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Annual Report 2007

The Swedish Knee Arthroplasty Register

Dept. of Orthopedics, Lund University Hospital

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This 2007 annual report of the Swedish Knee Arthroplasty Register (SKAR) concerns primary arthroplasties reported during 2006. It is based on the content of the register as of October 1st 2007.

The register has moved to new premises at the University Hospital in Lund. The new adress is: Klinikgatan 22, plan 2, Wigerthuset, 221 85 Lund. The phone and fax numbers are the same.

At the beginning of the year Catharina Nilsson (cn@knee.se) took over as project secretary and in March, Annette W-Dahl PhD, RN joined the register team.

The interest in the results of individual units has increased substantially over the years. In spite of earlier restraint, few years ago we started to officially publish the relative risk of revision for the different hospitals. Considering the fact that it is more likely that low-volume units will show extremely good or bad results we decided to use the so-called ”frailty analysis” in order to adjust for differences in volumes among the units. The statistical background for using this method is described in the article: Variation in outcome and issues in ranking hospitals: An analysis from the Swedish Knee Arthroplasty Register. Acta Orthop. 2006 Jun;77(3):487-93. (http://www.actaorthop.org). - However, it is important to realize that we have not taken into account possible differences in case-mix and that the results are historical (the surgery having been performed 1-11 years prior to the analysis).

As other so-called ”Quality Registers” within the Swedish healthcare system, the SKAR has received economic support from the government. At the turn of the year 2006/2007 the responsibility and administration regarding financial applications was moved from the National Board of Health and Welfare to the Swedish Association of Local Authorities and Regions (SALAR). At their request, the Register has delivered 5- and 10- year survival data for the different county councils as well as information on the number of primary operations and early revisions performed for infection. The SALAR has used this, as well as information from other registers, to summarize and disclose results of individual councils in the publication ”Öppna jämförelser av hälso- och sjukvårdens kvalitet och effektivitet”. The purpose was to stimulate improvement in the health care system.

The register continues to request that the units use the paper form when reporting their surgeries and that they provide one set of the stickers from the implant packages. Although it seems attractive to input data using the Internet, we still feel that the technology and flow of information from the implant distributors is not good enough in order for us changing our practice. Instead we plan to discuss with the SKAR contact physicians at the upcoming annual meeting if it would not be appropriate to increase the amount of information reported. Additional information regarding use of torniquett, drainage, timing of antibiotic prophylaxis etc. could provide a basis for continous quality improvement.

For those participants that are interested, the register can provide information by the Internet. The NKO (National Competence Center within the area of musculoskeletal disorders) has built a computer platform on which the participating units have their own “folder” which the contact physician can access after having been provided with a user name and password (from the SKAR project secretary). The folder contains among other things patient related data reported from the unit (Excel file) that includes information about patients that have been revised elsewhere. As it

is unclear if all the contact physicians have a current password we deliver the same information on a CD. It is our hope that this information will help the participating units to perform their own analyses.

As previously the report consists of 3 parts. The first part describes the routines of the register, epidemiology and general results. The second part contains information regarding what has been reported to the register during 2006 as well as analyses covering the 10-year period 1996-2005. The third part is specific for each reporting unit and contains lists with information regarding all the operations reported by the unit in 2006. One list is sorted by ID and the other by the date of operation.

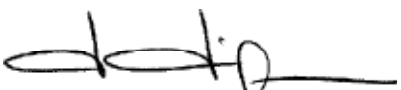
It is our hope that the lists will be compared to locally available information in an attempt to find and correct any errors in the registration. Further, we feel that it is important that information about the report is passed on at hospital meetings so that the content can be discussed and analyzed. As described above, for the third time openly we publicly render the risk ratios of individual units regarding cemented TKA in patients with osteoarthritis.

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

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

We at the knee register center in Lund want to thank you for your important contribution during the last years and ask you to analyze and circulate the presented information.

Lund, October 16th, 2007
On behalf of the Swedish Knee Arthroplasty Register



Lars Lidgren

Otto Robertsson

CONTENT

Definitions

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

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

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

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

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

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

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

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

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

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

Filling in the Knee Register form

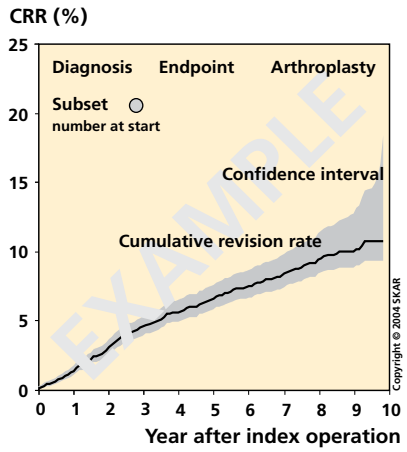
The Knee Register uses a form that is recommended to be filled in during the operation, (by a nurse or other attending staff). The implant stickers (containing the Part No's and Lot No's) for all used implants are to be affixed to the form. Besides the ID of the patient, the date of operation, diagnosis,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

How the register compares implants

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

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

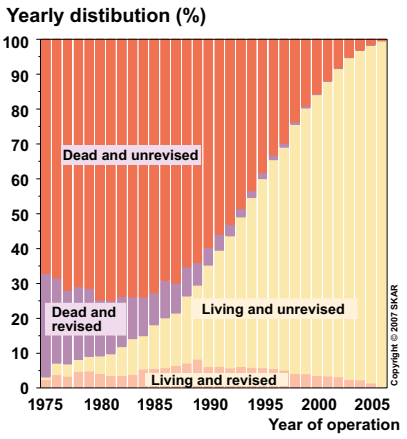
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared.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



CRR curve example.

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

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



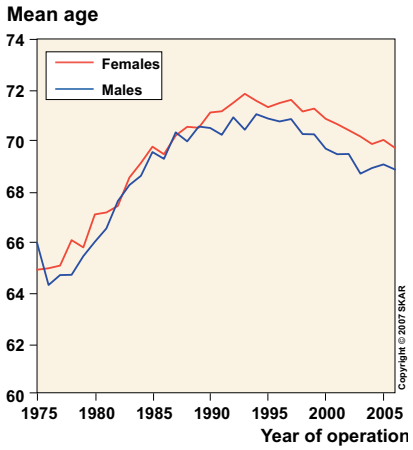
The status in 2006 for each yearly batch of patients operated since 1975.

Gender and age distribution

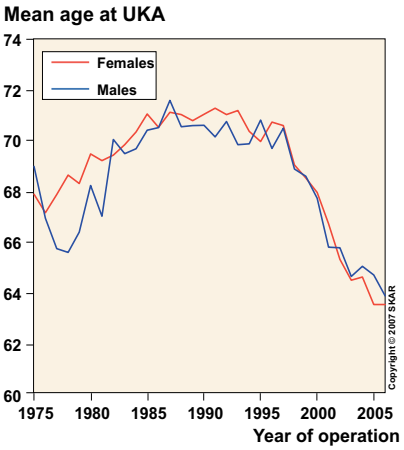
Between 1975 and 1994 the mean age at primary operation increased from 65 years to almost 72 years. The main reason was the relative large increase in number of operations for the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution of 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 2006 it was good 69 years and slightly higher for females (figure on the right).

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

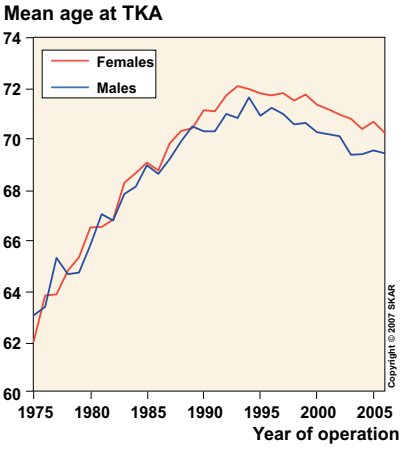
When comparing series of patients operated during different periods, the change in the mean age makes it necessary to account for age by use of regression or to analyze different age groups separately.



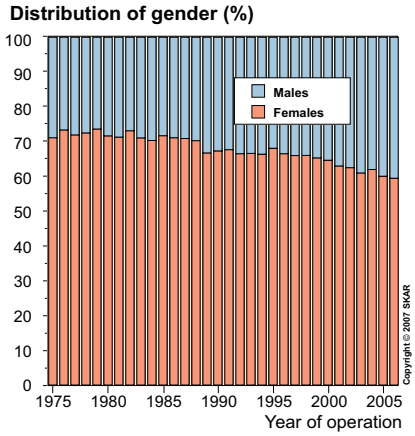
The mean age of patients at surgery (all types of implants) increased until the mid-nineties when it started to decrease.



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



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



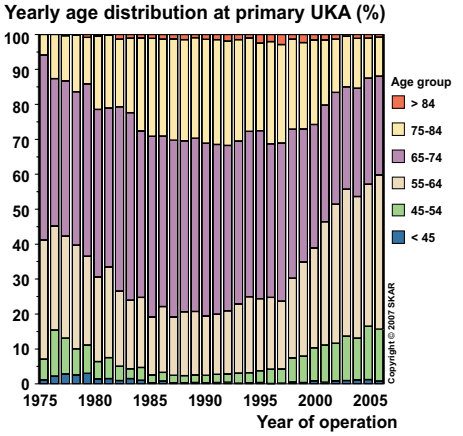
The proportion of males has increased slightly over the years.

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

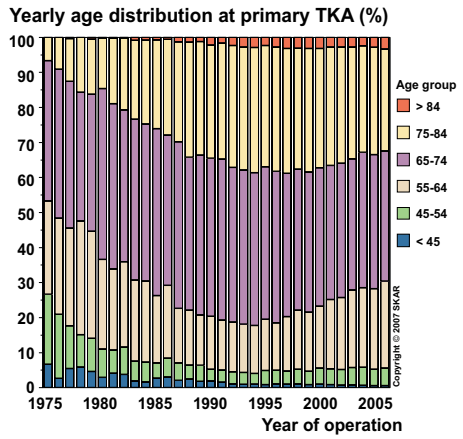
The figure to the right shows the relative number of operations performed on the different age groups during the years. In somewhat different manner than the mean age (last page) it shows how the relative proportion of the older groups increased until the mid-nineties after which their share again started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

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

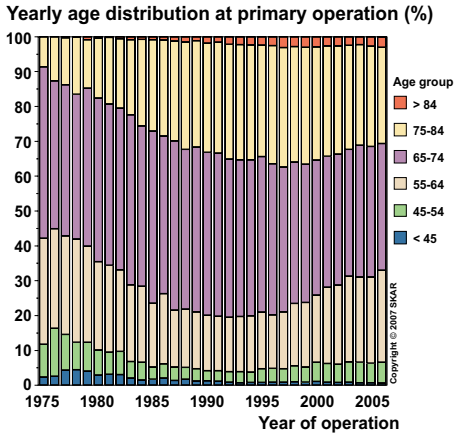
In UKA the relative proportion of patients less than 64 years of age has doubled after 1997, i.e. during the time when mini-invasive surgery catches on in Sweden. However, it has to be kept in mind that the actual number of UKA diminished by 15% during these years in contrast to TKA which doubled in number of operations. This implies that although the relative number of TKA among younger age groups has not increased as much as for UKA, the actual number of patients 45-65 years of age having a TKA tripled. This can be explained by an increased confidence in that knee arthroplasty is of benifit for younger patients.



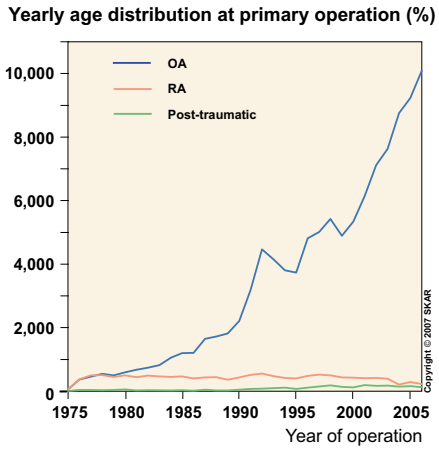
The relative distribution of primary UKA arthroplasties among different age groups.



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



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



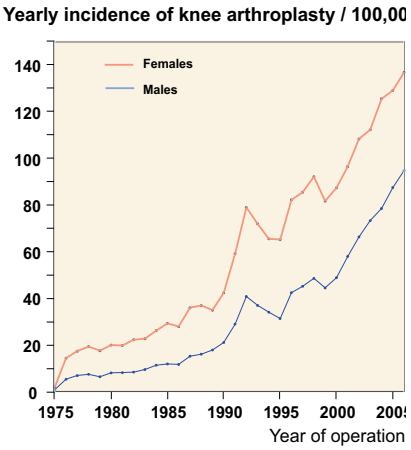
The yearly number of arthroplasties for different diagnoses.

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

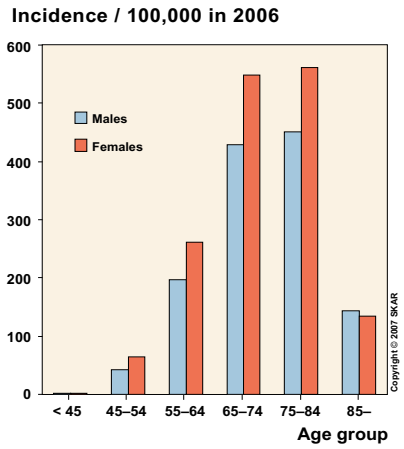
Incidence and prevalence

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

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



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

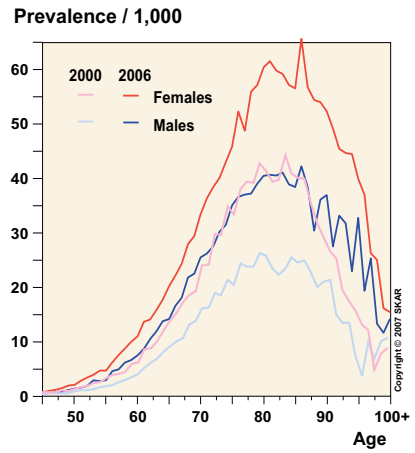


Incidence of primary knee arthroplasty in 2006 per 100,000 inhabitants (males and females) in the different age groups.

