Akademiska sjukhuset
Alingsås
ArtClinic Göteborg
ArtClinic Jönköping
Arvika
Bollnäs
Borås
Carlanderska
Danderyd
Eksjö-Nässjö
Elisabethkliniken
Enköping
Eskilstuna
Falun
Frölunda Spec, Sjh,
Gällivare
Gävle
Halmstad
Helsingborg
Huddinge
Hudiksvall
Hässleholm
Jönköping
Kalmar
Karlshamn
Karlskoga
Karlstad
Karolinska
Kullbergska
Kungälv
Kysthospitalet -DK
Lidköping
Lindesberg
Ljungby
Luleå-Sensia
Lund
Lycksele
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
Sunderby
Sundsvall
Södersjukhuset
Södertälje
Torsby
Trelleborg
Uddevalla
Umeå
Varberg
Visby
Värnamo
Västervik
Västerås
Växjö
Ängelholm
Örebro
Örnsköldsvik
Östersund

Annual Report 2016

Swedish Knee Arthroplasty Register

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

Primary knee arthroplasties 1975-2015
Revision knee arthroplasties 1975-2014
Knee osteotomies 2013-2015

To our contact surgeons

The statistics section on our website (www.knee.se) has changed considerably since the last report. Now you can specify what information you would like such as types of surgeries, patient profiles as well as perioperative data for the different counties, hospitals and time periods. We hope that you find the information interesting and relevant.

In this report, we have added a section on adverse events that occurred within 90 days of the primary knee replacement. In cooperation with the National Patient Register of the National Board of Health and Welfare we examined the ICD- and surgical codes that were used for the different diseases and surgeries of knee arthroplasty patients treated in the healthcare system after their primary surgeries. The objective was to collect information on health events that may have occurred or become symptomatic as a result of the surgery. Although there may be sources of error such as differences in coding procedures among the hospitals and counties, we are convinced that the data still yield useful information on how common adverse events are following knee arthroplasty surgery and may indicate where additional analyses and improvement measures are motivated.

We want to thank all our contact surgeons and associated staff for their dedicated work throughout the years. Your accurate reporting and focus on quality have resulted in close to complete coverage and your tireless effort of sharing the information has facilitated the implementation of the information into practice

Operating a register is a laborious long-term effort. With revision as the main indicator of failure in combination with the reluctance of Swedish surgeons in testing new implants, reports of early problems are unusual. However, the register has contributed to implants showing inferior results 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.

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

1) When calculating the incidence we now use information from the tax authorities on where the patients were residing at the time of surgery.
2) When calculating the relative risk for the different hospitals we now analyze both uncemented and cemented TKAs inserted for osteoarthritis.
3) The osteotomy register that started in 2013 has its own section at the end of the report.

The report consists of four parts.

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

The second part contains information on the data reported to the register in 2015 as well as analyses covering the 10-year period 2005-2014.

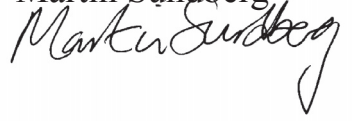
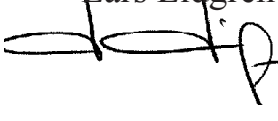
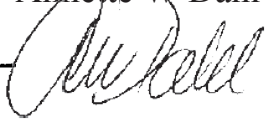
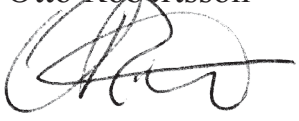
The third part concerns the osteotomy registry.

The fourth part is specifically prepared for each individual hospital. It is only delivered to the contact surgeon in charge and the head of department. It provides compilations of what the hospital has reported as well as information on all surgeries reported by the unit for 2015 (sorted by ID and date of surgery). It is our hope that this hospital specific information will be compared to other available information in order to identify and correct potential registration errors.
We also provide a USB stick containing all the reported surgeries by the hospital, the annual report and graphics comparing the revision rate of the unit to that of the national average. It is important to inform your colleagues about the report to stimulate discussions in order to initiate 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 operation nor the revision will be included in the analyses.

The register office in Lund would like to thank all contact surgeons, operation staff and secretarues for their important contribution throughout the years and ask you to carefully review and distribute the information presented.

On behalf of the Swedish Knee Arthroplasty Register

Martin Sundberg  Lars Lidgren  Annette W-Dahl  Otto Robertsson 

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CONTENT

Introduction

The beginning – In the early seventies, knee arthroplasty was an uncommon procedure restricted for those with severe disability. Little information was to be found in the literature while there was an abundant choice of implants which were continuously being modified. In this setting, the Swedish Orthopedic Association initiated a nationwide multicenter study in 1975, to prospectively monitor knee arthroplasty surgery. The orthopedic surgeons realized that it would be impossible for an individual surgeon to base his choice of optimal operative methods or implants on his own experience. The aim was to collect, analyze and render information that could warn against suboptimal techniques and implants.

Number of units – The vast improvement in quality of life for the majority of patients quickly made the surgery a success and the technique dispersed to more hospitals and surgeons. Since the start of the registration in 1975, participation has been voluntary. 24 units reported during the first year increasing to 51 in 1985 and to 82 in 1996. In the late nineties, the number of units diminished somewhat due to the merger of hospitals. In 2015, 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 2015 the number of primaries diminished as compared to 2014 by 0.9% or from 13,000 to 12,886. Whatever the reasons may be, we consider it likely that the volumes will increase again as the incidence in Sweden (see page 15) 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 64-69.

Registration of osteotomies – Osteotomies have been prospectively registered since 2013. This year the registration has a separate section on page 70.

Reporting to the register – The SKAR recommends that the form (page 77) 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 2015). Analyses concerning the revision rate end one year earlier (2014). 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 12.

Cooperation – The SKAR has had close collaboration with the RCSyd (Register Center South) facilitated by the two sharing premises in Lund. As the RCSyd now has moved 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 the onsite validation project but only managed to visit 3 hospitals during the last year.

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 are in the process of making this web-site more informative and have already introduced a new statistics section in which it is possible to get information for the country as a whole as well as for individual counties and hospitals..
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 2014

It is difficult to estimate how many of the 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- and surgical codes but 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 capture rate by the SKAR during 2014 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 that the SKAR had captured 96.8% of all admissions and the NPR 96.6%.

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 surgical coding was erroneous.

Hospital	Number	SKAR-percent	NPR percent
Akademiska sjukhuset	88	96,6	98,9
Alingsås	205	98,5	99,0
Arvika	170	97,6	97,6
Blekingesjukhuset*	4	0	100
Bollnäs	409	97,8	97,6
Borås**	78	100	94,9
Capio Läkargruppen	2	0	100
Carlanderska	140	97,9	97,9
Danderyd	196	93,9	99,5
Eksjö-Nässjö	213	99,1	99,5
Elisabethkliniken	7	100	100
Enköping	368	99,5	99,5
Eskilstuna Mälarsjh.	44	93,2	95,5
Falun	358	98,9	95,8
Frölunda spec. sjukhus	128	93,8	98,4
Gällivara	68	100	100
Gävle	136	94,1	94,1
Halmstad	192	99,0	99,5
Halmstad Capio	284	87,7	99,6
Helsingborg	46	95,7	95,7
Huddinge	168	98,8	98,8
Hudiksvall	61	98,4	98,4
Hässleholm	654	97,6	98,3
Jönköping Art Clinic	13	100	0
Jönlköping Ryhov	168	100	99,4
Kalmar	95	95,8	100
Karlshamn*	242	100	98,3
Karlskoga	129	96,1	100
Karlstad	169	96,4	100
Karolinska Solna	105	96,2	100
Kullbergska	200	99,0	98,5
Kungsbacka	2	0	100
Kungälv	198	99,0	99,0
Lidköping***	199	100	98,5
Lindesberg	172	98,8	100
Linköping	1	0	100
Ljungby	155	96,1	98,1
Lund	99	98,0	97,0
Lundby (Capio Gbg)	1	0	100
Luleå Sensia	4	100	0
Lycksele	94	100	97,9

Hospital	Number	SKAR-percent	NPR percent
Malmö	2	0	100
Mora	152	98,7	99,3
Motala	473	98,3	99,2
Nacka	112	99,1	97,3
Norrköping Vrinnevisjh.	142	98,6	97,2
Norrtälje	87	97,7	98,9
NU-sjukvården	2	0	100
Nyköpings	98	98,0	100
Ortho Center IFK Kliniken	106	96,2	98,1
Orthocenter Stockholm	404	99,8	98,8
Ortopediska Huset	432	96,8	75,0
Oskarshamn	275	97,5	99,6
Piteå	260	99,6	98,1
S:t Görans	404	94,8	98,0
Sabbatsberg	141	100	80,1
Sahlgrenska****	400	74,5	98,0
Skaraborgs sjukhus***	13	0	100
Skellefteå	109	98,2	96,3
Skene**	104	100	100
Skövde***	115	100	98,3
Sollefteå	92	96,7	94,6
Sophiahemmet	97	100	0
Spenshult	161	96,3	99,4
Sundsvall	96	99,0	97,9
Södersjukhuset	322	97,5	97,5
Södertälje	111	99,1	95,5
Södra Älvsborgs sjukhus**	6	0	100
Torsby	111	99,1	99,1
Trelleborg	703	99,4	99,3
Uddevalla	207	100	99,0
Umeå	108	94,4	98,1
Varberg	155	94,8	98,1
Visby	73	95,9	97,3
Värnamo	167	97,0	98,8
Västervik	97	96,9	99,0
Västerås	248	98,4	98,0
Växjö	110	99,1	99,1
Ängelholm	237	97,5	93,7
Örebro	54	100	100
Örnsköldsvik	90	97,8	98,9
Östersund	110	96,4	98,2

* Blekingesjukhuset includes Karlshamn (that is in the list) as well as Karlskrona.
** Södra Älvsborgs sjukhus includes Borås and Skene (which both are in the list).
*** Skaraborgs sjukhus includes Lidköping and Skövde (which both are in the list) as well as Falköping och Mariestad.
**** Sahlgrenska University hospital also includes Mölndal and Östra (most of the surgeries are performed at Mölndal.

Adverse events within 90 days of knee arthroplasty

Introduction –

Resurfacing a damaged joint considerably improves quality of life, making joint replacements among the most cost-effective interventions. Although the procedure is considered safe with few complications, some patients experience health problems that may have been caused by, or become symptomatic as a result of the surgery.

Of historical and practical reasons, the Knee Arthroplasty Register (SKAR) has focused on reoperations in the knee and not registered other health issues. However, the national patient register (NPR) does that by registering ICD- and procedure codes for all patients treated in the official health system.

The National board of Health and Welfare has in cooperation with the Swedish Association of Local Authorities and Regions (SKL) described adverse events after hip- and knee arthroplasties, in their publication "Open comparisons". These have been based on readmissions using a short list of codes representing medical or surgical issues (http://www.socialstyrelsen.se/indikatorer).

The SKAR has with staff from the National Board of Health and Welfare examined the ICD10 and NOMESCO codes that occur in the NPR during admission for, and after knee arthroplasty. This has resulted in a longer list of codes that may represent adverse events when they occur during the hospital stay or in readmissions within 90 days of surgery.

Description –

Patients having primary total knee arthroplasty for osteoarthritis during 2012-2014 were included. If both knees were operated within 90 days only the latter was included and only one knee in the case of simultaneous bilateral surgery. The SKAR sent data on registered patients to the NPR which performed the match. For all the patients it was examined if they had received diagnostic and/or procedure codes that corresponded to the definition of adverse events, during or after the hospital stay and up to 90 days after the primary surgery.

The codes were classified into following groups:

A) Surgical procedure codes that include reoperations of knee implants and other procedures that may represent a complication.

DA) Diagnostic codes that imply surgical complications.

DB) Diagnostic codes that cover knee related diseases that may have been used for complications after knee arthroplasty surgery.

DC) Diagnostic codes covering cardiovascular events that may be related to the surgery.

DM) Diagnostic codes concerning other medical events not related to the knee but that may be related to the surgery if they occur shortly afterwards.

Additionally it was checked if patients had died during the first 90 days.

The codes and information on how they were used can be found on page 83.

Error sources –

The definition of an adverse event is based on diagnostic and procedure codes and there may be differences between counties and units in how carefully the coding has been performed. However, information on death is not dependent on coding.

Inadequate registration in the NPR of secondary surgical dates during the primary hospital stay can result in an adverse event not being included.

Occasional units performing knee arthroplasty surgery do not report to the NPR. For these, adverse events occurring during the primary admission will not be included..

As the information in the NPR on laterality of the surgery is uncertain a complication in the opposite knee will count as an adverse event. However, we consider it unlikely that a complication or a procedure will be registered in the opposite knee within 90 days of surgery.

Finally it is important to realize that many adverse events (especially the medical ones) do not need to be causally related to the surgery. E.g. a patient might have a heart attack or die even without having an arthroplasty. This implies that regional differences in general health, access to health care and preventive medicine may influence the outcome.

Results–

In the following pages we show for the different counties and units what adverse events occurred within 90 days (surgical, cardiovascular, other medical, death and all adverse events). Note that only one adverse event is counted for a patient within each group while the same patient can occur in multiple groups.

WOMEN in the counties

Adverse surgical events within 90 days (A, DA & DB)

County	Surgeries	Events	Risk/1000
Blekinge	370	17	45.9
Dalarna	834	23	27.6
Gotland	125	6	48.0
Gävleborg	794	19	23.9
Halland	1,383	51	36.9
Jämtland	249	14	56.2
Jönköping	825	25	30.3
Kalmar	746	49	65.7
Kronoberg	358	16	44.7
Norrbotten	575	21	36.5
Skåne	2,597	59	22.7
Stockholm	3,860	138	35.8
Sörmland	575	14	24.3
Uppsala	828	61	73.7
Värmland	703	23	32.7
Västerbotten	498	51	102.4
Västernorrland	479	21	43.8
Västmanland	433	20	46.2
Västra Götaland	2,604	59	22.7
Örebro	597	8	13.4
Östergötland	1,015	40	39.4
The Ccountry	20,448	735	35.9

MEN in the counties

Adverse surgical events within 90 days (A, DA & DB)

County	Surgeries	Events	Risk/1000
Blekinge	336	20	59.5
Dalarna	659	26	39.5
Gotland	112	6	53.6
Gävleborg	668	24	35.9
Halland	1,107	44	39.7
Jämtland	158	14	88.6
Jönköping	589	23	39.0
Kalmar	554	32	57.8
Kronoberg	260	16	61.5
Norrbotten	456	15	32.9
Skåne	1,924	66	34.3
Stockholm	2,717	117	43.1
Sörmland	406	19	46.8
Uppsala	597	43	72.0
Värmland	509	22	43.2
Västerbotten	348	37	106.3
Västernorrland	382	20	52.4
Västmanland	305	12	39.3
Västra Götaland	2,120	62	29.2
Örebro	462	13	28.1
Östergötland	687	46	67.0
The Ccountry	15,356	677	44.1

Adverse cardiovascular events within 90 days (DC)

County	Surgeries	Events	Risk/1000
Blekinge	370	1	2.7
Dalarna	834	5	6.0
Gotland	125	1	8.0
Gävleborg	794	3	3.8
Halland	1,383	4	2.9
Jämtland	249	2	8.0
Jönköping	825	8	9.7
Kalmar	746	7	9.4
Kronoberg	358	2	5.6
Norrbotten	575	5	8.7
Skåne	2,597	14	5.4
Stockholm	3,860	28	7.3
Sörmland	575	7	12.2
Uppsala	828	8	9.7
Värmland	703	4	5.7
Västerbotten	498	8	16.1
Västernorrland	479	3	6.3
Västmanland	433	9	20.8
Västra Götaland	2,604	18	6.9
Örebro	597	6	10.1
Östergötland	1,015	8	7.9
The Ccountry	20 448	151	7.4

Adverse cardiovascular events within 90 days (DC)

County	Surgeries	Events	Risk/1000
Blekinge	336	5	14.9
Dalarna	659	12	18.2
Gotland	112	2	17.9
Gävleborg	668	11	16.5
Halland	1,107	12	10.8
Jämtland	158	6	38.0
Jönköping	589	7	11.9
Kalmar	554	4	7.2
Kronoberg	260	3	11.5
Norrbotten	456	4	8.8
Skåne	1,924	19	9.9
Stockholm	2,717	24	8.8
Sörmland	406	5	12.3
Uppsala	597	7	11.7
Värmland	509	7	13.8
Västerbotten	348	8	23.0
Västernorrland	382	6	15.7
Västmanland	305	2	6.6
Västra Götaland	2,120	18	8.5
Örebro	462	7	15.2
Östergötland	687	7	10.2
The Ccountry	15,356	176	11.5

Other adverse medical events within 90 days. (DM)

County	Surgeries	Events	Risk/1000
Blekinge	370	3	8.1
Dalarna	834	9	10.8
Gotland	125	2	16.0
Gävleborg	794	12	15.1
Halland	1,383	13	9.4
Jämtland	249	6	24.1
Jönköping	825	14	17.0
Kalmar	746	14	18.8
Kronoberg	358	5	14.0
Norrbotten	575	4	7.0
Skåne	2,597	24	9.2
Stockholm	3,860	41	10.6
Sörmland	575	7	12.2
Uppsala	828	10	12.1
Värmland	703	6	8.5
Västerbotten	498	9	18.1
Västernorrland	479	12	25.1
Västmanland	433	2	4.6
Västra Götaland	2,604	29	11.1
Örebro	597	2	3.4
Östergötland	1,015	8	7.9
The Ccountry	20,448	232	11.3

Other adverse medical events within 90 days. (DM)

County	Surgeries	Events	Risk/1000
Blekinge	336	4	11.9
Dalarna	659	5	7.6
Gotland	112	2	17.9
Gävleborg	668	7	10.5
Halland	1,107	13	11.7
Jämtland	158	4	25.3
Jönköping	589	14	23.8
Kalmar	554	8	14.4
Kronoberg	260	7	26.9
Norrbotten	456	6	13.2
Skåne	1,924	36	18.7
Stockholm	2,717	37	13.6
Sörmland	406	5	12.3
Uppsala	597	11	18.4
Värmland	509	8	15.7
Västerbotten	348	18	51.7
Västernorrland	382	12	31.4
Västmanland	305	1	3.3
Västra Götaland	2,120	26	12.3
Örebro	462	2	4.3
Östergötland	687	16	23.3
The Ccountry	15,356	242	15.8

WOMEN in the counties
Death within 90 days

County	Surgeries	Events	Risk/1000
Blekinge	370	1	2.7
Dalarna	834	3	3.6
Gotland	125	0	0.0
Gävleborg	794	1	1.3
Halland	1,383	0	0.0
Jämtland	249	1	4.0
Jönköping	825	0	0.0
Kalmar	746	3	4.0
Kronoberg	358	0	0.0
Norrbotten	575	2	3.5
Skåne	2,597	3	1.2
Stockholm	3,860	5	1.3
Sörmland	575	3	5.2
Uppsala	828	1	1.2
Värmland	703	1	1.4
Västerbotten	498	0	0.0
Västernorrland	479	0	0.0
Västmanland	433	0	0.0
Västra Götaland	2,604	4	1.5
Örebro	597	0	0.0
Östergötland	1,015	0	0.0
The Ccountry	20,448	28	1.4

MEN in the counties
Death within 90 days

County	Surgeries	Events	Risk/1000
Blekinge	336	1	3.0
Dalarna	659	3	4.6
Gotland	112	0	0.0
Gävleborg	668	1	1.5
Halland	1,107	0	0.0
Jämtland	158	1	6.3
Jönköping	589	3	5.1
Kalmar	554	0	0.0
Kronoberg	260	0	0.0
Norrbotten	456	2	4.4
Skåne	1,924	8	4.2
Stockholm	2,717	4	1.5
Sörmland	406	2	4.9
Uppsala	597	0	0.0
Värmland	509	0	0.0
Västerbotten	348	0	0.0
Västernorrland	382	1	2.6
Västmanland	305	0	0.0
Västra Götaland	2,120	2	0.9
Örebro	462	3	6.5
Östergötland	687	1	1.5
The Ccountry	15,356	32	2.1

All adverse events within 90 days (incl. death)

County	Surgeries	Events	Risk/1000
Blekinge	370	22	59.5
Dalarna	834	37	44.4
Gotland	125	8	64.0
Gävleborg	794	34	42.8
Halland	1,383	66	47.7
Jämtland	249	21	84.3
Jönköping	825	44	53.3
Kalmar	746	70	93.8
Kronoberg	358	23	64.2
Norrbotten	575	30	52.2
Skåne	2,597	97	37.4
Stockholm	3,860	203	52.6
Sörmland	575	28	48.7
Uppsala	828	75	90.6
Värmland	703	32	45.5
Västerbotten	498	61	122.5
Västernorrland	479	34	71.0
Västmanland	433	28	64.7
Västra Götaland	2,604	100	38.4
Örebro	597	16	26.8
Östergötland	1,015	54	53.2
The Ccountry	20,448	1,083	53.0

All adverse events within 90 days (incl. death)

County	Surgeries	Events	Risk/1000
Blekinge	336	29	86.3
Dalarna	659	42	63.7
Gotland	112	10	89.3
Gävleborg	668	39	58.4
Halland	1,107	66	59.6
Jämtland	158	22	139.2
Jönköping	589	46	78.1
Kalmar	554	42	75.8
Kronoberg	260	23	88.5
Norrbotten	456	26	57.0
Skåne	1,924	111	57.7
Stockholm	2,717	176	64.8
Sörmland	406	27	66.5
Uppsala	597	57	95.5
Värmland	509	36	70.7
Västerbotten	348	51	146.6
Västernorrland	382	36	94.2
Västmanland	305	15	49.2
Västra Götaland	2,120	103	48.6
Örebro	462	22	47.6
Östergötland	687	65	94.6
The Ccountry	15,356	1,044	68.0

The unadjusted tables, for the counties above and for the hospitals on the following pages, show the adverse events occurring during the primary stay or within 90 days or surgery.

It can be seen that adverse events are more common for men in all the groups. This is also true after adjustment for age (not shown). Four % of the patients experience surgical events which may include aspirations, wound problems, manipulation under anesthesia, hematoma etc. The "true" in which implant components are added, removed or exchanged, and which the SKAR focuses on, account for less than one fifth of the adverse events the first three months. 0.9% have cardiovascular events, 1.3% have other adverse medical events while only 0.17% die within the first 90 days. The overall risk for a patient for experiencing an adverse event during this time is 5.9%.

It may be helpful to have access to this information when patients are informed about possible risks associated with the surgery. T

It may be problematic to compare the number of adverse events between hospitals and counties as there may be a variation in the routines for coding events. However, the numbers provide useful information of how common adverse events are at the different locations and may indicate where additional analyses and improvement measures are indicated.

Age- and sex adjusted results for the counties
Death within 90 days

County	Surgeries	Events	Risk/1000
Blekinge	706	2	2.5
Dalarna	1,493	6	4.0
Gotland	237	0	0.0
Gävleborg	1,462	2	1.4
Halland	2,490	0	0.0
Jämtland	407	2	3.8
Jönköping	1,414	3	2.0
Kalmar	1,300	3	2.2
Kronoberg	618	0	0.0
Norrbotten	1,031	4	4.1
Skåne	4,521	11	2.4
Stockholm	6,577	10	1.5
Sörmland	981	4	4.4
Uppsala	1,425	1	0.8
Värmland	1,212	1	0.7
Västerbotten	846	0	0.0
Västernorrland	861	1	1.2
Västmanland	738	0	0.0
Västra Götaland	4,724	6	1.3
Örebro	1,059	3	3.1
Östergötland	1,702	1	0.5
The Ccountry	35,804	60	1.7

Age- and sex adjusted results for the counties
All adverse events within 90 days (incl. death)

County	Surgeries	Events	Risk/1000
Blekinge	706	47	67.1
Dalarna	1,493	79	53.0
Gotland	237	17	72.6
Gävleborg	1,462	73	50.0
Halland	2,490	134	53.8
Jämtland	407	43	104.5
Jönköping	1,414	89	63.3
Kalmar	1,300	111	85.3
Kronoberg	618	49	79.5
Norrbotten	1,031	56	54.4
Skåne	4,521	207	45.8
Stockholm	6,577	382	58.1
Sörmland	981	54	55.5
Uppsala	1,425	132	92.6
Värmland	1,212	67	55.6
Västerbotten	846	111	130.7
Västernorrland	861	71	82.1
Västmanland	738	42	57.2
Västra Götaland	4 724	202	42.8
Örebro	1,059	37	35.2
Östergötland	1,702	122	71.4
The Country	35,804	2,127	59.4

The tables above show age- and gender adjusted results for the counties concerning death as well as all adverse events. It can be seen for all adverse events that there is considerable variation between the counties in spite of the adjstment. This is also true for the number of deaths which are differently registered and not affected by differences in coding.

The following tables show the unadjusted number of adverse events in the different hospitals. It might be of interest for individual hospitals to receive information om which of their patients were affected. However, as the SKAR only receives aggregated information from the PAR we unfortunately do not have access to this information.

Adverse surgical events within 90 days (A, DA & DB)

Hospital (men & women)	Surgeries	Events	Risk/1000
Akademiska sjukhuset	246	15	61.0
Alingsås	594	9	15.2
Art Clinic Jönköping	22	0	0.0
Arvika	425	12	28.2
Bollnäs	910	22	24.2
Borås	239	14	58.6
Carlanderska	352	1	2.8
Danderyd	388	15	38.7
Eksjö-Nässjö	526	23	43.7
Elisabethkliniken	111	3	27.0
Enköping	1,068	86	80.5
Eskilstuna	101	6	59.4
Falun	994	41	41.2
Frölunda Spec.	356	5	14.0
Gothenburg Med Center	273	1	3.7
Gällivare	229	6	26.2
Gävle	355	14	39.4
Halmstad	642	37	57.6
Helsingborg	73	4	54.8
Huddinge	369	14	37.9
Hudiksvall	197	7	35.5
Hässleholm	1,790	68	38.0
Jönköping	460	10	21.7
Kalmar	247	7	28.3
Karlshamn	706	37	52.4
Karlskoga	385	7	18.2
Karlstad	441	27	61.2
Karolinska	284	22	77.5
Kullbergska sjukhuset	636	27	42.5
Kungälv	447	19	42.5
Lidköping	531	21	39.5
Lindesberg	526	11	20.9
Ljungby	314	15	47.8
Luleå-Sensia	9	0	0.0
Lund	143	6	42.0
Lycksele	224	18	80.4
Löwenströmska	1,209	23	19.0
Malmö	9	0	0.0
Mora	499	8	16.0
Motala	1,305	68	52.1
Movement Halmstad	650	16	24.6
Mölndal	645	13	20.2
Nacka-Proxima/Aleris	372	10	26.9
Norrköping	397	18	45.3
Norrtälje	211	12	56.9
Nyköping	244	0	0.0
Ortopediska huset	1,162	32	27.5
Oskarshamn	754	59	78.2
Piteå	790	30	38.0
S:t Göran	946	45	47.6
Sabbatsberg	386	3	7.8
Skellefteå	273	13	47.6
Skene	331	8	24.2
Skövde	416	13	31.3
Sollefteå	274	8	29.2
Sophiahemmet	205	6	29.3
Spenshult	728	22	30.2
Sunderby	3	0	0.0
Sundsvall	294	19	64.6
Södersjukhuset	766	58	75.7
Södertälje	279	15	53.8
Torsby	346	6	17.3
Trelleborg	1,943	31	16.0
Uddevalla	539	17	31.5
Umeå	349	57	163.3
Varberg	470	20	42.6
Visby	237	12	50.6
Värnamo	406	15	36.9
Västervik	299	15	50.2
Västerås	738	32	43.4
Växjö	304	17	55.9
Ängelholm	563	16	28.4
Örebro	148	3	20.3
Örnsköldsvik	293	14	47.8
Östersund	407	28	68.8
The Ccountry	35,804	1,412	39.4,

Adverse cardiovascular events within 90 days (DC)

Hospital (men & women)	Surgeries	Events	Risk/1000
Akademiska sjukhuset	246	3	12.2
Alingsås	594	2	3.4
Art Clinic Jönköping	22	0	0.0
Arvika	425	5	11.8
Bollnäs	910	5	5.5
Borås	239	2	8.4
Carlanderska	352	1	2.8
Danderyd	388	4	10.3
Eksjö-Nässjö	526	7	13.3
Elisabethkliniken	111	0	0.0
Enköping	1,068	12	11.2
Eskilstuna	101	2	19.8
Falun	994	8	8.0
Frölunda Spec.	356	0	0.0
Gothenburg Med Center	273	1	3.7
Gällivare	229	1	4.4
Gävle	355	7	19.7
Halmstad	642	4	6.2
Helsingborg	73	1	13.7
Huddinge	369	6	16.3
Hudiksvall	197	2	10.2
Hässleholm	1,790	12	6.7
Jönköping	460	3	6.5
Kalmar	247	3	12.1
Karlshamn	706	6	8.5
Karlskoga	385	6	15.6
Karlstad	441	1	2.3
Karolinska	284	7	24.6
Kullbergska sjukhuset	636	4	6.3
Kungälv	447	7	15.7
Lidköping	531	5	9.4
Lindesberg	526	7	13.3
Ljungby	314	3	9.6
Luleå-Sensia	9	1	111.1
Lund	143	2	14.0
Lycksele	224	2	8.9
Löwenströmska	1,209	3	2.5
Malmö	9	0	0.0
Mora	499	9	18.0
Motala	1,305	12	9.2
Movement Halmstad	650	4	6.2
Mölndal	645	4	6.2
Nacka-Proxima/Aleris	372	2	5.4
Norrköping	397	3	7.6
Norrtälje	211	3	14.2
Nyköping	244	6	24.6
Ortopediska huset	1,162	7	6.0
Oskarshamn	754	7	9.3
Piteå	790	7	8.9
S:t Göran	946	4	4.2
Sabbatsberg	386	1	2.6
Skellefteå	273	1	3.7
Skene	331	5	15.1
Skövde	416	1	2.4
Sollefteå	274	2	7.3
Sophiahemmet	205	1	4.9
Spenshult	728	3	4.1
Sunderby	3	0	0.0
Sundsvall	294	1	3.4
Södersjukhuset	766	11	14.4
Södertälje	279	3	10.8
Torsby	346	5	14.5
Trelleborg	1,943	15	7.7
Uddevalla	539	8	14.8
Umeå	349	13	37.2
Varberg	470	5	10.6
Visby	237	3	12.7
Värnamo	406	5	12.3
Västervik	299	1	3.3
Västerås	738	11	14.9
Växjö	304	2	6.6
Ängelholm	563	3	5.3
Örebro	148	0	0.0
Örnsköldsvik	293	6	20.5
Östersund	407	8	19.7
The Ccountry	35,804	327	9.1

Other adverse medical events within 90 days. (DM)

