Akademiska sjukhuset
Alingsås
Arvika
Bollnäs
Borås
Carlanderska
Danderyd
Eksjö-Nässjö
Elisabethsjukhuset
Enköping
Eskilstuna
Falköping
Falun
Frölunda Spec, Sjh,
Gällivare
Gävle
Halmstad
Helsingborg
Huddinge
Hudiksvall
Hässleholm
Jönköping
Kalmar
Karlshamn
Karlskoga
Karlstad
Karolinska
Kullbergska
Kungälv
Köping
Lidköping
Lindesberg
Ljungby
Lund
Lycksele
Malmö
Mora
Motala
Movement Halmstad
Mölndal
Nacka
Norrtälje
Nyköping
OrthoCenter IFK kliniken
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Oskarshamn
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Piteå
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Skövde
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Sundsvall
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Torsby
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Umeå
Varberg
Visby
Värnamo
Västervik
Västerås
Växjö
Örebro
Örnsköldsvik
Östersund
Östra sjukhuset
Ängelholm

# Annual Report 2012

Swedish Knee Arthroplasty Register

**Deptartment of Orthopedics**
**Skåne University Hospital, Lund**

**Concerning:**

**primaries 1975-2011**
**revisions 1975-2010**

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

As you may have noticed, the front page of the report has changed since the register implemented a new graphic layout. At the same time we are developing a new web portal which we hope will improve and facilitate the task of bringing back information to patients as well as professionals.

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 2011 as well as analyses covering the 10-year period 2001-2010.

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 2011. 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 that was published in Acta Orthopaedica last June we have started preparations for including osteotomies in the routine prospective registration.

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, 2012

On behalf of the Swedish Knee Arthroplasty Register

Martin Sundberg Lars Lidgren Annette W-Dahl Otto Robertsson

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## CONTENT

## Introduction

***The beginning*** – In the early seventies, knee arthroplasty 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 2011, 74 orthopedic units reported to the register, i.e. all units that routinely performed knee arthroplasty surgery in Sweden.

***Volumes*** – Since the registration started there has been an exponential increase in the number of operations (see page 12). In 2011, 12,753 primary arthroplasties were reported which was a decrease of 0.8% as compared to 2010. One can wonder if the health system has now reached an equilibrium marking an end to increasing volumes or if this is only a temporary interruption in a general trend. What contradicts this is that the incidence in Sweden (see page 13) 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 58) is filled in the operation theater and that one set of the stickers found in the implants and cement packages are placed on the backside. The form is then sent to the register office in Lund where the information is entered into the database. 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 that the registration is done in the operation room. This would call for improved computer solutions as well as a better flow of information from the implant distributors to the register 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 2011). Analyses concerning the revision rate end one year earlier (2010). The reason for this is that a few errors in the registration of revisions can have a large impact on the final result and an extra year allows for as complete and correct information as possible. 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 year 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 comparison of implants can be found on page 10.

***Cooperation*** – There is a close collaboration with RC Syd (Register Center South) which is facilitated by the fact that the SKAR and RC Syd share premises in Lund. The Nordic countries cooperate through the framework of NARA (Nordic Arthroplasty Register Association) performing analyses of combined datasets and the SKAR and the Australian Joint Replacement Registry have common research projects. Further, the SKAR cooperates with other international organizations such as ISAR (International Society of Arthroplasty Registries) and ICOR (International Collaboration of Orthopedic Registries) as well as with individual scientists in different countries.
Besides that 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. It was introduced to allow for monitoring quality of processes and facilitate systematic improvement work in the short and long term and contributes with information on surgical techniques, preventive treatment and other relevant information. Since 2010, all the reporting units have used the new form for reporting.

For the 13 new variables in 2011, we found that the completeness in reporting was at least 99% for each of the variables which is better than expected. 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).
Early, the SKAR started evaluating 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. However, recently there has been renewed interest in PROM for quality improvement.

In a pilot study, PROM data gathered in Skåne are being evaluated and last year we presented data from Trelleborg. The project has been expanded with Trelleborg data for an additional year as well as with data from Hässleholm concerning surgeries performed 2009-2010. The initial results are presented on page 50-55.

***Validation of data quality –*** In order to use register data for scientific studies and quality improvement, it is of greatest importance that the information found in the register is valid. Therefore we performed a study on how well information in the register agreed with that found at the hospitals. The aim was to gain more knowledge on the reiliablity of our survival analyses and to find out if the information concerning the new variables had sufficient quality for reliable statistical analyses and process measures. The outcome of the validation can be found on page 7-9.

***Feedback*** – The register reports in several ways; verbally, in print and using the Web. 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) where annual reports can be downloaded and a list of publications is available. There is also a secure server where participating units have their individual folder with their own data in a computerized form including revisions of their patients performed elsewhere.
A new and improved web-site is under construction where we hope to improve the feed-back of relevant information to the hospitals.

## 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).

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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.

## Completeness concerning primaries reported in 2010

It is not easy to estimate how many of the total number of knee arthroplasty operations performed in the country are reported to the SKAR.
It is however possible to compare the SKAR 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 for the year 2009, we found that 96.6% of the admissions had been registered in the SKAR. In the same way we now find for 2010 that 97.4% had been registered by the SKAR and 95.3% 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% completeness are marked in red. Units with low coverage are encouraged to investigate if they missed reporting any surgeries or if their ICD-10 coding is erroneous.

| Hospital | Number | SKAR percent | NPR percent |
|---|---|---|---|
| Akademiska | 159 | 96.9 | 96.9 |
| Alingsås | 211 | 98.1 | 98.6 |
| Arvika | 144 | 97.2 | 97.9 |
| Bollnäs sjukhus-Aleris | 304 | 98.4 | 95.7 |
| Borås + Skene | 243 | 94.2 | 97.9 |
| Carlanderska | 91 | 100.0 | 0.0 |
| Danderyd | 152 | 94.7 | 97.4 |
| Eksjö-Nässjö | 167 | 98.2 | 98.8 |
| Elisabethkliniken | 64 | 100.0 | 60.9 |
| Enköping | 256 | 99.2 | 98.4 |
| Eskilstuna | 33 | 97.0 | 97.0 |
| Falköping+Lidköping+Skövde | 455 | 98.2 | 97.4 |
| Falun | 305 | 99.3 | 99.0 |
| Frölunda | 116 | 99.1 | 99.1 |
| Gällivare | 64 | 95.3 | 98.4 |
| Gävle | 98 | 96.9 | 95.9 |
| Halmstad | 189 | 94.7 | 97.9 |
| Helsingborg | 28 | 71.4 | 96.4 |
| Huddinge | 144 | 94.4 | 97.9 |
| Hudiksvall | 109 | 100.0 | 98.2 |
| Hässleholm | 620 | 99.7 | 98.2 |
| Jönköping/Ryhov | 165 | 89.7 | 98.8 |
| Kalmar | 103 | 100.0 | 98.1 |
| Karlshamn | 236 | 97.0 | 97.0 |
| Karlskoga | 96 | 100.0 | 100.0 |
| Karlstad | 150 | 98.7 | 98.7 |
| Karolinska | 121 | 98.3 | 95.9 |
| Kullbergska | 247 | 96.4 | 96.0 |
| Kungälv | 167 | 95.8 | 98.2 |
| Lindesberg | 175 | 97.7 | 99.4 |
| Ljungby | 152 | 97.4 | 97.4 |
| Lund | 48 | 95.8 | 93.8 |
| Lycksele | 66 | 98.5 | 98.5 |
| Löwenströmska | 414 | 99.8 | 99.8 |
| Malmö | 11 | 90.9 | 90.9 |
| Mora | 160 | 98.8 | 100.0 |
| Motala | 558 | 96.8 | 98.4 |
| Movement Halmstad | 270 | 96.3 | 98.9 |
| Nacka | 157 | 96.8 | 93.0 |
| Norrköping | 155 | 98.1 | 99.4 |
| Norrtälje | 85 | 97.6 | 98.8 |
| Nyköping | 117 | 99.1 | 95.7 |
| OrthoCenter IFK kliniken | 134 | 99.3 | 96.3 |
| Ortopediska huset | 395 | 97.7 | 80.3 |
| Oskarshamn | 193 | 97.9 | 97.9 |
| Piteå | 234 | 99.6 | 99.1 |
| Sabbatsberg Aleris | 105 | 100.0 | 100.0 |
| Sahlgrenska+Mölndal+Östra | 288 | 92.4 | 94.4 |
| Skellefteå | 109 | 98.2 | 96.3 |
| Sollefteå | 132 | 92.4 | 91.7 |
| Sophiahemmet | 76 | 100.0 | 0.0 |
| Spenshult | 228 | 96.5 | 93.0 |
| St Göran | 396 | 98.5 | 87.1 |
| Sunderby sjukhus | 4 | 50.0 | 100.0 |
| Sundsvall | 126 | 99.2 | 96.8 |
| Södersjukhuset | 347 | 96.3 | 99.1 |
| Södertälje | 119 | 98.3 | 97.5 |
| Torsby | 104 | 100.0 | 100.0 |
| Trelleborg | 574 | 98.6 | 98.1 |
| Uddevalla | 213 | 94.8 | 95.8 |
| Umeå | 236 | 97.5 | 98.7 |
| Varberg | 151 | 94.7 | 97.4 |
| Visby | 80 | 92.5 | 97.5 |
| Värnamo | 129 | 92.2 | 99.2 |
| Västervik | 76 | 97.4 | 100.0 |
| Västerås | 326 | 95.7 | 93.3 |
| Växjö | 126 | 96.0 | 96.8 |
| Ängelholm | 141 | 100.0 | 97.9 |
| Örebro | 125 | 99.2 | 96.8 |
| Örnsköldsvik | 139 | 99.3 | 95.7 |
| Östersund | 161 | 100.0 | 96.3 |

## Validation of data quality.

***Background***

The registry has previously been validated by sending questionnaires to patients (Robertsson et al 1999) and has been checked against the national patient registry on several occasions. All hospitals, routinely performing knee arthroplasties, report to the SKAR (100% coverage). The last comparison with the patient registry (table left) shows that 97% of the individual patient admissions were found in the SKAR.

In January 2009, 13 new variables were added to the reporting form concerning surgical technique, prophylactic treatments and patient factors. The new variables are difficult to check by comparison of the SKAR to other databases and to get an idea on how accurately they have been reported they have to be validated by checking hospital records at the reporting hospitals.

***Objective***

In order to use register data for scientific studies and quality improvement, it is of greatest importance that the information found in the register is valid. The aim was to find out how well information in the register agreed with that found at the hospitals. In order to gain more knowledge on the reliability of our survival analyses and to find out if the information reported on the new variables had the quality allowing for reliable statistical analyses and process measures. This is essential in order to find problem areas and to be able to implement direct measures for improvements on hospital- as well on registry level.

***Methods***

Nine hospitals with an annual production of at least 50 knee arthroplasties, were randomly selected. The hospitals were asked to find records on 25 consecutive knee arthroplasty operations performed after March 1st 2010. Computer as well as paper records (incl. op- and anesthesia reports) were to be included. In the autumn of 2011, the hospital was visited by staff from SKAR and together with the local contact secretary filled in a new reporting form, but this time using information retrospectively available in the hospital records. This way, 225 operations were to be evaluated which seemed reasonable considering the estimate of 180 records being needed to evaluate the quality of the reporting with a reasonable confidence, if 90 percent of the information for each variable was correct.

After filling the new forms they were taken to the register office in Lund to be compared with the paper forms originally sent by the hospital which in turn were compared with the data that had been entered into the SKAR database.

***Results***

From the 225 knee surgeries two were excluded. The reason was that the registry only follows surgeries on Swedish inhabitants (using their unique personal identification number) and one foreign patient had received a bilateral simultaneous knee arthroplasty. By mistake, one unit had compiled information on 26 surgeries the total number of operations validated was 224.

It is noticeable that out of the 224 surgeries none were missing in the SKAR.

When evaluating essential data (date, hospital, laterality and diagnosis) there was no information missing. However, the new form, filled in during the hospital visit, differed from the original form in less than 1% of cases which in turn differed from the information in the SKAR database in less than 1% of cases.

Information on components and fixation contains the part- and lot-numbers for the femoral, tibial and patella components as well as their type of fixation (inclusive the cement brand in cemented cases). In 1% of cases the information in SKAR differed from that reported in the original form, for at least one of these variables. However, for 3% of the cases information regarding one or more of these variables was not to be found retrospectively in the hospital records while for the remaining 97%, the difference between the original- and the newly filled form was negligible.

Concerning the ”new variables”, the reported ”previous surgery of the index knee” does not give comprehensive information on what surgeries the patient may have experienced, but still gives an idea about the most common. For this variable, the database and the original form differed in less than 1% of cases. However, the original and the information gathered during the visit differed for good 7% while the reported information could not be found in the hospital records for 1%. Since the reporting form is to be filled in during surgery, it is possible that at the time, the surgeons knowledge concerning previous surgeries differs from what later can be verified in hospital records.

Information on the ”operation techniques” (use of bone transplants, drainage, tourniquet, MIS, CAS) differed in less than 1% between the database and what had been reported (the original) while the information in the original and the new form differed in 3% of cases and for 1% the reported information could not be found in hospital records. Use of bone transplant and/or navigation is uncommon in primary knee arthroplasty in Sweden. Information that it is easy to document in the operation theatre can be difficult to verify from hospital records. To understand from an op. report if MIS has been used, depends on how (or if) the orthopedic surgeon has described the surgery, as well as the readers knowledge on interpretation of operation reports. The use of tourniquet and drainage is on the other hand often documented in the op. report and even in the anesthesia report. In all cases the anesthesia report was a paper report that had been scanned into the local computer system, even at hospitals with systems allowing for computerized anesthesia reports.

Information concerning prophylaxis includes the start time (pre- or postoperatively), name of the drug, the doses of antibiotics and antithrombotic drugs as well as the use of local infiltration analgesia (LIA). In less than 1% of cases, the original differed from what was found in the database. However more than 8% of the information in the original differed from what was entered in the new form during the hospital visit. The difference mainly concerned the doses but not the drug used. It was later found that during the visit to one of the hospitals the doses 2g+1g+1g had mistakenly been interpreted by register staff as 2g x 3.

LIA is usually given during the last part of surgery and a catheter may also be entered into the knee for postoperative administration of analgesic and/or anti-inflammatory drugs.

The information in the original and that gathered during the visit differed in a number of cases concerning if a catheter had been left in the knee or not. However, this information may be difficult to gather from an op. report as the way of documenting/describing if a catheter was left may differ.

The time for administration of the preoperative antibiotic drug is the variable that most often differs between the original form and what was registered during the later visit to the hospital. In one fourth of the cases the time difference exceeds 15 minutes.

The optimal time for administrating the preoperative prophylactic antibiotic is considered to be 15-45 minutes before surgery, based on the half-life of the most commonly used antibiotics. Thus, hospital guidelines often recommend that prophylactic antibiotics be administrated 30 minutes before start of surgery.

After the new form was introduced in 2009, the register noticed that some hospitals claimed having given the preoperative antibiotic exactly 30 minutes before surgery in more than 50% of their respective cases. This made one suspect that the time reported may have been the recommended time for administration but not the actual time. Since then we have informed the hospitals and stressed the importance of registering the actual time. During 2009 and 2010 the WHO checklist for safe surgery has been introduced at the hospitals and this has also improved the reporting of the actual time of antibiotic administration to the register.

The expected length of antibiotic treatment is a variable that also frequently differs. An explanation may be that on the report form, the planned dose is either stated in number of hours or number of days (e.g. 3 doses in 18 hours, on the day of surgery or over more days). However, during the hospital visit, the information on the duration of the prophylaxis was taken from the medicine list by noting the actual dates that the antibiotic treatment had been started and ended respectively which may help explain the discrepancies.

The expected length of antithrombotic treatment may also differ when comparing information entered during surgery and that gathered during the later hospital visit as the plan may change during the hospital stay. The patients stay for approx. 5 days at the hospital and for that time the medicine list contains the information but after discharge the information on the length of treatment is more uncertain. Some hospitals supply the patient with tablets/syringes while other write a prescription for x number of doses. Not all the discharge letters disclose how many days after leaving the hospital the patient was prescribed treatment.

On occasion, documentation on the height and/or weight of the patient was missing in the hospital records while being registered in the report form but the difference between the two registrations was overall insignificant. In the hospital records the information was in most cases found in the anesthesia record and in the scanned health statement supplied by the patient prior to surgery.

It was possible to find information on the operating time for all the cases and overall the differences between the original form, the new form and what was found in the register were insignificant.

However, for patients that had bilateral simultaneous surgeries, only the total operating time (for both knees) was typically registered in the hospital records. Thus, for these cases, information on operating time for each surgery could not be gathered during the hospital visit. However, the register asks that separate forms be filled in for each knee (even if both knees are operated on in the same anesthesia). Separate operation times for the respective knees are reported to the register as well if applicable.

The registration of the ASA rating reported on the original form and that found in the database did not differ. However, the original form and the hospitals records differed for 12% of the surgeries during the visit. At one hospital half of the cases had a higher ASA rating in the anesthesia record (ASA 3) than on the original form (ASA 2). For 2% of the surgeries no ASA rating could be found in the hospital records.

With respect to the type of anesthesia, the original form and the information found during the hospital visit differed for 7%. For 11 of 25 surgeries at one hospital the original form stated the use of spinal anesthesia while the new form filled in during the hospital visit stated spinal + general anesthesia. A possible explanation is that the anesthesia record was misinterpreted during the hospital visit. However, the original form and what had been entered into the SKAR database did not differ at all.

***Interpretation***

For the new variables, other than the timing for administration of preoperative antibiotics, differences were 3-12%, between the original form, (filled in during surgery) and the new form containing information gathered from hospitals records during the later visit. What information is correct may sometimes be difficult to decide afterwards because the information may not exist, or be difficult to find in the hospital records, besides the risk for differences in interpretation of the records.

The reporting form contained a question on how many minutes before surgery the prophylactic antibiotic was given. We found that it seemed more relevant to ask for the exact time instead, as this is what is registered in the hospital records besides that the start and end of surgery are reported this way. Therefore, a change in the reporting form has been introduced in 2012.

The hospitals are recommended to fill in the reporting form during the surgery because at this time all the relevant information should be readily available, increasing the likelihood of correct information being registered. Our experience from visiting the hospitals during the validation is that when trying to gather the same information from hospital records it may be difficult to find as it may be recorded in any (or none) of several possible locations and that it depends much on the experience and knowledge of the person trying to gather the information postoperatively.

We considered the validation to be successful and think that it may be appropriate to continue and include more hospitals. The reason for this is the additional benefit of the register and hospital staff meeting each other which improves cooperation and is an opportunity for providing education/information.

***Summary***

The latest comparison of the SKAR and the National Patient Registry (see page 6) showed that SKAR captured 97% of the hospital admissions of knee arthroplasty patients in 2010. Thus, one would expect that out of the 225 surgeries that the hospitals gathered, about 6-7 would not be found in the SKAR database. However, all the surgeries were found in SKAR which indicates a very good data capture. Also the information on the essential/base dataset as well as on the part numbers and fixation of components was very complete in the registry with less than 1% differing from what was found on the original form as well as from the information gathered when visiting the hospital. However, some of the information could not be found at all during the visit to the hospital.

The hospitals were effective in reporting the basic information. Further, the completeness in reporting the new 13 variables introduced 1st of January 2009 is good, considering that they had only been registered for 14 months at the time when the validated surgeries were performed. For some of the variables which differed from the original form and that gathered from the hospital it may be impossible to find out retrospectively exactly what was happened.

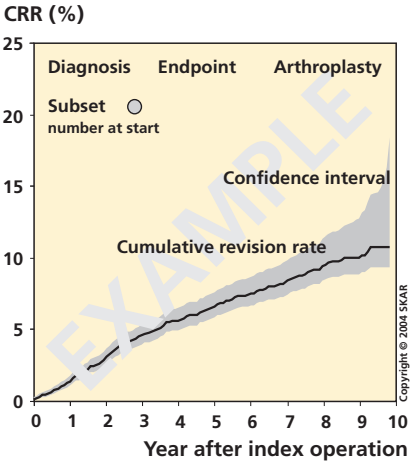
The validation has resulted in improved routines regarding reporting as well as co-operation of register- and hospital staff which motivates continuing the project at more hospitals.

## 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.

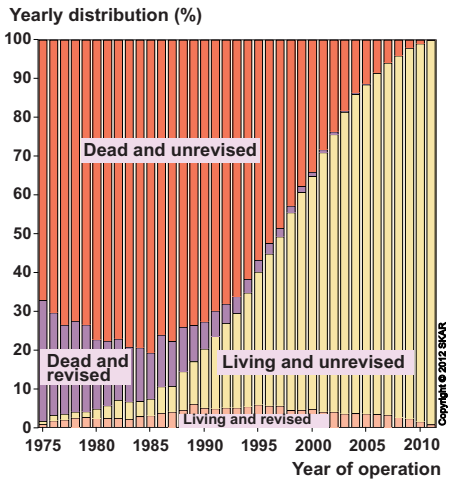
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared.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

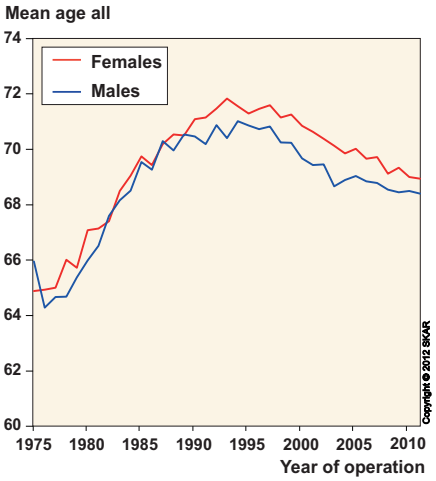



*The status in 2011 for each yearly batch of patients operated since 1975.*

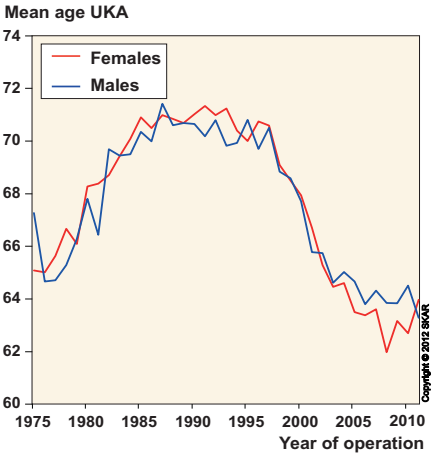
## Gender and age distribution

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).

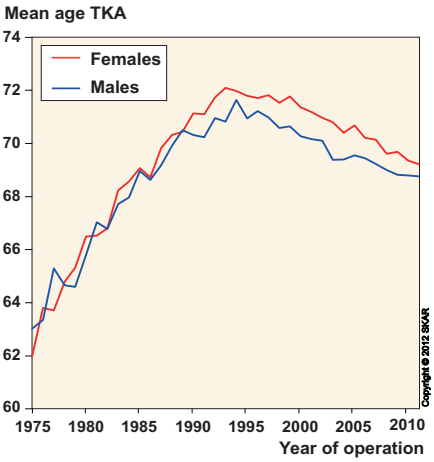
When TKA and UKA are analyzed separately, it is apparent that when TKA was introduced in the seventies it was used for younger patients than the UKA, which at the time was the standard treatment (figures below and on the next page). On the other hand, in recent years the mean age at UKA surgery has fallen 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.*

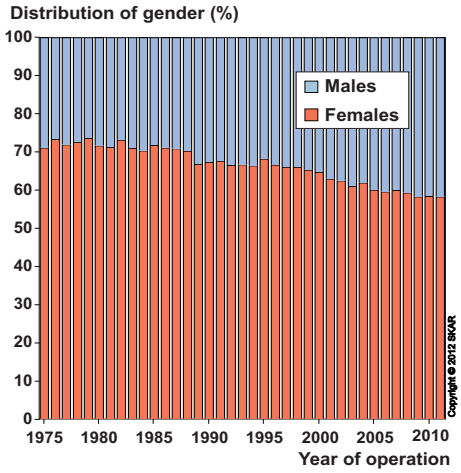



*For UKA, the mean age of patients at surgery has decreased sharply in recent years coinciding with the introduction of mini-invasive surgery.*




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

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.



