleopathological evidence (Leden et al, 1988).

1.2 Epidemiology of rheumatoid arthritis

1.2.1 Prevalence and incidence of rheumatoid arthritis.

Rheumatoid arthritis has been identified in all geographical areas, and in every racial and ethnic group that has been studied (Spector, 1990). Prevalence figures vary considerably between countries and races, and are reported to be as low as 0.3% in rural Chinese (Beasley et al, 1983) and as high as 5.3% in the Pima Indians of North America (Spector, 1990; Del Puente et al, 1989). In Europe a prevalence of 1% is frequently quoted in Caucasian adults (Spector, 1990). There has been only one community study of the prevalence of rheumatoid arthritis in Scotland (Steven, 1992). This showed a somewhat lower overall prevalence (0.4-0.5%) but a similar age and sex distribution to other studies.

In contrast to prevalence studies, there are relatively few studies examining the incidence of rheumatoid arthritis. A frequently quoted study reported an incidence of 2 to 4 per 10,000 per annum in Olmsted County, Minnesota between 1950 – 1974 (Linos et al, 1980). A prospective population based registration of all new cases of rheumatoid arthritis among 450,000 United Kingdom subjects, based on the 1987 American College
of Rheumatology criteria reported an incidence of 3.4 per 10,000 per annum for women and 1.4 for males (Symmons et al, 1994). These figures are consistent with the clinic-based estimates from the United States (Linos et al, 1980), but are much lower than data from other studies such as the OPCS surveys (HMSO, 1992), in which verification of diagnoses was unreliable. No studies have been undertaken of the incidence of rheumatoid arthritis in Scotland. There is some evidence to suggest that the incidence (Linos et al 1980; Silman, 1988) and severity (Silman et al, 1983) of rheumatoid arthritis may be declining, particularly in certain ethnic groups (Jacobsson et al, 1994). Other studies, however, suggest no significant change in the pattern of disease (Duthie et al, 1970).

1.2.2 Age and sex distribution of rheumatoid arthritis.
Rheumatoid arthritis is two to three times more common in females compared to males and this difference has been noted in all populations (Spector, 1990). The distribution of rheumatoid arthritis according to age is unimodal; the prevalence appears to increase with age in both sexes with peak onset in the fourth to the sixth decades.(Hochberg and Spector, 1990).

1.2.3 Morbidity and mortality in rheumatoid arthritis.
Perceptions of the impact of rheumatoid arthritis, both in terms of morbidity and mortality, have shifted dramatically in the last two decades. A favourable prognosis was often suggested for the majority of patients (McCarthy, 1985) but now the evidence points to a much poorer prognosis with progressive disease, severe functional decline, work disability and premature mortality (Pincus et al, 1984). It is now clear that the data on long-term outcome of rheumatoid arthritis from clinical trials is very dependent on
which patient group is studied (Scott and Long, 1996). Cases selected from the general population invariably do best. In general, 80% of cases first seen as hospital inpatients will be moderately or severely impaired after twenty years in contrast to about 20% of patients selected from the general population. The average outpatient with rheumatoid arthritis has an approximately 30% chance of becoming severely disabled (Scott and Long, 1996).

There are now many long term follow up studies of rheumatoid arthritis that highlight the poor functional outlook and excess mortality of rheumatoid arthritis (Scott et al 1987; Reilly et al, 1990; Prior et al, 1984; Vandenbroucke et al, 1984). In one prospective study of 112 patients with rheumatoid arthritis 35% were dead and 19% were severely disabled, despite intensive medical therapy when followed up at twenty years (Scott et al, 1987). In another long term follow up study of patients with rheumatoid arthritis there was an excess mortality of some 40% over a twenty five year period in both males and females (Reilly et al, 1990). Prior et al found a threefold increase in mortality (Prior et al, 1984), while Vandenbroucke et al showed median life expectancy was reduced by seven years in males and three years in females in a twenty five year follow up study (Vandenbroucke et al, 1984). Morbidity and mortality are also influenced by socio-economic factors; in North American studies educational status was found to be a predictor of prognosis (Pincus and Callahan, 1985).

When analysing the causes of death, most series have suggested that patients with rheumatoid arthritis die from similar causes to those in the general population, but at an earlier age. Most series have also demonstrated an increase in mortality from infection,
renal disease, particularly amyloidosis and from ischaemic heart disease compared with the general population (Spector and Scott, 1988). Similarly death rates from malignant disease are comparable with the exception of lymphoreticular malignancies, leukaemia and myeloma which may be partly related to the use of cytotoxic and immunosuppressive therapy (Isomaki et al, 1978).

1.3 Clinical aspects of rheumatoid arthritis.

1.3.1 Diagnostic criteria.

There is no single pathognomonic manifestation or diagnostic test for rheumatoid arthritis. Consequently there have been many attempts to delineate criteria that may be used in epidemiological and clinical research. The original American Rheumatism Association criteria of 1958 included clinical, serological, radiological and histological features and no fewer than twenty exclusions (Ropes et al, 1958). The main shortcomings of these criteria were their complexity and low specificity (O'Sullivan and Cathcart, 1972). This prompted modification in the form of the Rome (Kellgren, 1962) and New York criteria (Bennett and Burch, 1967). More recently the American College of Rheumatology (Arnett et al, 1988) has developed criteria to replace those of 1958 and these have been widely adopted. Based upon these criteria rheumatoid arthritis is diagnosed if at least four out of seven of the following are present -

- morning stiffness of at least one hour
- arthritis in at least three joint areas with swelling or fluid
- arthritis of hand joints
- symmetrical joint swelling and involvement
- subcutaneous nodules
- radiographic changes of rheumatoid arthritis
1.3.2 Clinical features of rheumatoid arthritis.

The onset of rheumatoid arthritis is typically slow and insidious but in a minority presentation is more acute and severe (Jacoby et al, 1973). Usually the presentation is insidious with joint pain, morning stiffness and swelling which is symmetrical and involves the small joints of the hands. Often non-specific constitutional symptoms such as weight loss, anorexia, fever and fatigue accompany the articular features. In the elderly prominent girdle symptoms may mimic polymyalgia rheumatica. A minority of patients present with recurring short lived episodes of arthritis which subside completely between attacks. This so-called 'palindromic rheumatism' may evolve into the typical polyarticular pattern in about one third of patients (Hench and Rosenberg, 1942; Schumacher, 1982). Occasionally presentation may be with extra-articular features such as nodules, vasculitis or pleuro-pericardial disease but more often these are complications of longer established rheumatoid arthritis.

The clinical course of rheumatoid arthritis is extremely diverse with regard to rate of progression and long-term outcome. There is some evidence that the mode of onset and pattern of presentation may influence subsequent progression and outcome of rheumatoid arthritis (Fleming et al, 1976). In one series of 102 adult patients with rheumatoid arthritis, the functional outcome of eleven patients with sudden onset compared favourably with sixty nine patients with slow onset of disease when assessed at five year follow up (Fleming et al, 1976). However, in a later series of 100 patients followed up for eleven years there was no significant difference in functional class according to pattern of onset (Jacoby et al, 1973). In a further study radiographic
evidence of joint damage after seven years was the same regardless of mode of onset (Luukkainen et al, 1983).

1.3.3 Management of rheumatoid arthritis.

The ultimate goal of treating rheumatoid arthritis is to induce a complete remission of disease. Complete remission has been carefully defined (Pinals et al, 1981) as the absence of -

- symptoms of inflammatory joint pain
- morning stiffness
- fatigue
- synovitis on joint examination
- progression of radiographic damage on sequential radiographs
- elevated erythrocyte sedimentation rate, or c reactive protein.

Unfortunately, even with optimal management, complete remission is rarely obtained and the emphasis then focuses on controlling disease activity, alleviating pain, maintaining function and maximising the quality of life (American College of Rheumatology, 1996).

There are many therapeutic modalities available for treating rheumatoid arthritis including education, rest, physiotherapy, occupational therapy, drug therapy and surgical intervention but not all are appropriate for all stages of the disease. For optimum management the most appropriate elements must be selected for each individual patient. In early disease, for example, the emphasis may be on suppressing
inflammation with anti-rheumatic drug therapy whereas in later disease, where mechanical problems may dominate, joint replacement surgery may be more appropriate. Over the years the approach to treatment has shifted. For instance, disease modifying drug therapy was originally reserved for patients with established disease who had already suffered significant disability. Today, there is more emphasis on intensive medical therapy for those with early disease in an attempt to prevent progressive joint damage and disability (Emery, 1994).

Despite changing emphasis the broad concept of multidisciplinary team rehabilitation has not altered since the early 1960s. Several studies have evaluated the benefits of rehabilitation programmes and demonstrated significant improvements in functional ability and employment status (Ahlmen et al 1988; Speigel et al 1986; Duthie et al 1964). In a nine year follow up study Duthie reported that severe restriction in functional capacity was present in 60% of 307 patients at baseline, but in only 40% at follow up at nine years (Duthie et al, 1964). The greatest improvement took place within two years of hospitalisation. At four years the percentage of patients able to perform light housework had risen from 6% to 68%.

1.4 Economic impact of rheumatoid arthritis.

This thesis focuses on rheumatoid arthritis, however, the broad principles of health economics and some of the limitations of this type of analysis, are widely applicable to other rheumatic diseases. Some of these have been highlighted in earlier reviews of the economics of arthritis (Nuki et al, 1972). There are now widely accepted standards for the methodology and reporting of economic evaluations (Drummond et al, 1996). The economic evaluations published in the field of
rheumatology and related disciples have been recently reviewed and have varied widely in terms of their adherence to accepted standards (Ferraz et al, 1997; Rothfuss et al, 1997; Ruof et al, 1999). As a result they have not had as much impact on shaping policy as they might and it is therefore particularly important that future studies conform closely to published quality guidelines (Ferraz et al, 1997; Ruof et al, 1999).

There are broadly two approaches taken to the economics of rheumatoid arthritis. Firstly, in cost of illness studies (Mcintosh, 1996) and total needs assessment (Donaldson and Farrar, 1991), an attempt is made to quantify the wider impact of rheumatoid arthritis on society. These studies demonstrate the considerable social and economic burden of rheumatoid arthritis but may be of less practical value for formulating policy since they take little account of the effectiveness, or otherwise, of medical intervention. Without such data, arguments for increased funding for medical intervention make little sense (Donaldson and Farrar, 1991). In the second approach the operational efficiency of specific interventions is examined using either a cost effectiveness or cost benefit framework (Robinson, 1993). Such evaluations have been undertaken of drug therapy (Thompson et al 1988; Thompson and Liang, 1990), surgery (Brooks, 1969; Jonsson and Larsson, 1991) and of various in-patient and day-patient treatment regimes for rheumatoid arthritis (Anderson et al, 1988; Helewa et al, 1989; Lambert et al, 1998). These studies allow comparisons between treatment regimes and the development of new management strategies.

1.4.1 Direct cost of rheumatoid arthritis.
Several studies have considered the economic impact of rheumatoid arthritis in Europe (McIntosh, 1996; van Jaarsveld et al, 1998) and North America (Lubeck et al, 1986; Meenan et al, 1978; Liang et al, 1984; Stone, 1984). A cost of illness study, using a prevalence based approach to identify cost has estimated the total economic impact of rheumatoid arthritis in England at £1.256 billion in 1992 (McIntosh, 1996). Direct costs amounted to £604.5 million (48% of total cost) of which the largest single component was the cost of providing hospital inpatient care (30% of direct cost). In a recent cross sectional study of 363 Dutch patients with rheumatoid arthritis of less than six years duration the annual direct cost due to arthritis was £3680 per patient (van Jaarsveld et al, 1998). These costs are comparable to those from North American studies (Lubeck et al, 1986; Meenan et al, 1978; Liang et al, 1984; Stone, 1984).

1.4.2 Indirect cost of rheumatoid arthritis.

It is worth stressing that most of the cost of rheumatoid arthritis to society arises through work disability and loss of production rather than the direct cost of medical or surgical intervention. Indirect costs account for at least 50% of total cost (McIntosh, 1996; Meenan et al, 1978; Liang et al, 1984; Stone, 1984). This reflects the high level of work disability in patients with rheumatoid arthritis which is often quoted to be as high as 50% of those of working age (Yelin et al, 1980; Reisine et al 1989; van Jaarsveld et al, 1998). Even those with a mean disease duration as short as 2.8 years have significantly reduced work capabilities with decreased employment rate and lower number of working hours compared with an age and sex matched population (van Jaarsveld et al, 1998).
1.4.3 Economic evaluation of drug treatment for rheumatoid arthritis.

In one recent study from the United Kingdom the cost of prescribing, monitoring and managing drug toxicity accounted for 15% of the total direct costs of rheumatoid arthritis and amounted to approximately £100 million (McIntosh, 1996). This was the third largest direct cost after hospital and long term community care costs (£170m and £130m respectively). Importantly, in this study and others the cost of prescribing accounted for only a third of the total, while monitoring and treating toxicity accounted for the balance. Measurement of the overall costs and benefits of medication in an integrated clinical and economic analysis is becoming a requirement by government licensing authorities in some countries (Henry, 1992) and is therefore increasingly included in comparative drug trials (Editorial, 1991; Evans, 1992). Combining economic data with data on comparative clinical efficacy and benefit, should contribute to the development of more rational prescribing, and should reduce the tendency to focus only on the prescription cost of medication.

While numerous trials have demonstrated the short and medium term efficacy of drug therapy on the process and outcome of rheumatoid arthritis, much less attention has been paid to the economic costs and benefits or to the global or overall health benefit of therapy. The only prospective randomised controlled trial of disease modifying anti-rheumatic drug therapy in which an economic evaluation was included was a six month study comparing oral gold with placebo (Thompson et al, 1988). Although this trial failed to reach a definitive economic conclusion it is none the less important and demonstrates some of the difficulties of combining economic and clinical evaluation.
Patients receiving oral gold showed a net improvement equivalent to all patients improving from being able to walk outdoors on level ground with much difficulty to being able to walk on level ground with some difficulty. Alternatively, the additional benefit of oral gold over placebo may be expressed as equivalent to the improvement in moving ones own wheelchair without help to walking with physical limitations. The total additional medical cost per patient receiving oral gold for 6 months was $1,160 per annum which includes: oral gold ($405), in-patient treatment ($406), out-patient visits ($153), laboratory tests ($226). Making the economic costs and health benefits explicit allowed one to ask whether the observed improvement in health was worth $1,160 per patient (Thompson et al, 1988).

No prospective trial in rheumatoid arthritis has demonstrated enhanced earnings as a result of disease modifying anti-rheumatic drug therapy (Thompson et al, 1988; Thompson and Liang, 1990; Yelin et al, 1980). Data from the oral gold trial suggested that the decline in earned income which accompanies progression of rheumatoid arthritis may be attenuated by disease modifying anti-rheumatic drug therapy but the income advantage in the group receiving oral gold was not statistically significant (Thompson et al, 1988). The clinical benefit of disease modifying anti-rheumatic drug therapy is usually only apparent after some months so prolonged trials of more than six months duration would be required to establish an effect of treatment on earnings.

1.4.4 Economic evaluation of surgery in rheumatoid arthritis.
Despite the high cost of surgery, which in one study amounted to 69% of the direct costs of treating rheumatoid arthritis (Wolfe, 1986), there is good evidence that surgical intervention in rheumatoid arthritis can be extremely cost beneficial (Brooks, 1969; Jonsson and Larsson, 1991; Patilala et al, 1976).

In one cost benefit analysis of a rheumatology service the indirect costs and benefits of surgical synovectomy of the knee were studied in 366 patients of whom the majority had rheumatoid arthritis (Brooks, 1969). This study demonstrated that surgical synovectomy provided net economic benefit even though it was only used on 19% of the patients and only the indirect benefits arising from return to employment were included in the calculation. It was shown that, even under the most pessimistic assumptions used to calculate the benefit, the indirect benefit arising from those able to return to work following surgery offset the cost of treating all 366 patients in the study.

A Swedish study of 54 patients with rheumatoid arthritis undergoing hip or knee arthroplasties also demonstrated net economic benefit as well as the expected health benefits in terms of improved locomotor function (Jonsson and Larsson, 1991). Although only four patients (7.4%) returned to employment the annual gain to society from these four patients was equal to the total costs of 12 hip or 7-8 knee replacements. To this could be added a substantial annual saving attributable to reduced need for social support as a result of improvement in locomotor function. In terms of work disability the economic benefit of hip replacement is rather less for patients with rheumatoid arthritis than with other forms of hip disease because of locomotor comorbidity (Nevitt et al, 1984). These data may therefore underestimate
the benefit accruing from arthroplasty for patients with single or limited joint pathology.

1.4.5 Economic evaluation of strategies for managing active rheumatoid arthritis.

Several studies have demonstrated that in-patient care accounts for most of the direct medical cost of treating patients with rheumatoid arthritis. In North America, while only 6.5% of a sample of 24,000 patients with rheumatoid arthritis were hospitalised and only 4.9% received nursing home care annually, these services accounted for 70% of rheumatoid arthritis-related expenditure (US$19.26 million) (Jacobs, 1988).

In a recent Dutch study of 363 patients with rheumatoid arthritis of less than six years duration 13% were admitted to hospital, rehabilitation centre or nursing home in the last twelve months of the study (van Jaarsveld et al, 1998). The average cost per inpatient was £5950 and this accounted for £310 (22%) of the overall cost per patient of £3680 per annum.

In the United Kingdom two studies demonstrated that 56% (£451k) and 70% (£290k) respectively of the total annual expenditure on hospital based rheumatology care was attributable to in-patient care (Bedi et al, 1987; Thould, 1985). In these rheumatology units, patients with rheumatoid arthritis accounted for 85% (Bedi et al, 1987) and 49% (Thould, 1985) of bed occupancy. Furthermore between 50% and 80% percent of in-patient costs are attributable to fixed costs over which clinicians have little or no control (Thould, 1985; Griffiths, 1992). Since
hospital medical admissions for rheumatoid arthritis are mainly for the treatment of active disease, and to a lesser extent for the management of systemic and neurological complications, the evidence for the effectiveness and economic efficiency of hospital based treatment of active rheumatoid arthritis warrants examination.

The rising cost of health care, limited budgets and tighter financial control have resulted in major changes in the delivery of medical care over the last couple of decades. Specialist rheumatology practice is also changing (Scott and Long, 1996). The Spa hospitals with large inpatient rheumatology units have long gone and hospital services are now largely outpatient based. There is considerable political pressure for shorter waiting times for new referrals and the place of long-term hospital follow up is increasingly questioned (Scott and Long, 1996). With bed numbers contracting in the acute sector and pressure mounting to reduce the length of hospital stay, a number of specialities have implemented day care as one way of improving the efficiency of hospital based care (Twaddle and Harper, 1992; Creed et al, 1997).

The obvious cost advantage of day care is the saving on so called "hotel" and night-time salary costs. In theory, planned day-care may allow patients to follow a prescribed programme of medication and exercises at home and, by shortening hospital based activity, it may either improve the rate of patient throughput or reduce bed occupancy. It is unclear, however, to what extent day care preserves the clinical benefits of traditional inpatient care for patients in specialities such as
rheumatology which aim to deliver holistic multidisciplinary care as opposed to 'procedure based' surgical or medical specialties.

As the economic and clinical benefits of day-patient care for rheumatoid arthritis remained uncertain a randomised trial was designed to compare the clinical and resource consequences of day-patient care with standard inpatient management for active rheumatoid arthritis (Lambert et al, 1998). The aim of the study was to test the null hypothesis that there would be no significant clinical or economic difference between the strategies. In order to examine the feasibility of undertaking such a study and in order to obtain some preliminary data on clinical outcome and distribution of costs a pilot study was undertaken of twenty patients who were randomised to receive either day-patient or inpatient care (Lambert et al, 1994).
CHAPTER II

Background to methodology

2.1 Selection of instruments for measuring outcome in clinical trials of rheumatoid arthritis

2.1.1 Introduction.

Economic evaluation requires the assessment of both clinical outcome and economic cost; it is therefore relevant to discuss the range of instruments available for measuring outcome and the process of selecting the most appropriate instruments for this work. The principles of economic evaluation are also reviewed in so far as they are relevant to this thesis.

Before Donabedian (Donabedian, 1966) suggested in the mid 1960s that the quality of medical care should be assessed by measuring separately its structure, process and outcome, rheumatologists had already begun to develop instruments such as painful joint scores (Lansbury, 1957) and functional categories (Steinbrocker et al, 1949) that were used in early clinical trials. Among more recent achievements in clinical rheumatology the development of instruments that are more suitable for recording outcome in routine clinical practice (Symmons, 1995) and the recent consensus about which of these should be systematically
incorporated into clinical trials of rheumatoid arthritis (Anderson et al, 1989; Feltson et al 1993) stand out.

Instruments used to measure clinical outcome can be broadly divided into two groups according to which facet of outcome they describe. Firstly, there are so called 'disease' or 'condition' specific instruments that are useful in measuring those aspects most closely related to the disease process (Lambert and Hurst, 1995). Examples include the Ritchie articular index in rheumatoid arthritis or peak flow rate in asthma. Whilst these instruments may allow some comparison of the outcome of treatment of similar diseases their application is limited as they do not permit wider comparisons between different specialties or other healthcare or social welfare programmes. Secondly, there are those termed 'generic' or 'global' instruments that measure overall health status or 'health related quality of life' and which may be used to make these wider comparisons (Lambert and Hurst 1995).

