

Past incidence and future demand for knee arthroplasty in Sweden

A report from the Swedish Knee Arthroplasty Register regarding the effect of past and future population changes on the number of arthroplasties performed

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ABSTRACT – By combining data from the Swedish Knee Arthroplasty Register and Swedish census registers we have calculated the past age-specific incidence of primary knee arthroplasties and predicted the demand.

During the last 20 years, osteoarthritis has accounted for the largest increase in number of knee arthroplasties while operations for rheumatoid arthritis remained constant. The mean yearly number of operations between the periods 1976–1980 and 1996–1997 increased more than five-fold, while only 6% of that increase could be explained by changes in the age-profile of the population. Most operations were performed on persons of 65 years and older who also had the largest increase in incidence. By using the incidences for 1996 and 1997 and taking into account the expected future changes in the age profile of the Swedish population, we estimate that, in the absence of an effective preventive treatment, the number of knee arthroplasties will increase by at least one third until 2030.

In recent decades, new forms of medical and surgical treatment have become available, while there has been a large shift in the age profile of the population which has led to an increase in musculo-skeletal disorders, notably joint diseases and fragility fractures. Although beneficial, the increasing possibilities to relieve pain and increase mobility by knee arthroplasty have led to a rise in medical expenses.

To be able to plan for future demand and cost, it is of value to estimate the need for a specific treatment.

By comparing population data and the number of knee arthroplasties performed in Sweden, the age-specific incidence was calculated and we tried to evaluate what portion of the observed increase in knee arthroplasties had been caused by population changes and estimate how such changes might affect the demand for knee arthroplasties in the coming decades.

Methods

The Swedish Knee Arthroplasty Register (SKAR) is a nationwide database that has registered primary arthroplasties and their revisions, defined as addition, exchange or removal of prosthetic components, in Sweden since 1975. The design and validation of the SKAR, which registers, among other things, the date of operations, gender and date of birth of patients has been described previously (Knutson et al. 1994, Robertsson et al. 1999, 2000).

The Statistical Central Bureau (SCB) keeps track of population figures in Sweden and makes projections on future changes. The numbers are published yearly (Statistics Sweden 1999).

The number of arthroplasties performed in Sweden increased sharply during the 20 years studied

Table 1. Number of primary knee arthroplasties by disease leading to surgery

Disease	Men	Women	Total
Osteoarthritis	14,871	29,989	44,860
Rheumatoid arthritis	2,392	7,574	9,966
Posttraumatic	503	720	1,223
Osteonecrosis	99	368	467
Various	255	430	685
Total	18,120	39,081	57,201

with as many procedures performed during the first 5-year period as in the last single year studied. For practical purposes, to reduce the effect of yearly variation, we divided the period 1976–1997 into four 5-year periods (1976–1995) and one 2-year period (1996–1997) and calculated the mean yearly incidence during each period. We then compared figures from the different periods and, by using the projected changes of the Swedish population until 2030, we estimated the future need for knee arthroplasty.

Results

During the period 1976–1997, 57,201 primary knee arthroplasties were performed in Sweden on 46,659 patients. The disease leading to knee arthroplasty was osteoarthritis in 78% of cases and 2/3 of operations were performed on women (Table 1, Figure 1).

The total number of revisions during 1976–1995 was 4,802 (4,607 knees). The number of revisions increased less than the number of primary

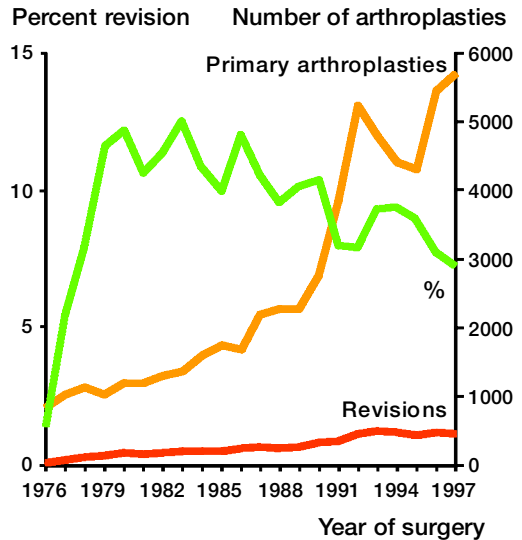


Figure 1. The number of revisions and primary arthroplasties in Sweden (brown lines/right axis). The ratio of revision arthroplasties/primary arthroplasties in percent per year (green line/left axis)

arthroplasties. In revised cases, the mean (median) time between the primary operation and revision was 4.4 years (3.3).

The incidence of primary arthroplasties increased with age, the lowest increase being in the youngest age group and the highest increase being in the oldest (Table 2).

