Annual report 2022

The Swedish Arthroplasty Register

SWEDISH
ARTHROPLASTY REGISTER

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Content

Glossary

Adverse event	An unexpected negative event, in this case, as a consequence of joint replacement surgery, for example an infection.
Ahlbäck classification	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 grater the degee 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/m²).
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.
Custom made instruments	Instruments or saw blocks specially made for the patient based on MRI or CT.
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.
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 administrating 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.

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 consept 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.
Local infiltration analgesia (LIA)	A multimodal concept for postoperative local pain relief.
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.
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 occation.
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.
PPFF	Periprosthetic femoral fracture.
Posterior stabilized knee replacement (PS)	A type of stabilizing knee prostesis that requires resection of the posterior cruciate ligament.
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.
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.

SD	Standard deviation.
Sequelae	Impairment after disease, injury or trauma.
SHAR	Swedish Hip Arthroplasty Register
SKAR	Swedish Knee Arthroplasty Register
SALAR (SKR)	Swedish Association of Local Authorities and Regions.
SOASP	Supported OsteoArthritis Self-management Programme. A structured way of conveying fist-line treatment for osteoarthritis, which means information and exercise.
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.
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.
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 occations.
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.

The merger is complete.

1. Introduction

Welcome to the Swedish Arthroplasty Register's annual report 2022, the second annual report of the register. 2021 was an eventful year. The 1st of September 2021, after several years of work and preparation, we were able to open the registration in the Swedish Arthroplasty Register. The new system has of course had its childhood problems but overall, it has worked well. All units performing hip and knee replacement surgery in Sweden, now register their operations in the Swedish Arthroplasty Register.

No printed edition of the annual report

This year's report will not be printed. This because the registry's allocation from the Swedish Association of Local Authorities and Regions for 2022 was halved as compared to the previous year. In order to economize the allocation, the register's steering group decided not to print the annual report. Some will say it was about time while others will miss the printed edition.

Uniform presentation of hip and knee data

In this year's report, we have continued the work to present data of hip and knee replacement surgery, as far as possible, in uniform manner. In several chapters hip and knee data are presented together. To view and evaluate hip and knee data together, we believe, gives a better understanding of hip and knee replacement surgery in Sweden.

This year's production

The Swedish Arthroplasty Register's annual report 2022 includes data of operations performed until 31st of December 2021. In 2021, 17,390 total hip replacements and 4,456 hemiarthroplasties from 82 active units performing hip replacement surgery, 12,624 knee replacements from 76 active units performing knee replacement surgery and 92 knee osteotomies from 18 active units were registered. In addition, 1,863 reoperations were registered after total hip replacements, 266 reoperations after hemiarthroplasties and 1,050 reoperations after knee replacements. The total number of registered primary hip and knee replacements is 838,329 divided in 327,352 knee replacements from 1975 until 2021, and 510,977 hip replacements (total and hemi) from 1979 until 2021. The corresponding numbers of reoperations was 123,237 of which 92,966 were reoperations of hip replacements and 30,271 of knee replacements (figures 1.1–1.6).

Effects of the pandemic

The pandemic led to drastic reduction of elective hip and knee replacements. In 2021, the pandemic continued to influence the elective replacement surgery. The production loss in 2021 was however not as large as compared to 2020. The production increased by 16% for hip replacements and 7% for knee replacements between these years. In absolute numbers, 16,095 fewer primary hip and knee replacement surgeries have been performed in 2020 and 2021 given that the same number of replacements as in 2019 had been performed. The number of reoperations after hip and knee replacements has decreased by 14% and 17% respectively in 2021 compared with 2019. The number of hemiarthroplasties, performed due to acute hip fracture, was at the same level as in 2019.

Completeness and adverse events

We are pleased to report that we have already received the completeness analysis for 2021 from the National Board of Health and Welfare. Normally, the National Board of Health and Welfare is not able to complete the data in

the National Patient Register (NPR) in order to deliver a completeness analysis in time for the annual report. Therefore, completeness analysis for both 2020 and 2021 are presented in this year's report. The completeness is still estimated to about 98% in both primary hip and knee replacements while the revisions are estimated to somewhat lower completeness with 94% of hip revisions and 85% of knee revisions. Considering revisions, we would really like to get better. Unfortunately, the National Board of Health and Welfare has not been able to deliver data on adverse events. Although that all data the National Board of Health and Welfare delivers to the register is aggregated, i.e. not on an individual level, they will not deliver data if there has been single or few events per unit. We have an ongoing dialogue with the National Board of Health and Welfare on how we in the best possible way will be able to continue to present adverse events.

Continued high research production

Despite another pandemic year and intense work with the merger, research with data from the register has been very high. In 2021, 19 scientific papers were published and five PhD students defended their theses, whose thesis works was wholly or in part based on data from what now is the Swedish Arthroplasty Register. Delightfully, we have research collaborations with all medical faculties in Sweden and many international research collaborations.

Contact surgeons' meeting together with the Swedish Hip and Knee Association

In two consecutive years the contact surgeons' meeting has been digital. This year, we plan to arrange a two days meeting, 10–11 November, together with the Swedish Hip and Knee Association where the contact surgeons' meeting is woven into the programme and of course, we are hoping for a large attendance in Stockholm.

Thanks to contact secretaries and contact surgeons

A prerequisite for the register to function is that the units register and provides the required information. We appreciate all the engagement and work that contact secretaries and contact surgeons around the country put in – in the end of the report you will find a list of all the contact secretaries and contact surgeons. We look forward to a continued good cooperation. Many thanks for all contributions in the past year!

August 2022, Register Management

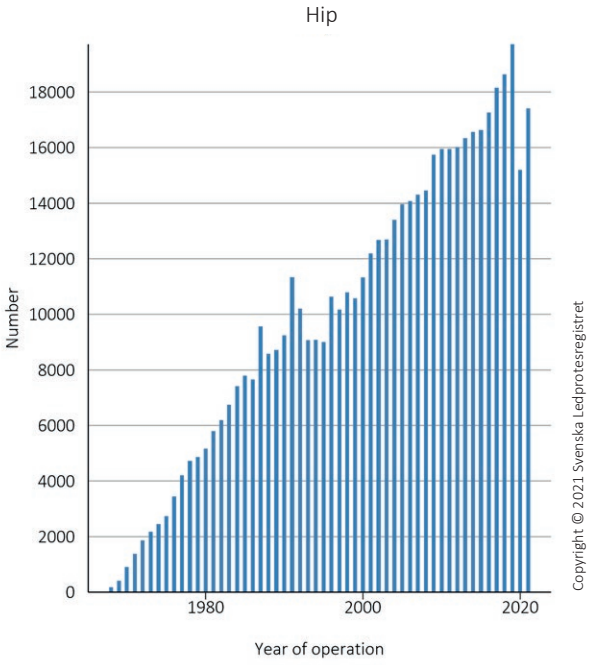

Figure 1.1. Primary total hip replacement surgery, 1968–2021.

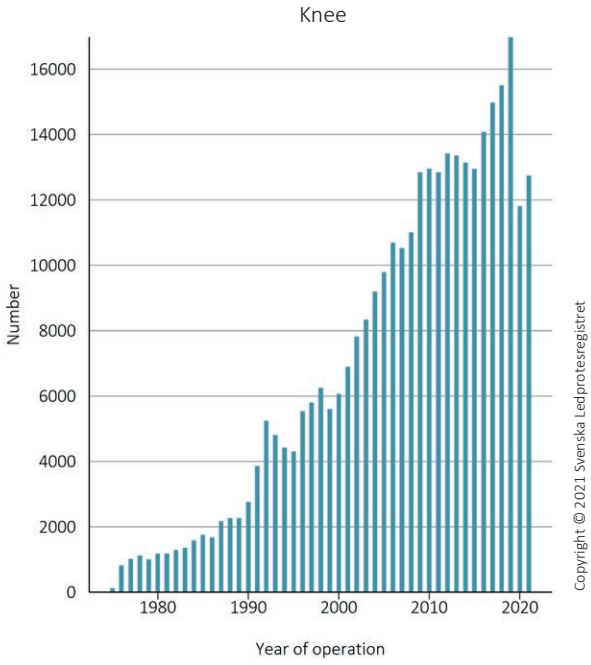

Figure 1.2. Primary knee replacement surgery, 1975–2021.

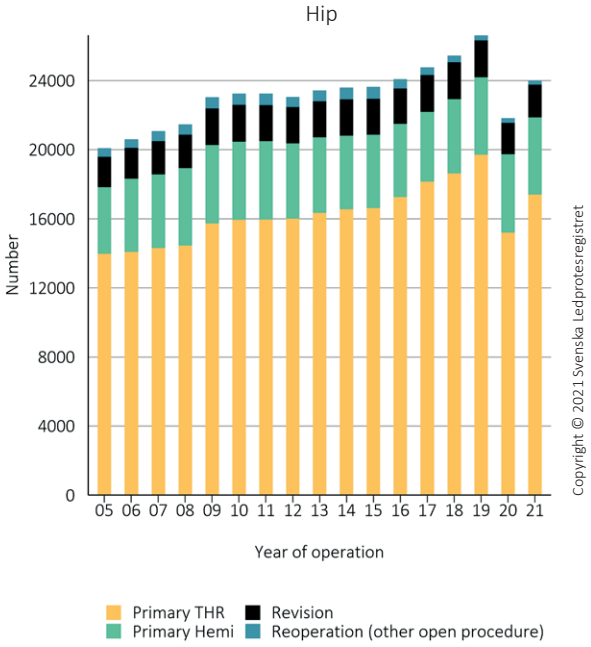

Figure 1.3. All hip replacements 2005–2021.

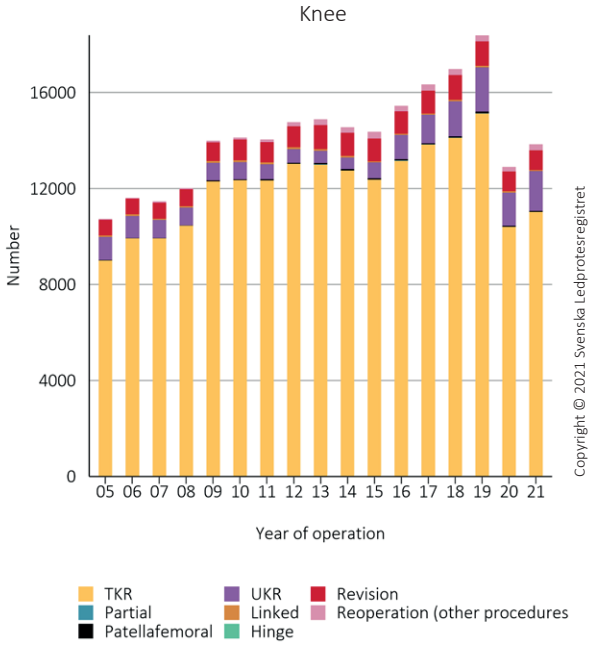

Figure 1.4. All knee replacements 2005–2022.

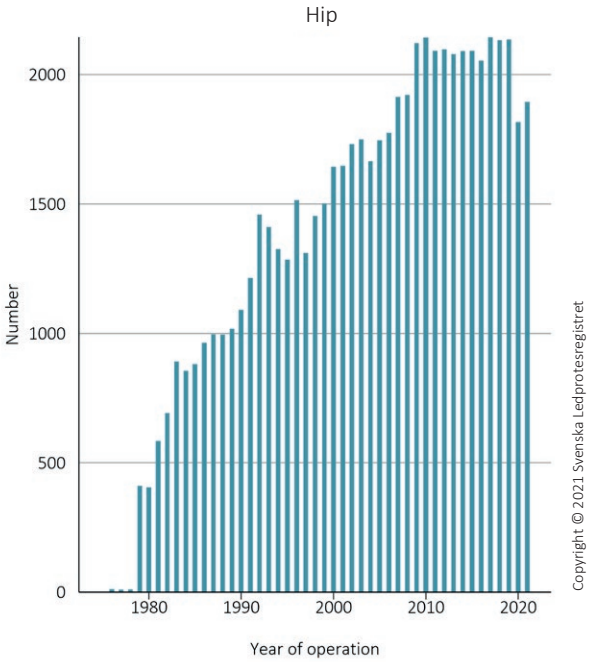

Figure 1.5. All hip revisions 1976–2021.

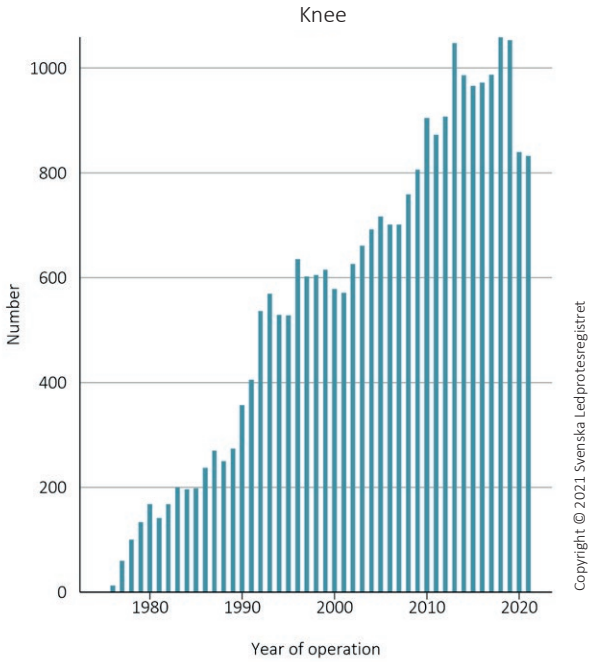

Figure 1.6. All knee revision 1975–2021.

High completeness is important for the use of data in development activities, improvement work and research.

2. Data quality

Completeness analysis

Authors: Annette W-Dahl and Ola Rolfson

An important part of the validity work is the yearly completeness analysis made in cooperation with the National Patient Register (NPR) of the National Board of Health and Welfare. By comparing the number of admissions and by assuming that the true number of admissions are the combined number in both registries the completeness can be estimated. The method is explained in table 2.1. The analysis comprises all primary operations, divided into total hip replacements, hemi arthroplasties, knee replacements, and hip and knee revisions. The NPR contains Swedish personal identity numbers and temporary identity numbers while the Swedish Arthroplasty Register only contains personal identity numbers. Previously, there has been a delay from the NPR before operations performed previous year is completed, however this year it is ready and the completeness analysis for operations performed 2020 and 2021 can be published.

That data entered in quality registries and health data registries is correct is a prerequisite prerequisite in order to be able to reassure that the results and analyses to have a high quality and reliability and enable better and fairer follow-up. Of the operations, registered in the Swedish Arthroplasty Register, we can very likely say that they are hip or knee replacements. We also know which intervention that has been reported since the registration among other things is based information from the stickers of the components in both primary operations and revisions. Furthermore, medical records regarding reoperations are sent to the register for review. However, units may fail to register operations both in the Swedish Arthroplasty Register and in the NPR, and some registrations in the NPR can be operations on individuals with temporary identity number that the Swedish Arthroplasty Register do not register. One example of a source of error that has been observed is when surgical codes for revision are reported to the NPR when in fact it was not a revision but another reoperation. In those cases, the operation appears as a revision in the NPR but not in the Swedish Arthroplasty Register.

In order to investigate trends in the reporting frequency, we present numbers for the last eleven years (2011–2021). The completeness rate for total hip replacements has in this period been between 97 and 99% and in 2020 and 2021 it was 98.4% and 98.1% respectively (figure 2.1 a). For hemiarthroplasties the completeness rate was 97.6% in 2020 and 97.9% in 2021, the highest so far, and the reporting frequency in the eleven-year period has been between 94 and 98%. For knee replacements the completeness rate was 97.6 and 96.1% respectively in 2020 and 2021 and the reporting frequency in the eleven-year period has been between 96 and 98% (figure 2.1 b).

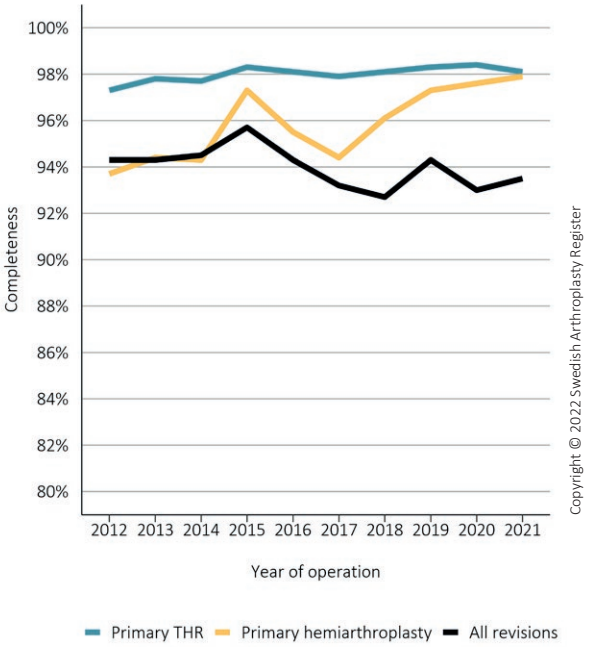

Figure 2.1a. Completeness for hip replacement 2011–2021.

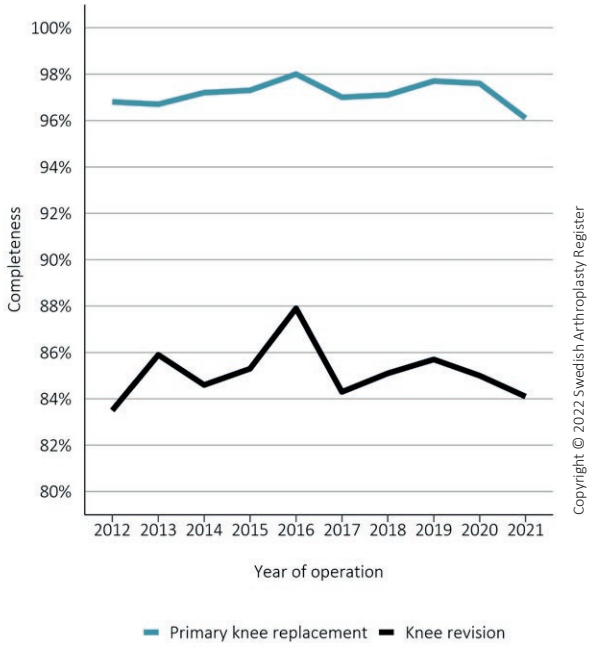

Figure 2.1b. Completeness for knee replacement 2011–2021.

The completeness for hip and knee revisions is presented with operations defined as revisions, removal, change or addition of any component. Codes for classification of care measures (abbreviated KVÅ in Swedish which is based on the Nordic Medico-Statistical Committee classification NOMESCO) for revision surgery is presented in table 2.1. The completeness rate for hip revisions has been presented for a couple of years and since last year for knee revisions. From 2011 to 2021 the completeness for hip revisions has been between 93% and 96%, in 2020 it was 93% and in 2021 it was 93.5% (figure 2.1 a). For knee revisions the completeness rate in the period have varied between 82% and 8% and was 85% in 2020 and 84.1% in 2021 (figure 2.1 b). In the completeness analyses for 2020 and 2021 we have tried to compensate for the source of error that reoperations (other procedures than revisions) are registered as revisions in the NPR. It has however been noted that units which carry out few or no revisions have sometimes reported a substantial number of revisions to the NPR. We will take a closer look at this to be able to get a more reliable validation against the NPR in the future.

Completeness analysis per unit

Completeness is presented for primary total hip replacement (table 2.2), hemiarthroplasty (table 2.3), knee replacement (table 2.4), hip revision (table 2.5), and knee revision (table 2.6) per unit. Observe that the percentages for units with few operations may be misleading. Operations where the unit is not clear from the information from the National Board of Health and Welfare or as being performed at a specific hospital but by an administrative body containing several hospitals are reported aggregated as "other units". There are units not reporting to the NPR but report to the Swedish Arthroplasty Register which means that a completeness analysis for these units is not possible. If the completeness is below 96% it is marked in red. For units with low completeness, we encourage local investigations to identify missing operations, and if the coding routines for surgical procedures is correct, provided that revision codes only are used for revisions and not for reoperations that not include removal, change or addition of any component.

Response rate of PROM-questionnaires

The PROMs programs for hip and knee replacements differ. PROMs for hip replacements are followed up for the individual while operations are followed up in knee replacements (see chapter 8). In hip replacements, individuals having a reoperation or having a replacement in the other hip in the year of follow-up are excluded while knee replacements are followed up one year postopera-

tively with or without reoperation in the year of follow-up. At the merger to the Swedish Arthroplasty Register the PROM-questionnaires for hip and knee replacements were harmonised. This implies that PROM-questionnaires for operations carried out in 2020 and in 2021 have been out of step, especially for knee replacements where most of the changes have been done (see chapter 8). The questionnaire for knee replacements earlier consisted of 60 questions and now 24 questions while the questionnaire for individuals having a hip replacement consisted of 12 questions and now consists of 25 questions. Satisfaction with the operation, is added to the postoperative questionnaires for both hip and knee. Hip replacements have been followed nationally since 2008 and knee replacements have been followed in units that wanted and had the ability to collect PROMs since 2009 (approximately 50% of the knee replacements in 2020). In this year's report the response rate for the last four years is presented (table 2.7), and shows that the response rate has varied between years and is lower in 2020 than previous years for both hip and knee. Reasons for the reduction may be that the handling of PROM has been affected by both the merger of the registries and the pandemic and there is room for improvement going forward.

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 2020 and 2021

	2020			2021		
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Country	**15,396**	**98.4**	**94.7**	**17,678**	**98.1**	**92.1**
Akademiska sjukhuset	177	96.6	98.3	222	98.6	100
Aleris specialistvård Elisabethsjukhuset	0			43	**0**	100
Aleris specialistvård Nacka	305	99.7	**91.5**	397	99	**92.4**
Aleris specialistvård Ängelholm	463	99.8	**94.2**	582	97.6	**90.7**
Alingsås and Kungälv	232	99.1	97	208	99.5	96.2
Art Clinic Göteborg	213	100	99.1	322	98.4	99.4
Art Clinic Jönköping	172	100	98.3	299	99.3	97
Arvika	136	**95.6**	**95.6**	290	98.3	97.6
Bollnäs	247	98.4	**95.1**	366	99.2	**93.4**
Borås and Skene	196	98.5	97.4	210	99	96.7
Capio Artro Clinic and Sophiahemmet	733	99.7	**65.2**	900	99.8	**64**
Capio Movement Halmstad	433	99.1	98.6	479	99.8	**84.8**
Capio Ortopedi Motala	299	99	100	357	99.7	100
Capio Ortopediska Huset	610	99.3	99.7	775	99.4	98.3
Capio S:t Göran	373	99.2	98.7	405	97.5	99.5
Carlanderska sjukhuset	502	99.4	98.8	577	96.5	97.6
Danderyd	195	93.3	97.9	204	96.6	97.5
Eksjö	179	97.8	98.3	274	97.8	98.5
Enköping	405	100	99.5	463	99.6	99.6
Eskilstuna	101	100	100	108	98.1	99.1
Falu lasarett	76	100	100	124	100	100
Frölundaortopeden	10		**0**	17		**0**
GHP Ortho Center Göteborg	295	99	**37.6**	318		**0**
GHP Ortho Center Stockholm	741	99.3	**92.8**	822	99.4	**80.7**
Gällivare	92	100	100	66	100	100
Gävle	186	98.4	**90.3**	140	96.4	**82.9**
Halmstad and Varberg	381	99	99.2	363	98.1	98.3
Helsingborg	78	98.7	97.4	88	100	97.7
Hermelinen	22		**0**	30		**0**
Hudiksvall	67	100	**86.6**	75	**92**	**94.7**
Hässleholm	616	100	99.5	648	99.8	99.8
Jönköping	95	**94.7**	96.8	89	96.6	97.8
Kalmar	90	98.9	100	76	100	97.4
Karlshamn and Karlskrona	258	98.8	98.8	222	99.1	98.6
Karlstad	103	100	99	97	93.8	97.9
Karolinska Huddinge	184	97.3	97.8	236	98.3	96.2

The table continues on the next page.

Completeness for primary hip replacement 2020 and 2021, cont.

	2020			2021	
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Karolinska Solna	68	**66.2**	**95.6**	77	**61**	100
Kristianstad	18	100	**88.9**	18	88.9	**94.4**
Kullbergska sjukhuset	220	100	100	315	100	99.4
Lidköping and Skövde	312	97.8	99.4	229	96.9	96.1
Linköping	97	93.8	96.9	119	**95.8**	96.6
Ljungby	116	98.3	98.3	129	99.2	**93**
Lycksele	329	**89.4**	**89.7**	257	**92.6**	**89.9**
Mora	241	97.9	98.3	232	99.1	98.7
Norrköping	174	100	100	179	98.3	99.4
Norrtälje	117	99.1	99.1	146	98.6	100
Nyköping	127	99.2	99.2	144	98.6	98.6
Oskarshamn	285	99.6	100	305	100	99.7
Piteå	327	99.7	100	357	99.4	100
Sollefteå	204	99.5	98.5	384	99.2	99.2
Skellefteå	124	**94.4**	98.4	112	100	100
Specialistcenter Scandinavia Eskilstuna	10		**0**	99		0
SU/Mölndal	371	**93**	96	384	97.9	97.1
Sunderby sjukhus	71	100	100	63	96.8	100
Sundsvall	33	**93.9**	97	34	**91.2**	**85.3**
SUS/Lund	104	98.1	**92.3**	92	98.9	**95.7**
SUS/Malmö	26	96.2	**92.3**	15	100	**93.3**
Södersjukhuset	183	98.9	97.8	173	96	97.1
Södertälje	176	98.9	99.4	168	100	99.4
Torsby	80	100	97.5	177	99.4	99.4
Trelleborg	297	100	99.3	386	99.5	99.2
Uddevalla NÄL	259	100	98.8	301	99.7	98.7
Umeå	69	98.6	**95.7**	72	95.8	97.2
Visby	141	**93.6**	96.5	157	**94.3**	**94.3**
Värnamo	117	96.6	99.1	196	98	98.5
Västervik	103	100	100	167	98.2	98.8
Västerås	405	97.8	99	427	97.9	98.4
Växjö	151	98.7	99.3	131	93.1	97.7
Ystad	14	**92.9**	**92.9**			
Örebro, Lindesbergs lasarett and Karlskoga	433	99.8	100	509	99.6	99.8
Örnsköldsvik	109	100	100	102	99	99
Östersunds	220	97.3	98.2	127	**93.7**	**94.5**
Other units	0			3	**66.7**	100

Table 2.2. The completeness for primary total hip replacement per unit 2020 and 2021.

Completeness for primary hemiarthroplasty hip 2020 and 2021

	2020			2021		
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Country	**4,641**	**97.6**	**95.6**	**4,561**	**97.9**	**94.1**
Akademiska	151	98.7	98.7	152	100	98
Alingsås and Kungälv	97	96.9	**94.8**	101	99	**93.1**
Borås and Skene	114	100	97.4	76	100	97.4
Capio S:t Göran	140	97.9	97.9	148	99.3	**93.9**
Danderyd	234	97.9	97	216	97.2	97.7
Eksjö	43	97.7	97.7	36	100	100
Eskilstuna	60	100	98.3	74	100	97.3
Falun	100	98	99	113	100	99.1
Gällivare	25	100	100	35	100	**94.3**
Gävle	84	100	**81**	99	99	**73.7**
Halmstad and Varberg	198	98.5	98.5	191	97.4	96.3
Helsingborg	159	98.1	98.1	181	97.8	96.7
Hudiksvall	84	100	**79.8**	56	100	**87.5**
Jönköping	58	98.3	98.3	49	98	**93.9**
Kalmar	87	97.7	96.6	75	98.7	96
Karlshamn and Kalskrona	109	99.1	**95.4**	132	98.5	**92.4**
Karlstad	133	100	97	139	100	**92.1**
Karolinska Huddinge	106	**92.5**	**92.5**	100	98	**93**
Karolinska Solna	33	**69.7**	**72.7**	20	65	**90**
Kristianstad	127	100	97.6	127	99.2	**93.7**
Lidköping and Skövde	107	98.1	**92.5**	102	97.1	**92.2**
Linköping	148	98.6	**93.2**	161	99.4	**94.4**
Ljungby	25	100	100	21	100	**95.2**
Lycksele	27	100	**55.6**	19	100	**94.7**

The table continues on the next page.

Completeness for primary hemiarthroplasty hip 2020 and 2021, cont.

	2020			2021	
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Mora	63	**92.1**	**90.5**	47	**85.1**	**87.2**
Norrköping	69	**95.7**	98.6	70	**91.4**	97.1
Norrtälje	33	100	100	32	96.9	**93.8**
Nyköping	37	100	97.3	39	100	**94.9**
Skellefteå	46	100	**93.5**	53	100	98.1
SU/Mölndal	271	98.2	98.2	249	98.8	**92.4**
Sunderby sjukhus	104	100	100	107	99.1	97.2
Sundsvall	95	**95.8**	**95.8**	94	98.9	**94.7**
SUS/Lund	171	98.2	**91.8**	136	97.8	**92.6**
SUS/Malmö	231	**94.4**	**95.7**	225	96	**90.7**
Södersjukhuset	243	98.4	97.9	237	98.3	98.3
Torsby	23	100	100	17	100	88.2
Uddevalla NÄL	186	98.4	99.5	207	99	96.1
Umeå	79	100	100	72	100	**94.4**
Visby	31	**80.6**	**80.6**	50	**76**	**74**
Värnamo	43	**95.3**	**95.3**	31	96.8	93.5
Västervik	43	100	100	57	100	98.2
Västerås	22	100	**77.3**	19	**94.7**	**78.9**
Växjö	49	**95.9**	98	72	**95.8**	**87.5**
Ystad	92	97.8	97.8	83	100	96.4
Örebro, Lindesberg and Karlskoga	125	96.8	98.4	127	99.2	95.3
Örnsköldsvik	69	97.1	97.1	51	100	100
Östersund	58	98.3	**89.7**	52	98.1	**94.2**
Other units	9	**66.7**	**77.8**	11	**45.5**	100

Table 2.3. The completeness for primary hemiarthroplasty hip per unit 2020 and 2021.

Completeness for primary knee replacement 2020 and 2021

	2020			2021	
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Country	**11,929**	**97.6**	**94.3**	**13,030**	**96.1**	**91.5**
Akademiska	54	**94.4**	98.1	44	**88.6**	100
Aleris specialistvård Nacka	160	98.8	**95**	307	97.1	**93.8**
Aleris Specialistvård Ängelholm and Helsingborg	557	98.7	**95.2**	626	98.2	**92.8**
Art Clinic Göteborg	203	**90.6**	97.5	315	**90.8**	98.4
Art Clinic Jönköping	210	98.6	**94.8**	214	98.1	98.1
Alingsås and Kungälv	227	97.8	98.2	156	98.1	96.8
Arvika	125	100	97.6	230	98.7	98.7
Bollnäs	253	98.4	**95.7**	351	96.9	**92.6**
Borås–Skene	157	**93.6**	98.7	127	96.1	98.4
Capio Artro Clinic and Ortopediskt Center Sophiahemmet	711	99.7	**67.2**	853	99.4	**68.1**
Capio Movement	496	98	98.2	519	98.7	**80.2**
Capio Ortopedi Motala	355	99.2	99.7	480	98.3	99
Capio Ortopediska Huset	578	98.8	99.1	727	97.9	98.9
Capio S:t Göran	258	96.5	98.1	181	**95.6**	98.3
Carlanderska and SportsMed	486	**93.8**	97.5	628	**76.1**	98.6
Danderyd	131	**90.8**	96.9	75	**77.3**	**94.7**
Eksjö	239	99.2	99.2	278	99.6	99.6
Enköping	337	99.7	99.4	409	98.5	99
Eskilstuna	48	**89.6**	100	31	100	100
Falun	55	100	100	91	98.9	97.8
Frölundaortopeden	16	100	**6.3**	26	100	**3.8**
GHP Ortho Center Göteborg	284	99.3	**33.1**	281	100	**0.7**
GHP Ortho Center Stockholm	643	99.2	**93.2**	695	99	**88.1**
Gällivare	65	96.9	100	38	100	100
Gävle	78	**94.9**	**93.6**	45	**88.9**	97.8
Halmstad and Varberg	301	99	99.7	253	**94.5**	97.2
Hermelinen	19		**0**	32		**0**
Hudiksvall	43	100	100	64	96.9	**92.2**
Hässleholm	572	99.5	99.8	685	98.8	99.1
Kalmar	57	96.5	98.2	37	**91.9**	**94.6**
Karlshamn	179	96.6	98.9	190	97.4	98.4
Karlstad	22	**95.5**	100	29	**82.8**	**86.2**
Karolinska Huddinge	124	**91.1**	100	118	**93.2**	97.5

The table continues on the next page.

Completeness for primary knee replacement 2020 and 2021, cont.

	2020			2021	
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Karolinska Solna	37	**56.8**	**94.6**	29	**51.7**	100
Kullbergska sjukhuset	236	99.2	98.7	270	99.6	99.3
Lidköping and Skövde	165	98.2	98.8	35	**94.3**	**91.4**
Lindesberg	273	99.6	99.6	270	100	99.6
Ljungby	76	98.7	97.4	112	96.4	**94.6**
Lycksele	162	**88.9**	**94.4**	210	**93.8**	**93.3**
Mora	175	96	98.3	172	98.3	98.8
Norrköping	79	100	100	83	100	100
Norrtälje	138	96.4	99.3	110	97.3	100
Nyköping	78	96.2	97.4	72	98.6	97.2
Oskarshamn	255	99.2	99.2	204	99.5	100
Piteå	252	100	100	272	100	99.6
Skellefteå	68	100	97.1	45	100	100
Sollefteå	118	97.5	98.3	140	98.6	97.1
Specialistcenter Scandinavia Eskilstuna				69		**0**
Specialistcenter Scandinavia Johanniskliniken				56	**21.4**	100
SU/Mölndal	160	**93.8**	98.1	104	**94.2**	100
Sundsvall	14	100	**92.9**	8	**87.5**	**87.5**
SUS/Lund	40	100	100	16	**75**	**93.8**
Södersjukhuset	86	96.5	98.8	34	100	97.1
Södertälje	79	98.7	98.7	82	**93.9**	**93.9**
Torsby	93	97.8	97.8	169	**95.9**	**95.9**
Trelleborg	349	99.4	99.7	364	98.9	98.6
Uddevalla	159	96.2	98.7	139	98.6	99.3
Umeå	129	99.2	**95.3**	48	97.9	**95.8**
Visby	69	**92.8**	**95.7**	126	**91.3**	**94.4**
Värnamo	138	97.8	98.6	192	96.9	99.5
Västervik	75	98.7	100	113	97.3	98.2
Växjö	63	**95.2**	98.4	55	98.2	98.2
Västerås	121	97.5	100	172	98.8	99.4
Örnsköldsvik	89	98.9	100	74	**95.9**	98.6
Östersund	105	**88.6**	99	42	**92.9**	97.6
Other units	4	**80**	**80**	8	**0**	100

Table 2.4. The completeness for primary knee replacement per unit 2020 and 2021.

Completeness for hip revisions 2020 and 2021

	2020			2021		
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Country	**2,300**	**93**	**77.9**	**2,317**	**93.5**	**79.4**
Akademiska	126	98.4	**92.1**	119	97.5	**83.2**
Aleris Specialistvård Ängelholm	7	**71.4**	**85.7**			
Alingsås and Kungälv	18	**94.4**	**77.8**	23	**87**	**69.6**
Bollnäs				6	100	**66.7**
Borås and Skene	50	100	**80**	34	**94.1**	**79.4**
Capio Ortopedi Motala	12	100	**66.7**	19	**94.7**	**68.4**
Capio S:t Görans	96	**94.8**	**61.5**	101	**81.2**	**81.2**
Danderyd	115	**92.2**	**86.1**	167	**95.2**	**87.4**
Eksjö	44	97.7	**45.5**	45	97.8	**57.8**
Eskilstuna	42	100	**73.8**	66	100	**72.7**
Falun	51	98	**58.8**	63	100	**71.4**
Gävle	58	96.6	**74.1**	58	98.3	**74.1**
GHP Ortho Center Stockholm				8	**87.5**	**37.5**
Halmstad and Varberg	60	**86.7**	**78.3**	73	**84.9**	**84.9**
Helsingborg	66	97	**87.9**	59	**94.9**	**76.3**
Hudiksvall	6	100	**83.3**			
Hässleholm	87	**94.3**	**88.5**	63	98.4	**88.9**
Jönköping	30	**86.7**	**73.3**	36	**91.7**	**83.3**
Kalmar	18	**88.9**	**72.2**	20	**95**	**80**
Karlshamn and Karlskrona	41	**95.1**	**87.8**	42	100	**92.9**
Karlstad	56	96.4	**75**	60	**91.7**	**71.7**
Karolinska Huddinge	102	97.1	**87.3**	114	99.1	**83.3**
Karolinska Solna	29	**75.9**	**86.2**	25	**60**	**92**
Kristianstad	15	**53.3**	**46.7**	13	**61.5**	**38.5**
Lidköping and Skövde	50	100	**76**	47	**95.7**	**83**

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Completeness for hip revisions 2020 and 2021, cont.

	2020			2021	
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Linköping	63	95.2	69.8	75	98.7	60
Ljungby	10	100	50	7	100	57.1
Mora	14	85.7	57.1			
Norrköping	35	91.4	80	11	100	81.8
Norrtälje	7	85.7	85.7	14	92.9	64.3
Nyköping	12	83.3	83.3	18	94.4	66.7
Piteå	25	92	96	29	96.6	100
Skellefteå	11	72.7	81.8	10	100	80
SU/Mölndal	202	93.6	73.8	177	98.3	78.5
Sundsvall	17	76.5	70.6	14	85.7	92.9
Sunderby sjukhus	24	54.2	95.8	26	26.9	100
SUS/Lund	104	95.2	94.2	123	94.3	87.8
Södersjukhuset	88	94.3	50	79	98.7	74.7
Trelleborg	7	100	100	8	87.5	100
Uddevalla	47	97.9	85.1	64	95.3	93.8
Umeå	81	95.1	88.9	54	92.6	88.9
Visby	19	63.2	57.9	19	68.4	73.7
Värnamo	12	75	41.7	14	85.7	42.9
Västervik	28	92.9	85.7	29	89.7	75.9
Växjö	44	100	59.1	46	91.3	63
Västerås	92	87	92.4	78	93.6	93.6
Ystad	7	85.7	71.4			
Örebro, Lindesbergs and Karlskoga	89	97.8	74.2	79	100	75.9
Östersunds sjukhus	49	91.8	81.6	44	97.7	79.5
Other units	34	79.4	73.5	38	86.8	47.4

Table 2.5. The completeness for hip revisions per unit 2020 and 2021.

Completeness for knee revisions 2020 and 2021

	2020			2021		
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Country	**987**	**85**	**85.1**	**979**	**84.1**	**86**
Akademiska sjukhuset	40	**92.5**	**95**	46	97.8	**95.7**
Alingsås and Kungälv	23	**91.3**	**73.9**	23	**95.7**	**82.6**
Bollnäs	9	100	**88.9**	17	100	**88.2**
Borås and Skene	25	**80**	**88**	24	**75**	**87.5**
Capio Artro Clinic and Ortopediskt Center Sophiahemmet	17	100	**5.9**	9	**88.9**	**22.2**
Capio Ortopedi Motala	48	**81.3**	**95.8**	47	**87.2**	**89.4**
Capio Ortopediska huset	13	**46.2**	**84.6**	13	**7.7**	**92.3**
Capio S:t Göran	44	**90.9**	**90.9**	41	**58.5**	**87.8**
Danderyd	25	**92**	**84**	22	**95.5**	**86.4**
Eksjö	25	**88**	**92**	29	**69**	**86.2**
Eskilstuna	24	**83.3**	**70.8**	24	**91.7**	**87.5**
Falun	24	**91.7**	**70.8**	23	**95.7**	**73.9**
GHP Ortho Center Stockholm	7	100	**85.7**	13	100	**61.5**
Gävle	16	100	**56.3**	17	100	**64.7**
Halmstad and Varberg	33	**84.8**	**87.9**	34	**94.1**	**82.4**
Helsingborg	7	**85.7**	**85.7**	18	100	**77.8**
Hudiksvall	7	100	100			
Hässleholm	74	**93.2**	**93.2**	82	**91.5**	**93.9**
Kalmar	6	**83.3**	**66.7**	8	100	100
Karlshamn and Karlskrona	9	**66.7**	100			
Karlstad				7	100	**71.4**
Karolinska Huddinge	31	**80.6**	**87.1**	26	**92.3**	**76.9**
Karolinska Solna	14	**64.3**	**71.4**	16	**56.3**	**87.5**
Kullbergska sjukhuset				8	**0**	100

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Completeness for knee revisions 2020 and 2021, cont.

	2020			2021	
	Total number	SAR %	NPR %	Total number	SAR %	NPR %
Lidköping and Skövde	27	100	100	15	**86.7**	**80**
Lindesberg	33	**93.9**	**81.8**	34	**79.4**	**85.3**
Ljungby				6	100	100
Lycksele	11	**9.1**	100	27	**0**	100
Mora	6	**83.3**	**50**			
Norrköping	11	**90.9**	**90.9**	11	100	**90.9**
Norrtälje	8	**50**	**87.5**	10	**70**	**90**
Nyköping				9	**88.9**	**88.9**
Oskarshamn	12	**75**	100			
Piteå	9	**88.9**	100	9	**88.9**	**88.9**
SU/Mölndal	47	**83**	**83**	58	**87.9**	96.6
Sunderby sjukhus	8	**87.5**	**62.5**			
Sundsvall	16	**87.5**	**81.3**	6	100	**66.7**
SUS/Lund	40	**90**	**90**	31	**93.5**	**80.6**
Södersjukhuset	31	**74.2**	**90.3**	19	**94.7**	**89.5**
Trelleborg	11	**81.8**	100	8	**87.5**	**87.5**
Uddevalla	12	100	**91.7**	16	**87.5**	**93.8**
Umeå	67	**62.7**	**95.5**	36	**83.3**	**91.7**
Visby	8	100	**75**	8	**87.5**	100
Värnamo	10	100	**50**	10	**80**	**80**
Västervik	7	100	**71.4**	8	100	**62.5**
Växjö				10	100	**60**
Västerås	22	100	**95.5**	47	**93.6**	**95.7**
Östersund	15	**86.7**	**93.3**	6	**83.3**	100
Other units	55	**87.2**	**70.9**	48	**87.5**	**66.7**

Table 2.6. The completeness for knee revisions per unit 2020 and 2021.

PROM, response rate

Surgical year	2017	2018	2019	2020
Avaliable data for all elective total hip replacements				
Total number of replacements	15,168	15,998	16,382	17,515
Diceased within one year (as first event), n	132	123	118	141
Reopererated within one year (as first event) , n	276	275	314	296
Included in the one-year follow-up, n	14,760	15,600	15,950	17,078
Preoperative response, n	12,512	13,033	13,561	14,116
Proportion of all, %	83	82	83	81
One-year postoperative response, n	12,825	13,252	13,113	13,576
Proportion of those included in the follow-up routine, %	87	85	82	80
Pre- and one-year postoperative response, n	10,673	10,826	10,898	11,010
Proportion of those included in the follow-up routine, %	72	69	68	65
Avaliable data for all elective total hip replacements – OA				
Total number of replacements	13,999	14,769	15,112	16,085
Diceased within one year (as first event), n	104	95	97	114
Reopererated within one year (as first event) , n	239	248	266	260
Included in the one-year follow-up, n	13,656	14,426	14,749	15,711
Preoperative response, n	11,680	12,154	12,656	13,111
Proportion of all, %	83	82	84	82
One-year postoperative response, n	11,947	12,321	12,197	12,579
Proportion of those included in the follow-up routine, %	88	85	83	80
Pre- and one-year postoperative response, n	10,029	10,133	10,228	10,278
Proportion of those included in the follow-up routine, %	73	70	69	65
Available data for all knee replacements				
Total number of replacements for units included in the PROM project	5,574	6,455	7,655	8,160
Diceased within one year (as first event), number	38	36	34	35
Included in the one-year follow-up, number	5,536	6,419	7,621	8,125
Preoperative response, number	4,650	5,234	6,290	7,263
Proportion of all, %	84	82	83	89
One-year postoperative response, n	4,382	4,936	5,857	6,849
Proportion of those included in the follow-up routine, %	79	77	77	84
Pre- and one-year postoperative response, n	3,907	4,258	5,109	6,120
Proportion of those included in the follow-up routine, %	71	66	67	75

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PROM, response rate, cont.

Surgical year	2017	2018	2019	2020
Available data for total knee replacements – OA				
Total number of replacements for units included in the PROM project	4,805	5,732	6,723	7,033
Diceased within one year (as first event), number	34	33	28	29
Included in the one year follow-up, n	4,771	5,699	6,695	7,004
Preoperative response, n	4,077	4,782	5,570	6,320
Proportion of all, %	85	84	83	90
One-year postoperative response, n	3,801	4,525	5,164	5,923
Proportion of those included in the follow-up routine, %	80	79	77	85
Preoperative and one year postoperative response, n	3,433	3,907	4,552	5,352
Proportion of those included in the follow-up routine, %	72	69	68	76
Available data in unicompartmental knee replacements – OA				
Total number of replacements for units included in the PROM project	467	482	635	849
Diceased within one year (as first event), number	1	0	1	2
Included in the one year follow-up, n	466	482	634	847
Preoperative response, n	382	396	510	712
Proportion of all, %	82	82	80	84
One-year postoperative response, n	360	353	490	701
Proportion of those included in the follow-up routine, %	77	73	77	83
Pre- and one-year postoperative response, n	315	302	406	582
Proportion of those included in the follow-up routine, %	68	63	64	69

Table 2.7. PROM, response rate 2017–2020.

Demography (from Greek demos – people and gráfo – writing) is the science of the distribution, size and composition of a population.

3. Demography

Authors: Annette W-Dahl and Ola Rolfson

All hip and knee replacements

In 2021, 15,302 primary elective hip replacements, 6,474 primary hip replacements due to fracture, 12,741 primary knee replacements and 1,894 hip revisions and 808 knee revisions were reported.

Sex

Women have more often primary hip or knee replacement than men. The proportion of women having primary elective hip replacement has been stable since 2004 and varied between 56 and 58% (figure 3.1 a) while the proportion of women having hip replacement due to fracture has decreased from just over 74% in 2004 to a just over 64% in 2021 (figure 3.1 b). In primary knee replacements the proportion of women has decreased from 62% in 2004 to just over 55% in 2021 (figure 3.1 c). In hip revision, the proportion of men and women was similar while the proportion of women was higher in knee revision (table 3.1).

Age

The mean age was 68.5 years at primary elective hip replacement, 81.4 years at hip replacement due to fracture and 68.7 years at all primary knee replacements in 2021 (table 3.1). The mean age in men and women respectively has remained mainly unchanged from 2004 to 2021 at primary elective hip replacement. In primary knee replacements the mean age in men has been the same while the mean age in women has decreased with approximately one year (figure 3.2 a-b). The same applies at total knee replacement (TKR) (figure 3.3 a). In both women and men (figure 3.3 b). The mean age at primary hip replacement due to fracture was 73 years in men and 75 years in women in 2004. The mean age increased with just over six years in both men and women in 2005 and has remained mainly unchanged since then (figure 3.4). The reason for the increase is that hemiarthroplasty, which is a common treatment in fracture, started to be registered in 2005. Before 2005 only those fractures treated with total hip replacement were registered in the register. In hip revision, the mean age was hardly five years higher than at primary elective hip replacement and in knee revision just more than half a year higher than at primary knee replacement in 2021.

In primary elective hip replacement surgery there has been relatively small changes in the distribution of age groups since 2005–2006 until 2021. It has increased slightly in the age group 45–54 years and decreased slightly in the age group 55–64 years (figure 3.5 a). In primary hip replacement surgery due to fracture, about 80% are 75 years or older. Since 2005–2006 there has been a change in the older age groups with an increase in the proportion ≥85 years and a decrease in the age group 75–84 years (figure 3.5 b).

In primary TKR the proportion ≤65 years has increased 2004 until 2021 from 27% to 31% while the proportion ≤65 years in primary UKR has decreased from 55% in 2004–2005 to 46% 2020–2021 (figure 3.5 c-d).

