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Annual Report 2008

The Swedish Knee Arthroplasty Register

Dept. of Orthopedics, Lund University Hospital

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There is a continued interest in comparing results between individual clinics. The Knee Register has always held a restrictive attitude to open disclosure of the results of individual clinics and have pointed out the problems involving this matter. It is difficult if not impossible to adjust for differences in case-mix or change the fact that the results are historical (the surgery having been performed 1-11 years prior to the analysis). Considering that it is more likely that low-volume units will show extremely good or bad results, we have used ”frailty analysis” to adjust for differences in volumes among the units. The statistical background for using this method is described in the article: Variation in outcome and issues in ranking hospitals: An analysis from the Swedish Knee Arthroplasty Register. Acta Orthop. 2006 Jun;77(3):487-93. (http://www.actaorthop.org). Further, in this report we use simulation methods for the first time in order to observe the uncertainty in the ranking order, i.e. for the rank of each unit we also disclose the ranks which lie within the 95% confidence interval. For further information we refer to our newly published article in Läkartidningen 2008, 105(35):2313-4.

We consider it important that results are published in scientific journals so that the methods and findings are scientifically reviewed (peer-reviewed).

We have recently published that compared to unilateral TKA, the 30-day mortality is increased if both knees are operated at the same time (Stéfansdóttir A, Lidgren L, Robertsston O. Higher Early Mortality with Simultaneous Rather than Staged Bilateral TKAs: Results from the Swedish Knee Arthroplasty Register. Clin Orthop Relat Res 2008, Aug 1, /Epub ahead of print/).

We have also lately shown that young patients operated on with a TKA have a higher cardiovascular mortality and suggested that they should be offered consultation of a cardiologist or internist. (Robertsson O, Stefansdottir A, Lidgren L, Ranstam J. Increased long-term mortality in patients less than 55 years old who have undergone knee replacement for osteoarthritis: results from the Swedish Knee Arthroplasty Register. J Bone Joint Surg Br 2007 May;89(5):599-603).

In a relatively short-term study in patients with systemic immunological disease and a knee implant, we have previously found a small increased risk of hematologic malignancy (Lewold S, Olsson H, Gustafson P, Rydholm A, Lidgren L. Overall cancer incidence not increased after prosthetic knee replacement: 14,551 patients followed for 66,622 person-years). We are in the process of repeating this study with a long term follow-up in cooperation with the Swedish Cancer Registry.

The importance of surgical training has been coming back in our presentations and we have in several instances discussed the effect of volume and time on results. In a recent study we have presented how the introduction of mini-invasive surgery (MIS) for unicompartmental arthroplasty affected the initial results and how the introduction of new implants and techniques may introduce or prolong the learning curve. Thus, we recommend training of surgeons and other relevant staff when units change their choice of implants. (Robertsson O, Lidgren L. The Short-Term Results of 3 Common UKA Implants During Different Periods in Sweden. J Arthroplasty 2008 Sep;23(6):801-7).

The register continues to use paper forms, including the implant stickers, for reporting from the units. Although it seems attractive to input data using the Internet, we still feel that the technology and the flow of information from the implant distributors is not good enough in order for us to change our practice.

At our Arlanda meeting in 2007 we discussed if it was not appropriate to ask for additional information on the form, in order to gather information on the use of torniquet, drains, timing of antibiotic prophylaxis etc. This could render a basis for further continuous quality improvement. It was decided that we should test the new forms in selected units during 2007. We have done so and taken into consideration suggestions made. The new form is to be used by all units from Jan. 1st 2009.

For interested participants, the register has provided information by the Internet. The NKO (National Competence Centre within the area of musculoskeletal disorders) built a computer platform on which the participating units have their own "folder" which the contact physician can access. The folder contains among other things the unit's patient related data (Excel file) which also includes information on patients revised elsewhere. As it is unclear if all the contact physicians have a current password we deliver the same information on a CD and include information on how to access the "folder" as well as new user identities and passwords. It is our hope that this information will help the participating units to perform their own analyses.

As previously the report consists of 3 parts. The first part describes the routines of the register, epidemiology and general results. The second part contains information regarding what has been reported to the register during 2007 as well as analyses covering the 10-year period 1997-2006. The third part is specific for each reporting unit and contains lists with information regarding all the operations reported by the unit in 2007. One list is sorted by ID and the other by the date of operation. – It is our hope that the lists will be compared to locally available information, in an attempt to find and correct any errors in the registration. Further, we consider it important that colleagues receive information about the report at hospital meetings so that the content can be discussed and analyzed.

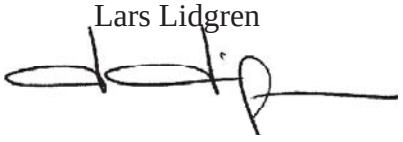
Again, we find it appropriate to remind you that the SKAR is a prospective project and that any revision reported to the register is only entered into the database if the primary operation was previously reported according to prevalent routines. Further, if a primary operation is discovered only when it became subject of a revision at a later time neither the primary nor the revision will be taken into account. Late reporting of primary procedures is only allowed in cases when all primaries performed during a time period are reported collectively.

Some of the issues dominating the international scientific debate on knee arthroplasty are the boundaries between the joint saving surgery (osteotomy), unicompartmental- and total knee surgery, the importance of surgical training, the effect of implant design on survival, the risks of bacterial resistance and the type of revision surgery after prosthetic infection. All these issues are subject for ongoing studies by the register group.

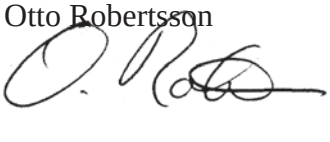
We at the The Knee Register in Lund want to thank our contact physicians and secretaries for their important contribution during the years and ask you to analyze and circulate the presented information.

Lund, October 15th, 2008
On behalf of the Swedish Knee Arthroplasty Register

Lars Lidgren



Otto Robertsson



CONTENT

Definitions

Revision is defined as a new operation in a previously resurfaced knee during which one or more of the components are exchanged, removed or added (incl. arthrodesis or amputation). This implies that soft tissue operations such as arthroscopy and lateral release are not considered revisions. The reason for this stringent definition is that some minor operations are not necessarily related to the primary surgery and thus cannot be considered a complication or failure.

TKA (Total or Tricompartmental Knee Arthroplasty) is defined as a knee arthroplasty in which the femoral component has a flange and thus all three compartments of the knee are affected. Even in cases where a patellar button is absent, the flange resurfaces half of the femoropatellar compartment and the arthroplasty is still considered to be a TKA.

Bicompartmental arthroplasty (historical) uses two components, one on the femoral and one on the tibial side to resurface both the femorotibial compartments (medial and lateral) but not the femoropatellar compartment. Thus, this implant has no femoral flange and is not meant to allow for resurfacing of the patella.

UKA (Unicompartmental Knee Arthroplasty) implies an arthroplasty that separately resurfaces the medial or lateral femorotibial compartment. (med. UKA or lat. UKA). If 2 UKA implants are used to resurface both femorotibial compartments the arthroplasty it is named bilateral UKA.

Patellar arthroplasty is used to resurface only the femoropatellar compartment. Even if this arthroplasty is unicompartmental by definition, it is accounted for separately.

Hinged implants. As the name implies these implants only allow for flexion and extension through a fixed axis.

Linked implants (Linked/Rotating hinge) have a mechanical coupling between the femoral and tibial components allowing for flexion and extension as well as for varying amount of rotation.

Stabilized implants. Even if the hinges and the linked implants are extremely stabilizing, the term stabilized implants is used for a group of prostheses that are a kind of TKA but use the form of the femoral and tibial components to restrict movement in valgus, varus and rotation. The posterior cruciate sacrificing type most often has an eminence in the middle part of the tibial polyethylene that can be contained by a box in the femoral component that lies between the medial and lateral sliding surfaces. By a camshaft-like property, the femoral component is forced to slide back during flexion, which simulates the effect of the posterior cruciate ligament. The fit between polyethylene and metal is such that it allows for some rotation. In so-called superstabilized implants the congruency has been increased by making the eminence larger with a total fit against the box of the femoral component thus, restricting the rotation and varus/valgus movement. Intermediary forms also occur. Stabilized implants are most often used for revision but also for the more difficult primary arthroplasties.

The ordinary TKA can be made somewhat more stabilized by increasing the congruency between the sliding surfaces. In these instances there is a slight eminence of the polyethylene that fits against the femoral component. However, the term stabilized is only used for those implants that are more stabilized than usual by use the above mentioned camshaft construction.

For those interested there is an excellent article on the history and the developement of the TKA; Robinson RP; The Early Innovators of Today's Resurfacing Condylar Knees. J of Arthroplasty 2005 (suppl 1); 20: 1.

Filling in the Knee Register form

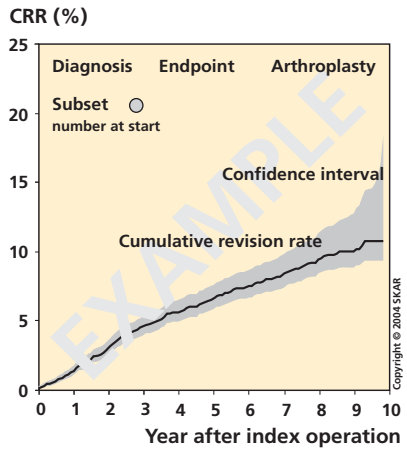
The Knee Register uses a form that is recommended to be filled in during the operation, (by a nurse or other attending staff). The implant stickers (containing the Part No's and Lot No's) for all used implants are to be affixed to the form. Besides the ID of the patient, the date of operation, diagnosis, side operated, brand of cement and cementing of components has to be filled in. Information whether a mini-arthrotomy was used must be specified. Information regarding the operating surgeon is voluntary. Forms are sent to Lund (once a month is recommended) where the data is computerized. In our opinion, this procedure has considerable advantages such as a minimal workload for the participating units and the most correct information with the least risk of wrong coding. Furthermore, it allows the staff of the registry to check unknown Part No's during input.

How the register compares implants

Survival analyses are used for graphical presentation of data. The curves show the Cumulative Revision Rate (CRR) which describes what percentage of the operated patients was expected to become revised with time. The calculation is based on the sum of all the revisions and expresses the rate for surviving patients. Most often the time axis shows a 10-year period. However, it has to be kept in mind that patients are continuously being added during this time. Thus, all the patients have not been followed for the whole period. This implies that if 1,000 patients were operated on each year (and nobody dies), a 10-year study would include 10,000 patients of which only 1,000 had been followed for more than 9 years. The last part of the curve (at the right) therefore expresses the long-term rate of revision for patients operated more than 9 years earlier. As the number of these patients is relatively small, the 95% confidence interval becomes large. When the number of patients at risk is small (at the right of the curve), each revision has a large effect (e.g. 50% are revised when 2 patients are left at risk and one of them has a revision). For this reason the Register cuts the curves when less than 40 patients are left at risk.

Survival statistics are used to calculate how long an implant is left unrevised. With increasing observation time the fraction of deceased patients increases (figure below). These patients are not disregarded because they were at risk of becoming revised during their lifetime and are thus allowed to deliver data for the period they lived. The probability for each revision is related to the number of remaining unrevised patients. The sum of all the probabilities is the cumulative risk of revision which specifies the risk for a surviving patient of becoming revised at a given time.

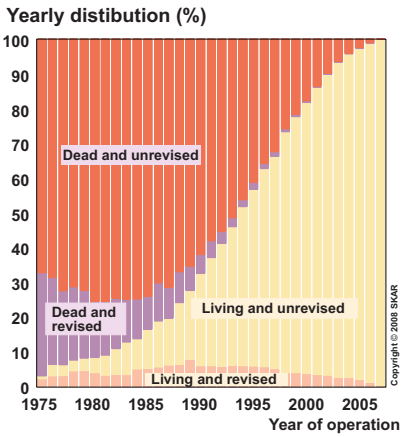
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared. An implant with the risk of 1.2 thus has a 20% increased risk of becoming revised etc.. For numerical variables (e.g. age) the risk ratio relates to the change in risk if the variable increases by one unit (e.g. 1 year). When comparing groups where uneven distribution of factors can be expected (e.g. age in cemented vs. uncemented implants) the Cox regression is especially important.



CRR curve example.

It is important to note that as the individual patient also is at risk of dying, the real proportion of revisions is lower than the CRR. As the figure below shows, more than 3/4 of the patients that were operated in 1980 deceased without having been revised Half of those still alive have suffered revision.

When one tries to estimate differences in risk of revision between units this is complicated by the variation in volume. The reason is that units with few observations (operations) are more likely to have overly good or bad results. Thus the register received help from NKO statisticians to calculate the risk using a “shared gamma frailty model” which takes volume into consideration. However, one has to remember that the units may have different “case-mix”, i.e. patients with different grade of joint destruction or differences in general health and activity. These factors, which we at present are unable to take into account, may influence the risk of revision and thus the results of individual units.



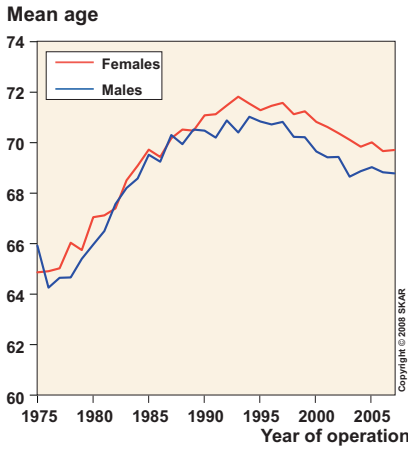
The status in 2007 for each yearly batch of patients operated since 1975.

Gender and age distribution

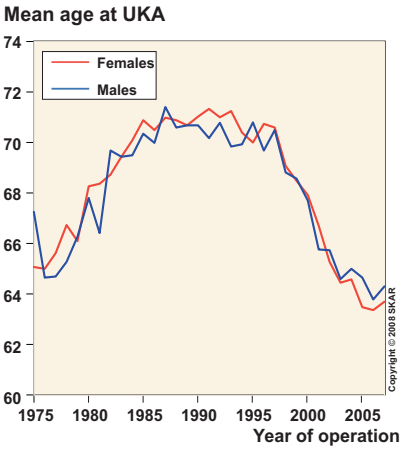
Between 1975 and 1994 the mean age at primary operation increased from 65 years to almost 72 years. The main reason was the relatively large increase in number of operations for the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution of the population. Since 1994 the proportion of patients less than 65 years of age has increased again, why the mean age again started to decrease. In 2007 it was a good 69 years and slightly higher for females (figure on the right).

If TKA and UKA are analyzed separately, it is apparent that when TKA was introduced in the seventies it was to a larger extent used in young patients rather than the UKA, which at the time was the standard treatment (figures below and on the next page). On the other hand, in recent years the mean age at UKA surgery has fallen considerably which coincides with the introduction of mini-invasive surgery. An interpretation of these observations may be that new technology to a larger extent is being tested in younger patients.

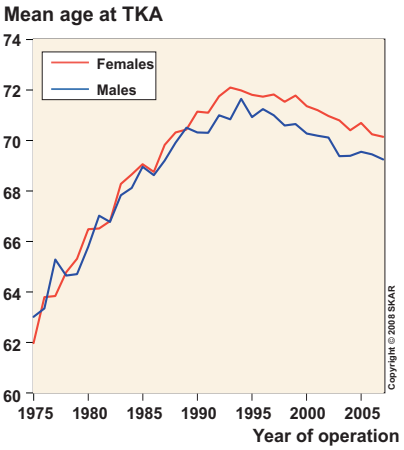
When comparing a series of patients operated during different periods, the change in the mean age makes it necessary to account for age by use of regression or to analyze different age groups separately.



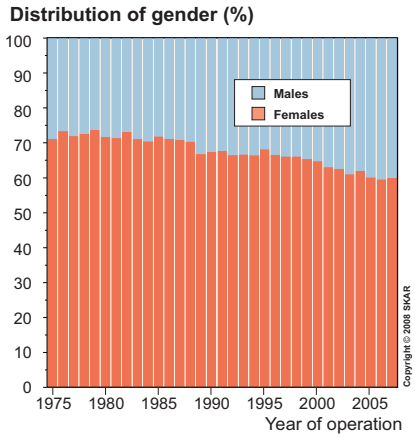
The mean age of patients at surgery (all types of implants) increased until the mid-nineties when it started to decrease.



In UKA, the mean age of patients at surgery has decreased sharply in recent years which coincides with the introduction of mini-invasive surgery



The mean age at surgery was lower for TKA than UKA when TKA was introduced in the seventies (cp the figure above).



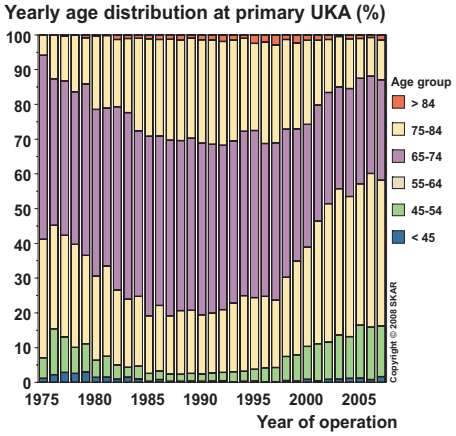
The proportion of males has increased slightly over the years.

Knee arthroplasty is more common in females than in males. At the start of the registration, females accounted for good 70% of the operations. As the figure above shows, the proportion of men has been slowly increasing so at present they account for 40%. Separate analyses of OA and RA show that it is mainly in OA that the proportion of men has increased. In RA men account only for one fourth of the operations and the proportion has not changed.

