

ORIGINAL REPORT

## WHICH PATIENTS IMPROVE THE MOST AFTER ARTHRITIS REHABILITATION? A STUDY OF PREDICTORS IN PATIENTS WITH INFLAMMATORY ARTHRITIS IN NORTHERN EUROPE, THE STAR-ETIC COLLABORATION

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**Objective:** To study health-related quality of life (HRQoL) in arthritis rehabilitation performed by multidisciplinary teams in patients with chronic inflammatory arthritis. Predictors of change in health-related quality of life and the proportion of patients with clinical improvement were investigated.

**Design:** Multicentre prospective observational study in 4 European countries.

**Methods:** HRQoL was measured with the European Quality 5 Dimensions (EQ-5D) and the Short Form 36 Health Survey (SF-36) in 731 patients who underwent multidisciplinary rehabilitation. Potential predictors were physical functioning (Health Assessment Questionnaire (HAQ)), self-efficacy (Arthritis Self Efficacy Scale (ASES)), psychological health (Hopkins Symptom Check List (HSCL-25)), pain/fatigue (numeric rating scales (NRS)), age, sex, diagnosis, comorbidity, education, clinical setting and change of medication during rehabilitation. Analysis of covariance (ANCOVA) was used to assess for potential predictors and interactions. The minimal important differences for HRQoL were analysed.

**Results:** Reporting worse function ( $b$  0.05,  $p=0.01$ ), less psychological well-being ( $b$  0.09,  $p=0.000$ ), and experiencing more pain ( $b$  0.03,  $p=0.000$ ) or fatigue ( $b$  0.02,  $p=0.000$ ) at admission predicted improved HRQoL. Change in medication during rehabilitation ( $b$  0.08,  $p=0.013$ ) was associated with greater improvement in HRQoL. These EQ-5D findings were supported by SF-36 findings. Positive minimal important differences were noted in 46% (EQ-5D) and 23–47% (SF-36 subscales) of the patients.

**Conclusion:** Patients with more severe symptoms experienced the largest gain in HRQoL post-intervention. The results of this study are of value for selecting the right patients for rheumatological team rehabilitation.

**Key words:** rehabilitation; quality of life; rheumatoid arthritis; ankylosing spondylitis.

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### INTRODUCTION

For patients with chronic inflammatory arthritis the inflammatory process affects many aspects of life, resulting in impaired health-related quality of life (HRQoL) (1). During recent decades, patients with chronic inflammatory arthritis have benefited from improved pharmacological treatment with positive effects on disease activity control and disability prevention. Improved, or sometimes even normalized, function, pain, HRQoL and less joint destruction are important findings for some patients (2, 3). However, despite these improvements in pharmacological treatment, patients with chronic inflammatory arthritis are still suffering from the disease. Furthermore, not all patients with arthritis are eligible for, or respond to, the drugs, which results in a persisting high level of disease activity (4).

The negative impact on HRQoL is well documented and known to affect both patients with recent onset and longstanding chronic arthritis, irrespective of age and gender (5–8). HRQoL has been recognized as an important measure when evaluating healthcare interventions by both healthcare professionals and patients (9, 10).

Rehabilitation in patients with inflammatory arthritis aims at maintaining or improving physical and psychological functioning and health. Arthritis rehabilitation is a complex, multimodal treatment approach complementary to pharmacological and surgical treatment aimed at targeting complex disease consequences for which single interventions are not sufficient. Arthritis rehabilitation provided by a team of health professionals, can be described as management of the consequences of the diseases (11), and has proven beneficial in improving HRQoL and different aspects of physical functioning in patients with inflammatory arthritis (12, 13). Team rehabilitation has been questioned because it incurs great personnel costs, and (14) the societal benefits have not yet been determined (15, 16). As team rehabilitation is a complex intervention, randomized controlled studies are difficult to perform and few randomized studies are available. Furthermore, results from existing studies are not easily interpreted and comparable, because descriptions of the performed intervention, the team, and the healthcare institutions are often inadequate (17). Another weakness of existing studies is that the number of included patients often is small (18). Despite the scientific problems of describing and analysing the intervention, team rehabilitation is practiced in a variety of clinical settings around the world.