BMI

The mean BMI in primary hip replacement is lower (BMI 27.3) compared with primary knee replacement (BMI 28.7) (table 3.1). The proportion that are defined as obese (BMI ≥ 30) according to the WHO classification is considerably higher for primary knee replacement (36.3%) compared with primary elective hip replacement (25.7%) and in hip replacement due to fracture (9%) (table 3.1). In primary elective hip replacement, men are overrepresented in BMI class 25–29.9 (overweight) but the proportion of obese is similar in women and men (figure 3.6 a) with similar proportions in hip replacement due to fracture. In primary knee replacement, men on the other hand, are overrepresented in BMI class 25–29.9 (overweight) while the proportion of obese is higher in women than men (figure 3.6 b). In both hip and knee revision, the proportion of obese is somewhat higher than in primary elective hip and knee replacements with a somewhat greater difference in knee compared to hip (table 3.1).

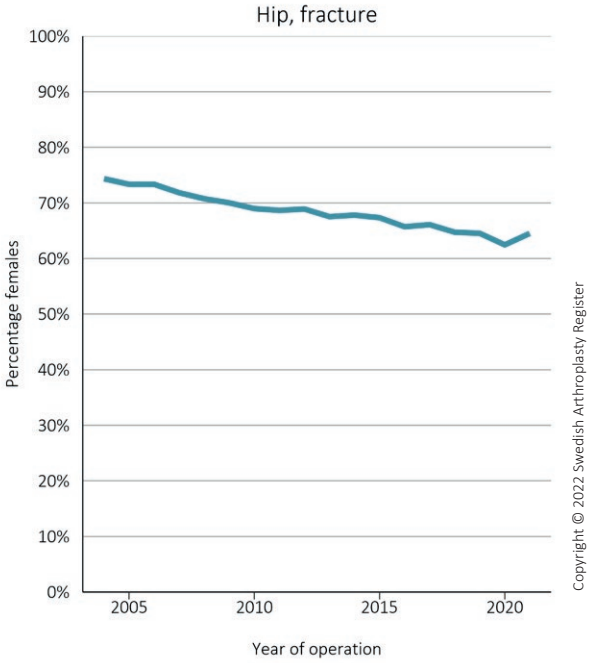


Figure 3.1 b. Proportion of females in primary hip replacement due to fracture 2004–2021.

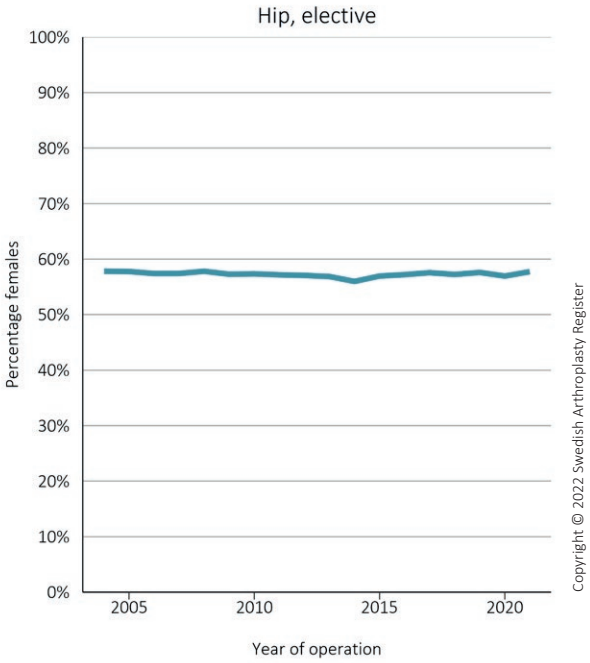


Figure 3.1 a. Proportion of females in elective primary hip replacement 2004–2021.

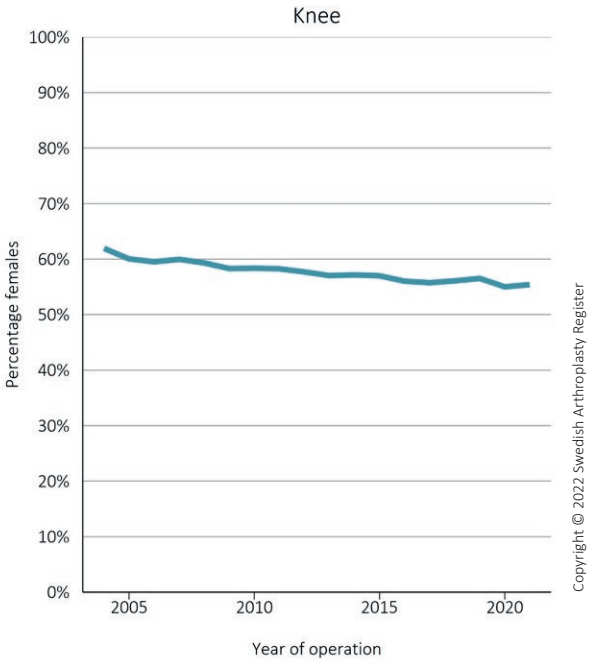


Figure 3.1 c. Proportion of females in primary knee replacement 2004–2021.

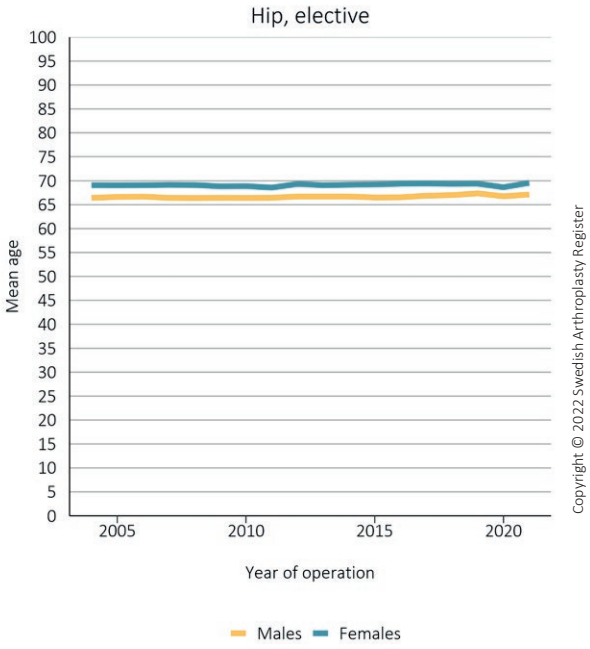


Figure 3.2 a. Mean age in elective primary hip replacement 2004–2021.

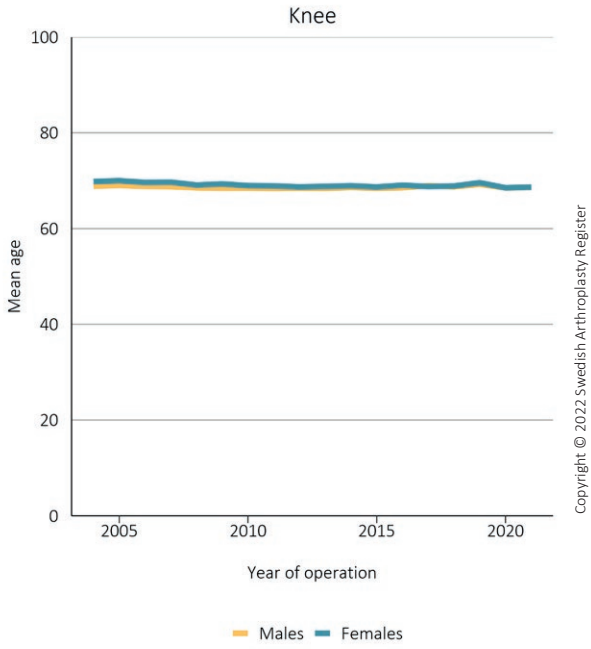


Figure 3.2 b. Mean age in primary knee replacement 2004–2021.

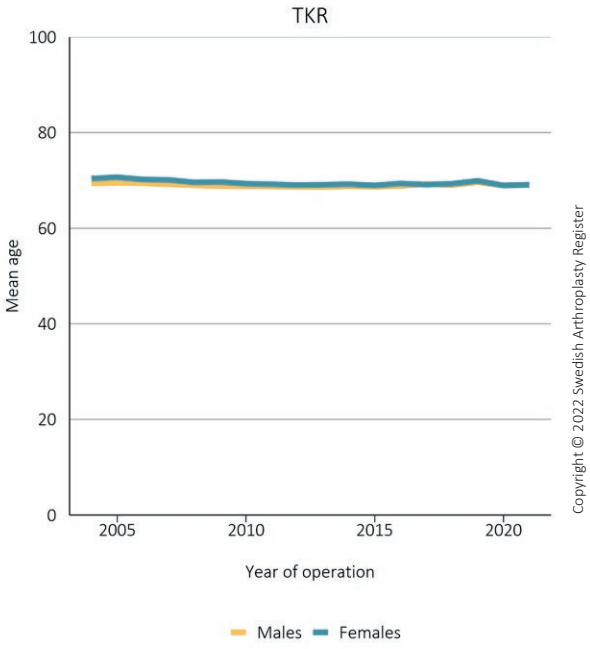


Figure 3.3 a. Mean age in primary TKA 2004–2021.

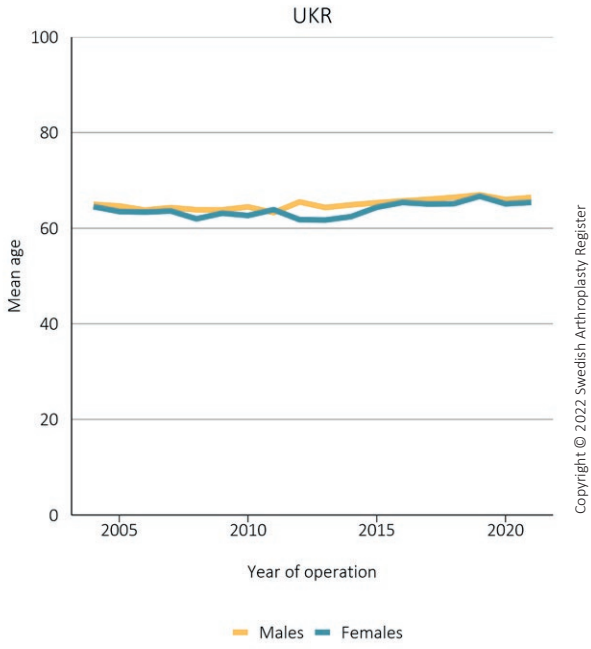


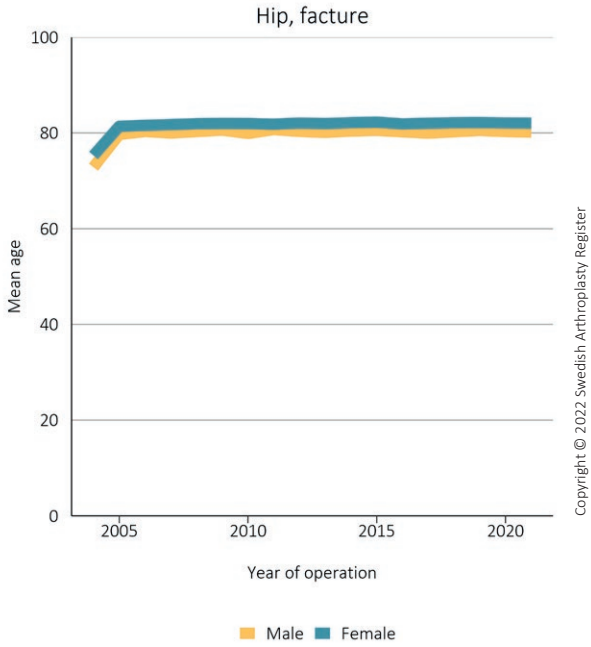
Figure 3.3 b. Mean age in primary UKA 2004–2021.

ASA class

The proportion who are classified as ASA III–IV in primary elective hip replacement (17.7%) and in primary knee replacement (16.2%) is similar while the proportion in hip replacement due to fracture is considerably higher (62.4%). The proportion with ASA class III–IV is slightly higher in men than in women both in primary hip and knee replacements (figure 3.7 a and c). In hip replacement due to fracture the proportion with ASA class III–IV is as well higher in men but the difference is somewhat larger. In hip revision the proportion of ASA III–IV is roughly two and a half times as high as for primary elective hip replacement and it is twice as high in knee revision as for primary knee replacement (table 3.1).

Diagnosis

Osteoarthritis is the absolute most common diagnosis in primary elective hip and knee replacements (92% and 97% respectively). Osteoarthritis as indication for primary surgery is followed by osteonecrosis in elective hip replacement (3.9%) and inflammatory joint disease (1.3%) in knee replacement (table 3.1).



Figur 3.4. Mean age in primary hip replacement due to fracture 2004–2021.

The proportion of those having primary hip replacement due to osteoarthritis has increased slightly since 2006–2007 in women and decreased somewhat in men while osteoarthritis has increased as diagnosis from the period 2003–2004 to the period 2020–2021 in both women and men at primary knee replacement (figures 3.8 a-b, 3.9 a-b).

The proportion of acute hip fracture as reason for primary hip replacement has increased from 2006–2007 to 2020–2021 and is more common in women than in men. The proportion of acute hip fracture has been mainly unchanged from 2006–2007 (31.4%) in women until 2020–2021 (31.3%) but has increased in men from 18.7% to 26.4% in the same period (figures 3.8 a-b).

Inflammatory joint disease that includes rheumatoid arthritis has decreased as reason for primary hip and knee replacement since the introduction of the modern medical treatments, which is reflected by the lower proportion in 2020–2021 compared with 2003–2004 (figures 3.8 a-b, 3.9 a-b).

The proportion of acute hip fracture as reason for primary hip replacement has increased over the last five years from 24.9% to 27.9% while the proportion of osteoarthritis has decreased from 66.6% in 2017 to 64.4% in 2021 (table 3.2). Osteoarthritis as reason for primary knee replacement has remained mainly unchanged the last five years (table 3.3).

Osteoarthritis as reason for primary hip replacement decreases with increasing age from the age group 55–64 years. The highest proportion is in the age group 55–64 years (86.4%) and the lowest in age group ≥ 85 years (17%). Sequelae after childhood disease is most common in the youngest age group, < 55 years. In acute hip fracture the relationship is reversed with a higher proportion with increasing age, the lowest proportion in the age group < 55 years (1.2%) and the highest proportion in the age group ≥ 85 years (77.2%) (table 3.4).

In primary knee replacement the proportion of osteoarthritis as reason for surgery increases with increasing age while the proportion of inflammatory joint disease and sequelae after fracture/trauma decreases with increasing age. Acute trauma as reason for primary knee replacement is uncommon, fewer than 70 operations (0.1%) were reported the last five years (table 3.5).

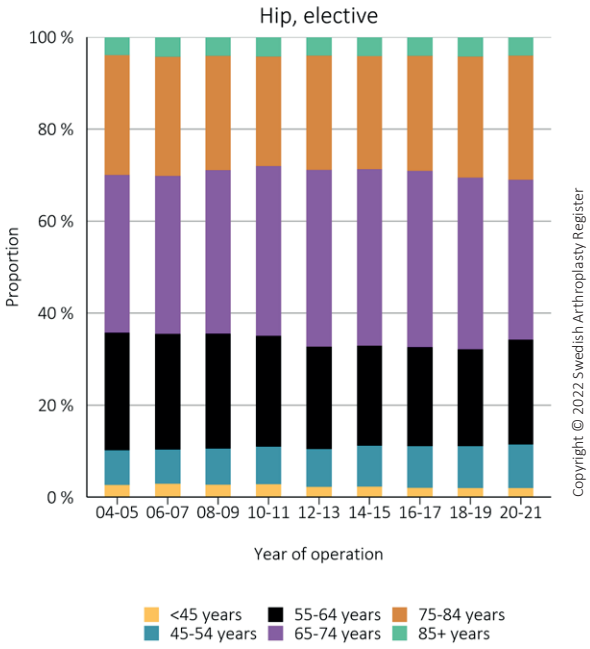


Figure 3.5 a. Distribution in age groups in elective primary hip replacement 2004–2021.

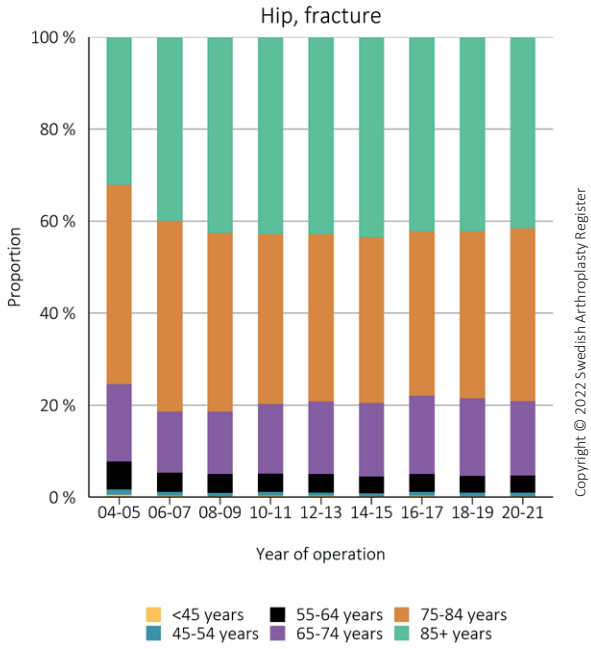


Figure 3.5 b. Distribution in age groups primary hip replacement due to fracture 2004–2021.

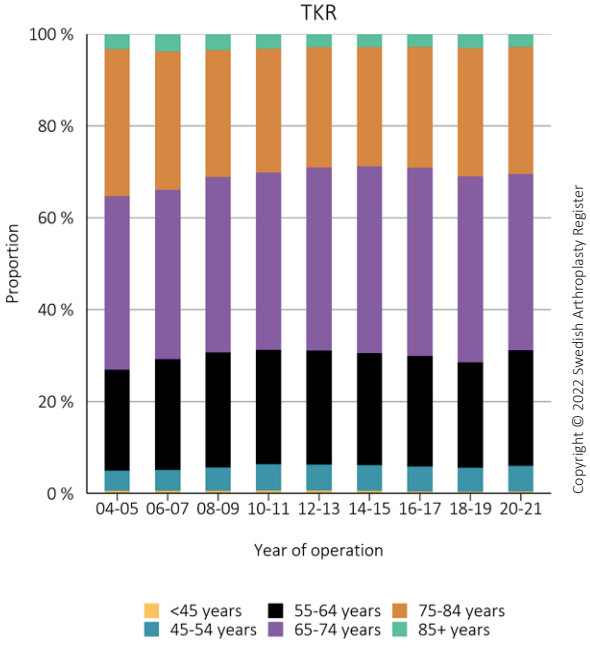


Figure 3.5 c. Distribution in age groups primary TKA 2004–2021.

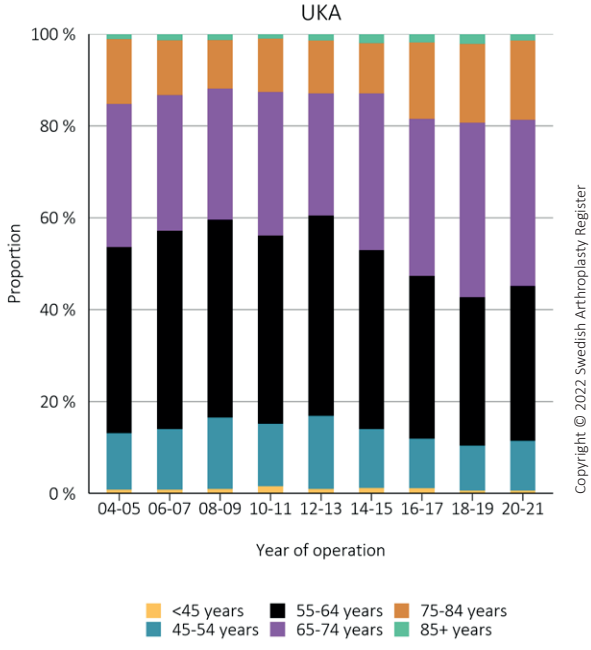


Figure 3.5 d. Distribution in age groups primary UKA 2004–2021.

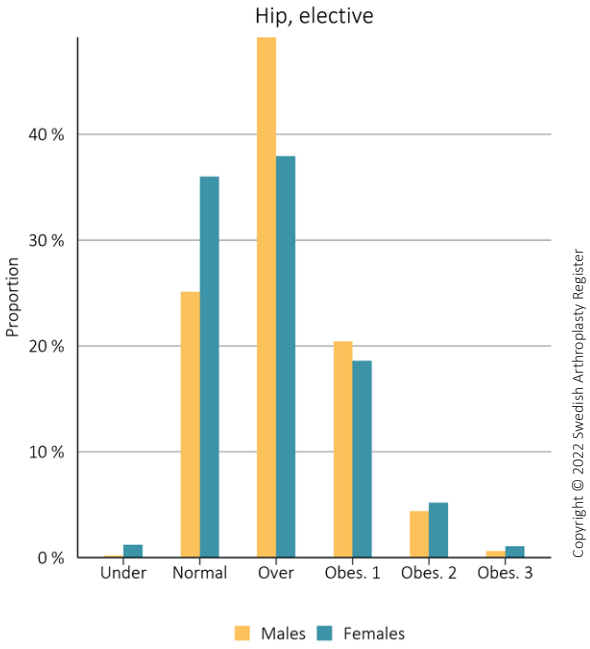


Figure 3.6 a. Distribution in BMI class and sex in elective primary hip replacement 2004–2021.

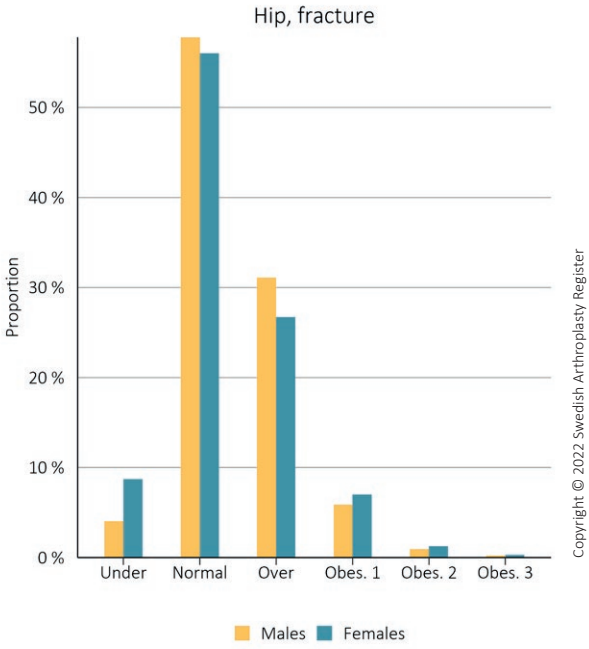


Figure 3.6 b. Distribution in BMI class and sex in primary hip replacement due to fracture 2004–2021.

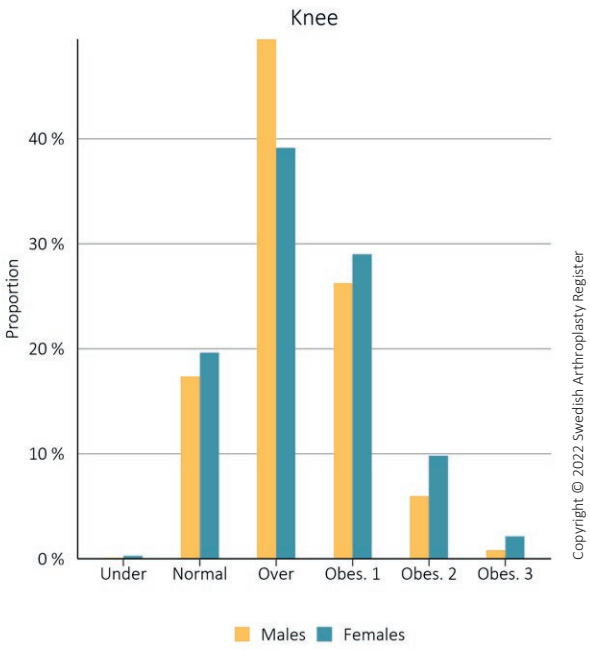


Figure 3.6 c. Distribution in BMI class and sex in primary knee replacement 2004–2021.

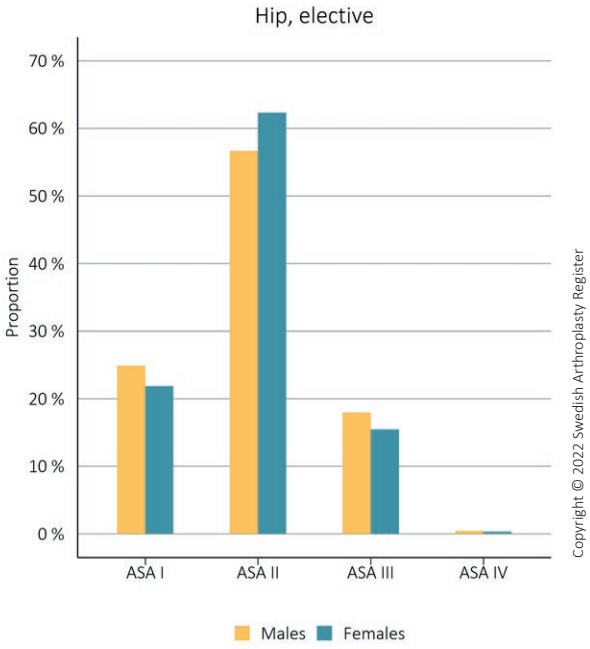


Figure 3.7 a. Distribution in ASA class and sex in elective primary hip replacement 2004–2021.

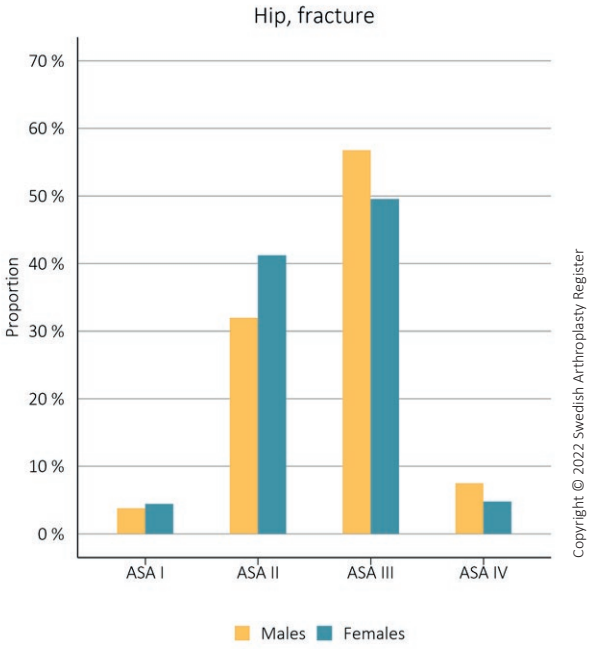


Figure 3.7 b. Distribution in ASA class and sex in primary hip replacement due to fracture 2004–2021.

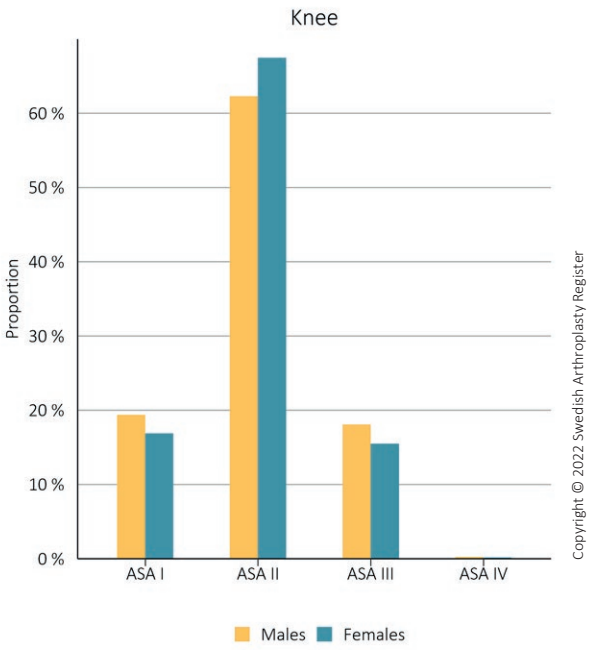


Figure 3.7 c. Distribution in ASA class and sex in primary knee replacement 2004–2021.

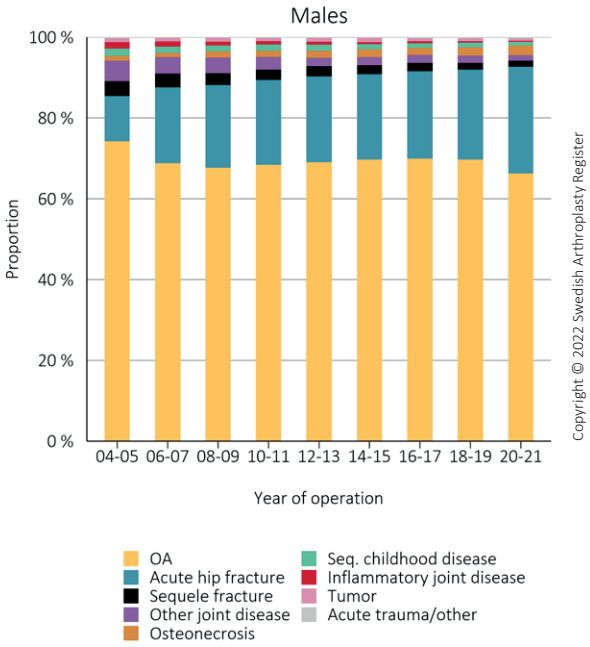


Figure 3.8 a. Distribution in diagnosis in elective primary hip replacement – males.

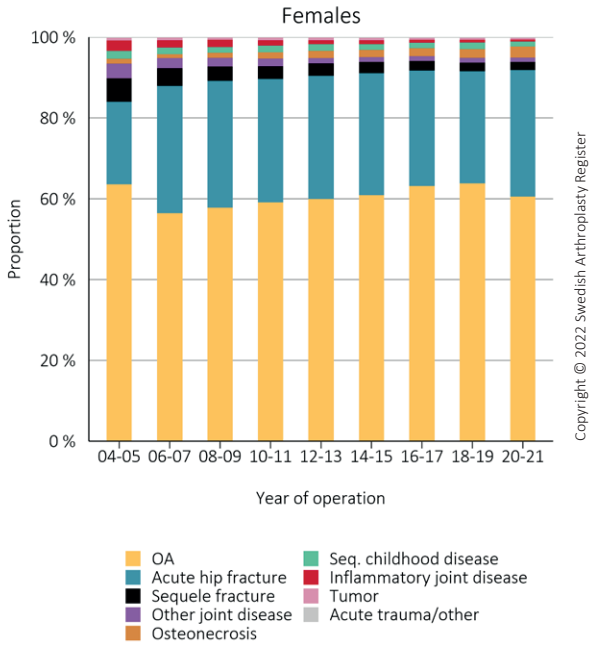


Figure 3.8 b. Distribution in diagnosis in elective primary hip replacement – females.

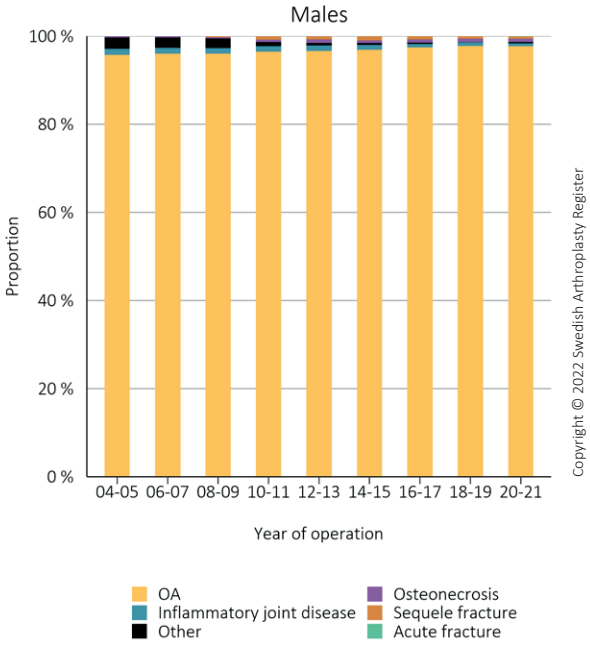


Figure 3.9 a. Distribution in diagnosis in primary knee replacement – males.

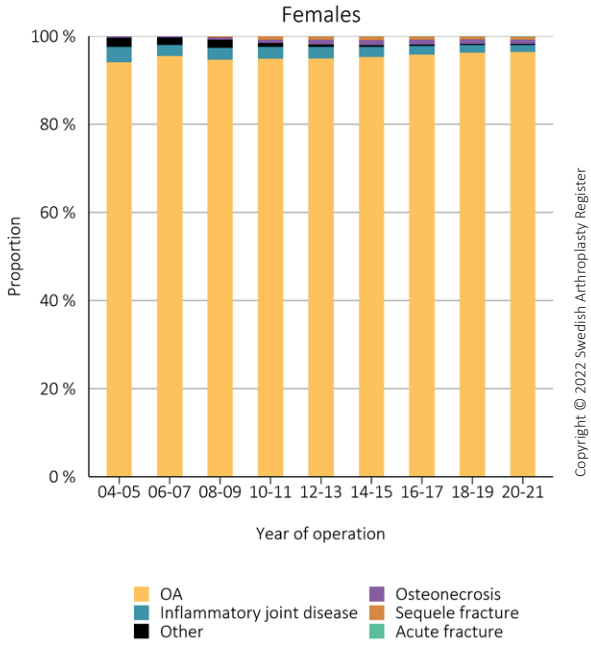


Figure 3.9 b. Distribution in diagnosis in primary knee replacement – females.

Demography in hip and knee replacements 2021

	Primary elective hip	Primary hip fracture	Revision hip	Primary knee	Revision knee
Number	15,302	6,474	1,850	12,743	760
Females (%)	8,834 (57.7)	4 ,177 (64.5)	928 (50.2)	7,058 (55.4)	422 (55.5)
Mean age (SD)	68.5 (10.8)	81.4 (9.3)	73.1 (11.4)	68.7 (9.2)	69.3 (10.3)
Age group (%)					
< 45	280 (1.8)	14 (0.2)	22 (1.2)	61 (0.5)	6 (0.8)
45–54	1,393 (9.1)	51 (0.8)	103 (5.6)	804 (6.3)	54 (7.1)
55–64	3,398 (22.2)	235 (3.6)	292 (15.8)	3,309 (26.0)	173 (22.8)
65–74	5,253 (34.3)	1,024 (15.8)	485 (26.2)	4,810 (37.7)	266 (35.0)
75–84	4,328 (28.3)	2,444 (37.8)	652 (35.2)	3,414 (26.8)	223 (29.3)
≥ 85	650 (4.2)	2,706 (41.8)	296 (16.0)	345 (2.7)	38 (5.0)
BMI Mean (SD)	27.3 (4.4)	24.1 (4.4)	27.3 (5.0)	28.7 (4.3)	29.2 (5.0)
BMI (%)					
<18,5	117 (0.8)	408 (7.7)	40 (2.3)	24 (0.2)	3 (0.4)
18,5–24,9	4,798 (31.6)	2,897 (54.6)	556 (32.1)	2,422 (19.1)	144 (19.4)
25–29,9	6,344 (41.8)	1,524 (28.7)	673 (38.8)	5,611 (44.3)	287 (38.7)
30–34,9	3,079 (20.3)	380 (7.2)	325 (18.8)	3,581 (28.3)	219 (29.5)
35–39,9	729 (4.8)	75 (1.4)	110 (6.3)	924 (7.3)	67 (9.0)
≥ 40	97 (0.6)	19 (0.4)	29 (1.7)	94 (0.7)	22 (3.0)
ASA class (%)					
ASA I	3,045 (20.0)	200 (3.2)	106 (5.8)	2,082 (16.4)	72 (9.6)
ASA II	9,488 (62.3)	2 168 (34.4)	835 (46.0)	8572 (67.4)	425 (56.7)
ASA III	2,655 (17.4)	3 469 (55.1)	831 (45.7)	2,049 (16.1)	236 (31.5)
ASA IV	48 (0.3)	462 (7.3)	45 (2.5)	15 (0.1)	16 (2.1)
Diagnosis (%)					
Osteoarthritis	14,097 (92.1)			12,354 (97.1)	
Acute hip fracture		6,098 (94.2)			
Sequele fracture/trauma		376 (5.8)		78 (0.6)	
Osteonecrosis	591 (3.9)			97 (0.8)	
Sequele childhood hip disease	234 (1.5)				
Inflamatory joint disease	66 (0.4)			161 (1.3)	
Tumor				8 (0.1)	
Acute trauma. other	62 (0.4)			26 (0.2)	
Other joint diseases	250 (1.6)			4 (0.0)	

Table 3.1. Demography in elective primary hip replacement, hip replacement due to fracture, knee replacement, hip revision and knee revision 2021.

Diagnosis in primary hip replacement

	2017	2018	2019	2020	2021	Total
Diagnosis, n (%)						
Osteoarthritis	14,774 (66.6)	15,115 (65.9)	16,099 (66.5)	12,065 (61.1)	14,097 (64.4)	72,150 (65.0)
Acute hip fracture	5,522 (24.9)	5,954 (26.0)	6,075 (25.1)	6,105 (30.9)	6,098 (27.9)	29,754 (26.8)
Sequele fracture/trauma	521 (2.3)	442 (1.9)	460 (1.9)	372 (1.9)	376 (1.7)	2,171 (2.0)
Osteonecrosis	426 (1.9)	450 (2.0)	539 (2.2)	487 (2.5)	591 (2.7)	2,493 (2.2)
Sequele childhood hip disease	290 (1.3)	328 (1.4)	376 (1.6)	256 (1.3)	234 (1.1)	1,484 (1.3)
Inflamatory joint disease	129 (0.6)	119 (0.5)	110 (0.5)	73 (0.4)	66 (0.3)	497 (0.4)
Tumor	136 (0.6)	146 (0.6)	129 (0.5)	104 (0.5)	104 (0.5)	619 (0.6)
Acute trauma, other	49 (0.2)	54 (0.2)	50 (0.2)	37 (0.2)	62 (0.3)	252 (0.2)
Other joint diseases	338 (1.1)	332 (1.4)	360 (1.1)	234 (1.2)	250 (1.1)	1 514 (1.4)
Total n	**22,190**	**22,941**	**24,200**	**19,735**	**21,880**	**110,946**

Table 3.2. Diagnosis in elective primary hip replacement 2017–2021.

Diagnosis in primary knee replacement

	2017	2018	2019	2020	2021	Total
Diagnosis, n (%)						
Osteoarthritis	14,525 (97,0)	14,997 (96,8)	16,491 (97,1)	11,458 (97,0)	12,354 (97,1)	69,825 (97,0)
Inflamatory joint disease	215 (1,4)	242 (1,6)	211 (1,2)	154 (1,3)	161 (1,3)	983 (1,4)
Osteonecrosis	133 (0,9)	136 (0,9)	148 (0,9)	110 (0,9)	97 (0,8)	624 (0,9)
Sequele fracture/trauma	89 (0,6)	106 (0,7)	107 (0,6)	62 (0,5)	78 (0,6)	442 (0,6)
Tumor	3 (0,0)	5 (0,0)	5 (0,0)	8 (0,1)	8 (0,1)	29 (0,0)
Acute trauma, other	6 (0,0)	10 (0,1)	12 (0,1)	15 (0,1)	26 (0,2)	69 (0,1)
Other joint diseases	4 (0,0)	3 (0,0)	3 (0,0)	2 (0,0)	4 (0,0)	16 (0,0)
Total n	**14,980**	**15,503**	**16,982**	**11,811**	**12,743**	**72,019**

Table 3.3. Diagnosis in primary knee replacement 2017–2021.

Diagnosis in age groups in primary hip replacement

	< 45	45–54	55–64	65–74	75–84	≥ 85	Total
Diagnosis, n (%)							
Osteoarthritis	740 (45,6)	6,213 (82,1)	15,867 (86,4)	27,079 (79,3)	19,423 (59,7)	2,828 (17,0)	72,150 (65,0)
Acute hip fracture	20 (1,2)	144 (1,9)	926 (5,0)	4,790 (14,0)	11,002 (33,8)	12,872 (77,2)	29,754 (26,8)
Sequele fracture/trauma	53 (3,3)	104 (1,4)	279 (1,5)	497 (1,5)	698 (2,1)	540 (3,2)	2 171 (2,0)
Osteonecrosis	153 (9,4)	223 (2,9)	431 (2,3)	743 (2,2)	725 (2,2)	218 (1,3)	2 493 (2,2)
Sequele childhood hip disease	319 (19,7)	512 (6,8)	354 (1,9)	215 (0,6)	71 (0,2)	13 (0,1)	1 484 (1,3)
Inflamatory joint disease	60 (3,7)	67 (0,9)	117 (0,6)	168 (0,5)	76 (0,2)	9 (0,1)	497 (0,4)
Tumor	37 (2,3)	48 (0,6)	91 (0,5)	219 (0,6)	159 (0,5)	65 (0,4)	619 (0,6)
Acute trauma, other	3 (0,2)	9 (0,1)	32 (0,2)	55 (0,2)	93 (0,3)	60 (0,4)	252 (0,2)
Other joint diseases	237 (14,6)	252 (3,4)	278 (1,5)	368 (1,1)	304 (0,9)	75 (0,4)	1 514 (1,4)
Total n	**1,624**	**7,573**	**18,377**	**34,139**	**32,552**	**16,681**	**110,946**

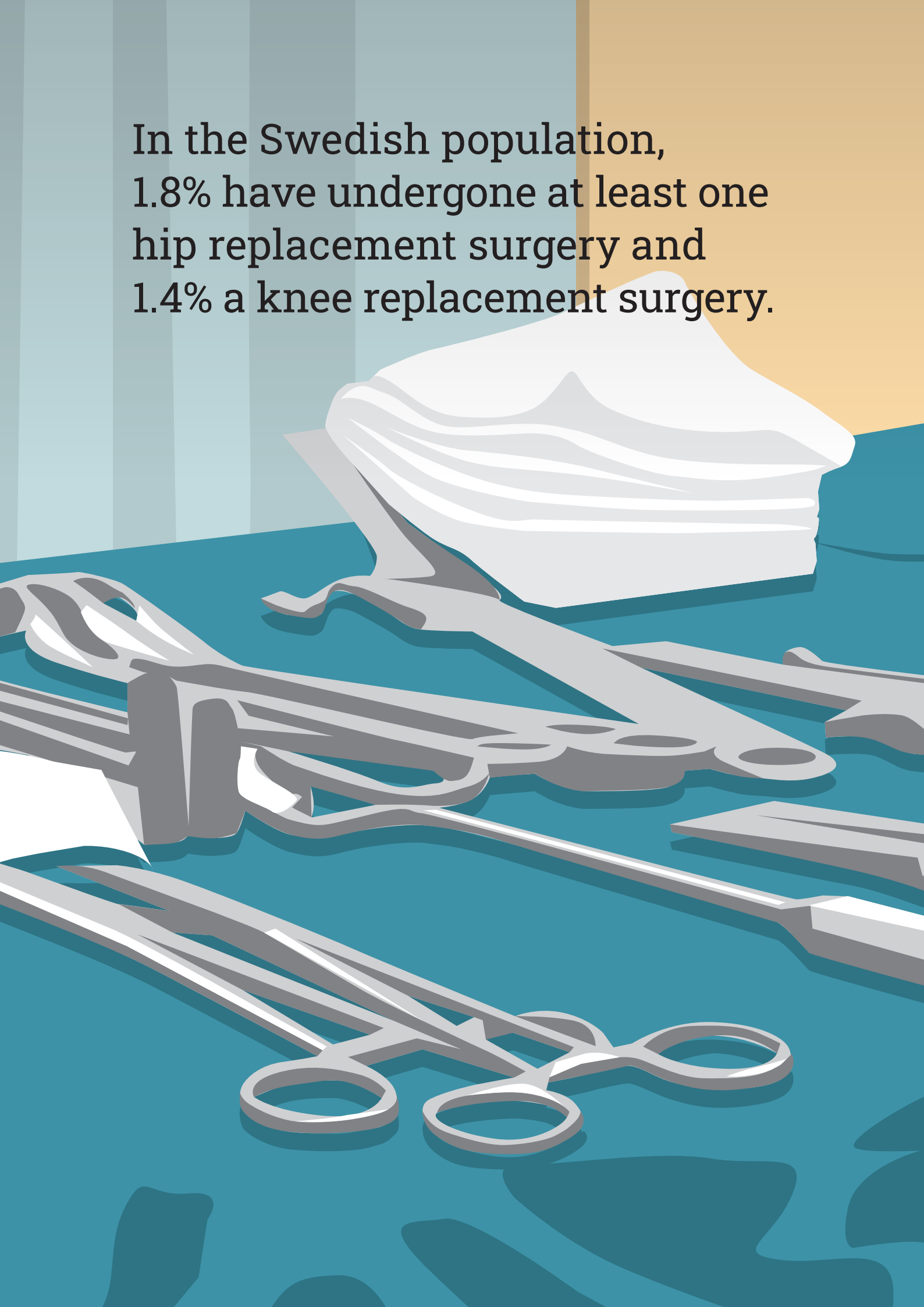
Table 3.4. Distribution of diagnosis by age group in primary hip replacement 2017–2021.

Diagnosis in age groups in primary knee replacement

	< 45	45–54	55–64	65–74	75–84	≥ 85	Total
Diagnosis, n (%)							
Osteoarthritis	259 (79,4)	4,126 (95,5)	17,391 (97,0)	27,602 (97,3)	18,471 (97,3)	1,976 (96,6)	69,825 (97,0)
Inflamatory joint disease	32 (9,8)	96 (2,2)	241 (1,3)	355 (1,3)	243 (1,3)	16 (0,8)	983 (1,4)
Osteonecrosis	8 (2,5)	36 (0,8)	145 (0,8)	243 (0,9)	165 (0,9)	27 (1,3)	624 (0,9)
Sequele fracture/trauma	13 (4,0)	52 (1,2)	140 (0,8)	149 (0,5)	73 (0,4)	15 (0,7)	442 (0,6)
Tumor	12 (3,7)	7 (0,2)	2 (0,0)	2 (0,0)	6 (0,0)	0 (0,0)	29 (0,0)
Acute trauma, other	1 (0,3)	2 (0,0)	12 (0,1)	24 (0,1)	19 (0,1)	11 (0,5)	69 (0,1)
Other joint diseases	1 (0,3)	3 (0,1)	1 (0,0)	6 (0,0)	4 (0,0)	1 (0,0)	16 (0,0)
Total n	**334**	**4,332**	**17,935**	**28,388**	**18,983**	**2,047**	**7,019**

Table 3.5. Distribution of diagnosis by age group in primary knee replacement 2017–2021.

In the Swedish population, 1.8% have undergone at least one hip replacement surgery and 1.4% a knee replacement surgery.



4. Epidemiology

Authors: Annette W-Dahl and Ola Rolfson

Hip and knee replacement surgery in Sweden

Prevalence

When the proportion of individuals who have a hip or a knee replacement are put in relation to the number of individuals in the country, it is referred to as the prevalence of individuals with a hip or a knee replacement.

Those individuals having a hip replacement after 1991 have been included, since the register started to register replacements on individual level in 1992. In knee replacements, the registration has been on individual level since the start of the register in 1975. Table 4.1 shows the number of individuals in each age group and men and women in their age groups respectively with a hip or a knee replacement, unilaterally or bilaterally operated. The corresponding numbers, but for individuals who have undergone bilateral hip or knee replacement surgery are shown in table 4.2. The tables also show the prevalence per 100 000 inhabitants ≥ 45 years at the end of each year respectively 2006–2021 in five-year intervals.

At the end of 2021, 222,249 individuals had at least one hip replacement and 155,041 individuals had at least one knee replacement. This means that 2.1% of the population have at least one hip replacement and 1.5% at least one knee replacement. 26.5% of the individuals with a hip replacement were bilaterally operated and 33.5% of those with a knee replacement. The prevalence is the highest in the ages 65–84 years for both hip and knee replacement and the prevalence is higher in women than men.

Incidence

When the number of primary replacements preformed in one year are put in relation to the number of inhabitants in the country it is refereed as the country's incidence for the procedure. Observe that the incidence of hip and knee replacement is computed based on the number of replacements while the prevalence is based on the number of individuals. In 2021, 21,776 primary hip replacements, of which 15,302 were primary total hip replacements and 12,739 primary knee replacements were registered, which gives the incidence 209 for hip replacement, 167 for total hip replacement and 122 for knee replacement. Compared with the first year of the pandemic 2020 when the incidence decreased, the number of hip and knee replacements have increased somewhat in 2021, 16% more hip replacements and 7% more knee replacements and thereby the incidence has increased somewhat.

