Akademiska sjukhuset
Alingsås
ArtClinic Jönköping
Arvika
Bollnäs
Borås
Carlanderska
Danderyd
Eksjö-Nässjö
Elisabethsjukhuset
Enköping
Eskilstuna
Falun
Frölunda Spec, Sjh,
Gällivare
Gävle
Halmstad
Helsingborg
Huddinge
Hudiksvall
Hässleholm
Jönköping
Kalmar
Karlshamn
Karlskoga
Karlstad
Karolinska
Kullbergska
Kungälv
Lidköping
Lindesberg
Ljungby
Lund
Luleå-Sensia
Lycksele
Malmö
Norrköping
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 2014

Swedish Knee Arthroplasty Register

Lund University
Department of Clinical Sciences, Orthopedics
Skane University Hospital, Lund
Sweden

Primary knee arthroplasties 1975-2013
Revision knee arthroplasties 1975-2012

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

Last year we started registration of knee osteotomies using a specific registration form found at the end. In this report we account for the different osteotomy methods used but it is to early for any reliable outcome report. As it may be other colleagues that are performing this type of surgical procedures at your unit, we ask you to inform about the new registration which concerns all ages and diagnoses as well as both primary procedures and reoperations.

The new website for patients (www.gangbar.se) has proved to be very appreciated and frequently visited. The website where you should be able to log in using smartcards has not always worked as well. We are resolving the matter and hope that this will have been adressed by the end of this year.

The annual report is similar to previous reports with two substantial modifications. The AGC implant is no longer being used in Sweden but it has been the reference to which other TKA models have been compared in our risk analyses. Instead we decided to select the metal backed PFC-Sigma prosthesis as a reference. The reason is that in the majority of cases the PFC-Sigma uses one type of femoral component, tibial baseplate and polyethylene insert. In this report we also show the age standardized incidence of knee arthroplasty surgery in the different counties. By taking into account age differences among the inhabitants of the counties, comparisons become easier.

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 2013 as well as analyses covering the 10-year period 2003-2012.
The third part is specific for each reporting unit and is only delivered to their respective contact surgeons and head of department. It contains information concerning the new variables and lists containing information on all the operations reported by the unit in 2013. 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. We consider it important you provide your colleagues with information about the report so that its content can be discussed, analyzed and stimulate improvement. You also receive an USB stick containing all reported surgeries, the annual report as well as a graphic presentation comparing the revision rate of the unit with that of the national average.

Validation of data is performed on a regular basis and the latest cross check against the national patient registry showed that we have been capturing 97% of all the hospital admissions.

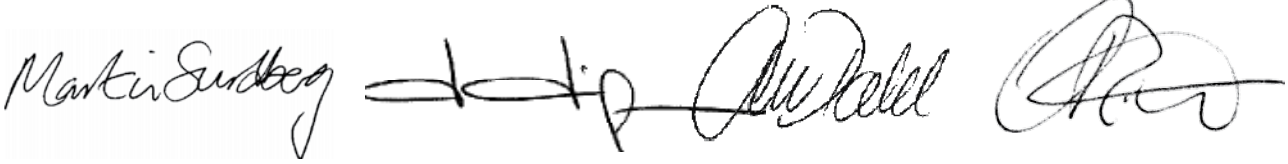
We want to remind you that the registration is prospective and that a reported revision is only included in the analyses if the primary procedure previously has been reported according to ordinary routines. Thus, if a primary operation is discovered only because of a revision at a later time, neither the primary nor the revision will be taken into account. Late reporting of primary procedures is only allowed if there is a reasonable explanation for why the reporting was missed in the first place and if there is no suspicion of bias. Late reporting may also occur when the register actively requests information on surgeries performed during a certain prior time period.

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

We at the register office 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, 2014
On behalf of the Swedish Knee Arthroplasty Register

Martin Sundberg Lars Lidgren Annette W-Dahl Otto Robertsson



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CONTENT

Introduction

The beginning – In the early seventies, knee arthroplasty was an uncommon procedure restricted for those with severe disability. Little information was to be found in the literature while 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 units lessened somewhat due to the merger of hospitals. In 2013, 74 orthopedic units reported to the register, i.e. all units that routinely performed knee arthroplasty surgery in Sweden.

Volumes – Since the registration started, there has been an exponential increase in the number of operations (see page 12). However, in 2013 approx. the same number of primary arthroplasties was reported as in 2012 (13,328). Although one might think that the increase has halted, it is not unlikely that we will see further increase in volumes as the incidence in Sweden (see page 13) still is lower than in countries such as USA and Germany. Further, 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 its backside. The form is then sent to the register office in Lund where the information is entered into the database. High volume units are requested to send the forms to Lund at least once a month. 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 fewer input errors. Further, during data entry, register staff can check part numbers against a local database and in the case of new numbers turning up contact the distributors.

For those units that wish to register PROM data, the register has developed a Web application and since the summer 2013 the units have been able to enter their data on-line. At present there are 8 hospitals delivering pre- and postoperative PROM.

Registration of osteotomies – Osteotomies have been prospectively registered since 2013.

More information can be found on the pages 8-9.

Annual report – Each annual report accounts for primary arthroplasties reported during the previous year (in this report 2013). Analyses concerning the revision rate end one year earlier (2012). 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, in June 2014, additional 89 primaries (0.7%) and 53 revisions (6.6%) had been reported for 2012 as compared to in what had been reported in June 2013 when data were extracted to be used in the previous annual report 2013.

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 201´3, less than 1 in thousand of the forms did not come with part numbers. For the 13 variables concerning patients, prophylaxis and techniques that we started requesting in 2009, the summary on page 52 shows a response rate of more than 98% which is better than we 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 gathered in Skåne during 2008-2012 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. We have previously described our hospital visits which have resulted in improved routines with respect to registration and cooperation. Therefore we continued and visited 5 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 the contact physicians at the participating units can access the information that the unit has delivered to the registry and that includes information on primaries having been revised elswhere. We hope to be able to make this web-site more user friendly and informative in the near future.

We also have a separate web-site aimed at patients where they can find practical information before surgery on how they can prepare themselves, what they can expect and how they can exercise when they come home after surgery (www.gangbar.se).

Definitions

Revision is defined as a new operation in a previously resurfaced knee in 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 not all surgeons do not consider some minor surgeries to be related to the arthroplasty or be a complication why reporting of such procedures is inconsequent.

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 an arthroplasty which resurfaces the femoropatellar compartment. Even if this arthroplasty is unicompartmental by definition, it is accounted for separately.

Partial Replacement Knee Arthroplasty (PRKA) are implants (e.g. buttons) that only replace a part of a knee compartment.

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 primaries. These are typically stabilized implants that often are used with stems. Many have proper names making them easy to distinguish from common TKA's. However, due to the modularity of the modern TKA, a TKA brand may 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 are only used for standard cases while others also may be 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, it complicates the comparison that the registers focus on different variables (operations vs. admissions) and that laterality is inconsequently recorded in the 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 2012 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 2011, we found that 97.7% of the admissions had been registered in the SKAR. In the same way we now find for 2012 that 97.2% had been registered by the SKAR and 96.3% by the NPR.

Below is a list of the units containing the combined number of operations in both registers as well as the coverage of respective registry. Those units who do not reach 96% completeness are marked in red. Units with low coverage are encouraged to investigate if they missed reporting any surgeries or if their ICD-10 coding is erroneous.

Hospital	Number	SKAR-percent	NPR percent
Akademiska sjukhuset	112	96.4	99.1
Alingsås lasarett	194	97.9	99.0
Arvika sjukhus	151	98.0	94.0
Bollnäs sjukhus	335	97.3	97.6
Borås + Skene	254	95.3	97.2
Carlanderska	124	100.0	0.0
Danderyds sjukhus	214	93.5	98.1
Eksjö-Nässjö	184	98.9	100.0
Elisabethkliniken	61	95.1	98.4
Enköping	333	99.1	100.0
Eskilstuna	34	94.1	100.0
Falu lasarett	361	97.5	97.5
Frölunda Spec. sjukhus	122	99.2	98.4
Gällivare	83	95.2	98.8
Gävle	165	93.9	98.2
Halmstad	247	97.6	98.8
Halmstad - Capio	245	90.2	99.2
Helsingborg	22	68.2	95.5
Huddinge	153	98.0	98.7
Hudiksvall	81	97.5	100.0
Hässleholm	630	97.8	98.6
Jönköping - Art Clinic	10	70.0	70.0
Jönköping - Ryhov	172	99.4	98.8
Kalmar	99	93.9	96.0
Karlshamn + Karlskrona	273	96.7	98.9
Karlskoga	141	99.3	100.0
Karlstads	142	99.3	97.2
Karolinska	130	97.7	98.5
Kullbergska	237	95.8	97.9
Kungälv	148	95.9	95.9
Lindesberg	200	97.5	99.5
Ljungby	135	98.5	97.0
Lund	69	94.2	95.7
Lycksele	66	95.5	98.5
Malmö	33	100.0	93.9
Mora	177	97.2	94.4
Motala	530	98.7	99.8

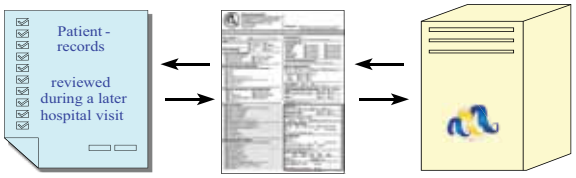
Klinik	Total antal	Knäprotes-reg. %	Patient-reg. %
Nacka	124	98.4	99.2
Norrköping Vrinnevisjh.	149	98.0	100.0
Norrtälje	91	97.8	95.6
Nyköping	127	96.9	98.4
OrthoCenter IFK	108	96.3	100.0
OrthoCenter Stockholm	433	100.0	99.5
OrthoCenter Skåne	6	0.0	100.0
Ortopediska Huset	380	98.7	76.8
Oskarshamn	265	99.2	99.2
Piteå	324	99.1	99.7
S:t Göran	349	98.0	99.4
Sabbatsberg	129	96.9	99.2
Sahlgrenska + Mölndal + Östra	222	92.8	97.7
Skaraborgs sjukhus	413	97.1	98.8
Skellefteå	91	98.9	98.9
Sollefteå	104	98.1	94.2
Sophiahemmet	112	100.0	98.2
Spenshult	344	96.2	98.0
Sunderbyn	3	100.0	100.0
Sundsvall	127	96.9	99.2
Södersjukhuset	291	96.6	97.6
Södertälje	87	100.0	98.9
Torsby sjukhus	121	97.5	97.5
Trelleborg	608	99.2	99.7
Uddevalla	171	97.1	99.4
Umeå	167	95.8	99.4
Varberg	208	96.2	99.5
Visby lasarett	95	97.9	94.7
Värnamo	145	94.5	96.6
Västerviks	117	97.4	96.6
Västerås	321	95.3	98.1
Växjö	146	95.9	97.3
Ängelholm	174	98.9	48.9
Örebro	71	100.0	98.6
Örnsköldsvik	102	99.0	97.1
Östersund	187	96.8	97.9

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 years (annual reports 2012 & 2013) indicated an 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 5 hospitals from around the country. The hospitals were asked to find records on 25 consecutive knee arthroplasty operations (primaries and revisions) performed after March 1st 2013. Computer as well as paper records (incl. op- and anesthesia reports) were to be included. During the winter 2013-2014 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 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 126 operations (116 primaries and 10 revisions was validated. One hospital delivered information on 26 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 one case, the 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 were identical. However, the information on the original form and that found in hospital records differed in 11% 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 was a case for which the form listed arthroscopy as being previous surgery while the hospital records stated arthroscopic meniscectomy. On the other hand, for 2% 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, MIS ,drainage and tourniquet), the difference between had been reported and what could be extracted at the hospital was negligible. No information was missing but in 3 cases, information that had been reported could not be found in the hospital records.

Regarding prophylactic drugs, doses of antithrombotic- and antibiotic prophylaxis as well as for the use of local infiltration analgesia (LIA) the information reported and that gathered during the hospital visit differed for 11%. Partially this was

because one unit reported having used LIA and a catheter while only documentation regarding the use of LIA could be found during the visit. On one other unit it was vice versa. Finally there were few cases for which it was reported that the antithrombotic prophylaxis had started preoperatively but where the medical record was interpretated so that it had been started postoperatively (or vice versa). Information was missing in one case.

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 14% of cases the time reported differed > 15 minutes from what was found in the records. This was an improvement as compared to our previous validations.
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 did not differ, neither between the original form and what had been entered into the database nor that what was found during the hospital visit.

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 4% of the surgeries the information differed more than a week.

On occasion, the weight of patients was missing in the hospital records although it had been reported on the form but the difference between the two registrations was overall insignificant.

Information on the operating time could be found for all the cases. However, in case of bilateral simultaneous knee arthroplasties, only the total anesthetic time was documented in the anesthesia records while the separate time for each knee was recorded on the reporting form.

The ASA rating reported and the rating found retrospectively in the anesthesia records differed for 5% of the cases. In one case, the reported ASA rating could not be found in the hospital records.

The validation this year as well as our previous ones indicates very good data capture and a very complete information on the essential/base dataset, the part numbers and type of fixation. With respect to the majority of the ”new” variables the data on the original form agreed well with the information found in hospital records.

The information on previous surgeries and on drug prophylaxis were the variables that differed most. Regarding the administration of the first antibiotic dose, the agreement between what was reported and what could be found in hospital records had improved, which may be explained the experiences gained during the validation in 2012. The validation has lead to improved registration routines and improved cooperation of 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 osteoarthritis 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. Björn Tjörnstrand estimated 1981 in his thesis; ”Osteotomy for medial gonarthrosis”, 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 most common, most often being 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 synthetic 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 and the postoperative care with the aim of improving results.

The choice of method and technique may have an effect on the short- and long-term risk for complications as well as influence a later knee replacement with respect to techniques used and outcome. The health economical perspective is also important for the health providers, the society and not least the patients.

A nationwide registration of osteotomies around the knee is relevant as different methods and teqhniques as well as new fixation materials and bone-substitutes are being used in relatively few procedues distributed around the country. This makes it possible to gather evidence based knowledge on this form of surgical treatment in knee osteoarthritis.

Thus, in April 2013 a prospective nationwide registration of knee osteotomies (proximal tibia and distal femur) was started. Primary surgeries and re-operations are recorded irrespective of age and diagnosis, similarly as we already do for knee arthroplasties. Each unit can download their own form on our website www.knee.se (an example can found at the end of this report)

We recommend that the form is filled in the operation theater where all the relevant information needed for the registration is readily available, including the stickers for any fixation material and bone-substitutes used.

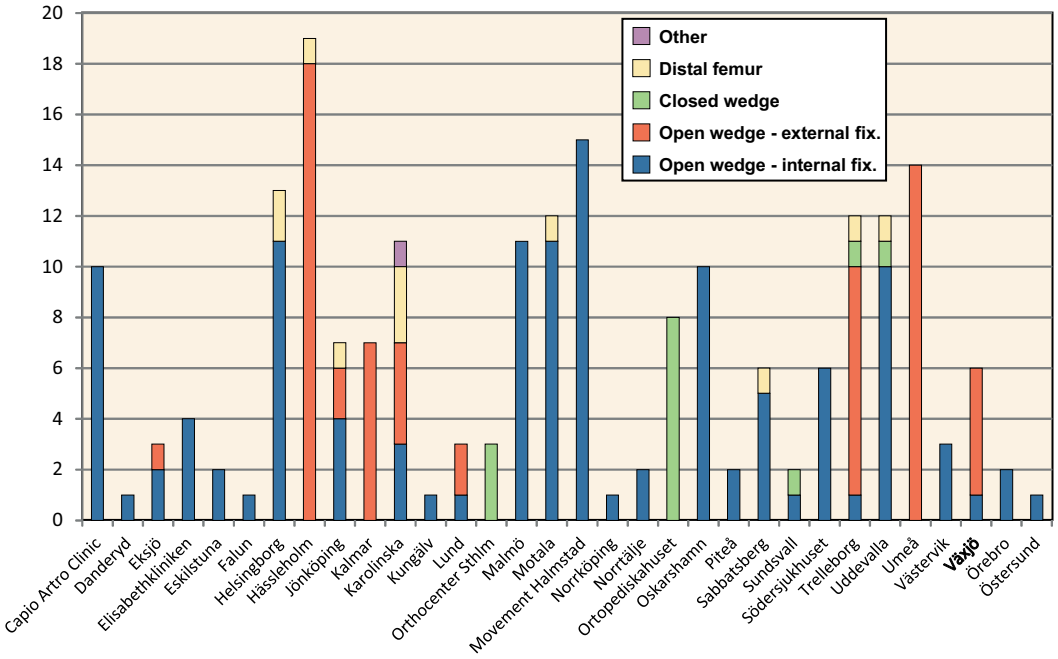
In total, 32 units reported 220 osteotomies. As can be seen in the figure below, only 11 units reported to have performed 10 or more osteotomies during the first year. The unit performing the most was Hässleholm which reported 15 surgeries.

The majority of the procedures were performed because of osteoarthritis (96%) and two third of the patients were males. The median age was 51 years which can be compared to the median age for the TKA and UKA patients in 2013 which was 69 and 62 years respectively.

The most popular method was open wedge using internal fixation followed by open wedge using external fixation. The previous standard method, the closed wedge was only used in 7% of cases.

We hope shortly to be able to report more detailed information on the osteotomies but will have to wait some years before evaluation of results becomes possible.

Number of osteotomies and the method(s) used at each unit between 1/4 2013 and 31/3 2014

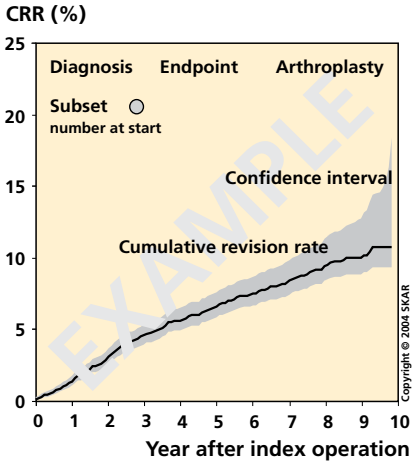


How the register compares implants

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.

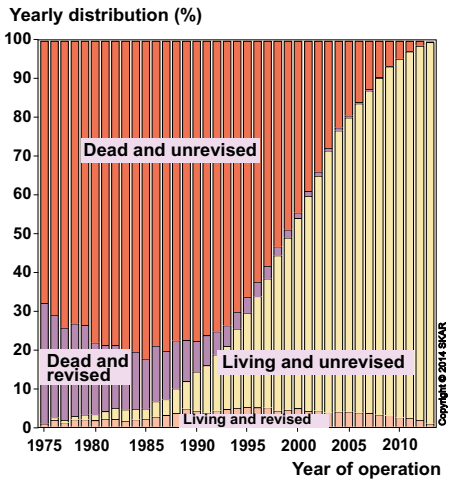
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared.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

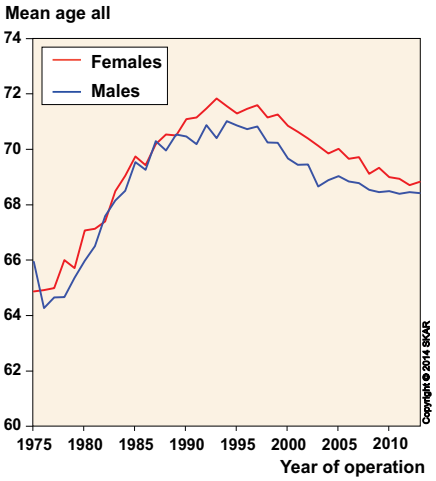


The status in 2013 for each yearly batch of patients operated since 1975.

Gender and age distribution

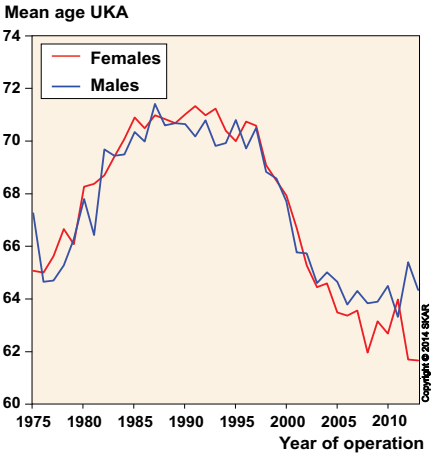
Between 1975 and 1994, the mean age at primary operation increased from 65 years to almost 72 years. The main reason was the relatively large increase in number of operations for the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution 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 so that in 2013 it was 68.3 years (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.

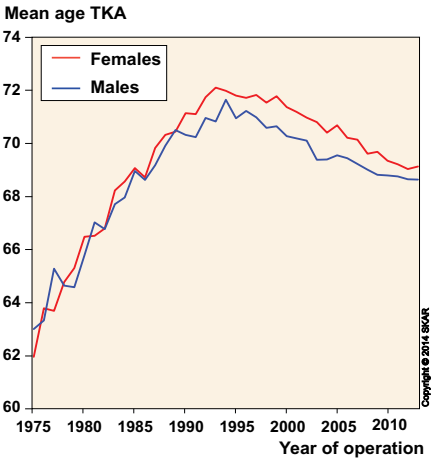


The mean age of patients at surgery (all types of implants) increased until the mid-nineties when it started to decrease.

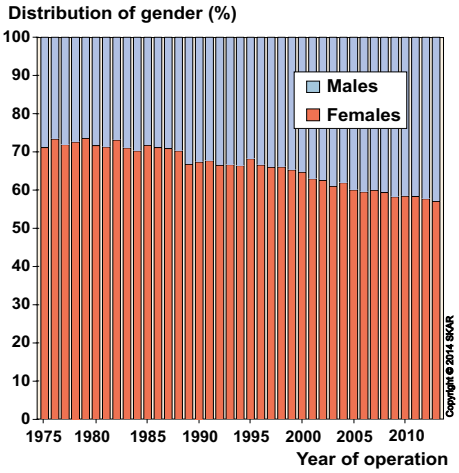
When comparing a series of patients operated on during different periods, the change in the mean age make it necessary to account for age by use of regression or to analyze different age groups separately.



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).



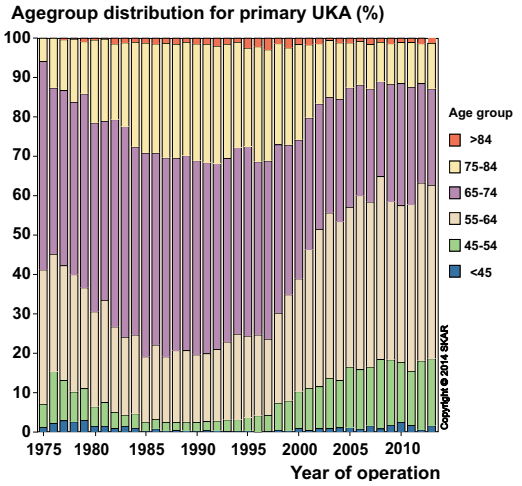
The proportion of males has increased slightly over the years.

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 43%. 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.

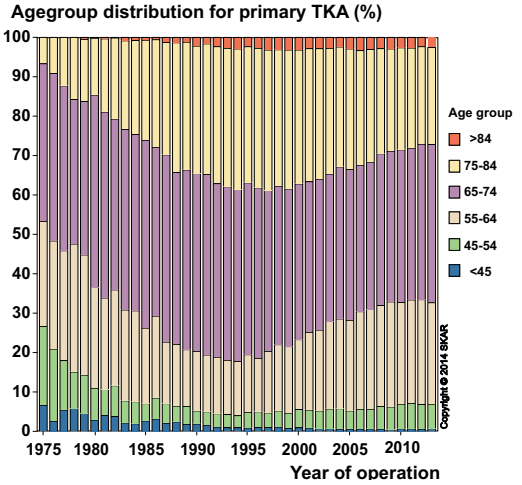
The figure to the right shows the relative number of operations performed on the different age groups over a period of thirty five years. In a somewhat different manner than the mean age (previous page) it shows how the relative proportion of the older groups increased until the mid-nineties after which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

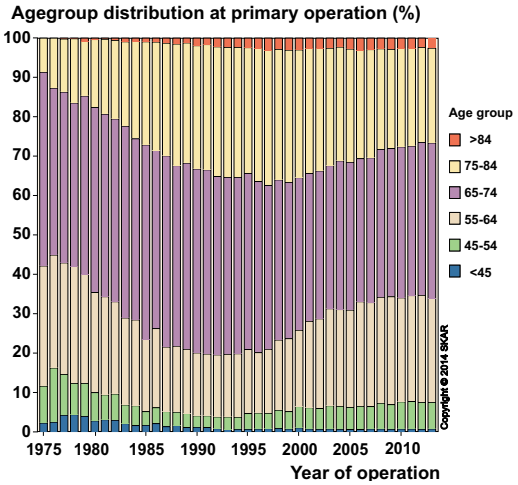
In UKA the relative proportion of patients less than 64 years of age doubled during 1998-2002, i.e. during the time when mini-invasive surgery caught on in Sweden. However, it has to be kept in mind that the actual number of UKA´s is now only half of what it was in 1998 while the number of TKA has more than doubled. 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 younger than 65 years of age having a TKA has almost tripled. This can be explained by an increased confidence in TKA as a treatment for younger patients with OA.



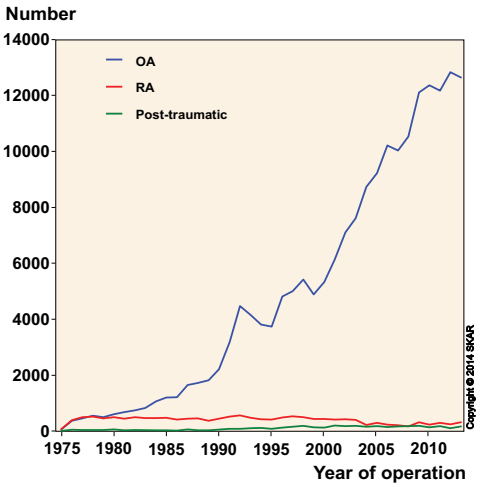
The relative distribution of primary UKA arthroplasties among different age groups.



