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

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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 (£1539 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; £639 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.⁵ 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.^{5,6} 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,⁷ the Ritchie index,⁸ and erythro-

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BMJ 1998;316:965-9

cyte sedimentation rate (Westergren method); psychological status, measured with the hospital anxiety and depression scale⁹; and Steinbrocker functional class¹⁰ were recorded on admission, discharge, and 12 month follow up. Secondary outcome measures were health utility, measured using the method of time trade off¹¹ and the quality of well being scale.¹²

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.⁵ 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

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), >20 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.¹³ The cost minimisation technique¹⁴ for the economic evaluation followed published decision rules for cost effectiveness analysis.¹⁵ The equivalence trial design to test the null hypothesis of no significant difference in outcomes¹⁶ 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.¹⁷ Non-parametric bootstrap methods^{18 19} were also used to calculate confidence intervals for arithmetic means of total resource use. All confidence intervals are based on 1000 bootstrap replications.²⁰

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 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 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

Table 1 Clinical and socioeconomic characteristics of patients with active rheumatoid arthritis

Characteristics	Day patients (n=56)	Inpatients (n=57)	Unable to travel (n=60)
Median (range) age (years)	59 (28-78)	55.5 (31-78)	57 (25-76)
Median (range) duration of disease (years)	6 (0.1-34)	4 (0.1-33)	8 (0.5-40)
No of women	40	41	47
No of patients with erosions	28	33	48
Steinbrocker class II	21	19	25
Steinbrocker class III	35	38	30
No living alone	10	13	37
No in paid employment	13	11	13
No unemployed	12	6	10
No on sick leave	2	5	2
No medically retired	12	15	11
No retired	17	16	22

Table 2 Description of treatment for active rheumatoid arthritis

Treatment	Day patients (n=56)	Inpatients (n=57)
Intra-articular steroid injections:		
No of patients	51	50
No of injections	148	120
Second line therapy:		
Started or restarted	26	27
Changed	15	18
Dose increased	7	10
Rheumatology outpatient visits	69	56
Community service visits:		
General practitioner	588	828
Practice nurse	703	800
District nurse	97	68
Physiotherapist	65	4
Occupational therapist	42	27
Chiropodist	73	43
Orthotist	4	4

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 between 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, £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 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

Table 3 Summary of clinical outcome data. Values are means (SD) determined by repeated measures analysis of variance corrected for baseline scores

Variable	Admission	Discharge	Follow up after 12 months
Ritchie index*			
Day patients	27 (15.2)	15.2 (11.6)	22.4 (12.3)
Inpatients	27 (14.5)	17.6 (11.7)	20.6 (10.1)
Erythrocyte sedimentation rate*			
Day patients	54 (34)	36 (32)	33 (27)
Inpatients	48 (32)	33 (28)	33 (25)
Score on health assessment questionnaire*			
Day patients	1.74 (0.42)	1.37 (0.65)	1.63 (0.6)
Inpatients	1.54 (0.44)	1.28 (0.57)	1.47 (0.55)
Anxiety (hospital anxiety and depression scale)			
Day patients	7.7 (3.4)	6.2 (3.5)	7.0 (4.5)
Inpatients	7.8 (4.2)	7.6 (4.3)	7.7 (4.6)
Depression (hospital anxiety and depression scale)			
Day patients	7.2 (3.0)	5.8 (3.0)	6.1 (3.5)
Inpatients	7.4 (3.5)	6.9 (3.8)	6.9 (4.1)
Score on quality of well being scale†			
Day patients	0.49 (0.05)	—	0.51 (0.06)
Inpatients	0.49 (0.06)	—	0.51 (0.05)
Score for time trade off†			
Day patients	0.76 (0.29)	—	0.80 (0.27)
Inpatients	0.66 (0.32)	—	0.76 (0.30)

*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 follow up at 12 months ($P<0.0001$) for both groups but no difference between day patients and inpatients.