The incidence has increased over the years in both hip and knee replacements. The strong increase of the number of knee replacements in the end of the 1980s has weakened somewhat after 2009. For hip replacements the increase has also diminished, and the incidence has been more or less constant. Since hip and knee replacements mainly are used for the elderly, a smaller proportion of the increase over time depends on the aging population.

Since the incidence is age-dependent and the age structure in different regions and countries can vary it is hard to make comparisons without some form of age standardisation. The so called "European Standard population" has been used to make comparisons possible. This standardisation describes what the incidence had been for a certain region/country if all regions/countries would have had the same age distribution.

In an international comparison Sweden has a higher incidence of hip replacements than the US, Australia and the UK, but a lower incidence than Denmark, Norway, Finland and Germany. For knee replacements, Sweden has a higher incidence than Norway but lower than Denmark, Finland, the US, Australia, the UK and Germany (OECD Health Statistics 2019).

Regional differences

According to the Health Care Act (SFS 2017:30) the aim for the healthcare is "… a good health and equal conditions for the whole population. Care is to be provided with respect for the equal value of each individual and for the dignity of each individual. Priority shall be given to the one who is in the greatest need of healthcare." An important aspect of equality is geographical differences in how healthcare is conducted and provided within the country. Equality may in a broad sense of the word be related to where in the country patient's lives. The 21 regions have independent government over their healthcare but have to follow the Health Care Act.

Production and consumption

Production and consumption are based on data from the Swedish Arthroplasty Register, the population statistics from Statistics Sweden and the address register of the Swedish Tax Agency. Production refers to the number of primary total hip replacements, elective total hip replacements and knee replacements regardless of where the individual having surgery lives, that is the region's production and is presented per 100,000 inhabitants. Consumption

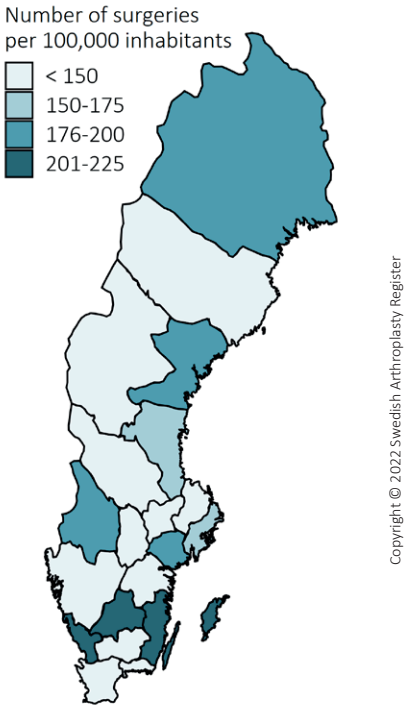


Figure 4.1 a. Production primary total hip replacement.

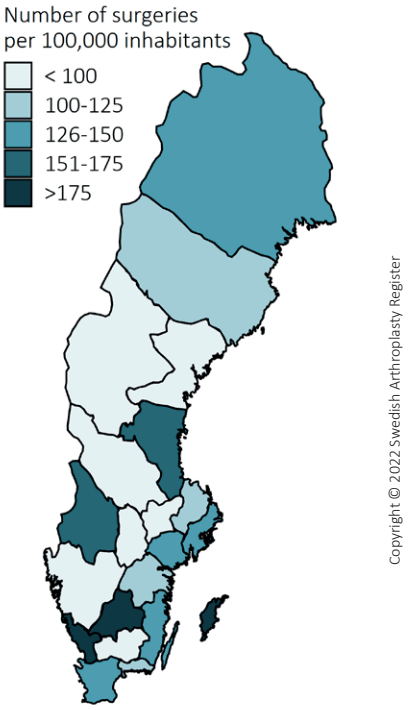


Figure 4.1 b. Production knee replacement.

refers to the number of primary total hip replacements, elective total hip replacements and knee replacements irrespectively of where the surgery is carried out and is presented per 100,000 inhabitants. Consumption thus entails that the inhabitants in the region have access to hip and knee replacement surgery independently if the surgery is carried out in their home region or somewhere else in the country. The consumption calculations are based on data from the Swedish Tax Agency on regional affiliation when the surgery is performed.

The Sweden maps show the distribution of production and consumption respectively in primary total hip replacement surgery (4.1 a and 4.2 a) and knee replacement surgery (4.1 b and 4.2 b) per 100,000 inhabitants in the 21 regions. The tables 4.3 and 4.4 shows the production and consumption respectively with incidence and age standardised incidence (European Standard population) in primary total hip replacement, elective total hip replacement and knee replacement surgery in the regions.

Regarding production, the age-standardised incidence varies from 112 to 275 in primary total hip replacement surgery (80 to 220 in elective total hip replacement surgery) and from 25 to 208 in knee replacement surgery. Halland has the highest production incidence in both hip and knee replacement surgery while Jämtland has the lowest incidence in both hip and knee. The production is almost two and a half times as high in Halland compared to Jämtland regarding primary hip replacement surgery and more than eight times as high in Halland than in Jämtland in knee replacement surgery. The differences in age-standardised incidence in consumption varies from 190 to 248 in primary total hip replacement surgery (128 to 208 in elective total hip replacement surgery) and from 79 to 160 in knee replacement surgery. In primary total hip replacement surgery, Blekinge has the lowest consumption, about 70% compared with Gotland which has the highest consumption. In knee replacement surgery, Gotland with the highest incidence, has twice the consumption of Västernorrland that has the lowest incidence. The differences in consumption are important considering the aim of the healthcare and the promise of equal care. Different effects of the pandemic in the regions 2020–2021 may have affected both production and consumption. The age standardised consumption has however varied relatively widely between regions and in regions different years.

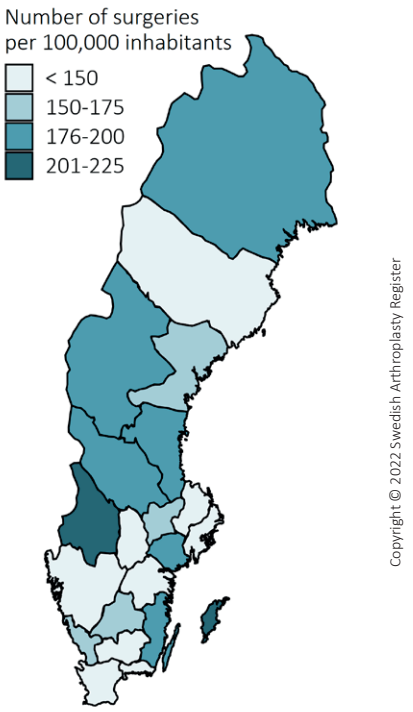


Figure 4.2 a. Consumption primary total hip replacement.

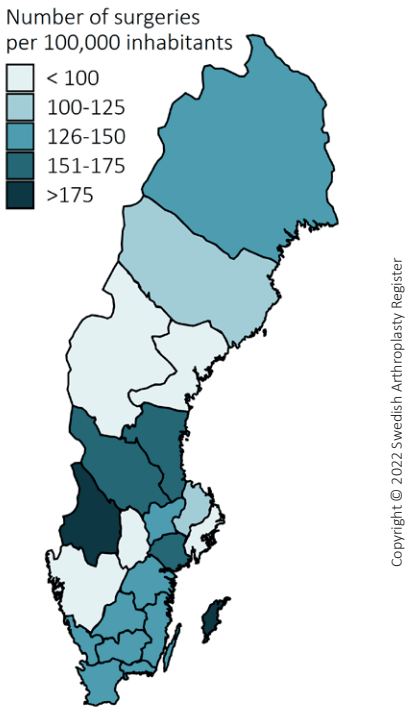


Figure 4.2 b. Consumption knee replacement.

Number of individuals with total hip replacement or knee replacement

	Hip			Knee		
Number per age group	**2006**	**2011**	**2021**	**2006**	**2011**	**2021**
< 45	1,782	2,130	1,943	295	356	325
45–54	4,598	6,192	8,146	1,858	2,729	3,250
55–64	18,209	20,738	25,222	10,090	14,468	19,224
65–74	32,444	45,580	57,056	19,593	30,961	46,777
75–84	42,607	53,554	81,193	27,653	34,624	58,020
85+	21,341	35,529	48,689	12,572	18,075	27,445
Total	120,981	163,723	222,249	72,061	101,213	155,041
Prevalence per 100,000 ≥45	3,051	3,894	4,753	1,817	2,407	3,316
Males						
< 45	827	1,039	978	123	151	148
45–54	2,337	3,302	4,234	685	1,043	1,313
55–64	8,618	9,937	12,832	4,178	6,090	8,147
65–74	13,857	19,876	25,837	7,946	13,271	20,982
75–84	15,291	19,807	32,215	9,245	12,672	24,670
85+	5,807	9,630	14,261	3,143	4,913	8,832
Total	46,737	63,591	90,357	25,320	38,140	64,092
Prevalence per 100,000 ≥45	2,471	3,140	3,958	1,339	1,883	2,807
Females						
< 45	955	1,091	965	172	205	177
45–54	2,261	2,890	3,912	1,173	1,686	1,937
55–64	9,591	10,801	12,390	5,912	8,378	11,077
65–74	18,586	25,704	31,219	11,647	17,690	25,795
75–84	27,316	33,747	48,978	18,408	21,952	33,350
85+	15,533	25,898	34,427	9,429	13,162	18,613
Total	74,242	100,131	131,891	46,741	63,073	90,949
Prevalence per 100,000 ≥45	3,579	4,595	5,512	2,253	2,894	3,801

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

Number of individuals with total hip replacement or knee replacement, bilaterally operated

	Hip			Knee		
Number per age group	**2006**	**2011**	**2021**	**2006**	**2011**	**2021**
< 45	367	425	345	72	58	43
45–54	846	1,249	1,809	361	552	653
55–64	3,777	4,698	6,443	2,332	3,610	5,254
65–74	6,991	11,319	15,512	5,329	9,115	15,682
75–84	7,417	11,862	22,804	8,004	10,956	20,633
85+	2,672	5,853	11,956	3,495	5,486	9,767
Total	22,070	35,406	58,869	19,593	29,777	52,032
Prevalence per 100,000 ≥45	557	842	1,259	494	708	1,112

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

Production in the regions

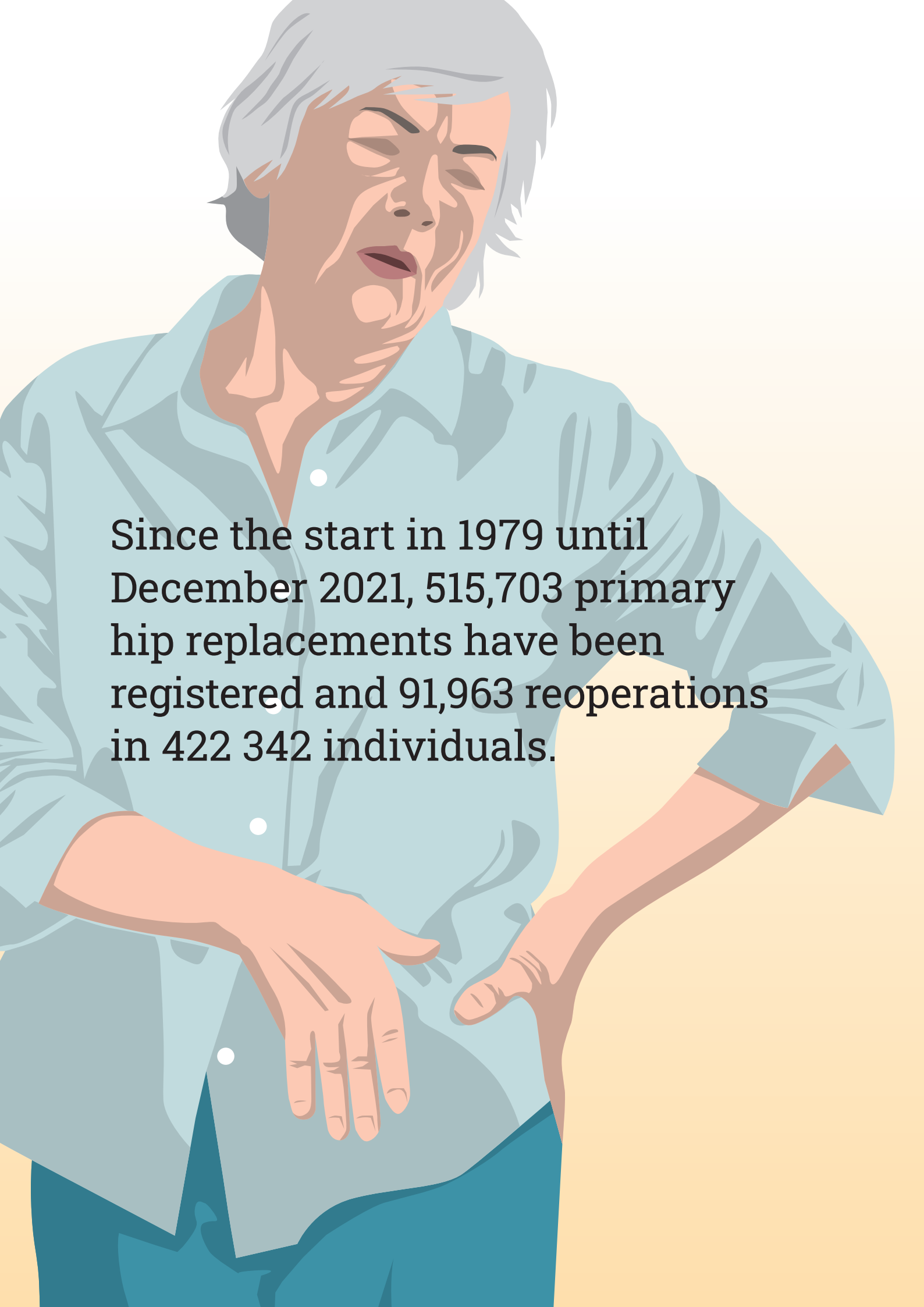
	Hip				Knee	
Region	Incidence primary total hip	Age standardized incidence primary total hip	Incidence elective total hip	Age standardized incidence elective total hip	Incidence	Age standardized incidence
Blekinge	221	182	139	120	117	100
Dalarna	176	141	123	101	90	75
Gotland	307	243	246	198	189	153
Gävleborg	251	209	197	167	154	130
Halland	300	275	245	228	222	208
Jämtland	133	112	94	80	30	25
Jönköping	261	251	230	224	185	181
Kalmar	273	222	220	183	140	115
Kronoberg	168	154	123	117	80	77
Norrbotten	262	217	205	173	142	120
Skåne	182	182	130	132	129	132
Stockholm	206	239	176	202	130	150
Sörmland	258	231	220	199	147	133
Uppsala	212	225	173	183	115	123
Värmland	251	208	196	166	157	133
Västerbotten	205	192	152	145	105	102
Västernorrland	269	222	210	176	88	75
Västmanland	160	145	154	139	61	56
Västra Götaland	187	187	145	147	93	94
Örebro	206	192	165	154	89	84
Östergötland	185	178	138	135	119	115
Country	**209**	**205**	**167**	**165**	**122**	**121**

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

Consumption in the regions

	Hip				Knee	
Region	Incidence primary total hip	Age standardized incidence primary total hip	Incidence elective total hip	Age standardized incidence elective total hip	Incidence	Age standardized incidence
Blekinge	229	190	147	128	130	113
Dalarna	252	209	199	169	159	136
Gotland	310	248	249	204	197	160
Gävleborg	275	231	221	188	170	145
Halland	228	208	175	162	150	140
Jämtland	259	224	220	192	92	83
Jönköping	219	210	188	182	141	137
Kalmar	267	218	215	180	143	118
Kronoberg	217	203	172	165	140	136
Norrbotten	274	228	218	184	145	123
Skåne	194	194	143	145	140	144
Stockholm	168	196	137	158	95	110
Sörmland	253	228	216	197	157	143
Uppsala	213	226	175	186	119	127
Värmland	292	247	236	204	181	154
Västerbotten	221	210	168	163	117	114
Västernorrland	247	206	191	162	91	79
Västmanland	232	214	225	208	145	137
Västra Götaland	193	193	151	153	98	99
Örebro	207	193	168	158	85	81
Östergötland	206	199	158	156	141	138
Country	**209**	**204**	**166**	**165**	**122**	**121**

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


Since the start in 1979 until December 2021, 515,703 primary hip replacements have been registered and 91,963 reoperations in 422 342 individuals.

5. Hip replacement

5.1. Primary total hip replacement

Author: Maziar Mohaddes

In 2021, in total of 17,413 primary total hip replacements were reported. Among these, 2,051 were performed in patients with a hip fracture or sequelae after hip fracture, and 71 total hip replacements due to tumour disease (table 5.1.1). **In this chapter total hip replacements performed due to fracture, sequelae after fracture and tumours are excluded.**

15,291 primary total hip replacements were reported in 2021 where the indication for surgery was osteoarthritis or other diagnoses. There is a 16% increase of reported hip replacements in 2021 compared with the previous year (table 5.1.2). This increase can to some extent be explained by the fact that several units have been able to resume the planned activity, from the lower levels that were caused by the first and second waves of the covid-pandemic. Further it is noted a continued increase in the proportion of operations performed at private units (table 5.1.2). In 2021, 41% of the operations were performed at private units. The corresponding proportion in 2000–2017 were 14%. In the last four years, the mean age has remained relatively unchanged with exception for 2019, where a reduction in mean age could be noted (table 5.1.3). Over the last four years the proportion of patients in different BMI-categories have been relatively constant (table 5.1.3).

The change seen in last year's report, with an increase of the proportion of healthy patients (ASA class I) has partly been broken and in 2021 most of the operated patients were classified as ASA class II (62%) (table 5.1.3). In table 5.1.4, selected demographic data for different selections of patients is presented per unit. The proportion of patients with BMI 35 and above varies between 0 and 16% and the proportion of patients with ASA class III or IV varies still more widely, between 1 and 75% (units with fewer than 50 reported operations are excluded).

Summary

Previous trend in reduction of the number of reported total hip replacements is partly broken.
In 2021, 15,291 operations were reported. The proportion of operations performed at private units has increased.
In 2021, 40% of the reported operation were performed at private units.

Type of prosthesis and indication

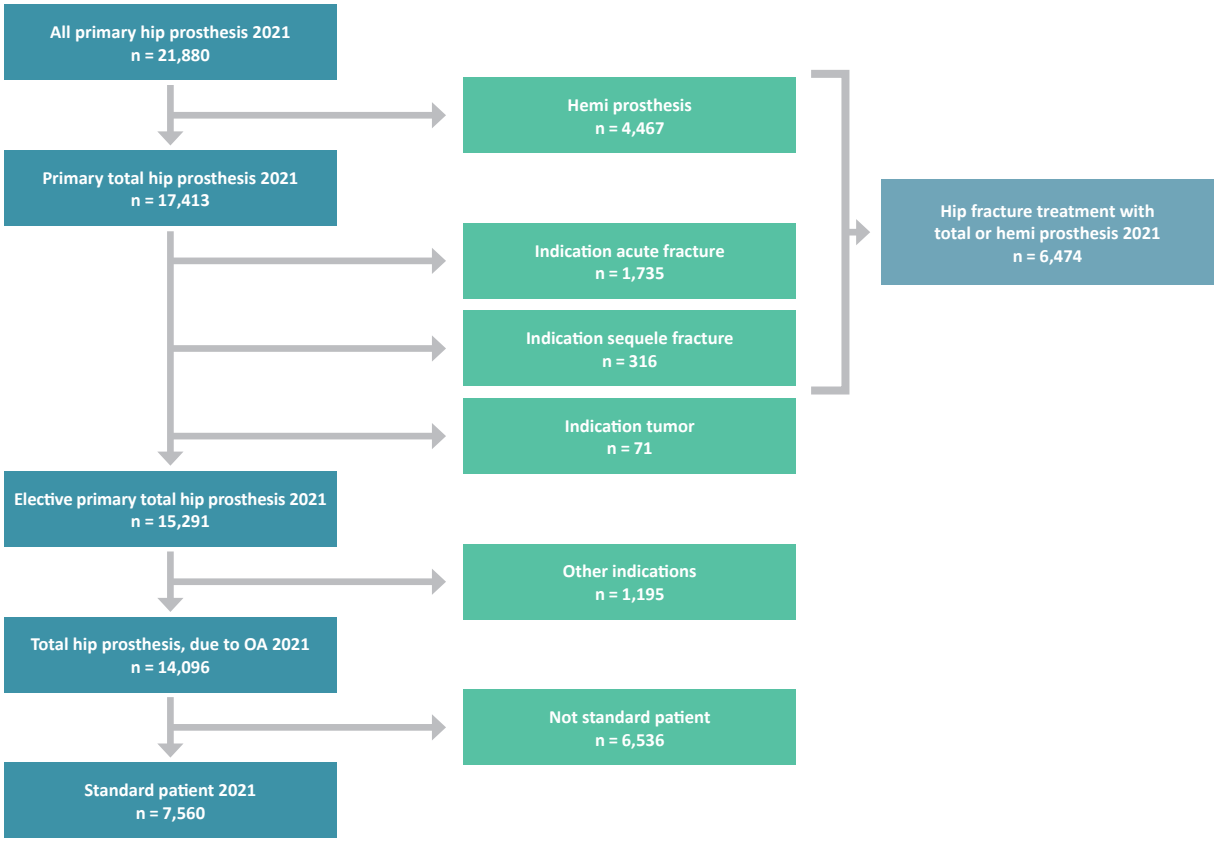
	Number
All primary hip prosthesis	21,880
Hemi prosthesis	4,467
Primary total hip prosthesis	17,413
Primary total hip prosthesis, indication acute fracture	1,735
Primary total hip prosthesis, indication sequele fracture	316
Primary total hip prosthesis, indication tumor	71
Hip fracture treatment with total or hemi prosthesis	6,474
Elective primary hip prosthesis	15,291
Elective primary hip prosthesis, other indications than OA	1,195
Elective primary hip prosthesis, due to OA	14,096
Elective primary hip prosthesis, due to OA, not standard patient	6,536
Standard patient	7,560

Table 5.1.1. Type of prosthesis and indication.

Surgical approach

Since 2005, posterior approach and direct lateral approach in lateral position or in supine position have been the dominating approaches used. In 2021, any of these approaches accounted for in total 99% of all procedures. The posterior approach is the most common (61%). Direct lateral approach in lateral position was used in 31% and direct lateral approach in supine position was used in 7%. Different variations of mini-incisions, Watson-Jones approach and incisions including trochanteric osteotomy were used only sporadically. The distribution between the three most used approaches does not show any larger difference between the sex (figure 5.1.1). Over the last years the use of posterior approach seems to have increased marginally (figure 5.1.2).

Selection groups in hip replacements 2021



Flow-chart, based on diagnostic indication and type of prosthesis, shows the different selections groups in primary hip replacements used in the annual report. Current example shows the numbers of operations performed in 2021.

Fixation

Cemented fixation is more commonly performed in females and uncemented fixation in males (figure 5.1.3). The figure should be interpreted against the background that other factors, such as age and individual bone quality most probably have influenced the choice of fixation. Poor results with uncemented fixation in the 1990s resulted in an increase of all cemented fixation with a peak at 93% at the turn of the millennium. Thereafter the proportion of patients operated with all cemented fixation has decreased each year, until 2020 (figure 5.1.4). In 2021, the proportion of all cemented prostheses was 52%.

Thus, choice of uncemented fixation for both components has increased in the last twenty years. In the year 2000 this group accounted for 2.4% of the total number of reported operations. The corresponding share in 2021 was slightly more than 32%. This increase has mainly taken place in the age groups below 75 years and especially below 65, whereas the share of hips operated with an all uncemented prosthesis in patients 75 years of age and older has remained rather constant (figure 5.1.4).

Since 2012 the number of reversed hybrids (cemented cup, uncemented stem) has decreased. Table 5.1.5 shows the number of operations per fixation type and age in 2021. The proportion of hybrid protheses (uncemented cup, cemented stem) has been small in the last ten-year period and was about 1.5% between 2007 and 2010 followed by an increase to 8% in 2021. In 2021, no resurfacing prostheses were reported.

Summary

Cemented fixation is still the most common fixation method. In 2021 a small increase of the proportion of patients with cemented fixation was noted. Considering existing evidence, we would like to continue to encourage the use of cemented fixation in patients older than 70 years.

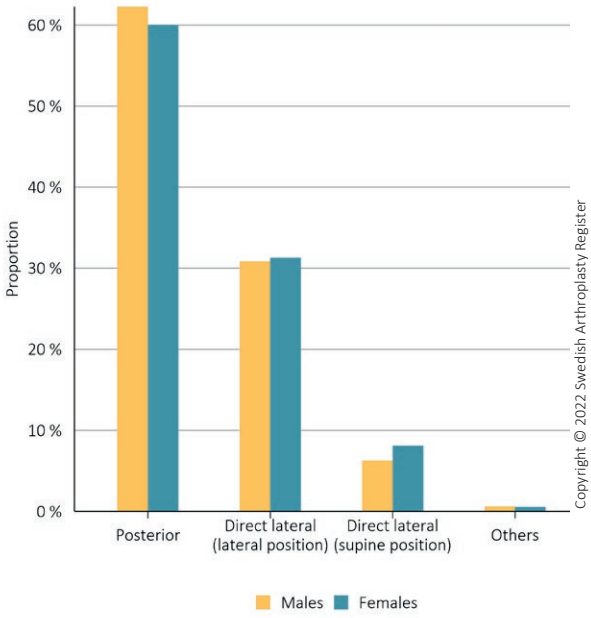


Figure 5.1.1. Distribution of surgical approach, sex.

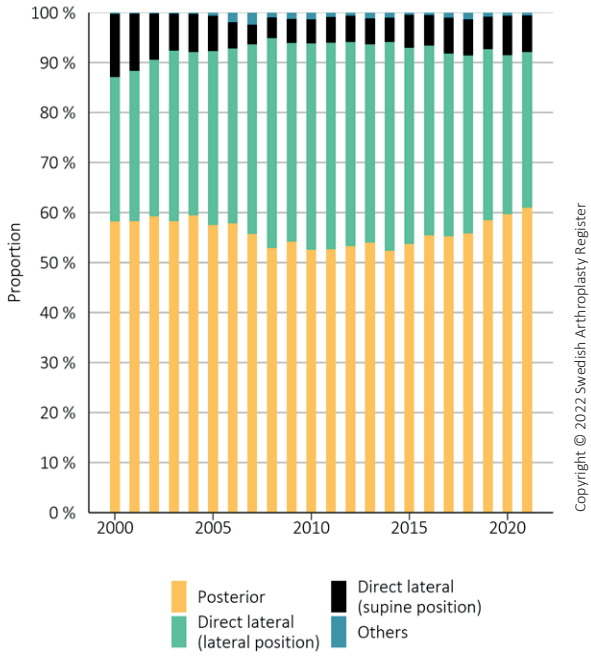


Figure 5.1.2. Time trend for surgical approach.

Choice of prosthesis

The most common prostheses are presented in tables 5.1.6–5.1.11. The five most used cemented cups in 2021 accounted for more than 93% of the total number of cups of their kind. On the stem side, Lubinus SPII, Exeter and MS30 are dominating. Together they account for 99% of all cemented stems. Since 2018 the register has collected data on type of cement. In the last three years Refobacin and Palacos have been the most reported. In 2021, one of these two brands were used in slightly more than 85% of the reported cases. Detailed data on cement type are shown in table 5.1.13 (a-c).

The variation of uncemented cups seems to be larger when compared to cemented designs. The five most commonly used cups accounted for 77% of all uncemented cups reported to the register. Continues slowdown is noted when it comes to the use of trabecular cups, probably because of remaining uncertainty about their long-term performance. There are reports about increased risk of dislocation for some of these designs, as previously noted in our annual reports. There are also other reports about increased frequency of radiolucency around these cups, still with uncertain clinical relevance. Until more information is available based on long-term results we suggest that these implants should be used with some restraint and preferably also be monitored more closely when being introduced (see also Chapter 5.5).

Regarding uncemented stems the diversification is less pronounced than on the cup side. Since 2009 the Corail stem has been the most used uncemented stem. The Corail stem accounts for 30% of all uncemented stems reported to the register in 2021.

There is a difference between regions concerning choice of method of fixation (figure 5.1.5). This difference may depend on local variations in patient demographics but may also reflect local preferences on unit level.

Use of cups with highly cross-linked polyethylene continues to increase. In 2021, these types of cups were almost exclusively chosen for uncemented cups (99% of all cases reported in 2021), whereas 11% of the cemented cups were made of "older" types of polyethylene. The proportion of ceramic-polyethylene articulation continues to increase. In 2021 this articulation was used in 27% of the operations, the corresponding proportion in 2020 was 26%. Femoral heads with a diameter of 32-millimeter continues to increase while the use of 36-millimetre femoral heads has stayed around 10% over the last few years, including 2021. Time trends regarding the choice of articulation and femoral head size are visualized in figures 5.1.6 and 5.1.7.

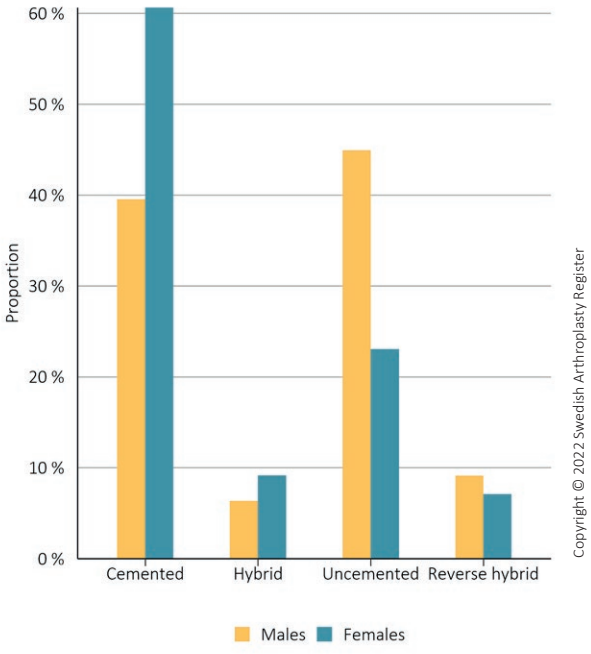


Figure 5.1.3. Distribution of fixation, sex.

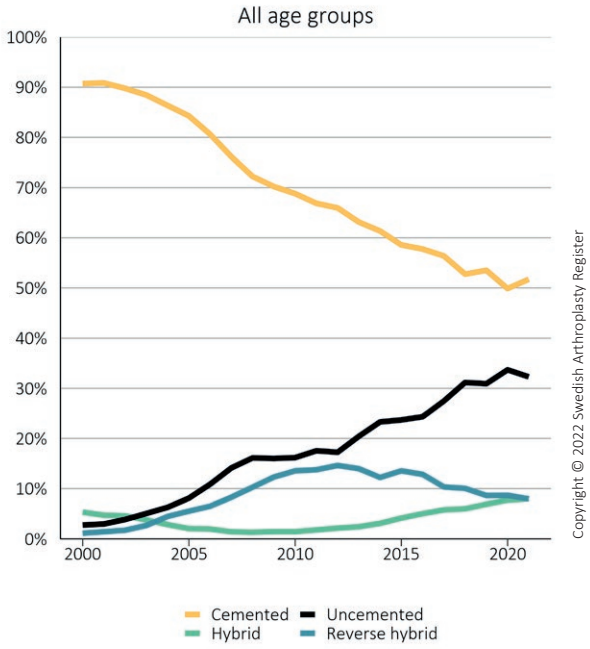


Figure 5.1.4 a. Time trend for fixation method.

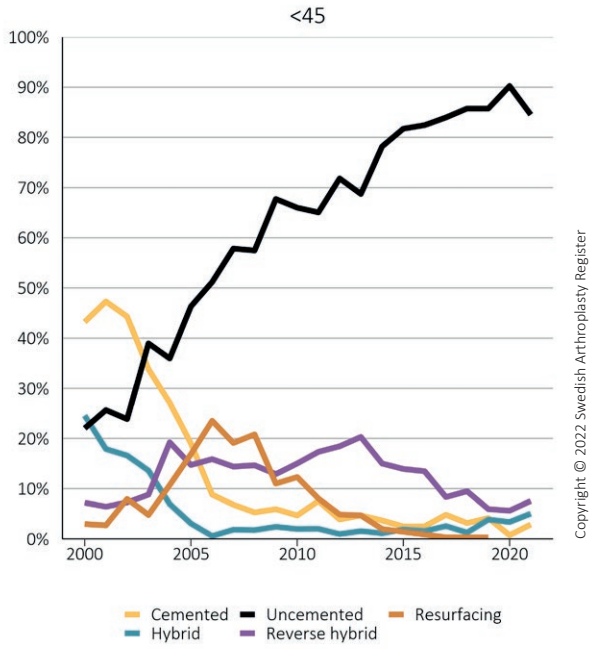


Figure 5.1.4 b. Time trend for fixation method, <45 years.

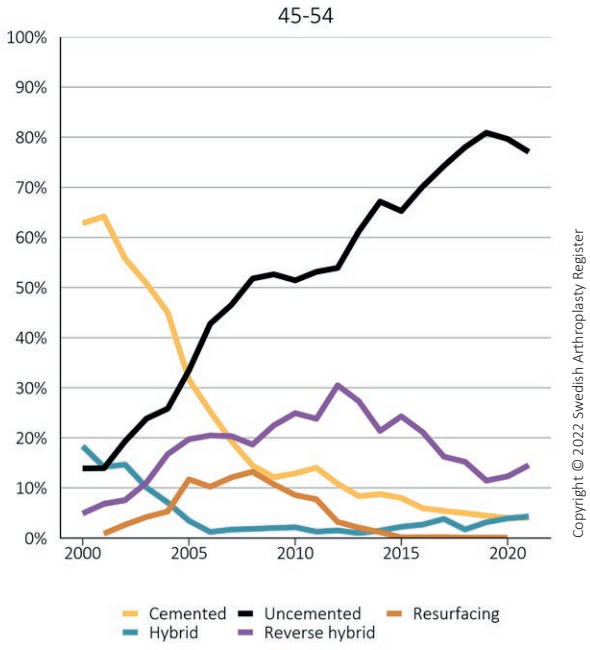


Figure 5.1.4 c. Time trend for fixation method, 45–54 years.

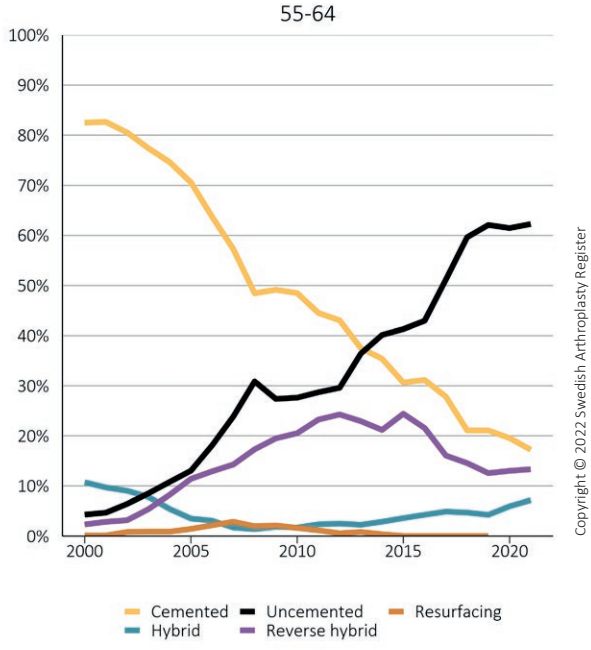


Figure 5.1.4 d. Time trend for fixation method, 55–64 years.

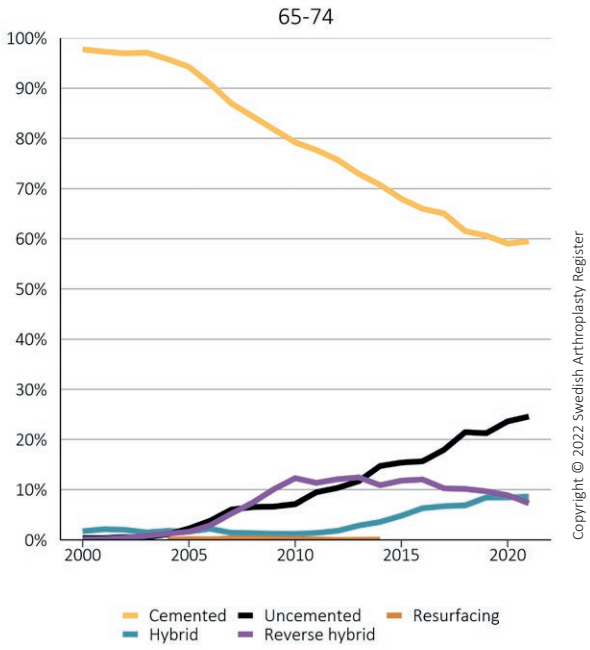


Figure 5.1.4 e. Time trend for fixation method, 65–74 years.

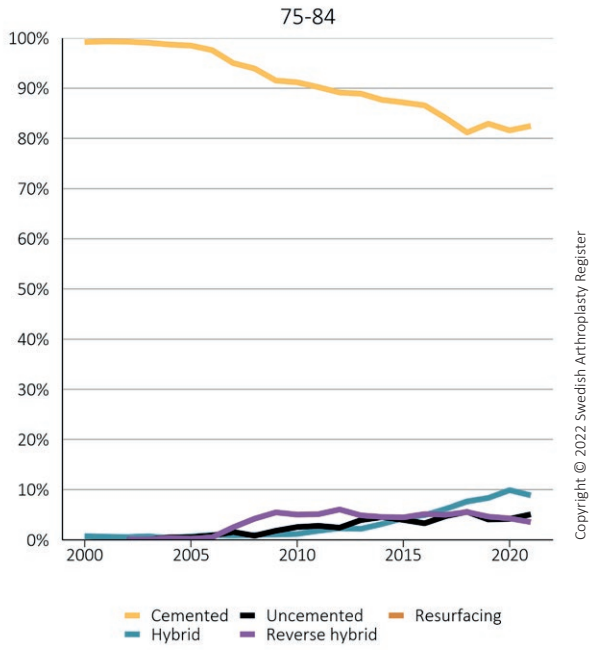


Figure 5.1.4 f. Time trend for fixation method, 75–84 years.

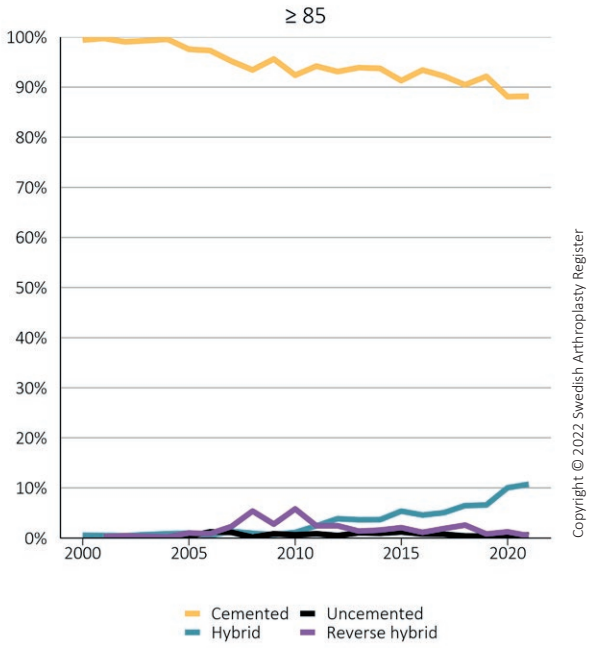


Figure 5.1.4 g. Time trend for fixation method, ≥85 years.

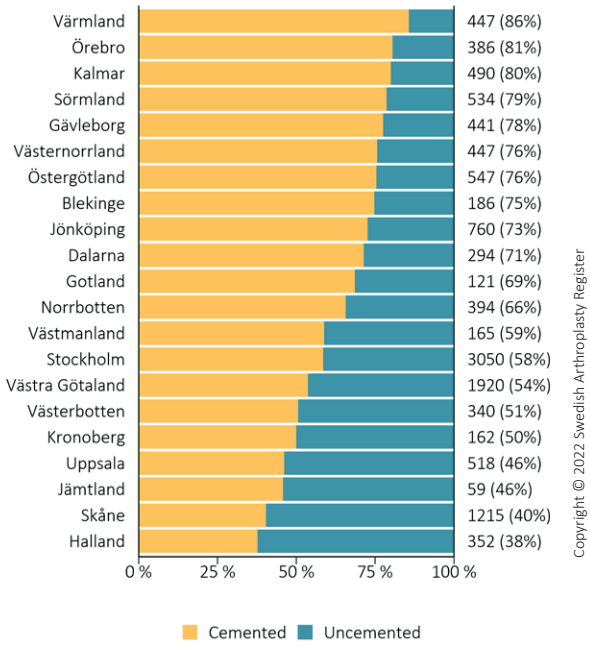


Figure 5.1.5. Use of fixation method per region. To the right, the number and percentage of cemented elective primary total hip replacements.

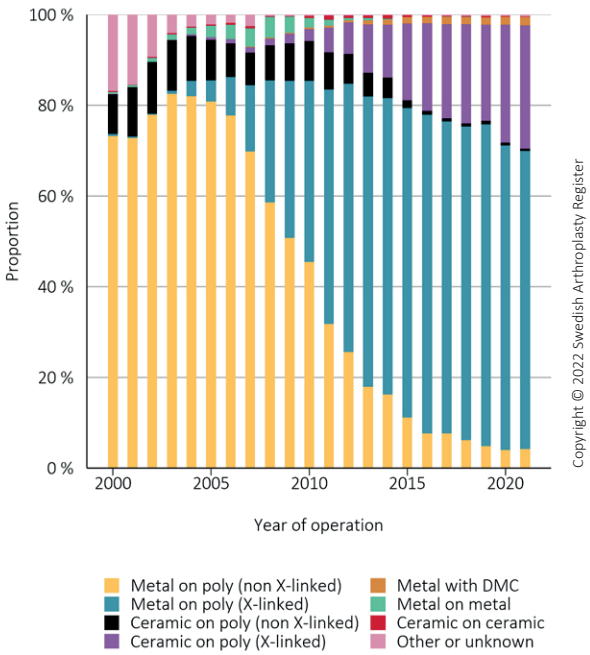


Figure 5.1.6. Time trend for articulation.

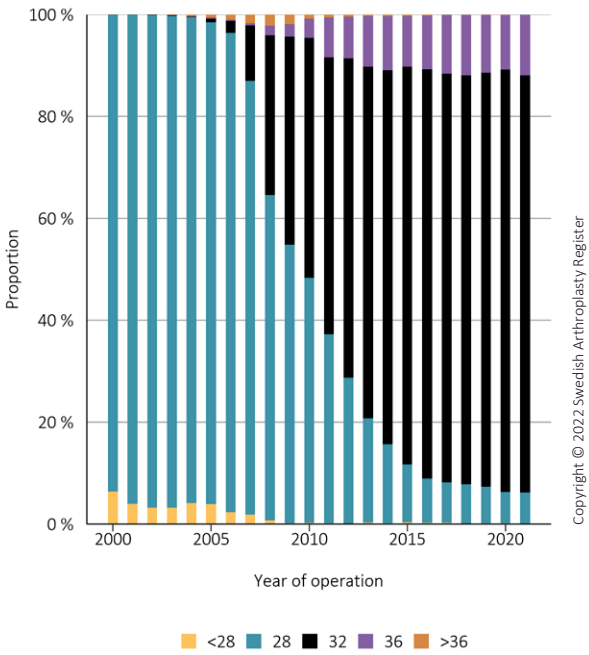


Figure 5.1.7. Time trend for head size.

All primary replacements per unit and year

Unit	2000 – 2017	2018	2019	2020	2021
Akademiska sjukhuset	3,162	106	100	71	110
Aleris Specialistvård Bollnäs	1,681	338	270		
Aleris Specialistvård Motala	4,059	595	105		
Aleris Specialistvård Nacka	1,533	243	263	304	393
Aleris Specialistvård Ängelholm	381	64	231	326	449
Alingsås	3,178	179	186	126	114
Art Clinic Göteborg	145	109	94	212	317
Art Clinic Jönköping	157	136	190	172	297
Arvika	2,306	215	231	132	287
Bollnäs	2,783		57	242	362
Borås	2,329	110	127	42	38
Capio Artro Clinic	259	357	395	517	641
Capio Movement	2,703	366	327	428	478
Capio Ortopedi Motala	1		353	295	356
Capio Ortopediska Huset	6,24	634	687	609	776
Capio S:t Göran	7,258	513	568	313	343
Carlanderska	1,758	265	393	499	559
Danderyd	5,193	205	183	105	121
Eksjö	3,321	224	231	154	250
Enköping	4,24	440	424	409	464
Eskilstuna	1,141	85	51	62	72
Falköping	2,446		107	42	
Falun	4,801	153	131	57	99
Frölundaortopeden	12	13	12	10	17
GHP Ortho Center Göteborg	1,335	234	306	296	319
GHP Ortho Center Stockholm	5,79	731	795	735	819
Gällivare	1,473	102	91	72	46
Gävle	2,512	103	131	118	63
Halmstad	3,217	170	203	151	116
Helsingborg	1,414	17	24	47	55
Hermelinen	61	20	26	21	30
Hudiksvall	1,928	70	86	50	54
Hässleholm	12,138	742	855	608	641
Jönköping	2,883	209	154	49	57
Kalmar	2,596	152	144	74	59

The table continues on the next page.

All primary replacements per unit and year, cont.

Unit	2000 – 2017	2018	2019	2020	2021
Karlshamn	3,423	280	308	209	176
Karlskoga	2,155	2			
Karlskrona	289	11	11	16	10
Karlstad	2,961	116	106	49	44
Karolinska Huddinge	3,39	145	189	148	194
Karolinska Solna	2,903	75	44	30	36
Kristianstad	32	2		1	
Kullbergska sjukhuset	3,751	259	327	225	318
Kungälv	2,947	158	194	69	57
Lidköping	2,933	171	231	163	108
Lindesberg	3,511	653	573	343	410
Linköping	1,196	64	89	76	92
Ljungby	2,252	174	164	93	103
Lycksele	4,54	309	238	287	232
Mora	3,114	238	231	206	207
Norrköping	3,018	184	193	132	132
Norrtälje	1,778	141	177	107	125
Nyköping	2,151	123	132	86	109
NÄL	10		4	7	1
Oskarshamn	3,575	287	395	281	303
Piteå	4,862	438	526	322	344
Skellefteå	1,824	126	109	99	96
Skene	1,79	171	184	120	125
Skövde	2,2	58	24	13	25
Sollefteå	2,348	315	308	203	379
Sophiahemmet	3,843	267	267	214	257
Specialistcenter Scandinavia, Eskilstuna	0		5	10	99
SU/Mölndal	4,412	465	494	238	230
Sunderby sjukhus	736	1	2	5	2
Sundsvall	2,429	6	32	7	8
SUS/Lund	1,339	54	43	45	44
SUS/Malmö	908	4	3	1	1
Södersjukhuset	4,55	189	224	95	64
Södertälje	1,923	143	137	97	105
Torsby	1,603	108	111	74	168

The table continues on the next page.

All primary replacements per unit and year, cont.

Unit	2000 – 2017	2018	2019	2020	2021
Trelleborg	8,648	683	673	286	376
Uddevalla	4,947	368	371	197	245
Umeå	1,037	32	82	37	37
Varberg	3,516	264	222	176	157
Visby	1,754	115	136	112	127
Värnamo	2,146	140	138	103	174
Västervik	1,806	141	139	89	132
Västerås	3,869	326	420	212	268
Växjö	1,878	99	151	114	83
Ystad	527				1
Ängelholm	1,705	169	198	134	118
Örebro	2,204	25	8	1	4
Örnsköldsvik	2,515	119	136	89	83
Östersund	3,5	264	249	175	80

Table 5.1.2. Number of primary operations per unit and year. Units with fewer than 20 primary replacements are excluded.