Hospital (men & women)	Surgeries	Events	Risk/1000
Akademiska sjukhuset	246	6	24.4
Alingsås	594	6	10.1
Art Clinic Jönköping	22	0	0.0
Arvika	425	3	7.1
Bollnäs	910	4	4.4
Borås	239	7	29.3
Carlanderska	352	1	2.8
Danderyd	388	13	33.5
Eksjö-Nässjö	526	10	19.0
Elisabethkliniken	111	1	9.0
Enköping	1,068	14	13.1
Eskilstuna	101	2	19.8
Falun	994	13	13.1
Frölunda Spec.	356	0	0.0
Gothenburg Med Center	273	0	0.0
Gällivare	229	1	4.4
Gävle	355	11	31.0
Halmstad	642	13	20.2
Helsingborg	73	1	13.7
Huddinge	369	2	5.4
Hudiksvall	197	4	20.3
Hässleholm	1,790	32	17.9
Jönköping	460	8	17.4
Kalmar	247	5	20.2
Karlshamn	706	7	9.9
Karlskoga	385	3	7.8
Karlstad	441	7	15.9
Karolinska	284	9	31.7
Kullbergska sjukhuset	636	7	11.0
Kungälv	447	3	6.7
Lidköping	531	10	18.8
Lindesberg	526	0	0.0
Ljungby	314	5	15.9
Luleå-Sensia	9	0	0.0
Lund	143	4	28.0
Lycksele	224	8	35.7
Löwenströmska	1,209	7	5.8
Malmö	9	0	0.0
Mora	499	1	2.0
Motala	1,305	9	6.9
Movement Halmstad	650	4	6.2
Mölndal	645	5	7.8
Nacka-Proxima/Aleris	372	0	0.0
Norrköping	397	15	37.8
Norrtälje	211	6	28.4
Nyköping	244	3	12.3
Ortopediska huset	1,162	2	1.7
Oskarshamn	754	14	18.6
Piteå	790	9	11.4
S:t Göran	946	16	16.9
Sabbatsberg	386	1	2.6
Skellefteå	273	3	11.0
Skene	331	8	24.2
Skövde	416	3	7.2
Sollefteå	274	3	10.9
Sophiahemmet	205	1	4.9
Spenshult	728	1	1.4
Sunderby	3	0	0.0
Sundsvall	294	7	23.8
Södersjukhuset	766	17	22.2
Södertälje	279	4	14.3
Torsby	346	4	11.6
Trelleborg	1,943	19	9.8
Uddevalla	539	12	22.3
Umeå	349	16	45.8
Varberg	470	8	17.0
Visby	237	4	16.9
Värnamo	406	10	24.6
Västervik	299	3	10.0
Västerås	738	3	4.1
Växjö	304	7	23.0
Ängelholm	563	4	7.1
Örebro	148	1	6.8
Örnsköldsvik	293	14	47.8
Östersund	407	10	24.6
The Ccountry	35,804	474	13.2

Death within 90 days

Hospital (men & women)	Surgeries	Events	Risk/1000
Akademiska sjukhuset	246	0	0.0
Alingsås	594	0	0.0
Art Clinic Jönköping	22	0	0.0
Arvika	425	0	0.0
Bollnäs	910	0	0.0
Borås	239	2	8.4
Carlanderska	352	0	0.0
Danderyd	388	1	2.6
Eksjö-Nässjö	526	3	5.7
Elisabethkliniken	111	0	0.0
Enköping	1,068	1	0.9
Eskilstuna	101	1	9.9
Falun	994	5	5.0
Frölunda Spec.	356	1	2.8
Gothenburg Med Center	273	0	0.0
Gällivare	229	1	4.4
Gävle	355	2	5.6
Halmstad	642	0	0.0
Helsingborg	73	3	41.1
Huddinge	369	1	2.7
Hudiksvall	197	0	0.0
Hässleholm	1,790	4	2.2
Jönköping	460	0	0.0
Kalmar	247	1	4.0
Karlshamn	706	2	2.8
Karlskoga	385	2	5.2
Karlstad	441	1	2.3
Karolinska	284	0	0.0
Kullbergska sjukhuset	636	2	3.1
Kungälv	447	0	0.0
Lidköping	531	0	0.0
Lindesberg	526	1	1.9
Ljungby	314	0	0.0
Luleå-Sensia	9	0	0.0
Lund	143	0	0.0
Lycksele	224	0	0.0
Löwenströmska	1,209	1	0.8
Malmö	9	0	0.0
Mora	499	1	2.0
Motala	1,305	1	0.8
Movement Halmstad	650	0	0.0
Mölndal	645	1	1.6
Nacka-Proxima/Aleris	372	0	0.0
Norrköping	397	0	0.0
Norrtälje	211	1	4.7
Nyköping	244	2	8.2
Ortopediska huset	1,162	1	0.9
Oskarshamn	754	1	1.3
Piteå	790	3	3.8
S:t Göran	946	2	2.1
Sabbatsberg	386	0	0.0
Skellefteå	273	0	0.0
Skene	331	0	0.0
Skövde	416	2	4.8
Sollefteå	274	0	0.0
Sophiahemmet	205	0	0.0
Spenshult	728	0	0.0
Sunderby	3	0	0.0
Sundsvall	294	0	0.0
Södersjukhuset	766	1	1.3
Södertälje	279	1	3.6
Torsby	346	0	0.0
Trelleborg	1,943	4	2.1
Uddevalla	539	0	0.0
Umeå	349	0	0.0
Varberg	470	0	0.0
Visby	237	0	0.0
Värnamo	406	0	0.0
Västervik	299	1	3.3
Västerås	738	0	0.0
Växjö	304	0	0.0
Ängelholm	563	0	0.0
Örebro	148	0	0.0
Örnsköldsvik	293	1	3.4
Östersund	407	2	4.9
The Ccountry	35,804	60	1.7

All adverse events within 90 days (incl. death)

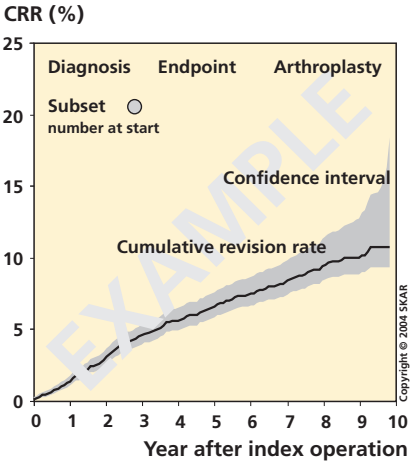
Hospital (men & women)	Surgeries	Events	Risk/1000
Akademiska sjukhuset	246	22	89.4
Alingsås	594	16	26.9
Art Clinic Jönköping	22	0	0.0
Arvika	425	20	47.1
Bollnäs	910	31	34.1
Borås	239	22	92.1
Carlanderska	352	2	5.7
Danderyd	388	31	79.9
Eksjö-Nässjö	526	40	76.0
Elisabethkliniken	111	4	36.0
Enköping	1,068	106	99.3
Eskilstuna	101	10	99.0
Falun	994	61	61.4
Frölunda Spec.	356	6	16.9
Gothenburg Med Center	273	2	7.3
Gällivare	229	9	39.3
Gävle	355	29	81.7
Halmstad	642	51	79.4
Helsingborg	73	8	109.6
Huddinge	369	23	62.3
Hudiksvall	197	13	66.0
Hässleholm	1,790	100	55.9
Jönköping	460	20	43.5
Kalmar	247	15	60.7
Karlshamn	706	51	72.2
Karlskoga	385	16	41.6
Karlstad	441	35	79.4
Karolinska	284	38	133.8
Kullbergska sjukhuset	636	37	58.2
Kungälv	447	28	62.6
Lidköping	531	34	64.0
Lindesberg	526	18	34.2
Ljungby	314	22	70.1
Luleå-Sensia	9	1	111.1
Lund	143	12	83.9
Lycksele	224	25	111.6
Löwenströmska	1,209	32	26.5
Malmö	9	0	0.0
Mora	499	18	36.1
Motala	1,305	85	65.1
Movement Halmstad	650	23	35.4
Mölndal	645	22	34.1
Nacka-Proxima/Aleris	372	11	29.6
Norrköping	397	34	85.6
Norrtälje	211	19	90.0
Nyköping	244	8	32.8
Ortopediska huset	1,162	41	35.3
Oskarshamn	754	78	103.4
Piteå	790	46	58.2
S:t Göran	946	64	67.7
Sabbatsberg	386	5	13.0
Skellefteå	273	14	51.3
Skene	331	20	60.4
Skövde	416	17	40.9
Sollefteå	274	13	47.4
Sophiahemmet	205	8	39.0
Spenshult	728	26	35.7
Sunderby	3	0	0.0
Sundsvall	294	26	88.4
Södersjukhuset	766	84	109.7
Södertälje	279	23	82.4
Torsby	346	13	37.6
Trelleborg	1,943	65	33.5
Uddevalla	539	34	63.1
Umeå	349	73	209.2
Varberg	470	32	68.1
Visby	237	18	75.9
Värnamo	406	30	73.9
Västervik	299	19	63.5
Västerås	738	43	58.3
Växjö	304	24	78.9
Ängelholm	563	23	40.9
Örebro	148	4	27.0
Örnsköldsvik	293	31	105.8
Östersund	407	43	105.7
The Ccountry	35,804	2,127	59.4

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.

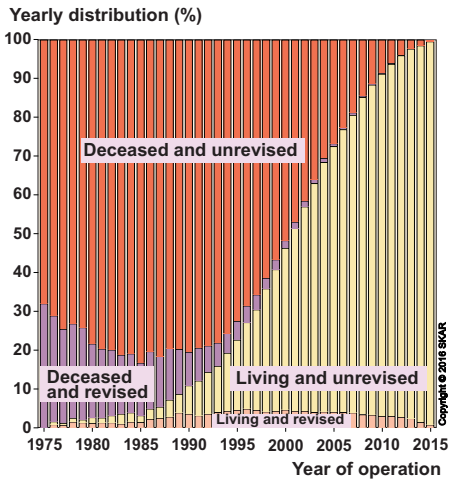
Cox regression allows for taking into account different factors that may vary within groups. The results are expressed as risk ratios (RR) between factors. If a factor is a category (e.g. implant model), one category is defined as a reference with a risk of 1 to which the other categories are compared.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



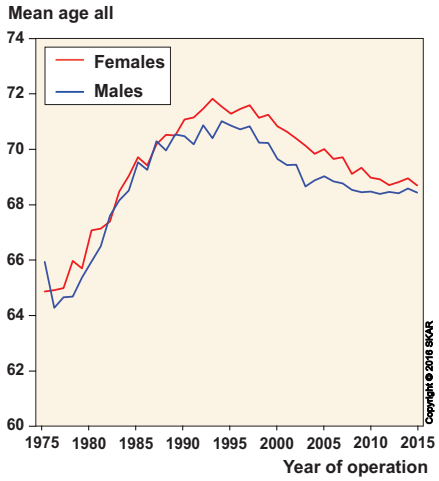
The present status for each yearly batch of patients operated since 1975.

Gender and age distribution

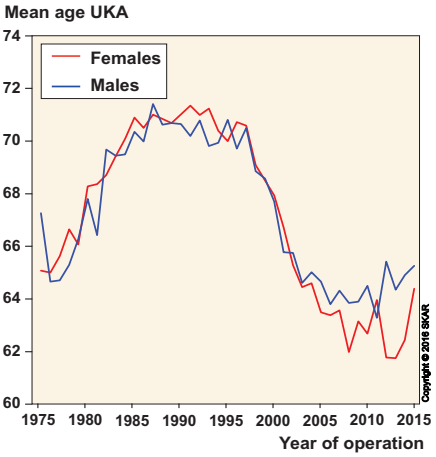
Between 1975 and 1994, the mean age at primary operation increased from 65 years to almost 72 years. The main reason was a relatively large increase in number of operations among the older age groups. Probable explanations are improvements in anesthetic techniques as well as a changed age distribution 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 2015 was 68.6 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, in the late nineties the mean age at UKA surgery fell 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.

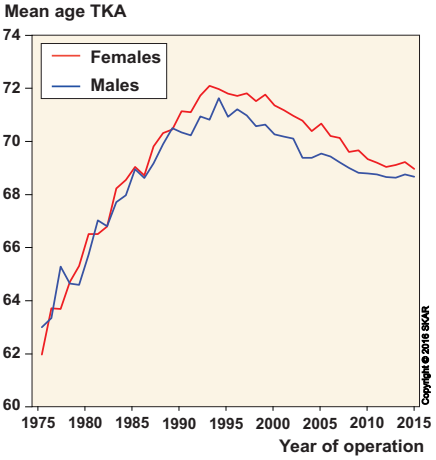
When comparing a series of patients operated on during different periods, the changes in the mean age make it necessary to account for age by use of regression or to analyze different age groups separately.



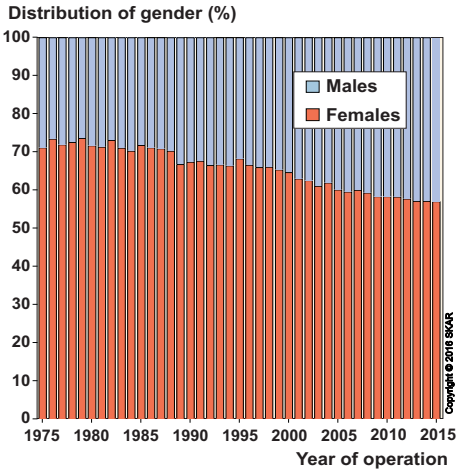
The mean age of patients at surgery (all types of implants) increased until the mid-nineties when it started to decrease.



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



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



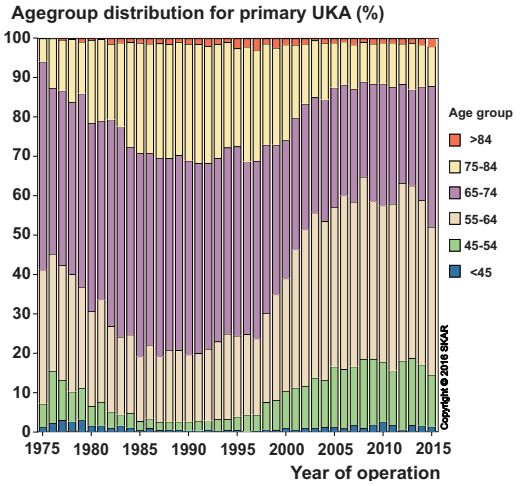
The proportion of males has increased slightly over the years.

Knee arthroplasty is more common in females than in males. At the start of the registration, females accounted for about 70% of the operations. As the figure above shows, the proportion of men has been slowly increasing and at present they account for 43%. Separate analyses of OA and RA show that it is mainly in OA that the proportion of men has increased. In RA men account only for one fourth of the operations and the proportion has not changed.

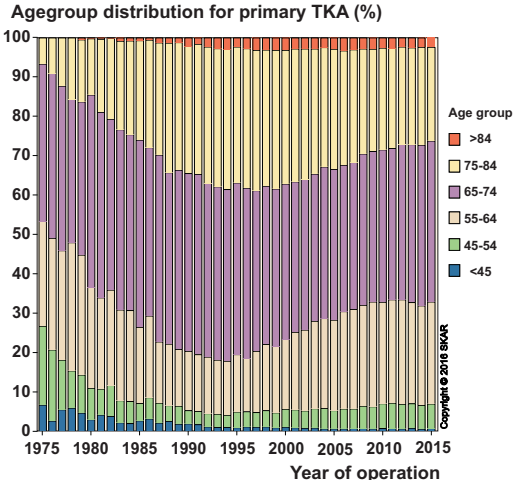
The figure to the right shows the relative number of operations performed in the different age groups over a period of thirty five years. In a somewhat different manner than the mean age (previous page) it shows how the relative proportion of the older groups increased until the mid-nineties after which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

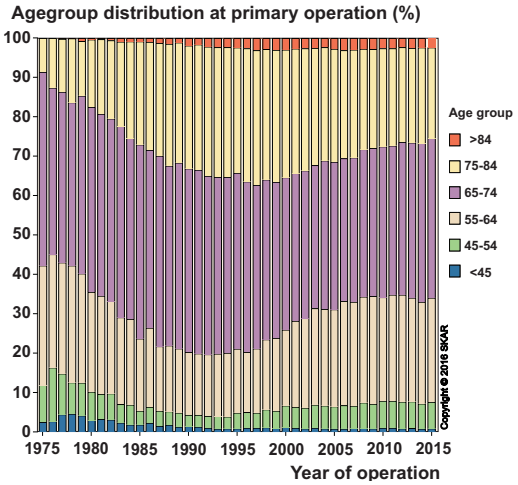
In UKA the relative proportion of patients less than 65 years of age doubled during 1998-2002, i.e. during the time when mini-invasive surgery caught on in Sweden. However, it has to be kept in mind that the actual number of UKA´s is now less than half of what it was in 1998 while the number of TKA has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



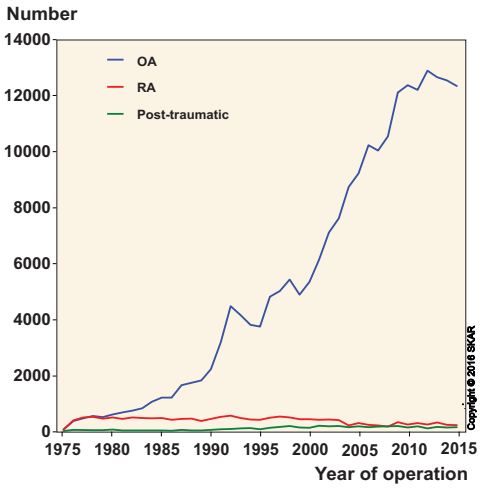
The relative distribution of primary UKA arthroplasties among different age groups.



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).



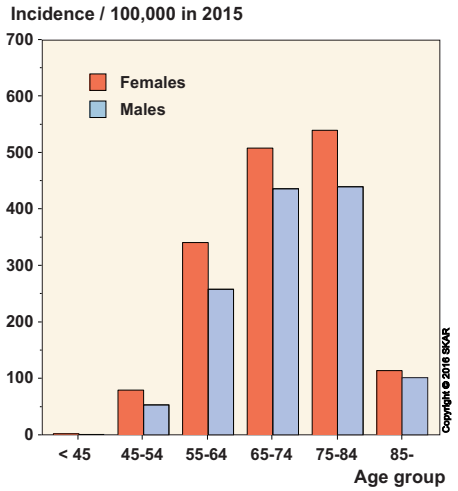
The yearly number of arthroplasties for different diagnoses

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.

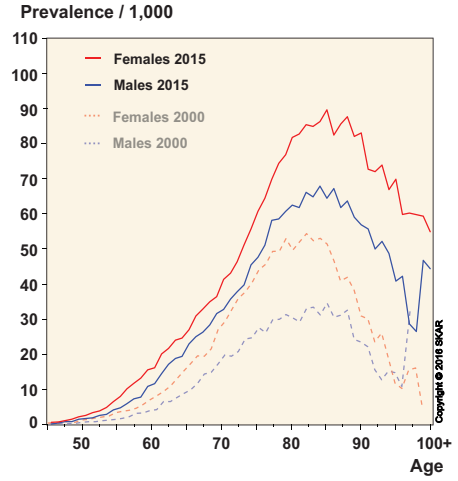
Incidence and prevalence

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.

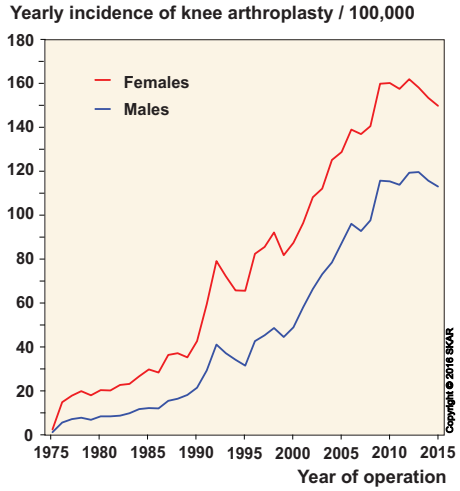
The figure below shows the incidence among different age groups during 2015. It peeks among those between 65 and 84 years of age. At this age, knee arthroplasty is 7.5 times more common than among those 45-54 years old and 4.5 times more common than among those 85 years or older. In 2015, women were overrepresented in all the age groups. A table showing the incidence for the different age groups can be found on page 18.



Incidence of primary knee arthroplasty in 2015 per 100,000 inhabitants (males and females) in the different age groups.



The prevalence of knee arthroplasty in 2000 and 2015. 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, i.e. the number of patients per 1,000 inhabitants in different age groups that were alive with at least one knee implant. As a quarter of the patients have bilateral implants the prevalence of implants is higher than that of patients.

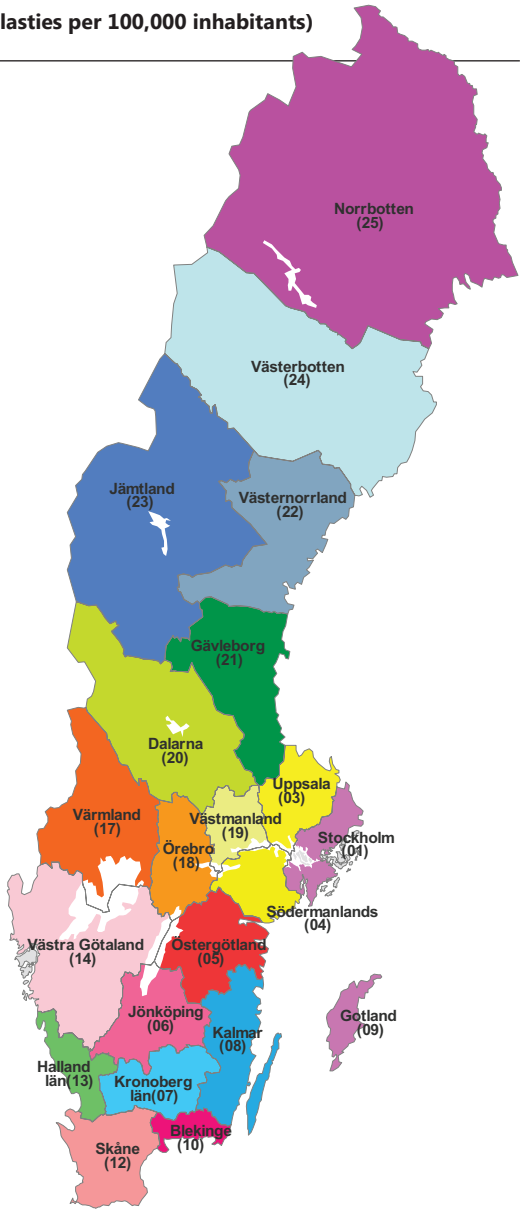
For both men and women in 2015, the prevalence peaks around 80-85 years of age at which 9% of the women and almost 7% of the men had at least one knee arthroplasty. Comparing the prevalence in 2015 with that in 2000, it can be seen that it has increased in all age groups. The fact that a large proportion 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 2009-2015 (knee arthroplasties per 100,000 inhabitants)

County and number of inhabitants 2015

No	County	Inhabitants
01	Stockholm	2,214,742
03	Uppsala	351,553
04	Södermanland	282,189
05	Östergötland	443,883
06	Jönköping	346,050
07	Kronoberg	190,249
08	Kalmar	236,639
09	Gotland	57,323
10	Blekinge	155,205
12	Skåne	1,296,268
13	Halland	312,725
14	Västra,Götaland	1,640,347
17	Värmland	275,298
18	Örebro	289,581
19	Västmanland	262,990
20	Dalarna	279,966
21	Gävleborg	280,903
22	Västernorrland	243,479
23	Jämtland	127,071
24	Västerbotten	262,870
25	Norrbotten	249,860

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



Knee arthroplasties per 100,000 inhabitants

County	2009	2010	2011	2012	2013	2014	2015
01 Stockholm	112.0	106.2	106.2	103.6	105.0	99.7	93.4
03 Uppsala	135.3	144.4	136.1	154.6	174.3	142.9	161.0
04 Södermanland	181.9	155.2	152.8	153.5	157.5	162.3	145.6
05 Östergötland	169.1	166.2	146.2	157.3	154.2	135.0	132.7
06 Jönköping	151.6	131.1	142.6	169.0	147.6	172.4	153.7
07 Kronoberg	145.6	148.2	124.3	158.7	115.3	149.4	154.5
08 Kalmar	167.4	146.8	155.2	168.9	175.9	167.0	172.4
09 Gotland	162.8	166.0	249.6	164.1	178.3	134.6	106.4
10 Blekinge	153.5	155.0	168.5	178.8	177.7	161.6	165.6
12 Skåne	122.4	117.3	122.2	125.6	137.1	142.6	144.1
13 Halland	177.8	155.3	150.0	178.3	165.6	168.7	155.7
14 Västra.Götaland	127.3	140.0	138.9	132.0	130.6	120.1	126.7
17 Värmland	188.4	172.7	170.3	179.2	180.3	195.8	184.2
18 Örebro	140.5	138.4	125.7	146.3	120.3	116.8	105.0
19 Västmanland	129.7	140.0	130.6	156.3	125.8	134.8	107.2
20 Dalarna	153.2	208.9	219.6	217.0	231.4	199.5	174.7
21 Gävleborg	166.6	192.1	173.4	192.1	188.6	213.6	206.1
22 Västernorrland	136.1	183.7	143.6	145.4	140.9	132.3	140.9
23 Jämtland	180.6	161.0	162.1	174.3	138.5	95.6	120.4
24 Västerbotten	152.2	145.2	119.9	122.3	126.2	117.7	117.2
25 Norrbotten	144.0	122.2	149.7	166.5	150.2	131.0	120.5
The whole country	137.9	137.9	135.8	140.8	139.0	134.6	131.5

Information on domicile is by the Swedish Tax Agency
For age-standardized incidence in 2015, see page 33

The incidence in the counties 2009-2015 (knee arthroplasties per 100,000 inhabitants)

Incidence for women

County	2009	2010	2011	2012	2013	2014	2015
01 Stockholm	135.3	128.7	128.8	130.0	123.1	113.5	106.6
03 Uppsala	163.3	185.9	154.1	178.0	193.1	170.6	185.0
04 Södermanland	180.7	164.2	178.0	179.7	181.2	185.2	155.1
05 Östergötland	206.6	185.1	163.8	182.1	172.5	159.9	156.4
06 Jönköping	184.9	152.5	174.3	202.9	174.4	202.1	176.1
07 Kronoberg	168.8	183.5	147.8	183.1	148.4	165.6	168.3
08 Kalmar	192.2	158.1	148.9	209.0	201.2	193.1	200.6
09 Gotland	194.2	204.2	273.4	159.2	208.1	128.5	114.5
10 Blekinge	167.5	168.7	188.5	188.9	187.5	182.3	168.9
12 Skåne	145.2	131.0	140.8	140.1	154.1	166.0	169.0
13 Halland	182.6	182.2	172.8	197.8	188.4	186.6	173.0
14 Västra.Götaland	146.8	162.1	160.3	147.0	148.2	133.4	145.0
17 Värmland	208.7	214.8	182.2	201.4	190.1	234.2	205.2
18 Örebro	155.9	162.4	152.0	158.4	129.6	135.7	127.7
19 Västmanland	146.4	158.3	151.1	173.6	140.3	157.5	126.5
20 Dalarna	161.5	233.7	248.3	242.1	260.7	222.4	195.0
21 Gävleborg	200.4	207.5	198.2	208.4	206.4	232.6	221.4
22 Västernorrland	164.9	235.1	173.1	163.6	164.6	149.7	154.4
23 Jämtland	216.0	205.2	212.0	204.7	179.4	107.9	153.6
24 Västerbotten	178.8	161.4	141.0	150.1	151.4	131.7	136.7
25 Norrbotten	165.2	137.0	183.8	190.6	170.8	150.2	141.3
The whole country	160.0	160.3	157.6	162.0	158.3	153.6	150.0

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 received, irrespective of if the surgery was performed in their home county or elsewhere. While the calculations do not consider differences in the age distribution, age-standardized calculations for the year 2015 can be found on page 33.

The calculations are based on information from the Swedish tax authorities concerning 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	2009	2010	2011	2012	2013	2014	2015
01 Stockholm	88.2	83.2	83.1	76.7	86.6	85.7	80.0
03 Uppsala	106.9	102.4	117.9	131.0	155.3	115.0	136.9
04 Södermanland	183.1	146.1	127.3	127.0	133.7	139.3	136.2
05 Östergötland	131.9	147.5	128.7	132.6	136.1	110.3	109.3
06 Jönköping	118.3	109.5	110.9	135.2	120.8	143.0	131.6
07 Kronoberg	122.8	113.5	101.1	134.8	82.8	133.5	141.1
08 Kalmar	142.6	135.5	161.4	128.7	150.5	141.0	144.6
09 Gotland	130.8	127.0	225.4	169.1	148.0	140.7	98.2
10 Blekinge	139.9	141.7	149.2	169.1	168.1	141.4	162.4
12 Skåne	99.1	103.3	103.2	110.9	119.7	118.7	118.9
13 Halland	173.0	128.1	127.0	158.6	142.7	150.8	138.4
14 Västra.Götaland	107.8	117.8	117.4	116.9	113.0	106.8	108.5
17 Värmland	168.1	130.5	158.4	156.9	170.5	157.4	163.2
18 Örebro	124.8	114.0	99.0	134.0	110.9	97.9	82.3
19 Västmanland	112.8	121.7	109.9	139.0	111.2	112.1	88.0
20 Dalarna	144.9	184.1	191.1	191.9	202.3	176.8	154.6
21 Gävleborg	132.8	176.7	148.5	175.8	170.8	194.7	190.9
22 Västernorrland	107.2	132.0	114.0	127.2	117.2	115.1	127.5
23 Jämtland	145.2	116.8	112.2	143.9	97.9	83.4	87.6
24 Västerbotten	125.8	129.2	98.9	94.9	101.4	103.8	98.0
25 Norrbotten	123.4	107.7	116.5	143.3	130.3	112.4	100.4
The whole country	115.7	115.4	113.8	119.4	119.7	115.7	113.0

Information on domicile is by the Swedish Tax Agency

Incidence in different age groups over time (number of arthroplasties/100,000 inhabitants)

Women

Age group	1976-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015
<45	1.0	0.9	1.0	1.3	1.8	1.8	2.5	2.2
45-54	13.6	11.1	14.4	24.3	45.0	69.1	89.5	79.7
55-64	41.8	54.2	96.5	127.3	181.4	271.6	331.9	341.1
65-74	87.3	146.3	283.7	358.4	445.3	551.5	548.3	508.1
75-84	59.2	131.0	285.3	365.1	448.3	567.3	614.2	539.7
>84	5.0	14.4	51.8	76.1	87.2	118.6	117.4	114.2
Total	20.2	33.3	64.0	81.5	106.1	141.2	158.3	150.0

Men

Age group	1976-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015
<45	0,4	0,4	0,5	0,6	0,8	1,4	1,5	1,4
45-54	5.5	4.6	7.8	12.3	26.7	43.4	51.2	53.5
55-64	18.7	24.7	60.9	75.4	132.6	206.0	266.7	258.3
65-74	38.4	73.7	165.4	222.2	312.6	432.4	453.0	435.7
75-84	29.7	78.2	183.2	231.4	311.4	438.1	492.0	438.4
>84	5.0	19.6	45.2	68.5	82.5	122.5	118.7	100.8
Total	8.0	14.6	32.6	42.4	65.0	98.0	116.8	113.0

Number of primary arthroplasties per unit and year

Hospital	1975-2010	2011	2012	2013	2014	2015	Totalt	Percent
Akademiska sjukhuset	2,725	79	108	90	86	109	3,197	1.3
Alingsås	1,624	189	193	214	204	193	2,617	1.1
Art Clinic Göteborg	.	.	.	.	.	16	16	0
Art Clinic Jönköping	.	.	8	2	13	29	52	0
Arvika	1,235	167	156	129	193	171	2,051	0.9
Avesta	67	.	.	.	.	.	67	0
Boden	1,622	.	.	.	.	.	1,622	0.7
Bollnäs	2,495	305	327	305	402	353	4,187	1.7
Borås	2,612	126	103	91	78	72	3,082	1.3
Carlanderska	250	162	126	108	137	136	919	0.4
Dalslands Sjukhus	81	.	.	.	.	.	81	0
Danderyd	2,851	192	200	196	185	183	3,807	1.6
Eksjö-Nässjö (Höglandssjukh.)	2,598	155	182	173	211	202	3,521	1.5
Elisabethkliniken	656	55	58	58	7	1	835	0.3
Enköping	1,825	329	342	415	373	393	3,677	1.5
Eskilstuna	1,778	40	32	43	41	38	1,972	0.8
Fagersta	71	.	.	.	.	.	71	0
Falköping	1,688	.	.	.	.	.	1,688	0.7
Falun	4,140	351	356	364	356	205	5,772	2.4
Frölunda Spec.	951	116	121	120	120	124	1,552	0.6
Gällivare	1,269	81	79	94	68	46	1,637	0.7
Gävle	2,995	96	155	164	129	132	3,671	1.5
Halmstad	2,697	201	241	232	190	186	3,747	1.6
Helsingborg	1,741	20	15	21	44	66	1,907	0.8
Huddinge	2,533	130	150	147	166	159	3,285	1.4
Hudiksvall	1,412	88	79	73	60	87	1,799	0.7
Hässleholm	6,117	666	664	698	683	645	9 473	3.9
Jönköping	2,434	168	173	167	168	141	3,251	1.3
Kalix	215	.	.	.	.	.	215	0.1
Kalmar	2,352	105	93	106	91	89	2,836	1.2
Karlshamn	2,321	248	264	260	242	249	3,584	1.5
Karlskoga	1,658	101	143	129	124	124	2,279	0.9
Karlskrona	1,118	.	.	.	.	.	1,118	0.5
Karlstad	3,762	176	168	192	193	182	4,673	1.9
Karolinska	2,304	108	128	140	101	93	2,874	1.2
Kristianstad	1,297	.	.	.	.	1	1,298	0.5
Kristinehamn	252	.	.	.	.	.	252	0.1
Kullbergska sjukhuset	1,888	229	228	228	201	157	2,931	1.2
Kungsbacka	38	.	.	.	.	.	38	0

(cont.)

