

Annual report 2024

The Swedish Arthroplasty Register



SWEDISH
ARTHROPLASTY REGISTER

Annual report 2024

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Glossary

Expression	Definition
Adverse event	An unexpected negative event, in this case, as a consequence of joint replacement surgery, for example an infection.
Ahlbäck classificationen	Radiological classification of knee osteoarthritis
ASA class	American Society of Anesthesiologist physical status classification: classification of patients regarding medical comorbidity. The higher the ASA class, the greater the degree of comorbidity
Aseptic loosening	Loosening of prosthesis component(s) without proven infection.
Bilateral prosthesis	Prosthesis in both right and left hip/knee respectively.
Bipolar head	Composite femoral head used for hemiarthroplasty where a smaller head is fixated on the prosthesis cone, and a larger head is snapped on to the smaller head. The result is that movement can take place in two joints, one between the smaller and the larger head, and one between the larger head and the acetabulum.
BMI	Body mass index= weight divided by length squared (kg/m ²).
Case-mix profile	Case-mix or distribution of patient characteristics at each unit respectively.
CE	Conformité Européenne (in free translation: European conformity).
Charnley class	Classification of comorbidity that mainly relates to mobility. Class A refers to unilateral hip/knee disease, class B refers to bilateral hip/knee disease, and class C refers to multiple joint disease or other medical conditions that affect the walking ability.
Closed reduction	Return body part or fracture to proper position without surgical incision.
Computer assisted surgery (CAS)	A surgical concept and set of methods that use computer technology for surgical planning and for guiding or performing surgical interventions.
Confidence Interval (CI)	An estimate of a calculated value's uncertainty indicating the lower and upper limit.
Consumption	Refers to the number of hip/knee replacements per 100,000 inhabitants regardless of where the surgery has been performed.
Cox regression	Regression model used for investigating the effect of several variables upon the time a specified event takes to happen.
CPUA	Central Personal Data Controller
Cruciate retaining (CR)	Minimally stabilizing, posterior cruciate retaining type of prosthesis.
Custom made instruments	Instruments or saw blocks specially made for the patient based on MRI or CT.
DAIR	Debridement, Antibiotics, Implant Retention; Surgical procedure in case of deep infection if the implant is stable, with the aim to retain the prosthesis by debridement, rinsing and administering antibiotics to heal the infection.
Dislocation	For hip prostheses, this means that the joint head jumps out of the center of the joint cup. For knee prostheses, this usually means that the patella jumps to the side, but it does occur also that the prosthetic components of the femur and lower leg separate from each other.
DMC	Dual Mobility Cup have two points of articulation, one between the shell and the polyethylene (external bearing) and one between the polyethylene and the femoral head.

Expression	Definition
Elective surgery	Planned surgery.
EQ-5D	A standardized instrument, questionnaire, to measure general health.
European standard population (ESP)	A theoretical population used to be able to compare information from different countries.
Fast track	Care concept based on accurate preoperative information, early mobilization and effective pain relief to minimize length of stay while maintain high quality of care.
HA	Hydroxyapatite
Hardinge approach	Direct lateral approach in supine position.
Hazard ratio (HR)	Ratio of the hazard rates corresponding to the conditions described by two levels of an explanatory variable in a survival analysis.
Hinged prosthesis	Knee prosthesis that only allow for flexion and extension through a fixed axis.
HKA (hip-knee-ankle) angle	A measure of lower limb alignment from x-ray, defined as the angle between the mechanical axes of the femur and the tibia.
HOOS	Hip dysfunction and Osteoarthritis Outcome Score. A standardized instrument, questionnaire, to measure knee-related pain, function and quality of life.
Hybrid prosthesis	Total hip prosthesis with uncemented cup and cemented stem or knee prosthesis with uncemented tibial plate and cemented femur.
ICD-10	The 10th edition of the International Statistical Classification of Diseases and Related Health Problems governed by World Health Organisation
Incidence	The number of events in a given population over a limited period of time.
ISAR	International Society of Arthroplasty Registries.
Kaplan-Meier	Statistical method for estimating the probability of not having experienced a specific event (eg. death or revision) at a certain given time.
Knee osteotomy	Re-angeling of the knee joint to unload the diseased/injured part of the knee. Joint preserving surgery.
KOOS	Knee injury and Osteoarthritis Outcome Score. A standardized instrument, questionnaire, to measure hip related pain, function and quality of life.
KVÅ	Swedish Classification system of surgical procedures based on the Nordic Medico-Statistical Committee (NOMESCO) classification of surgical procedures.
Lateral position	Side position during surgery.
Likert	A scale where the responder's different attitudes are measured Linkert scales usually have five levels, but seven levels also exist.
Linked knee 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.
Local infiltration analgesia (LIA)	A multimodal concept for postoperative local pain relief.

Expression	Definition
Logrank-test	Statistical method to compare the difference between two or several survival distributions (Kaplan-Meier) where the hypothesis is that the distributions are equal.
MDR	Medical Device Regulation. Regulation on medical devices within the EU.
Minimal invasive surgery (MIS)	This implies a (small) arthrotomy used to gain access to the joint without the patella having to be everted.
NARA	The Nordic Arthroplasty Register Association.
NOAK	Non vitamin-k Orala AntiKoagulantia
NPO	A national program for knowledge management.
One-stage surgery	An operation performed in one occasion.
Osteoarthritis (OA)	Osteoarthritis is a joint disease that affects the entire joint. The division in primary and secondary osteoarthritis is questionable as osteoarthritis is a complex condition that can have many contributing factors.
Osteolysis	Loosening of bone tissue.
Osteosynthesis	Repair a fracture with, for example, plates, screws, nails or steel wire.
NPR (PAR)	The national patient register of the National Board of Health and Welfare.
Partial knee resurfacing implant (PRKA)	“Buttons” that only replace a part of a knee compartment.
Patello-femoral knee replacement (PF)	A replacement which resurfaces the patello-femoral compartment.
Posterior stabilized knee replacement (PS)	A type of stabilizing knee prosthesis that requires resection of the posterior cruciate ligament.
PPFF	Periprosthetic femoral fracture.
Prevalence	Refers to the proportion of individuals who suffer from a certain disease or having a certain condition.
Production	Refers to the number of total hip/knee replacements per 100,000 inhabitants regardless of where the patient being operated lives.
PROM	Patient-Reported Outcome Measurement
p-value	Measure that indicate the probability that, for example, two mean values differ. Given that the hypothesis that two or more groups have the same mean is true, the p-value is the probability to have an outcome at least as extreme as the outcome that is actually observed.
Reoperation	Reoperation includes all kinds of surgical intervention that can be directly related to an inserted hip/knee arthroplasty irrespective of whether the prosthesis or one of its parts has been exchanged, removed or left untouched. For knee replacements this also includes mobilisation under anaesthesia.
Reverse hybride	Total hip prosthesis with cemented cup and uncemented stem or knee prosthesis with cemented tibial plate and uncemented femur.

Expression	Definition
Revision	Exchange, addition or extraction of one or more inserted prosthesis components (including arthrodesis and amputation).
Rheumatoid arthritis (RA)	Inflammatory joint disease
Risk ratio (RR)	The probability that some event will be observed in one group relative to the probability that it will be observed in another group.
SALAR (SKR)	Swedish Association of Local Authorities and Regions.
SD	Standard deviation.
Sequelae	Impairment after disease, injury or trauma.
SHAR	Swedish Hip Arthroplasty Register
SKAR	Swedish Knee Arthroplasty Register
SOASP	Supported OsteoArthritis Self-management Programme. A structured way of conveying fist-line treatment for osteoarthritis, which means information and exercise.
Stabilized knee prosthesis	The term stabilizing is used only for a group of TKA-type prostheses that use the shape of the femur and the tibial component to restrict movement in the varus / valgus and rotation.
Standard patient	Male or female 55-85 years with primary osteoarthritis, ASA class I-II and BMI less than 30 operated on with a primary hip replacement.
Swedish Arthroplasty Register (SAR)	Merger of the Swedish Hip Arthroplasty Register and the Swedish Knee Arthroplasty Register.
THR	Total hip replacement
TKR	Total knee replacement
TKR revision models	TKRs that are mainly used for revision or severe primary cases.
Two-stage surgery	An operation performed in two occasions.
Unicompartmental knee replacement (UKR)	Provide only the medial or lateral femorotibial compartment (medial UKR and lateral UKR respectively).
Unilateral prosthesis	Prosthesis only in one hip/knee.
Unipolar head	Femoral head that is fixated to the prosthesis cone, which articulates against acetabulum.
Unit	Clinic
Vancouver classification	Classification system for periprosthetic fractures. Type A: Trochanteric fractures that do not affect the prosthesis. Type B: Fracture in direct proximity to the prosthesis, subdivided into B1 (good bone-anchoring), B2 (loosening of the prosthesis), and B3 (loosening of the prosthesis and/or osteolysis). Type C: Fracture distally of the prosthesis.
VAS	Visual analogue scale. A 100 mm long horizontal scale where the value for a condition is given. Instrument for self-assessment.
Watson-Jones surgical approach	A type of antero-lateral surgical approach.

Significant increase in joint replacement surgeries, but despite this, long waiting times for sick and complex patients.



1. Introduction

Despite the number of primary hip and knee replacements in 2023 having increased by nearly 20% compared to the year before the pandemic, Swedish orthopedics is struggling with long waiting times for joint replacement surgery and a shortage of hospital beds and staff. This is particularly true for patients with comorbidities and those requiring more advanced surgery—revisions and complex primary operations. An increasing proportion of patients are being operated on by privately run healthcare providers. It is, of course, good that the capacity to perform joint replacement surgeries is increasing. Unfortunately, the shift to more surgeries being performed by privately run units has resulted in the public healthcare system being drained of resources to such an extent that the sickest and those in need of advanced surgery have suffered from unreasonably long waits for surgery.

This year's production—another record year

The Swedish Arthroplasty Registers Annual Report 2024 includes data on surgeries performed until December 31, 2023. During the operational year 2023, 22,581 total hip replacements, 5,145 hemiarthroplasties, 20,624 knee replacements, and 127 knee osteotomies were registered.

Additionally, 2,459 reoperations for hip replacements and 1,439 reoperations for knee replacements were recorded. In total, 52,092 prosthetic surgeries were registered, of which 48,350 were primary operations. For primary operations, this represents an increase of 13% compared to the previous year. We continue to see a recovery effect following the pandemic.

The total number of registered primary hip and knee replacements in the registry's database amounted to 936,618, with 366,809 knee replacements from 1975 through 2023 and 569,809 hip replacements (both total and hemi) from 1979 through 2023. The corresponding number for reoperations was 131,194, of which 97,943 were reoperations after hip replacement and 33,251 were reoperations after knee replacement (Figures 1.1–1.6).

Stepwise introduction of robot-assisted joint replacement surgery

In 2022, the first robot-assisted knee replacement surgeries were performed in Sweden. As part of a research collaboration between Sahlgrenska University Hospital and Örebro University Hospital, the first surgeries were conducted in Mölndal and Lindesberg. This is a good

example of the stepwise introduction of new technology in joint replacement surgery. In 2023, Caphio Ortopediska Huset began performing robot-assisted knee replacement surgery. By the end of the year, a total of 156 knee replacement surgeries had been performed with robotic assistance in Sweden.

PROM via 1177

In the spring of 2023, the procedure for sending out follow-up questionnaires was changed. All patients connected to 1177 now receive an invitation to respond to PROM (Patient-Reported Outcome Measures) follow-ups via the messaging service in 1177. The system ensures that those who are not connected to 1177, or those who do not respond via 1177, receive a paper version by mail. This significantly reduces the administrative burden on the units. In 2023, 33,517 preoperative questionnaires and 51,307 follow-up questionnaires were registered.

New principles for disclosure control

Disclosure refers to the situation where an external person gains new knowledge about a specific characteristic of an individual. Disclosure can occur, for example, when information about an individual is revealed in a table or when someone compiles statistical material and other information that could reveal details about that individual. The term “disclosure control” primarily refers to statistical disclosure control, which involves methods to ensure that information about individuals cannot be identified in presented statistics or statistical material. SAR has always prioritized disclosure control in the presentation of statistics in our annual reports. For example, we have not presented data at the unit level for units with few registrations during a period.

In 2024, Registercentrum Västra Götaland introduced new principles for disclosure control to be applied to all affiliated registries. The principle is that all numbers should be rounded to the nearest ten, numbers between one and four are indicated as zero, and five events are rounded to ten. However, SAR has chosen to modify the disclosure control principles, where we state that the number is less than five (<5) or equal to zero. Furthermore, data is not presented for units with fewer than 15 operations during a given time period. Otherwise, actual numbers are presented. As a consequence of these principles, for example, it is not possible for us to present demographic data for lateral unicompartmental knee replacements.

New reference prostheses

In the sections evaluating hip and knee implants, we have made several changes to the selection of reference prostheses. These changes reflect shifts in the usage of prosthesis models. For uncemented cups, Trilogy was previously the reference. However, since the use of Trilogy has significantly decreased over the past decade, we have chosen to use Trident Hemi as the reference prosthesis. For uncemented stems, we have now separated the standard version of Corail into collarless and collared versions, using the latter as the reference prosthesis. For total knee prostheses, we have switched from PFC Sigma MBT to NexGen MBT. This change is mainly due to the planned discontinuation of the PFC Sigma system within a few years. Regarding unicompartmental knee replacements, we have chosen to use the uncemented Oxford model as the reference, as it accounts for 75% of all unicompartmental knee replacements over the past decade.

Completeness and adverse events

Unfortunately, the National Board of Health and Welfare were not able to deliver the completeness analysis and adverse events data for this year's Swedish report. However, in this English version, we have received data for 2023 and included them. For 2023, the Swedish Arthroplasty Register continued to have very high completeness for primary procedures, with 98% for both knee replacements and total hip prostheses.

In-depth analyses

The report's section on in-depth analyses often attracts considerable attention. The increasing proportion of uncemented fixation in total hip replacements has prompted an in-depth analysis regarding the choice of fixation in different age groups. We have also examined differences in revision outcomes between the standard length and shorter version of the most commonly used cemented stem in Sweden, Lubinus SPII.

Continued high research production

In 2023, 17 scientific papers were published, and three PhD students, whose theses were based wholly or in part on data from what is now the Swedish Arthroplasty Register, successfully defended their theses. It is particularly gratifying that we have scientific collaborations with all medical faculties in Sweden and many international research partnerships.

The Autumn Meeting – contact Physician Meeting with the Swedish Hip and Knee Association

On November 9–10, the “Autumn Meeting” was held for the second consecutive year in collaboration with the Swedish Hip and Knee Association. The traditional “Contact Physician Meeting” was incorporated into the program, which also featured research presentations and engaging symposia on current topics in joint replacement surgery. In 2024, the meeting took place on October 17–18 in Stockholm with the international guest speakers Fares Haddad, Søren Overgaard, and Harvey Sandhu.

Thanks to contact secretaries and contact surgeons

A key requirement for the register to function is that units register and provide the necessary information. We greatly appreciate all the dedication and work that contact secretaries and contact physicians across the country put in. At the end of the report, you will find a list of all contact physicians and contact secretaries. We look forward to continued good cooperation in the future. A big thank you for all your contributions over the past year!

February 2025, Register Management

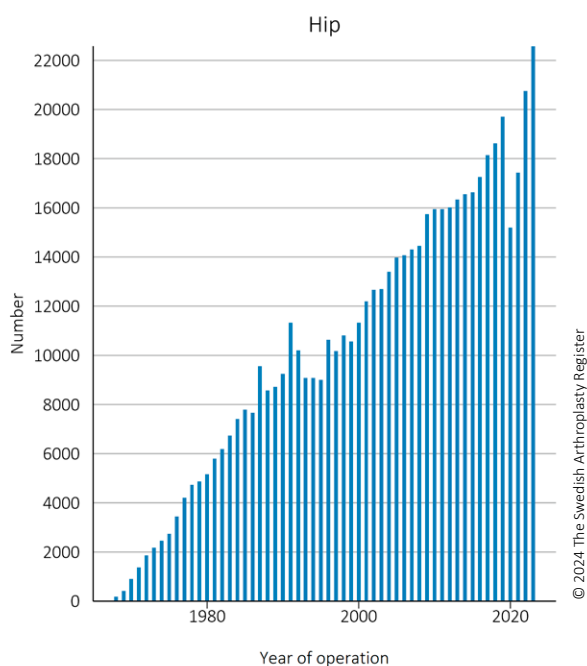


Figure 1.1 Primary total hip replacement surgery 1968–2023

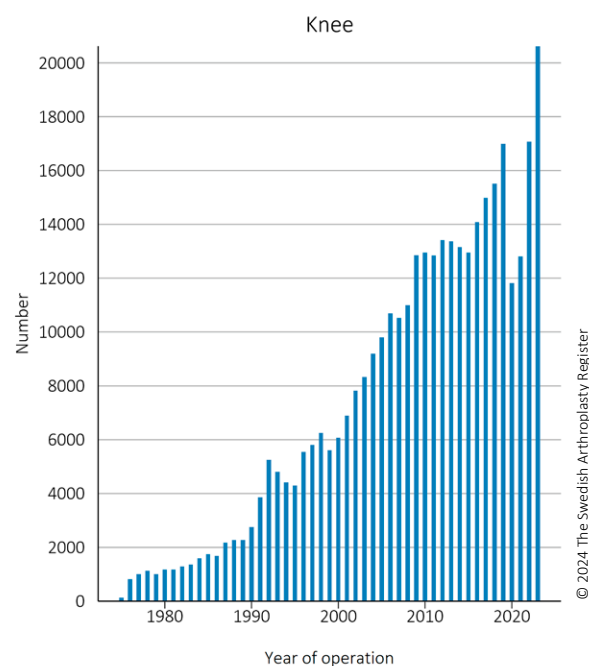


Figure 1.2 Primary knee replacement surgery 1975–2023

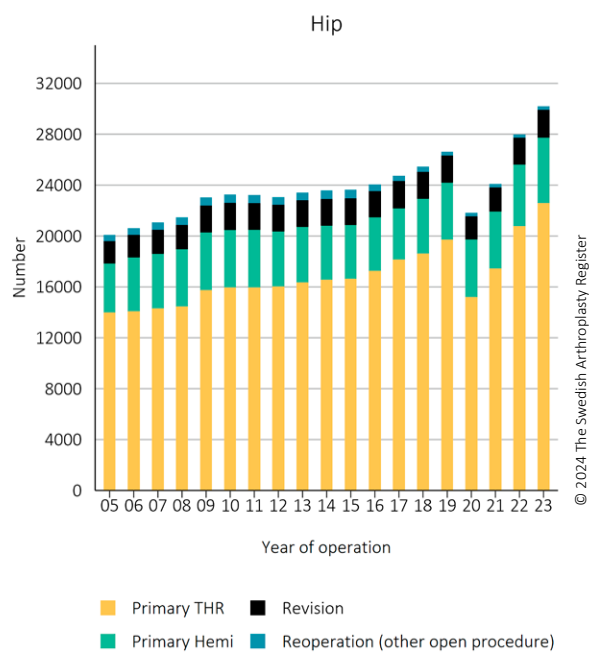


Figure 1.3 All hip replacements 2005–2023.

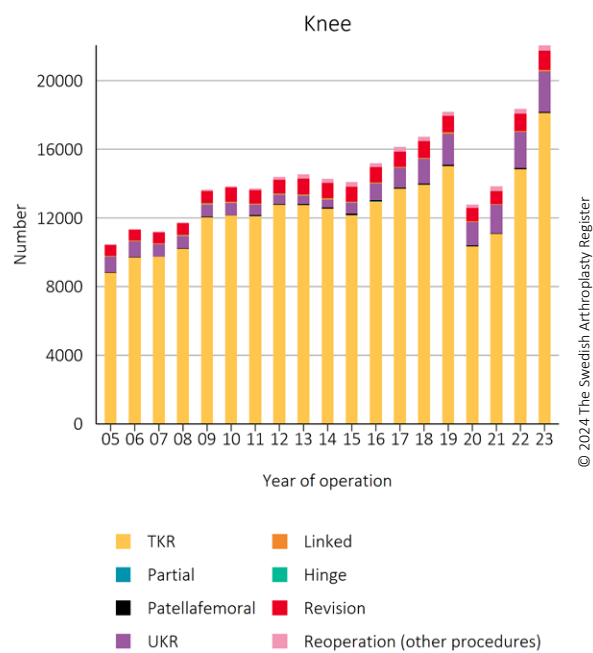


Figure 1.4 All knee replacements 2005–2023.

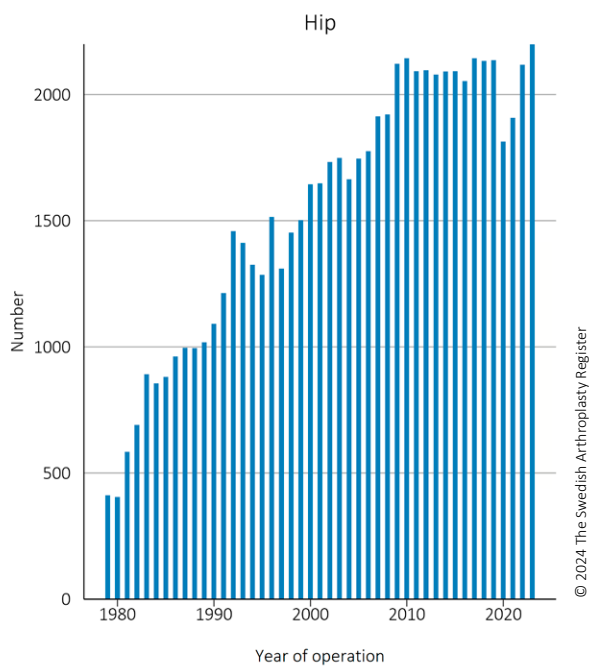


Figure 1.5 All hip revisions 1979–2023.

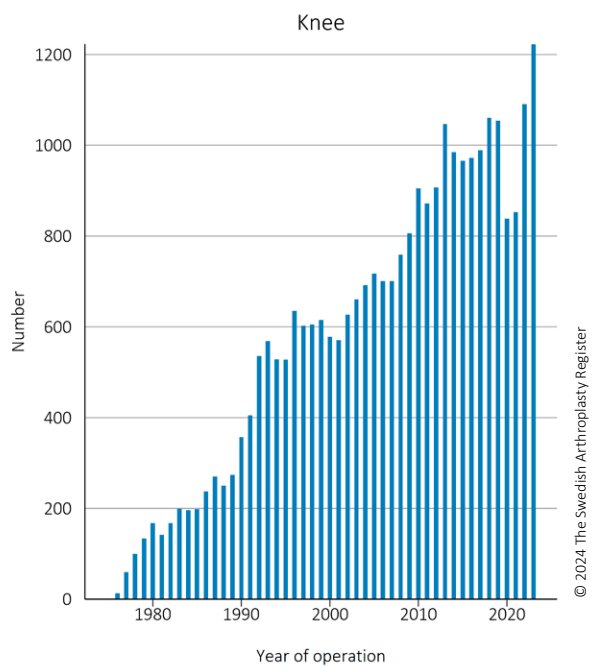


Figure 1.6 All knee revisions 1975–2023.

High data quality is crucial for drawing reliable conclusions, providing accurate recommendations, and achieving successful outcomes in clinical improvement work.



2. Data quality

Completeness analysis

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An important part of the validation work is the annual completeness analysis, conducted through a cross-check with the Patient Register of the National Board of Health and Welfare. By comparing the number of care episodes and assuming that the true number of episodes is the combined total from both registers, completeness can be estimated. The method is explained in Table 2.1. The analysis covers all primary surgeries, divided into total and hemi arthroplasty, knee replacements, as well as hip and knee revisions. The Patient Register includes Swedish personal identification numbers and coordination numbers, while the Swedish Arthroplasty Register only includes Swedish personal identification numbers. This year, we received the completeness analysis for 2023 in time for the English version of the annual report and data for 2023 is presented.

The accuracy of data entered into quality registers and health data registers is essential for ensuring that results and analyses are of high quality and reliability, which in turn enables better and fairer performance monitoring. For the operations recorded in the Swedish Arthroplasty Register, we can say with a high degree of certainty that they involve hip or knee replacement surgeries. We also know which procedure has been reported, as the

registration process includes the input of information from labels on prosthetic components during both primary surgeries and revisions. Additionally, medical records are submitted for reoperations. However, some units may fail to register operations in both the Swedish Arthroplasty Register and the Patient Register, and some entries in the Patient Register might involve operations on individuals with coordination numbers that the Swedish Arthroplasty Register does not record. One identified source of error is that procedure codes for revisions have been reported to the Patient Register when, in fact, the operation was not a revision but another type of reoperation. In such cases, the operation appears as a revision in the Patient Register but not in the Swedish Arthroplasty Register.

To examine trends in reporting frequency, we have compiled data for the past twelve years (2012–2023). The completeness for total hip replacements during this period has been 98%, and in 2023, it was 98.5% (Figure 2.1a). For hemi arthroplasties, the completeness in 2022 was 97.5%, with the reporting frequency over the twelve-year period ranging between 94% and 98%. For knee replacements, the completeness in 2023 was 97.8%, with the reporting frequency over the twelve-year period ranging between 97% and 98% (Figure 2.1b).

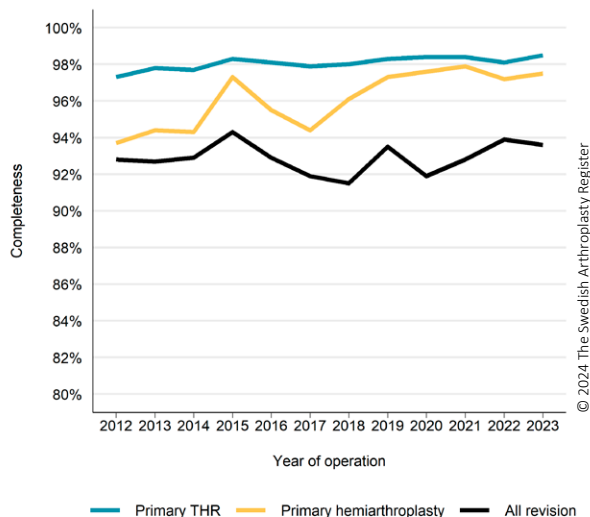


Figure 2.1a. Completeness for hip replacement 2012–2023.

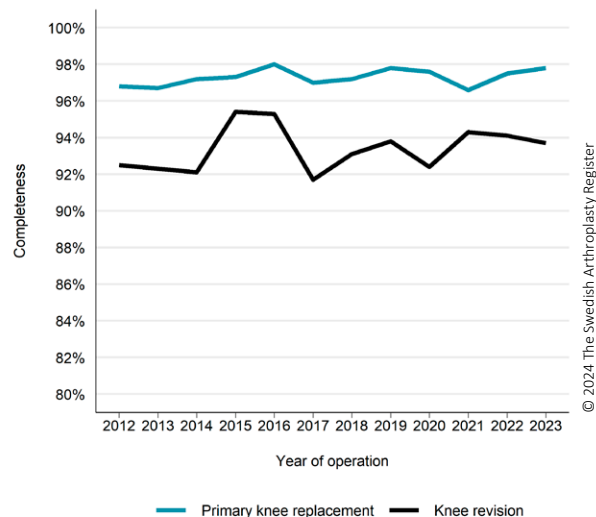


Figure 2.1b. Completeness for knee replacement 2012–2023.

The completeness for hip and knee revisions is presented based on surgeries classified as revisions, which include the removal, replacement, or addition of any prosthetic component. The Classification of Care Measures (KVÅ) for revisions is presented in Table 2.1. From 2012 to 2023, the completeness for hip revisions ranged between 92% and 94%, and in 2023 it was 93.6% (Figure 2.1a). For knee revisions, the completeness during this period varied between 92% and 94%, and it was 93.7% in 2023 (Figure 2.1b). In this completeness analysis, we have attempted to compensate for the error where reoperations (other procedures than revisions) are registered as revisions in the Patient Register. However, in the past years it has been observed that units performing few or no knee revisions have sometimes reported significant numbers of revisions (27 to 39 revisions) to the Patient Register. We have investigated this issue more closely together with these units and the Patient Register and found that the Patient Register have used the KVÅ code NGB59 (addition of patella in primary surgery) as a revision code. Removing this code, resulted in a completeness more in line with our view and other means of checking the completeness previously used for knee revisions.

Coverage analysis (completeness) by unit

Completeness is presented for primary total hip replacements (Table 2.2), hemi arthroplasties (Table 2.3), knee replacements (Table 2.4), as well as hip revisions (Table

2.5) and knee revisions (Table 2.6) by unit. Please note that percentage figures for units with a small number of operations can be misleading. Under “Other Units,” we categorize operations where the unit is not specified in the information from the Swedish National Board of Health and Welfare or where operations performed at a specific unit are reported as being performed by a hospital operator responsible for several hospitals. Some units do not report to the Patient Register but do report to the Swedish Arthroplasty Register, meaning that a completeness analysis for these clinics is not possible. If the completeness is below 96%, it is marked in red. For units with low registration rates, it is important to investigate whether the reporting of operations has been missed and whether the surgical coding of procedures is accurate, ensuring that revision codes are only used for revisions and not for reoperations that do not involve the removal, replacement, or addition of prosthetic components.

Reporting frequency of PROM

The PROM (Patient-Reported Outcome Measures) programs for hip and knee replacements differ from each other. For hip replacements, PROM is tracked on a per-person basis, whereas for knee replacements, it is tracked on a per-operation basis (see Chapter 8). For hip replacements, individuals who have undergone reoperation or surgery on the other hip during the follow-up year are excluded. In contrast, knee replacements are followed up one year

postoperatively, regardless of whether a reoperation has occurred during the follow-up year. When the two registries were merged into the Swedish Arthroplasty Register, the PROM questionnaires for hip and knee replacement surgeries have been harmonized. This has led to some delays in the PROM questionnaires for operations performed in 2021, particularly for knee replacements where most changes have occurred (see Chapter 8). The knee replacement questionnaire consists of 24 questions, while the questionnaire for hip replacement patients consists of 25 questions. Additionally, a question on satisfaction with the surgery is included in the postoperative forms for both hip and knee procedures. Hip replacements have been monitored nationally since 2008, while knee replacements have been tracked at participating units since 2009. Since the merge on September 1, 2021, all

knee replacements are now monitored. This year's report includes the response rates for the past five years (Table 2.7) and shows that the response rate has fluctuated over the years, with a decrease observed from 2020 to 2022 for knee replacements. The decrease may be attributed to the impact of both the merge and the pandemic on PROM management.

For 2023, only preoperative responses are available, with a response rate for knee replacements of 65%, which is lower than the 74% response rate for hip replacements. This lower rate is likely due to several units that had not previously participated in the knee replacement PROM program not being fully operational yet, presenting an opportunity for improvement in the future.

Description of the completeness analysis

Completeness
Primary hip replacements (total and hemi), primary knee replacements and hip and knee revisions in the Swedish Arthroplasty Register (SAR) are compared with corresponding in the National Patient Register (NPR), in 2020 and 2021. The completeness is calculated as a percentage of: Nominator All replacements/revisions in the SAR, performed in the current year. Denominator The total number of replacements/revisions either in the SAR or in the NPR, performed in the current year. A maximum of one procedure per individual and date has been included.
Selection from the Swedish Arthroplasty Register
Hip and knee replacement surgeries and revisions of hip and knee replacements, performed in the current year.
Selection from the National Patient Register
Hip and knee replacements and revisions of hip and knee replacements registered in the NPR inpatient care, performed in the current year. Registrations with procedure codes for each type of surgery were included; primary total hip replacements NFB29, NFB39, NFB49, NFB62 or NFB99 primary hemi hip replacements NFB09 or NFB19 primary knee replacements NGB09, NGB19, NGB29, NGB39, NGB49, NGB53, NGB59 or NGB99 revisions of hip replacements NFC, NFU09 or NFU19 revision of knee replacements NGC, NGU03, NGU09, NGU19 or NGU59 Maximum one procedure per individual and date has been included.
Matching criterion
Operations in the SAR were matched against the NPR by the unique personal identification number and procedure date +/- 7 days.
More about the processing
Information on the unit was obtained primarily from the SAR and secondary from the NPR. Only registrations with a Swedish personal identification number or temporary number were included in the sample selection from each register. Operations classified as hip or knee revisions in the NPR but as other reoperations for knee and hip replacements in the SAR were excluded as they were probably misclassified.

Table 2.1. Description of the completeness analysis.

Completeness for primary hip replacement 2023

	Total number	SAR %	PAR %
Riket	21 015	97,9	92,8
Akademiska sjukhuset	303	94.7	98.3
Aleris Malmö Arena	266	100	98.5
Aleris specialistvård Nacka	664	99.1	83.1
Aleris Specialistvård Renmarkstorget, Umeå	45	100	2.2
Aleris specialistvård Ängelholm	685	96.9	93.3
Art Clinic Göteborg	443	100	99.8
Art Clinic Jönköping	262	98.1	99.6
Arvika	295	97.3	97.6
Bollnäs	384	99.2	95.8
Borås - Skene	430	98.1	98.4
Capio Artro Clinic / Sophiahemmet	611	100	88.2
Capio Movement Halmstad	416	98.8	100
Capio Ortho Center Göteborg	253	99.2	98.8
Capio Ortho Center Stockholm	903	100	99.9
Capio Ortho och Spine Center Skåne	260	96.9	98.8
Capio Ortopedi Motala	420	100	99
Capio Ortopediska Huset	778	98.3	94.6
Capio S:t Görans	425	98.6	99.3
Capio Spine Center Göteborg	67	100	76.1
Carlanderska	699	98.4	90.4
Danderyds	252	97.2	95.6
Eksjö	310	99.7	99.7
Enköping	543	99.6	99.3
Eskilstuna	80	97.5	98.8
Falun	198	97.5	97
Frölundaortopeden	11	100	0
Gällivare	94	100	100
Gävle	184	95.7	92.9
Halmstad - Varberg	270	94.4	98.1
Helsingborg	76	98.7	97.4
Hermelinen	38	100	0
Hudiksvall	76	97.4	90.8
Hässleholms	767	100	99.9
Jönköping	245	98.4	97.6
Kalmar	122	99.2	97.5
Karlshamn–Karlskrona	356	98.9	98.9
Karlstad	128	97.7	97.7
Karolinska Huddinge	243	92.2	95.9
Karolinska Solna	66	84.8	98.5
Kristianstad	17	100	100

Table continued on next page.

Completeness for primary hip replacement 2023, cont.

	Total number	SAR %	PAR %
Kullbergsgka sjukhuset	426	100	99.8
Kungälv - Alingsås	360	97.2	98.3
Ledplastikcentrum Bromma	809	99.1	97.3
Lidköping - Skävde	442	98.2	98
Linköping	98	94.9	96.9
Ljungby	144	97.2	100
Lycksele	306	97.7	97.4
Mora	326	99.4	97.9
Norrköping	240	99.2	99.2
Norrtälje	170	98.2	100
Uddevalla	394	99.5	99.2
Nyköping	168	98.2	98.8
Ortopediskt Center, Sophiahemmet	262	100	0.4
Oskarshamns	380	100	98.9
Piteå	440	98.2	98.9
Skellefteå	147	100	99.3
Sollefteå	428	99.5	98.8
Specialistcenter S:t Johanniskliniken	10	100	0
Specialistcenter Scandinavia Eskilstuna	208	100	0
Specialistcenter Scandinavia Malmö	122	100	0
SU/Möln dal	452	98.2	97.6
Sunderby	73	91.8	91.8
Sundsvall	68	92.6	95.6
SUS/Lund	106	99.1	95.3
SUS/Malmö	13	76.9	92.3
Södersjukhuset	258	99.6	99.6
Södertälje	174	99.4	100
Torsby	163	100	99.4
Trelleborg	401	99.5	98.3
Umeå	60	81.7	96.7
Visby	149	98.7	98
Värnamo	173	98.8	97.1
Västervik	167	98.8	96.4
Västerås	658	99.1	98.8
Växjö	223	99.6	96
Ystad	11	100	100
Örebro - Lindesberg - Karlskoga	676	99	99
Örnsköldsvik	169	97.6	98.8
Östersund	253	98.4	97.2
Other units	16	31	100

Table 2.2. The completeness for primary total hip replacement per unit 2023.

Completeness for primary hemiarthroplasty hip 2023

	Total number	SAR %	PAR %
Country	5,279	97.5	94.2
Akademiska sjukhuset	179	92.2	98.3
Borås - Skene	93	98.9	90.3
Capio S:t Göran	176	93.2	96
Danderyd	257	98.1	97.3
Eksjö	52	100	92.3
Eskilstuna	103	100	97.1
Falun	117	100	97.4
Gällivare	43	100	97.7
Gävle	135	99.3	78.5
Halmstad - Varberg	205	97.1	97.1
Helsingborg	187	97.3	96.3
Hudiksvall	63	95.2	92.1
Jönköping	64	100	96.9
Kalmar	120	96.7	95.8
Karlshamn - Karlskrona	95	97.9	80
Karlstad	148	100	95.3
Karolinska Huddinge	127	98.4	93.7
Karolinska Solna	33	87.9	87.9
Kristianstad	146	98.6	91.8
Kungälv - Alingsås	121	99.2	90.1
Lidköping - Skövde	142	96.5	93
Linköping	172	98.3	95.3
Ljungby	19	100	94.7
Lycksele	22	95.5	100

Table continued on next page.

Completeness for primary hemiarthroplasty hip 2023, cont.

	Total number	SAR %	PAR %
Mora	78	93.6	87.2
Norrköping	86	98.8	97.7
Norrtälje	35	100	94.3
Nyköping	47	97.9	89.4
Skellefteå	56	100	94.6
SU/Mölnadal	292	99	94.5
Sunderby	126	88.9	96.8
Sundsvall	97	97.9	94.8
SUS/Lund	183	99.5	90.2
SUS/Malmö	198	95.5	92.4
Södersjukhuset	282	99.6	98.9
Södertälje	7	100	100
Torsby	29	100	93.1
Uddevalla	215	98.6	95.8
Umeå	109	100	96.3
Visby	39	89.7	82.1
Värnamo	45	100	91.1
Västervik	54	100	92.6
Västerås	13	100	84.6
Växjö	64	98.4	92.2
Ystad	117	97.4	97.4
Örebro - Lindesberg - Karlskoga	151	96.7	94.7
Örnsköldsvik	66	97	98.5
Östersund	63	98.4	95.2
Other units	8	25	100

Table 2.3. The completeness for primary hemiarthroplasty hip per unit 2023.

Completeness for primary knee replacement 2023

	Total number	SAR %	PAR %
Country	20,864	97.8	93
Akademiska sjukhuset	127	97.6	99.2
Aleris Malmö Arena	292	100	99
Aleris specialistvård Nacka	744	98.4	78.1
Aleris Specialistvård Ängelholm	7	0	100
Art clinic Göteborg	488	99.8	99.6
Art Clinic Jönköping	332	99.1	99.1
Arvika	260	94.2	95
Bollnäs	437	98.9	96.8
Borås - Skene	319	97.5	97.8
Capio Arthro Clinic / Sophiahemmet	1 167	99.9	67.3
Capio Movement Halmstad	703	95.7	96.4
Capio Ortho Center Göteborg	327	99.7	99.1
Capio Ortho Center Stockholm	854	99.6	100
Capio Ortho och Spine Center Skåne	371	93.8	98.1
Capio Ortopedi Motala	674	98.1	99.6
Capio Ortopediska huset	887	98.3	96.1
Capio S:t Göran	358	96.6	98
Capio Spine Center Göteborg	9	100	66.7
Carlanderska	725	96.4	87.2
Danderyd	135	96.3	97.8
Eksjö	349	100	100
Enköping	541	98.3	98.3
Eskilstuna	48	93.8	100
Falun	198	98	96
Frölundaortopeden	14	100	0
Gällivare	45	100	100
Gävle	69	94.2	97.1
Halmstad - Varberg	266	90.2	96.6
Hermelinen	37	100	0
Hudiksvall	46	97.8	93.5
Hässleholm	934	98.5	98.6
Kalmar	93	97.8	97.8
Karlshamn	309	98.7	99
Karlstad	24	91.7	100
Karolinska Huddinge	147	96.6	98
Karolinska Solna	47	78.7	97.9

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Completeness for primary knee replacement 2023 cont.

	Total number	SAR %	PAR %
Kullbergsga sjukhuset	434	100	100
Kungälv - Alingsås	362	98.1	96.7
Ledplastikcentrum Bromma	910	95.1	97.9
Lidköping - Skövde	266	98.1	98.1
Lindesberg	449	99.3	99.8
Ljungby	126	90.5	98.4
Lycksele	199	98.5	100
Mora	285	97.5	99.3
Norrköping	163	97.5	100
Norrtälje	199	99	98.5
Nyköping	95	98.9	97.9
Ortopediskt Center Sophiahemmet			
Oskarshamn	400	98.3	99
Piteå	425	98.1	97.6
Skellefteå	68	95.6	100
Sollefteå	193	98.4	98.4
Specialistcenter S:t Johanniskliniken	152	98.7	81.6
Specialistcenter Scandinavia Eskilstuna	167	100	0
Specialistcenter Scandinavia Malmö	202	100	0
Specialisthuset Sundsvall AB	26	100	0
SU/Mölnådal	299	98	99
Sundsvall	57	86	96.5
SUS/Lund	22	90.9	95.5
Södersjukhuset	107	98.1	100
Södertälje	141	97.2	97.2
Torsby	127	99.2	99.2
Trelleborg	412	98.3	98.8
Uddevalla	198	99.5	98
Umeå			
Visby	97	96.9	97.9
Värnamo	237	97	100
Västervik	119	93.3	98.3
Västerås	290	99.3	99
Växjö	140	95.7	97.9
Ängelholm - Helsingborg	726	98.5	91.6
Örnsköldsvik	213	100	97.7
Östersund	163	95.1	96.9
Other units	12	25	100

Table 2.4. The completeness for primary knee replacement per unit 2023.

Completeness for hip revisions 2023

	Total number	SAR %	PAR %
Country	2,392	93.6	87.6
Akademiska sjukhuset	137	96.4	94.2
Borås - Skene	54	96.3	92.6
Capio Ortopedi Motala	21	100	85.7
Capio S:t Göran	75	84	81.3
Danderyd	200	96.5	92
Eksjö	27	100	88.9
Eskilstuna	54	96.3	88.9
Falun	48	100	89.6
Gällivare	9	100	66.7
Gävle	62	95.2	79
Halmstad - Varberg	67	80.6	88.1
Helsingborg	78	98.7	78.2
Hässleholm	46	97.8	87
Jönköping	38	94.7	81.6
Kalmar	24	95.8	91.7
Karlshamn - Karlskrona	44	90.9	100
Karlstad	71	95.8	95.8
Karolinska Huddinge	123	88.6	87
Karolinska Solna	26	50	92.3
Kristianstad	11	63.6	72.7
Kungälv - Alingsås	36	94.4	66.7
Lidköping - Skövde	67	95.5	83.6
Linköping	57	98.2	86

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Completeness for hip revisions 2023, cont.

	Total number	SAR %	PAR %
Ljungby	21	95.2	66.7
Mora	14	78.6	42.9
Norrköping	20	90	90
Norrtälje	12	83.3	100
Nyköping	29	93.1	82.8
Ortopediskt Center, Sophiahemmet	6	100	0
Piteå	75	100	96
Skellefteå	16	81.3	87.5
SU/Mölndal	155	97.4	92.3
Sunderby	9	55.6	77.8
Sundsvall	31	93.5	71
SUS/Lund	113	99.1	89.4
Södersjukhuset	61	100	95.1
Trelleborg	29	100	96.6
Uddevalla	52	98.1	92.3
Umeå	33	90.9	93.9
Visby	19	73.7	68.4
Värnamo	9	88.9	55.6
Västervik	26	88.5	80.8
Västerås	82	95.1	87.8
Växjö	27	88.9	81.5
Örebro - Lindesberg - Karlskoga	81	95.1	98.8
Örnsköldsvik	10	90	80
Östersund	55	96.4	83.6
Other units	32	71.8	78.1

Table 2.5. The completeness for hip revisions per unit 2023.

Completeness for knee revisions 2023

	Total number	SAR %	PAR %
Country	1,279	93.7	85
Akademiska sjukhuset	55	98.2	90.9
Bollnäs	12	100	100
Borås - Skene	26	96.2	88.5
Capio Ortopedi Motala	83	97.6	91.6
Capio Artro clinic / Sophiahemmet	20	100	20
Capio Movement	7	100	71.4
Capio Ortho Center Stockholm	14	100	100
Capio Ortopediska huset	10	100	30
Capio S:t Göran	45	86.7	86.7
Danderyd	66	92.4	84.8
Eksjö	41	100	92.7
Enköping	7	100	100
Eskilstuna	31	96.8	96.8
Falun	39	94.9	89.7
Gällivare	7	100	57.1
Gävle	29	96.6	62.1
Halmstad - Varberg	33	81.8	84.8
Hässleholm	101	93.1	91.1
Kalmar	16	93.8	75
Karlshamn	18	94.4	88.9
Karlstad	9	88.9	77.8
Karolinska Huddinge	27	85.2	70.4
Karolinska Solna	10	40	100

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Completeness for knee revisions 2023, cont.

	Total number	SAR %	PAR %
Kungälv - Alingsås	16	100	75
Ledplastikcentrum Bromma	8	75	100
Lidköping - Skövde	23	95.7	91.3
Lindesberg	44	100	79.5
Lycksele	4	100	50
Mora	20	80	50
Norrköping	10	90	100
Norrtälje	14	100	78.6
Piteå	25	92	100
Skellefteå	12	83.3	41.7
SU/Mölndal	73	94.5	93.2
Sundsvall	11	81.8	45.5
SUS/Lund	52	96.2	88.5
Södersjukhuset	26	96.2	96.2
Södertälje	11	90.9	100
Torsby	11	100	100
Trelleborg	20	100	95
Uddevalla - NÄL	17	100	100
Umeå	15	80	93.3
Visby	4	100	100
Värnamo	11	90.9	54.5
Västerås	39	100	97.4
Växjö	11	100	63.6
Ängelholm - Helsingborg	21	100	85.7
Östersund	26	96.2	84.6
Other units	49	87.7	67.3

Tabell 2.6. The completeness for knee revisions per unit 2023.

PROM, response rate

Surgical year	2019	2020	2021	2022	2023
Available data for all elective total hip replacements					
Total number of replacements	17,518	13,137	15,325	18,512	20,297
Deceased within one year (as first event), n	144	105	114	157	
Reoperated within one year (as first event) , n	217	150	181	245	
Included in the one-year follow-up, n	17,157	12,882	15,030	18,110	20,297
Preoperative response, n	14,117	10,093	11,629	14,435	15,019
Proportion of all, %	81	77	76	78	74
One-year postoperative response, n	13,633	9,993	12,306	14,274	
Proportion of those included in the follow-up routine, %	80	78	82	79	
Pre- and one-year postoperative response, n	11,011	7,616	9,542	11,483	
Proportion of those included in the follow-up routine, %	64	59	64	63	
Available data for all knee replacements					
Total number of replacements for units included in the PROM project	9,365	6,565	9,489	17,193	20,690
Deceased within one year (as first event), number	41	23	61	111	70
Included in the one-year follow-up, number	9,324	6,542	9,428	17,082	20,620
Preoperative response, number	8,002	5,075	6,090	11,410	13,388
Proportion of all, %	86	78	65	67	65
One-year postoperative response, n	6,868	5,741	7,526	9,703	
Proportion of those included in the follow-up routine, %	84	88	80	57	
Pre- and one-year postoperative response, n	6,120	4,021	5,007	7,001	
Proportion of those included in the follow-up routine, %	74	61	53	41	

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PROM, response rate, cont.

Surgical year	2019	2020	2021	2022	2023
Available data for total knee replacements					
Total number of replacements for units included in the PROM project	8,242	5,748	8,158	15,002	18,148
Deceased within one year (as first event), number	34	18	55	98	63
Included in the one year follow-up, n	8 208	5,730	8,103	14,904	18,085
Preoperative response, n	7 108	4,497	5,178	10,018	11,815
Proportion of all, %	87	78	64	67	65
One-year postoperative response, n	6 102	5,070	6,508	8,537	
Proportion of those included in the follow-up routine, %	74	88	80	57	
Preoperative and one year postoperative response, n	5 123	3,595	4,268	6,171	
Proportion of those included in the follow-up routine, %	62	63	53	41	
Available data in unicompartmental knee replacements					
Total number of replacements for units included in the PROM project	876	770	1,252	2,119	2,390
Deceased within one year (as first event), number	2	2	3	9	6
Included in the one year follow-up, n	874	768	1,249	2,110	2,384
Preoperative response, n	735	556	880	1,354	1,493
Proportion of all, %	81	84	70	64	63
One-year postoperative response, n	722	648	967	1,131	
Proportion of those included in the follow-up routine, %	83	84	77	54	
Pre- and one-year postoperative response, n	577	412	718	808	
Proportion of those included in the follow-up routine, %	66	54	57	38	

Table 2.7. PROM, response rate 2019–2023.

Demography (from the Greek words *démos* – people, and *gráfo* to write) is the science of studying the distribution, size, and composition of a population.



3. Demography

Authors: Annette W-Dahl and Ola Rolfson

All hip and knee replacement surgeries

In 2023, the following surgeries were reported 20,297 primary elective hip replacements 7,258 primary hip replacements due to fracture, 20,622 primary knee replacements 2,142 hip revisions and 1,079 knee revisions.

Sex

Females receive primary hip or knee replacements more frequently than males. The proportion of females receiving a primary elective hip replacement has remained stable since 2006, varying between 56% and 58% (Figure 3.1a). However, the percentage of females receiving a hip replacement due to fracture has decreased from 73% in 2006 to 62% in 2023 (Figure 3.1b). The proportion of females undergoing primary knee replacement surgery has decreased from 60% in 2006 to 56% in 2023 (Figure 3.1c). The proportion of females was slightly lower than males for hip revisions, but higher for knee revisions (Table 3.1).

Age

The mean age was 69 years for primary elective hip replacements, 81.4 years for hip replacements due to fracture, and 69.4 years for all primary knee replacements in 2023 (Table 3.1). The mean age for both males and females has remained largely unchanged from 2006 to 2023 for primary elective hip and knee replacements (Figures 3.2a–b).

This is also true for total knee replacement (TKR) (Figure 3.3a). For unicompartmental knee replacement (UKR), the mean age has increased by about three years for both males and females (Figure 3.3b). In 2006, the mean age for primary hip replacement due to fracture was 80 years for males and 82 years for females, and it has remained relatively stable for both sex since then (Figure 3.4). The mean age for hip revision was nearly five years higher than for primary elective hip replacement, and for knee revision, it was nearly one year higher than for primary knee replacement in 2023.

For primary elective hip replacement, there have been relatively minor changes in age group distribution from 2006–2007 to 2022–2023. There has been a slight decrease in the 55–64 year age group and an increase in the 75–84 year age group (Figure 3.5a). For primary hip replacement due to fracture, approximately 80% are 75 years and older. Since 2006–2007, there has been a shift in the older age groups, with a decrease in the proportion of those aged 75–84 years and ≥ 85 years, and an increase of nearly 3% in the 65–74 year age group (Figure 3.5b). For primary TKR, the proportion of those under 65 years has decreased from 29% in 2006 to 28% in 2023, and for primary UKR, the proportion under 65 years has decreased from 57% in 2006–2007 to 42% in 2022–2023 (Figures 3.5c–d).

BMI

The mean BMI for primary hip replacement is lower (BMI 27.4) compared to primary knee replacement (BMI 28.7) (Table 3.1). The proportion classified as obese (BMI ≥ 30) according to WHO's classification is significantly higher for primary knee replacement (36.6%) than for primary elective hip replacement (26.9%) and for hip replacements due to fracture (8.3%) (Table 3.1). In primary elective hip replacement, males are overrepresented in the BMI category of 25–29.9 (overweight), and the proportion of obese individuals is also higher for males compared to females (Figure 3.6a). For hip replacement due to fracture, males are similarly overrepresented in the BMI category of 25–29.9, while the proportion of obese individuals is roughly the same (Figure 3.6b). For primary knee replacements, males are also overrepresented in the BMI category of 25–29.9 (overweight), but the proportion of obese individuals is higher among females than males (Figure 3.6c). For both hip and knee revisions, the proportion of obese individuals is approximately the same as for primary elective hip and knee replacement (Table 3.1).

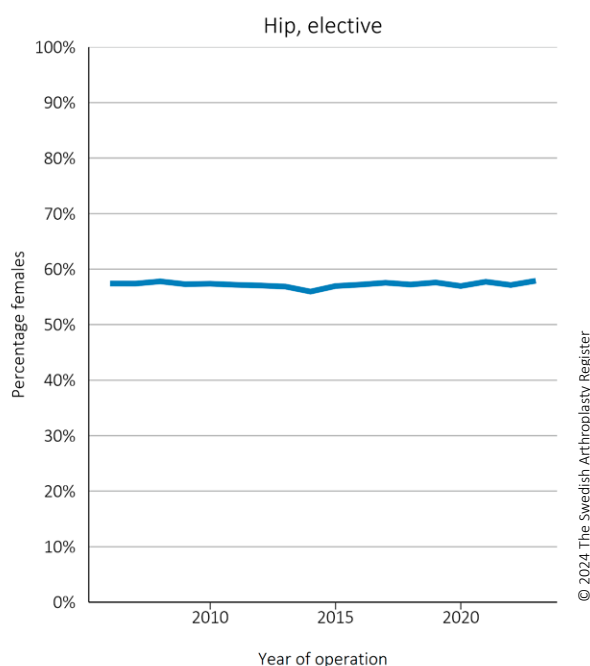


Figure 3.1a. Proportion of females in elective primary hip replacement 2005–2023.

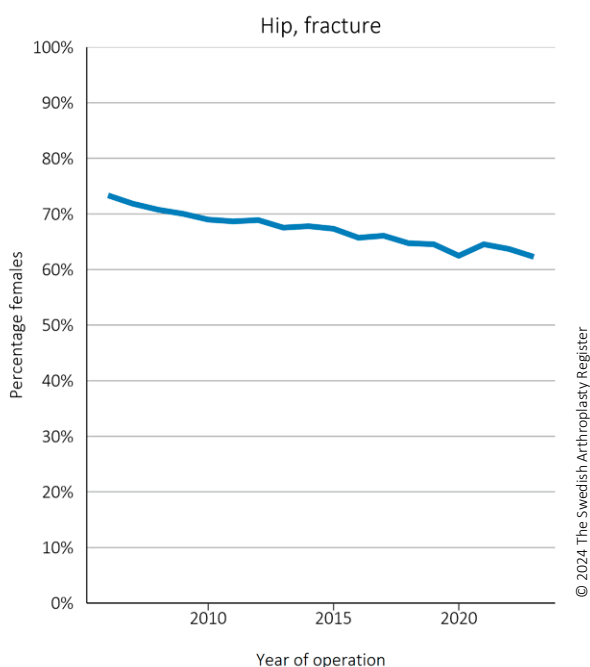


Figure 3.1b. Proportion of females in primary hip replacement due to fracture 2005–2023.

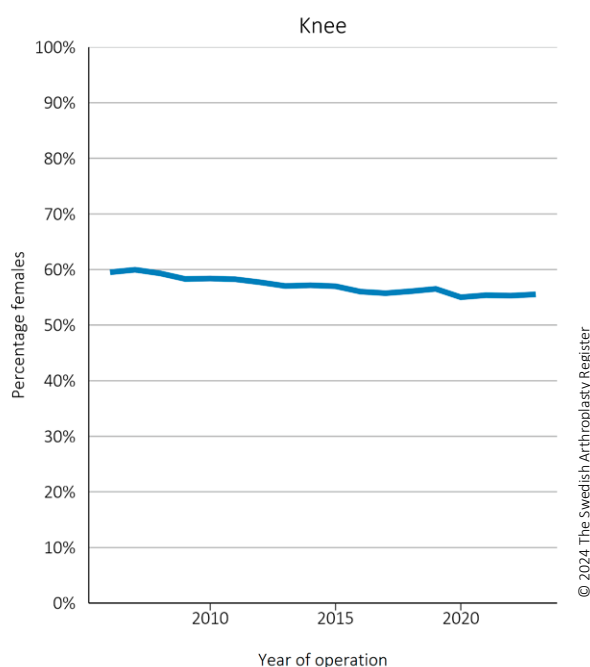


Figure 3.1c. Proportion of females in primary knee replacement 2005–2023.

Demography in hip and knee replacements 2023

	Elective primary total hip	Primary hip fracture	Revision hip	Primary knee	Revision knee
Number	20,367	7,264	2,149	20,622	1,081
Females n (%)	11,791 (57,9)	4,524 (62,3)	1,012 (47,1)	11,450 (55,5)	558 (51,6)
Mean age (SD)	69.0 (10.5)	81.4 (9.1)	73.7 (10.9)	69.4 (9.0)	70.3 (9.5)
Age group n (%)					
< 45 years	325 (1.6)	15 (0.2)	19 (0.9)	76 (0.4)	10 (0.9)
45-54 years	1,586 (7.8)	34 (0.5)	104 (4.8)	1,048 (5.1)	52 (4.8)
55-64 years	4,662 (22.9)	269 (3.7)	298 (13.9)	4,989 (24.2)	232 (21.5)
65-74 years	6,804 (33.4)	1,115 (15.3)	581 (27.0)	7,925 (38.4)	383 (35.4)
75-84 years	6,077 (29.8)	2,973 (40.9)	847 (39.4)	6,010 (29.1)	359 (33.2)
≥85 years	913 (4.5)	2,858 (39.3)	300 (14.0)	574 (2.8)	45 (4.2)
Mean BMI (SD)	27.4 (4.5)	24.1 (4.2)	27.2 (4.9)	28.7 (4.3)	29.1 (4.72)
BMI n (%)					
< 18.5	163 (0.8)	487 (7.6)	37 (1.8)	44 (0.2)	<5
18.5-24.9	6,197 (30.7)	3,530 (55.1)	689 (33.7)	3,940 (19.3)	186 (17.7)
25-29.9	8,365 (41.5)	1,854 (28.9)	765 (37.5)	8,987 (43.9)	458 (43.6)
30-34.5	4,320 (21.4)	436 (6.8)	420 (20.6)	5,845 (28.6)	289 (27.5)
35-39.9	988 (4.9)	82 (1.3)	102 (5.0)	1,472 (7.2)	91 (8.7)
≥ 40	128 (0.6)	16 (0.2)	29 (1.4)	171 (0.8)	23 (2.2)
ASA-class n (%)					
ASA I	3,617 (17.8)	206 (2.9)	110 (5.2)	2,977 (14.5)	73 (6.8)
ASA II	12,791 (63.0)	2,343 (33.0)	997 (46.9)	13,865 (67.5)	630 (58.7)
ASA III	3,809 (18.8)	4,015 (56.5)	939 (44.2)	3,676 (17.9)	355 (33.1)
ASA IV	73 (0.4)	537 (7.6)	80 (3.8)	34 (0.2)	16 (1.5)
Diagnosis n (%)					
Osteoarthritis	18,980 (94.6)			20,117 (97.7)	
Acute hip fracture		6,912 (95.2)			
Sequele fracture/trauma		352 (4.8)		98 (0.5)	
Osteonecrosis	702 (3.5)			133 (0.6)	
Sequele childhood hip disease	266 (1.3)				
Inflammatory joint disease	38 (0.2)			182 (0.9)	
Tumor	0 (0.0)			8 (0.0)	
Acute trauma	63 (0.3)			46 (0.2)	
Other joint diseases	9 (0.0)			7 (0.0)	

Table 3.1. Demography in elective primary hip replacement, hip replacement due to fracture, knee replacement, hip revision and knee revision 2023.

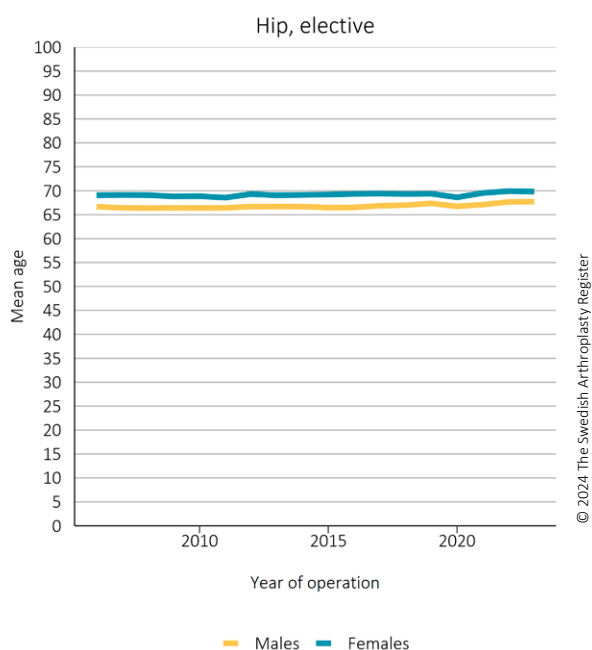


Figure 3.2a. Mean age in elective primary hip replacement 2005–2023.

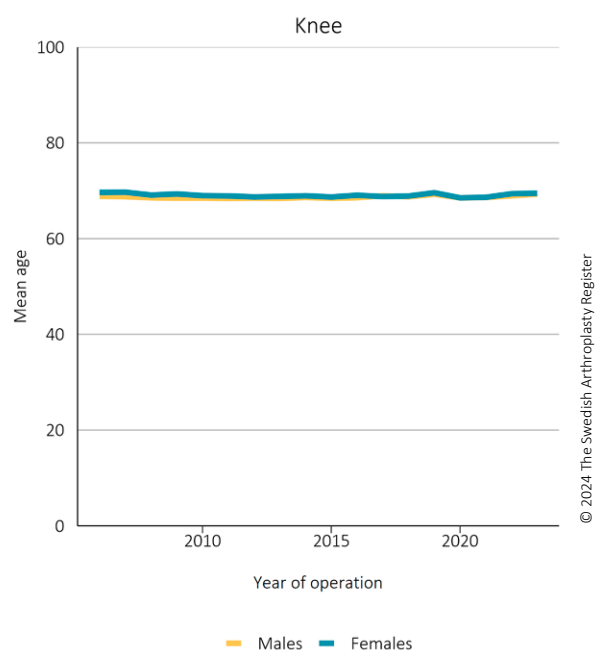


Figure 3.2b. Mean age in primary knee replacement 2005–2023.

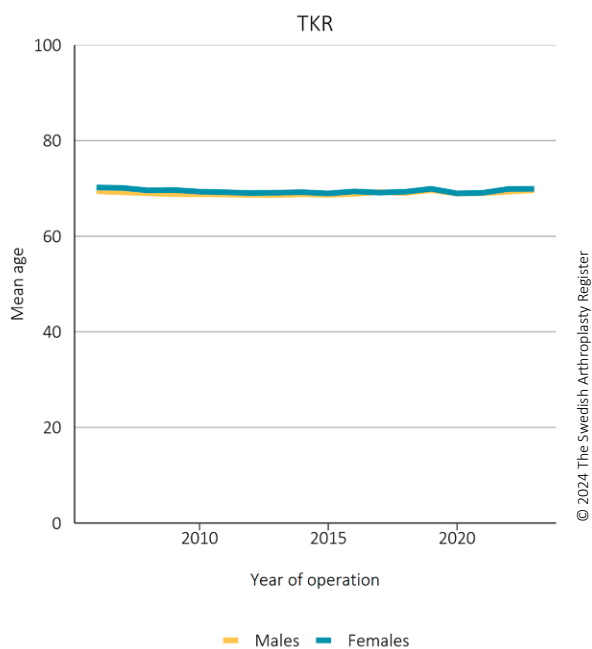


Figure 3.3a. Mean age in primary TKR 2005–2023.

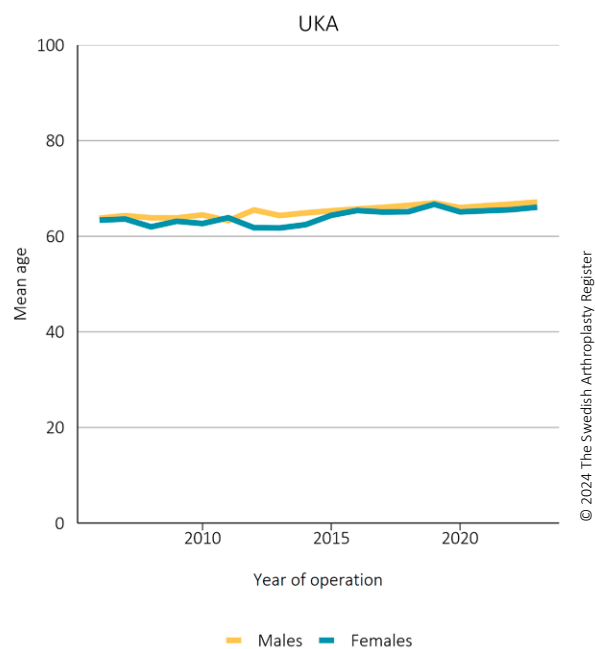


Figure 3.3b. Mean age in primary UKR 2005–2023.

ASA classification

The proportion of patients classified as ASA III–IV for primary elective hip replacement (19.2%) and primary knee replacement (18.1%) is relatively similar. However, the proportion for hip replacements due to fracture is significantly higher at 64.1%. The proportion of ASA III–IV classification is slightly higher for males than for females in both primary hip and knee replacement (Figures 3.7a and 3.7c). For hip replacement due to fracture, the proportion of ASA III–IV is higher for males (69.6%) compared to females (60.7%) (Figure 3.7b). For hip revisions, the proportion of ASA III–IV is more than twice as high as for primary elective replacements, and nearly twice as high for knee revisions compared to primary knee replacements (Table 3.1).

Diagnosis

Osteoarthritis is the most common diagnosis for primary elective hip and knee replacements, accounting for 94.6% and 97.7% of cases, respectively. For primary elective hip replacement, osteoarthritis is followed by osteonecrosis (3.5%) and inflammatory joint disease (0.9%) for knee prostheses (Table 3.1).

The proportion of patients undergoing primary hip replacement due to osteoarthritis has increased slightly since 2006–2007 for females and has remained relatively stable for males. For primary knee replacements, the proportion of osteoarthritis cases has increased from the 2006–2007 period to the 2022–2023 period for both females and males (Figures 3.8a–b, 3.9a–b).

The proportion of primary hip replacements performed due to acute hip fractures has remained relatively stable from 2006–2007 to 2022–2023 and is more common among females than males. The proportion of acute hip fractures has decreased slightly for females from 31.4% in 2006–2007 to 27.1% in 2022–2023 but has increased for males from 18.7% to 23% over the same period (Figures 3.8a–b).

Inflammatory joint disease, including rheumatoid arthritis, as a reason for primary hip and knee replacement has decreased with the introduction of modern medical treatments, as reflected by the lower proportion in 2022–2023 compared to 2006–2007 (Figures 3.8a–b, 3.9a–b).

The proportion of acute hip fractures as a reason for primary hip replacement has varied somewhat over the past

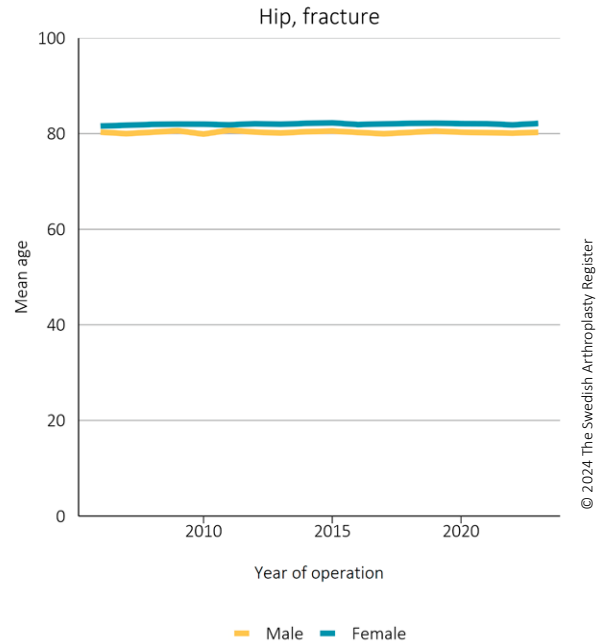


Figure 3.4. Mean age in primary hip replacement due to fracture 2005–2023.

five years, with a slightly higher proportion during the pandemic years. However, the proportion in 2023 is the same as in 2019, while the proportion of osteoarthritis has increased slightly from 2019 to 2023, with a lower proportion during the pandemic years (Table 3.2). The proportion of osteoarthritis as a reason for primary knee replacement has remained largely unchanged over the past five years (Table 3.3).

For primary hip replacement, the proportion of osteoarthritis as a reason decreases with increasing age starting from the 55–64 year age group. The highest proportion is in the 55–64 year age group (87.4%) and the lowest is in the ≥ 85 year age group (18.6%). Sequelae from childhood diseases are most common in the youngest age groups, < 55 years. For acute hip fractures, the pattern is reversed, with a higher proportion in older age groups, the lowest proportion in the < 45 and 45–54 year age groups (1.8%), and the highest proportion in the ≥ 85 year age group (76.2%) (Table 3.4).

For primary knee replacements, the proportion of osteoarthritis as the reason for surgery increases with age, while the proportion of inflammatory joint disease and sequelae from fractures/trauma decreases with increasing age. Acute trauma as a reason for primary knee prosthesis surgery is rare, with just over 125 surgeries (0.2%) reported in the past five years (Table 3.5).

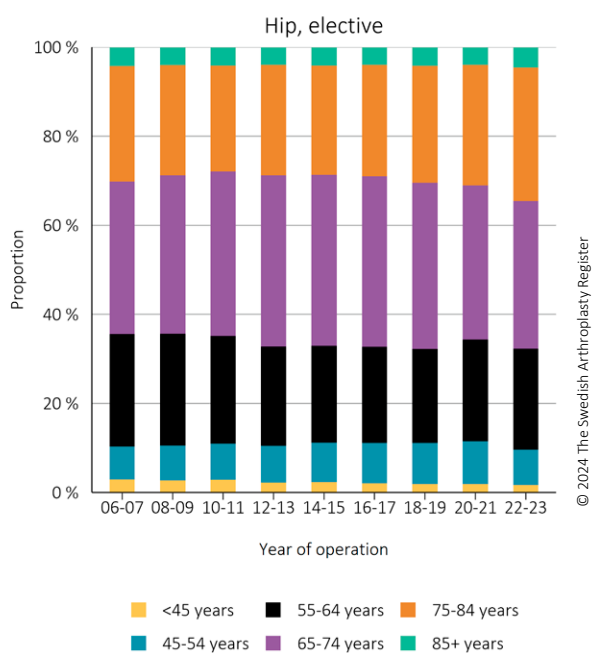


Figure 3.5a. Distribution of age groups in elective primary hip replacement 2006–2023.

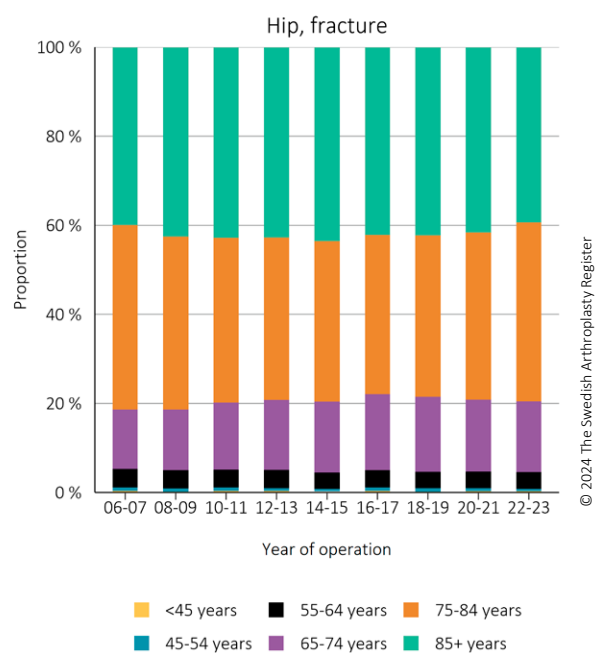


Figure 3.5b. Distribution of age groups in primary hip replacement due to fracture 2006–2023.

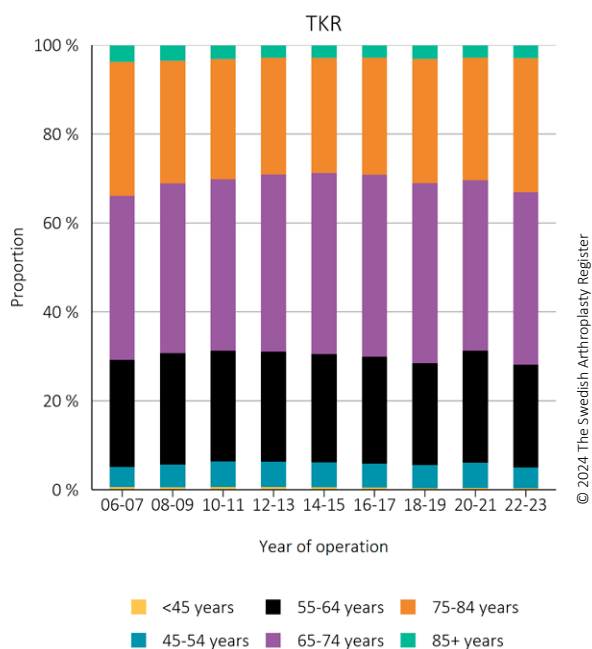


Figure 3.5c. Distribution of age groups in primary TKR 2006–2023.

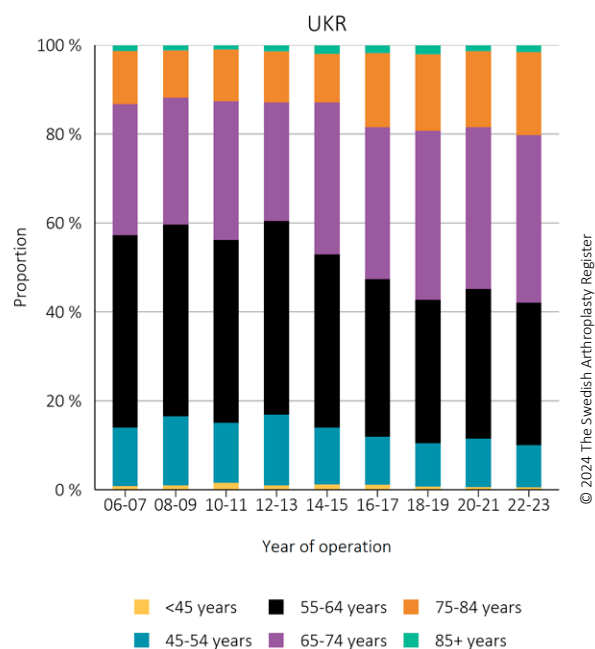


Figure 3.5d. Distribution of age groups in primary UKR 2006–2023.

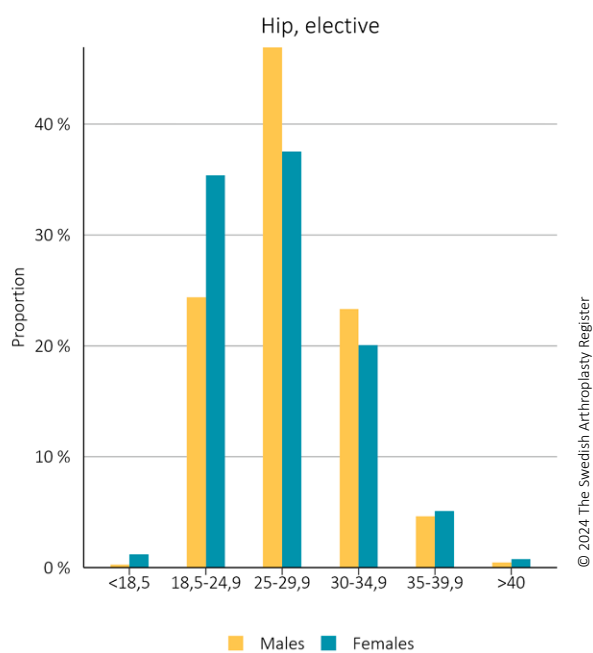


Figure 3.6a. Distribution of BMI class and sex in elective primary hip replacement 2006–2023.

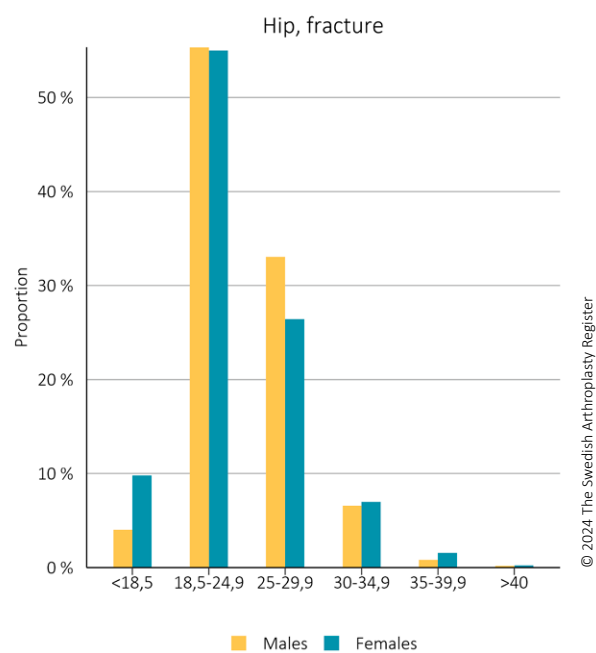


Figure 3.6b. Distribution of BMI class and sex in primary hip replacement due to fracture 2006–2023.

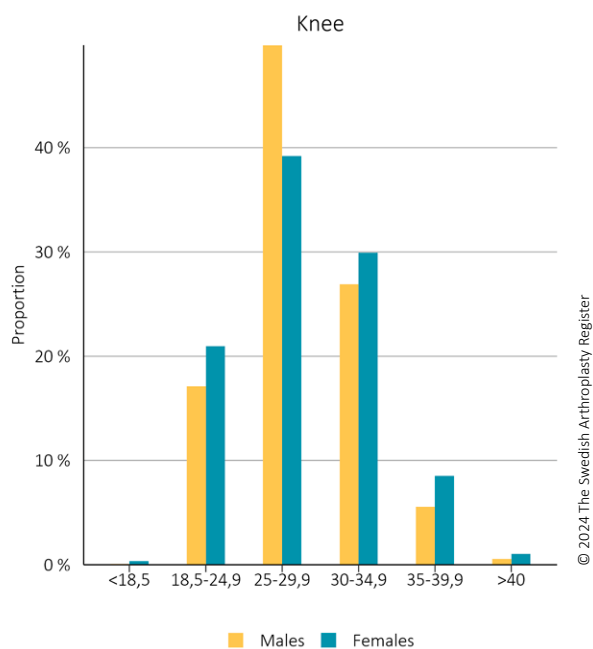


Figure 3.6c. Distribution of BMI class and sex in primary knee replacement 2006–2023.

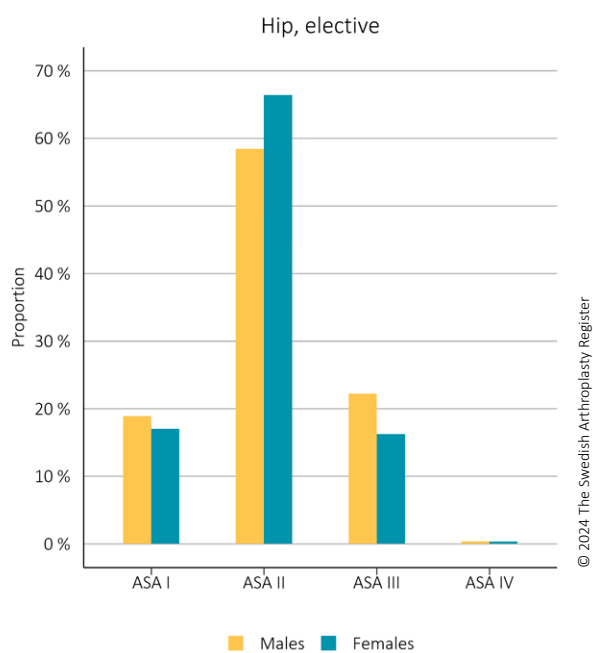


Figure 3.7a. Distribution of ASA class and sex in elective primary hip replacement 2006–2023.

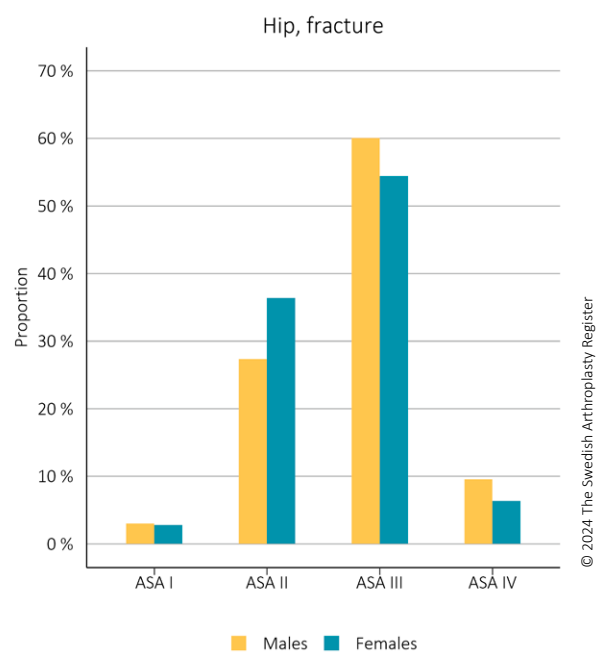


Figure 3.7b. Distribution of ASA class and sex in primary hip replacement due to fracture 2006–2023.

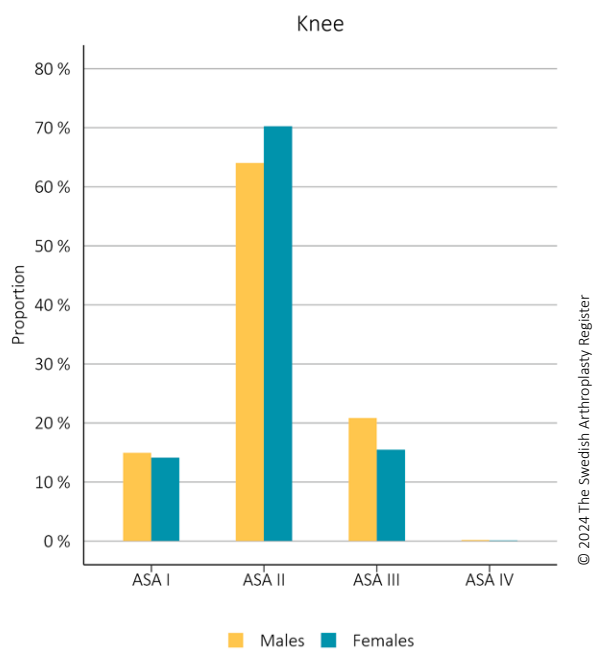


Figure 3.7c. Distribution of ASA class and sex in primary knee replacement 2006–2023.

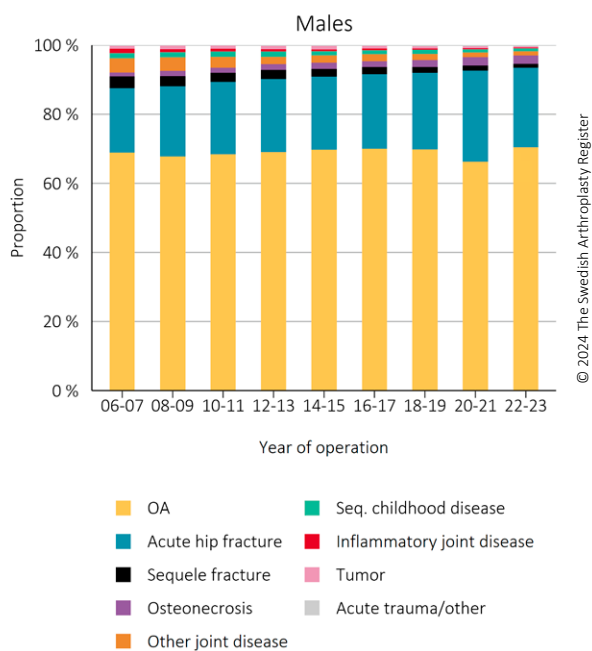


Figure 3.8a. Distribution of diagnoses in elective primary hip replacement 2006–2023 – males.

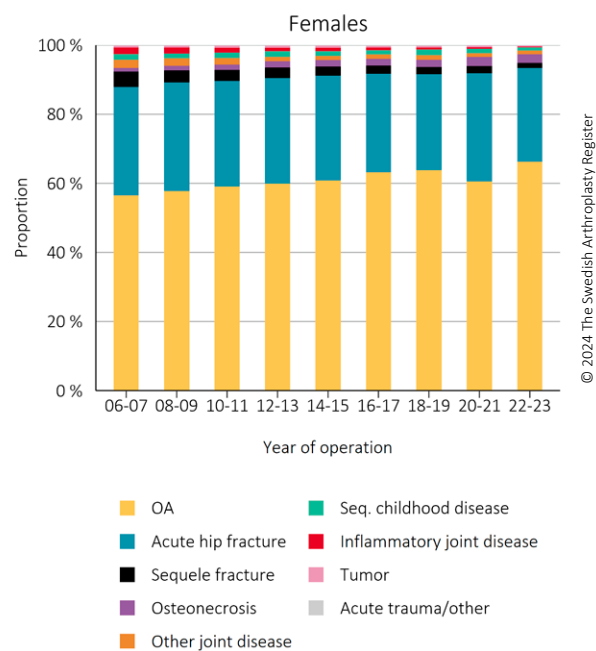


Figure 3.8b. Distribution of diagnoses in elective primary hip replacement 2006–2023 – females.

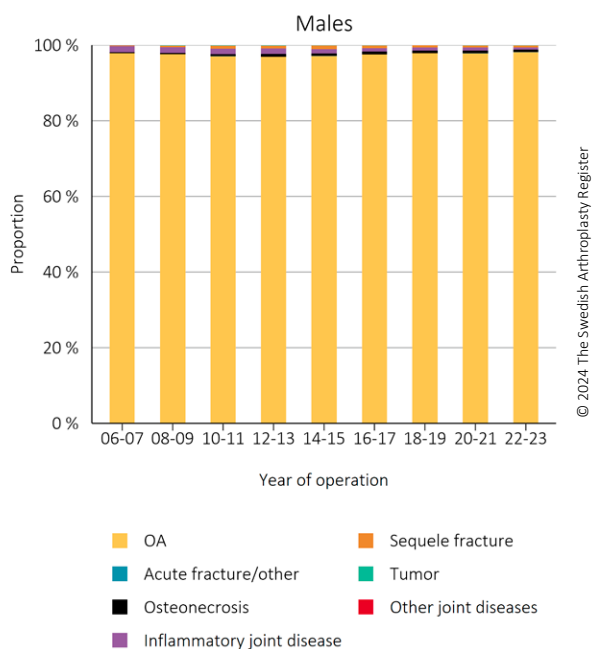


Figure 3.9a. Distribution of diagnoses in primary knee replacement 2006–2023 – males.

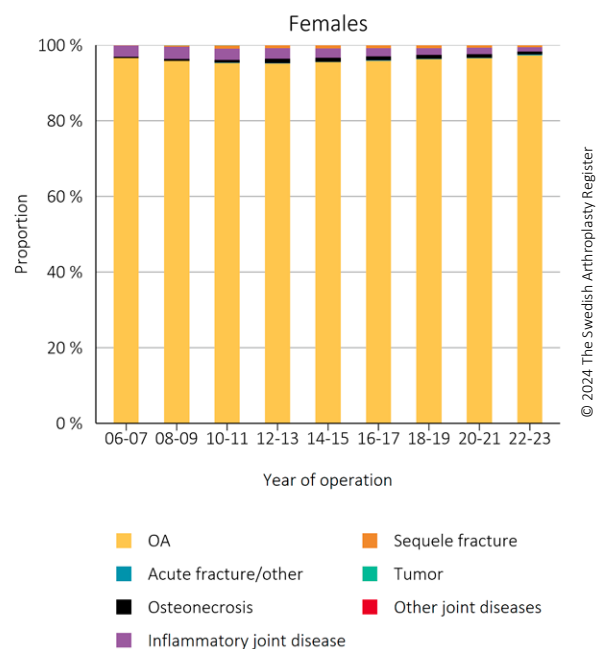


Figure 3.9b. Distribution of diagnoses in primary knee replacement 2006–2023 – females.

Diagnosis in primary hip replacement

	2019	2020	2021	2022	2023	Total
Number	24,188	19,730	21,917	25,600	27,726	119,161
Diagnosis n (%)						
Osteoarthritis	16,088 (66.5)	12,058 (61.1)	14,130 (64.5)	17,256 (67.4)	18,980 (68.5)	78,512 (65.9)
Acute hip fracture	6,072 (25.1)	6,103 (30.9)	6,101 (27.8)	6,639 (25.9)	6,912 (24.9)	31,827 (26.7)
Sequele fracture/trauma	460 (1.9)	375 (1.9)	376 (1.7)	364 (1.4)	352 (1.3)	1,927 (1.6)
Osteonecrosis	539 (2.2)	488 (2.5)	589 (2.7)	614 (2.4)	704 (2.5)	2,934 (2.5)
Sequele childhood hip disease	376 (1.6)	256 (1.3)	234 (1.1)	280 (1.1)	266 (1.0)	1,412 (1.2)
Inflammatory joint disease	111 (0.5)	73 (0.4)	66 (0.3)	43 (0.2)	38 (0.1)	331 (0.3)
Tumor	130 (0.5)	104 (0.5)	104 (0.5)	71 (0.3)	84 (0.3)	493 (0.4)
Acute trauma	50 (0.2)	37 (0.2)	63 (0.3)	57 (0.2)	69 (0.2)	276 (0.2)
Other joint diseases	360 (1.5)	234 (1.2)	252 (1.1)	273 (1.1)	309 (1.1)	1,428 (1.2)

Table 3.2. Diagnosis in elective primary hip replacement 2019–2023.

Diagnosis in primary knee replacement

	2019	2020	2021	2022	2023	Total
Number	16,985	11,816	12,809	17,074	20,622	79,306
Diagnosis n (%)						
Osteoarthritis	16,493 (97.2)	11,461 (97.0)	12,417 (97.1)	16,623 (97.6)	20,117 (97.7)	77,111 (97.4)
Sequele fracture/trauma	107 (0.6)	62 (0.5)	78 (0.6)	89 (0.5)	98 (0.5)	434 (0.5)
Osteonecrosis	148 (0.9)	110 (0.9)	97 (0.8)	109 (0.6)	133 (0.6)	597 (0.8)
Inflammatory joint disease	211 (1.2)	155 (1.3)	163 (1.3)	174 (1.0)	182 (0.9)	885 (1.1)
Tumor	5 (0.0)	8 (0.1)	9 (0.1)	9 (0.1)	8 (0.0)	39 (0.0)
Acute trauma	12 (0.1)	15 (0.1)	26 (0.2)	28 (0.2)	46 (0.2)	127 (0.2)
Other joint diseases	<5	<5	<5	7 (0.0)	7 (0.0)	23 (0.0)

Table 3.3. Diagnosis in primary knee replacement 2019–2023.

Diagnosis in age groups in primary hip replacement

	< 45 years	45-54 years	55-64 years	65-74 years	75-84 years	≥85 years
Number	1,647	7,664	20,287	34,877	37,234	17,452
Diagnosis n (%)						
Osteoarthritis	776 (47.2)	6,440 (84.0)	17,735 (87.4)	27,684 (79.4)	22,632 (60.8)	3,245 (18.6)
Acute hip fracture	29 (1.8)	135 (1.8)	1,007 (5.0)	5,009 (14.4)	12,353 (33.2)	13,294 (76.2)
Sequele fracture/trauma	50 (3.0)	86 (1.1)	251 (1.2)	409 (1.2)	675 (1.8)	456 (2.6)
Osteonecrosis	188 (11.4)	247 (3.2)	510 (2.5)	846 (2.4)	884 (2.4)	259 (1.5)
Sequele childhood hip disease	295 (17.9)	447 (5.8)	353 (1.7)	211 (0.6)	93 (0.2)	13 (0.1)
Inflammatory joint disease	38 (2.3)	44 (0.6)	66 (0.3)	123 (0.4)	50 (0.1)	10 (0.1)
Tumor	27 (1.6)	26 (0.3)	77 (0.4)	186 (0.5)	133 (0.4)	44 (0.3)
Acute trauma	<5	9 (0.1)	28 (0.1)	58 (0.2)	114 (0.3)	64 (0.4)
Other joint diseases	238 (14.5)	230 (3.0)	255 (1.3)	342 (1.0)	296 (0.8)	67 (0.4)

Table 3.4. Distribution of diagnosis by age group in primary hip replacement 2019–2023.

Diagnosis in age groups in primary knee replacement

	< 45 år	45–54 år	55–64 år	65–74 år	75–84 år	≥ 85 år
Number	311	4,502	19,504	30,794	21,923	2,272
Diagnosis n (%)						
Osteoarthritis	221 (77.3)	4,299 (96.1)	18,978 (97.4)	30,007 (97.5)	21,410 (97.7)	2,196 (96.7)
Sequele fracture/trauma	9 (3.1)	50 (1.1)	143 (0.7)	151 (0.5)	65 (0.3)	16 (0.7)
Osteonecrosis	9 (3.1)	34 (0.8)	132 (0.7)	236 (0.8)	158 (0.7)	28 (1.2)
Inflammatory joint disease	26 (9.1)	76 (1.7)	205 (1.1)	321 (1.0)	239 (1.1)	18 (0.8)
Tumor	19 (6.6)	6 (0.1)	<5	5 (0.0)	7 (0.0)	0 (0.0)
Acute trauma	<5	9 (0.2)	27 (0.1)	47 (0.2)	30 (0.1)	12 (0.5)
Other joint diseases	<5	<5	<5	<5	7 (0.0)	5 (0.0)

Table 3.5. Distribution of diagnosis by age group in primary knee replacement 2019–2023.

In the entire Swedish population,
3.4% have undergone at least one
hip or knee replacement.



4. Epidemiology

Authors: Annette W-Dahl and Ola Rolfson

Hip and Knee Replacement in Sweden

Prevalence

When the proportion of individuals who have undergone hip or knee replacement is related to the total population, it is referred to as the prevalence of people with a hip or knee replacement.

For individuals who have undergone hip replacement since 1991, we include data starting from 1992, when the registry began recording prostheses at the individual level. For knee prostheses, which have been recorded at the individual level since the start of the register in 1975, all records are included. Table 4.1 shows the number of individuals in each age group, as well as males and females in each age group, with hip or knee replacement, either unilateral or bilateral. Corresponding figures for individuals with bilateral hip and knee replacements, hip replacements, or knee replacement are displayed in Table 4.2. These tables also show prevalence per 100,000 inhabitants at the end of each year, 2013 and 2023.

By the end of 2023, 363,384 individuals had a hip or knee replacement, 226,163 had a hip replacement, and 164,701 had a knee replacement. This means that 3.4% of the population has a hip or knee replacement, 2.1% have at least one hip replacement, and 1.6% have at least one knee replacement. Among those with hip and knee replacements, 9.3% were bilaterally operated, 27.4% of those with hip replacement were bilaterally operated, and 33.5% of those with knee replacement.

Prevalence is highest in the age groups 65–84 years for both hip and knee replacements, with a higher prevalence in females compared to males.

The prevalence per 100,000 inhabitants of having a hip or knee replacement has increased from 2.6% in 2012 to 3.4% in 2023. This increase is similar for females and males, with female's prevalence rising from 3.2% in 2012 to 4.0% in 2023, and male's rising from 2.1% to 2.9% (Figure 4.1 a). Over 20% (22.1%) of all 85-year-olds in

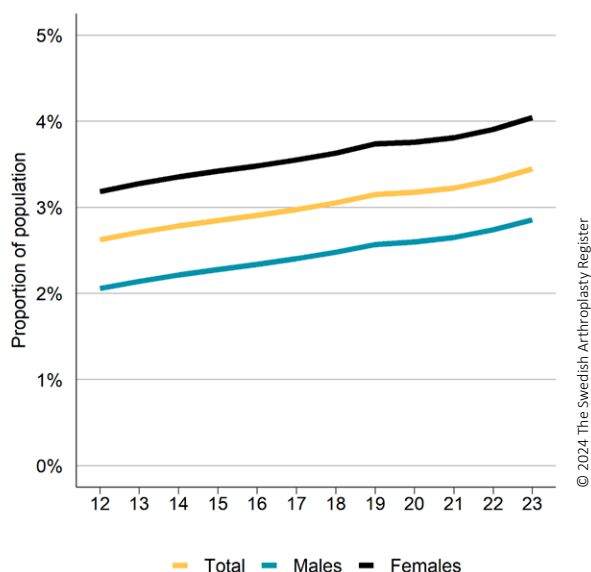


Figure 4.1 a. Prevalence of at least one hip or knee replacement in the population 2012–2023

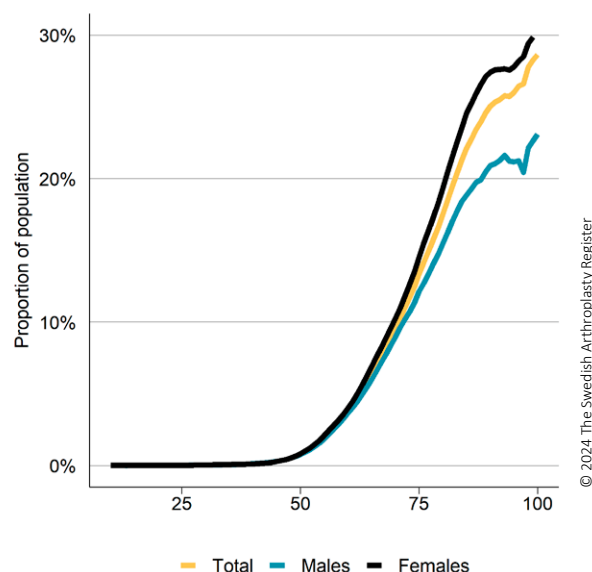


Figure 4.1 b. Prevalence of at least one hip or knee replacement in the population on 31 December 2023 divided by age.

Sweden have a hip or knee replacement, with a higher prevalence among 85-year-old females (24.4%) compared to 85-year-old males (19.1%) (Figure 4.1 b).

Prevalence per 100,000 inhabitants of having at least one hip replacement in the population has increased from 1.7% to 2.1% between 2012 and 2023. The increase has been slightly greater for knee replacement, rising from 1.1% to 1.6%. The increase has been similar for both females and males for both hip and knee replacement (Figures 4.2 a and 4.3 a).

In 2023, 14.8% of all 85-year-olds had at least one hip replacement, and 9.6% had at least one knee replacement. Females had a higher prevalence of both hip and knee replacements compared to males, with 16.7% of females having a hip replacement and 10.4% having a knee replacement, compared to 12.1% and 8.7% for males, respectively (Figures 4.2 b and 4.3 b).

Incidence

The number of primary replacements implanted in a year in relation to the population size, is referred to as the national incidence of the procedure. Note that the incidence of hip and knee replacements is calculated based on the number of procedures, while prevalence pertains to

the number of individuals. In 2023, 27,726 primary hip replacements were registered, including 20,367 primary total hip replacements, and 20,622 primary knee replacements. This results in incidences of 224 per 100,000 for hip replacements, 203 per 100,000 for total hip replacements, and 196 per 100,000 for knee replacements. Compared to 2022, the incidence of primary total hip replacements and knee replacements increased, while the incidence for hip replacements decreased in 2023.

Over the years, the incidence has increased for both hip and knee replacements. The sharp increase in knee replacements in the late 1980s has somewhat plateaued since 2009. For hip replacements, the increase has also slowed, and the incidence has remained relatively stable.

As hip and knee replacements are primarily used for older individuals, a portion of the increase over time can be attributed to the aging population. Because incidence is age-dependent and age structures can vary across regions or countries, comparisons are challenging without some form of age standardization. The “European Standard Population” has been used to make comparisons feasible. This standardization describes how the incidence would be for a given region or country if all regions/countries had the same age distribution.

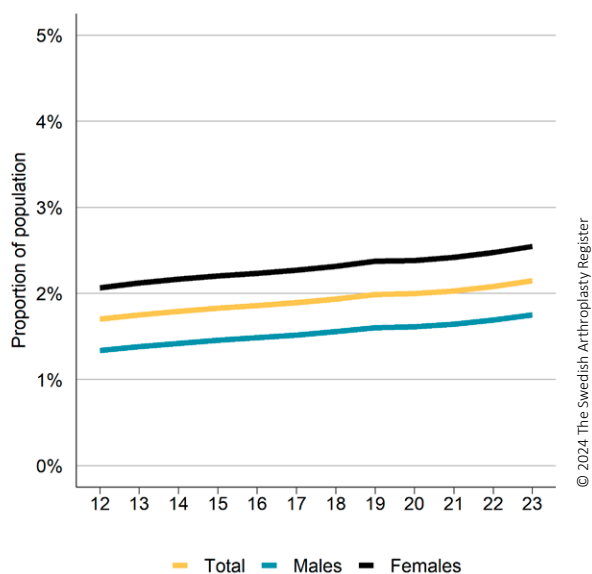


Figure 4.2 a. Prevalence of at least one hip replacement in the population 2012–2023.

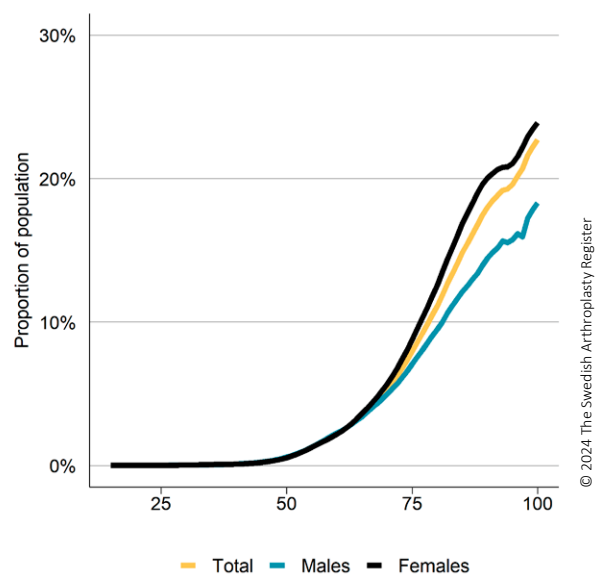


Figure 4.2 b. Prevalence of at least one hip replacement in the population on 31 December 2023 divided by age.

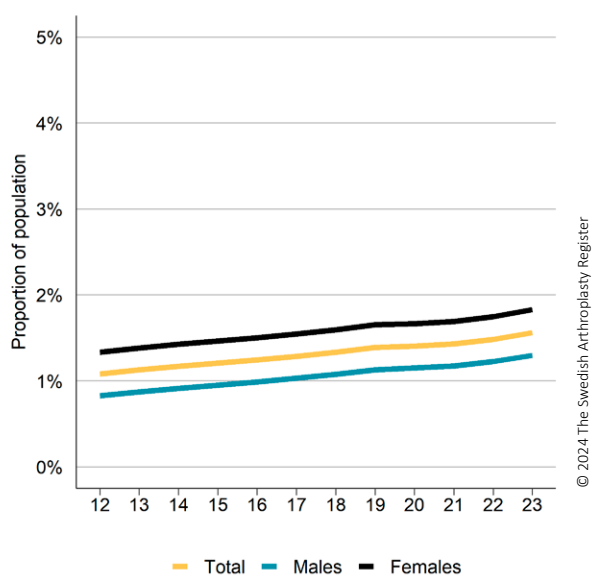


Figure 4.3 a. Prevalence of at least one knee replacement in the population 2012–2023.

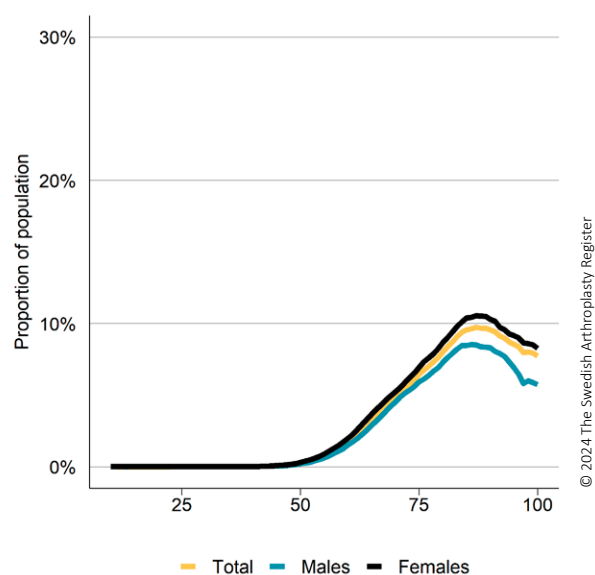


Figure 4.3 b. Prevalence of at least one knee replacement in the population on 31 December 2023 divided by age.

In international comparisons, Sweden had a higher incidence of hip replacements than the USA, Australia, and the UK, but lower than Denmark, Norway, Finland, and Germany in 2019 (OECD does not have current figures beyond the pandemic years). For knee replacements, Sweden has a higher incidence than Norway but lower than Denmark, Finland, the USA, Australia, the UK, and Germany (OECD Health Statistics 2023).

Regional differences

According to the Health Care Act (SFS 2017:30), the goal of healthcare is "... to ensure good health and care on equal terms for the entire population. Care should be provided with respect for all people's equal worth and individual dignity. Those with the greatest need for healthcare should be given priority in receiving care."

An important aspect of equity is the geographical variation in how healthcare is provided and delivered across the country. Equity, in a broad sense, can relate to where a patient lives within the country. The 21 regions have autonomy over their healthcare services but must adhere to the Health Care Act.