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).



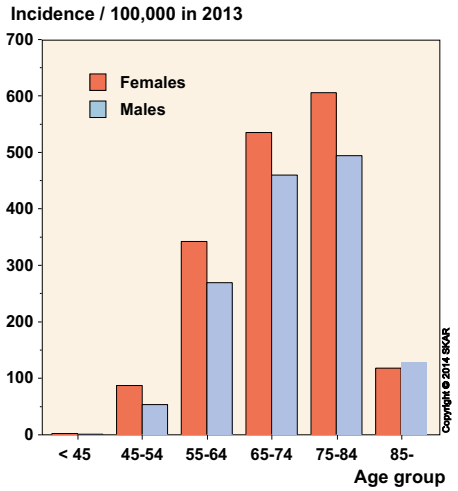
The yearly number of arthroplasties for different diagnoses

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.

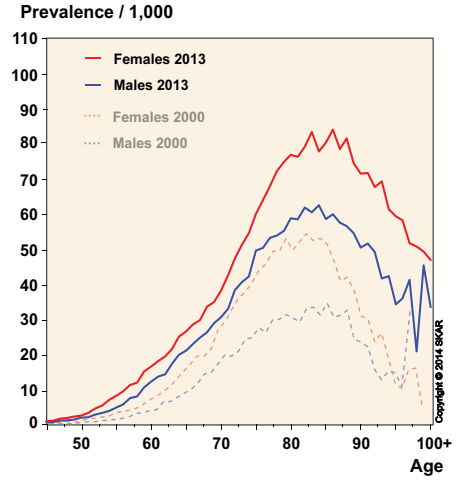
Incidence and prevalence

The incidence of knee arthroplasty is found by dividing the number of primary knee arthroplasties by the number of inhabitants. As the graph to the right shows, the rise in incidence that began in the late eighties leveled of in 2009. A part of the increase in incidence over time reflects aging of the population as knee arthroplasty is mainly used in the elderly.

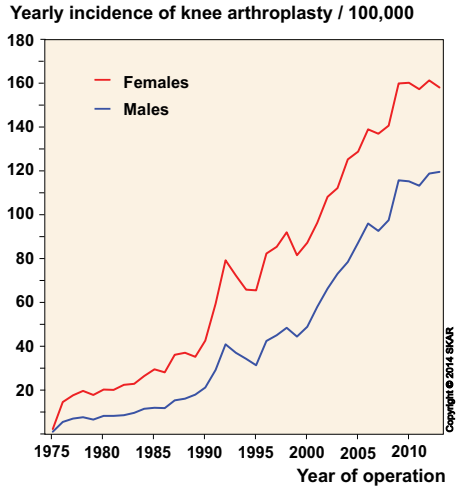
The figure below shows the incidence among different age groups during 2013. It peeks among those between 65 and 84 years of age. At this age, knee arthroplasty is 7-8 times more common than among those 45-54 years old and 4-5 times more common than among those 85 years or older. In 2013, women were overrepresented in all the age groups except the oldest one. A table showing the incidence for the different age groups can be found on page 16.



Incidence of primary knee arthroplasty in 2013 per 100,000 inhabitants (males and females) in the different age groups.



The prevalence of knee arthroplasty in 2000 and 2013. One of fourteen elderly women has a knee arthroplasty.



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

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 below on the left shows the prevalence in 2013 i.e. the number of patients per 1,000 inhabitants in different age groups that are alive and that have at least one knee implant. As a quarter of the patients have bilateral implants the prevalence of implants is higher than of patients.

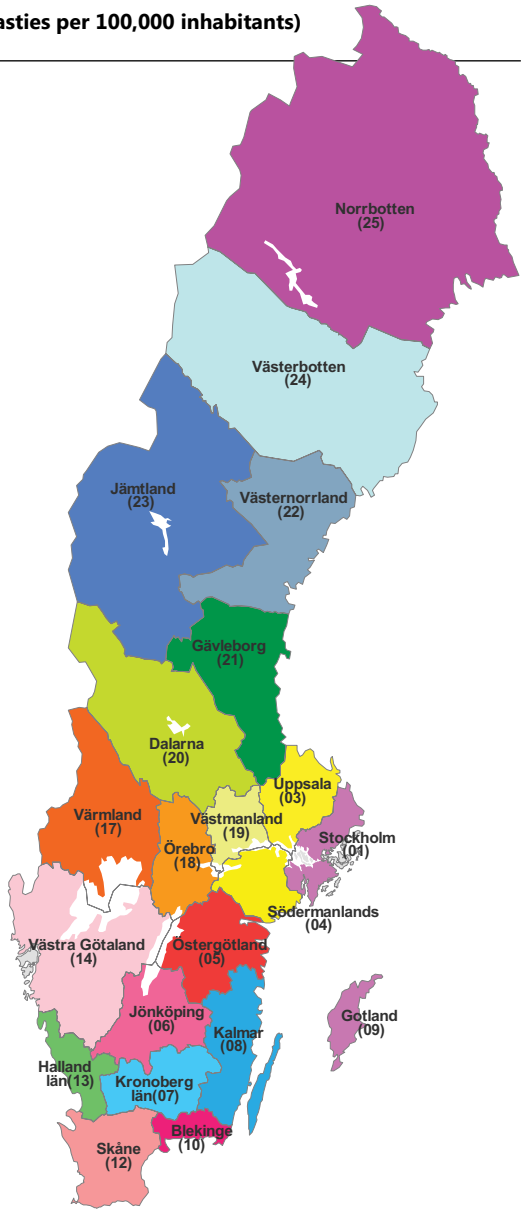
For both men and women the prevalence peaks around 80-85 years of age at with 8% of women and 6% of men had at least one knee arthroplasty. Comparing the prevalence in 2013 with that in 2000, it can be seen that it has increased in all age groups. The fact that a large proportion of the older population is walking around with knee-, hip- or other types of joint implants, will probably result in an increase need for revisions in the future as well as as an increased risk of periprosthetic fractures when such patients are exposed to trauma.

The incidence in the counties 2007-2013 (knee arthrplasties per 100,000 inhabitants)

County and number of inhabitants 2013

No	County	Inhabitants
01	Stockholm	2,145,024
03	Uppsala	343,729
04	Södermanland	276,146
05	Östergötland	435,816
06	Jönköping	340,176
07	Kronoberg	186,522
08	Kalmar	233,711
09	Gotland	57,201
10	Blekinge	152,536
12	Skåne	1,,268,579
13	Halland	305,478
14	Västra,Götaland	1,,607,766
17	Värmland	273,448
18	Örebro	284,254
19	Västmanland	257,639
20	Dalarnas	276,952
21	Gävleborg	277,304
22	Västernorrland	242,069
23	Jämtland	126,331
24	Västerbotten	260,665
25	Norrbotten	249,037

Mean population during the year (www.scb.se)



Knee arthroplasties per 100,000 inhabitants

County	2007	2008	2009	2010	2011	2012	2013
01 Stockholm	89.6	100.9	112.8	106.5	105.4	103.4	104.9
03 Uppsala	127.5	111.6	136.9	149.2	138.8	159.6	175.7
04 Södermanland	108.3	190.3	177.8	152.3	151.3	148.7	157.9
05 Östergötland	122.3	160.0	167.0	166.2	143.8	153.6	151.9
06 Jönköping	111.6	117.5	151.9	136.7	143.5	167.2	151.7
07 Kronoberg	115.4	109.1	152.7	149.3	127.0	163.5	124.4
08 Kalmar	155.3	161.8	173.4	147.7	153.9	170.2	175.4
09 Gotland	176.5	159.5	161.1	162.5	251.4	164.1	178.3
10 Blekinge	118.7	136.8	144.3	145.8	163.9	172.9	167.8
12 Skåne	99.3	98.3	122.4	118.3	122.4	125.4	137.0
13 Halland	111.7	109.1	177.5	151.9	151.0	176.9	163.4
14 Västra Götaland	120.2	114.3	126.4	139.0	137.6	131.5	130.6
17 Värmland	173.2	183.1	191.0	174.6	171.1	178.8	178.8
18 Örebro	135.0	126.0	138.7	138.8	126.0	142.7	120.3
19 Västmanland	133.8	109.8	130.5	140.8	130.2	157.5	126.9
20 Dalarnas	129.9	138.2	151.4	206.3	218.2	213.7	228.9
21 Gävleborg	143.7	129.8	164.5	190.0	173.0	188.1	186.8
22 Västernorrland	119.4	107.2	135.7	179.1	141.9	144.6	138.8
23 Jämtland	97.7	137.1	183.8	167.4	163.6	179.0	144.1
24 Västerbotten	93.2	111.0	153.4	143.3	119.5	122.0	125.8
25 Norrbotten	161.2	132.7	145.2	121.8	150.9	165.3	151.4
The whole country	115.0	119.2	137.9	137.9	135.3	140.1	138.9

Based on domicile at the beginning of 2014

For age-standardized incidence in 2013, see page 29

The incidence in the counties 2007-2013 (knee arthrplasties per 100,000 inhabitants)

Incidence for women

County	2007	2008	2009	2010	2011	2012	2013
01 Stockholm	111.4	128.0	136.5	129.2	128.3	129.7	123.1
03 Uppsala	147.3	131.8	162.1	190.0	158.3	181.5	193.1
04 Södermanland	118.8	217.9	177.0	156.9	172.1	173.2	181.2
05 Östergötland	138.7	187.9	202.8	185.1	161.5	178.0	171.1
06 Jönköping	132.5	140.8	187.3	160.2	174.8	202.3	178.0
07 Kronoberg	147.4	142.1	177.6	182.4	153.3	189.6	157.0
08 Kalmar	169.4	176.5	199.9	158.1	151.5	207.3	200.4
09 Gotland	197.0	190.8	190.8	200.8	276.8	162.7	208.1
10 Blekinge	134.4	150.2	156.9	160.7	183.2	186.2	180.8
12 Skåne	120.8	118.7	145.2	133.4	141.8	139.8	153.7
13 Hallands	126.7	119.7	179.9	176.9	172.2	197.8	186.4
14 Västra Götaland	146.1	133.0	146.0	160.9	157.8	146.0	147.8
17 Värmland	218.4	192.3	211.6	215.5	185.9	202.1	190.9
18 Örebro	159.4	151.6	155.2	162.4	150.6	154.2	129.6
19 Västmanland	148.1	129.4	144.8	163.0	151.9	173.6	141.9
20 Dalarna	156.6	161.7	161.5	230.8	246.9	241.4	256.4
21 Gävleborg	150.5	143.4	198.2	205.3	198.9	207.7	203.5
22 Västernorrland	148.1	123.7	166.5	229.4	172.3	161.1	163.0
23 Jämtland	105.3	158.9	216.0	210.0	212.0	206.2	187.3
24 Västerbotten	115.9	121.4	179.6	159.1	141.0	148.6	151.4
25 Norrbotten	196.1	162.1	165.2	137.0	186.3	190.6	170.8
The whole country	137.0	140.7	159.9	160.2	157.3	161.3	158.1

Baseed on domicile at the beginning of 2014

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. While the calculations do not consider differences in the age distribution, age-standardized calculations for the year 2013 can be found on page 29.

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

Incidence for men

County	2007	2008	2009	2010	2011	2012	2013
01 Stockholms län	67.2	73.0	88.5	83.2	82.1	76.7	86.5
03 Uppsala län	107.3	91.1	111.2	107.8	119.1	137.5	158.3
04 Södermanlands län	97.6	162.5	178.6	147.6	130.3	124.1	134.5
05 Östergötlands län	105.9	132.1	131.4	147.5	126.4	129.4	132.9
06 Jönköpings län	90.5	94.1	116.5	113.1	112.1	132.2	125.5
07 Kronobergs län	83.9	76.6	128.2	116.7	101.1	138.0	92.4
08 Kalmar län	140.9	147.0	146.9	137.2	156.3	133.0	150.5
09 Gotlands län	155.7	127.5	130.8	123.4	225.4	165.6	148.0
10 Blekinge län	103.2	123.6	132.1	131.4	145.3	160.1	155.2
12 Skåne län	77.1	77.6	99.1	103.0	102.7	110.7	120.1
13 Hallands län	96.4	98.3	175.0	126.7	129.7	155.9	140.1
14 Västra Götalands län	94.0	95.5	106.6	117.0	117.4	116.9	113.2
17 Värmlands län	127.7	173.9	170.3	133.5	156.2	155.5	166.8
18 Örebro län	110.0	99.9	121.9	114.8	101.1	131.1	110.9
19 Västmanlands län	119.5	90.0	116.0	118.5	108.4	141.4	111.9
20 Dalarnas län	103.1	114.6	141.3	181.9	189.6	186.1	201.6
21 Gävleborgs län	136.8	116.3	130.6	174.6	147.0	168.6	170.1
22 Västernorrlands län	90.5	90.6	104.7	128.7	111.5	128.0	114.7
23 Jämtlands län	90.0	115.2	151.5	124.7	115.3	151.9	101.1
24 Västerbottens län	70.5	100.6	127.4	127.6	98.1	95.6	100.6
25 Norrbottens län	127.2	104.1	125.8	106.9	116.5	140.9	132.6
The whole country	92.7	97.6	115.7	115.3	113.2	118.8	119.7

Based on domicile at the beginning of 2014

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

Women

Age group	1976-1982	1983-1987	1988-1992	1993-1997	1998-2002	2003-2007	2008-2012	2013
<45	1.1	0.9	1.0	1.1	1.6	1.7	2.4	2.6
45-54	14.2	11.0	13.0	19.0	34.6	58.7	87.5	87.4
55-64	40.7	49.3	76.9	112.8	153.7	236.1	317.9	341.9
65-74	80.4	127.3	225.4	331.0	396.1	520.4	562.7	534.8
75-84	51.4	105.3	217.0	337.5	406.7	528.9	609.1	604.8
>84	2.9	11.6	35.0	65.0	87.4	105.1	120.9	118.1
Total	18.9	28.6	50.9	74.4	93.2	128.6	155.9	158.1

Men

Age group	1976-1982	1983-1987	1988-1992	1993-1997	1998-2002	2003-2007	2008-2012	2013
<45	0.4	0.3	0.5	0.5	0.8	1.2	1.5	1.6
45-54	5.8	4.8	6.2	10.1	19.0	37.6	50.1	54.0
55-64	17.8	21.8	45.3	69.5	101.9	175.4	252.5	269.2
65-74	34.2	61.2	124.9	197.8	267.9	395.8	452.2	459.5
75-84	24.2	58.1	142.8	211.6	272.7	390.1	482.9	493.7
>84	4.3	13.9	34.4	64.9	68.9	111.7	119.0	129.0
Total	7.3	12.0	25.1	38.0	53.2	85.6	112.2	119.7

Number of primary arthroplasties per unit and year

Hospital	1975-2008	2009	2010	2011	2012	2013	Totalt	Percent
Akademiska, Uppsala	2,440	130	155	79	108	89	3,001	1.4
Alingsås	1,227	188	209	189	193	214	2,220	1,0
Art,Clinic, Jönköping	.	.	.	.	7	2	9	0,0
Arvika	926	155	154	167	156	129	1,687	0.8
Avesta	67	.	.	.	.	.	67	0,0
Boden	1,622	.	.	.	.	.	1,622	0.8
Bollnäs	1,908	285	302	305	327	305	3,432	1.6
Borås	2,402	94	116	126	103	90	2,931	1.4
Carlanderska	102	52	95	162	125	108	644	0.3
Dalsland	81	.	.	.	.	.	81	0
Danderyd	2,529	178	144	192	200	196	3,439	1.6
Eksjö-Nässjö (Höglandssjukh.)	2,266	168	164	155	182	173	3,108	1.4
Elisabethkliniken	501	91	64	55	58	58	827	0.4
Enköping	1,304	253	268	329	342	415	2,911	1.4
Eskilstuna	1,698	48	32	40	32	43	1,893	0.9
Fagersta	71	.	.	.	.	.	71	0,0
Falköping	1,355	143	190	.	.	.	1,688	0.8
Falun	3,589	245	306	351	356	360	5,207	2.4
Frölunda Spec.	711	125	115	116	121	120	1,308	0.6
Gällivare	1,135	73	61	81	79	94	1,523	0.7
Gävle	2,838	60	97	96	155	164	3,410	1.6
Halmstad	2,329	188	180	201	241	232	3,371	1.6
Helsingborg	1,695	26	20	20	15	21	1,797	0.8
Huddinge	2,227	170	136	130	150	147	2,960	1.4
Hudiksvall	1,216	85	111	88	79	73	1,652	0.8
Hässleholm	4,759	719	639	666	664	698	8,145	3.8
Jönköping	2,080	205	149	167	173	167	2,941	1.4
Kalix	215	.	.	.	.	.	215	0.1
Kalmar	2,129	120	103	105	93	106	2,656	1.2
Karlshamn	1,868	222	231	248	264	259	3,092	1.4
Karlskoga	1,468	94	96	101	143	129	2,031	0.9
Karlskrona	1,117	.	1	.	.	.	1,118	0.5
Karlstad	3,393	193	176	176	168	192	4,298	2,0
Karolinska	2,060	121	123	108	128	139	2,679	1.2
Kristianstad	1,297	.	.	.	.	.	1,297	0.6
Kristinehamn	252	.	.	.	.	.	252	0.1
Kullbergska	1,333	312	243	229	228	226	2,571	1.2
Kungsbacka	37	1	.	.	.	.	38	0.0

(cont.)

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

Hospital	1975-2008	2009	2010	2011	2012	2013	Total	Percent
Kungälv	1,371	149	162	175	142	155	2,154	1.0
Köping	1,526	79	.	.	.	.	1,605	0.7
Landskrona	1,918	.	.	.	.	.	1,918	0.9
Lidköping	1,289	149	154	169	196	199	2,156	1.0
Lindesberg	1,312	150	171	157	199	192	2,181	1.0
Linköping	1,735	.	.	.	.	.	1,735	0.8
Linköping medical cent	15	.	.	.	.	.	15	0.0
Ljungby	1,277	112	148	119	136	81	1,873	0.9
Ludvika	339	.	.	.	.	.	339	0.2
Luleå	2	.	.	.	.	7	9	0.0
Lund	2,505	40	46	40	49	86	2,766	1.3
Lycksele	502	62	65	60	63	69	821	0.4
Löwenströmska *	1,426	404	415	442	432	440	3,559	1.7
Malmö	2,174	25	10	15	13	.	2,237	1.0
Mora	1,435	129	163	166	172	186	2,251	1.0
Motala	2,365	548	547	458	536	519	4,973	2.3
Movement,Halmstad	478	246	261	275	222	218	1,700	0.8
Mölndal	1,355	198	262	266	206	237	2,524	1.2
Nacka	203	.	.	.	.	.	203	0.1
Nacka-Proxima	129	101	152	136	122	145	785	0.4
Norrköping	2,011	148	152	158	146	143	2,758	1.3
Norrtälje	958	93	83	81	89	73	1,377	0.6
Nyköping	1,228	115	121	120	124	79	1,787	0.8
OrthoCenter IFK klin. **	407	122	143	139	109	96	1,016	0.5
Ortopediska,huset	2,103	437	386	347	375	390	4,038	1.9
Oskarshamn	1,816	225	189	239	263	260	2,992	1.4
Piteå	1,385	278	233	285	321	273	2,775	1.3
S:t,Göran	5,912	323	396	367	347	400	7,745	3.6
Sabbatsberg (Aleris)	1,452	101	105	104	125	125	2,012	0.9
Sahlgrenska	1,525	4	4	8	2	1	1,544	0.7
Sala	115	.	.	.	.	.	115	0.1
Sandviken	301	.	.	.	.	.	301	0.1
Sergelkliniken	160	.	.	.	.	.	160	0.1
Simrishamn	1,021	.	.	.	.	.	1,021	0.5
Skellefteå	1,059	106	107	98	90	97	1,557	0.7
Skene	1,088	105	115	107	139	135	1,689	0.8
Skövde	2,397	99	104	186	206	145	3,137	1.5
Sollefteå	992	88	123	102	102	97	1,504	0.7
Sophiahemmet	1,216	97	77	74	112	121	1,697	0.8
Spenshult	189	141	221	238	331	330	1,450	0.7
Sunderby	383	6	2	4	3	.	398	0.2
Sundsvall	2,467	110	125	118	123	114	3,057	1.4
Säffle	484	.	.	.	.	.	484	0.2
Söderhamn	279	.	.	.	.	.	279	0.1
Södersjukhuset	3,642	357	340	324	285	271	5,219	2.4
Södertälje	1,028	122	117	121	87	88	1,563	0.7
Torsby	1,232	99	109	80	121	131	1,772	0.8
Trelleborg	3,961	579	599	609	673	705	7,126	3.3
Uddevalla	2,872	290	203	186	166	230	3,947	1.8
Umeå	2,156	216	230	165	160	155	3,082	1.4
Varberg	2,229	201	144	167	206	173	3,120	1.5
Visby	1,119	89	76	114	93	88	1,579	0.7
Vänersborg-NÄL	939	.	.	.	.	.	939	0.4
Värnamo	1,590	120	119	113	137	142	2,221	1.0
Västervik	1,571	102	74	97	114	113	2,071	1.0
Västerås	1,924	231	315	280	309	256	3,315	1.5
Växjö	1,787	123	121	97	141	98	2,367	1.1
Ystad	1,169	.	.	.	.	.	1,169	0.5
Ängelholm	1,637	149	143	162	172	201	2,464	1.1
Örebro	2,907	141	125	117	72	51	3,413	1.6
Örnsköldsvik	1,628	118	141	107	102	110	2,206	1.0
Östersund	1,672	135	161	166	182	164	2,480	1.2
Östra sjukhuset	2,068	32	.	.	.	.	2,100	1.0
Total	**149,682**	**12,838**	**12,939**	**12,840**	**13,405**	**13,338**	**215,042**	**100**

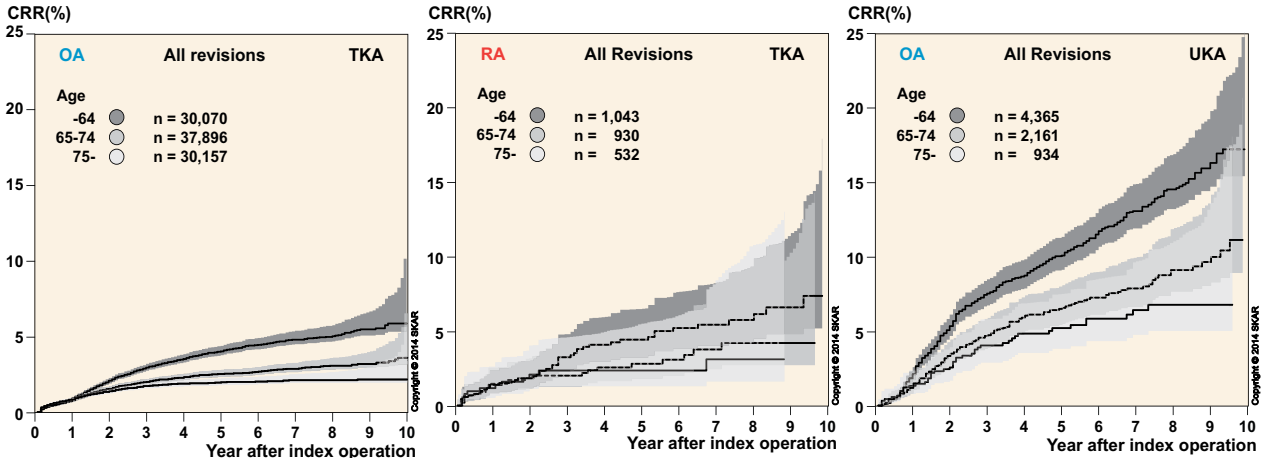
* Lövenströmska was replaced by Stockholms Specialistvård in 2001 and OrthoCenter Stockholm in 2008.

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

Factors that influence the revision rate

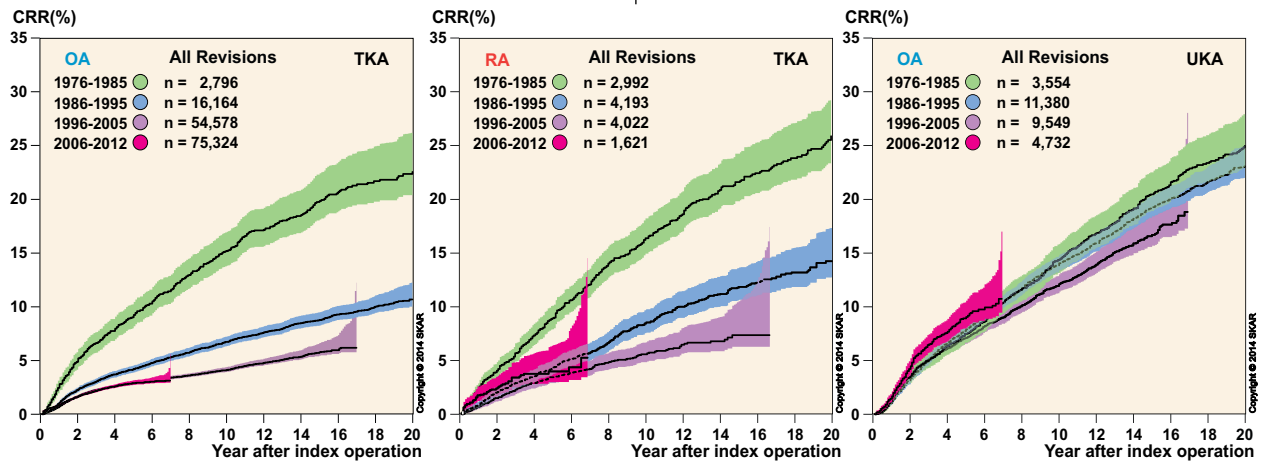
Primary disease – It early became evident that patients with rheumatoid arthritis (RA) and osteoarthritis (OA), were different with respect to outcome. Therefore, the registry always showed outcome for these diagnoses separately. However, the modern medical treatment of RA has resulted in a reduced need 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 separate 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.