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

Hospital	1975-2010	2011	2012	2013	2014	2015	Total	Percent
Kungälv	1,682	175	142	155	197	215	2,566	1.1
Köping	1,605	.	.	.	.	.	1,605	0.7
Landskrona	1,918	.	.	.	.	.	1,918	0.8
Lidköping	1,592	169	196	200	199	234	2,590	1.1
Lindesberg	1,633	157	199	192	172	162	2,515	1
Linköping	1,735	.	.	.	.	.	1,735	0.7
Linköping medical cent	15	.	.	.	.	.	15	0
Ljungby	1,537	119	136	81	150	142	2,165	0.9
Ludvika	339	.	.	.	.	.	339	0.1
Luleå	2	.	.	7	4	6	19	0
Lund	2,591	40	51	87	98	103	2,970	1.2
Lycksele	629	60	63	69	94	40	955	0.4
Löwenströmska *	2,245	442	432	443	403	431	4,396	1.8
Malmö	2,209	15	13	3	.	.	2,240	0.9
Mora	1,727	166	172	186	150	186	2,587	1.1
Motala	3,463	458	536	519	470	510	5,956	2.5
Movement Halmstad	985	275	222	218	250	431	2,381	1
Mölndal	1,815	266	206	237	297	383	3,204	1.3
Nacka	203	.	.	.	.	.	203	0.1
Nacka-Proxima	382	136	122	145	111	144	1,040	0.4
Norrköping	2,311	158	146	144	140	129	3,028	1.3
Norrtälje	1,134	81	89	74	85	94	1,557	0.6
Nyköping	1,464	120	124	79	100	101	1,988	0.8
OrthoCenter IFK klin. **	672	139	109	96	108	113	1,237	0.5
Ortopediska huset	2,925	347	375	390	418	459	4,914	2
Oskarshamn	2,230	239	263	260	268	275	3,535	1.5
Piteå	1,896	285	321	273	259	244	3,278	1.4
S:t Göran	6,630	367	347	400	387	424	8,555	3.5
Sabbatsberg (Aleris)	1,658	104	125	125	141	23	2,176	0.9
Sahlgrenska	1,535	8	2	1	4	2	1,552	0.6
Sala	115	.	.	.	.	.	115	0
Sandviken	301	.	.	.	.	.	301	0.1
Sergelkliniken	160	.	.	.	.	.	160	0.1
Simrishamn	1,021	.	.	.	.	.	1,021	0.4
Skellefteå	1,272	98	90	97	107	119	1,783	0.7
Skene	1,308	106	139	135	104	97	1,889	0.8
Skövde	2,600	186	206	145	115	120	3,372	1.4
Sollefteå	1,203	102	103	97	89	93	1,687	0.7
Sophiahemmet	1,390	74	112	121	98	136	1,931	0.8
Spenshult	551	238	331	330	155	.	1,605	0.7
Sunderby	391	4	3	.	.	.	398	0.2
Sundsvall	2,702	118	123	114	95	44	3,196	1.3
Säffle	484	.	.	.	.	.	484	0.2
Söderhamn	279	.	.	.	.	.	279	0.1
Södersjukhuset	4,339	325	285	270	317	280	5,816	2.4
Södertälje	1,267	121	87	88	110	113	1,786	0.7
Torsby	1,440	80	121	131	114	129	2,015	0.8
Trelleborg	5,139	608	673	707	759	791	8,677	3.6
Uddevalla	3,365	186	166	229	207	187	4,340	1.8
Umeå	2,603	165	160	155	102	146	3,331	1.4
Varberg	2,574	167	206	173	149	127	3,396	1.4
Visby	1,284	114	93	88	70	60	1,709	0.7
Vänersborg-NÄL	939	.	.	.	.	.	939	0.4
Värnamo	1,829	113	137	142	163	148	2,532	1.1
Västervik	1,747	97	114	113	94	90	2,255	0.9
Västerås	2,470	280	309	256	246	173	3,734	1.5
Växjö	2,031	97	141	98	109	115	2,591	1.1
Ystad	1,169	.	.	.	.	.	1,169	0.5
Ängelholm	1,929	162	172	201	233	220	2,917	1.2
Örebro	3,173	117	72	51	54	30	3,497	1.5
Örnsköldsvik	1,887	107	102	112	88	115	2,411	1
Östersund	1,968	166	182	164	106	120	2,706	1.1
Östra sjukhuset	2,100	.	.	.	.	.	2,100	0.9
Total	**175,464**	**12,840**	**13,410**	**13,360**	**13,055**	**12,886**	**241,015**	**100**

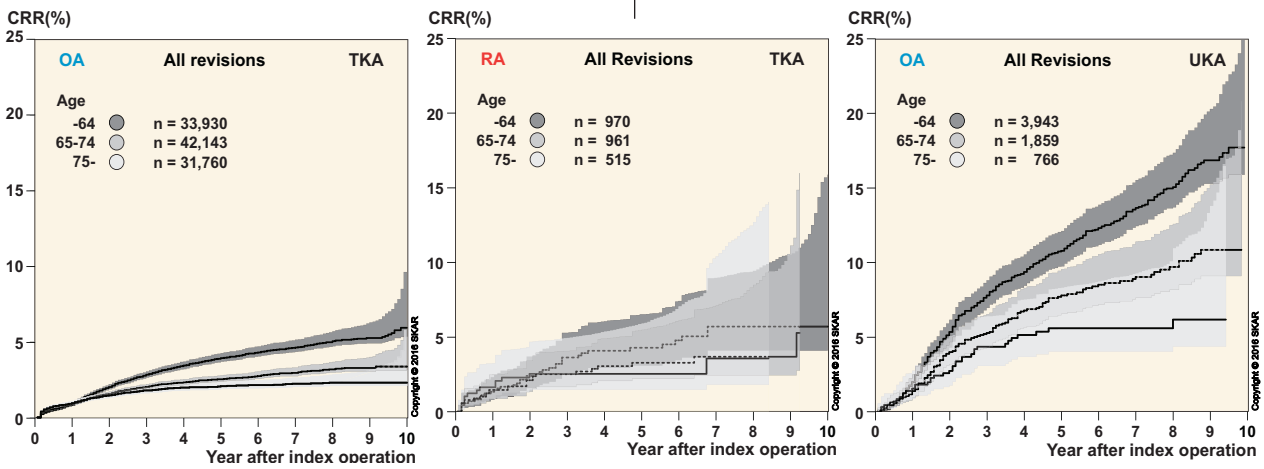
* Lövenströmska was replaced by Stockholms Specialistvård in 2001 and OrthoCenter Stockholm in 2008.

** 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 14) making statistical differences more difficult to detect.

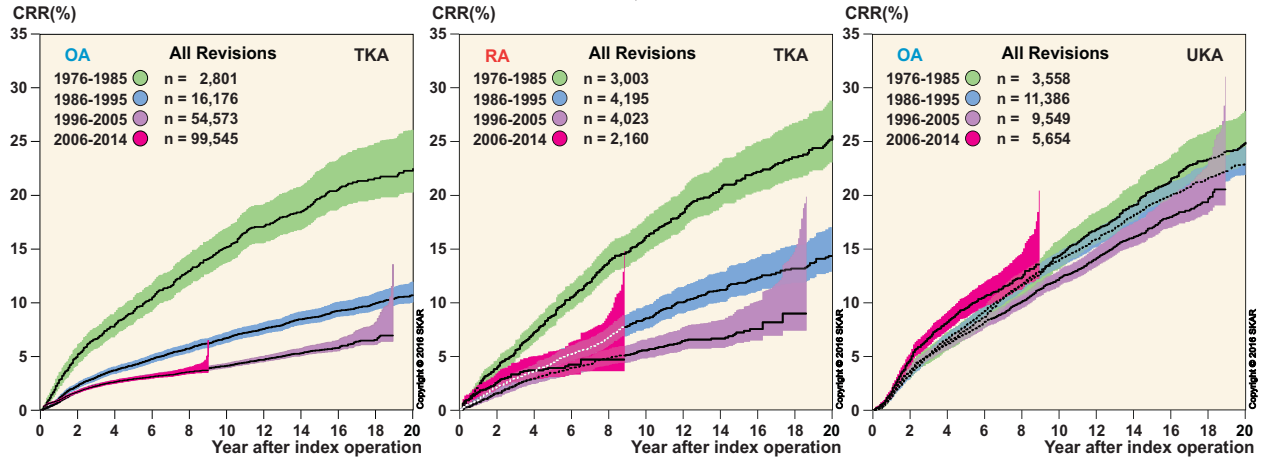
Age – By dividing patients into separate age groups one can see the large effect that age has on the revision rate both in TKA and UKA. One can only speculate in the reasons for this effect. Possible explanations are that the younger have higher physical activity, higher expectancy of pain relief and a health condition allowing for revision surgery. Irrespective of the type of implant, the risk of revision increases with decreasing age.



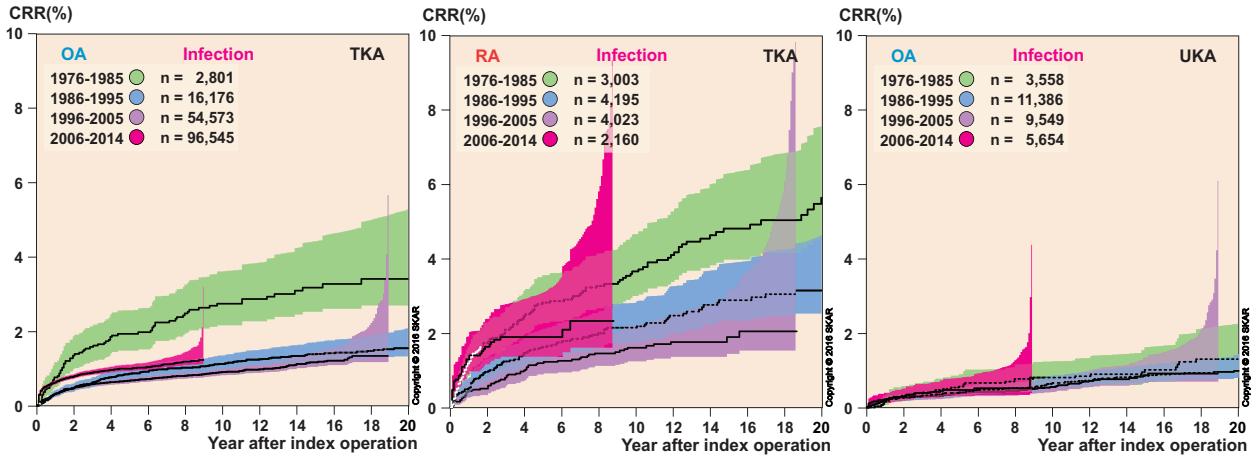
The CRR (2005–2014) for the 3 age groups <65, 65–75, >75 show for TKA (OA & RA) and UKA/OA increasing risk with decreasing age. E.g., younger than 65 have 1.8 times the risk of those over 75 in TKA/OA, 1.5 times in TKA/RA and 2.3 times the risk in UKA/OA.

Year of operation – For TKA, the risk of revision has decreased over time which not has been as apparent for UKA. However, when using Cox regression we find for TKA/RA that the risk has increased in 2006-2014 as compared to 1996-2005. The reason for this is mainly an increase in revisions for early infections (see next page).

The same is not true for UKA for which the reason for the graph showing a higher CRR in the period 2006-2014 is mainly that the proportion of younger patient has increased during the recent years which is adjusted for in the regression but not in the graph which shows the cumulative revision rate without adjusting for age.



Comparing the CRR of different time periods, one finds for TKA, that the revision rate has decreased over time. However, for RA the risk is higher during 2006-2014 than the previous period (Cox). The reason for the increase in CRR after UKA in 2006-2014 is mainly an increase in the proportion of younger patients having UKA in recent years and that age is not adjusted for in the figures..



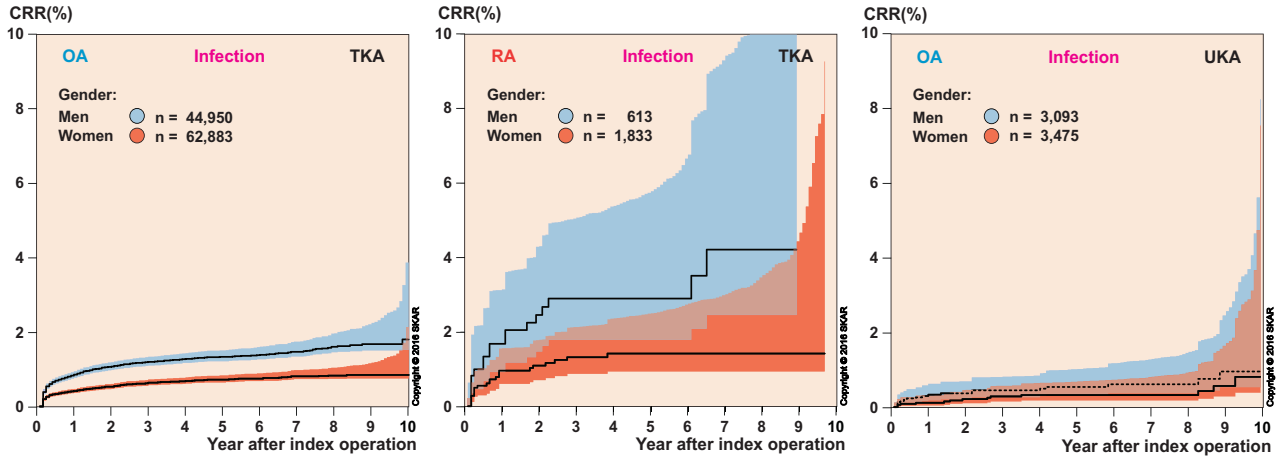
Comparing the CRR, using only revision for infection as end-point, we find an improvement with time for both TKA and UKA. However, in TKA (OA & RA) the risk has invreased in 2006-2014 as compared to the period 1996-2005.

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 2006-2014 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.

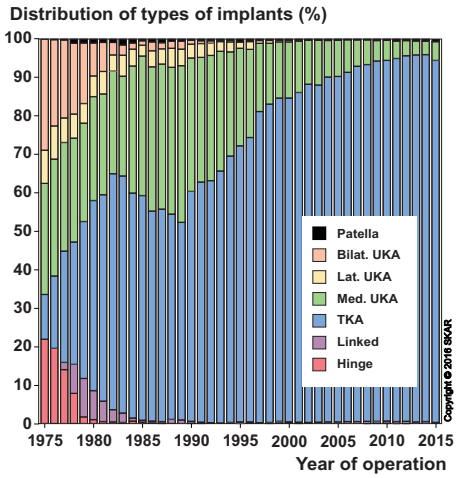
Gender – Using Cox Regression, we have hitherto not been able to find significant gender differences in the CRR (all revisions) neither for TKA nor UKA. This year, for 2005-2014 we find a higher risk for men (RR 1.1) that is caused by men having a considerably higher risk of being revised for infection (see figures below), irrespective of if change of inlay is 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. That the 10-year risk n spite of this is similar for the genders is partly explained by women more often being revised for instability and early loosening.



Using the end-point; revision for infection, the CRR (2005–2014) we find men having a higher risk than women (TKA/OA: RR 1.9 and TKA/RA: RR 2.6). In UKA which has a lower risk of infection men also have a tendency of higher risk than women although the difference is not significant for the current period. In TKA, patients with RA are more affected than those with OA (RR 2.1).

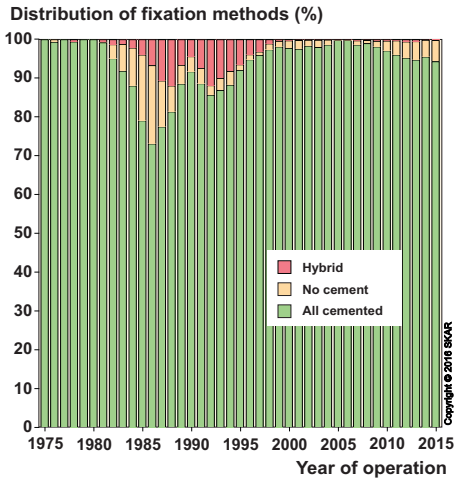
Type of implant – The modern condylar tricompartmental knee implant (TKA) was developed in the seventies when hinged and unicondylar implants were already available. When the register started in 1975, TKA had just been introduced in Sweden, which is the reason for hinges and uni's amounting for the larger 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 20). However, serious complications (infections/arthrodeses/amputations) are less common after UKA.



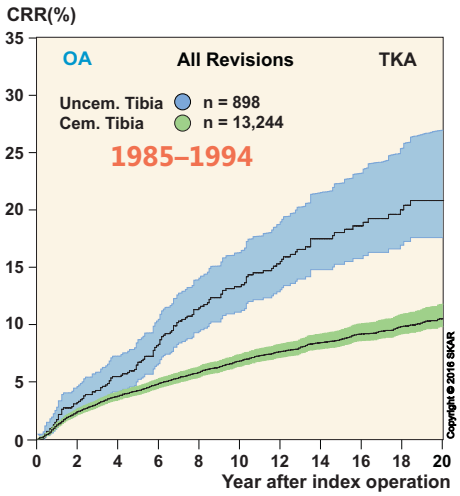
The relative yearly distribution of implant types used for primary surgery.

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 2014, the risk is higher for cases in which the tibial component was left uncemented (see figure right).



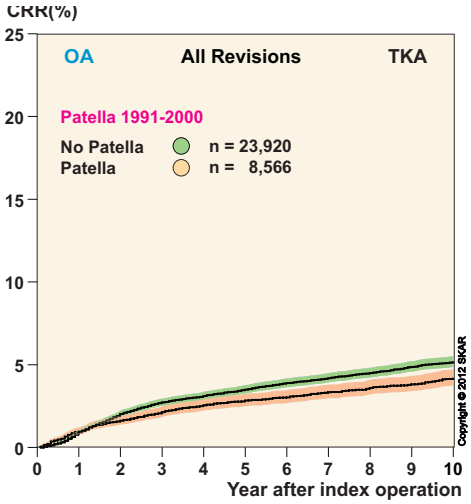
The relative yearly distribution regarding the use of cement for fixation.



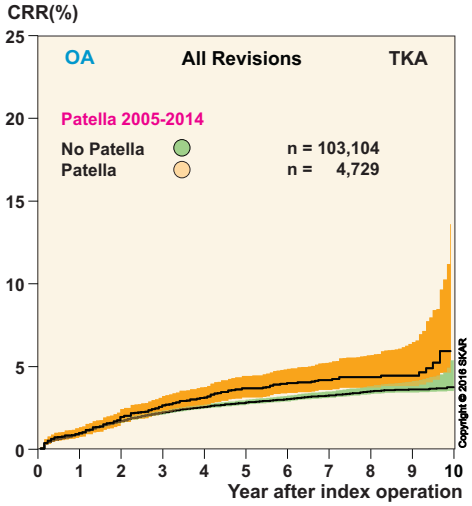
The CRR for TKA inserted 1985-1994 in which the tibial component was fixed with or without cement.
(note that in the 2015 report the y-scale was wrong (went to 25))

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.

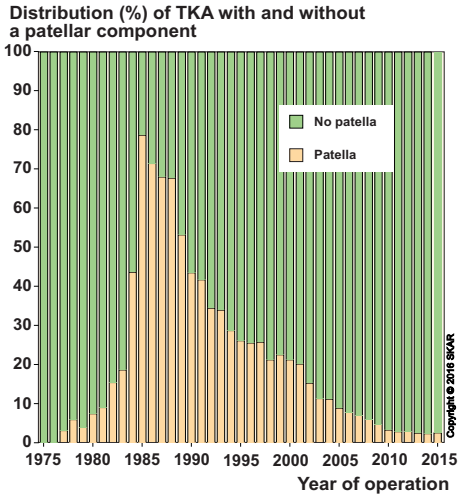
Patellar button in TKA – Estimating how the use of a patellar button affects the revision rate is complex. The use of a patellar button varies with the brand of prosthesis used and its use also has lessened in recent years. During the eighties, when patellar button was used in a good half of the cases, its use had a negative effect. Since then its use has diminished so that it was only used in 2.5% if the TKA cases in 2015 (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 2005-2014 (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 1.3 (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 44-47), 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 52-55), 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 (https://www.sundhed.dk/content/cms/99/4699_dkrrapport2015.pdf)) reports that a patellar button was used in 79% of TKA cases (2014) while it was only used in 3% of cases in Norway during 2015 according to the Norwegian arthroplasty register report (http://nrlweb.ihelse.net/Rapporter/Rapport2016.pdf). According to the 2015 annual report of the Australian Joint Replacement Registry (https://aoanjrr.sahmri.com/home), the use of a patellar button has increased in recent years from 41% of the TKA cases in 2005 to 59% in 2014. They also reported that compared to TKAs using a patellar button, TKAs without a button had 1.3 (1.3-1.4) times higher risk of becoming revised. 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 2015

Types of primary arthroplasties

	Number	Percent
Linked	38	0.3
TKA	12,134	94.2
UKA medially	631	4.9
UKA laterally	14	0.1
Fem-Pat	65	0.5
Partial (PRKA)	4	0.0
Total :	12,886	100

The TKA has become the standard treatment and in 2015 it accounted for 94% 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 2015 it was only used in 5% of the cases (fig. page 22). No PRKA (partial replacement knee arthroplasty) was reported in 2014 but four in 2014.

All 74 units performing elective knee arthroplasties reported to the registry during 2015. 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, 12,886 primaries had been reported for 2015 which is 0.9% less than at the same time in 2014 (13,000).

Implants for primary TKA

	Number	Percent
NexGen MBT	5,572	45.9
PFC-MBT	2,501	20.6
Triathlon	1,334	11.0
Vanguard	1,079	8.9
PFC-APT	914	7.5
Legion/GenII Prim	169	1.4
Genesis II	157	1.3
NexGen TM	150	1.2
Attune	26	0.2
PFC-RP	6	0.1
Link Gemini	6	0.1
NexGen APT	5	0.1
Others*	229	1.9
Totalt:	12,134	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 95% of all the TKA primaries. NexGen from Zimmer was used in almost half of the primaries while PFC from DePuy came second with a good quarter. Triathlon from Stryker and Vanguard from Biomet came in third and fourth. Profix that was had 28 cases in 2014 was not reported in 2015. The group "Others" mainly stands for revision models (see table right).

The use of UKA has diminished for years but in 2015, their use increased by 42% in 2015. The Oxford accounted for 64% of the cases while the proportion for Link diminished to 14%. In spite of the increase, UKAs only account for 5% of the primary cases.

Implants for primary UKA

	Number	Percent
Oxford	410	63.6
Link	91	14.1
ZUK	79	12.2
Sigma PKR	31	4.8
Triathlon PKR	29	4.5
Genesis	2	0.3
Ibalance	2	0.3
Missing	1	0.2
Total :	645	100

Ordinary TKA implants, used with stems longer than 5 cm on either side, are defined as being revision models. Together with specific revision brands they are not included in our survival analyses for TKA's as such implants are mainly used for difficult cases and not for typical OA cases.

Besides these revision models, 38 linked implants were used for primary arthroplasty in 2015, mainly rotating hinges for treatment of malignancies, fractures and other difficult cases.

Revision implants for primary TKA

	Antal	Procent
NexGen Revision	66	32.8
PFC Revision	66	32.8
Triathlon Revision	44	21.9
Vanguard Revision	14	7.0
Legion/Genesis Revision	11	5.5
Total :	201	100

916 revisions were reported in 2015 of which 227 were secondary (not the first revision). In 714 cases the primary was a TKA, in 168 it was an UKA, in 24 a linked implant and in 10 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 2014.

The most common implants in the counties in 2015

TKA in the counties

	Model 1	n	Model 2	n	Model 3	n	Other
01 Stockholm	NexGen	1,072	PFC Sigma	975	Triathlon	111	121
03 Uppsala	PFC Sigma	395	NexGen	105	Vanguard	1	1
04 Södermanland	PFC Sigma	191	Vanguard	58	NexGen	41	4
05 Östergötland	NexGen	424	Legion/Genesis	60	PFC Sigma	9	10
06 Jönköping	Vanguard	328	NexGen	141	Other	3	
07 Kronoberg	Vanguard	108	PFC Sigma	67	NexGen	16	14
08 Kalmar	NexGen	441	Other	9			
09 Gotland	PFC Sigma	58	Other	1			
10 Blekinge	Vanguard	136	NexGen	102	Other	2	
12 Skåne	Triathlon	1,210	PFC Sigma	282	NexGen	193	97
13 Halland	NexGen	708	Other	5			
14 Västra.Götaland	NexGen	923	PFC Sigma	478	Vanguard	371	33
17 Värmland	NexGen	476	Other	5			
18 Örebro	Genesis II	157	NexGen	147	Other	2	1
19 Västmanland	NexGen	167	Other	3			
20 Dalarna	NexGen	199	PFC Sigma	185	Other	5	
21 Gävleborg	PFC Sigma	519	NexGen	21	Link Gemini	3	1
22 Västernorrland	NexGen	246	Other	4			
23 Jämtland	NexGen	119	Other	1			
24 Västerbotten	NexGen	174	Legion/Genesis	106	Other	11	
25 Norrbotten	PFC Sigma	259	Triathlon	12	Other	4	3

The table above shows that in 2015. only 8 of 21 counties reported having used more than 2 ordinary TKA models used (revision models not counted) and that only a 3 counties used 3 models to a greater extent.

UKA in the counties

	Model 1	n	Model 2	n	Model 3	n	Other
01 Stockholm	Oxford	130	ZUK	46	Link	29	32
03 Uppsala	Oxford	1					
04 Södermanland	Link	2					
05 Östergötland	Oxford	127					
06 Jönköping	Link	24	Oxford	20	ZUK	4	
07 Kronoberg	Oxford	49					
08 Kalmar	Link	2					
09 Gotland							
10 Blekinge	Oxford	9					
12 Skåne	Link	18	Oxford	13	Triathlon PKR	8	
13 Halland	ZUK	13	Sigma PKR	8			
14 Västra.Götaland	Oxford	61	ZUK	10	Link	3	1
17 Värmland							
18 Örebro	ZUK	6					
19 Västmanland	Genesis	2	Triathlon PKR	1			
20 Dalarna							
21 Gävleborg	Link	11					
22 Västernorrland							
23 Jämtland							
24 Västerbotten	Link	2					
25 Norrbotten	Sigma PKR	13					

The table above shows that only 3 counties. Stockholm, Östergötland and Västra Götaland reported more than 50 UKA's in 2015. Three counties reported between 30 and 50 UKA's, ten counties between 1 and 21 and five counties reported no UKA procedures.

Bone cement and minimally invasive surgery in 2015

Use of cement in primary surgery

	Primary TKA	Primary UKA
No component without cement	11,408	393
Only the femoral component without cement	3	15
Only the tibial component without cement	20	4
The femur- and tibial components without cement	668	232
Unknown	35	1
Total	12,134	645

	Primary TKA		Primary UKA	
	Number	Percent	Number	Percent
Refobacin (gentamicin)	6,733	58.7	281	68.0
Palacos R+G (gentamicin)	4,302	37.5	109	26.4
Smartset GHV gentamycin	286	2.5	18	4.4
Cemex	103	0.9	3	0.7
Copal (genta+vanco)	4	0.0		
Refobacin Revision	4	0.0	1	0.2
Copal (genta+clinda	2	0.0		
CMW med Gentamicin	1	0.0		
Missing	31	0.3	1	0.2
Subtotal:	11,466	100	413	100
All parts without cement	668	5.5	232	36.0
Total	12,134		645	

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. Cementless fixation has again become slightly more common. It was used in 5.5% of the TKA's in 2015 while 0.2% were hybrids. In UKA the Oxford cementless version has become common and it was used cementless in 36% of the UKA's and as hybrid in 3%.
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 645 primary UKA

	Standard incision	Mini-incision	Missing
Oxford	129	279	2
Link	91		
ZUK	63	15	1
Sigma PKR	31		
Triathlon PKR	12	17	
Genesis	2		
Ibalance	1	1	
Missing		1	
Total	329	313	3

In 2015 49% 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 2015

The use of patellar resurfacing has been decreasing since the mid-eighties so that it is now only used in 2.5% of the TKA cases. During 2015 a button was most commonly used in the counties of Gävlsborg and Gotland but not at all in Uppsala, Kalmar, Värmland 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.sahmri.com/home).