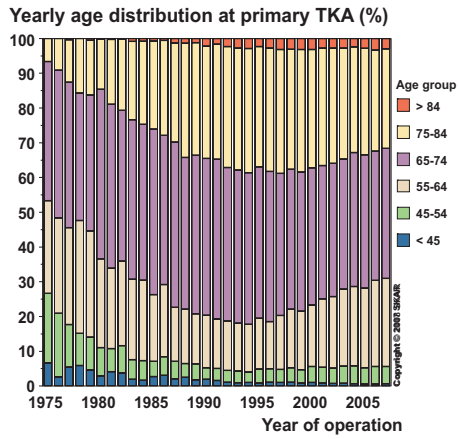
The figure to the right shows the relative number of operations performed on the different age groups over a period of more than thirty years. In a somewhat different manner than the mean age (last page) it shows how the relative proportion of the older groups increased until the mid-nineties after which their share again started to diminish.

The figures below show the age distribution for UKA respective TKA. It is evident that when the registration began in the seventies, the relative proportion of the youngest age groups was higher for TKA than for UKA.

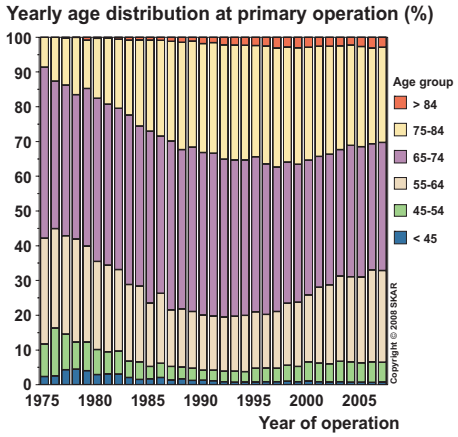
In UKA the relative proportion of patients less than 64 years of age has doubled after 1997, i.e. during the time when mini-invasive surgery catches on in Sweden. However, it has to be kept in mind that the actual number of UKA diminished by 30% since 1997 in contrast to TKA which doubled in number of operations. This implies that although the relative number of TKA among younger age groups has not increased as much as for UKA, the actual number of patients 45-65 years of age having a TKA tripled. This can be explained by an increased confidence in that knee arthroplasty is of benefit for younger patients.



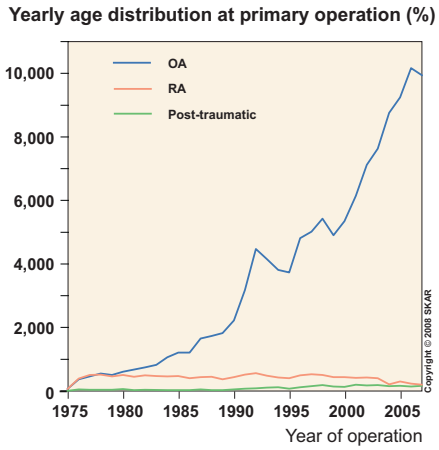
The relative distribution of primary UKA arthroplasties among different age groups.



The relative distribution of primary TKA arthroplasties among different age groups.



The relative distribution of primary arthroplasties among different age groups (all types of implants).



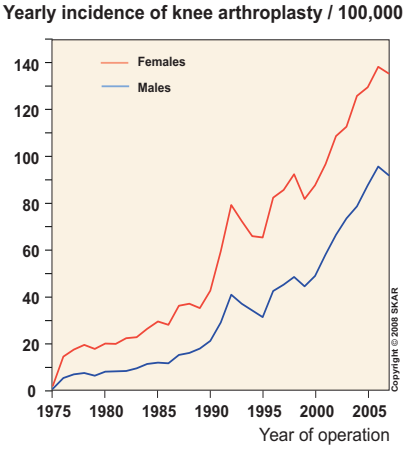
The yearly number of arthroplasties for different diagnoses.

In the eighties the use of knee arthroplasty really started to increase (graph above) mainly because of increased treatment of osteoarthritic patients. On the other hand has the number of operations for rheumatoid arthritis lessened, especially during the last few years which may be explained by the advance of new types of medical treatment. The number of operation for posttraumatic conditions has only increased slightly during the years. During the last decade, these three diagnoses were stated as the reason for surgery in 98% of cases.

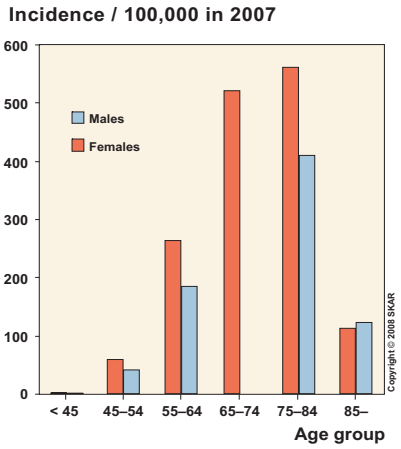
Incidence and prevalence

When the number of primary knee arthroplasties is divided by the number of inhabitants it can be characterized as the incidence of knee arthroplasty. As the graph to the right shows, the increase in incidence which started in the late eighties has still not culminated. As this is the incidence for the whole population (all ages) a small part of the increase in incidence reflects aging of the population over time.

In the year 2000, the register published an article in which it was estimated how projected changes in the age distribution in Sweden could affect the demand for knee arthroplasty surgery. Using the incidence observed during 1996-1997, it was found that by 2030 only aging of the population would call for an increase in the number of operations by 36% to 7,580 operations. That this number was already reached in 2002 shows that aging only explains a small part of the observed increase in incidence.



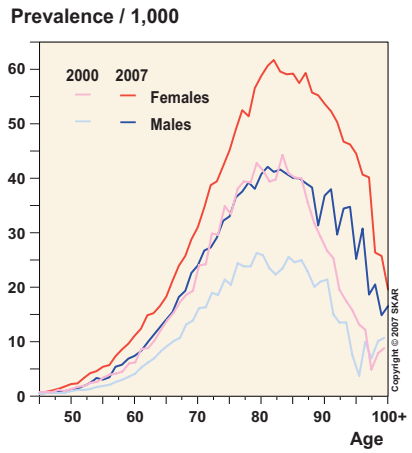
Incidence of primary knee arthroplasty per 100,000 inhabitants (all types of implants).



Incidence of primary knee arthroplasty in 2007 per 100,000 inhabitants (males and females) in the different age groups.

The figure to the left shows the age-specific incidence for different age groups in 2007. It is highest among those between 65 and 84 years of age. At this age, knee arthroplasty is almost 10 times more common than among those 45-54 years of age and 3-5 times more common than among those 85 years or older. Knee arthroplasty is more common in women in all age groups but the oldest one. As the incidence is so dependent on age and because the age distribution among different nations may vary, it is difficult to compare different countries without performing some form of age standardization.

The increase in number of operations causes a rise in the number of patients walking around with knee implants. The graph on the left shows the prevalence in 2007 i.e. the number of patients per 1,000 inhabitants in different age groups with a knee implant. For both men and women it peaks around 80-85 years of age. The decrease thereafter is probably a sign of the fact that the oldest group has been provided below its actual needs. Compared to the prevalence in 2000 the influx seems to be insignificant after 87 years of age. The increase in prevalence for the oldest age groups is mainly caused by ageing of previously operated patients by seven years. Thus, it seems that within few years there will be a steady state among the elderly in which at least one in fifteen women has a knee implant. Further increase is still possible through widening of indications.



The prevalence of knee arthroplasty in 2000 and 2007. One of fifteen elderly women has a knee arthroplasty.

Incidence in Sweden over time

Kvinnor

Agegroup	1975-1980	1981-1985	1986-1990	1991-1995	1996-2000	2000-2005	2006-2007
<45	1.1	1.0	0.9	1.1	1.5	1.7	1.6
45-54	14.6	11.7	11.4	15.7	27.5	49.9	62.2
55-64	40.2	44.6	57.4	103.7	134.1	199.4	263.7
65-74	76.3	108.8	159.1	308.0	375.3	479.7	537.3
75-84	47.3	84.1	147.3	312.4	393.2	489.4	567.5
>84	3.3	8.6	20.9	58.9	89.2	99.9	128.7
Total	17.89	24.20	35.76	68.14	85.73	114.24	135.96

Män

Agegroup	1975-1980	1981-1985	1986-1990	1991-1995	1996-2000	2000-2005	2006-2007
<45	0.5	0.3	0.4	0.4	0.7	0.8	1.4
45-54	6.0	4.9	4.4	8.8	14.4	30.0	42.1
55-64	17.6	20.4	28.5	64.9	81.8	149.5	191.3
65-74	32.0	51.3	82.8	178.9	242.5	350.9	424.4
75-84	21.9	44.4	95.6	200.5	255.0	353.7	438.7
>84	4.4	9.4	24.9	56.7	78.8	98.4	138.7
Total	6.87	9.89	16.42	34.37	45.81	72.62	93.12

Number of primary arthroplasties per unit and year

Unit	1975-2002	2003	2004	2005	2006	2007	Totalt	Percent
Akademiska sjukhuset	1,729	93	143	111	131	118	2,325	1.7
Alingsås	364	87	97	145	164	187	1,044	0.8
Arvika	333	35	124	120	84	74	770	0.6
Avesta	67						67	0.0
Boden	1,617						1,617	1.2
Bollnäs / Söderhamn	578	179	201	242	230	228	1,658	1.2
Borås	1,727	74	116	125	112	143	2,297	1.7
Carlanderska				21	31	28	80	0.1
Dalslands sjukhus	65	16					81	0.1
Danderyd	1,479	118	125	172	186	217	2,297	1.7
Eksjö-Nässjö	1,623	86	106	114	98	118	2,145	1.6
Elisabethsjukhuset	18	36	68	88	76	107	393	0.3
Enköping	363	118	104	144	183	194	1,106	0.8
Eskilstuna	1,441	15	21	40	57	48	1,622	1.2
Fagersta / Västerås	71						71	0.1
Falköping	616	113	137	122	132	122	1,242	0.9
Falun	2,385	186	264	150	180	223	3,388	2.5
Frölunda Spec.Sjukhus	106	73	68	94	127	120	588	0.4
Gällivare	665	57	72	81	120	93	1,088	0.8
Gävle	2,354	158	77	67	63	68	2,787	2.0
Halmstad	1,417	140	128	160	196	160	2,201	1.6
Helsingborg	1,465	89	51	43	18	14	1,680	1.2
Huddinge	1,541	89	116	80	24	96	1,946	1.4
Hudiksvall	764	79	73	79	73	86	1,154	0.8
Hässleholm	1,801	390	434	529	527	519	4,200	3.0
Jönköping	1,374	112	136	106	107	90	1,925	1.4
Kalix	139	42	34				215	0.2
Kalmar	1,380	130	132	134	130	102	2,008	1.5
Karlshamn	808	157	166	184	178	169	1,662	1.2
Karlskoga	893	111	95	73	92	105	1,369	1.0
Karlskrona	1,088	10	7	6	6		1,117	0.8
Karlstad	2,229	132	200	170	214	231	3,176	2.3
Karolinska	903	180	178	280	121	162	1,824	1.3
Kristianstad	1,297						1,297	0.9
Kristinehamn	252						252	0.2
Kullbergska sjukhuset	532	72	96	121	125	96	1,042	0.8
Kungsbacka	1	9	11	12	4		37	0.0
Kungälv	576	106	68	164	134	183	1,231	0.9

(cont.)

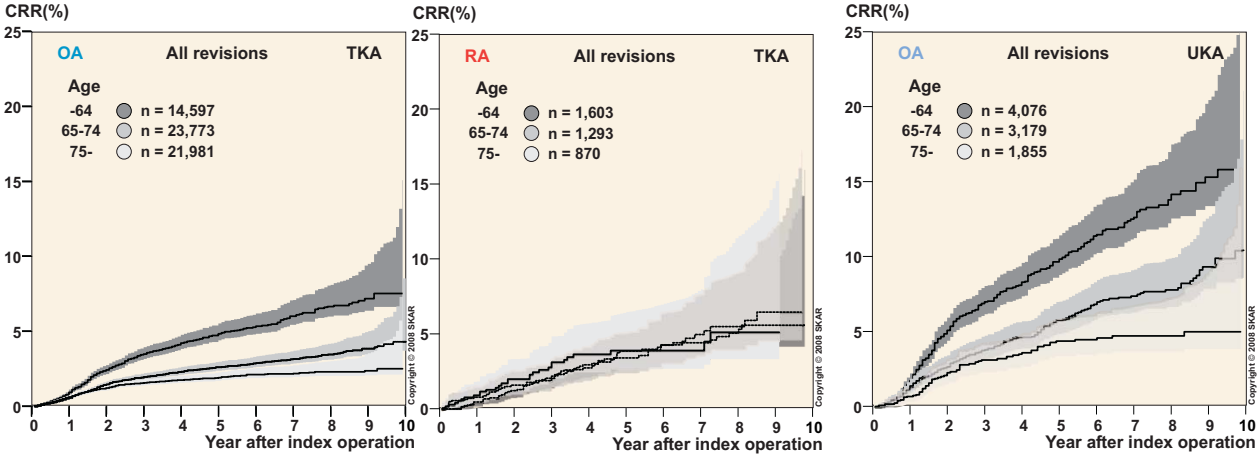
Number of primary arthroplasties per unit and year (cont.)

Unit	1975-2002	2003	2004	2005	2006	2007	Totalt	Percent
Köping	662	106	94	99	246	215	1,422	1.0
Landskrona	1,463	238	216				1,917	1.4
Lidköping	402	133	124	186	160	147	1,152	0.8
Lindesberg	732	80	84	117	119	95	1,227	0.9
Linköping	1,572	127	33			1	1,733	1.3
Linköping medical cent	11						11	0.0
Ljungby	828	53	87	86	83	73	1,210	0.9
Ludvika	338						338	0.2
Luleå	2						2	0.0
Lund	2,265	50	43	51	40	23	2,472	1.8
Lycksele	231	37	40	61	59	34	462	0.3
Löwenströmska	405						405	0.3
Malmö	1,946	32	31	46	56	27	2,138	1.5
Mora	820	107	98	98	98	99	1,320	1.0
Motala	385	94	282	409	447	357	1,974	1.4
Movement Halmstad	.	7	6	63	98	132	306	0.2
Mölndal	884	64	70	88	2	107	1,215	0.9
Nacka / Södersjukhuset	202						202	0.1
Nacka-Proxima				8	68	37	113	0.1
Norrköping	1,777	89	23				1,889	1.4
Norrtälje	482	67	66	79	95	78	867	0.6
Nyköping	651	81	72	96	105	102	1,107	0.8
OrthoCenter IFK klin.		41	84	92	87	20	324	0.2
Ortopediska huset	315	156	189	228	411	422	1,721	1.2
Oskarshamn	615	79	113	187	253	265	1,512	1.1
Piteå	211	78	84	179	261	292	1,105	0.8
S:t Göran	3,607	406	447	419	471	224	5,574	4.0
Sabbatsberg	628						628	0.5
Sabbatsbergs närsjh	400	269	152				821	0.6
Sahlgrenska	1,171	77	94	99	70	4	1,515	1.1
Sala	115						115	0.1
Sandviken	299						299	0.2
Sergelkliniken Gbg	27	76	57				160	0.1
Simrishamn	446	162	209	204			1,021	0.7
Skellefteå	613	49	83	90	96	51	982	0.7
Skene	628	75	70	68	72	89	1,002	0.7
Skövde	1,835	98	70	104	107	94	2,308	1.7
Sollefteå	372	102	103	107	119	108	911	0.7
Sophiahemmet	457	130	125	176	112	106	1,106	0.8
Spenshult						53	53	0.0
Stockholms Specialistvård	119	92	124	143	157	185	820	0.6
Sunderby sjukhus	176	41	66	38	32	22	375	0.3
Sundsvall	1,827	161	144	75	85	89	2,381	1.7
Säffle	484						484	0.4
Söderhamn	279						279	0.2
Södersjukhuset	2,301	108	101	127	311	330	3,278	2.4
Södertälje	412	81	84	81	103	124	885	0.6
Torsby	764	47	69	92	77	92	1,141	0.8
Trelleborg	1,577	194	233	396	488	494	3,382	2.4
Uddevalla	1,917	108	115	185	185	180	2,690	1.9
Umeå	1,421	64	109	139	161	138	2,032	1.5
Varberg	1,347	114	140	125	173	179	2,078	1.5
Visby	728	32	42	46	80	100	1,028	0.7
Vänersborg-NÄL	936						936	0.7
Värnamo	928	85	113	94	114	125	1,459	1.1
Västervik	954	91	124	118	98	88	1,473	1.1
Västerås	1,398	44	55	82	86	83	1,748	1.3
Växjö	1,241	45	81	81	107	127	1,682	1.2
Ystad	972	80	69	48	1		1,170	0.8
Ängelholm	837	118	149	54	169	164	1,491	1.1
Örebro	2,100	102	133	119	139	156	2,749	2.0
Örnsköldsvik	834	91	196	150	146	105	1,522	1.1
Östersund	1,092	96	83	111	110	94	1,586	1.1
Östra sjukhuset	1,451	82	68	75	120	149	1,945	1.4
Total	**89,953**	**8,331**	**9,195**	**9,796**	**10,600**	**10,380**	**138,255**	**100.0**

Factors that influence the revision rate

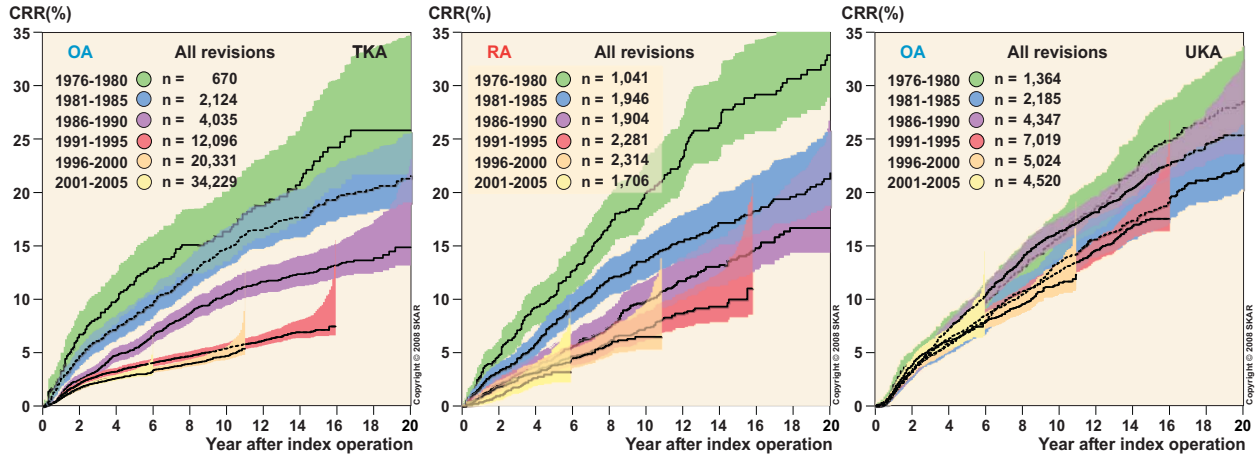
Primary disease – It became evident early that patients with different primary disease, e.g. rheumatoid arthritis (RA) and osteoarthritis (OA) followed a different postoperative course with differences in the revision rate. Therefore the registry has always produced separate curves for these diagnoses. The differences in CRR between OA and RA treated with unicompartmental arthroplasty (UKA) demonstrate the importance of this.

