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Alingsås
Arvika
Bollnäs - Söderhamn
Borås
Carlanderska
Danderyd
Eksjö-Nässjö
Elisabethsjukhuset
Enköping
Eskilstuna
Falköping
Falun
Frölunda Spec, Sjh,
Gällivare
Gävle
Halmstad
Helsingborg
Huddinge
Hudiksvall
Hässleholm/Kristianstad
Jönköping
Kalmar
Karlshamn
Karlskoga
Karlstad
Karolinska
Kullbergska
Kungälv
Köping
Lidköping
Lindesberg
Ljungby
Lund
Lycksele
Malmö
Mora
Motala Proxima AB
Movement Halmstad
Mölndal
Nacka Proxima
Norrtälje
Nyköping
Orthocenter Göteborg
Orthocenter Stockholm
Oskarshamn
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Skellefteå
Skene
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Sollefteå
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Spenshult
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Annual Report 2011

The Swedish Knee Arthroplasty Register

Dept. of Orthopedics, Skåne University Hospital, Lund

Concerning:

primaries 1975-2010
revisions 1975-2009

To the orthopedic surgeon, locally responsible for the Swedish Knee Arthroplasty Register

Our new form has been in use at hospitals since January 1st, 2009. As usual after introducing new routines, it may take time until everybody has observed the changes. However, we have seen that the reporting in 2010 has been better than expected with the new variables being reported for 98% of the patients.
Again we want to remind everybody that the new information to be reported are not the general routines of the hospital but events, drugs, planning and timing concerning the individual patient.

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 2010 as well as analyses covering the 10-year period 2000-2009.

The third part is specific for each reporting unit and is only delivered to their respective contact surgeons and directors. It contains information concerning the new variables and lists containing information on all the operations reported by the unit in 2010. One list is sorted by ID and the other by the date of surgery.
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, analyzed and result in improvement.

We want to remind you that the SKAR is prospective and that any revision reported to the register is only included in the analyses if the primary operation has previously been reported to the register according to ordinary routines. Thus, if a primary operation is discovered only as 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, in which there is a reasonable explanation for why the reporting was missed in the first place and when there is no suspicion of a bias. Late reporting may also occur when the register retroactively requests information regarding primaries performed during a certain time period.

An important part of the reconstructive surgery that can be offered to patients with osteoarthritis are osteotomies of the proximal tibia which hitherto have not been reported to the register. After having conducted a retrospective study (submitted) we decided that osteotomies around the knee should be prospectively registered and have began preparations for this.

The Knee Register in Lund would like 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 7th, 2011
On behalf of the Swedish Knee Arthroplasty Register

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Introduction

The beginning – In the early seventies, endoprosthetic surgery of the knee was a relatively uncommon procedure restricted for those with severe disability. Little information was to be found in the literature and there was an abundant choice of implants which were continuously being modified. In this setting, the Swedish Orthopedic Association initiated a nationwide multicenter study in 1975, to prospectively monitor knee arthroplasty surgery. The orthopedic surgeons realized that it would be impossible for an individual surgeon to base his choice of optimal operative methods or implants on his own experience. The aim was to collect, analyze and render information that could warn against suboptimal techniques and implants.

Number of units – The vast improvement in quality of life for the majority of patients quickly made the surgery a success and the technique dispersed to more hospitals and surgeons. Since the start of the registration in 1975, participation has been voluntary. 24 units reported during the first year increasing to 51 in 1985 and to 82 in 1996. In the late nineties, the number of reporting units lessened somewhat due to the merger of hospitals.
In 2010, 75 orthopedic units reported to the register, i.e. all units that routinely performed knee arthroplasty surgery in Sweden.

Volumes – Since the start of the registration there has been an exponential increase in the number of operations (see page 8). In 2010, 12,861 primary arthroplasties were reported which was an increase of only 1.3% from 2009. One wonders if this marks an end for the increase observed in the recent decades or if the year 2010 like the year 2007 only is an exception. What contradicts that the top is about to be reached is that the incidence in Sweden (see page 9) is still considerably lower than in countries such as USA and Germany. Even without a further increase in age specific incidence, the expected changes in the age distribution of the population will still increase the demand for surgery.

Reporting – The SKAR recommends that the form (page 53) is filled in the operation theater and that one set of the stickers found in the implants and cement packages are placed on the form. The form is then sent to the register office at Lund University Hospital where the computer registration occurs. Units with high volume of surgeries are requested to send the forms to Lund at least once a month and in case of revisions, a copy of the operation report and discharge letter is required. The majority of the units observe the recommendations.
The reason for not having introduced decentralized computer registration is that we consider it important the registration is done in the operation theater. Further, the technology and the flow of information from the implant distributors to the register is not sufficient in order to maintain an up-to-date part number database. In our view, the paper-based system has essential advantages at present such as less workload for the surgical units, the most reliable information and the least chance of input error. Further, during the input of data the register staff is able to check part numbers against a local database and in the case of new numbers turning up, directly contact the distributors.

Annual report – Each annual report accounts for primary arthroplasties reported during the previous year (in this report 2010). Analyses concerning the revision rate end one year prior to that (in this report 2009). The reason for the survival analyses ending one year earlier is that a few errors in the registration of revisions can have a large impact on the final result. As revisions are often complicated, the forms, discharge letters and operation reports have to be examined thoroughly. Supplementary information is often needed before the reason for and the type of revision is reasonably clear. Unfortunately, it also happens that unit's send completing information after discovering, by examining the annual report and the accompanying lists, that their previous reporting had been incomplete. Thus, the extra years allows for the most complete and correct information on revisions possible.

10-year analyses – Some have wondered why the register most often accounts for 10-year revision rate while the registration has been going on for more than 30 years.
There are several reasons: The main reason is that the interest usually focuses on relatively modern techniques and implants. Another reason is that survival analyses allow for inclusion of patients during the entire observation period. i.e. implants have been inserted in the beginning as well as in the end of the observation period. This implies that the first part of a revision (survival) curve includes operations performed both during the first

and last part of the observation period. The end of the curve (to the right), only includes operations inserted during the first part of the period. The result is that the latter part of the curve represents older techniques and implants as well as the younger part of the patients (those more likely to live to the end of the observation period). In summary, this means that without special selections it is difficult to interpret curves that stretch over long time periods. A more detailed description on how the register compares implants can be found on page 6.

Cooperation – There is a close collaboration with RC-Syd (Register Centrum South (previously NKO)) which is facilitated by the fact that the SKAR and RC-Syd share premises at the University Hospital in Lund. The Nordic countries cooperate through the framework of NARA (Nordic Arthroplasty Register Association) where combined analyses of knee arthroplasty data are being performed. The SKAR and AOANJRR (Australian Orthopaedic Association National Joint Replacement Registry) have a common research project and the SKAR also collaborates with individual scientists in different countries.
Besides that such collaborative projects may result in interesting findings they give the participants insight into each other´s methods for registration, selection, analyses and reporting. In turn this hopefully will result in the registers approaching each other so that it will be easier to compare their results in scientific papers and reports in the future.

The new form –
The new reporting form, that has been in use since January 1st, 2009, was introduced to allow for monitoring quality of processes and facilitate systematic improvement work in the short and long term. Additions to the new form include new information on surgical techniques, preventive treatment and other relevant information concerning the patients.
During 2010, all the reporting units used the new form for reporting. The initial compilation for the new 13 variables shows that information was at least 98% complete (page 43). This result is better than expected after only 2 years with the new form.The form, as well as the manual describing of how it should be filled out, is found at the end of this report.

Patient Reported Outcome – Nationally and internationally there has been increasing interest in patient reported outcome measures (PROM).
The SKAR started early on to evaluate PROM in order to find the most relevant instrument to be used for patients undergoing knee arthroplasty surgery. This work resulted in a thesis being published in 2001. The renewed interest in PROM has been for using it to increase hospital quality. In a pilot study, the SKAR has tried to evaluate some of the PROM's used for patients operated on with primary TKA at the Trelleborg hospital. Some initial results regarding the available variables can be found on page 46-51.

Feedback – The register reports in several ways; verbally, in writing and using modern computer technology. At annual meetings, contact surgeons from the participating hospitals are informed. Each unit receives their own data annually so they have the opportunity to check their own results. By publication of annual reports and scientific articles, as well as through participation in national and international conferences the register disseminates information to professionals, administrators and other interested bodies.
The register has a Web-site (www.knee.se) were annual reports can be downloaded and where a list of publications is available. There is also a secure server where participating units have their individual folder in which they are provided with their own data in a computerized form including revisions of their patients performed elsewhere.
Hitherto, the register has not seen the cost-benefit in using the Web-site to provide the units with constantly updated information. The reason for this is that the units report to the register irregularly and that there may be a delay in registration of revision information (see annual report above). It can be assumed that the individual units have access to local computer systems containing information concerning their own patients. The information that the SKAR has on revisions performed elsewhere is supplementary information of restricted use as it is not certain that it is complete. However, the new process variables we have started to register may be more important for the units in a shorter term. The first results are found at the end of this report and we hope that we in the future will be able to provide continuous reporting through our web-site.

Comparison of coverage in 2009

Estimating the percentage of operations accounted for in the SKAR is not easy. The register can only compare itself with the National Patient Register (NPR), an inpatient-care register of the health authorities, based on ICD coding. However, NPR did not have nationwide coverage the first 12 years of the SKAR. Further complicating the comparison of these registers is that they have registered different variables (operations vs. admissions) and that the side treated has not been registered in NPR.

During the late eighties, the coverage of the SKAR was estimated as being 85%. However, after validation in 1997 using mail enquires to all patients and performing a search of missing operations in the NPR followed by improved routines for reporting, coverage was estimated as 95%.

In order to estimate the percentage of surgeries captured by the SKAR it was compared to the NPR. By comparing the number of admissions and assuming the true number of admissions is the combined number of admissions in both registers it is possible to estimate the "coverage". Although there is a possibility for patients having knee arthroplasty surgery without being registered in any of the registers, they are presumably few.

Using this method in the previous report we found for the year 2008 that 97.1% of the admissions had been registered in the SKAR. This year we found for 2009 that 96.6% of the admissions had been registered by the SKAR and 96.2% by the NPR.

Below is a list of the units containing the combined number of operations in both registers as well as the coverage of respective registry.

Those units who do not reach 96% coverage are marked in red. Units with low coverage have reason to investigate if they missed reporting surgeries and if their ICD-10 coding is satisfactory.

Hospital	Number	SKAR percent	NPR percent
Akademiska	140	92.1	94.3
Alingsås lasarett	190	97.9	97.9
ArthroCenter Stockholm	9	0.0	100.0
Arthro-SpineCenter Göteborg	3	0.0	100.0
Arvika	140	98.6	98.6
Bollnäs	293	96.2	98.3
Borås &Skene	206	96.6	97.1
Calanderska	51	100.0	0.0
Dalens sjukhus	1	0.0	100.0
Danderyd	183	97.3	98.4
Eksjö-Nässjö	170	98.8	100.0
Elisabethkliniken	138	65.9	66.7
Enköping	243	99.2	99.2
Eskilstuna	48	100.0	97.9
Falköping+Lidköping+Skövde	396	98.7	98.5
Falun	243	99.2	99.6
Gällivare	74	98.6	91.9
Gävle	63	95.2	93.7
Halmstad	194	96.9	95.9
Helsingborg	31	83.9	100.0
Huddinge	175	94.9	98.3
Hudiksvall	82	100.0	96.3
Hässleholm+Kristianstad	711	98.6	97.3
Jönköping	213	95.8	98.6
Kalmar	123	97.6	96.7
Karlshamn	225	98.7	94.2
Karlskoga	97	96.9	99.0
Karlstads	165	97.6	97.0
Karolinska	126	96.0	98.4
Kullbergska	307	97.1	89.9
Kungälv	151	98.7	95.4
Köping	80	98.8	97.5
Lindesberg	148	99.3	100.0
Linköping	1	0.0	100.0
Ljungby	110	98.2	97.3
Lund	41	95.1	97.6
Lycksele	65	95.4	95.4
Malmö	24	100.0	83.3

Hospital	Number	SKAR percent	NPR percent
Mora	128	99.2	99.2
Motala lasarett	544	96.3	98.7
Movement medical AB	250	97.2	100.0
Nacka-Proxima	100	100.0	100.0
Norrköping	150	98.7	100.0
Norrtälje	99	93.9	99.0
Nyköping	115	97.4	83.5
Ortho Center Göteborg	109	100.0	98.2
Ortho Center Stockholm	398	100.0	99.2
Ortopediska Huset	448	97.5	82.6
Oskarshamn	230	97.8	98.3
Piteå	283	98.2	97.5
S:t Göran	325	97.2	99.1
Sabbatsberg - Aleris	101	100.0	96.0
Sahlgrenska+Mölndal+Östra	261	87.4	96.2
Skellefteå	110	94.5	97.3
Sollefteå	108	80.6	89.8
Sophiahemmet	97	99.0	96.9
Spenshult	140	99.3	95.0
Sunderbyn	6	100.0	100.0
Sundsvall	118	92.4	99.2
Södersjukhuset	364	95.9	97.0
Södertälje	126	96.8	96.8
Torsby	99	98.0	98.0
Trelleborg	560	98.4	98.6
Uddevalla	297	96.6	99.3
Umeå	220	98.2	99.1
Varberg	211	94.8	97.6
Visby	95	93.7	94.7
Värnamo	126	95.2	98.4
Västervik	104	97.1	99.0
Västerås	240	96.3	97.9
Västra Frölunda	128	97.7	99.2
Växjö	131	93.1	97.7
Ängelholm	150	99.3	98.0
Örebro	145	97.2	96.6
Örnsköldsvik	120	98.3	95.0
Östersund	137	98.5	99.3

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 is named bilateral UKA.

Patello-femoral 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 a 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 super stabilized 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 of the above mentioned camshaft construction.

TKA-revision models are TKA that are mainly used for revisions or difficult primary cases. As mentioned above, these are often stabilized implants, which additionally are often used with stems. Many have proper names that make them easy to distinguish from common TKA's. However, due to the modularity of the modern TKA, a TKA brand can represent either a common TKA or a stabilized stemmed TKA depending on which components have been assembled. For the primary surgeries, this implies that some TKA brands have only been used for standard cases while others also have been used for difficult primary cases. This can result in bias when comparing models. In order to make comparison of revision rates after primary surgery as fair as possible, the SKAR classifies certain TKA as being "revision models" and excludes them from the analyses. Accordingly, revision models with identifiable names are excluded (e.g. NexGen-LCCK, AGC-Dual Articular and F/S-Revision) as well as those modular TKA's that have been inserted using extra long stems (5 cm. or more).

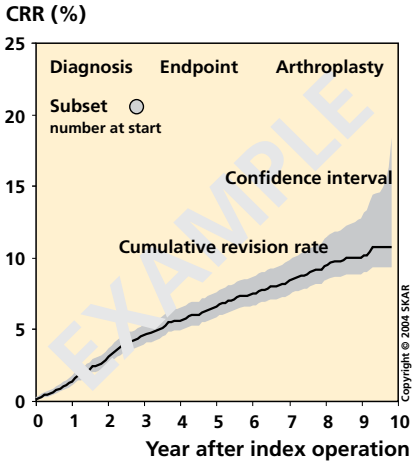
For those interested there is an excellent article on the history and the developement of the TKA; Robinson RP; The Early Innovators of Today's Resurfacing Condylar Knees. J of Arthroplasty 2005 (suppl 1); 20: 1..

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.

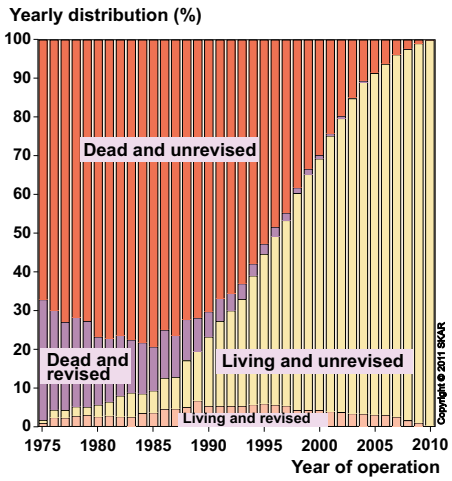
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared. 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 it 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 RC-Syd 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 grades 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.

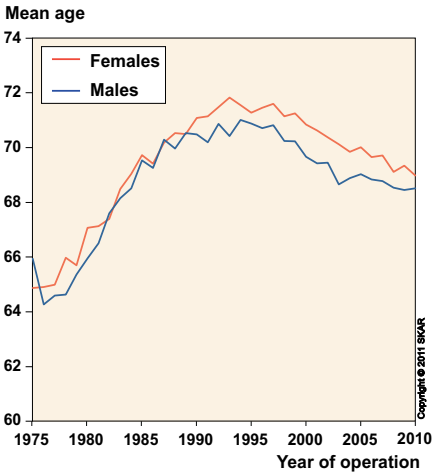


The status in 2010 for each yearly batch of patients operated since 1975.

Gender and age distribution

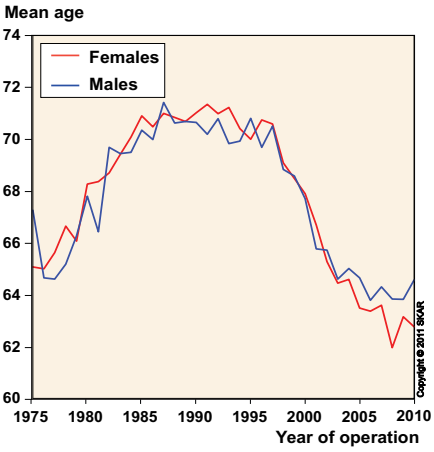
Between 1975 and 1994, the mean age at primary operation increased from 65 years to almost 72 years. The main reason was the relatively large increase in number of operations for the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution 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 2009, it was a barely 69 years and slightly higher for females (figure on the right).

When TKA and UKA are analyzed separately, it is apparent that when TKA was introduced in the seventies it was used for younger patients 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.

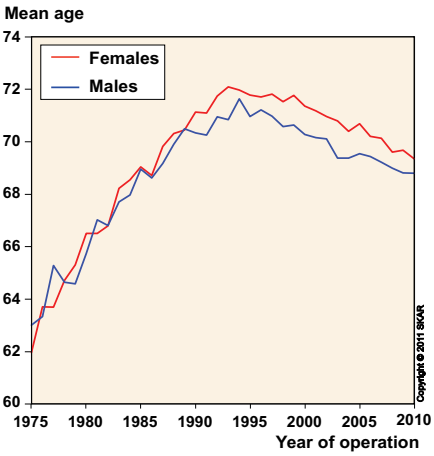


The mean age of patients at surgery (all types of implants) increased until the mid-nineties when it started to decrease.

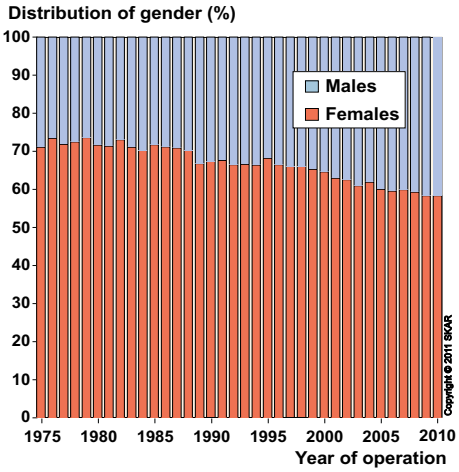
When comparing a series of patients operated on during different periods, the change in the mean age make it necessary to account for age by use of regression or to analyze different age groups separately.



For UKA, the mean age of patients at surgery has decreased sharply in recent years coinciding 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).



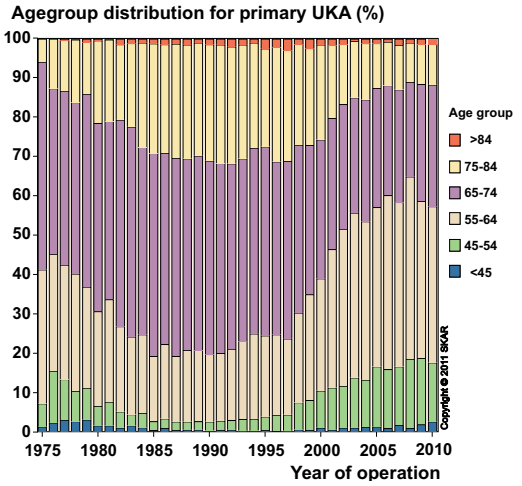
The proportion of males has increased slightly over the years.

Knee arthroplasty is more common in females than in males. At the start of the registration, females accounted for about 70% of the operations. As the figure above shows, the proportion of men has been slowly increasing and at present they account for 42%. 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.

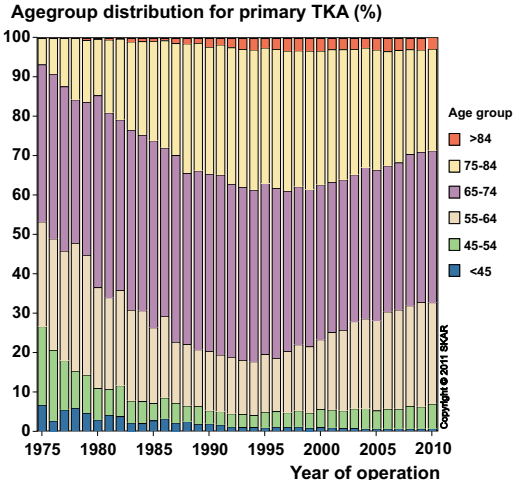
The figure to the right shows the relative number of operations performed on the different age groups over a period of thirty five years. In a somewhat different manner than the mean age (last page) it shows how the relative proportion of the older groups increased until the mid-nineties after which their proportion 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 young age groups was higher for TKA than for UKA.

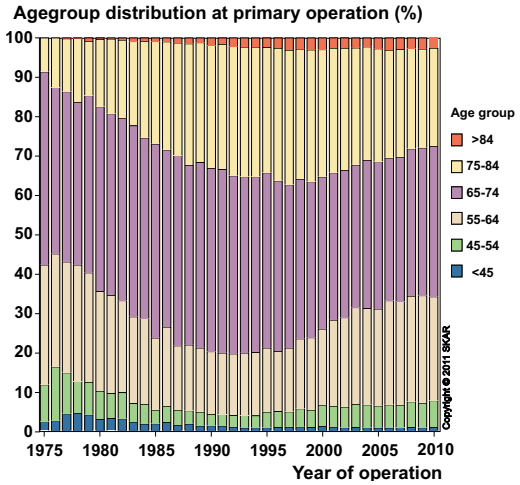
In UKA the relative proportion of patients less than 64 years of age has doubled after 1998, i.e. during the time when mini-invasive surgery caught on in Sweden. However, it has to be kept in mind that the actual number of UKA´s has diminished by 31% since 1998 in contrast to the number of TKA which has more than doubled. 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 that knee arthroplasty is of benefit for younger patients.



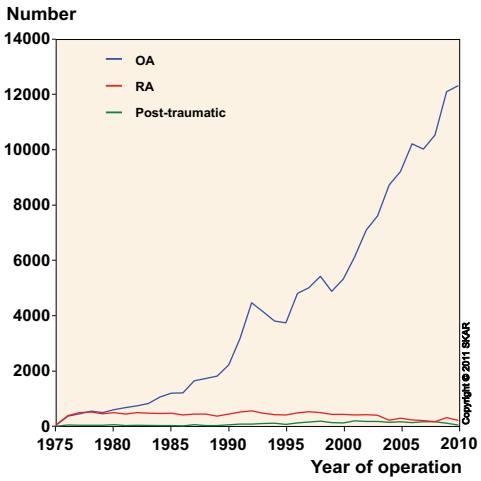
The relative distribution of primary UKA arthroplasties among different age groups.



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).