The figure to the left shows the age-specific incidence for different age groups in 2006. It is highest among those between 65 and 84 years of age, at which age, knee arthroplasty is almost 10 times more common than among those 45-54 years of age and 3-4 times more common than among those 85 years or older. The surgery is more common in women in all age groups but the oldest one.

As the incidence is so dependent on age and because the age distribution among different nations may vary, it is difficult to compare different countries without performing some form of age standardization.

The increase in number of operations causes a rise in the number of patients walking around with knee implants. The graph on the left shows the prevalence in 2006 i.e. the number of patients per 1,000 inhabitants in different age groups with a knee implant. For both men and women it peaks around 80-85 years of age. The decrease after 85 years of age is probably a sign of that this group is provided below its actual needs. Compared to the prevalence in 2000 the influx seems to be insignificant after 87 years of age. The increase in prevalence for the oldest age groups is mainly caused by ageing of previously operated patients by six years. Thus, it seems that within few years there will be a steady state among the elderly in which at least one in fifteen women has a knee implant. Further increase is still possible through widening of indications.

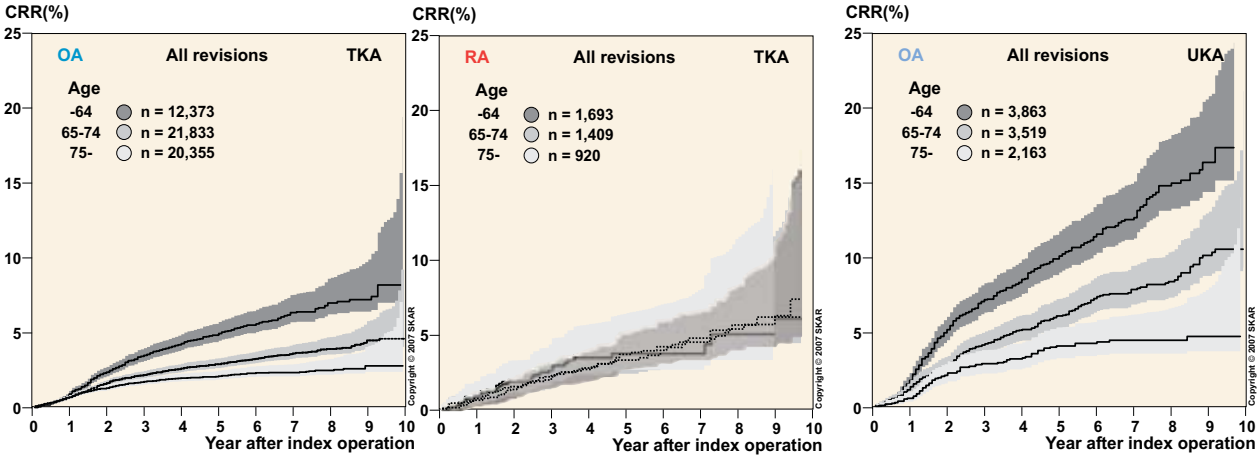


The prevalence of knee arthroplasty in 2000 and 2006. One of fifteen elderly women has a knee arthroplasty.

Factors that influence the revision rate

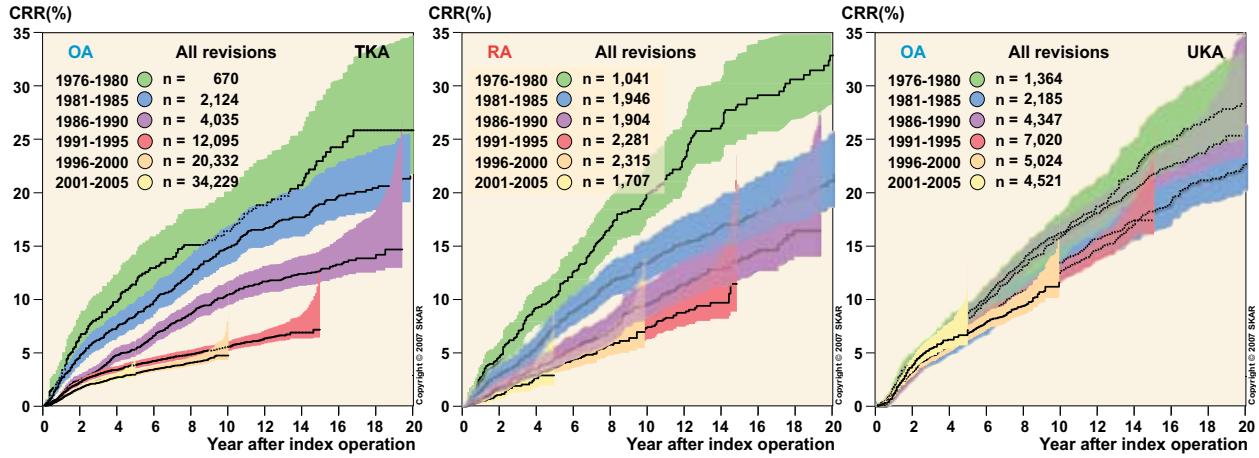
Primary disease – Early it became evident that patients with different primary disease, e.g. rheumatoid arthritis (RA) and osteoarthritis (OA) followed a different postoperative course with differences in the revision rate. Therefore the registry has always produced separate curves for these diagnoses.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

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

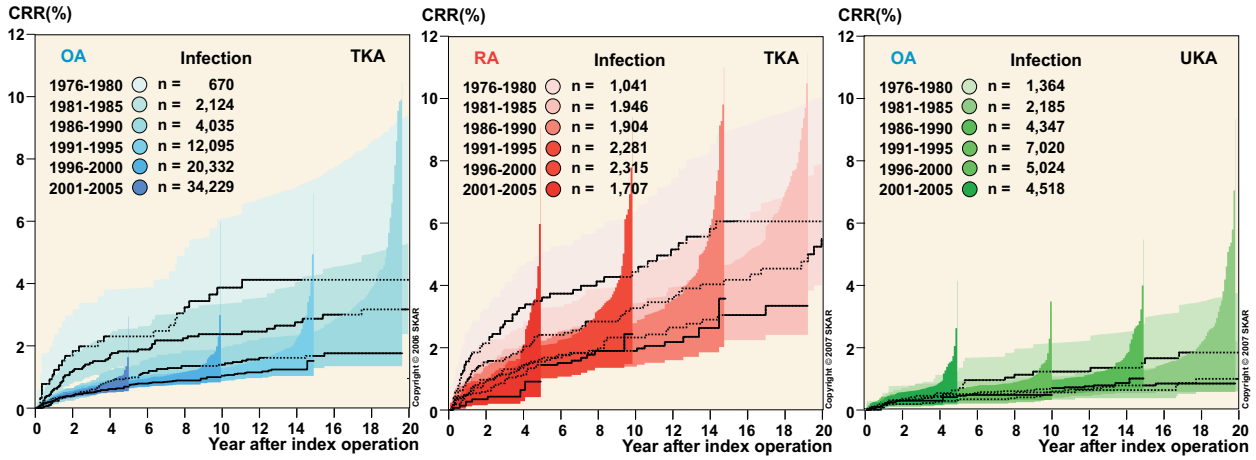


The differences in CRR (1996–2005) between the 3 age groups <65, 65–75, >75 were significant for OA operated on with TKA and UKA but nor for RA operated on with TKA.

Year of operation – During 1975-1995 we find for TKA that there has been a constant reduction in risk of revision. The reduction can't only be explained by an increasing mean age of patients at surgery. Even if improved implants may provide some explanation, reduction has also been seen for unchanged implants (Lewold et al. 1993). This indicates improvement in technique (cementing/seating) or in patient selection which has caused us to take into account the time-period during which the operations were made, when comparing implants by Cox regression. Improvement with time has not



Comparing the CRR of operations performed during the time periods 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000 and 2001-2005 we found improvement for the TKA until 1995 but not for UKA.



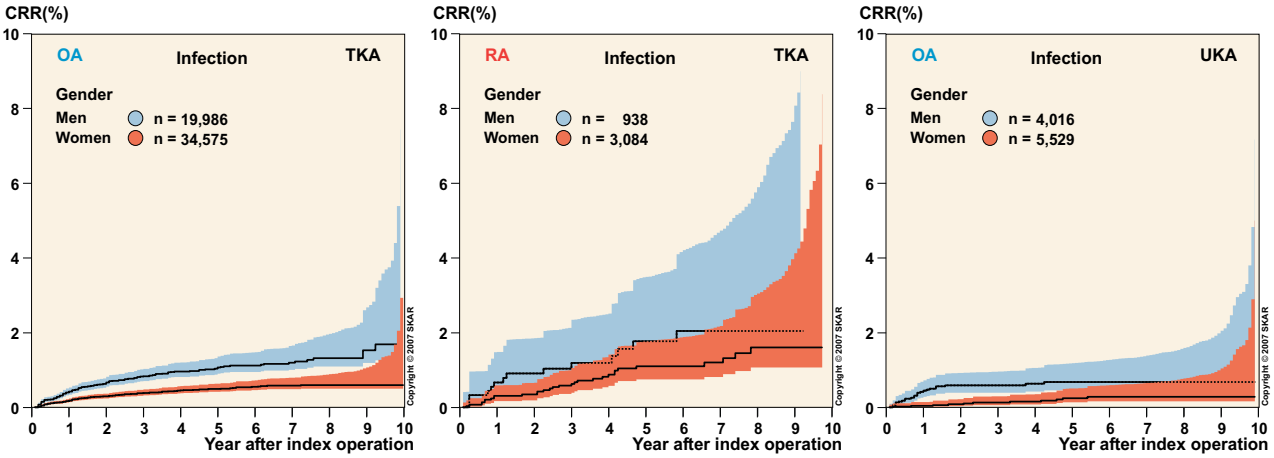
Comparing the CRR of operations performed during the time periods 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000 and 2001-2005 using only revision for infection as end-point, we found improvement with time for both TKA and UKA.

been seen for the UKA, which probably is caused by some newer models and methods with inferior results. Furthermore, the relative number of UKA operations has decreased which may have reduced the surgical routine which has been found to be of importance. Further, changes in implants, instruments, surgical technique and approach may have resulted in a new or prolonged learning curve.

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

Gender – Analyzing OA in the period 1995-2004 (Cox regression), no significant difference in CRR was found between the sexes, whether it was for TKA or UKA. Overall, there was neither any significant difference between the sexes for RA (TKA). However, there was a sex difference regarding revision for infection (see below).

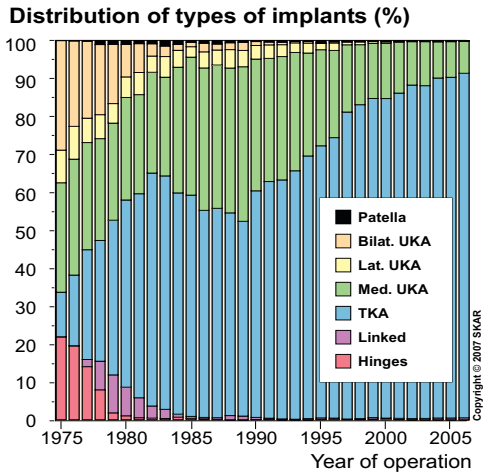
It is well known that RA patients have a greater risk of infection which has been ascribed to the effect of corticosteroid and immunosuppressive medications. Still, it is not as obvious why men more often are having their knee arthroplasties revised for infection than women. Either males are more prone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



Using the end-point revision for infection, the CRR (1996–2005) shows in TKA for OA that men are more affected than women (RR 2.2). 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 3.2 times the risk of women of becoming revised for infection. In TKA, patients with RA are more affected than those with OA (RR 1.6).

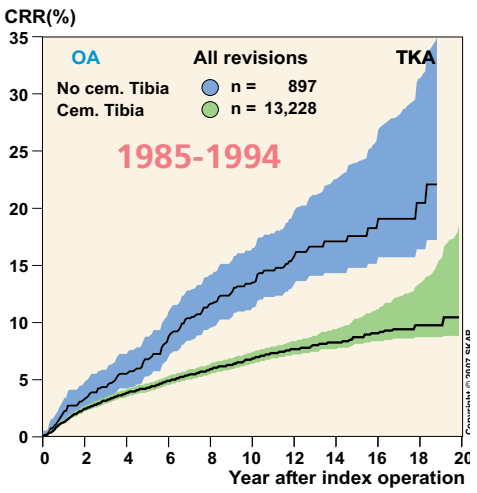
Type of implant – The modern condylar tricompartmental knee implant (TKA) was developed in the seventies when hinged and unicondylar implants were already available. When the register started in 1975, TKA had just been introduced in Sweden, which is the reason for hinges and uni's amounting for the larger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

Although UKA has been found to have a substantially higher CRR than TKA (see figures on page 6), the number of serious complications such as infections/arthrodeses/amputations is much less. If a primary UKA is revised to a TKA at a later time, the risk of re-revision is not significantly increased compared to the risk of revision if the patient had primarily been treated with a TKA. As the UKA implants are less expensive than the TKA, the increased number of revisions due to their use has not resulted in additional cost. When asked, patients with TKA and UKA seem equally satisfied with their knees. In summary we conclude that it cannot be considered wrong to use UKA implants in OA patients with unicompartmental disease.

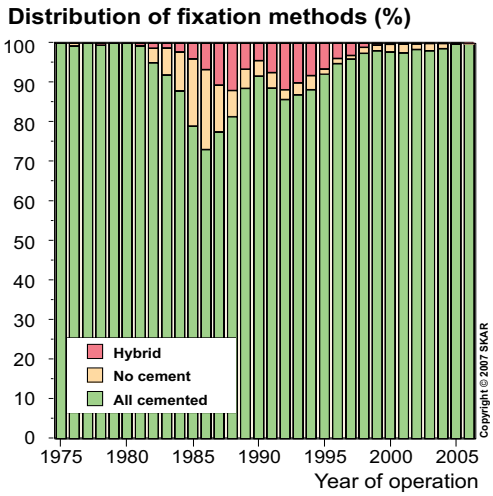


The relative yearly distribution of implant types used for primary surgery.