Production and consumption

Production and consumption are based on data from the Swedish Arthroplasty Register, Statistics Sweden's population statistics, and the Swedish Tax Agency's address register. Production refers to the number of hip replacement, total hip replacement, and knee replacement surgeries performed, regardless of where the patient resides. It is presented per 100,000 inhabitants, indicating the volume of surgeries performed within a region. Consumption refers to the number of hip replacement, total hip replacement, and knee replacement surgeries performed, regardless of where the surgery took place. It is presented per 100,000 inhabitants, reflecting the availability of these surgeries to the residents of a region, regardless of where the surgery is conducted. Consumption calculations are based on data from the Tax Agency regarding the region of residence at the time of the operation.

The maps of Sweden illustrate the distribution of production and consumption for hip replacements (4.4 a and 4.5 a) and knee replacements (4.4 b and 4.5 b) per 100,000 inhabitants in the 21 regions. Tables 4.3 and 4.4 show production and consumption with incidence rates and age-standardized incidence (European Standard population) for hip replacements, total hip replacements, and knee replacements across the regions.

For production, the age-standardized incidence varies from 193 to 299 for hip replacements (129 to 246 for total hip replacements) and from 90 to 262 for knee replacements. Södermanland has the highest production incidence for hip replacement surgeries, while Stockholm leads for knee replacements. Conversely, Dalarna has the lowest incidence for hip replacements, and Västerbotten has the lowest for knee replacements. Production rates are nearly twice as high in Södermanland compared to Dalarna for total hip replacement surgeries and almost three times higher in Stockholm compared to Västerbotten for knee replacement surgeries.

Differences in age-standardized incidence for consumption range from 195 to 283 for hip replacements (164 to 253 for total hip replacements) and from 125 to 280 for knee replacements. For hip replacements, Blekinge has the lowest consumption, at nearly 50% of the incidence compared to Västernorrland, which has the highest consumption. For total hip replacements, Östergötland has the lowest consumption at just over 50% compared to Västernorrland, which again has the highest. For knee replacements, Kronoberg has the highest consumption, with an incidence more than twice that of Västerbotten, which has the lowest.

These variations underscore significant disparities in both the provision and access to hip and knee replacement surgeries between regions and across different years. The differences in age-standardized incidence highlight the inconsistencies in how care is distributed and accessed, reflecting potential inequalities in healthcare delivery.

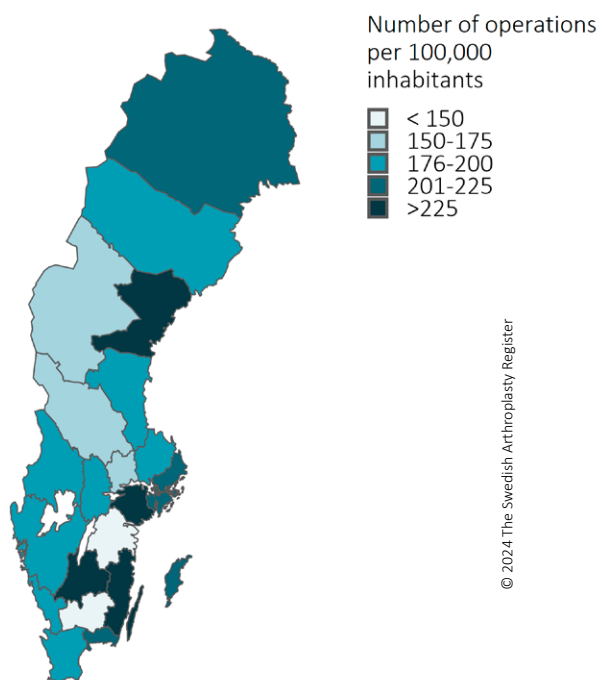


Figure 4.4 a. Production elective hip replacement.

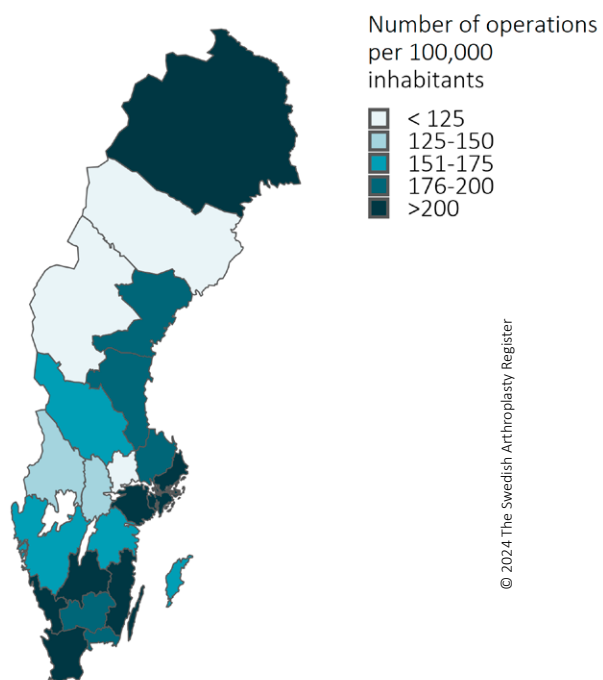


Figure 4.4 b. Production knee replacement.

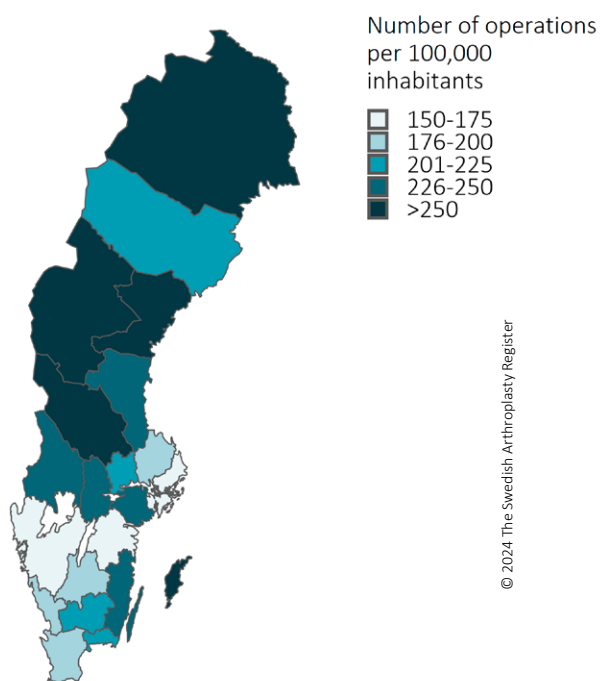


Figure 4.5 a. Consumption elective hip replacement.

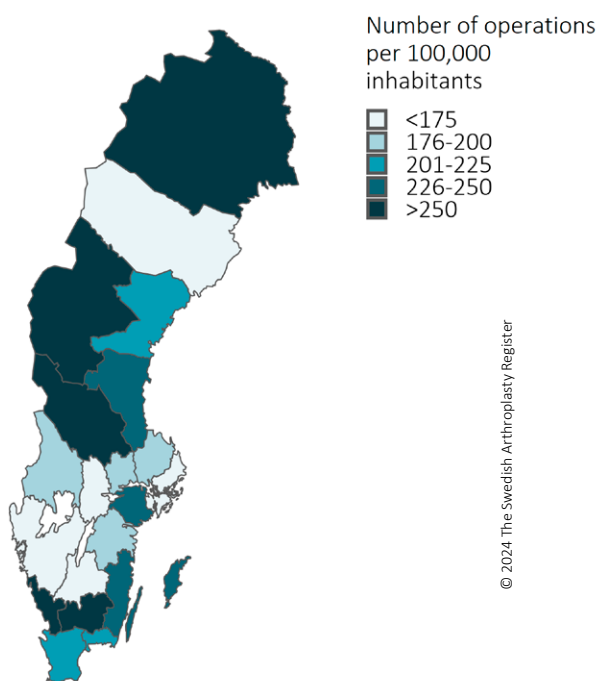


Figure 4.5 b. Consumption knee replacement.

Number of individuals with at least one total hip replacement or knee replacement

Number per age group	Hip or Knee		Hip		Knee	
	2013	2023	2013	2023	2013	2023
< 45 years	2,255	2,185	1,911	1,887	389	332
45-54 years	9,100	10,411	6,274	7,324	3,039	3,280
55-64 years	34,136	45,907	19,701	26,708	15,566	20,896
65-74 years	79,972	98,263	48,963	54,843	35,403	49,673
75-84 years	85,753	138,359	55,702	87,105	36,823	63,704
≥85 years	49,817	68,259	36,110	48,296	17,419	26,816
Total	261,033	363,384	168,661	226,163	108,639	164,701
Prevalence per 100,000	2,706	3,444	1,749	2,143	1,126	1,561
Males						
< 45 years	1,120	1,136	961	980	159	156
45-54 years	4,541	5,157	3,358	3,825	1,183	1,332
55-64 years	16,210	22,558	9,645	13,554	6,565	9,004
65-74 years	37,123	47,485	21,708	25,089	15,415	22,396
75-84 years	34,899	62,319	20,970	35,119	13,929	27,200
≥85 years	14,487	23,160	9,749	14,356	4,738	8,804
Total	108,380	161,815	66,391	92,923	41,989	68,892
Prevalence per 100,000	2,251	3,046	1,379	1,749	872	1,297
Females						
< 45 years	1,180	1,083	950	907	230	176
45-54 years	4,772	5,447	2,916	3,499	1,856	1,948
55-64 years	19,057	25,046	10,056	13,154	9,001	11,892
65-74 years	47,243	57,031	27,255	29,754	19,988	27,277
75-84 years	57,626	88,490	34,732	51,986	22,894	36,504
≥85 years	39,042	51,952	26,361	33,940	12,681	18,012
Total	168,920	229,049	102,270	133,240	66,650	95,809
Prevalence per 100,000	3,497	4,372	2,117	2,543	1,380	1,829

Table 4.1. Number of individuals in each age group and males and females in each age group with hip replacement or knee replacement, unilaterally or bilaterally operated.

Number of individuals with hip or knee replacement, bilaterally operated

	Hip and Knee		Hip		Knee	
Number per age group	2013	2023	2013	2023	2013	2023
< 45 years	14	9	388	350	55	41
45-54 years	29	34	1,302	1,600	593	631
55-64 years	141	159	4,524	6,901	4,071	5,716
65-74 years	440	781	12,533	15,288	10,843	16,981
75-84 years	639	1,548	13,535	25,081	12,210	23,148
≥85 years	278	832	6,569	12,725	5,631	9,874
Total	1,541	3,363	38,851	61,945	33,403	56,391
Prevalence per 100,000	16	32	403	587	346	534

Table 4.2. Number of individuals in each age group and males and females in each age group with hip replacement or knee replacement, bilaterally operated.

Production in the regions

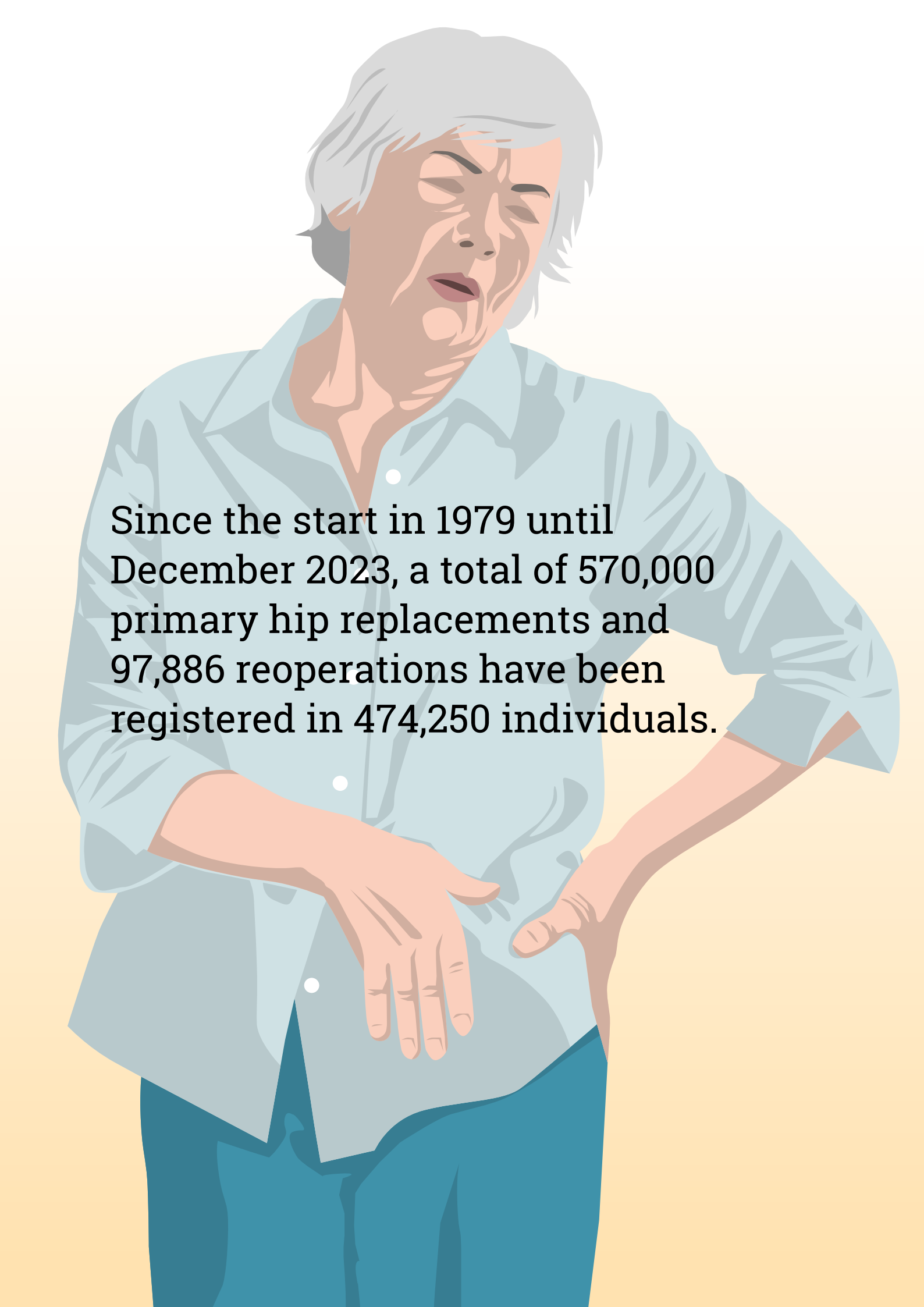
Region	Hip				Knee	
	Incidence	Age standardized incidence	Incidence	Age standardized incidence total hip	Incidence	Age standardized incidence
Blekinge	282	228	206	173	192	161
Dalarna	246	193	157	129	164	135
Gotland	298	226	221	172	154	118
Gävleborg	291	234	199	164	190	156
Halland	252	222	183	166	266	243
Jämtland	241	196	158	130	117	96
Jönköping	309	288	247	235	247	234
Kalmar	339	270	260	213	241	192
Kronoberg	218	195	143	132	189	175
Norrbottn	316	253	221	182	204	168
Skåne	247	243	181	181	211	214
Stockholm	263	298	212	239	230	262
Sörmland	341	299	275	246	246	217
Uppsala	251	261	185	194	200	211
Värmland	266	215	177	149	146	121
Västerbotten	262	245	178	170	95	90
Västernorrland	336	273	254	212	197	161
Västmanland	239	208	158	143	103	94
Västra Götaland	247	242	180	180	167	167
Örebro	264	240	191	177	146	134
Östergötland	213	199	149	143	174	167
Country	263	252	195	190	197	192

Table 4.3. Production with incidence and age-standardized incidence (European Standard Population) for hip replacements, total hip replacements and knee replacements in the regions.

Consumption in the regions

Region	Hip				Knee	
	Incidence	Age standardized incidence	Incidence	Age standardized incidence total hip	Incidence	Age standardized incidence
Blekinge	231	194	216	182	215	181
Dalarna	307	254	279	234	269	225
Gotland	288	226	261	207	246	194
Gävleborg	273	227	242	203	238	198
Halland	221	198	195	177	266	242
Jämtland	308	263	273	236	284	245
Jönköping	235	221	200	191	175	165
Kalmar	263	214	245	201	238	191
Kronoberg	274	250	203	190	298	280
Norrbottn	314	257	266	221	262	218
Skåne	209	207	183	183	203	206
Stockholm	179	202	152	171	171	194
Sörmland	269	239	236	211	243	215
Uppsala	214	224	191	201	185	194
Värmland	257	218	227	195	199	168
Västerbotten	224	212	206	197	129	125
Västernorrland	340	283	299	253	218	179
Västmanland	254	228	222	203	199	184
Västra Götaland	208	205	174	174	171	171
Örebro	277	254	226	210	158	146
Östergötland	207	195	171	164	199	193
Country	224	216	194	189	196	192

Table 4.4. Consumption with incidence and age-standardized incidence (European Standard Population) for hip replacements, total hip replacements and knee replacements in the regions.



Since the start in 1979 until December 2023, a total of 570,000 primary hip replacements and 97,886 reoperations have been registered in 474,250 individuals.

5. Hip replacement

5.1. Primary total hip replacement

Author: Maziar Mohaddes

In 2023, a total of 27,726 primary hip replacements were reported, including 42 performed due to tumors and 5,145 hemiarthroplasties. Among the 22,539 primary total hip replacements, 2,172 were performed on patients with hip fractures or sequelae from hip fractures (Figure 5.1.1). This chapter excludes primary hip replacements performed due to tumors, fractures, or sequelae from fractures.

Among the 20,367 primary elective total hip replacements reported in 2023, the indication for surgery was osteoarthritis in 18,980 cases and other diagnoses in 1,387 cases (Figure 5.1.1). This represents a 10% increase in reported primary elective total hip replacements compared to the previous year. The increase is likely due to several hospitals ramping up production to address the growing backlogs caused by the COVID-19 pandemic. Since both private and public providers have increased their production, the distribution between them has remained largely unchanged from the previous year. In 2023, private providers accounted for 39% of all elective primary total hip replacements, the same proportion as in 2022.

Over the past four years, the proportion of patients under 45 years of age has slightly decreased, while the age distribution has remained relatively constant (Table 5.1.2). The proportion of patients in different BMI categories has also remained relatively stable (Table 5.1.2). The change observed during the pandemic years, where there was an increase in the proportion of healthy patients (ASA class I), has reversed, and in 2023, the majority of operated patients were classified as ASA class II (63%) (Table 5.1.2).

Table 5.1.3 provides the case-mix of units with demographic data for patients operated on at each unit. Notably, the proportion of patients with a BMI 35 and above varies between 0% and 16%. The corresponding proportion for patients with ASA class III and IV ranges from 0% to 76%. Please note that the percentage figures for units with few operations may be misleading.

Summary

The reduction in the number of reported total replacements during the pandemic years has been reversed. In 2023, 22,539 primary total hip replacements were reported. A continued high proportion of surgeries are performed by private providers. In 2023, nearly 39% of the reported surgeries were conducted by private entities.

Surgical approach

Since 2003, the posterior and direct lateral incisions in the supine or lateral position have been the dominant techniques in Sweden. In 2023, these two types of incisions accounted for 99% of all procedures. The posterior incision remains the most common (66%). In recent years, the proportion of patients undergoing surgery with a posterior incision has increased. The direct lateral incision in the lateral position was used in 28% of cases, and the direct lateral incision in the supine position in 5%. Mini-incisions, Watson-Jones incisions, and direct lateral/posterior incisions combined with trochanteric osteotomy were used

Selections groups in primary hip replacements, 2023

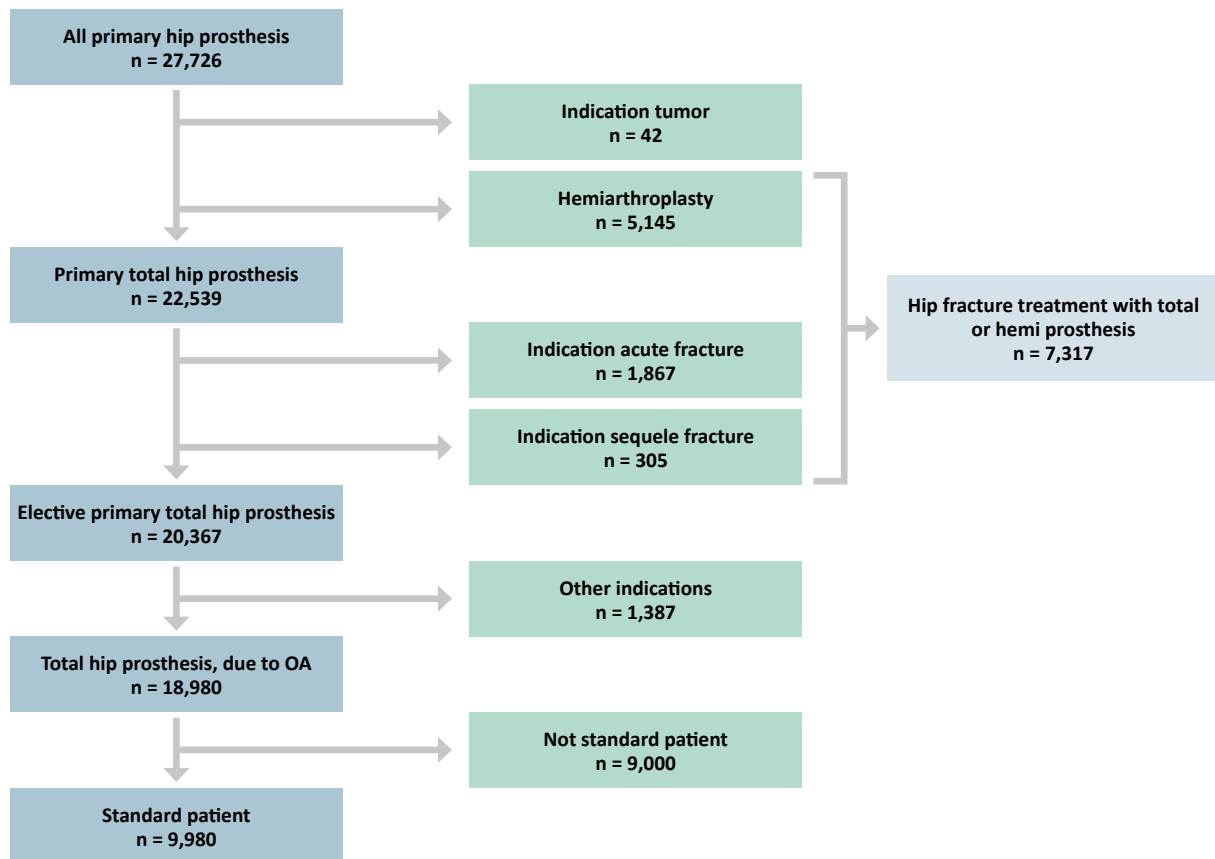


Figure 5.1.1. Flow-chart, based on diagnostic indication and type of prosthesis, shows the different selections groups in primary hip replacements 2023 used in the annual report.

only sporadically (Figure 5.1.3). The distribution among the three most commonly used incisions shows no significant difference between the sex (Figure 5.1.3). In recent years, the use of the posterior incision has increased slightly (Figure 5.1.2).

Surgical approach and operating time

Table 5.1.4 presents the proportion of surgeries using the posterior incision and the median operation time for elective total hip replacements in 2023. There are differences in the proportion of patients undergoing surgery with a posterior incision among various units. At 24 units, the posterior incision was used in all cases (5,274 surgeries), with a median operating time of 76 minutes. At 12 units, 100% of the surgeries were performed using incisions other than the posterior incision (1,752 surgeries), with a reported median operating time of 86 minutes.

Fixation

Fully cemented fixation is reported more frequently for surgeries in females, whereas fully uncemented fixation is more common in surgeries in males (Figure 5.1.4). This figure should be interpreted with the understanding that other factors, such as the age and bone quality of the patient, may influence the choice of fixation. Poor outcomes with uncemented fixation in the 1990s led to an increase in fully cemented fixation, reaching a peak of 93% around the turn of the millennium. Since then, the proportion of patients undergoing cemented fixation has decreased each year until 2020 (Figure 5.1.5 a). In 2023, the proportion of fully cemented prostheses was 51%.

Fully uncemented fixation has become increasingly common over the past 20 years. In 2003, fully uncemented prostheses accounted for 5% of all reported surgeries. By 2023, this proportion had risen to just over 34% (Figure 5.1.5 a). The increase in uncemented fixation has primarily

occurred in age groups younger than 65 years and in the 65–74 age group, but not in the two oldest age groups (Figures 5.1.5 b–g). Since 2012, the proportion of reversed hybrids (cemented cup, uncemented stem) has decreased. Hybrid prostheses (uncemented cup, cemented stem) have been rare over the past decade, at around 1.5% during 2007–2010, but have increased to nearly 10% in 2023 (Figure 5.1.5 a). Previous reports have indicated regional differences in fixation choices. This year’s report details the use of various fixation methods across units in Sweden (Figure 5.1.6). Regional differences persist when comparing different units. Cemented fixation is used in between 0% and 88% of reported surgeries at various units. The corresponding proportions for uncemented fixation range from 4% to 96%, and for hybrid fixation from 0% to 59%. Some of the differences in fixation methods can likely be explained by variations in patient groups treated at different units, while local traditions and the surgeon’s experience and preferences may contribute significantly to these differences.

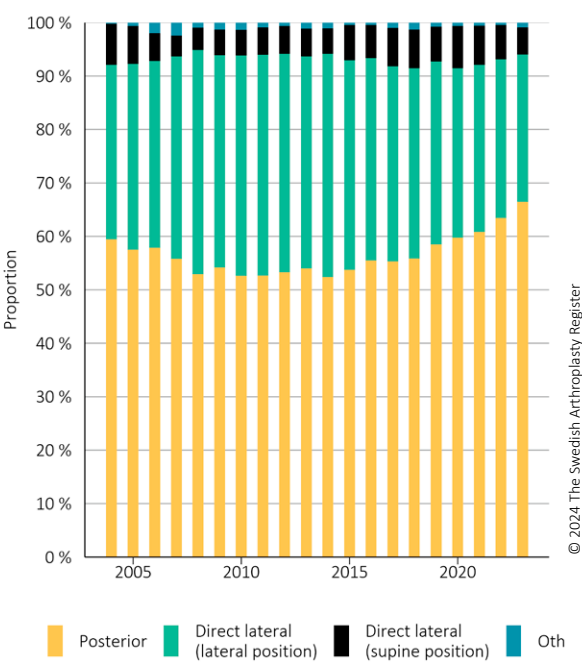


Figure 5.1.3. Time trend for surgical approach.

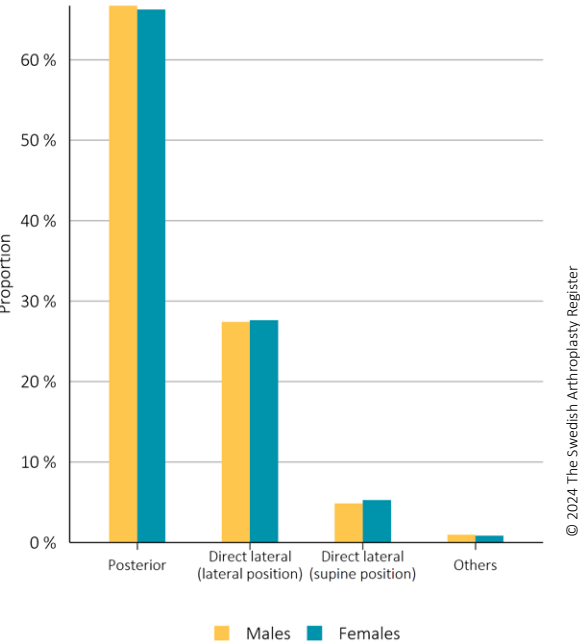


Figure 5.1.2. Distribution of surgical approach, sex.

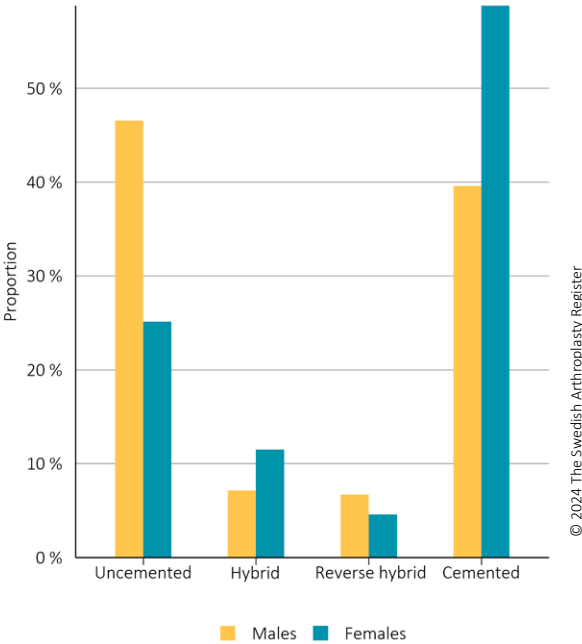


Figure 5.1.4. Distribution of fixation, sex.

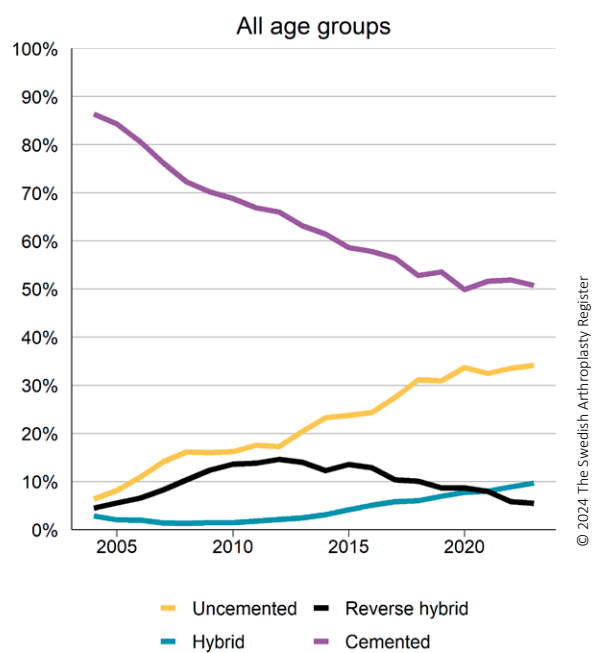


Figure 5.1.5a. Time trend for fixation method 2004–2023.

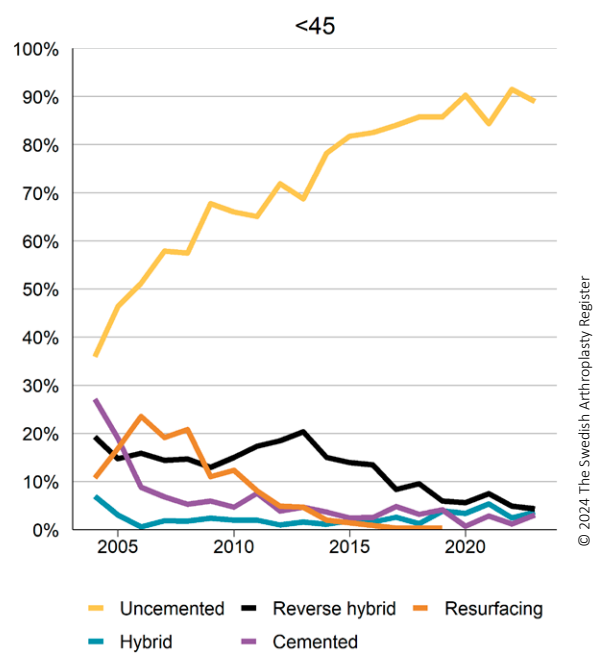


Figure 5.1.5b. Time trend for fixation method, < 45 years.

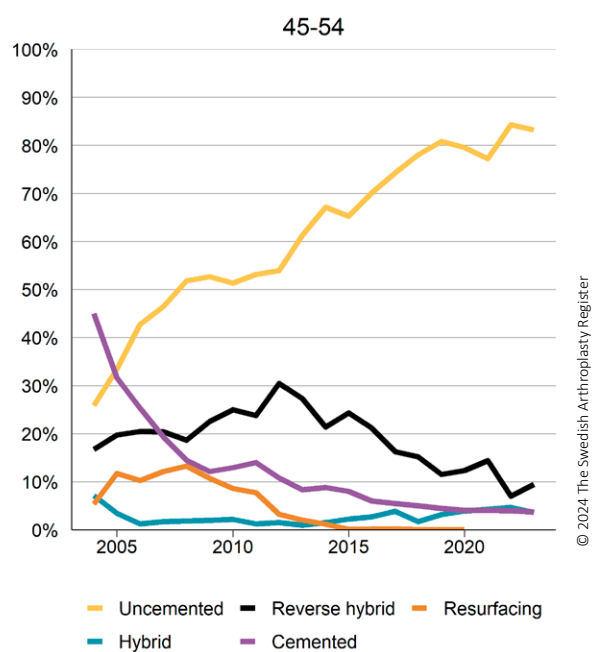


Figure 5.1.5c. Time trend for fixation method, 45–54 years.

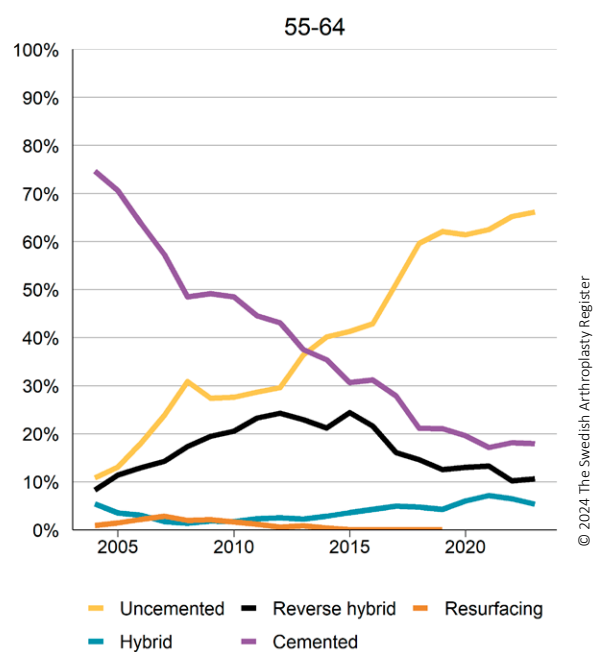


Figure 5.1.5d. Time trend for fixation method, 55–64 years.

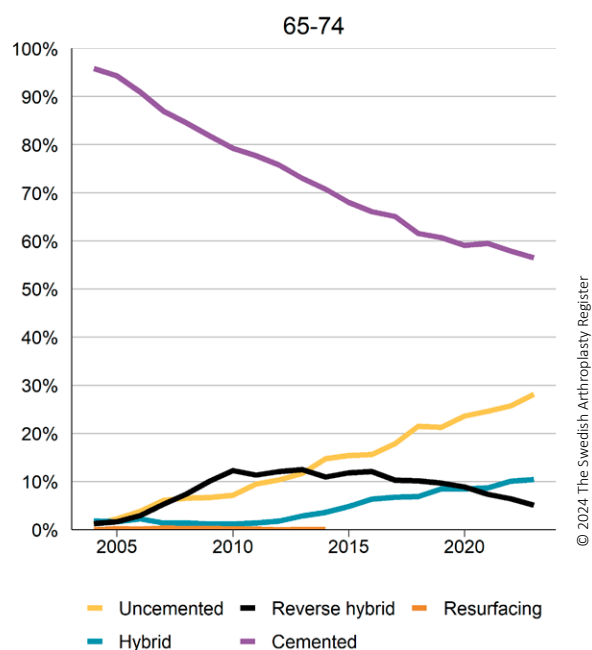


Figure 5.1.5e. Time trend for fixation method, 65–74 years.

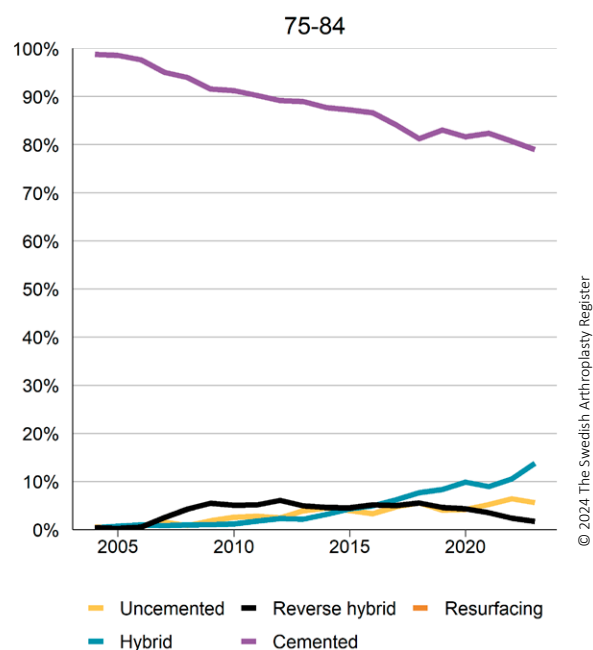


Figure 5.1.5f. Time trend for fixation method, 75–84 years.

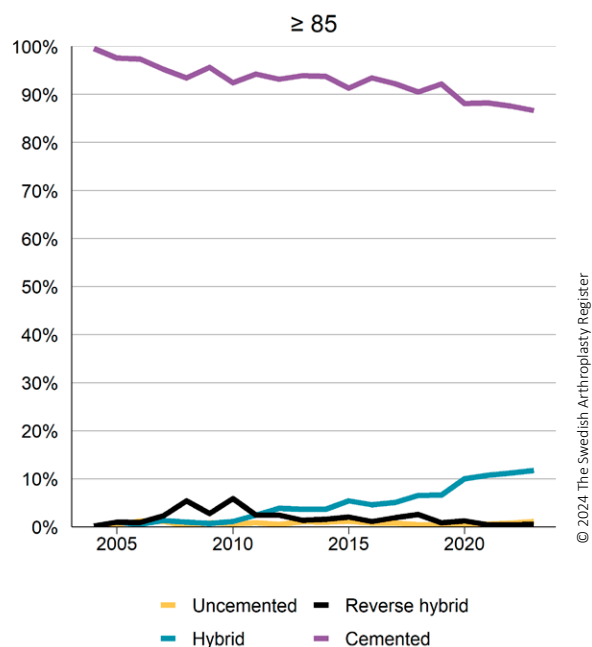


Figure 5.1.5g. Time trend for fixation method, ≥ 85 years.

Summary

Cemented fixation remains the most commonly used fixation method. Over the past decade, the proportion of patients undergoing cemented fixation has decreased. Significant variations in fixation choices exist between different units. Given the existing evidence, the register continues to encourage the use of cemented fixation, particularly on the stem side, for patients over 75 years of age.

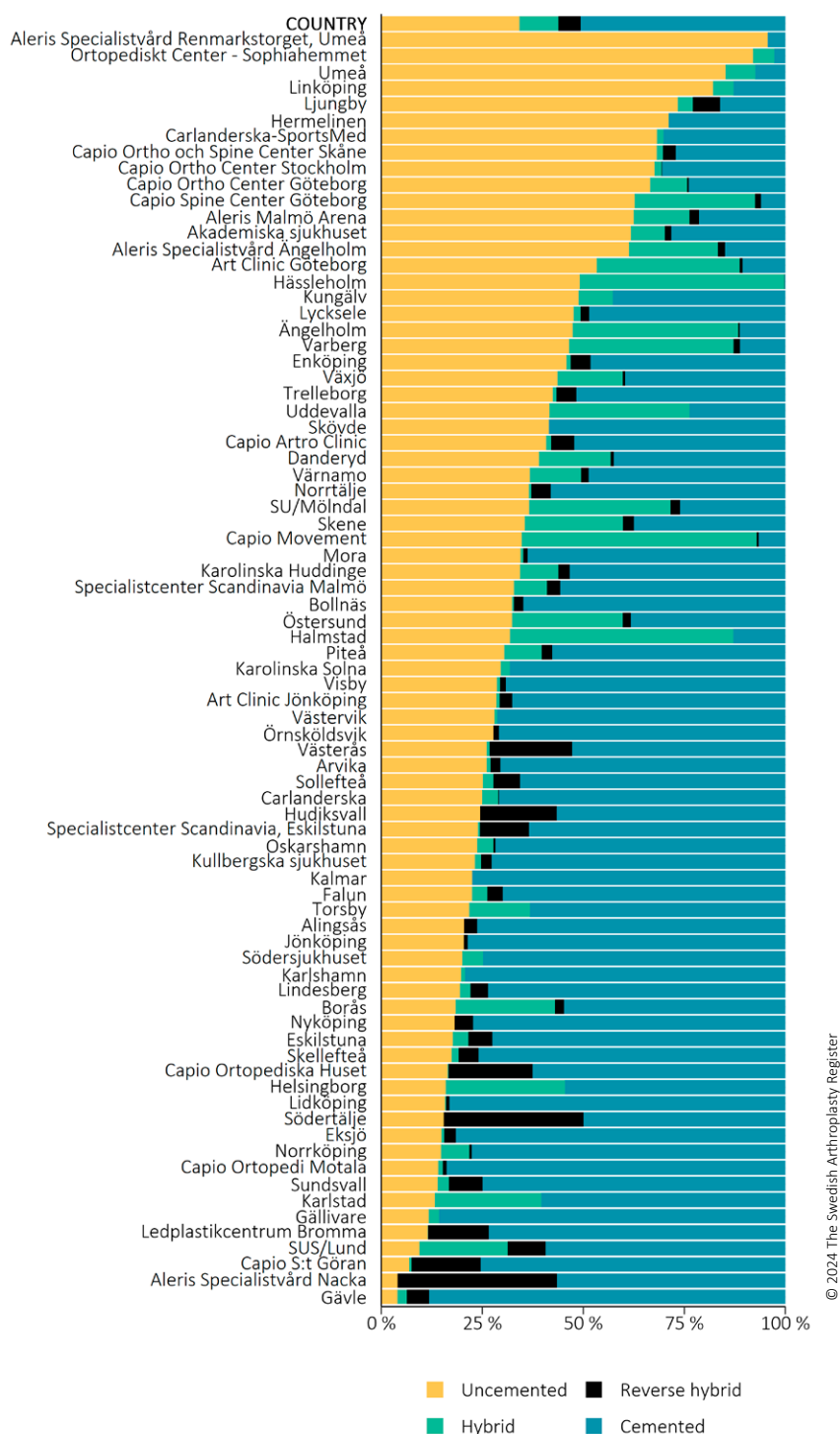


Figure 5.1.6. Use of fixation method per unit.

Implant choice

The most commonly used prostheses are detailed in Tables 5.1.5–5.1.11. In 2023, the five most commonly used cemented cups accounted for approximately 90% of all cups of their type. For stems, Lubinus SPII, Exeter, and MS30 dominate, representing 99% of all cemented stems. The variety of uncemented cups is greater, with the top five accounting for only about 76% of all uncemented cups. Diversification in uncemented stems is less pronounced compared to cups. Since 2009, the Corail stem has been the most frequently used uncemented stem. In 2023, the Corail stem constituted 51% of all uncemented stems reported to the register.

In 2023, highly cross-linked polyethylene was used in 92% of all hip replacements. Ceramic head-polyethylene articulation was used in 24% of surgeries. The previously noted increases in the use of highly cross-linked polyethylene and ceramic head-polyethylene articulation have plateaued. During 2023, a 32 mm head diameter was used in 82% of operations, while a 36 mm head diameter was used in 13% of operations. Time trends regarding articulation choice and head diameter are illustrated in Figures 5.1.7 and 5.1.8.

At the group level, cemented fixation of the stem for patients aged 75 and older has proven to be safer, as the risk of complications, particularly fractures around the stem, is lower compared to uncemented fixation. Therefore, cemented fixation is recommended for this age group, though deviations from this recommendation may be justified in individual cases. Figure 5.1.9 shows the proportion of cemented and uncemented stems by unit for patients aged 75 and older. Over 95% of units use a cemented stem in more than 80% of cases in this age group.

Since 2018, the article numbers for cement type and mixing systems have been recorded for hip replacements. The pre-filled systems Optipac Refobacin Bone Cement R and Palacos R+G Pro have been used for the majority of cemented prostheses reported to the register over the past three years. In 2023, one of these two systems was used in approximately 70% of reported cases. Detailed information on cement types is presented in Tables 5.1.12 a–d.

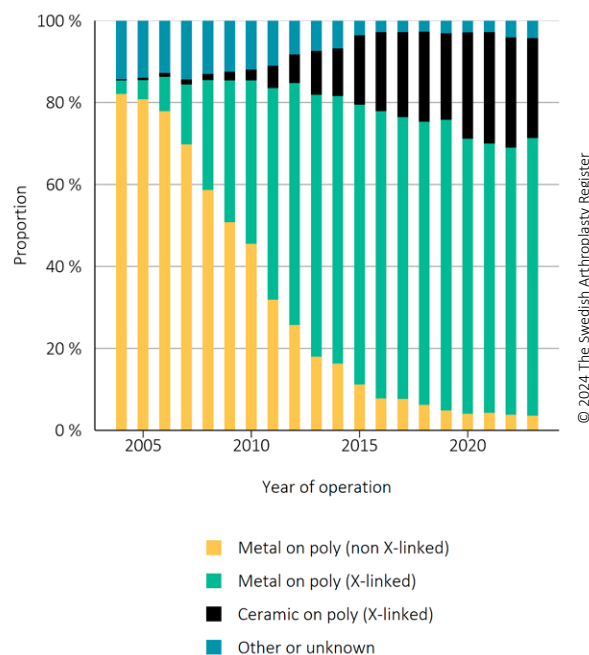


Figure 5.1.7. Time trend for articulation, 2004–2023.

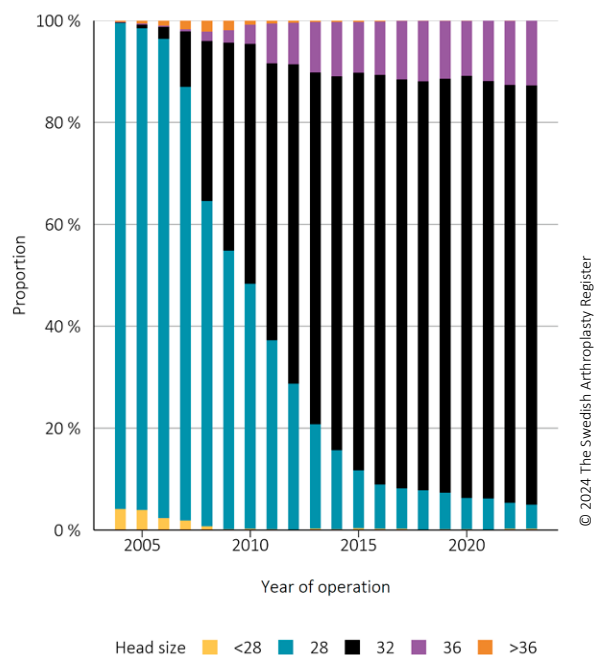


Figure 5.1.8. Time trend for head size, 2004–2023.

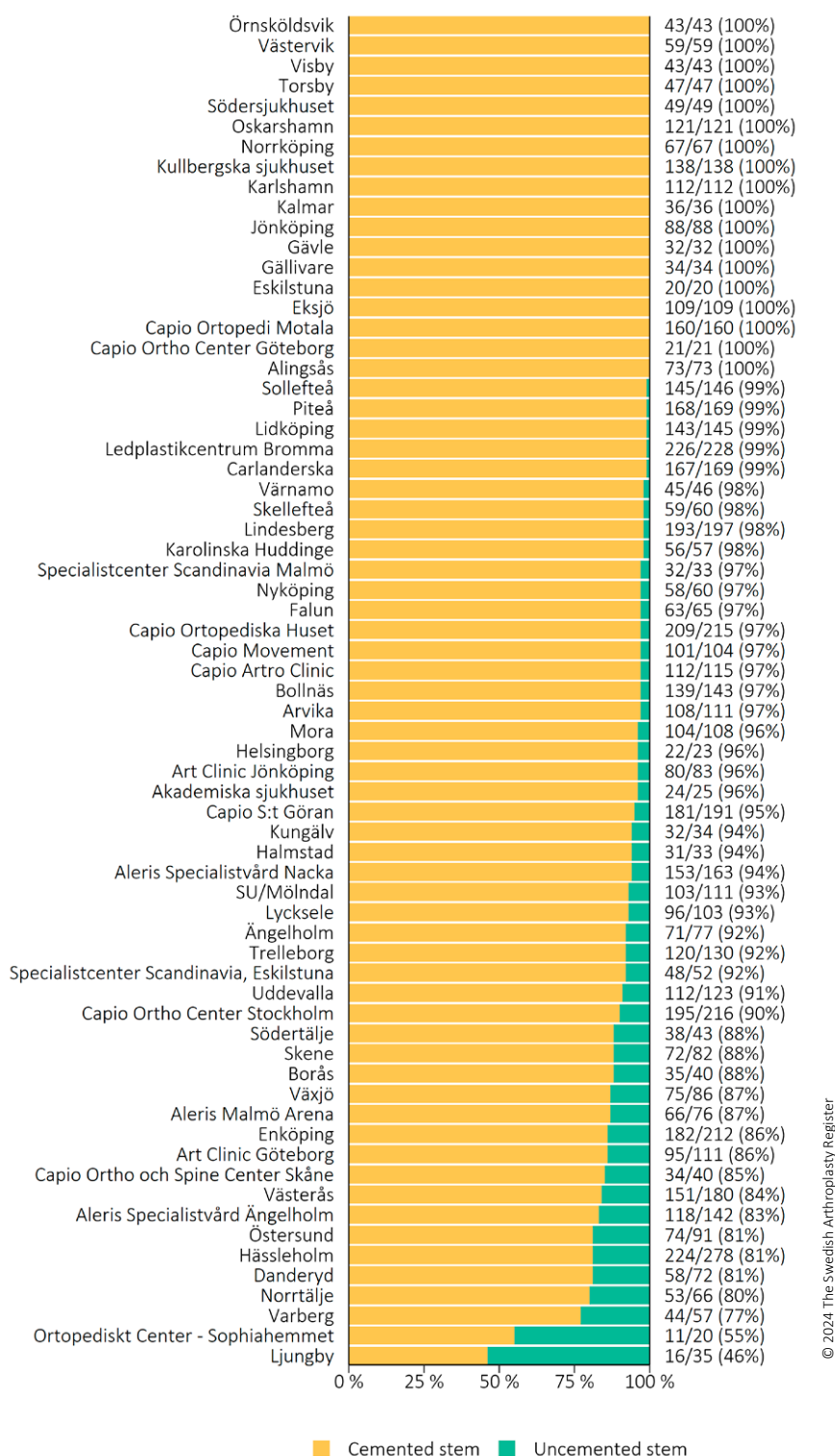


Figure 5.1.9. Proportion of total hip replacement with cemented stem in patients ≥ 75 years per unit in 2023.

All primary replacements per unit and year

Unit	2002–2019	2020	2021	2022	2023
Akademiska sjukhuset	3,090	71	151	187	188
Aleris Malmö Arena				31	266
Aleris Specialistvård Nacka	2,034	303	393	537	658
Aleris Specialistvård Renmarkstorget, Umeå				<5	45
Aleris Specialistvård Ängelholm	676	327	449	516	421
Alingsås	3,344	126	114	190	185
Art Clinic Göteborg	348	212	317	276	443
Art Clinic Jönköping	483	172	297	265	257
Arvika	2,700	132	287	305	288
Bollnäs	2,670	242	362	349	384
Borås	2,331	42	38	69	93
Capio Artro Clinic	1,010	517	641	713	612
Capio Movement	3,391	428	478	473	411
Capio Ortho Center Göteborg	1,870	295	318	309	251
Capio Ortho Center Stockholm	7,233	732	816	859	904
Capio Ortho och Spine Center Skåne				206	251
Capio Ortopedi Motala	354	295	356	453	420
Capio Ortopediska Huset	7,330	609	776	802	778
Capio S:t Göran	7,445	313	343	358	362
Capio Spine Center Göteborg				<5	67
Capio Sports Medicine Umeå AB					5
Carlanderska	2,259	497	557	361	446
Carlanderska-SportsMed				220	239
Danderyd	4,865	105	121	216	146
Eksjö	3,465	154	250	307	288
Enköping	4,905	409	463	532	549
Eskilstuna	1,113	62	71	59	51
Falköping	2,220	42			
Falun	4,694	57	99	169	156
Frölundaortopeden	37	10	16	13	11
Gällivare	1,493	72	46	41	77
Gävle	2,393	118	63	97	127
Halmstad	3,211	151	116	142	85
Helsingborg	1,157	46	55	56	44
Hermelinen	106	21	30	38	38

Table continued on next page.

All primary replacements per unit and year, cont.

Unit	2002–2019	2020	2021	2022	2023
Hudiksvall	1,858	53	54	69	53
Hässleholm	13,148	608	641	633	769
Jönköping	2,939	49	57	150	196
Kalmar	2,640	74	59	89	104
Karlshamn	3,792	209	176	283	305
Karlskrona	207	16	10	14	16
Karlstad	3,050	49	44	40	53
Karolinska Huddinge	3,482	149	194	300	178
Karolinska Solna	2,620	30	37	39	44
Kristianstad	25	<5		<5	<5
Kullbergsga sjukhuset	4,104	225	318	356	429
Kungälv	3,001	68	57	105	117
Ledplastikcentrum Bromma				260	819
Lidköping	3,100	163	108	215	325
Lindesberg	4,569	343	410	412	575
Linköping	1,136	76	92	85	78
Ljungby	2,370	93	103	105	105
Lycksele	4,842	287	233	230	290
Mora	3,307	206	207	254	296
Norrköping	3,073	132	132	143	197
Norrtälje	1,940	107	125	150	148
Nyköping	2,218	86	110	128	132
NÄL	14	7	<5	<5	7
Ortopediskt Center - Sophiahemmet	0			292	262
Oskarshamn	4,085	281	303	422	379
Piteå	5,702	322	344	396	422
Skellefteå	1,822	99	96	137	121
Skene	1,999	120	125	225	259
Skövde	2,086	13	26	47	41
Sollefteå	2,825	203	379	379	426
Sophiahemmet	3,869	214	257		
Specialistcenter S:t Johanniskliniken					10
Specialistcenter Scandinavia Malmö				122	122
Specialistcenter Scandinavia, Eskilstuna	5	10	99	124	208
SU/Mölndal	5,113	238	230	436	334

Table continued on next page.

All primary replacements per unit and year, cont.

Unit	2002–2019	2020	2021	2022	2023
Sunderby sjukhus	533	5	<5		<5
Sundsvall	2,143	7	8	13	36
SUS/Lund	1,268	44	44	30	32
SUS/Malmö	642	<5			<5
Södersjukhuset	4,675	95	64	142	135
Södertälje	1,983	97	105	103	116
Torsby	1,598	74	168	125	152
Trelleborg	9,692	286	376	276	385
Uddevalla	5,347	197	244	320	337
Umeå	1,015	37	39	60	27
Varberg	3,645	175	155	189	125
Visby	1,852	112	127	110	133
Värnamo	2,230	103	174	156	158
Västervik	1,898	89	132	116	150
Västerås	4,443	212	268	348	441
Växjö	1,951	114	84	187	179
Ystad	310		<5		
Ängelholm	1,791	134	118	186	239
Örebro	2,014	<5	<5	<5	<5
Örnsköldsvik	2,629	89	83	157	148
Östersund	3,798	175	79	194	201
Riket	228,138	13,168	15,325	18,512	20,367

Table 5.1.1. Number of primary operations per unit and year. Units with fewer than 20 primary replacements are excluded.

Demography 2020–2023

	2020	2021	2022	2023
Number	13,138	15,325	18,512	20,367
Mean age (SD)	67.8 (10.8)	68.5 (10.8)	69.0 (10.8)	69.0 (10.5)
Age group n (%)				
< 45 years	268 (2.0)	281 (1.8)	329 (1.8)	325 (1.6)
45–54 years	1,320 (10.0)	1,403 (9.2)	1,500 (8.1)	1,586 (7.8)
55–64 years	3,090 (23.5)	3,407 (22.2)	4,166 (22.5)	4,662 (22.9)
65–74 years	4,622 (35.2)	5,254 (34.3)	6,068 (32.8)	6,804 (33.4)
75–84 years	3,356 (25.5)	4,333 (28.3)	5,573 (30.1)	6,077 (29.8)
≥85 years	482 (3.7)	647 (4.2)	876 (4.7)	913 (4.5)
Females n (%)	7,482 (56.9)	8,845 (57.7)	10,576 (57.1)	11,791 (57.9)
BMI n (%)				
< 18.5	90 (0.7)	118 (0.8)	141 (0.8)	163 (0.8)
18.5–24.9	4,082 (31.4)	4,807 (31.6)	5,790 (31.6)	6,197 (30.7)
25–29.9	5,485 (42.2)	6,352 (41.8)	7,679 (42.0)	8,365 (41.5)
30–34.5	2,609 (20.1)	3,088 (20.3)	3,700 (20.2)	4,320 (21.4)
35–39.9	629 (4.8)	727 (4.8)	862 (4.7)	988 (4.9)
≥ 40	89 (0.7)	96 (0.6)	122 (0.7)	128 (0.6)
ASA-class n (%)				
ASA I	2,896 (22.3)	3,053 (20.0)	3,364 (18.3)	3,617 (17.8)
ASA II	7,979 (61.3)	9,510 (62.3)	11,396 (61.9)	12,791 (63.0)
ASA III	2,103 (16.2)	2,648 (17.4)	3,585 (19.5)	3,809 (18.8)
ASA IV	34 (0.3)	48 (0.3)	76 (0.4)	73 (0.4)

Table 5.1.2. Demography, 2023.

Case-mix per unit 2023

Unit	Number	Females %	< 55 years %	Charnley C %	BMI ≥ 35 %	ASA-class III–IV %	Standard patient %
Akademiska sjukhuset	188	38.8	19.7	29.3	7.0	30.9	32.6
Aleris Malmö Arena	266	36.5	9.4	0.0	1.5	3.0	65.0
Aleris Specialistvård Nacka	658	44.2	12.2	30.1	2.7	5.2	56.9
Aleris Specialistvård Renmarkstorget, Umeå	45	64.4	6.7	15.6	4.7	6.7	65.1
Aleris Specialistvård Ängelholm	421	43.2	7.8	27.1	2.4	12.6	56.5
Alingsås	185	37.8	11.4	38.4	5.5	22.7	42.6
Art Clinic Göteborg	443	38.6	6.8	30.7	1.6	2.9	68.1
Art Clinic Jönköping	257	40.5	10.1	22.2	1.2	7.8	61.9
Arvika	288	39.9	7.6	27.4	1.8	16.1	51.2
Bollnäs	384	40.1	8.3	31.5	1.6	9.6	56.5
Borås	93	39.8	4.3	30.1	15.1	60.2	16.1
Capio Artro Clinic	612	36.8	15.8	25.0	2.5	0.8	63.1
Capio Movement	411	43.8	8.8	5.8	2.9	17.0	58.6
Capio Ortho Center Göteborg	251	51.4	17.9	17.5	2.8	5.6	59.6
Capio Ortho Center Stockholm	904	41.7	13.7	27.2	4.2	5.0	59.4
Capio Ortho och Spine Center Skåne	251	51.8	15.5	16.7	2.0	9.2	53.4
Capio Ortopedi Motala	420	41.9	4.5	27.6	4.1	21.0	60.0
Capio Ortopediska Huset	778	38.7	10.5	26.5	1.7	0.0	69.0
Capio S:t Göran	362	39.0	3.3	37.0	4.2	52.6	34.5
Capio Spine Center Göteborg	67	38.8	9.0	19.4	0.0	1.5	64.2
Capio Sports Medicine Umeå AB	5	40.0	20.0	0.0	0.0	0.0	60.0
Carlanderska	446	40.4	6.7	16.4	0.9	4.0	66.6
Carlanderska-SportsMed	239	66.9	25.5	9.2	8.5	2.9	54.0
Danderyd	146	43.8	8.9	13.7	11.2	59.6	20.3
Eksjö	288	39.6	8.0	27.1	3.0	19.4	53.2
Enköping	549	37.0	4.6	20.4	4.6	18.3	55.2
Eskilstuna	51	41.2	15.7	45.1	9.8	49.0	27.5
Falun	156	40.4	9.0	30.1	15.8	32.7	34.9
Frölundaortopedien	11	54.5	27.3	18.2	0.0	9.1	45.5
Gällivare	77	45.5	3.9	26.0	7.9	32.9	46.7
Gävle	127	46.5	6.3	27.6	11.0	38.6	18.9
Halmstad	85	41.2	9.4	30.6	8.8	23.8	39.0
Helsingborg	44	50.0	9.1	31.8	15.9	72.7	9.1
Hermelinen	38	55.3	26.3	10.5	2.6	0.0	44.7
Hudiksvall	53	47.2	7.5	30.2	4.0	41.5	26.0
Hässleholm	769	39.7	8.6	35.6	5.5	19.8	47.9
Jönköping	196	42.3	8.2	29.1	4.8	34.7	38.8
Kalmar	104	56.7	4.8	31.7	2.9	32.7	33.7

Table continued on next page.

Case-mix per unit 2023, cont.

Unit	Number	Females %	< 55 years %	Charnley C %	BMI ≥ 35 %	ASA-class III–IV %	Standard patient %
Karlshamn	305	45.6	8.2	29.5	9.8	10.5	53.8
Karlskrona	16	43.8	12.5	6.2	12.5	68.8	0.0
Karlstad	53	41.5	13.2	35.8	15.4	26.4	15.4
Karolinska Huddinge	178	44.4	12.9	23.0	14.8	48.9	17.0
Karolinska Solna	44	43.2	9.1	9.1	3.4	59.5	11.1
Kristianstad	<5						
Kullbergska sjukhuset	429	45.0	6.8	35.0	6.5	12.4	53.8
Kungälv	117	43.6	12.8	41.9	14.7	27.4	23.3
Ledplastikcentrum Bromma	819	38.2	8.8	10.5	3.1	0.1	67.8
Lidköping	325	46.5	7.1	35.1	8.7	35.6	31.3
Lindesberg	575	40.0	7.8	20.2	7.8	24.7	41.5
Linköping	78	50.0	34.6	28.2	9.1	15.4	29.9
Ljungby	105	42.9	7.6	35.2	8.6	25.7	44.8
Lycksele	290	38.3	11.7	35.2	6.9	21.0	43.1
Mora	296	43.6	7.4	33.1	11.1	28.4	46.3
Norrköping	197	43.7	7.6	26.9	5.1	23.0	41.3
Norrtälje	148	41.2	4.7	33.1	6.1	37.2	41.9
Nyköping	132	44.7	6.8	32.6	6.1	21.2	50.0
NÄL	7	57.1	0.0	14.3	0.0	71.4	0.0
Ortopediskt Center - Sophiahemmet	262	55.7	12.6	27.5	4.6	7.6	61.5
Oskarshamn	379	46.7	7.7	36.9	6.9	12.9	55.7
Piteå	422	42.9	7.8	34.4	9.5	29.8	41.9
Skellefteå	121	36.4	2.5	11.6	5.0	25.4	49.1
Skene	259	42.9	7.7	20.8	5.8	14.8	47.4
Skövde	41	36.6	7.3	29.3	0.0	7.3	70.7
Sollefteå	426	41.1	7.5	34.7	7.1	19.6	50.6
Specialistcenter S:t Johanniskliniken	10	30.0	0.0	0.0	0.0	0.0	80.0
Specialistcenter Scandinavia Malmö	122	45.1	5.7	20.5	4.1	4.3	66.1
Specialistcenter Scandinavia, Eskilstuna	208	44.2	11.5	27.4	2.6	0.5	62.4
SU/Möndal	334	39.5	16.8	29.6	6.9	31.7	31.4
Sunderby sjukhus	<5						
Sundsvall	36	38.9	8.3	33.3	13.8	51.5	18.5
SUS/Lund	32	53.1	6.2	40.6	9.4	68.8	0.0
SUS/Malmö	<5						
Södersjukhuset	135	38.5	3.7	27.4	16.4	75.6	8.2
Södertälje	116	43.1	10.3	29.3	6.9	35.3	29.3
Torsby	152	44.7	7.2	13.8	7.9	32.9	42.4
Trelleborg	385	39.5	10.1	44.7	10.4	39.0	25.5

Table continued on next page.

Case-mix per unit 2023, cont.

Unit	Number	Females %	< 55 years %	Charnley C %	BMI ≥ 35 %	ASA-class III–IV %	Standard patient %
Uddevalla	337	37.7	8.3	38.3	8.3	41.8	34.8
Umeå	27	48.1	18.5	29.6	0.0	12.5	40.9
Varberg	125	44.8	5.6	28.0	9.7	20.8	46.0
Visby	133	40.6	6.8	40.6	3.9	13.6	55.0
Värnamo	158	43.7	7.6	41.1	3.2	24.7	45.6
Västervik	150	42.0	10.7	26.0	3.4	10.7	55.4
Västerås	441	42.4	7.5	28.3	8.3	39.8	33.3
Växjö	179	44.1	8.4	0.0	7.3	30.7	45.5
Ängelholm	239	39.7	6.7	32.2	9.7	25.5	43.7
Örebro	<5						
Örnsköldsvik	148	47.3	4.1	38.5	9.5	38.5	38.5
Östersund	201	35.3	5.0	38.8	6.3	37.0	40.7
RIKET	20,367	42.1	9.4	27.0	5.5	19.1	49.7

Table 5.1.3. Case-mix per unit 2023. Units with fewer than 20 primary replacements are excluded. Note that percentages for units with few operations may be misleading.

Surgical approach and operating time per unit 2023

Unit	Number of reports	Complete reports %	Posterior approach %	Median op-time
Country	20 468	99.4	66.4	68
University units				
Akademiska	188	100.0	1.1	61
Karolinska Huddinge	178	94.9	93.3	102
Karolinska Solna	44	70.5	65.9	117
Linköping	78	100.0	97.4	80
SU/Mölndal	336	99.7	56.6	84
SUS/Lund	32	100.0	98.9	102
SUS/Malmö	<5			
Umeå	27	96.3	100.0	85
Örebro	<5			
Privately run units				
Aleris Specialistvård Malmö Arena	267	100.0	100.0	54
Aleris Specialistvård Nacka	659	99.7	98.9	28
Aleris Specialistvård Renmarkstorget, Umeå	45	91.1	100.0	75
Aleris Specialistvård Ängelholm	421	100.0	100.0	41
Art Clinic Göteborg	443	99.8	85.8	58
Art Clinic Jönköping	257	100.0	35.0	77
Capio Artro Clinic	614	100.0	57.8	55

Table continued on next page.

Surgical approach and operating time per unit 2023, cont.

Unit	Number of reports	Complete reports %	Posterior approach %	Median op-time
Capio Movement	412	100.0	83.7	47
Capio Ortho Center Göteborg	252	100.0	56.8	83
Capio Ortho Center Stockholm	909	100.0	75.1	61
Capio Ortho och Spine Center Skåne	251	98.8	99.6	56
Capio Ortopedi Motala	421	95.5	100.0	61
Capio Ortopediska Huset	778	99.9	29.1	44
Capio Spine Center Göteborg	68	100.0	98.5	59
Capio Sports Medicine Umeå AB	5	100.0	100.0	84
Capio S:t Göran	368	100.0	14.4	83
Carlanderska	446	100.0	36.3	68
Carlanderska-SportsMed	239	97.1	4.6	53
Frölundaortopeden	13	100.0	0.0	59
Hermelinen	38	100.0	100.0	48
Ledplastikcentrum Bromma	832	100.0	84.7	52
Ortopedisk Center Sophiahemmet	262	100.0	100.0	50
Specialistcenter Scandinavia Eskilstuna	208	99.0	48.6	54
Specialistcenter Scandinavia Johanniskliniken	10	100.0	70.0	30
Specialistcenter Scandinavia Malmö	122	99.2	100.0	58
Other units				
Alingsås	185	100.0	17.3	99
Arvika	290	99.0	0.0	93
Bollnäs	388	100.0	93.8	64
Borås	93	100.0	2.2	97
Danderyd	147	100.0	91.8	85
Eksjö	305	99.0	100.0	79
Enköping	550	99.3	40.7	65
Eskilstuna	51	100.0	0.0	89
Falun	156	99.4	36.5	110
Gällivare	77	100.0	97.4	103
Gävle	127	100.0	82.7	79
Halmstad	85	94.1	10.6	74
Helsingborg	46	93.5	100.0	74
Hudiksvall	53	100.0	100.0	134
Hässleholm	770	100.0	100.0	54
Jönköping	197	99.5	97.5	100
Kalmar	104	100.0	96.2	73
Karlshamn	305	100.0	100.0	76
Karlskrona	16	100.0	93.8	84
Karlstad	53	100.0	0.0	125

Table continued on next page.

Surgical approach and operating time per unit 2023, cont.

Unit	Number of reports	Complete reports %	Posterior approach %	Median op-time
Kristianstad	<5			
Kullbergska sjukhuset	432	100.0	1,0	77
Kungälv	118	100.0	0.0	92
Lidköping	325	99.7	100.0	78
Lindesberg	575	100.0	99.8	90
Ljungby	105	100.0	0.0	54
Lycksele	290	100.0	100.0	91
Mora	309	100.0	0.0	79
Norrköping	197	98.5	0.0	101
Norrtälje	153	100.0	37.3	76
Nyköping	132	100.0	38.6	81
NÄL Trollhättan	7	100.0	0.0	93
Oskarshamn	379	100.0	4.2	67
Piteå	425	100.0	100.0	78
Skellefteå	121	92.6	100.0	126
Skene	260	99.6	5.0	89
Skövde	41	100.0	100.0	55
Sollefteå	428	100.0	99.8	96
Sunderby sjukhus	<5			
Sundsvall	36	86.1	100.0	114
Södersjukhuset	135	100.0	45.9	97
Södertälje	122	100.0	0.0	80
Torsby	152	0.0	27.6	100
Trelleborg	385	100.0	91.4	79
Uddevalla	337	100.0	0.0	82
Varberg	125	100.0	99.2	69
Visby	133	99.3	33.1	110
Värnamo	158	100.0	100.0	70
Västervik	150	100.0	0.0	83
Västerås	442	100.0	100.0	64
Växjö	179	99.4	98.3	49
Ängelholm	240	100.0	99.2	64
Örnsköldsvik	148	100.0	100.0	91
Östersund	201	92.5	100.0	80

Tabell 5.1.4. Surgical approach and operating time per unit 2023.

Most common implants

Year	2012-2023	2012-2021	2022	2023
Number	188,516	150,721	18,358	19,437
Implant, stem (cup), n (%)				
(SPII 150 mm) Lubinus X-link	39,266 (20.8)	31,017 (20.6)	3,954 (21.5)	4,295 (22.1)
(Exeter 150 mm) Exeter Rim-fit	14,814 (7.9)	11,477 (7.6)	1,551 (8.4)	1,786 (9.2)
(SPII) Lubinus	13,569 (7.2)	12,266 (8.1)	623 (3.4)	680 (3.5)
(Corail standard) Pinnacle W/Gription	8,607 (4.6)	6,332 (4.2)	1,059 (5.8)	1,216 (6.3)
(Exeter 150 mm) Marathon	7,568 (4.0)	7,112 (4.7)	326 (1.8)	130 (0.7)
(MS30) Exeter Rim-fit	4,978 (2.6)	4,505 (3.0)	238 (1.3)	235 (1.2)
(MS30) ZCA XLPE	4,812 (2.6)	4,675 (3.1)	137 (0.7)	0 (0.0)
(Corail high offset) Pinnacle W/Gription 100	3,283 (1.7)	2,466 (1.6)	364 (2.0)	453 (2.3)
(CLS) Trilogy	3,070 (1.6)	3,009 (2.0)	61 (0.3)	0 (0.0)
(Accolade II) Trident hemi	2,997 (1.6)	1,923 (1.3)	570 (3.1)	504 (2.6)
(Corail standard) Pinnacle 100	2,923 (1.6)	2,238 (1.5)	383 (2.1)	302 (1.6)
(Exeter 150 mm) Trident hemi	2,848 (1.5)	2,456 (1.6)	233 (1.3)	159 (0.8)
(Corail standard) Lubinus x-link	2,590 (1.4)	1,920 (1.3)	363 (2.0)	307 (1.6)
(SP II <150/>150 mm) Lubinus x-link	2,571 (1.3)	1,839 (1.2)	367 (2.0)	365 (1.9)
(Corail coxa vara) Pinnacle W/Gription	2,507 (1.3)	1,556 (1.0)	419 (2.3)	532 (2.7)
Other	72,113 (38.3)	55,930 (37.1)	7,710 (42.0)	8,473 (43.6)

Table 5.1.5. Most common implants, 2012–2023.

Most common cemented implants

Year	2012-2023	2012-2021	2022	2023
Number	104,988	85,667	9,495	9,826
Implant, stem (cup), n (%)				
(SPII 150 mm) Lubinus X-link	39,266 (37.4)	31,017 (36.2)	3,954 (41.6)	4,295 (43.7)
(Exeter 150 mm) Exeter Rim-fit	14,814 (14.1)	11,477 (13.4)	1,551 (16.3)	1,786 (18.2)
(SPII) Lubinus old poly	13,569 (12.9)	12,266 (14.3)	623 (6.6)	680 (6.9)
(Exeter 150 mm) Marathon	7,568 (7.2)	7,112 (8.3)	326 (3.4)	130 (1.3)
(MS30) Exeter Rim-fit	4,978 (4.7)	4,505 (5.3)	238 (2.5)	235 (2.4)
(MS30) ZCA XLPE	4,812 (4.6)	4,675 (5.5)	137 (1.4)	0 (0.0)
(SP II <150/>150 mm) Lubinus x-link	2,571 (2.4)	1,839 (2.1)	367 (3.9)	365 (3.7)
(SPII 150 mm) IP Link	2,133 (2.0)	1,632 (1.9)	268 (2.8)	233 (2.4)
(MS30) Exceed ABT without flange	1,900 (1.8)	1,053 (1.2)	368 (3.9)	479 (4.9)
(MS30) Lubinus X-link	1,572 (1.5)	37 (0.0)	866 (9.1)	669 (6.8)
(Exeter 150 mm) Contemporary Hooded Duration	1,360 (1.3)	1,360 (1.6)	0 (0.0)	0 (0.0)
(Exeter </> 150 mm) Exeter Rim-fit	1,228 (1.2)	1,063 (1.2)	78 (0.8)	87 (0.9)
(SPII 150 mm) Marathon	1,180 (1.1)	846 (1.0)	143 (1.5)	191 (1.9)
(SPII 150 mm) Avantage	1,007 (1.0)	821 (1.0)	93 (1.0)	93 (0.9)
(MS30) ZCA old poly	869 (0.8)	836 (1.0)	33 (0.3)	0 (0.0)
Other	6,161 (5.9)	5,128 (6.0)	450 (4.7)	583 (5.9)

Table 5.1.6. Most common cemented implants, 2012–2023.

Most common uncemented implants

Year	2012-2023	2012-2021	2022	2023
Number	53,228	40,089	6,195	6,944
Implant, stem (cup), n (%)				
44038 (Corail standard) Pinnacle W/Gription	8,607 (16.3)	6,332 (15.8)	1,059 (17.1)	1,216 (18.3)
46038 (Corail high offset) Pinnacle W/Gription 100	3,283 (6.2)	2,466 (6.2)	364 (5.9)	453 (6.8)
3097 (CLS) Trilogy	3,070 (5.8)	3,009 (7.5)	61 (1.0)	0 (0.0)
63057 (Accolade II) Trident hemi	2,997 (5.7)	1,923 (4.8)	570 (9.2)	504 (7.6)
44035 (Corail standard) Pinnacle 100	2,923 (5.5)	2,238 (5.6)	383 (6.2)	302 (4.5)
45038 (Corail coxa vara) Pinnacle W/Gription	2,507 (4.7)	1,556 (3.9)	419 (6.8)	532 (8.0)
3081 (CLS) Continuum	1,651 (3.1)	1,617 (4.0)	22 (0.4)	12 (0.2)
45035 (Corail coxa vara) Pinnacle 100	1,597 (3.0)	993 (2.5)	319 (5.2)	285 (4.3)
156132 (Echo-Bimetric (FPP) G7 PPS	1,572 (3.0)	906 (2.3)	353 (5.7)	313 (4.7)
158121 (Bi-Metric X por HA NC) Exceed ABT Rinblock	1,375 (2.6)	1,375 (3.4)	0 (0.0)	0 (0.0)
19038 (M/L Taper) Pinnacle W/Gription	1,272 (2.4)	541 (1.4)	368 (6.0)	363 (5.5)
44125 (Corail standard) Pinnacle W/Gription Sector	1,259 (2.4)	845 (2.1)	175 (2.8)	239 (3.6)
19081 (M/L Taper) Continuum	1,167 (2.2)	977 (2.49)	88 (1.4)	102 (1.5)
158098 (Bi-Metric X por HA NC) Trilogy IT	926 (1.8)	926 (2.3)	0 (0.0)	0 (0.0)
11081 (Wagner Cone) Continuum	887 (1.7)	831 (2.1)	34 (0.6)	22 (0.3)
Other	17,790 (33.6)	13,520 (33.8)	1,966 (31.8)	2,304 (34.7)

Table 5.1.7 Most common uncemented implants, 2012–2023.

Most common hybrid implants, cup/stem

Year	2012-2023	2012-2021	2022	2023
Number	11,435	7,946	1,611	1,878
Implant, stem (cup), n (%)				
(Exeter 150 mm) Trident hemi	2,848 (24.9)	2,456 (30.9)	233 (14.5)	159 (8.5)
(MS30) Pinnacle W/Gription 100	1,303 (11.4)	631 (7.9)	393 (24.4)	279 (14.9)
(Exeter <150/>150 mm) Trident hemi	964 (8.4)	839 (10.6)	61 (3.8)	64 (3.4)
(SPII 150 mm) Pinnacle Sector	489 (4.3)	288 (3.6)	66 (4.1)	135 (7.2)
(MS30) Pinnacle W/Gription Sector	375 (3.3)	227 (2.9)	86 (5.3)	62 (3.3)
(SPII 150 mm) Pinnacle W/Gription 100	331 (2.9)	150 (1.9)	58 (3.6)	123 (6.5)
(Exeter 150 mm) Trident II	324 (2.8)	81 (1.0)	54 (3.4)	189 (10.1)
(Exeter 150 mm) Trident AD LW	322 (2.8)	221 (2.8)	55 (3.4)	46 (2.4)
(Exeter 150 mm) Pinnacle W/Gription Sector	286 (2.5)	201 (2.5)	36 (2.2)	49 (2.6)
(SPII 150 mm) Pinnacle W/Gription Sector	266 (2.3)	39 (0.5)	106 (6.6)	121 (6.4)
(SPII 150 mm) Trilogy	250 (2.2)	250 (3.1)	0 (0.0)	0 (0.0)
(SPII 150 mm) Trilogy IT	248 (2.2)	195 (2.5)	19 (1.2)	34 (1.8)
(Exeter 150 mm) Tritanium	234 (2.0)	213 (2.7)	15 (0.9)	6 (0.3)
(SPII 150 mm) Continuum	179 (1.6)	127 (1.6)	28 (1.7)	24 (1.3)
(Exeter 150 mm) Pinnacle W/Gription 100	161 (1.4)	99 (1.2)	21 (1.3)	41 (2.2)
Other	2,855 (25.0)	1,929 (24.3)	380 (23.6)	546 (29.1)

Table 5.1.8. Most common hybrid implants, 2012–2023.

Most common reverse hybrid implants, cup/stem

Year	2012-2023	2012-2021	2022	2023
Number	19,210	17,053	1,071	1,086
Implant, stem (cup), n (%)				
(Corail standard) Lubinus x-link	2,590 (13.5)	1,920 (11.3)	363 (33.9)	307 (28.3)
(Corail standard) Exeter Rim-fit	2,327 (12.1)	2,292 (13.4)	13 (1.2)	22 (2.0)
(Corail standard) Marathon	1,649 (8.6)	1,597 (9.4)	22 (2.1)	30 (2.8)
(Corail standard) Lubinus old poly	1,219 (6.3)	1,119 (6.6)	44 (4.1)	56 (5.2)
(M/L Taper) Exeter Rim-fit	866 (4.5)	841 (4.9)	18 (1.7)	7 (0.6)
(Corail coxa vara) Lubinus x-link	866 (4.5)	675 (4.0)	79 (7.4)	112 (10.3)
(ABG II HA) Marathon	842 (4.4)	842 (4.9)	0 (0.0)	0 (0.0)
(Corail high offset) Marathon	825 (4.3)	787 (4.6)	17 (1.6)	21 (1.9)
(M/L Taper) Lubinus x-link	824 (4.3)	346 (2.0)	312 (29.1)	166 (15.3)
(Corail high offset) Exeter Rim-fit	722 (3.8)	712 (4.2)	4 (0.4)	6 (0.6)
(Bi-Metric X por HA NC) Marathon	582 (3.0)	582 (3.4)	0 (0.0)	0 (0.0)
(Bi-Metric por HA NC) Lubinus x-link	552 (2.9)	552 (3.2)	0 (0.0)	0 (0.0)
(Corail high offset) Lubinus x-link	415 (2.2)	336 (2.0)	32 (3.0)	47 (4.3)
(Corail coxa vara) Lubinus old poly	342 (1.8)	325 (1.9)	9 (0.8)	8 (0.7)
(Corail standar) ZCA XLPE	326 (1.7)	326 (1.9)	0 (0.0)	0 (0.0)
Other	4,263 (22.2)	3,801 (22.3)	158 (14.8)	304 (28.0)

Table 5.1.9. Most common reverse hybrid implants, 2012–2023.

Most common cup components

	All	2012-2021	2022	2023
Number	190,132	151,253	18,512	20,367
Implant, n (%)				
Lubinus x-link	50,401 (26.5)	37,942 (25.1)	6,087 (33.1)	6,372 (31.5)
Pinnacle W/Cripton 100	17,724 (9.3)	11,913 (7.9)	2,695 (14.6)	3,116 (15.4)
Exeter Rim-fit	25,896 (13.6)	21,498 (14.2)	1,974 (10.7)	2,424 (12.0)
Trident hemi	8,662 (4.6)	6,530 (4.3)	1,067 (5.8)	1,065 (5.3)
G7 PPS	3,549 (1.9)	1,434 (0.9)	990 (5.4)	1,125 (5.6)
Pinnacle 100	5,745 (3.0)	4,092 (2.7)	880 (4.8)	773 (3.8)
Lubinus	16,678 (8.8)	15,149 (10.0)	746 (4.1)	783 (3.9)
Marathon	13,765 (7.3)	12,812 (8.5)	539 (2.9)	414 (2.0)
Pinnacle W/Gription Sector	3,,083 (1.6)	1,853 (1.2)	536 (2.9)	694 (3.4)
Exceed ABT E-poly without flange (cem)	2,344 (1.2)	1,472 (1.0)	389 (2.1)	483 (2.4)
IP Link	2,606 (1.4)	1,795 (1.2)	345 (1.9)	466 (2.3)
Continuum	5,670 (3.0)	5,265 (3.5)	215 (1.2)	190 (0.9)
Trilogy IT	2,404 (1.3)	2,150 (1.4)	149 (0.8)	105 (0.5)
ZCA XLPE	6,635 (3.5)	6,498 (4.3)	137 (0.7)	0 (0.0)
Trilogy	4,349 (2.3)	4,268 (2.8)	81 (0.4)	0 (0.0)
Other	20,341 (10.7)	16,533 (10.9)	1,581 (8.6)	2,227 (11.0)

Table 5.1.10. Most common cup components, 2012 –2023.

Most common stem components

	All	2012–2021	2022	2023
Number	190,132	151,253	18,512	20,367
Implant, n (%)				
SPII standard	66,246 (34.9)	52,847 (35.0)	6,197 (33.5)	7,202 (35.4)
Exeter standard	32,999 (17.4)	27,454 (18.2)	2,630 (14.2)	2,915 (14.3)
Corail standard	24,586 (12.9)	19,806 (13.1)	2,270 (12.3)	2,510 (12.3)
MS-30 polished	16,979 (8.9)	12,654 (8.4)	2,273 (12.3)	2,052 (10.1)
Accolade II	6,733 (3.5)	4,175 (2.8)	1,160 (6.3)	1,398 (6.9)
Corail coxa vara	7,765 (4.1)	5,429 (3.6)	1,043 (5.6)	1,293 (6.4)
M/L Taper	5,430 (2.9)	3,264 (2.2)	1,045 (5.6)	1,121 (5.5)
Corail high offset	7,518 (4.0)	6,078 (4.0)	651 (3.5)	789 (3.9)
CLS	7,654 (4.0)	6,758 (4.5)	473 (2.6)	423 (2.1)
Echo Bi-Metric (FPP)	2,312 (1.2)	1,490 (1.0)	478 (2.6)	344 (1.7)
CPT	579 (0.3)	436 (0.3)	74 (0.4)	69 (0.3)
Wagner Cone	1,544 (0.8)	1,398 (0.9)	79 (0.4)	67 (0.3)
Accolade straight	637 (0.3)	635 (0.4)	0 (0.0)	2 (0.0)
Bi-Metric X por HA NC	4,799 (2.5)	4,799 (3.2)	0 (0.0)	0 (0.0)
ABG II HA	1,260 (0.7)	1,260 (0.8)	0 (0.0)	0 (0.0)
Other	3,012 (1.6)	2,723 (1.8)	137 (0.7)	152 (0.7)

Table 5.1.11. Most common stem components, 2012–2023.

Number and proportion of replacements per type of stem cement

	All	2021	2022	2023
Number	32,602	9,126	11,209	12,267
Stem cement, n (%)				
Optipac Refobacin	17,918 (55.0)	4,950 (54.2)	6,937 (61.9)	6,031 (49.2)
Palacos R+G Pro	7,626 (25.3)	2,311 (25.3)	2,409 (21.5)	2,906 (23.7)
Palacos R+G (genta)	3,073 (8.7)	796 (8.7)	969 (8.6)	1,308 (10.7)
CMV	2,510 (8.3)	762 (8.3)	774 (6.9)	974 (7.9)
Refobacin Bone Cement (genta)	1,082 (2.3)	208 (2.3)	5 (0.0)	869 (7.1)
Copal (genta + clinda)	219 (.4)	35 (0.4)	67 (0.6)	117 (1.0)
Copal (genta + vanco)	94 (0.3)	25 (0.3)	33 (0.3)	36 (0.0)
Refobacin Revision Cement (genta + clinda)	35 (0.1)	11 (0.1)	5 (0.0)	19 (0.0)
Smartset GHV (genta)	21 (0.0)	5 (0.0)	9 (0.0)	7 (0.0)
Other	24 (0.0)	23 (0.2)	<5	0 (0.0)

Table 5.1.12 a. Number and proportion of replacements per type of stem cement and year, 2021–2023.

Number and proportion of replacements per type of cup cement

	All	2021	2022	2023
Number	31,150	9,115	10,635	11,400
Cup cement, n (%)				
Optipac Refobacin	16,032 (51.5)	4,766 (52.3)	6,090 (57.3)	5,176 (45.4)
Palacos R+G Pro	6,958 (22.3)	2,024 (22.2)	2,241 (21.1)	2,693 (23.6)
CMV	3,901 (12.5)	1,357 (14.9)	1,235 (11.6)	1,309 (11.5)
Palacos R+G (genta)	3,047 (9.8)	671 (7.4)	962 (9.0)	1,414 (12.4)
Refobacin Bone Cement (genta)	864 (2.8)	229 (2.5)	5 (0.0)	630 (5.5)
Copal (genta + clinda)	219 (0.7)	36 (0.4)	65 (0.6)	118 (1.0)
Copal (genta + vanco)	68 (0.2)	21 (0.2)	21 (0.2)	26 (0.2)
Refobacin Revision Cement (genta + clinda)	42 (0.1)	9 (0.1)	8 (0.1)	25 (0.2)
Smartset GHV (genta)	19 (0.1)	<5	8 (0.1)	9 (0.1)

Table 5.1.12 b. Number and proportion of replacements per type of cup cement and year, 2021–2023.

Number and proportion of replacements per type of the combination of stem and cup cement

	All	2021	2022	2023
Number	36,000	10,341	12,282	13,377
Combination of stem and cup, n (%)				
Optipac Refobacin	18,966 (52.7)	5,425 (52.5)	7,347 (59.8)	6,194 (46.3)
Palacos R+G Pro	7,858 (21.8)	2,398 (23.2)	2,440 (19.9)	3,020 (22.6)
CMV	3,434 (9.5)	1,199 (11.6)	1,052 (8.6)	1,183 (8.8)
Palacos R+G (genta)	3,305 (9.2)	756 (7.3)	1,084 (8.8)	1,465 (11.0)
Different cement stem/cup	1,126 (3.1)	249 (2.4)	240 (2.0)	637 (4.8)
Refobacin Bone Cement (genta)	912 (2.5)	219 (2.1)	3 (0.0)	690 (5.2)
Copal (genta + clinda)	224 (0.6)	35 (0.3)	68 (0.6)	121 (0.9)
Copal (genta + vanco)	98 (0.3)	26 (0.3)	36 (0.3)	36 (0.3)
Refobacin Revision Cement (genta + clinda)	36 (0.1)	10 (0.1)	<5	22 (0.2)
Smartset GHV (genta)	17 (0.0)	<5	7 (0.1)	9 (0.1)
Other	24 (0.1)	23 (0.2)	<5	0 (0.0)

Table 5.1.12 c. Number and proportion of replacements per type of the combination of stem and cup cement and year, 2021–2023.

Number and proportion of replacements per type of the combination of stem and cup and type of fixation

	2021				2022				2023	
	All	Hybrid	Reverse hybrid	Cemented	Hybrid	Reverse hybrid	Cemented	Hybrid	Reverse hybrid	Cemented
Number	36,000	1,224	1,215	7,902	1,641	1,065	9,576	1,964	1,110	10,303
Combination of stem and cup, (%)										
Optipac Refobacin	18,966 (52.7)	681 (55.6)	522 (43.0)	4,222 (53.4)	1,271 (77.5)	570 (53.5)	5,506 (57.5)	1,256 (64.0)	492 (44.3)	4,446 (43.2)
Palacos R+G Pro	7,858 (21.8)	404 (33.0)	175 (14.4)	1,819 (23.0)	212 (12.9)	77 (7.2)	2,151 (22.5)	328 (16.7)	119 (10.7)	2,573 (25.0)
CMV	3,434 (9.5)	6 (0.5)	442 (36.4)	751 (9.5)	9 (0.5)	278 (26.1)	765 (8.0)	11 (0.6)	219 (19.7)	953 (9.2)
Palacos R+G (genta)	3,305 (9.2)	89 (7.3)	46 (3.8)	621 (7.9)	128 (7.8)	132 (12.4)	824 (8.6)	81 (4.1)	200 (18.0)	1,184 (11.5)
Different cement stem/cup	1,126 (3.1)	0 (0.0)	0 (0.0)	249 (3.2)	0 (0.0)	0 (0.0)	240 (2.5)	0 (0.0)	0 (0.0)	637 (6.2)
Refobacin Bone Cement (genta)	912 (2.5)	10 (0.8)	25 (2.1)	184 (2.3)	<5	0 (0.0)	<5	262 (13.3)	68 (6.1)	360 (3.5)
Copal (genta + clinda)	224 (0.6)	<5	<5	33 (0.4)	<5	<5	62 (0.6)	9 (0.5)	5 (0.5)	107 (1.0)
Copal (genta + vanco)	98 (0.3)	6 (0.5)	<5	17 (0.2)	15 (0.9)	<5	18 (0.2)	12 (0.6)	<5	23 (0.2)
Refobacin Revision Cement (genta + clinda)	36 (0.1)	<5	0 (0.0)	6 (0.1)	<5	<5	<5	5 (0.3)	<5	13 (0.1)
Smartset GHV (genta)	17 (0.0)	0 (0.0)	<5	0 (0.0)	0 (0.0)	0 (0.0)	7 (0.1)	0 (0.0)	<5	7 (0.1)
Other	24 (0.1)	23 (1.9)	0 (0.0)	0 (0.0)	<5	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Table 5.1.12 d. Number and proportion of replacements per type of the combination of stem and cup cement and type of fixation, 2021–2023.

Prophylactic antibiotics

Prophylactic antibiotics began to be reported for hip replacements following the merger in 2021 and are reported for the first time in this year's report for elective total hip replacements. Indicators for prophylactic antibiotics (Table 5.1.13) are based on the PRISS project recommendations for 2023. Due to the higher risk of revision due to infection in patients who received clindamycin compared to those who received cloxacillin (Robertsson et al. 2017), the recommendations for penicillin allergy have been revised. The updated recommendation (April 2023) is available at www.patientforsakringen.se. All units report using cloxacillin as the first-choice preparation. Dalacin was reported in 3.5% of surgeries and Cefotaxim in 1.5%. The recommended dose of each antibiotic was used in 93% of surgeries. Since cloxacillin has a short half-life, it is crucial that it is administered within the correct time interval. In just under 55% of surgeries, the preoperative dose was reported to be administered 45–30 minutes before the start of the operation. Only five units have successfully implemented the latest recommendation. Just over 78% are reported to have received their preoperative dose according to the previous recommendation of 45–15 minutes before the start of the operation.

Thromboprophylaxis

There is a discrepancy in national and international guidelines for the initiation, choice of medication, and duration of thromboprophylaxis which is partly reflected in the data presented in Table 5.1.14. The columns show the respective proportions of elective total hip replacement where thromboprophylaxis was planned to start postoperatively, where NOACs were planned, and where the planned treatment duration was 15 days or longer. It was most common to start thromboprophylaxis postoperatively. In 56% of surgeries, only NOACs are planned, while a combination of injections and NOACs was reported for just over 10% of surgeries. For 66% of surgeries, thromboprophylaxis is planned for 15 days or longer. The proportion of surgeries reported to have a shorter prophylaxis (1–7 days) was just over 10%, while the proportion reported to have no prophylaxis at all was 4%. The proportion of surgeries where patients had an on-going long-term treatment was 7%.

Prophylactic antibiotics per unit 2023

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim or Clindamycin %	Percent having dosage 2 g x 3, 2 g x 2 or 600 mg x 2 %	Percent AB ime within (45–15 min) %	Percent AB time within (45–30 min) %
Country	20,468	93.7	98.8	93.2	78.2	54.7
University units						
Akademiska	188	98.9	98.9	87.2	88.3	44.2
Karolinska Huddinge	178	88.8	98.3	80.3	73.6	44.4
Karolinska Solna	44	22.7	29.6	31.8	20.5	18.2
Linköping	78	82.1	94.9	89.7	70.5	57.7
SU/Mölndal	336	97.9	98.8	94.4	70.2	55.4
SUS/Lund	32	93.8	93.8	81.3	78.1	46.9
SUS/Malmö	<5					
Umeå	27	51.9	85.2	40.7	33.3	18.5
Örebro	<5					
Privately run units						
Aleris Specialistvård Malmö Arena	267	98.9	99.6	97.8	79.4	23.6
Aleris Specialistvård Nacka	659	98.8	98.9	97.4	87.9	62.1
Aleris Specialistvård Renmarkstorget, Umeå	45	35.6	97.8	33.3	66.7	48.9
Aleris Specialistvård Ängelholm	421	99.1	99.1	97.9	93.8	22.6
Art Clinic Göteborg	443	98.4	98.7	98.7	95.5	42.0
Art Clinic Jönköping	257	99.6	100.0	98.8	98.8	50.6
Capio Arthro Clinic	614	99.2	99.5	96.1	64.3	61.9
Capio Movement	412	97.8	99.0	98.8	51.9	46.6
Capio Ortho Center Göteborg	252	86.1	98.8	80.2	65.1	59.9
Capio Ortho Center Stockholm	909	99.9	100.0	97.9	95.3	92.3
Capio Ortho och Spine Center Skåne	251	98.8	100.0	99.6	66.5	46.2
Capio Ortopedi Motala	421	94.8	99.5	93.4	86.0	78.2
Capio Ortopediska Huset	778	99.0	99.9	99.1	73.0	46.5
Capio Spine Center Göteborg	68	95.6	98.5	97.1	72.1	64.7
Capio Sports Medicine Umeå AB	5	100.0	100.0	100.0	100.0	100.0
Capio S:t Göran	368	98.4	98.9	95.1	53.5	42.4
Carlanderska	446	89.5	99.8	96.9	93.5	49.8
Carlanderska-SportsMed	239	82.3	91.2	96.2	85.4	45.2
Frölundaortopedien	13	100.0	100.0	100.0	100.0	69.2
Hermelinen	38	100.0	100.0	100.0	89.5	13.2

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Prophylactic antibiotics per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim or Clindamycin %	Percent having dosage 2 g x 3, 2 g x 2 or 600 mg x 2 %	Percent AB ime within (45–15 min) %	Percent AB time within (45–30 min) %
Ledplastikcentrum Bromma	832	95.9	96.4	98.7	88.1	71.5
Ortopedisk Center Sophiahemmet	262	98.9	98.9	98.9	89.3	80.2
Specialistcenter Scandinavia Eskilstuna	208	95.2	99.0	89.4	74.5	27.4
Specialistcenter Scandinavia Johanniskliniken	10	90.0	100.0	80.0	70.0	60.0
Specialistcenter Scandinavia Malmö	122	96.7	98.4	97.5	68.9	23.0
Other units						
Alingsås	185	98.9	100.0	96.8	76.8	68.1
Arvika	290	53.8	99.3	54.5	81.7	73.5
Bollnäs	388	98.7	99.7	99.0	80.7	55.9
Borås	93	100.0	100.0	96.8	72.0	43.0
Danderyd	147	82.3	95.2	63.3	60.5	42.9
Eksjö	305	38.0	29.7	37.4	77.1	70.8
Enköping	550	99.1	99.1	98.7	89.3	70.7
Eskilstuna	51	98.0	98.0	100.0	82.4	49.0
Falun	156	90.4	100.0	89.7	85.9	43.0
Gällivare	77	100.0	98.7	98.7	63.6	26.0
Gävle	127	98.4	99.2	87.4	81.9	41.7
Halmstad	85	94.1	100.0	92.9	80.0	52.9
Helsingborg	46	100.0	100.0	97.8	71.7	58.7
Hudiksvall	53	96.2	98.1	96.2	77.4	52.8
Hässleholm	770	100.0	99.9	98.7	87.3	56.2
Jönköping	197	91.4	97.5	89.3	82.7	71.1
Kalmar	104	100.0	100.0	98.1	83.7	51.9
Karlshamn	305	99.7	99.7	98.4	87.5	59.3
Karlskrona	16	93.6	93.8	87.5	68.8	56.3
Karlstad	53	100.0	100.0	98.1	66.0	54.7
Kristianstad	<5					
Kullbergsska sjukhuset	432	98.8	99.8	98.2	82.4	63.2
Kungälv	118	100.0	100.0	98.3	41.5	33.9
Lidköping	325	100.0	100.0	97.9	84.6	69.5
Lindesberg	575	99.5	99.7	95.0	56.7	41.2
Ljungby	105	100.0	100.0	93.3	89.5	79.1

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Prophylactic antibiotics per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim or Clindamycin %	Percent having dosage 2 g x 3, 2 g x 2 or 600 mg x 2 %	Percent AB ime within (45–15 min) %	Percent AB time within (45–30 min) %
Lycksele	290	99.3	100.0	99.3	61.7	46.9
Mora	309	98.1	98.4	98.4	84.1	76.4
Norrköping	197	0.0	100.0	96.5	0.0	0.0
Norrtälje	153	97.4	99.4	98.0	73.2	60.8
Nyköping	132	100.0	100.0	97.7	81.1	52.3
NÄL Trollhättan	7	100.0	100.0	100.0	71.4	28.6
Oskarshamn	379	98.7	100.0	100.0	90.0	66.0
Piteå	425	98.1	98.8	98.1	83.5	70.6
Skellefteå	121	92.6	100.0	96.7	52.9	36.4
Skene	260	95.0	99.6	94.6	74.2	46.9
Skövde	41	97.6	100.0	95.1	87.8	70.7
Sollefteå	428	97.9	99.3	98.1	93.2	53.0
Sunderby sjukhus	<5					
Sundsvall	36	83.3	100.0	88.9	50.0	38.9
Södersjukhuset	135	88.2	91.1	58.5	67.4	25.9
Södertälje	122	98.4	100.0	97.5	82.8	33.6
Torsby	152	97.4	100.0	98.7	92.8	87.5
Trelleborg	385	100.0	100.0	98.4	85.5	48.3
Uddevalla	337	98.5	96.1	92.3	61.7	49.6
Varberg	125	0.0	99.2	1.0	0.0	0.0
Visby	133	93.2	98.5	96.2	75.2	52.6
Värnamo	158	98.7	100.0	99.4	82.9	58.2
Västervik	150	92.7	97.3	94.0	78.7	41.3
Västerås	442	97.7	99.3	92.3	79.4	45.9
Växjö	179	95.5	100.0	98.9	78.2	30.2
Ängelholm	240	98.3	98.8	99.2	80.4	25.8
Örnsköldsvik	148	98.0	98.7	94.6	78.4	60.1
Östersund	201	54.2	98.0	58.2	71.1	49.3

Table 5.1.13. Prophylactic antibiotics per unit 2023.

Thromboprophylaxis per unit 2023

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Country	20,468	99.4	85.8	66.0*	69.1
University units					
Akademiska	188	100.0	81.9	79.3*	86.6
Karolinska Huddinge	178	99.4	77.0	77.5	77.2
Karolinska Solna	44	36.4	27.3	25.0	13.6
Linköping	78	88.5	39.7	0.0	1.3
SU/Mölndal	336	100.0	83.9	80.1	84.5
SUS/Lund	32	100.0	62.5	0.0	21.9
SUS/Malmö	<5				
Umeå	27	81.5	70.4	70.4	77.8
Örebro	<5				
Privately run units					
Aleris Specialistvård Malmö Arena	267	100.0	94.0	95.5	0.0
Aleris Specialistvård Nacka	659	100.0	97.4	98.5	98.5
Aleris Specialistvård Renmarkstorget, Umeå	45	95.6	88.9	91.1	86.8
Aleris Specialistvård Ängelholm	421	99.8	91.7	92.2	1.0
Art Clinic Göteborg	443	99.3	97.8	97.3	97.1
Art Clinic Jönköping	257	100.0	97.3	95.7	97.3
Capio Arthro Clinic	614	100.0	98.9	99.5	98.9
Capio Movement	412	98.8	91.0	8.7*	2.2
Capio Ortho Center Göteborg	252	99.2	100.0	99.2	99.2
Capio Ortho Center Stockholm	909	100.0	99.1	98.9	99.0
Capio Ortho och Spine Center Skåne	251	99.6	99.2	98.8	1.2
Capio Ortopedi Motala	421	99.8	80.5	0.0	80.1
Capio Ortopediska Huset	778	100.0	98.8	99.4	98.2
Capio Spine Center Göteborg	68	100.0	92.7	95.6	67.7
Capio Sports Medicine Umeå AB	5	100.0	80.0	100.0	100.0
Capio S:t Göran	368	100.0	68.5	44.3*	27.6
Carlanderska	446	99.6	94.0	94.4	93.2
Carlanderska-SportsMed	239	99.6	94.1	95.4	90.2
Frölundaortopeden	13	100.0	76.9	76.9	76.9
Hermelinen	38	100.0	97.4	100.0	100.0
Ledplastikcentrum Bromma	832	99.3	99.2	99.3	98.3
Ortopedisk Center Sophiahemmet	262	100.0	100.0	100.0*	99.6

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Thromboprophylaxis per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Specialistcenter Scandinavia Eskilstuna	208	98.1	90.9	91.4*	82.4
Specialistcenter Scandinavia Johanniskliniken	10	100.0	100.0	100.0	30.0
Specialistcenter Scandinavia Malmö	122	100.0	97.5	99.2	88.5
Other units					
Alingsås	185	100.0	97.3	0.5	97.3
Arvika	290	99.7	81.4	80.3	80.9
Bollnäs	388	100.0	90.2	93.0	93.3
Borås	93	100.0	80.7	86.0	76.7
Danderyd	147	97.3	73.5	0.0	82.3
Eksjö	305	99.3	29.5	0.0	1.7
Enköping	550	99.8	88.0	88.6	87.9
Eskilstuna	51	100.0	68.3	72.6	74.5
Falun	156	97.4	95.5	0.0	0.0
Gällivare	77	100.0	90.9	88.3	90.9
Gävle	127	100.0	80.3	78.0	82.7
Halmstad	85	100.0	94.1	1.2	1.2
Helsingborg	46	100.0	60.9	60.9	56.8
Hudiksvall	53	100.0	83.0	0.0	84.9
Hässleholm	770	100.0	86.8	0.0	6.8
Jönköping	197	98.0	50.8	0.5	19.7
Kalmar	104	100.0	60.6	0.0	60.6
Karlshamn	305	100.0	94.4	93.4	93.4
Karlskrona	16	93.8	75.0	25.0	81.3
Karlstad	53	100.0	92.5	90.6	94.3
Kristianstad	<5				
Kullbergsgka sjukhuset	432	100.0	91.9	91.4	92.4
Kungälv	118	98.3	83.1	84.6	85.2
Lidköping	325	100.0	83.7	84.3	83.1
Lindesberg	575	100.0	86.3	74.8	88.4
Ljungby	105	100.0	86.7	87.6	87.6
Lycksele	290	99.3	26.2	33.1	99.0
Mora	309	99.4	87.1	87.4	88.0
Norrköping	197	100.0	48.7	0.0	1.5
Norrtälje	153	100.0	86.3	0.7	79.0

Table continued on next page.