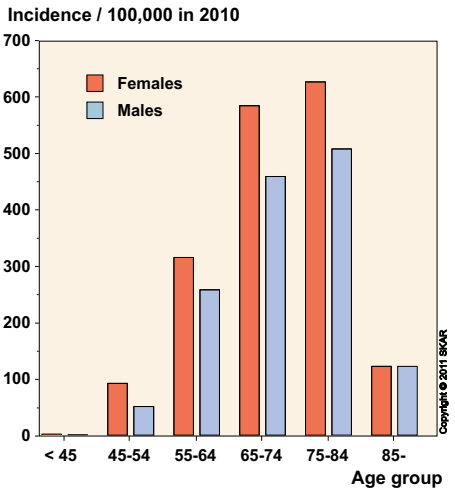
The yearly number of arthroplasties for different diagnoses

In the eighties, the use of knee arthroplasty really started to increase (graph above) mainly because of the increased treatment of osteoarthritic patients. On the other hand, the number of operations for rheumatoid arthritis lessened, especially during recent years which may be explained by the advancement of new types of medical treatment. The number of operations for post-traumatic 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.

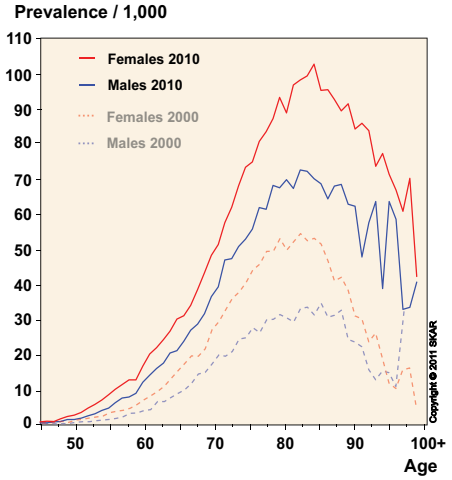
Incidence and prevalence

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 ceased at least for the year 2010. Knee arthroplasty is mainly used in the elderly and a small part of the increase in incidence reflects aging of the population over time.

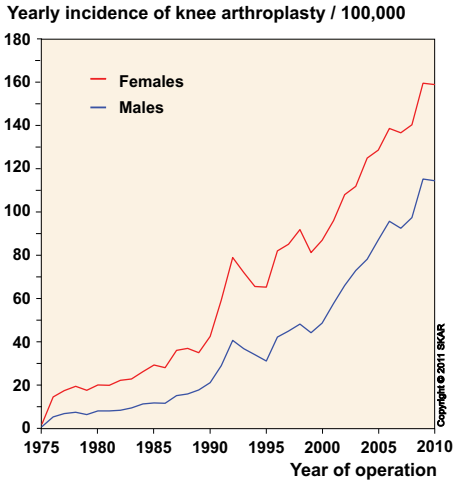
In 2000, the register published an article in which it was estimated how projected changes in the age distribution in Sweden could affect the demand for knee arthroplasty surgery. Using the incidence observed during 1996-1997, it was found that by 2030 only aging of the population would result in an increase in the number of operations by 36% to 7,580 operations. The fact 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 in 2010 per 100,000 inhabitants (males and females) in the different age groups.



The prevalence of knee arthroplasty in 2000 and 2010. One of fourteen elderly women has a knee arthroplasty.



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

The figure to the left shows the age-specific incidence for different age groups in 2010. 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 except older than 85. As the incidence is so dependent on age and because the age distribution may vary among different nations, it is difficult to compare different countries without performing some form of age standardization.

The increase in the number of operations causes a rise in the number of patients walking around with knee implants. The figure on the left shows the prevalence in 2010 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. Comparing the prevalence in 2000 and 2010 it can be seen how fast the progress has been during the last decade. In 2000, 5% of all elderly women and 3% of the men had at least one knee arthroplasty. In 2010 the numbers were 10% and 7.0% respectively. In the future this will be reflected in the need for revisions and the risk of periprosthetic fractures in accidents.

In 2007, it seemed that the increase in incidence had halted, only to increase again and in 2010 it halted again (figure above). It remains to be seen if the top of the curve has been reached.

Incidence in Sweden over time (number of arthroplasties/100,000 inhabitants)

Women

Agegroup	1976–1980	1981–1985	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
<45	1.1	1.0	0.9	1.1	1.5	1.8	2.6
45-54	14.6	11.6	11.4	15.7	27.5	49.9	95.1
55-64	40.1	44.5	57.4	104.1	133.9	199.0	360.9
65-74	75.5	107.9	158.0	306.7	373.2	476.5	709.5
75-84	45.8	81.9	143.7	305.7	385.0	479.2	729.2
>84	2.4	7.9	19.2	54.4	82.6	92.4	152.2
Total	17.9	24.2	35.9	68.5	85.8	114.4	184.5

Men

Agegroup	1976–1980	1981–1985	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
<45	0.5	0.3	0.4	0.4	0.7	0.9	1.9
45-54	6.0	4.8	4.5	8.8	14.4	30.0	58.3
55-64	17.4	20.3	28.3	64.9	81.5	149.2	277.6
65-74	31.4	50.5	81.5	176.6	239.6	347.0	558.7
75-84	20.6	42.5	91.7	193.1	246.3	342.4	572.6
>84	3.9	8.4	22.4	51.2	71.3	89.4	157.5
Total	6.9	9.9	16.5	34.5	45.9	72.8	129.6

Number of primary arthroplasties per unit and year

Hospital	1975-2005	2006	2007	2008	2009	2010	Total	Percent
Akademiska sjukhuset	2,079	131	119	109	130	153	2,721	1.6
Alingsås	693	164	187	183	188	209	1,624	0.9
Arvika	612	84	74	156	155	154	1,235	0.7
Avesta	67	.	.	.	.	.	67	0.0
Boden	1,617	.	.	.	.	.	1,617	0.9
Bollnäs / Söderhamn	1,202	230	228	248	285	301	2,494	1.4
Borås	2,047	112	143	95	94	91	2,582	1.5
Carlanderska	21	31	28	22	52	95	249	0.1
Dalslands sjukhus	81	.	.	.	.	.	81	0.0
Danderyd	1,895	186	218	227	178	143	2,847	1.6
Eksjö-Nässjö (Höglandssjh.)	1,931	98	118	119	168	164	2,598	1.5
Elisabethsjukhuset	210	76	107	108	91	63	655	0.4
Enköping	730	183	194	197	253	269	1,826	1.0
Eskilstuna (Mälarsjh.)	1,519	57	48	72	48	32	1,776	1.0
Fagersta / Västerås	71	.	.	.	.	.	71	0.0
Falköping	988	132	122	113	143	190	1,688	1.0
Falun	2,985	179	223	202	245	304	4 138	2.4
Frölunda Spec.Sjukhus	341	127	120	123	125	115	951	0.5
Gällivare	876	120	93	46	73	61	1,269	0.7
Gävle	2,657	63	68	48	60	97	2,993	1.7
Halmstad	1,845	196	161	127	188	177	2,694	1.5
Helsingborg	1,650	18	14	13	26	19	1,740	1.0
Huddinge	1,829	77	162	156	171	136	2,531	1.4
Hudiksvall	995	73	86	62	85	108	1,409	0.8
Hässleholm	3,154	528	518	557	717	632	6 106	3.5
Jönköping (Ryhov)	1,728	107	100	142	205	148	2,430	1.4
Kalix	215	.	.	.	.	.	215	0.1
Kalmar	1,777	130	102	119	120	103	2,351	1.3
Karlshamn	1,315	178	169	205	222	230	2,319	1.3
Karlskoga	1,172	92	105	98	94	96	1,657	0.9
Karlskrona	1,111	6	.	.	.	1	1,118	0.6
Karlstad	2,733	214	232	212	193	176	3,760	2.1
Karolinska	1,543	121	162	234	121	123	2,304	1.3
Kristianstad	1,297	.	.	.	.	1	1,298	0.7
Kristinehamn	252	.	.	.	.	.	252	0.1
Kullbergska sjukhuset	821	125	96	291	311	243	1,887	1.1
Kungsbacka	33	4	.	.	1	.	38	0.0
Kungälv	914	134	183	140	149	161	1,681	1.0

(cont.)

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

Hospital	1975-2005	2006	2007	2008	2009	2010	Total	Percent
Köping	961	246	215	103	79	.	1,604	0.9
Landskrona	1,918	.	.	.	.	.	1,918	1.1
Lidköping	846	160	147	136	149	154	1,592	0.9
Lindesberg	1,014	119	95	84	150	171	1,633	0.9
Linköping	1,730	.	.	.	.	.	1,730	1.0
Linköping medical cent	12	.	.	.	.	.	12	0.0
Ljungby	1,054	83	73	66	112	148	1,536	0.9
Ludvika	338	.	.	.	.	.	338	0.2
Luleå	2	.	.	.	.	.	2	0.0
Lund	2,413	40	26	23	39	46	2,587	1.5
Lycksele	369	59	35	39	62	65	629	0.4
Löwenströmska*	409	.	.	.	.	.	409	0.2
Malmö	2,055	56	27	26	25	9	2,198	1.3
Mora	1,123	98	99	115	129	163	1,727	1.0
Motala (Proxima AB)	1,169	447	357	392	547	546	3,458	2.0
Movement Halmstad	76	98	132	172	243	261	982	0.6
Mölndal	1,106	2	107	140	197	262	1,814	1.0
Nacka / Södersjukhuset	203	.	.	.	.	.	203	0.1
Nacka-Proxima	8	68	37	16	101	152	382	0.2
Norrköping (Vrinnevisjh.)	1,892	.	.	118	148	151	2,309	1.3
Norrtälje	693	95	79	89	93	83	1,132	0.6
Nyköping	901	105	102	120	115	121	1,464	0.8
OrthoCenter IFK klin. *	218	87	20	83	122	139	669	0.4
OrthoCenter Stockholm**	478	158	184	197	404	415	1,836	1.0
Ortopediska huset	889	411	422	381	437	386	2,926	1.7
Oskarshamn	994	252	265	304	225	188	2,228	1.3
Piteå	552	261	292	280	278	232	1,895	1.1
S:t Göran	4,898	471	224	318	319	396	6,626	3.8
Sabbatsberg	629	.	.	.	2	104	735	0.4
Sabbatsbergs närsjh	821	.	.	.	99	1	921	0.5
Sahlgrenska	1,445	70	4	5	4	4	1,532	0.9
Sala	115	.	.	.	.	1	116	0.1
Sandviken	301	.	.	.	.	.	301	0.2
Sergelkliniken Gbg	160	.	.	.	.	.	160	0.1
Simrishamn	1,021	.	.	.	.	.	1,021	0.6
Skellefteå	835	96	51	77	105	107	1,271	0.7
Skene	842	72	89	85	105	114	1,307	0.7
Skövde	2,107	107	94	87	99	103	2,597	1.5
Sollefteå	684	119	108	81	87	123	1,202	0.7
Sophiahemmet	895	112	107	102	97	76	1,389	0.8
Spenshult	.	.	54	135	141	220	550	0.3
Sunderby sjukhus	321	32	23	7	6	2	391	0.2
Sundsvall	2,207	85	89	87	110	125	2,703	1.5
Säffle	484	.	.	.	.	.	484	0.3
Söderhamn	279	.	.	.	.	.	279	0.2
Södersjukhuset	2,644	311	330	353	358	340	4 336	2.5
Södertälje	657	103	124	143	122	117	1,266	0.7
Torsby	972	77	92	90	99	108	1,438	0.8
Trelleborg	2,403	524	553	480	578	599	5,137	2.9
Uddevalla	2,327	185	180	177	288	196	3,353	1.9
Umeå	1,732	162	138	120	216	232	2,600	1.5
Varberg	1,726	173	179	150	201	141	2,570	1.5
Visby	849	80	101	88	89	73	1,280	0.7
Vänersborg-NÄL	939	.	.	.	.	.	939	0.5
Värnamo	1,220	114	125	131	120	119	1,829	1.0
Västervik	1,287	98	88	98	101	74	1,746	1.0
Västerås	1,581	86	84	172	231	311	2,465	1.4
Växjö	1,449	107	127	102	122	120	2,027	1.2
Ystad	1,169	.	.	.	.	.	1,169	0.7
Ängelholm	1,159	168	163	145	149	142	1,926	1.1
Örebro	2,457	139	156	154	141	124	3,171	1.8
Örnsköldsvik	1,271	146	105	106	118	141	1,887	1.1
Östersund	1,381	110	94	84	135	160	1,964	1.1
Östra sjukhuset	1,680	120	149	116	31	.	2,096	1.2
Total	**117,439**	**10,690**	**10,525**	**11,002**	**12,823**	**12,866**	**175,345**	**100.0**

* Gothenburg Medical Center was replaced by OrthoCenter IFK kliniken in 2008.

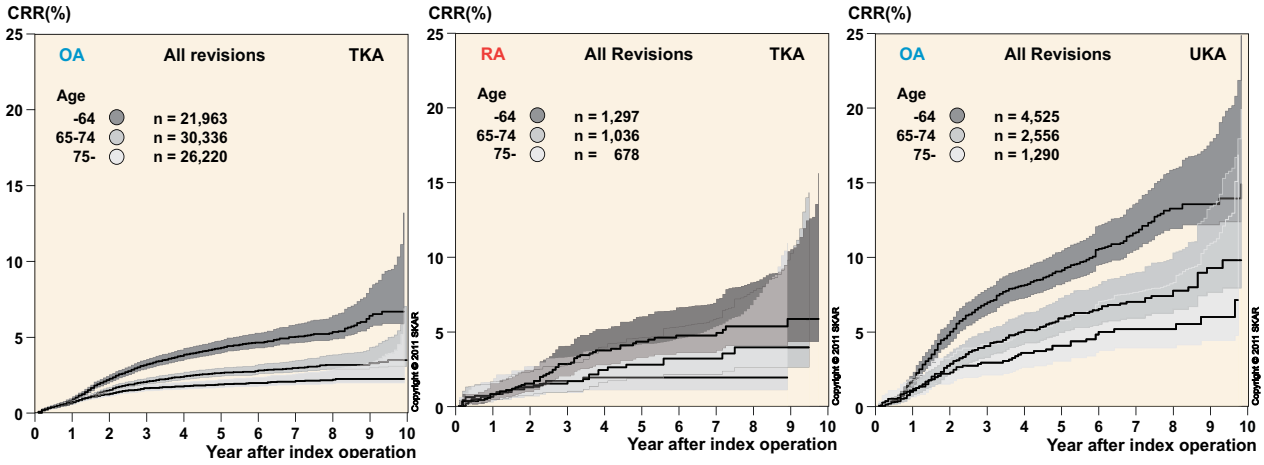
**Lövenströmska was replaced by Stockholms Specialistvård in 2001 and OrthoCenter Stockholm in 2008.

Factors that influence the revision rate

Primary disease – It became evident early on that patients with different diseases, e.g. rheumatoid arthritis (RA) and osteoarthritis (OA), were different with respect to outcome. This was especially evident in UKA, after which patients with OA and RA had large differences in CRR. Therefore, the registry has always produced separate curves for these diagnoses.

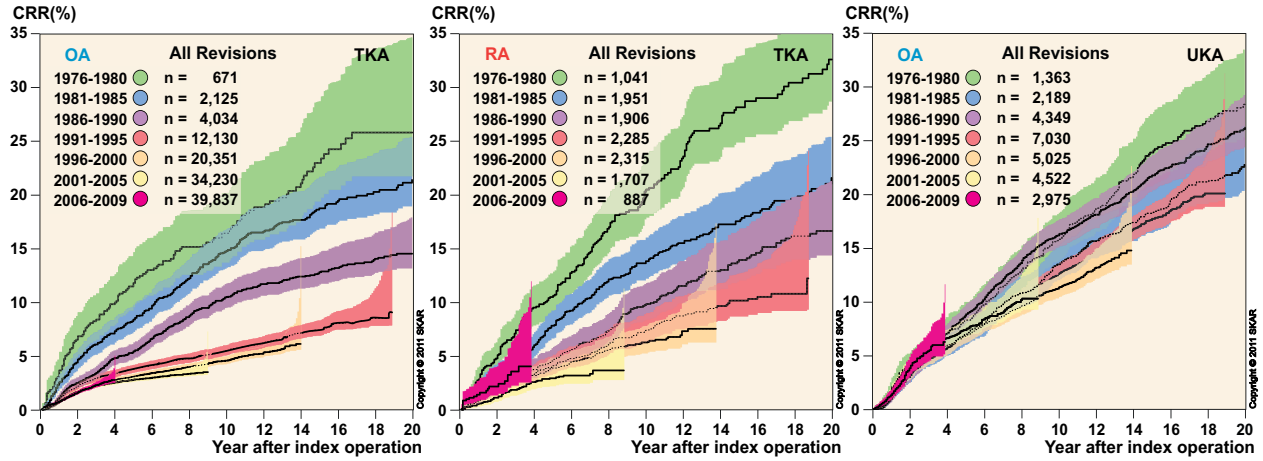
Age – For OA the age has a considerable effect on the rate of revision both in TKA and UKA. One can wonder why this is the case. A possible explanation is that the younger patients have a higher level of activity, higher demand of pain-relief and a state of health that more often allows for revision surgery.

For RA patients, age has hitherto not significantly affected the CRR which has been explained by a multiple joint disease, a lower physical level and poorer general health, irrespective of age. However, this year age has become a significant factor even in RA.

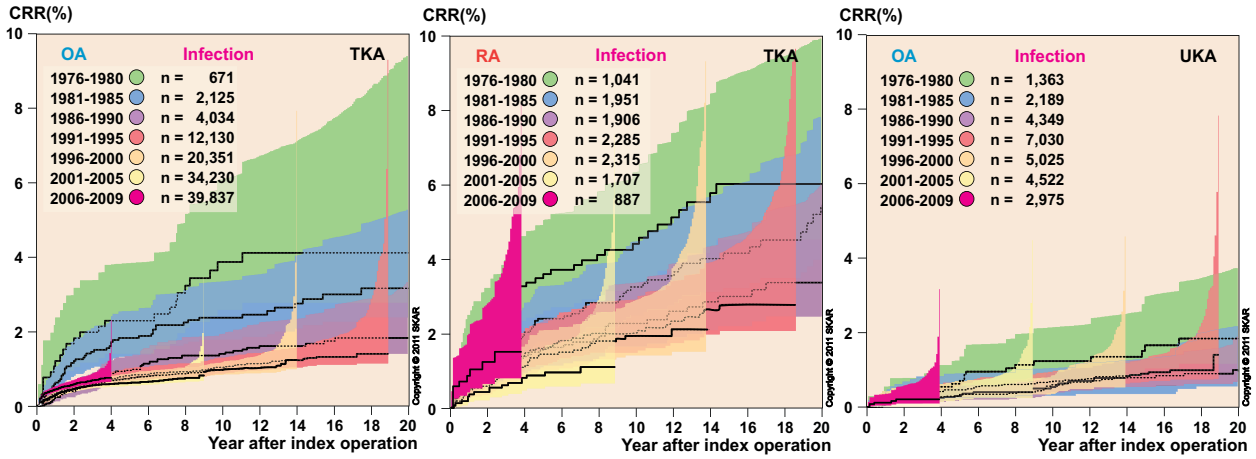


The differences in CRR (2000–2009) between the 3 age groups <65, 65–75, >75 were significant for TKA (OA & RA) as well as UKA.

Year of operation – For TKA there has been a constant reduction in risk of revision over time. The increasing mean age of patients at surgery cannot be the only explanation and even if improvement in implants may provide some explanation, the reduction has also been seen for unchanged implants (Lewold et al. 1993). This indicates improvement in technique (cementing/seating) or in patient selection. Therefore, we take into account the time-period during which the operations were made, when comparing implants by Cox regression. Improvement with time has not been seen for the UKA, which probably is caused by some newer models with inferior results. Further, the number



Comparing the CRR of different time periods, one finds for TKA, that the revision rate has decreased over the years. This is not as apparent for UKA. However, for TKA/RA, the CRR during 2006-2009 has increased again as compared to 2001-2005 and 1996-2000.



Comparing the CRR, using only revision for infection as end-point, we find an improvement with time for both TKA and UKA. However, in TKA (OA & RA) the CRR for infection during 2006-2009 has increased as compared to 2001-2005.

of UKA operations have decreased, reducing the surgical routine which has been found to affect the revision rate. Furthermore, changes in implants, instruments, surgical techniques and approaches may have resulted in a new or prolonged learning curve.

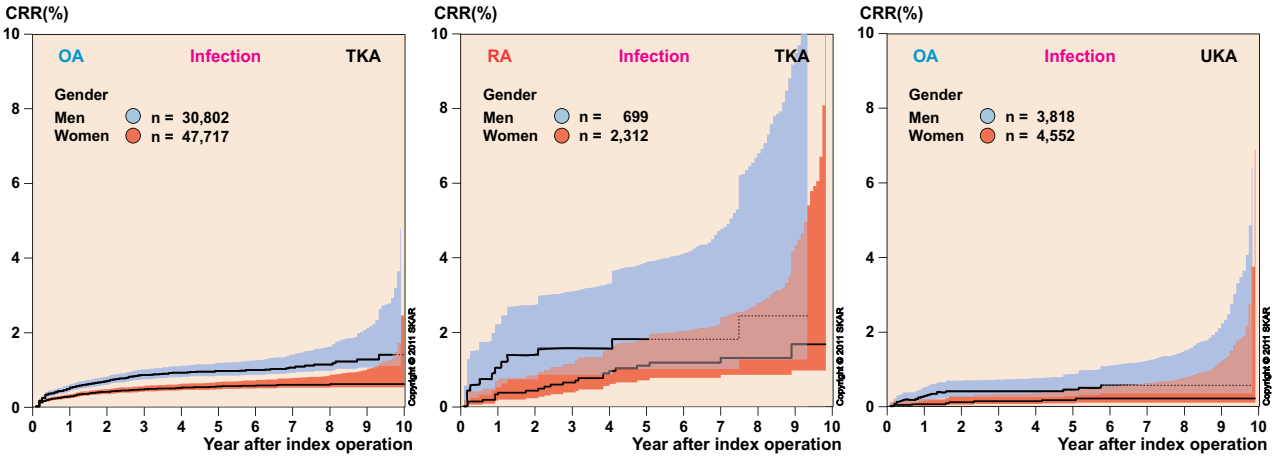
When the Knee Register estimates the risk of revision due to infection, it counts the first revision due to infection in the affected knee. It does not matter if it is the primary or any subsequent revision. Over time we have seen a reduction in this risk both for OA and RA. However, for 2006-2009 as compared to 2001-2005, an increase in the risk of early revision can be seen. A part of the increase is due to infected revisions in which only the inlay was exchanged.

UKA have significantly lower risk of infection than TKA and patients with OA have a lower risk than those with RA.

Gender – When analyzing OA during 2000-2009 (Cox regression), no significant difference in CRR was found between the sexes, whether it was for TKA or UKA. For RA (TKA), no overall significant difference between the sexes could be found.

However, regarding revisions for infection there was a considerable gender difference (see below).

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

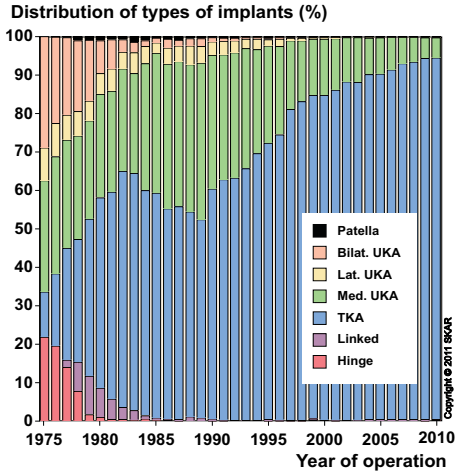


Using the end-point; revision for infection, the CRR (2000–2009) shows in TKA for OA that men are more affected than women (RR 1.8). The same tendency is true for RA, although not significant. UKA with its smaller implant size does better than the larger TKA but even in UKA men have 3.0 times the risk of women of becoming revised for infection. In TKA, patients with RA are more affected than those with OA (RR 2.0).