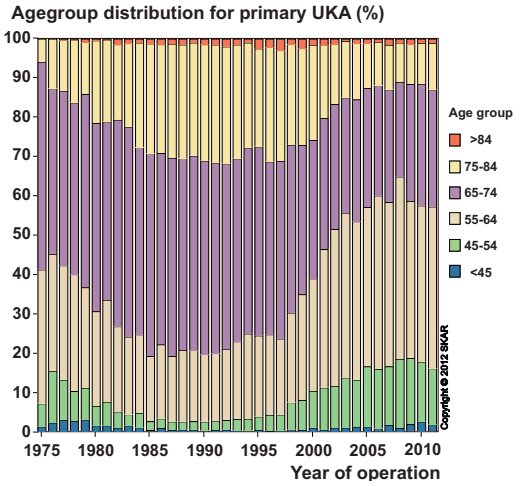

*The proportion of males has increased slightly over the years.*

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.

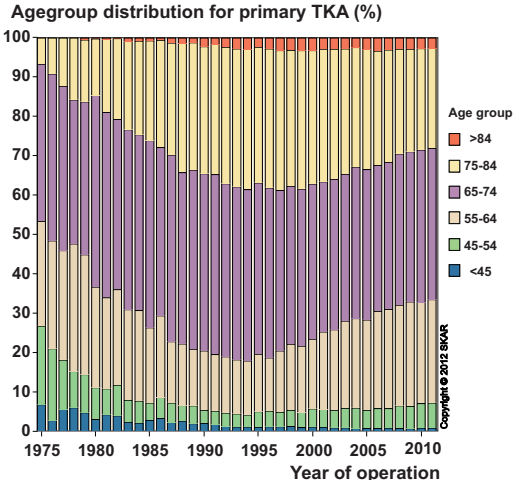
The figure to the right shows the relative number of operations performed on the different age groups over a period of thirty five years. In a somewhat different manner than the mean age (last page) it shows how the relative proportion of the older groups increased until the mid-nineties after which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

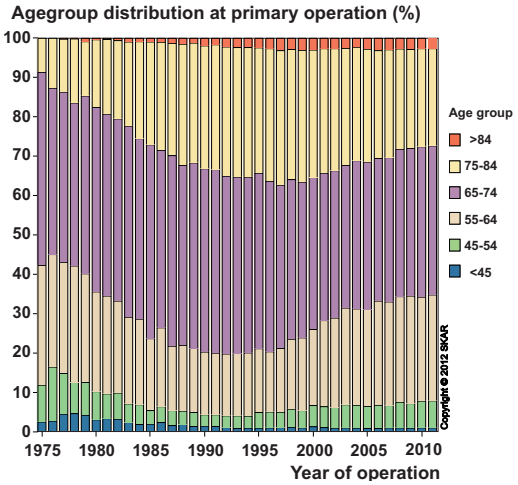
In UKA the relative proportion of patients less than 64 years of age has doubled after 1998, i.e. during the time when mini-invasive surgery caught on in Sweden. However, it has to be kept in mind that the actual number of UKA´s has diminished by 31% since 1998 in contrast to the number of TKA which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



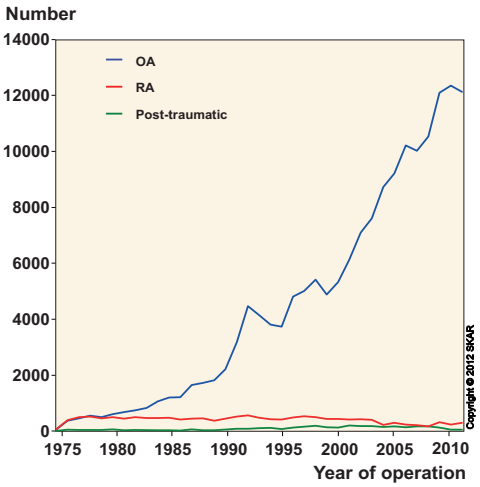

*The relative distribution of primary UKA arthroplasties among different age groups.*




*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).*



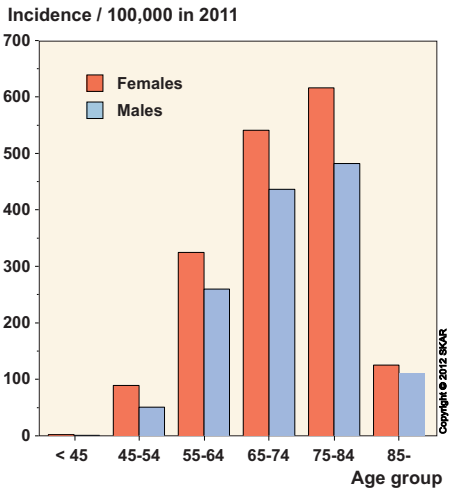

*The yearly number of arthroplasties for different diagnoses*

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.

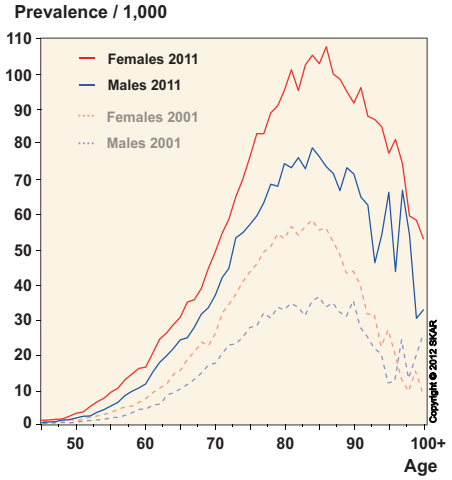
## Incidence and prevalence

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 2011. Knee arthroplasty is mainly used in the elderly and a small part of the increase in incidence reflects aging of the population over time.

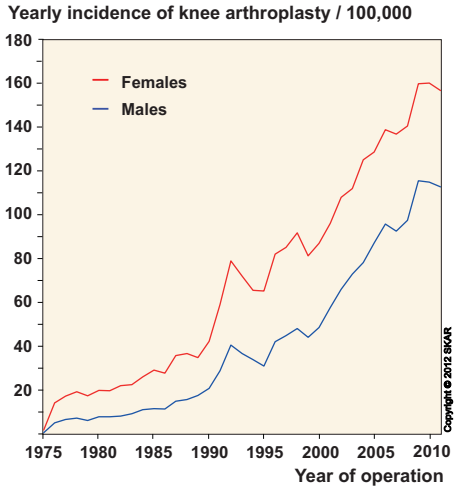
In 2000, the register published an article in which it was estimated how projected changes in the age distribution in Sweden could affect the demand for knee arthroplasty surgery. Using the incidence observed during 1996-1997, it was found that by 2030 only aging of the population would result in an 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 2011 per 100,000 inhabitants (males and females) in the different age groups.*




*The prevalence of knee arthroplasty in 2001 and 2011. 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 2011. 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. In 2011, knee arthroplasty was more common in women in all age groups. 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 2011 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 2001 and 2011 it can be seen how fast the progress has been during the last decade. In 2001, 6% of all elderly women and 4% of the men had at least one knee arthroplasty. In 2011 the numbers were 11% and 8.0% 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. However, 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 | 2011 |
|---|---|---|---|---|---|---|---|---|
| <45 | 1.1 | 1.0 | 0.9 | 1.1 | 1.5 | 1.8 | 2.0 | 2.6 |
| 45-54 | 14.6 | 11.6 | 11.4 | 15.7 | 27.5 | 49.9 | 76.0 | 89.6 |
| 55-64 | 40.1 | 44.5 | 57.4 | 104.1 | 133.9 | 199.0 | 289.4 | 325.9 |
| 65-74 | 75.6 | 107.9 | 158.0 | 306.8 | 373.2 | 476.6 | 562.6 | 542.4 |
| 75-84 | 45.8 | 81.9 | 143.7 | 305.7 | 385.0 | 479.2 | 586.0 | 617.3 |
| >84 | 2.4 | 7.9 | 19.2 | 54.4 | 82.6 | 92.4 | 121.4 | 125.9 |
| Total | 17.9 | 24.2 | 35.9 | 68.5 | 85.8 | 114.4 | 147.5 | 156.8 |

### Men

| Agegroup | 1976–1980 | 1981–1985 | 1986–1990 | 1991–1995 | 1996–2000 | 2001–2005 | 2006–2010 | 2011 |
|---|---|---|---|---|---|---|---|---|
| <45 | 0.5 | 0.3 | 0.4 | 0.4 | 0.7 | 0.9 | 1.5 | 1.7 |
| 45-54 | 6.0 | 4.8 | 4.5 | 8.8 | 14.4 | 30.0 | 46.6 | 51.5 |
| 55-64 | 17.4 | 20.3 | 28.4 | 64.9 | 81.5 | 149.2 | 222.8 | 260.4 |
| 65-74 | 31.4 | 50.5 | 81.5 | 176.6 | 239.6 | 347.1 | 441.8 | 437.6 |
| 75-84 | 20.9 | 42.5 | 91.7 | 193.1 | 246.3 | 342.4 | 458.6 | 483.4 |
| >84 | 3.9 | 8.4 | 22.4 | 51.2 | 71.3 | 89.4 | 125.3 | 112.1 |
| Total | 6.9 | 9.9 | 16.5 | 34.5 | 45.9 | 72.8 | 103.6 | 113.0 |

## Number of primary arthroplasties per unit and year

| Hospital | 1975-2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Totalt | Percent |
|---|---|---|---|---|---|---|---|---|
| Akademiska sjukhuset | 2,210 | 119 | 109 | 130 | 154 | 79 | 2,801 | 1.5 |
| Alingsås | 857 | 187 | 183 | 188 | 209 | 189 | 1,813 | 1.0 |
| Arvika | 696 | 74 | 156 | 155 | 154 | 165 | 1,400 | 0.7 |
| Avesta | 67 | . | . | . | . | . | 67 | 0.0 |
| Boden | 1,620 | . | . | . | . | . | 1,620 | 0.9 |
| Bollnäs / Söderhamn | 1,432 | 228 | 248 | 285 | 302 | 304 | 2,799 | 1.5 |
| Borås | 2,159 | 143 | 95 | 94 | 116 | 125 | 2,732 | 1.5 |
| Carlanderska | 52 | 28 | 22 | 52 | 95 | 162 | 411 | 0.2 |
| Dalslands Sjukhus | 81 | . | . | . | . | . | 81 | 0.0 |
| Danderyd | 2,081 | 218 | 227 | 178 | 144 | 192 | 3,040 | 1.6 |
| Eksjö-Nässjö (Höglandssjh.) | 2,029 | 118 | 119 | 168 | 164 | 156 | 2,754 | 1.5 |
| Elisabethkliniken | 286 | 107 | 108 | 91 | 64 | 55 | 711 | 0.4 |
| Enköping | 913 | 194 | 197 | 253 | 268 | 328 | 2,153 | 1.1 |
| Eskilstuna (Mälarsjh.) | 1,576 | 48 | 72 | 48 | 32 | 40 | 1,816 | 1.0 |
| Fagersta | 71 | . | . | . | . | . | 71 | 0.0 |
| Falköping | 1,120 | 122 | 113 | 143 | 190 | . | 1,688 | 0.9 |
| Falun | 3,163 | 223 | 202 | 245 | 306 | 351 | 4,490 | 2.4 |
| Frölunda Spec.Sjukhus | 468 | 120 | 123 | 125 | 115 | 115 | 1,066 | 0.6 |
| Gällivare | 996 | 93 | 46 | 73 | 61 | 81 | 1,350 | 0.7 |
| Gävle | 2,719 | 68 | 48 | 60 | 97 | 96 | 3,088 | 1.6 |
| Halmstad | 2,041 | 161 | 127 | 188 | 179 | 200 | 2,896 | 1.5 |
| Helsingborg | 1,668 | 14 | 13 | 26 | 20 | 20 | 1,761 | 0.9 |
| Huddinge | 1,906 | 162 | 156 | 170 | 136 | 129 | 2,659 | 1.4 |
| Hudiksvall | 1,068 | 86 | 62 | 85 | 110 | 88 | 1,499 | 0.8 |
| Hässleholm | 3,682 | 518 | 557 | 717 | 637 | 663 | 6 774 | 3.6 |
| Jönköping (Ryhov) | 1,835 | 100 | 142 | 205 | 149 | 166 | 2,597 | 1.4 |
| Kalix | 215 | . | . | . | . | . | 215 | 0.1 |
| Kalmar | 1,907 | 102 | 119 | 120 | 103 | 105 | 2,456 | 1.3 |
| Karlshamn | 1,493 | 169 | 205 | 222 | 230 | 247 | 2,566 | 1.4 |
| Karlskoga | 1,264 | 105 | 98 | 94 | 96 | 101 | 1,758 | 0.9 |
| Karlskrona | 1,117 | . | . | . | 1 | . | 1,118 | 0.6 |
| Karlstad | 2,947 | 232 | 212 | 193 | 176 | 176 | 3,936 | 2.1 |
| Karolinska | 1,664 | 162 | 234 | 121 | 123 | 108 | 2,412 | 1.3 |
| Kristianstad | 1,297 | . | . | . | . | . | 1,297 | 0.7 |
| Kristinehamn | 252 | . | . | . | . | . | 252 | 0.1 |
| Kullbergska sjukhuset | 946 | 96 | 291 | 311 | 243 | 228 | 2,115 | 1.1 |
| Kungsbacka | 37 | . | . | 1 | . | . | 38 | 0.0 |

(cont.)

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

| Hospital | 1975-2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total | Percent |
|---|---|---|---|---|---|---|---|---|
| Kungälv | 1,048 | 183 | 140 | 149 | 161 | 175 | 1,856 | 1.0 |
| Köping | 1,208 | 215 | 103 | 79 | . | . | 1,605 | 0.9 |
| Landskrona | 1,918 | . | . | . | . | . | 1,918 | 1.0 |
| Lidköping | 1,006 | 147 | 136 | 149 | 154 | 169 | 1,761 | 0.9 |
| Lindesberg | 1,133 | 95 | 84 | 150 | 171 | 157 | 1,790 | 1.0 |
| Linköping | 1,732 | . | . | . | . | . | 1,732 | 0.9 |
| Linköping medical cent | 12 | . | . | . | . | . | 12 | 0.0 |
| Ljungby | 1,137 | 73 | 66 | 112 | 148 | 119 | 1,655 | 0.9 |
| Ludvika | 338 | . | . | . | . | . | 338 | 0.2 |
| Luleå | 2 | . | . | . | . | . | 2 | 0.0 |
| Lund | 2,454 | 26 | 23 | 40 | 46 | 39 | 2,628 | 1.4 |
| Lycksele | 428 | 35 | 39 | 62 | 65 | 60 | 689 | 0.4 |
| Löwenströmska** | 1,045 | 184 | 197 | 404 | 415 | 442 | 2,687 | 1.4 |
| Malmö | 2,111 | 27 | 26 | 25 | 10 | 15 | 2,214 | 1.2 |
| Mora | 1,221 | 99 | 115 | 129 | 163 | 166 | 1,893 | 1.0 |
| Motala | 1,616 | 357 | 392 | 547 | 546 | 457 | 3,915 | 2.1 |
| Movement Halmstad | 174 | 132 | 172 | 243 | 260 | 275 | 1,256 | 0.7 |
| Mölndal | 1,108 | 107 | 140 | 198 | 262 | 266 | 2,081 | 1.1 |
| Nacka / Södersjukhuset | 203 | . | . | . | . | . | 203 | 0.1 |
| Nacka | 76 | 37 | 16 | 101 | 152 | 136 | 518 | 0.3 |
| Norrköping (Vrinnevisjh.) | 1,892 | . | 118 | 148 | 152 | 158 | 2,468 | 1.3 |
| Norrtälje | 789 | 79 | 89 | 93 | 83 | 81 | 1,214 | 0.6 |
| Nyköping | 1,006 | 102 | 120 | 115 | 121 | 120 | 1,584 | 0.8 |
| OrthoCenter IFK klin.* | 304 | 20 | 83 | 122 | 143 | 139 | 811 | 0.4 |
| Ortopediska huset | 1,299 | 422 | 381 | 437 | 386 | 346 | 3,271 | 1.7 |
| Oskarshamn | 1,246 | 265 | 304 | 225 | 189 | 239 | 2,468 | 1.3 |
| Piteå | 813 | 292 | 280 | 278 | 232 | 285 | 2,180 | 1.2 |
| S:t Göran | 5 369 | 224 | 318 | 321 | 395 | 366 | 6 993 | 3.7 |
| Sabbatsberg (Aleris) | 1,450 | . | . | 101 | 105 | 104 | 1,760 | 0.9 |
| Sahlgrenska | 1,515 | 4 | 5 | 4 | 4 | 8 | 1,540 | 0.8 |
| Sala | 115 | . | . | . | . | . | 115 | 0.1 |
| Sandviken | 301 | . | . | . | . | . | 301 | 0.2 |
| Sergelkliniken Gbg | 160 | . | . | . | . | . | 160 | 0.1 |
| Simrishamn | 1,021 | . | . | . | . | . | 1,021 | 0.5 |
| Skellefteå | 931 | 51 | 77 | 106 | 107 | 98 | 1,370 | 0.7 |
| Skene | 914 | 89 | 85 | 105 | 115 | 106 | 1,414 | 0.8 |
| Skövde | 2,214 | 94 | 87 | 99 | 103 | 186 | 2,783 | 1.5 |
| Sollefteå | 803 | 108 | 81 | 88 | 123 | 102 | 1,305 | 0.7 |
| Sophiahemmet | 1,007 | 107 | 102 | 98 | 76 | 75 | 1,465 | 0.8 |
| Spenshult | . | 54 | 135 | 141 | 220 | 238 | 788 | 0.4 |
| Sunderby | 353 | 23 | 7 | 6 | 2 | 4 | 395 | 0.2 |
| Sundsvall | 2,292 | 89 | 87 | 110 | 125 | 119 | 2,822 | 1.5 |
| Säffle | 484 | . | . | . | . | . | 484 | 0.3 |
| Söderhamn | 279 | . | . | . | . | . | 279 | 0.1 |
| Södersjukhuset | 2,955 | 330 | 353 | 357 | 340 | 323 | 4,658 | 2.5 |
| Södertälje | 760 | 124 | 143 | 122 | 117 | 120 | 1,386 | 0.7 |
| Torsby | 1,049 | 92 | 90 | 99 | 108 | 80 | 1,518 | 0.8 |
| Trelleborg | 2,927 | 553 | 480 | 578 | 600 | 605 | 5 743 | 3.1 |
| Uddevalla | 2,512 | 180 | 177 | 289 | 201 | 127 | 3,486 | 1.9 |
| Umeå | 1,894 | 138 | 120 | 216 | 230 | 165 | 2,763 | 1.5 |
| Varberg | 1,899 | 179 | 150 | 201 | 144 | 166 | 2,739 | 1.5 |
| Visby | 929 | 101 | 88 | 89 | 74 | 115 | 1,396 | 0.7 |
| Vänersborg-NÄL | 939 | . | . | . | . | . | 939 | 0.5 |
| Värnamo | 1,334 | 125 | 131 | 120 | 119 | 113 | 1,942 | 1.0 |
| Västervik | 1,385 | 88 | 98 | 101 | 74 | 97 | 1,843 | 1.0 |
| Västerås | 1,667 | 84 | 172 | 231 | 316 | 279 | 2,749 | 1.5 |
| Växjö | 1,556 | 127 | 102 | 122 | 121 | 97 | 2,125 | 1.1 |
| Ystad | 1,169 | . | . | . | . | . | 1,169 | 0.6 |
| Ängelholm | 1,327 | 163 | 145 | 149 | 143 | 161 | 2,088 | 1.1 |
| Örebro | 2,596 | 156 | 154 | 141 | 124 | 117 | 3,288 | 1.7 |
| Örnsköldsvik | 1,417 | 105 | 106 | 118 | 141 | 107 | 1,994 | 1.1 |
| Östersund | 1,491 | 94 | 84 | 135 | 161 | 163 | 2,128 | 1.1 |
| Östra sjukhuset | 1,800 | 149 | 116 | 31 | . | . | 2,096 | 1.1 |
| **Total** | **128,068** | **10,525** | **11,001** | **12,825** | **12,921** | **12,753** | **188,093** | **100** |

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

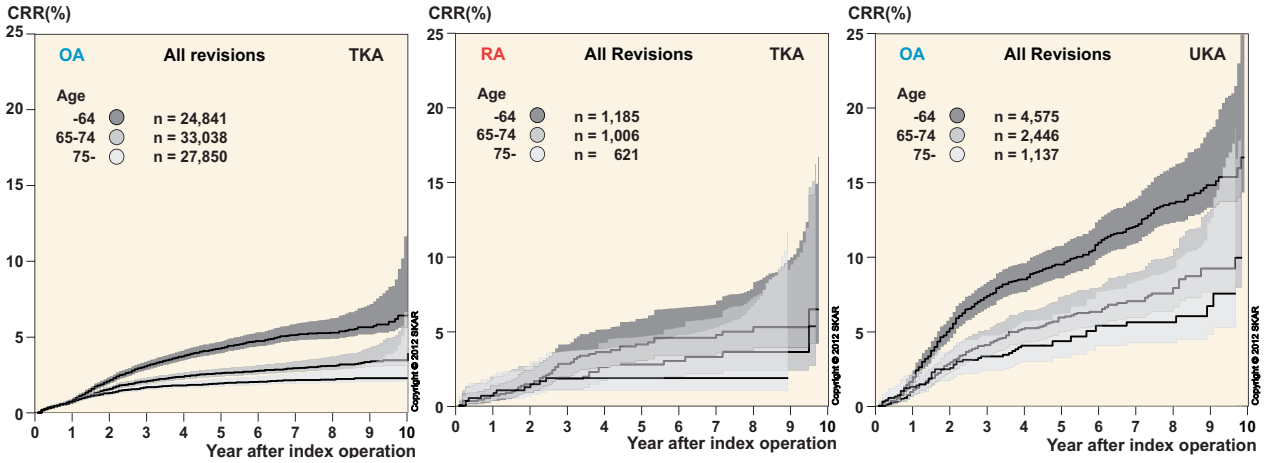
**Lövenströmska was replaced by Stockholms Specialistvård in 2001 and OrthoCenter Stockholm in 2008.

## 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.

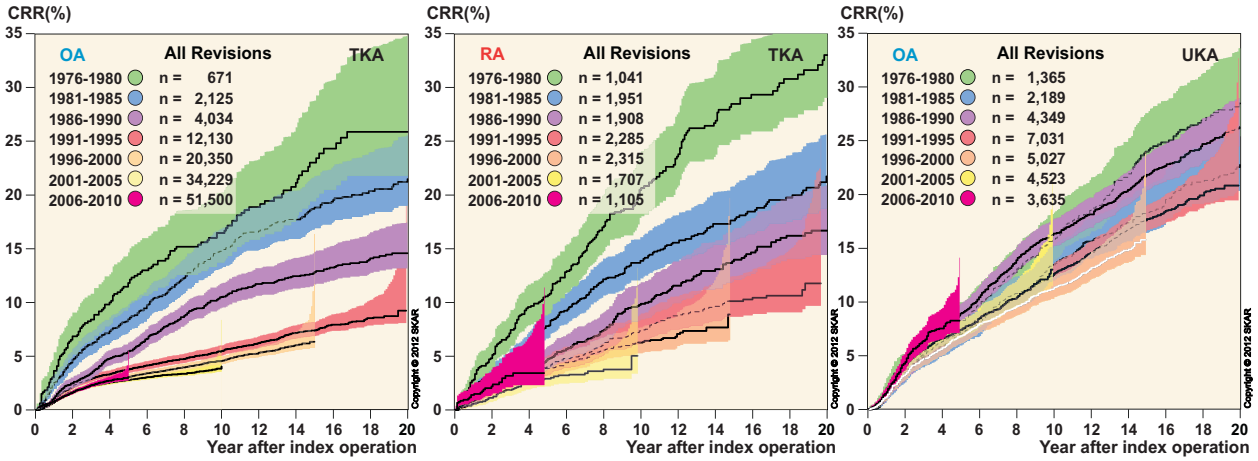
In RA, age has not affected the CRR to the same extent as in OA which has been explained by RA patients having a multiple joint disease, a lower physical level and poorer general health, irrespective of age. Still, this year age is a significant factor even in RA.