2.1.2 Joint indices.

It is generally accepted that joint involvement in rheumatoid arthritis is an important variable for evaluation in routine clinical practice as well as in clinical trials (Egger et al, 1985; Prevoo et al, 1993). Assessment of joint involvement has the advantage over laboratory or radiographic information in that it gives an indication of joint synovitis and therefore of disease activity which is immediately and rapidly quantifiable (Prevoo et al, 1993). A number of studies have analysed how best to measure joint involvement, resulting in many different types of joint indices. These differ according to the number of joints assessed, whether
tenderness alone or swelling and tenderness are measured and whether the result equates to the number of abnormal joints (joint counts) or whether swelling or tenderness at each joint are graded (joint scores). Joint counts tend to be more reproducible than joint scores (Symmons, 1995) but at present no consensus exists on an optimal joint index (Prevo et al, 1993).

Several early joint indices combined measures of joint tenderness and swelling together with an assessment of functional disability and as a result were too cumbersome for clinical use. The first joint index to be widely accepted, the Ritchie articular index (Ritchie et al, 1968), graded joint tenderness (0-non tender, to 3- wince and withdrawal) at 50 sites according to the response to firm pressure over the joint margin or passive movement where pressure was not feasible e.g. the cervical spine. The Ritchie index takes about two minutes to perform and has good intra-observer test / retest reproducibility. The inter-observer error is, however, high (Ritchie et al 1968; Thompson et al, 1987). The instrument has been demonstrated to be sensitive to change produced by anti-inflammatory therapy (Ritchie et al, 1968).

Other joint indices have been developed which assess joint swelling and tenderness at a reduced number of sites. The rationale for restricting the assessment to as few as 28 sites (Fuchs et al, 1989) is that some of the joints included in more comprehensive counts are not frequently involved in rheumatoid arthritis (eg the acromioclavicular and the temporomandibular joints), or are difficult to assess for the presence of swelling (eg the hip or glenohumeral joint). There are good data to suggest that including fewer joints
does not sacrifice sensitivity (Fuchs and Pincus, 1994) and shorter joint indices are now recommended (American College of Rheumatology, 1994).

Joint indices measure an endpoint that is clearly relevant to the management of rheumatoid arthritis and since the Ritchie index remains widely used it was selected for this study.

2.1.3 Functional outcome.

One of the principle objectives of intervention for rheumatoid arthritis is to prevent or reduce disability. For this reason an appropriate instrument to record functional capacity is now considered an essential component of a core data set for clinical trials in rheumatoid arthritis (American College of Rheumatology, 1993). Furthermore, functional capacity has been demonstrated to be one of the most reliable predictors of longterm outcome of rheumatoid arthritis, including mortality, decreased earning capacity and increased utilisation of health care services (Wolfe, 1988).

Early attempts to evaluate disability were pursued in a non-standardised format, which made comparison between studies impossible. One of the earliest attempts to group patients with rheumatoid arthritis according to functional capacity was the American Rheumatism Association functional class which comprised four broad categories of functional status (Steinbrocker et al, 1949). The Steinbrocker functional class is still used in its revised form to define broad bands of disability and to follow cohorts of patients in long term follow up studies.
(Symmons, 1995). However, it is too insensitive to detect smaller changes in
disability which are nevertheless clinically important.

Recently several standardised questionnaires have been developed to assess
functional capacity in patients with rheumatoid arthritis which are based on the
patients' ability to perform various activities of daily living (Hamilton et al, 1987;
Fries et al, 1980; Meenan et al, 1980).

Instruments, such as the Functional Independence Measure (Hamilton et al
1987) require a trained observer to score a standardised questionnaire
according to the level of assistance required to complete specific activities of
daily living. This instrument proved time consuming to complete and score in the
pilot study and was therefore omitted from the main study.

There are two self-reported instruments widely used to record functional status
in clinical trials of rheumatoid arthritis, the Health Assessment Questionnaire
(Fries et al, 1980) and Arthritis Impact Measurement Scale (Meenan et al,
1980).

In the original Stanford Health Assessment Questionnaire (Fries et al 1980)
patients had to rate their ability to perform twenty activities of daily living which
were grouped into eight categories. Subsequently the instrument has been
modified to include only one activity from each category and this retained most
of the information derived from the longer questionnaire (Pincus, 1983). The
eight items relate to different aspects of activities of daily living such as,
dressing and grooming, walking and hygiene and are scored by the patient according to the level of difficulty. Scores are then adjusted to take account of any assistance or aids that the patient might have and finally summed to produce a "disability index" between 3 (unable to do) to 0 (without any difficulty).

A modified Health Assessment Questionnaire which is short, simple to complete and rapidly scored has been adapted to assess disability in British patients with rheumatoid arthritis (Kirwan et al, 1986). The instrument has been included in many cross sectional studies (Deighton et al, 1992) and longitudinal trials comparing different types of intervention for rheumatoid arthritis including surgery (Liang, 1985), medication (Thompson et al, 1988) and multidisciplinary care (Anderson et al, 1988; Helewka et al, 1989; Vliet Vlieland et al, 1996; Lambert et al, 1998). The Health Assessment Questionnaire is valuable in assessing short-term response to treatment (Symmons, 1995), and as a predictor of future disability and premature death (Pincus and Callahan, 1992). For patients with greater levels of disability there is evidence that the Health Assessment Questionnaire suffers from a boundary or 'ceiling effect' and it is relatively insensitive to further deterioration in those already moderately to severely disabled (Gardiner et al, 1993). For this reason the Health Assessment Questionnaire should be used with caution in longitudinal studies with long term follow up (Gardiner et al, 1993). Over the time scale of the current research these shortcomings were not relevant and the modified Stanford Health Assessment Questionnaire was selected for both pilot and main studies. Whilst the Arthritis Impact Measurement Scale would have been equally suitable it felt that the modified Stanford Health Assessment Questionnaire was more widely
used in British studies. In a previous unpublished pilot study undertaken in this unit we have also found the modified Stanford Health Assessment Questionnaire simpler to administer than the Arthritis Impact Measurement Scale.

2.1.4 Psychological outcome.

The prevalence of psychiatric disorder in medical clinics is high and is probably due to the interplay of multiple factors (Maguire et al, 1974; Moffic and Paykel, 1975). It is important to recognise the coexistence of somatic and psychological factors and to address the medical, emotional and social facets of rheumatoid arthritis in parallel (Jette, 1982).

In common with patients who have other chronic diseases raised levels of depression and anxiety have frequently been found in patients with rheumatoid arthritis (Newman et al, 1989; Anderson et al, 1985; Frank et al, 1988). Several early studies considered the origins and interrelationship between mood disorders and rheumatoid arthritis but the results have often been conflicting and the methodology flawed. For example, studies frequently overlooked the extent to which specific aspects of the disease, such as pain and stiffness, response to functional loss, social isolation or economic deprivation, may have contributed to psychological morbidity (Oberai and Kirwan, 1988). The development of validated instruments for measuring emotional status and the recognition that socio-economic factors are important considerations alongside the more obvious clinical variables have improved the scientific rigour of more recent studies (Newman et al, 1989; Creed, 1990; Hawley and Wolfe, 1988;
Frank et al, 1988). From these studies it now seems clear that the development of depression is closely associated with socio-economic factors (Hawley and Wolfe, 1988) and that disease activity itself appears to have limited impact on psychological status (Hawley and Wolfe, 1988; Newman et al 1989). Although no firm conclusions regarding the aetiology of emotional illness arise from these studies it seems clear that disease related variables have a complex interaction alongside socio-economic and demographic influences and that emotional status is an important outcome to assess in clinical trials of rheumatoid arthritis.

Careful consideration should be given to the choice of instrument used to assess psychological morbidity in patients with arthritis if spurious conclusions are to be avoided (Oberai and Kirwan, 1998; Pincus et al, 1986). Studies using the Minnesota Multiphasic Personality Inventory to assess patients with rheumatoid arthritis have reported raised levels of depression, hysteria and hypochondriasis (Moos and Solomon, 1964; Liang et al, 1984). Pincus et al examined the characteristics of this instrument in relation to rheumatoid arthritis and concluded that elevated scores were an artefact and reflected specific responses to three somatic items on the scale that were directly related to the disease, for example 'I do not tire easily', rather than psychological status. This has raised doubts about the use of this scale for arthritis and highlighted the need for an instrument to reliably assess psychological morbidity in patients with somatic complaints due to medical illness (Oberai and Kirwan, 1988).

The General Health Questionnaire (Goldberg, 1979) has been widely used as a screening instrument to detect psychiatric disorder in patient and community
samples. However, although it reliably detects emotional distress it does not distinguish between anxiety and depression (Zigmond and Snaith, 1983) and in addition it is fairly lengthy to administer. The Hospital Anxiety and Depression Scale (Zigmond and Snaith, 1983) was developed specifically as a screening instrument for the detection of clinically significant anxiety and depression in patients attending general medical clinics. The instrument consists of two component scales one for anxiety and one for depression with seven items on each scale. Care was taken in designing the instrument to avoid items such as tiredness or headache that might be features of either physical or psychological disease as this problem had confounded previous instruments. Nevertheless the depression sub scale retains somatic items, for example 'I feel slowed down' which may make interpretation of responses difficult in physically disabled patients.

The Hospital Anxiety and Depression Scale is used in clinical and research settings in rheumatology. The Hospital Anxiety and Depression Scale correlates closely with the anxiety and depression components of the Arthritis Impact Measurement Scale (Hill et al, 1990) and also with two generic health status instruments (Hurst et al, 1998; Hurst et al, 1994). It has the advantage of being short, easy to administer and is able to distinguish between anxiety and depression; furthermore the individual scales have been shown to be valid measures of the severity of mood disorder and for these reasons the scale was selected for use in these studies.
Generic health status instruments.

Measurement of health status is particularly relevant when considering a chronic disease such as rheumatoid arthritis whose major impact is on the quality rather than length of life. Furthermore, the ultimate therapeutic goal is to improve overall health rather than only specific facets of it, and therefore it is important to have instruments that are sensitive to overall change in wellbeing. The holistic definition of health, as defined by the World Health Organisation as a state of complete physical, mental and social wellbeing, has lent greater relevance to generic health status instruments as indicators of health outcome (WHO, 1958).

Generic health status instruments are designed to capture information on the overall health related quality of life and measure the net outcome of medical intervention, that is the health gain minus any losses related to side effects of treatment (Lambert and Hurst, 1995). Health status instruments have been shown to be better than conventional rheumatological measures as predictors of long term outcome in rheumatoid arthritis in terms of both morbidity and mortality (Wolfe and Cathey, 1991). There is good evidence to suggest that the responsiveness to clinically significant changes in health over time for generic instruments is similar to that of disease specific instruments (Hurst et al, 1997). There are therefore good reasons for including health status instruments in clinical trials of therapy for rheumatoid arthritis.

Generic instruments that measure health-related quality of life fall into two categories: health status profiles and health utility measurements (Guyatt et al,
Health status profiles such as the MOS Short Form 36 (Ware and Sherbourne, 1992), the Nottingham Health Profile (Hunt et al, 1981) and the Sickness Impact Profile (Bergner et al, 1981) are based on psychometric methods and require the respondent to indicate the presence, frequency and intensity of symptoms, behaviours and feelings. These are used to generate a profile of health status, with separate scores for each of several domains; e.g. physical function, mental health, social or work role functioning. Utility measures, on the other hand, are based on economic theory and create a single utility or 'index' of health; examples include the Quality of Well Being Index (Kaplan et al, 1976) and the Euroqol (Euroqolgroup, 1990).

2.1.5.1 The Quality of Wellbeing Index.

The Quality of Wellbeing Index (Kaplan et al, 1976) requires patients to complete a questionnaire on their performance within three dimensions: mobility, physical and social activity. Each dimension has several levels of performance giving 43 possible combinations each describing a unique health state. Each health state together with symptoms and problems on a standard list have been valued by the general population by means of a ordinal rating from 0, indicating dead, to 1, indicating perfect health. The ratings are used to assign a 'preference weight' (ie value) to each health state described by the scale into which the patient is classified. The preference weights of patients with moderate to severe rheumatoid arthritis have been determined and are similar to those derived from a general population (Balaban, 1986). Thus, having a chronic medical condition does not alter the valuations applied to the scale.
The Quality of Wellbeing Index has been evaluated as an generic outcome measure in patients with acquired immune deficiency syndrome, cystic fibrosis, arthritis (Kaplan et al, 1989) and chronic obstructive pulmonary disease (Kaplan et al, 1984) and found to be valid, reliable and sensitive to clinical change in these conditions. However, in comparison with a disease specific instrument, the Arthritis Impact Measurement Scale, the Quality of Wellbeing Index was found to be considerably less sensitive to improvements in pain and function in patients with arthritis (Liang 1985).

A further study has compared outcome over six months for patients receiving oral gold or placebo using the Health Assessment Questionnaire as a condition specific instrument and the Quality of Wellbeing Index as a generic outcome measure (Thompson et al, 1988). Despite concern when the trial was planned about the possible insensitivity of the generic instrument to changes in rheumatoid arthritis patients, the Quality of Wellbeing Index proved highly sensitive to treatment effect. At baseline the oral gold and placebo had similar indices of 0.599 and 0.600 respectively, on a scale of 0 (death) to 1.000 (full health). At six months the oral gold group had improved by 0.023 and the placebo group had deteriorated slightly by -0.001. This difference in treatment effect of 0.024 was approximately equivalent to the patient receiving oral gold treatment improving from a state where they require help to use a wheelchair to being able to walk with some physical limitation (Paterson, 1988). Alternatively, a difference of 0.024 translates into 2.4 well years for each 100 patients who maintain such an improvement for one year (Kaplan et al, 1989).
2.1.5.2 Standard gamble and time trade off

**Standard gamble.** The standard gamble technique is the original method of determining utility values and is based directly on utility theory (Von Neumann and Morgenstern, 1944). The method consists of paired comparison in which the patient must chose between two alternatives. Alternative 1 is a choice with two outcomes: a good outcome i.e. living in perfect health, with probability $P$; or a bad outcome, dying, with probability $1-P$. Alternative 2 has one outcome intermediate between death and perfect health and this represents the patients' current health state. The probability, $P$ is then varied until the patient is indifferent between the alternatives, at which point the utility for the health state of the patient has been determined. The assumption underlying the standard gamble approach is that patients with better health accept less risk in order to improve than those with poorer health (Torrance, 1987). Standard gamble techniques have been used to study the risk of sudden death that patients with rheumatoid arthritis would accept in order to achieve a hypothetical cure (Thompson, 1986). Ninety-eight percent of subjects estimated the maximum acceptable risk of immediate death at an average of 27% chance. The most highly correlated clinical variable with the risk of death was the pain score.

Since rheumatic diseases cause chronic morbidity and disability rather than a high mortality it has been suggested that direct confrontation with the risk of dying, as described above may be inappropriate and the results from such studies possibly misleading (Bakker et al, 1993). Various modifications to the basic technique have therefore been devised to take account of this potential problem (Drummond et al, 1987).
**Time trade off.** Time trade off is a method of deriving a utility value based on patient's response to decision situations which, unlike the standard gamble method, do not involve taking risks. (Bakker et al, 1993). In the time trade off method the patient must chose between two alternatives; alternative 1 is to maintain the patients' health state for the rest of their life (time t), while the alternative is a shorter time (time x) in perfect health. Time x is varied until the patient is indifferent to the alternatives, at which point the value for the patients' health state is x/t. The underlying assumption in the time trade off method is that the less desirable the patients health state, the larger the amount of lifetime the patient will trade off in order to be enjoy perfect health (Torrance, 1987). For the purposes of this study patients were asked how many years of perfect health they would regard as being equivalent to ten years in their current health state.

**2.1.5.3 Health profile versus utility measure.**

A health profile identifies change in distinct domains, for instance physical function, psychological status or social role and it is likely to be clinically relevant to identify which facets of overall health-related quality of life have changed as a result of intervention. On the other hand, a utility value, being a single score from 0 (representing death) to 1 (representing perfect health), does not indicate which areas of health have changed. Utility-based health indices do however provide societal valuations (health preferences) for different health states. This single value for health outcome can be incorporated in a cost utility evaluation
and so permit comparisons to be drawn between widely different health and social welfare programmes.

When incorporated into clinical trials utility measures summarise both the positive and negative effects of an intervention on a single scale and this 'net' change in health related quality of life may be a relevant outcome measure. Besides interventions primarily directed at improving the quality of life, a number of healthcare interventions do affect both the quality and quantity of life. To allow the comparison of effectiveness between these various interventions the 'quality adjusted life year' or QALY has been introduced (Weinstein and Stasson, 1977). The QALY is a single comprehensive outcome measure that includes effects in terms of quality and survival. The QALY value is obtained by multiplying the utility index by the remaining years survived.

Health status scales and health utility/preference scales measure different, although related, aspects of health related quality of life and the two approaches result in different yet related and complementary assessments of health outcome. Similarly the different methods for measuring health-related utility are not interchangeable because they are based on different assumptions and do not all include a risk component (Bakker et al, 1993). Indeed widely different values may be derived using the different methods of eliciting patient well being. This, of course, will directly affect the cost utility analysis and it is therefore important to stipulate the method used to derive a utility value when reporting a trial. On the available evidence it is not possible to suggest which utility
measurement is superior. Further research is required that focuses on aspects such as validity and sensitivity to clinically important changes in health.

A concern common to both forms of generic instrument pertains to their responsiveness in comparison to disease specific instruments. This concern seems to be based more on prejudice than evidence as data that are available suggest that healthy profiles and indices are at least if not more responsive than traditional disease specific measures (Hurst, 1997).
2.2 Principles of economic evaluation

2.2.1 Introduction.

Economics has been defined by Samuelson as ‘the study of how men and society end up choosing, with or without the use of money, to employ scarce productive resources that could have alternative uses…….’. It analyses the costs and benefits of improving patterns of resource allocation’ (Samuelson, 1976). In order to address these issues economists have developed a number of techniques which may be broadly described as forms of ‘economic analysis’ or ‘economic evaluation’ (Drummond et al, 1987). Although an economic evaluation may take different forms these share a common purpose, that is to assist decision making when choices have to be made between several courses of action.

We are not always conscious of it, but in fact we are making decisions in our everyday lives in much the same way as in an economic analysis. Few of us can afford everything that we like. For example, we may have to decide whether to buy a car or to build an extension or we might choose to postpone the family holiday in order to use the money to redecorate the house. Implicit in these mundane decisions are several fundamental economic concepts. Firstly the fact that resources are scarce and that when we are faced with a number of options we have to weigh up their individual benefits. Secondly by choosing to spend money on one project we accept that we must forgo the benefit that would have arisen from spending it on an alternative. In economic jargon, resource consumption carries an ‘opportunity cost’, which may be defined as the next best opportunity forgone. Finally, because resources are scarce we must prioritise; for example which do I need most today, eggs or bread? The purpose of prioritisation is to
ensure that maximum benefit is obtained from a given budget (Drummond et al 1987; Mooney 1992; Hurst and Lambert 1995).

It is hardly surprising that with the rising cost of healthcare and advances in technology constantly outstripping our ability or willingness to finance them that issues of scarcity, choice, opportunity cost and prioritisation in health care already occupy centre stage both at a political and hospital level. Over twenty years ago Sir Richard Doll commented that 'the NHS should be evaluated on medical outcome, economic efficiency and social acceptability' (Doll, 1973). Today it is more important than ever to ensure that our treatments are effective (produce the desired health outcome) and efficient (produce the desired outcome for least expenditure) (Drummond et al 1987; Mooney 1992).

Economic efficiency implies that the choice of medical treatment produces maximum benefit from the available resources. In practice this involves weighing up the relative benefits and costs of alternative treatments and giving priority to those producing the greatest net benefit (benefit minus cost).

Health economic evaluation comprises the systematic appraisal of the costs, the benefits and the relative economic efficiency of different medical interventions. Economic evaluation and assessment of health outcomes should not be divorced from one another; indeed they measure different facets of the same problem, namely how to deploy health resources to best effect (Drummond et al 1987; Mooney 1992).
Whilst the costs of a health programme are readily measured in monetary terms, the benefits may be measured in terms of monetary gain, health gain or both. Assessment of health gain, which is both difficult and controversial, may be achieved using either condition specific or generic instruments. Monetary gains arising from a health intervention, such as improved productivity or a reduced dependence on services, must also be quantified (Drummond et al, 1987).

2.2.2 Techniques of economic evaluation.

Economic evaluation is a generic term for a range of techniques that may be used to assemble data on the costs and consequences of different procedures or programmes. Four main approaches are currently used and will be considered further below:

- Cost minimisation analysis
- Cost effectiveness analysis
- Cost benefit analysis
- Cost utility analysis

Each approach involves the systematic identification, measurement and, where appropriate, valuation of all relevant costs and consequences. The approach to measuring costs or inputs has been fairly well standardised and the techniques differ in their approach to measuring the consequences or outputs of intervention.

2.2.2.1 Cost analysis.
The analysis of cost forms the basis of all types of economic evaluation. It is important at the outset to determine from whose perspective the economic evaluation is to be undertaken as this will have a direct bearing on which costs (and consequences) require to be included in the analysis. For example, in one study it may be appropriate to adopt the perspective of an individual patient and ignore costs falling to service providers, government agencies or society in general. However, it is usually more appropriate to adopt the widest perspective possible and to consider the broad societal viewpoint. The advantage of adopting this approach is that all costs and benefits are included no matter to whom they accrue. One difficulty that ensues, if this approach is adopted, is the tricky task of measuring and valuing items that do not have readily obvious market values attached to them, for instance the cost of time taken to undergo treatment or the loss of enjoyment resulting from treatment side effects.