An observational study design has many strengths, including similarities with actual clinical practice and the ability to monitor patients for longer periods of time. At times, an observational study design may reveal important findings that may not otherwise have been noticed (19). Separating structure, context and process in descriptions and analyses could enable a better understanding of team rehabilitation (20, 21).

Since evidence of team rehabilitation and outcome is still relatively limited, an observational study conducted in a large number of patients participating in well-described rehabilitative interventions, where the analysis focuses on explanatory factors of the outcome, would contribute to the level of evidence in arthritis rehabilitation.

The aim of this study was to analyse the outcome HRQoL, and determine which variables predict change in HRQoL after a period of team rehabilitation in a large number of patients with chronic inflammatory arthritis in 4 European countries. A further objective was to study the proportion of patients who showed a minimal important clinical improvement.

## METHODS

In 2005 Danish, Dutch, Norwegian and Swedish clinicians and researchers involved in multidisciplinary team rehabilitation developed a shared register to monitor rehabilitation data for patients with inflammatory arthritis, the Scandinavian Team Arthritis Register-European Team Initiative for Care (STAR-ETIC). Data were collected at 18 sites representing different multidisciplinary team rehabilitation models (referred to below as "arthritis rehabilitation") in different clinical settings (Table I).

The main objective of the STAR-ETIC project was to describe and explore the structure, process, and outcome of rehabilitative team interventions in patients with chronic inflammatory arthritis in Northern Europe ([www.star-etic.se](http://www.star-etic.se)). A number of outcome measures were agreed upon, based on recommendations from arthritis working groups (Outcome measures in Rheumatology; OMERACT, Assessment

in Spondylo Arthritis international Society; ASAS (22), International Classification of Functioning, Disability and Health (ICF) core sets (22, 23)) and recommendations established at conferences (the CARE conferences, [www.reumacare.org](http://www.reumacare.org)).

A rehabilitation diary or patient schedule was used to gather data on the rehabilitative process. During the data collection period, a framework for identifying domains and elements of importance for arthritis rehabilitation was developed (24). Between 2006 and 2008, all sites in the STAR-ETIC project recruited patients participating in arthritis rehabilitation, and by the end of 2009 data were completed with 12 months follow-ups at all participating sites. The STAR-ETIC framework (24) and data on structure and process (25) have been described previously. The present paper is based on outcome data from the rehabilitation period.

### Study sites

In Denmark the King Christian X's Hospital, University of Southern Denmark participated (inpatient rehabilitation), and in the Netherlands the day patient multidisciplinary team care ward of the Rheumatology Rehabilitation Clinic, the Department of Rheumatology, Leiden University Medical Center participated in the project. In Norway 4 hospitals and 6 rehabilitation centres provided data. Inpatient rehabilitation was offered at 3 hospitals (National Treatment Center for Rehabilitation Medicine; NRRE Diakonhjemmet Hospital, Martina Hansen Hospital, and Lillehammer Rheumatological Hospital) and at the 6 rehabilitation centres (Valnesfjord, Borger Bad, Skogli, Jeløya, Tonsåsen rehabilitation centers and Vikersund Kurbad). Structure and process data differed among the 3 inpatient specialist units, therefore they are described and analysed separately (Norway site 2–4), while the data from the 6 Norwegian rehabilitation centres did not differ, and these are collapsed and referred to as 'Norway, Rehab Centres'.

In Sweden 3 rheumatological sites participated: the Spenshult Hospital for Rheumatic Diseases (inpatient rehabilitation) and the Clinics of Rheumatology in Lund and Malmö at Skåne University Hospital (outpatient rehabilitation). Structure and process data varied between the 3 sites, thus they are described and analysed separately (Sweden site 1–3) (25).

### Subjects

Patients referred to arthritis rehabilitation at the participating sites during the study period were offered participation. Specific inclusion criteria in this study was: a diagnosis of rheumatoid arthritis (RA) or spondyloarthritis (ankylosing spondylitis, undifferentiated spondyloarthritis and psoriatic arthritis) determined by the physician, age 18 years or older and having completed an arthritis rehabilitation period of at least 5 days. The patients were also required to have completed patient-reported outcome measures (PROMs) at admission and discharge. Exclusion criteria were: inability to communicate in written Norwegian/Danish/Dutch/Swedish. For patients with more than one rehabilitation period data from the first period only were included. In Norway, patients older than 75 years were not included.