Age – The effect that the age of the patients has on the CRR can be illustrated by analyzing different age groups separately. For OA the age has a considerable effect on the rate of revision both in TKA and UKA. One can wonder why this is the case. A possible explanation is that the younger have a higher level of activity, higher demand regarding pain-relief and a state of health that more often allows for revision surgery. In RA (TKA) there is no similar effect of age to be found which can be due to the fact that the younger have multiple joint disease, a lower physical level, a higher pain threshold and poorer general health which may reduce the likelihood of being offered revision surgery.

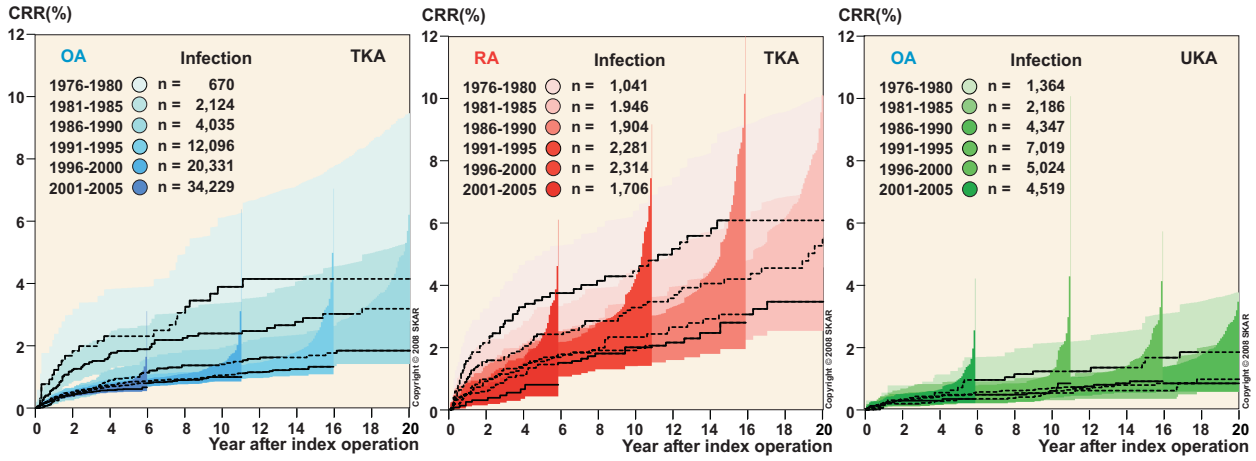


The differences in CRR (1997–2006) between the 3 age groups <65, 65–75, >75 were significant for OA operated on with TKA and UKA but nor for RA operated on with TKA.

Year of operation – For TKA that there has been a constant reduction in risk of revision over time. The reduction can't only be explained by an increasing mean age of patients at surgery. Even if improved implants may provide some explanation, reduction has also been seen for unchanged implants (Lewold et al. 1993). This indicates improvement in technique (cementing/seating) or in patient selection which has caused us to take into account the time-period during which the operations were made, when comparing implants by Cox regression. Improvement with time has



Comparing the CRR of operations performed during the time periods 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000 and 2001-2005, there has been a reduction in the revision rate over time for TKA, but not for UKA.



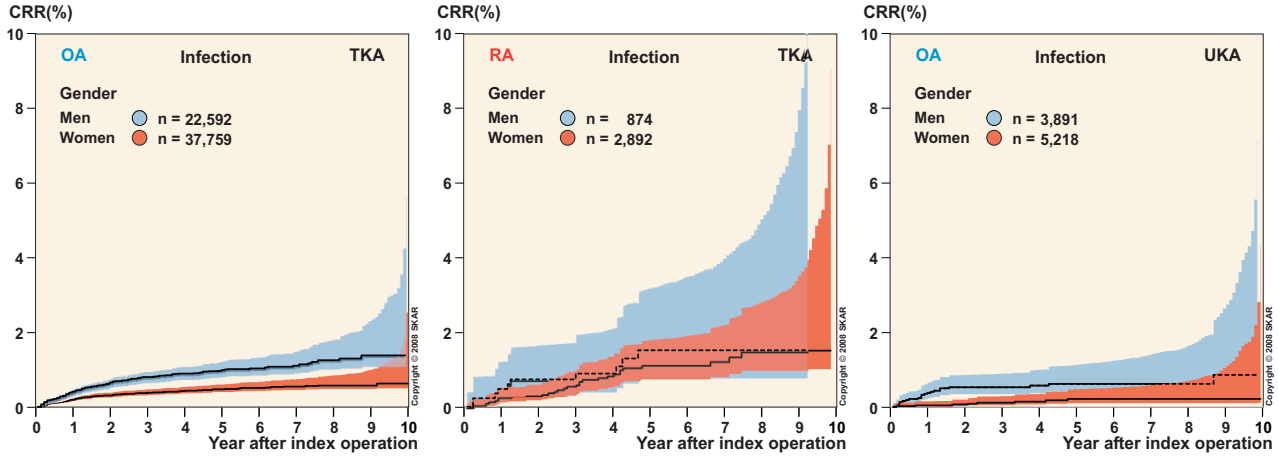
Comparing the CRR of operations performed during the time periods 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000 and 2001-2005 using only revision for infection as end-point, we found improvement with time for both TKA and UKA.

not been seen for the UKA, which probably is caused by some newer models and methods with inferior results. Furthermore, the number of UKA operations has decreased, reducing the surgical routine which has been found to affect the revision rate. Further, changes in implants, instruments, surgical technique and approach may have resulted in a new or prolonged learning curve.

When the Knee Register accounts for the risk of revision due to infection, this means the risk of not only the first, but any revision after the primary operation, having being performed for infection. With time we have seen a reduction in this risk both for OA and RA. However, infection as the proportion of the total revision-burden has not diminished.

Gender – Analyzing OA in the period 1997-2006 (Cox regression), no significant difference in CRR was found between the sexes, whether it was for TKA or UKA. Overall, there was neither any significant difference between the sexes for RA (TKA). However, there was a gender difference regarding revision for infection (see below).

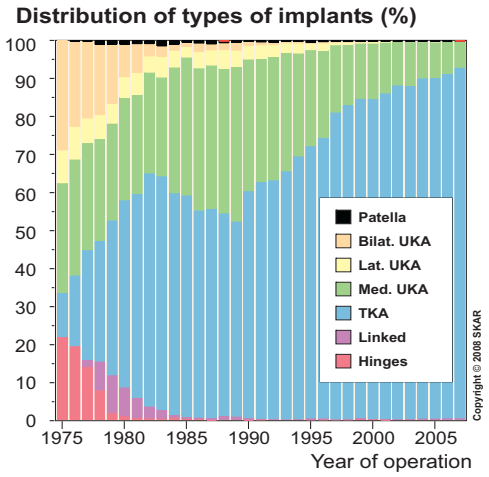
It is well known that RA patients have a greater risk of infection which has been ascribed to the effect of corticosteroid and immunosuppressive medications. Still, it is not as obvious why men more often than women are having their knee arthroplasties revised for infection. Either males are more prone to infections or they more often than females are being offered revision surgery for their infected knee implants. The latter is contradicted by the fact that in other contects men have also been found more susceptible to infections than women



Using the end-point revision for infection, the CRR (1997–2006) shows in TKA for OA that men are more affected than women (RR 2.1). The same tendency is true for RA, although not significant. UKA with its smaller implant size does better than the larger TKA but even in UKA men have 4.0 times the risk of women of becoming revised for infection. In TKA, patients with RA are more affected than those with OA (RR 1.6).

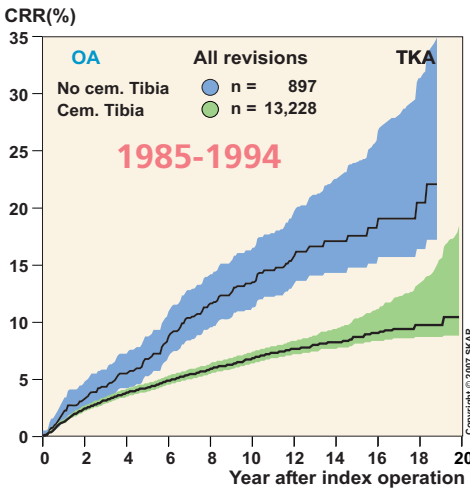
Type of implant – The modern condylar tricompartmental knee implant (TKA) was developed in the seventies when hinged and unicondylar implants were already available. When the register started in 1975, TKA had just been introduced in Sweden, which is the reason for hinges and uni's amounting for the larger part of the surgery at the time (figure right). It was also common to combine two uni's (bilateral UKA) when the knee disease affected more than one compartment. As the use of TKA became common, the surgeons quit using two UKA's in one knee. Today, hinges, linked and stabilized implants are mainly used for revisions or especially difficult primary cases. In uncomplicated primary cases a TKA is used and if the disease is unicompartmental a UKA may do.

Although UKA has been found to have a substantially higher CRR than TKA (see figures on page 8), the number of serious complications such as infections/arthrodeses/amputations is much less. If a primary UKA is revised to a TKA at a later time, the risk of re-revision is not significantly increased compared to the risk of revision if the patient had primarily been treated with a TKA. As the UKA implants are less expensive than the TKA, the increased number of revisions due to their use has not resulted in additional cost. When asked, patients with TKA and UKA seem equally satisfied with their knees. In summary we conclude that it cannot be considered wrong to use UKA implants in OA patients with unicompartmental disease.

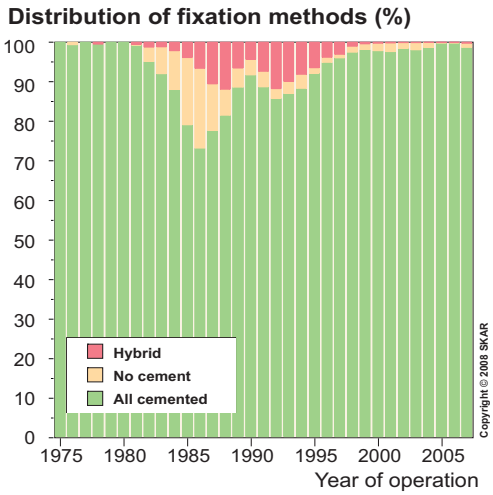


The relative yearly distribution of implant types used for primary surgery.

Use of bone-cement – As can be seen from the figure to the right, bone-cement has been used in the majority of arthroplasties that have been performed in recent years. As the number of uncemented arthroplasties has become so small in recent years it is no longer possible to perform meaningful comparisons. However, when analyzing the period 1985–1994, during which time use of uncemented implants was relatively common, we found that the risk of revision was higher if the tibial component was left uncemented (figure to the left). Cox regression, adjusting for age, gender, year of operation and use of patellar component shows that the risk for TKA with uncemented tibia component was 1.5 (1.2-2.8) times higher than for those cemented. This is in agreement with the results of the Finnish implant register which also has found substantially increased risk of revision for uncemented implants.

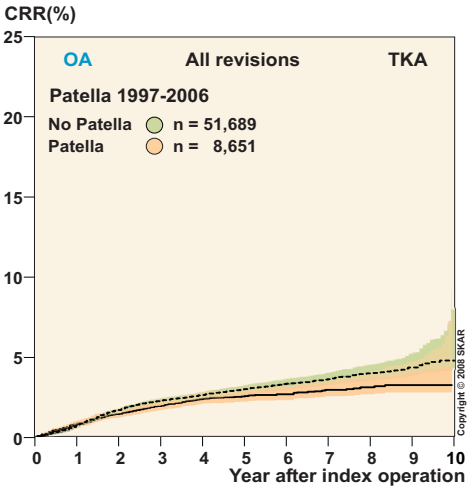


The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.

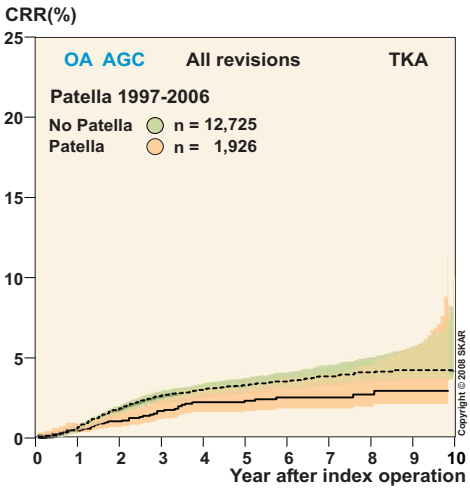


The relative yearly distribution regarding the use of cement for fixation.

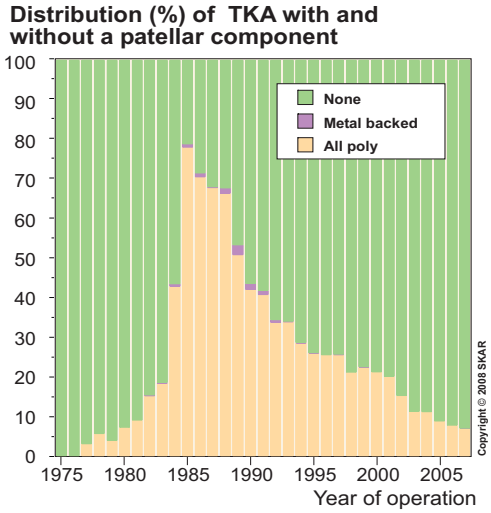
Patellar button in TKA – Estimating how the use of a patellar button affects the revision rate is complex. The use of a patellar button varies with the brand of prosthesis used and its use also has lessened in the recent years. Earlier, when analyzing all TKA implants together, we did not find that the use of patellar button influenced the revision rate. However, when analyzing different time-periods we found that during the eighties, when patellar buttons were used in half of the cases, its use had a negative effect. Since then its use has continuously diminished and in 2007 a button was used in less than 10% of the TKA cases. At the same time, as we have described in previous reports, the curves have turned to the advantage of the patellar button.



CRR during the current 10-year period for all TKA OA, with and without patellar component respectively.



CRR during the current 10-year period for all AGC OA, with and without patellar component respectively.



The figure shows the yearly distribution regarding the use of patellar button in TKA.

However, it has to be kept in mind that revisions for femoropatellar symptoms generally are performed relatively soon after the primary operation while revisions for wear or loosening of the patellar component occur later on. This in combination with our previous finding that patients who have had patellar resurfacing more often are satisfied with their knee, at least initially, speaks for a more liberal use of the patellar button, at least in the elderly.

For the current period (1997–2006) we found that OA patients that underwent surgery using TKA without a patellar button were at 1.2 (1.1-1.4) times higher risk for revision than the patients operated on with a button (see figure left). If only AGC implants were analyzed, the risk for revision without a patellar button was 1.6 (1.2-2.2) times higher (see figure left below). For RA we also found significantly higher risk when not using a button (times 2.0 (1.2-3.3)). The increased frequency of revisions is caused by the need for secondary patellar resurfacing because of femoropatellar pain.

It can then be debated if one should take the use of patellar button into consideration when units and implants are compared with respect to risk of revision. In the figures, we have chosen to describe the total CRR of all implants (with and without a button). That way one can get a general picture of the results for certain groups of patients and implants. When comparing the risk-ratios of the implants (page 26-27) we separately account for the results of TKA with and without a patellar button. Finally, when comparing the risk of revision for the different units (page 33), we include the use of patellar button in the regression analysis.

cont. Use of patellar button – The use of patellar button varies between countries. The Danish knee arthroplasty register (http://www.ortopaedi.dk/registre.htm) reports that a patellar button is used in 70% of TKA cases (2006) while it is only used in 5% of cases in Norway (2007) according to the Norwegian arthroplasty register (http://www.haukeland.no/nrl/).
According to the 2008 annual report of the Australian Joint replacement Register (http://www.dmac.adelaide.edu.au/aoanjrr/index.jsp), patellar button was used in 45% of the TKA cases in 2007. It was also reported that compared to TKA using a patellar button, TKA without a button had 1.3 (1.2-1.4) times higher risk of becoming revised which is similar to the Swedish findings.