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

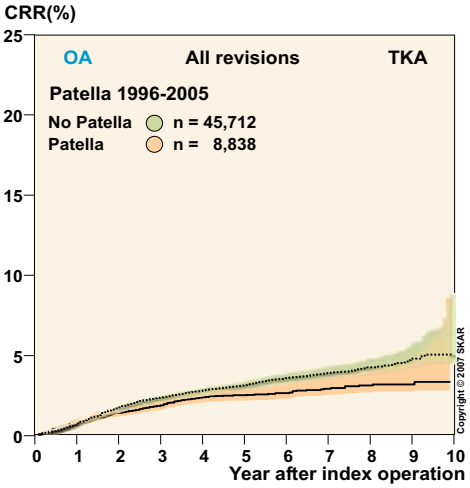


The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.

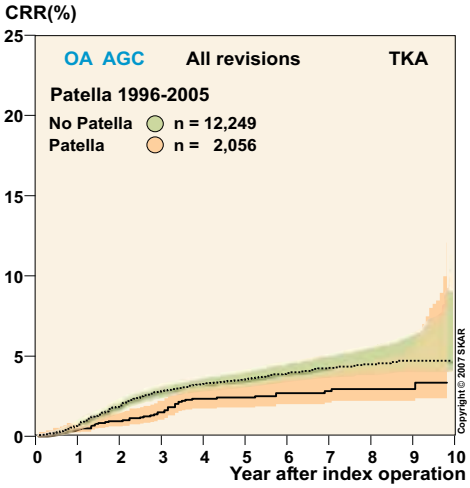


The relative yearly distribution regarding the use of cement for fixation.

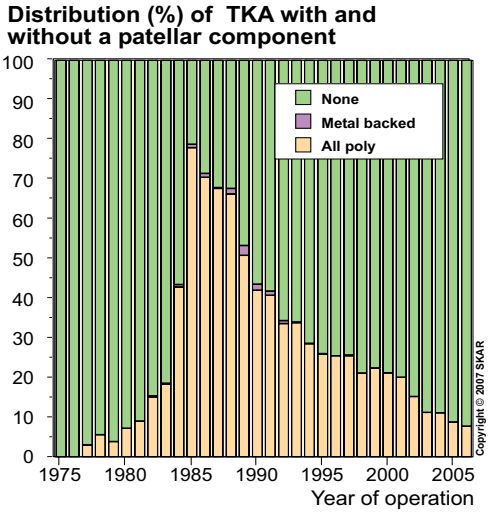
Patellar button in TKA – Estimating how the use of a patellar button affects the revision rate is complex. The use of a patellar button varies with the brand of prosthesis used and its use also has lessened in the recent years. Earlier, when analyzing all TKA implants together, we did not find that the use of patellar button influenced the revision rate. However, when analyzing different time-periods we found that during the eighties, when patellar buttons were used in half of the cases, its use had a negative effect. Since then its use has continuously diminished and in 2006 a button was used in less than 10% of the TKA cases. At the same time, as we have described in previous reports, the curves have turned to the advantage of the patellar button.



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



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



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

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

For the current period (1996–2005) we found for TKA patients operated for OA that compared to TKA using a patellar button, the CRR was 1.3 (1.1-1.6) times higher if no button had been used (see figure above). If only AGC implants were analyzed, the risk for revision without a patellar button was 1.6 (1.2-2.2) times higher (see figure above right). For RA we now also found significantly higher risk when not using a button (times 1.9 (1.2-3)). The increased frequency of revisions is caused by the need for secondary patellar resurfacing because of femoropatellar pain.

It can then be debated if one should take this 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 24-25) we separately account for the results of TKA with and without a patellar button. Finally, when comparing the risk of revision for the different units (page 31), we include the use of patellar button in the regression analysis.

cont. Use of patellar button – The use of patellar button varies between countries. The Danish knee arthroplasty register (http://www.ortopaedi.dk/registre.htm) reports that a patellar button is used in 72% of TKA cases (2005) while it is only used in 4% of cases in Norway (2006) according to the Norwegian arthroplasty register (http://www.haukeland.no/nrl/).
According to the 2006 annual report of the Australian Joint replacement Register (http://www.dmac.adelaide.edu.au/aoanjrr/index.jsp), patellar button was used in 40% of the Australian cases. It was also reported that compared to TKA using a patellar button, TKA without a button had 1.4 (1.3-1.6) times higher risk of becoming revised which is a similar to the Swedish findings.

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

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

Historically, the most commonly used implants in Sweden have also been those with the lowest CRR. This may be due to a good design but also due to the increased surgical routine when the same implant is often used. Models that have been found to have considerably inferior results most often have 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.

Types of operation and implants in 2006

10,544 primary arthroplasties reported in 2005 by type and region

TYPE	Stockholm Gotland	Uppsala Örebro	Southeast	South	West	North
Hinge	–	–	–	–	–	–
Linked	3	11	11	10	12	3
TKA	1,853	2,135	1,174	1,569	1,724	1,127
UKA medial	245	228	55	88	227	55
UKA lateral	3	1	1	–	–	–
Patella	2	–	–	6	1	–
Total:	2,106	2,375	1,241	1,673	1,964	1,185

Implants for primary TKA in2006

	Number	Percent
PFC Sigma	2,935	30,6
NexGen	2,177	22,7
AGC	1,813	18,9
Duracon	916	9,6
F/S MIII	914	9,5
Triathlon	158	1,6
Natural	150	1,6
Vanguard	147	1,5
Profix	131	1,4
PFC Mobile Bearing	92	1
Kinemax	60	0,6
Other	90	0,9
Total :	9,583	100

Implants for primary UKA in 2006

	Number	Percent
Link UKA	341	37,8
Oxford-UKA	230	25,5
MillerGalante-UKA	202	22,4
Genesis	66	7,3
Preservation	32	3,5
Other	32	3,5
Total :	903	100

78 units reported to the registry during 2006 which were all units performing elective knee arthroplasty surgery. Although 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 9,707 in 2005 to 10,544 or by 8.6%. The increase was 9.7% for TKA while UKA was reduced by 1%.

In 2006, 605 revisions were performed of which 127 were secondary revisions. In 405 of the revisions the primary procedure had been a TKA and in 196 cases an UKA. One has to take into consideration that since 1996 the use of UKA has been reduced by a third while the use of TKA has more than doubled. Thus, the proportion of primaries and revisions does not give a true picture of the risk for revision which is better estimated using survival statistics.

De 3 most common implants for primary TKA in each region in 2006

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	PFC Sigma	1,038	F/S MIII	325	NexGen	150	340
Uppsala/Örebro	NexGen	821	AGC	529	F/S MIII	328	457
Southeast	PFC Sigma	444	NexGen	403	AGC	269	58
South	PFC Sigma	591	Duracon	373	AGC	276	329
West	AGC	482	NexGen	422	PFC Sigma	262	558
North	NexGen	381	PFC Sigma	365	AGC	146	235

De 3 most common implants for primary UKA in each region in 2006

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	MillerGalante	140	Link	73	Oxford	35	–
Uppsala/Örebro	Link	140	Genesis	45	Preservation	30	14
Southeast	Link	26	Genesis	17	Oxford	7	6
South	Link	57	Oxford	27	EIUS	2	2
West	Oxford	161	MillerGalante	29	ZUK	17	20
North	Link	29	MillerGalante	18	ZUK	8	–

Bone cement and minimally invasive surgery in 2006

Use of cement in primary surgery during 2006

	Primary TKA		Primary UKA	
No components inserted without cement	9,393		900	
Only the femoral component without cement	2			
Only the tibial component without cement	2			
The femur- and tibial components without cement	13			
Only the patellar button without cement	157			
Information missing	16		3	
Total	9,583		903	
	Number	Percent	Number	Percent
Palacos Genta	4,935	51,6	473	52,4
Refobacin-bonecement	3,604	37,7	279	30,9
Refobacin-Palacos R	574	6,0	106	11,7
Cemex Genta	333	3,5	35	3,9
Palacos	8	0,1		
Gentamicin	5	0,1		
CMW SmartSet Genta	9	0,1		
CMW Genta	2	0,0		
Copal	3	0,0		
SIMPLEX Tobramycin	1	0,0		
Home-mixed	2	0,0	2	0,2
Information missing	94	1,0	8	0,9
Total:	9,570	100,0	903	100,0
All implanted components without cement	13			
Grand Total	9,583		903	

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

Type of bone cement

In Sweden, the use of bone cement is the most common method for fixing components to the bone. During 2006, only 0.1% of all TKA were completely without cement (1.2% in 2004) and cement was used in all UKA. Previously there was only one manufacturer of the Palacos cement type but presently there are several generic copies. Combined these cements were used in 96% of the cemented cases during 2006. As only 0.1% of the TKA were inserted completely without cement the variation is minimal and statistical comparisons are not meaningful.

We want to remind the surgical units to report the type of bone cement used using the stickers that normally are to be found in the cement packages.

Minimally invasive surgery in UKA

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

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

From the start of the registration in 1999, the popularity of minimally invasive surgery for UKA continued to increase until 2003 when it was being used in 58% of cases. In 2004 the proportion of MIS diminished to 53% after which it increased again. In 2006 MIS was used in 59% of the UKA cases.

The Register has previously reported that there were indications that the mini-incision might increase the revision rate. Further analyses suggest that the method may initiate a new learning process which however can be shortened if the surgeons are offered training before they start using the method.

The type of incision for 912 primary UKA in 2005

	Standard incision	Mini-incision	Missing
Link-Uni	228	109	4
Genesis	40	22	4
MillerGalante	38	159	5
Preservation	27	3	2
Oxford	11	215	4
Other	8	22	2
Total	352	530	21

The use of patellar button for TKA in 2006

The use of patellar button is heavily dependent on the implant model used. Thus, in primary arthroplasty, surgeons using the Freeman-Samuelson and Kinemax implants commonly resurface the patella while those using the Natural and NexGen infrequently do so.

As last year, the northern region during 2006 was the one using a patellar button most infrequently while the western region most often used a patellar button (see figure below). Overall, the differences between the regions have diminished somewhat.

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

In Sweden, females operated on with TKA have their patella resurfaced slightly more often than males. In the whole material from the start to the end of 2006, 22.5% of the women had their patella resurfaced compared to 19.6% of the males which is a significant difference. An explanation that has been suggested claims that femoropatellar pain is more common in females. However, during 2006 8% of the men had a patellar button compared to 7.6% of the women (not a significant difference).

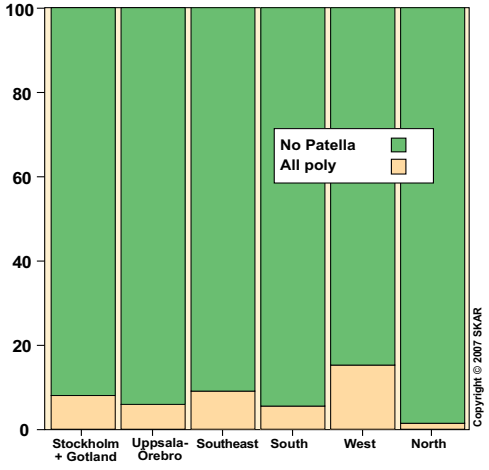
Looking at the relative use of patellar button in the different age groups during 2006 (see figure below) it can be noted that the youngest category of patients of patients less than 45 years of age is the one that most often has a patellar resurfacing. This is a change compared to 2005 when there were small differences between the groups and the oldest age group relatively most often had a patellar resurfacing.

Some discussion regarding how the frequency of revisions is influenced by the use of patellar button can be found on page 9 together with CRR curves for TKA inserted during the current period of 1996-2005, with and without a button respectively.

Use of patellar button with different TKA implants in 2006

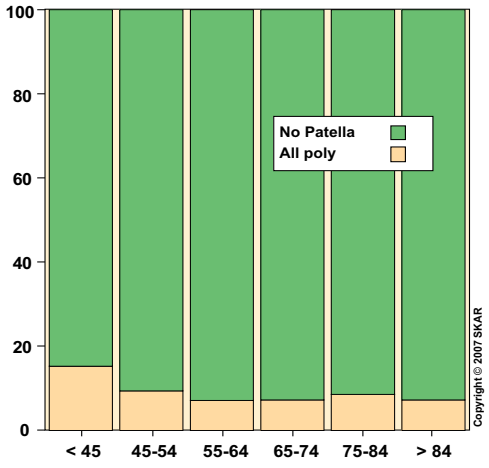
	No Patellar button	%	Patellar button	%
PFC Sigma	2,838	96,7	96	3,3
NexGen	2,160	99,2	17	0,8
AGC	1,581	87,2	232	12,8
Duracon	812	88,6	104	11,4
F/S MIII	706	77,3	207	22,7
Natural II	150	100,0	0	0,0
Triathlon	144	91,1	14	8,9
Vanguard	141	95,9	6	4,1
Profix	122	93,1	9	6,9
PFC Mobile Bearing	86	93,5	6	6,5
Kinemax	13	22,0	46	78,0
Other	84	93,3	6	6,7
Total	8,837	92,2	743	7,8

Distribution (%) of patellar resurfacing in the regions 2006



The figure shows the relative proportion in 2006 of TKA with and without patellar button in the different regions.

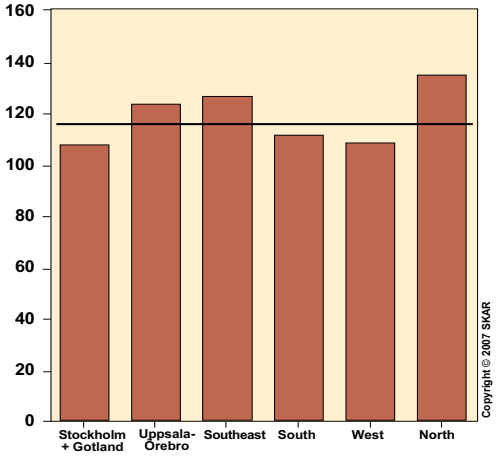
Distribution (%) of patellar resurfacing in different age groups 2006



The figure shows the relative proportion in 2006 of TKA with and without patellar button in the different age-groups.