### Outcome measure

*Health-related quality of life.* The European Quality 5 Dimensions (EQ-5D) and the Short Form 36 Health Survey (SF-36) were used as outcome measures to evaluate change in HRQoL. The EQ-5D consists of 5 questions on mobility, self-care, pain, usual activities, and psychological status (0–1, worst to best) (26). The 36 questions of the SF-36 cover 8 subscales: physical function (PF), bodily pain (BP), role physical (RP), general health (GH), vitality (VT), social function (SF), mental health (MH) and role emotional (RE) (0–100, worst to best) (27).

Data collection was started first in Norway, where the SF-36 was the sole outcome measure for evaluation of HRQoL. When data collection was started in the other countries (Denmark, the Netherlands and Sweden), the EQ-5D was added for HRQoL evaluation. In Malmö, the SF-36 was used at admission (and after 6 months), because of the

short duration of the rehabilitation and the psychometric characteristics of SF-36.

#### Baseline variables

Measures of disease activity, levels of functioning, self-efficacy, psychological health, pain and fatigue were evaluated at admission. The self-administered Health Assessment Questionnaire (HAQ, 20 questions, 0–3, best to worse) was used to assess physical functioning and activity limitations (28, 29).

Coping strategies were evaluated by the Arthritis Self Efficacy Scale (ASES 10–100, 1–5 Dutch version, worst to best) (30, 31). The subscales for evaluation of “pain” (5 items) and of “other symptoms” (4 items) were used.

For assessment of psychological well-being the Hopkins Symptom Check List (HSCL-25, 0–4, best to worse) was used (32).

Numeric rating scales (NRS, 0–10, best to worst) were used to evaluate pain and fatigue.

#### Patient demographics

Age, gender, comorbidities and length of education were patient reported at admission. Information on diagnosis and pharmacological treatment at admission and discharge was physician reported.

#### Ethics

All patients gave permission to be included in the register by signing a written consent. The study was approved by the Institutional Review Boards in Lund, Sweden (number 52/2007), and in the Netherlands (number P.08.038). In Norway the regional ethics committee and the Norway Science Data Services (NSD) approved the protocol in 2005/2006. The regional ethics committee of Southern Denmark was informed about the study, but decided that the study required no formal ethics approval (18.12.2007). The study was reported to the Danish Data Protection Agency (2007-41-1659).

#### Statistical analysis

Change after intervention (discharge-baseline) of the EQ-5D and the SF-36 subscales were used as dependent variables. Data was approximately normally distributed and the analysis of covariance (ANCOVA) was used. The regression coefficient (b) is presented, with 95% confidence intervals (95% CIs). All included independent factors were first analysed separately (unadjusted b) and in a second step every proposed predictive factor was controlled for confounding factors (adjusted b).

All hypotheses were based on a literature search and clinical experience. Proposed predictive factors were function (HAQ), self-efficacy (ASES symptom, ASES pain), psychological well-being (HSCL-25), pain and fatigue at baseline and change of medication during rehabilitation (disease-modifying anti-rheumatic drugs (DMARDs), biologics or oral steroids). Age, sex, diagnosis, having comorbidity or not, length of education (12 years or more vs less than 12 years) and clinical setting were included as possible confounding factors.

The level of statistical significance was established at  $p < 0.05$ .

Because of the 2 different versions of ASES (10–100 vs 1–5) present in this study, the median score was used to dichotomize data in each site separately before including ASES in the ANCOVA.

ANCOVA was also used to study interaction between variables. The normality of the residuals in the models was checked using the Shapiro–Wilk test ( $\geq 0.9$ ). Hypothesized potential interactions in the models were entered and studied, together with their main effects.

We further analysed patients who achieved minimal important difference (MID) in the EQ-5D and in the SF-36 subscales. The MID was used to explain change and defined as a 0.05 change in EQ-5D (33, 34). The MID of the SF-36 was calculated for each subscale to be 0.5 of the baseline standard deviation (SD) (34).

## RESULTS

#### Subjects

A total of 839 patients with chronic inflammatory arthritis completed arthritis rehabilitation in the STAR-ETIC project between 2006 and 2008. A total of 731 patients fulfilled the inclusion criteria. The mean age was 54 years (SD 14), 491 (67%) were females, 426 (58%) were diagnosed with RA and 303 (42%) with spondyloarthritis (SpA) (Table I).

