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
Luleå-Sensia
Lund
Lycksele
Malmö
Mora
Motala
Movement Halmstad
Mölndal
Nacka
Norrköping
Norrtälje
Nyköping
OrthoCenter IFK kliniken
OrthoCenter Stockholm
Ortopediska huset
Oskarshamn
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 2015

Swedish Knee Arthroplasty Register

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

40 years

1975-2015

Primary knee arthroplasties 1975-2014
Revision knee arthroplasties 1975-2013
Knee osteotomies 2013-2014

To our contact surgeons

This year marks the 40th anniversary of the Knee Arthroplasty Register. At a Swedish Orthopedic Society meeting in Uppsala in 1975, 20 orthopedic surgeons decided to start reporting their knee arthroplasty surgeries and thereby the world's first national implant register had begun.

In the first year, 24 hospitals reported to the registry, and by 2002 this number had increased to 83. The number of reporting hospitals has diminished since then because of mergers and the emergence of specific implant centers. In 2014, all 74 hospitals performing knee arthroplasties in Sweden reported to the register.

In collaboration with representatives from the Hip Arthroplasty Register, annual meetings have been arranged for the register representatives at Arlanda, Sweden, for more than 20 years. Initially, the meetings were held to demonstrate to the surgeons that the data they reported were indeed compiled and analyzed and could be used as a base for improvements. The meetings also offer a venue for constructive feedback.

That findings from the register are used in clinical practice was shown in a 2011 survey in which 75 percent of the register representatives stated that they had shared information from the register with co-workers, and 50 percent stating that the information had resulted in changes at their respective hospitals. This is, of course, gratifying because it is difficult for the register to initiate quality improvement which has to be supported and carried out locally in order to be successful. This also shows that the providers have confidence in the Knee Arthroplasty Register and trust the results it provides.

We want to thank all our contact surgeons and associated staff for their dedicated work throughout the years. Your accurate reporting, focus on quality assurance and dissemination efforts have resulted in close to complete coverage and that the information becomes implemented into practice.

Running a register is a long-term laborious effort and with revision as the main indicator for failure, reports of early failures are unusual. However, the register has contributed to implants being removed from the market and has stimulated the surgeons to use well documented implants and techniques thereby providing better results for the patients. This, in turn, has resulted in Sweden having the lowest risk for revisions in the world.

Since 2009, processes that may be of importance with respect to infections, re-operations and costs have been registered. Patient reported outcomes (PROMs) have been collected in targeted studies since the start of the register but have now become part of the ordinary registration for those units that choose to participate.

The Knee Arthroplasty Register has also gathered international interest and has served as a role-model when registers have been set up in other countries (e.g. Norway, Australia, Canada and Lithuania). Because of the international interest, the annual report has been translated to English for the last 15 years. A large number of scientific studies have been published, many in highly ranked scientific journals such as the BMJ and Lancet. Research findings are being presented continuously, both in domestic and international settings through invited lectures and meetings. Our register network has grown over the years and global collaborations with other registries, authorities, and individual researchers have flourished.

The structure of the annual report is similar to previous reports but we would like to draw attention to the following changes:

1) Calculating incidence based on the residence of the patients we previously used their municipality at the beginning of the year after surgery. We now use information from the tax authorities on current residence at the time of surgery.
2) When calculating the relative risk for the different hospitals we traditionally have only included cemented TKAs inserted for osteoarthritis. This year we also include uncemented TKAs.
3) The osteotomy register that started in 2013 has been given more focus in a separate section at the end of the report.

The report consists of 4 parts.

The first part summarizes the routines of the register, epidemiology, and general results.

The second part contains information regarding what was reported to the register in 2014 as well as analyses covering the years 2004-2013.

The third part concerns the osteotomy registry.

The fourth part is for each reporting unit specifically. It is only delivered to the respective contact surgeons and heads of departments as applicable. This section provides compilations of what the hospital has reported as well as information on all operations reported by the unit in 2014 (sorted by ID and date of surgery). It is our hope this unit specific information will be compared to other available information in order to identify and correct potential errors in the registration.
We also provide an USB stick containing all reported surgeries, the annual report and graphics comparing the revision rate of the unit to that of the national average. It is important that you inform your colleagues about the report to stimulate discussions and improvement efforts.

We would also like to take this opportunity to remind you that the registration is prospective and that a reported revision can only be included in the analyses if the primary procedure was reported previously according to normal routines. This means that if a primary operation is discovered only because of a revision at a later time, neither the primary nor the revision will be included in the analyses.

The members of the register have been very active attending national and international meetings as invited lecturers in the last year. 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.

On behalf of the Swedish Knee Arthroplasty Register

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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 diminished somewhat due to the merger of hospitals. In 2014, 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 10). However, in 2013 the increase halted and in 2014 the number of primaries diminished by 2.5% or to 13,000 as compared with 13,338 in 2013. Whatever the reasons may be, we consider it likely that the volumes will increase again as the incidence in Sweden (see page 13) still is lower than in countries such as USA and Germany. Further, even without an additional increase in age specific incidence, the expected changes in the age distribution of the population will increase the demand for surgery.

Patient Reported Outcome – The SKAR began early evaluating PROMs and put in effort searching for the most relevant instrument for patients undergoing knee arthroplasty surgery which resulted in a thesis published in 2001. Recently there has been a renewed interest in PROMs by the authorities for the purpose of quality improvement. Thus, in 2008 the register started gathering PROM data from Skåne and since then, 8 units from other parts of the country have joined. Results can be found on the pages 60-65.

Registration of osteotomies – Osteotomies have been prospectively registered since 2013. This year the registration has a separate section on page 66.

Reporting to the register – The SKAR recommends that the form (page 73) is filled in the operation theater and that one set of the stickers found in the implant and cement packages are stuck on the backside. The form is then sent to the register office in Lund where the information is entered into the database. The hospitals are requested to send the forms to the registry at least once a month. In the 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 at present essential advantages such as less workload at 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.
However, decentralized Internet data entering is used for PROMs. Those units that have decided to participate in the PROM project have an access to a specific Web application for this purpose.

Annual report – Each annual report accounts for primary arthroplasties reported during the previous year (in this report 2014). Analyses concerning the revision rate end one year earlier (2013). The reason for this is that only 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. It also happens that unit's send completing information after discovering, by examining the annual report and the accompanying lists, that their previous reporting had been incomplete. The register is trying to improve the response times so that waiting an extra year will not be needed. How-

ever, this will demand an increased effort from the register staff as well as a quicker response from the hospitals when asked to complement their reporting or provide supplementary information.

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 8.

Cooperation – The SKAR has had close collaboration with the RCSyd (Register Center South) facilitated by the two sharing premises in Lund. As the RCSyd is now moving to new offices we hope to be able to continue the good and fruitful cooperation in spite of a little longer distance. The Nordic countries cooperate through the framework of NARA (Nordic Arthroplasty Register Association) performing analyses of combined datasets (Denmark, Norway, Sweden, Finland). 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 collaborative projects resulting 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 – Knee arthroplasty surgeries as well as osteotomies are reported on a very similar one page form that is used for both primaries and revisions (found at the end of the report). One set of the stickers that are found in the packages for the parts that are implanted in the patient (prosthesis, cement, osteotomy plates, bone substitute...) and which contain the part- and lot numbers should be placed on the backside of the form.

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 have continued with onsite validation project and visited 6 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 are available. There is also a secure server where the contact physicians at the participating units can access the information that their unit has delivered to the registry and which includes information on primaries having been revised elsewhere. We hope to be able to make this web-site more users-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 2013

It is hard to exactly estimate how many of the total number of knee arthroplasties performed are reported to the SKAR. It is possible to compare the SKAR with the National Patient Register (NPR), an inpatient register of the health authorities, based on ICD coding although it complicates the comparison that the registers focus on different variables (operations vs. admissions) and that laterality is inconsequently recorded in the NPR.

An additional problem may occur when surgeries are not reported to the NPR as being performed at a specific hospital but as being from an administrative body containing many hospitals.

To estimate the percentage of surgeries captured by the SKAR in 2013 the register was compared to the NPR. By assuming that the true number of admissions was the combined number of admissions in both registers the completeness could be estimated. 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, we found as last year that the SKAR had captured 97.2% of all admissions while the NPR captured 97.3% (96.3% last year). Below is a list of the units containing the combined number of operations from both registers as well as the completeness for each of the hospitals. Those 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 was erroneous.

Hospital	Number	SKAR-percent	NPR percent
Akademiska sjukhuset	90	100	97.8
Alingsås	215	99.1	99.5
Arvika	121	99.2	96.7
Blekingesjukhuset*	5	0	100
Bollnäs	312	100	98.0
Borås**	90	100	98.9
Carlanderska	108	100	100
Danderyd	202	96.5	98.0
Eksjö-Nässjö	181	95.6	98.9
Elisabethkliniken	59	98.3	98.3
Enköping	405	100	100
Eskilstuna Mälarsjh.	48	87.5	97.9
Falun	371	97.0	95.4
Frölunda Spec. sjukhus	124	96.8	96.8
Gällivare	94	100	100
Gävle	181	90.6	97.8
Halmstad	239	97.1	97.9
Halmstad - Capio	242	89.7	97.9
Helsingborg	24	87.5	91.7
Huddinge	146	100	100
Hässleholm	666	98.5	99.4
Jönköping - Art Clinic	3	66.7	100
Jönköping Ryhov	179	93.3	99.4
Kalmar	108	98.1	100
Karlshamn*	259	100	99.6
Karlskoga	128	100	100
Karlstad	156	100	100
Karolinska Solna	144	97.2	98.6
Kullbergska	236	95.3	96.6
Kungsbacka	2	0	100
Kungälv	158	97.5	98.7
Lidköping***	199	100	99.0
Lindesberg	191	99.5	100
Ljungby	89	91.0	100
Lund	87	97.7	97.7
Luleå - Sensia	7	100	0
Lycksele	69	100	100
Malmö	5	40	100
Mora	189	98.4	98.9
Motala	517	98.6	99.4

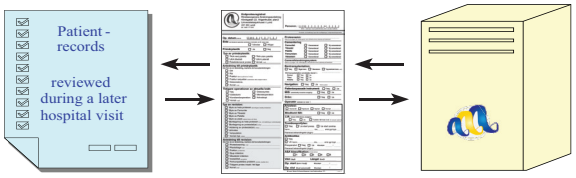
Hospital	Number	SKAR-percent	NPR percent
Mölndal ****	235	100	97.4
Nacka	146	99.3	100
Norrköping Vrinnevisjh.	144	99.3	99.3
Norrtälje	79	93.7	98.7
NU-sjukvården	4	0	100
Nyköping	78	100	100
Ortho Center IFK Kliniken AB	96	95.8	4.2
Ortho Center Stockholm	448	98.2	98.7
Ortopediska Huset	405	96.3	77.8
Oskarshamn	262	99.2	100
Piteå	278	98.2	98.2
S:t Göran	406	96.6	99.5
Sabbatsberg	126	99.2	95.2
Sahlgrenska sjukhuset ****	27	3.7	100
Skaraborgs sjukhus***	17	0	100
Skellefteå	98	99.0	99.0
Skene**	135	100	99.3
Skövde***	145	100	97.2
Sollefteå	98	99.0	96.9
Sophiahemmet	131	91.6	98.5
Spenshult	338	97.6	98.2
Sundsvall	115	99.1	99.1
Södersjukhuset	279	95.3	98.9
Södertälje	91	96.7	96.7
Södra Älvsborgs sjukhus**	7	0	100
Torsby	131	96.9	100
Trelleborg	657	99.2	99.4
Uddevalla	228	100	98.2
Umeå	159	96.9	100
Varberg	174	98.3	98.3
Visby	96	91.7	100
Värnamo	148	94.6	98.6
Västervik	116	97.4	100
Västerås	270	94.8	96.7
Växjö	102	96.1	96.1
Ängelholm	205	98.0	97.6
Örebro	52	98.1	100
Örnsköldsvik	112	100	99.1
Östersund	166	98.8	99.4

Validation of data quality.

The aim of validating the data quality is to investigate the accuracy of the information the register as compared to that in hospital records. This provides us with knowledge regarding the quality of the entered data and helps us assess if the information has the quality allowing for reliable statistical analyses and process measures.

The validation efforts during the last 3 years (annual reports 2012-2014) indicated an excellent completeness and that basic information about the surgery as well as the implants was very reliable. With respect to the 13 variables that were introduced in 2009, the completeness was very good and the information in the register in good agreement with that found in hospital records.

This year, the validation included 6 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 2014. Computer as well as paper records (incl. op- and anesthesia reports) were to be reviewed. In February 2015, the hospital was visited by staff from SKAR and together with the local contact secretary/contact physician a new reporting form was filled according to the information found in the hospital records. The data of the new form were compared to the original form sent to SKAR and additionally compared to what had finally been entered into the register database.



This way, information on 152 operations (139 primaries, 11 revisions and 3 reoperations) was validated. Three hospitals delivered information on 25 cases, and two hospitals on 27 respective 26 cases. One revision was found that had not been reported to the SKAR from a unit for which 24 cases were validated.

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

Information on implants and their fixation contains part- and lot-numbers for any femoral, tibial patella, stem components used 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 found on the original form which in turn did not differ from that gathered during the hospital visit. However, in two cases, information that had been reported on forms could not be found again in the hospital records.

When evaluating 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 14% of cases. An explanation may be that the hospital records may contain historical information and have 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 retrospectively can be gathered from hospital records. E.g. there were cases for which the form listed arthroscopy as being previous surgery while the hospital records stated arthroscopic meniscectomy.

With respect to the ”operation techniques” (use of bone transplants, MIS ,drainage and tourniquet), the difference between that reported and what could be extracted at the hospital was negligible. No information was missing.

Regarding prophylactic drugs, doses of antithrombotic- and antibiotic prophylaxis as well as for the use of local infiltration analgesia (LIA) the information reported and what was gathered during the hospital visit differed for <1%. Information was missing in three cases.

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

12% 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, in 2012 the routines for reporting were changed, so that instead of reporting how many minutes before surgery the first antibiotic dose of was administrated the definite time was to be stated 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 was a variable found to differ from what was expected and registered during surgery and what was found to be the case during the later hospital visit. Probably the plans changed during the hospital stay. For 1% of the surgeries the information differed more than a week.

The weight of all the patients was available in the hospital records. The difference between what was documented on the original form and that found in the hospital records was negligible.

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

The ASA rating reported as compared to that found retrospectively in the anesthesia records differed for 1% of the cases. In two cases, an ASA rating could not be found in the hospital records.

It is our opinion that the validation performed this year as well as previous years indicate very good data capture and that the information on the essential/base dataset, the part numbers and type of fixation is very complete. With respect to the majority of the ”new” variables the data on the original form agreed well with the information found in hospital records.

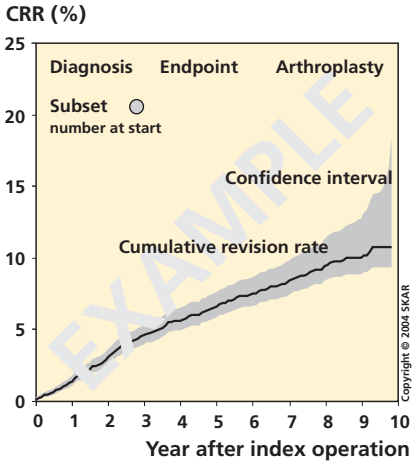
The information on previous surgeries was the variable that differed most. Regarding the administration of the first antibiotic dose, the agreement between what was reported and what could be found in hospital records had improved, which may be explained the experiences gained during the validation in 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.

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.

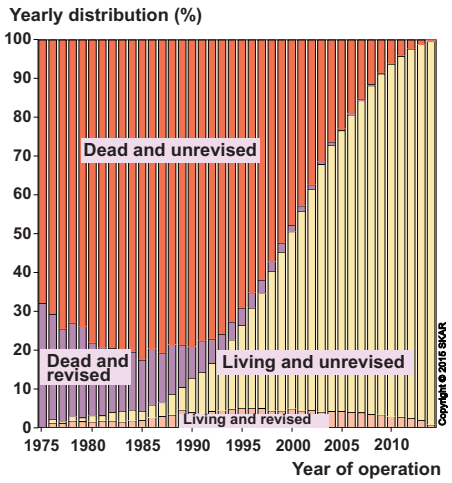
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared.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

Estimating differences between units in risk of revision is complicated by their varying volumes. The reason is that units performing few operations are more likely to have overly good or bad results. Therefore, the register received help from RCSyd statisticians to calculate risks using a "shared gamma frailty model" which takes volume into consideration. Still it has to observed that the units may have different "case-mix", e.g. patients with different grades of joint destruction, differences in general health, activity etc.. Such factors, which we at are unable to take into account, may influence the risk of revision and thus the results of individual units.

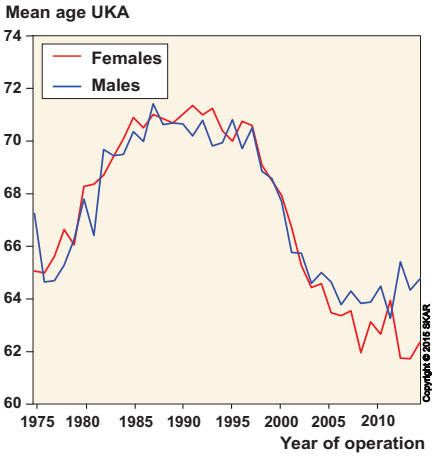


The present status for each yearly batch of patients operated since 1975.

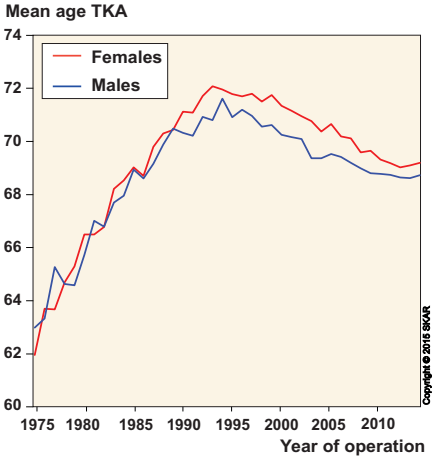
Gender and age distribution

Between 1975 and 1994, the mean age at primary operation increased from 65 years to almost 72 years. The main reason was a relatively large increase in number of operations among the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution of the population. After 1994 the proportion of patients less than 65 years of age increased and the mean age started to decrease. This tendency has not continued the last few years and the mean age in 2014 was 68.8 years (figure on the right).

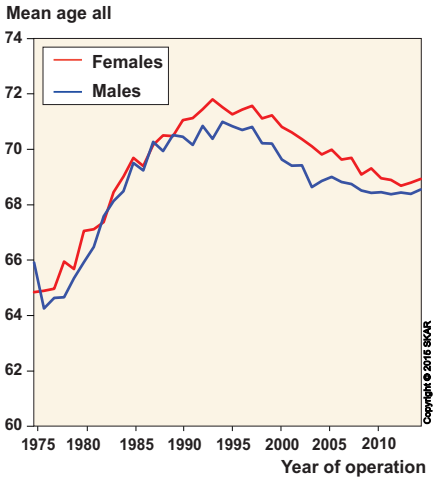
When TKA and UKA are analyzed separately, it is apparent that when TKA was introduced in the seventies it was used for younger patients than the UKA, which at the time was the standard treatment (figures below and on the next page). However, since the late nineties the age at UKA surgery has



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

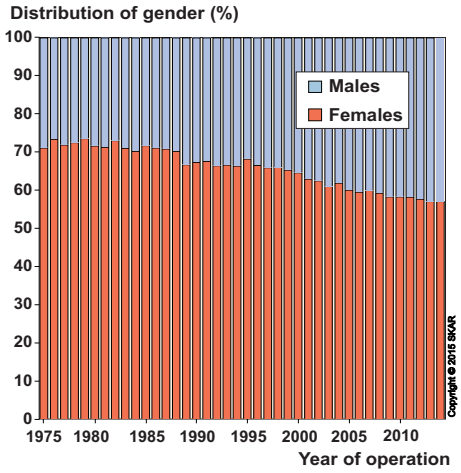


The mean age at surgery was lower for TKA than UKA when TKA was introduced in the seventies (cp the figures above).



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

fallen considerably which coincided with the introduction of mini-invasive surgery. An interpretation of these observations may be that new technology to a larger extent is being tested in younger patients. When comparing a series of patients operated on during different periods, the changes in the mean age make it necessary to account for age by use of regression or to analyze different age groups separately.



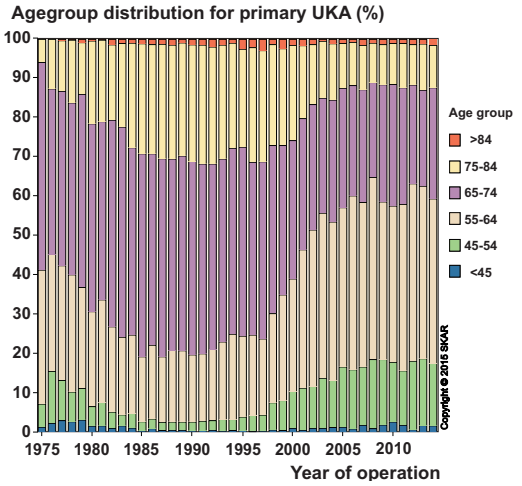
The proportion of males has increased slightly over the years.

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

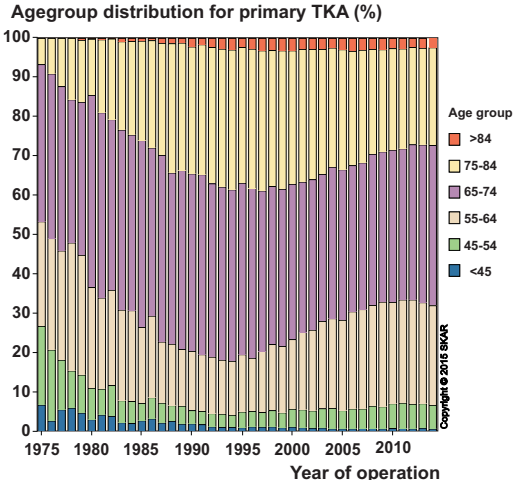
The figure to the right shows the relative number of operations performed in the different age groups over a period of thirty five years. In a somewhat different manner than the mean age (previous page) it shows how the relative proportion of the older groups increased until the mid-nineties after which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

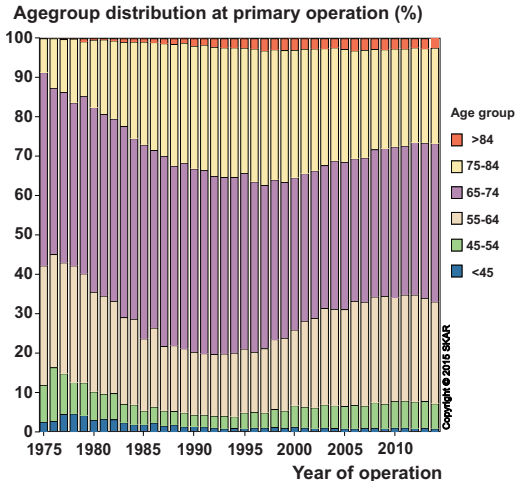
In UKA the relative proportion of patients less than 65 years of age doubled during 1998-2002, i.e. during the time when mini-invasive surgery caught on in Sweden. However, it has to be kept in mind that the actual number of UKA´s is now less than half of what it was in 1998 while the number of TKA has 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 TKA patients younger than 65 years of age has more than tripled while the number of UKA patients less than 65 is almost unchanged.



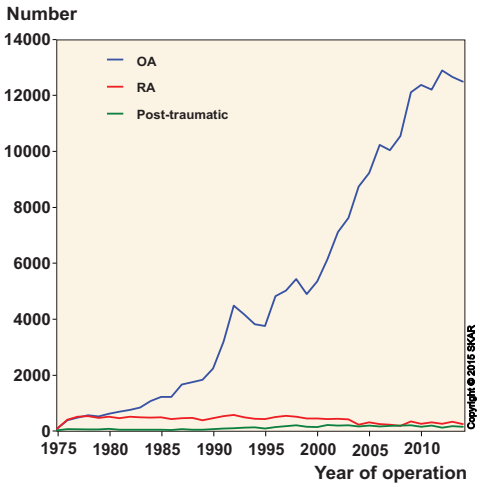
The relative distribution of primary UKA arthroplasties among different age groups.



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).



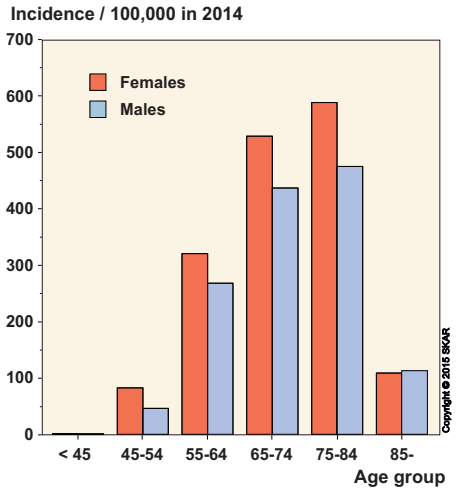
The yearly number of arthroplasties for different diagnoses

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.

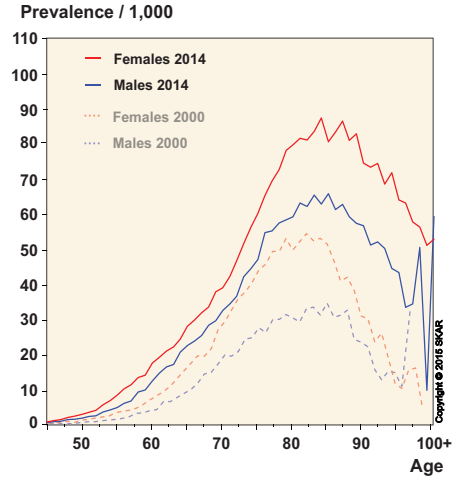
Incidence and prevalence

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 off 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.

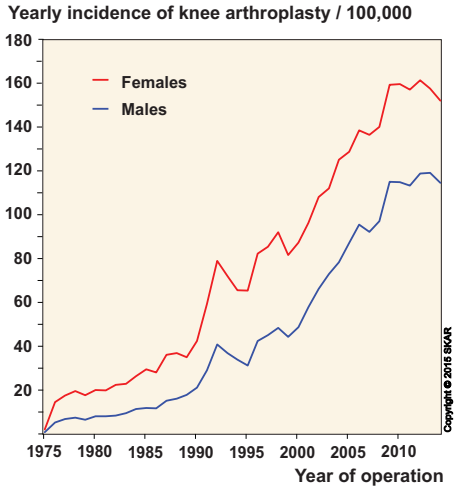
The figure below shows the incidence among different age groups during 2014. It peeks among those between 65 and 84 years of age. At this age, knee arthroplasty is 7-8 times more common than among those 45-54 years old and 4-5 times more common than among those 85 years or older. In 2014, women were 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 14.



Incidence of primary knee arthroplasty in 2014 per 100,000 inhabitants (males and females) in the different age groups.



The prevalence of knee arthroplasty in 2000 and 2014. 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 2014 i.e. the number of patients per 1,000 inhabitants in different age groups that were alive with at least one knee implant at the end of the year. As a quarter of the patients have bilateral implants the prevalence of implants is higher than of patients.