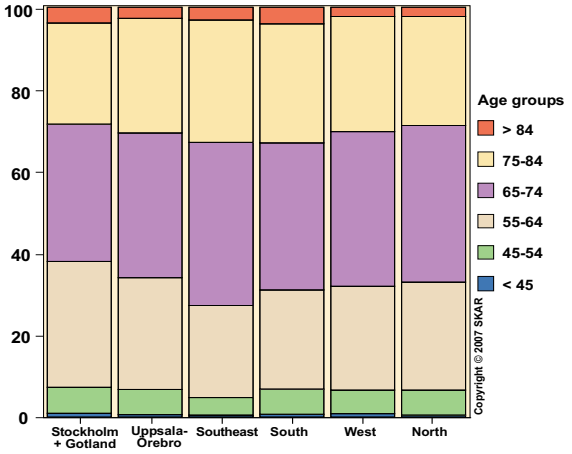
Age distribution and incidence in the regions 2006

Incidence per 100 000 in the regions in 2006 (all types of primary implants)



The incidence per inhabitants in respective region is highest in the North region and lowest in Stockholm/Gotland (the black line shows the mean for the whole country).

Distribution (%) of gender in the regions during 2006 (all types of primary implants)



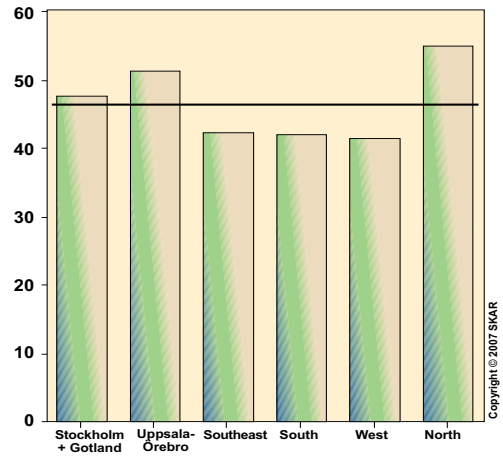
The age distribution at primary surgery varies among the regions. The Southeast region has relatively the largest proportion of patients older than 64 years.

The figure above shows the incidence of primary knee arthroplasty per 100,000 inhabitants in respective regions. It is evident that the incidence is highest in the North region but lowest in the West region.

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

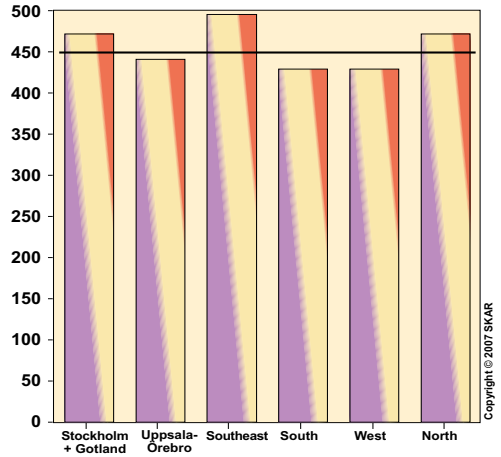
Even if such summary information can provide information on the distribution of resources in the region the variation in age distribution does that it can't be used to decide if the principles of treatment differ in the regions. Differences between the regions can partly or completely be caused by variations in the age distribution for the inhabitants. The figure above shows that the relative number of operations in patients over 64 years of age is lowest in the Stockholm/Gotland region. However, this can be explained by the fact that this region has relatively the highest number of younger inhabitants. Thus comparing the incidence in patients younger and older than 65 years (figures below), shows that older patients do not seem to be less often treated in the Stockholm/Gotland region.

Incidence in 2006 for younger than 65 per 100,000 (all types of primary implants)



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

Incidence in 2006 for 65 years or older per 100,000 (all types of primary implants)



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

Number of primaries per unit and year

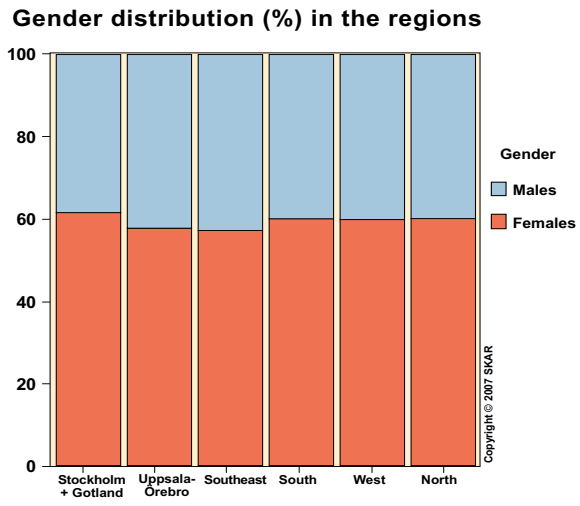
Klinik	1975-2001	2002	2003	2004	2005	2006	Totalt	Percent
Alingsås	291	73	87	97	145	163	856	0,7
Arvika	323	10	35	124	120	84	696	0,5
Avesta	67						67	0,1
Boden	1,617						1,617	1,3
Bollnäs	517	61	179	202	242	229	1,430	1,1
Borås	1,664	63	74	116	125	112	2,154	1,7
Carlanderska					21	31	52	0,0
Dalslands Sjukhus	38	27	16				81	0,1
Danderyd	1,338	141	118	125	172	186	2,080	1,6
Eksjö-Nässjö	1 522	101	86	106	114	98	2,027	1,6
Elisabethkliniken	5	13	36	68	88	76	286	0,2
Enköping	246	117	118	104	144	183	912	0,7
Eskilstuna	1 ,416	25	15	21	40	57	1,574	1,2
Fagersta	71						71	0,1
Falköping	567	49	113	138	122	133	1,122	0,9
Falun	2,232	153	186	264	150	178	3,163	2,5
Frölunda Spec.	10	96	73	68	94	127	468	0,4
Gothenburg Med Center			41	84	92	87	304	0,2
Gällivare	622	43	57	72	81	120	995	0,8
Gävle	2,189	165	158	77	67	63	2,719	2,1
Halmstad	1,285	132	140	128	160	189	2,034	1,6
Helsingborg	1,349	116	89	51	43	18	1,666	1,3
Huddinge	1,452	89	89	116	80		1,826	1,4
Hudiksvall	687	77	79	73	79	73	1,068	0,8
Hässleholm	1,505	296	390	434	529	527	3,681	2,9
Jönköping	1,280	94	111	136	106	106	1,833	1,4
Kalix	103	36	42	34			215	0,2
Kalmar	1,255	125	130	132	134	130	1,906	1,5
Karlshamn	705	102	157	166	184	178	1,492	1,2
Karlskoga	791	102	111	95	73	92	1,264	1,0
Karlskrona	1,069	19	10	7	6	6	1,117	0,9
Karlstad	2,096	133	132	200	170	215	2,946	2,3
Karolinska	705	198	180	178	280	119	1,660	1,3
Kristianstad	1,297						1,297	1,0
Kristinehamn	252						252	0,2
Kullbergska sjukhus	435	97	72	96	121	124	945	0,7
Kungsbacka		1	9	11	12	4	37	0,0
Kungälv	453	123	106	68	164	134	1,048	0,8
Köping	550	113	106	94	99	245	1,207	0,9
Landskrona	1,264	199	238	215			1,916	1,5
Lidköping	298	104	133	125	186	160	1,006	0,8
Lindesberg	659	73	80	84	116	119	1,131	0,9
Linköping	1 ,450	122	127	33		1	1,733	1,4
Linköping medical center	11						11	0,0
Ljungby	758	70	53	87	86	83	1,137	0,9
Ludvika	338						338	0,3
Luleå	2						2	0,0
Lund	2,228	37	49	43	51	40	2,448	1,9
Lycksele	197	34	37	39	61	59	427	0,3
Löwenströmska	405						405	0,3
Malmö	1,902	44	32	31	46	56	2,111	1,7
Mora	728	92	107	98	99	98	1,222	1,0
Motala	324	61	94	282	409	444	1,614	1,3
Movement Halmstad			7	6	63	98	174	0,1
Mölndal	810	74	64	70	88	2	1,108	0,9
Nacka	202						202	0,2
Nacka-Proxima					8	67	75	0,1
Norrköping	1,677	100	89	23			1,889	1,5
Norrtälje	437	45	67	66	79	95	789	0,6
Nyköping	593	58	81	72	96	105	1,005	0,8
Ortopediska huset	163	153	156	189	228	410	1,299	1,0
Oskarshamn	522	93	79	111	187	250	1,242	1,0
Piteå	147	64	78	84	179	258	810	0,6
S:t Göran	3,210	397	406	447	419	466	5,345	4,2

(cont.)

Number of primaries per unit and year (cont.)

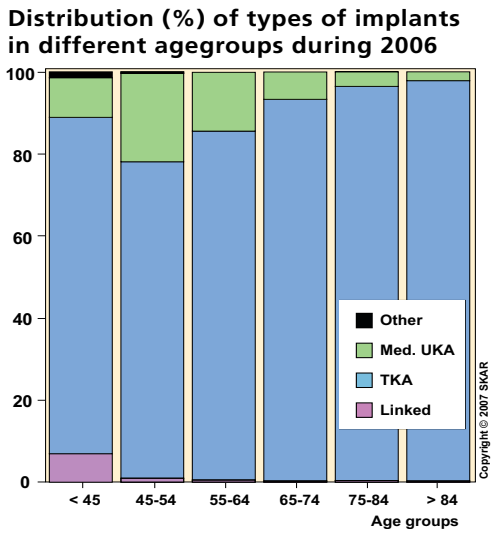
Klinik	1975-2001	2002	2003	2004	2005	2006	Totalt	Andel
Sabbatsb.närsjh.	239	161	269	152			821	0,6
Sabbatsberg	628						628	0,5
Sahlgrenska	1,102	69	77	94	99	70	1,511	1,2
Sala	115						115	0,1
Sandviken	299						299	0,2
Sergelkliniken		27	76	57			160	0,1
Simrishamn	301	145	162	209	204		1,021	0,8
Skellefteå	556	57	49	83	90	96	931	0,7
Skene	521	107	75	70	68	72	913	0,7
Skövde	1,746	89	98	70	104	107	2,214	1,7
Sollefteå	287	85	102	103	107	119	803	0,6
Sophiahemmet	361	96	131	125	176	112	1,001	0,8
Stockh. Specialistvård	34	85	92	125	143	157	636	0,5
Sunderby	126	50	41	66	38	31	352	0,3
Sundsvall	1,705	122	161	144	75	85	2,292	1,8
Säffle	453	30					483	0,4
Söderhamn	279					1	280	0,2
Södersjukhuset	2,192	110	108	101	127	311	2,949	2,3
Södertälje	318	94	81	84	81	103	761	0,6
Torsby	693	71	47	69	92	77	1,049	0,8
Trelleborg	1,356	221	194	233	396	488	2,888	2,3
Uddevalla	1,787	130	108	115	185	184	2,509	2,0
Umeå	1,364	58	64	109	139	161	1,895	1,5
Uppsala	1,641	88	93	143	111	129	2,205	1,7
Varberg	1,196	153	114	140	125	171	1,899	1,5
Visby	676	52	32	42	46	80	928	0,7
Vänersborg-NÄL	936						936	0,7
Värnamo	845	83	85	113	94	114	1,334	1,0
Västervik	862	92	91	124	118	98	1,385	1,1
Västerås	1,336	63	44	54	82	86	1,665	1,3
Växjö	1,169	71	45	81	79	106	1,551	1,2
Ystad	915	57	80	69	48	1	1,170	0,9
Ängelholm	698	139	118	149	54	170	1,328	1,0
Örebro	1,986	114	102	133	119	141	2,595	2,0
Örnsköldsvik	750	84	91	197	150	146	1,418	1,1
Östersund	1,017	75	96	83	112	110	1,493	1,2
Östra sjukhuset	1,326	125	82	69	75	120	1,797	1,4
	82,144	7,813	8,330	9,196	9,795	10,544	127,822	100

Gender distribution in the regions



The proportion of females having knee arthroplasty is good 60% in all the regions. Stockholm/Gotland has the largest proportion but then the region also has most women.

Type of implants in different age groups



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

Implants and revisions 1996–2005

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

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

Implants for primary TKA during 1996-2005

	Number	Percent
AGC	15 879	26,1
PFC Sigma	14 632	24,0
F/S MIII	6 980	11,5
Duracon	6 850	11,2
NexGen	6 809	11,2
Kinemax	2 487	4,1
Scan	1 880	3,1
PFC	1 707	2,8
Profix	653	1,1
AMK	614	1,0
MillerGalante2	596	1,0
LCS	461	0,8
Natural	271	0,4
PFC Mobile Bearing	150	0,2
Axiom	139	0,2
F/S unspec	50	0,1
Triathlon	49	0,1
Vanguard	46	0,1
Rotaglide	34	0,1
Nuffield	29	0,0
Genesis	27	0,0
NexGen Mobile bearing	27	0,0
Oxford Rotating TKA	26	0,0
MillerGalante unspec	24	0,0
Performance	14	0,0
Evolution	12	0,0
Other	490	0,8
Total :	60 936	100

Implants for primary UKA during 1996-2005

	Number	Percent
Link	4 259	43
MillerGalante	2 429	24,6
Oxford	980	9,9
Genesis	474	4,8
PFC	462	4,7
Duracon	318	3,2
Marmor	301	3
Brigham	250	2,5
Allegretto	179	1,8
Repicci(AARS)	122	1,2
Preservation	59	0,6
EIUS	43	0,4
Other	18	0,2
Total	9 894	100

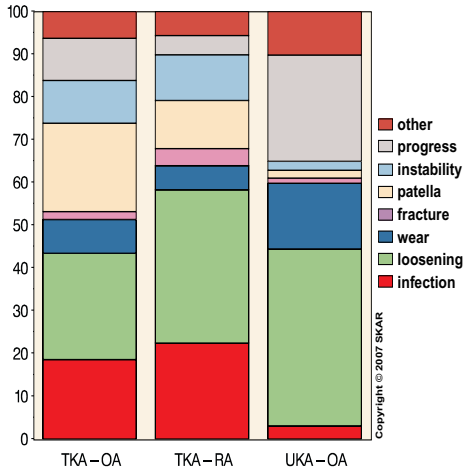
Linked implants (primaries) during 1996-2005

	Number	Percent
Rotalink	175	71,4
Kotz	30	12,2
NexGen Rot. hinge	12	4,9
Stryker/Howm. Rot. hinge	12	4,9
Noiles Rot. hinge	11	4,5
Other	5	2
Total	245	100

Revisions during 1996-2005

1,819 revisions of TKA´s for OA, 378 of TKA´s for RA and 1,641 revisions of UKA´s for OA were performed during the 10-year period. The indications for the revisions are shown in the diagram to the right. Note that the primary operations may have been performed before the accounted 10-year period. Loosening remains the dominant reason for revision. ”Progression” in TKA mainly reflects revisions performed for femoropatellar arthrosis/arthritis. ”Patella” includes all kind of problems with the patella in patients that had their primaries inserted with or without a patellar button (excluding loosening and wear). Please note that the distribution of the indications does not have to reflect the risk for revision. The sharp increase in the number of primaries over the years leads to overrepresentation of early revisions.

