EXTENDED REPORT

# Orthopaedic surgery of the lower limbs in 49 802 rheumatoid arthritis patients: results from the Swedish National Inpatient Registry during 1987 to 2001

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**Objectives:** To analyse changes in the rates of hospital admission and use of orthopaedic surgery to the lower limbs in Swedish patients with rheumatoid arthritis between 1987 and 2001.
**Methods:** Data for all rheumatoid patients admitted to hospital between 1987 and 2001 were abstracted from the Swedish National Hospital Discharge Register (SNHDR). The data in the register are collected prospectively, recording all inpatient admissions throughout Sweden. The SNHDR uses the codes for diagnoses at discharge and surgical procedures according to the Swedish version of the *International Classification of Diseases* (ICD).
**Results:** In all, 49 802 individual patients with rheumatoid arthritis were identified, accounting for 159 888 inpatient visits. Hospital admissions for rheumatoid arthritis decreased by 42% ($p<0.001$) during the period 1987 to 2001. Twelve per cent of all admissions were for a rheumatoid arthritis related surgical procedure to the lower limbs; those admissions decreased markedly (by 16%) between 1987 and 1996, and by 12% between 1997 and 2001, as did the overall number of rheumatoid arthritis related surgical procedures to the lower limbs during both time periods. Between 1997 and 2001, 47% of all rheumatoid arthritis related surgical procedures were total joint arthroplasties. There was an overall trend towards reduced length of hospital stay after orthopaedic surgery to the lower limbs during the study period.
**Conclusions:** Rates of hospital admission and rheumatoid arthritis related surgical procedures to the lower limbs in Swedish patients with rheumatoid arthritis decreased between 1987 and 2001. This may reflect trends in disease severity, management, and health outcomes of this disease in Sweden.

Destruction of the joint is one of the most serious consequences of rheumatoid arthritis. Small joints tend to be affected earlier than large joints, and lower extremity joints are generally affected earlier than upper extremity joints. Rheumatoid arthritis causes a substantial burden for public health care systems by giving rise to occupational difficulties in many patients and causing early disability in a few.[1]

During the past two decades, medicinal and physical treatment possibilities for rheumatoid arthritis have been continuously improving. The destructive inflammatory course of the disease has been further elucidated and new strategies for therapeutic protection from joint damage have been developed. The increasing and strategically varied use of potent disease modifying antirheumatic drugs during the past 10 years has been shown to be at least partially responsible for a less severe disease course, especially with respect to joint destruction.[2] In addition, orthopaedic procedures—including, for example, modern joint replacement techniques—have also undergone constant technical and material modifications and have been shown to result in substantial improvement in the function and quality of life of patients with rheumatoid arthritis.

The need for orthopaedic surgery is considered a marker of disease severity.[3] Recent population based studies have reported a decline in the use of orthopaedic joint surgery in rheumatoid patients diagnosed after 1985[4] and a decrease in hospital admissions for manifestations of severe rheumatoid arthritis since the early 1980s, suggesting that the long term clinical outcome of patients with rheumatoid arthritis has improved consistently during the last 20 years.[5]

Hospital admissions are common events in rheumatoid arthritis, and in the case of admissions for orthopaedic surgery, detailed data on a large, population based, rheumatoid arthritis patient cohort—especially regarding the type, frequency, success, and long term results of the surgical procedures undertaken—is of great medical and economic importance.

Our aim in the present study was to investigate whether the rates of hospital admission and the use of orthopaedic surgery to the lower limbs in Swedish rheumatoid patients have changed during the period 1987 to 2001.

## METHODS

This general population based study was conducted to identify changes over time in hospital admissions and the use of orthopaedic surgery to the lower limbs in all Swedish patients with rheumatoid arthritis between 1987 and 2001.

### Source of data

Data were obtained from the Swedish National Hospital Discharge Register (SNHDR),[6] which has recorded all data for each individual patient's hospital inpatient diagnoses and discharges since 1962. It allows the study of various groups of patients on the basis of their diagnoses and designated operation codes, as it covers more than 98% of all hospital admissions in Sweden.