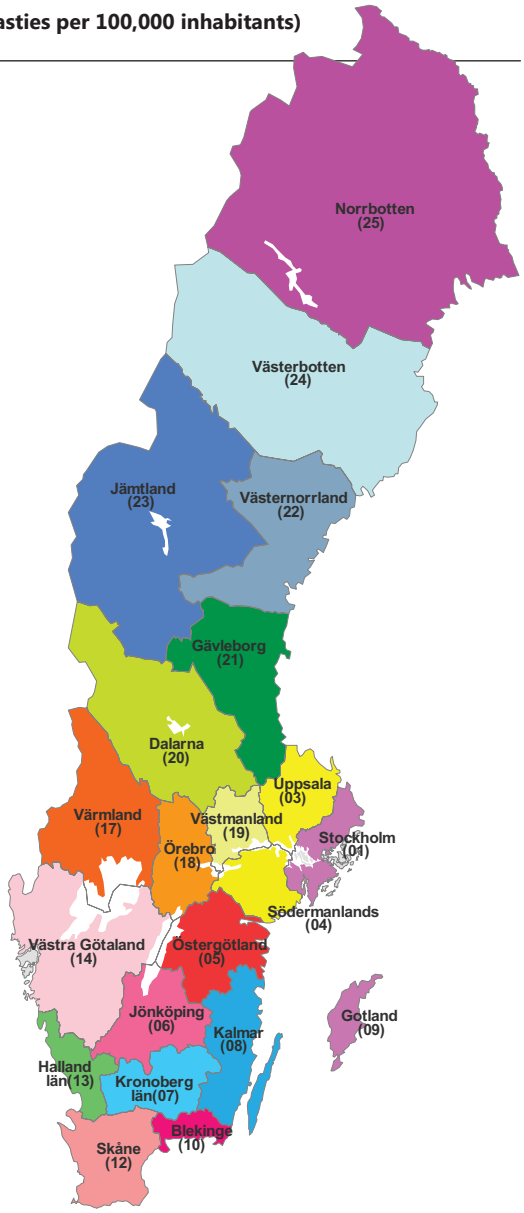
For both men and women the prevalence peaks around 80-85 years of age at which almost 8% of the women and more than 6% of the men had at least one knee arthroplasty. Comparing the prevalence in 2014 with that in 2000, it can be seen that it has increased in all age groups. The fact that a large proportion 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 2008-2014 (knee arthrplasties per 100,000 inhabitants)

County and number of inhabitants 2014

No	County	Inhabitants
01	Stockholm	2,180,543
03	Uppsala	347,211
04	Södermanland	279,117
05	Östergötland	439,976
06	Jönköping	342,748
07	Kronoberg	188,142
08	Kalmar	234,736
09	Gotland	57,208
10	Blekinge	153,457
12	Skåne	1,281,488
13	Halland	308,752
14	Västra,Götaland	1,623,548
17	Värmland	274,253
18	Örebro	286,772
19	Västmanland	260,378
20	Dalarna	278,126
21	Gävleborg	278,980
22	Västernorrland	242,608
23	Jämtland	126,613
24	Västerbotten	261,737
25	Norrbotten	249,711

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



Knee arthroplasties per 100,000 inhabitants

County	2008	2009	2010	2011	2012	2013	2014
01 Stockholm	100.6	112.2	106.4	106.3	103.8	104.9	97.6
03 Uppsala	112.2	135.6	145.9	136.7	154.9	174.6	142.9
04 Södermanland	189.2	181.5	154.9	150.9	151.7	157.2	162.3
05 Östergötland	160.7	169.1	165.7	146.9	157.5	154.2	135.0
06 Jönköping	117.2	152.5	131.7	142.3	168.4	147.6	172.1
07 Kronoberg	103.0	146.1	146.6	123.7	158.7	115.3	149.9
08 Kalmar	163.9	167.0	146.8	154.3	168.4	175.9	167.0
09 Gotland	159.5	161.1	164.2	249.6	165.9	178.3	132.8
10 Blekinge	140.1	152.9	155.0	169.2	178.8	177.7	161.6
12 Skåne	98.4	122.2	117.4	122.3	125.8	137.2	142.6
13 Halland	111.8	176.8	153.9	150.0	177.3	165.6	168.1
14 Västra.Götaland	113.7	127.2	140.3	139.0	132.0	130.9	119.7
17 Värmland	186.4	189.2	172.4	170.0	179.9	180.3	195.8
18 Örebro	124.2	140.1	138.4	125.7	146.3	120.3	116.8
19 Västmanland	114.6	129.7	140.8	128.2	156.3	125.4	134.8
20 Dalarna	138.9	153.2	208.5	219.6	217.0	231.4	199.5
21 Gävleborg	129.1	166.3	191.1	174.4	191.4	188.6	213.6
22 Västernorrland	108.5	135.7	182.8	143.2	145.4	141.3	132.3
23 Jämtland	134.7	181.4	161.8	162.1	175.0	138.5	95.6
24 Västerbotten	110.6	152.6	144.4	119.9	122.7	126.2	117.3
25 Norrbotten	129.5	144.4	122.2	150.1	165.7	150.2	130.6
The whole country	119.2	137.9	137.9	135.8	140.8	139.1	134.1

Information on domicile is by the Swedish Tax Agency

For age-standardized incidence in 2014, see page 29

The incidence in the counties 2008-2014 (knee arthrplasties per 100,000 inhabitants)

Incidence for women

County	2008	2009	2010	2011	2012	2013	2014
01 Stockholm	127.8	135.5	128.9	129.2	130.3	123.0	110.9
03 Uppsala	131.8	162.7	188.8	155.3	178.6	193.1	170.6
04 Södermanland	216.4	180.0	164.2	173.6	176.8	181.2	185.2
05 Östergötland	190.8	206.6	184.6	165.2	182.6	172.5	159.9
06 Jönköping	140.2	186.7	153.1	174.3	202.3	174.4	201.5
07 Kronoberg	135.4	171.0	182.4	147.8	183.1	148.4	165.6
08 Kalmar	174.0	191.3	158.1	148.9	209.0	201.2	193.1
09 Gotland	190.8	190.8	200.8	273.4	162.7	208.1	128.5
10 Blekinge	158.2	166.2	168.7	188.5	188.9	187.5	182.3
12 Skåne	119.3	144.7	131.3	140.8	140.1	154.3	166.0
13 Halland	120.3	182.6	178.9	173.5	197.8	188.4	186.6
14 Västra.Götaland	132.7	146.4	162.5	160.1	146.9	148.3	132.6
17 Värmland	195.2	209.4	214.8	182.2	202.9	190.1	234.2
18 Örebro	148.8	155.9	162.4	152.0	157.7	129.6	135.7
19 Västmanland	131.8	146.4	159.1	147.9	172.8	140.3	157.5
20 Dalarna	163.1	162.2	232.2	248.3	242.1	260.7	222.4
21 Gävleborg	142.6	199.7	206.1	198.9	207.7	206.4	232.6
22 Västernorrland	123.7	164.9	233.5	172.3	163.6	165.4	149.7
23 Jämtland	160.5	217.6	206.8	212.0	206.2	179.4	107.9
24 Västerbotten	119.8	179.6	160.6	141.0	150.1	151.4	131.7
25 Norrbotten	158.9	166.0	136.2	184.7	190.6	170.8	150.2
The whole country	140,7	160,0	160,3	157,6	162,0	158,3	152,8

Information on domicile is by the Swedish Tax Agency

The incidence calculations for the counties are based on the number of knee arthroplasties their inhabitants of 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 2014 can be found on page 29.

The calculations are based on information from the Swedish tax authorities on the domicile of patients at the time of surgery. Note that that only surgeries on patients that are Swedish residents are considered.

Incidence for men

County	2008	2009	2010	2011	2012	2013	2014
01 Stockholm	72.6	88.4	83.4	82.9	76.9	86.6	84.2
03 Uppsala	92.4	108.2	102.4	117.9	131.0	155.9	115.0
04 Södermanland	161.7	183.1	145.4	128.1	126.3	133.0	139.3
05 Östergötland	130.6	131.9	147.0	128.7	132.6	136.1	110.3
06 Jönköping	94.1	118.3	110.1	110.3	134.6	120.8	143.0
07 Kronoberg	71.1	121.7	111.3	100.0	134.8	82.8	134.5
08 Kalmar	153.8	142.6	135.5	159.7	127.8	150.5	141.0
09 Gotland	127.5	130.8	127.0	225.4	169.1	148.0	137.2
10 Blekinge	122.3	139.9	141.7	150.5	169.1	168.1	141.4
12 Skåne	77.1	99.3	103.1	103.3	111.3	119.7	118.7
13 Halland	103.2	171.0	128.8	126.4	156.6	142.7	149.5
14 Västra.Götaland	94.5	107.9	118.0	117.8	117.0	113.4	106.8
17 Värmland	177.5	168.8	129.8	157.7	156.9	170.5	157.4
18 Örebro	99.2	124.0	114.0	99.0	134.7	110.9	97.9
19 Västmanland	97.3	112.8	122.5	108.4	139.8	110.4	112.1
20 Dalarna	114.6	144.2	184.8	191.1	191.9	202.3	176.8
21 Gävleborg	115.5	132.8	176.0	149.9	175.1	170.8	194.7
22 Västernorrland	93.1	106.4	132.0	114.0	127.2	117.2	115.1
23 Jämtland	108.9	145.2	116.8	112.2	143.9	97.9	83.4
24 Västerbotten	101.4	125.8	128.4	98.9	95.6	101.4	103.1
25 Norrbotten	101.0	123.4	108.5	116.5	141.7	130.3	111.6
The whole country	97,6	115,7	115,4	113,7	119,4	119,7	115,3

Information on domicile is by the Swedish Tax Agency

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

Women

Age group	1976-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	2009-2013	2014
<45	1.1	0.9	1.0	1.2	1.7	1.8	2.5	1.8
45-54	13.7	11.3	13.9	22.1	38.5	64.1	89.4	82.9
55-64	41.2	52.7	86.5	122.5	163.0	251.7	331.7	320.3
65-74	83.5	137.9	257.7	345.5	408.6	536.8	562.0	528.3
75-84	54.4	122.2	253.3	351.8	420.8	543.2	621.4	587.7
>84	4.2	13.2	43.0	71.8	86.7	109.2	122.6	109.3
Total	19.4	31.5	58.0	78.3	97.3	134.3	159.6	152.8

Men

Age group	1976-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	2009-2013	2014
<45	0.4	0.4	0.5	0.6	0.8	1.2	1.6	1.4
45-54	5.6	4.7	7.3	10.9	22.6	40.0	52.1	46.8
55-64	17.9	23.5	54.7	71.7	116.9	185.9	265.4	268.3
65-74	36.4	67.1	146.8	211.9	284.7	411.5	459.6	436.5
75-84	26.2	67.7	165.2	223.9	286.3	409.7	497.7	474.8
>84	4.4	18.5	41.6	64.0	76.1	115.7	121.9	113.0
Total	7.6	13.3	29.4	40.3	58.2	90.5	116.8	115.3

Number of primary arthroplasties per unit and year

Hospital	1975-2008	2010	2011	2012	2013	2014	Totalt	Percent
Akademiska, Uppsala	2,570	155	79	108	90	86	3,088	1.4
Alingsås	1,415	209	189	193	214	204	2,424	1.1
Art,Clinic, Jönköping	.	.	.	8	2	13	23	0.0
Arvika	1,081	154	167	156	129	193	1,880	0.8
Avesta	67	.	.	.	.	.	67	0.0
Boden	1,622	.	.	.	.	.	1,622	0.7
Bollnäs	2,193	302	305	327	305	402	3,834	1.7
Borås	2,496	116	126	103	90	75	3,006	1.3
Carlanderska	154	95	162	126	108	137	782	0.3
Dalsland	81	.	.	.	.	.	81	0.0
Danderyd	2,707	144	192	200	196	142	3,581	1.6
Eksjö-Nässjö (Höglandssjukh.)	2,434	164	155	182	173	210	3,318	1.5
Elisabethkliniken	592	64	55	58	58	7	834	0.4
Enköping	1,557	268	329	342	415	373	3,284	1.4
Eskilstuna	1,746	32	40	32	43	41	1,934	0.8
Fagersta	71	.	.	.	.	.	71	0.0
Falköping	1,498	190	.	.	.	.	1,688	0.7
Falun	3,834	306	351	356	364	356	5,567	2.4
Frölunda Spec.	836	115	116	121	120	120	1,428	0.6
Gällivare	1,208	61	81	79	94	68	1,591	0.7
Gävle	2,898	97	96	155	164	129	3,539	1.6
Halmstad	2,517	180	201	241	232	190	3,561	1.6
Helsingborg	1,721	20	20	15	21	44	1,841	0.8
Huddinge	2,397	136	130	150	147	166	3,126	1.4
Hudiksvall	1,301	111	88	79	73	60	1,712	0.8
Hässleholm	5,478	640	666	664	698	683	8,829	3.9
Jönköping	2,285	149	167	173	167	168	3,109	1.4
Kalix	215	.	.	.	.	.	215	0.1
Kalmar	2,249	103	105	93	106	91	2,747	1.2
Karlshamn	2,090	231	248	264	260	242	3,335	1.5
Karlskoga	1,562	96	101	143	129	124	2,155	0.9
Karlskrona	1,117	1	.	.	.	.	1,118	0.5
Karlstad	3,586	176	176	168	192	193	4,491	2.0
Karolinska	2,181	123	108	128	140	99	2,779	1.2
Kristianstad	1,297	.	.	.	.	.	1,297	0.6
Kristinehamn	252	.	.	.	.	.	252	0.1
Kullbergska	1,645	243	229	228	226	201	2,772	1.2
Kungsbacka	38	.	.	.	.	.	38	0

(cont.)

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

Hospital	1975-2008	2010	2011	2012	2013	2014	Total	Percent
Kungälv	1,520	162	175	142	155	197	2,351	1.0
Köping	1,605	.	.	.	.	.	1,605	0.7
Landskrona	1,918	.	.	.	.	.	1,918	0.8
Lidköping	1,438	154	169	196	200	199	2,356	1.0
Lindesberg	1,462	171	157	199	192	172	2,353	1.0
Linköping	1,735	.	.	.	.	.	1,735	0.8
Linköping medical cent	15	.	.	.	.	.	15	0.0
Ljungby	1,389	148	119	136	81	150	2,023	0.9
Ludvika	339	.	.	.	.	.	339	0.1
Luleå	.	.	.	.	7	3	10	0.0
Lund	2,545	46	40	51	87	98	2,867	1.3
Lycksele	564	65	60	63	69	94	915	0.4
Löwenströmska *	1,830	415	442	432	440	402	3,961	1.7
Malmö	2,199	10	15	13	3	.	2,240	1.0
Mora	1,564	163	166	172	186	150	2,401	1.1
Motala	2,913	550	458	536	519	470	5,446	2.4
Movement,Halmstad	724	261	275	222	218	250	1,950	0.9
Mölndal	1,553	262	266	206	237	296	2,820	1.2
Nacka	203	.	.	.	.	.	203	0.1
Nacka-Proxima	230	152	136	122	145	111	896	0.4
Norrköping	2,159	152	158	146	143	140	2,898	1.3
Norrtälje	1,051	83	81	89	74	85	1,463	0.6
Nyköping	1,343	121	120	124	79	100	1,887	0.8
OrthoCenter IFK klin. **	529	143	139	109	96	107	1,123	0.5
Ortopediska,huset	2,539	386	347	375	390	418	4,455	2.0
Oskarshamn	2,041	189	239	263	260	268	3,260	1.4
Piteå	1,663	233	285	321	273	259	3,034	1.3
S:t,Göran	6,234	396	367	347	400	387	8,131	3.6
Sabbatsberg (Aleris)	1,553	105	104	125	125	141	2,153	0.9
Sahlgrenska	1,530	5	8	2	1	3	1,549	0.7
Sala	115	.	.	.	.	.	115	0.1
Sandviken	301	.	.	.	.	.	301	0.1
Sergelkliniken	160	.	.	.	.	.	160	0.1
Simrishamn	1,021	.	.	.	.	.	1,021	0.4
Skellefteå	1,165	107	98	90	97	106	1,663	0.7
Skene	1,193	115	106	139	135	104	1,792	0.8
Skövde	2,496	104	186	206	145	114	3,251	1.4
Sollefteå	1,080	123	102	103	97	89	1,594	0.7
Sophiahemmet	1,313	77	74	112	121	98	1,795	0.8
Spenshult	330	221	238	331	330	155	1,605	0.7
Sunderby	389	2	4	3	.	.	398	0.2
Sundsvall	2,577	125	118	123	114	95	3,152	1.4
Säffle	484	.	.	.	.	.	484	0.2
Söderhamn	279	.	.	.	.	.	279	0.1
Södersjukhuset	3,999	340	324	285	271	320	5,539	2.4
Södertälje	1,150	117	121	87	88	110	1,673	0.7
Torsby	1,331	109	80	121	131	114	1,886	0.8
Trelleborg	4,540	599	608	673	707	759	7,886	3.5
Uddevalla	3,162	203	186	166	229	206	4,152	1.8
Umeå	2,372	230	165	160	155	102	3,184	1.4
Varberg	2,430	144	167	206	173	149	3,269	1.4
Visby	1,208	76	114	93	88	69	1,648	0.7
Vänersborg-NÄL	939	.	.	.	.	.	939	0.4
Värnamo	1,710	119	113	137	142	163	2,384	1.0
Västervik	1,673	74	97	114	113	94	2,165	0.9
Västerås	2,155	315	280	309	256	246	3,561	1.6
Växjö	1,910	121	97	141	98	109	2,476	1.1
Ystad	1,169	.	.	.	.	.	1,169	0.5
Ängelholm	1,786	143	162	172	201	233	2,697	1.2
Örebro	3,048	125	117	72	51	54	3,467	1.5
Örnsköldsvik	1,746	141	107	102	112	88	2,296	1.0
Östersund	1,807	161	166	182	164	106	2,586	1.1
Östra sjukhuset	2,100	.	.	.	.	.	2,100	0.9
Total	**162,520**	**12,944**	**12,838**	**13,410**	**13,354**	**13,000**	**228,066**	**100**

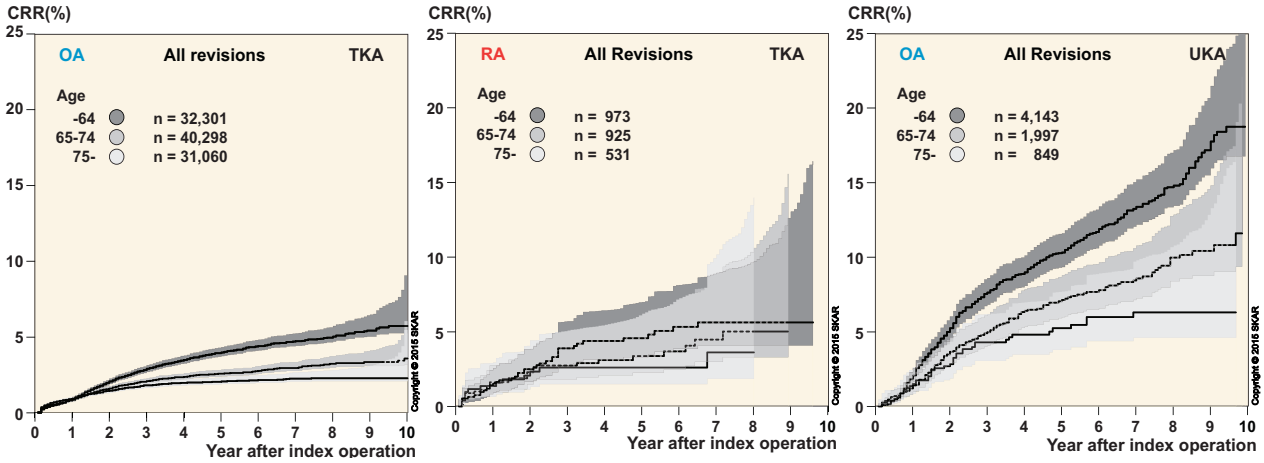
* Lövenströmska was replaced by Stockholms Specialistvård in 2001 and OrthoCenter Stockholm in 2008.

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

Factors that influence the revision rate

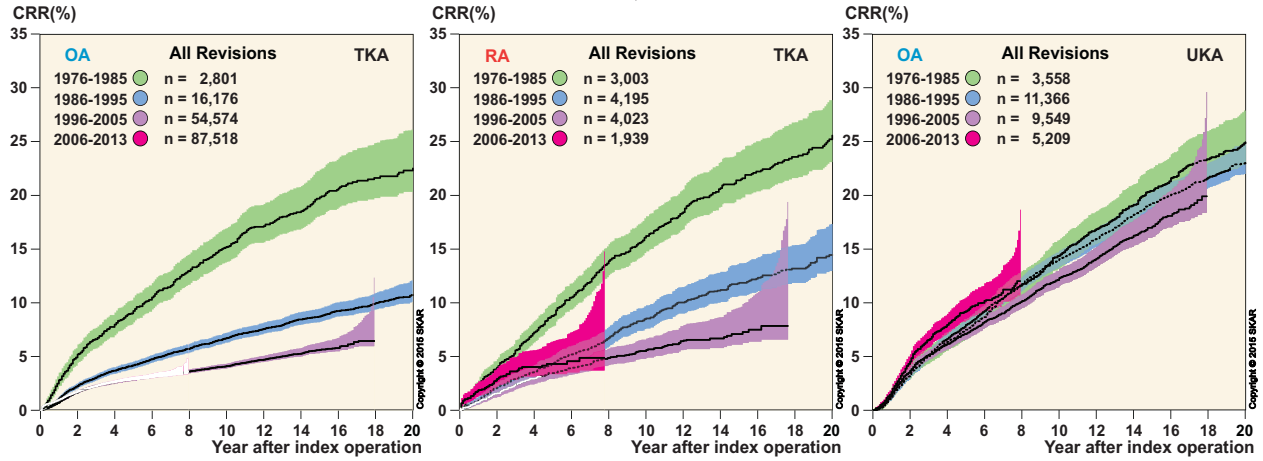
Primary disease – Early it became evident that patients with rheumatoid arthritis (RA) and osteoarthritis (OA) were different with respect to outcome. Therefore, the registry always showed outcome for these diagnoses separately. However, the modern medical treatment of RA has resulted in a reduced need for knee arthroplasty for these patients (fig. page 10) making statistical differences more difficult to detect.

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 only 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, those less than 65 years of age have twice the risk of revision as compared with those over 75.

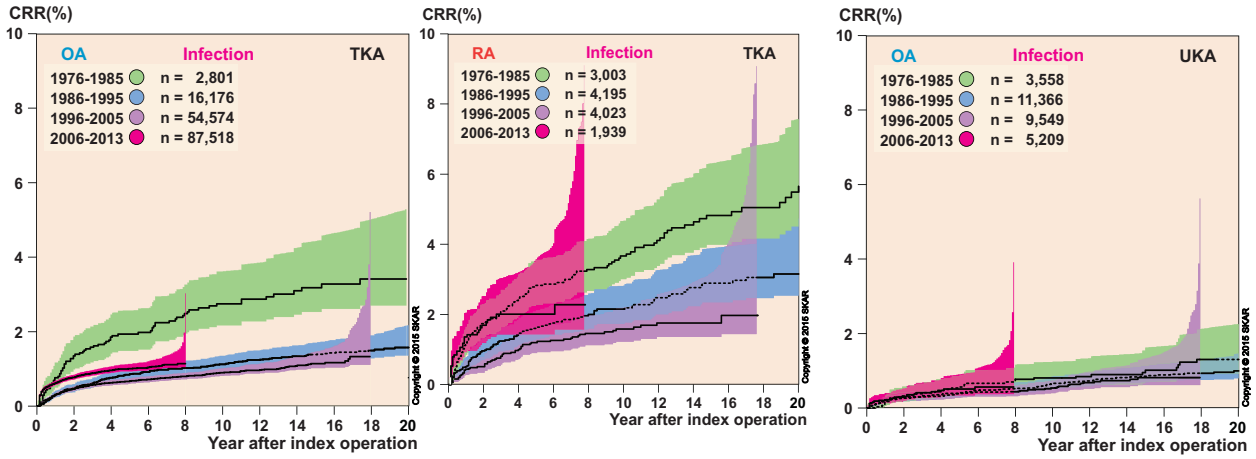


The differences in CRR (2004–2013) between the 3 age groups <65, 65–75, >75 were significant for TKA (OA & RA) as well as UKA.

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 2006-2013 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 2006-2013. 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.



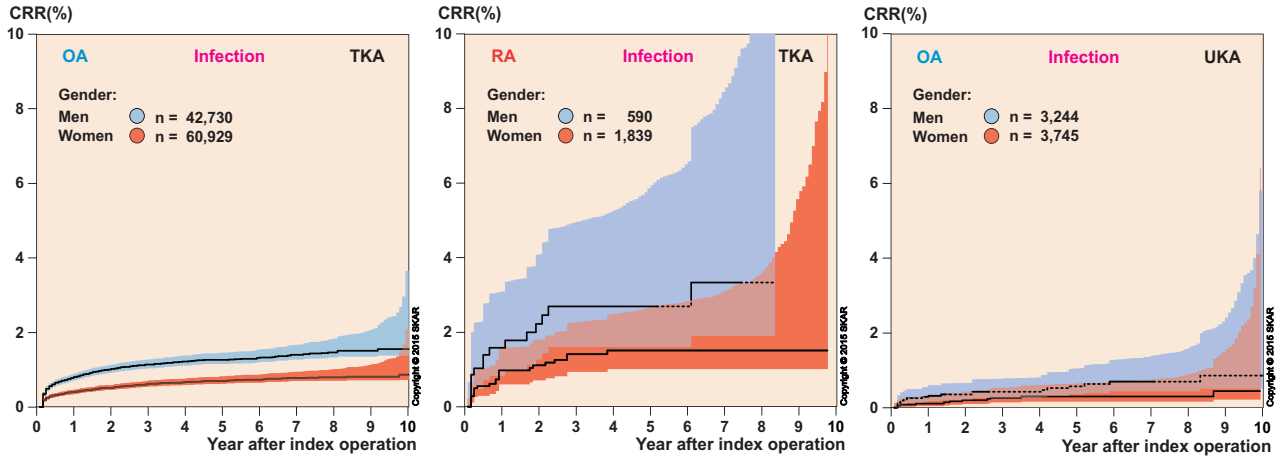
Comparing the CRR, using only revision for infection as end-point, we find an improvement with time for both TKA and UKA. However, in TKA (OA & RA) the CRR for infection during 2006-2013 has increased as compared to 1996-2005.

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 2006-2013 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.

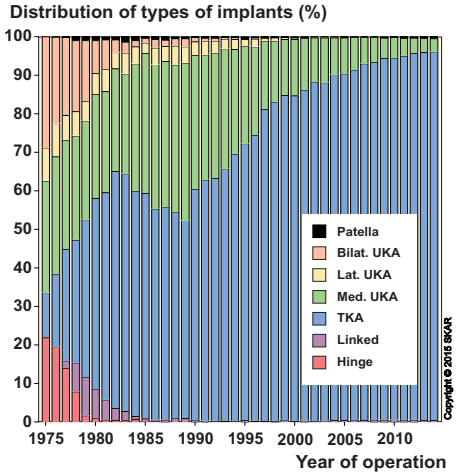
Gender – When analyzing OA during 2004-2013 (Cox regression), no significant difference in CRR was found between the sexes, whether it was for TKA (OA & RA) or UKA (OA). However, there was a considerable gender difference with respect to revision for infection (see figures below). This was irrespective of if change of inlay was considered being revision or not.

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 have their knee arthroplasties revised for infection. In spite of this, the 10-year risk is similar for the genders which partly is because women more often are revised for instability and early loosening.



Using the end-point; revision for infection, the CRR (2004–2013) shows that men are more affected than women (TKA/OA: RR 1.8 and TKA/RA: RR 2.0). UKA with its smaller implant size does better than the larger TKA but even in UKA men have 2.1 times the risk of women of becoming revised for infection. In TKA, patients with RA are more affected than those with OA (RR 2.1).

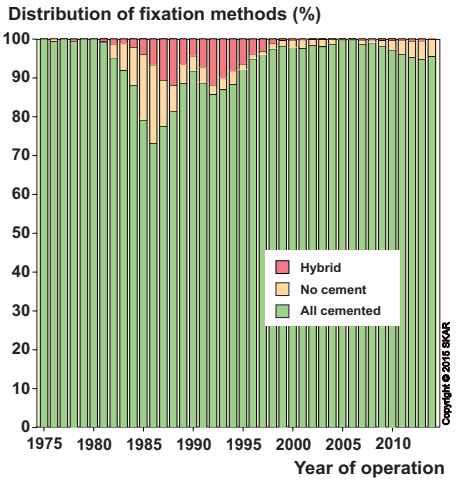
Type of implant – The modern condylar tricompartmental knee implant (TKA) was developed in the seventies when hinged and unicondylar implants were already available. When the register started in 1975, TKA had just been introduced in Sweden, which is the reason for hinges and uni's amounting for the larger part of the surgeries 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 16). However, serious complications (infections/arthrodeses/amputations) are less common after UKA.



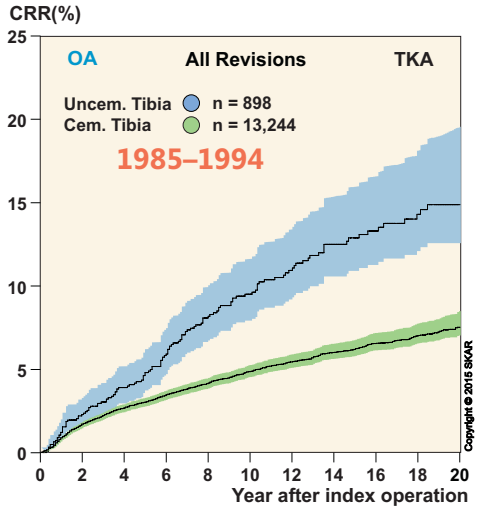
The relative yearly distribution of implant types used for primary surgery.

Some years ago 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, 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. The use of uncemented implants has increased slightly in the last years but this is mainly due to one unit that accounts for more than half of the cases. Looking at the last 10-year period we see no significant difference depending on if cement was used or not. However, for the period 1985–1994 with follow-up until 2013, the risk is higher for cases in which the tibial component was left uncemented (see figure right).



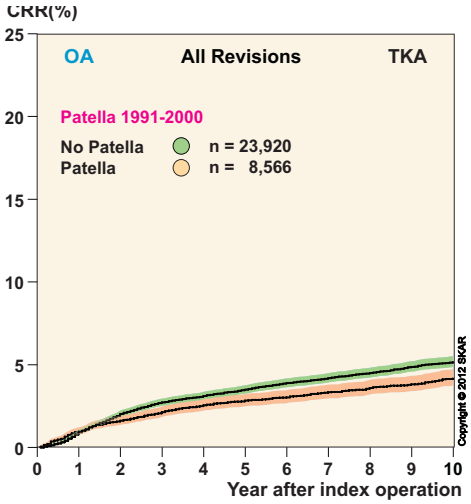
The relative yearly distribution regarding the use of cement for fixation.



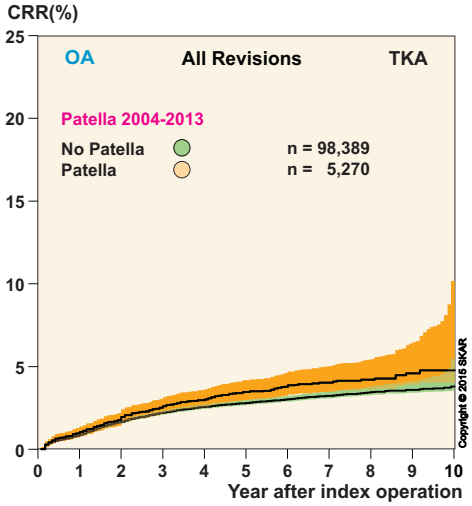
The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.