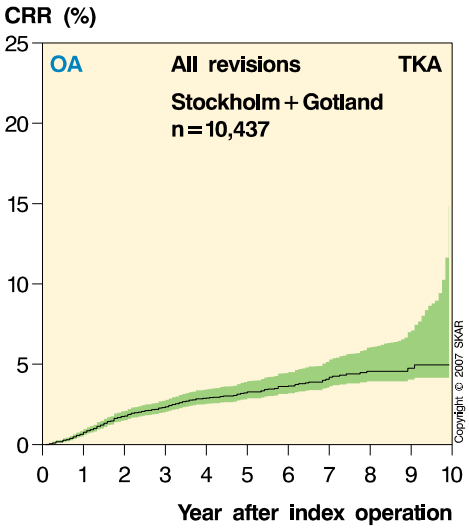
Distribution (%) of indications for revision 1995-2004



Primary TKA implants for OA in the regions during 1996-2005

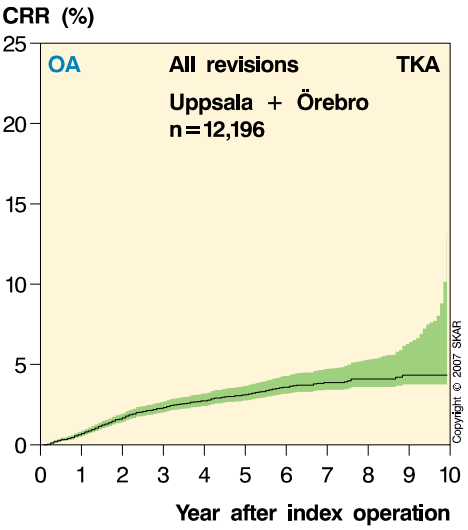
Stockholm + Gotland
Implants for primary TKA in OA 1996-2005

	Number	Percent
PFC Sigma	5 511	52,8
Duracon	1 195	11,4
AGC	1 064	10,2
F/S MIII	758	7,3
NexGen	626	6
Kinemax	605	5,8
PFC	395	3,8
Natural	72	0,7
AMK	62	0,6
PFC mobile bearing	49	0,5
Profix	18	0,2
Genesis	14	0,1
Rotaglide	10	0,1
LCS	10	0,1
Other	48	0,5
Total:	10,437	100.0



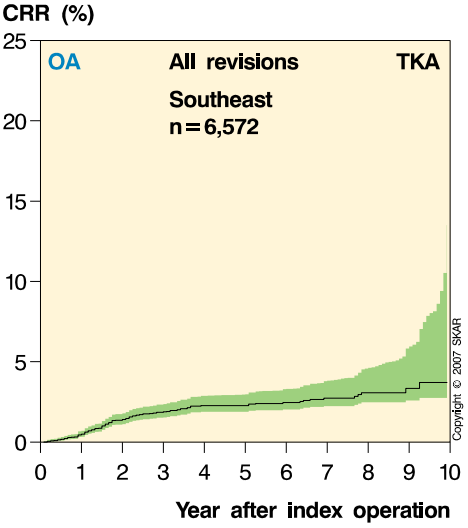
Uppsala+Örebro
Implants for primary TKA in OA 1996-2005

	Number	Percent
AGC	3 326	27,3
F/S MIII	3 072	25,2
NexGen	1 979	16,2
Kinemax	1 581	13
PFC Sigma	1 071	8,8
AMK	305	2,5
MillerGalante2	275	2,3
Duracon	202	1,7
Scan	155	1,3
Natural	95	0,8
PFC	63	0,5
NexGen mobile bearing	27	0,2
Other	45	0,4
Total	12 196	100



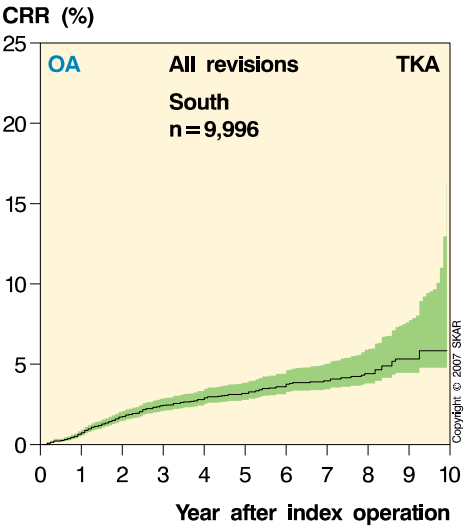
Southeast
Implants for primary TKA in OA 1996-2005

	Number	Percent
AGC	2 246	34,2
NexGen	1 933	29,4
PFC Sigma	1 706	26
PFC	236	3,6
Duracon	188	2,9
MillerGalante2	182	2,8
Vanguard	11	0,2
Evolution	11	0,2
Scan	10	0,2
Other	49	0,8
Total	6 572	100



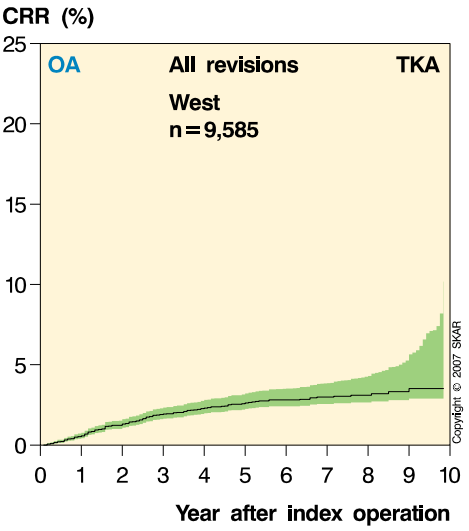
South
Implants for primary TKA in OA 1996-2005

	Number	Percent
PFC Sigma	3 021	30,2
Duracon	2 918	29,2
AGC	2 247	22,5
Scan	880	8,8
PFC	441	4,4
PFC mobile bearing	72	0,7
Axiom Knee	62	0,6
F/S MIII	60	0,6
Triathlon	49	0,5
LCS	47	0,5
Nuffieid	29	0,3
Rotaglide	24	0,2
Oxford mobile bearing	22	0,2
AMK	13	0,1
Profix	11	0,1
Other	100	1,0
Total	9 996	100



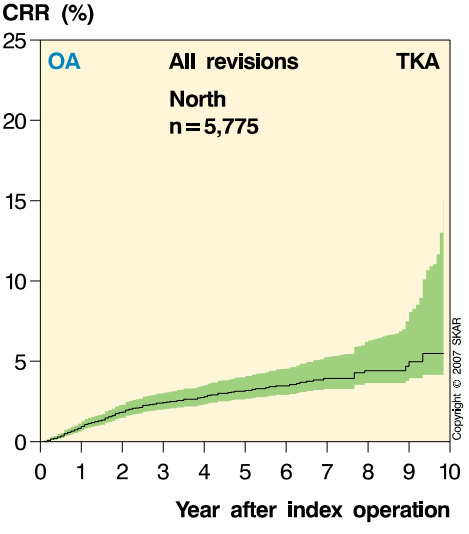
West
Implants for primary TKA in OA 1996-2005

	Number	Percent
AGC	3 536	36,9
F/S MIII	2 230	23,3
Duracon	1 127	11,8
PFC Sigma	1 062	11,1
NexGen	861	9
Scan	365	3,8
AMK	100	1
Natural	84	0,9
Axiom	72	0,8
PFC	34	0,4
F/S unspec.	30	0,3
Vanguard	22	0,2
MillerGalante unspec	16	0,2
Other	46	0,5
Total	9 585	100



North
Implants for primary TKA in OA 1996-2005

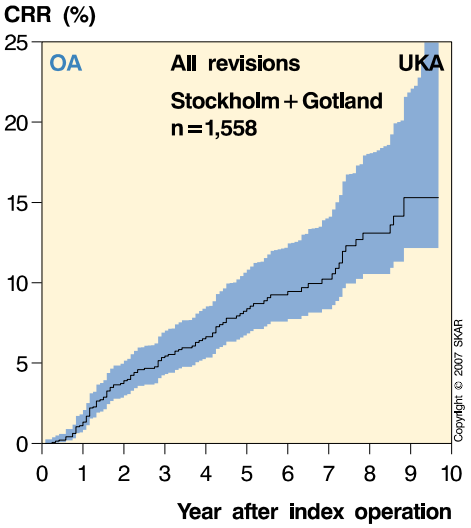
	Number	Percent
AGC	1 888	32,7
PFC Sigma	1 024	17,7
NexGen	920	15,9
Duracon	650	11,3
Profix	481	8,3
LCS	333	5,8
PFC	246	4,3
Scan	57	1
F/S MIII	43	0,7
AMK	42	0,7
MillerGalante2	39	0,7
Performance	13	0,2
PFC rot, platform	12	0,2
Other	27	0,4
Total	5 775	100



Primary UKA implants for OA in the regions during 1996-2005

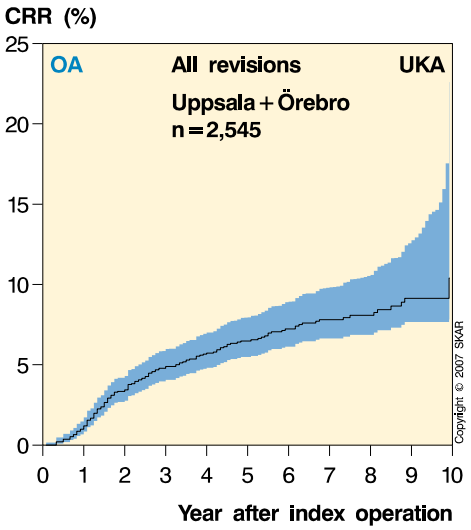
Stockholm + Gotland
Implants for primary UKA in OA 1996-2005

	Number	Percent
MillerGalante	1 001	64,2
Link	178	11,4
Brigham	154	9,9
Oxford	103	6,6
Genesis	47	3
Allegretto	37	2,4
Repicci(AARS)	18	1,2
Preservation	14	0,9
Other	6	0,3
Total:	1 558	100



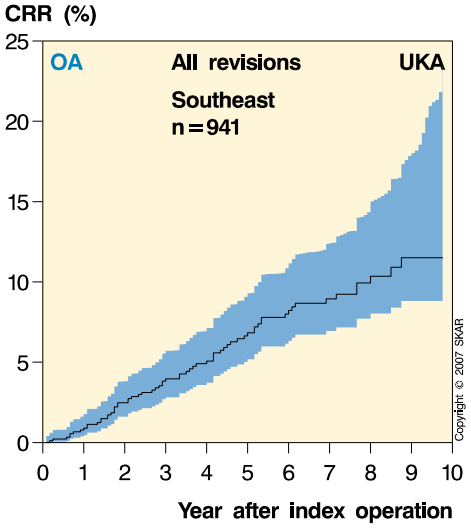
Uppsala+Örebro
Implants for primary UKA in OA 1996-2005

Number	Percent	
Link	1 836	72,1
PFC	223	8,8
Genesis	164	6,4
Marmor	129	5,1
MillerGalante	123	4,8
Preservation	33	1,3
Duracon	16	0,6
Allegretto	12	0,5
Other	9	0,4
Total:	2 545	100



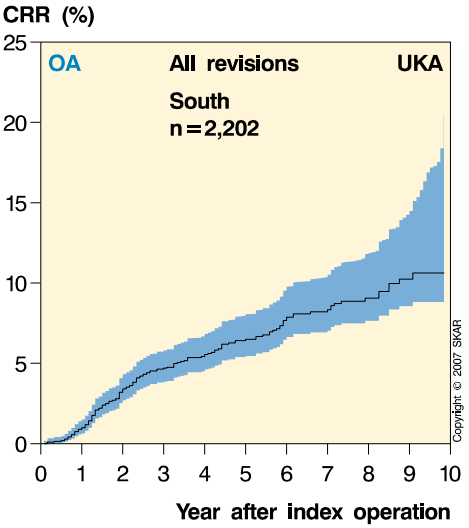
Southeast
Implants for primary UKA in OA 1996-2005

	Number	Percent
Link	285	30,3
Genesis	190	20,2
MillerGalante	109	11,6
Duracon	97	10,3
Marmor	89	9,5
Brigham	54	5,7
PFC	48	5,1
Allegretto	43	4,6
Oxford	21	2,2
Other	5	0,5
Total:	941	100



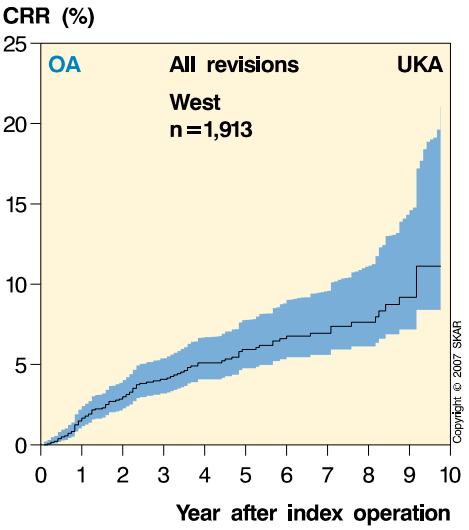
South
Implants for primary UKA in OA 1996-2005