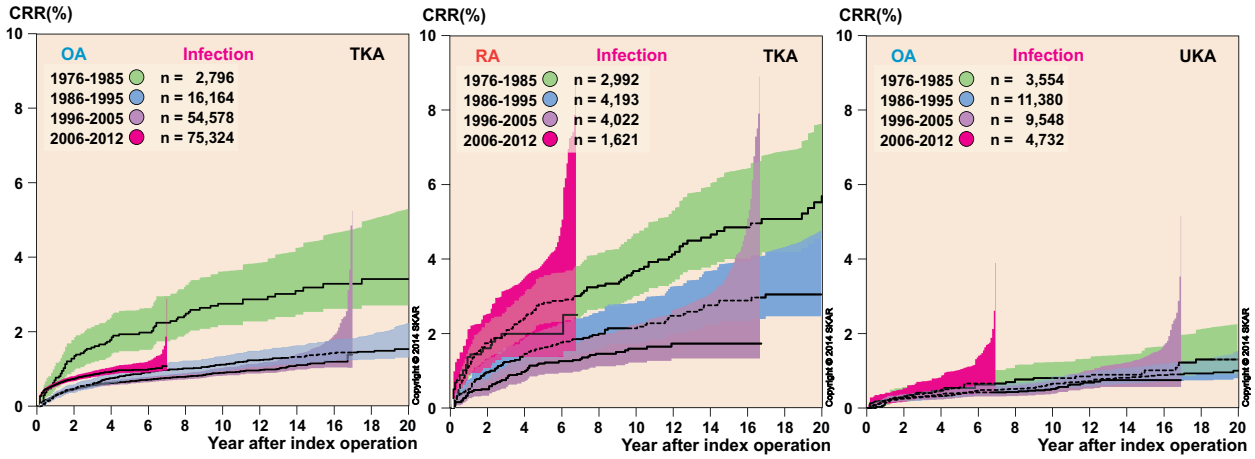


The differences in CRR (2002–2012) between the 3 age groups <65, 65–75, >75 were significant for TKA (OA & RA) as well as UKA.

Year of operation – For TKA there has been a constant reduction in risk of revision over time (OA and RA) which not has been as apparent for UKA. Using Cox regression to compare the period 2006-2012 with the period 1996-2005 we find no significant reduction in risk for TKA and UKA for OA. The reason for the graph showing UKA having higher CRR in the latter period is that the proportion of younger patient has increased which is adjusted for in the regression but not the graph. For TKA/RA the risk of revision has increased in the period 2006-2012. The reason for this is mainly an increase in the number of revisions for infection (see next page).



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, when compared with the previous period, is unchanged in OA but higher for RA. The reason for the increase in CRR after UKA in the most revent period is mainly the increase in the proportion of younger patients having UKA.

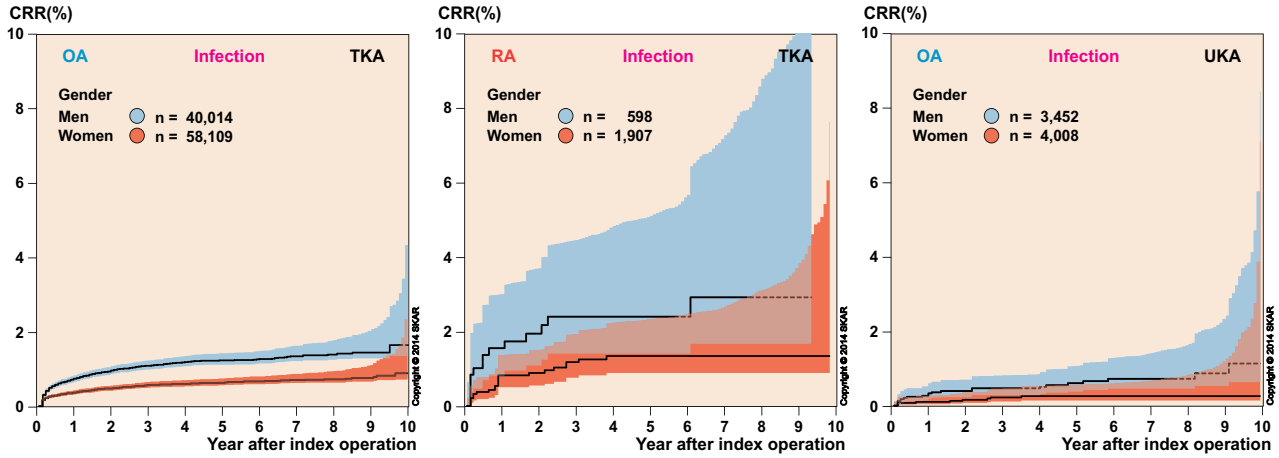


Comparing the CRR, using only revision for infection as end-point, we find an improvement with time for both TKA and UKA. However, in TKA (OA & RA) the CRR for infection during 2006-2012 has increased as compared to 1996-2005.

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 2006-2012 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.

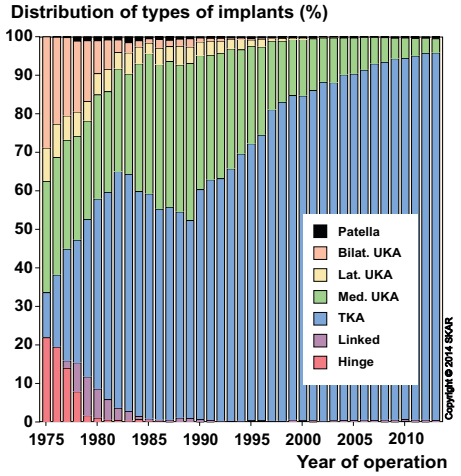
UKA have significantly lower risk of infection than TKA and patients with OA have a lower risk than those with RA. This is independent of if changes of inlays due to infection are considered being revisions or not.

Gender – When analyzing OA during 2002 2012 (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. That the 10-year risk of revision in spite of this is similar for the genders is partly because women more often than men are revised for instability and early loosening.



Using the end-point; revision for infection, the CRR (2002–2012) shows that men are more affected than women (TKA/OA: RR 1.9 adnd TKA/RA: RR 2.1). UKA with its smaller implant size does better than the larger TKA but even in UKA men have 2.9 times the risk of women of becoming revised for infection. In TKA, patients with RA are more affected than those with OA (RR 2.0).

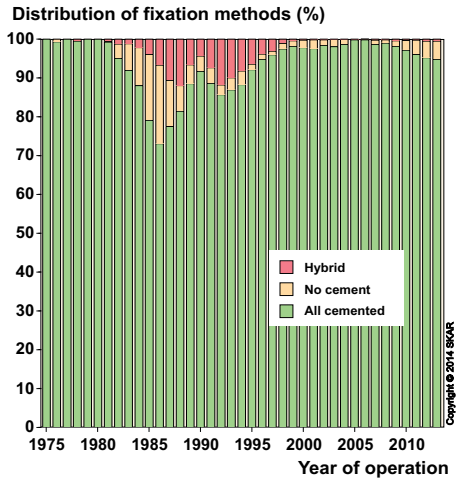
Type of implant – The modern condylar tricompartmental knee implant (TKA) was developed in the seventies when hinged and unicondylar implants were already available. When the register started in 1975, TKA had just been introduced in Sweden, which is the reason for hinges and uni's amounting for the larger part of the surgery at the time (figure right). It was also common to combine two uni's (bilateral UKA) when the knee disease affected more than one compartment. As the use of TKA became more 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. Ordinary TKA's are most often used for uncomplicated primary cases while some use UKA when the disease is unicompartmental, mainly on the medial side. However, the use of UKA has diminished over the years, both proportionally as well as in number of surgeries. The reason may be that in OA, UKA has a substantially higher CRR than TKA (see figures on page 18). However, serious complications (infections/arthrodeses/amputations) are less common after UKA.



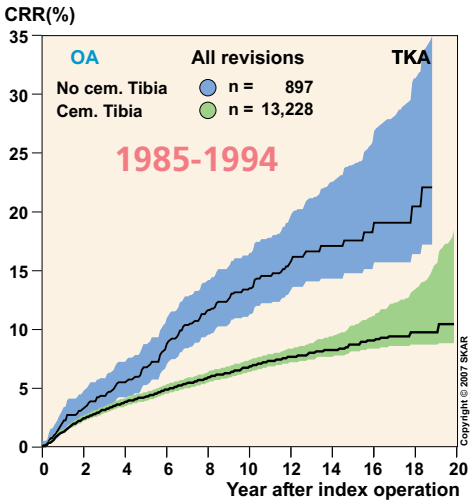
The relative yearly distribution of implant types used for primary surgery.

Previously we found that TKA after previous UKA did not have a significantly increased risk as compared to the risk for primary TKA's inserted at the time when the UKA's were performed. However, at the time the 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 have fond UKA conversions to have approx. 2 times the risk of primary TKA's.

Use of bone-cement – As the figure below shows, bone cement 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).



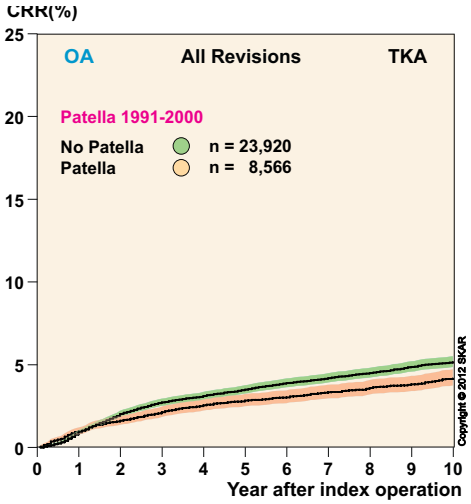
The relative yearly distribution regarding the use of cement for fixation.



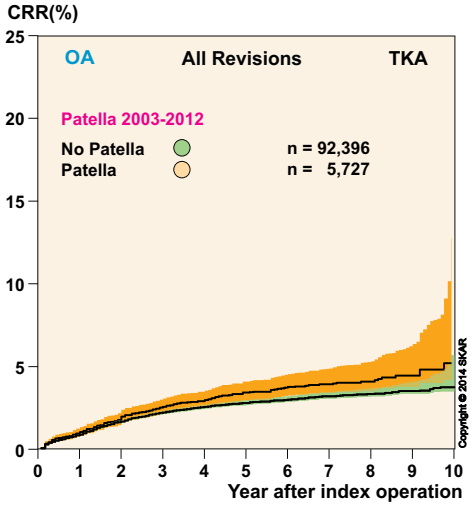
The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.

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 1.7 (1.4-1.9) times higher than for those cemented. This is in agreement with registers in Finland, England, New-Zealand and California which also have found substantially increased risk of revision for uncemented implants.

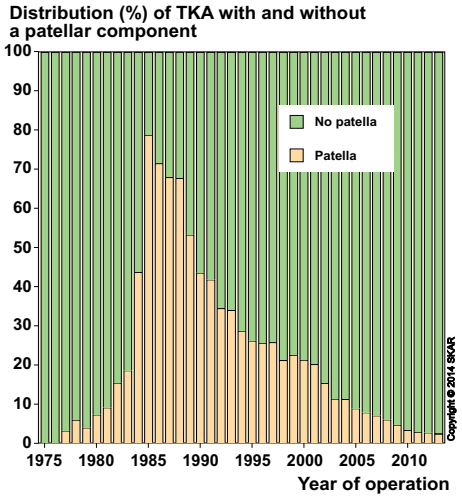
Patellar button in TKA – Estimating how the use of a patellar button affects the revision rate is complex. The use of a patellar button varies with the brand of prosthesis used and its use also has lessened in recent years. During the eighties, when patellar button was used in a good half of the cases, its use had a negative effect. Since then its use has continuously diminished so that it was only used in 2.3% if the TKA cases in 2013 (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 figure below shows the 10-year CRR for TKA inserted during the period,One can see that the TKA without a patellar button had a significantly higher revision rate than those without (RR x 1.3 (CI 1.1-1.4)).



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



CRR for TKA/OA inserted during the current 10-year period 2002-2012, with and without patellar component respectively. TKA with patella has a higher CRR.



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

In 2007 the advantage of using a patellar button started to decrease and in 2010 (for surgeries performed 1999-2008) we could no find an advantage of using a button. However, for the current period 2003-2012 (figure left, below) we find the opposite of that observed during 1991-2000. TKA with a patellar button now have a higher risk than TKA without a button (RR x 1.2 (CI 1.1-1.4)).

One can only speculate on the reasons for these variations in findings. The insertion of the button takes time and there is an additional component that has to stay fixed to bone and that can wear. This increases the possibility of infection, loosening and wear. Thus, changes in the quality of the poly as well as fixation may explain changes in CRR over time. On the other hand, a number of TKA without a button have a secondary one due to patellar pain. So if the femoral components have become more "patellar friendly" or if the surgeons have discovered that patellar additions not always are successful, the number of such secondary patellar resurfacing would decrease improving the results of those without a primary button as compared to those that received one.

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 77% of TKA cases (2013) while it was only used in 2% of cases in Norway that same year according to the Norwegian arthroplasty register report 2011 (http://nrlweb.ihelse.net/).
According to the 2013 annual report of the Australian Joint Replacement Registry (https://aoanjrr.dmac.adelaide.edu.au/), the use of a patellar button has increased in recent years from 41% of the TKA cases in 2005 to 54% in 2012. They 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, but that also depends on the implant brand. As can be seen on the previous page this is similar as what we found in Sweden for the period 1991-2000 when the use of patellar button was relatively more common but that the results had become the opposite in the period 2003-2012 when TKA with patellar button had higher risk of revision than those without.

It is unclear why the policies with respect to use of patellar buttons differ so much between the surgeons in the mentioned countries and regions. However, it is possible that previous bad experience of using metal backed patellar buttons has played a role.

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 (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 2013

Types of primary arthroplasties reported in 2013

	Number	Percent
Linked	56	0.4
TKA	12 732	95.5
UKA medially	490	3.7
UKA laterally	3	0.0
Fem-Pat	56	0.4
Partial (PRKA)	1	0.0
Total :	13,338	100

The standard type of knee arthroplasty has become the TKA which accounted for for 95% of the surgeries´in 2013 (table above). The use of UKA has diminished since 1989 when the type was used in 44% of cases to less than 4% of the cases in 2013 (fig. page 20). Only one PRKA (partial replacement knee arthroplasty) was reported in 2013.

All 74 units performing elective knee arthroplasty surgery reported to the registry during 2013. Although a few reports may be turned in late, they are expected to have a small effect on the number of operations. This summer, 13,338 primaries had been reported for 2013 which is similar as had been reported for 2012 at the same time last year (13,316).

Implants for primary TKA in 2013

	Number	Percent
NexGen	6,021	47.3
PFC Sigma	3,402	26.7
Vanguard	1,451	11.4
Triathlon	1,340	10.5
Genesis II	186	1.5
Profix	90	0.7
Link Gemini	21	0.2
PFC Rotating Platform	12	0.1
Journey	1	0
Other*	208	1.6
Total :	12,732	100

*Mainly revision models (see separate table) except 11 knee for which part numbers are missing

As compared to last year, TKA increased by 0.5%. Four TKA brands dominated the market in 2013 accounting for 95.9% of all the primaries. 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 Genesis and Profix increased somewhat while the use of the PFC rotating platform which has had a relatively high risk of revision continues to diminish and was only used in 12 cases.

The use of UKA diminished by 8% between 2012 and 2013. Oxford accounted for almost half of the procedures and Link for a good one fourth. IBalance from Arthrex was introduced 2013

Implants for primary UKA in 2013

	Number	Percent
Oxford-UKA	230	46.7
Link UKA	138	28.0
ZUK	81	16.4
Triathlon PKR	23	4.7
Genesis UKA	12	2.4
Sigma PKR	6	1.2
IBalance UKA	3	0.6
Total :	493	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, 56 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 2013

	Antal	Procent
NexGen Revision	61	31.0
PFC Revision	61	31.0
Triathlon Revision	47	23.9
Vanguard Revision	21	10.7
Other	7	3.6
Total :	197	100

979 revisions were reported in 2013 of which 232 were secondary (not the first revision). In 731 cases the primary was a TKA, in 209 an UKA, in 27 a linked implant in 11 cases a Femoro-Patellar implant and in one case a partial implant (PRKA).

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 2012.

The most common implants in the counties in 2013

TKA in the counties

	Model 1	n	Model 2	n	Model 3	n	Other
01 Stockholm	NexGen	1,087	PFC Sigma	1,017	Triathlon	87	110
03 Uppsala	PFC Sigma	415	NexGen	140			
04 Södermanland	PFC Sigma	255	NexGen	69	PFC Rot Platf	10	4
05 Östergötland	NexGen	603	Vanguard	15	Other	4	
06 Jönköping	Vanguard	453	Other	2			
07 Kronoberg	Vanguard	161	Other	4	Triathlon	2	
08 Kalmar	NexGen	458	Other	9			
09 Gotland	PFC Sigma	87					
10 Blekinge	Vanguard	255	Other	3			
12 Skåne	Triathlon	1,251	PFC Sigma	273	NexGen	62	103
13 Halland	NexGen	912	Other	4			
14 Västra Götaland	NexGen	936	Vanguard	462	PFC Sigma	211	36
17 Värmland	NexGen	317	PFC Sigma	130	Other	3	
18 Örebro	Genesis II	186	NexGen	171	Journey	1	1
19 Västmanland	NexGen	241	Other	4			
20 Dalarna	NexGen	339	PFC Sigma	186	Other	6	
21 Gävleborg	PFC Sigma	477	Other	15	NexGen	5	1
22 Västernorrland	NexGen	313	Other	5			
23 Jämtland	NexGen	158	Other	3			
24 Västerbotten	NexGen	206	Profix	90	Other	4	3
25 Norrbotten	PFC Sigma	351	Other	12	NexGen	4	

The table above shows that in 2013, only 8 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-UKA	111	Link UKA	54	ZUK	20	19
03 Uppsala	Oxford-UKA	5					
04 Södermanland	Link UKA	10					
05 Östergötland	Oxford-UKA	28	ZUK	6			
06 Jönköping	Oxford-UKA	15	Genesis	6	Link UKA	6	
07 Kronoberg	Oxford-UKA	9					
08 Kalmar	Link UKA	12					
09 Gotland	Link UKA	1					
10 Blekinge	Oxford-UKA	1					
12 Skåne	Triathlon PKR	7	Oxford-UKA	6	Link UKA	3	
13 Halland	ZUK	27					
14 Västra Götaland	Oxford-UKA	55	ZUK	13	Link UKA	2	2
17 Värmland							
18 Örebro	Link UKA	7	ZUK	3			
19 Västmanland	Genesis	6	Triathlon PKR	4			
20 Dalarna	ZUK	6					
21 Gävleborg	Link UKA	33					
22 Västernorrland	ZUK	1					
23 Jämtland	ZUK	1					
24 Västerbotten	Link UKA	5	ZUK	4			
25 Norrbotten	Link UKA	5					

The table above shows that only 2 counties, Stockholm and Västra Göraland reported more than 50 UKA in 2013. 3 counties reported 27, 28 and 33 UKA respectively but otherwise the counties reported between 1 and 15 procedures except Värmland which reported none.

Bone cement and minimally invasive surgery in 2013

Use of cement in primary surgery during 2013

	Primary TKA	Primary UKA
No component without cement	12,021	453
Only the femoral component without cement	12	1
Only the tibial component without cement	52	1
The femur- and tibial components without cement	598	35
Unknown	49	3
Total	12,732	493

	Primary TKA		Primary UKA	
	Number	Percent	Number	Percent
Refobacin (gentamicin)	6,775	55.8	281	61.3
Palacos R+G (gentamicin)	4,616	38.0	162	35.4
Smartset GHV gentamycin	376	3.1	12	2.6
Cemex Genta	307	2.5		
Copal (genta+clinda)	10	0.1		
Refobacin Revision (genta+clinda)	10	0.1		
Hi-Fatigue Bone cement (no antibiotic)	4	0.0		
Palacos LV+G (gentamicin)	1	0.0		
Smartset HV (no antibiotic)	1	0.0		
Missing	34	0.3	3	0.7
Subotal:	12,134	100	458	100
All parts without cement	598	4.7	35	7.1
Totalt	12,732		493	

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. In 2013, 5% of all the TKA's were without cement and 0.5% were hybrids. In UKA uncemented implants accounted for 7%, i.e. the new Oxford uncemented version. Almost all the cement used in primaries contained gentamicin.

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 identification of the cement brands.

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 MIS implies that the surgeon gains access to the knee joint by the use of a small arthrotomy (no specific length) without dislocating / everting the patella. The benefit of the procedure has been claimed to result in less traumatic surgery, quicker rehabilitation and shorter hospital stay.

From the start of the registration in 1999, the popularity of minimally invasive surgery for UKA 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 493 primary UKA in 2013

	Standard incision	Mini-incision	Missing
Link UKA	129	9	
Oxford-UKA	81	146	3
ZUK	59	22	
Genesis	12		
Triathlon PKR	9	14	
Sigma PKR	5	1	
Ibalance UKA		3	
Total	295	195	3

In 2013 40% of the UKA were inserted using MIS. Initially MIS seemed to be associated with a higher revision rate that may have been caused by the learning curve when beginning to use a new method. However, with the present 12-year follow-up, we cannot find that the type of arthrotomy significantly affects the overall revision rate.

The use of patella button for TKA in 2013

The use of a patella button has been decreasing since the mid-eighties so that it is now only used in good 2% of the TKA cases. During 2013 a button was most often used in the county of Kronoberg but not at all in Uppsala, Kalmar 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 (https://aoanjrr.dmac.adelaide.edu.au/) 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 2013, button was most commonly used in primary arthroplasty with the Profix.

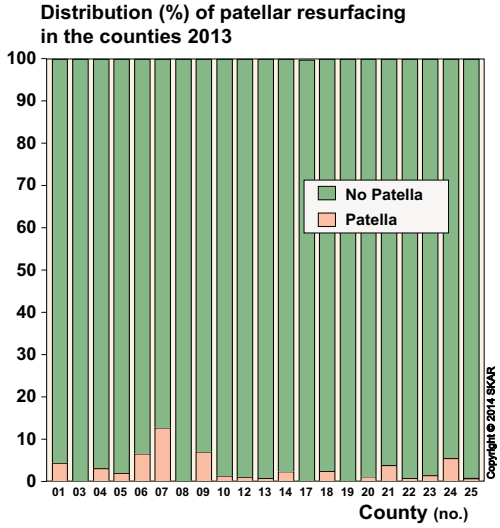
In Sweden, females have their patella resurfaced slightly more often than males. In the whole material, from the start to the end of 2013, 14.8% of the women had their patella resurfaced compared to 11.5% of the males which is a significant difference. During 2013 1.5% of the men had a patella button compared to 2.8% of the women.

Use of patella button with different TKA implants in 2013

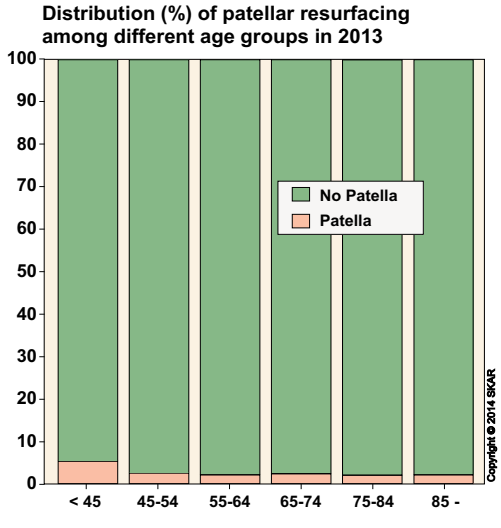
	No patella button	%	Patella button	%
NexGen	5,915	98.2	106	1.8
PFC Sigma	3,297	96.9	105	3.1
Vanguard	1,400	96.5	51	3.5
Triathlon	1,331	99.3	9	0.7
Genesis II	184	98.9	2	1.1
Profix	80	88.9	10	11.1
PFC Rotating Platform	12	100.0	.	.
Legion	3	100.0	.	.
Journey	1	100.0	.	.
Other	221	97.8	5	2.2
Total	12,444	97.7	288	2.3

Looking at the relative use of a patella button in the different age groups during 2013 (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.

How the risk of revision is influenced by the use of a patella button is discussed on page 21 where curves can be found showing the CRR during the current period of 2003-2012, for TKA with and without a button respectively.

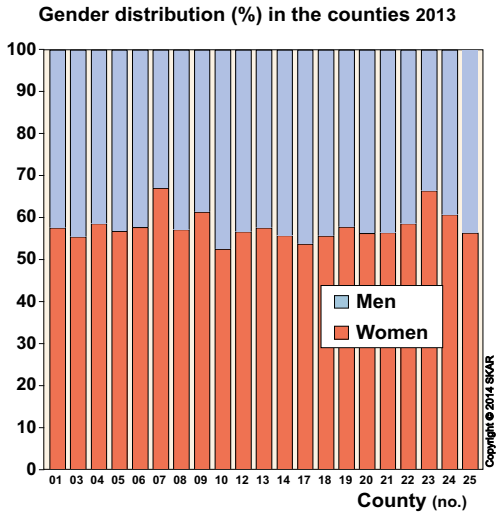


The figure shows the relative proportion of TKA with and without patella button in the different counties during 2013 (the counties are listed on page 28).



