Akademiska sjukhuset
Alingsås
ArtClinic Jönköping
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
Lidköping
Lindesberg
Ljungby
Lund
Lycksele
Malmö
Mora
Motala
Movement Halmstad
Mölndal
Nacka
Norrtälje
Nyköping
OrthoCenter IFK kliniken
OrthoCenter Stockholm
Oskarshamn
Ortopediska huset
Piteå
S:t Göran
Sabbatsberg
Sahlgrenska
Skellefteå
Skene
Skövde
Sollefteå
Sophiahemmet
Spenshult
Sunderby
Sundsvall
Södersjukhuset
Södertälje
Torsby
Trelleborg
Uddevalla
Umeå
Varberg
Visby
Värnamo
Västervik
Västerås
Växjö
Ängelholm
Örebro
Örnsköldsvik
Östersund

Annual Report 2013

Swedish Knee Arthroplasty Register

Deptartment of Orthopedics
Skåne University Hospital, Lund

Concerning:

primaries 1975-2012
revisions 1975-2011

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

We have since the beginning of 2013 been registering joint preserving surgery for osteoarthritis, i.e knee osteotomies, in a special form that can be found at the end of this report. As osteotomies are an alternative for young and physically active patients, we consider it important to follow and compare the outcome especially with uni compartmental arthroplasty Thus, we ask that you inform your colleagues about the new registration which concern both primary procedures as well as reoperations.

During the year we have developed a new web-site which now has a special page for patients: www.gangbar.se. The webpage for the orthopedic surgeons has also been reconstructed and contains statistics that both are public and such that require log in by use of smart cards. As contact surgeon you will also gain access to the parts that require log-in.

The structure of the annual report is similar to the previous ones with the difference that we this year also report aggregated results of counties instead of regions. Further, we have split the 2 largest generic model groups by their type of tibial components. Consequently we have in this report NexGen MBT (metal backed tibia), NexGen APT (all poly tibia) and NexGen TM (trabecular metal). Similarly the PFC has been split into PFC MBT and PFC APT.

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 2012 as well as analyses covering the 10-year period 2002-2011.

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 2012. 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 because 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.

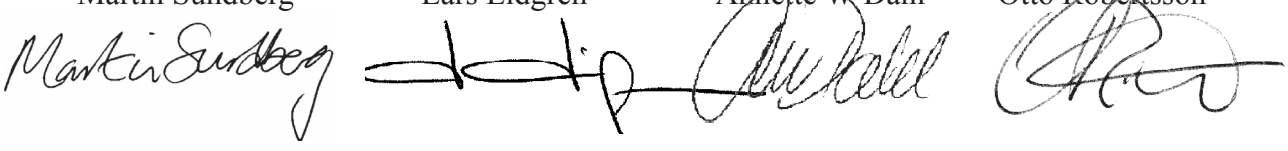
The members of the register have been very active attending national and international meetings as invited lecturers. The scientific publications are listed at the end of the report.
The Knee Register in Lund would like to thank our contact physicians, operation staff and secretaries for their important contribution during the years and ask you to process and circulate the presented information.

The members of the register have been very active attending national and international meetings as invited lecturers. The scientific publications are listed at the end of the report.

The SKAR in Lund would like to thank our contact surgeons, operation staff and secretaries for their important contribution during the years and ask you to process and circulate the presented information.

Lund, september 23rd, 2013
On behalf of the Swedish Knee Arthroplasty Register

Martin Sundberg Lars Lidgren Annette W-Dahl Otto Robertsson



Printed in Sweden 2013

Elvins Grafiska AB, Helsingborg

ISBN 978-91-979924-9-7

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 2012, 75 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 2012, 13,316 primary arthroplasties were reported which was an increase of 4.4% as compared to 2011. This compensated well for the transitory decrease of 0,8% which was observed between 2010 and 2011. It is not unlikely that we will see further increase in volumes because the incidence in Sweden (see page 13) is still lower than in countries as USA and Germany. However, 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 63) 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.
For those units that wish to register PROM data, the register has developed a Web application and since the summer the units have been able to enter their data on-line. At present there are 8 hospitals delivering pre- and postoperative PROM.

Annual report – Each annual report accounts for primary arthroplasties reported during the previous year (in this report 2012). Analyses concerning the revision rate end one year earlier (2011). 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 happens that unit's send completing information after discovering, by examining the annual report and the accompanying lists, that their previous reporting had been incomplete. Thus, the extra years allows for the most complete and correct information on revisions possible.

Registration of osteotomies – This year we began registering osteotomies around the knee joint. More information can be found on the pages 8-9.

10-year analyses – Some have wondered why the register most often accounts for a 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 mainly the younger 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 description of how the register compares implants can be found on page 10.

Cooperation – There is a close collaboration with RCSyd (Register Center South) which is facilitated by the fact that the SKAR and RCSyd 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 reporting form – The same one page form is used for both primaries and revisions (see page 64). One set of the stickers which accompany the implant and cement packages and which contain the part- and lot numbers should be placed on the backside of the form. In 2012, less than 1 in thousand of the forms did not come with part numbers. For the 13 variables we started requesting in 2009, the summary on page 52 shows a response rate of 99% which was better than expected.

Patient Reported Outcome – Nationally and internationally there has been increasing interest in patient reported outcome measures (PROM).
The SKAR started early 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 published in 2001. However, recently there has been renewed interest in PROM for quality improvement.
Thus, the register has evaluated PROM data that were gathered in Skåne during 2008-2011 and the results can be found for 5 units on page 55-61.

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. In the last report, we described how we had visited 9 hospitals in the winter 2011-2012 and had found that the registration was very reliable. The hospital visits themselves resulted in improved routines with respect to registration and cooperation. Therefore we continued and visited 8 hospitals during the last year. Additional information on these visits can be found on page 6-7.

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.

We have constructed a special web site for patients (www.gangbar.se) and an improved site for the profession (www.knee.se) where participating hospitals will be able to access data through a secure connection. The patient section is already on-line and that for the profession will be ready before the end of the year.

Definitions

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

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

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

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

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

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

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

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

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

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

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

Completeness concerning primaries reported in 2011

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, based on a validation in 1997, with following comparisons against PAR as well as by hospital visits, the reporting completeness has been estimated as 97% in the recent years.

In order to estimate the percentage of surgeries captured by the SKAR in 2011 the register 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 completeness. 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 2010, we found that 97.4% of the admissions had been registered in the SKAR. In the same way we now find for 2011 that 97.7% had been registered by the SKAR and 95.1% 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	83	95.2	95.2
Alingsås	196	96.4	99.0
Arvika	156	95.5	98.1
Bollnäs	307	99.3	97.1
Borås + Skene	242	95.5	96.3
Carlanderska	159	100	0
Dalens	1	0.0	100
Danderyd	199	96.5	93.0
Eksjö-Nässjö	160	96.9	98.1
Elisabethkliniken	56	98.2	100
Enköping	315	99.7	99.7
Eskilstuna	42	95.2	100.0
Falu lasarett	356	98.6	97.8
Frölunda Spec. sjukhus	120	95.8	98.3
Gällivare	83	97.6	100
Gävle	98	98.0	95.9
Halmstad - Capio	277	99.3	99.3
Halmstad	201	99.5	99.0
Helsingborg	22	90.9	100
Huddinge	130	99.2	98.5
Hudiksvall	93	95.7	94.6
Hässleholm	640	98.6	99.7
Jönköping Ryhov	165	100	99.4
Kalmar	111	95.5	96.4
Karlshamn+Karlskrona	249	97.6	99.2
Karlskoga	102	99.0	99.0
Karlstad	151	98.7	98.7
Karolinska	112	96.4	100
Kullbergska	231	98.7	97.4
Kungälv	185	95.1	95.7
Lindesberg	156	99.4	100
Linköping	1	0	100
Ljungby	120	98.3	97.5
Lund	40	100	97.5
Lycksele	60	100	96.7
Löwenströmska - Artro Center	4	0	100
Löwenströmska sjukhuset	443	99.8	99.3

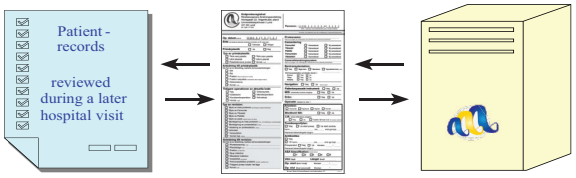
Hospital	Number	SKAR-percent	NPR percent
Malmö	15	100	100
Mora	169	98.2	98.2
Motala	463	97.0	99.6
Nacka	138	98.6	97.1
Norrköping Vrinnevisjh.	160	98.1	99.4
Norrtälje	81	100	100
Nyköping	117	99.1	94.0
Ortopediska Huset	358	96.9	79.9
Oskarshamn	244	98.0	98.8
Piteå	287	99.3	99.3
S:t Göran	372	98.1	99.5
Sabbatsberg	104	100	99.0
Sahlgrenska+Mölndal+Östra	283	96.5	97.2
Skellefteå	98	100	99.0
Skövde+Falköping+Lidköping	380	93.4	98.9
Sollefteå	111	91.9	92.8
Sophiahemmet	74	98.6	91.9
Spenshult	241	98.8	97.9
Spine Center Göteborg	138	100	0
Sunderbyn	4	100	100
Sundsvall	123	96.7	96.7
Södersjukhuset	332	96.7	98.2
Södertälje	126	96.0	97.6
Torsby sjukhus	82	96.3	98.8
Trelleborg	584	98.3	99.5
Uddevalla	199	93.5	97.5
Umeå	167	98.8	98.2
Varberg	165	98.8	98.8
Visby lasarett	114	100	93.0
Värnamo	118	95.8	99.2
Västerviks	96	100	100
Västerås	288	96.5	96.9
Växjö	101	96.0	96.0
Ängelholm	161	99.4	67.7
Örebro	121	96.7	100
Örnsköldsvik	110	97.3	97.3
Östersund	168	97.6	97.0

Validation of data quality.

The aim of validating the data quality is to investigate the correctness of the information found in the register 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.

The validation performed last year (annual report 2012) indicated a excellent completeness and that the basic information about the surgery as well as about the implants was very reliable. With respect to the 13 new variables that were introduced in 2009, the completeness was good and the information in good accordance to what was found in the register.

The validation performed this year included 8 hospitals from around the country. The hospitals were asked to find records on 25 consecutive knee arthroplasty operations performed after March 1st 2012. Computer as well as paper records (incl. op- and anesthesia reports) were to be included. During the winter 2012-2013 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. The information on the new form was then compared to the original form which again was compared to what was found to have been entered in the register.



This way, information on 203 operations (189 primaries, 13 revisions and 1 re-operation) was validated. One hospital delivered information on 28 cases. Of the gathered surgeries at the hospitals none was missing in the SKAR.

When evaluating essential data (date, hospital, laterality and diagnosis), less than 1% of cases differed in the information found in SKAR as compared to the orignal form or the information gathered at the hospital visit. No information was missing.

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 for cemented cases). Less than 1% of the information in the SKAR differed from the original form wich in turn differed from that gathered during the hospital visit in 3 cases. However, in 6% of cases reported information could not be found again at the hospital.

When checking the variable ”previous surgery of the index knee” the database and the original form differed in less than 1% of cases. However, the information on the original form and that found in hospital records differed in 22% of cases. An explanation may be that the hospital records may contain very old information and also include more details. As the form is to be filled in the operation theater during the surgery, the surgeon’s knowledge on previous surgeries may not be as extensive as what can retrospectively be gathered from hospital records. E.g. there were many cases for which the form listed arthroscopy as being previous surgery while the hospital records stated arthroscopic meniscectomy. On the other hand, for 1% the information stated on the form could not be verified in hospital records.

With respect to information on the ”operation techniques” (use of bone transplants, drainage, tourniquet, MIS, CAS), the name of prophylactic drugs, doses of antithrombotic- and antibiotic prophylaxis as well as for the use of local infiltration analgesia (LIA) the difference between what was found on the original form and that gathered during the hospital visit was negligible. Few data were missing.

The time for administration of the first dose of the prophylactic antibiotic drug could be found in the pharmaceutical records at most of the units. For 17% of cases the time reported differed < 15 minutes from what was found in the records. This was an improvement as compared to the previous validation.

However, since then the routines for reporting have changed, so that instead of reporting how many minutes before surgery the first antibiotic dose of was administrated the definite time is to be registered on the reporting form.

The expected length of antibiotic treatment is a variable that differs for 10% of the arthroplasties. An explanation for this is the fact that the plan was registered on the reporting form in hours or days while the time acquired during the hospital visit was calculated in days based on what was registered in the pharmaceutical records.

The planned length of antithrombotic treatment is a variable likely to differ from what was expected and registered during surgery and what was found to be the case during the later hospital visit. The reason is that the plan may change during the hospital stay. For almost 5% of the surgeries the information differed more than a week.

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.

It was possible to find information on the operating time for all the cases. However, for cases having bilateral simultaneous knee arthroplasties only the total anesthetic time was documented in the anesthesia records. However, on the reporting form the time for each knee was registered.

The ASA rating reported on the original form and that what was found retrospectively in the anesthesia journal differed for 13% of the cases. At 3 hospitals it was noted that for one third of the operations the ASA class in the anesthesia journal was higher than on the original form. For a few patients, the ASA rating could not be found in hospital records during the visit.

With respect to the type of anesthesia, the original form and the information found during the hospital visit differed for 6%. The information did not differ from what had been entered into the SKAR database. However, for 1% the information reported could not be found retrospectively in hospital regards

This year's results of the data quality validation were similar to that of last year indicating very good data capture. Further, the information on the essential/base dataset as well as on the part numbers and fixation of components was very complete. With respect to the"new" variables the results were similar or somewhat better than last year. The information on previous surgeries was the variable that differed most. Regarding the drug prophylaxis and the timing for the first antibiotic dose administrated there were fewer differences than last year. The reason is probably the experience gained during the previous validation which lead to improved registration routines as well as improved contacts with register staff. Thus, we hope to be able to continue with the project until we have visited all the hospitals.

Joint preserving surgery

Knee osteotomy

High tibial osteotomy was introduced in Sweden in 1969 as a standard treatment for unicompartmental ostoearthritis by Göran Bauer Professor in Lund. However, after the modern knee implants were introduced in the seventies they quickly became the most common surgical option for osteoarthrits. Since then the number of osteotomies has constantly diminished. In his 1981 thesis; ”Osteotomy for medial gonarthrosis”, Björn Tjörnstrand estimated that that one third of the surgical knee reconstructions were osteotomies while the SKAR in 1994 estimated that they accounted for 20%.

Of the osteotomies performed around the knee joint, Tibia osteotomy is the absolutely most common. Most often it is used for medial osteoarthritis while its use for lateral arthritis is less common. Osteotomies of the femur are more infrequent and are used mostly for serious congenital or acquired deformities as well as sometimes for lateral osteoarthritis.

There are several osteotomy methods and there are different types of fixation which often depend on the method used.

The ”closed wedge” osteotomy is a ”minus osteotomy” in which a bone wedge, of a size that relates to the correction needed, is removed. The osteotomy can be fixed with one or more staples, a plate and screws or with an external frame.

Closed wedge osteotomy using a staple for fixation.. The inserted picture above shows the wedge that is removed before the osteotomy is closed..

Open wedge osteotomy is a ”plus osteotomy” in which a wedge is opened up in order to gain the decided amount of correction. The osteotomy can be fixed internally, most commonly with plate and screws, with staples or with an external frame. When the osteotomy is opened up during surgery a bone autograft or bone substitute is used to fill the gap (see the left figure below). If an external frame is used for fixation it is possible to gradually open the osteotomy over few weeks which is the biological procedure used for bone lengthening which has the name hemicallostasis (see figure to the right below).

Finally there is also the curved or dome osteotomy which is rarely used in Sweden.

Open wedge osteotomy with staple fixation

Open wedge osteotomy with external fixation

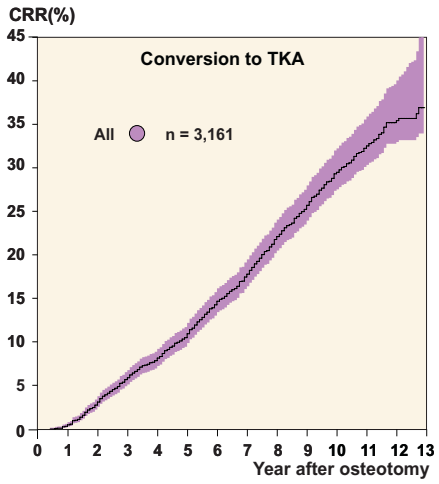
The results after osteotomy are related to how the surgery gains and maintains the optimal correction. Thus the operation demands careful preoperative planning with respect to the correction needed, that the correction aimed for is achieved during surgery and that the fixation is stable so it can preserve the level of correction during bone healing.

Each of the different techniques has their pros and cons and there has been a continuing development of the procedure with the introduction of new materials and improved postoperative care.

As opposed to the well documented knee arthroplasty surgery, there has in recent years been a lack of knowledge with respect to the use and outcome of tibia osteotomy for knee osteoarthrits. Therefore a retrospective population study was performed which was published in Acta Orthopaedica in June 2012 (W-Dahl et al 2012).

From the Swedish official in- and outpatient databases 3,161 osteotomies were identified that had been performed during 1998-2007 in patients over 30 years of age for knee osteoarthritis. Patient records were then used to verify the diagnosis and the method of osteotomy after which the Swedish Knee Arthroplasty Register was used to find those osteotomies that had been converted to knee arthroplasty before the end of 2010. The study showed that the number of osteotomies had diminished one third between 1998 and 2007 or from 338 to 257. I.e. from having amounted for 6.8% of the knee reconstructive surgery it had become only 2.5%.

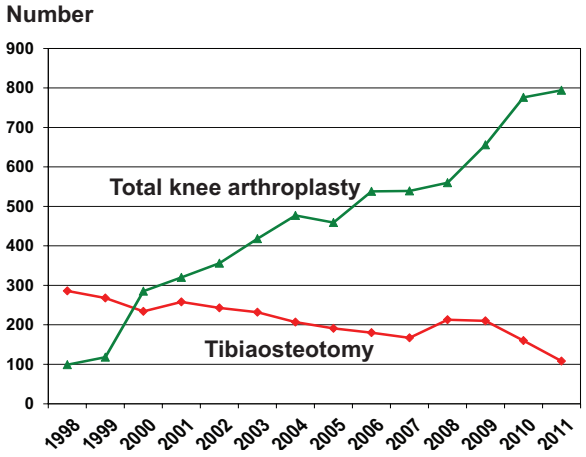
69% of the patients were men, 70% were less than 55 years of age and the mean age was 52 years. Open wedge osteotomy with external fixation was the most common method during this 10-year period and the cumulative risk for being converted to a knee arthroplasty was 30% after 10 years and 36% after 13 years (see figure below).



CRR for osteotomies, evaluating the cumulative risk of revision, i.e. conversion to knee arthroplasty.

Thus, as compared to total knee arthroplasty, the risk of revision after osteotomy was found to be considerably higher. However, if it is considered advantageous to avoid inserting an implant in the young and/or physically active osteoarthritic patients which have a relatively high risk of revision after knee arthroplasty (see page 18), then knee osteotomy may be a reasonable choice. That 70% of the osteotomy patients had not been converted after 10 years shows that this joint preserving surgery has been successful in delaying arthroplasty surgery for the majority of patients.

Before year 2000, tibia osteotomy was the most common surgical treatment for patients less than 55 years (see figure below). However, since the millennium the number of total knee arthroplasties has strikingly increased among this group of patients. This coincides with the industrialization of the knee arthroplasty surgery with introduction of high-volume units, guarantees for health care and economic incentives for arthroplasty surgery. It may be that this has contributed to the trend of offering arthroplasty instead of osteotomy.



The number of TKA's and tibiaosteotomies/year among patients less than 55 years during 1998-2011.

A nationwide registration of knee osteotomies is necessary because relatively few patients are being treated with different methods and techniques including different types of fixation and bone substitution. This will make it possible to create evidence based knowledge for selecting surgical treatment for knee osteoarthritis.

The choice of method and technique for osteotomy may affect the risk for complications in the short- and long term as well as affect a later knee arthroplasty both technically and with respect to outcome. The health economical perspective is also important for the health providers, the society and not least the patients.

Therefore, preparations were made in 2012 for a nationwide prospective registration of knee osteotomies which was started in the spring 2013.

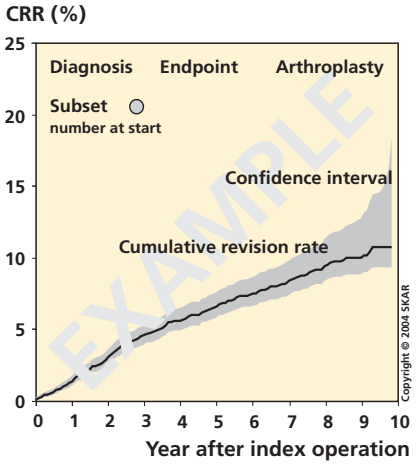
The form and the manual for registration of knee osteotomies is found at the end of this report.

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.

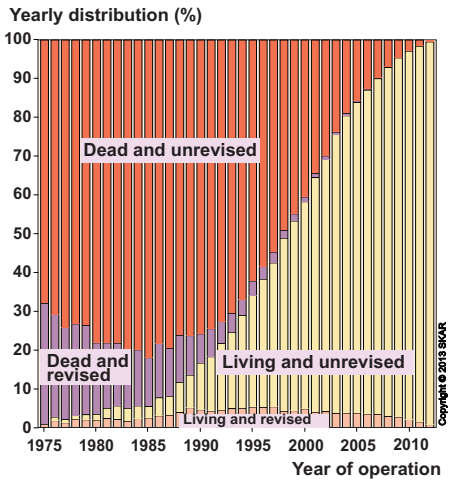
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared.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

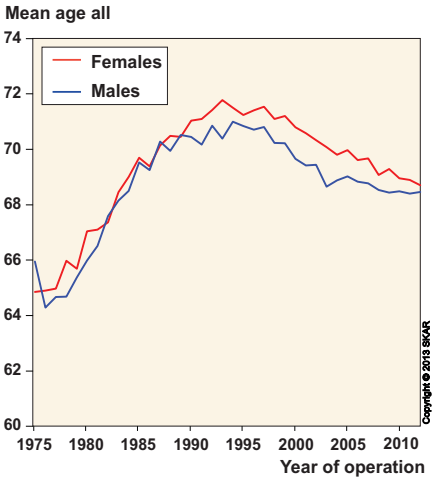


The status in 2012 for each yearly batch of patients operated since 1975.

Gender and age distribution

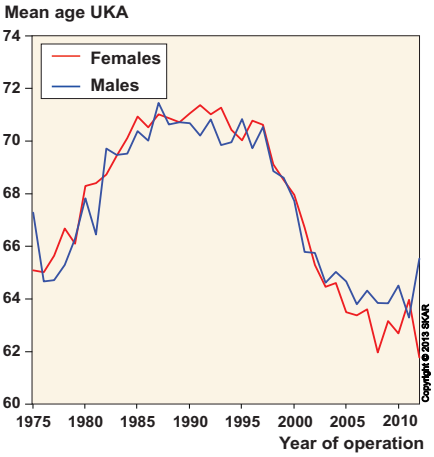
Between 1975 and 1994, the mean age at primary operation increased from 65 years to almost 72 years. The main reason was the relatively large increase in number of operations for the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution 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 2012, it was a barely 69 years and slightly higher for females (figure on the right).

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

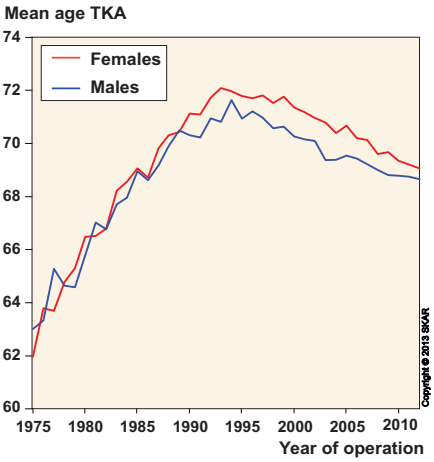


The mean age of patients at surgery (all types of implants) increased until the mid-nineties when it started to decrease.

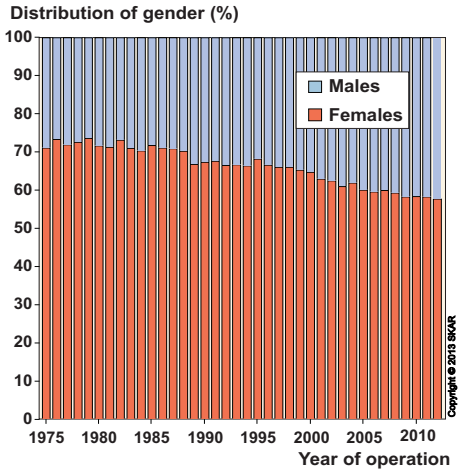
When comparing a series of patients operated on during different periods, the change in the mean age make it necessary to account for age by use of regression or to analyze different age groups separately.



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



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



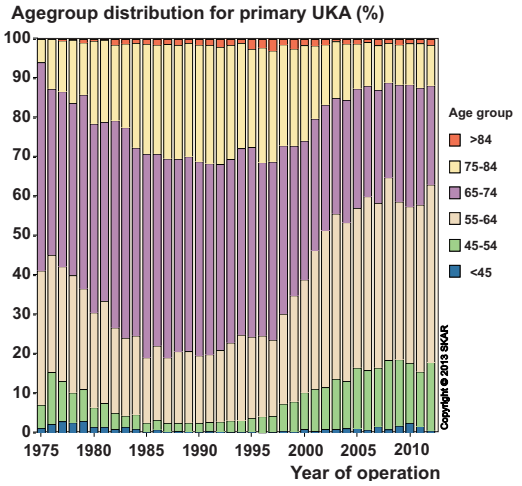
The proportion of males has increased slightly over the years.

Knee arthroplasty is more common in females than in males. At the start of the registration, females accounted for about 70% of the operations. As the figure above shows, the proportion of men has been slowly increasing and at present they account for 42%. Separate analyses of OA and RA show that it is mainly in OA that the proportion of men has increased. In RA men account only for one fourth of the operations and the proportion has not changed.

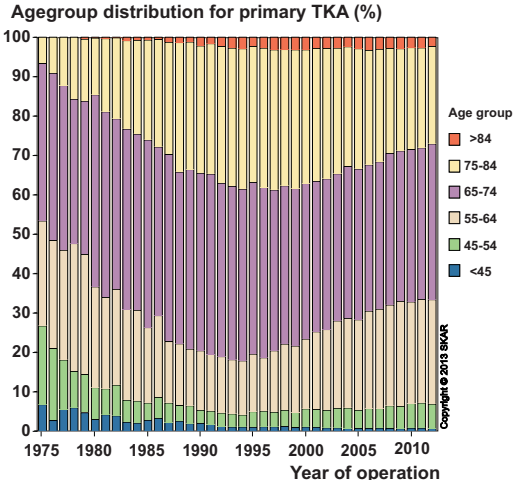
The figure to the right shows the relative number of operations performed on the different age groups over a period of thirty five years. In a somewhat different manner than the mean age (previous page) it shows how the relative proportion of the older groups increased until the mid-nineties after which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

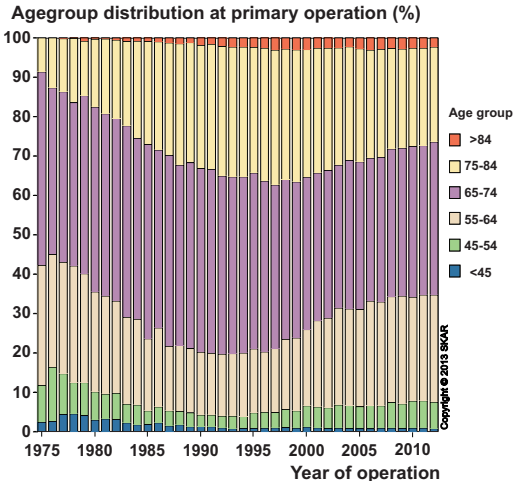
In UKA the relative proportion of patients less than 64 years of age has doubled after 1998, i.e. during the time when mini-invasive surgery caught on in Sweden. However, it has to be kept in mind that the actual number of UKA´s is now only half of what it was in 1998 while the number of TKA has more than doubled in the same period. This implies that although the relative number of TKA among younger age groups has not increased as much as for UKA, the actual number of patients 45-65 years of age having a TKA tripled. This can be explained by an increased confidence in total knee arthroplasty as a treatment for younger patients with OA.