Three main categories of cost can be identified:

**Direct costs.** Direct costs are those that are an immediate consequence of the treatment and includes all health service costs. Direct costs are sometimes divided into variable costs, which vary according to the level of activity (for example medication and catering), and fixed costs which are incurred whatever the level of activity (for example capital charge and heating). In practice, this distinction can become blurred as in the long run practically all costs become variable, for example capital charge and heating costs will rise if new ward accommodation is opened. It is also important to distinguish between average and marginal cost. Average cost may be defined as the total cost (ie fixed costs plus the variable costs) divided by
the total number of patients treated. Marginal cost is simply the additional cost incurred by treating one extra patient within an existing programme. If though, a facility is operating to full capacity, treating extra patients would require new facilities or resources and would be costly. Since most decisions in health care are concerned with whether a little more or a little less of the service should be provided, rather than whether a service should be provided marginal cost is usually the more appropriate consideration. For similar reasons, marginal analysis, in which the focus is on marginal cost and marginal benefit, is often more appropriate than analysis of "total" cost and benefit. Since in practice it is small shifts of resources that are usually the issue rather than all or nothing decisions about service provision, marginal analysis offers a practical alternative to needs assessment as a basis for allocating resources. Marginal analysis provides a framework by which the effects on health outcome of small changes in the pattern of resource allocation "at the margins" of different programmes can be measured. Resources may then be redeployed to interventions for which the benefits are high in relation to their cost with the result that economic efficiency is improved.

**Indirect costs.** Indirect costs are those costs that are attributable to production losses. Indirect costs are usually calculated using the human capital approach that uses earnings lost due to morbidity or mortality to value production losses. There is considerable debate about the pros and cons of including production losses and gains in an economic analysis and as yet no consensus has been reached.

**Intangible costs.** Intangible costs are those not readily measured but which are nevertheless important. They include factors such as convenience, loss of
enjoyment, increasing dependence on relatives and friends, social isolation and loss of self-esteem.

2.2.2.2 Cost minimisation analysis.

This form of economic analysis is appropriate when there is good evidence that the clinical outcomes of the programmes under consideration are similar (Robinson, 1993; Drummond, 1987). The analysis therefore focuses on costs rather than clinical outcome and seeks to identify the least cost option. There is an obvious limitation to this form of analysis since very few interventions produce truly similar outcomes and inappropriate use of the cost minimisation analysis is liable to give quite misleading results.

2.2.2.3 Cost effectiveness analysis.

Where different healthcare interventions are not expected to produce similar outcome, both the costs and the consequences need to be assessed (Robinson, 1993; Drummond, 1987). In a cost effectiveness analysis the cost per unit change in health outcome is calculated. In this form of economic evaluation although the quantitative outcomes of different programmes may be expected to vary, these outcomes can be expressed in common natural units, for example the improvement in functional capacity measured with the health assessment questionnaire or reduction in erythrocyte sedimentation rate.

2.2.2.4 Cost benefit analysis.

Cost benefit analysis is probably the most comprehensive form of economic evaluation and it has been used as an aid to decision making in social policy for
over fifty years (Robinson, 1993; Drummond, 1987). The main difference between cost benefit analysis and other forms of economic evaluation is that both the inputs (costs) and outputs (benefits) are evaluated in monetary terms. Herein lies both the strength and weakness of the method. Having a monetary value on each side of the equation makes it very easy to assess the net effect of a programme and because the net effect is expressed in monetary terms it is very easy to compare the results of cost benefit analysis for widely differing programmes. This is one of the reasons why this form of analysis has found such widespread application in social policy research.

The difficulty with cost benefit analysis in healthcare is how to place a monetary value on health change and the other less tangible costs and benefits that may be involved. This difficulty has been approached from two directions, the human capital approach and using willingness to pay data.

The human capital approach, previously described, values human life according to the expectation of long-term earnings, accepting that earnings potential can be affected by sickness and premature death. Accounting procedures are needed to give a present day valuation to costs and benefits arising in the future using a process known as discounting; benefits accruing today are more valuable than those in the future, while the reverse is true of costs.

In the willingness to pay approach, subjects are asked what monetary value they would place on a hypothetical cure or specified improvement in their health. The technique has been extensively applied in inferring the value of a human
life from what people would pay to reduce their risk of sudden death (Acton, 1973). There are a number of difficulties associated with willingness to pay. Firstly the values may be unduly influenced by how much money people have and can afford to pay. Expressing the monetary values as a percentage of earnings can largely solve this difficulty. A theoretical advantage of the willingness to pay approach to measuring health utility is that conceptually it ought to be easier for patients to decide how much they are prepared to pay for some benefit whereas rating scales, time trade off and risk probabilities are more abstract principles. It is also possible using willingness to pay to obtain values for partial improvement in health by rephrasing the question appropriately.

2.2.2.5 Cost utility analysis.
In the health care context, "utility" refers to the subjective level of wellbeing or "quality of life" that people experience in different states of health (Robinson, 1993; Drummond, 1987). Measurement of quality of life is particularly relevant when considering chronic diseases such as rheumatoid arthritis whose major impact is more on the quality rather than the length of life.

For cost utility analysis an instrument that generates a single index of health status, usually on a scale of 1 (perfect health) to 0 (death) is required. Using this index, each year of survival may then be adjusted for the quality of life during that year to derive a "quality adjusted life year" (Bakker et al, 1993). Despite the appeal of having a single index which incorporates a measure of both quality and quantity of life, "cost per quality adjusted life year" league
tables which rank treatments on the basis of the marginal cost per additional quality adjusted life year gained should be interpreted with considerable caution (Rawles, 1989; Mason et al, 1993). Problems include the philosophical difficulty of accepting the validity of a single unit of health, the fact that calculation of cost per quality adjusted life year assumes that improvement in health is constant over a period of time, and that the marginal cost of achieving an increase in quality adjusted life years is heavily dependent on the control group being used for comparison. For example, the control might be an active intervention in which case the benefits might be small and the costs also small and marginal, or it might be a placebo, in which case both costs and clinical effects might be very much greater. The arguments for and against quality adjusted life years and the application of different forms of economic evaluation to the assessment of health care intervention have recently been reviewed (Rawles, 1989; Mason et al, 1993; Robinson, 1993). It is clear that no single approach to health economic analysis is sufficient for all circumstances. The methods most appropriate to the problem under investigation must be chosen and applied carefully.

2.2.3  Assessment of economic efficiency.

Broadly there are two forms of economic efficiency, 'technical' or 'operational' efficiency and 'allocative' efficiency (Drummond et al 1987; Mooney 1992; Ives and Lambert, 1995).

2.2.3.1  Operational efficiency. Operational efficiency begins with the assumption that the condition is to be treated and that it is worthwhile to do so; the
issue is how to meet the objective, for instance achieving remission of active rheumatoid arthritis, at least cost. Operational efficiency is optimal when the programme produces the desired clinical outcome at least cost. Since the role of providers is to win and fulfil contracts for delivery of healthcare in a competitive market, the ability to demonstrate operational efficiency will be important in influencing prospective purchasers. Cost effectiveness analysis, in which the cost per unit change in health outcome is calculated, is the most appropriate technique for assessing operational efficiency. The former is likely to be most relevant to the practising rheumatologist who is concerned with drawing up business plans and contracts.

2.2.3.2 Allocative efficiency. Allocative efficiency is concerned with the wider "political" issue of whether it is worth achieving a given objective or whether an alternative programme would produce greater overall benefit to society. Either cost benefit analysis or cost utility analysis may be used to assess allocative efficiency.

2.2.4 Economic evaluation as a basis for changes in resource provision.
As a provider, it is desirable to have some insight in to how purchasers may set priorities and how the rational basis for these decisions could be improved by greater attention to economic considerations. One approach to defining priorities, which has persisted despite considerable concern about its validity, is based upon an assessment of total need for a particular service with a proportionate allocation of resources (Donaldson and Farrar, 1991). Estimation of total need is expensive and, because in reality resources could never be expected to meet this need, it is
largely irrelevant. Furthermore prioritisation by needs assessment takes no account of the effectiveness of intervention and it is therefore divorced from consideration of efficiency criteria. "Cost of illness" data, which have also been used to set priorities, have similar drawbacks (Shiell et al, 1987; Donaldson and Farrar, 1991).

Rheumatologists may apply the principles of health economics discussed above in order to improve the technical efficiency of the treatment provided, and to identify which service or interventions should be expanded. First, the overall apportionment of the costs of the service between different key activities needs to be calculated, for instance between in patient and out patient services or between different types of out-patient activity. A judgement should also be made regarding the clinical effectiveness of each part of the service - an exercise that requires data on clinical outcome. Some examples where a critical economic appraisal may be worthwhile include joint injection clinics, second line drug monitoring clinics, the use of nurse practitioners and outreach clinics in general practitioners surgeries.

There are three different options that might be used to improve technical efficiency: the zero cost option, the marginal expenditure option and the cost saving option.

In the zero cost option the question is whether simple redistribution of existing resources within the service will provide a more efficient service; this will enable more patients to be treated for the same total cost. For example, implementation of a day-patient programme as a cheaper alternative to in patient care might liberate resources that could be used to expand other activity. The marginal expenditure option assumes that somewhere in the system there is spare capacity which is not being used because of a rate limiting factor such as clinic space or nursing staff
which, if rectified, would allow more patients to be seen. The cost saving option is the same as the zero cost option but it is decided to save the money from day care implementation rather than expand other activity.
CHAPTER III

A pilot study of the economic cost and clinical outcome of day-patient versus inpatient management of active rheumatoid arthritis

3.1 Introduction

Inpatient care of patients with active rheumatoid arthritis has been shown to be clinically effective in a number of studies in both the UK and North America, but it is unfortunately expensive because of high fixed costs such as hospital, overheads and ward running costs. Admission for multidisciplinary care comprises several elements including bed rest, withdrawal from domestic pressures, medication, education and physical therapy, but the individual contribution of each element to the overall clinical benefit remains uncertain. Day care, by eliminating some of the high fixed costs and overheads yet preserving all of the clinical elements of inpatient care, could be a more efficient method of managing patients with active rheumatoid arthritis. This pilot study has been designed to test the feasibility of day care, the practicality of the trial protocol design and to obtain preliminary economic data.
3.2 Methods

3.2.1 Aims.
The aims of the pilot study, which compares day-patient with in-patient care for management of active rheumatoid arthritis, were:

- to examine the feasibility of the protocol design including the method of randomisation and the practicality of data collection,
- to assess the suitability of the process and outcome measures,
- to obtain preliminary information on economic cost and clinical outcome of these two methods of management.

3.2.2 Subjects.
Twenty consecutive patients attending a teaching hospital rheumatic diseases unit, in whom the decision had been made to admit to hospital for further management of active rheumatoid arthritis, were randomised to receive either day-patient (ten patients) or in-patient care (ten patients).

3.2.3 Inclusion criteria.
The criteria for admission, which are those normally applicable in this unit, comprised patients with active rheumatoid arthritis with one or more of the following:

- deteriorating functional status,
- active synovitis,
- laboratory evidence of active inflammation,
- the need for rest and physical or psychological treatment,
• modification or introduction of second line drug treatment.

3.2.4 Exclusion criteria.

The exclusion criteria comprised one or more of the following:

- specific medical complications of rheumatoid arthritis e.g. septic arthritis, vasculitis, neuropathy, myelopathy,
- those for whom admission had been specifically requested by the general practitioner,
- other medical contraindications to day-patient care eg: severe cardiac failure,
- inability to reach hospital by 10 am when the ward therapy programme began. A time rather than distance limit from the hospital was set for practical reasons - the rheumatology unit covers both the city of Edinburgh and large country areas, and ease of access to the hospital is to some extent dependent on place of residence rather than distance.

3.2.5 Trial design and randomisation procedure.

The study design was a prospective randomised control trial comparing conventional in-patient care with novel day-care. After the decision to admit had been taken, each patient was randomised using a sequence of sealed envelopes containing computer generated random treatment assignments. Written explanation of the purpose of the study was given to those patients randomised to the day patient group. Informed consent was sought in writing from day-patients according to the method of "randomised consent"
(Zelin, 1979). It was made clear to patients randomised to the day-patient group that they could elect to transfer to in patient care, if they desired, without prejudice to their management. Day-patients could be transferred to in-patient care if medically indicated but the results were analysed on the basis of intention to treat. Re-admission for active rheumatoid arthritis, during the trial period, was recorded as an outcome and the costs of readmission were included in the economic analysis. Readmission for medical or surgical complications of rheumatoid arthritis was recorded but the costs were not calculated.

3.2.6 Clinical management protocol.

The clinical treatment of both groups conformed to normal clinical practice. Patients were randomly allocated to one of the two treatment groups and received therapy either as an in-patient or as a day-patient. Whereas in-patients were treated as one continuous admission until discharge, day-patients received hospital therapy (between 10am and 5pm) interspersed with periods at home, following prescribed regimens of rest, physiotherapy and medication. Hospital therapy for each patient ended when medical control of rheumatoid arthritis had been achieved, and relevant physiotherapy, occupational therapy, social and psychological needs had been identified and addressed. Patients in each group were assessed twice per week in order to monitor progress and identify satisfactory completion of therapy. Frequency of day patient attendance, and the use of weekend “leave” for in-patients, during the period of intensive therapy depended upon the patient’s clinical progress and was left to the discretion of the attending physician.
The treatment programme for both groups included the following:

- physiotherapy – general programme of joint maintenance exercises as well as attention to specific requirements (eg correction of deformities, provision of splints),
- occupational therapy – advice on joint protection, identification of needs and provision of aids,
- patient education – concerning the nature of rheumatoid arthritis and its management (including the safe use of medication). Education was given by nursing staff, occupational therapist, ward pharmacist, social worker and physiotherapist,
- social work – where appropriate, advice was given regarding grants, housing and other welfare benefits by a social worker,
- clinical psychology – where appropriate, psychological counselling was offered by a clinical psychologist and antidepressant therapy was prescribed by the attending physician,
- medical management – the frequency of intra-articular steroid injections and changes in disease modifying anti-rheumatic drug therapy were left to the discretion of the attending physician,
- pharmacy – advice on safe use of medication and need for monitoring was given by a pharmacist,
- chiropody and orthotics supplied as required.
The hospital treatment programme ended for both the day- and in-patients when the following objectives were accomplished:

- optimal medical control of symptoms and signs of disease,
- functional status had reached a plateau,
- occupational therapy, orthotic and social needs identified and steps taken to meet them,
- psychological problems identified and, where appropriate, treatment instituted.

In cases where the disease relapsed and further intensive therapy was required, the patient returned to the "start" of the management protocol and remained in the same management group. The need to recommence the protocol due to active rheumatoid arthritis was recorded as an outcome and the additional costs were included in the economic analysis. Admission to hospital for any indication other than uncomplicated active rheumatoid arthritis was not recorded. A record was kept of patients randomised to receive day-patient therapy who for medical reasons were transferred to in-patient management. Such patients were included in the final analysis which was conducted on the basis of intention to treat.

Multidisciplinary care was provided by physicians, nurses, physiotherapists, occupational therapists, a ward pharmacist and a social worker. The prescription of medication or other therapy was left to the discretion of the attending physician. Changes in disease modifying anti-rheumatic drug therapy, the frequency of intra-articular steroid use and the number of contacts with paramedical services were recorded. In cases where the disease subsequently
relapsed requiring further hospital based care, the patient remained in the same allocation group and recommenced therapy.

3.2.7 Clinical assessments.
The following measurements were recorded on admission, discharge and at three and six month follow up assessments-

- Ritchie articular index (Ritchie et al., 1968),
- Erythrocyte sedimentation rate (Westergren method),
- Modified Stanford Health Assessment Questionnaire, adapted for British patients (Kirwan et al., 1986),
- Functional Independence Measurement (Hamilton et al., 1987),
- Hospital Anxiety and Depression Scale (Zigmond and Snaith, 1983).

3.2.8 Economic assessments.
Before calculating the direct hospital costs for each group a total cost analysis of running costs for the rheumatology ward was performed (Table 3.1). From these data a standard cost per patient which covered all relevant components was calculated for day patients and inpatients. This cost for a 'unit treatment day' comprised, for day patients, all costs incurred between 9am and 5pm each day and, for in patients, all costs incurred between 9am and 9am the following day. The total cost for each patient was then derived by multiplying the number of days of hospital treatment by the cost of the appropriate unit treatment day.

3.2.8.1 Total cost analysis of rheumatology ward 1992/93.
Ward running costs fall into four major categories - patient care, patient services, overheads and opportunity costs. Patient care costs were those directly attributable to the rheumatology unit and included the costs of medical, nursing and paramedical salaries, medication and investigations. Implementation of a day-patient programme may allow savings on salary costs between 5pm and 10am. However, as this trial did not permit actual reduction in staff levels, these costs have been assumed to be similar for both groups. Patient services including laundry and catering costs were itemised and calculated for day and inpatients separately. Hospital overheads comprised capital charges, energy consumption and maintenance costs were obtained from the hospital administration and were derived from overall aggregated hospital costs based upon the volume of hospital space occupied by the rheumatology unit. The capital charge was based upon a surface area of 1,145sqm. The electrical consumption of 196,223 kWh per annum was priced at £0.04 per kWh. The gas consumption of 446,760 kWh per annum for heating was priced at £0.06 per kWh. The opportunity cost may be defined as the benefit foregone (or income foregone) as a result of undertaking one activity rather than the next best alternative. The most economic and practical alternative to which the ward could be put was considered to be office space with an imputed rental value of £100,000 per annum. Use of the ward as "hotel" accommodation for patients not requiring nursing supervision was considered as an alternative model and would raise a lower income of £86,000 per annum, based upon 80% occupancy and using bed and breakfast rates. The total cost of running a 28-bed rheumatology ward and the apportioned cost for the unit treatment day for both day patients and inpatients is shown (Table 3.1).
<table>
<thead>
<tr>
<th></th>
<th>Total cost/28 beds (£/annum) 1992/93</th>
<th>Day-patient (£/day)</th>
<th>In-patient (£/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salaries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>78,114</td>
<td>9.55</td>
<td>9.55</td>
</tr>
<tr>
<td>Nursing</td>
<td>177,501</td>
<td>21.77</td>
<td>21.77</td>
</tr>
<tr>
<td>Other</td>
<td>53,631</td>
<td>6.87</td>
<td>6.87</td>
</tr>
<tr>
<td></td>
<td>309,246</td>
<td>38.19</td>
<td>38.19</td>
</tr>
<tr>
<td>Medication</td>
<td>40,000</td>
<td>4.89</td>
<td>4.89</td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Patient services</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catering</td>
<td>39,347</td>
<td>2</td>
<td>3.85</td>
</tr>
<tr>
<td>Laundry</td>
<td>5,110</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>44,457</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overheads</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>7,848</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>2,724</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance/Building</td>
<td>6,000</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>16,572</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital charge</td>
<td>6,762</td>
<td>0.84</td>
<td>0.84</td>
</tr>
<tr>
<td>Imputed rental value</td>
<td>100,000</td>
<td>9.72</td>
<td>9.72</td>
</tr>
<tr>
<td><strong>TOTAL COST</strong></td>
<td>517,037</td>
<td>59.64</td>
<td>61.99</td>
</tr>
</tbody>
</table>
The methodology for economic data collection is described separately for hospital, transport, community and indirect costs respectively.

3.2.8.2 Transport costs during hospital therapy.
Transport details, including distance from home to hospital, number of journeys made and method of travelling were recorded. Costs were based on single journeys for each trip to or from hospital for both in- and day-patients using taxi cabs at local charges (156p for first mile + 88p per mile thereafter + 60p booking fee + 50p waiting).

3.2.8.3 Community costs.
Community costs comprise transport costs for attending hospital outpatient clinics or general practitioners surgeries, salary costs for medical, nursing and paramedical services and continuing direct medical costs for medication and laboratory monitoring. Community transport costs to out-patients, GP surgery etc, were again calculated using taxi rates. Where a single visit served more than one purpose, e.g. a visit to general practitioners and practice nurse, the cost of transport was shared. Diaries were issued on admission to the study and patients were requested to record the date and duration of contact with all medical and paramedical staff over the period of the study. Salary costs were allocated on a fraction of earnings basis according to average contact time derived from the diary records. The accuracy of these data was verified by cross checking the general practitioner's records by telephone enquiry on two patients selected randomly from each group. Medication costs were assumed to remain
unchanged from discharge from hospital. The cost of each visit to a rheumatology out-patient clinic was estimated to be £45 (Griffiths, 1992).

3.2.8.4 Indirect costs.
Loss of productive output in the course of the study which were attributable to either the patient or their carers, either as a result of arthritis or its treatment, were recorded. Indirect costs were calculated according to the nature of employment on admission to the study rather than prior to the onset of disease. Although this underestimates the lifetime economic impact of rheumatoid arthritis it does reflect the indirect costs of the treatment more accurately and may reveal differences in indirect costs between the groups. Patients who were unemployed, medically retired or of pensionable age on admission had no attributable indirect costs.

Information on days lost from work or unpaid activity was collected by personal interview at three and six months following recruitment. Patients were supplied with diaries and requested to note any change in their employment status between discharge and three and six month interviews.

3.2.8.5 Other costs
A number of additional costs have been omitted from this study. The costs associated with loss of leisure time were not included as it was felt that patients with active rheumatoid arthritis already suffered from loss of 'quality' (i.e. pain free) leisure time and it was felt unlikely that either group would differ in this respect. Similarly loss of carers time has not been quantified. In patients may
have required less carer time at home but their carers were presumed to visit hospital on a regular basis which would minimise any difference between the groups. While these additional costs were carefully considered when designing the study it was not thought to be practical to collect these data bearing in mind the additional resources that this would entail.