The reasons are unclear why the surgeons in the mentioned countries and regions differ so much with respect to use of patellar button but possibly previous bad experience with metal backed patella components played a role.

Implant model (brand) – The model is the factor that generates most interest and most often is related to the result after knee arthroplasty. As can be seen from what has been said previously, the results are not only affected by the model or design of the implants but also by other factors such as the so called "case-mix". In the analyses, we try to limit the effect of the case-mix on results by adjusting for factors such as diagnosis, gender, age and the time period during which the operations were performed.
An important factor which the register is unable to adjust for is the surgical routine of the individual surgeons. It is obvious that surgeons may be more or less competent with respect to arthroplasty surgery which may influence the results for specific models, especially if use of that model has been limited to a few surgeons or hospitals. Just as it may be claimed that deviating results are being influenced by surgical skill, it could be debated if it is at all fair to account for the results of specific models. Responding to this we can only say that the risk of revision for specific brands shows what its users could bring about with that particular model. The final result is determined by a combination of factors including design, material, durability, accompanying instruments, user-friendliness, safety marginal's (how the implant behaves if it is not inserted exactly) together with the surgeon's skill and training of using the instruments/implant as well as selecting the appropriate patients for the surgery. The producers together with the distributors have an opportunity to influence most of these factors. Therefore, it can't be considered inappropriate to associate the model to the result, in spite of the outcome being affected not only by design, material and durability.

Historically, the most commonly used implants in Sweden have also been those with the lowest CRR. This may be due to a good design but also due to the increased surgical routine when the same implant is used often. Models that have been found to have considerably inferior results have most often been withdrawn from the Swedish market. An exception is the Oxford implant that initially had inferior results but that after modifications and increased training of surgeons showed improved results leading to continued use.

Type of operation and implants in 2007

10,380 primary arthroplasties reported in 2007 by type and region

TYPE	Stockholm Gotland	Uppsala Örebro	Southeast	South	West	North
Hinge	2	17	2	7	12	7
TKA	1,883	2,219	1,073	1,545	1,892	990
UKA medial	193	181	68	55	192	28
UKA lateral	1	2	–	–	–	–
Patella	2	1	3	3	1	1
Total:	2,081	2,420	1,146	1,610	2,097	1,026

Implants for primary TKA in 2007

	Number	Percent
NexGen	2,787	29.0
PFC Sigma	2,484	25.9
AGC	1,535	16.0
Duracon	889	9.3
F/S MIII	683	7.1
Triathlon	451	4.7
Vanguard	270	2.8
Profix	182	1.9
PFC Mobile Bearing	124	1.3
Natural	81	0.8
Other	116	1.2
Total :	9 602	100

Implants for primary UKA in 2007

	Number	Percent
Link UKA	236	32.8
Oxford-UKA	192	26.7
MillerGalante-UKA	140	19.4
Genesis	70	9.7
ZUK	58	8.1
Preservation	24	3.3
Total :	720	100

All the 76 units performing elective knee arthroplasty surgery reported to the registry during 2007. Although a few reports may turn up at a later time, they are only expected to have a small effect on the number of operations. The number of reported primary arthroplasties decreased from 10,544 in 2006 to 10,380, or by 1.6%. For TKA there was an increase of 0.2% for while UKA decreased by 20,3%.

In 2007, 617 revisions were performed of which 128 were secondary revisions. In 411 of the revisions the primary procedure had been a TKA and in 199 cases a UKA. One has to take into consideration that since 1996 the use of UKA has been reduced by half while the use of TKA has more than doubled. Thus, the proportion of primaries and revisions does not give a true picture of the risk for revision which is better estimated using survival statistics.

De 3 most common implants for primary TKA in each region in 2007

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	PFC Sigma	844	NexGen	327	F/S MIII	285	427
Uppsala/Örebro	NexGen	1,115	AGC	531	F/S MIII	176	397
Southeast	PFC Sigma	393	NexGen	327	AGC	260	93
South	PFC Sigma	469	Triathlon	386	AGC	236	453
West	NexGen	661	AGC	376	Duracon	277	582
North	PFC Sigma	381	NexGen	356	Duracon	86	167

De 3 most common implants for primary UKA in each region in 2007

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	MillerGalante	91	Oxford	52	Link	37	14
Uppsala/Örebro	Link	110	Genesis	33	Preservation	18	22
Southeast	Genesis	37	Link	17	Oxford	11	3
South	Link	42	Oxford	10	ZUK	2	1
West	Oxford	119	MillerGalante	30	ZUK	30	13
North	Link	17	ZUK	10	MillerGalante	1	–

Bone cement and minimally invasive surgery in 2007

Use of cement in primary surgery during 2007

	Primary TKA		Primary UKA	
No component without cement	9,420		719	
Only the femoral component without cement	–		–	
Only the tibial component without cement	29		–	
The femur- and tibial components without cement	100		–	
Only the patellar button without cement	53		–	
Information missing	–		1	
Total	9,602		720	
	Number	Percent	Number	Percent
Palacos Genta	4,767	50.2	363	50.4
Refobacin-bonecement	4,185	44.0	281	39.0
Cemex Genta	515	5.4	72	10.0
CMW	3	0.0	–	
CMW Genta	2	0.0	–	
Copal	1	0.0	–	
Refobacin plus	1	0.0	–	
Refobacin revision	1	0.0	1	0.1
Information missing	27	0.3	3	0.4
Total	9,506	100.0	720	100.0
All components without cement	100		–	
Grand Total	9,602		720	

NB Handwriting the type of cement on the report form may be a source of error.
The units are encouraged to use the sticker that comes with the cement package.

Type of bone cement

In Sweden, the use of bone cement is the most common method for fixing components to the bone. Further, almost all the cement has added antibiotics, mostly gentamicin.

During 2007, 1% of all TKA were completely without cement (0.1% in 2006) and cement was used in all UKA. As the use of cement is so common, the variation is minimal and statistical comparisons are not meaningful.

Some units have the habit of handwriting the name of the cement, which is a source of error. We want to remind the surgical units to use the stickers normally to be found in the cement packages.

Minimally invasive surgery in UKA

For UKA, we have since 1999 registered whether the implant was inserted by a mini-arthrotomy.

Our definition of mini-incision implies that the surgeon gains access to the knee joint by the use of a very small arthrotomy and without dislocating / everting the patella. The benefit of the procedure has been claimed to result in less traumatic surgery, quicker rehabilitation and shorter hospital stay.

From the start of the registration in 1999, the popularity of minimally invasive surgery for UKA continued to increase until 2003 when it was being used in 58% of cases. In 2004 the proportion of MIS diminished to 53% after which it increased again. In 2007 MIS was used in 61% of the UKA cases.

The Register has previously reported that there were indications that the mini-incision might increase the revision rate. Further analyses suggest that the method may initiate a new learning process which however can be shortened if the surgeons are offered training before they start using the method. After up to seven years of follow-up we have not found the revision rate of MIS to be increased compared to the standard arthrotomy

The type of incision for 720 primary UKA in 2007

	Standard incision	Mini-incision	Missing
Link	145	82	9
Genesis	44	23	3
Preservation	18	5	–
MillerGalante	17	116	7
ZUK	13	37	8
Oxford	7	178	7
Other	1	–	–
Total	245	441	34

The use of patellar button for TKA in 2007

The use of patellar button is heavily related to the implant model used. As can be seen from the table to the right, surgeons using PFC Mobile Bearing implants often resurface the patella while those who use Natural and NexGen infrequently do so.

In the Uppsala-Örebro and North regions, the use of patellar button was relatively infrequent while the Southeast and West most often used a button. (see figure below). Overall, the differences between the regions have diminished somewhat since 2006.

It is not only in Sweden that geographical variations are to be found. The Australian arthroplasty register (http://www.dmac.adelaide.edu.au/aoanjrr/index) reports that there is up to 30% difference in use of patellar button between the different states.

In Sweden, females operated on with TKA have their patella resurfaced slightly more often than males. In the whole material from the start to the end of 2007, 21.3% of the women had their patella resurfaced compared to 18.3% of the males which is a significant difference. An explanation that has been suggested claims that femoropatellar pain is more common in females. However, during 2007 6.5% of the men had a patellar button compared to 7.3% of the women (not a significant difference).

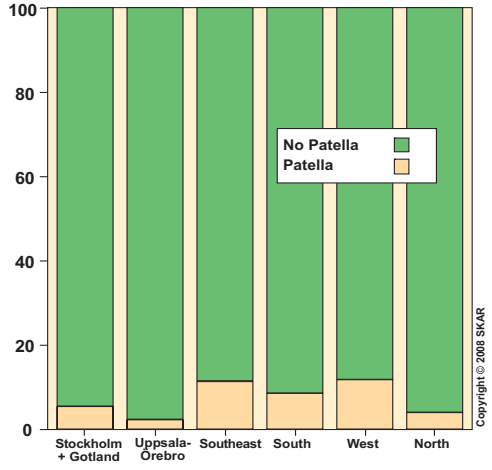
Use of patellar button with different TKA implants in 2007

	No Patellar button	%	Patellar button	%
NexGen	2,763	99.1	24	0.9
PFC Sigma	2,393	96.3	91	3.7
AGC	1,303	84.9	232	15.1
Duracon	749	84.3	140	15.7
F/S MIII	608	89.0	75	11.0
Triathlon	432	95.8	19	4.2
Vanguard	264	97.8	6	2.2
Profix	158	86.8	24	13.2
Natural	81	100.0	0	0.0
PFC Mobile Bearing	72	58.1	52	41.9
Other	110	94.8	6	5.2
Total	8,933	93.0	669	7.0

Looking at the relative use of patellar button in the different age groups during 2007 (see figure below), it can be noted that patellar resurfacing is used in approximally the same percentage of cases in all the agegroups. This is a change compared to 2006 when the 2 youngest agegroups most often had a patellar resurfacing.

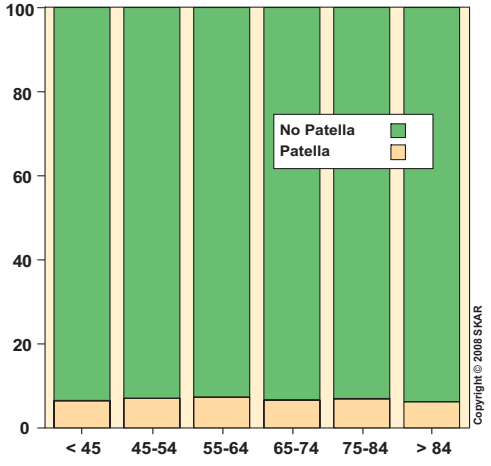
Some discussion regarding how the frequency of revisions is influenced by the use of patellar button can be found on page 11 together with CRR curves for TKA inserted during the current period of 1997-2006, with and without a button respectively.

Distribution (%) of patellar resurfacing in the regions 2007



The figure shows the relative proportion in 2007 of TKA with and without patellar button in the different regions.

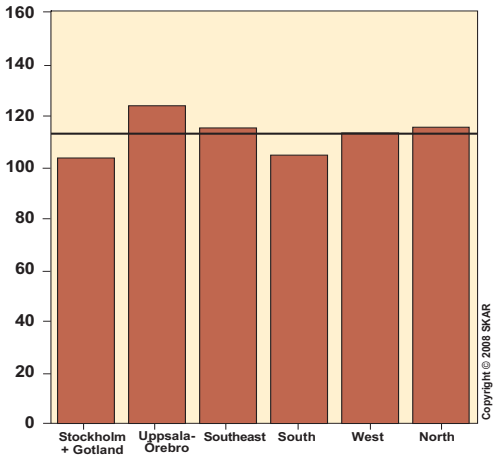
Distribution (%) of patellar resurfacing in different age groups in 2007



The figure shows the relative proportion in 2007 of TKA with and without patellar button in the different age-groups.

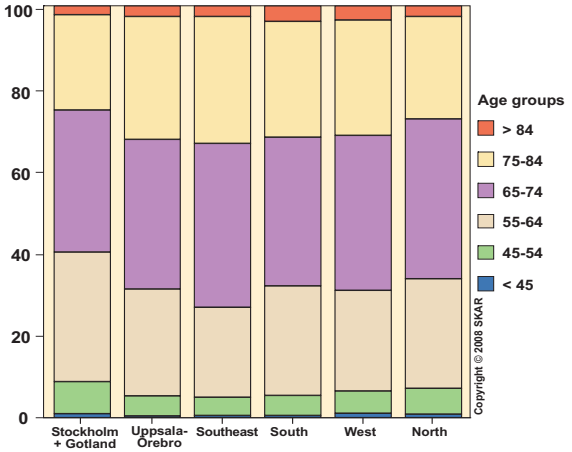
Age distribution and incidence in the regions 2007

Incidence per 100 000 in the regions in 2007 (all types of primary implants)



The incidence per inhabitants in respective region is highest in the Uppsala-Örebro region and lowest in Stockholm/Gotland and South Regions (the black line shows the mean for the whole country (113.5)).

Distribution (%) of gender in the regions during 2007 (all types of primary implants)



The age distribution at primary surgery varies among the regions. The Southeast region has relatively the largest proportion of patients older than 64 years.

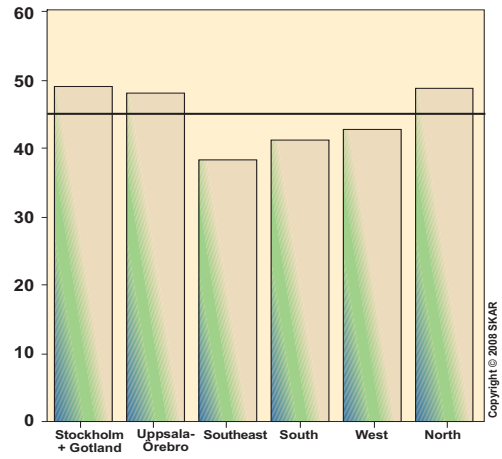
The figure above shows the incidence of primary knee arthroplasty per 100,000 inhabitants in respective regions. It is evident that the incidence is the highest in the Uppsala-Örebro region but the lowest in the Stockholm-Gotland and South regions.

The figure above to the right shows the relative distribution in the number of operations in the different age groups in the regions.

Even if such summary information can provide information on the distribution of resources in the region, the variation in age distribution can't be used to decide if the principles of treatment differ in the regions. Differences between the regions can partly or completely be caused by variations in the age distribution for the inhabitants.

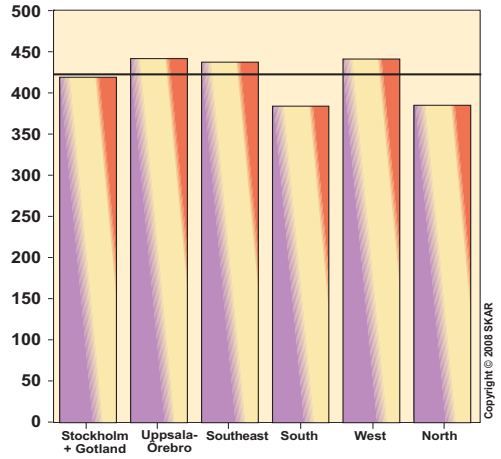
The figures below show the incidence of knee arthroplasty in patients that are less than 65 years of age, respectively 65 years and older. It can be observed that the Southeast region has a lower than average incidence in the younger group and higher than average in the older, while the opposite is true for the North region.

Incidence in 2007 for younger than 65 per 100,000 (all types of primary implants)



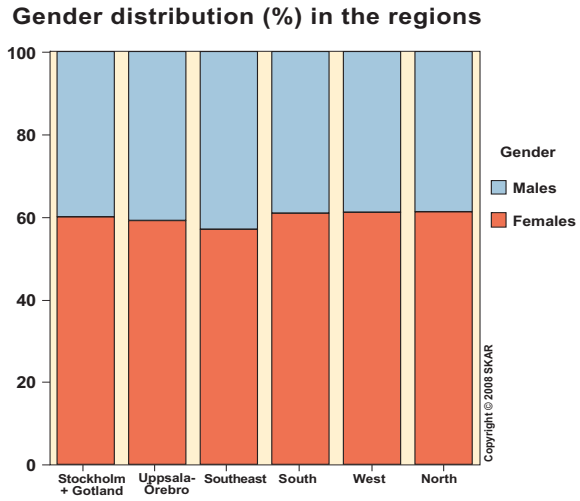
The incidence per inhabitants younger than 65 years of age is lowest in the Southeast region.
(the black line shows the mean for the whole country (45.5)).

Incidence in 2007 for 65 years or older per 100,000 (all types of primary implants)



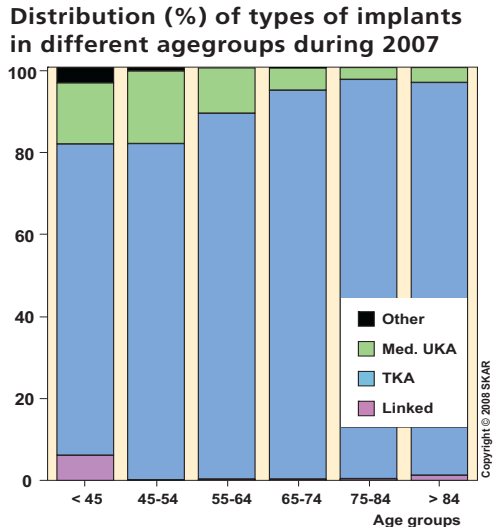
The incidence per inhabitants that are 65 years of age or older is lowest in the South and West.
(the black line shows the mean for the whole country (422.9)).