Cox regression, adjusting for age, gender, year of operation and use of a patellar component shows that the risk for TKA with an uncemented tibial component was 1.6 (1.3-1.9) times higher than for those cemented. This is in agreement with registers in Finland, England, New-Zealand and California which also have found substantially increased risk of revision for uncemented implants.

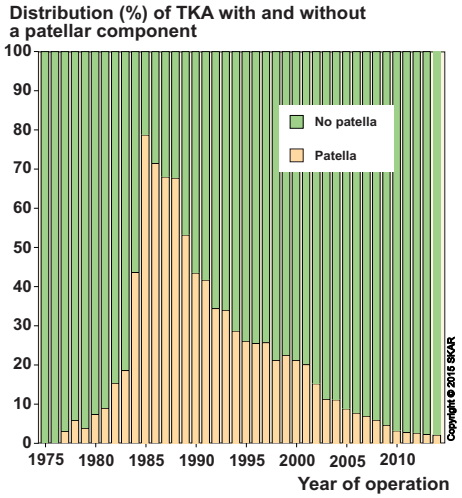
Patellar button in TKA – Estimating how the use of a patellar button affects the revision rate is complex. The use of a patellar button varies with the brand of prosthesis used and its use also has lessened in recent years. During the eighties, when patellar button was used in a good half of the cases, its use had a negative effect. Since then its use has continuously diminished so that it was only used in 2.2% if the TKA cases in 2014 (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 that 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 the 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, 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 not find an advantage of using a button. However, for the current period 2004-2013 (figure left, below) we find the opposite of that observed during 1991-2000; TKA with a patellar button now have a higher risk of revision than TKA without a button (RR x 1.2 (CI 1.1-1.5)).

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 (http://nrlweb.ihelse.net/).
According to the 2014 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 57% in 2013. They also reported in their 2013 annual report that compared to TKAs using a patellar button, TKAs without a button had 1.3 (1.2-1.3) 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 implant model is what generates the most interest and which is most often connected to the results of knee arthroplasties. 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. However, there is a multitude of patient related factors that we do not adjust for, such as grade of joint disease, activity, expectations and socioeconomic factors just to mention a few.

An additional 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 many 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 2014

Types of primary arthroplasties reported in 2014

	Number	Percent
Linked	61	0.5
TKA	12,428	95.6
UKA medially	448	3.4
UKA laterally	5	0
Fem-Pat	58	0.5
Partial (PRKA)	0	0
Total :	13,000	100

The TKA has become the standard treatment and in 2014 it accounted for 96% of the surgeries (table above). In 1989 UKAs accounted for 44% of the knee arthroplasties but since then it's use has diminished and in 2014 it was only used in 4% of cases (fig. page 18). Only one PRKA (partial replacement knee arthroplasty) was reported in 2013 and none in 2014.

All 74 units performing elective knee arthroplasties reported to the registry during 2014. Although a few reports may not yet have been turned in, their effect on the total number of operations is expected to be negligible. This summer, 13,000 primaries had been reported for 2014 which is 2.5% less than at the same time in 2013 (13,338).

Implants for primary TKA in 2014

	Number	Percent
NexGen MBT	5,737	46.2
PFC-MBT	2,278	18.3
Vanguard	1,584	12.7
Triathlon	1,380	11.1
PFC-HPT	782	6.3
Genesis II	168	1.4
NexGen TM	157	1.3
NexGen HPT	64	0.5
Legion/Genesis II	45	0.4
Profix	28	0.2
PFC-RP	7	0.1
Link Gemini	6	0.0
Others	192	1.5
Totalt:	12,428	100

*Mainly revision models (see separate table) except 13 knee for which part numbers are missing

As compared to last year, TKA had decreased by 2.4%. The same 4 TKA brands as last year dominate, accounting for 96% of all the primaries. NexGen from Zimmer was used in almost half of the primaries while PFC from DePuy came second with a quarter. Vanguard from Biomet and Triathlon from Stryker came in third and fourth. A new combination of Legion femur parts and Genesis baseplates is now being reported. The group "Others" mainly stands for revision models (see table right).

The use of UKA continues to diminish or by 8% between 2013 and 2014. The Oxford accounted for good half of the procedures and Link for little less than one fourth.

Implants for primary UKA in 2014

	Number	Percent
Oxford	241	53.2
Link	103	22.7
ZUK	77	17.0
Triathlon PKR	23	5.1
Sigma PKR	6	1.3
Genesis	2	0.4
Missing	1	0.2
Total :	453	100

Ordinary TKA implants that use stems longer than 5 cm either on the femur or the tibia are defined as being revision models (together with specific revision brands). 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 typical OA cases.

Besides these revision models, 61 linked implants were used for primary arthroplasty in 2014, mainly rotating hinges for treatment of malignancies, fractures and other difficult cases.

Revision implants for primary TKA in 2014

	Antal	Procent
NexGen Revision	59	33.0
Triathlon Revision	51	28.5
PFC Revision	39	21.8
Vanguard Revision	24	13.4
Legion/Genesis Rev.	6	3.4
Total :	179	100

904 revisions were reported in 2014 of which 235 were secondary (not the first revision). In 676 cases the primary was a TKA, in 190 it was an UKA, in 24 a linked implant and in 13 cases a Femoro-Patellar implant.

The annual report together with accompanying lists of reported surgeries are sent to the contact surgeons each year. This usually results in some extra revisions becoming reported. Because few missed revisions can have a large effect on the results and because revisions are complicated procedures for which supplementary information is often needed, our survival analyses end 2013.

The most common implants in the counties in 2014

TKA in the counties

	Model 1	n	Model 2	n	Model 3	n	Other
01 Stockholm	NexGen	1.116	PFC Sigma	942	Triathlon	103	120
03 Uppsala	PFC Sigma	373	NexGen	86			
04 Södermanland	PFC Sigma	232	NexGen	99	PFC Rot Platf	7	2
05 Östergötland	NexGen	539	Legion/Genesis	5	PFC Sigma	1	1
06 Jönköping	Vanguard	522	Other	5			
07 Kronoberg	Vanguard	173	PFC Sigma	23	Legion/Genesis	10	9
08 Kalmar	NexGen	448	Other	4			
09 Gotland	PFC Sigma	65	Other	3			
10 Blekinge	Vanguard	235	Other	2			
12 Skåne	Triathlon	1.266	PFC Sigma	276	NexGen	141	103
13 Halland	NexGen	721	Other	1			
14 Västra.Götaland	NexGen	993	Vanguard	544	PFC Sigma	126	29
17 Värmland	NexGen	447	PFC Sigma	47	Other	4	
18 Örebro	NexGen	169	Genesis II	168	Legion/Gen Rev	1	
19 Västmanland	NexGen	232	Other	7			
20 Dalarna	NexGen	349	PFC Sigma	151	Other	1	
21 Gävleborg	PFC Sigma	523	NexGen	15	Link Gemini	4	
22 Västernorrland	NexGen	263	Other	6			
23 Jämtland	NexGen	102	Other	2			
24 Västerbotten	NexGen	230	Legion/Genesis	30	Profix	28	5
25 Norrbotten	PFC Sigma	302	NexGen	8	Triathlon	6	3

The table above shows that in 2014. only 9 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	87	Link	38	ZUK	29	11
03 Uppsala	Oxford	3	ZUK	1			
04 Södermanland	Link	1					
05 Östergötland	Oxford	54	ZUK	5			
06 Jönköping	Oxford	13	Link	10	ZUK	3	1
07 Kronoberg	Oxford	39					
08 Kalmar	Link	1					
09 Gotland	Link	1					
10 Blekinge	Oxford	5					
12 Skåne	Triathlon PKR	13	Oxford	8	Link	2	
13 Halland	ZUK	16					
14 Västra.Götaland	Oxford	32	ZUK	11	Link	7	3
17 Värmland							
18 Örebro	Link	6	ZUK	4			
19 Västmanland	Triathlon PKR	4	Genesis	1			
20 Dalarna	ZUK	2					
21 Gävleborg	Link	30					
22 Västernorrland	ZUK	3					
23 Jämtland							
24 Västerbotten	ZUK	2					
25 Norrbotten	Link UKA	7					

The table above shows that only 2 counties. Stockholm and Östergötland reported more than 50 UKA in 2014. 3 counties reported between 30 and 40 UKA respectively but otherwise the counties reported between 1 and 16 procedures except Värmland and Jämtland which reported none.

Bone cement and minimally invasive surgery in 2014

Use of cement in primary surgery during 2014

	Primary TKA	Primary UKA
No component without cement	11,809	356
Only the femoral component without cement	6	2
Only the tibial component without cement	14	
The femur- and tibial components without cement	536	89
Unknown	63	6
Total	12,428	453

	Primary TKA		Primary UKA	
	Number	Percent	Number	Percent
Refobacin (gentamicin)	6,650	55.9	230	63.2
Palacos R+G (gentamicin)	4,388	36.9	106	29.1
Smartset GHV gentamycin	397	3.3	16	4.4
Cemex Genta System	387	3.3	3	0.8
Copal (genta+clinda	10	0.1		
Refobacin Revision	4	0	1	0.3
Copal (genta+vanco)	1	0	1	0.3
CMW (gentamicin)			1	0.3
Missing	55	0.5	6	1.6
Subtotal:	11,892	100	364	100
All parts without cement	536		89	
Total	12,428		453	

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 2014, only 4% of all the TKA's were without cement and 0.2% were hybrids. After Biomet introduced Oxford in a cementless version the proportion of uncemented UKA has increased and in 2014 it was 20% (all Oxford).

Practically all the cement that was used for the primary knee arthroplasties 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. However, since 2007, almost all the hospitals have used stickers allowing for identification of the cement brands.

The mixing system may have an effect on the cement quality. Thus, in cases where a separate mixing system (not a part of the cement package) is used we are interested in receiving the part numbers.

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 2014

	Standard incision	Mini-incision	Missing
Link	100	3	
Oxford	86	150	5
ZUK	59	17	
Triathlon	13	10	
Sigma	6		
Genesis	2		
Unknown		2	
Total	268	180	5

In 2014 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 13-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 2014

The use of patellar resurfacing has been decreasing since the mid-eighties so that it is now only used in good 2% of the TKA cases. During 2014 a button was most commonly used in the county of Västerbotten 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 in the 2009 annual report also found substantial regional differences in the use of patellar buttons (https://aoanjrr.dmac.adelaide.edu.au/).

In Sweden, the use of a patella button has also been heavily related to the implant brand used although this effect has diminished as its use has become more uncommon. In 2014, button was most often used in primary arthroplasty together with the PFC Sigma TKA.

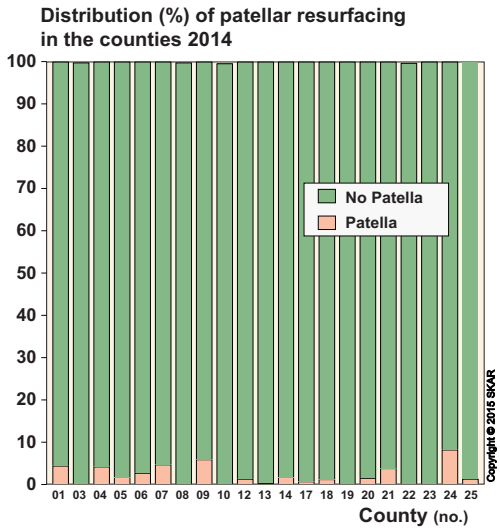
In Sweden, females have their patella resurfaced slightly more often than males whcih some have explained by femoropatellar pain being more common in women. In the whole material, from 1975 to the end of 2014, 14.1% of the women had their patella resurfaced compared to 10.7% of the males, which is a significant difference. During 2014 1.6% of the men had a patella button compared to 2.6% of the women which also is a significant difference.

Use of patella button with different TKA implants in 2014

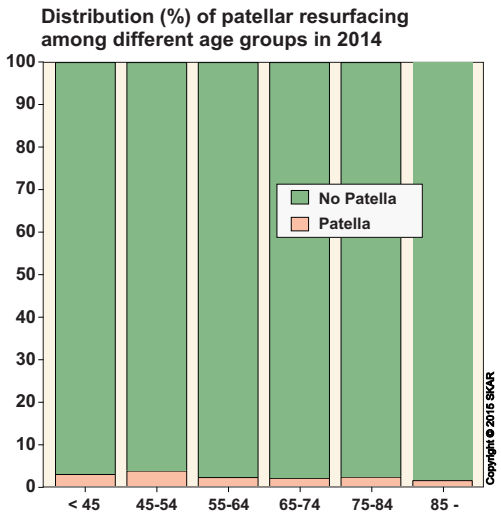
	No patella button	%	Patella button	%
NexGen	5,870	98.5	88	1.5
PFC Sigma	2,946	96.2	115	3.8
Vanguard	1,556	98.2	28	1.8
Triathlon TKA	1,363	98.8	17	1.2
Genesis II	167	99.4	1	0.6
Legion/Genesis	42	93.3	3	6.7
Profix	22	78.6	6	21.4
PFC Rotating Platform	6	85.7	1	14.3
Link Gemini	6	100.0	0	0.0
Övriga	182	95.3	9	4.7
Total	12,160	97,8	268	2,2

Looking at the relative use of a patella button in the different age groups during 2014 (see figure below), it can be seen patellar resurfacing was similar in all the age groups except the youngest, in which it is slightly more common. This has varied somewhat in recent years because of the low number of young patients.

How the risk of revision is influenced by the use of a patella button is discussed on page 19 where curves can be found showing the CRR during the current period of 2004-2013, 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 2014 (the counties are listed on page 12).



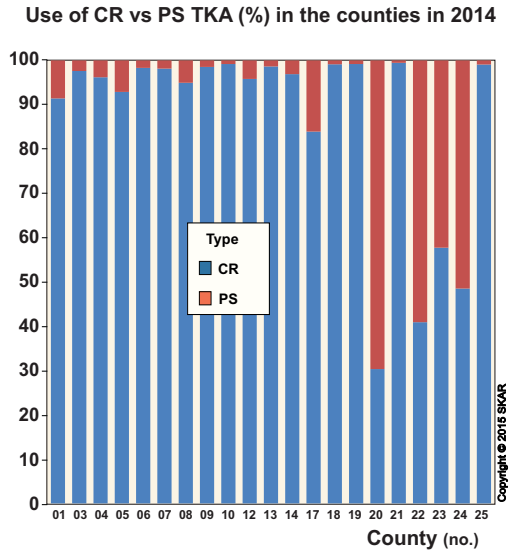
The figure shows the relative proportion of TKA with and without patella button in the different age-groups during 2014.

Posterior stabilized prostheses during 2014

As explained on page 4, there are TKA types called posterior stabilizing (PS) as they simulate the effect of the posterior cruciate ligament by an eminence in the middle part of the tibial polyethylene that is contained by a box between the medial and lateral sliding surfaces in the femoral component. The construct limits the anterior posterior slide but allows for some rotation. The type assumes resection of the posterior cruciate if present.

Those advocating the use of PS claim that it allows for better flexion and more normal knee movement than the cruciate retaining (CR) type which spares the posterior cruciate ligament.

The disadvantage of PS is that the increased stability may result in increased stress on the polyethylene as well as the bone surfaces and thus theoretically increase the risk of wear and loosening. Use of PS is common in other countries such as the USA. However, in Sweden surgeons have hitherto preferred using the CR implants at least for knees with intact posterior cruciate and without gross deformity.

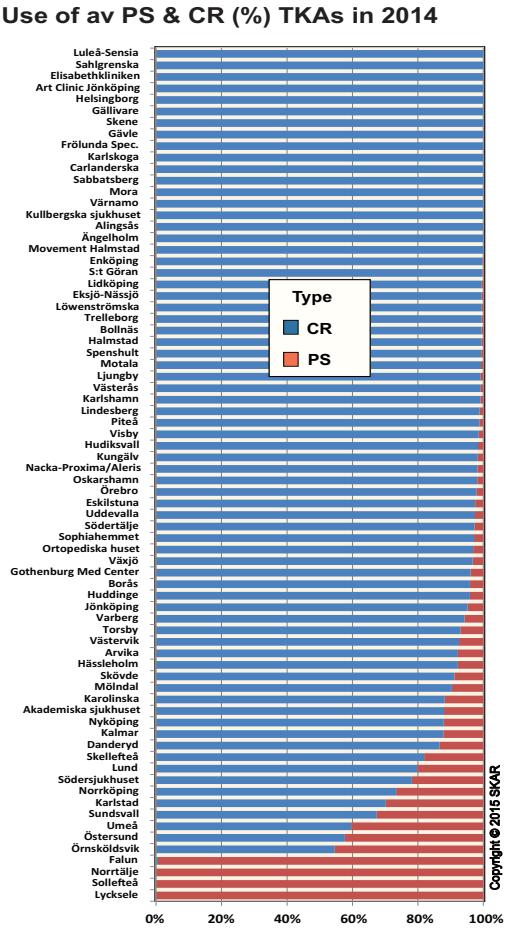


The figure shows the relative use of CR and PS implants in the different counties during 2014

As can be seen from the figure above, the counties are different with respect to use of PS implants. During 2004 PS implants were most commonly used in 4 counties; Dalarna, Västernorrland, Västerbotten, och Värmland (a list with the numbers, names and localization of the counties is on page 12).

During 2014 almost 10% of the primary TKAs were of the PS type (including revision and stemmed implants). This was a slight increase as compared to 2004 when the proportion was just over 7%.

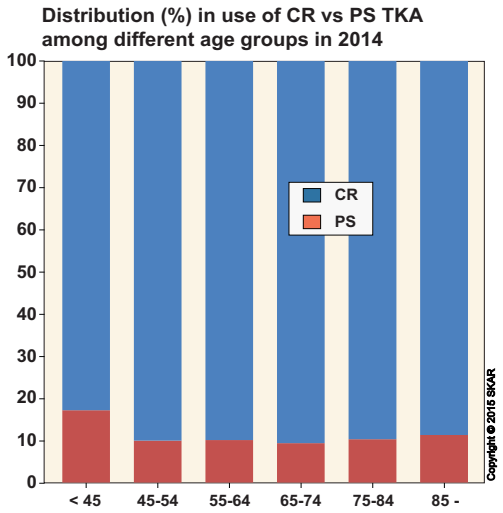
As can be seen from the figure below the use of PS knees varies among the hospitals with 4 units exclusively using PS and 18 exclusively using CR implants.



The figure shows the relative use of CR and PS implants in the different hospitals during 2014

We do not have any good explanation why the use of PS implants differs so much among the hospitals. Common for those 4 that exclusively used PS knees was that they almost only used the NexGen MBT implant (see table on next page). However, looking at the whole country, 83% of the NexGen MBT implants are of the CR type. (cont.)

Posterior stabilized prostheses cont. –
There was no significant difference in use of PS implants depending on gender. The relative use of PS implants in the different age groups was similar with the exemption that PS was more common in the youngest group. However, the number of surgeries in that group was small.



The figure shows the relative use of cruciate retaining (CR) and posterior stabilized (PS) implants among the different age groups during 2014.

As can be seen from the table below, the use of PS implants is most common in the group of "other" implants. This can be explained by that the group consists of stemmed and revisions models (see page 30). Among the "common" TKAs, use of PS is most frequent among the users of NexGen TM and NexGen MBT.

The relative proportion of CR and PS implants among the brands used for primary TKA in 2004

	CR	%	PS	%
NexGen MBT	4,752	82.8	985	17.2
PFC-MBT	2,247	98.6	31	1.4
Vanguard	1,567	98.9	17	1.1
Triathlon	1,359	98.5	21	1.5
PFC-HPT	781	99.9	1	0.1
Genesis II	166	98.8	2	1.2
NexGen TM	103	65.6	54	34.4
NexGen HPT	64	100	0	0.0
Legion/GenII Prim	40	88.9	5	11.1
Profix	28	100	0	0.0
PFC-RP	7	100	0	0.0
Link Gemini	6	100	0	0.0
Other	78	40.6	114	59.4
Total	11,198	90.1	1,230	9.9

Unfortunately it is not straightforward to compare the results of the two types. The reason is that because of their greater stability, many surgeons reserve the use of PS knees for cases having insufficient ligaments or greater deformity.

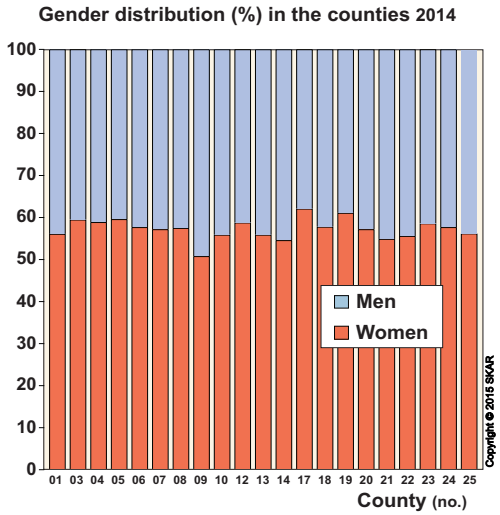
Even though some hospitals exclusively use one or the other type, the comparison is not straightforward as it is possible that more difficult cases are referred from hospitals exclusively using CR knees to hospitals that have more experience with PS knees.

An additional complicating factor is that the use of PS knees is more common in some implant brands as compared to others (see table above).

It is probably necessary to perform a randomized trial in order to estimate the differences in survival between the types.

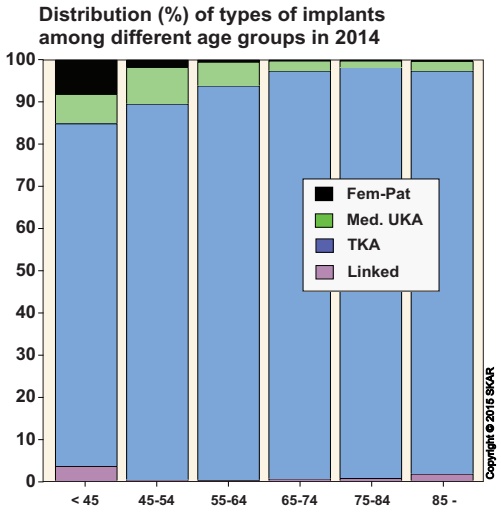
Please note that tibia components that in order to increase stability use an anterior lip or an extra concave polyethylene (deep dish) are not considered being PS implants. These versions can be used both with an intact cruicate ligament as well as when the cruciate is insufficient or abscent. They have been marketed in Sweden the last 3-4 years but their numbers are insignificant.

Gender distribution in the counties



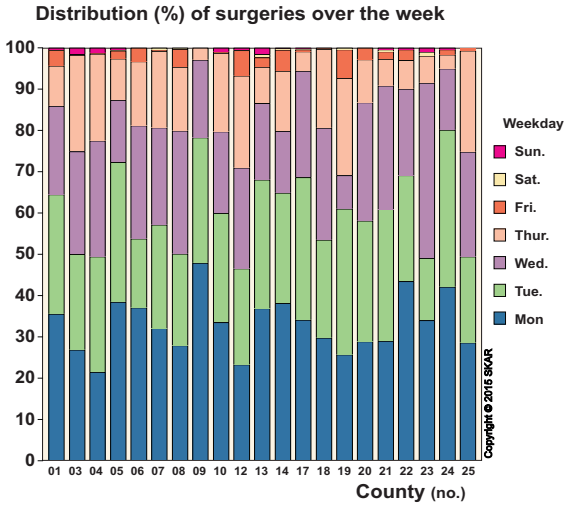
The proportion of females is 56-60% in the counties.

Type of implants in different age groups

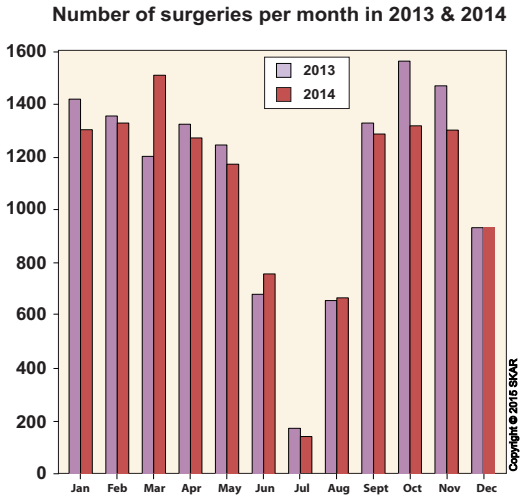


Uncommon models are most often used in patients younger the 45 years. The relative high proportion of linked implant is caused by serious conditions (tumors. trauma etc.)

Distribution of surgery on the weekdays and months



Distribution of surgery on the weekdays during 2014. Surgery on Fridays and weekends is uncommon.



The mean number of primary knee arthroplasties inserted each month during 2013 and 2014.

Knee arthroplasty is not often 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.

All the counties except 3 (Västmanland, Skåne and Västra Götaland) perform at least 95% of their knee arthroplasties Monday to Thursday.

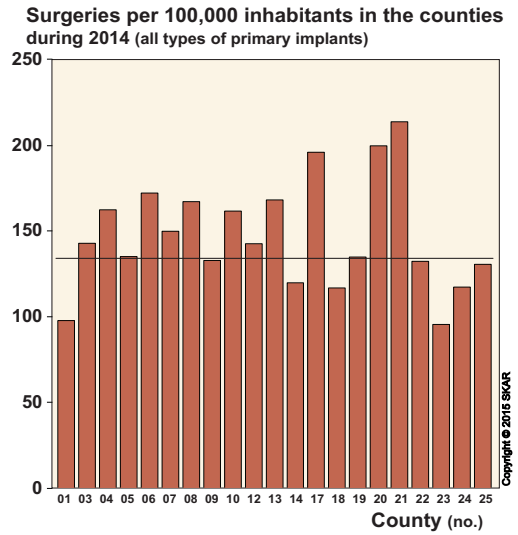
The figure above shows the number of surgeries during the different months of 2013 and 2014. It is evident how the production drops during the summer as around Christmas.

Age distribution and incidence in the counties 2014

County and number of inhabitants 2014

Nr	County	No. of inhabitants	no. of primaries	Incidence/ 100.000
01	Stockholm	2,180,543	2,129	97.6
03	Uppsala	347,212	496	142.9
04	Södermanland	279,118	453	162.3
05	Östergötland	439,977	594	135.0
06	Jönköping	342,749	590	172.1
07	Kronoberg	188,142	282	149.9
08	Kalmar	234,736	392	167.0
09	Gotland	57,208	76	132.8
10	Blekinge	153,457	248	161.6
12	Skåne	1,281,489	1,827	142.6
13	Halland	308,753	519	168.1
14	Västra.Götaland	1,623,548	1,944	119.7
17	Värmland	274,253	537	195.8
18	Örebro	286,773	335	116.8
19	Västmanland	260,379	351	134.8
20	Dalarna	278,126	555	199.6
21	Gävleborg	278,981	596	213.6
22	Västernorrland	242,609	321	132.3
23	Jämtland	126,613	121	95.6
24	Västerbotten	261,737	307	117.3
25	Norrbotten	249,712	326	130.6
	Country	9.696 110	13.000	134.1

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

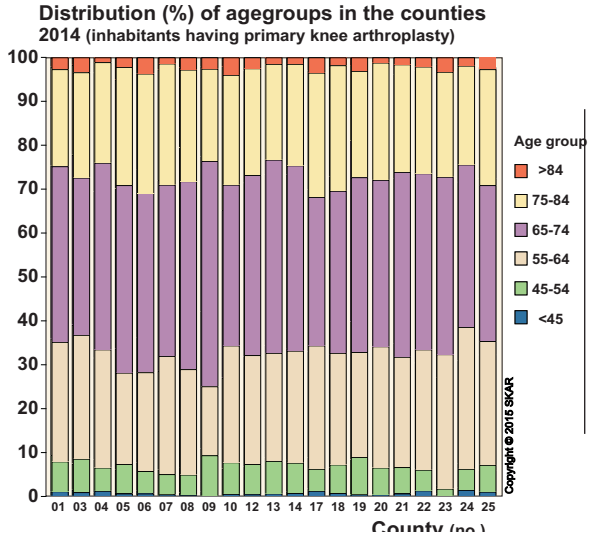


Incidence (no. of arthroplasties per 100.000 inhabitants)

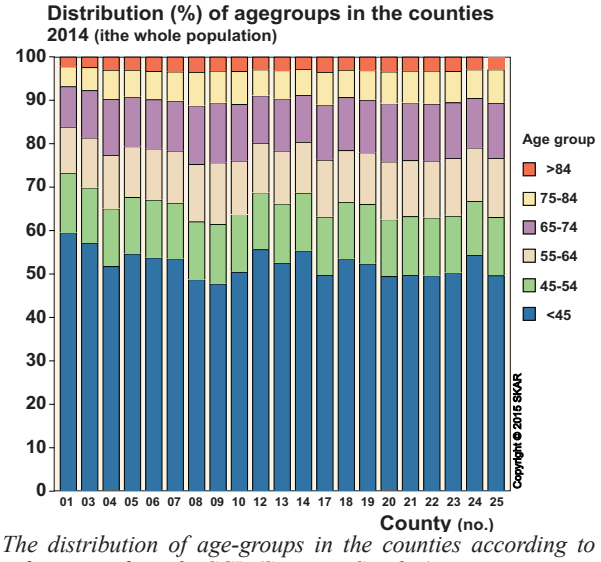
The table and figure above show the number of primary knee arthroplasties per 100.000 inhabitants in each county in 2014. The calculations are based on the domicile of patients at surgery. The incidence (not age-standardized) is highest in Gävlborg county and lowest in the county of Jämtland.