3.2.9 Statistical methods.

The Wilcoxon's signed rank test was used to compare clinical variables for day-patients and inpatients at admission, discharge and six month follow up.
3.3 Results

3.3.1 Analysis of admissions. During the period of study between January and June 1992, a total of seventy six patients were admitted to the rheumatic diseases unit. Patients with uncomplicated active rheumatoid arthritis accounted for 58% (44/76) of the in-patient workload and day-patient treatment offered a practical alternative for 45% (20/44) of patients with active rheumatoid arthritis who would normally have been admitted as in-patients. Sixteen patients were ineligible for entry to the study due to a primary diagnosis other than active rheumatoid arthritis and a further seventeen had rheumatoid arthritis but were ineligible due to medical contraindications (Table 3.2). Twenty three patients were unable to reach hospital by 10am.

<table>
<thead>
<tr>
<th>“Non RA” diagnoses</th>
<th>Medical exclusions with RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=16</td>
<td>n=17</td>
</tr>
<tr>
<td>Undefined polyarthritis</td>
<td>Septic arthritis</td>
</tr>
<tr>
<td>Psoriatic arthritis</td>
<td>Emergency admission</td>
</tr>
<tr>
<td>Temporal arteritis</td>
<td>Cervical myelopathy</td>
</tr>
<tr>
<td>Systemic vasculitis</td>
<td>Respite care for RA</td>
</tr>
<tr>
<td>Prostacyclin infusion</td>
<td>Pre-op assessment</td>
</tr>
<tr>
<td>Gout (acute)</td>
<td>Immunosuppressive therapy</td>
</tr>
<tr>
<td>TB reactive arthritis</td>
<td>Rheumatoid vasculitis</td>
</tr>
<tr>
<td>Myositis</td>
<td>Infected ulcer</td>
</tr>
<tr>
<td>Acute disc prolapse</td>
<td>Pregnancy + diabetes mellitus</td>
</tr>
<tr>
<td>Yt synovectomy</td>
<td>Depression + cystitis</td>
</tr>
<tr>
<td>Anxiety state</td>
<td></td>
</tr>
</tbody>
</table>

3.3.2 Assessment of trial design. Day-patient care proved to be acceptable to all eligible patients and none had to be transferred to in-patient therapy. This suggested that randomised consent was viable for the purposes of this study and that the trial
would not be compromised by a significant number of patients changing treatment groups.

3.3.3 Clinical management protocols. The total duration of hospital based therapy was similar in both groups; day-patients median: 19 days (range 10-28), in-patients median: 20 days (range 14-27). The difference between the groups with respect to the number of hospital treatment days (9 versus 18) is accounted for by day patients spending part of the programme at home. The intensity of treatment with respect to intra-articular steroids, disease modifying anti-rheumatic drugs, physiotherapy and occupational therapy was comparable in both groups (Table 3.3).

<table>
<thead>
<tr>
<th>TABLE 3.3</th>
<th>DESCRIPTION OF TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day-patient</td>
</tr>
<tr>
<td>Intra-articular (I/A) steroid</td>
<td>8</td>
</tr>
<tr>
<td>No. patients given I/A steroid</td>
<td>8</td>
</tr>
<tr>
<td>Total no. I/A steroid</td>
<td>16</td>
</tr>
<tr>
<td>Second line therapy</td>
<td>4</td>
</tr>
<tr>
<td>Commenced</td>
<td>4</td>
</tr>
<tr>
<td>Reintroduced</td>
<td>2</td>
</tr>
<tr>
<td>Dose increased</td>
<td>0</td>
</tr>
<tr>
<td>Changed</td>
<td>4</td>
</tr>
<tr>
<td>Discontinued</td>
<td>0</td>
</tr>
<tr>
<td>Stable</td>
<td>0</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>7</td>
</tr>
<tr>
<td>No. individual contacts (mean)</td>
<td>7</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>1</td>
</tr>
<tr>
<td>No. individual contacts (mean)</td>
<td>1</td>
</tr>
</tbody>
</table>
3.3.4 **Clinical evaluation.** The numbers in the pilot study were small and it was not designed or powered to permit firm statistical conclusions to be drawn regarding differences in clinical outcome between day-patients and in-patients. However it is appropriate to comment on broad trends in process and outcome measurements. Clinical data on admission to the study confirmed that both groups were evenly matched for disease process, functional and psychological parameters (Table 3.4 and Appendices 7.1.1-7.1.6). There were no significant differences between the in patients or day-patients at discharge or six month follow up (Wilcoxon sign rank p>0.05) (Appendix 7.1.7).
<table>
<thead>
<tr>
<th></th>
<th>Admission Mean (95%CI)</th>
<th>Discharge Mean (95%CI)</th>
<th>Six months Mean (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESR</td>
<td>DP 70 (49-92)</td>
<td>54 (35-72)</td>
<td>40 (18-61)</td>
</tr>
<tr>
<td></td>
<td>IP 75 (44-105)</td>
<td>64 (39-88)</td>
<td>66 (42-89)</td>
</tr>
<tr>
<td>RITCHIE</td>
<td>DP 28 (13-43)</td>
<td>20 (7-33)</td>
<td>19 (9-30)</td>
</tr>
<tr>
<td></td>
<td>IP 32 (27-37)</td>
<td>17 (7-27)</td>
<td>25 (14-36)</td>
</tr>
<tr>
<td>HAQ</td>
<td>DP 2.24 (1.79-2.69)</td>
<td>2.09 (1.62-2.56)</td>
<td>1.63 (0.99-2.25)</td>
</tr>
<tr>
<td></td>
<td>IP 2.4 (2.16-2.61)</td>
<td>2.06 (1.64-2.48)</td>
<td>2.05 (1.54-2.56)</td>
</tr>
<tr>
<td>FIM</td>
<td>DP 104 (94-114)</td>
<td>109 (103-116)</td>
<td>112 (105-120)</td>
</tr>
<tr>
<td></td>
<td>IP 101 (95-106)</td>
<td>112 (108-115)</td>
<td>104 (96-113)</td>
</tr>
<tr>
<td>HAD (Anxiety)</td>
<td>DP 8.7 (5.6-11.8)</td>
<td>7.7 (4.5-10.9)</td>
<td>6 (2.3-9.7)</td>
</tr>
<tr>
<td></td>
<td>IP 8.8 (5.9-11.7)</td>
<td>5.6 (3.5-7.7)</td>
<td>9.4 (6.4-12.4)</td>
</tr>
<tr>
<td>HAD (Depression)</td>
<td>DP 7.8 (5.1-10.5)</td>
<td>7.4 (5.4-9.4)</td>
<td>6.7 (3.0-10.3)</td>
</tr>
<tr>
<td></td>
<td>IP 7.6 (5.3-9.8)</td>
<td>5.4 (2.4-8.4)</td>
<td>6.2 (3.9-8.5)</td>
</tr>
</tbody>
</table>

(Day-patient [DP] Vs In-patient [IP] at each time point p>0.05 Wilcoxon signed rank- Appendix 7.1)
3.3.5 **Economic evaluation.** Data on the hospital cost, transport cost and community costs are given in Table 3.5.

| TABLE 3.5 |
| SUMMARY OF ECONOMIC DATA |

<table>
<thead>
<tr>
<th></th>
<th>Day-patient</th>
<th>In-patient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost/day (£)</td>
<td>59.64</td>
<td>61.99</td>
</tr>
<tr>
<td>No. treatment days</td>
<td>94</td>
<td>182</td>
</tr>
<tr>
<td>Hospital cost (£)</td>
<td>5,606</td>
<td>11,282</td>
</tr>
<tr>
<td><strong>Transport costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean distance home/hospital (miles)</td>
<td>9.15</td>
<td>7.10</td>
</tr>
<tr>
<td>No. visits to/from hospital</td>
<td>184</td>
<td>39</td>
</tr>
<tr>
<td>Transport cost (£)</td>
<td>1,808</td>
<td>306</td>
</tr>
<tr>
<td><strong>Community costs (£)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td>751</td>
<td>790</td>
</tr>
<tr>
<td>Medication</td>
<td>713</td>
<td>713</td>
</tr>
<tr>
<td>General practitioner visits</td>
<td>472</td>
<td>455</td>
</tr>
<tr>
<td>Out-patient rheumatology visits</td>
<td>250</td>
<td>855</td>
</tr>
<tr>
<td>Paramedical services</td>
<td>672</td>
<td>127</td>
</tr>
<tr>
<td>Community cost</td>
<td>2,858</td>
<td>2,940</td>
</tr>
<tr>
<td><strong>TOTAL COST (£)</strong></td>
<td>10,272</td>
<td>14,528</td>
</tr>
</tbody>
</table>

Although the sample size was small major differences in costs between the groups were apparent at six-month follow up. The cost of direct hospital care, transport and community costs of treating ten day-patients was £10,272 compared with £14,528 for ten in-patients. The increased cost of in-patient care over day-patient care, the incremental cost, was 41.4%.  

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3.3.6 **Indirect costs.** One in-patient and two day-patients were in part employment on admission to the trial and incurred indirect costs of £224 and £2,014 respectively. As these economic data related to so few patients their inclusion in the main economic analysis would have distorted the results unduly and they were therefore omitted. They have however been included in the sensitivity analysis.

3.3.7 **Sensitivity analysis.** Sensitivity analysis was undertaken to test the effect of altering occupancy rates, transport costs and imputed rental value for the ward space, on the calculated incremental cost of in-patient care. Increasing bed occupancy rates from 80% to 100% had a small effect and reduced the incremental cost of in-patient therapy by only 4.4% from 41.4% to 36.6%. Reducing the imputed rental value of ward space by 14% by basing it on hostel accommodation (income £86,000pa) instead of office space (income £100,000pa), also had a negligible effect and reduced the incremental cost of in-patient care by only 0.9% to 40.5%. However, if transport costs were calculated using ambulance car rates that are 40% cheaper than commercial taxi rates, there was a 9.4% increase in the incremental cost of in-patient therapy from 41.4% to 50.8%. Day-care therefore becomes more cost efficient compared to in-patient therapy if cheaper transport is used, but slightly less cost efficient if bed occupancy rates rise or the imputed rental value is lower. If the indirect costs are included in the economic analysis the incremental cost of inpatient acre over day-patient care is reduced significantly from 41.1% to 24%.
3.3.8 Marginal cost and incremental cost

The marginal cost in this trial would be the cost of treating one additional day or in-patient. Since bed occupancy rates approach 100% the actual cost of treating one extra in-patient (i.e. 365 bed days per annum) would be very high since this would require additional ward accommodation and nursing staff. Similarly the day patient unit was operating at full capacity and it would not have been possible to treat one additional patient per day within the existing resources. If our occupancy rate was lower the marginal cost would be minimal and cover additional laundry and catering requirements.

The incremental cost refers to the additional cost of one therapy over another, in this case inpatient care over day-patient therapy.
3.4 Conclusions

This pilot study demonstrated that the design of the protocol was practical. In particular, the method of randomisation using randomised consent (Zelin, 1979) did not pose problems and the method of data collection proved feasible. No one allocated to day-patient care transferred to inpatient care and day-patient care was acceptable to all eligible patients.

The preliminary economic data suggest that day care might be substantially cheaper (40%) than conventional inpatient care.

This pilot study was not powered to address the question of whether clinical outcome of day-patient therapy is equivalent to that of inpatient care. A larger prospective randomised clinical and economic evaluation was therefore undertaken, based on the methodology piloted in this study.

As a result of the pilot study, the selection of outcome instruments was refined; the Functional Independence Measure proved too cumbersome to administer and was omitted and the Quality of Wellbeing Index was included as a generic health status instrument. Questionnaires on willingness to pay and time trade off were also included.
CHAPTER IV

Randomised controlled clinical and economic evaluation of day-patient care versus inpatient care for active rheumatoid arthritis.

4.1 Introduction

The pilot study had demonstrated that day patient care is acceptable to patients with active rheumatoid arthritis and that the protocol for the trial design, including the method of randomisation and data collection, is practical. The pilot study had also suggested that day patient care may be less costly and may not compromise clinical outcome. However, the sample size was small and it was not the intention to evaluate formally the clinical efficacy of day patient care in the pilot study; this issue has been addressed in the second larger study described below. The hypothesis tested is that the clinical outcome and resource consequences of inpatient and day patient management of patients with uncomplicated active rheumatoid arthritis are equivalent. The experimental design is a randomised controlled clinical trial with an integrated cost minimisation economic evaluation.
4.2 Methods

4.2.1 Aims.
The aim was to test the hypothesis that the clinical outcome of inpatient and day care management of patients with uncomplicated active rheumatoid arthritis is equivalent and that there is no difference in the use of resources.

4.2.2 Subjects.
One hundred and eighteen consecutive patients attending the rheumatic diseases unit, in whom the decision had been made to admit to hospital for further management of active rheumatoid arthritis, were randomised to receive either day-patient or in-patient care. The trial design, criteria for inclusion and exclusion, randomisation procedure and clinical management protocol were identical to that described for the pilot study.

4.2.3 Clinical assessments.
The following measurements were recorded on admission, discharge and twelve month follow up-

- Ritchie articular index (Ritchie et al, 1968),
- Erythrocyte sedimentation rate (Westergren method),
- Steinbrocker functional class (Steinbrocker et al, 1949),
- modified Stanford Health Assessment Questionnaire adapted for British patients (Kirwan et al, 1986),
- Hospital Anxiety and Depression Scale (Zigmond and Snaith, 1983).
Secondary outcome measures were health utility measured using the method of time trade off (Torrance et al, 1972) and the Quality of Well Being Scale (Kaplan et al, 1976) and health valuation using the method of willingness to pay (Thompson, 1986).

Other outcomes recorded include the number of readmissions and outpatient attendances, which were undertaken at the discretion of the attending physician, and death.

4.2.4 Demographic assessments.

The age, sex, number of adults and children in the household, number of such persons providing active support, employment or, if unemployed, most recent full-time employment were all recorded

4.2.5 Economic assessments.

The methodology for economic data collection was similar to that described for the pilot study but the ward running costs were recalculated to reflect costs in 1994/95 (Table 4.1).
TABLE 4.1
HOSPITAL COSTS

<table>
<thead>
<tr>
<th>Total cost/28 beds (£/annum) 1994/95</th>
<th>Day-patient (£/day)</th>
<th>In-patient (£/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>90,300</td>
<td>11.25</td>
</tr>
<tr>
<td>Nursing</td>
<td>207,365</td>
<td>28.13</td>
</tr>
<tr>
<td>Other</td>
<td>74,620</td>
<td>9.30</td>
</tr>
<tr>
<td>Medication</td>
<td>38,112</td>
<td>4.75</td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical supplies</td>
<td>8,632</td>
<td>1.07</td>
</tr>
<tr>
<td>Orthotics</td>
<td>8,633</td>
<td>1.08</td>
</tr>
<tr>
<td>Patient services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catering</td>
<td>44,457</td>
<td>3.33</td>
</tr>
<tr>
<td>Laundry</td>
<td>11,139</td>
<td>0.31</td>
</tr>
<tr>
<td>Overheads</td>
<td>18,045</td>
<td>2.35</td>
</tr>
<tr>
<td>Capital charge</td>
<td>130,000</td>
<td>16.20</td>
</tr>
<tr>
<td>Imputed rental value</td>
<td>110,000</td>
<td>13.70</td>
</tr>
<tr>
<td>TOTAL COST</td>
<td>741,303</td>
<td>95.41</td>
</tr>
</tbody>
</table>

4.2.6 Clinical management protocol.
This was the same as that described for the pilot study.

4.2.7 Statistical methods.

4.2.7.1 Power calculation. To test equivalence, the largest acceptable clinical differences in outcome between groups were chosen as >0.25 points on the health assessment questionnaire (the main outcome measure), >20mm/hour difference in the erythrocyte sedimentation rate, or >3 points on either the anxiety or depression scales of the hospital anxiety and depression scale. A total sample size of 105 patients was required to detect this difference in the
health assessment questionnaire between unpaired groups, with a power of 90% at the p<0.05 level (two tailed test).

4.2.7.2 Clinical data. Analysis of covariance was used to establish whether there was a significant difference in clinical outcome over time between inpatients and day-patients. The 95% confidence intervals for the mean difference between day patients and inpatients at discharge and twelve month follow up, adjusted for difference in baseline variables on admission, were obtained using analysis of covariance (Altman and Gardner, 1989; Armitage and Berry, 1987).

4.2.7.3 Economic data. The distribution of resource outcomes was compared using generalised quantile regression to estimate cost quartiles, conditional on inpatient or day patient treatment. The impact of heteroskedasticity on standard errors and confidence intervals of coefficients was considered by comparing estimates based on analytical methods and bootstrap resampling (Gould, 1992). Non parametric bootstrap methods (Chaudhary and Stearn, 1996; Efron and Tibshirani, 1993; Briggs et al 1997) were also used to calculate confidence intervals for arithmetic means of total resource use. All confidence intervals are based on 1000 bootstrap replications (Stata statistical software; release 5.0. College Station, TX: Stata Corporation).
4.3 Results

4.3.1 Analysis of admissions. Between May 1993 and January 1995, 557 rheumatology outpatients were admitted to hospital and were screened for the study. Of the 200 patients with active rheumatoid arthritis, 118 satisfied the entry criteria and were randomised to receive day-care (59) or inpatient care (59), 60 were unable to travel and 22 had medical complications. In each group, 51 patients completed the trial and eight were lost to follow up. During the study 11 day-patients transferred to inpatient care, five due to travelling difficulties, 2 for clinical reasons, 2 for domestic reasons and 2 stated a preference for inpatient care. Two inpatients requested day-patient care and were transferred.

4.3.2 Analysis of baseline clinical and social characteristics. There were no significant differences in the baseline clinical and socio-economic characteristics of the two groups (Table 4.2).
TABLE 4.2
CLINICAL & SOCIOECONOMIC CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th>Day-patients (n = 59)</th>
<th>In-patients (n = 59)</th>
<th>Unable to travel (n = 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Median (range)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>59 (28-78)</td>
<td>55.5 (31-78)</td>
<td>57 (25-76)</td>
</tr>
<tr>
<td>Disease duration (years)</td>
<td>6 (0.1-34)</td>
<td>4 (0.1-33)</td>
<td>8 (0.5-40)</td>
</tr>
<tr>
<td><strong>Number of patients</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>40</td>
<td>41</td>
<td>47</td>
</tr>
<tr>
<td>With erosions</td>
<td>28</td>
<td>33</td>
<td>48</td>
</tr>
<tr>
<td>Steinbrocker class II</td>
<td>21</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Steinbrocker class III</td>
<td>35</td>
<td>38</td>
<td>30</td>
</tr>
<tr>
<td>Living alone</td>
<td>10</td>
<td>13</td>
<td>37</td>
</tr>
<tr>
<td>In paid employment</td>
<td>13</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Unemployed</td>
<td>12</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Sick leave</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Medically retired</td>
<td>12</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Retired</td>
<td>17</td>
<td>16</td>
<td>22</td>
</tr>
</tbody>
</table>

The mean duration of the initial hospital treatment episode was similar for daypatients (13 days) and inpatients (14 days). Twelve daypatients and 7 inpatients required re-admission. The mean duration of re-admission was also similar for daypatients (12 days) and inpatients (13 days). However, the mean number of days in which a bed was actually occupied during the initial treatment episode was significantly less for daypatients (9 days) than inpatients (14 days). The difference in bed occupancy is accounted for by daypatients spending part of the treatment period at home. The hospital and community treatment received is shown (Table 4.3). The discrepancy in physiotherapy use is accounted for by two of the day patients having multiple visits to hydrotherapy. The number of patients using the service, as oppose to number of sessions used, was similar for both groups.
### TABLE 4.3
DESCRIPTION OF TREATMENT

<table>
<thead>
<tr>
<th></th>
<th>Day-patients (n=51)</th>
<th>In-patients (n=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra-articular (I/A) steroid</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients given I/A steroid</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>Total no. I/A steroid injections</td>
<td>148</td>
<td>120</td>
</tr>
<tr>
<td><strong>Second line therapy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commenced or restarted</td>
<td>26</td>
<td>27</td>
</tr>
<tr>
<td>Changed</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Dose increased</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td><strong>Rheumatology out-patient visits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>69</td>
<td>56</td>
</tr>
<tr>
<td><strong>Community service visits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td>588</td>
<td>828</td>
</tr>
<tr>
<td>Practice nurse</td>
<td>703</td>
<td>800</td>
</tr>
<tr>
<td>District nurse</td>
<td>97</td>
<td>68</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>65</td>
<td>4</td>
</tr>
<tr>
<td>Occupational therapist</td>
<td>42</td>
<td>27</td>
</tr>
<tr>
<td>Chiropodist</td>
<td>73</td>
<td>43</td>
</tr>
<tr>
<td>Orthotist</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

#### 4.3.3 Clinical evaluation. 
On admission there was no significant difference between groups in the erythrocyte sedimentation rate, Ritchie articular index or Hospital Anxiety and Depression scale but day-patients were slightly more disabled on the Health Assessment Questionnaire score (Table 4.4, Appendix 7.3). Adjusting for baseline variance there was no significant difference between day patients or in patients in any clinical variable at discharge or follow up, except for the anxiety score on discharge (analysis of covariance, Appendix 7.4). At baseline there was no significant difference in health utility between day and in-patients recorded by time trade off or Quality of
Wellbeing Index (unpaired t-test p>0.1). Adjusting for baseline variability there was no difference between day patients and inpatients for time trade off values or Quality of Wellbeing Index.