**Abbreviation:** SNHDR, Swedish National Hospital Discharge Register

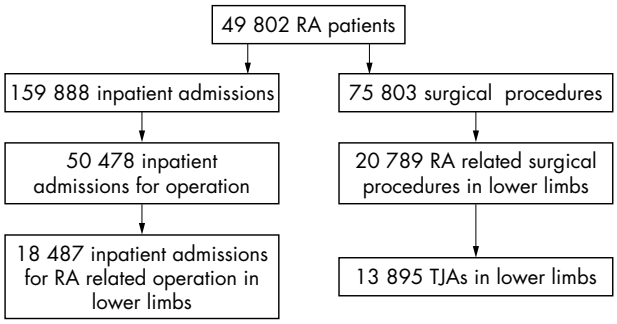


**Figure 1** Total number of Swedish rheumatoid arthritis inpatients, inpatient admissions, admissions for surgery, surgical procedures, and total joint arthroplasty operations during 1987 to 2001. RA, rheumatoid arthritis; TJA, total joint arthroplasty.

The SNHDR uses the codes for diagnoses at discharge and surgical procedures according to the *International Classification of Diseases* (ICD). The register provides data for age, sex, medical diagnoses, date of admission, and date of discharge of the patients.

During the study period, the ICD coded register was revised, so that both the ninth revision (ICD-9; 1987–1996) and the 10th revision (ICD-10; 1997 to the present) were in use. All inpatient visits from 1 January 1987 to 31 December 2001 of patients older than 18 years with a rheumatoid arthritis related diagnosis were identified (ICD-9 codes 714, 720, 447G; ICD-10 codes M05.-, M06.0, M06.8, M06.9, and M08.-). When choosing the rheumatoid arthritis relevant surgical intervention codes for this study, all those related to orthopaedic surgical interventions on the lower limbs, excluding fracture or infection related codes, were recorded. Rheumatoid arthritis related operations were defined as disease related joint surgery, including reconstructive joint surgery, primary total joint arthroplasty, and other surgical procedures such as resections and joint fusions. All ICD-9 and ICD-10 operation codes were analysed in three groups with regard to the foot, the knee, and the hip (details can be provided on request).

One county (Skåne) used the ICD-9 throughout 1997 and changed to ICD-10 in 1998; therefore data from 1997 were excluded for the analysis of temporal trends. ICD-10 is more detailed than ICD-9 and although ICD-9 contains some of the same procedure codes as ICD-10, the anatomical regions of the procedures performed are not so detailed in ICD-9. We therefore excluded some ICD-9 procedure codes in the data analyses, even though they were rheumatoid arthritis related, if the codes did not specify an anatomical region in the lower limb. Age in years was divided into the following groups: <30, 30 to 59, and 60+. Length of hospital stay was divided into groups of 0 to 2, 3 to 7, and 8+ days.

### Statistical analysis

Descriptive analysis was used to investigate the frequency of admissions, patients, and operations. Logistic regression analysis was used to investigate the length of hospital admission. Adjustment was made for age group and sex. The number of admissions within the two time periods 1987 to 1996 and 1998 to 2001, and the number of admissions including any operation, rheumatoid arthritis related operations to the lower limbs, and total joint arthroplasty were identified. All measures were modelled as a series of dummy variables. The unadjusted and adjusted odds ratios (OR) were calculated, together with their 95% confidence intervals (CI). The difference in median age between the first foot, knee, and hip operation was analysed using the Kruskall–Wallis test. The year of discharge became the unit of analysis in order to investigate the overall number of admissions and the number of rheumatoid arthritis related operations over time. A summary variable recorded how many rheumatoid arthritis related operations had been undertaken each year. This variable was the dependent variable in linear regression analysis, with year of discharge as an independent variable. A similar sum variable was created for overall admissions, showing the number of admissions each year. Adjustment was made for the proportion over 65 years of age and for sex. All analyses of temporal trends were carried out with and without data for Skåne, and we also investigated the change between 1997 and the following years before excluding 1997. All statistical analyses were done using SPSS 11.5 for Windows (SPSS Inc, Chicago, Illinois, USA).