Gender distribution in the regions



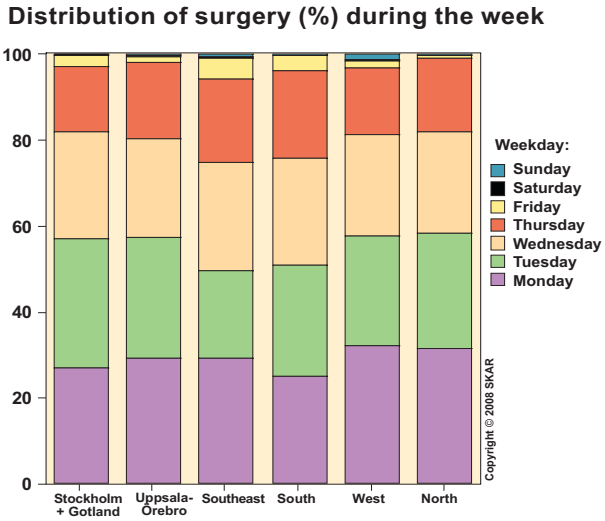
The proportion of females having knee arthroplasty is around 60% in all the regions. In 2007 the Southeast region had somewhat lower proportion of women than the other regions.

Type of implants in different age groups

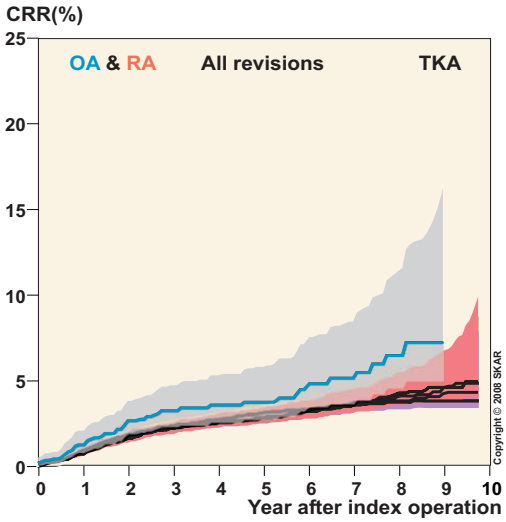


Uncommon models are relatively most often used in patients younger the 45 years. The relative high proportion of linked implant is caused by serious conditions (tumors, RA etc.)

Distribution of surgery on the weekdays 1997-2006



Deistribution of surgery on the weekdays 1997-2006. Surgery on Fridays and weekends is uncommon.



Operationer (TKA) gjorda under fredagen (blå linje) har en högre risk för revision än de gjorda måndag till torsdag (RR 1,5)

The reasons for knee arthroplasty surgery being so uncommon on Fridays are among other, reduced working hours on Fridays and the lack of rehabilitation during the weekends. Surgery on Fridays is relatively most common in the Southeast region and least common in the North.

The graph above shows that operations performed on Fridays have an increased risk of becoming revised as compared to those inserted Monday to Thursday (RR 1.47 - CI 1.09-1.97). The explanation for this may be that more urgent and difficult cases are operated on Fridays, but also that the younger and less experienced surgeons have increased opportunity on Fridays.

Implants for primary arthroplasty 1997–2006

To be able to account for the reasonably long-term results of relatively modern implant types, the register usually use the latest 10-year period that is available for analysis. As there is always some delay related to the control of reported revisions and because a low number of failures may have a large effect on the results, the period used for analysis finishes one year before the period for which primaries are reported.

Operations performed early on during the analyzed period have a relatively large influence on the cumulative revision rate. Subsequently, this mainly affects the older models.

Implants that are specially made for being used in revision surgery or standard models with extra long stems are classified as revision models and are not included in the analysis of standard models.

Implants for primary TKA during 1997–2006

	Number	Percent
PFC Sigma	17,579	26.7
AGC	16,105	24.4
NexGen	8,991	13.6
Duracon	7,479	11.3
F/S MIII	7,367	11.2
Kinemax	2,206	3.3
Scan	1,517	2.3
PFC	1,265	1.9
Profix	768	1.2
AMK	537	0.8
Natural	421	0.6
LCS	410	0.6
MillerGalante2	353	0.5
PFC Mobile Bearing	244	0.4
Triathlon	209	0.3
Vanguard	193	0.3
Axiom	104	0.2
F/S unspecified	49	0.1
NexGen Mobile bearing	28	0.0
Oxford Rotating TKA	26	0.0
Genesis	24	0.0
MillerGalante ospec	20	0.0
Performance	14	0.0
Evolution	12	0.0
Other	23	0.0
Total :	65,944	100

Revision models* for primary TKA during 1997–2006

	Number	Percent
PFC revision	152	28.8
AGC revision	149	28.2
Duracon revision	83	15.7
NexGen revision	68	12.9
Freeman revision	25	4.7
Profix revision	21	4.0
Other	30	5.7
Total :	528	100

*Revision models are those implant that are specially made for revision surgery as well as standard models in with extra long stems. fixed or modular (5 cm or more).

Linked implants (primary) during 1997–2006

	Number	Percent
Rotalink	Number	Percent
Kotz	25	9.0
NexGen rotating hinge	19	6.9
Noiles rotating hinge	16	5.8
Stryker/Howm. rotating hinge	13	4.7
Other	9	3.2
Total	277	100

Implants for primary UKA during 1997–2006

	Number	Percent
Link	4,068	43.2
MillerGalante	2,523	26.8
Oxford	1,164	12.4
Genesis	514	5.5
PFC	352	3.7
Duracon	209	2.2
Allegretto	127	1.3
Brigham	113	1.2
Marmor	111	1.2
Preservation	94	1.0
Repicci(AARS)	55	0.6
EIUS	45	0.5
ZUK	41	0.4
Other	6	0.1
Total	9,422	100

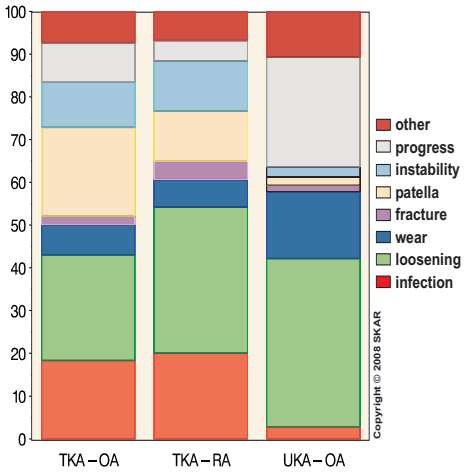
Femoropatellar implants during 1997–2006

	Number	Percent
Lubinus/Link	63	46.0
Richard/Blazina	47	34.3
Avon	25	18.2
LCS	2	1.5
Total	137	100

Revisions 1997–2006

1,971 revisions of TKA´s for OA, 331 of TKA´s for RA and 1,590 revisions of UKA´s for OA were performed during the 10-year period. The indications for the revisions are shown in the diagram to the right. Note that the primary operations may have been performed before the accounted 10-year period. Loosening remains the dominant reason for revision. ”Progression” in TKA mainly reflects revisions performed for femoropatellar arthrosis/arthritis. ”Patella” includes all kind of problems with the patella in patients that had their primaries inserted with or without a patellar button (excluding loosening and wear). Please note that the distribution of the indications does not have to reflect the risk for revision. The sharp increase in the number of primaries over the years leads to overrepresentation of early revisions.

Distribution (%) of indications for revision 1997-2006



Type of revision 1997–2006 in which the primary had been a TKA/OA

	Number	Percent
Linked implant	149	7.6
TKA	497	25.2
Exchange femur comp.	33	1.7
Exchange of tibia comp.	145	7.4
Exchange of disc/inlay	218	11.1
Patella addition	570	28.9
Patellar exchange	25	1.3
Patella removal	14	0.7
Implant removed	269	13.6
Arthrodesis	33	1.7
Amputation	18	0.9
Total	1,971	100

Type of revision 1997–2006 in which the primary had been a TKA/RA

	Number	Percent
Linked implant	54	15.0
TKA	124	34.3
Exchange of femur comp.	6	1.7
Exchange of tibia comp.	14	3.9
Exchange of disc/inlay	27	7.5
Patella addition	54	15.0
Patellar exchange	4	1.1
Patella removal	2	0.6
Implant removed	50	13.9
Arthrodesis	10	2.8
Amputation	16	4.4
Total	361	100

Type of revision 1997–2006 in which the primary had been a UKA/OA

	Number	Percent
Hinged implant	1	0.1
Linked implant	22	1.4
TKA	1456	91.6
Medial UKA	24	1.5
Lateral UKA	6	0.4
Exchange of femur	1	0.1
Exchange of disc/inlay	5	0.3
Exchange of tibia	17	1.1
Patella addition	6	0.4
Patellar exchange	0	0.0
Patella removal	1	0.1
Implant removed	41	2.6
Amputation	10	0.6
Total	1,590	100

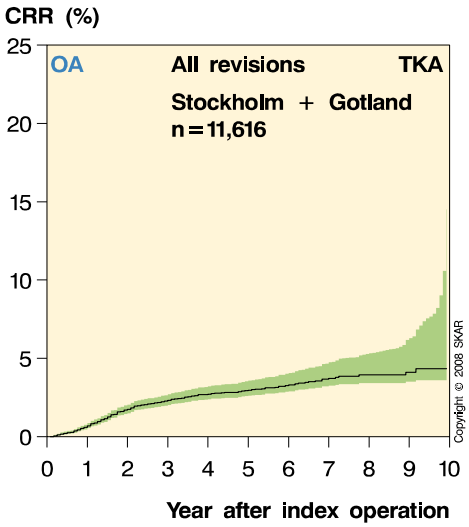
The tables show the different types of revisions (first) that were performed during 1997-2006. There are separate tables depending on the type of primary surgery (TKA/OA, TKA/ RA, UKA/OA). It should be noted that only one type is permitted for each revision. This implies that exclusive patellar surgery is listed, but not patellar surgery done in combination with exchange of other components.

TKA revisions only affecting the patella are common (31% in OA and 17% in RA). Extensive revisions (linked implants, arthrodesis, amputations) seem more common in RA. For UKA it is pleasant to note that revisions using a new UKA are few, as these type of revisions have been found to have a very high rate of re-revision.

Primary TKA implants for OA in the regions during 1997–2006

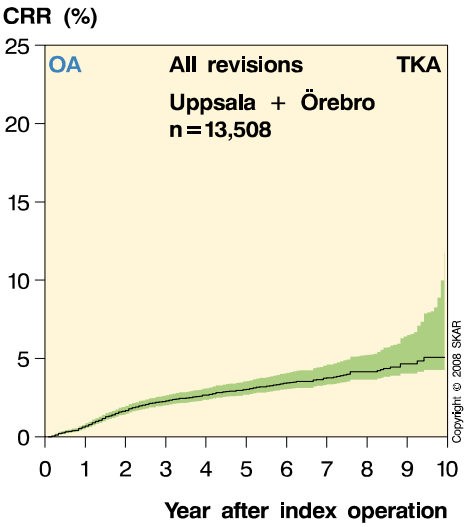
Stockholm + Gotland
Implants for primary TKA in OA 1997–2006

	Number	Percent
PFC Sigma	6,525	56.2
Duracon	1,291	11.1
F/S MIII	1,055	9.1
NexGen	770	6.6
AGC	704	6.1
Kinemax	581	5.0
PFC	393	3.4
PFC Mobile Bearing	74	0.6
Natural	72	0.6
AMK	62	0.5
Profix	20	0.2
Genesis	11	0.1
Other	58	0.5
Total:	11,616	100



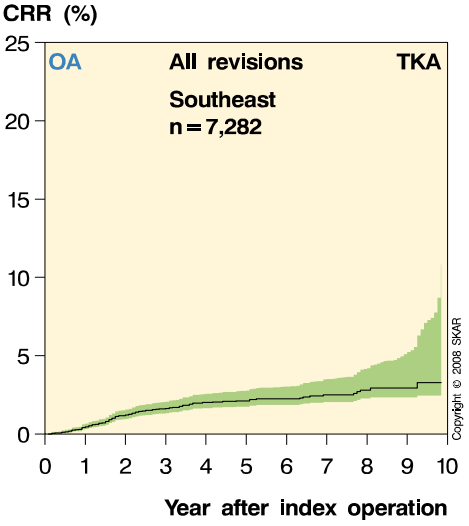
Uppsala+Örebro
Implants for primary TKA in OA 1997–2006

	Number	Percent
AGC	3,667	27.1
F/S MIII	3,134	23.2
NexGen	2,771	20.5
Kinemax	1,385	10.3
PFC Sigma	1,301	9.6
Duracon	298	2.2
AMK	291	2.2
MillerGalante2	215	1.6
Natural	191	1.4
Scan	114	0.8
PFC	50	0.4
NexGen Mobile bearing	28	0.2
Other	63	0.5
Total	13,508	100



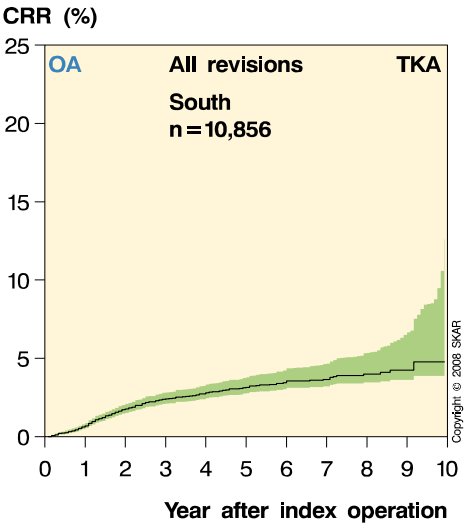
Southeast
Implants for primary TKA in OA 1997–2006

	Number	Percent
NexGen	2,325	31.9
AGC	2,288	31.4
PFC Sigma	2,144	29.4
Duracon	173	2.4
PFC	170	2.3
MillerGalante2	62	0.9
Vanguard	33	0.5
PFC Mobile Bearing	11	0.2
Evolution	11	0.2
Profix	10	0.1
Scan	10	0.1
Other	45	0.6
Total	7,282	100



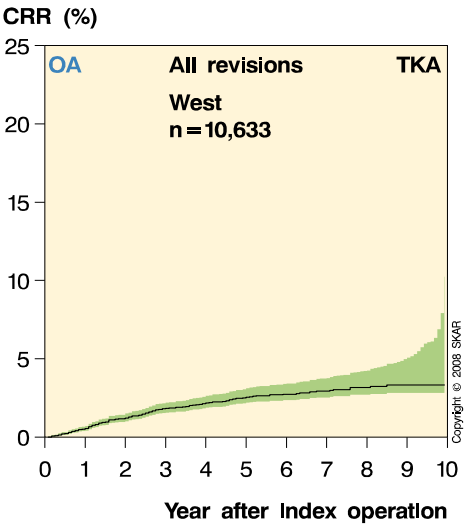
South
Implants for primary TKA in OA 1997–2006

	Number	Percent
PFC Sigma	3,591	33.1
Duracon	3,172	29.2
AGC	2,447	22.5
Scan	721	6.6
PFC	242	2.2
Triathlon	197	1.8
PFC Mobile Bearing	113	1.0
Vanguard	77	0.7
LCS	47	0.4
F/S MIII	42	0.4
Axiom	42	0.4
Oxford Rotating TKA	22	0.2
Profix	17	0.2
AMK	13	0.1
Other	113	1.0
Total	10,856	100



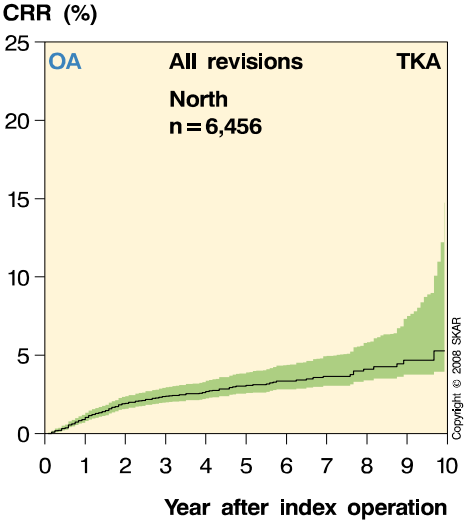
West
Implants for primary TKA in OA 1997–2006

	Number	Percent
AGC	3,644	34.3
F/S MIII	2,370	22.3
PFC Sigma	1,309	12.3
Duracon	1,294	12.2
NexGen	1,271	12.0
Scan	316	3.0
Natural	133	1.3
Axiom	60	0.6
AMK	56	0.5
Vanguard	43	0.4
PFC	34	0.3
F/S unspec	29	0.3
MillerGalante ospec	14	0.1
Other	60	0.6
Total	10,633	100



North
Implants for primary TKA in OA 1997–2006

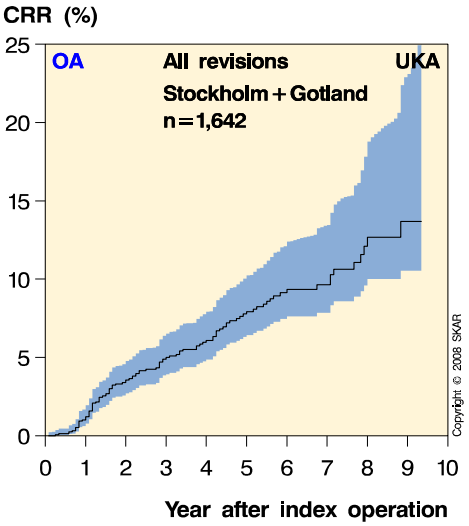
	Number	Percent
AGC	1,903	29.5
PFC Sigma	1,371	21.2
NexGen	1,285	19.9
Duracon	693	10.7
Profix	559	8.7
LCS	298	4.6
PFC	170	2.6
AMK	40	0.6
Scan	31	0.5
MillerGalante2	18	0.3
PFC Mobile Bearing	17	0.3
F/S MIII	17	0.3
Performance	13	0.2
Other	41	0.6
Total	6,456	100