### TABLE 4.4
SUMMARY OF OUTCOME DATA

<table>
<thead>
<tr>
<th></th>
<th>Admission mean (95%CI)</th>
<th>Discharge mean (95%CI)</th>
<th>12 month follow-up mean (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ritchie</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26 (22-31)</td>
<td>14 (11-18)</td>
<td>22 (19-26)</td>
</tr>
<tr>
<td></td>
<td>27 (23-31)</td>
<td>17 (14-20)</td>
<td>20 (17-23)</td>
</tr>
<tr>
<td>ESR</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>54 (44-64)</td>
<td>36 (26-46)</td>
<td>33 (25-41)</td>
</tr>
<tr>
<td></td>
<td>48 (38-58)</td>
<td>33 (24-41)</td>
<td>32 (25-40)</td>
</tr>
<tr>
<td>HAQ</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.76 (1.64-1.88)</td>
<td>1.38 (1.19-1.57)</td>
<td>1.65 (1.48-1.83)</td>
</tr>
<tr>
<td></td>
<td>1.53 (1.39-1.66)</td>
<td>1.24 (1.07-1.41)</td>
<td>1.44 (1.28-1.61)</td>
</tr>
<tr>
<td>HAD (Anxiety)</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.78 (6.73-8.84)</td>
<td>6.35 (5.32-7.38)</td>
<td>7.37 (6.02-8.72)</td>
</tr>
<tr>
<td></td>
<td>7.55 (6.32-8.78)</td>
<td>7.40 (6.16-8.65)</td>
<td>7.43 (6.15-8.70)</td>
</tr>
<tr>
<td>HAD (Depression)</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.28 (6.38-8.18)</td>
<td>5.96 (5.06-6.86)</td>
<td>6.26 (5.19-7.33)</td>
</tr>
<tr>
<td></td>
<td>7.45 (6.39-8.50)</td>
<td>6.66 (5.61-7.71)</td>
<td>6.55 (5.42-7.69)</td>
</tr>
<tr>
<td>QWB</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.49 (0.471-0.501)</td>
<td>-</td>
<td>0.51 (0.487-0.525)</td>
</tr>
<tr>
<td></td>
<td>0.49</td>
<td>-</td>
<td>0.51 (0.493-0.522)</td>
</tr>
<tr>
<td></td>
<td>(0.477-0.508)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTO</td>
<td>DP</td>
<td>IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.76 (0.669-0.841)</td>
<td>-</td>
<td>0.80 (0.717-0.879)</td>
</tr>
<tr>
<td></td>
<td>0.66</td>
<td>-</td>
<td>0.76 (0.671-0.842)</td>
</tr>
<tr>
<td></td>
<td>(0.567-0.746)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DP= Day-patient, IP = inpatient, ESR = erythrocyte sedimentation rate, HAQ = Health Assessment Questionnaire, HAD = Hospital Anxiety and Depression Scale, QWB = Quality of Wellbeing Index, TTO = time trade off value.
4.3.4 Economic evaluation. The mean (95% CI) hospital cost per patient for
day-care, £798 (705-888) was lower than for inpatient care, £1253 (1155-1370)
but this difference was offset by higher community, travel and re admission
costs. The difference in total cost per patient between day-care, £1789 (1539-
2027) and inpatient care, £2021 (1834-2230) was therefore small (Table 4.5).

<table>
<thead>
<tr>
<th>Resource category</th>
<th>Day-patients £/patient mean (95%CI)</th>
<th>In-patients £/patient mean (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>798 (705, 888)</td>
<td>1253 (1155,1370)</td>
</tr>
<tr>
<td>Community</td>
<td>323 (247, 463)</td>
<td>298 (258, 337)</td>
</tr>
<tr>
<td>Travel</td>
<td>417 (370, 472)</td>
<td>293 (251, 340)</td>
</tr>
<tr>
<td>Re-admission</td>
<td>218 (96, 384)</td>
<td>143 (38, 306)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1789 (1539,2027)</td>
<td>2021 (1834,2230)</td>
</tr>
</tbody>
</table>

The cost difference between day-patients and inpatients was further examined
using quantile regression (Table 4.6). The cost quartiles for inpatient care are
given by the coefficient reported for inpatient care. The sum of the inpatient and
day patient coefficients provide an estimate of the cost quartiles for day patient
care. The coefficients reported for the day patient group, which also represent
the differences between day-patients and in-patients, were negative at the 25th
and 50th percentiles and significantly different from zero. The cost differential,
whilst still in favour of day patient care, diminishes towards the upper end of the distribution as indicated by the small absolute difference at the 75th percentile of around 5% in overall costs.

<table>
<thead>
<tr>
<th>Percentile</th>
<th>In-patient</th>
<th>Day-patient</th>
<th>Upper 95% CI</th>
<th>Lower 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>25th</td>
<td>1635</td>
<td>-364</td>
<td>1447</td>
<td>1823</td>
</tr>
<tr>
<td>50th</td>
<td>1930</td>
<td>-374</td>
<td>1717</td>
<td>2143</td>
</tr>
<tr>
<td>75th</td>
<td>2271</td>
<td>-121</td>
<td>1929</td>
<td>2613</td>
</tr>
</tbody>
</table>

95% CI are based on standard errors estimated using bootstrap re-sampling.
During the twelve month follow up none of the 23 day-patients and 27 inpatients, who were previously on sick leave due to rheumatoid arthritis or medically retired due to rheumatoid arthritis, resumed active paid employment. Of those in full time employment at study entry only 2 of 6 inpatients and 5 of 8 day-patients continued full time work. Of those in part time work 0 of 5 inpatients and 2 of 5 day-patients continued in work.

At the end of the study 31 patients (62%) of the day-patient group and 21 (42%) of the in-patient group (52% overall) expressed a preference to be a day-patient in the future.

Since the clinical outcome of inpatient and day-patient care are equivalent the economic analysis takes the form of a cost minimisation study. Issues of relative cost benefit or cost utility do not therefore arise and the Quality of Wellbeing index and time trade off data were not used to generate utility values. In so far as the Quality of Wellbeing index provides data on overall health related quality of life it is reasonable to retain it in the clinical analysis.

An attempt was made to collect data on the willingness to pay to obtain a given health gain. For the purposes of this study patients were asked how much they would pay, as a proportion of their monthly income, for an improvement of one category of the Steinbrocker functional class. This was felt to be a more realistic expectation for improvement in health than the willingness to pay for a
hypothetical cure of the disease. The data obtained on willingness to pay were incomplete as patients were often unwilling to divulge sensitive financial information and the minority that completed the questionnaire frequently gave unrealistic values; for instance stating that they would forgo 50% of their monthly income.
4.4 Conclusions

Day care and conventional inpatient care are clinically equivalent for patients with active rheumatoid arthritis. The overall resource costs of day care are slightly lower than those of in-patients care. Day care is associated with lower hospital costs but higher costs to patient and family due to increased transport costs. Clinical benefit from either day care or inpatient care is short lived.
5.1 Acceptability of day-patient care.

In both studies it was found that day-care was acceptable to patients with active rheumatoid arthritis. One of the potential outcomes of a study with this design could have been that significant numbers of day-patients would elect to change to inpatient care after randomisation rather than travel on a daily basis. If this had occurred, analysis on the basis of intention to treat would have reduced the probability of detecting a true clinical or economic difference between the groups. Ethical considerations dictated that day patients were given this opportunity but in practice the regimes were equally acceptable and 60% of day-patients would chose day-care in future if indicated. Day patient care may be suitable for a significant proportion of patients currently managed as in patients. However the results also highlight the need for inpatient facilities for patients with rheumatoid arthritis; 30% of those with active rheumatoid arthritis were medically unfit to travel on a daily basis and 10% developed medical complications for which inpatient care was indicated.
5.2 Clinical management protocol.

The duration of treatment in both groups deserves comment. In the pilot study the overall length of stay was similar for day and in patients (20 days), with daypatients actually occupying a bed for about 9 days. In the second larger study the overall duration of therapy was slightly lower (13 days for each group) with daypatients occupying a bed for 9 days. The reasons for the discrepancy between the pilot and main studies with respect to overall length of stay are not clear. It may simply reflect pressure to limit healthcare costs but it is also possible that, as a result of implementing day care in the pilot study, the efficiency of the multidisciplinary team was improved. The number of days taken for day patients to reach the endpoints of the study was 9 days in both studies which suggests that this may be the minimum duration of care required to achieve these health benefits. Linear improvement in serial global assessments in inpatients over 21 day period has been reported (Sibley et al, 1990) but it is difficult to know how comparable regimes in different units and countries are to our own. In a recent Dutch study of inpatient multidisciplinary treatment versus routine out patient care for active rheumatoid arthritis, 11 days was chosen as the optimal duration of inpatient care (Vliet Vlieland et al, 1996) and in a similar North American study an average period of 16 days of in patient care was reported (Helewa et al, 1989).

5.3 Clinical outcome.

Although several early and mostly uncontrolled studies reported the benefit of prolonged bed rest and immobilisation in the management of active rheumatoid arthritis (Harris and Copp, 1962; Gault and Spyker, 1969) this was not substantiated by controlled trials which demonstrated similar outcome with shorter

Anderson compared short and long-term efficacy of intensive in-patient care with out-patient care and concluded that hospitalisation brought about prompt, sustained improvement in two weeks (Anderson et al, 1988). Overall health care costs were substantially higher for in-patients with an incremental cost of US$4866 over the two year study. This trial was small and not randomised, and the two groups were poorly matched for disease severity; the trial was therefore open to bias. Finally, as the authors point out, the economic analysis was incomplete as it failed to quantify the indirect costs and benefits. Thus no clear economic conclusion could be drawn. Four other studies, three non-randomised and one controlled, demonstrated short term clinical benefit from in-patient care for active rheumatoid arthritis compared with out-patient care (Al-Awadhi and McKendry, 1990; Shope et al, 1983; Spiegel et al, 1986; Lee et al, 1974) but none included an economic evaluation.

A more complete economic analysis was included in a randomised study of in-patient versus intensive out-patient therapy (Helewa et al, 1989). All relevant costs were measured for in-patient and intensive out-patient care and clinical outcome was compared using a composite score derived from mean change scores for
laboratory and clinical variables. Apart from the period of hospitalisation every effort was made to apply a similar treatment strategy to both groups and outcome was evaluated at nineteen weeks. In-patient therapy produced a sustained three-fold increase in efficacy, at a 2.5 fold increase in cost, suggesting that in-patient treatment is more cost effective than out-patient therapy. The incremental benefit of in-patient care was calculated to have cost an additional $3,000 (Canadian dollars) per patient.

There are clearly short-term clinical benefits arising from hospital admission and contact with a multidisciplinary team, but it is not clear whether a shorter period of in-patient care would yield similar benefit at less cost (Epstein, 1990). There is some evidence that serial global assessments, whether determined by physician, patient or physiotherapist, improve linearly for the first 21 days of admission for active rheumatoid arthritis (Sibley et al, 1990). Very brief in-patient admission may therefore fail to achieve optimal outcome.

The pilot study was too small to permit firm conclusions to be drawn regarding the clinical efficacy of day-care, but there was no obvious disadvantage to the day-care group in terms of the outcome measures studied. The clinical equivalence of the regimes was confirmed in the main study. There is conflicting evidence regarding the duration of benefit following intensive intervention for active rheumatoid arthritis; our study suggests that the benefit is short term. Disability, measured using the Health Assessment Questionnaire had deteriorated significantly for both groups at one year follow up, despite continuing medical and paramedical supervision in the community. Interestingly
the psychological benefits of hospital based intervention were maintained as measured by the Hospital Anxiety and Depression Scale. A recent Dutch study reported conflicting results- the effect of hospitalisation on disease activity remained at one year whereas emotional status deteriorated (Vliet Vlieland et al, 1996). Failure to preserve the benefits of hospital intervention after discharge may carry heavy financial penalties in terms of greater subsequent demand for healthcare, particularly orthopaedic surgery, earlier loss of independence and loss of productivity. Unless health benefits can be maintained in a way that is cost effective it may be difficult to justify the hospital programme. By comparison the longer term health and economic benefits of surgical intervention are easier to quantify (Brooks, 1969).

5.4 Total cost analysis.

In a previous total cost analysis of this rheumatic disease unit a similar methodology was used and the total cost of providing inpatient rheumatology services was estimated at ~£350,000 in 1986 (Meldrum, 1987) compared with the results of our own studies- ~£500,000 in 1992/3 and ~£750,000 in 1994/95. In 1991 the rheumatic diseases unit moved from a small specialist hospital with fewer than two hundred beds to its current site at the Western General Hospital, an 800 bed teaching hospital. Logistic differences and the effect of inflation are likely to explain most of the differences in cost between the two analyses. For instance, the earlier study estimated the cost of providing a dedicated patient transport service at ~£14,000 and this was no longer required after the transfer of services. Similarly the difference in the cost of overheads probably represent economies of scale at the larger hospital. Changing trends in healthcare can
also be inferred for instance, the use of splints, which was far higher in the earlier study, accounted for ~£15,000 in 1986 and ~£8600 in 1994.

For most services the increase in cost between the 92/93 and 94/95 analyses is between 10-20%. It was considerably higher for laundry services (117%) due to private tendering and for capital charge (2000%). A provisional estimate, based on the rateable value of the ward accommodation at the previous site, was given by the hospital administration for 92/93 due to lack of more accurate information. This proved to be a gross underestimate for the new location but since the capital charge was equally apportioned between the two groups the discrepancy did not effect the economic analysis or the stability of the conclusions. A similar methodology using comprehensive per diem hospital costs for 92/93 has been used to calculate an average charge of F4,400 (Dutch guilders) for an inpatient stay of 11 days for patients with active rheumatoid arthritis. (Vliet Vlieland et al 1996).

5.5 Economic outcome.

The pilot study suggested that day-care was significantly cheaper than conventional in-patient management, with an incremental cost of £425 per in-patient. This represents a 40% increase in the cost for in-patients over day-patients and was largely attributable to the longer total duration of hospital based therapy for the in-patient group (182 versus 94 days) and thus higher direct medical costs (£11,282 versus £5,606). Transport costs, based on the most expensive option, for day-patients were substantially higher than for the in-
patient group (£1,808 versus £306) but were offset by the larger difference in direct medical costs.

The main study demonstrated a small reduction in resource cost in favour of day patients but certainly not of similar magnitude to the results of the pilot study. The ratio of costs per day for day patients and inpatients was comparable in both studies (pilot study: 1.04, main study: 1.02) and would not account for the different economic conclusions. The major determinant of overall direct hospital cost, and the explanation for the different conclusions, is the duration of hospital based therapy which was significantly shorter for inpatients in the main study compared with the pilot study (13 and 20 days respectively).

Several factors probably contribute to the shorter duration of inpatient stay in the main study. Firstly it would appear that, on average, patients in the main study were slightly less disabled than those in the pilot study as reflected in lower scores on the Health Assessment Questionnaire. The inclusion criteria, which included deteriorating functional status, were similar for both studies but, to be eligible, patients were only required to fulfil one of five criteria. It is therefore possible that the two studies differed in respect to which individual inclusion criteria were fulfilled. Secondly pressure for beds from acute specialities may have resulted in earlier supported discharge. Finally, although day patients and inpatients received similar clinical care, it is possible that the pilot study improved the efficiency with which this was delivered. One of the prerequisites of day care is an element of forward planning by the multidisciplinary team to combine hospital and home based care and this probably improved
communication and efficiency within the team. It would seem unlikely that a more efficient package of care would be restricted to the day care limb of the trial and this may also have played a part in shortening duration of inpatient therapy in the main study.

Although this study has demonstrated a small reduction in cost for daypatients it has also indicated that implementing day care would alter the distribution of cost between hospital, community and patient. In particular the cost of providing community care for day patients is significantly higher than for inpatients and patients themselves bear significantly higher transport costs. It may be currently politically expedient to shift the burden of care from hospital to community. However patients with chronic diseases are already socially and economically disadvantaged and it is questionable whether it would be reasonable for them to carry additional costs.

It is uncertain whether the potential savings from implementing a day care facility would be realised in practice. A day patient unit would probably generate additional workload and the spare inpatient capacity would be redeployed. Day-patient care may offer a cheaper alternative to conventional admission (Lambert and Hurst, 1995; Ives and Lambert, 1995). By returning home at night there may be savings on "hotel" costs, particularly night-time salary costs. Planned day-care, adjusted to individual requirements allows patients to follow a prescribed programme of medication and exercises at home between episodes of hospital based activity. With conventional in-patient care these patients would have occupied a hospital bed continuously, and incurred the associated fixed costs. Planned day-care may,
by concentrating hospital based activity, reduce the time spent on therapy based in hospital and either improve the rate of patient throughput or reduce bed occupancy.

5.6 Conclusions and direction of future research.

This research has demonstrated that the clinical outcome of day-patient care for patients with active rheumatoid arthritis is equivalent to that of in patient care and that there is a small reduction in cost. The saving is marginal and alone is probably insufficient justification to promote day-patient care. However, day-patient care was certainly well accepted by patients and does offer a cost-effective alternative to conventional admission.

An obvious problem, which the results of this work have highlighted, is that the benefits of either form of intensive hospital based therapy are short term. This may not directly reflect on the efficacy of the intervention but it does raise the issue of whether the expense of providing this care can be justified without an effective method of maintaining the clinical benefit. This is one of the issues that future research must address.

Another related area for further work concerns the refinement of outcome instruments. At the moment the use of these instruments remains largely confined to clinical trials and health services research and few units routinely incorporate outcome assessment in clinical practice. There are several practical issues to be resolved before this becomes feasible but there may be considerable economic and clinical benefits in being able to monitor changes in health in 'real time' and target intervention accordingly.
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Appendix 7.1.
Pilot study
Boxplots of day and in patients on admission, discharge and six month follow up
Median, inter-quartile range, range and extreme outliers shown

7.1.1 Erythrocyte sedimentation rate

7.1.2 Ritchie articular index
7.1.3 Health assessment questionnaire

7.1.4 Functional independence measure
7.1.5 Hospital anxiety and depression scale, anxiety score

7.1.6 Hospital anxiety and depression scale - depression score
Appendix 7.1.4
Pilot study - Wilcoxon Signed Ranks Test

### Test Statistics

<table>
<thead>
<tr>
<th>Z (2-tailed)</th>
<th>ESR5 - ESR at admission</th>
<th>ESR6 - ESR at discharge</th>
<th>ESR7 - ESR at 6 month follow-up</th>
<th>RA5 - RAI pain at admission</th>
<th>RA6 - RAI pain at discharge</th>
<th>RA7 - RAI pain at 6 month follow-up</th>
</tr>
</thead>
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<td>-1.690a</td>
<td>-.561a</td>
<td>-.663b</td>
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<td>.508</td>
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<th>Z (2-tailed)</th>
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<th>HAQ6 - HAQ at discharge</th>
<th>HAQ7 - HAQ at 6 month follow-up</th>
<th>FIM5 - FIM at admission</th>
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- **a.** Based on negative ranks.
- **b.** Based on positive ranks.
- **c.** Wilcoxon Signed Ranks Test
Appendix 7.2
Main study
Frequency distributions for aggregated data on admission

Appendix 7.2.1
Erythrocyte sedimentation rate

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![Box plot of blood sedimentation rate on admission]
Appendix 7.2.2
Ritchie articular index

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![Box plot for Ritchie articular index](image)
Appendix 7.2.3
Health assessment questionnaire

Statistics

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![Box plot of HAQ - adm scores]
Appendix 7.2.4
Hospital anxiety and depression scale (anxiety)

### Statistics

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![Box plot for HAD Anxiety adm](image)
Appendix 7.2.5
Hospital anxiety and depression scale (depression)

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[Box plot diagram for HAD Depression - adm]
Appendix 7.3
Main study
Boxplots of day-patient and inpatient data on admission, discharge and 12 month follow up

7.3.1 Ritchie articular index

7.3.2 Erythrocyte sedimentation rate

7.3.4 Health assessment questionnaire
7.3.5 Hospital anxiety and depression scale, anxiety score

7.3.6 Hospital anxiety and depression scale, depression score

7.3.7 Quality of well-being index
7.3.8 Time trade off value
APPENDIX 7.4
Main study
Analysis of covariance

Appendix 7.4.1
Regression ESR- discharge

Variables Entered/Removed\(^a\)

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\(^a\) All requested variables entered.

\(^b\) Dependent Variable: blood sediment rate - discharge

Coefficients\(^a\)

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\(^a\) Dependent Variable: blood sediment rate - discharge
Appendix 7.4.2
Regression ESR- follow up

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a. All requested variables entered.
b. Dependent Variable: blood sedmn rate - follow-up

Coefficients

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a. Dependent Variable: blood sedmn rate - follow-up
OUTCOMES IN RHEUMATOLOGY
SERIES EDITORS: D. L. SCOTT AND A. SILMAN
HEALTH ECONOMICS AS AN ASPECT OF HEALTH OUTCOME:
BASIC PRINCIPLES AND APPLICATION IN RHEUMATOID ARTHRITIS
C. M. LAMBERT and N. P. HURST
Economic and Health Outcomes Research Group, Rheumatic Diseases Unit, Western General Hospital, Crewe Road
South, Edinburgh, EH4 2XU

SUMMARY
Health economic evaluation comprises the systematic appraisal of the costs, the benefits and the relative economic efficiency of different medical interventions. The first section of this paper outlines the techniques of economic analysis and how they relate to the efficient use of health resources. This is followed by a review of the health economics of rheumatoid arthritis as a model for the wider application of health economics in the field of rheumatology.

KEY WORDS: Health economics, Health outcome, Rheumatoid arthritis, Economic evaluation.

‘The NHS should be evaluated on medical outcome, economic efficiency and social acceptability’ [1]. Perhaps at no time over the intervening 20 yr since Sir Richard Doll made these comments has there been a more pressing need to ensure that our treatments are effective (produce the desired health outcome) and efficient (produce desired outcome for least expenditure). Economic efficiency implies that the choice of medical treatment produces the maximum benefit from available resources. In practice this involves weighing up the relative benefits and costs of alternative treatments and giving priority for funding to those producing the greatest net benefit (benefit minus cost).