## RESULTS

### Overall admissions

During the observation period between 1987 and 2001, 160 071 rheumatoid arthritis inpatient visits were identified; 183 visits (0.1%) were excluded because of missing data for date of admission, date of discharge, or national registration number. Hence, 159 888 inpatient visits remained for our analyses (table 1; fig 1).

During the study period, 50 478 admissions for rheumatoid arthritis (32%) were for a surgical procedure. This could have been a rheumatoid arthritis related procedure on the limbs or spine, or an operation unrelated to the rheumatoid disease. Other reasons for admission were non-surgical (109 410 admissions (68%)). In all, 18 487 admissions in the entire study period (12%) were for a rheumatoid arthritis related surgical procedure of the lower limbs (table 1; fig 2).

The total number of hospital admissions with a diagnosis of rheumatoid arthritis decreased significantly (by 42%) over time between 1987 and 2001 ($p<0.001$), from 13 065 admissions in 1987 to 7333 in 2001. This was confirmed by linear regression: unadjusted $B = -385.90$ (95% CI, −450.33 to −321.48), $p = 0.000$; adjusted $B = -320.33$ (95% CI, −558.52 to −82.13), $p = 0.013$ (fig 2).

A decline in the total number of admissions for rheumatoid arthritis related surgical procedures on the lower limbs was also seen within both time periods. The number decreased by 16% during 1987 to 1996, from 1280 to 1073 (NS), and by 12% during 1998 to 2001, from 1401 to 1235 ($p = 0.013$), independent of age and sex (fig 2).

### Rheumatoid arthritis patients

In all, 49 802 Swedish patients with diagnosed rheumatoid arthritis were included in this analysis. During the whole 15 year study period the median number of hospital stays per admitted patient was 2.0 (range 1 to 106) (table 1; fig 1).

Between 1987 and 1996, 38 908 rheumatoid patients were admitted to a Swedish hospital. Of these, 18 326 (47%) were operated on during their hospital stay. Of all patients with rheumatoid arthritis admitted during this period, 8396 (22%) had an operation on the lower limbs which was related to the rheumatoid disease (table 1).

A similar pattern was evident between 1997 and 2001: of all 19 790 patients with rheumatoid arthritis who were admitted to hospital, 8771 (44%) were operated on at least once; this could have been any kind of surgical procedure, and 5125 (26%) of all these patients had at least one rheumatoid arthritis related orthopaedic surgical procedure on the lower limbs (table 1).

### Surgical procedures

In all, 75 803 surgical procedures were carried out in our Swedish study population between 1987 and 2001. Of these, 20 789 (27%) were rheumatoid arthritis related orthopaedic procedures on the lower limbs (table 1; fig 1).

**Table 1** Demographic characteristics of patients with rheumatoid arthritis admitted to hospital in Sweden between 1987 and 2001