Primary UKA implants for OA in the regions during 1997–2006

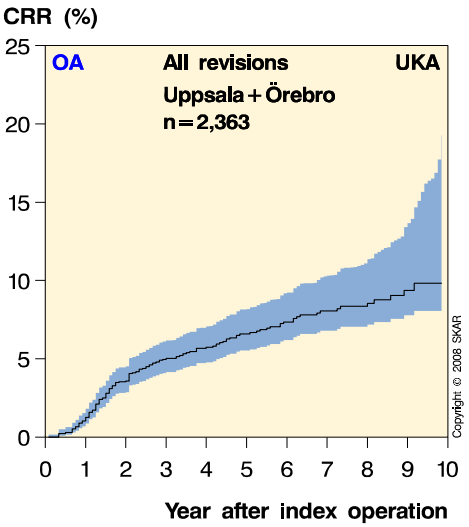
Stockholm + Gotland
Implants for primary UKA in OA 1997–2006

	Number	Percent
MillerGalante	1,105	67.3
Link	248	15.1
Oxford	132	8.0
Brigham	66	4.0
Allegretto	37	2.3
Genesis	23	1.4
Preservation	17	1.0
Repicci (AARS)	13	0.8
Other	1	0.1
Total:	1,642	100



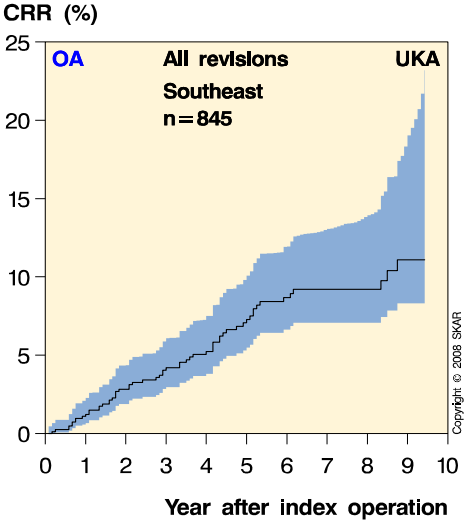
Uppsala+Örebro
Implants for primary UKA in OA 1997–2006

Number	Percent	
Link	1,730	73.2
Genesis	207	8.8
PFC	159	6.7
MillerGalante	132	5.6
Preservation	62	2.6
Marmor	41	1.7
Allegretto	12	0.5
Other	20	0.8
Total:	2,363	100



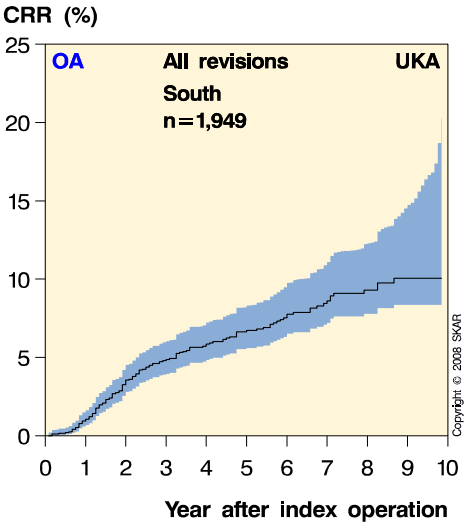
Southeast
Implants for primary UKA in OA 1997–2006

	Number	Percent
Link	294	34.8
Genesis	207	24.5
MillerGalante	115	13.6
Duracon	62	7.3
Marmor	45	5.3
Brigham	36	4.3
PFC	36	4.3
Allegretto	25	3.0
Oxford	20	2.4
Other	5	0.6
Total:	845	100



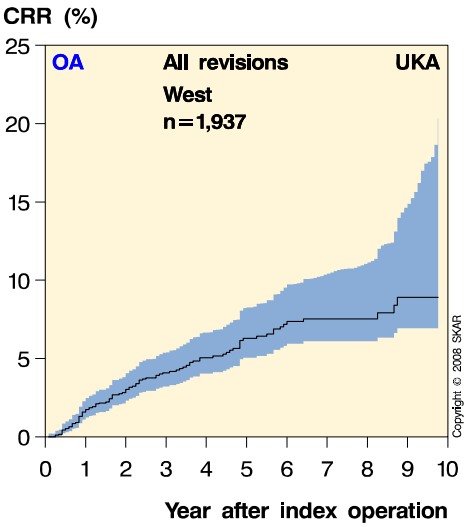
South
Implants for primary UKA in OA 1997–2006

	Number	Percent
Link	1,188	61.0
Oxford	186	9.5
MillerGalante	177	9.1
PFC	133	6.8
Duracon	83	4.3
Genesis	55	2.8
Allegretto	41	2.1
EIUS	40	2.1
Marmor	22	1.1
Repicci (AARS)	11	0.6
Other	13	0.7
Total:	1,949	100



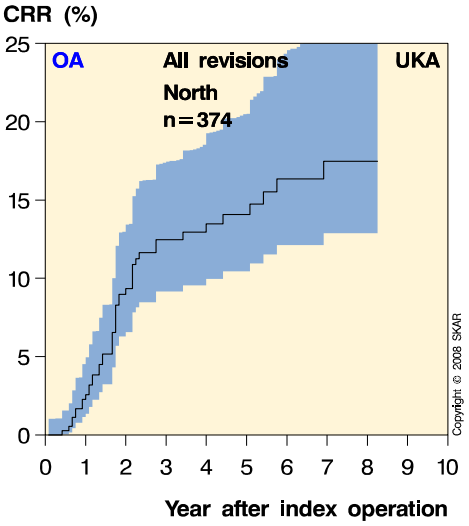
West
Implants for primary UKA in OA 1997–2006

	Number	Percent
MillerGalante	815	42.1
Oxford	780	40.3
Link	233	12.0
Duracon	43	2.2
Repicci (AARS)	28	1.4
ZUK	27	1.4
Other	11	0.6
Total:	1,937	100



North
Implants for primary UKA in OA 1997–2006

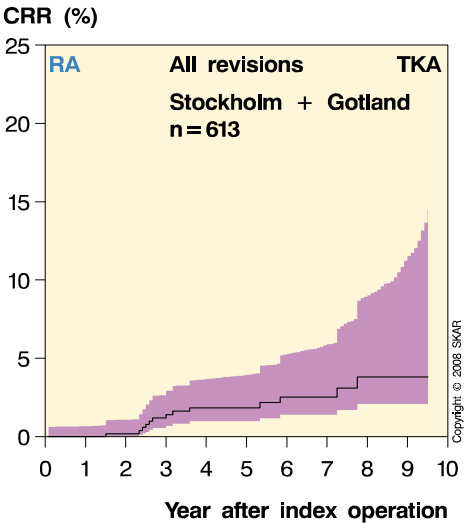
	Number	Percent
Link	255	68.2
MillerGalante	90	24.1
Oxford	13	3.5
Other	16	4.3
Total	374	100



Primary TKA implants for RA in the regions during 1997–2006

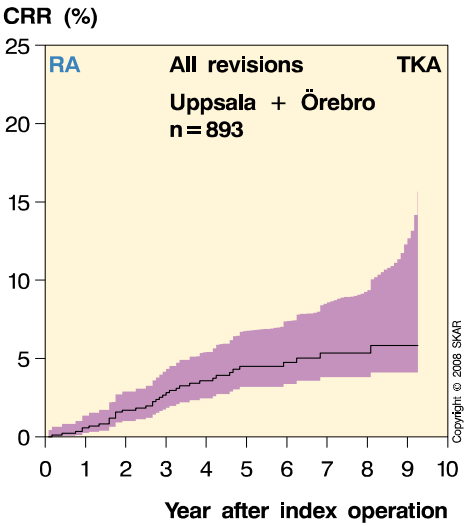
Stockholm + Gotland
Implants for primary TKA in RA 1997–2006

	Number	Percent
PFC Sigma	307	50.1
Duracon	115	18.8
AGC	72	11.7
PFC	41	6.7
Kinemax	24	3.9
NexGen	12	2.0
PFC Mobile Bearing	10	1.6
Other	32	5.2
Total	613	100



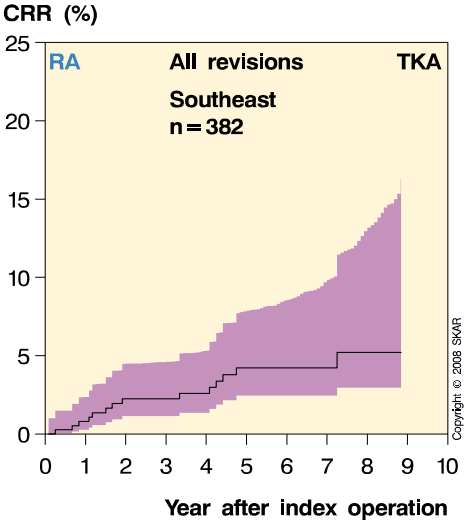
Uppsala+Örebro
Implants for primary TKA in RA 1997–2006

	Number	Percent
F/S MIII	271	30.3
AGC	256	28.7
Kinemax	128	14.3
NexGen	103	11.5
Scan	33	3.7
PFC Sigma	31	3.5
MillerGalante2	27	3.0
AMK	15	1.7
Other	29	3.2
Total	893	100



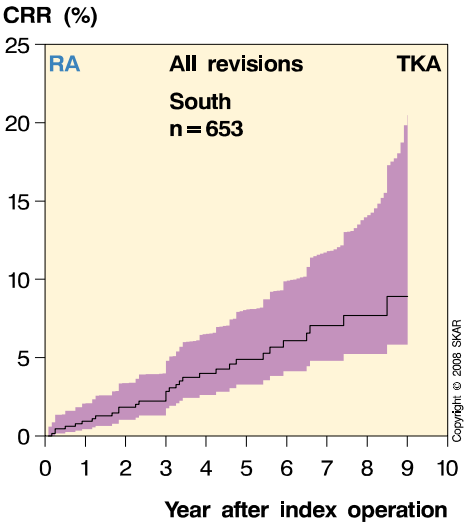
Southeast
Implants for primary TKA in RA 1997–2006

	Number	Percent
NexGen	138	36.1
AGC	115	30.1
PFC Sigma	83	21.7
PFC	17	4.5
Duracon	13	3.4
Other	16	4.2
Total	382	100



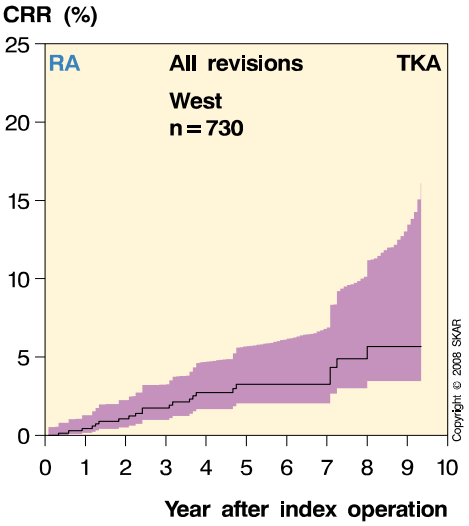
South
Implants for primary TKA in RA 1997–2006

	Number	Percent
Scan	165	25.3
PFC Sigma	149	22.8
AGC	122	18.7
Duracon	104	15.9
PFC	47	7.2
Vanguard	19	2.9
Profix	16	2.5
Other	31	4.7
Total	653	100



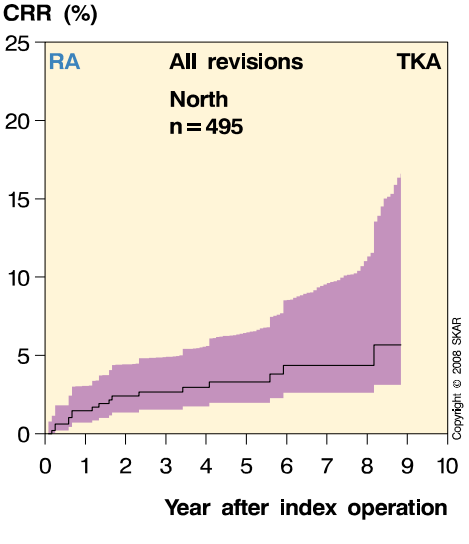
West
Implants for primary TKA in RA 1997–2006

	Number	Percent
AGC	287	39.3
F/S MIII	196	26.8
PFC Sigma	80	11.0
Duracon	57	7.8
Scan	52	7.1
NexGen	24	3.3
AMK	11	1.5
Other	23	3.2
Total	730	100



North
Implants for primary TKA in RA 1997–2006

	Number	Percent
AGC	125	25.3
PFC Sigma	118	23.8
Duracon	65	13.1
Profix	64	12.9
NexGen	36	7.3
PFC	30	6.1
LCS	23	4.6
Other	34	6.9
Total	495	100



The relative risk for implants used in primary arthroplasty during 1997–2006

The registry typically uses the latest 10-year period available for analysis. Unfortunately this implies that the number of implants available for analysis may increase or decrease, depending on the model, which in turn may affect results.

For the first time we now include the TKA implants PFC mobile bearing, Triathlon and Vanguard, as well as the UKA implant Preservation of which almost all (98%) are of the fixed bearing type.

The risk of revision is one of the many measures of outcome. Although not accounted for here, the type of the revision should also be considered.

Deliberately avoiding primary use of patellar button while preparing for a secondary resurfacing, when needed, increases the risk of revision. Therefore, we have decided to separately account for OA/TKA when used with and without a patellar button (see next page).

Below you will find tables for the most common TKA and UKA models in which Cox regression, adjusting for age, gender and year of operation, has been used to estimate the risk for revision.

For TKA inserted for OA, the implants with significantly lower or higher risk than the reference implant AGC are the same as in last years report.

The risk of revision (RR) with 95% confidence intervals. AGC is the reference in TKA and Link in UKA. The Cox regression adjusts for differences in gender, age and year of operation.

OA / TKA	n	p-value	RR	95% CI
AGC	14,653		ref.	
PFC-Sigma	16,241	0.45	0.94	0.81-1.10
NexGen	8,458	<0.01	0.43	0.34-0.56
Duracon	6,921	0.41	0.92	0.77-1.12
F/S MIII	6,618	0.02	0.79	0.65-0.96
Kinemax	1,975	<0.01	1.55	1.23-1.95
Scan	1,192	0.07	1.31	0.97-1.77
PFC	1,059	<0.01	1.68	1.27-2.22
Profix	623	0.68	0.89	0.51-1.55
AMK	469	<0.01	1.85	1.28-2.68
Natural II	396	0.68	1.17	0.55-2.49
LCS	346	0.12	0.53	0.23-1.18
MillerGalante II	298	0.40	1.27	0.73-2.21
PFC mobile bearing	221	0.27	0.46	0.11-1.84
Triathlon	202	0.84	0.82	0.12-5.87
Vanguard	161	0.98	1.03	0.14-7.36
Other	518	0.05	1.53	1.00-2.36
Gender (male is ref.)		0.93	1	0.89-1.11
Age (per year)		<0.01	0.96	0.95-0.97
Year of op. (per year)		0.34	1.01	0.99-1.0

RA / TKA	n	p–value	RR	95% CI
AGC	977		ref.	
PFC-Sigma	768	0.02	0.47	0.25-0.89
NexGen	315	0.02	0.18	0.04-0.76
Duracon	358	0.42	0.77	0.41-1.46
F/S MIII	475	0.03	0.48	0.25-0.93
Kinemax	152	0.11	1.66	0.89-3.10
Scan	254	0.19	1.44	0.83-2.49
PFC	141	0.97	1.01	0.48-2.13
Profix	82	0.38	0.41	0.06-2.99
AMK	32	0.48	0.49	0.07-3.57
Natural II	14	0.21	3.64	0.49-27.37
LCS	*26*	*0.98*	*<0.01*	
MillerGalante II	40	0.28	1.77	0.63-4.99
PFC mobile bearing	13	0.12	4.97	0.66-37.41
Triathlon	*0*			
Vanguard	*22*	*0.99*	*<0.01*	
Other	97	0.74	0.82	0.26-2.65
Gender (male is ref.)		0.64	0.91	0.61-1.36
Age (per year)		0.16	1.01	1.00-1.03
Year of op. (per year)		0.66	0.98	0.89-1.07

Implants lacking sufficient numbers for analysis are shown in italics

OA / UKA	n	p–value	RR	95% CI
Link	3,948		ref.	
MillerGalante	2,434	0.11	1.18	0.96-1.44
Oxford	1,132	0.65	1.08	0.79-1.47
Genesis	497	0.35	1.2	0.82-1.76
PFC	335	<0.01	1.83	1.31-2.55
Duracon	196	<0.01	2.39	1.63-3.50
Allegretto	121	0.13	1.49	0.89-2.50
Brigham	109	0.19	1.49	0.82-2.71
Marmor/Richards	108	0.7	1.14	0.58-2.24
Preservation	92	0.79	1.16	0.37-3.67
Other	138	0.65	1.18	0.58-2.38
Gender (male is ref.)		0.58	0.96	0.81-1.13
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.98	1	0.96-1.04

For TKA inserted for RA there is now a significantly less risk for the PFC-Sigma, NexGen and F/S MIII.