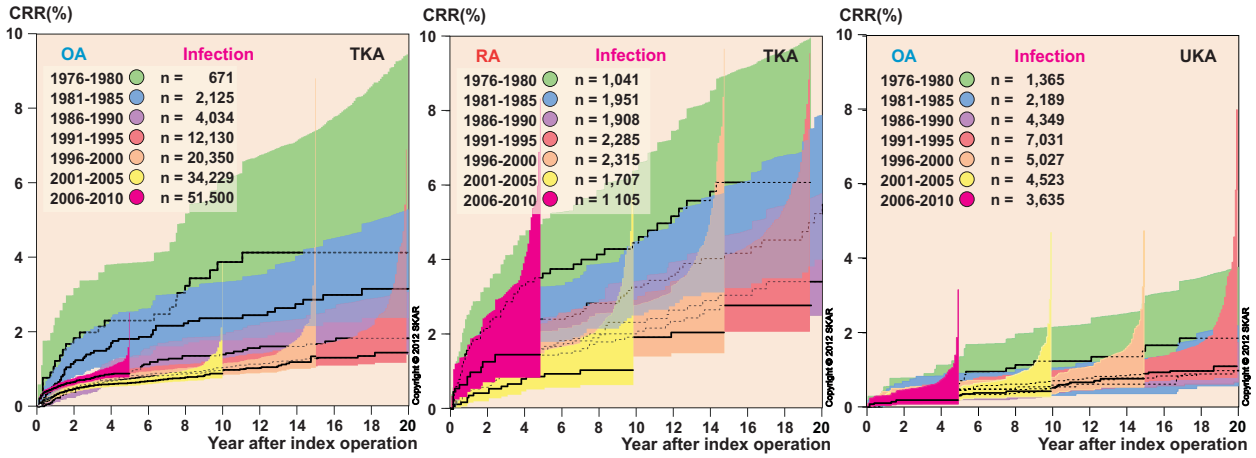

*The differences in CRR (2001–2010) between the 3 age groups <65, 65–75, >75 were significant for TKA (OA & RA) as well as UKA.*

***Year of operation*** – For TKA there has been a constant reduction in risk of revision over time with the exception of the last period (2006-2010) which has a higher risk than the previous 5-year period, especially for RA. The reason for this is mainly an increase in the number of revisions for infection (see next page). Improvement with time has not been seen for the UKA, probably as newer models have not been an improvement while changes in implants, instruments, techniques and approaches have resulted in a new or prolonged learning curve.

Further, the number of UKA ¬operations has decreased, reducing the surgical routine which has been found to be especially important in UKA.




*Comparing the CRR of different time periods, one finds for TKA, that the revision rate has decreased over the years exept for the last period for which the risk is somewhat higher than for the previous period.. An improvement with time is not as apparent for the UKA.*




*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 2006-2010 has increased as compared to 2001-2005.*

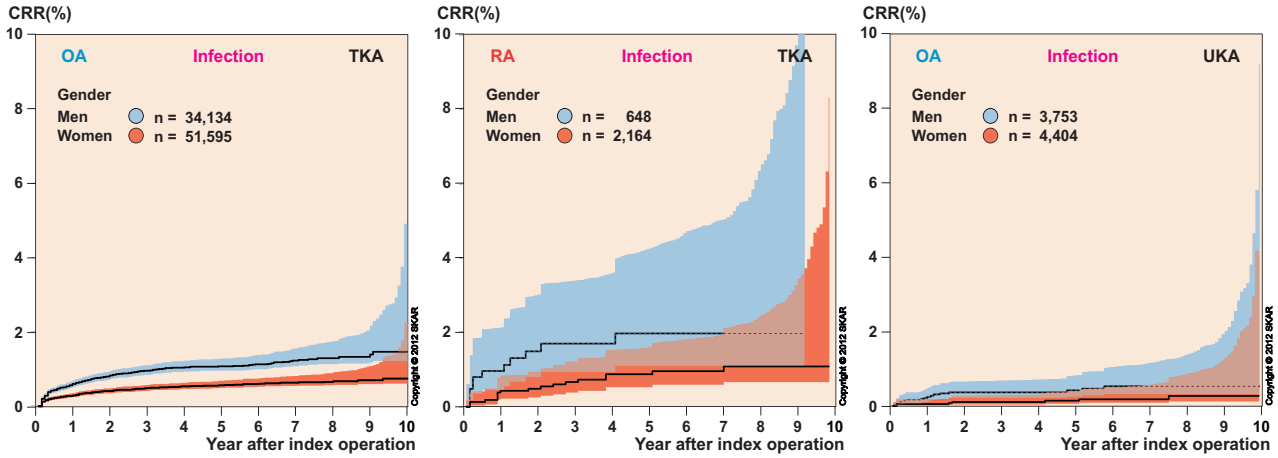
When the Knee Register estimates the risk of revision due to infection, it counts the first revision due to infection in the affected knee. It does not matter if it is the primary or any subsequent revision. Over time we have seen a reduction in this risk both for OA and RA. However, for 2006-2010 as compared to 2001-2005, an increase in the risk of early revision can be seen. This increase is mainly due to early liner exchanges performed for infections or suspected infections. The reason for this may be that surgeons have become more proactive in suspected early infections, among other things because of the PRISS project (Prosthetic Related Infections Shall be Stopped) which has visited a number hospitals to examine their treatment routines.

UKA have significantly lower risk of infection than TKA and patients with OA have a lower risk than those with RA. This is independent of if changes of inlays in for infections are considered to be revisions or not.

***Gender*** – When analyzing OA during 2001 2010 (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 the 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.

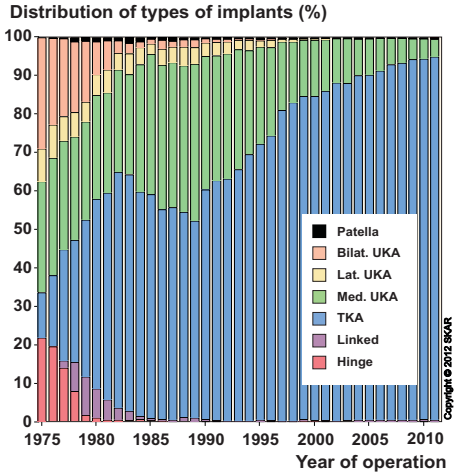



*Using the end-point; revision for infection, the CRR (2001–2010) shows in TKA for OA that men are more affected than women (RR 1.9). The same tendency is true for RA, although not significant. UKA with its smaller implant size does better than the larger TKA but even in UKA men have 2.8 times the risk 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.

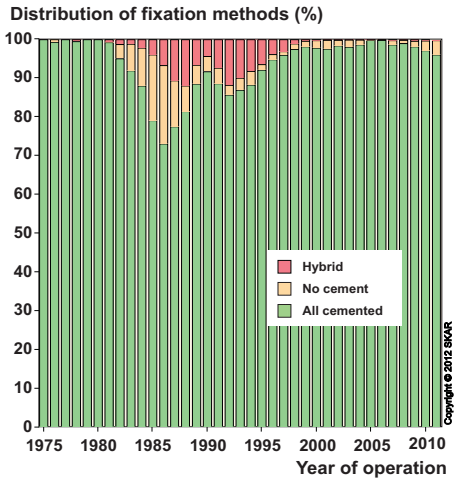
The use of UKA has diminished during the years. The reason may be that UKA has been found to have a substantially higher CRR than TKA (see figures on page 16). However, serious complications (infections/arthrodeses/amputations) are less common after UKA. When patients were asked in a mail inquiry how 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.

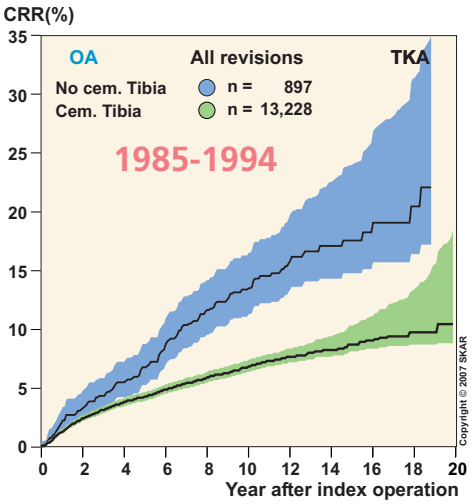



*The relative yearly distribution of implant types used for primary surgery.*

***Use of bone-cement*** – As the figure below shows, bonecement has been used in the majority of arthroplasties since the register was started. 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.*

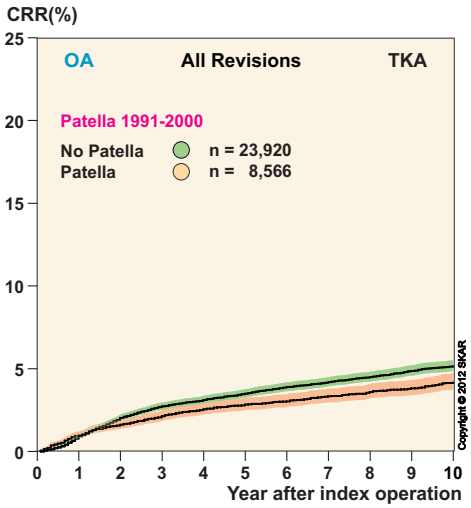



*The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.*

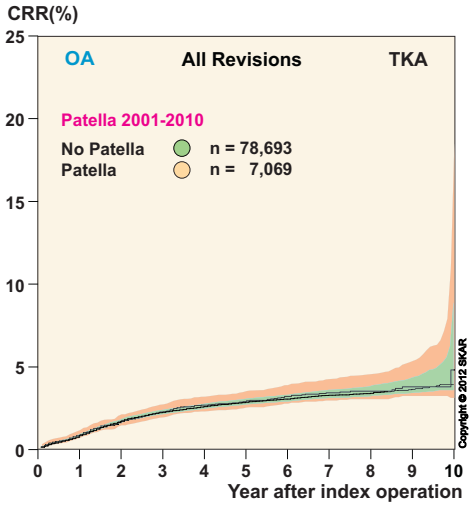
Cox regression, adjusting for age, gender, year of operation and use of a patellar component shows that the risk for TKA with an uncemented tibial component was 1.6 (1.3-1.9) times higher than for those cemented. This is in agreement with the results of the Finnish implant register which also found substantially 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. During the eighties, when patellar button was used in a good half of the cases, its use had a negative effect. Since then its use has continuously diminished so that it was only used in 3% if the TKA cases in 2011 (see figure right).

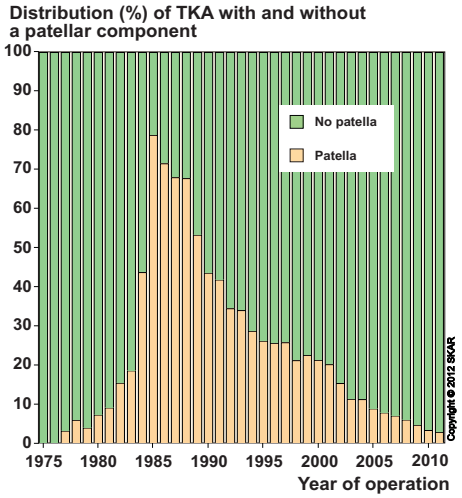
In our 2002 annual report (for the period 1991-2000) we for the first time observed that TKA with a patellar button had a lower risk of revision than those without. The increased frequency of revisions was caused by the need for secondary patellar resurfacing because of femoropatellar pain. In 2007 the benefit of the button began diminishing and had become not significant in 2010 (all TKA, 1999-2008).




*10-year CRR for TKA/OA inserted during the earlier 10-year period 1991-2000 (with follow-up untill 2010), with and without patellar component respectively*




*10-year CRR for TKA/OA inserted during the current 10-year period 2001-2010, with and without patellar component respectively*




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

The picture on the left shows the 10-year CRR for TKA inserted during the period 1991-2000, with or without a patellar button, respectively. The follow-up ended in 2010 which means that all non-deceased patients have been followed for 10 years. One can see that during this period a TKA without a patellar button had a significantly higher revision rate than those without (RR x 1.3 (CI 1.1-1.4). However, for the current period 2001-2010 (figure left, below) there was no significant difference (p=0.5). We have no way knowing if the explanation for this may be that the femoral components have become more "patellar friendly" or if the surgeons have discovered that a patellar addition is not always successful and thus are performing fewer such revisions.

It has to be kept in mind that patellar additions 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 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.

It may 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. We have decided to show in the figures the total CRR of all TKA together (with and without a button) giving a general picture of the results for certain groups of patients and implants. When comparing the risk-ratios of implants (page 34-37), we separately account for the results of TKA with, and without a button. Finally, when comparing the risk of revision for the different hospitals (page 42-45), 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 2011 (http://www.haukeland.no/nrl/).
According to the 2011 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.

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***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 2011

**12,753 primary arthroplasties reported in 2011 by type and region**

| TYPE | Stockholm Gotland | Uppsala Örebro | Southeast | South | West | North |
|---|---|---|---|---|---|---|
| Linked | 5 | 19 | 5 | 5 | 20 | 8 |
| TKA | 2,371 | 2,779 | 1,380 | 1,892 | 2,468 | 1,158 |
| UKA medial | 133 | 128 | 99 | 61 | 156 | 10 |
| UKA lateral | 2 | . | 1 | . | . | . |
| Patella | 25 | 3 | 6 | 8 | 2 | 8 |
| Other | . | 1 | . | . | . | . |
| Total: | 2,536 | 2,930 | 1491 | 1,966 | 2,646 | 1,184 |

**Implants for primary TKA in 2011**

| Number | Percent | |
|---|---|---|
| NexGen | 5,538 | 46.0 |
| PFC Sigma | 3,256 | 27.0 |
| Vanguard | 1,299 | 10.8 |
| Triathlon | 1,172 | 9.7 |
| Profix | 253 | 2.1 |
| AGC | 159 | 1.3 |
| PFC Rotating Platform | 82 | 0.7 |
| Journey TKA | 34 | 0.3 |
| Genesis | 23 | 0.2 |
| Other* | 232 | 1.9 |
| Total : | 12,048 | 100 |

*Mainly revision models

**Implants for primary UKA in 2011**

| | Number | Percent |
|---|---|---|
| Oxford | 262 | 44.4 |
| Link | 156 | 26.4 |
| ZUK | 97 | 16.4 |
| Genesis | 37 | 6.3 |
| Triathlon PKR | 25 | 4.2 |
| MillerGalante | 6 | 1.0 |
| DePuy UKA (new) | 4 | 0.7 |
| Preservation | 2 | 0.3 |
| Missing | 1 | 0.2 |
| Total: | 590 | 100 |

All 74 units routinely performing elective knee arthroplasty surgery in Sweden reported to the registry during 2011. Although a few reports may be turned in late, they are expected to have a small effect on the number of operations.

The number of reported primary arthroplasties decreased from 12,861 in 2010 to 12,753, or by 0.8%. For UKA there was a hefty decrease of 13.6% while but only 0.3% for TKA.

830 revisions have been reported for 2011 of which 182 were secondary (not the first revision). In 604 cases the primary was a TKA, in 203 a UKA, in 10 a Femoro-Patellar implant and in 13 cases a linked implant. The annual report and the accompanying lists that are sent to the contact surgeons result every year in a number of extra revisions becoming reported. Because of this and the fact that revisions are complicated procedures for which supplementary information is often needed the survival analyses end 2010.

**The 3 most common implants for primary TKA in each region in 2011**

| | Modell 1 | n | Modell 2 | n | Modell 3 | n | Other |
|---|---|---|---|---|---|---|---|
| Stockholm/Gotland | NexGen | 1,064 | PFC Sigma | 980 | Triathlon | 208 | 119 |
| Uppsala/Örebro | NexGen | 1,265 | PFC Sigma | 1124 | AGC | 98 | 292 |
| Southeast | NexGen | 963 | Vanguard | 407 | NexGen LCCK | 9 | 1 |
| South | Triathlon | 915 | PFC Sigma | 443 | Vanguard | 390 | 144 |
| West | NexGen | 1,700 | Vanguard | 388 | PFC Sigma | 332 | 48 |
| North | NexGen | 538 | PFC Sigma | 376 | Profix | 85 | 159 |

**The 3 most common implants for primary UKA in each region in 2011**

| | Modell 1 | n | Modell 2 | n | Modell 3 | n | Other |
|---|---|---|---|---|---|---|---|
| Stockholm/Gotland | Oxford | 60 | ZUK | 31 | Link | 30 | 14 |
| Uppsala/Örebro | Link | 74 | ZUK | 20 | Genesis | 19 | 15 |
| Southeast | Oxford | 65 | Genesis | 18 | Link | 17 | . |
| South | Oxford | 30 | Triathlon | 16 | Link | 15 | . |
| West | Oxford | 97 | ZUK | 41 | Link | 15 | 3 |
| North | Link | 5 | ZUK | 5 | . | . | . |

# Bone cement and minimally invasive surgery in 2011

**Use of cement in primary surgery during 2011**

| | Primary TKA | Primary UKA |
|---|---|---|
| No component without cement | 11,547 | 588 |
| Only the femoral component without cement | 16 | 1 |
| Only the tibial component without cement | 19 | – |
| The femur- and tibial components without cement | 444 | – |
| Only the patellar button without cement | – | – |
| Unknown | 22 | 1 |
| Total | 12,048 | 590 |

| | Number | Percent | Number | Percent |
|---|---|---|---|---|
| Refobacin (gentamicin) | 5,460 | 47,1 | 382 | 64,7 |
| Palacos R+G (gentamicin) | 5,392 | 46,5 | 189 | 32,0 |
| Smartset GHV (gentamycin) | 366 | 3,2 | 15 | 2,5 |
| Cemex (gentamicin) | 341 | 2,9 | 3 | 0,5 |
| Simplex P | 12 | 0,1 | 1 | 0,2 |
| Other cement | 17 | 0,1 | – | – |
| Missing | 16 | 0,1 | – | – |
| Subtotal | 11,604 | 100 | 590 | 100 |
| All parts without cement | 444 | 3,7 | 0 | – |
| Total | 12,048 | | 590 | |

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 2011, 3.7% of the TKA´s were inserted without the use of cement (2.4% in 2010) 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 three 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 590 primary UKA in 2011**

| | Standard incision | Mini-incision | Missing |
|---|---|---|---|
| Oxford | 61 | 199 | 2 |
| Link | 128 | 28 | |
| ZUK | 42 | 55 | |
| Genesis | 37 | | |
| Triathlon | 10 | 15 | |
| MillerGalante | 2 | 4 | |
| Other | 3 | 4 | |
| Total | 283 | 305 | 2 |

## The use of patellar button for TKA in 2011

The use of a patellar button has been decreasing since the mid-eighties so that it is now only used in barely 3% of the TKA cases. During 2011 use of a button was most common in the Southeast region as well as in Stockholm+Gotland (see figure below).

It is not only in Sweden that geographical variations are to be found. The Australian arthroplasty register annual report in 2009 (http://www.dmac.adelaide.edu.au/aoanjrr/index) reported a substantial regional difference in the use of a patellar button.

The use of a patellar button has also been heavily related to the implant model used although the difference has diminished as its use hase become more uncommon. In 2011, button was most commonly used with Vanguard, Profix and PFC rotating platform implants.

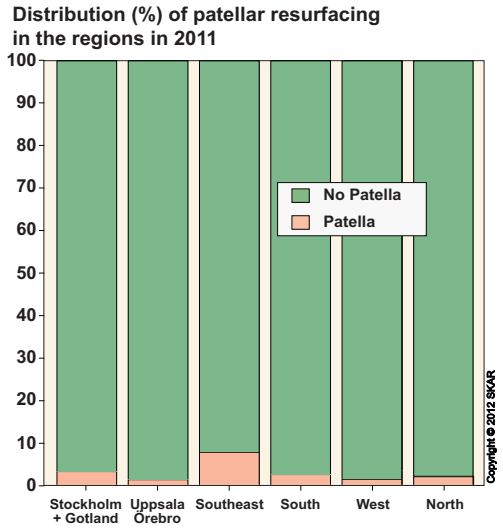
In Sweden, females have their patella resurfaced slightly more often than males. In the whole material, from the start to the end of 2011, 16.6% of the women had their patella resurfaced compared to 13.3% of the males which is a significant difference. During 2011 2.1% of the men had a patellar button compared to 3.2% of the women..

**Use of patellar button with different TKA implants in 2011**

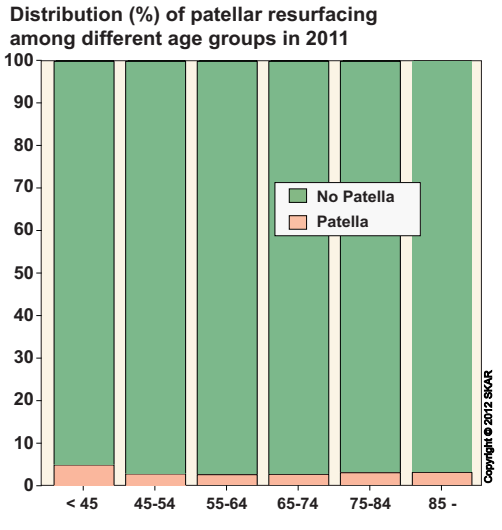
| | No patellar button | % | Patellar button | % |
|---|---|---|---|---|
| NexGen | 5,447 | 98.4 | 91 | 1.6 |
| PFC Sigma | 3,186 | 97.9 | 70 | 2.1 |
| Vanguard | 1,177 | 90.6 | 122 | 9.4 |
| Triathlon | 1,160 | 99.0 | 12 | 1.0 |
| Profix | 231 | 91.3 | 22 | 8.7 |
| AGC | 158 | 99.4 | 1 | 0.6 |
| PFC Rotating Platform | 76 | 92.7 | 6 | 7.3 |
| Journey TKA | 34 | 100.0 | . | . |
| Övriga | 248 | 97.3 | 7 | 2.7 |
| Total | 11,717 | 97.3 | 331 | 2.7 |

Looking at the relative use of a patellar button in the different age groups during 2011 (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 19 together with CRR curves for TKA inserted during the current period of 2001-2010, with and without a button respectively.