The overall incidence increased 5-fold between the periods 1976–1980 and 1996–1997. The increase and aging of the population were responsible for only a small fraction of the increased number of operations, or 6% of the increase from 1976–1980 and 4% of the increase since 1981–

Table 2. Mean yearly incidence per 10⁵ inhabitants of knee arthroplasty in the age groups and during the time periods shown (males (M) and females (F))

Age	1976–1980			1981–1985			1986–1990			1991–1995			1996–1997		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
<45	0.4	1.1	0.8	0.3	1.0	0.6	0.4	0.9	0.7	0.4	1.1	0.7	0.5	1.4	0.9
45–54	6.0	15	10	4.8	12	8.2	4.5	11	7.8	8.9	16	12	12	23	17
55–64	18	40	29	20	45	33	28	57	43	65	104	84	75	122	98
65–74	32	76	56	52	109	82	83	159	124	179	309	249	231	367	304
75–84	22	48	38	45	85	69	96	149	127	204	316	270	248	389	332
85–	4.4	4.6	4.5	9.4	8.9	9.0	27	22	23	58	60	59	92	83	86
Total	6.9	18	13	9.9	24	17	17	36	26	35	69	52	43	83	63

Mean yearly number of arthroplasties

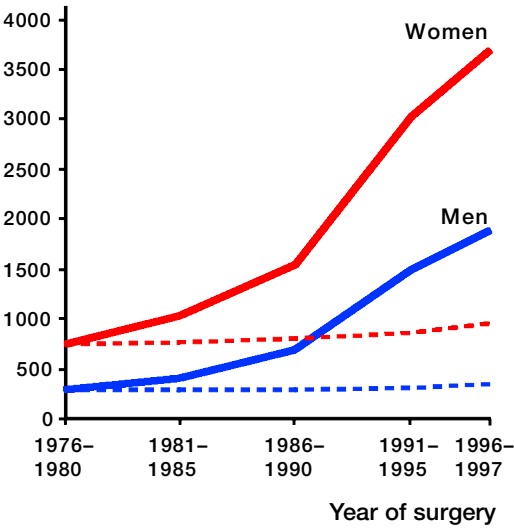


Figure 2. The number of knee arthroplasties performed per year during the time intervals shown. Solid lines are the observed numbers while dotted lines show the expected numbers, if the increase in number of operations had only been due to changes in the age profile of the population since 1976-1980. Women are marked red, men blue.

Mean yearly incidence/100,000

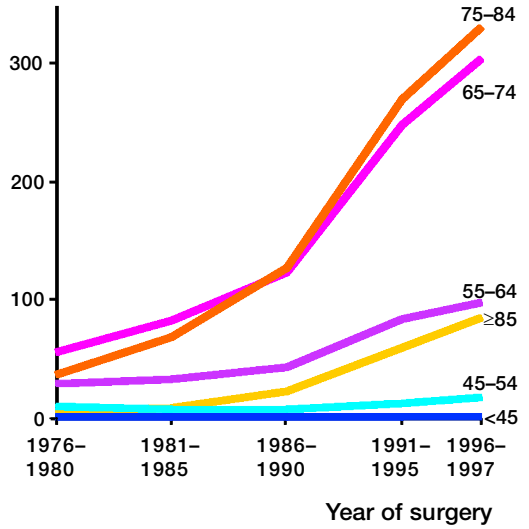


Figure 3. Mean yearly incidence per 100,000 inhabitants of primary knee arthroplasty for both genders in different age groups, during the year-intervals shown.

Mean yearly incidence/100,000

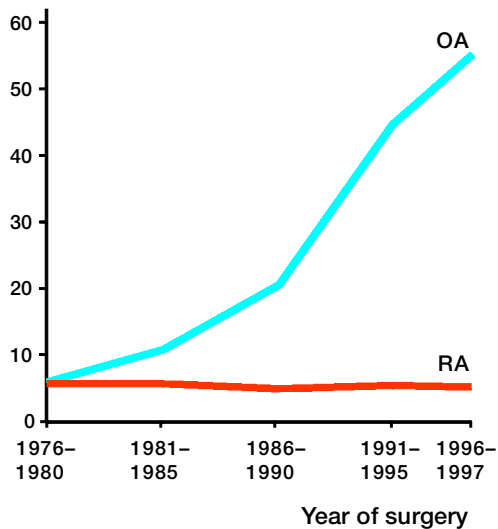


Figure 4. A. Mean yearly incidence per 100,000 inhabitants of arthroplasties performed for OA and RA.