	Number	Percent
Link	1 281	58,2
MillerGalante	177	8
Oxford	160	7,3
PFC	157	7,1
Duracon	116	5,3
Marmor	77	3,5
Allegretto	74	3,4
Genesis	55	2,5
EIUS	38	1,7
Repicci(AARS)	32	1,5
Brigham	31	1,4
Other	4	0,1
Total:	2 202	100



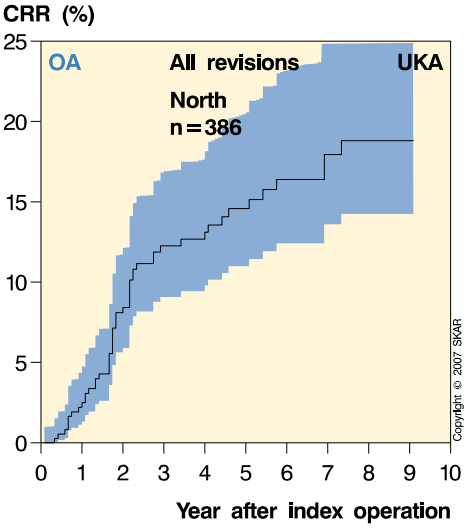
West
Implants for primary UKA in OA 1996-2005

	Number	Percent
MillerGalante	853	44,6
Oxford	651	34
Link	261	13,6
Repicci(AARS)	66	3,5
Duracon	65	3,4
Other	17	0,9
Total:	1 913	100



North
Implants for primary UKA in OA 1996-2005

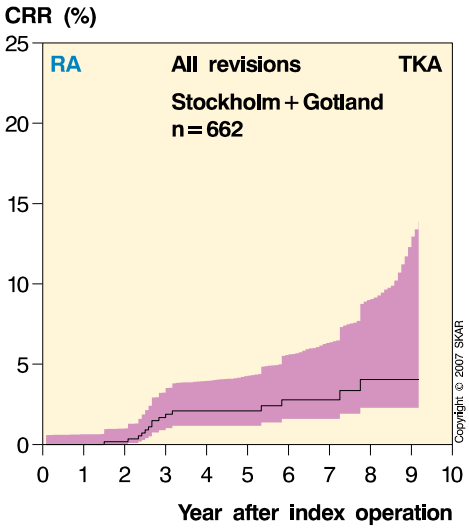
	Number	Percent
Link	283	73,3
MillerGalante	78	20,2
Oxford	13	3,4
Other	12	3
Total	386	100



Primary TKA implants for RA in the regions during 1996-2005

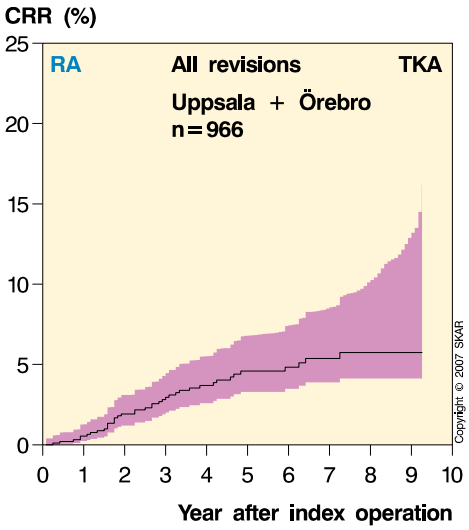
Stockholm + Gotland
Implants for primary TKA in RA 1996-2005

	Number	Percent
PFC Sigma	292	44,1
AGC	129	19,5
Duracon	115	17,4
PFC	41	6,2
Kinemax	35	5,3
Other	50	7,6
Total	662	100



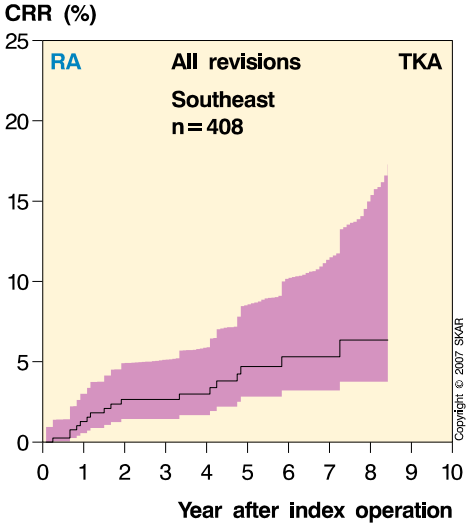
Uppsala+Örebro
Implants for primary TKA in RA 1996-2005

	Number	Percent
F/S MIII	300	31,1
AGC	257	26,6
Kinemax	163	16,9
NexGen	87	9
Scan	48	5
MillerGalante2	35	3,6
PFC Sigma	28	2,9
AMK	15	1,6
PFC	11	1,1
Other	22	2,2
Total	966	100



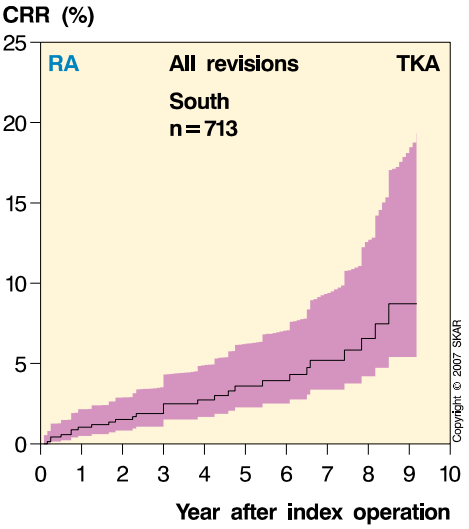
Southeast
Implants for primary TKA in RA 1996-2005

	Number	Percent
AGC	134	32,8
NexGen	133	32,6
PFC Sigma	75	18,4
PFC	24	5,9
MillerGalante2	16	3,9
Duracon	16	3,9
Other	10	2,4
Total	408	100



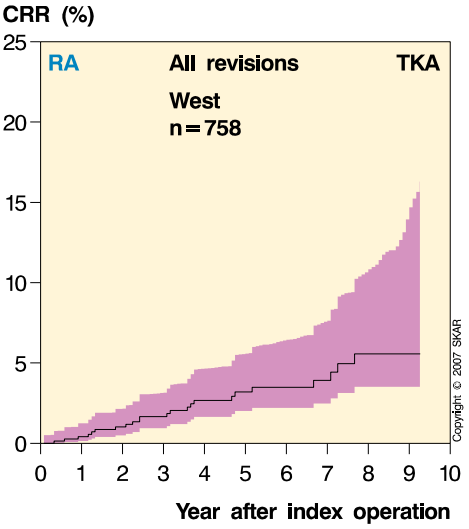
South
Implants for primary TKA in RA 1996-2005

	Number	Percent
Scan	209	29,3
PFC Sigma	138	19,4
AGC	125	17,5
Duracon	109	15,3
PFC	77	10,8
Profix	16	2,2
Other	39	5,5
Total	713	100



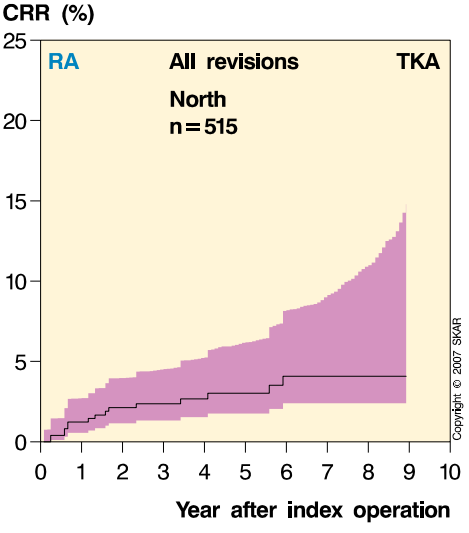
West
Implants for primary TKA in RA 1996-2005

	Number	Percent
AGC	287	37,9
F/S MIII	227	29,9
Scan	69	9,1
PFC Sigma	68	9,0
Duracon	53	7,0
AMK	19	2,5
NexGen	15	2,0
Other	20	2,6
Total	758	100



North
Implants for primary TKA in RA 1996-2005

	Number	Percent
AGC	132	25,6
PFC Sigma	107	20,8
Duracon	81	15,7
Profix	57	11,1
PFC	46	8,9
NexGen	29	5,6
LCS	25	4,9
MillerGalante2	15	2,9
Other	23	4,5
Total	515	100



The relative risk for implants used in primary arthroplasty during 1996-2005

The registry typically uses the latest 10-year period available for analysis when presenting the results of relatively modern implant types with a reasonable long-term follow-up. Unfortunately this implies that the number available for analysis can increase or decrease, depending on the model, which in turn may affect results.

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.

If the use of patellar button is primarily deliberately avoided with a preparedness for a secondary resurfacing of the patella if needed, this will increase the risk of revision. Therefore, we have decided to also account for OA/TKA separately when used with and without a patellar button (see next page).

Below you will find tables for the most common TKA and UKA models in which Cox regression has been used to estimate the risk for revision.

For TKA inserted for OA it can be noted that the implants having significantly lower or higher risk than the reference implant AGC are the same as in last years report. However, this year Kinemax just reached the 0.05 limit.

For TKA inserted for RA there is now a significant positive difference for the PFC-Sigma while Kinemax as in OA lies at the 0.05 limit.

For UKA inserted in OA, only the first 4 implants have been used in any numbers during the last 2 years. Compared to the earlier report Allegretto now has a significantly higher CRR than Link but otherwise the results are very similar.

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

OA / TKA	n	p-value	RR	95% CI
AGC	14,307		ref.	
PFC-Sigma	13,528	0,12	0,87	0,74-1,04
NexGen	6,354	<0,01	0,40	0,30-0,54
Duracon	6,280	0,41	0,92	0,76-1,12
F/S MIII	6,163	<0,01	0,65	0,53-0,81
Kinemax	2,195	0,05	1,26	1,00-1,59
Scan	1,467	0,20	1,19	0,91-1,57
PFC	1,415	<0,01	1,54	1,21-1,97
AMK	529	0,02	1,55	1,08-2,23
Profix	517	0,22	0,64	0,32-1,30
MillerGalante II	499	0,28	1,26	0,83-1,91
LCS	391	0,24	0,67	0,35-1,30
Natural II	251	0,61	1,29	0,48-3,47
Other	665	0,27	1,26	0,84-1,91
Gender (male is ref.)	.	0,33	0,95	0,84-1,06
Age (per year)	.	<0,01	0,96	0,95-0,97
Year of op. (per year)	.	0,95	1,00	0,97-1,03

RA / TKA	n	p-value	RR	95% CI
AGC	1,064		ref.	
PFC-Sigma	717	0,04	0,48	0,23-0,97
NexGen	275	0,05	0,25	0,06-1,02
Duracon	378	0,73	0,90	0,48-1,66
F/S MIII	536	0,02	0,45	0,24-0,88
Kinemax	198	0,05	1,75	1,00-3,08
Scan	331	0,92	1,03	0,58-1,83
PFC	199	0,69	1,14	0,60-2,14
AMK	*41*	*0,98*	*<0,01*	.
Profix	75	0,55	0,55	0,07-4,01
MillerGalante II	67	0,47	1,41	0,55-3,61
LCS	*28*	*0,98*	*<0,01*	.
Natural II	*12*			
Other	101	0,79	1,15	0,41-3,20
Kön		0,19	0,78	0,53-1,13
Age (per year)		0,26	1,01	0,99-1,02
Year of op. (per year)		0,80	0,99	0,90-1,08

OA / UKA	n	p-value	RR	95% CI
Link	4,124		ref.	
MillerGalante	2,341	0,05	1,23	1,00-1,51
Oxford	950	1,00	1,00	0,71-1,42
Genesis	457	0,73	1,07	0,71-1,63
PFC	438	<0,01	1,83	1,36-2,48
Duracon	300	<0,01	2,12	1,51-2,98
Marmor/Richards	295	0,16	1,34	0,89-2,02
Brigham	239	0,06	1,51	0,99-2,31
Allegretto	172	0,04	1,58	1,01-2,46
Repicci (AARS)	116	<0,01	2,13	1,30-3,48
Other	113	0,81	0,87	0,28-2,72
Gender (male is ref.)	,	0,33	0,92	0,79-1,08
Age (per year)	,	<0,01	0,95	0,94-0,96
Year of op. (per year)	,	0,48	1,01	0,98-1,06

The Axiom TKA has been replaced by the Natural II

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

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

Without patellar button OA / TKA	n	p-value	RR	95% CI
AGC	12,249		ref.	
PFC-Sigma	12,628	0,11	0,86	0,72-1,03
NexGen	6,221	<0,01	0,38	0,28-0,52
Duracon	5,806	0,28	0,90	0,74-1,09
F/S MIII	1,879	0,24	0,80	0,56-1,16
Kinemax	1,691	0,19	1,19	0,92-1,53
Scan	1,419	0,52	1,10	0,83-1,45
PFC	1,238	0,02	1,37	1,06-1,79
AMK	472	0,21	1,29	0,87-1,93
Profix	454	0,13	0,54	0,24-1,20
MillerGalante II	483	0,57	1,13	0,74-1,73
LCS	391	0,17	0,63	0,32-1,21
Natural II	223	0,37	1,57	0,58-4,24
Other	558	0,43	1,20	0,76-1,88
Gender (male is ref.)		0,63	0,97	0,86-1,10
Age (per year)		<0,01	0,96	0,95-0,96
Year of op. (per year)		0,34	0,99	0,96-1,02

With patellar button OA / TKA	n	p-value	RR	95% CI
AGC	2,056		ref.	
PFC-Sigma	899	0,90	0,96	0,54-1,71
NexGen	132	0,69	1,27	0,39-4,15
Duracon	469	0,87	0,94	0,44-2,02
F/S MIII	4,284	0,31	0,82	0,57-1,20
Kinemax	504	0,04	1,75	1,02-3,00
Scan	48	0,14	2,41	0,74-7,82
PFC	177	<0,01	2,70	1,42-5,14
AMK	56	<0,01	4,35	1,84-10,29
Profix	63	0,45	1,74	0,42-7,21
MillerGalante II	*16*	*0,32*	*2,72*	*0,37-19,92*
LCS				
Natural II	*28*	*0,97*	*<0,01*	.
Other	106	0,32	1,69	0,61-4,69
Gender (male is ref.)		0,20	0,83	0,62-1,11
Age (per year)		0,01	0,98	0,96-0,99
Year of op. (per year)		0,23	1,04	0,97-1,11

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

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

Analyzing implants inserted without patellar button and using AGC as a reference, only two implants differ significantly, NexGen with a lower and the old PFC with a higher risk. For implants inserted with a patellar button Kinemax, PFC and AMK all have significantly higher risk than the AGC reference.