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 difficult primary cases, trauma, malignancies and revisions.

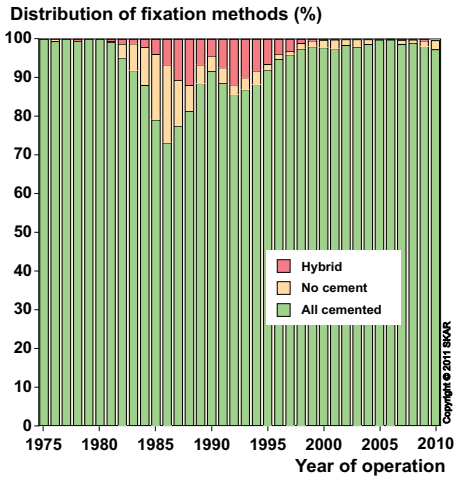
The use of UKA has diminished during the years. The reason may be that UKA has been found to have a substantially higher CRR than TKA (see figures on page 12). However, serious complications (infections/arthrodeses/amputations) are less common after UKA. When patients were asked in a mail inquiry how satisfied they were with their knee, there did not seem to be any difference between TKA and UKA.

For UKA being revised to a TKA, we found earlier that the risk of additional revision, was not significantly increased as compared to the risk for primary TKA's inserted at the time the primary UKA's had been performed. At this time there was a rapid improvement in the TKA results and the UKA conversions had the benefit of being compared to older TKA results. This is no longer true and we now find UKA conversions to have approximately 2 times the risk of primary TKA's.

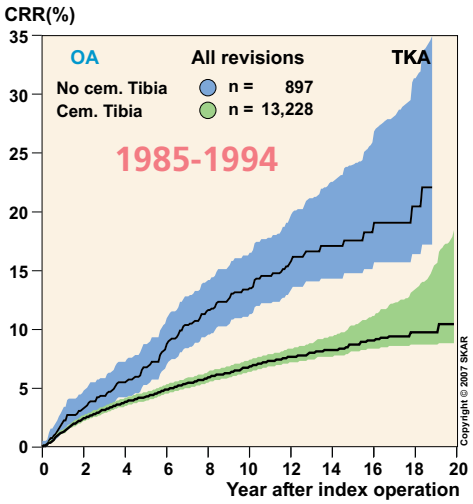


The relative yearly distribution of implant types used for primary surgery.

Use of bone-cement – As the figure below shows, bone-cement has been used in the majority of arthroplasties inserted in recent years. The number of uncemented cases has become so small that it is no longer possible to perform meaningful comparisons. However, for the period 1985–1994, when uncemented implants were relatively common, we found that the risk of revision was higher if the tibial component was left uncemented (figure to the right).



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

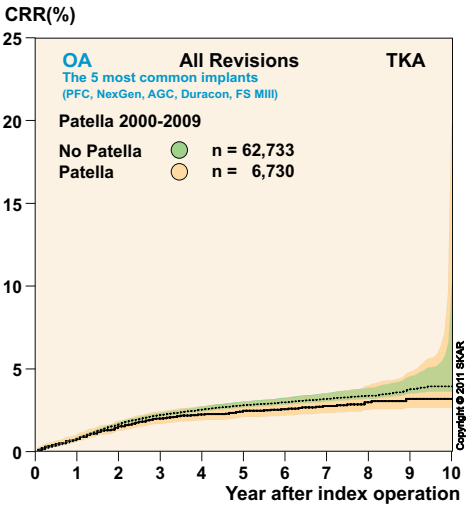


The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.

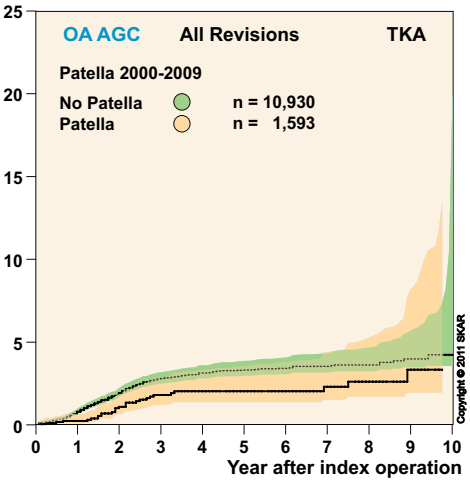
Cox regression, adjusting for age, gender, year of operation and use of a patellar component shows that the risk for TKA with an uncemented tibial component was 1.5 (1.2-2.8) times higher than for those cemented. This is in agreement with the results of the Finnish implant register which also found substantially increased risk of revision for uncemented implants.

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 recent years. Analyzing different time periods, one finds that during the eighties, when patellar buttons were used in a good half of the cases, its use had a negative effect. Since then its use has continuously diminished and in 2010 a button was used in good 3% 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.

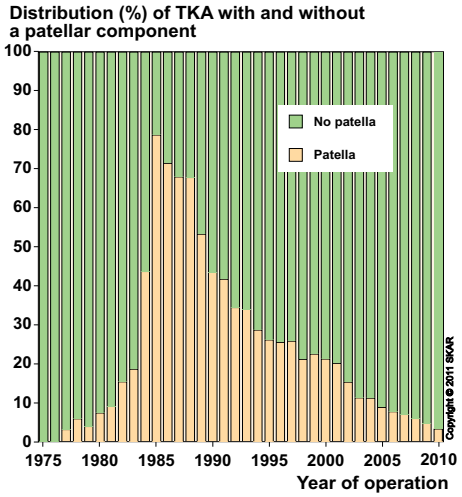
However, it has to be kept in mind that revisions for femoropatellar symptoms generally are performed relatively soon after the primary operation



CRR (2000-2009) for the 5 most common TKA (OA) implants, with and without patellar component respectively



CRR (2000-2009) only for AGC (OA), with and without patellar component respectively.



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

while revisions for wear or loosening of the patellar component occur later on. This, in combination with our previous finding that patients with a patellar resurfacing are more often 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 (2000–2009), as in recent years, we find a tendency for a higher risk of revision after TKA if a button is not used although the difference is not significant when analyzing all TKA together. However, when limiting the analysis to the 5 most common implants (all used both with and without a button) the difference is significant with patients without a patellar button having 1.27 (1.05-1.52) times higher risk of revision than those with a button (see figure left). If only AGC implants are analyzed, the risk of revision without a patellar button was 1.56 (1.05-2.31) times higher. The increased frequency of revisions is caused by the need for secondary patellar resurfacing because of femoropatellar pain and the main part occurs during the first 2-3 years.

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 30-33), we separately accounted for the results of TKA with, and without, a patellar button. Finally, when comparing the risk of revision for the different units (page 38-41), we include the use of patellar button in the regression analysis.

cont. Use of patellar button – The use of a patellar button varies between countries. In its annual report, the Danish knee arthroplasty register (http://www.dkar.dk) reports that a patellar button was used in 72% of TKA cases (2009) while it was only used in 2% of cases in Norway (2009) according to the Norwegian arthroplasty register report 2010 (http://www.haukeland.no/nrl/).
According to the 2010 annual report of the Australian Joint Replacement Registry (http://www.dmac.adelaide.edu.au/aoanjrr/index.jsp), the use of a patellar button has increased in recent years from 41% of the TKA cases in 2005 47% in 2009. 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.

It is unclear why the surgeons in the mentioned countries and regions differ so much with respect to use of a patellar button. Probably, there is a combination of reasons such as education, tradition, experience (good or bad) or marketing policies governed by the manufacturers.

Implant model (brand) – The model is the factor that generates the most interest and is most often 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 surgeons skill and training in 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 cannot 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 operations and implants in 2010

12,860 primary arthroplasties reported in 2010 by type and region

TYPE	Stockholm Gotland	Uppsala Örebro	Southeast	South	West	North
Hinge	9	.	.	4	6	.
Linked	2	17	1	5	7	13
TKA	2,436	2,855	1,292	1,874	2,419	1,206
UKA medial	91	121	195	59	196	18
UKA lateral	2	.	1	.	.	.
Patella	5	2	4	5	4	11
Total:	2,545	2,995	1,493	1,947	2,632	1,248

Implants for primary TKA in 2010

	Number	Percent
NexGen	5,202	43.1
PFC Sigma	3,116	25.8
Vanguard	1,344	11.1
Triathlon	997	8.3
AGC	424	3.5
Profix	387	3.2
PFC Rotating Platform	252	2.1
Duracon	125	1.0
Other*	236	2.0
Total :	12,083	100

*Mainly revision models

Implants for primary UKA in 2010

	Number	Percent
Oxford	313	45,8
Link	157	23,0
ZUK	98	14,3
MillerGalante	52	7,6
Genesis	30	4,4
Triathlon PKR	30	4,4
Other	3	0,4
Total:	683	100

All the 75 units routinely performing elective knee arthroplasty surgery in Sweden reported to the registry during 2010. 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 increased from 12,707 in 2009 to 12,861, an increase of 1.2%. For TKA there was an increase of 1.3% while UKA decreased by 0.6%.

813 revisions have been reported for 2010 of which 162 were secondary. In 157 cases the primary was a TKA, in 226 a UKA, in 11 a Femoro-Patellar implant and in 9 cases a Linked implant. As revisions are complicated procedures for which supplementry information often is needed our information regarding 2010 is still incomplete. As few errors regarding revisions can have a large effect our survival analyses end 2009.

The 3 most common implants for primary TKA in each region in 2010

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	NexGen	1033	PFC Sigma	1017	Triathlon	264	122
Uppsala/Örebro	NexGen	1299	PFC Sigma	842	AGC	258	456
Southeast	NexGen	793	Vanguard	330	AGC	89	80
South	Triathlon	697	PFC Sigma	591	Vanguard	333	253
West	NexGen	1452	Vanguard	534	PFC Sigma	326	107
North	NexGen	597	PFC Sigma	279	Profix	129	201

The 3 most common implants for primary UKA in each region in 2010

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	Oxford	38	MillerGalante	25	Link	21	9
Uppsala/Örebro	Link	84	MillerGalante	16	Genesis	13	8
Southeast	Oxford	167	Genesis	17	MillerGalante	8	4
South	Triathlon PKR	28	Link	15	Oxford	14	2
West	Oxford	94	ZUK	75	Link	25	2
North	Link	8	ZUK	7	Triathlon PKR	2	1

Bone cement and minimally invasive surgery in 2010

Use of cement in primary surgery during 2010

	Primary TKA	Primary UKA
No component without cement	11,719	671
Only the femoral component without cement	15	10
Only the tibial component without cement	25	–
The femur- and tibial components without cement	288	–
Only the patellar button without cement	–	–
Unknown	36	2
Total	12,083	683

	Number	Percent	Number	Percent
Refobacin-bonecement	5,872	49.8	461	67.5
Palacos Genta	5,073	43.0	204	29.9
Cemex Genta	581	4.9	3	0.4
CMW SmartSet GHV	108	0.9	9	1.3
CMW SmartSet HV	48	0.4	4	0.6
Palacos R	35	0.3	–	–
Other cement	13	0	1	0.1
Unknown	65	0.6	1	0.1
Total:	11,795	100	683	100
All components without cement	288	–	0	–
Grand Total	12,083		683	

NB The units are encouraged to use the stickers that comes with the cement packages

Type of bone cement

In Sweden, the use of bone cement is the most common method for fixing components to the bone. Almost all the cement contains antibiotics, mostly gentamicin.

During 2010, only 2.4% of the TKA´s were inserted without the use of cement (1.4% in 2009) while all the UKA´s were cemented. As the use of cement is the standard, the variation is minimal and statistical comparisons are not meaningful.

To ensure that we can discern the different cement types, we want to remind the surgeons to use the stickers found in the cement packages. In case of seperate mixing systems being used that have their own part numbers, we are also interested in these.

Minimally invasive surgery (MIS) in UKA

For UKA, we have registered the use of mini-arthrotomy since 1999.

Our definition of mini-incision implies that the surgeon gains access to the knee joint by the use of a small arthrotomy and without the need for 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 quickly increased and reached maximum in 2007 when it was being used in 61% of cases. For the last two years MIS has been used for 52-53% of the UKA although the proportion depends on the implant used (see table below).

Initially MIS seemed to be associated with a higher revision rate. However, with the present 10-year follow-up, we cannot find that the type of arthrotomy significantly affects the results.

Previous analyses have however shown that new implants/methods may initiate a new learning process which can be shortened if the surgeons are offered training before starting to use them.

The type of incision for 683 primary UKA in 2010

	Standard incision	Mini-incision	Missing
Oxford	67	236	10
Link	127	29	1
ZUK	50	48	
MillerGalante	12	40	
Genesis	29	1	
Triathlon PKR	25	5	
Other	3	0	
Total	313	359	11

The use of patellar button for TKA in 2010

The use of a patellar button has been decreasing since the mid-eighties so that it is now only used in a good 3% of the TKA cases. As in the previous report, a patellar button was most infrequently used in the Uppsala-Örebro and most frequently used in the South (see figure below).

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 for 2010 that the difference in use of a patellar button between the different states approached 30%.

The use of a patellar button is heavily related to the implant model used. As can be seen from the table to the right, surgeons who use the NexGen and PFC Sigma use a patellar button infrequently while its use is more common with AGC and PFC rotating platform.

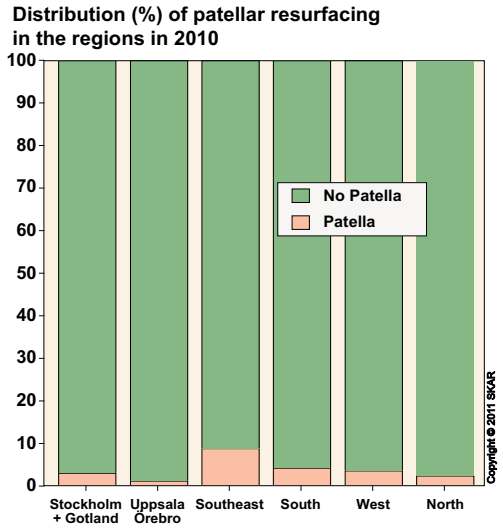
In Sweden, females have their patella resurfaced slightly more often than males. In the whole material, from the start to the end of 2010, 17.6% of the women had their patella resurfaced compared to 14.4% of the males which is a significant difference. However, during 2010 4.0% of the men had a patellar button compared to 5.1% of the women (n.s.).

Use of patellar button with different TKA implants in 2010

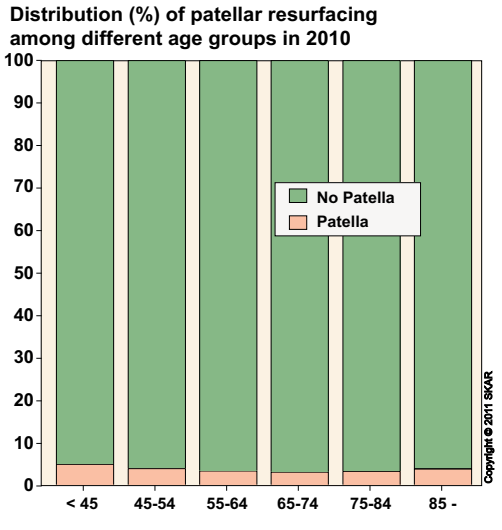
	No patellar button	%	Patellar button	%
NexGen	5,124	98.5	78	1.5
PFC Sigma	3,070	98.5	46	1.5
Vanguard	1,275	94.9	69	5.1
Triathlon	974	97.7	23	2.3
Profix	360	93.0	27	7.0
AGC	341	80.4	83	19.6
PFC Rotating Platform	214	84.9	38	15.1
Duracon	110	88.0	15	12.0
Other	227	96.2	9	3.8
Total	11,695	96.8	388	3.2

Looking at the relative use of a patellar button in the different age groups during 2010 (see figure below), it can be seen that the use of patellar resurfacing was similar in all the age groups except the youngest, in which it was most common. This has varied somewhat in recent years depending on the few number of patients less than 45 years of age.

Some discussion regarding how the frequency of revisions is influenced by the use of a patellar button can be found on page 15 together with CRR curves for TKA inserted during the current period of 2000-2009, with and without a button respectively.

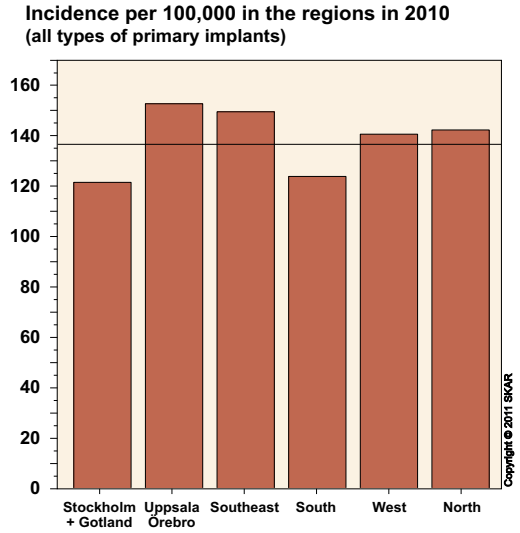


The figure shows the relative proportion of TKA with and without patellar button in the different regions during 2010

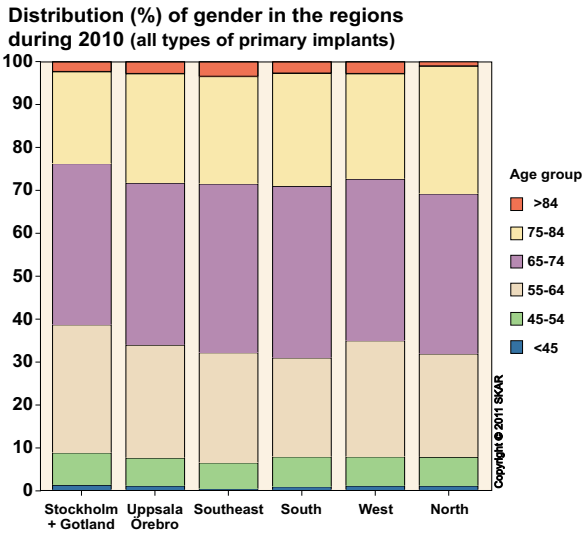


The figure shows the relative proportion of TKA with and without patellar button in the different age-groups during 2010.

Age distribution and incidence in the regions 2010



The incidence for each of the regions. It is highest in the Southeast and lowest in the South & North regions (the black line shows the mean for the whole country (137.1)



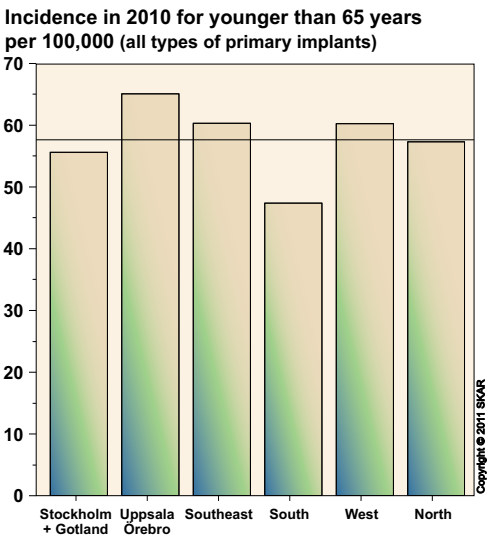
The age distribution at primary surgery varies somewhat between the regions although the differences are small. As previously, Stockholm and Gotland has the youngest patients.

The figure above shows the incidence of primary knee arthroplasty in the respective regions during 2010. Please note that this relates to the number of surgeries performed, not the number of inhabitants operated.

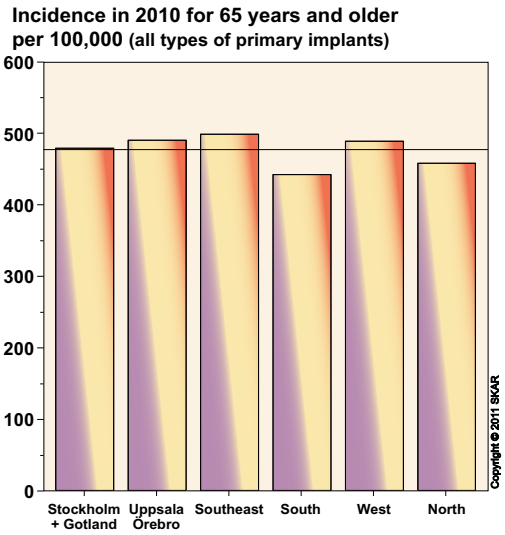
As compared to the 2009 report, the incidence has increased from 136.6 to 137.1 which is a slight increase as compared to the 15% increase between 2008 and 2009.

The figure above to the right shows the relative distribution in the number of operations among the different age groups in the regions. Even if such summary can provide information on the distribution of resources, the variation in the age distribution cannot be used to decide if the principles of treatment differ in the regions, as this may be caused by variations in the age of their inhabitants.

The figures below show the incidence of knee arthroplasty among patients less than 65 years of age and those 65 years and older. For the younger, the incidence is highest in the Uppsala-Örebro and lowest in the South and in the country as a whole it is unchanged compared to 2009. In those 65 and older, the incidence decreased by 5.3% compared to 2009, mostly due to a reduction in the Southeast. The differences between the regions were realtively small in 2010.

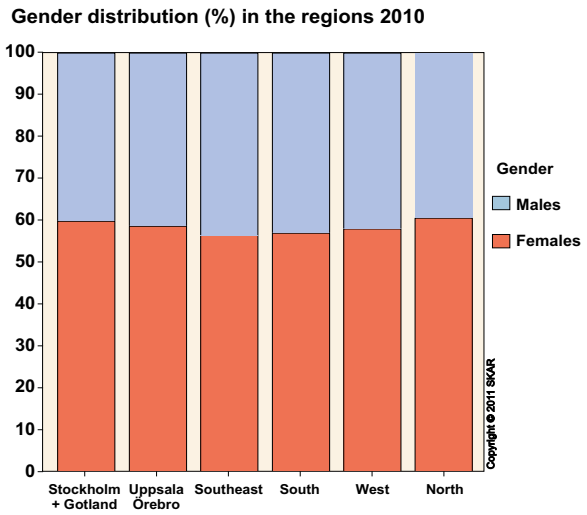


The incidence per inhabitants younger than 65 years of age is highest in the Uppsala Örebro region. (the black line shows the mean for the whole country (57.7).



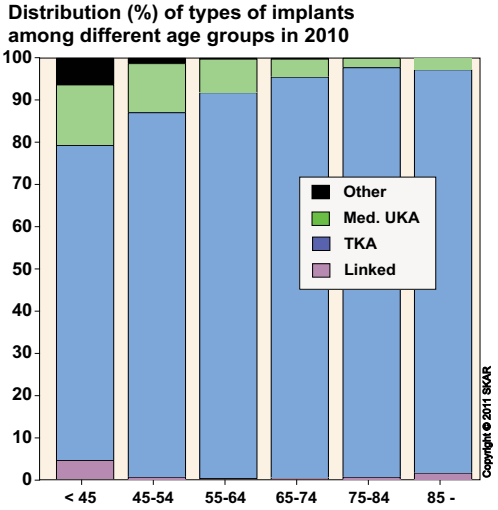
The incidence per inhabitants that are 65 years of age or older is lowest in the North and South regions. (the black line shows the mean for the whole country (476.9).

Gender distribution in the regions



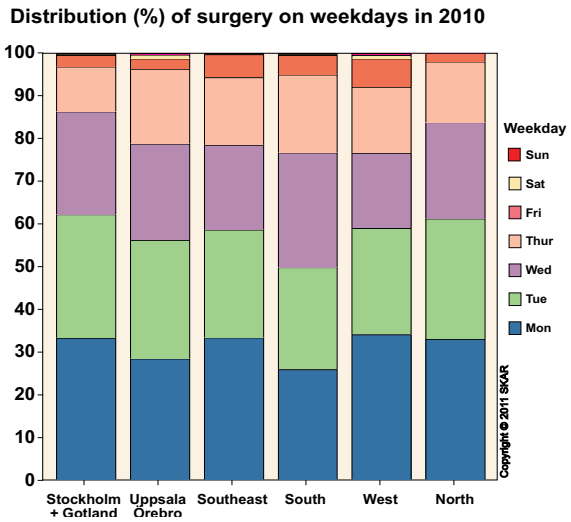
The proportion of females is 56-60% in the regions.