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 2015, button was most often used in primary arthroplasty together with the PFC Sigma TKA.

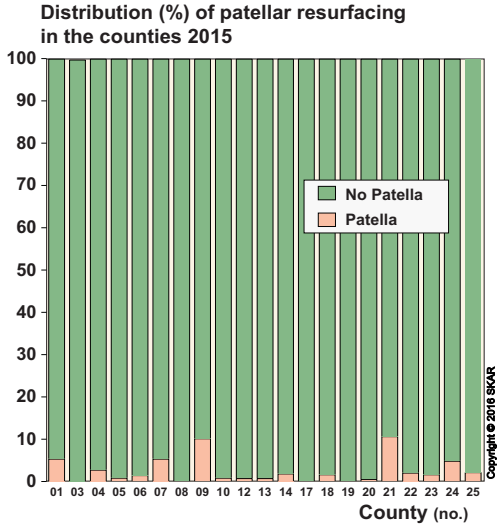
In Sweden, females have their patella resurfaced slightly more often than males whcih some have explained by femoropatellar pain being more common in women. In the whole material, from 1975 to the end of 2015, 13.5% of the women had their patella resurfaced compared to 10.2% of the males, which is a significant difference. During 2015 2.0% of the men had a patella button compared to 2.9% of the women which also is a significant difference.

Use of patella button with different TKA implants

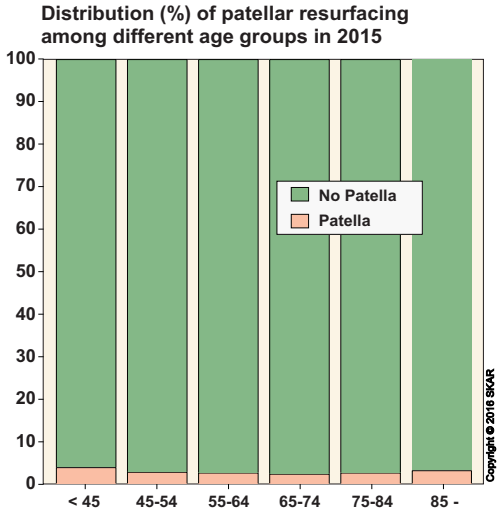
	No patella button	%	Patella button	%
NexGen	5,636	98.6	79	1.4
PFC Sigma	3,240	94.8	178	5.2
Triathlon	1,325	99.3	9	0.7
Vanguard	1,056	98.4	17	1.6
Legion/Genesis	164	97.0	5	3.0
Genesis II	152	96.8	5	3.2
Attune	26	100.0	.	0
PFC Rotating Platform	6	100.0	.	0
Link Gemini	6	100.0	.	0
Other	220	95.7	10	4.3
Total	11,831	97.5	303	2.5

Looking at the relative use of a patella button in the different age groups during 2015 (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 2005-2014, 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 2015 (a list and a chart for the counties can be found on page 16).



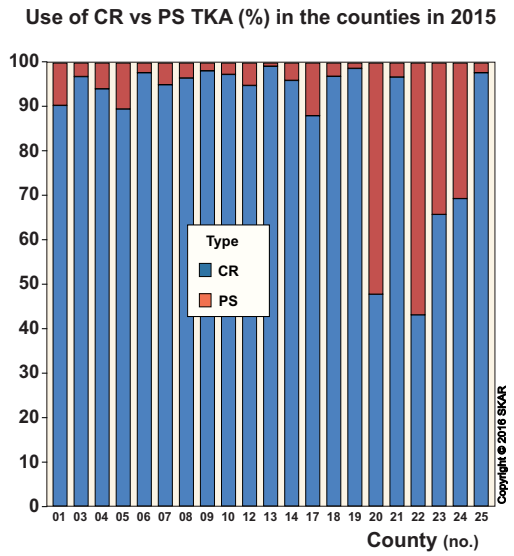
The figure shows the relative proportion of TKA with and without patella button in the different age-groups during 2015.

Posterior stabilized prostheses during 2015

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.

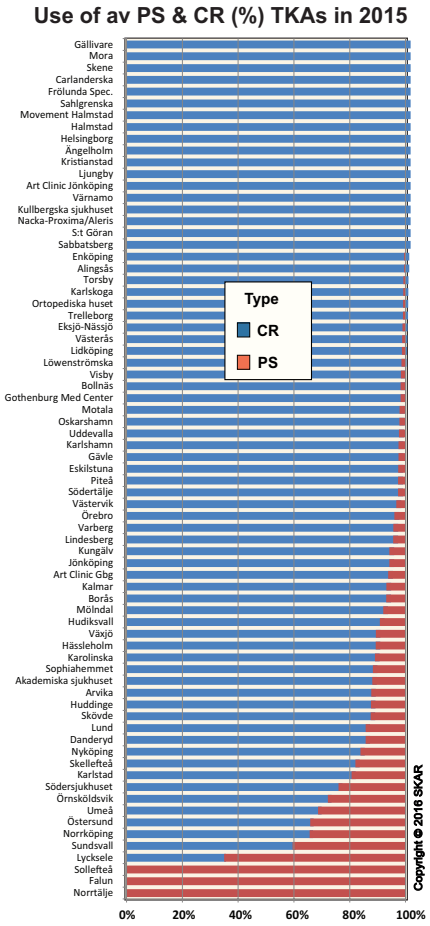


The figure shows the relative use of CR and PS implants in the different counties during 2015

As can be seen from the figure above, the counties are different with respect to use of PS implants. During 2015 PS implants were most commonly used in 4 counties; Dalarna, Västernorrland, Jämtland och Västerbotten (a list with the numbers, names and localization of the counties can be found on page 16).

During 2015 almost 9% of the primary TKAs were PS (including revision and stemmed implants). The proportion has increased since the turn of the millennium when it was used in 1% of cases.

As can be seen from the figure below the use of PS knees varies among the hospitals with 3 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 2015

We do not have any good explanation why the use of PS implants differs so much among the hospitals. Common for those 3 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, 87% of the NexGen MBT implants were 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.

As can be seen from the table below, the use of PS implants is most common in the group of "other" implants but the group consists mainly of stemmed and revisions models (see page 34). Among the "ordinary" TKAs, the use of PS is most frequent among the users of NexGen implants.

The relative proportion of CR and PS implants among the brands used for primary TKA in 2015

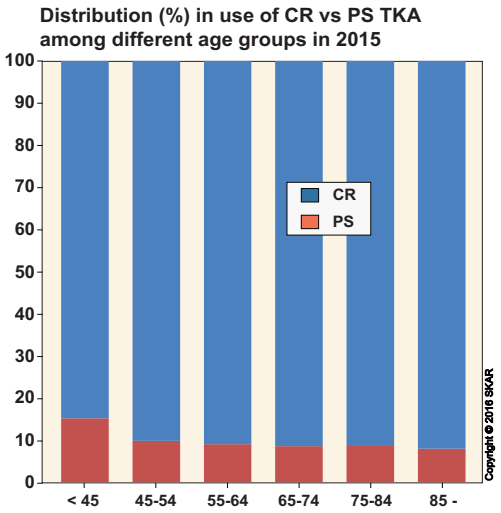
	CR	%	PS	%
NexGen MBT	4,846	87.2	714	12.8
PFC-MBT	2,426	97.0	75	3.0
Triathlon	1,292	96.9	42	3.1
Vanguard	1,059	98.1	20	1.9
PFC-HPT	914	100.0	0	0.0
Legion/GenII Prim	149	88.2	20	11.8
Genesis II	151	96.2	6	3.8
NexGen TM	92	61.3	58	38.7
Attune	26	100.0	0	0.0
PFC-RP	4	66.7	2	33.3
Link Gemini	6	100.0	0	0.0
NexGen HPT	5	100.0	0	0.0
Others	91	40.1	136	59.9
Total	11,061	91.2	1,073	8.8

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).

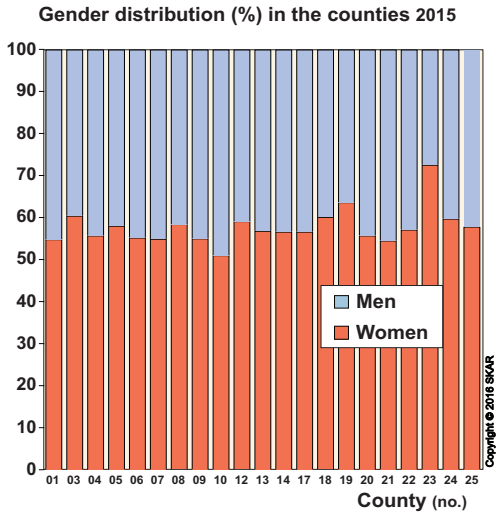
It is probably necessary to perform a randomized trial in order to estimate the differences in survival between the types.



The figure shows the relative use of cruciate retaining (CR) and posterior stabilized (PS) implants among the different age groups during 2015.

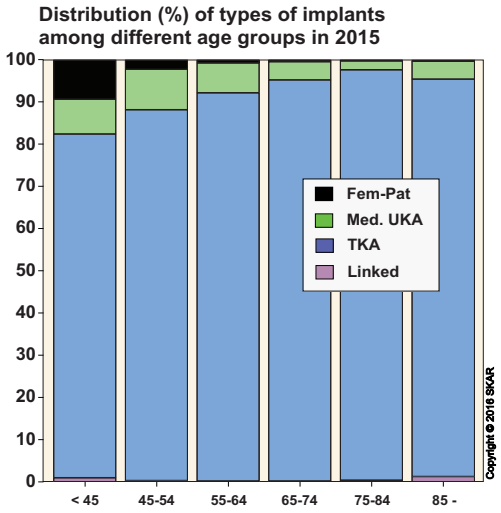
Please note that tibia components that in order to increase stability use an anterior lip or an extra concave polyethylene (deep dish) are not considered being PS implants. Some can be used both with an intact cruciate ligament as well as when the cruciate is insufficient or absent. However, there are several versions having different degree of conformity and in Sweden relatively few of the more stabilizing versions for substituting the posterior cruciate ligament have been used.

Gender distribution in the counties



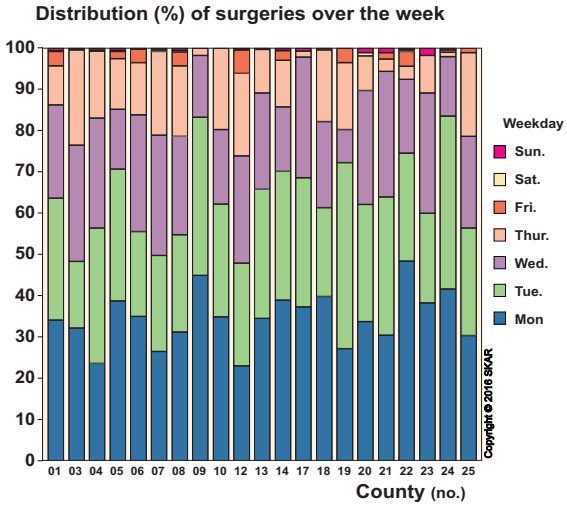
The proportion of females having surgery in the different counties was 51-72% during 2015.

Type of implants in different age groups

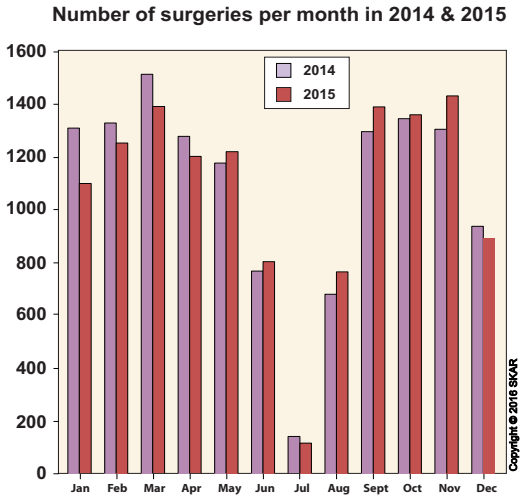


Uncommon models are most often used in patients younger the 45 years. The use of linked implant was limited in 2015 but these are used for serious conditions (tumors. trauma etc.)

Distribution of surgery on the weekdays and months



Distribution of surgery on the weekdays during 2015. Surgery on Fridays and weekends is uncommon.



The mean number of primary knee arthroplasties inserted each month during 2014 and 2015.

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 perform at least 94% of their surgeries Monday to Thursday. Skåne is the county that most frequently operates on Fridays.

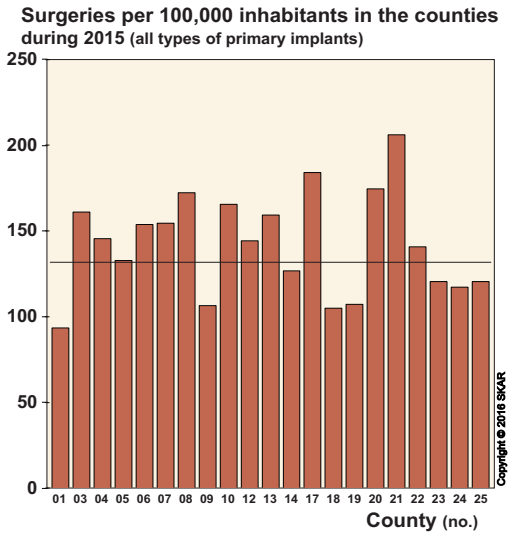
The figure above shows the number of surgeries during the different months of 2014 and 2015. It is evident how the production drops during the summer as around Christmas.

Age distribution and incidence in the counties 2015

County and number of inhabitants 2015

Nr	County	No. of inhabitants	no. of primaries	Incidence/ 100.000
01	Stockholm	2,214,742	2068	93.4
03	Uppsala	351,553	566	161.0
04	Södermanland	282,189	411	145.6
05	Östergötland	443,883	589	132.7
06	Jönköping	346,05	532	153.7
07	Kronoberg	190,249	294	154.5
08	Kalmar	236,639	408	172.4
09	Gotland	57,323	61	106.4
10	Blekinge	155,205	257	165.6
12	Skåne	1,296,268	1868	144.1
13	Halland	312,725	487	155.7
14	Västra,Götaland	1,640,347	2079	126.7
17	Värmland	275,298	507	184.2
18	Örebro	289,581	304	105.0
19	Västmanland	262,99	282	107.2
20	Dalarna	279,966	489	174.7
21	Gävleborg	280,903	579	206.1
22	Västernorrland	243,479	343	140.9
23	Jämtland	127,071	153	120.4
24	Västerbotten	262,87	308	117.2
25	Norrbotten	249,86	301	120.5
Country		9,799,191	12,886	131.5

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

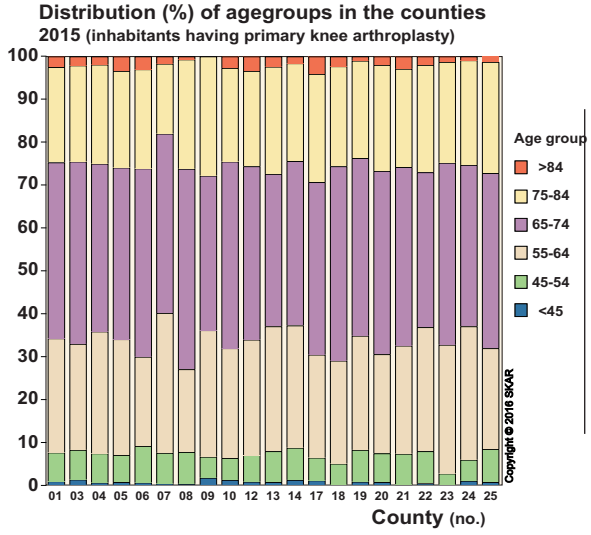


Incidence (no. of arthroplasties per 100.000 inhabitants)

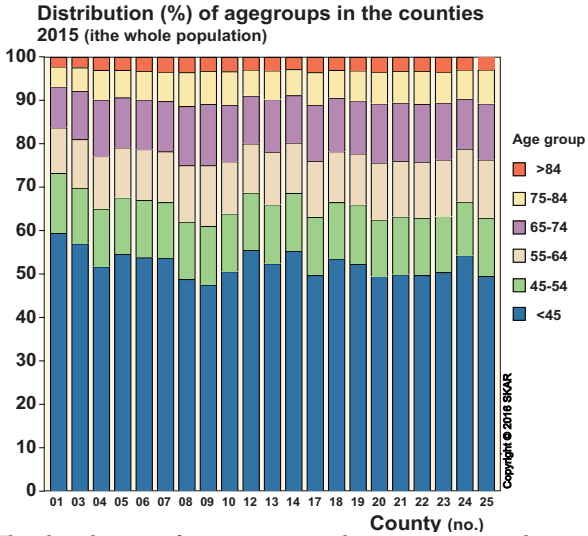
The table and figure above show the number of primary knee arthroplasties per 100.000 inhabitants in each county in 2015. The calculations are based on the domicile of patients at surgery. The incidence (not age-standardized) is highest in Gävlborg county and lowest in the county of Jämtland.

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 Kronoberg county but lowest in Kalmar county. Värmland 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 (59%) 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 2015

Distribution (%) of age groups in the counties in 2015 (whole population)

Age group:	0-44	45-54	55-64	65-74	75-84	85-
Stockholm	59.4	13.8	10.6	9.4	4.6	2.2
Uppsala	57.0	12.7	11.3	11.1	5.4	2.5
Södermanland	51.7	13.3	12.2	12.9	6.8	3.1
Östergötland	54.6	13.0	11.6	11.5	6.3	3.0
Jönköping	53.8	13.3	11.7	11.4	6.6	3.3
Kronoberg	53.7	12.8	11.8	11.6	6.7	3.4
Kalmar	48.8	13.2	13.0	13.6	7.8	3.5
Gotland	47.5	13.5	14.0	14.1	7.5	3.3
Blekinge	50.6	13.3	12.1	12.9	7.7	3.4
Skåne	55.6	13.2	11.3	11.0	6.1	2.9
Halland	52.4	13.6	12.0	12.1	6.7	3.1
Västra.Götaland	55.3	13.3	11.6	10.9	6.0	2.8
Värmland	49.7	13.4	12.9	12.9	7.5	3.5
Örebro	53.5	13.0	11.7	12.3	6.4	3.1
Västmanland	52.3	13.7	11.7	12.3	6.9	3.2
Dalarna	49.5	13.0	13.1	13.6	7.4	3.4
Gävleborg	49.9	13.4	12.8	13.5	7.3	3.2
Västernorrland	49.7	13.3	12.9	13.3	7.7	3.2
Jämtland	50.4	13.0	13.0	13.1	7.1	3.4
Västerbotten	54.3	12.3	12.2	11.6	6.7	2.9
Norrbotten	49.5	13.4	13.4	12.9	7.8	3.0
The country	54.8	13.3	11.6	11.3	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 101.5 in Västmannaland county and highest 180.3 in in Gävleborg county.

Uppsala has 50% 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 2015)

Nr	County	Incidence
01	Stockholm	111.2
03	Uppsala	170.2
04	Södermanland	134.4
05	Östergötland	131.8
06	Jönköping	149.9
07	Kronoberg	150.9
08	Kalmar	145.7
09	Gotland	112.2
10	Blekinge	147.1
12	Skåne	147.6
13	Halland	148.7
14	Västra.Götaland	130.2
17	Värmland	160.9
18	Örebro	108.7
19	Västmanland	101.5
20	Dalarna	150.7
21	Gävleborg	180.3
22	Västernorrland	123.6
23	Jämtland	116.9
24	Västerbotten	113.6
25	Norrbotten	104.3
	The country	132.2

Implants for primary arthroplasty 2005–2014

In the tables below, the implants used during the investigated period 2005-2014 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 followed by the PFC. Vanguard which has replaced the AGC that no longer is used was in the third place followed by Triathlon the successor to Duracon.

Implants for primary TKA

	Number	Percent
NexGen	43,958	39.0
PFC	30,892	27.4
Vanguard	9,489	8.4
Triathlon	8,196	7.3
AGC	7,626	6.8
Duracon	4,113	3.7
F/S MIII	2,517	2.2
Profix	1,979	1.8
PFC-Rotating Platform	1,090	1.0
Genesis II, Legion/Gen.	602	0.5
Natural II	359	0.3
Kinemax	131	0.1
Journey	84	0.1
Link Gemini	62	0.1
Vanguard XP	13	0.0
Other TKA's	13	0.0
Revision TKA's*	1,518	1.4
Missing	66	0.1
Total	112,708	100

* For revision models. see table right.

Among the UKA's, 2 models account for the majority of surgeries. Of the ten models listed below, seven were used in 2015.

Implants for primary UKA

	Number	Percent
Oxford	2,497	37.0
Link	2,054	30.5
MillerGalante	811	12.0
ZUK	662	9.8
Genesis	407	6.0
Triathlon PKR	142	2.1
Preservation	122	1.8
Sigma PKR	40	0.6
Ibalance	3	0.0
EIUS	2	0.0
Missing	1	0.0
Total	6,742	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

	Number	Percent
NexGen Revision	417	27.5
Triathlon Revision	339	22.3
PFC Revision	337	22.2
Vanguard Revision	113	7.4
Duracon Revision	108	7.1
AGC Revision	103	6.8
Profix Revision	74	4.9
Legion/Genesis Revision	25	1.6
F/S Revision	2	0.1
Total	1,518	100

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

Hinged implants (primary)

	Number	Percent
Rotalink	240	40.7
Nexgen RHK	170	28.8
MUTARS	54	9.2
S-ROM Noiles RHK	43	7.3
Stryker/Howmedica RHK	35	5.9
METS	28	4.7
Stanmore	7	1.2
Biomet Rotating Hinge	6	1.0
Other	6	1.0
Missing	1	0.2
Total	590	100

Femoro-patellar implants are uncommon. Only 338 cases using 8 different brands were reported during the 10 year period.

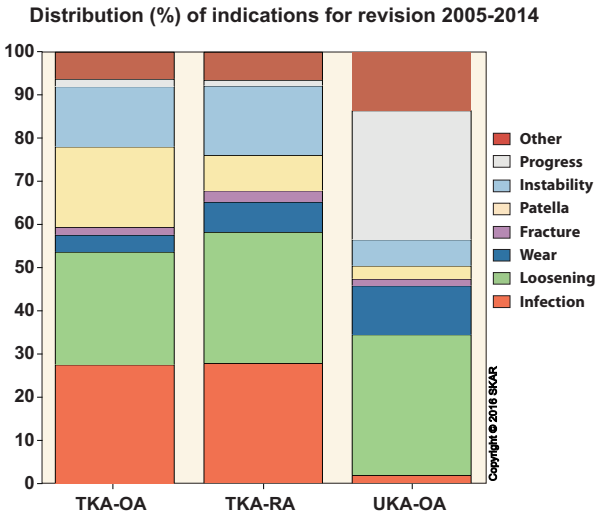
Femoro-Patellar implants

	Number	Percent
Zimmer P-F	193	57.1
Avon P-F	57	16.9
PFC P-F	31	9.2
Link P-F	28	8.3
Journey P-F	7	2.1
Vanguard P-F	6	1.8
Richard /Blazina	5	1.5
LCS P-F	5	1.5
Other	3	0.9
Missing	3	0.9
Total	338	100

Revisions during 2005–2014

During the 10-year period, 6,127 first time revisions were performed. 3,830 were revisions of TKAs for OA, 230 of TKAs for RA and 1,630 were revisions of UKAs 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 2005-2014. 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 (23% in OA and 20s% 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 in which the primary was a TKA/OA

	Number	Percent
Linked (rot. hinge)	367	9.6
TKA	1,033	27.0
Exchange of femur comp.	42	1.1
Exchange of tibia comp.	272	7.1
Exchange of disc/inlay	899	23.5
Patella addition	732	19.1
Patella exchange	10	0.3
Patella removal	36	0.9
Total implant removal	394	10.3
Arthrodesis	15	0.4
Amputation	25	0.7
Other	5	0.1
Total	3,830	100

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

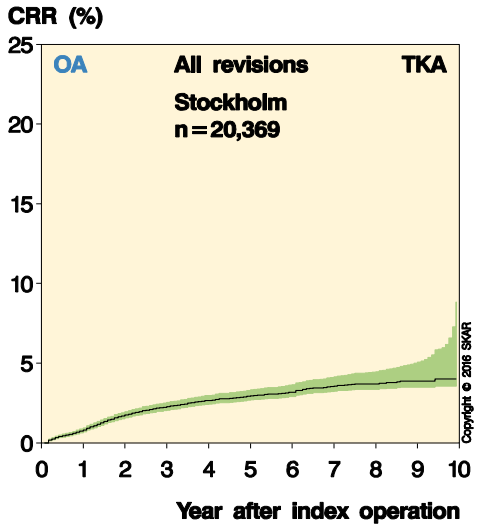
	Number	Percent
Linked (rot. hinge)	34	2.1
TKA	1,489	91.3
UKA	8	0.5
Exchange of femur comp.	6	0.4
Exchange of tibia comp.	7	0.4
Exchange/reposition of poly	61	3.7
Patella addition	5	0.3
Total implant removal	18	1.1
Amputation	2	0.1
Totalt	1,630	100

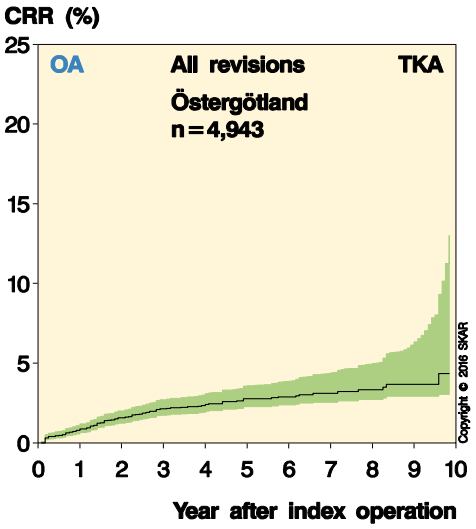
Type of revision in which the primary was a TKA/RA

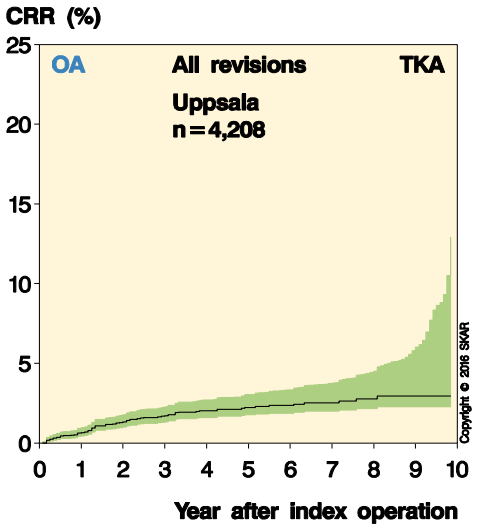
	Number	Percent
Linked (rot. hinge)	45	19.6
TKA	71	30.9
Exchange of femur comp.	6	2.6
Exchange of tibia comp.	6	2.6
Exchange of disc/inlay	46	20.0
Patella addition	21	9.1
Total implant removal	30	13.0
Arthrodesis	2	0.9
Amputation	3	1.3
Total	230	100

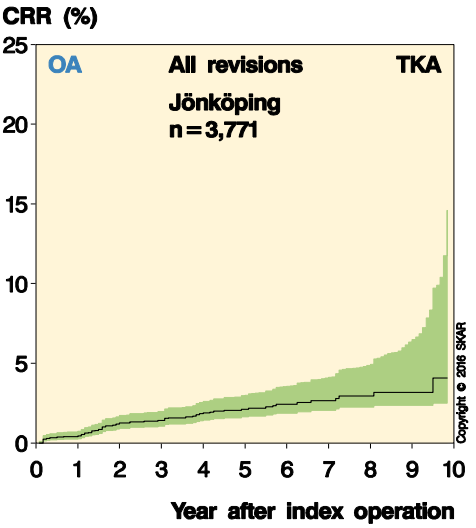
When evaluating the survival curves it should be noted that as the part of the curve to the right contains implants with long follow-up it also to a larger extent reflects older models.