Thromboprophylaxis per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Nyköping	132	99.2	90.2	90.2	87.1
NÄL Trollhättan	7	100.0	71.4	0.0	71.4
Oskarshamn	379	100.0	55.4	0.3	53.4
Piteå	425	100.0	75.5	91.3*	90.1
Skellefteå	121	100.0	100.0	100.0	100.0
Skene	260	97.7	88.9	89.6	89.1
Skövde	41	100.0	95.1	97.6	100.0
Sollefteå	428	99.8	88.3	87.9	88.4
Sunderby sjukhus	<5				
Sundsvall	36	100.0	88.9	63.9	83.3
Södersjukhuset	135	99.3	83.0	16.3*	25.9
Södertälje	122	100.0	80.3	0.8	80.3
Torsby	152	100.0	88.8	87.5	90.1
Trelleborg	385	100.0	96.9	0.0	3.9
Uddevalla	337	100.0	82.5	83.1*	83.9
Varberg	125	100.0	88.8	0.0	0.0
Visby	133	99.3	92.5	91.0	92.1
Värnamo	158	100.0	23.4	0.0	3.2
Västervik	150	94.7	22.0	0.0	19.7
Västerås	442	100.0	94.8	1.0*	4.8
Växjö	179	100.0	89.4	89.9	89.7
Ängelholm	240	100.0	86.7	89.1	88.7
Örnsköldsvik	148	100.0	88.5	81.1	86.5
Östersund	201	97.5	86.1	0.0	4.9

Table 5.1.14. Thromboprophylaxis per unit 2023.

* Includes a combination of injection and NOAC

5.2. Reoperation hip replacement

Author: Johan Kärrholm

Reoperation encompasses all types of surgical procedures directly related to a previously implanted hip prosthesis, whether the prosthesis or any of its components are replaced, extracted, or left untouched. This section covers all types of reoperations following the insert of primary total hip replacement.

Between 2003 and 2010, the number of reoperations increased from 2,108 to 2,455. Over the following five years, the number remained relatively constant, ranging from 2,379 to 2,474, before slowly decreasing back to 1,833 by 2020. In the past three years, the number has again increased, with 2,208 reoperations reported in 2023 (Figure 5.2.1). Despite these fluctuations, the proportion of reoperations relative to the total number of primary and reoperations of total hip replacement has gradually decreased since the three-year period from 2000 to 2002. During those years, reoperations accounted for 14.0%. In the most recent period, 2021–2023, this proportion has decreased to 9.3% (Figure 5.2.2). The observed reduction between the periods 2003–2005 and 2021–2023 is

primarily due to a significant increase in the number of primary operations. In absolute terms, the two periods differ by only 62 reoperations (approximately 20 per year). If two-stage operations are considered as a single treatment (one operation), the relative proportion of reoperations is reduced to 13.1% during the period 2003–2005 and to 8.9% for the period 2021–2023.

The number of reported reoperations has not increased despite the rise in the number of primary prostheses performed. However, it should be noted that the completeness for revisions is around 94%, and for reoperations, it is likely somewhat lower. Previous studies have shown that procedures without implant extraction or exchange are reported less frequently than operations where the implant is replaced or removed. It is likely that this is partly because these procedures are sometimes performed by surgeons who do not typically carry out hip replacement surgeries. Inadequate information or inadequate impact of the information coming from the register also likely plays a role. Accurate coding of the procedures performed is, of

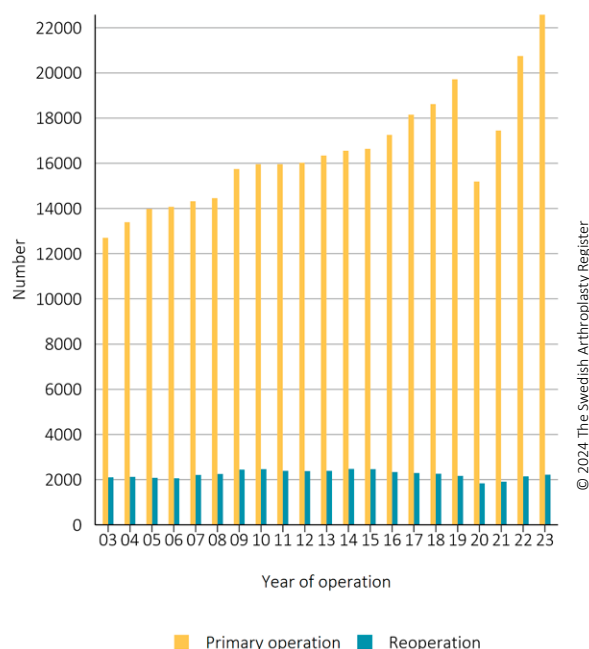


Figure 5.2.1. Number of primary and reoperations per year in 2003–2023.

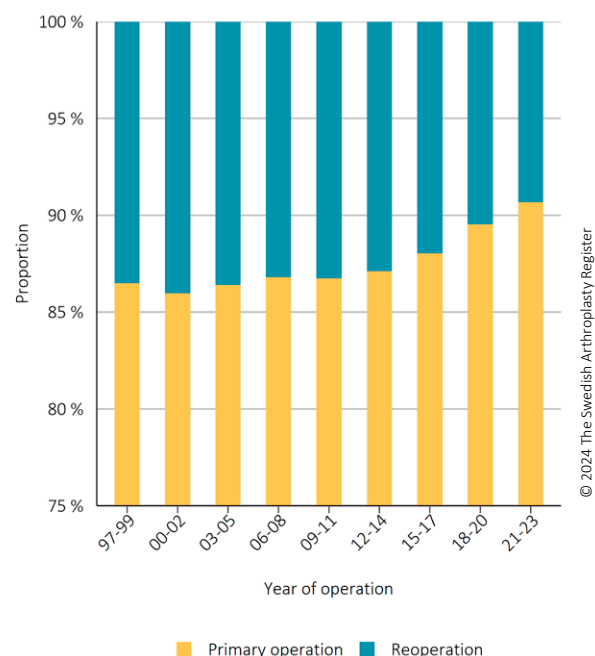
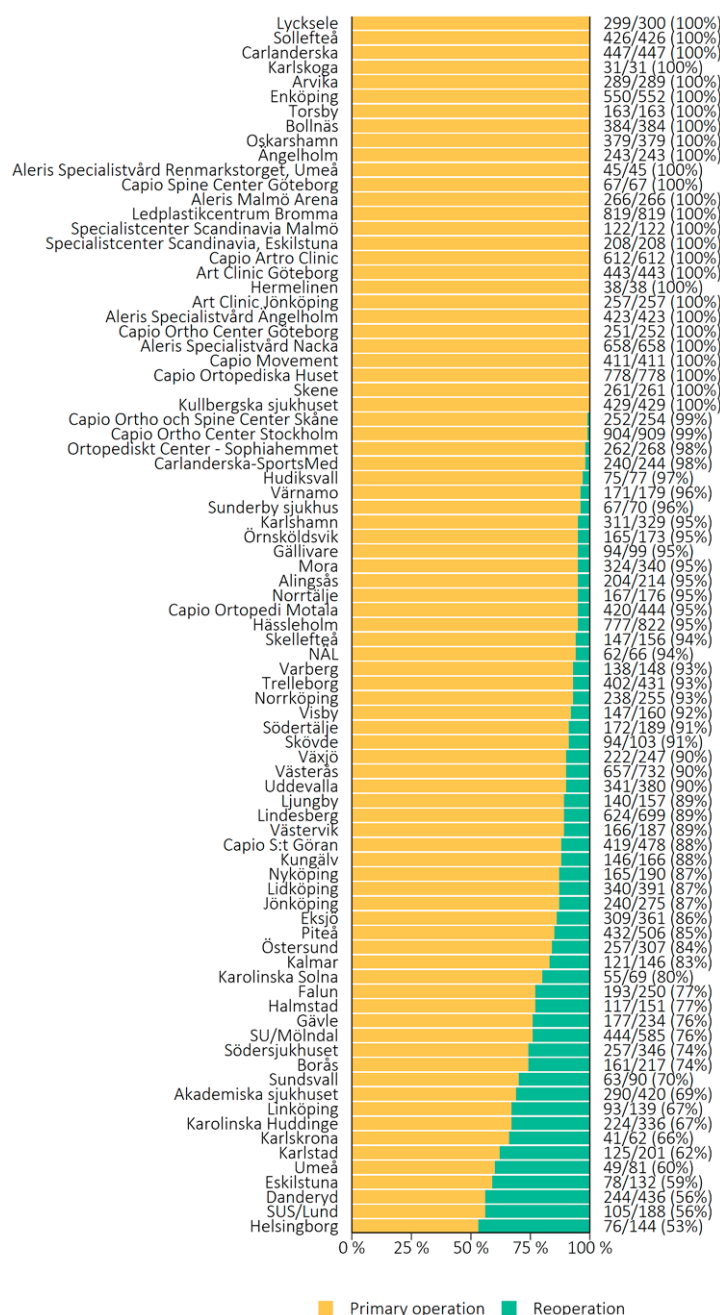


Figure 5.2.2. The distribution between reoperations (revisions and other reoperations) and primary hip replacements in 1997–2023 divided in three-year periods. The y-axis scale is adjusted and starts at 75%.



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Figure 5.2.3 The distribution of primary replacements and reoperations per operating units in Sweden 2023.

course, a prerequisite for effective reporting. Another factor to be aware of when interpreting the data presented is that, despite the best efforts of the register coordinators, reporting lags behind, which often affects reoperations, including revisions. Although the number of such cases is not large, this means that data may vary between subsequent annual reports, particularly regarding data for the most recent year. However, the variation is usually minor and generally does not affect the overall picture.

The ratio of reoperations to primary operations provides some insight into the extent to which reoperations strain healthcare resources for hip replacement surgery within a country or region. However, it is not a suitable measure for other purposes due to its sensitivity to fluctuations in the number of primary operations performed. The ratio is also influenced by many other factors, such as patient flows between healthcare regions, the medical profession's attitude towards performing reoperations,

Distribution of sex, age, BMI, and ASA-class in all types of reoperations

	Reoperation 2011–2013	Reoperation 2015–2017	Reoperation 2021–2023	Primary operation 2021–2023
Number	7,153	7,078	6,249	60,741
Mean age (SD)	71.6 (11.5)	72.0 (11.2)	72.8 (11.1)	69.4 (10.7)
Age group n (%)				
< 55 years	568 (8)	541 (8)	418 (7)	5,598 (9)
55–64 years	1,061 (15)	1,027 (15)	963 (15)	12,871 (21)
65–74 years	2,394 (34)	2,451 (35)	1,734 (28)	20,333 (34)
75–84 years	2,311 (32)	2,212 (31)	2,325 (32)	18,754 (31)
≥85 years	819 (11)	847 (12)	809 (13)	3,185 (5)
Females n (%)	3,629 (51)	3,615 (51)	3,205 (51)	35,223 (58)
BMI n (%)				
< 18.5	93 (2)	90 (1)	89 (2)	766 (1)
18.5–24.9	1,965 (33)	2,216 (35)	1,892 (32)	20,247 (34)
25–29.9	2,437 (41)	2,401 (37)	2,290 (39)	24,153 (41)
30–34.5	1,002 (17)	1,212 (19)	1,171 (20)	11,436 (19)
35–39.9	321 (5)	356 (6)	335 (6)	2,610 (4)
≥ 40	104 (2)	106 (2)	89 (2)	348 (1)
Missing	1,231	697	383	1,181
ASA-class n (%)*				
ASA I	763 (12)	590 (9)	363 (6)	10,532 (17)
ASA II	3,327 (51)	3,352 (50)	2,942 (48)	36,814 (61)
ASA III	2,325 (35)	2,608 (39)	2,647 (43)	12,696 (21)
ASA IV	133 (2)	172 (3)	158 (3)	364 (1)
Missing	605	356	137	335

Table 5.2.1. Distribution of sex, age, BMI, and ASA-class in all types of reoperations in selected three-year periods 2011–2023. Data for primary operations 2021–2023 are shown for comparison.

* percentages exclude missing observations

and the duration for which hip replacement surgery has been practiced within a healthcare region. As noted above, reporting of reoperations is less thorough than for primary operations, which is important to consider when interpreting the data presented. Cross-referencing with the Patient Register is an option to capture more cases but is complicated by the fact that procedure codes are sometimes too nonspecific. We would like to highlight this issue to emphasize the importance of using accurate codes for both diagnosis and procedure.

Distribution of reoperations between units

In 2023, the proportion of reoperations performed at university hospitals and private units continued to decrease. During this year (with data for 2022 in parentheses), 25.4% (28.0%) of reoperations for total hip replacements were performed at university hospitals, 70.2% (66.2%) at other regional units, and 4.4% (5.8%) at private units. The number of units performing ten or fewer reoperations in 2023 was marginally lower (n=25) compared to the previous year (n=27). Similarly, the number of units

performing between 11 and 25 reoperations (2023: n=16; 2022: n=14, Figure 5.2.3) was relatively similar. In both 2023 and 2022, 23 units performed between 26 and 99 reoperations, and four units performed more than 100 reoperations. Thus, the number of units performing ten or fewer reoperations per year remains notably high (see also Chapter 5.3 for a more detailed analysis based on performed revisions).

Demographics

This year's report compares reoperations performed during three periods: 2011–2013, 2015–2017, and 2021–2023. Additionally, demographic data for primary hip replacements operated on during the most recent three-year period are presented. Table 5.2.1 shows that the average age at reoperation exhibits a slight tendency to increase. During the most recent three-year period, it was over three years higher than at primary hip replacement surgery. The proportion of females undergoing reoperation decreased by about 2.5% between the periods 2015–2017 and 2021–2023. During the latest period, 2021–2023, the proportion of females undergoing reoperation was nearly 10% lower than the proportion of females who received primary operations, reflecting the fact that males are more frequently affected by various prosthetic complications that lead to surgical intervention.

Patients who underwent reoperation from 2021 to 2023 had, on average, a slightly higher BMI than those who underwent primary prosthesis surgery. Between the first and most recent three-year periods, the proportion of reoperated patients with ASA class III–V increased significantly from 34.4% to 44.9%. For reoperations in 2021–2023, the corresponding proportion for primary operations was half as large, at 21.4%.

In summary, males are more frequently affected by reoperations than expected based on the sex distribution at primary operations. Patients undergoing reoperation also tend to be somewhat older, have a higher BMI, and a significantly higher degree of comorbidity compared to those undergoing primary operations. Additionally, particularly the level of comorbidity—and to a lesser extent, reported BMI and age—tends to have gradually increased for patients undergoing reoperation.

Reason for reoperation

Since 2016, the Swedish Arthroplasty Register has recorded the reason or reasons for a reoperation using two variables: a primary reason and, if applicable, an additional reason (secondary reason). For total hip replacements, there are 35 predefined reasons, which are often condensed into main categories in reports. For example, three different reasons—loosening, osteolysis, and wear—are often reported under the main category of loosening. For patients reoperated before 2016, secondary reasons are provided when relevant information has been converted and extracted from one or more variables.

Figure 5.2.4 presents the reasons for reoperation grouped into combined main categories, and Table 5.2.2 provides a more detailed breakdown of the primary reasons for reoperation related to the last two decades. The table distinguishes between first-time reoperations and reoperations that have been preceded by at least one previous reoperation. Since the database had significantly more reasons until 2015, these data have been classified according to the new categorization as much as possible. In some cases, information in the old database was likely missing. Table 5.2.2 also includes some simplification, such as combining all types of osteolyses into a single group regardless of localization. In addition to the primary reason, a secondary reason may also be recorded if deemed relevant but less significant. These data are not presented here.

Since the period 1997–1999, the proportion of reoperations due to loosening has gradually decreased until the period 2015–2017 and has since remained relatively constant between 35% and 37% per three-year period. The proportion of reoperations due to infection has increased from just over 9% during the first period shown (1997–1999) to 30.5% in the most recent period (2021–2023). The proportion of dislocations rose towards the end of the 1990s and the early 2000s up to and including the period 2006–2008. In the following periods, this proportion decreased to around 12%, but there is a tendency for it to increase again. Between 2020 and 2022, an increase of approximately 1% per year (from 11.3% to 13.5%) was observed, reaching 13.9% in 2023. The proportion of periprosthetic fractures continuously increased from 6.7% (n=95) in 1997 to 16.2% (n=382) in 2010. During the period 2012–2014, there was a reduction, possibly due to incomplete reporting. In the most recent period 2021–2023, their proportion had again increased to 14.5%.

Detailed main reason for reoperation in the two last ten-year periods

Reason	2003–2012				2013–2023			
	First reoperation		At least one previous reoperation		First reoperation		At least one previous reoperation	
	Number	%	Number	%	Number	%	Number	%
Total	14,825	100.0	6,620	100.0	14,592	100.0	6,377	100.0
Loosening (regardless of time after op)	7,198	48.6	1,914	28.9	6,074	41.6	1,385	21.7
Fracture femur	2,273	15.3	740	11.2	2,296	15.7	602	9.4
Dislocation, instability, subdislocation	1,807	12.2	1,064	16.1	1,781	12.2	813	12.7
Infection	1,718	11.6	2,237	33.8	3,038	20.8	3,112	48.8
Osteolysis acetabulum and/or femur	742	5.0	111	1.7	255	1.7	27	0.4
Cup or liner wear	413	2.8	50	0.8	256	1.8	31	0.5
Implant fracture (including plate)	186	1.3	96	1.5	128	0.9	76	1.2
Unclear pain	126	0.8	70	1.1	158	1.1	64	1.0
Trochanteric problems, limp, gluteus medius rupture	56	0.4	21	0.3	99	0.7	11	0.2
Incorrectly inserted implant (eg.penetration)	44	0.3	14	0.2	40	0.3	8	0.1
Heterotopic bone formation	34	0.2	15	0.2	43	0.3	17	0.3
ALVAL/pseudotumor	24	0.2	5	0.1	111	0.8	20	0.3
Bleeding, hematoma	24	0.2	38	0.6	39	0.3	43	0.7
Loose implant part	24	0.2	13	0.2	8	0.1	6	0.1
Other left material	23	0.2	51	0.8	7	0.0	10	0.2
Difference in leg length	20	0.1	5	0.1	16	0.1	7	0.1
Cement problem (loose pice of cement, inadequate cementation etc.)	20	0.1	8	0.1	29	0.2	6	0.1
Wound complication (wound rupture, wound granuloma)	20	0.1	17	0.3	20	0.1	16	0.3
Delayed fracture healing	12	0.1	94	1.4	6	0.0	37	0.6
Elevated metal ions/corrosion	11	0.1	<5	0.0	61	0.4	8	0.1
Fracture under resurfacing prosthesis	10	0.1	<5	0.0	19	0.1	0	0.0
Malignant or benign tumor	6	0.0	<5	0.0	9	0.1	5	0.1
Cyst/bursa	5	0.0	<5	0.0	10	0.1	<5	0.0
Fracture acetabulum	<5	0.0	<5	0.0	26	0.2	15	0.2
Allergy (suspected or known)	0	0.0	<5	0.0	<5	0.0	<5	0.0
Dislocation/fracture spacer	0	0.0	40	0.6	<5	0.0	33	0.5
Nerve or vascular injury	0	0.0	<5	0.0	<5	0.0	0	0.0
Per operative fracture (previous op)	0	0.0	0	0.0	8	0.1	5	0.1
Other reason (including technical)	25	0.2	8	0.1	46	0.3	16	0.3
Not available	1	0.0	<5	0.0	0	0.0	0	0.0

Table 5.2.2. Detailed primary reason for reoperation during the last two ten-year periods, divided into first-time reoperations and procedures preceded by at least one previous reoperation. The primary reason for performing the surgery is indicated here. Additional specified reasons are reported in 14.5% of reoperations performed from 2004 to 2013, and in 11.5% of reoperations performed from 2014 to 2023.

Among the reasons that are usually not presented except as part of a main group, it can be noted that the number of reoperations due to wear and osteolysis has decreased, likely as a result of the increasing use of highly cross-linked polyethylene. The length of the periods is intended to make it easier to assess data concerning rare reasons, which results in some lag. For example, in the previous year's report, it was noted that reoperations due to unclear pain and trochanteric problems were higher in the later than in the earlier decade, despite these reasons significantly decreasing towards the end of the period. In this year's report, these reasons are still more common in first-time reoperations during the most recent period, but the differences have decreased. During the period 2021–2023, four to six first-time reoperations per year were reported due to pain and one to five due to trochanteric problems. The corresponding numbers for reoperations not performed for the first time ranged from two to three for pain and zero to one for trochanteric problems.

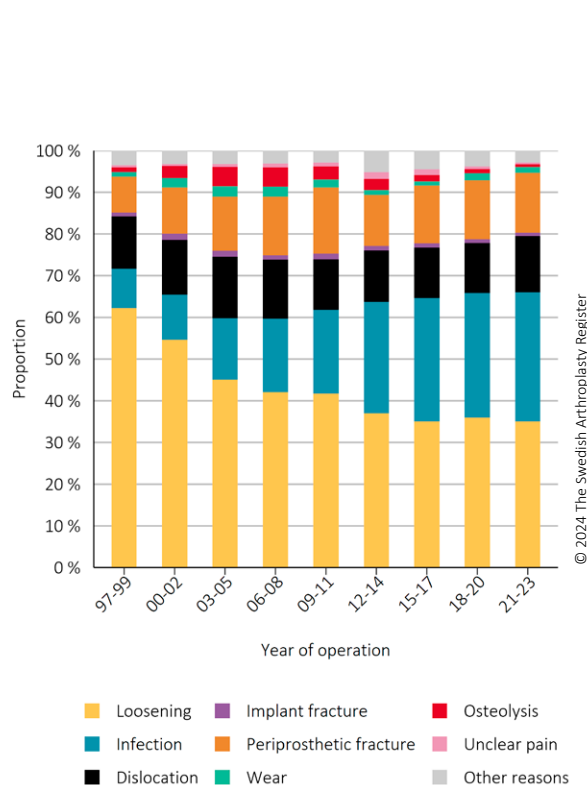


Figure 5.2.4. Reason for reoperation 1997–2023 divided into three-year periods.

The highest number of reoperations due to pseudotumor (ALVAL, Aseptic Lymphocyte-dominated Vasculitis-Associated Lesions, or ALTR, Adverse Local Tissue Reaction) was recorded during the last year of the first period (2013). In that year, 48 reoperations were performed where pseudotumor (ALVAL) or elevated metal ions were cited as the primary or secondary reason (see Figure 5.2.5). After that, the number decreased to ten or fewer in 2021–2022. In 2023, 20 cases were reported. Of these, 16 cases were noted as pseudotumor. Among the 20 prostheses reoperated in 2023, five were surface replacement prostheses, an additional seven had metal–metal bearings (of which four had a surface replacement cup), and eight were standard prostheses. Although complications caused by increased metal release are rare, it can be valuable to consider this complication in cases with unclear hip pain.

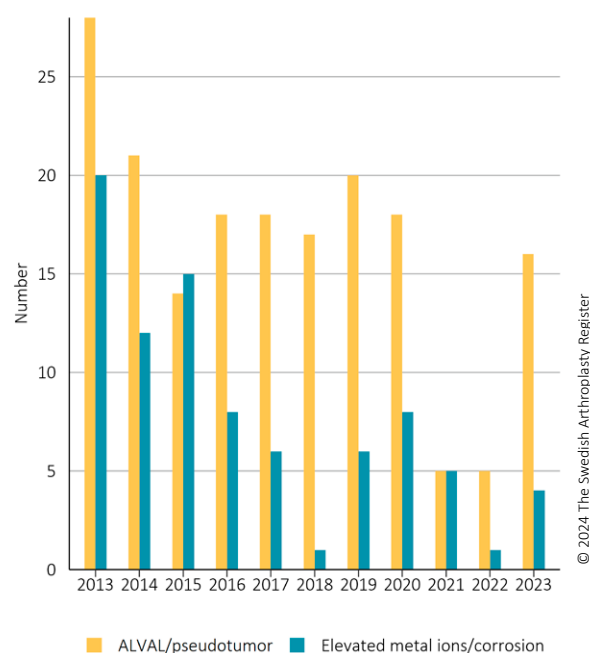


Figure 5.2.5. Incidence of reoperations where pseudotumor (ALVAL) or elevated metal ions were the main reason or a contributing reason for the surgery. The report begins 2013, when the highest number was recorded since the start of the Swedish Arthroplasty Register, and extends to 2023. The data differs from table 5.2.2, where only the main reason is reported.

The distribution of reasons for reoperation primarily provides an understanding of the distribution of prosthesis-related problems that lead to surgical intervention. However, it gives a very limited view of how the quality of primary prostheses may change over time, measured as the proportion that ends with a reoperation. To better illustrate this, Figure 5.2.6 shows the proportion of reoperations within ten years for primary prostheses inserted during three-year periods from 1997 to 2014, ensuring that all primary surgeries within the group have been observed for ten years. As shown in the figure, the overall percentage of primary prostheses that are re-operated on has gradually decreased over the period. During the first period, 7.5% of re-operations were reported, whereas only 4.3% were reported in the last period. However, as previously noted (see Figure 5.2.8), there is a change in the underlying causes of re-operations over time. Changes in surgical indications, shifts in the type and occurrence of infectious agents over time, the introduction of new materials and prosthesis designs, and, not least, a more stringent selection of implants may have contributed to this development.

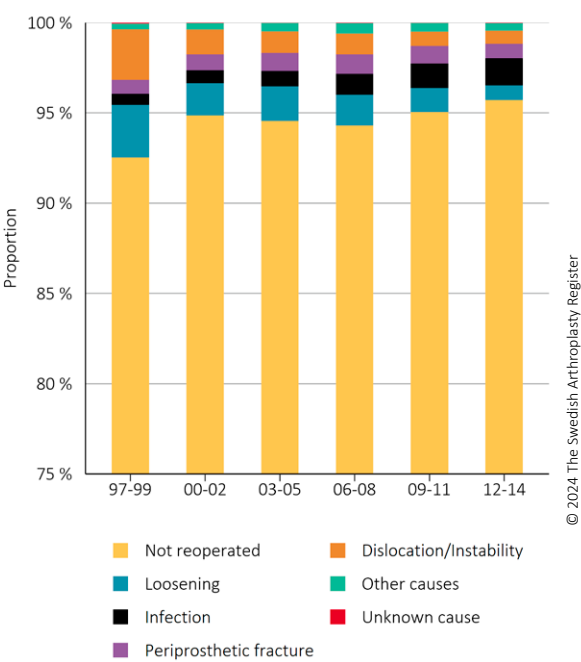


Figure 5.2.6. Primary hip replacements operated on during consecutive three-year periods starting from 1997 to 1999 and until the period 2012-2014, covering the years 1996 to 2013, where all hip replacements were followed up to reoperation if it occurred within 10 years after the primary operation, or to potential death within the same period, or if neither of these occurred, until 10 years after the primary operation. The figure illustrates how the proportion of patients reoperated within a ten-year period has gradually decreased. In addition to the proportion of reoperations, the reason of the reoperations is also indicated.

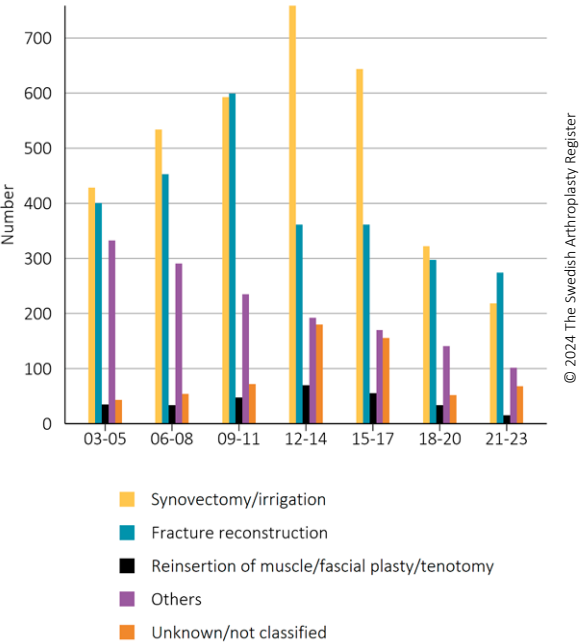


Figure 5.2.7. The most common procedures in reoperations without exchange or extraction of implant parts, divided into three-year periods between 2003 and 2023.

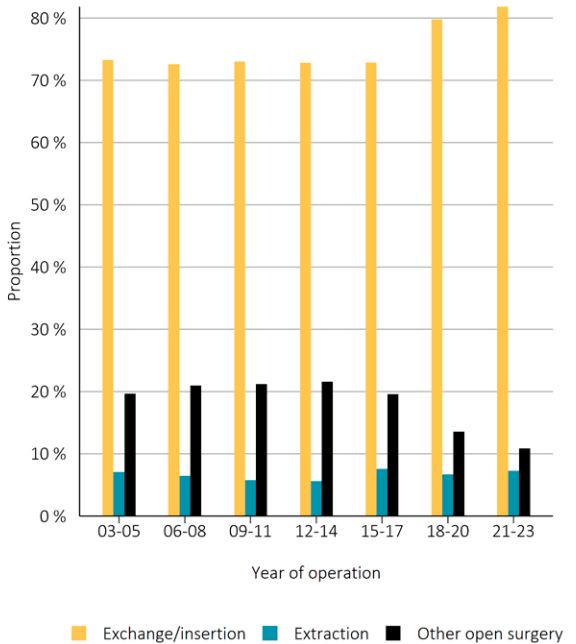


Figure 5.2.8. The distribution of the main procedures exchange/insertion, extraction and other open procedures without implant exchange or extraction in three-year periods 2003–2023.

Reoperation without implant exchange/extraction

Reoperations without the exchange or extraction of implant components are most often performed due to infection or fracture (see Figure 5.2.7). In the early 2000s, dislocation was also one of the dominant reasons but has decreased in frequency. This is likely because it has become increasingly rare to perform only an open reduction without exchanging components such as the liner and head or conducting a more extensive procedure like cup exchange and possible stem revision. During the 1990s and until 2004, approximately 50 operations per year involved fastening a cup augment to the existing cup to prevent dislocation. Following a review of the disappointing Swedish results, the number of such procedures decreased significantly and almost ceased altogether from 2013–2014 (included in “other measures” in Figure 5.2.8). The proportion of reoperations without implant exchange or extraction (other open procedures in Figure 5.2.8) increased up until the 2012–2014 period due to a rise in procedures such as synovectomy/debridement for infection, and to a lesser extent, fracture reconstruction. Since then, the number of reoperations for infection without implant exchange has decreased, which is a positive development, especially as these procedures have been replaced by interventions involving the exchange of the head and possibly the liner, which have been shown to have a higher likelihood of healing. Between the 2012–2014 period and the most recent period, the visualized decrease in the percentage of total synovectomy/debridement procedures translates to a reduction in the annual number from approximately 250 to about 70. The figure also shows an increase in the number of fracture reconstructions without implant exchange until the years 2009, 2010, and 2011. After that, the number declined significantly. This could be due to a greater tendency to revise these patients, though it is more likely that the primary reason is underreporting, as data up to 2011 partially rely on targeted linkage with the patient register as part of a dissertation project. Soft tissue interventions, particularly with re-suturing or muscle/tendon repair mainly due to limping and trochanteric problems, as well as overall reoperations, have significantly reduced since the 2012–2014 period.

Summary

The proportion of reoperations relative to the total number of hip related surgeries has decreased over the past two decades, from 14.0% to around 9.3% during the 2021–2023 period. This decline is primarily due to the increased number of primary surgeries.

Reoperations due to infection have risen in absolute terms, while those due to loosening have decreased. It is unclear whether the increased number of reoperations for infection is due to a more active approach to surgical treatment or a real increase in infections, though it is likely that both factors have contributed.

Males experience reoperations more frequently than expected based on the sex distribution at primary surgeries. Patients undergoing reoperations are older and have a higher degree of comorbidity compared to those undergoing primary surgeries. Over the past decade, the level of comorbidity, and to some extent BMI and age, has increased among patients who require reoperation.

It is important to report all reoperations, including those where no prosthetic components are exchanged. The frequency of reoperations is one of our most crucial quality parameters.

5.3. Reoperation within two years

Author: Johan Kärrholm

The proportion of primary surgeries that result in a reoperation within two years is an important quality indicator. This is because the most common reason of early reoperation—such as infection, dislocation, fracture, and early loosening—are modifiable factors that reflect existing routines, their adherence, surgical technique, and the unit's patient demographics.

Reoperation within two years includes all forms of additional surgery directly related to a previous total hip replacement. This outcome measure primarily reflects early and serious complications. The indicator is quickly available and easier to use for clinical improvement efforts compared to the cumulative revision risk at ten years. However, this parameter is also significant as it more accurately reflects how choices regarding fixation and components, and their positioning, affect the risk of complications leading to surgical treatment. Patient selection, healthcare processes, and implant choices often undergo more or less extensive changes over a ten-year period. This means that outcomes may be difficult to interpret from an improvement perspective based on the current situation.

Reoperation within two years has been selected by Swedish Association of Local Authorities and Regions and the National Board of Health and Welfare as a national quality indicator. The indicator is considered one of the most important and influential outcome measures reported by the Arthroplasty Register. The proportion of reoperations during the third year is not included in this quality indicator but is shown for increased transparency.

The reason a patient undergoes hip replacement varies significantly between university hospitals, privately driven units, and other units. In 2023, 24.3% of primary surgeries at university hospitals were performed due to a diagnosis of osteoarthritis. This proportion increases to 49.1% when including surgeries conducted at external units but managed under the university hospital's auspices. For other public units, the proportion of osteoarthritis cases was 78.5%, and for privately driven units, it was even higher at 97.5% (Figure 5.3.1 a-d).

It is well-known that the type and extent of perioperative and postoperative complications can vary significantly depending on the primary diagnosis. Since diagnoses such as acute fracture, residual conditions after previous trauma, and tumor diagnoses are so unevenly distributed across different units, these have been excluded. Therefore, data for reoperation within two years are based only on patients with a diagnosis of osteoarthritis or "other hip diseases." Nationwide, this proportion in 2023 was 5.6%, with just over half (54.1%) diagnosed with idiopathic necrosis, followed by residual conditions from childhood diseases and 18.9% without known trauma. Over the past four periods, the proportion of reoperations within two years has remained relatively constant, slightly above two percent for the country as a whole (Tables 5.3.1 and 5.3.2). For units that performed at least 500 surgeries in the most recent period, the variation in the proportion of reoperations within two years was substantial, ranging from 0.5% to 4.6%. For units reporting 1,000 or more surgeries, the range was marginally narrower (0.5% to 4.2%).

Since 2006–2007, there has been a clear shift in the reason of early reoperation. The relative proportion of reoperations due to infection has increased by approximately 20%, mainly at the expense of dislocation and periprosthetic fracture, whose proportions have decreased from nearly 23.7% to around 15.1% and from 18.5% to 10.4%, respectively (Figure 5.3.2). Proportions in the categories of loosening and other reasons have also decreased, though to a lesser extent (from 7.0% to 5.4% and from 8.5% to 6.1%, respectively). The increase in infections is likely due to several factors. It most probably reflects a more proactive approach to surgical treatment when an infection is suspected. The observed increase might also be due to a real rise in the selection of more antibiotic-resistant strains over time and/or a greater awareness that reoperations without implant exchange should also be recorded. Likely, all these factors contribute to varying degrees.

The likelihood of undergoing reoperation within the first three years after a primary surgery is highest during the first year (Figure 5.3.3). The cause of reoperation varies

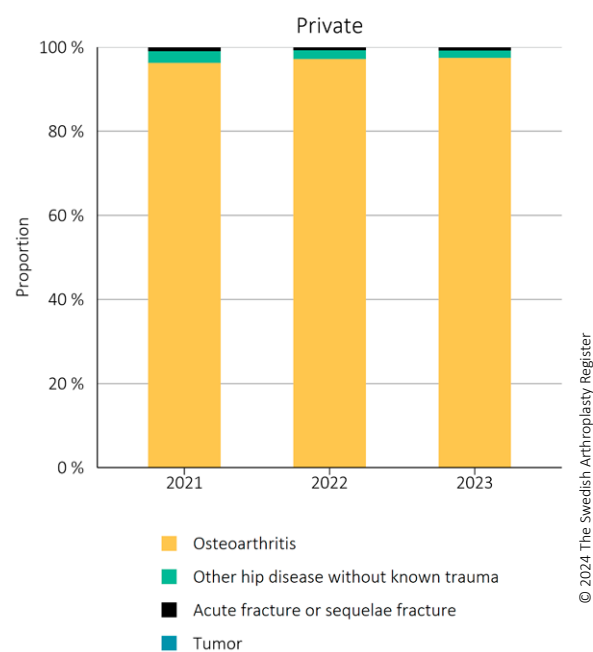
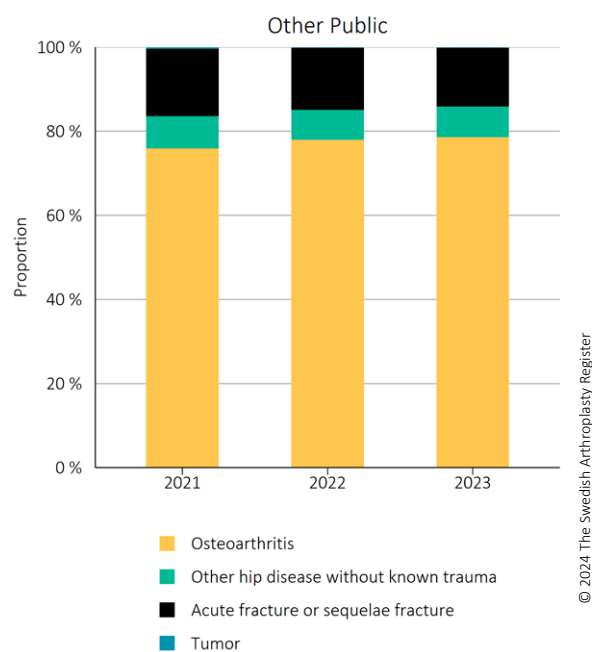
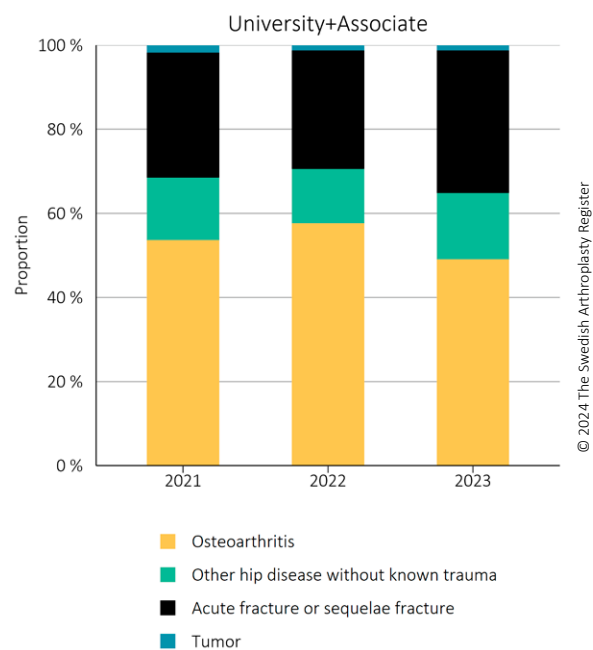
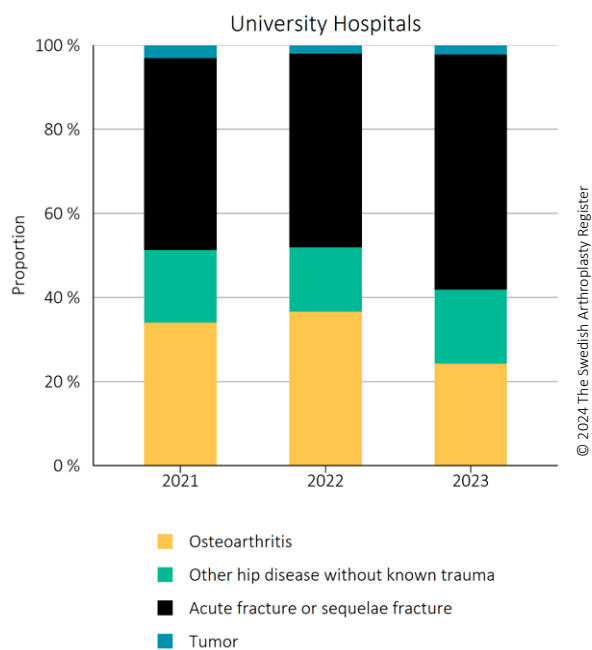


Figure 5.3.1 a–d. Distribution of the diagnoses OA, other hip diseases without known trauma, and tumors at university hospitals (a), university hospitals including associated units (b), other public units (c), and privately run units (d).

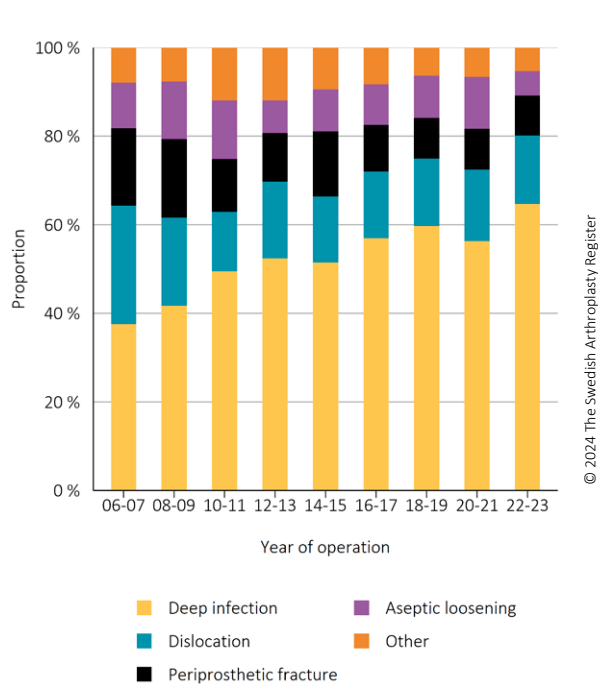


Figure 5.3.2. Distribution of the most common reasons for reoperation within two years during two-year periods from 2006 to 2023. The proportion of reoperations due to infection has increased, while the other reason groups, especially dislocation and periprosthetic fracture, have decreased.

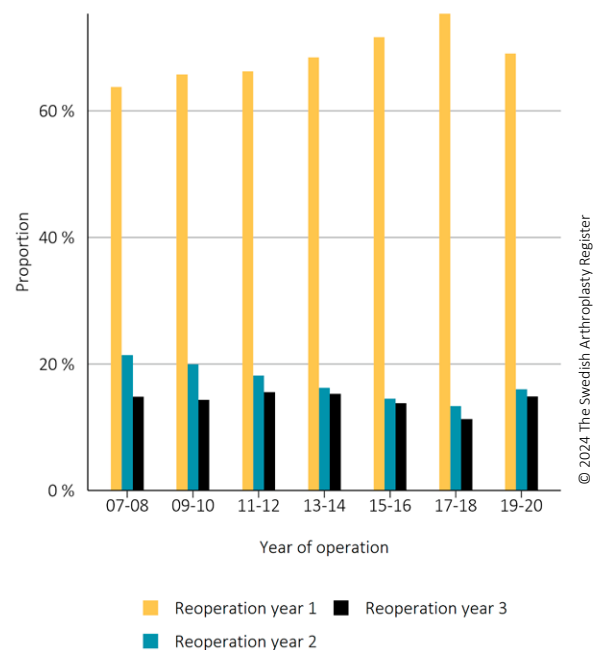


Figure 5.3.3. The proportion of reoperations during the first, second, and third years after primary surgery related to the time period of prosthesis insertion. Trauma and tumor diagnoses have been excluded.

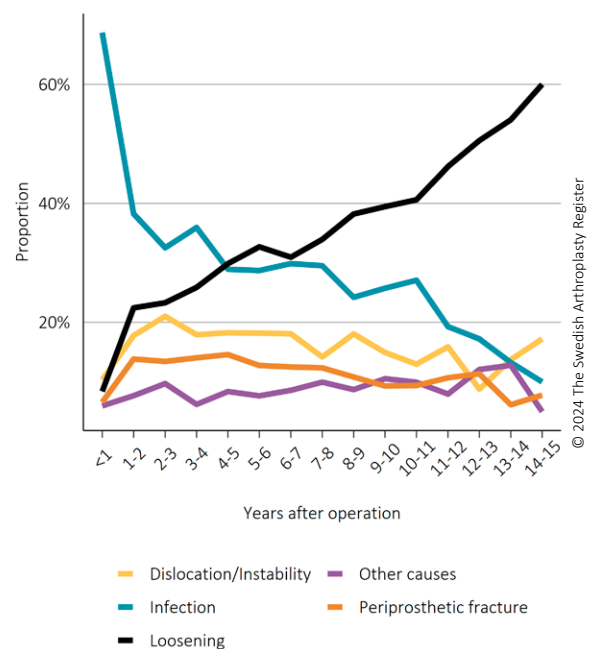
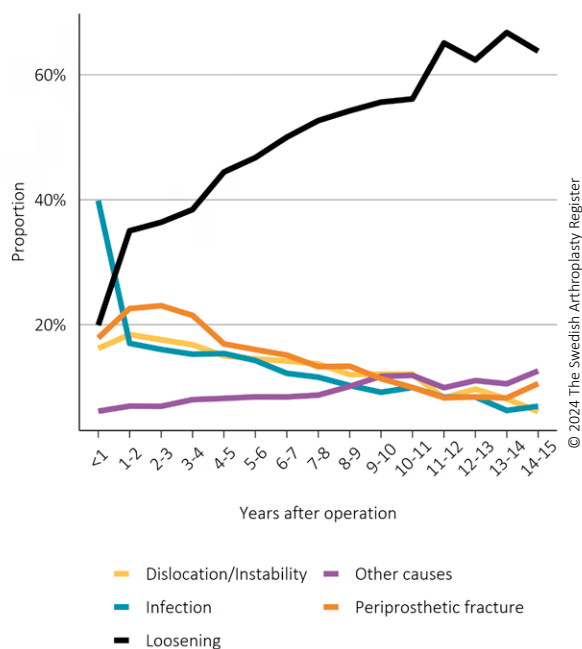


Figure 5.3.4 a–b. Most common reasons for reoperation per year up to 15 years after primary surgery for first-time reoperations (a) and after at least one previous reoperation for comparison (b). All diagnoses are included. The diagrams are based on primary surgeries (a) and reoperations (b) performed from 2005 to 2023.

depending on the time after the previous primary or reoperation. To present the most clinically relevant data possible, the following report includes all reoperations, regardless of diagnosis. In the overall group of total hip replacements, infection is by far the most common reason of reoperation in the first year after surgery, accounting for 40% of reoperations at the first revision during the period from 2005 to 2023 (Figure 5.3.4 a).

In the case of multiple revisions, the proportion of infections is significantly higher (68.7%, Figure 5.3.4 b). If trauma and tumor diagnoses are excluded from the first-time revisions, this proportion decreases to 37%. For first-time revisions, aseptic loosening becomes the most common reason already by the second year (36.4%). Over the following years, the proportion of loosening gradually increases until about 10 years have elapsed after the primary surgery. The proportion of revisions due to dislocation increases until the second year (18.4%) and then slowly decreases to under 10% after about 10 years. Reoperations due to of periprosthetic fracture show a similar pattern.

In multiple revisions, the pattern is similar, but the proportion of reoperations due to infection is significantly higher, and this reason remains the most common during the first four years after the primary operation. Even during the subsequent period of 5–11 years, the proportion of reoperations due to infection constitutes 24 to 30% of cases. Aseptic loosening is the most common reason after four years but increases more slowly compared to the situation in first-time revisions and reaches a proportion of 60% after 15 years.

The distribution of reasons over time partially reflects the choice of implants, cement, and surgical technique. For example, the risk of periprosthetic fracture and possibly also infection might look somewhat different if Sweden used even more uncemented implants. Finally, the distribution is also influenced by the length of the time window.

Summary

Reoperations within two years are a crucial quality indicator as they partly reflect existing routines, their adherence, and surgical techniques. However, the reported data may be misleading if the variation in complication risk based on the unit's patient demographics is not considered.

In recent years, the proportion of reoperations within two years has been at 2.2% for the country as a whole. For units that performed at least 500 surgeries, the proportion of reoperations within two years during the most recent period has varied from half a percent to nearly five percent.

Since 2005–2006, the relative proportion of reoperations due to infection has doubled, mainly at the expense of dislocation and periprosthetic fracture. Infection is by far the most common reason of reoperation in the first year after elective total hip prosthesis surgery. In the subsequent years, loosening becomes the predominant reason, with its proportion gradually increasing over time. Among all patients undergoing total hip replacement, the proportion reoperated due to dislocation decreases slowly after the second year, and due to periprosthetic fracture after the third year. Excluding trauma and tumor diagnoses, the overall pattern remains largely unchanged, though the proportion of deep infections, dislocations, and periprosthetic fractures decreases by up to nearly three percent in certain periods, while the proportion of reoperations due to loosening increases.

The distribution of reasons for reoperation over time to a certain extent reflects the choice of implants and surgical techniques during the evaluated period.

Reoperations within two years per unit based on primary total hip replacements performed due to osteoarthritis

	Primary	Reoperation		Revision	Deep infection		Dislocation		Fracture		Other	
Unit	n	n	%	n	n	%	n	%	n	%	n	%
University units												
Akademiska sjukhuset	597	10	1.9	9	9	1.7	1	0.2	0	0.0	0	0.0
Karolinska Huddinge	821	14	1.7	10	10	1.2	2	0.2	2	0.2	0	0.0
Karolinska Solna	150	6	5.9	6	2	1.4	2	2.2	0	0.0	1	1.5
Linköping	331	4	1.2	4	3	0.9	1	0.3	0	0.0	0	0.0
SU/Mölndal	1,238	48	4.2	43	27	2.3	11	1.0	4	0.3	5	0.5
SUS/Lund	150	7	5.8	7	3	2.6	3	2.3	1	1.0	0	0.0
Umeå	163	4	2.5	0	2	1.2	0	0.0	0	0.0	2	1.3
Privately run units												
Aleris Specialistvård Ängelholm	1,713	34	2.4	34	17	1.1	7	0.5	3	0.2	7	0.6
Aleris Specialistvård Nacka	1,891	18	1.2	16	8	0.4	7	0.5	0	0.0	3	0.2
Art Clinic Göteborg	1,248	13	1.2	13	5	0.5	4	0.3	2	0.2	2	0.2
Art Clinic Jönköping	991	8	0.9	0	7	0.8	0	0.0	1	0.1	0	0.0
Capio Arthro Clinic	2,483	59	2.7	53	33	1.4	6	0.3	6	0.2	13	0.6
Capio Movement	1,790	19	1.2	19	4	0.3	5	0.3	8	0.5	2	0.1
Capio Ortho Center Göteborg	1,173	39	3.7	38	30	2.9	2	0.2	4	0.4	3	0.3
Capio Ortho Center Stockholm	3,311	55	1.9	51	26	0.9	10	0.4	7	0.2	12	0.5
Capio Ortopedi Motala	1,524	27	1.9	26	20	1.4	0	0.0	2	0.1	5	0.4
Capio Ortopediska Huset	2,965	59	2.4	54	33	1.2	3	0.1	11	0.4	11	0.6
Capio S:t Göran	1,376	23	1.8	22	12	0.9	5	0.4	0	0.0	5	0.5
Carlanderska	1,861	27	1.7	26	18	1.1	2	0.1	4	0.3	3	0.2
Frölundaortopeden	50	1	2.0	0	1	2.0	0	0.0	0	0.0	0	0.0
Hermelinen	127	1	0.8	0	1	0.8	0	0.0	0	0.0	0	0.0
Sophiahemmet	471	7	1.5	0	3	0.6	2	0.4	0	0.0	2	0.4
Specialistcenter Scandinavia, Eskilstuna	441	6	2.1	0	2	0.5	3	1.3	1	0.3	0	0.0
Other units												
Alingsås	615	17	3.2	15	13	2.3	2	0.4	0	0.0	2	0.5
Ängelholm	677	6	0.9	6	2	0.3	3	0.5	0	0.0	1	0.2
Arvika	1,012	17	2.0	15	11	1.1	1	0.2	2	0.3	3	0.4
Bollnäs	1,337	18	1.7	17	11	0.9	3	0.3	2	0.2	2	0.3
Borås	242	3	1.3	0	3	1.3	0	0.0	0	0.0	0	0.0
Danderyd	589	21	4.3	19	13	2.5	4	1.1	0	0.0	0	0.0

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Reoperations within two years per unit based on primary total hip replacements performed due to osteoarthritis, cont.

	Primary	Reoperation		Revision	Deep infection		Dislocation		Fracture		Other	
Unit	n	n	%	n	n	%	n	%	n	%	n	%
Eksjö	999	21	2.3	20	19	2.1	2	0.2	0	0.0	0	0.0
Enköping	1,953	57	3.4	51	27	1.5	15	0.9	4	0.2	11	0.9
Eskilstuna	243	8	3.5	8	5	2.2	2	0.9	1	0.4	0	0.0
Falköping	42	1	2.4	1	1	2.4	0	0.0	0	0.0	0	0.0
Falun	481	9	2.3	8	5	1.1	3	1.0	0	0.0	1	0.2
Gällivare	236	1	0.4	0	0	0.0	0	0.0	0	0.0	1	0.4
Gävle	405	8	2.5	8	3	0.8	0	0.0	0	0.0	5	1.7
Halmstad	495	10	2.1	10	8	1.6	0	0.0	0	0.0	2	0.5
Hässleholm	2,651	30	1.2	25	23	0.9	3	0.1	2	0.1	2	0.1
Helsingborg	201	8	4.6	8	3	1.5	3	1.6	0	0.0	2	1.5
Hudiksvall	228	2	1.3	2	1	0.4	1	0.9	0	0.0	0	0.0
Jönköping	452	7	1.9	0	4	0.9	2	0.5	0	0.0	1	0.5
Kalmar	326	4	1.3	0	4	1.3	0	0.0	0	0.0	0	0.0
Karlshamn	973	17	1.9	17	6	0.7	7	0.8	2	0.2	2	0.2
Karlskrona	56	2	4.9	2	2	4.9	0	0.0	0	0.0	0	0.0
Karlstad	186	5	3.1	5	1	0.5	3	2.0	1	0.5	0	0.0
Kullbergsgka sjukhuset	1,328	29	2.5	28	21	1.7	4	0.3	1	0.1	3	0.4
Kungälv	347	12	3.6	12	10	3.0	1	0.3	0	0.0	1	0.3
Lidköping	811	8	1.2	8	5	0.6	2	0.4	1	0.1	0	0.0
Lindesberg	1,740	8	0.5	6	4	0.2	1	0.1	1	0.1	2	0.1
Ljungby	406	10	2.7	10	5	1.2	4	1.2	0	0.0	1	0.2
Lycksele	1,040	11	1.1	10	5	0.5	1	0.1	1	0.1	4	0.5
Mora	963	11	1.4	10	10	1.2	0	0.0	0	0.0	1	0.2
Norrköping	604	4	0.8	4	3	0.5	0	0.0	0	0.0	1	0.3
Norrtälje	530	23	4.6	22	13	2.5	5	1.0	2	0.4	3	0.7
Nyköping	456	16	4.3	16	11	2.6	3	1.0	1	0.3	1	0.4
Örnsköldsvik	477	6	1.4	6	4	1.0	1	0.2	0	0.0	1	0.2
Oskarshamn	1,385	26	2.0	26	23	1.7	1	0.1	1	0.1	1	0.1
Östersund	649	15	2.6	15	9	1.6	4	0.6	1	0.2	1	0.2
Piteå	1,484	22	1.8	20	7	0.5	7	0.5	1	0.1	6	0.5
Skellefteå	453	4	1.3	0	0	0.0	0	0.0	0	0.0	4	1.3
Skene	729	10	1.7	8	8	1.4	0	0.0	1	0.1	1	0.2
Skövde	127	4	5.0	4	3	4.2	0	0.0	1	0.8	0	0.0
Södersjukhuset	436	7	1.8	6	5	1.2	1	0.2	1	0.3	0	0.0

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Reoperations within two years per unit based on primary total hip replacements performed due to osteoarthritis, cont.

	Primary	Reoperation		Revision	Deep infection		Dislocation		Fracture		Other	
Unit	n	n	%	n	n	%	n	%	n	%	n	%
Södertälje	421	8	1.9	0	7	1.7	0	0.0	1	0.2	0	0.0
Sollefteå	1,387	20	1.6	20	18	1.4	1	0.1	0	0.0	1	0.1
Sundsvall	64	2	3.2	0	1	1.7	1	1.6	0	0.0	0	0.0
Torsby	519	9	2.0	8	3	0.6	1	0.3	4	0.8	1	0.2
Trelleborg	1,323	20	1.7	20	8	0.7	6	0.5	4	0.3	2	0.2
Uddevalla	1,098	24	2.5	22	16	1.7	0	0.0	6	0.6	2	0.2
Varberg	644	7	1.1	6	2	0.3	1	0.2	2	0.3	1	0.2
Värnamo	591	19	3.6	16	11	2.2	2	0.3	1	0.2	4	0.7
Västerås	1,269	43	4.1	43	24	2.1	8	0.7	2	0.2	9	1.1
Västervik	487	15	3.3	14	11	2.3	1	0.2	0	0.0	3	0.8
Växjö	564	13	2.4	13	10	1.9	3	0.5	0	0.0	0	0.0
Visby	482	9	2.3	8	4	0.9	0	0.0	2	0.5	3	0.9
Country	64,121	1,177	2.1	1,049	703	1.2	189	0.4	105	0.2	168	0.4

Table 5.3.1. Reoperations within two years per unit based on primary total hip replacements due to OA 2020-2023. Units with fewer than 20 primary replacements in the current period are excluded. The number of patients with short-term complications may differ from the sum of the number of complications, as each patient may have more than one type of complication. All proportions are calculated using competing risk analysis.

Reoperations within two years per unit, trend 2017–2023

Unit	2017–2020 Proportion	2018–2021 Proportion	2019–2022 Proportion	2020–2023 Proportion
University units				
Akademiska sjukhuset	3.6	3.3	2.8	1.9
Karolinska Huddinge	2.8	2.5	1.7	1.7
Karolinska Solna	6.3	5.9	5.1	5.9
Linköping	4.6	4	3.8	1.2
SU/Mölndal	3.0	3.7	4.5	4.2
SUS/Lund	2.5	3.8	4.0	5.8
SUS/Malmö	*	*	*	*
Umeå	3.1	4.2	2.3	2.5
Örebro	2.0	2.6	*	*
Privately run units				
Capio Ortopediska Huset	1.5	2.0	2.4	2.4
Capio Movement	1.9	1.8	1.4	1.2
Aleris Specialistvård Nacka	1.4	1.4	1.4	1.2
Capio Ortho Center Stockholm	1.7	1.9	1.8	1.9
Capio Ortho Center Göteborg	2.0	2.3	3.2	3.7
Aleris Specialistvård Motala	1.5	1.4	1.0	
Aleris Specialistvård Ängelholm	2.9	2.7	2.9	2.4
Art Clinic Jönköping	0.4	0.6	0.7	0.9
Aleris Specialistvård Bollnäs	1.1	1.0	0.4	
Hermelinen	0.0	1.0	0.9	0.8
Art Clinic Göteborg	0.8	1.0	1.1	1.2
Frölundaortopeden	2.3	2.0	0.0	2.0
Capio Artro Clinic		2.8	2.9	2.7
Capio Ortopedi Motala	2.2	2.1	1.9	1.9
Specialistcenter Scandinavia, Eskilstuna				2.1
Sophiahemmet	1.7	1.7	1.9	1.5
Carlanderska	1.2	1.2	1.4	1.7
Capio S:t Göran	1.9	1.7	1.8	1.8
Other units				
Halmstad	2.6	2.3	1.3	2.1
Falköping	2.0	2.0	2.0	2.4
Kullbergsga sjukhuset	3.3	2.8	2.8	2.5
Helsingborg	6.6	6.4	4.2	4.6

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Reoperations within two years per unit, trend 2017–2023, cont.

Unit	2017–2020 Proportion	2018–2021 Proportion	2019–2022 Proportion	2020–2023 Proportion
Skene	2.2	2.5	1.8	1.7
Piteå	1.0	1.2	1.7	1.8
Sunderby sjukhus	*	*	*	*
Hässleholm	1.5	1.1	1.2	1.2
Jönköping	2.4	2.3	1.3	1.9
Kalmar	1.0	1.4	0.8	1.3
Karlskrona	6.7	6.2	2.3	4.9
Karlstad	4.7	4.8	3.4	3.1
Kristianstad	*	*	*	*
Borås	1.6	1.9	1.2	1.3
Norrköping	0.7	0.8	0.8	0.8
Skövde	6.0	7.4	7.1	5.0
Danderyd	3.8	4.2	3.7	4.3
Sundsvall	2.0	1.9	3.3	3.2
Södersjukhuset	3.0	2.6	2.8	1.8
Trelleborg	1.4	1.4	1.4	1.7
Uddevalla	1.9	1.9	2.1	2.5
Varberg	1.0	1.1	1.4	1.1
NÄL	*	*	*	*
Västervik	1.8	2.2	3.6	3.3
Västerås	4.2	4.8	4.4	4.1
Eksjö	3.7	2.9	2.1	2.3
Växjö	4.2	5.4	3.4	2.4
Ystad		*	*	*
Ängelholm	1.5	1.8	1.8	0.9
Östersund	3.1	3.0	3.7	2.6
Lidköping	2.1	1.8	1.6	1.2
Hudiksvall	1.1	1.1	1.3	1.3
Eskilstuna	2.9	3.3	4.1	3.5
Oskarshamn	1.5	1.9	2.1	2.0
Nyköping	3.7	3.5	4.1	4.3
Bollnäs	2.3	2.0	1.6	1.7
Visby	2.1	2.4	2.3	2.3
Torsby	4.3	3.7	3.2	2.0

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Reoperations within two years per unit, trend 2017–2023, cont.

Unit	2017–2020 Proportion	2018–2021 Proportion	2019–2022 Proportion	2020–2023 Proportion
Enköping	2.3	2.5	3.0	3.4
Falun	4.0	3.2	1.8	2.3
Södertälje	1.5	0.8	0.7	1.9
Norrtälje	2.8	3.1	4.1	4.6
Värnamo	2.8	3.4	3.8	3.6
Kungälv	3.7	4.6	4.5	3.6
Arvika	4.7	3.2	2.2	2.0
Alingsås	2.3	3.1	2.9	3.2
Karlskoga	0.0	*		
Lindesberg	1.2	1.2	0.9	0.5
Mora	1.4	1.2	1.1	1.4
Gällivare	0.0	0.0	0.0	0.4
Ljungby	1.2	1.3	1.8	2.7
Örnsköldsvik	1.2	0.9	1.6	1.4
Sollefteå	1.1	1.1	1.2	1.6
Gävle	2.1	2.2	1.8	2.5
Lycksele	1.4	1.3	1.2	1.1
Skellefteå	1.1	0.5	1.5	1.3
Karlshamn	2.3	2.3	2.1	1.9
Country	2.1	2.1	2.1	2.1

Table 5.3.2. Reoperations within two years per unit based on primary elective total hip replacements performed 2016–2023. Patients operated on due to acute fracture, sequele fracture/trauma or with a tumor diagnosis have been excluded. All proportions are calculated using competing risk analysis at two-years follow-up.

–) No primary replacements reported.

*) Fewer than 20 operations in the period.

5.4. Revision Hip Replacement

Author: Johan Kärrholm

This section covers the revision of total hip replacement regardless of the primary diagnosis. A revision of a hip replacement involves replacing or removing all or part of the prosthesis due to a complication. If the prosthesis or any of its parts is first removed and later re-implanted—such as when waiting for an infection to heal (a two-stage procedure)—these two interventions are recorded as a single procedure unless otherwise specified. For example, if a primary replacement is revised in two stages, the extraction date is recorded as the time of revision for the primary prosthesis operation, while the re-implantation date marks the start of ongoing observation of a first-time revision. If the replacement is permanently removed (with no re-implantation registered by the final observation date, which is December 31, 2023, in this year's report), the extraction is classified as permanent. The absence of a reported re-implantation after a prior extraction is thus critical in determining whether the extraction is considered permanent. Some extractions performed in the latter part of 2023, where re-implantation is planned for 2024, may have been incorrectly classified as permanent.

Since 1979, revisions (and other reoperations) have been reported at the individual level, allowing for the collection of extensive data spanning more than 40 years. However, primary replacements were classified at the aggregated unit level until 1991, and it wasn't until 1992 that individual-based registration linked to personal identification numbers began. In 1999, a more detailed registration of components used in both primary replacements and revisions was introduced.

Many patients wonder how long their replacement will last. One way to describe this is by reporting the proportion of patients who still have their replacement at a certain time after the primary operation, with some retaining their replacement for life. Over time, the proportion of revised primary replacement from a given year will increase, while the corresponding proportion of patients still alive will decrease. The vast majority of patients will not require a revision during their remaining lifetime.

Figure 5.4.1 illustrates that of the patients who received a primary hip replacement in 1994, 79.7% retained their replacement for life, and an additional 5.4% of the patients were still alive with their original replacement, which had been implanted at least 19 years earlier. Meanwhile, 14.7% had undergone at least one revision, with 5.3% of these patients still alive at the end of 2023. The closer one looks at more recent years in the diagram, the more patients are still alive and retain their primary replacement. For patients who were operated on in 2013, roughly 10 years ago, 24.6% had died with their primary replacement intact, 68.8% were still living with their primary replacement, 1.0% had died after at least one revision, and 2.6% were alive after undergoing at least one revision.

The proportion of revisions in relation to the total number of hip replacements has decreased over the past two decades. Between the periods 2003–2005 and 2021–2023, the number of primary operations increased from an average of 13,356 to 20,246 per year (see Figures 5.4.2 and 5.4.3). The number of revisions during the first three-year period was 1,596 per year, accounting for 10.7% of all total hip replacements during that time. During the most recent period (2021–2023), the total number of revisions per year was slightly higher at 1,756, which corresponded to about 8.0% of all total hip replacements during the period.

Given that the proportion of elderly people and the number of individuals with hip replacement in the population are increasing, one might expect the number of revised hips to also rise. An increasing number of first-time and multiple revisions were reported during the 1980s, 1990s, and early 2000s. The highest number was recorded between 2009 and 2011, with 1,402 first-time revisions and 420 multiple revisions per year. Since then, the number of both first-time and multiple revisions has remained relatively constant and, if anything, has tended to decrease. During the 2021–2023 period, 1,368 first-time and 388 multiple revisions were reported annually, representing a slight reduction. At the same time, the number of primary total replacements increased by 4,367 per year between the 2009–2011 and 2021–2023 periods. So far, this has not resulted in an increased number of revisions.

Patients undergoing revision, like those undergoing reoperation, differ demographically from patients receiving a primary replacement. This is a natural consequence of patients with risk factors for revision being gradually selected into the revision groups as they undergo additional revisions. Generally, these patients are older, more often male, and have a higher degree of comorbidities (as shown in Table 5.4.1). The proportion of patients with an osteoarthritis diagnosis decreases with an increasing number of revisions. At the time of primary surgery, 81.6% of patients had this diagnosis, but among those who had undergone at least two revisions, the proportion had decreased to 64.3%. A corresponding increase in relative numbers is seen mainly for diagnoses such as inflammatory joint disease, sequelae of hip disease during childhood, and complications or sequelae after trauma. However, the proportion with acute hip fracture is lower in the revision groups (5–6%) than in the primary group (9.2%). High comorbidity, increased mortality, and lower activity levels in this group are most likely contributing factors.

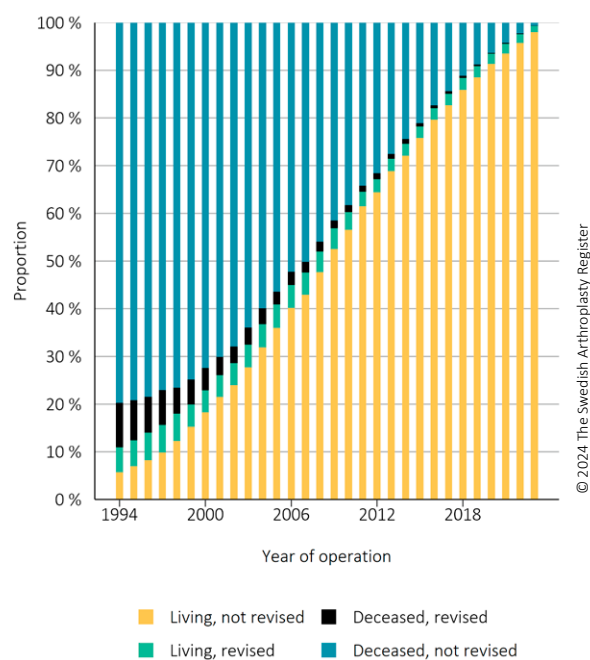


Figure 5.4.1. Distribution of patients with primary hip replacement and revision having surgery 1994–2023 divided into those who were alive and those who had died 31st of December 2023.

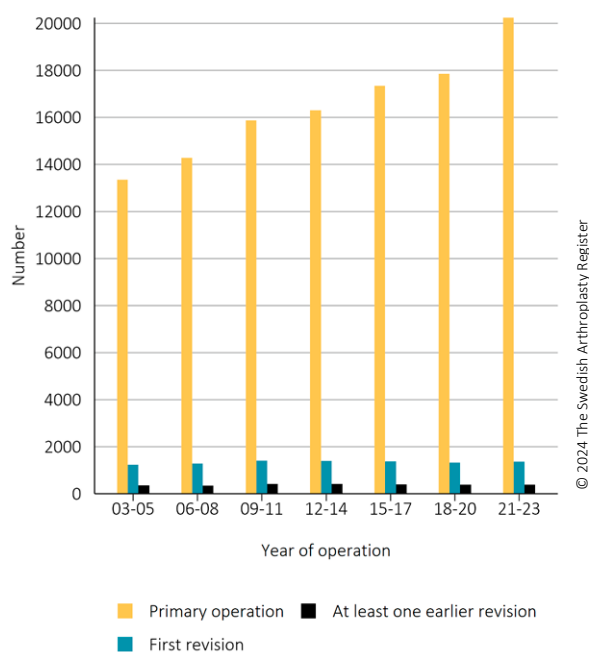


Figure 5.4.2 Number of primary hip replacements, first and multiple-time revisions respectively in 2003–2023. The figure shows the number of replacements as mean per year calculated in three-year periods. Over the time, the number of primary replacements increase considerably more than the number of revision surgeries.

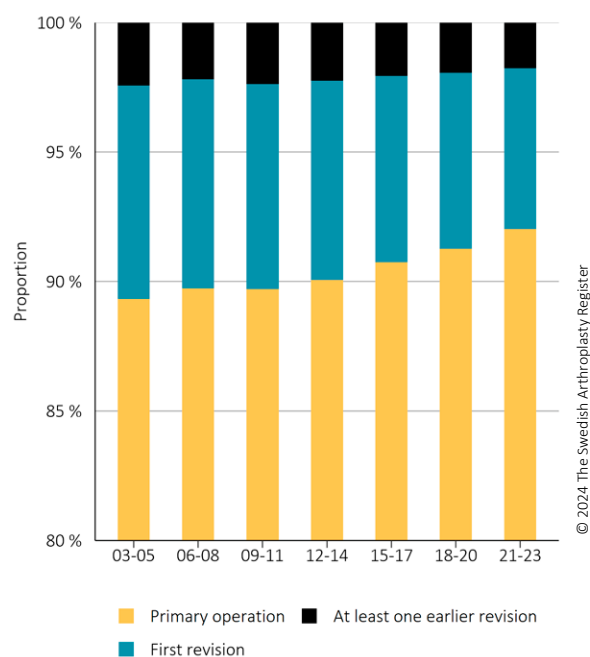


Figure 5.4.3. Proportion of primary hip replacements, first and multiple-time revisions in 2001–2022. The proportion of revisions decreased from 10.7% in the period 2003–2005 to 8.0% in the period 2021–2023.

Demography in first, second and multiple-time revision and primary hip replacement 2014–2023

	Previous revisions, none 2014–2023	Previous revisions, one 2014–2023	Previous revisions, ≥2 2014–2023	Primary replacement 2014–2023
Number	13,591	2,759	1,163	182,903
Mean age (SD)	72.2 (11.0)	72.3 (10.4)	71.9 (10.8)	69.1 (10.7)
Age group n (%)				
<45	199 (1.5)	27 (1.0)	11 (0.9)	3,356 (1.8)
45–54	759 (5.6)	135 (4.9)	84 (7.2)	14,822 (8.1)
55–64	2,028 (14.9)	417 (15.1)	167 (14.4)	37,726 (20.6)
65–74	4,375 (32.2)	919 (33.3)	384 (33.0)	65,946 (36.1)
75–84	4,715 (34.7)	963 (34.9)	389 (33.4)	51,609 (28.2)
≥ 85	1,515 (11.1)	298 (10.8)	128 (11.0)	9,444 (5.2)
Females n (%)	6,856 (50.5)	1,343 (48.7)	558 (48.3)	106,046 (58.0)
BMI n (%)				
<18.5	163 (1.3)	31 (1.2)	25 (2.3)	2,171 (1.2)
18.5–24.9	4,135 (32.2)	866 (33.2)	358 (32.8)	59,009 (33.2)
25–29.9	5,186 (40.3)	1,014 (38.9)	407 (37.2)	73,254 (41.2)
30–34.9	2,485 (19.3)	478 (18.3)	198 (18.1)	33,775 (19.0)
35–39.9	707 (5.5)	156 (6.0)	80 (7.3)	8,151 (4.6)
≥40	180 (1.4)	63 (2.4)	25 (2.3)	1,289 (0.7)
ASA-class n (%)				
ASA I	1,173 (8.8)	159 (5.9)	49 (4.3)	35,098 (19.4)
ASA II	6,967 (52.4)	1,317 (48.9)	464 (41.2)	107,996 (59.7)
ASA III	4,879 (36.7)	1,141 (42.3)	587 (52.1)	36,718 (20.3)
ASA IV	279 (2.1)	78 (2.9)	27 (2.4)	1,144 (0.6)

Table 5.4.1. Demography in first, second and multiple-time revisions from 2014. Corresponding variables are shown for primary hip replacements for comparison.

Revision Volume per Unit

For several years, we have monitored the distribution of surgery volumes and noted that some units perform only a few revisions per year. In 2023, primary total replacements were performed at 89 facilities in Sweden, of which 63 reported at least one revision. Twenty-five of these units performed between one and ten revisions per year, 13 performed between 11 and 25, 12 performed between 26 and 50, ten performed between 51 and 100, and three (Akademiska Sjukhuset, Danderyd, SU Mölndal) performed between 116 and 163 revisions. The year before (2022), the number of units in the group with the lowest volume (up to 10 per year) was about the same (n=24), and in the group with the second-lowest volume (11–25 revisions per year) was slightly higher (n=16). Eleven units performed 26–50 revisions, eight performed 51–100, and four units (Akademiska Sjukhuset, Danderyd, Karolinska Huddinge, SU Mölndal) performed between 114 and 124 revisions. Figures 5.4.4 and 5.4.5 show the distribution of primary replacements and revision surgeries per unit in the group of total replacements during 2022 and 2023. The total number of these operations is also provided to assess the relevance of the percentage distribution.

A few of the units reporting ten or fewer revisions per year may have issues with poor reporting, but in the majority of cases, the reported numbers are likely accurate. Altogether, these units performed 82 first-time and 13 multiple revisions in 2023. The most common causes were infection (n=42), followed by dislocation (n=21), loosening (n=12), or periprosthetic fracture (n=6). The most common procedures were head replacement (n=46), stem replacement (n=16), cup/liner replacement (n=14), and head/liner replacement (n=8). In the remaining cases, a cup/liner + stem replacement or prosthesis extraction was performed. In two cases, no information on the procedure was provided.

In summary, the number of units with small revision volumes per year has remained relatively constant. We believe it is advantageous to maintain a certain volume of revisions, particularly as determining indications and choosing techniques can be challenging, and intraoperative complications and unexpected findings during revision surgery are not uncommon. In these cases, it is important to have experienced and specially trained staff, as well as access to special instruments, bone bank, and a sufficiently large range of implants.

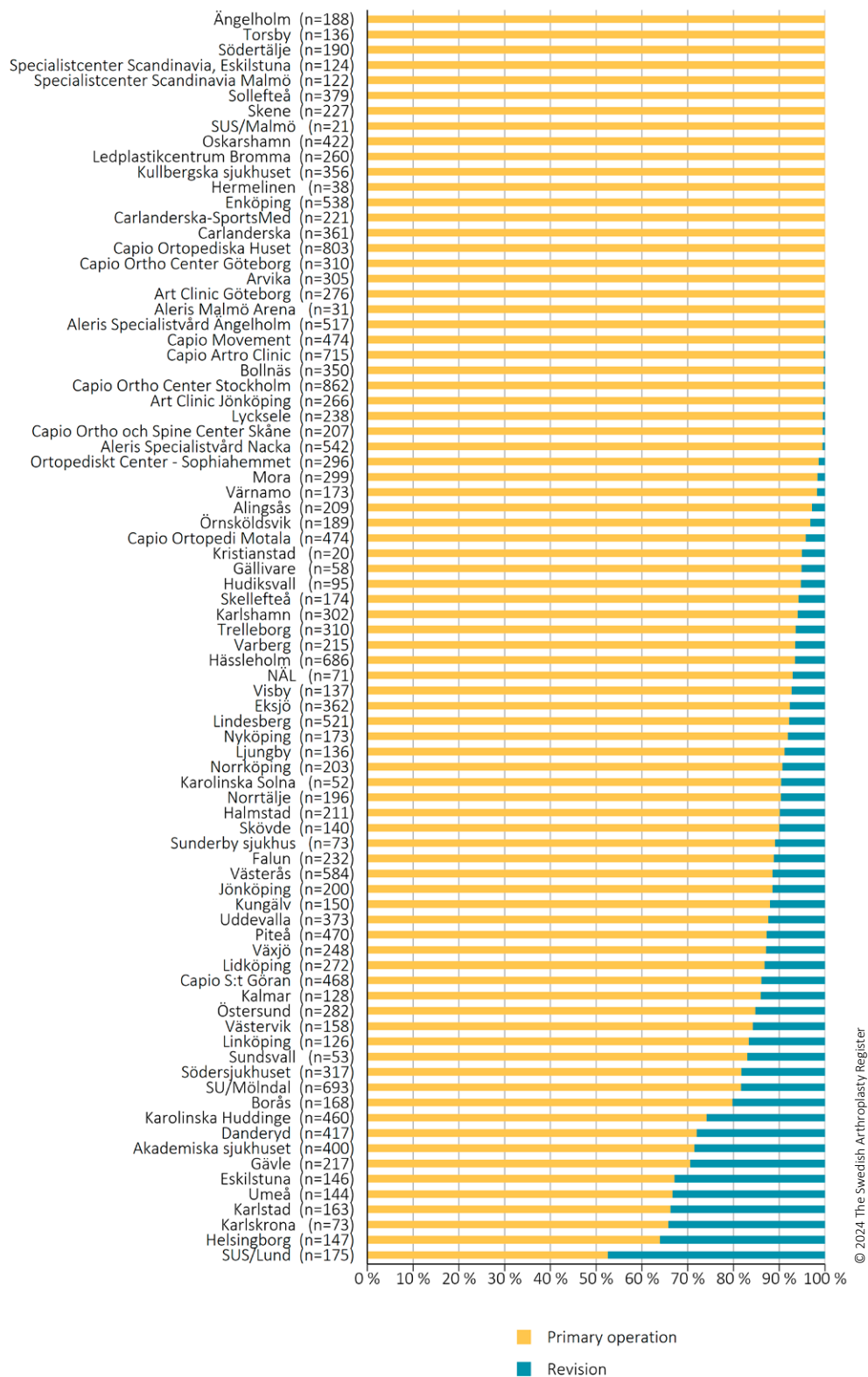
Risk of Revision Related to Operating Unit

The outcome for individual units regarding the risk of revision after primary surgery is influenced by many factors, such as the determination of indications, patient composition, degree of preoperative optimization, choice of implant, surgical environment, and several other more or less known factors. Additionally, there is a random variation. Nevertheless, it is important to identify and visualize differences, as they have proven to be an excellent basis for further analysis and potential improvement efforts.

Table 5.4.2 shows the number of primary hip replacements performed for osteoarthritis at each unit during the analyzed five-year period (2018–2023) and how many of these have been revised. Table 5.4.3 presents the corresponding data for a ten-year period (2013–2023). This is followed by RR (relative revision risk) with a 95% confidence interval. Here, unit effects on revision risk are estimated relative to the national average and have been calculated as in previous years using the “shared gamma frailty model.” Finally, the unit’s observed rank is shown along with a 95% confidence interval for the ranking, calculated using the Monte Carlo method. Only units that performed more than 50 primary replacements during the period are included in the analysis. Units that are significantly better or worse than the national average are marked in green and red, respectively.

Since the analysis window only shifts one year forward for each annual report, no dramatic changes from year to year should be expected. However, over a five-year period, the variation can become more pronounced. Of the ten units with a significantly increased revision risk at five years and for which ten-year data are also available, six show a significantly increased and none show a significantly decreased revision risk in the ten-year data analysis. Among the 13 units with a significantly decreased risk at five years, eight units also show a continued decreased risk at ten years, and none show an increased risk.

Figure 5.4.6 shows CRR after ten years (including primary replacements from 2013–2023). Units with fewer than 50 primary operations over the past five or ten years are not reported.



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Figure 5.4.4. Distribution of primary total hip replacements and revisions of total hip replacements per unit in 2022. Total number of primaries and revisions are shown in parentheses.

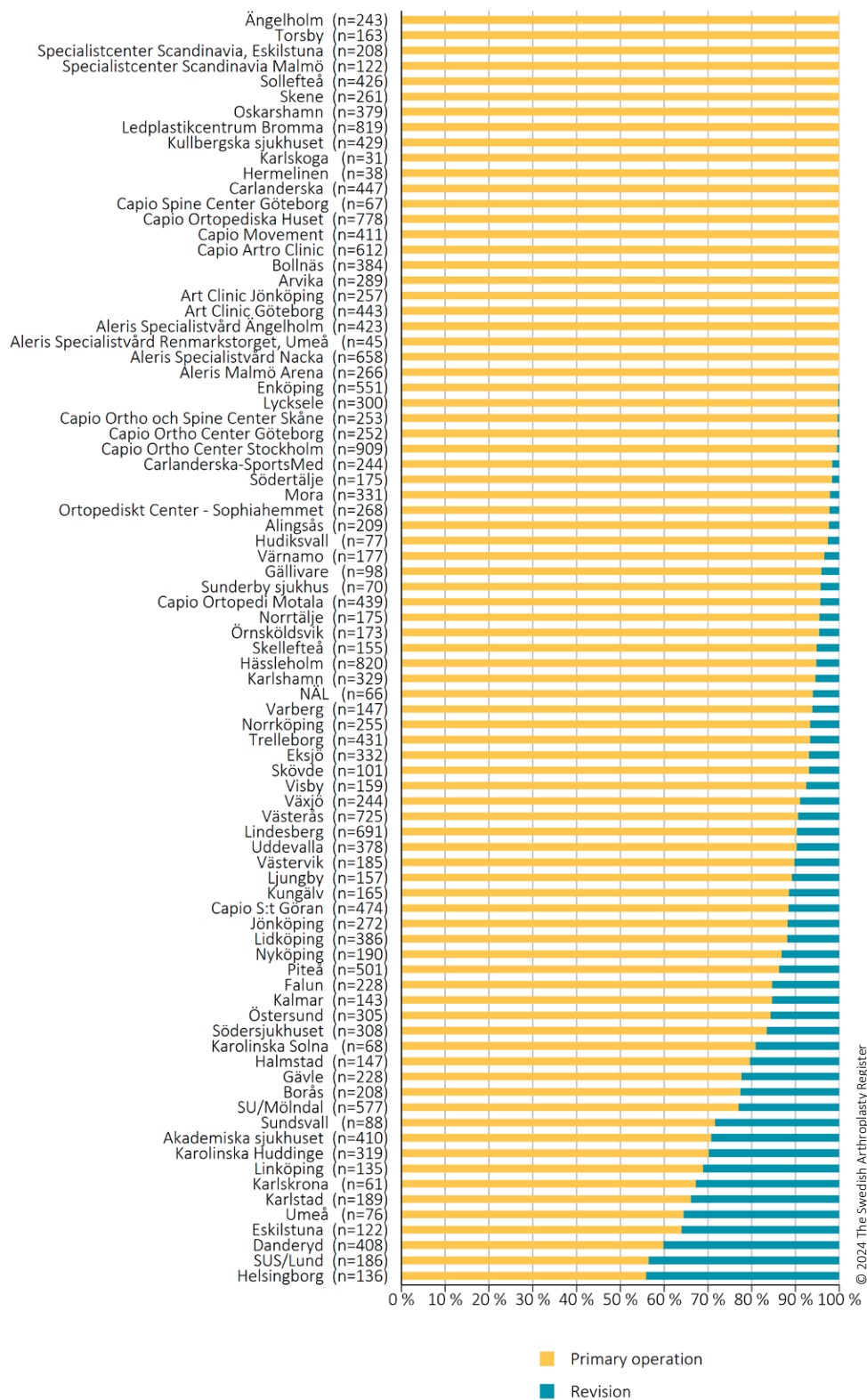


Figure 5.4.5. Distribution of primary total hip replacements and revisions of total hip replacements per unit in 2023. Total number of primaries and revisions are shown in parentheses.

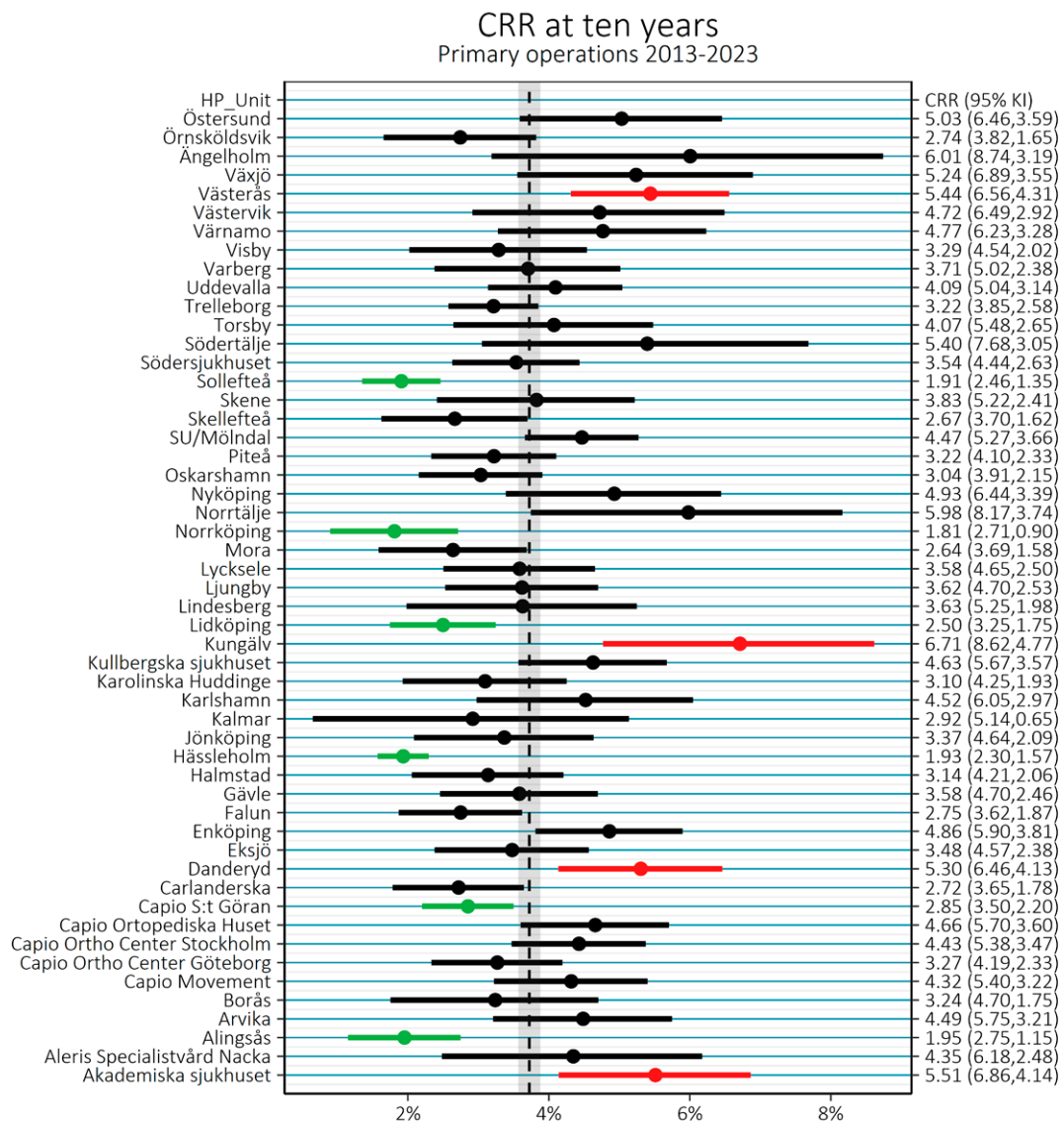


Figure 5.4.6. Cumulative risk of revision per unit based on replacements performed 2013–2023. Patients with a diagnosis of trauma (acute or sequele) and tumor have been excluded. The cumulative risk of revision at 10 years has been adjusted for differences in distribution of diagnosis, age, sex and year of surgery.

Relative risk of revision per unit, five years

Unit	Number	Revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Art Clinic Jönköping	1,317	10	0.44	0.26; 0.72	1	1–24
Norrköping	981	7	0.44	0.25; 0.78	2	1–29
Gällivare	429	2	0.47	0.23; 0.98	3	1–46
Hässleholm	4,247	44	0.49	0.37; 0.65	4	2–17
Aleris Specialistvård Nacka	2,394	22	0.49	0.34; 0.72	5	1–23
Lindesberg	2,966	33	0.52	0.37; 0.71	6	2–22
Varberg	1,130	12	0.54	0.33; 0.87	7	1–37
Hudiksvall	384	3	0.58	0.29; 1.15	8	1–57
Eksjö	1,454	17	0.59	0.39; 0.90	9	2–40
Aleris Specialistvård Bollnäs	608	9	0.61	0.36; 1.04	10	2–50
Carlanderska	2,518	35	0.63	0.46; 0.86	11	5–36
Sophiahemmet	1,001	19	0.65	0.43; 0.97	12	4–45
Hermelinen	172	1	0.65	0.29; 1.44	13	1–70
Örnsköldsvik	732	9	0.67	0.40; 1.13	14	3–56
Lycksele	1,587	23	0.68	0.47; 0.99	15	5–47
Capio Movement	2,481	37	0.69	0.51; 0.93	16	7–42
Mora	1,432	20	0.69	0.47; 1.02	17	5–49
Kalmar	622	9	0.73	0.43; 1.23	18	4–61
Södertälje	701	10	0.73	0.44; 1.21	19	4–60
Sollefteå	2,010	30	0.74	0.53; 1.04	20	8–50
Skellefteå	688	10	0.75	0.46; 1.25	21	5–62
Capio S:t Göran	2,457	40	0.77	0.57; 1.03	22	11–49
Karolinska Huddinge	1,155	18	0.77	0.51; 1.16	23	7–58
Trelleborg	2,678	48	0.77	0.59; 1.01	24	12–48
Art Clinic Göteborg	1,451	21	0.78	0.53; 1.15	25	9–57
Borås	479	7	0.78	0.45; 1.38	26	4–68
Aleris Specialistvård Motala	700	16	0.8	0.52; 1.22	27	8–61
Capio Ortho Center Stockholm	4,834	87	0.8	0.65; 0.98	28	16–47
Piteå	2,447	44	0.8	0.60; 1.06	29	13–52
Lidköping	1,213	19	0.81	0.54; 1.20	30	9–60
Skene	1,084	18	0.81	0.54; 1.22	31	9–61
Capio Ortopediska Huset	4,286	77	0.81	0.65; 1.01	32	17–48
Bollnäs	1,394	21	0.82	0.56; 1.21	33	10–60
Ängelholm	1,044	18	0.83	0.55; 1.26	37	10–63
Falköping	149	3	0.88	0.44; 1.76	34	4–78

Table continued on next page.

Relative risk of revision per unit, five years, cont.

Unit	Number	Revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Oskarshamn	2,066	42	0.92	0.69; 1.23	35	20–62
Uddevalla	1,837	37	0.93	0.69; 1.27	36	20–63
Södersjukhuset	849	17	0.94	0.62; 1.42	37	14–70
Visby	733	16	0.97	0.63; 1.49	38	16–72
Ljungby	744	17	0.97	0.64; 1.48	39	16–72
Karlshamn	1,561	34	0.99	0.72; 1.35	40	23–67
Jönköping	815	17	0.99	0.65; 1.50	41	17–72
Alingsås	980	21	0.99	0.67; 1.45	42	19–71
Frölundaortopeden	75	2	0.99	0.47; 2.06	43	6–82
Falun	765	16	1	0.65; 1.54	44	17–73
Halmstad	868	21	1.01	0.69; 1.48	45	20–72
Gävle	638	14	1.01	0.65; 1.59	46	17–75
Kullbergska sjukhuset	1,914	45	1.1	0.83; 1.46	47	33–71
Capio Ortho Center Göteborg	1,712	48	1.11	0.85; 1.46	48	34–71
Sundsvall	102	3	1.13	0.57; 2.26	49	11–83
Akademiska sjukhuset	803	21	1.16	0.79; 1.70	50	30–78
Capio Arthro Clinic	3,235	83	1.16	0.94; 1.44	51	42–71
Umeå	277	9	1.19	0.71; 2.01	52	22–82
Aleris Specialistvård Ängelholm	2,008	50	1.2	0.92; 1.56	53	41–74
Enköping	2,817	75	1.23	0.99; 1.54	54	45–74
Västervik	767	23	1.27	0.88; 1.85	55	37–80
Arvika	1,458	40	1.28	0.95; 1.71	56	43–78
Torsby	738	22	1.31	0.90; 1.91	57	39–81
Eskilstuna	379	13	1.33	0.84; 2.11	58	34–83
Danderyd	976	30	1.34	0.96; 1.86	59	44–80
Linköping	484	18	1.34	0.89; 2.03	60	39–82
Värnamo	869	27	1.35	0.95; 1.91	61	43–81
Karlskrona	78	4	1.39	0.72; 2.66	62	24–84
Östersund	1,162	39	1.41	1.05; 1.90	63	50–81
SU/Mölndal	2,197	73	1.42	1.13; 1.78	64	55–79
Nyköping	711	24	1.42	0.99; 2.05	65	46–82
Skövde	209	10	1.58	0.95; 2.61	66	44–84

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Relative risk of revision per unit, five years, cont.

Unit	Number	Revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Karlstad	408	18	1.61	1.07; 2.43	67	52–84
Växjö	814	31	1.64	1.18; 2.27	68	58–84
SUS/Lund	247	13	1.71	1.08; 2.71	69	52–84
Västerås	2,015	78	1.74	1.40; 2.17	70	68–83
Helsingborg	241	12	1.75	1.09; 2.81	71	53–84
Kungälv	699	31	1.75	1.26; 2.43	72	63–84
Karolinska Solna	270	16	1.79	1.17; 2.75	73	58–84
Norrtälje	848	39	1.89	1.40; 2.54	74	69–84

Table 5.4.2. Relative risk of revision per unit, five years. Units that are significantly better or worse than the national average have been highlighted with green and red respectively.

Relative risk of revision per unit, ten years

Unit	Number	Revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Norrköping	2,000	23	0.48	0.34; 0.69	1	1–16
Eksjö	2,458	32	0.56	0.41; 0.77	2	1–24
Kalmar	1,324	18	0.57	0.39; 0.85	3	1–34
Hässleholm	8,033	127	0.61	0.52; 0.73	4	3–20
Lindesberg	4,581	66	0.61	0.49; 0.77	5	2–25
Alingsås	1,974	30	0.63	0.46; 0.87	6	2–36
Aleris Specialistvård Sabbatsberg	340	6	0.64	0.37; 1.11	7	1–58
Mora	2,532	41	0.67	0.50; 0.89	8	3–39
Hermelinen	231	2	0.68	0.35; 1.32	9	1–72
Sophiahemmet	2,124	49	0.69	0.53; 0.90	10	4–39
Karolinska Huddinge	2,086	37	0.7	0.52; 0.95	11	4–44
Karlskoga	628	13	0.71	0.46; 1.10	12	2–57
Carlanderska	3,307	56	0.71	0.56; 0.92	13	5–41
Lidköping	2,526	47	0.74	0.57; 0.97	14	6–46
Örnsköldsvik	1,496	27	0.74	0.53; 1.04	15	4–53
Aleris Specialistvård Nacka	3,319	54	0.75	0.58; 0.97	16	7–46
Gällivare	817	15	0.75	0.49; 1.14	17	3–60
Sollefteå	2,857	46	0.75	0.58; 0.99	18	6–48
Piteå	4,223	82	0.77	0.62; 0.94	19	9–44
Falun	2,105	44	0.77	0.58; 1.01	20	7–50
Hudiksvall	875	17	0.77	0.51; 1.15	21	3–61
Oskarshamn	3,463	67	0.77	0.62; 0.98	22	9–47
Örebro	351	8	0.78	0.47; 1.29	23	2–71
Capio S:t Göran	4,79	93	0.78	0.64; 0.95	24	11–44
Aleris Specialistvård Motala	3,464	88	0.8	0.65; 0.98	25	12–48
Trelleborg	5,909	135	0.82	0.69; 0.97	26	15–47
Sundsvall	494	12	0.83	0.53; 1.30	27	4–71
Frölunda Specialistsjukhus	257	7	0.85	0.50; 1.45	28	3–79
Skellefteå	1,238	26	0.87	0.62; 1.22	29	9–66
Aleris Specialistvård Bollnäs	2,046	56	0.87	0.68; 1.12	30	14–59
Borås	1,026	22	0.87	0.61; 1.26	31	8–69
Capio Ortho Center Göteborg	2,44	58	0.87	0.68; 1.12	32	15–59
Capio Ortopediska Huset	6,583	144	0.88	0.75; 1.04	33	21–53
Lycksele	3,135	73	0.88	0.71; 1.10	34	17–58
Varberg	2,147	49	0.89	0.68; 1.16	35	15–62

Table continued on next page.

Relative risk of revision per unit, ten years, cont.

Unit	Number	Revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Halmstad	1,801	44	0.89	0.68; 1.18	36	14–63
Visby	1,293	29	0.9	0.65; 1.24	37	11–68
Bollnäs	1,394	21	0.93	0.64; 1.35	38	11–74
Jönköping	1,524	35	0.93	0.69; 1.26	39	15–69
Falköping	149	3	0.94	0.51; 1.76	40	3–87
Skene	1,76	41	0.94	0.71; 1.26	41	18–69
Capio Ortho Center Stockholm	7,318	175	0.97	0.84; 1.12	42	31–60
Södersjukhuset	2,313	61	0.97	0.76; 1.23	43	23–67
Gävle	1,401	38	1	0.75; 1.34	44	21–74
Capio Movement	3,802	98	1.04	0.86; 1.26	45	34–70
Spenshult	335	14	1.05	0.68; 1.61	46	15–84
Ängelholm	1,53	38	1.05	0.78; 1.41	47	26–77
Södertälje	1,233	34	1.08	0.79; 1.46	48	27–80
Uddevalla	3,608	101	1.08	0.89; 1.31	49	38–72
Ljungby	1,452	44	1.1	0.84; 1.45	50	32–79
Karlshamn	2,744	78	1.11	0.90; 1.38	51	39–76
Karolinska Solna	884	32	1.12	0.81; 1.53	52	29–82
Värnamo	1,52	45	1.14	0.87; 1.50	53	35–81
Västervik	1,305	39	1.16	0.86; 1.55	54	35–83
Kullbergska sjukhuset	3,073	89	1.18	0.96; 1.45	55	45–79
Östersund	2,382	78	1.21	0.97; 1.50	56	46–81
Enköpings	4,589	133	1.21	1.02; 1.43	57	50–78
Torsby	1,263	39	1.23	0.92; 1.64	58	41–85
SU/Mölndal	4,440	147	1.24	1.06; 1.46	59	53–80
Eskilstuna	691	23	1.25	0.87; 1.79	60	36–87
Aleris Specialistvård Ängelholm	2,381	62	1.25	0.99; 1.59	61	47–84
Linköping	711	27	1.3	0.92; 1.82	62	41–88
Helsingborg	652	24	1.3	0.91; 1.85	63	41–88
Nyköping	1,262	44	1.34	1.02; 1.76	64	50–87
SUS/Lund	779	32	1.35	0.99; 1.86	65	48–88
Akademiska sjukhuset	1,649	64	1.36	1.07; 1.71	66	55–87
Växjö	1,339	48	1.4	1.07; 1.83	67	55–88
Arvika	2,402	83	1.41	1.15; 1.74	68	60–87
Skövde	852	39	1.44	1.08; 1.93	69	55–89
Västerås	3,487	131	1.49	1.26; 1.77	70	69–88

Table continued on next page.

Relative risk of revision per unit, ten years, cont.

Unit	Number	Revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Karlstad	1,176	54	1.51	1.17; 1.94	71	63–89
Danderyd	2,277	95	1.52	1.25; 1.85	72	68–88
Umeå	500	24	1.52	1.07; 2.17	73	55–89
Karlskrona	113	7	1.55	0.92; 2.63	74	41–89
Norrtälje	1,447	59	1.58	1.24; 2.02	75	67–89
Kungälv	1,554	73	1.67	1.34; 2.09	76	74–89

Table 5.4.3. Relative risk of revision per unit, ten years. Units that are significantly better or worse than the national average have been highlighted with green and red respectively.

Cause of Revision

Between 2003 and 2023, aseptic loosening (50.9%), infection (18.8%), dislocation (14.3%), and periprosthetic fracture (9.9%) have been the most common reasons for revision, regardless of whether there was a previous revision or not. However, the distribution of causes has changed over time (Figure 5.4.7 a and b). For first-time revisions, 64.4% of surgeries performed between 2003 and 2005 were due to loosening, osteolysis,

and/or wear. The latter two causes are also included in this group. Dislocation ranked second (11.7%), followed by periprosthetic fracture (8.0%) and infection (2.7%). For multiple revisions during the same period, the proportion of revisions due to infection and dislocation was higher at the expense of a decreasing share of revisions due to loosening (loosening: 50.5%, dislocation: 19.8%, periprosthetic fracture: 7.9%, infection: 6.0%).

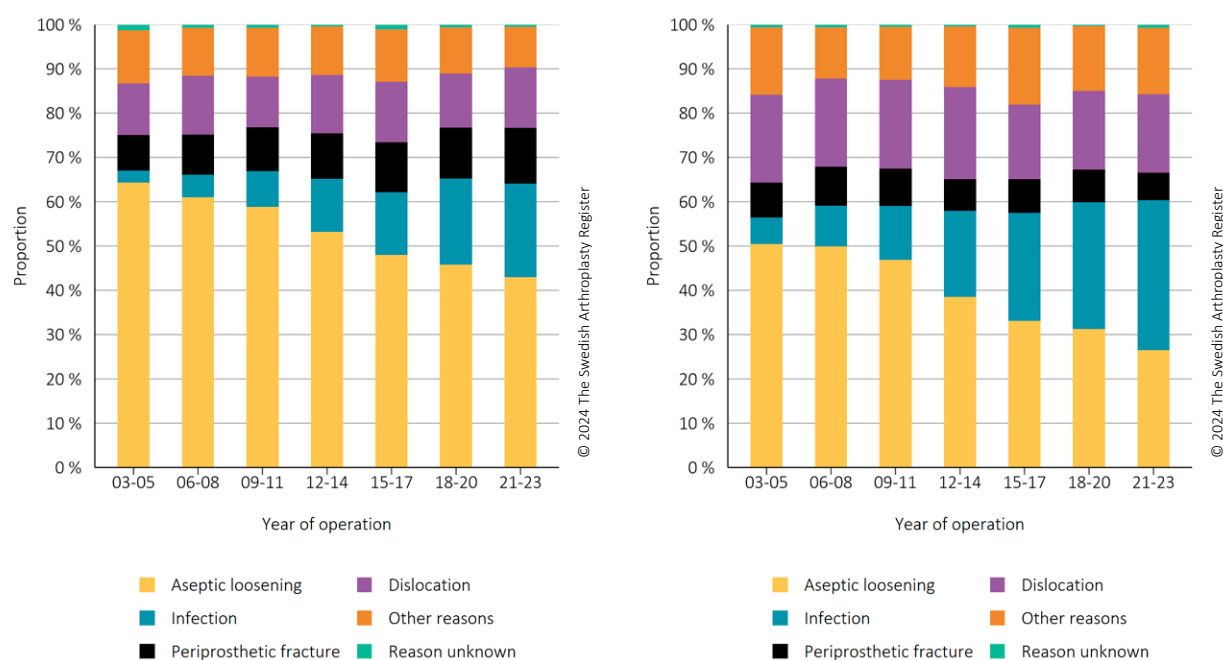


Figure 5.4.7 a–b. Distribution of reasons in first time (a) and multiple-time revisions (b) in three-year periods between 2003 and 2023.

Until the period 2021–2023, this distribution gradually changes in both groups. For first-time revisions, loosening still dominates but has decreased to 42.9%, followed by infection (21.2%), dislocation (13.7%), and periprosthetic fracture (12.5%). During the same period, infection became the most common cause of multiple revisions (33.8%), followed by loosening (26.5%), dislocation (17.8%), and periprosthetic fracture (6.2%). The total number of revisions, whether first-time or multiple revisions, due to loosening decreased from 986 per year during the period 2003–2005 to 693 per year during 2021–2023. During the same periods, there was a significant increase in revisions due to infection, from 136 per year in the first period to 511 per year in the most recent period. For dislocation, the change was more modest, with a slight increase from 218 per year in 2003–2005 to 258 per year in 2020–2022. Regarding periprosthetic fractures treated with revision, the relative change was somewhat larger, increasing from 130 to 196 per year. The number of reported periprosthetic fractures increased from 123 in 2003 to 182 in 2010. Since then, the number has fluctuated from 169 (in 2013) to 218 (in 2022) without a clear pattern.