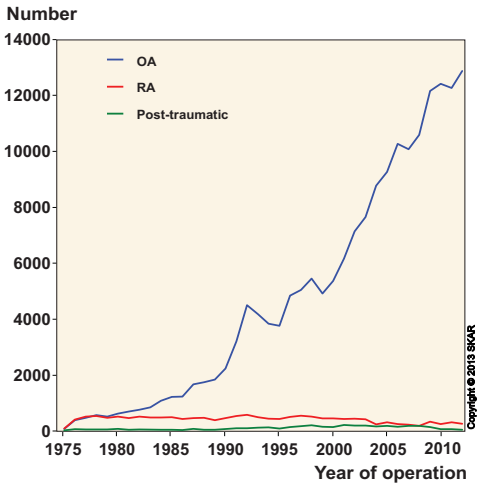
The relative distribution of primary UKA arthroplasties among different age groups.



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).



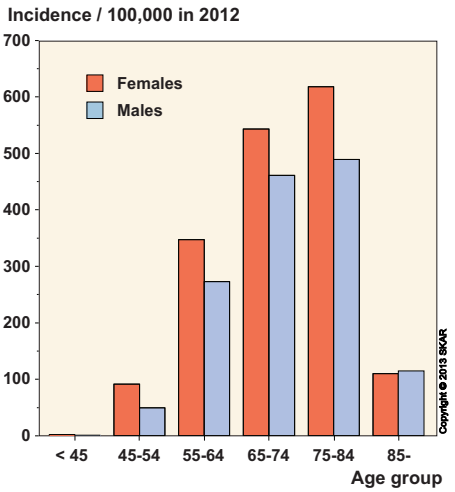
The yearly number of arthroplasties for different diagnoses

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.

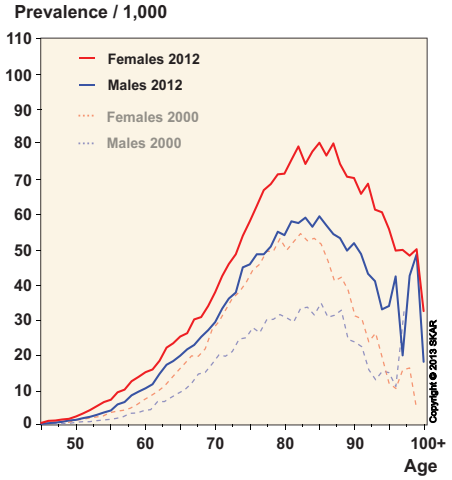
Incidence and prevalence

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 has increased almost continously since the late eighties. As can be seen from the picture below, knee arthroplasty is mainly used in the elderly and a small part of the increase in incidence reflects aging of the population over time.

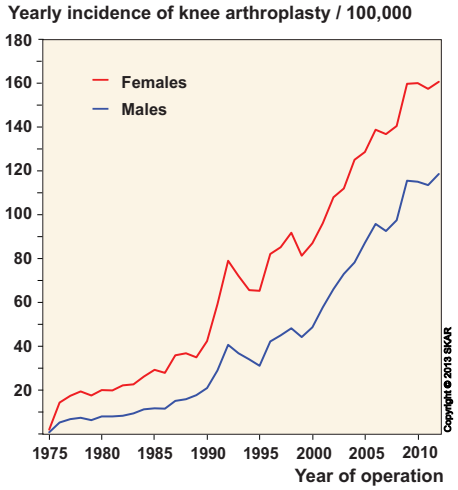
In 2000, the register published an article in which it was estimated how projected changes in the age distribution in Sweden could affect the demand for knee arthroplasty surgery. Using the incidence observed during 1996-1997, it was found that by 2030 only aging of the population would result in an 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 2012 per 100,000 inhabitants (males and females) in the different age groups.



The prevalence of knee arthroplasty in 2000 and 2012. 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 2012. 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 2012, knee arthroplasty was more common in women in all age groups except the oldest one. 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 2012 i.e. the number of patients per 1,000 inhabitants in different age groups with a knee implant. Note, that due to a programming error the figure last year erroneously showed the prevalence for implants but not patients. As a good one fifth of the patients have bilateral implants the prevalence for implants is higher than of patients.

For both men and women the prevalence peaks around 80-85 years of age at with 8% of women and 6% of men had at least one knee arthroplasty. Comparing the prevalence in 2000 and 2012 it can be seen that it has increased in all age groups.

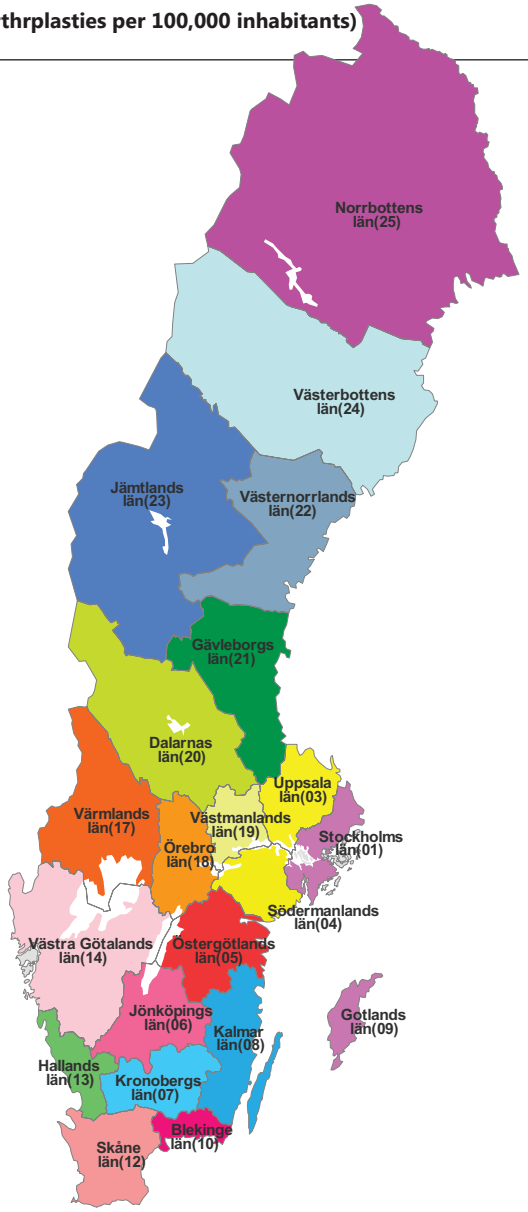
In the future this will be reflected in increased need for revisions and risk of periprosthetic fractures when patients are exposed to trauma.

The incidence in the counties 2006-2012 (knee arthrplasties per 100,000 inhabitants)

County and number of inhabitants 2012

No	County	Inhabitants
01	Stockholm	2 109 239
03	Uppsala	340 303
04	Södermanland	273 643
05	Östergötland	432 429
06	Jönköping	338 506
07	Kronoberg	185 270
08	Kalmar	233 319
09	Gotland	57 274
10	Blekinge	152 647
12	Skåne	1 258 010
13	Halland	302 920
14	Västra Götaland	1 595 525
17	Värmland	272 908
18	Örebro	282 342
19	Västmanland	255 240
20	Dalarnas	276 560
21	Gävleborgs	276 383
22	Västernorrland	242 068
23	Jämtland	126 250
24	Västerbotten	259 942
25	Norrbotten	248 591

Mean population during the year (scb.se)



Knee arthroplasties per 100,000 inhabitants

County	2006	2007	2008	2009	2010	2011	2012
01 Stockholm	86.4	89.7	100.4	111.6	106.3	105.6	103.6
03 Uppsala	128.7	128.7	111.9	135.0	147.1	138.5	148.4
04 Södermanland	136.4	107.9	193.0	182.3	151.9	151.7	149.1
05 Östergötland	127.1	121.8	157.6	166.1	166.0	145.5	155.6
06 Jönköping	95.8	111.9	118.4	151.4	136.1	145.5	167.5
07 Kronoberg	112.8	115.4	107.4	150.5	149.8	127.0	164.1
08 Kalmar	175.7	156.5	163.9	175.6	148.1	154.3	171.4
09 Gotland	156.8	176.5	163.0	166.3	160.7	251.4	164.1
10 Blekinge	127.1	119.3	138.7	146.3	145.8	163.3	171.6
12 Skåne	103.3	100.0	99.1	122.7	118.3	121.9	125.6
13 Halland	141.6	115.5	111.5	179.9	152.3	151.7	177.6
14 Västra Götaland	117.2	119.1	113.5	126.3	138.8	138.1	131.9
17 Värmland	148.5	171.0	183.8	190.3	174.6	170.7	168.2
18 Örebro	132.6	135.0	125.0	138.3	138.4	126.4	143.8
19 Västmanland	164.3	134.2	110.2	132.4	142.0	130.6	155.5
20 Dalarna	117.1	129.1	138.5	154.3	207.0	218.9	214.1
21 Gävleborg	130.5	143.0	130.2	164.1	190.3	174.8	190.7
22 Västernorrland	138.2	119.8	109.7	135.3	179.1	141.5	144.2
23 Jämtland	111.8	97.7	133.2	184.6	166.6	162.9	179.0
24 Västerbotten	131.6	91.2	108.3	150.3	143.7	120.2	122.0
25 Norrbotten	167.2	160.0	132.7	144.4	122.2	150.5	166.5
The whole country	117.6	114.9	119.2	137.8	137.8	135.7	139.8

Baseed on domicile at the beginning of 2013

The incidence in the counties 2006-2012 (knee arthrplasties per 100,000 inhabitants)

Incidence for women

County	2006	2007	2008	2009	2010	2011	2012
01 Stockholm	109.1	110.7	127.6	134.4	129.1	128.7	130.2
03 Uppsala	145.6	149.1	131.8	159.7	187.7	158.3	169.2
04 Södermanland	156.4	119.5	222.4	185.2	157.6	172.1	173.2
05 Östergötland	142.2	140.2	185.6	201.9	184.6	162.4	180.3
06 Jönköping	118.0	134.9	143.2	184.3	159.7	177.2	202.9
07 Kronoberg	123.4	147.4	140.9	172.1	183.5	153.3	189.6
08 Kalmar	196.5	171.1	176.5	205.0	158.1	149.8	207.3
09 Gotland	165.0	197.0	194.3	194.2	197.3	276.8	162.7
10 Blekinge	145.3	134.4	154.2	159.5	160.7	183.2	186.2
12 Skåne	125.2	121.8	119.2	145.1	133.6	141.2	139.9
13 Halland	155.0	130.9	123.7	186.0	176.9	174.8	199.1
14 Västra Götaland	141.7	145.4	132.2	146.6	160.7	158.5	146.3
17 Värmland	177.6	213.3	191.6	212.3	214.8	185.9	190.4
18 Örebro	141.9	157.3	147.3	151.6	161.7	150.6	154.9
19 Västmanland	189.7	150.5	129.4	149.6	163.8	152.7	171.2
20 Dalarna	134.1	155.2	161.7	162.9	231.5	246.9	240.7
21 Gävleborg	148.9	150.5	144.8	199.0	205.3	198.9	209.2
22 Västernorrland	157.0	150.6	127.0	164.0	231.0	172.3	162.0
23 Jämtland	128.9	105.3	154.2	214.5	210.0	208.9	204.7
24 Västerbotten	162.4	112.0	118.3	177.2	159.9	141.8	148.6
25 Norrbotten	203.6	192.1	161.3	166.0	137.9	185.5	190.6
The whole country	139.0	136.9	140.6	159.8	160.2	157.6	160.8

Baseed on domicile at the beginning of 2013

The incidence calculations for the counties show how many knee arthroplasties the inhabitants of each county have received irrespective of if they had the surgery in their home county or elsewhere.

It needs to be noted that he calculations are based on domicile information for patients in the beginning of 2013. Therefore, the information may be obsolete for some patients. However, this has probably only minor effect on the incidence as we have found that less than 1.2% of patients moved between counties during a 3 year period.

Incidence for men

County	2006	2007	2008	2009	2010	2011	2012
01 Stockholm	63.0	68.1	72.4	88.3	83.1	82.2	76.6
03 Uppsala	111.4	108.0	91.7	110.0	106.0	118.5	127.4
04 Södermanland	116.0	96.1	163.2	179.3	146.1	131.0	124.8
05 Östergötland	111.9	103.5	129.7	130.4	147.5	128.7	131.2
06 Jönköping	73.4	88.7	93.5	118.3	112.5	113.8	132.2
07 Kronoberg	102.4	83.9	74.4	129.3	116.7	101.1	139.0
08 Kalmar	154.8	141.8	151.3	146.0	138.1	158.8	135.5
09 Gotland	148.4	155.7	131.0	137.9	123.4	225.4	165.6
10 Blekinge	109.1	104.5	123.6	133.4	131.4	144.0	157.5
12 Skåne	80.8	77.6	78.6	99.8	102.8	102.4	111.0
13 Halland	128.1	99.9	99.0	173.7	127.4	128.4	155.9
14 Västra Götaland	92.4	92.6	94.8	105.8	116.8	117.7	117.4
17 Värmland	119.1	128.4	176.1	168.1	134.2	155.5	145.9
18 Örebro	123.1	112.2	102.1	124.8	114.8	101.9	132.6
19 Västmanland	138.8	117.8	90.8	115.2	120.1	108.4	139.8
20 Dalarna	100.2	103.1	115.4	145.6	182.6	191.1	187.6
21 Gävleborg	112.0	135.3	115.5	129.1	175.3	150.6	172.2
22 Västernorrland	119.3	88.9	92.3	106.4	127.1	110.7	126.4
23 Jämtland	94.6	90.0	112.0	154.7	123.1	116.9	153.4
24 Västerbotten	100.8	70.5	98.3	123.5	127.6	98.9	95.6
25 Norrbotten	131.7	128.8	104.9	123.4	106.9	116.5	143.3
The whole country	95.9	92.7	97.6	115.6	115.2	113.6	118.7

Baseed on domicile at the beginning of 2013

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

Women

Age group	1976-1981	1982-1986	1987-1991	1992-1996	1997-2001	2002-2006	2007-2011	2012
<45	1.1	1.0	1.0	1.1	1.5	1.8	2.2	2.4
45-54	14.1	11.3	11.8	18.1	30.3	55.6	80.9	93.5
55-64	39.9	47.1	64.2	110.1	143.2	219.5	301.7	345.5
65-74	77.7	114.2	188.4	327.7	378.7	506.0	560.4	566.5
75-84	48.5	90.4	173.6	329.2	394.2	507.1	599.0	623.0
>84	2.4	9.4	25.7	59.7	85.0	101.6	121.8	111.0
Total	**18.3**	**25.9**	**42.2**	**73.1**	**88.7**	**122.9**	**151.2**	**162.0**

Men

Age group	1976-1981	1982-1986	1987-1991	1992-1996	1997-2001	2002-2006	2007-2011	2012
<45	0.4	0.3	0.4	0.5	0.8	1.0	1.6	1.3
45-54	6.0	4.8	5.2	9.4	16.7	33.9	48.4	51.2
55-64	17.9	20.6	35.0	69.1	90.1	165.4	235.2	271.6
65-74	32.6	53.6	99.4	191.5	252.1	376.9	444.1	482.1
75-84	22.4	49.2	112.3	208.5	255.8	373.3	467.8	500.9
>84	3.7	10.5	24.1	61.2	71.8	101.5	120.9	116.5
Total	**7.1**	**10.6**	**20.0**	**37.2**	**49.0**	**80.4**	**107.1**	**119.7**

Number of primary arthroplasties per unit and year

Hospital	1975-2007	2008	2009	2010	2011	2012	Totalt	Percent
Akademiska sjukhuset	2,329	109	130	154	79	64	2,865	1.4
Alingsås	1,044	183	188	209	189	193	2,006	1.0
Art Clinic Jönköping	.	.	.	.	.	7	7	0.0
Arvika	770	156	155	154	165	127	1,527	0.8
Avesta	67	.	.	.	.	.	67	0.0
Boden	1,620	.	.	.	.	.	1,620	0.8
Bollnäs / Söderhamn	1,660	248	285	302	305	327	3,127	1.6
Borås	2,302	95	94	116	126	103	2,836	1.4
Carlanderska	80	22	52	95	162	125	536	0.3
Dalslands Sjukhus	81	.	.	.	.	.	81	0.0
Danderyd	2,299	227	178	144	192	200	3,240	1.6
Eksjö-Nässjö (Höglandssjh.)	2,147	119	168	164	155	182	2,935	1.5
Elisabethkliniken	393	108	91	64	55	58	769	0.4
Enköping	1,107	197	253	268	329	342	2,496	1.2
Eskilstuna (Mälarsjh.)	1,624	72	48	32	40	32	1,848	0.9
Fagersta	71	.	.	.	.	.	71	0.0
Falköping	1,242	113	143	190	.	.	1,688	0.8
Falun	3,386	202	245	306	351	356	4,846	2.4
Frölunda Spec.Sjukhus	588	123	125	115	115	121	1,187	0.6
Gällivare	1,089	46	73	61	81	79	1,429	0.7
Gävle	2,787	48	60	97	96	155	3,243	1.6
Halmstad	2,202	127	188	180	200	241	3,138	1.6
Helsingborg	1,682	13	26	20	20	15	1,776	0.9
Huddinge	2,068	156	170	136	129	151	2,810	1.4
Hudiksvall	1,154	62	85	110	88	79	1,578	0.8
Hässleholm	4,200	557	717	638	664	664	7,440	3.7
Jönköping (Ryhov)	1,935	142	205	149	167	172	2,770	1.4
Kalix	215	.	.	.	.	.	215	0.1
Kalmar	2,009	119	120	103	105	93	2,549	1.3
Karlshamn	1,662	205	222	231	247	264	2,831	1.4
Karlskoga	1,369	98	94	96	101	143	1,901	0.9
Karlskrona	1,117	.	.	1	.	.	1,118	0.6
Karlstad	3,179	212	193	176	176	168	4,104	2.0
Karolinska	1,826	234	121	123	108	126	2,538	1.3
Kristianstad	1,297	.	.	.	.	.	1,297	0.6
Kristinehamn	252	.	.	.	.	.	252	0.1
Kullbergska sjukhuset	1,042	291	311	243	229	228	2,344	1.2
Kungsbacka	37	.	1	.	.	.	38	0.0

(cont.)

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

Hospital	1975-2007	2008	2009	2010	2011	2012	Total	Percent
Kungälv	1,231	140	149	162	175	142	1,999	1.0
Köping	1,423	103	79	.	.	.	1,605	0.8
Landskrona	1,918	.	.	.	.	.	1,918	1.0
Lidköping	1,153	136	149	154	169	195	1,956	1.0
Lindesberg	1,228	84	150	171	157	199	1,989	1.0
Linköping	1,732	.	.	.	.	.	1,732	0.9
Linköping medical cent	12	.	.	.	.	.	12	0.0
Ljungby	1,210	66	112	148	119	136	1,791	0.9
Ludvika	338	.	.	.	.	.	338	0.2
Luleå	2	.	.	.	.	.	2	0.0
Lund	2,480	23	40	46	40	65	2,694	1.3
Lycksele	463	39	62	65	60	63	752	0.4
Löwenströmska**	1,229	197	404	415	442	432	3,119	1.5
Malmö	2,138	26	25	10	15	36	2,250	1.1
Mora	1,320	115	129	163	166	171	2,064	1.0
Motala	1,973	392	547	547	458	534	4,451	2.2
Movement Halmstad	306	172	246	261	275	222	1,482	0.7
Mölndal	1,215	140	198	262	266	204	2,285	1.1
Nacka - Söder	203	.	.	.	.	.	203	0.1
Nacka - Proxima	113	16	101	152	136	122	640	0.3
Norrköping (Vrinnevisjh.)	1,892	118	148	152	158	146	2,614	1.3
Norrtälje	868	89	93	83	81	88	1,302	0.6
Nyköping	1,108	120	115	121	120	124	1,708	0.8
OrthoCenter IFK klin. *	324	83	122	143	139	109	920	0.5
Ortopediska huset	1,721	381	437	386	347	375	3,647	1.8
Oskarshamn	1,511	304	225	189	239	263	2,731	1.4
Piteå	1,105	280	278	232	285	322	2,502	1.2
S:t Göran	5,593	318	321	395	367	347	7,341	3.6
Sabbatsberg (Aleris)	1,450	.	101	105	104	125	1,885	0.9
Sahlgrenska	1,519	5	4	4	8	2	1,542	0.8
Sala	115	.	.	.	.	.	115	0.1
Sandviken	301	.	.	.	.	.	301	0.1
Sergelkliniken Gbg	160	.	.	.	.	.	160	0.1
Simrishamn	1,021	.	.	.	.	.	1,021	0.5
Skellefteå	982	77	106	107	98	90	1,460	0.7
Skene	1,003	85	105	115	106	138	1,552	0.8
Skövde	2,308	87	99	104	186	206	2,990	1.5
Sollefteå	911	81	88	123	102	102	1,407	0.7
Sophiahemmet	1,114	102	97	76	74	112	1,575	0.8
Spenshult	54	135	141	221	238	331	1,120	0.6
Sunderby	376	7	6	2	4	3	398	0.2
Sundsvall	2,381	87	110	125	119	123	2,945	1.5
Säffle	484	.	.	.	.	.	484	0.2
Söderhamn	279	.	.	.	.	.	279	0.1
Södersjukhuset	3,285	353	357	340	324	285	4,944	2.5
Södertälje	884	143	122	117	121	87	1,474	0.7
Torsby	1,141	90	99	109	80	121	1,640	0.8
Trelleborg	3,480	480	578	600	606	635	6,379	3.2
Uddevalla	2,692	177	289	202	186	166	3,712	1.8
Umeå	2,032	120	216	230	165	160	2,923	1.5
Varberg	2,078	150	201	144	167	206	2,946	1.5
Visby	1,030	88	89	74	115	93	1,489	0.7
Vänersborg-NÄL	939	.	.	.	.	.	939	0.5
Värnamo	1,459	131	120	119	113	137	2,079	1.0
Västervik	1,473	98	101	74	97	113	1,956	1.0
Västerås	1,751	172	231	315	279	303	3,051	1.5
Växjö	1,683	102	123	121	97	141	2,267	1.1
Ystad	1,169	.	.	.	.	.	1,169	0.6
Ängelholm	1,490	145	149	143	162	172	2,261	1.1
Örebro	2,752	154	141	124	117	72	3,360	1.7
Örnsköldsvik	1,522	106	118	141	107	101	2,095	1.0
Östersund	1,585	84	135	161	165	182	2,312	1.1
Östra sjukhuset	1,949	116	31	.	.	.	2,096	1.0
Total	**138,593**	**11,001**	**12,829**	**12,930**	**12,828**	**13,316**	**201,497**	**100.0**

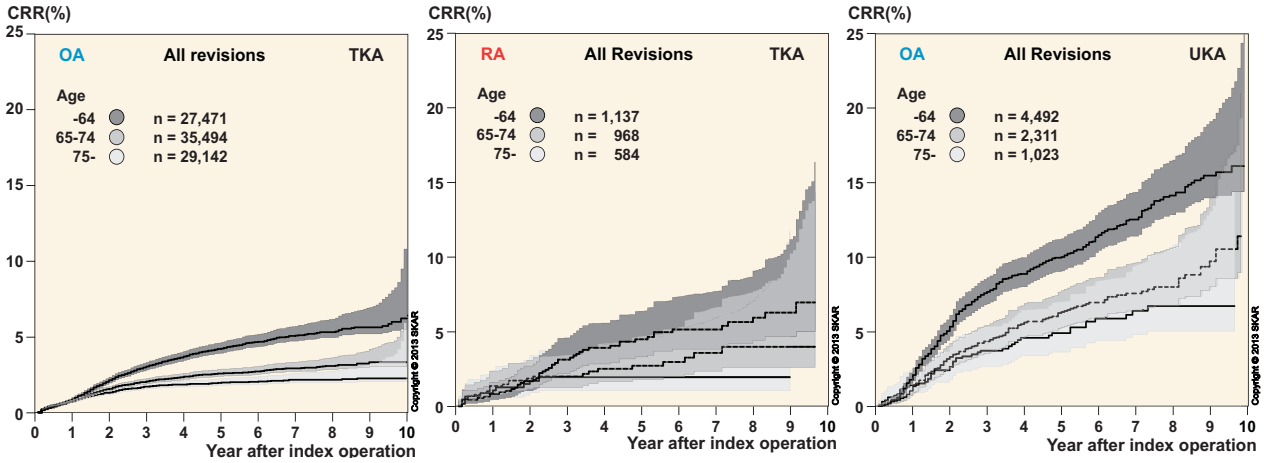
* Gothenburg Medical Center was replaced by OrthoCenter IFK kliniken in 2008.

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

Factors that influence the revision rate

Primary disease – It early became evident that patients with rheumatoid arthritis (RA) and osteoarthritis (OA), were different with respect to outcome. Therefore, the registry always showed outcome for these diagnoses separately. However, the modern medical treatment of RA has resulted in a reduced need for knee arthroplasty (fig. page 12) why statistical differences have become more difficult to detect. Thus, when comparing implants (page 40-43) we do not have seperate tables for RA in this report.

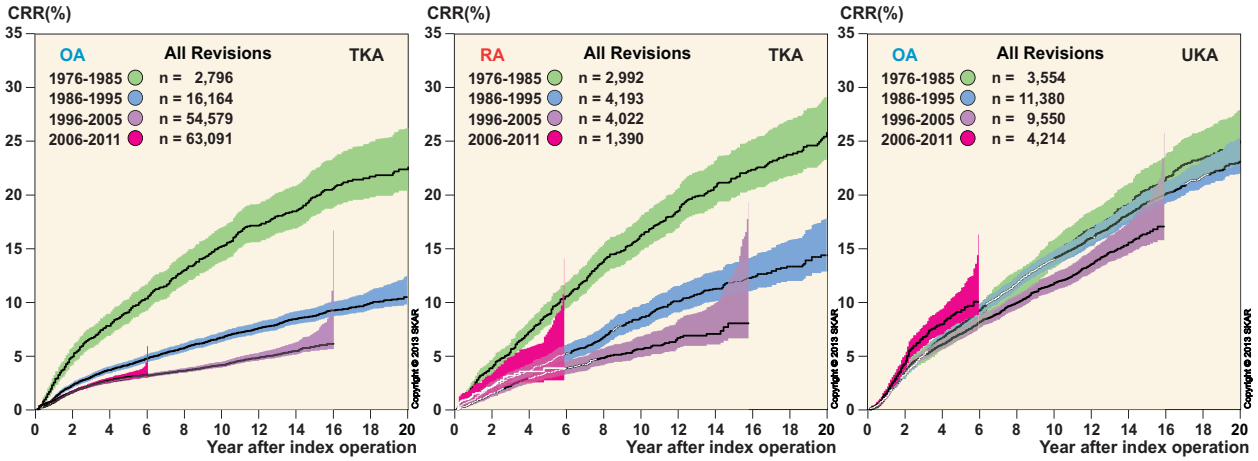
Age – By dividing patients into separate age groups one can see the large effect that age has on the revision rate both in TKA and UKA. One can speculate in the reasons for this effect. Possible explanations are that the younger have higher physical activity, higher expectancy of pain relief and a general health condition that easier permits revision surgery. Irrespective of the type of implant or diagnosis, those less than 65 years of age have twice the risk of revision as compared with those over 75.