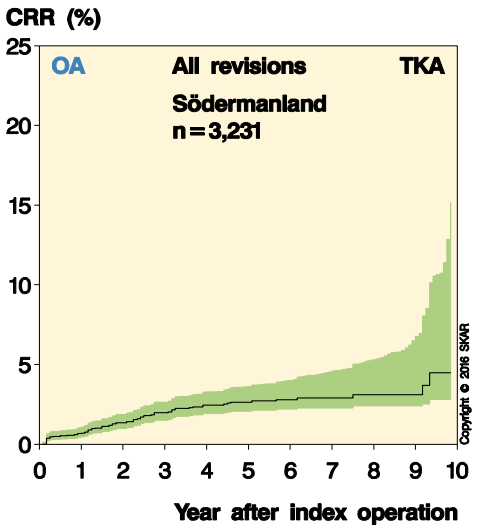
CRR in the counties after primary TKA for OA 2005–2014

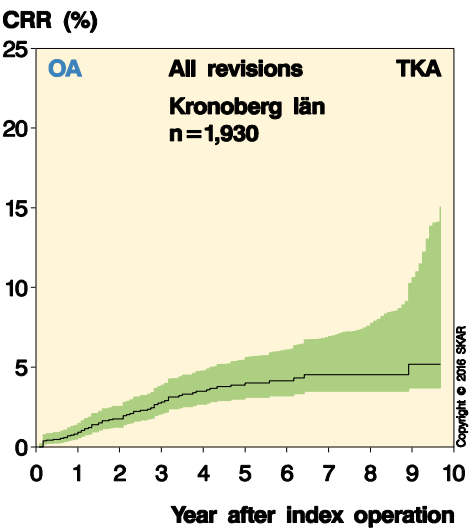




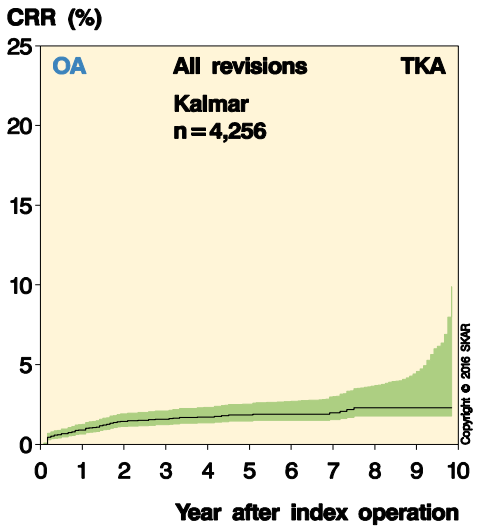


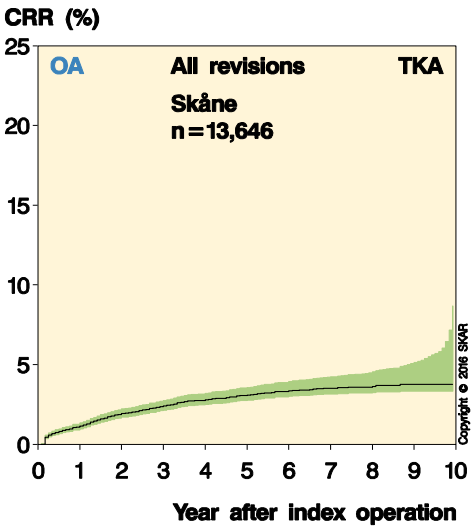


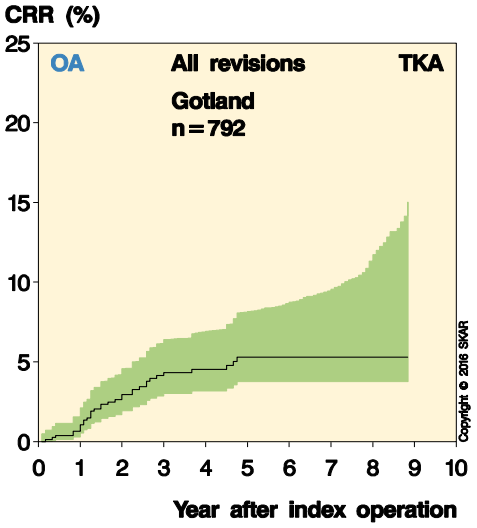


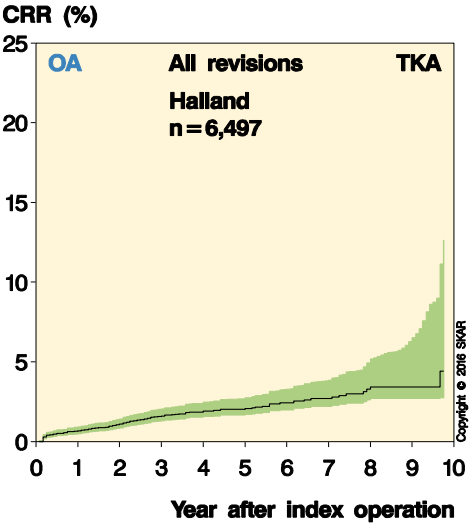


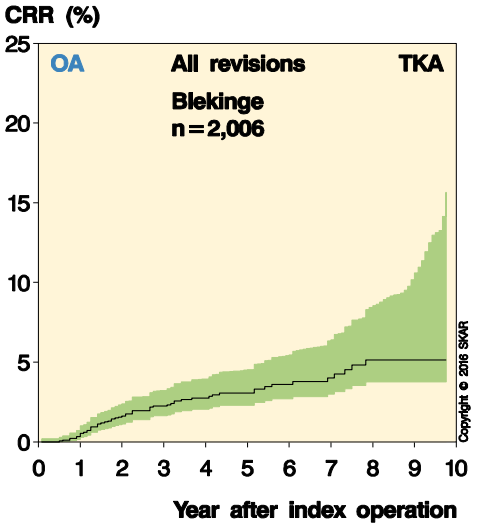
The curves are cut when less than 40 patients are left "at risk"

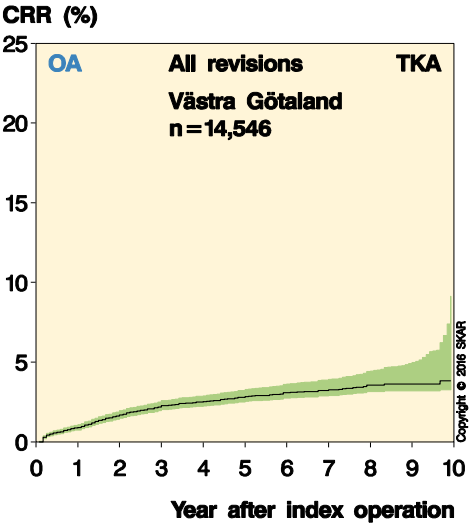






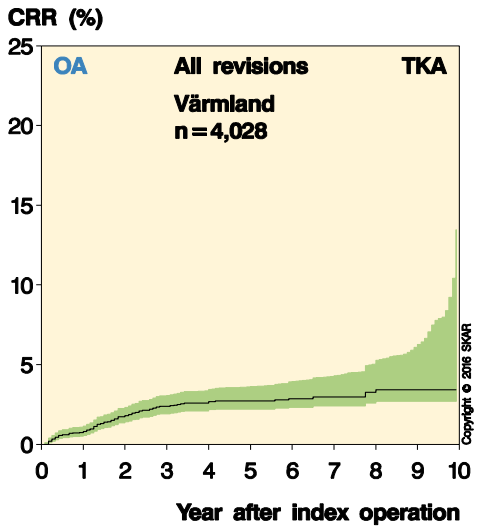


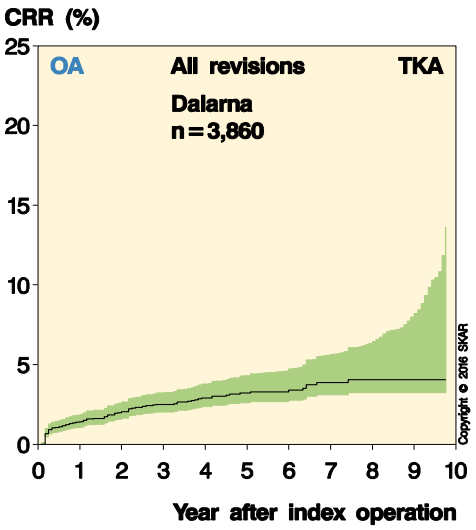


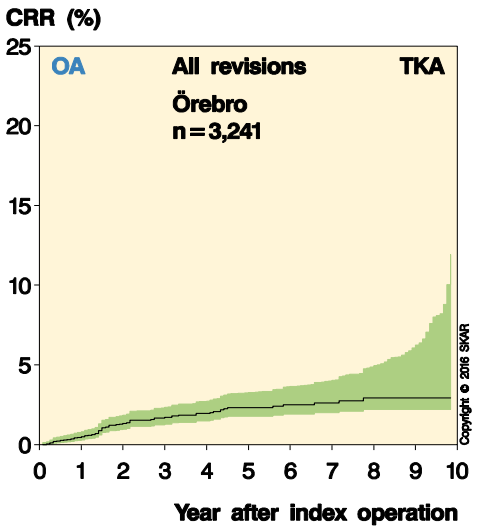


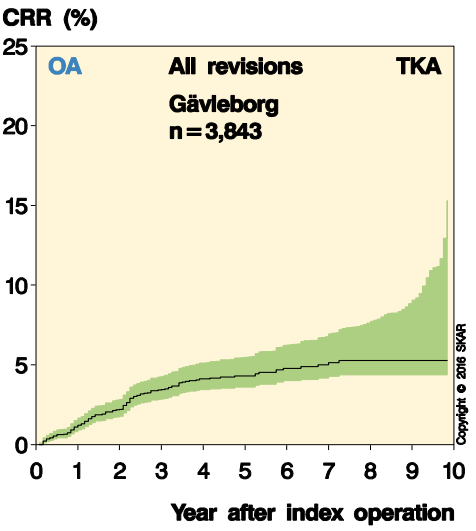
The curves are cut when less than 40 patients are left "at risk"

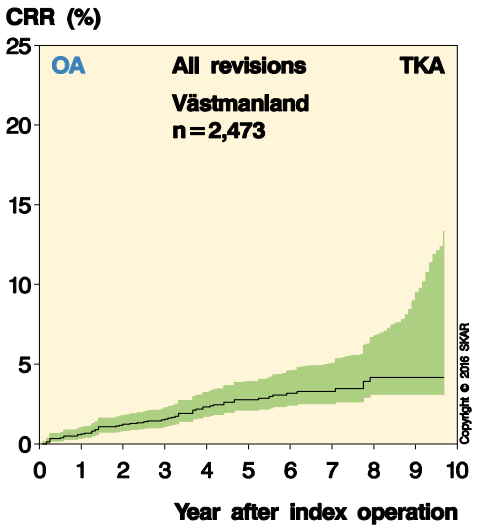
CRR in the counties after primary TKA for OA 2005–2014

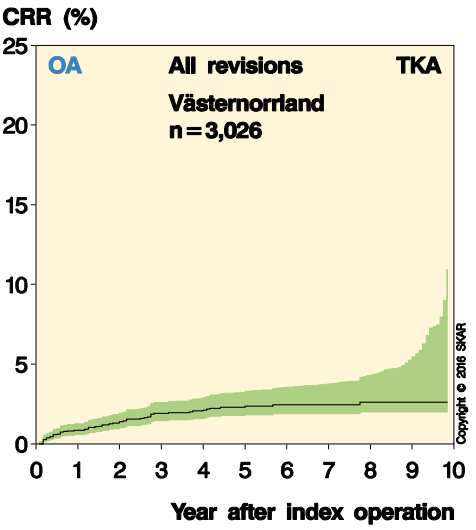




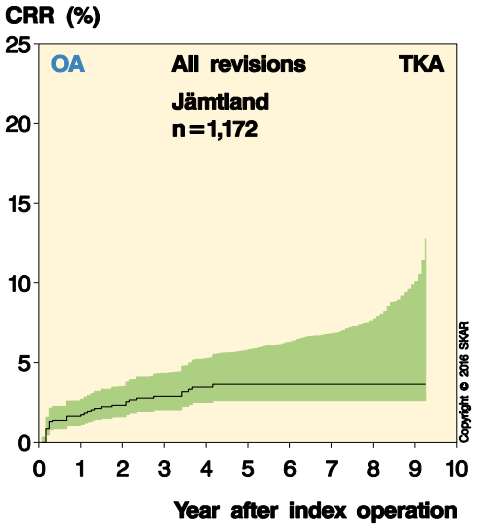


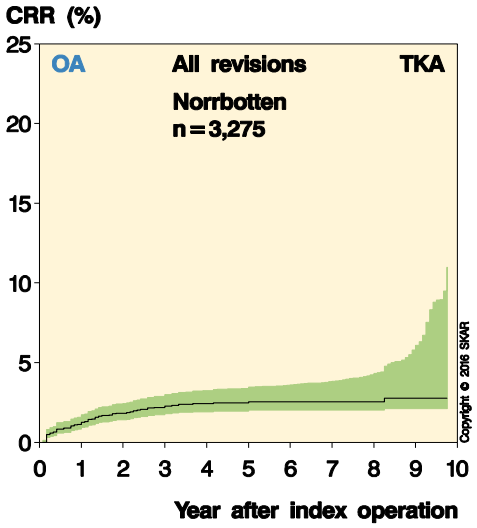


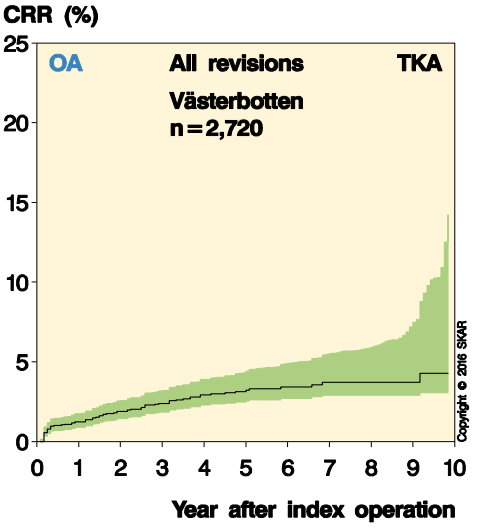




The curves are cut when less than 40 patients are left "at risk"







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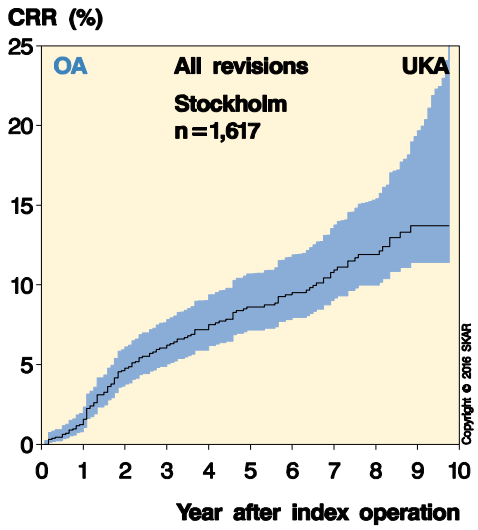
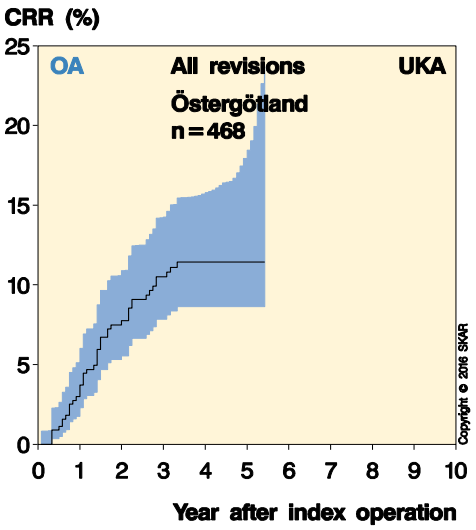
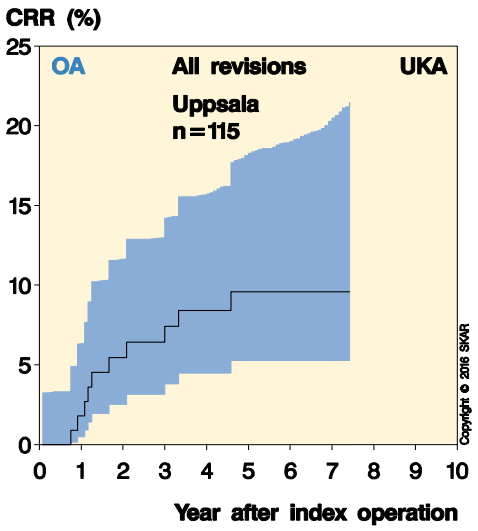
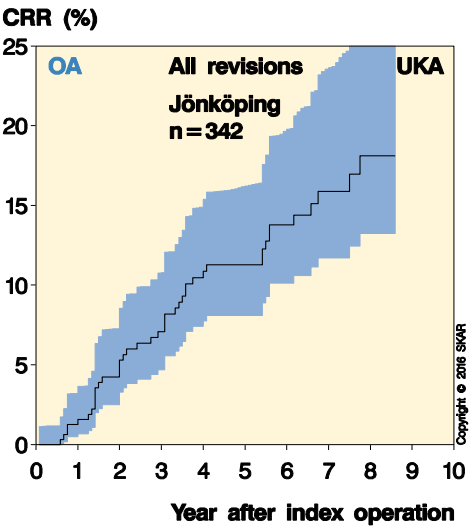
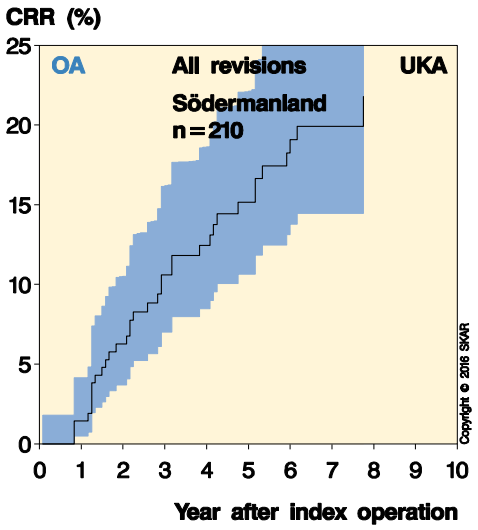
CRR in the counties after primary UKA for OA 2005–2014

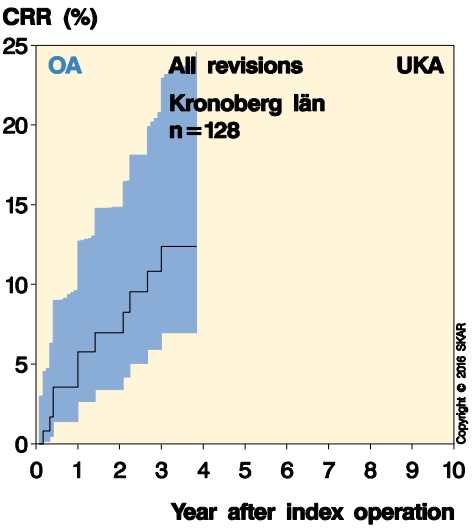












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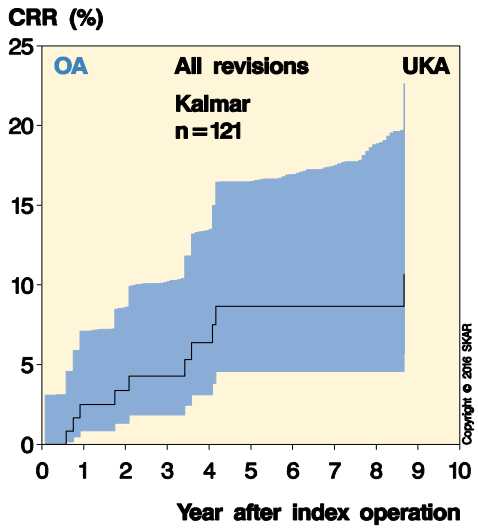
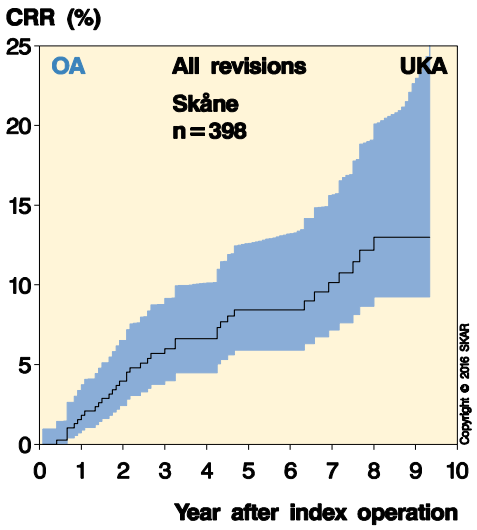
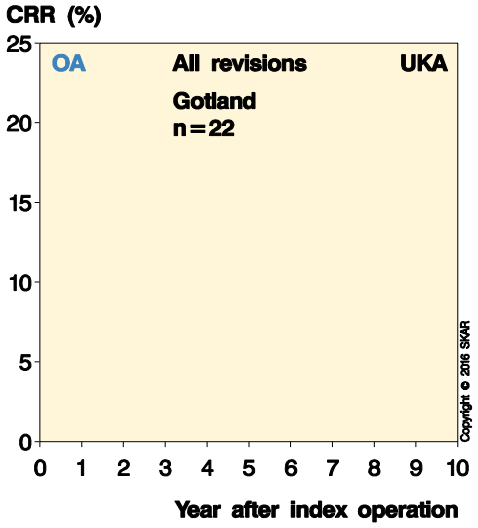
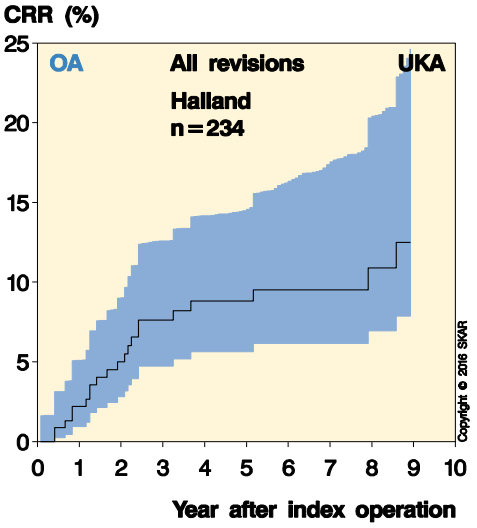
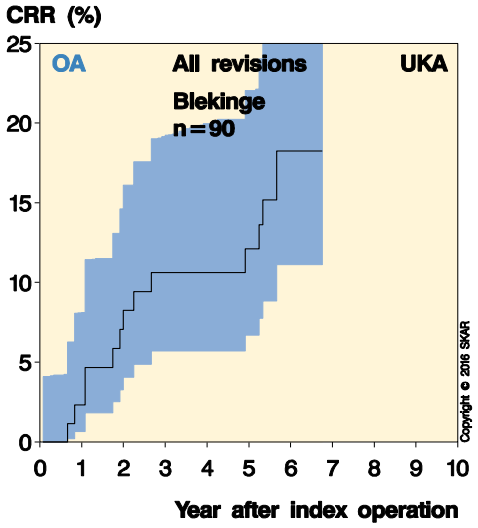
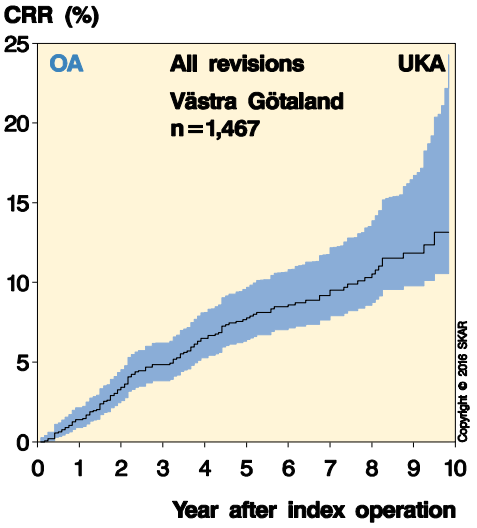






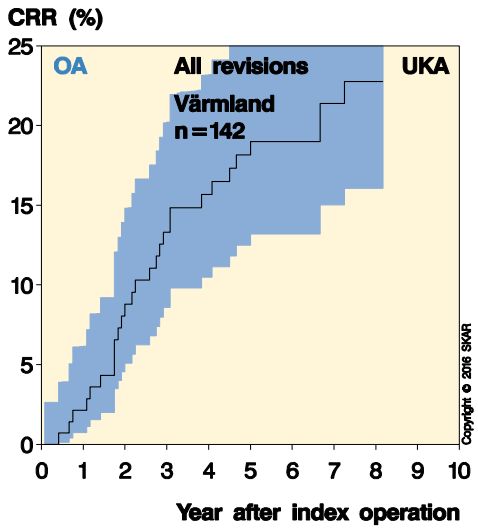


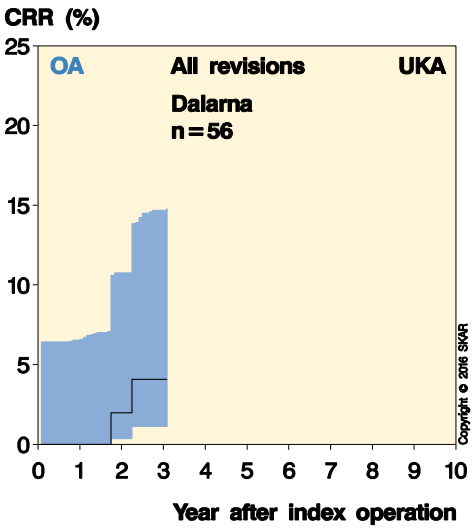


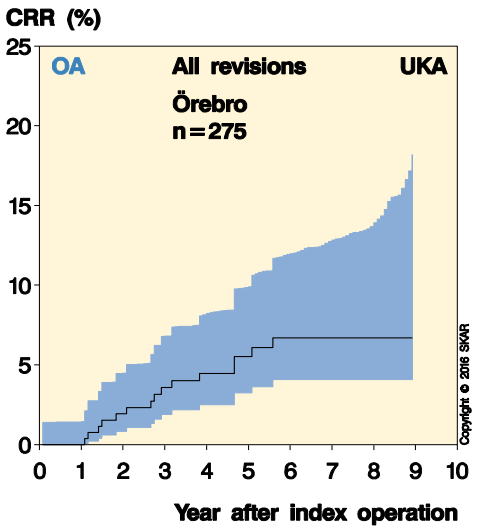


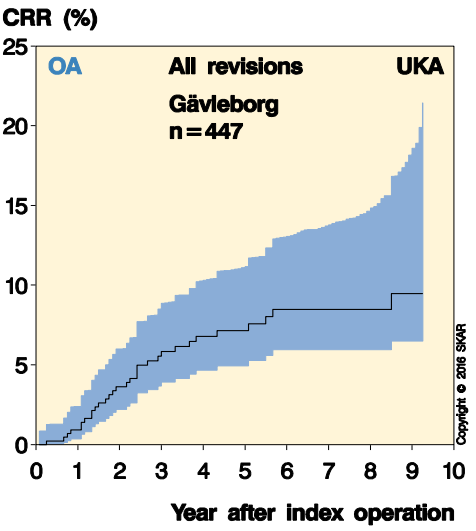
The curves are cut when less than 40 patients are left "at risk"

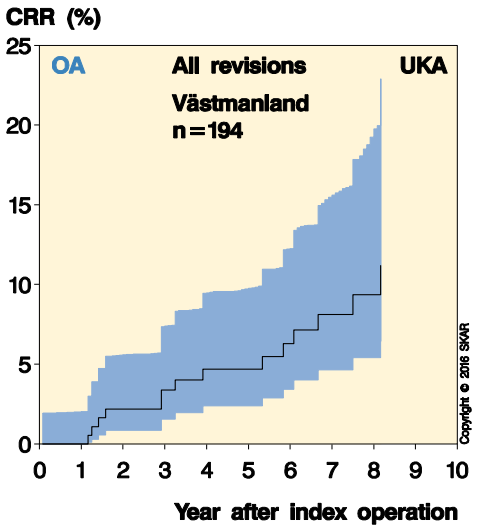
CRR in the counties after primary UKA for OA 2005–2014

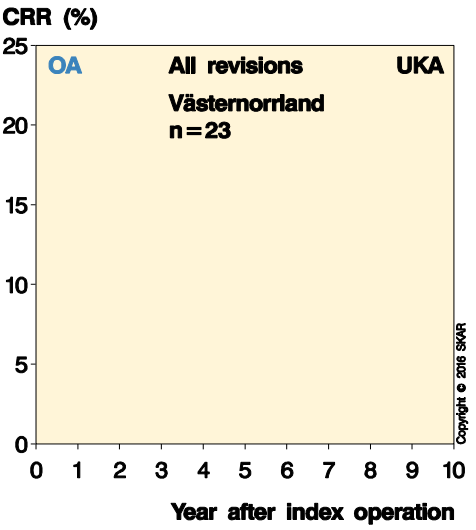




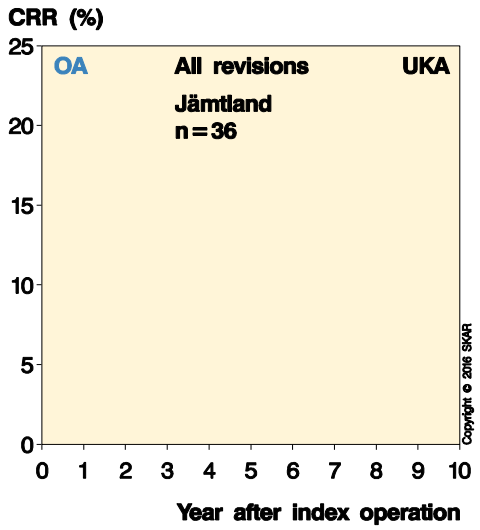


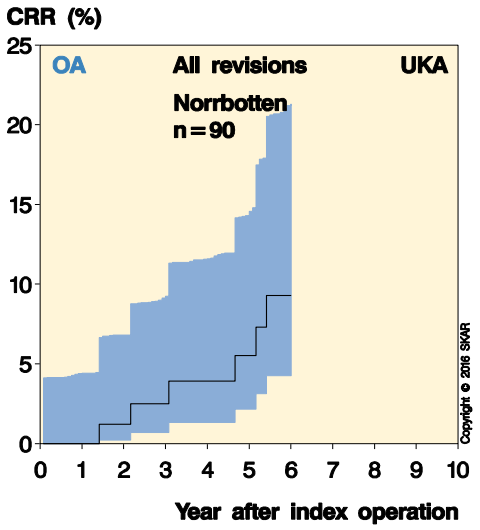


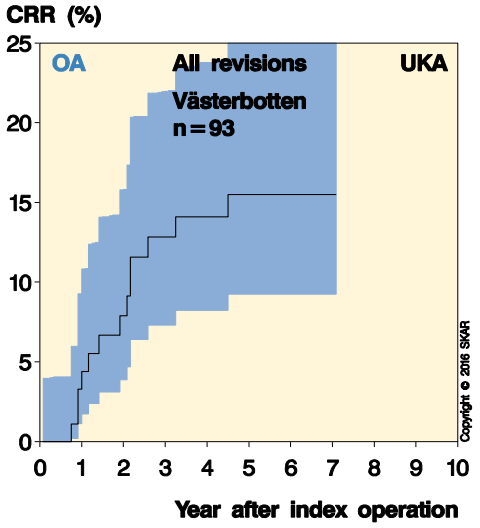




The curves are cut when less than 40 patients are left "at risk"







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

The relative risk for implants used in primary arthroplasty during 2005–2014

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, 92% of the PFC Sigma use the same type of a ”non-porous C/R” femur component which in 44% 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 46% were CR Option. On the tibia side, 88% were MBT (of which Option was 88%), 9% 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 (92%) together with the same type of tibia baseplate (77%) and with a curved inlay (98%).

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 46-47.

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	17,780		ref.	
AGC	7,294	<0.01	1.29	1.10-1.51
Duracon	3,911	<0.01	1.31	1.08-1.59
F/S MIII	2,434	<0.01	1.86	1.53-2.28
Genesis II	545	0.50	0.75	0.34-1.69
NexGen APT	4,089	0.51	0.93	0.74-1.16
NexGen MBT	37,041	0.04	0.88	0.77-0.99
NexGen TM	1,106	0.03	0.61	0.39-0.94
PFC-Sigma APT	11,972	<0.01	0.77	0.65-0.90
PFC-RP	1,019	<0.01	2.14	1.68-2.74
Profix	1,855	0.07	1.29	0.98-1.69
Triathlon	7,883	0.89	0.99	0.82-1.19
Vanguard	9,092	0.08	1.16	0.98-1.37
Others	1,811	<0.01	1.64	1.28-2.11
Gender (male is ref.)		0.06	0.93	0.86-1.00
Age (per year)		<0.01	0.97	0.96-0.97
Year of op. (per year)		<0.01	1.03	1.01-1.05

OA / UKA	n	p–value	RR	95% CI
Link	2,020		ref.	
Genesis	398	0.35	1.17	0.85-1.61
MillerGalante	788	0.12	1.20	0.95-1.52
Oxford	2,437	0.37	0.91	0.74-1.12
Preservation	120	0.05	1.57	1.00-2.47
Triathlon PKR	138	0.56	1.20	0.65-2.23
ZUK	621	0.60	0.92	0.66-1.26
Others	46	0.68	0.75	0.18-3.02
Gender (male is ref.)		0.95	0.99	0.85-1.1
Age (per year)		<0.01	0.97	0.96-0.98
Year of op. (per year)		0.02	1.05	1.01-1.09

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	17,302		ref.	
AGC	6,246	<0.01	1.39	1.18-1.65
Duracon	3,411	0.05	1.24	1.00-1.53
F/S MIII	1,901	<0.01	2.13	1.72-2.63
Genesis II	540	0.35	0.66	0.27-1.59
NexGen APT	4,016	0.88	0.98	0.79-1.23
NexGen MBT	36,509	0.11	0.90	0.80-1.02
NexGen TM	1,077	0.06	0.66	0.42-1.01
PFC-Sigma APT	11,645	0.01	0.79	0.67-0.94
PFC-RP	803	<0.01	2.14	1.62-2.83
Profix	1,684	0.08	1.30	0.97-1.72
Triathlon	7,696	0.76	1.03	0.85-1.24
Vanguard	8,619	0.01	1.26	1.07-1.50
Other	1,654	<0.01	1.70	1.31-2.21
Gender (male is ref.)		0.14	0.94	0.87-1.02
Age (per year)		<0.01	0.97	0.97-0.97
Year of op. (per year)		0.01	1.03	1.01-1.05

With patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	478		ref.	
AGC	1,048	<0,01	0,39	0,23-0,67
Duracon	500	0,61	0,87	0,51-1,49
F/S MIII	533	0,02	0,48	0,26-0,90
Genesis II	5	0,10	5,59	0,74-42,44
NexGen APT	*73*	*1,00*	*0,00*	
NexGen MBT	532	0,13	0,61	0,32-1,16
NexGen TM	*29*	*1,00*	*0,00*	
PFC-Sigma APT	327	0,03	0,37	0,15-0,90
PFC-RP	216	0,80	0,93	0,51-1,69
Profix	171	0,51	0,75	0,33-1,74
Triathlon	187	0,06	0,36	0,13-1,05
Vanguard	473	<0,01	0,08	0,02-0,34
Other	157	0,39	0,69	0,29-1,61
Gender (male is ref.)		0,05	0,73	0,54-0,99
Age (per year)		<0,01	0,96	0,94-0,97
Year of op. (per year)		0,35	1,04	0,96-1,14

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 have very similar results as last year where 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 as last year the PFC-APT, NexGen MBT and NexGen TM.