The cause of revision differs between sex. During the period 2021–2023, loosening was the most common cause of revision for both males and females (38.7%/41.2%). Infection was significantly more common among males (34.8%/24.0%), while dislocation was more common among females (11.4%/18.4%). Revisions due to periprosthetic fracture were evenly distributed (11.4%/11.2%). All percentages include both first-time and multiple revisions.

Cause of Re-revision Related to Previous Revision Cause

The reason for a patient's first revision influences the cause profile for a potential second revision (Table 5.4.4). Whether a patient undergoes a first or second revision and then needs another revision, it is highly likely that the next revision will be performed for the same reason as the previous one. This is especially evident in cases of loosening/osteolysis, infection, or dislocation, where 5.3%, 14.8%, and 6.4%, respectively, were revised a second time for the same reason during the period 2005 to 2023. If you also include patients who were treated with permanent extraction, these percentages increase to 5.7%, 21%, and 8.9% for first-time revisions and to 8.2%, 29.7%, and 14.7% for second-time revisions.

An exception to the rule that the specific cause of revision often remains the same if a patient is revised multiple times is the patient group that is revised due to periprosthetic fracture. In these cases, the most common cause of a subsequent revision is dislocation, followed by loosening and infection, after both first and second revisions. Regardless of the reason for the revision, the risk of needing a re-revision due to infection is elevated after a first-time revision compared to the situation after a primary operation. The difference in risk is lowest when comparing primary replacements and first-time revision due to loosening. Nevertheless, the proportion of first-time revisions that are re-revised due to infection is twice as high compared to the proportion of primary operations revised for the same reason. After a revision due to infection, the proportion that is re-revised for the same reason is more than ten times greater than after a primary operation, regardless of whether it is a first or subsequent revision.

Prosthesis Extraction Without Subsequent Insertion of a New Prosthesis

It is not possible, based on registry data alone, to determine with complete certainty whether an extraction is permanent or not. A large proportion of the patients who underwent extraction in the latter part of 2023 are highly likely to be provided with a prosthesis during 2023. Additionally, a small number of patients who underwent prosthesis extraction earlier may also receive a new prosthesis. It is estimated that this could involve around thirty cases, based on the additional number of cases reported in 2023 (2023: 70 cases; average for the period 2018–2022 = 42). Due to the uncertainty in this estimate, this loss has not been considered here.

Throughout the period from 2003 to 2023, the proportion of revisions that resulted in definitive complete or partial prosthesis extraction was 1.9% (an average of 25 per year) for first-time revisions and 6.2% (24 per year) for multiple revisions. The number has varied between 129 and 172 over a three-year period (Figure 5.4.8). The most common causes were deep infection (62.3%), followed by dislocation (19.8%), loosening (10.6%), and periprosthetic fracture (5.9%). During this period, there was a gradual increase in definitive extractions due to infection, while the proportions for other causes decreased. Between 2018 and 2020, when it can be assumed that the majority of planned replacements were registered, 68.2% of extractions were due to infection, 12.9% due to loosening, 9.1% due to dislocation, and 8.3% due to periprosthetic fracture.

Reason for re-revision grouped by reason why the previous procedure was performed

	Loosening	Infection	Periprosthetic fracture	Dislocation	Other/missing
Primary replacement 2005-2023 n = 319,683					
First revision, %	1.3	1.2	0.5	0.7	0.3
No revision, %	96.1				
Second revision 2005-2023 n = 25,648					
No reported incision, %	0.4	6.2	1.5	2.5	0.5
Loosening, %	5.3	1.6	2.8	1.6	4.3
Infection, %	2.4	14.8	3.3	5.7	3.9
Periprosthetic fracture, %	1.2	0.5	0.9	0.9	1.2
Dislocation, %	2.2	1.7	3.6	6.4	3.8
Other/missing, %	1.0	0.5	0.7	0.7	2.0
No re-revision, %	87.8	74.7	87.2	82.1	84.3
Third revision 2005-2023 n = 5,328					
No reported incision, %	1.3	10.5	2.5	4.5	1.1
Loosening, %	6.9	1.4	4.5	2.8	6.0
Infection, %	3.7	19.2	3.8	6.4	4.2
Periprosthetic fracture, %	1.4	0.4	0.7	1.6	0.7
Dislocation, %	3.1	2.9	6.8	10.2	4.2
Other/missing, %	0.8	0.8	0.9	1.00	2.5
No re-revision, %	82.8	64.8	80.9	73.8	81.3

Table 5.4.4. Distribution of reason for second-time and third-time revisions in percentage, grouped by the reason of the most recent previous revision. Includes patients who underwent primary surgery or revision between 2005 and 2023. The group loosening includes osteolysis and wear. For two-stage operations, the reason listed is that relevant to the first stage (extraction). Prosthesis extraction not followed by insertion is listed as a separate group. For a small portion of these, prosthesis insertion may be planned for 2024.

Patients who undergo permanent prosthesis extraction are somewhat older than those who are revised for other reasons (average age for permanent extraction/other procedures: 76.0/71.6 years). They are more likely to have a diagnosis other than osteoarthritis (39.1% versus 23.9%) and a higher degree of comorbidity. In the group that underwent permanent extraction, 73.5% had an ASA class of III or higher, whereas in the group that was revised for other reasons, this proportion was 37.5%. However, 34.8% and 24.7% of observations are missing as the ASA class was not reported at the beginning of the period. The mortality rate among these patients is high, particularly initially (Figure 5.4.9). During the observation period from 2003 to 2023, 77.2% of patients who underwent permanent extraction died. The corresponding proportion among those revised for other reasons was 42.3%.

Revision Procedure

Since 2003, replacing both the cup and/or liner and stem has been the most common procedure for both first-time and multiple revisions (Figure 5.4.10 a and b). However, the replacement of both the cup/liner and stem has decreased in both absolute and relative terms for both first-time and multiple revisions. Instead, replacement of the head and/or liner has increased, as DAIR (Debridement, Antibiotics, Implant Retention) procedures have become more common. It is also not surprising that the proportion of extractions without recorded replacement constitutes a significantly larger percentage of multiple revisions compared to first-time revisions.

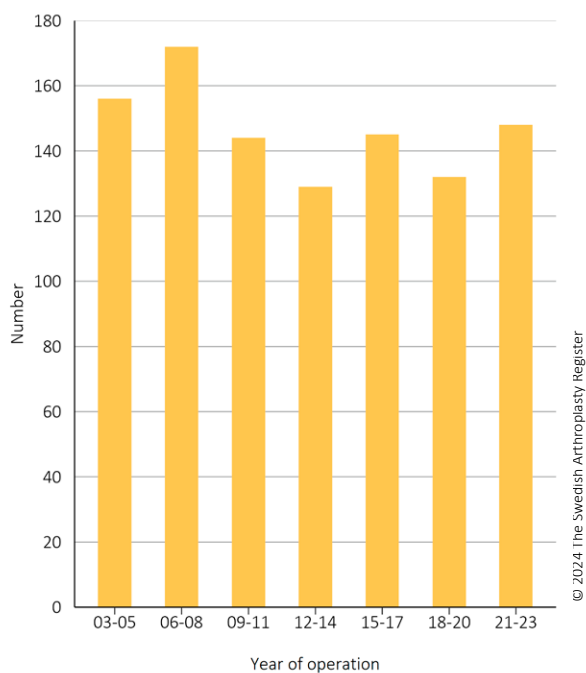


Figure 5.4.8. Number of total and partial extractions per three-year period where there is no report on a subsequent insertion of a new prosthesis or prosthesis component(s).

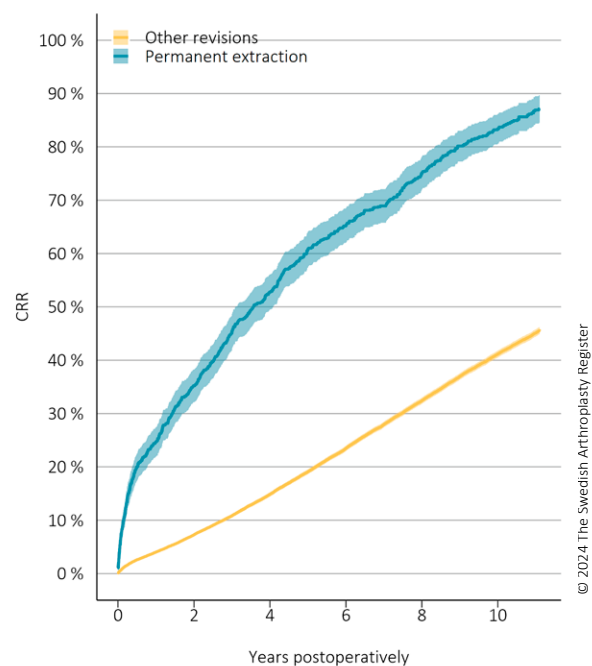


Figure 5.4.9. Cumulative risk of mortality in patients treated with definitive prosthesis extraction and in patients revised with prosthesis exchange in one or more stages.

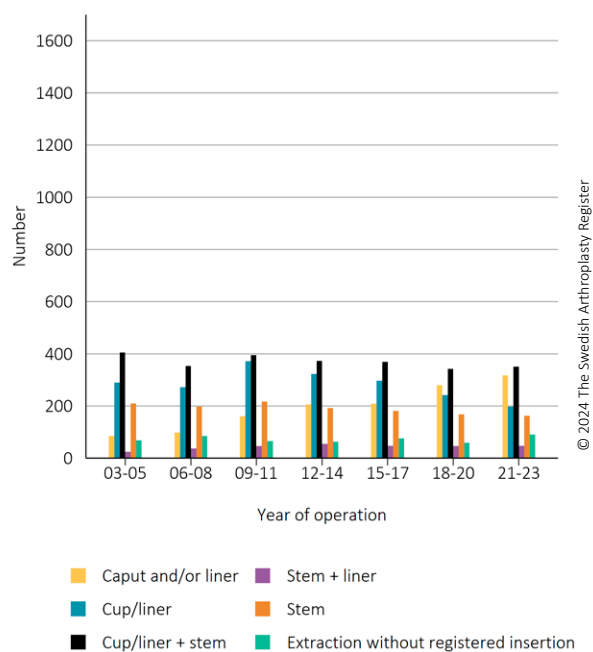
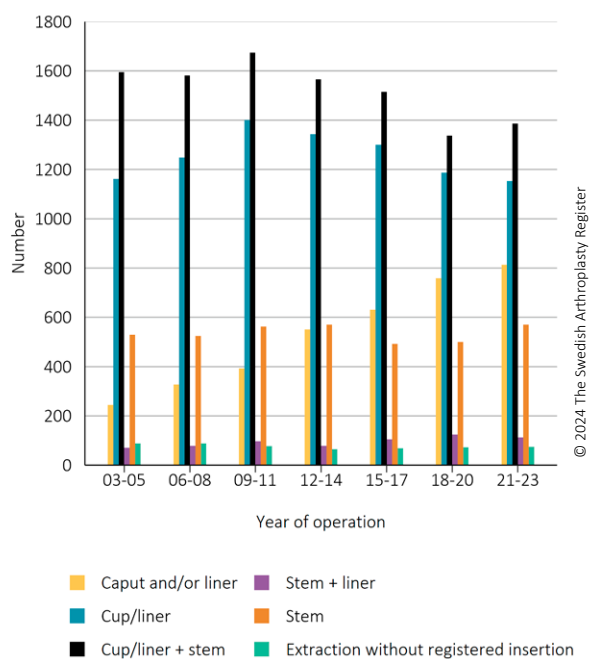


Figure 5.4.10 a–b. Number of different procedures at first (a) and multiple revisions (b) in three-year periods from 2003 to 2023.

Choice of procedure related to reason for revision

The type of procedure varies depending on the reason for revision. As noted elsewhere in this section, “exchange/insertion” indicates that the patient may have undergone a two-stage procedure. Extractions followed by recorded prosthesis insertion have therefore been excluded. Figures 5.4.11 a and b illustrate the relative distribution of procedures related to the reason for revision for first-time and multiple revisions performed from 2018 to 2023.

For aseptic loosening in first-time revisions, the predominant procedure is exchange of the cup/liner, with or without stem exchange. In multiple revisions, it is relatively more common to only revise the stem and possibly also change the liner. In cases of deep infection, exchange of the head and/or liner is dominant for both first-time and multiple revisions. As expected, the relative proportion of definitive extractions increases significantly if the hip replacement has been revised at least once before. The majority of periprosthetic fractures are revised with stem exchange, while cup exchange is performed in 29.1% of first-time revisions and 27.1% of cases in multiple revisions.

In the few cases where only the cup/liner was exchanged (18 first-time revisions and 6 multiple revisions), it involved a periacetabular fracture with a fixed stem in 18 of the cases. In the remaining 6 cases, there was a femoral fracture fixed with a plate, with the cup being exchanged. The most common procedure for first-time revisions due to dislocation is cup exchange with or without stem exchange (75.4% for first-time, 55.1% for multiple revisions). Only exchange of the head/liner was performed in 18.4% and 31.0% of cases, respectively.

Choice of Fixation

The shift towards increased use of uncemented fixation occurred somewhat earlier in revision surgeries compared to primary operations. On the acetabular side, an increase in uncemented fixation was observed in first-time revisions until the 2012–2014 period, and in multiple revisions until the 2009–2011 period (see figures 5.4.12 a and b). After these peaks, the total number of cup revisions began to decline. From 2021 to 2023, uncemented cups were used in 61.3% of first-time revisions and 58.4% of multiple revisions. A similar pattern can be seen on the stem side. The highest number of uncemented stems in first-time revisions was recorded during 2012–2014, with

1,047 uncemented stems reported. For multiple revisions, the peak occurred in 2009–2011, with 379 uncemented stems (see figures 5.4.13 a and b). Since then, the relative use of uncemented stems in first-time revisions has only shown marginal fluctuations, ranging from 46% to 48%. In multiple revisions, the percentage varied between 53% and 58% since the 2006–2008 period. In the most recent period (2021–2023), the proportion was 54.4%. In summary, uncemented cups were more frequently used in both first-time and multiple revisions over the last three years. Cemented stems were more common in first-time revisions, while uncemented stems dominated in multiple revisions.

Bone grafts were used more often in cup than stem revisions, particularly with cemented fixation. From 2021 to 2023, bone grafts were utilized in 23.9% of first-time revisions involving cemented cups and 37.3% for uncemented cups. For multiple revisions, these proportions were slightly lower, at 35.5% and 31.3%, respectively. In first-time stem revisions, bank bone was used in 7.5% of cemented and 6.0% of uncemented stem procedures. For multiple stem revisions, the figures were 8.4% and 6.7%, respectively. The use of bone grafts in cup insertions has decreased since the 2006–2008 period, from 37.0% to 23.9% in first-time revisions, regardless of fixation type. A similar decrease was observed in multiple revisions, dropping from 31.3% to 14.9%. The use of bone grafts in stem revisions has declined even more in relative terms, from 16.3% to 5.1% for first-time revisions between 2003–2005 and 2021–2023. In multiple revisions, the reduction was slightly lower, from 14.7% to 5.4%.

In revision surgery, the terms “fully cemented,” “fully uncemented,” “hybrid,” and “reverse hybrid” can be difficult to interpret, depending on whether the entire prosthesis or only parts are replaced. Here, we have chosen to reflect only the first option—cases where all prosthesis components were replaced, regardless of whether the procedure was performed in one or two stages.

Between 2003 and 2023, both the number and proportion of complete exchange/insertion of both the cup and stem decreased. The number of reported cases fluctuated over the years but showed a trend towards fewer cases overall. The highest and lowest counts were recorded in 2009 and 2020, with 709 and 504 cases, respectively. After 2020, there was a slight increase, reaching 555 cases by 2023.

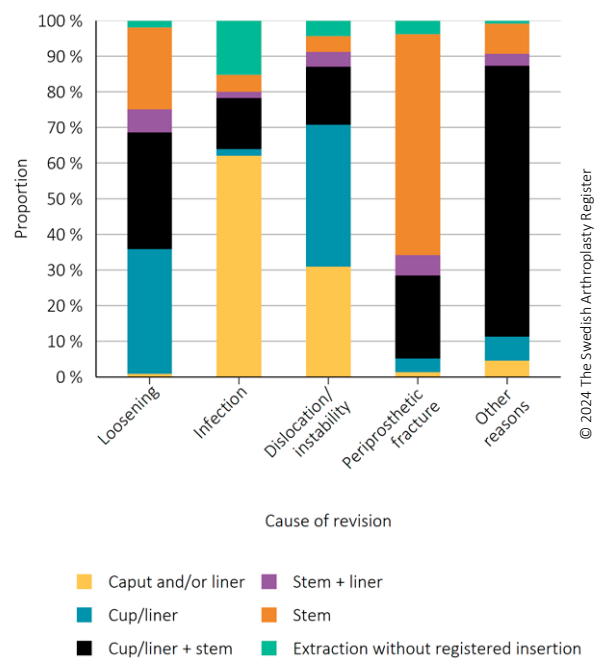
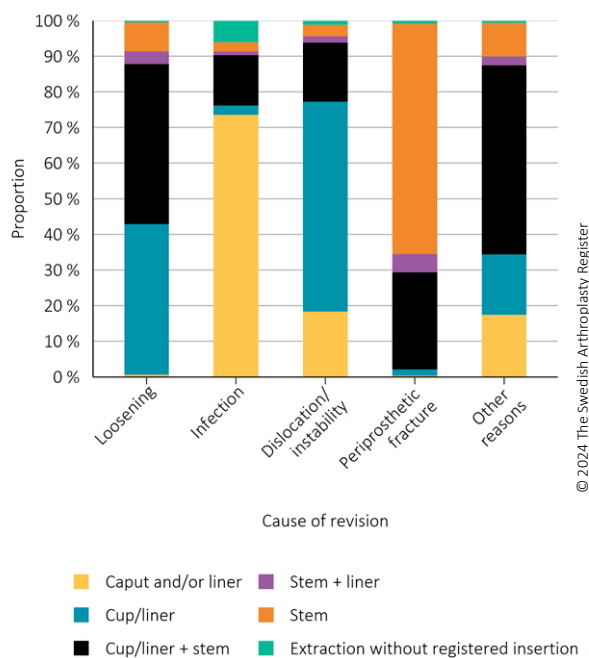


Figure 5.4.11 a–b. Relative distribution of procedures grouped by reason for revision at first (a) and multiple revisions (b) during the period 2018–2023.

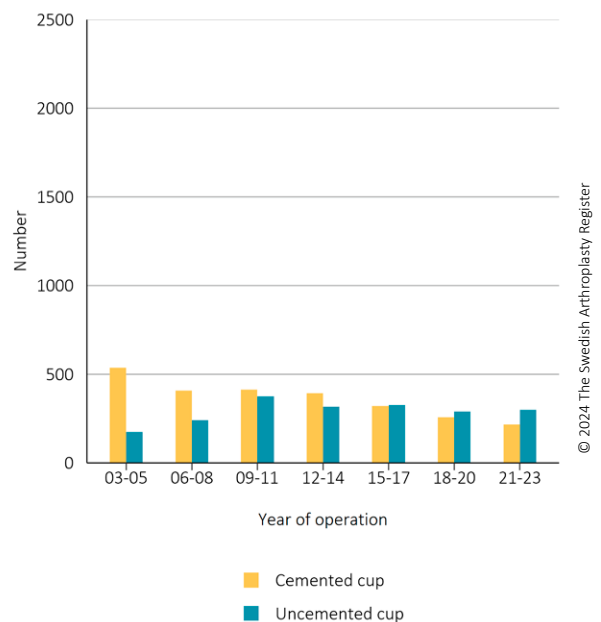
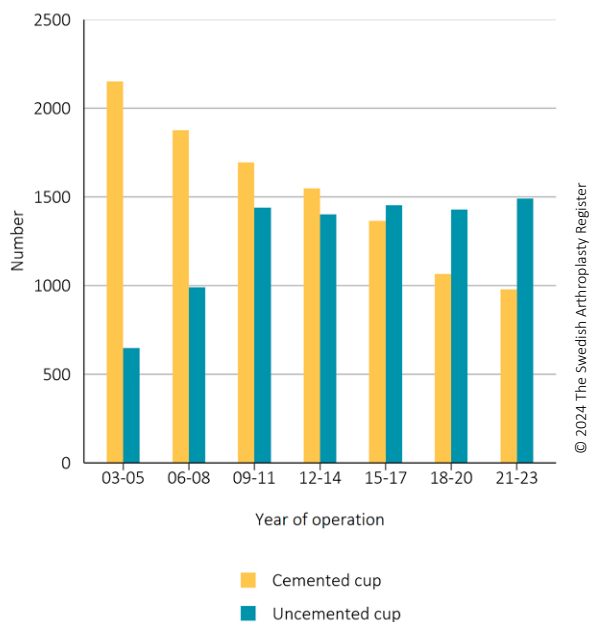


Figure 5.4.12 a–b. Distribution of cemented and uncemented fixation of the cup at first (a) and multiple revisions (b) in three-year periods from 2003 to 2023.

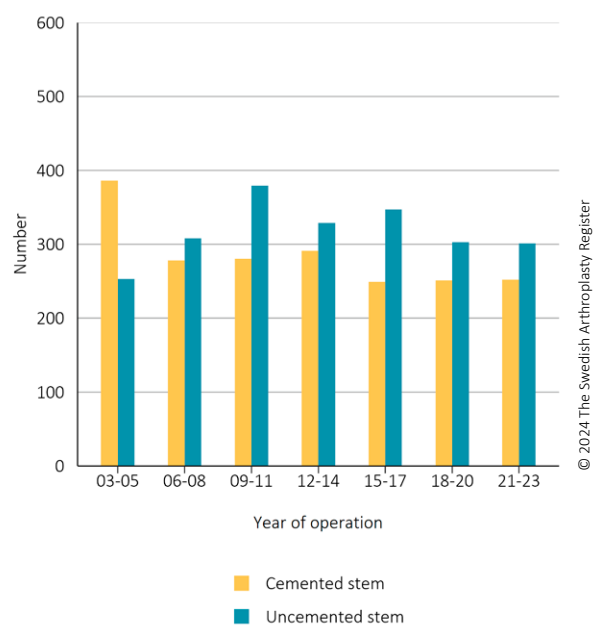
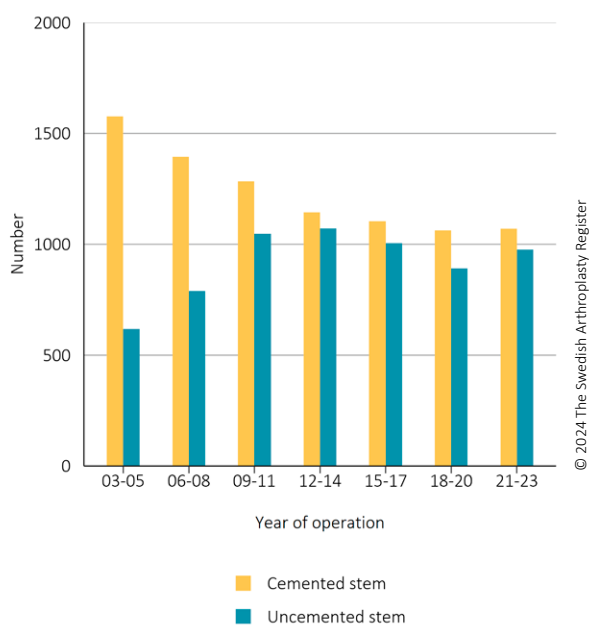


Figure 5.4.13 a–b. Distribution of cemented and uncemented fixation of the stem at first (a) and multiple revisions (b) in three-year periods from 2003 to 2023.

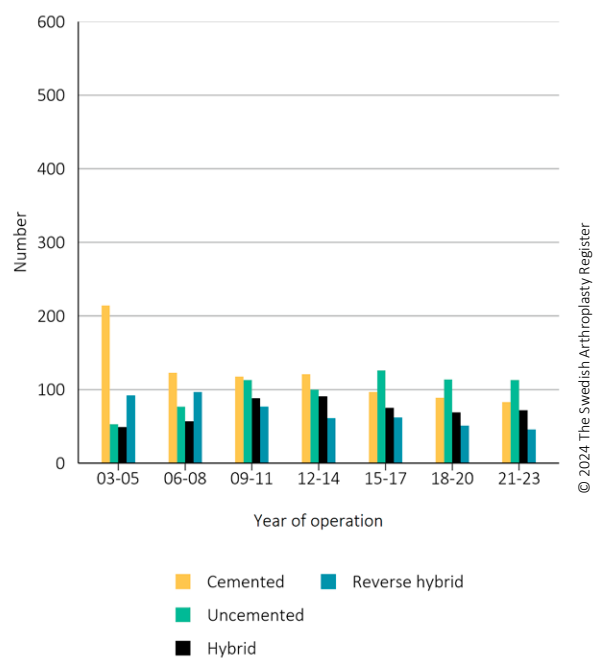
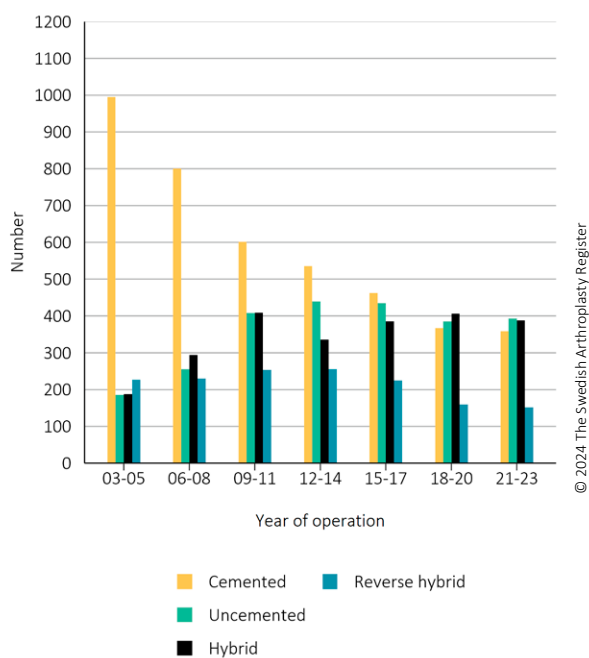


Figure 5.4.14 a–b. Number of revisions and choice of fixation in cases where all prosthesis components are exchanged at first (a) and multiple revisions (b) in three-year periods from 2003 to 2023.

In the early 2000s, cemented fixation was by far the most common option for first-time revisions (Figure 5.4.14 a). However, the use of uncemented and hybrid fixation increased over time, while fully cemented fixation decreased. Since the 2018–2020 period, the number of cemented, uncemented, and hybrid fixation procedures has been relatively balanced. Reverse hybrid fixation increased modestly until 2012–2014 but then declined. In the most recent period, reverse hybrid fixation accounted for just under 12%, while the other three methods (cemented, uncemented, and hybrid) each made up about 28–30% of the total. A similar pattern can be observed in multiple revisions concerning the use of cemented and uncemented fixation, although hybrid fixation tends to be slightly less common in these cases (Figure 5.4.14 b).

Choice of liner and dual articulation

Over the past two decades, the use of cup or liner designs aimed at reducing the risk of dislocation has become increasingly common (Figures 5.4.15 a and b). Liner designs with features such as elevated rims, increased inclination, or similar characteristics were introduced as early as the 1980s. At that time, some cemented cups were available with a “snap-fit” feature, where the cup opening was slightly smaller than the femoral head, requiring some force to push the head back into the cup during

repositioning. However, snap-fit cups were eventually discontinued as they were believed to increase the risk of loosening. A more effective way to secure the femoral head in the cup is through the use of a “constrained liner,” which remains in limited use today, likely due to similar issues observed with the snap-fit cups, despite mixed results in the literature. Dual Mobility Cup (DMC) were first reported in 2002 (a single revision case) and have seen increasing use since then. In 2023, 529 revision cases were reported, meaning that DMCs were used in 46.2% of all cup revisions. That same year, DMCs were used in 6.2% of all primary surgeries, regardless of diagnosis.

Cemented fixation has been far more common than uncemented in cases where standard revision cups were used. From 2021 to 2023, cemented DMCs were used in 485 first-time revisions and 123 second-time revisions. In comparison, uncemented DMCs were used in 129 and 24 cases, respectively. When including cases where a DMC was cemented into an uncemented cup shell, as well as cases where an uncemented cup was converted to a DMC, the uncemented group expands to 540 first-time revisions and 192 second-time revisions. This makes the uncemented group larger than the group where the DMC was cemented directly to the bone, whether it was a first- or multiple-time revision.

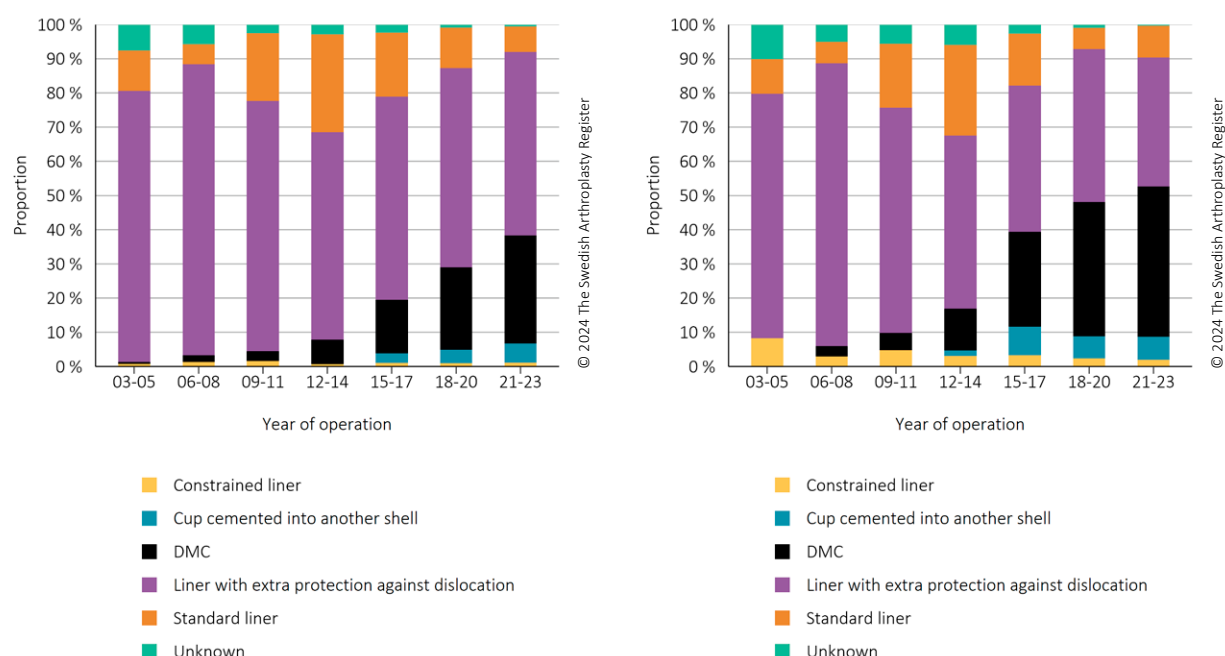


Figure 5.4.15 a–b. Use of liner type in first (a) and multiple revisions (b) from 2003 to 2023, aimed at stabilizing the femoral head to prevent dislocation.

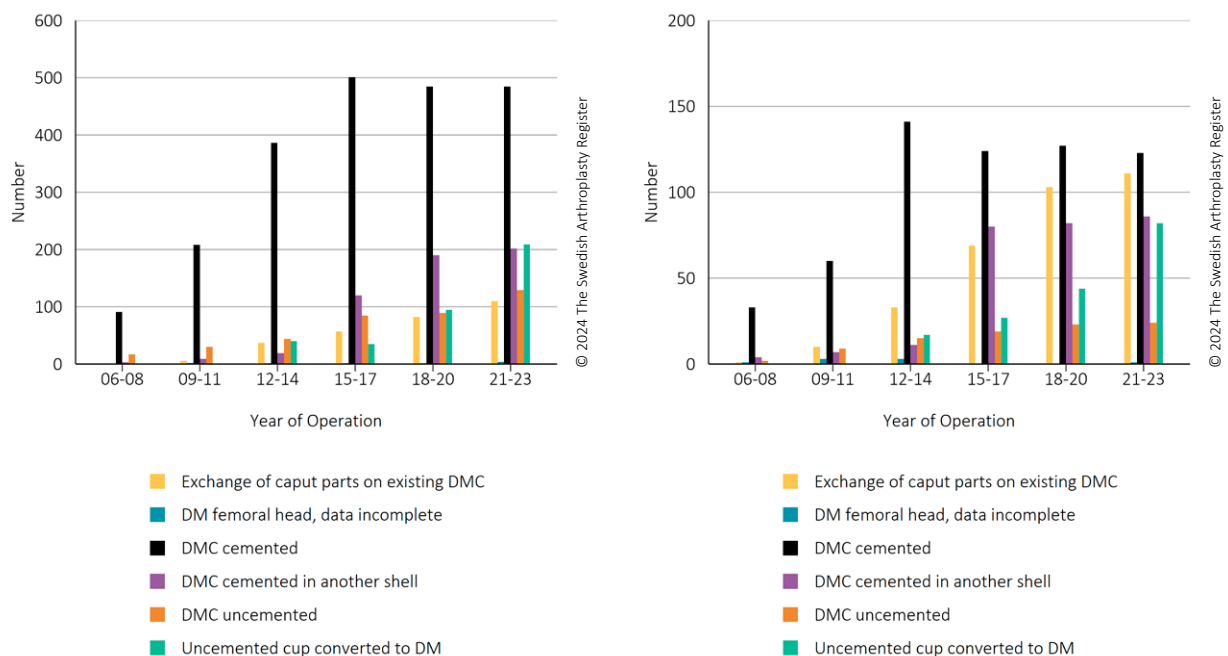
Choice of femoral head

The selection of femoral heads for standard cups, excluding those with double-articulating joints, is discussed here. Femoral heads are routinely replaced in nearly all revisions. Since 2003, information on the inserted femoral head is available for 91.6% of all revisions. In the remaining cases, the head either was not replaced or the replacement was not reported. Figures 5.4.17 a and b show how the choice of femoral head size has changed from 2003–2005 for both first-time and repeat revisions. Over time, there has been a transition towards 32 mm and 36 mm heads, due to the introduction of highly cross-linked polyethylene and the desire to reduce dislocation risk. For both first-time and repeat revisions, 32 mm heads have become the most common, used in 61.8% of first revisions and 49.4% of repeat revisions during the 2021–2023 period. When excluding cases where this information is missing, these proportions increase to 64.4% and 57.2%, respectively. The use of 36 mm heads has increased during the entire period for first-time revisions and accounted for approximately one-quarter (24.1%, including missing data) of all cases from 2021–2023. In repeat revisions, the use of 36 mm heads peaked in 2015–2017 at 24.3%, followed by a slight decline in the most recent period.

The choice of stem

Since 2003, the number of stem revisions has shown a tendency to decrease. During the 2003–2005 period, there were 2,834 reported revisions where the stem was replaced, either with or without simultaneous cup/liner revision. In the following three-year periods, the number of stem revisions fluctuated between 2,773 and 2,991. However, starting from the 2015–2017 period, the number of revisions began to decline, and in the most recent period (2021–2023), 2,628 stem revisions were reported—about 200 fewer than during 2003–2005. This reduction was fairly evenly distributed between first-time and repeat revisions.

For this report, the classification of stems was updated to better reflect current practices while maintaining clarity. In cemented fixation, standard-length stems (≤ 15 cm) were predominantly used in both first-time and repeat revisions, though more frequently in first-time revisions (figures 5.4.18 a and b). During the 2021–2023 period, 49.7% of first-time revisions with a standard stem involved a “cement-in-cement” revision. The corresponding figure for repeat revisions was slightly lower at 42.1%.



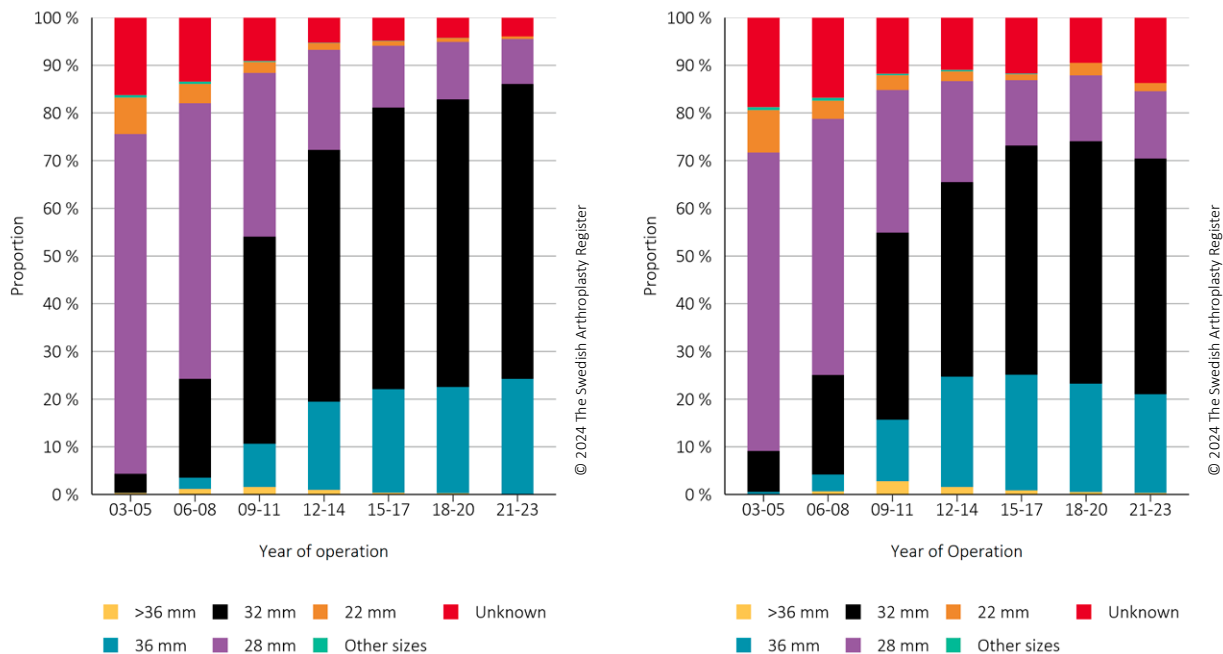


Figure 5.4.17 a–b. Choice of femoral head size in first (a) and multiple revisions (b) from 2003 to 2023. Prostheses with dual-mobility cups have been excluded.

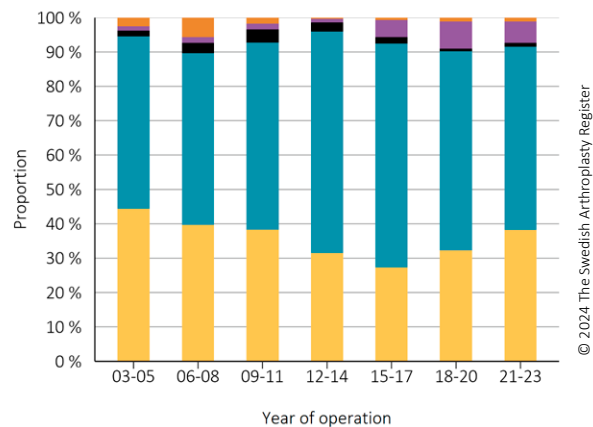
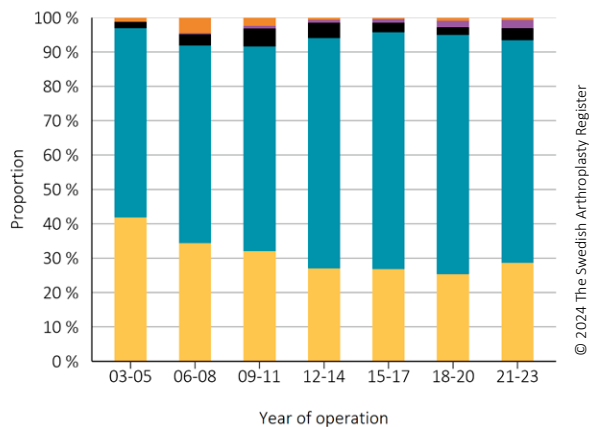
Cemented modular stems have been used infrequently, but their use has increased over time. Only seven cases were reported in the 2003–2005 period, but by 2021–2023, there were 43 cases, with 26 of these being first-time revisions. Among uncemented stems, modular designs have become the dominant choice, particularly in repeat revisions (figures 5.4.18 c and d). Their use increased until 2012–2014 for first-time revisions and until 2015–2017 for repeat revisions, after which it stabilized at around 80% for first-time revisions and just over 85% for repeat revisions.

Choice of Specific Implants

Table 5.4.5 details the most commonly used cemented and uncemented cups and stems for 2022, 2023, and 2013, with annual updates. The stem classification adjustment revealed that some MP stems had been mistakenly categorized as uncemented, which affected the distribution of the top five most-used revision stems in 2022.

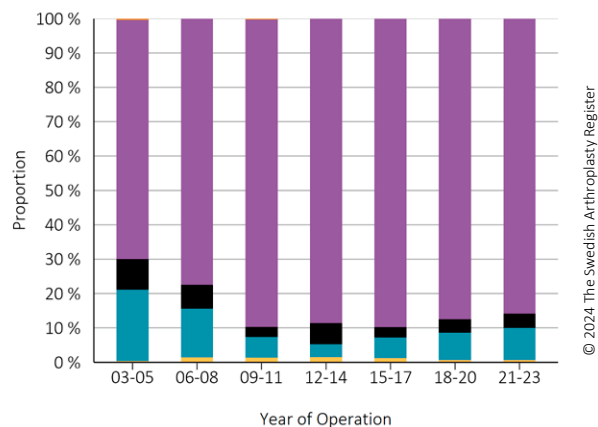
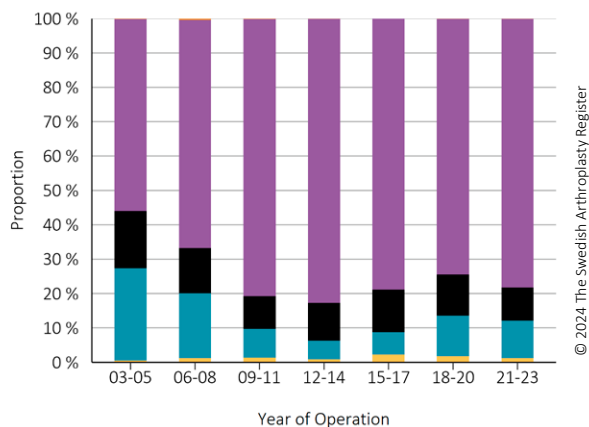
For cemented cups, three of the most-used options were double-articulating, though the Exeter Rim Fit cup was the most common. In 2023, more than half (52.3%) of cemented cup revisions involved a DM cup. For uncemented cup revisions, the most popular options in both 2022 and 2023 were the Tritanium and TMT revision cups. These were often used with DM articulation, either through the use of metal liners or by cementing a DM cup into a metal shell. In 2023, of all uncemented cup revisions with DM articulation, 17.1% (111 cases) involved a metal liner, 12.6% (82 cases) involved cementing a DM cup into an uncemented shell, and 7.9% (51 cases) involved the use of an uncemented DM cup.

For cemented fixation of the stem, the Exeter standard (15 cm long) or SPII (130 or 150 cm) were the most frequently used in all three reported years (2013, 2022, and 2023). Between 2013 and 2023, the majority of revisions using the Exeter standard stem involved either a cement-in-cement revision (50.0% of operations) or bone transplantation (25.8%). For revisions with the SPII stem, the corresponding rates were 21.0% for cement-in-cement and 20.9% for the use of bone allografts (excluding cortical grafts).



- Cemented long stem, length >15 cm
- Cemented standard stem, ≤ 15 cm
- Cemented standard stem, varying length dependent on size
- Cemented two-part stem
- Cemented, not classified/unknown

- Cemented long stem, length >15 cm
- Cemented standard stem, ≤ 15 cm
- Cemented standard stem, varying length dependent on size
- Cemented two-part stem
- Cemented, not classified/unknown



- Uncemented, intended for metaphyseal fixation
- Uncemented long revision stem
- Uncemented standard stem, varying length dependent on size
- Uncemented two-part stem
- Uncemented, not classified/unknown

- Uncemented, intended for metaphyseal fixation
- Uncemented long revision stem
- Uncemented standard stem, varying length dependent on size
- Uncemented two-part stem
- Uncemented, not classified/unknown

Figure 5.4.18 a–d. Distribution of cemented (a–b) and uncemented (c–d) stem types in first (a and c) and multiple revisions (b and d) from 2003 to 2023.

The shorter Exeter stem was above all used for cement-in-cement revisions, accounting for at least 89.9% of cases. In 6.6% of the cases, information on this variable was missing, meaning the actual percentage could be even higher. Over the period, the use of the short Exeter stem decreased by more than half, from 72 in 2013 to 33 in 2023, while the use of the Exeter standard and SPII stems (≤ 150 cm) increased from 156 to 180 and from 129 to 161 per year, respectively.

For uncemented revision stems, modular stems were used in just under 80% of all cases with uncemented fixation during both 2022 and 2023. The four designs currently in use, which are also four of the five most-used according to Table 5.4.5, are Restoration, MP, Arcos, and Revitan. In 2023, a long uncemented revision stem was used in 11.0% of cases, with the Corail Revision stem being the most dominant, accounting for 8.4% of all uncemented revision stems (36 out of 47 revisions with long uncemented stems).

Results

The risk of revision surgery increases progressively with each hip revision. The cumulative 15-year risk for primary total hip replacements (THRs) performed from 2003 onwards is $7.9\% \pm 0.2\%$ (39,620 observations at 15 years). This risk increases significantly with subsequent revisions: $22.2\% \pm 0.8\%$ after the first revision (2,294 observations), $27.4\% \pm 1.8\%$ after the second revision (446 observations), and $35.5\% \pm 3.4\%$ for hips revised at least twice previously (116 observations). These risks are depicted in Figure 5.4.19. The risk data are also broken down by gender in Figure 5.4.20, but only up to 13 years, as only 87 male and 116 female hip replacements remained at that point. Males generally have a higher cumulative revision risk for primary, first, and second revision surgeries.

The prognosis worsens with each additional revision, as the risk of re-revision increases. Cox regression analysis, adjusted for factors such as age, sex, primary diagnosis, and year of operation, shows that the cumulative revision risk from 2003 to 2023 was 3.8 times higher after a first revision compared to a primary surgery (95% confidence interval: 3.7–4.0). The risk increases to 5.5 times for second revisions (CI: 5.2–5.9) and 7.8 times higher for hips revised at least twice previously (CI: 7.2–8.5). Overall, the risk is about 38% higher in males compared to females (hazard ratio: 1.38, CI: 1.34–1.41).

The reason for revision also affects the likelihood of further revisions. The cumulative risk of re-revision is highest within the first few years after the index revision, especially for cases due to infection or dislocation, as shown in Figures 5.4.21 a and b. Early revisions tend to occur shortly after the index operation, with infection and dislocation being common reasons. However, after four to five years, the curves for different revision causes diverge, primarily because the risk of re-revision due to infection decreases. This group also experiences high mortality, and many hips revised due to infection undergo prosthesis extraction.

Over the past 25–30 years, the outcomes of primary hip replacement surgery, measured as the risk of revision, have gradually improved, and the same trend is observed for revisions. While the risk of early re-revision after first-time revisions has increased, long-term results have improved (Figure 5.4.22). The increase in early revisions can partly be attributed to a growing number of revisions due to infection (Figure 5.4.23). Increased use of uncemented fixation, which carries a higher risk of early periprosthetic fractures, may also have played a role. The reasons for the improved outcomes over the long term, when the revision risk curves begin to converge and eventually cross, are less clear. As noted, the number of revisions due to loosening has decreased over the past two decades, likely due to the transition from older plastic types to more wear-resistant plastics with extra crosslinking. Increased use of uncemented fixation, which may reduce the risk of loosening in the long run, may also have contributed, although further evidence is needed to confirm this.

For second-time revisions, a similar pattern emerges regarding how the cumulative risk of re-revision has changed over time. Initially, the risk is elevated for the periods 2006–2014 and 2015–2023. However, after seven to eight years, the revision risk decreases, and the lines representing the 1997–2005 and 2006–2014 periods cross each other (Figure 5.4.24). For patients operated on between 2015 and 2023, the number of observations drops below 100 just before the eight-year mark. Regarding patients who have undergone at least two prior revisions, a similar trend is observed. Patients re-revised between 2006 and 2014 show a lower long-term risk compared to those re-revised between 1997 and 2005 (Figure 5.4.25). Whether multiple revisions performed after 2014 will show better long-term outcomes compared to earlier periods remains uncertain. The limited number of observations and the uncertainty of long-term trends make it difficult to draw definitive conclusions at this stage.

Most used cup and stem

2013		2022		2023	
Name	%	Name	%	Name	%
Cup, Cemented, n	644	Cup, Cemented, n	419	Cup, Cemented, n	386
Avantage	23.9	Avantage	24.3	Exeter Rim-fit	23.6
Exeter Rim-fit	23.0	Exeter Rim-fit	23.2	Avantage	21.2
Marathon	14.1	Lubinus x-link	16.0	BiMobile shell	17.6
Lubinus x-link	11.5	BiMobile shell	11.2	Lubinus x-link	11.1
Lubinus	5.9	Polarcup cemented	11.0	Polarcup cemented	10.4
Other	21.6	Other	14.3	Other	12.1
Cup, Uncemented, n	573	Cup, Uncemented, n	598	Cup, Uncemented, n	679
TMT revision	26.4	Tritanium revision (trident)	23.4	Tritanium revision (trident)	23.6
Continuum	17.8	TMT revision	20.6	TMT revision	17.1
Trilogy	8.6	Continuum	7.0	G7 OsseoTi	9.0
TMT modular	5.6	Pinnacle W/Gription 100	6.7	Pinnacle W/Gription 100	8.2
Mallory Head	5.4	G7 OsseoTi	6.4	Pinnacle 100	6.5
Other	36.3	Other	36.0	Other	35.6
Stem, Cemented, n	481	Stem, Cemented, n	477	Stem, Cemented, n	484
Exeter standard	32.4	SPII standard (≤ 15 cm)	36.5	Exeter standard	37.2
SPII standard (≤ 15 cm)	26.8	Exeter standard	34.4	SPII standard (≤ 15 cm)	33.3
Exeter short revision stem	15.0	Exeter long	9.6	Exeter long	7.6
Exeter long	6.7	Exeter short revision stem	7.1	Exeter short revision stem	6.8
MS-30 polished	4.6	MP cemented	2.9	MP cemented	3.5
Other	14.6	Other	9.4	Other	11.6
Stem, Uncemented, n	447	Stem, Uncemented, n	391	Stem, Uncemented, n	428
MP	43.8	Restoration	37.1	Restoration	34.1
Restoration	21.3	MP	19.7	MP	21.5
Revitan	13.2	Arcos	15.9	Arcos	19.6
Arcos	4.3	Revitan	7.2	Corail revision	8.4
Bi-Metric X por HA NC	4.0	Corail revision	6.9	Revitan	5.1
Other	13.4	Other	13.3	Other	11.7

Table 5.4.5. The five most commonly used cemented and uncemented cups and stems in revision surgery, expressed as a percentage of the total number reported in 2013, 2022, and 2023. Includes both first-time and multiple revisions.

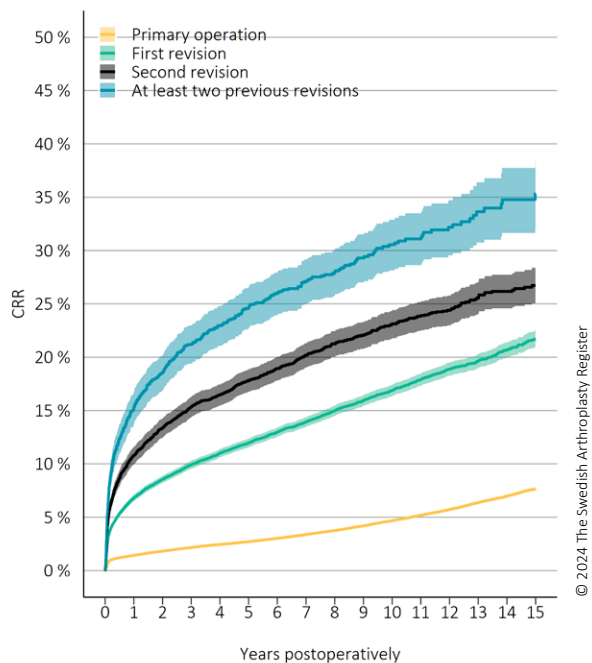


Figure 5.4.19. Cumulative risk of revision until 15 years, regardless of sex, based on the outcome of revision for any reason.

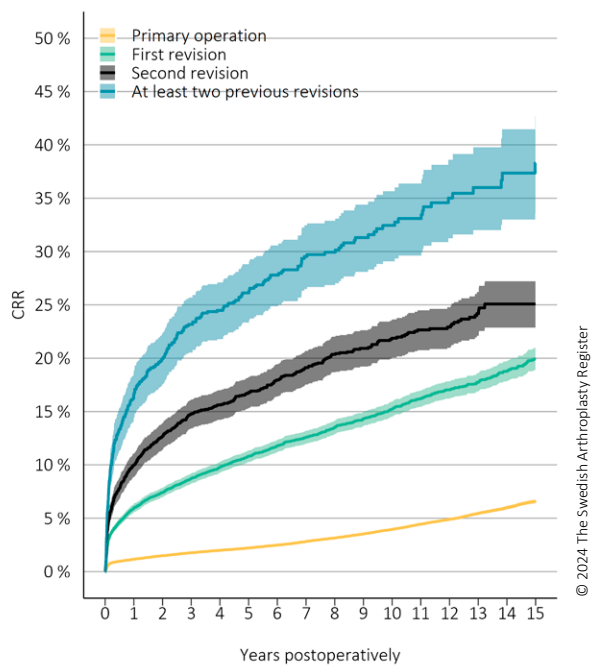
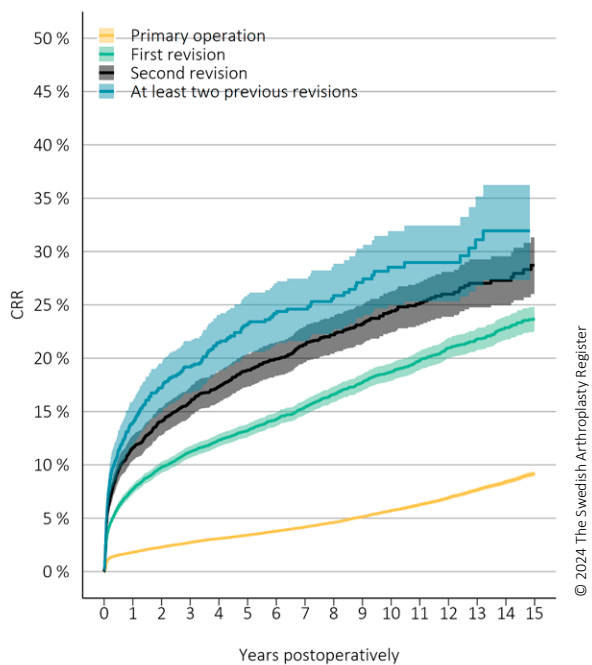


Figure 5.4.20 a–b. Cumulative risk of revision in males (a) and females (b) until 13 years. Includes revisions regardless of reason and procedure for primary total hip replacement, first- and second-time revisions, as well as revisions of hip replacements that have undergone at least two previous revisions. Revisions performed from 2003 onwards are included.

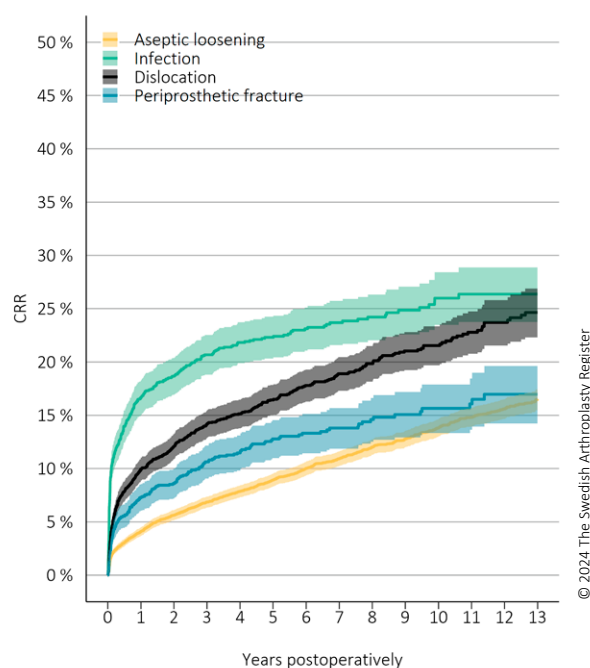
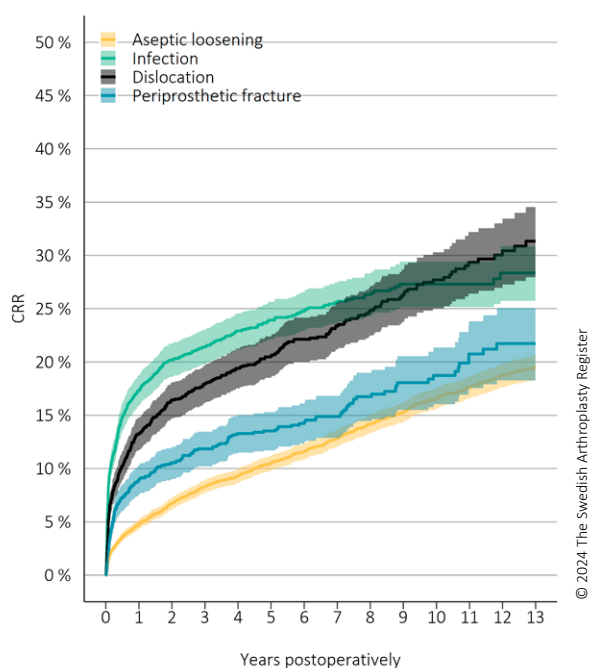


Figure 5.4.21 a–b. Cumulative risk of revision in males (a) and females (b), divided by reason for revision and based on the outcome of revision regardless of reason, procedure, or the number of previous revisions. Revisions performed from 2003 onwards are included. The curves are truncated at 13 years, as the number of observations in the smallest group falls below 100 thereafter.

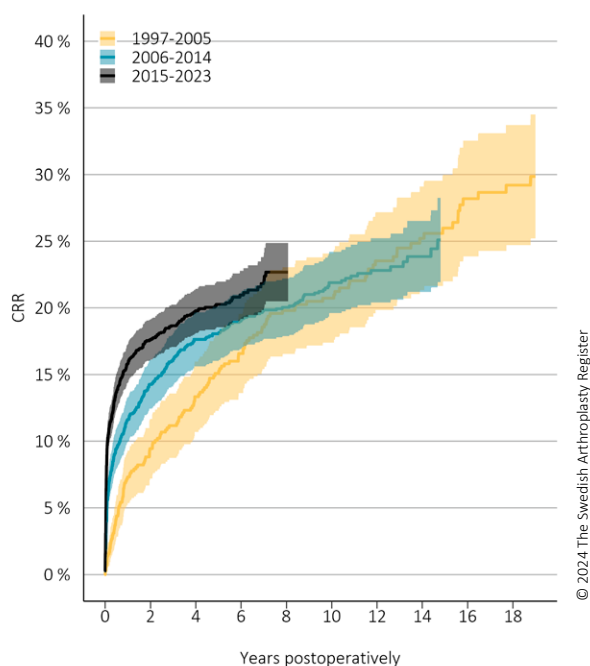
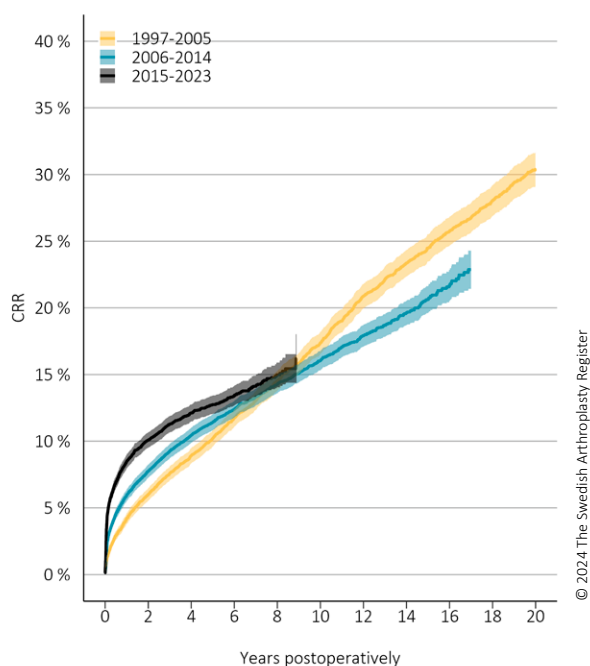


Figure 5.4.22. Cumulative risk of re-revision for all reasons and procedures following first-time revisions performed regardless of reason during the periods 1997-2005, 2006-2014, and 2015-2023. Calculations are terminated when fewer than 100 observations remain (for the periods 2006-2014 and 2015-2023) or after 20 years (for the period 1997-2005).

Figure 5.4.23. Cumulative risk of re-revision for all reasons and procedures following first-time revisions performed due to infection during the periods 1997-2005, 2006-2014, and 2015-2023. Calculations are terminated when fewer than 100 observations remain.

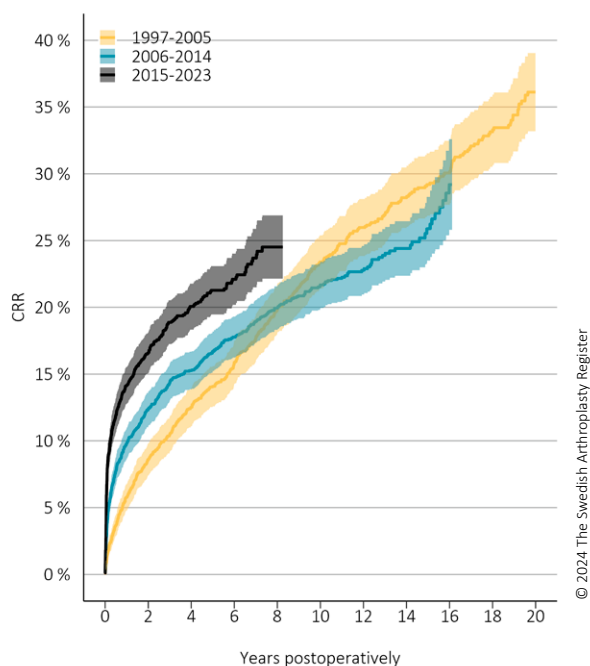


Figure 5.4.24. Cumulative risk of re-revision for all reasons and procedures following second-time revisions performed regardless of reason during the periods 1997-2005, 2006-2014, and 2015-2023. Calculations are terminated when fewer than 100 observations remain.

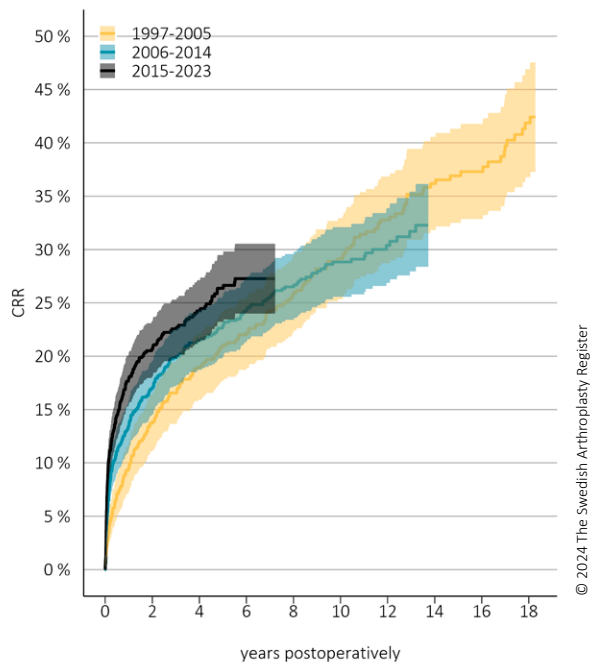


Figure 5.4.25. Cumulative risk of re-revision for all reasons and procedures following revisions that were preceded by at least two previous revisions and performed regardless of reason during the periods 1997-2005, 2006-2014, and 2015-2023. Calculations are terminated when fewer than 100 observations remain.

Summary

Revision of a hip replacement involves a patient who has previously undergone hip replacement undergoing an additional operation where the entire prosthesis or parts of it are replaced or extracted.

Since the period 2003 to 2005, the proportion of revisions out of the total number of primary and revision surgeries has decreased from 10.7% to 8.0% during 2021 to 2023.

Since 2003, loosening has been the predominant cause of first-time and multiple revisions, but its relative proportion has gradually decreased. Instead, the proportion of revisions due to infection has increased and become the most common reason for revision in cases that have been revised at least once before.

Patients undergoing revision are generally older, more often male, and have more often diagnoses other than osteoarthritis, as well as a higher degree of comorbidity compared to those undergoing primary prosthesis surgery.

Long-term outcomes after primary and first-time revision, measured as the risk of further revision, have improved. However, in the first few years following the index operation, the risk of re-revision has increased due to a growing number of re-revisions caused by infection.

The risk of experiencing additional revisions increases with the number of previous revisions. The prognosis is worst for revisions due to infection, followed by revisions due to dislocation. Therefore, the importance of optimizing outcomes at the primary surgery cannot be overstated.

5.5. Evaluation of implants and implant combinations

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Regulations for medical devices

From 1993 to 2017, implants in the EU were regulated under a directive (Medical Device Directive, MDD) aimed at harmonizing laws and regulations across the EU. To comply with the then-current regulations, manufacturers had to ensure that their products met relevant health, environmental, and safety requirements, which was achieved through external assessment by a designated organization (notified body). The resulting CE marking (CE = Conformité Européenne) indicated that the product could be used on the European market. CE marking for implants did not require evidence of acceptable results from well-designed clinical studies but assessed the product more from a material perspective.

In 2017, a new, more ambitious regulatory framework was introduced, the Medical Device Regulation (MDR, Regulation (EU) 2017/745), which came into effect on May 26, 2021. Transitional provisions apply to certain types of implants. The regulation is extensive and emphasizes the importance of clinically demonstrable benefits related to the level of risks, unique identification of implants, and post-market surveillance. The regulation applies not only to entirely new implants but can also pertain to a new size of an existing prosthesis. The manufacturer must demonstrate that the new prosthesis provides clear clinical patient benefits combined with a low risk of complications. In practice, this means that unrestricted clinical use cannot be permitted until a sufficiently large patient population has been followed for a sufficient period. Additionally, the clinical outcome based on patient-reported data must meet current standards, and the risk of complications must be low. Although the key parts of the regulation have been implemented, some transitional provisions will remain in effect until December 31, 2028. The concept also includes the creation of a database (European Databank on Medical Devices, EUDAMED) where all information about a current prosthesis will be collected and to which complications can be reported. The database is still under development. It will provide a unique product identification (unique device identifier – UDI), information on clinical trials, and will serve, among other things, for safety monitoring and market control.

There has been some criticism of the MDR as the regulation leaves the choice of study design to manufacturers, national regulations, and organizations designated within a country to assess products and determine what type of evidence is required for an implant to be considered effective and safe. In 2020, the EFORT Patient & Implant Safety Initiative (IPSI) was initiated by EFORT, resulting in an initial consensus document on how the introduction of joint prostheses should occur within MDR 2017/745. This work was followed by a more comprehensive study, divided into 32 different areas, all related to implants and implant evaluation, with each area being highlighted by a selected expert group (www.researchgate.net/publication/376751347).

In principle, the new regulation is beneficial as patient benefits are significant. The level of safety will be higher, and the risk of future implant-related problems will be reduced. However, the regulation also makes it more complicated, time-consuming, and likely more expensive to introduce new implants and innovations. On the other hand, the need for well-designed clinical studies will also increase. Reasonably, prices will also be affected, but the extent of this remains unclear.

Situation in Sweden

In Sweden, there has long been a cautious stance regarding the replacement of standard implants. This attitude is likely the main reason why Sweden has among the lowest revision rates in the world. The clinical outcomes for the majority of new implants have often been comparable to, and in several cases worse than, existing ones. In some cases, this cautious attitude may have resulted in implants with better characteristics than the current standard being introduced late into Swedish healthcare. However, this disadvantage is relatively minor compared to the good results noted for the most commonly used prosthesis types in Sweden, as well as the sometimes catastrophic consequences that can arise when a new and unknown implant is used on a large number of patients.

Currently, there are no preclinical tests that can reliably determine whether a new prosthesis functions better or worse than existing ones. Since the prostheses currently used in Sweden generally meet high standards, further implant development is expected to make a difference mainly in selected patient groups. Replacing standard implants also involves some risk because new procedures must be learned. Given this, it is clear that implant changes should only be made when there is a clinical need and the replacement implant has documented advantages. Service and pricing also matter, although the price usually represents a minor part of the total cost.

The merged hip and knee arthroplasty registers in Sweden have a long history, the longest in the world. Continuous feedback of results has meant that, in general, only well-documented implants are routinely used. Despite this, differences in the risk of revision exist among the implant combinations used. When assessing these differences, it is important to relate them to a clinical reality. If a reference implant experiences one revision per 1,000 inserted prostheses over a ten-year period, and another implant experiences two revisions per 1,000 inserted prostheses, the risk for the latter implant is doubled. The risk also doubles if the reference implant experiences one revision per 100 inserted prostheses and the other implant experiences two revisions per 100 inserted prostheses. Despite the same increase in risk, case two results in ten times more patients needing revision over a ten-year period. When evaluating the clinical significance of an increased risk, it is therefore of great interest to assess how common it is for the reference implant to undergo revision.

This year's evaluation of cemented and uncemented cups and stems includes surgeries performed between 2013 and 2023. Surgeries caused by acute or previous trauma (such as fractures/dislocations or residual conditions after these injuries) and tumor diagnoses have been excluded. The risk of revision is adjusted for differences in the distribution of diagnosis, age, sex, and year of surgery. As mentioned above, increased or decreased risk should be evaluated against the absolute number of revisions in the reference group. One should also consider that the analyses presented are more or less affected by partially unknown factors such as patient and provider selection. Many factors must be taken into account when interpreting the results.

In previous annual reports, we have briefly summarized how other prosthesis registers evaluate implants to

illustrate that the procedure for implant evaluation is not entirely simple or obvious. Most registers use the outcome of revision, regardless of the reason or which component is revised. Some registers multiply the number of observed components by the number of observation years, which means they do not account for the fact that the causes of revision vary over time. To the extent that comparisons with other prostheses are made, the comparison group can correspond to all other implants, all other implants in the same product category, a selected reference group, or a reference implant. Sometimes a fixed threshold, such as 5% cumulative revision risk after 10 years, is used. To date, there has been no established standard. Such a standard is not easy to achieve since the conditions vary between different registers concerning the total number of observations, the number of different implants used within the register's coverage, the length of follow-up time, and the extent of the individual register's data capture. Additionally, the thresholds set for acceptable revision risk are constructed at a specific point in time. What constitutes an acceptable standard today may not always hold true.

Selection of outcome and control group

Cemented and uncemented implants have been separated, which may be questioned (see separate in-depth analysis). However, the indication for choosing fixation varies, which may support a division based on fixation type. When evaluating the risk of revision for the cup versus the stem, we have chosen outcomes such as cup or stem revision caused by non-infectious complications, regardless of the cause. For cups, the outcome is thus cup revision including liner revision, provided that the revision was not due to infection. For stems, the corresponding outcome is non-infectious stem revision. In both cases, revisions where other components have also been replaced or extracted are included. To report data, the number of observed implants must exceed 100.

In each of the four analyses (cemented cup, uncemented cup, cemented stem, uncemented stem), a comparison is made against a reference implant. The selection criteria for the reference implant are based on sufficiently high and continuous usage during the analyzed period. The advantage of a reference implant is that the data may be easier to interpret. A possible disadvantage is that the reference implant may need to be changed over time if it is modified or its relative use decreases or ceases, which in this year's analysis applies to the Trilogy cup. This year's

analysis is based on components inserted from 2013 to 2023 with follow-up until December 31, 2023. When evaluating cups, hip replacements with both cemented and uncemented stems are included. Similarly, cases with both cemented and uncemented cups are included in the stem analysis. This procedure is not obvious because, for example, the risk of cup revision may be influenced by the choice of stem fixation. Uncemented stems are more likely to experience early periprosthetic fractures. During revision, it may also be necessary to replace the cup to avoid dislocation. However, we believe that this bias is relatively limited. Different types of bias and random variations should be considered especially carefully if the implant group of focus is below 500 to 1,000 observations and the number of revisions is not notably high.

Cemented cup

In the group of cemented cups, Marathon has been used as the reference. This cup was introduced in 2008. The polyethylene is irradiated with 5 MRad. Between 2013 and 2023, the number of reported insertions decreased progressively from 1,816 in 2013 to 393 in 2023. In Table 5.5.1, we see that none of the cups used during the period have a significantly lower risk than the Marathon cup for non-infectious cup revision. As in previous years, there are four cups that show an increased risk. Three of them are made from polyethylene materials that were standard for cemented cups in Sweden until the first decade of the 2000s (Lubinus, Contemporary Hooded Duration, ZCA). In all these cases, these cups are revised more often due to loosening (percentage of cup revisions during the period: 0.8%, 1.7%, 2.0%; reference - Marathon 0.6%) and less frequently due to dislocation (0.4%, 0.6%, 0.6%; reference - Marathon 0.3%). ZCA XLPE, made of highly cross-linked polyethylene, is revised more often than the Marathon cup, mainly due to dislocation (0.8%). The Contemporary Hooded Duration cup is also notably revised more often due to periprosthetic fractures of the femur or acetabulum (1.1%; reference - Marathon 0.5%).

Uncemented cup

The first version of the Trilogy cup has been used as the reference until the previous year's report. This cup has been used in Sweden since 1994. Between 2012 and 2021, the number of reported Trilogy cups varied from 331 to 672. In 2022, 81 cases were registered, and none

in 2023. For this year's report, a different reference cup, Trident Hemi, which previously showed a risk for cup revision not significantly different from Trilogy, has been chosen. During the period 2013 to 2023, the number of inserted Trident Hemi cups increased from 302 in 2013 to 1,029 in 2023, totaling 8,378 over the entire period. Most of the Trident Hemi cups have been inserted with some type of liner with dislocation protection, and a few (n=34) with a metal insert and dual-articulating joint. Sixteen of the 24 cups presented in Table 5.5.2 have been used only with highly cross-linked polyethylene liners. In five of these (Pinnacle W/Gription 100, Pinnacle 100, Allofit, Regenerex, TMT revision), liners of older polyethylene types have been used in a few cases (up to 5 cases). Ceramic liners occur in up to 2.6% (Pinnacle Sector) among the cups that may have different types of inserts. Among those that can be converted to dual-articulating function, this function has been utilized in up to 9% (Tritanium Revision, G7 OsseoTi).

In Table 5.5.2, none of the uncemented cups significantly differ from the reference cup due to a lower revision risk. Thirteen cups have a significantly increased risk of cup revision, nine of which also showed increased risk in the previous year's report when compared to the Trilogy cup. The risk increase for some of these cups, especially those used more frequently, is in many cases doubled and in some cases even tripled. All but Trilogy IT and Pinnacle W/Gription Sector show a marginally to slightly increased risk of cup revision due to loosening (Pinnacle Sector: 0.4%, Pinnacle W/Gription 100: 0.4%, Pinnacle 100: 0.5%, Trident AD LW: 0.5%, TMT Revision: 0.6%, reference - Trident Hemi: 0.2%). For some cups, the difference is more pronounced (Delta-TT: 0.7%, Continuum: 0.7%, BHR: 1.7%, Avantage Reload: 2.5%), but the number of observations for the last two is small. All cups with increased revision risk are revised more often due to dislocation except for G7 PPS. The highest frequency of revision due to dislocation occurs after the insertion of Continuum, Trilogy IT, and TMT Revision (1.4–2.5%), while the increase for others is more moderate (0.5 to 0.9%; reference - Trident Hemi: 0.3%). In three cases, the cup has been revised more often in connection with revision due to periprosthetic fracture (Avantage Reload, Trident AD LW, Trilogy IT, all 0.8%; reference - Trident Hemi: 0.3%).

Hazard ratio for cemented cup revision with Marathon cup as the reference

	Number	Revisions Number	Follow-up*	HR (95% CI)	p
Marathon	11,457	82	10	Reference	
Lubinus x-link	48,894	307	10	1.16 (0.91;1.49)	0.23
Exeter Rim-fit	24,533	144	10	1.03 (0.78;1.35)	0.84
Lubinus	13,074	146	10	1.71 (1.30;2.24)	<0.01
ZCA XLPE	4,808	73	10	1.96 (1.43;2.69)	<0.01
IP Link	2,594	13	9	1 (0.56;1.81)	0.99
Exceed ABT E-poly without flange (cem)	2,266	10	10	0.98 (0.51;1.9)	0.96
Avantage	1,826	14	10	1.32 (0.74;2.35)	0.34
Contemporary Hoded Duration	1,306	32	10	2.89 (1.92;4.36)	<0.01
ZCA	1,135	27	9	2.89 (1.87;4.48)	<0.01
Polarcup cemented	317	<5	8	0.61 (0.09;4.43)	0.63
BiMobile shell	293	<5	2	2.5 (0.61;10.29)	0.20
FAL	161	<5	10	2.1 (0.66;6.67)	0.21
<i>FAL x-link</i>	<i>153</i>	<i>0</i>	<i>10</i>		
Low profile cup	137	<5	9	1.78 (0.44;7.25)	0.42
Other	379	7	10	2.62 (1.21;5.67)	0.01
Diagnosis (OA)				0.48 (0.39;0.59)	<0.01
Increasing age (per year)				0.97 (0.97;0.98)	<0.01
Sex (female)				0.9 (0.78;1.03)	0.12
Later surgical year (per year)				1.06 (1.03;1.09)	<0.01

Table 5.5.1. Hazard ratio (HR) with 95% confidence interval for undergoing cup revision with the use of cemented fixation. The Marathon cup serves as the reference (value 1). To be included in the analysis, at least 100 observations are required. Implants with no reported cup revisions are indicated in italics. The reported hazard ratios are adjusted for diagnosis, age, sex, and year of surgery. Follow-up time is reported until fewer than 20 observations remain. Red text indicates a statistically significant increased risk of revision (the lower limit of the confidence interval is above 1.0). Green text indicates a statistically significant decreased risk of revision (the upper limit of the confidence interval is below 1.0).

*) Time point in years after the primary surgery when the number of remaining observations is at least 20.

Hazard ratio for uncemented cup revision with Trident Hemi as the reference

	Number	Proportion with liner of standard type %	Revisions Number	Follow-up*	HR (95 % CI)	p
Trident Hemi	8,378	9.8	39	10	Reference	
Pinnacle W/Gription 100	17,502	75.2	168	10	2.36 (1.66;3.35)	<0.01
Pinnacle 100	5,398	41	65	10	2.67 (1.80;3.98)	<0.01
Continuum	5,280	62.1	101	10	3.15 (2.17;4.57)	<0.01
Trilogy	3,676	1.7	15	10	0.68 (0.38;1.24)	0.21
G7 PPS	3,531	22.7	24	8	2.25 (1.34;3.78)	<0.01
Pinnacle W/Gription Sector	3,077	73.3	31	10	2.60 (1.62;4.18)	<0.01
Trilogy IT	2,375	22.8	47	10	3.57 (2.33;5.47)	<0.01
Pinnacle sector	1,946	77.1	19	10	2.11 (1.22;3.65)	0.008
Exceed ABT Ringlock	1,593	1.8	15	10	1.40 (0.77;2.55)	0.275
Trident AD LW	1,459	1.3	16	10	2.15 (1.20;3.85)	0.01
Trident II	1,150	8.3	<5	5	1.43 (0.51;4.03)	0.501
Tritanium	1,018	26.5	8	10	1.42 (0.66;3.05)	0.364
Trident AD WHA	1,001	19	6	10	1.08 (0.46;2.56)	0.857
Allofit	793	17	5	10	1.09 (0.43;2.79)	0.85
Delta-TT	698	73.4	9	10	2.09 (1.01;4.32)	0.047
Regenerex	614	0.3	6	10	1.36 (0.57;3.22)	0.489
TMT revision	360	5.3	9	10	3.72 (1.79;7.74)	<0.01
Tritanium revision (trident)	146	2.1	<5	6	1.62 (0.22;11.84)	0.635
BHR	120	-	5	10	4.94 (1.92;12.72)	<0.01
Avantage Reload	118	-	<5	8	4.49 (1.38;14.59)	0.012
Delta Motion	116	-#	<5	10	0.91 (0.12;6.68)	0.927
G7 OsseoTi	110	67.3	<5	8	4.74 (1.14;19.66)	0.03
R3	107	97.2	<5	10	1.16 (0.16;8.48)	0.882
Delta-PF	100	96	<5	9	2.94 (0.71;12.20)	0.138
Other	743	35.7	23	10	5.13 (3.04;8.65)	<0.01
Diagnosis (OA)					0.68 (0.54;0.86)	<0.01
Increasing age (per year)					1.00 (0.99;1.00)	0.2
Sex (female)					0.95 (0.81;1.11)	0.53
Later surgical year (per year)					0.99 (0.96;1.02)	0.51

Table 5.5.2. Hazard ratio (HR) with 95% confidence interval for undergoing cup revision with the use of uncemented fixation. The proportion of cups inserted with a standard liner is reported separately. The Trident Hemi cup serves as the reference (value 1). To be included in the analysis, at least 100 observations are required. The reported hazard ratios are adjusted for diagnosis, age, sex, and year of surgery. Follow-up time is reported until fewer than 20 observations remain. Red text indicates a statistically significant increased risk of revision (the lower limit of the confidence interval is above 1.0). Green text indicates a statistically significant decreased risk of revision (the upper limit of the confidence interval is below 1.0).

*) Time point in years after the primary surgery when the number of remaining observations is at least 20.

#) Monoblock cup with a ceramic bearing surface

-) Shell for dual mobility cup or surface replacement cup

Cemented stem

In the analysis of cemented stems, the SPII stem 150 mm has been used as the reference. This choice is based on a large number of observations and long-term documentation. Previous reports have shown a low risk of revision for the SPII stem, with some reservation for the smallest size (extra narrow, size 01). Size 01 constitutes 2.4% of the reference group. In the Swedish Arthroplasty Register's database, the length of a relatively large proportion of Exeter stems (18.6%) is missing. In the previous year's analysis, these were combined with Exeter stems of length 150 mm. This year, the group with unknown stem length is reported separately ("Exeter stem length unknown," Table 5.5.3).

Five of the seven cemented stem types reported (MS30, Exeter 150, Exeter 125, SPI 130, Exeter stem length unknown) have an increased risk of stem revision during the current period. All except Exeter 150 mm show a more than doubled risk. CPT 130 mm also has a doubled risk, but unlike the previous year, the difference is not statistically significant. MS30, Exeter 150 mm, Exeter 125 mm, and the Exeter group with unknown stem length all show an increased proportion revised due to periprosthetic fracture (all 0.3 to 0.4%; reference - SPII 150 mm: <0.05%). MS30 is also relatively more often revised due to dislocation (0.2%; reference stem <0.05%). The short Exeter stem is revised more frequently due to implant fracture (0.07%; reference stem: 0.002%). Regarding Lubinus 130 mm, it is revised twice as often due to loosening compared to the two-centimeter longer stem of the same design (see separate in-depth analysis).

Hazard ratio for cemented stem revision with SPII 150 mm as the reference

	Number	Revisions Number	Follow-up*	HR (95 % CI)	p
SPII 150 mm	56 472	214	10	Referens	
MS30	15 588	116	10	2,42 (1,93;3,04)	<0,01
Exeter 150 mm	21 422	121	10	1,42 (1,13;1,74)	<0,01
Exeter 125 mm#	2 805	21	10	2,42 (1,53;3,84)	<0,01
CPT 130 mm	508	<5	8	2,02 (0,63;6,44)	0,213
SPII 130 mm	3 610	29	10	2,72 (1,83;4,04)	<0,01
Exeter stamlängd okänd	5 676	45	10	2,32 (1,63;3,24)	<0,01
SPII 170 mm	129	0	1		
Övriga	413	6	10	2,32 (1,03;5,44)	0,038
Diagnos (artros)				0,42 (0,33;0,64)	<0,01
Ökande ålder (per år)				0,92 (0,93;1,04)	0,61
Kön (kvinna)				0,42 (0,33;0,44)	<0,01
Senare operationsår (per år)				1,02 (0,93;1,04)	0,37

Table 5.5.3. Hazard ratio (HR) with 95% confidence interval for undergoing stem revision with the use of cemented fixation. The SPII stem 150 mm serves as the reference (value 1). To be included in the analysis, at least 100 observations are required. The reported hazard ratios are adjusted for diagnosis, age, sex, and year of surgery. Follow-up time is reported until fewer than 20 observations remain. Red text indicates a statistically significant increased risk of revision (the lower limit of the confidence interval is above 1.0). Green text indicates a statistically significant decreased risk of revision (the upper limit of the confidence interval is below 1.0). Italic text indicates that the data set is insufficient for analysis.

*) Time point in years after the primary surgery when the number of remaining observations is at least 20.

#) Includes short revision stems

Uncemented stem

In this year's analysis, Corail standard with collar has been used as the reference. In previous reports, standard stems with and without collars were grouped together. In 2013, the collarless variant was more common, accounting for about two-thirds of all reported standard stems (64.5%). However, a change occurred in 2018, when

the relative proportion of Corail standard stems with a collar increased, and by 2020, the ratio of collared to collarless stems was reversed (64.9% collared stems). Since then, their proportion has continued to rise, and by 2023, 89.1% of the reported Corail standard stems were collared.

Hazard ratio for revision of uncemented stem with Corail standard with collar as the reference

	Number	Revisions Number	Follow-up*	HR (95 % CI)	p
Corail standard with collar	11,848	73	10	Reference	
Corail standard without collar	11,180	94	10	1.10 (0.80;1.50)	0.555
Corail coxa vara	7,422	27	10	0.55 (0.36;0.86)	0.009
Corail high offset	7,002	83	10	1.67 (1.21;2.31)	<0.01
CLS	6,924	60	10	1.26 (0.89;1.79)	0.197
Accolade II	6,451	28	10	0.72 (0.46;1.11)	0.134
M/L Taper	5,383	44	10	1.52 (1.04;2.22)	0.03
Bi-Metric X por HA NC	4,059	61	10	1.71 (1.20;2.46)	<0.01
Echo-Bimetric (FPP)	2,312	14	9	1.14 (0.64;2.03)	0.659
Wagner Cone	1,417	20	10	2.00 (1.21;3.33)	0.007
ABG II HA	1,062	29	10	3.23 (2.07;5.03)	<0.01
Accolade Straight	415	<5	10	0.54 (0.13;2.20)	0.386
SP-CL	393	<5	8	1.24 (0.39;3.93)	0.72
Echo-Bimetric (RPP)	333	<5	9	1.55 (0.49;4.93)	0.457
Bi-Metric por HA	223	<5	7	0.59 (0.08;4.23)	0.597
ANATO	151	<5	9	4.03 (1.47;11.04)	0.007
Fitmore	147	<5	10	0.75 (0.10;5.45)	0.779
CFP	125	<5	10	3.56 (1.29;9.86)	0.015
Other	638	7	10	1.47 (0.67;3.21)	0.333
Diagnosis (OA)				0.79 (0.59;1.07)	0.127
Increasing age (per year)				1.02 (1.01;1.03)	<0.01
Sex (female)				0.93 (0.78;1.10)	0.399
Later surgical year (per year)				1.00 (0.97;1.04)	0.917

Table 5.5.4. Hazard ratio (HR) with 95% confidence interval for undergoing stem revision with the use of uncemented fixation. The Corail stem with standard offset and 135° CCD angle with collar serves as the reference (value 1). To be included in the analysis, at least 100 observations are required. The reported hazard ratios are adjusted for diagnosis, age, sex, and year of surgery. Follow-up time is reported until fewer than 20 observations remain. Red text indicates a statistically significant increased risk of revision (the lower limit of the confidence interval is above 1.0). Green text indicates a statistically significant decreased risk of revision (the upper limit of the confidence interval is below 1.0).

*) Time point in years after the primary surgery when the number of remaining observations is at least 20.

Of the seven stems that show an increased risk of stem revision, five of them have a higher risk for revision due to loosening. For the M/L Taper, which in previous years was not associated with a significant increase in revision risk, the increase is marginal (0.3%, compared to the reference Corail standard with collar: 0.2%). The M/L Taper stem also shows a marginally increased risk for revision due to periprosthetic fracture (0.3%, reference: 0.2%). The other stems that exhibit higher frequencies of revision due to loosening include: Corail High Offset and ABG II HA (both 0.7%), Wagner Cone (1.0%), ANATO (2.0%), CFP (3.2%). Aside from M/L Taper (0.3%, reference: 0.2%), ABG II HA (1.5%) also shows an increased frequency of revision due to periprosthetic fracture, as does Bi-Metric X por HA NC (1.2%) and Corail High Offset (0.4%). Wagner Cone, ABG II HA, and ANATO have also been revised more frequently due to dislocation (Wagner Cone: 0.3%, ABG II HA: 0.5%, ANATO: 0.7%; reference: 0.1%).

As noted, interpreting the clinical significance of increased or decreased revision risk can be challenging. More detailed data are often required to assess the extent to which patient selection, hip anatomy, and factors such as the care process and surgical technique have influenced the results. Factors that might have relatively greater influence, especially when the number of observations is relatively small, need to be considered. For implants used in thousands and showing increased revision risk over ongoing years, the likelihood that the observed risk increase is at least partially attributable to the implant itself is higher. However, biases might still exist, such as with stems primarily used for patients with unusual hip anatomy or cups that are almost exclusively used with standard liners compared to those used with liners or inserts that offer increased protection against dislocation.

Summary

The European Union's Medical Device Regulation (MDR) came into effect at the end of May 2021. This new regulation requires that the clinical benefit of orthopedic implants, combined with a low risk of complications, must be demonstrated before an implant can be marketed. This means that unrestricted clinical use cannot be permitted until a sufficiently large patient population has been followed up for a sufficient period of time. Transitional rules apply until 2028.

In the evaluation of implants inserted from 2013 to 2023, no specific design, except for the Corail Coxa Vara stem, showed a significantly lower risk for non-infectious cup or stem revision compared to the selected reference implants after adjusting for age, sex, and diagnosis. However, several implants showed an increased risk, which could be attributed to implant-specific factors. Other factors, such as the choice of articulation, surgical technique, and comorbidities, may also have influenced the results, especially in cases with a limited number of observations.

5.6 Hip fracture treatment with hemiarthroplasty or total hip replacement

Author: Cecilia Rogmark

In 2023, the number of individuals treated with a prosthesis for hip fractures continued to increase, reaching 7,264.

This chapter covers both hemiarthroplasty and total hip replacement as methods of fracture treatment, which are the most common approaches for displaced femoral neck fractures. Other types of hip fractures are typically treated with internal fixation. Over 40% of patients undergoing surgery for a hip fracture receive a hip prosthesis.

In 2023, the Swedish Fracture Register reported 15,363 hip fractures in adults. Considering the known completeness of the register, this figure would correspond to nearly 17,000 hip fractures. No exact number can be drawn from the National Patient Register (NPR), as the same fracture can be registered multiple times and right/left codes are sparse used. Adding to the uncertainty about the exact number of hip fractures, a recently published epidemiological study indicates that only 13,929 hip fractures occurred in people over 50 years of age in Sweden in 2019 (Michaëlsson et al. Sci Re. 2024 Jan 6;14(1):706). This

Demography in hip arthroplasty as fracture treatment

	2019	2020	2021	2022	2023
Number	6,532	6,478	6,477	7,003	7,264
Mean age (SD)	81.6 (9.3)	81.4 (9.5)	81.4 (9.3)	81.2 (9.3)	81.4 (9.1)
Age group n (%)					
< 45 years	11 (0.2)	17 (0.3)	14 (0.2)	22 (0.3)	15 (0.2)
45-54 years	51 (0.8)	44 (0.7)	50 (0.8)	42 (0.6)	34 (0.5)
55-64 years	239 (3.7)	248 (3.8)	234 (3.6)	268 (3.8)	269 (3.7)
65-74 years	1,046 (16.0)	1,068 (16.5)	1,026 (15.8)	1,163 (16.6)	1,115 (15.3)
75-84 years	2,442 (37.4)	2,422 (37.4)	2,445 (37.7)	2,746 (39.2)	2,973 (40.9)
≥85 years	2,743 (42.0)	2,679 (41.4)	2,708 (41.8)	2,762 (39.4)	2,858 (39.3)
Females n (%)	4,216 (64.5)	4,047 (62.5)	4,180 (64.5)	4,461 (63.7)	4,524 (62.3)
BMI n (%)					
< 18.5	364 (7.0)	341 (6.7)	410 (7.7)	423 (7.1)	487 (7.6)
18.5-24.9	2,888 (55.6)	2,918 (57.3)	2,918 (54.7)	3,303 (55.1)	3,530 (55.1)
25-29.9	1,516 (29.2)	1,431 (28.1)	1,529 (28.7)	1,750 (29.2)	1,854 (28.9)
30-34.5	362 (7.0)	332 (6.5)	383 (7.2)	431 (7.2)	436 (6.8)
35-39.9	52 (1.0)	64 (1.3)	75 (1.4)	71 (1.2)	82 (1.3)
≥ 40	14 (0.3)	9 (0.2)	19 (0.4)	18 (0.3)	16 (0.2)
ASA-class n (%)					
ASA I	235 (3.7)	161 (2.6)	199 (3.1)	213 (3.1)	206 (2.9)
ASA II	2,258 (35.7)	2,138 (34.1)	2,170 (34.3)	2,302 (33.6)	2,343 (33.0)
ASA III	3,428 (54.2)	3,542 (56.5)	3,492 (55.2)	3,878 (56.5)	4,015 (56.5)
ASA IV	399 (6.3)	426 (6.8)	463 (7.3)	466 (6.8)	537 (7.6)

Table 5.6.1. Demography in fracture related hip arthroplasty.

The most common stem components in fracture patients

	2013	2022	2023
Number	6,241	7,003	7,264
Implant, n (%)			
SPII standard	2,751 (44.1)	4,547 (65.4)	4,938 (68.5)
Exeter standard	2,057 (33.0)	1,703 (24.5)	1,615 (22.4)
MS-30 polished	325 (5.2)	393 (5.7)	338 (4.7)
Covision straight	373 (6.0)	145 (2.1)	148 (2.1)
CPT	382 (6.1)	9 (0.1)	7 (0.1)
Corail standard	104 (1.7)	16 (0.2)	23 (0.3)
Exeter long	34 (0.5)	19 (0.3)	16 (0.2)
Restoration	16 (0.3)	26 (0.4)	26 (0.4)
MP proximal standard	20 (0.3)	15 (0.2)	15 (0.2)
Bi-Metric X por HA NC	46 (0.7)	0 (0.0)	0 (0.0)
Corail coxa vara	16 (0.3)	11 (0.2)	6 (0.1)
Wagner Cone	29 (0.5)	<5	<5
Corail high offset	6 (0.1)	10 (0.1)	10 (0.1)
Accolade II	<5	10 (0.1)	11 (0.2)
Other	79 (1.3)	29 (0.4)	26 (0.4)
Unknown	0 (0.0)	19 (0.3)	26 (0.4)

Table 5.6.2. The most common stem components in fracture patients.

analysis, based on the NPR and not considering national quality registers, concludes that the number of fractures has decreased and will continue to decrease. While this message is encouraging for both individuals and society, the discrepancy between various calculations and sources remains frustrating.

In 2023, there was a shift in the age demographics for hip fracture patients, with the 75–84 age group becoming the largest. Previously, those aged 85 and older had constituted the largest group. This change reflects the large cohorts born from 1945 onward. At the same time, there is a slight increase in the proportion of patients who are significantly ill (ASA class 3 and 4). Other demographic factors remain unchanged (Table 5.6.1).

The rising number of individuals treated with hip prosthesis due to fracture has led to an increase in direct lateral approach, but the ratio of surgical approaches remains relatively stable (Figure 5.6.1). Internationally, various anterior approaches have gained increased interest. These approaches have some advantages in terms of dislocation

rates but are also more complex. It is assumed that there is a learning curve of around 100 surgeries before mastering the technique. This makes the anterior approach less suitable for low-volume surgeons, and its use for fracture patients in Sweden remains low. This year, the number of hemiarthroplasties and total hip replacements with DM cups continues to increase, while the number of conventional total hip replacements remains unchanged (Figure 5.6.5).

Regarding femoral stems, the use of Lubinus SPII stems has further increased, with 68% of patients receiving this type in 2023. The Exeter stem was used for 22% of fracture patients. Including MS-30 and Covision straight stems, nearly 98% of patients are now treated with these cemented stems (Table 5.6.2). These four types show relatively similar rates of revision surgery (Figure 5.6.2 b-e). Lubinus SPII and Exeter stems can now be followed up to 15 years, with a revision rate of just under 7%. The MS-30 stem shows a slightly higher rate at 14 years (9%), while Covision straight has a revision rate around 4% at 11 years.

Sweden exhibits a uniquely low use of uncemented stems for fracture surgery. The most common uncemented stem, Corail, has a higher revision rate compared to cemented stems, with a rate of just over 12% at 14 years (Figure 5.6.2 a).

Surgeons have the option to choose between a hemiarthroplasty or a total hip replacement with an acetabular cup. These options contribute to a wider variety of implant models regarding articulation (Table 5.6.3) compared to the stem options.

The unipolar prosthetic head remains the most common choice, followed by the relatively new Modular Trauma Head (unipolar) and the bipolar UHR Universal Head. When an acetabular cup is used, Lubinus X-link is the most common. The proportion of DM cups is slightly increasing, with Advantage being the most common choice.

The direct lateral approach has a lower revision rate throughout the entire 15-year period compared to the posterior (Figure 5.6.3).

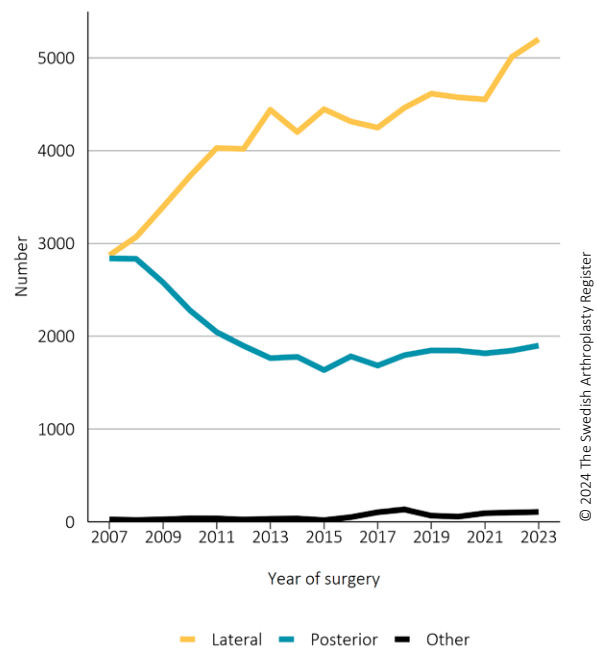


Figure 5.6.1. Choice of surgical approach in fracture related hip arthroplasty.

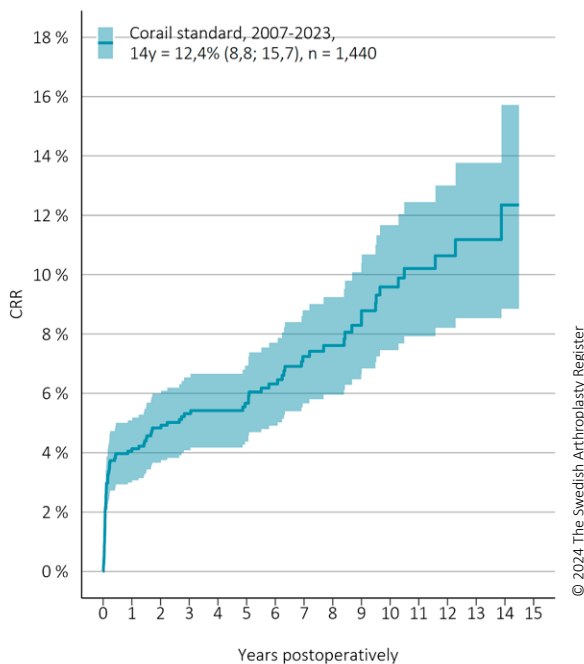


Figure 5.6.2 a. Cumulative risk of revision for the uncemented Corail stem.

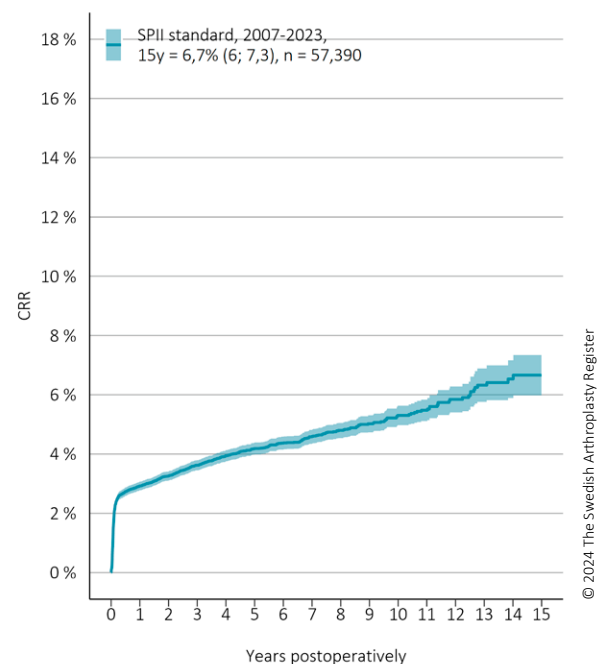


Figure 5.6.2 b. Cumulative risk of revision for the cemented Lubinus II stem.

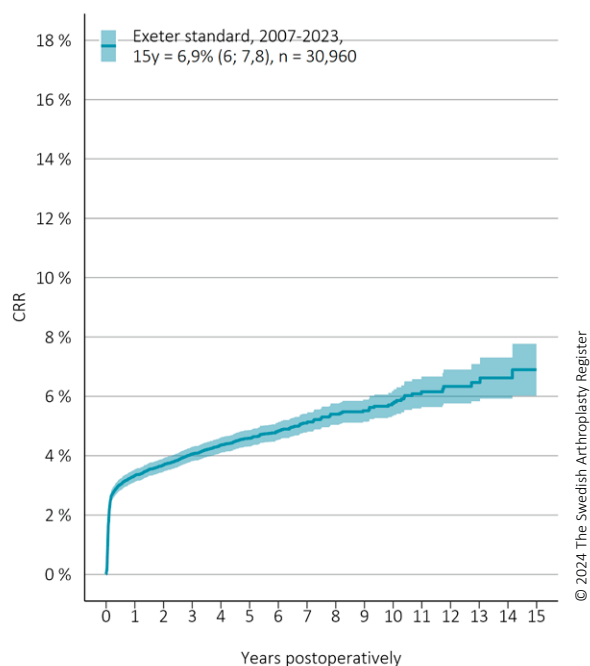


Figure 5.6.2 c. Cumulative risk of revision for the cemented Exeter standard stem.

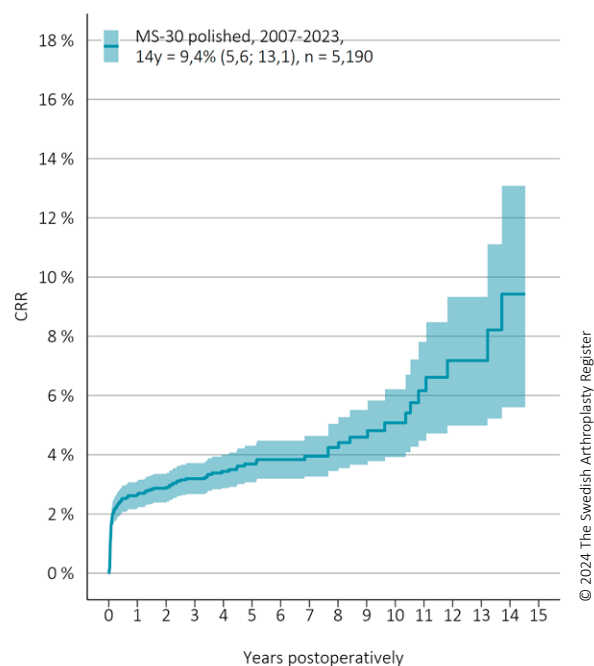


Figure 5.6.2 d. Cumulative risk of revision for the cemented MS30 polished stem.

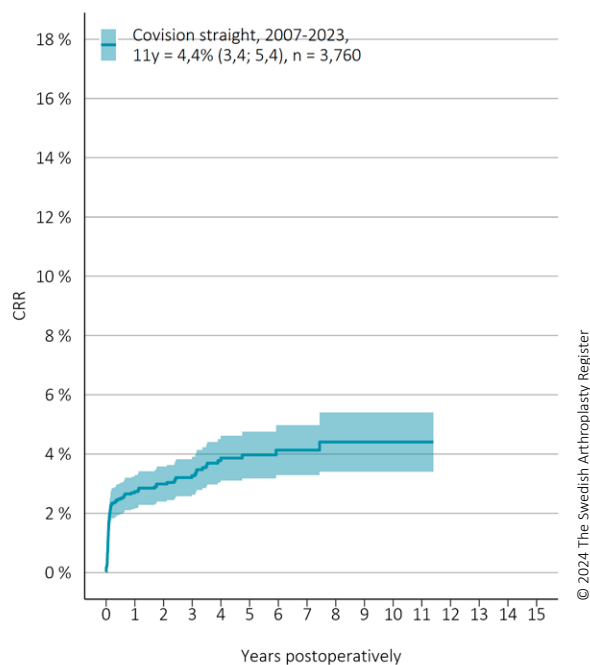


Figure 5.6.2e. Cumulative risk of revision for the cemented Covision straight stem.