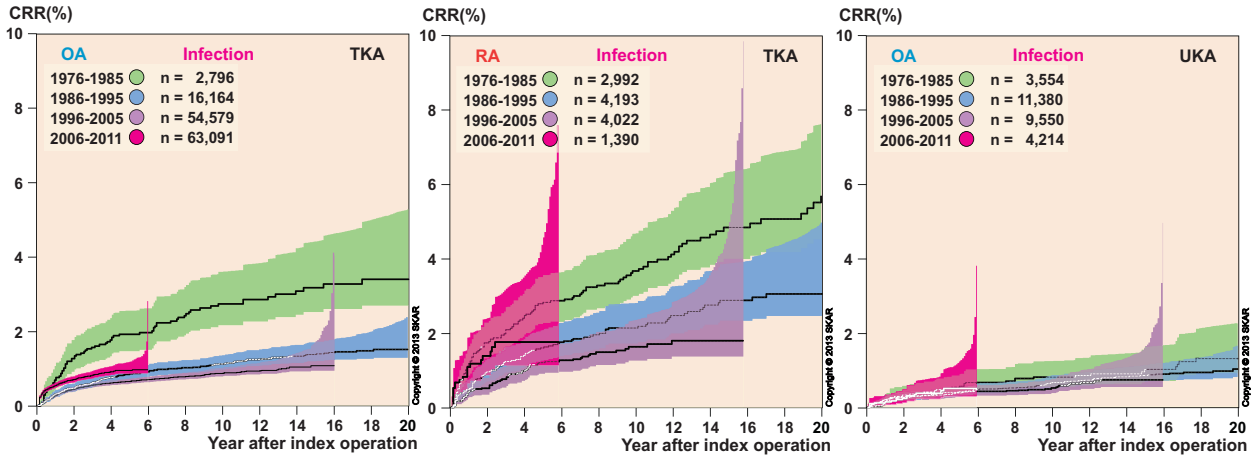
The differences in CRR (2002–2011) between the 3 age groups <65, 65–75, >75 were significant for TKA (OA & RA) as well as UKA.

Year of operation – For TKA there has been a constant reduction in risk of revision over time with the exception of the last period (2006-2011) which has a higher risk than the previous 10-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.

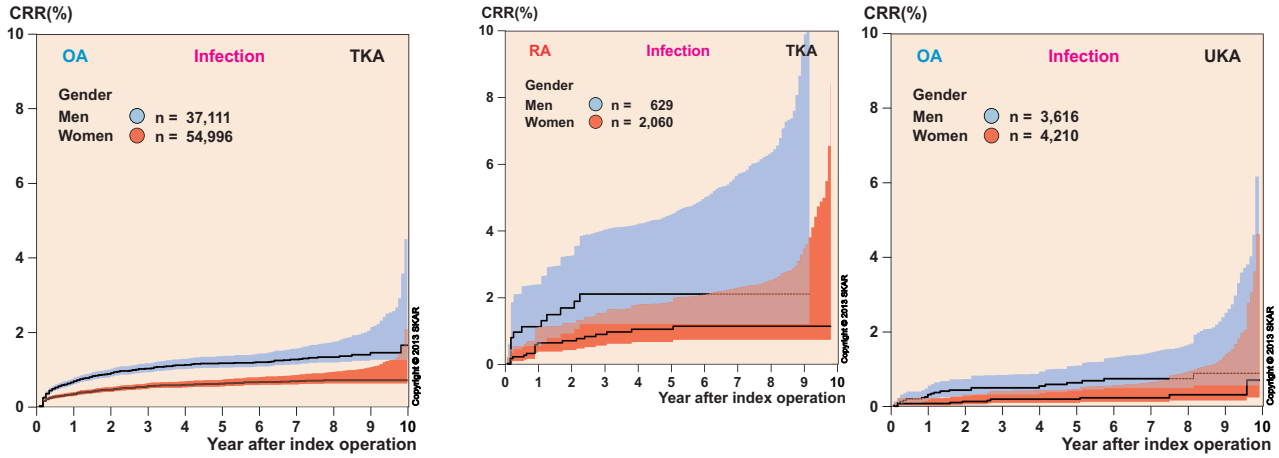


Comparing the CRR, using only revision for infection as end-point, we find an improvement with time for both TKA and UKA. However, in TKA (OA & RA) the CRR for infection during 2006-2011 has increased as compared to 1996-2005.

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 the period 2006-2011 we see an increase in the risk of revisions as compared to the previous 20 years. The 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) in which all the hospitals have participated.

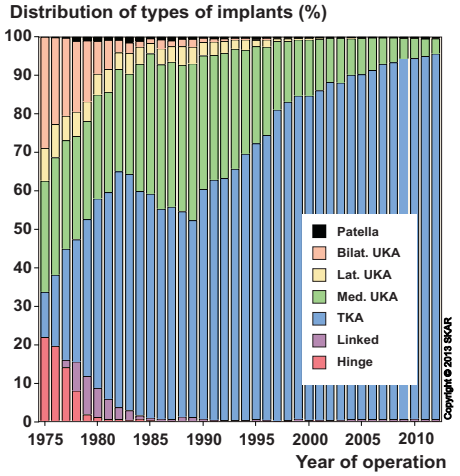
UKA have significantly lower risk of infection than TKA and patients with OA have a lower risk than those with RA. This is independent of if changes of inlays in for infections are considered to be revisions or not.

Gender – When analyzing OA during 2002 2011 (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 although there was a considerable gender difference with respect to revision for infection (see below). While it is well known that RA patients have a higher risk of infection, being ascribed to the effect of corticosteroid and immunosuppressive medications, it is not obvious why men, more often than women, have their knee arthroplasties revised for infection. Either, men are more prone to infections or they more often than women, are being offered revision surgery for their infected knee implants. The latter is contradicted by the fact that in other contexts men have also been found to be more susceptible to infections than women.



Using the end-point; revision for infection, the CRR (2002–2011) 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 2.7 times the risk of women of becoming revised for infection. In TKA, patients with RA are more affected than those with OA (RR 1.8).

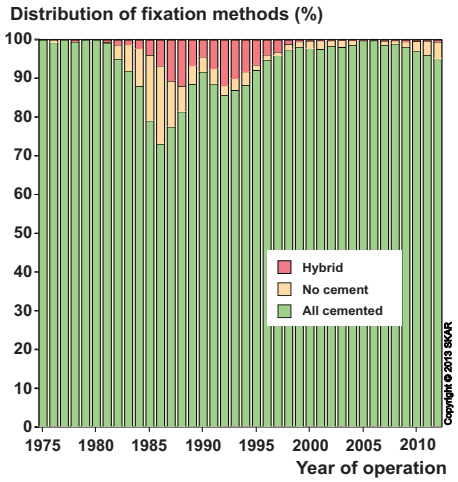
Type of implant – The modern condylar tricompartmental knee implant (TKA) was developed in the seventies when hinged and unicondylar implants were already available. When the register started in 1975, TKA had just been introduced in Sweden, which is the reason for hinges and uni's amounting for the larger 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. TKA is most often used for uncomplicated primary cases and UKA are sometimes for unicompartmental disease. However, the use of UKA has diminished over the years, both proportionally as well as in number of surgeries. The reason may be that UKA has a substantially higher CRR than TKA (see figures on page 18). 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.



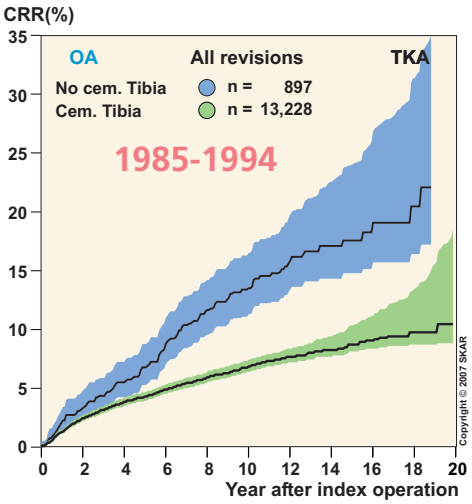
The relative yearly distribution of implant types used for primary surgery.

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 when the UKA's were performed. During this period, TKA results were rapidly improving 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 approx. 2 times the risk of primary TKA's.

Use of bone-cement – As the figure below shows, bonecement has been used for the majority of arthroplasties in recent years although use of uncemented implants has increased slightly the last 4 years. The few uncemented cases of which 60% were inserted at one unit make interpretation of results difficult. 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 (see figure right).



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

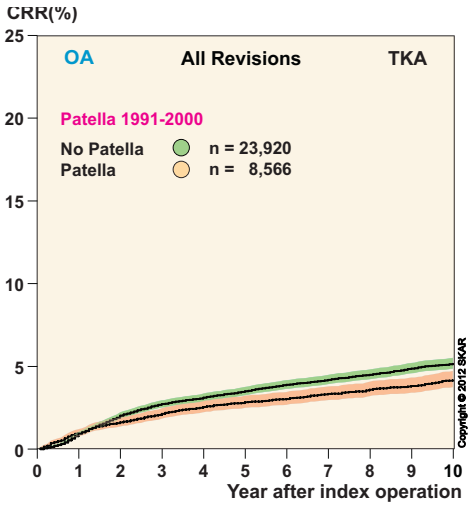


The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.

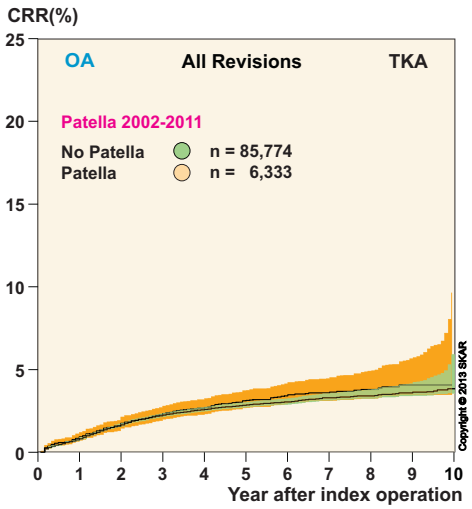
Cox regression, adjusting for age, gender, year of operation and use of a patellar component shows that the risk for TKA with an uncemented tibial component was 1.6 (1.3-1.9) times higher than for those cemented. This is in agreement with the results of the Finnish implant register which also found substantially 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 2.6% if the TKA cases in 2012 (see figure right).

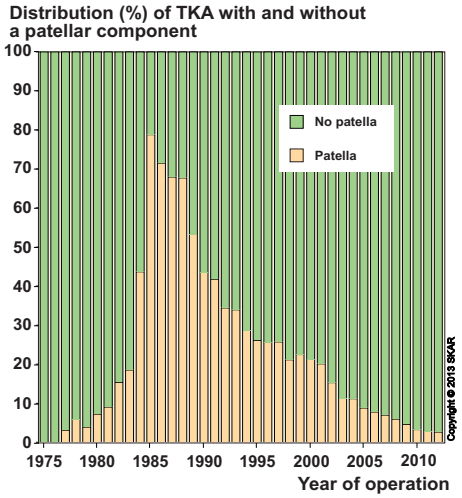
In our 2002 annual report (for the period 1991-2000) we for the first time observed that TKA with a patellar button had a lower risk of revision than those without. The increased frequency of revisions was caused by the need for secondary patellar resurfacing because of femoro-patellar pain. In 2007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



CRR for TKA/OA inserted during a earlier 10-year period 1991-2000, with and without patellar component respectively



CRR for TKA/OA inserted during the current 10-year period 2002-2011, 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 2002-2011 (figure left, below) there was no significant difference (p=0.2). 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 40-43), 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 48-51), 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 76% of TKA cases (2012) while it was only used in 2% of cases in Norway that same year according to the Norwegian arthroplasty register report 2011 (http://www.haukeland.no/nrl/).
According to the 2012 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 to 53% in 2011. It was also reported that compared to TKA using a patellar button, TKA without a button had 1.3 (1.3-1.4) times higher risk of becoming revised which is similar to the what we have previously found in Sweden

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

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

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

Type of operations and implants in 2012

Types of primary arthroplasties reported in 2012

	Antal	Procent
Linked	66	0,5
TKA	12 672	95,2
UKA medially	533	4,0
UKA laterally	3	0.0
Fem-Pat	42	0,3
Total :	13 316	100

The standard type of primary knee arthroplasty has become the TKA which accounts for 95% of the surgeries (see table above). The use of UKA has constantly lessened since 1989 when the type was used in 44% of cases to only 4% of the cases in 2012 (fig. page 20).

All 75 units routinely performing elective knee arthroplasty surgery in Sweden reported to the registry during 2012. 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 increased from 12,753 in 2011 to 13,316, or by 4.4%.

Implants for primary TKA in 2012

	Number	Percent
NexGen	6 035	47,6
PFC Sigma	3 362	26,5
Vanguard	1 497	11,8
Triathlon TKA	1 225	9,7
Genesis II	177	1,4
Profix	85	0,7
Link Gemini	34	0,3
AGC	27	0,2
PFC Rotating Platform	17	0,1
Duracon	2	0
Journey	2	0
Legion	2	0
Other*	207	1,6
Total :	12 672	100

*Mainly revision models (see separate table) except 9 knee for which part numbers are missing

As compared to last year TKA increased by 5.2%. The 4 most common TKA models all increased somewhat and now account for 95.6% of all the TKA primaries as compared to 93.5% in 2011. NexGen from Zimmer accounted for almost half of the implants while PFC from DePuy was in second place with a good one fourth. AGC from Biomet which was introduced in the eighties and was popular untill few years ago has been replaced with the Vanguard from the same company. The use of Profix, PFC rotating platform and Journey diminished while the use of Genesis II has increased and Link Gemini has been introduced.

The use of UKA diminished by 9.1% between 2011 and 2012. Oxford accounted for half of the procedures and Link for one fourth. No Miller Galante or Preservation was reported in 2012.

Implants for primary UKA in 2012

	Number	Percent
Oxford	267	49,8
Link	126	23,5
ZUK	76	14,2
Triathlon PKR	26	4,9
Genesis	17	3,2
Sigma Partial	24	4,5
Total :	536	100

We define revision models as being ordinary TKA implants that use stems longer than 5 cm either on the femur or the tibia. These are not included in our survival analyses for ordinary TKA's as implants using long stems are mainly used for difficult cases but not in the typical OA case.

Besides these revision models, 66 linked implants were used for primary arthroplasty, mainly rotating hinges for treatment of malignancies, fractures and other difficult cases.

Revision implants for primary TKA in 2012

	Antal	Procent
Triathlon revision	70	35,4
NexGen revision	64	32,3
PFC revision	34	17,2
Vanguard revision	26	13,1
Profix revision	8	2,0
Total :	198	100

807 revisions were reported in 2012 of which 205 were secondary (not the first revision). In 588 cases the primary was a TKA, in 202 an UKA, in 14 a linked implant and in 3 cases a Femoro-Patellar 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 2011.

The most common implants in the counties in 2012

TKA in the counties

	Model 1	n	Model 2	n	Model 3	n	Other
01 Stockholm	NexGen	1,084	PFC Sigma	916	Triathlon	158	108
03 Uppsala	PFC Sigma	342	NexGen	118	Vanguard	1	
04 Södermanland	PFC Sigma	250	NexGen	90	PFC RPF	9	1
05 Östergötland	NexGen	628	Övriga	7			
06 Jönköping	Vanguard	481	Övriga	4			
07 Kronoberg	Vanguard	252	Övriga	3			
08 Kalmar	NexGen	451	Övriga	9			
09 Gotland	PFC Sigma	89	Övriga	1			
10 Blekinge	Vanguard	255	Övriga	4			
12 Skåne	Triathlon	1,043	PFC Sigma	372	Vanguard	59	69
13 Halland	NexGen	968	Övriga	2			
14 Västra Götaland	NexGen	827	Vanguard	395	PFC Sigma	326	35
17 Värmland	NexGen	294	PFC Sigma	102	Triathlon	16	3
18 Örebro	NexGen	201	Genesis II	172	AGC	18	6
19 Västmanland	NexGen	288	Övriga	3			
20 Dalarna	NexGen	338	PFC Sigma	170	Övriga	6	.
21 Gävleborg	PFC Sigma	409	NexGen	50	Link Gemini	34	6
22 Västernorrland	NexGen	319	Övriga	6			
23 Jämtland	NexGen	175	Övriga	4			
24 Västerbotten	NexGen	168	Profix	85	PFC Sigma	20	26
25 Norrbotten	PFC Sigma	366	NexGen	17	Triathlon	8	5

The table above shows that in 2012, only 10 of 21 counties reported having used more than 2 ordinary TKA models used (revision models not counted) and that only a couple used 3 models to a greater extent.

UKA in the counties

	Model 1	n	Model 2	n	Model 3	n	Other
01 Stockholm	Oxford	102	ZUK	23	Link	18	17
03 Uppsala	ZUK	2					
04 Södermanland	Link	34					
05 Östergötland	Oxford	38	ZUK	1			
06 Jönköping	Link	6	Genesis	5			
07 Kronoberg	Oxford	16	ZUK	3			
08 Kalmar	Link	9					
09 Gotland	Link	3					
10 Blekinge	Oxford	4					
12 Skåne	Triathlon PKR	18	Oxford	9	Link	9	
13 Halland	ZUK	15	Oxford	6			
14 Västra Götaland	Oxford	77	Övriga	15	ZUK	8	6
17 Värmland							
18 Örebro	ZUK	13	Link	4			
19 Västmanland	Genesis	12					
20 Dalarna	ZUK	6					
21 Gävleborg	Link	30	Oxford	15			
22 Västernorrland	ZUK	1					
23 Jämtland	ZUK	1					
24 Västerbotten	ZUK	3					
25 Norrbotten	Link	7					

The table above shows that only 2 counties, Stockholm and Västra Göraland reported more than 100 UKA in 2012. 4 counties reported between 24 and 45 procedures but otherwise the counties reported between 1 and 20 procedures except Värmland which reported none.

Bone cement and minimally invasive surgery in 2012

Use of cement in primary surgery during 2012

	Primary TKA	Primary UKA
No component without cement	12,036	526
Only the femoral component without cement	22	3
Only the tibial component without cement	48	–
The femur- and tibial components without cement	537	2
Only the patellar button without cement	–	–
Unknown	29	5
Total	12,672	536

	Number	Percent	Number	Percent
Refobacin (gentamicin)	5,768	47.5	332	62.2
Palacos R+G (gentamicin)	5,593	46.1	168	31.5
Smartset GHV gentamycin	385	3.2	26	4.9
Cemex Genta System Fast	342	2.8	1	0.2
Simplex P	12	0.1	1	0.2
Palacos MV (Palamed)	2	0.0	1	0.2
Refobacin Revision (genta+clinda)	1	0.0	2	0.4
Copal	2	0.0	–	
Palacos LV	1	0.0	–	
Missing	29	0.2	3	0.6
Subotal:	12,135	100	534	100
All parts without cement	537	4.2	2	0.4
Totalt	12,672		536	

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. Fixation without cement has become little less unusual. In 2012, 4.2% of all the TKA's were without cement and 0.2% were hybrids. Almost all the cement contains antibiotics.

Previously when the brand name for the cement was handwritten on the form it became difficult to discern the brands because the name Palacos had almost become generic for any cement including antibiotics. Now, almost all the forms contain stickers that allow for positive identification of the cement brand.

The type of mixing system may also have an effect on the cement quality and thus we are interested in the part numbers for these, in case a separate mixing system (not included in the cement package) has been used.

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. Some implants are more often used with MIS than others (see table below).

The type of incision for 536 primary UKA in 2012

	Standard incision	Mini-incision	Missing
Link	109	16	1
Oxford	92	172	3
ZUK	44	31	1
Genesis	17	–	–
Triathlon PKR	6	20	–
Other	13	11	–
Total	281	250	5

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 use of patella button for TKA in 2012

The use of a patella button has been decreasing since the mid-eighties so that it is now only used in barely 3% of the TKA cases. During 2012 a button was most often used in the county of Jönköping but not at all in Värmland, Västmanland, Dalarna and Västernorrland (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 patella button.

The use of a patella button has also been heavily related to the implant model selected although the difference has diminished as its use has become more uncommon. In 2012, button was most commonly used with Vanguard, Profix and PFC rotating platform implants.

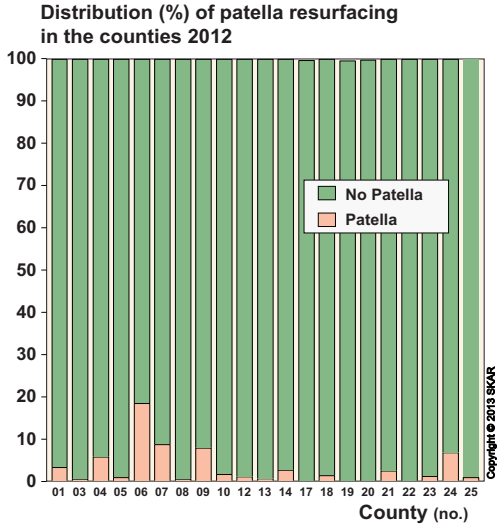
In Sweden, females have their patella resurfaced slightly more often than males. In the whole material, from the start to the end of 2012, 15.6% of the women had their patella resurfaced compared to 12.3% of the males which is a significant difference. During 2012 1.9% of the men had a patella button compared to 3.1% of the women.

Use of patella button with different TKA implants in 2012

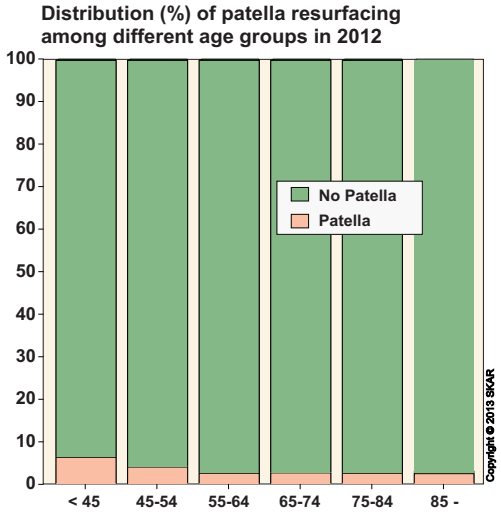
	No patella button	%	Patella button	%
NexGen	5,931	98.3	104	1.7
PFC Sigma	3,283	97.7	79	2.3
Vanguard	1,380	92.2	117	7.8
Triathlon TKA	1,213	99.0	12	1.0
Genesis II	177	100.0	0	0.0
Profix	78	91.8	7	8.2
Link Gemini	34	100.0	0	0.0
AGC	27	100.0	0	0.0
PFC Rotating Platform	16	94.1	1	5.9
Other	204	95.8	9	4.2
Total	12 343	97.4	329	2.6

Looking at the relative use of a patella button in the different age groups during 2012 (see figure below), it can be seen that the use of patella resurfacing was similar in all the age groups except the youngest, in which it was most common. This has varied somewhat in recent years because of how few young patients there are.

Some discussion regarding how the frequency of revisions is influenced by the use of a patella button can be found on page 21 together with CRR curves for TKA inserted during the current period of 2002-2011, with and without a button respectively.



The figure shows the relative proportion of TKA with and without patella button in the different counties during 2012

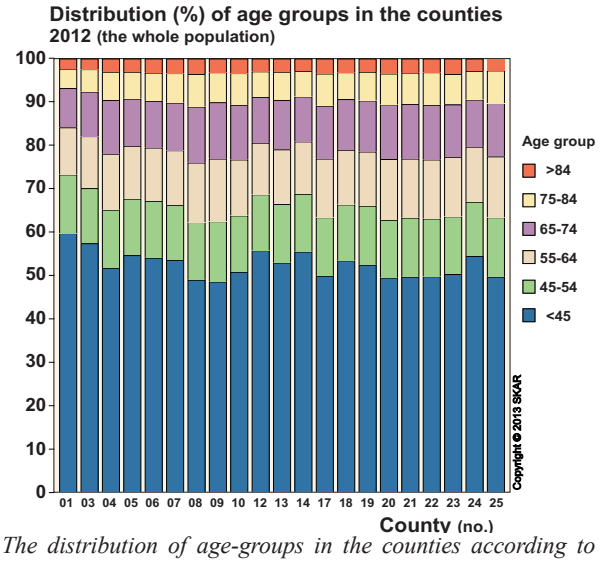


The figure shows the relative proportion of TKA with and without patella button in the different age-groups during 2012.

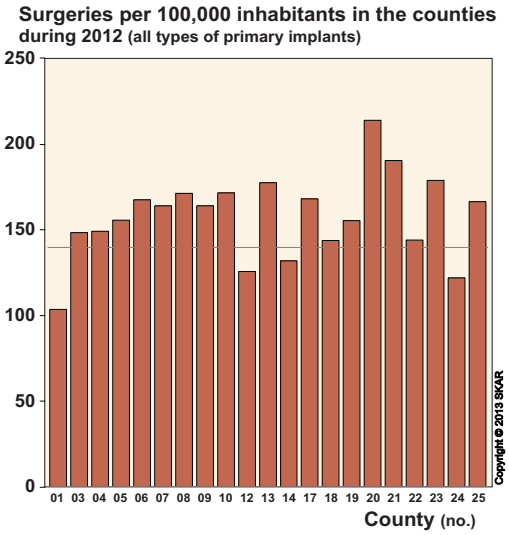
Age distribution and incidence in the counties 2012

County No. and number of inhabitants 2012

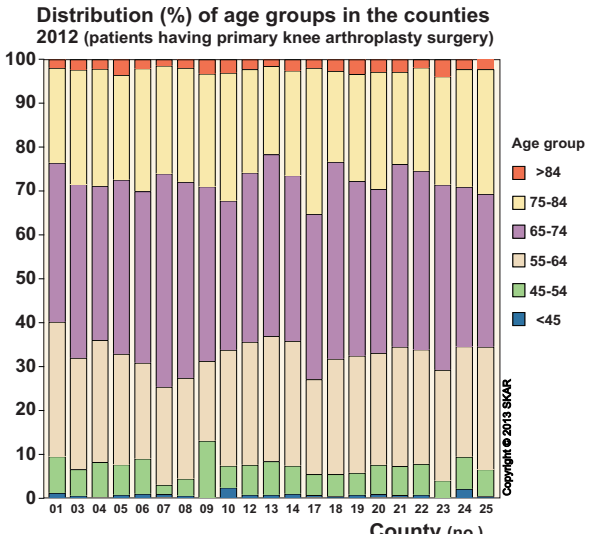
No.	County	Inhabitants
01	Stockholm	2,109,239
03	Uppsala	340,303
04	Södermanland	273,643
05	Östergötland	432,429
06	Jönköping	338,506
07	Kronoberg	185,270
08	Kalmar	233,319
09	Gotland	57,274
10	Blekinge	152,647
12	Skåne	1,258,010
13	Halland	302,920
14	Västra Götaland	1,595,525
17	Värmland	272,908
18	Örebro	282,342
19	Västmanland	255,240
20	Dalarna	276,560
21	Gävleborg	276,383
22	Västernorrland	242,068
23	Jämtland	126,250
24	Västerbotten	259,942
25	Norrbotten	248,591



The distribution of age-groups in the counties according to information from the SCB (Statistics Sweden)



Incidence (no. of arthroplasties per 100,000 inhabitants)



The agedistribution at primary surgery varies somewhat between the counties.

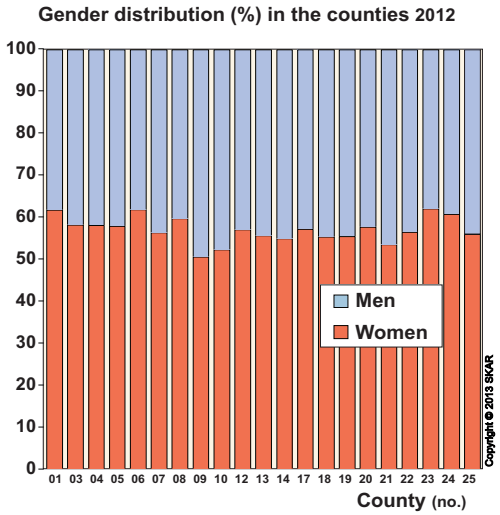
The figure above shows the incidence of primary knee arthroplasty in the respective county during 2012 and is based on the domicile of the patients early 2013. The incidence is highest in the county of Dalarna and lowest in Stockholm.

The top right figure shows the relative distribution of different age-groups among the inhabitants of the counties. The county of Stockholm has the largest proportion of inhabitants less than 45 years of age while the county of Kalmar has the highest number of inhabitants 65 years and older.

The figure above to the right shows the relative distribution the relative age distribution among inhabitants of the counties that had knee arthroplasty. Such surgery in patients younger than 65 years of age was most common in the county of Stockholm but least common in Jönköping. The county of Värmland has the largest proportion of surgery among those 75 years and older.