Demography 2018–2021

	2018	2019	2020	2021
Number	16,382	17,529	13,144	15,291
Age mean (SD)	68.33 (10.69)	68.53 (10.71)	67.82 (10.82)	68.53 (10.76)
Age group (%)				
<45	316 (1.9)	338 (1.9)	267 (2.0)	280 (1.8)
45–54	1,505 (9.2)	1,607 (9.2)	1,317 (10.0)	1,393 (9.1)
55–64	3,532 (21.6)	3,627 (20.7)	3,092 (23.5)	3,397 (22.2)
65–74	6,143 (37.5)	6,519 (37.2)	4,627 (35.2)	5,249 (34.3)
75–84	4,194 (25.6)	4,712 (26.9)	3,359 (25.6)	4,326 (28.3)
≥ 85	692 (4.2)	726 (4.1)	482 (3.7)	646 (4.2)
Females (%)	9,372 (57.2)	10,094 (57.6)	7,483 (56.9)	8,826 (57.7)
BMI (%)				
<18.5	112 (0.7)	128 (0.7)	90 (0.7)	117 (0.8)
18.5–24.9	4,979 (30.9)	5,388 (31.0)	4,084 (31.4)	4,794 (31.6)
25–29.9	6,817 (42.3)	7,315 (42.0)	5,492 (42.3)	6,341 (41.8)
30–34.9	3,264 (20.2)	3,608 (20.7)	2,605 (20.1)	3,079 (20.3)
35–39.9	816 (5.1)	845 (4.9)	630 (4.8)	728 (4.8)
≥40	135 (0.8)	124 (0.7)	89 (0.7)	97 (0.6)
ASA class (%)				
ASA I	3,521 (21.7)	3,477 (19.9)	2,899 (22.3)	3,045 (20.0)
ASA II	9,750 (60.2)	1,0740 (61.6)	7,981 (61.3)	9,484 (62.3)
ASA III	2,856 (17.6)	3167 (18.2)	2,104 (16.2)	2,648 (17.4)
ASA IV	69 (0.4)	64 (0.4)	34 (0.3)	48 (0.3)

Table 5.1.3. Demography 2018–2021.

Case-mix per unit 2021

Unit	Number	Females %	< 55 years %	Charnley C %	BMI ≥ 35 %	ASA ≥ III
Akademiska sjukhuset	110	50.9	18.2	28.2	9.1	43.9
Aleris Specialistvård Nacka	393	46.6	15.5	31.3	2.3	3.8
Aleris Specialistvård Ängelholm	449	42.5	11.6	25.4	2.5	5.1
Alingsås	114	36.8	6.1	35.1	6.1	14
Art Clinic Göteborg	317	36.9	15.5	25.6	1	1.6
Art Clinic Jönköping	297	46.5	13.5	26.3	5.7	0.7
Arvika	287	39.7	4.9	18.5	4.3	4.3
Bollnäs	362	43.1	10.8	31.8	3	9.1
Borås	38	39.5	5.3	28.9	7.9	55.3
Capio Artro Clinic	641	39.2	15.8	26.5	2.7	2.2
Capio Movement	478	40.4	10.9	18.4	7.1	19.7
Capio Ortopedi Motala	356	42.4	7.9	22.8	3.4	19
Capio Ortopediska Huset	776	37.5	11.6	25.5	1.7	0.5
Capio S:t Göran	343	33.5	7.6	19	7.6	56.4
Carlanderska	559	43.8	13.4	14	5.6	5.4
Danderyd	121	40.5	6.6	5.8	8.3	50.4
Eksjö	250	48.4	10.8	24.8	3.9	19.8
Enköping	464	39.7	6.2	17.7	5.8	14.7
Eskilstuna	72	55.6	13.9	31.9	0	27.8
Falun	99	42.4	7.1	30.3	14.4	38.4
GHP Ortho Center Göteborg	319	51.1	25.1	15	0.3	2.5
GHP Ortho Center Stockholm	819	44.7	14	26.7	2.2	2.8
Gällivare	46	32.6	6.5	30.4	4.4	23.9
Gävle	63	41.3	7.9	33.3	16.1	52.4
Halmstad	116	36.2	11.2	19.8	5.2	13.8
Helsingborg	55	56.4	3.6	30.9	12.7	63.6
Hermelinen	30	50	10	33.3	16.7	0
Hudiksvall	54	48.1	5.6	22.2	3.7	42.6
Hässleholm	641	43.2	7.8	35.3	5.3	19
Jönköping	57	45.6	15.8	33.3	10.9	35.1
Kalmar	59	33.9	11.9	39	5.1	28.8
Karlshamn	176	36.4	9.7	26.1	9.1	10.3
Karlstad	44	36.4	13.6	22.7	2.4	25
Karolinska Huddinge	194	39.2	13.4	24.7	6.2	51.5
Karolinska Solna	36	38.9	44.4	16.7	2.9	31.4
Kullbergska sjukhuset	318	41.2	7.5	34.9	7.9	15.8

The table continues on the next page.

Case-mix per unit 2021, cont.

Unit	Number	Females %	< 55 years %	Charnley C %	BMI ≥ 35 %	ASA ≥ III
Kungälv	57	38.6	7	19.3	7	35.1
Lidköping	108	40.7	6.5	36.1	6.5	28.7
Lindesberg	410	46.1	8.3	14.4	9.3	24.4
Linköping	92	40.2	26.1	0	13.5	23.3
Ljungby	103	38.8	4.9	33	10.8	23.3
Lycksele	232	43.5	8.2	26.3	4.7	16.2
Mora	207	37.2	6.3	29	3.9	26.6
Norrköping	132	47	14.4	21.2	4.6	17.8
Norrtälje	125	48.8	4	21.6	7.2	39.2
Nyköping	109	43.1	8.3	38.5	6.4	21.1
Oskarshamn	303	40.3	6.9	37.6	6	13.6
Piteå	344	45.1	9.9	32.6	9.9	24.6
Skellefteå	96	43.8	5.2	16.7	10.4	24.2
Skene	125	38.4	8.8	36	3.2	7.2
Skövde	25	20	8	52	24	48
Sollefteå	379	41.7	5.3	34.3	0.8	15.3
Sophiahemmet	257	62.3	24.1	21.4	2.8	3.9
Specialistcenter Scandinavia, Eskilstuna	99	44.4	16.2	21.2	1	3.1
SU/Mölndal	230	40.9	13.9	16.5	4.9	23.5
SUS/Lund	44	40.9	9.1	22.7	11.4	61.4
Södersjukhuset	64	37.5	9.4	21.9	16.1	75
Södertälje	105	40	6.7	34.3	8.6	52.4
Torsby	168	42.3	7.1	32.1	4.2	22.6
Trelleborg	376	41	13.6	33.8	11.7	26.9
Uddevalla	245	38	9.4	38	12.3	35.7
Umeå	37	43.2	10.8	24.3	11.4	36.1
Varberg	157	43.3	5.7	27.4	7	17.3
Visby	127	46.5	7.9	31.5	4.3	16
Värnamo	174	44.8	5.2	27.6	2.9	35.6
Västervik	132	43.9	9.8	34.1	3.1	12.1
Västerås	268	45.1	9.7	29.5	9	33
Växjö	83	33.7	14.5	31.3	7.4	28.9
Ängelholm	118	33.1	8.5	31.4	8.5	32.2
Örnsköldsvik	83	43.4	7.2	42.2	7.4	32.9
Östersund	80	31.2	7.5	28.8	13	35
Country	**15,291**	**42.3**	**10.9**	**26.2**	**5.4**	**17.7**

Table 5.1.4. Case-mix per unit 2021. Units with fewer than 20 replacements are not presented, however, included in national data. Note that percentages for units with few replacements may be misleading.

Number of replacements per type of fixation and age 2021

Age group	< 45	45–54	55–64	65–74	75–84	≥ 85
Number (%)	**280**	**1,393**	**3,397**	**5,249**	**4,326**	**646**
Type of fixation						
Cemented	8 (2.9)	57 (4.1)	584 (17.2)	3,119 (59.5)	3,562 (82.5)	567 (88.2)
Hybrid	14 (5.0)	60 (4.3)	243 (7.2)	451 (8.6)	383 (8.9)	69 (10.7)
Uncemented	235 (84.5)	1,072 (77.1)	2,112 (62.3)	1,288 (24.6)	220 (5.1)	4 (0.6)
Reverse hybrid	21 (7.6)	202 (14.5)	452 (13.3)	384 (7.3)	154 (3.6)	3 (0.5)
Resurfacing	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Table 5.1.5. Number of operations per type of fixation and age group 2021.

Most common implants

	2000–2021	2000–2009	2010–2019	2020	2021
Number	**298,615**	**123,461**	**137,079**	**13,144**	**15,291**
Implant (%)					
Lubinus (SPII standard)	63,606 (21.3)	43,866 (35.5)	15,691 (11.4)	504 (3.8)	587 (3.8)
Lubinus x-link (SPII standard)	33,500 (11.2)	22 (0.0)	26,819 (19.6)	2,987 (22.7)	3,672 (24.0)
Exeter Rim-fit (Exeter standard)	13,620 (4.6)	99 (0.1)	11,355 (8.3)	956 (7.3)	1,210 (7.9)
Exeter (Exeter standard)	10,049 (3.4)	8,628 (7.0)	65 (0.0)	0 (0.0)	0 (0.0)
Marathon (Exeter standard)	9,851 (3.3)	1,466 (1.2)	7,649 (5.6)	388 (3.0)	348 (2.3)
ZCA XLPE (MS-30 polished)	9,112 (3.1)	3,362 (2.7)	5,360 (3.9)	188 (1.4)	202 (1.3)
Elite Ogee (Exeter standard)	6,651 (2.2)	6,298 (5.1)	20 (0.0)	0 (0.0)	0 (0.0)
Pinnacle W/Cripton 100 (Corail standard)	6,351 (2.1)	0 (0.0)	4,493 (3.3)	966 (7.3)	892 (5.8)
Contemporary Hoded Duration (Exeter standard)	6,219 (2.1)	4,208 (3.4)	2,010 (1.5)	0 (0.0)	0 (0.0)
Trilogy (CLS)	5,938 (2.0)	2,546 (2.1)	2,531 (1.8)	402 (3.1)	452 (3.0)
FAL (SPII standard)	5,501 (1.8)	4,812 (3.9)	528 (0.4)	0 (0.0)	0 (0.0)
Exeter Rim-fit (MS-30 polished)	4,660 (1.6)	20 (0.0)	3,081 (2.2)	687 (5.2)	872 (5.7)
Reflection all-poly (Spectron EF Primary)	4,803 (1.6)	4,355 (3.5)	5 (0.0)	0 (0.0)	0 (0.0)
Contemporary (Exeter standard)	3,482 (1.2)	3,334 (2.7)	129 (0.1)	0 (0.0)	0 (0.0)
Trident hemi (Exeter standard)	3,432 (1.1)	66 (0.1)	2,648 (1.9)	362 (2.8)	356 (2.3)
Other	111,840 (37.5)	40,379 (32.7)	54,695 (39.9)	5,704 (43.4)	6,700 (43.8)

Table 5.1.6. Most common implants 2000–2021.

Most common cemented implants

	2000 – 2021	2000 – 2009	2010 – 2019	2020	2021
Number	**201,432**	**97,400**	**80,850**	**6,549**	**7,897**
Implant (%)					
Lubinus (SPII standard)	63,599 (31.6)	43,864 (45.0)	15,689 (19.4)	502 (7.7)	586 (7.4)
Lubinus x-link (SPII standard)	33,447 (16.6)	22 (0.0)	26,773 (33.1)	2,983 (45.5)	3,669 (46.5)
Exeter Rim-fit (Exeter standard)	13,605 (6.8)	99 (0.1)	11,345 (14.0)	951 (14.5)	1,210 (15.3)
Exeter (Exeter standard)	10,048 (5.0)	8,627 (8.9)	65 (0.1)	0 (0.0)	0 (0.0)
Marathon (Exeter standard)	9,802 (4.9)	1,466 (1.5)	7,605 (9.4)	388 (5.9)	343 (4.3)
ZCA XLPE (MS-30 polished)	9,111 (4.5)	3,362 (3.5)	5,360 (6.6)	188 (2.9)	201 (2.5)
Elite Ogee (Exeter standard)	6,650 (3.3)	6,297 (6.5)	20 (0.0)	0 (0.0)	0 (0.0)
Contemporary Hoded Duration (Exeter standard)	6,218 (3.1)	4,208 (4.3)	2,009 (2.5)	0 (0.0)	0 (0.0)
FAL (SPII standard)	5,499 (2.7)	4,810 (4.9)	528 (0.7)	0 (0.0)	0 (0.0)
Reflection all-poly (Spectron EF Primary)	4,803 (2.4)	4,355 (4.5)	5 (0.0)	0 (0.0)	0 (0.0)
Exeter Rim-fit (MS-30 polished)	4,659 (2.3)	20 (0.0)	3,081 (3.8)	686 (10.5)	872 (11.0)
Contemporary (Exeter standard)	3,482 (1.7)	3,334 (3.4)	129 (0.2)	0 (0.0)	0 (0.0)
Charnley LPW (Charnley)	2,009 (1.0)	1,308 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
ZCA XLPE (SPII standard)	1,991 (1.0)	1,033 (1.1)	957 (1.2)	1 (0.0)	0 (0.0)
Charnley OGEE (Charnley)	1,972 (1.0)	1,268 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
Other	24,537 (12.2)	13,327 (13.7)	7,284 (9.0)	850 (13.0)	1,016 (12.9)

Table 5.1.7. Most common cemented implants 2000 –2021.

Most common uncemented implants

	2000–2021	2000–2009	2010–2019	2020	2021
Number	**55,467**	**12,637**	**33,207**	**4,425**	**4,931**
Implant (%)					
Pinnacle W/Cripton 100 (Corail standard)	6,350 (11.4)	0 (0.0)	4,492 (13.5)	966 (21.8)	892 (18.1)
Trilogy (CLS)	5,936 (10.7)	2,546 (20.1)	2,530 (7.6)	402 (9.1)	451 (9.1)
Pinnacle 100 (Corail standard)	2,600 (4.7)	210 (1.7)	1,874 (5.6)	236 (5.3)	280 (5.7)
Pinnacle W/Cripton 100 (Corail high offset)	2,474 (4.5)	0 (0.0)	1,840 (5.5)	365 (8.2)	269 (5.5)
Allofit (CLS)	2,086 (3.8)	1,336 (10.6)	635 (1.9)	68 (1.5)	47 (1.0)
Trident hemi (Accolade II)	1,920 (3.5)	0 (0.0)	1,222 (3.7)	263 (5.9)	435 (8.8)
Continuum (CLS)	1,749 (3.2)	37 (0.3)	1,674 (5.0)	26 (0.6)	12 (0.2)
Pinnacle W/Cripton 100 (Corail coxa vara)	1,559 (2.8)	0 (0.0)	945 (2.8)	289 (6.5)	325 (6.6)
Exceed ABT Ringlock (Bi-Metric X por HA NC)	1,494 (2.7)	2 (0.0)	1,492 (4.5)	0 (0.0)	0 (0.0)
Pinnacle 100 (Corail coxa vara)	1,028 (1.9)	39 (0.3)	623 (1.9)	151 (3.4)	215 (4.4)
Continuum (M/L Taper)	977 (1.8)	0 (0.0)	720 (2.2)	142 (3.2)	115 (2.3)
CLS (CLS)	954 (1.7)	840 (6.6)	73 (0.2)	0 (0.0)	0 (0.0)
Trilogy IT (Bi-Metric X por HA NC)	928 (1.7)	1 (0.0)	927 (2.8)	0 (0.0)	0 (0.0)
G7 PPS (Echo Bi-Metric (FPP))	906 (1.6)	0 (0.0)	456 (1.4)	211 (4.8)	239 (4.8)
Trident AD WHA (Accolade straight)	859 (1.5)	657 (5.2)	202 (0.6)	0 (0.0)	0 (0.0)
Other	23,647 (42.6)	6,969 (55.1)	13,502 (40.7)	1,306 (29.5)	1,651 (33.5)

Table 5.1.8. Most common uncemented implants 2000–2021.

Most common hybrid implants

	2000–2021	2000–2009	2010–2019	2020	2021
Number	**11,576**	**2,997**	**5,829**	**1,016**	**1,220**
Implant (%)					
Trident hemi (Exeter standard)	3,432 (29.6)	66 (2.2)	2,648 (45.4)	362 (35.6)	356 (29.2)
Trilogy (SPII standard)	1,251 (10.8)	821 (27.4)	305 (5.2)	0 (0.0)	0 (0.0)
Trilogy (Spectron EF Primary)	957 (8.3)	798 (26.6)	0 (0.0)	0 (0.0)	0 (0.0)
Pinnacle W/Cripton 100 (MS-30 polished)	631 (5.5)	0 (0.0)	75 (1.3)	220 (21.7)	336 (27.5)
Tritanium (Exeter standard)	310 (2.7)	0 (0.0)	280 (4.8)	15 (1.5)	15 (1.2)
Pinnacle sector (SPII standard)	306 (2.6)	3 (0.1)	247 (4.2)	27 (2.7)	29 (2.4)
Trident AD LW (Exeter standard)	252 (2.2)	6 (0.2)	194 (3.3)	26 (2.6)	26 (2.1)
Pinnacle W/Gription Sector (MS-30 polished)	227 (2.0)	0 (0.0)	126 (2.2)	42 (4.1)	59 (4.8)
Pinnacle W/Gription Sector (Exeter standard)	206 (1.8)	0 (0.0)	156 (2.7)	32 (3.1)	18 (1.5)
Trilogy IT (SPII standard)	202 (1.7)	0 (0.0)	148 (2.5)	27 (2.7)	27 (2.2)
Trilogy (MS-30 polerad)	195 (1.7)	77 (2.6)	46 (0.8)	31 (3.1)	41 (3.4)
TOP pressfit (SPII standard)	159 (1.4)	147 (4.9)	4 (0.1)	0 (0.0)	0 (0.0)
Pinnacle W/Cripton 100 (SPII standard)	158 (1.4)	0 (0.0)	80 (1.4)	38 (3.7)	40 (3.3)
Continuum (MS-30 polished)	144 (1.2)	0 (0.0)	144 (2.5)	0 (0.0)	0 (0.0)
Continuum (SPII standard)	136 (1.2)	0 (0.0)	113 (1.9)	11 (1.1)	12 (1.0)
Other	3,010 (26.0)	1,079 (36.0)	1,263 (21.7)	185 (18.2)	261 (21.4)

Table 5.1.9. Most common hybrid implants 2000–2021.

Most common reverse hybrid implants

	2000–2021	2000–2009	2010–2019	2020	2021
Number	**27,526**	**8,570**	**16,490**	**1,140**	**1,216**
Implant (%)					
Exeter Rim-fit (Corail standard)	2 327 (8,5)	7 (0,1)	2 090 (12,7)	211 (18,5)	19 (1,6)
Marathon (Corail standard)	2 172 (7,9)	345 (4,0)	1 775 (10,8)	27 (2,4)	25 (2,1)
Lubinus (Corail standard)	1 974 (7,2)	598 (7,0)	1 294 (7,8)	36 (3,2)	46 (3,8)
Lubinus x-link (Corail standard)	1 937 (7,0)	1 (0,0)	1 378 (8,4)	198 (17,4)	360 (29,6)
Marathon (Corail high offset)	1 134 (4,1)	243 (2,8)	881 (5,3)	4 (0,4)	6 (0,5)
Marathon (ABG II HA)	1 019 (3,7)	94 (1,1)	925 (5,6)	0 (0,0)	0 (0,0)
Marathon (Bi-Metric X por HA NC)	903 (3,3)	169 (2,0)	734 (4,5)	0 (0,0)	0 (0,0)
Exeter Rim-fit (M/L Taper)	841 (3,1)	0 (0,0)	67 (0,4)	370 (32,5)	404 (33,2)
Exeter Rim-fit (Corail high offset)	724 (2,6)	1 (0,0)	685 (4,2)	33 (2,9)	5 (0,4)
Lubinus x-link (Corail coxa vara)	681 (2,5)	0 (0,0)	563 (3,4)	36 (3,2)	82 (6,7)
Lubinus (Corail coxa vara)	649 (2,4)	236 (2,8)	400 (2,4)	7 (0,6)	6 (0,5)
Lubinus (CLS)	598 (2,2)	378 (4,4)	220 (1,3)	0 (0,0)	0 (0,0)
Lubinus x-link (Bi-Metric X por HA NC)	553 (2,0)	0 (0,0)	553 (3,4)	0 (0,0)	0 (0,0)
Lubinus (Bi-Metric X por HA NC)	552 (2,0)	394 (4,6)	158 (1,0)	0 (0,0)	0 (0,0)
ZCA XLPE (Corail standard)	516 (1,9)	140 (1,6)	373 (2,3)	3 (0,3)	0 (0,0)
Övriga	10 946 (39,8)	5 964 (69,6)	4 394 (26,6)	215 (18,9)	263 (21,6)

Table 5.1.10. Most common reverse hybrid implants 2000–2021.

Most common cup components

	2000–2021	2000–2009	2010–2019	2020	2021
Number	**298,615**	**123,461**	**137,079**	**13,144**	**15,291**
Implant (%)					
Lubinus	68,494 (22.9)	45,990 (37.3)	18,303 (13.4)	573 (4.4)	663 (4.3)
Lubinus x-link	38,593 (12.9)	23 (0.0)	30,870 (22.5)	3,374 (25.7)	4,326 (28.3)
Exeter Rim-fit	22,827 (7.6)	131 (0.1)	17,855 (13.0)	2,301 (17.5)	2,540 (16.6)
Marathon	17,380 (5.8)	2,633 (2.1)	13,714 (10.0)	535 (4.1)	498 (3.3)
ZCA XLPE	14,182 (4.8)	5,980 (4.8)	7,801 (5.7)	199 (1.5)	202 (1.3)
Trilogy	12,072 (4.0)	6,562 (5.3)	4,212 (3.1)	435 (3.3)	497 (3.3)
Pinnacle W/Cripton 100	11,938 (4.0)	0 (0.0)	7,599 (5.5)	2,097 (16.0)	2,242 (14.7)
Exeter	10,870 (3.6)	9,393 (7.6)	71 (0.1)	0 (0.0)	0 (0.0)
Elite Ogee	10,406 (3.5)	9,420 (7.6)	263 (0.2)	0 (0.0)	0 (0.0)
Contemporary Hoded Duration	7,668 (2.6)	5,046 (4.1)	2,621 (1.9)	0 (0.0)	0 (0.0)
Trident hemi	7,472 (2.5)	710 (0.6)	5,121 (3.7)	694 (5.3)	947 (6.2)
FAL	5,759 (1.9)	5,021 (4.1)	576 (0.4)	0 (0.0)	0 (0.0)
Continuum	5,554 (1.9)	65 (0.1)	5,010 (3.7)	280 (2.1)	199 (1.3)
Reflection all-poly	4,993 (1.7)	4,529 (3.7)	16 (0.0)	0 (0.0)	0 (0.0)
Pinnacle 100	4,635 (1.6)	349 (0.3)	3,167 (2.3)	496 (3.8)	623 (4.1)
Other	55,687 (18.7)	27,581 (22.3)	19,870 (14.5)	2,147 (16.4)	2,525 (16.5)

Table 5.1.11. Most common cup components 2000–2021.

Most common stem components

	2000–2021	2000–2009	2010–2019	2020	2021
Number	**298,615**	**123,461**	**137,079**	**13,144**	**15,291**
Implant (%)					
SPII standard	114,889 (38.5)	53,211 (43.1)	49,232 (35.9)	4,023 (30.6)	4,881 (31.9)
Exeter standard	59,478 (19.9)	27,125 (22.0)	26,307 (19.2)	1,930 (14.7)	2,176 (14.2)
Corail standard	23,343 (7.8)	2,301 (1.9)	17,319 (12.6)	1,866 (14.2)	1,856 (12.1)
MS-30 polished	18,429 (6.2)	4,422 (3.6)	10,377 (7.6)	1,543 (11.7)	1,982 (13.0)
CLS	14,720 (4.9)	7,021 (5.7)	6,461 (4.7)	571 (4.3)	584 (3.8)
Bi-Metric X por HA NC	8,964 (3.0)	3,451 (2.8)	5,513 (4.0)	0 (0.0)	0 (0.0)
Spectron EF Primary	7,947 (2.7)	7,128 (5.8)	128 (0.1)	1 (0.0)	0 (0.0)
Corail high offset	7,245 (2.4)	763 (0.6)	5,404 (3.9)	570 (4.3)	508 (3.3)
Corail coxa vara	6,186 (2.1)	501 (0.4)	4,310 (3.1)	620 (4.7)	755 (4.9)
Accolade II	4,176 (1.4)	0 (0.0)	2,812 (2.1)	573 (4.4)	791 (5.2)
Charnley	3,998 (1.3)	2,586 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)
ABG II HA	3,409 (1.1)	1,866 (1.5)	1,535 (1.1)	0 (0.0)	0 (0.0)
M/L Taper	3,265 (1.1)	0 (0.0)	1,549 (1.1)	761 (5.8)	955 (6.2)
CPT	2,430 (0.8)	1,711 (1.4)	396 (0.3)	46 (0.3)	47 (0.3)
Wagner Cone	2,185 (0.7)	626 (0.5)	1,356 (1.0)	85 (0.6)	75 (0.5)
Other	17,818 (6.0)	10,670 (8.6)	4,335 (3.2)	555 (4.2)	675 (4.4)

Table 5.1.12. Most common stem components 2000–2021.

Number and proportion of replacements per type of stem cement

	2019–2021	2019	2020	2021
Number	**27,258**	**10,577**	**7,565**	**9,116**
Stem cement n (%)				
Optipac Refobacin	13,503 (49.5)	4,999 (47.3)	3,562 (47.1)	4,942 (54.2)
Palacos R+G Pro	7,183 (26.4)	2,466 (23.3)	2,407 (31.8)	2,310 (25.3)
Palacos R+G (genta)	2,944 (10.8)	1,486 (14.0)	662 (8.8)	796 (8.7)
Refobacin Bone Cement (genta)	1,673 (6.1)	1,085 (10.3)	380 (5.0)	208 (2.3)
CMV	1,447 (5.3)	292 (2.8)	394 (5.2)	761 (8.3)
Copal (genta + clinda)	136 (0.5)	40 (0.4)	61 (0.8)	35 (0.4)
Copal (genta + vanco)	69 (0.3)	29 (0.3)	15 (0.2)	25 (0.3)
Refobacin Revision Cement (genta + clinda)	46 (0.2)	27 (0.3)	8 (0.1)	11 (0.1)
Smartset GHV (genta)	9 (0.0)	4 (0.0)	0 (0.0)	5 (0.1)
Other	248 (0.9)	149 (1.4)	76 (1.0)	23 (0.3)

Table 5.1.13 a. Number and proportion of replacements per type of stem cement and year 2019–2021.

Number and proportion of replacements per typ of cup cement

	2019–2021	2019	2020	2021
Number	**27,682**	**10,884**	**7,687**	**9,111**
Cup cement n (%)				
Optipac Refobacin	12,924 (46.7)	4,860 (44.7)	3,304 (43.0)	4,760 (52.2)
Palacos R+G Pro	6,985 (25.2)	2,457 (22.6)	2,505 (32.6)	2,023 (22.2)
CMV	3,254 (11.8)	1,042 (9.6)	855 (11.1)	1,357 (14.9)
Palacos R+G (genta)	2552 (9.2)	1,339 (12.3)	542 (7.1)	671 (7.4)
Refobacin Bone Cement (genta)	1,705 (6.2)	1,083 (10.0)	393 (5.1)	229 (2.5)
Copal (genta + clinda)	137 (0.5)	38 (0.3)	62 (0.8)	37 (0.4)
Copal (genta + vanco)	57 (0.2)	21 (0.2)	14 (0.2)	22 (0.2)
Refobacin Revision Cement (genta + clinda)	40 (0.1)	22 (0.2)	8 (0.1)	10 (0.1)
Smartset GHV (genta)	20 (0.1)	14 (0.1)	4 (0.1)	2 (0.0)
Other	8 (0.0)	8 (0.1)	0 (0.0)	0 (0.0)

Table 5.1.13 b. Number and proportion of replacements per type of cup cement and year 2019–2021.

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

	2019–2021	2019	2020	2021
Number	**31,1361**	**12,094**	**8,705**	**10,332**
Combination of stem and cup (%)				
Optipac Refobacin	14,640 (47.0)	5,453 (45.1)	3,770 (43.3)	5,417 (52.4)
Palacos R+G Pro	7,746 (24.9)	2,544 (21.0)	2,805 (32.2)	2,397 (23.2)
Palacos R+G (genta)	2,814 (9.0)	1,470 (12.2)	588 (6.8)	756 (7.3)
CMV	2,503 (8.0)	627 (5.2)	678 (7.8)	1,198 (11.6)
Refobacin Bone Cement (genta)	1,749 (5.6)	1,167 (9.6)	363 (4.2)	219 (2.1)
Different cement cup/stam	1,176 (3.8)	595 (4.9)	332 (3.8)	249 (2.4)
Copal (genta + clinda)	136 (0.4)	36 (0.3)	64 (0.7)	36 (0.3)
Copal (genta + vanco)	72 (0.2)	27 (0.2)	19 (0.2)	26 (0.3)
Refobacin Revision Cement (genta + clinda)	38 (0.1)	20 (0.2)	8 (0.1)	10 (0.1)
Smartset GHV (genta)	10 (0.0)	7 (0.1)	2 (0.0)	1 (0.0)
Other	247 (0.8)	148 (1.2)	76 (0.9)	23 (0.2)

Table 5.1.13 c. Number and proportion of replacements per type of the combination of stem and cup cement and year 2019–2021.

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

	2019–2021	Cemented 2019	Hybrid 2019	Reverse hybrid 2019	Cemented 2020	Hybrid 2020	Reverse hybrid 2020	Cemented 2021	Hybrid 2021	Reverse hybrid 2021
Number	**31,131**	**9,372**	**1,208**	**1,514**	**6,549**	**1,016**	**1,140**	**7,897**	**1,219**	**1,216**
Combination of stem and cup, n (%)										
Optipac Refobacin	14,640 (47.0)	4,316 (46.1)	629 (52.0)	508 (33.6)	2,966 (45.3)	519 (51.1)	285 (25.0)	4,216 (53.4)	679 (55.7)	522 (42.9)
Palacos R+G Pro	7,746 (24.9)	1,996 (21.3)	153 (12.7)	395 (26.1)	2,005 (30.6)	318 (31.3)	482 (42.3)	1,818 (23.0)	404 (33.1)	175 (14.4)
Palacos R+G (genta)	2,814 (9.0)	1,177 (12.6)	141 (11.7)	152 (10.0)	506 (7.7)	48 (4.7)	34 (3.0)	621 (7.9)	89 (7.3)	46 (3.8)
CMV	2,503 (8.0)	286 (3.1)	1 (0.1)	340 (22.5)	380 (5.8)	4 (0.4)	294 (25.8)	751 (9.5)	5 (0.4)	442 (36.3)
Refobacin Bone Cement (genta)	1,749 (5.6)	937 (10.0)	124 (10.3)	106 (7.0)	290 (4.4)	37 (3.6)	36 (3.2)	184 (2.3)	10 (0.8)	25 (2.1)
Different cement cup/stam	1,176 (3.8)	595 (6.3)	0 (0.0)	0 (0.0)	332 (5.1)	0 (0.0)	0 (0.0)	249 (3.2)	0 (0.0)	0 (0.0)
Other	247 (0.8)	8 (0.1)	140 (11.6)	0 (0.0)	0 (0.0)	76 (7.5)	0 (0.0)	0 (0.0)	23 (1.9)	0 (0.0)
Copal (genta + clinda)	136 (0.4)	33 (0.4)	2 (0.2)	1 (0.1)	56 (0.9)	5 (0.5)	3 (0.3)	33 (0.4)	1 (0.1)	2 (0.2)
Copal (genta + vanco)	72 (0.2)	19 (0.2)	7 (0.6)	1 (0.1)	10 (0.2)	5 (0.5)	4 (0.4)	18 (0.2)	5 (0.4)	3 (0.2)
Refobacin Revision Cement (genta + clinda)	38 (0.1)	4 (0.0)	11 (0.9)	5 (0.3)	4 (0.1)	4 (0.4)	0 (0.0)	7 (0.1)	3 (0.2)	0 (0.0)
Smartset GHV (genta)	10 (0.0)	1 (0.0)	0 (0.0)	6 (0.4)	0 (0.0)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)	1 (0.1)

Table 5.1.13 d. Number and proportion of replacements per type of the combination of stem and cup cement and type of fixation 2019–2021.

5.2 Reoperation hip replacement

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Reoperation comprises all types of surgical procedures that can be directly related to an earlier inserted hip prosthesis, regardless if the prosthesis or any of its parts are exchanged, extracted or left untouched. This section embraces all types of reoperations after inserted primary total hip replacement. Since 2001 the absolute number of reoperations increased successively until 2009 from 1,965 to about 2,450. Hereafter the number of procedures varied between 2,380 and 2,474 to decrease gradually starting in 2016 to 1,833 in 2020 and 1,866 in 2021 (figure 5.2.1). Between the periods 1995–1997 and 2019–2021 the proportion of reoperations related to the total production of hip related operations (primary replacements and reoperations) has decreased from 13.5% to 10% (figure 5.2.2). The observed reduction between the first and last three-year period depends exclusively on a relatively larger increase of primary operations. Between the period 1995–1997 and 2019–2021 the reoperations increased by 26.2% and the primary operations with 68.9%. The reason for this relative decrease of the proportion of reoperations depends primarily on the fact that the proportion of revisions due to loosening has decreased from 8.5% to 3.5% of all total hip replacements between the first and last observational period. The proportion of operations performed due to dislocation has also decreased but more modestly from 1.5% to 1.1%.

The relative decrease of reoperations is probably real but varying degree of underreporting especially of reoperations without exchange or extraction of at least one prosthesis component may also have influenced the result. Such procedures include irrigation and synovectomy or plate fixation of a periprosthetic fracture. We do not think that the reporting of these operations has worsened but rather that is has improved against the background that several studies have focused on the problem. The collaboration with the Swedish Fracture Register that started in the latter part of the observational time mainly to improve the reporting of periprosthetic fractures treated without exchange of prosthesis parts, should also have contributed to a better completeness.

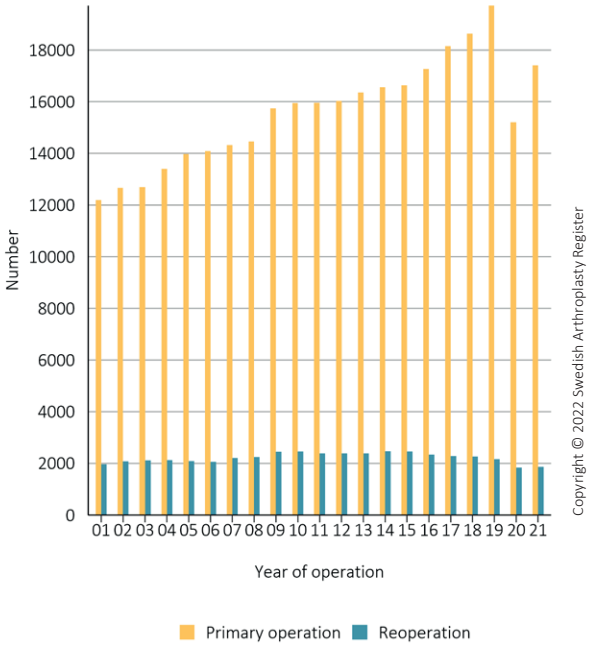

Figure 5.2.1. Number of primary and reoperations per year in 2001–2021.

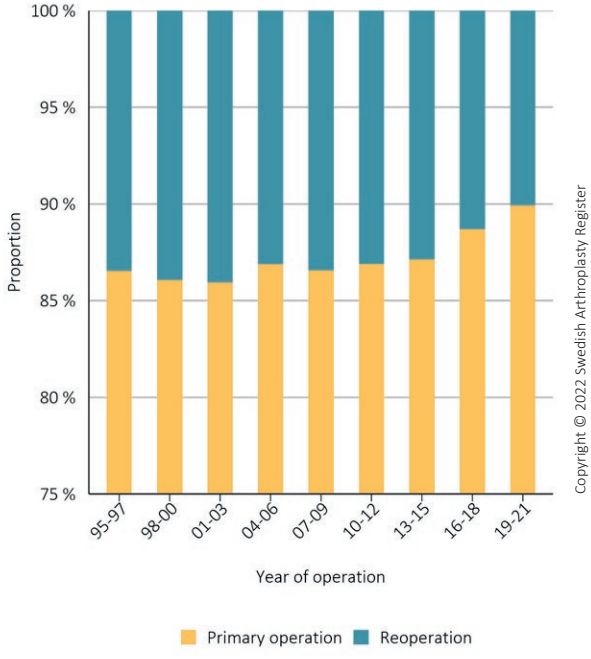

Figure 5.2.2. The distribution between reoperations (revisions and other reoperations) and primary hip replacements in 1995–2021 divided in three-years periods. The y-axis scale is adjusted and starts at 75%. The proportion of reoperations of the total number of hip related procedures has gradually been reduced and is approximately 3–4% lower in the last period as compared with the first three-years period.

The relation between reoperations and primary operations gives a certain view of to which extent reoperations burdens the healthcare resources for hip replacement in a country or in a region. It is however not a suitable measure for other purposes due to its sensitivity for the number of performed primary operations. The quota is also affected by many other factors such as patient flow between healthcare regions, the attitude of the medical profession towards carrying out reoperations and by the time-period in which hip replacement surgery has been practised in a healthcare region. As noted above the reporting of reoperations is worse than for primary operations. This is especially true for reoperations where the implant is left untouched. The reason can be that this type of operation is not so uncommonly performed by orthopaedic surgeons without a special profile towards prosthesis surgery. A lacking knowledge about the fact that reoperations are to be reported to the register as well, even though the prosthesis has not been exchanged or extracted, is another reason. A deficient penetration of the information left by the register management may also have contributed. We hope however that the awareness within the profession regarding the importance of reporting also these measures increase successively. Linkage with the Patient Register is a possibility to nevertheless catch these cases but is aggravated by the fact that used measure codes sometimes are too unspecific. We are eager to highlight this problem to stress the importance of using the correct code both for diagnosis and for surgical procedures.

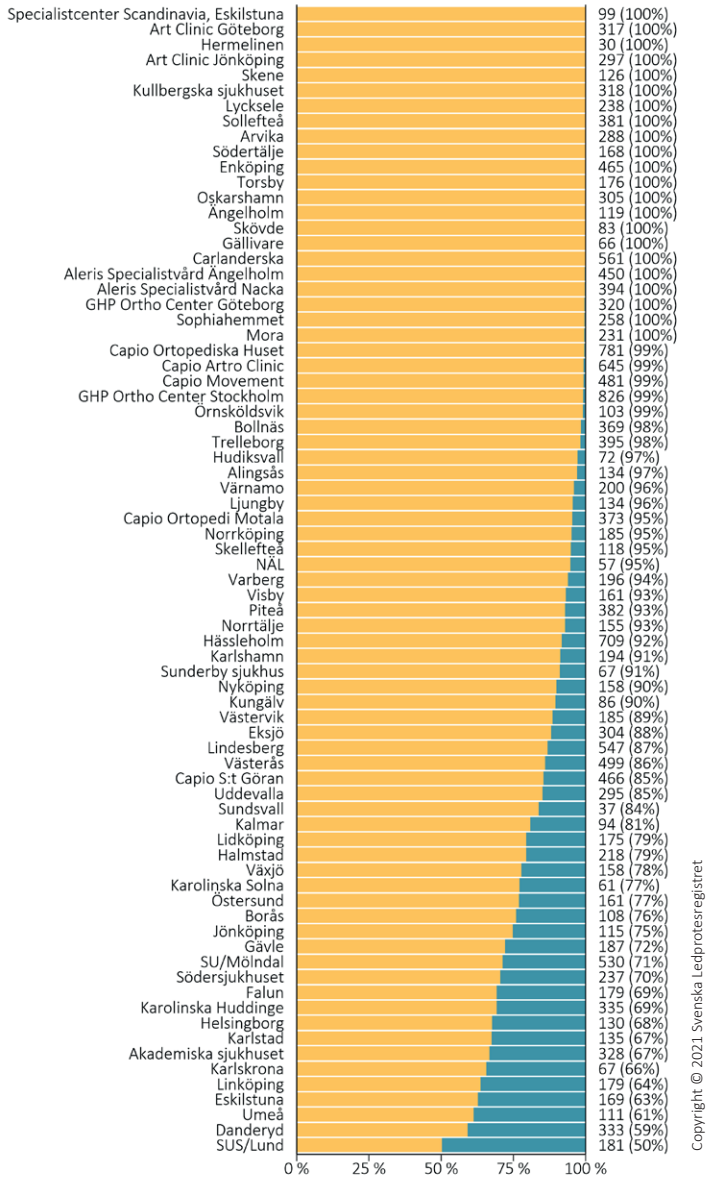

Figure 5.2.3 The distribution of primary replacements and reoperations per operating unit in Sweden 2021. 15 units performed between 11 and 25, and 23 units 10 or fewer reoperations. The column to the right presents the number (%) of primary replacements.

Demography of reoperation from selected time periods 2009–2021.
Primary procedures performed 2019–2021 for comparison.

	Reoperation 2009 – 2011	Reoperation 2013 – 2015	Reoperation 2019 – 2021	Primary operation 2019 – 2021
Number	**7,291**	**7,321**	**5,856**	**52,340**
Age mean (SD)	**71.97 (11.50)**	**71.81 (11.19)**	**72.35 (11.30)**	**69.07 (10.80)**
Age group (%)				
<45	550 (7.5)	554 (7.6)	418 (7.1)	5,398 (10.3)
45–54	1,114 (15.3)	1,065 (14.5)	927 (15.8)	10,744 (20.5)
55–64	2,280 (31.3)	2,540 (34.7)	1,765 (30.1)	18,548 (35.4)
65–74	2,451 (33.6)	2,317 (31.6)	1,998 (34.1)	15,003 (28.7)
75–84	896 (12.3)	845 (11.5)	748 (12.8)	2,647 (5.1)
≥ 85	154 (0.50)	151 (0.50)	148 (0.50)	158 (0.49)
Females (%)	3,922 (54.0)	3,720 (50.9)	2,831 (48.4)	30,423 (58.1)
BMI (%)				
<18.5	112 (2.0)	116 (1.8)	83 (1.5)	633 (1.2)
18.5–24.9	1,870 (33.8)	2,126 (33.0)	1,691 (30.8)	17,031 (33.3)
25–29.9	2,242 (40.6)	2,643 (41.0)	2,214 (40.3)	20,983 (41.1)
30–34.9	966 (17.5)	1,085 (16.8)	1,059 (19.3)	9,818 (19.2)
35–39.9	253 (4.6)	366 (5.7)	336 (6.1)	2,303 (4.5)
≥40	85 (1.5)	104 (1.6)	108 (2.0)	334 (0.7)
ASA class (%)				
ASA I	799 (12.5)	690 (10.0)	388 (6.8)	9,897 (19.1)
ASA II	3,298 (51.8)	3,474 (50.4)	2,875 (50.2)	31,292 (60.3)
ASA III	2,135 (33.5)	2,577 (37.4)	2,312 (40.4)	10,439 (20.1)
ASA IV	136 (2.1)	155 (2.2)	150 (2.6)	296 (0.6)

Table 5.2.1. The distribution of sex, age, BMI and ASA class for all types of reoperations in three selected periods 2009–2021. Data for primary replacements 2019–2021 are shown for comparison.

Distribution of reoperations between units

In 2021 (data for 2020 within parenthesis) 31.0% (32.5%) of the reoperations of total hip replacements were performed at university or regional units, 49.2% (49.0%) at county units, 14.0% (13.4%) at local units and 5.8% (5.3%) at private units. In 2021, 15 of these units performed between 11 and 25 reoperations and 23 (25) units ten or fewer reoperations (figure 5.2.3). The number of units that perform ten of fewer reoperations per year is conspicuously many (see also chapter 5.3 for a more detailed analysis based on performed revisions).

Demography

This year's report compares reoperations performed in the three periods 2009–2011, 2013–2015 and 2019–2021. Moreover, demographic data for primary hip replacements performed in the last three-year periods are shown. Table 5.2.1 shows that the mean age for reoperation in the last period continues to increase, although marginally and lies a little more than three years above the mean age for primary hip replacements. The proportion of males that are reoperated is higher than the proportion of males that are operated with a primary hip replacement since males in general are reoperated more often than females.

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

	2002–2011				2012–2021			
	First reoperation		At least one previous reoperation		First reoperation		At least one previous reoperation	
Reason	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %
Total	**14,682**	**100**	**6,420**	**100**	**14,625**	**100**	**6,626**	**100**
Loosening (regardless of time after op)	7,310	49.8	1,933	30.1	6,175	42.2	1,464	22.1
Fracture femur	2,242	15.3	739	11.5	2,233	15.3	619	9.3
Dislocation, instability, subdislocation	1,789	12.2	1,052	16.4	1,759	12	838	12.6
Infection	1,569	10.7	2,057	32	2,948	20.2	3,178	48
Osteolysis acetabulum and/or femur	727	5	111	1.7	312	2.1	34	0.5
Cup or liner wear	428	2.9	56	0.9	254	1.7	35	0.5
Implant breakage (including plate)	179	1.2	91	1.4	137	0.9	81	1.2
Unclear pain	106	0.7	62	1	176	1.2	75	1.1
Trocanteric problems, limp, gluteus medius rupture	45	0.3	21	0.3	107	0.7	15	0.2
Incorrectly inserted implant (eg.penetration)	41	0.3	16	0.2	38	0.3	8	0.1
Other left material	30	0.2	51	0.8	8	0.1	12	0.2
Heterotopic bone formation	30	0.2	14	0.2	43	0.3	17	0.3
Loose implant part	29	0.2	15	0.2	8	0.1	7	0.1
Bleeding, hematoma	26	0.2	38	0.6	40	0.3	45	0.7
Other reason (incl. technical)	25	0.2	8	0.1	46	0.3	16	0.2
Cement problem (loose piece of cement, inadequate cementation etc.)	23	0.2	9	0.1	27	0.2	6	0.1
Wound complication (wound rupture, wound granuloma)	22	0.1	15	0.2	18	0.1	19	0.3
Difference in leg length	18	0.1	4	0.1	17	0.1	8	0.1
ALVAL/pseudotumor	14	0.1	4	0.1	118	0.8	20	0.3
Delayed fracture healing	8	0.1	81	1.3	11	0.1	58	0.9
Fracture under resurfacing prosthesis	7	0			22	0.2	2	0
Malignant or benign tumor	7	0	1	0	9	0.1	4	0.1
Cyst/bursa	3	0	1	0	12	0.1	2	0
Fracture acetabulum	2	0	1	0	22	0.2	14	0.2
Elevated metal ions/corrosion	1	0			71	0.5	9	0.1
Not availiable	1	0	1	0	1	0		
Allergy (suspected or known)			1	0	2	0	2	0
Dislocation/fracture spacer			37	0.6	1	0	34	0.5
Nerve or vascular injury			1	0	3	0		
Per operative fracture (previous op)					7	0	4	0.1

Table 5.2.2. The distribution of reasons for reoperation at detailed level in the last 20 years divided in ten-year periods for the first reoperation and for hips reoperated at least once before.

This difference also seems to increase over time. Between 2009 and 2011 46.0% of the reoperations were performed in males which increased to 51.6% in the period 2019 to 2021.

Patients that are reoperated have a higher BMI and a higher ASA class compared with primary replacements. Over time, the patient group that is reoperated shows a tendency towards increasing BMI and increasing comorbidity. The proportion of patients in the highest BMI classes also tends to increase among the reoperated. The difference in BMI compared with the primary replacement group is however not that large and can possibly be explained by the fact that a reoperation more uncommonly can be postponed due to high BMI, whereas this is a common situation when a primary hip replacement is planned.

In summary, males are more commonly reoperated than expected based on the sex distribution in primary operation. Patients who undergo reoperation also tend to be somewhat older, have a somewhat higher BMI and a higher degree of comorbidity compared with the situation for primary operation. Furthermore, the degree of comorbidity and to a lesser extent reported BMI and age tend to have increased gradually in recent years in the group of patients undergoing reoperation.