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

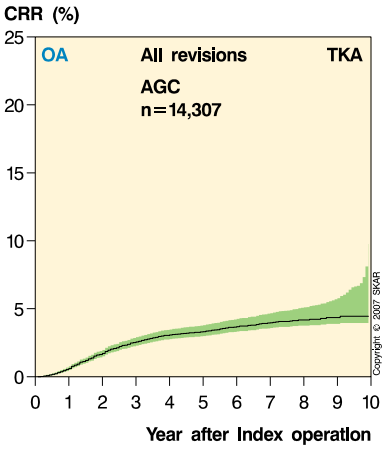
If the risk of revision for implants is differently affected by if a patellar button was used or not, this can be a sign of some buttons having a higher risk of complications but also that some femur components may be more suitable than others when used with or without a patellar resurfacing.

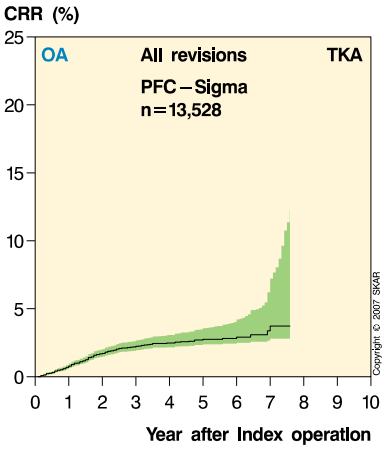
With patellar button (using F/S MIII as the ref.) OA / TKA	n	p-value	RR	95% CI
F/S MIII	4,284		ref.	
AGC	2,056	0,31	1,21	0,84-1,76
PFC-Sigma	899	0,57	1,17	0,69-1,99
NexGen	132	0,46	1,54	0,48-4,92
Duracon	469	0,73	1,14	0,55-2,37
Kinemax	504	<0,01	2,13	1,29-3,52
Scan	48	0,07	2,93	0,91-9,42
PFC	177	<0,01	3,27	1,75-6,12
AMK	56	<0,01	5,28	2,26-12,34
Profix	63	0,30	2,11	0,51-8,61
MillerGalante II	*16*	*0,24*	*3,30*	*0,45-24,08*
LCS				
Natural II	*28*	*0,97*	*<0,01*	.
Other	106	0,16	2,05	0,75-5,62
Gender (male is ref.)		0,20	0,83	0,62-1,11
Age (per year)		0,01	0,98	0,96-0,99
Year of op. (per year)		0,23	1,04	0,97-1,11

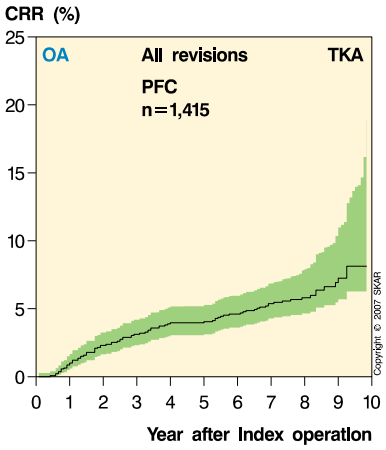
The Axiom TKA has been replaced by the Natural II

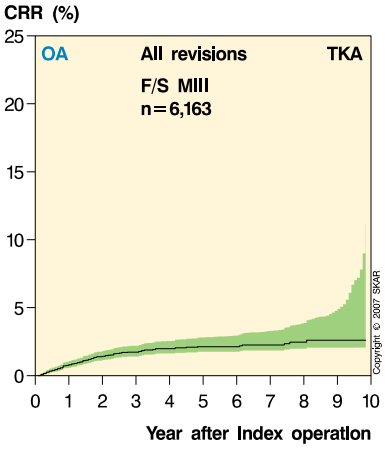
Significant difference with higher risk ratio.
Significant difference with lower risk ratio.

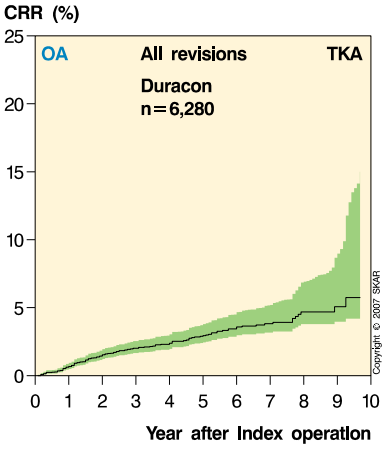
CRR for commonly used TKA implants in OA during 1996–2005

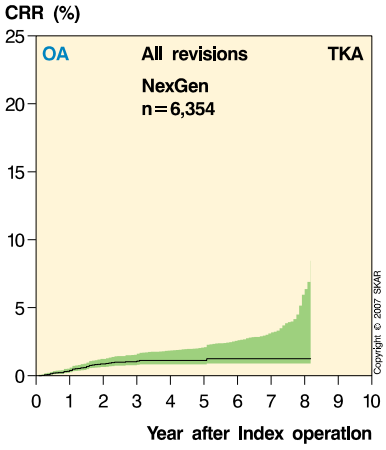


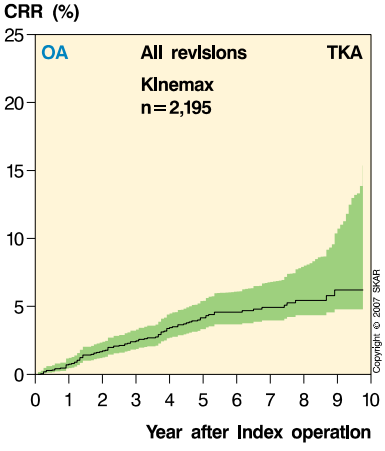


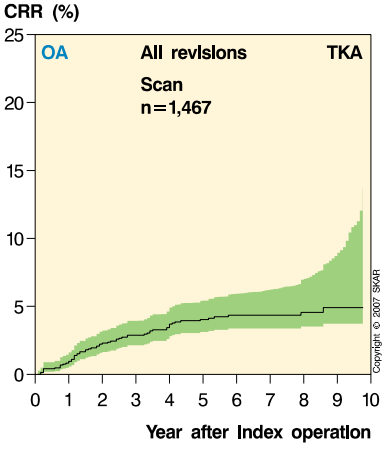


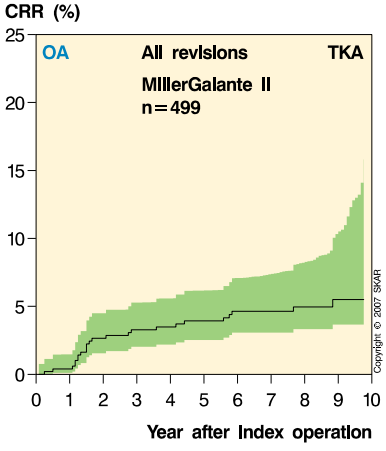


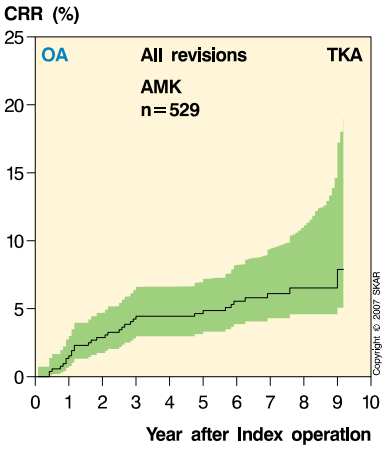











CRR (%)
OA
All revisions
TKA
AMK
n=529
Year after Index operation
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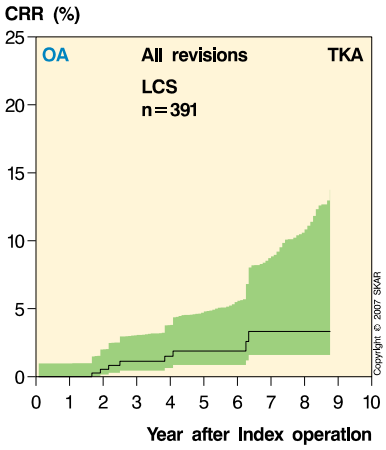
CRR (%)
OA
All revisions
TKA
LCS
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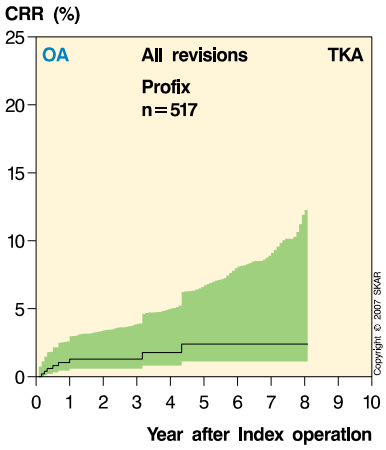
CRR (%)
OA
All revisions
TKA
Profix
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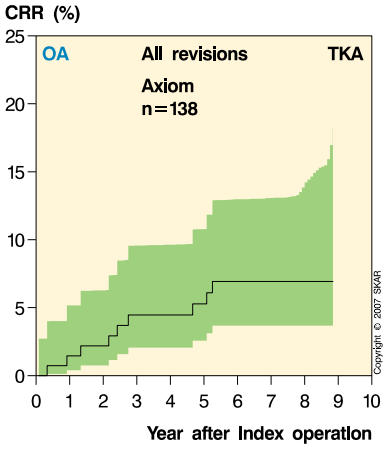
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All revisions
TKA
Axiom
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Year after Index operation
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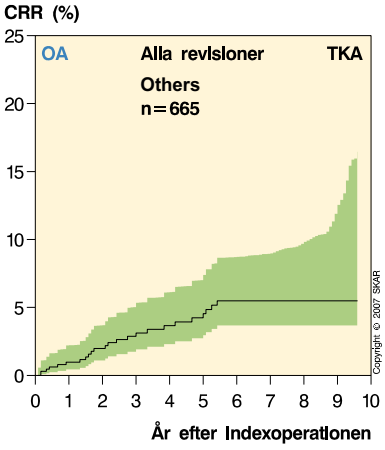
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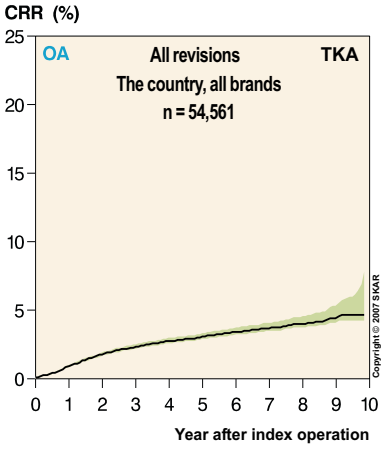
Alla revisloner
TKA
Others
n=665
År efter Indexoperationen
Copyright © 2007 SKAR


CRR (%)
OA
All revisions
TKA
The country, all brands
n=54,561
Year after index operation
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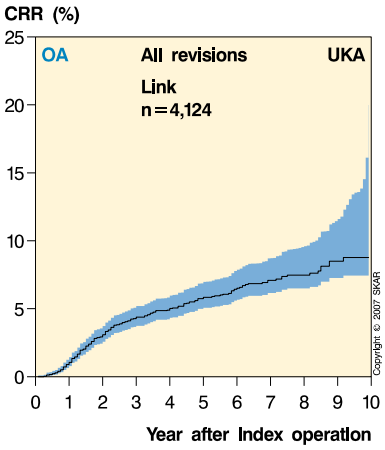
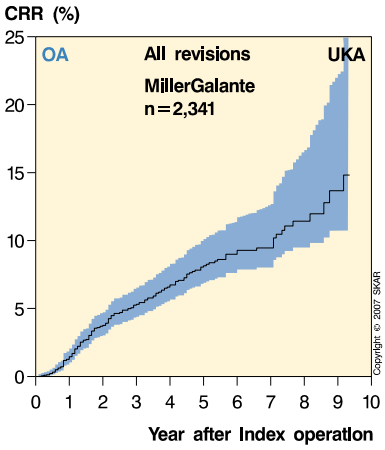
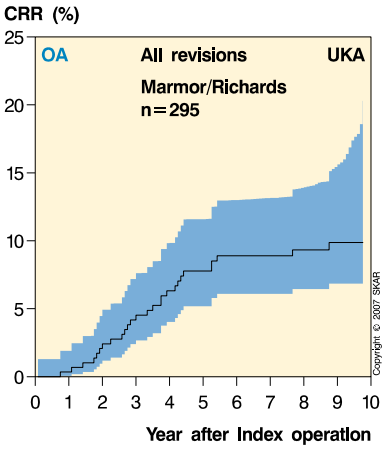
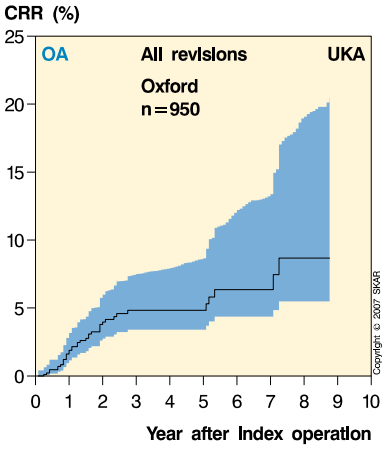
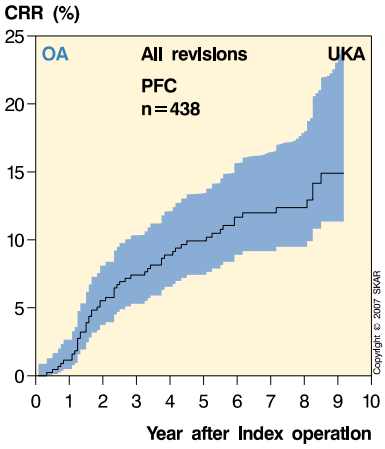
CRR for commonly used UKA implants in OA during 1996–2005