| Study period | 1987 to 2001 | % | 1987 to 1996 | % | 1997 to 2001 | % |
|---|---|---|---|---|---|---|
| *Number of admissions* | | | | | | |
| Total number of Swedish RA patient hospital admissions | 159 888 | | 118 192 | | 41 696 | |
| Without surgery | 109 410 | 68 | 81 162 | 69 | 28 248 | 68 |
| With at least one SP | 50 478 | 32 | 37 030 | 31 | 13 448 | 32 |
| With at least one SP in the lower limbs (RA related) | 18 487 | 12 | 11 892 | 10 | 6 595 | 16 |
| With at least one foot SP (RA related) | 3 973 | 3 | 1 523 | 1 | 2 450 | 6 |
| With at least one knee SP (RA related) | 7 248 | 5 | 5 014 | 4 | 2 234 | 5 |
| With at least one hip SP (RA related) | 7 353 | 5 | 5 402 | 5 | 1 951 | 5 |
| With at least one TJA in the lower limbs | 13 250 | 8 | 9 682 | 8 | 3 568 | 9 |
| With at least one foot TJA | 180 | 0.1 | 119 | 0.1 | 61 | 0.1 |
| With at least one knee TJA | 6 383 | 4 | 4 622 | 4 | 1 761 | 4 |
| With at least one hip TJA | 6 719 | 4 | 4 968 | 4 | 1 751 | 4 |
| *Number of RA patients* | | | | | | |
| Total number | 49 802 | | 38 908 | | 19 790 | |
| Men | 15 083 | 30 | 11 399 | 29 | 5 610 | 28 |
| Women | 34 719 | 70 | 27 509 | 71 | 14 180 | 72 |
| Without surgery | 26 784 | 54 | 20 582 | 53 | 11 019 | 56 |
| With at least one SP | 23 018 | 46 | 18 326 | 47 | 8 771 | 44 |
| With at least one SP in the lower limbs (RA related) | 12 166 | 24 | 8 396 | 22 | 5 125 | 26 |
| With at least one SP in the lower limbs (RA related), men | 2 921 | 24 | 2 013 | 24 | 1 167 | 23 |
| With at least one SP in the lower limbs (RA related), women | 9 245 | 76 | 6 383 | 76 | 3 958 | 77 |
| With at least one foot SP (RA related) | 3 170 | 6 | 1 336 | 3 | 2 028 | 10 |
| With at least one knee SP (RA related) | 5 750 | 12 | 4 046 | 10 | 1 935 | 10 |
| With at least one hip SP (RA related) | 5 814 | 12 | 4 353 | 11 | 1 718 | 9 |
| With at least one TJA in the lower limbs | 9 316 | 19 | 7 044 | 18 | 2 999 | 15 |
| With at least one foot TJA | 157 | 0.3 | 105 | 0.3 | 57 | 0.3 |
| With at least one knee TJA | 5 133 | 10 | 3 783 | 10 | 1 564 | 8 |
| With at least one hip TJA | 5 460 | 11 | 4 083 | 11 | 1 571 | 8 |
| *Number of surgical procedures* | | | | | | |
| Total number | 75 803 | | 53 704 | | 22 099 | |
| Men | 16 993 | 22 | 12 143 | 23 | 4 850 | 22 |
| Women | 58 810 | 78 | 41 561 | 77 | 17 249 | 78 |
| Lower limbs (RA related) | 20 789 | 27 | 12 902 | 24 | 7 887 | 36 |
| Lower limbs (RA related), men | 4 719 | 23 | 3 001 | 23 | 1 718 | 22 |
| Lower limbs (RA related), women | 16 070 | 77 | 9 901 | 77 | 6 169 | 78 |
| TJA in the lower limbs | 13 895 | 18 | 10 194 | 19 | 3 701 | 17 |
| Foot TJA | 181 | 0.2 | 120 | 0.2 | 61 | 0.3 |
| Foot TJA, men | 37 | | 26 | | 11 | |
| Foot TJA, Women | 144 | | 94 | | 50 | |
| Knee TJA | 6 902 | 9 | 5 037 | 9 | 1 865 | 8 |
| Knee TJA, men | 1 619 | | 1 195 | | 424 | |
| Knee TJA, women | 5 283 | | 3 842 | | 1 441 | |
| Hip TJA | 6 812 | 9 | 5 037 | 9 | 1 775 | 8 |
| Hip TJA, men | 1 687 | | 1 237 | | 450 | |
| Hip TJA, women | 5 125 | | 3 800 | | 1 325 | |
| Maximum SPs/patient | | | 56 | | 112 | |
| Maximum SPs/patient (lower limbs, RA related) | | | 12 | | 11 | |

RA, rheumatoid arthritis; SP, surgical procedure; TJA, total joint arthroplasty.

The total number of rheumatoid arthritis related surgical procedures on the lower limbs decreased significantly (by 24%) during 1987 to 1996, from 1482 to 1123: unadjusted B = −37.76 (95% CI, −62.76 to −12.77), p = 0.008; and by 8% during 1998 to 2001, from 1661 to 1530: unadjusted B = −43.10 (95% CI, −52.20 to −34.00), p = 0.002, independent of age and sex (fig 3).

In relation to rheumatoid arthritis related operations on the lower limbs between 1996 and 2001, a foot operation was most likely to be the first one done (n = 1873 operations). Operations to the foot comprised 36% of all first operations on the lower limbs (95% CI, 34.8% to 37.5%). Knee operations were next (n = 1722; 34% of all first operations (95% CI, 32.3% to 34.9%)), followed by hip operations (n = 1526; 30% of all first operations (28.5% to 31.0%)), and finally a combination of more than one type of operation (n = 24; 1% of all first operations (0.3% to 0.7%)).