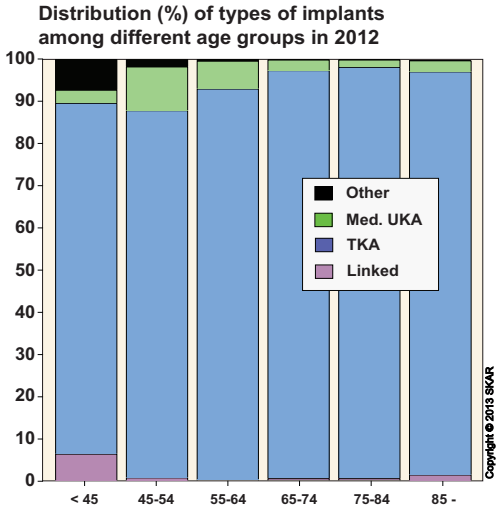
With respect to the incidence in the country as a whole, it has increased from 135.7 in 2011 to 139.8 in 2012. In 2000 the incidence was only 68.3.

Gender distribution in the regions



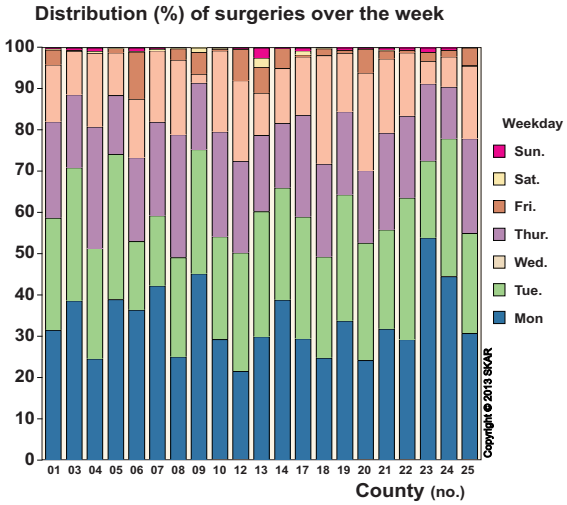
The proportion of females is 56-60% in the counties.

Type of implants in different age groups

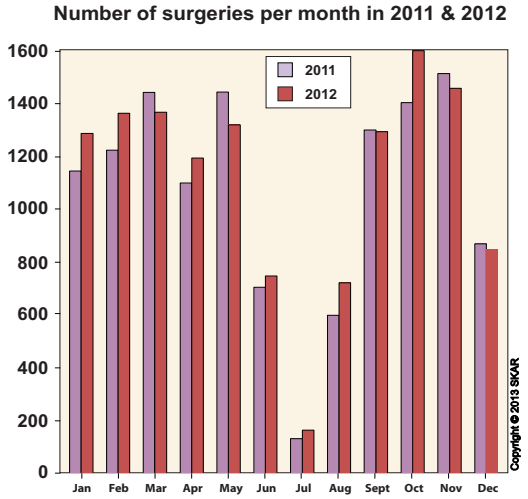


Uncommon models are most often used in patients younger the 45 years. The relative high proportion of linked implant is caused by serious conditions (tumors, trauma etc.)

Distribution of surgery on the weekdays and months



Distribution of surgery on the weekdays during 2012. Surgery on Fridays and weekends is uncommon.



The mean number of primary knee arthroplasties inserted each month during 2011 and 2012.

Knee arthroplasty is seldom performed on Fridays and weekends. The reasons, among others, are reduced working hours on Fridays as well as reduced means for rehabilitation in combination with reduced number of available hospital beds during weekends. This results in arthroplasty surgery being concentrated during the first part of the week so that the patients can be discharged not later than Friday.

Knee arthroplasty surgery on Fridays was in 2012 most common in the county of Jönköping while surgery on Saturdays and Sundays was almost non-existent except in the county of Halland.

The figure above shows the number of knee arthroplasty surgeries during the different months of 2011 and 2012. It is evident how the production drops during the summer as in December and January.

Implants for primary arthroplasty 2002–2011

In the tables below, the implants used during the investigated period 2002-2011 are listed. One must observe that the individual models, especially in case of modular types, may include several different implant variants. For the 10-year period, NexGen took over from PFC being the most commonly used model. AGC is still in third place although its use has quickly diminished after Biomet introduced Vanguard as its successor which became the third most used implant in 2012 (page 23).

Among the UKA 3 models account for the majority of surgeries. Of the 12 models listed below, only six were used in 2012.

Implants for primary TKA during 2002–2011

	Number	Percent
NexGen	29,624	30.5
PFC Sigma	28,457	29.3
AGC	12,217	12.6
Duracon	6,776	7.0
Vanguard	4,980	5.1
Free-Sam MIII	4,941	5.1
Triathlon	4,245	4.4
Profix	2,027	2.1
PFC Rotating Platform	1,126	1.2
Kinemax	625	0.6
Natural	502	0.5
Scan	224	0.2
LCS	129	0.1
Journey	81	0.1
Genesis	25	0.0
Oxford Rotating Knee	23	0.0
Performance	15	0.0
Legion	13	0.0
Missing	46	0.0
Other*	1,119	1.2
Total	97,195	100

*Mainly revision models, see table above right.

Implants for primary UKA during 2002–2011

	Number	Percent
Link	2,985	37.1
Oxford	2,162	26.9
MillerGalante	1,652	20.5
Genesis	497	6.2
ZUK	429	5.3
Preservation	156	1.9
Triathlon PKR	70	0.9
EIUS	46	0.6
PFC	16	0.2
Duracon	11	0.1
Allegretto	9	0.1
Sigma PKR	4	0.0
Other	2	0.0
Total	8,039	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 2002–2011

	Number	Percent
PFC Revision	280	25.5
NexGen Revision	245	22.3
Triathlon Revision	171	15.5
Duracon Revision	143	13.0
AGC Revision	133	12.1
Profix Revision	75	6.8
Vanguard Revision	43	3.9
F/S Revision	10	0.9
Other	0	0
Total	1,100	100

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

Hinged implants (primary) during 2002–2011

	Number	Percent
Rotalink	246	50.7
Nexgen RHK	107	22.1
MUTARS	38	7.8
Noiles RHK	36	7.4
Stryker/Howmedica RHK	29	6.0
METS	14	2.9
Stanmore	7	1.4
Biomet RHK	3	0.6
Övriga	5	1.0
Total	485	100

Femoropatellar implants are uncommon. Only 212 cases have been reported the last 10 years using 7 different brands.

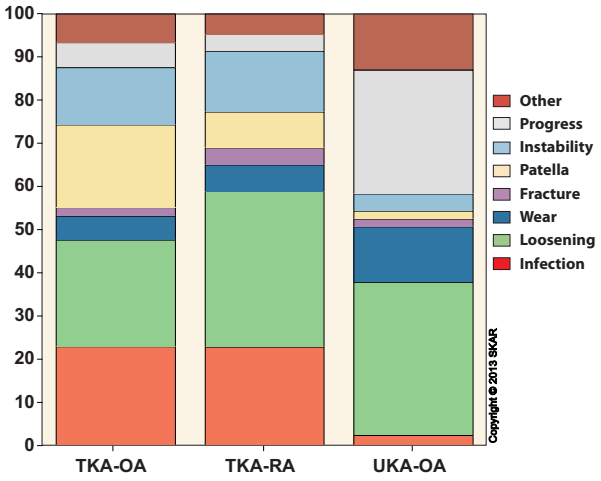
Patello-femoral implants during 2002–2011

	Number	Percent
Zimmer P-F	82	38,7
Avon P-F	56	26.4
Link P-F	40	18.9
Richard /Blazina	16	7.5
Journey P-F	7	3.3
Vanguard P-F	6	2.8
LCS P-F	5	2.4
Total	212	100

Revisions during 2002–2011

During the 10-year period, 5,423 revisions were performed. 3,102 were revisions after TKA for OA, 273 after TKA for RA and 1,628 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. ”Progress” 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 2002-2011. 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 (24% in OA and 11% 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.

Type of revision 2002–2011 in which the primary was a TKA/OA

	Number	Percent
Linked (rot. hinge)	291	9.4
TKA	821	26.5
Exchange of femur comp.	32	1.0
Exchange of tibia comp.	214	6.9
Exchange of disc/inlay	593	19.1
Patella addition	696	22.4
Patella exchange	35	1.1
Patella removal	10	0.3
Total implant removal	367	11.8
Arthrodesis	25	0.8
Amputation	17	0.5
Other	1	0
Total	3,102	100

Type of revision 2002–2011 in which the primary was a UKA/OA

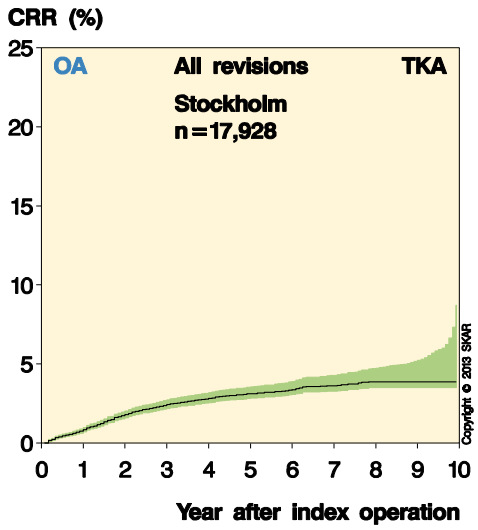
	Number	Percent
Linked (rot. hinge)	28	1,7
TKA	1,505	92,4
UKA	12	0,7
Exchange of femur comp.	5	0,3
Exchange of tibia comp.	7	0,4
Exchange of meniscus/inlay	37	2,3
Patella addition	4	0,2
Total implant removal	29	1,8
Arthrodesis	0	0
Amputation	1	0,1
Total	1,628	100

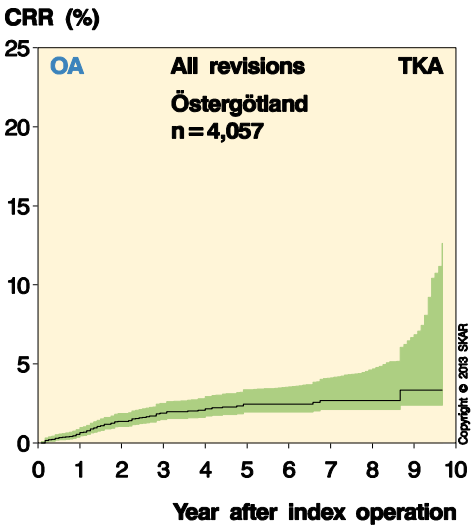
Type of revision 2002–2011 in which the primary was a TKA/RA

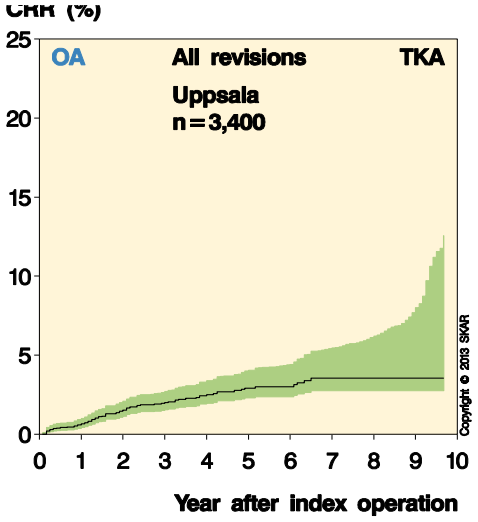
	Number	Percent
Linked (rot. hinge)	57	20.9
TKA	94	34.4
Exchange of femur comp.	6	2.2
Exchange of tibia comp.	11	4
Exchange of disc/inlay	35	12.8
Patella addition	27	9.9
Patella exchange	1	0.4
Patella removal	1	0.4
Total implant removal	38	13.9
Artrodes	2	0.7
Amputation	1	0.4
Total	273	100

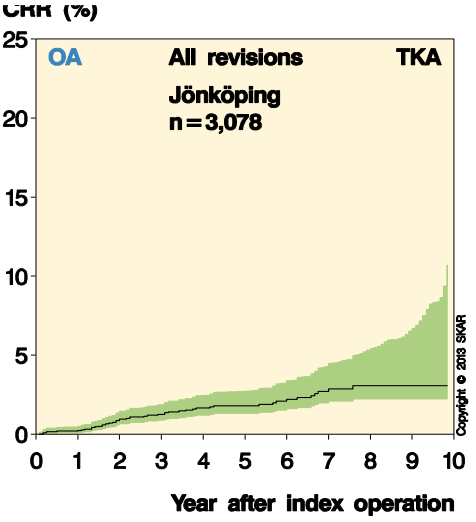
When evaluating the survival curves it should be noted that as the part of the curve to the right contains implants with long follow-up it also to a larger extent reflects older models.

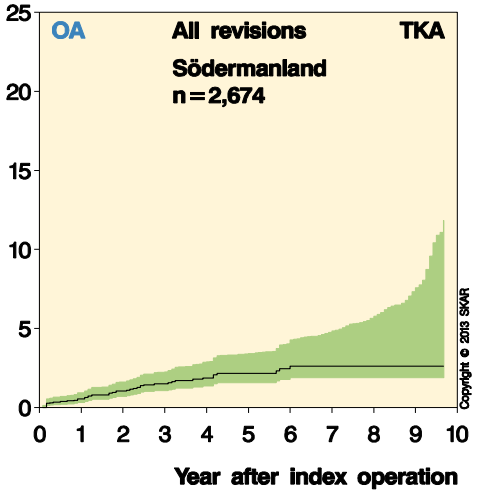
CRR in the counties after primary TKA for OA 2002–2011

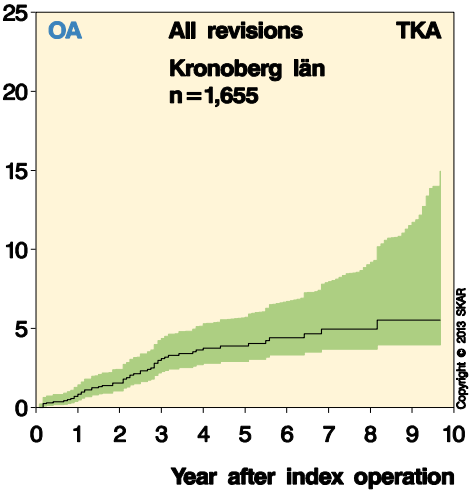




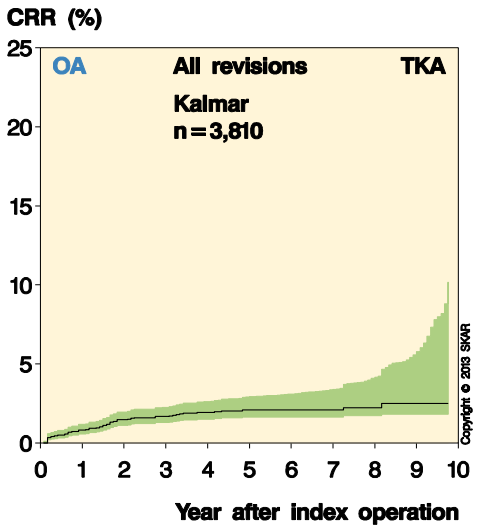


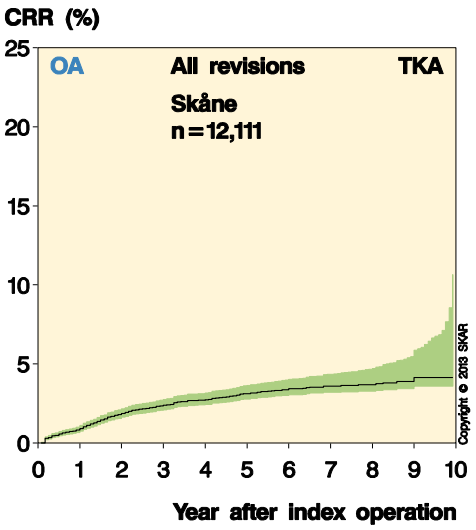


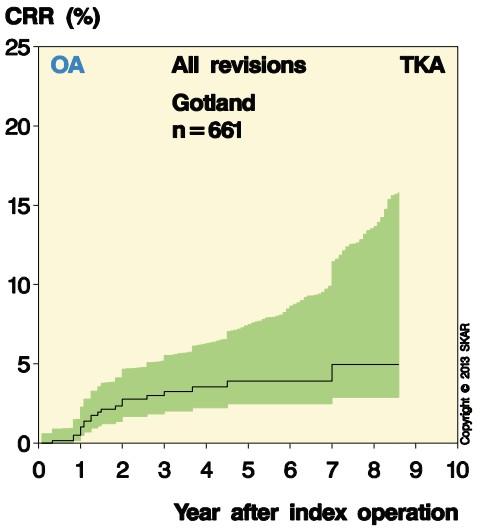


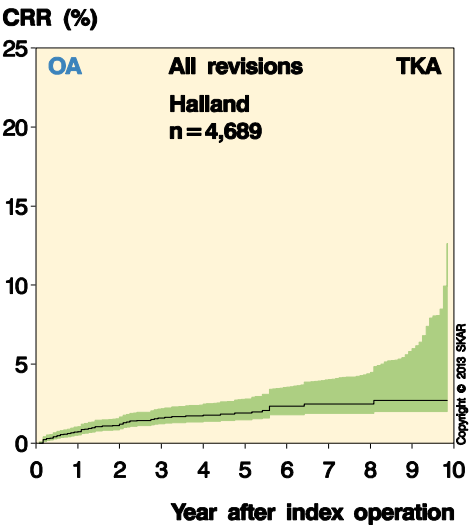


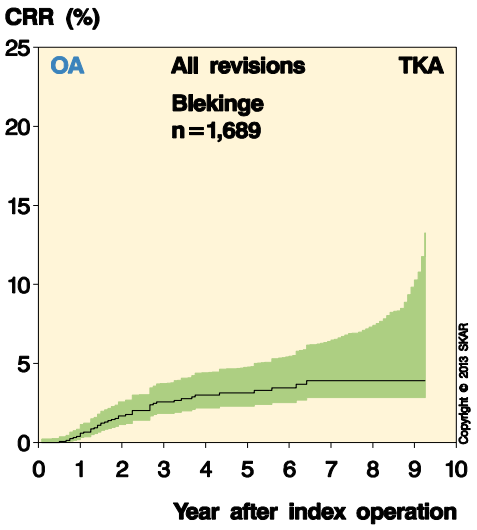
The curces are cut when less than 40 patients are left "at risk"

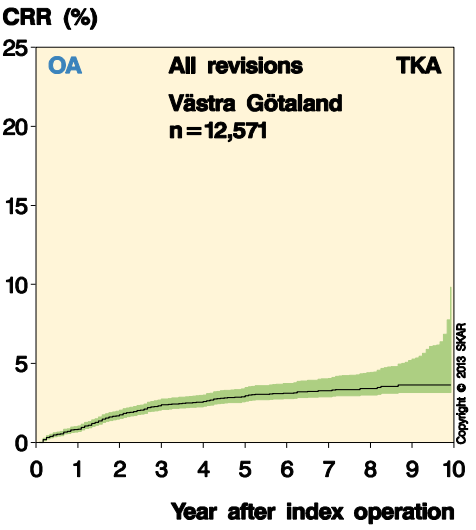






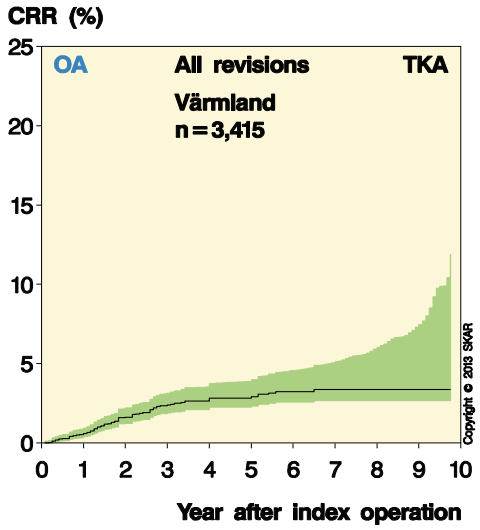


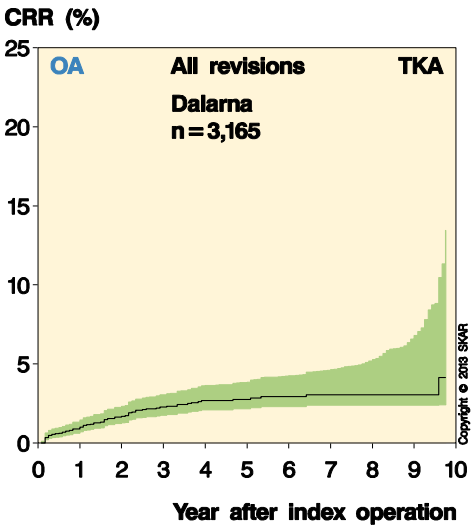


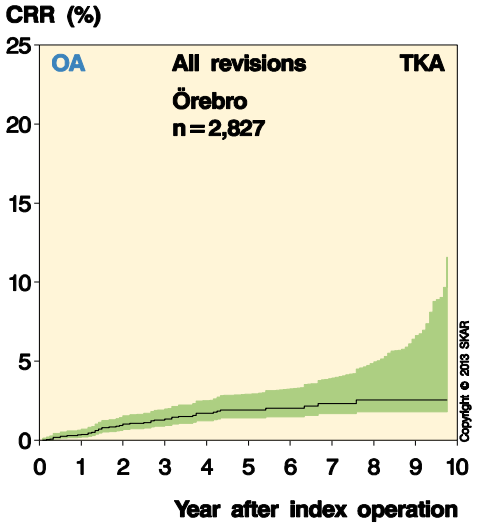


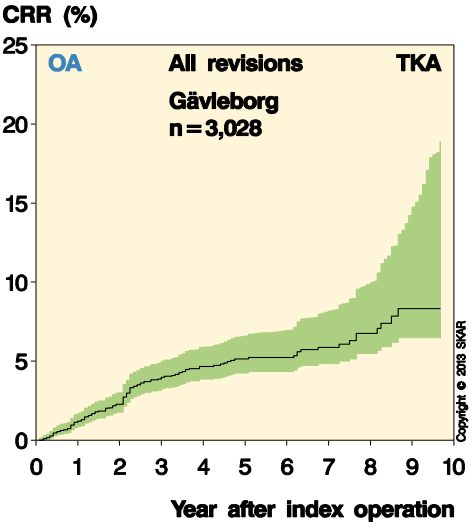
The curces are cut when less than 40 patients are left "at risk"

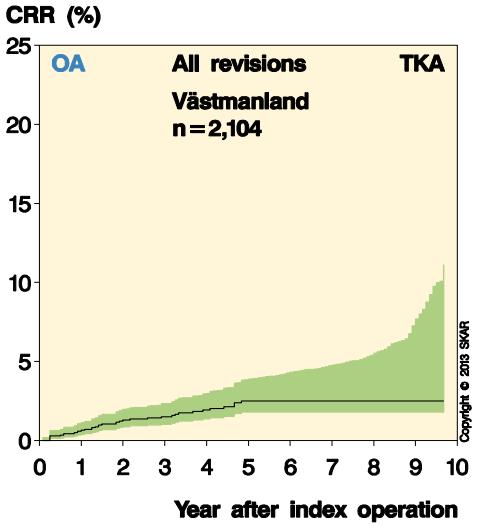
CRR in the counties after primary TKA for OA 2002–2011

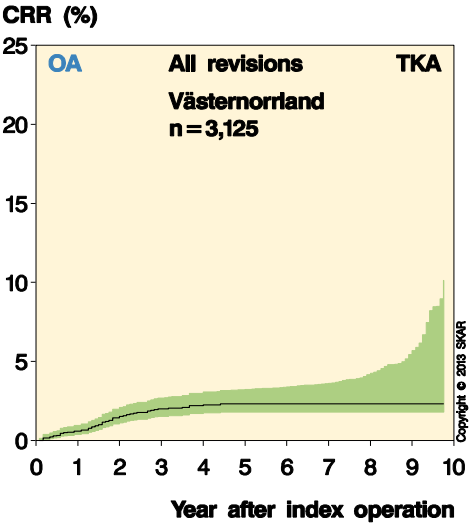




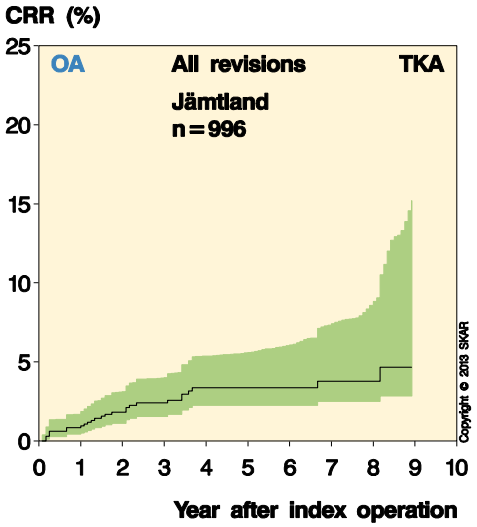


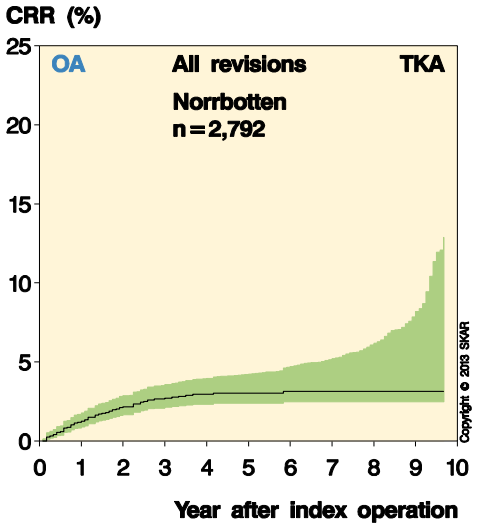


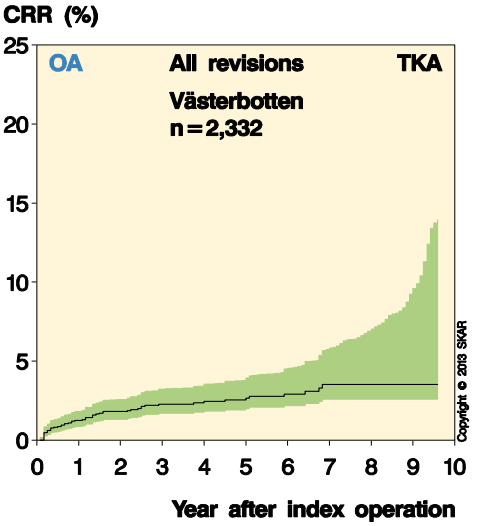




The curces are cut when less than 40 patients are left "at risk"