Fourteen of the 108 patients not fulfilling inclusion criteria were excluded from analysis, due to multiple episodes of rehabilitation. The remaining 94 patients were excluded due to incomplete patient reported outcome data ( $n=93$ ), and a rehabilitation length of less than 5 days ( $n=1$ ). The 94 patients excluded were older (63 years (SD 16)), a similar proportion were females (71%) and 68% were diagnosed with RA. The mean HAQ score was 1.0 (SD 0.6).

Table I. Baseline characteristics at the participating sites

	Norway							Sweden		
	DK <i>n</i> =91	NL <i>n</i> =80	Rehab centres <i>n</i> =65		Site 1 <i>n</i> =18	Site 2 <i>n</i> =8	Site 3 <i>n</i> =28	Site 4 <i>n</i> =30	Site 1 <i>n</i> =80	Site 2 <i>n</i> =87
	Inpatient	Outpatient	Inpatient	Outpatient	Inpatient	Inpatient	Inpatient	Outpatient	Outpatient	Inpatient
Inpatient/outpatient Rehabilitation length, days, mean (SD)	12.5 (3.4)	8.4 (3.2) <sup>a</sup>	19.3 (4.8)	10.4 (0.5)	18.9 (4.9)	11.2 (0.8)	11.9 (4.0)	18 (fixed no)	5 (fixed no)	16.8 (3.7)
Age years, mean (SD)	59 (13)	53 (15)	56 (11)	56 (9)	44 (10)	48 (14)	53 (11)	51 (12)	52 (15)	56 (13)
Female, <i>n</i> (%)	64 (70)	44 (55)	56 (86)	12 (67)	6 (75)	12 (43)	16 (53)	59 (74)	64 (74)	158 (65)
Diagnosis <sup>b</sup> , RA, <i>n</i> (%)	74 (81)	49 (61)	30 (46)	11 (61)	5 (62)	5 (18)	16 (53)	48 (60)	69 (79)	120 (49)
Comorbidity <sup>c</sup>	72 (79) 0	60 (75) 0	53 (81) 0	12 (67) 0	6 (75) 0	20 (71) 0	22 (73) 0	73 (91) 1	62 (71) 0	219 (90) 0
DMARDS – used <sup>c</sup>	67 (74) 5	46 (58) 0	11 (17) 0	13 (72) 0	3 (38) 0	8 (29) 0	10 (67) 0	54 (67) 4	72 (83) 6	129 (53) 24
Biologics – used <sup>c</sup>	16 (17) 7	20 (25) 0	6 (9) 0	3 (17) 0	3 (38) 0	5 (18) 0	6 (20) 0	40 (50) 5	10 (12) 23	41 (17) 34
Length of education <sup>c</sup>										
<12 y <sup>c</sup>	68 (75) 0	37 (46) 1	38 (58) 1	9 (50) 1	5 (62) 0	16 (57) 0	18 (60) 0	32 (40) 5	49 (56) 0	157 (64) 6

<sup>a</sup>Intermittent rehabilitation over a mean period of 24.4 working days (SD 12.8).

<sup>b</sup>Diagnosis RA or spondyloarthritis.

<sup>c</sup>*n* (%) missing *n*.

DK: Denmark; NL: the Netherlands; SD: standard deviation; RA: rheumatoid arthritis; DMARDS: disease-modifying anti rheumatic drugs; y: years.

*Baseline variables and differences between participating sites*

Disparities were found among the participants at the different sites; mean age varied from 44 years (SD 10) to 59 years (SD 13), mean baseline HAQ ranged from 0.5 (SD 0.5) to 1.24 (SD 0.67) and biologics were used by 3–41% of the participants. The clinical characteristics of the patients and the rehabilitation for each participating site are described in Table I.

Greater differences were found among the sites than between in- and out-patient clinical settings. Among all sites, length of rehabilitation varied from 5 to 19 days. Outpatient length of rehabilitation varied from 5 to 18 days. The length of inpatient rehabilitation varied from mean 11 days (SD 1) to mean 19 days (SD 5).