## Total joint arthroplasties

In all, 13 895 (18%) of all surgical interventions were total joint arthroplasties (primary and revision) in the foot, knee, or hip. Between 1997 and 2001, 47% of all rheumatoid arthritis related surgical procedures of the lower limbs were total joint arthroplasties (table 1; fig 1). Overall, 9316 (19%) of all 49 802 rheumatoid arthritis inpatients in the study period had at least one total joint arthroplasty of the foot, knee, or hip joint (table 1).

## Sex differences

Between 1987 and 1996, 75% of all admissions for rheumatoid arthritis were female patients, the proportion being similar between 1998 and 2001. Female patients were significantly more likely to be admitted for an operation than male patients: unadjusted OR = 1.19 (95% CI, 1.16 to 1.22), p = 0.000; OR adjusted for age = 1.19 (1.16 to 1.22), p = 0.000. Moreover, women were more likely than men to be admitted for a rheumatoid arthritis related operation on the lower limbs (unadjusted OR = 1.15 (1.10 to 1.19), p = 0.000; OR adjusted for age = 1.14 (1.10 to 1.18), p = 0.000), or for a total joint arthroplasty (unadjusted OR = 1.08 (1.03 to 1.12), p = 0.001) (adjusted for age OR = 1.06 (1.02 to 1.11), p = 0.003).

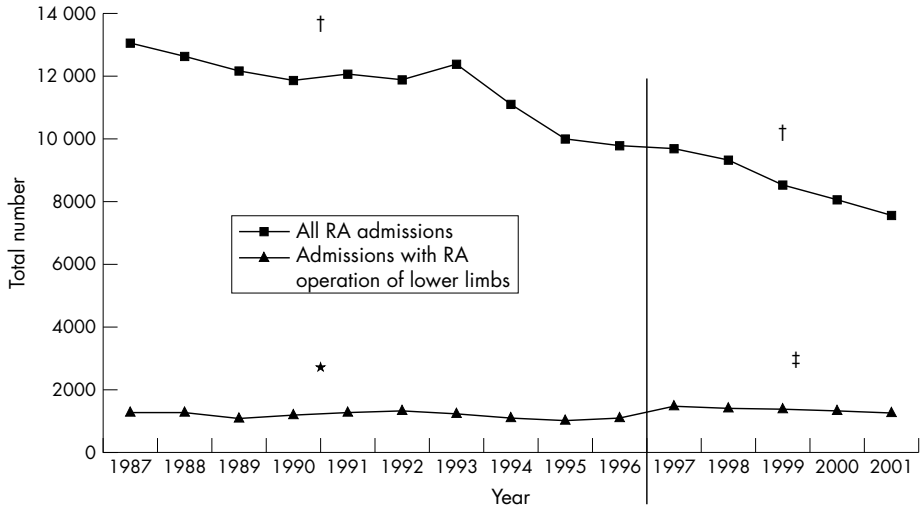


**Figure 2** The annual number of Swedish inpatient admissions with diagnosed rheumatoid arthritis and for rheumatoid arthritis related surgical procedures to the lower limbs during 1987 to 2001, analysed by linear regression. †Unadjusted B = −385.90 (95% CI, −450.33 to −321.48), p = 0.000; adjusted B = −320.33 (95% CI, −558.52 to −82.13), p = 0.013. *NS. ‡Unadjusted B = −52.90 (95%CI, −78.60 to 27.20), p = 0.013, independent of age and sex. RA, rheumatoid arthritis.

### Age at first orthopaedic surgery to the lower limbs

The median age of Swedish patients with rheumatoid arthritis who had an operation on the lower limbs was 66 years between 1987 and 1996 and 63 years between 1997 and 2001. Patients having foot operations between 1987 and 1996 were younger (median age 62 years) than patients who had to undergo knee (median age 68 years) or hip operations (median age 65 years) ($p<0.001$) (table 1). Similarly, between 1997 and 2001 the median age of rheumatoid patients at the time of foot surgery was lower (median age 59 years) than in patients having knee (median age 65 years) or hip operations (median age 64 years) ($p<0.001$) (table 2).