Reason for reoperation

Since the last six years, the Swedish Arthroplasty Register registers the reason or reasons for a reoperation with two variables, which means that two different reasons can be entered. For total hip replacements there are 35 different predefined reasons, often condensed to fewer main groups. As an example, it can be mentioned that three different reasons, loosening, osteolysis and wear often are presented under the main heading loosening. Table 5.2.2 shows reason for reoperation in detail in the last two ten-year periods divided into first time reoperations and reoperations that have been preceded by at least one previous reoperation. Since the database until 2015 had considerably more reasons, these data have been reclassified according to the new classification to the greatest extent possible. Also, in table 5.2.2 there has been a certain simplification. For example, all osteolysis patients have been gathered in one group regardless of localisation. Among the reasons that are usually not presented as other than in a main group it can be noted that the number of reoperations due to wear and osteolysis have decreased, probably as an effect of increasing use of highly cross-linked polyethylene. Furthermore, an increase in the number of reoperations due to unclear pain and trochanteric problems can be noted. This increase may seem hard to motivate against the background that there are still weak or non-existent evidence for these indications. The increase of the number of reoperations due to pseudotumour and high metal ion concentrations/corrosion is on the other hand expected against the background of the earlier use of resurfacing prostheses and large metal heads.

Figure 5.2.4 presents the most common reasons for reoperation. Since the period 1995–1997 the proportion of reoperations due to loosening has decreased successively and the proportion of reoperations due to infection has increased. The proportion of dislocations increased at the end of the 1990s and the beginning of the 2000s to stabilize around 12% starting with the period 2010 to 2012. The proportion of periprosthetic fractures also increased until the period 2010–2012, probably due to improved reporting. Since 2013 to 2015 the proportion has reduced marginally possibly due to a certain underreporting.

The distribution of reasons for reoperation gives above all a view of the distribution of the prosthesis-related problems that lead to a surgical intervention. However, it gives a very limited perception of how the quality of the primary hip replacements that is performed may change over time as proportion ending with a reoperation. To illustrate this, we present in figure 5.2.5, the proportion of reoperated within ten years in primary hip replacements performed in three-year periods starting in 1995 to 2011 so that all primary operations included in the group have been observed for ten years. In addition, there is information on distribution of reasons in main groups. Even if the mortality probably has decreased over time, we think that this only marginally affects the outcome. We then find that the proportion of reoperated within ten years decreased from 9.5% in the first period to 4.8% in the last period. It is unclear if the marginal reduction from 5.5% to 4.8% between the last periods reflects a real reduction of the need or if it is an effect of longer waiting time due to the pandemic.

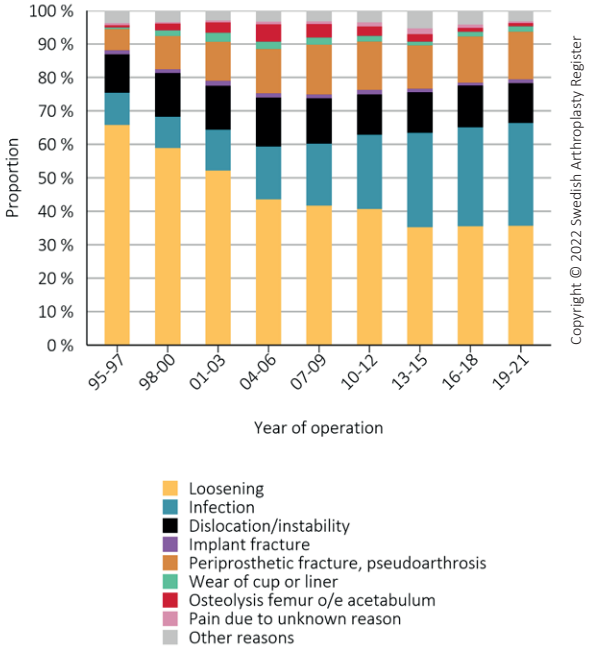

Figure 5.2.4. Reason for reoperation 1995–2021 divided in three-year periods. The proportion reoperations due to loosening as well as due to wear or osteolysis has decreased, while the proportion due to infection has increased. Loosening, osteolysis and wear often occur simultaneously and are often reported as a group but are labelled here by main reason.

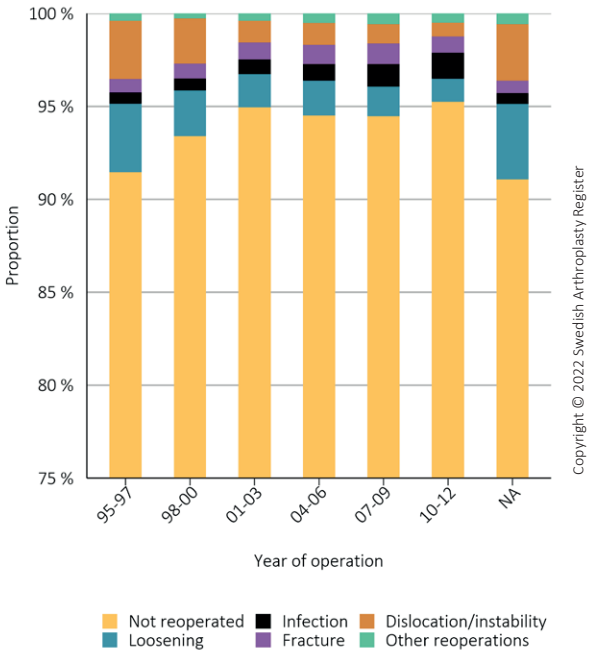

Figure 5.2.5. The distribution of reasons for reoperations within 10 years after primary total hip replacement in three-year periods 1995–2021. In all six periods, reoperations after ten years are excluded to facilitate comparison.

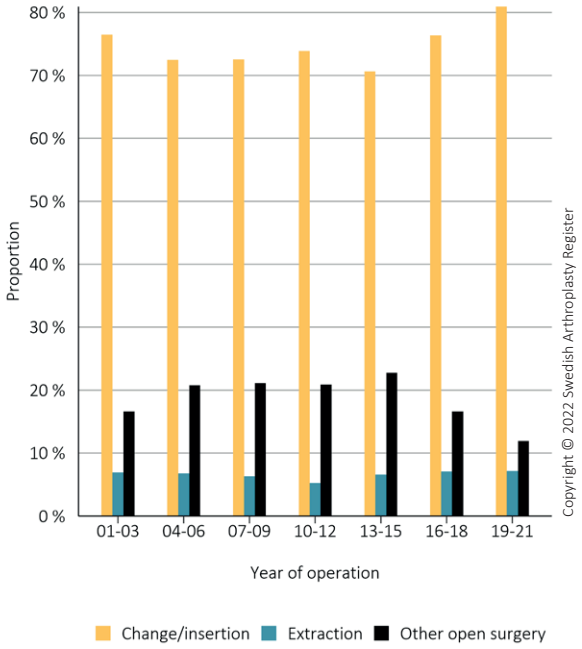

Figure 5.2.6. The distribution of the main procedures exchange/insertion, extraction and other open procedures where the implant has not been exchanged or extracted in three-year periods 2001–2021.

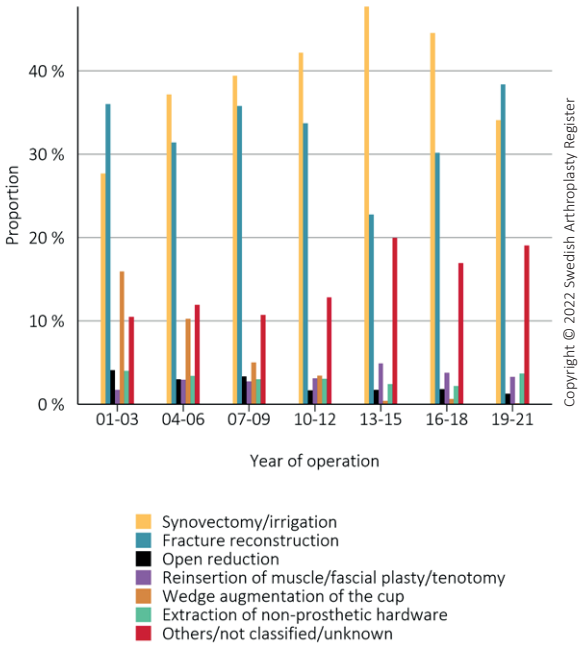

Figure 5.2.7. The most common reasons for reoperation in three-year periods 2001–2021.

Reoperation without exchange/extraction of implants

Reoperations without exchange or extraction of implant components are often performed due to infection or fracture. In the beginning of the 2000s dislocation was also one of the dominating reasons but has decreased in frequency, probably since it has become uncommon just to carry out an open reduction without exchanging for example liner and femoral head or undertaking a more extensive procedure such as cup and/or stem revision.

The proportion of reoperations without implant exchange or extraction (other open procedures in figure 5.2.6) increased until the period 2013 to 2015 due to an increased number of operations of the type synovectomy/irrigation for infection and to a lesser extent fracture reconstruction. Hereafter the number of reoperations due to infection and without implant exchange has decreased, a positive development provided that these procedures were extended to also comprise change of femoral head and in cases with an uncemented modular cup also liner-exchange, since these measures seem to be associated with improved probability for healing. In figure 5.2.7 a reduction of the proportion of synovectomy/irrigation can also be noted. Between the period 2013 to 2015 and the last one the visualized decrease in percentage of the total numbers corresponds to a decrease per year from 250–300 to less than 100 operations. The figure also shows a relative increase of the number of fracture reconstructions without implant exchange. This increase does not correspond to an increasing number of operations but depends on the fact that these procedures constitute an increasing proportion of a type of reoperation that as a group tends to become smaller. Examples of type operations that show a clear reduction in the last 10 to 20 years are except for synovectomy/irrigation, insertion of an acetabular wedge augment aimed to decrease the risk of dislocation, open reduction of a dislocated joint, extraction of osteosynthesis, pieces of cement or other "non-prosthetic" hardware and delayed wound closures. The number of procedures that have not been possible to classify also belong to this group. The largest number was noted in 2013–2015 (n = 172), in the last period there were 9 cases, maybe as an effect of the introduction of a new system for classification.

Summary

The proportion of reoperations in terms of the total number of hip replacement-related operations has decreased in the past two decades from just under 13.5% to approximately 10% in the period 2019–2021, primarily due to the fact that reoperations due to loosening have decreased.

Reoperation due to infection has increased. It is unclear whether this is due to a more active attitude towards surgical treatment of infected hip replacements or a real increase in the number of infections, but it is likely that both of these factors have contributed.

Males are affected by reoperation to a greater extent than expected based on the sex distribution in primary surgery.

Patients who undergo reoperation are older, have a higher BMI and a higher degree of comorbidity than the patients who undergo primary surgery.

In the last decade, the degree of comorbidity and to some extent BMI and age have increased among patients undergoing reoperation.

Be sure to report all reoperations, even those where no prosthetic component is exchanged. The frequency of reoperation is one of our most important quality parameters.

5.3. Reoperation within two years

Author: Johan Kärrholm

Reoperations that occur in the first two years after a primary operation are used as a quality indicator. The motive is that the most common reasons for early reoperation, infection, dislocation, fracture and early loosening are possible to influence and among other things, reflect existent routines, how they are adhered to, surgical technique and the unit's case-mix.

Reoperation within two years comprises all forms of additional surgery after operation with a total prosthesis. This outcome measure reflects mainly early and serious complications. The indicator is therefore quickly available and easier to use in clinical improvement work compared with cumulative revision risk at ten years. This parameter is also an important measure of the quality of the operations performed and reflects to a higher degree than early reoperation the effects of an implant choice. Furthermore, patient selection, healthcare process and choice of implants may have been subject to substantial changes in a ten-year period, which makes the outcome potentially difficult to interpret from an improvement perspective regarding the present situation.

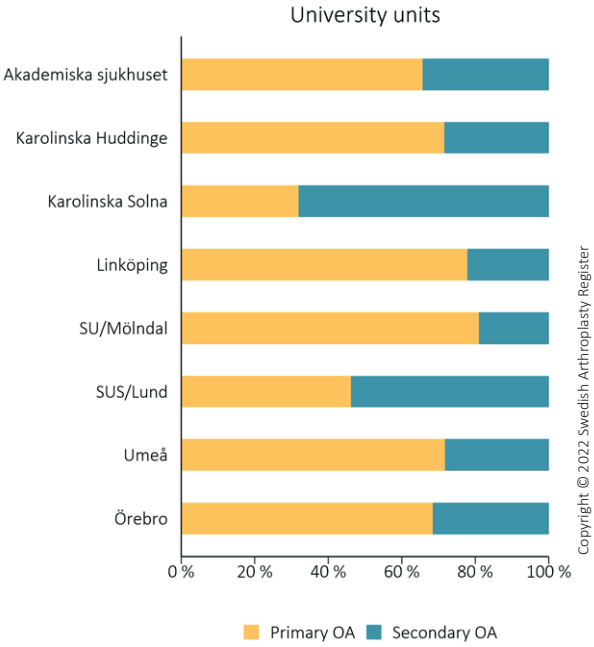

Figure 5.3.1 a. The distribution of primary hip replacements performed due to OA without specified reason (primary OA) and performed due to other reasons (secondary OA). The diagnosis acute hip fracture, sequel fracture or trauma or tumour diagnosis are excluded. University units are shown.

Reoperation within two years is selected by the Swedish Association of Local Authorities and Regions, and by the National Board of Health and Welfare as a national quality indicator. The indicator can be seen as one of the most important and most influenceable measures of outcome that the Swedish Arthroplasty Register reports. The proportion of reoperations in the third year is not part of this quality indicator but is shown anyway for increased transparency.

In this year's report data based on reoperations of all elective total hip replacements is given. This means that acute hip fractures, sequelae after previous trauma and tumour diagnosis have been excluded. As can be seen by figure 5.3.1 a-c the proportion of primary osteoarthritis varies between the different units. In general, units with the label "local hospital" and "private hospital" operates between 84.6% and 98.6% and between 90.6% and 100% patients with primary osteoarthritis respectively. Units labelled "county hospitals" show a greater variation (63.1% to 96.0%) and the variation is the largest for "university/regional hospitals" (31.9% to 81.0%). Since the risk of reoperation is increased for several of the diagnoses that are part of the group "other diagnoses" this should be taken into consideration in the event of comparing different units (table 5.3.1). Since the period 2015–2017 the proportion of reoperations within two years has stayed constant at 2.2% for the country (table 5.3.2). Since the years 2004 to 2005 there has however been a clear redistribution regarding reason for early reoperation. The relative proportion of reoperation due to infection has increased, above all at the expense of the reason groups dislocation and periprosthetic fracture, whose proportions have been reduced from just under 29.8% to about 15.2% and from 16.5% to 9.2% respectively (figure 5.3.2). Also, the proportions in the reason groups loosening and "others" have decreased but to a somewhat lesser extent (4.3% and 5.3% respectively). The increase of the proportion of infections is probably due to several different factors. Most likely a more active

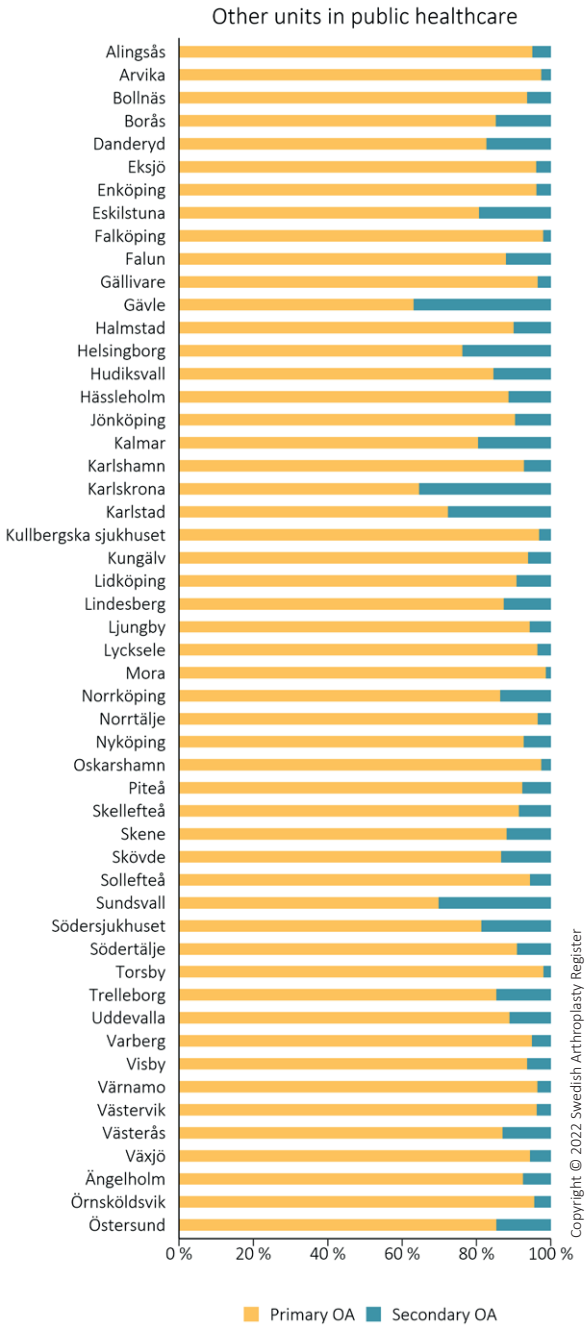

Figure 5.3.1 b. The distribution of primary hip replacements performed due to OA without specified reason (primary OA) and performed due to other reasons (secondary OA). The diagnosis acute hip fracture, sequel fracture or trauma or tumour diagnosis are excluded. All units in public healthcare except University units are shown.

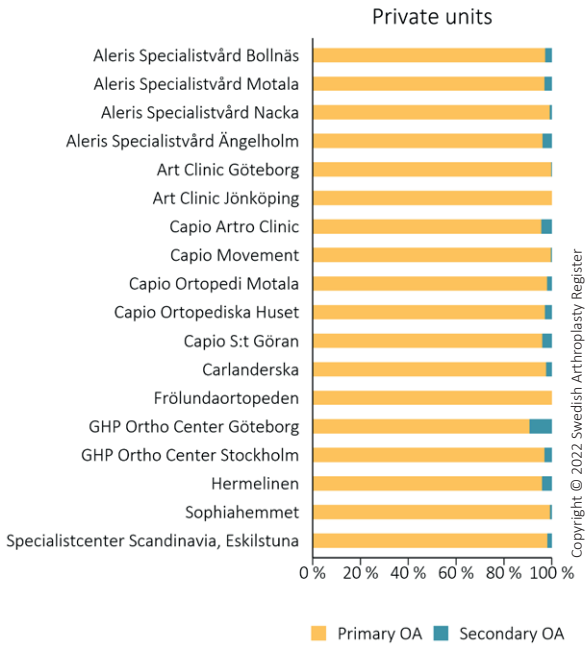

Figure 5.3.1 c. The distribution of primary hip replacements performed due to OA without specified reason (primary OA) and performed due to other reasons (secondary OA). The diagnosis acute hip fracture, sequel fracture or trauma or tumour diagnosis are excluded. Private units are shown.

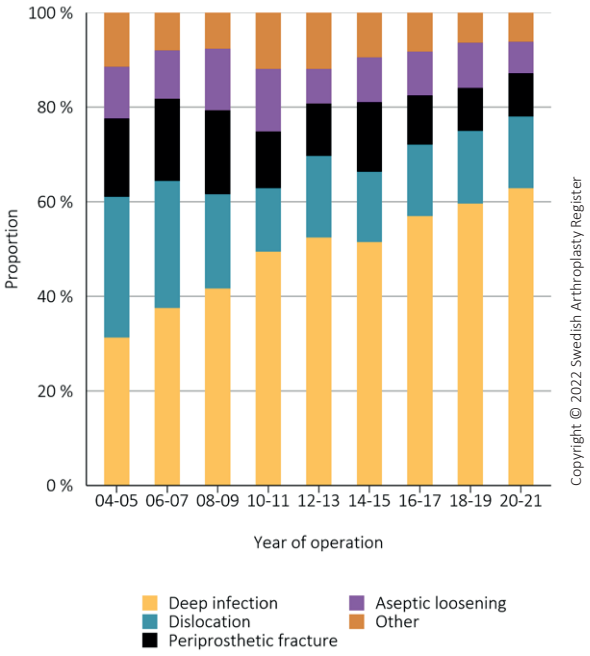

Figure 5.3.2. The distribution of reoperations within two years after the primary operation divided in nine time periods between 2004–2021.

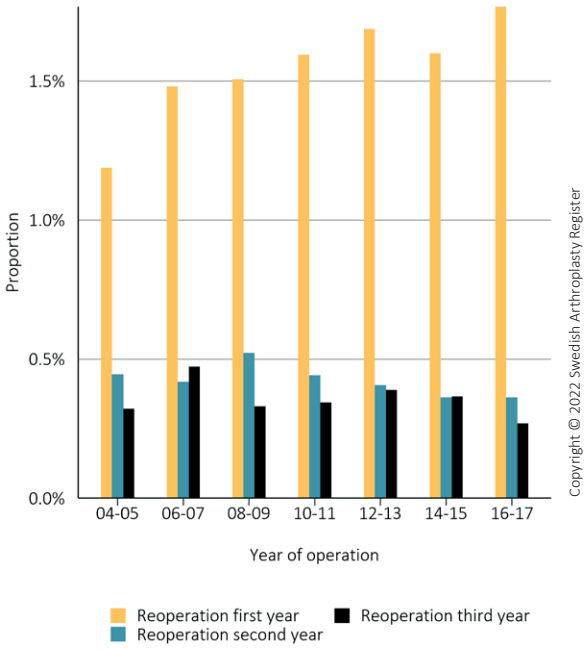

Figure 5.3.3. The proportion of reoperations in the first, second and third year respectively after the primary operation related to time period for prosthesis insertion.

attitude towards surgical treatment when suspecting infection is reflected. The observed increase may also depend on a real increase with selection of more antibiotic resistant stems over time and/or an increased awareness that reoperations without implant exchange are also to be reported. Probably all these factors contribute to a varying degree.

The probability that one is affected by reoperation in the three first years after a primary operation is the largest in the first year (figure 5.3.3). Beginning with the period 2002–2008 and until 2018–2021 the proportion of reoperated in the first year after surgery increased from 1.2% to around 1.7%. This can probably be explained by the fact that reoperation due to infection dominates as reason in the first year. Among the patients who had surgery between the years 2004–2017 30.4% of all reoperations until 2021 were registered in year one, 8.2% in year two and 6.9% in year three. The corresponding distribution for reoperations due to infection was 65.0%, 7.0% and 6.3% respectively.

Reoperations within two years per unit, primary replacements due to OA 2018–2021

	Primary	Revision	Reoperation		Infection		Dislocation		Fracture		Other	
Unit	Number	Number	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %
University units												
Akademiska sjukhuset	387	12	13	3.6	11	3	2	0.6	0	0	0	0
Karolinska Huddinge	676	13	17	2.7	12	1.8	2	0.4	3	0.5	0	0
Karolinska Solna	185	8	10	5.8	7	3.9	0	0	0	0	3	2
Linköping	321	13	13	5.2	6	2.3	6	2.3	1	0.6	0	0
SU/Mölndal	1,427	43	49	3.7	32	2.3	4	0.3	4	0.3	9	0.7
SUS/Lund	186	4	4	2.5	2	1.1	2	1.4	0	0	0	0
Umeå	188	7	7	3.9	6	3.4	1	0.5	0	0	0	0
Örebro	38	1	1	2.6	0	0	1	2.6	0	0	0	0
Private units												
Aleris Specialistvård Bollnäs	608	5	6	1	2	0.3	3	0.5	0	0	1	0.2
Aleris Specialistvård Motala	700	8	10	1.4	7	1	0	0	0	0	3	0.4
Aleris Specialistvård Nacka	1,203	13	14	1.3	7	0.6	3	0.3	1	0.1	3	0.3
Aleris Specialistvård Ängelholm	1,07	23	23	2.7	9	0.9	8	1	2	0.2	4	0.6
Art Clinic Göteborg	732	6	6	0.9	1	0.1	2	0.3	2	0.3	1	0.1
Art Clinic Jönköping	795	2	3	0.5	2	0.3	1	0.2	0	0	0	0
Capio Artro Clinic	1,910	40	45	2.8	26	1.7	3	0.2	4	0.2	10	0.6
Capio Movement	1,599	24	25	1.8	8	0.6	6	0.5	6	0.4	5	0.4
Capio Ortopedi Motala	1004	19	19	2.1	15	1.6	0	0	1	0.1	3	0.4
Capio Ortopediska Huset	2,706	38	44	2	22	0.9	2	0.1	5	0.2	14	0.7
Capio S:t Göran	1,737	22	26	1.6	7	0.4	5	0.3	3	0.2	10	0.7
Carlanderska	1716	17	17	1.3	12	0.9	1	0.1	0	0	3	0.2
Frölundaortopeden	52	1	1	2.5	1	2.5	0	0	0	0	0	0
GHP Ortho Center Göteborg	1,155	21	22	2.2	19	1.9	2	0.3	1	0.1	0	0
GHP Ortho Center Stockholm	3,08	48	49	1.9	25	1	11	0.4	5	0.2	8	0.3
Hermelinen	97	0	0	0	0	0	0	0	0	0	0	0
Sophiahemmet	1,005	12	13	1.3	8	0.8	2	0.2	2	0.2	1	0.1
Specialistcenter Scandinavia, Eskilstuna	114	0	0	0	0	0	0	0	0	0	0	0

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Reoperations within two years per unit, primary replacements due to OA 2018–2021, cont.

	Primary	Revision	Reoperation		Infection		Dislocation		Fracture		Other	
Unit	Number	Number	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %
Other units												
Alingsås	605	12	18	3.4	14	2.5	3	0.6	0	0	1	0.2
Arvika	865	24	26	3.5	18	2.2	0	0	4	0.6	4	0.7
Bollnäs	661	8	9	2.1	6	1.5	1	0.2	0	0	1	0.2
Borås	317	5	6	2	4	1.3	1	0.3	1	0.4	0	0
Danderyd	614	18	20	3.4	10	1.7	4	0.7	4	0.7	1	0.2
Eksjö	859	22	23	2.9	19	2.3	1	0.1	2	0.3	1	0.2
Enköping	1,737	37	40	2.7	16	1	8	0.5	4	0.2	12	1
Eskilstuna	270	8	8	3.2	8	3.2	0	0	0	0	0	0
Falköping	149	3	3	2	3	2	0	0	0	0	0	0
Falun	440	9	13	3.2	7	1.7	1	0.2	0	0	5	1.3
Gällivare	311	0	0	0	0	0	0	0	0	0	0	0
Gävle	415	8	8	2.1	4	1	2	0.5	0	0	2	0.5
Halmstad	640	14	15	2.4	10	1.6	0	0	1	0.2	2	0.4
Helsingborg	143	8	8	6.4	5	4.2	2	1.5	0	0	1	0.7
Hudiksvall	260	2	2	0.8	2	0.8	0	0	0	0	0	0
Hässleholm	2,845	26	28	1.1	21	0.8	1	0	4	0.2	2	0.1
Jönköping	469	9	10	2.2	7	1.6	1	0.2	0	0	2	0.4
Kalmar	429	6	6	1.4	5	1.2	1	0.2	0	0	0	0
Karlshamn	973	20	21	2.4	7	0.8	8	0.9	3	0.4	3	0.3
Karlskrona	48	3	3	7.5	1	3.4	2	4.2	0	0	0	0
Karlstad	315	15	15	5	12	4	1	0.3	2	0.7	0	0
Kullbergska sjukhuset	1,129	27	30	2.9	20	1.9	4	0.4	1	0.1	5	0.6
Kungälv	478	22	22	4.7	20	4.3	0	0	0	0	2	0.4
Lidköping	673	10	10	1.5	2	0.3	4	0.6	2	0.3	2	0.3
Lindesberg	1,979	20	24	1.3	13	0.7	3	0.2	2	0.1	5	0.3
Ljungby	534	7	7	1.4	3	0.6	3	0.7	1	0.2	0	0
Lycksele	1,066	10	13	1.4	3	0.3	3	0.4	3	0.3	4	0.4
Mora	882	8	10	1.4	8	1	1	0.1	0	0	1	0.2

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Reoperations within two years per unit, primary replacements due to OA 2018–2021, cont.

	Primary	Revision	Reoperation		Infection		Dislocation		Fracture		Other	
Unit	Number	Number	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %	Number	Proportion %
Norrköping	641	4	4	0.7	4	0.7	0	0	0	0	0	0
Norrtälje	550	14	14	2.9	9	1.7	3	0.6	0	0	2	0.6
Nyköping	450	14	14	3.2	11	2.5	0	0	0	0	2	0.5
Oskarshamn	1,266	23	23	2.1	20	1.8	2	0.2	1	0.1	0	0
Piteå	1,63	15	15	1.1	1	0.1	8	0.6	1	0.1	3	0.2
Skellefteå	430	2	2	0.5	1	0.2	0	0	0	0	1	0.3
Skene	600	11	13	2.5	10	1.8	1	0.2	0	0	2	0.4
Skövde	120	7	8	7.1	6	5.4	0	0	2	1.7	0	0
Sollefteå	1,205	10	10	1	6	0.5	1	0.1	2	0.2	1	0.1
Sundsvall	53	1	1	1.9	1	1.9	0	0	0	0	0	0
Södersjukhuset	572	12	15	2.9	8	1.5	2	0.4	4	0.8	1	0.2
Södertälje	482	3	4	0.9	2	0.4	0	0	1	0.2	1	0.2
Torsby	461	15	16	3.9	8	1.9	4	1.1	4	0.9	0	0
Trelleborg	2,018	25	26	1.4	14	0.7	7	0.4	4	0.2	1	0.1
Uddevalla	1,181	16	17	1.5	14	1.2	0	0	1	0.1	2	0.2
Varberg	819	6	9	1.2	5	0.7	1	0.1	2	0.3	1	0.1
Visby	490	6	8	2	1	0.2	1	0.3	1	0.2	5	1.3
Värnamo	555	14	17	3.3	15	2.8	0	0	0	0	1	0.3
Västervik	501	10	10	2	7	1.4	2	0.4	1	0.2	0	0
Västerås	1,226	50	51	4.5	29	2.5	11	1	3	0.2	8	0.8
Växjö	447	23	23	5.4	18	4.2	4	1	0	0	1	0.2
Ängelholm	619	11	11	2	7	1.2	2	0.5	1	0.2	1	0.2
Örnsköldsvik	427	4	4	1.2	3	0.8	0	0	0	0	1	0.3
Östersund	768	23	23	3.1	11	1.5	6	0.8	3	0.4	3	0.4
Country	62,345	1,081	1,174	2.1	706	1.2	177	0.3	106	0.2	171	0.3

Table 5.3.1. Reoperations within two years per unit based on primary hip replacements due to OA 2018-2021. Units with fewer than 20 primary replacements in the current period are excluded. Total number of reoperations and revisions may differ from the sum of specified complications since there might be more than one type of complication. All proportions are calculated using competing risk analysis.

Reoperations within two years per unit, primary replacement due to OA – trend 2015–2021

Unit	2015–2018 Proportion %	2016–2019 Proportion %	2017–2020 Proportion %	2018–2021 Proportion %
University units				
Akademiska sjukhuset	3.3	3.2	2.8	2.6
Karolinska Huddinge	2.7	2.8	3.4	3
Karolinska Solna	6.3	6	7.3	7.5
Linköping	3.5	5.2	4.5	4.6
SU/Mölndal	2.4	3	3.1	3.9
SUS/Lund	2.5	2.3	2.4	2.9
SUS/Malmö	2.2	2	2.1	0.8
Umeå	3.9	2.8	3.1	3.9
Örebro	4.6	3.6	2.8	3.6
Private units				
Aleris Specialistvård Bollnäs	1.4	1	1.1	1
Aleris Specialistvård Motala	1.7	1.7	1.5	1.4
Aleris Specialistvård Nacka	1.8	1.6	1.3	1.3
Aleris Specialistvård Sabbatsberg	0	-	-	-
Aleris Specialistvård Ängelholm	1.1	2.2	2.7	2.7
Art Clinic Göteborg	1.2	0.9	0.8	0.9
Art Clinic Jönköping	0.8	0.5	0.4	0.5
Capio Artro Clinic	2.4	2.7	2.5	2.8
Capio Movement	2.1	2.1	1.9	1.8
Capio Ortopedi Motala	-	3.1	2.2	2.2
Capio Ortopediska Huset	1.1	1.3	1.4	2
Capio S:t Göran	2	2.1	2	1.7
Carlanderska	1	1.2	1.2	1.3
Frölundaortopeden	4	2.7	2.3	2.5
GHP Ortho Center Göteborg	1.3	1.4	1.9	2.2
GHP Ortho Center Stockholm	1.7	1.6	1.8	1.9
Hermelinen	0	0	0	0
Sophiahemmet	2	2.1	1.7	1.3

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Reoperations within two years per unit, primary replacement due to OA – trend 2015–2021, cont.

Unit	2015–2018 Proportion %	2016–2019 Proportion %	2017–2020 Proportion %	2018–2021 Proportion %
Other units				
Alingsås	2.2	2.2	2.7	3.3
Arvika	4.9	4.6	4.6	3.5
Bollnäs	-	3.5	2.1	2
Borås	1.9	2	1.9	2
Danderyd	3.9	3.9	3.8	3.5
Eksjö	4.2	4.1	3.9	3.2
Enköping	2	2	2.3	2.7
Eskilstuna	2.5	3	3.1	3
Falköping	-	1.9	2	2
Falun	3.5	3.9	3.8	2.9
Frölunda Specialistsjukhus	2.4	-	-	-
Gällivare	0.8	0.7	0.2	0.3
Gävle	1.9	1.6	2	1.9
Halmstad	3.5	3	3	2.8
Helsingborg	3.8	4.5	6.5	5.8
Hudiksvall	1.9	1.7	1.2	1.3
Hässleholm	1.5	1.5	1.5	1.1
Jönköping	2.9	2.8	2.3	2.1
Kalmar	1.1	1.1	0.8	1.2
Karlshamn	2.7	2.7	2.3	2.4
Karlskoga	3.2	3.9	1.9	0
Karlskrona	2.9	2.6	3.2	3.4
Karlstad	4.3	4.8	4.5	4.2
Kristianstad	0.6	0.6	0.7	0
Kullbergska sjukhuset	3.9	4	3.2	2.9
Kungälv	3.4	3.7	4.1	5.1
Lidköping	2.3	2.4	2.1	1.7
Lindesberg	1.4	1.6	1.4	1.4
Ljungby	2.5	2.1	1.9	1.9

The table continues on the next page.

Reoperations within two years per unit, primary replacement due to OA – trend 2015–2021, cont.

Unit	2015–2018 Proportion %	2016–2019 Proportion %	2017–2020 Proportion %	2018–2021 Proportion %
Lycksele	1.9	2.1	1.5	1.6
Mora	1.2	1.3	1.3	1.3
Norrköping	1	1.2	0.9	0.9
Norrtälje	2.6	2.7	3.1	3.1
Nyköping	3.1	3.2	3.4	3
NÄL	1.6	1.8	1.7	1.8
Oskarshamn	1	1.3	1.5	2
Piteå	0.8	1.1	1.2	1.2
Skellefteå	1.8	1.8	2.1	1.7
Skene	1.4	1.6	2.1	2.4
Skövde	4.8	5.2	5	4.7
Sollefteå	1.8	1.6	1.1	1
Sunderby sjukhus	2.2	1.3	0.5	0
Sundsvall	3.7	2.7	1.8	0.7
Södersjukhuset	2.7	2.8	2.7	2.4
Södertälje	3.6	2.9	1.8	1.4
Torsby	3.4	3.6	3.8	3.9
Trelleborg	1.5	1.6	1.4	1.5
Uddevalla	2.5	2.1	2	1.6
Varberg	1.3	1.2	1	1.2
Visby	2.6	2.2	2.1	2.4
Värnamo	1.3	1.8	2.5	3.3
Västervik	1.2	2.1	2.2	2.5
Västerås	3.1	3.6	4.1	4.3
Växjö	4.5	4.4	3.8	4.8
Ystad	*	*	22.2	17.9
Ängelholm	1	1.7	1.9	2.3
Örnsköldsvik	1.2	1.3	1.3	1
Östersund	2.9	3.4	3.3	3.1
Country	**2.2**	**2.3**	**2.2**	**2.2**

Table 5.3.2. Reoperations within two years per unit based on primary hip replacements performed due to OA 2018–2021. All proportions are calculated using competing risk analysis at two-years follow-up.

–) No primary replacements reported.

**) Fewer than 20 primary replacements in the period.*

5.4. Revision hip replacement

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This section comprises revision of total hip replacements regardless of primary diagnosis. When revising a hip replacement, parts or the whole prosthesis are exchanged or extracted due to a complication. If the prosthesis or some of its parts are extracted at first and are inserted at a later stage, waiting for example the remediation of an infection (two stage or two step procedure), these two procedures are registered as one measure if not otherwise stated. If for example a primary hip replacement is revised in two stages, the extraction date will become the time for revision of the primary replacement, while the insertion time will become starting point for the continued observation of a first-time revision. If the prosthesis is extracted for good (no prosthesis insertion is registered at the last date of observation, 2021-12-31 in this year's report) the extraction is classified as permanent. The lack of reported prosthesis insertion after previous extraction is thus decisive if the extraction should be treated as permanent or not. Some extractions in the latter part of 2021 where insertion is planned in 2022 may then have been erroneously classified as permanent.

Since 1979 revisions (and other reoperations) have been reported on an individual level, which means that more comprehensive data can be collected more than 40 years back in time. On the other hand, primary hip replacements have been classified on an aggregated unit level until 1991 and first in 1992 an individual based registration based on personal identity numbers started. In 1999 a more detailed registration of components used both in primary replacements and revisions was added.

Many patients wonder for how long their prosthesis will last. One way of describing this is to report the proportion of patients that have been able to keep their prosthesis to the end of their lives or who are alive and still retain the prosthesis based on operating year. Over time an increasing proportion of the primary replacements that have been performed a certain year will be revised and the proportion of patients alive is decreasing. Most of the patients will not be revised in their remaining lifetime. In figure 5.4.1 it is shown that of those patients that had their primary replacement in 1994 77.8% retained their prosthesis to the end of their lives, 7.7% were still alive with their primary prosthesis and 14.5% have been revised at least once of which 6.0% are still alive. The closer one moves to the present in the diagram the more patients are alive and retain their prosthesis. For those patients that were operated in 2012, about 10 years ago, the corresponding distribution is 24.6% deceased with primary prosthesis, 71.9% are alive with primary prosthesis, 0.9% are deceased after at least one revision and 2.6% are alive after at least one revision.

The proportion of revisions of the total production of total hip replacements has decreased in the last two decades. Between the periods 2001–2003 and 2016–2018 the number of primary operations increased from on average 12,521 to 18,020 per year to decrease marginally to 17,446 per year in the period 2019–2021 (figure 5.4.2 and 5.4.3). The number of revisions were 1,710 per year in the first three-year period and then constituted 11.5% of all total hip replacements in the period. 2016–2018 more revisions in absolute numbers were reported (n =1,913 per year) but was then just 9.1% of the total number. In the last period the number of revisions decreased to 1,720 per year corresponding to about 8.4% of the total number of total hip replacements in that period.

Against the background that the proportion of elderly and the number of individuals with an inserted hip prosthesis increases in the population one could expect that the number of hips that are revised several times also would increase. Such an increase was also noted in the 1980s and 1990s. Until 1982 multiple revisions accounted for 8% of all revisions. The proportion increased successively to 26.0% in the period 2001 to 2003 to thereafter vary relatively marginally between 25.7 and 27.3% until today. In the last three-year period the multiple revisions were 26.9% of all revisions.

In summary the number of revisions performed from 2010 and until 2019 has been relatively constant, about 1,800 and 1,900 per year. In 2020 and 2021 the number was somewhat lower (1,589 and 1,677 respectively). Likely this reduction is due to the pandemic even if a reduced need cannot be completely ruled out.

Patients undergoing revision differ (as do those who undergo reoperation) demographically from the patients that are operated with a primary prosthesis. This can be seen as a natural effect of the fact that patients with risk factors for revision successively are selected to the revision groups as they undergo additional revisions. In general, they are elder, often males, and have a high degree of comorbidity (table 5.4.1). The diagnosis primary osteoarthritis is less common in revisions and especially in multiple revisions. The proportion of hips with acute hip

fracture is also lower in the revision group compared with the primary group and is even smaller in multiple revision. A high degree of comorbidity and mortality are contributing factors in this group. Those patients that have at least one revision behind them and that undergo yet another revision in general also have a higher degree of comorbidity, here measured as ASA class and an even greater proportion of these have initially been operated due to secondary osteoarthritis. The mean BMI is relatively similar between the groups, however with a tendency to a higher proportion of patients with a BMI of 30 and above in revision.

Revision volume per unit

We have followed the distribution of operation volumes for several years and have noted that some units only perform a few cases per year. This year's analysis comprises only total hip replacements. In 2021 these operations were performed at 81 units in Sweden, of which 60 reported at least one revision. 26 of the units performed between one and ten revisions per year, eleven between 11 and 25, eleven between 26 and 50, nine between 51 and 100, and three (Akademiska Sjukhuset, Danderyd, SU Mölndal) between 103 and 136 revisions. The year

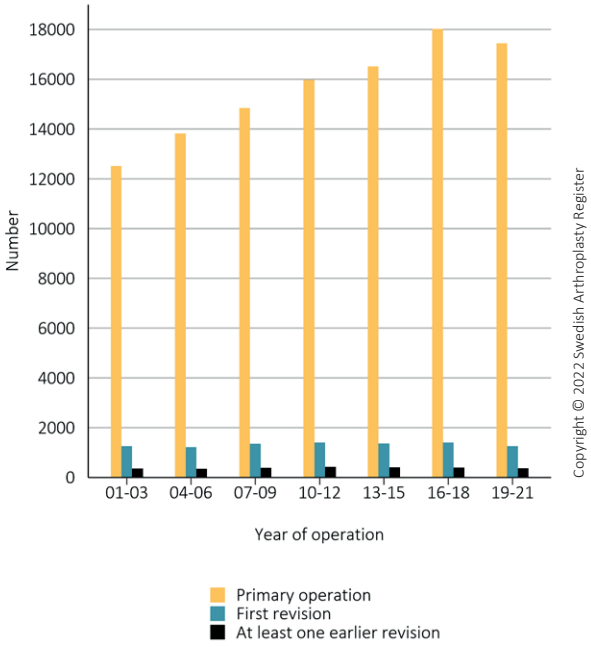

Figure 5.4.2 Number of primary hip replacements, first and multiple-time revisions respectively in 2001–2021. The figure shows the number of replacements as mean per year calculated in three-year periods. Even if the number of primary replacements decreased somewhat in the last three-year period, there is a substantially increase of primary replacements as compared to revisions throughout the period 2001–2021.

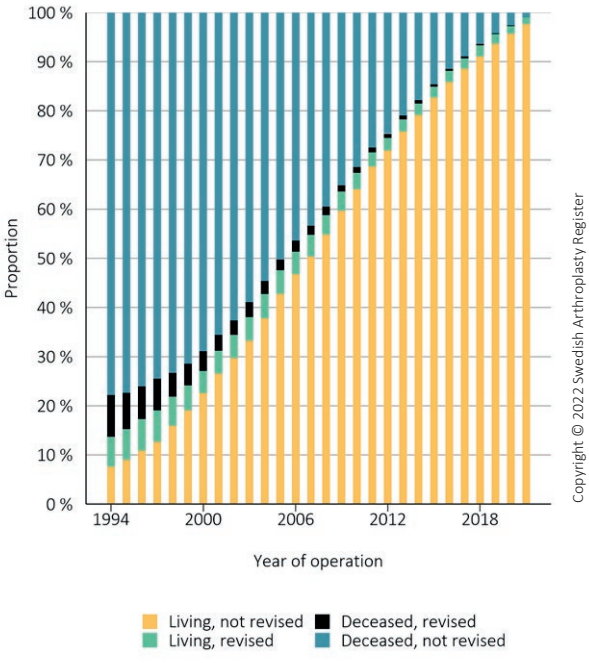

Figure 5.4.1. Distribution of patients with primary hip replacement and revision having surgery 1994–2021 divided into those who were alive and those who had died 31st of December 2021.

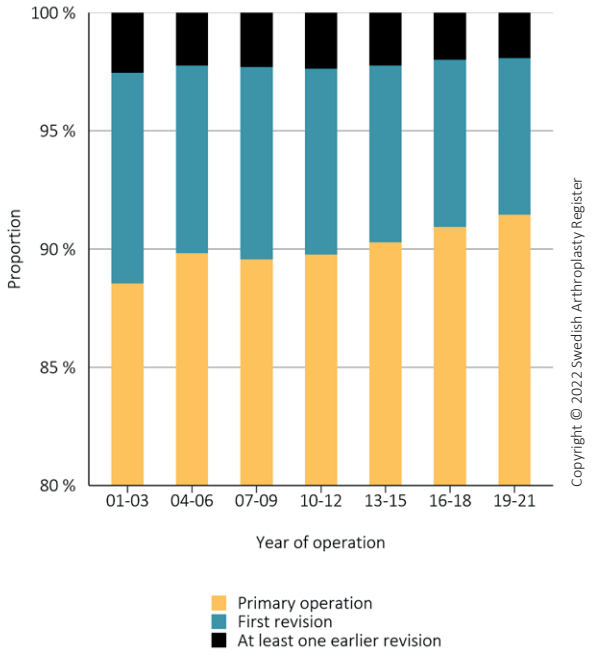

Figure 5.4.3. Proportion of primary hip replacements, first and multiple-time revisions in 2001–2022. The proportion of revisions decreased from 11.7% in the period 2001–2002 to 8.8% in the period 2019–2021.

Demography in first, second and multiple-time revision and primary hip replacement 2012–2021*

	Primary replacement	Previous revision, none	Previous revision 1	Previous revision > = 2
Number	171,972	13,521	2,823	1,095
Mean age (SD)	68.91 (10.73)	71.87 (11.02)	71.99 (10.69)	71.20 (10.92)
Age group (%)				
<45	3,326 (1.9)	232 (1.7)	42 (1.5)	14 (1.3)
45–54	14,121 (8.2)	750 (5.5)	140 (5.0)	79 (7.2)
55–64	35,291 (20.5)	2,051 (15.2)	412 (14.6)	165 (15.1)
65–74	63,978 (37.2)	4,550 (33.7)	981 (34.8)	386 (35.3)
75–84	46,488 (27.0)	4,488 (33.2)	951 (33.7)	342 (31.2)
≥ 85	8,768 (5.1)	1,450 (10.7)	297 (10.5)	109 (10.0)
Females (%)	99,764 (58.0)	6,900 (51.0)	1,344 (47.7)	539 (49.6)
BMI (%)				
<18.5	2,001 (1.2)	157 (1.2)	35 (1.3)	23 (2.3)
18.5–24.9	55,178 (33.3)	4,094 (32.3)	852 (32.4)	309 (30.7)
25–29.9	68,801 (41.5)	5,160 (40.8)	1,056 (40.2)	392 (38.9)
30–34.9	30,839 (18.6)	2,353 (18.6)	475 (18.1)	189 (18.8)
35–39.9	7,658 (4.6)	701 (5.5)	150 (5.7)	73 (7.2)
≥ 40	1,337 (0.8)	194 (1.5)	59 (2.2)	21 (2.1)
ASA class (%)				
ASA I	34,963 (20.6)	1,322 (10.0)	205 (7.5)	50 (4.7)
ASA II	100,150 (59.1)	6,976 (53.0)	1,340 (48.9)	462 (43.8)
ASA III	33,369 (19.7)	4,625 (35.1)	1,127 (41.1)	520 (49.2)
ASA IV	1,093 (0.6)	241 (1.8)	71 (2.6)	24 (2.3)
Diagnosis (%)				
Osteoarthritis	139,036 (80.9)	10,402 (78.1)	2,014 (73.3)	691 (65.1)
Inflamatory joint disease	1,298 (0.8)	504 (3.8)	195 (7.1)	104 (9.8)
Acute trauma, hip fracture	15,819 (9.2)	668 (5.0)	119 (4.3)	50 (4.7)
Sequele childhood hip disease	2,994 (1.7)	425 (3.2)	135 (4.9)	69 (6.5)
Osteonecrosis	4,363 (2.5)	320 (2.4)	57 (2.1)	26 (2.4)
Sequele fracture/trauma	4,042 (2.4)	455 (3.4)	116 (4.2)	67 (6.3)
Tumor	823 (0.5)	47 (0.4)	11 (0.4)	6 (0.6)
Other secondary osteoathritis	2,960 (1.7)	392 (2.9)	63 (2.3)	28 (2.6)
Acute trauma, other	401 (0.2)	55 (0.4)	18 (0.7)	7 (0.7)
Other joint diseases, missing	136 (0.1)	51 (0.4)	18 (0.7)	14 (1.3)

Table 5.4.1. Age, sex, BMI, ASA class and diagnosis in first, second and multiple-time revisions from 2012. Corresponding variables are shown for primary hip replacements for comparison.