Type of implants in different age groups

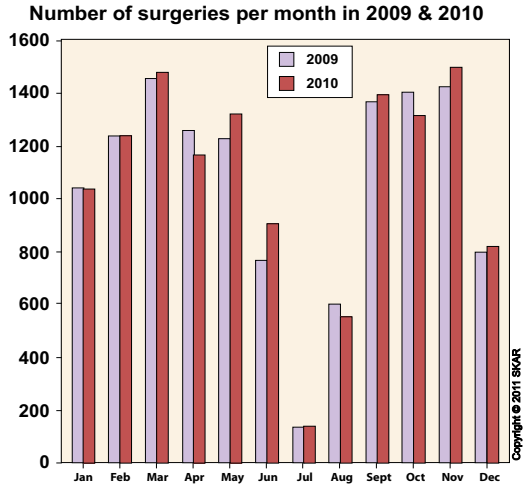


Uncommon models are most often used in patients younger the 45 years. The relative high proportion of linked implant is caused by serious conditions (tumors, trauma etc.)

Distribution of surgery on the weekdays and months



Distribution of surgery on the weekdays during 2010. Surgery on Fridays and weekends is uncommon.



The mean number of primary knee arthroplasties inserted each month during 2009 and 2010.

Knee arthroplasty is seldom performed on Fridays and weekends. The reasons, among others, are reduced working hours on Fridays and the lack of rehabilitation during the weekends. During 2010, surgeries on Fridays were most common in the West Region and least common in the Uppsala-Örebro and the North regions.

The picture above shows the mean number of operations per month during 2009 and 2010. It is obvious how the production diminishes during the summer months and in December and January. If the same number of surgeries as on Mondays would be performed all days of the week, during the whole year, the number of arthroplasties would double.

Implants for primary arthroplasty 2000–2009

In the tables below, the implants used during the investigated period 2000-2009 are listed. One must observe that the individual models, especially in case of modular types, may include several different implant variants. Among the TKA the PFC Sigma was the most common model and the NexGen second. AGC which in the previous report was the second most common, now was the third most common. Its use has diminished since Biomet introduced the Vanguard implant which became the third most commonly used implant in 2010 (page 17).

Among the UKA 3 models account for the majority of surgeries. Of the 11 models listed below, only six were still being used in 2010.

Implants for primary TKA during 2000–2009

	Number	Percent
PFC Sigma	24,898	29.7
NexGen	19,649	23.4
AGC	14,770	17.6
Duracon	7,933	9.4
F/S MIII	6,433	7.7
Vanguard	2,273	2.7
Triathlon	2,105	2.5
Profix	1,370	1.6
Kinemax	1,211	1.4
PFC Rotating Platform	791	0.9
Scan	578	0.7
Natural	502	0.6
LCS	268	0.3
AMK	75	0.1
NexGen mobile bearing	28	0.0
Oxford Rotating TKA	26	0.0
Journey TKA	16	0.0
Performance	15	0.0
Evolution	12	0.0
Other*	1,018	1.2
Total	83,971	100

*Mainly revision models, see table above right.

Implants for primary UKA during 2000–2009

	Number	Percent
Link	3,525	40.9
MillerGalante	2,178	25.3
Oxford	1,763	20.5
Genesis	539	6.3
ZUK	233	2.7
Preservation	153	1.8
PFC	79	0.9
Duracon	59	0.7
EIUS	47	0.5
Allegretto	22	0.3
Triathlon	15	0.2
Total	8,613	100

Implants that are specifically made for use in revision surgery or standard models with extra long stems (5cm or longer) are classified as revision models. When used for primary surgery they are excluded from the analyses concerning standard models. The same applies for hinges and linked implants. The most common types are listed below.

Revision Models* for primary TKA during 2000–2009

	Number	Percent
PFC revision	266	27.0
AGC revision	171	17.3
NexGen revision	159	16.1
Profix revision	149	15.1
Duracon revision	147	14.9
Triathlon revision	32	3.2
Vanguard revision	25	2.5
Freeman revision	23	2.3
Other	14	1.4
Total	986	100

*"Revision models" are implants made specifically for revisions, or ordinary models with extra long stems (5 cm or more).

Hinged implants (primary) during 2000–2009

	Number	Percent
Rotalink	228	59.4
Nexgen Rotating Hinge Knee	58	15.1
Noiles Rotating Hinge Knee	31	8.1
Stryker/Howm. Rotating Hinge	26	6.8
Mutars	16	4.2
Kotz	10	2.6
Other	15	3.9
Total	384	100

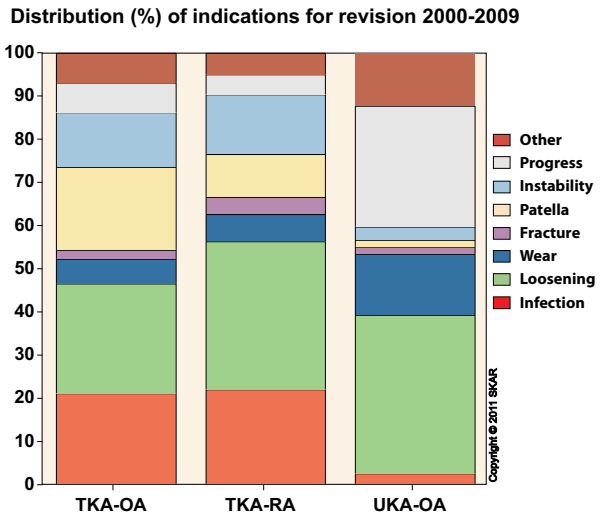
Patello-femoral implants during 2000–2009

	Number	Percent
Lubinus / Link PF	49	30.6
Avon	43	26.9
Richard / Blazina	33	20.6
Zimmer P-F	23	14.4
LCS P-F	5	3.1
Journey P-F	5	3.1
Other	2	1.3
Total	160	100

Revisions during 2000–2009

During the 10-year period, 4,835 revisions were performed. 2,542 were revisions after TKA for OA, 305 after TKA for RA and 1,579 were revisions after UKA for OA. The reasons for the revisions are shown in the diagram to the right. Note that some 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 kinds of problems associated 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.

The tables show the different types of revisions (first) that were performed during 2000-2009. 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 (27% in OA and 15% in RA). Extensive revisions (linked implants, arthrodesis, amputations) seem more common in RA. For UKA, it is satisfying 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.

Type of revision 2000–2009 in which the primary was a TKA/OA

	Number	Percent
Linked (rot. hinge)	233	9.2
TKA	675	26.6
Exchange of femur comp.	29	1.1
Exchange of tibia comp.	181	7.1
Exchange of disc/inlay	400	15.7
Patella addition	632	24.9
Patella exchange	37	1.5
Patella removal	12	0.5
Total implant removal	298	11.7
Arthrodesis	32	1.3
Amputation	13	0.5
Total	2,542	100

Type of revision 2000–2009 in which the primary was a UKA/OA

	Number	Percent
Linked (rot. hinge)	24	1.5
TKA	1,474	93.4
Medial UKA	14	0.9
Lateral UKA	1	0.1
Exchange of femur comp.	2	0.1
Exchange of tibia comp.	5	0.3
Exchange of meniscus/inlay	20	1.3
Open reposition of meniscus	3	0.2
Patella addition	5	0.3
Total implant removal	31	2.0
Arthrodesis	0	0
Amputation	0	0
Total	1,576	100

Type of revision 2000–2009 in which the primary was a TKA/RA

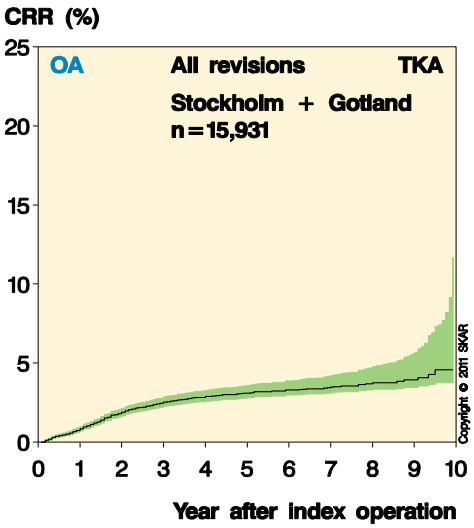
	Number	Percent
Linked (rot. hinge)	57	18.7
TKA	102	33.4
Exchange of femur comp.	5	1.6
Exchange of tibia comp.	14	4.6
Exchange of disc/inlay	32	10.5
Patella addition	42	13.8
Patella exchange	1	0.3
Patella removal	1	0.3
Total implant removal	47	15.4
Artrodes	3	1.0
Amputation	1	0.3
Total	305	100

When evaluating the survival curves it should be noted that as the right part of the curve contains implants with long follow-up it also to a larger extent represents older models.

Primary TKA implants for OA in the regions during 2000–2009

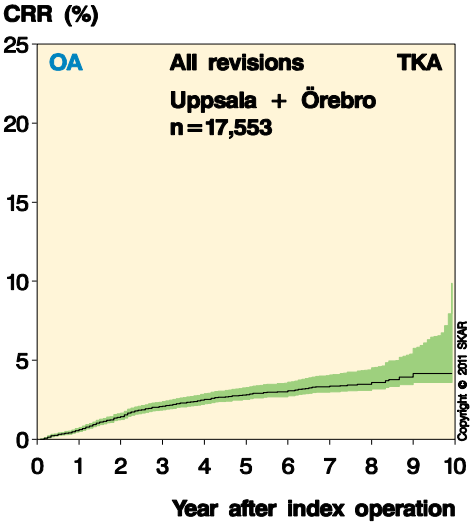
Stockholm + Gotland
Primary TKA implants for OA, 2000–2009

	Number	Percent
PFC Sigma	8,595	54.0
NexGen	2,837	17.8
Duracon	1,750	11.0
F/S MIII	1,361	8.5
Kinemax	359	2.3
AGC	319	2.0
PFC Rotating Platform	212	1.3
Triathlon	178	1.1
Vanguard	108	0.7
Natural	72	0.5
Profix	33	0.2
Other	107	0.7
Total	15,931	100.0



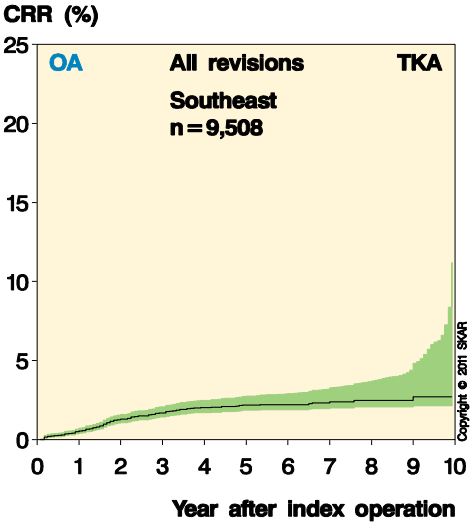
Uppsala+Örebro
Primary TKA implants for OA, 2000–2009

	Number	Percent
NexGen	6,124	34.9
AGC	4,090	23.3
PFC Sigma	2,748	15.7
F/S MIII	2 ,572	14.7
Kinemax	759	4.3
Duracon	555	3.2
Natural	268	1.5
PFC Rotating Platform	139	0.8
Profix	72	0.4
AMK	63	0.4
NexGen Mobile bearing	28	0.2
Vanguard	26	0.1
Triathlon	21	0.1
Journey TKA	15	0.1
Other	73	0.4
Total	17,553	100



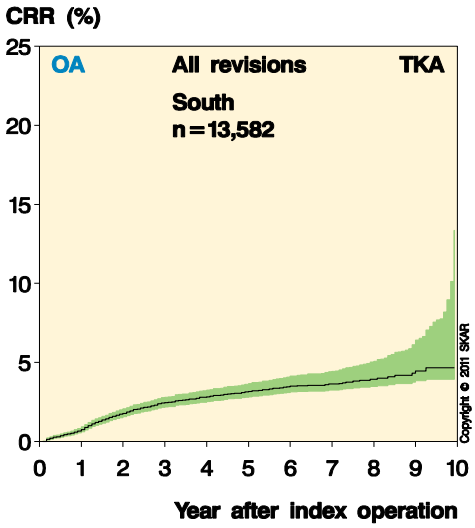
Southeast
Primary TKA implants for OA, 2000–2009

	Number	Percent
NexGen	3,308	34.8
PFC Sigma	3,237	34.0
AGC	2,255	23.7
Vanguard	452	4.8
Triathlon	107	1.1
PFC Rotating Platform	26	0.3
Profix	24	0.3
Evolution	11	0.1
Duracon	10	0.1
Scan	9	0.1
Other	69	0.7
Total	9,508	100



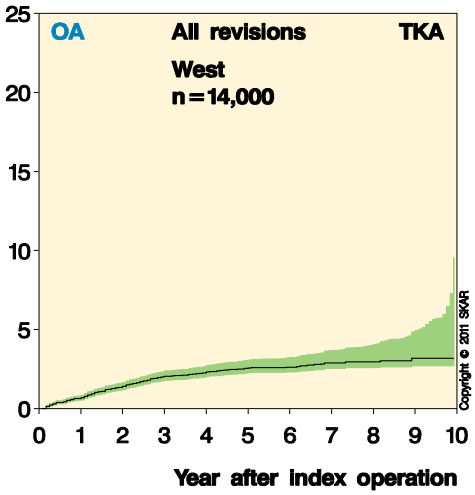
South
Primary TKA implants for OA, 2000–2009

	Number	Percent
PFC Sigma	4,867	35.8
Duracon	2,820	20.8
AGC	2,447	18.0
Triathlon	1,653	12.2
Vanguard	519	3.8
Profix	400	2.9
Scan	317	2.3
PFC Rotating Platform	291	2.1
LCS	24	0.2
Oxford Rotating TKA	22	0.2
NexGen	13	0.1
Other	209	1.5
Total	13,582	100



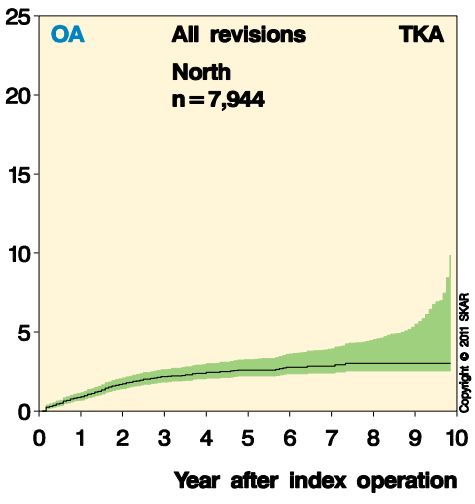
West
Primary TKA implants for OA, 2000–2009

	Number	Percent
NexGen	4,070	29.1
AGC	3,146	22.5
F/S MIII	2,045	14.6
PFC Sigma	1,808	12.9
Duracon	1,601	11.4
Vanguard	933	6.7
Natural	133	1.0
Scan	114	0.8
PFC Rotating Platform	38	0.3
Triathlon	28	0.2
Profix	8	0.1
Other	76	0.5
Total	14,000	100



North
Primary TKA implants for OA, 2000–2009

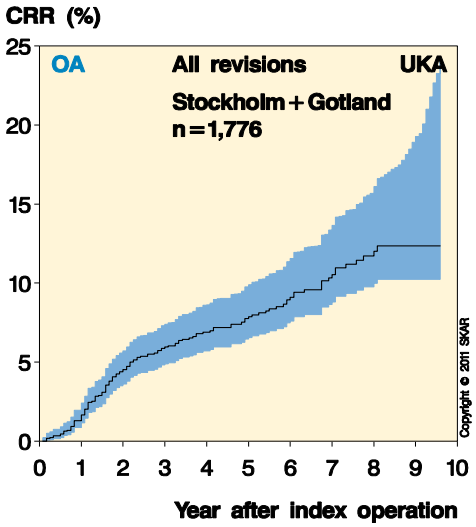
	Number	Percent
NexGen	2,345	29.5
PFC Sigma	2,243	28.2
AGC	1,549	19.5
Duracon	709	8.9
Profix	680	8.6
LCS	196	2.5
Vanguard	97	1.2
PFC Rotating Platform	30	0.4
Performance	13	0.2
Triathlon	8	0.1
Other	74	0.9
Total	7,944	100



Primary UKA implants for OA in the regions during 2000–2009

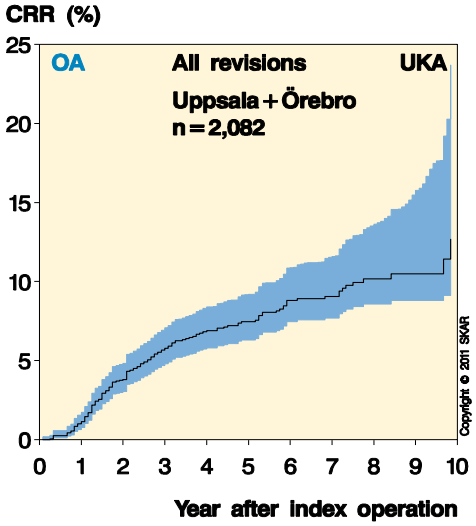
Stockholm + Gotland
Primary UKA implants for OA, 2000–2009

	Number	Percent
MillerGalante	1,056	59.5
Link	334	18.8
Oxford	301	16.9
Preservation	45	2.5
Allegretto	20	1.1
Genesis	12	0.7
ZUK	8	0.5
Total	1,776	100



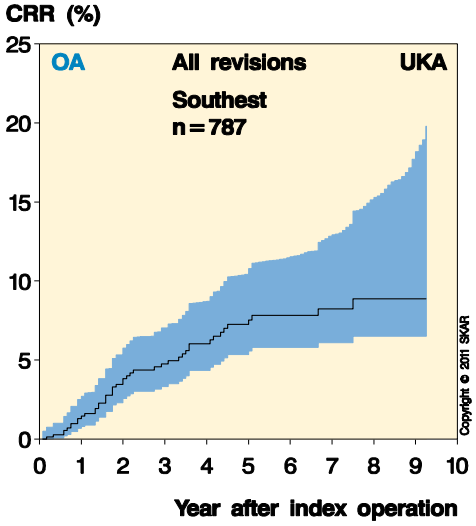
Uppsala+Örebro
Primary UKA implants for OA, 2000–2009

	Number	Percent
Link	1,517	72.9
Genesis	246	11.8
MillerGalante	156	7.5
Preservation	92	4.4
PFC	41	2.0
ZUK	23	1.1
EIUS	5	0.2
Marmor	2	0.1
Total	2,082	100



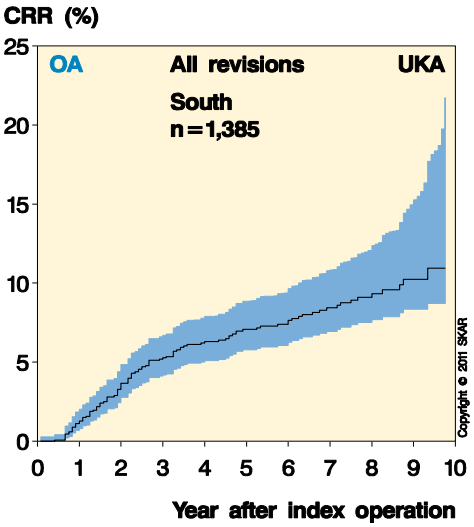
Southeast
Primary UKA implants for OA, 2000–2009

	Number	Percent
Genesis	242	30.7
Link	233	29.6
Oxford	157	19.9
MillerGalante	119	15.1
PFC	25	3.2
Duracon	5	0.6
Preservation	5	0.6
Allegretto	1	0.1
Total	787	100



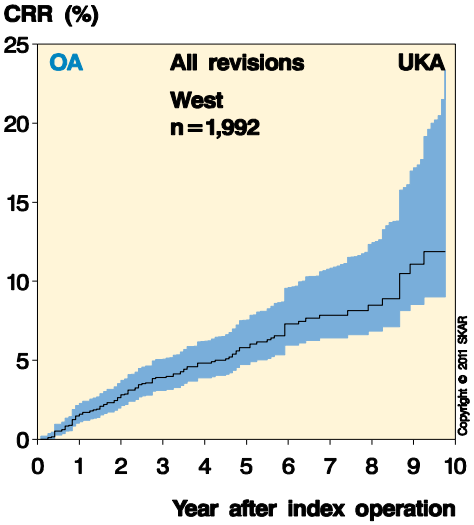
South
Primary UKA implants for OA, 2000–2009

	Number	Percent
Link	929	67.1
Oxford	227	16.4
MillerGalante	105	7.6
EIUS	41	3.0
Duracon	38	2.7
Triathlon	15	1.1
Genesis	14	1.0
PFC	8	0.6
Preservation	5	0.4
ZUK	3	0.2
Total	1,385	100



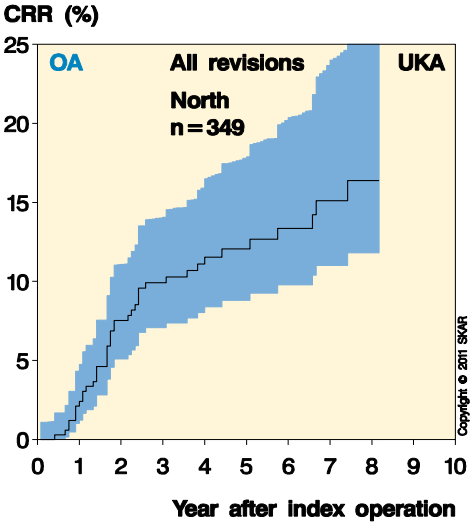
West
Primary UKA implants for OA, 2000–2009

	Number	Percent
Oxford	1,022	51.3
MillerGalante	586	29.4
Link	199	10.0
ZUK	171	8.6
Duracon	9	0.5
Genesis	5	0.3
Total	1,992	100



North
Primary UKA implants for OA, 2000–2009

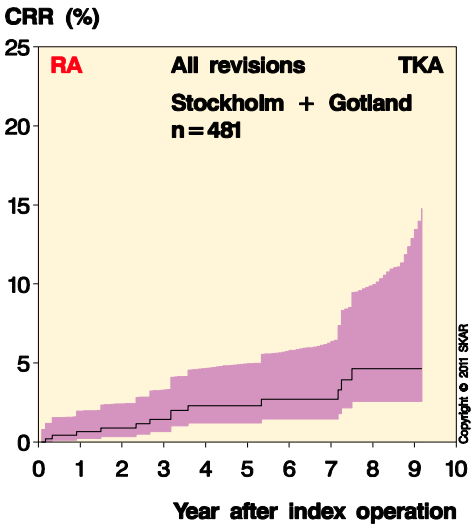
	Number	Percent
Link	233	66.8
MillerGalante	80	22.9
ZUK	23	6.6
Oxford	10	2.9
PFC	3	0.9
Total	349	100



Primary TKA implants for RA in the regions during 2000–2009

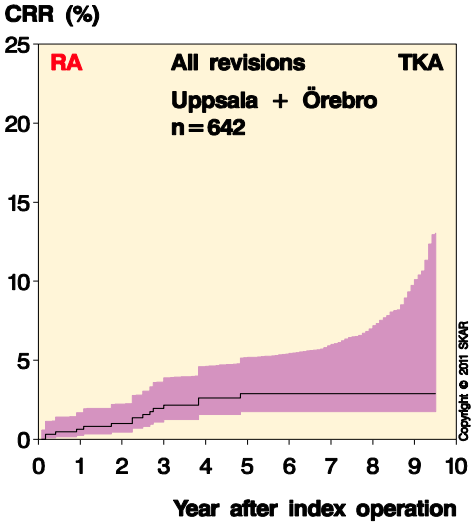
Stockholm + Gotland
Primary TKA implants for RA, 2000–2009