Comorbidity was reported by 67–91% of the patients. Length of education shorter than 12 years was reported by 59% of all participating patients, with a variation from 40% to 75% among the sites (Table I).

The number of patients who had a change of medication during the rehabilitation period differed between the study sites and were performed in 12% of the Danish patients and 31% of the patients from the Netherlands. At the Norwegian Rehabilitation Centres 12% of the patients had changes performed in their medication during rehabilitation, while the proportion at the Norwegian hospitals were 22% (Site 1), 25% (Site 2), 7% (Site 3), and 50% (Site 4). In Sweden there was one site where changes in medication were not performed during the intervention (Site 2), in the other two sites the proportions were 5% (Site 1) and 16% (Site 3).

At baseline the HRQoL outcome measures EQ-5D and SF-36 differed among the sites. The baseline and change values for all included patients used in the ANCOVA analyses are shown in Tables II–III.

*Predictors of change in HRQoL – EQ-5D*

Changes in HRQoL at the end of rehabilitation measured with the EQ-5D ranged from 0.04 to 0.13 between the sites. Reporting worse function (b 0.05,  $p=0.01$ ), less psychological well-being (b 0.09,  $p=0.000$ ), experiencing more pain (b 0.03,  $p=0.000$ ) or fatigue (b 0.02,  $p=0.000$ ) at admission predicted

Table III. Baseline data and change values after rehabilitation in European Quality 5 Dimensions (EQ-5D) and Short Form 36 Health Survey (SF-36)

	<i>n</i>	Baseline (admission) Mean (SD)	Change at discharge Mean (95% CI)
EQ-5D	533	0.52 (0.29)	0.12 (0.1 to 0.14)
SF-36 PF	615	48.7 (24.3)	6.9 (5.5 to 8.3)
SF-36 BP	618	37.5 (19.0)	7.2 (6.0 to 8.4)
SF-36 RP	594	28.7 (35.9)	9.6 (6.8 to 12.5)
SF-36 GH	598	43.5 (19.7)	3.5 (2.3 to 4.6)
SF-36 VT	610	38.6 (21.8)	11.4 (9.9 to 12.9)
SF-36 SF	601	62.0 (27.9)	7.1 (5.3 to 9.0)
SF-36 MH	609	67.5 (18.6)	3.9 (2.7 to 5.1)
SF-36 RE	598	57.1 (42.5)	5.5 (2.4 to 8.6)

SD: standard deviation; CI: confidence interval; PF: physical functioning; BP: bodily pain; RP: role physical; GH: general health; VT: vitality; SF: social functioning; MH: mental health; RE: role emotional.

a greater improvement in EQ-5D. Also, change in medication predicted change in EQ-5D (b 0.08,  $p=0.013$ ). All predictive variables were controlled for age, sex, diagnosis, comorbidity or not, length of education and site (Table IV).

Interaction analysis of EQ-5D change in the variables HAQ-sex, HAQ-age, HAQ-comorbidities, HSCL-age, HSCL-sex and HSCL-comorbidities was performed. Statistical significant interaction was found between HAQ and age ( $p=0.033$ ), lower age (b 0.06), higher age (b 0.00). Statistically significant interaction was also found between HSCL and comorbidities ( $p=0.035$ ), no comorbidities at baseline (b -0.13), and comorbidities at baseline (b 0.11). Other interactions investigated were found to be non-significant.

*Predictors of change in HRQoL – SF-36*

The results of the SF-36 were in line with the results of the EQ-5D. All independent predictors presented below were controlled for age, diagnosis, comorbidity or not, length of education and site (adjusted b).

Worse self-reported functioning, as measured by the HAQ at baseline, was found to predict an improvement in the SF (b 4.2,  $p=0.018$ ) and MH (b 2.3,  $p=0.048$ ) subscales.