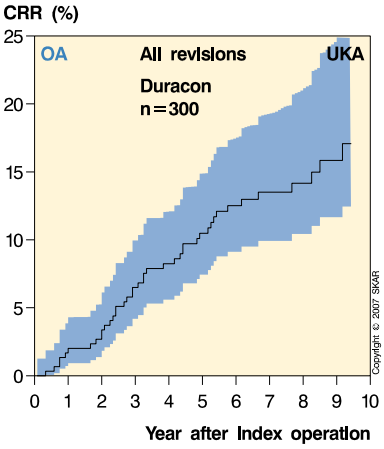


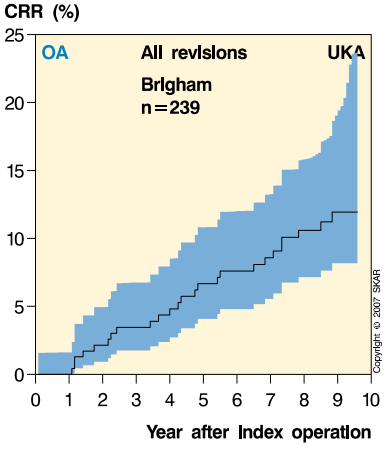


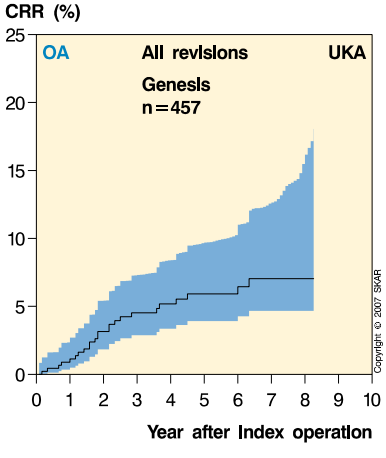


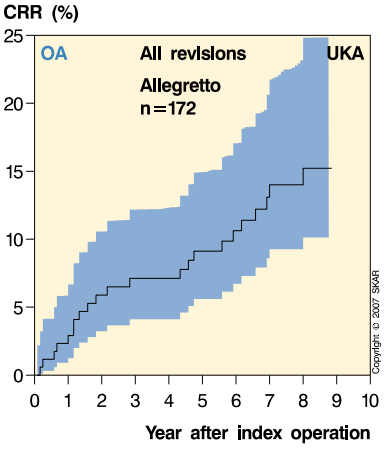


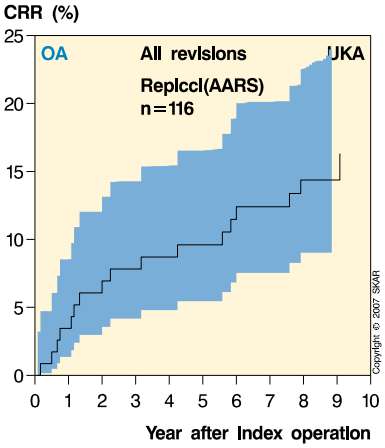


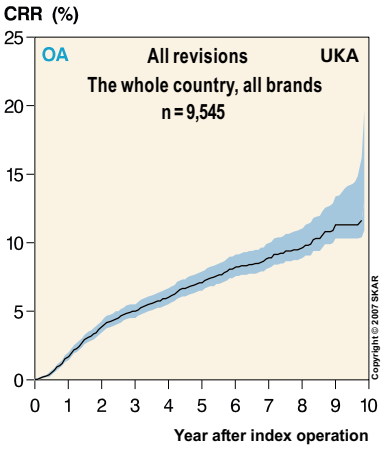












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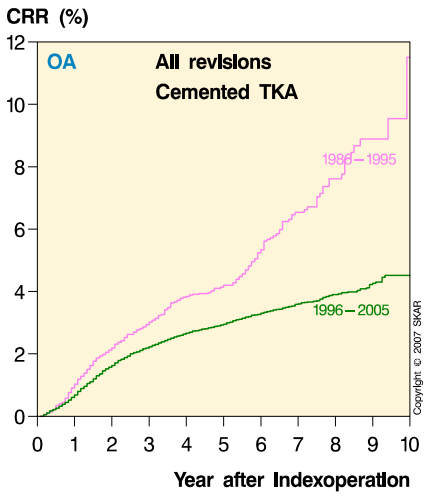
Relative risk of revision over time (cemented TKA/OA)

The hospitalspecific risk of revision – The register has been requested to account for hospital specific results. In order to do a reasonable comparison with respect to risk for revision only analyzed cemented TKA inserted for OA. The 10-year risk of revision was calculated by the shared gamma frailty model. The method takes into consideration that units performing few operations more easily suffer far too optimistic or pessimistic risk estimates. Further, the results are adjusted for differences in age and gender as well as for differences with respect to if a patellar button had been used or not.

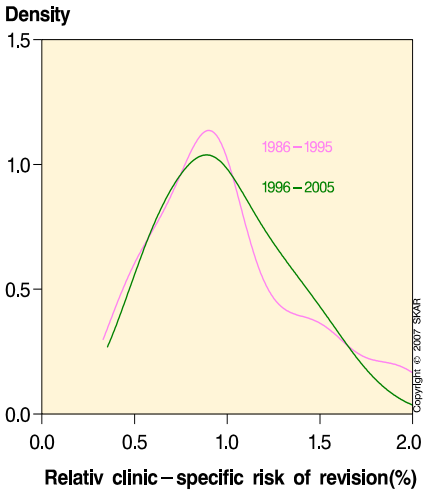
Compared to the period 1986-1995, the total risk of revision had decreased by 50% in 1996-2005 (figure upper, left). At the same time the distribution in the absolute risk of revision among the units had considerably reduced (figure below, right). However, the relative differences between the units have remained unchanged with some units having half or double the risk (figure below, left).

A complete list with the relative risk for each hospital, as compared to the national mean in 1996-2005, is shown on the opposite page. There were 10 hospitals having significantly better results than the average hospital and 8 with significantly inferior results. One can only speculate on the causes for these differences. Unfortunate choice of implants, methods or surgeons may be the explanation but also selection of patients with higher risk profile (case-mix).

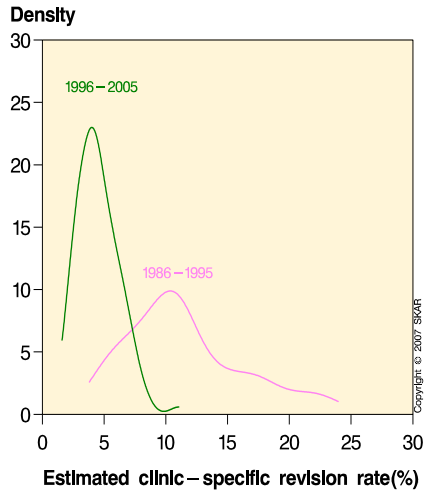
We find it appropriate to point out that the results are based on historical data in which the last implants were inserted 2 years ago and the first 12 years ago. Thus, the results do not have to reflect the current risk for patients undergoing surgery.



Total CRR for cemented TKA in OA during the 2 periods 1986–1995 and 1996–2005. Implants inserted during the latter period have half the risk of becoming revised.



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 1986–1995 and 1996–2005 (x-axis = relative risk).



Plotting the estimated absolute clinicspecific risk of revision shows that the absolute distribution has diminished between 1986-1995 and 1996-2005 (x-axis = absolute risk of revision)

Relative risk of revision for hospitals during 1996–2005 (cemented TKA/OA)

Kod	Klinik	n	rev.	RR	95% CI
10484	Sabbatsbergs närsjh	704	3	0,35	0,17-0,73
62011	Örnsköldsvik	786	4	0,39	0,20-0,76
13010	Eskilstuna	370	2	0,39	0,18-0,85
21001	Linköping	612	6	0,47	0,26-0,87
53010	Falköping	601	4	0,49	0,25-0,96
53013	Skövde	603	5	0,49	0,26-0,93
22012	Värnamo	683	7	0,52	0,29-0,93
52011	Borås	751	9	0,55	0,32-0,94
28013	Simrishamn	735	5	0,55	0,29-1,05
56012	Köping	719	8	0,56	0,32-0,98
54013	Säffle	405	5	0,58	0,31-1,10
22010	Jönköping	776	9	0,59	0,34-1,00
50010	Östra sjukhuset	759	10	0,59	0,35-0,99
52012	Alingsås	569	5	0,60	0,32-1,13
21014	Motala	1 016	8	0,62	0,35-1,08
55012	Lindesberg	592	7	0,63	0,35-1,13
65014	Kalix	164	1	0,64	0,28-1,49
64010	Skellefteå	546	7	0,65	0,36-1,16
11001	Karolinska	970	11	0,65	0,40-1,08
13012	Kullbergska sjukhuset	638	8	0,66	0,38-1,15
13011	Nyköping	408	5	0,66	0,35-1,25
42011	Varberg	974	16	0,67	0,43-1,03
50071	Frölunda Spec.Sjukhus	256	2	0,72	0,33-1,55
27011	Karlshamn	823	11	0,72	0,43-1,18
56010	Västerås	436	7	0,73	0,41-1,31
50080	Sergelkliniken Gbg	140	1	0,75	0,33-1,74
50001	Sahlgrenska	507	9	0,76	0,45-1,31
12010	Enköping	669	9	0,77	0,45-1,32
23010	Växjö	510	9	0,79	0,46-1,35
42010	Halmstad	879	16	0,80	0,52-1,24
41001	Lund	212	4	0,80	0,41-1,58
65016	Sunderby sjukhus	262	4	0,81	0,41-1,60
65012	Gällivare	422	8	0,82	0,47-1,43
27010	Karlskrona	314	8	0,82	0,47-1,44
54010	Karlstad	800	13	0,83	0,52-1,34
54012	Arvika	395	5	0,87	0,46-1,65
12481	Elisabethsjukhuset	153	1	0,87	0,38-2,02
28011	Ängelholm	726	16	0,89	0,58-1,38
21013	Norrköping	613	16	0,90	0,58-1,39
24010	Västervik	717	14	0,90	0,57-1,42
54014	Torsby	582	12	0,91	0,56-1,48
55011	Karlskoga	517	10	0,91	0,54-1,53
41012	Helsingborg	497	12	0,92	0,57-1,50
42015	Movement Halmstad	75	0	0,93	0,37-2,36
10015	Sophiahemmet	622	12	0,93	0,58-1,52
11011	Södertälje	605	13	0,94	0,59-1,50
53011	Lidköping	600	12	0,95	0,59-1,55
64011	Lycksele	320	7	0,97	0,55-1,74
64001	Umeå	490	10	0,99	0,59-1,67
55010	Örebro	577	13	1,00	0,62-1,60
41010	Landskrona	637	16	1,03	0,66-1,59
50020	Gothenb. Med Center	96	1	1,03	0,45-2,39
63010	Östersund	611	14	1,03	0,65-1,63
25010	Kalmar	907	22	1,05	0,71-1,54
10013	Södersjukhuset	941	29	1,14	0,81-1,61
57011	Mora	819	24	1,15	0,79-1,66
10011	S:t Göran	2 618	71	1,16	0,92-1,46
11010	Danderyd	1 106	32	1,16	0,84-1,61
28012	Hässleholm	2 213	54	1,17	0,90-1,52
26010	Visby	408	13	1,17	0,73-1,87
52013	Skene	536	17	1,17	0,77-1,79
10016	Ortopediska huset	727	16	1,18	0,76-1,82
65010	Boden	196	9	1,22	0,71-2,08
11002	Huddinge	577	19	1,23	0,82-1,85
11013	Löwenströmska	136	8	1,25	0,72-2,19
23011	Ljungby	523	18	1,30	0,86-1,97
61011	Bollnäs / Söderhamn	712	19	1,31	0,87-1,96
51010	Uddevalla	813	24	1,31	0,90-1,89
25011	Oskarshamn	635	17	1,32	0,86-2,02
61012	Hudiksvall	484	17	1,33	0,87-2,03
11913	Stockh. Specialistvård	422	11	1,36	0,82-2,24
62010	Sundsvall	860	31	1,36	0,98-1,90
22011	Eksjö-Nässjö	608	23	1,42	0,98-2,07
41013	Ystad	359	14	1,44	0,91-2,28
30001	Malmö	280	13	1,49	0,93-2,38
57010	Falun	1 455	56	1,49	1,15-1,92
51011	Mölndal	455	18	1,49	0,98-2,26
11012	Norrtälje	488	21	1,54	1,04-2,27
52016	Vänersborg-NÄL	100	8	1,55	0,89-2,71
51012	Kungälv	783	31	1,57	1,12-2,18
54011	Kristinehamn	131	9	1,61	0,94-2,74
62013	Sollefteå	487	18	1,64	1,08-2,48
41011	Trelleborg	1 347	44	1,68	1,26-2,24
61010	Gävle	413	21	1,76	1,19-2,60
12001	Akademiska sjukh.	818	45	1,86	1,41-2,47
65013	Piteå	493	26	2,45	1,71-3,50

Only units that inserted more than 50 primaries during the period ar listed

The risk of revision has been calculated using ”the shared gamma frailty model” that estimates how the risk of revision is affected by the operating hospital. In the table, the risk is shown as compared to the national mean (RR=relative risk of revision).
The method takes into consideration that units performing few operations more easily suffer far too optimistic or pessimistic risk estimates. Thus, the method shrinks such estimates towards the national mean in proportion to the amount of information they are based on.
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The results are adjusted for differences in sex and gender as well as for differences with respect to if a patellar button had been used or not.

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