Although the techniques of economic evaluation are equally relevant to both purchasers and providers in the NHS, this paper aims to demonstrate their potential to the rheumatologist, firstly as a means of improving the technical efficiency of treatment for rheumatic disease and secondly, armed with economic data on the efficiency of different treatments, as a means of advancing the claim that greater resources should be allocated to particular rheumatology services. An outline of the techniques of economic analysis and how they relate to different types of economic efficiency is presented in the first section. This is followed by an examination of the available evidence on the economic efficiency of treatment for rheumatoid arthritis (RA) which highlights the limitations of existing studies and suggests the direction that further studies might take. The paper concludes with the proposal that a core set of routine economic outcome measures should be included in all RA trials.

TECHNIQUES OF ECONOMIC ANALYSIS
Health economic evaluation comprises the systematic appraisal of the costs, the benefits and the relative economic efficiency of different medical interventions.

Economic evaluation and assessment of health outcomes should not be divorced from one another; indeed they measure different facets of the same problem, namely how to deploy health resources to best effect.

Whilst the costs of a health programme are readily measured in monetary terms, the benefits may be measured in terms of monetary gain, health gain or both. Assessment of health gain, which is both difficult and controversial, may be achieved using either so-called ‘disease specific’ or ‘generic’ instruments. The latter are particularly useful when comparison is to be made between health programmes for different diseases since they permit measurement of health gain in terms of common ‘health units’. Monetary gains arising from a health intervention, such as improved productivity or a reduced dependence on services, must also be quantified. The use of each of the main types of health outcome instrument in health economic analysis will be discussed below. It should be emphasized that the relevance of economic evaluation to practising rheumatologists is that it provides the means of demonstrating value for money which may help in the fight for a bigger allocation of the local ‘health cake’. At the very least an understanding of the issues will enable rheumatologists to ensure that their allocated slice of health cake is used to greatest benefit. Providers ignore this at their peril since some health board purchasing teams may already be using economic and health outcome indicators to evaluate their purchasing priorities. In the longer term, failure to provide evidence of health gain and economic efficiency may result in loss of resources. Taking a more cynical view, purchasing teams may employ the methodologies of health economics as a means of cost-containment rather than for achieving an equitable distribution of health care.

Assessment of economic efficiency
Broadly there are two forms of economic efficiency: technical (operational) efficiency and allocative efficiency. The former is likely to be most relevant to the practising rheumatologist who is concerned with drawing up business plans and contracts.
Operational efficiency begins with the assumption that the condition is to be treated and that it is worthwhile to do so; the issue is how to meet the objective, for instance achieving remission of active RA, at least cost. Cost-effectiveness analysis (CEA), in which the cost per unit change in health outcome is calculated, is the most appropriate technique for assessing operational efficiency. In CEA although the quantitative outcomes of different programmes may be expected to vary, these outcomes can be expressed in common natural units, for example the improvement in functional capacity measured with the Health Assessment Questionnaire (HAQ) or reduction in erythocyte sedimentation rate. Technical efficiency is optimal when the programme produces the desired clinical outcome at least cost. Since the role of providers is to secure and fulfil contracts for delivery of healthcare in a competitive market, the ability to demonstrate technical efficiency will be important in influencing prospective purchasers.

Allocative efficiency is concerned with the wider political issue of whether it is worth achieving a given objective or whether an alternative programme would produce greater overall benefit to society. Two techniques, cost–benefit analysis (CBA) and cost–utility analysis (CUA) may be used to assess allocative efficiency. CBA values both costs and benefits in monetary terms. Thus it is possible, at least in theory, to compare directly the benefits of quite disparate programmes, for instance a new sewerage plant vs a new hospital, in order to derive maximum total benefit from the available resources. Because of the practical difficulty of valuing the benefit of medical treatment in monetary terms, CBA has been rather neglected in the medical literature.

Allocative efficiency may also be examined using CUA. In the healthcare context, ‘utility’ refers to the subjective level of wellbeing or ‘quality of life’ that people experience in different states of health. Measurement of quality of life is particularly relevant when considering chronic diseases such as RA whose major impact is more on the quality rather than the length of life. This has given impetus to the development of ‘generic instruments’ which measure overall health status, independently of the underlying disease. Generic instruments fall into two categories: health indices which generate a single ‘utility’ unit of health, such as the Quality of Wellbeing index (QWB) [2], Euroqol [3] and Rosser index [4], and health profiles such as the Short Form 36 [5] and Nottingham Health Profile [6] which generate a profile of health status with separate scores for each of several domains, e.g. physical function, mental health, social or work role functioning.

For CUA an instrument which generates a single index of health status, usually on a scale of 1 (perfect health) to 0 (death) is required. Using this index, each year of survival may then be adjusted for the quality of life during that year to derive a ‘quality adjusted life year’ (QALY). Despite the appeal of having a single index which incorporates a measure of both quality and quantity of life, ‘cost per QALY’ league tables, which rank treatments on the basis of the marginal cost per additional QALY gained, should be interpreted with considerable caution. Problems include the philosophical difficulty of accepting the validity of a single unit of health, the fact that calculation of cost per QALY assumes that improvement in health is constant over a period of time, and that the marginal cost of achieving an increase in QALYs is heavily dependent on the control group being used for comparison. For example, the control might be an active intervention in which case the benefits might be small and the costs also small, or it might be a placebo, in which case both costs and clinical effects might be very much greater. The arguments for and against QALYs and the application of different forms of economic evaluation to the assessment of healthcare intervention have recently been reviewed [7–9]. It is clear that no single approach to health economic analysis is sufficient for all circumstances. The methods most appropriate to the problem under investigation must be chosen and applied carefully.

Analysis of the costs
Cost analysis is common to all forms of economic evaluation but there are different ways of expressing cost and, in the context of healthcare, it is particularly important to distinguish between average and marginal cost. Average cost may be defined as the total cost (i.e. fixed costs, such as overheads, plus the variable costs, such as catering and medication) divided by the total number of patients treated. Marginal cost is simply the additional cost incurred by treating one extra patient within an existing programme. If a facility is already operating at full capacity, treating additional patients would require new facilities or resources and would be costly. Since most decisions in healthcare are concerned with whether a little more or a little less of the service should be provided, rather than whether a service should be provided at all, marginal cost is usually the more appropriate consideration. For similar reasons, marginal analysis, in which the focus is on marginal cost and marginal benefit, is often more appropriate than analysis of ‘total’ cost and benefit.

Economic evaluation as a basis for changes in resource provision
As a provider, it is desirable to have some insight in to how purchasers may set priorities and how the rational basis for these decisions could be improved by greater attention to economic considerations. One approach to defining priorities, which has persisted despite considerable concern about its validity, is based upon an assessment of total need for a particular service with a proportionate allocation of resources [10]. Estimation of total need is expensive and, because in reality resources could never be expected to meet this need, it is largely irrelevant. Furthermore prioritization by needs assessment takes no account of the effectiveness of intervention and it is therefore divorced from consideration of efficiency criteria. ‘Cost of illness’
data, which have also been used to set priorities, have similar drawbacks [11, 12].

Since in practice it is small shifts of resources that are usually the issue rather than all or nothing decisions about service provision, marginal analysis offers a practical alternative to needs assessment as a basis for allocating resources. Marginal analysis provides a framework by which the effects on health outcome of small changes in the pattern of resource allocation ‘at the margins’ of different programmes can be measured. Resources may then be redeployed to interventions for which the benefits are high in relation to their cost with the result that technical efficiency is improved.

Rheumatologists may apply the principles of health economics discussed above in order to improve the technical efficiency of the treatment provided, and to identify which service or interventions should be expanded. First, the overall apportionment of the costs of the service between different key activities needs to be calculated, for instance between in-patient and out-patient services or between different types of out-patient activity. A judgement should also be made regarding the clinical effectiveness of each part of the service—an exercise which requires data on clinical outcome. Some examples where a critical economic appraisal may be worthwhile include: joint injection clinics, clinics for monitoring disease-modifying anti-rheumatic drug (DMARD) therapy, the use of nurse practitioners and outreach clinics in GP’s surgeries.

There are three different options which might be used to improve technical efficiency: the neutral cost option, the marginal expenditure option and the cost-saving option.

In the neutral cost option the question is whether simple redistribution of existing resources within the service will provide a more efficient service; this would enable more patients to be treated for the same total cost. For example, implementation of a day-patient programme as a cheaper alternative to in-patient care might liberate resources that could be used to expand other activity.

The marginal expenditure option assumes that somewhere in the system there is spare capacity which is not being used because of a rate-limiting factor such as clinic space or nursing staff which, if rectified, would allow more patients to be seen.

The cost-saving option is the same as the neutral cost option, but it is decided to save money from day-care implementation rather than expand other activities.

THE ECONOMICS OF RA

Economic evaluation of intervention in RA

While this review focuses on RA, the methodologies and problems are equally applicable to all other areas of rheumatology, and have been highlighted in earlier reviews of the economics of arthritis [13]. Economic evaluation has been undertaken of drug therapy, surgery and of various in-patient and day-patient regimes for RA. Most studies have been concerned with operational efficiency and have used CEA or CBA. A few have examined the wider economic impact of RA on society, but are of less practical value since they take little account of the effectiveness, or otherwise of medical intervention in RA.

Economic evaluation of drug treatment for RA

While numerous trials have demonstrated the short- and medium-term efficacy of drug therapy in RA, much less attention has been paid to the economic costs and benefits or to the global or overall health benefit of therapy. Measurement of the true costs, which include the cost of drug monitoring, medical supervision and iatrogenic morbidity, and benefits of medication is now considered mandatory by some government licensing authorities [14] and is becoming an important aspect of comparative drug trials [15, 16]. Combining economic data with data on comparative clinical efficacy and benefit will contribute to the development of more rational prescribing, and will hopefully reduce the tendency to focus only on the cost of the medication.

The only prospective randomized controlled trial of DMARD therapy in which an economic evaluation was included was a 6-month study comparing oral gold with placebo [17]. The HAQ was used to assess functional outcome and the QWB scale was used to derive a utility value to describe net health outcome. Patients receiving auranofin showed a net improvement in HAQ of 0.14 compared with placebo, which is equivalent to all patients improving from being able to walk outdoors on level ground with much difficulty to being able to walk on level ground with some difficulty. Similarly, in terms of the QWB score, the additional benefit of oral gold over placebo was expressed as being equivalent to the improvement in moving ones own wheelchair without help to walking with physical limitations.

The total additional medical cost per patient receiving auranofin for 6 months was US$1160 per annum which includes: auranofin ($405), in-patient treatment ($406), out-patient visits ($153) and laboratory tests ($226). The fact of making the economic costs and health benefits explicit allows one to ask whether the observed improvement in health is worth $1160 per patient.

Unfortunately, the authors did not try to quantify the economic benefit of the observed health gain. Instead they attempted to evaluate the economic benefits by asking patients how much money they would pay and what risk of immediate death they would accept in return for a hypothetical cure for their disease [18]. Overall, these subjects, who had suffered from unremitting RA for at least the previous 6 months, on average were prepared to accept a 27% chance of immediate death and would pay 22% of their household income to obtain a cure. However, whilst these figures amply illustrate how seriously patients regard their arthritis, they do not represent the actual sum that patients would forego, or the risk they would incur, in return for the actual benefit of auranofin therapy and could not therefore be used in CBA.

The other problem with this study is that it is not possible to use the utility value derived from the QWB
scale to calculate a QALY for CUA. In general, calculation of cost per QALY assumes that improvement has been constant over a given period. In the auranofin study the observed improvement was observed only over 6 months and was clearly not constant over that time [19]. A much longer period of observation, and an attempt to integrate utility values over time, would have been required to undertake CUA.

By analogy with indirect cost, an improvement in employment status as a result of therapy represents an indirect benefit. No prospective trial in RA has demonstrated enhanced earnings as a result of DMARD therapy [17, 20, 21]. Data from the auranofin trial suggested that the decline in earned income which accompanies progression of RA may be attenuated by DMARD therapy, but the income advantage in the group receiving oral gold was not statistically significant [17]. The clinical benefit of DMARD therapy is usually only apparent after some months and prolonged trials of more than 6 months duration would be required to establish an effect of treatment on earnings.

Although the auranofin study has shortcomings, it illustrates a number of the problems in attempting to combine measurement of economic and health outcomes and provides a model on which other studies might build.

**Economic evaluation of surgery in RA**

Despite its cost, which in one study amounted to 69% of the direct costs of treating RA [22], there is good evidence that surgical intervention in RA can be extremely cost beneficial [23–25].

In one CBA of a rheumatology service the indirect costs and benefits of surgical synovectomy of the knee were studied in 366 patients of whom the majority had RA [23]. This study demonstrated that surgical synovectomy provided net economic benefit even though it was only used on 19% of the patients and only the indirect benefits arising from return to employment were included in the calculation. It was shown that, even under the most pessimistic assumptions used to calculate the benefit, the indirect benefit arising from those able to return to work following surgery offset the cost of treating all 366 patients in the study.

A Swedish study of 54 patients with RA undergoing hip or knee arthroplasties also demonstrated net economic benefit as well as the expected health benefits in terms of improved locomotor function [24]. Although only four patients (7.4%) returned to employment the annual gain to society from these four patients was equal to the total costs of 12 hip or seven to eight knee replacements. To this could be added a substantial annual saving attributable to reduced need for social support as a result of improvement in locomotor function. In terms of work disability the economic benefit of hip replacement is rather less for patients with RA than with other forms of hip disease because of locomotor comorbidity [26]; these data therefore underestimate the benefit accruing from arthroplasty in patients with single or limited joint pathology.

**Economic evaluation of in-patient and day-patient regimes for active RA**

Several studies have demonstrated that in-patient care accounts for most of the direct medical cost of patients with RA. In the United States, while only 6.5% of a sample of 24,000 patients with RA were hospitalized and 4.9% received nursing home care annually, these services accounted for 70% of RA-related expenditure (US$19.26 million) [27]. In the UK, two recent studies demonstrated that 56% (£450,000) and 70% (£290,000), respectively, of the total annual expenditure on hospital-based rheumatology care was attributable to in-patient care [28, 29]. In these rheumatology units, patients with RA accounted for 85% [28] and 49% [29] of bed occupancy. Furthermore between 50 and 80% of in-patient costs are attributable to fixed costs over which clinicians have little or no control [29, 30]. Since hospital medical admissions for RA are mainly for the treatment of active disease, and to a lesser extent for the management of systemic and neurological complications, the evidence for the effectiveness and economic efficiency of hospital-based treatment of active RA warrants examination.

Although several early and mostly uncontrolled studies reported the benefit of prolonged bed rest and immobilization in the management of active RA [31, 32] this was not substantiated by controlled trials which demonstrated similar outcome with shorter duration of admission [33, 34]. Until recently it remained unclear to what extent the individual components comprising in-patient therapy contributed to overall clinical improvement or indeed whether in-patient therapy offered any advantage over out-patient care. Several recent uncontrolled and controlled trials have addressed this issue [35–41].

Anderson et al. compared short- and long-term efficacy of intensive in-patient care with out-patient care and concluded that 2 weeks hospitalization brought about prompt, sustained improvement as measured by early morning stiffness, pain and joint scores over 12 weeks [35]. The out-patient group improved only in pain score. Over the 2-yr study period overall healthcare costs were substantially higher for in-patients with an incremental cost of US$4866, but after 2 yr there was little clinical difference between the groups. This trial was small, unrandomized and the two groups were poorly matched for disease severity; the trial was therefore open to bias. Finally, as the authors point out, the economic analysis was incomplete as it failed to quantify the indirect costs and benefits and thus no useful estimate of cost effectiveness could be made. Four other studies, three non-randomized and one controlled, demonstrate short-term clinical benefit from in-patient care for active RA compared with out-patient care [36–39] but none include an economic evaluation.

A more complete economic analysis was included in a randomized study of in-patient vs intensive out-
patient therapy [40]. All relevant costs were measured for in-patient and intensive out-patient care and clinical outcome was compared using a composite score derived from mean change scores for laboratory and clinical variables. Apart from the period of hospitalization every effort was made to apply a similar treatment strategy to both groups and outcome was evaluated at 19 weeks. In-patient therapy produced a sustained 3-fold increase in efficacy, at a 2.5-fold increase in cost, suggesting that in-patient is more cost effective than out-patient therapy. The incremental benefit of in-patient care was calculated to have cost an additional Can$3000 per patient. Again, these data allow some judgements to be made as to whether the gain in health is worth the extra expenditure. However, to be of greater relevance such studies need to use common, agreed clinical and economic outcome measures to enable a comparison of cost effectiveness with other interventions.

There are clearly short-term clinical benefits arising from hospital admission and contact with a multidisciplinary team, but it is not clear whether a shorter period of in-patient care would yield similar benefit at less cost [42]. There is some evidence that serial global assessments, whether determined by physician, patient or physiotherapist, improve linearly for the first 21 days of admission for active RA [43]. Very brief in-patient admission may therefore fail to achieve optimal outcome.

Day-patient care may offer a cheaper alternative to conventional admission. By returning home at night there may be savings on 'hotel' costs, particularly night-time salary costs. Planned day-care, adjusted to individual requirements, allows patients to follow a prescribed programme of medication and exercises at home between episodes of hospital-based activity. With conventional in-patient care these patients would have occupied a hospital bed continuously, and incurred the associated fixed costs. Planned day-care may, by concentrating hospital-based activity, reduce the time spent on therapy based in hospital and either improve the rate of patient throughput or reduce bed occupancy. There is preliminary evidence that day-patient therapy does not compromise short-term clinical outcome and may be more cost effective when compared to in-patient care [41].

The economic impact of RA on society—the indirect costs

The inappropriateness of basing funding priorities on total needs assessment and cost of illness data has already been stressed, namely, that no account is taken of the effectiveness of medical intervention. Without such data, arguments for increased funding for medical intervention make little sense. A full discussion of the indirect costs of RA is beyond the scope of this article. However, it is worth indicating that most of the cost of RA to society arises through work disability and loss of production rather than the direct cost of medical or surgical intervention [44]. The younger the age of onset the greater the indirect cost [44].

These data raise potentially emotive issues about whether healthcare expenditure on RA should be targeted on selected groups in order to improve economic efficiency. For example, if provision of a rheumatology service focused specifically on 'high-risk' patients, of either sex, and of working age with early RA in functional class I or II was demonstrated to be cost beneficial by virtue of slowing the rate of functional decline and thereby reducing indirect costs, should this group receive priority either of access to care or funding? Some clinical indicators of poor prognosis are available, such as current functional status, which might allow selection of high-risk individuals [45, 46] and there is evidence that medical intervention is effective at least in the short and medium term. The social acceptability or 'equity' of this approach would be highly controversial. Nevertheless the extent to which we are prepared to sacrifice efficiency in order to preserve equity deserves consideration; protagonists of economic evaluation may argue that we could already fund greater equity if current efficiency was increased. Perhaps those advocating the targeting of patients with early polyarthritis, through provision of 'early synovitis' clinics [47] and who are implicitly arguing for a shift in limited resources should consider more carefully whether this policy is an equitable use of resources.

Limitations of economic evaluation

Early studies of the economics of RA [23, 35] adopted a relatively narrow perspective of the costs and benefits of treatment for RA. It is perhaps more appropriate to consider a global or 'societal' perspective which includes all the costs and benefits irrespective of to whom they are attributable. Much of the burden of RA does not have an economic impact and the 'intangible costs' such as loss of leisure time and suffering which impact on quality of life should also be assessed and measured. More recent economic evaluations in RA do adopt a societal perspective [17, 40, 41] and include quality of life measures [17].

Economic evaluation should be viewed as an aid to decision making rather than as a prescription. Without such tools assessment of the relative values of treatment options would be ill informed and based on arbitrary assumptions regarding costs and outcomes. Equally, it would be inappropriate to rely exclusively

<table>
<thead>
<tr>
<th>Costs</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct</strong></td>
<td><strong>Health benefits</strong></td>
</tr>
<tr>
<td>Hospital</td>
<td>e.g. quality of life</td>
</tr>
<tr>
<td>(including cost of treating</td>
<td></td>
</tr>
<tr>
<td>side-effects)</td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td><strong>Economic benefits</strong></td>
</tr>
<tr>
<td></td>
<td>e.g. willingness to pay</td>
</tr>
<tr>
<td><strong>Indirect</strong></td>
<td><strong>Return to productivity</strong></td>
</tr>
<tr>
<td>Loss of productivity</td>
<td>(work)</td>
</tr>
<tr>
<td>(work)</td>
<td></td>
</tr>
</tbody>
</table>

| TABLE I                      |                         |
| Components of an economic evaluation |                 |


on economic considerations when making decisions on resource allocation. The limitation of existing methodologies, in particular cost per QALY league tables, must be understood and other factors, such as equity, borne in mind [48].

CONCLUSIONS

Whilst we can demonstrate that some current therapy for RA is effective it is more difficult to argue on existing evidence that it is used in the most efficient manner. The same is almost certainly true for most of clinical practice. Medical audit provides an opportunity to correct this deficiency, but, by largely restricting its concern to effectiveness with little attention to the cost, has so far done little to improve the efficiency of healthcare in the UK. Recently an international group has set out a core set of clinical outcome measures for use in all RA clinical trials and this recommendation has been endorsed by the International League Against Rheumatism and the American College of Rheumatology [49]. The greatest single contribution to improving the economic efficiency of future treatment for RA would be to have similar consensus on a core set of economic outcome measures for all RA trials.

At the very least, when assessing a novel intervention, a careful appraisal of the direct and indirect costs and benefits, as measured by agreed clinical and economic outcome measures would permit an evaluation of cost effectiveness (Table I). This would allow a direct comparison with other available interventions within that field. Not only would such a policy lead to refinement of future management strategies for RA, but it would also strengthen arguments for increased funding for the treatment of RA.