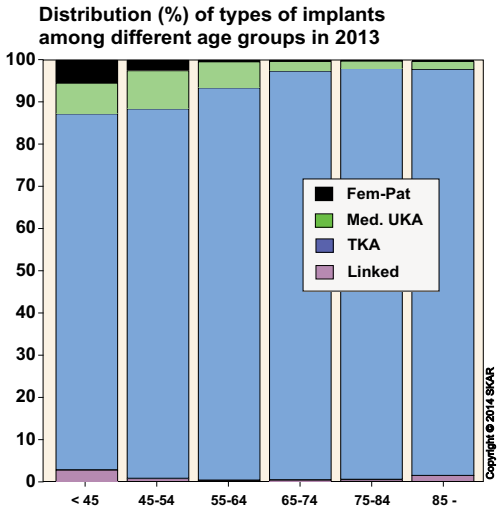
The figure shows the relative proportion of TKA with and without patella button in the different age-groups during 2013.

Gender distribution in the counties



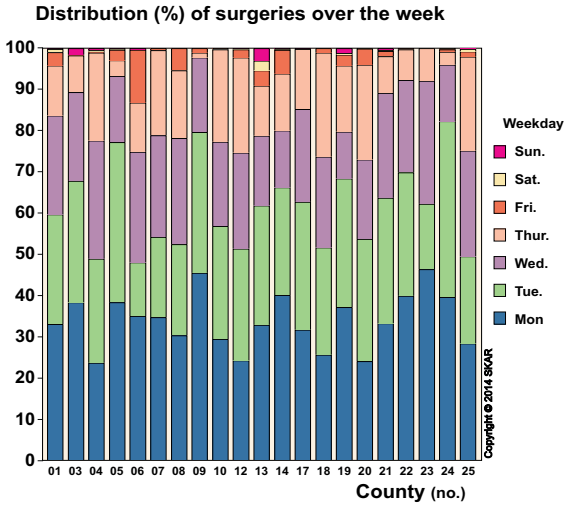
The proportion of females is 56-60% in the counties.

Type of implants in different age groups

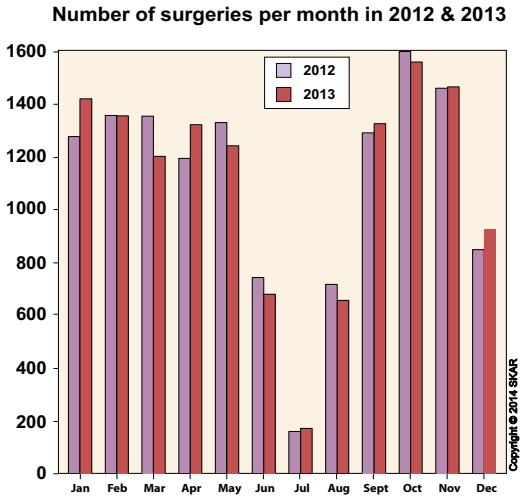


Uncommon models are most often used in patients younger the 45 years. The relative high proportion of linked implant is caused by serious conditions (tumors, trauma etc.)

Distribution of surgery on the weekdays and months



Distribution of surgery on the weekdays during 2013. Surgery on Fridays and weekends is uncommon.



The mean number of primary knee arthroplasties inserted each month during 2012 and 2013.

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 2013 most common in the county of Jönköping while surgery on Saturdays and Sundays was almost non-existent except in the county of Halland, Uppsala and Västmanland.

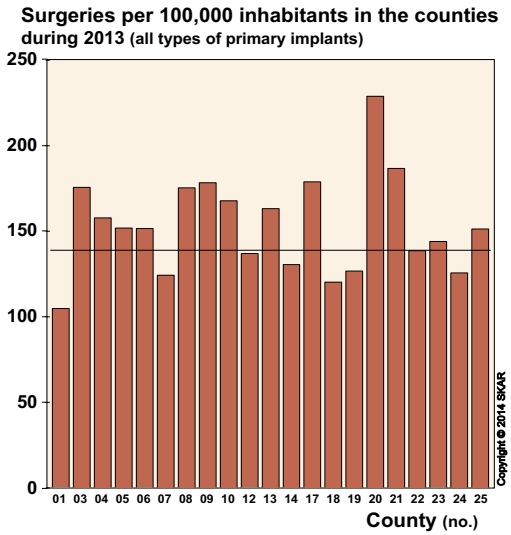
The figure above shows the number of surgeries during the different months of 2012 and 2013. It is evident how the production drops during the summer as around Christmas.

Age distribution and incidence in the counties 2013

County and number of inhabitants 2013

Nr	County	No. of inhabitants	no. of primaries	Incidence/ 100,000
01	Stockholm	2,145,024	2,251	104.9
03	Uppsala	343,729	604	175.7
04	Södermanland	276,146	436	157.9
05	Östergötland	435,816	662	151.9
06	Jönköping	340,176	516	151.7
07	Kronoberg	186,522	232	124.4
08	Kalmar	233,711	410	175.4
09	Gotland	57,201	102	178.3
10	Blekinge	152,536	256	167.8
12	Skåne	1,268,579	1,738	137.0
13	Halland	305,478	499	163.4
14	Västra Götaland	1,607,766	2,099	130.6
17	Värmland	273,448	489	178.8
18	Örebro	284,254	342	120.3
19	Västmanland	257,639	327	126.9
20	Dalarna	276,952	634	228.9
21	Gävleborg	277,304	518	186.8
22	Västernorrland	242,069	336	138.8
23	Jämtland	126,331	182	144.1
24	Västerbotten	260,665	328	125.8
25	Norrbotten	249,037	377	151.4
Country		**9,600,383**	**13,338**	**138.9**

(mean yearly no. of inhabitants: www.scb.se)

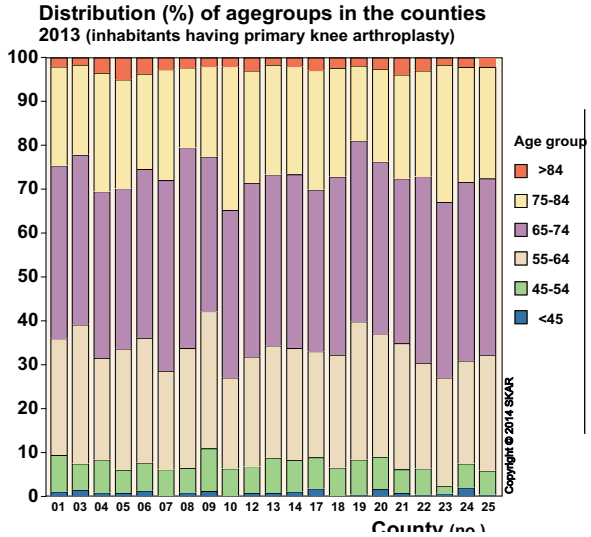


Incidence (no. of arthroplasties per 100,000 inhabitants)

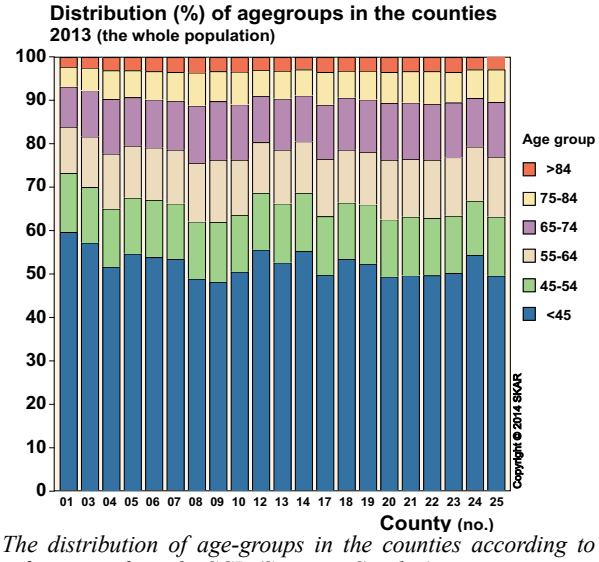
The table and figure above show the number of primary knee arthroplasties per 100,000 inhabitants in each county in 2013. The calculations are based on the domicile of patients in the beginning of 2014. The incidence (not age-standardized) is highest in Dalarna county and lowest in the county of Stockholm.

The figure below shows for each county, the relative proportion of age groups having a primary arthroplasty. The proportion of patients less than 65 years of age was highest in Gotland but lowest in Blekinge and Jämtland. Blekinge had the highest proportion of patients 75 years or older.

How many younger or older inhabitants have surgery is partially affected by how many they are. The figure below as well as the table next page show for each county, the relative proportion of inhabitants in each of the age groups It can be seen that Stockholm county has the highest proportion of inhabitants less than 45 years of age (60%) while Kalmar has the highest proportion of those 65 years and older (25%). When the 2 figures are compared it does not seem consistent that the age distribution decides how many in each age group are provided with a knee arthroplasty.



The agedistribution at primary surgery varies somewhat between the counties.



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

Age standardized incidence in 2013

Distribution (%) of age groups in the counties in 2013 (whole population)

Age group:	0-44	45-54	55-64	65-74	75-84	85-
Stockholm	59.6	13.7	10.7	9.3	4.5	2.3
Uppsala	57.2	12.8	11.7	10.7	5.2	2.5
Södermanland	51.6	13.4	12.7	12.6	6.6	3.1
Östergötland	54.6	13.0	12.0	11.2	6.2	3.0
Jönköping	53.8	13.2	12.0	11.1	6.5	3.3
Kronoberg	53.4	12.8	12.3	11.3	6.7	3.4
Kalmar	48.8	13.3	13.4	13.3	7.6	3.6
Gotland	48.1	13.9	14.4	13.5	7.0	3.2
Blekinge	50.4	13.2	12.7	12.8	7.5	3.3
Skåne	55.6	13.1	11.6	10.8	6.0	2.9
Halland	52.6	13.6	12.4	11.8	6.5	3.1
Västra Götaland	55.3	13.4	11.9	10.6	5.9	2.9
Värmland	49.7	13.5	13.3	12.5	7.5	3.5
Örebro	53.4	13.0	12.2	12.1	6.2	3.1
Västmanland	52.3	13.7	12.2	12.1	6.6	3.1
Dalarna	49.3	13.3	13.7	13.1	7.2	3.4
Gävleborg	49.6	13.6	13.3	13.1	7.2	3.2
Västernorrland	49.6	13.3	13.4	12.9	7.5	3.2
Jämtland	50.2	13.2	13.5	12.6	7.1	3.4
Västerbotten	54.3	12.5	12.6	11.2	6.6	2.9
Norrbotten	49.5	13.7	13.8	12.6	7.6	2.8
The country	54.8	13.3	12.0	11.0	6.0	2.9
ESP (European Standard Population)	54.0	14.0	12.5	10.5	6.5	2.5

The age distribution is somewhat different in the counties as it can be seen from the table above (source SCB). If it is the intention to compare the incidence of knee arthroplasty, i.e. how common it is for the inhabitants of the counties of having knee replacement, the age distribution has to be taken into account because a younger population has not the same need for arthroplasty as an older one. This is achieved by age standardization which means that the incidence is recalculated to what it would have been if the age distribution had been the same in all the counties.

In order to also make it possible to compare different countries we used a 2013 recommendation to the European Commission on a new ”EU-27 + EFTA standard population” (Report of Eurostat’s task force ISBN 978-92-79-31094-2).

The distribution of age groups according to this European standard population is shown in the last line of the table above and the age standardized incidence in the table to the right.

It can bee seen that the age-standardized incidence is lowest 120.4 in Västernorrland while it is 66% higher in Dalarna (200.4). Uppsala has 50% higher incidence than Stockholm, counties that are geographically side by side, both having university hospitals.

We have really no good explanation for the large differences between counties, in how often their inhabitants are provided with a knee arthroplasty.

Age standardized incidence in the counties
(primaries per 100,000 inhabitants in 2013)

Nr	County	Incidence
01	Stockholm	126.1
03	Uppsala	188.5
04	Södermanland	146.1
05	Östergötland	151.4
06	Jönköping	149.4
07	Kronoberg	127.7
08	Kalmar	150.0
09	Gotland	154.1
10	Blekinge	161.8
12	Skåne	141.3
13	Halland	156.8
14	Västra Götaland	134.7
17	Värmland	158.5
18	Örebro	122.5
19	Västmanland	120.4
20	Dalarna	200.4
21	Gävleborg	164.2
22	Västernorrland	120.4
23	Jämtland	127.8
24	Västerbotten	122.6
25	Norrbottens	131.9
	The Country	140.6

Implants for primary arthroplasty 2003–2012

In the tables below, the implants used during the investigated period 2003-2012 are listed. One must observe that the individual models, especially in case of modular types, may include several different implant variants. During the 10-year period, NexGen was the most commonly used model, PFC in second place and AGC still in third place although its use has halted since Biomet introduced its successor, the Vanguard, which was the third most used implant in 2013 (page 23).

Among the UKA's, 3 models account for the majority of surgeries. Of the 11 models listed below, only six were used in 2013.

Implants for primary TKA during 2003–2012

	Number	Percent
NexGen	34,794	33.8
PFC Sigma	29,639	28.8
AGC	10,669	10.4
Vanguard	6,462	6.3
Duracon	5,919	5.8
Triathlon TKA	5,472	5.3
Free-Sam MIII	4,040	3.9
Profix	2,049	2.0
PFC Rotating Platform	1,130	1.1
Natural	489	0.5
Kinemax	404	0.4
Genesis II	201	0.2
Scan	118	0.1
LCS	87	0.1
Journey TKA	83	0.1
Link Gemini	34	0.0
Oxford Rotating Knee	16	0.0
Performance	15	0.0
Evolution	12	0.0
Missing	51	0.1
Other*	1,269	1.2
Total	102,953	100

*Mainly revision models, see table above right.

Implants for primary UKA during 2003–2012

	Number	Percent
Link-Uni	2,688	35.1
Oxford-Uni	2,344	30.6
MillerGalante-Uni	1,340	17.5
ZUK	503	6.6
Genesis-Uni	464	6.1
Preservation	153	2.0
Triathlon PKR	96	1.3
EIUS	28	0.4
Sigma PKR	28	0.4
Allegretto	6	0.1
PFC-Sigma-Uni	3	0.0
Missing	1	0.0
Total	7,654	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 2003–2012

	Number	Percent
NexGen Revision	306	24.2
PFC Revision	296	23.5
Triathlon Revision	241	19.1
Duracon Revision	136	10.8
AGC Revision	118	9.4
Profix Revision	77	6.1
Vanguard Revision	68	5.4
Legion	15	1.2
F/S Revision	5	0.4
Total	1,262	100

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

Hinged implants (primary) during 2003–2012

	Number	Percent
Rotalink	252	47.1
Nexgen RHK	128	23.9
MUTARS	44	8.2
Noiles RHK	39	7.3
Stryker/Howmedica RHK	29	5.4
METS	22	4.1
Stanmore	7	1.3
Biomet RHK	6	1.1
Saknas	2	0.4
Other	6	1.1
Total	535	100

Femoro-patellar implants are uncommon. Only 247 cases using 8 different brands were reported during the 10 year period. The PFC P-F was introduced in 2012 in Sweden.

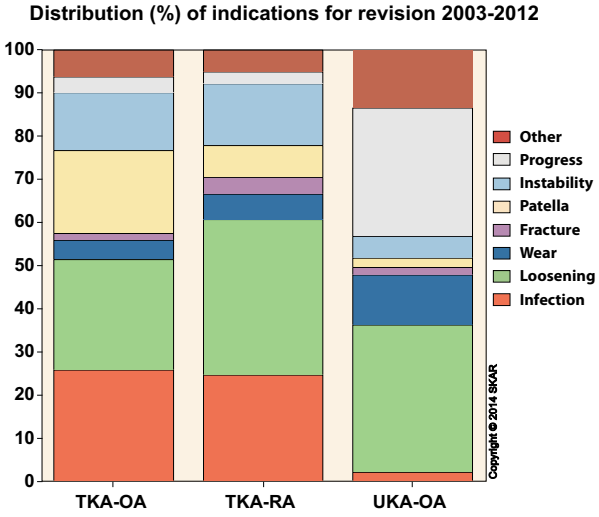
Femoro-Patellar implants during 2003–2012

	Number	Percent
Zimmer P-F	118	47.8
Avon P-F	58	23.5
Link P-F	37	14.6
Richard /Blazina	12	4.9
Journey P-F	7	2.8
Vanguard P-F	6	2.4
LCS P-F	5	2.0
PFC P-F	2	1.2
Missing	2	0.8
Total	247	100

Revisions during 2003–2012

During the 10-year period, 5,637 first time revisions were performed. 3,313 were revisions after TKA for OA, 259 after TKA for RA and 1,641 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. After TKA infection and loosening are now equally often the reason for revision while loosening previously dominated. ”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 that include infection.

The tables show the different types of revisions (first) that were performed during 2003-2012. 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.

For TKA the proportion of revisions in which the poly is exchanged has increased as compared to previously (20% in OA and 15% in RA) which is because of increased aggressively in revision of early infections. 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 2003–2012 in which the primary was a TKA/OA

	Number	Percent
Linked (rot. hinge)	315	9.5
TKA	867	26.2
Exchange of femur comp.	31	0.9
Exchange of tibia comp.	236	7.1
Exchange of disc/inlay	680	20.5
Patella addition	718	21.7
Patella exchange	37	1.1
Patella removal	11	0.3
Total implant removal	374	11.3
Arthrodesis	22	0.7
Amputation	20	0.6
Other	2	0.1
Total	3,313	100

Type of revision 2003–2012 in which the primary was a UKA/OA

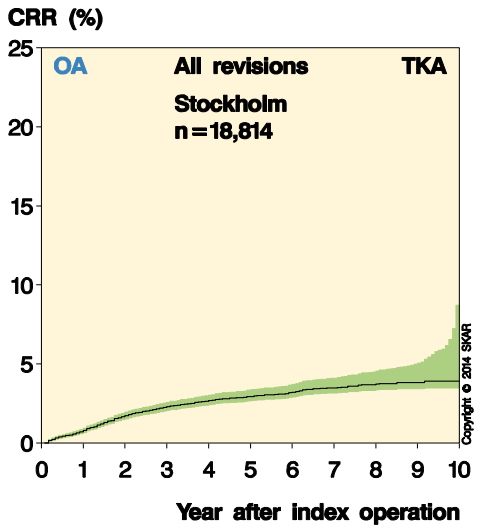
	Number	Percent
Linked (rot. hinge)	32	2.0
TKA	1,512	92.1
UKA	12	0.7
Exchange of femur comp.	6	0.4
Exchange of tibia comp.	5	0.3
Exchange of meniscus/inlay	44	2.7
Patella addition	5	0.3
Total implant removal	23	1.4
Arthrodesis	0	0.0
Amputation	2	0.1
Total	1,641	100

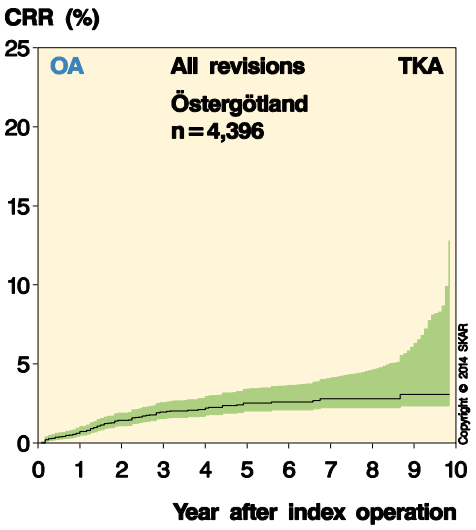
Type of revision 2003–2012 in which the primary was a TKA/RA

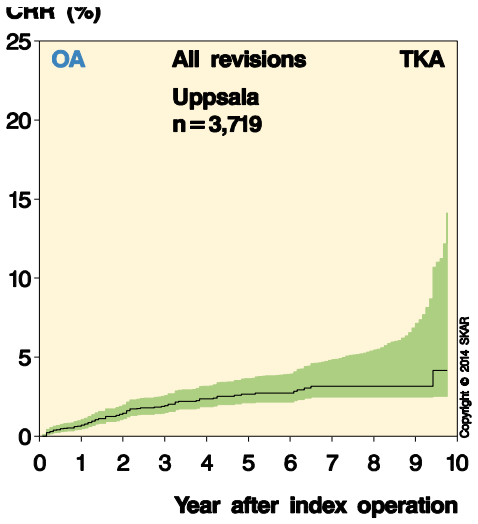
	Number	Percent
Linked (rot. hinge)	53	20.5
TKA	92	35.5
Exchange of femur comp.	6	2.3
Exchange of tibia comp.	10	3.9
Exchange of disc/inlay	38	14.7
Patella addition	23	8.9
Patella exchange	1	0.4
Patella removal	0	0
Total implant removal	33	12.7
Artrodes	2	0.8
Amputation	1	0.4
Total	259	100

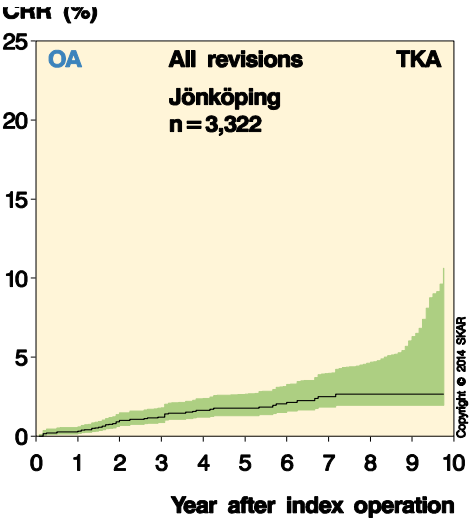
When evaluating the survival curves it should be noted that as the part of the curve to the right contains implants with long follow-up it also to a larger extent reflects older models.