### Length of hospital stay in days

Between 1987 and 1996 there was a significant reduction in the length of hospital stay after the first rheumatoid arthritis related foot operation: 0–2 *v* 3–7 days, unadjusted OR = 0.95 (95% CI, 0.91 to 1.00), p = 0.050; adjusted OR = 0.94 (0.89 to 0.99), p = 0.015; and 0–2 *v* 8+ days, unadjusted OR = 0.86 (0.82 to 0.91), p = 0.000; adjusted OR = 0.86 (0.82 to 0.91), p = 0.000.

There was a also significant reduction between 1998 and 2001 in the length of hospital stay (0–2 *v* 8+ days, with adjustment for age) after the first knee operation, suggesting that the patients spent less time in hospital (unadjusted OR = 0.86 (95% CI, 0.72 to 1.02), p = 0.088; adjusted OR = 0.83 (0.69 to 1.00), p = 0.049).

## DISCUSSION

In this population based study we aimed to analyse whether the rates of hospital admission and the use of orthopaedic

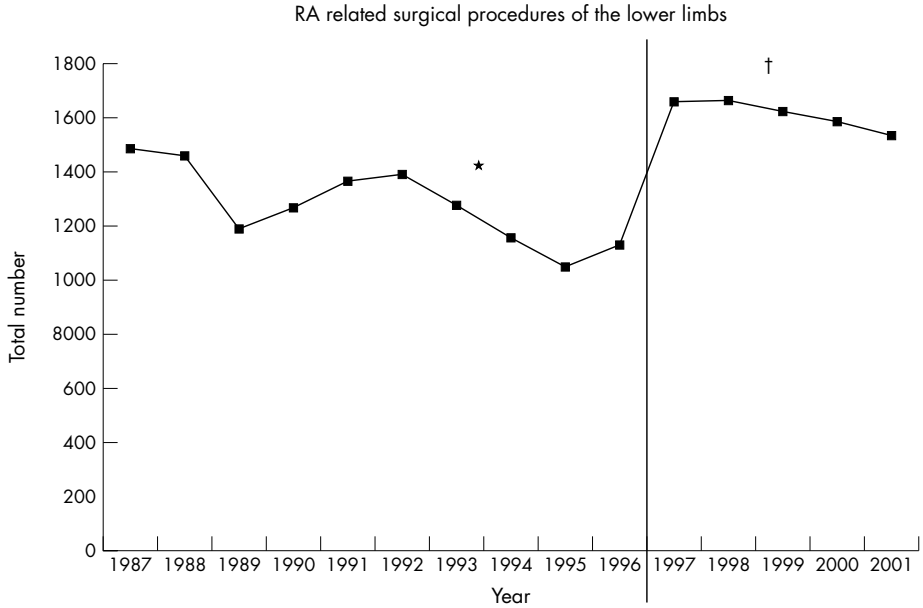


**Figure 3** The annual number of rheumatoid arthritis related operations of the lower limbs in patients with rheumatoid arthritis in Sweden during 1987 to 2001, analysed by linear regression. *Unadjusted B = −37.76 (95% CI, −62.76 to −12.77), p = 0.008, independent of age and sex. †Unadjusted B = −43.10 (95% CI, −52.20 to −34.00), p = 0.002, independent of age and sex. RA, rheumatoid arthritis.

**Table 2** Age in years and length of hospital admission in days resulting from surgical procedures to the lower limbs for inpatients with rheumatoid arthritis in Sweden between 1987 and 2001