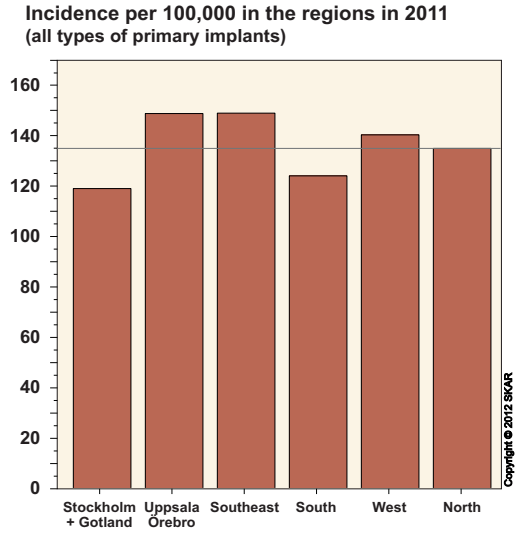



*The figure shows the relative proportion of TKA with and without patellar button in the different regions during 2011*

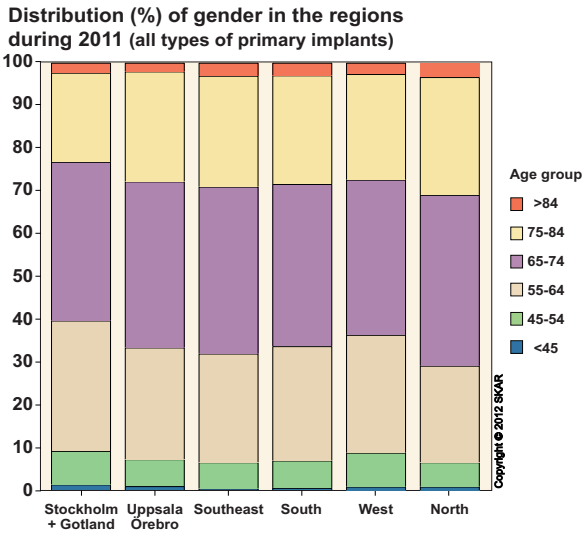



*The figure shows the relative proportion of TKA with and without patellar button in the different age-groups during 2011.*

## Age distribution and incidence in the regions 2011




*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 (135.0)*



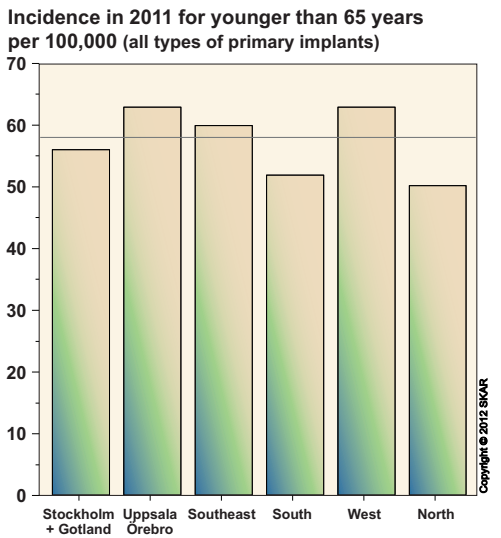

*The age distribution at primary surgery varies somewhat between the regions although the differences are small. As previously, Stockholm and Gotland has the youngest patients.*

The figure above shows the incidence of primary knee arthroplasty in the respective regions during 2011. Please note that this relates to the number of surgeries performed, not the number of inhabitants operated.

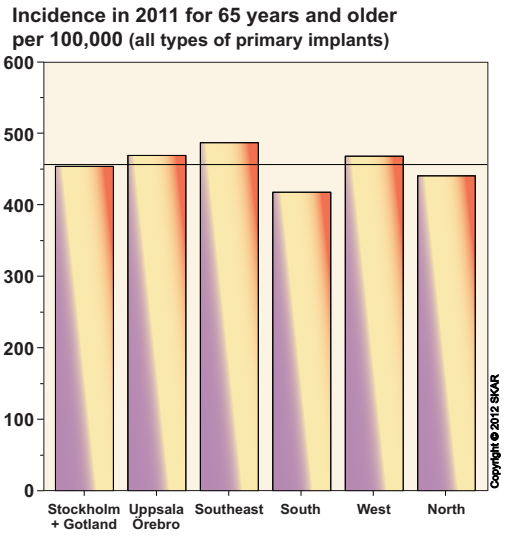
As compared to 2010, the incidence has decreased from 137.1 to 135.0 which is a modest decrease considering that the incidence was 68.3 in 2000.

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 their age profiles.

The figures below show the incidence 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 the West but lowest in the South and North. In the country as a whole it is unchanged compared to 2010. In those 65 and older, the incidence decreased by 5.3% from 2010 with small differneces amongst the regions.

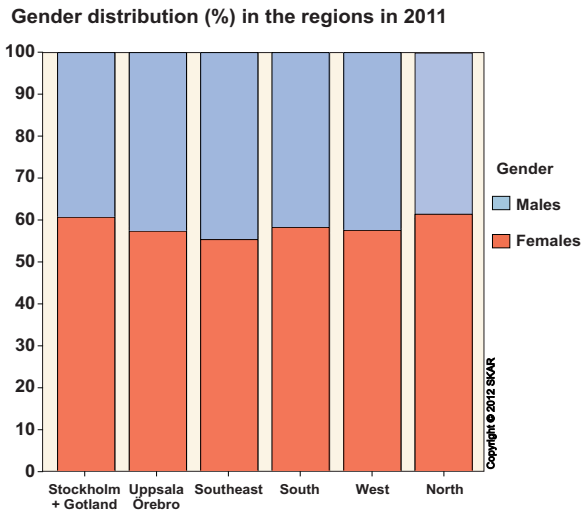



*The incidence per inhabitants younger than 65 years of age is highest in the Uppsala Örebro region. (the black line shows the mean for the whole country (58.1).*



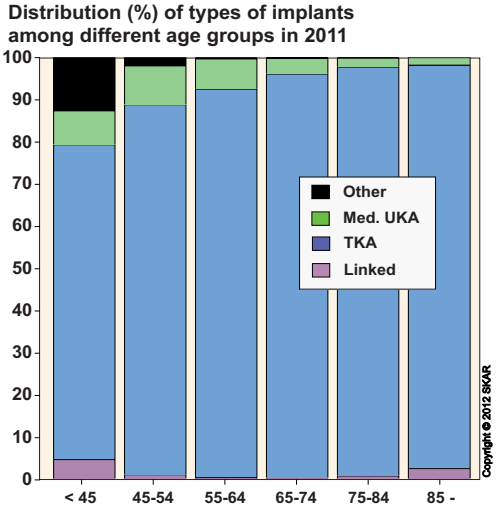

*The incidence per inhabitants that are 65 years of age or older is lowest in the North and South regions. (the black line shows the mean for the whole country (456.3).*

## Gender distribution in the regions



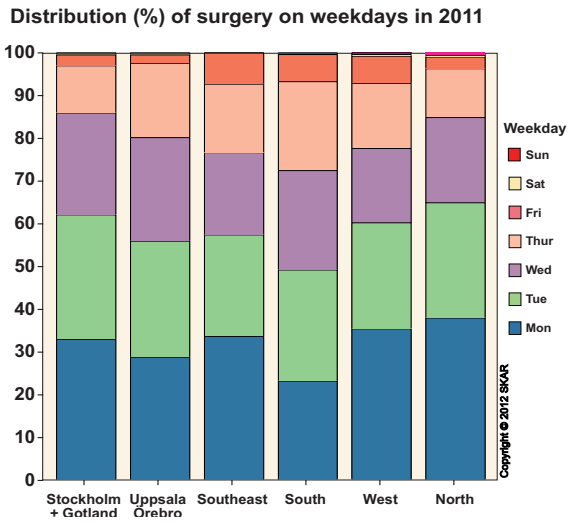

*The proportion of females is 56-60% in the regions.*

## Type of implants in different age groups

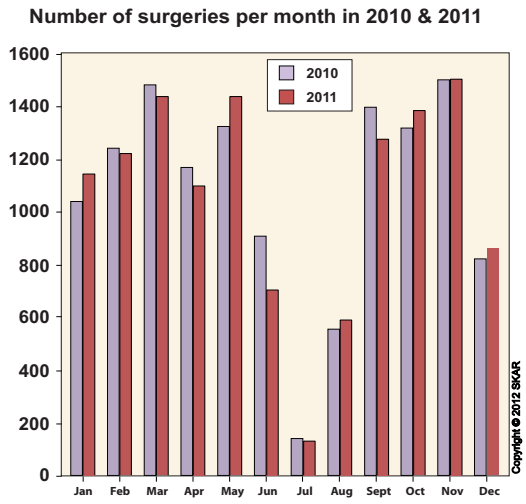



*Uncommon models are most often used in patients younger the 45 years. The relative high proportion of linked implant is caused by serious conditions (tumors, trauma etc.)*

## Distribution of surgery on the weekdays and months




*Distribution of surgery on the weekdays during 2011. Surgery on Fridays and weekends is uncommon.*




*The mean number of primary knee arthroplasties inserted each month during 2010 and 2011.*

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 2011, surgeries on Fridays were most common in the Southeast, South and West while surgeries on saturdays and sundays were almost nonexistent.

The picture above shows the mean number of operations per month during 2010 and 2011. 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 2001–2010

In the tables below, the implants used during the investigated period 2001-2010 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 is still the third most common implant although its use has diminished considerably since Biomet introduced the Vanguard implant which was the third most commonly used implant in 2011 (page 21).

Among the UKA 3 models account for the majority of surgeries. Of the 11 models listed below, only six were still being used in 2011.

### Implants for primary TKA during 2001–2010

| | Number | Percent |
|---|---|---|
| PFC Sigma | 26,752 | 29.4 |
| NexGen | 24,561 | 27.0 |
| AGC | 13,701 | 15.1 |
| Duracon | 7,478 | 8.2 |
| F/S MIII | 5,757 | 6.3 |
| Vanguard | 3,623 | 4.0 |
| Triathlon | 3,072 | 3.4 |
| Profix | 1,721 | 1.9 |
| PFC Rotating Platform | 1,043 | 1.1 |
| Kinemax | 892 | 1.0 |
| Natural | 502 | 0.6 |
| Scan | 385 | 0.4 |
| LCS | 202 | 0.2 |
| Journey | 47 | 0.1 |
| Oxford Rotating TKA | 26 | 0.0 |
| NexGen Mobile bearing | 23 | 0.0 |
| AMK | 17 | 0.0 |
| Performance | 15 | 0.0 |
| Evolution | 12 | 0.0 |
| Other | 1 120 | 1.2 |
| Missing | 26 | 0.0 |
| Other* | 1.018 | 1.2 |
| Total | 90,975 | 100 |

*Mainly revision models, see table above right.

### Implants for primary UKA during 2001–2010

| | Number | Percent |
|---|---|---|
| Link | 3,264 | 38.9 |
| Oxford | 1,985 | 23.7 |
| MillerGalante | 1,969 | 23.5 |
| Genesis | 506 | 6.0 |
| ZUK | 332 | 4.0 |
| Preservation | 154 | 1.8 |
| EIUS | 47 | 0.6 |
| PFC | 45 | 0.5 |
| Triathlon | 45 | 0.5 |
| Duracon | 32 | 0.4 |
| Allegretto | 12 | 0.1 |
| Marmor | 1 | 0 |
| Total | 8,392 | 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 2001–2010

| | Number | Percent |
|---|---|---|
| PFC revision | 268 | 24.2 |
| NexGen revision | 186 | 16.8 |
| Profix revision | 186 | 16.8 |
| AGC revision | 156 | 14.1 |
| Duracon revision | 147 | 13.3 |
| Triathlon revision | 105 | 9.5 |
| Vanguard revision | 31 | 2.8 |
| Freeman revision | 17 | 1.5 |
| Other | 11 | 1.0 |
| Total | 1,107 | 100 |

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

### Hinged implants (primary) during 2001–2010

| | Number | Percent |
|---|---|---|
| Rotalink | 246 | 55.4 |
| Nexgen rotating hinge | 83 | 18.7 |
| Noiles rotating hinge | 33 | 7.4 |
| Stryker/Howm. rotating hinge | 30 | 6.8 |
| MUTARS | 27 | 6.1 |
| METS | 9 | 2.0 |
| Stanmore | 7 | 1.6 |
| Kotz | 3 | 0.7 |
| Other | 6 | 1.4 |
| Total | 444 | 100 |

Femoropatellar implants are uncommon. Only 175 cases have been reported the last 10 years using 7 different brands.

### Patello-femoral implants during 2001–2010

| | Number | Percent |
|---|---|---|
| Avon P-F | 49 | 28,0 |
| Zimmer P-F | 44 | 25,1 |
| Link / Lubinus P-F | 43 | 24,6 |
| Richard/Blazina | 23 | 13,1 |
| Journey P-F | 6 | 3,4 |
| LCS P-F | 5 | 2,9 |
| Vanguard P-F | 4 | 2,3 |
| Unknown | 1 | 0,6 |
| Totalt | 175 | 100 |

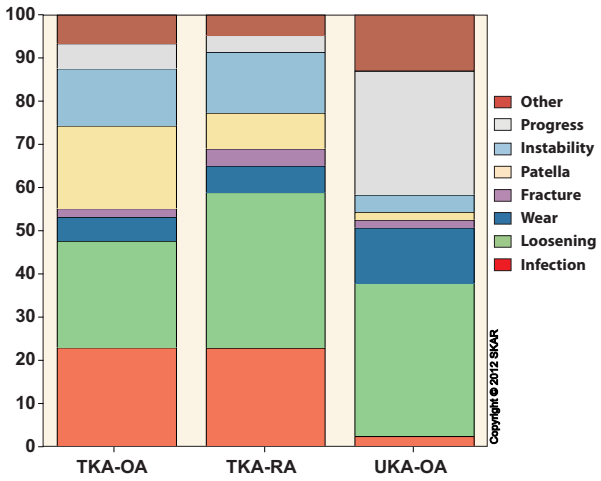
## Revisions during 2001–2010

During the 10-year period, 5,146 revisions were performed. 2,823 were revisions after TKA for OA, 281 after TKA for RA and 1,622 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 2001-2010. There are separate tables depending on if the primary surgery was TKA/OA, TKA/ RA or UKA/OA. It should be noted that in revision surgery, only one type of revision can be stated. 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 (25% in OA and 12% in RA). Extensive revisions using linked implants 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.

**Distribution (%) of indications for revision 2001-2010**




**Type of revision 2001–2010 in which the primary was a TKA/OA**

| | Number | Percent |
|---|---|---|
| Linked (rot. hinge) | 267 | 9.5 |
| TKA | 744 | 26.4 |
| Exchange of femur comp. | 33 | 1.2 |
| Exchange of tibia comp. | 194 | 6.9 |
| Exchange of disc/inlay | 489 | 17.3 |
| Patella addition | 669 | 23.7 |
| Patella exchange | 35 | 1.2 |
| Patella removal | 11 | 0.4 |
| Total implant removal | 334 | 11.8 |
| Arthrodesis | 31 | 1.1 |
| Amputation | 16 | 0.6 |
| Total | 2,823 | 100 |

**Type of revision 2001–2010 in which the primary was a UKA/OA**

| | Number | Percent |
|---|---|---|
| Linked (rot. hinge) | 26 | 1.6 |
| TKA | 1,506 | 92.8 |
| Medial UKA | 12 | 0.7 |
| Lateral UKA | 1 | 0.1 |
| Exchange of femur comp. | 4 | 0.2 |
| Exchange of tibia comp. | 6 | 0.4 |
| Exchange of meniscus/inlay | 29 | 1.8 |
| Open reposition of meniscus | 3 | 0.2 |
| Patella addition | 5 | 0.3 |
| Total implant removal | 29 | 1.8 |
| Arthrodesis | 0 | 0.0 |
| Amputation | 1 | 0.1 |
| Total | 1,622 | 100 |

**Type of revision 2001–2010 in which the primary was a TKA/RA**

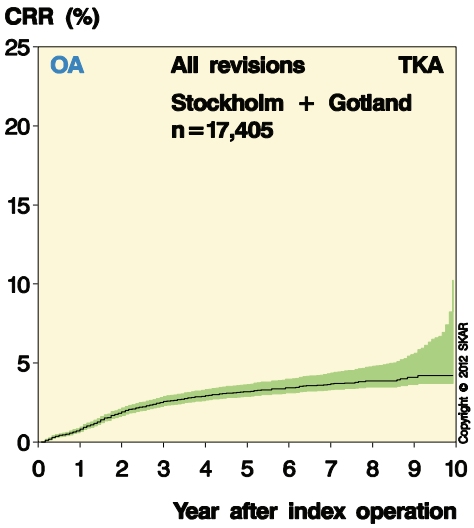
| Number | Percent | |
|---|---|---|
| Linked (rot. hinge) | 55 | 19.6 |
| TKA | 93 | 33.1 |
| Exchange of femur comp. | 5 | 1.8 |
| Exchange of tibia comp. | 14 | 5.0 |
| Exchange of disc/inlay | 32 | 11.4 |
| Patella addition | 33 | 11.7 |
| Patella exchange | 1 | 0.4 |
| Patella removal | 1 | 0.4 |
| Total implant removal | 44 | 15.7 |
| Artrodes | 2 | 0.7 |
| Amputation | 1 | 0.4 |
| Total | 281 | 100 |

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

# Primary TKA implants for OA in the regions during 2001–2010

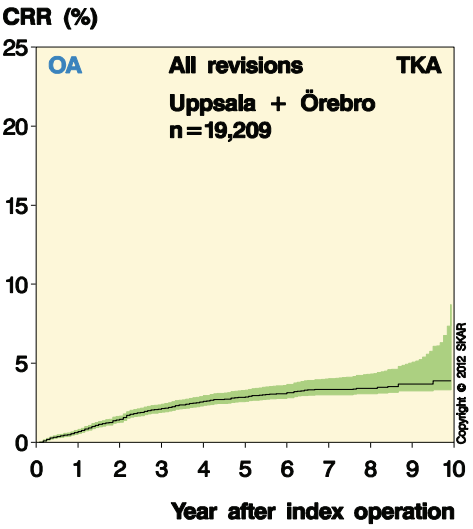
### Stockholm + Gotland
### Primary TKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| PFC Sigma | 8,989 | 51.6 |
| NexGen | 3,828 | 22 |
| Duracon | 1,617 | 9.3 |
| F/S MIII | 1,318 | 7.6 |
| Triathlon | 430 | 2.5 |
| Kinemax | 322 | 1.9 |
| AGC | 264 | 1.5 |
| PFC Rotating Platform | 256 | 1.5 |
| Vanguard | 142 | 0.8 |
| Natural | 72 | 0.4 |
| Profix | 33 | 0.2 |
| Övriga | 134 | 0.8 |
| Totalt | 17,405 | 100.0 |



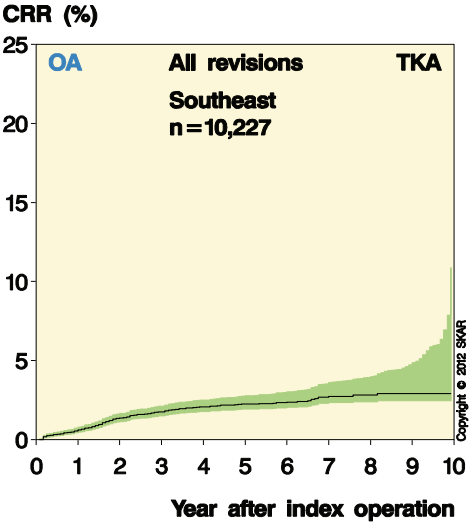

### Uppsala+Örebro
### Primary TKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| NexGen | 7,257 | 37.8 |
| AGC | 4,005 | 20.8 |
| PFC Sigma | 3,543 | 18.4 |
| F/S MIII | 2,286 | 11.9 |
| Duracon | 644 | 3.4 |
| Kinemax | 502 | 2.6 |
| PFC Rotating Platform | 282 | 1.5 |
| Natural | 268 | 1.4 |
| Profix | 206 | 1.1 |
| Journey TKA | 60 | 0.3 |
| Vanguard | 28 | 0.1 |
| NexGen Mobile bearing | 23 | 0.1 |
| Triathlon | 21 | 0.1 |
| Övriga | 84 | 0.4 |
| Totalt | 19,209 | 100 |



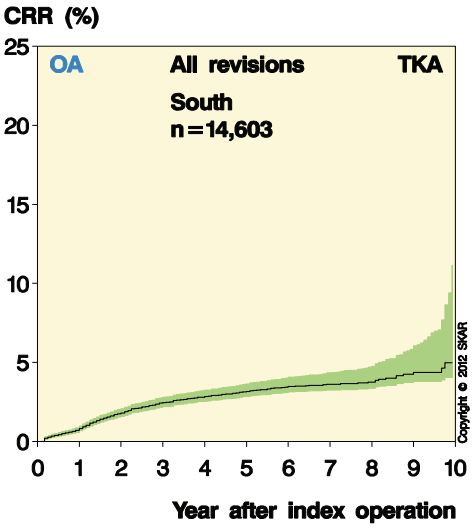

### Southeast
### Primary TKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| NexGen | 3,937 | 38.5 |
| PFC Sigma | 3,123 | 30.5 |
| AGC | 2,150 | 21 |
| Vanguard | 772 | 7.5 |
| Triathlon | 107 | 1 |
| PFC Rotating Platform | 28 | 0.3 |
| Profix | 25 | 0.2 |
| Evolution | 11 | 0.1 |
| Duracon | 6 | 0.1 |
| Övriga | 68 | 0.7 |
| Totalt | 10,227 | 100 |



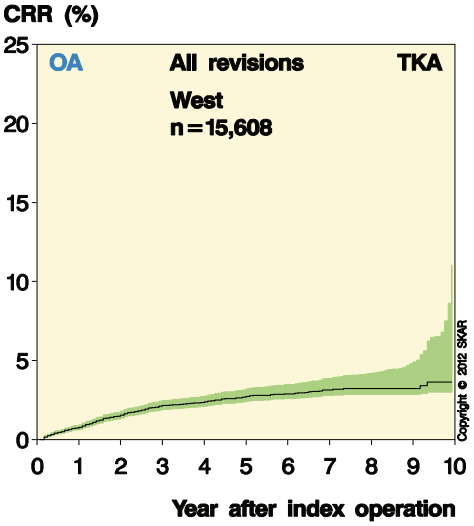
### South
### Primary TKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| PFC Sigma | 5,317 | 36.4 |
| Duracon | 2,537 | 17.4 |
| Triathlon | 2,326 | 15.9 |
| AGC | 2,178 | 14.9 |
| Vanguard | 827 | 5.7 |
| Profix | 518 | 3.5 |
| PFC Rotating Platform | 326 | 2.2 |
| Scan | 223 | 1.5 |
| NexGen | 38 | 0.3 |
| Oxford Rotating TKA | 22 | 0.2 |
| LCS | 8 | 0.1 |
| Övriga | 283 | 1.9 |
| Totalt | 14,603 | 100 |



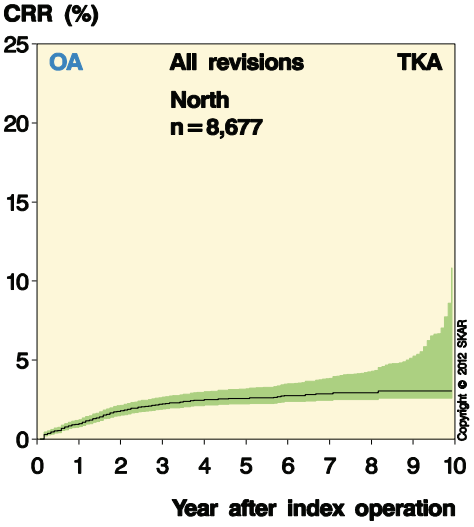

### West
### Primary TKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| NexGen | 5,469 | 35 |
| AGC | 2,854 | 18.3 |
| PFC Sigma | 2,068 | 13.2 |
| F/S MIII | 1,796 | 11.5 |
| Duracon | 1,584 | 10.1 |
| Vanguard | 1,454 | 9.3 |
| Natural | 133 | 0.9 |
| Triathlon | 59 | 0.4 |
| Scan | 57 | 0.4 |
| PFC Rotating Platform | 46 | 0.3 |
| Profix | 10 | 0.1 |
| Övriga | 80 | 0.5 |
| Totalt | 15 ,608 | 100 |