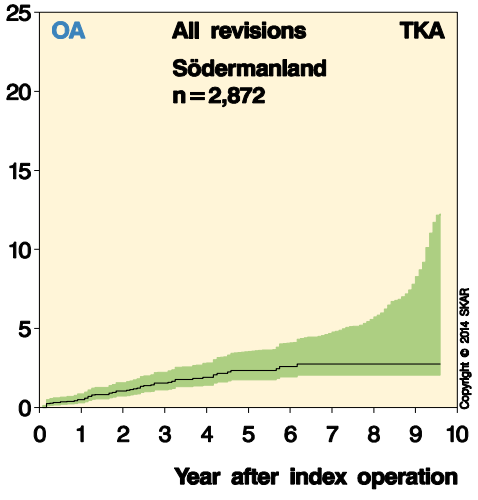
CRR in the counties after primary TKA for OA 2003–2012

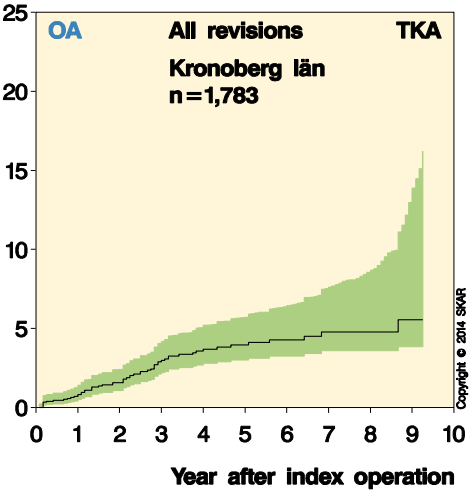




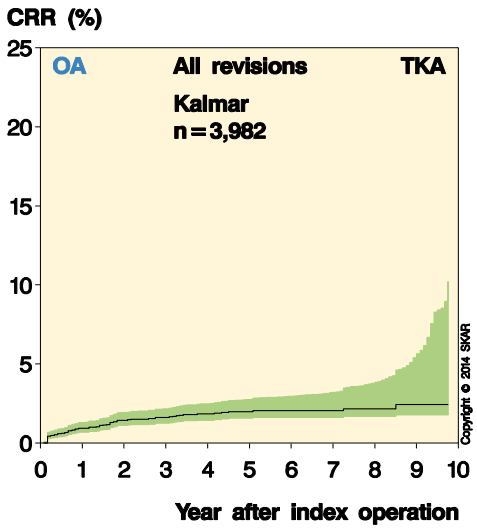


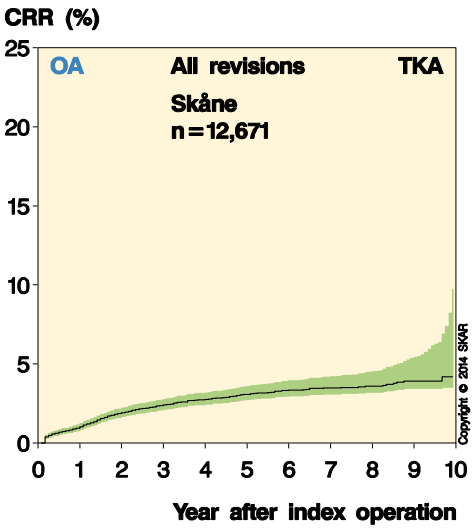


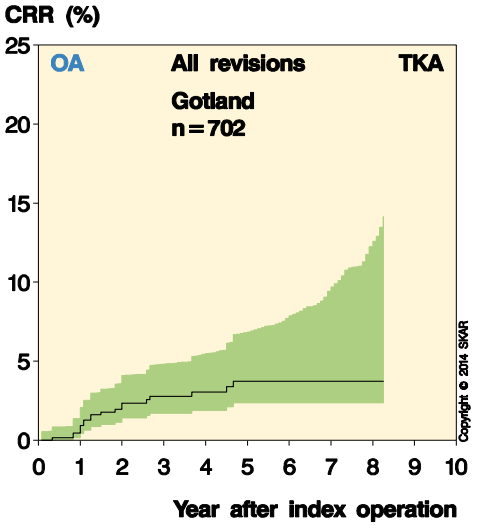


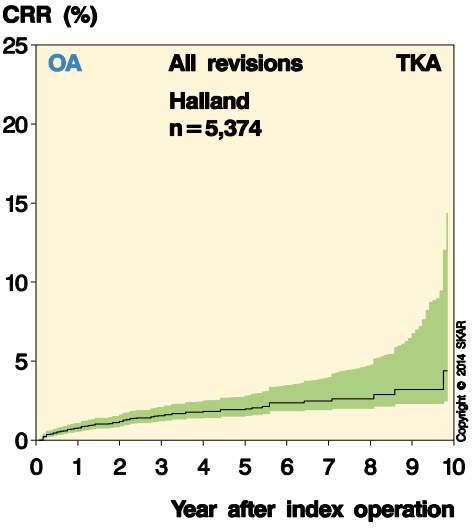


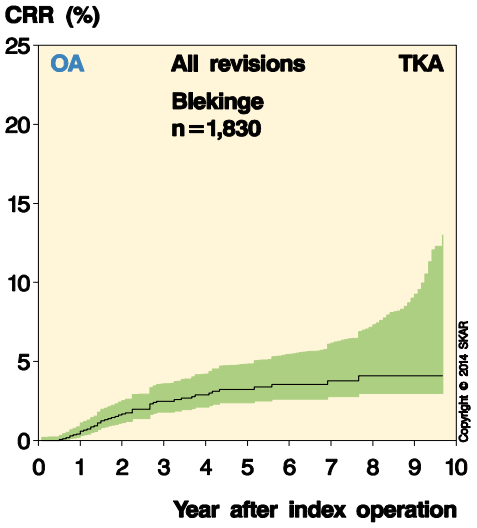
The curces are cut when less than 40 patients are left "at risk"

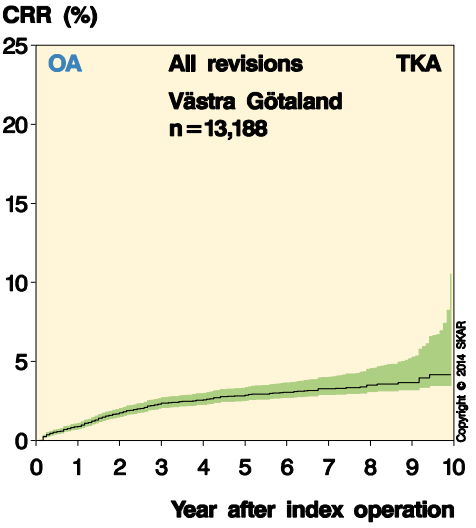






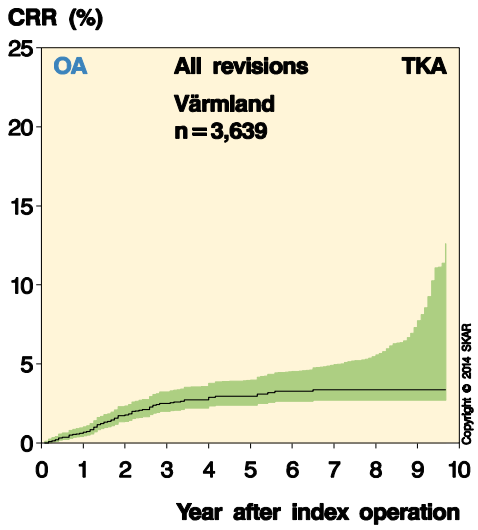


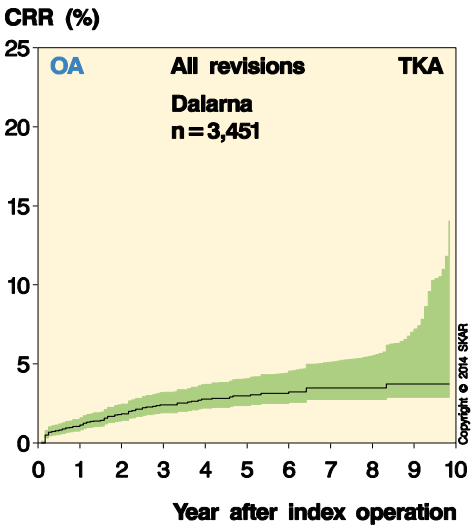


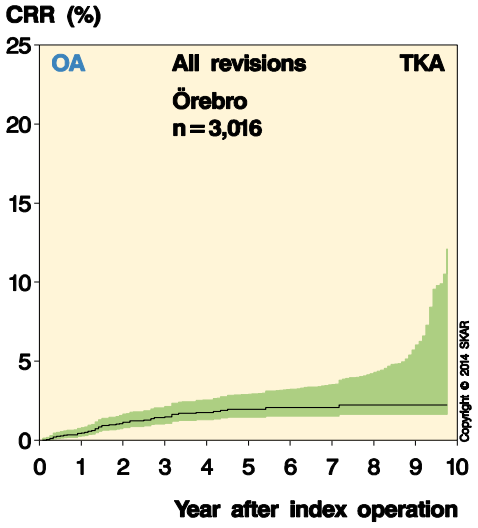


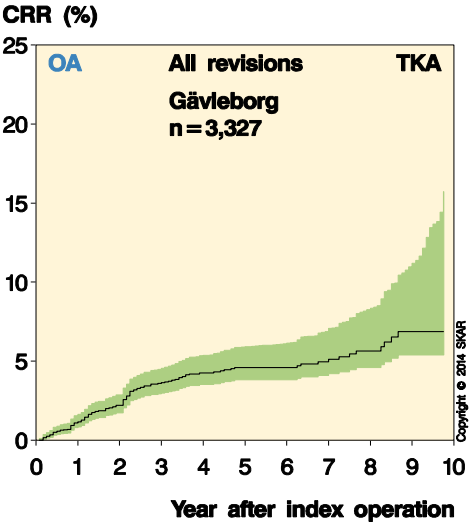
The curces are cut when less than 40 patients are left "at risk"

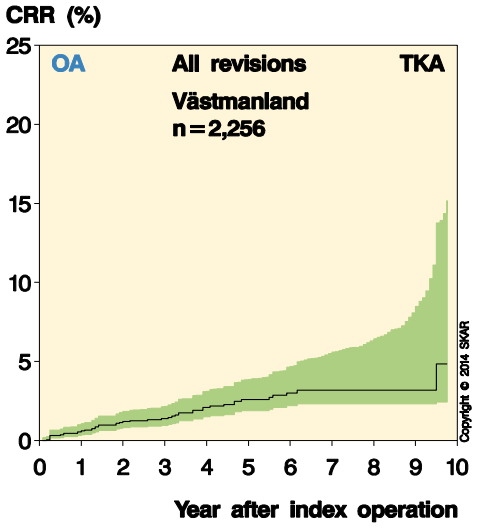
CRR in the counties after primary TKA for OA 2003–2012

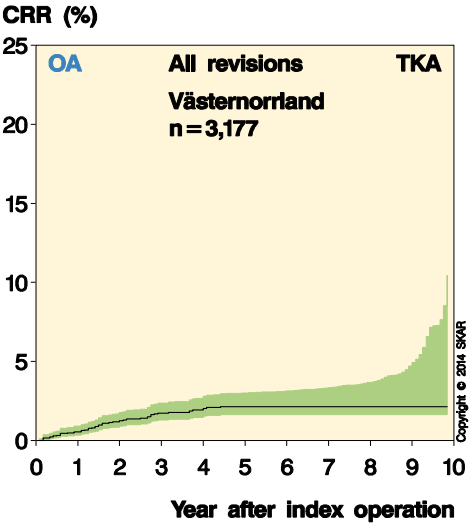




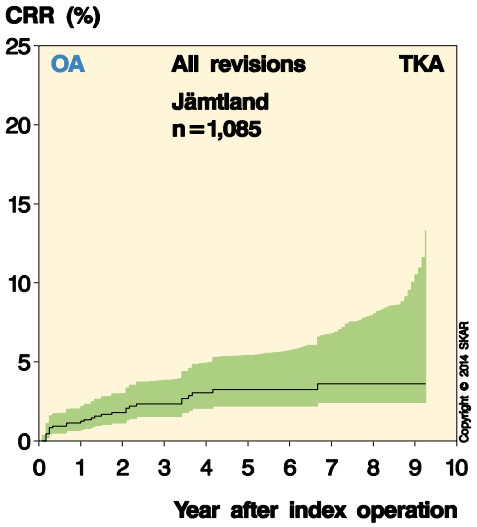


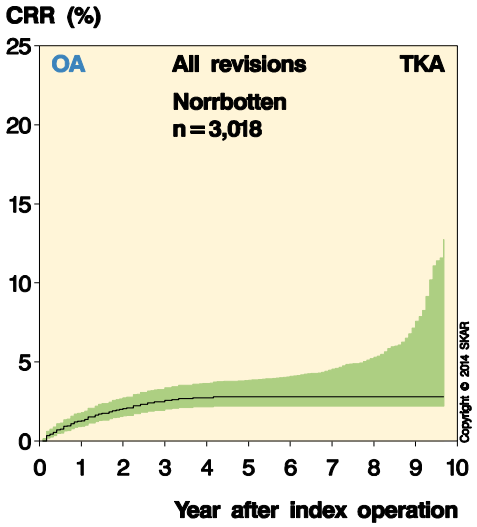


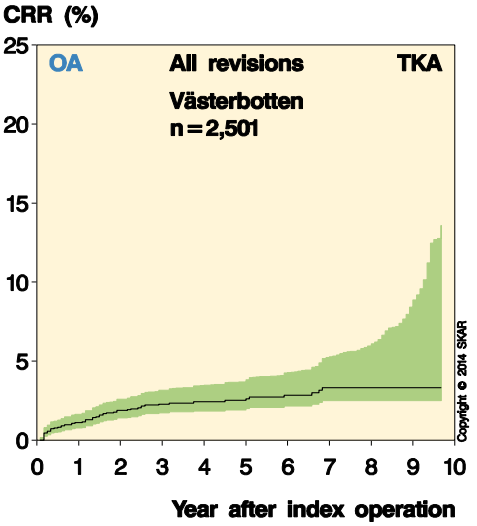




The curces are cut when less than 40 patients are left "at risk"

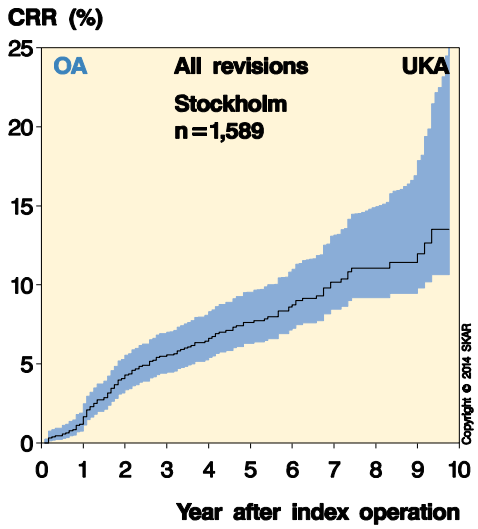


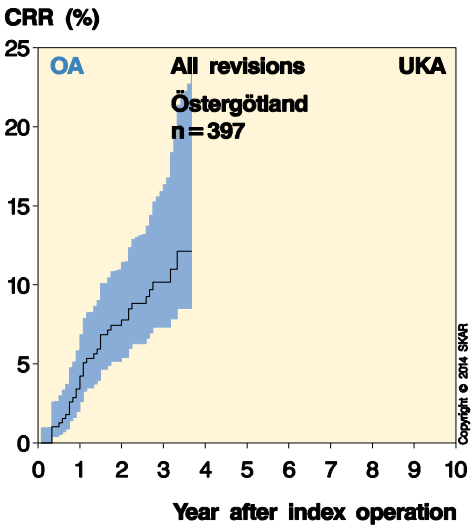


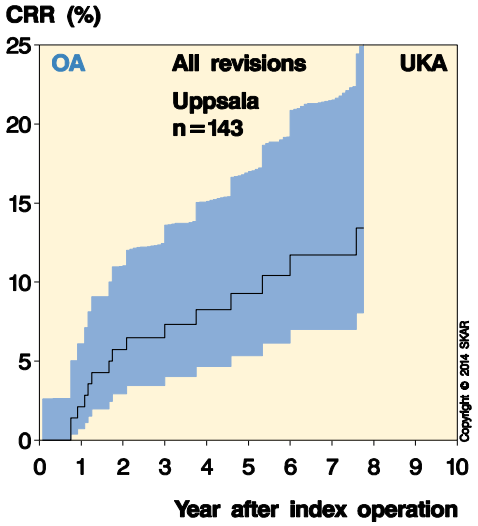


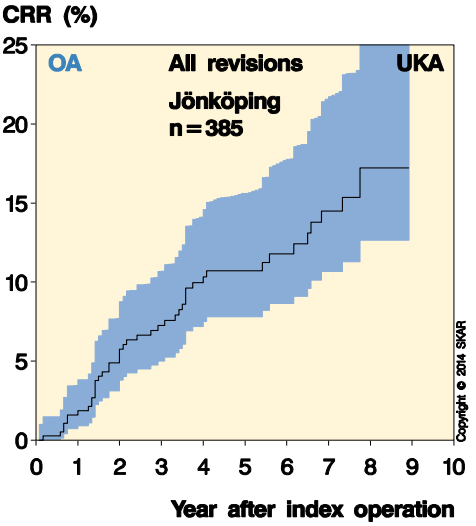
The curces are cut when less than 40 patients are left "at risk"

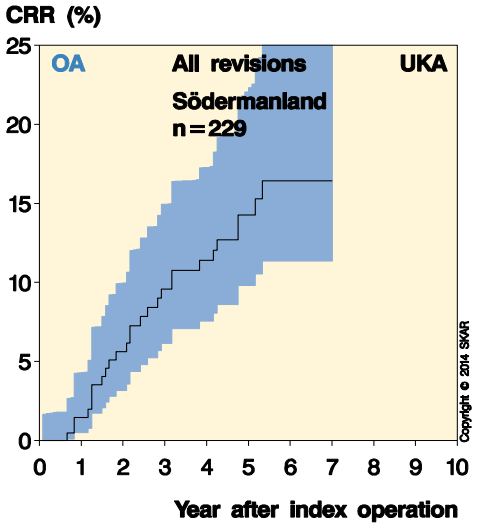
CRR in the counties after primary UKA for OA 2003–2012

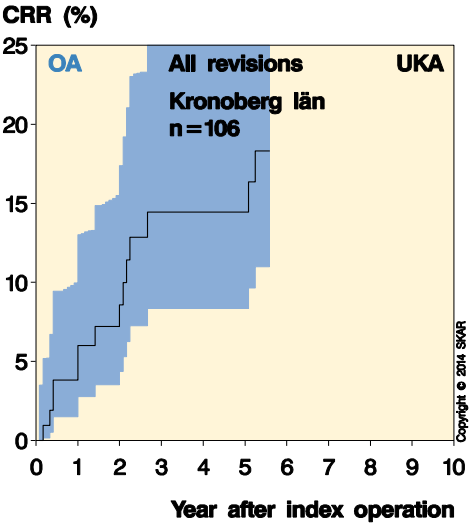




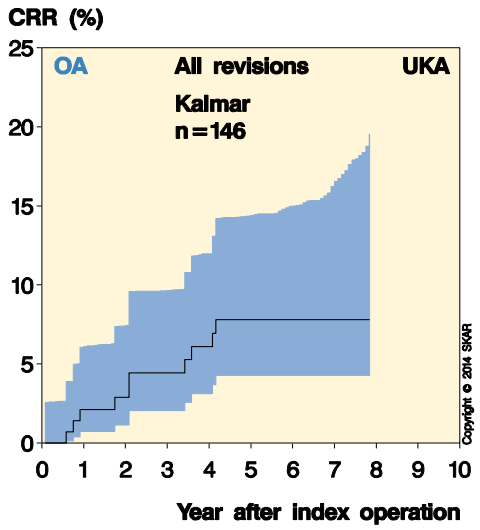


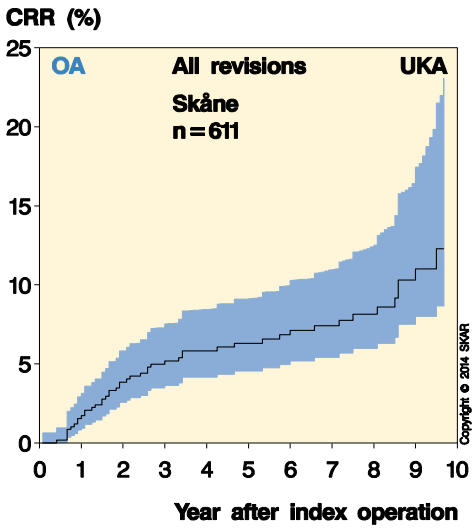


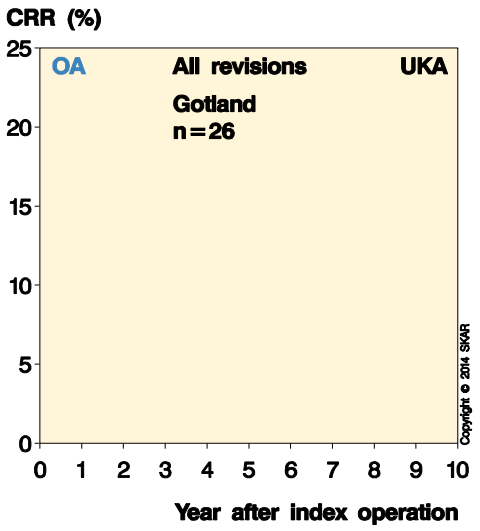


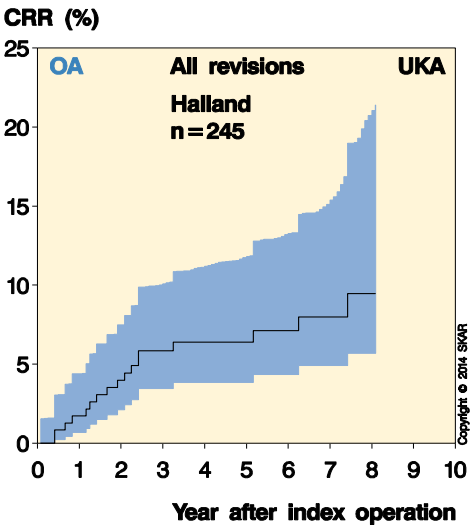


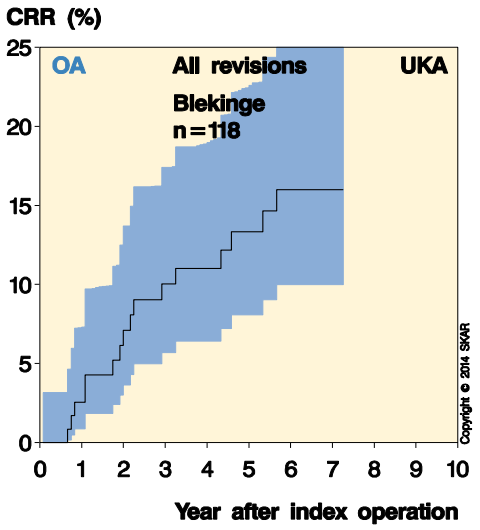
The curces are cut when less than 40 patients are left "at risk"

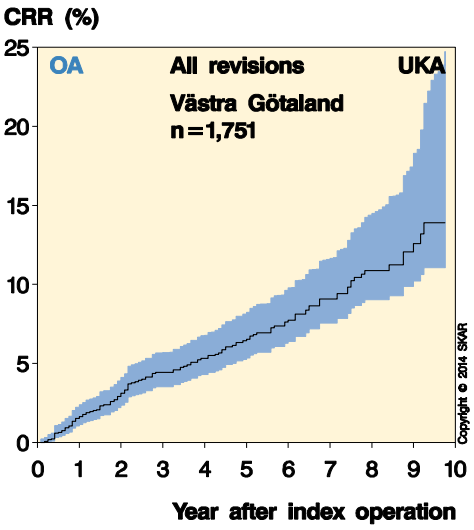






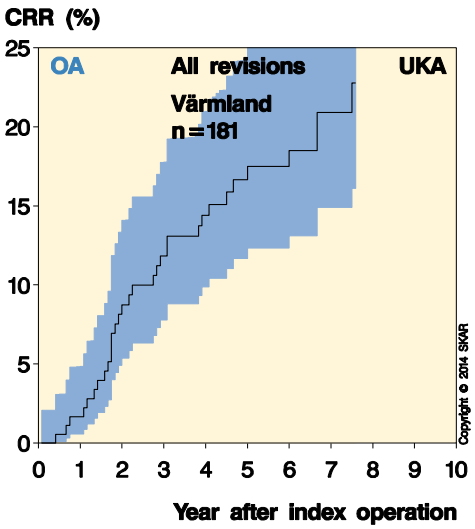


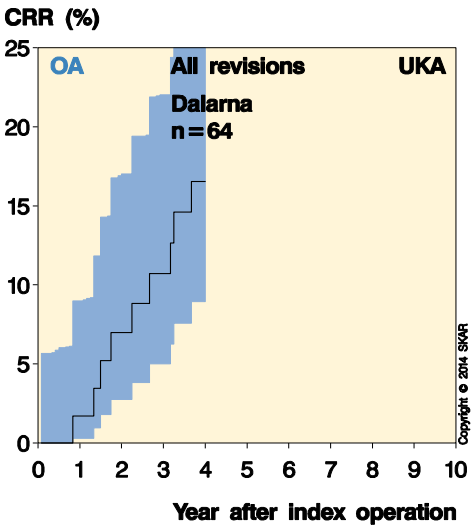


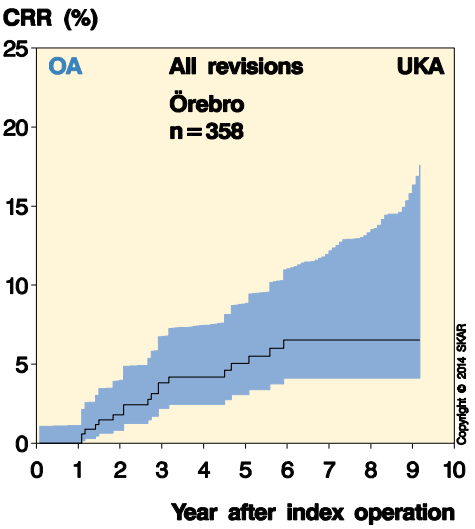


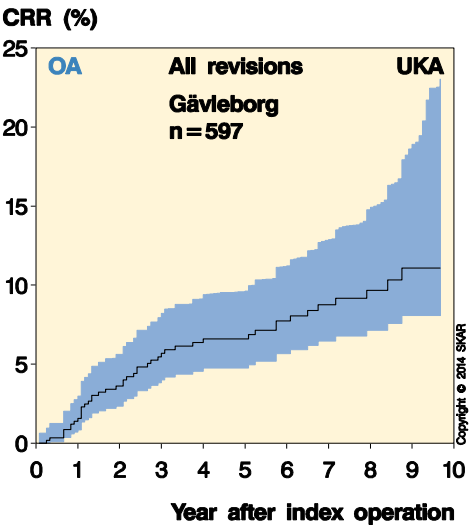
The curces are cut when less than 40 patients are left "at risk"

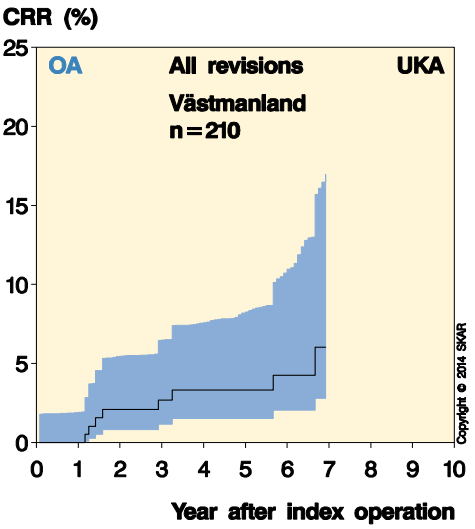
CRR in the counties after primary UKA for OA 2003–2012

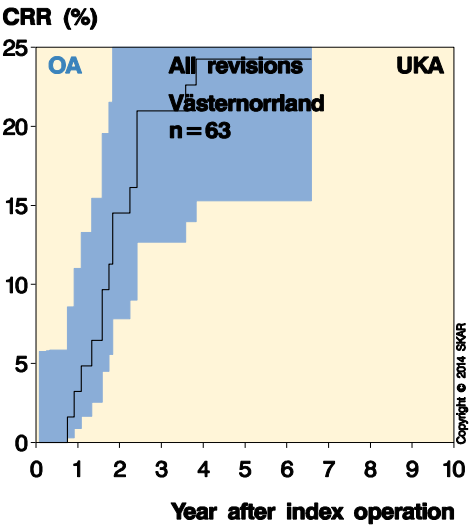




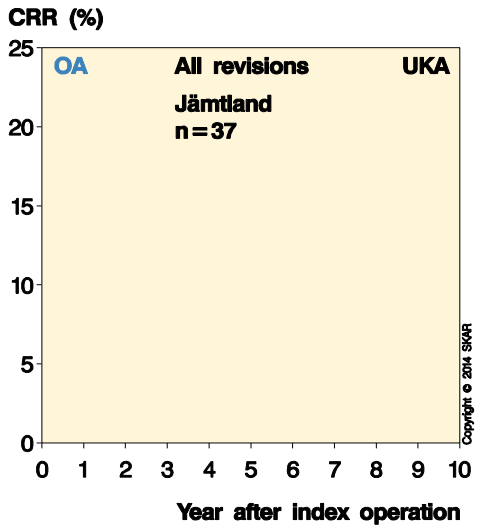


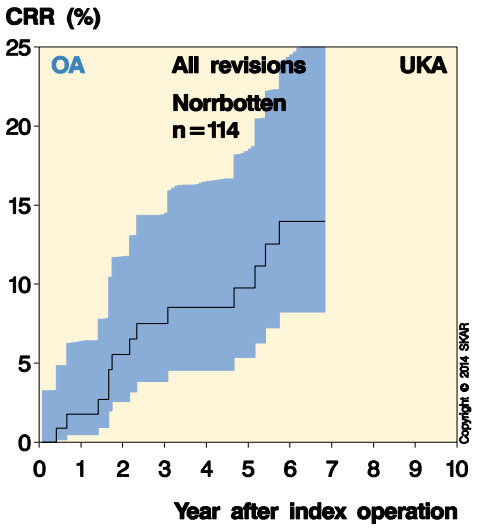


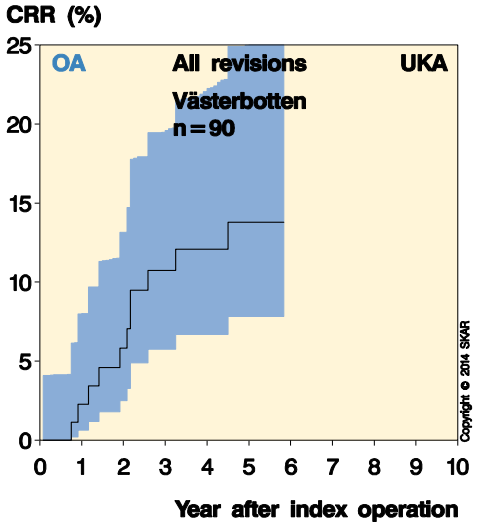




The curces are cut when less than 40 patients are left "at risk"







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

The relative risk for implants used in primary arthroplasty during 2003–2012

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. One must realize that individual models may represent different variants depending on modularity and marketing. Still, there are usually a few combinations that dominate within each brand.