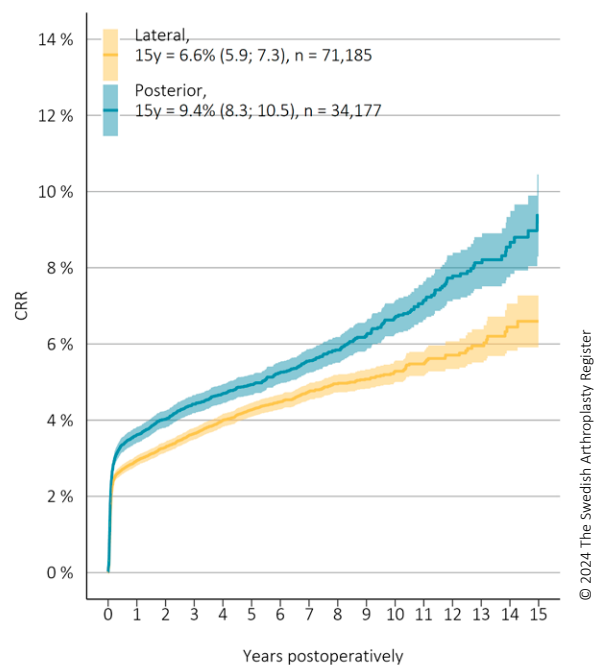


Figure 5.6.3. Cumulative risk of revision related to surgical approach.

Among the four articulation types, the cumulative revision rates are similar (Figure 5.6.4). Total hip replacements have a lower revision rate in the initial years, but after 3 to 4 years, no significant difference is observed. The DM cups follow similar trends to the other articulation types. However, revision rates do not fully capture the overall clinical picture; a significant proportion of patients who experience complications are treated either with less invasive interventions or non-operatively, and their complications are not reflected in this analysis.

New national recommendations

The recommended treatment for femoral neck fractures is outlined in the National Guidelines for Hip Fractures published in 2024 (vardpersonal.1177.se/globalassets/nkk/nationell/media/dokument/kunskapsstod/wardprogram/nationellt-wardprogram-for-hoftfraktur.pdf).

For undisplaced femoral neck fractures, the new recommendation is that most patients, regardless of age or functional ability, should undergo internal fixation with 2–3 parallel pins or screws, or alternatively a sliding screw plate. Prosthesis surgery can be considered for older patients with fracture angulation in the lateral plane greater than 20 degrees backward. The latter could lead to a slight increase in the number of hip replacements performed.

For undisplaced fractures, the Swedish orthopedic community is also awaiting the results of the register-based randomized HipSTHeR study, which compares internal fixation with prosthesis surgery in patients over 75 years of age, regardless of lateral plane angulation.

For displaced femoral neck fractures, internal fixation is advised against for older patients who are deemed capable of undergoing prosthesis surgery. However, internal fixation should be offered to younger, healthier, and more active individuals, despite a higher risk of reoperations. This aligns with current practice in Swedish hospitals, where a (biological) age threshold between “younger” and “older” is set at 60–65 years.

The choice between hemiarthroplasty and total hip replacement varies significantly between hospitals. The national recommendations are:

- Avoid hemiarthroplasty for active **and** cognitively intact individuals who walk outdoors (without walking aids) **and** can perform daily activities independently, to reduce the risk of acetabular erosion and subsequent osteoarthritis.
- Avoid hemiarthroplasty for patients with symptomatic arthritis or osteoarthritis in the affected hip.
- Avoid total hip replacement for patients with cognitive impairment, those who need walking aids for daily activities, or those with a short expected lifespan, to reduce the risk of dislocation.

Considering the fact that most patients with hip fracture are frail and have reduced function before their injury, these recommendations should lead to a decrease in the number of total hip replacements and an increase in hemiarthroplasties.

The guidelines also mentions that direct lateral approach is the preferred choice for hip replacement due to hip fracture and that a DM cup may reduce the risk of dislocation after total hip replacement; for hemiarthroplasty, soft-tissue preserving surgical techniques may have a beneficial effect.

Early reoperations

Early complications such as deep infection, dislocation, and periprosthetic fracture are the most common amongst people who had their arthroplasty due to acute fracture. If there are reasons to avoid revision surgery, the physician may opt for other, less invasive procedures. Therefore, both major and minor secondary procedures are reported in Table 5.6.4 “Reoperations within six months”. This table should be interpreted with caution: if a hospital does not manage registry work satisfactorily, a low number here may indicate poor reporting practices.

The national average result is 3% early reoperations. Among the 16 units with reoperation rates over 4%, there are some small units where individual cases significantly impact the outcomes, as well as units with atypical case mixes. A high frequency of early reoperations may also reflect a proactive approach to addressing issues such as dislocation surgically. Nonetheless, units with high reoperation rates are recommended to conduct local quality improvement efforts.

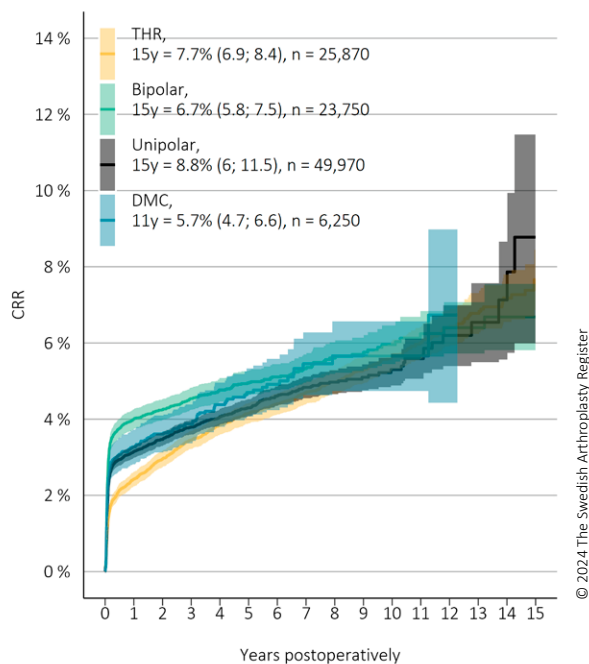


Figure 5.6.4. Cumulative risk of revision related to type of prosthesis.

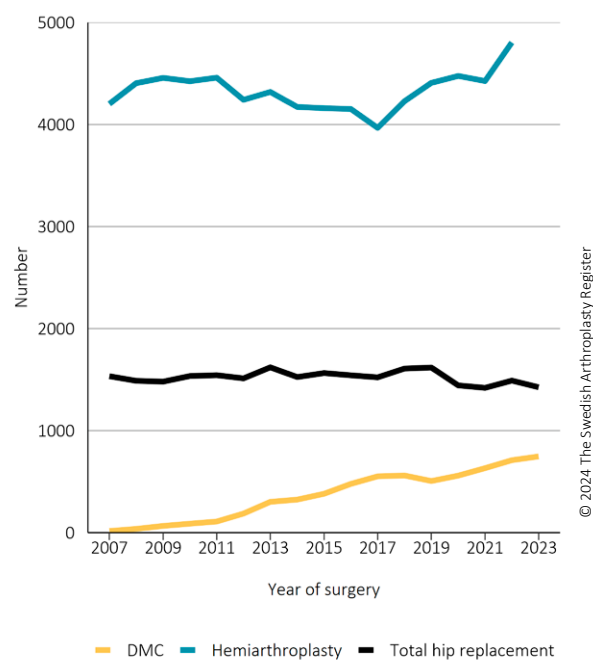


Figure 5.6.5. Choice of prosthesis in fracture related hip arthroplasty.

The most common cup/head components

	2013	2022	2023
Number	6,241	7,003	7,264
Implant, n (%)			
Unipolar femoral head	1,557 (24.9)	1,669 (23.8)	1,809 (24.9)
Modular Trauma Heads	0 (0.0)	1,182 (16.9)	1,391 (19.1)
UHR Universal Head	670 (10.7)	914 (13.1)	954 (13.1)
Lubinus x-link	250 (4.0)	613 (8.8)	600 (8.3)
Unitrax modular endohead	564 (9.0)	404 (5.8)	318 (4.4)
Avantage	203 (3.3)	331 (4.7)	346 (4.8)
Exeter Rim-fit	151 (2.4)	309 (4.4)	305 (4.2)
Lubinus	446 (7.1)	178 (2.5)	118 (1.6)
Marathon	393 (6.3)	154 (2.2)	161 (2.2)
Covision unipolar	376 (6.0)	144 (2.1)	148 (2.0)
MultiPolar Bipolar Cup	126 (2.0)	184 (2.6)	176 (2.4)
Vario cup	186 (3.0)	126 (1.8)	136 (1.9)
V40 unipolar	367 (5.9)	0 (0.0)	<5
BiMobile shell	0 (0.0)	160 (2.3)	196 (2.7)
Polarcup cemented	76 (1.2)	142 (2.0)	115 (1.6)
Other	876 (14.0)	493 (7.0)	490 (6.7)

Table 5.6.3. The most common cup/head components in fracture patients.

Reoperations within six months per unit

Unit	Number of primary operations ¹	Number of reoperations ²	Proportion (%) ³
University units			
Akademiska sjukhuset	769	16	2.1
Karolinska Huddinge	430	17	4.2
Karolinska Solna	40	1	2.6
Linköping	540	19	3.7
SU/Möln dal	1,174	31	2.8
SUS/Lund	641	15	2.4
SUS/Malmö	659	28	4.4
Umeå	365	8	2.3
Örebro	110	4	4.1
Privately run units			
Capio S:t Göran	628	16	2.7
Other units			
Alingsås	159	12	7.8
Borås	422	7	1.8
Danderyd	966	31	3.3
Eksjö	198	11	6.0
Eskilstuna	362	16	4.6
Falun	455	15	3.4
Gällivare	175	11	6.6
Gävle	501	11	2.3
Halmstad	385	8	2.2
Helsingborg	609	26	4.5
Hudiksvall	231	2	0.9
Hässleholm	26	0	0.0
Jönköping	267	6	2.4
Kalmar	341	3	0.9
Karlskoga	368	10	2.9
Karlskrona	429	5	1.2
Karlstad	584	20	3.6
Kristianstad	441	17	4.0
Kungälv	287	8	2.9
Lindesberg	212	2	1.0
Lidköping	134	2	1.5

Table continued on next page.

Reoperations within six months per unit, cont.

Unit	Number of primary operations ¹	Number of reoperations ²	Proportion (%) ³
Ljungby	139	6	4.4
Lycksele	82	1	1.2
Mora	252	6	2.5
Norrköping	328	2	0.6
Norrtälje	156	7	4.6
Nyköping	221	7	3.2
NÄL	816	25	3.2
Piteå	34	2	6.1
Skellefteå	225	7	3.3
Skövde	492	20	4.3
Sunderby sjukhus	513	6	1.2
Sundsvall	362	6	1.8
Södersjukhuset	1 095	23	2.2
Södertälje	221	2	1.0
Torsby	100	2	2.2
Trelleborg	45	4	9.7
Varberg	380	8	2.1
Visby	160	7	4.5
Värnamo	165	7	4.4
Västerås	589	15	2.7
Växjö	314	10	3.3
Ystad	316	11	3.6
Örnsköldsvik	232	1	0.4
Östersund	310	9	2.9
Country	20,747	579	2.9

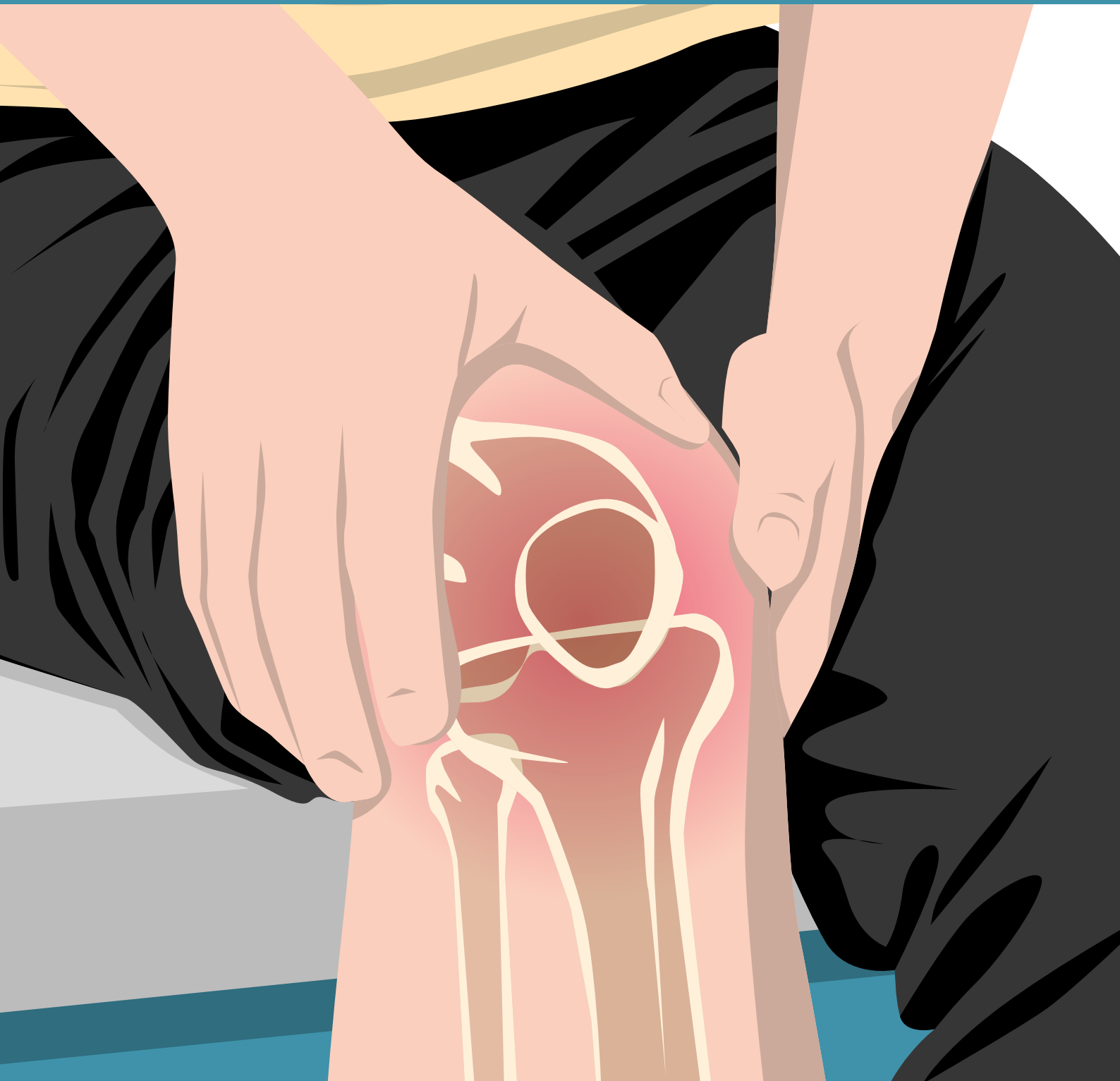
Table 5.6.4. Reoperations within six months per unit.

1) Number of primary operations for fracture patients 2021–2023. Units with less than 20 operations in the period are excluded.

2) Number of re-operations within six months.

3) Proportion of reoperations calculated using competing risk analysis at six months' follow-up.

Since its start in 1975 until December 2023, a total of 365,252 primary knee replacements and 31,640 reoperations have been registered in 275,835 individuals.



6. Knee replacement

6.1. Primary knee replacement

Authors: Annette W-Dahl and Perna Ighani Arani

In 2023, 20,622 primary knee replacements were registered, an increase of over 3,600 compared to 2022, representing a 17% rise. The standard treatment for a primary knee replacement is a total knee replacement (TKR), which accounted for 88% of the procedures in 2023. The proportion of unicompartmental knee replacement (UKR) is slightly lower than in 2022, with 11.6% of operations being UKRs, of which 2.5% were lateral UKRs. Other types of replacements (patellofemoral prostheses and partial prostheses) were reported in limited numbers (see Figure 6.1.1). A total of 80 units reported to the register during the year, including all those performing elective knee replacement surgeries. It should be noted that the number of replacements may vary slightly between analyses as the data were extracted at different time points. Table 6.1.1 shows the demographics for primary knee replacements divided into TKR and medial UKR.

The mean age for primary knee replacement in 2023 was 69.4 years, similar to 2022 (69.2 years). Historically, the mean age has increased from slightly over 65 years in 1975 to just over 71 years in 1994. This increase was primarily due to the largest rise in the number of operations among older age groups. A likely explanation for this trend is improved anesthesiology techniques, which increased safety for older patients, along with shifts in the population's age structure. After 1994, the proportion of patients under 65 years slightly increased, resulting in a decrease in the mean age. However, this trend has not continued in recent years, with the exception of the pandemic years 2020 and 2021, when many older patients did not receive care to the same extent as before. The age group 65–74 years constitutes the largest portion of patients, at 38.4%, followed by the age group 75–84 years, which accounts for 29.1%. Slightly more than one fourth (26.7%) of primary knee replacements were performed on patients under 65 years.

Flow-chart knee replacements 2023

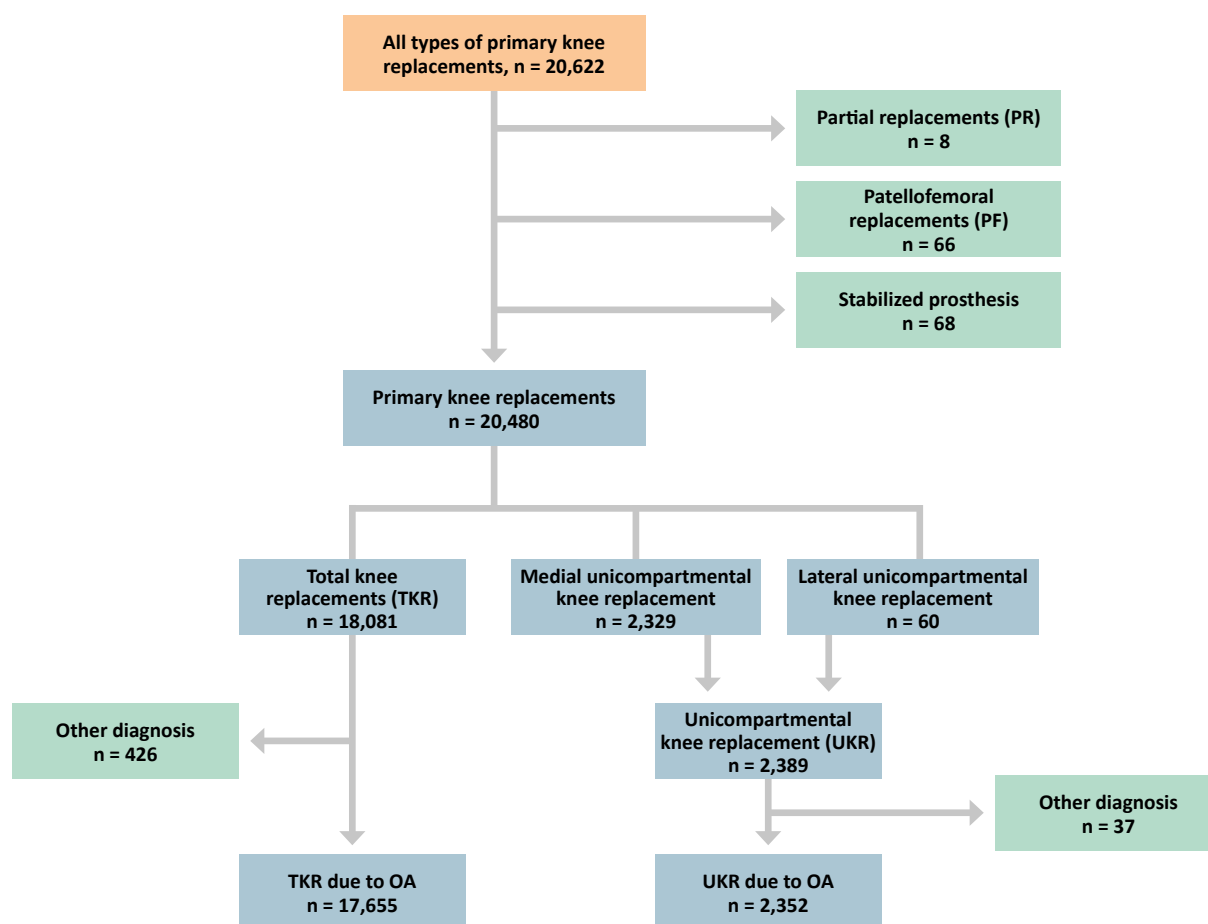


Figure 6.1.1 Flow-chart knee replacements 2023.

The mean age of patients undergoing medial UKR is about 3 years younger than those undergoing TKR (66.6 years vs. 69.8 years). In contrast, the mean age for patients undergoing lateral UKR is about two years older than for those undergoing medial UKR (68.5 years). In 2023, slightly more than one fourth (27.9%) of TKRs were performed on patients aged 65 years or younger, compared to 41.8% of those undergoing medial UKR and 38.3% of those undergoing lateral UR.

Knee replacement surgery is more common among females than males. In the early 1980s, 70% of the surgeries were performed on females. Since then, the proportion of surgeries performed on males has gradually increased, reaching just over 44.6% in 2023. A higher proportion of females undergo TKR (56.2%). In medial UKR, the proportion of males is higher (51.2%) compared to TKR and lateral UKR (33.3%).

The registration of BMI and ASA class for knee replacements was initiated in 2009. The proportion of primary knee replacements on individuals with obesity (BMI ≥ 30) remains largely the same from 2009/2010 (just over 37%) to 2023 (36.3%). However, the proportion of individuals with a BMI ≥ 35 has decreased from 11% to 7%. The proportion of primary TKR procedures for individuals with obesity (BMI ≥ 30) is slightly higher (37%) compared to those receiving UKR (32%). Just over 28% of patients undergoing lateral UKR have obesity, compared to approximately one-third of those undergoing medial UKR. The corresponding proportions for those with BMI ≥ 35 are 8.3% for TKR, 6.1% for medial UKR, and 1.7% for lateral UKR.

In 2023, the proportion of primary surgeries performed on individuals classified as ASA class III–IV was slightly higher (18%) compared to 2009/2010 (15.2%). Among

Demography TKR and UKR 2021–2023

	2021		2022		2023	
	TKR	UKR medial	TKR	UKR medial	TKR	UKR medial
Number	11,146	1,619	15,013	2,054	18,289	2,335
Mean age (SD)	69.1 (9.1)	65.9 (9.0)	69.7 (8.9)	66.1 (9.0)	69.8 (8.8)	66.58 (8.85)
Age group, n (%)						
< 45 years	46 (0.4)	9 (0.6)	53 (0.4)	10 (0.5)	50 (0.3)	9 (0.4)
45–54 years	638 (5.7)	160 (9.9)	735 (4.9)	207 (10.1)	820 (4.5)	208 (8.9)
55–64 years	2,784 (25.0)	538 (33.2)	3,469 (23.1)	659 (32.1)	4,228 (23.1)	758 (32.5)
65–74 years	4,224 (37.9)	608 (37.6)	5,828 (38.8)	791 (38.5)	7,071 (38.7)	874 (37.4)
75–84 years	3,125 (28.0)	283 (17.5)	4,483 (29.9)	350 (17.0)	5,571 (30.5)	456 (19.5)
≥85 years	329 (3.0)	21 (1.3)	445 (3.0)	37 (1.8)	549 (3.0)	30 (1.3)
Females, n(%)	6,284 (56.4)	773 (47.7)	8,428 (56.1)	988 (48.1)	10,282 (56.2)	1,139 (48.8)
BMI, n(%)						
< 18.5	22 (0.2)	<5	31 (0.2)	<5	41 (0.2)	<5
18.5–24.9	2,114 (19.1)	298 (18.5)	2,926 (19.7)	374 (18.4)	3,467 (19.1)	462 (19.9)
25–29.9	4,833 (43.7)	793 (49.2)	6,455 (43.4)	969 (47.6)	7,890 (43.5)	1,107 (47.7)
30–34.5	3,160 (28.6)	436 (27.1)	4,258 (28.6)	585 (28.7)	5,241 (28.9)	609 (26.2)
35–39.9	849 (7.7)	77 (4.8)	1,078 (7.2)	100 (4.9)	1,342 (7.4)	130 (5.6)
≥ 40	90 (0.8)	5 (0.3)	127 (0.9)	8 (0.4)	160 (0.9)	11 (0.5)
ASA-class, n(%)						
I	1,689 (15.3)	389 (24.2)	2,439 (13.9)	465 (22.7)	2,439 (13.5)	500 (21.6)
II	7,478 (67.7)	1,044 (64.8)	9,880 (66.8)	1,304 (63.7)	12,178 (67.5)	1,565 (67.6)
III–V	1,874 (17.0)	177 (11.0)	2,861 (19.3)	279 (13.6)	3,418 (18.9)	251 (10.9)
Diagnosis, n (%)						
Osteoarthritis	10,801 (97.0)	1,584 (97.8)	14,607 (97.5)	2,021 (98.4)	17,833 (97.6)	2,299 (98.5)
Acute trauma	23 (0.2)	<5	26 (0.2)	<5	43 (0.2)	<5
Osteonecrosis	67 (0.6)	30 (1.9)	80 (0.5)	28 (1.4)	102 (0.6)	29 (1.2)
Inflammatory joint disease	161 (1.4)	0 (0.0)	173 (1.2)	<5	180 (1.0)	<5
Sequele fracture/trauma	75 (0.7)	0 (0.0)	88 (0.6)	<5	98 (0.5)	0 (0.0)
Tumor	6 (0.1)	0 (0.0)	9 (0.1)	0 (0.0)	8 (0.0)	0 (0.0)
Other joint diseases	<5	<5	6 (0.0)	<5	5 (0.0)	<5

Table 6.1.1. Demography in TKR and UKR 2023.

those who underwent TKR, a larger proportion was classified as ASA III–IV (18.9%) compared to those receiving medial UKR (10.8%) and lateral UKR (18.3%).

Osteoarthritis was the predominant indication for primary knee replacement for TKR (97.6%), medial UKR (98.5%), and lateral UKR (98.3%). The number of surgeries for inflammatory joint diseases, primarily rheumatoid arthritis, has decreased, particularly in recent years, possibly due to advancements in medical treatment. Osteonecrosis was a more common diagnosis for medial UKR (1.3%) compared to TKR (0.6%).

In 2023, 78 stabilized prostheses, 66 patellofemoral prostheses, and 8 partial prostheses were reported. The mean age was 68.6 years for those who received a stabilized prosthesis, 59.4 years for those with a patellofemoral prosthesis, and 41.0 years for those with a partial prosthesis. More females than males were reported for both stabilized prostheses (59/19) and patellofemoral prostheses (54/12).

Case mix

Table 6.1.2 shows the proportion of surgeries performed due to osteoarthritis (OA), the proportion of females, the proportion under 55 years of age, the proportion with a BMI of 35 or above, and the proportion classified as ASA III or higher for each unit.

University hospitals had a higher proportion of diagnoses other than OA and ASA class $\geq$ III compared to the national average. University hospitals generally have a higher proportion of patients under 55 years of age. Privately run units typically report a lower proportion of ASA $\geq$ III compared to the national average, with exceptions including Capio Movement, Capio Orthopedics Motala, and St. Görans Hospital.

Regionally run units that are not categorized as university hospitals show minimal differences from the national average, with some exceptions. For instance, the proportion of patients with BMI $\geq$ 35 is up to three times higher in Borås, Gävle, Kungälv, and Varberg. Borås, Danderyd, and Södersjukhuset have three times the national average proportion of patients with ASA $\geq$ III, while Helsingborg, Kalmar, Norrtälje, Södertälje, Trelleborg, and Västerås have more than double the national average. In contrast, Karlshamn and Västervik have approximately half the proportion of ASA $\geq$ III compared to the national average. The variation between units in case-mix is substantial and

cannot be generalized for university hospitals, privately run units, or other types of units.

It was reported that 15% of the knee replacements involved a previous surgery on the same knee (not shown in the table). Meniscus surgery was the most common (6%), followed by arthroscopy (3.5%), cruciate ligament surgery (2.6%), osteosynthesis (0.9%), osteotomy (0.8%), and other surgeries (1.3%). For 3% of the knee replacements, more than one previous surgery was reported. This data provides an overview of known prior procedures at the time of the current surgery but does not offer a detailed account of past interventions.

Prophylactic antibiotics

The indicators for prophylactic antibiotic (Table 6.1.3) are based on the recommendations from the PRISS project reported for 2023. Due to a Swedish study (Robertsson et al. 2017) which demonstrated an increased risk of revision due to infection in patients who received clindamycin compared to those given cloxacillin, the recommendations for penicillin-allergic patients have been revised. The revised recommendation, effective from April 2023, is available at www.patientforsakringen.se.

The columns “% receiving Cloxacillin/Cefotaxime/Dalacin”, “% receiving dose 2 g $\times$ 3/2 g $\times$ 2/600 mg $\times$ 2”, and “% with AB timing (45–30 min)” indicate the proportion of surgeries where antibiotics were administered according to the PRISS recommendations. The column “% with AB timing (45–15 minutes)” shows the proportion of reported operations where the preoperative dose was administered 45–15 minutes before the start of the surgery, which was the previously recommended time interval and has been reported in previous annual reports.

All units report that they used cloxacillin or an equivalent as the first choice. The use of Dalacin as prophylaxis decreased from 7.5% in 2017 to 3.6% in 2023. Cefotaxime was reported in 1.9% of operations. Due to the short half-life of cloxacillin, it is crucial that it is administered within the right time interval. A study from the register showed inadequate routines when administering prophylactic antibiotics in knee replacement surgery (Stefánsdóttir A et al. 2009). There has been a gradual improvement since the register began recording the timing of the first dose in 2009. The proportion within the 45–15 minute time interval increased to 88% in the following two years. However, from 2013 to 2023, this proportion decreased to 81%.

In 2023, only 52% of operations had the preoperative antibiotic dose administered 45–30 minutes before the start of the operation. Only Capio Ortho Center Stockholm, Ljungby, and Torsby have succeeded in implementing the latest recommendation, reporting that 85% or more receive the preoperative dose within 45–30 min before the start of surgery.

Thromboprophylaxis

Since there are no national or international guidelines or best practices regarding the start, choice of drug, and duration of thromboprophylaxis, the choices presented in Table 6.1.4 are based on what was commonly reported at the start of the register in 2009, with the exception of the proportion of NOAC (Non-vitamin K antagonist oral anticoagulants) which has been changed from the proportion of drug for injection (Dalteparin, Tinzaparin or Enoxaparin) in last year's report.

The columns show the proportion of knee replacement surgeries where thromboprophylaxis was planned to start postoperatively, the proportion of surgeries where NOACs were planned, and the proportion with a planned treatment duration of 8–14 days. The table shows that it was most common to start thromboprophylaxis postoperatively, with Lycksele being the only unit reporting a higher frequency of preoperative start. In 55.2% of surgeries, only NOAC was planned, which is similar to 2022 (54.9%). A combination of injection and NOAC was reported in 11%, a decrease from 15.2% in 2022. Overall, 66% received thromboprophylaxis with NOACs in 2023, compared to 70% in 2022.

The planned duration of thromboprophylaxis has been relatively consistent over the years since this variable was first recorded in 2009 (see previous reports), with approximately 72–82% of surgeries reporting a planned prophylaxis duration of 8–14 days. In 2023, this proportion was 74%. The proportion of surgeries reported with a shorter prophylaxis (1–7 days) was almost the same in 2023 (11.2%) as in 2022 (11.4%). The proportion of surgeries reported with no prophylaxis at all was also similar as the previous year, 3.5% in 2023 compared to 3.9% in 2022.

Surgical technique

As with thromboprophylaxis, there are no guidelines regarding the choice of anesthesia, use of a tourniquet, drains, and local infiltration anesthesia (LIA); information in the form we call “surgical variables”. Table 6.1.5a presents the proportion of surgeries using general anesthesia,

tourniquet, drains, and LIA with or without a remaining catheter, as well as the median operating time for each unit. Spinal anesthesia was the most common reported form of anesthesia (55%). The proportion of general anesthesia had stagnated before the pandemic at 32.4% in 2019. During the pandemic years, the proportion of general anesthesia increased slightly (34.6% in 2020 to 38.9% in 2021). In 2023, general anesthesia was reported for 36.7% of the surgeries, with 16 units reported more than 80% of their surgeries in general anesthesia. The use of drains has decreased from 26% in 2011 to 0.1% in 2023. In 2023, there was a slightly lower proportion of surgeries performed without a tourniquet compared to 2022. Thus, the proportion of surgeries performed using tourniquet decreased from 90% in 2011 to just under 25% in 2023. LIA, with or without a remaining catheter, continues to be used in the majority of surgeries.

The median operating time for a primary knee replacement (not considering the type of prosthesis and fixation) varied between units, ranging from 26 to 148 minutes. Nationally, the median time for TKR was 64 minutes, for UKR 51 minutes, for patellofemoral prostheses 64 minutes, for partial prostheses 53 minutes, and for stabilized prostheses 140 minutes. Since 2009, the median operation time for TKR has varied between 64 and 82 minutes, and for UKR between 50 and 80 minutes. Bone grafting occurs rarely in primary surgeries and was almost exclusively in form of auto graft. Bone grafting was performed in less than 1% of surgeries and was more common in the tibia (73%) than in the femur (32%). Computer-assisted surgery (CAS) was reported in 14 surgeries from four units (seven in Lindesberg, three in Hässleholm, three in SU/Mölndal, and one in Umeå). No UKR surgeries were reported as performed with CAS. Custom made instruments/sawing-blocks were reported in 4 surgeries in 2023, which is one-tenth of what was reported in 2022 (40 surgeries). This technique was reported by 3 units.

Robot surgery

In the fall 2022, the first TKR procedures utilizing robotic surgery were performed at Lindesberg and SU/Mölndal. Both units have initiated a randomized study with the MAKO robot (Stryker) and cemented Triathlon CR MBT prostheses. In addition, Lindesberg performs UKR with the MAKO robot. For UKR, the Restoris prosthesis is used, which can only be utilized with the robot. Since May 2023, Capio Ortopediska huset has been using the CORI robot (Smith & Nephew) with Genesis II MBT and has reported over 80 surgeries (see Table 6.1.5b).

Case-mix per unit 2023

Unit	Number of reports	Complete reports %	OA %	Females %	< 55 years %	BMI ≥35 %	ASA ≥III %
Country	20,622	99.0	97.5	55.5	5.5	8.0	18.0
University units							
Akademiska	124	100.0	90.5	58.0	9.0	7.5	18.5
Karolinska Huddinge	142	98.6	86.5	61.0	5.0	12.0	63.5
Karolinska Solna	37	97.3	65.0	43.0	16.0	5.5	59.5
SU/Möln dal	293	99.7	92.5	61.5	7.0	10.5	30.5
SU/Sahlgrenska	<15	100.0					
SUS/Lund	20	95	50.0	65.0	10.0	10.5	60.0
Umeå	<15	100.0					
Privately run units							
Aleris Specialistvård Malmö Arena	292	97.3	99.0	53.5	7.0	3.5	3.5
Aleris Specialistvård Nacka	732	100.0	99.0	53.5	6.0	4.5	5.5
Aleris Specialistvård Ängelholm	466	99.8	99.0	55.0	4.0	4.0	11.5
Art Clinic Göteborg	488	99.2	99.5	53.5	5.0	3.0	4.5
Art Clinic Jönköping	329	100.0	99.5	54.5	3.5	4.5	11.0
Capio Arthro Clinic	943	99.6	99.5	56.5	9.0	4.5	1.0
Capio Movement	674	99.7	99.5	56.0	5.0	6.0	21.0
Capio Ortho Center Göteborg	326	99.7	98.5	47.0	11.5	1.5	5.5
Capio Ortho Center Stockholm	854	100.0	98.5	55.0	6.3	6.5	4.5
Capio Ortho och Spine Center Skåne	348	98.3	97.5	57.0	8.0	3.0	10.0
Capio Ortopedi Motala	662	95.6	98.5	56.5	5.0	8.5	20.5
Capio Ortopediska Huset	872	99.9	99.5	59.0	5.5	3.5	0.5
Capio Spine Center Göteborg	<15	100.0					
Capio S:t Göran	346	97.1	96.5	56.0	1.0	7.5	64.5
Carlanderska	445	98.7	100.0	56.0	3.0	1.5	6.0
Carlanderska-SportsMed	254	98	100.0	33.0	10.0	12.5	2.5
Frölundaortopedien	<15	100.0					
Hermelinen	37	100.0	94.5	43.0	11.0	21.5	11.0
Ledplastikcentrum Bromma	912	99.6	99.5	62.0	6.5	7.5	1.0
Ortopedisk Center Sophiah.	242	99.2	99.0	32.5	13.5	7.0	9.0
Specialistcenter Scandinavia Eskilstuna	167	94	100.0	53.5	6.0	4.0	1.0
Specialistcenter Scandinavia Johanniskliniken	151	98	97.5	53.0	10.5	2.5	2.0
Specialistcenter Scandinavia Malmö	205	93.7	98.5	50.0	4.5	5.0	3.5
Specialistläkarhuset Sundsvall AB	26	76.9	100.0	34.5	4.0	4.5	11.5
Other units							
Alingsås	203	100.0	99.5	52.5	3.5	16.5	18.0
Arvika	266	97	99.0	49.5	3.0	1.5	18.5
Bollnäs	432	100.0	95.0	54.5	5.0	1.5	17.0
Borås	78	100.0	98.5	56.5	4.0	28.0	56.5
Danderyd	130	100.0	93.0	51.5	4.5	14.6	55.5
Eksjö	352	98	97.0	57.0	1.5	6.5	19.5
Enköping	535	99.8	99.5	59.0	3.5	9.0	22.5

Table continued on next page.

Case-mix per unit 2023, cont.

Unit	Number of reports	Complete reports %	OA %	Females %	< 55 years %	BMI ≥35 %	ASA ≥III %
Eskilstuna	45	93.3	91.0	60.0	9.0	9.5	29.0
Falun	194	99.5	96.0	56.5	6.0	11.5	26.5
Gällivare	45	97.8	100.0	53.5	2.0	18.0	35.5
Gävle	65	100.0	83.0	58.5	1.5	23.0	51.0
Halmstad	130	99.2	95.5	58.5	7.0	18.0	28.5
Helsingborg	255	96.5	97.0	52.0	6.5	15.0	39.0
Hudiksvall	46	100.0	95.5	50.0	0.0	4.5	24.0
Hässleholm	997	99.9	93.0	54.5	6.0	9.0	16.0
Kalmar	91	100.0	87.0	57.0	4.5	6.5	37.5
Karlshamn	304	99.7	96.5	53.0	2.5	6.5	9.0
Karlstad	22	100.0	100.0	68.0	0.0	0.0	18.0
Kullbergska sjukhuset	436	100.0	98.5	59.5	6.5	12.5	14.0
Kungälv	152	96.1	96.5	56.0	4.0	22.5	29.5
Lidköping	225	100.0	99.5	59.0	3.0	11.0	35.5
Lindesberg	449	100.0	99.0	55.0	3.0	8.0	25.5
Ljungby	115	100.0	96.5	56.5	5.0	9.5	31.5
Lycksele	196	100.0	91.5	56.5	6.0	9.5	19.0
Mora	278	98.2	100.0	50.0	3.0	13.5	28.0
Norrköping	159	99.4	98.0	54.5	6.0	10.0	24.0
Norrtälje	198	100.0	100.0	57.5	5.5	13.0	37.0
Nyköping	94	100.0	99.0	61.5	2.0	9.5	21.5
NÄL Trollhättan	<15	100.0					
Oskarshamn	393	99.8	98.5	56.5	1.5	8.4	12.0
Piteå	424	99.1	95.0	58.0	4.5	16.5	30.0
Skellefteå	66	95.5	98.5	63.5	4.5	7.5	26.0
Skene	233	98.3	98.5	54.0	6.0	9.0	17.0
Skövde	<15	97.2					
Sollefteå	190	99.5	98.0	51.5	5.0	8.5	21.0
Sundsvall	49	93.9	100.0	59.0	2.0	2.0	45.0
Södersjukhuset	105	97.1	95.0	60.0	5.5	18.5	61.0
Södertälje	137	89.1	99.0	60.0	0.5	16.5	36.5
Torsby	126	100.0	98.5	54.0	3.0	8.5	24.5
Trelleborg	422	100.0	94.0	63.0	5.0	17.0	36.0
Uddevalla	197	100.0	93.5	57.5	5.0	8.5	34.0
Varberg	110	97.3	97.5	54.5	3.5	21.5	32.0
Visby	94	93.6	95.5	50.0	6.5	4.5	26.5
Värnamo	230	100.0	97.0	58.5	4.5	6.0	32.0
Västervik	111	99.1	100.0	48.0	2.0	4.5	9.0
Västerås	290	99.3	93.5	61.5	5.0	9.0	41.5
Växjö	135	100.0	100.0	50.5	3.5	3.5	27.5
Örnsköldsvik	213	98.6	98.0	55.0	4.0	18.0	35.0
Östersund	155	98.7	93.5	57.5	2.5	12.0	33.5

Table 6.1.2. Case-mix per unit 2023.

Prophylactic antibiotics per unit 2023

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim or Clindamycin %	Percent having dosage 2 g x 3, 2 g x 2 or 600 mg x 2 %	Percent AB time within (45–15 min) %	Percent AB time within (45–30 min) %
Country	20 622	98,0	99.5	97	81.5	52
University units						
Akademiska	124	97.5	99	89.5	92,0	48.5
Karolinska Huddinge	142	98,0	100	96.5	81,0	55.5
Karolinska Solna	37	97,0	100	97.5	78.5	65
SU/Möndal	293	100,0	99.5	96	70,0	57
SU/Sahlgrenska	<15	100,0				
SUS/Lund	20	100,0	90	85	60,0	35
Umeå	<15	100,0				
Privately run units						
Aleris Specialistvård Malmö Arena	292	99,0	99.5	98	68,0	16
Aleris Specialistvård Nacka	732	99,0	100	98	82,0	63
Aleris Specialistvård Ängelholm	466	99.5	100	98	76.5	5.5
Art Clinic Göteborg	488	100,0	100	99.5	91.5	10.5
Art Clinic Jönköping	329	99.5	100	99	90,0	15
Capio Arthro Clinic	943	99,0	99.5	99	82.5	73
Capio Movement	674	98.5	99.5	98.5	62,0	54
Capio Ortho Center Göteborg	326	100,0	100	97.5	80,0	64.5
Capio Ortho Center Stockholm	854	99.5	99.5	98	94.5	89.5
Capio Ortho och Spine Center Skåne	348	97.5	99.5	98.5	64,0	43.5
Capio Ortopedi Motala	662	99.5	100	99.5	92.5	78.5
Capio Ortopediska Huset	872	99,0	99.5	99	79,0	47.5
Capio Spine Center Göteborg	<15	100,0				
Capio S:t Göran	346	99,0	99.5	95	59,0	50.5
Carlanderska	445	99,0	100	98	94,0	36
Carlanderska-SportsMed	254	99,0	100	99.5	90.5	38
Frölundaortopeden	<15	100,0				
Hermelinen	37	100,0	100	100	92,0	13.5
Ledplastikcentrum Bromma	912	99,0	99.5	99	87,0	63
Ortopedisk Center Sophiah.	242	99.5	100	99	80.5	71.5
Specialistcenter Scandinavia Eskilstuna	167	94,0	99	93	74.5	27.5
Specialistcenter Scandinavia Johanniskliniken	151	73,0	100	90.5	67,0	23
Specialistcenter Scandinavia Malmö	205	97,0	100	98	78.5	21.5
Specialistläkarhuset Sundsvall AB	26	96,0	100	100	88.5	57.5
Other units						
Alingsås	203	100,0	100	99.5	91,0	67
Arvika	266	55.5	100	56	75,0	58.5
Bollnäs	432	99.5	99.5	99.5	87,0	59.5
Borås	78	100,0	98.5	95	69,0	34.5
Danderyd	130	99,0	99	95.5	61,0	45.5
Eksjö	352	99.5	100	99	88.5	62
Enköping	535	100,0	99.5	98	95,0	54.5

Table continued on next page.

Prophylactic antibiotics per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim or Clindamycin %	Percent having dosage 2 g x 3, 2 g x 2 or 600 mg x 2 %	Percent AB time within (45–15 min) %	Percent AB time within (45–30 min) %
Eskilstuna	45	100,0	100	91	84.5	55.5
Falun	194	100,0	100	98.5	85.5	51
Gällivare	45	98,0	100	98	55.5	35.5
Gävle	65	100,0	100	94	84.5	44.5
Halmstad	130	97,0	100	91.5	73,0	52.5
Helsingborg	255	88.5	97	88	75.5	30
Hudiksvall	46	100,0	100	98	82.5	63
Hässleholm	997	99.5	99.5	96	82,0	27
Kalmar	91	98,0	100	98	90,0	53
Karlshamn	304	99,0	99.5	97.5	82,0	49
Karlstad	22	95.5	100	95.5	91,0	72.5
Kullbergsga sjukhuset	436	99,0	100	93.5	87,0	61
Kungälv	152	100,0	100	94	68,0	50.5
Lidköping	225	99.5	100	99.5	85.5	54.5
Lindesberg	449	100,0	100	94	80,0	48.5
Ljungby	115	100,0	100	99	94,0	84.5
Lycksele	196	99.5	100	99	79,0	60
Mora	278	96.5	99.5	95.5	87.5	75.5
Norrköping	159	97.5	100	97.5	58,0	41.5
Norrtälje	198	99.5	100	99.5	79.5	64
Nyköping	94	100,0	100	99	73.5	61.5
NÄL Trollhättan	<15	100,0				
Oskarshamn	393	98,0	99.5	99.5	86,0	63
Piteå	424	96.5	98	93.5	90.5	66
Skellefteå	66	94,0	100	98.5	60.5	35
Skene	233	92,0	100	98	78,0	42.5
Skövde	<15	97,0				
Sollefteå	190	98.5	100	99	96,0	51
Sundsvall	49	96,0	100	94	55,0	39
Södersjukhuset	105	99,0	99	88.5	55,0	17
Södertälje	137	96.5	100	98	78,0	37
Torsby	126	97.5	100	100	93.5	92
Trelleborg	422	100,0	100	97.5	82,0	42
Uddevalla	197	100,0	99.5	98.5	71.5	55
Varberg	110	93,0	100	82	81,0	70
Visby	94	98,0	100	95.5	73.5	41.5
Värnamo	230	100,0	100	100	83,0	59.5
Västervik	111	98,0	100	98	80,0	47
Västerås	290	98,0	99.5	93.5	79.5	43
Växjö	135	95.5	100	98.5	83.5	20
Örnsköldsvik	213	100,0	100	96	87.5	65
Östersund	155	97,0	99.5	99.5	73.5	42

Table 6.1.3. Prophylactic antibiotics per unit 2023.

Thromboprophylaxis per unit 2023

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Country	20,622	99.0	88.0	66.0*	74.0
University units					
Akademiska	124	100.0	93.5	94*	82.5
Karolinska Huddinge	142	98.5	98.0	86.0	90.0
Karolinska Solna	37	92.0	94.5	57.0*	73.0
SU/Möndal	293	100.0	85.5	85.0*	82.0
SU/Sahlgrenska	<15	100.0			
SUS/Lund	20	100.0	65.0	0.0	55.0
Umeå	<15	100.0			
Privately run units					
Aleris Specialistvård Malmö Arena	292	99.5	96.0	96.0	95.0
Aleris Specialistvård Nacka	732	99.5	98.5	99.5	98.5
Aleris Specialistvård Ängelholm	466	100.0	91.5	92.0	91.0
Art Clinic Göteborg	488	99.5	96.5	96.0	93.5
Art Clinic Jönköping	329	100.0	97.5	97.5	96.5
Capio Arthro Clinic	943	99.5	98.5	99.5	98.5
Capio Movement	674	99.5	90.5	11.0*	0.5
Capio Ortho Center Göteborg	326	99.5	99.5	99.5	98.5
Capio Ortho Center Stockholm	854	99.5	99.0	99.0	97.5
Capio Ortho och Spine Center Skåne	348	99.0	99.5	99.5	96.5
Capio Ortopedi Motala	662	99.5	88.5	0.5	84.5
Capio Ortopediska Huset	872	100.0	97.0	99.0*	97.0
Capio Spine Center Göteborg	<15	100.0			
Capio S:t Göran	346	100.0	72.5	56.5*	59.0
Carlanderska	445	99.5	93.5	93.0	94.5
Carlanderska-SportsMed	254	99.0	97.0	96.0	92.5
Frölundaortopedien	<15	100.0			
Hermelinen	37	100.0	100.0	100.0	0.0
Ledplastikcentrum Bromma	912	99.5	99.5	99.5*	95.5
Ortopedisk Center Sophiah.	242	99.5	98.0	84.5*	
Specialistcenter Scandinavia Eskilstuna	167	97.0	96.5	96.5*	86.0
Specialistcenter Scandinavia Johanniskliniken	151	99.5	95.5	97.5	88.0
Specialistcenter Scandinavia Malmö	205	100.0	96.5	97.0	95.5
Specialistläkarhuset Sundsvall AB	26	92.5	88.5	0.0	92.5
Other units					
Alingsås	203	100.0	99.0	0.0	99.0
Arvika	266	97.5	84.0	81.0	82.0
Bollnäs	432	98.0	90.5	91.0	88.0
Borås	78	96.0	84.5	87.0	70.5
Danderyd	130	97.0	67.5	99.5	51.0
Eksjö	352	97.0	15.5	0.5	12.0
Enköping	535	100.0	86.0	87.5*	86.5

Table continued on next page.

Thromboprophylaxis per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Eskilstuna	45	100.0	84.5	88.5	84.5
Falun	194	100.0	96.5	0.0	22.0
Gällivare	45	98.0	91.0	91.0	86.5
Gävle	65	100.0	77.0	67.5	77.0
Halmstad	130	98.5	90,0	1.0	3.0
Helsingborg	255	99.0	86.0	86.5	80.5
Hudiksvall	46	100.0	93.5	0.0	93.5
Hässleholm	997	97.0	87.0	0.0	13.5
Kalmar	91	100.0	54.0	0.0	48.5
Karlshamn	304	100.0	94.0	94.0	94.0
Karlstad	22	100.0	91.0	91.0	86.5
Kullbergska sjukhuset	436	99.0	91.5	93.0	91.0
Kungälv	152	100.0	87.0	89.5	88.0
Lidköping	225	100.0	88.0	90.0	86.0
Lindesberg	449	0.0	91.5	78.0*	74.5
Ljungby	115	100.0	80.0	81.0	81.0
Lycksele	196	99.0	34.5	41.0	97.5
Mora	278	97.5	87.0	89.5	87.0
Norrköping	159	98.0	50.5	0.0	50.5
Norrtälje	198	99.0	89.5	0.0	88.5
Nyköping	94	100.0	89.5	91.5	88.5
NÄL Trollhättan	<15	100.0			
Oskarshamn	393	100.0	65.0	0.0	60.5
Piteå	424	99.0	73.0	93.0*	92.0
Skellefteå	66	100.0	100.0	100.0	100.0
Skene	233	99.5	94.0	95.0	92.0
Skövde	<15	100.0			
Sollefteå	190	100.0	89.5	89.5	75.5
Sundsvall	49	100.0	80.0	85.5	79.5
Södersjukhuset	105	0.0	65.5	4.0*	66.5
Södertälje	137	100.0	88.5	0.0	60.0
Torsby	126	100.0	88.0	85.0*	80.0
Trelleborg	422	100.0	97.0	0.0	7.0
Uddevalla	197	99.5	80.0	80.0	82.0
Varberg	110	98,0	94.5	0.0	73.5
Visby	94	97.0	87.0	89.5	51.0
Värnamo	230	100.0	41.5	0.0	35.0
Västervik	111	99.0	4.5	0.0	3.5
Västerås	290	100.0	87.0	2.0*	5.0
Växjö	135	98.0	84.5	85.0	86.0
Örnsköldsvik	213	100.0	87.5	81.0	85.0
Östersund	155	97.5	84.0	1.0	81.5

Table 6.1.4. Thromboprophylaxis per unit 2023.

* Include a combination of injection and NOAC

Surgical technique per unit 2023

Unit	Number of reports	Complete reports %	Percent having general anesthesia %	Percent drainage %	Percent tourniquet %	Percent LIA %	Median Op time
Country	20 622	98.2	37.0	<0.5	25.0	97.0	63
University units							
Akademiska	124	97.6	83.0	0.0	1.5	92.5	77
Karolinska Huddinge	142	98.6	15.0	0.0	0.0	98.0	107
Karolinska Solna	37	100.0	11.0	2.5	2.5	92.0	103
SU/Möndal	293	99.7	5.0	0.0	7.0	87.5	90
SU/Sahlgrenska	<15	100.0					
SUS/Lund	20	100.0	50.0	0.0	5.0	75.0	148
Umeå	<15	50.0					
Privately run units							
Aleris Specialistvård Malmö Arena	292	99.3	99.0	0.0	0.0	99.0	60
Aleris Specialistvård Nacka	732	99.0	99.5	<0.5	56.0	97.0	26
Aleris Specialistvård Ängelholm	466	99.4	100.0	0.0	<0.5	98.5	45
Art Clinic Göteborg	488	99.8	99.5	<0.5	4.0	100.0	58
Art Clinic Jönköping	329	99.1	99.0	0.0	6.0	96.5	62
Capio Arthro Clinic	943	99.2	2.0	<0.5	1.0	99.0	49
Capio Movement	674	98.5	0.0	0.0	13.0	98.5	51
Capio Ortho Center Göteborg	326	99.7	92.0	0.0	1.0	96.5	86
Capio Ortho Center Stockholm	854	99.4	1.5	0.0	7.5	99.5	60
Capio Ortho och Spine Center Skåne	348	92.5	3.0	0.0	11.0	95.5	61
Capio Ortopedi Motala	662	99.6	4.0	0.5	16.5	99.5	60
Capio Ortopediska Huset	872	98.7	1.5	0.0	20.5	99.0	43
Capio Spine Center Göteborg	<15	88.9					
Capio S:t Göran	346	99.4	9.5	0.5	47.5	98.0	79
Carlanderska	445	97.3	3.5	0.0	6.0	99.5	63
Carlanderska-SportsMed	254	93.1	0.5	1.0	10.0	99.0	42
Frölundaortopedien	<15	100.0					
Hermelinen	37	100.0	2.5	0.0	2.5	100.0	56
Ledplastikcentrum Bromma	912	98.9	99.0	<0.5	7.0	100.0	45
Ortopedisk Center Sophiah.	242	100.0	0.5	0.0	37.5	58.5	63
Specialistcenter Scandinavia Eskilstuna	167	98.2	2.0	0.0	0.0	95.0	53
Specialistcenter Scandinavia Johanniskliniken	151	98.7	84.0	0.5	94.0	99.5	36
Specialistcenter Scandinavia Malmö	205	87.8	4.0	0.0	68.0	97.5	58
Specialistläkarhuset Sundsvall AB	26	96.2	7.5	0.0	4.0	100.0	62
Other units							
Alingsås	203	100.0	1.0	0.0	0.0	100.0	70
Arvika	266	90.2	2.5	0.5	2.0	97.0	71
Bollnäs	432	100.0	90.5	0.0	83.0	97.0	60
Borås	78	100.0	9.0	0.0	78.0	96.0	91
Danderyd	130	90.0	10.0	0.0	24.0	91.0	90
Eksjö	352	90.9	12.0	0.0	1.5	94.0	66
Enköping	535	98.7	85.5	0.0	31.5	99.5	67

Table continued on next page.

Surgical technique per unit 2023, cont.

Unit	Number of reports	Complete reports %	Percent having general anesthesia %	Percent drainage %	Percent tourniquet %	Percent LIA %	Median Op time
Eskilstuna	45	97.8	9.0	0.0	0.0	100.0	95
Falun	194	99.5	34.0	1.0	95.5	99.5	62
Gällivare	45	91.1	4.5	0.0	29.0	86.5	78.5
Gävle	65	95.4	47.5	4.5	95.5	100.0	70
Halmstad	130	93.9	4.5	0.0	87.0	95.5	83
Helsingborg	255	93.7	47.5	0.0	0.5	97.0	70
Hudiksvall	46	100.0	13.0	0.0	4.5	95.5	64
Hässleholm	997	99.3	90.0	0.0	0.0	99.5	49
Kalmar	91	98.9	9.0	0.0	0.0	99.0	88
Karlshamn	304	99.0	98.5	0.0	83.0	96.5	66
Karlstad	22	100.0	23.5	0.0	0.0	86.5	96.5
Kullbergsgka sjukhuset	436	100.0	4.0	0.0	12.5	98.5	61
Kungälv	152	100.0	18.0	0.0	29.5	97.5	92
Lidköping	225	100.0	11.0	0.0	2.0	98.5	68
Lindesberg	449	100.0	100.0	0.0	0.0	100.0	84
Ljungby	115	100.0	81.5	0.0	29.5	93.0	59
Lycksele	196	99.0	11.5	0.0	98.0	97.5	86
Mora	278	94.0	12.0	0.0	98.0	88.0	60
Norrköping	159	98.7	13.0	0.0	10.5	78.0	92
Norrtälje	198	98.0	17.5	0.0	91.5	97.0	73
Nyköping	94	100.0	1.0	0.0	42.5	100.0	77
NÄL Trollhättan	<15	0.0					
Oskarshamn	393	99.5	11.5	<0.5	66.0	99.5	71
Piteå	424	98.4	1.5	0.5	75.0	95.5	62
Skellefteå	66	99.9	0.0	0.0	94.0	100.0	85.5
Skene	233	92.7	8.5	0.0	86.5	95.5	84
Skövde	<15	97.2		0.0			
Sollefteå	190	99.5	3.0	0.0	70.5	99.0	85
Sundsvall	49	100.0	6.0	0.0	2.0	98.0	114
Södersjukhuset	105	97.1	11.5	0.0	0.0	100.0	84
Södertälje	137	100.0	12.5	0.0	0.0	100.0	66
Torsby	126	99.2	16.0	0.0	16.5	98.5	79
Trelleborg	422	99.8	37.0	0.0	35.5	99.0	82
Uddevalla	197	99.5	8.0	0.0	0.0	99.0	105
Varberg	110	95.5	15.5	0.0	1.0	90.0	85
Visby	94	88.3	9.5	0.0	0.0	87.0	93.5
Värnamo	230	100.0	11.0	0.0	0.0	100.0	80
Västervik	111	98.2	28.0	0.0	1.0	100.0	77
Västerås	290	97.6	8.5	0.0	0.0	98.5	58
Växjö	135	97.8	86.0	0.0	5.0	98.5	49
Örnsköldsvik	213	96.2	1.0	0.5	92.5	99.0	76
Östersund	155	97.4	26.5	0.0	83.0	97.5	89.5

Table 6.1.5.a. Surgical technique per unit 2023.

Robot assisted surgery 2022 and 2023

Unit	2022			2023		
	Robot	TKR number	UKR number	Robot	TKR number	UKR number
Capio Ortopediska huset				CORI	84	
Lindesberg	MAKO	7		MAKO	27	22
SU/Mölndal	MAKO	4		MAKO	15	
Total		11			126	22

Table 6.1.5b. Robot assisted surgery 2022 and 2023.

Type of arthrotomy in UKR

Model	Mini incision number	Standard incision number	Unknown number
Oxford	1,171	628	1
ZUK	31	135	2
Persona-PK	27	49	0
Triathlon Uni	3	113	0
Restoris	0	21	0
Link	0	126	0
Sigma-PKR	0	62	0
Total	1,232	1,134	3

Table 6.1.6. Type of arthrotomy in UKR 2023.

Arthrotomy

Since 1999 it is registered if the minimally invasive surgery (MIS) was used. We define MIS as a small arthrotomy (without a specific limit on the length) where the operation is performed without everting the patella. While the use of MIS in TKR is rare, its popularity for UKR surged rapidly in the late 1990s, peaking in 2007 when 61% of all UKRs were performed with MIS. Certain prosthesis models, especially the Oxford, are used more frequently with MIS than others. In 2023, MIS was reported in 52% of UKR surgeries (see Table 6.1.6) but only in 0.9% of TKR cases.

Fixation

The use of cement remains the most common method for fixating the components to bone. In 2010, 2.4% of all TKR procedures were completely cementless, and by 2023, 6.8% were reported as completely uncemented. Uncemented fixation has decreased over the past two years from 9% in 2021. In 2023, 1.2% of TKRs were hybrids (see Figure 6.1.2). For UKR, the change has been significant in recent years. Before 2010, nearly all UKRs were cemented, but since 2013, there has been a notable change. In 2023, 70.5% of UKRs were performed without cement, and 4.3% were hybrids (see Figure 6.1.3). This shift is primarily due to the popularity of the Oxford uncemented version, used in 96.5% of Oxford cases. Figure 6.1.4 shows the percentage of type of by region for TKR in 2023. Skåne reports cementless fixation in one-third of TKR cases (32.9%), Västerbotten in just under a quarter (24.4%), Dalarna 13.4%, and Västernorrland 11.4%, while most regions reported no or very low percentages of cementless TKRs.

Cement

Since 2007, labels with article numbers for cements used in nearly all surgeries where cement was used have been available, ensuring that cement types can be accurately identified (see Table 6.1.7). As the type of mixing system may affect the cement quality, we are also interested in the article numbers for these systems, i.e., whether separate mixing systems with their own article numbers were used. Practically all cement reported in 2023 for primary surgeries contained antibiotics of the gentamicin type.

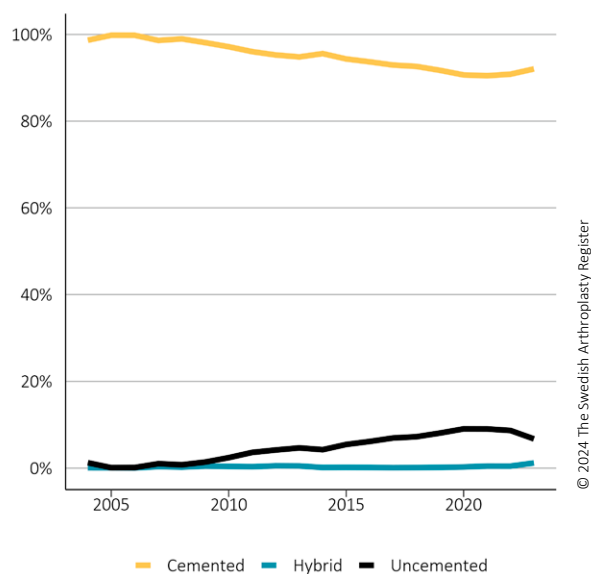


Figure 6.1.2. Time trend for fixation method, TKR/OA.

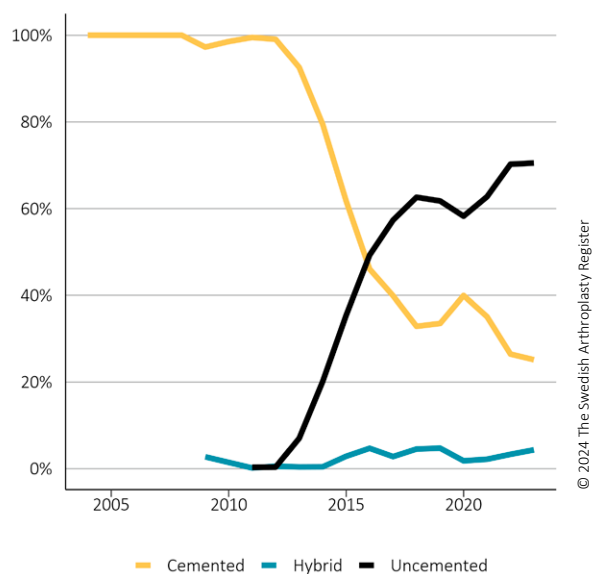


Figure 6.1.3. Time trend for fixation method, UKR/OA.

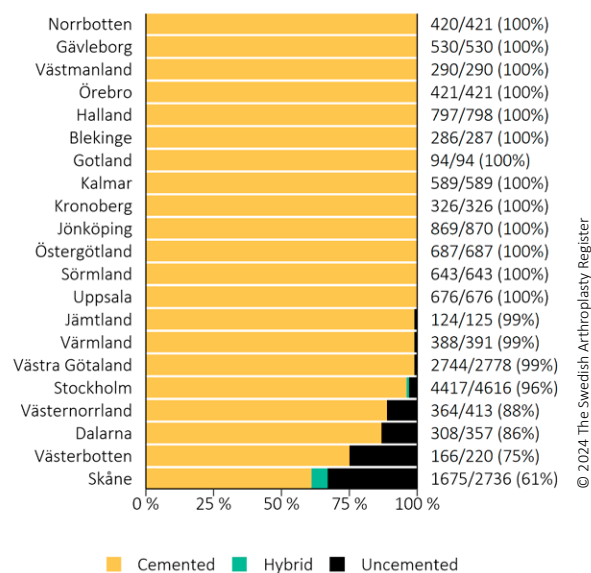


Figure 6.1.4. The relative use of fixation type in TKR/OA. The column on the right shows the number cemented/total number (%).

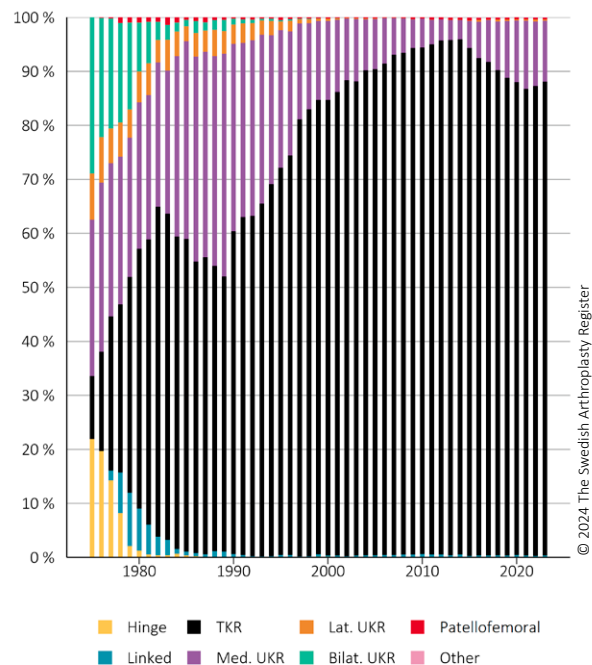


Figure 6.1.5 Distribution of type of prosthesis in primary surgery 1975–2023.

Type of cement

Cement	TKR		UKR	
	Number	Proportion %	Number	Proportion %
Optipac Refobacin (prefilled)	10,227	60	335	49
Palacos R+G Pro (prefilled)	3,516	21	107	16
Smartset GHV (gentamicin)	1,160	7	163	24
Palacos R+G (gentamicin)	1,063	6	43	6
Refobacin Bone Cement (genta)	1,048	6	38	6
Copal (genta + vanco)	23	0	0	0
Copal (genta + clinda)	13	0	1	0
Refobacin Revision Cement (genta+clinda)	12	0	0	0
CMW with Gentamicin	8	0	3	0
Optipac Refobacin Plus (prefilled)	2	0	0	0
Optipac Refobacin Revision (prefilled)	2	0	0	0
Palacos R	1	0	0	0
Total	17,075	100	690	100

Table 6.1.7. Type of cement in TKR and UKR 2023.

Implants

TKR was developed in the 1970s, a time when hinge prostheses and UKR were already available. When the knee arthroplasty register started registration in 1975, TKR had just been introduced in Sweden. Consequently, hinge prostheses and UKR were used for the majority of primary operations (see Figure 6.1.5). It was also common to perform bilateral UKR, where two UKRs were used in the same knee when knee disease affected more than one compartment. However, as the use of TKR became more widespread, bilateral UKR ceased to be used. Today, hinge prostheses, linked and stabilizing prostheses are primarily reserved for particularly difficult primary cases, trauma, tumors, and revisions. For uncomplicated primary cases, TKR is most commonly used, though UKR is still used in some cases of unicompartmental disease.

The use of UKR declined steadily from 1990 to 2014 but has been increasing gradually since then. Using UKR on the lateral side of the knee has been extremely rare since the mid-1990s. The decreased popularity of UKR may be attributed to its considerably higher revision rate compared to TKR (see Figure 6.4.4). However, it should

be noted that the disease may progress in the parts of the knee that are not replaced in UKR. This can make it tempting to offer revision from UKR to TKR for patients with unexplained pain. Nonetheless, the risk of revision due to infection is significantly lower for UKR compared to TKR. This also applies to the risk that revisions may be performed with stabilized implant, arthrodesis or amputation, which of course is in favor in UKRs (see Table 6.4.2 a-b).

Prosthesis model

The prosthesis model is probably the factor that generates the most interest and that is most often related to the outcome after knee replacement. However, it is not only the model/design that determines the risk of a later reoperation, but also the so-called case-mix. The Swedish Arthroplasty Register attempts to mitigate the effects of case-mix in its analyses by considering factors such as patients' underlying diseases, sex, age, and the time period during which the operations were performed.

Another important factor that the register is not able to include in the analyses is the surgical experience of the individual surgeon. It is obvious that surgeons and surgical teams can be more or less skilled at operating, which may influence the results of individual implants, especially when the use has been limited to a few surgeons and units. Therefore, it could be discussed whether it is fair to report results for individual models when it can be argued that deviant outcomes may be influenced by the skill of the surgeon and team. To this, we can only say that the risk of revision for individual models is the result of what the users have been able to achieve with that particular model. The final result is determined by the prosthesis's design, material, durability, accompanying instruments, user-friendliness, safety margins (how the prosthesis behaves if it is not inserted in exact position), along with the skill of the surgeon and the surgical team, and the training in using the instruments/prosthesis and in selecting appropriate patients for this particular surgery. Manufacturers, together with distributors, have the opportunity to influence most of these factors. Therefore, it cannot be considered wrong to associate the model with the results, even if the results are not solely due to design, material, and durability.

Historically, the most used knee replacement models in Sweden have also had the lowest revision rates. This may be because surgeons and units have managed to choose the best models, but it may also be because when the same implant is used frequently, surgical expertise increases. Models that have shown significantly worse results than others have usually disappeared from the Swedish market. One exception, however, was the Oxford UKR prosthesis, which initially had poor results but recovered after modifications and increased surgical experience.

Table 6.1.8 a shows the most commonly used TKR (including revision models) and 6.1.8 b UKR implants used in primary surgery in 2023. Table 6.1.8 a does not include 78 linked prostheses reported during primary surgery, mainly rotation models (Link Endo, MUTARS, NexGen, S-ROM Noiles, Smith & Nephew, and Stryker) for the treatment of malignancy, fractures, and other special cases. Just like last year, the same three models dominate. NexGen MBT from Zimmer Biomet accounts

for nearly half (45%) of the implants, while Triathlon MBT from Stryker accounts for 20%, Persona from Zimmer Biomet for 11%, and Attune from DePuy for 10%. Regarding UKR, the Oxford model dominated, being used in 75% of procedures in 2023, which is a higher proportion than in 2022.

Types of polyethylene

Figure 6.1.6 shows that Swedish orthopedic surgeons have been relatively late in replacing the well-proven conventional polyethylene (UHMWPE) with the newer highly cross-linked polyethylene (HXLPE). Since its introduction in Sweden in 2006, the proportion of highly cross-linked polyethylene has increased gradually, reaching 28.3% in 2019, but has since declined in recent years to 16%.

The majority of implants using highly cross-linked polyethylene in Sweden until 2023 have been Triathlon (X3 polyethylene), PFC (XLK polyethylene), or Persona (Vivacit-E polyethylene). In last year's report, we presented an in-depth analysis comparing the conventional and highly cross-linked polyethylene showing a statistically significant disadvantage for the highly cross-linked polyethylene, with 34% higher risk of revision for all causes. Due to the possibility that the issues with Triathlon's uncemented version, which we reported in the 2022 report (chapter 9.2), influenced the outcome, we conducted a sensitivity analysis where we excluded uncemented prostheses. In the sensitivity analysis, the increased risk for the highly cross-linked polyethylene was not as pronounced, at 21%, but we still found a statistically significant higher risk of revision compared to the conventional polyethylene.

A study from the National Joint Registry (NJR) found no advantage for highly cross-linked polyethylene compared to the conventional polyethylene in follow-up up to 12 years after total knee replacement surgery (Partridge et al. 2020), while the Australian registry (AOANJRR) has reported lower revision rates for the highly cross-linked polyethylene. However, the result was dependent on the specific prosthesis model studied (de Steiger et al. 2015). The latest meta-analyses have not been able to show that

highly cross-linked polyethylene improves clinical and radiological outcomes compared to the conventional polyethylene in total knee replacement (Sheridan et al. 2021, Gkiatas et al. 2022, Bistolfi et al. 2022).

It is important to remember that the methods used to increase the durability of the new polyethylene types through radiation and/or the addition of antioxidants vary greatly among manufacturers.

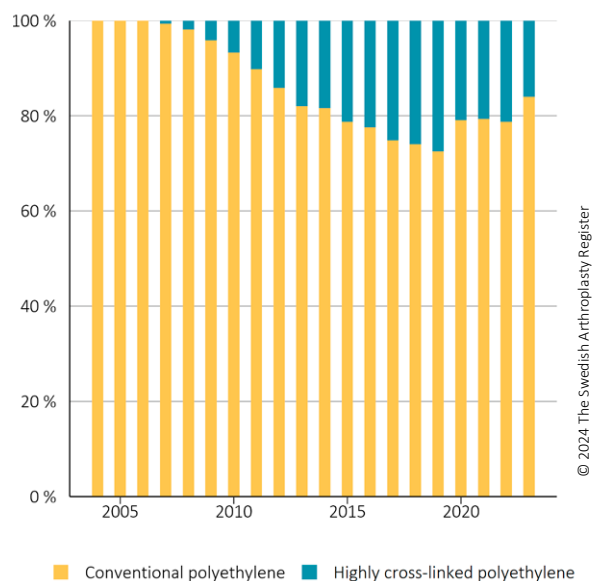


Figure 6.1.6. Distribution of UHMWPE and the highly cross-linked polyethylene.

Most common TKR implants

Model	2011–2020		2021		2022		2023	
	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %
NexGen MBT	60,967	47.2	5,845	52.5	7,285	48.5	8,207	44.9
Triathlon MBT – cemented	9,382	7.3	901	8.1	1,558	10.4	2,739	15.0
Persona TKA	1,213	0.9	536	4.8	1,156	7.7	1,999	10.9
Attune MB TKA	139	0.1	55	0.5	812	5.4	1,765	9.7
PFC Sigma TKA MBT	24,318	18.8	1,853	16.6	1,808	12.1	968	5.3
Triathlon MBT – uncemented	5,591	4.3	762	6.8	891	5.9	907	5.0
Genesis II MBT	2,416	1.9	226	2.0	211	1.4	329	1.8
NexGen Trabecular Metal	2,305	1.8	139	1.3	228	1.5	187	1.0
Persona TKA Trabecular Metal	47	0.0	138	1.2	232	1.6	186	1.0
PFC Sigma TKA APT	8,767	6.8	166	1.5	98	0.7	167	0.9
Triathlon MBT - Hybrid	34	0.0	9	0.1	14	0.1	165	0.9
NexGen Revision	589	0.5	66	0.6	111	0.7	146	0.8
Triathlon Total Stabilizer	734	0.6	114	1.0	146	1.0	140	0.8
Legion/Genesis II Pri MBT	1,880	1.5	185	1.7	180	1.2	121	0.7
PFC Sigma TC-3 (revision)	436	0.3	59	0.5	71	0.5	61	0.3
Triathlon APT	97	0.1			42	0.3	32	0.2
Journey TKA	170	0.1	18	0.2	47	0.3	26	0.1
Other	10,043	7.8	36	0.6	62	0.8	56	0.8
Total	129,128	100.0	11,142	100.0	15,009	100.0	18,285	100.0

Table 6.1.8 a. Most common TKR implants (including revision models) in primary surgery 2023.

Most common UKR implants

Model	2012–2021		2022		2023	
	Number	Proportion %	Number	Proportion %	Number	Proportion %
Oxford Phase III Uni Twin Pegged – Cementless	5,399	50.7	1,482	70.1	1,688	71.2
ZUK Uni MBT	837	8.0	132	6.2	168	7.1
Link Endo Sled UniAPT	1,370	12.7	158	7.5	126	5.3
Triathlon Uni	760	7.1	135	6.4	116	4.9
Persona PK unspec.	169	1.6	88	4.2	76	3.2
Sigma PKR	313	2.9	34	1.6	62	2.6
Oxford Phase III Uni Twin Pegged – Hybrid	154	1.4	22	1.0	61	2.6
Oxford Fixed Lateral	177	1.7	48	2.3	43	1.8
Restoris					21	0.9
Oxford Phase III Uni Twin Pegged – Cemented	1,053	9.9	11	0.5	8	0.3
Other	419	3.9	15	0.3	0	0.0
Total	10,651	100.0	2,114	100.0	2,369	100.0

Table 6.1.8 b. Most common UKR implants in primary surgery 2023.

Patella component in TKR

During the 1980s, patella components were used in over half of TKR cases. Since then, the use has decreased, but in 2021 it increased slightly from previous years (just under 3%) to 4.6% in 2021, 4% in 2022, and then decreased again to just over 3% in 2023 (Figure 6.1.7 and Table 6.1.9). The use of the patella component has historically been strongly associated with the prosthesis model. In 2023, the patella component was most commonly used proportionally with the Journey, Genesis, and Triathlon Total Stabilizer models. In Sweden, females are slightly more likely than males to receive a patella component during TKR. This has been explained by the fact that femoral patellar problems are more common in females. In 2023, 2.5% of males received a patella component compared to 4.2% of females. The relative use of patella components across different age groups in 2023 shows that they are slightly more common in the youngest age groups (Figure 6.1.8). However, the proportions have fluctuated somewhat due to the relatively small number of young patients and those aged 85 and older. How the use of a patella component affects the risk of revision is discussed in Chapter 6.4, along with CRR curves (Figures 6.4.8 and 6.4.9), which show how the impact has changed over time.

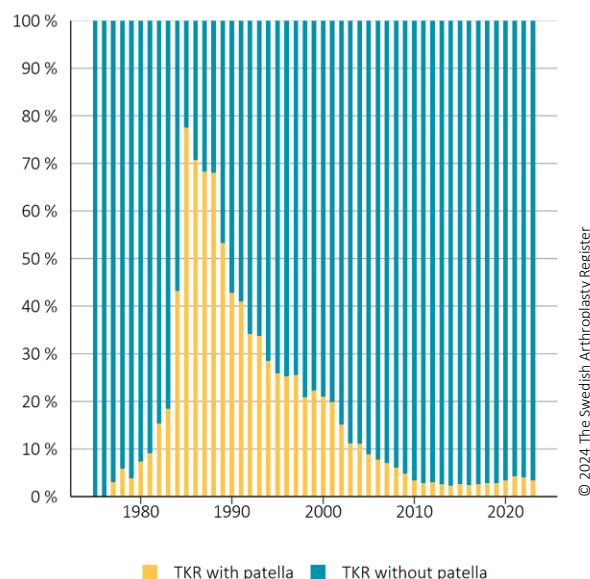


Figure 6.1.7. Distribution of TKR with or without patella component.

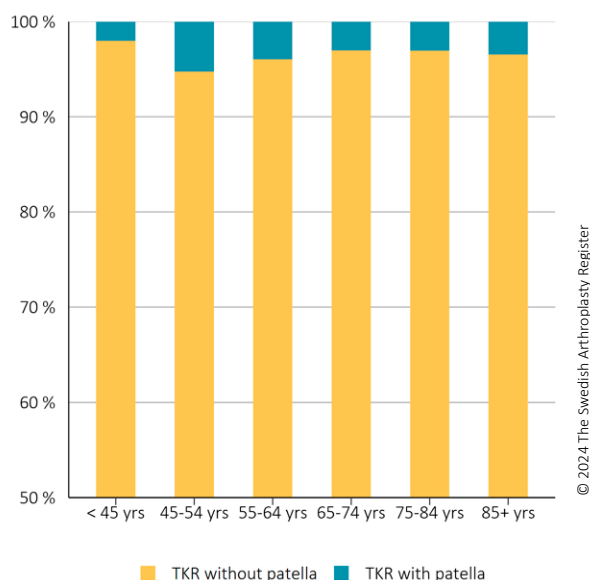


Figure 6.1.8. Distribution of the use of patella component in the different age groups 2023

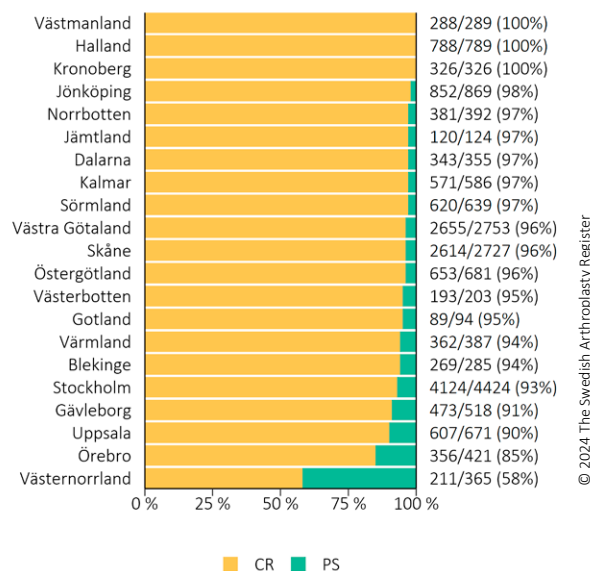


Figure 6.1.9. The relative use of CR and PS TKR respectively in the regions 2023. The column on the right shows the number of CR/total number (%).

Cruciate ligament retaining and cruciate ligament sacrificing TKR

There are cruciate ligament sacrificing types of TKRs that stabilize the knee. Most common with an eminence in the middle part of the tibia polyethylene that goes into a box in the femoral component between the medial and lateral gliding surfaces without affecting the rotation too much. The type is called “posterior stabilized” (PS) and requires resection of the posterior cruciate ligament. Those advocating the use of PS claim that it provides increased flexion and more normal knee movement than the minimally stabilizing, posterior cruciate retaining (CR) type. The disadvantages of PS implants are that the increased stability stresses on the polyethylene and bone surfaces and thus theoretically increase the risk of wear and loosening.

PS implants have been popular in other countries such as the USA. However, they have not been used much in Sweden as CR implants has been preferred, at least in those knees that are without major malalignment and that have an intact posterior cruciate ligament.

As shown in Figure 6.1.9, there are regional differences in the use of PS prostheses. In 2023, this type was relatively common in two regions: Västernorrland and Örebro. In 2019, 8% of primary TKR procedures were of the PS type when revision models and stemmed prostheses were included, but the use of PS models halved to 4% in 2021, increased to 6.3% in 2022, and then decreased again to 3.9% in 2023. At the turn of the millennium, the proportion of PS was just over 1% of operations.

Use of patella component

Model	Number TKR with patella	Proportion TKR with patella %	Number TKR without patella	Proportion TKR without patella %
NexGen MBT	129	1.6	8,078	98.4
Triathlon MBT	182	4.8	3,631	95.2
Persona TKA	27	1.4	1,972	98.7
Attune MB TKA	132	7.5	1,633	92.5
PFC Sigma TKA MBT	35	3.6	933	96.4
Genesis II MBT	5	1.5	324	98.5
Persona TKA Trabecular Metal	7	3.8	179	96.2
NexGen Trabecular Metal	9	4.8	178	95.2
PFC Sigma TKA APT	11	6.6	156	93.4
NexGen Revision	11	7.5	135	92.5
Triathlon Total Stabilizer	16	11.4	124	88.6
Legion/Genesis II Pri MBT	28	23.1	93	76.9
PFC Sigma TC-3 (revision)	<5	6.6	57	93.4
Other	10	8.9	102	91.1
Total	616		17,669	

Table 6.1.9. The use of patella component in primary TKR 2023.

6.2. Reoperation of knee replacements regardless of diagnosis, cause, and previous surgeries

Authors: Annette W-Dahl and Ola Rolfson

Reoperation includes all types of procedures related to a previously inserted knee replacement, regardless of whether components are inserted, any of the components are replaced, extracted (including arthrodesis and amputation), or left untouched. The number of reoperations has increased year by year in line with the growing number of primary operations, with a slight additional increase from 2013, except for the pandemic years 2020 and 2021 (Figure 6.2.1). The reason for the increase in recent years is likely because, before 2013, procedures other than those defined as revisions (where prosthesis parts are replaced, added, or removed) were not requested in the reporting of knee replacement surgery, but were registered if they were submitted to the register. The year 2020 was the first year in which the reoperation variable was reported. It should be noted that other procedures are not as well-defined as revisions. It is difficult to determine to what extent all reoperations are reported, and this may affect the outcome and disadvantage units that are diligent in reporting other procedures.

The relative proportion of reoperations decreased since the early 1990s, then increased again between 2012 and

2014, and has remained at roughly the same level since then (Figure 6.2.2). The reason for this is likely the same as described above. Figure 6.2.3 shows the distribution of primary operations and reoperations reported per unit in 2023. The number and proportion of primary operations are shown in the column to the right. Units with fewer than 20 operations have been excluded. The proportion of reoperations relative to a unit's production varies, from SUS/Lund, where more than half of the operations are reported as reoperations, to units that have not reported any reoperations at all. This variation may be due, for example, to primary operations being performed at one or several units in a region, while reoperations are concentrated in another unit within the region.

The mean age was just over a year older, and the proportion of males was slightly higher in reoperations compared to primary operations in 2023 (Table 6.2.1). The age group 75 and older was slightly more represented in reoperations compared to primary operations. Compared to primary operations, a larger proportion had a BMI ≥ 35 , ASA $\geq III$, and diagnoses other than osteoarthritis (from the primary operation).

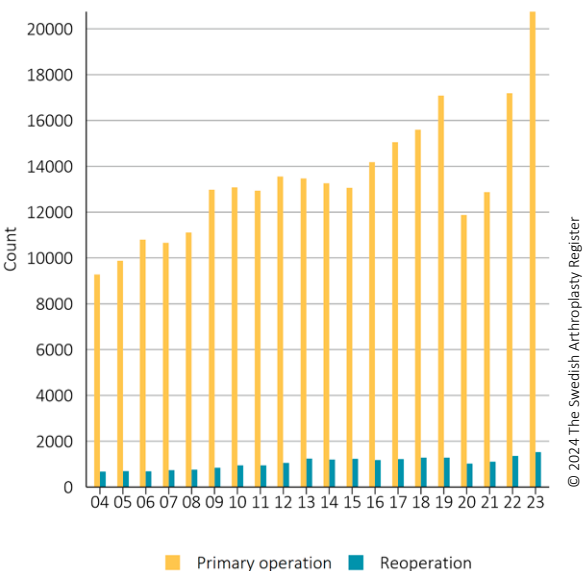


Figure 6.2.1. Number of primary and reoperations per year 2004–2023.

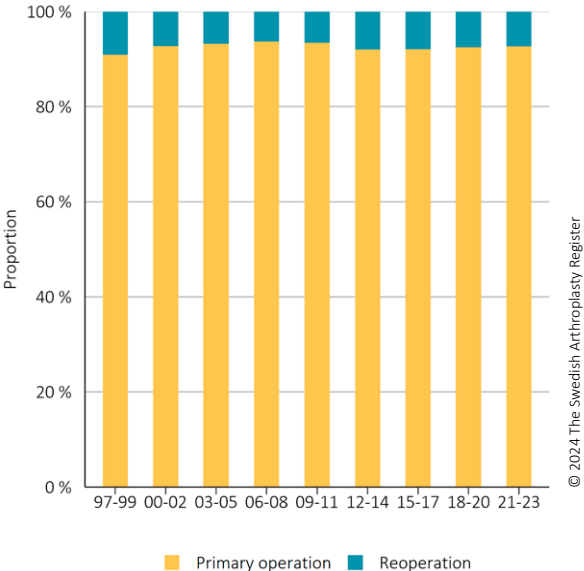
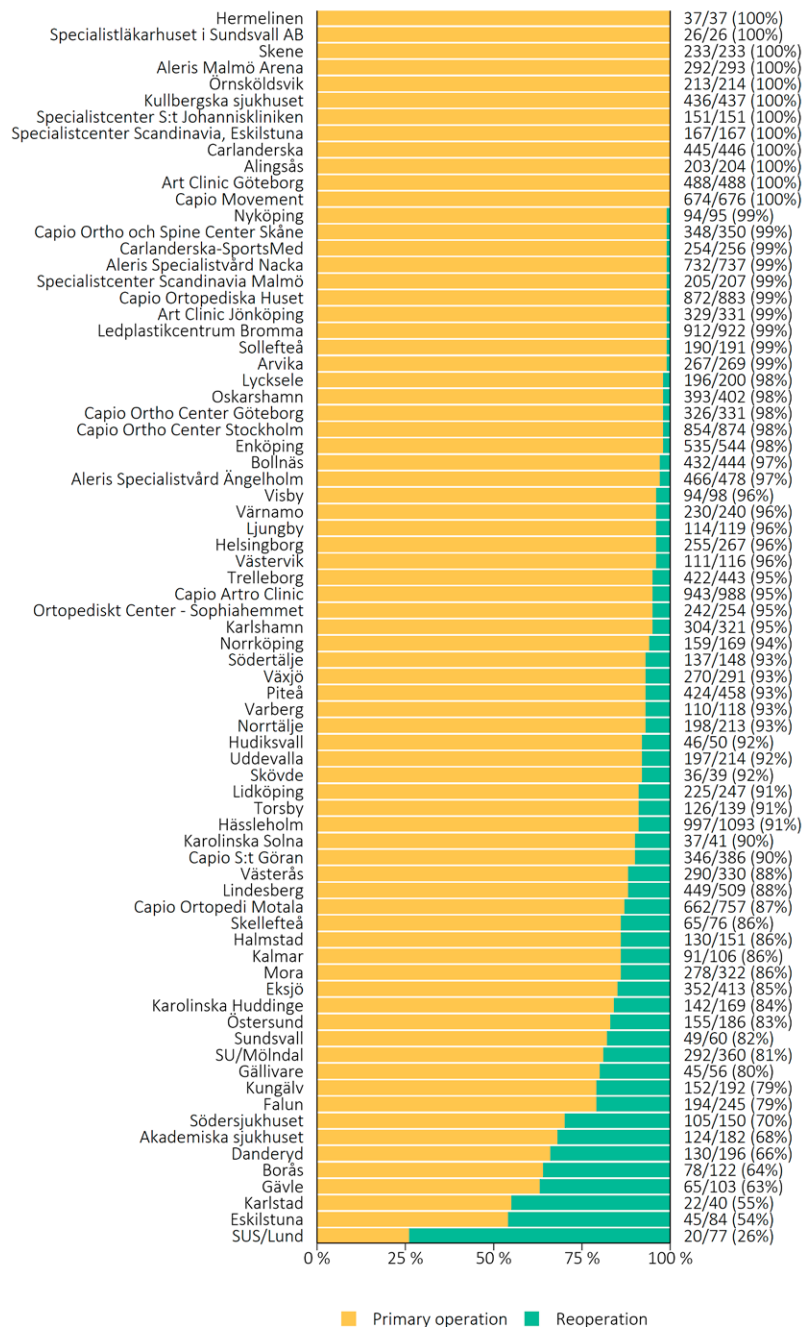


Figure 6.2.2. Distribution of primary knee replacements and reoperations (revision + other procedures) 1997–2023 divided in three-year periods.



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Figure 6.2.3. Distribution of primary and reoperations per unit 2023. Units with fewer than 20 operations are excluded. The column on the right shows the number of primary operations/total number of operations (% primary operations).

The most common reasons for reoperation over the past 10 years for TKR/osteoarthritis and UKR/osteoarthritis are shown in Figure 6.2.4. For TKR/osteoarthritis, infection is the single most common reason for reoperation. The reoperation reason 'osteoarthritis' in the context of TKR generally refers to patellofemoral osteoarthritis. The reoperation reason 'patella' includes various patellar issues in prostheses implanted both with and without a patella component (excluding loosening or wear of the patella component). Note that the distribution of reoperation

reason does not necessarily reflect the risk of experiencing these complications.

As the number of primary TKR/osteoarthritis surgeries has increased significantly over time, early reoperations, such as infections and joint contractures, are overrepresented. For UKR/osteoarthritis, loosening is the most common reason of reoperation, closely followed by the progression of osteoarthritis. The proportion of reoperations due to loosening is higher than in TKR/osteoarthritis, while infection is uncommon.

Figure 6.2.5 shows the distribution of the main interventions: exchange/insertion, extraction, and other procedures where the implant is not affected, over three-year periods from 2002 to 2023. Exchange/insertion of prosthesis components has been the dominant intervention. However, during the last four three-year periods, the

proportion has decreased due to increased reporting of other procedures. The most commonly reported procedures where the prosthesis is not affected are infection treatment/investigation and manipulation under anesthesia.

Demography in reoperation

	Reoperation	Primary operation
Number	1,523	20,758
Mean age (SD)	70.4 (9.8)	69.4 (9.0)
Age group, n (%)		
< 45 years	11 (0.7)	77 (0.4)
45-54 years	82 (5.4)	1,052 (5.1)
55-64 years	328 (21.5)	5,014 (24.2)
65-74 years	518 (34.0)	7,974 (38.4)
75-84 years	499 (32.8)	6,058 (29.2)
≥85 years	85 (5.6)	583 (2.8)
Females, n (%)	799 (52.5)	11,518 (55.5)
BMI, n (%)		
< 18.5	6 (0.4)	44 (0.2)
18.5-24.9	264 (18.5)	3,970 (19.3)
25-29.9	596 (41.7)	9,054 (44.0)
30-34.5	406 (28.4)	5,879 (28.5)
35-39.9	129 (9.0)	1,477 (7.2)
≥ 40	29 (2.0)	171 (0.8)
ASA-class, n (%)		
I	99 (6.7)	2,987 (14.4)
II	833 (56.4)	1,3954 (67.4)
III-V	545 (36.9)	3,748 (18.1)
Diagnosis, n (%)		
Artros	1,421 (94.0)	20,253 (97.7)
Acute trauma	5 (0.3)	46 (0.2)
Osteonecrosis	25 (1.7)	133 (0.6)
Inflammatory joint disease	34 (2.2)	182 (0.9)
Sequele fracture/trauma	22 (1.5)	98 (0.5)
Tumor	5 (0.3)	8 (0.0)
Other joint diseases	0 (0.0)	7 (0.0)

Table 6.2.1. Demography in reoperations 2023 (with diagnosis from primary operation). Primary operations performed in 2023 for comparison.

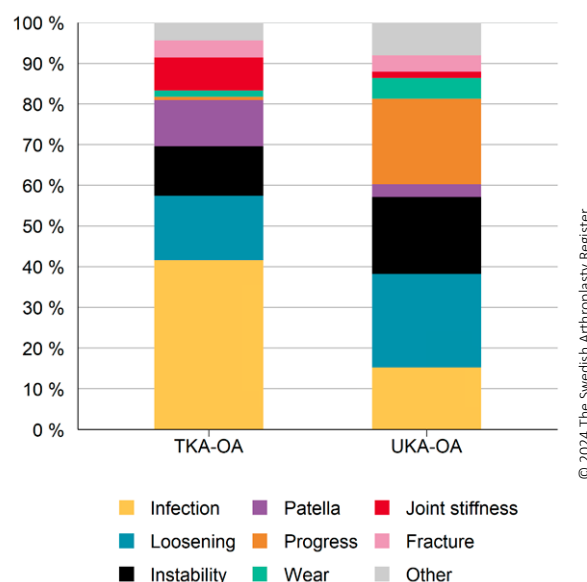


Figure 6.2.4. The most common reasons for reoperation in the last 10 years per type of operation.

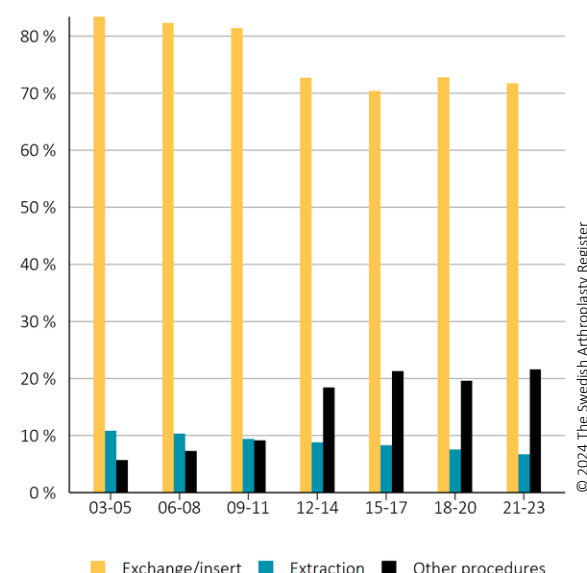


Figure 6.2.5. Distribution of the main procedures exchange/insertion, extraction and other procedures where the implant is not affected in three-year periods 2003–2023.

6.3. Reoperation within two years for TKR/OA

Authors: Annette W-Dahl and Ola Rolfson

Reoperations that occur within the first two years after a primary operation have been used as a quality indicator in hip replacement surgery for several years and have been selected by the Swedish Association of Local Authorities and Regions and the National Board of Health and Welfare as a national quality indicator. This variable is also included in “Vården i siffror” (vardenisiffror.se). Reoperation within two years includes all forms of additional surgery after the primary operation. This outcome measure primarily reflects early and serious complications. The indicator is considered important, quickly accessible, and easier to use for clinical improvement work compared to the ten-year revision risk.

As previously described in Chapter 6.2, we began systematically requesting reports of other procedures, beyond revisions, from units starting in 2013 for knee replacement surgery. The reason two-year reoperations have not been reported earlier is partly due to uncertainties about the reliability of reporting other procedures, and partly because the number of reoperations per unit per year is low. Therefore, several years of reporting are needed to gather a sufficient number for meaningful analysis at the unit level. It is also difficult to determine to what extent other procedures are reported, which may affect the results and disadvantage units that are diligent in reporting procedures beyond prosthesis surgeries.

Furthermore, an indicator requires reliable reporting, which we currently do not assess to be the case for knee replacement surgery. Despite the shortcomings in reporting, we have chosen to present the indicator “Reoperation within two years for TKR/OA” for several reasons. It is naturally important to monitor the early reoperation frequency for units with good reporting. For units that have not yet reviewed their procedures for reporting reoperations that are not revisions, we want to encourage improved reporting. The presentation is also part of harmonizing the presentation of hip and knee replacement data following the merging of the registries. A corresponding analysis for hip replacements is presented in Chapter 5.3.

The most common reasons for reoperation within two years were infection, patella problems, and loosening in 2007, with an increasing proportion of infections in 2008–2009 (Figure 6.3.1). This increase coincides with

the adoption of more surgically aggressive treatment for suspected early infections. After 2013, infection remains the most common reason for reoperation within two years, but the proportion of joint stiffness as a reason for reoperation has increased, likely due to changes in reporting routines.

For TKR in OA, reoperations within two years for 2020–2023 are presented by unit (university hospitals, privately run units, and other units in alphabetical order) and refer to first-time occurrences (number and percentage) within two years of the primary operation (Table 6.3.1). Due to the low number of reported reoperations within two years, only infection (suspected or verified) is presented as a separate group, while other causes of reoperation are combined into one group, “other causes.” The number of revisions (and the percentage of reoperations) is listed to provide an understanding of each unit’s reporting of procedures beyond revision. The result of the compilation is currently uncertain and does not provide a fair picture of the proportion of reoperations within two years at the national and unit levels.

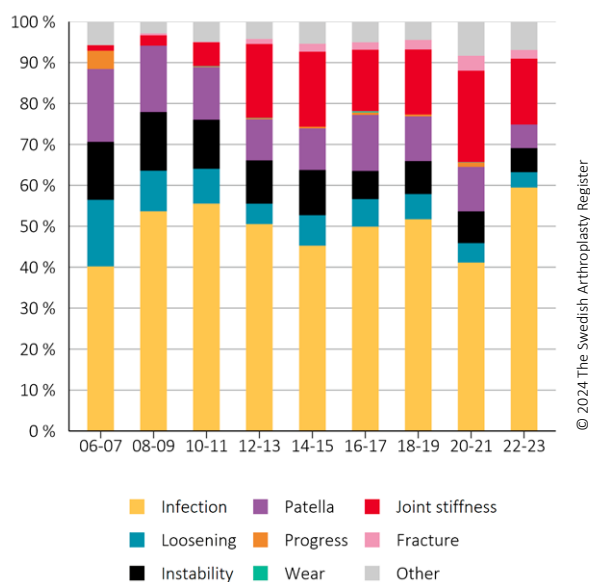


Figure 6.3.1. Distribution of reason for reoperation within two years after the primary operation in TKR/OA.

Number and proportion of reoperations within two years after the primary operation per unit 2020–2023

Unit	Number primary	Number reoperations	Whereof revisions	Infection Number	Infection %	Other reason Number	Other reason %
University units							
Akademiska sjukhuset	324	11	5	4	1.2	7	2.2
Karolinska Huddinge	440	9	6	3	0.7	6	1.4
Karolinska Solna	76	2	1	2	2.6	0	0.0
SU/Möln dal	745	17	15	9	1.2	8	1.1
SUS/Lund	54	0	0	0	0.0	0	0.0
Umeå	161	10	9	4	2.5	6	3.7
Privately run units							
Aleris Malmö Arena	313	5	5	3	1.0	2	0.6
Aleris Specialistvård Nacka	755	4	3	4	0.5	0	0,0
Aleris Specialistvård Ängelholm	1,363	32	31	13	1.0	19	1.4
Art Clinic Göteborg	1,219	8	6	6	0.5	2	1.2
Art Clinic Jönköping	913	9	8	3	0.3	6	0.7
Capio Artro Clinic	2,609	106	25	22	0.8	84	3.2
Capio Movement	1,987	17	14	9	0.5	8	0.4
Capio Ortho Center Göteborg	1,118	18	15	7	0.6	11	1.0
Capio Ortho Center Stockholm	2,384	63	34	20	0.8	43	1.8
Capio Ortho och Spine Center Skåne	460	5	5	4	0.9	1	0.3
Capio Ortopedi Motala	1,579	45	37	17	1.1	28	1.8
Capio Ortopediska Huset	2,848	71	24	21	0.7	50	1.8
Capio S:t Göran	810	11	11	3	0.4	8	1.0
Carlanderska	1,380	11	6	6	0.4	5	0.4
Carlanderska-SportsMed	628	6	4	2	0.3	4	0.6
Frölundaortopeden	71	2	2	0	0.0	2	2.8
Hermelinen	121	1	1	1	0.8	0	0.0
Ledplastikcentrum Bromma	967	12	5	8	0.8	4	0.4
Ortopediskt Center - Sophiahemmet	449	11	10	8	1.8	3	0.7
Specialistcenter S:t Johanniskliniken	50	1	1	0	0.0	1	2.0
Specialistcenter Scandinavia Malmö	178	1	1	1	0.6	0	0.0
Specialistcenter Scandinavia, Eskilstuna	290	3	1	0	0.0	3	1.0
Other units							
Alingsås	629	6	5	3	0.5	3	0.5
Arvika	974	16	12	7	0.7	9	0.9
Bollnäs	1,153	22	15	15	1.3	7	0.6
Borås	194	7	5	2	1.0	5	2.6

Table continued on next page.

Number and proportion of reoperations within two years after the primary operation per unit 2020–2023, cont.

Unit	Number primary	Number reoperations	Whereof revisions	Infection Number	Infection %	Other reason Number	Other reason %
Danderyd	273	13	12	10	3.7	3	1.1
Eksjö	1,113	28	23	15	1.3	13	1.2
Enköping	1,700	42	33	14	0.8	28	1.6
Eskilstuna	150	10	6	3	2.0	7	4.7
Falköping	27	0	0	0	0.0	0	0.0
Falun	376	9	4	3	0.8	6	1.6
Gällivare	171	2	1	1	0.6	1	0.6
Gävle	192	8	6	4	2.1	4	2.1
Halmstad	414	4	4	4	1.0	0	0.0
Helsingborg	797	9	8	5	0.6	4	0.5
Hudiksvall	183	1	1	1	0.5	0	0.0
Hässleholm	2,905	39	38	16	0.6	23	0.8
Kalmar	224	3	3	3	1.3	0	0.0
Karlshamn	820	3	3	3	0.4	0	0.0
Karlstad	86	1	1	0	0.0	1	1.2
Kullbergska sjukhuset	1,048	18	11	6	0.6	12	1.1
Kungälv	301	20	6	7	2.3	13	4.3
Lidköping	453	6	5	4	0.9	2	0.4
Lindesberg	1 266	22	15	11	0.9	11	0.9
Ljungby	276	5	4	3	1.1	2	0.7
Lycksele	565	18	15	13	2.3	5	0.9
Mora	688	39	5	6	0.9	33	4.8
Norrköping	384	8	8	1	0.3	7	1.8
Norrtälje	564	14	12	11	2.0	3	0.5
Nyköping	224	2	2	2	0.9	0	0.0
Oskarshamn	1,158	26	12	8	0.7	18	1.6
Piteå	948	24	11	10	1.1	14	1.5
Skellefteå	246	10	10	7	2.8	3	1.2
Skene	598	6	2	2	0.3	4	0.7
Skövde	76	1	1	1	1.3	0	0.0
Sollefteå	574	18	15	16	2.8	2	0.3
Sundsvall	82	3	3	2	2.4	1	1.2
Södersjukhuset	352	14	4	9	2.6	5	1.4
Södertälje	422	5	5	2	0.5	3	0.7
Torsby	442	5	4	2	0.5	3	0.7

Table continued on next page.

Number and proportion of reoperations within two years after the primary operation per unit 2020–2023, cont.