| Study period | 1987 to 1996 | % | 1997 to 2001 | % |
|---|---|---|---|---|
| **Age at first surgery (median (SEM))** | | | | |
| Lower limbs (RA related) | 66 (0.1) | | 63 (0.2) | |
| Foot SP (RA related) | 62 (0.3) | | 59 (0.3) | |
| Knee SP (RA related) | 68 (0.2) | | 65 (0.3) | |
| Hip SP (RA related) | 65 (0.2) | | 64 (0.4) | |
| **Length of admission (days) for first operation (median (SEM))** | | | | |
| Lower limbs (RA related) | 12±0.1 | | 7±0.1 | |
| Foot SP (RA related) | 4±0.3 | | 4±0.1 | |
| 0–2 days | | 24 | | 28 |
| 3–7 days | | 47 | | 55 |
| 8+ days | | 30 | | 17 |
| Knee SP (RA related) | 14±0.2 | | 8±0.2 | |
| 0–2 days | | 1 | | 9 |
| 3–7 days | | 10 | | 29 |
| 8+ days | | 90 | | 62 |
| Hip SP (RA related) | 13±0.2 | | 9±0.2 | |
| 0–2 days | | 1 | | 2 |
| 3–7 days | | 11 | | 30 |
| 8+ days | | 88 | | 68 |
| **Hospital admission (days) for different age groups** | | | | |
| *Foot SP (RA related)* | | | | |
| 30–59 years of age | | | | |
| 0–2 days | | 28 | | 33 |
| 3–7 days | | 50 | | 55 |
| 8+ days | | 22 | | 12 |
| 60+ years of age | | | | |
| 0–2 days | | 21 | | 25 |
| 3–7 days | | 45 | | 54 |
| 8+ days | | 35 | | 21 |
| *Knee SP (RA related)* | | | | |
| 30–59 years of age | | | | |
| 0–2 days | | 1 | | 15 |
| 3–7 days | | 10 | | 36 |
| 8+ days | | 89 | | 50 |
| 60+ years of age | | | | |
| 0–2 days | | 0.4 | | 4 |
| 3–7 days | | 10 | | 26 |
| 8+ days | | 90 | | 70 |
| *Hip SP (RA related)* | | | | |
| 30–59 years of age | | | | |
| 0–2 days | | 1 | | 3 |
| 3–7 days | | 14 | | 38 |
| 8+ days | | 86 | | 59 |
| 60+ years of age | | | | |
| 0–2 days | | 0.4 | | 2 |
| 3–7 days | | 10 | | 26 |
| 8+ days | | 89 | | 72 |

RA, rheumatoid arthritis; SP, surgical procedure.

surgery to the lower limbs in Swedish patients with rheumatoid arthritis have changed during the period 1987 to 2001. Our results indicate that the rates of admission decreased significantly (by 42%) from the mid-1980s to the end of 2001. In parallel, the total number of rheumatoid arthritis related surgical procedures to the lower limbs also decreased significantly, by 24% during 1987 to 1996 and by 8% during 1997 to 2001. There have been no large demographic changes in Sweden during the study period that could account for these trends. Adjustment for age and sex did not alter the temporal trends.

Da Silva *et al* documented the frequent use of rheumatoid arthritis related orthopaedic surgery, with a 34% cumulative incidence of joint surgery at 30 years.[4] These investigators reported an overall trend towards a reduction in joint surgery in patients with rheumatoid arthritis diagnosed after 1985, suggesting that more recently diagnosed patients receiving modern drug regimens may require less orthopaedic joint surgery than their predecessors.[4]

The positive trend to fewer inpatient admissions and less rheumatoid arthritis related joint surgery can be seen as the combined result of improved diagnostic procedures and earlier therapeutic intervention, new and more effective therapeutic regimens, and an improvements in rheumatological and orthopaedic practice. It is generally recognised that the pharmacological treatment of patients with rheumatoid arthritis has become more effective in terms of both clinical and pharmacological outcome, with fewer side effects. While in a study from the USA from the mid-1980s, 43% of medical admissions were for the treatment of drug related side effects, these numbers have now dramatically decreased.[7] There have been several reports suggesting that rheumatoid arthritis might have become a ''milder'' disease over recent decades.[2 8 9]

The reduction in admissions could also be attributed to an economically motivated shift from inpatient treatment to a greater emphasis on outpatient treatment for minor surgical procedures and for patients receiving non-surgical treatment.