In UKA for OA, MillerGalante and Alligretto no longer have higher risk than the reference implant, Link. With respect to MG, the reason is probably that the earliest models are no longer included (avoiding the learning curve) and for the Alligretto the number of implants analyzed has decreased as the implant is no longer in use in Sweden.

As previously there is no difference depending on gender and in OA, but not RA, the risk of revision decreases with increasing age.

The risk of revision (RR) with 95% confidence intervals for TKA/OA inserted without and with a patellar component respectively. In the lower right table, F/S MIII is used as reference instead of AGC.

Utan patellakomponent OA / TKA	n	p–value	RR	95% CI
AGC	12,725		ref.	
PFC-Sigma	15,258	0.34	0.92	0.79-1.09
NexGen	8,311	<0.01	0.41	0.32-0.54
Duracon	6,368	0.32	0.91	0.75-1.10
F/S MIII	2,523	0.66	0.93	0.69-1.27
Kinemax	1,470	<0.01	1.48	1.14-1.91
Scan	1,163	0.26	1.19	0.88-1.62
PFC	895	0.01	1.49	1.09-2.03
Profix	557	0.53	0.82	0.45-1.50
AMK	434	0.04	1.54	1.03-2.30
Natural II	368	0.49	1.31	0.62-2.78
LCS	346	0.09	0.49	0.22-1.11
MillerGalante II	295	0.55	1.19	0.68-2.08
PFC mobile bearing	215	0.25	0.44	0.11-1.77
Triathlon	188	0.88	0.86	0.12-6.17
Vanguard	152	0.9	1.13	0.16-8.07
Other	421	0.04	1.61	1.01-2.55
Gender (male is ref.)	.	0.67	1.03	0.91-1.16
Age (per year)	.	<0.01	0.96	0.95-0.96
Year of op. (per year)	.	0.59	1.01	0.98-1.04

Med patellakomponent OA / TKA	n	p–value	RR	95% CI
AGC	1,926		ref.	
PFC-Sigma	983	0.78	1.08	0.62-1.90
NexGen	147	0.75	1.21	0.37-3.97
Duracon	548	0.86	0.93	0.43-2.03
F/S MIII	4,094	0.86	1.04	0.70-1.53
Kinemax	504	<0.01	2.17	1.26-3.71
Scan	29	0.02	4.33	1.32-14.22
PFC	164	<0.01	3.14	1.61-6.12
Profix	66	0.43	1.79	0.43-7.47
AMK	34	<0.01	6.8	2.65-17.49
Natural II	*28*	*0.97*	*<0.01*	
LCS	*0*			
MillerGalante II	*3*	*0.99*	*<0.01*	
PFC mobile bearing	*6*	*0.99*	*<0.01*	
Triathlon	*14*	*0.99*	*<0.01*	
Vanguard	*9*	*0.99*	*<0.01*	
Other	96	0.53	1.46	0.45-4.74
Gender (male is ref.)	.	0.23	0.84	0.63-1.12
Age (per year)	.	0.03	0.98	0.97-1.00
Year of op. (per year)	.	0.73	1.01	0.95-1.08

Implants lacking sufficient numbers for analysis are shown in italics

Differentiating between TKA inserted with and without patellar button reduces the number of implants available for analysis which can make it more difficult to demonstrate small differences.

Using AGC as a reference, when no patellar button is used (table above), the results are quite similar to that when all the implants are analyzed together (opposite page). That F/S MIII lost its significant advantage is probably caused by the low number of implants as the majority is being used with a button.

Using AGC as a reference, using a patellar button (table above right), it is the same three implants that show a significantly higher risk.

If F/S MIII instead of AGC is used as a reference for implants inserted with a patellar button (table to the right) it are still the same three implants that significantly differ.

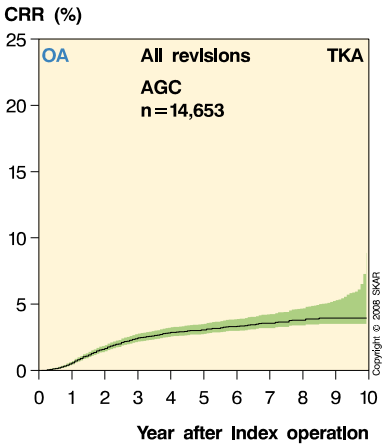
None of the significantly inferior models were being used in Sweden in 2007.

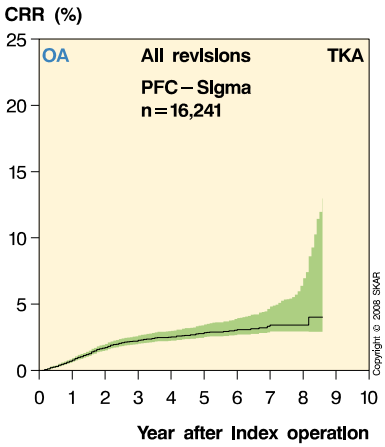
Med patellakomponent (F/S MIII som referens) OA / TKA	n	p–value	RR	95% CI
F/S MIII	4,094		ref.	
AGC	1,926	0.86	0.97	0.65-1.43
PFC-Sigma	983	0.85	1.05	0.64-1.73
NexGen	147	0.79	1.17	0.37-3.73
Duracon	548	0.78	0.9	0.43-1.88
Kinemax	504	<0.01	2.09	1.30-3.38
Scan	29	0.02	4.17	1.30-13.43
PFC	164	<0.01	3.03	1.61-5.68
Profix	66	0.45	1.73	0.42-7.06
AMK	34	<0.01	6.57	2.63-16.41
Natural II	*28*	*0.97*	*<0.01*	
LCS	*0*			
MillerGalante II	*3*	*0.99*	*<0.01*	
PFC mobile bearing	*6*			
Triathlon	*14*			
Vanguard	*9*			
Other	96	0.56	1.41	0.44-4.47
Gender (male is ref.)	.	0.23	0.84	0.63-1.12
Age (per year)	.	0.03	0.98	0.97-1.00
Year of op. (per year)	.	0.74	1.01	0.95-1.08

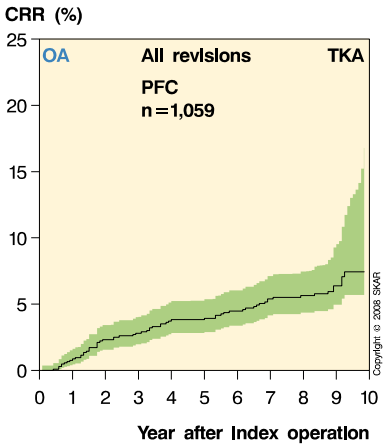
Implants lacking sufficient numbers for analysis are shown in italics

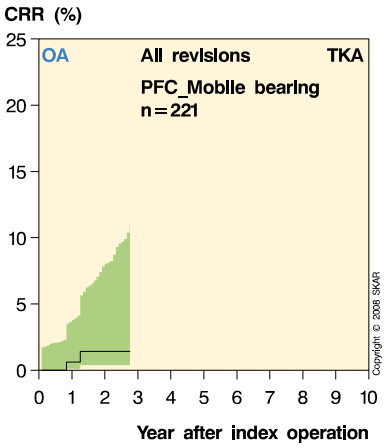
Significant difference with higher risk ratio.
Significant difference with lower risk ratio.

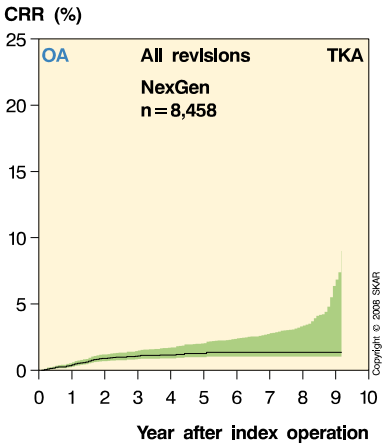
CRR for commonly used TKA implants in OA during 1997–2006

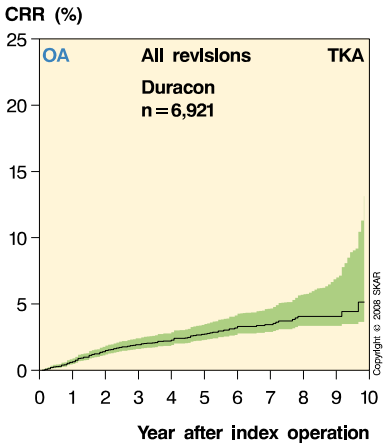


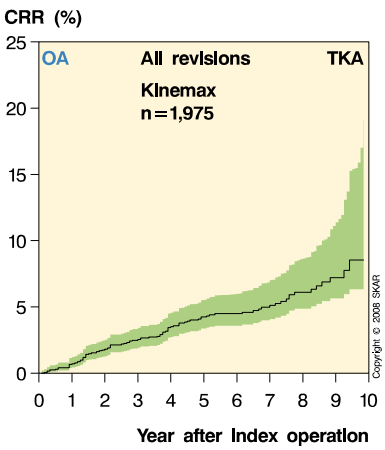


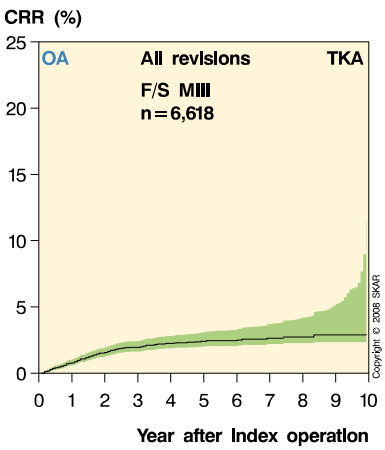


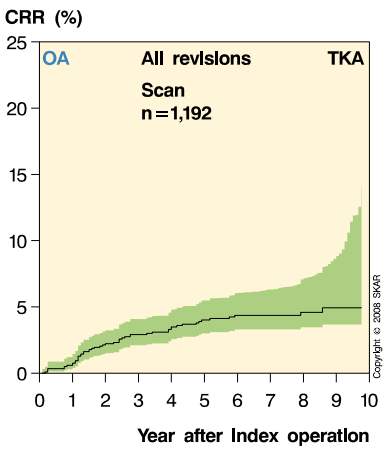


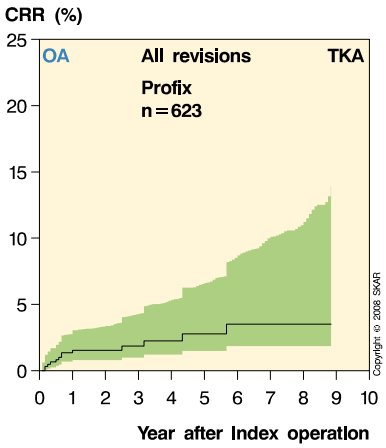











CRR (%)
OA
All revisions
TKA
Profix
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Year after Index operation
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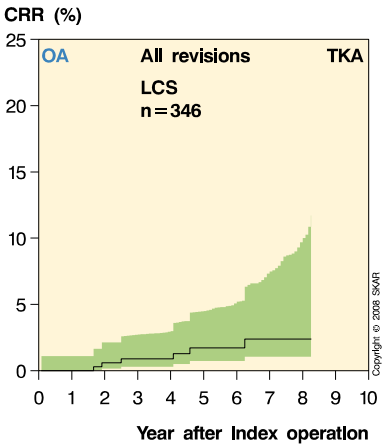
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TKA
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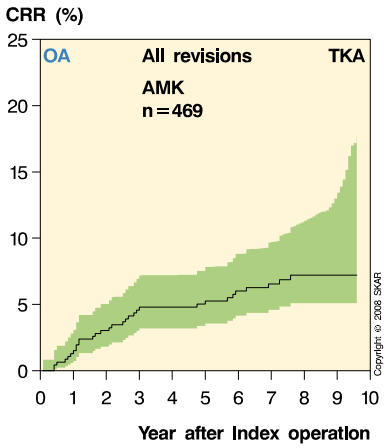
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All revisions
TKA
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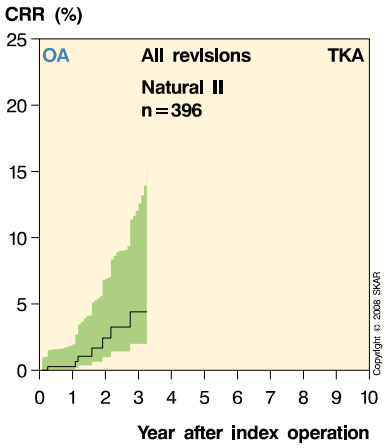
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OA
All revisions
TKA
Natural II
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Year after index operation
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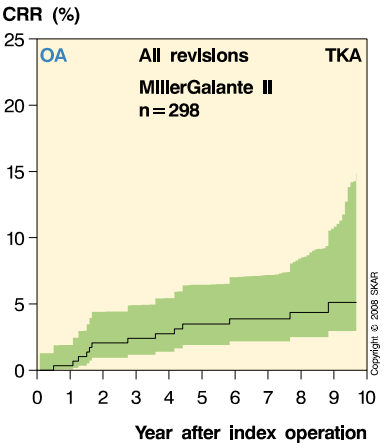
CRR (%)
OA
All revisions
TKA
MillerGalante II
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Year after index operation
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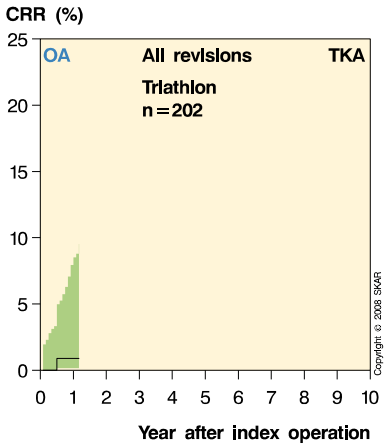
CRR (%)
OA
All revisions
TKA
Triathlon
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Year after index operation
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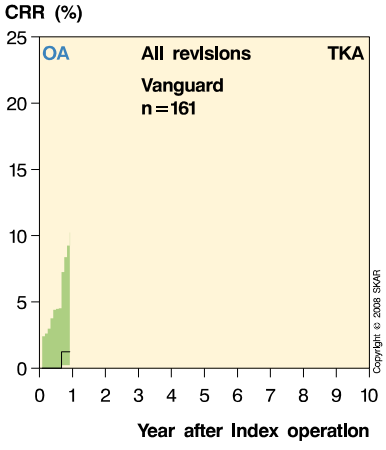
CRR (%)
OA
All revisions
TKA
Vanguard
n=161
Year after Index operation
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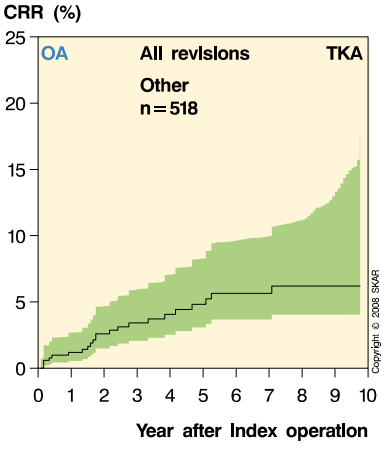
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OA
All revisions
TKA
Other
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Year after Index operation
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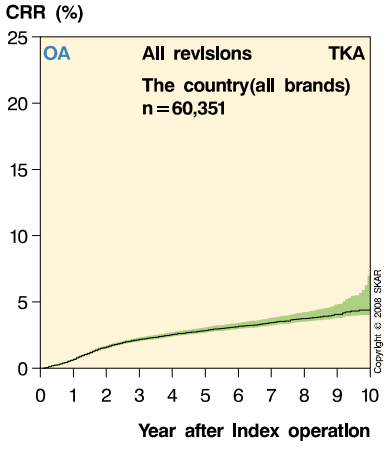
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All revisions
TKA
The country(all brands)
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Year after Index operation
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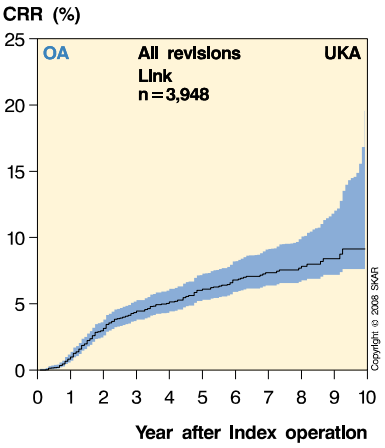
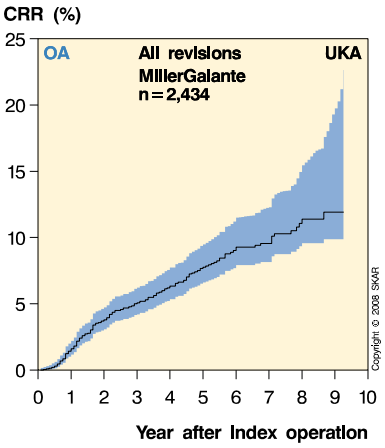
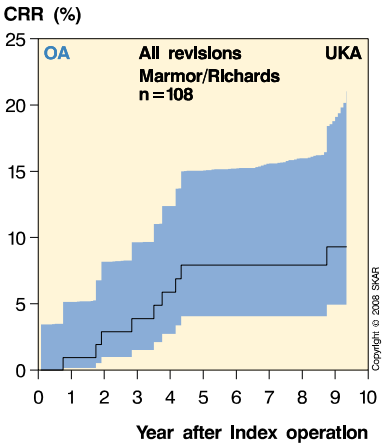
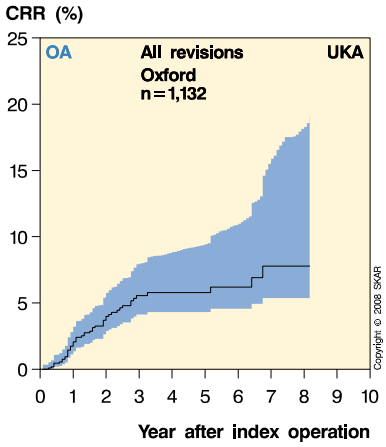
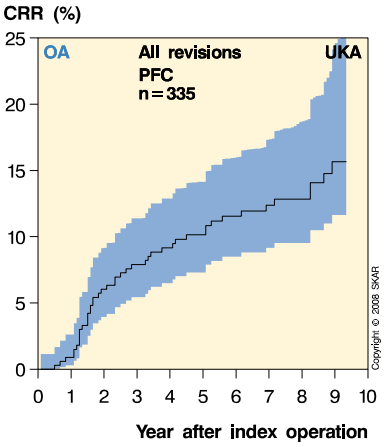
CRR for commonly used UKA implants in OA during 1997–2006