Unit	Number primary	Number reoperations	Whereof revisions	Infection Number	Infection %	Other reason Number	Other reason %
Trelleborg	1,374	18	17	12	0.9	6	0.4
Uddevalla	606	8	7	5	0.8	3	0.5
Varberg	401	3	3	2	0.5	1	0.2
Visby	334	4	3	1	0.3	3	0.9
Värnamo	712	12	10	6	0.8	6	0.8
Västervik	407	10	8	6	1.5	4	1.0
Västerås	751	17	17	10	1.3	7	0.9
Växjö	338	6	4	3	0.9	3	0.9
Örnsköldsvik	417	5	3	5	1.2	0	0.0
Östersund	278	7	7	6	2.2	1	0.4
Country	53,008	1,070	696	469	0.9	600	1.1

Table 6.3.1. Number and proportion of first reoperations (suspected or verified infection or other reason) within two years after primary operation 2020–2023 per unit. The number of primary and revisions (and proportion of primary operations) are given for comparison. Units with fewer than 20 primary operations in the current period are excluded but are included in the national figures. It should be noted that it is difficult to determine to what extent other procedures than revision is reported and thus it can affect the outcome and disadvantage units that are good at reporting other procedures.

6.4. Revision knee replacement

Authors: Annette W-Dahl and Ola Rolfson

A revision is defined as reoperations of a knee replacement where prosthetic components are added, exchanged, or removed (including arthrodesis and amputation). This means that soft tissue interventions such as arthroscopy and “lateral release” are not registered as revisions. The current status per surgical year in knee replacement surgery is illustrated in Figure 6.4.1 (a person can be included with both the right and left knee). As shown in Figure 6.4.1, more than 85% of the patients who were operated on in 1990 have not undergone a revision during their lifetime. Slightly over 10% of those operated on at that time have undergone a revision, and of the few who are still alive, less than half have been revised.

Demographics

There was a difference of just over one year in the average age at the time of the first revision of TKR 2023 compared to primary TKR in 2023 (Table 6.4.1). The mean age at first revision of UKR in 2023 was two years higher compared to primary UKR in 2023. A slightly higher proportion of males underwent revision in the TKR group, while a slightly higher proportion of females underwent revision in the UKR group compared to the proportion of males and females who underwent primary TKR and UKR. In the revision of TKR, the proportion of individuals with BMI ≥ 30 was higher than at the time of the primary operation, and in the UKR group, the proportion of individuals with BMI ≥ 35 was higher than at the primary operation. In both TKR and UKR revisions, the proportion of individuals classified as ASA $\geq III$ was higher than at the primary surgery.

Figure 6.4.2 shows the distribution of primary operations and revisions per unit in 2023. The number and proportion of primary operations are indicated in the column on the right. Units with fewer than 20 operations have been excluded. The proportion of revisions relative to the unit’s production varies from SUS/Lund, where 62% of the operations are reported as revisions, to units that have not reported any revisions at all. This variation can, for example, be due to the fact that primary operations are performed at one or more units in a region, while revisions are concentrated at other units within the region.

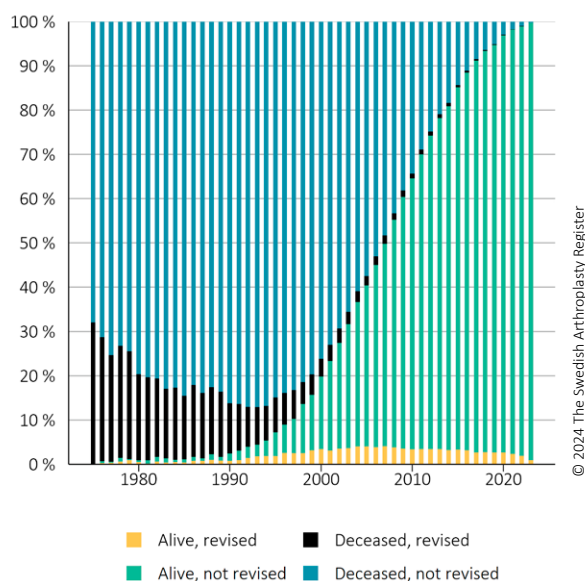


Figure 6.4.1. Current status per surgical year in patients having knee replacement.

Reason for revision

The most common reason for revision over the past ten years for TKR due to OA and UKR due to OA are shown in Figure 6.4.3. For TKR/OA, infection has been the most common reason for revision in recent years, compared to earlier years when loosening was the dominant reason for revision. The revision reason termed “progress” for TKR mainly refers to femoropatellar OA. The revision reason “patella” includes various patellar issues in patients with replacement, regardless of whether a patellar component was used (excluding loosening or wear of the patellar component). It should be noted that the distribution of reasons for revision does not necessarily reflect the actual risk of experiencing these complications. Due to the significant increase in the number of primary operations for TKR/OA over time, early revisions—and thus infections—are overrepresented. For UKR/OA, the most common reason for revision is the progression of OA. However, the proportion of revisions due to loosening is higher, and the proportion of revisions due to infection is lower compared to TKR/OA.

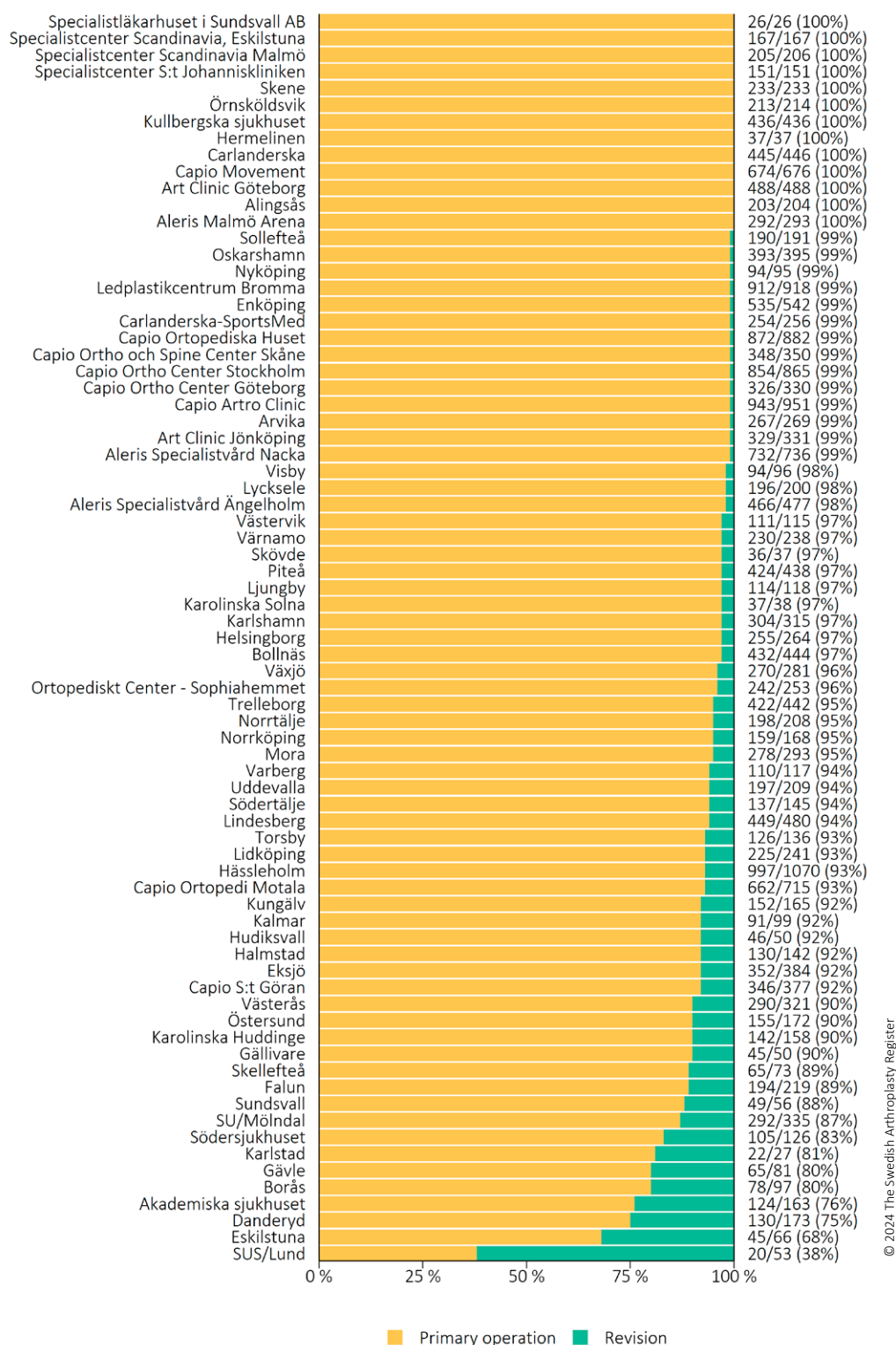


Figure 6.4.2. Revisions per unit 2023. The column on the right shows the number of primary operations/total number (% primary).

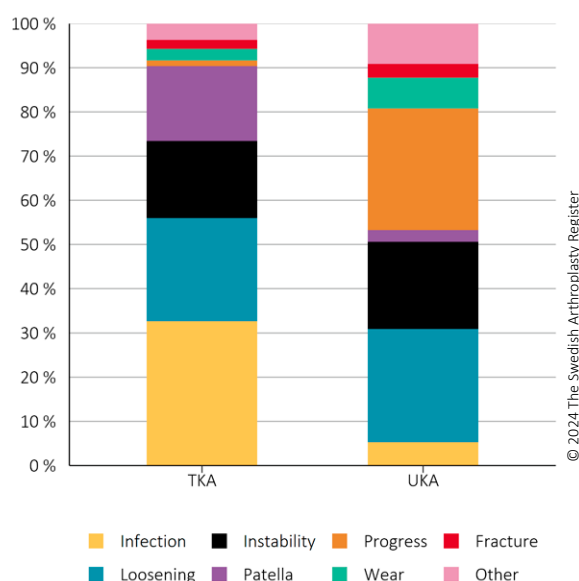


Figure 6.4.3. Distribution of reason for revision 2014–2023.

Revision procedures

Tables 6.4.2 a-b show the different types of first-time revisions performed between 2014–2023, categorized by the type of primary operation (TKR and UKR). It should be noted that the type of revision is exclusive (only one type is allowed for each revision), meaning that, for example, in a patellar procedure combined with a polyethylene exchange, only the patellar procedure is recorded. For TKR, we see that revisions involving the exchange of polyethylene components have stagnated but are slightly higher than in the period reported in last year's report. For UKR, revision to a TKR is the most common procedure.

Factors affecting revision rates

The impact of implants on revision rates is covered in a separate section (Chapter 6.5: Evaluation of implants) in this year's report as part of the harmonization of reporting for knee and hip replacement surgeries.

Underlying disease

It was recognized early on that patients with different underlying disease, such as RA and OA, could have different postoperative courses with varying revision rates. Therefore, separate curves for these diagnoses have always been presented. However, modern medical treatments for

RA have reduced the need for knee replacements in this group, making it increasingly difficult to identify statistically significant differences. Therefore, we have chosen not to present RA separately due to too few reported cases.

Age

The effect of age at the time of the primary operation can be illustrated by dividing patients into different age groups. It is evident for both TKR and UKR that the risk of revision is higher for those who undergo surgery at a younger age (Figure 6.4.4). Possible explanations include higher physical activity levels, greater demands for pain relief and function, a different life situation, and a health condition that allows for revision more easily than in older individuals.

Surgical year

For TKR, we saw a decrease in revision risk during the first three decades since the start of the register, which has not been as clear for UKR (Figure 6.4.5). During the period 2006–2015, the number of early revisions for TKR increased, a trend that has continued into the most recent period of 2016–2023. This has mainly been due to an increase in early revisions for infection (Figure 6.4.6). For UKR, the improvement over the first three decades has not been as significant as for TKR. However, even for UKR, the early revision rate increased during the periods 2006–2015 and 2016–2023. The explanation here is primarily that since the late 1990s, the relative proportion of younger patients receiving UKR has increased, and they have a higher risk. However, we see a decrease in the revision rate for UKR in the latest period compared to 2006–2015 (Figure 6.4.5). Since UKR began increasing in numbers again in 2013, the average age has increased by just over three years, which may be one of the explanations for the decline in the revision rate during the 2016–2023 period.

Risk of revision due to infection

When the Swedish Arthroplasty Register reports the risk of revision due to infection, this refers specifically to the risk of infection at the first revision, with other revision causes censored (Figure 6.4.6). This risk decreased in the early decades for OA. However, during the period 2006–2015, we observed a significant increase in the risk of infection for TKR, which continued 2016–2023, now also affecting UKR. The increase is primarily due to

early polyethylene insert exchanges in cases of infection or suspected infection. This rise is likely related to more aggressive surgical treatment for early suspected infections in recent years.

Sex

The effect of sex on the risk of revision is complex, as males and females have different revision patterns. Early revision due to infection is more common in males, while for females, loosening and patella-related problems are the dominant reasons for early revision. The difference between sex is even more pronounced when only revisions due to infection are considered (Figure 6.4.7). The reason why males are more often revised for infection than females is unclear.

Patella component in TKR

Assessing how the use of a patella component affects the risk of revision is challenging. The use of patella components varies depending on the prosthesis model, and their use has decreased over time. In the 2002 annual report, we noted for the first time that TKRs with a patella component (inserted between 1991 and 2000) had a lower revision risk than those without (Figure 6.4.8). During this period, TKRs without a patella component had a significantly higher revision rate than those with one (HR 1.3, CI 1.1–1.4). However, an analysis of the period 2001–2010 (Figure 6.4.9) showed the opposite,

with TKRs without a patella component having a significantly lower revision rate (HR 0.8, CI 0.7–0.9). For the current period (2014–2023), the risk remains the same and is not significant (HR 0.8, CI 0.7–1.01).

The reasons for these results can only be speculated. Inserting the patella component adds extra time to the surgery and introduces an additional prosthesis part that must adhere to the bone implicating an increased risk for infection, loosening, and wear. Changes in the quality and fixation of patella components could explain the shift in revision risk over time. On the other hand, some TKRs inserted without an initial patella component are later revised to include one. Changes in femoral component design, making them more “patella-friendly,” or shifts in surgeons’ enthusiasm for secondary patella resurfacing may also explain these inconsistent outcomes.

The question arises whether the use of a patella component should be considered when evaluating revision risks for individual units or implants. We have chosen to report the overall revision risk of implants (both with and without a patella component) to provide a comprehensive overview of how certain patient groups and implants perform. When comparing HRs for implants (Tables 6.5.3 and 6.5.4), we present both combined and separate results for TKRs with and without patella components. Additionally, when evaluating the revision risk for different units, we account for the use of patella components in our regression analysis.

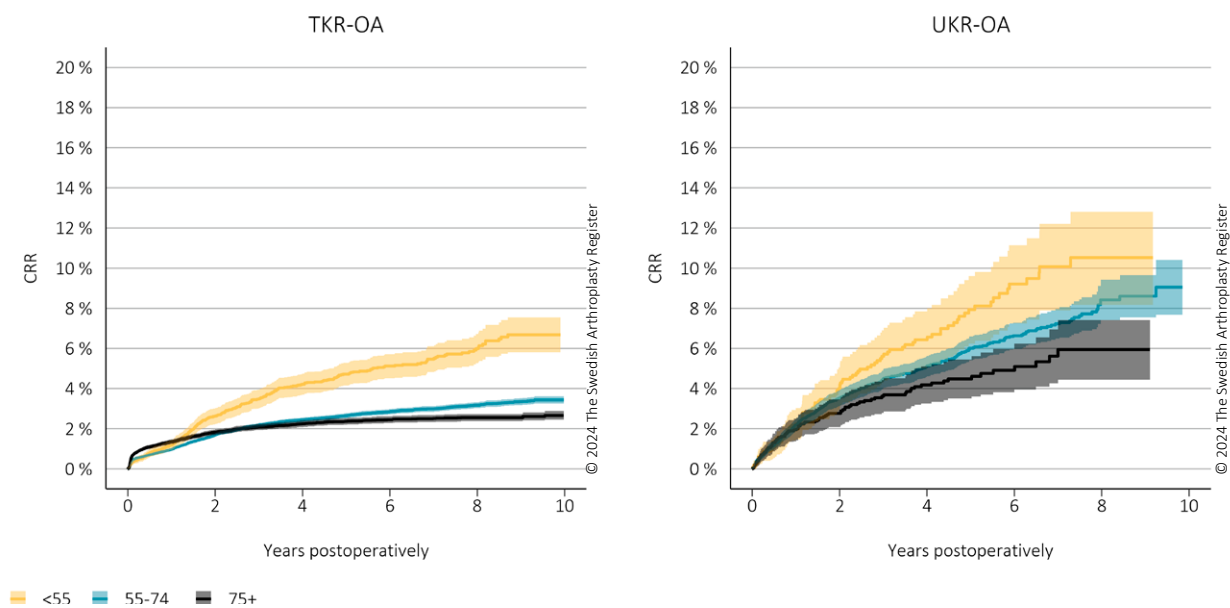


Figure 6.4.4. CRR in different age groups TKR/OA (left) and UKR/OA (right) inserted in the period 2014–2023.

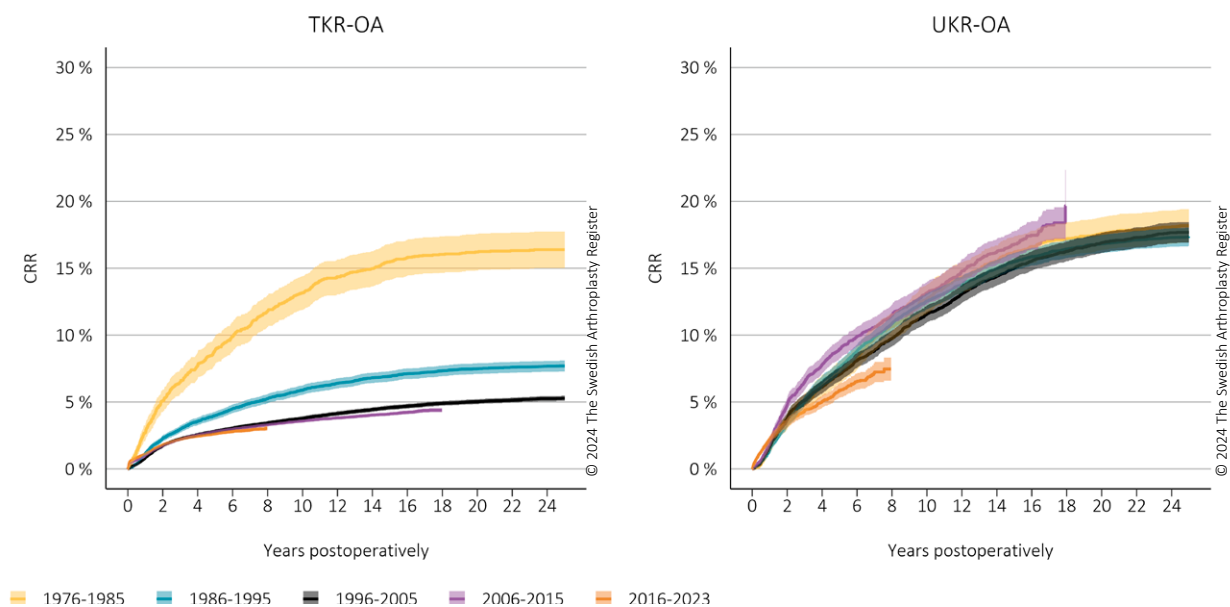


Figure 6.4.5. CRR in different periods up to 20 years in TKR/OA (left) and UKR/OA (right).

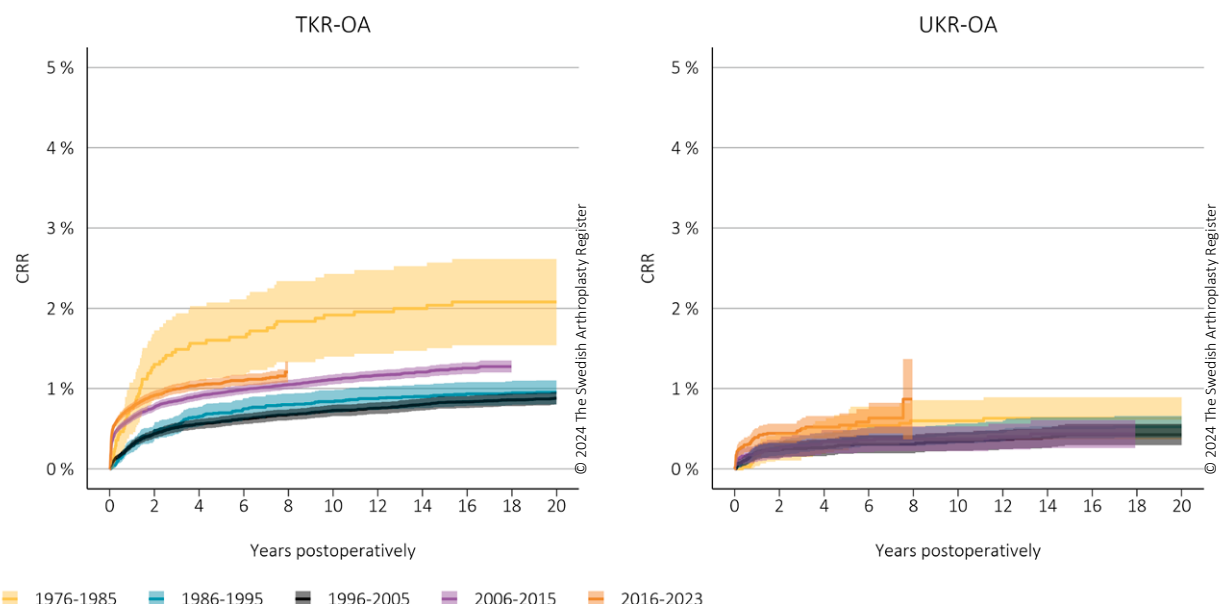


Figure 6.4.6. CRR due to infection in different periods up to 20 years in TKR/OA (left) and UKR/OA (right).

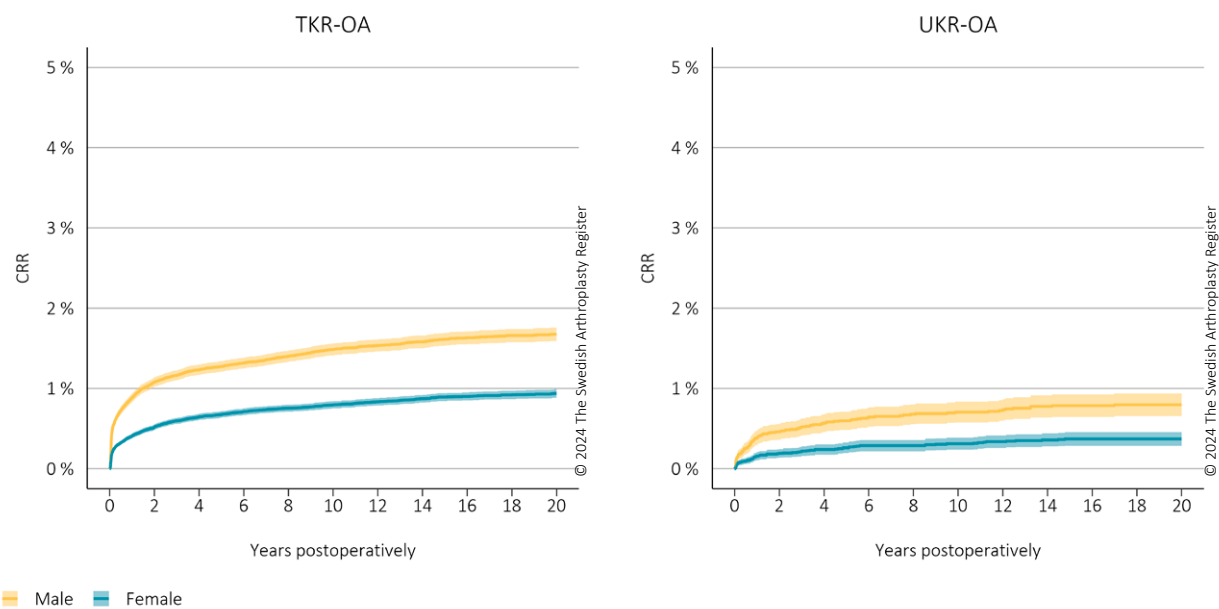


Figure 6.4.7. CRR due to infection by sex up to 20 years in TKR/OA (left) and UKR/OA (right).

Demography in first time revisions 2023

	TKR revision	UKR revision	Primary operation TKR	Primary operation UKR
Number	669	217	18,289	2,395
Mean age (SD)	71.0 (9.2)	68.6 (9.5)	69.8 (8.8)	66.6 (9.0)
Age group, n (%)				
< 45 years	<5	<5	50 (0.3)	12 (0.5)
45-54 years	28 (4.2)	14 (6.5)	820 (4.5)	215 (9.0)
55-64 years	133 (19.9)	67 (30.9)	4,228 (23.1)	771 (32.2)
65-74 years	240 (35.9)	62 (28.6)	7,071 (38.7)	884 (36.9)
75-84 years	233 (34.8)	64 (29.5)	5,571 (30.5)	479 (20.0)
≥85 years	31 (4.6)	8 (3.7)	549 (3.0)	34 (1.4)
Females, n (%)	365 (54.6)	112 (51.6)	10,282 (56.2)	1,179 (49.2)
BMI, n (%)				
18.5-24.9	<5	0 (0.0)	41 (0.2)	<5
25-29.9	112 (17.3)	38 (18.3)	3,467 (19.1)	481 (20.2)
30-34.5	269 (41.5)	96 (46.2)	7,890 (43.5)	1,131 (47.5)
35-39.9	188 (29.0)	56 (26.9)	5,241 (28.9)	625 (26.2)
≥ 40	62 (9.6)	15 (7.2)	1,342 (7.4)	131 (5.5)
ASA-class, n (%)				
I	15 (2.3)	3 (1.4)	160 (0.9)	11 (0.5)
II	43 (6.5)	21 (9.7)	2,455 (13.5)	510 (21.4)
III-V	377 (56.7)	151 (69.9)	12,300 (67.5)	1,610 (67.6)
III-V	245 (36.8)	44 (20.4)	3,477 (19.1)	263 (11.0)

Table 6.4.1. Demography in first time revisions 2023 divided in TKR and UKR with primary operation TKR and UKR 2023 for comparison.

Procedure in revision of primary TKR

Procedure	Number	Proportion %
Exchange of meniscal bearing/insert	1,770	31.5
TKA without patella	1,260	22.4
Patella addition	1,048	18.7
Linked (rot. Hinge) without patella	436	7.8
TKR with patella	337	6.0
Extraction (two-staged)	216	3.8
Exchange tibia	186	3.3
Extraction	133	2.4
Exchange femur	63	1.1
Linked (rot. Hinge) with patella	54	1.0
Linked (rot. Hinge) with patella	44	0.8
Extraction + prosthesis spacer	23	0.4
Exchange patella	17	0.3
Arthrodesis	10	0.2
Reposition of the same insert	8	0.1
Patella extraction	6	0.1
Exchange of hinge part	3	0.1
Extraction tibia	1	0.0
Hinged without patella	1	0.0
Extraction (empty joint)	1	0.0
Unknown	2	0.0
Total	5,619	100.0

Table 6.4.2 a. Procedure for revision in primary TKR/OA 2014–2023.

Procedure in revision of primary UKR

Procedure	Number	Proportion %
TKR without patella	1,189	75.4
Exchange of meniscal bearing/insert	210	13.3
TKR with patella	109	6.9
Linked (rot. Hinge) without patella	24	1.5
Extraction (two-staged)	17	1.1
Exchange tibia	7	0.4
Patellofemoral prosthesis	4	0.3
Extraction	4	0.3
UKR medial	3	0.2
Linked (rot. Hinge) with patella	1	0.1
UKR lateral	1	0.1
Exchange femur	1	0.1
Reposition of the same insert	1	0.1
Patella addition	1	0.1
Femoral amputation	1	0.1
Unknown	5	0.3
Total	1,578	100.0

Table 6.4.2 b. Procedure for revision in primary UKR/OA 2014–2023.

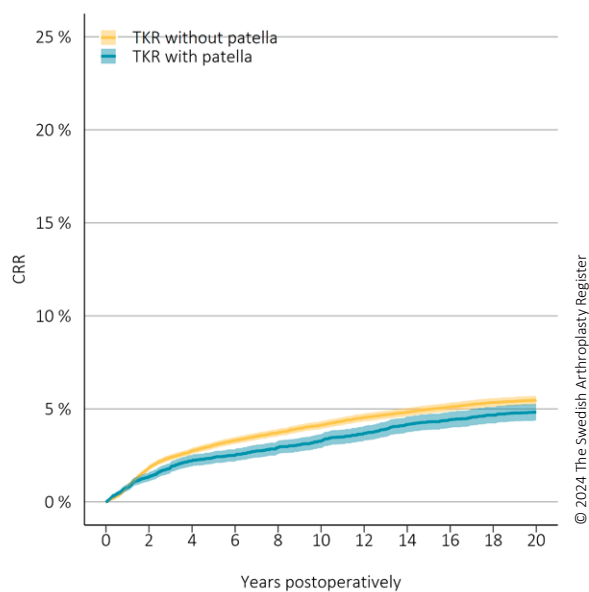


Figure 6.4.8. CRR in TKR/OA inserted in the ten-year period 1991–2000, with or without patella component respectively.

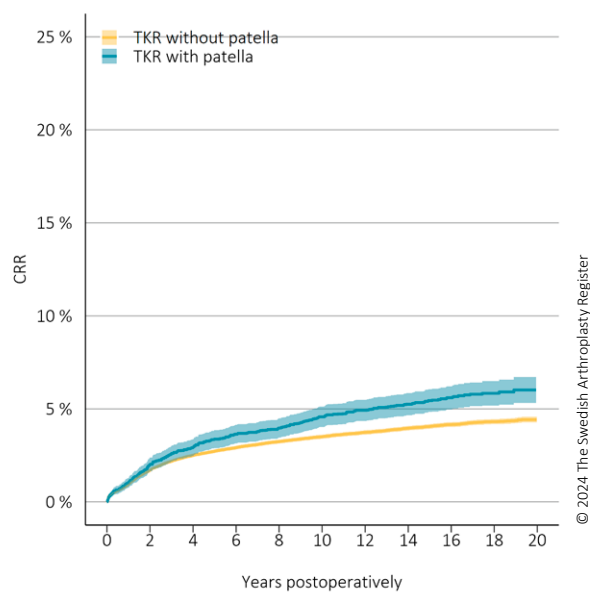


Figure 6.4.9. CRR in TKR/OA inserted in the ten-year period 2001–2010, with or without patella component respectively.

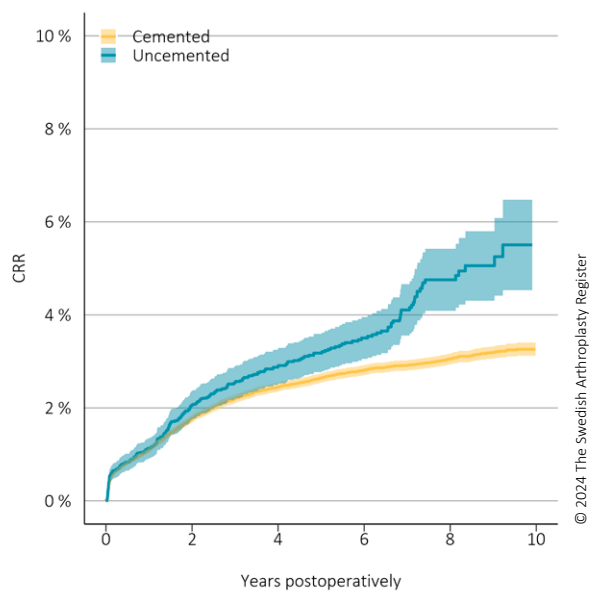


Figure 6.4.10. CRR in cemented and uncemented TKR/OA inserted in the ten-year period 2013–2023.

Use of cement

Cement has been used in a vast majority of surgeries since the mid-1990s, although there has been an increase in the use of uncemented implants in recent years. Previous analyses of TKRs performed between 1985 and 1994, when uncemented implants were somewhat more common, showed that these had a higher risk of revision. In the most recent decade, we continue to observe a significantly higher risk for uncemented implants compared to cemented ones (Figure 6.4.10). Uncemented implants have about a 2% higher risk of revision, which may be influenced by issues with the Triathlon uncemented version reported in the 2022 annual report (Chapter 9.2).

Revision risk per unit

The true average outcome of a particular treatment at a given unit can only be determined for defined groups of already treated patients. Such outcomes, however, reflect only historical conditions and cannot easily be used to compare future treatment results. The observed average outcome of a treatment at a unit is not constant. Different patient selections receiving the same treatment can lead to varying average outcomes, as can individual surgeons. This unit-specific variability must be considered for meaningful comparisons between units.

The Swedish Arthroplasty Register has standardized selection, methods, and presentation of results to ensure comparability for both knee and hip replacements, though inconsistencies remain. Traditionally, operations from a ten-year period have been included with a one-year delay (e.g., 2011–2020) when calculating cumulative revision rates (CRR). In the analyses that follow, an additional year has been included (making it an eleven-year period) and

the most recent year has been added, resulting in a period from 2013 to 2023. This change allows surgeries to be followed for more than ten years instead of just over nine. Including revisions from the most recent year might result in some revisions being missed, as revisions reported from the previous year are often added in the following year.

Table 6.4.3 shows the number of primary surgeries (TKR) performed for OA at each unit during the analyzed five-year period (2018–2023) and how many of these have been revised. Table 6.4.4 presents the corresponding numbers for a ten-year period (2013–2023). This is followed by the relative risk of revision (RR) with a 95% confidence interval. This estimates the unit effects on revision risk relative to the national average, calculated as in previous years using the “shared gamma frailty model.” Finally, the observed rank of each unit is shown along with a 95% confidence interval for the rank. The calculation was performed using the Monte Carlo method.

Only units where more than 50 primary operations have been performed during the period are included in the analysis of all TKRs performed for OA. The results have been adjusted for differences in sex and age distribution, as well as for variations in the distribution of replacements with and without a patella component. Units that are significantly better or worse than the national average are marked in green and red, respectively.

Figures 6.4.11 and 6.4.12 show the CRR after five and ten years, respectively (including primary operations from 2018–2023 and 2013–2023). Units with fewer than 50 primary operations in the past five or ten years are not reported.

Relative risk of revision per unit, five years

Unit	Number TKR	TKR revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Karlshamn	1,301	8	0.44	0.26; 0.74	1	1–21
Art Clinic Jönköping	1,288	9	0.47	0.28; 0.79	2	1–24
Alingsås	1,015	7	0.49	0.28; 0.86	3	1–29
Carlanderska	1,923	16	0.5	0.33; 0.77	4	1–22
Skene	872	6	0.53	0.30; 0.94	5	1–35
Aleris Specialistvård Bollnäs	601	6	0.54	0.30; 0.96	6	1–37
Capio Movement	2,849	28	0.54	0.38; 0.76	7	2–22
Halmstad	713	6	0.56	0.31; 1.00	8	1–39
Carlanderska-SportsMed	807	7	0.59	0.34; 1.02	9	1–41
Aleris Specialistvård Nacka	1,160	11	0.6	0.37; 0.97	10	2–37
Art Clinic Göteborg	1,432	14	0.63	0.40; 0.99	11	3–38
Gällivare	352	3	0.66	0.33; 1.28	12	1–55
Kalmar	408	4	0.69	0.37; 1.31	13	2–56
Capio Ortho Center Göteborg	1,530	20	0.69	0.47; 1.03	14	5–41
Varberg	696	9	0.7	0.42; 1.17	15	3–50
Capio Ortopediska Huset	4,140	57	0.72	0.56; 0.93	16	9–35
Piteå	1,505	20	0.73	0.49; 1.07	17	6–44
Hudiksvall	297	3	0.73	0.37; 1.43	18	2–60
Aleris Specialistvård Motala	502	8	0.75	0.44; 1.28	19	4–55
Nyköping	395	5	0.78	0.42; 1.42	20	3–60
Uddevalla	1,080	16	0.79	0.51; 1.20	21	7–52
Falköping	63		0.79	0.34; 1.81	22	1–68
Trelleborg	2,893	49	0.82	0.62; 1.07	23	12–44
Karolinska Solna	123	1	0.82	0.38; 1.77	24	2–68
Capio Artro Clinic	3,384	52	0.83	0.64; 1.08	25	13–45
Mora	1,066	16	0.83	0.55; 1.27	26	8–55
Karolinska Huddinge	666	10	0.84	0.51; 1.38	27	6–59
Örnsköldsvik	632	9	0.84	0.50; 1.40	28	6–60
Oskarshamn	1,911	32	0.87	0.63; 1.20	29	13–51
Hermelinen	153	2	0.87	0.43; 1.78	30	3–68
Bollnäs	1,195	18	0.87	0.58; 1.32	31	10–57
Torsby	656	11	0.89	0.55; 1.44	32	8–61
Södersjukhuset	750	14	0.91	0.59; 1.43	33	11–61
Arvika	1,427	25	0.92	0.64; 1.32	34	14–57
Falun	658	12	0.95	0.60; 1.52	35	11–63
Södertälje	712	13	0.96	0.61; 1.51	36	12–63
SU/Mölndal	1,444	28	0.97	0.69; 1.37	37	17–59
Lindesberg	2,131	42	0.99	0.74; 1.32	38	20–57

Table continued on next page.

Relative risk of revision per unit, five years, cont.

Unit	Number TKR	TKR revised	RR	RR 95 % CI	Rank	Rank 95 % CI
Värnamo	1,099	21	0.99	0.67; 1.45	39	16–61
SUS/Lund	93	2	1.0	0.49; 2.04	40	6–70
Helsingborg	1,196	23	1.0	0.69; 1.44	41	17–61
Ljungby	482	10	1.02	0.62; 1.68	42	12–67
Lidköping	821	16	1.03	0.67; 1.57	43	16–65
Capio S:t Göran	1,520	31	1.03	0.75; 1.44	44	21–61
Gävle	369	9	1.05	0.62; 1.75	45	13–68
Capio Ortho Center Stockholm	3,503	74	1.06	0.84; 1.33	46	28–57
Karlstad	321	8	1.07	0.63; 1.82	47	13–69
Borås	387	9	1.07	0.64; 1.80	48	14–68
Frölundaortopeden	106	3	1.08	0.55; 2.12	49	9–71
Visby	550	13	1.1	0.69; 1.73	50	17–67
Skövde	122	3	1.11	0.57; 2.18	51	10–71
Kullbergska sjukhuset	1,419	31	1.16	0.84; 1.61	52	27–66
Hässleholm	4,546	108	1.16	0.96; 1.41	53	36–61
Enköping	2,503	58	1.18	0.92; 1.52	54	33–64
Östersund	615	16	1.22	0.80; 1.87	55	25–69
Aleris Specialistvård Ängelholm	1,615	38	1.24	0.92; 1.68	56	33–67
Västervik	603	16	1.25	0.82; 1.91	57	26–70
Norrtälje	904	25	1.3	0.91; 1.86	58	33–69
Akademiska sjukhuset	465	13	1.31	0.83; 2.07	59	27–71
Eksjö	1,688	46	1.34	1.02; 1.77	60	40–68
Sollefteå	938	27	1.36	0.96; 1.92	61	37–70
Skellefteå	445	15	1.4	0.91; 2.16	62	33–71
Växjö	974	28	1.44	1.03; 2.03	63	41–71
Kungälv	632	21	1.45	0.99; 2.13	64	38–71
Västerås	1 282	39	1.48	1.10; 1.99	65	45–70
Eskilstuna	279	12	1.53	0.96; 2.45	66	36–72
Sundsvall	146	7	1.56	0.90; 2.71	67	32–72
Sophiahemmet	208	12	1.58	0.99; 2.52	68	38–72
Lycksele	759	30	1.72	1.23; 2.40	69	53–72
Umeå	410	22	1.76	1.20; 2.56	70	51–72
Danderyd	445	20	1.84	1.25; 2.72	71	54–72
Norrköping	655	31	2.03	1.46; 2.81	72	62–72

Table 6.4.3. Relative risk of revision per unit, five years. Units with significantly better or worse results than the national average are shown in green and red respectively.

Relative risk of revision per unit, ten years

Klinik	Antal TKA	Reviderade	RR	RR 95 % KI	Rank	Rank 95 % KI
Art Clinic Jönköping	1,422	10	0.43	0.26; 0.71	1	1–18
Aleris Specialistvård Nacka	1,877	17	0.43	0.28; 0.65	2	1–14
Alingsås	1,975	21	0.46	0.31; 0.67	3	1–15
Karlskoga	494	5	0.47	0.25; 0.86	4	1–30
Karlshamn	2,533	31	0.51	0.37; 0.71	5	1–18
Kalmar	836	10	0.57	0.34; 0.94	6	1–36
Carlanderska	2,284	26	0.57	0.40; 0.81	7	2–25
Gällivare	652	8	0.58	0.33; 0.99	8	1–40
Carlanderska–SportsMed	1,181	16	0.58	0.38; 0.89	9	2–32
Sabbatsberg	285	4	0.59	0.31; 1.14	10	1–51
Karolinska Huddinge	1,246	18	0.62	0.41; 0.93	11	3–35
Skene	1,387	20	0.65	0.44; 0.96	12	3–38
Capio Ortho Center Göteborg	2,112	34	0.66	0.48; 0.91	13	5–34
Capio Movement	4,500	76	0.68	0.55; 0.85	14	8–29
Jönköping	577	12	0.7	0.43; 1.12	15	3–51
Karolinska Solna	476	9	0.71	0.42; 1.20	16	3–56
Spenshult	431	10	0.72	0.43; 1.19	17	3–55
Halmstad	1,645	32	0.72	0.52; 1.00	18	7–41
Hudiksvall	632	11	0.72	0.44; 1.18	19	4–54
Piteå	2,693	50	0.76	0.58; 0.99	20	9–40
Falköping	63		0.76	0.32; 1.83	21	1–75
Capio Arthro Clinic	3,599	55	0.78	0.60; 1.00	22	10–42
Uddevalla	2,035	39	0.78	0.58; 1.05	23	10–45
Capio Ortopediska Huset	6,667	131	0.78	0.66; 0.93	24	14–36
Trelleborg	6,685	148	0.79	0.67; 0.93	25	14–36
Varberg	1,421	31	0.82	0.59; 1.14	26	10–52
Oskarshamn	3,346	71	0.85	0.68; 1.06	27	15–46
Värnamo	1,815	37	0.85	0.63; 1.15	28	12–52
Capio Ortho Center Stockholm	5,560	121	0.87	0.72; 1.03	29	18–44
Mora	1,969	42	0.87	0.65; 1.16	30	14–53
Torsby	1,220	27	0.88	0.62; 1.24	31	12–58
Capio S:t Göran	3,378	78	0.88	0.71; 1.10	32	17–49
Frölunda Specialistsjukhus	362	11	0.92	0.56; 1.51	33	9–69
Lindesberg	3,322	74	0.92	0.74; 1.15	34	19–53
Borås	738	18	0.94	0.62; 1.42	35	12–66
Örnsköldsvik	1,230	29	0.94	0.67; 1.32	36	15–63
Nyköping	780	19	0.95	0.63; 1.41	37	13–66
Aleris Specialistvård Bollnäs	2,143	64	0.95	0.75; 1.21	38	20–56
Bollnäs	1,195	18	0.96	0.64; 1.46	39	13–68

Table continued on next page.

Relative risk of revision per unit, ten years, cont.

Klinik	Antal TKA	Reviderade	RR	RR 95 % KI	Rank	Rank 95 % KI
Örebro	149	5	0.99	0.53; 1.83	40	7–75
Ängelholm	87	3	1.0	0.50; 1.99	41	6–76
Aleris Specialistvård Motala	2,376	76	1.01	0.81; 1.26	42	25–60
Arvika	2,290	55	1.01	0.78; 1.31	43	23–62
SU/Mölndal	3,149	88	1.03	0.84; 1.26	44	27–60
Västerås	2,342	62	1.04	0.82; 1.33	45	26–63
Södersjukhuset	2,032	62	1.05	0.83; 1.34	46	27–64
Lidköping	1,890	53	1.06	0.82; 1.37	47	26–65
Karlstad	1,145	37	1.06	0.78; 1.44	48	23–67
Växjö	1,782	48	1.08	0.82; 1.42	49	26–67
Elisabethsjukhuset	55	3	1.12	0.56; 2.23	50	9–77
Södertälje	1,322	39	1.14	0.85; 1.53	51	28–70
Visby	928	28	1.15	0.82; 1.62	52	26–72
Östersund	1,255	38	1.15	0.85; 1.55	53	29–71
Ljungby	991	31	1.17	0.84; 1.62	54	28–72
Helsingborg	1,618	45	1.19	0.90; 1.57	55	33–71
Aleris Specialistvård Ängelholm	2,495	69	1.19	0.95; 1.50	56	37–69
Eksjö	2,607	76	1.21	0.97; 1.51	57	39–70
Enköping	4,329	131	1.22	1.03; 1.45	58	43–68
Falun	1,982	71	1.22	0.97; 1.53	59	39–70
Skellefteå	897	31	1.23	0.89; 1.71	60	32–73
Gävle	892	33	1.25	0.91; 1.72	61	34–74
Sophiahemmet	628	29	1.25	0.89; 1.76	62	33–74
Norrtälje	1,372	42	1.26	0.95; 1.68	63	37–73
Sollefteå	1,504	47	1.27	0.97; 1.67	64	39–73
Skövde	653	26	1.28	0.90; 1.82	65	33–75
Västervik	1,062	36	1.32	0.97; 1.80	66	39–75
Akademiska sjukhuset	865	33	1.34	0.98; 1.85	67	39–75
Danderyd	1,021	37	1.35	1.00; 1.83	68	41–75
Sundsvall	388	16	1.37	0.89; 2.10	69	33–76
Kullbergsgka sjukhuset	2,340	78	1.39	1.12; 1.73	70	50–74
Umeå	947	45	1.48	1.12; 1.96	71	50–76
Hässleholm	8,060	317	1.53	1.37; 1.72	72	64–74
SUS/Lund	340	19	1.61	1.08; 2.41	73	48–77
Norrköping	1,350	60	1.64	1.29; 2.10	74	60–77
Lycksele	1,209	52	1.68	1.29; 2.18	75	61–77
Kungälv	1,430	75	1.85	1.49; 2.31	76	69–77
Eskilstuna	508	34	2.16	1.58; 2.96	77	71–77

Table 6.4.4. Relative risk of revision per unit, ten years. Units with significantly better or worse results than the national average are shown in green and red respectively.

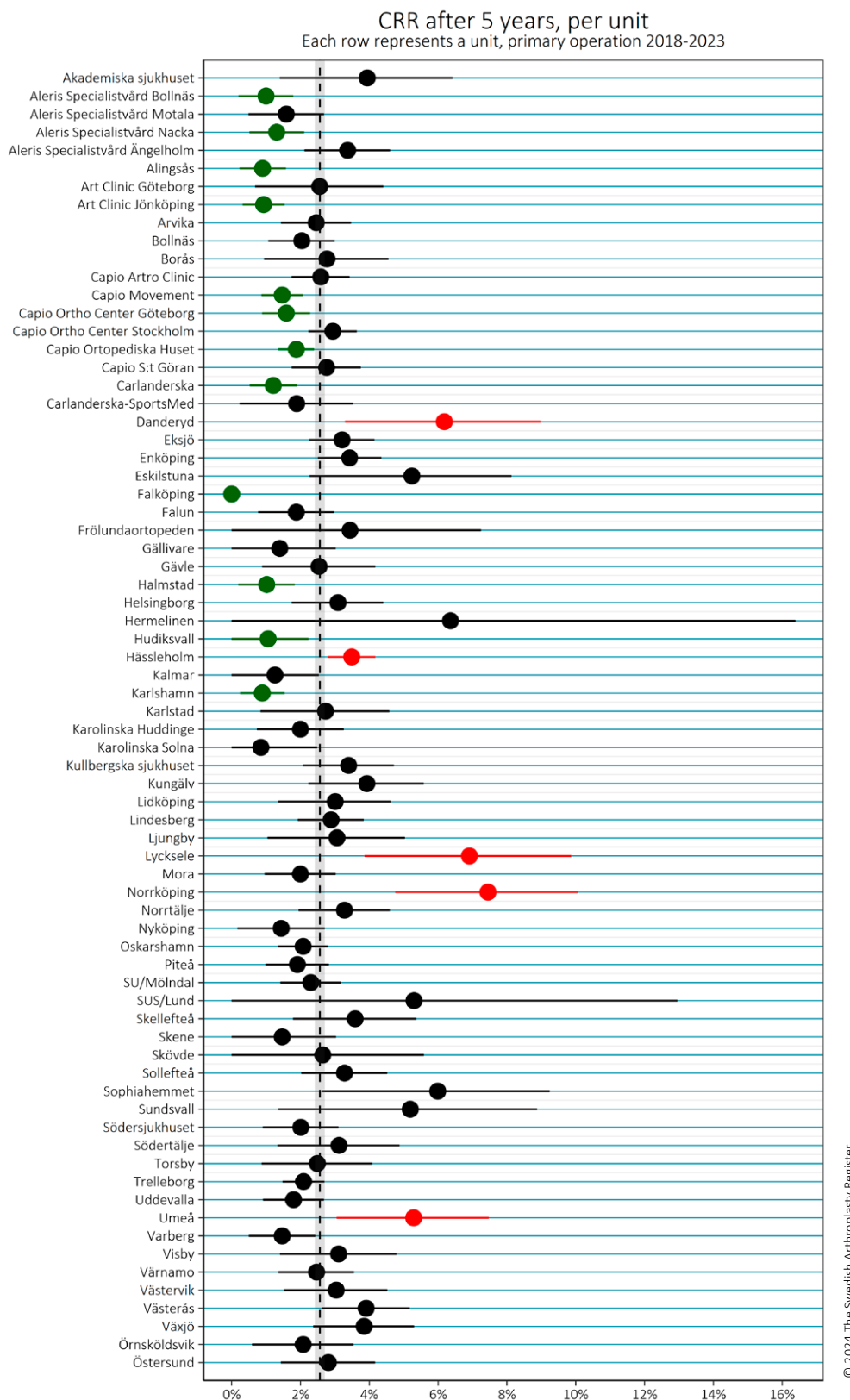


Figure 6.4.11. CRR after five years per unit (primary operation 2018–2023). Units with fewer than 50 primary operations in the last five years are not presented.

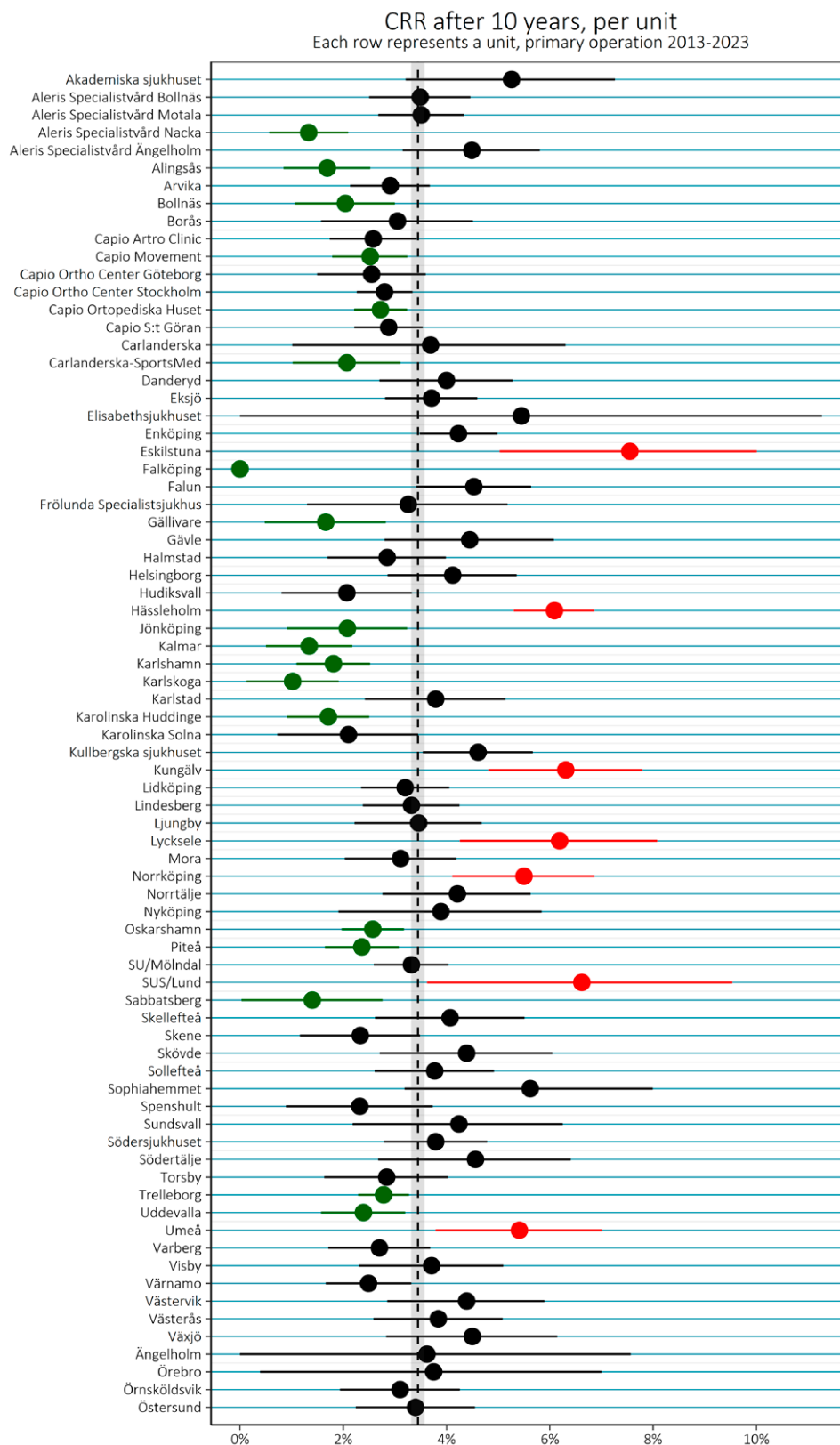


Figure 6.4.12. CRR after ten years per unit (primary operation 2013–2023). Units with fewer than 50 primary operations in the last five years are not presented.

Patellofemoral prosthesis

A patellofemoral prosthesis addresses only the femoro-patellar compartment and is a less commonly used type of prosthesis. Its use has increased over the past 15 years, rising from 10–20 implants per year to 50–60 per year. Figure 6.4.13 shows the cumulative revision rate (CRR) at nine years (14 CI 9.7–18.1) for patellofemoral prostheses implanted between 2013 and 2023.

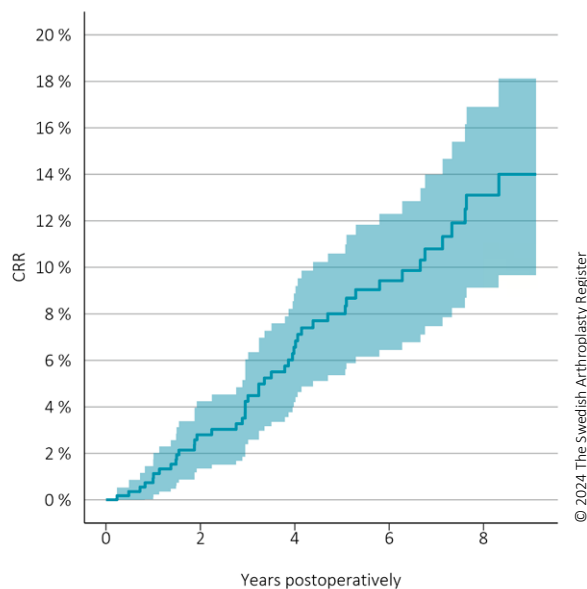


Figure 6.4.13. CRR for patellofemoral replacements inserted in the ten-year period 2013-2023.

Partial resurfacing prosthesis

The first partial resurfacing prosthesis, Episealer, was registered in 2011, and various numbers have been reported over the years, with 75 implants registered in 2023. Episealer is a custom-made implant based on MRI images and is used in the femoral condyles of the knee joint (both medial and lateral), the trochlear area of the knee joint, or both, primarily for local cartilage damage. Figure 6.4.14 shows the CRR at eight years (9.4 CI 1.1–16.9) for implants inserted between 2013 and 2023.

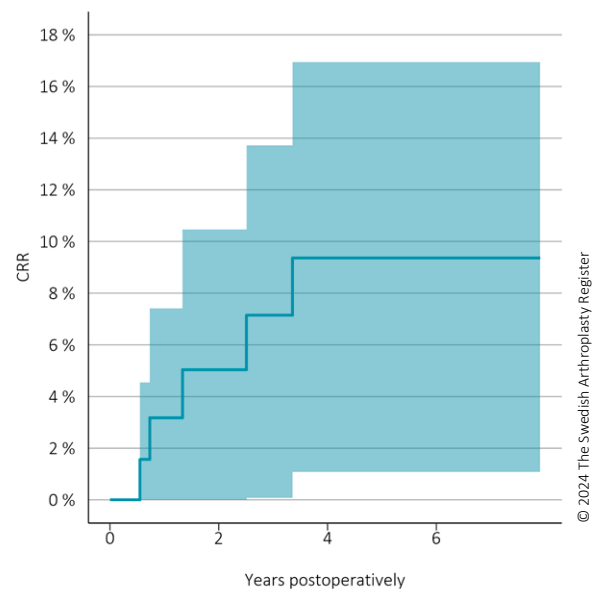


Figure 6.4.14. CRR for partial knee replacements inserted in the ten-year period 2013-2023. Due to that there are relatively few replacements, the curve ends when the number “at risk” is below ten replacements (unlike other CRR figures where the curves end at 50 at risk).

6.5. Evaluation of implant

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In the evaluation of implants, we have chosen to present relatively modern prosthesis models with reasonably long follow-up times, using data from the most recent ten-year period. A model is also reported after it has ceased to be used as long as there is a sufficient amount of data to analyze. Note that individual prosthesis models may represent different prosthesis variants due to factors such as modularity and marketing. However, within each model, there are usually a few dominant combinations. In this year's report, models that have been reported in 100 or more surgeries from 2014–2023 are included, as well as

revision models used in primary surgeries. Triathlon MBT is reported separately for cemented and uncemented versions, as it is the most commonly reported uncemented prosthesis in Sweden. The hazard ratio (HR) is adjusted for sex, age, and year of surgery (Table 6.5.1).

This year, we have chosen to replace PFC-Sigma MBT as the reference for TKR with NexGen MBT, as it is the most commonly used prosthesis in the recent ten-year period. NexGen MBT is considered a well-defined prosthesis despite the many combinations available, as most consist

Hazard ratio with 95% confidence interval in revision TKR/OA

Model	Number	Revised	HR (95% CI)	p
NexGen MBT	64,742	1,349	Reference	
NexGen Trabecular Metal	2,113	39	0.69 (0.50; 0.96)	0.03
PFC Sigma TKA APT	5,477	99	0.73 (0.59; 0.89)	< 0.01
Triathlon MBT Hybrid	204	2	0.89 (0.22; 3.55)	0.86
Genesis II MBT	2,736	54	0.96 (0.73; 1.26)	0.76
Vanguard I-Beam Modular	1,332	45	1.16 (0.86; 1.56)	0.35
Triathlon MBT Cemented	11,547	250	1.19 (1.04; 1.36)	0.01
PFC Sigma TKA MBT	21,670	624	1.27 (1.16; 1.40)	< 0.01
Attune MB TKA	2,669	34	1.46 (1.03; 2.06)	0.03
Triathlon APT	170	5	1.47 (0.61; 3.54)	0.39
Vanguard Finned Stem Modular	1,690	71	1.49 (1.17; 1.90)	< 0.01
Triathlon MBT uncemented	6,894	221	1.55 (1.35; 1.79)	< 0.01
Persona	5,368	107	1.60 (1.31; 1.95)	< 0.01
Other	538	23	1.72 (1.14; 2.61)	< 0.01
NexGen Revision	559	18	1.82 (1.15; 2.90)	0.01
PFC Sigma TC-3 (revision)	380	16	2.17 (1.33; 3.56)	< 0.01
Triathlon Total Stabilizer	802	34	2.35 (1.67; 3.31)	< 0.01
Legion/Genesis II Pri MBT	2,271	117	2.46 (2.03; 2.97)	< 0.01
Journey TKA	216	17	3.87 (2.40; 6.24)	< 0.01
Sex=Female			0.89 (0.83; 0.96)	< 0.01
Age			0.98 (0.98; 0.99)	< 0.01
Surgical year			1.00 (0.98; 1.01)	0.56

Table 6.5.1. Hazard ratio for revision with 95% confidence interval in TKR/OA 2014–2023.

Units with significantly better or worse results than the national average are shown in green and red respectively.

of the same type of femur, tibial plate, and polyethylene insert. Among those classified as NexGen MBT, five combinations of femur, tibia, and polyethylene insert account for 95%, with three combinations making up 91%.

Triathlon MBT cemented, PFC Sigma TKA MBT, Attune MB TKA, Vanguard Finned Stem Modular, Triathlon MBT uncemented, Persona, Legion/Genesis II MBT, Journey TKA, and revision models such as NexGen Revision, PFC Sigma TC-3 (revision), and Triathlon Total Stabilizer show a significantly higher risk of revision (higher HR) compared to the reference NexGen MBT. Journey TKA is used less frequently, Triathlon MBT uncemented is used approximately the same amount, while Persona is increasing in usage.

On the other hand, NexGen TM and PFC-Sigma APT have lower HRs compared to the reference.

As in previous years, we have included revision models if they have been reported sufficiently. We are aware that these are used on primary patients with more advanced OA/malalignments and sicker patients, but we still find it interesting to show how these groups perform. All revision models show a higher HR than the reference prosthesis.

There are two different variants of the Vanguard prosthesis: one uses a tibial plate with an I-Beam stem, while the other uses a plate with a finned stem. The latter began to

be used in 2010. In the 2018 report, the finned version had a significantly higher risk than the reference model, but in recent years the difference has not been significant, although it now shows a significantly higher risk compared to NexGen MBT. Since Vanguard is no longer used in Sweden, this is of mostly historical interest.

Females have a significantly lower ten-year HR for revision (all types) than males, which is mainly explained by male's higher risk of infection, which is most common early post-operatively. As in previous years, the risk decreases with increasing age, while the year of surgery does not affect the risk.

For UKR, we have also chosen to change the reference prosthesis from Link to Oxford's uncemented prosthesis (Table 6.5.2). For UKR due to OA, Oxford models account for 75% of surgeries, while Link accounts for just over 5%. Link has a significantly higher risk, while no prosthesis has a significantly lower risk of revision compared to the reference prosthesis, and the risk decreases with increasing age.

The risk of revision is just one measure of prosthesis model performance. The type of revision should also be considered, even though it is not reported here. A deliberately sparing use of patellar components, with the option to provide patellar support secondarily if needed, raises the reported revision rate. We therefore report TKA/OA

Hazard ratio with 95% confidence interval in revision UKR/OA

Model	Number	Revised	HR (95% CI)	p
Oxford uncemented	8,407	358	Reference	
Sigma-PKR	368	9	0.52 (0.27; 1.01)	0.05
ZUK	1,156	45	0.74 (0.54; 1.02)	0.06
Other	600	27	1.04 (0.70; 1.53)	0.86
Oxford cemented	662	51	1.10 (0.81; 1.51)	0.54
Triathlon Uni	914	49	1.10 (0.82; 1.49)	0.53
Link	1,382	92	1.29 (1.02; 1.63)	0.03
Persona-PK	323	15	1.34 (0.80; 2.25)	0.27
Sex = Female			1.01 (0.86; 1.18)	0.91
Age			0.98 (0.97; 0.99)	< 0.01
Surgical year			1.03 (0.99; 1.06)	0.2

Table 6.5.2. Hazard ratio for revision with 95% confidence interval in UKR/OA 2014–2023. Units with significantly better or worse results than the national average are shown in green and red respectively.

separately for those with and without a patellar component. In the tables, models that are used both with and without a patellar component are listed separately. All other models, including revision models, are categorized as “others.”

We have categorized TKR/OA into two groups: those used without a patellar component (Table 6.5.3) and those with

a patellar component (Table 6.5.4). This categorization results in a reduced number of implants available for analysis, particularly for the group where a patellar component has been used. To enable the analysis of comparable groups, we have combined certain groups compared to the classification in Table 6.5.1.

Hazard ratio with 95% confidence interval in revision TKR/OA without patella component

Model	Number	Revised	HR (95% CI)	p
NexGen MBT	63,764	1,321	Reference	
PFC Sigma TKA APT	5,160	94	0.74 (0.60; 0.91)	< 0.01
Vanguard I-Beam Modular	1,303	45	1.19 (0.88; 1.61)	0.25
Triathlon MBT Cemented	11,225	243	1.19 (1.04; 1.36)	0.01
PFC Sigma TKA MBT	20,708	597	1.28 (1.16; 1.41)	< 0.01
Other	16,728	400	1.37 (1.22; 1.53)	< 0.01
Triathlon MBT Uncemented	6,565	214	1.57 (1.36; 1.82)	< 0.01
Legion/Genesis II Pri MBT	2,081	107	2.44 (2.00; 2.97)	< 0.01
Sex = Female			0.92 (0.85; 0.98)	0.02
Age			0.98 (0.98; 0.99)	< 0.01
Surgical year			1.00 (0.98; 1.01)	0.69

Table 6.5.3. Hazard ratio for revision with 95% confidence interval in TKR/OA without patella component 2014–2023. Units with significantly better or worse results than the national average are shown in green and red respectively.

Hazard ratio with 95% confidence interval in revision TKR/OA with patella component

Model	Number	Revised	HR (95% CI)	p
NexGen MBT	978	28	Reference	
PFC Sigma TKA APT	317	5	0.48 (0.18; 1.26)	0.13
Triathlon MBT Uncemented	329	7	0.83 (0.35; 1.96)	0.67
PFC Sigma TKA MBT	962	27	0.87 (0.52; 1.49)	0.62
Triathlon MBT Cemented	322	7	0.90 (0.39; 2.06)	0.8
Attune MB TKA	222	4	0.97 (0.32; 2.91)	0.96
Other	524	16	1.08 (0.58; 2.00)	0.81
Legion/Genesis II Pri MBT	190	10	1.92 (0.93; 3.95)	0.08
Sex = Female			0.45 (0.31; 0.67)	< 0.01
Age			1.00 (0.98; 1.02)	0.68
Surgical year			1.01 (0.93; 1.10)	0.74

Table 6.5.4. Hazard ratio for revision with 95% confidence interval in TKR/OA with patella component 2014–2023. Units with significantly better or worse results than the national average are shown in green and red respectively.

In the analysis of TKR without a patellar component (Table 6.5.3), it is noted that the same models show significantly higher or lower HRs compared to the reference model, NexGen MBT, as seen in the analysis of TKR with or without a patellar component (Table 6.5.1).

Since the use of a patellar component is relatively rare, it becomes more challenging to demonstrate and interpret significant differences. None of the prostheses with a patellar component have significantly better or worse outcomes

compared to the reference, except for the Legion/Genesis II MBT, which has a higher risk with a patellar component than the reference. The impact of sex, age, and increasing year of surgery remains unchanged regardless of whether all TKRs are included or only those without a patellar component. However, when only those with a patellar component are considered, only female patients show a lower HR.

Hazard ratio with 95 % confidence interval in revision TKR/OA.
(exchange of insert, in case of infection, is not considered to be revision)

Model	Number	Revised	HR (95% CI)	p
NexGen MBT	64,742	951	Reference	
Genesis II MBT	2,736	30	0.76 (0.53; 1.10)	0.15
Triathlon MBT Hybrid	204	1	0.81 (0.11; 5.75)	0.83
NexGen Trabecular Metal	2,113	39	0.86 (0.62; 1.18)	0.35
PFC Sigma TKA APT	5,477	99	0.99 (0.81; 1.22)	0.94
Triathlon MBT Cemented	11,547	164	1.13 (0.96; 1.34)	0.14
Attune MB TKA	2,669	13	1.21 (0.70; 2.10)	0.5
Vanguard I-Beam Modular	1,332	38	1.28 (0.92; 1.78)	0.14
PFC Sigma TKA MBT	21,670	462	1.30 (1.17; 1.46)	< 0.01
Other	538	16	1.55 (0.95; 2.55)	0.08
Vanguard Finned Stem Modular	1,690	57	1.58 (1.20; 2.07)	< 0.01
NexGen Revision	559	11	1.65 (0.91; 2.99)	0.1
Persona	5,368	67	1.73 (1.34; 2.23)	< 0.01
Triathlon MBT Uncemented	6,894	172	1.73 (1.47; 2.03)	< 0.01
Triathlon Total Stabilizer	802	21	2.06 (1.34; 3.17)	< 0.01
Triathlon APT	170	5	2.17 (0.90; 5.23)	0.08
Legion/Genesis II Pri MBT	2,271	94	2.83 (2.29; 3.50)	< 0.01
PFC Sigma TC-3 (revision)	380	16	3.10 (1.89; 5.09)	< 0.01
Journey TKA	216	16	5.12 (3.12; 8.40)	< 0.01
Sex = Female			1.14 (1.05; 1.24)	< 0.01
Age			0.97 (0.96; 0.97)	< 0.01
Surgical year			0.99 (0.97; 1.01)	0.18

Table 6.5.5. Hazard ratio for revision with 95% confidence interval in TKR/OA 2014–2023. Exchange of insert due to infection has not been classified as revision. Units with significantly better or worse results than the national average are shown in green and red respectively.

Hazard ratio with 95 % confidence interval in revision UKR/OA
(exchange of insert, in case of infection, is not considered to be revision)

Model	Number	Revised	HR (95% ci)	p
Oxford uncemented	8,407	336	Referens	
Sigma-PKR	368	9	0.55 (0.28; 1.07)	0.08
ZUK	1,156	40	0.69 (0.50; 0.97)	0.03
Oxford cemented	662	48	1.07 (0.78; 1.48)	0.68
Triathlon Uni	914	46	1.09 (0.80; 1.49)	0.57
Other	600	27	1.10 (0.74; 1.62)	0.65
Persona-PK	323	13	1.24 (0.71; 2.16)	0.45
Link	1,382	92	1.36 (1.08; 1.72)	< 0.01
Sex = Female			1.06 (0.90; 1.24)	0.48
Age			0.98 (0.97; 0.99)	< 0.01
Surgical year			1.02 (0.98; 1.06)	0.4

Table 6.5.6. Hazard ratio for revision with 95% confidence interval in UKR/OA 2014–2023. Exchange of insert due to infection has not been classified as revision. Units with significantly better or worse results than the national average are shown in green and red respectively.

As previously, we also present separate tables (6.5.5 and 6.5.6) where revisions involving a polyethylene component exchange due to infection are not counted as revisions. It has been argued that the register's definitions might disadvantage certain implant types. This is because nearly half of all revisions for infection involve synovectomies, which also include a polyethylene component exchange (thus being counted as revisions). Conversely, a synovectomy on an implant where the component cannot be changed is not counted as a revision. Thus, exchange of the polyethylene component in cases of infection could arguably be considered a soft tissue intervention rather than a revision. On the other hand, implants where the component cannot be replaced typically require a total revision due to the impossibility of complete cleaning, potentially leading to reverse bias if component exchange is not considered a revision. Without definitively determining what is most reasonable, we have chosen to present the risk where component exchange due to infection is not counted as a revision. Note that such an exclusion reduces the number of revisions, which in turn decreases the sensitivity of statistical calculations.

For TKR/OA without considering patellar supply (Table 6.5.5), compared to Table 6.5.1, the same prostheses show higher HRs compared to the reference, with the exception of the cemented Triathlon MBT and Attune MB TKA. Component exchange is not possible for the PFC-Sigma APT and the monoblock variant of NexGen TM, so they cannot benefit from the exclusion of component exchange. Compared to the NexGen MBT reference (with replaceable polyethylene), these are not significantly better than the reference.

The ZUK prosthesis, which had a significantly lower HR when all revisions were included, also maintains a lower HR when component exchange due to infection is excluded for UKR/OA (Table 6.5.6).

In summary, it can be observed that the outcome is affected when component exchange due to infection is not counted as a true revision. HR slightly decreases for some fully modular models, while others no longer have a significantly higher risk. For prostheses with non-modular tibial component, HR slightly increases with this adjustment and no longer shows a significantly lower risk.

6.6. Knee Osteotomy

Authors: Annette W-Dahl and Ola Rolfson

Joint preserving surgery – knee osteotomy

Tibial osteotomy was introduced in Sweden in 1969 by Professor Göran Bauer in Lund as a standard procedure for unicompartmental knee osteoarthritis. After the introduction of modern knee prostheses in the mid-1970s, these quickly became the most common surgical treatment for knee osteoarthritis.

The number of osteotomies has gradually decreased since then. In 1981, Björn Tjörnstrand estimated in his dissertation, “Tibial Osteotomy for Medial Gonarthrosis,” that one-third of knee reconstruction surgery consisted of tibial osteotomies. By the mid-1990s, the Swedish Knee Arthroplasty Register reported that they accounted for only about 20% of knee reconstruction surgeries.

Among the osteotomies performed around the knee, tibial osteotomy is by far the most common method. It is used primarily for medial osteoarthritis and less frequently for lateral osteoarthritis. Femoral osteotomies are rarer in Sweden and are mostly used for more severe deformities, whether congenital or acquired, as well as for lateral osteoarthritis of the knee.

There are several techniques for knee osteotomy, and the initial fixation of the osteotomy varies depending on the method used. Closed wedge osteotomy (“minus osteotomy”), a bone wedge, sized according to the required degree of correction, is removed (Figure 6.6.1). The osteotomy can be fixed with a clamp, plate with screws, or an external frame. Open wedge osteotomy (“plus osteotomy”), a wedge is opened to achieve the desired degree of correction. Fixation can involve internal fixation, usually with a plate screwed in place (Figure 6.6.2), or external fixation, which involves an external metal frame (Figure 6.6.3). Internal fixation may include a plate with screws or a clamp, and sometimes a bone graft or bone substitute (artificial bone) is used. In open wedge osteotomy with external fixation, correction can be achieved gradually by slowly separating the ends of the bone, allowing new bone to grow into the osteotomy. This is a biological procedure also used for lengthening or other bone corrections, such as such as improperly healed fracture, also known as hemicallostasis. Lastly, there is the curved or “dome” osteotomy, which is rare in Sweden.

The outcomes of knee osteotomy are related to the ability to achieve and maintain the predetermined correction of the deformity. This requires not only achieving the intended degree of correction during the operation but also maintaining a stable fixation of the correction until the bone heals. Each technique has its own advantages and disadvantages, and there is ongoing development in techniques, materials, and management to achieve better results.

The choice of method and technique in knee osteotomy can influence the risk of complications both in the short and long term, and it can also impact future knee replacement surgery from both technical and outcome perspectives. Using the appropriate technique for the right patient is crucial from both a health economic and patient perspective.



Figure 6.6.1. Closed wedge osteotomy fixed with a staple. The inserted picture above shows the wedge that is removed before the osteotomy is closed.

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Figure 6.6.2. Open wedge osteotomy with internal fixation.



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Figure 6.6.3. Open wedge osteotomy with external fixation.

Sweden was the first in the world to initiate knee osteotomy registration as a complement to knee replacement registration (W-Dahl et al., 2014). Australia started in the fall of 2016, and New Zealand plans to start a similar registration. Both countries have harmonized their reporting forms with Sweden's to facilitate future comparisons and collaboration. The United Kingdom started its osteotomy registration in the fall of 2014, funded by the industry and independent from the English joint replacement register (Elson et al., 2015).

In 2023, a total of 107 primary osteotomies were reported from 19 units. As shown in Figure 6.6.1, only three units reported performing 10 or more osteotomies during the year. The hospital that reported the highest number was Capio Artro Clinic, with 29 procedures. There were 25 more knee osteotomies reported in 2023 compared to 2022.

It is challenging to assess how many of the osteotomies performed in the country are also reported to the knee osteotomy register. The procedure codes for knee osteotomy (NGK59 and NFK59) which are used for osteotomies performed on the femur and tibia, also apply to osteotomies performed for other reasons than disease or

injury in the knee. Information from the National Board of Health and Welfare in a previous analysis indicated that approximately 400 different diagnoses, of which 148 were primary diagnoses, were listed for the procedure code NGK59 in the National Patient Register (NPR). 65% of the operations could be attributed to osteoarthritis and instability diagnoses. We have extracted the number of NGK59 from the National Board of Health and Welfare's statistics for the years 2014–2022 and compared these with all primary osteotomies performed for osteoarthritis or instability in the knee osteotomy register for the corresponding years. Assuming that the osteotomy register predominantly captures osteoarthritis and instability diagnoses, we estimate that the completeness of the knee osteotomy register was 75–87% during the period 2014–2022.

The Centre of Registers Västra Götaland has implemented principles for anonymization, meaning that it should not be possible to identify an individual in the annual report. These principles are extensive and could affect the purpose of the report and, in some cases, provide incorrect information. As the Swedish Arthroplasty Register absolutely does not intend to disclose any identities, we have chosen not to show numbers in any category below

Type of knee osteotomy per unit 2013–2023

Unit	Open wedge osteotomy internal fixation	Open wedge osteotomy external fixation	Distal femur osteotomy	Closed wedge osteotomy	Double osteotomy (F&T)	Dome osteotomy	Rotational osteotomy	Total
Aleris Specialistvård Eskilstuna	5	0	0	0	0	0	0	5
Aleris Specialistvård Ängelholm	<5	0	0	0	0	0	0	<5
Art Clinic Jönköping	7	0	0	0	0	0	0	7
Borås	<5	0	0	0	0	<5	0	<5
Capio Artro Clinic	67	0	10	0	0	<5	0	79
Capio Movement	72	0	0	0	0	0	0	72
Capio OrthoCenter Stockholm	0	0	<5	<5	0	0	0	<5
Capio Ortho och Spine Center Skåne	8	0	0	0	0	0	0	8
Capio Ortopedi Motala	127	0	16	0	0	0	0	143
Capio Ortopediskahuset	0	0	0	12	0	0	0	12
Danderyd	6	0	<5	0	0	0	0	7
Eksjö	26	8	<5	0	0	0	0	35
Elisabethkliniken	11	0	0	0	0	0	0	11
Enköping	25	0	0	0	0	0	0	25
Eskilstuna	15	0	0	0	0	0	0	15
Falun	<5	0	0	0	0	0	<5	<5
Gävle	113	0	8	5	10	<5	0	138
Helsingborg	52	0	8	0	0	0	0	60
Hudiksvall	51	0	<5	0	0	0	0	53
Hässleholm	0	136	<5	0	0	0	0	137
Jönköping	17	<5	<5	0	0	0	0	20
Kalmar	0	23	0	0	0	0	0	23
Karolinska Huddinge	0	0	0	5	0	0	0	5
Karolinska Solna	17	12	19	0	28	<5	<5	80
Kungsbacka	42	0	<5	<5	0	0	0	48
Kungälv	13	0	0	0	0	0	0	13
Köping	<5	0	0	0	0	0	0	<5
Norrköping	5	0	0	0	0	0	<5	6
Norrtälje	11	0	0	0	0	0	0	11
Ortopediskt Center/ Sophiahemmet	37	0	<5	0	0	0	0	39
Oskarshamn	64	0	0	0	0	0	0	64
Piteå	5	0	0	0	0	0	0	5

Table continued on next page.

Type of knee osteotomy per unit 2013-2023, cont.

Unit	Open wedge osteotomy internal fixation	Open wedge osteotomy external fixation	Distal femur osteotomy	Closed wedge osteotomy	Double osteotomy (F&T)	Dome osteotomy	Rotational osteotomy	Total
Sabbatsberg	6	0	<5	0	0	0	0	8
SU/Mölndal	<5	0	0	0	0	0	0	<5
Sunderby sjukhus	<5	0	0	0	0	0	0	<5
Sundsvall	<5	0	0	<5	0	0	0	<5
SU/Sahlgrenska	<5	0	0	0	0	0	0	<5
SUS/Lund	6	<5	<5	0	0	0	0	10
SUS/Malmö	30	<5	10	0	<5	0	0	43
Södersjukhuset	39	0	11	0	0	0	0	50
Trelleborg	76	19	9	<5	0	0	1	106
Uddevalla	157	<5	20	<5	0	0	0	179
Umeå	<5	60	<5	0	0	0	<5	65
Visby	15	0	<5	0	0	0	0	17
Västervik	<5	0	0	0	0	0	0	<5
Västerås	6	0	0	<5	0	0	0	7
Växjö	<5	24	0	0	0	0	0	26
Ängelholm	<5	0	0	0	0	0	0	<5
Örebro	6	0	<5	0	0	0	0	7
Östersund	<5	0	0	0	0	0	0	<5
Total	976	261	98	29	15	5	<5	1,673

Table 6.6.1. Type of knee osteotomy per unit 2013-2023.

Demography knee osteotomy 2023

	All	Proximal Tibia	Distal Femur
Number	127	99	16
Age			
Median (min–max)	49 (16–65)	50 (17–62)	38,5 (16–65)
< 45 years, n (%)	48 (38)	31	11
45–54 years, n (%)	54 (42)	48	<5
55–64 years, n (%)	25 (20)	20	<5
≥ 65 years, n (%)	1 (1)	0	<5
Sex			
Females, n (%)	46 (36)	34	9

Table continued on next page.

Demography knee osteotomy 2023, cont.

	All	Proximal Tibia	Distal Femur
BMI			
Median (range)	27 (19–40)	27 (19–40)	26 (20–35)
18.5–24.9, n (%)	37 (29)	26	7
25–29.9, n (%)	58 (46)	49	<5
30–34.9, n (%)	23 (18)	18	<5
35–39.9, n (%)	7 (6)	6	0
Missing, n (%)	<5	0	<5
ASA-class, n (%)			
I	63 (50)	49	9
II	55 (43)	44	5
III–V	8 (6)	5	<5
Missing	1 (1)	1	0
Previous surgery, n (%)			
None	64 (50)	50	6
Osteosynthesis	9 (7)	<5	<5
Cruciate ligament repair	10 (8)	9	<5
Meniscal surgery	22 (17)	18	<5
Arthroscopy	14 (11)	13	<5
Other	6 (5)	<5	<5
Missing	2 (2)	2	0
Diagnosis OA			
Number, (%)	94 (74)	79	12
Ahlbäck 1	26	21	5
Ahlbäck 2	17	15	<5
Ahlbäck 3–4	<5	<5	0
Missing a)	48	40	6
Varus/valgus			
Number (%)	127	99	16
Varus	102 (80)	90	<5
Valgus	19 (15)	<5	13
Missing	6 (5)	5	0
Preop HKA-angle			
Number	121	94	16
Median (range)	7 (0–25)	7 (0–25)	7 (1–25)

Table 6.6.2. Demography knee osteotomy 2023.

five but instead indicate <5 to avoid this possibility. As a consequence of these principles, it is, for example, not possible for us to present which units performed knee osteotomies and which methods and techniques they used for 2023. Instead, we have chosen to show the number of knee osteotomies and the type of osteotomy per unit from 2013 to 2023, i.e., since the start of the registration (Table 6.6.1).

Results

The Knee Osteotomy Register records similar information as the Swedish Arthroplasty Register regarding patients (BMI, ASA, previous surgeries), antibiotics, thromboprophylaxis, and surgical techniques. Additionally, information on deformity measured by the HKA angle and osteoarthritis grade at the time of diagnosis according to Ahlbäck’s classification is collected for knee osteotomies. The results for 2023 are presented with numbers and, where appropriate, percentage values.

Demographics

Nearly two-thirds of the patients were males, and the median age was 49 years, compared to a median age of 71 years for TKR and 67 years for UKR in 2023. Half of

the patients were reported as healthy (ASA I) and had a median BMI of 27. There was a period during which the variable “Osteoarthritis Grade” was mistakenly removed from the web form, resulting in missing information for over half of the knee osteotomies performed for osteoarthritis. Most patients were reported to have medial osteoarthritis, with a median deformity of 7 degrees varus or valgus. Patients who underwent distal femoral osteotomy were younger, with a higher proportion of females compared to those who had proximal tibial osteotomy, but had similar degrees of preoperative deformity (Table 6.6.2).

When reporting previous surgeries on the affected knee, multiple options can be selected. Half of the patients reported having had a knee surgery before the current osteotomy, with 15% having undergone more than one. In comparison, for knee replacement patients, just under 15% reported having had a knee surgery before the current operation, and 3% had undergone more than one. The reported information about previous surgeries does not provide a comprehensive description of the type of procedures but gives an overview of what was known at the time of surgery (Table 6.6.1).

Type of knee osteotomy and reason for surgery

Diagnosis	Open wedge HTO internal fixation	Open wedge HTO external fixation	Closed wedge	Distal femoral osteotomy	Double osteot- omy	Rotational osteotomy	Total
OA	65	14	0	12	0	0	94
Acquired deformity	<5	0	0	<5	<5	0	5
Congenital deformity	6	0	<5	<5	8	<5	18
Instability	<5	0	<5	<5	0	0	<5
Osteonecrosis	<5	0	0	0	0	0	<5
Other	<5	0	0	<5	0	0	5
Missing	0	0	0	0	0	0	0
Total	81	4	<5	16	12	<5	127

Table 6.6.3. Type of knee osteotomy and reason for surgery 2023.

Reason and type of osteotomy

The majority of the procedures were performed due to osteoarthritis. The most popular method was open wedge osteotomy with internal fixation, followed by distal femoral osteotomy. Only two closed wedge osteotomies were reported in 2023. For open wedge osteotomies with external fixation, only Orthofix was reported in 2023 (Table 6.6.3).

Type of plate fixation and bone grafting

For open wedge osteotomy with internal fixation, several different plates were used. The Tomofix plate was the most frequently reported for open wedge osteotomy with internal fixation. Six different types of plate fixation were used in osteotomies with this technique. In just over half of the open wedge osteotomies with internal fixation, no bone grafting was reported. When bone grafting was used, synthetic bone was reported most frequently, with Innothera being the most common form. For distal femoral osteotomies, various types of fixation were reported, with Tomofix being the most common (Table 6.6.4).

Thrombosis and Antibiotic Prophylaxis

Innohep and Fragmin were the most commonly reported antithrombotic agents, while NOACs were reported in only 10% of surgeries. This contrasts with 66% of knee replacement surgeries, where NOACs or a combination of injections and NOACs were used for prophylaxis. Prophylaxis with Fragmin, Innohep, and Klexane was more frequently started postoperatively. In four surgeries, no thrombosis prophylaxis was reported. The duration of prophylaxis varied, but in nearly three-quarters of the surgeries, prophylaxis was planned to last 8–14 days (Table 6.6.5).

Cloxacillin was reported as the infection prophylaxis in the majority of surgeries in 2023, and Dalacin (clindamycin) was reported in 5% of surgeries. In contrast, only 4% of knee replacement surgeries used clindamycin. Given that clindamycin has shown a higher risk of revision due to infection in knee prosthesis surgery (Robertsson et al. 2017), the PRISS recommendations were updated in April 2018 and April 2023 (www.patientforsakringen.se). In nearly half of the surgeries, the preoperative dose was administered according to PRISS recommendations,

which suggests administering it 2 g × 3 on the first day of surgery or a single 2 g dose. Since Cloxacillin has a short half-life, it must be administered within the correct time interval. The updated PRISS recommendations (April 2018 and April 2023) specify the optimal time as 45–30 minutes before surgery, a narrower interval than previously recommended (45–15 minutes) (Table 6.6.5).

Other surgical variables

General anesthesia was the most commonly reported form of anesthesia, used in 60% of surgeries. The use of tourniquet has decreased among Swedish orthopedic surgeons but is reported slightly more frequently for knee osteotomies (50%) compared to knee prosthesis surgeries (25%). The use of drains has become increasingly rare, with no drains used in the osteotomies and less than 0.5% used in knee preplacement surgeries.

In one-third of surgeries, an additional simultaneous procedure was performed alongside the knee osteotomy, with arthroscopy being the most common (Table 6.6.6). The median operation time, excluding osteotomies with additional simultaneous procedures, was shorter for open wedge osteotomies with external fixation (61 minutes, 38–118 minutes) than with internal fixation (70.5 minutes, 27–209 minutes). The median time for distal femoral osteotomy was 113 minutes (32–167 minutes) and for double osteotomy was 172 minutes (110–271 minutes). Table 6.6.4 shows median times including the duration of any additional simultaneous procedures. None of the osteotomies were performed using computer-assisted navigation (CAS).

Reoperation

Since the start of the knee osteotomy register in 2013, around one hundred reoperations have been reported. The most common reasons for reoperation have been pain/irritation of the plate, pseudoarthrosis/delayed healing, and over- or under-correction.

The cumulative revision rate (CRR) at ten years for open wedge osteotomies performed from 2013 to 2023 and followed up to December 31, 2023, with internal and external fixation was 25.2% (95% CI 17.8–31.9) and 26.1% (95% CI 21.4–30.6), respectively (Figure 6.6.4).

Type of plate fixation and bone graft

	Open wedge HTO internal fixation, number	Distal femoral osteotomy, number
Type of plate		
Tomofix	14	10
PEEKPower	14	<5
Puddo	13	
Activmotion	<5	<5
Other	<5	
Missing	0	<5
Total	81	16
Bone graft		
None	49	11
Autograft	6	<5
Bank bone	<5	0
Synthetic graft	24	<5
Missing	<5	0
Total	81	16
Synthetic graft		
INNOTERE	13	<5
ChronOS	6	<5
Aktivmotion	<5	<5
Other	<5	0
Missing	0	0
Total	24	<5

Table 6.6.4. Type of plate fixation and bone graft 2023.

Thrombosis prophylaxis and prophylactic antibiotics

Thrombosis prophylaxis and prophylactic antibiotics	
Thrombosis prophylaxis, number (%)	
No prophylaxis	<5
Dalteparin preop	<5
Dalteparin postop	55 (44)
Tinzaparin preop	<5
Tinzaparin postop	30 (24)
Enoxaparin postop	13 (10)
Apixaban	13 (10)
Missing	<5
Total	127
Number of days, number (%)	
No prophylaxis	<5
1-7	6 (5)
8 - 14	92 (72)
>14	21 (17)
Missing	<5
Total	127
Prophylactic antibiotics, number (%)	
No prophylaxis	<5
Cloxacillin	118 (93)
Cindamycin	6 (5)
Cefotaxim	<5
Missing	<5
Total	127
Dosage, Cloxacillin, number (%)	
2g x 1	30 (25)
2g x 2	35 (30)
2g x 3	53 (45)
Missing	0
Total	118
Minutes before surgery, number	
No prophylaxis	<5
0 - 29	31 (24)
30 - 45	57 (45)
>45	35 (28)
Missing	<5
Total	127

Table 6.6.5. Thromboprophylaxis and prophylactic antibiotics 2023.

Type of anesthesia and surgical variables

Type of anesthesia and surgical variables	
Type of anesthesia, number (%)	
Generell	75 (59)
Spinal	28 (22)
Epidural	7 (5)
Combination	16 (13)
Missing	<5
Total	127
Tourniquet, number (%)	
Yes	64 (51)
No	60 (47)
Missing	<5
Total	127
Drainage, number (%)	
Yes	0
No	124 (98)
Missing	<5
Total	127
Concomitant surgery, number (%)	
None	85 (67)
Arthroscopy	18 (14)
Cruciate ligament reapi	5 (4)
Meniscal surgery	<5
Other	9 (7)
Missing	8 (6)
Total	127
Surgical time minutes, median (min-max)	
Open wedge internal	74 (27–257)
Open wedge external	61 (38–118)
Closed wedge	229.5 (192–267)
Distal femoral	112.5 (32–320)
Double osteotomy	191.5 (110–307)
Rotational osteotomy	164 (151–177)

Table 6.6.6. Type of anesthesia and surgical variables 2023.

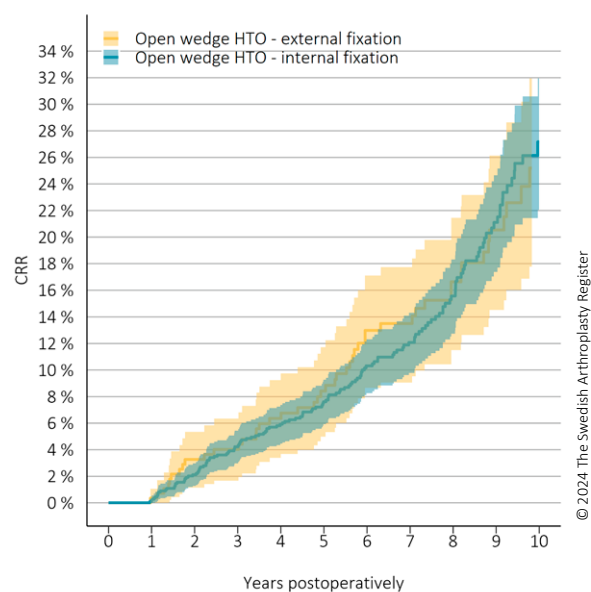


Figure 6.6.4. CRR for conversion to TKR after open wedge osteotomy.



An adverse event is any unfavorable event in a patient that occurs during or after treatment but is not necessarily causally related to that treatment.

7. Adverse events

Authors: Cecilia Rogmark, Annette W-Dahl, and Ola Rolfson

7.1. 90-day mortality

The 90-day mortality rate is often used to assess the risks associated with various medical treatments and is openly reported. This year's report presents regional data for both primary hip and knee replacement surgeries, as well as hip fractures. The Swedish Arthroplasty Register database is updated nightly with any recorded patient death dates from the Swedish Tax Agency. The data includes the last three years (2021–2023) to account for random variation.

Elective orthopedic surgeries, such as joint replacement, are typically performed when the patient's health is as stable as possible. In some cases, surgery may be deemed too risky and therefore not recommended. This careful selection and optimization of patients undergoing joint replacement surgeries contribute to a low mortality rate. The 90-day mortality after a primary elective total hip replacement is 1.7 ‰ (see Table 7.1.1). However, mortality varies between regions. In one region, no deaths were reported within 90 days, while another region reported a mortality rate of 8.1‰. Mortality after knee replacement surgery is even lower, at 1.0‰ (Table 7.1.1). The variation between regions is smaller for knee replacement, ranging from 0 to 3.4‰. Gotland has a relatively high mortality rate following hip replacement surgery but one of the lowest in the country after knee replacement surgery. However, as Gotland is one of the smallest regions, even a single death can significantly impact the overall mortality rate. Halland, Kronoberg, Uppsala, Västerbotten,

and Västmanland have mortality rates above the national average for both hips and knees.

A joint replacement carries an increased risk of potentially life-threatening complications, such as infections and thromboembolic events. Comprehensive information is a crucial part of the decision-making process for patients considering an elective operation, and while mortality rates may appear low, there is always room for improvement. It is also essential that other units treating newly operated patients with complications inform the operating unit of these cases. If the orthopedic surgeon is not aware of these severe incidents, they may mistakenly assume such complications do not occur.

For patients with a hip fracture, surgery is almost always performed, regardless of coexisting illnesses. Therefore, the 90-day mortality rate after hip fracture surgery is higher than after elective surgeries. The national level is slightly lower than in the previous year, at 12.1% (see Table 7.1.2). A few regions, such as Jämtland and Västmanland, report even higher rates, around 14%. These regions tend to have a higher proportion of male patients and patients with severe health conditions. In Västernorrland, patients are more frequently ill and/or over 80 years old. A significant proportion of patients in Västra Götaland, Halland, and Blekinge are also over 80 years old. High mortality rates should prompt internal review and analysis.

90-days mortality after primary elective hip replacements and knee replacements

Region	Hip			Knee		
	Number of operations	Number of deaths	Mortality, ‰	Number of operations	Number of deaths	Mortality, ‰
Blekinge	804	1	1.2	729	0	0.0
Dalarna	1,181	2	1.7	1,153	1	0.9
Gotland	370	3	8.1	285	0	0.0
Gävleborg	1,558	2	1.3	1,463	0	0.0
Halland	2,175	5	2.3	2,436	4	1.6
Jämtland	474	2	4.2	297	1	3.4
Jönköping	2,555	1	0.4	2,350	1	0.4
Kalmar	1,754	0	0.0	1,493	2	1.3
Kronoberg	763	2	2.6	644	1	1.6
Norrbottnen	1,435	5	3.5	1,257	1	0.8
Skåne	6,273	12	1.9	7,112	5	0.7
Stockholm	13,806	19	1.4	13,536	11	0.8
Sörmland	2,085	2	1.0	1,808	2	1.1
Uppsala	2,080	9	4.3	2,010	3	1.5
Värmland	1,462	1	0.7	1,326	1	0.8
Västerbotten	1,285	4	3.1	862	2	2.3
Västernorrland	1,629	2	1.2	1,068	3	2.8
Västmanland	1,057	3	2.8	704	1	1.4
Västra Götaland	8,098	13	1.6	6,963	9	1.3
Örebro	1,406	3	2.1	1,048	1	1.0
Östergötland	1,956	3	1.5	1,958	2	1.0
Country	54,206	94	1.7	50,502	51	1.0

Table 7.1.1. 90-day mortality after primary elective total hip and knee replacement per region 2021–2023.

90-days mortality after hip fracture

Region	Number of operations ¹	>80 years ²	Males ³	ASA III ⁴	ASA IV ⁵	Acute fracture ⁶	Number of deaths	Mortality ⁷
Blekinge	437	59.3	36.8	46.0	4.6	95.9	59	13.5
Dalarna	707	57.4	39.2	52.0	7.8	96.2	86	12.2
Gotland	160	53.8	35.0	48.3	4.8	94.4	20	12.5
Gävleborg	733	53.2	39.3	44.4	7.1	96.2	70	9.5
Halland	765	60.4	38.7	45.6	8.3	96.1	104	13.6
Jämtland	310	50.6	39.7	59.0	10.4	92.9	44	14.2
Jönköping	630	55.1	37.5	55.6	9.0	95.6	62	9.8
Kalmar	571	54.3	32.7	51.5	4.2	95.8	44	7.7
Kronoberg	453	57.6	34.4	56.6	7.8	94.9	56	12.4
Norrbottnen	722	58.7	40.4	54.9	10.1	94.7	92	12.7
Skåne	2,747	57.5	36.3	55.2	5.2	94.2	313	11.4
Stockholm	3,539	57.1	35.5	65.9	7.5	91.9	412	11.6
Sörmland	583	54.7	36.4	53.3	6.9	93.3	69	11.8
Uppsala	777	56.9	38.0	62.7	5.8	94.5	87	11.2
Värmland	686	56.9	38.6	52.7	4.9	96.2	87	12.7
Västerbotten	672	56.5	36.9	56.5	6.8	96.0	82	12.2
Västernorrland	596	59.1	33.4	56.1	13.0	97.0	80	13.4
Västmanland	589	54.5	40.9	62.7	9.0	97.6	80	13.6
Västra Götaland	3,511	59.1	35.6	54.1	6.9	96.2	476	13.6
Örebro	690	53.3	36.1	56.4	8.9	93.3	91	13.2
Östergötland	869	57.7	33.9	51.8	8.5	93.9	91	10.5
Country	20,747	57.1	36.5	56.1	7.2	94.7	2,505	12.1

Table 7.1.2. 90-day mortality after hip fracture per region 2021–2023.

1) Number of primary surgeries in the current period

2) Number of surgeries in the age group >80 years.

3) Proportion of males in the current period.

4) Proportion with ASA class III.

5) Proportion with ASA class IV.

6) Proportion with acute fracture.

7) 90-day mortality (proportion who have died within 90 days after surgery).

7.2. Adverse events

Joint replacements are among the interventions that have the greatest cost benefits in healthcare. Although the surgery is considered safe and have few complications some patients experience health problems after surgery that could have arisen or become symptomatic as a result of the surgery.

Description of the analysis

The analysis is performed by linking the register data to the Patient Register of the National Board of Health and Welfare (PAR). We have examined the diagnostic and procedure codes that have been reported to the PAR during and after hip and knee replacement surgery and have identified codes that may represent adverse events during the hospital stay or during readmission within 90 days of surgery (see table 7.2.1).

Due to the Swedish National Board of Health and Welfare's changed regulations regarding confidentiality, the method for analyzing adverse events has been altered over the past few years. It is no longer allowed to present the number of adverse events if they are three or fewer per unit. Data from the Swedish National Board of Health and Welfare's were not available when the Swedish version of the annual report was published. However, in this English version we have included adverse events for 2023.

In order not to risk revealing information on individuals, the National Board of Health and Welfare delivers the number of adverse events as intervals of five events (min, max; 0–4, 5–9, 10–14, etc.), where the actual number of events is within the interval. All proportions are calculated based on the midpoint of the interval (for example, the numerator is set to 12 if the interval is 10–14). The lower bound of the confidence interval is calculated on the lowest possible number of events according to the number interval and the upper limit is calculated based on that the highest possible number. So the confidence interval includes both the uncertainty from the rounding and from the random variation. For the country and larger units, the interval will be roughly the same as before but generally it will be wider range and fewer significant differences.

In the comparison of units, data from five years has been used, 2019–2023. Units with fewer than 40 operations are not shown.

This year, the National Board of Health and Welfare has delivered adverse events after 30 and 90 days per unit in elective hip replacements and total knee replacements due to osteoarthritis respectively, hip replacements due to fracture and those having first-time revision of primary hip and knee replacements. The analyses include partly 2013–2023 and partly the most recent five-year period, 2019–2023.

If both hips/knees have been operated within 90 days only the latter is included and only one hip or knee if both have been operated the same day. The Swedish Arthroplasty Register sends data on all registered operations to the National Board of Health and Welfare which performs the match against the PAR and codes corresponding to the definition of adverse events, during or after the hospital stay, up to 90 days after the operation is sought.

The codes were divided into the following groups (table 7.2.1):

- A – Surgical procedure codes that include reoperations of hip or knee replacement and other procedures that may represent a complication.
- DA – Diagnosis codes that imply surgical complications.
- DB – Diagnosis codes that cover hip/knee-related diseases that may have been used for complication after hip/knee replacement surgery.
- DC – Diagnosis codes covering cardiovascular events that may be related to the surgery.
- DM – Diagnosis codes considering other medical events not related to the surgery if they occur shortly afterwards.

Codes for adverse events

	Used for primary surgeries	Used for reoperations and revisions	HIP ICD-10 and NOMESCO codes	Additional codes for hip fractures	KNEE ICD-10 and NOMESCO codes
Surgical					
A NOMESCO codes Complications and suspected complications	If the procedure occur after the operation date OR during an admission after the operation	If the procedure occur during an admission after the operation	Exact code NFA02, NFA11, NFA12, NFA20, NFA21, NFA22, NFQ09, NFU09, NFU19, NFU39, NFU89, NFU99, QDA10, QDB00, QDB05, QDB99, QDE35, QDG30, TNF05, TNF10 Start with NFC.., NFF.., NFG.., NFH.., NFJ.., NFK.., NFL.., NFM.., NFS.., NFT.., NFW..		Exact code NFQ09, NFQ19, NFQ99, NGB59* NGF01, NGF02, NGF10, NGF11, NGF12, NGF91, NGF92, NGK09, NGK19, NGM09, NGQ09, NGT09, NGT19, QDA10, QDE35, TNG05, TNG10 Start with NGA.., NGC.., NGE.., NGG.., NGH.., NGJ.., NGL.., NGS.., NGU.., NGW.., QDB.., QDG..
	If the procedure occur during an admission after the operation	If the procedure occur during an admission after the operation	NFU49		NGB59
DA ICD-10 codes Surgical complications	If they occur as main or co-diagnosis at the time for surgery or as main code at re-admission	If they occur as main diagnosis at re-admission	G978, G979, M966F, M968, M969, T810, T812, T813, T814, T815, T816, T817, T818, T818W, T819, T840, T840F, T843, T843F, T844, T844F, T845, T845F, T847, T847F, T848, T848F, T849, T888, T889		G978, G979, M966G, M968, M969, T810, T812, T813, T814, T815, T816, T817, T818, T818W, T819, T840, T840G, T843, T843G, T844, T844G, T845, T845G, T847, T847G, T848, T848G, T849, T888, T889
DB ICD-10 codes for hip/knee related conditions	If they occur as main or co-diagnosis at the time for surgery or as main code at re-admission	If they occur as main diagnosis at re-admission	G570, G571, G572, M000, M000F, M002F, M008F, M009F, M243, M244, M244F, S730. Start with S74.., S75.., S76..		G573, G574, M000, M000G, M002G, M008G, M009G, M220, M221, M236, M244G, M621G, M662G, M663G, M843G, S342, S800, S810, S830, S831, S834L, S834M, S835R, S835S, S835X, S840, S841
	If they occur as main diagnosis at re-admission	If they occur as main diagnosis at re-admission	M240F, M245F, M246F, M610F, M621F, M662F, M663F, M843F, M860F, M861F, M866, M866F, M895E		M235, M240, M245, M246, M256, M659G, M860G, M861G, M866, M866G, M895G

Table continued on next page.

Codes for adverse events, cont.

	Used for primary surgeries	Used for reoperations and revisions	HIP ICD-10 and NOMESCO codes	Additional codes for hip fractures	KNEE ICD-10 and NOMESCO codes
Cardiovascular					
DC ICD-10 codes for serious cardiovascular conditions	If they occur as main or co-diagnosis at the time for surgery or as main code at re-admission	If they occur as main or co-diagnosis at the time for surgery or as main code at re-admission	Exact code I260, I269, I460, I461, I469, I490, I649, I770, I771, I772, I819, I978, I979, J809, J819, T811 Start with I21.., I24.., I60.., I61.., I62.., I63.., I65.., I66.., I72.., I74.., I82..		Exact code I260, I269, I460, I461, I469, I490, I649, I770, I771, I772, I819, I978, I979, J809, J819, T811 Start with I21.., I24.., I60.., I61.., I62.., I63.., I65.., I66.., I72.., I74.., I82..
Medical					
DM ICD-10 codes for other medical conditions	If they occur as main or co-diagnosis at the time for surgery or as main code at re-admission	If they occur as main or co-diagnosis at the time for surgery or as main code at re-admission	Exact code J952, J953, J955, J958, J959, J981, N990, N998, N999, R339 Start with I80.., J13.., J14.., J15.., J16.., J17.., J18.., J96.., K25.., K26.., L89.., N17..	N300, N308, N309, N390	Exact code J952, J953, J955, J958, J959, J981, N990, N998, N999, R339 Start with I80.., J13.., J14.., J15.., J16.., J17.., J18.., K25.., K26.., K27.., L89.., N17..
	If they occur as main diagnosis at re-admission	If they occur as main diagnosis at re-admission	Exact code K590, N991 Start with J20.., J21.., J22.., K29..		Exact code K590, N991 Start with J20.., J21.., J22.., K29..