	Number	Percent
PFC Sigma	269	55.9
Duracon	86	17.9
NexGen	32	6.7
TriathloN	14	2.9
AGC	12	2.5
Kinemax	11	2.3
PFC Rotating Platform	10	2.1
F/S MIII	10	2.1
Natural	5	1.0
Other	32	6.6
Total	481	100



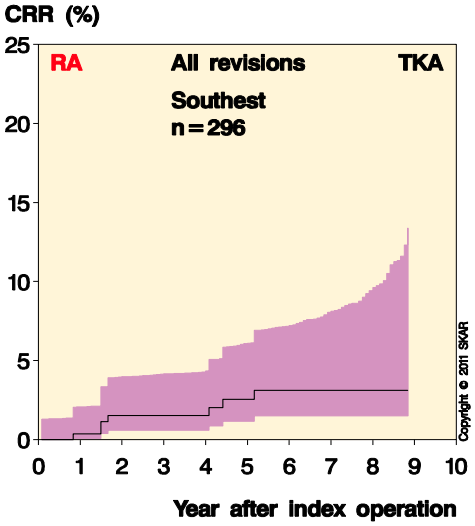
Uppsala+Örebro
Primary TKA implants for RA, 2000–2009

	Number	Percent
AGC	187	29.1
NexGen	159	24.8
F/S MIII	151	23.5
Kinemax	48	7.5
PFC Sigma	47	7.3
Duracon	15	2.3
Natural	9	1.4
AMK	6	0.9
Other	20	3.2
Total	642	100



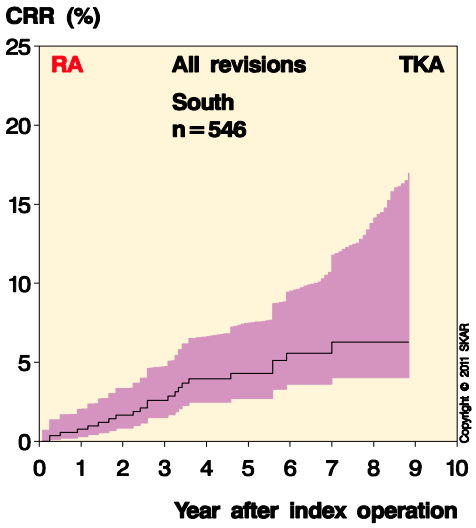
Southeast
Primary TKA implants for RA, 2000–2009

	Number	Percent
NexGen	119	40.2
PFC Sigma	84	28.4
AGC	65	22.0
Vanguard	7	2.4
Other	21	7.1
Total	296	100



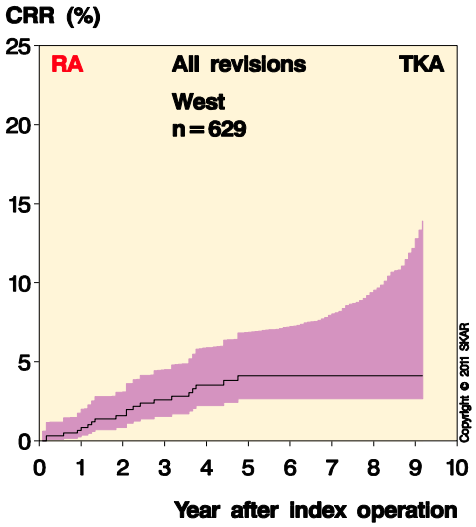
South
Primary TKA implants for RA, 2000–2009

	Number	Percent
PFC Sigma	154	28.2
Scan	90	16.5
AGC	87	15.9
Duracon	75	13.7
Vanguard	59	10.8
Triathlon	27	4.9
Profix	21	3.8
Other	33	6.1
Total	546	100



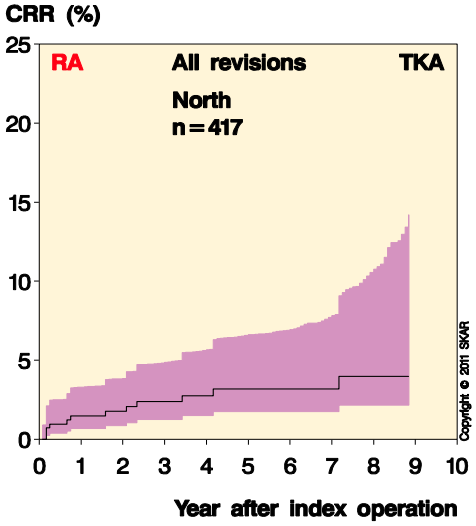
West
Primary TKA implants for RA, 2000–2009

	Number	Percent
AGC	199	31.6
F/S MIII	115	18.3
NexGen	102	16.2
PFC Sigma	102	16.2
Duracon	55	8.7
Scan	26	4.1
Vanguard	11	1.7
Other	19	3.1
Total	628	100



North
Primary TKA implants for RA, 2000–2009

	Number	Percent
PFC Sigma	114	27.3
Profix	67	16.1
AGC	64	15.3
NexGen	57	13.7
Duracon	51	12.2
LCS	20	4.8
Other	44	10.5
Total	425	100



The relative risk for implants used in primary arthroplasty during 2000–2009

In order to account for results of relatively modern implants with reasonably long follow-up, the registry uses the latest 10-year period available for analysis. When an implant has been put on the list, it stays on the list as long as there are reasonable numbers to be analyzed even if its use has ceased. Unfortunately, this implies that the number of implants analyzed may increase or decrease, depending on whether the use of the brand is increasing or decreasing, which in turn may affect results.

The individual models may represent different variants depending on modularity and marketing. Within each model there are usually a few combinations that dominate. Accordingly 96% of the PFC Sigma use the same type of a ”non porous C/R” femur component in combination with a cemented modular or All-Poly tibia component. 72% of the NexGen use a ”standard Option” femur in combination with an Option, All-Poly or pegged tibia. PS variants constitute 9% and High-Flex 19% of which ”Gender” are 4%. For the AGC, the V2 Anatomic Interlok CR femur and V2 Interlok tibia compose 87% of the cases.

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. For the second time we also make seperate calculations in which an isolated exchange of an inlay because of infection is not considered being a revision. The explanation for doing so is explained together with the tables on page 32-33.

Below you will find Cox regresstion tables for OA and RA in which different TKA models are compared to a reference implant which is the AGC. The models are the same as in last years report.

After TKA inserted for OA, Kinemax and Scan have a significantly higher risk of revision than the reference. However, these two implants have not been in use in Sweden since 2006. As last year, the PFC Sigma and NexGen have a lower risk than the reference.

TKA inserted for RA, NexGen and PFC Sigma are not significantly different from the reference. Kinemax has a higher risk while Scan and Vanguard lie on the border. However, the numbers are few.

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

OA / TKA	n	p–value	RR	95% CI
AGC	13,806		reference	
F/S MIII	5,979	0.5	0.94	0.79-1.12
PFC-Sigma	23,498	0.01	0.83	0.73-0.95
Scan	440	0.02	1.62	1.07-2.45
Kinemax	1,118	<0.01	1.83	1.41-2.38
Duracon	7,445	0.87	1.01	0.86-1.20
Profix	1,217	0.86	1.04	0.70-1.54
NexGen	18,697	<0.01	0.56	0.48-0.67
LCS	220	0.1	0.39	0.12-1.20
Natural II	473	0.97	0.99	0.59-1.66
PFC Rot. Platf.	736	0.27	1.27	0.83-1.95
Triathlon	1,995	0.16	0.73	0.46-1.13
Vanguard	2,135	0.22	1.27	0.87-1.84
Other	760	0.11	1.39	0.93-2.06
Gender (male is ref.)		0.27	1.06	0.96-1.16
Age (per year)		<0.01	0.96	0.96-0.97
Year of op. (per year)		0.09	1.02	1.00-1.04

RA / TKA	n	p–value	RR	95% CI
AGC	614		reference	
F/S MIII	276	0.74	0.86	0.36-2.08
PFC-Sigma	770	0.64	1.16	0.62-2.19
Scan	116	0.05	2.33	1.00-5.42
Kinemax	59	0.01	3.78	1.48-9.66
Duracon	282	0.15	1.73	0.83-3.64
Profix	93	0.67	1.3	0.38-4.48
NexGen	473	0.17	0.49	0.18-1.36
LCS	*22*	*0.98*	*<0.01*	
Natural II	17	0.44	2.21	0.29-16.79
PFC Rot. Platf.	20	0.5	2.02	0.26-15.57
Triathlon	*44*	*0.99*	*<0.01*	
Vanguard	80	0.05	3.22	1.00-10.37
Other	145	0.87	0.9	0.26-3.09
Gender (male is ref.)		0.35	0.8	0.50-1.28
Age (per year)		0.28	0.99	0.97-1.01
Year of op. (per year)		0.22	1.07	0.96-1.18

Implants lacking sufficient numbers for analysis are shown in italics

Red is significant difference with higher risk ratio.
Greein is significant difference with lower risk ratio.

The risk of revision (RR) with 95% confidence intervals for OA/TKA inserted respectively without and with a patellar button. AGC is used as reference.

Without patella button OA / TKA	n	p–value	RR	95% CI
AGC	12,070		reference	
F/S MIII	3,072	0.37	1.1	0.89-1.37
PFC-Sigma	22,463	<0.01	0.81	0.70-0.93
Scan	440	0.05	1.51	1.00-2.29
Kinemax	828	<0.01	1.69	1.24-2.29
Duracon	6,658	0.66	0.96	0.81-1.15
Profix	1,091	0.5	0.86	0.54-1.35
NexGen	18,434	<0.01	0.54	0.46-0.65
LCS	220	0.08	0.36	0.12-1.13
Natural II	445	0.91	1.03	0.61-1.73
PFC Rot. Platf.	561	0.5	1.18	0.73-1.90
Triathlon	1,881	0.16	0.72	0.46-1.14
Vanguard	2,055	0.17	1.3	0.89-1.90
Other	692	0.31	1.25	0.81-1.92
Gender (male is ref.)		0.14	1.08	0.97-1.20
Age (per year)		<0.01	0.96	0.96-0.97
Year of op. (per year)		0.45	1.01	0.99-1.03

With patella button OA / TKA	n	p–value	RR	95% CI
AGC	1,736		reference	
F/S MIII	2,907	0.57	1.13	0.74-1.73
PFC-Sigma	1,035	0.5	1.2	0.71-2.03
Scan				
Kinemax	290	<0.01	2.82	1.58-5.04
Duracon	787	0.08	1.6	0.95-2.72
Profix	126	<0.01	3.68	1.53-8.85
NexGen	263	0.42	1.43	0.60-3.43
LCS				
Natural II	*28*	*0.98*	*<0.01*	
PFC Rot. Platf.	175	0.15	2.05	0.78-5.41
Triathlon	114	0.9	0.88	0.12-6.49
Vanguard	*80*	*0.98*	*<0.01*	
Other	68	0.03	3.27	1.16-9.23
Gender (male is ref.)		0.29	0.85	0.64-1.14
Age (per year)		<0.01	0.98	0.96-0.99
Year of op. (per year)		0.09	1.06	0.99-1.13

Implants lacking sufficient numbers for analysis are shown in italics

In the tables above the TKA implants have been divided into those inserted without (left) and with (right) a patellar button. This reduces the number of implants available for each of the analyses, making it more difficult to demonstrate differences.

Without a patellar button, the same implants differ from the reference as when the group is analyzed as a whole which is not surprising as this group includes the majority of the procedures. When using a patellar button, Kinemax, as well as Profix, have a significantly higher risk than the reference.

In recent years we have included a separate table using F/S MIII as a reference for TKA with a patellar button. As the implant is no longer used in Sweden we have ceased doing this.

As previously, we find no significant differences depending on gender, neither for TKA nor UKA. Age has effect in TKA and UKA when inserted for OA, in which the risk significantly diminishes with increasing age. For RA there is a similar tendency although it does not reach significance.

RR (risk ratio) for OA/UKA. Link is used as reference.

OA / UKA	n	p–value	RR	95% CI
Link	3,445		reference	
Oxford	1,698	0.490	1.090	0.86-1.38
MillerGalante	2,102	0.470	1.080	0.88-1.31
Genesis	519	0.440	1.150	0.80-1.66
Preservation	147	0.020	1.860	1.11-3.11
ZUK	228	0.810	0.910	0.42-1.96
Other	232	0.190	1.320	0.87-2.01
Gender (male is ref.)		0.570	0.950	0.81-1.12
Age (per year)		<0.01	0.960	0.96-0.97
Year of op. (per year)		0.840	1.000	0.96-1.04

With respect to UKA inserted for OA, the number of implants available for analysis has constantly become less. This year Duracon and PFC disappear but they were the only implants last year that had a higher risk than the reference Link.

For the 3 most commonly used implants used during the last decade we can find no significant differences in risk of revision. However, this year Preservation has a significantly higher risk.

During 2001-2006 there were few EIUS implants inserted in Sweden. In Australia, there have been reports of an inferior outcome and the implant has been withdrawn worldwide. In Sweden, only one of the 47 inserted knees has been revised which cannot be considered remarkable.

The relative risk for implants used in primary arthroplasty during 2000–2009 if the exchange of an inlay, in case of infection, is not considered to be a revision

The SKAR defines a revision as being a second surgery (reoperation) of the knee in which implant components are exchanged, added or removed.

The reason for other types of surgeries not being considered is that, shortly after the start of the register, it was noted that many surgeons did not report reoperations which they did not interpret as directly related to the prior knee arthroplasty. This resulted in different types of soft tissue surgeries never being reported and thus, the register decided to use a stricter definition of revision which surely had something to do with the implant.

It has been claimed that when the reason for revision is infection, this strict definition may treat certain implant brands unfairly. The reason is that one fifth of all revisions for infection are synovectomies during which the inlay is also exchanged (defining them as being revisions). However, a synovectomy in a knee having an implant in which the inlay is fixed (cannot be exchanged) is not counted as a revision, which in turn may favor the type. Thus, the argument has been made that an exchange of inlay in the case of an infection should not be considered a revision but a synovectomy. On the opposite it can be claimed that infected TKA´s with fixed inlays are generally treated with a complete exchange of components, as a comprehensive synovectomy is not considered possible. This would result in a reversed bias if the exchange of an inlay is not considered as being a revision.

Without being able to give a definite answer regarding what is most reasonable we decided to also produce tables in which the exchange of inlays (for infection) are not considered as revisions. It has to be observed that such exclusion reduces the number of revisions, which in turn reduces the sensitivity of the statistical calculations.

Excluding exchange of inlays in infected cases we see the following in the tables below:

For TKA/OA (left) Scan no longer has a significantly higher risk than the reference and gender has become significant with women having a higher risk than men.

For TKA/RA (right) Vanguard now has a significantly higher risk than the reference although the AGC has a fixed poly and there was no exchange of inlay for the Vanguard. Thus the observed change is caused by changes in weighting of covariates caused by the reduced number of revisions.

The risk of revision (RR) with 95% confidence intervals. AGC is used as reference.
The exchange of inlay, in case of infection, is not considered a revision.

OA / TKA	n	p–value	RR	95% CI
AGC	13,806		reference	
F/S MIII	5,979	0.15	0.88	0.73-1.05
PFC-Sigma	23,498	<0.01	0.78	0.68-0.89
Scan	440	0.1	1.43	0.94-2.19
Kinemax	1,118	<0.01	1.66	1.27-2.17
Duracon	7,445	0.3	0.91	0.77-1.08
Profix	1,217	0.35	0.8	0.50-1.27
NexGen	18,697	<0.01	0.47	0.40-0.57
LCS	220	0.08	0.36	0.12-1.12
Natural II	473	0.95	1.02	0.61-1.70
PFC Rot. Platf.	736	0.23	1.31	0.85-2.02
Triathlon	1,995	0.1	0.65	0.39-1.08
Vanguard	2,135	0.82	0.95	0.59-1.52
Other	760	0.33	1.23	0.81-1.88
Gender (male is ref.)		0.01	1.15	1.03-1.27
Age (per year)		<0.01	0.96	0.96-0.97
Year of op. (per year)		0.41	0.99	0.97-1.0

RA / TKA	n	p–value	RR	95% CI
AGC	614		reference	
F/S MIII	276	0.1	0.36	0.11-1.23
PFC-Sigma	770	0.81	1.08	0.57-2.06
Scan	116	0.06	2.24	0.96-5.23
Kinemax	59	0.03	3	1.10-8.18
Duracon	282	0.13	1.78	0.85-3.73
Profix	93	0.9	0.91	0.21-3.96
NexGen	473	0.07	0.32	0.09-1.10
LCS	*22*	*0.98*	*<0.01*	
Natural II	17	0.41	2.34	0.31-17.84
PFC Rot. Platf.	20	0.46	2.18	0.28-16.86
Triathlon	*44*	*0.99*	*<0.01*	
Vanguard	80	0.02	3.93	1.20-12.93
Other	145	0.52	0.62	0.14-2.69
Gender (male is ref.)		0.53	0.85	0.50-1.42
Age (per year)		0.24	0.99	0.97-1.01
Year of op. (per year)		0.59	1.03	0.92-1.1

Implants lacking sufficient numbers for analysis are shown in italics

Red is significant difference with higher risk ratio.
Greein is significant difference with lower risk ratio.

The risk of revision (RR) with 95% confidence intervals for OA/TKA inserted respectively without and with a patellar button. The exchange of inlay, in case of infection, is not considered a revision

Without patella button OA / TKA	n	p–value	RR	95% CI
AGC	12,070		reference	
F/S MIII	3,072	0.41	1.1	0.88-1.37
PFC-Sigma	22,463	<0.01	0.75	0.66-0.87
Scan	440	0.19	1.33	0.87-2.04
Kinemax	828	0.01	1.51	1.11-2.06
Duracon	6,658	0.13	0.87	0.72-1.04
Profix	1,091	0.22	0.73	0.44-1.21
NexGen	18,434	<0.01	0.46	0.38-0.55
LCS	220	0.06	0.34	0.11-1.05
Natural II	445	0.79	1.07	0.64-1.80
PFC Rot. Platf.	561	0.34	1.26	0.78-2.04
Triathlon	1,881	0.15	0.69	0.41-1.15
Vanguard	2,055	0.96	0.99	0.62-1.58
Other	692	0.72	1.09	0.69-1.73
Gender (male is ref.)		<0.01	1.18	1.06-1.32
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.07	0.98	0.95-1.00

With patella button OA / TKA	n	p–value	RR	95% CI
AGC	1,736		reference	
F/S MIII	2,907	0.92	0.98	0.64-1.50
PFC-Sigma	1,035	0.79	1.08	0.63-1.85
Scan				
Kinemax	290	<0.01	2.59	1.44-4.66
Duracon	787	0.22	1.41	0.82-2.45
Profix	126	0.3	1.86	0.57-6.12
NexGen	263	0.39	1.46	0.61-3.50
LCS				
Natural II	28	0.98	<0.01	
PFC Rot. Platf.	175	0.28	1.81	0.62-5.30
Triathlon	*114*	*0.98*	*<0.01*	
Vanguard	*80*	*0.98*	*<0.01*	
Other	68	0.03	3.22	1.14-9.10
Gender (male is ref.)		0.42	0.88	0.65-1.20
Age (per year)		<0.01	0.97	0.96-0.99
Year of op. (per year)		0.3	1.04	0.97-1.11

Implants lacking sufficient numbers for analysis are shown in italics

In the tables above the TKA implants have been divided into those inserted without (left) and with a patellar button (right).

For TKA/OA without a patellar button, the only significant change is that women now have a significantly higher risk than men.

For TKA/OA with a patellar button, Profix no longer has a higher risk than the reference.

For UKA/OA in the table below, no changes have occurred but there were also very few exchanges of inlays.

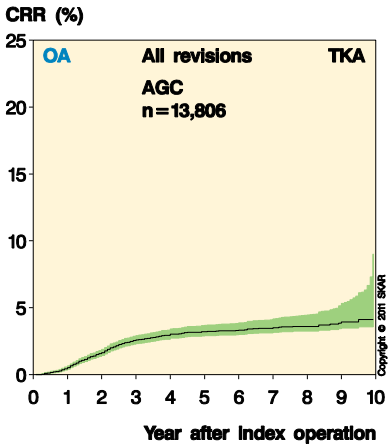
RR (risk ratio) for OA/UKA. Link is used as reference. The exchange of inlay, in case of infection, is not considered a revision

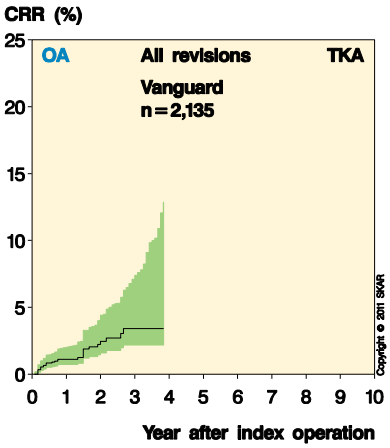
OA / UKA	n	p–value	RR	95% CI
Link	3,445		reference	
Oxford	1,698	0.59	1.07	0.84-1.36
MillerGalante	2,102	0.47	1.07	0.88-1.31
Genesis	519	0.44	1.15	0.80-1.66
Preservation	147	0.02	1.87	1.12-3.13
ZUK	228	0.83	0.92	0.43-1.98
Other	232	0.2	1.32	0.87-2.00
Gender (male is ref.)	.	0.63	0.96	0.82-1.13
Age (per year)	.	<0.01	0.96	0.95-0.97
Year of op. (per year)	.	0.75	0.99	0.95-1.0

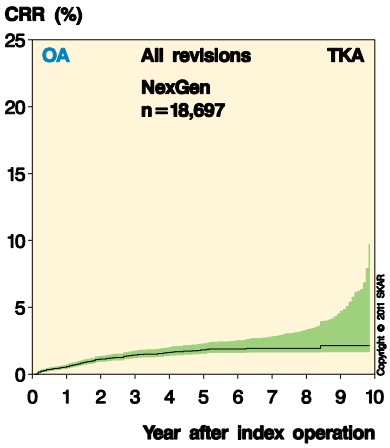
In summary one can establish that excluding an exchange of inlay in infected cases does affect the results although the effect is relatively small for models that have been used in reasonably large numbers. On the other hand for models used in a small number of patients, a limited change in the number of revisions can have a large effect.

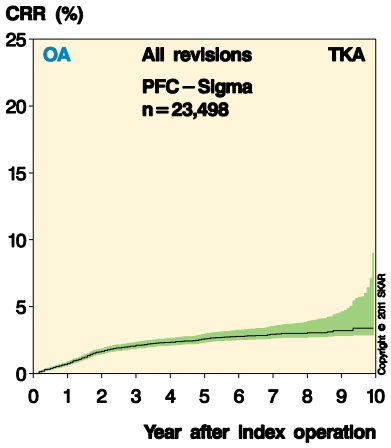
Not considering an exchange of an inlay as a revision in infected cases reduces the total number of revisions for infection. We have previously shown that men are more often revised for infection than women (page 13) and the effect of this reduction is that this advantage of female gender is reduced. This in turn affects the weight of gender as a covariate in the regression which may help explain observed changes in risk estimates when comparing models that have not encountered exchange of inserts.