### North
### Primary TKA implants for OA, 2001–2010

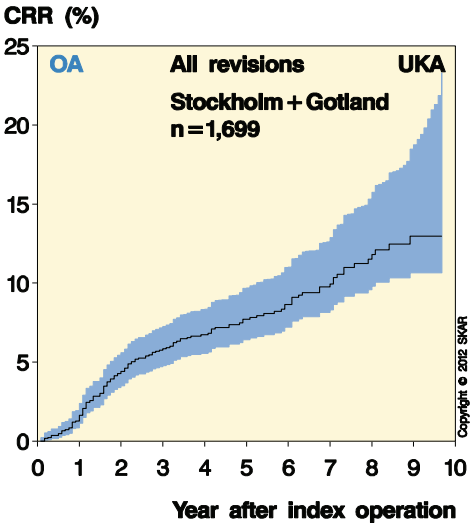
| Number | Percent | |
|---|---|---|
| NexGen | 2,907 | 33.5 |
| PFC Sigma | 2,392 | 27.6 |
| AGC | 1,453 | 16.7 |
| Profix | 774 | 8.9 |
| Duracon | 660 | 7.6 |
| Vanguard | 199 | 2.3 |
| LCS | 157 | 1.8 |
| PFC Rotating Platform | 30 | 0.3 |
| Performance | 13 | 0.1 |
| Triathlon | 10 | 0.1 |
| Övriga | 82 | 0.9 |
| Totalt | 8,677 | 100 |



# Primary UKA implants for OA in the regions during 2001–2010

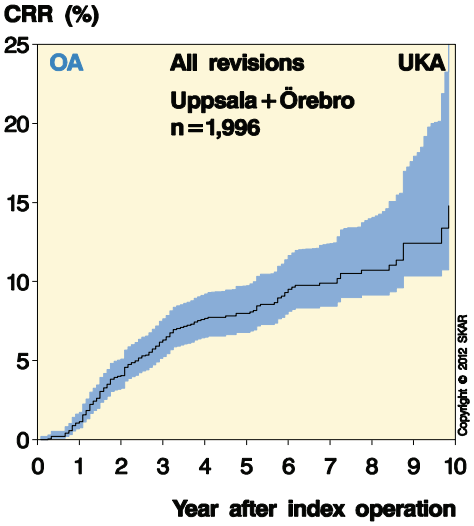
### Stockholm + Gotland
### Primary UKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| MillerGalante-UKA | 975 | 57.4 |
| Link UKA | 331 | 19.5 |
| Oxford-UKA | 315 | 18.5 |
| Preservation | 45 | 2.6 |
| ZUK | 16 | 0.9 |
| Allegretto | 12 | 0.7 |
| Genesis | 5 | 0.3 |
| Totalt | 1,699 | 100 |



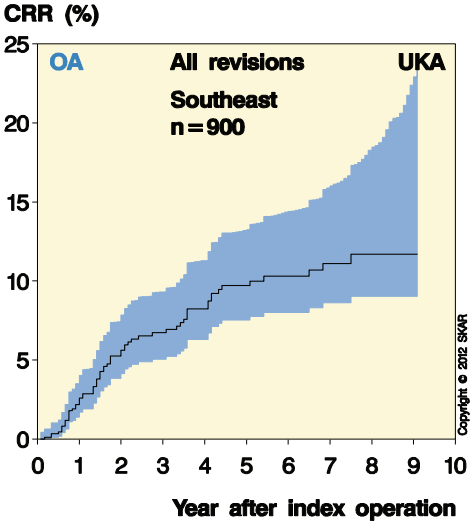

### Uppsala+Örebro
### Primary UKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| Link UKA | 1,430 | 71.6 |
| Genesis | 241 | 12.1 |
| MillerGalante-UKA | 172 | 8.6 |
| Preservation | 93 | 4.7 |
| PFC-UKA | 27 | 1.4 |
| ZUK | 27 | 1.4 |
| EIUS | 5 | 0.3 |
| Marmor | 1 | 0.1 |
| Totalt | 1,996 | 100 |



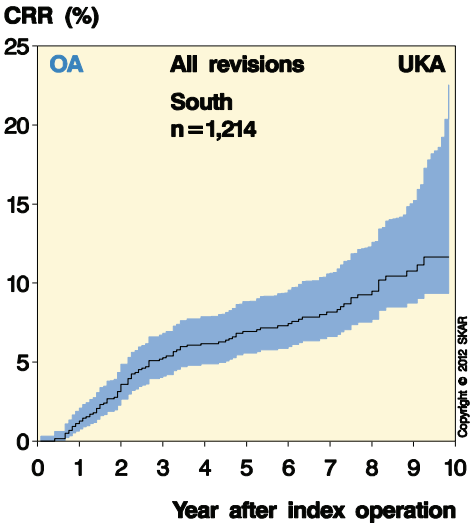

### Southeast
### Primary UKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| Oxford-UKA | 323 | 35.9 |
| Genesis | 231 | 25.7 |
| Link UKA | 219 | 24.3 |
| MillerGalante-UKA | 108 | 12 |
| PFC-UKA | 14 | 1.6 |
| Preservation | 5 | 0.6 |
| Totalt | 900 | 100 |



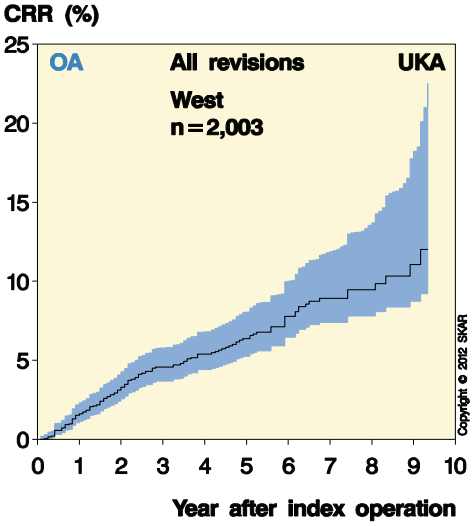
### South
### Primary UKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| Link UKA | 793 | 65.3 |
| Oxford-UKA | 227 | 18.7 |
| MillerGalante-UKA | 66 | 5.4 |
| Triathlon | 43 | 3.5 |
| EIUS | 41 | 3.4 |
| Duracon-UKA | 25 | 2.1 |
| Genesis | 6 | 0.5 |
| Preservation | 5 | 0.4 |
| ZUK | 5 | 0.4 |
| PFC-UKA | 3 | 0.2 |
| Totalt | 1,214 | 100 |



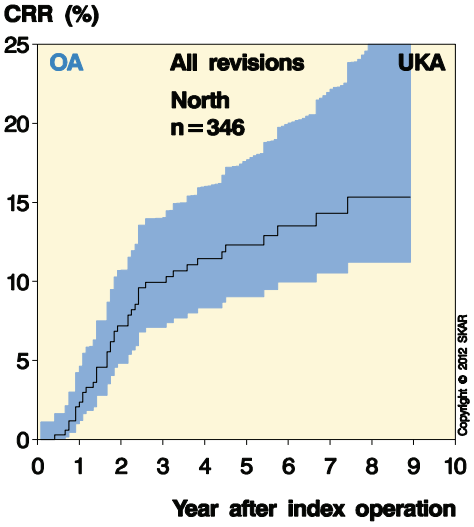

### West
### Primary UKA implants for OA, 2001–2010

| Number | Percent | |
|---|---|---|
| Oxford-UKA | 1058 | 52.8 |
| MillerGalante-UKA | 507 | 25.3 |
| ZUK | 237 | 11.8 |
| Link UKA | 194 | 9.7 |
| Genesis | 5 | 0.2 |
| Duracon-UKA | 2 | 0.1 |
| Totalt | 2,003 | 100 |




### North
### Primary UKA implants for OA, 2001–2010

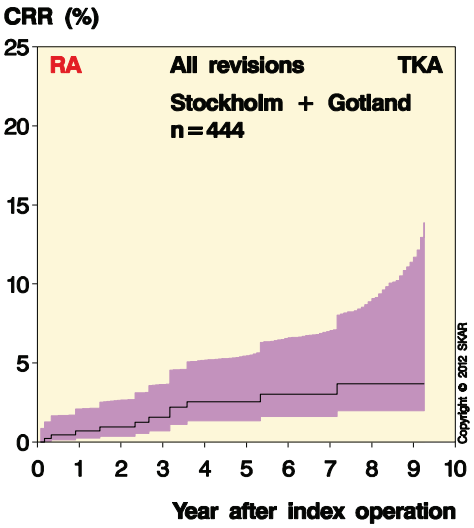
| Number | Percent | |
|---|---|---|
| Link UKA | 228 | 65.9 |
| MillerGalante-UKA | 77 | 22.3 |
| ZUK | 30 | 8.7 |
| Oxford-UKA | 9 | 2.6 |
| Triathlon | 2 | 0.6 |
| Totalt | 346 | 100 |



# Primary TKA implants for RA in the regions during 2001–2010

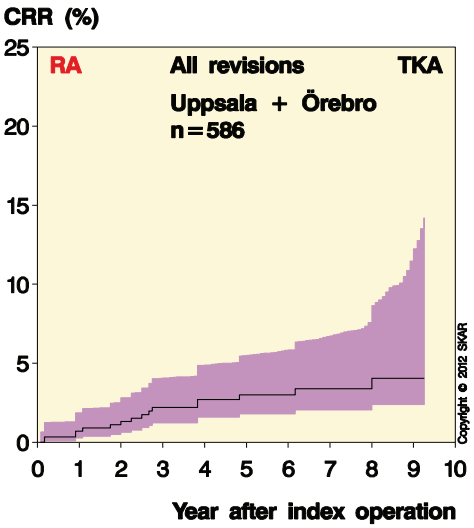
### Stockholm + Gotland
### Primary TKA implants for RA, 2001–2010

| Number | Percent | |
|---|---|---|
| PFC Sigma | 246 | 55.4 |
| Duracon | 71 | 16 |
| NexGen | 39 | 8.8 |
| Triathlon | 18 | 4.1 |
| PFC Rotating Platform | 10 | 2.3 |
| F/S MIII | 8 | 1.8 |
| Kinemax | 7 | 1.6 |
| AGC | 7 | 1.6 |
| Natural | 5 | 1.1 |
| Övriga | 33 | 7.4 |
| Totalt | 444 | 100 |



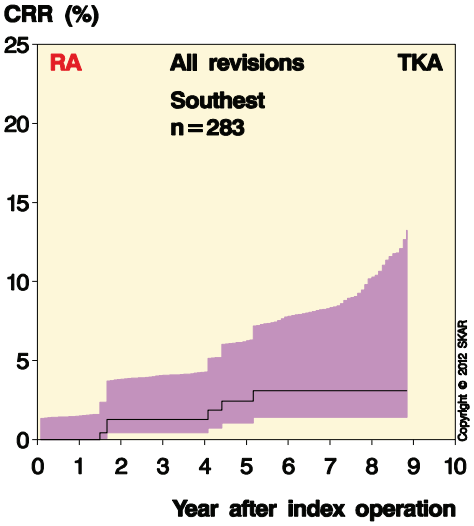

### Uppsala+Örebro
### Primary TKA implants for RA, 2001–2010

| | Number | Percent |
|---|---|---|
| NexGen | 171 | 29.2 |
| AGC | 146 | 24.9 |
| F/S MIII | 123 | 21 |
| PFC Sigma | 60 | 10.2 |
| Kinemax | 34 | 5.8 |
| Duracon | 19 | 3.2 |
| Natural | 9 | 1.5 |
| PFC Rotating Platform | 8 | 1.4 |
| Profix | 3 | 0.5 |
| Triathlon | 3 | 0.5 |
| Övriga | 10 | 1.8 |
| Totalt | 586 | 100 |



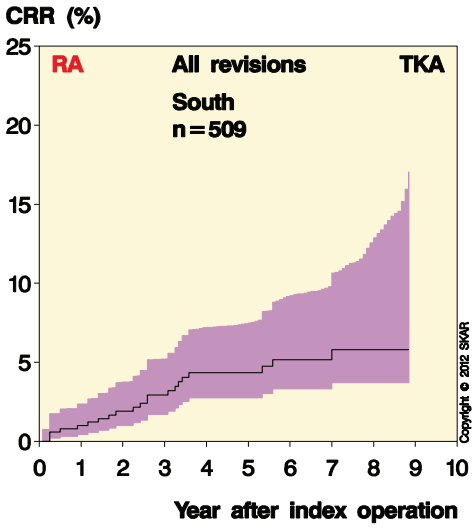

### Southeast
### Primary TKA implants for RA, 2001–2010

| Number | Percent | |
|---|---|---|
| NexGen | 122 | 43.1 |
| PFC Sigma | 76 | 26.9 |
| AGC | 52 | 18.4 |
| Vanguard | 14 | 4.9 |
| PFC Rotating Platform | 5 | 1.8 |
| Övriga | 14 | 4.9 |
| Totalt | 283 | 100 |



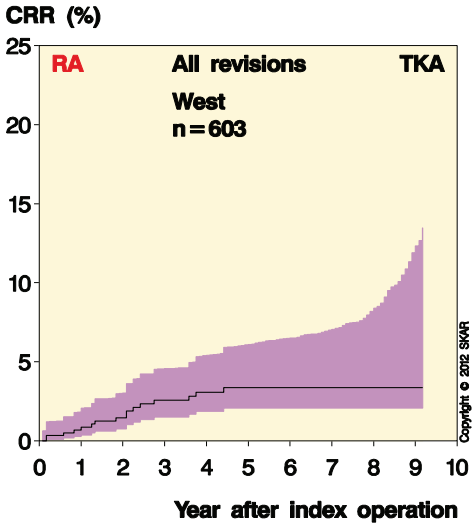
## South
### Primary TKA implants for RA, 2001–2010

| Number | Percent | |
|---|---|---|
| PFC Sigma | 137 | 26.9 |
| Scan | 77 | 15.1 |
| AGC | 74 | 14.5 |
| Vanguard | 73 | 14.3 |
| Duracon | 64 | 12.6 |
| Profix | 23 | 4.5 |
| Triathlon | 22 | 4.3 |
| NexGen | 6 | 1.2 |
| Övriga | 33 | 6.5 |
| Totalt | 509 | 100 |



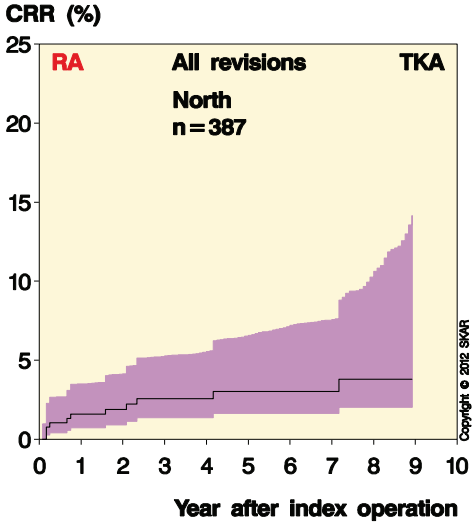

## West
### Primary TKA implants for RA, 2001–2010

| Number | Percent | |
|---|---|---|
| AGC | 169 | 28 |
| NexGen | 143 | 23.7 |
| PFC Sigma | 104 | 17.2 |
| F/S MIII | 85 | 14.1 |
| Duracon | 50 | 8.3 |
| Vanguard | 21 | 3.5 |
| Scan | 16 | 2.7 |
| Triathlon | 3 | 0.5 |
| Övriga | 12 | 2.1 |
| Totalt | 603 | 100 |




## North
### Primary TKA implants for RA, 2001–2010

| Number | Percent | |
|---|---|---|
| PFC Sigma | 101 | 26.1 |
| NexGen | 70 | 18.1 |
| Profix | 66 | 17.1 |
| AGC | 49 | 12.7 |
| Duracon | 41 | 10.6 |
| LCS | 17 | 4.4 |
| Vanguard | 7 | 1.8 |
| Övriga | 36 | 9.3 |
| Totalt | 387 | 100 |



## The relative risk for implants used in primary arthroplasty during 2001–2010

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 98% 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. 68% of the NexGen use a ”standard Option” femur in combination with an Option, All-Poly or pegged tibia. PS variants constitute 7% and High-Flex 15% of which ”Gender” are 3%. For the AGC, the V2 Anatomic Interlok CR femur and V2 Interlok tibia compose 90% 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 the use of patellar button in primary surgery and instead preparing for secondary resurfacing when needed, may increase the risk of revision, at least in the short term. Therefore, we separately account for OA/TKA when used with and without a patellar button. For the second time we also make separate calculations in which isolated exchanges of inlays due to infection are not considered being revisions. The explanation for doing so is discusssed together with the tables on page 36-37.

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.

For TKA/OA, Kinemax, Scan and the PFC rotating platform have a significantly higher risk of revision than the reference AGC. However, the first 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.

The decrease in surgeries for RA in recent years has reduced the number of implants available for analysis, making it difficult to show significant differences. This year, no implant was found to have lower risk than AGC and only Kinemax had a higher risk.

**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 | 12,904 | | reference | |
| F/S MIII | 5,400 | 0.48 | 1.06 | 0.90-1.26 |
| PFC-Sigma | 25,432 | <0.01 | 0.82 | 0.72-0.94 |
| Scan | 280 | <0.01 | 2.04 | 1.30-3.21 |
| Kinemax | 824 | <0.01 | 1.72 | 1.27-2.33 |
| Duracon | 7,048 | 0.78 | 0.98 | 0.83-1.15 |
| Profix | 1,564 | 0.93 | 0.98 | 0.69-1.41 |
| NexGen | 23,436 | <0.01 | 0.62 | 0.53-0.72 |
| LCS | 165 | 0.24 | 0.51 | 0.16-1.58 |
| Natural II | 473 | 0.88 | 0.96 | 0.58-1.59 |
| PFC Rot. Platf. | 968 | 0.01 | 1.53 | 1.10-2.13 |
| Triathlon | 2,951 | 0.03 | 0.68 | 0.47-0.96 |
| Vanguard | 3,422 | 0.22 | 1.19 | 0.90-1.58 |
| Other | 862 | 0.07 | 1.42 | 0.97-2.07 |
| Gender (male is ref.) | | 0.69 | 1.02 | 0.93-1.12 |
| Age (per year) | | <0.01 | 0.97 | 0.96-0.97 |
| Year of op. (per year) | | 0.05 | 1.02 | 1.00-1.04 |

| RA / TKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| AGC | 497 | | reference | |
| F/S MIII | 216 | 0.63 | 0.78 | 0.28-2.16 |
| PFC-Sigma | 724 | 0.43 | 1.31 | 0.67-2.54 |
| Scan | 93 | 0.10 | 2.23 | 0.85-5.84 |
| Kinemax | 41 | <0.01 | 4.57 | 1.63-12.83 |
| Duracon | 245 | 0.38 | 1.46 | 0.63-3.40 |
| Profix | 95 | 0.70 | 1.28 | 0.36-4.46 |
| NexGen | 551 | 0.42 | 0.69 | 0.28-1.69 |
| *LCS* | *17* | *0.99* | *<0.01* | |
| Natural II | 17 | 0.47 | 2.13 | 0.28-16.31 |
| PFC Rot.Platf. | 27 | 0.65 | 1.60 | 0.21-12.48 |
| *Triathlon* | *46* | *0.99* | *<0.01* | |
| Vanguard | 115 | 0.21 | 2.14 | 0.65-7.01 |
| Other | 128 | 0.95 | 1.04 | 0.30-3.67 |
| Gender (male is ref.) | | 0.24 | 0.7 | 0.46-1.22 |
| Age (per year) | | 0.25 | 0.9 | 0.97-1.01 |
| Year of op. (per year) | | 0.26 | 1 | 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<br>OA / TKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| AGC | 11,279 | | reference | |
| F/S MIII | 2,994 | 0.10 | 1.19 | 0.97-1.46 |
| PFC-Sigma | 24,491 | <0.01 | 0.79 | 0.69-0.90 |
| Scan | 280 | <0.01 | 1.93 | 1.22-3.03 |
| Kinemax | 577 | 0.05 | 1.45 | 0.99-2.11 |
| Duracon | 6,268 | 0.34 | 0.92 | 0.77-1.10 |
| Profix | 1,417 | 0.45 | 0.86 | 0.58-1.27 |
| NexGen | 23,107 | <0.01 | 0.60 | 0.51-0.70 |
| LCS | 165 | 0.21 | 0.48 | 0.15-1.50 |
| Natural II | 445 | 0.96 | 0.99 | 0.60-1.63 |
| PFC Rot. Platf. | 756 | 0.02 | 1.53 | 1.07-2.19 |
| Triathlon | 2,814 | 0.02 | 0.66 | 0.46-0.95 |
| Vanguard | 3,275 | 0.17 | 1.22 | 0.92-1.61 |
| Övriga | 793 | 0.14 | 1.35 | 0.90-2.01 |
| Gender (male is ref.) | | 0.41 | 1.04 | 0.95-1.15 |
| Age (per year) | | <0.01 | 0.96 | 0.96-0.97 |
| Year of op. (per year) | | 0.25 | 1.01 | 0.99-1.04 |

| With patella button<br>OA / TKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| AGC | 1,625 | | reference | |
| F/S MIII | 2,406 | 0.19 | 1.34 | 0.87-2.06 |
| PFC-Sigma | 941 | 0.17 | 1.43 | 0.86-2.38 |
| *Scan* | | | | |
| Kinemax | 247 | <0.01 | 3.26 | 1.82-5.84 |
| Duracon | 780 | 0.05 | 1.66 | 1.00-2.76 |
| Profix | 147 | 0.02 | 2.75 | 1.14-6.62 |
| NexGen | 329 | 0.51 | 1.32 | 0.58-2.98 |
| *LCS* | | | | |
| *Natural II* | *28* | *0.98* | *<0.01* | |
| PFC Rot. Platf. | 212 | 0.17 | 1.80 | 0.78-4.18 |
| Triathlon | 137 | 0.99 | 1.01 | 0.24-4.27 |
| *Vanguard* | *147* | *0.97* | *<0.01* | |
| Övriga | 69 | 0.14 | 2.45 | 0.75-7.99 |
| Gender (male is ref.) | | 0.19 | 0.83 | 0.62-1.10 |
| Age (per year) | | <0.01 | 0.98 | 0.96-0.99 |
| Year of op. (per year) | | 0.05 | 1.07 | 1.00-1.15 |

Implants lacking sufficient numbers for analysis are shown in italics

In the tables above the TKA implants have been divided into those without (left) and with (right) a patellar button. This reduces the number of implants available for each of the analyses, especially for the group having a patellar button.

Without a patellar button, the implants that differ from the reference are the same as when the group is analyzed as a whole. This is not surprising as the group includes the majority of the procedures.

When using a patellar button, Kinemax and Profix have a higher revision rate than the reference while Duracon is nearly significant.

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 is not significant.

One should also note that for TKA/OA and UKA/OA, the year of operation affects results such that the risk slightly increases over the period. This is opposite from what was seen few years ago when the risk lessened with time.

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

| OA / UKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| Link | 3,195 | | reference | |
| Oxford | 1,905 | 0.62 | 1,06 | 0,85-1,31 |
| MillerGalante | 1,905 | 0.99 | 1,00 | 0,82-1,21 |
| Genesis | 488 | 0.85 | 1,04 | 0,72-1,48 |
| Preservation | 148 | 0.07 | 1,56 | 0,96-2,52 |
| ZUK | 315 | 0.48 | 1,19 | 0,73-1,95 |
| Övriga | 202 | 0.41 | 1,22 | 0,76-1,98 |
| Gender (male is ref.) | | 0.92 | 1,01 | 0,86-1,18 |
| Age (per year) | | <0,01 | 0,96 | 0,96-0,97 |
| Year of op. (per year) | | 0.03 | 1,04 | 1,00-1,08 |

With respect to UKA inserted for OA, the number of brands available for analysis has constantly become less. During the last decade the Link, Oxford and M/G have been the most popular brands and for these we can find no significant differences in risk. Last year. the Preservation had a higher risk than the Link reference.but this year the difference is not significant.