Table 7.2.1. Codes for adverse events.

* Only for readmission.

Sources of error

The definition of an adverse event is based on diagnostic and procedure codes. There may be differences between units in the accuracy of the coding during hospital stay. Information on death after surgery is not depending on coding.

Inadequate registration in the PAR of surgical date can influence if an adverse event during the surgery is included or not. Some units performing hip and knee replacements do not report to the PAR and for those, adverse events occurring during the admission will not be included in the indicator. The PAR lacks certain information on laterality. Therefore, a complication in the other hip/knee than the current will be registered as an adverse event. However, we consider it unlikely that a complication or surgical procedure is registered in the opposite hip or knee within 90 days after hip or knee replacement surgery. That only adverse events that occur during the primary admission or during readmission are included is a weakness of the analysis. Outpatient care is not included. A patient with a closed reduction of a dislocation in an emergency unit and returns to home is not included. This also applies to, for example, venous thromboses, which usually do not lead to inpatient care. Furthermore, the coding routines differ between different units. In some cases, there may exist economic incentives to register many codes to increase the DRG-creep. The threshold for including certain complication codes differs between units.

The unit's result should be followed over time to stimulate local analysis. The panorama of adverse events must be better understood, thereby identifying areas of improvement. The aim of the quality indicator is not primarily to compare results between units. Finally, it is important to realize that many adverse events (especially the medical ones) do not have to have a causally related to the surgery. This implies that local differences in general health (case-mix), the access to healthcare and preventive medicine partly may influence the outcome.

Results

Regarding both hip and knee replacement surgery, elective primary procedures are distinguished. In knee surgery, total replacements due to osteoarthritis are reported. In hip surgery, elective total hip replacements (includes all diagnoses other than hip fracture and tumour) and first-time revisions are reported (figures 7.2.1 and 7.2.2). The results for patients with hip fractures treated with hip replacement are reported separately, as they differ from those having an elective procedure due to osteoarthritis. Those with fracture are older, sicker and often in need of immediate surgery. However, the fracture group also include those who are re-operated with a hip replacement after failed internal fixation. "Fracture cases" means for some elective units only such planned salvage procedures, which may explain a lower incidence of adverse events compared to units doing emergency surgery only. The fracture group has in general the highest incidence of adverse events, about one third are affected in the first 90 days.

The incidence of adverse events is fairly the same after both primary elective hip and knee replacement surgery. After revision of a primary hip replacement, the incidence is almost 10 percent higher than after revision of a primary knee replacement. We have not analysed the reasons for this, but one possible explanation may be that a number of fracture patients also need revision surgery and then bring their increased risk into the group. It is gratifying that the incidence of adverse events is decreasing in both primary hip and knee replacement and hip revision 2013–2023. (figures 7.2.1 and 7.2.2). Surgical adverse events, decreased somewhat after all procedures/diagnoses (figures 7.2.3 and 7.2.4). The results of each unit must be seen in the light of its case-mix.

Therefore, the proportion of adverse events per unit is presented for both hip replacement and for the "standard patient" (standardised case-mix) (figures 7.2.5 and 7.2.6), and for the fracture patients (figure 7.2.7). The proportion of adverse events after total knee replacement due to osteoarthritis shows relatively large variations between the units (figure 7.2.9). Regarding the proportion of adverse events after hip and knee revision possibly case-mix and varying degrees of complicated revisions explain some of the varying outcome (figures 7.2.8 and 7.2.10). Units with a deviating result here should perform local improvement work.

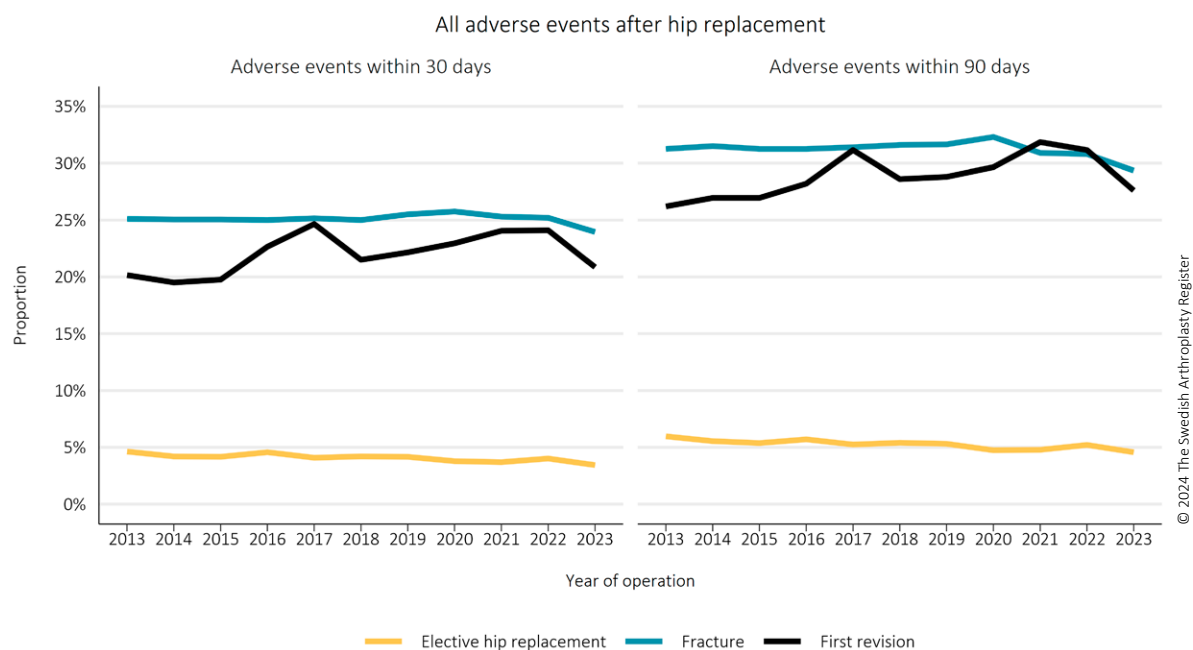


Figure 7.2.1. Adverse events within 30 and 90 days after primary hip replacement and hip revision 2013-2023.

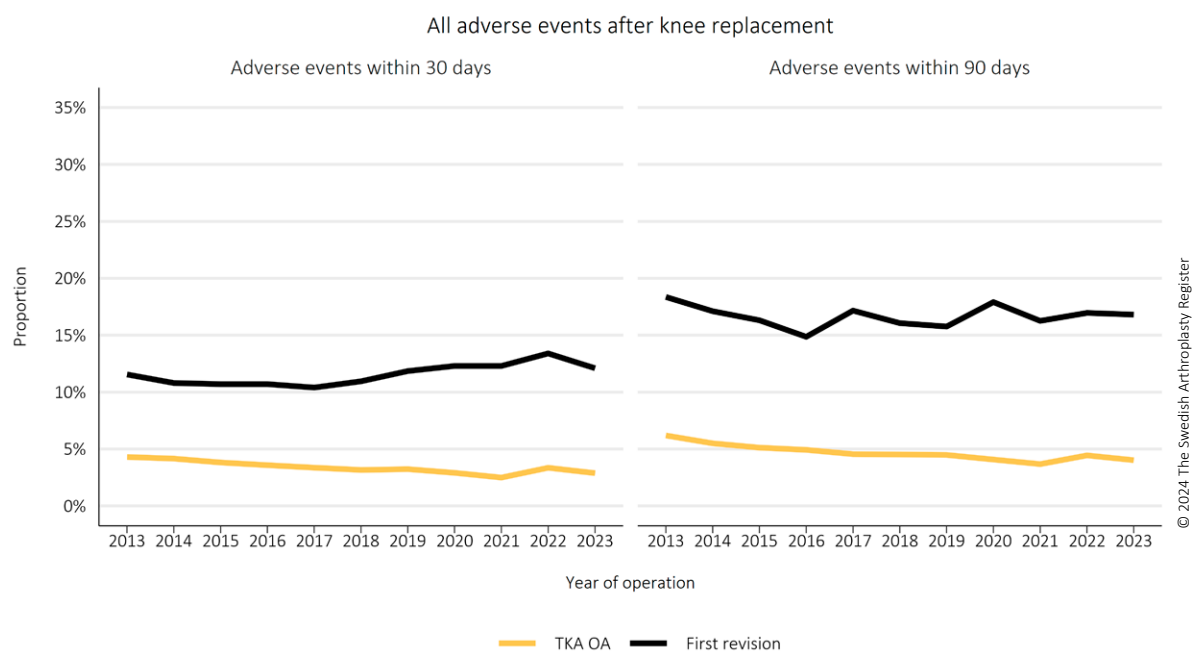


Figure 7.2.2. Adverse events within 30 and 90 days after primary total knee replacement and knee revision 2013-2023.

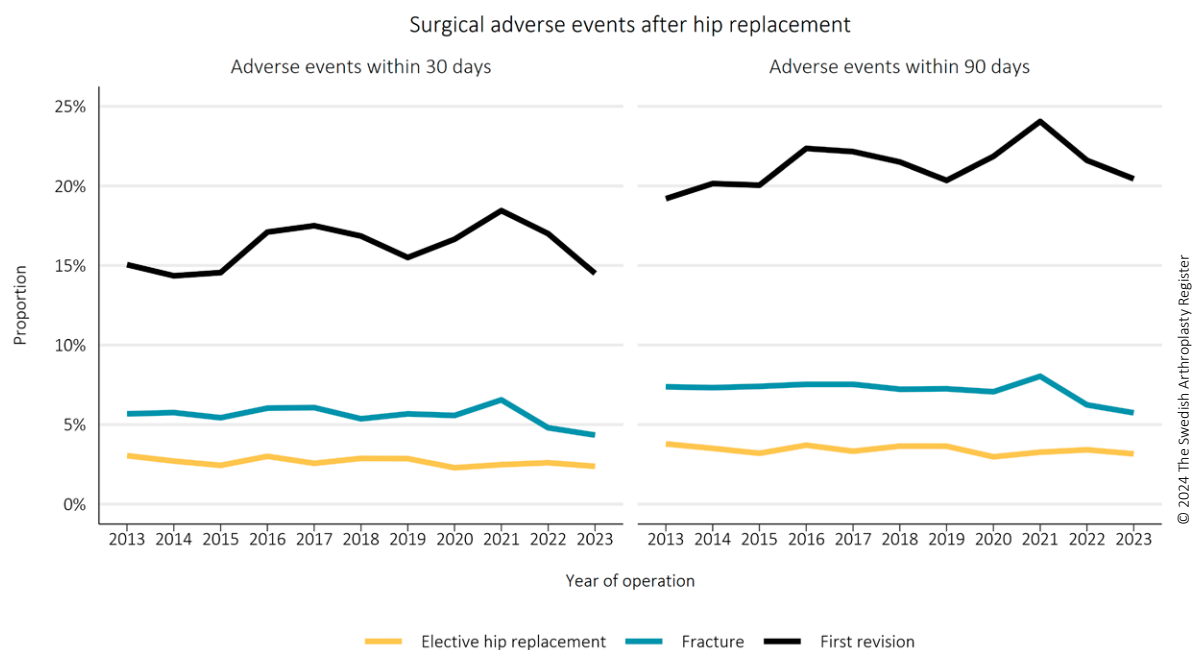


Figure 7.2.3. Adverse surgical events within 30 and 90 days after primary hip replacement and hip revision 2013-2023.

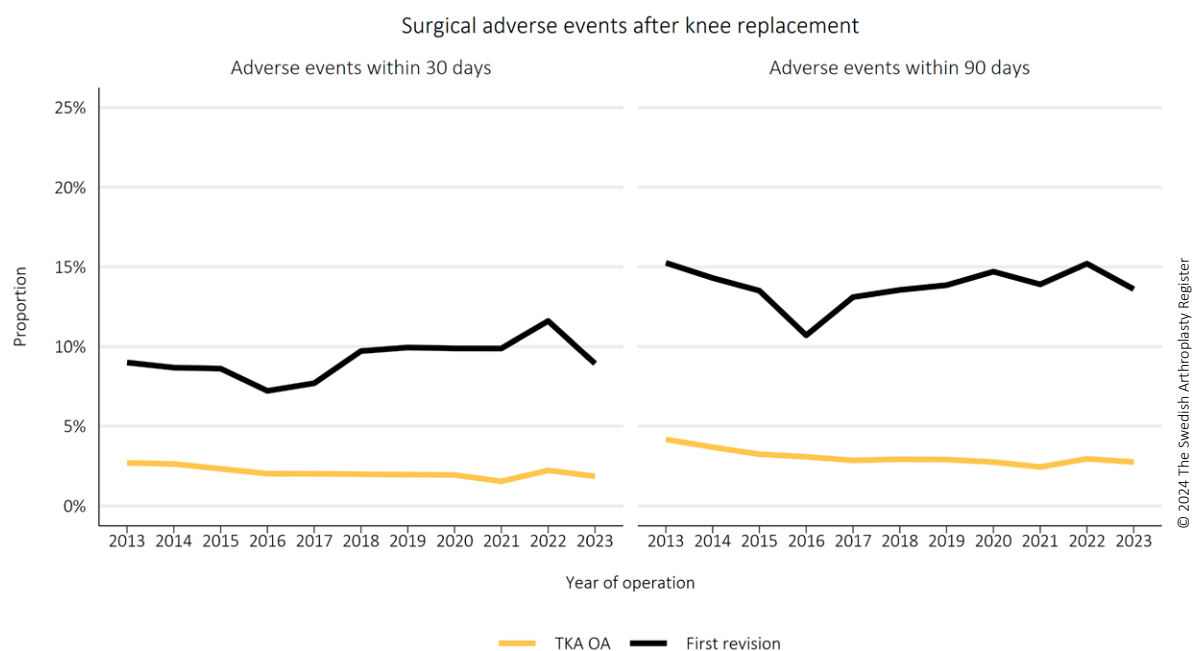


Figure 7.2.4. Adverse surgical events within 30 and 90 days in primary total knee replacement and knee revision 2013-2023.

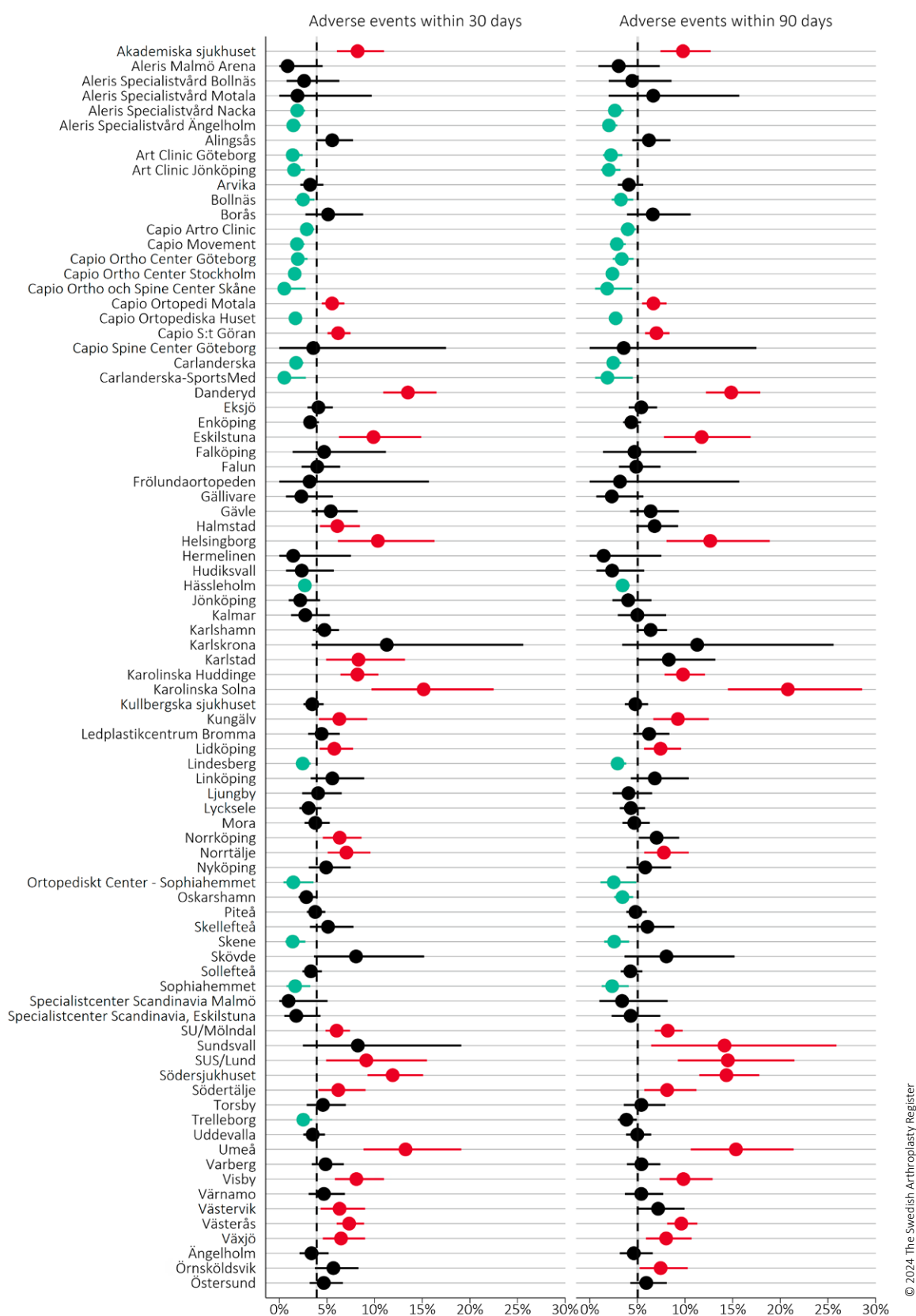
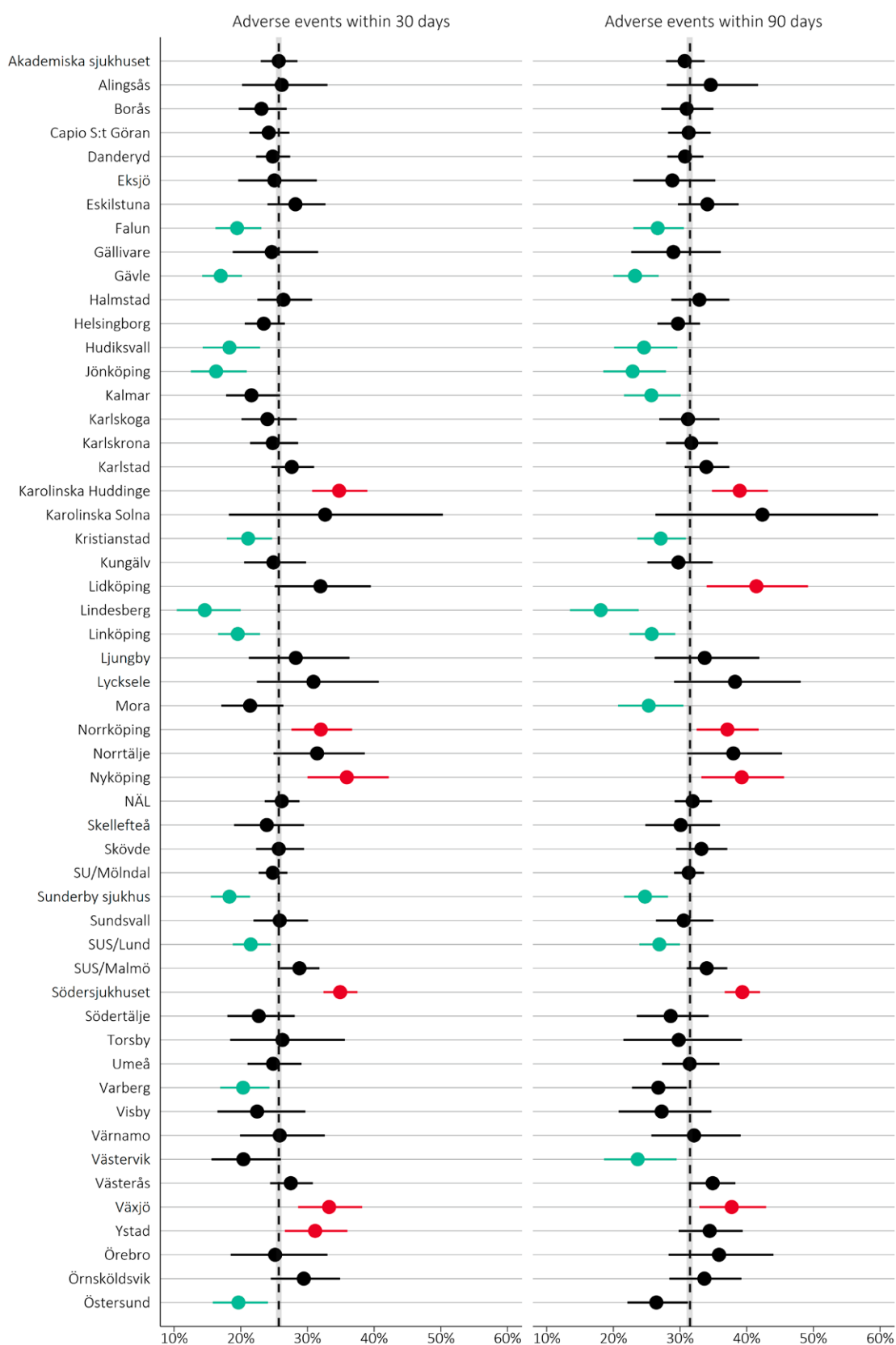


Figure 7.2.5. Adverse events per unit 2019-2023, elective hip replacement.



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Figure 7.2.7. Adverse events per unit 2019-2023, hip replacement due to fracture,

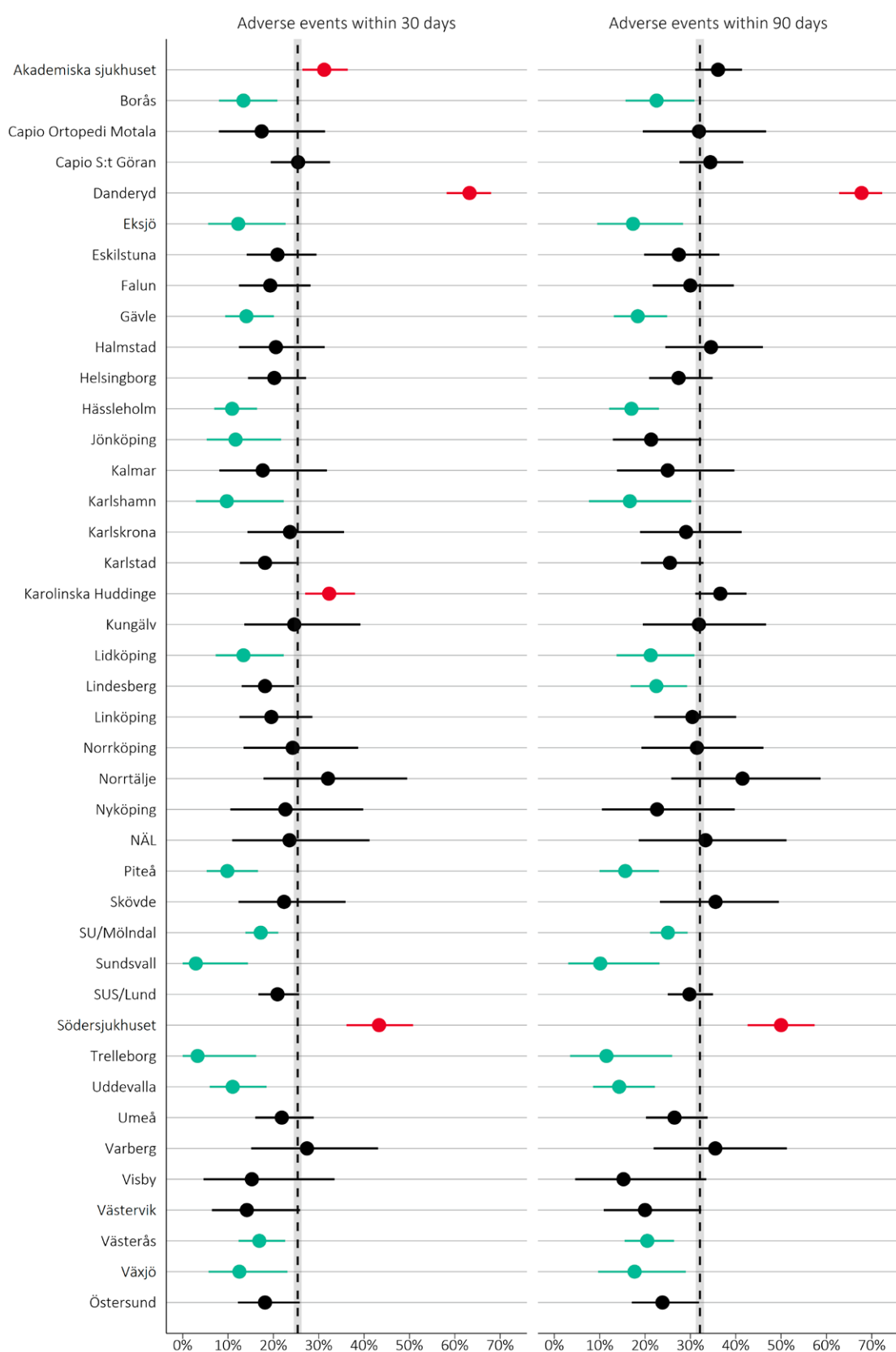
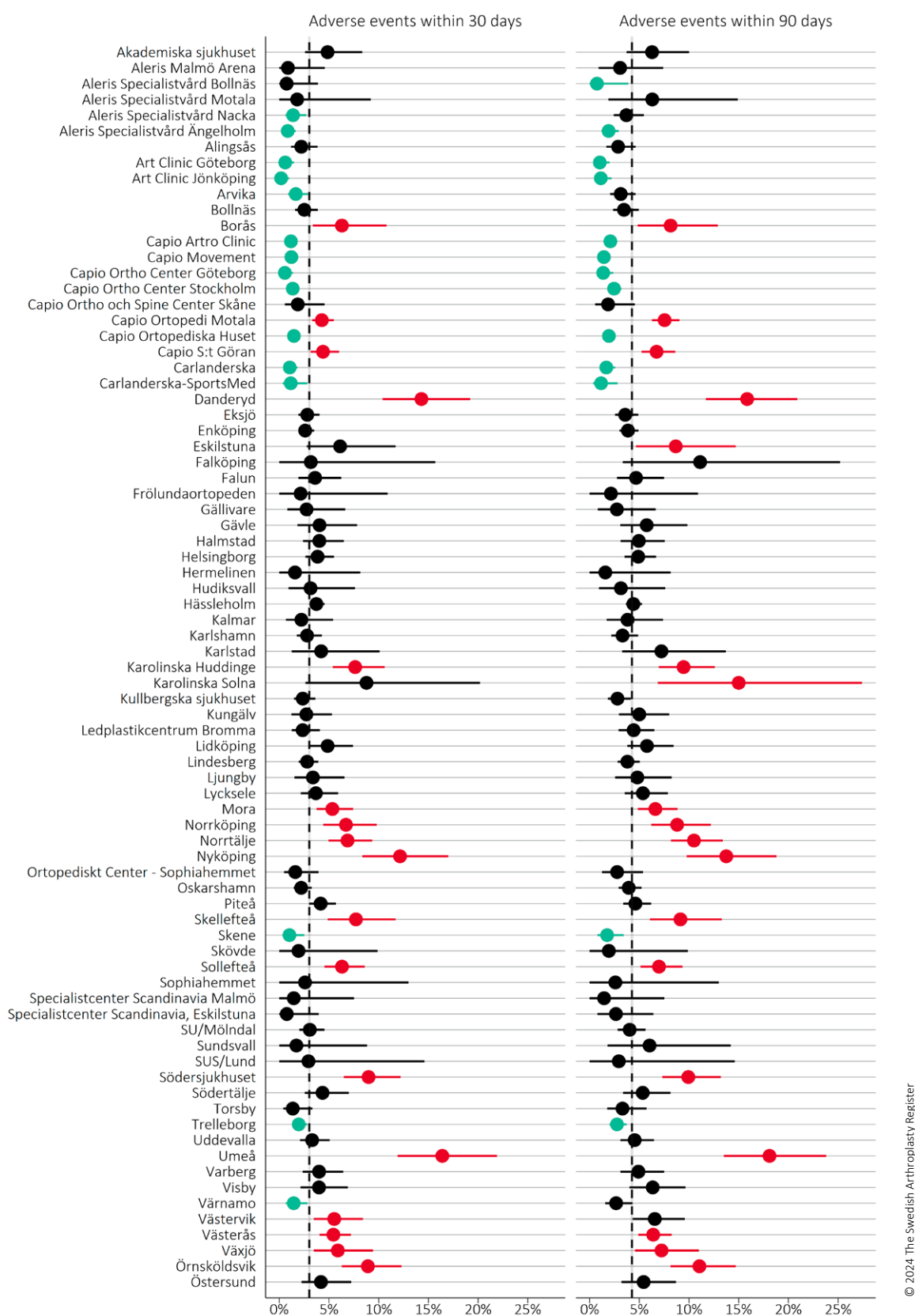
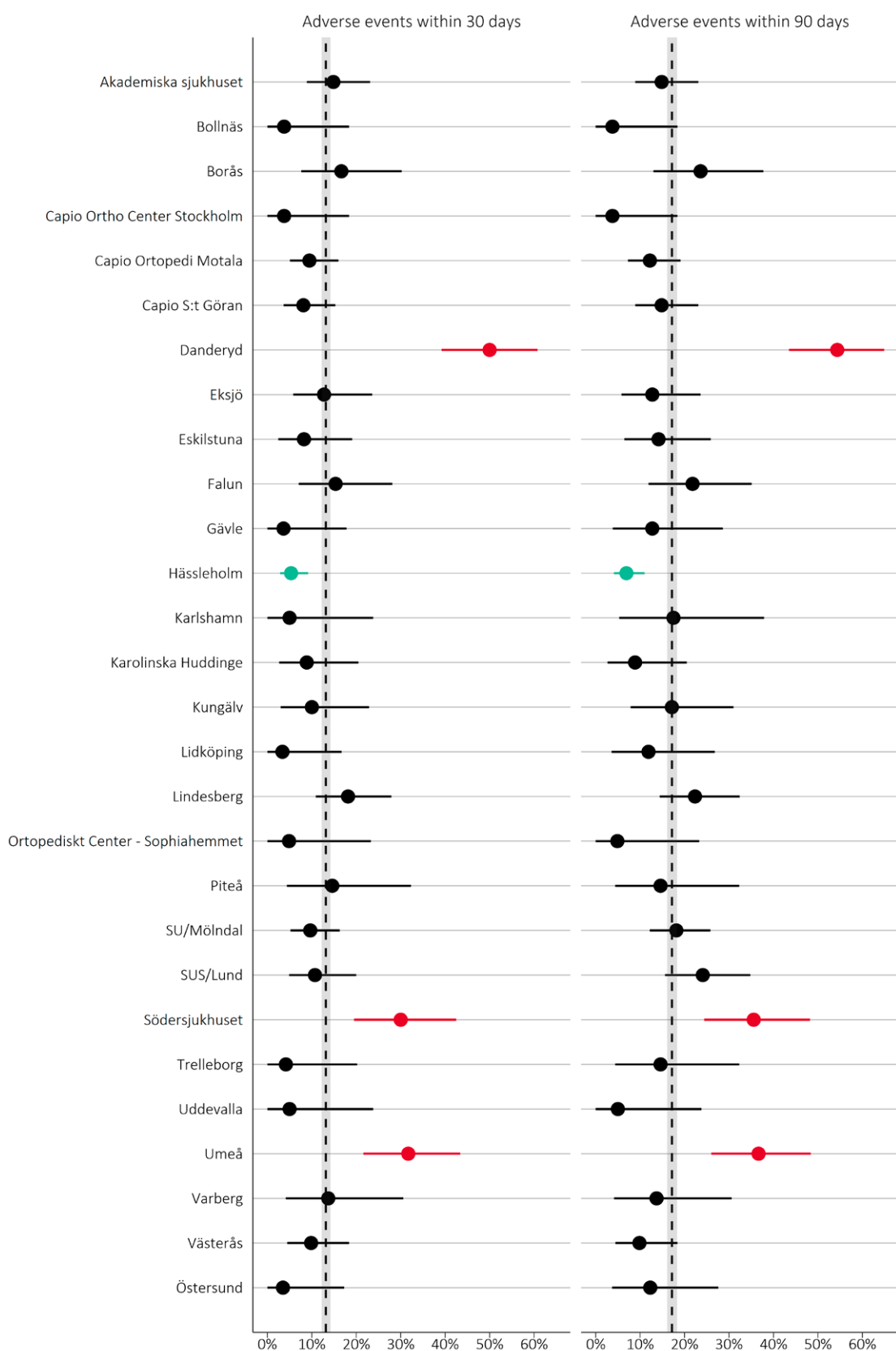


Figure 7.2.8. Adverse events per unit 2019-2023, first hip revision.



Figur 7.2.9. Adverse events per unit 2019-2023, total knee replacement due to OA.



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Figur 7.2.10. Adverse events per unit 2019-2023, first knee revision.

The goal is a life without
pain, with restored function
and quality of life.



8. Patient-Reported Outcome Measures

Authors: Annette W-Dahl and Ola Rolfson

Patient-Reported Outcome Measures (PROMs) are tools used to assess health or health-related aspects based on the patient's own experience. The instruments or tools used for measuring these outcomes are standardized questionnaires completed by patients, with no interpretation from anyone else. The primary goal of most hip and knee replacement surgeries is to reduce pain and improve function, thereby enhancing the patient's health-related quality of life.

Development of PROM collection for hip and knee replacement surgeries

The PROM routine for hip replacement surgeries began as a pilot project in northern Sweden and the Västra Götaland region in 2002. Over time, more units joined, and since 2008, all units have participated in the follow-up routine.

For knee replacement surgeries, PROM collection started as a pilot project in Trelleborg in 2008. Over the following years, the rest of Skåne joined. Units that wished to participate were invited, and by the end of 2012/2013, Norrköping, Motala, and Oskarshamn had joined. Since then, more units have gradually been added, and by 2021, PROM was collected from over 50% of all primary operations. Units could choose whether to collect all

PROMs included in the project or only parts of it. With the merging of the hip and knee replacement registers into the Swedish Arthroplasty Register, PROM collection for knee replacement surgeries now includes all units, just like for hip replacement surgeries. Patients operated on in 2022 are the first cohort with both pre- and postoperative responses since the merger. Six units did not report any PROMs for patients operated on in 2022, but three of these have started collecting PROMs for patients operated on in 2023.

Outcome Measures

All patients scheduled for elective total hip or knee replacement surgery are asked to complete a questionnaire before surgery, containing 25 questions for hip and 24 for knee procedures. Postoperatively, an additional question on satisfaction with the operation outcome is included, using a 5-point Likert scale. The questionnaires cover comorbidities and walking ability to determine Charnley class, questions about hip pain (right and left) or knee pain (current knee), rated on a 5-point Likert scale, and the EQ-5D tool, which measures overall health status. Since 2017, the new version of the EQ-5D tool (EQ-5D-5L) has been used instead of the previous EQ-5D-3L for elective total hip replacement surgeries, and with the register merger, it is also used for knee replacement surgeries.

The EQ-5D-5L consists of two parts: the first includes five general questions, each with five response options, creating a health profile that can be converted into an index. The second part is a visual analog scale (VAS) thermometer, where patients rate their current health on a scale from 0 to 100. The EQ-5D index is calculated using the Swedish value set, meaning an algorithm converts the index. Values can be presented either as VAS units (ranging from worst to best health, 0-100) or on a scale from death to full health, ranging from 0-1.

A question about smoking, included for hip replacements since 2013, was added for knee replacements from September 1, 2021. New since the 2021 merger are two questions about weekly physical exercise and everyday activity, recommended by the National Board of Health and Welfare. As part of the PROM harmonization, the full KOOS (Knee injury and Osteoarthritis Outcome Score), consisting of 42 questions, has been replaced by KOOS-12, and the hip-specific HOOS-12 (Hip dysfunction and Osteoarthritis Outcome Score 12) has been used since September 1, 2021, for elective total hip replacements. Both KOOS-12 and HOOS-12 contain three subscales (0-100): pain, daily living activities (ADL), and quality of life (QoL). A total score can also be calculated by averaging the three subscales (0-100).

The term “responder” is a method used to evaluate the percentage of hip and knee replacement patients who improve from preoperative to one year postoperative, instead of using a PROM average, which can mask both poor and good results. The Osteoarthritis Research Society International (OARSI) working group, Outcome Measures in Arthritis Clinical Trials (OMERACT-OARSI), developed criteria for defining a responder. These criteria have been used in previous annual reports for knee replacement patients, based on WOMAC. Since KOOS-12 has replaced the full KOOS, it is no longer possible to convert to WOMAC. However, OMERACT-OARSI responder criteria can still be used for KOOS/HOOS-12 by calculating a combination of absolute and relative changes in KOOS/HOOS-12 pain, ADL, and total score one year after knee and hip replacement surgery. A high responder is a patient who has improved by 50% or more and has an absolute improvement of 20 points or more in KOOS/HOOS-12 pain or ADL. If these criteria are not met, a patient can still be classified as a low responder if they improve by 20% or more and have an absolute change of 10 points or more in two of KOOS/HOOS-12 pain, ADL, or total score. Each patient is classified

according to these criteria one year after surgery as either a responder (high or low) or not a responder. The percentage of responders is presented as a percentage.

Until the merger, the hip questionnaire included a question about whether the patient had seen a physiotherapist or participated in an osteoarthritis school. This question has now been removed from the survey. Instead, data from the Swedish Arthroplasty Register and the Swedish Osteoarthritis Register (formerly the BOA register) have been linked to determine how many hip and knee replacement surgeries have a record in the Osteoarthritis Register.

Collection Methods

The methods of collection differ slightly between hip and knee replacement surgeries. Knee replacements are tracked per operation (both right and left), meaning all primary and reoperations are followed up after one year. In contrast, the most recent hip replacement surgery is followed up after one, six, and ten years, including reoperations. There are two different follow-up forms for knees: one for unilateral knee replacements and one for patients who have both knees replaced at the same time. Similarly, for hips, there are separate forms for patients with a replacement in one hip (unilateral) and for those with replacement in both hips (bilateral). The follow-up routine is managed by contact secretaries who send out forms, enter the survey responses into the PROM database, and send a reminder after about two months if there is no response. The option to receive the follow-up form via email was discontinued on May 24, 2023, and replaced with a notification from 1177 (the Swedish national patient portal) that a follow-up form is available with a link to respond.registercentrum.se.

Patients who have not activated their 1177 account will continue to receive a paper survey, and those who do not respond will receive a reminder with a paper form. This new routine relieves the units of the task of entering survey responses. It is also possible for units to collect PROM data digitally preoperatively. However, units no longer have direct access to these pre- and postoperative results at the patient level as before, but they can request access to them through a data extraction request for the unit's PROM responses. The new routine does not affect statistical display.

In the previous PROM routine (hip until 2017 and knee until 2021), pain and satisfaction with the surgical

Pareto classification hip

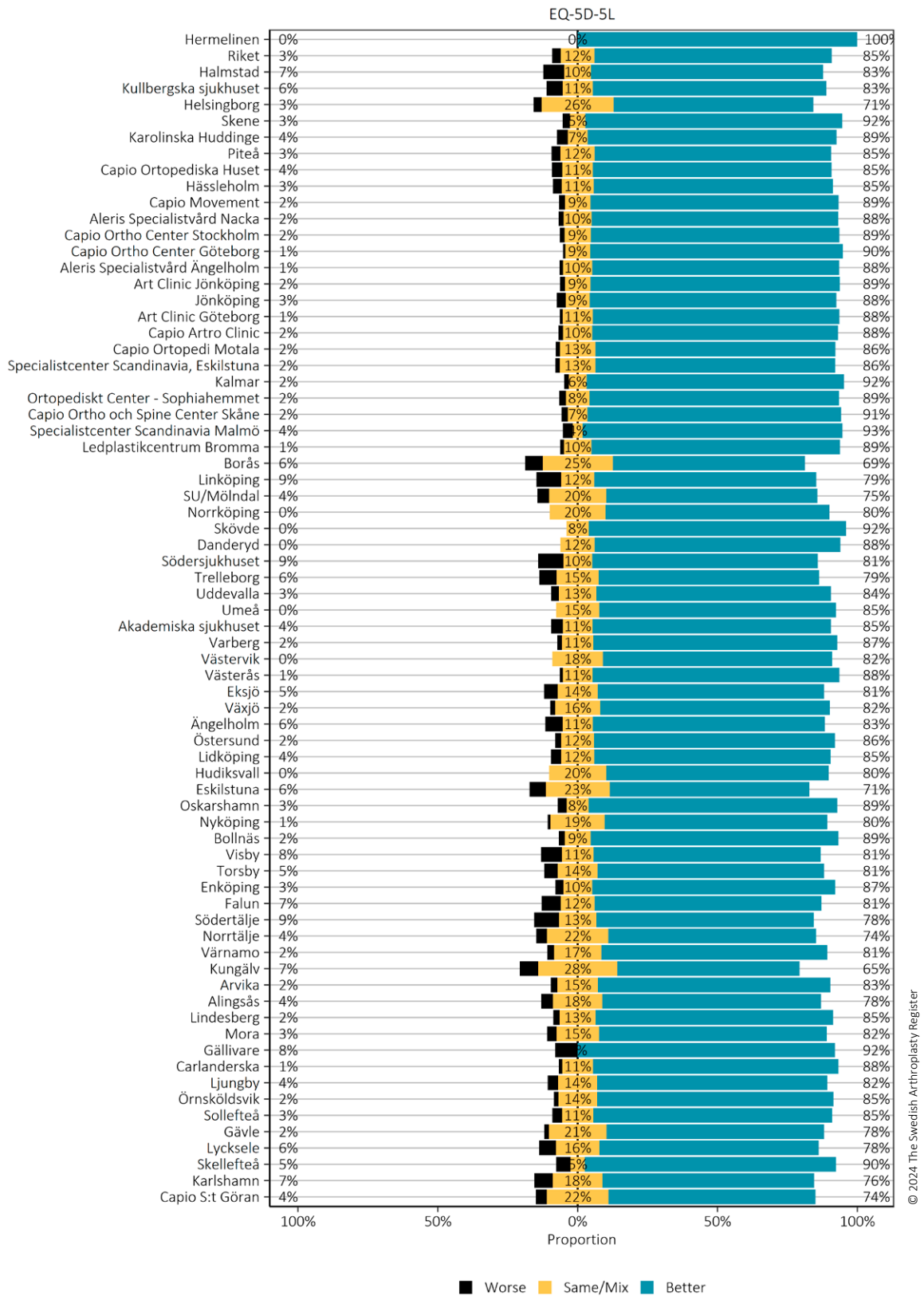


Figure 8.1. Pareto classification EQ-5D-5L, elective total hip replacement 2022.

PROMs in hip replacement 2020–2023

	Primary operation				Revision	
	Pre-operatively	1 year post-operatively	6 years post-operatively	10 years post-operatively	Pre-operatively	1 year post-operatively
Number	51,277	62,152	47,396	33,793	1,694	7,408
Hip Pain, n (%)						
None	379 (0.7)	32,562 (52.8)	26,595 (56.6)	18,264 (54.6)	82 (4.9)	2,442 (33.2)
Very mild	446 (0.9)	14,617 (23.7)	8,630 (18.4)	5,986 (17.9)	83 (4.9)	1,645 (22.4)
Mild	1,379 (2.7)	7,169 (11.6)	5,187 (11.0)	3,959 (11.8)	152 (9.1)	1,200 (16.3)
Moderate	16,115 (31.7)	5,662 (9.2)	4,989 (10.6)	4,004 (12.0)	594 (35.4)	1,489 (20.2)
Severe	32,568 (64.0)	1,671 (2.7)	1,553 (3.3)	1,213 (3.6)	768 (45.7)	580 (7.9)
Mobility, n (%)						
I have no problems in walking about	1,438 (2.8)	30,838 (49.6)	22,755 (48.0)	14,867 (44.0)	143 (8.4)	2,075 (28.0)
I have slight problems in walking about	5,001 (9.8)	15,390 (24.8)	10,355 (21.8)	7,479 (22.1)	236 (13.9)	1,860 (25.1)
I have moderate problems in walking about	16,629 (32.4)	10,412 (16.8)	8,722 (18.4)	6,666 (19.7)	555 (32.8)	1,897 (25.6)
I have severe problems in walking about	26,356 (51.4)	4,915 (7.9)	4,831 (10.2)	4,009 (11.9)	629 (37.1)	1,219 (16.5)
I am unable to walk about	1,853 (3.6)	597 (1.0)	733 (1.5)	772 (2.3)	131 (7.7)	357 (4.8)
Self-care, n (%)						
I have no problems washing or dressing myself	14,551 (28.4)	46,307 (74.5)	35,499 (74.9)	24,286 (71.9)	734 (43.4)	4,228 (57.2)
I have slight problems washing or dressing myself	16,641 (32.5)	11,071 (17.8)	7,371 (15.6)	5,604 (16.6)	463 (27.4)	1,741 (23.5)
I have moderate problems washing or dressing myself	14,819 (28.9)	3,668 (5.9)	3,220 (6.8)	2,607 (7.7)	349 (20.6)	979 (13.2)
I have severe problems washing or dressing myself	5,074 (9.9)	899 (1.4)	923 (1.9)	909 (2.7)	123 (7.3)	315 (4.3)
I am unable to wash or dress myself	192 (0.4)	207 (0.3)	383 (0.8)	387 (1.1)	22 (1.3)	133 (1.8)
Usual activities, n (%)						
I have no problems doing my usual activities	2,718 (5.3)	31,512 (50.7)	24,081 (50.8)	15,981 (47.3)	176 (10.4)	2,182 (29.5)
I have slight problems doing my usual activities	8,704 (17.0)	17,418 (28.0)	11,899 (25.1)	8,568 (25.4)	361 (21.4)	2,159 (29.2)
I have moderate problems doing my usual activities	16,446 (32.1)	8,639 (13.9)	7,037 (14.8)	5,496 (16.3)	510 (30.2)	1,683 (22.8)
I have severe problems doing my usual activities	18,688 (36.4)	3,595 (5.8)	3,278 (6.9)	2,655 (7.9)	454 (26.9)	939 (12.7)
I am unable to do my usual activities	4,721 (9.2)	988 (1.6)	1,101 (2.3)	1,093 (3.2)	189 (11.2)	428 (5.8)
Pain/discomfort, n (%)						
I have no pain or discomfort	142 (0.3)	21,720 (34.9)	16,396 (34.6)	11,031 (32.6)	46 (2.7)	1,554 (21.0)
I have slight pain or discomfort	1,458 (2.8)	21,833 (35.1)	14,381 (30.3)	10,026 (29.7)	195 (11.6)	2,420 (32.7)
I have moderate pain or discomfort	17,887 (34.9)	13,828 (22.2)	12,107 (25.5)	9,204 (27.2)	704 (41.7)	2,359 (31.9)

Table continued on next page.

PROMs in hip replacement 2020–2023, cont.

	Primary operation				Revision	
	Pre-operatively	1 year post-operatively	6 years post-operatively	10 years post-operatively	Pre-operatively	1 year post-operatively
I have severe pain or discomfort	28,045 (54.7)	4,406 (7.1)	4,123 (8.7)	3,178 (9.4)	648 (38.4)	945 (12.8)
I have extreme pain or discomfort	3,745 (7.3)	365 (0.6)	389 (0.8)	354 (1.0)	95 (5.6)	117 (1.6)
Anxiety/depression, n (%)						
I am not anxious or depressed	18,155 (35.4)	42,088 (67.7)	31,276 (66.0)	21,319 (63.1)	658 (38.9)	3,884 (52.5)
I am slightly anxious or depressed	20,332 (39.7)	14,581 (23.5)	11,482 (24.2)	8,804 (26.1)	599 (35.4)	2,203 (29.8)
I am moderately anxious or depressed	9,166 (17.9)	3,981 (6.4)	3,389 (7.2)	2,620 (7.8)	291 (17.2)	907 (12.3)
I am severely anxious or depressed	3,21 (6.1)	1,278 (2.1)	1,027 (2.2)	872 (2.6)	120 (7.1)	335 (4.5)
I am extremely anxious or depressed	503 (1.0)	224 (0.4)	222 (0.5)	178 (0.5)	24 (1.4)	70 (0.9)
EQ VAS, mean (SD)	54.7 (22.3)	74.2 (19.2)	71.3 (20.8)	69.4 (21.5)	55.60 (22.27)	65.5 (22.3)
Satisfaction with the surgery, n (%)						
Very dissatisfied		1,132 (1.8)	1,164 (2.5)	774 (2.3)		523 (7.1)
Dissatisfied		2,219 (3.6)	2,021 (4.3)	1,299 (3.9)		758 (10.3)
Neither satisfied nor dissatisfied		4,694 (7.7)	3,678 (7.9)	2,671 (8.0)		1,202 (16.3)
Satisfied		13,484 (22.0)	10,326 (22.2)	7,766 (23.4)		2,191 (29.8)
Very satisfied		39,783 (64.9)	29,411 (63.1)	20,676 (62.3)		2,681 (36.5)
EQ5D-index, Swedish TTO, mean (SD)	0.64 (0.14)	0.86 (0.13)	0.85 (0.14)	0.84 (0.14)	0.68 (0.15)	0.79 (0.16)
EQ5D-index, Swedish VAS, mean (SD)	46.97 (13.35)	73.06 (15.76)	71.84 (16.74)	70.28 (17.32)	51.16 (15.79)	63.99 (18.35)

Tabell 8.1. PROM-svar för höftprotesoperationer 2020–2023.

outcome were measured using a Visual Analog Scale (VAS). Now, a 5-point Likert scale is used. VAS results from previous years have been converted to the Likert scale using a transposition key that corresponds to the distribution of current responses on the Likert scale.

PROM for hip replacement surgeries 2020–2023

Table 8.1 is a summary of all PROM responses collected between 2020 and 2023, divided into preoperative, and one, six, and ten years postoperative for primary surgeries, as well as preoperative and one year postoperative for revisions. Note that the summary consists of cross-sectional data for the patients who responded during the period, rather than longitudinal data. In over 95% of cases, patients reported moderate or severe pain in the affected hip preoperatively. For the one-year follow-up, 76% reported no or very mild pain in the operated hip. Although the percentage of pain-free patients was lower

at the six- and ten-year follow-ups, most seem to maintain relatively good overall health in the long term.

There have been significantly more one-year follow-ups after hip revision surgeries compared to preoperative responses. The routine for collecting preoperative PROM for revisions does not appear to be as well-established as for primary surgeries. However, the follow-up process seems to be functioning satisfactorily. Part of the data loss can naturally be explained by the fact that many revision surgeries are performed semi-urgently, meaning that patients do not go through the elective admission process. The Swedish Arthroplasty Register urges units to review their routines for collecting preoperative PROM for revisions, especially considering that patient-reported health one year after revision is significantly worse compared to after a primary replacement. Around 17% were dissatisfied or very dissatisfied, and 28% reported moderate or severe pain in the operated hip one year after revision surgery.

PROMs in hip replacement 2022

	Primary operation	
	Preoperatively	1 year postoperatively
Number	11,575	11,575
Hip pain, n (%)		
None	82 (0.7)	6,304 (54.9)
Very mild	88 (0.8)	2,733 (23.8)
Mild	294 (2.6)	1,207 (10.5)
Moderate	3,676 (32.1)	950 (8.3)
Severe	7,306 (63.8)	283 (2.5)
Mobility, n (%)		
I have no problems in walking about	368 (3.2)	5,974 (51.6)
I have slight problems in walking about	1,121 (9.7)	2,830 (24.4)
I have moderate problems in walking about	3,858 (33.3)	1,847 (16.0)
I have severe problems in walking about	5,877 (50.8)	856 (7.4)
I am unable to walk about	351 (3.0)	68 (0.6)
Self-care, n (%)		
I have no problems washing or dressing myself	3,393 (29.3)	8,856 (76.5)
I have slight problems washing or dressing myself	3,899 (33.7)	1,966 (17.0)
I have moderate problems washing or dressing myself	3,169 (27.4)	593 (5.1)
I have severe problems washing or dressing myself	1,075 (9.3)	142 (1.2)
I am unable to wash or dress myself	39 (0.3)	18 (0.2)
Usual activities, n (%)		
I have no problems doing my usual activities	681 (5.9)	6,162 (53.2)
I have slight problems doing my usual activities	2,109 (18.2)	3,323 (28.7)
I have moderate problems doing my usual activities	3,847 (33.2)	1,384 (12.0)
I have severe problems doing my usual activities	4,003 (34.6)	585 (5.1)
I am unable to do my usual activities	935 (8.1)	121 (1.0)
Pain/discomfort, n (%)		
I have no pain or discomfort	29 (0.3)	4,050 (35.0)
I have slight pain or discomfort	322 (2.8)	4,161 (35.9)
I have moderate pain or discomfort	4,190 (36.2)	2,524 (21.8)
I have severe pain or discomfort	6,261 (54.1)	788 (6.8)
I have extreme pain or discomfort	773 (6.7)	52 (0.4)
Anxiety/depression, n (%)		
I am not anxious or depressed	4,243 (36.7)	7,978 (68.9)
I am slightly anxious or depressed	4,640 (40.1)	2,672 (23.1)
I am moderately anxious or depressed	1,962 (17.0)	655 (5.7)
I am severely anxious or depressed	644 (5.6)	238 (2.1)
I am extremely anxious or depressed	86 (0.7)	32 (0.3)

Table continued on next page.

PROMs in hip replacement 2022, cont.

	Primary operation	
	Preoperatively	1 year postoperatively
EQ VAS, mean (SD)	54.16 (22.15)	73.87 (18.61)
Satisfaction with the surgery, n (%)		
Very dissatisfied		190 (1.7)
Dissatisfied		403 (3.5)
Neither satisfied nor dissatisfied		755 (6.6)
Satisfied		2,394 (20.9)
Very satisfied		7,691 (67.3)
EQ5D-index, Swedish TTO, mean (SD)	0.65 (0.14)	0.87 (0.12)
EQ5D-index, Swedish VAS, mean (SD)	47.71 (13.17)	73.91 (15.18)
Number	4,078	4,078
HOOS-12, mean (SD)		
Pain	85 (20)	30 (15)
Function in daily living	82 (20)	35 (18)
QoL	77 (22)	20 (14)

Table 8.2. PROMs pre- and one-year postoperatively in primary total hip replacements 2022.

Elective total hip replacement 2022

Table 8.2 shows data for those who underwent hip replacement surgery in 2022 and had completed pre- and one-year postoperative PROM responses. 87% reported being satisfied or very satisfied with the surgery, and just over 76% reported no or very mild pain in the hip. It was also noted that the mean change in EQ VAS was 19 units on the 100-point scale. In terms of the EQ-5D dimensions, pain, mobility, and daily activities showed the most improvement.

Changes in the EQ-5D dimensions can be described using the so-called Pareto classification. If there is an improvement in one or more dimensions without a deterioration in any other, it is classified as “better.” If there is deterioration in one or more dimensions without improvement in any other, it is classified as “worse.” No change is classified as “same,” and mixed results are classified as “mixed.” Figure 8.1 shows how EQ-5D dimensions change across different units after primary elective total hip replacement surgery. For the nation, 85% improved, and only 3% worsened. However, there was significant variation across the country. The highest proportion of patients who improved was at Hermelinen (100%), while 65% improved in Kungälv. At some units, none or just 1% of patients worsened, while 9% of patients at Linköping, Södersjukhuset, and Södertälje worsened.

There was also considerable variation in the proportion of patients who remained the same or experienced mixed changes (0–25%).

Proportion of satisfied patients and responders after primary total hip replacement by unit

Table 8.3 shows the response rate and the proportion of patients satisfied (very satisfied or satisfied) with the surgical outcome for those who underwent elective primary total hip replacement in 2022 and answered the one-year follow-up. The table also shows the response rate and proportion of responders for patients who underwent surgery in 2022 and completed the HOOS-12 survey both preoperatively and one year postoperatively. Results for units with fewer than 20 responses are not presented but are included in the national totals. 88% of patients reported being satisfied with the surgical outcome, but there are significant differences between units, with the proportion of satisfied patients ranging from 75% to 97%. Four units had a satisfaction rate below 80%, while 29 units had satisfaction rates of 90% or higher. Among the large-volume units, it was noted that Hässleholm and Ortho Center Stockholm continue to have a high proportion of satisfied patients. The variation in the proportion of responders is not as large as the variation in satisfied

Proportion of satisfied and responders after primary total hip replacement per unit 2022

Unit	Number response	Response rate, %	Proportion satisfied, %	Number response	Response rate, %	Proportion responders, %
Akademiska sjukhuset	153	82	84	120	64	91
Aleris Malmö Arena	21	68	90	0		
Aleris Specialistvård Nacka	468	87	94	417	78	96
Aleris Specialistvård Ängelholm	400	78	92	292	57	96
Alingsås	125	66	86	117	62	92
Art Clinic Göteborg	234	85	91	190	69	99
Art Clinic Jönköping	237	89	93	229	86	98
Arvika	242	79	83	102	33	95
Bollnäs	297	85	90	283	81	95
Borås	57	83	82	33	48	91
Capio Arthro Clinic	563	79	85	450	63	95
Capio Movement	419	89	88	219	46	95
Capio Ortho Center Göteborg	249	81	88	127	41	94
Capio Ortho Center Stockholm	737	86	94	620	72	96
Capio Ortho och Spine Center Skåne	125	61	95	80	39	98
Capio Ortopedi Motala	402	89	89	321	71	97
Capio Ortopediska Huset	698	87	82	0		
Capio S:t Göran	196	55	83	143	40	95
Carlanderska	227	63	90	60	17	95
Carlanderska-SportsMed	23	10	96	<20		
Danderyd	116	54	94	39	18	100
Eksjö	262	85	89	221	72	94
Enköping	435	82	86	278	52	95
Eskilstuna	44	75	75	33	56	91
Falun	80	47	85	73	43	90
Gällivare	35	85	89	24	59	100
Gävle	79	81	91	62	64	98
Halmstad	119	83	83	82	57	93
Helsingborg	48	86	85	32	57	91
Hermelinen	29	76	97	24	63	100
Hudiksvall	54	78	96	43	62	93
Hässleholm	535	85	92	460	73	94
Jönköping	120	80	83	88	59	91
Kalmar	66	74	91	62	70	95
Karlshamn	230	81	90	214	76	93
Karlstad	23	58	83	16	40	
Karolinska Huddinge	181	60	88	113	38	97
Karolinska Solna	20	51		<20		

Table continued on next page.

Proportion of satisfied and responders after primary total hip replacement per unit 2022, cont.

Unit	Number response	Response rate, %	Proportion satisfied, %	Number response	Response rate, %	Proportion responders, %
Kullbergska sjukhuset	315	88	80	312	88	91
Kungälv	85	81	76	35	33	86
Ledplastikcentrum Bromma	141	54	89	72	28	94
Lidköping	134	62	84	106	49	94
Lindesberg	313	76	90	171	42	97
Linköping	67	79	84	34	40	97
Ljungby	87	83	91	74	70	96
Lycksele	206	90	90	187	81	93
Mora	225	89	84	176	69	94
Norrköping	122	85	80	76	53	97
Norrtälje	122	81	87	102	68	95
Nyköping	114	89	77	90	70	92
Ortopediskt Center – Sophiahemmet	232	79	91	202	69	96
Oskarshamn	385	91	90	364	86	96
Piteå	298	75	88	236	60	92
Skellefteå	78	57	90	38	28	89
Skene	141	63	87	0		
Skövde	31	66	90	25	53	100
Sollefteå	337	89	89	309	82	95
Specialistcenter Scandinavia Malmö	85	70	95	55	45	91
Specialistcenter Scandinavia, Eskilstuna	74	60	85	60	48	93
SU/Möndal	339	78	79	292	67	91
SUS/Lund	22	73	77	<20		
Södersjukhuset	104	73	88	72	51	85
Södertälje	53	51	83	43	42	91
Torsby	78	62	85	64	51	92
Trelleborg	234	85	87	205	74	91
Uddevalla	281	88	88	244	76	95
Umeå	54	90	89	23	38	100
Varberg	165	87	92	115	61	97
Visby	89	81	85	76	69	92
Värnamo	137	88	83	125	80	96
Västervik	64	55	89	44	38	98
Västerås	226	65	90	171	49	97
Växjö	163	87	90	51	27	92
Ängelholm	152	82	87	129	69	89
Örnsköldsvik	138	88	88	122	78	95
Östersund	155	80	92	132	68	92
Country	14,430	78	88	10,332	56	95

Table 8.3. Response rate and proportion of satisfied and responders after primary total hip replacement per unit 2022.

HOOS-12 per unit 2022 and 2023

Unit	Surgical year	Number response	Response rate	Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preoperatively	1 year	Preoperatively	1 year	Preoperatively	1 year
Akademiska sjukhuset	2022	120	64	34	27 (15)	83 (22)	35 (19)	81 (23)	17 (13)	75 (25)
	2023	127	68	43	29 (15)		33 (19)		18 (14)	
Aleris Malmö Arena	2022	0								
	2023	0								
Aleris Specialistvård Nacka	2022	417	78	36	32 (14)	90 (16)	37 (17)	87 (16)	21 (13)	81 (19)
	2023	577	88	33	33 (15)		38 (18)		21 (14)	
Aleris Specialistvård Renmarkstorget, Umeå	2022									
	2023	22	49	32	32 (14)		39 (16)		20 (14)	
Aleris Specialistvård Ängelholm	2022	292	57	38	28 (14)	87 (19)	32 (16)	84 (20)	18 (12)	81 (21)
	2023	273	65	39	29 (15)		33 (19)		21 (14)	
Alingsås	2022	117	62	36	33 (14)	84 (20)	37 (17)	81 (20)	21 (14)	76 (24)
	2023	156	84	44	33 (15)		37 (18)		20 (13)	
Art Clinic Göteborg	2022	190	69	31	31 (14)	87 (18)	37 (17)	86 (19)	20 (14)	79 (22)
	2023	384	87	35	32 (14)		36 (17)		21 (14)	
Art Clinic Jönköping	2022	229	86	33	28 (13)	87 (17)	33 (16)	86 (17)	20 (12)	79 (19)
	2023	237	92	24	29 (14)		33 (16)		20 (13)	
Arvika	2022	102	33	40	28 (15)	80 (21)	32 (15)	79 (19)	19 (13)	69 (25)
	2023	189	66	40	32 (14)		37 (17)		22 (15)	
Bollnäs	2022	283	81	32	30 (15)	86 (19)	34 (17)	83 (19)	19 (14)	79 (21)
	2023	375	98	32	30 (14)		33 (17)		20 (15)	
Borås	2022	33	48	36	25 (18)	72 (21)	29 (17)	64 (23)	16 (15)	65 (24)
	2023	48	52	54	25 (13)		28 (15)		11 (10)	
Capio Artro Clinic	2022	450	63	33	32 (15)	85 (19)	38 (19)	84 (18)	21 (14)	74 (22)
	2023	505	83	29	35 (16)		42 (18)		23 (14)	
Capio Movement	2022	219	46	34	35 (14)	90 (17)	42 (18)	88 (16)	25 (14)	82 (19)
	2023	125	30	19	34 (14)		41 (16)		25 (13)	
Capio Ortho Center Göteborg	2022	127	41	26	31 (13)	85 (19)	41 (16)	85 (18)	21 (12)	76 (22)
	2023	157	63	27	33 (15)		37 (16)		20 (13)	
Capio Ortho Center Stockholm	2022	620	72	31	33 (15)	89 (17)	39 (18)	87 (17)	22 (14)	80 (20)
	2023	740	82	32	35 (15)		40 (18)		23 (14)	
Capio Ortho och Spine Center Skåne	2022	80	39	33	32 (17)	91 (14)	40 (19)	89 (16)	23 (16)	84 (17)
	2023	128	51	32	32 (15)		39 (17)		21 (13)	
Capio Ortopedi Motala	2022	321	71	34	29 (13)	85 (17)	33 (15)	81 (18)	20 (12)	76 (20)
	2023	343	82	33	30 (14)		32 (17)		20 (13)	
Capio Ortopediska Huset	2022	0								
	2023	156	20	36	37 (18)		42 (19)		24 (16)	
Capio S:t Göran	2022	143	40	40	31 (17)	84 (19)	35 (18)	80 (18)	20 (14)	75 (23)
	2023	290	80	43	33 (16)		38 (17)		22 (14)	
Capio Spine Center Göteborg	2022									
	2023	44	66	30	29 (14)		33 (17)		19 (13)	

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HOOS-12 per unit 2022 and 2023, cont.

Unit	Surgical year	Number response	Response rate	Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Carlanderska	2022	60	17	25	31 (15)	86 (18)	37 (19)	84 (18)	21 (16)	78 (21)
	2023	208	47	35	34 (13)		37 (17)		21 (14)	
Carlanderska – SportsMed	2022	<20								
	2023	81	34	25	35 (14)		38 (18)		23 (12)	
Danderyd	2022	39	18	36	31 (15)	86 (18)	35 (19)	83 (20)	18 (14)	80 (21)
	2023	41	28	49	32 (16)		35 (17)		23 (12)	
Eksjö	2022	221	72	34	31 (15)	83 (20)	34 (18)	79 (21)	21 (14)	76 (20)
	2023	213	74	36	32 (15)		36 (18)		22 (13)	
Enköping	2022	278	52	32	29 (14)	84 (19)	33 (16)	82 (20)	20 (13)	76 (23)
	2023	342	62	31	30 (15)		34 (17)		21 (13)	
Eskilstuna	2022	33	56	38	25 (16)	73 (25)	28 (17)	70 (23)	17 (16)	62 (26)
	2023	35	69	66	24 (16)		28 (17)		17 (15)	
Falun	2022	73	43	41	27 (18)	80 (23)	31 (20)	78 (22)	18 (16)	73 (27)
	2023	117	75	38	28 (17)		33 (19)		19 (16)	
Gällivare	2022	24	59	38	27 (17)	90 (15)	32 (16)	84 (17)	19 (18)	79 (18)
	2023	61	79	33	29 (16)		30 (19)		19 (13)	
Gävle	2022	62	64	53	23 (14)	82 (20)	27 (17)	74 (23)	13 (12)	74 (21)
	2023	81	64	43	26 (16)		29 (20)		16 (14)	
Halmstad	2022	82	57	32	28 (15)	81 (21)	35 (18)	81 (20)	18 (14)	75 (22)
	2023	62	73	39	30 (17)		36 (18)		18 (14)	
Helsingborg	2022	32	57	50	29 (13)	76 (25)	31 (18)	69 (27)	18 (16)	75 (25)
	2023	32	73	42	23 (19)		22 (19)		10 (14)	
Hermelinen	2022	24	63	25	33 (13)	93 (11)	40 (17)	89 (15)	20 (11)	81 (20)
	2023	29	76	14	28 (13)		38 (13)		18 (11)	
Hudiksvall	2022	43	62	42	27 (13)	86 (18)	29 (14)	78 (22)	15 (12)	81 (20)
	2023	38	72	42	23 (15)		22 (15)		13 (13)	
Hässleholm	2022	460	73	37	30 (15)	84 (20)	36 (17)	82 (20)	22 (15)	78 (21)
	2023	662	86	40	31 (15)		36 (18)		22 (15)	
Jönköping	2022	88	59	39	31 (13)	83 (19)	37 (19)	80 (18)	23 (15)	77 (19)
	2023	136	69	41	29 (14)		32 (17)		21 (16)	
Kalmar	2022	62	70	37	30 (14)	87 (19)	34 (15)	84 (18)	19 (13)	82 (19)
	2023	100	96	33	32 (14)		36 (16)		21 (14)	
Karlshamn	2022	214	76	32	30 (14)	84 (21)	34 (16)	81 (21)	21 (13)	78 (23)
	2023	268	88	31	31 (15)		34 (18)		22 (15)	
Karlstad	2022	<20								
	2023	42	79	45	30 (15)		34 (20)		19 (15)	
Karolinska Huddinge	2022	113	38	42	29 (17)	82 (23)	32 (19)	79 (23)	17 (12)	76 (24)
	2023	91	51	44	25 (16)		27 (19)		12 (12)	
Karolinska Solna	2022	<20								
	2023	<20								

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HOOS-12 per unit 2022 and 2023, cont.

Unit	Surgical year	Number response	Response rate	Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Kullbergsska sjukhuset	2022	312	88	32	30 (14)	81 (22)	36 (16)	78 (22)	22 (15)	71 (24)
	2023	418	97	36	30 (14)		35 (17)		22 (14)	
Kungälv	2022	35	33	51	25 (13)	71 (25)	28 (19)	69 (24)	15 (14)	60 (26)
	2023	102	87	48	27 (16)		29 (19)		16 (13)	
Ledplastikcentrum Bromma	2022	72	28	26	32 (15)	87 (18)	39 (18)	86 (16)	21 (13)	79 (22)
	2023	245	30	34	35 (14)		41 (18)		23 (14)	
Lidköping	2022	106	49	43	28 (16)	83 (19)	32 (18)	77 (20)	17 (14)	74 (22)
	2023	264	81	38	30 (15)		34 (18)		19 (14)	
Lindesberg	2022	171	42	22	26 (14)	86 (18)	31 (16)	83 (18)	17 (12)	77 (21)
	2023	312	54	37	27 (14)		30 (16)		17 (13)	
Linköping	2022	34	40	30	25 (13)	81 (20)	36 (17)	83 (19)	17 (13)	70 (23)
	2023	66	85	33	26 (15)		32 (18)		17 (14)	
Ljungby	2022	74	70	32	35 (14)	85 (19)	39 (18)	84 (21)	26 (15)	80 (21)
	2023	97	92	37	35 (16)		37 (16)		28 (17)	
Lycksele	2022	187	81	45	31 (16)	83 (21)	34 (17)	80 (22)	19 (14)	76 (23)
	2023	261	90	38	29 (15)		33 (18)		19 (14)	
Mora	2022	176	69	38	29 (16)	82 (22)	31 (18)	79 (21)	17 (14)	75 (24)
	2023	240	81	40	30 (14)		31 (15)		19 (12)	
Norrköping	2022	76	53	46	27 (16)	80 (21)	30 (19)	76 (20)	16 (14)	69 (25)
	2023	136	69	38	27 (14)		31 (17)		16 (12)	
Norrtälje	2022	102	68	38	36 (15)	81 (19)	40 (16)	78 (19)	25 (13)	73 (22)
	2023	122	82	38	33 (17)		38 (21)		24 (15)	
Nyköping	2022	90	70	46	27 (14)	78 (23)	30 (15)	75 (23)	17 (11)	70 (26)
	2023	119	90	35	31 (14)		34 (19)		19 (13)	
Ortopediskt Center – Sophiahemmet	2022	202	69	20	34 (15)	91 (17)	41 (19)	90 (14)	23 (14)	82 (20)
	2023	241	92	30	36 (16)		42 (18)		25 (14)	
Oskarshamn	2022	364	86	36	29 (14)	86 (18)	34 (17)	83 (19)	20 (14)	77 (21)
	2023	359	95	39	29 (14)		33 (17)		20 (13)	
Piteå	2022	236	60	41	26 (15)	82 (22)	33 (18)	79 (23)	16 (13)	76 (24)
	2023	322	76	43	29 (15)		32 (18)		19 (13)	
Skellefteå	2022	38	28	42	29 (12)	86 (17)	42 (14)	86 (16)	18 (13)	76 (20)
	2023	30	25	43	48 (23)		60 (23)		32 (20)	
Skene	2022	0								
	2023	41	16	38	30 (13)		35 (14)		20 (10)	
Skövde	2022	25	53	48	31 (14)	85 (16)	35 (15)	85 (16)	25 (15)	75 (20)
	2023	39	95	31	33 (14)		43 (18)		25 (13)	
Sollefteå	2022	309	82	30	32 (14)	87 (19)	35 (16)	82 (20)	20 (13)	79 (22)
	2023	404	95	35	31 (15)		35 (17)		21 (14)	
Specialistcenter Scandinavia Malmö	2022	55	45	24	29 (15)	87 (18)	36 (20)	86 (18)	20 (15)	78 (22)
	2023	65	53	34	30 (15)		35 (21)		23 (15)	

Table continued on next page.

HOOS-12 per unit 2022 and 2023, cont.

Unit	Surgical year	Number response	Response rate	Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Specialistcenter Scandinavia, Eskilstuna	2022	60	48	27	31 (12)	86 (18)	36 (14)	82 (20)	21 (13)	79 (20)
	2023	169	81	31	30 (14)		36 (15)		20 (13)	
SU/Mölnadal	2022	292	67	42	27 (15)	78 (22)	31 (18)	75 (23)	17 (13)	69 (25)
	2023	262	78	38	29 (17)		31 (18)		17 (14)	
Sundsvall	2022									
	2023	28	78	39	32 (20)		32 (22)		19 (17)	
SUS/Lund	2022	<20								
	2023	<20								
Södersjukhuset	2022	72	51	42	31 (17)	78 (23)	38 (20)	71 (24)	19 (14)	72 (23)
	2023	78	58	42	30 (14)		35 (19)		18 (15)	
Södertälje	2022	43	42	44	30 (15)	78 (23)	36 (16)	78 (24)	19 (14)	72 (25)
	2023	85	73	40	30 (17)		34 (18)		21 (15)	
Torsby	2022	64	51	44	28 (14)	83 (23)	36 (17)	82 (24)	20 (13)	75 (25)
	2023	43	28	49	36 (15)		39 (17)		24 (17)	
Trelleborg	2022	205	74	38	29 (16)	80 (23)	36 (22)	78 (22)	20 (15)	74 (25)
	2023	363	94	46	26 (16)		34 (21)		18 (14)	
Uddevalla	2022	244	76	38	29 (16)	83 (21)	31 (17)	79 (21)	18 (14)	73 (22)
	2023	309	92	40	28 (15)		30 (18)		17 (14)	
Umeå	2022	23	38	13	36 (12)	88 (20)	46 (19)	89 (19)	27 (18)	82 (20)
	2023	<20								
Varberg	2022	115	61	34	28 (14)	85 (20)	33 (16)	81 (22)	18 (13)	78 (22)
	2023	91	73	36	33 (15)		35 (16)		21 (14)	
Visby	2022	76	69	39	27 (13)	77 (22)	32 (17)	75 (21)	20 (13)	70 (23)
	2023	110	83	45	31 (14)		34 (17)		20 (13)	
Värnamo	2022	125	80	37	30 (14)	80 (22)	33 (16)	79 (21)	20 (13)	74 (24)
	2023	148	94	44	29 (14)		34 (16)		21 (13)	
Västervik	2022	44	38	48	29 (16)	85 (21)	34 (19)	82 (20)	21 (15)	78 (23)
	2023	79	53	47	28 (15)		28 (16)		20 (13)	
Västerås	2022	171	49	41	26 (14)	84 (20)	30 (17)	80 (21)	17 (13)	77 (21)
	2023	352	80	35	28 (15)		30 (17)		18 (13)	
Växjö	2022	51	27	45	36 (15)	87 (17)	39 (17)	83 (19)	24 (14)	79 (20)
	2023	<20								
Ängelholm	2022	129	69	39	30 (15)	81 (22)	35 (19)	78 (25)	20 (16)	74 (24)
	2023	196	82	38	29 (13)		35 (17)		21 (12)	
Örnsköldsvik	2022	122	78	40	27 (15)	85 (19)	31 (15)	83 (19)	17 (12)	78 (22)
	2023	145	98	39	30 (15)		32 (18)		21 (15)	
Östersund	2022	132	68	36	30 (16)	86 (20)	36 (17)	83 (20)	20 (15)	79 (23)
	2023	177	88	43	27 (14)		30 (17)		17 (12)	
Country	2022	10,332	56	35	30 (15)	84 (20)	35 (18)	82 (20)	20 (14)	76 (22)
	2023	14,090	69	36	31 (15)		35 (18)		20 (14)	

Table 8.4. HOOS-12, elective total hip replacement per unit 2022 and 2023.

patients, ranging from 86% to 100%. However, there are 18 units with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries. Among these, the proportion of responders varies from 91% at Kullbergsska Hospital, Nyköping, and Trelleborg to 98% at Art Clinic Jönköping. The response rate for satisfaction is relatively high, while it is lower for responders, which likely reflects that the collection of HOOS-12 began in September 2021.

HOOS-12 – elective total hip replacement by unit

Table 8.4 shows the results for the three HOOS-12 subscales and the proportion classified as Charnley C by unit. HOOS-12 is presented for patients who underwent elective total hip replacement surgery in 2022 and responded both preoperatively and one year postoperatively, as well as for those who responded preoperatively and were operated on in 2023. The proportion classified as Charnley Class C preoperatively at the units that reported HOOS was 35% in 2022 and 37% in 2023, with variation among units with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries in 2022, ranging from 30% in Sollefteå to 45% in Lycksele, and in 2023 from 24% at Art Clinic Jönköping to 48% in Kungälv. These proportions should be interpreted cautiously due to the relatively low response rate. There were 19 units with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries in 2022, and the difference in the HOOS-12 subscales varied between zero to nine points preoperatively and zero to ten points one year postoperatively. For other units, the variation is greater. The response rate for preoperative HOOS-12 is significantly higher for those who underwent surgery in 2023, and all but one unit have reported preoperative HOOS-12. Here too, the results should be interpreted cautiously when comparing different units due to the relatively low response rate.

Patient-Reported Outcomes for primary knee replacement surgeries 2022

Due to the harmonization of PROM in the merger, the response rates from units have been negatively affected. Some units initially experienced issues with the PROM manager or misunderstandings during data entry.

Both preoperative and postoperative responses have decreased by up to 20% for patients who underwent surgery in 2022 compared to before the merger, leading to a decrease in the proportion of patients with both pre- and postoperative responses, which varies between 46% and

36%, depending on the PROM and type of replacement. However, the proportion of preoperative responses from patients operated on in 2023 has increased but is still lower than before the merger. Transitioning from units independently collecting PROM to a national routine requires patience, and it is encouraging that 77 out of 80 units are currently collecting PROM.

Results for units with fewer than 20 responses are not presented but are included in the national totals. Units that performed surgeries during the year but did not report PROM are marked with zero, and for those that did not perform surgeries during the year, there is a blank space.

Note that results and percentages for units with few operations and/or a low response rate may be misleading.

Table 8.5 shows that general health (EQ VAS) reported improvements from preoperative to one year postoperative, with a mean change of 12 units on the 100-point scale for TKR and 14 units for UKR. 93% and 94% of TKR and UKR patients, respectively, reported moderate or severe pain in the affected knee preoperatively. One year postoperatively, 64% of TKR patients and 65% of UKR patients reported no or very mild pain in the operated knee. Knee-related pain, ADL function, and QoL measured with KOOS-12 improved at the group level from preoperative to one year postoperative. For general health, knee pain, and KOOS-12 three subscales, the results were relatively similar for TKR and UKR, with a slightly higher proportion reporting being satisfied (very satisfied or satisfied) with the surgical outcome after UKR (84%) compared to TKR (81%).

Changes in the EQ-5D dimensions can be described using the so-called Pareto classification. If there is an improvement in one or more dimensions without deterioration in any other, it is classified as “better.” If there is deterioration in one or more dimensions without improvement in any other, it is classified as “worse.” No change is classified as “same,” and mixed changes are classified as “mixed.” Figure 8.2 shows how EQ-5D dimensions change across different units after primary knee replacement surgery. For the nation, 77% improved, and 6% worsened. However, there was significant variation. The highest proportion of patients who improved was in Skövde (90%), while 54% improved in Skene. At some units, none or only a small proportion worsened, while 15% of patients in Skene experienced deterioration. There was also considerable variation in the proportion of patients who had the same or mixed changes (10–37%).

PROMs in primary knee replacements 2022 with both pre and 1-year postoperative response

	TKR		UKR	
	Preoperatively	1 year postoperatively	Preoperatively	1 year postoperatively
Knee pain in the operated knee, n (%)	5,975	5,975	791	791
None	14 (0)	2,018(34)	3 (0)	254 (32)
Very mild	79 (1)	1,774 (30)	12 (2)	263 (33)
Mild	330 (6)	1,083 (18)	35 (4)	143 (18)
Moderate	2,944 (49)	868 (14)	397 (50)	106 (14)
Severe	2,608 (44)	232 (4)	344 (44)	25 (3)
Satisfaction with the surgery, n (%)		8,441		1,120
Very dissatisfied		221 (3)		24 (2)
Dissatisfied		474 (5)		53 (5)
Neither satisfied nor dissatisfied		928 (11)		107 (9)
Satisfied		2,426 (29)		302 (27)
Very satisfied		4,392 (52)		634 (57)
Charnley class, n (%)	9,955		1,346	
A	3,597 (36)		552 (41)	
B	3,116 (31)		454 (34)	
C	3,242 (33)		340 (25)	
Number	5,490	5,490	768	768
KOOS-12, mean (SD)				
Pain	35 (14)	78 (21)	35 (14)	77 (22)
Function in daily living	43 (18)	79 (20)	38 (18)	75 (21)
QoL	23 (13)	68 (23)	22 (13)	67 (23)
Number	3,369	3,369	696	696
EQ VAS, mean (SD)	61 (21)	73 (19)	61 (22)	75 (18)
Number	5,990	5,990	783	783
EQ5D-index, Swedish TTO, mean (SD)	0.72 (0.12)	0.86 (0.13)	0.73 (0.12)	0.88 (0.11)
EQ5D-index, Swedish VAS, mean (SD)	54.40 (12.84)	72.73 (15.20)	54.92 (12.58)	74.04 (13.60)
EQ-5D index, svensk VAS, medel (SD)	54,40 (12,84)	72,73 (15,20)	54,92 (12,58)	74,04 (13,60)

Table 8.5. PROMs in primary knee replacements 2022 with both pre- and one-year postoperative response.

Pareto classification knee

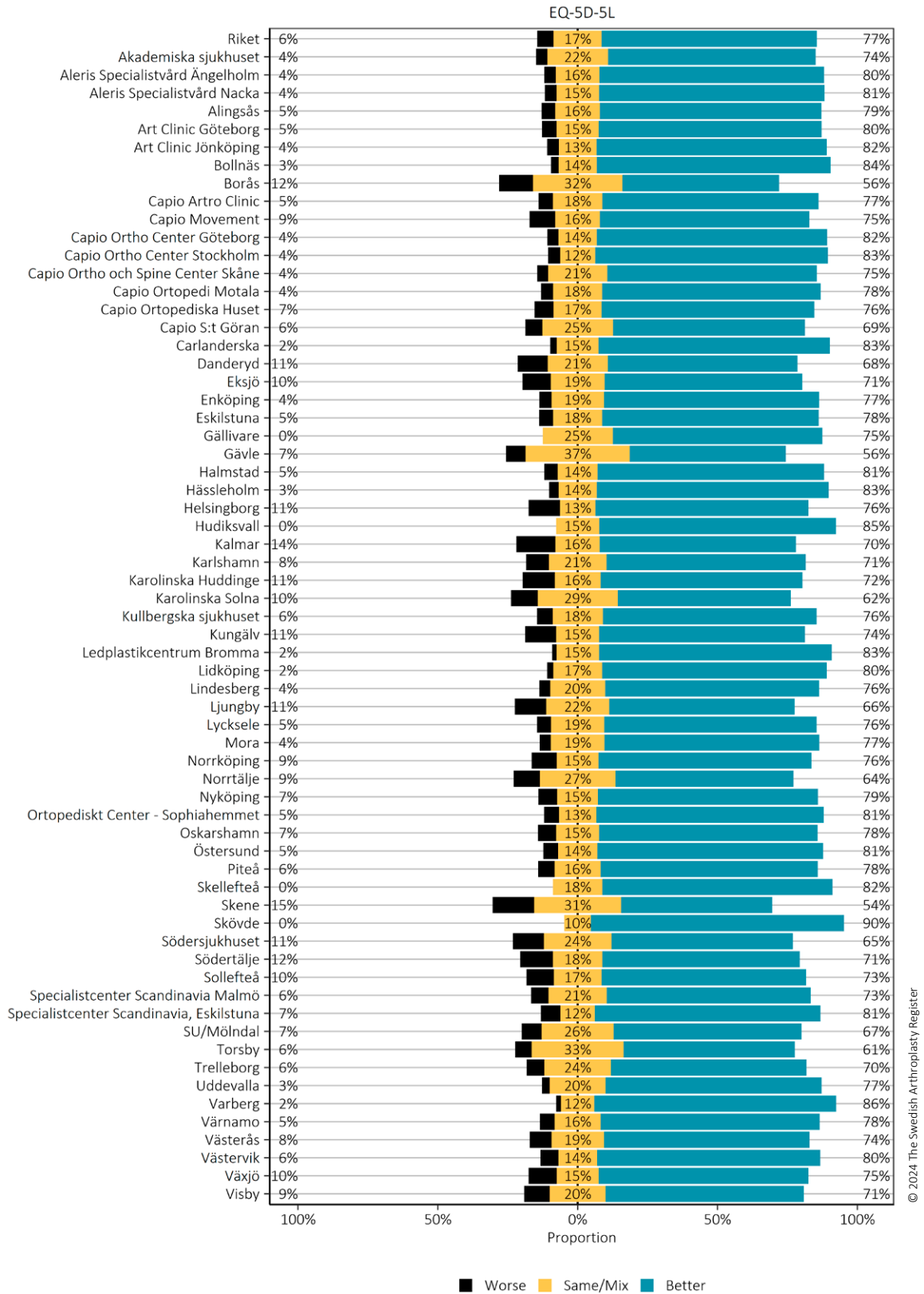


Figure 8.2. Pareto classification EQ-5D-5L, knee replacement 2022.

Primary knee replacement results per unit

Table 8.6 shows the proportion of patients satisfied (very satisfied or satisfied) with the surgical outcome. Among units with a relatively high response rate ($\geq 70\%$) and ≥ 70 knee replacement surgeries, satisfaction rates vary significantly from 72% in Kungälv and Norrtälje to 86% in Uddevalla. 91% of those who reported KOOS-12, having surgery in 2022, were classified as responders. Only five units (Eksjö, Ljungby, Lycksele, Oskarshamn, and Sollefteå) had a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries, with satisfaction rates ranging from 92% in Ljungby, Oskarshamn, and Sollefteå to 88% in Eksjö. For units with a low response rate and/or few surgeries, the proportion of responders ranged between 74% and 100%. The low response rate likely reflects changes in PROM collection following the merger.

General health for primary TKR and UKR

General health (EQ VAS) for TKR and UKR at each unit is shown in Table 8.7. Preoperatively, general health ranged from 44 to 72 units on the 100-point scale for TKR, and from 62 to 79 units postoperatively. For the few units with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries, EQ VAS ranged from 58 to 72 units preoperatively and from 68 to 73 units one year postoperatively. For UKR, general health ranged from 53 to 67 units preoperatively and from 70 to 79 units postoperatively among units with 20 or more responses.

KOOS-12 – TKR

Table 8.8 shows the results for KOOS-12 three subscales with both pre- and one year postoperative responses, as well as the proportion classified as Charnley C for TKR surgeries in 2022 at each unit, and preoperative responses for TKR surgeries in 2023. The proportion classified as Charnley class C at the three units (Ljungby, Lycksele, and Oskarshamn) with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries reporting KOOS in 2022 varied among units from 30% in Oskarshamn to 35% in Ljungby and 38% in Lycksele. For 2023, where significantly more units had a relatively high response rate, 19% of patients at Orthopedic Center, Sophiahemmet were classified as Charnley C, while 49% in Trelleborg were classified

similarly. The difference in KOOS various subscales varies most preoperatively with ten points among the three units, and between zero and four points postoperatively in 2022. The response rate for preoperative KOOS-12 is significantly higher for those operated in 2023, with all units except three reporting KOOS-12 preoperatively. For 2023, only preoperative responses are available and vary between 22 and 23 points in KOOS-12 different subscales at the units.

KOOS-12 – UKR

Table 8.9 shows the results for KOOS-12 three subscales with both pre- and one year postoperative responses, as well as the proportion classified as Charnley C for UKR surgeries in 2022 at each unit, and preoperative responses for UKR surgeries in 2023. The proportion classified as Charnley class C at the units reporting KOOS varied from 6% at Capio Movement to 38% at Nyköping. For 2023, the proportion was 25%, ranging from 15% at Orthopedic Center Sophiahemmet to 47% at Capio Movement.

No units reporting KOOS-12 for UKR had a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries for 2022, and results in the different subscales of KOOS-12 varied greatly both preoperatively and postoperatively. For 2023, there are two units (Aleris Specialistvård Nacka and Capio Ortho Center Stockholm) with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries that reported KOOS-12, showing a difference of one point in the three subscales.

Variation in results between units

Group-level results vary among comparable units, those with a relatively high response rate ($\geq 70\%$) and ≥ 70 surgeries. When a unit has relatively few surgeries and/or significant dropout, it is challenging to compare their results with other units. Additionally, we do not account for case mix, which may reduce or increase differences between units, when presenting patient-reported outcomes in this year's report.

Proportion of satisfied and responders after primary knee replacement per unit 2022

Unit	Number response	Response rate, %	Proportion satisfied, %	Number response	Response rate, %	Proportion responders, %
Akademiska	49	49	63	48	47	88
Aleris Malmö Arena	0			0		
Aleris Specialistvård Nacka	283	55	86	257	50	91
Aleris Specialistvård Ängelholm	387	63	78	272	44	91
Alingsås	115	56	83	102	47	94
Art Clinic Göteborg	250	71	83	211	60	89
Art Clinic Jönköping	164	66	86	148	59	97
Arvika	141	44	87	<20		
Bollnäs	252	67	83	243	64	94
Borås	32	60	72	21	40	100
Capio Artro Clinic	460	58	83	313	39	93
Capio Movement	391	73	84	229	43	92
Capio Ortho Center Göteborg	163	55	85	101	34	93
Capio Ortho Center Stockholm	462	53	88	391	45	93
Capio Ortho och Spine Center Skåne	75	41	83	39	22	90
Capio Ortopedi Motala	264	58	5	98	43	96
Capio Ortopediska Huset	484	57	80	0		
Capio S:t Göran	112	39	75	90	31	88
Carlanderska	181	50	87	64	18	92
Carlanderska-SportsMed	0			0		
Danderyd	60	31	75	25	13	92
Eksjö	247	79	78	226	72	88
Enköping	371	74	80	102	20	80
Eskilstuna	26	49	69	23	43	96
Falun	27	14	81	0		
Frölundaortopedien	<20			<20		
Gällivare	<20			<20		
Gävle	37	58	78	30	47	93
Halmstad	62	53	81	25	21	92
Helsingborg	148	57	74	92	36	83
Hermelinen	<20			<20		
Hudiksvall	20	53	75	<20		
Hässleholm	437	44	80	378	38	90
Kalmar	46	49	87	45	48	91
Karlshamn	132	55	77	116	48	88
Karlstad	<20			<20		
Karolinska Huddinge	85	50	74	39	23	74
Karolinska Solna	26	54	62	<20		
Kullbergska sjukhuset	197	58	83	198	59	94
Kungälv	85	83	72	64	62	88

Table continued on next page.

Proportion of satisfied and responders after primary knee replacement per unit 2022, cont.

Unit	Number response	Response rate, %	Proportion satisfied, %	Number response	Response rate, %	Proportion responders, %
Ledplastikcentrum Bromma	95	31	81	42	14	98
Lidköping	36	37	56	30	32	87
Lindesberg	183	56	82	33	10	91
Ljungby	87	78	82	90	80	92
Lycksele	185	83	82	164	74	90
Mora	147	65	85	92	41	93
Norrköping	105	91	77	63	55	89
Norrtälje	116	71	72	92	56	86
Nyköping	66	60	80	60	55	88
NÄL Trollhättan	<20			<20		
Ortopedisk Center Sophiah.	143	64	90	121	54	92
Oskarshamn	281	81	81	264	76	92
Piteå	208	62	83	171	51	93
Skellefteå	36	50	69	24	34	88
Skene	94	49	82	63	33	87
Skövde	<20			<20		
Sollefteå	108	75	81	103	73	92
Specialistcenter Scandinavia Eskilstuna	54	45	89	49	41	96
Specialistcenter Scandinavia Johanniskliniken	24	28	92	0		
Specialistcenter Scandinavia Skåne	54	66	82	35	61	94
SU/Möndal	163	54	69	143	47	90
SU/Sahlgrenska	0			0		
Sundsvall	<20			<20		
SUS/Lund	<20			<20		
Södersjukhuset	88	59	72	60	40	83
Södertälje	61	46	75	40	30	85
Torsby	54	43	83	39	31	95
Trelleborg	173	53	75	126	38	89
Uddevalla	125	82	86	103	68	96
Umeå	<20			<20		
Varberg	74	69	84	42	39	95
Visby	48	63	79	39	51	85
Värnamo	106	54	78	103	53	91
Västervik	70	63	79	65	58	89
Västerås	93	38	78	75	31	93
Växjö	79	66	67	21	18	76
Örnsköldsvik	40	20	93	0		
Östersund	54	53	89	50	49	98
Country	7,796	46	81	6,479	38	91

Table 8.6. Response rate and proportion of satisfied and responders after primary knee replacement per unit 2022.

EQ VAS in primary knee replacement 2022

Unit	Number response	Response rate, %	TKR mean (SD)		Number response	Response rate, %	UKR mean (SD)	
			pre	1 year			pre	1 year
Akademiska	47	47	55 (17)	71 (18)	0			
Aleris Malmö Arena	0							
Aleris Specialistvård Nacka	92	51	60 (21)	75 (15)	156	47	60 (20)	73 (15)
Aleris Specialistvård Ängelholm	213	45	62 (22)	75 (17)	52	37	55 (19)	73 (16)
Alingsås	100	49	66 (20)	74 (18)	0			
Art Clinic Göteborg	189	55	61 (21)	74 (18)	<20			
Art Clinic Jönköping	140	60	62 (21)	75 (17)	<20			
Arvika	<20				0			
Bollnäs	211	65	58 (20)	72 (19)	25	57	63 (19)	74 (19)
Borås	<20				0			
Capio Arthro Clinic	273	38	65 (20)	75 (16)	38	43	62 (19)	74 (17)
Capio Movement	190	41	64 (20)	75 (18)	38	58	66 (19)	77 (15)
Capio Ortho Center Göteborg	93	33	61 (18)	75 (18)	<20			
Capio Ortho Center Stockholm	300	45	61 (19)	74 (16)	85	43	62 (18)	78 (13)
Capio Ortho och Spine Center Skåne	37	23	61 (23)	73 (23)	<20			
Capio Ortopedi Motala	86	22	56 (22)	72 (17)	<20			
Capio Ortopediska Huset	385	47	63 (20)	75 (17)	<20			
Capio S:t Göran	71	30	63 (20)	71 (19)	<20			
Carlanderska	60	18	64 (19)	73 (18)	<20			
Carlanderska-SportsMed	0				0			
Danderyd	17	15	51 (21)	69 (22)	<20			
Eksjö	218	72	64 (18)	72 (16)	<20			
Enköping	90	19	58 (22)	66 (21)	<20			
Eskilstuna	20	41	52 (17)	63 (20)				
Falun	0				0			
Frölundaortopedien	<20				<20			
Gällivare	<20				0			
Gävle	26	48	54 (21)	62 (22)	<20			
Halmstad	<20		44 (20)	69 (20)	<20			
Helsingborg	81	34	63 (21)	67 (21)	<20			
Hermelinen	<20							
Hudiksvall	<20							
Hässleholm	363	49	63 (20)	73 (21)	<20			
Kalmar	45	48	64 (18)	73 (17)				
Karlshamn	111	49	66 (17)	73 (19)	<20			
Karlstad	<20							
Karolinska Huddinge	36	22	52 (21)	62 (20)	<20			
Karolinska Solna	<20							
Kullbergsga sjukhuset	174	60	60 (19)	72 (18)	22	48	59 (17)	79 (14)
Kungälv	57	68	56 (23)	69 (22)	<20			

Table continued on next page.

EQ VAS in primary knee replacement 2022, cont.

Unit	Number response	Response rate, %	TKR mean (SD)		Number response	Response rate, %	UKR mean (SD)	
			pre	1 year			pre	1 year
Ledplastikcentrum Bromma	28	13	57 (19)	76 (15)	<20			
Lidköping	25	27	46 (25)	66 (20)	<20			
Lindesberg	31	10	63 (21)	76 (17)	<20			
Ljungby	63	75	72 (16)	73 (16)	23	82	67 (21)	73 (21)
Lycksele	133	74	61 (21)	70 (19)	27	69	59 (17)	71 (15)
Mora	76	42	60 (20)	74 (17)	<20			
Norrköping	53	51	54 (20)	67 (20)	<20			
Norrtälje	87	58	60 (20)	69 (21)	<20			
Nyköping	37	51	61 (18)	69 (20)	22	58	54 (21)	70 (19)
NÄL Trollhättan	<20							
Ortopedisk Center Sophiah.	76	58	66 (21)	79 (15)	45	51	66 (18)	76 (16)
Oskarshamn	249	72	61 (19)	73 (17)	<20			
Piteå	136	51	56 (21)	69 (21)	26	43	53 (20)	70 (19)
Skellefteå	22	31	63 (15)	74 (13)				
Skene	55	30	62 (21)	71 (20)	<20			
Skövde	<20							
Sollefteå	99	70	58 (20)	68 (17)				
Specialistcenter Scandinavia Eskilstuna	43	39	59 (19)	73 (17)	<20			
Specialistcenter Scandinavia Johannisk- liniken	0				0			
Specialistcenter Scandinavia Skåne	21	41	56 (22)	74 (19)	<20			
Specialistläkarhuset i Sundsvall AB	<20							
SU/Mölndal	132	46	55 (22)	65 (23)	<20			
SU/Sahlgrenska	0							
Sundsvall	<20							
SUS/Lund	<20							
Södersjukhuset	58	41	57 (17)	66 (19)				
Södertälje	37	28	51 (22)	64 (21)				
Torsby	31	28	63 (19)	76 (16)	<20			
Trelleborg	120	38	55 (21)	66 (20)	<20			
Uddevalla	101	67	56 (21)	72 (19)				
Umeå	<20							
Varberg	40	39	64 (20)	80 (16)	<20			
Visby	36	48	61 (19)	69 (18)	<20			
Värnamo	99	53	60 (21)	74 (16)	<20			
Västervik	62	55	53 (20)	70 (20)				
Västerås	70	29	62 (20)	70 (18)				
Växjö	21	18	58 (19)	66 (23)	<20			
Örnsköldsvik	0				0			
Östersund	33	45	52 (20)	69 (20)	<20			
Country	5,923	40	60(20)	72 (19)	778	37	61 (20)	74 (17)

Table 8.7. EQ VAS in primary knee replacement per unit 2022.

KOOS-12 per unit TKR 2022 and 2023

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Akademiska	2022	47	47	43	29 (14)	68 (23)	32 (16)	67 (26)	18 (11)	59 (24)
	2023	99	81	36	32 (15)		35 (17)		19 (11)	
Aleris Malmö Arena	2022	0								
	2023	0								
Aleris Specialistvård Nacka	2022	87	48	32	36 (14)	82 (19)	40 (16)	79 (20)	22 (12)	72 (21)
	2023	269	85	33	34 (15)		40 (20)		22 (14)	
Aleris Specialistvård Ängelholm	2022	216	46	33	33 (15)	76 (22)	36 (17)	75 (21)	22 (13)	68 (24)
	2023	208	55	29	34 (14)		36 (18)		22 (13)	
Alingsås	2022	97	48	31	37 (12)	81 (19)	45 (15)	80 (19)	24 (12)	71 (22)
	2023	149	73	38	35 (16)		39 (18)		23 (14)	
Art Clinic Göteborg	2022	198	58	22	34 (15)	78 (22)	40 (19)	78 (21)	22 (13)	69 (24)
	2023	382	85	26	36 (13)		39 (16)		23 (13)	
Art Clinic Jönköping	2022	137	58	29	34 (14)	80 (20)	38 (17)	77 (19)	22 (12)	71 (22)
	2023	262	87	31	35 (14)		38 (17)		24 (13)	
Arvika	2022	<20								
	2023	145	55	37	36 (13)		39 (16)		23 (12)	
Bollnäs	2022	206	63	33	36 (14)	80 (21)	38 (17)	73 (18)	23 (13)	62 (23)
	2023	408	97	29	34 (14)		37 (18)		22 (14)	
Borås	2022	<20								
	2023	44	62	43	30 (15)		31 (19)		18 (13)	
Capio Artro Clinic	2022	274	39	24	39 (16)	80 (20)	44 (18)	79 (19)	23 (13)	68 (22)
	2023	679	79	27	38 (15)		44 (18)		25 (14)	
Capio Movement	2022	181	39	33	38 (14)	81 (20)	45 (18)	80 (20)	27 (14)	73 (22)
	2023	164	27	31	38 (13)		43 (17)		28 (14)	
Capio Ortho Center Göteborg	2022	94	34	27	33 (14)	78 (21)	38 (18)	77 (21)	20 (13)	66 (24)
	2023	179	58	22	38 (15)		45 (18)		25 (14)	
Capio Ortho Center Stockholm	2022	299	44	28	37 (14)	81 (19)	41 (18)	79 (19)	23 (14)	70 (22)
	2023	575	84	29	36 (15)		40 (18)		23 (13)	
Capio Ortho och Spine Center Malmö	2022	37	23	22	32 (14)	79 (18)	40 (21)	75 (18)	23 (13)	65 (22)
	2023	133	43	29	35 (14)		42 (17)		25 (13)	
Capio Ortopedi Motala	2022	85	22	27	30 (16)	80 (20)	32 (17)	77 (20)	20 (13)	68 (22)
	2023	229	42	34	35 (15)		38 (18)		22 (13)	
Capio Ortopediska Huset	2022	0								
	2023	197	23	26	39 (16)		44 (18)		27 (13)	
Capio Spine Center Göteborg	2022									
	2023	<20								
Capio S:t Göran	2022	70	29	38	34 (15)	72 (23)	41 (17)	70 (21)	23 (14)	66 (25)
	2023	239	78	40	35 (17)		39 (20)		23 (15)	
Carlanderska	2022	59	18	30	35 (13)	77 (20)	40 (15)	75 (21)	23 (13)	66 (25)
	2023	172	40	27	36 (13)		41 (16)		26 (12)	

Table continued on next page.

KOOS-12 per unit TKR 2022 and 2023, cont.

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Carlanderska – SportsMed	2022	0								
	2023	65	28	18	37 (14)		41 (18)		23 (13)	
Danderyd	2022	<20								
	2023	26	28	37	29 (16)		31 (19)		17 (13)	
Eksjö	2022	208	68	30	37 (13)	76 (21)	40 (15)	75 (20)	26 (13)	66 (21)
	2023	283	83	31	36 (13)		39 (16)		24 (12)	
Enköping	2022	87	19	31	30 (14)	71 (24)	34 (17)	69 (22)	21 (13)	63 (24)
	2023	170	33	34	34 (17)		36 (18)		21 (13)	
Eskilstuna	2022	<20								
	2023	34	81	44	32 (19)		35 (20)		22 (19)	
Falun	2022	0								
	2023	0								
Frölundaortopeden	2022	<20								
	2023	<20								
Gällivare	2022	<20								
	2023	32	68	31	32 (13)		37 (18)		21 (12)	
Gävle	2022	26	48	40	32 (12)	78 (19)	34 (14)	64 (20)	19 (11)	62 (22)
	2023	41	79	46	26 (13)		25 (14)		14 (11)	
Halmstad	2022	<20								
	2023	46	44	39	34 (15)		34 (16)		21 (13)	
Helsingborg	2022	77	32	30	32 (14)	70 (26)	39 (17)	71 (26)	22 (14)	66 (27)
	2023	163	67	33	30 (14)		33 (18)		21 (14)	
Hermelinen	2022	<20								
	2023	31	78	29	34 (15)		38 (14)		20 (13)	
Hudiksvall	2022	<20								
	2023	35	76	43	35 (13)		35 (14)		22 (11)	
Hässleholm	2022	353	47	34	36 (15)	78 (22)	40 (18)	76 (21)	25 (14)	68 (25)
	2023	749	77	33	35 (15)		39 (18)		24 (14)	
Kalmar	2022	45	48	37	42 (18)	82 (18)	43 (19)	80 (17)	27 (19)	72 (22)
	2023	83	97	37	33 (13)		36 (16)		22 (12)	
Karlskrona	2022	108	48	28	36 (15)	77 (22)	39 (18)	75 (20)	24 (13)	65 (23)
	2023	255	89	24	36 (14)		39 (16)		25 (13)	
Karlstad	2022	<20								
	2023	<20								
Karolinska Huddinge	2022	35	21	34	26 (18)	64 (27)	27 (22)	62 (25)	12 (12)	55 (30)
	2023	42	30	51	30 (15)		30 (16)		17 (12)	
Karolinska Solna	2022	<20								
	2023	20	56	30	32 (11)		32 (18)		18 (10)	
Kullbergsga sjukhuset	2022	174	60	28	34 (13)	76 (21)	38 (15)	75 (20)	25 (15)	66 (24)
	2023	369	97	36	33 (14)		36 (17)		22 (13)	

Table continued on next page.

KOOS-12 per unit TKR 2022 and 2023, cont.