REFERENCES


CLINICAL AUDIT

A PILOT STUDY OF THE ECONOMIC COST AND CLINICAL OUTCOME OF DAY PATIENT VS INPATIENT MANAGEMENT OF ACTIVE RHEUMATOID ARTHRITIS

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*Economic and Health Outcomes Research Group, Rheumatic Diseases Unit, Western General Hospital, Edinburgh. †Department of Public Health Sciences, Medical School, University of Edinburgh

SUMMARY
The aims of this pilot study, which compares day patient with inpatient care for management of active RA were (i) to test the feasibility of a trial protocol design including the method of randomization and the practicality of data collection, and (ii) to obtain preliminary information on economic cost and clinical outcome of these two methods of management. Twenty consecutive patients requiring admission for management of active RA were randomized to receive either day patient or inpatient care. All hospital, transport, community and indirect costs incurred over a 6-month period from recruitment were collected for each patient. Disease activity and clinical outcome were assessed using the Ritchie articular index, ESR, Health Assessment Questionnaire, Functional Independence Measure and Hospital Anxiety and Depression Scale. The trial protocol was found to be feasible and no patient allocated to the day patient group requested or required to be transferred to inpatient care. Day care was significantly cheaper than inpatient care despite higher transport costs; the total cost of treating 10 day patients was £10 272 compared with £14 528 for 10 inpatients. Clinical outcome was comparable in both groups for all parameters studied and there was no obvious detrimental effect on patients receiving day care. This pilot study demonstrates that day care is feasible and acceptable to patients with active RA. The preliminary data suggest that day care is substantially cheaper than inpatient care and does not apparently compromise clinical outcome.

KEY WORDS: Rheumatoid arthritis, Day care, Outcome, Therapy, Health economics.

INCREASING constraints on healthcare expenditure are forcing a re-evaluation of inpatient care for a number of medical conditions, including active RA. In some parts of the UK it is becoming increasingly difficult to provide inpatient care for patients with active RA. It may therefore be appropriate to reappraise the benefits and costs of hospitalization of patients with active RA and to consider whether alternative management strategies may offer comparable clinical outcome at lower cost.

Hospitalization of patients with active RA has been shown to be clinically effective in a number of studies both in the UK and North America [1-4], but is unfortunately relatively expensive because of high fixed costs such as hospital overheads and ward running costs [5, 6]. Admission for multidisciplinary care comprises several elements including bed rest, withdrawal from domestic pressures, medication, education and physical therapy, but the individual contribution of each element to the overall clinical benefit remains uncertain. We have therefore examined the possibility that a day patient regimen for patients with active RA may be cheaper while preserving the clinical benefits of full inpatient care.

We report here the results of a pilot study which compares the clinical outcome and economic cost of day patient care with inpatient care for the management of active RA. The purpose of this pilot study was to test the feasibility of day care, the practicality of a trial protocol design, including the randomization method and collection of economic and clinical outcome data, and to obtain preliminary economic data. Although clinical outcomes have been recorded it must be emphasized that it was not the intention of this pilot study to evaluate formally the clinical efficacy of day patient care.

PATIENTS AND METHODS

Subjects
Twenty consecutive patients attending the rheumatic diseases unit, in whom the decision had been made to admit to hospital for further management of active RA, were randomized to receive either day patient or inpatient care. The criteria for admission, which are those normally applicable in our unit, included deteriorating functional status, active synovitis, laboratory evidence of active inflammation, the need for rest and physical or psychological treatment and, usually, modification or introduction of second-line drug treatment.

Exclusion criteria included (a) medical complications of RA (e.g. septic arthritis, vasculitis, neuropathy, myelopathy); (b) those for whom admission had been specifically requested by the general practitioner and (c) inability to reach hospital by 10.00 hours when the ward therapy programme began. A time rather than distance limit from the hospital was set for practical reasons—the rheumatology unit covers both the city of...
Edinburgh and large country areas, and ease of access to the hospital is to some extent dependent on place of residence rather than distance.

**Trial design and randomization procedure**

After the decision to admit had been taken, each patient was randomized using a sequence of sealed envelopes containing random treatment assignments. Written explanation of the purpose of the study was given to those patients randomized to the day patient group. Informed consent was sought in writing from day patients according to the method of 'randomized consent' [7]. It was made clear to patients randomized to the day patient group that they could elect to transfer to inpatient care, if they desired, without prejudice to their management. Day patients could be transferred to inpatient care if medically indicated but the results were analysed on the basis of intention to treat. Readmission for active RA during the trial period, was recorded as an outcome and the costs of readmission were included in the economic analysis. Readmission for medical or surgical complications of RA were recorded but the costs were not calculated.

**Patient management protocols**

The treatment of both groups conformed to normal clinical practice. Multidisciplinary care was provided by physicians, nurses, paramedical staff and a social worker and the prescription of medication or other therapy was left to the discretion of the attending physician. Whereas inpatients were treated as one continuous admission until discharge, day patients received hospital therapy (between 10.00 and 17.00 hours) interspersed with periods at home, following prescribed regimens of rest, physiotherapy and medication. Hospital therapy for each patient ended when medical control of RA had been achieved, and relevant physiotherapy, occupational therapy, social and psychological needs had been identified and addressed. Patients in each group were fully assessed twice per week in order to monitor progress and identify satisfactory completion of therapy. Changes in DMARD therapy, the frequency of intra-articular steroid use and the number of contracts with paramedical services were recorded. In cases where the disease subsequently relapsed requiring further hospital-based care, the patient remained in the same allocation group and recommenced therapy.

**Assessment protocols**

**Disease process assessments.** The Ritchie articular index [8] and the ESR (Westergren) were recorded on admission, discharge and at 3 and 6 months.

**Disease outcome assessments.** Physical function was measured using the Health Assessment Questionnaire (HAQ) as modified for British patients [9] and the Functional Independence Measurement (FIM) [10]. The latter is an observer assessed instrument for measuring functional status employing seven levels of functional status for each of six areas of daily living. Psychological outcome was measured using the Hospital Anxiety and Depression Scale (HAD). Measurements were recorded on admission, discharge and 3- and 6-month follow up.

**Economic assessments.** The methodology for economic data collection is described separately for hospital, transport, community and indirect costs respectively.

**Hospital costs.** To facilitate calculation of the direct hospital costs for each group, hospital activity has been described in terms of a 'Unit Treatment Day' for inpatients (UTD-i) and day-patients (UTD-d) respectively. A standard cost has been calculated for UTD-i and UTD-d using data from a total cost analysis of rheumatology ward running costs (Table I). The cost of the UTD-d included all costs incurred between 09.00 and 17.00 hours each day, and of the UTD-i all costs incurred between 09.00 and 09.00 hours the following day. The total cost for each patient is then derived by multiplying the number of days of hospital treatment by the cost of the appropriate UTD.

These ward running costs fall into four major categories—patient care, patient services, overheads and opportunity costs. Patient care costs, which include medical, nursing and paramedical salaries, medication and investigations, are directly attributable to the rheumatology unit and have not been derived from overall average hospital costs. Although implementation of a day patient programme may allow savings on salary costs between 17.00 and 10.00 hours, this trial did not permit actual reduction in staff levels these costs have been assumed to be similar for both groups. Patient services including laundry and catering costs were itemized and calculated for day patients and inpatients separately. Overheads which comprise capital charges, energy consumption and maintenance have been obtained from the hospital administration and are derived from overall aggregate hospital costs and the percentage volume of hospital space occupied by the rheumatology unit. The opportunity cost may be defined as the benefit foregone (or income foregone) as a result of undertaking one activity rather than the next best alternative. The most economic and practical alternative to which ward space could be put has been considered to be office space with an imputed rental value of £100 000 per annum. Use of the ward as ‘hotel’ accommodation for patients not requiring nursing supervision was considered as an alternative model and

<table>
<thead>
<tr>
<th>Table I</th>
<th>Hospital costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UTD day patient (£ per day)</td>
</tr>
<tr>
<td>Salaries</td>
<td>Medical</td>
</tr>
<tr>
<td></td>
<td>Nursing</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td>Medication/investigation</td>
<td>6.89</td>
</tr>
<tr>
<td>Patient services</td>
<td>2</td>
</tr>
<tr>
<td>Overheads</td>
<td>2.84</td>
</tr>
<tr>
<td>Imputed rental value</td>
<td>9.78</td>
</tr>
<tr>
<td>Total</td>
<td>59.64</td>
</tr>
</tbody>
</table>

UTD, Unit Treatment Day.
would raise a lower income of £86 000 per annum, based upon 80% occupancy and using bed and breakfast rates.

Transport costs during hospital therapy. Transport details, including distance from home to hospital, number of journeys made and method of travelling were recorded. Costs were based on single journeys for each trip to or from hospital for both inpatients and day patients using taxi cabs at local charges (156p for first mile + 88p per mile there after + 60p booking fee + 50p waiting).

Community costs. Community costs comprise transport costs for attending hospital outpatient clinics or GP surgeries, salary costs for medical, nursing and paramedical services and continuing direct medical costs for medication and laboratory monitoring. Community transport costs to outpatients, GP surgery etc., were again calculated using taxi rates. Where a single visit served more than one purpose, e.g., a visit to GP and practice nurse, the cost of transport was shared. Diaries were issued on admission to the study and patients were requested to record the date and duration of contact with all medical and paramedical staff over the period of the study. Salary costs have been allocated on a fraction of earnings basis according to average contact time derived from the dairy records (Table II). The accuracy of these data was verified by cross checking the GP's records by telephone enquiry on two patients selected randomly from each group. Medication costs have been assumed to remain unchanged from discharge from hospital. The cost of each visit to the rheumatology outpatient clinic has been estimated to be £45 [12].

TABLE III
Trial exclusions

<table>
<thead>
<tr>
<th>'Non-RA' diagnosis</th>
<th>Medical exclusions with RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 16)</td>
<td>(n = 17)</td>
</tr>
<tr>
<td>Undefined polyarthritis</td>
<td>Septic arthritis</td>
</tr>
<tr>
<td>Psoriatic arthritis</td>
<td>Emergency admission</td>
</tr>
<tr>
<td>Temporal arteritis</td>
<td>Cervical myelopathy</td>
</tr>
<tr>
<td>Systemic vasculitis</td>
<td>Respite care for RA</td>
</tr>
<tr>
<td>Prostacycline infusion</td>
<td>Pre-operative assessment</td>
</tr>
<tr>
<td>Gout (acute)</td>
<td>Immunosuppressive therapy</td>
</tr>
<tr>
<td>Tuberculosis reactive arthritis</td>
<td>Rheumatoid vasculitis</td>
</tr>
<tr>
<td>Myositis</td>
<td>Infected ulcer</td>
</tr>
<tr>
<td>Acute cervical disc prolapse</td>
<td>Pregnancy + diabetes mellitus</td>
</tr>
<tr>
<td>Yttrium synovectomy</td>
<td>Depression + cystitis</td>
</tr>
</tbody>
</table>

Indirect costs. Indirect costs relate to production losses attributable to either the patient or their carers as a result of arthritis or its treatment. Indirect costs have been calculated according to the nature of employment on admission to the study rather than prior to the onset of disease. Whilst this may underestimate the true economic impact of the disease it reflects the indirect cost of treatment more accurately and allows the indirect costs of both groups to be compared. Patients who were unemployed, medically retired or of pensionable age on admission thus had no attributable indirect costs.

The indirect costs include the production losses arising from attending the hospital programme, and time off work during the remaining period of the study. There were no production gains arising from patients who were unemployed prior to admission to the study returning to work, which could be set off against production losses.

Information on days lost from work or unpaid activity has been collected by personal interview at 3 and 6 months from recruitment. Patients were supplied with diaries and requested to note any change in their employment status between discharge and 3- and 6-month interviews.

RESULTS

Analysis of admissions

During the period of study between January and June 1992, a total of 76 patients were admitted to hospital under the care of the rheumatologist. Patients with uncomplicated active RA accounted for 58% (44/76) of the inpatient workload and day patient treatment offered a practical alternative for 45% (20/44) of patients with active RA who would normally have been admitted as inpatients. Sixteen patients were ineligible for entry to the study due to a primary diagnosis other than RA and a further 17 had RA but were ineligible due to medical contraindications (Table III). Twenty-three patients were unable to reach hospital by 10.00 hours.

Assessment of method of randomization

Day patient care proved to be acceptable to all

TABLE IV
Summary of economic data

<table>
<thead>
<tr>
<th>Costs</th>
<th>Day patient</th>
<th>Inpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital cost</td>
<td>£59.64</td>
<td>£61.99</td>
</tr>
<tr>
<td>No. treatment days</td>
<td>194</td>
<td>182</td>
</tr>
<tr>
<td>Hospital cost (£)</td>
<td>£5006</td>
<td>11282</td>
</tr>
<tr>
<td>Transport cost</td>
<td>£1808</td>
<td>306</td>
</tr>
<tr>
<td>Mean distance home/hospital (miles)</td>
<td>9.15</td>
<td>7.10</td>
</tr>
<tr>
<td>No. visits to/from hospital</td>
<td>184</td>
<td>39</td>
</tr>
<tr>
<td>Community cost (£)</td>
<td>£2858</td>
<td>2940</td>
</tr>
<tr>
<td>Travel</td>
<td>751</td>
<td>790</td>
</tr>
<tr>
<td>Medication</td>
<td>713</td>
<td>713</td>
</tr>
<tr>
<td>GP visits</td>
<td>472</td>
<td>455</td>
</tr>
<tr>
<td>Outpatient rheumatology visits</td>
<td>250</td>
<td>855</td>
</tr>
<tr>
<td>Paramedical services</td>
<td>672</td>
<td>127</td>
</tr>
<tr>
<td>Total cost (£)</td>
<td>£10272</td>
<td>14528</td>
</tr>
</tbody>
</table>
eligible patients and none had to be transferred to inpatient therapy. The results suggest that randomized consent is a viable trial design for the purposes of this study and in particular show that the efficacy of this method is not compromised by a significant number of patients changing treatment groups.

Economic assessments

Data on the hospital cost, transport cost and community costs are given in Table IV. Although the sample size was small a major difference in costs between the groups was apparent at 6-month follow up. The cost of direct hospital care, transport and community costs of treating 10 day patients was £10 272 compared with £14 528 for 10 inpatients. The increased cost of inpatient care over day patient care, the incremental cost, is 41.4%. One inpatient and two day patients were in part employment on admission to the trial and incurred indirect costs of £224 and £2014 respectively. As these economic data related to so few patients their inclusion in the economic analysis would have unduly distorted the results and they have not been considered further.

Sensitivity analysis. Sensitivity analysis was undertaken to test the effect of altering occupancy rates, transport costs and imputed rental value for the ward space, on the calculated incremental cost of inpatient care. Increasing bed occupancy rates from 80 to 100% had a small effect and reduced the incremental cost of inpatient therapy by only 4.4% from 41.4 to 36.6%. Reducing the imputed rental value of ward space by 14% by basing it on hostel accommodation (income £86 000 per annum) instead of office space (income £100 000 per annum), also had a negligible effect and reduced the incremental cost of inpatient care by only 0.9 to 40.5%. However, if transport costs were calculated using ambulance car rates which are 40% cheaper than commercial taxi rates, there was a 9.4% increase in the incremental cost of inpatient therapy from 41.4 to 50.8%. Day care therefore becomes more cost efficient compared to inpatient therapy if cheaper transport is used, but slightly less cost efficient if bed occupancy rates rise or the imputed rental value is lower.

Clinical management protocols

The total duration of hospital-based therapy was similar in both groups; day patients median: 19 days (range 10–28), inpatients median: 20.5 days (range 14–27). The difference between the groups with respect to the number of hospital treatment days (9.4 vs 18.2) is accounted for by day patients spending part of the programme at home. The intensity of treatment with respect to intra-articular steroids, DMARDs, physiotherapy and occupational therapy is comparable in both groups (Table V).

Clinical outcome

The size of this pilot study does not permit firm statistical conclusions to be drawn regarding differences in clinical outcome between day patients and inpatients. However it is appropriate to comment on broad trends in process and outcome measurements. Clinical data on admission to the study confirm that both groups are evenly matched for disease process and functional and psychological parameters (Table VI). On discharge from hospital therapy both groups had achieved comparable improvement in process and physical function parameters. Six-month follow up data demonstrate that the day patients continued to

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Day patient</th>
<th>Inpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-articular (I/A) steroid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. patients given I/A steroid</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Total No. I/A steroid injections</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>DMARD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DMARD commenced</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>DMARD reintroduced</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>DMARD dose increased</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DMARD changed</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>DMARD discontinued</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DMARD stable</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. individual contacts (mean)</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Occupational therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. individual contacts (mean)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Clinical outcome

<table>
<thead>
<tr>
<th></th>
<th>Admission median (range)*</th>
<th>Discharge median (range)*</th>
<th>Six-months median (range)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESR</td>
<td>DP 69 (27–113)</td>
<td>IP 75 (30–120)</td>
<td>IP 105.5 (88–111)</td>
</tr>
<tr>
<td>Ritchie</td>
<td>DP 24.5 (13–71)</td>
<td>IP 30 (23–45)</td>
<td>IP 105.5 (88–111)</td>
</tr>
<tr>
<td>HAQ</td>
<td>DP 2.44 (0.88–2.88)</td>
<td>IP 2.5 (1.88–2.86)</td>
<td>IP 105.5 (88–111)</td>
</tr>
<tr>
<td>FIM</td>
<td>DP 109.5 (78–120)</td>
<td>IP 105.5 (89–111)</td>
<td>IP 105.5 (88–123)</td>
</tr>
<tr>
<td>HAD (anxiety)</td>
<td>DP 7.5 (3–17)</td>
<td>IP 9.5 (3–15)</td>
<td>IP 6 (0–15)</td>
</tr>
<tr>
<td>HAD (depression)</td>
<td>DP 6.5 (3–14)</td>
<td>IP 8 (3–13)</td>
<td>IP 7 (1–12)</td>
</tr>
</tbody>
</table>

HAQ, Health assessment questionnaire; FIM, functional independence measure; HAD, hospital anxiety and depression scale.
*Day patient (DP) vs inpatient (IP) at each point P>0.05 Wilcoxon.
improve with respect to each parameter while the inpatient group stabilized or showed slight deterioration. Statistical analysis using the Wilcoxon signed rank test indicates that the differences do not reach statistical significance (Table V). Based upon these and other data a trial of 60 patients in each group would be required to identify an important difference in outcome with an 80% power.

DISCUSSION

In this pilot study we have demonstrated that use of planned day-care is significantly cheaper than conventional inpatient management, with an incremental cost of £425 per inpatient. This represents a 40% increase in the cost for inpatients over day patients and is largely attributable to the longer total duration of hospital-based therapy for the inpatient group (182 vs 94 days) and thus higher direct medical costs (£11,282 vs £5,006). Transport costs, based on the most expensive option, for day patients were substantially higher than for the inpatient group (£1,080 vs £306) but were offset by the larger difference in direct medical costs. The overall demand placed upon the community services was similar in both groups. Sixty-five per cent of the difference in outpatient costs is accounted for by two inpatients attending on four occasions over 6 months (median no. visits for each group: 2). Both of these patients had admission and discharge indices of disease activity and physical and psychological function of comparable severity to the rest of the study population. Differences in the pattern of community care will be reflected in the cost of service provision and will be one indicator of the efficacy of day patient care.

The study is too small to permit firm conclusions to be drawn regarding the clinical efficacy of day care, but there was no obvious disadvantage to the day care group in terms of the outcome measures studied. The study also confirmed that the trial methodology is practicable and that the number of patients, in this unit, for whom day patient care could be applicable is sufficient to justify more detailed investigation. Day patient therapy may offer clinicians an alternative approach to inpatient care and, as it preserves the benefits of a multi-disciplinary team approach, it may also find wider application by those who presently are forced to treat active RA on an outpatient basis. We are now undertaking a larger study which will permit definite conclusions to be reached regarding both clinical and economic outcome.

The specific value of hospitalization for active RA was first demonstrated in a controlled trial comparing inpatient and outpatient treatment [3]. A 4-week period of hospitalization produced significant benefit for inpatients which was not apparent in the outpatient controls. Today, such a prolonged admission may be neither feasible nor desirable to the patient. More recent controlled trials have reported prompt and sustained benefit following 2-week admission [13]. It is unclear, however, from this and similar studies to what extent the individual components comprising inpatient therapy contribute to the overall clinical benefit.

Another randomized controlled trial demonstrated no difference between two groups of hospitalized patients, one permitted free activity, the other maintained on strict rest [14]. This calls into question the value of prolonged bed rest, one of the fundamental arguments in support of hospitalization for active RA. It is probable that the benefits consistently demonstrated by admission are achieved by a combination of the skills of the multidisciplinary team and the provision of a supportive environment which offers shelter from social and physical pressures and an opportunity to address psychological, emotional and educational as well as medical needs.

An analysis of the costs of providing inpatient rheumatoid facilities is the subject of two recent British papers [5, 6]. As we have found, in both studies RA patients account for a substantial proportion of inpatient workload. Over 50% of the allocation for provision of rheumatology services was consumed by inpatient care of which up to 80% was attributable to hospital overheads and ward running costs, including nursing salaries [5]. It is therefore apparent that most of the inpatient costs are 'fixed' rather than 'marginal' and that the total cost is therefore relatively insensitive to clinical activity. It follows that high bed occupancy rates coupled with shorter duration of hospital stay will reduce the average cost per patient. Alternatively, a day care strategy which reduces the need for night time medical or nursing cover and hence reduces fixed costs, may also be expected to reduce the total annual cost of inpatient care. Such savings would be unacceptable however if day care compromised clinical outcome to any significant extent. To address this issue well designed studies of cost-effectiveness are required.