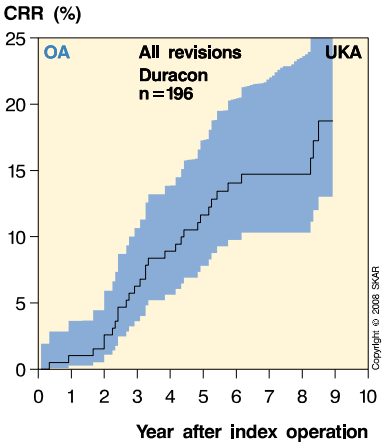


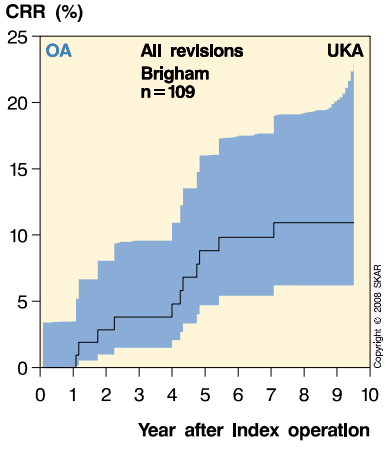


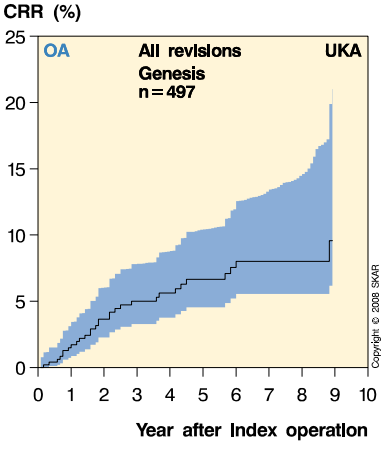


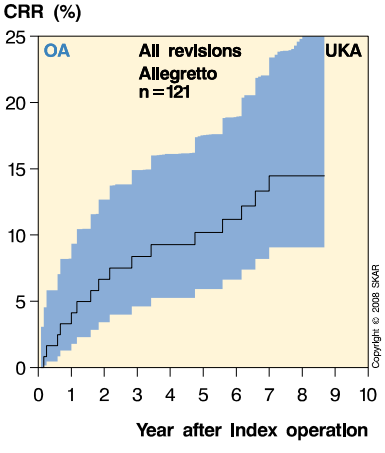


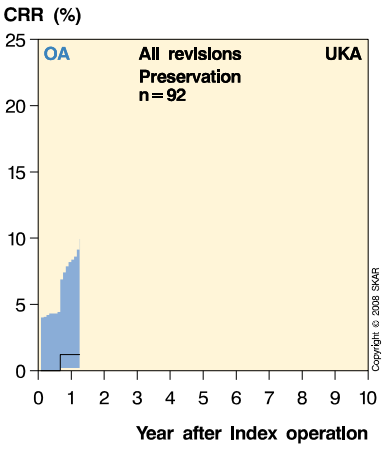


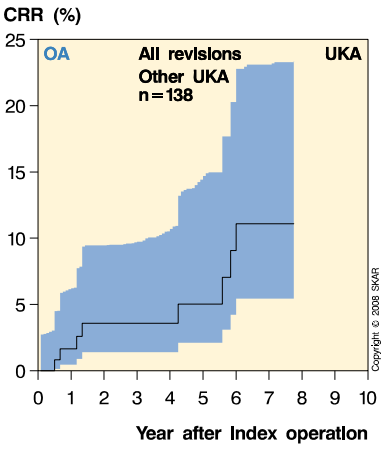


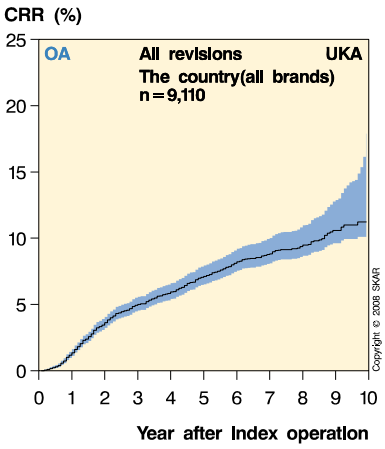












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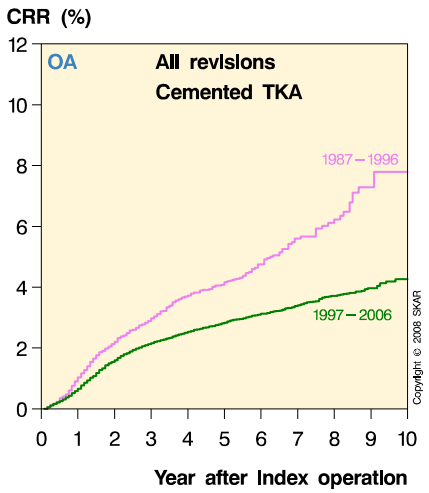
Relative risk of revision over time (cemented TKA/OA)

The figure below shows the overall risk of revision for the current 10-year period (1997-2006) as well as for the previous period (1987-1996). As in the previous reports it can be observed that the risk of revision for the current period has been reduced to half that of the previous period.

If the absolute clinic´s specific risk of revision is plotted for both periods (figure below left), it can be seen that besides the risk reduction the distribution has lessened. This implies that the results have improved overall and at the same time the results for the different units have become more similar (less spread in results).

When looking instead on the relative clinic´s specific risk of revision (figure below) it can be seen that the curves for the two periods are much the same shape. This implies that relative difference between the units has not changed between the two periods and that some units still have 1.5-2 times higher or lower risk than the average unit.

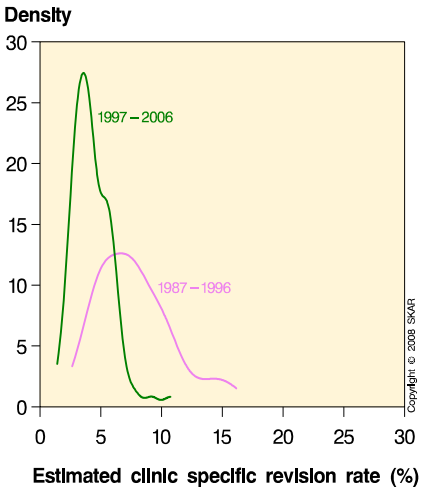
The figures illustrate well the (sad) fact that irrespective of whatever improvement, there will always be units with better, respectively worse, results than the average.



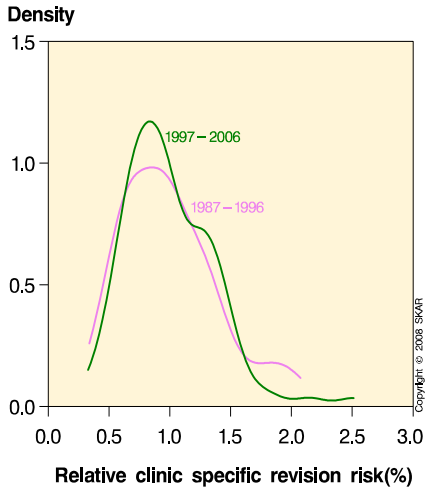
Total CRR for cemented TKA in OA during the 2 periods 1987–1996 and 1997–2006. Implants inserted during the latter period have half the risk of becoming revised.

The register has been requested to account for hospital specific results. A complete list with the relative risk for each hospital 1997-2006, as compared to the national average, is shown on the opposite page. There were 6 hospitals having significantly better results than the average hospital and 8 with significantly inferior results. One can only speculate on the causes for these differences. An unfortunate choice of implants, methods or surgeons may be the explanation but also a selection of patients with higher risk profile (case-mix).

We find it appropriate to point out that the results are based on historical data in which the last implants were inserted 2 years ago and the first 12 years ago. Thus, the results do not have to reflect the current risk for patients undergoing surgery.



Plotting the estimated absolute clinicspecific risk of revision shows that the absolute distribution has diminished between 1987-1996 and 1997–2006 (x-axis = absolute risk of revision)



Plotting the relative clinicspecific risk of revision as compared to the national mean shows that the distribution of relative risk among the hospitals has not changed between 1987–1996 and 1997–2006 (x-axis = relative risk).

Relative risk of revision for hospitals during 1997–2006 (cemented TKA/OA)

The true average result of a certain treatment can only be determined for defined groups of previously treated patients. However, such results only reflect historical circumstances and can't automatically be used to compare future results. The observed average result of a treatment at a hospital is not constant. Different selections of patients that get the same treatment have different average results. Thus, hospital specific variability has to be taken into consideration of comparisons if hospitals are to be meaningful.

The table below shows the number of primary operations (TKA) for OA performed at each hospital during the analyzed period and how many of these that were revised. Then there is the RR (relative risk of revision) with its 95% confidence interval. The RR describes each hospital's deviation from the national average in multiplicative terms. It has been calculated using "the shared gamma frailty model" which takes into consideration that units performing few operations more easily suffer far too optimistic or pessimistic risk estimates. Thus, the method shrinks such estimates towards the national mean in proportion to the amount of information they are based on.

For further information; Glidden DV & Vittinghoff E. Modelling clustered survival data from multicenter clinical trials. Statistics in Medicine 2004; 23: 369-388.

Finally the observed rank for the hospital is shown together with 95% confidence interval for its ranking, i.e. what rank places lie within the confidence interval. The calculations were performed using Monte Carlo simulation. For further information; Goldstein H, Spiegelhalter DJ. League tables and their limitations: statistical issues in comparisons of institutional performance. J R Statist Soc (A) 1996;159:384-43.

Only units performing more than 50 procedures during the 10-year period were included in the analysis. Only cemented TKA inserted for OA were included. The results are adjusted for differences in sex and gender as well as for differences with respect to if a patellar button had been used or not.

Units with significantly better or worse results than the national average are shown in green and red respectively.

Relative risk of revision for units

code	unit	no. TKA	no. revised	RR	95% CI	rank	95% CI
10484	Sabbatsbergs närsjukhus	704	3	0,33	0,16-0,67	1	1-20
21001	Linköping	541	4	0,42	0,22-0,81	2	1-31
62011	Örnsköldsvik	864	6	0,46	0,25-0,83	3	1-33
21014	Motala	1 384	7	0,46	0,26-0,81	4	1-31
50010	Östra sjukhuset	808	8	0,54	0,31-0,92	5	2-41
52012	Alingsås	701	5	0,54	0,29-1,01	6	1-47
56012	Köping	928	10	0,58	0,35-0,97	7	2-44
23010	Växjö	585	6	0,59	0,32-1,06	8	2-51
53013	Skövde	619	7	0,60	0,34-1,07	9	2-50
50071	Frölunda Spec,Sjukhus	358	2	0,61	0,29-1,28	10	1-63
22010	Jönköping	825	10	0,62	0,37-1,03	11	3-48
53010	Falköping	676	7	0,62	0,35-1,10	12	2-52
22012	Värnamo	732	8	0,63	0,36-1,09	13	3-53
65014	Kalix	164	1	0,63	0,28-1,42	14	1-71
28013	Simrishamn	715	9	0,65	0,38-1,10	15	3-53
13010	Eskilstuna	344	4	0,65	0,34-1,26	16	2-64
65012	Gällivare	489	6	0,69	0,38-1,24	17	3-63
12010	Enköping	833	9	0,71	0,42-1,20	18	4-60
64011	Lycksele	350	4	0,72	0,37-1,38	19	3-69
42011	Varberg	1 050	16	0,72	0,46-1,11	20	6-54
50001	Sahlgrenska	501	7	0,72	0,41-1,28	21	4-65
21013	Norrköping	544	11	0,73	0,44-1,19	22	5-60
52011	Borås	774	11	0,73	0,44-1,21	23	5-60
11001	Karolinska	1 054	16	0,73	0,47-1,12	24	6-55
41012	Helsingborg	458	8	0,75	0,43-1,29	25	5-65
13012	Kullbergska sjukhuset	735	10	0,75	0,45-1,25	26	6-63
27010	Karlskrona	277	6	0,76	0,42-1,39	27	5-70
54013	Säffle	370	6	0,77	0,42-1,41	28	4-70

(forts,)

relative risk of revision (cont.)

code	unit	no. TKA	no. revised	RR	95% CI	rank	95% CI
55011	Karlskoga	579	9	0,79	0,46-1,33	29	6-67
42015	Movement Halmstad	170	0	0,80	0,33-1,93	30	2-82
64010	Skellefteå	594	10	0,81	0,48-1,34	31	7-68
56010	Västerås	452	8	0,81	0,47-1,40	32	6-70
55010	Örebro	641	11	0,83	0,50-1,35	33	8-67
50080	Sergelkliniken Gbg	140	2	0,83	0,39-1,75	34	4-79
53011	Lidköping	668	11	0,83	0,51-1,36	35	9-68
55012	Lindesberg	675	12	0,85	0,53-1,37	36	10-69
13011	Nyköping	463	8	0,87	0,50-1,50	37	8-73
41001	Lund	193	4	0,89	0,46-1,71	38	6-79
63010	Östersund	670	12	0,89	0,55-1,43	39	11-71
10015	Sophiahemmet	715	14	0,89	0,57-1,40	40	12-70
28011	Ängelholm	831	17	0,90	0,59-1,36	41	13-69
30001	Malmö	262	5	0,90	0,48-1,67	42	7-77
27011	Karlshamn	959	18	0,91	0,60-1,37	43	15-69
42010	Halmstad	994	17	0,91	0,59-1,42	44	14-70
11011	Södertälje	683	14	0,92	0,58-1,44	45	13-72
25010	Kalmar	962	21	0,98	0,67-1,45	46	19-72
24010	Västervik	784	18	0,98	0,65-1,48	47	18-73
41010	Landskrona	605	16	0,99	0,64-1,52	48	18-74
54014	Torsby	614	14	0,99	0,63-1,56	49	17-75
65016	Sunderby sjukhus	283	7	1,00	0,56-1,76	50	12-80
12481	Elisabethsjukhuset	220	3	1,00	0,50-2,01	51	8-82
64001	Umeå	587	12	1,02	0,63-1,64	52	17-77
54010	Karlstad	926	17	1,02	0,67-1,57	53	19-75
10011	S:t Göran	2 891	67	1,02	0,81-1,30	54	30-66
10013	Södersjukhuset	1 084	25	1,09	0,76-1,56	55	27-75
57011	Mora	852	23	1,10	0,75-1,59	56	26-76
11002	Huddinge	520	16	1,13	0,73-1,74	57	25-79
28012	Hässleholm	2 579	62	1,16	0,90-1,48	58	38-74
25011	Oskarshamn	856	18	1,16	0,77-1,75	59	28-80
26010	Visby	441	12	1,19	0,73-1,92	60	24-81
62010	Sundsvall	876	28	1,22	0,86-1,72	61	35-79
11010	Danderyd	1 205	34	1,24	0,90-1,72	62	38-79
11913	Stockholms Specialistvård	569	14	1,25	0,79-1,96	63	30-82
57010	Falun	1549	49	1,27	0,97-1,67	64	43-78
10016	Ortopediska huset	1 047	25	1,28	0,89-1,84	65	37-81
51010	Uddevalla	945	27	1,28	0,90-1,82	66	38-80
65010	Boden	155	8	1,28	0,74-2,21	67	26-83
54012	Arvika	463	12	1,30	0,80-2,09	68	30-83
52013	Skene	565	20	1,31	0,88-1,95	69	37-82
41013	Ystad	334	13	1,35	0,85-2,15	70	34-83
23011	Ljungby	561	20	1,35	0,91-2,01	71	39-82
51011	Mölndal	419	16	1,36	0,88-2,09	72	37-83
61011	Bollnäs / Söderhamn	876	25	1,39	0,97-1,99	73	43-82
22011	Eksjö-Nässjö	650	24	1,42	0,98-2,05	74	44-83
50020	OrthoCenter IFK klin,	170	5	1,43	0,77-2,67	75	28-85
54011	Kristinehamn	112	7	1,44	0,82-2,55	76	32-85
52016	Vänersborg-NÄL	56	5	1,45	0,78-2,70	77	29-85
51012	Kungälv	911	34	1,48	1,08-2,04	78	52-83
61012	Hudiksvall	493	20	1,51	1,02-2,24	79	48-84
61010	Gävle	437	19	1,51	1,01-2,26	80	47-84
62013	Sollefteå	588	20	1,55	1,04-2,30	81	49-84
41011	Trelleborg	1 776	56	1,70	1,32-2,20	82	66-84
11012	Norrtälje	540	25	1,84	1,27-2,66	83	64-85
12001	Akademiska sjukhuset	872	52	2,17	1,66-2,83	84	77-85
65013	Piteå	740	36	2,52	1,85-3,44	85	81-85

Only units that inserted more than 50 TKA for OA during the period are listed

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