Table II. Baseline values of the independent variables at the participating sites

	HAQ 0–3 Mean (SD)	ASES sympt 10–100 Mean (SD)	ASES pain 10–100 Mean (SD)	HSCL 0–4 Mean (SD)	Pain 0–10 Mean (SD)	Fatigue 0–10 Mean (SD)
Denmark, <i>n</i> =91	1.04 (0.69)	55.0 (18.8)	52.1 (16.0)	1.6 (0.5)	5.2 (2.0)	5.5 (2.1)
The Netherlands, <i>n</i> =80	1.24 (0.67)	3.2 (0.98) <sup>a</sup>	2.6 (0.97) <sup>a</sup>	1.7 (0.4)	5.9 (2.4)	6.3 (2.3)
Norway						
Rehab centres, <i>n</i> =65	0.8 (0.52)	61.8 (17.8)	56.4 (20.5)	1.8 (0.5)	6.0 (2.1)	6.4 (2.5)
Site 1, <i>n</i> =18	0.58 (0.46)	69.2 (17.8)	58.1 (17.9)	1.7 (0.4)	4.9 (2.1)	5.4 (2.8)
Site 2, <i>n</i> =8	0.95 (0.48)	68.3(12.0)	68.0 (16.2)	2.0 (0.4)	5.1 (2.4)	7.2 (2.8)
Site 3, <i>n</i> =28	0.5 (0.5)	69.1 (16.0)	63.9 (17.1)	1.6 (0.5)	5.6 (1.9)	5.7 (2.6)
Site 4, <i>n</i> =30	0.74 (0.49)	64.4 (18.0)	50.1 (16.0)	1.7 (0.4)	5.4 (2.4)	5.2 (3.0)
Sweden						
Site 1, <i>n</i> =80	0.95 (0.5)	57.2 (17.8)	57.4 (19.6)	1.7 (0.5)	5.0 (2.0)	5.9 (2.4)
Site 2, <i>n</i> =87	0.76 (0.52)	57.0 (19.3)	54.4 (21.0)	1.6 (0.5)	4.1 (2.5)	4.2 (2.5)
Site 3, <i>n</i> =244	0.98 (0.62)	57.7 (18.3)	53.7 (20.1)	1.7 (0.5)	5.9 (2.2)	6.0 (2.4)

<sup>a</sup>Scale 0–5. HAQ: Health Assessment Questionnaire; ASES: Arthritis Self Efficacy Scale; sympt: symptom; HSCL: Hopkins Symptoms Check List; SD: standard deviation.

Table IV. Analysis of predictors for European Quality 5 Dimensions (EQ-5D) change. Presenting regression coefficient (b) and confidence intervals (CI) for outcome with regard to explanatory variables (unadjusted b). Predictive variables were included separately in the multiple linear regression analysis and controlled for age, sex, diagnosis, comorbidity, education and clinical setting (adjusted b)

Potential predictors for EQ-5D change	b (unadjusted)	95% CI	p-value	b (adjusted)	95% CI	p-value
Age, 10 years	-0.01	-0.003; 0.000	0.095			
Female sex	0.039	-0.01; 0.087	0.117			
SpA diagnosis	0.02	-0.027; 0.067	0.395			
No comorbidity	-0.009	-0.071; 0.053	0.777			
Education <12 years	0.003	-0.043; 0.05	0.89			
DMARDs, biologics, corticosteroids change	0.1	0.035; 0.165	0.003	0.085	0.018 to 0.153	0.013
HAQ (0-3)	0.047	0.011; 0.084	0.012	0.054	0.013 to 0.094	0.01
Self-efficacy Symptom, ASES (less than median)	0.009	-0.037; 0.055	0.691	0.010	-0.04 to 0.06	0.696
Self-efficacy Pain, ASES (less than median)	0.012	-0.034; 0.057	0.62	0.010	-0.04 to 0.06	0.702
Psychological well-being, HSCL (1-4)	0.098	0.053; 0.143	0.000	0.092	0.046 to 0.138	0.000
Pain, NRS (0-10)	0.03	0.021; 0.04	0.000	0.029	0.019 to 0.039	0.000
Fatigue, NRS (0-10)	0.024	0.015; 0.033	0.000	0.023	0.013 to 0.032	0.000

SpA: spondyloarthritis; RA: rheumatoid arthritis; DMARDs: disease-modifying anti rheumatic drugs; HAQ: Health Assessment Questionnaire; HSCL: Hopkins Symptom Check List; NRS: numeric rating scale; ASES: Arthritis Self-Efficacy Scale.