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Kungälv	2022	54	64	41	31 (17)	66 (24)	32 (19)	67 (24)	20 (15)	60 (25)
	2023	96	89	39	33 (15)		34 (18)		20 (15)	
Ledplastikcentrum Bromma	2022	29	14	40	32 (14)	86 (17)	36 (17)	82 (18)	20 (12)	71 (17)
	2023	177	23	33	37 (14)		43 (17)		26 (14)	
Lidköping	2022	29	32	32	27 (17)	71 (26)	32 (19)	68 (25)	18 (14)	62 (24)
	2023	180	83	34	36 (16)		38 (17)		25 (14)	
Lindesberg	2022	32	10	34	31 (17)	78 (23)	35 (20)	76 (23)	22 (15)	62 (24)
	2023	87	21	28	31 (14)		36 (18)		20 (13)	
Ljungby	2022	65	77	35	38 (11)	79 (20)	46 (15)	75 (20)	30 (13)	70 (21)
	2023	76	94	44	38 (15)		37 (18)		25 (14)	
Lycksele	2022	125	70	38	38 (11)	79 (20)	36 (16)	73 (20)	22 (12)	66 (21)
	2023	135	88	32	35 (14)		40 (17)		23 (13)	
Mora	2022	74	41	35	34 (15)	82 (21)	38 (20)	79 (22)	22 (14)	72 (23)
	2023	173	74	30	34 (13)		37 (17)		22 (13)	
Norrköping	2022	52	50	38	30 (14)	71 (26)	32 (19)	65 (26)	19 (13)	58 (25)
	2023	95	66	37	30 (14)		32 (17)		19 (11)	
Norrtälje	2022	86	57	36	34 (14)	72 (24)	40 (16)	72 (24)	24 (12)	61 (25)
	2023	152	82	34	36 (14)		41 (15)		26 (14)	
Nyköping	2022	36	50	32	36 (13)	77 (17)	38 (18)	74 (19)	23 (13)	66 (21)
	2023	42	78	52	33 (15)		36 (20)		21 (13)	
NÄL Trollhättan	2022	<20								
	2023	0								
Ortopediskt Center – Sophiahemmet	2022	75	57	20	39 (14)	85 (18)	45 (16)	83 (18)	25 (12)	76 (19)
	2023	104	71	19	39 (15)		44 (16)		24 (15)	
Oskarshamn	2022	251	73	30	34 (13)	79 (21)	37 (15)	76 (20)	23 (12)	69 (23)
	2023	365	93	29	36 (14)		38 (17)		24 (14)	
Piteå	2022	140	52	44	32 (15)	80 (22)	35 (17)	75 (23)	19 (12)	70 (23)
	2023	254	75	41	33 (14)		35 (17)		20 (12)	
Skellefteå	2022	24	34	28	43 (12)	79 (20)	42 (18)	74 (21)	30 (17)	69 (21)
	2023	22	34	23	45 (18)		47 (23)		30 (19)	
Skene	2022	58	31	38	42 (17)	77 (22)	40 (18)	75 (20)	22 (15)	67 (22)
	2023	127	56	26	36 (16)		37 (19)		19 (13)	
Skövde	2022	<20								
	2023	32	89	34			39 (18)		23 (17)	
Sollefteå	2022	95	67	31	34 (14)	76 (22)	36 (15)	74 (21)	22 (12)	67 (23)
	2023	183	96	35	35 (14)		38 (16)		23 (12)	
Specialistcenter Scandinavia Eskilstuna	2022	45	41	30	33 (10)	81 (19)	41 (14)	80 (19)	20 (14)	69 (20)
	2023	127	76	22	34 (13)		40 (15)		23 (13)	
Specialistcenter Scandinavia Johanniskliniken	2022	0								
	2023	0								

Table continued on next page.

KOOS-12 per unit TKR 2022 and 2023, cont.

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Specialistcenter Scandinavia Skåne	2022	21	41	39	35 (15)	80 (22)	41 (20)	78 (24)	22 (14)	70 (27)
	2023	80	61	30	34 (15)		37 (17)		24 (13)	
Specialistläkarhuset Sundsvall AB	2022									
	2023	0								
SU/Mölnadal	2022	136	47	55	31 (15)	72 (25)	35 (19)	72 (25)	18 (13)	61 (26)
	2023	210	80	30	32 (13)		35 (17)		19 (13)	
SU/Sahlgrenska	2022									
	2023									
Sundsvall	2022	<20								
	2023	41	84	27	37 (14)		38 (16)		23 (14)	
SUS/Lund	2022	<20								
	2023	<20								
Södersjukhuset	2022	58	41	37	34 (15)	75 (24)	37 (20)	71 (23)	20 (14)	67 (25)
	2023	67	68	49	32 (15)		36 (19)		19 (14)	
Södertälje	2022	38	29	42	34 (14)	69 (23)	34 (17)	69 (22)	21 (12)	61 (24)
	2023	94	68	44	33 (18)		35 (21)		23 (15)	
Torsby	2022	31	28	36	38 (14)	83 (23)	41 (19)	84 (19)	25 (15)	78 (21)
	2023	24	23	29	35 (16)		40 (16)		21 (11)	
Trelleborg	2022	116	37	48	31 (13)	69 (24)	34 (15)	69 (24)	22 (14)	60 (26)
	2023	325	79	49	32 (16)		34 (17)		22 (15)	
Uddevalla	2022	101	67	37	32 (13)	80 (19)	34 (18)	75 (21)	20 (13)	70 (22)
	2023	176	90	25	34 (14)		36 (18)		21 (14)	
Umeå	2022	<20								
	2023	<20								
Varberg	2022	40	39	40	38 (13)	84 (18)	39 (15)	82 (20)	23 (13)	77 (19)
	2023	<20		38	32 (12)		32 (17)		20 (14)	
Visby	2022	37	49	28	33 (14)	77 (23)	34 (16)	72 (20)	20 (13)	66 (24)
	2023	76	81	43	28 (12)		34 (16)		20 (12)	
Värnamo	2022	101	53	33	34 (16)	78 (23)	37 (17)	76 (21)	23 (14)	70 (23)
	2023	215	95	34	33 (15)		37 (18)		24 (14)	
Västervik	2022	63	56	34	33 (14)	77 (24)	35 (16)	73 (25)	21 (12)	69 (26)
	2023	58	52	34	32 (13)		37 (16)		22 (14)	
Västerås	2022	73	30	39	36 (14)	77 (22)	36 (16)	73 (21)	23 (14)	66 (24)
	2023	207	72	29	31 (8)		34 (16)		20 (14)	
Växjö	2022	<20								
	2023	<20								
Örnsköldsvik	2022	0								
	2023	142	94	46	32 (13)		34 (15)		22 (13)	
Östersund	2022	33	45	41	29 (13)	76 (21)	27 (16)	75 (21)	16 (10)	71 (22)
	2023	96	76	41	34 (14)		34 (18)		21 (14)	
Country	2022	5,490	37	33	35 (14)	77 (22)	38 (18)	75 (21)	22 (13)	67 (23)
	2023	11,277	62	32	35 (15)		38 (18)		23 (14)	

Table 8.8. KOOS-12 per unit TKR 2022 and 2023.

KOOS-12 per unit UKR 2022 and 2023

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preoperatively	1 year	Preoperatively	1 year	Preoperatively	1 year
Akademiska	2022	<20								
	2023									
Aleris Malmö Arena	2022	0								
	2023	0								
Aleris Specialistvård Nacka	2022	160	49	27	33 (13)	76 (23)	40 (16)	75 (22)	22 (12)	67 (23)
	2023	371	91	25	36 (13)		41 (16)		24 (12)	
Aleris Specialistvård Ängelholm	2022	52	37	25	32 (12)	70 (22)	41 (17)	72 (19)	20 (10)	59 (22)
	2023	49	53	31	37 (14)		43 (16)		28 (14)	
Art Clinic Göteborg	2022	<20								
	2023	38	90	21	38 (14)		42 (20)		23 (13)	
Art Clinic Jönköping	2022	<20								
	2023	25	89	16	37 (12)		42 (17)		22 (12)	
Arvika	2022									
	2023	<20								
Bollnäs	2022	23	52	30	40 (14)	78 (18)	46 (16)	79 (17)	25 (10)	66 (24)
	2023	<20					51 (15)		28 (13)	
Capio Artro Clinic	2022	39	44	24	38 (14)	73 (21)	45 (20)	74 (21)	25 (13)	64 (21)
	2023	63	78	27	40 (16)		47 (18)		23 (13)	
Capio Movement	2022	39	60	6	42 (15)	82 (18)	48 (20)	85 (17)	31 (16)	72 (19)
	2023	23	29	47	39 (12)		42 (17)		26 (13)	
Capio Ortho Center Göteborg	2022	<20								
	2023	<20								
Capio Ortho Center Stockholm	2022	84	42	24	37 (15)	85 (16)	44 (21)	87 (12)	24 (13)	76 (18)
	2023	144	83	24	35 (14)		41 (17)		24 (13)	
Capio Ortho och Spine Center Malmö	2022	<20								
	2023	22	48	18	36 (13)		46 (10)		29 (16)	
Capio Ortopedi Motala	2022	<20								
	2023	34	32	32	33 (15)		41 (22)		25 (16)	
Capio Ortopediska Huset	2022	0								
	2023	<20								
Capio S:t Göran	2022	<20								
	2023	26	84	42	36 (15)		46 (21)		24 (13)	
Carlanderska	2022	<20								
	2023	<20								

Table continued on next page.

KOOS-12 per unit UKR 2022 and 2023, cont.

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Carlanderska – SportsMed	2022	0								
	2023	<20								
Danderyd	2022	<20								
	2023	<20								
Eksjö	2022	<20								
	2023	<20								
Enköping	2022	<20								
	2023	<20								
Eskilstuna	2022									
	2023	<20								
Falun	2022	0								
	2023	0								
Frölundaortopedien	2022	0								
	2023	0								
Gävle	2022	<20								
	2023	<20								
Halmstad	2022	<20								
	2023	<20								
Helsingborg	2022	<20								
	2023	<20								
Hässleholm	2022	<20								
	2023	<20								
Kalmar	2022									
	2023	<20								
Karlshamn	2022	<20								
	2023	<20								
Karolinska Huddinge	2022	0								
	2023	0								
Kullbergsga sjukhuset	2022	23	50	20	35 (16)	83 (18)	42 (17)	82 (20)	26 (12)	70 (21)
	2023	56	98	46	34 (16)		42 (18)		23 (12)	
Kungälv	2022	<20								
	2023	40	91	44	31 (15)		37 (16)		21 (13)	
Ledplastikcentrum Bromma	2022	<20								
	2023	33	22	24	38 (10)		43 (14)		23 (9)	

Table continued on next page.

KOOS-12 per unit UKR 2022 and 2023, cont.

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Lidköping	2022	0								
	2023	<20								
Lindesberg	2022	<20								
	2023	<20								
Ljungby	2022	22	79	22	37 (14)	80 (20)	43 (16)	76 (18)	24 (13)	68 (24)
	2023	34	100	30	39 (13)		45 (18)		29 (14)	
Lycksele	2022	27	69	29	36 (12)	81 (18)	42 (16)	82 (17)	25 (13)	74 (21)
	2023	30	86	42	38 (14)		44 (18)		29 (15)	
Mora	2022	<20								
	2023	33	73	21	36 (12)		44 (15)		23 (12)	
Norrköping	2022	<20								
	2023	<20								
Norrtälje	2022	<20								
	2023	<20								
Nyköping	2022	23	61	38	34 (14)	80 (23)	41 (19)	73 (24)	23 (13)	65 (28)
	2023	36	88	33	33 (14)		41 (20)		23 (13)	
Ortopediskt Center – Sophiahemmet	2022	44	50	22	35 (11)	81 (19)	46 (17)	80 (20)	21 (12)	71 (22)
	2023	60	67	15	40 (17)		45 (18)		24 (14)	
Oskarshamn	2022	<20								
	2023	<20								
Piteå	2022	26	43	33	31 (11)	90 (14)	36 (17)	90 (13)	16 (10)	85 (13)
	2023	66	78	29	31 (12)		36 (16)		20 (13)	
Skene	2022	<20								
	2023	<20								
Specialistcenter Scandinavia Eskilstuna	2022	<20								
	2023									
Specialistcenter Scandinavia Johanniskliniken	2022	0								
	2023	0								
Specialistcenter Scandinavia Skåne	2022	<20								
	2023	41	55	32	33 (16)		41 (22)		24 (17)	
SU/Mölndal	2022	<20								
	2023	<20								
Torsby	2022	<20								
	2023	<20								

Table continued on next page.

KOOS-12 per unit UKR 2022 and 2023, cont.

Unit	Year	Number response	Response rate	Proportion Charnley C	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
			%	%	Preopera- tively	1 year	Preopera- tively	1 year	Preopera- tively	1 year
Trelleborg	2022	<20								
	2023	<20								
Varberg	2022	<20								
	2023	<20								
Visby	2022	<20								
	2023									
Värnamo	2022	<20								
	2023	<20								
Växjö	2022	0								
	2023	0								
Örnsköldsvik	2022	0								
	2023	62	98	21	32 (17)		36 (18)		22 (17)	
Östersund	2022	<20								
	2023	24	83	40	37 (13)		38 (16)		27 (14)	
Country	2022	768	36	26	35 (14)	78 (21)	43 (18)	76 (20)	23 (13)	68 (23)
	2023	1,493	62	27	36 (14)		42 (17)		24 (13)	

Table 8.9. KOOS-12 per unit UKR 2022 and 2023.

Small differences in results since 2009

Since 2009, when patient-reported outcomes for TKR from Trelleborg were first presented, until this year's report on TKR performed in 2022, the variation has been minimal. General health one year postoperatively has ranged from 75 to 78. The proportion of OMERTACT-OARSI responders was 85% in 2009 and has been 89% in recent years. For 2021, the proportion of responders was 92%, and for 2022, it was 91% based on KOOS-12. The proportion of satisfied patients has increased since 2009 (Trelleborg patients only) from 81% to a range of 81% to 88% in recent years. In the full-scale KOOS (42 questions), the variation in the five subscales has been small over the years, between 1 and 4 points, and in KOOS-12 for 2021 and 2022, the variation in the three subscales was between zero and two points. These small variations between years are notable considering that different patients report each year.

Daily exercise and physical activity in elective total hip and knee replacement

Table 8.10 presents the two new questions regarding how much time is spent on daily exercise and physical activity each week. The table includes patients who were operated on in 2022 and who have pre- and one-year postoperative responses per unit. Here too, the response rate is low, likely due to the same reasons mentioned earlier in the chapter, and for units with few operations and/or a low response rate, the results and percentages may be misleading. 24% of hip replacement patients and 29% of knee replacement patients reported engaging in daily exercise for more than 150 minutes per week preoperatively, and 33% of hip replacement patients and 35% of knee replacement patients reported doing so one year postoperatively. Corresponding figures for physical activity for more than 60 minutes per week were 22% and 27% for hip and knee replacement patients preoperatively, and 33% and 37% one year postoperatively.

Hip and Knee Prosthesis Surgeries with Registration in the Swedish Osteoarthritis Register Before Surgery

The purpose of the Osteoarthritis Register is to follow up and improve the basic treatment for patients with osteoarthritis. Basic treatment includes information, exercise, and weight control, which patients can access by participating in an osteoarthritis school. In this year's report, we have cross-referenced the Swedish Osteoarthritis Register with the Swedish Arthroplasty Register to determine the proportion of total hip and knee replacement surgeries performed in 2021 and 2022 due to osteoarthritis that are registered in the Osteoarthritis Register. Table 8.11 shows that approximately 25.5% of total hip replacement surgeries and 27% of knee replacement surgeries are registered in the Osteoarthritis Register. The table also indicates significant variation between different units. In Helsingborg, only 6% of total hip replacement surgeries have a registration in the Osteoarthritis Register, while 52% in Mora do. Corresponding figures for knee replacement surgeries are 5% in Gällivare and 52% in Skövde. Table 8.12 shows similar information by region. Even at the regional level, there is significant variation from just over 9% and 11% in Norrbotten for hip and knee replacement surgeries, respectively, to 48% and 46% in Dalarna.

The relatively low proportion and large variation of total hip and knee replacement surgeries registered in the Osteoarthritis Register for 2022 and 2023 may be due to several factors. One reason may be that the units' routines for recommending or requiring osteoarthritis school before surgery vary, and regional priorities set by politicians might differ.

Everyday exercise and physical activity in hip and knee replacement 2022

Hip							Knee					
Enhet	Number re-sponse	Re-sponse rate %	Everyday exercise >150 min/week, %		Physical activity >60 min/week, %		Number re-sponse	Re-sponse rate %	Everyday exercise >150 min/week, %		Physical activity >60 min/week, %	
			pre	1 year	pre	1 year			pre	1 year	pre	1 year
Akademiska	50	62	22	32	21	40	45	44	53	33	22	33
Aleris Malmö Arena	0	0					0					
Aleris Specialistvård Nacka	153	88	27	39	29	45	249	47	30	37	24	40
Aleris Specialistvård Ängelholm	97	70	41	41	31	43	262	43	35	39	35	42
Alingsås	26	36	18	36	24	37	106	51	34	44	36	35
Art Clinic Göteborg	96	74	22	30	18	42	201	57	34	38	23	38
Art Clinic Jönköping	83	82	21	33	23	37	150	60	27	35	32	40
Arvika	67	62	27	23	20	40	<20					
Bollnäs	98	82	28	34	18	38	237	63	27	35	23	38
Borås	<20						22	42	14	14	18	36
Capio Artro Clinic	203	71	35	43	31	47	310	38	39	40	31	44
Capio Movement	66	42	34	39	31	42	236	44	33	42	35	44
Capio Ortho Center Göteborg	50	45	39	44	30	38	95	32	39	39	31	48
Capio Ortho Center Stockholm	230	74	32	41	35	47	387	44	31	38	35	46
Capio Ortho och Spine Center Skåne	41	43	48	52	45	62	38	21	34	45	39	47
Capio Ortopedi Motala	111	74	30	33	19	31	97	21	19	31	18	29
Capio Ortopediska Huset	223	73	34	41	27	41	392	46	29	39	26	40
Capio S:t Göran	52	37	21	28	16	36	88	30	24	39	31	35
Carlanderska	20	18	26	32	39	37	65	17	48	48	35	48
Carlanderska – SportsMed	<20						0					
Danderyd	21	19	7	25	24	29	24	12	21	33	25	25
Eksjö	92	75	18	29	19	28	227	72	27	36	37	37
Enköping	137	64	21	35	23	33	101	20	30	35	38	43
Eskilstuna	18	62					22	40	18	23	18	23
Falun	22	31	14	13	19	13	0					
Frölundaortopeden							<20					
Gällivare	<20						<20					
Gävle	<20						30	48	13	20	20	20
Halmstad	25	49	21	37	10	26	25	20	32	40	24	44
Helsingborg	<20						89	34	27	26	25	31
Hermelinen							<20					

Table continued on next page.

Everyday exercise and physical activity in hip and knee replacement 2022, cont.

Hip							Knee					
	Number re- sponse	Re- sponse rate %	Everyday exercise >150 min/week, %		Physical activity >60 min/week, %		Number re- sponse	Re- sponse rate %	Everyday exercise >150 min/week, %		Physical activity >60 min/week, %	
Enhet			pre	1 year	pre	1 year			pre	1 year	pre	1 year
Hudiksvall	<20						<20					
Hässleholm	227	77	29	40	19	29	375	48	31	31	29	42
Jönköping	35	55	20	27	20	29						
Kalmar	26	65	22	30	27	26	45	50	24	29	20	29
Karlshamn	57	69	26	28	22	30	115	48	26	36	28	31
Karlstad							<20					
Karolinska Huddinge	53	34	18	27	12	31	35	20	29	23	14	31
Karolinska Solna							<20					
Kullbergsgka sjukhuset	113	88	22	29	8	33	195	57	33	39	27	36
Kungälv	32	52	22	15	10	25	64	62	19	31	17	30
Ledplastikcentrum Bromma	65	28	27	40	25	41	42	13	38	38	41	50
Lidköping	42	45	15	31	11	27	31	33	13	26	23	19
Lindesberg	24	23	19	25	22	25	31	10	29	32	35	29
Linköping	<20											
Ljungby	32	70	17	31	19	31	84	74	25	25	21	33
Lycksele	78	84	15	28	19	24	165	73	21	36	18	27
Mora	95	75	16	26	16	25	92	40	22	32	21	38
Norrköping	43	61	29	28	23	30	61	52	23	38	25	26
Norrtälje	33	63	30	46	11	36	88	52	28	39	20	28
Nyköping	42	71	21	25	10	25	58	52	31	31	29	34
NÄL Trollhättan							<20					
Ortopediskt Center – Sophiahemmet	69	70	41	46	37	44	123	54	34	40	46	50
Oskarshamn	134	88	36	41	27	39	259	74	34	35	29	36
Piteå	104	70	13	21	13	34	171	51	17	20	14	27
Skellefteå	<20						22	31	31	27	36	27
Skene	0	0					0					
Skövde	25	61	24	37	30	22	<20					
Sollefteå	128	81	17	26	20	29	100	69	22	28	20	25
Specialistcenter Scandinavia Eskilstuna	28	64	26	34	28	45	45	37	29	38	31	38
Specialistcenter Scandinavia Johanniskliniken							0					

Table continued on next page.

Everyday exercise and physical activity in hip and knee replacement 2022, cont.

Hip							Knee					
	Number re- sponse	Re- sponse rate %	Everyday exercise >150 min/week, %		Physical activity >60 min/week, %		Number re- sponse	Re- sponse rate %	Everyday exercise >150 min/week, %		Physical activity >60 min/week, %	
Enhet			pre	1 year	pre	1 year			pre	1 year	pre	1 year
Specialistcenter Scandinavia Skåne	25	49	33	35	19	48	33	40	27	24	33	42
Specialistläkarhuset i Sundsvall AB							0					
SU/Möndal	114	66	25	29	21	34	143	47	31	38	32	34
SU/Sahlgrenska												
Sundsvall							<20					
SUS/Lund							<20					
Södersjukhuset	41	60	6	7	10	17	63	42	25	25	24	35
Södertälje	<20						40	29	30	30	18	48
Torsby	21	40	25	35	19	32	38	30	29	39	34	45
Trelleborg	69	78	24	34	23	34	126	38	26	29	21	30
Uddevalla	122	80	20	23	13	30	102	65	29	35	25	38
Umeå							<20					
Varberg	34	55	21	15	13	22	42	39	29	33	19	40
Visby	26	72	13	23	23	37	38	49	32	35	29	42
Värnamo	54	81	17	28	14	21	100	50	24	33	20	32
Västervik	<20						66	58	35	42	30	36
Västerås	72	49	19	24	16	32	66	27	20	33	24	33
Växjö	<20						20	17	35	25	5	10
Ängelholm	58	64	20	30	19	26						
Örnsköldsvik	46	87	12	30	27	30	0					
Östersund	97	71	21	29	18	22	45	43	16	33	16	22
Country	11,240	54	24	33	22	33	6,709	39	29	35	27	37

Table 8.10. Proportion everyday exercise >150 min/week and physical activity >60 min/week preoperatively and one year postoperatively in hip and knee replacement 2022.

Proportion of hip and knee replacements for OA with a registration
in the Osteoarthritis registry before the replacement per unit

Unit	Total hip		Knee	
	Number in SAR	% in OA registry	Number in SAR	% in OA registry
Akademiska sjukhuset	307	19.9	211	19.0
Aleris Malmö Arena	293	21.8	323	20.1
Aleris Specialistvård Nacka	1,172	26.3	1,246	23.0
Aleris Specialistvård Renmarkstorget, Umeå	44	22.7		
Aleris Specialistvård Ängelholm	918	20.4	1,063	25.3
Alingsås	354	40.4	403	45.7
Art Clinic Göteborg	721	36.5	837	34.9
Art Clinic Jönköping	525	38.9	572	40.2
Arvika	581	27.0	583	34.3
Bollnäs	685	14.5	774	17.6
Borås	133	23.3	127	36.2
Capio Arthro Clinic	1,318	23.4	1,735	23.1
Capio Movement	882	26.5	1,199	28.1
Capio Ortho Center Göteborg	518	29.2	610	26.1
Capio Ortho Center Stockholm	1,744	28.9	1,706	28.6
Capio Ortho och Spine Center Skåne	431	21.3	519	17.5
Capio Ortopedi Motala	874	43.0	1,108	43.1
Capio Ortopediska Huset	1,577	30.5	1,712	27.8
Capio S:t Göran	696	22.8	616	18.5
Capio Spine Center Göteborg	69	20.3	<20	
Capio Sports Medicine Umeå AB	<20			
Carlanderska	792	36.1	816	37.0
Carlanderska-SportsMed	454	20.0	467	17.1
Danderyd	298	12.8	296	12.2
Eksjö	621	17.7	651	20.0
Enköping	1,012	19.3	1,038	19.3
Eskilstuna	92	21.7	91	20.9
Falun	294	51.7	375	49.3
Frölundaortopedien	26	19.2	40	27.5
Gällivare	113	23.1	74	5.4
Gävle	67	16.4	112	9.8
Halmstad	200	12.0	250	13.2
Helsingborg	72	5.6	499	19.2

Table continued on next page.

Proportion of hip and knee replacements for OA with a registration in the Osteoarthritis registry before the replacement per unit, cont.

Unit	Total hip		Knee	
	Number in SAR	% in OA registry	Number in SAR	% in OA registry
Hermelinen	72	13.9	70	8.6
Hudiksvall	102	11.8	82	17.1
Hässleholm	1,289	17.2	1,645	23.0
Jönköping	332	20.2		
Kalmar	148	35.8	151	29.8
Karlshamn	559	22.5	525	33.7
Karlskrona	<20			
Karlstad	48	20.8	38	36.8
Karolinska Huddinge	383	22.2	277	19.5
Karolinska Solna	30	23.3	54	16.7
Kristianstad	<20			
Kullbergsga sjukhuset	781	26.4	765	26.7
Kungälv	181	27.6	246	36.2
Ledplastikcentrum Bromma	1,069	31.0	1,210	31.3
Lidköping	499	36.3	318	42.8
Lindesberg	853	24.6	768	27.3
Linköping	122	42.6		
Ljungby	185	21.6	222	23.4
Lycksele	487	15.8	386	22.3
Mora	562	52.1	504	41.3
Norrköping	296	44.9	268	48.9
Norrtälje	294	4.8	364	24.2
Nyköping	258	17.4	203	1.7
NÄL	<20		<20	
Ortopediskt Center – Sophiahemmet	553	21.2	461	15.0
Oskarshamn	793	0.3	728	34.5
Piteå	753	8.5	715	12.4
Skellefteå	247	13.4	136	8.1
Skene	428	33.4	415	30.1
Skövde	80	45.0	68	51.5
Sollefteå	782	12.8	326	16.3
Specialistcenter S:t Johanniskliniken	<20		232	22.8
Specialistcenter Scandinavia Malmö	244	16.8	283	28.6

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Proportion of hip and knee replacements for OA with a registration in the Osteoarthritis registry before the replacement per unit, cont.

Unit	Total hip		Knee	
	Number in SAR	% in OA registry	Number in SAR	% in OA registry
Specialistcenter Scandinavia, Eskilstuna	331	23.6	284	31.3
Specialistläkarhuset i Sundsvall AB			31	12.9
SU/Möndal	615	35.1	552	34.6
Sundsvall	41	7.3	67	20.9
SUS/Lund	<20		<20	
Södersjukhuset	217	25.3	244	22.5
Södertälje	202	16.8	270	17.0
Torsby	273	22.3	252	31.7
Trelleborg	502	16.7	720	19.3
Uddevalla	590	32.0	332	38.0
Umeå	67	13.4	<20	
Varberg	296	11.5	214	14.0
Visby	228	25.0	163	37.4
Värnamo	310	12.3	416	16.8
Västervik	255	18.0	224	25.9
Västerås	710	38.7	507	42.0
Växjö	354	22.9	255	25.1
Ängelholm	399	12.5		
Örnsköldsvik	285	14.7	411	19.5
Östersund	353	33.7	237	40.9
Country	36,462	25.5	36,737	27.0

Table 8.11. Proportion of total hip and knee replacements due to OA with a registration in the Swedish Osteoarthritis Registry before the replacement per unit 2022 and 2023. Units with fewer than 20 operations are excluded.

Proportion of hip and knee replacements for OA with a registration
in the Osteoarthritis registry before the replacement per region

Region	Total hip		Knee	
	Number in SAR	% in OA registry	Number in SAR	% in OA registry
Blekinge	597	22.9	556	33.1
Dalarna	1,547	48.1	1,455	45.8
Gotland	266	25.9	223	38.6
Gävleborg	1,142	15.1	1,179	16.6
Halland	1,225	13.3	1,491	14.8
Jämtland	649	30.8	641	33.9
Jönköping	1,469	17.7	1,141	19.5
Kalmar	1,076	28.3	1,041	31.9
Kronoberg	764	24.5	772	29.7
Norrbottnen	1,181	9.5	1,101	11.3
Skåne	4,220	17.7	4,974	21.6
Stockholm	6,959	23.8	7,239	21.7
Sörmland	1,249	22.3	1,204	25.0
Uppsala	1,395	19.2	1,323	19.1
Värmland	1,111	29.2	1,013	33.7
Västerbotten	1,008	16.2	698	17.5
Västernorrland	1,232	13.7	888	17.7
Västmanland	1,122	39.8	1,021	42.3
Västra Götaland	5,546	355,0	5,362	37.6
Örebro	1,010	23.9	780	26.9
Östergötland	1,495	42.5	1,612	43.6
Country	36,462	25.5	36,737	27.0

Table 8.12. Proportion of total hip and knee replacements due to OA with a registration in the Swedish Osteoarthritis Registry before the replacement per region 2022 and 2023.

Analyses for a deeper
understanding of selected areas.



9. In-Depth Analyses

9.1. Custom made cups

Author: Johan Kärrholm

Patients with significant pelvic defects due to previous implant failures or other reasons, such as tumors or pelvic fractures, present a surgical challenge when prosthetic reconstruction becomes necessary. In the last two decades, the use of custom-made cups has become increasingly common for these cases. By utilizing electron beam melting (EBM), metal particles are directed in a vacuum to build up an implant layer by layer, reflecting the three-dimensional extent of the bone defect based on radiological mapping with computed tomography (CT). The result is an implant that more or less accurately fills the created defect. Additionally, screw holes are placed to provide optimal fixation in the remaining bone. Typically, a standard cup or a dual mobility cup is cemented into the metal shell. In rarer cases, a liner intended for one of the standard cups available on the market has been used instead.

The literature includes a relatively large number of mainly retrospective studies with up to 50 cases, as well as meta-analyses often including other types of surgical solutions. The most common indication is pelvic dissociation, though other less pronounced bone defects and tumor cases also occur. After a follow-up period of two to five years, the revision rate for the cup is reported to be around five percent, while the overall revision rate may be significantly higher. The most common reason for revision are dislocation and infection. In the current timeframe, loosening has been cited as a cause for revision only in a few cases, though based on small materials. For pelvic dissociation, custom-made cups have been compared with several other techniques, including uncemented cups with or without augmentation, reinforcement rings, trabecular metal cups combined with modified reinforcement rings (cup-cage), or using distraction techniques or simultaneous plate fixation of the pelvis.

The first custom-made cup was reported to the Swedish Arthroplasty Register in 2012. By 2017, the number of reports had increased to 29. Since then, the number has varied between five and 17 per year. Because the Swedish Arthroplasty Register lacks information based on radiographic examinations, it is not possible to define a truly appropriate comparison group, especially since patients with the most pronounced bone defects are likely selected for surgery with a custom-made cup.

To provide a benchmark comparison group, we identified a group using techniques involving uncemented cups with augmentation and/or some form of reinforcement ring. The majority of these cases are first-time revisions, while custom-made cups have been used equally often for both primary and second-time revisions. Since custom-made cups have also been used in primary surgery, these cases are included in both groups. There are many manufacturers of custom-made cups, but in Sweden, almost exclusively one (Materialize) has been used. Therefore, only these implants are included in the study group. Furthermore, the use of augmentation or reinforcement rings was not detailed until 2017, after the reoperation database was restructured the year before. Therefore, data for custom-made cups between 2017 and 2023 is reported separately (in parentheses) in Table 9.1.1. Between 2012 and 2023, 150 custom-made cups were reported to the register (2017–2023: $n=101$). The corresponding number for the comparison group from 2017 to 2023 was 331. Of these, 275 had augments, 46 had a reinforcement ring, nine had been operated with two augments, and one hip had both two augments and a reinforcement ring.

As shown in the table, there are differences in background factors between the groups. In the study group, for example, the proportion of primary prostheses is lower, the proportion of “other diagnoses” is higher, the proportion

of posterior approaches is higher, and the proportion with dual mobility cups is higher. In the study group, 16 out of 17 replacements were revised either due to infection or dislocation, and none due to loosening. One was revised due to fracture (“other reasons” in Table 9.1.1), and none due to loosening. In the comparison group, the same primary reasons for revision dominated, totaling 25 out of 34 cases. Loosening was the main reason in five of these cases. The cumulative risk of revision did not differ between the groups (Log Rank test, all observations: $p=0.98$; observations from 2017 onwards: $p=0.57$).

In summary, we find that the risk of revision is similar in both groups, possibly with a trend towards increased risk of revision due to loosening and a slightly lower risk of revision due to infection and dislocation in the comparison group. Since we do not know the indication for the surgeries performed, the extent of bone defects, and the groups also show differences in background factors, no definitive conclusions can be drawn. However, it is of interest to describe these surgeries and the results achieved, especially considering that patients undergoing these procedures often suffer from severe disability, where surgical options to maintain walking function are highly limited.

Demographics, approach, implant choices, and outcomes related to the type of surgery in primary total prosthesis or revision using a custom-made cup between 2012 and 2023, as well as between 2017 and 2023 for an uncemented cup with augment and/or reinforcement ring

	Type of implant	
	Custom made cups ^{1, 2}	Uncemented cup + augment a/o ring
Number	150 (101)	331
Primary replacements, n (%)	12 (8)	81 (24,5)
Follow-up year, mean, (95% CI)	3.6 (3.2-4.1) (2.6 (2.2-3.1))	2.3 (3 2.1-2.5)
Age, mean (95% CI)	67.0 (64.8-69.6) (68.2(65.8-70.7))	71.3 (70.1-72.5)
Females %	63.3 (65.3)	57.4
Diagnosis, n (%)		
OA	66 (44.0) (47 (46.5))	208 (62.8)
Fracture/Trauma ³	12 (8.0) (5 (5.0))	14 (4.2)
Tumor	5 (3.3) (1 (1.0))	2 (0.8)
Other diagnosis ⁴	67 (44.7) (48 (47.5))	107 (32.3)
ASA-class, n (%)		
ASA I-II	75 (50.0) (58 (57.5))	206 (62.2)
ASA III-V	70 (46.7) (42 (41.6))	123 (37.2)
Missing	7 (3.3) (1 (1.0))	2 (0.6)
BMI		
Mean (95% CI)	25.6 (24.8-26.3) (25.4 (24.4-26.4))	26.9 (26.4-27.4)
Missing, n (%)	3 (2.0) (1 (1.0))	4 (1.2)
Approach, n (%)		
Posterior	108 (72.0) (72 (71.3))	186 (56.2)
Direct lateralt lateral- or supine position	21 (14.0) (21 (20.8))	137 (41.4)
Other	11 (7.3) (-)	3 (0.9)
Missing, n (%)	10 (6.7) (4 (4.0))	5 (1.5)
Bone graft/bone substitute, n (%)	85 (56.6) (56 (55.5))	176 (53.2)
Type of cup, the five most used, n (%)		
Materialize	150 (100) (101 (100))	-
TMT revision	-	105 (31.7)
Continuum	-	86 (26.0)
Tritanium revision	-	45 (13.6)
Pinnacle W/Gription	-	36 (10.9)
Other	-	59 (17.8)

Table continued on next page.

Demographics, approach, implant choices, and outcomes related to the type of surgery in primary total prosthesis or revision using a custom-made cup between 2012 and 2023, as well as between 2017 and 2023 for an uncemented cup with augment and/or reinforcement ring, cont.

	Type of implant	
	Custom made cups ^{1, 2}	Uncemented cup + augment a/o ring
Type of inlay, n (%)		
Cup fixed with cement	143 (95.3) (96 (95.0))	61 (18.4)
Liner fixed without or with cement	3 (2.0) (1 (1.0))	260 (78.5)
Missing	4 (2.7) (4 (4.0))	10 (3.0)
DM cup/inlay, n (%)⁵	54 (36.0) (39 (38.6))	77 (23.2)
Reason for revision/re-revision, n (%)		
All reasons	17 (11.3) (13 (12.9))	34 (10.3)
Loosening	- (-)	5 (1.5)
Infection	8 (5.3) (6 (5.9))	14 (4.2)
Dislocation	8 (5.3) (7 (6.9))	11 (3.3)
Other	1 (0.7)	3 (0.9)
Missing	- (-)	1 (0.3)
Procedure in revision/re-revision, n (%)		
Exchange of cup/liner ± exchange of another part	5 (3.3) (4 (4.0))	9 (2.7)
Complete extraction	2 (2.3) (2 (2.0))	3 (0.9)
Other procedures	10 (6.6) (8 (8.0))	21 (6.3)
Missing	-	1 (0.3)
All observations	150	332
CRR revision 5 year ⁶ (95% CI)	12.3 (6.6-18.8)	11.8 (8.8-15.8)
Observations 2017-2023	101	331
CRR revision ⁷ (95% CI).	12.6 (5.8-19.4)	11.0 (7.2-14.8)

Table 9.1.1. Demographics, approach, implant choices, and results related to the type of surgery at the insertion of a primary total hip replacement or revision using a custom-made cup between 2012 and 2023, and between 2017 to 2023 for an uncemented cup with augment and/or reinforcement ring.

1) all manufactured by Materialize.

2) hips operated 2017–2023 in brackets

3) including sequele after trauma .

4) diagnosis is missing for five and nine cases respectively in the respective groups

5) All variants of dual mobility joints, 3 and 28 had missing observations in each group (all observations).

6) 70 and 81 observations respectively left at five years.

7) 50 and 137 observations respectively left at fouryears.

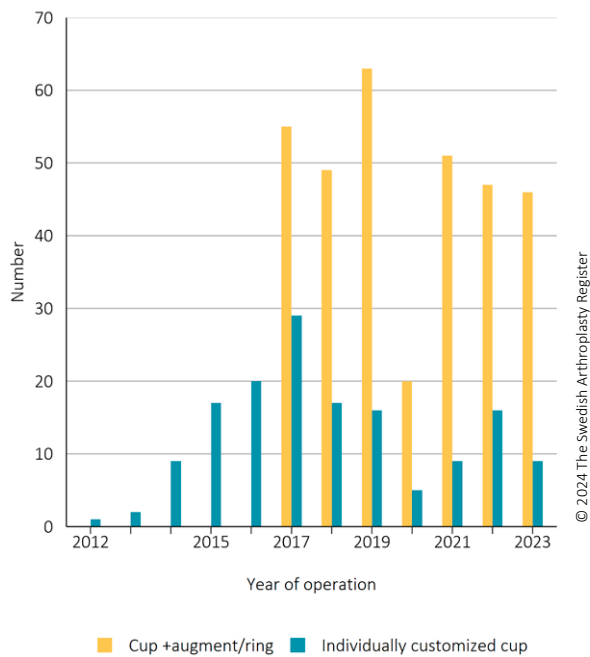


Figure 9.1.1. Annual distribution of custom-made cups and uncemented cups combined with augment and/or reinforcement ring.

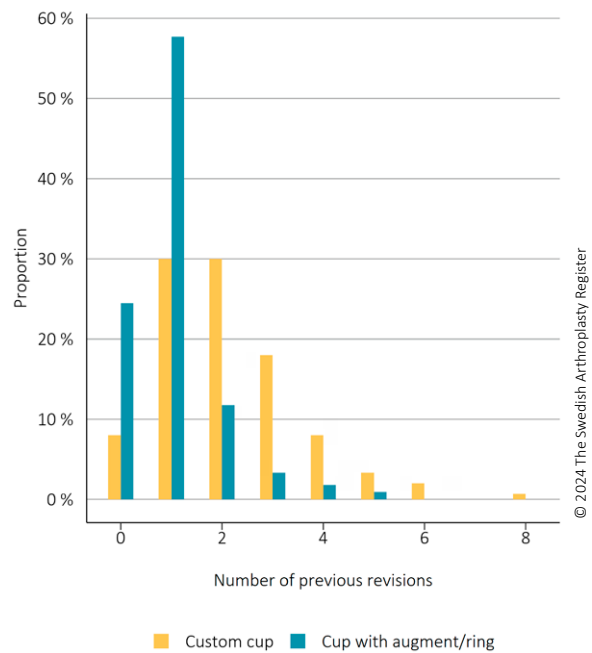


Figure 9.1.2. Distribution of primary surgeries (0), first (1), and multiple revisions (2-8) for custom-made cups and uncemented cups combined with augment and/or reinforcement ring.

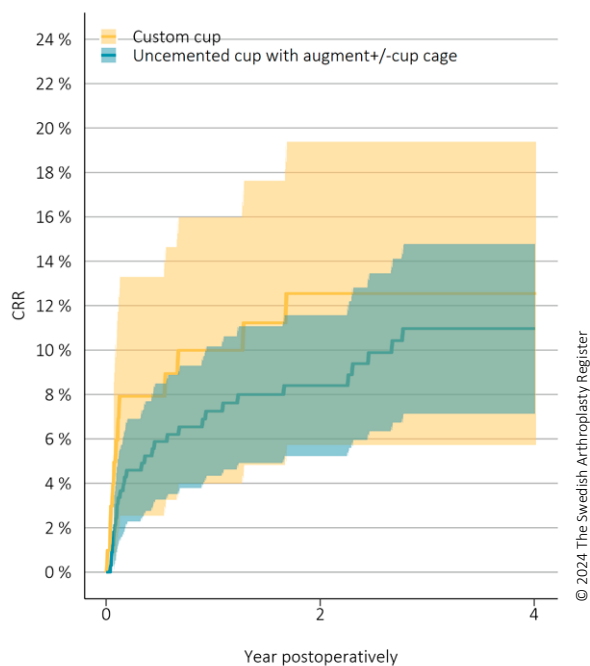


Figure 9.1.3. Cumulative risk of revision for custom-made cups (yellow line) and uncemented cups with augment and/or reinforcement ring (blue line). Only implants inserted between 2017 and 2023 are included.

9.2 SPII stem 130 or 150 mm?

Author: Johan Kärrholm

The SPII stem with a 130 mm length was introduced to the market in 1995. It has been represented in the Swedish Arthroplasty Register since 1999, the first year stem length was recorded. Until 2013, the number of reported cases was low, ranging from 0 to 19 per year. After that, the number increased, and by 2022, 7.9% of all SPII implants were either 130 or 150 mm in length. The following year, the proportion dropped to 6.4% (Figure 9.2.1). According to the manufacturer, the short stem represented 23% of all SPII stems produced and sold in 2022. Most were sold in Germany, the Netherlands, Sweden, and the United Kingdom. In Sweden, nine units reported at least 50 inserted 130 mm stems from 2014 to 2023, accounting for 94% of the total number. All units using the 130 mm stem also used the 150 mm stem, with seven out of nine using the latter more frequently. An additional 26 units have used the 130 mm stem more sporadically, with numbers ranging between 1 and 47 during the period from 2014 to 2023.

Previous annual reports have shown that the short SPII stem experiences more revisions compared to the 150 mm

stem. This in-depth analysis aims to investigate whether this difference could be due to variations in patient demographics, choice of cup, joint surface, stem size, or surgical technique, based on data reported to the Swedish Arthroplasty Register. Although register data can never provide definitive conclusions, in-depth analysis can shed more light on the results.

To ensure a fair evaluation and avoid cases with missing data, 104 short stems and 3,745 standard stems have been excluded (Figure 9.2.2). The analysis focuses on 4,191 130 mm stems and 60,752 150 mm stems (Table 9.2.1). After selection, several more or less pronounced differences remain between the groups. The follow-up time is slightly shorter in the short stem group, the proportion of females is higher, and the proportion with trauma diagnosis is lower, while the proportion with “other diagnoses” is higher. Regarding other implant choices, the short stem is used more often with older types of polyethylene in the cup, more frequently with a 36 mm head, more often with a metal head, and the two smallest stem sizes are used more frequently.

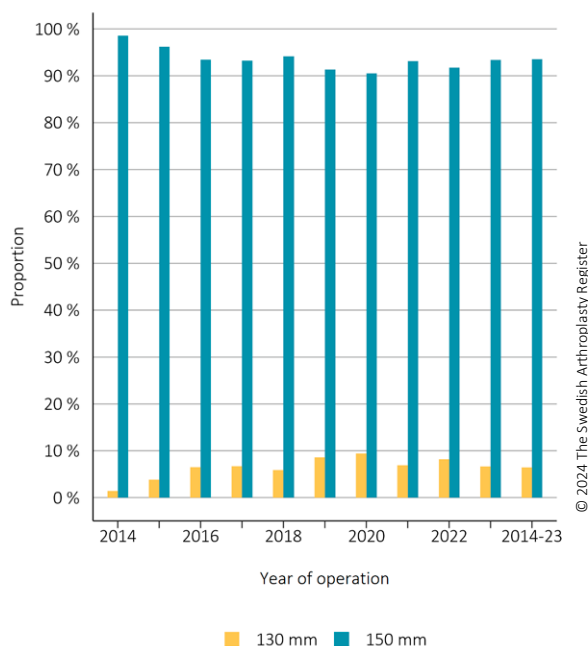


Figure 9.2.1. Distribution between 130 mm and 150 mm SPII stems reported to the Swedish Arthroplasty Register from 2014 to 2023. Throughout the period, the short stem accounted for 6.5% (bars on the right).

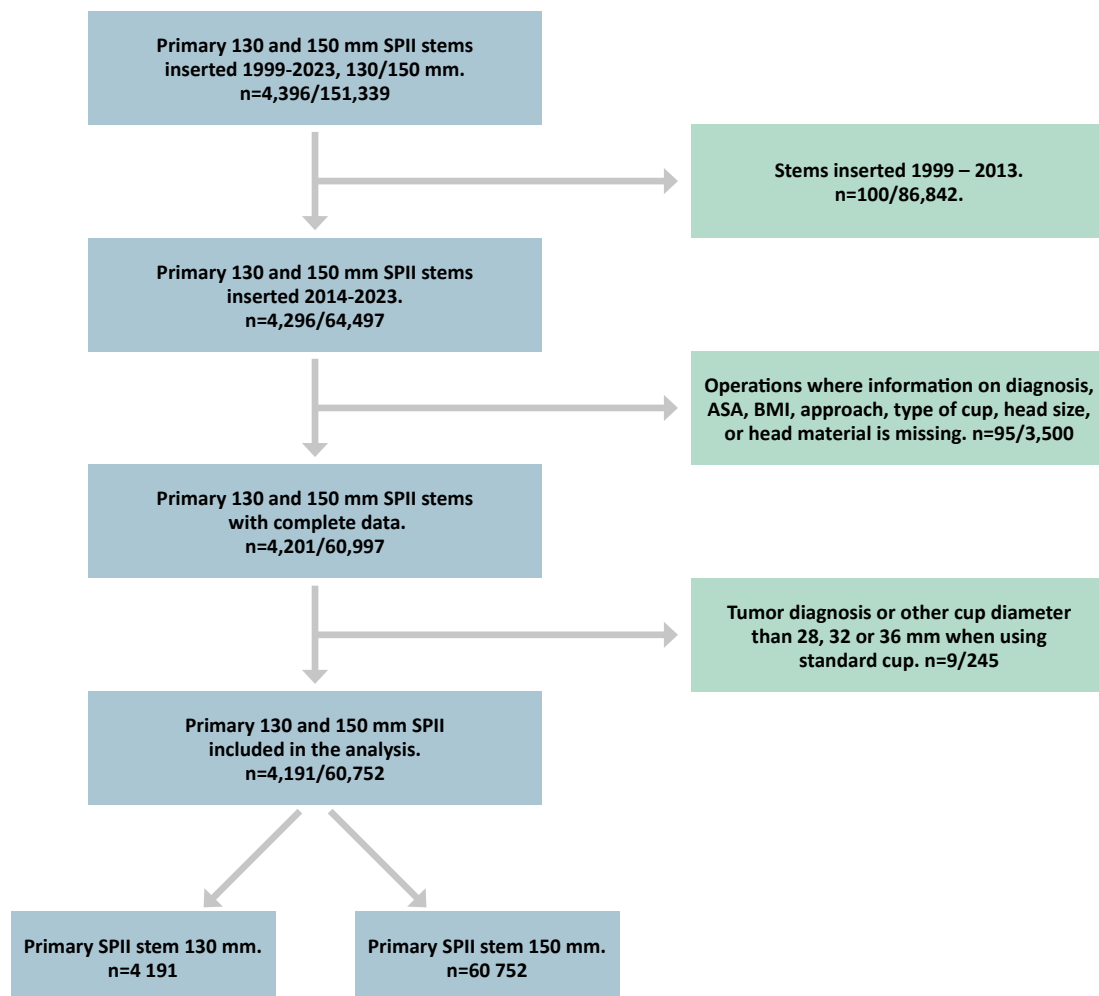


Figure 9.2.2. Flow-chart showing the number of primary SPII stems included in the analysis and reason for exclusion.

Loosening, infection, and dislocation, in that order, are the most common reasons for revision in both groups. The short stem is revised slightly more often than the standard stem due to loosening (0.5% of cases compared to 0.3%). The cumulative risk of revision has been calculated up to 9 years, with 67 cases remaining in the smaller group (130 mm stem). Whether considering all types of revision (Figure 9.2.3) or only stem revision regardless of reason, the risk of revision is greater with the short stem ($p=0.001$ and 0.023 , Log Rank test). If infection-related revisions are excluded from the latter outcome, the difference remains ($p<0.001$), although the number of revisions in the short stem group is limited in this analysis (29 short, 243 standard stems revised, Figure 9.2.4).

Evaluation in a regression analysis, adjusting for factors listed in the footnotes of Table 9.2.1, shows that the risk of revision is increased by about 60% for the short stem when stem revision regardless of reason is the outcome. Excluding cases with dual mobility cups and including only standard cups leaves the outcome largely unchanged. For stem revision due to non-infectious reasons, the risk ratio increases to 2.0 (100%) before and 2.2 (120%) after adjustment. Again, only a marginal change occurs if operations with dual mobility cups are excluded. In both analyses, stem revisions where the reason is unspecified (standard stem only) are classified as non-infectious.

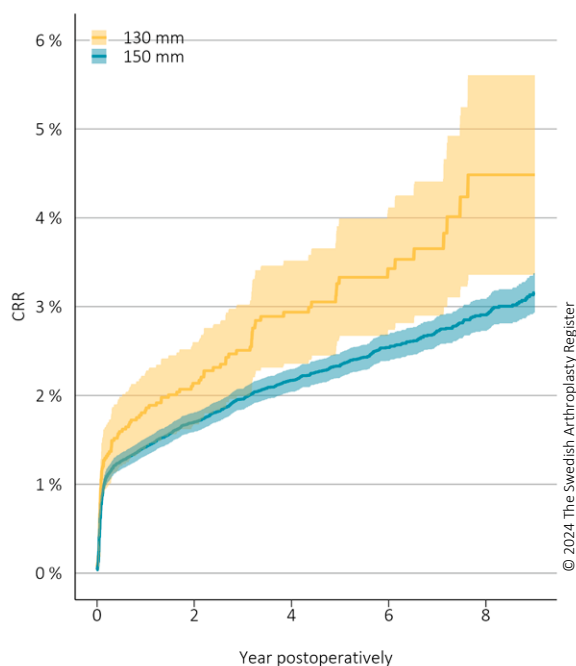


Figure 9.2.3. Cumulative risk of revision with all outcomes and all reason for surgeries with 130 mm or 150 mm SP II stems included in the analysis according to figure 9.2.2. After nine years, 67 stems of 130 mm and 4,098 stems of 150 mm remain.

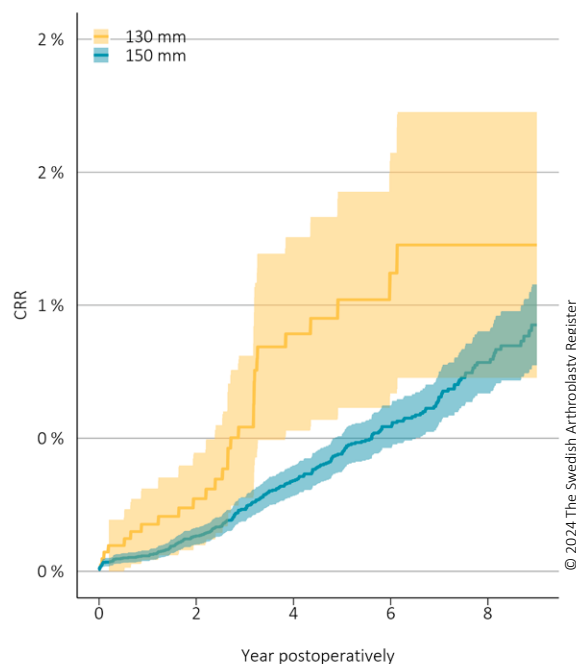


Figure 9.2.4. Cumulative risk of revision with stem revision for all reasons excluding infection for surgeries with 130 mm or 150 mm SP II stems included in the analysis according to figure 9.2.2. After nine years, 67 stems of 130 mm and 4,098 stems of 150 mm remain.

Summary

Over the past decade, the short SPII stem has shown a higher risk of revision compared to the 150 mm stem, primarily due to an increased incidence of revisions related to loosening. Our data suggest that when choosing between a short and a standard stem, the latter should be preferred, especially if the risk of loosening is considered high.

Theoretically, a short stem might be preferable over a longer one in the event of a potential revision due to a lower risk of perioperative and postoperative complications.

However, it remains to be evaluated whether outcomes after stem revision differ based on which of these two stems was used in the primary surgery.

This analysis should be interpreted with the understanding that the short SPII stem has been used more frequently by a relatively small number of units and less frequently by many others, and that some background factors remain unknown.

Demographics, approach, implant choices, and results related to stem length
(130 or 150 mm) in primary total hip replacement 2014–2023

	Stem length 130 mm	Stem length 150 mm
Number	4,191	60,752
Follow-up year, mean, (95% CI)	3.8 (3.8-3.9)	4.4 (4.4-4.4)
Age, mean (95% CI)	74.2 (74.0-74.5)	74.0 (74.0-74.0)
Females, n (%)	2,980 (71.1)	37,864 (62.3)
Diagnosis, n (%)		
OA	3,282 (78.3)	47,242 (77.8)
Fracture/Trauma ¹	612 (14.6)	10,528 (17.3)
Other diagnosis	297 (7.1)	2,982 (4.9)
ASA-class, n (%)		
ASA I-II	3,102 (74.0)	43,933 (72.3)
ASA III-V	1,089 (26.0)	16,819 (27.7)
BMI, mean (95% CI)	26.9 (26.8-27.1)	26.7 (26.7-26.8)
Approach, n (%)		
Posterior	2,399 (57.2)	35,451 (58.4)
Direct lateral/ lateral- or supine position	1,699 (40.5)	24,836 (40.9)
Other	93 (2.2)	465 (0.8)
Type of cup, n (%)		
Cemented	4,010 (95.7)	58,131 (95.7)
Articulation, n (%)		
Older types of polyethylene	880 (21.0)	9,543 (15.7)
Highly cross-linked polyethylene	2,932 (70.0)	46,619 (76.7)
DM cup	374 (8.9)	4,523 (7.4)
Other, missing	5 (0.1)	67 (0.1)
Most common cup, n (%)		
Lubinus x-link	2,737 (65.3)	39,458 (64.9)
Lubinus older type of polyethylene	879 (21.0)	9,439 (15.5)
Avantage	205 (4.9)	3,066 (5.0)
Other	370 (8.8)	8,789 (14.5)
Femoral head size, n (%)²		
28 mm	151 (4.0)	2,584 (4.6)
32 mm	3 234 (84.7)	51,128 (90.9)
36 mm	432 (11.3)	2,517 (4.2)
Femoral head material, n (%)³		
Metal	3,526 (84.1) (3,259 (85.4))	48,826 (80.4) (44,493 (79.1))
Ceramics	665 (15.9) (558 (14.6))	11,926 (19.6) (11,736 (20.9))

Table continued on next page.

Demographics, approach, implant choices, and results related to stem length (130 or 150 mm) in primary total hip replacement 2014-2023, cont.

	Stem length 130 mm	Stem length 150 mm
Stem size, n (%)		
01	114 (2.7)	1,326 (2.2)
1	1,552 (37.0)	16,869 (27.8)
Other sizes	2,525 (60.2)	42,557 (70.1)
Revision, all reasons and procedures, n (%)	118 (2.8)	1,332 (2.2)
Reason for stem revision, n (%)		
All reasons	35 (0.8)	383 (0.6)
Loosening	21 (0.5)	170 (0.3)
Infection	6 (0.1)	143 (0.2)
Dislocation	3 (0.1)	40 (0.1)
Other reasons	5 (0.1)	25 (0.0)
Missing	-	5 (0.0)
Cumulative risk of revision at 9 years (95% CI)⁴		
All reasons and procedures	4.4 (3.3-5.5)	3.2 (3.0-3.5)
Stem revision all reasons	1.6 (1.0-2.2)	1.3 (1.1-1.5)
Stem revision for non-infectious reasons only	1.2 (0.7-1.7)	0.9 (0.7-1.1)
Outcome stem revision all reasons		
Risk ratio all observations, (95% CI)		
Unadjusted	1.5 (1.1 – 2.1). p=0.02	1
Adjusted ⁵	1.6 (1.1-2.3). p=0.007	1
Risk ratio standard cup only, (95% CI)		
Unadjusted	1.5 (1.03-2.1). p=0.04	1
Adjusted ⁶	1.6 (1.1-2.2). p=0.02	1
Outcome stem revision, not infection		
Risk ratio all observations, (95% CI)		
Unadjusted	2.0 (1.4-3.0). p<0.001	1
Adjusted ⁵	2.2 (1.5-3.2). p<0.001	
Risk ratio standard cup only, (95% CI)		
Unadjusted	2.1 (1.4-3.0). p<0.001	1
Adjusted ⁶	2.2 (1.5-3.3). p<0.001	1

Table 9.2.1. Demographics, approach, implant choices, and results related to stem length (130 or 150 mm) at the insertion of a primary total replacement from 2014 to 2023. Excluded observations and reasons for exclusion are indicated in figure 9.2.2.

1) Including sequele after trauma.

2) Only standard cups.

3) Data for standard cup in parentheses.

4) Number of observations at nine years: 67 in the short stem group and 4,098 in the standard stem group.

5) Adjusted for age, sex, ASA, diagnosis, type of bearing (highly cross-linked polyethylene, older polyethylene, DM cup), and stem size. Operations with missing information on the bearing surface are excluded.

6) Adjusted for age, sex, ASA, diagnosis, type of bearing (highly cross-linked polyethylene, older polyethylene), head size and material, and stem size. Operations with missing information on the bearing surface are excluded.

9.3 Choice of fixation related to age

Author: Johan Kärrholm

Despite Sweden's higher proportion of cemented prostheses compared to most other countries, the use of completely uncemented fixation has gradually increased over the past two decades. In 2023, 45.5% of all reported primary cups were fixed without cement, and the corresponding proportion for stems was 41.2%. Previous reports have shown that cemented fixation generally results in fewer revisions over a medium-term period for patients aged 65 and older. This also applies to the group under 65, considered as a homogeneous group, provided all reasons of revision, including infection, are included as outcome parameters. The group younger than 65 years includes a wide age range, with a relatively large number of operations for patients aged 50 to 64 and fewer for those younger. Most patients under 50 are operated with completely uncemented prostheses, which complicates or prevents a fair comparison between cemented and uncemented fixation among the youngest patients.

This year's in-depth analysis does not focus on individual components but instead examines the choice of prosthesis fixation based on the prosthesis type, i.e., whether the patient receives a fully cemented, fully uncemented, hybrid, or reverse hybrid prosthesis. Clinically, fixation choice is made for each component, and for the patient, it may be less significant, though not indifferent, which components are revised. This year's analysis considers revision regardless of intervention and reason, although we know that the prognosis for further revisions varies depending on the reason for the initial revision. The aim is to make the evaluation as clinically relevant as possible from the patient's perspective.

To minimize confounding factors and ensure relevance, only operations using metal–polyethylene or ceramic–polyethylene articulations, standard cups with highly cross-linked polyethylene, heads with diameters of 28, 32, or 36 mm, and patients operated with posterior or direct lateral incisions are included. Furthermore, only operational years with at least 20 surgeries reported for the smallest fixation group (fully cemented, uncemented, hybrid, or reverse hybrid) and implant types reported in at least 475 surgeries during the period (2006 to 2023) are included. Figure 9.3.2a shows that the number of replacements meeting the inclusion criteria has gradually increased since 2006, with a temporary decline during the

pandemic years. The later introduction of highly cross-linked polyethylene for cemented cups means that the relative proportion of these implants (fully cemented and reverse hybrid prostheses) was relatively low in the early years (Figure 9.3.2b).

The analysis is based on five age groups, with the youngest group chosen to ensure sufficient observations in each prosthesis group. Table 9.3.2 highlights the age groups used in the statistical analysis. For the youngest and oldest groups, subgroups are also shown for increased transparency. In the youngest group under 55 years, most patients are between 45 and 54 years. Patients aged 44 and younger have primarily been operated with uncemented fixation (n=3,285) or reverse hybrid (n=428). In the cemented and hybrid groups, there are about 100 cases per group. In the oldest group, aged 85 and older, the vast majority have been operated with cemented prostheses (n=6,246), followed by hybrid prostheses (n=532). Fully uncemented or reverse hybrid fixation has been used in fewer than 100 cases.

The analysis of combined groups (all ages) shows that uncemented prostheses are predominantly used for males, and these patients, as well as those receiving hybrid prostheses, are somewhat more likely to have osteoarthritis with known reason. There are also differences between groups regarding incision choice, head size, and head material (Table 9.3.3). Overall, the revision rate is highest among uncemented and reverse hybrid prostheses. The reason for revision varies, with a higher proportion of revisions due to loosening in the uncemented and reverse hybrid fixation groups. Revision due to infection is most common in the uncemented group, and periprosthetic fracture is most common in the reverse hybrid group. Assessing the performed intervention is more complex, as liner exchange is only relevant for uncemented fixation. However, the proportion of cup and/or stem exchanges is higher in the uncemented and reverse hybrid fixation groups, with isolated cup or stem exchanges more frequent in the reverse hybrid fixation group.

In the total dataset, including all ages, the cumulative risk of revision is lowest in the cemented and hybrid groups (Figure 9.3.3). After 10 years, the risk tends to increase in all groups, and after approximately 13 years, the situation

Flow-chart cemented cup

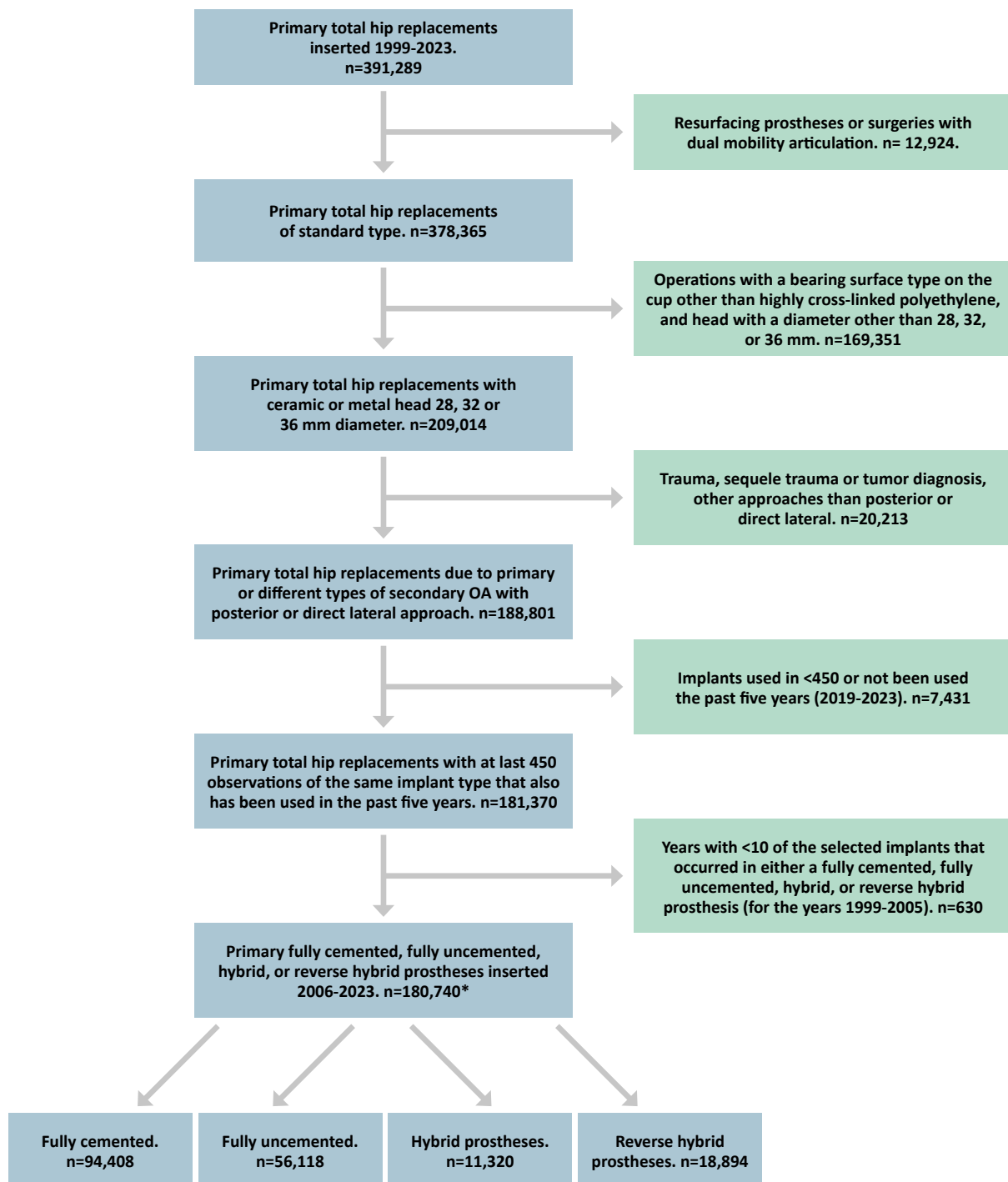


Figure 9.3.1. The flowchart shows the selection of fully cemented, fully uncemented, hybrid, and reverse hybrid prostheses included in the analysis. See Table 9.3.1 for selected implants.

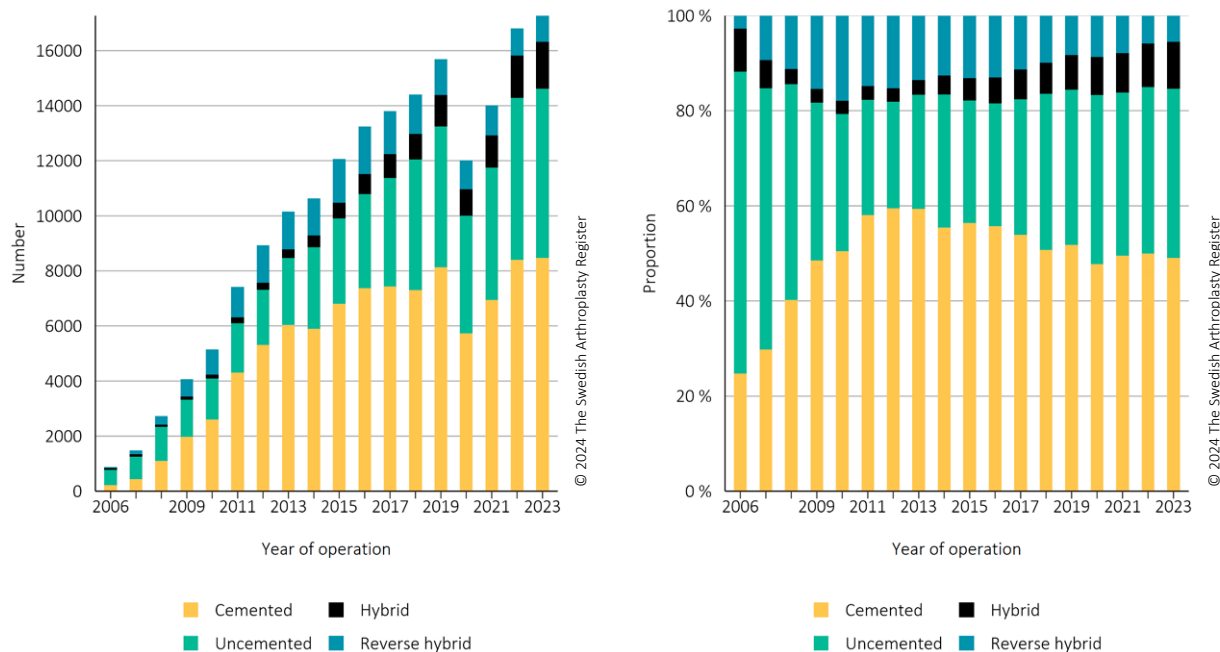


Figure 9.3.2 a-b. Number (a) and relative distribution (b) of cemented, uncemented, hybrid, and reverse hybrid prostheses included in the analysis.

becomes difficult to assess, likely due to a decreasing number of observations. Evaluation in a regression analysis shows that the risk of revision is lowest for the cemented group and increases progressively with the use of hybrid, reverse hybrid, and uncemented prostheses. In the age groups ranging from 55 to 84 years (Table 9.3.4), the risk of revision remains elevated with the use of uncemented and reverse hybrid fixation compared to fully cemented fixation. In the youngest group under 55 years, there is no statistically significant difference between the replacement groups. In the oldest group, 85 years and older, the number of observations is too few to analyze uncemented and reverse hybrid fixation.

Hybrid prostheses present a more complex picture, with a tendency towards increased or comparable risk of revision in the age groups between 55 and 84 years. In the oldest group, the risk is significantly lower compared to fully cemented fixation. However, the number of hybrid prostheses inserted in patients aged 85 years and older is limited to 532.

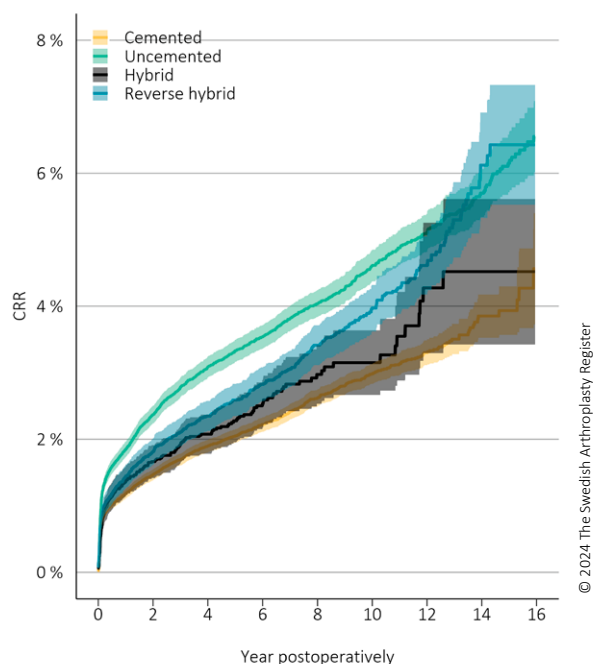


Figure 9.3.3. Cumulative risk of revision related to the choice of fixation. After 16 years, 266, 1,096, 93, and 105 remain in the respective groups of cemented, uncemented, hybrid, and reverse hybrid prostheses.

Implants included in the analysis of fixation

Type of cup	Number	Type of stem	Number
Cemented cup		Cemented stem	
Lubinus x-link	50,236	SPII 130 or 150 mm	50,496
Exeter Rim-fit	26,627	Exeter standard 125, 150 mm#	34,495
Marathon	17,751	MS-30 polished	20,154
ZCA XLPE	13,846	CPT 130 mm	573
IP cup	2,572		
Exceed ABT without flange (E-poly)	2,263		
Uncemented cup		Uncemented stem	
Pinnacle Gription, all variations	20,077	Corail (standard*, coxa vara, high offset)	38,881
Trident, all variations	11,951	CLS	11,132
Trilogy ± HA	8,546	Accolade (Straight eller typ II)	7,559
Pinnacle porocoat, all variations	8,029	Bi-Metric X por HA NC	6,569
Continuum	5,507	M/L Taper	5,345
G7 PPS	3,082	Echo Bi-Metric, FPP eller RPP	2,008
Trilogy IT	2,231	ABG II HA	1,839
Allofit	1,787	Wagner Cone	1,689
Exceed ABT (Ringlock eller Taper-Fit)	1,720		
Tritanium, all variations	1,173		
Trident II	1,124		
TMT, modular or revision	904		
Regenerex	836		
Delta, TT or Delta-One TT	478		

Table 9.3.1. Implants used in 180,740 primary hip replacements (94,408 fully cemented, 56,118 fully uncemented, 11,320 hybrid and 18,894 reverse hybrid prostheses) included in the fixation analysis.

Age distribution for the hip replacements included in the fixation analysis

Age	Cemented, number (%)	Uncemented, number (%)	Hybrid, number (%)	Reverse hybrid, number (%)
0–24 years	6 (3.6)	146 (86.9)	3 (1.8)	13 (7.7)
25–34 years	19 (2.8)	588 8(6.2)	19 (2.8)	56 (8.2)
35–44 years	85 (2.8)	2,551 (83.1)	74 (2.4)	359 (11.7)
45–54 years	879 (5.1)	13,001 (75.4)	524 (3.0)	2,847 (16.5)
<55 years	989 (4.7)	16,286 (76.9)	620 (2.9)	3,275 (15.5)
55–64 years	10,118 (23.7)	23,597 (55.2)	2,030 84.8)	6,984 (16.3)
65–74 years	40,077 (61.7)	13,755 (21.2)	4,581 (7.1)	6,556 (10.1)
75–84 years	36,978 (82.3)	2,414 (5.4)	3,557 (7.9)	1,989 (4.4)
85– years	6,246 (90.1)	65 (0.9)	532 (7.7)	90 (1.3)
85–94 years	6,189 (90.1)	65 (0.9)	526 (7.7)	90 (1.3)
≥ 95 years	57 (90.5)	0 (0.0)	6 (9.5)	0 (0.0)

Table 9.3.2. Age distribution for the hip replacement included in the fixation analysis. Bold font indicates the groups used in the statistical analysis. Additionally, a more detailed breakdown is provided for the youngest and oldest age groups. Approximately 100 operations with fully cemented or hybrid prostheses were performed during the period in patients younger than 45 years, following exclusion as per figure 9.3.1, and fewer than 100 uncemented or reverse hybrid prostheses in patients aged 85 years and older. Percentages refer to the distribution of fixation methods within the specified age group.

Demographics, approach, reason and procedure in case of revision, and results.
All age groups have been included.

	Cemented	Uncemented	Hybrid	Reverse hybrid
Number	94,408	56,118	11,320	18,894
Follow-up, mean (95% CI)	5.8 (5.8-5.8)	5.8 (5.8-5.8)	4.5 (4.4-4.6)	7.1 (7.1-7.2)
Age mean (95% CI)¹	74.2 (74.0-74.5)	74.0 (74.0-74.0)	74.2 (74.0-74.5)	74.0 (74.0-74.0)
Sex, females, n (%)	61,092 (64.7)	24,039 (42.8)	7,183 (63.5)	10,179 (53.9)
Diagnosis, primary OA, n (%)	89,291 (94.6)	50,223 (89.5)	9,920 (87.6)	17,695 (93.7)
ASA-class, n (%)				
ASA I-II	73,053 (77.4)	48,717 (86.8)	8,785 (77.6)	16,506 (87.4)
ASA III-V	19,599 (20.8)	5,338 (9.5)	2,193 (19.4)	2,001 (10.6)
Missing	1,756 (1.9)	2,063 (3.7)	342 (3.0)	387 (2.0)
BMI, mean, (95% CI)	27.0 (27.0-27.0)	28.0 (27.9-28.0)	27.0 (26.9-27.1)	27.5 (27.5-27.6)
Missing, n %	2,400 (2.5)	2,417 (4.3)	386 (3.4)	505 (2.7)
Approach, n (%)				
Posterior	49,712 (52.7)	33,648 (60.0)	8,388 (74.1)	9,103 (48.2)
Direct lateral lateral or supine position	44,696 (47.3)	22,470 (40.0)	2,932 (25.9)	9,791 (51.8)
Caput size, n (%)²				
28	8,580 (9.1)	4,102 (7.3)	322 (2.8)	4,473 (23.7)
32	80,043 (84.8)	42,194 (75.2)	6,133 (54.2)	13,795 (73.0)
36	5,785 (6.1)	9,822 (17.5)	4,865 (43.0)	626 (3.3)
Caputmaterial, n (%)³				
Metal	81,638(86.5)	37,044 (66.0)	10,631 (93.9)	14,073 (74.5)
Ceramic	12,770 (13.5)	19,074 (34.0)	699 (6.1)	4,821 (25.5)
Revision, all reasons and procedures, n (%)	118 (2.8)	1,332 (2.2)	118 (2.8)	1,332 (2.2)
Reason for stem revision, n (%)³				
All reasons	2,065 (2.2)	1,952 (3.5)	249 (2.2)	625 (3.3)
Loosening	367 (0.4)	322 (0.6)	33 (0.3)	208 (1.1)
Infection	988 (1.0)	840 (1.5)	117 (1.0)	162 (0.9)
Dislocation	357 (0.4)	402 (0.7)	49 (0.4)	69 (0.4)
Periprosthetic fracture	257 (0.3)	231 (0.4)	38 (0.3)	145 (0.8)
Other reasons	67(0.1)	127(0.2)	4(0.0)	30(0.2)
Missing	29 (0.0)	30 (0.1)	8 (0.1)	11 (0.1)

Table continued on next page.

Demographics, approach, reason and procedure in case of revision, and results, cont.
All age groups have been included.

	Cemented	Uncemented	Hybrid	Reverse hybrid
Procedure at revision, n (%)³				
Exchange caput	839 (0.9)	839 (0.9)	839 (0.9)	839 (0.9)
Exchange caput a/o liner	0 (0.0)	524 (0.9)	23 (0.2)	0 (0.0)
Exchange cup	424 (0.4)	288 (0.5)	32 (0.3)	187 (1.0)
Exchange cup+stem	293 (0.3)	273 (0.5)	21 (0.2)	72 (0.4)
Exchange stem +/-liner	332 (0.4)	512 (0.9)	59 (0.5)	211 (1.1)
Partial/total extraction	161 (0.2)	198 (0.4)	28 (0.2)	40 (0.2)
Missing	12 (0.09)	10 (0.0)	3 (0.2)	1 (0.0)
Cumulative risk of revision at 16 years (95% CI)⁴				
All reasons and procedures	4.6 (3.8-5.4)	6.5 (6.0-7.0)	4.5 (3.4-5.6)	7.3 (5.4-9.2)
Outcome all reasons				
Risk ratio all observations, (95% CI)				
Crude	1	1.6 (1.5-1.7). p<0.001	1.1 (1.0-1.3). p=0.05	1.3 (1.2-1.4). p<0.001
Adjusted ⁵	1	1.6 (1.5-1.7). p<0.001	1.2 (1.1-1.4). p=0.005	1.4 (1.2-1.5). p<0.001
Adjusted ⁶	1	1.6 (1.5-1.8). p<0.001	1.2 (1.1-1.49). p=0.006	1.4 (1.2-1.5). p<0.001

Table 9.3.3. Demographics, approach, reason, and procedure of any revision, along with the outcomes. All age groups are included.

1) See table 9.3.2 for the number of observations within each age group.

2) See figure 9.3.1 for inclusion and exclusion criteria.

3) The sum of percentage values may deviate from the total percentage due to rounding effects.

4) Number of observations at 16 years: 266 cemented, 1,096 uncemented, 93 hybrid prostheses and 105 reverse hybrid prostheses.

5) Adjusted for age, sex, diagnosis, choice of incision, head size, and head material.

6) Adjusted for age, sex, diagnosis, choice of incision, head size, head material, ASA-class, and BMI (174,162 observations).

Cumulative risk of revision and risk ratio for revision regardless of reason divided in five age groups

	Cemented	Uncemented	Hybrid	Reverse hybrid
Age group < 55 years, n	989	16,286	620	3,275
Observations at 12 years, n	133	2,312	80	508
Cumulative risk of revision at 12 years, (95% CI)	4.4 (2.8-6.0)	5.1 (4.6-5.6)	7.3 (4.8-10.8)	4.0 (3.2-4.8)
Risk of revision, all reasons, (95% CI)				
0–4 years¹				
Unadjusted	1	1.4(0.9-2.3). p<0.1	1.4 (0.8-2.7). p=0.3	1.0 (0.6-1.7). p<0.9
Adjusted ²	1	1.4(0.9-2.2). p<0.1	1.5 (0.8-2.8). p=0.2	1.0 (0.6-1.7). p=1.0
> 4 years¹				
Unadjusted	1	0.8 (0.5-1.5). p<0.5	1.4 (0.8-2.7). p=0.3	1.0 (0.6-1.7). p<0.9
Adjusted ²	1	0.8 (0.5-1.5). p<0.5	1.6 (0.7-3.8). p=0.3	0.8 (0.4-1.5). p=0.5

Table continued on next page.

Cumulative risk of revision and risk ratio for revision regardless of reason divided in five age groups, cont.

	Cemented	Uncemented	Hybrid	Reverse hybrid
Age group 55-64 years, n	10,118	23,597	2,030	6,984
Observations at 14 years, n	435	1,496	88	328
Cumulative risk of revision at 14 years, (95% CI)	4.2 (3.4-5.0)	5.8 (5.2-6.6)	3.8 (2.7-4.9)	6.2 (4.8-6.6)
Risk of revision, all reasons, (95% CI)⁵				
Unadjusted	1	1.6(1.4-1.9). p<0.001	1.4 (1.0-1.9). p=0.03	1.3 (1.1-1.6). p<0.005
Adjusted ²	1	1.6(1.3-1.8). p<0.001	1.4 (1.0-1.8). p=0.05	1.3 (1.1-1.6). p=0.008
Age group 65-74 years, n	40,077	13,755	4,581	6,556
Observations at 13 years, n	1,788	667	105	497
Cumulative risk of revision at 13 years, (95% CI)	3.4 (3.1-3.7)	5.2 (4.5-5.9)	5.4 (2.8-8.0)	6.3 (5.1-7.5)
Risk of revision, (95% CI)				
Unadjusted	1	1.6(1.4-1.9). p<0.001	0.9 (0.8-1.2). p=0.6	1.4 (1.2-1.6) p<0.001
Adjusted ²	1	1.6(1.4-1.8). p<0.001	1.1 (0.9-1.4). p=0.5	1.4 (1.2-1.7). p<0.001
Age group 75-84 years, n	36,978	2,415	3,557	1,989
Observations at 11 years, n	2,622	154	82	234
Cumulative risk of revision at 11 years, (95% CI)	3.1 (2.8-3.4)	5.8 (3.8-7.8)	3.4 (2.2-4.6)	4.4 (3.0-5.8)
Risk of revision, (95% CI)				
Unadjusted	1	1.8(1.4-2.2). p<0.001	1.2 (1.0-1.6). p=0.07	1.4 (1.1-1.8). p=0.006
Adjusted ²	1	1.6(1.3-2.0). p<0.001	1.3 (1.0-1.6). p=0.05	1.4 (1.1-1.8). p<0.01
Age group ≥ 85 years, n	6,246	65	532	90
Observations at 6 years, n	1,860	23	94	39
Cumulative risk of revision at 6 years, (95% CI)	2.6 (2.1-3.1)	³	0.7 (0.0-1.9)	³
Risk of revision 0-6 years, (95% CI)				
Unadjusted	1	³	0.3 (0.1-0.8). p=0.02	³
Adjusted ²	1	³	0.2 (0.1-0.7). p=0.01	³

Table 9.3.4: Relative risk of revision, regardless of reason or procedure, divided into five age groups. Cumulative risk of revision is calculated until at least 80 observations remain in the smallest group. Cumulative revision risk and risk ratio for revision, regardless of reason or procedure, are presented with 95% confidence intervals (CI).

1) Divided into two intervals to maintain conditions for evaluation using Cox regression.

2) Adjusted for age, sex, diagnosis, incision, head size, and head material.

3) Not calculated due to a small number of observations.

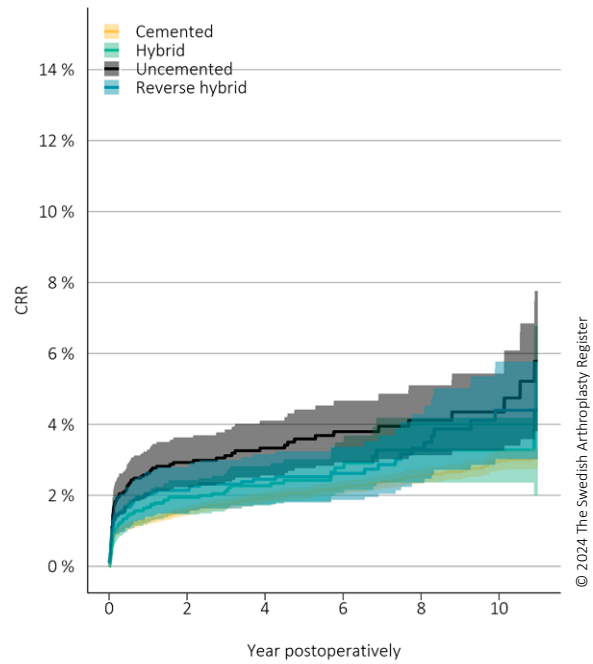
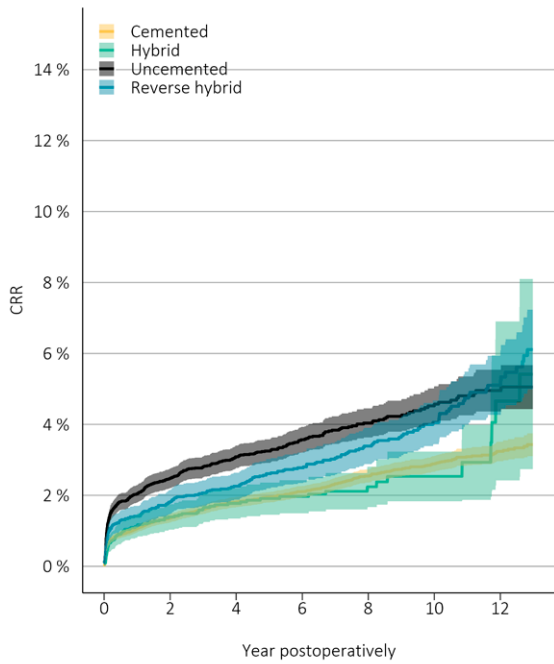
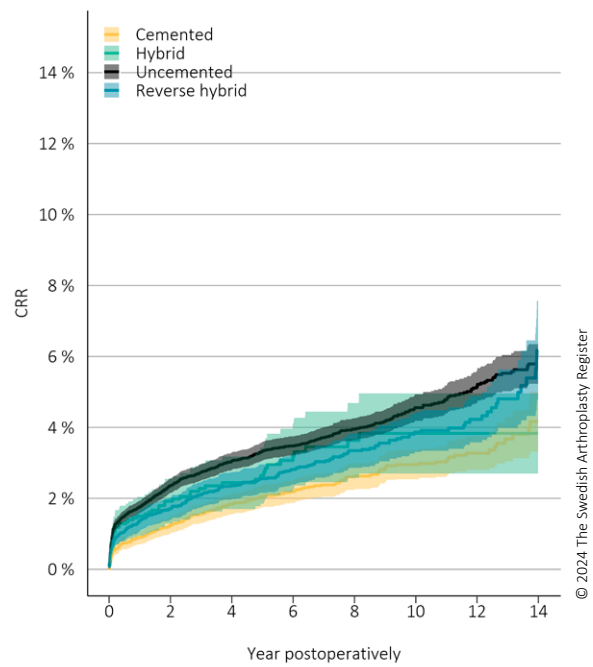
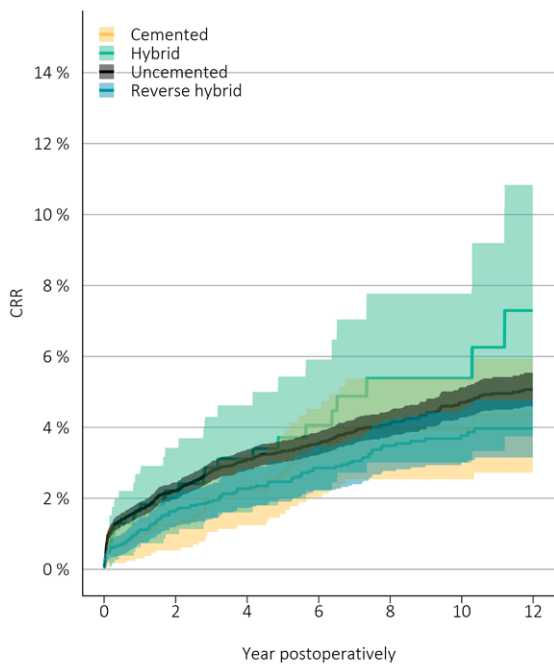


Figure 9.3.4 a-e. Cumulative risk of revision related to the choice of fixation in the age groups younger than 55 years (a), 55-64 years (b), 65-74 years (c), 75-84 years (d), and 85 years and older (e, see next page). Observation period and the number of observations at the start and end of each period are specified in Table 9.3.4.

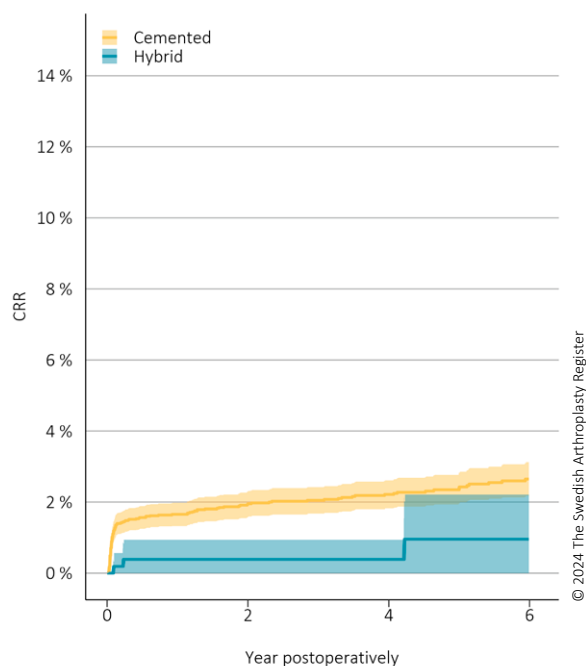


Figure 9.3.4 e. Cumulative risk of revision related to the choice of fixation in the age group 85 years and older.

Summary

Cemented fixation is an excellent choice, provided that these prostheses are used in the ways that have been standard in Sweden over the past two decades. Hybrid prostheses yield largely similar results but offer no added value, except possibly for our very oldest patients.

For the youngest patient group, this analysis does not provide specific guidelines, especially for patients under 45 years of age, as these patients are few in number and the vast majority are operated on with fully uncemented fixation. The relatively low cumulative risk of revision in this group, with no tendency to increase after 10 years in three of the groups, is particularly advantageous for fully uncemented and reverse hybrid fixation, given that results in these two groups are based on a large number of observations.

The analysis has several limitations, including that it is only applicable to the implant choices and surgical environment relevant in Sweden, and that the observation period extends only 11–16 years after surgery.

Swedish Arthroplasty Register and clinical research

Author: Ola Rolfson

The government, together with the Swedish Association of Local Authorities and Regions, has entered into an agreement to finance Swedish national quality registers. The vision is that these registers will become an integrated part of a national system for collective knowledge management and for monitoring Swedish healthcare. The registers aim to contribute to learning and improvement, quality development, saving lives, achieving equitable health, research, resource-efficient healthcare and social care, and improvement work among healthcare providers, as well as serving as a source for clinical research, including collaborations with the life science sector. Apart from financing costs for managing the registries, the allocations from the Swedish Association of Local Authorities and Regions and the government go to the two first missions. The idea is that register-based research should be financed through other means.

What is Research and What is Activity Evaluation?

The line between what should be considered clinical research and activity evaluation or improvement work is unclear. All register analyses aimed at providing feedback to improve activities are based on scientific methods. Within the register, we conduct targeted in-depth analyses, validation studies, and combine data with other health data registers, following established register research methods. There is ongoing work, based on scientific principles, to improve and develop the methods used in register work. Although central funding is not intended for research, the Swedish Association of Local Authorities and Regions and the Swedish Agency for Health and Care Services Analysis regularly evaluate the research activity within the registers. A high level of research activity is a criterion for a register to be awarded the highest certification level.

66 Theses from the Swedish Arthroplasty Register

When all the theses that are fully or partly based on data from the Swedish Hip and Knee Arthroplasty Registers are combined, it is evident that we have had an impressive research output since the registers were established in the

mid-1970s. The total number of scientific publications from the registers amounts to nearly 500, and in 2023 alone, 17 articles were published using data from the Swedish Arthroplasty Register. We will continue to work strategically to maintain the research infrastructure to uphold high research activity. It is particularly gratifying that the PhD candidates currently working on their theses using data from the Swedish Arthroplasty Register represent six Swedish universities (Uppsala University, Lund University, University of Gothenburg, Umeå University, Linköping University, Karolinska Institute, and Örebro University).

Theses Defended in 2023

In 2023, three theses based partly on data from the Swedish Arthroplasty Register were defended:

- On femoral neck fractures in the elderly by Johan Lagergren, 2023-11-24
- Hip and Knee Osteoarthritis: Who Are the Patients Referred to First-Line Intervention and What Happens to Them? by Kristin Gustafsson, 2023-09-22
- Total Knee Arthroplasty and Bariatric Surgery: Patients, Outcomes and Surgeons by Perna Ighani Arani, 2023-06-02

Why is Observational Research Necessary?

Register studies and randomized clinical trials (RCTs) complement each other. Research in joint replacement surgery requires long follow-up periods and a large number of patients. Some key outcome parameters (reoperations, prosthesis survival, and mortality) are relatively rare. This makes register studies particularly useful for research in joint replacement surgery. Register studies have several advantages that are worth highlighting:

- Register studies represent real-world outcomes. This means the results are highly generalizable. A register study provides an accurate picture of how a particular treatment performs in routine care in the general population.

- Due to their size and long follow-up, register studies can investigate rare exposures and outcomes that occur infrequently.
- The registration of an individual in a quality register does not require written informed consent, making it easier to collect complete data and conduct data collection at a lower cost.
- Continuous longitudinal data collection allows for the analysis of changes in patient demographics, treatment, and outcomes over time.

What is Required to Use Register Data for Research Purposes?

All register-based research involving individual data requires approval from the Swedish Ethical Review Authority (EPM). All information in the register is considered public but is protected by confidentiality according to the Public Access to Information and Secrecy Act. The Västra Götaland Region is the central data controller (CPUA), and the operational manager at Registercentrum Västra Götaland is responsible for confidentiality and harm assessments in data release requests. We use specific forms for data extraction requests, available for download from the Registercentrum website (registercentrum.se/research). Work is ongoing at Registercentrum to digitalize the data request application process. Regulations regarding register research are available on the Swedish Association of Local Authorities and Regions website about Quality Registers.

If you wish to discuss a research project, we recommend contacting the register management. The register management is open to ideas, proposals, and discussions about collaborations in new register studies. The registry's databases are also well-suited for scientific work during specialist training (ST), medical program theses, and master's projects.

Register Research Internships

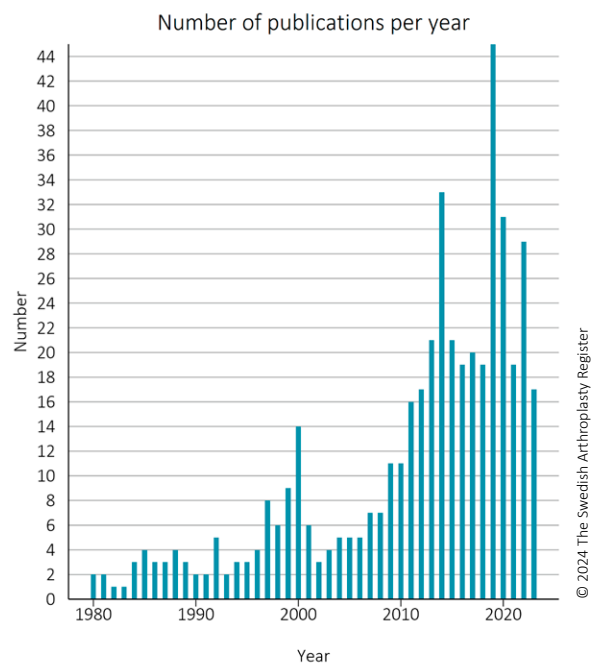
Since 2012, we have held annual retreats for register research. PhD candidates, supervisors, and other researchers working with register studies on musculoskeletal diseases and injuries have participated. Both general and specific research questions are discussed in workshop format. After a brief hiatus due to the pandemic, we resumed a productive two-day meeting in January 2023.

Many Researchers Contribute to the Register's Activity

Within the register management and steering group, there are senior researchers who supervise PhD candidates associated with the register. In addition, steering group members and other researchers collaborate with register staff to conduct research in the field. Ongoing studies involve various implants and fixation types, epidemiology, health economics, equitable healthcare, hip fractures and joint replacement, periprosthetic fractures, revision surgery, statistical methodology, infections, and patient-reported outcomes after joint replacement surgery.

International Research Collaborations

The register has an intensive research collaboration within the NARA (Nordic Arthroplasty Register Association), a registry collaboration between Finland, Norway, Denmark, and Sweden, which has created a common database since 2007. The group has now published around 50 scientific articles, and additional manuscripts are in progress. NARA data is also available to Swedish PhD candidates. Through the International Society of Arthroplasty Registries (ISAR), research collaboration exists with about ten other arthroplasty registers worldwide. The international collaboration is described in more detail in a separate section of the annual report.



Production of scientific publications containing data from the Swedish Arthroplasty Register from its start.

ABOGRAFT – Bone grafts treated with antibiotics to reduce the risk of infection in hip replacement surgery

Author: Jörg Schilcher, Linköping University

Why the ABOGRAFT study?

The ABOGRAFT study is a double-blind randomized clinical drug trial, with the primary goal of determining whether antibiotic-impregnated bone graft can reduce the risk of prosthetic joint infection (PJI) after total hip replacement (THR). PJI is the most severe complication following total hip replacement. As noted in this annual report, almost two-thirds of the revisions performed within two years of primary THR in Sweden are due to infection. The risk of infection is even higher in more complex procedures, such as revision surgeries or total hip replacement in cases of dysplasia or failed fracture treatment.

Antibiotic-loaded bone cement, along with perioperative intravenous antibiotic treatment, has been the standard in primary THR. An alternative carrier for local antibiotic treatment is morselized bone graft, which is used to fill bone defects. Antibiotic-impregnated bone graft offers better antibiotic release compared to cement, and it is both simple and cost-effective to add antibiotics to bone graft. The combination of vancomycin, which targets gram-positive bacteria, and tobramycin, which is effective against gram-negative bacteria, is considered effective for treating most bacterial infections in PJI. This regimen is associated with a low risk of osteotoxicity and systemic side effects due to minimal systemic absorption. Morselized

bone graft has been used as a carrier for local antibiotic treatment in several pilot studies and appears to be an attractive and effective treatment option for established infections. However, to date, no randomized clinical trial has supported its use for prophylactic purposes.

Research question and objectives

The aim of this research is to investigate whether antibiotics mixed into bone graft can reduce the risk of infection after hip replacement surgery. As a secondary objective, we will assess the risk of reoperation or revision and examine the resistance patterns in patients who develop PJI.

Method and patient group

This study is a Phase II, international, randomized, double-blind clinical trial with a total follow-up period of five years. The primary outcome measure is reoperation due to infection or clinical diagnosis of PJI after two years.

All patients scheduled for total hip replacement surgery who require bone grafting are eligible to participate, except for those with an ongoing infection.

Progress to date

We have included and operated more than 55 patients in the study out of a total of 850 required. In the spring of 2024, we began including patients at additional study sites. More hospitals will join our consortium in 2024 and 2025, with funding provided by an initial grant from the Swedish Research Council.

Interested in including patients?

Contact us at jorg.schilcher@liu.se or visit our website for more information: www.abograft.se.



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International work

Author: Ola Rolfson

A key platform for our international work is the NARA collaboration (Nordic Arthroplasty Register Association). Since 2007, we have regularly combined anonymized hip and knee replacement data from Denmark, Norway, Sweden, and Finland for unique studies. This collaboration has resulted in over 50 scientific publications that have significantly contributed to advancing the evidence base in joint replacement surgery. It has also led to the harmonization of research methods and the way register data are analyzed and presented. The collaboration has gained renewed momentum post-pandemic under the leadership of Professor Nils Hailer, who is also a member of the Swedish Arthroplasty Register steering group.

Another important international platform is the International Society of Arthroplasty Registries (ISAR), where we are actively involved in the organization's management and working groups. The ISAR collaboration has led to several projects combining data from multiple registers, and we continued to participate actively in ISAR's working groups throughout 2023.

We have also contributed to the OECD's working group for "Patient-Reported Indicator Surveys (PaRIS) on Hip and Knee Replacement Surgery." The first report was published in 2019, the second in 2022, and we have provided data for the upcoming OECD report.

An additional example of our international efforts is the collaboration with Australia and Kaiser Permanente in the USA. In September 2022, Peter defended his PhD-work that studied revision rates after total knee replacement using information from joint replacement registers in these three countries (Knee replacement revision – An international comparison), lucris.lub.lu.se/ws/portalfiles/portal/122386605/Knee_replacement_revision_dissertation.pdf).

Moreover, a collaboration between 14 international joint replacement registers has resulted in two published articles on the use of bone cement with or without antibiotics in knee replacement surgery and the risk of infection-related revisions: (Leta TH et al. The use of antibiotic-loaded bone cement and systemic antibiotic prophylactic use in 2,971,357 primary total knee arthroplasties from 2010 to 2020: an international register-based observational study

among countries in Africa, Europe, North America, and Oceania. *Acta Orthop*. 2023 Aug 9;94:416-425 och Leta TH et al. Periprosthetic Joint Infection After Total Knee Arthroplasty With or Without Antibiotic Bone Cement. *JAMA Netw Open*. 2024 May 1;7(5):e2412898. doi: 10.1001/jamanetworkopen.2024.12898).

Since 2021, we have also been part of the EU-funded Horizon 2020 project CORE-MD (Coordinating Research and Evidence for Medical Devices). The project aims to enhance knowledge on methods for testing and evaluating implants. The project has been highly relevant, given the challenges manufacturers and regulatory authorities face in implementing the new EU Medical Device Regulation (MDR). The three-year project has recently concluded, and a follow-up project is in development.

The Swedish Arthroplasty Register has been represented at several international meetings in 2023, organized by groups such as the European Federation of National Associations of Orthopaedics and Traumatology, the Osteoarthritis Research Society International, International Society of Arthroplasty Registries, and the Nordic Orthopaedic Federation. At these meetings, research findings from the Swedish Arthroplasty Register were presented.

In addition, that such collaboration projects lead to interesting results, they contribute to the various actors receiving information about each other's methods for registration, selection, analyses and reporting. In turn, this also hopefully means that the registries are approaching each other so that in the future it will become easier to compare the individual countries' results in scientific articles and reports.

We believe that the growing international cooperation in recent years has had a positive impact both on research, activities and not least for patients.

Publications 2021–2024

Here is a list of scientific articles that have fully or partially utilized data from the Swedish Arthroplasty Register or its predecessors from January 1, 2021, to May 8, 2024. For the complete publication list, please refer to the Swedish Arthroplasty Register's website.

2024 (until 8 May)

Rahmanian S, Aggerød C, Gustafson P, Heijbel S, W-Dahl A, Hedström M. Regional skillnad i incidensen av skador efter ledprotesoperation [Considerable regional differences in patient injuries after primary hip and knee arthroplasty and between orthopedic departments depending on surgical volume]. *Lakartidningen*. 2024 May 8;121:23140. Swedish.

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2023

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Ferid K, Slavko M, Svemir C, Mirsad F, Sahmir S, Johan K. Influence of immigrant background on the outcome of total hip arthroplasty: better outcome in 280 native patients in Bosnia and Herzegovina than in 449 immigrants living in Sweden. *Hip Int*. 2023 Oct 5;11207000231182321.

Persson A, Sköldenberg O, Mohaddes M, Eisler T, Gordon M. Increased mortality after total hip prosthetic joint infection is mainly caused by the comorbidities rather than the infection itself. *Acta Orthop*. 2023 Sep 26;94:484-489.

Schaufelberger M, Rolfson O, Kärrholm J. Outcome of patients with osteoarthritis aged 90 to 101 years after cemented total hip arthroplasty: 1,385 patients from the Swedish Arthroplasty Register. *Acta Orthop*. 2023 Sep 22;94:477-483.

Gustafsson K, Kvist J, Eriksson M, Rolfson O. What Factors Identified in Initial Osteoarthritis Management Are Associated With Poor Patient-reported Outcomes After THA? A Register-based Study. *Clin Orthop Relat Res*. 2023 Sep 1;481(9):1732-1742.

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Dissertations 2023

The following theses with data from the Swedish Arthroplasty Register or its predecessors were defended in 2023.

For a complete list of dissertations, please refer to the Register's website.

- On femoral neck fractures in the elderly. Johan Lagergren, 2023-11-24.
- Hip and Knee Osteoarthritis: Who Are the Patients Referred to First-Line Intervention and What Happens to Them? Kristin Gustafsson, 2023-09-22.
- Total knee Arthroplasty and Bariatric Surgery – Patients, Outcome and Surgeons. Perna Ighani Arani, 2023-06-02.

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