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 Västerbotten but lowest on Gotland. Värmland and Jönköping county had the highest proportion of patients 75 years and 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 2014

Distribution (%) of age groups in the counties in 2014 (whole population)						
Age group:	0-44	45-54	55-64	65-74	75-84	85-
Stockholm	59.6	13.7	10.6	9.3	4.6	2.2
Uppsala	57.1	12.8	11.5	10.9	5.3	2.5
Södermanland	51.7	13.3	12.4	12.8	6.7	3.0
Östergötland	54.7	13.0	11.7	11.4	6.3	3.0
Jönköping	53.8	13.2	11.9	11.3	6.5	3.3
Kronoberg	53.5	12.8	12.1	11.5	6.7	3.4
Kalmar	48.7	13.3	13.2	13.5	7.8	3.5
Gotland	47.7	13.8	14.2	13.8	7.3	3.2
Blekinge	50.4	13.3	12.4	13.0	7.6	3.3
Skåne	55.6	13.1	11.4	10.9	6.0	2.9
Halland	52.5	13.6	12.2	12.0	6.6	3.1
Västra.Götaland	55.3	13.3	11.8	10.8	6.0	2.8
Värmland	49.7	13.4	13.1	12.7	7.6	3.5
Örebro	53.5	13.0	12.0	12.2	6.3	3.1
Västmanland	52.3	13.7	11.9	12.2	6.8	3.1
Dalarna	49.4	13.1	13.4	13.4	7.3	3.4
Gävleborg	49.7	13.5	13.0	13.3	7.3	3.2
Västernorrland	49.6	13.3	13.1	13.1	7.6	3.2
Jämtland	50.3	13.1	13.3	12.9	7.2	3.4
Västerbotten	54.3	12.4	12.4	11.4	6.7	2.9
Norrbotten	49.6	13.5	13.6	12.8	7.7	2.9
The country	54.8	13.3	11.8	11.2	6.1	2.9
ESP (European Standard Population)	54.0	14.0	12.5	10.5	6.5	2.5

The age distribution differs in the counties (table above from the SCB). For a meaningful comparison of incidence, 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 does not have the same need for arthroplasties as an older one. This can be achieved by age standardization in which the incidence is recalculated to what it would have been if the age distribution had been the same in all the counties.

To 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 be seen that the age-standardized incidence is lowest 93.3 in Jämtland while it the double in Gävleborg county (186.8). Uppsala has 30% higher incidence than Stockholm but the counties are geographically side by side and both have 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 2014)

Nr	County	Incidence
01	Stockholm	116.7
03	Uppsala	153.3
04	Södermanland	149.1
05	Östergötland	134.1
06	Jönköping	167.9
07	Kronoberg	144.9
08	Kalmar	141.2
09	Gotland	122.2
10	Blekinge	143.8
12	Skåne	146.4
13	Halland	159.2
14	Västra.Götaland	122.8
17	Värmland	172.6
18	Örebro	113.6
19	Västmanland	127.1
20	Dalarna	173.8
21	Gävleborg	186.8
22	Västernorrland	114.9
23	Jämtland	93.3
24	Västerbotten	114.1
25	Norrbotten	113.9
	The Country	135.1

Implants for primary arthroplasty 2004–2013

In the tables below, the implants used during the investigated period 2004-2013 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 that is no longer used is still in the third place followed by its successor, the Vanguard, which was the third most used implant in 2014 (page 21).

Among the UKA's, 3 models account for the majority of surgeries. Of the 11 models listed below, only six were used in 2014.

Implants for primary TKA during 2004–2013

	Number	Percent
NexGen	39,565	36.5
PFC Sigma	30,692	28.3
AGC	9,168	8.1
Vanguard	7,927	7.3
Triathlon	6,818	6.3
Duracon	5,088	4.7
F/S MIII	3,309	3.1
Profix	2,068	1.9
PFC Rotating Platform	1,125	1.0
Natural	432	0.4
Genesis II	388	0.4
Kinemax	230	
Journey TKA	84	0.1
Link Gemini	55	0.1
LCS	40	0.0
Scan	32	0.0
Missing	63	0.1
Other*	1,405	1.3
Total	108,489	100

*Mainly revision models. see table above right.

Implants for primary UKA during 2004–2013

	Number	Percent
Oxford	2,420	33.7
Link	2,363	33.0
MillerGalante	1,058	14.8
ZUK	585	8.2
Genesis	438	6.1
Preservation	139	1.9
Triathlon PKR	119	1.7
Sigma PKR	34	0.5
EIUS	9	0.1
Ibalance	3	0.0
Allegretto	2	0.0
Missing	1	0.0
Total	7,171	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 2004–2013

	Number	Percent
NexGen Revision	360	25.7
PFC Revision	326	23.3
Triathlon Revision	288	20.6
Duracon Revision	123	8.8
AGC Revision	114	8.1
Vanguard Revision	89	6.4
Profix Revision	79	5.6
Legion/Genesis II Revision	19	1.4
F/S Revision	2	0.1
Total	1,400	100

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

Hinged implants (primary) during 2004–2013

	Number	Percent
Rotalink	246	43.2
Nexgen RHK	152	26.7
MUTARS	52	9.1
S-ROM Noiles RHK	40	7.0
Stryker/Howmedica RHK	31	5.4
METS	27	4.7
Stanmore	7	1.2
Biomet Rotating Hinge	6	1.1
Missing	3	0.5
Other	6	1.1
Total	570	100

Femoro-patellar implants are uncommon. Only 294 cases using 8 different brands were reported during the 10 year period.

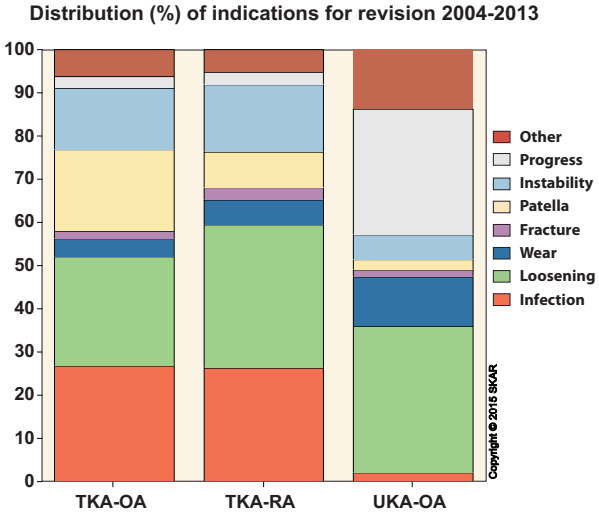
Femoro-Patellar implants during 2004–2013

	Number	Percent
Zimmer P-F	163	55.4
Avon P-F	58	19.7
Link P-F	33	11.2
PFC P-F	10	3.4
Richard /Blazina	9	3.1
Journey P-F	7	2.4
Vanguard P-F	6	2.0
LCS P-F	5	1.7
Missing	3	1.0
Total	294	100

Revisions during 2004–2013

During the 10-year period, 5,930 first time revisions were performed. 3,603 were revisions after TKA for OA, 246 after TKA for RA and 1,650 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. Infection and loosening are now equally often the reason for revision of TKAs 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 2004-2013. 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 (22% in OA and 17s% 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 types of revisions have been found to have a very high rate of re-revision.

Type of revision 2004–2013 in which the primary was a TKA/OA

	Number	Percent
Linked (rot. hinge)	345	9.6
TKA	951	26.4
Exchange of femur comp.	37	1.0
Exchange of tibia comp.	261	7.2
Exchange of disc/inlay	790	21.9
Patella addition	728	20.2
Patella exchange	38	1.1
Patella removal	10	0.3
Total implant removal	396	11.0
Arthrodesis	19	0.5
Amputation	23	0.6
Other	5	0.1
Total	3,313	100

Type of revision 2004–2013 in which the primary was a UKA/OA

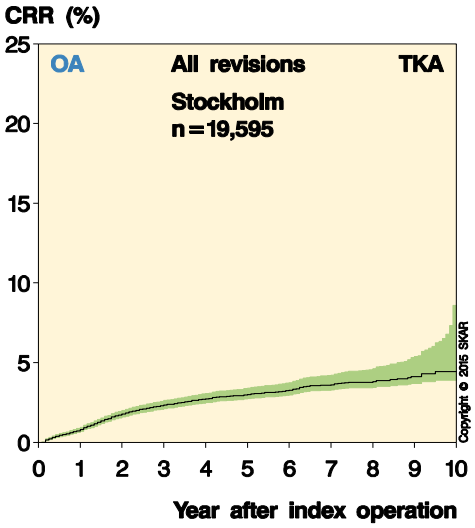
	Number	Percent
Linked (rot. hinge)	35	2.1
TKA	1,514	91.8
UKA	11	0.7
Exchange of femur comp.	6	0.4
Exchange of tibia comp.	6	0.4
Exchange/reposition of poly	52	3.2
Patella addition	4	0.2
Total implant removal	20	1.2
Amputation	2	0.1
Totalt	1,650	100

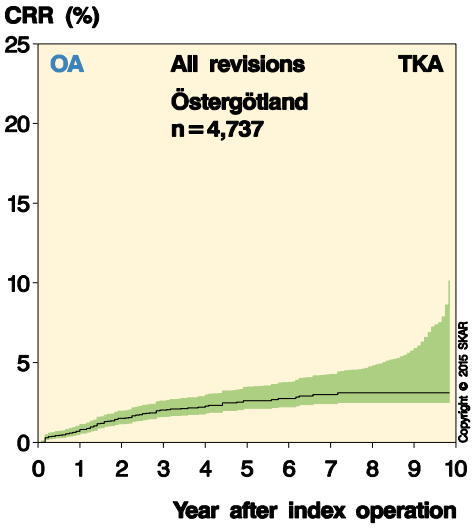
Type of revision 2004–2013 in which the primary was a TKA/RA

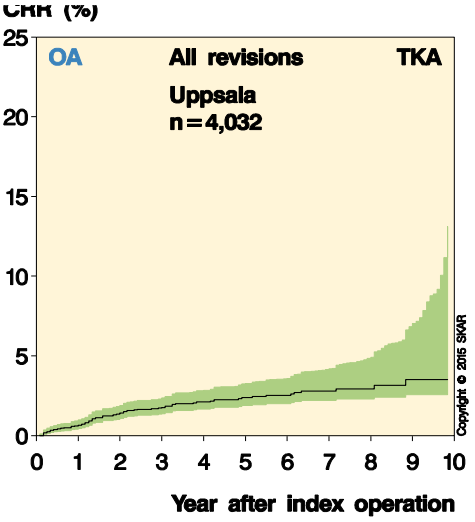
	Number	Percent
Linked (rot. hinge)	51	20.7
TKA	78	31.7
Exchange of femur comp.	6	2.4
Exchange of tibia comp.	8	3.3
Exchange of disc/inlay	42	17.1
Patella addition	24	9.8
Patella exchange	1	0.4
Total implant removal	33	13.4
Arthrodesis	2	0.8
Amputation	1	0.4
Total	246	100

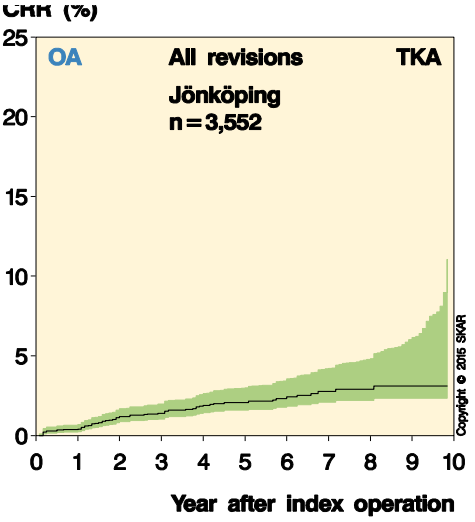
When evaluating the survival curves it should be noted that as the part of the curve to the right contains implants with long follow-up it also to a larger extent reflects older models.

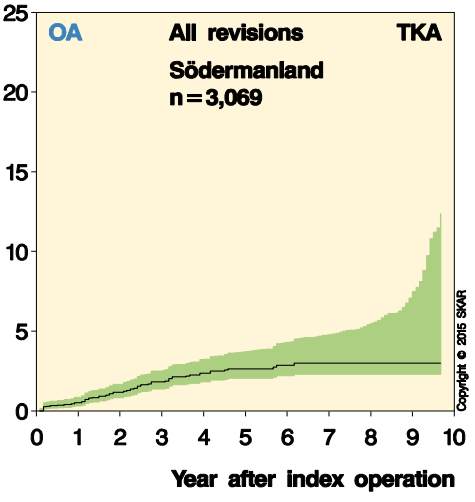
CRR in the counties after primary TKA for OA 2004–2013

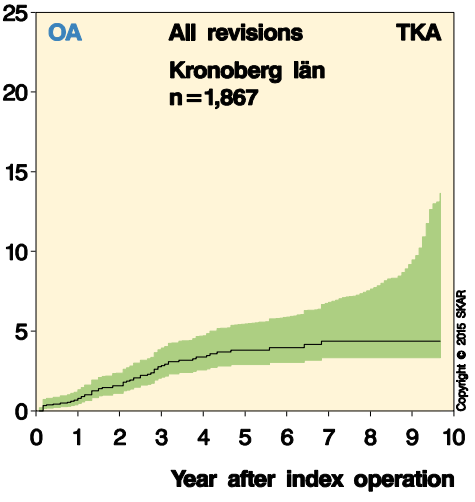




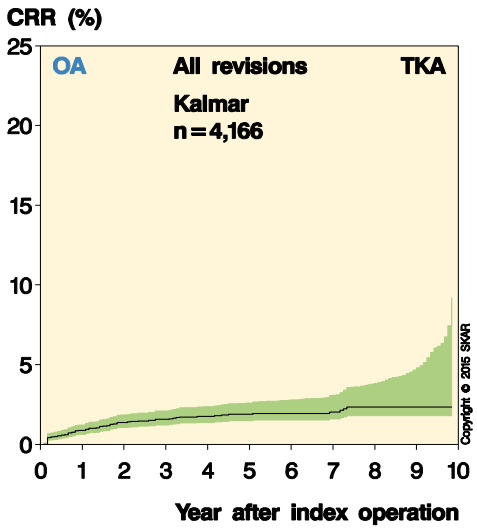


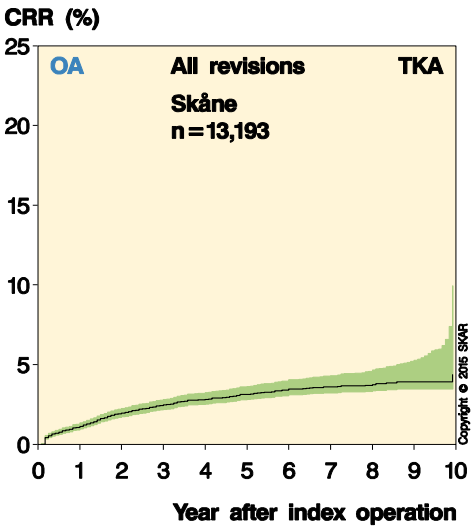


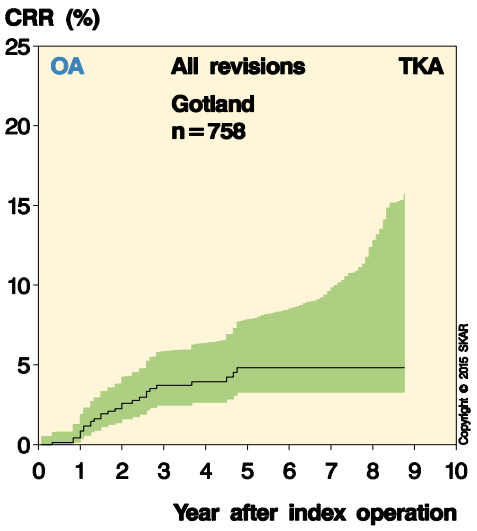


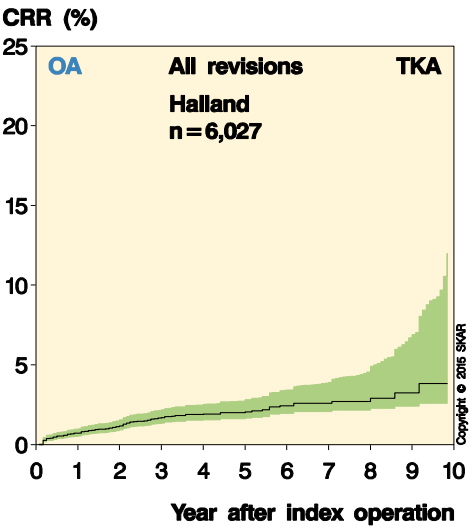


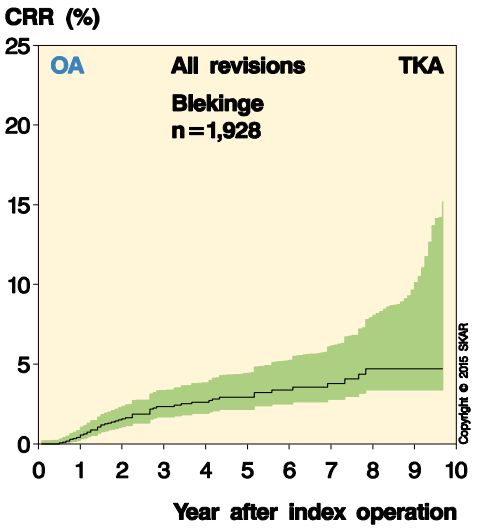
The curces are cut when less than 40 patients are left "at risk"

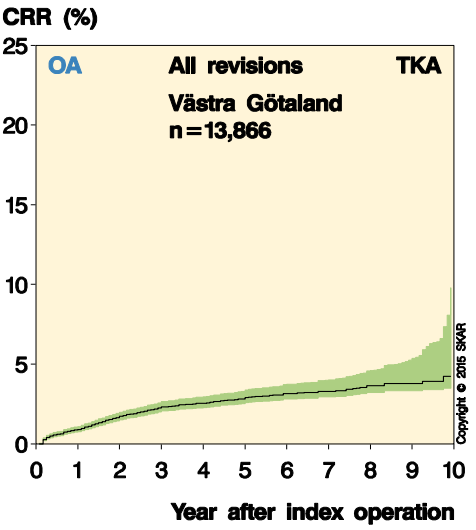






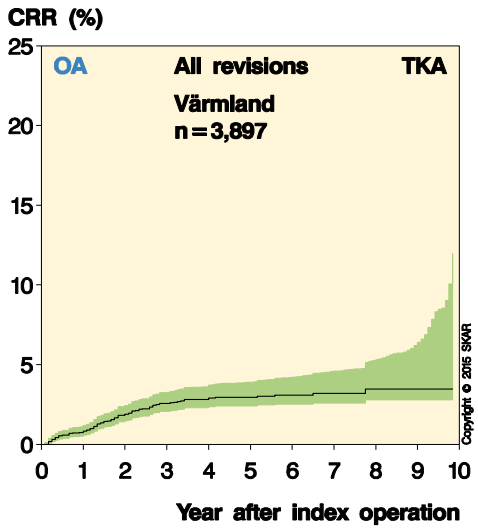


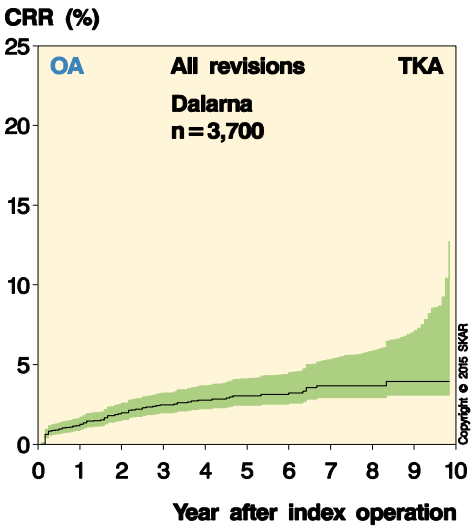


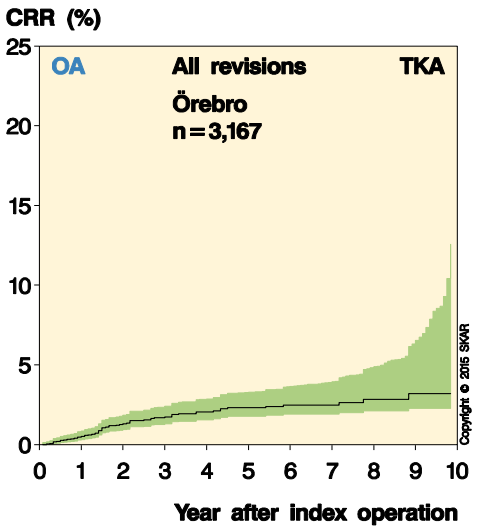


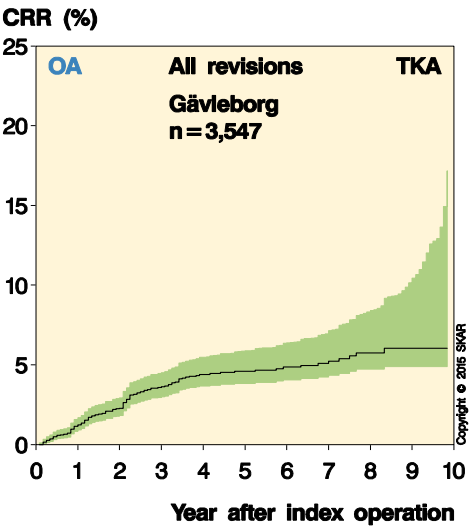
The curces are cut when less than 40 patients are left "at risk"

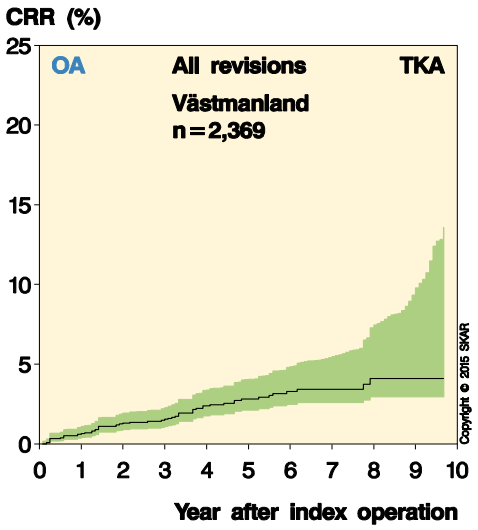
CRR in the counties after primary TKA for OA 2004–2013

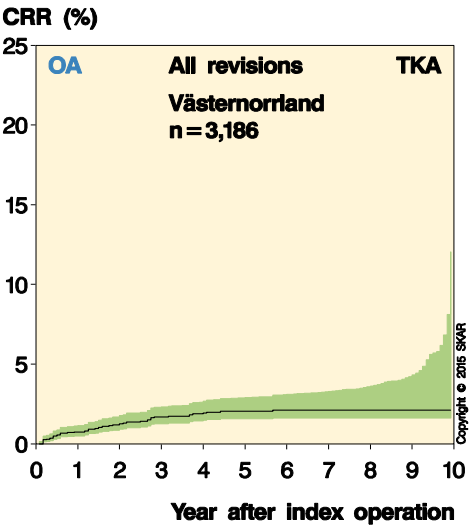




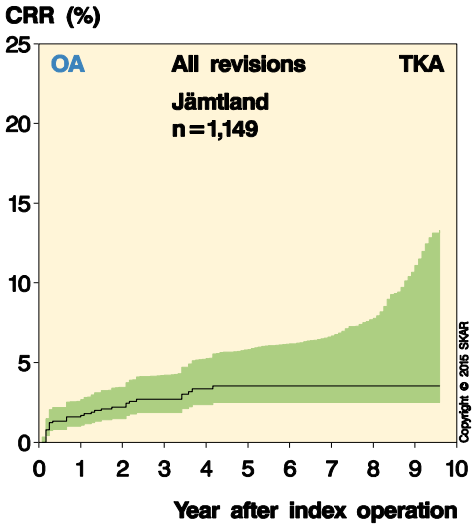


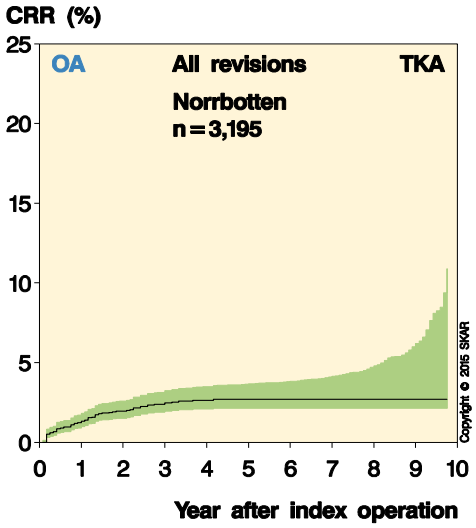


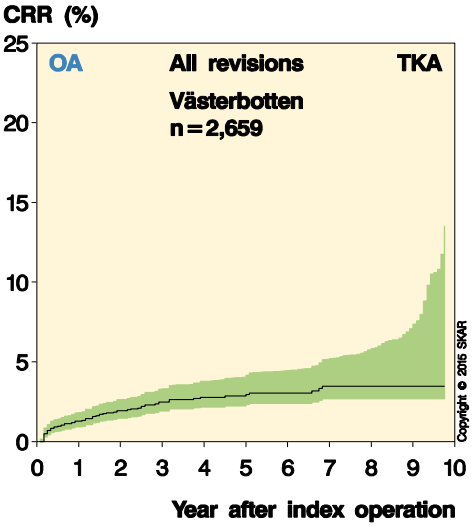




The curces are cut when less than 40 patients are left "at risk"

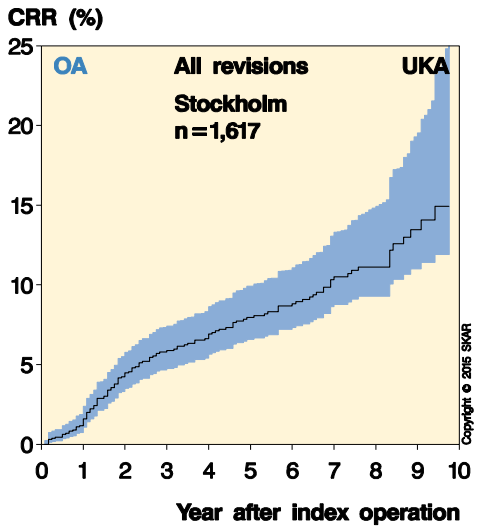


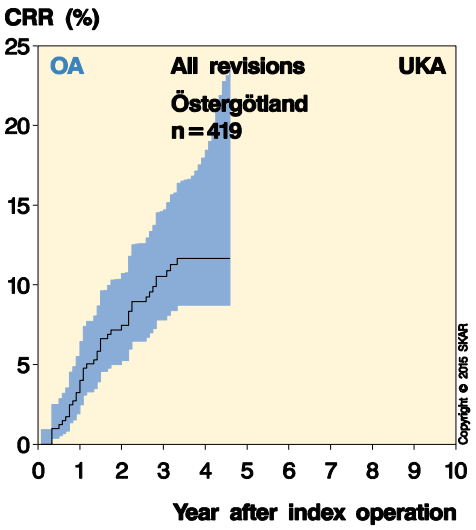


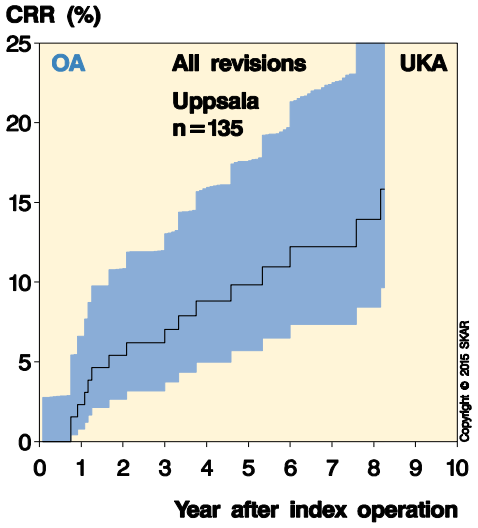


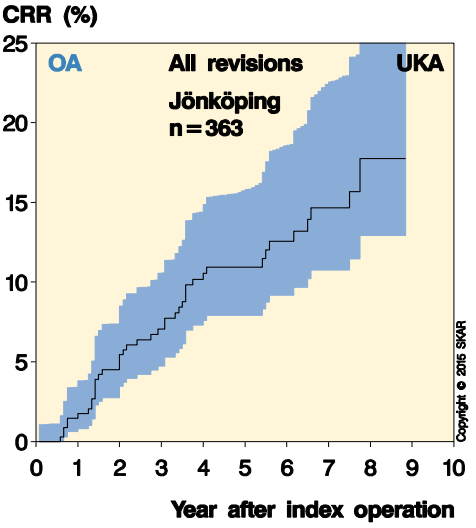
The curces are cut when less than 40 patients are left "at risk"

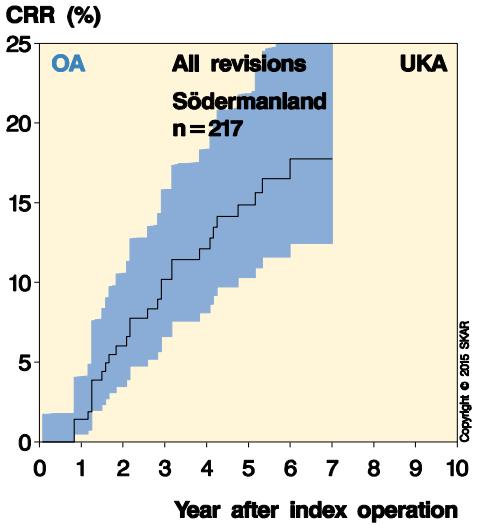
CRR in the counties after primary UKA for OA 2004–2013