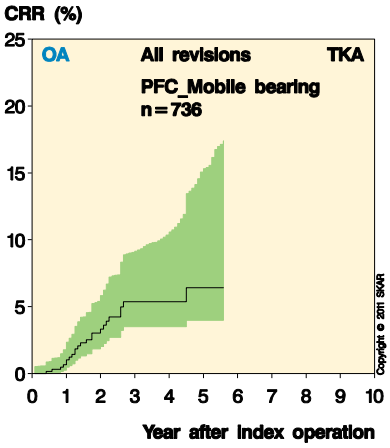
CRR for commonly used TKA implants for OA 2000–2009

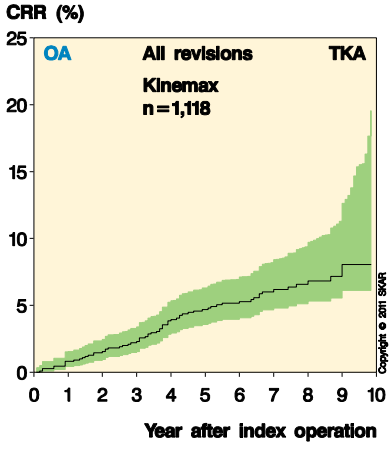


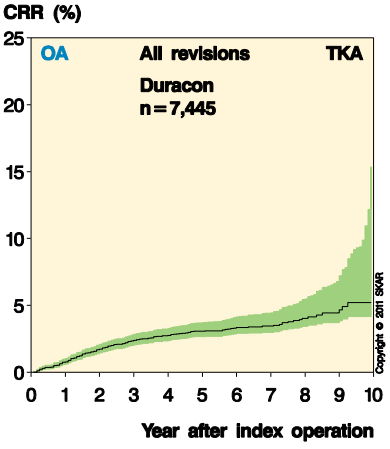


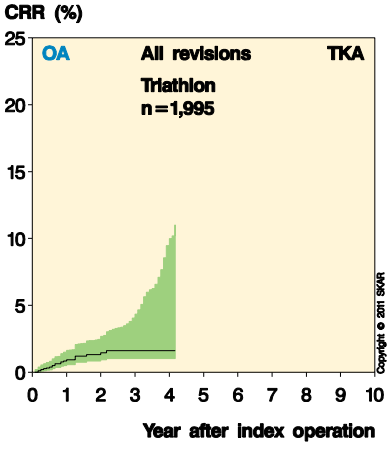


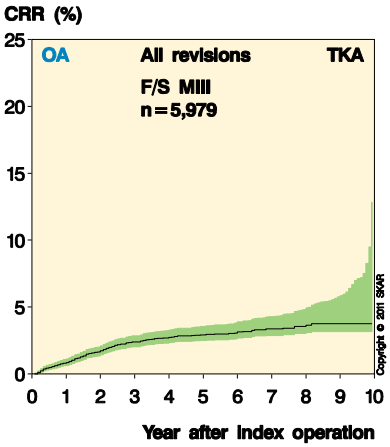


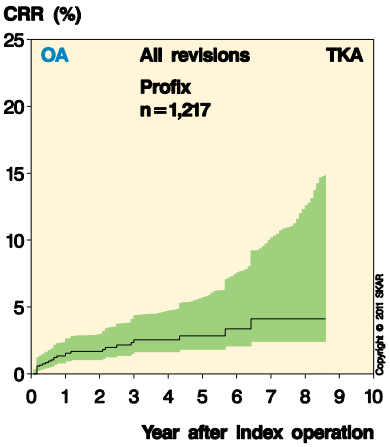


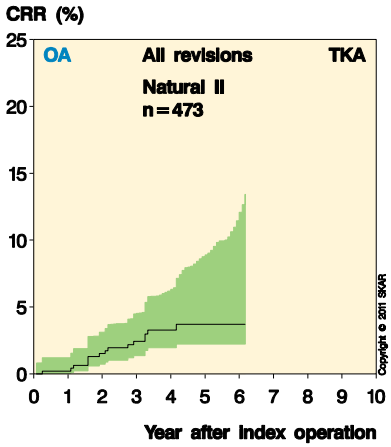


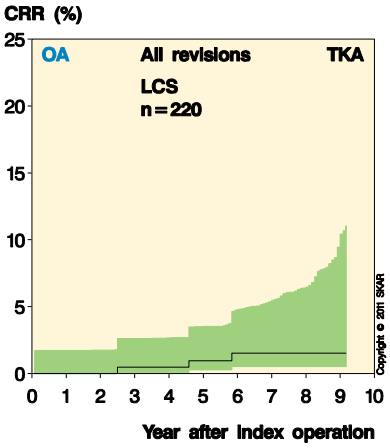


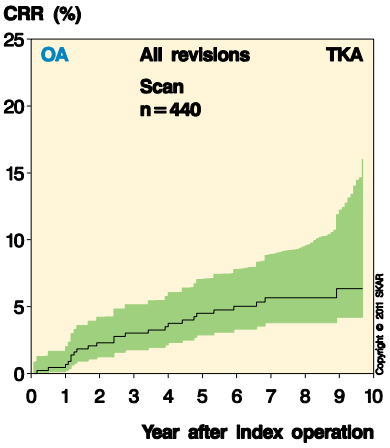


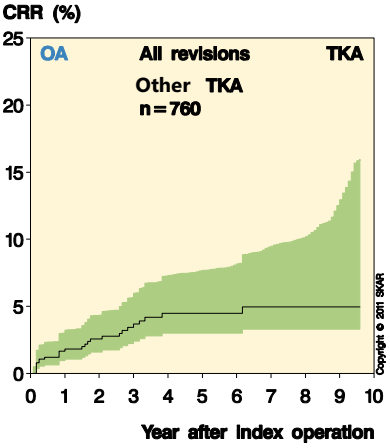

CRR (%)
OA
All revisions
TKA
F/S MIII
n=5,979
Year after index operation

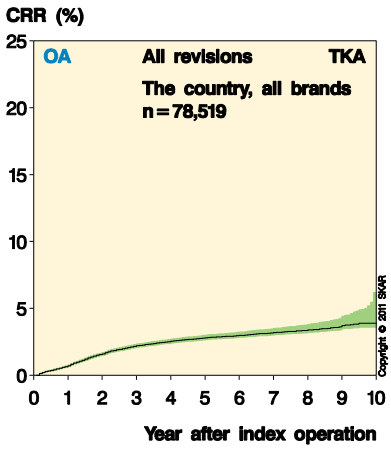

CRR (%)
OA
All revisions
TKA
Profix
n=1,217
Year after index operation


CRR (%)
OA
All revisions
TKA
Natural II
n=473
Year after index operation

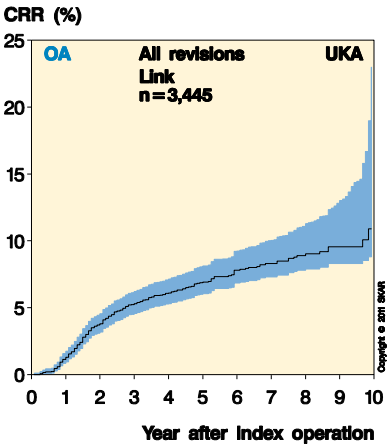

CRR (%)
OA
All revisions
TKA
LCS
n=220
Year after index operation

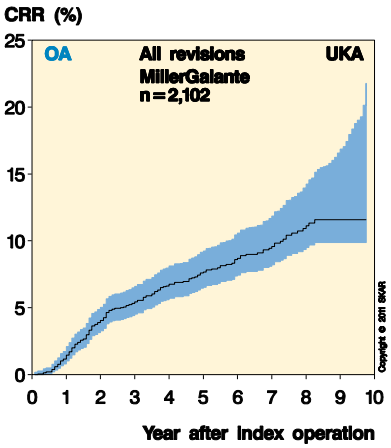

CRR (%)
OA
All revisions
TKA
Scan
n=440
Year after index operation

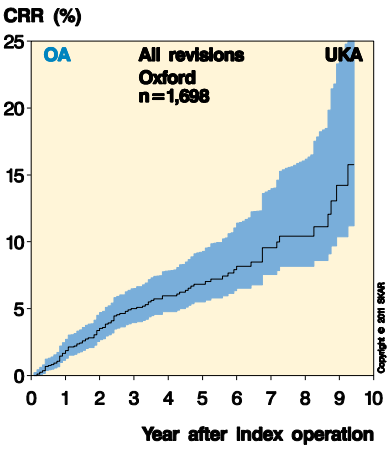

CRR (%)
OA
All revisions
TKA
Other TKA
n=760
Year after index operation

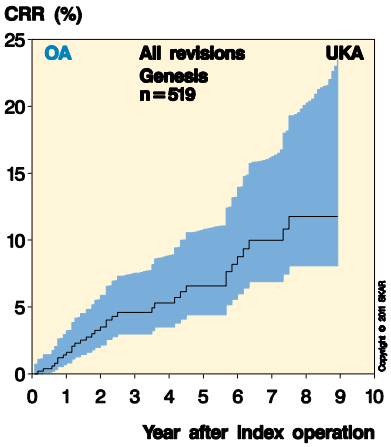

CRR (%)
OA
All revisions
TKA
The country, all brands
n=78,519
Year after index operation

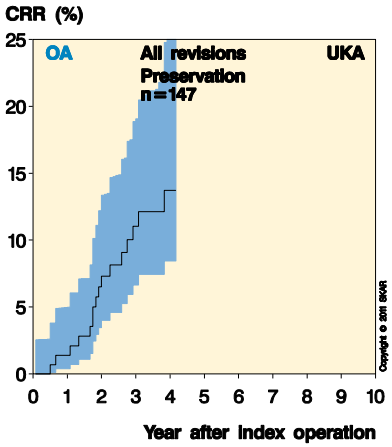
CRR for commonly used UKA implants for OA 2000–2009

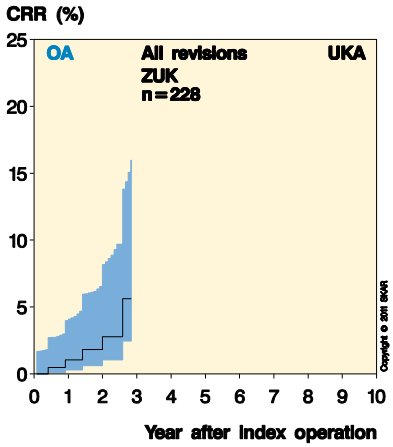


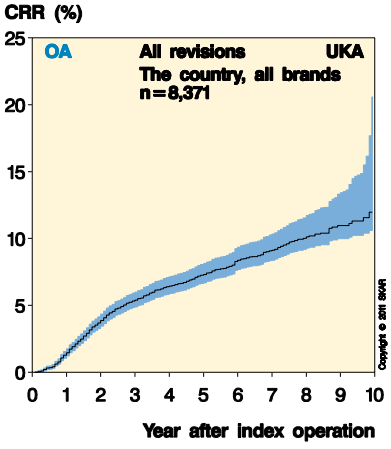












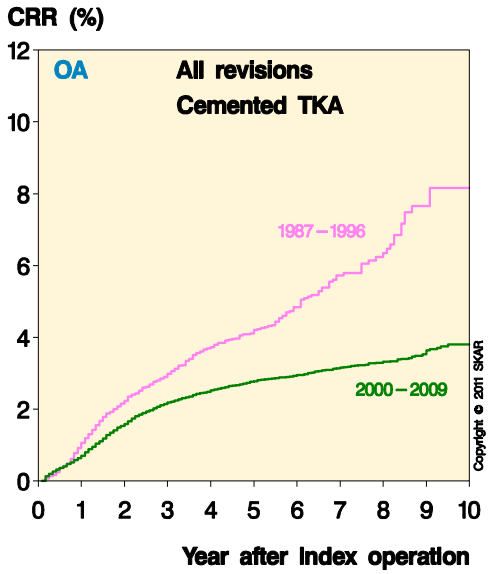
Changes in risk of revision over time (cemented TKA)

The figure below shows the overall risk of revision for the current 10-year period, 2000-2009, as compared to the period 1987-1996. It can be observed that the risk for the current period is considerably lower than for the earlier period.

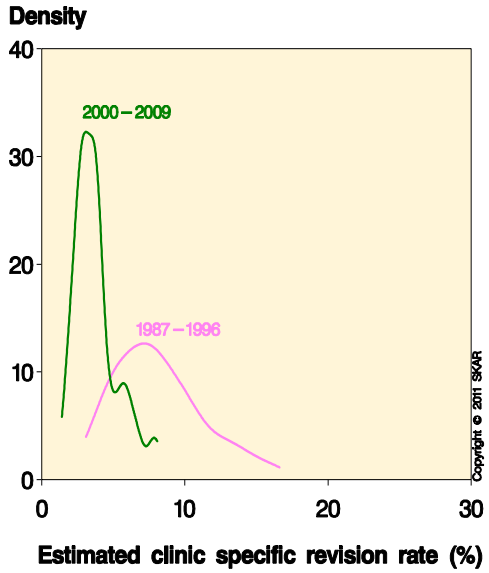
When the absolute specific risk of revision for the units is plotted for both periods (figure below left), it can be seen that the risk has become lower and the distribution has diminished. This implies that the results have improved overall and at the same time the results for the different units have become more similar (less variance in the results).

However, when looking on the relative specific risk of revision (figure below) it can be seen that the curves for the two periods are similar in shape. This implies that the relative difference between the units has not changed between the two periods and that some units still have a 1.5-2 times higher or lower risk than the average unit. The figures also illustrate the fact, that irrespective of improvement, there will always be units with better, or worse, results than the average.

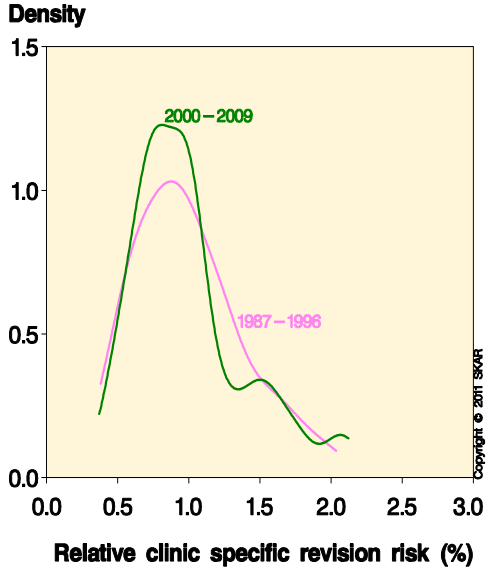
The register is requested to account for hospital specific results which can be found on the next pages. There were 10 hospitals having significantly better results than the average hospital and 13 with inferior results. One can only speculate on the causes for these differences. An unfortunate choice of implants, methods or surgeons may be the explanation, as well as a selection of patients with a 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 neccesarily reflect the current risk for patients undergoing surgery.



Total CRR for cemented TKA in OA during the 2 periods 1987–1996 and 2000–2009 shows a considerable reduction in CRR over time.



Plotting the estimated absolute clinicspecific risk of revision shows that the absolute distribution has diminished between 1987-1996 and 2000–2009 (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 1987–1996and 2000–2009 (x-axis = relative risk).

Relative risk of revision for hospitals 2000–2009 (cemented TKA för 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 cannot automatically be used to predict future results. The observed average result of a hospital treatment is not constant. Different selections of patients that get the same treatment have different average results. Thus, the hospital specific variability has to be taken into consideration if comparisons of hospitals are to be meaningful.

The table below shows the number of primary operations (cemented TKA for OA) performed at each hospital during the analyzed period and how many of these were revised. The RR (relative risk of revision) is shown 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, relative 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.

It is the location for the hospital that decides where the operation is registered. This implies that in spite of any name or ownership changes, the whole period is analyzed for the particular location.

Finally the observed rank for the hospital is shown together with a 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 and only cemented TKA for OA were included. The results are adjusted for differences in age and gender as well as for differences in use of a patellar button.

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	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
52012	Alingsås	1 142	6	0.38	0.21-0.69	1	1-22
10484	Sabbatsbergs närsjh	732	7	0.48	0.27-0.85	2	1-36
21001	Linköping	372	3	0.48	0.23-0.97	3	1-47
56010	Västerås	752	4	0.48	0.24-0.93	4	1-43
64011	Lycksele	393	2	0.51	0.24-1.10	5	1-56
42011	Varberg	1 291	14	0.53	0.34-0.84	6	2-36
12010	Enköping	1 375	12	0.53	0.33-0.86	7	1-38
65014	Kalix	164	1	0.57	0.25-1.32	8	1-67
53011	Lidköping	833	8	0.57	0.33-1.00	9	2-50
62011	Örnsköldsvik	1 027	12	0.58	0.36-0.94	10	2-43
13012	Kullbergska sjukhuset	1 244	12	0.59	0.36-0.95	11	2-47
50010	Östra sjukhuset	856	11	0.63	0.38-1.04	12	3-52
57010	Falun	1 615	21	0.64	0.43-0.94	13	4-45
42015	Movement Halmstad	703	5	0.65	0.34-1.22	14	2-63
65012	Gällivare	579	7	0.66	0.37-1.17	15	3-60
50480	Carlanderska	125	0	0.69	0.27-1.73	16	1-77
11001	Karolinska	1 469	24	0.70	0.48-1.01	17	7-50
22012	Värnamo	916	13	0.70	0.43-1.13	18	4-59
56012	Köping	1 091	17	0.71	0.46-1.08	19	6-55
50001	Sahlgrenska	312	5	0.72	0.38-1.37	20	3-68
53010	Falköping	935	13	0.73	0.45-1.17	21	5-59
21014	Motala	2 394	32	0.73	0.53-1.02	22	9-51
28013	Simrishamn	715	15	0.74	0.47-1.16	23	6-60
12481	Elisabethsjukhuset	481	6	0.74	0.41-1.36	24	4-68
13010	Eskilstuna	324	4	0.75	0.38-1.47	25	3-71
11002	Huddinge	822	12	0.75	0.46-1.22	26	6-62

(cont.)

Relative risk of revision for units (continued)

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
50080	Sergelkliniken Gbg	140	2	0.76	0.35-1.64	27	2-75
23010	Växjö	783	12	0.76	0.47-1.23	28	6-63
28011	Ängelholm	1 070	17	0.77	0.50-1.18	29	8-60
53013	Skövde	595	9	0.77	0.45-1.32	30	5-66
50071	Frölunda Spec.Sjukhus	655	10	0.79	0.47-1.32	31	6-66
52011	Borås	793	13	0.79	0.49-1.27	32	7-65
54013	Säffle	221	4	0.79	0.40-1.56	33	3-74
41012	Helsingborg	376	7	0.80	0.45-1.43	34	5-70
22010	Jönköping	1 006	16	0.81	0.52-1.25	35	9-64
55012	Lindesberg	830	13	0.81	0.51-1.30	36	8-67
62013	Sollefteå	794	14	0.82	0.52-1.30	37	9-66
30001	Malmö	226	4	0.84	0.43-1.64	38	5-76
55010	Örebro	869	15	0.85	0.55-1.33	39	10-67
65016	Sunderby sjukhus	304	7	0.86	0.48-1.53	40	7-73
55011	Karlskoga	741	14	0.89	0.57-1.41	41	12-70
25010	Kalmar	1 039	19	0.89	0.59-1.34	42	14-67
25011	Oskarshamn	1 518	27	0.94	0.66-1.33	43	19-67
57011	Mora	973	20	0.94	0.63-1.40	44	16-69
21013	Norrköping	570	11	0.94	0.57-1.55	45	13-73
10011	S:t Göran	3 175	73	0.96	0.76-1.20	46	28-62
13011	Nyköping	635	12	0.97	0.60-1.57	47	14-74
24010	Västervik	887	20	0.97	0.65-1.44	48	18-70
42010	Halmstad	1 242	27	0.98	0.68-1.41	49	21-69
11015	Nacka-Proxima	173	2	0.98	0.46-2.12	50	6-82
54010	Karlstad	1 340	27	0.99	0.70-1.41	51	22-70
42420	Spenshult	254	3	1.00	0.49-2.05	52	7-82
41013	Ystad	240	7	1.02	0.57-1.82	53	13-79
22011	Eksjö-Nässjö	796	17	1.02	0.67-1.56	54	20-74
27011	Karlshamn	1 383	31	1.03	0.74-1.44	55	27-70
64001	Umeå	827	18	1.04	0.68-1.57	56	21-74
64010	Skellefteå	621	14	1.04	0.66-1.64	57	19-75
10015	Sophiahemmet	878	24	1.04	0.72-1.51	58	25-72
28012	Hässleholm	3 712	83	1.04	0.84-1.29	59	34-66
11011	Södertälje	944	22	1.05	0.71-1.54	60	24-73
27010	Karlskrona	78	3	1.05	0.51-2.14	61	8-83
11913	Löwenströmska*	1 315	26	1.05	0.74-1.50	62	25-72
11010	Danderyd	1 311	32	1.10	0.79-1.52	63	30-73
10013	Södersjukhuset	1 640	34	1.10	0.80-1.52	64	32-73
54014	Torsby	788	21	1.15	0.78-1.70	65	30-77
63010	Östersund	796	20	1.15	0.77-1.72	66	29-77
62010	Sundsvall	906	27	1.25	0.88-1.78	67	39-78
41010	Landskrona	454	18	1.29	0.85-1.95	68	36-81
52013	Skene	672	22	1.29	0.88-1.91	69	38-80
51010	UddevAll	1 318	37	1.40	1.03-1.91	70	51-80
54012	Arvika	755	21	1.44	0.98-2.13	71	47-83
26010	Visby	586	20	1.47	0.99-2.19	72	48-83
51011	Mölndal	608	19	1.50	1.00-2.25	73	48-84
61010	Gävle	497	20	1.50	1.01-2.23	74	49-84
50020	Gothenburg Med. Center**	375	13	1.53	0.95-2.44	75	45-85
41011	Trelleborg	2 989	88	1.57	1.27-1.93	76	65-81
65013	Piteå	1 465	46	1.61	1.22-2.13	77	62-83
23011	Ljungby	630	26	1.64	1.15-2.35	78	59-84
61011	Bollnäs / Söderhamn	1 481	56	1.77	1.37-2.29	79	68-84
10016	Ortopediska huset	2 211	84	1.78	1.44-2.20	80	70-84
41001	Lund	125	9	1.80	1.05-3.06	81	53-85
12001	Akademiska sjukhuset	883	46	2.02	1.53-2.68	82	73-85
11012	Norrtälje	620	32	2.08	1.49-2.91	83	72-85
61012	Hudiksvall	543	31	2.12	1.52-2.95	84	73-85
51012	Kungälv	1 104	56	2.14	1.66-2.77	85	76-85

* Lövenströmska was taken over by Stockholms Specialistvård in 2001 and by OrthoCenter Stockholm in 2008.

** Gothenburg Medical Center was discontinued and OrthoCenter IFK kliniken was started in 2008.

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

Relative risk of revision for hospitals 1999–2008 (cemented TKA) if the exchange of an inlay, in case of infection, is not considered to be a revision

As described on page 32, the SKAR defines a revision as being a reoperation in which implant components are exchanged, added or removed.

The reason for this is shortly after the start of the register, it was noted that many surgeons did not report reoperations which they did not interpret as directly related to the prior knee arthroplasty. This resulted in different types of soft tissue surgeries never being reported and thus, the register decided to use a stricter definition of revision which could definately be related to the implant.

It has been claimed that for infected cases this strict definition may unfairly treat different implant brands and consequently those hospitals using these brands. The reason is that one fifth of all revisions for infection are synovectomies during which the inlay is exchanged (defining them as being revisions). However, a synovectomy in a knee with an implant in which the inlay is fixed to the baseplate, and thus cannot be exchanged, will not count as a revision which in turn may favor the type. Thus, the argument has been made that exchange of an inlay in the case of an infection should not be considered a revision, but a synovectomy.

On the other hand it, can be claimed that infected TKA´s with fixed inlays are generally treated with a complete exchange of components, as a comprehensive synovectomy is not considered possible. This would result in a reversed bias when the exchange of an inlay is not considered as a revision.

Without being able to give a definite answer regarding what is the most appropriate method, we decided to do both, showing separate calculations in which the exchange of inlays (for infection) are not being considered revisions.

If the table below is compared to the one on the previous page, it can be seen that although the rank has changed somewhat, the effect is relatively small. Thus, 7 of the 10 units with better results than the national average keep their status while no new unit is added. On the other end, Lund and Mölndal are removed from the group of units worse than the national average while Visby, Gothenburg Medical Centre and Arvika move in.