** Two step procedures is considered as one revision.*

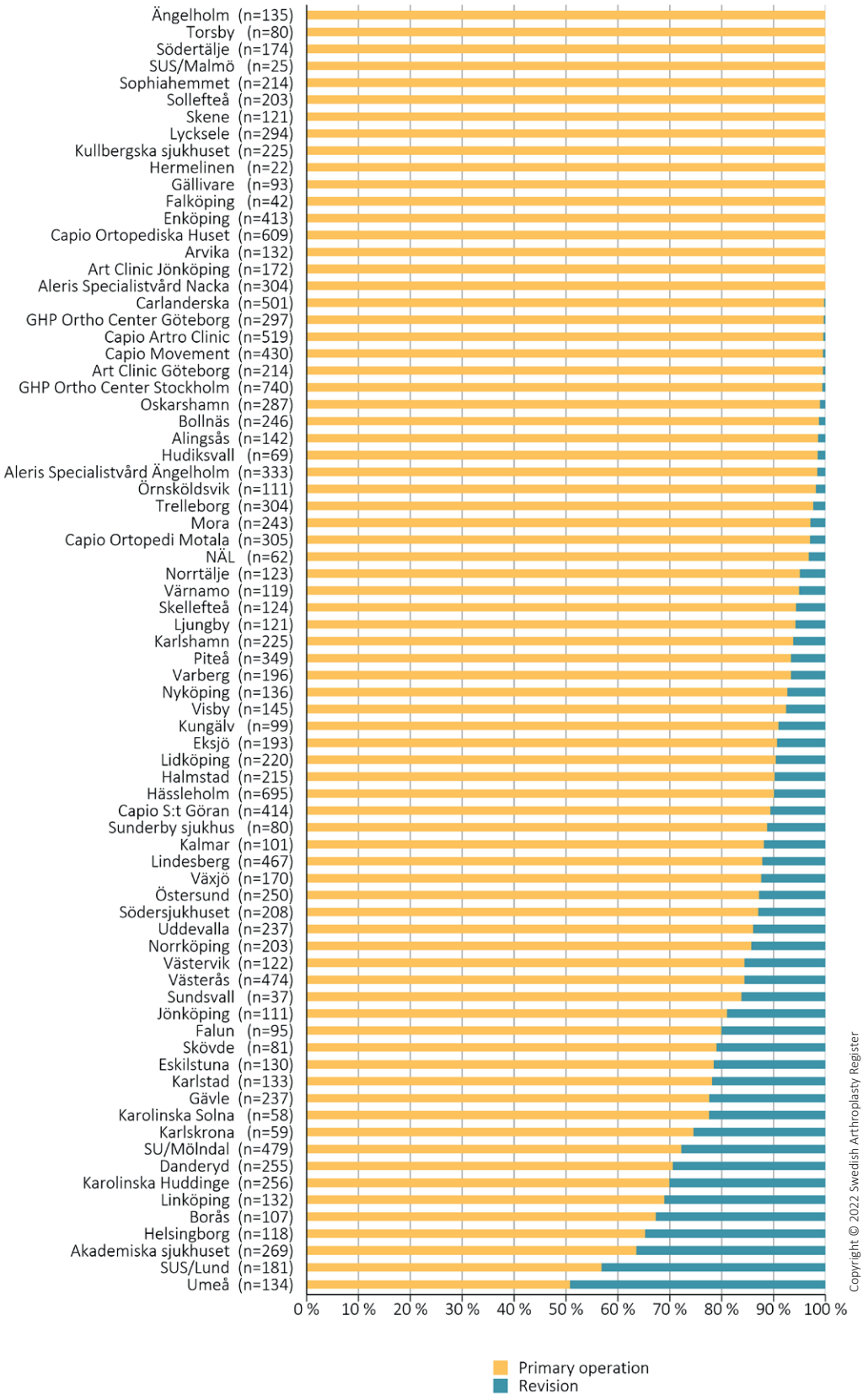

Figure 5.4.4. Distribution of primary total hip replacements and revisions of total hip replacements per unit in 2020. Total number of primaries and revisions are shown to the left.

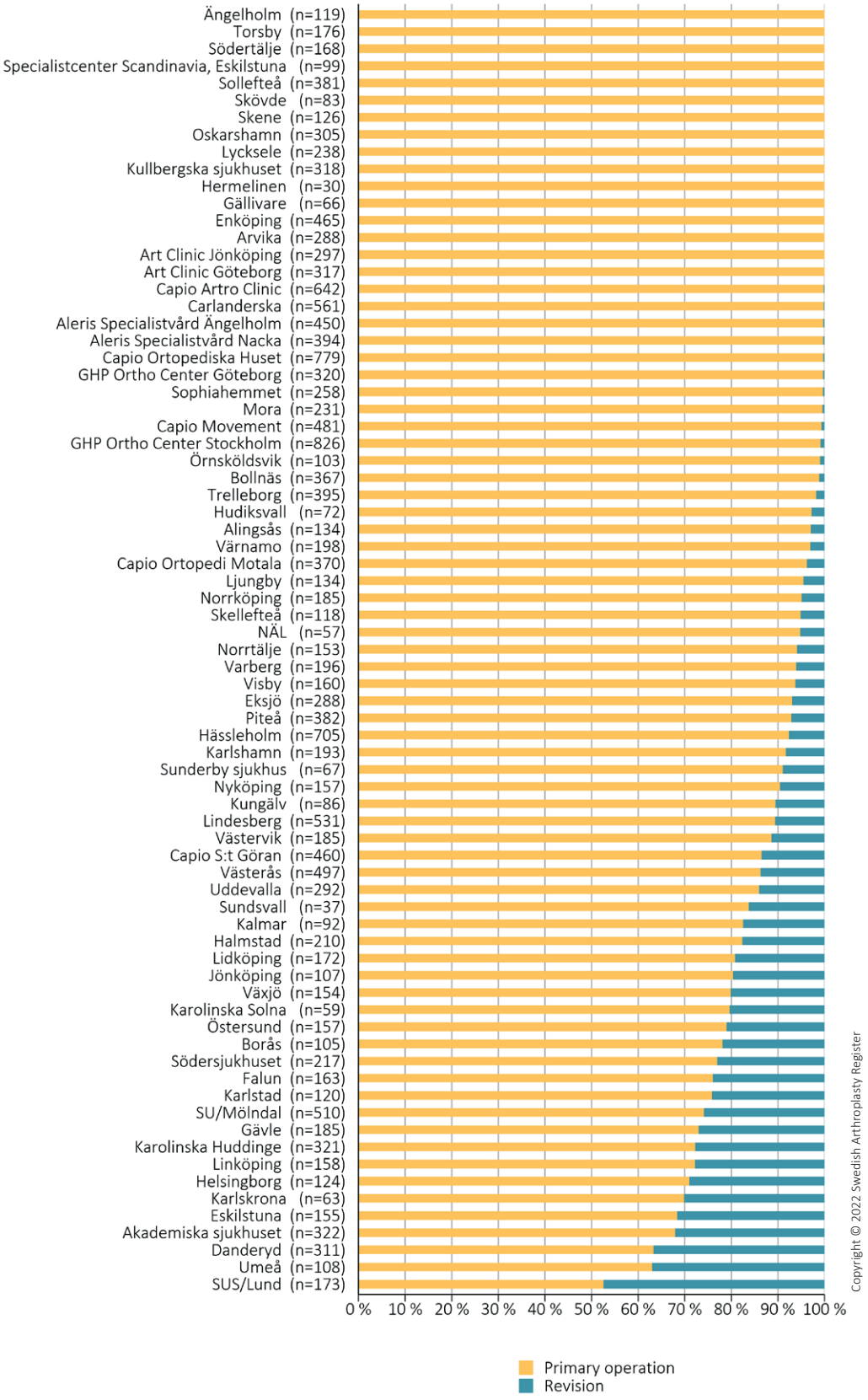

Figure 5.4.5. Distribution of primary total hip replacements and revisions of total hip replacements per unit in 2021. Total number of primaries and revisions are shown to the left. The number of units performing few revisions have been relatively constant over time. In 2021, 37 units reported 25 or fewer revisions and 26 of them performed at the most 10 revisions.

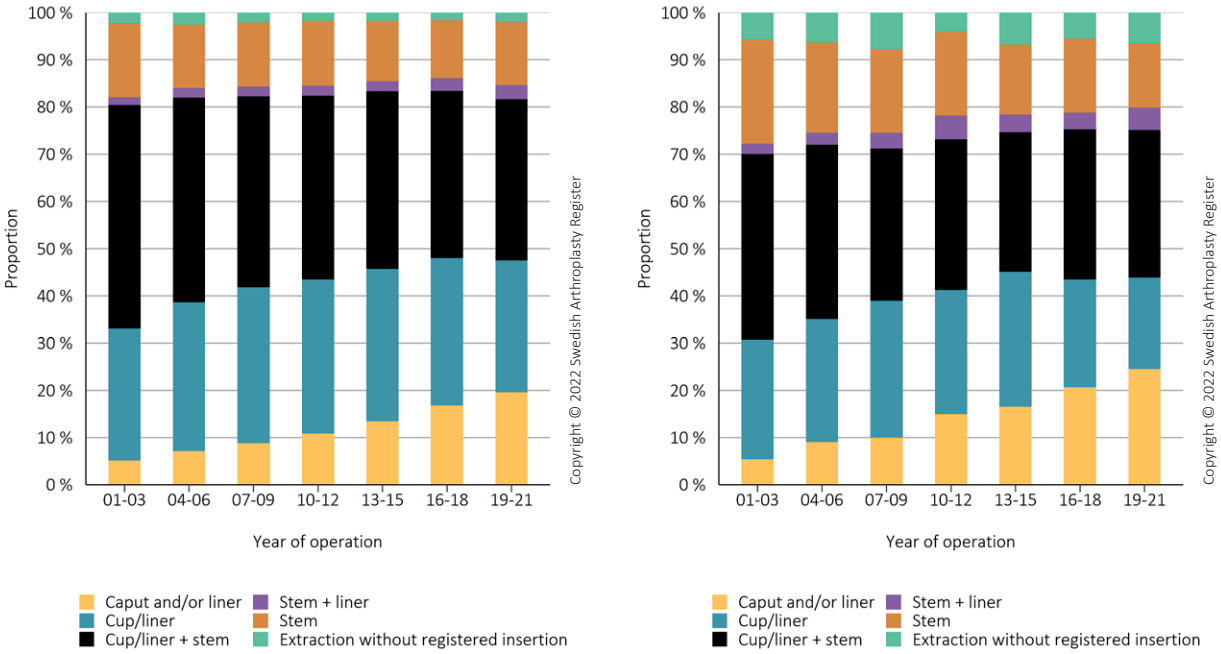

Figure 5.4.6 a–b. Distribution of reasons in first time (a) and multiple-time revisions (b) in two-year periods between 2001 and 2021.

before (2020) the distribution was relatively similar. 25 units performed 1 to 10, 14 units 11–25, 11 units 26–50, 8 units 51–100, and 2 units (Akademiska Sjukhuset, SU Mölndal) performed 109 and 138 revisions respectively.

In figure 5.4.4 and 5.4.5 the distribution of primary hip replacements and revisions per unit is given in the group total replacements in 2020 and 2021. The total number of these operations is also given in order to be able to assess the relevance of the percentage distribution.

Single units that report ten or fewer revisions per year may have problems with bad reporting, but in most cases the reported number should be correct. In total, these hospitals have performed 115 revisions in 2021, in most cases due to infection (n = 45), loosening (n = 40) or dislocation (n = 29). Exchange of femoral head with or without concurrent liner exchange (n = 47), exchange of cup and/or liner (n = 40), exchange of cup/liner and stem (n = 22) were the most common measures. In other cases, a prosthesis extraction or exchange of stem was performed.

In summary the number of units with small revision volumes per year has been relatively constant. We think it is an advantage to maintain a certain volume of revisions not least as decisions about performing a revision or not and choice of technique may be difficult. In addition, peroperative complications and unexpected findings and events in revision surgery are not uncommon. In these cases, an experienced and for the purpose trained personnel and access to special instruments, bone bank and a sufficiently large assortment of implants should be available.

Reason for revision

Between 2004 and 2021 aseptic loosening (49.2%), infection (21.5%), dislocation (13.4%) and periprosthetic fracture (9.2%) have been the most common reasons for revision regardless of existence of earlier revision or not. Over time the distribution of reasons has however changed (figure 5.4.6 a and b). For first-time revision 65% of the operations performed 2004–2005 were caused by loosening, osteolysis and/or wear that also form part of this group. Dislocation came in second (12.8%) followed by periprosthetic fracture (8.5%) and infection (7.1%). For multiple revision in the same period, above all, the proportion of revisions due to infection and dislocation is higher at the expense of a decreasing number of revisions due to loosening (loosening: 40.8%, infection: 28.0%, dislocation: 17.7%, periprosthetic fracture: 7.1%).

Until the period 2020–2021 this distribution is changed in both groups. In first-time revision loosening still dominates, but has been reduced to 44%, followed by infection (24.5%), periprosthetic fracture (13.2%) and dislocation (12.4%). Deep infection was the most common

reason for multiple revision in the period 2020–2021 (56.2%) followed by loosening (21.8%), dislocation (13.2%) and periprosthetic fracture (5.0%). The total number of revisions regardless of if it is a first-time or multiple revision has regarding loosening decreased from about 970 per year in 2004 and 2005 to 617 per year 2020 to 2021. Between the corresponding periods a most significant increase of revisions due to infection can be seen from 213 per year in the first period to about 550 per year in the last period. For the reason dislocation the number of cases decreases marginally from 235 per year in 2004–2005 to 205 per year 2020–2021. Regarding periprosthetic fractures that are treated with revision, there is an increase to about 185 per year until 2018–2019 where after the number has been relatively constant.

In general, the distribution of the four most common reason groups loosening/osteolysis/wear, infection, dislocation and periprosthetic fracture differ between first-time and multiple revisions. There is also a sex-related difference. In the last six years, revision due to loosening has been the most common reason for revision in females (43.6%). Regarding males, loosening and infection share the position as most common reason for revision. 36.9% of the males are revised due to loosening and just as a large proportion due to infection. Infection is second among the female patients (23.5%), followed by dislocation (16.2%) and periprosthetic fracture (9.5%). The proportion of males revised due to periprosthetic fracture is similar as the dislocation group (10.1%). The total number of reported revisions in 2016–2021 was somewhat higher for males (5 550) than for females (5 342).

In the group other reasons for revision several different diagnoses and procedures can be found. Several of them are also treated surgically without implant exchange or extraction why chapter 5.2 and the chapter "Uncommon reasons for reoperation" in the annual report of 2018 give a better overview. One of these other reasons is implant fracture which we have accounted for in the last annual reports.

Implant fracture

Implant fracture is an unusual complication that in most cases is synonymously with fracture of the prosthesis stem. Stem fracture is however not given as specific cause in the Swedish Arthroplasty Register. Instead implant fracture which also encompasses fracture of internal fixation material and in very rare cases fracture of the cup. Exact data on which component or components that have been affected is thus missing. In table 5.4.2 we have defined those operations where a primary operation has been revised or a revision has been re-revised with stem revision due to implant fracture. The table shows the total number of reported stems of a specific design, the number that has been revised due to implant fracture divided into primary and revision cases and the proportion of fractures in relation to the total number of reported operations with each stem respectively regardless of if it is a revision or primary operation. In the column farthest to the right we have tried to define how many of the implant fractures that affect the smallest stem size and other stem sizes. In some cases, information is however lacking for some (for example SP dysplasia) or for all implants why this data has been left out or been given as the smallest certain proportion.

Five stems have a fracture frequency about one percent or more. Three of those (MP custom-made, Reef and ZMR) have only been used in a few cases, why any conclusions cannot be drawn. Regarding the remaining two the observed total number of SPII dysplasia is low (n = 59) while the short Exeter revision stem has been used in 1,062 primary or revision operations. Revitan had in earlier annual reports about one percent stem revisions due to implant fracture but is now at 0.6%. Regarding Lubinus SPII it is above all stem size 01 that is affected by revision due to implant fracture. In total in the period 1999–2021 there are 89 fractured stem-cases (0.6%) after primary operations and 6 cases (1.0%) after revision. The corresponding proportions for the smallest sized Exeter stem of standard length is 0.1% and 0.7% respectively and for Exeter short revision stem 0.4% and 1.3% respectively.

In general, the risk of implant fracture is higher (0.23%) after revision than after a primary operation (0.05%). If one divides into uncemented and cemented fixation we find that the increased frequency of revision mainly can be attributed to the cemented group where 0.06% of the cemented primary prostheses and 0.02% of the uncemented primary prostheses have been revised due to implant fracture. The corresponding distribution for revisions is 0.4% and 0.2% respectively, probably depending on the fact that small, cemented stems have been used in cement-in-cement revision.

In summary, we find that the risk of implant fracture is increased in the use of certain cemented stems. In general, small stems of certain models should not be used in younger patients with a narrow medullary cavity. We

Stems inserted 2001–2021 and revised because of implant fracture (n = 286)

	Number inserted 2001–2021	Fracture of primary/ revision stem	Proportion with implant fracture	Smallest size /other stem sizes [2)]
		Number	% [1)]	Numbers with fracture
Cemented				
Cenator	275	1/0	0.4	0/1
Charnley	6,173	3/0	0.05	–
CPT	6,787	2/5	0.10	0/7
Durom	381	1/0	0.3	–
Elite Plus	1,723	3/0	0.2	2/3
Exter short revision stem	1,062	1/11	1.1	–
Exter long	1,804	1/3	0.2	0/4
Exeter standard	98,110	57/14	0.1	26/45
MP custom-made	2	0/1	50	–
MS-30 polished	23,793	4 1/2	0.05	2/10
Müller straight	1,257	2/0	0.2	–
Spectron EF Primary	11,736	11	0.1	9/2
SP II Dysplasi	67	2	4.5	1/2
SP II standard	181,433	100/17	0.1	95/22
Uncemented				
Bi-Metric X por HA NC	9,465	6/0	0.1	0/6
CFP	464	1/0	0.2	1/0
CLS	15,239	6/0	0.04	0/6
Corail high offset	7,464	1/0	0.01	0/1
Corail Revision	285	1/1	0.4	≥0/≤2
Corail standard	25,344	6/1	0.02	0/75
MP	3,750	0/3	0.1	–
Reef	25	0/1	4	–
Restoration	1,873	0/1	0.1	–
Revitan	1,162	0/7	0.6	–
Wagner Cone	2,542	2/0	0.1	0/2
Wagner SL Revision	823	0/1	0.1	–
ZMR Taper	10	0/1	10	–
No information			1/31	
All cemented/uncemented	**334,603/68,446**	**215/71**	**0.1 [3)]**	

Table 5.4.2. Stems revised due to implant fracture after a primary or revision procedure (regardless number of previous revisions) 2001–2021.

1) Primary and revision-prostheses.

2) Smallest size according to registration in SAR.

3) 0.06% of primary stems, 0.36 of revision stems.

–) No information about stem size or not relevant. Some groups may include different stem lengths.

hope that this overview in part can be of help, at least regarding designs that, if possible, should be avoided. Regarding best choice any specific recommendations cannot be given except that well-documented stems of size and model that have the lowest frequency in table 5.4.2 or that cannot be found there at all should be used. It should however be pointed out that a stem fracture not always is a completely avoidable complication and the more a stem is used the greater is the probability that at least a few stem fractures will occur. When assessing stems that are not in the list the number of used stems and observational time for the stem model in question must be considered.

Reason for re-revision related to previous reason of revision

The reason of the first-time revision of a patient affects the reason profile for a possible second time revision (table 5.4.3). A patient who undergoes a first revision due to loosening/osteolysis, infection or dislocation has a high probability of being revised in a possible second revision for the same reason. The same applies for patients who undergo a second revision where this trend is, if possible, even more clear except in the infection group. In infection an extraction of the prosthesis on the other hand becomes even more common with increasing number of passed revisions. If one adds the groups re-revision due to infection with the group that undergo extraction this group accounts for 16.7% of the first-time revisions and 19.6% of the second time revisions.

Reason for revision related to the previous one

	Loosening	Infection	Periprosthetic fracture	Dislocation	Other/Missing
Primary replacement 2003–2021 n = 302,536					
First revision, %	1.4	1.1	0.5	0.7	0.3
No revision, %	96				
First revision 2003–2021 n = 25,073					
No reported insertion, %	1.2	7.4	1.5	3.2	2.6
Loosening, %	**5.6**	1.1	2.7	1.9	3.8
Infection, %	1.1	**9.3**	2.1	3.3	3.2
Periprosthetic fracture, %	1.1	0.4	0.8	0.9	1.1
Dislocation, %	2.2	1.2	**3.6**	**6.8**	3.6
Other/Missing, %	0.7	0.5	0.7	0.6	1.4
No re-revision, %	88.1	80.2	88.5	83.4	84.3
Second revision 2003–2021 n = 5,301					
No reported insertion, %	1.8	10.7	1.8	4.1	3.8
Loosening, %	**6.5**	0.7	4.7	2.8	3.4
Infection, %	1.9	**8.9**	2	2.8	5
Periprosthetic fracture, %	1.1	0.4	0.7	1.3	0.5
Dislocation, %	3.3	1.9	**6.8**	**8.8**	5.4
Other/Missing, %	0.8	0.6	0.7	1.1	1.2
No re-revision, %	84.6	76.9	83.3	79.1	80.6

Table 5.4.3. Distribution of reason for second and third revision respectively in percent, related to the reason for any preceding revision. Primary replacements and revisions between 2003–2021 are included. The group loosening includes osteolysis and wear. For two-staged revisions, the reason that were relevant for the first stage (extraction) is stated. Prosthesis extraction that is not followed by insertion is presented in a separate group. For a smaller proportion of these, insertion of a prosthesis may be planned in 2022. Percentage indicating the most common reason for re-revision in bold.

An exception from the rule that the specific reason for revision remains the same if the patient is revised again constitute of the patient group that is re-revised due to periprosthetic fracture. In these cases, the most common reason for a possible subsequent revision is dislocation followed by loosening and infection, both after first-time and second time revision. This year primary and revision operations performed between 2003 and 2021 are reported. As in the previous annual report complete and partial prosthesis extractions where a second procedure (stage 2) has not been registered are reported. In these cases, based on the dates for those prosthesis extraction performed, we can assume that most of those patients who underwent this procedure in the three to six last months in 2021 will also undergo prosthesis insertion in the beginning of 2022.

Prosthesis extraction without subsequent insertion of a new prosthesis

Between 2001 and 2021 the proportion of revisions that meant a definitive complete or partial prosthesis extraction constituted 1.9% (mean: 26 per year) in first-time revision and 7.3% (35 per year) in multiple revision. In revision of hemi arthroplasties definitive extraction is relatively much more common (13.8% of all first-time revisions and 24.9% of all multiple revisions correspond-

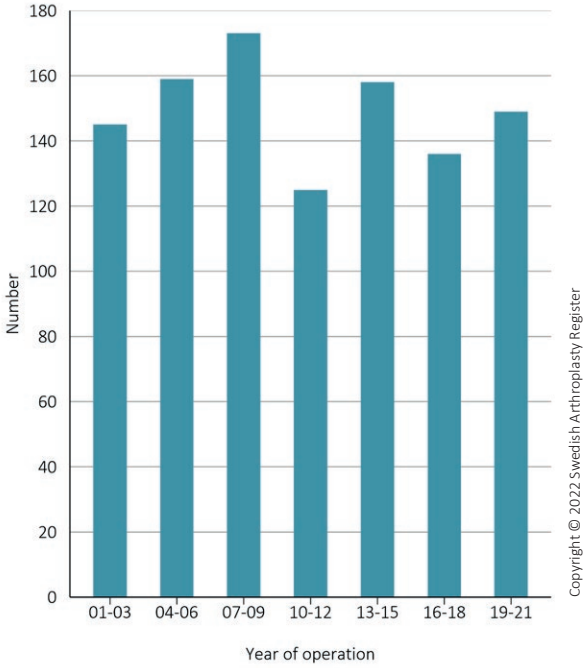

Figure 5.4.7. Number of total and partial extractions per three-year period where there is no report on a subsequent insertion of a new prosthesis or prosthesis component(s).

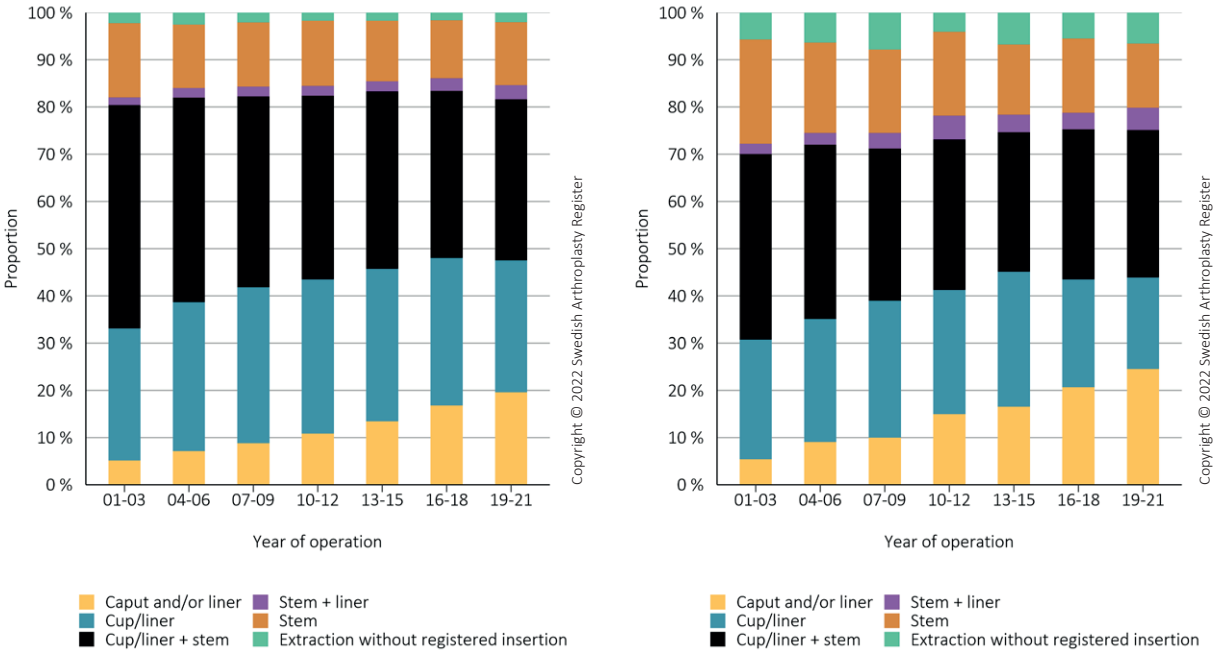

Figure 5.4.8. Relative distribution of procedures in first (a) and multiple-time revision (b) in three-year periods 2001–2021.

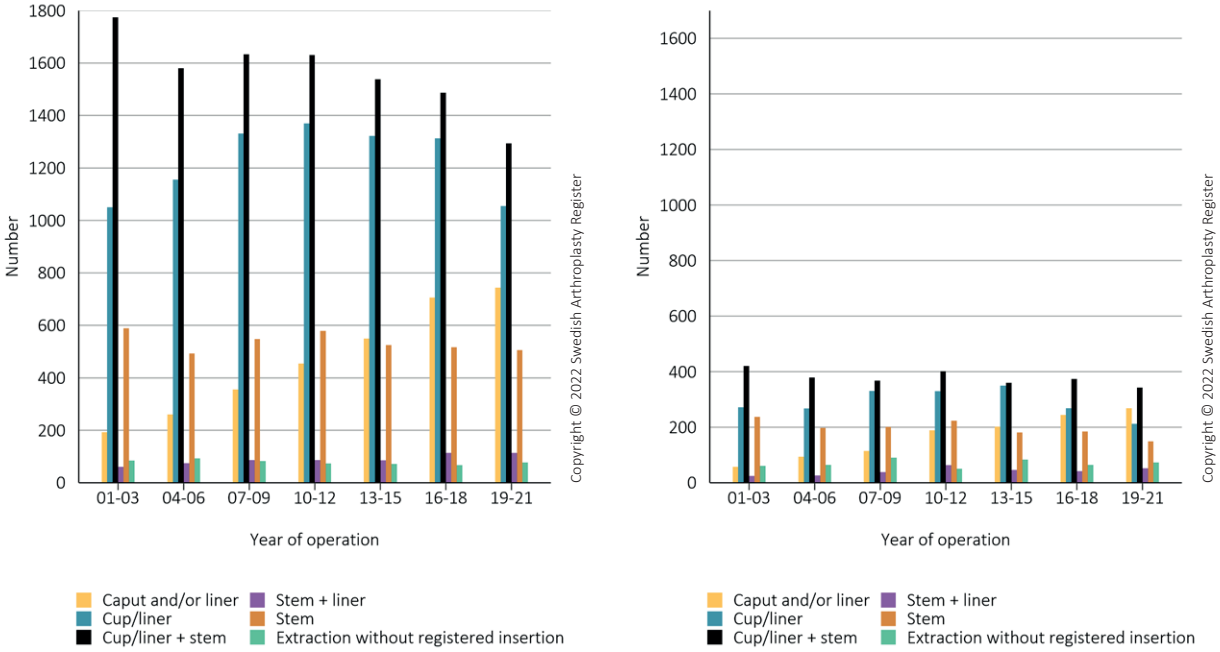

Figure 5.4.9. Number of reported procedures in first (a) and multi-time revision (b) in three-year periods 2000–2021.

ing to 18 and 9 operations per year respectively). In total hip replacements the total number has varied between 124 and 172 in a three-year period (figure 5.4.7). The most common reason in the period 2001 to 2021 was deep infection (first-time/multiple revision: 55.3 / 66.3%) followed by dislocation (21.9 / 20.92%) and loosening (12.5 / 8.8%). In the period, a successive increase of definitive extractions due to infection could be seen at the same time as the reason groups loosening and to an even higher extent dislocation decreased.

In 2020 to 2021 the reason infection constituted 77.6% (n = 45) of all definitive extractions in first-time revision. The corresponding proportion in multiple revision was larger (84.9%, n = 45). In the same period, the reasons loosening and dislocation constituted between 5.7 and 12.1% (n = 3–7 depending on reason and regardless of the number of previous revisions). The remaining proportion (3.4 / 1.9%) were caused by periprosthetic fracture. The mortality among these patients is high, which is to be expected considering that they mainly encompass cases with difficult to treat infection, periprosthetic fracture or dislocation and furthermore have a high degree of comorbidity. Half of the patients who were operated in 2000 and onwards live without a hip prosthesis for just under three years (median: 2.8 years) and just over 9.6% live for ten years or longer.

Type of revision procedure

Exchange of both cup and/or liner and stem has been the most common procedure in both first-time and multiple revisions since 2001 (figures 5.4.8 a and b). Concurrent cup/liner and stem exchange has however decreased both in absolute and relative numbers both in first-time revision and in multiple revision. Instead exchange of femoral head and/or liner has increased since the DAIR-procedures (Debridement Antibiotics Implant Retention) have become increasingly common. Nor is it unexpected that the proportion of extractions without registered insertion constitute a considerably larger proportion of the multiple revisions than of the first-time revisions. However, somewhat more permanent prosthesis extractions are performed, measured as absolute numbers, in first-time revisions than in multiple revisions (figures 5.4.9 a and b).

Choice of procedure related to reason for revision

The type of procedure varies depending on the reason for revision. Here as in other parts of this section the heading exchange/insertion indicates that the patient may have undergone a two-stage procedure. Extractions followed by a registered prosthesis insertion have thus been excluded. Figures 5.4.10 a and b show the relative distribution of procedures related to reason for revision in first-time and

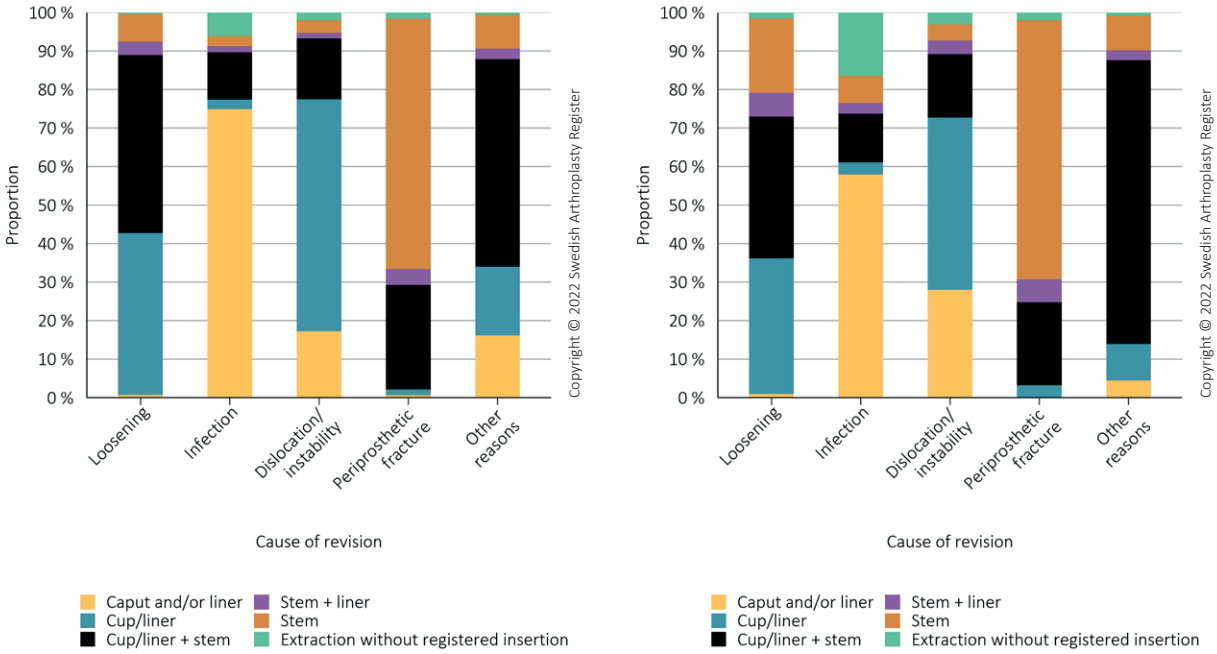

Figure 5.4.10. Relative distribution of procedure per reason for revision in first (a) and multiple-time revision (b) 2016–2021.

multiple revisions performed 2016 to 2021. In aseptic loosening and first-time revision cup/liner exchange combined with stem exchange dominates followed by a small margin by cup/liner exchanges. In multiple revision it becomes relatively more common that only one of the components is revised. In deep infection femoral head and/or liner exchanges dominate in both first-time and multiple revision, and as expected the relative proportion of extractions increases considerably if the hip prosthesis is revised at least one time before. Most periprosthetic fractures are as expected revised with stem exchange. A concurrent exchange of cup is performed in just under one third of the first-time revisions and in one fourth of the cases in multiple revisions. The most common procedure in first-time revision due to dislocation is cup exchange with or without exchange of stem (76.1% in first-time revisions, 62.2% in multiple revisions). Only femoral head/liner exchange was performed in 17% and 28% of cases respectively. In these cases, a dual mobility cup was used sporadically in first-time revision (3.2%) and more frequently in multiple revision (19.7%).

Choice of fixation

As in primary hip replacements the number of operations performed with use of an uncemented cup has increased at the expense of decreasing use of cemented fixation. This proportional increase of uncemented cups was substantial until the period 2010 to 2012 (figures 5.4.11 a and b). Since then, the use of uncemented cup has been relatively stable with a slight tendency towards a decrease in absolute numbers in 2019 and 2021, however not as pronounced as for cemented cups. Similar tendencies are seen in multiple revision even if the number of inserted implants is considerably lower. On the stem side, similar pattern can be observed even if the use of uncemented stem in multiple revision started to dominate a little earlier than on the acetabular side (figures 5.4.12 a and b). Overall, the number of inserted cups and stems starts to decrease from the period 2010–2012 when 3,728 cups were inserted (1,944 cemented, 1,784 uncemented) and 2,982 stems (1,533 cemented, 1,449 uncemented) in revision regardless of the number of previous revisions. In the period 2019–2021 the corresponding number of cups was 2,839 (1,188 cemented, 1,651 uncemented) and 2,441 stems (1,232 cemented, 1,209 uncemented), corresponding a reduction of 24% and 18% respectively. This is reflected in both fewer isolated cup and stem exchanges as well as concurrent exchanges/insertions of both cup and stem.

In revision surgery the concept completely cemented, completely uncemented, hybrid and reverse hybrid become difficult, since only parts of the prosthesis mostly

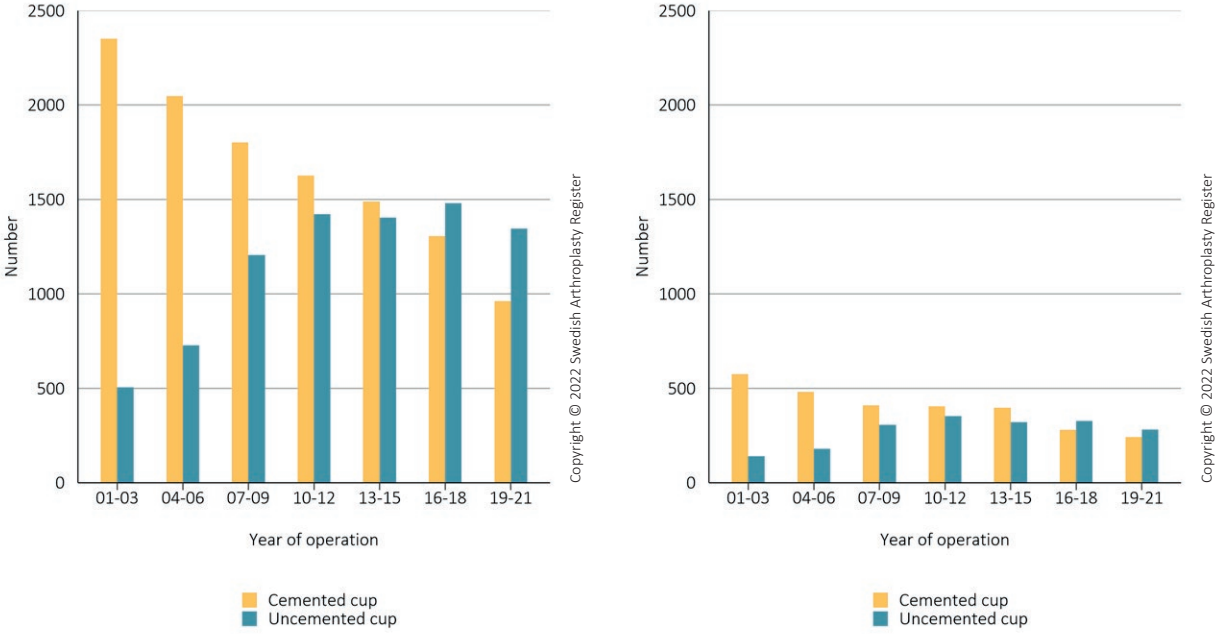

Figure 5.4.11. Distribution of cemented and uncemented fixation respectively of the cup in first (a) and multiple-time revision (b) in three-year periods 2001–2021.

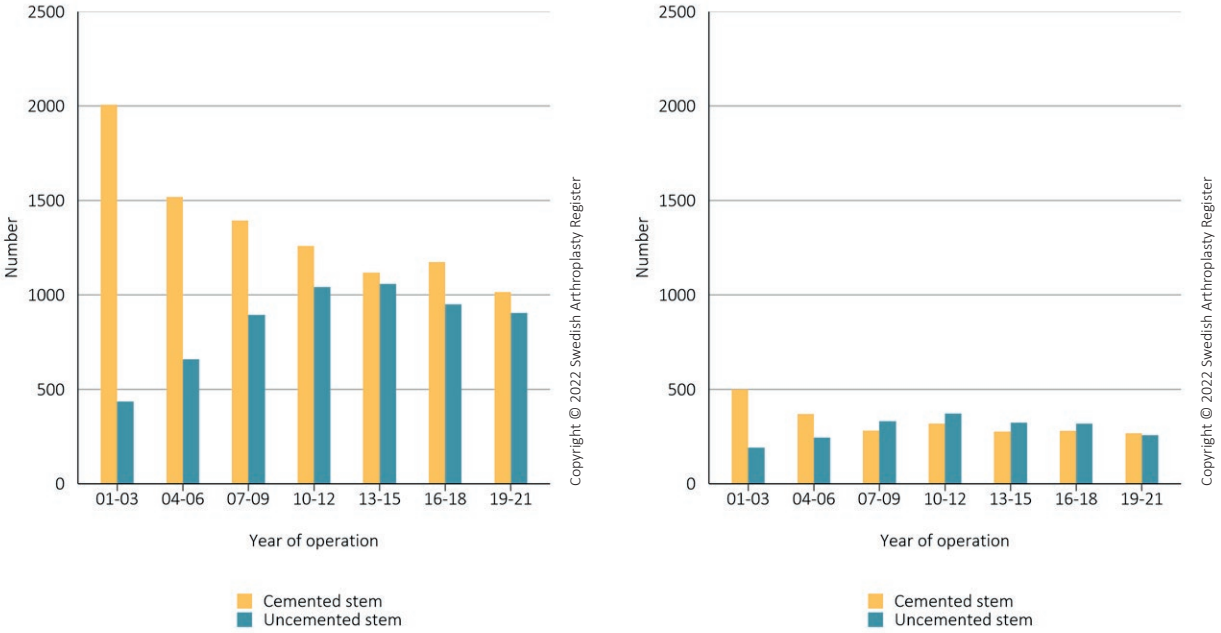

Figure 5.4.12. Distribution of cemented and uncemented fixation respectively of the stem in first (a) and multiple-time revision (b) in three-year periods 2001–2021.

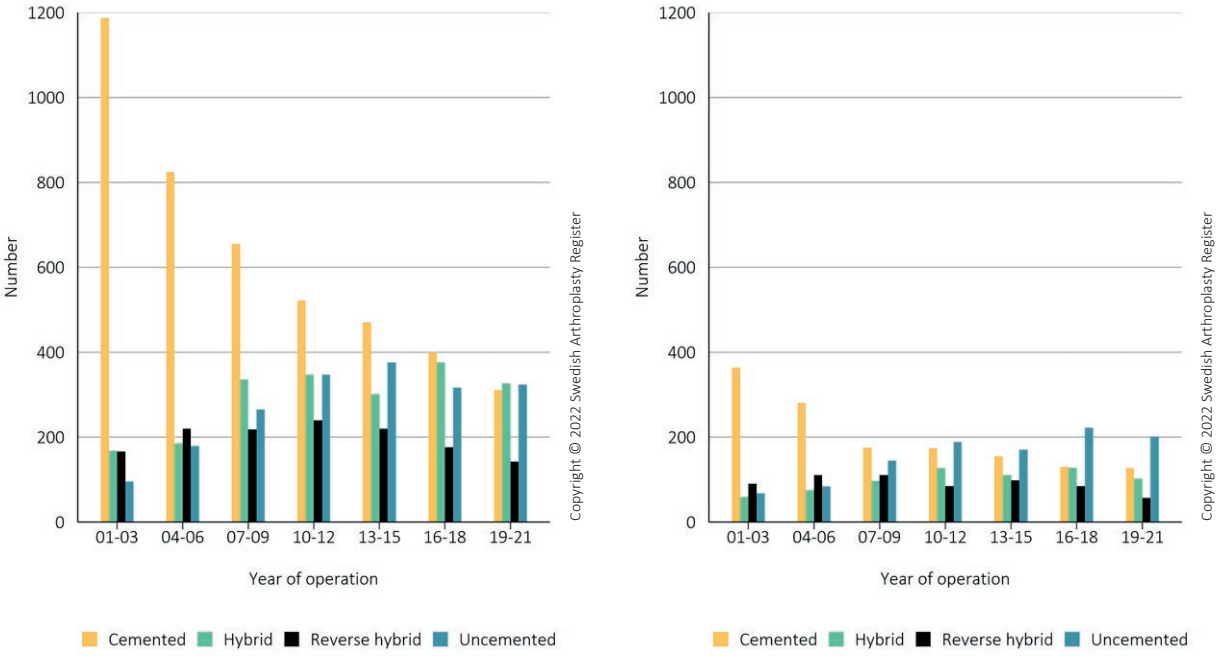

Figure 5.4.13. Distribution of completely cemented, completely uncemented, hybrid and reverse hybrid fixation in cases where all components were exchanged in first (a) and multiple-time revision (b) in three-year periods 2001–2021.

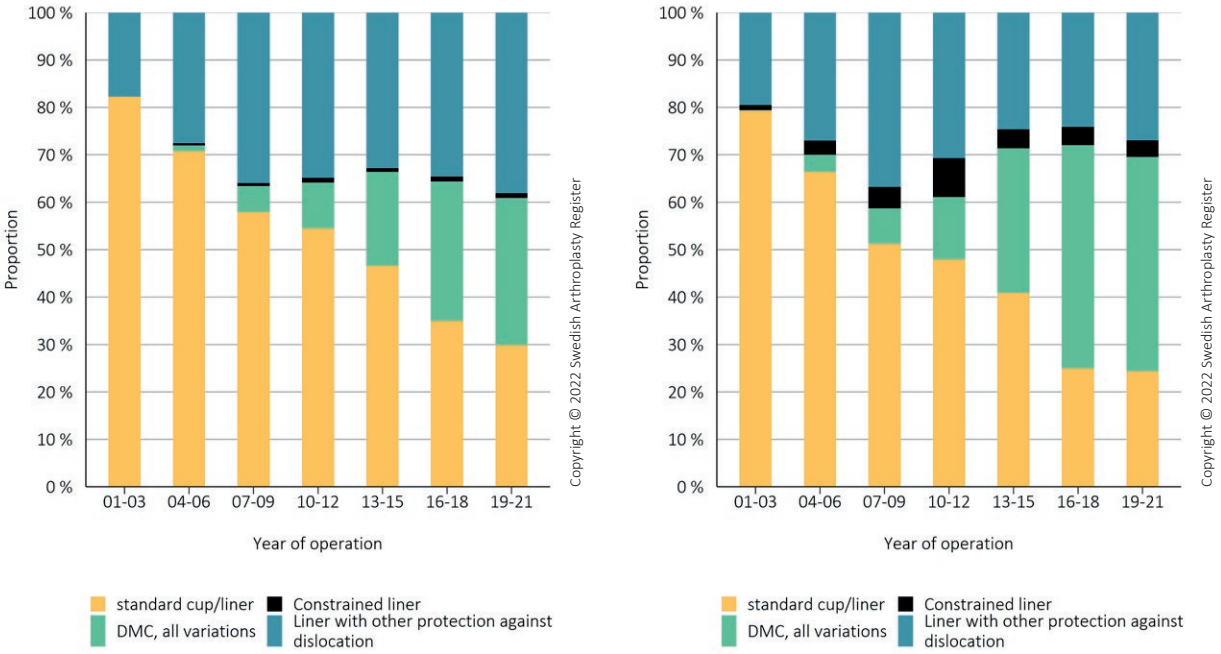

Figure 5.4.14. Distribution of various cup or liner constructions in first (a) and multiple-time revision (b) in three-year periods 2001–2021 used to protect against dislocation.

are exchanged. This means for example that a prosthesis that after revision is deemed to be a hybrid may retain one to several "original parts" or constitute a completely new prosthesis if all parts have been exchanged. In the period 2001 to 2021 all components were exchanged in one-stage or two-stage procedures for 39.3% of all first-time revisions and in 45.5% of all multiple revisions (figures 5.4.13 a and b). Between the years 2000 and 2003 both components were cemented in most cases. Since then, there is an increase of combinations where at least one uncemented component is included and in multiple revisions this increase applies, above all, for all uncemented revisions. Since the period 2007–2009, hybrid fixation has been as common as completely uncemented fixation in first-time revision while the use of the reverse hybrid-concept has decreased successively.

Choice of cup and liner

In the last two decades the use of cup or liner constructions that are designed to decrease the risk for dislocation has become ever more common (figures 5.4.14 a and b). Initially this increase was mainly caused by use of liners with an acetabular wedge augment or an elevated rim, increased inclination, or similar modifications. Another alternative is plastic inserts that have a lock-in effect on the femoral head, "constrained liner" which is used in only a limited number of cases, maybe due to varying clinical results in the literature. Dual mobility cup (DMC) was reported the first time in 2002 (a revision) and has since then been used in increasing numbers until 2018 (500 revisions) to decrease somewhat thereafter. In 2020 and 2021 about 370 insertions per year were reported, probably in parallel with fewer performed revisions. As in primary operation the cemented DMC has been the most used. However, it has however become increasingly common to cement a DM-cup in an existent shell in revision or that the cup is converted to DM-function by using a metal insert (figure 5.4.15).