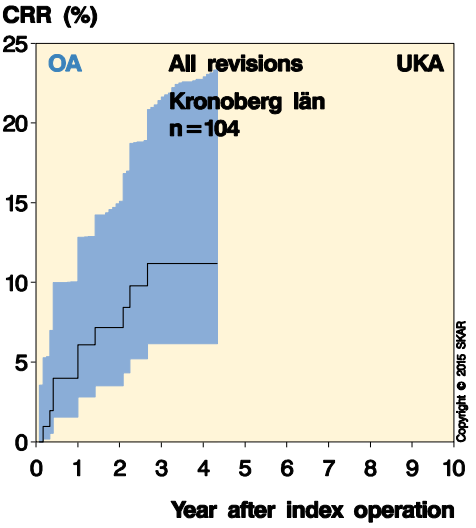




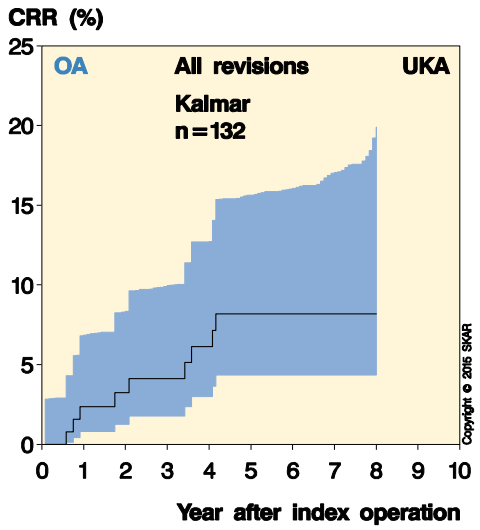


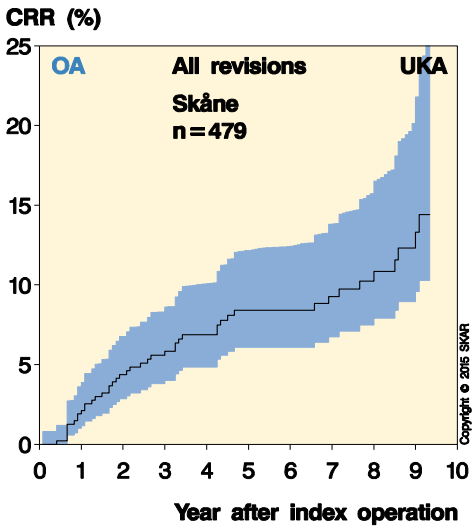


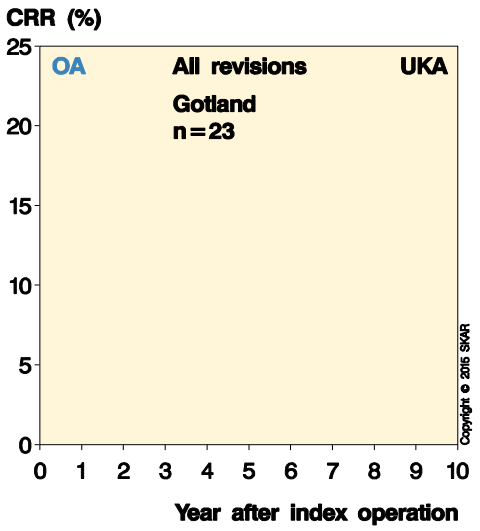


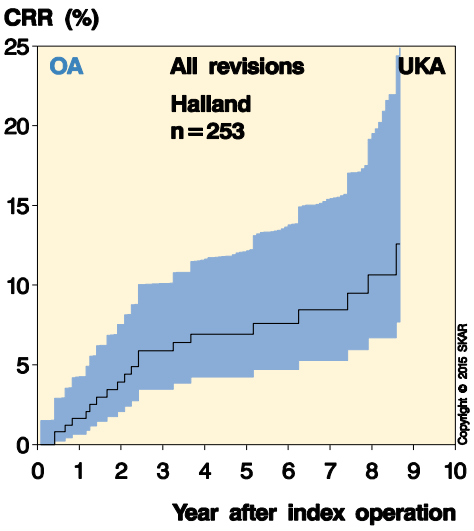


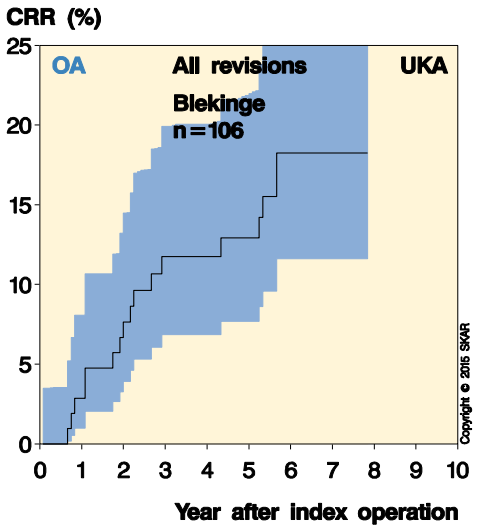
The curces are cut when less than 40 patients are left "at risk"

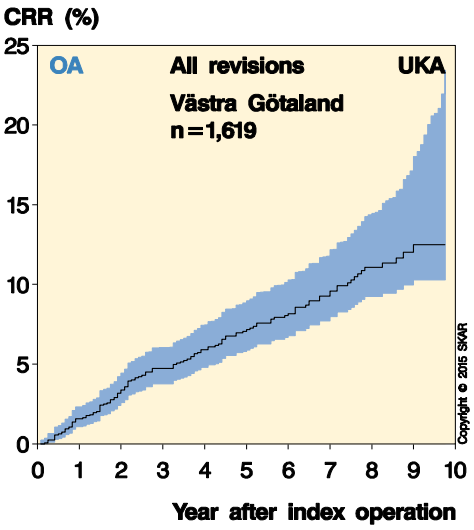






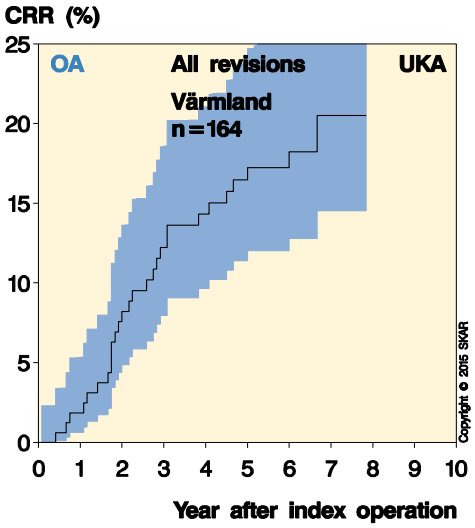


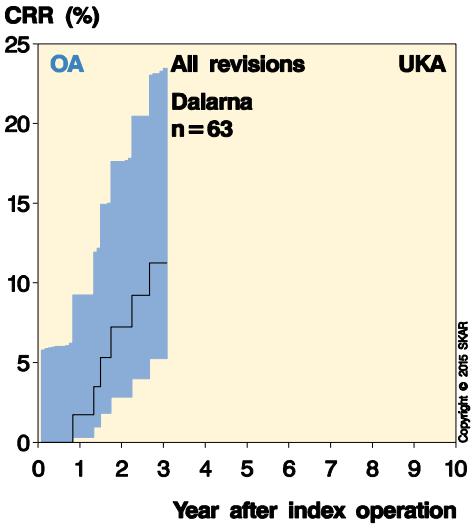


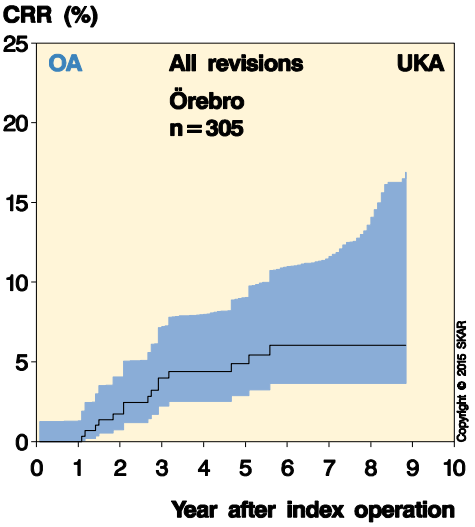


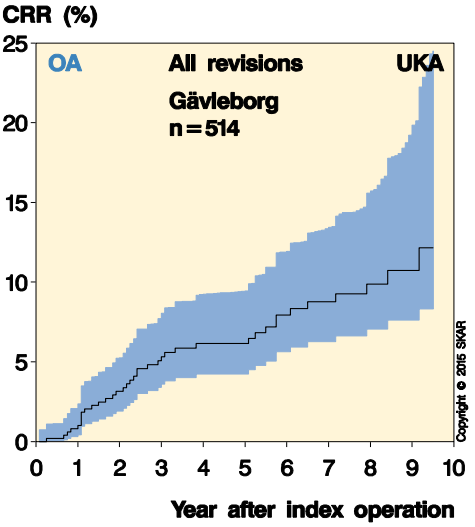
The curces are cut when less than 40 patients are left "at risk"

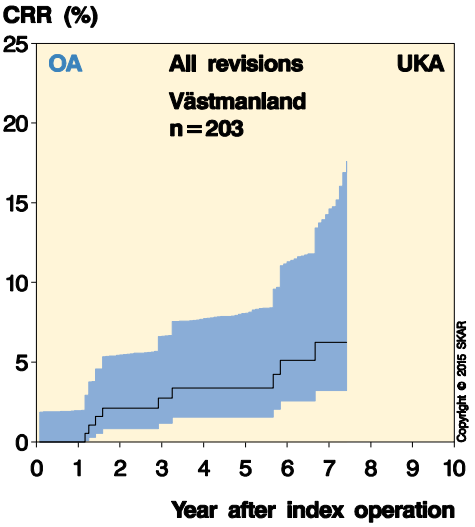
CRR in the counties after primary UKA for OA 2004–2013

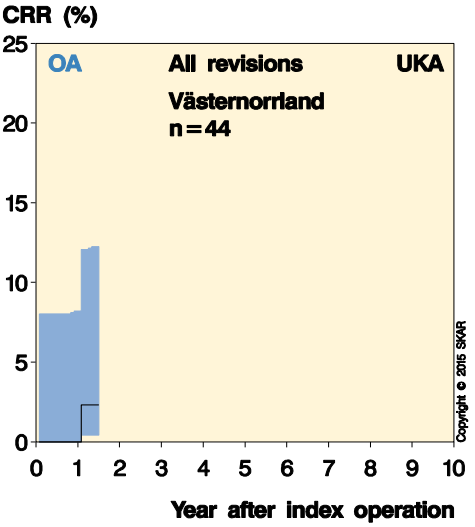




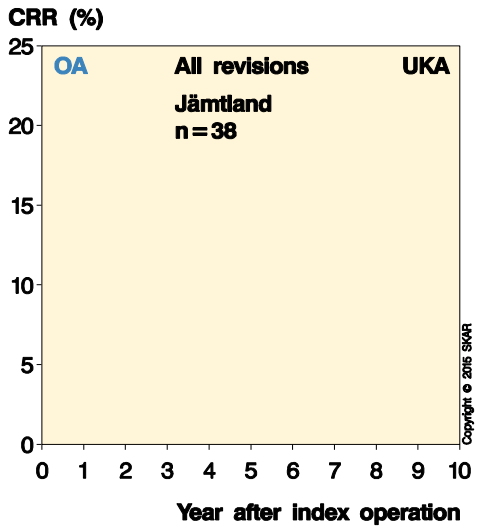


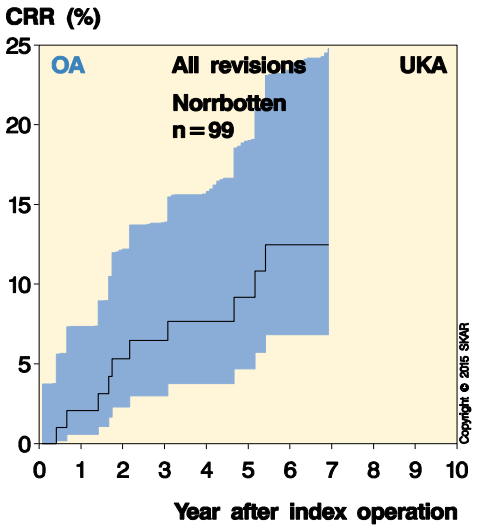


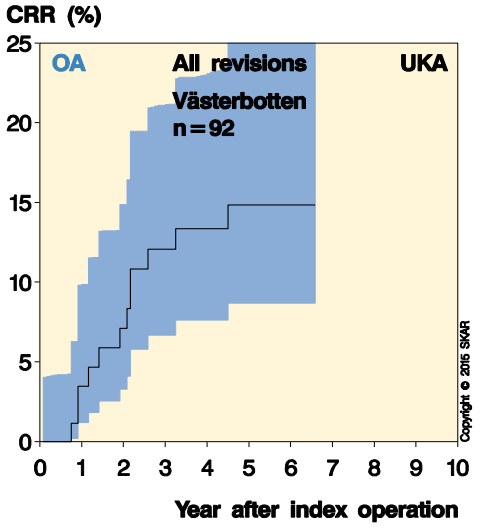




The curces are cut when less than 40 patients are left "at risk"







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

The relative risk for implants used in primary arthroplasty during 2004–2013

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, 94% of the PFC Sigma use the same type of a ”non-porous C/R” femur component which in 49% of cases was inserted with a cemented metal backed tibia component (MBT) and in 40% with an all-poly tibia (APT) component. NexGen had more femoral variants of which 53% were CR Option. On the tibia side, 87% were MBT (of which Option was 88%), 10% had an AP tibia and in 3% had a trabecular metal (TM) tibia component.

As last year we use the PFC Sigma-MBT as the reference for TKAs which is a relatively well defined brand, i.e. it mainly consists of the same type of femur (93%) together with the same type of tibia baseplate (82%) together with a 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 above the PFC-MBT but for UKA it is the Endo-Link as previously.

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	17,566		ref.	
AGC Anat	8,571	0.01	1.21	1.04-1.41
F/S MIII	3,194	<0.01	1.77	1.47-2.12
PFC-Sigma APT	11,962	<0.01	0.75	0.63-0.88
Duracon	4,854	0.03	1.22	1.02-1.46
Profix	1,935	0.12	1.24	0.94-1.63
NexGen MBT	32,928	<0.01	0.84	0.73-0.95
NexGen APT	4,071	0.64	0.95	0.76-1.19
NexGen TM	968	0.05	0.61	0.37-0.99
PFC RP	1,048	<0.01	2.11	1.64-2.70
Triathlon	6,554	0.51	0.93	0.76-1.15
Vanguard	7,574	0.09	1.17	0.98-1.40
Genesis II	379	0.91	0.95	0.35-2.54
Other	2,055	<0.01	1.78	1.42-2.23
Gender (male is ref.)		0.83	0.99	0.92-1.07
Age (per year)		<0.01	0.97	0.97-0.97
Year of op. (per year)		<0.01	1.04	1.02-1.06

OA / UKA	n	p–value	RR	95% CI
Link	2,321		ref.	
Oxford	2,364	0.75	0.97	0.79-1.18
MillerGalante	1,024	0.58	1.06	0.86-1.32
Genesis	427	0.8	1.05	0.75-1.47
Preservation	136	0.04	1.58	1.03-2.42
ZUK	551	0.32	0.83	0.57-1.20
Triathlon PKR	118	0.9	0.95	0.42-2.16
Other	48	0.48	1.43	0.53-3.86
Gender (male is ref.)		0.60	1.04	0.89-1.22
Age (per year)		<0.01	0.97	0.96-0.98
Year of op. (per year)		0.09	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. PFC-Sigma MBT is used as reference.

Without patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	17 086		ref.	
AGC Anat	7,420	<0.01	1.32	1.12-1.54
F/S MIII	2,277	<0.01	2.00	1.63-2.44
PFC-Sigma APT	11,635	<0.01	0.76	0.64-0.90
Duracon	4,253	0.12	1.17	0.96-1.42
Profix	1,764	0.23	1.20	0.89-1.60
NexGen MBT	32,451	0.01	0.85	0.75-0.97
NexGen APT	3,999	0.94	0.99	0.79-1.24
NexGen TM	952	0.07	0.64	0.39-1.04
PFC RP	833	<0.01	2.10	1.60-2.78
Triathlon	6,386	0.67	0.96	0.78-1.18
Vanguard	7,144	0.01	1.26	1.05-1.51
Genesis II	375	0.59	0.73	0.23-2.28
Other	1,814	<0.01	1.82	1.43-2.31
Gender (male is ref.)		0.93	1.00	0.92-1.09
Age (per year)		<0.01	0.97	0.97-0.97
Year of op. (per year)		<0.01	1.04	1.02-1.06

With patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	480		ref.	
AGC Anat	1,151	<0.01	0.42	0.24-0.74
F/S MIII	917	0.16	0.67	0.39-1.17
PFC-Sigma APT	327	0.19	0.58	0.26-1.31
Duracon	601	0.86	0.95	0.55-1.65
Profix	171	0.76	1.13	0.50-2.57
NexGen MBT	477	0.42	0.75	0.37-1.52
NexGen APT	*72*	*0.97*	*<0.01*	
NexGen TM	*16*	*0.99*	*<0.01*	
PFC RP	215	0.59	1.20	0.62-2.30
Triathlon	168	0.24	0.52	0.18-1.53
Vanguard	430	<0.01	0.06	0.01-0.49
Genesis II	*4*			
Other	241	0.92	0.97	0.48-1.95
Gender (male is ref.)		0.18	0.82	0.61-1.10
Age (per year)		<0.01	0.97	0.95-0.98
Year of op. (per year)		0.50	1.03	0.95-1.12

Implants lacking sufficient numbers for analysis are shown in italics

Using our division of TKA implants inserted for OA (left table on the previous page), we find that the AGC, F/S MIII, Duracon, PFC RP and the combination of "Other" models have significantly higher risk than the reference PFC-MBT. F/S MIII and Duracon were used in Sweden in the nineties, the F/S until 2008 and the Duracon until 2011. The use of AGC, which was our reference for many years, began in the eighties and it was used until 2012. The PFC rotating platform was introduced at the start of the millennium and became most popular during 2009-2010 after which its use sharply diminished. Implants with lower risk than the reference were the PFC-APT, NexGen MBT and NexGen TM.

The risk of revision decreases with increasing age but increases with time. This may be caused by an increasing number of inlay exchanges in manifest or suspected infections. 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 being 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 PFC-Sigma APT and NexGen MBT have a significantly lower risk of revision than the reference PFC-MB while the AGC, F/S MIII, PFC rotating platform, the group of "Other" models as well as the Vanguard have a higher risk. The Duracon has on the other hand no longer an increased risk as compared to the reference

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 both the AGC and Vanguard which had a higher risk than the reference when no button was used have a lower risk when used together with a button.

The relative risk for implants used in primary arthroplasty during 2004–2013 if the exchange of inlay, in case of infection, is not considered to be a revision

The SKAR defines a revision being a secondary surgery (reoperation) in a knee having an implant during which implant components are exchanged, added or removed.

The reason for other types 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 a 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 in infected revisions, the strict definition may treat certain implants unfairly. The reason is that almost half of all the 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 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 infection should not be considered a revision but a synovectomy.

On the opposite it can be claimed that infected TKA´s with fixed inlays will be treated with a complete exchange of components, as a comprehensive synovectomy is not considered possible without removal of the inlay. This could result in a reversed bias when 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. During the 10-year period we accordingly excluded 416 TKA and 6 UKA revisions. However, any later revisions of these knees will count instead.

For TKA/OA, without considering patella resurfacing (table below), we see in comparison to the table on page 40 that the same implants have an increased risk with the exemption of Vanguard which no longer has an increased risk. Of the 3 that had lower risk than the reference only NexGen MBT is left while the PFC-Sigma APT and NexGen TM are no longer significantly different. It should be noted that the poly cannot be exchanged in the PFC-APT or the Monoblock NexGen TM (the majority of the TMs) which as well as the NexGen APT will not benefit for any exclusion of inlay exchanges.

After the exclusion women have an increased risk of revision, the reason being that men more often are revised for infection including with change of inlay (see page 17). The negative effect of time (increasing op. year) has also disappeared, as exclusion of inlay changes counteracts the effect the increased aggressiveness in treating early or suspected infections by debridement and exchange of inlay when possible.

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	17,566		ref.	
AGC Anat	8,571	<0.01	1.44	1.22-1.69
F/S MIII	3,194	<0.01	1.95	1.61-2.36
PFC-Sigma APT	11,962	0.58	0.95	0.80-1.13
Duracon	4,854	0.03	1.25	1.03-1.52
Profix	1,935	0.03	1.38	1.03-1.86
NexGen MBT	32,928	<0.01	0.80	0.69-0.93
NexGen APT	4,071	0.06	1.25	0.99-1.57
NexGen TM	968	0.13	0.66	0.38-1.13
PFC RP	1,048	<0.01	2.41	1.86-3.12
Triathlon	6,554	0.15	0.83	0.65-1.07
Vanguard	7,574	0.03	1.27	1.03-1.56
Genesis II	379	0.59	1.37	0.44-4.29
Other	2,055	<0.01	1.79	1.40-2.29
Gender (male is ref.)		<0.01	1.14	1.05-1.25
Age (per year)		<0.01	0.96	0.96-0.97
Year of op. (per year)		0.51	0.99	0.97-1.00

OA / UKA	n	p–value	RR	95% CI
Link	2,321		ref.	
Oxford	2,364	0.65	0.95	0.78-1.17
MillerGalante	1,024	0.58	1.06	0.86-1.32
Genesis	427	0.77	1.05	0.75-1.48
Preservation	136	0.04	1.58	1.03-2.43
ZUK	551	0.37	0.84	0.58-1.22
Triathlon PKR	118	0.95	0.98	0.43-2.22
Other	48	0.45	1.46	0.54-3.93
Gender (male is ref.)		0.62	1.04	0.89-1.22
Age (per year)		<0.01	0.97	0.96-0.98
Year of op. (per year)		0.16	1.03	0.99-1.00

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. 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	17,086		ref.	
AGC Anat	7,420	<0.01	1.55	1.31-1.83
F/S MIII	2,277	<0.01	2.24	1.82-2.76
PFC-Sigma APT	11,635	0.69	0.97	0.81-1.15
Duracon	4,253	0.15	1.17	0.94-1.45
Profix	1,764	0.03	1.40	1.02-1.91
NexGen MBT	32,451	<0.01	0.81	0.70-0.95
NexGen APT	3,999	0.02	1.31	1.04-1.65
NexGen TM	952	0.18	0.69	0.40-1.18
PFC RP	833	<0.01	2.44	1.83-3.24
Triathlon	6,386	0.3	0.87	0.68-1.13
Vanguard	7,144	<0.01	1.37	1.11-1.69
Genesis II	375	0.95	0.95	0.24-3.85
Övriga	1,814	<0.01	1.77	1.36-2.31
Gender (male is ref.)		<0.01	1.16	1.06-1.28
Age (per year)		<0.01	0.96	0.96-0.97
Year of op. (per year)		0.43	0.99	0.97-1.01

With patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	480		ref.	
AGC Anat	1,151	0.05	0.54	0.30-1.00
F/S MIII	917	0.47	0.80	0.43-1.47
PFC-Sigma APT	327	0.53	0.76	0.33-1.77
Duracon	601	0.64	1.15	0.63-2.10
Profix	171	0.83	0.89	0.33-2.44
NexGen MBT	477	0.51	0.76	0.34-1.70
NexGen APT	*72*	*0.97*	*<0.01*	
NexGen TM	*16*	*0.99*	*<0.01*	
PFC RP	215	0.41	1.35	0.66-2.77
Triathlon	168	0.08	0.17	0.02-1.27
Vanguard	430	0.02	0.09	0.01-0.67
Genesis II	*4*			
Övriga	241	0.55	1.26	0.60-2.63
Gender (male is ref.)		0.54	0.90	0.66-1.24
Age (per year)		<0.01	0.96	0.95-0.98
Year of op. (per year)		0.57	1.03	0.94-1.12

Implants lacking sufficient numbers for analysis are shown in italics

In case of UKA (table previous page right), there were only 6 exchanges of inlays because of manifest or suspected infection during the 10-year period and the table is almost identical to the table on page 40.

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

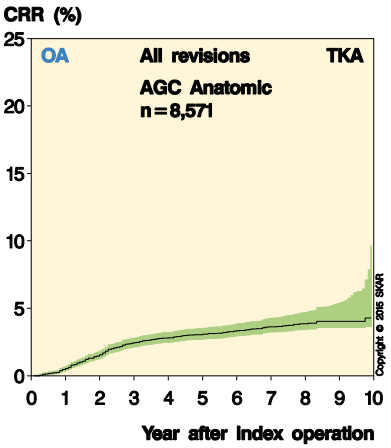
In the table left above, in which no patella button was used, the result is quite similar to that when exchange of tibia inlays were included with the exception that the PFC-APT no longer has significantly lower risk than the PFC-MBT reference and NexGen-APT now has a significantly increased risk.

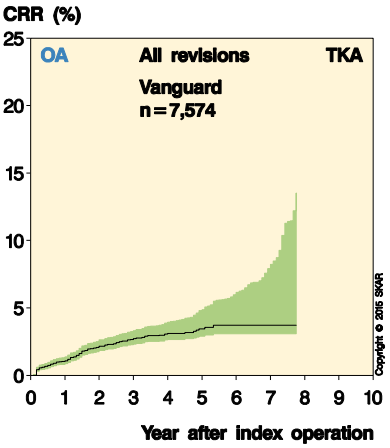
As for all TKA's, with and without patellar button (table left on the previous page), women have higher risk than men. Further, we no longer can see significantly increased risk with a later year of surgery which was observed when inlay exchanges were considered revisions.

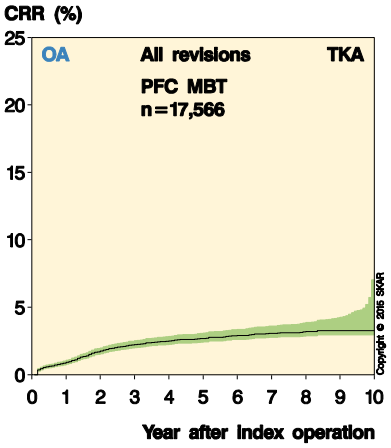
The table above to the right concerns TKA's in which a patellar button was used. When this table is compared to the table on page 41 the only difference is that the AGC no longer has a lower risk than the reference PFC-Sigma MBT.