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

Table 4 Mean (95% confidence interval) resource costs (£/patient) by treatment regimen and resource category

Resource category	Day patients	Inpatients
Hospital	798 (705 to 888)	1253 (1155 to 1370)
Community	323 (247 to 463)	298 (258 to 337)
Travel	417 (370 to 472)	293 (251 to 340)
Readmission	218 (96 to 384)	143 (38 to 306)
Total	1789 (1539 to 2027)	2021 (1834 to 2230)

Table 5 Quantile regression comparing total costs of inpatient and day care

	Coefficient	95% CI *
25th centile:		
Inpatient	1635	1447 to 1823
Day patient	-364	-647 to -82
50th centile:		
Inpatient	1930	1717 to 2143
Day patient	-374	-639 to -109
75th centile:		
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.²⁻⁴ Only one randomised study included a complete economic evaluation, and it found that inpatient care was more cost effective than outpatient care.³

In Canada a randomised controlled trial comparing inpatient with day care for active rheumatoid arthritis used similar inclusion criteria to our own study.²¹ 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 shortcoming of the initial intervention. Nevertheless, for the expenditure on intensive intervention to be economically 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.²²⁻²⁵ 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.²⁴ This study shows that day care is only slightly more cost effective than inpatient care. It is also uncertain whether the potential savings from implementing a day care facility and freeing beds would be

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

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,²⁵⁻²⁷ 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 medical intervention and a failure to reduce patients' incapacity for work. Further prospective controlled evaluation is needed to show that improved outpatient care as has been recommended²²⁻²⁵ 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 analysed the economic data. AL contributed to the discussion of core ideas and supervised the database design and data collection. MM collected the clinical and economic data. GN contributed to the discussion of core ideas, helped to develop 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.

Conflict of interest: None.

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(Accepted 27 November 1997)

Benefit of heparin in peripheral venous and arterial catheters: systematic review and meta-analysis of randomised controlled trials

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Abstract

Objective: To evaluate the effect of heparin on duration of catheter patency and on prevention of complications associated with use of peripheral venous and arterial catheters.

Design: Critical appraisal and meta-analysis of 26 randomised controlled trials that evaluated infusion of heparin intermittently or continuously. Thirteen trials of peripheral venous catheters and two of peripheral arterial catheters met criteria for inclusion.

Main outcome measures: Data on the populations, interventions, outcomes, and methodological quality.

Results: For peripheral venous catheters locked between use flushing with 10 U/ml of heparin instead of normal saline did not reduce the incidence of catheter clotting and phlebitis or improve catheter patency. When heparin was given as a continuous infusion at 1 U/ml the risk of phlebitis decreased (relative risk 0.55; 95% confidence interval 0.39 to 0.77), the duration of patency increased, and infusion failure was reduced (0.88; 0.72 to 1.07). Heparin significantly prolonged duration of patency of radial artery catheters and decreased the risk of clot formation (0.51; 0.42 to 0.61).

Conclusions: Use of intermittent heparin flushes at doses of 10 U/ml in peripheral venous catheters locked between use had no benefit over normal saline flush. Infusion of low dose heparin through a peripheral arterial catheter prolonged the duration of patency but further study is needed to establish its benefit for peripheral venous catheters.

Introduction

Almost all patients admitted to hospital require a peripheral intravenous catheter to provide access for administration of drugs and fluids and parenteral

nutrition. In addition, many critically ill patients require arterial catheterisation for haemodynamic monitoring and blood sampling. Maintenance of the patency of these indwelling catheters is important for minimising patients' discomfort and the expense associated with replacement. Vascular thrombosis,¹ visible scarring, and infection related to the catheter² are complications associated with use of these indwelling vascular devices.

The anticoagulant properties of heparin led clinicians to use heparin flushes or heparinised infusion in an attempt to prevent thrombus formation and to prolong the duration of catheter patency. The effective dose of heparin, however, has not been clearly established for venous and arterial catheters. Two meta-analyses evaluating use of heparin flush solutions for peripheral intermittent infusion devices concluded that the effect of heparin flushes was equivalent to that of 0.9% sodium chloride flushes. Both meta-analyses combined the results of controlled and uncontrolled trials.^{3,4} Goode et al included 17 studies (seven randomised controlled trials)³ and Peterson et al included 20 studies (three randomised controlled trials).⁴ Peterson et al combined trials that evaluated continuous infusion of heparinised solution with trials that assessed intermittent flushing in catheters locked between use.⁴ None the less, these results led some organisations to state that sodium chloride injection should be the standard of care for maintaining intravenous catheters used for peripheral intermittent infusion.⁵

Despite its beneficial antithrombotic effects, decreasing unnecessary exposure to heparin is important to minimise the complications resulting from sensitisation. Autoimmune mediated thrombocytopenia induced by heparin occurs in about 3% of patients exposed to unfractionated heparin, which greatly

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BMJ 1998;316:969-75