During the last decades, the number of beds in Swedish hospitals has decreased by nearly 80% from 120 000 to just over 27 000, while at the same time outpatient units have expanded.[10]

Ward reported that the rates of hospital admission for rheumatoid vasculitis and splenectomy in Felty's syndrome—representing severe manifestation of rheumatoid arthritis—were markedly lower (33% and 71%, respectively) in 1998 to 2001 than in 1983 to 1987.[5] In parallel, there was a significant decrease in the rates of total knee arthroplasties during 1998 to 2001 compared with the rates in the early 1990s.[5]

Compared with the 1980s to the mid-1990s, severe functional disability in rheumatoid arthritis has become rare, and the rate of radiological damage has decreased in inception cohorts analysed more recently.[11 12] The patients in these latter cohorts received more and different treatment with disease modifying antirheumatic drugs than patients 20 years ago.[5]

In our analysis, 19% of all inpatients with rheumatoid arthritis received at least one total joint arthroplasty of the lower limbs. Total joint replacements seem to comprise many of the operations carried out on the lower limbs: 47% of all rheumatoid arthritis related surgical procedures on the lower limbs were total joint arthroplasties between 1997 and 2001. These figures might be lower in the entire Swedish rheumatoid arthritis population because we analysed a selected population that needed hospital admission.

Genetic factors, sex, and age seem to influence disease severity, as well as other aspects of the disease course: 75% of all admissions for rheumatoid arthritis to a Swedish hospital in the study period were female; and more female inpatients had rheumatoid arthritis related surgery and received total joint arthroplasty in a lower limb. A similar pattern was reported by Weyand *et al*, who found that orthopaedic joint surgery was more often done in women (50%) than in men (27%).[13] Arthroplasties were more common in women.[13]

The median age at the first operation on a lower limb in Swedish hospital inpatients with rheumatoid arthritis was 66 years during 1987 to 1996 and 63 years during 1997 to 2001. Similar figures were presented by Massardo *et al*[14] for first surgery in rheumatoid arthritis (average age 61.4 years). In our inpatient cohort, the foot was most likely to be operated on first. These results suggest that the small joints develop structural deformities requiring surgery at an earlier age in rheumatoid arthritis.

We identified a trend over time for Swedish patients with rheumatoid arthritis to be retained in hospital for shorter periods following rheumatoid arthritis related operations to the lower limbs. This is in line with a recent report on French patients with rheumatoid arthritis,[15] and reflects a general effort to cut costs by reducing the length of hospital stay.

Our study, based on a national register, has certain limitations. The SNHDR database contains no information about disease onset, disease duration, and duration or dose of drug treatments. In recent years a shift from inpatient to outpatient treatment has occurred in Swedish hospital care, which is not reflected in the SNHDR database. This mainly applies to surgical procedures on the foot in our study population.

A considerable number of surgical procedures had to be excluded between 1987 and 1996, as some operation codes did not identify whether they were joint specific. This may explain the increase in operations and admissions for rheumatoid arthritis related operations of the lower limbs when the 10th ICD revision was introduced in 1997. Moreover, our analysis is based only on the clinical and economical health care system in Sweden, which may differ from other Western countries. Such national variations in indications for surgery, surgery rates, or waiting times to admission for patients with rheumatoid arthritis may limit the generalisability of our results. Nonetheless, an investigation of all inpatient admissions for rheumatoid arthritis followed systematically for 15 years and covering the entire rheumatoid arthritis population of Sweden has not been undertaken before. The data in the SNHDR are collected prospectively and undergo no further selection, so they provide a nationwide perspective, not merely one that reflects a representative inpatient population. The data presented here reinforce the important role of orthopaedic surgery in the evolution of rheumatoid arthritis, and show the progress in rheumatoid arthritis related orthopaedic surgery to the lower limbs during the past two decades.

## Conclusions

Despite the general emphasis on early intervention with drug treatment, severe joint failure as early as a few years after the onset of rheumatoid arthritis may still occur in patients with this disease. New therapeutic regimens may influence the future need for hospital admission and orthopaedic joint surgery in patients with rheumatoid arthritis. During the past 15 years, the need for orthopaedic surgery and hospital admission has decreased consistently. This can be seen as reflecting improvements in the management of rheumatoid arthritis and in this particular orthopaedic field. Knowledge of the disease course and its impact on hospital admissions, as well as the need for orthopaedic joint surgery, is of great importance for clinicians, economic health professionals, and not least for all patients with this disease.

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