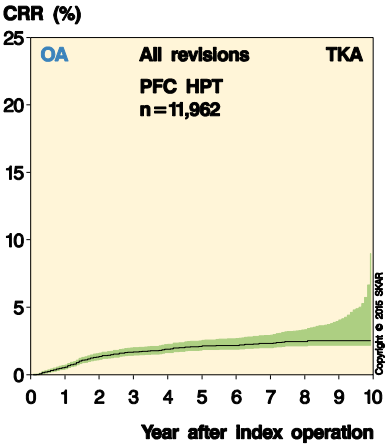
In summary one can establish that excluding an exchange of inlay in infected cases does affect the results and that the effect negatively affects non-modular implants as compared to modular ones. One explanation may be that a number of debridement's without exchange of inlays in non-modular TKA's have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

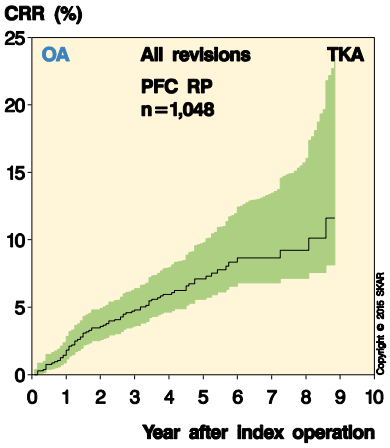
CRR for commonly used TKA implants for OA 2003–2011

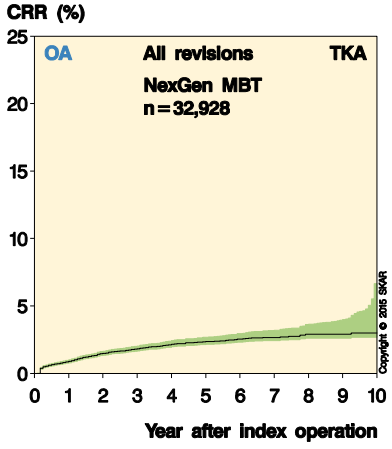


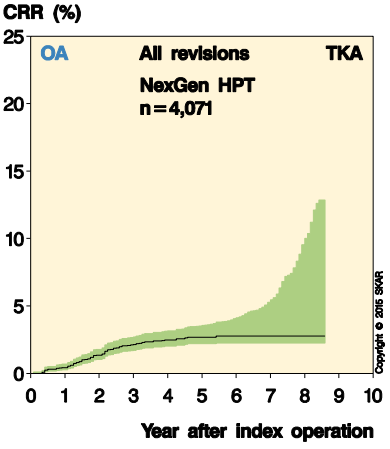


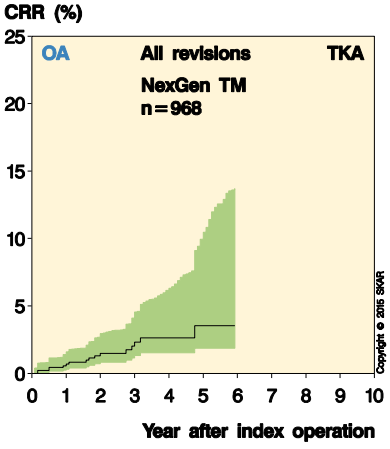


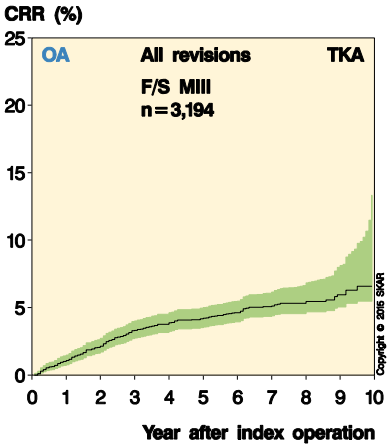











CRR (%)
OA
All revisions
TKA
F/S MIII
n=3,194
Year after index operation
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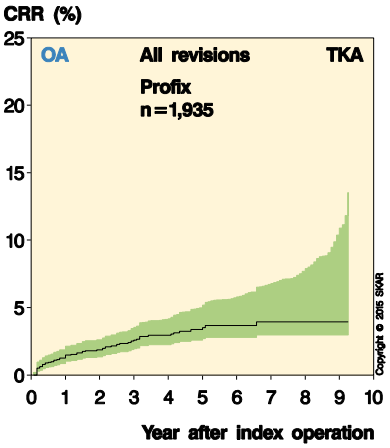
CRR (%)
OA
All revisions
TKA
Profix
n=1,935
Year after index operation
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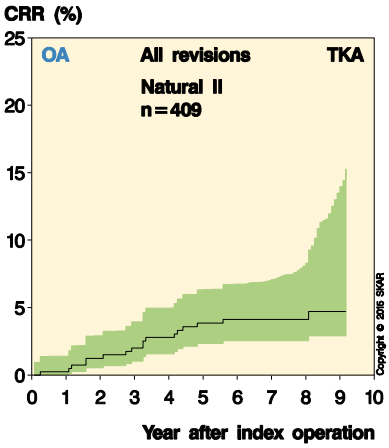
CRR (%)
OA
All revisions
TKA
Natural II
n=409
Year after index operation
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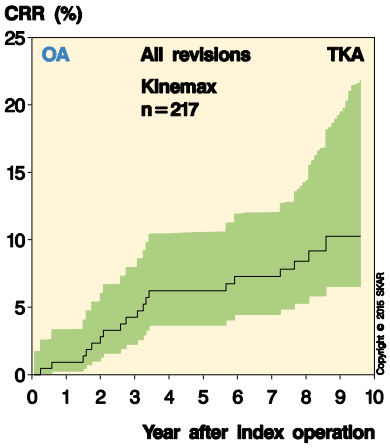
CRR (%)
OA
All revisions
TKA
Kinemax
n=217
Year after index operation
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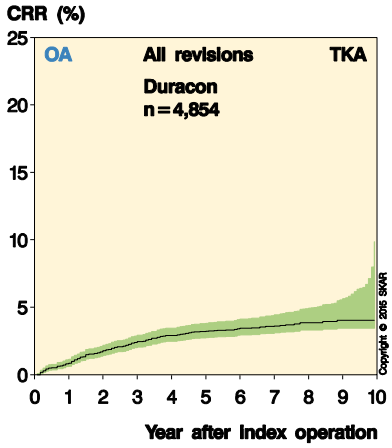
CRR (%)
OA
All revisions
TKA
Duracon
n=4,854
Year after index operation
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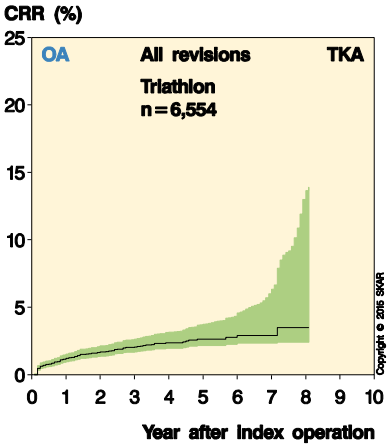
CRR (%)
OA
All revisions
TKA
Triathlon
n=6,554
Year after index operation
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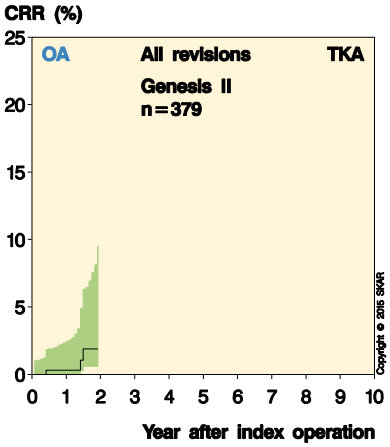
CRR (%)
OA
All revisions
TKA
Genesis II
n=379
Year after index operation
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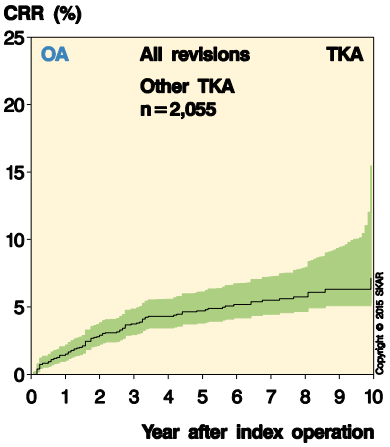
CRR (%)
OA
All revisions
TKA
Other TKA
n=2,055
Year after index operation
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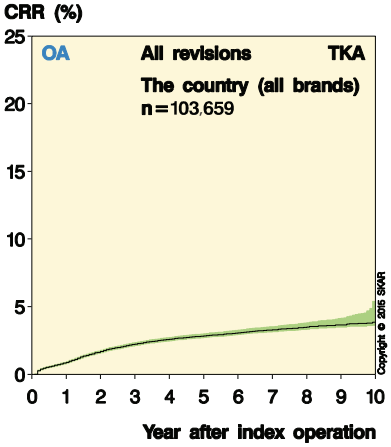
CRR (%)
OA
All revisions
TKA
The country (all brands)
n=103,659
Year after index operation
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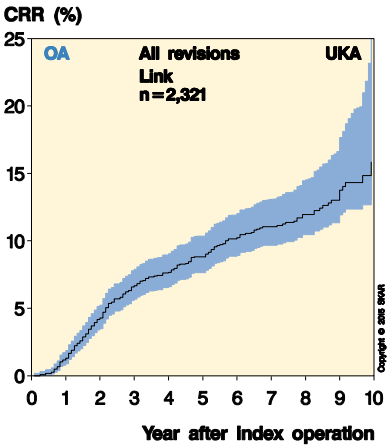
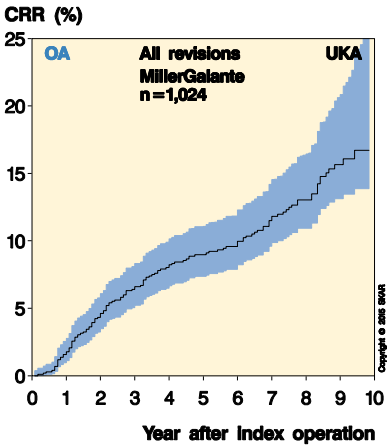
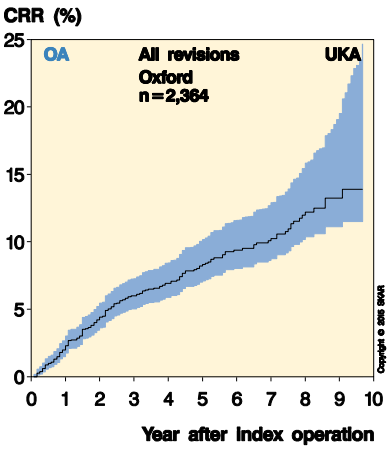
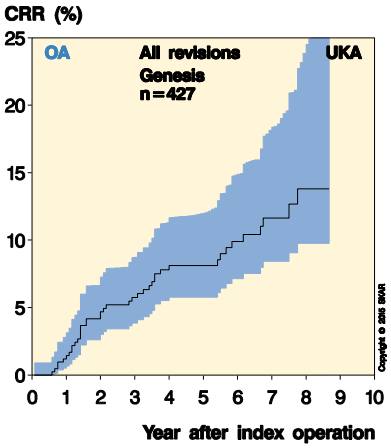
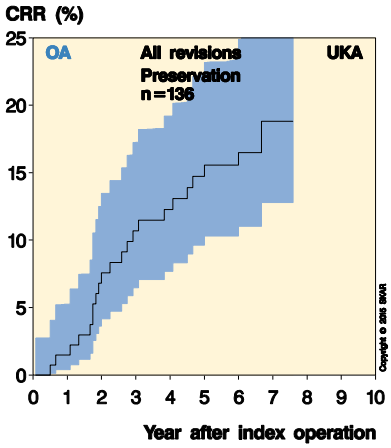
CRR for commonly used UKA implants for OA 2004–2013

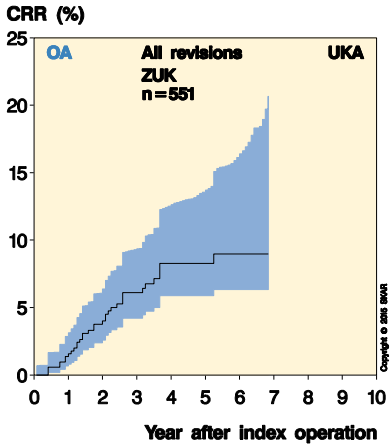


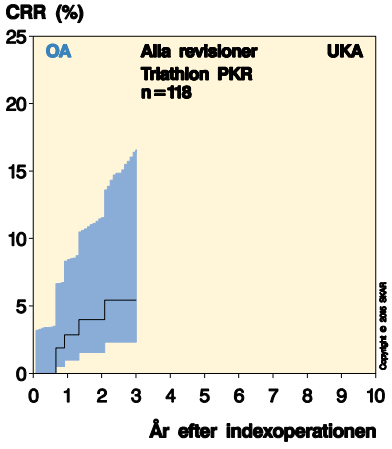


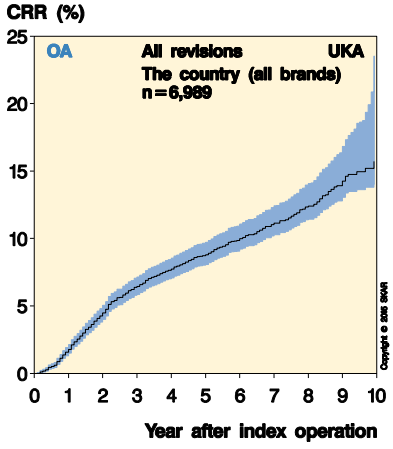












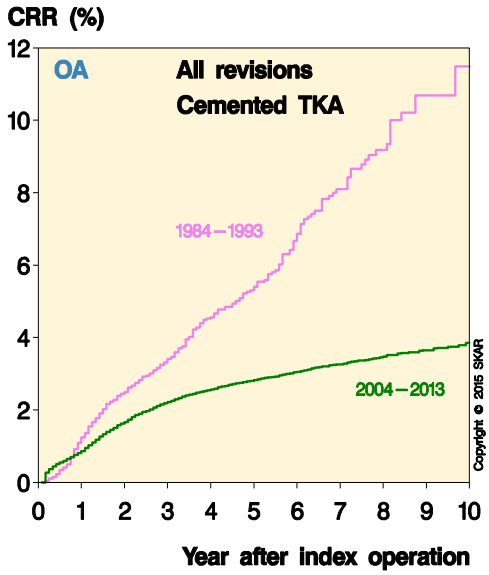
Changes in risk of revision over time (TKA for OA)

The figure below shows the overall risk of revision for the current 10-year period, 2004-2013, as compared to the period 1984-1993. It can be observed that the risk for the current period is considerably lower than for the earlier period.

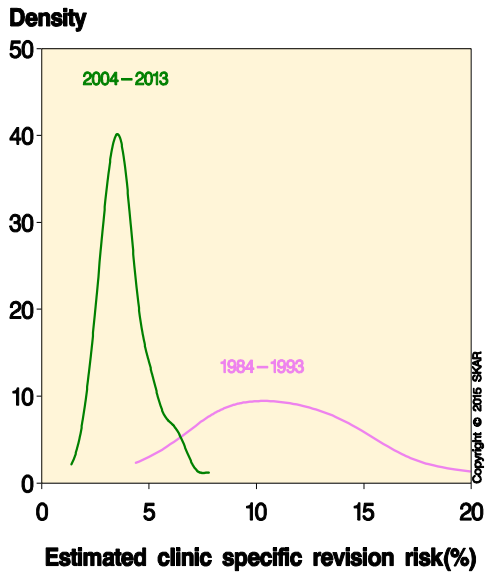
When the absolute specific risk of revision for the units is plotted for both periods (figure below left), it can be seen that the risk has become lower and the distribution has diminished. This implies that the results have improved overall and at the same time the results for the different units have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

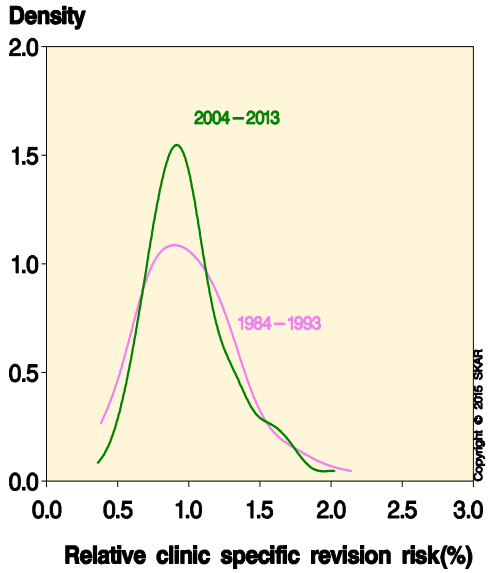
The register is requested to account for hospital specific results which can be found on the next pages. This year, there were 5 hospitals having significantly better results than the average hospital and 8 with inferior results. One can only speculate on the causes for these differences. An unfortunate 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 necessarily reflect the current risk for patients undergoing surgery.



Total CRR for cemented TKA in OA during the 2 periods 1984–1993 and 2004–2013 shows a considerable reduction in CRR over time.



Plotting the estimated absolute clinicspecific risk of revision shows that the absolute distribution has diminished between 1984-1993 and 2004–2013 (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 1984–1993 and 2004–2013 (x-axis = relative risk).

Relative risk of revision for hospitals 2004–2013 (cemented and uncemented TKA for 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 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 TKAs for OA during the 10-year period were included (cemented and uncemented). 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	1,697	10	0.36	0.23-0.59	1	1-7
12010	Enköping	2,369	22	0.52	0.36-0.75	2	1-19
52013	Skene	802	8	0.55	0.33-0.91	3	1-35
10010	Sabbatsberg (Aleris)	661	5	0.58	0.33-1.02	4	1-47
12481	Elisabethkliniken	651	8	0.60	0.36-1.00	5	1-44
50480	Carlanderska	595	5	0.61	0.35-1.08	6	1-51
62011	Örnsköldsvik	1,237	18	0.63	0.43-0.94	7	2-38
25011	Oskarshamn	2,195	33	0.67	0.49-0.92	8	3-37
11002	Huddinge	1,065	16	0.69	0.46-1.04	9	3-47
11015	Nacka-Proxima	724	8	0.70	0.42-1.16	10	2-58
42015	Movement Halmstad	1,646	25	0.72	0.51-1.02	11	4-46
53011	Lidköping	1,154	16	0.72	0.48-1.09	12	3-51
13010	Eskilstuna	370	5	0.72	0.41-1.27	13	2-64
42011	Varberg	1,478	25	0.73	0.52-1.04	14	4-47
65012	Gällivare	721	11	0.75	0.47-1.19	15	3-59
42420	Spenshult	1,219	15	0.76	0.50-1.15	16	4-56
11013	Löwenströmska*	2,782	47	0.77	0.59-1.00	17	7-45
62010	Sundsvall	973	16	0.77	0.51-1.16	18	4-56
25010	Kalmar	1,022	17	0.77	0.52-1.15	19	4-57
22012	Värnamo	1,119	24	0.77	0.53-1.12	20	5-55
22010	Jönköping	1,281	21	0.78	0.54-1.12	21	5-55
28011	Ängelholm	1,349	23	0.79	0.55-1.13	22	5-55
11001	Karolinska	1,356	29	0.80	0.58-1.12	23	7-54

(cont.)

Relative risk of revision for units (continued)

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
41013	Ystad	90	1	0.81	0.41-1.60	24	2-74
55010	Örebro	936	19	0.83	0.56-1.22	25	6-61
22011	Eksjö-Nässjö (Höglandssjukh.)	1,143	19	0.83	0.57-1.23	26	6-61
13012	Kullbergska sjukhuset	1,865	38	0.87	0.65-1.17	27	11-58
52011	Borås	941	22	0.87	0.60-1.27	28	8-63
10011	S:t Göran	3,366	74	0.88	0.70-1.09	29	14-53
55012	Lindesberg	1,267	23	0.88	0.62-1.26	30	9-63
55011	Karlskoga	964	19	0.89	0.60-1.31	31	8-65
53010	Falköping	899	22	0.89	0.62-1.28	32	9-64
50010	Östra sjukhuset	537	13	0.89	0.57-1.38	33	6-68
21014	Motala	3,876	80	0.90	0.72-1.11	34	16-54
65016	Sunderby	128	3	0.90	0.49-1.66	35	3-75
62013	Sollefteå	975	21	0.90	0.62-1.30	36	9-65
10013	Södersjukhuset	2,370	50	0.91	0.70-1.18	37	14-59
64011	Lycksele	543	11	0.93	0.58-1.47	38	7-71
54010	Karlstad	1,724	38	0.94	0.70-1.26	39	14-63
41012	Helsingborg	202	4	0.94	0.52-1.69	40	5-76
23010	Växjö	1,007	23	0.95	0.66-1.36	41	12-67
42010	Halmstad	1,684	40	0.97	0.72-1.30	42	17-65
28013	Simrishamn	407	14	0.97	0.63-1.49	43	10-72
24010	Västervik	949	22	0.97	0.68-1.40	44	13-69
56010	Västerås	1,648	34	0.99	0.73-1.34	45	17-67
50071	Frölunda Spec.	957	23	0.99	0.69-1.42	46	14-70
30001	Malmö	141	4	1.00	0.56-1.80	47	6-78
56012	Köping	721	22	1.01	0.70-1.46	48	15-71
50001	Sahlgrenska	183	7	1.02	0.61-1.72	49	8-76
11011	Södertälje	1,050	28	1.04	0.74-1.45	50	18-71
13011	Nyköping	834	21	1.04	0.72-1.51	51	16-73
28012	Hässleholm	5,534	140	1.06	0.90-1.26	52	33-64
53013	Skövde	916	20	1.07	0.73-1.56	53	18-73
64010	Skellefteå	804	21	1.07	0.74-1.56	54	18-73
64001	Umeå	1,312	37	1.09	0.81-1.46	55	24-71
54014	Torsby	922	23	1.09	0.76-1.56	56	20-74
27011	Karlshamn	1,915	49	1.10	0.84-1.43	57	28-70
65013	Piteå	2,308	60	1.11	0.88-1.42	58	31-70
41010	Landskrona	207	9	1.12	0.69-1.82	59	13-78
57010	Falun	2,401	61	1.12	0.88-1.42	60	31-70
57011	Mora	1,299	34	1.14	0.84-1.55	61	28-73
11010	Danderyd	1,379	38	1.14	0.85-1.53	62	29-73
21013	Norrköping	828	20	1.19	0.82-1.74	63	26-77
50020	OrthoCenter IFK klin**	774	26	1.21	0.86-1.71	64	31-76
10015	Sophiahemmet	792	30	1.24	0.90-1.71	65	34-76
63010	Östersund	1,149	33	1.26	0.92-1.71	66	36-77
54012	Arvika	1,251	37	1.26	0.94-1.69	67	37-76
41011	Trelleborg	5,076	153	1.32	1.12-1.55	68	54-74
61012	Hudiksvall	614	21	1.33	0.92-1.93	69	35-79
51011	Mölndal	1,287	38	1.33	0.99-1.79	70	43-78
26010	Visby	758	27	1.36	0.97-1.90	71	41-79
61010	Gävle	680	22	1.39	0.97-2.00	72	41-79
41001	Lund	187	9	1.49	0.92-2.43	73	36-80
51010	Uddevalla	1,705	61	1.51	1.18-1.91	74	58-79
23011	Ljungby	860	34	1.53	1.12-2.08	75	54-80
61011	Bollnäs	2,253	89	1.61	1.32-1.98	76	65-79
12001	Akademiska sjukhuset	1,012	51	1.63	1.26-2.11	77	63-80
10016	Ortopediska huset	3,325	149	1.72	1.46-2.02	78	71-80
11012	Norrtälje	724	38	1.73	1.28-2.33	79	64-80
51012	Kungälv	1,369	72	2.01	1.61-2.52	80	75-80

* 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 2004–2013 (cemented and uncemented TKA for OA) 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 those 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 4 of the 5 units having results better than the national average (when liner exchange is considered a revision) keep their status. Skene is no longer better than the average while Movement Halmstad and Lidköping become better than the average. At the other end, 7 of 8 units that were significantly inferior to the national average keep their status. Trelleborg disappears while Arvika, Visby, Hudiksvall and Gävle appear.

The 4 units that became significantly worse all used monobloc tibia to a relatively large extent. Thus it seems that the modularity of the tibia has an effect on the risk of becoming revised for manifest or suspected infection.

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	1,697	8	0.36	0.21-0.60	1	1-11
53011	Lidköping	1,154	7	0.49	0.29-0.85	2	1-29
62011	Örnsköldsvik	1,237	11	0.51	0.31-0.81	3	1-27
42015	Movement Halmstad	1,646	15	0.56	0.37-0.86	4	2-31
10010	Sabbatsberg (Aleris)	661	4	0.58	0.31-1.08	5	1-50
52013	Skene	802	8	0.61	0.36-1.03	6	1-47
12481	Elisabethkliniken	651	7	0.61	0.35-1.04	7	1-47
12010	Enköping	2,369	22	0.61	0.42-0.89	8	2-34
50480	Carlanderska	595	4	0.62	0.33-1.14	9	1-55
25010	Kalmar	1,022	11	0.66	0.41-1.06	10	2-49
25011	Oskarshamn	2,195	27	0.66	0.47-0.94	11	4-38
42420	Spenshult	1,219	10	0.67	0.41-1.10	12	2-52
22010	Jönköping	1,281	15	0.69	0.45-1.06	13	3-49
13010	Eskilstuna	370	4	0.71	0.38-1.31	14	2-64
62010	Sundsvall	973	12	0.71	0.45-1.13	15	3-55
24010	Västervik	949	12	0.71	0.45-1.13	16	3-55
42011	Varberg	1,478	21	0.72	0.50-1.06	17	5-49
11015	Nacka-Proxima	724	7	0.74	0.43-1.26	18	3-62
65012	Gällivare	721	9	0.74	0.45-1.23	19	3-61
11002	Huddinge	1,065	16	0.77	0.50-1.16	20	5-57
52011	Borås	941	16	0.77	0.50-1.18	21	5-58
22011	Eksjö-Nässjö (Höglandssjukh.)	1,143	14	0.77	0.50-1.20	22	5-59
57010	Falun	2,401	34	0.78	0.57-1.07	23	8-50

(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
41012	Helsingborg	202	2	0.81	0.41-1.60	24	2-73
55011	Karlskoga	964	14	0.81	0.52-1.26	25	6-62
28011	Ängelholm	1,349	20	0.81	0.55-1.20	26	7-58
41013	Ystad	90	1	0.82	0.40-1.71	27	2-75
22012	Värnamo	1,119	23	0.84	0.57-1.23	28	8-60
11001	Karolinska	1,356	28	0.87	0.62-1.23	29	11-60
50010	Östra sjukhuset	537	11	0.88	0.55-1.41	30	8-68
54010	Karlstad	1,724	30	0.89	0.64-1.23	31	13-61
55012	Lindesberg	1,267	19	0.89	0.60-1.32	32	10-65
55010	Örebro	936	18	0.89	0.60-1.33	33	10-65
11013	Löwenströmska*	2,782	47	0.90	0.68-1.18	34	15-58
21014	Motala	3,876	67	0.90	0.71-1.14	35	17-56
13012	Kullbergska sjukhuset	1,865	34	0.92	0.67-1.25	36	14-61
53010	Falköping	899	20	0.93	0.63-1.37	37	12-66
65016	Sunderby	128	3	0.93	0.49-1.78	38	5-76
62013	Sollefteå	975	19	0.94	0.64-1.39	39	12-68
10013	Södersjukhuset	2,370	44	0.94	0.71-1.25	40	18-62
30001	Malmö	141	3	0.95	0.50-1.81	41	5-77
28012	Hässleholm	5,534	105	0.96	0.79-1.16	42	24-57
42010	Halmstad	1,684	34	0.97	0.71-1.33	43	17-66
10011	S:t Göran	3,366	72	0.99	0.79-1.24	44	24-61
64011	Lycksele	543	10	0.99	0.61-1.61	45	10-73
64010	Skellefteå	804	16	1.00	0.66-1.52	46	14-72
65013	Piteå	2,308	45	1.01	0.77-1.33	47	22-65
11010	Danderyd	1,379	28	1.02	0.73-1.42	48	19-69
28013	Simrishamn	407	14	1.05	0.68-1.62	49	15-73
50071	Frölunda Spec.	957	21	1.05	0.72-1.53	50	18-71
21013	Norrköping	828	14	1.08	0.69-1.67	51	17-75
50001	Sahlgrenska	183	7	1.08	0.63-1.86	52	11-77
23010	Växjö	1,007	23	1.08	0.75-1.56	53	20-72
63010	Östersund	1,149	23	1.08	0.75-1.56	54	21-73
64001	Umeå	1,312	32	1.08	0.79-1.49	55	24-71
53013	Skövde	916	17	1.10	0.73-1.65	56	20-75
11011	Södertälje	1,050	26	1.10	0.78-1.56	57	23-72
56010	Västerås	1,648	32	1.10	0.80-1.52	58	25-71
41011	Trelleborg	5,076	107	1.11	0.92-1.34	59	36-66
41010	Landskrona	207	8	1.11	0.66-1.87	60	15-78
56012	Köping	721	22	1.14	0.78-1.65	61	24-74
10015	Sophiahemmet	792	24	1.17	0.82-1.67	62	26-74
54014	Torsby	922	21	1.18	0.81-1.72	63	26-76
13011	Nyköping	834	21	1.19	0.82-1.74	64	26-76
57011	Mora	1,299	30	1.20	0.86-1.66	65	31-75
51011	Mölndal	1,287	30	1.27	0.92-1.76	66	37-76
27011	Karlshamn	1,915	49	1.29	0.99-1.68	67	42-75
50020	OrthoCenter IFK klin**	774	25	1.34	0.94-1.91	68	39-78
54012	Arvika	1,251	35	1.41	1.04-1.92	69	48-78
26010	Visby	758	25	1.46	1.03-2.08	70	46-79
61012	Hudiksvall	614	20	1.47	1.00-2.16	71	44-80
61010	Gävle	680	20	1.49	1.02-2.19	72	46-80
12001	Akademiska sjukhuset	1,012	41	1.50	1.13-2.00	73	54-79
23011	Ljungby	860	28	1.51	1.08-2.11	74	50-80
51012	Kungälv	1,369	46	1.55	1.18-2.04	75	57-79
41001	Lund	187	9	1.64	0.99-2.72	76	43-80
11012	Norrtälje	724	32	1.70	1.23-2.36	77	60-80
51010	Uddevalla	1,705	59	1.72	1.35-2.20	78	66-80
61011	Bollnäs	2,253	86	1.85	1.50-2.27	79	70-80
10016	Ortopediska huset	3,325	148	1.99	1.69-2.34	80	74-80

* 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

Patient characteristics and case-mix at knee arthroplasty surgery

The table "Patient characteristics and case-mix" shows what the hospitals reported for primary knee arthroplasties in 2014.

Topmost is the average for the country as a whole after which the results for the respective hospitals are shown. They have been classified depending on if they are university hospitals, private hospitals or for the others depending on if their reported number of surgeries was less than 100, 100-300 or more than 300.

The first column shows the total number reported and the second the proportion of complete reports. The rest of the information is based only on complete reports and shows the proportion of patients having their surgery for OA, of women, of those younger than 55, those with BMI of 35 and over and those having been classified with ASA III or higher. Please note that the percentages may be misleading for units having reported few surgeries.

Among the university hospitals we can see that some units have a higher proportion of surgeries for other diagnoses than OA, of women and that of sicker patients (ASA ≥3) while other university hospitals do not seem to differ so much from the national average. Umeå and Akademiska have a higher proportion of patients younger than 55 years and the Akademiska reports twice the proportion of patients with a BMI of 35 or over as compared to the national average.

The private hospitals, with the exemptions of Motala, Movement Halmstad and St Görans hospital, generally report a lower proportion of patients with ASA ≥3. Sophiahemmet (and the university hospital Akademiska) have the highest proportion of patients less than 55 years of age.

The County hospitals, not classified as university hospitals, do not differ from the national average with a few exceptions. The proportion of patients with BMI of 35 and over is 3 times higher in Västerås and 2 times higher in Borås and Karlstad while it is half that in Frölunda, Hässleholm, Norrköping, Skene and Sundsvall. The proportion of patients with ASA ≥3 is twice the national average in Danderyd, Norrtälje, Piteå and Södertälje while it is half in Lidköping, Lindesberg, Karshamn Kullbergska, Mora, Trelleborg and Varberg.

The variation in patient characteristics is large and it does not seem to be possible to generalize based on if the unit is a university or private hospital or by the number of reported surgeries.

A previous surgery of the index knee (not shown in the table) was reported for 19% of the patients.