Thus, 95% of the PFC Sigma use the same type of a ”non-porous C/R” femur component which in 51% of cases was inserted with a cemented metal backed tibia component (MBT) and in 39% with an all-poly tibia (APT) component. NexGen had more femoral variants (61% CR Option) which in 85% of cases were combined with a MB tibia (of which Option was 90%), in 13% with an AP tibia and in 2% with a trabecular metal (TM) tibia component.

For the first time, this year we now do not use the AGC as the reference implant. Instead we choose the PFC Sigma-MBT which is a relatively well defined brand, i.e. it mainly consists of the same type of femur (95%) together with the same type of tibia (90%) using the same type of curved inlay (97%)

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.

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 as described abobe the PFC-MBT but for UKA it is the Endo-Link as before.

The risk of revision (RR) with 95% confidence interval. For TKA the reference is PFC-Sigma MBT 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
PFC-Sigma MBT	16,760		ref.	
AGC Anat	9,718	0.16	1.11	0.96-1.29
F/S MIII	3,869	<0.01	1.45	1.21-1.74
PFC-Sigma APT	11,695	<0.01	0.66	0.56-0.78
Duracon	5,633	0.29	1.10	0.92-1.31
Profix	1,911	0.28	1.17	0.88-1.55
NexGen MBT	28,654	<0.01	0.74	0.65-0.85
NexGen APT	3,957	0.43	0.91	0.72-1.15
NexGen TM	751	0.04	0.53	0.29-0.97
PFC RP	1,050	<0.01	1.67	1.27-2.19
Triathlon	5,271	0.21	0.86	0.68-1.09
Vanguard	6,179	0.30	1.11	0.91-1.37
Other	2,677	<0.01	1.44	1.16-1.79
Gender (male is ref.)		0.89	0.99	0.91-1.08
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	2,639		ref.	
Oxford	2,290	0.73	1.04	0.85-1.27
MillerGalante	1,294	0.96	1.01	0.82-1.24
Genesis	453	0.52	1.12	0.80-1.57
Preservation	147	0.04	1.57	1.02-2.40
ZUK	478	0.57	0.89	0.59-1.34
Triathlon PKR	95	0.96	1.03	0.38-2.80
Other	64	0.73	0.84	0.31-2.26
Gender (male is ref.)		0.86	0.99	0.84-1.15
Age (per year)		<0.01	0.97	0.96-0.98
Year of op. (per year)		0.12	1.03	0.99-1.07

Red is significant difference with higher risk ratio.
Green 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
PFC-Sigma MBT	16,264		ref.	
AGC Anat	8,489	0.01	1.21	1.04-1.41
F/S MIII	2,581	<0.01	1.66	1.36-2.03
PFC-Sigma APT	11,375	<0.01	0.68	0.57-0.81
Duracon	4,967	0.54	1.06	0.88-1.28
Profix	1,742	0.45	1.13	0.83-1.53
NexGen MBT	28,249	<0.01	0.76	0.66-0.87
NexGen APT	3,886	0.74	0.96	0.76-1.22
NexGen TM	738	0.06	0.56	0.31-1.03
PFC RP	834	<0.01	1.76	1.30-2.38
Triathlon	5,110	0.32	0.89	0.70-1.13
Vanguard	5,798	0.07	1.21	0.99-1.49
Other	2,365	0.01	1.37	1.08-1.74
Gender (male is ref.)		0.97	1.00	0.92-1.09
Age (per year)		<0.01	0.97	0.96-0.97
Year of op. (per year)		<0.03	1.02	1.00-1.04

With patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	496		ref.	
AGC Anat	1,229	<0.01	0.34	0.20-0.59
F/S MIII	1,288	0.05	0.61	0.37-1.01
PFC-Sigma APT	320	0.03	0.37	0.15-0.91
Duracon	666	0.49	0.83	0.50-1.40
Profix	169	0.95	0.97	0.44-2.17
NexGen MBT	405	0.13	0.56	0.26-1.18
NexGen APT	*71*	*0.97*		
NexGen TM	*13*	*0.99*		
PFC RP	216	0.31	0.68	0.33-1.42
Triathlon	161	0.17	0.47	0.16-1.38
Vanguard	381	<0.01	0.07	0.01-0.50
Other	312	0.57	1.19	0.66-2.14
Gender (male is ref.)		0.43	0.89	0.66-1.19
Age (per year)		<0.01	0.97	0.95-0.98
Year of op. (per year)		0.02	1.10	1.01-1.19

Implants lacking sufficient numbers for analysis are shown in italics

Using the current division of TKA implants inserted for OA (left table on the previous page), we find that it is only the PFC rotating platform, the F/S MIII and the combination of "Other" models that have significantly higher risk than the reference PFC-MBT. F/S MIII was used in Sweden in the nineties and until 2008. The PFC rotating platform was introduced at the start of the millennium and was most popular during 2009-2010 after which its use sharply diminished. The PFC-APT, NexGen MBT and NexGen TM 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 during a treatment of a manifest or suspected infection. On the next page we have performed the same analysis but without considering such inlay exchanges being revisions and then the effect of the year of surgery 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. The only model with higher risk of revision than the Link reference was Preservation which has not been reported having been used since 2011.

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 in which a patellar button was used.

Without a patellar button, the implants that differ from the reference are the PFC-Sigma APT and NexGen MBT which have a significantly lower risk of revision while the F/S MIII, PFC rotating platform, the group of "Other" models as well as the prior reference AGC have a significantly higher risk.

The number of arthroplasties in which a patellar button was used is rather small which makes it more difficult to show significant differences. However, it is interesting to see that the AGC which had a higher risk than the reference when no button was used has a lower risk when using a button. Also the Vanguard has lower risk than the reference and the PFC-APT continues to have a lower risk than the MBT version.

The relative risk for implants used in primary arthroplasty during 2003–2012 if the exchange of 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 being 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 as compared to the table on page 40 is that Triathlon now has significantly lower risk than the reference while the AGC with a monobloc tibia (inlay cannot be exchanged) has a significantly higher risk. However, the PFC-APT still has a lower risk than the PFC-MBT reference (not as pronounced) but like the AGC it has a non-modular tibia and does not benefit from the exclusion of inlay exchanges.

After the exclusion women have a higher risk of revision and the reason is that men more often are revised for infection (see page 19). The negative effect of time (increasing op.-year) has also disappeared, probably as there has been an increased aggressiveness treating early infections or suspected infections by opening the knee, perform debridement and exchange of inlay when possible.

In case of UKA's (table below), there were only 5 exchanges of inlays because of manifest or supected infection during the 10-year period and the table is almost identical to the table on page 40.

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

OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	16 760		ref.	
AGC Anat	9,718	<0.01	1.29	1.10-1.50
F/S MIII	3,869	<0.01	1.56	1.29-1.88
PFC-Sigma APT	11,695	0.03	0.82	0.68-0.98
Duracon	5,633	0.36	1.09	0.90-1.32
Profix	1,911	0.13	1.27	0.93-1.73
NexGen MBT	28,654	<0.01	0.68	0.58-0.79
NexGen APT	3,957	0.14	1.2	0.94-1.53
NexGen TM	751	0.06	0.5	0.25-1.02
PFC RP	1,050	<0.01	1.89	1.42-2.51
Triathlon	5,271	0.03	0.72	0.54-0.97
Vanguard	6,179	0.16	1.18	0.94-1.49
Other	2,677	<0.01	1.49	1.18-1.87
Gender (male is ref.)		0.01	1.12	1.02-1.23
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.08	0.98	0.96-1.00

OA / UKA	n	p–value	RR	95% CI
Link	2 639		ref.	
Oxford	2,290	0.86	1.02	0.83-1.25
MillerGalante	1,294	0.98	1	0.81-1.24
Genesis	453	0.49	1.12	0.80-1.58
Preservation	147	0.04	1.57	1.02-2.40
ZUK	478	0.63	0.9	0.60-1.36
Triathlon PKR	95	0.91	1.06	0.39-2.89
Other	64	0.72	0.83	0.31-2.24
Gender (male is ref.)		0.86	0.99	0.84-1.15
Age (per year)		<0.01	0.97	0.96-0.98
Year of op. (per year)		0.20	1.03	0.99-1.07

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 to be a revision

Without patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	16,264		ref.	
AGC Anat	8,489	<0.01	1.39	1.19-1.63
F/S MIII	2,581	<0.01	1.84	1.50-2.26
PFC-Sigma APT	11,375	0.06	0.84	0.70-1.01
Duracon	4,967	0.79	1.03	0.84-1.26
Profix	1,742	0.13	1.28	0.93-1.78
NexGen MBT	28,249	<0.01	0.69	0.59-0.81
NexGen APT	3,886	0.05	1.28	1.00-1.63
NexGen TM	738	0.09	0.54	0.26-1.09
PFC RP	834	<0.01	2.03	1.50-2.77
Triathlon	5,110	0.08	0.77	0.57-1.03
Vanguard	5,798	0.03	1.29	1.02-1.63
Other	2,365	0.02	1.37	1.06-1.77
Gender (male is ref.)		<0.01	1.14	1.03-1.25
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.02	0.97	0.95-1.00

With patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	496		ref.	
AGC Anat	1,229	<0.01	0.42	0.24-0.75
F/S MIII	1,288	0.17	0.68	0.40-1.18
PFC-Sigma APT	320	0.1	0.47	0.19-1.16
Duracon	666	0.9	0.97	0.55-1.69
Profix	169	0.56	0.74	0.28-2.00
NexGen MBT	405	0.2	0.58	0.25-1.33
NexGen APT	*71*	*0.97*	*<0.01*	.
NexGen TM	*13*	*0.99*	*<0.01*	.
PFC RP	216	0.37	0.69	0.31-1.55
Triathlon	161	0.06	0.15	0.02-1.12
Vanguard	381	0.02	0.09	0.01-0.69
Other	312	0.23	1.46	0.79-2.72
Gender (male is ref.)		0.83	0.97	0.71-1.32
Age (per year)		<0.01	0.96	0.95-0.98
Year of op. (per year)		0.05	1.09	1.00-1.19

Implants lacking sufficient numbers for analysis are shown in italics

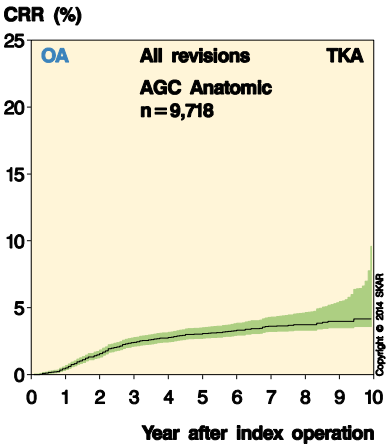
Above we have as on page 41 divided the TKA for OA into those that are used without respective with a patellar component.

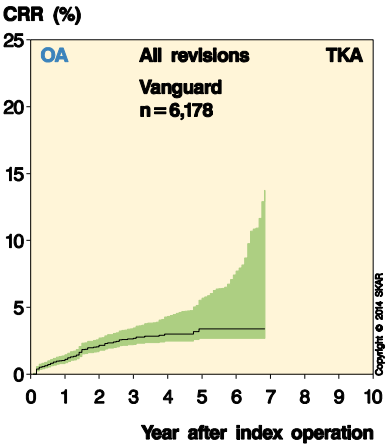
In the table left above, in which no patella button was used, the result is quite similar to that when exchange of tibia inlays was excluded with the exception that the PFC-APT no longer has significantly lower risk than the PFC-MBT reference and that the Vanguard now has a significantly increased risk. As for all TKA's, with and without patellar button (table on the left page), women have higher risk than men. However, instead of the increased risk with later year of surgery that was observed when inlay exchanges were considered revisions the risk now decreases with increasing year of surgery.

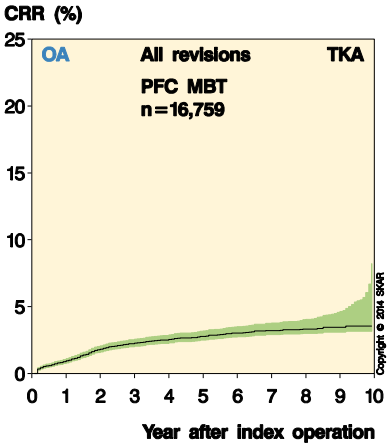
The right table above concerns TKA's in which a patellar button was used. When this table is compared to the table on page 40 one finds that the AGC and Vanguard still have lower risk than the reference PFC-MBT while the PFC-APT no longer has significantly lower risk than the reference.

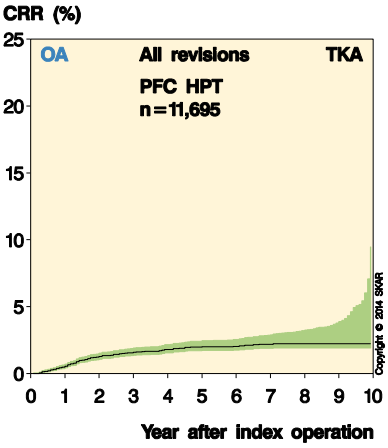
In summary one can establish that excluding an exchange of inlay in infected cases does affect the results and that the effect negatively affects the results of non-modular implants when compared to modular ones. The explanation may be that a number of debridement's without exchange of inlays in non-modular TKA's has succeeded in curing the infection (if not cured, a later revision would probably have been performed). Another possibility is that the increased agressiveness in opening the knee and performing debridement, especially when an inlay can be exchanged, has resulted in non-infected cases becoming subject to such surgery.

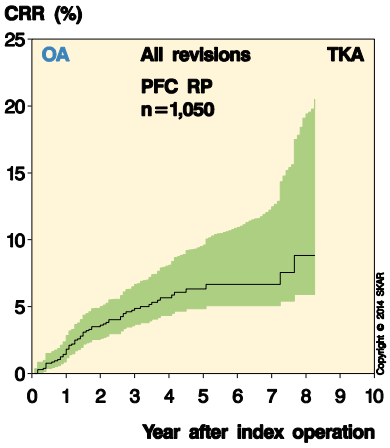
CRR for commonly used TKA implants for OA 2003–2011

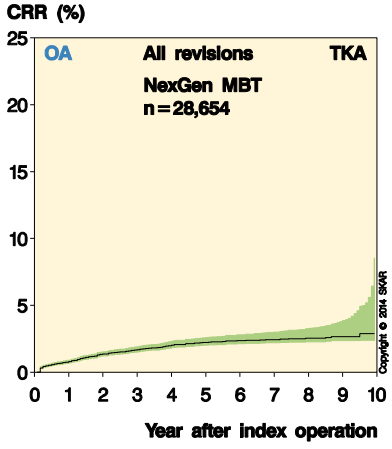


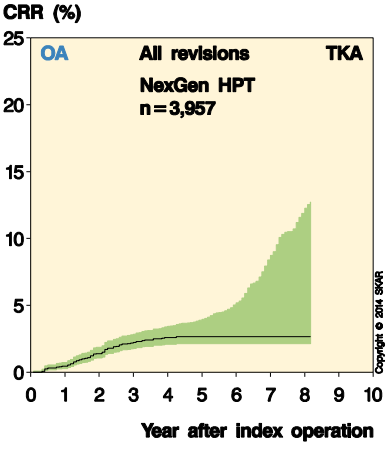


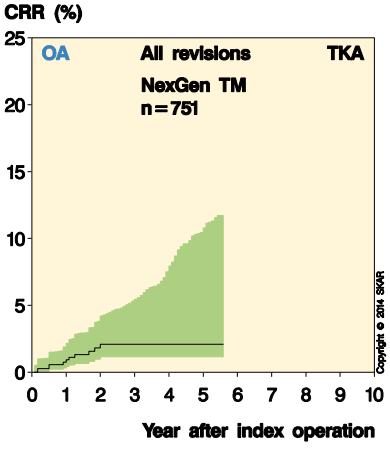


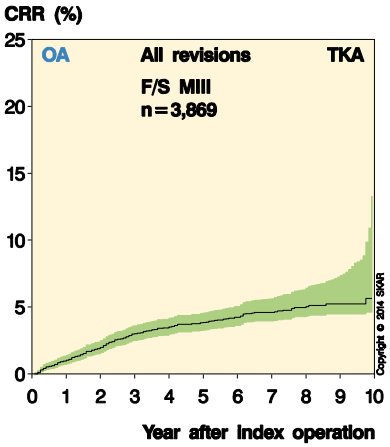











CRR (%)
OA
All revisions
TKA
F/S MIII
n=3,869
Year after index operation
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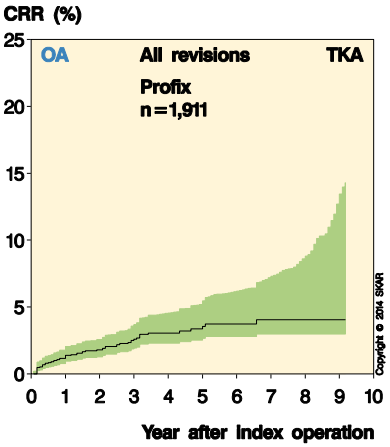
CRR (%)
OA
All revisions
TKA
Profix
n=1,911
Year after index operation
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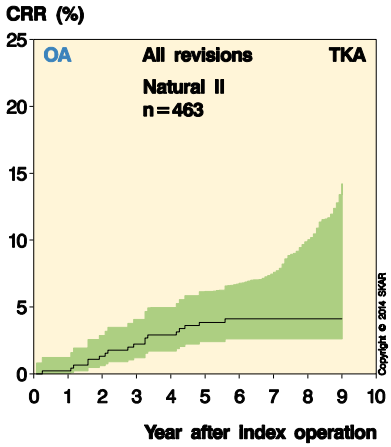
CRR (%)
OA
All revisions
TKA
Natural II
n=463
Year after index operation
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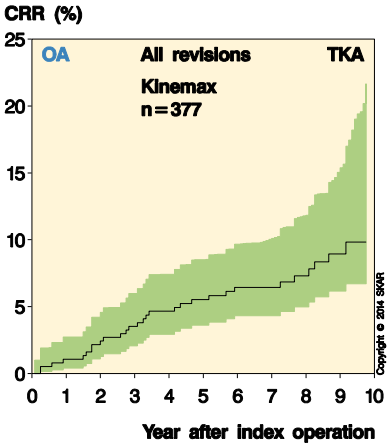
CRR (%)
OA
All revisions
TKA
Kinemax
n=377
Year after index operation
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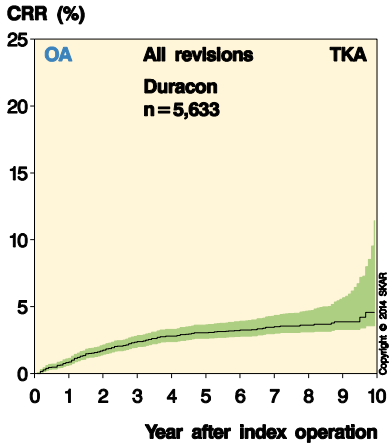
CRR (%)
OA
All revisions
TKA
Duracon
n=5,633
Year after index operation
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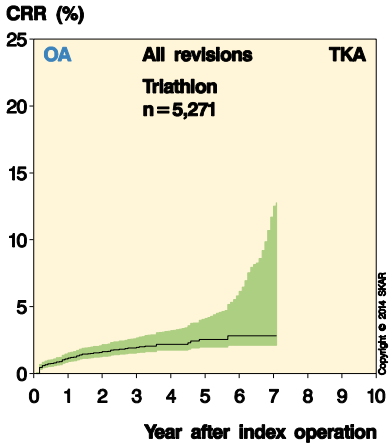
CRR (%)
OA
All revisions
TKA
Triathlon
n=5,271
Year after index operation
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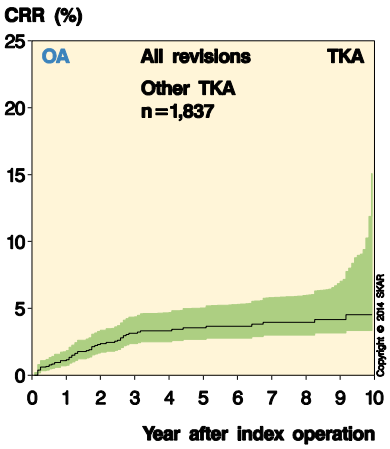
CRR (%)
OA
All revisions
TKA
Other TKA
n=1,837
Year after index operation
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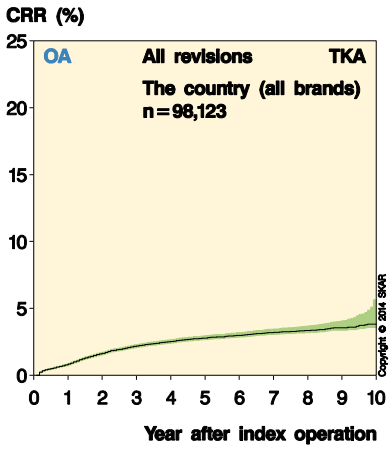
CRR (%)
OA
All revisions
TKA
The country (all brands)
n=98,123
Year after index operation
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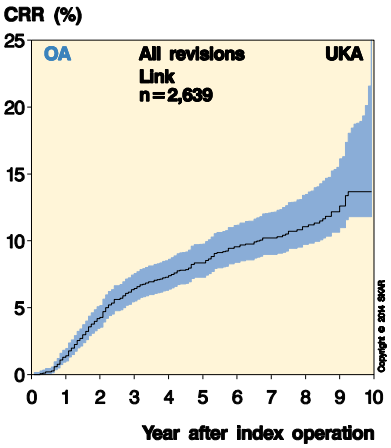
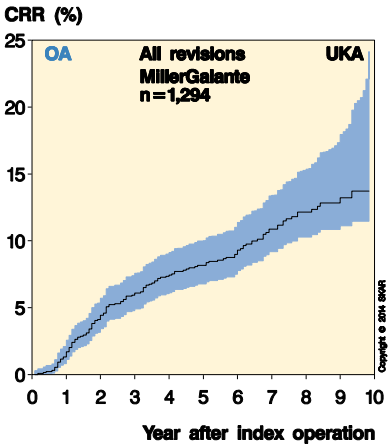
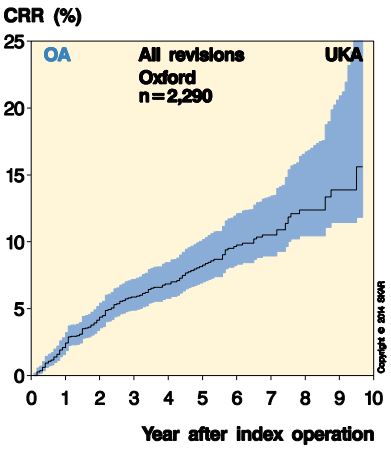
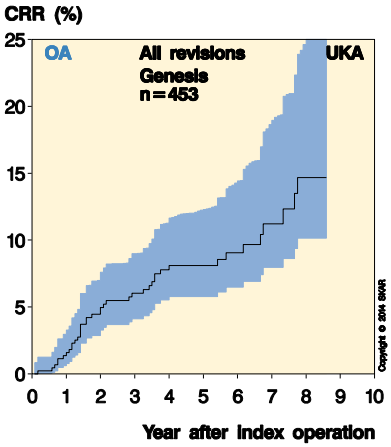
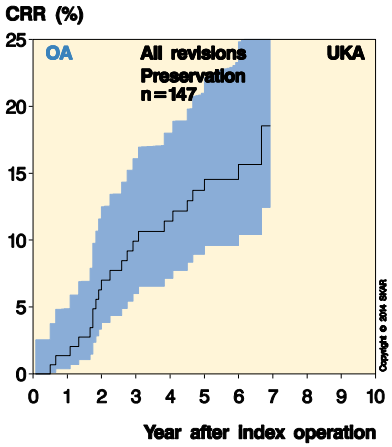
CRR for commonly used UKA implants for OA 2003–2012

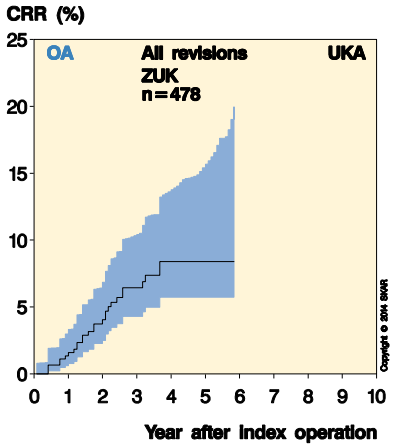


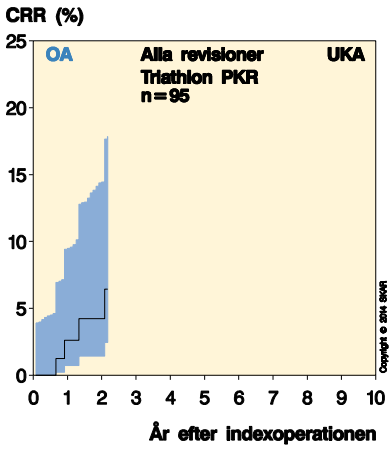


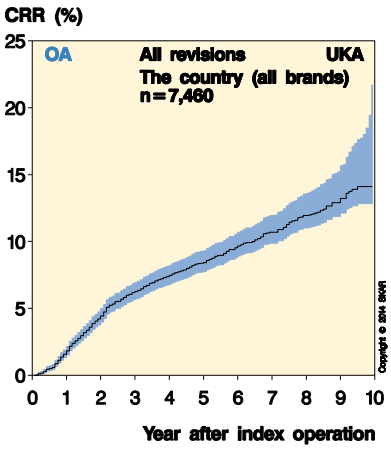












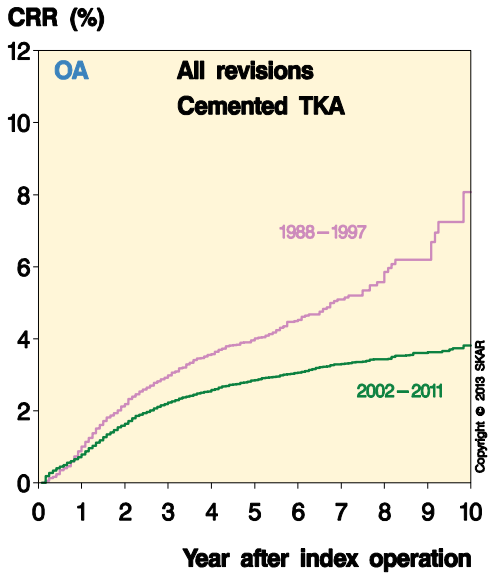
Changes in risk of revision over time (cemented TKA)

The figure below shows the overall risk of revision for the current 10-year period, 2003-2012, 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.