The cost-effectiveness of inpatient and outpatient care has been examined in two studies from North America. Anderson et al. compared short and long term efficacy of intensive inpatient care with outpatient care and concluded that hospitalization brought about prompt, sustained improvement in 2 weeks albeit at a higher hospital cost [13]. This trial suffered several important drawbacks. Small numbers of patients were studied, the control group of outpatients was unrandomized and consisted of those who had refused inpatient care, and the two groups were not evenly matched for disease severity; the trial was therefore open to bias. Finally, as the authors point out, the economic analysis was incomplete as it failed to quantify the indirect costs i.e. productivity losses or gains. A more complete economic analysis was included in a randomized study of inpatient vs intensive outpatient therapy [15]. All relevant costs were measured for inpatient and intensive outpatient care and clinical outcome was compared using a pooled index. Inpatient therapy produced a sustained threefold increase in efficiency, at a 2.5 increase in cost, suggesting that inpatient is more cost effective than outpatient therapy. These studies thus leave open the question of whether a day patient regime which preserves all aspects of inpatient therapy except overnight admission, might be as effective as
inpatient care and better than intensive outpatient patient care.

Day patient care for patients with active RA may, by preserving the benefits of contact with a multidisciplinary care team, provide an alternative to conventional admission. By returning home at night there may be savings on ‘hotel’ costs, particularly night time salary costs. Planned day care, adjusted to individual requirements, allows patients to follow a prescribed programme of medication and exercises at home between episodes of hospital-based activity. With conventional inpatient care these patients would have occupied a hospital bed continuously, and incurred the associated fixed costs. Planned day care may, by concentrating hospital-based activity, reduce the time spent on therapy based in hospital and improve the rate of patient throughput.

This pilot study has demonstrated that day care is feasible for managing active RA and is acceptable to patients. The preliminary economic data suggest that day care may be substantially less expensive than conventional inpatient care but our pilot study is unable to address the question of whether the clinical outcome of day patient care is comparable to that of inpatient care. A larger more detailed economic and clinical outcome study which incorporates a generic instrument to record changes in health status is underway to compare day care and inpatient regimes.

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Is day care equivalent to inpatient care for active rheumatoid arthritis? Randomised controlled clinical and economic evaluation

C Michael Lambert, Nigel P Hurst, John F Forbes, Alison Lochhead, Mary Macleod, George Nuki

Abstract

Objective: To test the clinical equivalence and resource consequences of day care with inpatient care for active rheumatoid arthritis.

Design: Randomised controlled clinical trial with integrated cost minimisation economic evaluation.

Setting: Rheumatic diseases unit at a teaching hospital between 1994 and 1996.

Subjects: 118 consecutive patients with active rheumatoid arthritis randomised to receive either day care or inpatient care.

Main outcome measures: Clinical assessments recorded on admission, discharge, and follow up at 12 months comprised: the health assessment questionnaire, Ritchie articular index, erythrocyte sedimentation rate, hospital anxiety and depression scale, and Steinbrocker functional class. Resource estimates were of the direct and indirect costs relating to treatment for rheumatoid arthritis. Secondary outcome measures (health utility) were ascertained by time trade off and with the quality of well being scale.

Results: Both groups had improvement in scores on the health assessment questionnaire and Ritchie index and erythrocyte sedimentation rate after hospital treatment (P < 0.0001) but clinical outcome did not differ significantly between the groups either at discharge or follow up. The mean hospital cost per patient for day care, £798 (95% confidence interval £705 to £888), was lower than for inpatient care, £1253 (£1155 to £1370), but this difference was offset by higher community, travel, and readmission costs. The difference in total cost per patient between day care and inpatient care was small (£1789 (£1592 to £2027) v £2021 (£1834 to £2230)). Quantile regression analysis showed a cost difference in favour of day care up to the 50th centile (£374; £839 to £109).

Conclusions: Day care and inpatient care for patients with uncomplicated active rheumatoid arthritis have equivalent clinical outcome with a small difference in overall resource cost in favour of day care. The choice of management strategy may depend increasingly on convenience, satisfaction, or more comprehensive health measures reflecting the preferences of patients, providers, and service commissioners.

Introduction

Admission to hospital for treatment of active rheumatoid arthritis has been shown in controlled trials to be more effective than intensive outpatient care.1,4 The information available, however, is insufficient to assess whether inpatient care is more cost effective than management strategies that use outpatient or day care.

In an earlier pilot study we showed that day care, which preserves the benefits of multidisciplinary care, is acceptable to patients and might be less costly than inpatient care.2 The study was too small to draw firm conclusions regarding differences in clinical outcome, but the results suggested that day care did not compromise outcome.

Using a randomised controlled clinical trial with an integrated cost minimisation economic evaluation, we tested the hypothesis that inpatient and day care management of patients with uncomplicated active rheumatoid arthritis are clinically equivalent and that the resources needed are equivalent.

Subjects and methods

Subjects

A total of 118 consecutive patients attending the rheumatic diseases unit, for whom admission for management of active rheumatoid arthritis was indicated, were randomised to either day care or inpatient care. The basic criterion for admission was active rheumatoid arthritis, defined as deteriorating functional status, active synovitis, the need for review of second line drug regimen, and the need for physical or psychological treatment.

Exclusion criteria were medical complications of rheumatoid arthritis requiring immediate hospitalisation; inpatient care specifically requested by the general practitioner; and inability to reach hospital by 10 am, when the programme started. The method of randomised consent was used.31,1 Sealed envelopes containing random treatment assignments were used to allocate individual treatments. Results were analysed on the basis of intention to treat. Ethical approval had been obtained for the study.

Patient management protocols

Multidisciplinary care and medication were left to the discretion of the attending doctor. Whereas inpatients were treated during one continuous episode until discharge, day patients received treatment in hospital between 10 am and 4 pm, interspersed with periods at home, where they followed prescribed treatment. Patients were assessed twice each week, and treatment ended when there was no further clinical improvement. The intensity of hospital based and primary care intervention was recorded. If subsequently there was relapse of disease requiring admission, the patient remained in his or her original group and resumed treatment. At the conclusion of the study all patients were requested to state whether they would prefer day care or inpatient care for future flares of active rheumatoid arthritis.

Clinical assessments

Disability, measured with the modified health assessment questionnaire, the Ritchie index, and erythro-
cyte sedimentation rate (Westergren method); psychological status, measured with the hospital anxiety and depression scale; and Steinbrocker functional class were recorded on admission, discharge, and 12 month follow up. Secondary outcome measures were health utility, measured using the method of time trade off and the quality of well being scale.

**Economic assessments**

Costs were measured from the perspective of the health service and the patient. They comprised the direct costs of hospital based and community care intervention, transport costs, and the indirect costs incurred by patients involving forgone production as measured by cost of wages. A unit cost per day was calculated for each group; this consisted of patient care costs (salaries, medication and investigations), patient services (catering, laundry), overheads (energy consumption, capital charge, maintenance), and opportunity cost. The total hospital cost was then derived by multiplying the number of days of hospital treatment by the appropriate unit cost. Community costs consisted of costs of attending the general practitioner’s surgery, practice or district nursing, and paramedical services; for social support and domestic help; and for drugs not supplied on prescription. Transport details, including distance from home to hospital and to the surgery, number of journeys made, and method of travelling were recorded. Costs were based on total distance by ambulance car. Use of

<table>
<thead>
<tr>
<th>Table 1 Clinical and socioeconomic characteristics of patients with active rheumatoid arthritis</th>
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<tbody>
<tr>
<td><strong>Characteristics</strong></td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>Median (range) age (years)</td>
</tr>
<tr>
<td>Median (range) duration of disease (years)</td>
</tr>
<tr>
<td>No of women</td>
</tr>
<tr>
<td>No of patients with erosions</td>
</tr>
<tr>
<td>Steinbrocker class II</td>
</tr>
<tr>
<td>Steinbrocker class III</td>
</tr>
<tr>
<td>No living alone</td>
</tr>
<tr>
<td>No in paid employment</td>
</tr>
<tr>
<td>No unemployed</td>
</tr>
<tr>
<td>No on sick leave</td>
</tr>
<tr>
<td>No medically retired</td>
</tr>
<tr>
<td>No retired</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2 Description of treatment for active rheumatoid arthritis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Intra-articular steroid injections:</td>
</tr>
<tr>
<td>No of patients</td>
</tr>
<tr>
<td>No of injections</td>
</tr>
<tr>
<td>Second line therapy:</td>
</tr>
<tr>
<td>Started or restarted</td>
</tr>
<tr>
<td>Changed</td>
</tr>
<tr>
<td>Dose increased</td>
</tr>
<tr>
<td>Rheumatology outpatient visits</td>
</tr>
<tr>
<td>Community service visits:</td>
</tr>
<tr>
<td>General practitioner</td>
</tr>
<tr>
<td>Practice nurse</td>
</tr>
<tr>
<td>District nurse</td>
</tr>
<tr>
<td>Physiotherapist</td>
</tr>
<tr>
<td>Occupational therapist</td>
</tr>
<tr>
<td>Chiropodist</td>
</tr>
<tr>
<td>Orthotist</td>
</tr>
</tbody>
</table>

resources in the community and changes in employment status reported by the patient were verified by interviewing all patients. Primary care records were checked on a random sample of 10 patients in each group.

**Statistical and economic analysis**

To test clinical equivalence, the largest acceptable clinical differences in outcome between groups were chosen as: >0.25 points on the health assessment questionnaire (the main outcome measure), >50 mm/h difference in erythrocyte sedimentation rate, or >3 points on either the anxiety or depression scale of the hospital anxiety and depression scale. A total sample size of 105 patients was required to detect this difference in the health assessment questionnaire, between unpaired groups, with a power of 90% at the P<0.05 level (two tailed test).

Repeated measures analysis of variance were applied to data obtained at admission, discharge, and 12 month follow up to establish whether there were significant differences over time and between day patients and inpatients. Multivariate models were also used to explore the effect of baseline variables on outcome.

The clinical and economic evaluations were integrated in the trial design and execution. The cost minimisation technique for the economic evaluation followed published decision rules for cost effectiveness analysis. The equivalence trial design to test the null hypothesis of no significant difference in outcomes was followed, using a range of specific clinical assessments and health related utility measures.

The distribution of resource outcomes was compared by using generalised quantile regression to estimate cost quartiles, conditional on inpatient or day patient treatment. The impact of heteroskedasticity on standard errors and confidence intervals of coefficients was considered by comparing estimates based on analytical methods and bootstrap resampling. Non-parametric bootstrap methods were also used to calculate confidence intervals for arithmetic means of total resource use. All confidence intervals are based on 1000 bootstrap replications.

**Results**

**Analysis of admissions**

Between May 1993 and January 1995, 557 rheumatology outpatients who required admission to hospital and were screened for the study. Of the 200 patients with active rheumatoid arthritis, 118 satisfied the entry criteria and were randomised to receive day care (59 patients) or inpatient care (59 patients). Sixty patients were unable to travel and had medical complications. In each group, 51 patients completed the trial and eight were lost to follow up. During the study 11 day patients transferred to inpatient care, five owing to travelling difficulties, two for clinical reasons, two for domestic reasons, and two out of preference. Two inpatients requested day patient care and were transferred. The groups did not differ significantly in the baseline clinical and socioeconomic characteristics (table 1).

The mean duration of the initial hospital treatment episode was similar for day patients (13.2 days) and inpatients (13.6 days). Twelve day patients and seven
inpatients required readmission. The mean duration of readmission was similar for day patients (11.6 days) and inpatients (12.7 days). The mean number of days in which a bed was actually occupied during the initial treatment episode was significantly less for day patients (8.8 days) than inpatients (13.6 days); this is accounted for by day patients spending part of the treatment episode at home. Table 2 shows the hospital and community treatment received.

**Clinical evaluation**

On admission the erythrocyte sedimentation rate, Ritchie index, and hospital anxiety and depression scale scores were similar in the two groups, but day patients were slightly more disabled on the health assessment questionnaire score (P = 0.04, unpaired t test) (table 3). The erythrocyte sedimentation rate, health assessment questionnaire, and Ritchie index scores differed significantly over time (P < 0.0001, analysis of variance) but did not differ significantly between inpatients and day patients. Substantial improvement in disability (health assessment questionnaire), joint score (Ritchie index) and erythrocyte sedimentation rate were seen in both day patients and inpatients at admission and discharge (P < 0.0001, analysis of variance). Although small differences were observed in hospital anxiety and depression scale depression scores, these were not considered to be of clinical importance. During follow up after discharge from hospital, the health assessment questionnaire and Ritchie index scores deteriorated significantly in both groups (P < 0.0001, analysis of variance), but the erythrocyte sedimentation rate and the hospital anxiety and depression scale score did not (P > 0.5). The difference in health assessment questionnaire and Ritchie index remained highly significant after baseline variables were included as covariates in the models (table 3). Thus the groups showed equivalent clinical improvement with the initial hospital treatment and similar deterioration over the next year.

At baseline there was no significant difference in health utility between day patients and inpatients as recorded by time trade off or the quality of well being scale (P > 0.1, unpaired t test). Over the 12 months of follow up, both scores improved significantly (P = 0.025 and P = 0.001, respectively; analysis of variance), and were similar in day patients and inpatients. The magnitude of change in these measures was small and the clinical significance is uncertain (table 3).

**Economic evaluation**

The mean hospital cost per patient for day care, £708 (95% confidence interval £705 to £708), was lower than for inpatient care, £1253 (£1155 to £1370), but this difference was offset by higher community, travel and readmission costs. The difference in total cost per patient between day care and inpatient care was therefore small (£1789 £1539 to £2027) v £2021 (£1834 to £2230) (table 4).

The cost difference between day patients and inpatients was further examined using quantile regression (table 5). The cost quartiles for inpatient care are given by the coefficient reported for inpatient care. The sum of the inpatient and day patient coefficients provide an estimate of the cost quartiles for day patient care. The coefficients reported for the day patient group, which also represent the difference between day patients and inpatients, are negative at the 25th and 50th centiles and significantly different from zero. The cost differential, while still in favour of day patient care, diminishes towards the upper end of the distribution, as indicated by the small absolute difference at the 75th centile of around 5% in overall costs.

During the 12 month follow up, none of the 23 day patients and 27 inpatients who were previously on sick leave or medically retired due to rheumatoid arthritis resumed active paid employment. Of those in full time

<p>| Table 3 | Summary of clinical outcome data. Values are means (SD) determined by repeated measures analysis of variance corrected for baseline scores |</p>
<table>
<thead>
<tr>
<th>Variable</th>
<th>Admission</th>
<th>Discharge</th>
<th>Follow up after 12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ritchie index*</td>
<td>Day patients</td>
<td>27 (15.2)</td>
<td>27 (14.5)</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>27 (14.5)</td>
<td>27 (15.7)</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate*</td>
<td>Day patients</td>
<td>54 (34)</td>
<td>54 (32)</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>54 (32)</td>
<td>54 (30)</td>
</tr>
<tr>
<td>Score on health assessment questionnaire*</td>
<td>Day patients</td>
<td>1.74 (0.42)</td>
<td>1.37 (0.65)</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>1.54 (0.44)</td>
<td>1.28 (0.57)</td>
</tr>
<tr>
<td>Anxiety (hospital anxiety and depression scale)</td>
<td>Day patients</td>
<td>7.7 (3.4)</td>
<td>6.2 (3.5)</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>7.6 (4.2)</td>
<td>7.6 (4.3)</td>
</tr>
<tr>
<td>Depression (hospital anxiety and depression scale)</td>
<td>Day patients</td>
<td>7.2 (3.0)</td>
<td>5.8 (3.0)</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>7.4 (3.5)</td>
<td>5.9 (3.8)</td>
</tr>
<tr>
<td>Score on quality of well being scale†</td>
<td>Day patients</td>
<td>0.49 (0.05)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>0.49 (0.06)</td>
<td>—</td>
</tr>
<tr>
<td>Score for time trade off†</td>
<td>Day patients</td>
<td>0.76 (0.29)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Inpatients</td>
<td>0.65 (0.32)</td>
<td>—</td>
</tr>
</tbody>
</table>

*No significant difference (P > 0.05) over time between day patients and inpatients for any of the variables, but significant improvement in erythrocyte sedimentation rate, health assessment questionnaire, and Ritchie index between admission and discharge (P < 0.0001) and subsequent deterioration in health assessment questionnaire and Ritchie index between discharge and follow up (P < 0.0001).
†Significant improvement between admission and discharge up to 12 months (P < 0.0001) for both groups but no difference between day patients and inpatients.

<p>| Table 4 | Mean (95% confidence interval) resource costs (£/patient) by treatment regimen and resource category |</p>
<table>
<thead>
<tr>
<th>Resource category</th>
<th>Day patients</th>
<th>Inpatients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>768 (£705 to £888)</td>
<td>1253 (£1155 to £1370)</td>
</tr>
<tr>
<td>Community</td>
<td>323 (£247 to £463)</td>
<td>298 (£258 to £337)</td>
</tr>
<tr>
<td>Travel</td>
<td>417 (£370 to £472)</td>
<td>472 (£347 to £390)</td>
</tr>
<tr>
<td>Readmission</td>
<td>218 (£96 to £384)</td>
<td>134 (£38 to £205)</td>
</tr>
<tr>
<td>Total</td>
<td>1769 (£1533 to £2027)</td>
<td>2021 (£1834 to £2230)</td>
</tr>
</tbody>
</table>

| Table 5 | Quantile regression comparing total costs of inpatient and day care |
| --- | --- | --- |
| 25th centile: | Coefficient | 95% CI * |
| Inpatient | 1635 | 1477 to 1823 |
| Day patient | —364 | —647 to —82 |
| 50th centile: | Coefficient | 95% CI * |
| Inpatient | 1930 | 1717 to 2143 |
| Day patient | —374 | —659 to —109 |
| 75th centile: | Coefficient | 95% CI * |
| Inpatient | 2271 | 1929 to 2613 |
| Day patient | —121 | —769 to 527 |

*Based on standard errors estimated using bootstrap resampling.
employment at entry to the study, only two of the six
inpatients and five of the eight day patients continued
full time work. Of those in part time work, none of the
five inpatients and two of the five day patients
continued in work.

At the end of the study 31 (62%) of the day patients
and 21 (42%) of the inpatients (52% overall) expressed
a preference to be a day patient in the future.

Discussion

This study has shown that the clinical outcome of
day care for patients with active rheumatoid arthritis
is equivalent to that of inpatient care, but there is a small
reduction in resource cost. This finding may be
relevant to other medical specialties in which day care
is a possibility.

Several randomised studies have confirmed the
clinical benefit of multidisciplinary inpatient care
for active rheumatoid arthritis,1-3 which was suggested by
earlier unrandomised studies.4 However, the cost of
such treatment has restricted its application, and more
cost effective strategies have been sought. Three studies
that compared inpatient care with outpatient care
concluded that inpatient care gave the better clinical
outcome.5-7 Only one randomised study included a
complete economic evaluation, and it found that inpa-
tient care was more cost effective than outpatient care.8

In Canada a randomised controlled trial compar-
ing inpatient with day care for active rheumatoid
arthritis used similar inclusion criteria to our own
study.9 As in our study, functional outcomes were not
significantly different between the groups at discharge.

Duration of benefit

There is conflicting evidence regarding the duration of
benefit after intensive medical intervention for active
rheumatoid arthritis. Our study and most others
suggest that improvement is short term. This may
reflect inadequate outpatient care rather than a short-
coming of the initial intervention. Nevertheless, for the
expenditure on intensive intervention to be economi-
cally and clinically worthwhile it is crucial that benefits
are maintained for as long as possible. Guidelines on
the management of rheumatoid arthritis have been
published recently, and these emphasise the
importance of regular, long term follow up.9,20
Although implementing these recommendations may
require additional resources, failure to preserve the
benefits of intensive intervention may also carry heavy
financial penalties in terms of greater subsequent
demand for health care, particularly orthopaedic
surgery, earlier loss of independence, and loss of
productivity. Further controlled trials are needed to
test the effectiveness of these recommendations.

Financial considerations

Financial rather than clinical considerations have
driven many of the recent changes in the delivery of
health care in Britain, and it is appropriate to consider
whether the benefits of inpatient treatment for active
rheumatoid arthritis could be achieved in a more cost
effective way.21 This study shows that day care is only
slightly more cost effective than inpatient care. It is also
uncertain whether the potential savings from imple-
menting a day care facility and freeing beds would be
realised in practice; a day patient unit would probably
generate additional workload and the spare inpatient
capacity would be redeployed.

Day care has been shown to be cost effective for
selected patients in other specialties,10-12 but our study
shows that one consequence of implementing this
model for active rheumatoid arthritis might be to
transfer costs from the hospital sector to patients and
their families. Whether this is reasonable for patients
with chronic disease, who are already subject to
adverse social, health, and economic consequences, is
questionable.

This and other studies highlight the failure to
maintain improvements in health after intensive medi-
cal intervention and a failure to reduce patients'
capacity for work. Further prospective controlled
evaluation is needed to show that improved outpatient
care as has been recommended13-25 is of benefit in these
respects.

Contributors: CML and NPH had the original idea for the study.
Together they developed the protocol, coordinated the trial, and
analysed the clinical data. JFF contributed to the discussion of core
ideas, helped design the protocol, and edited the manuscript. The
paper was written by CML, NPH, and JFF. CML is guarantor for the paper.

Funding: Project grant from the Scottish Office, Department of
Health.

Conflicts of interest: None.

Key messages

- Day care and conventional inpatient care are clinically
  equivalent for patients with active rheumatoid arthritis
- The overall resource costs of day care are slightly lower
  than those of inpatient care
- Day care is associated with lower hospital costs
  but higher costs to patient and family; nevertheless
  half of all patients studied expressed a preference for
day care
- Clinical benefit from either day care or
  inpatient care is short lived

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