Like the previous table, only units performing more than 50 procedures during the period and only cemented TKA/OA are included. Units with significantly better or worse results than the national average are shown in green and red respectively.

Relative risk of revision for units. The exchange of inlay, in case of infection, is not considered a revision.

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
52012	Alingsås	1 142	5	0.37	0.19-0.70	1	1-24
53011	Lidköping	833	5	0.47	0.25-0.89	2	1-40
62011	Örnsköldsvik	1 027	8	0.47	0.27-0.82	3	1-33
42015	Movement Halmstad	703	2	0.48	0.22-1.04	4	1-52
21001	Linköping	372	3	0.5	0.24-1.02	5	1-51
10484	Sabbatsbergs närsjh	732	7	0.5	0.28-0.90	6	1-40
56010	Västerås	752	4	0.51	0.26-1.01	7	1-49
64011	Lycksele	393	2	0.54	0.25-1.17	8	1-58
42011	Varberg	1 291	13	0.54	0.34-0.87	9	2-39
12010	Enköping	1 375	12	0.58	0.36-0.94	10	3-44
65014	Kalix	164	1	0.58	0.25-1.36	11	1-67
50010	Östra sjukhuset	856	9	0.59	0.34-1.01	12	2-49
50001	Sahlgrenska	312	3	0.6	0.29-1.23	13	1-61
13012	Kullbergska sjukhuset	1 244	11	0.6	0.36-1.00	14	3-48
57010	Falun	1 615	18	0.61	0.40-0.92	15	4-43
65012	Gällivare	579	6	0.64	0.35-1.17	16	2-59
50480	Carlanderska	125	0	0.71	0.28-1.81	17	1-78
25010	Kalmar	1 039	13	0.72	0.45-1.15	18	6-57
24010	Västervik	887	13	0.74	0.46-1.19	19	7-60
53010	Falköping	935	12	0.74	0.46-1.20	20	6-61
22010	Jönköping	1 006	13	0.74	0.46-1.19	21	7-60
11001	Karolinska	1 469	24	0.75	0.52-1.09	22	10-55
22012	Värnamo	916	13	0.76	0.47-1.23	23	7-62
21014	Motala	2 394	30	0.76	0.54-1.07	24	11-54
56012	Köping	1 091	17	0.76	0.50-1.17	25	8-58
23010	Växjö	783	11	0.77	0.46-1.27	26	7-64

(forts.)

Relative risk of revision for units (cont.) The exchange of inlay, in case of infection, is not considered a revision

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
42420	Spenshult	254	1	0.77	0.33-1.81	27	2-79
55012	Lindesberg	830	11	0.78	0.47-1.29	28	7-64
50071	Frölunda Spec.Sjukhus	655	9	0.78	0.46-1.34	29	6-66
50080	Sergelkliniken Gbg	140	2	0.78	0.36-1.71	30	3-76
28013	Simrishamn	715	15	0.79	0.50-1.23	31	9-62
13010	Eskilstuna	324	4	0.79	0.40-1.56	32	4-73
12481	Elisabethsjukhuset	481	6	0.79	0.43-1.46	33	6-70
11002	Huddinge	822	12	0.81	0.50-1.31	34	8-65
21013	Norrköping	570	8	0.81	0.46-1.42	35	7-68
64001	Umeå	827	12	0.81	0.50-1.32	36	9-65
53013	Skövde	595	9	0.83	0.48-1.41	37	8-69
54013	Säffle	221	4	0.83	0.42-1.64	38	5-75
28011	Ängelholm	1 070	17	0.83	0.54-1.27	39	11-64
62013	Sollefteå	794	13	0.83	0.52-1.34	40	10-66
41012	Helsingborg	376	7	0.85	0.47-1.52	41	7-71
52011	Borås	793	13	0.85	0.52-1.38	42	10-67
11010	Danderyd	1 311	22	0.86	0.58-1.26	43	14-63
30001	Malmö	226	4	0.87	0.44-1.72	44	6-77
42010	Halmstad	1 242	22	0.9	0.60-1.33	45	15-66
65016	Sunderby sjukhus	304	7	0.9	0.50-1.62	46	9-74
55011	Karlskoga	741	13	0.91	0.57-1.46	47	13-70
55010	Örebro	869	15	0.92	0.59-1.44	48	14-70
25011	Oskarshamn	1 518	24	0.93	0.64-1.35	49	18-66
57011	Mora	973	19	0.97	0.65-1.46	50	19-70
13011	Nyköping	635	11	0.98	0.59-1.62	51	15-74
10015	Sophiahemmet	878	21	1	0.67-1.48	52	21-71
10013	Södersjukhuset	1 640	28	1.02	0.72-1.44	53	25-70
10011	S:t Göran	3 175	72	1.02	0.81-1.29	54	33-65
11015	Nacka-Proxima	173	2	1.03	0.47-2.25	55	7-84
64010	Skellefteå	621	13	1.05	0.66-1.69	56	20-75
27010	Karlskrona	78	3	1.07	0.52-2.21	57	10-83
41013	Ystad	240	7	1.07	0.60-1.92	58	15-80
54010	Karlstad	1 340	27	1.08	0.76-1.54	59	29-73
11011	Södertälje	944	21	1.08	0.73-1.60	60	26-74
22011	Eksjö-Nässjö	796	17	1.1	0.72-1.69	61	25-76
28012	Hässleholm	3 712	81	1.12	0.90-1.39	62	40-68
27011	Karlshamn	1 383	31	1.13	0.81-1.57	63	33-73
11913	Löwenströmska*	1 315	26	1.15	0.81-1.65	64	33-75
63010	Östersund	796	20	1.24	0.83-1.85	65	35-79
54014	Torsby	788	21	1.24	0.84-1.84	66	35-79
41010	Landskrona	454	17	1.3	0.85-1.99	67	36-82
62010	Sundsvall	906	26	1.3	0.91-1.87	68	42-80
52013	Skene	672	22	1.4	0.95-2.07	69	45-82
51011	Mölndal	608	16	1.41	0.91-2.18	70	42-83
41011	Trelleborg	2 989	74	1.47	1.17-1.84	71	58-80
54012	Arvika	755	20	1.51	1.02-2.25	72	49-84
51010	UddevAll	1 318	37	1.53	1.13-2.09	73	56-83
65013	Piteå	1 465	40	1.56	1.16-2.10	74	58-83
26010	Visby	586	20	1.59	1.07-2.38	75	53-85
61010	Gävle	496	20	1.61	1.08-2.40	76	53-85
50020	Gothenburg Med. Center**	375	13	1.65	1.03-2.64	77	50-85
23011	Ljungby	630	24	1.65	1.14-2.40	78	58-85
41001	Lund	125	8	1.74	0.99-3.03	79	48-85
51012	Kungälv	1 104	42	1.78	1.33-2.38	80	65-85
12001	Akademiska sjukhuset	884	39	1.87	1.38-2.54	81	67-85
10016	Ortopediska huset	2 211	83	1.93	1.55-2.39	82	72-85
61011	Bollnäs / Söderhamn	1 481	56	1.94	1.50-2.51	83	71-85
11012	Norrtälje	621	29	2.07	1.46-2.93	84	70-85
61012	Hudiksvall	543	28	2.08	1.47-2.94	85	70-85

* Lövenströmska was taken over by Stockholms Specialistvård in 2001 and by OrthoCenter Stockholm in 2008.

** Gothenburg Medical Center was discontinued and OrthoCenter IFK kliniken was started in 2008.

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

The new form – results for 2009 and 2010

This is a general description of the new variables, reported from the units since 2009. The results are for primary knees reported in the period 2009-2010.

Previous surgery

Reporting previous surgery of the current knee, it is possible to mark more than one alternative:

No previous surgery was reported in 79% of cases, 19.5% had one previous surgery before the primary arthroplasty and 1.6% more than one.

The table below shows the most common operations. It is not a comprehensive description of the previous surgery performed, but illustrates what the surgeon knew at the time of performing the primary arthroplasty.

Previous surgery in the index knee

Surgery	Percent: 2009	2010
None	73.0	78.9
Osteosynthesis	0.8	1.0
Osteotomy	2.1	2.1
Menisceal surgery	6.7	7.8
Cruciate ligament surgery	0.9	1.0
Arthroscopy	4.7	5.3
Other	2.1	2.3
Missing	9.7	1.6
Total	100	100

ASA

The American Society of Anesthesiologists classification is an estimate of the patient's health, and thus of the risk associated with the imminent anesthesia and surgery. As can be seen below, three quarters of the patients were considered healthy or only having a mild systemic disease (class I or II)

ASA classification (simplified)

Type		Percent: 2009	2010
ASA I	Healthy patient	18.5	19.6
ASA II	Mild systemic disease	58.3	64.2
ASA III	Severe systemic disease	13.5	14.9
ASA IV	Severe disease, constant threat to life	0.2	0.3
ASA V	Not expected to live without surgery	0.0	0.0
Missing		9.5	1.0
Total		100	100

Body Mass Index (BMI)

One third of patients had a BMI of 30 or more, which is obesity according to the WHO classification. 2.5% had a BMI over 40, i.e. morbid obesity. Women had a slightly higher BMI than men, but the difference was small.

Body Mass Index (kg/m2)

BMI group	Percent: 2009	2010
<25	17,6	18,3
25-29.9	39,4	42,8
30-39.9	30,6	35,4
≥40	2,1	2,5
Missing	10,3	1,0
Total	100	100

Body Mass Index (kg/m2)

Gender	BMI (median): 2009	2010
Males	28.0	28.1
Females	28.8	28.9
All	28.4	28.6

Antithrombotic prophylaxis

Fragmin was the most commonly reported antithrombotic drug. With Fragmin, Inohep and Klexane, it was equally common that the treatment started pre- as well as post-operatively. During 2010 the use of Pradaxa and Xarelto increased. These are per-oral drugs and the treatment is started 1-4 hours and 6-10 hours after surgery respectively.

Antithrombotic prophylaxis

Type	Percent: 2009	2010
No prophylaxis	0.3	0.1
Fragmin started pre-op	24.5	13.0
Fragmin started post-op	22.0	27.0
Inohep started pre-op	12.1	11.3
Inohep started post-op	14.7	16.8
Klexane started pre-op	6.6	6.0
Klexane started post-op	6.1	6.5
Xarelto	1.8	5.2
Pradaxa	1.1	12.5
Other	0.1	0.2
Missing	10.7	1.4
Total	100	100

The length of the planned antithrombotic treatment varies. For two thirds of the patients, it was 8-14 days, although treatment for up to 42 days was reported. Not using any prophylactic medication is uncommon (see table below).

Thromboprophylaxis - length of treatment

Days	Percent: 2009	2010
No prophylaxis	0.3	0.1
1-7	13.6	8.9
8-14	62.9	77.0
15-21	3.7	4.1
22-28	6.2	5.9
29-35	1.9	1.6
>35	0.5	0.5
Missing	10.9	1.9
Total	100	100

Type of antibiotic

Cloxacillin was the antibiotic reported by the majority of units for almost 90% of the patients. Dalacin (klindamycin) was used in 7% of the surgeries, which can be interpreted as the percentage of patients being suspected of having penicillin allergy. Cephalosporin is infrequently used in comparison to that which is reported by other countries, e.g. Norway.

Antibiotic type

Substance	Percent: 2009	2010
Kloxacillin	80.8	88.4
Dalacin	5.9	7.2
Zinazef	3.8	3.5
Cefotaxim	0.2	0.2
Vancomycin	0.1	0.0
Other	0.1	0.1
Missing	9.2	0.6
Total	100	100

Cloxacillin dose

		Percent: 2009	2010
Cloxacillin	2gx3	51.5	58.8
Cloxacillin	2gx4	29.9	32.6
Cloxacillin	1gx3	3.9	2.1
Cloxacillin	1gx4	1.8	2.3
Cloxacillin	2g+1g+1g	9.0	0.7
Cloxacillin	other	2.0	2.2
Missing		1.9	1.3
Total		100	100

Cloxacillin - dose

The most common cloxacillin dose was 2g x 3 (see table below, left), most often within the course of 24 hours. However, this varied from 8 hours to 48 hours.

Antibiotics - time of administration

The aim of antibiotic prophylaxis is having the concentration in the tissues at its highest at the start of surgery. Antibiotics such as cloxacillin and cephalosporin have a short half-life and thus, it is commonly recommended to administrate the antibiotic approximately 30 minutes before start of surgery. When using a tourniquet, the antibiotic should not be injected too late if a reasonable concentration is to be reached in the tissues. For knee arthroplasty which most often is performed using a tourniquet, it is recommended that the antibiotic is administrated 15-45 minutes prior to turning it on.

A study from the register found imperfect routines concerning prophylatic antibiotics in 2007 (Stefánsdóttir A et al. 2009). On January 1st 2009 the register started to record the time for the administration of the prophylaxis. Therefore we have become able to follow-up if hospitals adhere to optimal routines and can contribute to the national quality improvement effort for reduction of infections after implant surgery (W-Dahl A et al. 2011).

In the previous report we could report that an improvement had occurred. During 2010 this has continued with prophylactic antibiotics being administrated within the recommended timeframe in 81% of the surgeries (information missing for 2%).

Still we can note that some hospitals report the antibiotic being administrated exactly 30 min. prior to surgery, in more than half of their cases. This can be interpreted as the general hospital routine being reported but not the exact time for the injection. We assume that this is a run-in problem with the new form and that the real time for antibiotic administration will be reported in the future.

Antibiotic - time (minutes before surgery)

Minutes pre-op.	Percent: 2009	2010
0-14	3.7	4.4
15-45	69.2	81.3
>45	14.8	11.9
Administrated after surgery	1.5	0.7
Missing	10.8	1.7
Total	100	100

The new form (cont.)

Anesthesia

Spinal anesthesia was the most common form of anesthesia, being used in 80-90% of cases. General anesthesia was used in 10% of cases and epidural anesthesia in only 1%.

Type of anesthesia

Type	Percent: 2009	2010
General	8.4	10.1
Epidural	1.1	0.9
Spinal	80.7	87.5
Other	0.3	0.7
Missing	9.5	0.8
Total	100	100

Tourniquet and drainage

The benefit of a tourniquet is still vividly being debated. However, the Swedish orthopedic surgeons seem to rely on it as 93% of the knee arthoplasties are reported being performed using a tourniquet.

Drainage was only used in barely 30% of cases. This may have to do with the recent popularity of the LIA analgesia, after which a catheter is often left in the knee for later injection, resulting in surgeons avoiding the use of drainage.

Tourniquet and drainage

Tourniquet	Percent: 2009	2010
Yes	84.7	92.5
No	5.1	6.4
Missing	10.2	1.1
Total	100	100

Drainage	Percent: 2009	2010
Yes	28.9	28.3
No	61.5	70.8
Missing	9.6	0.9
Total	100	100

Transplantation of bone

Bone transplantation is infrequently used in primary knee arthroplasty and if used, it is almost exclusively auto transplantation. Transplantation was reported in 1.7% of cases. 60% had the bone transplanted in the femur, 30% in the tibia and 10% in both femur and tibia. Information on bone transplantation was missing in 1% of the reports.

Computer aided surgery (CAS)

Only 0.7% of the cases were reported as having been operated on with CAS. 75% of the surgeries were performed at 4 hospitals (Hässleholm, Huddinge, Umeå and Visby) although the method was tested at 14 units, half as many as during 2009. CAS was more often used for TKA than for UKA.

According to the annual report of the Norwegian arthroplasty register, 19% of the TKA and 1% of the UKA were performed using CAS in 2009.

Thus, use of CAS in Sweden is less common compared to Norway.

LIA (local infiltration analgesia)

This type of anesthesia originates from Australia but was introduced in Sweden in approx. 2003. Besides studies on pain, the literature is sparse and the effect on long term results is unknown. The table below shows the method has spread quickly with 84% of the patients having LIA in 2010. In 40% of the cases (with or without LIA) a catheter was left in the knee for a later injection.

Local infiltration analgesia - LIA

Type		Percent
None	5.8	4.2
LIA	44.4	49.8
Only catheter	10.3	10.8
LIA and catheter	29.7	34.2
Missing	9.7	1.0
Total	100	100

Operating time

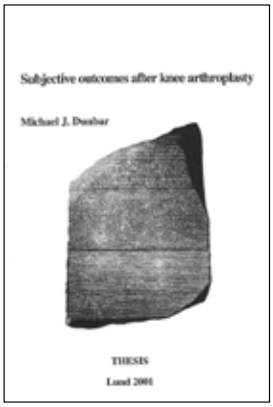
In 2010, the median time for the operations was 125 min. for linked implants, 80 min. for TKA´s, 71 min. for UKA´s and 80 min. for femoro-patellar implants. As compared to 2009, the time was approximately the same for TKA but had become 9 minutes shorter for the UKA. However for femoro-patellar implants the median time increased by 15 minutes.

Patient reported outcome

History

The SKAR started early on to ask patients about their opinion of their knee surgery. In 1997, 94% of all the alive patients who underwent knee arthroplasty answered a mail survey concerning non-reported revisions and patient satisfaction (Robertsson 2000).

In 1998, different patient questionnaires were tested in order to find the most suitable for use after knee arthroplasty and the SF-12 and Oxford-12 were found to be the most relevant. (Dunbar 2001).



PROM was the subject for a dissertation in 2001 based on data from the knee register.

We also found that the number of questions affected the answering rate and the proportion of complete answers. Further, non-responders were more often unsatisfied than responders.

Using self-administrated disease specific or general health questionnaires to evaluate results of surgery turned out to be more complicated than expected. There are many reasons for this, including among others that there is no clear definition of what outcome can be expected after knee arthroplasty (the aim of the surgery may vary), the initial health status and the expectations of the patients differ and observed changes in health over time need not be related to the surgery of the joint.

A national pre- as well as post-operative registration of PROM requires a large amount of resources both at a hospital and register level. Without a well defined purpose it is difficult to choose a fitting instrument as well as decide if the response rate can be expected to be adequate. Therefore the SKAR has awaited international consensus on the matter.

The pilot project in Trelleborg

Within the Region Skåne a PROM is used as a quality measure of the care provided. Below there is a compilation of the outcome instruments for patients operated on with TKA at the arthroplasty centre in Trelleborg which is used by both university hospitals of Lund and Malmö.

Evaluating instruments

EQ-5D is a general health instrument measuring quality of life based on the answers of 5 different questions (mobility, usual activities, self-care, pain/discomfort, anxiety/depression). Each of the questions can be answered by 1= no problem, 2= moderate problem and 3= extreme problem.

The EQ-5D index is calculated from the answers by use of a tariff for the normal population to weight the answers. However, lacking a Swedish tariff the British has been used instead. The lowest value is -0.594 and the highest 1.0 which represents a fully healthy individual. The index is intended to be used for health economic calculations although it has also been used to estimate quality of care which has proved to be somewhat problematic because of the lack of a normal distribution as recently was reported in the Läkartidningen (36, 2011).

If one wants to perform statistical analyses using a single value as a measure of the health related quality of life it is possible to use the EQ-VAS. It measures the self-perceived general health of the patient on a scale (0-100) from the best (100 to the worst imaginable health status (0) (www.euroqol.org).

KOOS is a disease specific questionnaire consisting of 42 questions and is designed to be used for short and long time follow-up after knee trauma or osteoarthritis. KOOS consists of 5 subscales; Pain, other Symptoms, Activity in Daily Life function (ADL), Sport and Recreation function (Sport/Rec) and knee related Quality of life (QoL). Standardized answer options are given (5 Likert boxes) and each question gets a score from 0 to 4. A normalized score (100 indicating no symptoms and 0 indicating extreme symptoms) is calculated for each subscale (www.koos.nu).

The results for the 4 subscales are presented as a mean value with 95% CI before and one year after surgery as well as for each case-mix factor and the satisfaction of the patient with the knee operation.

A Visaual Analog Scale (VAS) was used to have the patients estimate their knee pain by marking their pain score on a 0-100 scale (VAS) in which 0= no pain and 100= worst imaginable pain. This was done before as well as one year after the knee arthroplasty.

Patient satisfaction with the arthroplasty surgery one year postoperatively was also evaluated using a 0-100 scale (VAS) in which 0= the highest imaginable satisfaction and 100= the worst imaginable satisfaction.

The VAS knee pain is presented as a mean with a 95% CI before and one year after surgery for each case-mix factor and the satisfaction of the patient with the knee operation. The patient satisfaction as measured by VAS was categorized into 5 groups; very satisfied (0-20), satisfied (21-40), moderately satisfied (41-60), unsatisfied(61-80) and very unsatisfied (81-100).

Patient selection

1,064 primary knee arthroplasties were inserted in Trelleborg 2008-2009. UKA and PF were excluded (to few patients), as well as diagnoses other than OA and the second knee if both had arthroplasty during the one year follow-up period (left knee in case of simultaneous bilateral arthroplasty). Additionally only patients with complete pre- and one year postoperative data (EQ-5D, EQ-VAS and KOOS) were included. The result was that 694 patients could be evaluated or 78% of all the primary TKA performed for OA.

Description of patients

	All	Males	Females
	n=694	n=244	n=450
		(35%)	(65%)
Age (years)			
Mean	69.5	68.9	69.8
SD	8.4	8.6	8.3
BMI (kg/m2)*			
Mean	29.2	28.5	29.5
SD	5	4.1	5.4
Charnley category (%)			
A	208 (30)	87 (35.7)	121 (26.9)
B	193 (27.8)	65 (26.6)	128 (28.4)
C	293 (42.2)	92 (37.7)	201 844.7)
ASA classification (%)**			
ASA I	131 (20.3)	55 (24.4)	76 (18.1)
ASAII	427 (66.3)	141 (62.7)	286 (68.3)
ASAIII	86 (13.4)	29 (12.9)	57 (13.6)

* n=615
** n= 644

Case-mix classification

Gender	**Male / Female**	
Age	**55-64 year**	
	65-74 year	
	75-84 year	
	85 years and older	
Charnley category		
	A	**- unilateral knee disease**
	B	**- bilateral knee disease**
	C	**- disease in multiple joints and/or other diseases affecting the walking ability**
American Society of Anesthesiologists classification (ASA)		
	ASA I	**- healthy**
	ASA II	**- mild systemic disease**
	ASA III	**- severe systemic disease**
	ASA IV	**- severe disease, constant threat to life**
	ASA V	**- not expected to live without surgery**
Body mass index (BMI)		
	<25	**- normal weight**
	25-29.9	**- overweight**
	30-39.9	**- obesety**
	≥40	**- morbid obesity**

Logistics

The patients filled in the questionnaires at the outpatient visit approximately 2 weeks prior to surgery. One year postoperatively the same questionnaire was mailed to the patients together with the question on satisfaction with the knee arthroplasty. The patients had been informed of the planned one year follow-up, but no reminders were sent in case of no response at that time.

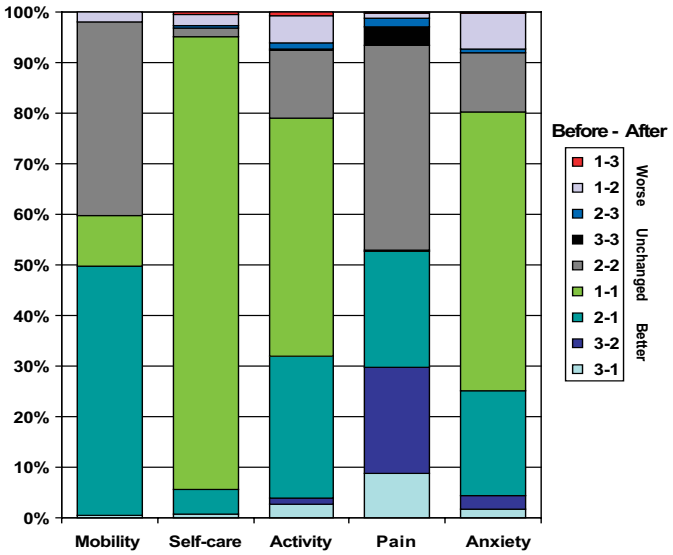
In the results that follow, the minimal clinical significant difference has been defined as 10 points for EQ-VAS and KOOS as well as satisfaction and pain measured with VAS. Differences that are accounted for in the text concern differences that are both statistically and clinically significant ($p<0.05$) according to this definition.