The risk of revision decreases with increasing age but increases with time. The latter 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 (table on the previous page) one can see that 2 models account for the majority of surgeries. The risk increases with time (Op. year) which may indicate that the UKA revision rate has increased over the 10-year period. The only model with higher risk than the Link reference is as last year the 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, only the PFC-Sigma APT has a significantly lower risk of revision than the reference while the NexGen MBT and NexGen TM are no longer ignificantly better. than the reference. The models with higher risk than the reference are the same as when all TKA's are analyzed (table on the previous page).

As compared to last year, the NexGen MBT has no longer significantly lower risk than the reference while the risk for the Duracon has again become significantly higher.

With a patellar button, the number of arthroplasties is rather small which makes it more difficult to show significant differences. However, it is interesting to see that the AGC, F/S MIII and Vanguard which all 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 2005–2014 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 541 TKA and 4 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 44 that the same implants have an increased risk except that Vanguard and Profix have joined the group. The three that had lower risk than the reference (NexGen MBT, NexGen TM and PFC-Sigma APT) are no longer significantly different. It should be noted that the poly cannot be exchanged in the PFC-APT or the Monoblock NexGen TM (2/3 of the TMs) which as well as the NexGen APT will not benefit for any exclusion of inlay exchanges.

After the exclusion the negative effect of time (year of op.) has disappeared. The cause is probably the increased aggressiveness in recent years in treating early or suspected infections by debridement and exchange of inlay when possible. This has resulted in increased number of inlay revisions in recent years causing the negative effect of time in the previous table.

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	17 780		ref.	
AGC	7,294	0.00	1.57	1.32-1.86
Duracon	3,911	0.00	1.38	1.12-1.70
F/S MIII	2,434	0.00	2.11	1.71-2.61
Genesis II	545	0.82	1.11	0.46-2.69
NexGen APT	4,089	0.08	1.23	0.98-1.54
NexGen MBT	37,041	0.05	0.87	0.75-1.00
NexGen TM	1,106	0.09	0.67	0.42-1.06
PFC-Sigma APT	11,972	0.96	1.00	0.84-1.18
PFC-RP	1,019	0.00	2.41	1.87-3.12
Profix	1,855	0.02	1.44	1.07-1.93
Triathlon	7,883	0.44	0.92	0.73-1.14
Vanguard	9,092	0.02	1.27	1.05-1.54
Others	1,811	0.00	1.65	1.24-2.18
Gender (male is ref.)		0.07	1.08	0.99-1.18
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.75	1.00	0.98-1.02

OA / UKA	n	p–value	RR	95% CI
Link	2.020		ref.	
Genesis	398	0.34	1.17	0.85-1.61
MillerGalante	788	0.13	1.20	0.95-1.51
Oxford	2,437	0.29	0.90	0.73-1.10
Preservation	120	0.05	1.57	1.00-2.46
Triathlon PKR	138	0.54	1.21	0.65-2.26
ZUK	621	0.62	0.92	0.67-1.27
Others	46	0.69	0.75	0.19-3.06
Gender (male is ref.)		0.91	0.99	0.85-1.16
Age (per year)		<0.01	0.97	0.96-0.98
Year of op. (per year)		0.03	1.05	1.01-1.09

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	17,302		ref.	
AGC	6,246	<0.01	1.71	1.43-2.04
Duracon	3,411	0.04	1.27	1.01-1.60
F/S MIII	1,901	<0.01	2.48	1.98-3.09
Genesis II	540	0.91	0.94	0.35-2.54
NexGen APT	4,016	0.02	1.31	1.04-1.65
NexGen MBT	36,509	0.16	0.90	0.78-1.04
NexGen TM	1,077	0.18	0.72	0.45-1.16
PFC-Sigma APT	11,645	0.67	1.04	0.87-1.24
PFC-RP	803	<0.01	2.46	1.84-3.28
Profix	1,684	0.01	1.52	1.12-2.07
Triathlon	7,696	0.88	0.98	0.79-1.23
Vanguard	8,619	<0.01	1.40	1.15-1.70
Others	1,654	<0.01	1.68	1.24-2.26
Gender (male is ref.)		0.03	1.11	1.01-1.21
Age (per year)		<0.01	0.96	0.95-0.96
Year of op. (per year)		0.52	0.99	0.97-1.01

With patella button OA / TKA	n	p–value	RR	95% CI
PFC-Sigma MBT	478		ref.	
AGC	1,048	0.01	0.46	0.26-0.81
Duracon	500	1.00	1.00	0.57-1.77
F/S MIII	533	0.04	0.49	0.25-0.96
Genesis II	5	0.06	7.30	0.95-56.09
NexGen APT	73	1.00	0.00	
NexGen MBT	532	0.14	0.58	0.28-1.19
NexGen TM	*29*	*1.00*	*0.00*	
PFC-Sigma APT	327	0.08	0.44	0.18-1.09
PFC-RP	216	0.88	0.95	0.5-1.81
Profix	171	0.19	0.49	0.17-1.43
Triathlon	187	0.03	0.11	0.01-0.79
Vanguard	473	0.00	0.09	0.02-0.40
Others	157	0.68	0.83	0.35-1.99
Gender (male is ref.)		0.18	0.80	0.57-1.11
Age (per year)		<0.01	0.95	0.94-0.97
Year of op. (per year)		0.23	1.06	0.96-1.17

Implants lacking sufficient numbers for analysis are shown in italics

In case of UKA (table previous page right), there were only 4 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 44.

Above we have as on page 45 divided the TKA for OA into those that are used without respective with a patellar button.

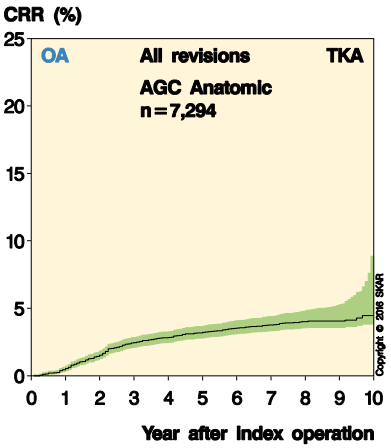
In the table left above, in which no patella button was used, the result is quite similar to that when all the TKA's were included (table on the page to the left) with the exception that the NexGen-APT now has a significantly increased risk as compared to the reference. Further, an increased risk for women has become significant but it was not when knees with and without patellar button were analyzed together.

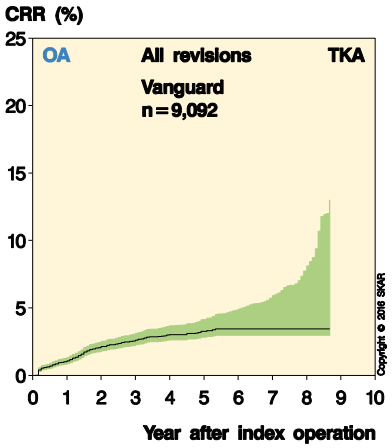
As compared to the table on page 45 where change of inlays for infection were considered revisions the only difference is that PFC-Sigma APT is no longer better than the reference and that Profix now has significantly higher risk.

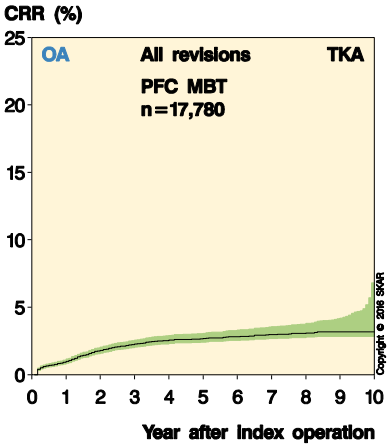
The table above to the right concerns TKA's in which a patellar button was used. When this table is compared to the table on page 44 the only difference is that the PFC-Sigma APT no longer has a lower risk than the reference PFC-Sigma MBT.

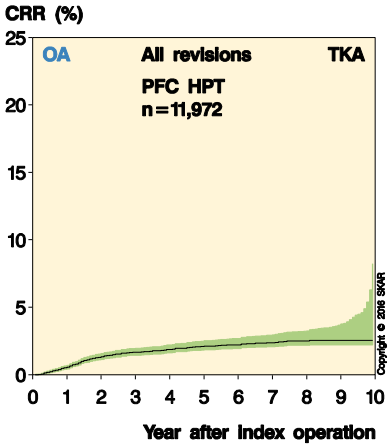
In summary one can establish that excluding an exchange of inlay in infected cases does affect the results and that the effect negatively affects non-modular implants as compared to modular ones. One explanation may be that a number of debridement's without exchange of inlays in non-modular TKA's have 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 have resulted in knees becoming revised that would have maked it without.

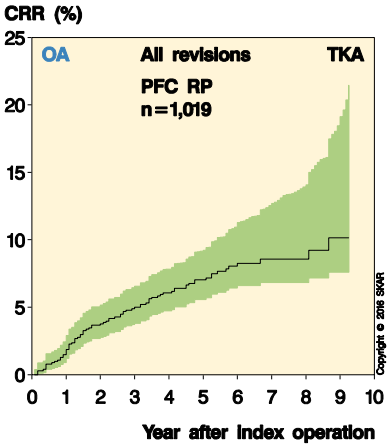
CRR for commonly used TKA implants for OA 2005–2014

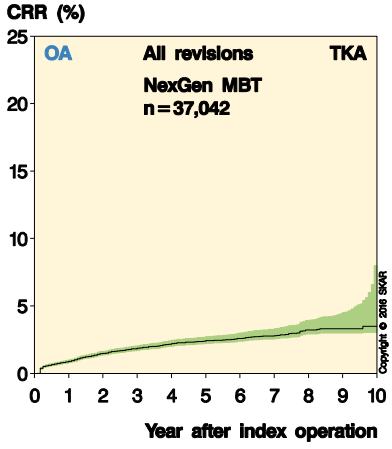


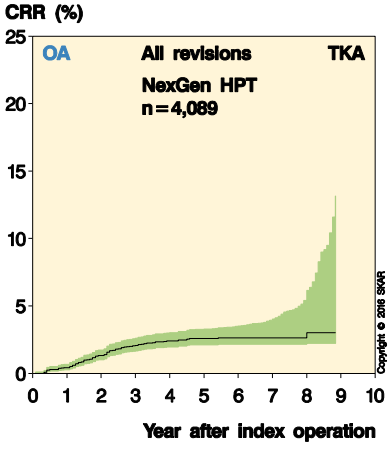


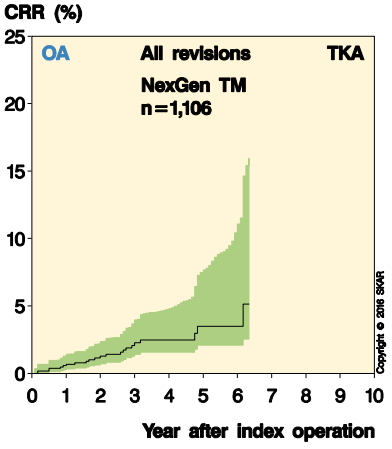


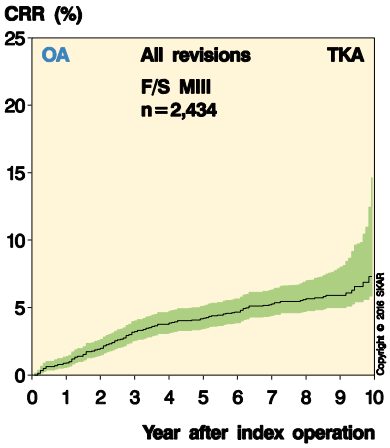











CRR (%)
OA
All revisions
TKA
F/S MIII
n=2,434
Year after index operation
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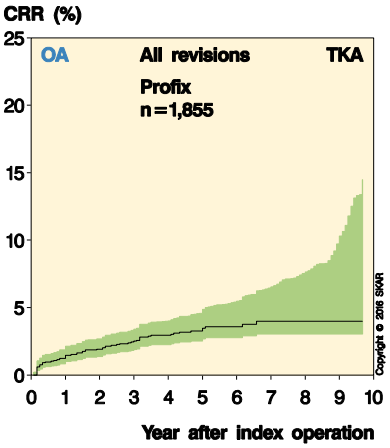
CRR (%)
OA
All revisions
TKA
Profix
n=1,855
Year after index operation
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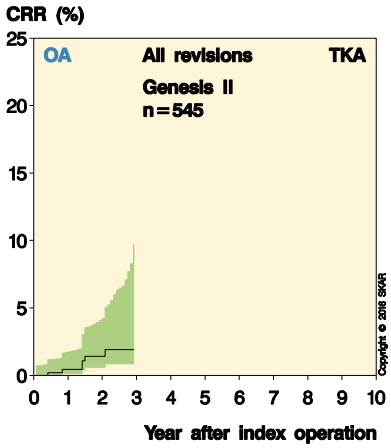
CRR (%)
OA
All revisions
TKA
Genesis II
n=545
Year after index operation
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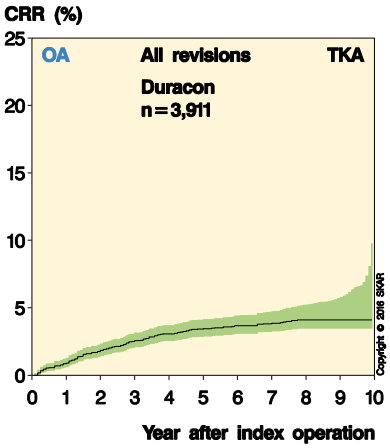
CRR (%)
OA
All revisions
TKA
Duracon
n=3,911
Year after index operation
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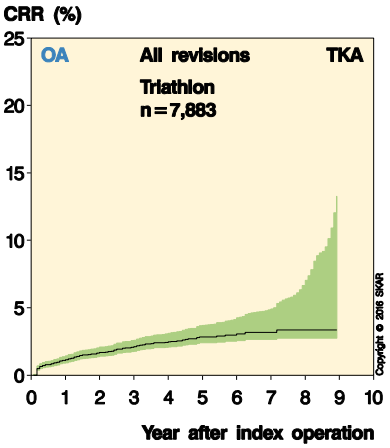
CRR (%)
OA
All revisions
TKA
Triathlon
n=7,883
Year after index operation
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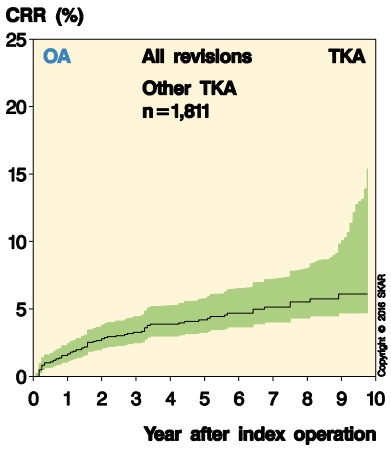
CRR (%)
OA
All revisions
TKA
Other TKA
n=1,811
Year after index operation
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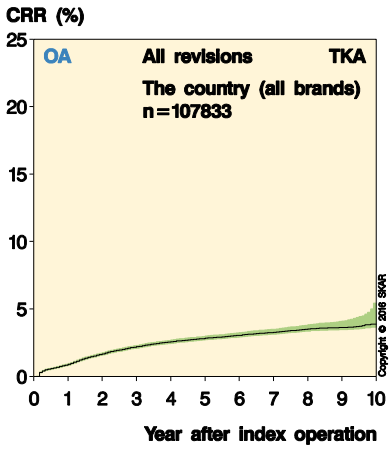
CRR (%)
OA
All revisions
TKA
The country (all brands)
n=107833
Year after index operation
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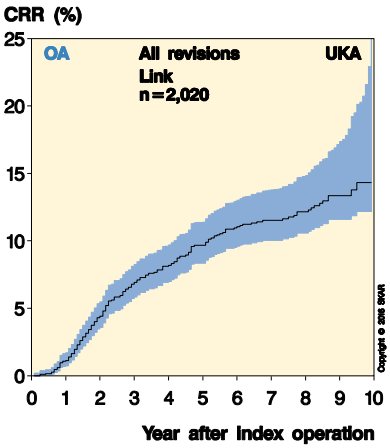
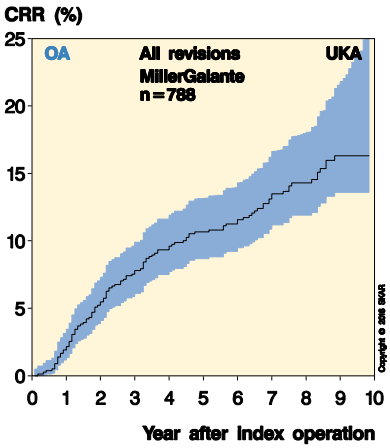
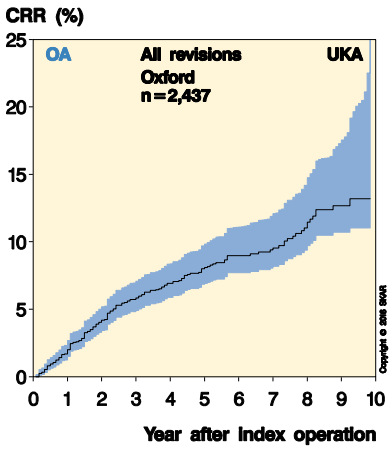
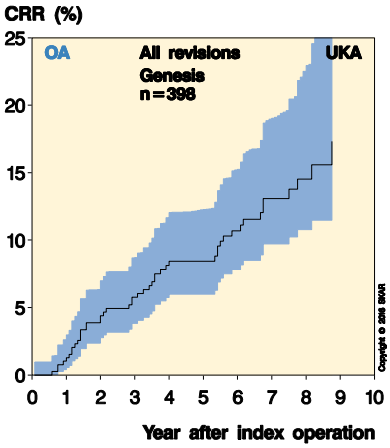
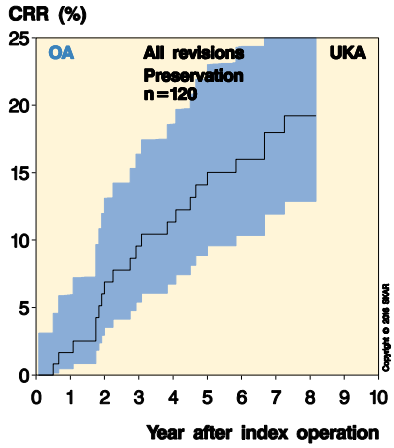
CRR for commonly used UKA implants for OA 2005–2014

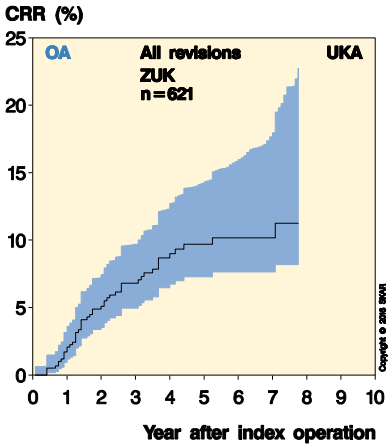


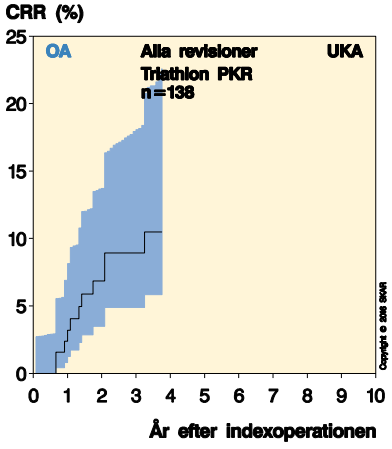


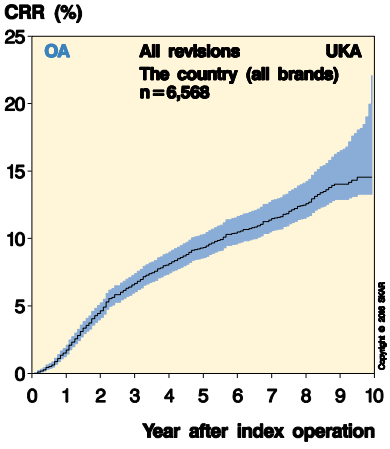












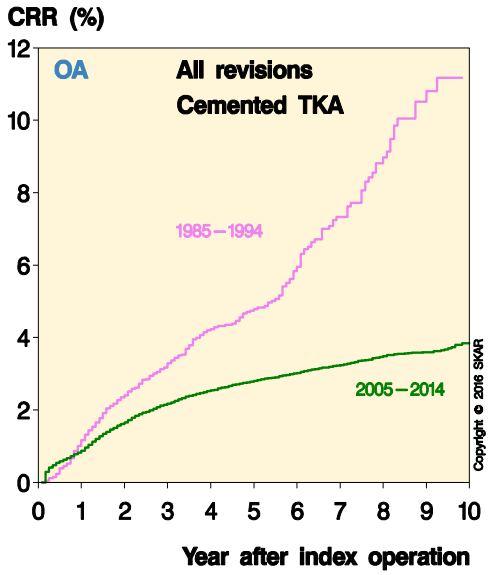
Changes in risk of revision over time (TKA for OA)

The figure below shows the overall risk of revision for the current 10-year period, 2005-2014, as compared to the period 1985-1994. It can be observed that the risk for the current period is considerably lower than for the earlier period.

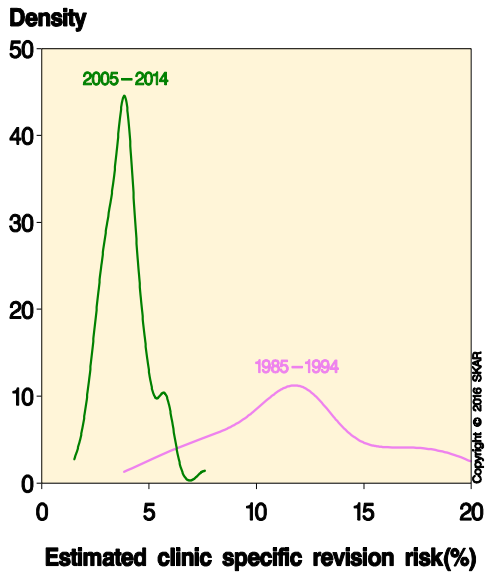
When the absolute specific risk of revision for the units is plotted for both periods (figure below left), it can be seen that the risk has become lower and the distribution has diminished. This implies that the results have improved overall and at the same time the results for the different units have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

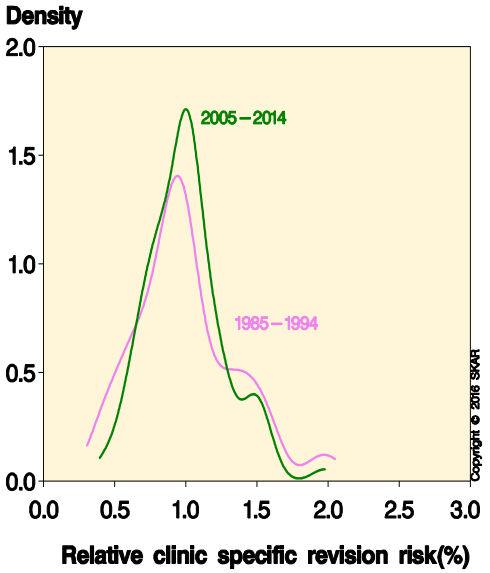
The register is requested to account for hospital specific results which can be found on the next pages. This year, there were 8 hospitals having significantly better results than the average hospital and 10 with inferior results. One can only speculate on the causes for these differences. An unfortunate 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 1985–1994 and 2005–2014 shows a considerable reduction in CRR over time.



Plotting the estimated absolute clinicspecific risk of revision shows that the absolute distribution has diminished between 1985-1994 and 2005–2014 (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 1985–1994 and 2005–2014 (x-axis = relative risk).

Relative risk of revision for hospitals 2005–2014 (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	1,806	12	0.39	0.26-0.61	1	1-8
52013	Skene	834	7	0.50	0.30-0.83	2	1-24
50480	Carlanderska	726	6	0.57	0.34-0.96	3	1-38
10010	Sabbatsberg (Aleris)	688	4	0.57	0.33-1.00	4	1-41
12010	Enköping	2,636	30	0.60	0.43-0.82	5	2-24
12481	Elisabethkliniken	603	8	0.62	0.38-1.01	6	1-43
11015	Nacka-Proxima	834	9	0.65	0.41-1.04	7	2-46
11002	Huddinge	1,106	15	0.66	0.44-0.99	8	2-41
25010	Kalmar	988	13	0.68	0.45-1.04	9	2-46
42015	Movement Halmstad	1,880	28	0.68	0.49-0.95	10	3-36
25011	Oskarshamn	2,348	37	0.69	0.52-0.93	11	4-35
53011	Lidköping	1,291	17	0.70	0.47-1.04	12	3-45
62011	Örnsköldsvik	1,135	19	0.73	0.50-1.06	13	3-48
42011	Varberg	1,487	26	0.76	0.54-1.06	14	5-48
42420	Spenshult	1,362	21	0.78	0.54-1.12	15	4-53
11013	Löwenströmska*	3,069	55	0.78	0.61-1.00	16	7-42
22011	Eksjö-Nässjö (Höglandssjukh.)	1,263	19	0.79	0.54-1.14	17	5-55
65012	Gällivare	728	12	0.79	0.51-1.23	18	4-60
55010	Örebro	884	17	0.80	0.54-1.18	19	5-57
22012	Värnamo	1,172	27	0.80	0.57-1.14	20	5-54
13010	Eskilstuna	387	7	0.81	0.49-1.34	21	3-67
55012	Lindesberg	1,360	23	0.83	0.58-1.17	22	6-57
22010	Jönköping	1,314	23	0.83	0.58-1.18	23	6-57

(cont.)

Relative risk of revision for units (continued)

Code	Hospital	no. of TKA	Revised	RR	95% CI	Rank	95% CI
28011	Ängelholm	1,433	25	0.83	0.59-1.17	24	6-57
11001	Karolinska	1,282	29	0.84	0.61-1.16	25	7-56
65016	Sunderby	72	1	0.87	0.46-1.65	26	3-75
53010	Falköping	770	19	0.88	0.60-1.28	27	7-63
52011	Borås	922	22	0.88	0.61-1.27	28	8-63
62010	Sundsvall	921	18	0.88	0.60-1.30	29	7-65
10013	Södersjukhuset	2,571	55	0.89	0.70-1.15	30	13-55
13011	Nyköping	872	19	0.94	0.64-1.36	31	9-67
54010	Karlstad	1,733	38	0.94	0.71-1.26	32	14-62
50010	Östra sjukhuset	476	13	0.96	0.63-1.47	33	9-70
10011	S:t Göran	3,282	79	0.97	0.78-1.20	34	20-58
64010	Skellefteå	826	19	0.98	0.68-1.43	35	11-69
41012	Helsingborg	212	4	0.98	0.56-1.72	36	5-76
13012	Kullbergska sjukhuset	1,972	48	0.99	0.76-1.28	37	17-64
56010	Västerås	1,835	40	0.99	0.74-1.31	38	17-65
62013	Sollefteå	969	24	0.99	0.70-1.40	39	13-68
55011	Karlskoga	997	23	1.00	0.70-1.42	40	13-69
21014	Motala	4,006	95	1.00	0.82-1.22	41	23-60
28013	Simrishamn	200	7	1.00	0.61-1.65	42	7-75
54014	Torsby	965	22	1.01	0.71-1.44	43	14-70
50020	OrthoCenter IFK klin.**	842	23	1.01	0.71-1.43	44	14-69
23010	Växjö	1,021	26	1.01	0.72-1.42	45	15-69
65013	Piteå	2,466	60	1.02	0.80-1.29	46	21-64
50071	Frölunda Spec.	1,022	26	1.03	0.74-1.45	47	16-70
56012	Köping	638	21	1.04	0.72-1.49	48	15-71
64011	Lycksele	598	14	1.04	0.69-1.57	49	12-73
42010	Halmstad	1,768	47	1.04	0.80-1.36	50	22-67
10015	Sophiahemmet	762	24	1.05	0.74-1.49	51	17-71
11010	Danderyd	1,393	35	1.05	0.78-1.42	52	20-70
24010	Västervik	920	23	1.05	0.74-1.50	53	16-72
28012	Hässleholm	5,768	147	1.06	0.90-1.25	54	31-62
21013	Norrköping	937	21	1.09	0.76-1.57	55	18-73
30001	Malmö	128	5	1.10	0.64-1.87	56	10-77
57010	Falun	2,508	63	1.11	0.88-1.41	57	29-69
61012	Hudiksvall	617	17	1.12	0.76-1.66	58	18-75
53013	Skövde	970	24	1.13	0.80-1.59	59	21-74
50001	Sahlgrenska	113	6	1.15	0.68-1.93	60	13-77
27011	Karlshamn	1,997	55	1.16	0.90-1.49	61	31-72
54012	Arvika	1,330	35	1.16	0.86-1.57	62	27-74
64001	Umeå	1,296	43	1.19	0.90-1.57	63	32-74
41011	Trelleborg	5,636	162	1.24	1.06-1.44	64	47-70
51011	Mölndal	1,504	41	1.24	0.93-1.64	65	34-75
41001	Lund	230	7	1.24	0.75-2.05	66	17-78
57011	Mora	1,352	42	1.28	0.97-1.69	67	39-76
63010	Östersund	1,172	36	1.29	0.96-1.73	68	37-76
11011	Södertälje	1,074	38	1.31	0.98-1.75	69	39-76
12001	Akademiska sjukhuset	969	43	1.43	1.09-1.89	70	50-77
51010	Uddevalla	1,798	63	1.46	1.15-1.84	71	55-77
61010	Gävle	742	27	1.46	1.05-2.03	72	47-78
26010	Visby	792	33	1.47	1.08-2.00	73	49-78
11012	Norrtälje	739	33	1.50	1.10-2.04	74	51-78
61011	Bollnäs	2,484	91	1.52	1.24-1.85	75	61-77
10016	Ortopediska huset	3,568	146	1.55	1.32-1.82	76	65-77
23011	Ljungby	909	37	1.57	1.17-2.10	77	57-78
51012	Kungälv	1,472	77	1.97	1.59-2.45	78	74-78

* 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 2005–2014 (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 46) 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 44-47 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 also show risk calculations when an exchange of inlay (for infection) is not, considered as being a revision.