Patient characteristics and case-mix

Hospital	Number of reports	Complete reports %	% OA	% Women	% <55 years	% BMI 35+	% ASA ≥3
Country	**13,006**	**99.6**	**96.2**	**57.1**	**7.1**	**10.1**	**17.3**
University Hospitals							
Akademiska	**87**	**98.9**	**85.0**	**58.1**	**21.2**	**19.8**	**24.4**
Huddinge	**166**	**100.0**	**90.4**	**62.7**	**10.8**	**16.3**	**45.8**
Karolinska Solna	**100**	**100.0**	**81.0**	**49.0**	**11.0**	**13.0**	**62.0**
Lund	**98**	**100.0**	**66.3**	**59.2**	**10.2**	**12.2**	**61.2**
Sahlgrenska (excl. Mölndal)	**3**	**100.0**	**0.0**	**66.7**	**33.3**	**0.0**	**0.0**
Umeå	**102**	**99.0**	**88.1**	**60.4**	**14.9**	**9.9**	**21.8**
Örebro	**54**	**100.0**	**96.3**	**59.3**	**14.8**	**7.4**	**9.3**
Private Units							
ArtClinic Jönköping	**13**	**100.0**	**100.0**	**53.8**	**23.1**	**0.0**	**0.0**
Bollnäs Aleris	**402**	**100.0**	**97.3**	**56.5**	**6.0**	**8.2**	**4.0**
Carlanderska	**137**	**98.5**	**96.3**	**37.8**	**10.4**	**3.7**	**0.7**
Elisabethkliniken	**7**	**100**	**100.0**	**42.9**	**28.6**	**0.0**	**0.0**
Luleå- Sensia	**3**	**100.0**	**100.0**	**66.7**	**33.3**	**0.0**	**0.0**
Motala	**470**	**99.6**	**95.1**	**59.4**	**6.8**	**7.7**	**20.7**
Movement Halmstad	**250**	**100.0**	**98.4**	**51.6**	**10.4**	**8.4**	**23.6**
Nacka	**111**	**100.0**	**99.1**	**65.8**	**6.3**	**4.5**	**5.4**
OrthoCenter IFK-kliniken	**107**	**100.0**	**99.1**	**30.8**	**12.2**	**3.7**	**7.4**
OrthoCenter Sthlm	**402**	**100.0**	**98.3**	**58.0**	**6.2**	**4.7**	**4.5**
Ortopediska huset	**418**	**98.6**	**99.3**	**51.5**	**8.5**	**6.3**	**1.0**
Sabbatsberg Aleris	**141**	**100.0**	**100.0**	**58.9**	**5.7**	**0.7**	**4.3**
Sophiahemmet	**98**	**100.0**	**96.9**	**43.9**	**16.3**	**9.2**	**6.1**
Spenshult	**155**	**99.3**	**94.2**	**55.8**	**8.4**	**3.9**	**0.0**
St Göran	**387**	**99.7**	**96.6**	**57.8**	**10.4**	**8.3**	**35.1**
Ängelholm Proxima	**167**	**99.4**	**96.4**	**60.2**	**5.4**	**4.8**	**15.1**

Meniscal surgery was most common (6.5%) followed by arthroscopy (5%), osteotomy (2%), cruciate surgery (1.7%) osteosynthesis (0.7%) and "other" (2.2%). For 3% of the patients more than one previous surgery was stated. The previous surgeries reported are not comprehensive but illustrate what the surgeon knew at the time of the primary arthroplasty.

Patient characteristics and case-mix

Hospital	Number of reports	Complete reports %	% OA	% Women	% <55 years	% BMI 35+	% ASA ≥3
Country	13,006	99.6	96.2	57.1	7.1	10.1	17.3
< 100 operations/year							
Borås	75	100.0	96.0	64.0	10.7	23.7	20.0
Eskilstuna	41	97.6	85.0	57.5	5.0	20.0	42.5
Gällivare	68	100.0	95.6	54.4	4.4	4.4	25.0
Helsingborg	44	100.0	95.5	52.3	13.6	18.2	25.0
Hudiksvall	60	100.0	100.0	45.0	6.7	5.0	8.3
Kalmar	91	100.0	95.6	50.5	0.0	6.6	12.1
Lycksele	94	100.0	100.0	59.6	3.2	12.8	7.4
Norrtälje	85	100.0	96.5	56.5	3.5	7.1	44.7
Sollefteå	89	97.8	93.1	51.7	3.4	16.1	8.0
Sundsvall	95	100.0	90.5	64.2	4.2	4.2	15.8
Visby	69	100.0	97.1	50.7	7.2	10.1	5.8
Västervik	94	100.0	97.9	52.2	4.3	9.6	10.6
Ängelholm	67	98.5	97.0	55.2	6.0	7.5	9.0
Örnsköldsvik	88	100.0	95.5	50.0	3.4	10.2	25.0
100-300 operations/year							
Alingsås	204	99.5	98.5	49.3	5.4	8.4	7.4
Arvika	193	99.5	99.5	63.5	1.6	9.4	20.3
Danderyd	142	99.3	95.0	54.6	5.0	7.1	39.7
Eksjö-Nässjö	211	100.0	97.6	56.4	3.3	9.5	26.5
Frölunda Spec. sjukhus	120	98.3	99.2	59.3	4.2	5.1	10.2
Gävle	129	99.2	93.0	54.7	8.6	15.6	29.7
Halmstad	190	99.5	98.4	59.3	9.5	18.5	18.0
Jönköping	168	99.4	97.0	58.7	7.8	12.6	12.0
Karlshamn	242	100.0	95.0	55.8	7.4	7.9	3.7
Karlskoga	124	93.5	99.1	55.2	2.6	13.8	13.8
Karlstad	193	99.5	95.8	67.8	10.0	21.4	27.1
Kullbergska sjukhuset	201	100.0	98.5	60.7	7.0	9.0	0.0
Kungälv	197	100.0	94.4	45.7	4.1	10.2	15.2
Lidköping	199	99.5	98.5	57.6	3.0	8.6	3.5
Lindesberg	172	99.4	98.8	58.5	5.8	5.3	5.8
Ljungby	151	100.0	98.1	51.7	2.6	10.6	13.9
Mora	150	100.0	98.7	47.3	2.7	8.7	6.7
Mölndal	296	98.3	92.8	60.8	8.9	14.1	14.4
Norrköping	140	100.0	95.7	60.0	6.4	4.3	12.1
Nyköping	101	100.0	96.0	55.4	3.0	11.9	15.8
Oskarshamn	268	99.6	96.6	61.4	6.0	14.2	16.9
Piteå	259	100.0	93.8	56.4	6.2	9.7	34.7
Skellefteå	107	100.0	96.3	52.3	3.7	12.1	27.1
Skene	104	100.0	96.2	56.7	12.5	1.9	0.0
Skövde	114	99.1	91.2	68.1	11.5	13.3	16.8
Södertälje	110	100.0	97.3	64.5	7.3	10.9	49.1
Torsby	114	100.0	97.4	50.0	5.3	18.4	15.8
Uddevalla	206	99.5	96.1	65.4	2.9	9.8	19.0
Varberg	149	100.0	98.7	59.1	9.4	9.4	8.7
Värnamo	163	100.0	98.8	58.9	6.1	11.2	11.0
Västerås	246	99.6	95.5	61.2	9.0	27.8	31.4
Växjö	109	99.1	98.1	65.7	8.3	13.9	20.4
Östersund	106	100.0	94.3	58.5	0.0	9.4	18.9
> 300 operations/year							
Enköping	372	99.7	97.8	60.1	5.1	10.8	25.9
Falun	356	100	98.6	61.2	6.7	14.9	13.2
Hässleholm	683	100	95	55.7	6.9	5.3	21.1
Södersjukhuset	320	100	94.7	53.8	10.6	11.9	46.9
Trelleborg	759	100	99.2	61.7	7	12.5	4.7

Prophylactic antibiotics for knee arthroplasties

The table ”Prophylactic antibiotics” shows what the hospitals reported having administrated for primary knee arthroplasties in 2014.

Topmost is the average for the country as a whole after which the results for the respective hospitals are shown. They have been classified depending on if they are university hospitals, private hospitals or for the others depending on if their reported number of surgeries was less than 100, 100-300 or more than 300.

The first column shows the total number reported and the second the proportion of complete reports. The rest of the information is based only on complete reports. Please note that the percentages may be misleading for units having reported only few surgeries. The choice of the variables shown in the other columns is based on the recommendations of the PRISS project (Prosthetic Related Infections Shall be Stopped). The final report is available at www. patientforsakringen.se.

In short, the recommendations are to give Cloxacilline 2g x 3 i.v.. The first dose 45-30 minutes before start of surgery or inflation of a tourniquet, the second dose 2 hours after the first one and the third after additional 4 hours. In case of penicillin allergy Clindamycin is used instead (600mg x 2) with the first dose administrated as for Cloxacilline and the second dose 4 hours after the first one.

The columns "% having Cloxacilline or Clindamycin", "% with dose 2g x 3 or 600mg x 2" and "% having AB within 45-30 min" thus show the proportion of surgeries in which antibiotics are given according to the current PRISS routines. The column "% having AB within 45-15 min" shows the proportion for which the dose was given within the previously recommended time interval which has been shown in earlier reports.

The majority of the hospitals reported that the adhered to the PRISS recommendations. Only three units reported that they used Cephalosporins as prophylaxis. Most of those units that did not follow the dosage recommendations used instead Cloxacilline 2g x 4 and/or Clindamycin 600mg x 3.

At the start of surgery a reasonable tissue concentration of the antibiotic should have been reached in order to counteract any bacteria in the field. Due to the short half-life of Cloxacilline it is important that it is administrated within a correct time interval. However, an earlier study from the register found imperfect routines concerning prophylactic antibiotics in 2007 (Stefánsdóttir A et al. 2009).

Prophylactic antibiotics

Hospital	Number of reports	Complete reports %	% having Cloxacillin or Clindamycin	% with dose 2g x 3 or 600mg x 2	% having AB within 45-30 min	% having AB within 45-15 min
Country	**13,006**	**99.0**	**98.0**	**71.7**	**42.7**	**79.6**
University Hospitals						
Akademiska	**87**	**97.7**	**21.2**	**9.4**	**43.5**	**70.6**
Huddinge	**166**	**99.4**	**99.4**	**94.5**	**44.8**	**71.5**
Karolinska Solna	**100**	**100.0**	**100.0**	**79.0**	**37.0**	**91.0**
Lund	**98**	**100.0**	**100.0**	**93.8**	**50.5**	**80.4**
Sahlgrenska (excl. Mölndal)	**3**	**100.0**	**33.3**	**0**	**66.7**	**66.7**
Umeå	**102**	**100.0**	**100.0**	**91.2**	**35.3**	**87.3**
Örebro	**54**	**98.1**	**100.0**	**92.5**	**32.1**	**73.6**
Private Units						
ArtClinic Jönköping	**13**	**100.0**	**100.0**	**92.3**	**46.2**	**100.0**
Bollnäs Aleris	**402**	**100.0**	**100.0**	**93.3**	**17.7**	**80.0**
Carlanderska	**137**	**96.4**	**99.2**	**93.2**	**67.4**	**93.0**
Elisabethkliniken	**7**	**100**	**57.1**	**42.9**	**28.6**	**28.6**
Luleå- Sensia	**3**	**99.3**	**100.0**	**100.0**	**66.7**	**66.7**
Motala	**470**	**100.0**	**99.8**	**97.0**	**43.4**	**86.2**
Movement Halmstad	**250**	**98.9**	**99.6**	**50.4**	**12.8**	**84.4**
Nacka	**111**	**100.0**	**100.0**	**93.6**	**69.7**	**84.4**
OrthoCenter IFK-kliniken	**107**	**97.2**	**100.0**	**91.3**	**56.7**	**93.3**
OrthoCenter Sthlm	**402**	**100.0**	**100.0**	**66.4**	**64.9**	**96.0**
Ortopediska huset	**418**	**96.7**	**100.0**	**93.6**	**49.8**	**90.2**
Sabbatsberg Aleris	**141**	**99.3**	**5.7**	**0.0**	**51.4**	**87.1**
Sophiahemmet	**98**	**93.9**	**100.0**	**88.0**	**42.4**	**53.3**
Spenshult	**155**	**100.0**	**100.0**	**2.6**	**29.7**	**78.7**
St Göran	**387**	**97.4**	**99.7**	**94.7**	**29.4**	**94.4**
Ängelholm Aleris	**167**	**97.0**	**96.3**	**89.5**	**22.2**	**60.5**

The registry started to register the time for delivery of the first dose in 2009 after which some improvement in the routines was noted with 87% of patients in 2011 being reported to having received the dose within the recommended 45-15 minutes. However during 2013-2014 the proportion has lessened to 79%.

Prophylactic antibiotics

Hospital	Number of reports	Complete reports %	% having Cloxacillin or Dalacine	% with dosis 2g x 3 or 600mg x 2	% having AB within 45-30 min	% having AB within 45-15 min
Country	13,006	99.0	98.0	71.7	42.7	79.6
< 100 operations/year						
Borås	75	97.3	100.0	84.9	69.7	89.0
Eskilstuna	41	100.0	100.0	78.0	39.0	82.9
Gällivare	68	98.5	100.0	95.5	32.8	82.1
Helsingborg	44	100.0	99.7	95.5	22.7	72.7
Hudiksvall	60	100.0	100.0	96.7	35.0	85.0
Kalmar	91	100.0	100.0	3.3	52.7	86.8
Lycksele	94	99.0	100.0	96.8	63.4	78.5
Norrtälje	85	96.5	100.0	81.7	29.3	72.0
Sollefteå	89	87.6	98.7	87.2	93.6	98.7
Sundsvall	95	98.9	100.0	94.7	47.9	73.4
Visby	69	98.6	100.0	89.7	42.6	79.4
Västervik	94	100.0	100.0	1.1	43.6	81.9
Ängelholm	67	94.0	100.0	88.9	46.0	79.4
Örnsköldsvik	88	97.7	100.0	0.0	44.2	77.9
100-300 operations/year						
Alingsås	204	100.0	100.0	97.5	63.7	88.2
Arvika	193	99.5	100.0	82.3	39.1	53.6
Danderyd	142	98.6	100.0	60.7	38.6	66.7
Eksjö-Nässjö	211	99.5	99.5	95.7	59.5	81.4
Frölunda Spec. sjukhus	120	97.5	99.1	90.6	54.7	81.2
Gävle	129	99.2	99.4	84.4	33.6	81.3
Halmstad	190	99.5	98.9	82.0	44.4	74.1
Jönköping	168	99.4	100.0	92.2	52.1	80.2
Karlshamn	242	100.0	99.6	66.1	17.4	78.1
Karlskoga	124	99.2	99.2	93.5	37.4	76.4
Karlstad	193	97.9	100.0	91.5	45.5	56.1
Kullbergska sjukhuset	201	100.0	99.5	88.6	56.2	74.6
Kungälv	197	99.5	99.5	98.0	28.1	82.1
Lidköping	199	99.5	100.0	92.4	85.4	96.0
Lindesberg	172	99.5	100.0	90.6	47.1	60.6
Ljungby	151	98.8	99.3	26.5	47.0	85.4
Mora	150	97.0	98.7	4.7	48.7	79.3
Mölndal	296	98.9	99.3	92.3	46.7	70.4
Norrköping	140	99.3	100.0	95.0	61.2	82.0
Nyköping	101	98.0	100.0	4.0	45.5	58.6
Oskarshamn	268	99.3	99.2	1.5	21.8	67.7
Piteå	259	99.6	93.4	85.7	15.1	91.5
Skellefteå	107	100.0	100.0	0.0	34.6	65.4
Skene	104	100.0	99.0	52.9	56.7	90.4
Skövde	114	99.1	99.1	87.6	39.8	48.7
Södertälje	110	100.0	100.0	97.3	31.8	69.1
Torsby	114	99.1	100.0	92.9	60.2	76.1
Uddevalla	206	99.0	100.0	90.7	45.6	76.0
Varberg	149	99.3	100.0	56.1	56.1	96.6
Värnamo	163	100.0	98.8	93.3	47.9	77.9
Västerås	246	100.0	99.6	92.3	53.3	72.4
Växjö	109	98.2	99.1	33.6	43.0	72.9
Östersund	106	100.0	99.1	97.2	44.3	91.5
> 300 operations/year						
Enköping	372	99.2	99.5	89.2	50.1	83.5
Falun	356	99.4	99.3	5.7	53.7	88.7
Hässleholm	683	99.9	99.0	3.4	22.1	76.7
Södersjukhuset	320	99.7	99.7	90.3	39.8	67.1
Trelleborg	759	99.2	99.3	96.3	40.4	79.9

Antithrombotic prophylaxis for knee arthroplasties

The table ”Antithrombotic prophylaxis” shows what the hospitals reported having administrated for primary knee arthroplasties in 2014.

Topmost is the average for the country as a whole after which the results for the respective hospitals are shown. They have been classified depending on if they are university hospitals, private hospitals or for the others depending on if their reported number of surgeries was less than 100, 100-300 or more than 300.

The first column shows the total number reported and the second the proportion of complete reports. The rest of the information is based only on complete reports. Please note that the percentages may be misleading for units having reported only few surgeries. The choice of variables in the three next columns is based on what was reported as being the most common routines. They show respectively the proportion of primary knee arthroplasties in which it was planned to start the prophylaxis postoperatively, the proportion in which an injection was used (Fragmin, Innohep och Klexane) and the proportion for which the planned duration for the treatment was 8-14 days.

As it can be seen in the table, it is most common to start the antithrombotic prophylaxis postoperatively and only few units report that they more commonly start preoperatively.

For a good three quarters of the surgeries it is reported that it is the intention to use injectable drugs. The proportion has varied between 81-83% during 2011-2013 and was 78% in 2014 which indicates increased use of per-oral drugs such as Pradaxa, Xarelto and Eliqvis.

The duration of the planned prophylaxis has been relatively constant since the register started registration of this variable (see previous reports).

For approximately 79% of the surgeries the planned duration has been 8-14 days while 6-8% of the surgeries have been planned having a shorter duration.

Antithrombotic prophylaxis

Hospital	Number of reports	Complete reports %	Percent starting postoperatively	Percent having injection	Percent treated for 8-14 days
Country	**13,006**	**99.5**	**80.1**	**77.7**	**79.0**
University Hospitals					
Akademiska	87	97.7	12.6	89.7	92.0
Huddinge	166	100.0	93.4	100.0	92.2
Karolinska Solna	100	100.0	7.0	98.0	70.0
Lund	98	100.0	85.7	98.0	44.9
Sahlgrenska (excl. Mölndal)	3	100.0	0.0	100.0	100.0
Umeå	102	100.0	98.0	2.9	100.0
Örebro	54	98.1	77.8	14.8	94.4
Private Units					
ArtClinic Jönköping	13	100.0	100.0	100.0	100.0
Bollnäs Aleris	402	100.0	98.3	100.0	96.5
Carlanderska	137	99.3	94.9	4.4	94.2
Elisabethkliniken	7	100.0	100.0	100.0	42.9
Luleå- Sensia	3	100.0	100.0	0.0	100.0
Motala	107	99.4	95.5	99.2	95.5
Movement Halmstad	402	100.0	91.2	100.0	2.0
Nacka	418	100.0	95.5	100.0	99.1
OrthoCenter IFK-kliniken	470	99.1	98.1	4.7	85.1
OrthoCenter Sthlm	250	100.0	97.5	99.8	98.5
Ortopediska huset	111	100.0	92.1	100.0	98.8
Sabbatsberg Aleris	141	100.0	97.9	100.0	95.7
Sophiahemmet	98	91.9	82.7	91.8	31.6
Spenshult	155	98.1	91.6	4.5	96.1
St Göran	387	98.4	87.9	97.2	96.1
Ängelholm Aleris	167	100.0	94.6	88.0	95.2

Antithrombotic prophylaxis

Hospital	Number of reports	Complete reports %	Percent starting postoperatively	Percent having injection	Percent treated for 8-14 days
Country	13,006	99.5	80.1	77.7	79.0
< 100 operations/year					
Borås	75	100.0	89.3	100.0	94.7
Eskilstuna	41	100.0	95.1	100.0	92.7
Gällivare	68	100.0	95.6	100.0	91.2
Helsingborg	44	100.0	75.0	100.0	97.7
Hudiksvall	60	98.3	78.3	98.3	85.0
Kalmar	91	100.0	87.9	100.0	92.3
Lycksele	94	98.9	9.6	98.9	98.9
Norrtälje	85	100.0	87.1	27.1	65.9
Sollefteå	89	97.7	46.1	97.8	1.1
Sundsvall	95	100.0	76.8	10.5	83.2
Visby	69	98.5	89.9	97.1	84.1
Västervik	94	100.0	68.1	100.0	94.7
Ängelholm	67	100.0	84.7	98.5	91.0
Örnsköldsvik	88	100.0	93.2	98.9	81.8
100-300 operations/year					
Alingsås	204	100.0	96.6	99.0	93.6
Arvika	193	100.0	79.3	19.1	89.6
Danderyd	142	96.5	80.3	96.5	83.8
Eksjö-Nässjö	211	100.0	47.4	100.0	97.6
Frölunda Spec. sjukhus	120	99.2	91.7	0.0	99.2
Gävle	129	100.0	86.8	99.2	92.3
Halmstad	190	99.5	83.2	12.1	89.5
Jönköping	168	100.0	3.0	100.0	98.8
Karlshamn	242	100.0	94.6	100.0	94.2
Karlskoga	124	99.2	14.5	97.6	95.2
Karlstad	193	99.5	89.1	9.8	86.5
Kullbergska sjukhuset	201	100.0	98.5	100.0	95.5
Kungälv	197	100.0	92.9	99.0	94.4
Lidköping	199	99.0	90.0	9.6	68.8
Lindesberg	172	99.4	75.6	23.3	82.6
Ljungby	151	100.0	8.6	100.0	99.3
Mora	150	100.0	92.7	10.0	94.0
Mölndal	296	97.6	86.5	7.1	94.3
Norrköping	140	100.0	91.4	100.0	94.3
Nyköping	101	100.0	97.0	99.0	95.1
Oskarshamn	268	100.0	87.3	100.0	97.4
Piteå	259	99.6	3.5	98.5	96.5
Skellefteå	107	99.1	99.1	99.1	99.1
Skene	104	99.0	96.2	99.0	97.1
Skövde	114	100.0	32.5	99.1	98.3
Södertälje	110	100.0	99.2	100.0	70.9
Torsby	114	100.0	87.7	15.8	80.7
Uddevalla	206	100.0	29.1	99.5	96.6
Varberg	149	100.0	88.6	6.0	94.6
Värnamo	163	100.0	44.2	100.0	96.3
Västerås	246	98.8	94.7	15.5	95.9
Växjö	109	98.2	8.3	98.2	87.2
Östersund	106	99.1	91.5	99.1	91.5
> 300 operations/year					
Enköping	372	100.0	48.9	99.7	2.2
Falun	356	100.0	89.6	10.4	94.9
Hässleholm	683	99.7	96.9	99.6	29.1
Södersjukhuset	320	99.7	90.1	93.1	93.8
Trelleborg	759	100.0	97.2	100.0	7.9

Surgical technique for knee arthroplasties

The table ”Surgical technique” shows what the hospitals reported for having used in their primary knee arthroplasties in 2014.

Topmost is the average for the country as a whole after which the results for the respective hospitals are shown. They have been classified depending on if they are university hospitals, private hospitals or for the others depending on if their reported number of surgeries was less than 100, 100-300 or more than 300.

The first column shows the total number reported and the second the proportion of complete reports. The rest of the information is based only on complete reports. Please note that the percentages may be misleading for units having reported only few surgeries.

The proportion of surgeries in which general anesthesia, tourniquet, drainage and LIA (local infiltration anesthesia) was used is shown as percentages. The median operating time for the respective hospital is given in minutes.

Spinal anesthesia is most common (76%) but the proportion of general anesthesia (22.5%) has more than doubled since 2011. Bollnäs, Nacka, Karlshamn and Södertälje performed more than 80% of their arthroplasties using general anesthesia.

The use of drainage has lessened from 26% in 2011 to 13% in 2014. Motala, Sophiahemmet, Sollefteå and Kullbergska still use drainage for the majority of their knee arthroplasties.

More surgeries were in 2014 reported to have been performed without tourniquet than previously. The proportion of surgeries using tourniquet has lessened from 90% in 2011 to 70% in 2014.

The use of LIA, with or without a catheter being left in the knee, was used in the majority of the surgeries.

There was a large variation in the median time for performing the primary knee arthroplasties; from 45 minutes to more than two hours. The median time for TKA's was 74 min., for UKA's 77 min., for femoropatellar arthroplasties 66 min. and for linked implants 145 min.

Since 2009, the median operating time for TKA's has varied between 71 and 82 min. and for UKA's between 71 and 80 min..

Bone transplantation was only used in 1.3% of the primary knee arthroplasties. When used, it is almost exclusively auto transplantation, most often in the femur.

Surgical technique

Hospital	Number of reports	Complete reports %	Percent having General anesthesia	Percent Drainage	Percent Tourniquet	Percent LIA	Median Op-time
Country	**13,006**	**98.8**	**22.5**	**12.9**	**70.1**	**94.7**	**74**
University Hospitals							
Akademiska	**87**	**96.6**	**22.6**	**0.0**	**90.5**	**100.0**	**78**
Huddinge	**166**	**98.2**	**11.0**	**0.6**	**63.2**	**92.0**	**131**
Karolinska Solna	**100**	**97.0**	**9.3**	**6.2**	**94.8**	**71.1**	**83**
Lund	**98**	**98.0**	**43.8**	**1.0**	**38.5**	**93.8**	**91**
Sahlgrenska	**3**	**33.0**	**0.0**	**100.0**	**100.0**	**0.0**	**195**
Umeå	**102**	**96.1**	**7.1**	**11.2**	**81.6**	**95.9**	**106**
Örebro	**54**	**100.0**	**40.7**	**1.9**	**100.0**	**99.4**	**99**
Private Units							
ArtClinic Jönköping	**13**	**100.0**	**36.5**	**0.0**	**100.0**	**100.0**	**90**
Bollnäs Aleris	**402**	**99.0**	**94.2**	**15.3**	**73.4**	**99.2**	**50**
Carlanderska	**137**	**97.8**	**10.4**	**31.3**	**100.0**	**96.3**	**64**
Elisabethkliniken	**7**	**100**	**0.0**	**42.9**	**100.0**	**100.0**	**89**
Luleå- Sensia	**3**	**100.0**	**66.7**	**0.0**	**100.0**	**100.0**	**68**
Motala	**470**	**98.9**	**4.5**	**88.4**	**12.5**	**98.3**	**45**
Movement Halmstad	**250**	**99.6**	**7.6**	**0.0**	**73.5**	**99.0**	**71**
Nacka	**111**	**99.1**	**99.1**	**0.9**	**16.4**	**97.3**	**68**
OrthoCenter IFK-kliniken	**107**	**98.1**	**13.3**	**91.4**	**94.3**	**81.9**	**70**
OrthoCenter Sthlm	**402**	**99.3**	**1.3**	**1.3**	**99.5**	**83.0**	**62**
Ortopediska huset	**418**	**99.5**	**6.3**	**1.4**	**99.5**	**94.7**	**64**
Sabbatsberg Aleris	**141**	**100.0**	**16.3**	**0.0**	**98.6**	**90.1**	**62**
Sophiahemmet	**98**	**90.1**	**10.1**	**76.4**	**97.6**	**88.8**	**79**
Spenshult	**155**	**100.0**	**7.7**	**11.0**	**72.3**	**76.8**	**70**
St Göran	**387**	**96.4**	**10.5**	**1.6**	**97.1**	**95.2**	**60**
Ängelholm Aleris	**167**	**98.8**	**55.8**	**0.6**	**63.6**	**99.4**	**63**

Computer aided surgery (CAS) was only reported for 30 operations (0.2%) half of which were performed in Hässleholm and Umeå

Nine units reported having used CAS (12 in 2013). No UKA's were reported having been performed using CAS.