Choice of femoral head

Femoral heads are routinely exchanged in almost all revisions. Starting in 2001 there is data on inserted femoral head in 92.9% of all revisions. In other cases, the femoral head has not been exchanged or a possible exchange has not been reported. Figures 5.4.16 a and b illustrate the change in the choice of femoral head size since the period 2000 to 2002 in first-time revision and multiple revision. Over time there is a transition to 32 and 36 mm as an effect of the introduction of wear-resistant polyethylene with extra crosslinking with the wish to reduce the risk of dislocation. Since 2013 the relative proportion of 36 mm heads have been between 16 and 20% without any definite tendency to further increase. The same applies of double-articulating femoral heads that all have an outer diameter from 40 mm and upwards. Since 2016 the proportion has been about 22 to 23% of all first-time revisions and 33 to 34% of all multiple revisions. In revision, most cases are operated with a conventional femoral head made of metal (90% regardless of first-time or multiple revision). In 9% ceramics is used and in 1% of the cases the choice of material is missing.

Choice of stem

In the 2000s the number of revisions where the stem is exchanged has decreased slowly. The reduction has been somewhat more pronounces in the last twelve years. In 2001, 1,056 stem revisions were reported, in 2010, 981 stem revisions and in 2021 836. The reduction mainly reflects a decrease of combined stem/cup exchanges while the number of isolated stem revisions with or without liner exchange has been relatively constant.

In first-time revision the proportion of stems fixated with cement has dominated with the lowest proportion 2010 to 2012 (53.4%) and the increase slowly (figures 5.4.17 a and b). In multiple revision the proportion of

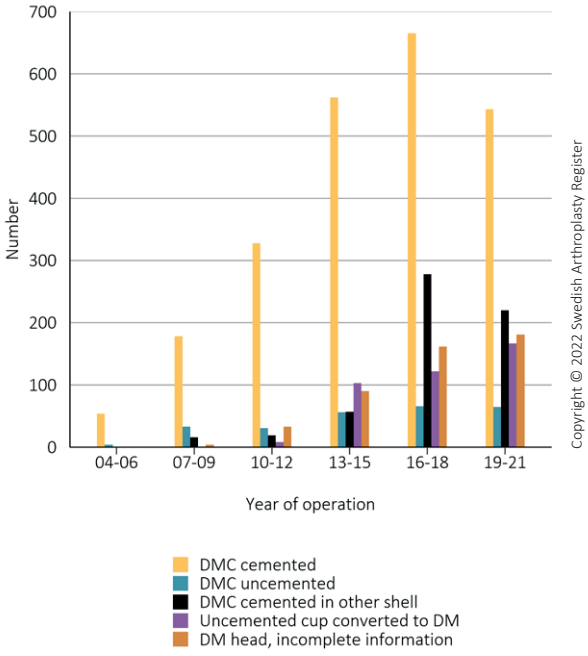

Figure 5.4.15. Choice of fixation concept using dual mobility cup. Both first- and multiple-time revisions are included.

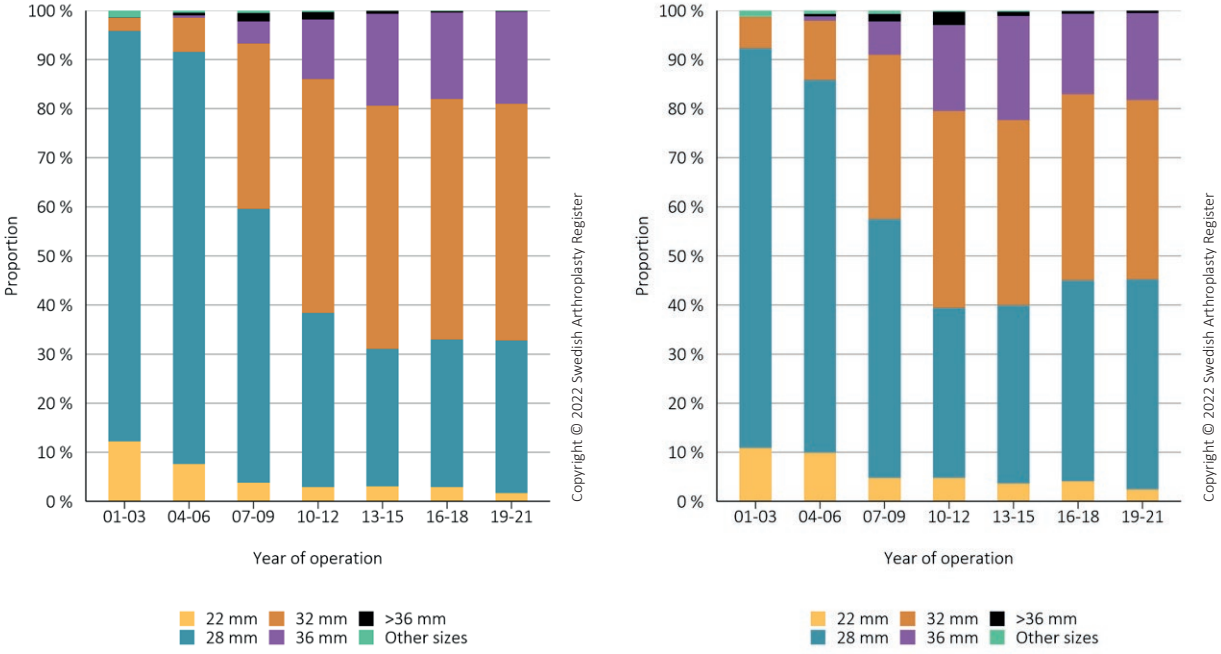

Figure 5.4.16. Choice of femoral head size in first (a) and multiple-time revision (b) in three-year periods 2001–2021. Prosthesis with dual mobility cup are presented separately.

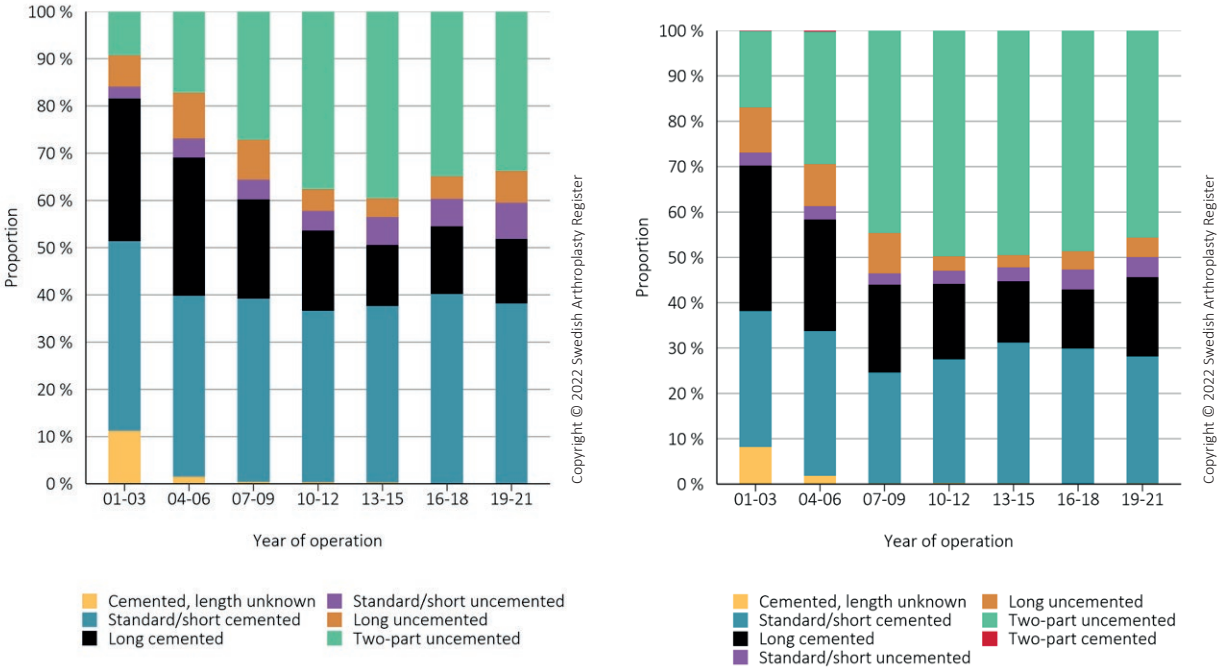

Figure 5.4.17. Distribution of cemented and uncemented types of stem respectively in first (a) and multiple-time revision (b) in three-year periods 2001–2021. The stem is defined as long if the length exceeds 150 mm.

Most used cup and stem

2011		2020		2021	
Name	**%**	**Name**	**%**	**Name**	**%**
Cup, Cemented, n	**627**	**Cup, Cemented, n**	**382**	**Cup, Cemented, n**	**360**
Exeter Rim-fit	19.8	Avantage	31.7	Avantage	33.1
Marathon	19.5	Exeter Rim-fit	20.4	Exeter Rim-fit	18.3
Lubinus	12.9	Lubinus x-link	19.1	Lubinus x-link	15.8
Avantage	12.1	Marathon	10.5	Polarcup cemented	11.9
ZCA XLPE	7	Polarcup cemented	9.2	Marathon	10.6
Other	28.7	Other	9.2	Other	10.3
Cup, Uncemented, n	**584**	**Cup, Uncemented, n**	**504**	**Cup, Uncemented, n**	**522**
Trilogy	21.6	TMT revision	25.6	Tritanium revision (trident)	23
TMT revision	21.2	Tritanium revision (trident)	20	TMT revision	19.7
Continuum	15.8	Pinnacle 100	8.5	Continuum	9.4
TMT modular	14	Continuum	7.7	Pinnacle 100	6.3
Trident AD LW	5.8	Pinnacle W/Gription Sector	6.2	Trilogy IT	5.2
Other	21.6	Other	31.9	Other	36.4
Stem, Cemented, n	**551**	**Stem, Cemented, n**	**401**	**Stem, Cemented, n**	**414**
Exeter standard	31.8	Exeter standard	36.4	Exeter standard	37.4
SPII standard	24.9	SPII standard	33.4	SPII standard	33.6
Exeter short rev stem	12.2	Exeter short rev stem	7	Exeter short rev stem	8.5
Exeter long	8.2	Exeter long	6.2	Exeter long	5.3
CPT long rev	7.3	MP proximal standard	4.5	MS-30 polerad	3.4
Other	15.8	Other	12.5	Other	11.8
Stem, Uncemented, n	**444**	**Stem, Uncemented, n**	**319**	**Stem, Uncemented, n**	**389**
MP proximal standard	44.8	Restoration	35.1	Restoration	31.6
Restoration	23	MP proximal standard	27.3	MP proximal standard	30.3
Revitan cylinder	16.7	Corail revision	11.6	Arcos (proximal part)	12.1
Bi-Metric X por HA NC	2	Arcos (proximal part)	6.6	Corail revision	8.2
Revitan spout	2	Revitan cylinder	5.6	Revitan cylinder	6.7
Other	11.5	Other	13.8	Other	11.1

Table 5.4.4. The five most used cemented an uncemented cup and stems in revision surgery presented as percent of the total number of reported in 2011, 2020 and 201. Both first and multiple-time revisions are included.

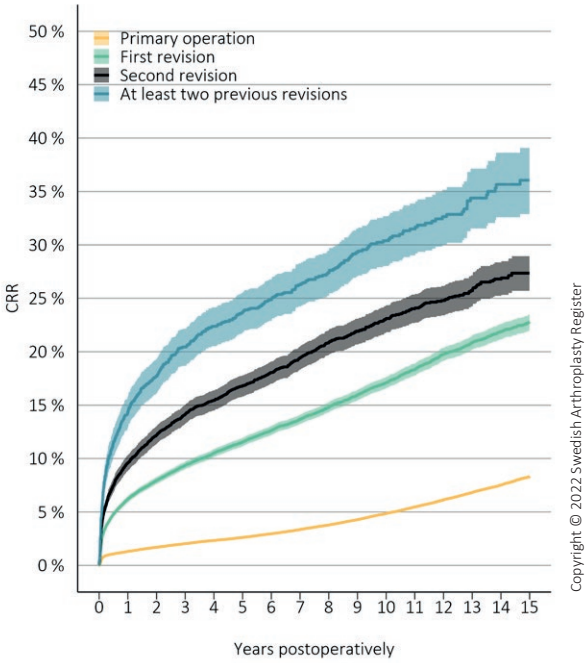

Figure 5.4.18. Cumulative risk of revision until 15 years including both sexes based on revision regardless reason or type of procedure in primary total hip replacements, first and second time revisions and in revisions of hip replacements with at least two previous revisions. Revisions from 2001 are included.

cemented fixation decreased to less than 50% in the period 2007 to 2009 with a weak tendency to recovery in the last three years based on increased use of long cemented stems. Between 2001 and 2003 long cemented stems were used in 32% of the multiple revisions. Since then, the proportion decreased to 13.1% in 2016 to 2018 to increase to 17.4% in the last three years.

Between the years 2001 and 2010 some sort of bone graft in femur was used in one third of the cases that had cemented fixation (first revision: 33.9%, multiple revision: 37%) and more uncommonly when the stem was fixated without cement (first-time revision: 4.3%, multiple revision: 6.8%). In the subsequent period until 2021 the proportion operated with some type of bone graft in femur has decreased to 22.9% / 28.9% (first-time/multiple revision) in fixation with cement. The corresponding proportion in uncemented fixation was 3% and 5.4% respectively. Unfortunately, it is not possible from register data to assess if these operations are performed with classic bone packing or not.

From the register's review of medical records, it is indicated if the existent cement mantle has not been extracted, which is used as an indicator for cement-in-cement revision. In first-time revision with cement this proportion has increased from 3.4% to just over 40% in 2013 to 2015 to thereafter be relatively constant. The same development applies for multiple revision but to a somewhat lower proportion (25.2% 2019 to 2021). In summary, this means that roughly 50 to 60% of the cemented stem revisions that are performed in Sweden either consist of cement-in-cement revision or revision combined with some type of bone transplantation.

Choice of specific implant

Table 5.4.4 lists the most used cemented and uncemented cups and stems in 2021, in the year before and in 2011. The schedule is rolling and updated yearly. As the data on stem length is not entirely complete, all SPII-stems and Exeter stems in standard design has been brought together in each group. Exeter short revision stem is reported separately since its result regarding risk of stem fracture is different from other stems in the same family.

Cemented dual mobility cup have in the last years been frequently used in revisions. In 2021, DM-cups of different brands accounted for half (54.1%) of the total number of cemented revision cups. Moreover, 28 DM-cups with uncemented fixation were reported and 183 operations were reported where a Dm-cup had been cemented in an uncemented shell whereof 69 in a shell that had been inserted in a previous operation. The by-far most used DM-cup is Avantage, also when cemented in an uncemented cup shell.

The two most used uncemented cups (Tritanium revision, TM revision) have changed places between 2020 and 2021. The change should perhaps be seen in the context that cups with a trabecular metal surface have not shown any safe advantages and at the same time cost more than cups that have a porous surface of standard type. The place of following brands differ as well between 2020 and 2021 but as the numbers are relatively small, no large changes in numbers are needed to change their place.

Different variations of Exeter and Lubinus SPII stems dominate when choosing cemented fixation in the whole period. In the last two years the distribution has remained unchanged.

Among uncemented revision stems the same implants as in 2020 remain even if the internal placement has changed. Compared with 2011 the proportion of two-

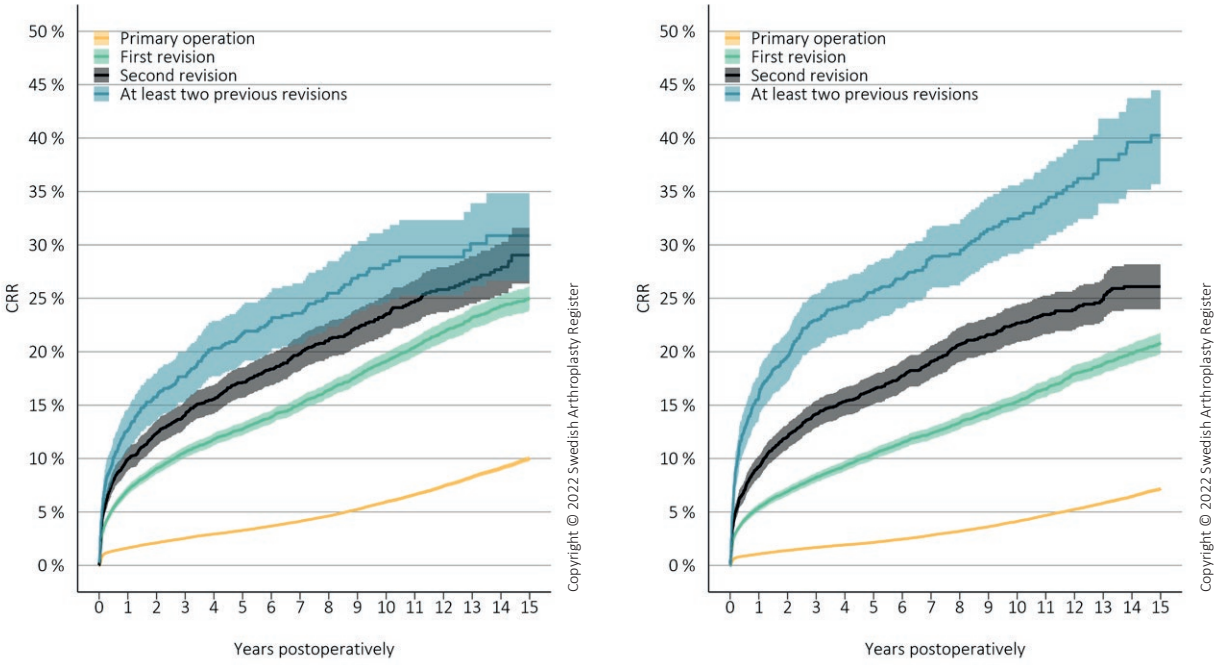

Figure 5.4.19. Cumulative risk of revision until 15 years' in males (a) and females (b) based on revision regardless reason or type of procedure in primary total hip replacements, first and second time revisions and in revisions of hip replacements with at least two previous revisions. Revisions from 2001 are included.

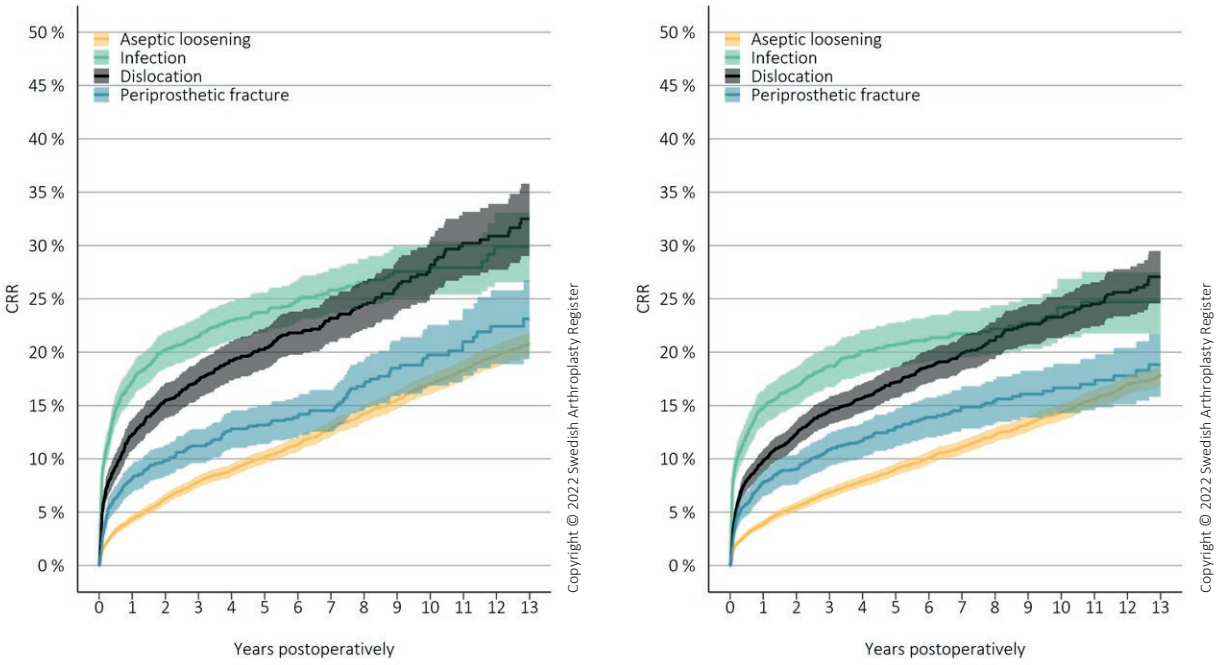

Figure 5.4.20. Cumulative risk of revision in males (a) and females (b) divided on reason for revision and based on outcome of revision regardless its reason, type of procedure performed and number of previous revisions. Revisions from 2001 are included. The curves end at 13 years as the number of observations at that time become less than 100 in some of the groups.

part revision stems has decreased somewhat with an increased use of Corail Revision (earlier Corail KAR).

Just as in primary surgery the consistency is in Sweden regarding choice of implant greatest for the choice of cemented fixation. The size of the group "others" in each fixation group respectively gives a certain, albeit, limited perception of how diversified the choice of implant is, because the way of classifying implants to some extent affects how large the group "others" becomes. Since 2011 the group others have decreased regarding choice of cemented revision cup while there has been an increase in the other groups and especially in the group uncemented cup. In this group there are 12 different systems of uncemented cups where Tritanium, TMT, Continuum, Pinnacle Gription and Pinnacle standard are the five most used.

Result

The risk of revision increases progressively the more times a hip prosthesis has been revised. The cumulative risk of revision after 15 years in primary total hip replacements operated from 2,000 and onwards is 8.8 ± 0.2% (mean ± 2 SEM, 36,761 observations at 15 years), in first-time revisions 23.2 ± 0.8% (2,145 observations), in second time revisions 27.2 ± 1.6% (474 observations) and in hips that have been revised at least twice previously 36.5 ± 2.8% (178 observations) (figure 5.4.18). In figures 5.4.19 a and b cumulative revision risk in males and females respectively is shown in the same period and with the same grouping. In the last years of observation, data is however more uncertain since only 90 (hip replacements in males) and 88 observations (females) at 15 years remains in the smallest group (two or more previous revisions). The grouping is the same as in figure 5.4.18. The cumulative revision risk in males is higher in three of the groupings (primary, first-time and second time revision).

The prognosis measured as risk of re-revision is therefore getting worse after each performed revision. Evaluation with Cox regression analysis including all diagnoses except tumour diagnosis at 15 years and with adjustment for age, sex, primary diagnosis and surgical year shows that the cumulative risk of (re)revision is 3.7 times higher (95% confidence interval: 3.6–3.9) after first-time revision compared with primary operation, 5.0 (4.7–5.3) times higher if the patient is revised for the second time and 7.2 (6.7–7.8) times higher if the hip has been revised at least twice previously. In general, males have 30% increased risk of revision or re-revision (1.30; 1.26–1.33).

The reason for revision affects the patient risk of having additional revisions, which has been illustrated previously in this section (table 5.4.3). Analysis of cumulative revision risk divided into to the four most common reasons for revision shows that the risk of re-revision is the highest if the reason is infection or dislocation. The cumulative revision risk increases early after the index operation, which means that these revisions occur early (figures 5.4.20 a and b). After four to five years the curves for the different reasons for revision lose their parallelism, especially because the risk of re-revision due to infection decreases. The mortality in this group is high and furthermore an increasing number of hips revised due to infection will have been operated with a prosthesis extraction.

Summary

Revision of a hip replacement means that a patient with a hip replacement having another operation where the whole or parts of the prosthesis are exchanged or extracted.

Since the period 2001 to 2003 the proportion of revisions of the total number of primary and revision operations has decreased from 11.5% to 8.5% in 2019 to 2021.

Since 2001 loosening has been the dominating reason in first-time and multiple revision but the relative proportion has decreased successively. Instead, above all revisions due to infection have increased and have become the most common reason for revision in those cases that have been revised at least once previously.

Patients having a revision are in general older, are more often males and have more often a secondary osteoarthritis and a higher degree of comorbidity than those operated with a primary hip replacement.

The number of low-volume units in Sweden has been relatively constant in the last ten years. In 2021, 37 units performed 25 or fewer revisions and 26 units performed only one to ten revisions.

The risk of having additional revisions increases with the number of already performed revisions. The prognosis is worst for revision due to infection followed by revision due to dislocation. The importance of optimising the result in the primary operation cannot be emphasized enough.

5.5. Evaluation of implants and implant combinations

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In the last 25–30 years, the results after hip replacement measured as risk of revision has changed successively. The risk of early revision in primary total hip replacement regardless of reason has increased (figure 5.5.1) but in the long-term perspective the results have improved (figure 5.5.2). The increase of the early revisions may in part be explained by an increasing number of revisions due to infection (figures 5.5.3 and 5.5.4), which is covered more thoroughly in chapters 5.2 to 5.4. Here the analyses are based on all total hip replacements regardless of diagnosis. An increased use of uncemented stems with an increased risk of early periprosthetic fracture may also have played a role. The reasons behind a lower risk of revision after about one to two years when the curves in figures 5.5.1 and 5.5.2 start to converge to cross each other later and hereafter diverge are unclear. In chapter 5.3 (revision) we could however observe that the number of revisions due to loosening has successively decreased in the last two decades. Conversion from older polyethylene types to more wear-resistant polyethylene with extra crosslinking has surely contributed to a reduction of the problems with wear, osteolysis and loosening. An increased use of uncemented fixation with a decreased risk of loosening in the longer perspective may also have contributed.

The Swedish Knee Arthroplasty Register has since several years presented a so-called ranking list in order to assess if the risk of revision after operation at a specific unit lies on the expected level or not. Since 2021 the Swedish Arthroplasty Register presents a corresponding analysis in primary elective hip replacements with a 10-year follow-up (figure 5.5.5). Unlike in previous annual report and in the first analyses in this section all diagnoses are included except hip fracture (acute or sequelae) and tumour. The cumulative risk of revision has been adjusted for differences in the distribution of diagnosis, age, sex and surgical year. Differences in addition to the expected may apart from real differences between implants also depend on other factors that are possible to influence, for example extent and quality in preoperative planning and patient optimisation, surgical process and technique, and

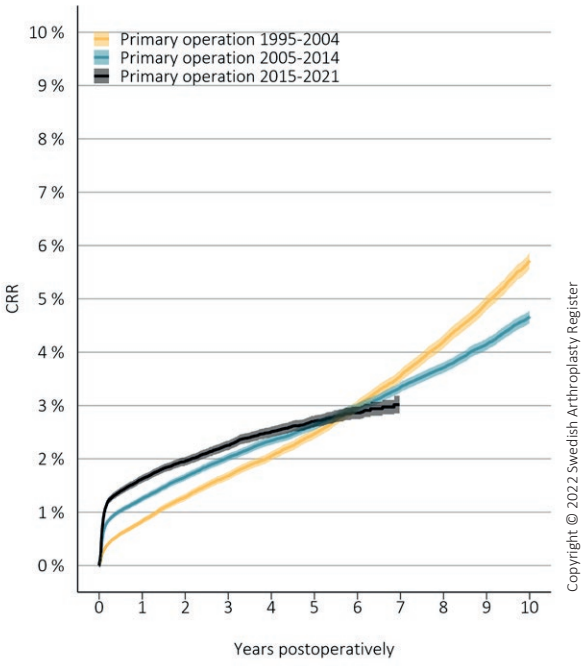


Figure 5.5.1. Cumulative risk of revision due to any reason up to ten years or shorter after primary hip replacement. Total hip replacements, regardless of diagnoses, operated 1995 to 2021 and separated into three following periods are shown.

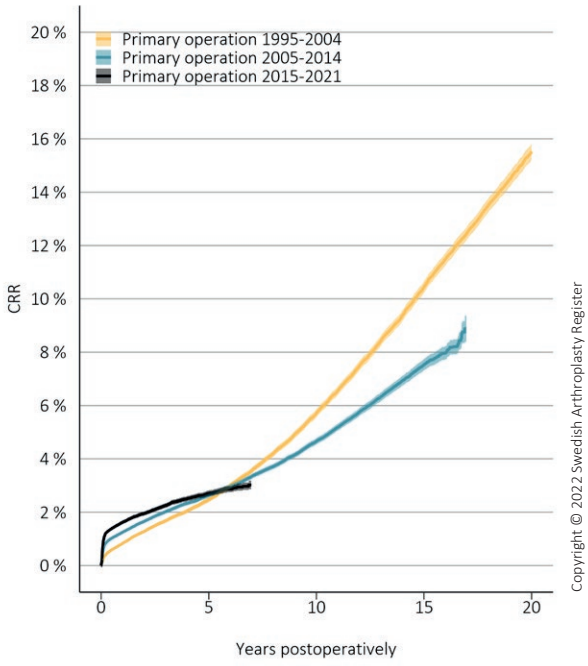


Figure 5.5.2. Cumulative risk of revision due to any reason up to 20 years or shorter after primary total hip replacement. Total hip replacements, regardless of diagnoses, operated 1995 to 2021 separated into three following periods are shown.

choice of articulation. Also, other factors such as proportion of patients with a high degree of comorbidity may play a role and may to a certain extent be affected through preoperative optimisation. The picture is distorted by the fact that patients with a high degree of comorbidity and deviant hip anatomy are often centralised to certain units. The threshold to performing a revision may also vary between different units.

An increased or decreased risk should also be assessed against the absolute number of revisions in the reference group. If some typical reasons for revision are extremely unlikely in this group a significant difference may result compared to the reference group despite a relatively modest increase or decrease of the number of cases in the study group. Thus, many factors must be considered when interpreting the results. Nonetheless, the performed analysis may stimulate to an analysis of causation and if needed, initiate improvement work.

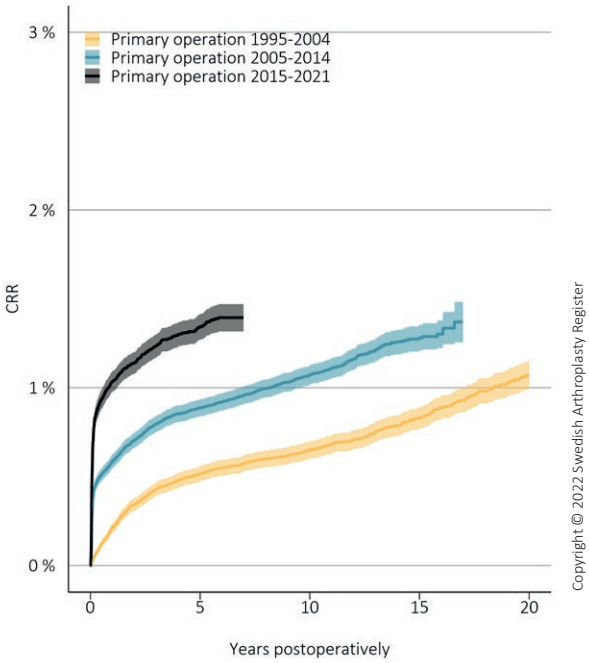


Figure 5.5.3. Cumulative risk of revision due to infection up to 20 years or shorter after primary total hip replacement. Total hip replacements operated, regardless of diagnoses, 1995 to 2021 separated into three following periods are shown.

Figure 5.5.4 a–b. Cumulative risk of revision due to infection up to 20 years or shorter after primary total hip replacement in males (a) and in females (b). Total hip replacements, regardless of diagnoses, operated 1995 to 2021 separated into three following periods are shown.

In Sweden, the merged registries in the Swedish Arthroplasty Register have a long history, the longest in the world. A continuous redistribution of results has meant that in general only well-documented implants are used routinely. Despite this there are differences in cumulative revision risk between the implant combinations that are used. The differences are in general small.

Legal framework for the introduction of implants

The new legal framework of the EU, among other, orthopaedic implants (Medical Device Regulation, MDR, the regulation of the European Parliament and the Council 2017/745) became effective at the end of May 2021. The framework is comprehensive and stresses the importance of clinically demonstrable good related to the degree of risks, unique identification of implants and post-market surveillance. The framework comprises not only completely new implants but can also refer to a new size of an existing prosthesis. Important in the new framework is that the manufacturer has to show that the new prosthesis entails a clear benefit for the patient combined with low risk of complications. In practice this means that a clinical use without limitations cannot be allowed before a sufficiently large patient population is followed-up in a sufficiently long time. Moreover, the clinical result based on patient-reported data must fulfil today's standard and at the same time the risk of complications should be low. How the detailed framework will be implemented will probably not be clear before 2024 when the transition period to the new framework is to be complete. The concept also comprises the construction of a databank (European Databank on Medical Devices, EUDAMED) where all information on a current prosthesis is to be gathered and to which complications can be reported. The database which is under construction contains a unique product identification (unique device identifier – UDI), information on clinical trials and should among other things function as safety monitoring and market control.

This new framework is welcome, as the patient benefit will be large with an increased safety level and the risk of future implant related problems can be reduced. The framework also means that it will become more complicated, time-consuming and probably more expensive to introduce new implants and innovations. On the other hand, the need of well-designed studies will increase as well. Probably the prices will also be affected but to which extent is so far unclear.

The situation in Sweden

In Sweden we have for a long time had a restrictive approach towards change of standard implants. This approach has proved successful since the clinical results of the newest implants at best are on par with already existing ones and several of them are worse. In single cases this cautious attitude may have resulted in a late introduction of implants with better properties than current standard in Swedish healthcare. This drawback weighs relatively light against the background of the good results that have been noted for the most used prosthesis types in Sweden and the sometimes disastrous consequences that can be the result when a new and unknown implant is inserted in a large number of patients.

Today there are no preclinical tests that in a safe way can decide if a new prosthesis functions better or worse than existing ones. Since the prostheses used today in Sweden in general have a very high standard it is mainly in selected patient groups one can expect that additional implant development may make a difference. A change of standard implant also entails a certain risk-taking since new routines must be learnt. Against this background it seems self-evident that change of implant only should be made in those cases where a clinical need exists and where the replacing implant has documented advantages. Service and price also play a role, even if the price often forms a small part of the total cost.

This year's implant evaluation

In previous annual reports we have made a short summary of how other prosthesis registers evaluate implants in order to illustrate that the procedure of implant evaluation is not entirely simple and self-evident. Most registers use the outcome revision, regardless of reason and regardless of which component that is revised. Some registers multiply the number of observed components with the number of observational years, which means that no regard is given to that the reasons for revision vary with time. To the extent a comparison with other prostheses is made, the comparing group may correspond to all other implants, all other implants in the same product category, a selected reference group or a reference implant. Sometimes a fixed limit corresponding to for

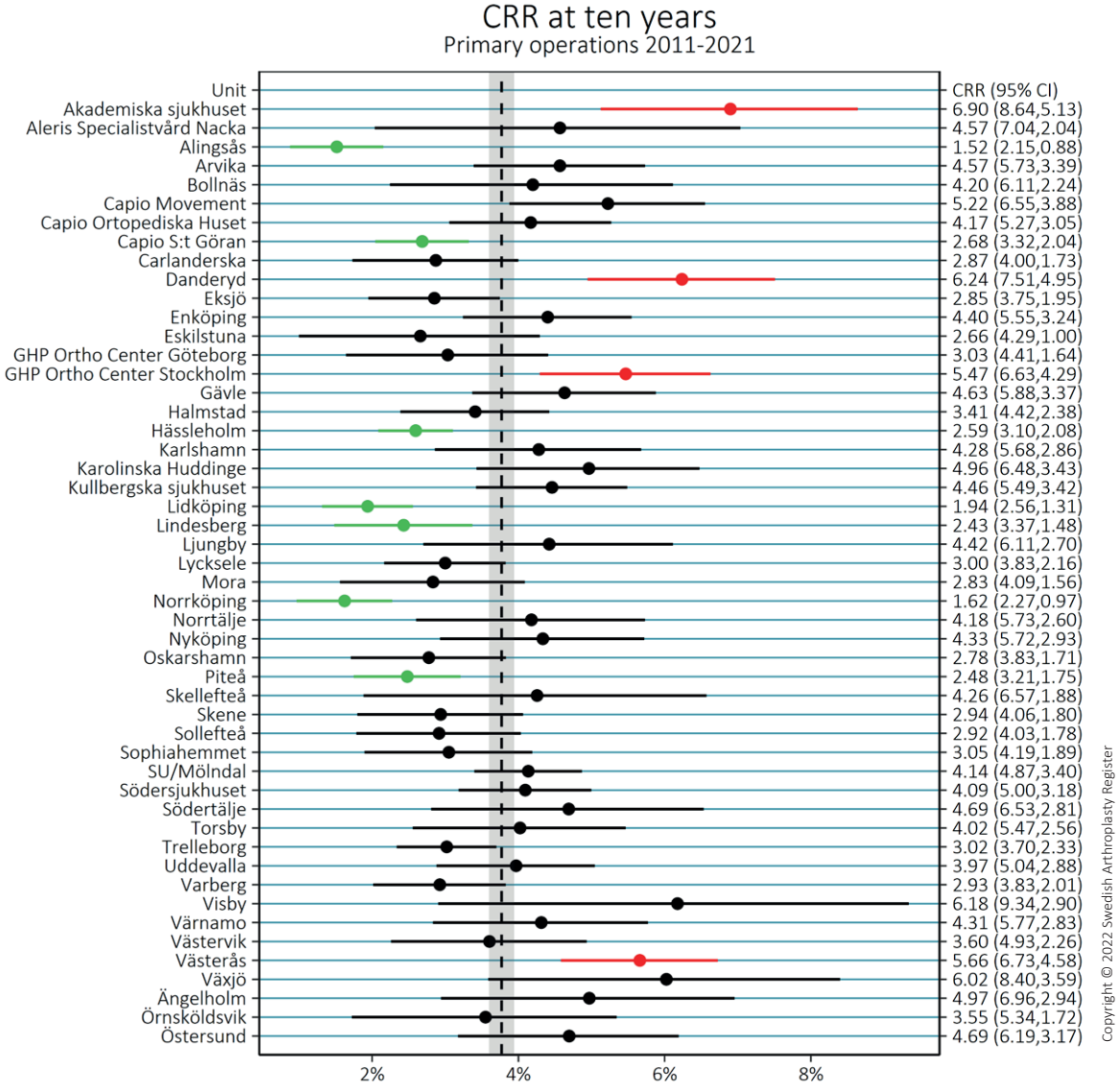


Figure 5.5.5. Comparison of the cumulative risk of revision due to any reason up to 10 years after primary hip replacement 2011–2021. Risk is presented as percent with 95% confidence interval. Green and red respectively indicate if the unit is better or worse than the national average.

example 5% cumulative revision risk after 10 years is used. So far, there has been no established standard. Nor is such a standard completely easy to achieve since conditions vary greatly between different registers regarding total number of observations, the number of different implants that is used within the register's covering area, the length of the follow-up and the extent of the data capture of the single register. Furthermore, exact limit values for quality are a constructed limit based on what is deemed acceptable at a certain point in time. Today's acceptable standard is not necessarily that of 10 to 20 years later.

Control group – choice of outcome

Until the annual report 2020 we have used a reference group consisting of implants with at least 95% component survival after ten years and where at least 50 prosthesis components have been followed in ten years. The outcome when assessing cups has been cup revision in-

cluding liner revision for uncemented modular cups. All reasons for revision except infection have been included. In stems the corresponding outcome is non-infectious stem revision. In both cases revisions are included where also other components have been exchanged or extracted.

The methodology used in the evaluation of risk of cup or stem revision is presented in the previous annual report. Unlike in the annual report of 2021 we include all elective hip replacements this year. This group comprises all diagnoses except hip fracture, sequelae after hip fracture and tumour. Data is adjusted regarding age, sex and diagnosis. In each of the four analyses (cemented cup, uncemented cup, cemented stem and uncemented stem) a comparison is done against a reference implant.

The selection criteria for the reference implant are based on a high and continuous use in the analysed period. The advantage with a reference implant is that data may be easier to interpret. A possible drawback is that the reference implant over time may need to be replaced to another one if it is modified or its relative use decreases or ceases. As in the evaluation of knee replacements the analysis is based on components inserted 2011–2020 with a follow-up to the 31st of December 2021. When analysing cups, hip replacements with both cemented and uncemented stems are included. In the same way cases with both cemented and uncemented cups are included when analysing stems. This way of doing things is not self-evident since for example the risk of cup revision could be supposed to be affected by the choice of stem fixation. Uncemented stems are more often hit by early periprosthetic fracture. In revision, the cup may also be exchanges to avoid dislocation. We think however that this bias is relatively limited. It should however be noted, especially if the group of implants that are in focus is relatively small.

In the group cemented cups, Marathon has been used as reference. This cup was introduced in 2008. The polyethylene is radiation-treated with 5 MRad. In the start of the period (2011–2012) about 2,000 implants were reported per year. Since then, the number of cases per year has successively decreased to 964 in 2020 and 534 in 2021. In table 5.5.1 we find that none of the other cups used between 2011 and 2020 have a significantly lower risk for non-infectiously caused cup revision in Sweden. One of the cups that is made of highly cross-linked polyethylene, ZCA XLPE shows an increased risk of revision. The most common reasons in this case have been dislocation (56.2% of all cup revisions in the period) followed by loosening (33.1%). We have pointed out the dislocation problems associated with the ZCA-cup in previous annual reports, and they can probably partly be explained by the fact that the cup is relatively shallow. Reflection XLPE also showed an increased risk of cup revision in the previous report. In this year's report the risk increase is 2.33 and not statistically significant. The analysis is however now only based 108 cases and 2 revisions due to loosening. 103 of these cups were inserted in 2011 and the latest in 2015.

Several cups made of older polyethylene show an increased risk of cup revision (Lubinus, Contemporary Hooded Duration, ZCA, FAL). In three of the cases loosening is the most common reason of revision while FAL have been revised somewhat more often due to dislocation. Even if the good results in cups made of polyethylene with extra crosslinking speak in their favour the follow-up time of cups with older polyethylene is on average just under two years longer in general, which may have affected the result. Several studies however support the idea that the introduction of polyethylene with extra cross-linking entails a lower risk for revision also with use of cemented fixation.

The first version of the Trilogy cup is the reference in uncemented cups. It has been used since the mid-1990s in Sweden and almost exclusively with the new type of polyethylene since 2007. In 2011, 866 cases were reported. Since then, the number decreased to 332 in 2018 to increase to 497 later in 2021. Most uncemented cups that have been reported in the period 2011 to 2021 have been inserted with highly cross-linked polyethylene (96.1%, ceramics 0.9%, metal/metal insert for conversion to DM or unknown: 3%).

In table 5.5.2 none of the uncemented cups differ significantly from the Trilogy-cup with a lower risk of cup and/or liner revision. In this year's analysis there are nine cup designs that differ on the negative side with an increased risk. Two cups, Trident AD LW and Tritanium show in this year's analysis, unlike in the analysis of the previous year, a statistically significant increase of the revision risk compared with Trilogy while the Delta-TT no longer reaches the limit for statistical significance. Regarding three (Continuum, Trilogy-IT, TMT revision) of the nine, we have previously noted that these cup types often are hit by revision due to dislocation, probably related to the fact that the joint surface is shallow with a lesser embedding of the femoral head or that they

Hazard ratio for cemented cup revision. The Marathon cup is reference.

				95 % CI		
	Number	Follow-up*	HR	Lower	Upper	p-value
Lubinus x-link	34,244	10	1.2	0.93	1.54	0.16
Exeter Rim-fit	20,156	10	0.93	0.7	1.25	0.65
Lubinus	**18,876**	**10**	**1.85**	**1.45**	**2.35**	**<0.01**
Marathon	14,249	10	Reference			
ZCA XLPE	**8**	**10**	**2.12**	**1.61**	**2.79**	**<0.01**
Contemporary Hoded Duration	**2,621**	**10**	**3.31**	**2.41**	**4.56**	**<0.01**
IP Link	1,662	8	1.18	0.59	2.35	0.64
Avantage	1,324	9	1.5	0.78	2.91	0.23
Exceed ABT E-poly without flange (cem)	1,108	10	0.65	0.24	1.78	0.41
ZCA	**1,051**	**7**	**2.2**	**1.27**	**3.8**	**<0.01**
FAL	**576**	**10**	**3.01**	**1.71**	**5.31**	**<0.01**
Other	**357**	**10**	**4.38**	**2.28**	**8.42**	**<0.01**
Elite Ogee	263	10	2.07	0.76	5.64	0.16
FAL x-link	235	10	0	0	Inf	0.98
Polarcup cemented	203	7	0.99	0.14	7.11	0.99
Contemporary	171	10	1.36	0.33	5.51	0.67
Low profile cup	140	7	2.18	0.54	8.84	0.28
Reflection XLPE	108	10	2.33	0.57	9.47	0.24
Primary OA			**0.54**	**0.44**	**0.67**	**<0.01**
Age			**0.98**	**0.97**	**0.98**	**<0.01**
Sex (female)			0.99	0.86	1.13	0.88
Surgical year			**1.04**	**1.01**	**1.08**	**0.01**

Table 5.5.1. Risk (Hazard ratio with 95% confidence interval (CI)) in cemented cup revisions. The Marathon cup is the reference. To be included in the analysis at least 100 observations are needed. The hazard ratios are adjusted for diagnosis, age, sex and surgical year.

Red text indicates statistically significant increased risk of revision and green text indicates statistically significant decreased risk of revision.

**) The follow-up is presented until 20 observations are left at risk.*

Hazard ratio for uncemented cup revision. The Trilogy cup is used as reference.

				95 % CI		
	Number	Follow-up*	HR	Lower	Upper	p-value
Pinnacle W/Gription 100	**9,696**	**9**	**2.11**	**1.2**	**3.73**	**<0.01**
Trident hemi	5,814	10	0.76	0.38	1.55	0.45
Continuum	**5,29**	**10**	**2.46**	**1.42**	**4.26**	**<0.01**
Trilogy	4,647	10	Reference			
Pinnacle 100	**3,663**	**10**	**2.69**	**1.5**	**4.84**	**<0.01**
Trilogy IT	**1,923**	**9**	**4.39**	**2.4**	**8.04**	**<0.01**
Exceed ABT Ringlock	1,911	10	1.45	0.67	3.16	0.34
Pinnacle W/Gription Sector	1,556	7	1.9	0.81	4.46	0.14
Pinnacle sector	1,372	10	1.32	0.52	3.34	0.56
Trident AD LW	**1,153**	**10**	**2.34**	**1.04**	**5.26**	**0.04**
G7 PPS	1,008	5	1.92	0.63	5.82	0.25
Other	**925**	**10**	**4.48**	**2.32**	**8.62**	**<0.01**
Tritanium	**922**	**10**	**2.31**	**1**	**5.32**	**0.05**
Trident AD WHA	909	10	1.17	0.39	3.45	0.78
Regenerex	775	10	0.33	0.04	2.44	0.28
Allofit	759	10	1.18	0.35	4	0.8
Delta-TT	639	8	1.94	0.65	5.75	0.23
TMT revision	**476**	**10**	**3.67**	**1.58**	**8.52**	**<0.01**
BHR	**333**	**10**	**8.82**	**4.24**	**18.35**	**<0.01**
TMT modular	247	10	1.46	0.34	6.34	0.61
Delta Motion	199	10	0.99	0.13	7.48	0.99
Allofit Alloclassic	**159**	**10**	**7.6**	**3.01**	**19.23**	**<0.01**
Ranawat/Burstein	133	10				
Trident II	131	2	0	0	Inf	0.99
R3	107	7				
Avantage Reload	105	7				
Primary OA			**0.59**	**0.44**	**0.81**	**<0.01**
Age			1.01	1	1.02	0.26
Sex			1.15	0.91	1.45	0.25
Surgical year			0.97	0.92	1.03	0.34

Table 5.5.2. Risk (Hazard ratio with 95 % confidence interval(CI)) in uncemented cup revisions. The Trilogy cup is the reference. To be included in the analysis at least 100 observations are needed. The hazard ratios are adjusted for diagnosis, age, sex and surgical year.

Red text indicates statistically significant increased risk of revision and green text indicates statistically significant decreased risk of revision.

**) The follow-up is presented until 20 observations are left at risk.*

Hazard ratio for cemented stem revision. The SPII standard 150 stem is used as reference.