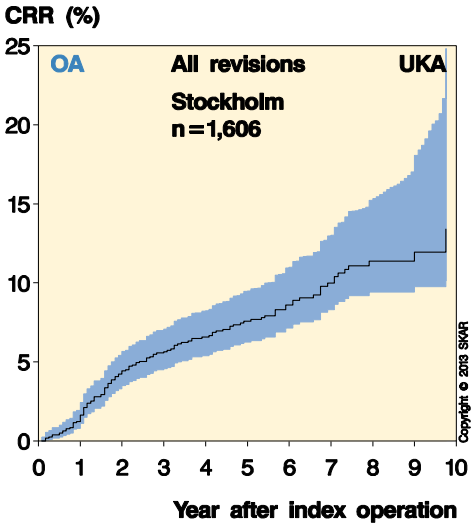


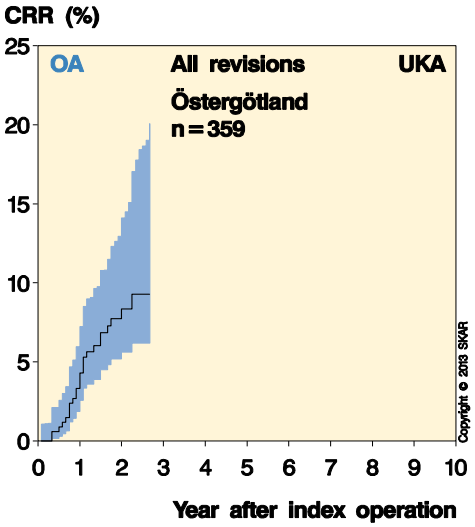


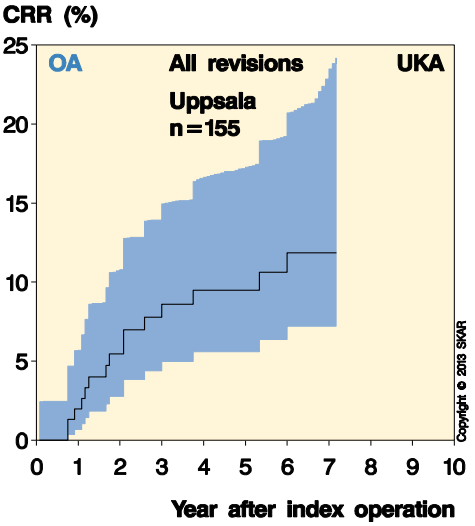


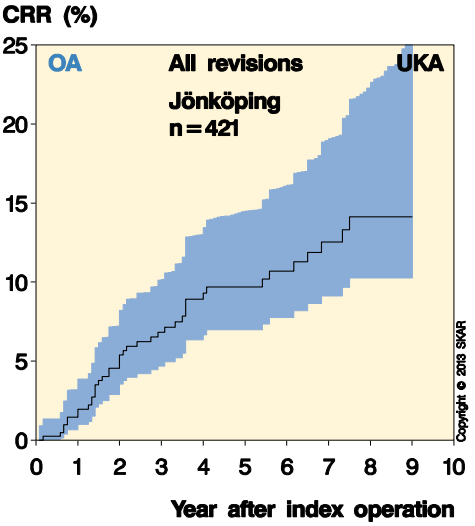
The curces are cut when less than 40 patients are left "at risk"

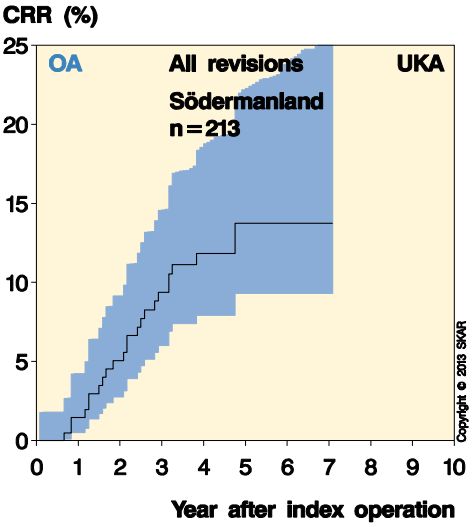
CRR in the counties after primary UKA for OA 2002–2011

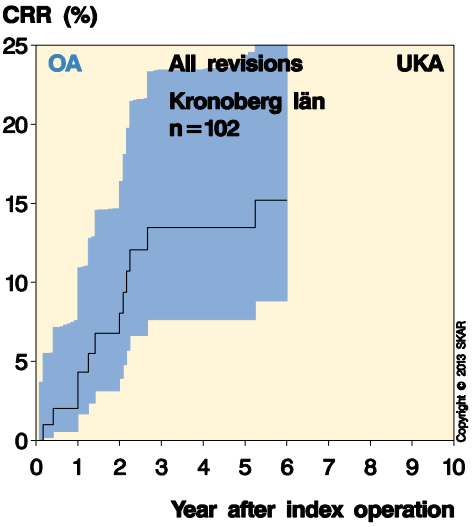




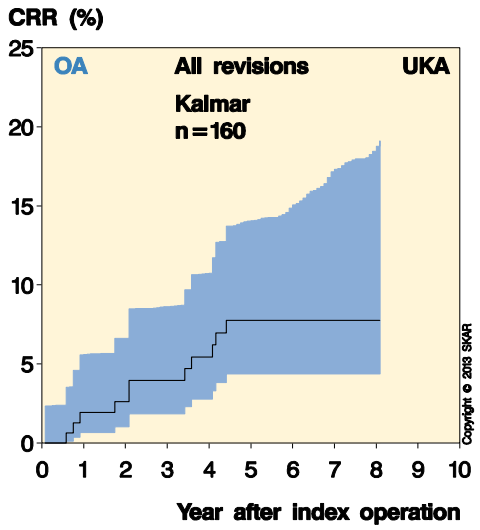


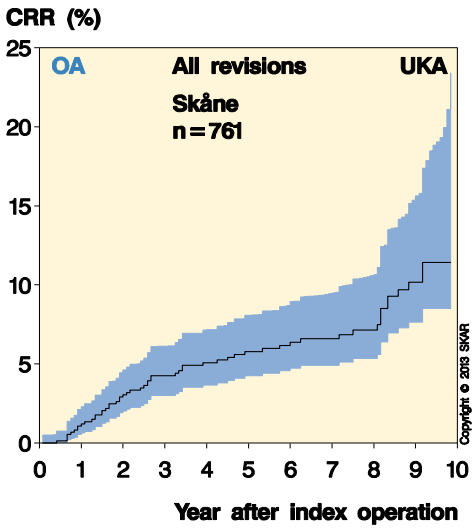


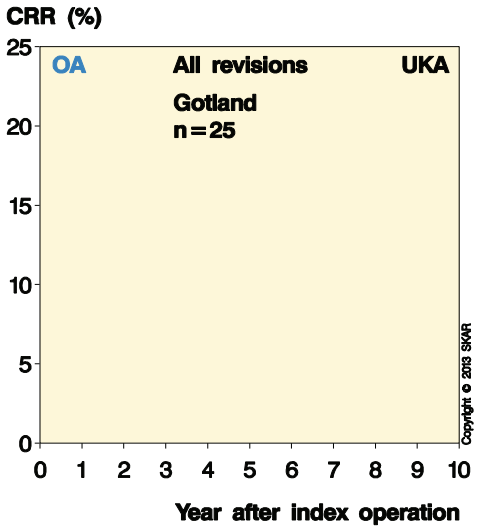


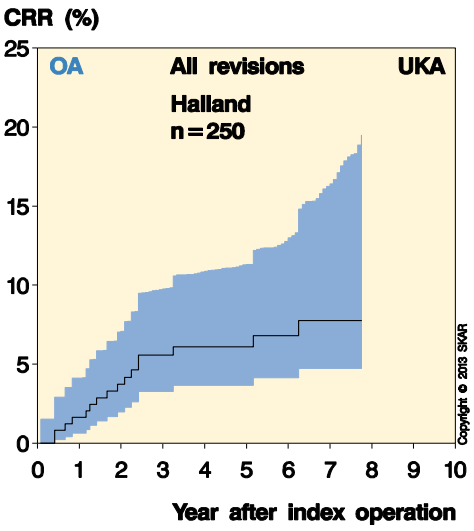


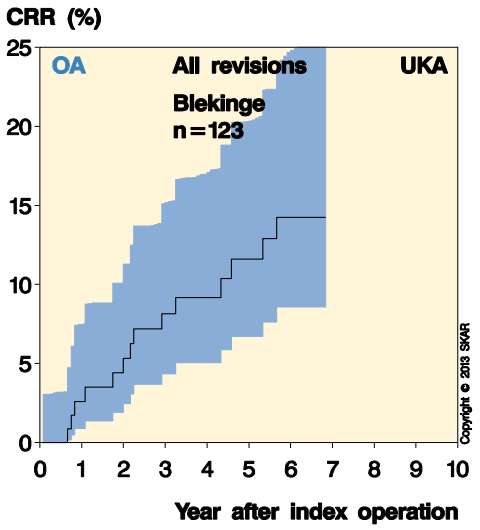
The curces are cut when less than 40 patients are left "at risk"

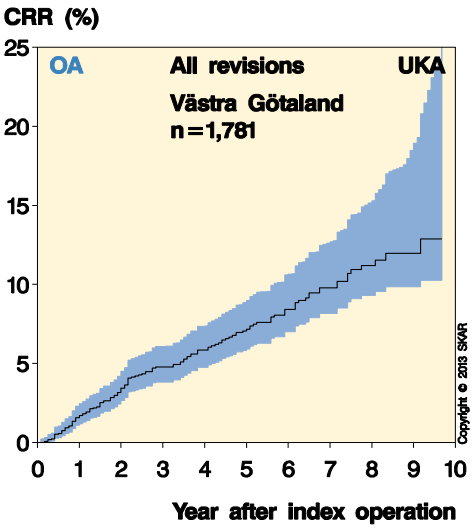






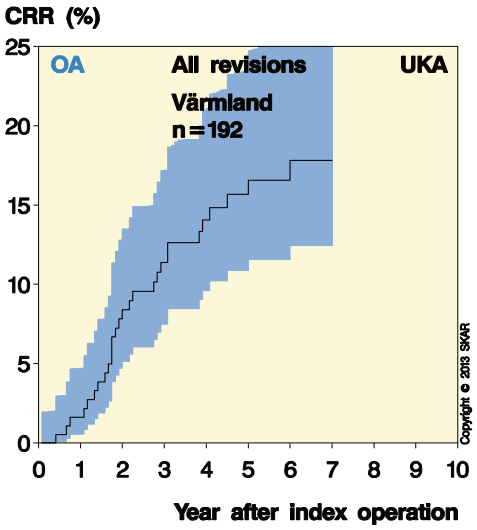


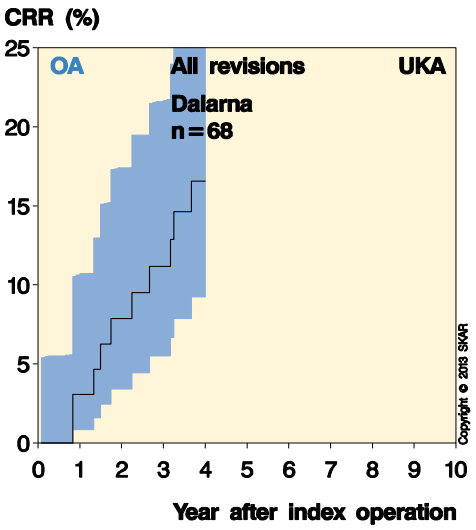


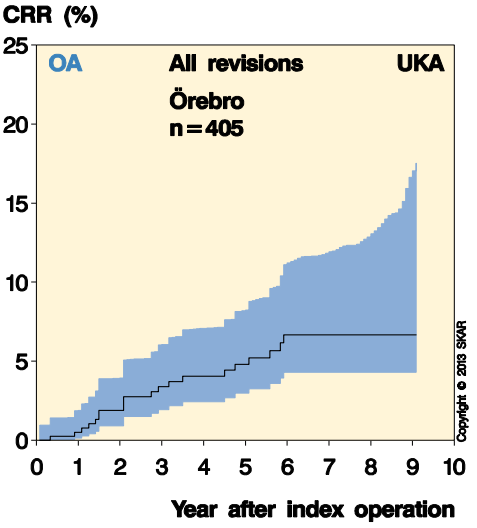


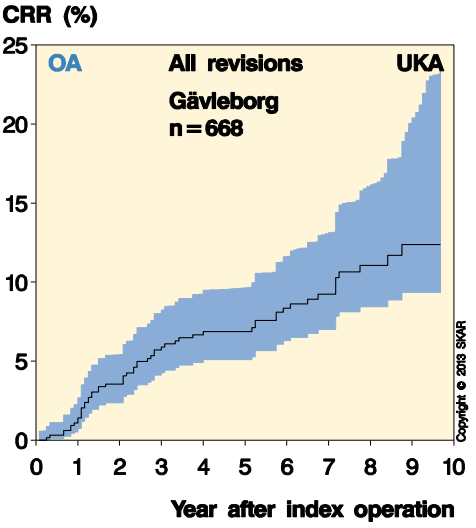
The curces are cut when less than 40 patients are left "at risk"

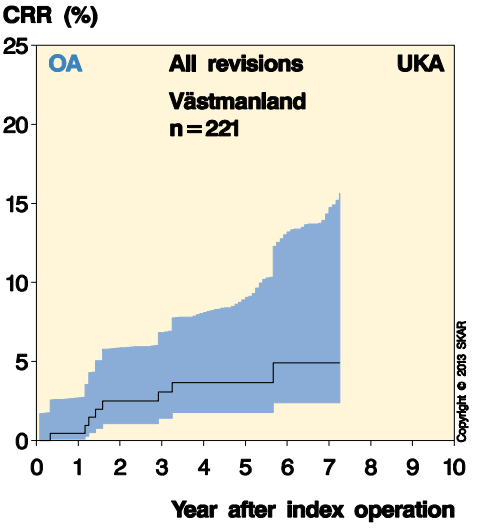
CRR in the counties after primary UKA for OA 2002–2011

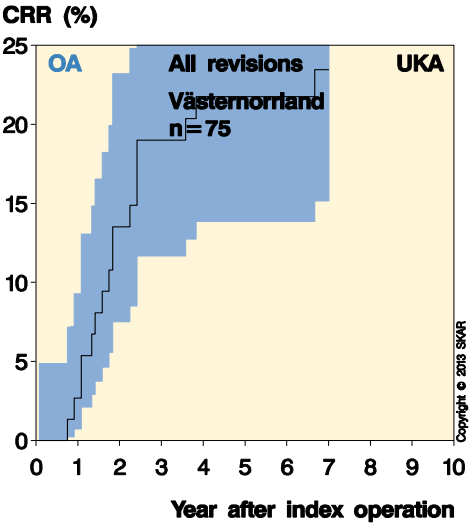




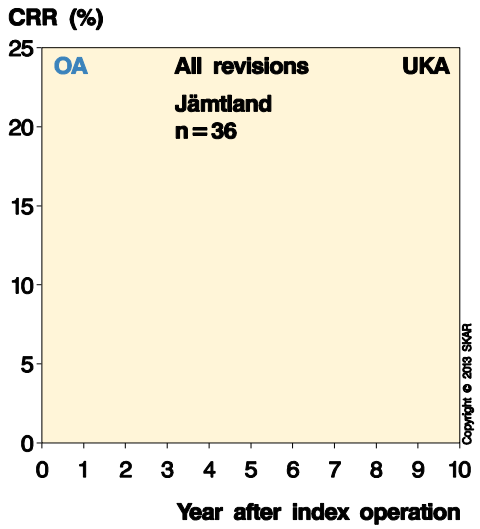


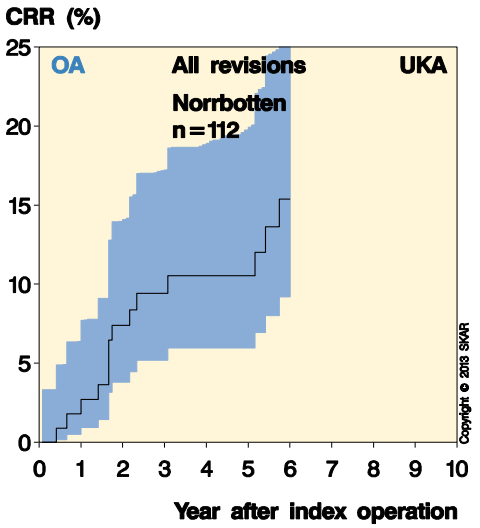


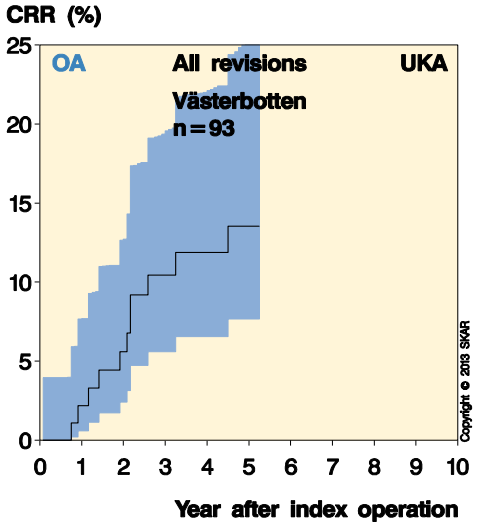




The curces are cut when less than 40 patients are left "at risk"







The curces are cut when less than 40 patients are left "at risk"

The relative risk for implants used in primary arthroplasty during 2002–2011

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. In this annual report, the number of Scan, Kinemax, LCS and Natural had become so small that they were not analyzed which reduced the number of models available for comparison.

The individual models may represent different variants depending on modularity and marketing. Within each model there are usually a few combinations that dominate.

Accordingly 96% of the PFC Sigma use the same type of a ”non-porous C/R” femur component which in 56% of cases was inserted with a cemented metal backed tibia component (MBT) and in 40% with an all-poly tibia (APT) component. NexGen had more femoral variants (68% CR Option) which in 85% of cases were combined with a MB tibia, in 13% with an AP tibia and in 2% with a trabecular metal (TM) tibia component.

This year we decided to split the PFC and NexGen into subgroups based on what type of tibia component had been used.

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 third 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 discussed together with the tables on page 42-43.

The number of knee arthroplasties for RA has become so low that it no longer is meaningful to compare different models and thus for the first time we do not have a separate table for TKA/RA.

Below you will find Cox regression tables for TKA/OA and UKA/OA in which the different models are compared to a reference implant. For TKA the reference is the AGC Anatomic and for UKA the Link.

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

OA / TKA	n	p–value	RR	95% CI
AGC Anat	10,868		ref.	
F/S MIII	4,674	0.16	1.14	0.95-1.36
PFC-Sigma MBT	16,098	0.29	0.93	0.80-1.07
PFC-Sigma APT	11,092	<0.01	0.63	0.53-0.76
Duracon	6,413	0.87	0.99	0.83-1.17
Profix	1,869	0.82	1.04	0.76-1.41
NexGen MBT	24,104	<0.01	0.62	0.54-0.72
NexGen APT	3,663	0.06	0.78	0.59-1.01
NexGen TM	520	0.17	0.63	0.32-1.23
PFC RP	1,042	<0.01	1.51	1.13-2.03
Triathlon	4,084	<0.01	0.66	0.49-0.89
Vanguard	4,730	0.15	1.18	0.94-1.49
Other	2,950	<0.01	1.41	1.15-1.73
Gender (male is ref.)		0.97	1	0.92-1.09
Age (per year)		<0.01	0.97	0.96-0.97
Year of op. (per year)		0.01	1.03	1.01-1.05

OA / UKA	n	p–value	RR	95% CI
Link	2,925		ref.	
Oxford	2,079	0.59	1.06	0.86-1.30
MillerGalante	1,596	0.77	0.97	0.79-1.19
Genesis	483	0.67	1.08	0.76-1.52
Preservation	150	0.09	1.48	0.94-2.33
ZUK	407	0.52	1.15	0.75-1.74
Other	186	0.26	0.68	0.35-1.33
Gender (male is ref.)		0.81	0.98	0.84-1.15
Age (per year)		<0.01	0.97	0.96-0.97
Year of op. (per year)		0.03	1.04	1.00-1.08

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 interval for OA/TKA inserted respectively without and with a patellar button. AGC is used as reference.

Without patella button OA / TKA	n	p–value	RR	95% CI
AGC Anat	9,537		ref.	
F/S MIII	2,843	0.02	1.27	1.03-1.55
PFC-Sigma MBT	15,555	0.05	0.86	0.74-1.00
PFC-Sigma APT	10,767	<0.01	0.61	0.51-0.73
Duracon	5,687	0.24	0.9	0.74-1.08
Profix	1,703	0.66	0.93	0.66-1.30
NexGen MBT	23,776	<0.01	0.59	0.51-0.69
NexGen APT	3,594	0.05	0.77	0.59-1.00
NexGen TM	511	0.17	0.63	0.32-1.22
PFC RP	826	0.02	1.48	1.07-2.04
Triathlon	3,934	<0.01	0.64	0.47-0.86
Vanguard	4,460	0.11	1.21	0.96-1.52
Other	2,581	0.01	1.32	1.06-1.64
Gender (male is ref.)		0.76	1.01	0.93-1.11
Age (per year)		<0.01	0.97	0.96-0.97
Year of op. (per year)		0.12	1.02	1.00-1.04

With patella button OA / TKA	n	p–value	RR	95% CI
AGC Anat	1,331		ref.	
F/S MIII	1,831	0.07	1.58	0.96-2.59
PFC-Sigma MBT	543	<0.01	2.65	1.54-4.56
PFC-Sigma APT	325	0.78	0.87	0.34-2.28
Duracon	726	<0.01	2.15	1.28-3.61
Profix	166	0.02	2.65	1.14-6.12
NexGen MBT	328	0.26	1.58	0.72-3.50
NexGen APT	*69*	*0.98*		
NexGen TM	*9*	*0.99*		
PFC RP	216	0.08	1.94	0.92-4.08
Triathlon	150	0.85	1.13	0.34-3.75
Vanguard	*270*	*0.97*		
Other	369	<0.01	2.74	1.49-5.02
Gender (male is ref.)		0.32	0.86	0.64-1.16
Age (per year)		<0.01	0.97	0.96-0.99
Year of op. (per year)		<0.01	1.13	1.05-1.22

Implants lacking sufficient numbers for analysis are shown in italics

Using the current division of implants for TKA inserted for OA (left table on the previous page), we find that it is only the PFC rotating platform and the combination with "Other" models that have significantly higher risk than the reference AGC. The PFC rotating platform also had a higher risk than the reference last year. On the other hand, the PFC-Sigma APT, NexGen MBT and Triathlon all have lower risk than the reference.

The risk of revision decreases with increasing age but increases with time. This may be caused by an increasing number of revisions in which the tibia inlay is exchanged due to a treatment of manifest or suspected infection. On the next page we have performed the same analysis but without considering such inlay exchanges being true revisions and then the effect of increased risk with time disappears.

With respect to UKA inserted for OA (right table on the previous page) one can see that 3 models account for the majority of surgeries. There was no significant difference in risk of revision between the Link reference and the other implants.

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 PFC-Sigma AP, NexGen MBT and Triathlon which have a significantly lower risk of revision than the reference AGC and the F/S MIII, PFC rotating platform as well as the group of "Other" models that have a significantly higher risk. However, FS MIII has not been used since 2008.

The number of arthroplasties in which a patellar button is used is rather small which makes it more difficult to show significant differences. However, when using a button, the PFC-Sigma,MBT, Duracon and Profix a higher risk of revision than the reference AGC.

The relative risk for implants used in primary arthroplasty during 2002–2011 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 it was noted early on that many surgeons did not report reoperations which they did not consider 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. 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.

For TKA/OA without considering patella resurfacing (table below), we see that the effect of not considering inlay change being revision is that PFC-Sigma MBT now has significantly lower risk than the reference and that the negative effect of time has disappeared. The reason for the latter is probably that in recent year there has been increased aggressiveness in treating early infections or suspected infections with opening of the knee and lavage.

The risk of revision (RR) with 95% confidence interval. For TKA the reference is AGC and for UKA Link.
The exchange of inlay, in case of infection, is not considered a revision.

OA / TKA	n	p–value	RR	95% CI
AGC Anat	10,868		ref.	
F/S MIII	4,674	0.58	1.05	0.88-1.26
PFC-Sigma MBT	16,098	<0.01	0.80	0.69-0.93
PFC-Sigma APT	11,092	<0.01	0.67	0.56-0.80
Duracon	6,413	0.12	0.87	0.73-1.04
Profix	1,869	0.71	0.94	0.67-1.31
NexGen MBT	24,104	<0.01	0.49	0.42-0.58
NexGen APT	3,663	0.38	0.89	0.68-1.16
NexGen TM	520	0.12	0.55	0.26-1.16
PFC RP	1,042	0.01	1.47	1.08-1.99
Triathlon	4,084	<0.01	0.47	0.32-0.68
Vanguard	4,730	0.61	1.07	0.83-1.38
Other	2,950	0.03	1.26	1.02-1.55
Gender (male is ref.)		0.05	1.10	1.00-1.20
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.12	0.98	0.96-1.00

RA / TKA	n	p–value	RR	95% CI
Link	2,925		ref.	
Oxford	2,079	0.66	1.05	0.85-1.29
MillerGalante	1,596	0.76	0.97	0.79-1.19
Genesis	483	0.66	1.08	0.77-1.52
Preservation	150	0.09	1.48	0.94-2.34
ZUK	407	0.49	1.16	0.76-1.76
Other	186	0.26	0.68	0.35-1.33
Gender (male is ref.)		0.76	0.98	0.84-1.14
Age (per year)		<0.01	0.97	0.96-0.97
Year of op. (per year)		0.05	1.04	1.00-1.08

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 interval for OA/TKA inserted respectively without and with a patellar button. The exchange of inlay, in case of infection, is not considered a revision

Without patella button OA / TKA	n	p–value	RR	95% CI
AGC Anat	9,537		ref.	
F/S MIII	2,843	0.06	1.22	1.00-1.50
PFC-Sigma MBT	15,555	<0.01	0.75	0.64-0.88
PFC-Sigma APT	10,767	<0.01	0.65	0.54-0.78
Duracon	5,687	0.01	0.78	0.65-0.95
Profix	1,703	0.55	0.90	0.63-1.28
NexGen MBT	23,776	<0.01	0.47	0.40-0.56
NexGen APT	3,594	0.41	0.89	0.68-1.17
NexGen TM	511	0.13	0.55	0.26-1.18
PFC RP	826	0.01	1.52	1.09-2.10
Triathlon	3,934	<0.01	0.49	0.33-0.70
Vanguard	4,460	0.44	1.11	0.85-1.44
Other	2,581	0.19	1.16	0.93-1.45
Gender (male is ref.)		0.02	1.12	1.02-1.23
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.01	0.97	0.95-0.99

With patella button OA / TKA	n	p–value	RR	95% CI
AGC Anat	1,331		ref.	
F/S MIII	1,831	0.18	1.41	0.85-2.34
PFC-Sigma MBT	543	<0.01	2.22	1.25-3.92
PFC-Sigma APT	325	0.79	0.88	0.34-2.28
Duracon	726	<0.01	2.00	1.18-3.38
Profix	166	0.43	1.53	0.53-4.40
NexGen MBT	328	0.38	1.45	0.63-3.34
NexGen APT	*69*	*0.99*		
NexGen TM	*9*	*1.00*		
PFC RP	216	0.47	1.37	0.58-3.20
Triathlon	*150*	*0.98*		
Vanguard	*270*	*0.98*		
Other	369	<0.01	2.69	1.46-4.93
Gender (male is ref.)		0.46	0.89	0.65-1.21
Age (per year)		<0.01	0.97	0.95-0.98
Year of op. (per year)		0.01	1.11	1.03-1.21

Implants lacking sufficient numbers for analysis are shown in italics

In case of UKA for OA (right table on the previous page), there were only 2 exchanges of an inlay due to infection or suspected one. Therefore, the table is almost identical to the table on page 40.

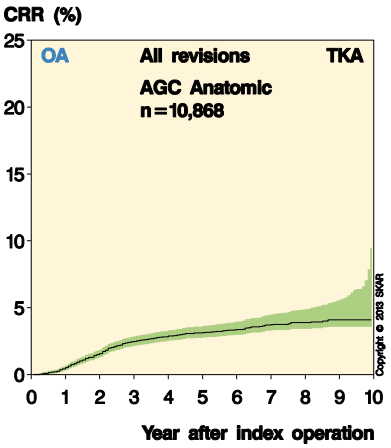
Above we have as on page 41 divided the TKA for OA into those that are used without respective with a patellar component.

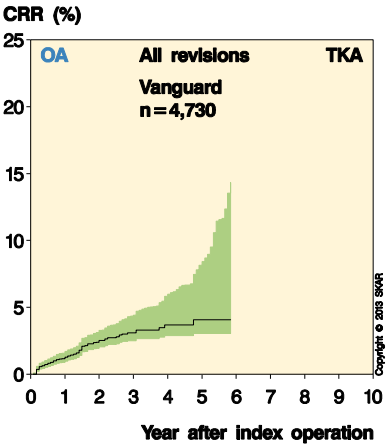
In the table left above, in which no patella button was used, the PFC-Sigma MBT which on page 41 lied just around the significance limit now has a lower risk than the reference AGC. The same applies for the Duracon. Another effect of not considering change of inlay revision is that women now have higher risk than men and that the risk of revision decreases with time. We have previously shown that men ar more often revised for infection than women (page 19). Not counting change of inlay as a true revision results in that the advantage for the women decreases which in turn has an effect of gender as a covariate in the regression.