If the table below is compared to the one on the previous page, it can be seen that 5 of the 8 units with results better than the average keep their status. Carlanderska, Sabbatsberg and Huddinge are no longer better than the average while Kalmar, Lidköping and Örnsköldsvik have become better than the average. At the other end, 8 of 10 units that were significantly inferior to the average keep their status. Trelleborg and Akademiska disappear while Karlshamn appears. As can be expected there are changes in the ranking of units occur.

Karlshamn that became worse than the average used monobloc tibia in more than half their cases while the thee units that lost their status as being better than the average all used modular components. Thus, although modularity may affect the risk of revision it does not automatically mean that units using modular components benefit from the exclusion of inlay exchanges in the ranking table.

Relative risk of revision for units. 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	1,806	10	0.4	0.25-0.65	1	1-12
52013	Skene	834	6	0.51	0.30-0.89	2	1-30
25010	Kalmar	988	6	0.52	0.30-0.89	3	1-32
53011	Lidköping	1,291	9	0.55	0.34-0.89	4	1-32
42015	Movement Halmstad	1,880	18	0.57	0.39-0.85	5	2-27
62011	Örnsköldsvik	1,135	11	0.58	0.36-0.91	6	1-33
10010	Sabbatsberg (Aleris)	688	3	0.58	0.32-1.08	7	1-48
50480	Carlanderska	726	5	0.6	0.34-1.04	8	1-45
12481	Elisabethkliniken	603	7	0.63	0.37-1.06	9	1-46
11015	Nacka-Proxima	834	7	0.65	0.38-1.09	10	2-49
25011	Oskarshamn	2,348	29	0.68	0.49-0.94	11	4-36
12010	Enköping	2,636	29	0.7	0.51-0.98	12	4-40
42420	Spenshult	1,362	15	0.72	0.47-1.09	13	4-50
57010	Falun	2,508	31	0.73	0.53-1.00	14	5-41
11002	Huddinge	1,106	15	0.74	0.49-1.12	15	4-52
22010	Jönköping	1,314	16	0.75	0.50-1.12	16	4-52
22011	Eksjö-Nässjö (Höglandssjukh.)	1,263	14	0.75	0.49-1.15	17	4-54
13010	Eskilstuna	387	5	0.76	0.43-1.33	18	3-63
42011	Varberg	1,487	22	0.78	0.54-1.12	19	6-52
62010	Sundsvall	921	12	0.78	0.50-1.22	20	4-59
52011	Borås	922	16	0.79	0.52-1.20	21	5-58
65012	Gällivare	728	10	0.81	0.50-1.30	22	5-63
55012	Lindesberg	1,360	19	0.85	0.58-1.25	23	8-61

(cont.)

(Cont.)
Relative risk of revision for units. 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
24010	Västervik	920	14	0.86	0.56-1.32	24	7-64
28011	Ängelholm	1,433	21	0.86	0.60-1.25	25	9-60
55010	Örebro	884	16	0.87	0.58-1.30	26	8-63
22012	Värnamo	1,172	26	0.87	0.60-1.25	27	9-62
64010	Skellefteå	826	13	0.88	0.57-1.36	28	7-65
41012	Helsingborg	212	2	0.88	0.46-1.67	29	3-74
11001	Karolinska	1,282	26	0.88	0.62-1.24	30	10-60
65016	Sunderby	72	1	0.89	0.45-1.76	31	3-75
54010	Karlstad	1,733	29	0.9	0.65-1.24	32	11-60
53010	Falköping	770	17	0.92	0.62-1.37	33	10-67
10015	Sophiahemmet	762	17	0.93	0.62-1.38	34	10-66
11013	Löwenströmska*	3,069	55	0.93	0.72-1.20	35	17-57
55011	Karlskoga	997	17	0.93	0.62-1.39	36	10-67
11010	Danderyd	1,393	25	0.94	0.67-1.33	37	12-65
65013	Piteå	2,466	45	0.95	0.72-1.24	38	16-60
28012	Hässleholm	5,768	107	0.95	0.79-1.15	39	21-54
10013	Södersjukhuset	2,571	49	0.96	0.73-1.25	40	17-60
50010	Östra sjukhuset	476	11	0.96	0.61-1.52	41	9-71
13012	Kullbergska sjukhuset	1,972	41	1.02	0.77-1.36	42	20-66
21013	Norrköping	937	15	1.02	0.67-1.55	43	14-71
54014	Torsby	965	18	1.03	0.69-1.52	44	15-71
21014	Motala	4,006	80	1.04	0.84-1.28	45	26-62
42010	Halmstad	1,768	39	1.04	0.78-1.40	46	21-67
41011	Trelleborg	5,636	112	1.05	0.87-1.26	47	29-61
30001	Malmö	128	4	1.07	0.59-1.91	48	9-77
28013	Simrishamn	200	7	1.07	0.64-1.81	49	11-76
53013	Skövde	970	18	1.07	0.73-1.59	50	17-72
13011	Nyköping	872	19	1.09	0.74-1.60	51	18-72
62013	Sollefteå	969	23	1.1	0.77-1.58	52	21-73
56010	Västerås	1,835	37	1.11	0.82-1.49	53	25-70
10011	S:t Göran	3,282	77	1.12	0.90-1.39	54	32-67
50020	OrthoCenter IFK klin.**	842	22	1.12	0.78-1.62	55	21-73
50071	Frölunda Spec.	1,022	24	1.13	0.79-1.60	56	22-73
63010	Östersund	1,172	25	1.13	0.80-1.60	57	23-72
64011	Lycksele	598	13	1.15	0.74-1.78	58	18-75
56012	Köping	638	21	1.17	0.81-1.70	59	24-75
23010	Växjö	1,021	26	1.18	0.84-1.66	60	26-74
64001	Umeå	1,296	37	1.2	0.89-1.62	61	31-73
50001	Sahlgrenska	113	6	1.22	0.71-2.09	62	16-78
12001	Akademiska sjukhuset	968	31	1.23	0.89-1.69	63	31-74
61012	Hudiksvall	617	16	1.25	0.83-1.88	64	26-77
51011	Mölndal	1,504	34	1.26	0.92-1.71	65	34-75
41001	Lund	230	6	1.28	0.75-2.20	66	19-78
54012	Arvika	1,330	32	1.3	0.95-1.78	67	37-76
11011	Södertälje	1,074	32	1.31	0.96-1.80	68	37-76
57011	Mora	1,352	35	1.32	0.97-1.78	69	39-76
27011	Karlshamn	1,997	55	1.4	1.09-1.80	70	49-76
11012	Norrtälje	739	26	1.42	1.01-2.01	71	42-78
61010	Gävle	742	22	1.46	1.01-2.10	72	42-78
51012	Kungälv	1,472	46	1.47	1.12-1.93	73	51-77
26010	Visby	792	30	1.59	1.15-2.19	74	53-78
23011	Ljungby	909	31	1.6	1.17-2.20	75	56-78
51010	Uddevalla	1,798	60	1.69	1.32-2.15	76	64-78
61011	Bollnäs	2,484	85	1.73	1.40-2.12	77	67-78
10016	Ortopediska huset	3,568	144	1.82	1.54-2.15	78	71-78

* 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 shows what was reported for primary knee arthroplasties in 2015.

Topmost is the average for the country as a whole after which the hospitals are classified as being university hospitals, private hospitals or "other" based 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. Karolinska sjukhuset in Solna and the Akademiska sjukhuset have a higher proportion of patients younger than 55 years.

The private hospitals, with the exemptions of Motala, Movement Halmstad, S:t Göran and Ängelholm , generally report a lower proportion of patients with ASA ≥3.

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 almost twice the national average in Gävle, Karlstad, Västerås and Växjö 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, S:t Göran, Södersjukhuset and Södertälje while it is half in Alingsås, Lidköping, Lindesberg, Ljungby, Karlshamn, Karskoga and Trelleborg.

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 19.5% of the patients. Meniscal surgery was most common (7.4%) followed by arthroscopy (5.4%), osteotomy (1.6%), cruciate surgery (1.4%) osteosynthesis (0.8%)

Patient characteristics and case-mix

Hospital	Number of reports	Complete reports %	% OA	% Women	% <55 years	% BMI 35+	% ASA ≥3
Country	**12,903**	**99.8**	**95.9**	**57.0**	**7.5**	**9.7**	**17.6**
University hospitals							
Akademiska	109	98.2	90.8	60.6	15.6	11.2	22.9
Huddinge	159	99.4	81.8	65.4	6.3	15.2	42.8
Karolinska Solna	93	100.0	80.7	59.1	18.3	11.8	64.5
Lund	103	99.0	74.8	63.1	6.8	11.8	55.3
Sahlgrenska	2	100.0	0.0	50.0	50.0	0.0	50.0
Umeå	146	100.0	92.5	63.0	9.6	15.1	17.2
Örebro	30	96.7	90.0	53.3	6.7	10.0	27.6
Private units							
ArtClinic Göteborg	16	100.0	93.8	50.0	6.3	6.3	18.8
ArtClinic Jönköping	29	100.0	96.6	37.9	13.8	3.5	10.3
Bollnäs Aleris	353	100.0	94.6	53.0	4.5	5.1	11.1
Carlanderska	136	99.3	97.1	59.7	4.2	8.1	2.2
Elisabethkliniken	1	100.0	100.0	100.0	0.0	0.0	0.0
Kysthospitalet - DK*	14	78.6	100.0	28.6	0.0	0.0	0.0
Luleå- Sensia	6	100.0	100.0	16.7	16.7	0.0	16.7
Motala Aleris	511	99.6	95.5	55.2	7.1	8.6	24.1
Movement Halmstad	431	100.0	97.5	55.9	12.5	8.6	21.8
Nacka Aleris	144	99.3	100.0	53.5	6.9	1.4	2.1
OrthoCenter IFK-kliniken	113	100.0	98.2	44.3	12.4	6.2	9.7
OrthoCenter Sthlm	431	99.8	97.9	52.4	11.1	3.7	2.1
Ortopediska huset	461	99.8	98.3	53.4	9.8	5.4	0.9
Sabbatsberg Aleris	23	95.7	100.0	73.9	8.7	0.0	0.0
Sophiahemmet	136	100.0	97.8	35.3	11.8	7.4	8.1
St Göran	424	100.0	96.9	62.3	6.4	8.0	35.9
Ängelholm Aleris	218	100.0	95.0	59.6	7.8	7.3	20.2

*** Kysthospitalet in Denmark reports Swedish patients that they opererate but these are not included in the country results**

and "other" (2.1%). For 3.4% 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
< 100 operations/year							
Borås	72	100.0	95.8	59.7	4.2	18.1	22.2
Eskilstuna	38	100.0	86.8	60.5	7.9	18.4	39.5
Gällivare	46	100.0	95.7	52.2	4.4	6.5	10.9
Helsingborg	66	100.0	98.5	60.6	9.1	15.2	24.2
Hudiksvall	87	100.0	98.9	60.9	8.1	16.1	13.8
Kalmar	89	98.9	95.5	58.4	7.9	3.4	5.6
Kristianstad	1	100.0	100.0	0.0	0.0	0.0	1.0
Lycksele	40	100.0	92.5	47.5	2.5	10.0	10.0
Norrtälje	94	98.9	97.9	35.1	1.1	11.8	40.9
Skene	97	100.0	97.9	47.4	9.3	1.0	0.0
Sollefteå	93	100.0	97.9	54.8	5.4	9.7	8.6
Sundsvall	44	100.0	90.9	52.3	2.3	4.6	34.1
Visby	60	100.0	93.3	55.0	6.7	11.7	6.7
Västervik	90	100.0	97.8	58.9	5.6	3.3	10.0
Ängelholm	2	100.0	100.0	100.0	0.0	50.0	50.0
100-300 operations/year							
Alingsås	193	100.0	99.5	54.9	4.7	9.3	5.7
Arvika	171	100.0	98.3	56.1	4.1	9.4	25.7
Danderyd	183	100.0	92.4	54.1	5.5	12.6	50.3
Eksjö-Nässjö	202	100.0	98.5	56.4	7.9	8.4	21.8
Falun	205	100.0	95.6	57.6	7.3	13.7	17.1
Frölunda Spec. sjukhus	124	100.0	100.0	64.5	2.4	3.2	9.7
Gävle	132	100.0	93.9	54.6	10.6	16.7	27.3
Halmstad	186	99.5	96.2	60.2	9.1	17.3	11.9
Jönköping	141	100.0	96.5	61.7	9.9	14.2	20.6
Karlshamn	249	100.0	94.8	51.0	6.8	10.8	8.0
Karlskoga	124	98.4	99.2	61.3	6.5	15.6	8.9
Karlstad	182	98.9	92.9	63.2	7.7	16.7	25.4
Kullbergska sjukhuset	157	98.7	94.9	54.8	5.1	3.2	0.7
Kungälv	215	100.0	94.0	57.7	8.8	14.4	15.8
Lidköping	234	100.0	99.6	62.8	6.8	11.5	5.1
Lindesberg	164	97.6	98.8	60.5	2.5	7.5	13.0
Ljungby	142	100.0	97.2	53.5	5.6	11.3	8.5
Mora	186	100.0	97.9	53.8	3.2	10.2	11.3
Norrköping	129	100.0	93.0	69.0	8.5	10.1	8.5
Nyköping	101	100.0	95.1	55.5	7.9	6.9	16.8
Oskarshamn	275	100.0	96.7	58.2	8.4	14.9	12.4
Piteå	244	100.0	92.6	59.8	7.8	4.9	28.3
Skellefteå	119	100.0	94.1	59.7	5.9	11.8	27.7
Skövde	120	98.3	95.0	47.4	9.3	12.5	21.2
Södersjukhuset	280	100.0	94.6	54.3	11.4	14.3	41.8
Södertälje	113	100.0	97.4	63.7	4.4	14.2	46.0
Torsby	130	100.0	100.0	47.7	3.4	9.2	20.8
Uddevalla	187	99.5	94.1	61.5	2.1	10.2	21.0
Varberg	127	100.0	92.9	55.1	9.5	7.1	9.5
Värnamo	148	100.0	97.3	50.7	10.8	11.5	11.5
Västerås	173	100.0	95.4	63.6	4.6	18.5	27.2
Växjö	115	100.0	98.3	56.5	9.6	17.4	18.3
Örnsköldsvik	115	100.0	97.4	60.9	7.8	12.2	10.4
Östersund	120	100.0	90.9	72.5	2.5	7.5	10.8
> 300 operations/year							
Enköping	393	99.7	95.2	60.3	4.3	12.0	27.8
Hässleholm	644	100.0	98.1	53.6	5.6	4.2	17.4
Mölndal	383	99.7	92.4	61.6	9.7	11.3	14.6
Trelleborg	791	100.0	99.1	63.0	5.9	10.6	5.9

Prophylactic antibiotics for knee arthroplasties

The table shows what was reported for primary knee arthroplasties in 2015.

Topmost is the average for the country as a whole after which the hospitals are classified as being university hospitals, private hospitals or "other" based 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 updated 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 regarding what drug to use. Only one unit reported using Cephalosporin 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).

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

Prophylactic antibiotics

Hospital	Number of reports	Complete reports %	% having Cloxacillin or Clindamycin	% with dose 2g x 3 or 600mg x 2	% having AB within 45-15 min	% having AB within 45-30 min
Country	**12,903**	**99.2**	**99.5**	**85.3**	**79.8**	**41.7**
University hospitals						
Akademiska	109	93.6	94.5	71.6	22.9	10.1
Huddinge	159	98.7	99.4	98.1	69.2	35.9
Karolinska Solna	93	97.8	98.9	84.6	89.3	46.2
Lund	103	98.1	99.0	77.2	68.0	36.7
Sahlgrenska	2	100.0	50.0	100.0	100.0	50.0
Umeå	146	97.9	99.3	97.2	87.0	41.1
Örebro	30	100.0	100.0	100.0	73.3	30.0
Private units						
ArtClinic Göteborg	16	100.0	100.0	100.0	75.0	50.0
ArtClinic Jönköping	29	100.0	100.0	100.0	89.7	65.5
Bollnäs Aleris	353	99.7	99.7	99.4	87.8	29.8
Carlanderska	136	99.3	100.0	99.3	90.4	49.3
Elisabethkliniken	1	100.0	100.0	0.0	100.0	100.0
Kysthospitalet - DK*	14	0.0	0.0	0.0	0.0	0.0
Luleå- Sensia	6	100.0	100.0	100.0	83.3	33.3
Motala Aleris	511	99.0	99.8	98.0	86.1	41.7
Movement Halmstad	431	99.5	100.0	98.4	81.7	11.6
Nacka Aleris	144	96.5	100.0	98.6	64.6	52.8
OrthoCenter IFK-kliniken	113	99.1	99.1	100.0	85.8	71.7
OrthoCenter Sthlm	431	98.8	100.0	96.8	95.6	44.8
Ortopediska huset	461	100.0	100.0	96.1	90.0	41.0
Sabbatsberg Aleris	23	100.0	4.4	100.0	95.7	39.1
Sophiahemmet	136	99.3	99.3	89.6	64.0	42.7
St Göran	424	99.8	99.8	97.9	92.0	22.2
Ängelholm Aleris	218	98.2	100.0	99.1	77.5	28.9

*** Kysthospitalet in Denmark reports Swedish patients that they opererate but these are not included in the country results**

within the recommended 45-15 minutes. However during 2013-2015 the proportion has lessened to 79%. Only few units (Lidköping och Sollefteå) have implemented the latest recommendation. During 2015, only 40% of the patients had their preoperative dose 45-30 min. prior to surgery. The adaption of the prior and present recommendation was low at the Akademiska sjukhuset and in Skövde.

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
< 100 operations/year						
Borås	72	100.0	100.0	97.2	69.4	48.6
Eskilstuna	38	100.0	100.0	79.0	73.7	42.1
Gällivare	46	100.0	100.0	100.0	71.7	37.0
Helsingborg	66	100.0	100.0	100.0	66.7	28.8
Hudiksvall	87	98.9	98.9	97.7	90.8	37.9
Kalmar	89	100.0	100.0	89.9	91.0	51.7
Kristianstad	1	100.0	100.0	0.0	100.0	0.0
Lycksele	40	100.0	100.0	90.0	70.0	57.5
Norrtälje	94	97.9	100.0	98.9	71.3	40.4
Skene	97	100.0	100.0	89.7	86.6	54.6
Sollefteå	93	100.0	100.0	97.9	90.3	86.0
Sundsvall	44	100.0	100.0	88.6	77.3	50.0
Visby	60	98.3	100.0	88.3	78.3	31.7
Västervik	90	100.0	100.0	12.2	75.6	51.1
Ängelholm	2	100.0	100.0	100.0	50.0	0.0
100-300 operations/year						
Alingsås	193	99.5	100.0	100.0	89.6	64.3
Arvika	171	99.4	100.0	99.4	59.1	45.6
Danderyd	183	98.9	98.9	68.0	70.0	43.2
Eksjö-Nässjö	202	100.0	100.0	99.5	91.1	66.8
Falun	205	100.0	100.0	9.3	90.7	46.3
Frölunda Spec. sjukhus	124	100.0	100.0	100.0	72.6	47.6
Gävle	132	97.0	97.7	98.4	83.3	36.4
Halmstad	186	99.5	100.0	94.6	73.7	38.2
Jönköping	141	100.0	100.0	97.2	80.1	43.3
Karlshamn	249	100.0	100.0	69.9	86.8	23.3
Karlskoga	124	98.4	100.0	100.0	66.9	37.9
Karlstad	182	98.9	100.0	100.0	58.2	47.8
Kullbergska sjukhuset	157	99.4	99.4	98.1	72.0	54.8
Kungälv	215	99.5	99.5	99.1	77.7	29.3
Lidköping	234	99.6	100.0	98.3	97.4	82.9
Lindesberg	164	98.8	100.0	99.4	59.9	42.6
Ljungby	142	99.3	99.3	96.5	85.9	54.9
Mora	186	98.4	98.4	5.5	72.0	48.9
Norrköping	129	100.0	100.0	99.2	81.4	58.9
Nyköping	101	99.0	100.0	19.8	56.4	38.6
Oskarshamn	275	99.3	100.0	15.6	77.8	30.6
Piteå	244	99.6	99.6	100.0	93.4	21.3
Skellefteå	119	100.0	100.0	68.1	79.8	51.3
Skövde	120	100.0	100.0	98.3	35.8	30.8
Södersjukhuset	280	99.6	100.0	98.6	77.5	42.5
Södertälje	113	100.0	100.0	99.1	84.1	51.3
Torsby	130	100.0	98.5	100.0	83.1	49.2
Uddevalla	187	99.5	99.5	97.9	87.7	59.4
Varberg	127	98.4	99.2	88.0	94.5	59.1
Värnamo	148	100.0	100.0	99.3	78.4	50.7
Västerås	173	98.3	100.0	97.1	80.4	45.7
Växjö	115	100.0	100.0	99.1	84.4	46.1
Örnsköldsvik	115	99.1	100.0	11.3	82.6	50.4
Östersund	120	99.2	100.0	99.2	86.7	30.8
> 300 operations/year						
Enköping	393	99.5	99.2	99.0	80.9	45.6
Hässleholm	644	99.7	99.7	15.1	74.8	23.1
Mölndal	383	97.1	99.4	94.2	65.3	45.4
Trelleborg	791	99.1	100.0	98.6	80.8	48.0

Antithrombotic prophylaxis for knee arthroplasties

The table ”Antithrombotic prophylaxis” shows what the hospitals reported having administrated for primary knee arthroplasties in 2015.

Topmost is the average for the country as a whole after which the hospitals are classified as being university hospitals, private hospitals or "other" based 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. As there is no national or international consensus concerning best practice regarding the drug to use, or when to start or end the treatment, we only show what is most commonly reported.

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 but was somewhat lower in 2014 and 2015. 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).

In recent years, 77-79% of the surgeries have had antithrombotic prophylaxis with a planned duration of 8-14 days but now, an increased proportion (15%) have a shorter planned length of treatment as compared to before (6-8%).

Antithrombotic prophylaxis

Hospital	Number of reports	Complete reports %	Percent starting postoperatively	Percent having injection	Percent treated for 8-14 days
Country	**12,903**	**99.8**	**87.1**	**77.6**	**77.3**
University hospitals					
Akademiska	109	100.0	20.2	91.7	89.9
Huddinge	159	99.4	97.5	98.7	88.1
Karolinska Solna	93	98.9	20.7	98.9	57.0
Lund	103	96.1	92.9	96.1	33.0
Sahlgrenska	2	100.0	50.0	100.0	50.0
Umeå	146	99.3	97.3	2.8	99.3
Örebro	30	100.0	80.0	20.0	90.0
Private units					
ArtClinic Göteborg	16	100.0	100.0	50.0	100.0
ArtClinic Jönköping	29	100.0	100.0	82.8	100.0
Bollnäs Aleris	353	100.0	92.9	100.0	96.0
Carlanderska	136	100.0	94.9	1.5	98.5
Elisabethkliniken	1	100.0	100.0	100.0	100.0
Kysthospitalet - DK*	14	100.0	100.0	100.0	0.0
Luleå- Sensia	6	100.0	83.3	50.0	100.0
Motala Aleris	511	99.4	96.5	99.4	96.9
Movement Halmstad	431	99.8	97.9	99.5	0.7
Nacka Aleris	144	100.0	96.5	100.0	98.6
OrthoCenter IFK-kliniken	113	100.0	95.6	4.4	95.6
OrthoCenter Sthlm	431	100.0	96.5	99.5	98.8
Ortopediska huset	461	99.8	96.1	100.0	98.7
Sabbatsberg Aleris	23	100.0	91.3	100.0	95.7
Sophiahemmet	136	100.0	95.6	100.0	40.4
St Göran	424	99.8	90.3	99.5	96.5
Ängelholm Aleris	218	99.1	96.8	95.0	98.2

*** Kysthospitalet in Denmark reports Swedish patients that they opererate but these are not included in the country results**

Antithrombotic prophylaxis

Hospital	Number of reports	Complete reports %	Percent starting postoperatively	Percent having injection	Percent treated for 8-14 days
Country	12,903	99.8	87.1	77.6	77.3
< 100 operations/year					
Borås	72	100.0	93.1	100.0	95.8
Eskilstuna	38	97.4	91.9	94.7	92.1
Gällivare	46	100.0	95.7	100.0	87.0
Helsingborg	66	100.0	86.7	100.0	98.5
Hudiksvall	87	100.0	67.8	100.0	94.3
Kalmar	89	100.0	91.0	100.0	92.1
Kristianstad	1	100.0	100.0	100.0	0.0
Lycksele	40	100.0	7.5	100.0	97.5
Norrtälje	94	100.0	85.1	27.7	40.4
Skene	97	100.0	96.9	100.0	96.9
Sollefteå	93	100.0	92.5	98.9	50.5
Sundsvall	44	100.0	70.5	18.2	79.6
Visby	60	100.0	90.0	98.3	91.7
Västervik	90	98.9	79.8	98.9	85.6
Ängelholm	2	100.0	100.0	100.0	100.0
100-300 operations/year					
Alingsås	193	100.0	94.8	91.7	89.9
Arvika	171	99.4	86.0	12.9	91.2
Danderyd	183	100.0	88.1	100.0	89.6
Eksjö-Nässjö	202	100.0	80.2	99.5	94.6
Falun	205	100.0	92.7	7.3	95.6
Frölunda Spec. sjukhus	124	100.0	92.8	0.8	99.2
Gävle	132	100.0	94.7	99.2	94.7
Halmstad	186	100.0	87.1	33.9	67.7
Jönköping	141	98.6	35.3	66.0	92.9
Karlshamn	249	99.6	95.2	99.6	94.0
Karlskoga	124	100.0	12.9	100.0	100.0
Karlstad	182	100.0	92.9	7.7	91.2
Kullbergska sjukhuset	157	100.0	97.5	100.0	94.3
Kungälv	215	100.0	94.0	99.5	94.9
Lidköping	234	100.0	91.0	10.7	73.9
Lindesberg	164	98.8	78.4	22.2	77.2
Ljungby	142	100.0	9.9	99.3	97.9
Mora	186	100.0	90.3	11.3	92.5
Norrköping	129	100.0	93.0	100.0	97.7
Nyköping	101	97.0	91.1	100.0	91.1
Oskarshamn	275	100.0	93.8	100.0	98.6
Piteå	244	100.0	92.2	7.8	95.5
Skellefteå	119	100.0	99.2	100.0	100.0
Skövde	120	100.0	92.5	97.5	91.7
Södersjukhuset	280	99.3	93.5	95.0	92.9
Södertälje	113	100.0	98.2	100.0	79.7
Torsby	130	100.0	90.0	9.2	90.0
Uddevalla	187	100.0	88.2	100.0	95.2
Varberg	127	100.0	85.8	32.3	68.5
Värnamo	148	100.0	31.1	100.0	96.0
Västerås	173	100.0	91.3	15.0	94.8
Växjö	115	100.0	8.7	100.0	86.1
Örnsköldsvik	115	100.0	90.4	28.7	87.8
Östersund	120	100.0	90.8	100.0	94.2
> 300 operations/year					
Enköping	393	100.0	72.0	99.8	69.2
Hässleholm	644	100.0	96.0	100.0	3.3
Mölndal	383	99.5	90.6	11.5	95.0
Trelleborg	791	100.0	98.2	99.8	1.9

Surgical technique for knee arthroplasties

The table ”Surgical technique” shows what the hospitals reported for having used in their primary knee arthroplasties in 2015.

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.

As there is no national or international consensus concerning best practice regarding the drug to use, or when to start or end the treatment, we show what is most commonly reported.

Spinal anesthesia is most common (74%) but the proportion of general anesthesia (25%) has more than doubled since 2011. Bollnäs, Nacka, Karlshamn and Södertälje report more than 80% of their arthroplasties being performed using general anesthesia.

The use of drains has lessened from 26% in 2011 to 8% in 2014. Motala, Sophiahemmet and Kullbergska still use drainage in the majority of their primaries.

More surgeries were in 2015 reported to have been performed without tourniquet than previously. The use tourniquet has lessened from 90% in 2011 to 60% in 2015.

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

The median time for performing a primary varied from 40 minutes to almost two hours. For TKA's it was 74 min., for UKA's 70 min., for femoropatellar arthroplasties 68 min. and for linked implants 134 min.

Since 2009, the median operating time for TKA's has varied between 71 and 82 min. and for UKA's between 70 and 80 min..

Bone transplantation is uncommon in primary arthroplasty and almost exclusively using auto transplantation. It was reported in 1.2% of the primaries and almost equally as often in the femur (48%) and the tibia (46%).

Computer aided surgery (CAS) was only reported for 19 cases (0.15%) at 14 units (9 in 2014).

Surgical technique

Hospital	Number of reports	Complete reports %	Percent having General anesthesia	Percent Drainage	Percent Tourniquet	Percent LIA	Median Op-time
Country	**12,903**	**99,8**	**25,1**	**7,7**	**60,2**	**95**	**74**
University Hospitals							
Akademiska	109	100.0	19.3	1.0	79.8	97.3	75
Huddinge	159	98.7	9.4	3.1	22.6	84.9	128
Karolinska Solna	93	97.8	15.1	7.5	90.3	81.7	80
Lund	103	100.0	51.5	1.9	29.1	94.2	86
Sahlgrenska	2	100.0	50.0	0.0	50.0	100.0	141
Umeå	146	96.6	11.9	4.8	78.1	90.4	104
Örebro	30	100.0	40.0	6.7	100.0	93.3	102
Private units							
ArtClinic Göteborg	16	100.0	0.0	0.0	93.8	81.3	92
ArtClinic Jönköping	29	100.0	10.3	0.0	100.0	100.0	95
Bollnäs Aleris	353	100.0	92.6	2.0	81.9	98.9	58
Carlanderska	136	100.0	17.7	20.6	95.6	97.8	57
Elisabethkliniken	1	100.0	100.0	0.0	1.0	1.0	116
Kysthospitalet - DK*	14	100.0	100.0	0.0	100.0	100.0	75
Luleå- Sensia	6	100.0	50.0	0.0	100.0	66.7	77
Motala Aleris	511	99.6	5.7	90.8	24.5	99.4	44
Movement Halmstad	431	100.0	3.5	0.5	34.8	99.5	68
Nacka Aleris	144	100.0	99.3	0.0	2.8	95.1	61
OrthoCenter IFK-kliniken	113	99.1	29.5	2.7	1.8	67.3	76
OrthoCenter Sthlm	431	100.0	1.9	1.4	71.9	82.8	62
Ortopediska huset	461	99.8	14.1	0.2	88.1	96.3	63
Sabbatsberg Aleris	23	100.0	17.4	0.0	100.0	100.0	60
Sophiahemmet	136	98.5	6.6	55.9	72.8	77.9	75
St Göran	424	98.8	28.5	0.7	94.6	95.5	60
Ängelholm Aleris	218	100.0	52.3	0.5	72.9	99.5	60

*** Kysthospitalet in Denmark reports Swedish patients that they opererate but these are not included in the country results**

No UKA's were reported having been performed using CAS.