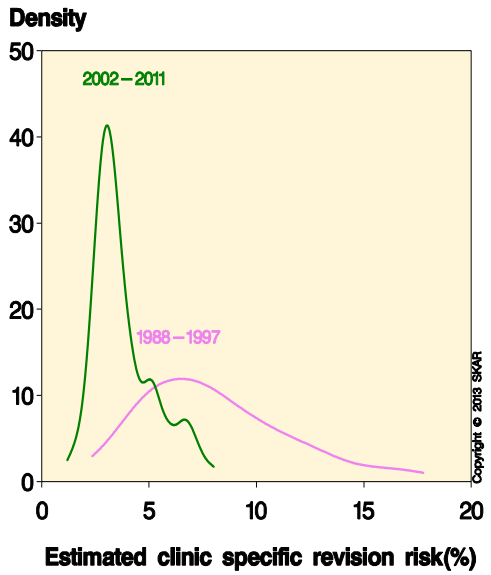
When the absolute specific risk of revision for the units is plotted for both periods (figure below left), it can be seen that the risk has become lower and the distribution has diminished. This implies that the results have improved overall and at the same time the results for the different units have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

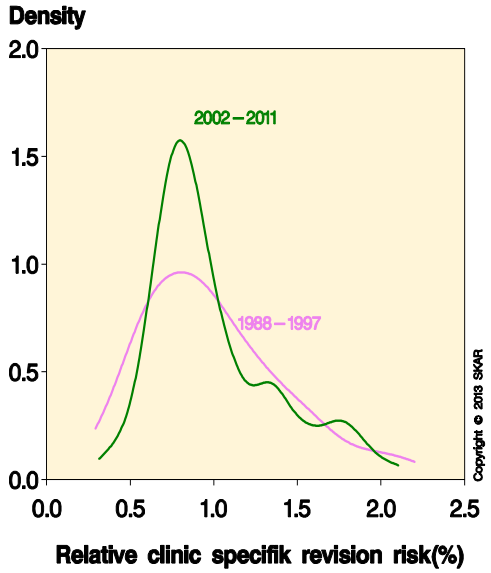
The register is requested to account for hospital specific results which can be found on the next pages. This year, there were 9 hospitals having significantly better results than the average hospital and 13 with inferior results. One can only speculate on the causes for these differences. An unfortunate choice of implants, methods or surgeons may be the explanation, as well as a selection of patients with a higher risk profile (case-mix). We find it appropriate to point out that the results are based on historical data in which the last implants were inserted 2 years ago and the first 12 years ago. Thus, the results do not neccesarily reflect the current risk for patients undergoing surgery.



Total CRR for cemented TKA in OA during the 2 periods 1988–1997 and 2003–2012 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 2003–2012 (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 2003–2012 (x-axis = relative risk).

Relative risk of revision for hospitals 2003–2012 (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	1,556	10	0.38	0.23-0.63	1	1-13
10010	Sabbatsberg (Aleris)	753	5	0.46	0.25-0.84	2	1-32
12010	Enköping	2,082	17	0.48	0.32-0.73	3	1-22
22011	Eksjö-Nässjö (Höglandssjukh.)	1,033	10	0.59	0.36-0.97	4	1-45
42011	Varberg	1,406	19	0.62	0.42-0.92	5	3-40
11002	Huddinge	1,014	13	0.62	0.39-0.98	6	2-46
62011	Örnsköldsvik	1,208	17	0.62	0.41-0.95	7	3-43
42015	Movement Halmstad	1,448	17	0.64	0.42-0.97	8	2-44
50480	Carlanderska	488	4	0.66	0.35-1.25	9	1-62
42420	Spenshult	860	7	0.66	0.38-1.15	10	2-57
25011	Oskarshamn	2,003	29	0.68	0.49-0.95	11	5-43
65012	Gällivare	671	9	0.69	0.41-1.16	12	2-59
65014	Kalix	64	0	0.7	0.30-1.62	13	1-75
28011	Ängelholm	1,235	18	0.7	0.47-1.05	14	4-51
55010	Örebro	960	15	0.72	0.47-1.11	15	4-55
21001	Linköping	146	2	0.73	0.35-1.49	16	2-71
52013	Skene	743	12	0.73	0.45-1.18	17	3-59
41013	Ystad	148	2	0.73	0.36-1.50	18	2-72
50010	Östra sjukhuset	609	11	0.74	0.46-1.20	19	4-61
41012	Helsingborg	243	3	0.74	0.38-1.45	20	2-71
64011	Lycksele	507	7	0.75	0.43-1.30	21	3-65
12481	Elisabethkliniken	629	11	0.75	0.46-1.22	22	4-61
11013	Löwenströmska*	2,455	38	0.75	0.56-1.02	23	8-48
13010	Eskilstuna	338	5	0.75	0.41-1.38	24	2-68
13012	Kullbergska sjukhuset	1,716	28	0.76	0.54-1.06	25	7-52

(cont.)

Relative risk of revision for units (continued)

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
25010	Kalmar	1,052	17	0.76	0.50-1.15	26	5-57
22012	Värnamo	1,058	21	0.77	0.51-1.14	27	6-57
11001	Karolinska	1,400	28	0.77	0.55-1.08	28	7-53
53011	Lidköping	1,058	16	0.78	0.51-1.19	29	6-59
11015	Nacka-Proxima	524	6	0.78	0.44-1.39	30	3-68
22010	Jönköping	1,201	19	0.78	0.52-1.16	31	6-58
55012	Lindesberg	1,144	17	0.78	0.51-1.18	32	6-59
55011	Karlskoga	907	15	0.79	0.51-1.22	33	5-61
62010	Sundsvall	1,009	18	0.81	0.54-1.22	34	7-61
50080	Sergelkliniken	114	2	0.81	0.40-1.67	35	2-76
10011	S:t Göran	3,387	69	0.83	0.66-1.05	36	15-51
54010	Karlstad	1,634	31	0.85	0.61-1.17	37	11-59
21014	Motala	3,429	64	0.86	0.68-1.09	38	17-54
53010	Falköping	1,004	22	0.86	0.59-1.25	39	10-63
56010	Västerås	1,443	23	0.87	0.60-1.26	40	11-64
62013	Sollefteå	956	20	0.9	0.61-1.33	41	12-67
30001	Malmö	144	3	0.91	0.46-1.78	42	4-79
65016	Sunderby	160	4	0.91	0.48-1.72	43	5-78
28013	Simrishamn	561	18	0.93	0.62-1.40	44	13-69
50071	Frölunda Spec.	887	19	0.93	0.63-1.39	45	13-69
52011	Borås	918	23	0.97	0.66-1.41	46	16-70
13011	Nyköping	816	18	0.99	0.66-1.49	47	16-72
11011	Södertälje	1,041	25	0.99	0.70-1.42	48	19-70
56012	Köping	812	23	0.99	0.69-1.44	49	18-70
28012	Hässleholm	4,248	103	1	0.83-1.22	50	30-62
50001	Sahlgrenska	231	8	1.01	0.59-1.73	51	11-77
23010	Växjö	939	22	1.03	0.71-1.50	52	20-73
64001	Umeå	1,140	28	1.04	0.74-1.46	53	23-71
11010	Danderyd	1,336	32	1.05	0.76-1.44	54	24-71
10013	Södersjukhuset	2,183	50	1.05	0.80-1.37	55	29-68
57010	Falun	2,079	48	1.08	0.82-1.41	56	30-70
24010	Västervik	926	24	1.08	0.75-1.55	57	23-74
42010	Halmstad	1,434	39	1.09	0.81-1.48	58	29-71
53013	Skövde	846	18	1.09	0.73-1.64	59	22-75
27011	Karlshamn	1,811	46	1.12	0.85-1.48	60	33-72
26010	Visby	699	19	1.15	0.77-1.71	61	26-78
54014	Torsby	836	22	1.17	0.80-1.70	62	29-77
57011	Mora	1,215	32	1.17	0.85-1.62	63	34-76
10015	Sophiahemmet	809	28	1.2	0.85-1.69	64	34-77
63010	Östersund	1,079	29	1.24	0.89-1.73	65	37-78
65013	Piteå	2,107	58	1.26	0.98-1.62	66	45-76
64010	Skellefteå	757	23	1.28	0.89-1.85	67	38-80
50020	Gothenburg Med Center**	670	23	1.34	0.93-1.94	68	40-81
61010	Gävle	600	19	1.36	0.91-2.02	69	40-81
21013	Norrköping	768	21	1.37	0.93-2.00	70	41-81
41011	Trelleborg	4,504	136	1.41	1.19-1.68	71	59-77
54012	Arvika	1,141	36	1.43	1.05-1.94	72	51-81
51011	Mölndal	1,124	34	1.44	1.06-1.98	73	51-81
51010	Uddevalla	1,580	53	1.47	1.14-1.91	74	56-81
41010	Landskrona	210	14	1.63	1.04-2.54	75	50-83
61011	Bollnäs	2,103	80	1.64	1.32-2.03	76	66-82
61012	Hudiksvall	583	25	1.67	1.17-2.38	77	59-83
41001	Lund	141	9	1.67	1.00-2.80	78	48-83
10016	Ortopediska huset	3,070	131	1.71	1.44-2.04	79	70-82
23011	Ljungby	820	34	1.72	1.25-2.35	80	63-83
12001	Akademiska (Uppsala)	998	50	1.73	1.33-2.26	81	66-83
11012	Norrtälje	733	41	1.98	1.47-2.66	82	72-83
51012	Kungälv	1,310	66	2.04	1.61-2.58	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 2003–2012 (cemented TKA) if the exchange of 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 that shortly after the start of the register, it was noted that many surgeons did not report reoperations which they did not interpret as directly related to the prior knee arthroplasty. This resulted in different types of soft tissue surgeries never being reported and therefore the register decided to use a stricter definition of revision which definitely was implant related.

As previously mentioned (page 42) it can be claimed that for infected cases this definition may be a disadvantage for certain implant brands and consequently those hospitals using these brands. The reason is that one third of all revisions for infection are debridement surgeries during which the inlay is exchanged (classifying them as revisions). However, a debridement in a knee with a monobloc tibia, in which no inlay can 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 debridement. 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 debridement is not considered possible without removal of an inlay. This would result in a reversed bias if the exchange of an inlay is not considered as a revision. However, on page 40-43 we saw that excluding exchange of the tibia inlay seemed to negatively affect the results of at least some implants with monobloc tibia.

Therefore we have chosen also to show risk calculations in which the exchange of inlay (for infection) is not, considered being revision.

If the table below is compared to the one on the previous page, it can be seen that although the rank has changed somewhat, the effect is relatively small. Thus, 7 of the 9 units with results better than the national average (when liner exchange is considered a revision) keep their status, Huddinge and Oskarshamn disappear and Lidköping appears. At the other end, 11 of 13 units that were significantly inferior keep their status while Gothenburg Medical Center (GMC) disappears and Landskrona appears. Of those significantly changing their rank, only Oskarshamn and GMC used monobloc tibia in any numbers, indicating that not only the modularity explains the observed changes in rank when changes of inlays in infected revisions are excluded.

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

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
52012	Alingsås	1,556	8	0.37	0.21-0.64	1	1-16
10010	Sabbatsberg (Aleris)	753	4	0.45	0.23-0.87	2	1-34
42015	Movement Halmstad	1,448	9	0.46	0.27-0.78	3	1-27
62011	Örnsköldsvik	1,208	10	0.47	0.28-0.79	4	1-28
41012	Helsingborg	243	0	0.49	0.20-1.19	5	1-58
22011	Eksjö-Nässjö (Höglandssjukh.)	1,033	7	0.53	0.30-0.94	6	1-41
53011	Lidköping	1,058	8	0.54	0.32-0.94	7	1-42
12010	Enköping	2,082	17	0.55	0.36-0.84	8	2-33
42011	Varberg	1,406	15	0.58	0.37-0.90	9	2-39
42420	Spenshult	860	5	0.63	0.34-1.17	10	2-57
50480	Carlanderska	488	3	0.65	0.32-1.31	11	2-65
65012	Gällivare	671	7	0.66	0.37-1.16	12	3-58
55011	Karlskoga	907	10	0.67	0.40-1.11	13	3-54
25011	Oskarshamn	2,003	24	0.67	0.46-0.96	14	5-44
25010	Kalmar	1,052	12	0.67	0.41-1.08	15	4-53
11002	Huddinge	1,014	13	0.69	0.43-1.09	16	4-54
65014	Kalix	64	0	0.69	0.29-1.68	17	1-76
50010	Östra sjukhuset	609	9	0.71	0.42-1.20	18	4-60
28011	Ängelholm	1,235	16	0.73	0.47-1.12	19	6-54
13010	Eskilstuna	338	4	0.73	0.38-1.41	20	3-68
22010	Jönköping	1,201	15	0.73	0.47-1.14	21	6-56
24010	Västervik	926	13	0.75	0.47-1.19	22	6-59
21001	Linköping	146	2	0.76	0.36-1.60	23	2-73
41013	Ystad	148	2	0.77	0.36-1.62	24	2-74
12481	Elisabethkliniken	629	10	0.77	0.46-1.28	25	5-64

(cont.)

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

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
55012	Lindesberg	1,144	14	0.77	0.49-1.21	26	7-61
57010	Falun	2,079	28	0.77	0.55-1.09	27	10-54
11015	Nacka-Proxima	524	5	0.79	0.42-1.47	28	4-71
55010	Örebro	960	15	0.8	0.52-1.25	29	8-61
13012	Kullbergska sjukhuset	1,716	26	0.81	0.57-1.16	30	11-57
52013	Skene	743	12	0.82	0.50-1.33	31	8-65
64011	Lycksele	507	7	0.83	0.47-1.46	32	6-70
30001	Malmö	144	2	0.83	0.39-1.75	33	3-77
62010	Sundsvall	1,009	16	0.84	0.54-1.28	34	10-63
50080	Sergelkliniken	114	2	0.85	0.40-1.79	35	3-78
11001	Karolinska	1,400	28	0.85	0.60-1.20	36	13-59
22012	Värnamo	1,058	21	0.85	0.57-1.28	37	11-63
54010	Karlstad	1,634	27	0.86	0.60-1.21	38	14-61
11013	Löwenströmska	2,455	38	0.87	0.64-1.18	39	16-59
21014	Motala	3,429	56	0.88	0.68-1.14	40	19-56
52011	Borås	918	18	0.89	0.58-1.35	41	12-67
53010	Falköping	1,004	20	0.89	0.60-1.32	42	13-65
11010	Danderyd	1,336	23	0.9	0.62-1.30	43	14-65
10011	S:t Göran	3,387	67	0.92	0.73-1.16	44	22-58
65016	Sunderby	160	4	0.96	0.50-1.85	45	8-79
50071	Frölunda Spec.	887	17	0.96	0.63-1.46	46	15-70
62013	Sollefteå	956	19	0.97	0.65-1.45	47	17-70
56010	Västerås	1,443	22	0.98	0.67-1.43	48	18-69
28012	Hässleholm	4,248	87	0.98	0.80-1.21	49	28-61
28013	Simrishamn	561	18	1.01	0.67-1.53	50	18-72
64001	Umeå	1,140	24	1.02	0.71-1.48	51	21-71
42010	Halmstad	1,434	33	1.07	0.77-1.48	52	26-71
56012	Köping	812	22	1.07	0.73-1.57	53	23-73
11011	Södertälje	1,041	24	1.07	0.74-1.55	54	24-73
10013	Södersjukhuset	2,183	44	1.07	0.81-1.43	55	29-69
50001	Sahlgrenska	231	8	1.08	0.62-1.87	56	15-79
63010	Östersund	1,079	22	1.12	0.77-1.64	57	26-75
13011	Nyköping	816	18	1.13	0.75-1.70	58	25-76
53013	Skövde	846	16	1.14	0.74-1.75	59	24-77
57011	Mora	1,215	27	1.16	0.82-1.65	60	31-75
23010	Växjö	939	22	1.17	0.80-1.70	61	29-77
10015	Sophiahemmet	809	24	1.18	0.82-1.70	62	30-76
41011	Trelleborg	4,504	97	1.19	0.97-1.45	63	44-71
64010	Skellefteå	757	18	1.19	0.79-1.80	64	27-78
26010	Visby	699	18	1.24	0.82-1.87	65	31-79
21013	Norrköping	768	16	1.28	0.83-1.96	66	31-80
65013	Piteå	2,107	50	1.28	0.98-1.67	67	44-76
54014	Torsby	836	21	1.29	0.87-1.90	68	35-79
27011	Karlshamn	1,811	46	1.29	0.98-1.71	69	44-76
51011	Mölndal	1,124	26	1.32	0.93-1.88	70	41-79
50020	Gothenburg Med Center**	670	22	1.46	1.00-2.13	71	45-82
61010	Gävle	600	18	1.47	0.98-2.22	72	44-82
12001	Akademiska (Uppsala)	998	39	1.54	1.14-2.07	73	55-82
51012	Kungälv	1,310	43	1.57	1.18-2.09	74	58-82
23011	Ljungby	820	27	1.61	1.14-2.28	75	56-83
54012	Arvika	1,141	35	1.61	1.18-2.20	76	57-82
51010	Uddevalla	1,580	52	1.68	1.29-2.18	77	63-82
41010	Landskrona	210	14	1.78	1.13-2.79	78	56-83
41001	Lund	141	9	1.81	1.07-3.06	79	52-83
61011	Bollnäs	2,103	76	1.81	1.45-2.26	80	70-83
61012	Hudiksvall	583	24	1.84	1.27-2.65	81	62-83
11012	Norrtälje	733	35	1.94	1.41-2.68	82	68-83
10016	Ortopediska huset	3,070	130	1.95	1.64-2.32	83	74-83

* 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 2011–2013

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 2011-2013.

Previous surgery

Reporting previous surgery of the index knee, it is possible to mark more than one alternative. No previous surgery was reported for 79% of the cases while 3% had more than one surgery before the primary knee arthroplasty being performed. The table below shows the most common operations. It is not a comprehensive description of previous surgeries performed, but illustrates what the surgeon knew at the time of the primary arthroplasty.

Previous surgery in the index knee

Surgery (%)	2011	2012	2013
None	78.7	78.9	78.7
Osteosynthesis	1.1	0.7	0.7
Osteotomy	2.0	1.9	1.8
Meniscal surgery	7.5	7.5	7.8
Cruciate ligament surgery	1.5	1.7	1.7
Arthroscopy	6.3	5.6	5.8
Other	1.9	2.2	2.2
Missing	1.0	1.5	1.3
Totalt	100	100	100

ASA

The American Society of Anesthesiologists classification is an estimate of the patient's health, and thus of the risk associated with the imminent anesthesia and surgery. As can be seen below, 83% of the patients are reported being healthy or only having a mild systemic disease (grade I or II)

ASA classification

Type (%)	2011	2012	2013
ASA I	19.6	19.0	18.8
ASA II	63.6	65.0	64.4
ASA III	16.4	15.6	16.3
ASA IV	0.2	0.2	0.2
ASA V	0.0	0.0	0.0
Missing	0.2	0.2	0.2
Total	100	100	100

Body Mass Index (BMI)

A good third of the patients had a BMI of 30 or more, which is obesity according to the WHO classification. 1.7% had morbid obesity, i.e. a BMI over 40, a reduction from 2.5% in 2010. Women had a slightly higher BMI than men, but the difference was small.

Body Mass Index (kg/m^2)

BMI group (%)	2011	2012	2013
<25	19.5	18.3	19.1
25-29.9	43.1	43.3	43.4
30-39.9	34.8	36.0	35.6
≥40	2.3	2.2	1.7
Missing	0.3	0.2	0.2
Total	100	100	100

Body Mass Index (kg/m^2)

Gender BMI (median):	2011	2012	2013
Males	29.2	28.1	28.1
Females	28.6	28.8	28.7
All	29.0	28.4	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 2013 the use of Pradaxa decreased somewhat while Xarelto increased slightly as compared to 2011 and 2012.

Trombosprofylax

Type (%)	2011	2012	2013
No prophylaxis	0.1	0.1	0.0
Fragmin pre-op	10.1	11.1	11.6
Fragmin post-op	24.8	28.4	28.2
Innohep pre-op	13.8	10.2	7.5
Inonhep post-op	19.4	19.3	20.5
Klexane pre-op	5.3	6.4	4.6
Klexane post-op	7.4	8.0	8.7
Xarelto	3.8	5.5	9.3
Pradaxa	14.9	10.7	8.4
Other	0.2	0.1	0.9
Missing	0.2	0.2	0.3
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. All patients received some sort of prophylactic medication in 2013 (see table below).

Thromboprophylaxis - length of treatment

Days (%)	2011	2012	2013
No prophylaxis	0.1	0.1	0.0
1-7	7.5	6.5	6.3
8-14	78.7	79.4	79.4
15-21	5.0	6.0	6.0
22-28	6.3	5.4	4.6
29-35	1.1	1.3	1.8
>35	0.4	0.5	0.5
Missing	0.4	0.5	0.5
Total	100	100	100

Type of antibiotic

Cloxacillin was the antibiotic reported by the majority of units and was used in almost 90% of the cases. Dalacin (Clindamycin) 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.

Antibiotic drug

Substance (%)	2011	2012	2013
Cloxacillin	89.7	89.9	90.1
Dalacin	7.6	7.6	7.5
Cefalosporin	2.4	2.3	2.2
Vancomycin	0.1	<0.1	<0.1
Other	0.1	<0.05	<0.1
Missing	0.1	<0.05	<0.1
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 6 to 48 hours.

Cloxacillin dose

Dose (%)	2011	2012	2013
Cloxacillin 2gx3	59.8	64.1	64.8
Cloxacillin 2gx4	30.9	31.1	31.1
Cloxacillin 1gx3	2.1	2.2	0.3
Cloxacillin 1gx4	1.8	0.6	0.3
Cloxacillin 2g+1g+1g	2.2	0.1	1.4
Cloxacillin other dosis	2.5	1.7	2.1
Missing dosis	0.7	0.2	0.0
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. 45-15 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). The proportion of patients having their antibiotics within the time limit improved somewhat between 2010 (81%) and 2011 (87%). However, during 2012 the proportion was 82% and in 2013 it had further worsened to 79% (see table below). The explanation may be that 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. (%)	2011	2012	2013
0-14	4.4	6.0	6.9
15-45	86.8	82.5	79.2
>45	7.7	10.3	12.8
Start after surgery	0.7	0.6	0.5
Missing	0.4	0.6	0.6
Total	100	100	100

Patients, prophylaxis and technique (cont.)