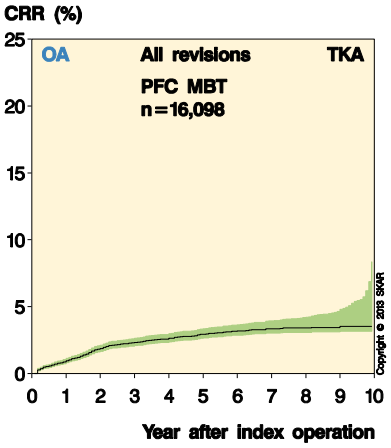
In the right table above, concerning arthroplasties in which a patellar button was used, the result is that Profix no longer has a higher risk of revision as compared to the reference AGC. Otherwise little has happened.

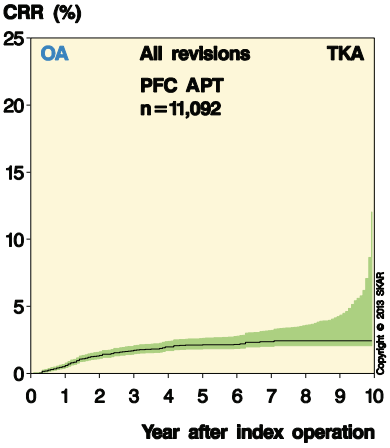
In summary one can establish that excluding an exchange of inlay in infected cases does affect the results. However, for most models the effect is relatively small although it may result in that a model moves across the significance limit. Further, for models used in a small number of patients, a limited change in the number of revisions can show a large effect.

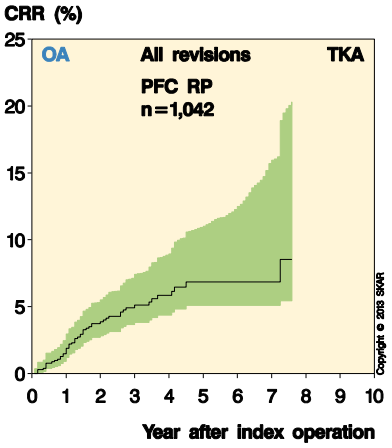
CRR for commonly used TKA implants for OA 2002–2011

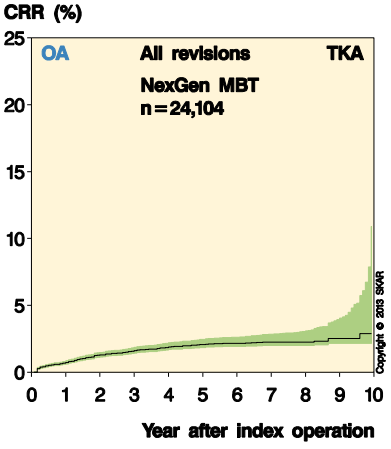


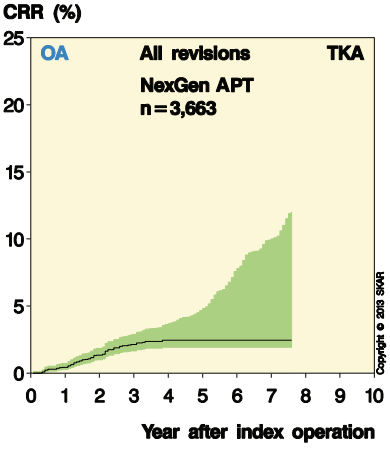


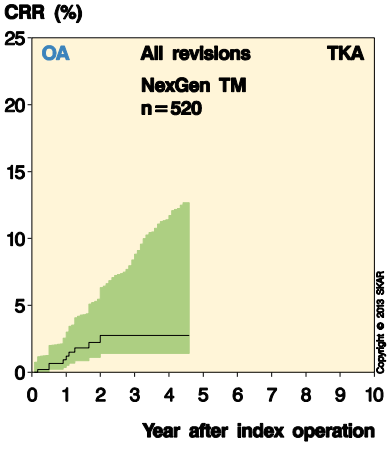


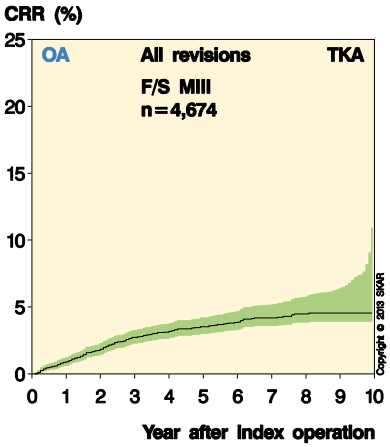


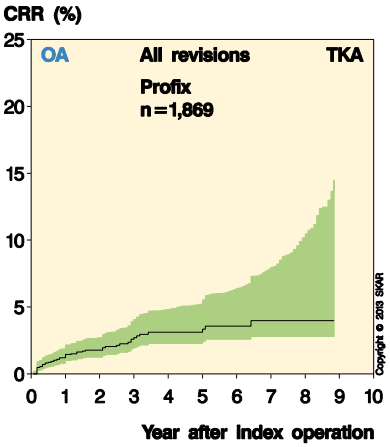


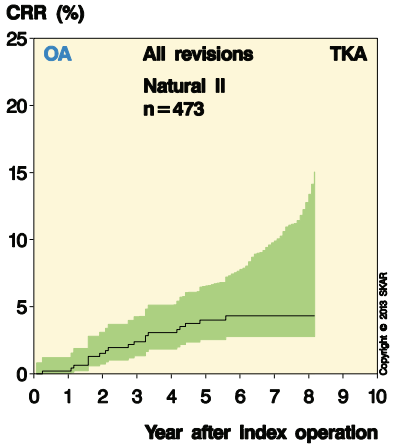


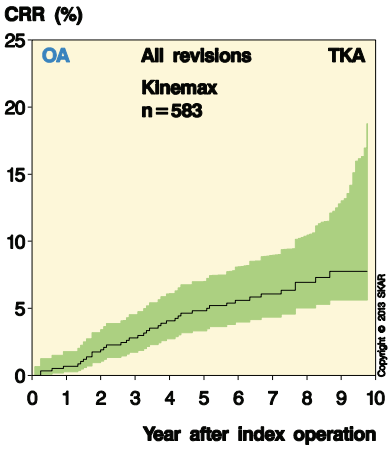


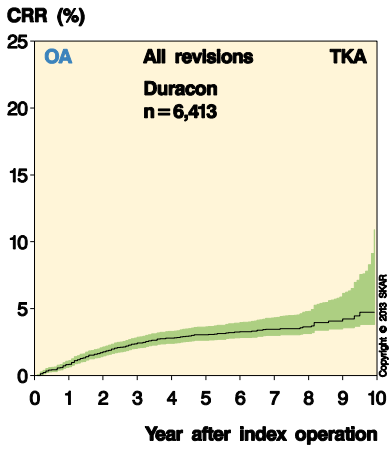


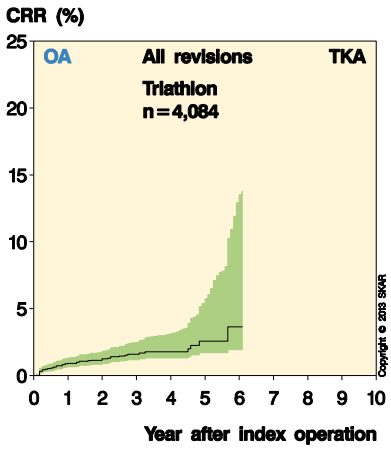

CRR (%)
OA
All revisions
TKA
F/S MIII
n=4,674
Year after index operation
Copyright © 2013 SKAR

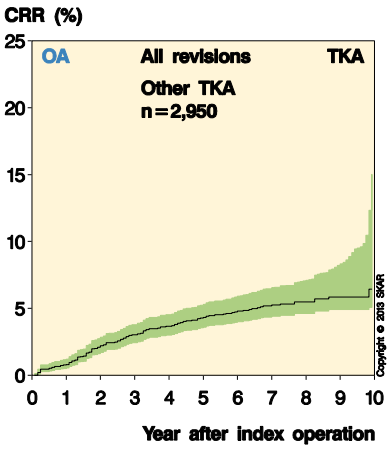

CRR (%)
OA
All revisions
TKA
Profix
n=1,869
Year after index operation
Copyright © 2013 SKAR

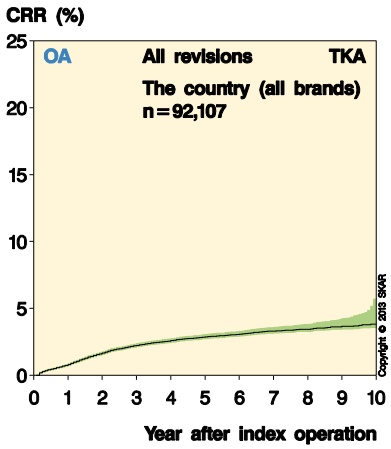

CRR (%)
OA
All revisions
TKA
Natural II
n=473
Year after index operation
Copyright © 2013 SKAR


CRR (%)
OA
All revisions
TKA
Kinemax
n=583
Year after index operation
Copyright © 2013 SKAR

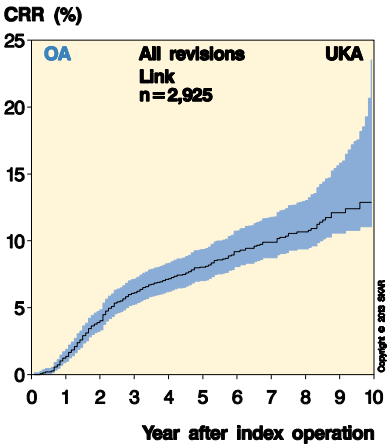

CRR (%)
OA
All revisions
TKA
Duracon
n=6,413
Year after index operation
Copyright © 2013 SKAR

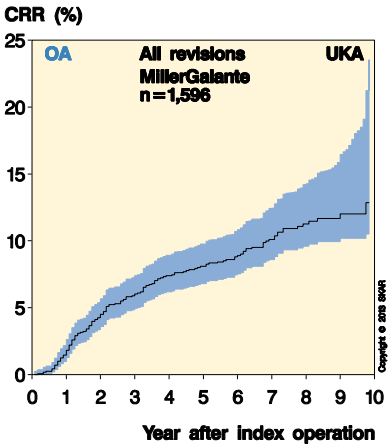

CRR (%)
OA
All revisions
TKA
Triathlon
n=4,084
Year after index operation
Copyright © 2013 SKAR

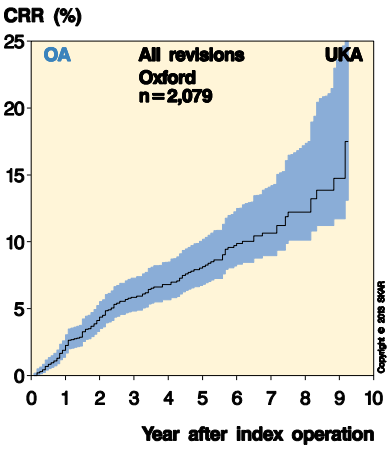

CRR (%)
OA
All revisions
TKA
Other TKA
n=2,950
Year after index operation
Copyright © 2013 SKAR

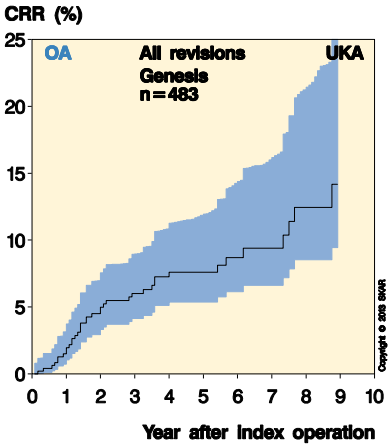

CRR (%)
OA
All revisions
TKA
The country (all brands)
n=92,107
Year after index operation
Copyright © 2013 SKAR

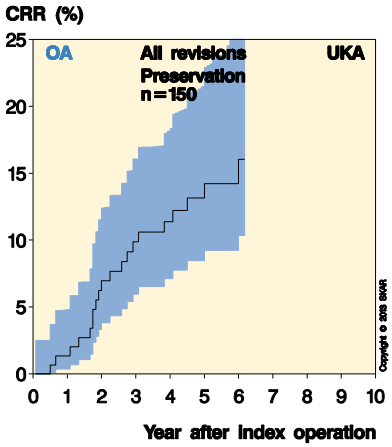
CRR for commonly used UKA implants for OA 2002–2011

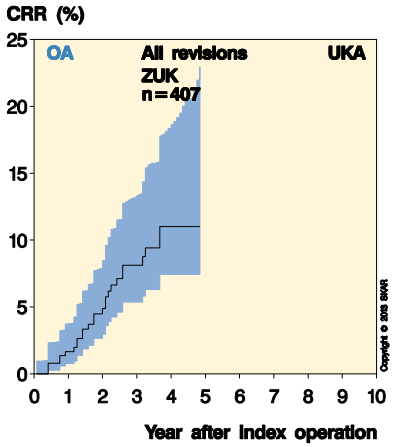


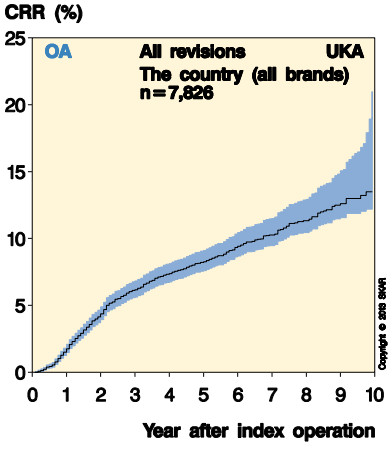












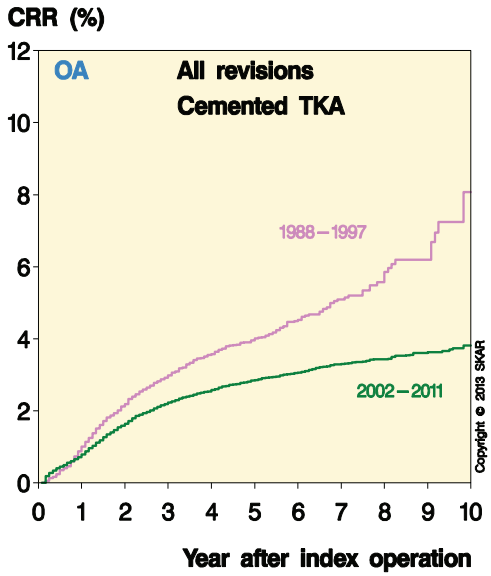
Changes in risk of revision over time (cemented TKA)

The figure below shows the overall risk of revision for the current 10-year period, 2002-2011, as compared to the period 1988-1997. It can be observed that the risk for the current period is considerably lower than for the earlier period.

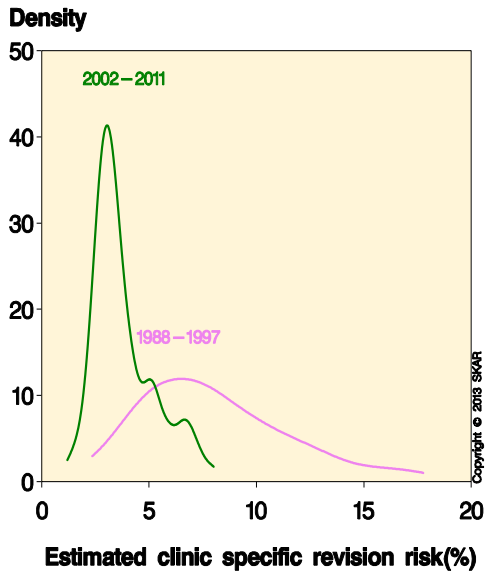
When the absolute specific risk of revision for the units is plotted for both periods (figure below left), it can be seen that the risk has become lower and the distribution has diminished. This implies that the results have improved overall and at the same time the results for the different units have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

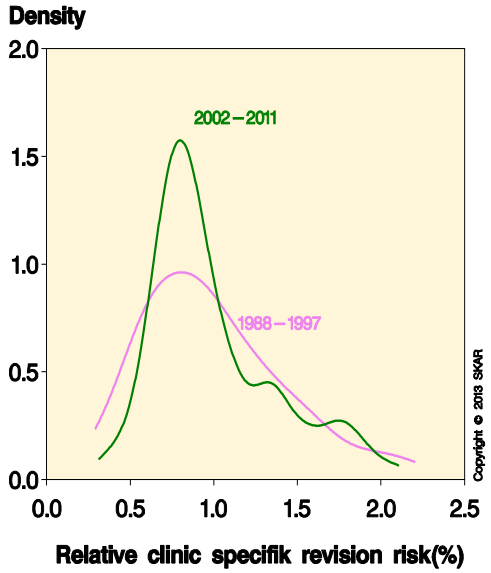
The register is requested to account for hospital specific results which can be found on the next pages. This year, there were 7 hospitals having significantly better results than the average hospital and 14 with inferior results. One can only speculate on the causes for these differences. An unfortunate 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 1988–1997 and 2002–2011 shows a considerable reduction in CRR over time.



Plotting the estimated absolute clinicspecific risk of revision shows that the absolute distribution has diminished between 1988-1997 and 2002–2011 (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 1988–1997 and 2002–2011 (x-axis = relative risk).

Relative risk of revision for hospitals 2002–2011 (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.

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.

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.

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	1,433	7	0.31	0.18-0.56	1	1-9
10010	Sabbatsberg (Aleris)	781	6	0.43	0.24-0.79	2	1-30
12010	Enköping	1,853	14	0.44	0.28-0.70	3	1-21
42011	Varberg	1,361	16	0.54	0.35-0.83	4	2-33
62011	Örnsköldsvik	1,184	16	0.6	0.39-0.92	5	2-42
42015	Movement Halmstad	1,236	12	0.6	0.37-0.97	6	2-46
11002	Huddinge	958	12	0.6	0.37-0.97	7	2-46
53011	Lidköping	978	11	0.61	0.37-1.00	8	2-47
41012	Helsingborg	287	3	0.63	0.31-1.29	9	2-64
50010	Östra sjukhuset	719	11	0.64	0.39-1.05	10	3-51
42420	Spenshult	582	4	0.64	0.33-1.24	11	2-62
21001	Linköping	262	4	0.65	0.34-1.27	12	2-63
28011	Ängelholm	1,174	17	0.68	0.44-1.03	13	4-51
22011	Eksjö-Nässjö (Höglandssjukh.)	933	12	0.68	0.42-1.10	14	3-55
55010	Örebro	973	15	0.71	0.45-1.10	15	4-55
65012	Gällivare	630	9	0.71	0.42-1.21	16	3-60
55011	Karlskoga	834	13	0.72	0.45-1.15	17	4-58
65014	Kalix	90	1	0.72	0.32-1.65	18	2-75
56010	Västerås	1,205	15	0.73	0.47-1.13	19	5-58
13012	Kullbergska sjukhuset	1,582	24	0.73	0.50-1.05	20	6-52
50480	Carlanderska	370	3	0.74	0.36-1.49	21	2-71
41013	Ystad	178	3	0.75	0.37-1.51	22	2-71
25011	Oskarshamn	1,835	30	0.75	0.54-1.05	23	8-52
22010	Jönköping	1,135	18	0.76	0.50-1.15	24	6-58
64011	Lycksele	475	7	0.76	0.43-1.35	25	4-66

(cont.)

Relative risk of revision for units (continued)

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
54010	Karlstad	1,583	27	0.76	0.54-1.08	26	8-54
13010	Eskilstuna	330	5	0.77	0.41-1.44	27	3-69
28013	Simrishamn	700	18	0.78	0.51-1.17	28	7-58
11001	Karolinska	1,459	31	0.78	0.56-1.09	29	10-54
62013	Sollefteå	931	17	0.79	0.52-1.21	30	7-61
25010	Kalmar	1,085	19	0.8	0.53-1.20	31	8-60
12481	Elisabethkliniken	583	11	0.8	0.49-1.31	32	6-64
21014	Motala	3,036	54	0.81	0.63-1.05	33	14-52
53013	Skövde	740	12	0.83	0.51-1.34	34	7-66
50080	Sergelkliniken	140	3	0.83	0.41-1.68	35	3-76
22012	Värnamo	997	20	0.83	0.55-1.25	36	9-62
10011	S:t,Göran	3,424	71	0.83	0.66-1.04	37	17-52
55012	Lindesberg	1,017	17	0.83	0.55-1.27	38	9-63
11015	Nacka-Proxima	428	5	0.86	0.46-1.61	39	5-74
52011	Borås	885	18	0.87	0.57-1.33	40	10-66
24010	Västervik	889	19	0.88	0.59-1.32	41	11-65
50001	Sahlgrenska	263	7	0.89	0.50-1.57	42	7-72
56012	Köping	897	22	0.89	0.61-1.30	43	12-65
65016	Sunderby	200	5	0.89	0.47-1.67	44	6-75
53010	Falköping	1,045	23	0.91	0.62-1.32	45	14-65
28012	Hässleholm	4,192	91	0.91	0.74-1.11	46	23-56
13011	Nyköping	761	15	0.92	0.59-1.44	47	12-69
30001	Malmö	175	4	0.93	0.48-1.80	48	6-78
50071	Frölunda,Spec.	847	19	0.93	0.62-1.40	49	13-68
11013	Löwenströmska*	2,117	41	0.93	0.70-1.25	50	20-62
64001	Umeå	1,056	23	0.96	0.66-1.40	51	17-68
11011	Södertälje	1,047	24	0.97	0.67-1.39	52	17-68
57010	Falun	1,928	41	0.98	0.73-1.31	53	23-65
23010	Växjö	876	21	1.01	0.69-1.50	54	20-71
57011	Mora	1,132	26	1.02	0.72-1.46	55	21-70
52013	Skene	718	19	1.07	0.71-1.61	56	21-73
62010	Sundsvall	1,008	26	1.07	0.75-1.53	57	25-72
27011	Karlshamn	1,659	41	1.08	0.81-1.45	58	31-69
42010	Halmstad	1,371	37	1.1	0.80-1.51	59	31-71
11010	Danderyd	1,324	34	1.1	0.80-1.52	60	30-71
10013	Södersjukhuset	2,013	48	1.12	0.85-1.47	61	35-70
54014	Torsby	783	22	1.2	0.82-1.75	62	32-77
10015	Sophiahemmet	796	29	1.24	0.89-1.75	63	39-77
26010	Visby	657	20	1.29	0.87-1.92	64	36-80
63010	Östersund	990	29	1.31	0.93-1.83	65	42-78
51011	Mölndal	994	26	1.34	0.94-1.91	66	43-80
50020	Gothenburg Med Center**	570	19	1.34	0.90-2.01	67	39-81
21013	Norrköping	726	20	1.35	0.91-2.01	68	41-81
65013	Piteå	1,866	56	1.37	1.06-1.77	69	52-77
64010	Skellefteå	719	24	1.39	0.97-2.01	70	45-80
54012	Arvika	996	31	1.43	1.02-1.98	71	50-80
61010	Gävle	548	21	1.48	1.00-2.18	72	48-82
51010	Uddevalla	1,541	54	1.55	1.20-2.01	73	60-81
41010	Landskrona	293	17	1.56	1.02-2.38	74	50-83
41011	Trelleborg	3,997	134	1.59	1.34-1.89	75	65-80
23011	Ljungby	755	32	1.72	1.24-2.38	76	62-83
10016	Ortopediska huset	2,825	120	1.72	1.44-2.06	77	68-82
41001	Lund	125	9	1.75	1.03-2.98	78	50-83
61011	Bollnäs	1,877	77	1.77	1.42-2.20	79	68-82
12001	Akademiska sjukhuset	954	50	1.85	1.41-2.42	80	68-83
61012	Hudiksvall	575	28	1.86	1.32-2.63	81	65-83
11012	Norrtälje	688	36	1.95	1.42-2.67	82	69-83
51012	Kungälv	1,284	67	2.11	1.66-2.66	83	75-83

* 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 2002–2011 (cemented TKA) if the exchange of an inlay, in case of infection, is not considered to be a revision

As described on page 4, 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 definitely be related to the implant.

As already has been mentioned (page 42) it can be 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 keep their status while Helsingborg becomes significantly better. In the other end, all the 14 units worse than average keep on being so and no new unit becomes significantly worse than the national average.

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	1,433	5	0.28	0.15-0.54	1	1-10
42015	Movement Halmstad	1,236	6	0.43	0.23-0.78	2	1-28
53011	Lidköping	978	6	0.45	0.25-0.83	3	1-33
62011	Örnsköldsvik	1,184	10	0.46	0.27-0.77	4	1-27
10010	Sabbatsberg (Aleris)	781	6	0.47	0.26-0.86	5	1-36
41012	Helsingborg	287	1	0.49	0.21-1.14	6	1-55
42011	Varberg	1,361	13	0.5	0.31-0.80	7	2-29
12010	Enköping	1,853	14	0.5	0.32-0.79	8	2-29
42420	Spenshult	582	2	0.54	0.25-1.17	9	1-57
50010	Östra sjukhuset	719	9	0.6	0.35-1.02	10	3-48
22011	Eksjö-Nässjö (Höglandssjukh.)	933	9	0.62	0.36-1.06	11	3-51
11002	Huddinge	958	12	0.65	0.40-1.06	12	4-51
24010	Västervik	889	12	0.67	0.42-1.09	13	5-53
21001	Linköping	262	4	0.69	0.35-1.35	14	3-65
25010	Kalmar	1,085	14	0.7	0.44-1.10	15	5-53
55011	Karlskoga	834	11	0.7	0.43-1.16	16	5-56
57010	Falun	1,928	25	0.71	0.49-1.02	17	7-48
65012	Gällivare	630	8	0.72	0.41-1.25	18	4-62
22010	Jönköping	1,135	15	0.73	0.47-1.13	19	6-56
13010	Eskilstuna	330	4	0.73	0.37-1.44	20	3-69
65014	Kalix	90	1	0.74	0.32-1.70	21	2-76
28011	Ängelholm	1,174	17	0.75	0.49-1.14	22	7-56
13012	Kullbergska sjukhuset	1,582	22	0.75	0.51-1.10	23	8-54
25011	Oskarshamn	1,835	27	0.77	0.54-1.10	24	10-53
55010	Örebro	973	15	0.78	0.50-1.21	25	8-60

(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
52011	Borås	885	14	0.78	0.49-1.25	26	7-62
41013	Ystad	178	3	0.78	0.38-1.60	27	4-72
54010	Karlstad	1,583	25	0.79	0.55-1.14	28	11-56
50480	Carlanderska	370	3	0.81	0.39-1.65	29	4-75
56010	Västerås	1,205	15	0.81	0.52-1.27	30	9-63
62013	Sollefteå	931	16	0.83	0.54-1.28	31	10-62
28013	Simrishamn	700	18	0.83	0.55-1.26	32	10-62
64011	Lycksele	475	7	0.83	0.46-1.48	33	7-69
55012	Lindesberg	1,017	15	0.84	0.54-1.32	34	10-64
11001	Karolinska	1,459	31	0.85	0.61-1.18	35	14-58
21014	Motala	3,036	50	0.85	0.65-1.11	36	17-55
30001	Malmö	175	3	0.86	0.42-1.76	37	5-77
50080	Sergelkliniken	140	3	0.86	0.42-1.77	38	5-76
12481	Elisabethkliniken	583	11	0.86	0.52-1.42	39	10-68
11010	Danderyd	1,324	23	0.87	0.60-1.27	40	13-63
10011	S:t Göran	3,424	69	0.89	0.71-1.13	41	21-56
50071	Frölunda Spec.	847	16	0.89	0.58-1.38	42	13-66
64001	Umeå	1,056	19	0.9	0.60-1.35	43	14-66
22012	Värnamo	997	20	0.9	0.60-1.37	44	14-66
53013	Skövde	740	12	0.91	0.56-1.48	45	11-70
53010	Falköping	1,045	21	0.93	0.63-1.37	46	16-66
28012	Hässleholm	4,192	83	0.93	0.75-1.15	47	24-57
50001	Sahlgrenska	263	7	0.93	0.52-1.67	48	9-75
65016	Sunderby	200	5	0.94	0.50-1.78	49	8-76
11015	Nacka-Proxima	428	5	0.95	0.50-1.79	50	8-77
56012	Köping	897	22	0.97	0.66-1.43	51	18-69
11011	Södertälje	1,047	23	1.02	0.70-1.49	52	21-70
13011	Nyköping	761	15	1.02	0.66-1.60	53	18-73
57011	Mora	1,132	23	1.03	0.70-1.49	54	22-70
42010	Halmstad	1,371	31	1.04	0.74-1.46	55	24-69
11013	Löwenströmska*	2,117	41	1.05	0.78-1.41	56	28-68
10013	Södersjukhuset	2,013	41	1.08	0.81-1.45	57	31-69
62010	Sundsvall	1,008	24	1.11	0.76-1.60	58	26-73
23010	Växjö	876	21	1.12	0.76-1.65	59	25-75
52013	Skene	718	19	1.17	0.78-1.77	60	28-77
27011	Karlshamn	1,659	41	1.21	0.90-1.62	61	38-74
10015	Sophiahemmet	796	26	1.23	0.86-1.76	62	35-77
51011	Mölndal	994	21	1.25	0.85-1.85	63	34-79
21013	Norrköping	726	16	1.26	0.82-1.95	64	31-80
64010	Skellefteå	719	19	1.27	0.85-1.91	65	34-79
63010	Östersund	990	26	1.32	0.92-1.89	66	41-79
54014	Torsby	783	22	1.33	0.91-1.95	67	39-80
41011	Trelleborg	3,997	100	1.36	1.11-1.65	68	53-75
65013	Piteå	1,866	49	1.36	1.04-1.78	69	49-78
26010	Visby	657	19	1.37	0.91-2.05	70	40-81
50020	Gothenburg Med Center**	570	18	1.41	0.93-2.14	71	42-82
54012	Arvika	996	30	1.55	1.11-2.17	72	54-82
41010	Landskrona	293	16	1.59	1.03-2.46	73	49-83
61010	Gävle	548	21	1.62	1.10-2.39	74	53-83
12001	Akademiska sjukhuset	954	40	1.63	1.21-2.20	75	60-82
23011	Ljungby	755	27	1.64	1.15-2.33	76	56-83
51012	Kungälv	1,284	47	1.68	1.27-2.21	77	63-82
51010	Uddevalla	1,541	53	1.71	1.32-2.23	78	64-82
41001	Lund	125	9	1.85	1.08-3.15	79	53-83
11012	Norrtälje	688	31	1.87	1.34-2.63	80	65-83
10016	Ortopediska huset	2,825	119	1.9	1.59-2.28	81	72-83
61011	Bollnäs	1,877	74	1.91	1.52-2.39	82	71-83
61012	Hudiksvall	575	27	1.99	1.40-2.83	83	67-83

* 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

Patients, prophylaxis and technique 2010–2012

Since 2009 the register has gathered information about the patients (BMI, ASA, previous surgery), the antibiotic and antithrombotic prophylaxis and the surgical technique. The following data concern primary knees reported in 2010-2012.