## The relative risk for implants used in primary arthroplasty during 2001–2010 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.

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

For TKA/OA, with and without a patellar button (lower left), there have been no other changes than the negative effect of a later year of surgery which is not significant.

For TKA/RA, both with and without a patellar button (lower right) there are no changes.

**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 | 12,904 | | ref. | |
| F/S MIII | 5,400 | 0.95 | 1.01 | 0.84-1.20 |
| PFC-Sigma | 25,432 | <0.01 | 0.77 | 0.68-0.88 |
| Scan | 280 | 0.01 | 1.8 | 1.13-2.85 |
| Kinemax | 824 | <0.01 | 1.6 | 1.18-2.17 |
| Duracon | 7,048 | 0.17 | 0.89 | 0.75-1.05 |
| Profix | 1,564 | 0.44 | 0.86 | 0.58-1.27 |
| NexGen | 23,436 | <0.01 | 0.53 | 0.45-0.62 |
| LCS | 165 | 0.20 | 0.48 | 0.15-1.49 |
| Natural II | 473 | 0.88 | 0.96 | 0.58-1.59 |
| PFC Rot. Platf. | 968 | 0.02 | 1.51 | 1.08-2.12 |
| Triathlon | 2,951 | <0.01 | 0.49 | 0.32-0.75 |
| Vanguard | 3,422 | 0.49 | 0.89 | 0.63-1.24 |
| Other | 862 | 0.17 | 1.32 | 0.89-1.96 |
| Gender (male is ref.) | | 0.09 | 1.09 | 0.99-1.19 |
| Age (per year) | | <0.01 | 0.9 | 0.96-0.97 |
| Year of op. (per year) | | 0.58 | 0.9 | 0.97-1.02 |

| RA / TKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| AGC | 497 | | ref. | |
| F/S MIII | 216 | 0.11 | 0.3 | 0.07-1.33 |
| PFC-Sigma | 724 | 0.56 | 1.22 | 0.62-2.40 |
| Scan | 93 | 0.12 | 2.14 | 0.82-5.64 |
| Kinemax | 41 | <0.01 | 4.37 | 1.56-12.29 |
| Duracon | 245 | 0.35 | 1.5 | 0.64-3.48 |
| Profix | 95 | 0.86 | 0.88 | 0.20-3.88 |
| NexGen | 551 | 0.37 | 0.65 | 0.26-1.66 |
| *LCS* | *17* | *0.98* | *<0.01* | . |
| Natural II | 17 | 0.45 | 2.19 | 0.29-16.79 |
| PFC Rot. Platf. | 27 | 0.60 | 1.74 | 0.22-13.56 |
| *Triathlon* | *46* | *0.99* | *<0.01* | . |
| Vanguard | 115 | 0.13 | 2.52 | 0.76-8.38 |
| Övriga | 128 | 0.68 | 0.73 | 0.17-3.26 |
| Gender (male is ref.) | | 0.41 | 0.78 | 0.46-1.32 |
| Age (per year) | | 0.23 | 0.99 | 0.97-1.01 |
| Year of op. (per year) | | 0.32 | 1.05 | 0.93-1.17 |

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<br>OA / TKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| AGC | 11,279 | | ref. | |
| F/S MIII | 2,994 | 0.13 | 1.17 | 0.95-1.44 |
| PFC-Sigma | 24,491 | <0.01 | 0.74 | 0.65-0.85 |
| Scan | 280 | 0.03 | 1.69 | 1.06-2.68 |
| Kinemax | 577 | 0.17 | 1.31 | 0.89-1.92 |
| Duracon | 6,268 | 0.04 | 0.83 | 0.69-0.99 |
| Profix | 1,417 | 0.36 | 0.82 | 0.54-1.25 |
| NexGen | 23,107 | <0.01 | 0.52 | 0.44-0.61 |
| LCS | 165 | 0.17 | 0.45 | 0.14-1.41 |
| Natural II | 445 | 1.00 | 1.00 | 0.60-1.65 |
| PFC Rot. Platf. | 756 | 0.01 | 1.58 | 1.10-2.27 |
| Triathlon | 2,814 | <0.01 | 0.51 | 0.33-0.79 |
| Vanguard | 3,275 | 0.61 | 0.92 | 0.65-1.29 |
| Other | 793 | 0.31 | 1.24 | 0.81-1.90 |
| Gender (male is ref.) | | 0.03 | 1.12 | 1.01-1.24 |
| Age (per year) | | <0.01 | 0.96 | 0.96-0.97 |
| Year of op. (per year) | | 0.17 | 0.98 | 0.96-1.01 |

| With patella button<br>OA / TKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| AGC | 1,625 | | ref. | |
| F/S MIII | 2,406 | 0.43 | 1.19 | 0.77-1.85 |
| PFC-Sigma | 941 | 0.41 | 1.25 | 0.74-2.13 |
| *Scan* | | | | |
| Kinemax | 247 | <0.01 | 3.16 | 1.76-5.65 |
| Duracon | 780 | 0.08 | 1.59 | 0.95-2.66 |
| Profix | 147 | 0.57 | 1.41 | 0.43-4.61 |
| NexGen | 329 | 0.73 | 1.16 | 0.49-2.79 |
| *LCS* | | | | |
| *Natural II* | *28* | *0.99* | *<0.01* | |
| PFC Rot. Platf. | 212 | 0.54 | 1.35 | 0.51-3.55 |
| *Triathlon* | *137* | *0.98* | *<0.01* | |
| *Vanguard* | *147* | *0.98* | *<0.01* | |
| Other | 69 | 0.14 | 2.45 | 0.75-8.00 |
| Gender (male is ref.) | | 0.19 | 0.82 | 0.61-1.10 |
| Age (per year) | | <0.01 | 0.98 | 0.96-0.99 |
| Year of op. (per year) | | 0.18 | 1.05 | 0.98-1.13 |

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 a patellar button (right).

For TKA/OA without a patellar button, the Duracon has become significantly better than the reference (p=0.04).

For TKA/OA with a patellar button, Profix and Duracon no longer have 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.

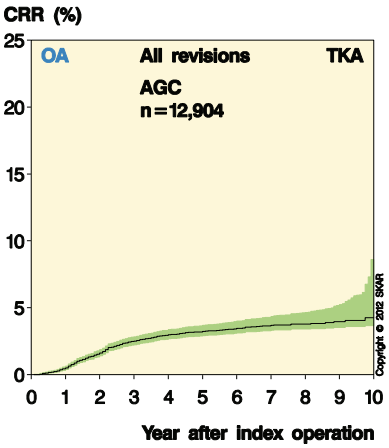
**RR (risk ratio) for OA/UKA. Link is used as reference. The exchange of inlay, in case of infection, is not considered a revision**

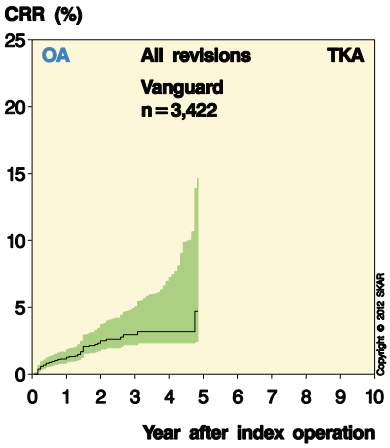
| OA / UKA | n | p–value | RR | 95% CI |
|---|---|---|---|---|
| Link | 3,195 | | referens | |
| Oxford | 1,905 | 0.62 | 1,05 | 0,85-1,31 |
| MillerGalante | 1,905 | 0.99 | 1,00 | 0,82-1,21 |
| Genesis | 488 | 0.85 | 1,04 | 0,72-1,49 |
| Preservation | 148 | 0.07 | 1,56 | 0,96-2,53 |
| ZUK | 315 | 0.48 | 1,20 | 0,73-1,97 |
| Other | 202 | 0.41 | 1,22 | 0,76-1,98 |
| Gender (male is ref.) | . | 0.95 | 1.0 | 0.86-1.18 |
| Age (per year) | . | <0.01 | 0.96 | 0.96-0.97 |
| Year of op. (per year) | . | 0.03 | 1.04 | 1.00-1.08 |

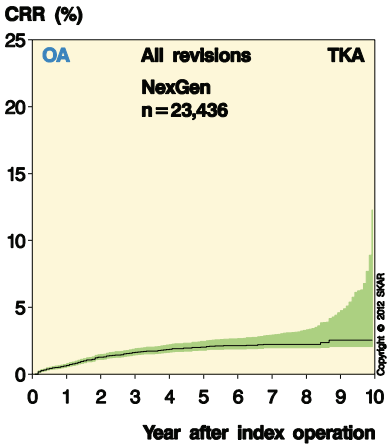
In summary one can establish that excluding an exchange of inlay in infected cases does affect the results although the effect is relatively small for models that have been used in reasonably large numbers. On the other hand for models used in a small number of patients, a limited change in the number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

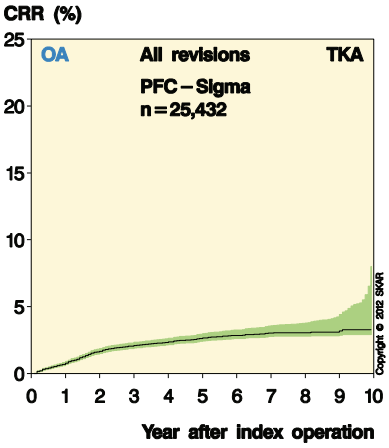
Not considering an exchange of an inlay as a revision in infected cases reduces the total number of revisions for infection. We have previously shown that men are more often revised for infection than women (page 17) and the effect of this reduction is that this advantage of female gender is reduced. 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.

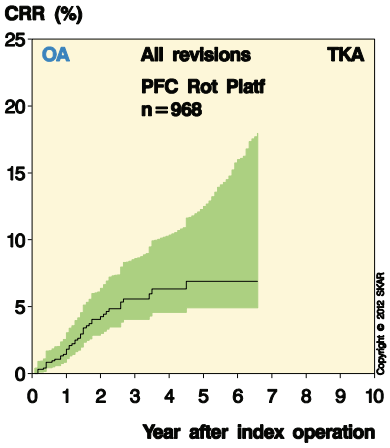
## CRR for commonly used TKA implants for OA 2001–2010

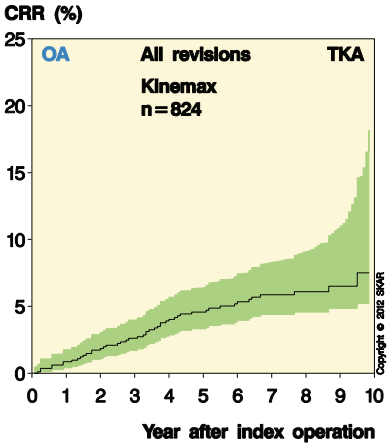


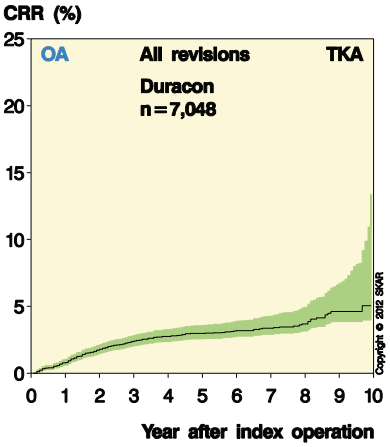



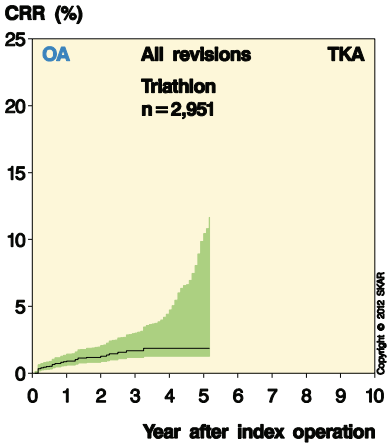



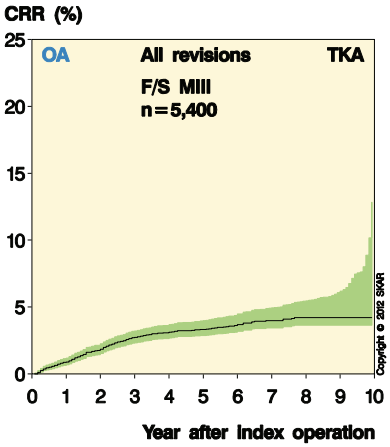



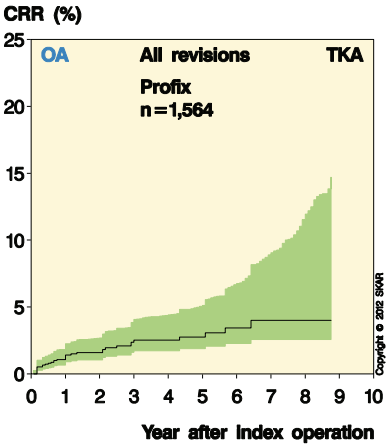



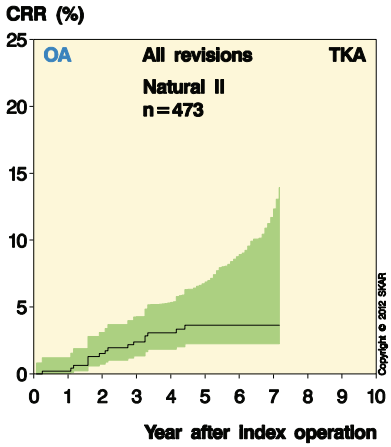



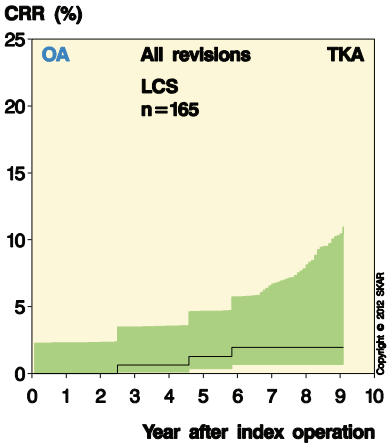




CRR (%)
OA
All revisions
TKA
F/S MIII
n=5,400
Year after index operation
Copyright © 2012 SKAR


CRR (%)
OA
All revisions
TKA
Profix
n=1,564
Year after index operation
Copyright © 2012 SKAR


CRR (%)
OA
All revisions
TKA
Natural II
n=473
Year after index operation
Copyright © 2012 SKAR


CRR (%)
OA
All revisions
TKA
LCS
n=165
Year after index operation
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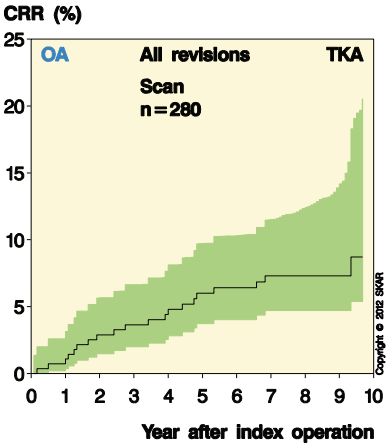
CRR (%)
OA
All revisions
TKA
Scan
n=280
Year after index operation
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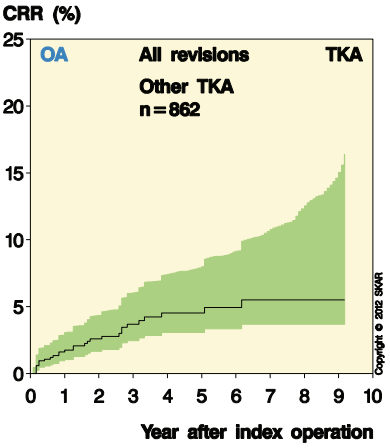
CRR (%)
OA
All revisions
TKA
Other TKA
n=862
Year after index operation
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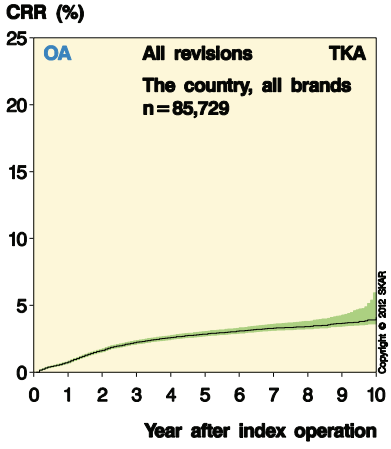
CRR (%)
OA
All revisions
TKA
The country, all brands
n=85,729
Year after index operation
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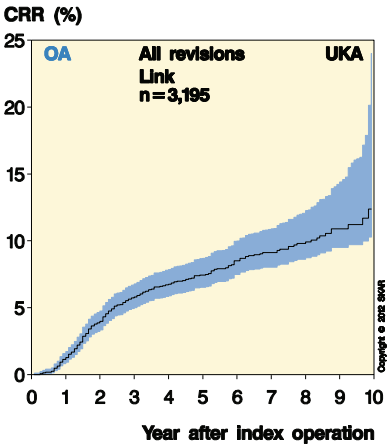
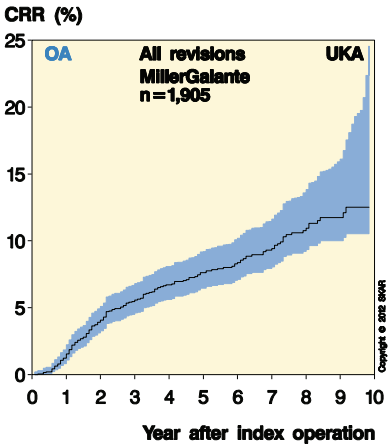
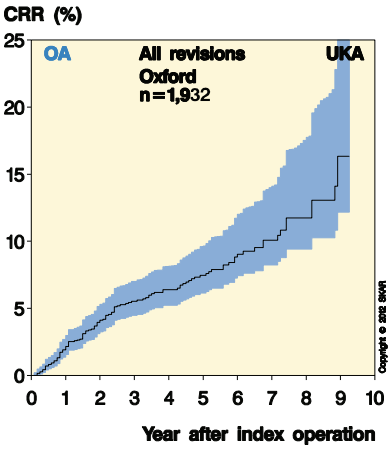
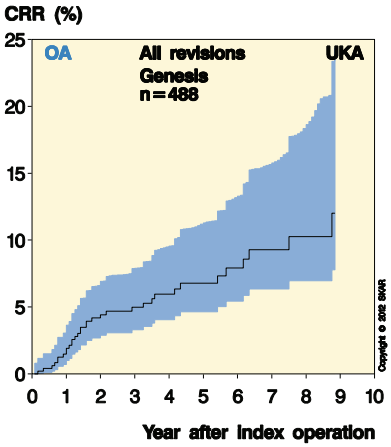
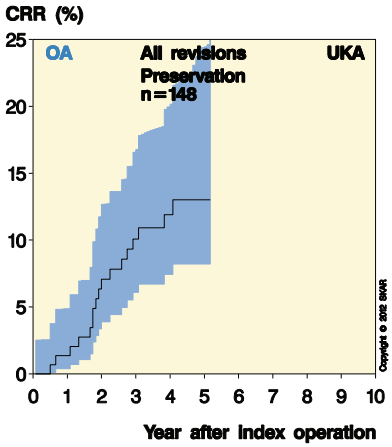
## CRR for commonly used UKA implants for OA 2001–2010

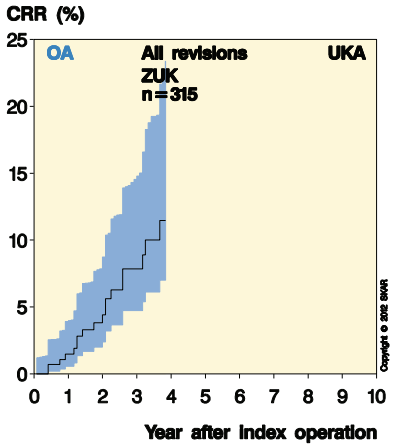


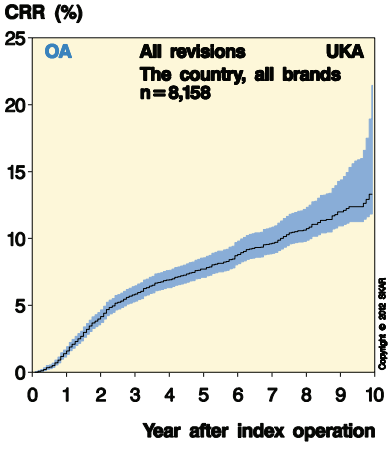



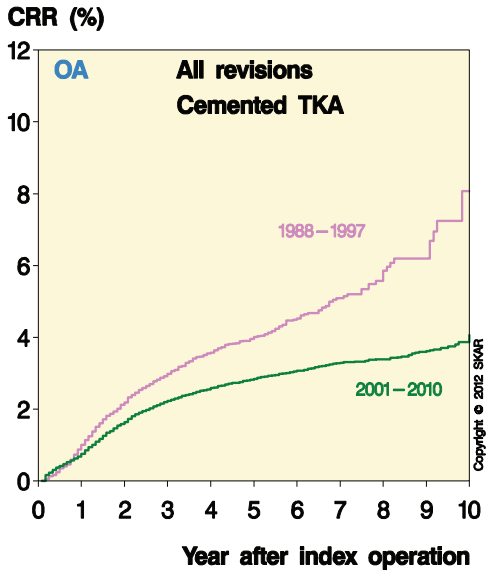
## Changes in risk of revision over time (cemented TKA)

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.