Anesthesia

Spinal anesthesia was most common being used in 81% of cases. Use of general anesthesia increased and was used in 16% of cases while epidural anesthesia accounted for only 0.3%. Combination treatments have started to appear, e.g. a combination of spinal and epidural anesthesia (SPEDA).

Type of anesthesia

Type (%)	2011	2012	2013
General	9.8	10.9	16.2
Epidural	0.6	0.3	0.3
Spinal	89.3	85.5	81.2
Combination		3.0	2.2
Other	0.2	0.2	0.0
Missing	0.1	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 still like using a tourniquet with a good 20% of the arthroplasties being performed without. However, its use has decreased since 2012 when only 13% of surgeries were performed without.

Drainage was used in 17% of cases in 2013 which is a reduction as compared to the previous years.

Tourniquet and drainage

Tourniquet (%)	2011	2012	2013
Yes	89.9	86.4	78.8
No	9.8	13.4	20.9
Missing	0.3	0.2	0.3
Total	100	100	100

Drainage (%)	2011	2012	2013
Yes	26.0	24.3	17.0
No	73.8	75.5	82.2
Missing	0.2	0.2	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 1.1% of cases, mostly for the femur. Information on bone transplantation was missing in 0.3% of the reports.

Computer aided surgery (CAS)

Only 0.3% of the cases (44 surgeries) were reported as having been performed using CAS. They were mainly performed in Hässleholm and Umeå although the method was reported being used in 12 units as compared to 18 in 2012.

In Norway the use of CAS in TKA has lessened from 21% i 2008 to 8% in 2013 and no UKA's were performed with the help of CAS in 2013.

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 (44) cases.

LIA (local infiltration analgesia)

This type of anesthesia originates from Australia but was introduced in Sweden in approx. 2003. Besides studies concerning the effect of pain relief, 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 2013. In 25% of the cases (with or without LIA) a catheter was left in the knee which was a reduction as compared to 2012 when a catheter was left in 33% of cases.

Local infiltration analgesia - LIA

Type (%)	2011	2012	2013
None	4.1	3.3	2.4
LIA	54.5	62.8	71.7
Only catheter	8.4	6.2	3.8
LIA+catheter	32.7	27.5	21.8
Missing	0.3	0.2	0.3
Total	100	100	100

Operating time

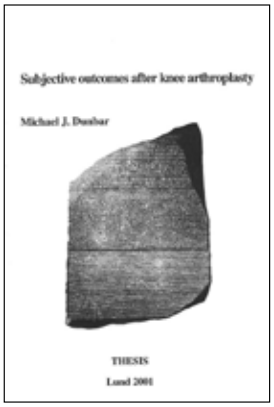
In 2013, the median time for the operations was 127 min. for linked implants, 75 min. for TKA´s, 77 min. for UKA´s and 69 min. for femoro-patellar implants. As compared to 2012, the time was approximately the same for TKA, UKA as well as the 56 femoro-patellar implants.

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.

The pilot project

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 two of the largest arthroplasty units in Sweden was small, in spite of some differences in case-mix.

In the 2013 report we included the rest of the hospitals in Skåne (Lund, Malmö, Helsingborg and Ängelholm) as well as added one year for Trelleborg and Hässleholm. As previously, we could only find small variations between patients having surgery in Trelleborg and Hässleholm, respectively.

However, the results differed from that in Lund which is a unit with few patients and a high response rate as well as that from units with a low response rate such as Helsingborg, Ängelholm and Malmö. This makes it difficult to interpret and compare results of different units as well as different years of surgery.

In this report the project has again been expanded to include an additional year from Trelleborg (2008-2012) and Hässleholm (2009-2012), Lund and Malmö (2008-2012) as well as Helsingborg and Ängelholm (2010-2012). Additionally we show the results for patients operated in Norrköping and Motala that were operated in October, respectivelly November and December 2012, but these two units began registration of PROM in the autumn of 2012.

Below follows a descriptive compilation of the PROM data for the TKA patients for the respective hospital and year of operation.

Instruments used for the evaluation

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

The EQ-5D index is calculated from the answers by use of a tariff for the normal population to weight the answers. However, lacking a Swedish tariff the British has been used instead. The lowest value is -0.594 and the highest 1.0 which represents a fully healthy individual. The index is intended to be used for health economic calculations although it has also been used to estimate quality of care which has proved to be somewhat problematic because of the lack of a normal distribution as recently was reported in the Läkartidningen (36, 2011). If one wants to perform statistical analyses using a single value as a measure of the health related quality of life it is possible to use the EQ-VAS. It measures the self-perceived general health of the patient on a scale (0-100) from the best (100 to the worst imaginable health status (0) (www.euroqol.org).

KOOS is a disease specific questionnaire consisting of 42 questions and is designed to be used for short and long time follow-up after knee trauma or osteoarthritis. KOOS consists of 5 subscales; Pain, other Symptoms, Activity in Daily Life function (ADL), Sport and Recreation function (Sport/Rec) and knee related Quality of life (QoL). Standardized answer options are given (5 Likert boxes) and each question gets a score from 0 to 4. A normalized score (100 indicating no symptoms and 0 indicating extreme symptoms) is calculated for each subscale (www.koos.nu). The results for the 5 subscales are presented as a mean value and standard deviation (SD) before and one year after surgery for all the patients as well as separately for each hospital and year of operation.

A Visual Analog Scale (VAS) was used to have the patients to estimate their knee pain by marking their pain score on a 0-100 scale (VAS) in which 0= no pain and 100= worst imaginable pain. The VAS knee pain is presented as a mean and SD before and one year after surgery for each hospital and year of operation.

Patient satisfaction with the arthroplasty surgery one year postoperatively was also evaluated using a 0-100 scale (VAS) in which 0= the highest imaginable satisfaction and 100= the worst imaginable satisfaction. The satisfaction (VAS) score was categorized into 5 groups; very satisfied (0-20), satisfied (21-40), moderately satisfied (41-60), unsatisfied (61-80) and very unsatisfied (81-100).

Case-mix classification

Gender	**Male / Female**	
Age		
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); weight (kg)/(height (m))^2		
	<25	**- normal weight**
	25-29.9	**- overweight**
	30-39.9	**- obesity**
	≥40	**- morbid obesity**

Case-mix

Fo TKA, the proportion of men having TKA was higher in Hässleholm than Trelleborg (table's right) but in 2013 the nationwide proportion of men having TKA for OA was 43%. The proportion of healthy patients (ASA I) was somewhat larger in Hässleholm than in Trelleborg as was the proportion of those having serious systemic disease (ASA III). Trelleborg had somewhat lower proportion of ASA III patients (TKA/OA) than the national average (17%). 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 but more than half of their patients were classified as ASA III. The case-mix for the units with low answering rate as well as Norrköping and Motala which only delivered data for few months are not accounted for as the results are probably not representative.

Description of patients in Trelleborg

	All	Males	Females
	n=2122	n= 803	n=1319
		(37.8%)	(62.2%)
Age (years)			
Mean	69.4	69.2	69.6
SD	8.6	8.5	8.7
BMI (kg/m2)			
Mean	29.0	28.4	29.4
SD	4.8	3.9	5.3
Charnley category (n (%)			
A	581 (27.5)	272 (34)	309 (23.5)
B	663 (31.3)	249 (31.1)	414 (31.5)
C	872 (41.2)	280 (35)	592 (45.0)
ASA classification n (%)			
ASA I	388 (19.7)	154 (20.6)	234 (19.1)
ASA II	1 359 (68.9)	509 (68.2)	850 (69.3)
ASA III	226 (11.5)	83 (11.1)	143 (11.7)

Description of patients in Lund

	All	Males	Females
	n=39	n= 22	n=17
Age (years)			
Mean	69.6	69.1	70.3
SD	10.5	9	12.4
BMI (kg/m2)			
Mean	29.8	29.7	29.9
SD	4.7	5.4	3.8
Charnley category (n (%)			
A	15	8	7
B	8	6	2
C	14	6	8
ASA classification n (%)			
ASA I	2	2	0
ASA II	16	9	2
ASA III	21	11	10

Description of patients in Hässleholm

	All	Males	Females
	n=1852	n= 883	n=969
		(47.7%)	(52.3%)
Age (years)			
Mean	68.6	68.9	68.3
SD	8.9	8.5	9.2
BMI (kg/m2)			
Mean	28.5	28.2	28.7
SD	4.1	3.5	4.6
Charnley category (n (%)			
A	525 (28.3)	274 (31.0)	251 (25.9)
B	588 (31.7)	307 (34.8)	281 (29.0)
C	739 (39.9)	302 (34.2)	437 (45.1)
ASA classification n (%)			
ASA I	454 (25.1)	220 (25.5)	234 (24.7)
ASA II	1,070 (59.1)	500 (58.0)	570 (60.1)
ASA III	287 (15.8)	142 (16.5)	145 (15.3)

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 in Trelleborg, Hässleholm and Lund were available for evaluation. In Helsingborg Ängelholm and Malmö the response rate was low (18-66%). In case of Norrköping it was possible to evaluate 33 of 44 surgeries after one year and in Motala 38 of 63 surgeries.

Logistics

The patients filled in the questionnaires at the outpatient visit approximately 2-6 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 from surgery until one year postoperatively by using the 9 combinations of pre- and post-operative EQ-5D answers that are possible for each of the questions.

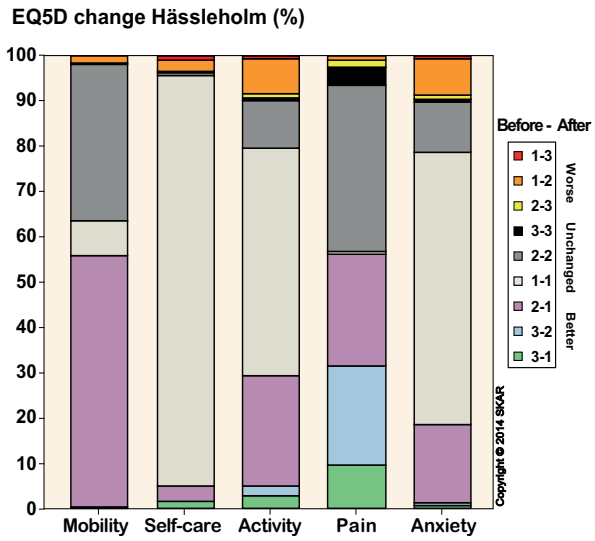
A preoperative answer of extreme problems can be unchanged at the follow-up (3-3) or there can be an improvement from extreme to moderate (3-2) or from extreme to none (3-1).

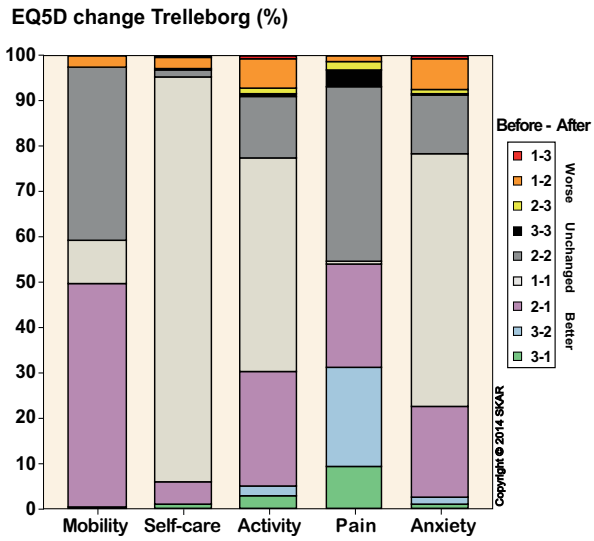
Moderate problems can stay unchanged (2-2), worsen into extreme (2-3) or improve to none (2-1). Finally no problems preoperatively can stay unchanged (1-1), worsen to moderate (1-2) or become extreme (1-3).

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.

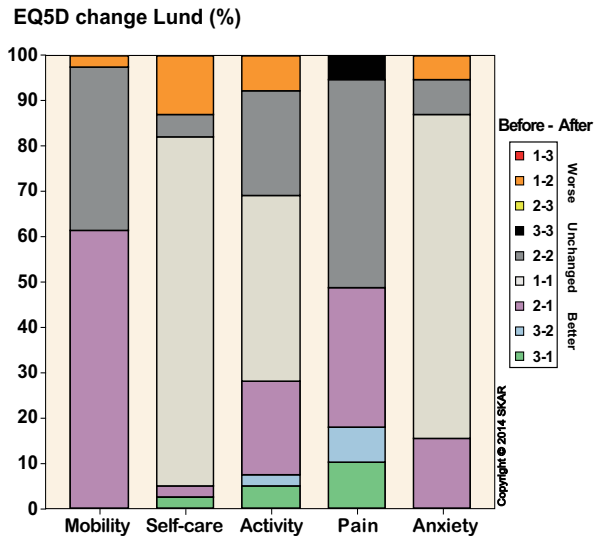
It can be seen that one year after surgery, half of the patients had improved mobility and half of them had experienced pain relief. Only a third had improved in their usual activities, some had reduced anxiety but only a few improved in self-care.

The proportion of patients, that for each dimension of the EQ5D had changed (improved or worsened) or stayed unchanged, differed negligibly (0.3%-6%) 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)

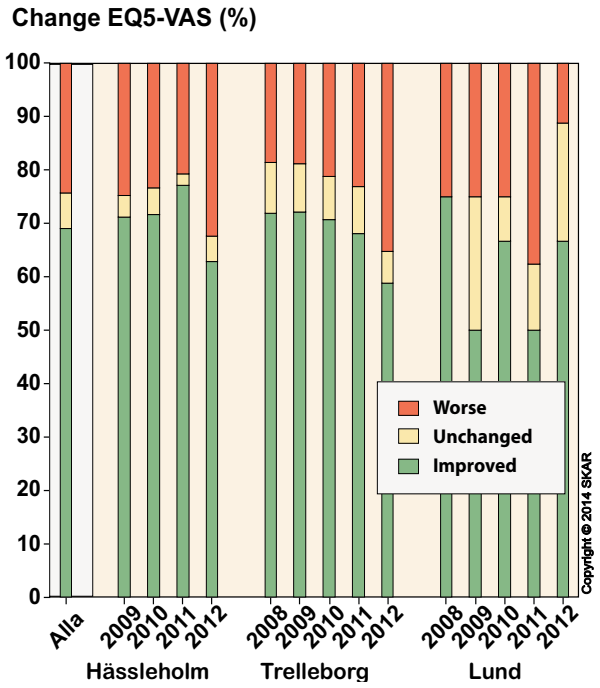


EQ-VAS

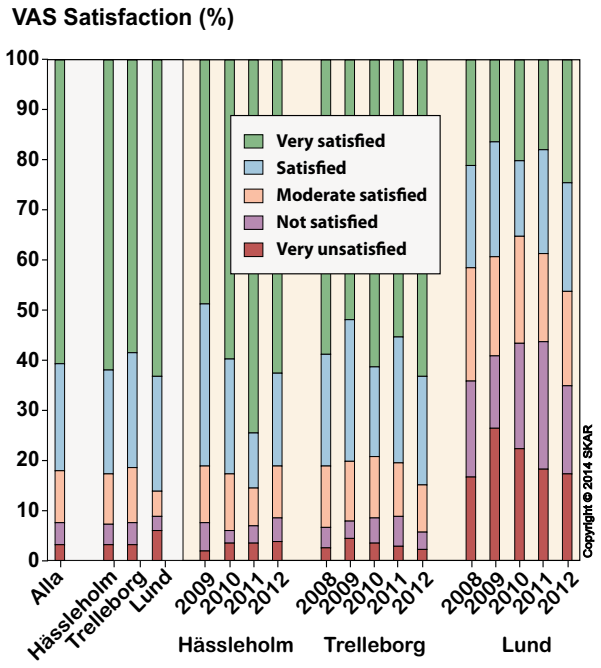
When using EQ-VAS to evaluate the change in pre- and postoperative general health, the differences between Trelleborg and Hässleholm, as well as well as between the different years of surgery were small (1-7 points). For Lund the results varied more as only relatively few patients were operated each year (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 (3 points). The VAS pain estimate was essentially the same independent of what year the surgery had been performed (see page 60).



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 (1-4 points) as well as for the different years of operation. In Lund the patients reported preoperatively more knee related pain, other symptoms as well as more problems with the activities of daily living (4-5 points) than in Trelleborg and Hässleholm. However, postoperatively the differences were small (1-5 points) with 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, 95% of the patients reported their satisfaction of which 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 (fig. upper, right) due to low number of patients.

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

The results for Norrköping and Motala from the last months of 2012 are only shown in the tables. Note that only preoperative KOOS data are available from Norrköping.

<u>*Summary*</u>

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

Oskarshamn started to gather data at the turn of the year 2012/2013 and additional units such as OrthoCenter Stockholm, Karolinska in Solna, Kalmar and Aleris in Ängelholm have joined the project and now enter their locally gathered data into the common database. It takes about 2 years before representative one-year results allowing for comparison against other units become available.

This pilot project can be a basis for further discussions regarding gathering of patient reported outcome on hospital level and register level, as well as how this can be used for clinical quality improvement projects.

Results for EQ-VAS and VAS–pain preoperatively and 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	4,290	61 (16)	20 (20)	62 (22)	76 (20)	4 023	22 (23)
Hospital (all years combined)							
Hässleholm	1,852	59 (16)	19 (20)	61 (22)	76 (20)	1,757	21 (23)
Trelleborg	2,122	62 (17)	20 (20)	63 (22)	76 (20)	1,958	23 (23)
Lund	39	58 (19)	17 (21)	61 (19)	74 (22)	35	22 (25)
Ängelholm	167	66 (14)	22 (23)	60 (24)	72 (23)	165	20 (24)
Helsingborg	30	67 (14)	30 (26)	58 (26)	66 (22)	30	28 (27)
Malmö	9	68 (15)	28 (28)	58 (22)	74 (21)	8	33 (37)
Motala *	38	56 (20)	19 (22)	65 (22)	77 (18)	38	14 (20)
Norrköping**	33	73 (12)	23 (26)	60 (22)	68 (25)	33	24 (32)
Year of sugery (all units)							
2008	358	62 (16)	21 (20)	61 (21)	76 (19)	354	23 (23)
2009	902	60 (17)	19 (20)	60 (21)	76 (20)	699	27 (22)
2010	927	60 (15)	20 (20)	60 (21)	75 (20)	873	23 (24)
2011	1,039	59 (16)	20 (21)	60 (22)	75 (21)	1,037	20 (24)
2012	1,064	64 (18)	20 (20)	66 (23)	75 (20)	1,060	21 (23)
Hässleholm (each year)							
2009	485	57 (16)	19 (19)	60 (21)	75 (20)	391	26 (21)
2010	427	58 (15)	19 (20)	58 (21)	76 (19)	427	21 (22)
2011	491	57 (15)	18 (20)	58 (22)	76 (21)	491	17 (23)
2012	449	63 (17)	19 (20)	66 (23)	76 (21)	448	22 (25)
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	466	61 (17)	21 (21)	63 (22)	75 (21)	466	23 (24)
2012	457	63 (18)	19 (19)	68 (22)	76 (19)	455	20 (21)
Lund (each year)							
2008	5	60 (17)	29 (26)	66 (11)	75 (31)	5	37 (35)
2009	4	69 (7)	23 (32)	55 (24)	68 (34)	4	21 (21)
2010	12	49 (12)	13 (16)	62 (18)	76 (16)	9	17 (14)
2011	8	45 (20)	10 (21)	68 (15)	74 (25)	7	17 (37)
2012	10	73 (20)	19 (19)	53 (23)	73 (20)	10	22 (20)
Ängelholm (each year)							
2010	41	66 (12)	22 (22)	62 (24)	65 (24)	41	20 (24)
2011	60	64 (14)	21 (25)	59 (23)	76 (25)	59	21 (27)
2012	66	68 (15)	22 (23)	60 (24)	71 (24)	65	18 (22)
Helsingborg (each year)							
2010	10	70 (11)	26 (20)	52 (24)	60 (26)	10	33 (28)
2011	11	61 (17)	34 (30)	68 (17)	63 (22)	11	30 (33)
2012	9	70 (14)	30 (27)	54 (34)	74 (15)	9	21 (15)

* operations performed 1/11 2012 - 31/12 2012

** operations performed 1/10 2012 - 31/12 2012

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

		Pain		Symptoms		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 ***	4,255	41 (16)	78 (21)	48 (18)	74 (20)	46 (16)	76 (22)	11 (14)	34 (27)	23 (14)	62 (25)
Hospital (all years combined)											
Hässleholm	1,852	39 (15)	77 (23)	47 (18)	75 (21)	44 (15)	75 (23)	11 (13)	34 (26)	23 (14)	62 (26)
Trelleborg	2,122	43 (16)	79 (21)	48 (16)	74 (19)	47 (17)	77 (21)	12 (15)	35 (27)	24 (14)	63 (24)
Lund	39	44 (19)	82 (18)	52 (20)	75 (18)	48 (21)	74 (23)	10 (12)	27 (28)	24 (11)	63 (25)
Ängelholm	167	39 (16)	76 (21)	47 (17)	74 (18)	45 (16)	76 (21)	10 (14)	32 (26)	22 (14)	60 (25)
Helsingborg	30	36 (17)	72 (25)	44 (20)	70 (18)	40 (20)	69 (24)	6 (8)	26 (23)	16 (10)	51 (28)
Malmö	9	42 (15)	69 (27)	57 (21)	73 (21)	48 (18)	75 (27)	9 (13)	36 (32)	24 (11)	56 (34)
Motala *	38	52 (12)	72 (18)	48 (18)	81 (19)	54 (17)	79 (20)	20 (24)	43 (30)	31 (18)	65 (24)
Norrköping **	33	42 (16)		38 (13)		43 (17)		8 (14)		21 (13)	
Year of sugery (all units)											
2008	358	42 (16)	79 (19)	49 (18)	74 (18)	47 (16)	77 (19)	11 (15)	31 (26)	23 (14)	61 (24)
2009	902	40 (17)	80 (20)	47 (18)	76 (18)	45 (17)	78 (20)	11 (14)	35 (26)	23 (16)	65 (23)
2010	927	41 (15)	79 (19)	47 (16)	75 (18)	46 (15)	76 (20)	11 (13)	34 (26)	23 (14)	63 (24)
2011	1,039	42 (16)	75 (27)	48 (18)	71 (25)	47 (17)	73 (27)	12 (15)	33 (27)	23 (15)	60 (28)
2012 ***	1,031	40 (15)	79 (19)	47 (18)	76 (17)	46 (16)	78 (20)	12 (15)	36 (27)	24 (14)	63 (25)
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	427	40 (13)	79 (19)	48 (16)	76 (17)	44 (13)	76 (20)	10 (13)	34 (25)	23 (13)	63 (23)
2011	491	41 (15)	73 (29)	48 (18)	71 (27)	45 (16)	72 (29)	12 (13)	33 (28)	23 (14)	59 (30)
2012	449	39 (14)	78 (20)	46 (17)	76 (18)	44 (15)	77 (20)	12 (14)	36 (27)	23 (13)	62 (25)
Trelleborg (each year)											
2008	352	42 (16)	79 (19)	49 (18)	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 (20)	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 (28)	23 (15)	63 (24)
2011	466	44 (17)	76 (24)	49 (18)	72 (23)	48 (18)	75 (24)	12 (16)	34 (27)	23 (15)	60 (26)
2012	457	44(15)	80 (17)	49 (18)	76 (17)	48 (16)	79 (19)	13 (15)	37 (28)	25 (14)	64 (24)
Lund (each year)											
2008	5	43 (24)	75 (25)	54 (21)	76 (20)	47 (29)	70 (29)	15 (15)	33 (30)	20 (14)	57 (36)
2009	4	38 (18)	981(20)	62 (39)	78 (12)	42 (7)	66 (32)	12 (13)	23 (31)	32 (11)	64 (32)
2010	12	48 (19)	83 (15)	53 (20)	64 (21)	53 (24)	79 (13)	7 (11)	23 (31)	24 (11)	61 (22)
2011	8	49 (21)	87 (20)	53 (15)	82 (17)	52 (22)	74 (34)	23 (13)	39 (35)	24 (16)	72 (28)
2012	10	37 (16)	83 (18)	48 (18)	77 (13)	41 (18)	73 (19)	9 (12)	23 (14)	23 (7)	63 (20)
Ängelholm (each year)											
2010	41	40 (16)	77 (22)	40 (16)	74 (17)	44 (14)	76 (21)	9 (9)	27 (22)	24 (14)	60 (23)
2011	60	39 (16)	77 (22)	45 (18)	73 (19)	45 (16)	76 (22)	13 (18)	36 (28)	20 (15)	58 (27)
2012	66	39 (15)	75 (20)	50 (17)	74 (17)	46 (17)	76 (19)	9 (12)	31 (25)	22 (14)	61 (25)
Helsingborg (each year)											
2010	10	25 (1)	72 (23)	38 (13)	72 (14)	30 (17)	71 (24)	4 (7)	34 (26)	9 (4)	51 (25)
2011	11	39 (19)	67 (29)	46 (20)	68 (19)	46 (23)	65 (24)	5 (8)	15 (15)	17 (11)	45 (27)
2012	9	43 (14)	77 (22)	49 (25)	71 (22)	46 (17)	72 (27)	10 (10)	29 (25)	20 (12)	57 (33)

* operations performed 1/11 2012 - 31/12 2012

** operations performed 1/10 2012 - 31/12 2012

*** Not including Norrköping

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.

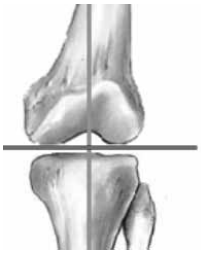
Height of the patient:
State in cm.

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: 19 _____-____
(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) 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 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

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