Previous surgery

Reporting previous surgery of the index knee, it is possible to mark more than one alternative. No previous surgery was reported in 79% of cases, 21% 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 (%)	2010	2011	2012
None	78.9	78.7	78.9
Osteosynthesis	1	1.1	0.7
Osteotomy	2.1	2	1.9
Menisceal surgery	7.8	7.5	7.5
Cruciate ligament surgery	1	1.5	1.7
Arthroscopy	5.3	6.3	5.6
Other	2.3	1.9	2.2
Missing	1.6	1	1.5
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, 84% of the patients are reported being healthy or only having a mild systemic disease (grade I or II)

ASA classification

Type (%)	2010	2011	2012
ASA I	19.6	19.6	19.0
ASA II	64.2	63.6	65.0
ASA III	14.9	16.4	15.6
ASA IV	0.3	0.2	0.2
ASA V	0	0	0
Missing	1.0	0.2	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. 2.2% 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 (%)	2010	2011	2012
<25	18.3	19.5	18.3
25-29.9	42.8	43.1	43.3
30-39.9	35.4	34.8	36.0
≥40	2.5	2.3	2.2
Missing	1.0	0.3	0.2
Total	100	100	100

Body Mass Index (kg/m^2)

Gender BMI (median):	2010	2011	2012
Males	28.1	29.2	28.1
Females	28.9	28.6	28.8
All	28.6	29.0	28.4

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 peroral drugs and when using them, treatment is started 1-4 hours and 6-10 hours after surgery respectively. In 2012 the use of Pradaxa decreased somewhat while Xarelto increased slightly as compared to 2011.

Trombosprofylax

Type (%)	2010	2011	2012
No prophylaxis	0.1	0.1	0.1
Fragmin pre-op	13.0	10.1	11.1
Fragmin post-op	27.0	24.8	28.4
Inohep pre-op	11.3	13.8	10.2
Inohep post-op	16.8	19.4	19.3
Klexane pre-op	6.0	5.3	6.4
Klexane post-op	6.5	7.4	8.0
Xarelto	5.2	3.8	5.5
Pradaxa	12.5	14.9	10.7
Other	0.2	0.2	0.1
Missing	1.4	0.2	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 (%)	2010	2011	2012
No prophylaxis	0.1	0.1	0.1
1-7	8.9	7.5	6.5
8-14	77.0	78.7	79.4
15-21	4.1	5	6.0
22-28	5.9	6.3	5.4
29-35	1.6	1.1	1.3
>35	0.5	0.4	0.5
Missing	1.9	0.9	0.8
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 (%)	2010	2011	2012
Cloxacillin	88.4	89.7	89.9
Dalacin	7.2	7.6	7.6
Cefalosportin	3.7	2.4	2.3
Vancomycin	0	0.1	<0.1
Other	0.1	0.1	<0.05
Missing	0.6	0.1	<0.05
Total	100	100	100

Cloxacillin - dose

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

Cloxacillin dose

Dose	2010	2011	2012
Cloxacillin 2gx3	58.8	59.8	64.1
Cloxacillin 2gx4	32.6	30.9	31.1
Cloxacillin 1gx3	2.1	2.1	2.2
Cloxacillin 1gx4	2.3	1.8	0.6
Cloxacillin 2g+1g+1g	0.7	2.2	0.1
Cloxacillin annan dos	2.2	2.5	1.7
Dose missing	1.3	0.7	0.2
Total	100	100	100

Antibiotic - 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. Thus, it is important for them to be administrated within a reasonable time limit. i.e. 15-45 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. 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 2010 and 2011. During 2012 we observed a slight detoriation with 82% of the units (table below) reporting antibiotics being administrated within the recommended timeframe (information missing for 0.6%). However, in April 2012 an updated reporting form was introduced. Instead of stating the number of minutes prior to surgery that the administration was started, the definite time was to be given This may have provided more accurate information on the timing because it is the definite time for administration which is recorded in the anesthetist medical list or electronic case record.

Antibiotic - time of administration

Minutes pre-op. (%)	2010	2011	2012
0-14	4.4	4.4	6.0
15-45	81.3	86.8	82.5
>45	11.9	7.7	10.3
Start after surgery	0.7	0.7	0.6
Missing	1.7	0.4	0.6
Total	100	100	100

Patients, prophylaxis and technique (cont.)

Anesthesia

Spinal anesthesia was the most common form of anesthesia, being used in 85% of cases. General anesthesia was used in 10% of cases while epidural anesthesia accounted for only 1%. Combination treatments have started to appear, e.g. a combination of spinal and epidural anesthesia (SPEDA).

Type of anesthesia

Type (%)	2010	2011	2012
General	10.1	9.8	10.9
Epidural	0.9	0.6	0.3
Spinal	87.5	89.3	85.5
Combination			3.0
Other	0.7	0.2	0.2
Missing	0.8	0.1	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 a tourniquet as only a good 13% of the arthroplaties were performed without. This is a slight increase as compared to 2011.

Drainage was only used in barely 25% of cases in 2012 which is a slight reduction as compared to the previous years.

Tourniquet and drainage

Tourniquet (%)	2010	2011	2012
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 (%)	2010	2011	2012
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 1.5% of cases, mostly for the femur. Information on bone transplantation was missing in 0.4% of the reports.

Computer aided surgery (CAS)

Only 0.4% of the cases (57 surgeries) were reported as having been performed using CAS. 75% of the surgeries were performed at 4 hospitals (Hässleholm, Huddinge, Karolinska and Umeå) although the method was tested at 18 units which is slightly more than during 2011. CAS was more often used for TKA than for UKA.

In Norway the use of CAS in TKA has lessened from 21% i 2008 to 9% in 2012 and no UKA's were performed with the help of CAS.

Custom made instruments

Since April 2012 we have registered the use of custom made instruments, specially adapted to the patient using MR or CT examinations. The method has only been reported for few (77) cases.

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 90% of the patients having LIA in 2012. In 33% of the cases (with or without LIA) a catheter was left in the knee which is a reduction of 10% as compared to 2011.

Local infiltration analgesia - LIA

Type (%)	2010	2011	2012
None	4.2	4.1	3.3
LIA	49.8	54.5	62.8
Only catheter	10.8	8.4	6.2
LIA+catheter	34.2	32.7	27.5
Missing	1.0	0.3	0.2
Total	100	100	100

Operating time

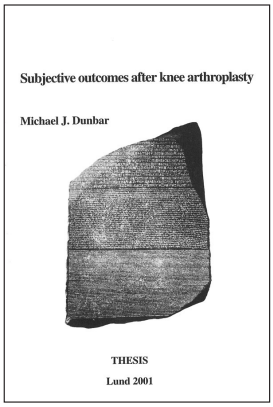
In 2012, the median time for the operations was 134 min. for linked implants, 77 min. for TKA´s, 75 min. for UKA´s and 66 min. for femoro-patellar implants. As compared to 2011, the time was approximately the same for TKA, UKA as well as the 42 femoro-patellar implants.

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.

PROM data

Within the Region of Skåne PROMs are used as a quality measure of the care provided. In the 2011 report we accounted for PROM data gathered 2008-2009 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.

In the 2012 report we had expanded the project with an additional year from Trelleborg as well as with data from Hässleholm regarding 2009-2010. On the individual level we found large variations in our PROM data while the variation when comparing the 2 of the largest arthroplasty units in Sweden was small, in spite of some differences in case-mix.

The PROM project has again been expanded to include an additional year from Trelleborg and Hässleholm, data gathered in Lund and Malmö (2008-2011) as well as Helsingborg and Ängelholm (2010-2011). 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

In Hässleholm, the proportion of men having TKA was higher than in Trelleborg (table's right) but on a national level the proportion of patients having TKA for OA was 42%. The proportion of healthy patients (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 Hässleholm being ASA III. Both hospitals had somewhat lower proportion of ASA III patients (TKA/OA) than the national average. (16%). The difference between the hospitals with respect to other case-mix factors was small. Lund which is a university clinic differs with respect to case-mix as compared to the two elective arthroplasty units. In Lund there was a somewhat lower proportion of women that also were younger (the national mean age for women is 69). According to the WHO classification the patients are overweight and more than 50% of them were classified as ASA III. The case-mix for the units with low answering rate is not accounted for as the results are not representative for the hospitals.

Case-mix classification

Gender	**Male / Female**	
Age		
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**

Description of patients in Hässleholm

	All	**Males**	**Females**
	n=1,209	**n=440**	**n=769**
		(36%)	**(64%)**
Age (years)			
Mean	**68.7**	**68.9**	**68.4**
SD	**8.9**	**8.6**	**9.2**
BMI (kg/m2)			
Mean	**28.5**	**28.3**	**28.8**
SD	**4.1**	**3.5**	**4.6**
Charnley category (n (%)			
A	**418 (29.8)**	**217 (31.9)**	**201 (27.7)**
B	**402 (28.6)**	**213 (31.4)**	**189 (26.1)**
C	**584 (41.6)**	**249 (36.7)**	**335 (46.2)**
ASA classification n (%)			
ASA I	**358 (26.1)**	**169 (25.4)**	**189 (26.8)**
ASA II	**814 (59.4)**	**388 (58.4)**	**426 (60.3)**
ASA III	**199 (14.5)**	**108 (16.2)**	**91 (12.9)**

Description of patients in Trelleborg

	All	Males	Females
	n=1,652	n= 614 (37.2%)	n=1,038 (62.8%)
Age (years)			
Mean	69.6	69.2	69.8
SD	8.6	8.5	8.6
BMI (kg/m2)			
Mean	29.1	28.5	29.5
SD	4.8	4	5.3
Charnley category (n (%)			
A	425 (27.3)	201 (32.7)	251 (24.2)
B	510 (30.9)	188 (30.6)	322 (31)
C	690 (41.8)	225 (36.7)	465 (44.8)
ASA classification n (%)			
ASA I	297 (19.6)	117 (20.8)	180 (18.8)
ASA II	1,033 (68.0)	375 (66.6)	658 (68.8)
ASA III	189 (12.4)	71 (12.6)	118 (12.4)

Description of patients in Lund

	All	Males	Females
	n=29	n= 16	n=13
Age (years)			
Mean	67.2	69.8	64.2
SD	14.2	9.7	18.2
BMI (kg/m2)			
Mean	30.2	30.1	30.4
SD	5.5	6.2	4.7
Charnley category (n (%)			
A	13	7	9
B	6	5	1
C	10	4	6
ASA classification n (%)			
ASA I	2	1	1
ASA II	11	6	5
ASA III	16	9	7

Patient selection

Primary TKA are included in the project. Diagnoses other than OA were excluded as well as the second knee in case of both knees having had an 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 80% of the patients operated for TKA/OA m Trelleborg Hässleholm were availiable for evaluation. In Helsingborg Ängelholm and Malmö the response rate was low (18-66%).

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 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.

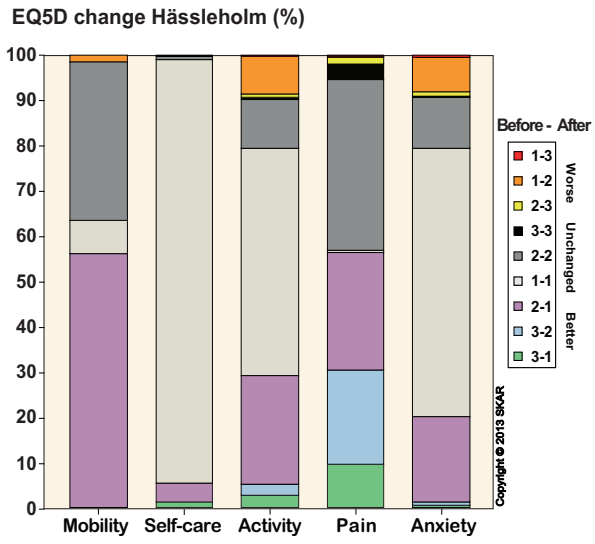
A preoperative answer of extreme problems can be unchanged at the follow-up (3-3) or there can be an improvement from extreme to moderate (3-2) or from extreme to none (3-1).

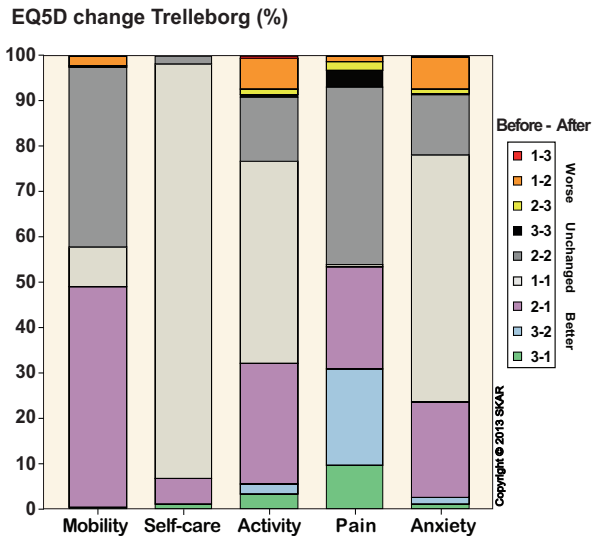
Moderate problems can stay unchanged (2-2), worsen into extreme (2-3) or improve to none (2-1). Finally no problems preoperatively can stay unchanged (1-1), worsen to moderate (1-2) or become extreme (1-3).

For Hässleholm, Trelleborg and Lund 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 post-operative answers.

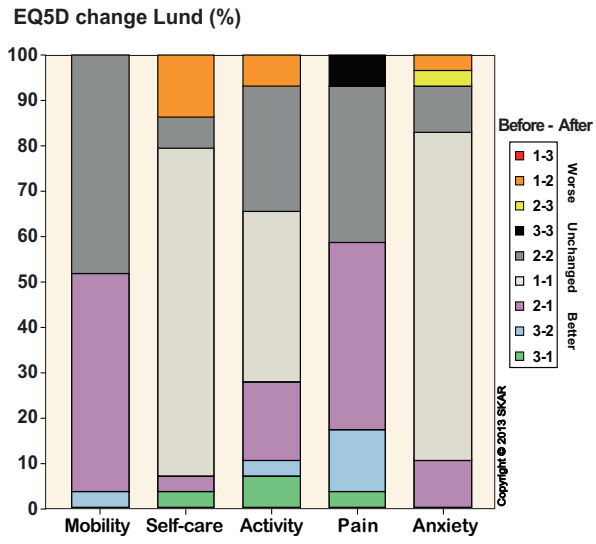
It can be seen that one year after surgery, half of the patients had improved mobility and half of them had experienced pain relief. Only a third had improved in their usual activities, some had reduced anxiety but only a few improved in self-care.

The proportion of patients, that for each dimension of the EQ5D had changed (improved or worsened) or stayed unchanged, differed negligibly (0.1%-3.5%) between Trelleborg and Hässleholm. Lund had so few patients that percentages may give misleading results.





The distribution (%) i 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)

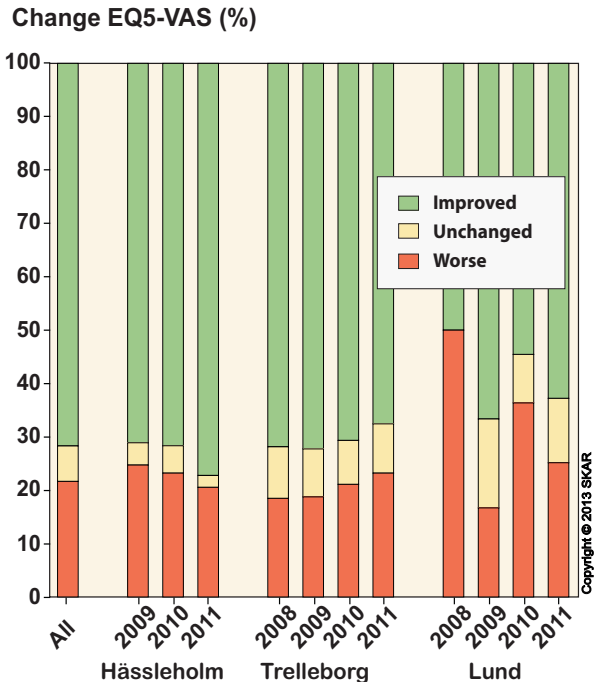


EQ-VAS

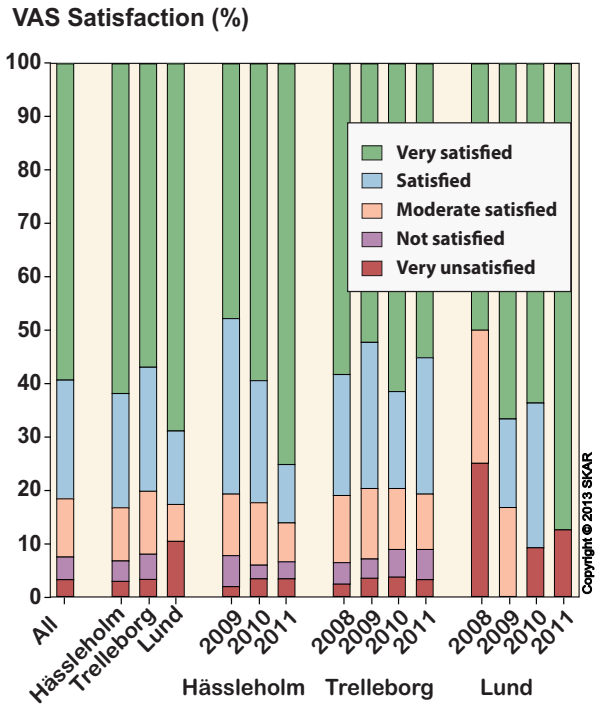
When evaluating the change in pre- and postoperatve general health, as measured by EQ-VAS, the difference between Trelleborg and Hässleholm, as well as between the different years of surgery was small (3-5 points). For Lund the results vary more when the patients are split beween the different years of surgery (fig. upper, left, next page).

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).



The change (%) in general health (EQ5D VAS) one year after surgery for all the patients, for the 3 hospitals as well as for the different years of surgery.



The distribution (%) for each level of satisfaction one year after surgery for all the patients, for the 3 hospitals as well as for the different year of surgery.

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 (0-7 points) as well as for the different years of operation. In Lund the patients reported preoperatively more knee related pain, other problems as well as more problems with the activities of daily living (5-7 points) than in Trelleborg and Hässleholm. However, postoperatively the differences were small, sport and recreation being the exception (8 points). The results between the different years varied more in Lund as there were fewer patients available (page 61).

VAS – Satisfaction with the arthroplasty surgery

One year after surgery, 92% of the patients reported how satisfied they were. Of these, 80% said they were very satisfied or satisfied. The variation between Trelleborg, Hässleholm and Lund was small. However, for Lund there was more variation between the different years of surgery (fig. upper, right) due to the few patients each year.

The mean value for Trelleborg and Hässleholm was quite similar but for the other units there was a greater variation (see next page).

<u>*Summary*</u>

In spite of some differences in case-mix, 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. However, for the other units with relatively few surgeries the results varied, both for Lund that had a high response rate and for Helsingborg, Ängelholm and Malmö that had a larger number of drop-outs. This makes it hard to interpret and compare results of different units as well as of years of surgery.

The autumn 2012 the units in Norrköping and Motala joined the project and Oskarshamn started to gather data at the turn of the year 2012/2013. The information is gathered locally and entered into a common database.

This pilot project may become a basis for further discussions regarding patient reported outcome on hospital level and register level, as well as how it can be used for clinical quality improvement projects and by the authorities.

Results for EQ-VAS and VAS–pain preoperatively as well as 1-year postoperatively as well as satisfaction with the surgery 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	3,230	58 (15)	19 (20)	59 (21)	76 (20)	2,973	21 (23)
Hospital (all years combined)							
Hässleholm	1,404	58 (15)	19 (20)	59 (21)	76 (20)	1,310	21 (23)
Trelleborg	1,652	62 (16)	21 (21)	62 (21)	76 (20)	1,507	24 (23)
Lund	29	54 (17)	17 (23)	61 (18)	70 (28)	29	21 (29)
Ängelholm	97	65 (13)	22 (23)	59 (29)	69 (28)	97	21 (26)
Helsingborg	23	67 (15)	30 (25)	58 (22)	60 (26)	23	30 (30)
Malmö	7	74 (13)	32 (31)	50 (27)	67 (24)	7	33 (35)
Year of sugery (all patients)							
2008	358	62 (16)	21 (20)	61 (21)	76 (19)	358	23 (23)
2009	904	60 (17)	19 (20)	60 (22)	76 (20)	702	27 (22)
2010	927	60 (15)	20 (20)	60 (21)	75 (21)	876	23 (24)
2011	1,041	59 (16)	20 (21)	60 (22)	75 (21)	1,041	20 (24)
Hässleholm (each year)							
2009	486	57 (16)	19 (19)	60 (21)	75 (20)	391	26 (21)
2010	428	58 (15)	19 (20)	58 (21)	76 (19)	427	21 (23)
2011	492	57 (15)	18 (20)	59 (22)	76 (21)	492	17 (23)
Trelleborg (each year)							
2008	352	62 (16)	21 (20)	61 (21)	76 (19)	348	22 (22)
2009	411	62 (18)	20 (21)	61 (22)	78 (19)	303	28 (22)
2010	436	62 (15)	21 (21)	63 (20)	75 (20)	385	24 (25)
2011	453	61 (17)	21 (21)	63 (22)	75 (21)	453	23 (24)
Lund (each year)							
2008	4	59 (18)	28 (30)	68 (12)	55 (48)	4	39 (40)
2009	6	64 (13)	17 (27)	51 (20)	75 (29)	6	19 (19)
2010	11	51 (13)	16 (23)	64 (8)	68 (23)	11	19 (27)
2011	8	48 (22)	13 (20)	61 (20)	77 (23)	8	16 (34)
Ängelholm (each year)							
2010	42	65 (12)	22 (22)	62 (24)	65 (29)	42	20 (23)
2011	55	65 (14)	22 (25)	57 (22)	72 (27)	55	22 (28)
Helsingborg (each year)							
2010	11	71 (10)	24 (20)	51 (22)	55 (30)	11	30 (29)
2011	12	64 (18)	35 (29)	64 (20)	65 (22)	12	29 (32)

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	3,230	41 (16)	78 (22)	48 (18)	74 (20)	46 (16)	76 (22)	11 (14)	34 (26)	23 (15)	62 (25)
Hospital (all years combined)											
Hässleholm	1,404	39 (15)	77 (23)	47 (18)	75 (21)	44 (15)	77 (23)	11 (13)	34 (26)	23 (15)	62 (26)
Trelleborg	1,652	43 (16)	79 (21)	48 (17)	74 (20)	47 (17)	77 (21)	11 (15)	34 (27)	23 (14)	62 (25)
Lund	29	46 (18)	80 (22)	56 (20)	74 (22)	50 (20)	72 (27)	10 (12)	26 (31)	23 (14)	62 (28)
Ängelholm	97	39 (15)	77 (22)	45 (17)	74 (18)	44 (14)	76 (22)	11 (15)	32 (25)	21 (13)	59 (25)
Helsingborg	23	33 (17)	67 (29)	44 (17)	67 (22)	40 (21)	66 (27)	5 (7)	23 (22)	13 (9)	45 (27)
Malmö	7	36 (12)	67 (29)	53 (21)	66 (28)	40 (12)	71 (26)	1 (2)	29 (35)	19 (10)	48 (35)
Year of sugery (all patients)											
2008	358	42 (16)	79 (19)	49 (18)	75 (18)	47 (16)	78 (19)	11 (15)	31 (26)	23 (14)	61 (24)
2009	904	40 (17)	80 (20)	47 (18)	76 (18)	45 (17)	78 (20)	11 (14)	35 (26)	23 (16)	64 (24)
2010	927	41 (15)	79 (19)	47 (16)	74 (18)	45 (15)	76 (20)	11 (13)	34 (26)	23 (14)	63 (24)
2011	1,041	42 (16)	75 (26)	49 (18)	71 (25)	47 (17)	73 (27)	12 (15)	33 (27)	23 (14)	60 (28)
Hässleholm (each year)											
2009	485	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)	48 (16)	76 (17)	44 (13)	76 (20)	10 (13)	34 (25)	23 (13)	63 (23)
2011	492	41 (15)	73 (29)	48 (18)	71 (27)	45 (16)	72 (29)	12 (13)	33 (27)	23 (14)	60 (30)
Trelleborg (each year)											
2008	352	42 (16)	79 (19)	49 (16)	75 (18)	47 (16)	78 (19)	11 (15)	32 (26)	23 (14)	61 (24)
2009	411	42 (17)	81 (19)	48 (17)	76 (19)	47 (18)	79 (18)	11 (15)	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)
2011	453	44 (17)	76 (24)	49 (18)	71 (23)	48 (18)	75 (24)	12 (16)	33 (27)	23 (15)	60 (26)
Lund (each year)											
2008	4	49 (24)	76 (29)	58 (23)	78 (22)	52 (31)	67 (32)	19 (14)	31 (34)	22 (16)	60 (41)
2009	6	40 (14)	84 (17)	56 (29)	77 (14)	44 (8)	73 (28)	8 (10)	20 (26)	25 (12)	63 (25)
2010	11	47 (19)	78 (24)	53 (21)	64 (27)	51 (22)	73 (24)	7 (10)	22 (33)	21 (12)	58 (28)
2011	8	46 (19)	83 (21)	58 (14)	83 (16)	52 (20)	73 (33)	13 (13)	32 (36)	25 (18)	69 (28)
Ängelholm (each year)											
2010	42	39 (16)	77 (22)	46 (16)	74 (14)	44 (14)	77 (21)	9 (9)	29 (22)	23 (14)	61 (23)
2011	55	39 (15)	77 (22)	44 (17)	73 (19)	44 (15)	75 (23)	12 (18)	34 (27)	19 (13)	58 (26)
Helsingborg (each year)											
2010	11	27 (14)	66 (31)	41 (16)	65 (25)	32 (17)	65 (31)	5 (7)	30 (27)	9 (4)	46 (29)
2011	12	39 (18)	68 (27)	47 (19)	69 (19)	47 (22)	66 (24)	6 (8)	16 (14)	17 (10)	45 (26)

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 (e.g. Ekvacillin), the dose (e.g. 2g) and the number of times per day it is to be given.
Specify the exact time at which the preoperative injection was started (e.g. 07:45). In case the injection was given after the operation started, then also specify the time.
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

Instructions for filling out the Knee Osteotomy Register 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 Osteotomy:
Mark "Yes" or "No".
Revision is defined as a re-operation of a prevous osteotomy. However, knee arthroplasty is not to be reported on this form but on the arthroplasty form.