Surgical technique

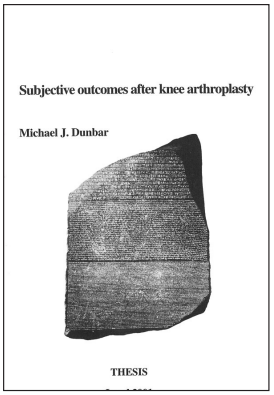
Hospital	Number of reports	Complete reports %	Percent having General anaesthesia	Percent Drainage	Percent Tourniquet	Percent LIA**	Median Op-time
Country	**13,006**	**98.8**	**22.5**	**12.9**	**70.1**	**94.7**	**74**
< 100 operations/year							
Borås	75	97.3	28.8	1.4	95.9	53.2	116
Eskilstuna	41	100.0	12.2	12.2	91.0	97.6	127
Gällivare	68	100.0	7.4	0.0	32.4	97.1	122
Helsingborg	44	100.0	29.5	4.5	15.9	97.7	96
Hudiksvall	60	100.0	15.0	0.0	96.7	83.3	88
Kalmar	91	100.0	12.1	1.1	1.1	84.7	99
Lycksele	94	98.9	4.3	0.0	100.0	67.7	104
Norrtälje	85	100.0	18.8	1.2	96.5	91.8	88
Sollefteå	89	95.5	10.6	96.5	100.0	96.5	110
Sundsvall	95	100.0	5.3	18.9	44.2	98.9	111
Visby	69	92.8	26.6	1.6	82.8	90.6	102
Västervik	94	100.0	17.0	2.1	57.4	100.0	79
Ängelholm	67	98.5	40.9	3.0	36.4	89.4	89
Örnsköldsvik	88	98.9	11.5	0.0	100.0	98.9	85
100-300 operations/year							
Alingsås	204	100.0	13.2	0.0	95.1	97.5	68
Arvika	193	98.4	8.4	1.6	5.3	99.5	76
Danderyd	142	97.2	4.3	5.1	90.6	97.1	99
Eksjö-Nässjö	211	99.5	22.9	19.0	95.7	98.6	68
Frölunda Spec. sjukhus	120	95.8	20.9	0.0	98.3	89.6	46
Gävle	129	99.2	31.3	14.8	96.9	95.3	72
Halmstad	190	100.0	14.7	27.9	96.8	85.8	80
Jönköping	168	99.4	16.8	0.6	95.8	93.4	91
Karlshamn	242	99.6	82.6	0.8	87.6	97.5	70
Karlskoga	124	96.8	14.2	20.0	76.7	100.0	113
Karlstad	193	98.4	17.4	0.0	2.1	98.9	62
Kullbergska sjukhuset	201	100.0	7.5	83.6	85.6	100.0	90
Kungälv	197	98.5	20.6	0.0	16.0	93.3	96
Lidköping	199	98.5	7.7	19.4	63.3	98.0	82
Lindesberg	172	98.8	19.4	1.8	68.2	99.4	88
Ljungby	151	97.4	26.5	0.7	82.3	98.6	70
Mora	150	98.7	4.1	0.0	99.3	99.3	63
Mölndal	296	96.3	35.8	1.8	7.4	95.4	91
Norrköping	140	100.0	15.0	0.0	94.3	96.4	88
Nyköping	101	100.0	15.8	8.9	19.8	90.1	97
Oskarshamn	268	98.5	14.0	0.0	89.8	94.3	64
Piteå	259	98.5	7.8	0.0	92.5	100.0	74
Skellefteå	107	100.0	0.0	0.0	100.0	100.0	90
Skene	104	100.0	15.4	3.8	99.0	94.2	88
Skövde	114	99.1	5.3	5.3	99.1	97.3	78
Södertälje	110	100.0	84.5	0.9	2.7	97.3	82
Torsby	114	99.1	9.7	0.9	0.0	99.1	60
Uddevalla	206	98.5	9.9	43.8	98.0	100.0	97
Varberg	149	98.7	19.7	0.0	84.4	73.5	85
Värnamo	163	99.4	9.3	66.7	98.8	73.5	99
Västerås	246	98.4	13.6	0.8	92.6	86.0	78
Växjö	109	100.0	30.3	0.0	64.2	87.2	100
Östersund	106	98.1	10.6	1.0	94.2	99.0	128
> 300 operations/year							
Enköping	372	99.2	8.7	0.0	98.6	97.0	70
Falun	356	99.2	16.1	2.0	98.3	99.4	78
Hässleholm	683	100.0	63.7	0.6	31.9	99.1	46
Södersjukhuset	320	99.0	12.9	35.0	31.2	93.7	76
Trelleborg	759	99.9	26.3	0.8	58.0	99.2	70

Patient reported outcome before and after knee arthroplasty

History

The SKAR started early on to ask patients about their opinion of their knee surgery. In 1997, 94% of all living patients that had undergone a 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 2012 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 varied in Lund which is a unit with few patients and a high response rate and in units with a low response rate such as Helsingborg, Ängelholm and Malmö. This makes it difficult to interpret and compare results of different units and for different years of surgery.

Last year's report showed that the project had been expanded with an additional year from Trelleborg (2008-2012), Hässleholm (2009-2012), Lund and Malmö (2008-2012), Helsingborg and Ängelholm (2010-2012) as well as Norrköping and Motala that had started their registration of PROM data in 2012. The results were quite similar to what had been reported earlier.

The PROM-project

More and more units have joined the pilot project which now can be considered permanent. In 2013 Oskarshamn joined and their one-year results for patients operated in 2013 are presented in this report (see page 63). Kalmar, Karolinska in Solna and OrthoCenter Stockholm started 2014 to report

and their preoperative data can also be found in this report. Still more units joined in 2015 and additional ones have expressed their interest and started the work to establish the project at their hospitals and to find resources for the gathering of PROM data. Below there is a summary of the PROM data of patients having primary knee arthroplasty which are presented descriptively for the respective hospitals and the year of surgery.

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 Visual Analog Scale (VAS) is 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.

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).

The Charnley classification is a simple method for judging comorbidity. The modified Charnley classification consists of four classes; class A which stands for a unitlateral knee disease, class B means bilateral disease which is divided into B1 if the knee which is not subject for the present surgery is not healthy and has not been resurfaced with an arthroplasty and B2 if it has been operated with an arthroplasty. Class C stands for multiple joint disease and/or another disease that affects the walking ability. The patients answer four questions that the classification is based on. The proportion of patients with Charnley class C is shown for each hospital in the table on page 65.

Patient selection

Only primary TKA's are included. Diagnoses other than OA are 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 number pf TKA's reported as well as the number of available PROM reports is shown in the tables on page 63 and 65.

Case-mix

A summary of case-mix factors such as gender, age, diagnosis, BMI and comorbidity is shown for the respective hospitals on page 52-53..

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.

Results

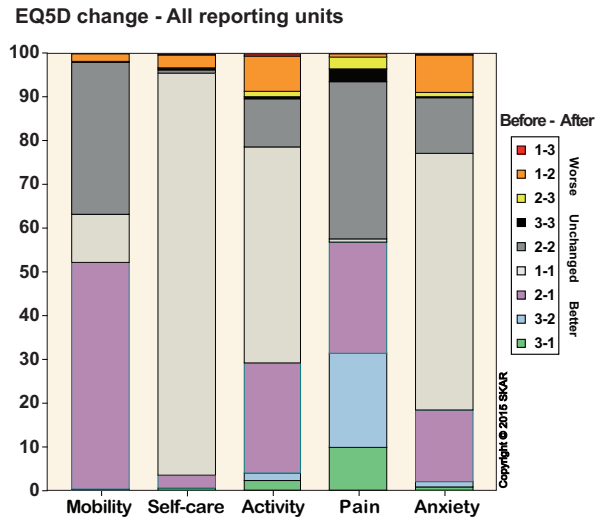
EQ5D

In order to visualize the change in general health from surgery until one year postoperatively we have classified 9 combinations of pre- and post-operative EQ-5D answers that are possible for the instrument.

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).

The figure below shows for each of the 9 possible combinations the change from before surgery until one year after. It can be seen that a good half of the patients improved their mobility and experienced pain relief while only a third improved in their daily activities, less than a fifth had reduced anxiety and only a few improved in self-care.



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)

Clinically relevant differences

In order for changes in points to be considered clinically relevant, the change on the VAS scale has to be 15-20 points and 8-10 points for each of the KOOS 5 subscales.

EQ-VAS

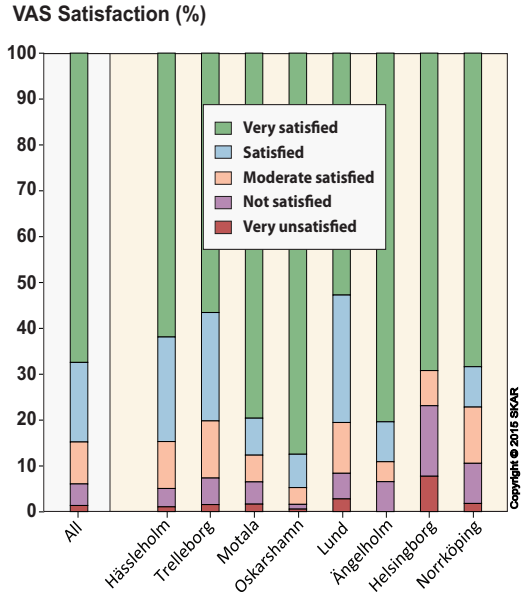
For units with high response rates (Hässleholm, Motala, Oskarshamn och Trelleborg) the differences between the units were small (1-8 points) both pre- and postoperatively when the patients operated 2013 estimated their general health. For units with few patients and/or low response rate the variation in the patient estimates was slightly larger (1-11 points). In 2014 the preoperative differences were also small (1-12 points).

VAS – Knee pain

The difference between units in the preoperative knee pain VAS estimate of patients opereated 2013 in Hässleholm, Motala, Oskarshamn och Trelleborg was small (1-3 points). One year postoperatively the difference was somewhat higher (1-10 points). For the other units the differences were also small, 1-3 points preopratively and 1-14 points one year postoperatively.

VAS – Satisfaction with the surgery

75 % of the patients had one year postoperatively reported their satisfaction with the arthroplasty surgery. Of these, 85% stated that they were very satisfied (0-20) or satisfied (21-40). Among the units with relatively high response rate, the patients in Oskarshamn were most often satisfied (95%) followed by Motala (87%), Hässleholm (85%) and Trelleborg (80%). For the other hospitals the proportion of satisfied patients varied between 69 and 89% (figure below).



The distribution (%) for each level of satisfaction one year after surgery for all the units combined as well as for each of the units,

The table to the right shows the number of complete reports together with the mean and standard deviation (SD) for the satisfaction with the surgery one year after it had been performed (in 2013). The average for all the reporting hospitals is shown as well as that of the respective units.

Satisfaction one year after surgery (2013)
VAS (0-100) (worst - best)

Hospital	Number of reports	Complete reports (%)	Postop Mean (SD)
All units	2,191	75,1	20
Helsingborg	20	65	29 (32)
Hässleholm	600	82	21 (24)
Lund	57	67	28 (28)
Motala	433	74	16 (23)
Norrköping	127	45	20 (26)
Oskarshamn	237	83	12 (20)
Trelleborg	615	78	25 (25)
Ängelholm	102	49	19 (29)

The EQ-VAS and VAS pain are shown in a similar way in the table below. For patients operated in 2013 both the pre- and postoperative results are shown but for patients operated in 2014 only the preoperative results are available.

Results for VAS–pain and EQ–VAS preoperatively and 1 year postoperatively.

			VAS pain 0–100 (best - worst)		EQ-VAS 0–100 (worst - best)	
Group	Patients n	Complete reports	Preop mean (SD)	Postop mean (SD)	Preop mean (SD)	Postop mean (SD)
All						
2013	2,191	75,1	64 (17)	18 (20)	67 (21)	76 (20)
2014	2,707	90,1	65 (18)		66 (22)	
Sjukhus						
Helsingborg						
2013	20	65	68 (18)	32 (31)	61 (15)	79 (14)
2014	42	93	72 (20)		59 (30)	
Hässleholm						
2013	600	82	62 (18)	18 (20)	71 (20)	77 (20)
2014	581	97	62 (18)		71 (21)	
Kalmar						
2014	84	62	64 (15)		67 (20)	
Karolinska						
2014	76	79	72 (18)		56 (22)	
Lund						
2013	57	67	69 (18)	22 (22)	62 (26)	68 (23)
2014	64	77	67 (18)		63 (18)	
Motala						
2013	433	74	65 (17)	17 (19)	63 (22)	75 (19)
2014	374	84	67 (17)		62 (23)	
Norrköping						
2013	127	45	70 (17)	17 (20)	53 (22)	72 (19)
2014	124	94	70 (17)		62 (24)	
OrthoCenter Sthlm						
2014	372	95	66 (17)		63 (27)	
Oskarshamn						
2013	237	83	65 (17)	11 (15)	63 (23)	77 (20)
2014	249	91	65 (17)		62 (24)	
Trelleborg						
2013	615	78	63 (19)	21 (20)	70 (20)	75 (20)
2014	680	92	63 (19)		70 (21)	
Ängelholm						
2013	102	49	67 (20)	18 (23)	63 (23)	80 (19)
2014	61	64	69 (18)		68 (25)	

KOOS

The differences are small between those units that had relatively high response rate and that reported both pre- and postoperative PROM data (Hässleholm, Motala, Oskarshamn och Trelleborg). The biggest difference (8-9 points) was found between Trelleborg and Oskarsham in the KOOS subscales of sports and recreation activities as well as knee related quality of life, the results being better for patients in Oskarshamn. For units with few patients and/or low response rate the results vary and are difficult to interpret.

The preoperative differences in 2014 were small with the exception of patients in Norrköping which reported more problems with symptoms (8-11 points) than the patients at the other hospitals.

The results for the KOOS 5 subscales are shown as mean and standard deviation for all patients as well as for the respective hospitals. For patients operated in 2013 both the pre- and postoperative results are shown but for patients operated in 2014 only preoperative results are available (see table on next page).

Summary

The result of the compilations showed again small variations between groups in spite of some differences in case-mix. However, it is worthwhile to point out that 95% of the patients in Oskarshamn were very satisfied or satisfied one year after their knee arthroplasty surgery.

The results vary for units performing few surgeries and those that have low response rate which makes it difficult to interpret and compare results between units as well as between different years of surgery.

Kungälv, Mölndal and Ängelholm Aleris began gathering PROM data in 2015 which they enter online into our common database. However, gathering a representative material with one year follow-up will take more than 2 years. First then, the participating units can start compare their results to that of others. However, the PROM project will serve as a basis for continued discussion regarding evaluation of patient reported outcomes in registries and hospitals and how the results can be used for clinical improvement.

Results for KOOS preoperatively (surgeries 2013 & 2014) as well as 1 year postoperatively (surgeries 2013)

				Pain		Symtoms		ADL		Sports/Rec.		QoL	
Group	Patients n	Complete reports %	Charnley C patients %	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													
2013	2 191	75	43,8	42 (15)	80 (19)	46 (18)	76 (17)	46 (16)	78 (20)	12 (14)	37 (28)	23 (14)	64 (24)
2014	2 707	90	44,6	40 (16)		46 (17)		46 (16)		11 (14)		23 (14)	
Sjukhus													
Helsingborg													
2013	20	65	53,8	39 (19)	74 (18)	50 (22)	71 (20)	43 (18)	71 (18)	13 (27)	38 (31)	17 (12)	50 (26)
2014	42	93	38,5	40 (15)		50 (20)		45 (14)		6 (11)		16 (11)	
Hässleholm													
2013	600	82	45,0	40 (14)	80 (20)	48 (19)	77 (17)	46 (15)	78 (20)	12 (13)	37 (28)	24 (14)	65 (25)
2014	581	97	43,5	39 (15)		46 (18)		45 (16)		12 (15)		24 (14)	
Kalmar													
2014	84	62	46,2	47 (14)		40 (14)		49 (15)		11 (19)		23 (13)	
Karolinska													
2014	76	79	46,6	39 (18)		48 (19)		44 (19)		12 (20)		18 (16)	
Lund													
2013	57	67	50,0	39 (15)	72 (25)	50 (22)	73 (23)	41 (17)	66 (24)	8 (11)	24 (26)	22 (13)	53 (27)
2014	64	77	55,1	42 (16)		51 (19)		43 (15)		7 (10)		19 (14)	
Motala													
2013	433	74	47,4	41 (16)	82 (18)	44 (15)	74 (16)	45 (16)	78 (19)	12 (16)	37 (27)	22 (14)	64 (23)
2014	374	84	43,5	39 (16)		42 (15)		44 (16)		11 (13)		22 (14)	
Norrköping													
2013	127	45	56,1	38 (13)	78 (22)	42 (13)	71 (18)	43 (11)	77 (21)	9 (10)	40 (31)	17 (12)	60 (25)
2014	124	94	54,1	35 (16)		40 (16)		41 (15)		7 (9)		19 (14)	
OrthoCenter Sthlm													
2014	372	95	46,8	41 (16)		43 (16)		47 (17)		12 (14)		21 (14)	
Oskarshamn													
2013	237	83	43,4	41 (15)	86 (16)	46 (16)	78 (15)	46 (15)	83 (19)	9 (11)	44 (28)	23 (12)	71 (22)
2014	249	91	45,3	40 (16)		44 (17)		45 (15)		10 (13)		22 (13)	
Trelleborg													
2013	615	78	37,5	43 (15)	79 (19)	49 (17)	75 (18)	49 (16)	78 (19)	13 (14)	35 (27)	25 (14)	63 (24)
2014	680	92	42,2	42 (15)		50 (18)		48 (16)		13 (14)		25 (14)	
Ängelholm													
2013	102	49	48,0	42 (15)	81 (21)	48 (18)	76 (18)	48 (17)	80 (21)	12 (15)	32 (26)	24 (16)	61 (27)
2014	61	64	46,2	41 (14)		49 (18)		45 (17)		8 (12)		23 (16)	

The knee osteotomy register

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 may be 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.

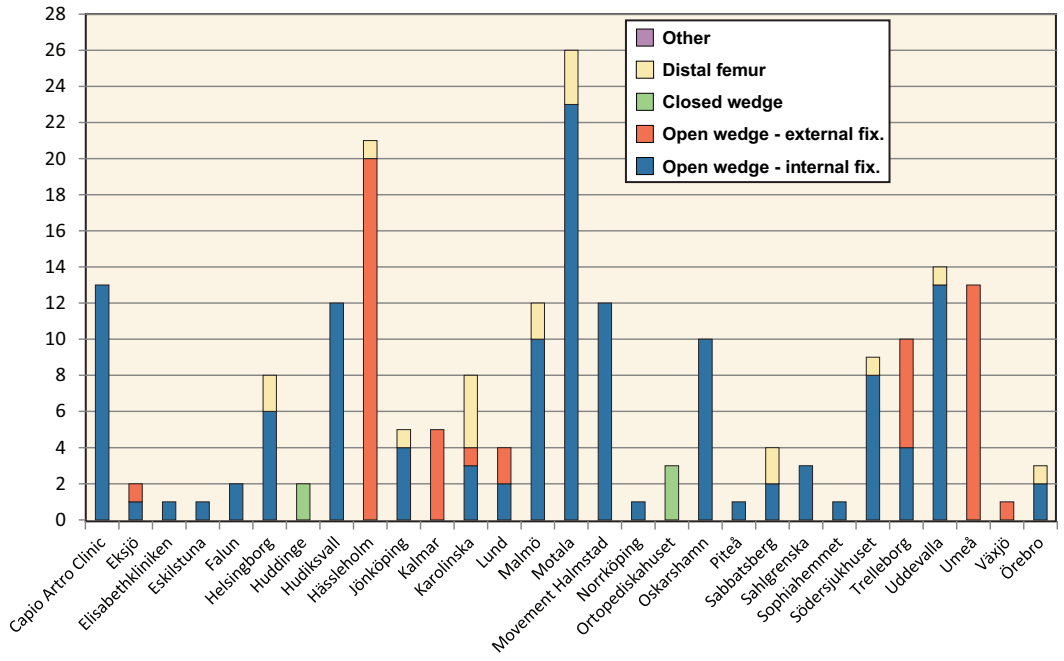
Each of the different techniques has their pros and cons and there has been a continuing development of the procedures and the postoperative care with the aim of improving results.

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.

In 2014, 210 osteotomies were reported from 29 hospitals. As the figure below shows, only 10 hospitals reported having performed 10 or more during the year. The hospital performing most was Motala that did 26. As compared to the first reported year (1/4 2013-31/3 2014) it seems that somewhat fewer osteotomies have been reported from fewer hospitals.

How many of the osteotomies performed in the country in 2014 the register captured is difficult to assess. The patient register of the health authorities, knee osteotomy uses the NOMESCO code NGK59. Data for 2014 are not yet available but as compared to the total number of osteotomies in 2013, for all ages and diagnoses, the register captured 65%. So far, no children have been reported to the register. Limiting the age interval to patients 15-65 years of age we estimate having captured approximately 80%.

Number of osteotomies and the method(s) used at each unit in 2014



Patient characteristics and case-mix in knee osteotomy surgery

Results

The following pages show the results for the knee osteotomies that were reported in 2014.

The knee osteotomy register gathers similar information as the knee arthroplasty register concerning the patients (BMI, ASA, previous surgeries), the use of antibiotics, thromboprophylaxis as well as the surgical technique.

Patient characteristics

Two thirds of the patients were males and the median age was 51 years that can be compared for the median age in 2014 for patients having TKA (69) and UKA (62). Two thirds of the patients were reported as healthy (ASA class I) and having a BMI less than 30 kg/m^2. The majority had medial osteoarthritis of grade 1-2 according to the Ahlbäck classification and the median axis deviation was slightly over 7 degrees. Patients having distal femur osteotomy were younger, most were women and they had a larger axis deviation than those having proximal tibia osteotomy (see below).

Patient characteristics - osteotomies

	All n=210	Prox. Tibia n= 191 (91%)	Dist. Femur n=19 (9%)
Age (years)			
median (range)	51 (18-67)	51 (18-67)	39 (18-65)
Gender			
Men - n (%)	135 (64)	129 (68)	6
Women - n (%)	75 (36)	62 (32)	13
Preop HKA angle, n=206			
median (range)	7.5 (0-42)	7.5 (0-26)	9 (3-42)
ASA classifikation, n=187			
ASA I - n (%)	127 (62)	113 (61)	14
ASA II - n (%)	71 (34)	66 (35)	5
ASA III - n (%)	8 (4)	8 (4)	0
OA type, n=189			
Medial n (%)	176 (93)	176 (99)	0
Lateral n (%)	13 (7)	2 (1)	11
OA grade, n=186			
Ahlbäck 1 - n (%)	72 (39)	62 (35)	1
Ahlbäck 2 - n (%)	85 (46)	85 (49)	4
Ahlbäck 3 - n (%)	29 (15)	28 (16)	6

Body Mass Index (kg/m^2)

BMI group	Number	Percent
<25	59	28.1
25-29.9	84	40.0
30-34,9	49	23.3
35-39,9	11	5.2
40+	1	0.5
Missing	6	2.9
Total	210	100

Previous surgery

Reporting previous surgery of the index knee, it is possible to mark more than one alternative. Previous surgery was reported for more than half of the patients and more than one surgery for 12%. This can be compared to the knee arthroplasty patients for whom 19% were reported to have had previous surgery and 4% more than one. What is reported cannot be considered a comprehensive description of previous surgeries but illustrates what the surgeon knew at the time of the primary arthroplasty.

Previous surgery in the index knee

Surgery	Number	Percent
None	80	38,1
Fracture surgery	3	1,4
Meniscal surgery	49	23,3
Cruciate surgery	20	9,5
Arthroscopy	40	19,1
Other	10	4,8
Missing	8	3,8
Total	210	100

Reason for and type of osteotomy

The majority of the surgeries (90%) were performed for osteoarthritis. The most common method was open wedge with internal fixation followed by open wedge with external fixation. Closed wedge osteotomy, which for a long time was the standard treatment for osteoarthritis in Sweden, was only used for good 2% of the osteotomies.

Reason for the osteotomy

Diagnosis	Number	Percent
Osteoarthritis	189	90
Acquired deformity	6	2.8
Congenital deformity	5	2.4
Instability	7	3.3
Osteonecrosis	1	0.5
Other	1	0.5
Missing	1	0.5
Total	210	100

Type of osteotomy

Type	Number	Percent
Open wedge intern fixation	135	64.3
Open wedge extern fixation	49	23.3
Closed wedge	5	2.4
Curved/Dome	1	0.5
Distal femur	19	9
Missing	1	0.5
Total	210	100

Technique and prophylaxis for knee osteotomies

Open wedge osteotomy with internal fixation

Many different plates were reported for fixation of the osteotomies. The Tomofix plate was the most commonly used plate but three types of plates accounted for more than 85% of those used in this type of surgeries (see below).

Type of fixation in open wedge osteotomy with internal fixation

Type	Number	Percent
Tomofix	67	49.6
CountureLock	19	14.1
Pudo	31	23.0
iBalance	8	6.0
OTIS	1	0.7
Peek power	3	2.2
Arthrex unspecified	2	1.5
Tibial Plate	3	2.2
Missing	1	0.7
Total	135	100

Transplantation of bone

In half of the open wedge osteotomies using internal fixation, no bone transplantation was reported. In case of bone transplantation, synthetic bone was most commonly used followed by bank bone and auto transplantation (see table). OSferion was the most commonly used synthetic bone.

Transplantation of bone in open wedge osteotomy with internal fixation

Bone transplantate	Number	Percent
None	68	50.4
Missing	0	0
Auto transplantation	15	11.1
Bank bone	16	11.9
Synthetic bone	36	26.6
Total	135	100
Synthetic bone:		
Arthrex Quickset	2	
Void Filler	1	
DePuy/Synthes Chronos	4	
Osferion	25	
OTIS	3	
Unspecified	1	

Open wedge osteotomy with external fixation

For this type of osteotomies, the Orthofix external fixation was used for all but two surgeries (see below).

Type of fixation in open wedge osteotomy with external fixation

Type	Number
Orthofix	47
Monotube	1
Tailor Spatial Frame	1
Missing	0
Total	49

Distal femur osteotomy

Different methods and techniques were used for this type of osteotomy which is relatively uncommon (see below).

Type of fixation for distal femur osteotomy

Type	Number
Femur OWO plate	1
Tomofix	7
Pudo	5
Synthes	2
Distal femur plate unspecified	2
Orthofix external fixation	1
Medullary nail	1
Total	19

Simultaneous surgery

An additional simultaneous surgery was reported to have been performed together with the osteotomy in 44 (21%) cases. Arthroscopy was the most common simultanous procedure (see below).

Simultaneous surgery with the osteotomy

Surgery	Number	Percent
None	151	71.9
Arthroscopy	24	11.4
Cruciate surgery	10	4.8
Meniscal surgery	1	0.5
Other	9	4.3
Missing	15	7.1
Total	210	100

Type of anesthesia

General anesthesia was most commonly used (57% of cases). A few patients were reported to have had a combination of general or spinal anesthesia together with a femoralis nerve block (see table).

.

Type of anesthesia

Type	Number	Percent
Generell	123	58.6
Epidural	0	0
Spinal	75	35.7
Combination	9	4.3
Missing	3	1.4
Total	210	100

Operating time

After excluding osteotomies performed with another simultaneous surgery, the median operating time was somewhat shorter for open wedge osteotomies with external fixation (50.5 min, 15-130) than with internal fixation (62 min, 22-215). Closed wedge osteotomies took longer time (75 min, 46-90) as well as dome osteotomies (76 min). and distal femur osteotomies (80 min, 35-241). The table below shows the median operating times including osteotomies with simultanous surgeries.

Operating time

Type of osteotomy	Median (min)	Range (Min)
Closed wedge	75	(46-90)
Open wedge intern	69	(22-265)
Open wedge extern	51	(15-333)
Dome	76	(76)
Distal femur	85	(35-285)

Computer aided surgery (CAS)

Only four osteotomies were reported to have ben performed with the help of navigation.

Thromboprophylaxis

Fragmin och Innohep were the most commonly used substances. The prophylaxis using Fragmin, Innohep and Klexane was more often started post-operatively. Thirteen percent of the osteotomy patients did not receive any thromboprophylaxis (see table), unlike the knee arthroplasty patients which almost all receive prophylaxis.

Thromboprophylaxis

Substance - time	Number	Percent
None	27	12.9
Fragmin - preop	14	6.7
Fragmin - postop	59	28.1
Innohep - preop	12	5.7
Innohep - postop	69	32.8
Klexane -preop	4	1.9
Klexane -postop	13	6.2
Xarelto	1	0.5
Pradaxa	1	0.5
Macrodex	3	1.4
Missing	7	3.3
Total	210	100

Thromboprophylaxis - length of treatment

The planned length of treatment varied but two thirds of the patients were planned to have 8-14 days of treatment (see table).

Thromboprophylaxis - length of treatment

Days	Number	Percent
No prophylaxis	27	12.9
1-7	22	10.4
8-14	139	66.2
15-21	12	5.7
22-28		
29-35	6	0.5
>35		
Missing	9	4.3
Total	210	100

Antibiotic drugs

Cloxacilline or Clindamycin were used in all the surgeries for which a substance was reported. Clindamycin was used in 7% of the surgeries which is the same proportion as seen for knee arthroplasties and which can be interpreted as the percentage of patients being suspected of having penicillin allergy.

Antibiotic drug

Substance	Number	Percent
Cloxacilline	194	92.4
Clindamycin	14	6.7
No prophylaxis	0	0
Missing	2	0.9
Total	210	100

Cloxacillin dosage

Using a prophylaxis of 2g of Cloxacillin as a single dosage was as common as using 2g x 3 post-operatively.

Cloxacillin dose

Dose	Number	Percent
Cloxacilline 2gx1	82	42.3
Cloxacilline 2gx2	7	3.6
Cloxacilline 2gx3	83	42.8
Cloxacilline 2gx4	19	9.8
Cloxacilline other dosage	1	0.5
Dosage missing	2	1.0
Total	194	100

Antibiotic - time of administration

At the start of surgery a reasonable tissue concentration of the antibiotic should have been reached in order to counteract any bacteria in the field. Due to the short half-life of Cloxacilline it is important that it is administrated within a correct time interval.

In November 2013 the PRISS recommendations were published (see page 54 and www.patientförsakringen.se) which considered the optimal time interval being 45-30 min before start of surgery which was a narrower interval than the 45-15 min. previously recommended..

For 35% of the osteotomies it was reported that the preoperative dose had been given within the currently PRISS recommended time interval and 63% within the previously recommended time interval (see table top right).

Antibiotic - time of administration (PRISS recommendation)

Min. before surgery	Number	Percent
0-29	75	35.7
30-45	73	34.8
>45	33	15.7
Start after surgery	13	6.2
Missing	16	7.6
Total	210	100

Tourniquet and drainage

Use of tourniquet is popular among Swedish orthopedic surgeons and as for knee arthroplasty it was used in 70% of the osteomies. However, drainage was used in 5% of the osteotomies (see tabels below) as compared to 13% of the knee arthroplasties.

Tourniquet and drainage

Tourniquet	Number	Percent
Yes	147	70.0
No	60	28.6
Missing	3	1.4
Total	210	100

Drainage	Number	Percent
Yes	11	5.2
No	194	92.4
Missing	5	2.4
Total	210	100

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-(0)46-171345

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 Swedish
Knee Osteotomy Register
Klinikgatan 22, Wigerthuset, floor 2
Lund University Hospital
SE-221 85, Lund
Phone. +46-(0)46-171345

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

From: Hospital name (institution No.) /

To be used for osteotomies around the knee

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

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

Primary osteotomy ☐ 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

Put stickers for inserted parts here
(plates, screws bone substitute ....)

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