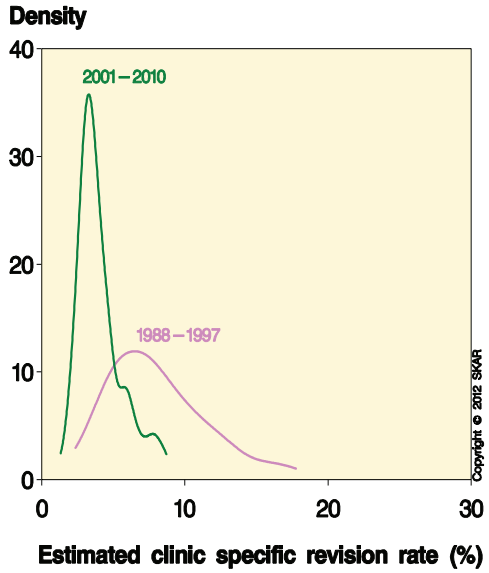
When the absolute specific risk of revision for the units is plotted for both periods (figure below left), it can be seen that the risk has become lower and the distribution has diminished. This implies that the results have improved overall and at the same time the results for the different units have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

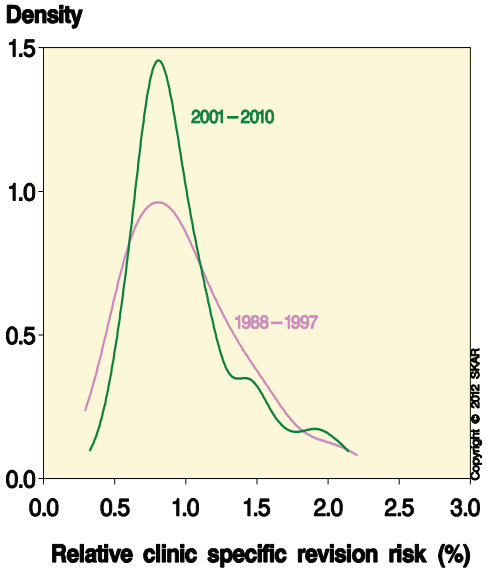
The register is requested to account for hospital specific results which can be found on the next pages. This year, there were 7 hospitals having significantly better results than the average hospital and 11 with inferior results. One can only speculate on the causes for these differences. An unfortunate 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 2001–2010 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 2001–2010 (x-axis = absolute risk of revision)*




*Plotting the relative clinicspecific risk of revision, as compared to the national mean, shows that the distribution of relative risk among the hospitals has not changed between 1987–1996 and 2001–2010 (x-axis = relative risk).*

## Relative risk of revision for hospitals 2001–2010 (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 | 1,296 | 6 | 0.33 | 0.18-0.59 | 1 | 1-13 |
| 10010 | Sabbatsberg | 777 | 7 | 0.46 | 0.26-0.82 | 2 | 1-32 |
| 12010 | Enköping | 1,599 | 14 | 0.51 | 0.32-0.80 | 3 | 1-30 |
| 21001 | Linköping | 313 | 3 | 0.53 | 0.26-1.07 | 4 | 1-54 |
| 64011 | Lycksele | 436 | 3 | 0.54 | 0.27-1.10 | 5 | 1-55 |
| 42015 | Movement Halmstad | 960 | 7 | 0.56 | 0.32-1.00 | 6 | 1-49 |
| 42011 | Varberg | 1,322 | 17 | 0.57 | 0.37-0.87 | 7 | 2-38 |
| 53011 | Lidköping | 888 | 9 | 0.58 | 0.34-0.99 | 8 | 2-47 |
| 62011 | Örnsköldsvik | 1,127 | 14 | 0.58 | 0.37-0.91 | 9 | 2-41 |
| 65014 | Kalix | 126 | 1 | 0.64 | 0.28-1.46 | 10 | 1-71 |
| 50010 | Östra | 782 | 12 | 0.67 | 0.41-1.08 | 11 | 3-54 |
| 11002 | Huddinge | 898 | 12 | 0.67 | 0.41-1.08 | 12 | 3-54 |
| 56010 | Västerås | 993 | 10 | 0.67 | 0.40-1.12 | 13 | 3-57 |
| 57010 | Falun | 1,744 | 25 | 0.68 | 0.48-0.98 | 14 | 5-48 |
| 28013 | Simrishamn | 715 | 15 | 0.69 | 0.44-1.08 | 15 | 4-54 |
| 50480 | Carlanderska | 216 | 1 | 0.71 | 0.31-1.60 | 16 | 1-74 |
| 11001 | Karolinska | 1,511 | 28 | 0.72 | 0.51-1.01 | 17 | 7-50 |
| 52011 | Borås | 835 | 13 | 0.72 | 0.45-1.16 | 18 | 4-60 |
| 62013 | Sollefteå | 892 | 14 | 0.73 | 0.46-1.15 | 19 | 5-58 |
| 65012 | Gällivare | 599 | 9 | 0.73 | 0.43-1.24 | 20 | 4-62 |
| 41012 | Helsingborg | 326 | 5 | 0.73 | 0.39-1.37 | 21 | 3-68 |
| 50080 | Sergelkliniken | 140 | 2 | 0.74 | 0.35-1.57 | 22 | 2-73 |
| 12481 | Elisabethkliniken | 532 | 8 | 0.74 | 0.43-1.28 | 23 | 4-65 |
| 30001 | Malmö | 210 | 3 | 0.74 | 0.37-1.50 | 24 | 2-72 |
| 42420 | Spenshult | 401 | 3 | 0.76 | 0.37-1.53 | 25 | 2-72 |

(forts.)

**Relative risk of revision for units (continued)**

| Code | Hospital | no. of TKA | Revised | RR | 95% CI | Rank | 95% CI |
|---|---|---|---|---|---|---|---|
| 55010 | Örebro | 930 | 15 | 0.76 | 0.49-1.19 | 26 | 6-60 |
| 28011 | Ängelholm | 1,130 | 19 | 0.77 | 0.52-1.16 | 27 | 7-59 |
| 13010 | Eskilstuna (Mälar) | 327 | 5 | 0.78 | 0.42-1.47 | 28 | 4-71 |
| 55012 | Lindesberg | 931 | 14 | 0.79 | 0.50-1.24 | 29 | 6-63 |
| 22012 | Värnamo | 967 | 18 | 0.8 | 0.53-1.23 | 30 | 8-63 |
| 22010 | Jönköping (Ryhov) | 1,067 | 18 | 0.81 | 0.53-1.22 | 31 | 8-62 |
| 55011 | Karlskoga | 792 | 14 | 0.81 | 0.51-1.27 | 32 | 7-64 |
| 13012 | Kullbergska | 1,421 | 23 | 0.81 | 0.56-1.18 | 33 | 10-61 |
| 54013 | Säffle | 157 | 3 | 0.81 | 0.40-1.65 | 34 | 3-76 |
| 21014 | Motala | 2,724 | 46 | 0.82 | 0.62-1.08 | 35 | 14-55 |
| 65016 | Sunderby | 264 | 6 | 0.83 | 0.45-1.51 | 36 | 5-71 |
| 53010 | Falköping | 1,066 | 18 | 0.83 | 0.55-1.26 | 37 | 9-64 |
| 56012 | Köping | 1,021 | 22 | 0.84 | 0.57-1.22 | 38 | 11-62 |
| 54010 | Karlstad | 1,459 | 27 | 0.86 | 0.60-1.22 | 39 | 13-62 |
| 25011 | Oskarshamn | 1,657 | 30 | 0.86 | 0.61-1.20 | 40 | 13-62 |
| 57011 | Mora | 1,057 | 20 | 0.87 | 0.58-1.29 | 41 | 12-65 |
| 50001 | Sahlgrenska | 286 | 7 | 0.88 | 0.49-1.56 | 42 | 6-73 |
| 10011 | S:t Göran | 3,352 | 74 | 0.89 | 0.71-1.12 | 43 | 22-57 |
| 13011 | Nyköping | 707 | 13 | 0.91 | 0.57-1.45 | 44 | 11-71 |
| 24010 | Västervik | 892 | 20 | 0.91 | 0.61-1.36 | 45 | 14-67 |
| 22011 | Eksjö-Nässjö (Högland.) | 865 | 16 | 0.91 | 0.59-1.41 | 46 | 12-69 |
| 23010 | Växjö | 836 | 17 | 0.91 | 0.60-1.39 | 47 | 13-69 |
| 50071 | Frölunda | 747 | 16 | 0.93 | 0.60-1.43 | 48 | 13-70 |
| 25010 | Kalmar | 1,064 | 22 | 0.94 | 0.64-1.37 | 49 | 16-68 |
| 41013 | Ystad | 220 | 6 | 0.94 | 0.52-1.71 | 50 | 8-77 |
| 28012 | Hässleholm | 4,024 | 87 | 0.94 | 0.76-1.16 | 51 | 26-60 |
| 27011 | Karlshamn | 1,528 | 33 | 0.96 | 0.70-1.33 | 52 | 20-67 |
| 64001 | Umeå | 978 | 21 | 1 | 0.68-1.48 | 53 | 19-72 |
| 11013 | Löwenströmska* | 1,754 | 36 | 1.01 | 0.74-1.38 | 54 | 25-68 |
| 53013 | Skövde | 633 | 15 | 1.03 | 0.66-1.61 | 55 | 18-75 |
| 11011 | Södertälje | 1,007 | 25 | 1.05 | 0.73-1.51 | 56 | 24-72 |
| 11010 | Danderyd | 1295 | 32 | 1.06 | 0.76-1.47 | 57 | 27-71 |
| 62010 | Sundsvall | 980 | 25 | 1.06 | 0.74-1.53 | 58 | 25-73 |
| 42010 | Halmstad | 1,310 | 34 | 1.08 | 0.77-1.49 | 59 | 27-72 |
| 54014 | Torsby | 828 | 21 | 1.09 | 0.74-1.61 | 60 | 24-74 |
| 11015 | Nacka-Proxima | 305 | 5 | 1.12 | 0.60-2.10 | 61 | 13-82 |
| 10015 | Sophiahemmet | 819 | 26 | 1.15 | 0.80-1.63 | 62 | 30-75 |
| 10013 | Södersjukhuset | 1,835 | 43 | 1.16 | 0.87-1.55 | 63 | 37-73 |
| 52013 | Skene | 728 | 22 | 1.18 | 0.80-1.73 | 64 | 30-77 |
| 21013 | Norrköping (Vrinnevi) | 655 | 16 | 1.19 | 0.77-1.82 | 65 | 26-79 |
| 63010 | Östersund | 886 | 24 | 1.23 | 0.85-1.77 | 66 | 35-78 |
| 64010 | Skellefteå | 671 | 19 | 1.23 | 0.82-1.84 | 67 | 32-79 |
| 54012 | Arvika | 883 | 24 | 1.34 | 0.93-1.93 | 68 | 42-80 |
| 26010 | Visby | 601 | 20 | 1.38 | 0.93-2.05 | 69 | 43-81 |
| 41010 | Landskrona | 375 | 18 | 1.41 | 0.93-2.13 | 70 | 43-82 |
| 51011 | Mölndal | 803 | 22 | 1.41 | 0.96-2.06 | 71 | 46-82 |
| 61010 | Gävle | 537 | 21 | 1.47 | 1.00-2.16 | 72 | 49-83 |
| 51010 | Uddevalla | 1,421 | 45 | 1.48 | 1.12-1.97 | 73 | 57-81 |
| 50020 | Gothenburg Med Center** | 454 | 17 | 1.49 | 0.98-2.27 | 74 | 47-83 |
| 65013 | Piteå | 1,635 | 52 | 1.49 | 1.15-1.94 | 75 | 58-81 |
| 23011 | Ljungby | 716 | 28 | 1.6 | 1.14-2.26 | 76 | 58-83 |
| 41011 | Trelleborg | 3,506 | 115 | 1.63 | 1.35-1.96 | 77 | 67-81 |
| 61011 | Bollnäs / Söderhamn | 1,672 | 65 | 1.72 | 1.35-2.18 | 78 | 67-83 |
| 10016 | Ortopediska huset | 2,551 | 106 | 1.78 | 1.47-2.16 | 79 | 71-83 |
| 41001 | Lund | 123 | 10 | 1.91 | 1.14-3.18 | 80 | 59-84 |
| 11012 | Norrtälje | 659 | 33 | 1.91 | 1.37-2.65 | 81 | 68-84 |
| 12001 | Akademiska sjukhuset | 931 | 48 | 1.96 | 1.49-2.58 | 82 | 71-84 |
| 61012 | Hudiksvall | 564 | 31 | 2.08 | 1.50-2.89 | 83 | 71-84 |
| 51012 | Kungälv | 1,199 | 63 | 2.15 | 1.69-2.73 | 84 | 76-84 |

* 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 2001–2010 (cemented TKA) if the exchange of an inlay, in case of infection, is not considered to be a revision

As described on page 36, 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, all the 7 units with better results than the national average kept their status while the Movement Halmstad became significantly better. In the other end, all the 11 units worse than average kept on being so while Visby and Gävle joined the group.

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 | 1,296 | 4 | 0.28 | 0.15-0.56 | 1 | 1-11 |
| 42015 | Movement Halmstad | 960 | 4 | 0.45 | 0.23-0.89 | 2 | 1-38 |
| 62011 | Örnsköldsvik | 1,127 | 9 | 0.45 | 0.27-0.77 | 3 | 1-28 |
| 53011 | Lidköping | 888 | 6 | 0.49 | 0.27-0.89 | 4 | 1-37 |
| 10010 | Sabbatsberg | 777 | 7 | 0.49 | 0.28-0.87 | 5 | 1-37 |
| 21001 | Linköping | 313 | 3 | 0.55 | 0.27-1.11 | 6 | 1-57 |
| 12010 | Enköping | 1,599 | 14 | 0.55 | 0.35-0.87 | 7 | 2-38 |
| 42011 | Varberg | 1,322 | 15 | 0.55 | 0.35-0.87 | 8 | 2-37 |
| 64011 | Lycksele | 436 | 3 | 0.57 | 0.28-1.17 | 9 | 1-59 |
| 42420 | Spenshult | 401 | 1 | 0.59 | 0.26-1.36 | 10 | 1-67 |
| 57010 | Falun | 1,744 | 20 | 0.61 | 0.41-0.92 | 11 | 4-41 |
| 50010 | Östra | 782 | 10 | 0.62 | 0.37-1.04 | 12 | 3-51 |
| 65014 | Kalix | 126 | 1 | 0.65 | 0.28-1.50 | 13 | 1-71 |
| 52011 | Borås | 835 | 11 | 0.69 | 0.41-1.14 | 14 | 4-58 |
| 41012 | Helsingborg | 326 | 4 | 0.69 | 0.35-1.34 | 15 | 3-66 |
| 11002 | Huddinge | 898 | 12 | 0.72 | 0.44-1.16 | 16 | 5-58 |
| 65012 | Gällivare | 599 | 8 | 0.72 | 0.41-1.25 | 17 | 4-62 |
| 28013 | Simrishamn | 715 | 15 | 0.73 | 0.47-1.14 | 18 | 6-58 |
| 56010 | Västerås | 993 | 10 | 0.73 | 0.44-1.22 | 19 | 5-61 |
| 24010 | Västervik | 892 | 14 | 0.74 | 0.47-1.16 | 20 | 6-59 |
| 62013 | Sollefteå | 892 | 13 | 0.74 | 0.46-1.18 | 21 | 6-60 |
| 50480 | Carlanderska | 216 | 1 | 0.74 | 0.32-1.70 | 22 | 2-76 |
| 22010 | Jönköping (Ryhov) | 1,067 | 15 | 0.75 | 0.48-1.18 | 23 | 7-60 |
| 50080 | Sergelkliniken | 140 | 2 | 0.76 | 0.35-1.63 | 24 | 3-74 |
| 55012 | Lindesberg | 931 | 12 | 0.76 | 0.47-1.23 | 25 | 6-62 |

(cont.)

**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 |
|---|---|---|---|---|---|---|---|
| 11001 | Karolinska | 1,511 | 28 | 0.77 | 0.54-1.09 | 26 | 10-54 |
| 30001 | Malmö | 210 | 3 | 0.77 | 0.38-1.57 | 27 | 3-73 |
| 55011 | Karlskoga | 792 | 12 | 0.77 | 0.48-1.25 | 28 | 7-63 |
| 25010 | Kalmar | 1,064 | 16 | 0.79 | 0.51-1.21 | 29 | 8-62 |
| 12481 | Elisabethkliniken | 532 | 8 | 0.79 | 0.45-1.37 | 30 | 6-67 |
| 50071 | Frölunda | 747 | 12 | 0.8 | 0.50-1.30 | 31 | 7-65 |
| 55010 | Örebro | 930 | 15 | 0.82 | 0.53-1.28 | 32 | 9-64 |
| 13012 | Kullbergska | 1,421 | 21 | 0.82 | 0.56-1.21 | 33 | 11-62 |
| 53010 | Falköping | 1,066 | 16 | 0.82 | 0.53-1.27 | 34 | 9-64 |
| 13010 | Eskilstuna (Mälar) | 327 | 5 | 0.83 | 0.44-1.56 | 35 | 5-72 |
| 28011 | Ängelholm | 1,130 | 19 | 0.84 | 0.56-1.25 | 36 | 11-63 |
| 54013 | Säffle | 157 | 3 | 0.84 | 0.41-1.73 | 37 | 4-77 |
| 21014 | Motala | 2,725 | 43 | 0.84 | 0.63-1.13 | 38 | 16-57 |
| 11010 | Danderyd | 1,295 | 23 | 0.86 | 0.59-1.25 | 39 | 13-63 |
| 65016 | Sunderby | 264 | 6 | 0.86 | 0.47-1.58 | 40 | 7-74 |
| 64001 | Umeå | 978 | 16 | 0.87 | 0.56-1.34 | 41 | 11-67 |
| 22012 | Värnamo | 967 | 18 | 0.87 | 0.57-1.33 | 42 | 11-66 |
| 25011 | Oskarshamn | 1,657 | 28 | 0.88 | 0.63-1.25 | 43 | 15-63 |
| 22011 | Eksjö-Nässjö (Högland.) | 865 | 14 | 0.89 | 0.56-1.41 | 44 | 11-68 |
| 56012 | Köping | 1,021 | 22 | 0.9 | 0.61-1.31 | 45 | 14-66 |
| 57011 | Mora | 1,057 | 19 | 0.9 | 0.60-1.35 | 46 | 13-67 |
| 50001 | Sahlgrenska | 286 | 7 | 0.92 | 0.51-1.64 | 47 | 8-75 |
| 54010 | Karlstad | 1,459 | 27 | 0.93 | 0.65-1.32 | 48 | 18-66 |
| 10011 | S:t Göran | 3,352 | 72 | 0.94 | 0.75-1.18 | 49 | 25-61 |
| 13011 | Nyköping | 707 | 13 | 0.98 | 0.61-1.57 | 50 | 15-73 |
| 41013 | Ystad | 220 | 6 | 0.98 | 0.54-1.79 | 51 | 10-78 |
| 23010 | Växjö | 836 | 17 | 0.99 | 0.65-1.51 | 52 | 17-71 |
| 28012 | Hässleholm | 4,024 | 85 | 1.01 | 0.81-1.25 | 53 | 31-63 |
| 42010 | Halmstad | 1,310 | 29 | 1.01 | 0.71-1.44 | 54 | 22-70 |
| 27011 | Karlshamn | 1,528 | 33 | 1.05 | 0.76-1.45 | 55 | 26-70 |
| 10013 | Södersjukhuset | 1,835 | 35 | 1.06 | 0.77-1.45 | 56 | 27-70 |
| 21013 | Norrköping (Vrinnevi) | 655 | 13 | 1.09 | 0.68-1.75 | 57 | 20-77 |
| 11011 | Södertälje | 1,007 | 24 | 1.09 | 0.76-1.58 | 58 | 26-74 |
| 64010 | Skellefteå | 671 | 15 | 1.1 | 0.70-1.72 | 59 | 22-76 |
| 10015 | Sophiahemmet | 819 | 23 | 1.1 | 0.76-1.61 | 60 | 26-74 |
| 53013 | Skövde | 633 | 15 | 1.11 | 0.71-1.73 | 61 | 22-77 |
| 62010 | Sundsvall | 980 | 24 | 1.11 | 0.77-1.60 | 62 | 27-74 |
| 11013 | Löwenströmska* | 1,754 | 36 | 1.11 | 0.81-1.52 | 63 | 32-72 |
| 54014 | Torsby | 828 | 21 | 1.18 | 0.80-1.74 | 64 | 30-77 |
| 11015 | Nacka-Proxima | 305 | 5 | 1.2 | 0.64-2.27 | 65 | 16-83 |
| 52013 | Skene | 728 | 22 | 1.27 | 0.86-1.87 | 66 | 37-79 |
| 63010 | Östersund | 886 | 23 | 1.28 | 0.88-1.86 | 67 | 38-79 |
| 65013 | Piteå | 1,635 | 44 | 1.4 | 1.06-1.86 | 68 | 52-79 |
| 54012 | Arvika | 883 | 23 | 1.41 | 0.97-2.05 | 69 | 45-82 |
| 41010 | Landskrona | 375 | 17 | 1.42 | 0.93-2.16 | 70 | 42-82 |
| 51011 | Mölndal | 803 | 20 | 1.42 | 0.95-2.11 | 71 | 44-82 |
| 41011 | Trelleborg | 3,506 | 91 | 1.43 | 1.17-1.76 | 72 | 59-78 |
| 26010 | Visby | 601 | 20 | 1.49 | 1.00-2.21 | 73 | 48-83 |
| 50020 | Gothenburg Med Center** | 454 | 16 | 1.53 | 0.99-2.36 | 74 | 47-84 |
| 61010 | Gävle | 537 | 21 | 1.57 | 1.06-2.32 | 75 | 53-83 |
| 51010 | Uddevalla | 1,421 | 44 | 1.59 | 1.20-2.12 | 76 | 60-82 |
| 23011 | Ljungby | 716 | 26 | 1.63 | 1.14-2.32 | 77 | 58-83 |
| 12001 | Akademiska sjukhuset | 931 | 38 | 1.7 | 1.26-2.31 | 78 | 63-83 |
| 51012 | Kungälv | 1,199 | 47 | 1.77 | 1.34-2.33 | 79 | 67-84 |
| 61011 | Bollnäs / Söderhamn | 1,672 | 64 | 1.85 | 1.46-2.36 | 80 | 70-84 |
| 10016 | Ortopediska huset | 2,551 | 106 | 1.95 | 1.61-2.36 | 81 | 74-84 |
| 41001 | Lund | 123 | 10 | 1.99 | 1.19-3.33 | 82 | 60-84 |
| 11012 | Norrtälje | 659 | 32 | 2 | 1.44-2.80 | 83 | 69-84 |
| 61012 | Hudiksvall | 564 | 30 | 2.17 | 1.55-3.03 | 84 | 72-84 |

* 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 - 2011

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 2009-2011.

### *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, 20% had one previous surgery before the primary arthroplasty and 3% 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 (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| None | 73.0 | 78.9 | 78.7 |
| Osteosynthesis | 0.8 | 1.0 | 1.1 |
| Osteotomy | 2.1 | 2.1 | 2.0 |
| Menisceal surgery | 6.7 | 7.8 | 7.5 |
| Cruciate ligament surgery | 0.9 | 1.0 | 1.5 |
| Arthroscopy | 4.7 | 5.3 | 6.3 |
| Other | 2.1 | 2.3 | 1.9 |
| Missing | 9.7 | 1.6 | 1.0 |
| Totalt | 100 | 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, 83% of the patients are reportet being healthy or only having a mild systemic disease (class I or II)

**ASA classification**

| Type (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| ASA I | 18.5 | 19.6 | 19.6 |
| ASA II | 58.3 | 64.2 | 63.6 |
| ASA III | 13.5 | 14.9 | 16.4 |
| ASA IV | 0.2 | 0.3 | 0.2 |
| ASA V | 0 | 0 | 0 |
| Missing | 9.5 | 1.0 | 0.2 |
| Total | 100 | 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. 2.3% 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/m$^2$)**

| BMI group (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| <25 | 17.6 | 18.3 | 19.5 |
| 25-29.9 | 39.4 | 42.8 | 43.1 |
| 30-39.9 | 30.6 | 35.4 | 34.8 |
| ≥40 | 2.1 | 2.5 | 2.3 |
| Missing | 10.3 | 1.0 | 0.3 |
| Total | 100 | 100 | 100 |

**Body Mass Index (kg/m$^2$)**

| Gender BMI (median): | 2009 | 2010 | 2011 |
|---|---|---|---|
| Males | 28.0 | 28.1 | 29.2 |
| Females | 28.8 | 28.9 | 28.6 |
| All | 28.4 | 28.6 | 29.0 |

### *Antithrombotic prophylaxis*

Fragmin and Innohep were the most commonly reported antithrombotic drugs. Prophylaxis with Fragmin, Inohep and Klexane more often starts postoperatively than preoperatively.

Pradaxa and Xarelto are per-oral drugs and when using them, treatment is started 1-4 hours and 6-10 hours after surgery respectively. In 2011 the use of Pradaxa increased somewhat while Xarelto lessened slightly as compared to 2010.