Type of primary knee osteotomy:
Mark an alternative för the method/technique used.

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

Preoperative HKA angle:
Note the varus, respektive the valgus hip-kne-ankle angle as measured preoperatively on long X-rays.

Preoperative X-ray grading of OA:
Note the preoperative X-ray grading of the osteoarthritis stage according to the Ahlbäck system.

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 re-operation:
Mark if the re-operation was re-osteotomy or removal of osteosynthesismaterial and/or write som other surgery as a free text..

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

Name of the fixation:
For external fixation provide the name of the intstrument and place any stickers concerning the pins on the back of the form.
For nternal fixation a neme does not have to be specified if the iimplant stickers are attached to the back of the form.

Bone transplantation:
Mark "No" or use the relevant alternatives for the type of bone that has been use. If a synthetic bone was used place any enclosed stickers on the back of the form.

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

Angulation gauge/meter
Write the name of any mechanical gauge that was used to evaluate the amount of correction during surgery

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

Other coincident surgery during the osteotomy:
State what other surgery was performed at the same time as the osteotomy (e.g. arthroscopy, cruciat ligament reconstruction).

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.

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 (e.g. Ekvacillin), the dose (e.g. 2g) and the number of times per day it is to be given.
Specify the exact time at which the preoperative injection was started (e.g. 07:45). In case the injection was given after the operation started, then also specify the time.
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:
For any ostesynthesis material, pins and synthetic bone that was used during surgery, place enclosed stickers on the back of the form.

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

The Knee Osteotomy Register
Rörelseorganens forskningsavdelning
Klinikgatan 22, Wigerthuset, plan2
Universitetssjukhuset i Lund
221 85 Lund
tel. 046-171345

Patient ID: |1|9| | | | | | |-| | | |
(Unique social security number which includes date of birth)

From: Hospital name (institution No.) /

To be used for osteotomies around the knee

Date of surgery (y.m.d) |2|0| | | | | |

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 knee osteotomy
☐ 1 Open wedge HTO - internal fixation
☐ 2 Open wedge HTO - external fixation
☐ 3 Closed wedge HTO
☐ 4 Curved / Dome HTO
☐ 5 Distal femur osteotomy
☐ 6 Other (what).....

Reason for the primary knee osteotomy
If more than one reason, mark the main reason
☐ 1 OA medially
☐ 2 OA laterally
☐ 3 Congenital deformity
☐ 4 Acquired deformity (not OA)
☐ 5 Osteonecrosis.
☐ 6 Other (what) .....

Preoperative HKA angle:
..... º Varus ..... º Valgus

Preoperative X-ray grading of OA:
☐ 0 Ahlbäck 1 ☐ 1 Ahlbäck 2
☐ 2 Ahlbäck 3 ☐ 3 Ahlbäck 4
☐ 4 Ahlbäck 5

Previous surgery of the index knee:
☐ 0 Nej ☐ 1 Osteosynthesis
☐ 2 Fracture surgery ☐ 3 Menisceal surgery
☐ 4 Cruciate lig. surgery ☐ 5 Arthroscopy
☐ 6 Other (what) .....

Type of re-operation:
☐ 1 Re-osteotomi
☐ 2 Removal of osteosynthesis material
☐ 3 Other type (what) .....

Reason for re-operation:
If more than one reason, mark the main reason
☐ 1 Loss of correction
☐ 2 Correction was to small
☐ 3 Correction was to large
☐ 4 Delayed healing
☐ 5 Pseudarthrosis
☐ 6 Other (what) .....

Name of the fixation: .....
(ot needed when implant stickers are provided on the other side)

Bone transplantation:
☐ 0 **No** ☐ 1 **Pat. own** ☐ 2 **Biobank** ☐ 3 **Synthetic bone** (whatt)
.....

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

Angulation guide: ☐ 0 Nej ☐ 1 Ja what.....

Drainage: ☐ 0 No ☐ 1 Yes

Other coincident surgery
☐ 1 Arthroscopy
☐ 2 Cruciate ligament reconstruction
☐ 3 Other (what) .....

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

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

Tourniquet: ☐ 0 No ☐ 1 Yes

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
stickers on the back side !!

In case of revision:
Send a copy of the op.report & discharge letter

Publications :

Juréus J, Lindstrand A, Geijer M, Robertsson O, Tägil M.
The natural course of spontaneous osteonecrosis of the knee (SPONK)
Acta Orthop. 2013 Jun 25 [Epub ahead of print].

Stefánsdóttir A, Johansson A, Lidgren L, Wagner P, W-Dahl A
Bacterial colonization and resistance patterns in 133 patients undergoing a primary hip- or knee replacement in Southern Sweden.
Acta Orthop. 2013 Feb;84(1):87-91

Lidgren L, Alriksson-Schmidt A, Ranstam J
ArthroplastyWatch--beyond borders, beyond compliance.
BMJ. 2013 Feb 19;346:f1013.

Wagner P, Olsson H, Ranstam J, Robertsson O, Zheng MH, Lidgren L.
Metal-on-metal joint bearings and hematopoetic malignancy.
Acta Orthop. 2012 Dec;83(6):553-8

W-Dahl A, Robertsson O, Lohmander LS.
High tibial osteotomy in Sweden, 1998-2007: a population-based study of the use and rate of revision to knee arthroplasty.
Acta Orthop. 2012 Jun;83(3):244-8.

Carr AJ, Robertsson O, Graves S, Price AJ, Arden NK, Judge A, Beard DJ.
Knee replacement.
Lancet. 2012 Apr 7;379(9823):1331-40. Review.

Robertsson O, Mendenhall S, Paxton EW, Inacio MCS, Graves SE.
Challenges in Prosthesis Classification.
J Bone Joint Surg Am. 2011;93 Suppl 3(E):72-5.

Namba RS, Inacio MC, Paxton EW, Robertsson O, Graves SE.
The role of registry data in the evaluation of mobile-bearing total knee arthroplasty.
J Bone Joint Surg Am. 2011 Dec 21;93 Suppl 3:48-50.

Havelin LI, Robertsson O, Fenstad AM, Overgaard S, Garellick G, Furnes O.
A Scandinavian Experience of Register Collaboration: The Nordic Arthroplasty Register Association (NARA).
J Bone Joint Surg Am. 2011;93 Suppl 3(E):13-9.

Ranstam J, Robertsson O, W-Dahl A, Löfvendahl S, Lidgren L.
EQ-5D – ett svårtolkat instrument för kliniskt förbättringsarbete.
Läkartidningen 2011; 108 (36): 1707-8.

W-Dahl A, Robertsson O, Stefánsdóttir A, Gustafson P, Lidgren L.
Timing of preoperative antibiotics for knee arthroplasties: Improving the routines in Sweden.
Patient Saf Surg. 2011 Sep 19;5:22.

Ranstam J, Kärrholm J, Pulkkinen P, Mäkelä K, Espehaug B, Pedersen AB, Mehnert F, Furnes O; NARA study group.
Statistical analysis of arthroplasty data. II. Guidelines.
Acta Orthop. 2011 Jun;82(3):258-67

Ranstam J, Kärrholm J, Pulkkinen P, Mäkelä K, Espehaug B, Pedersen AB, Mehnert F, Furnes O; NARA study group.
Statistical analysis of arthroplasty data. I. Introduction and background.
Acta Orthop. 2011 Jun;82(3):253-

Korosh Hekmat, Lennart Jacobsson, Jan-Åke Nilsson, Ingemar F Petersson, Otto Robertsson, Göran Garellick and Carl Turesson.
Decrease in the incidence of total hip arthroplasties in patients with rheumatoid arthritis – results from a well-defined population in south Sweden.
Arthritis Res Ther. 2011 Apr 21;13(2):R67.

Wagner P, Olsson H, Lidgren L, Robertsson O, Ranstam J.
Increased cancer risks among arthroplasty patients: 30year follow-up of the Swedish Knee Arthroplasty Register.
Eur J Cancer. 2011 May;47(7):1061-71.

Jämsen E, Furnes O, Engesaeter LB, Konttinen YT, Odgaard A, Stefánsdóttir A, Lidgren L
Prevention of deep infection in joint replacement surgery.
Acta Orthop. 2010 Dec;81(6):660-6. Review.

W-Dahl A, Robertsson O, Lidgren L.
Surgery for knee osteoarthritis in younger patients.
Acta Orthop. 2010 Apr;81(2):161-4.

W-Dahl A, Robertsson O, Lidgren L, Miller L, Davidson D, Graves S.
Unicompartmental knee arthroplasty in patients aged less than 65.
Acta Orthop. 2010 Feb;81(1):90-4.

Robertsson O, Bizjajeva S, Fenstad AM, Furnes O, Lidgren L, Mehnert F, Odgaard A, Pedersen AB, Havelin LI.
Knee arthroplasty in Denmark, Norway and Sweden.
Acta Orthop. 2010 Feb;81(1):82-9.

Ranstam J, Robertsson O.
Statistical analysis of arthroplasty register data.
Acta Orthop. 2010 Feb;81(1):10-4.

Knutson K, Robertsson O.
The Swedish Knee Arthroplasty Register (www.knee.se).
Acta Orthop. 2010 Feb;81(1):5-7.

Stefánsdóttir A, Robertsson O, W-Dahl A, Kiernan S, Gustafsson P, Lidgren L.
Inadequate timing of prophylactic antibiotics in orthopaedic surgery: We can do better.
Acta Orthop. 2009 Dec;80(6):633-8.

Stefánsdóttir A, Johansson D, Knutson K, Lidgren L, Robertsson O.
Microbiology of the infected knee arthroplasty. Report from the Swedish Knee Arthroplasty Register on 426 surgically revised cases.
Scand J Infect Dis. 2009;41(11-12):831-840

Tarasevicius S, Stucinskas J, Robertsson O, Wingstrand H.
Introduction of total knee arthroplasty in Lithuania: Results from the first 10 years.
Acta Orthop. 2009 Feb;80(1):51-4

Stefánsdóttir A, Lidgren L, Robertsson O.
Higher Early Mortality with Simultaneous Rather than Staged Bilateral TKAs: Results From the Swedish Knee Arthroplasty Register.
Clin Orthop Relat Res 2008; 466: 3066-3070.

Lidgren L, Robertsson O.
Wear and joint registers: Can national joint implant registers detect unexpected tribological failures?
Tribos Newsletter 2008; Nr 4: 4-5.

Ranstam J, Wagner P, Robertsson O, Lidgren L.
Healthcare quality registers: outcome-oriented ranking of hospitals is unreliable.
J Bone Joint Surg (Br) 2008;90-B:1558-61

Ranstam J, Wagner P, Robertsson O, Lidgren L.
Ranking in health care results in wrong conclusions.
Lakartidningen 2008; Aug 27-Sep 2;105 (35): 2313-4.

Robertsson O and Lidgren L.
The short-term results of 3 common UKA implants during different time periods in Sweden.
J Arthroplasty 2008 Sep; 23 (6): 801-7.

Lidgren L.
Chronic inflammation, joint replacement and malignant lymphoma.
J Bone Joint Surg Br 2008 Jan; 90 (1): 7-10.

Robertsson O.
Knee Arthroplasty Registers. Review.
J Bone Joint Surg (Br) 2007; 89-B: 1-4.

Robertsson O, Stefánsdóttir A, Ranstam J, Lidgren L.
Increased long-term mortality in patients less than 55 years old who have undergone knee replacement for osteoarthritis.
J Bone Joint Surg (Br) 2007 ; 89-B: 599-603.

Robertsson O, Ranstam J and Lidgren L.
Variation in outcome and issues in ranking hospitals: An analysis from the Swedish Knee Arthroplasty Register.
Acta Orthop 2006 Jun;77 (3): 487-93.

Bremander AB, Dunbar M, Knutson K, Petersson I F, Robertsson O.
Revision in previously satisfied knee arthroplasty patients is the result of their call on the physician, not on pre-planned follow-up: A retrospective study of 181 patients who underwent revision within 2 years.
Acta Orthop 2005 Dec; 6 (76): 785-90

Lidgren L, Robertson O.
Acrylic bone cements: clinical developments and current status: Scandinavia.
Orthop Clin North Am 2005 Jan; 36(1): 55-61. vi. Review.

Harrysson O L, Robertsson O, Nayfeh J F.
Higher Cumulative Revision Rate of Knee Arthroplasties in Younger Patients with Osteoarthritis.
Clin Orthop 2004 Apr; 1 (421): 162-168.

Dunbar M J, Robertsson O, Ryd L.
What's all that noise? The effect of co-morbidity on health outcome questionnaire results after knee arthroplasty.
Acta Orthop Scand 2004 Apr; 75 (2): 119-26.

Robertsson O, Ranstam J.
No bias of ignored bilaterality when analysing the revision risk of knee prostheses: analysis of a population based sample of 44,590 patients with 55,298 knee prostheses from the national Swedish Knee Arthroplasty Register.
BMC Musculoskelet Disord 2003 Feb 05; 4 (1): 1.

Lidgren L.
Arthroplasty and its complications.
In: Rheumatology, 3rd edition (Ed. Hochberg M C, Silman A J, Smolen J S, Weinblatt M E, Weissman M H). Mosby 2003; 1055-1065.

Lidgren L, Knutson K, Stéfansdóttir A.
Infection of prosthetic joints.
Best Pract Res Clin Rheumatol 2003; 17 (2): 209-218.

Lidgren L.
Arthroplasty and its complications.
In: Osteoarthritis, 2nd ed. (Eds. Brandt K D, Doherty M, Lohmander L S). Oxford Univerity Press, 2003; 9.19: 361-70.

Robertsson O, Knutson K.
Knee arthroplasty registers.
Prothéses totales du genou. Ed. by Roger Lemaire and Jacques Witvoet.
Éditions scientifiques et médicales Elsevier SAS, 2002.

Dunbar M J, Robertsson O, Ryd L, Lidgren L.
Appropriate Questionnaires for Knee Arthroplasty.
J Bone Joint Surg [Br] 2001; 83-B: 339-44.

Knutson K.
Arthroplasty and its complications.
In: Osteoarthritis 2nd ed (Eds. Brandt K D, Doherty M, Lomander LS).
Oxford University Press 2001;

Lindstrand A, Robertsson O, Lewold S, Toksvig-Larsen S.
The patella in total knee arthroplasty: resurfacing or non-resurfacing of patella.
Knee Surg Sports Traumatol Arthrosc 2001; 9 Suppl 1: S21-3.

Robertsson O, Knutson K, Lewold S, Lidgren L.
The Swedish Knee Arthroplasty Register 1975-1997: an update with special emphasis on 41,223 knees operated on in 1988-1997.
Acta Orthop Scand 2001; Oct;72 (5): 503-13.

Robertsson O, Knutson K, Lewold S, Lidgren L.
The routine of surgical management reduces failure after unicompartmental knee arthroplasty.
J Bone Joint Surg [Br] 2001; 83-B: 45-9.

Robertsson O, Dunbar M J.
Patient satisfaction compared with general health and disease-specific questionnaires in knee arthroplasty patients.
J Arthroplasty 2001 Jun;16 (4): 476-82.

Dunbar M J, Robertsson O, Ryd L, Lidgren L.
Translation and validation of the Oxford-12 item knee score for use in Sweden.
Acta Orthop Scand 2000 Jun; 71 (3): 268-74.

Robertsson O, Scott G and Freeman MAR.
Ten-year survival of the cemented Freeman-Samuelson primary knee arthroplasty. Data from the Swedish Knee Arthroplasty Register and the Royal London Hospital.
J Bone Joint Surg [Br] 2000 May;82(4):506-7.

Robertsson O, Lewold S, Knutson K, Lidgren L.
The Swedish Knee Arthroplasty Project.
Acta Orthop Scand 2000 Jun; 71 (1): 7-18.

Robertsson O, Dunbar M J, Knutson K, Lidgren L.
Past incidence and future need for knee arthroplasty in Sweden. A report from the Swedish Knee Arthroplasty Register regarding the affect of past and future population changes on the number of arthroplasties performed.
Acta Orthop Scand 2000; 71 (4): 376-80.

Robertsson O, Dunbar MJ, Knutson K, Lidgren L.
Patient satisfaction after knee arthroplasty: a report on 27,372 knees operated on between 1981 and 1995 in Sweden.
Acta Orthop Scand 2000 Jun; 71 (3): 262-7

Robertsson O.
Unicompartmental arthroplasty. Results in Sweden 1986-1995.
Orthopäde 2000 Jun;29 Suppl 1:S6-8

Sandmark H, Hogstedt C, Vingard E.
Primary osteoarthrosis of the knee in men and women as a result of lifelong physical load from work.
Scand J Work Environ Health. 2000 Feb;26(1):20-5.

Lidgren L, Lohmander L S.
Knäartros [Arthrosis of the knee].
Socialstyrelsens faktadatabas, : 1999.

Robertsson O, Borgquist L, Knutson K, Lewold S, Lidgren L.
Use of unicompartmental instead of tricompartmental prostheses for unicompartmental arthrosis in the knee is a cost-effective alternative. 15,437 primary tricompartmental prostheses were compared with 10,624 primary medial or lateral unicompartmental prostheses.
Acta Orthop Scand 1999; 70 (2): 170-5.

Robertsson O, Dunbar M J, Knutson K, Lewold S, Lidgren L.
Validation of the Swedish Knee Arthroplasty Register: a postal survey regarding 30,376 knees operated on between 1975 and 1995.
Acta Orthop Scand 1999; 70 (5): 467-72.

Robertsson O, Dunbar M J, Knutson K, Lewold S, Lidgren L.
The Swedish Knee Arthroplasty Register: 25 Years Experience.
Bulletin Hospital for Joint Diseases 1999; 58 (3): 133-8.

Sandmark H, Högstedt C, Lewold S, Vingard E.
Osteoarthrosis of the knee in men and women in association with overweight, smoking, and hormone therapy.
Ann Rheum Dis 1999; 58 (3): 151-5.

Sandmark H, Vingard E .
Sports and risk for severe osteoarthrosis of the knee.
Scand J Med Sci Sports 1999; Oct;9 (5): 279-84.

Knutson K.
Arthroplasty and its complications.
In: Osteoarthritis 1st ed (Eds. Brandt K D, Doherty M, Lomander LS).
Oxford University Press 1998; 9.17: 388-402.

Lewold S, Robertsson O, Knutson K, Lidgren L.
Revision of unicompartmental knee arthroplasty: outcome in 1,135 cases from the Swedish Knee Arthroplasty study.
Acta Orthop Scand 1998; 69 (5): 469-74.

Blunn G W, Joshi A B, Minns R J, Lidgren L, Lilley P, Ryd L, Engelbrecht E, Walker P S.
Wear in retrieved condylar knee arthroplasties. A comparison of wear in different designs of 280 retrieved condylar knee prostheses.
J Arthroplasty 1997; 12 (3): 281-90.

Knutson K, Lewold S, Lidgren L, Robertsson O.
Knie-TEP Revisionseingriffe. Lösungsmöglichkeiten bei Beschwerden nach Implantation einer Knieendoprothese
Georg Thieme verlag 1997; ISBN 3-13-104711-9: 107-12

Robertsson O, Knutson K, Lewold S, Goodman S, Lidgren L.
Knee arthroplasty in rheumatoid arthritis. A report from the Swedish Knee Arthroplasty Register on 4,381 primary operations 1985-1995.
Acta Orthop Scand 1997; 68 (6): 545-53.

Robertsson O, Knutson K, Lewold S, Goodman S, Lidgren L.
Selected Scientific Exhibits - Knee arthroplasty in rheumatoid arthritis.
Archives of the American Academy of Orthopaedic Surgeons 1997; 1 (1): 44-50.

Stenström S, Lindstrand A, Lewold S.
Unicompartmental knee arthroplasty with special reference to the Swedish Knee Arthroplasty Register.
Cahiers d´enseignement de la SOFCOT 1997 ; 159-62.

Lewold S, Olsson H, Gustafson P, Rydholm A, Lidgren L.
Overall cancer incidence not increased after prosthetic knee replacement: 14,551 patients followed for 66,622 person-years.
Int J Cancer 1996; 68 (1): 30-3.

Toksvig-Larsen S, Ryd L, Stentström A, Dansgard F, Jonsson K, Robertsson O, Lindstrand A.
The Porous-Coated Anatomic total knee experience. Special emphasis on complications and wear.
J Arthroplasty 1996; 11 (1): 11-7.

Lewold S, Goodman S, Knutson K, Robertsson O, Lidgren L.
Oxford meniscal bearing knee versus the Marmor knee in unicompartmental arthroplasty for arthrosis. A Swedish multicenter survival study.
J Arthroplasty 1995; 10 (6): 722-31.

Knutson K, Lewold S, Robertsson O, Lidgren L.
The Swedish knee arthroplasty register. A nation-wide study of 30,003 knees 1976-1992.
Acta Orthop Scand 1994; 65 (4): 375-86.

Lidgren L.
Low virulent bacteria in joint implant infection.
Zentralblatt für Bakteriologie 1994; Suppl 27: 363-7.

Lewold S, Knutson K, Lidgren L.
Reduced failure rate in knee prosthetic surgery with improved implantation technique.
Clin Orthop 1993; (287): 94-7.

Blunn G W, Joshi A B, Lilley P A, Engelbrecht E, Ryd L, Lidgren L, Hardinge K, Nieder E, Walker P S.
Polyethylene wear in unicondylar knee prostheses. 106 retrieved Marmor, PCA, and St Georg tibial components compared.
Acta Orthop Scand 1992; 63 (3): 247-55.

Goodman S, Lidgren L.
Polyethylene wear in knee arthroplasty. A review.
Acta Orthop Scand 1992; 63 (3): 358-64.

Lindstrand A, Stenstrom A, Lewold S.
Multicenter study of unicompartmental knee revision. PCA, Marmor, and St Georg compared in 3,777 cases of arthrosis.
Acta Orthop Scand 1992; 63 (3): 256-9.

Bengtson S, Knutson K.
The infected knee arthroplasty. A 6-year follow-up of 357 cases.
Acta Orthop Scand 1991; 62 (4): 301-11.

Odenbring S, Egund N, Knutson K, Lindstrand A, Toksvig-Larsen S.
Revision after osteotomy for gonarthrosis. A 10-19-year follow-up of 314 cases.
Acta Orthop Scand 1990; 61 (2): 128-30.

Bengtson S, Knutson K, Lidgren L.
Treatment of infected knee arthroplasty.
Clin Orthop 1989; (245): 173-8.

Bengtson S, Carlsson A, Relander M, Knutsson K, Lidgren L.
Prothèse du genou exposèe - traitement. [An exposed knee prosthesis--treatment].
Rev Chir Orthop Reparatrice Appar Mot 1988; 74 (Suppl 2): 322-3.

Bengtson S, Borgquist L, Lidgren L.
Cost analysis of prophylaxis with antibiotics to prevent infected knee arthroplasty.
British Medical Journal 1989; 299 (6701): 719-20.

Bengtson S, Carlsson A, Relander M, Knutson K, Lidgren L.
Treatment of the exposed knee prosthesis.
Acta Orthop Scand 1987; 58 (6): 662-5.

Bengtson S, Blomgren G, Knutson K, Wigren A, Lidgren L.
Hematogenous infection after knee arthroplasty.
Acta Orthop Scand 1987; 58 (5): 529-34.

Rööser B, Boegard T, Knutson K, Rydholm U, Lidgren L.
Revision knee arthroplasty in rheumatoid arthritis.
Clin Orthop 1987; (219): 169-73.

Bengtson S, Knutson K, Lidgren L.
Revision of infected knee arthroplasty.
Acta Orthop Scand 1986; 57 (6): 489-94.

Knutson K, Lindstrand A, Lidgren L.
Survival of knee arthroplasties. A nation-wide multicentre investigation of 8000 cases.
J Bone Joint Surg (Br) 1986 ; 68 (5): 795-803.

Rosenqvist R, Bylander B, Knutson K, Rydholm U, Rooser B, Egund N, Lidgren L.
Loosening of the porous coating of bicompartmental prostheses in patients with rheumatoid arthritis.
J Bone Joint Surg (Am) 1986; 68 (4): 538-42.

Knutson K, Lindstrand A, Lidgren L.
Arthrodesis for failed knee arthroplasty. A report of 20 cases.
J Bone Joint Surg (Br) 1985; 67 (1): 47-52.

Knutson K, Tjörnstrand B, Lidgren L.
Survival of knee arthroplasties for rheumatoid arthritis.
Acta Orthop Scand 1985; 56 (5): 422-5.

Rydholm U, Boegard T, Lidgren L.
Total knee replacement in juvenile chronic arthritis.
Scand J Rheumatol 1985; 14 (4): 329-35.

Tjörnstrand B, Lidgren L.
Fracture of the knee endoprosthesis. Report of three cases of tibial component failure.
Acta Orthop Scand 1985; 56 (2): 124-6.

Boegard T, Brattström H, Lidgren L.
Seventy-four Attenborough knee replacements for rheumatoid arthritis. A clinical and radiographic study.
Acta Orthop Scand, 55(2): 166-71, 1984.

Knutson K, Bodelind B, Lidgren L.
Stability of external fixators used for knee arthrodesis after failed knee arthroplasty.
Clin Orthop 1984; (186): 90-5.

Knutson K, Hovelius L, Lindstrand A, Lidgren L.
Arthrodesis after failed knee arthroplasty. A nationwide multicenter investigation of 91 cases.
Clin Orthop 1984; (191): 202-11.

Knutson K, Leden I, Sturfelt G, Rosen I, Lidgren L.
Nerve palsy after knee arthroplasty in patients with rheumatoid arthritis.
Scand J Rheumatol 1983; 12 (3): 201-5.

Knutson K, Lidgren L.
Arthrodesis after infected knee arthroplasty using an intramedullary nail. Reports of four cases.
Arch Orthop Trauma Surg 1982; 100 (1): 49-53.

Blader S, Knutson K, Surin V.
[Swedish experience with total endoprostheses of the knee (author's transl)].
Acta Chir Orthop Traumatol Cech 1981; 48 (3): 234-41.

Knutson K, Jonsson G, Langer Andersen J, Lárusdottir H, Lidgren L.
Deformation and loosening of the tibial component in knee arthroplasty with unicompartmental endoprostheses.
Acta Orthop Scand 1981; 52 (6): 667-73.

Jonsson G, Knutson K, Lidgren L, Lindstrand A.
Knäartrodes [Knee joint arthrodesis].
Läkartidningen 1980; 77 (22): 2115-7.

The Svedish Knee Arthroplasty Register

www.knee.se

Annual Report 2013

Manager
Otto Robertsson, MD, PhD

Deputy Manager
Annette W-Dahl, RN, associate professor

Register holder
Martin Sundberg, MD, associate professor

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
Tomasz Czuba, MSc, RCsyd

Steering group
Martin Sundberg,MD, associate professor, Skåne University Hospital, Lund
Johan Kärrholm, MD, professor, Sahlgrenska University Hospital, Göteborg
Peter Ljung, MD, PhD, Hässleholm Hospital
Kjell Nilsson, MD, professor, Norrland University Hospital, Umeå
Jonas Ranstam, CStat, professor, RCSyd, Lund
Otto Robertsson, MD, PhD, Skåne University Hospital, Lund
Susanna Söderström, MD, Bollnäs Hospital
Annette W-Dahl, RN, associate professor, Skåne University Hospital, Lund

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

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

ISBN 978-91-979924-9-7