Custom made instruments/cutting blocks were reported in 280 (2.2%) of the surgeries which was three times that reported in 2014. 25 units reported having used such instruments, most having only done a few. Movement Halmstad accounted for a half of the cases (146) while Kungälv (29), Mölndal (24) and Motala (15) accounted for a quarter.

Surgical technique

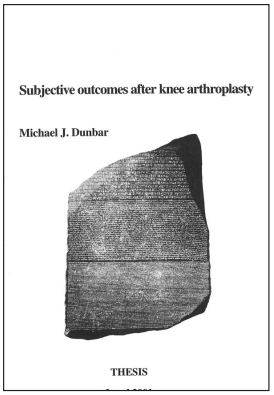
Hospital	Number of reports	Complete reports %	Percent having General anaesthesia	Percent Drainage	Percent Tourniquet	Percent LIA**	Median Op-time
Country	**12,903**	**99,8**	**25,1**	**7,7**	**60,2**	**95**	**74**
< 100 operations/year							
Borås	72	98.6	22.2	1.4	97.2	62.5	108
Eskilstuna	38	100.0	10.5	7.9	52.6	97.4	107
Gällivare	46	100.0	6.5	0.0	39.1	97.8	117
Helsingborg	66	100.0	33.3	9.1	4.6	97.0	90
Hudiksvall	87	100.0	6.9	0.0	56.3	89.7	79
Kalmar	89	100.0	19.1	0.0	1.1	96.3	99
Kristianstad	1	100.0	0.0	0.0	0.0	100.0	70
Lycksele	40	100.0	100.0	0.0	100.0	52.5	101
Norrtälje	94	100.0	22.3	0.0	95.7	83.0	89
Skene	97	100.0	14.4	0.0	95.9	91.9	91
Sollefteå	93	97.8	8.6	18.3	87.1	97.9	97
Sundsvall	44	100.0	2.3	11.4	36.4	100.0	105
Visby	60	100.0	26.7	0.0	71.7	100.0	110
Västervik	90	98.9	30.3	0.0	25.6	100.0	77
Ängelholm	2	100.0	100.0	0.0	50.0	100.0	67
100-300 operations/year							
Alingsås	193	100.0	17.1	0.5	96.4	96.4	75
Arvika	171	100.0	10.5	0.0	0.6	98.8	74
Danderyd	183	100.0	8.7	1.6	72.1	97.3	94
Eksjö-Nässjö	202	100.0	23.8	9.4	90.1	98.0	67
Falun	205	100.0	14.6	2.4	98.1	100.0	76
Frölunda Spec. sjukhus	124	100.0	22.6	0.8	100.0	82.3	46
Gävle	132	100.0	37.1	10.6	86.4	96.2	74
Halmstad	186	100.0	15.6	15.6	98.4	93.0	86
Jönköping	141	99.3	20.7	1.4	96.5	92.2	94
Karlshamn	249	99.6	83.9	0.0	87.6	99.2	72
Karlskoga	124	99.2	15.3	5.7	75.8	98.4	105
Karlstad	182	98.9	18.9	0.6	0.0	98.4	60
Kullbergska sjukhuset	157	100.0	20.4	86.6	93.0	94.9	89
Kungälv	215	100.0	30.2	0.0	19.5	89.7	88
Lidköping	234	100.0	10.7	4.3	13.3	97.0	86
Lindesberg	164	98.8	20.4	0.6	98.2	99.4	102
Ljungby	142	99.3	32.4	0.7	50.7	97.9	69
Mora	186	100.0	8.6	0.5	98.9	98.9	60
Norrköping	129	100.0	18.6	0.0	76.7	97.7	93
Nyköping	101	99.0	14.0	5.0	10.9	98.0	91
Oskarshamn	275	100.0	16.0	1.1	85.8	82.2	71
Piteå	244	100.0	8.2	0.4	95.5	98.0	73
Skellefteå	119	100.0	1.7	0.8	100.0	100.0	100
Skövde	120	100.0	14.2	0.8	75.8	96.7	83
Södersjukhuset	280	99.3	17.6	9.3	10.0	92.2	76
Södertälje	113	100.0	85.8	2.7	100.0	96.5	74
Torsby	130	100.0	13.9	0.0	0.0	97.7	54
Uddevalla	187	100.0	9.6	17.7	97.9	100.0	94
Varberg	127	99.2	10.3	0.0	55.1	70.1	90
Värnamo	148	100.0	11.5	18.9	99.3	96.0	101
Västerås	173	100.0	13.3	0.0	52.0	91.9	84
Växjö	115	100.0	39.1	0.0	20.9	92.2	97
Örnsköldsvik	115	100.0	5.2	0.9	100.0	98.3	84
Östersund	120	100.0	11.7	0.0	80.0	99.2	118
> 300 operations/year							
Enköping	393	99.5	13.6	1.3	99.0	98.0	74
Hässleholm	644	100.0	77.3	0.8	14.4	98.3	40
Mölndal	383	99.2	25.1	1.8	1.8	94.0	91
Trelleborg	791	100.0	25.4	0.3	55.9	99.4	71

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. We have also found that the observed proportion as well as which patients do not experience pain relief one year after total knee arthroplasty is dependent on the type of questionnaire used (W-Dahl et al 2014).

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

The project started within the Region of Skåne where 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.

In 2012 Hässleholm was included and in 2013 the remaining hospitals in Skåne (Lund, Malmö, Helsingborg and Ängelholm). In the 2014 and 2015 reports we expanded the reporting of PROM data ton include units outside Skåne (Norrköping, Motala and Oskarshamn).

What we have learned from the project is that it seems difficult to find statistically and clinically significant differences between units, that there were large variations between individuals and that in spite of some differences in case-mix bertween the two of the largest arthroplasty units in Sweden their differences in PROM results were small. In addition the number of procedures as well as the completeness in reporting varies which makes it difficult to interpret and compare results of different units and for different years of surgery.

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. Mölndal has however chosen to only register EQ-5D, VAS pain and satisfaction with the surgery one year postoperatively and not the disease specific KOOS. 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 69.

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 67 and 69.

Case-mix

A summary of case-mix factors such as gender, age, diagnosis, BMI and comorbidity is shown for the respective hospitals on page 56-57.

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.

UKA and PROM

The number of UKA’s performed for OA in the hospitals reporting PROM in 2014 was few (87 surgeries) with one unit performing more than half of the surgeries. Due to the low number of procedures in combination with low completeness (59%) we do not provide PROM-data for UKA's.

Results

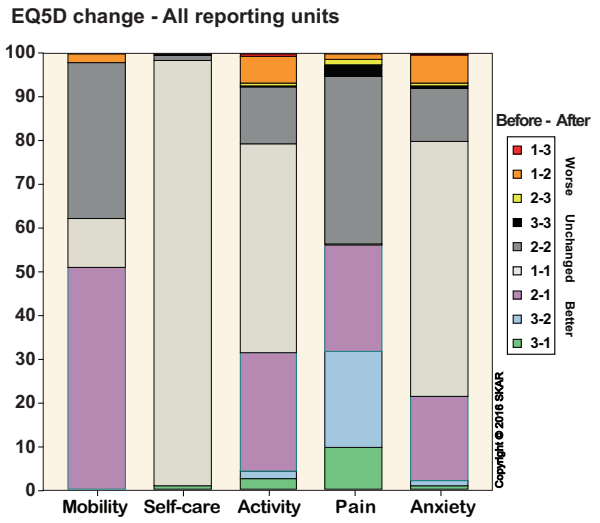
EQ5D

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, a fifth had reduced anxiety and only a few improved in self-care. The results are similar to those of previous years.



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

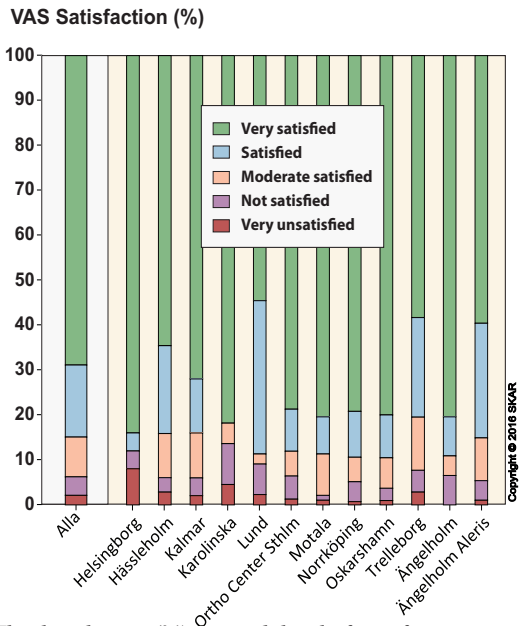
For units with high response rates (Hässleholm, Norrköping, OrthoCenter Stockholm, Oskarshamn and Trelleborg) the differences between the units were small (0-10 points) both pre- and postoperatively when the patients operated 2013 estimated their general health. For units with few patients and/or low response rate the variation in the patient estimates was slightly larger (2-23 points). In 2015, the preoperative differences were also small (1-15 points).

VAS – Knee pain

The difference in preoperative knee pain of patients operated 2014 in Hässleholm, Norrköping, OrthoCenter Stockholm, Oskarshamn och Trelleborg was small between the units (1-3 points). One year postoperatively the difference was similar (1-8 points). For the other units the differences were also small, 1-12 points preoperatively and 0-8 points one year postoperatively.

VAS – Satisfaction with the surgery

73 % 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 were most often satisfied in Oskarshamn (90%), OrthoCenter Stockholm (89%) and Norrköping (89%) followed by Hässleholm (84%) and



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

Trelleborg (81%). For the other hospitals (Helsingborg, Karolinska i Solna, Lund, Motala och Ängelholm) the proportion of satisfied patients varied between 82 and 89% (figure below to the left.).

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.

The EQ-VAS and VAS pain are shown in a similar way in the table below. For patients operated in 2014 both the pre- and postoperative results are shown but for patients operated in 2015 only the preoperative results are available.

Satisfaction one year after surgery (2014)
VAS (0-100) (worst - best)

Hospital	Number of reports	Complete reports (%)	Postop Mean (SD)
All units	2,116	73	19 (23)
Helsingborg	29	71	21 (32)
Hässleholm	508	88	19 (23)
Kalmar	47	70	16 (23)
Karolinska	20	26	16 (23)
Lund	43	70	22 (22)
Motala	244	66	15 (22)
Norrköping	99	80	14 (20)
OrthoCenter Sthlm	302	82	14 (23)
Oskarshamn	227	91	14 (19)
Trelleborg	599	82	23 (23)
Ängelholm	38	60	24 (27)
Ängelholm Aleris	96	67	21 (21)

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						
2014	2,216	75	64 (18)	18 (20)	67 (22)	76 (19)
2015	3,541	92	65 (18)		65 (23)	
Hospital:						
Helsingborg						
2014	29	73	71 (21)	17 (23)	57 (30)	77 (25)
2015	52	83	71 (17)		62 (21)	
Hässleholm						
2014	508	88	62 (18)	17 (19)	72 (21)	77 (18)
2015	547	99	62 (18)		71 (22)	
Kalmar						
fom 26/3 2014	47	70	64 (14)	17 (20)	66 (21)	74 (24)
2015	75	70	64 (20)		64 (21)	
Karolinska						
2014	20	26	72 (16)	15 (15)	54 (18)	79 (12)
2015	53	74	71 (17)		57 (23)	
Kungälv						
2015	137	87	66 (17)		63 (21)	
Lund						
2014	45	74	66 (18)	23 (20)	60 (18)	71 (15)
2015	56	77	62 (20)		65 (22)	
Motala						
2014	235	63	66 (17)	17 (19)	62 (22)	76 (19)
2015	276	81	67 (16)		63 (24)	
Mölndal						
2014	247	75	65 (18)		63 (21)	
Norrköping						
2014	96	79	70 (17)	19 (21)	62 (24)	77 (18)
2015	109	93	72 (16)		57 (25)	
OrthoCenter Sthlm						
2014	296	80	65 (17)	14 (18)	64 (22)	79 (17)
2015	355	92	66 (18)		63 (22)	
Oskarshamn						
2014	218	88	65 (17)	15 (17)	62 (24)	75 (20)
2015	235	92	65 (16)		62 (23)	
Trelleborg						
2014	556	82	63 (19)	22 (20)	70 (21)	75 (19)
2015	644	93	65 (19)		70 (21)	
Ängelholm						
2014	38	59	67 (17)	25 (24)	66 (24)	71 (23)
Ängelholm Aleris						
2014	90	63	60 (14)	18 (18)	60 (20)	78 (19)
2015	159	85	65 (14)		56 (24)	

KOOS

The differences were small between those units that in 2014 had a relatively high response rate and reported both pre- and postoperative PROM data (Hässleholm, Norrköping, OrthoCenter Stockholm, Oskarshamn och Trelleborg). For units with few patients and/or low response rate the results vary and are difficult to interpret. For 2015 the preoperative differences were also small.

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 2014 both the pre- and postoperative results are shown but for patients operated in 2015 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 89% of the patients in Oskarshamn, Norrköping and OrthoCenter Stockholm 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 on-line into our common database.

A number of units (Alingsås, Bollnäs, Eksjö-Nässjö, Karolinska i Huddinge, Karlskoga, Lindesberg, Södertälje och Örebro) began gathering PROM data in 2016 which they enter on-line into our common database.

Gathering a representative material with one year follow-up will take more than 2 years. Only then, the participating units can begin comparing their results to that of others. Still, 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 2014 & 2015) as well as 1 year postoperatively (surgeries 2014)

				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													
2014	2 216	75	42.6	41 (15)	80 (18)	47 (17)	76 (17)	46 (15)	79 (18)	12 (14)	37 (27)	23 (14)	64 (23)
2015	3 541	92	43.6	40 (15)		46 (18)		45 (16)		11 (15)		22 (14)	
Hospital													
Helsingborg													
2014	29	73	31	41 (16)	82 (17)	51 (20)	82 (17)	45 (15)	83 (16)	7 (11)	36 (26)	18 (11)	65 (24)
2015	52	83	52	40 (14)		46 (19)		43 (13)		7 (11)		18 (12)	
Hässleholm													
2014	508	88	42.5	39 (15)	81 (18)	46 (18)	76 (16)	45 (15)	79 (18)	12 (15)	39 (27)	24 (14)	65 (24)
2015	547	99	42.1	40 (15)		47 (17)		44 (16)		13 (15)		23 (13)	
Kalmar													
from 26/3 2014	47	70	44.7	40 (15)	79 (219	50 (16)	77 (19)	49 (15)	78 (24)	12 (19)	40 (27)	23 (14)	66 (24)
2015	75	70	40.5	43 (16)		49 (16)		48 (14)		17 (18)		23 (13)	
Karolinska													
2014	20	26	52.6	39 (15)	92 (7)	49 (20)	89 (8)	46 (16)	93 (6)	8 (10)	74 (15)	16 (9)	84 (12)
2015	53	74	58.5	37 (15)		41 (17)		40 (18)		9 (12)		19 (13)	
Kungälv													
2015	137	87	58.5	39 (14)		44 (17)		46 (16)		11 (15)		21 (14)	
Lund													
2014	45	74	57.8	41 (14)	76 (20)	51 (17)	75 (19)	43 (13)	76 (19)	6 (9)	29 (28)	19 (13)	60 (22)
2015	56	77	51.8	41 (17)		50 (21)		45 (17)		11 (13)		23 (16)	
Motala													
2014	235	63	41.2	40(15)	81 (18)	45 (16)	78 (17)	45 (15)	79 (19)	11 (13)	36 (26)	23 (14)	64 (21)
2015	276	81	45.8	39 (16)		43 (18)		45 (16)		12 (16)		21 (14)	
Norrköping													
2014	96	79	48.9	37 (17)	81 (16)	44 (16)	77 (16)	42 (15)	79 (16)	8 (10)	34 (27)	20 (14)	63 (22)
2015	109	93	48.1	37 (14)		44 (18)		42 (18)		9 (14)		20 (14)	
OrthoCenter Sthlm													
2014	296	80	45.9	43 (16)	83 (17)	46 (17)	77 (19)	49 (17)	82 (16)	13 (14)	39 (28)	22 (14)	64 (23)
2015	355	92	39.4	40 (16)		45 (18)		49 (17)		12 (15)		21 (14)	
Oskarshamn													
2014	218	88	43.9	40 (16)	82 (18)	47 (18)	78 (16)	45 (15)	79 (18)	10 (14)	36 (26)	22 (14)	65 (23)
2015	235	92	47.6	40 (15)		47 (17)		45 (15)		11 (14)		21 (13)	
Trelleborg													
2014	556	82	41,8	42 (15)	78 (18)	50 (17)	75 (179	47 (15)	77 (19)	13 (14)	35 (28)	25 (14)	62 (24)
2015	644	93	37,7	41 (16)		48 (18)		47 (16)		11 (14)		23 (14)	
Ängelholm													
2014	38	59	34.2	41 (14)	78 (21)	49 (17)	73 (19)	47 (16)	77 (21)	10 (13)	34 (28)	22 (16)	64 (25)
Ängelholm Aleris													
2014	90	63	30,3	41 (13)	82 (17)	47 (17)	78 (19)	46 (14)	82 (17)	14 (19)	40 (28)	23 (12)	67 (24)
2015	159	85	45,4	38 (14)		42 (16)		43 (15)		9 (13)		19 (13)	

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 osteoarthritis. 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.

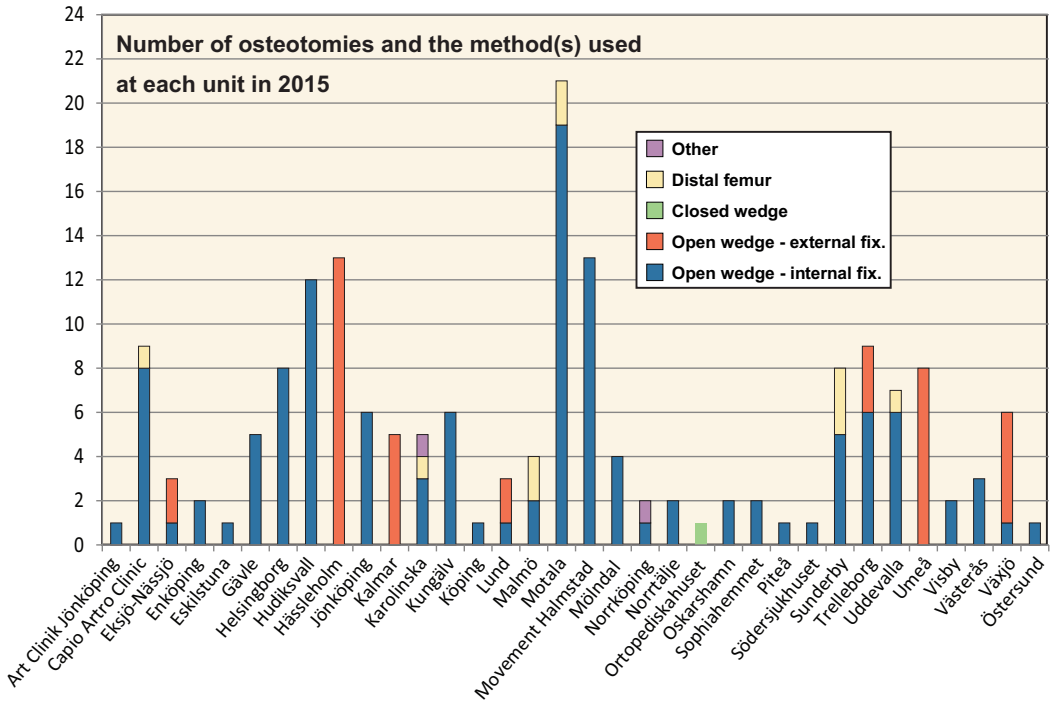
Sweden became the first country in the world to start a national osteotomy registration as a complement to the knee arthroplasty registry (W-Dahl et al. 2014).

Australia and New Zealand have plans of analogous registration together with their respective arthroplasty registries. They will harmonize their registration with the Swedish reporting form facilitating future co-operation and comparisons. In Great Britain a separate register of osteotomies was initiated in 2014 with a financial help from the industry (Elson et al. 2015).

In 2015, 177 osteotomies were reported from 34 hospitals. As the figure below shows, only 6 hospitals reported having performed 10 or more during the year. The hospital performing most was Motala that did 19. As compared to the previous years it seems that somewhat fewer osteotomies have been reported from more hospitals.

It is difficult to assess how many of the osteotomies performed in the country are captured by the register. The surgical code NGK59 (Nomesco) that the health authorities register when an osteotomy has been performed also applies to those performed for other reasons than disease or damage in the knee. The number of osteotomies captured in 2015 was approx. 47% of the total number of surgeries registered in 2015 by the authorities using the code NGK59 in 2014, irrespective of age or diagnosis. However, so far no children have been reported to the register and if the age interval is limited to patients 15-65 years of age, the proportion in the osteotomy register increases to 55%.

With help of the Registerservice by the Swedish Association of Local Authorities and Regions we have started a project of selecting reasonable ICD10 diagnostic codes that have to be combined with the surgical code NGK59 in order to better be able to assess the completeness of the osteotomy register.



Patient characteristics and case-mix in knee osteotomy surgery

Results

The following pages show the results for the knee osteotomies that were reported in 2015.

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

Patient characteristics

60% of the patients were males and the median age was 51 years that can be compared for the median age in 2015 for patients having TKA (69) and UKA (64). 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 7 degrees. Patients having distal femur osteotomy were younger, most were women and they had somewhat less axis deviation than those having proximal tibia osteotomy (see below).

Patient characteristics - osteotomies

	All n=177	Prox. Tibia n= 167 (94%)	Dist. Femur n=10 (6%
Age (years)			
median (range)	51 (20-69)	51 (20-69)	42 (27-60)
Gender			
Men - n (%)	107 (60)	106 (63)	1
Women - n (%)	70 (46)	61 (37)	9
Preop HKA angle, n=206			
median (range)	7 (0-30)	7.5 (0-30)	5 (0-15)
ASA classifikation, n=165			
ASA I - n (%)	101 (61)	94 (61)	7
ASA II - n (%)	62 (38)	59 (38)	3
ASA III - n (%)	2 (1)	2 (1)	0
OA type, n=189			
Medial n (%)	143 (91)	143 (95)	0
Lateral n (%)	15 (9)	7 (5)	8
OA grade, n=145			
Ahlbäck 1 - n (%)	68 (47)	62 (45)	6
Ahlbäck 2 - n (%)	53 (37)	52 (38)	1
Ahlbäck 3 - n (%)	24 (16)	23 (17)	1

Body Mass Index (kg/m^2)

BMI group	Number	Percent
<25	31	17.5
25-29.9	93	52.5
30-34.9	35	19.8
35-39.9	7	4
40+	0	0
Missing	11	6.2
Total	177	100

Previous surgery

Reporting previous surgery of the index knee, it is possible to mark more than one alternative. Previous surgery was reported for two thirds of the patients and more than one surgery for 14%. This can be compared to the knee arthroplasty patients for whom 19% were reported to have had previous surgery and 3% 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	59	33.3
Fracture surgery	6	3.4
Meniscal surgery	36	20.4
Cruciate surgery	16	9
Arthroscopy	42	23.7
Other	4	2.3
Missing	14	7.9
Total	177	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 in one case.

Reason for the osteotomy

Diagnosis	Number	Percent
Osteoarthritis	158	89.3
Acquired deformity	10	5.6
Congenital deformity	1	0.6
Instability	6	3.4
Osteonecrosis	0	0
Other	0	0
Missing	2	1.1
Total	177	100

Type of osteotomy

Type	Number	Percent
Open wedge intern fixation	126	71.2
Open wedge extern fixation	38	21.5
Closed wedge	1	0.6
Curved/Dome	1	0.6
Distal femur	10	5.6
Rotation osteotomy	1	21.4
Missing	0	0
Total	177	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 80% of those used in this type of surgeries (see below).

Type of fixation in open wedge osteotomy with internal fixation

Type	Number	Percent
Tomofix	69	54.8
CountureLock	10	7.9
Pudo	23	18.3
iBalance	6	4.7
OTIS	4	3.2
Peek power	1	0.8
Other	3	2.4
Missing	10	7.9
Total	135	100

Transplantation of bone

In a good 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	54
Auto transplantation		10	7.9
Bank bone		7	5.6
Synthetic bone		41	32.5
Missing		0	0
	Total	126	100
Synthetic bone:			
DePuy/Synthes Chronos		9	
Osferion		23	
OTIS		7	
Missing		2	

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	33
Monotube	5
Total	38

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 platta	1
Tomofix	6
Pudo	2
Arthrex femur plate	1
Total	10

Simultaneous surgery

An additional simultaneous surgery was reported to have been performed together with the osteotomy in 39 (22%) cases. Arthroscopy was the most common simultaneous procedure (see below).

Simultaneous surgery with the osteotomy

Surgery	Number	Percent
None	117	66.1
Arthroscopy	29	16.4
Cruciate surgery	5	2.8
Meniscal surgery	0	0
Other	5	2.8
Missing	21	11.9
Total	177	100

Type of anesthesia

General anesthesia which was used in 58% of cases was the most common method (see table).

.

Type of anesthesia

Type	Number	Percent
General	103	58.2
Epidural	2	1.1
Spinal	60	33.9
Combination	0	0
Missing	12	6.8
Total	177	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 (49 min, 21-94) than with internal fixation (64 min, 35-144). Closed wedge osteotomies took longer time (75 min as well as dome osteotomies (109 min) and distal femur osteotomies (76 min, 35-111). The table below shows the median operating times including osteotomies with simultaneous surgeries.

Operating time

Type of osteotomy	Median (min)	Range (Min)
Closed wedge	75	
Open wedge internal	71	(35-286)
Open wedge external	53	(21-155)
Dome	109	
Distal femur	85	(35-156)
Rotation osteotomy	190	

Computer aided surgery (CAS)

No osteotomies were reported to have ben performed with the help of navigation.

Antithrombotic prophylaxis

Fragmin och Innohep were the most commonly used substances. When using Fragmin, Innohep or Klexane, the prophylaxis using was more commonly started postoperatively. Eight percent of the osteotomy patients did not receive any antithrombotic prophylaxis at all (see table), unlike the knee arthroplasty patients which almost always receive prophylaxis.

Thromboprophylaxis

Substance - time	Number	Percent
None	15	8.5
Fragmin preop	6	3.4
Fragmin postop	45	25.4
Inohep preop	6	3.4
Inohep postop	68	38.4
Klexane preop	7	4
Klexane postop	13	7.3
Eliqvis	3	1.7
Macrodex	1	0.6
Missing	12	7.3
Total	177	100

Tromboprophylaxis - 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	15	8.5
1-7	22	12.4
8-14	116	65.6
15-21	6	3.4
22-28	2	1.1
29-35	2	1.1
>35	2	1.1
Missing	12	6.8
Total	177	100

Antibiotic drugs

Cloxacilline or Clindamycin were used in all surgeries for which a substance name was reported. Clindamycin was used in 8% 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	149	84,2
Clindamycin	15	8,4
Other	1	0,6
Missing	12	6,8
Total	177	100

Cloxacillin dosage

More than half received 2g x 3 within 24 hours while a third had 2g as a single dose.

Cloxacillin dose

Dose	Number	Percent
Cloxacilline 2gx1	59	39,6
Cloxacilline 2gx2	7	4,7
Cloxacilline 2gx3	81	54,4
Cloxacilline 2gx4	2	1,3
Total	149	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	64	36,1
30-45	60	33,9
>45	29	16,4
Start after surgery	9	5,1
Missing	15	8,5
Total	177	100

Tourniquet and drainage

Use of tourniquet is popular among Swedish orthopedic surgeons and it was used in 70% of the osteotomies as compared to 60% of the knee arthroplasties. However, drainage was used in only 7% of the osteotomies (see tables below)

Tourniquet and drainage

Tourniquet	Number	Percent
Yes	123	69,5
No	42	23,7
Missing	12	6,8
Total	177	100

Drainage	Number	Percent
Yes	13	7,3
No	152	85,9
Missing	12	6,8
Total	177	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 ....)

ICD10- and NOMESCO codes used for definition of unwanted events

DA - Surgical diagnoses

If the codes occur as a main- or secondary diagnosis during the first admission or as the main diagnosis at a later admission

Exact code	Exact code
G978	T840
G979	T840G
M966G	T843
M968	T843G
M969	T844
T810	T844G
T812	T845
T813	T845G
T814	T847
T815	T847G
T816	T848
T817	T848G
T818	T849
T818W	T888
T819	T889

DB - Diagnoses for knee related events

If the codes occur as a main- or secondary diagnosis during the first admission or as a secondary diagnosis at a later admission	If the codes occur as the main diagnosis after the first admission
Exact code	Exact code
G573	M235
G574	M240
M000	M245
M000G	M246
M002G	M256
M008G	M659G
M009G	M860G
M220	M861G
M221	M866
M236	M866G
M244G	M895G
M621G	
M662G	
M663G	
M843G	
S342	
S800	
S810	
S830	
S831	
S834L	
S834M	
S835R	
S835S	
S835X	
S840	
S841	

DC - Cardiovascular diagnoses

If the codes occur as a main- or secondary diagnosis during the first admission or as the main diagnosis at a later admission

Exact code	Starts with
I260	I21..
I269	I24..
I460	I60..
I461	I61..
I469	I62..
I490	I63..
I649	I65..
I770	I66..
I771	I72..
I772	I74..
I819	I82..
I978	
I979	
J809	
J819	
T811	

DM - Diagnoses for other medical events

If the codes occur as a main- or secondary diagnosis during the first admission or as a secondary diagnosis at a later admission		If the codes occur as the main diagnosis after the first admission	
Exact code	Börjar på	Exact code	Börjar på
J952	L89	K590	J20..
J953	I80	N991	J21..
J955	J13		J22..
J958	J14		K29..
J959	J15		
J981	J16		
N990	J17		
N998	J18		
N999	K25		
R339	K26		
	K27		
	N17		

A - Surgical intervention codes

If the codes occur during the first admission at a date ofter the primary surgery date or as the main intervention code at a later date

Exact code	Starts with
NFQ09	NGA..
NFQ19	NGC..
NFQ99	NGE..
NGB59*	NGG..
NGF01	NGH..
NGF02	NGJ..
NGF10	NGL..
NGF11	NGS..
NGF12	NGU..
NGF91	NGW..
NGF92	QDB..
NGK09	QDG..
NGK19	
NGM09	
NGQ09	
NGT09	
NGT19	
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QDE35	
TNG05	
TNG10	

*enbart vid återinläggning

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