Results

EQ5D

We have tried visualizing the change in general health related quality of life during the first year, as measured by EQ-5D, by using the 9 combinations of pre- and post-operative answers that are possible for each of the questions. A preoprative answer of extreme problems can be unchanged at the follow-up (3-3) or there can be an improvement from extreme to moderate (3-2) or from extreme to none (3-1). Moderate problems can stay unchanged (2-2), worsen into extreme (2-3) or improve to none (2-1) and finally no problems preoperatively can stay unchanged (1-1), worsen to moderate (1-2) or become extreme (1-3).

For each of the 5 EQ-5D questions, the figure to the right shows the relative proportion of the 9 possible combination of change from preoperatively to 1 year after surgery. It can be seen that half of the patients improved in mobility and a good half got better with respect to pain while only a third improved their usual activities, one fourth reduced in anxiety and only a few improved in self-care.



The distribution (%) for the different combinations of pre- and one year postoperatve answers for each of the EQ-5D questions. (1=no problem, 2=some or moderate problems 3=extreme problems)

EQ-VAS

The majority of patients (71%) had improved their self-perceived general health one year after the knee arthroplasty, 9% were unchanged while 20% marked that their general health had declined. Patients reporting a decline in their general health one year after surgery (EQ-VAS 61, CI 75-81) had stated a relatively high preoperative general health (EQ-VAS 78, CI 70-78). Those with unchanged general health EQ-VAS had a relatively good general health before as well as one year after surgery (EQ-VAS 74, CI 70-78) while those that had improved in general health after one year (EQ-VAS 81, CI 80-83) had somewhat worse preoperative general health (EQ-VAS 56, CI 54-57).

When EQ-VAS was analyzed separately for each of the case-mix categories as well as with respect to satisfaction with the arthroplasty surgery, it was found that everybody improved in their self-perceived general health except those 85 years or older, the ones with morbid obesity as well as those unsatisfied with the surgery (page 50).

KOOS

Irrespective of the case-mix category or if the patients were satisfied or not, everybody had improved in the areas of pain, symptoms, function and knee related one year after the arthroplasty surgery (page 51).

– Preoperative

Patients less than 55 years of age reported more symptoms than patients of age 65-74. Patients with morbid obesity had more pain and problems with Sport/Rec than those with normal weight as well as worse ADL than both those normal- and ower-weight (page 51).

– Postoperative (1-year after)

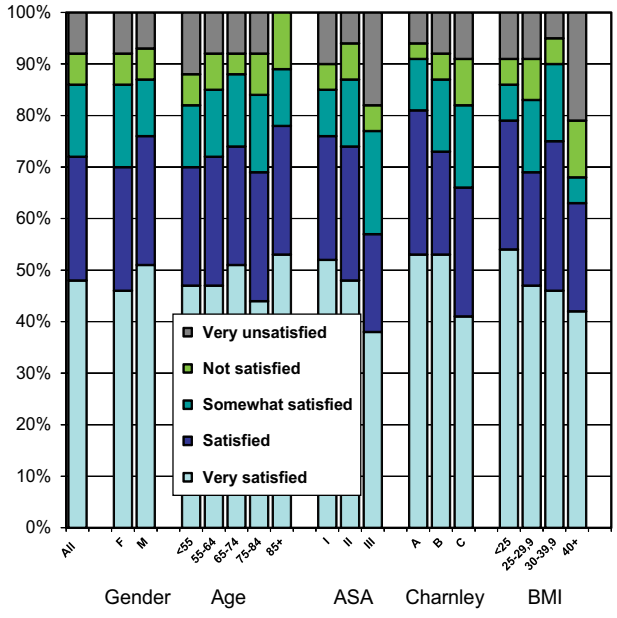
Patients 85 years or older reported more problems with the ADL than those 65-74 years. Those 75-84 years of age had more problems with Sport/Rec than those 65-74 years. Morbidly obese patients had more problems with ADL than normal- or overweight individuals as well as more problems with Sport/Rec than those with normal weight. Patients in Charnley category C reported more problems with ADL and worse knee related QoL than those in category A. Patients classified as having ASA grade III reported more problems with ADL than those with ASA grade I. Patients stating they were unsatisfied with the knee arthroplasty surgery (unsatisfied and very unsatisfied) reported bigger problems than those satisfied (very satisfied and satisfied) in all of the KOOS subscales (page 51).

VAS – Knee pain

Preoperatively, patients less than 55 years and those morbidly obese reported more pain than those 65-74 years of age and those of normal weight. Patients that were unsatisfied with the surgery reported more pain one year postoperatively than those satisfied (page 50).

VAS – Satisfaction with the arthroplasty surgery

Patients reporting that they were unsatisfied with the surgery also reported worse general- and knee related quality of life, more pain, more symptoms and worse function than the patient that were satisfied (page 50-51), Patients with morbid obesity were the group with the largest proportion of unsatisfied or very unsatisfied patients (see figure below).



The distribution (%) for each level of satisfaction after surgery for all the patients as well as the different case-mix factors.

Year of surgery

We could not find any difference in PROM between the years 2008-2009 (page 50-51). This is somewhat remarkable as a separate registration of complications in Trelleborg showed a reduction in the proportion of complications (irrespective of dignity) from 12% to 7%.

Summary

The results were as one could expect. That is, with respect to general health, having a knee arthroplasty did not improve the quality of life for the oldest, heaviest and unsatisfied patients. However regarding knee specific questions such as pain, symptoms, function and quality of life there was an improvement independent of the category of case-mix as well as satisfaction with surgery.

In spite of a 50% reduction in complications between 2008 and 2009 for this group of patients, no change was observed with respect to patient reported outcome.

One fifth of the patients were excluded due to incomplete filled forms. The response rate may be improved by sending a reminder to the patients.

We found that it seems difficult to demonstrate statistically and clinically significant differences between hospitals using EQ-VAS, KOOS and VAS-Pain. Only 20 of the 75 hospital performing knee arthroplasty in Sweden did more than 200 arthroplasties in 2010 and only three more than 500.

In this pilot-project using selected data from Trelleborg concerning a two-year production of more than 1000 operations we could find few significant differences. However, the project can be a basis for further discussions regarding patient reported outcome on hospital level and register level, as well as how it can be used for clinical quality improvement projects and by the authorites.

Preoperative results for EQ–VAS and VAS–Pain as well as one year postoperatively for all the patients as well as grouped by case-mix, satisfaction and year of surgery.

	EQ-VAS 0–100 (worst-best)				VAS Pain 0–100 (worst-best)		
Group	Patients n	Preop mean (95% CI)	Postop mean (95% CI)		Patients n	Preop mean (95% CI)	Postop mean (95% CI)
All	694	62 (60-63)	77 (75-78)		688	62 (60-63)	20 (19-22)
Gender							
Males	244	67 (65-70) *	79 (77-81)		242	59 (57-61) *	20 (17-22)
Females	450	59 (57-61) *	75 (74-77)		446	63 (62-65) *	21 (19-23)
Age (years)							
<55	21	50 (39-60) §	72 (62-81)		21	69 (63-75) §	29 (17-40)
55-64	191	59 (56-62)	77 (74-80)		190	65 (63-67)	21 (18-24)
65-74	280	64 (62-67) §	80 (78-82)		280	59 (57-62) §	18 (16-20)
75-84	171	63 (60-66)	72 (69-75)		167	61 (59-64)	22 (19-25)
85+	26	60 (53-68)	73 (66-80)		25	61 (53-68)	26 (19-33)
BMI (kg/m2)							
<25	108	65 (61-69)	80 (76-83) §		108	57 (54-61) §	18 (14-23)
25-29.9	274	63 (60-65)	77 (74-79) §		274	61 (59-63)	20 (18-22)
30-39.9	209	58 (55-61)	75 (72-77)		208	65 (62-67)	22 (19-25)
40+	20	57 (48-66)	63 (55-72) §		20	70 (63-76) §	26 (14-37)
Charnley category							
A	207	67 (65-70) §	81 (78-83) §		205	59 (57-61) *	17 (14-20) *
B	193	62 (59-65)	81 (78-83) §		192	61 (58-63)	19 (17-22)
C	292	57 (55-60) §	71 (69-74) §		289	64 (62-66) *	23 (21-26) *
ASA classification							
I	130	64 (60-68) *	83 (80-85) §		129	59 (56-62)	19 (15-22)
II	426	62 (60-64)	76 (75-78) *		423	62 (60-63)	21 (19-23)
III	85	55 (51-59) *	69 (65-73) §		84	64 (61-68)	21 (16-25)
Satisfaction							
Satisfied	429	63 (61-65)	80 (78-81) §		427	61 (60-63)	17 (16-19) §
Not satisfied	83	60 (55-65)	67 (62-71) §		83	60 (57-64)	37 (31-43) §
Year of surgery							
2008	317	62 (59-64)	76 (74-78)		313	62 (60-64)	21 (19-23)
2009	377	62 (60-64)	78 (76-80)		375	62 (60-63)	20 (18-22)

*** statistically significant difference (p<0,5) between groups (e.g. Males vs Females)**
§ statistically (p<0,5) and clinically significant difference (≥ 10 mm) between groups (e.g. satisfied vs not satisfied)
Red = No statistically significant difference (p>0,05) between the preoperative VAS and the one year postoperative VAS.

Preoperative results for KOOS as well as one year postoperatively for all the patients as well as grouped by case-mix, satisfaction and year of surgery.

		Pain		Symtoms		ADL		Sport/Rec.		QoL	
Group	Patients n	Preop mean (95% CI)	Postop mean (95% CI)	Preop mean (95% CI)	Postop mean (95% CI)	Preop mean (95% CI)	Postop mean (95% CI)	Preop mean (95% CI)	Postop mean (95% CI)	Preop mean (95% CI)	Postop mean (95% CI)
All	694	43 (42-44)	80 (79-81)	49 (47-50)	75 (73-76)	48 (46-49)	79 (77-80)	12 (11-13)	35 (33-37)	24 (23-25)	63 (61-64)
Gender											
Males	244	47 (45-49) *	82 (79-84)	52 (50-54) *	76 (74-78)	52 (50-54) *	80 (78-82)	16 (14-19) *	38 (35-41)	26 (24-28)	63 (60-66)
Females	450	41 (39-42) *	79 (77-81)	47 (45-48) *	74 (72-76)	45 (44-47) *	78 (76-80)	9 (8-11) *	33 (31-36)	23 (22-24)	63 (60-65)
Age (years)											
<55	21	37 (32-42) *	74 (63-84)	39 (33-46) §	66 (56-76)	48 (42-54)	76 (67-85)	12 (5-18)	30 (20-40)	20 (15-25)	53 (42-64)
55-64	191	39 (37-41)	77 (74-80) *	44 (42-47)	70 (68-73) *	46 (44-48)	78 (75-81)	9 (7-11)	33 (29-36) *	22 (20-24)	60 (57-63)
65-74	280	45 (43-47) *	83 (81-85) *	49 (47-51) §	77 (75-79) *	49 (47-51)	83 (81-85) §	13 (11-15)	40 (37-43)§	25 (23-27)	65 (63-68)
75-84	171	45 (43-47) *	79 (76-82)	53 (51-56) §	76 (73-79	48 (45-50)	75 (72-78) *	12 (10-15)	30 (26-34) §	25 (23-28)	63 (60-67)
85+	26	45 (37-52)	78 (71-84)	50 (42-58)	77 (71-83)	44 (37-51)	68 (61-76) §	15 (5-25)	30 (18-42)	24 (17-30)	58 (48-69)
BMI (kg/m2)											
<25	108	48 (44-51) §	82 (79-86)	50 (47-53)	77 (74-81)	53 (50-57) §	82 (79-86) §	15 (12-19) §	39 (34-44)	27 (24-30)	66 (62-71)
25-29.9	274	44 (42-45)	81 (79-83)	49 (46-51)	76 (74-78)	48 (47-50) §	80 (77-82) §	12 (10-14) *	37 (33-40)	24 (23-26)	63 (60-66)
30-39.9	209	41 (39-43)	77 (75-80)	48 (45-50)	72 (70-75)	45 (43-47) *	76 (73-79)	10 (8-12) *	31 (28-35)	22 (20-24)	61 (57-64)
40+	20	35 (28-43) §	69 (60-79)	49 (42-57)	64 (55-74)	37 (29-45) §	62 (51-73) §	4 (1-7) §	26 (14-38)	19 (12-26)	58 (47-70)
Charnley category											
A	207	47 (45-49) *	84 (81-86) *	51 (48-53)	78 (75-80)	53 (51-55) *	84 (81-86) §	15 (13-17) *	39 (36-43) *	28 (26-30) *	69 (66-72) §
B	193	41 (39-44) *	81 (79-84)	49 (46-51)	75 (72-77)	48 (45-50)	82 (80-84) *	11 (9-13)	35 (32-39)	23 (21-25)	63 (60-67)
C	292	41 (39-43) *	76 (74-79) *	47 (45-49)	73 (71-75)	44 (42-46) *	73 (70-75) §	10 (8-12) *	31 (28-34) *	22 (21-24) *	58 (55-61) §
ASA classification											
I	130	45 (43-47)	81 (78-84)	47 (44-50)	74 (71-77)	52 (49-55)	83 (80-86) §	13 (11-15)	38 (34-43)	25 (23-27)	63 (59-67)
II	426	42 (41-44)	80 (78-81)	49 (47-50)	75 (73-76)	47 (45-48)	78 (76-80)	12 (10-13)	35 (32-37)	24 (23-26)	63 (61-65)
III	85	45 (41-48)	78 (74-83)	51 (47-55)	75 (71-80)	46 (42-49)	73 (69-78) §	10 (7-14)	29 (23-35)	23 (20-25)	60 (55-66)
Satisfaction											
Satisfied	429	44 (42-45)	83 (82-85) §	49 (48-51)	77 (76-79) §	48 (47-50)	81 (80-83) §	12 (11-13)	37 (34-39) §	24 (23-25)	66 (64-68) §
Not satisfied	83	43 (40-46)	66 (61-71) §	49 (46-52)	64 (58-68) §	47 (44-51)	65 (60-70) §	12 (9-16)	23 (18-28) §	24 (21-27)	45 (39-51) §
Year of surgery											
2008	317	43 (41-45)	79 (77-81)	49 (47-51)	74 (72-76)	48 (46-49)	78 (76-80)	12 (10-13)	32 (29-35)	23 (22-25)	61 (58-63)
2009	377	43 (41-45)	81 (79-93)	48 (46-50)	75 (73-77)	48 (46-59)	79 (77-81)	12 (10-13)	37 (34-40)	25 (23-26)	64 (62-67)

*** statistically significant difference (p<0,5) between groups (e.g. Males vs Females)**
§ statistically (p<0,5) and clinically significant difference (≥ 10 mm) between groups (e.g. satisfied vs not satisfied)

Instructions for filling out the SKAR form;

Patient ID:
12 digits (preferably stamp or stickers)

Hospital and hospital number:
Should be pre-printed upper left.
This implies the hospital were the operation was performed

/The hospital which is responsible
Specified only if necessary beside the Hospital name.
Only in the case of the operation being performed by the assignment of another hospital (to which the patients and surgeons belong to).

Date of surgery:
Year-month-day

Side:
Mark the side operated. If both knees are operated on, use two forms, one for each knee.

Primary arthroplasty:
Mark "Yes" or "No".
Revision is defined as a surgery in which implant components are exchanged, added or removed. Note that this includes arthrodesis and amputation during which a previously inserted implant is removed.

Type of primary arthroplasty:
Mark one alternative with the exception if more than one type of surgery is performed in the same knee (e.g. medial and lateral UKA).

Reason for primary arthroplasty:
Mark the reason for the surgery or write the reason as free text. (OA = Osteoarthritis, RA = Rheumatoid arthritis)
In the case of more than one reason, then indicate the main reason for the operation (e.g. underlining)

Previous surgery of the index knee (for primaries only):
Mark "No" or specify the type of surgery. Note that only previous surgeries, known by the surgeon at the time, are to be specified. It is not the intention that information is to be searched in old patient charts.

Type of revision:
What has been performed during surgery. More than one alternative can be chosen, or if necessary, written as a free text.

Reason for the revision:
Mark the type of revision or write as free text.
In the case of more than one reason, then indicate the main reason for the operation (e.g. underlining).

Implant name:
Does not have to be specified if the implant stickers are attached to the back of the form.

Cemented parts
Mark the use of cement for relevant parts. Note that "stem" includes both fixed and modular stems.

Cement name:
Instead of the name of the cement we prefer the stickers for the cement to be attached to the lower back of the form. If separate stickers are avialable for the mixing system please include them.

Bone transplantation:
Mark "No" or use the relevant alternatives for the type of bone that has been use. Further mark the location in which the bone transplant was placed.

Navigation:
Mark "Yes" or "No". If Yes, specify what system was used (e.g. Aesculap, Brain Lab). Preferably the model, if available.

Custom made instruments
Mark "Yes" or "No" if the operation has been using instruments or saw blocks specially made for the patient based on MRI or CT.

MIS (Minimal Invasive Surgery):
This implies a (small) arthrotomy used to gain access to the joint without the patella having to be everted. This is to be filled in for both TKA and UKA.

Drainage:
Mark "Yes" or "No", specifying if a surgical drain has been left in the knee or not.

Surgeon:
The initials of the surgeon or his code. (Voluntary)

Anesthesia:
Mark the type of anesthesia used (more than one is allowed if relevant)

Tourniquet:
Mark "Yes" or "No", specifying if a tourniquet was used during the whole, or a part of the operation.

LIA (local infiltration analgesia):
Mark "Yes" or "No". If Yes, specify if a catheter was left in the knee for a later injection.

Antithrombotic prophylaxis:
Mark one of the three alternatives. If Yes, then also inform of the drug used, the dose (e.g. Klexane 40 mg x 1) as well as the planned length of treatment (e.g. 10 days).

Antibiotic prophylaxis:
Mark "Yes" or "No". In case of a prophylaxis being used, specify the name of the drug and the dose (e.g. Ekvacillin 2g x 3). Specify the number of minutes that the preoperative injection in fact was started (e.g. 25 min.). In case the injection was given after the operation started, then specify the time with a minus (-) sign. Finally, always state the planned length of treatment (e.g. 2 days).

ASA classification (American Society of Anaesthesiologists classification):
State the ASA class which the anesthesia staff recorded for the patient in the charts, prior to surgery.

Weight of the patient:
State in kg.

Height of the patient:
State in cm.

Start of surgery:
The time when the knife goes through the skin (e.g. 11:35)

End of surgery:
The time when closing of the skin was completed (ex. 13:15).

On the reverse side:
Attach the stickers at their intended spot:
The uppermost for the femoral components (e.g. stem, augments, ..)
The middle part for the tibial components (e.g. insert, stem, ..)
The bottom part for cement and other components (patellar button, ..)

IN CASE OF REVISION:
Do not forget to enclose a copy of the operation report and the discharge letter.

The Swedish Knee Arthroplasty Register
Klinikgatan 22, Wigerthuset, floor 2
Lund University Hospital
SE-221 85, Lund
Phone. +46-46-171345 Fax +46-46-177167

Patient ID: 19 _____-____
(Unique social security number which includes date of birth)

From: Hospital name (institution No.) /

To be used when implant components are inserted, added, exchanged or removed

Date of surgery (y.m.d) 20 __ __ __ __ __

Side (in case of bilateral operation please use 2 forms, one for each side)
☐ 1 Left ☐ 2 Right

Primary arthroplasty ☐ 1 Yes ☐ 2 No

Type of primary arthroplasty:
☐ 1 TKA incl. patella ☐ 2 TKA excl. patella
☐ 3 UKA Medial ☐ 4 UKA Lateral
☐ 5 Patello-femoral ☐ 6 Other (what).....

Reason for primary arthroplasty:
If more than one reason, mark the main reason
☐ 1 OA
☐ 2 RA
☐ 3 Fracture (recent (not older than 3 months))
☐ 4 Fracture sequelae (damage by earlier fracture)
☐ 5 Osteonecrosis
☐ 6 Other (what) .....

Previous surgery of the index knee:
☐ 0 No ☐ 1 Osteosynthesis
☐ 2 Osteotomy ☐ 3 Menisceal surgery
☐ 4 Cruciate lig. surgery ☐ 5 Arthroscopy
☐ 6 Other (what) .....

Implant name: .....
(not needed when implant stickers are provided on the other side)

Cemented parts:

Femur	☐ 1 **Cemented**	☐ 2 **Not Cemented**
Tibia	☐ 1 **Cemented**	☐ 2 **Not Cemented**
Patella	☐ 1 **Cemented**	☐ 2 **Not Cemented**
Femoral stem	☐ 1 **Cemented**	☐ 2 **Not Cemented**
Tibial stem	☐ 1 **Cemented**	☐ 2 **Not Cemented**

Cement name .....
(not needed when sticker(s) for the cement are provided on the other side)

Bone transplantation:
☐ 0 **No** ☐ 1 **Pat. own** ☐ 2 **Biobank** ☐ 3 **Synthetic bone** (what) .....
When used, the bone was used in the :

Femur	☐ 0 No	☐ 1 Yes
Tibia	☐ 0 No	☐ 1 Yes
Patella	☐ 0 No	☐ 1 Yes

Navigation: ☐ 0 No ☐ 1 Yes system used: .....

Custom Made Instruments: ☐ 0 No ☐ 1 Yes

MIS: (minimally invasive surgery) ☐ 0 No ☐ 1 Yes

Drainage: ☐ 0 No ☐ 1 Yes

Surgeon (initials or code) : .....

Type of revision:
☐ 1 Total exchange (all previously inserted components exchanged)
☐ 2 Exchange of Femoral component
☐ 3 Exchange of Tibial component
☐ 4 Exchange of Patellar button
☐ 5 Exchange of poly/insert
☐ 6 Total implant removal (all previously inserted components)
☐ 7 Removal of component(s) (what) .....
☐ 8 Addition of component(s) (what) .....
☐ 9 Arthrodesis
☐ 10 Amputation
☐ 11 Other (what) .....

Reason for the revision:
If more than one reason, mark the main reason
☐ 1 Loosening (where) .....
☐ 2 Poly wear (where) .....
☐ 3 Fracture (periprosthetic)
☐ 4 Deep infection
☐ 6 Suspected infection
☐ 7 Instability (not of the patella)
☐ 8 Femoropatellar problem
☐ 9 Suboptimal situs of the previous implant
☐ 8 Other (what) .....

Anesthesia:
☐ 1 General ☐ 2 Epidural ☐ 3 Spinal ☐ 4 Other .....

Tourniquet: ☐ 0 No ☐ 1 Yes

LIA: (local infiltration analgesia)
☐ 0 No ☐ 1 Yes ☐ 2 Catheter left in knee (for later injection)

Antithrombotic prophylaxis:
☐ 0 No ☐ 1 Yes start pre-op. ☐ 2 Yes start post-op.
Name:..... dose:..... no. per day:.....
Planned length of treatment (days): .....

Prophylactic antibiotics:
☐ 0 No
☐ 1 Yes: Name:..... dose:..... no. per day:.....
Start Preop. ☐ 0 No ☐ 1 Yes min. before surgery :.....
Planned length of treatment (days): .....

ASA classification: (according to anesthesiologist)
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Weight (kg): ..... **Height:** (cm): .....

Start of surgery (skin incision) **Time:** ..... : .....

End of surgery (skin closed) **Time:** ..... : .....

Remember to put stickers on the back !!!

Put stickers for parts used on femur here
(femoral component, stem, augments ....)

Put stickers for parts used on tibia here
(tibia component, inlay, stem, augments ....)

---

remember the cement sticker!

Put other stickers here
(cement, patellar button ....)

<u>In case of revision:</u>
Send a copy of op. report and discharge letter

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