Experiencing less self-efficacy (below median) of the ASES symptom scale at rehabilitation start was found to predict an improvement in the SF (b 4.6,  $p=0.028$ ) and MH (b 2.8,  $p=0.040$ ) subscales. The ASES pain scale yielded similar results in the MH (b 3.0,  $p=0.029$ ) and SF (b 4.4,  $p=0.032$ ) subscales. However, in the PF subscale a deterioration (b -3.4,  $p=0.029$ ) was found for low self-efficacy (ASES pain).

Less psychological well-being, as measured by the HSCL at baseline, predicted an improvement in HRQoL, as measured by the VT (b 4.9,  $p=0.002$ ), SF (b 9.7  $p=0.000$ ), MH (b 9.3,  $p=0.000$ ), and RE (b 18.8,  $p=0.000$ ) subscales.

Higher fatigue at baseline was found to predict an improved HRQoL after completed rehabilitation, as captured by the BP (b 0.6,  $p=0.028$ ), VT (b 1.3,  $p=0.000$ ), SF (b 0.8,  $p=0.052$ ), MH (b 0.9,  $p=0.001$ ) and RE (b 1.4,  $p=0.041$ ) subscales.

Change in medication did not predict change in any of the SF-36 subscales.

Regarding the subscales RP and GH, no baseline variables analysed were found to significantly predict change after rehabilitation.

Interaction analysis of change in all SF-36 subscales was performed in the variables HAQ-age, HAQ-sex, HAQ-comorbidities, HSCL-sex, HSCL-age, and HSCL-comorbidities. Significant interaction was found between SF-36 PF and HAQ-

age ( $p=0.009$ ), lower age (b 5.07), and higher age (b -2.99). All other interactions were non-significant.

#### Minimal important difference

In analysis of the MID we found that 46% of the patients evaluated with EQ-5D reached a positive MID, i.e. a change value of more than 0.05, while 14% of the patients deteriorated 0.05 units or more (Table V).

Similar findings were seen when analysing change in HRQoL measured by the SF-36. Positive MID of 0.5 SD was reached by 23-47% of the patients, while 9-19% of the patients deteriorated 0.5 SD or more (Table V).

## DISCUSSION

From this multicentre arthritis rehabilitation study we learned that arthritis rehabilitation seems to be most beneficial in improving the HRQoL of patients struggling with more severe consequences of their disease. Patients who report worse function, less psychological well-being, greater pain or greater fatigue were likely to have larger change in HRQoL after team rehabilitation. The result was based on EQ-5D and was supported by similar findings in the SF-36. Also, change of medication during rehabilitation was associated with a larger change in the EQ-5D. Based on MID, every second patient improved in HRQoL.

An implication of our findings is that more resource-demanding arthritis rehabilitation performed by a multidisciplinary team should primarily be earmarked to the patients who have more severe consequences of the disease.

Many patients who have had the disease for a long time struggle with severe disability, and approximately 30% of patients do not respond to, or cannot tolerate, the new drugs (35). These patients thus experience many restrictions in life due to pain, decreased HRQoL, functional impairment, restrictions in occupational work, activity in daily life and in participation (36-38). Supported by this study these patients will benefit from arthritis rehabilitation in the future, even

Table V. Percentage of patients achieving minimal important difference (MID) in the Short Form 36 Health Survey (SF-36) subscales

Short Form 36 Health Survey subscale	Minimal important difference	
	Positive %	Negative %
Physical functioning	32	9
Bodily pain	47	16
Role physical	33	14
General health	34	19
Vitality	43	10
Social functioning	29	11
Mental health	28	14
Role emotional	23	14

though this may be regarded by some as too expensive and has been excluded as a treatment option due to lack of scientific evidence for its benefits (39).

In patients who respond to the new improved pharmacological treatments, inflammatory arthritis nowadays results in less detrimental effects on HRQoL and other aspects of health and the patients might not require all healthcare professionals. In the STAR-ETIC project we found that clear recommendations for admission to the rehabilitative interventions were lacking at most participating sites (25). An international consensus supporting decisions on which patients should be recommended the different types of rehabilitation interventions would be useful for patients and caregivers alike and might also help in making political decisions.

The detrimental impact of chronic inflammatory arthritis on HRQoL is profound, well known, and important to prevent (7). However, few studies on team rehabilitation and change in HRQoL have previously been published in inflammatory arthritis, showing an improvement post-rehabilitation (14). Other consequences of the disease, such as disability, coping and stress, are interacting with each other and HRQoL (40). Outcome measures, such as HRQoL, have been recommended by the OMERACT, the American College of Rheumatology (ACR), the ICF, and by patients, for evaluation or monitoring of patients with inflammatory arthritis (41).