Mean yearly incidence/100,000

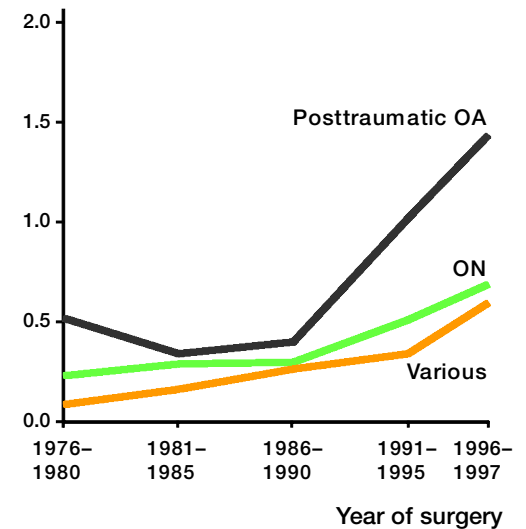


Figure 4. B. Mean yearly incidence per 100,000 inhabitants of arthroplasties performed for posttraumatic conditions, osteonecrosis and various diseases other than OA and RA.

1985 (Figure 2). The age-specific incidence seems to be leveling off somewhat during the last time intervals measured (Figure 3).

When the change in incidence was analyzed for different diagnostic groups, we found that, while

the incidence for rheumatoid arthritis remained unchanged, it increased for other diagnoses, and especially for arthrosis (Figure 4).

If the projected number of those in the different age groups until 2030, together with the incidence

Table 3. Expected number of operations to be performed in Sweden, taking into account population changes using the incidence of knee arthroplasty for the different age groups as it was 1996–1997, and the increase, compared to 1997

Year	Men	Women	Total	% Increase
2000	1,928	3,719	5,647	1
2005	2,028	3,809	5,837	5
2010	2,210	4,028	6,238	12
2015	2,417	4,337	6,754	21
2020	2,576	4,605	7,181	29
2025	2,678	4,791	7,469	34
2030	2,725	4,854	7,579	36

figures during the last period (1996–1997) are used to compute the future number of primary knee arthroplasties, an increase by 12% by 2010, 29% by 2020 and 36% by 2030 is to be expected (Table 3).

Discussion

During the 23-year period studied, reports to the SKAR by units performing knee arthroplasties have been voluntary and reporting routines have evolved (Robertsson et al. 2000). For the period 1987–1991, during which there was the sharpest increase in number of operations performed (Figure 1), the percentage of unreported arthroplasties has previously been estimated to be 15%/year (Knutson et al. 1994). A validation of the register in 1997 indicated that the accuracy in reporting declined somewhat after the initial decade of registration (Robertsson et al. 1999). The increase observed in the number of knee arthroplasties performed cannot be explained by an increase in reporting to the SKAR.

The figures for Sweden show that the main increase in number of knee arthroplasties performed has been caused not by an aging population, but because a new treatment has been offered to an increasingly wider selection of patients. There has been no increase in incidence of knee arthroplasties in rheumatoid arthritis nor in the younger age groups while the incidence in the older age-groups has been ten-fold.

By assuming that no new treatment will be introduced that changes the demand for knee arthro-

plasty, it can be anticipated that only because of changes in the population will there be a need for a 36% increase in the number of operations in Sweden by 2030. However the incidence has not leveled off, and therefore a further increase may be expected.

Our population-based estimates of the increase in number of arthroplasties are not so dramatic as the 85% increase projected in the USA for the period between 1996 and 2030 (AAOS Bulletin 1999). This is partly caused by the differences in the composition of the population, since the Swedish population presently is older than that of the USA. In Sweden in 1996, persons 65 years and older accounted for 17% of the population, as compared to 13% in the USA. The expected percentage of elderly persons by 2030 is 24% for Sweden and 20% for the USA (U.S. Bureau of the Census 1996, 1998, Statistics Sweden 1999)

Is an additional increase to be expected ?

In the USA with a population of 265 millions in 1996, there were 245,000 primary total knee arthroplasties or 92/10⁵ inhabitants (68 in men, 116 in women). In Sweden, despite a higher percentage of senior citizens, the number of arthroplasties performed was 63/10⁵ inhabitants (43 in men, 82 in women). This might be caused by a backlog of patients waiting for knee replacement, differences in indications for surgery or a different incidence of diseases leading to knee replacement.

What might indicate that a further rise in the Swedish incidence of knee arthroplasties can be expected is that the prevalence of both joint complaints and radiographic arthrosis among elderly persons has been found to be twice as high in the knee as in the hip joint (Bergström et al. 1986, Bagge et al. 1992). Despite this, the number of knee arthroplasties performed in Sweden has been half that of hip arthroplasties (Malchau and Herberts 1998). In the USA, the number of knee and hip arthroplasties is approximately equal.

On the other hand, we found that there are no indications of a hidden demand for future revision surgery. The ratio of revisions/primaries has been fairly constant, or even diminishing slightly, over the years and as the main increase in number of primary operations has been in the older age groups, it is unlikely that this will change.

We conclude that a one third increase in knee arthroplasty surgery is to be expected in the next 30 years, only because of changes in number and age distribution of the population. However, given the number of elderly with joint complaints, a substantial further increase is likely.

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