**Trombosprofylax**

| Type (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| No prophylaxis | 0.3 | 0.1 | 0.1 |
| Fragmin pre-op | 24.5 | 13.0 | 10.1 |
| Fragmin post-op | 22.0 | 27.0 | 24.8 |
| Inohep pre-op | 12.1 | 11.3 | 13.8 |
| Inohep post-op | 14.7 | 16.8 | 19.4 |
| Klexane pre-op | 6.6 | 6.0 | 5.3 |
| Klexane post-op | 6.1 | 6.5 | 7.4 |
| Xarelto | 1.8 | 5.2 | 3.8 |
| Pradaxa | 1.1 | 12.5 | 14.9 |
| Other | 0.1 | 0.2 | 0.2 |
| Missing | 10.7 | 1.4 | 0.2 |
| Total | 100 | 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 (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| No prophylaxis | 0.3 | 0.1 | 0.1 |
| 1-7 | 13.6 | 8.9 | 7.5 |
| 8-14 | 62.9 | 77.0 | 78.7 |
| 15-21 | 3.7 | 4.1 | 5 |
| 22-28 | 6.2 | 5.9 | 6.3 |
| 29-35 | 1.9 | 1.6 | 1.1 |
| >35 | 0.5 | 0.5 | 0.4 |
| Missing | 10.9 | 1.9 | 0.9 |
| Total | 100 | 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 good 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 brand**

| Substance (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| Cloxacillin | 80.8 | 88.4 | 89.7 |
| Dalacin | 5.9 | 7.2 | 7.6 |
| Zinazef | 3.8 | 3.5 | 2.1 |
| Cefotaxim | 0.2 | 0.2 | 0.3 |
| Vancomycin | 0.1 | 0 | 0.1 |
| Other | 0.1 | 0.1 | 0.1 |
| Missing | 9.2 | 0.6 | 0.1 |
| Total | 100 | 100 | 100 |

**Cloxacillin dose**

| Dose | 2009 | 2010 | 2011 |
|---|---|---|---|
| Cloxacillin 2gx3 | 51.5 | 58.8 | 59.8 |
| Cloxacillin 2gx4 | 29.9 | 32.6 | 30.9 |
| Cloxacillin 1gx3 | 3.9 | 2.1 | 2.1 |
| Cloxacillin 1gx4 | 1.8 | 2.3 | 1.8 |
| Cloxacillin 2g+1g+1g | 9.0 | 0.7 | 2.2 |
| Cloxacillin annan dos | 2.0 | 2.2 | 2.5 |
| Dose missing | 1.9 | 1.3 | 0.7 |
| Total | 100 | 100 | 100 |

### *Cloxacillin - dose*

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

### *Antibiotics - time of administration*

The aim of prophylactic antibiotics is that the tissue concentration at the start of surgery should be at its maximum.

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 a tourniquet i used, 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 prophylactic antibiotics in 2007 (Stefánsdóttir A et al. 2009) but in the previous report we could report that an improvement had been observed between 2009 and 2010. During 2011 this trend continued with prophylactic antibiotics being administrated within the recommended timeframe in 87% of the surgeries (information missing for 0.4%). 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 as intended.

However, the definite time for administration of the first dose is recorded in the anesthetist medical list or electronic case record. Therefore, we have started asking for the definite time for the dose, instead of how many minutes prior to surgery. We hope this will result in more accurate information being recorded.

**Antibiotic - time (minutes before surgery)**

| Minutes pre-op. (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| 0-14 | 3.7 | 4.4 | 4.4 |
| 15-45 | 69.2 | 81.3 | 86.8 |
| >45 | 14.8 | 11.9 | 7.7 |
| Start after surgery | 1.5 | 0.7 | 0.7 |
| Missing | 10.8 | 1.7 | 0.4 |
| Total | 100 | 100 | 100 |

## The new form (cont.)

### *Anesthesia*

Spinal anesthesia was the most common form of anesthesia, being used in 89% of cases.

General anesthesia was used in 10% of cases while epidural anesthesia accounted for only 1%.

**Type of anesthesia**

| Type (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| General | 8.4 | 10.1 | 9.8 |
| Epidural | 1.1 | 0.9 | 0.6 |
| Spinal | 80.7 | 87.5 | 89.3 |
| Other | 0.3 | 0.7 | 0.2 |
| Missing | 9.5 | 0.8 | 0.1 |
| Total | 100 | 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 90% of the knee arthoplasties are reported being performed using a tourniquet. This is a slight reduction as compared to 2010.

Drainage was only used in barely 26% of cases in 2011 which is a slight reduction as compared to the previous years.

**Tourniquet and drainage**

| Tourniquet (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| Yes | 84.7 | 92.5 | 89.9 |
| No | 5.1 | 6.4 | 9.8 |
| Missing | 10.2 | 1.1 | 0.3 |
| Total | 100 | 100 | 100 |

| Drainage (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| Yes | 28.9 | 28.3 | 26.0 |
| No | 61.5 | 70.8 | 73.8 |
| Missing | 9.6 | 0.9 | 0.2 |
| Total | 100 | 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 1.2% 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 0.4% 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 87% of the patients having LIA in 2011. In 44% of the cases (with or without LIA) a catheter was left in the knee for a later injection.

**Local infiltration analgesia - LIA**

| Type (%) | 2009 | 2010 | 2011 |
|---|---|---|---|
| None | 5.8 | 4.2 | 4.1 |
| LIA | 44.4 | 49.8 | 54.5 |
| Only catheter | 10.3 | 10.8 | 8.4 |
| LIA+catheter | 29.7 | 34.2 | 32.7 |
| Missing | 9.7 | 1.0 | 0.3 |
| Total | 100 | 100 | 100 |

### *Operating time*

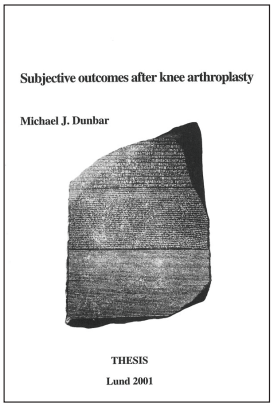
In 2011, the median time for the operations was 142 min. for linked implants, 80 min. for TKA´s, 75 min. for UKA´s and 60 min. for femoro-patellar implants. As compared to 2010, the time was approximately the same for TKA and UKA.
However, for the 54 femoro-patellar implants the median time was similar as reported in 2009 but 20 minutes shorter than in 2010.

## 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 of Skåne PROMs are used as a quality measure of the care provided. In last years report we accounted for PROM data gathered 2009-2010 for TKA patients operated at the arthroplasty center in Trelleborg, which is jointly used by the university hospitals in Lund and Malmö.

Our compilation showed results that could be expected, i.e. that while having a knee arthroplasty did not improve the general health for the oldest, heaviest and most dissatisfied patients their knee related pain, symptoms, function and quality of life improved independent of the case-mix category.

Further, the results indicated that it would be difficult to demonstrate statistically and clinically significant differences on a clinical level.

The pilot project has since been expanded to include an additional year from Trelleborg as well as data from the Hässleholm hospital for 2009-2010. Below follows a descriptive compilation of the PROM data for the TKA patients for the respective hospital and year of operation.

*Instruments used for the evaluation*

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 5 subscales are presented as a mean value and standard deviation (SD) before and one year after surgery for all the patients as well as separately for each hospital and year of operation.

A Visual Analog Scale (VAS) was used to have the patients to 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. The VAS knee pain is presented as a mean and SD before and one year after surgery for each hospital and year of operation.

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 satisfaction (VAS) score was categorized into 5 groups; very satisfied (0-20), satisfied (21-40), moderately satisfied (41-60), unsatisfied(61-80) and very unsatisfied (81-100).

**Case-mix classification**

| | | |
|---|---|---|
| **Gender** | **Male / Female** | |
| **Age** | **<55, 55-64, 65-74, 75-84, ≥85** | |
| **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** | **- obesity** |
| | **≥40** | **- morbid obesity** |

*Case-mix*

In Hässleholm, the proportion of men was higher than in Trelleborg (tables below). The proportion of patients classified as healthy (ASA I) was somewhat larger in Hässleholm than in Trelleborg. On the other hand, the proportion having serious systemic disease (ASA III) was relatively similar at the two hospitals, but with a slightly higher proportion of the males in Hälssleholm being ASA III. Both hospitals had somewhat lower proportion ASA III patients than the national average (15%). The difference between the hospitals with respect to other case-mix factors was small.

**Description of patients Hässleholm**

| | All | Males | Females |
|---|---|---|---|
| | n=914 | n=442 | n=516 |
| | | (48%) | (52%) |
| **Age (years)** | | | |
| **Mean** | 69.9 | 69.3 | 68.6 |
| **SD** | 9.1 | 8.7 | 9.4 |
| **BMI (kg/m2)*** | | | |
| **Mean** | 28.7 | 28.3 | 29.1 |
| **SD** | 4.4 | 3.7 | 5 |
| **Charnley category (n (%))** | | | |
| **A** | 282 (30.9) | 148 (33.5) | 134 (28.4) |
| **B** | 267 (29.2) | 137 (31) | 130 (27.5) |
| **C** | 365 (39.9) | 157 (35.5) | 208 (44.1) |
| **ASA classification (n (%))**** | | | |
| **ASA I** | 234 (26.1) | 109 (25.1) | 125 (27) |
| **ASA II** | 543 (60.5) | 254 (58.4) | 289(62.4) |
| **ASA III** | 121 (13.5) | 72 (16.5) | 49 (10.6) |

* n=855
** n=898

**Description of patients Trelleborg**

| | All | Males | Females |
|---|---|---|---|
| | n=1 209 | n=440 | n=769 |
| | | (36%) | (64%) |
| **Age (years)** | | | |
| **Mean** | 69,6 | 68,9 | 67 |
| **SD** | 8,4 | 8,2 | 8,5 |
| **BMI (kg/m2)*** | | | |
| **Mean** | 29,2 | 28,6 | 29,6 |
| **SD** | 4,9 | 3,9 | 5,3 |
| **Charnley category (n (%))** | | | |
| **A** | 324 (26,8) | 139 (31,6) | 185 (24,1) |
| **B** | 376 (31,1) | 139 (31,6) | 237 (30,8) |
| **C** | 509 (42,1) | 162 (36,8) | 347 (45,1) |
| **ASA classification (n (%))**** | | | |
| **ASA I** | 210 (19) | 92 (23) | 118 (16,7) |
| **ASA II** | 763 (68,9) | 262 (65,3) | 501 (70,9) |
| **ASA III** | 135 (12,1) | 47 (11,7) | 88 (12,4) |

* n=1091
** n=1108

*Patient selection*

1,660 primary knee arthroplasties were operated on during 2008-2010 in Trelleborg and 1,355 in Hässleholm. Of these, UKA and PF were excluded (too few patients), as well as diagnoses other than OA. The second knee was also excluded if both knees 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 2,123 patients could be evaluated (1,209 from Trelleborg and 914 frin Hässleholm) or 75%, respective 72% of of all the primary TKA performed for OA.

*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.

*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.

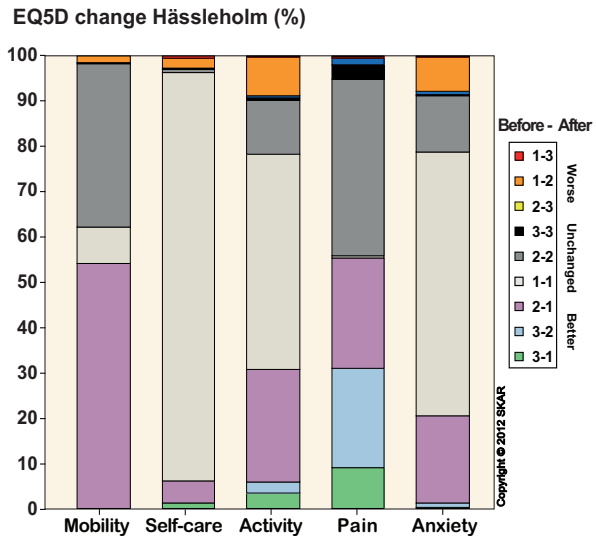
A preoprative answer of extreme problems can be unchanged at the follow-up (3-3) or there can be an improvement from extreme to moderate (3-2) or from extreme to none (3-1).

Moderate problems can stay unchanged (2-2), worsen into extreme (2-3) or improve to none (2-1). Finally no problems preoperatively can stay unchanged (1-1), worsen to moderate (1-2) or become extreme (1-3).

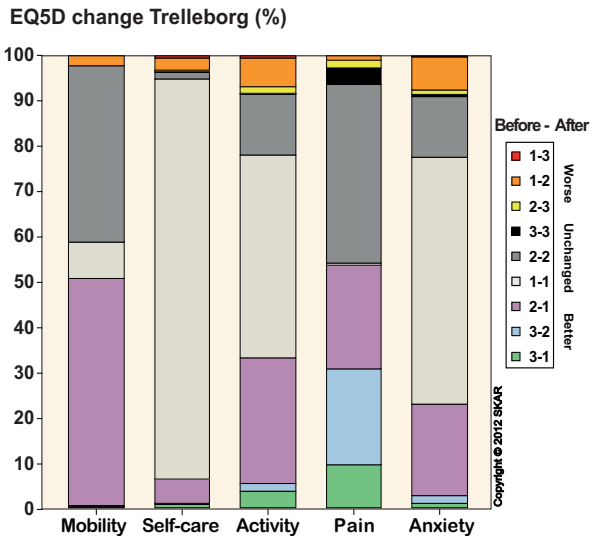
For Hässleholm and Trelleborg respectively and for each of the 5 EQ-5D questions, the figures below show the relative proportion of the 9 possible combinations of change in the pre- and postoperative answers.

It can be seen that one year after surgery, half of the patients had improved mobility and half of them had experienced pain relief. Only a third had improved in their usual activities; one fifth had reduced anxiety and only a few improved in self-care.

The proportion of patients, that for each dimension of the EQ5D had changed (improved or worsened) or stayed unchanged, differed negligibly between the two hospitals (0.1%-3.5%).



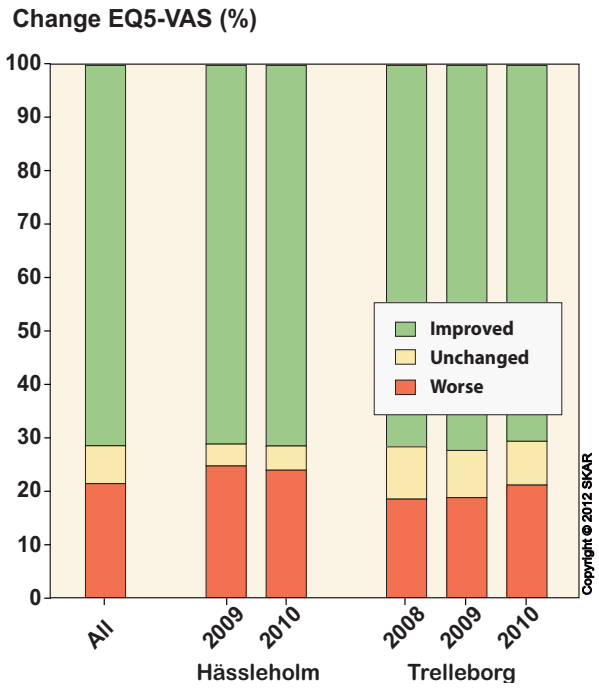

*The distribution (%) in Hässleholm for the different combinations of pre- and postoperatve (1-year) change for each of the EQ-5D questions. (1=no problem, 2=some or moderate problems 3=extreme problems)*




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

*EQ-VAS*

When evaluating the change in pre- and postoperatve general health, as measured by EQ-VAS, the difference between the two hospitals as well as between the two different years of surgery was small (3-4 points) as the figure below shows.




*The change (%) in general health (EQ5D VAS) one year after surgery for all the patients as well as for the two hospitals and respective year of surgery.*

*VAS – Knee pain*

The difference between Hässleholm and Trelleborg in the preoperative pain estimate (VAS) was small (4 points) and one year after surgery the difference was even smaller (2 points). The VAS pain estimate was essentially the same independent of what year the surgery had been performed (next page).

*KOOS*

When the patients valued their knee-related pain, symptoms, function and quality of life, both pre- and postoperatively, the difference was small between Hässleholm and Trelleborg (2-6 points) as well as for the different years of operation (page 55).

*VAS – Satisfaction with the arthroplasty surgery*

One year after surgery, 90% of the patients reported how satisfied they were. Of these, 80% said they were very satisfied or satisfied. The variation between the hospitals and the different years of surgery was approx. 2% (figure right) and the differences in mean values were small (next page).

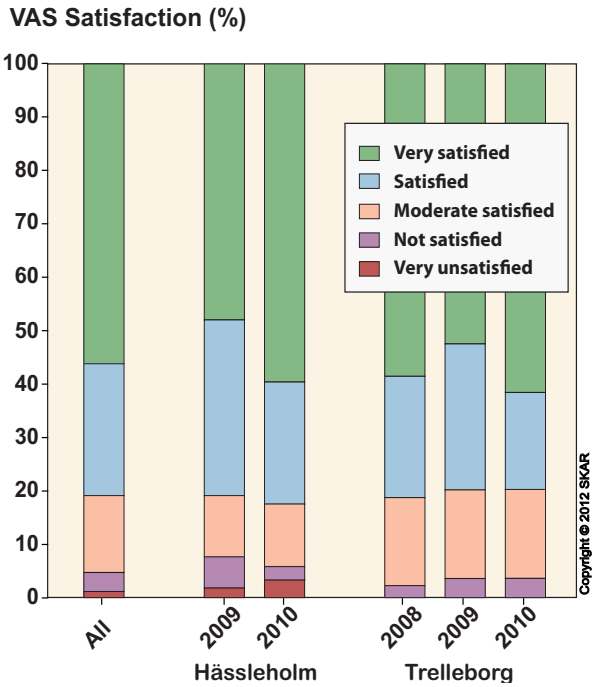
*Summary*

There were small variations between patients operated in Hässleholm and Trelleborg concerning general health, knee-related pain, symptoms, function and quality of life. The same was true when the different years of surgery were compared.

Hässleholm was found to have somewhat higher proportion of men as well as patients classified as ASA I which might be explained by the fact that men, more often than women, use the option of having a free choice of care and that Hässleholm has a higher proportion of patients seeking care from other districts.

On the individual level there were large variations in PROM data while the difference on the group level showed little difference between two of the larger Swedish arthroplasty units in spite of them having a certain difference in case-mix.

This pilot project could be the 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. The SKAR intends to offer the rest of the hospitals the opportunity of participation in the project by entering their data into a common PROM database.




*The distribution (%) for each level of satisfaction after surgery for all the patients as well as for the two hospitals and respective year of surgery.*

**Results for EQ-VAS and VAS–pain preoperatively as well as 1-year postoperatively.**

| | | VAS pain 0–100 (best - worst) | | EQ-VAS 0–100 (best - worst) | | Satisfaction 0–100 (best - worst) | |
|---|---|---|---|---|---|---|---|
| Group | Patients n | Preop mean (SD) | Postop mean (SD) | Preop mean (SD) | Postop mean (SD) | Patients n | Postop mean (SD) |
| All | 2,123 | 60 (16) | 20 (20) | 60 (21) | 76 (19) | 1,864 | 24 (23) |
| Hospital | | | | | | | |
| Hässleholm | 914 | 58 (15) | 19 (19) | 59 (21) | 75 (20) | 820 | 24 (22) |
| Trelleborg | 1,209 | 62 (16) | 21 (21) | 62 (21) | 76 (19) | 1,044 | 25 (23) |
| Year of surgery | | | | | | | |
| 2008 | 357 | 62 (16) | 21 (20) | 61 (21) | 76 (19) | 352 | 22 (22) |
| 2009 | 902 | 59 (17) | 19 (20) | 60 (22) | 76 (20) | 699 | 27 (21) |
| 2010 | 864 | 60 (15) | 20 (20) | 60 (21) | 75 (20) | 813 | 23 (24) |
| Hässleholm | | | | | | | |
| 2009 | 486 | 57 (16) | 19 (19) | 60 (21) | 75 (20) | 392 | 26 (21) |
| 2010 | 428 | 58 (15) | 19 (19) | 58 (21) | 76 (19) | 428 | 21 (23) |
| Trelleborg | | | | | | | |
| 2008 | 357 | 62 (16) | 21 (20) | 61 (21) | 76 (19) | 352 | 22 (22) |
| 2009 | 416 | 62 (18) | 20 (20) | 61 (22) | 78 (19) | 307 | 27 (22) |
| 2010 | 436 | 62 (15) | 21 (21) | 63 (20) | 75 (20) | 385 | 24 (25) |

**Results för KOOS preoperatively as well as 1-year postoperatively.**

| | | Pain | | Symtoms | | ADL | | Sports/Rec. | | QoL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Goupp | Patients n | Preop mean (SD) | Postop mean (SD) | Preop mean (SD) | Postop mean (SD) | Preop mean (SD) | Postop mean (SD) | Preop mean (SD) | Postop mean (SD) | Preop mean (SD) | Postop mean (SD) |
| All | 2,123 | 41 (17) | 79 (19) | 48 (17) | 75 (18) | 45 (16) | 77 (19) | 11 (14) | 34 (26) | 23 (15) | 63 (24) |
| Hospital | | | | | | | | | | | |
| Hässleholm | 914 | 39 (15) | 79 (19) | 47 (18) | 77 (17) | 43 (15) | 76 (20) | 11 (13) | 34 (25) | 22 (15) | 64 (23) |
| Trelleborg | 1,209 | 42 (16) | 80 (19) | 48 (17) | 75 (18) | 47 (17) | 76 (19) | 11 (15) | 34 (27) | 23 (14) | 63 (24) |
| Year of sugery | | | | | | | | | | | |
| 2008 | 357 | 42 (16) | 79 (19) | 49 (18) | 75 (18) | 47 (16) | 78 (19) | 11 (15) | 31 (26) | 23 (14) | 62 (24) |
| 2009 | 902 | 40 (17) | 80 (20) | 47 (18) | 76 (18) | 45 (17) | 78 (20) | 11 (14) | 35 (26) | 23 (16) | 64 (23) |
| 2010 | 864 | 41 (14) | 79 (19) | 47 (16) | 75 (18) | 46 (15) | 76 (20) | 11 (14) | 35 (26) | 23 (14) | 63 (24) |
| Hässleholm | | | | | | | | | | | |
| 2009 | 486 | 38 (16) | 78 (20) | 46 (19) | 77 (17) | 42 (16) | 77 (19) | 11 (13) | 34 (25) | 21 (16) | 64 (23) |
| 2010 | 428 | 40 (13) | 79 (19) | 47 (16) | 76 (17) | 44 (13) | 76 (20) | 10 (13) | 34 (26) | 23 (13) | 63 (23) |
| Trelleborg | | | | | | | | | | | |
| 2008 | 357 | 42 (16) | 79 (19) | 49 (18) | 75 (18) | 47 (16) | 78 (19) | 11 (15) | 31 (26) | 23 (14) | 62 (24) |
| 2009 | 416 | 42 (17) | 81 (19) | 48 (17) | 76 (19) | 47 (18) | 80 (20) | 11 (14) | 37 (27) | 24 (15) | 65 (24) |
| 2010 | 436 | 42 (16) | 79 (19) | 47 (17) | 73 (18) | 47 (16) | 77 (20) | 12 (14) | 35 (27) | 23 (15) | 63 (24) |

## 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 / mixing system** .....
(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
☐ 5 Suspected infection
☐ 6 Instability (not of the patella)
☐ 7 Femoropatellar problem (pain, disclocation etc.)
☐ 8 Suboptimal situs of the previous implant
☐ 9 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 **Time:** ..... : .....
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**

## Publications :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### Deputy Manager
Annette W-Dahl, RN, PhD

### Register holder
Martin Sundberg, MD, PhD

### Register Associates
Anna Stefansdottir, MD, PhD
Kaj Knutson, MD, PhD
Lars Lidgren, MD, professor

### Project Secretary
Catharina Nilsson

### Consulting Statisticians
Jonas Ranstam, CStat, Professor, RCsyd
Caddie Zhou, MSc, RCsyd

### Steering group
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Tore Dalén, MD, PhD, Norrland University Hospital, Umeå
Johan Kärrholm, MD, professor, Sahlgrenska University Hospital, Göteborg
Peter Ljung, MD, PhD, Hässleholm Hospital
Otto Robertsson, MD, PhD, Skåne University Hospital, Lund
Susanna Söderström, MD, Bollnäs Hospital
Annette W-Dahl, RN PhD, Skåne University Hospital, Lund

### Visiting address
Klinikgatan 22, Wigerthuset, 2nd floor
Skåne University Hospital, Lund, SE-221 85.

Phone: +46-(0)46-171345
Fax: +46-(0)46-177167
e-mail: knee@med.lu.se




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