Psychological symptoms and fatigue are common in chronic inflammatory arthritis. Fatigue is a consequence of disease with great impact on life and HRQoL and is related to other symptoms, such as disease activity and pain (37, 42, 43). Fatigue has been ranked as an important aspect of inflammatory arthritis by patients and by the OMERACT (44). A multidimensional approach to target fatigue has been asked for (45), since it is difficult to distinguish the diagnoses fatigue, depression and pain, due to overlapping symptoms (46). Our finding that patients experiencing worse function, high fatigue, less psychological well-being, or pain were the ones that had the largest improvement in HRQoL, support that multidisciplinary interventions are beneficial for patients with these important problems.

HRQoL is known to be affected by disease activity, socio-demographic characteristics, fatigue, not being able to cope, and poor self-reported function in patients with arthritis (6, 40), thus all data were controlled for age, sex, diagnosis, comorbidity and education at baseline.

Recent findings indicate that physical and mental health and disability in patients with RA are also affected by site and setting of the clinic providing care, and by nationality, thus data were also controlled for clinical site (47, 48). In the STAR-ETIC project we have described the structure, processes and patient descriptives of the different participating rehabilitation sites and countries. Regardless of the fact that the participating sites serve and represent 4 countries of different sociodemographic character and have somewhat different intentions with their rehabilitation programmes, the patients suffering the most from disease consequences were the ones who improved the most.

The clinical implications of this study are thus that patients with worse disease consequences benefit the most after arthritis rehabilitation. Another clinical implication of our findings is that every second patient achieved MID, with regards to HRQoL. Different methods on how to report study outcome relevant to the clinic have been developed and their specific benefits are discussed. The MID and the minimally clinical important difference (MCID) are 2 examples on useful methods, yet with some limitations (33). We used the MID, defined as a 0.05 change of the EQ-5D, that we found most frequently reported (33, 49). Regarding the SF-36, the MID has been mainly defined for the mental and physical scores, but not for all the subscales. We followed the recommendation of using a MID of 0.5 of the SD (33) as we preferred to report the score of each subscale.

The STAR-ETIC project was initiated in 2005, the evaluation instruments should be useable in different clinical settings, available in all languages and were chosen based on evidence present at the time. The EQ-5D has been proven a valid and feasible measure of utility and HRQoL in the arthritis population (50). We find it supporting that both outcome measures used to measure HRQoL rendered similar findings even though we are aware of recent discussions concerning strengths and weaknesses of the EQ-5D and the SF-36 (49). Questions have been raised concerning the EQ-5D and its limitation of being bimodal in distribution (49, 51). However, the EQ-5D change values in our study were normally distributed according to Shapiro-Wilk  $\geq 0.9$ .

Lately there has been a request for large observational studies in interventions, such as team rehabilitation, to complement randomized controlled trials (18). On the other hand, an objection to observational studies could refer to "regression towards the mean" and its potential impact on the outcome (52). This problem will, however, always occur with an uncontrolled study design, and our results have to be interpreted with this in mind.

The sole measure of disease activity and functioning in our study was the HAQ. Other measures of disease activity and disease duration were not included, since outcome data were patient reported. Disease activity is well known to interact with physical functioning, as captured by the HAQ (53, 54). Age and disease duration are also likely to interact, since increasing age enables longer possible duration of the disease. Long-term outcome is warranted and data from the 6- and 12-month follow-ups have not yet been analysed.

The patients excluded from analyses ( $n=108$ ) were older, with a higher mean HAQ at admission, and the proportion diagnosed with RA was larger, although the female/male distribution was comparable between the groups.

In conclusion, we found that HRQoL in patients with chronic inflammatory arthritis improved after arthritis rehabilitation performed by a multidisciplinary team. Those struggling with more severe consequences of their disease in terms of function, psychological well-being, fatigue and pain experienced the largest gain in HRQoL. Improved HRQoL, classified as

positive MID, was achieved in almost half of the patients. The results of this study are of value in selecting patients for rheumatological team rehabilitation.

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