				95 % CI		
	Number	Follow-up*	HR	Lower	Upper	p-value
SPII standard 150	50,73	10	Reference			
Exeter standard	**28,236**	**10**	**1.76**	**1.45**	**2.15**	**<0.01**
MS-30 polerad	**11,92**	**10**	**2.19**	**1.71**	**2.79**	**<0.01**
SPII standard 130	**2,365**	**7**	**3.11**	**1.93**	**5.02**	**<0.01**
CPT	**442**	**10**	**6.42**	**3.28**	**12.58**	**<0.01**
Other	**296**	**10**	**3.06**	**1.25**	**7.5**	**0.01**
SPII standard other	160	8				
BHR	**155**	**10**	**3.75**	**1.61**	**8.73**	**<0.01**
BHR upgrade	**142**	**10**	**4.23**	**1.82**	**9.86**	**<0.01**
Spectron EF Primary	129	10	1.7	0.24	12.15	0.6
Exeter short rev stem	**128**	**8**	**11.67**	**4.32**	**31.51**	**<0.01**
Primary OA			**0.58**	**0.44**	**0.76**	**<0.01**
Age			0.99	0.98	1.01	0.35
Sex (female)			**0.44**	**0.37**	**0.53**	**<0.01**
Surgical year			1.05	1.01	1.09	0.02

Table 5.5.3. Risk (Hazard ratio with 95 % confidence interval(CI)) in cemented stem revisions. The SPII stem is the reference. To be included in the analysis at least 100 observations are needed. The hazard ratios are adjusted for diagnosis, age, sex and surgical year.

Red text indicates statistically significant increased risk of revision and green text indicates statistically significant decreased risk of revision

**) The follow-up is presented until 20 observations are left at risk.*

more uncommonly were used together with a liner that has some form of in-built protection against dislocation.

Pinnacle W/Gription 100 and Pinnacle 100 have been inserted in a large number in the current period. Pinnacle W/Gription 100 has been used in 9,696 operations between 2011 and 2020 and Pinnacle 100 in 3,663 operations. In both cases, dislocation is the most common reason of revision (56.1% and 43.1% respectively) followed by loosening (25.5%, 33.3%). Trident AD LW has been revised just as often due to dislocation as due to loosening (41.7% due to dislocation, 41.7% due to loosening), while loosening dominates as the reason of revision of the Tritanium-cup (72.7 %, 8 revisions). The BHR-cup has been revised due to loosening (38.5%), fracture below the femoral component (23.1%), pseudo tumour (15.4%), and unclear pain (15.4%). The most common reason of revision of the Allofit Alloclastic-cup is dislocation (83.3%, 5 cases). The number of observations is however low (in total 159 cases).

The SP-stem has been used in Sweden since the early 1980s. The original model was 150 mm long regardless of size. In the latter part of the 1980s a modification was introduced with a modular femoral head and the stem changed name from SPI to SPII. Single operations with a stem length of 130 are registered since more than 20 years back. In 2015 the reported number exceeded 100 and increased to 2019 when 624 stems were reported. Since then, the number has decreased. In 2021, 427 insertions are reported. Five units have reported more than 100 operations (196-1,104 per unit) corresponding to 86.4% of all operations with SPII 130 mm.

Hazard ratio for uncemented stem revision. The Corail stem is used as reference.

				95 % CI		
	Number	Follow-up*	HR	Lower	Upper	p-value
Corail	30,089	10	Reference			
CLS	7,032	10	0.96	0.73	1.26	0.75
Bi-Metric X por HA NC	5,513	10	1.28	0.99	1.66	0.06
Accolade II	3,385	9	0.67	0.42	1.08	0.1
M/L Taper	2,31	9	0.83	0.49	1.43	0.51
ABG II HA	**1,535**	**10**	**2.48**	**1.78**	**3.45**	**<0.01**
Wagner Cone	**1,44**	**10**	**2.13**	**1.41**	**3.23**	**<0.01**
Echo Bi-Metric (FPP)	1,023	6	1.14	0.53	2.43	0.74
Accolade straight	883	10	0.98	0.53	1.8	0.94
Other	**542**	**10**	**2**	**1.14**	**3.51**	**0.02**
SP-CL	325	5	0.97	0.24	3.9	0.96
Fitmore	276	10	1.51	0.62	3.67	0.37
Bi-Metric por HA	229	5	0.53	0.07	3.81	0.53
CFP	**211**	**10**	**3.6**	**1.84**	**7.04**	**<0.01**
Echo Bi-Metric (RPP)	208	7	0.8	0.11	5.75	0.83
Bi-metric HA FMRL	163	4	0.83	0.12	5.89	0.85
Symax	150	10	0.55	0.08	3.91	0.55
ANATO	**125**	**6**	**3.48**	**1.11**	**10.89**	**0.03**
Primary OA			0.85	0.65	1.12	0.25
Age			**1.02**	**1.01**	**1.03**	**<0.01**
Sex (female)			**0.74**	**0.62**	**0.87**	**<0.01**
Surgical year			0.97	0.94	1.01	0.12

Table 5.5.4. Risk (Hazard ratio with 95 % confidence interval (CI)) in uncemented stem revisions. The Corail stem is the reference. To be included in the analysis at least 100 observations are needed. Implants without any reported cup revision is presented in italics. The hazard ratios are adjusted for age, sex and surgical year.

Red text indicates statistically significant increased risk of revision and green text indicates statistically significant decreased risk of revision.

**) The follow-up is presented until 20 observations are left at risk.*

SPII 150 mm is the most used prosthesis stem in the country and has been chosen as reference stem. In table 5.5.3 we see that all stems, except SPII with a stem length over 150 mm (SP II other) show a significantly higher risk of being revised compared with SPII. This observation should be interpreted against the background that three groups (including the reference group) comprise 10,000 operations or more and that the proportion of revised stems in these groups is below one percent. Three of the stems with relatively few observations (Spectron EF Primary, BHR, BHR Upgrade) have been inserted in single cases or have not been used at all in 2021 due to suboptimal results and/or serious complications.

Regarding CPT, Exeter standard and MS30 periprosthetic fracture is the most important reason to an increased risk of revision (see section 9.4, Reoperation due to periprosthetic fracture and polished stem).

Regarding Exeter short revision stem half of the revisions have been performed due to loosening. The remaining half consists of equal proportions of revision due to implant fracture and periprosthetic fracture. The most common reason for revision of SPII 130 mm is loosening (57.1%, 0.9% of all observations; SPII 150 mm: 48%, 0.5% of all observations). The second most common reason for revision of the 130 mm-stem is dislocation (31%). The proportion being revised due to periprosthetic fracture amounts to 7.1% (0.11% of all observations; SPII: 3.9%, 0.05% of all observations). Thus, much speaks in favour for using SPII 150 mm as first choice.

The Corail stem is at present the most used uncemented stem in Sweden. Since 2011 on average 3,088 inserted prostheses per year have been reported in the period 2011 to 2021 in elective primary operation. As a comparison it can be mentioned that the corresponding average for the most used cemented stem is more than twice that (6,555 per year).

The Corail stem exists in three main variants of which two are mainly or only used with (coxa vara) or without collar (high offset). As reference prosthesis we have here chosen to gather all these variations regardless of the existence of collar or not and regardless of offset and CCD-angle in analogy with the reference stem for the evaluation of cemented stems.

In this year's report it is like in the previous year's, four uncemented stems that have an increased revision risk compared with the control group. Fitmore has however now ended up below the significance limit and has been replaced by ANATO, a development of the ABG-stem. Regarding ABG II the most common reason is periprosthetic fracture (48.8% of all non-infectious stem revisions). CFP and ANATO are revised most often due to loosening (64.3% and 75.0%). Fitmore and CFP have in general been decommissioned as only 3 Fitmore and 1 CFP stem were reported 2020–2021. In the same period ANATO reported 49 stems (24–25 per year). Wagner Cone is mainly used in operations where a deviant anatomy of the hip can be expected. In this group 52.0% of the patients have the diagnosis sequelae after childhood disease. In the control group the corresponding proportion is only 2.7%. Most revisions of the Wagner Cone stem are done due to loosening (49.2%) followed by dislocation (33.8%).

Summary

In the last 25–30 years the risk of revision within two years has increased. The long-term result measured as risk of revision after 10 to 20 years has improved, probably due to decreased problems with wear, osteolysis and loosening.

The new legal framework of the EU considering orthopaedic implants became effective at the end of May 2021. The new framework means that clinical patient good combined with a low risk of complications must be demonstrated before a new implant can be marketed. This means that clinical use without limitations cannot be allowed before a sufficiently large patient population has been followed-up in a sufficient long time. Until 2024 transition rules apply.

When evaluating implants inserted 2011 to 2021 there is no specific design which has a lower risk of non-infectious cup and stem revision respectively compared with the selected reference implant after adjustment for age, sex and diagnosis. Several have however an increased risk that may be due to implant specific factors. Other factors such as choice of articulation, surgical technique and comorbidity may however have influenced the result especially in those cases when the number of observations is limited.

5.6. Hip fracture treatment with total or hemiarthroplasty

Author: Cecilia Rogmark

More than one third of those who fracture their hip in Sweden are treated by a hip arthroplasty as first treatment. This could either be a total or hemiarthroplasty. In Sweden, this treatment tradition is roughly 20 years old. Earlier mostly internal fixation was used and hip arthroplasty was reserved as secondary treatment only. Due to this solid tradition of internal fixation as gold standard, hip arthroplasty as primary treatment was introduced with a certain caution, even if studies at the time showed that the method had clear advantages compared to fixation. In the past decades the indications have been widened. Now also the oldest and frailest patients are given a hip arthroplasty as first treatment. In 2006, 755 patients were older than 90 years, in 2021 the number was 1,187 and out of these 29 patients were between 100 and 104 years. That the proportion with serious comorbidity (ASA III–IV) has increased from 51 to 63% underlines the same willingness to choose a primary prosthesis. Also, even younger patients get a primary arthroplasty nowadays; in 2006, 158 patients were younger than 65 years of age, in 2021 there were 229.

This chapter accounts the results for individuals treated for a hip fracture with either a hemi or a total prosthesis. Arthroplasty as acute treatment is the most common, but

Demography in hip arthroplasty as fracture treatment

	2017	2018	2019	2020	2021
Number	**6,043**	**6,396**	**6,535**	**6,477**	**6,474**
Mean age (SD)	81.33 (9.54)	81.47 (9.58)	81.58 (9.25)	81.42 (9.44)	81.40 (9.33)
Age group (%)					
<45	16 (0.3)	15 (0.2)	11 (0.2)	17 (0.3)	14 (0.2)
45–54	52 (0.9)	51 (0.8)	51 (0.8)	43 (0.7)	51 (0.8)
55–64	255 (4.2)	228 (3.6)	239 (3.7)	248 (3.8)	235 (3.6)
65–74	1,013 (16.8)	1,134 (17.7)	1,047 (16.0)	1,069 (16.5)	1,024 (15.8)
75–84	2,141 (35.4)	2,248 (35.1)	2,444 (37.4)	2,423 (37.4)	2,444 (37.8)
≥ 85	2,566 (42.5)	2,720 (42.5)	2,743 (42.0)	2,677 (41.3)	2,706 (41.8)
Females	3,993 (66.1)	4,140 (64.7)	4,217 (64.5)	4,045 (62.5)	4,177 (64.5)
BMI (%)					
<18.5	296 (6.7)	317 (6.8)	365 (7.0)	341 (6.7)	408 (7.7)
18,5–25	2,506 (56.6)	2,654 (56.6)	2,889 (55.6)	2,916 (57.2)	2,897 (54.6)
25–30	1,248 (28.2)	1,337 (28.5)	1,516 (29.2)	1,432 (28.1)	1,524 (28.7)
30–35	308 (7.0)	314 (6.7)	362 (7.0)	332 (6.5)	380 (7.2)
35–40	58 (1.3)	61 (1.3)	52 (1.0)	64 (1.3)	75 (1.4)
≥ 40	13 (0.3)	9 (0.2)	14 (0.3)	9 (0.2)	19 (0.4)
ASA class (%)					
ASA I	228 (4.0)	251 (4.1)	236 (3.7)	161 (2.6)	200 (3.2)
ASA II	2,081 (36.1)	2,189 (36.0)	2,259 (35.7)	2,140 (34.2)	2,168 (34.4)
ASA III	3,127 (54.3)	3,274 (53.8)	3,427 (54.2)	3,538 (56.5)	3,469 (55.1)
ASA IV	326 (5.7)	373 (6.1)	400 (6.3)	426 (6.8)	462 (7.3)

Table 5.6.1. Demography in hip arthroplasty as fracture treatment 2017–2021.

6% have received their prosthesis due to complications after other, initial fracture treatment. Counting only the total arthroplasties, 15% of these procedures are performed due to fracture complications. Hemiarthroplasty is a more uncommon option as secondary treatment, just under 2% are inserted in such circumstances.

Looking at the last five years, few changes have taken place. Age distribution, proportion of underweight and overweight, choice of surgical approach and type of prosthesis respectively are unchanged (table 5.6.1, figures 5.6.1 and 5.6.6). As previously noted, the number of obese are higher than the underweighted – otherwise, hip fracture is often associated with frailness and malnutrition.

The two most common stems have become even more dominating: the Lubinus SPII stem was used in 2021 in 64% of the fracture patients and the Exeter stem in 25% of fracture patients. If one counts in the MS30 and the Covision straight stem, 98% are now treated with a well-established cemented stem (table 5.6.2). These four stems have a relatively similar risk of revision at 4–6% after ten years (figures 5.6.2 b-e). In 2021 the uncemented stems constituted less than 1%. The most common Corail stem has higher risk of revision than the cemented stems, 9.6% at 12 years (figure 5.6.2 a). That the direct lateral approach is the most common, may also be seen as an advantage compared with posterior approach, at least when looking at the lower risk of revision in the whole 12-year period (figure 5.6.3).

The surgeon may choose a hemiarthroplasty, or a total arthroplasty with an acetabulum cup. The choices contribute to more implant models regarding articulation (table 5.6.3) compared with the stem side. The most used femoral heads for hemiarthroplasty are Unipolar femoral head, UHR Universal Head (bipolar) and the newly launched Modular Trauma Head (unipolar). When an

The most common stem components in fracture patients

	All	2011	2020	2021
Number	**19,062**	**6,111**	**6,477**	**6,474**
Implant (%)				
SPII standard	10,919 (57.4)	2,702 (44.2)	4,110 (63.5)	4,107 (63.9)
Exeter standard	5,170 (27.2)	1,872 (30.6)	1,692 (26.1)	1,606 (25.0)
MS-30 polished	1017 (5.4)	241 (3.9)	369 (5.7)	407 (6.3)
Covision straight	671 (3.5)	336 (5.5)	171 (2.6)	164 (2.6)
CPT	431 (2.3)	416 (6.8)	11 (0.2)	4 (0.1)
Corail standard	193 (1.0)	152 (2.5)	24 (0.4)	17 (0.3)
Spectron EF Primary	175 (0.9)	174 (2.8)	0 (0.0)	1 (0.0)
Other	116 (0.6)	52 (0.9)	33 (0.5)	31 (0.5)
Restoration	61 (0.3)	11 (0.2)	24 (0.4)	26 (0.4)
Exeter long	54 (0.3)	23 (0.4)	17 (0.3)	14 (0.2)
Bi-Metric X por HA NC	47 (0.2)	47 (0.8)	0 (0.0)	0 (0.0)
Corail coxa vara	42 (0.2)	32 (0.5)	7 (0.1)	3 (0.0)
MP proximal standard	34 (0.2)	18 (0.3)	3 (0.0)	13 (0.2)
Wagner Cone	30 (0.2)	23 (0.4)	3 (0.0)	4 (0.1)
Unknown	25 (0.1)	0 (0.0)	7 (0.1)	18 (0.3)
Corail high offset	24 (0.1)	11 (0.2)	5 (0.1)	8 (0.1)

Table 5.6.2. The most common stem components in fracture patients 2011, 2020 and 2021.

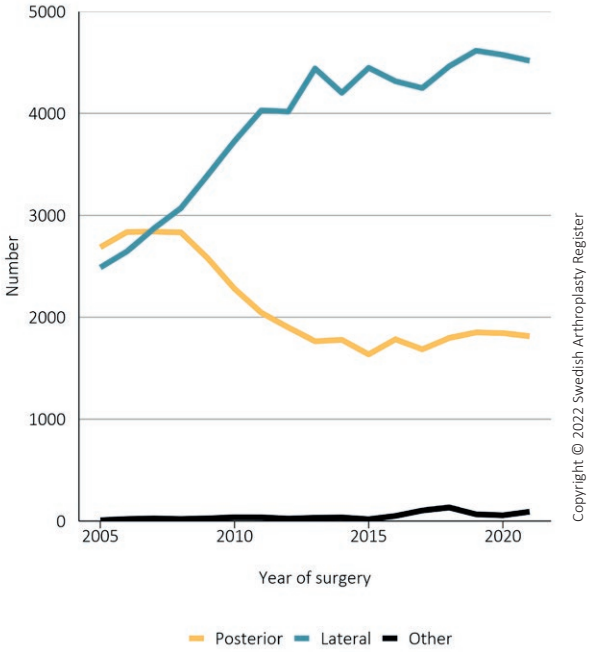


Figure 5.6.1. Choice of surgical approach for arthroplasty due to fracture.

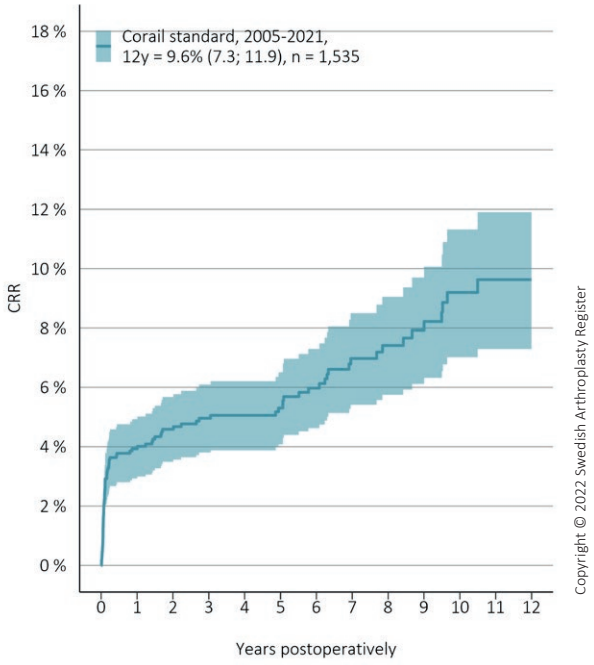


Figure 5.6.2 a. Cumulative risk of revision for the cementless Corail stem.

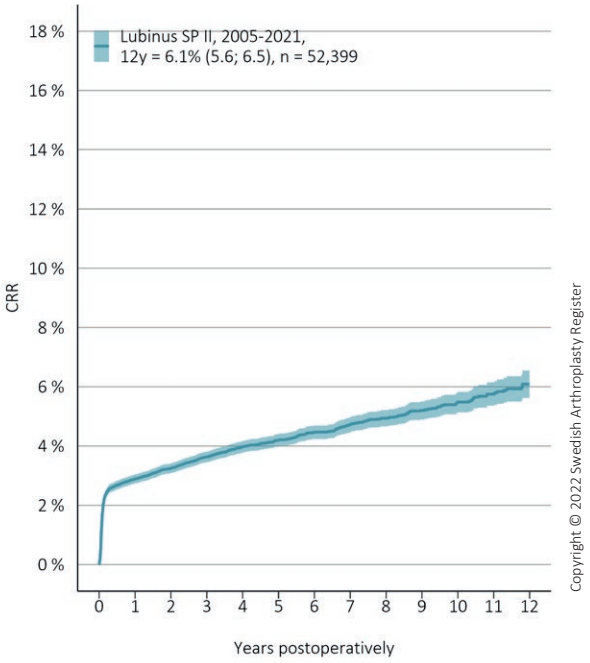


Figure 5.6.2 b.

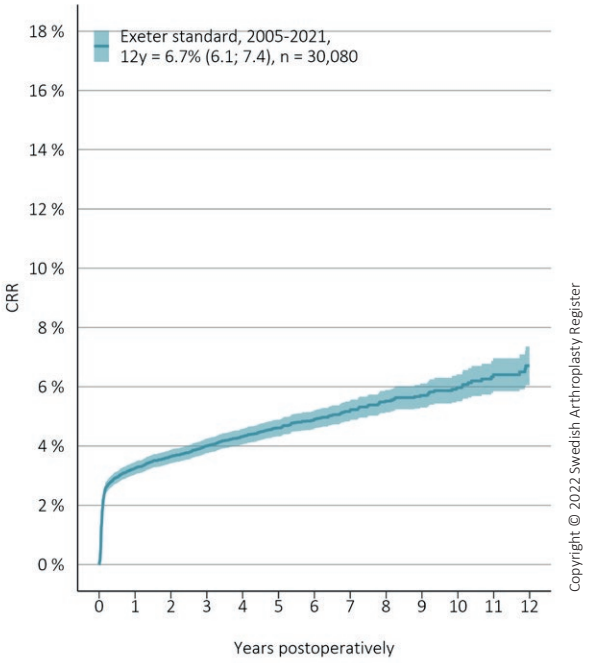


Figure 5.6.2 c.

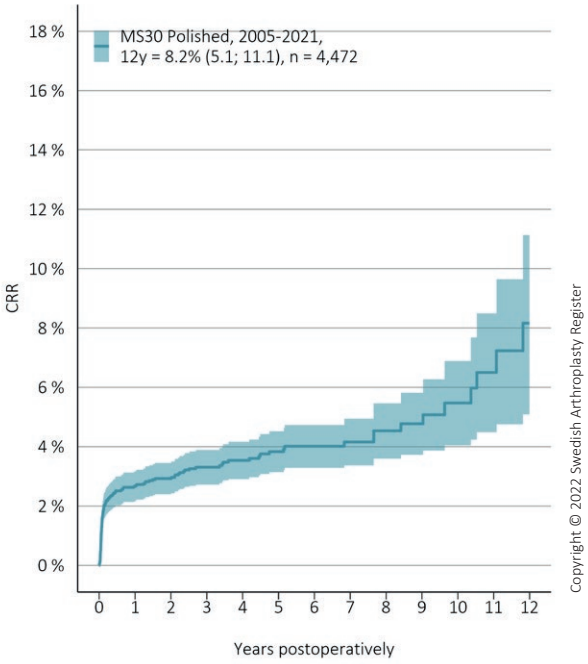


Figure 5.6.2 d.

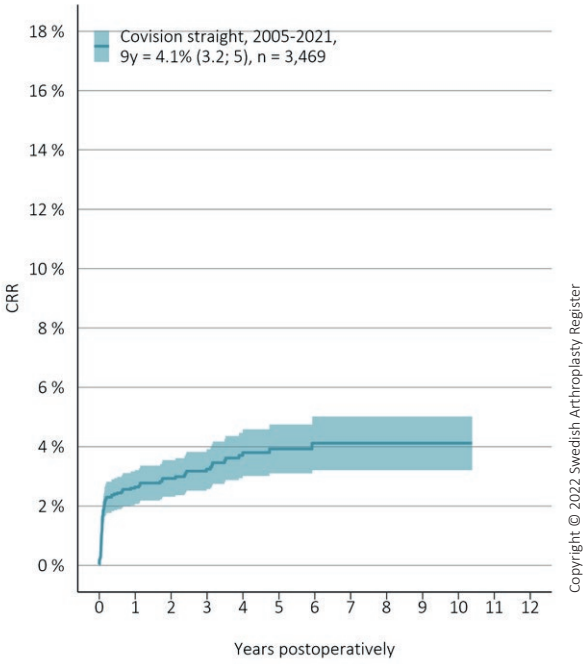


Figure 5.6.2 e.

Figures 5.6.2 b-e. Cumulative risk of revision for the four most common cemented stems.

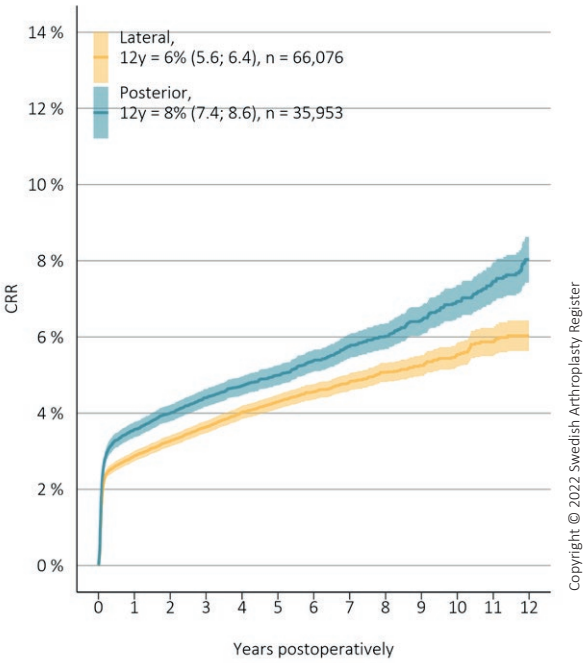


Figure 5.6.3. Cumulative risk of revision related to surgical approach.

acetabulum cup is inserted, the Lubinus X-link is the most common. A dual-mobility cup (DMC) was chosen to every tenth patient with a hip fracture in 2021. They are however used differently compared with the usual hemi and total arthroplasties. Among those who were acutely operated due to fracture, 9% were given a DMC, but for those operated due to fracture complications in a later stage, the DMC accounted for 33% of the articulations.

The cumulative revision rate is similar for all four types of articulations (figure 5.6.5). Bipolar hemiarthroplasties lie a bit higher the first years and total arthroplasties clearly lower, but after three to five years, no differences can be seen. The Swedish units vary extremely in their use of total arthroplasty (figure 5.6.4), with anywhere from 1% to 93%. Probably the availability of arthroplasty specialists on-call will determine how many total arthroplasties a unit decides to do, since total arthroplasty is deemed to be more technically demanding than hemiarthroplasty. Local quality work should however be able to clarify other important results – the number of dislocations, patient reported outcome and cost-benefit. In addition, it should be noted that current scientific results show no clinically relevant difference between hemi and total arthroplasty when several important factors are considered (Ekhtiari et al. JBJS (2020): 102 (18), 1638-1645).

There is always reason to remind, that the revision rate is only the tip of an iceberg. Many are affected by complications that do not lead to such a large procedure, but the patients' suffering may still be considerable.

The most common cup components

	All	2011	2020	2021
Number	**19,062**	**6,111**	**6,477**	**6,474**
Implant (%)				
Unipolar femoral head	5,337 (28.0)	1,535 (25.1)	2,047 (31.6)	1,755 (27.1)
UHR Universal Head	2,322 (12.2)	627 (10.3)	864 (13.3)	831 (12.8)
Other	1,688 (8.9)	1,054 (17.2)	248 (3.8)	386 (6.0)
Unitrax modular endohead	1,360 (7.1)	417 (6.8)	487 (7.5)	456 (7.0)
Lubinus x-link	1,356 (7.1)	71 (1.2)	659 (10.2)	626 (9.7)
Modular Trauma Heads	1,239 (6.5)	0 (0.0)	504 (7.8)	735 (11.4)
Lubinus	922 (4.8)	591 (9.7)	172 (2.7)	159 (2.5)
Avantage	818 (4.3)	70 (1.1)	356 (5.5)	392 (6.1)
Marathon	736 (3.9)	352 (5.8)	194 (3.0)	190 (2.9)
Covision unipolar	674 (3.5)	342 (5.6)	168 (2.6)	164 (2.5)
Vario cup	566 (3.0)	362 (5.9)	95 (1.5)	109 (1.7)
Exeter Rim-fit	560 (2.9)	68 (1.1)	256 (4.0)	236 (3.6)
MultiPolar Bipolar Cup	466 (2.4)	86 (1.4)	194 (3.0)	186 (2.9)
V40 unipolar	430 (2.3)	430 (7.0)	0 (0.0)	0 (0.0)
Unipolar	301 (1.6)	68 (1.1)	105 (1.6)	128 (2.0)
Polarcup cemented	287 (1.5)	38 (0.6)	128 (2.0)	121 (1.9)

Table 5.6.3. The most common cup/head components in fracture patients 2011, 2020 and 2021.

Total arthroplasty, hip fracture and cement

That a hemiarthroplasty is to be fixated with cement is well-founded by scientific studies. Since total arthroplasty as acute fracture treatment has not been as established, the evidence regarding fixation is weaker. The total arthroplasty is also chosen for younger and healthier individuals and that may lead the surgeon to think that the bone quality is good and maybe is suitable for uncemented fixation. A newly published study from Sweden and Denmark shows however that only 12% of those younger than 60 years of age with hip fracture have normal DEXA-values (Ström Rönnquist et al. Osteoporosis International (2022): 1-19). Something that is even less studied and discussed is the choice of cup fixation. In Sweden, uncemented stems are becoming rarer, also for the group that is treated with a total arthroplasty: in the period 2011–2016, 6.9% of the stems were uncemented, but in 2017–2021 the proportion had decreased to 2.3%. However, for cups, the proportion of uncemented remains unchanged in the past decade, 3.6% and 3.7% respectively. Although if the number is low, clinical analyses at the units that choose uncemented cup would be of great value. How common is acetabulum fracture, dislocation and cup loosening? These are questions that are poorly studied in patients with hip fracture regardless of if their cup has been fixated with cement or not, and comparing studies are needed. If there is an interest at current units, the register is happy to support an in-depth study if desired. Those cups that are inserted without cement are mainly variants of Pinnacle and Trident. Among the dual mobility cups, there is only a small number of Ades and Avantage cups that are cementless.

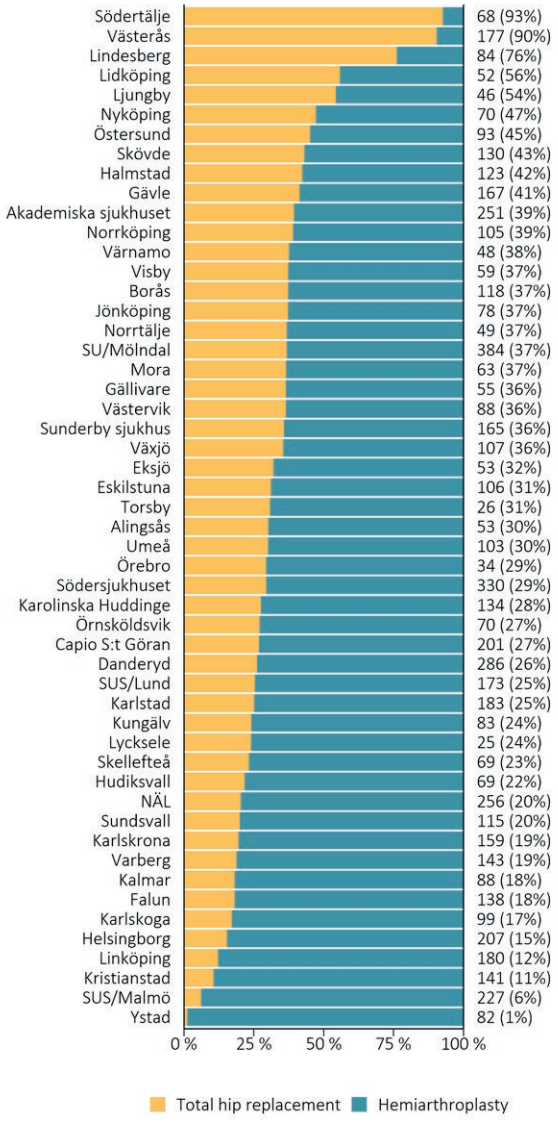


Figure 5.6.4. Proportion of total and hemiarthroplasty as treatment of hip fracture. To the right, the number and percentage of total hip arthroplasty.

Register collaboration

There is linking of data between the Swedish Arthroplasty Register and the Swedish Fracture Register. If an arthroplasty procedure with the diagnosis hip fracture is found in one of the registers, but not in the other, data is transferred to the other register. The created registration must nevertheless be manually completed by local co-workers. For example, the Swedish Arthroplasty Register does not register the exact date of injury, which is mandatory in the Fracture Register. But as a reminder of missing operations, we think that the function is more on the positive side than on the negative side. The register managements are happy to receive input from the users. The next step will be to transfer data on periprosthetic fractures. We are aware of the underreporting of such fractures to the Swedish Arthroplasty Register, in particular, cases only treated with internal fixation. But even these cases – when there is no exchange of prosthesis components – are to be reported to the Swedish Arthroplasty Register! Periprosthetic fracture is a serious complication after arthroplasty and important to measure.

Early reoperations

Most complications in the fracture group occur early. Deep infections, dislocations and periprosthetic fractures are the most common. These do not always lead to revision, as the surgeon may prefer limiting the procedure to "minor" surgery due to the patient's frailty. Therefore we present any open surgery in "Reoperations within six months" in order to cover any secondary procedures. The drawback is the known underreporting from certain hospitals regarding reoperations not being revisions. I.e. a low number of early reoperations may in the worst be due to a suboptimal reporting routine. A high frequency of early reoperations may be due to a proactive attitude towards treating complications such as dislocation surgically. Nonetheless, hospitals with high reoperation rates should perform a local review to identify factors to improve.

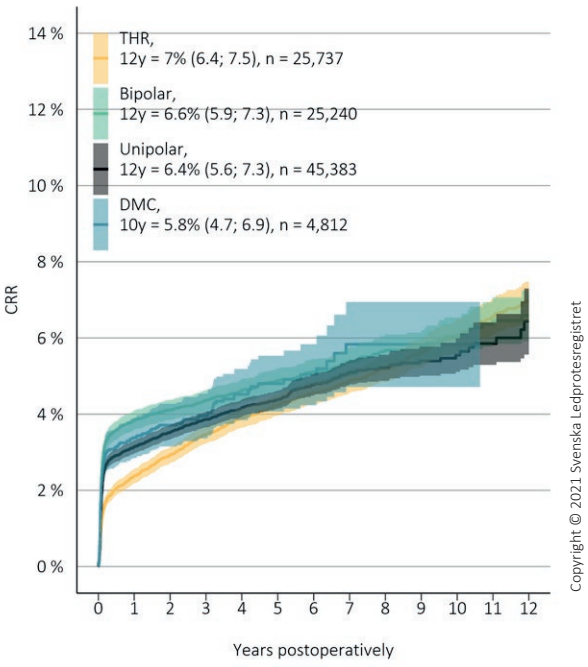


Figure 5.6.5. Type of prosthesis – cumulative risk of revision.

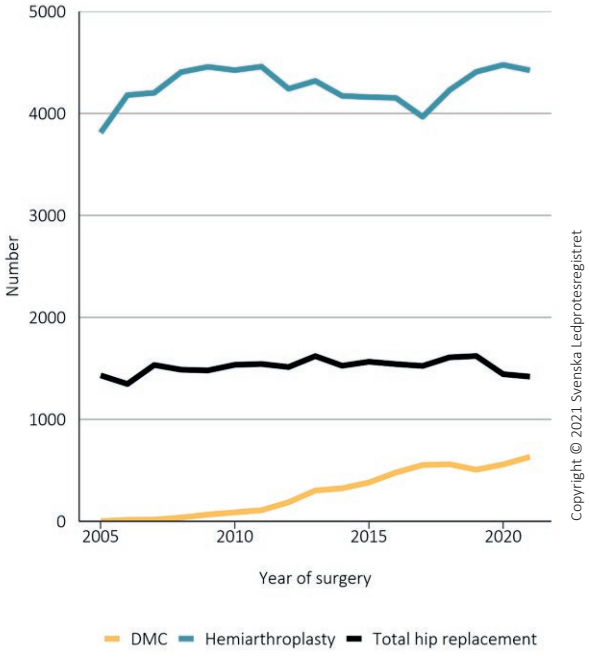


Figure 5.6.6. Choice of prosthesis in fracture-related hip arthroplasty.

Reoperations within 6 months per unit. Fracture patients 2019 – 2021.

Unit	Primary operations Number [1)]	Re-operations Number [2)]	Proportion % [3)]
Country	**19,486**	**598**	**3.2**
University units			
Akademiska sjukhuset	711	22	3.2
Karolinska Huddinge	405	17	4.4
Karolinska Solna	46	1	2.2
Linköping	451	15	3.5
SU/Mölndal	1,177	41	3.6
SUS/Lund	603	22	3.8
SUS/Malmö	684	17	2.6
Umeå	329	9	2.9
Örebro	143	3	2.2
Other units			
Alingsås	155	4	2.7
Borås	406	7	1.8
Danderyd	867	34	4
Eksjö	159	9	5.9
Eskilstuna	326	11	3.5
Falun	387	12	3.2
Gällivare	151	4	2.7
Gävle	477	7	1.5
Halmstad	350	7	2.1
Helsingborg	593	25	4.4
Hudiksvall	277	7	2.6
Hässleholm	41	2	4.9
Jönköping	250	8	3.3
Kalmar	300	2	0.7
Karlskoga	269	6	2.3
Karlskrona	434	11	2.7
Karlstad	564	24	4.3
Kristianstad	419	21	5.1
Kungälv	244	13	5.5
Lidköping	175	6	3.6
Lindesberg	233	1	0.4
Ljungby	127	4	3.3

The table continues on the next page.

Reoperations within 6 months per unit. Fracture patients 2019 – 2021, cont.

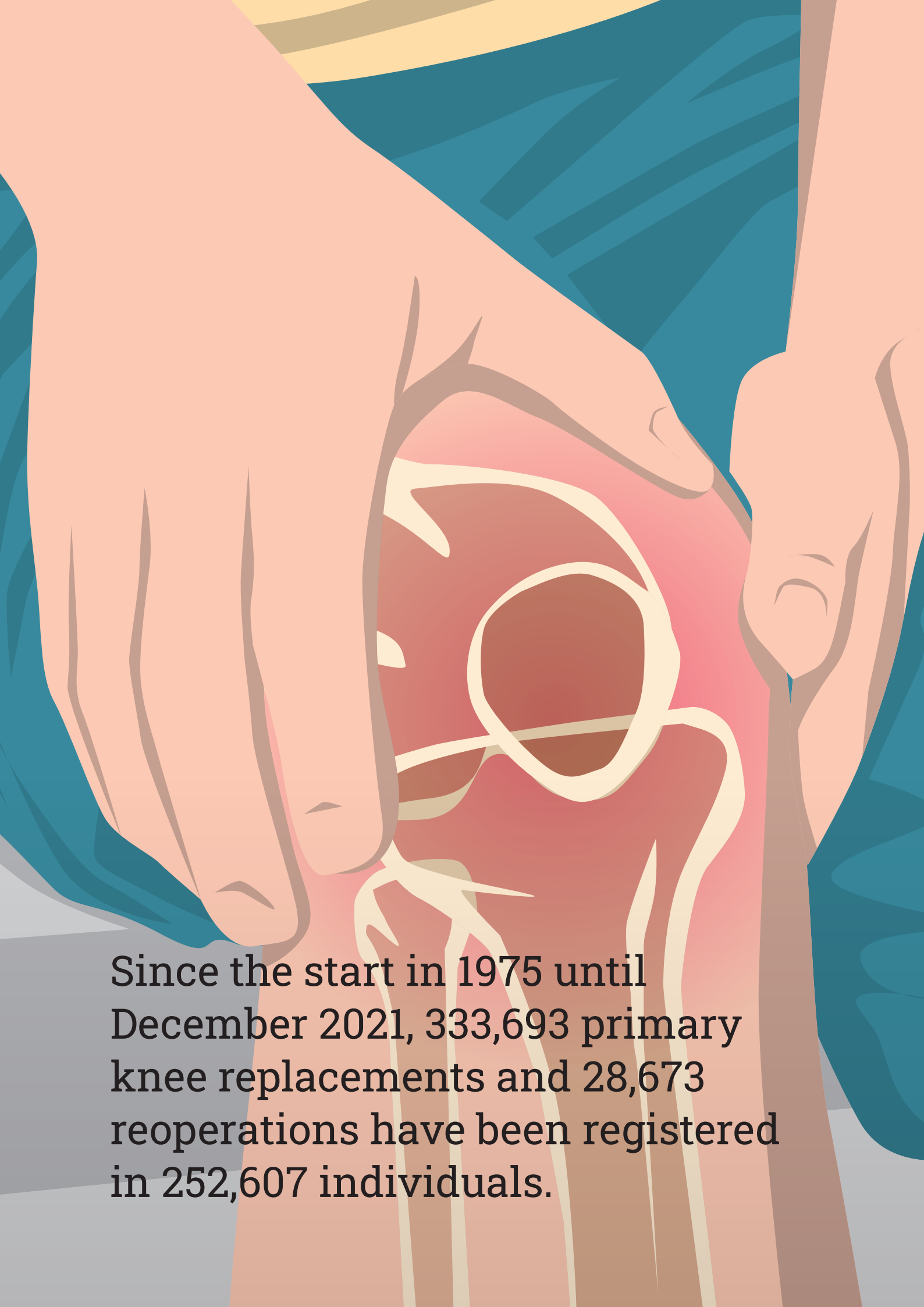
Unit	Primary operations Number [1)]	Re-operations Number [2)]	Proportion % [3)]
Lycksele	102	2	2
Mora	240	6	2.5
Norrköping	340	6	1.8
Norrtälje	145	5	3.6
Nyköping	197	5	2.6
NÄL	737	25	3.5
Piteå	27	1	4.3
Skellefteå	200	10	5.1
Skövde	388	13	3.5
Sunderby sjukhus	491	5	1.1
Sundsvall	336	8	2.5
Södersjukhuset	985	19	2
Södertälje	225	2	0.9
Torsby	86	2	2.5
Trelleborg	33	2	6.6
Uddevalla	20	1	5.3
Varberg	364	7	2
Visby	142	4	2.9
Värnamo	148	7	4.9
Västervik	215	10	4.8
Västerås	558	20	3.8
Växjö	284	11	4
Ystad	256	13	5.3
Örnsköldsvik	247	6	2.5
Östersund	302	18	6.1
Private units			
Capio S:t Göran	610	17	2.9

Table 5.6.4.

1) Number of primary operations for fracture patients 2019–2021. 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 the start in 1975 until December 2021, 333,693 primary knee replacements and 28,673 reoperations have been registered in 252,607 individuals.

6. Knee replacement

6.1. Primary knee replacement

Authors: Annette W-Dahl and Martin Sundberg

In 2021, 12,742 primary knee replacements were registered, 8% more than in 2020 but 25% fewer than in 2019. This decrease is probably due to the pandemic (covid 19). The standard treatment for primary knee replacement is a total knee replacement (TKR), that in 2021 accounted for 86.3% of the operations. The proportion of unicompartmental knee replacements (UKR) has increased somewhat to 12.8%. Other types of prosthesis (patellofemoral replacement and partial replacement) were reported to a limited extent. In 2021, 77 units reported to the register, which includes all units performing elective (planned) knee replacement.

It shall be noted that the number of replacements may differ somewhat in different analyses as data has been extracted at different times. Table 6.1.1 shows demographics in primary knee replacements divided into TKR and UKR.

The mean age for a primary knee replacement was similar in 2021 (68.7 years) and 2020 (68.5 years). Historically the mean age increased from just over 65 years in 1975 to just over 71 years in 1994. The main reason was an increase in the number of surgeries within the older age groups. A probable explanation for this is an improved anaesthesiologic technique with increased safety in older patients and an altered age structure in the society. After 1994 the proportion of patients below 65 years of age increased somewhat and the mean age decreased. This tendency has not continued in recent years with exception of the pandemic years 2020 and 2021 when many older patients did not received care to the same extent as before. The age group 65–74 years constitute the largest proportion with 37.7% followed by the age group 75–84 years (26.8%). Almost one third (32.3%) of the primary knee replacements in 2021 were performed in individuals under 65 years of age.

The mean age of those operated on with a UKR is just over three years younger than those operated on with a TKR (65.9 years and 69.1 years respectively). In 2021 almost one third (31 %) of those operated with a TKR were ≤ 65 years of age compared with almost half (43.9%) of those operated on with a UKR were ≤ 65 years of age.

Knee replacement is more common in females than in males. In the early 1980's 70% of the operations were performed in females. Since then, the proportion of operations in males slowly increased, and in 2021 accounted for 44.6%.

There is a larger proportion of females having TKR (56.4%), while a larger proportion of males are operated on with UKR (52%).

Demography TKR and UKR 2021

	TKR	UKR
Number	10,999	1,636
Age mean(SD)	69.1 (9)	65.9 (9)
Age group (%)		
< 45 years	40 (0.4)	10 (0.6)
45–54 years	622 (5.7)	165 (10.1)
55–64 years	2,744 (24.9)	544 (33.3)
65–74 years	4,182 (38.0)	602 (36.8)
75–84 years	3,090 (28.1)	293 (17.9)
85+ years	321 (2.9)	22 (1.3)
Females	6,197 (56.3)	786 (48.0)
BMI (%)		
< 18.5	19 (0.2)	2 (0.1)
18.5–24.9	2,083 (19.1)	302 (18.6)
25–29.9	4,773 (43.7)	796 (49.0)
30–34.5	3,121 (28.6)	442 (27.2)
35–39.9	840 (7.7)	79 (4.9)
≥ 40	87 (0.8)	5 (0.3)
ASA class (%)		
I	1,671 (15.2)	393 (24.1)
II	7,443 (67.8)	1,065 (65.3)
III–V	1,864 (17.0)	174 (10.7)
Diagnosis (%)		
Osteoarthritis	10,672 (97.1)	1,601 (97.9)
Inflamatory joint disease	159 (1.4)	0 (0.0)
Sequele fracture/trauma	73 (0.7)	0 (0.0)
Osteonecrosis	62 (0.6)	30 (1.8)
Acute trauma	21 (0.2)	3 (0.2)
Other joint diseases	2 (0.0)	2 (0.1)

Table 6.1.1. Demography in TKR and UKR 2021.

The registration of BMI and ASA class in knee replacements started in 2009. The proportion of primary knee replacements in obese individuals (BMI of ≥ 30) is similar in 2009/10 (just over 37%) as it is in 2021. On the other hand, the proportion with a BMI ≥ 35 has decreased from 11% to 8%. The proportion of primary TKRs in obese individuals (BMI ≥ 30) is somewhat higher (37.1%) than for those that receive UKA (32.4%). The corresponding proportion for those with BMI ≥ 35 are 8.5% for TKR and 5.3% for UKR.

The proportion of primary operations in individuals classified as ASA class III–IV is roughly the same in 2021 (16.2%) compared with 2009/10 (15.2%). Individuals operated with TKAR were classified as ASA III–IV to a somewhat higher proportion (17%) than those having UKR (10.7%).

Osteoarthritis is the predominating reason for primary knee replacement surgery in both TKR (97.1%) and UKR (97.9%). The number of operations for inflammatory joint disease, especially rheumatoid arthritis, has however decreased, especially in recent years, possibly due to the introduction of new medical treatment. Osteonecrosis was a more common diagnosis in UKR (1.8%) than in TKR (0.6%).

46 stabilized prostheses, 44 patellofemoral prostheses and 4 partial prostheses were reported in 2021. The mean age of these operations was 65.2 years, 62.3 and 43.4 years respectively. More females than males were reported for those having a stabilized prosthesis (35/46) and a patellofemoral prosthesis (34/44). Two males and two females each were reported having partial prostheses.

Tables 6.1.2–5 show primary knee replacements reported by the units in 2021. Topmost, the average for the whole country is shown and thereafter for each unit respectively where the units are divided into university units, privately run units or other units and then in alphabetical order. To the far left the total number of operations that have been reported is given and in the next column the proportion of the reports that were complete. The rest of the data is only based on complete reports. Please note that the percentages for units with few operations may be misleading.

Case-mix

Table 6.1.2 shows for each unit respectively the proportion of the operations performed due to osteoarthritis (OA), the proportion of females, patients younger than 55 years of age, BMI 35 or above and the proportion classified as ASA-grade III or higher. Among the university units we can see that there are units that report a higher proportion of other diagnoses than OA and ASA

class ≥ III while other university units do not differ to any great extent from the rest of the country. The university units in general have a larger proportion of patients younger than 55 years of age. The privately run units report in general a lower proportion of ASA ≥ III than the country with an exception for Capio Ortopedi Motala, Capio Movement and S:t Görans sjukhus. The regionally run units that have not been categorised as university units do not differ to any great extent from the country, with some exceptions. For example, the proportion with BMI 35 and above is twice as high in Halmstad, Mora and Västerås. The proportion of ASA ≥ III is almost three times higher in Danderyd and Helsingborg, Norrtälje and Västerås has more than twice as high a proportion of ASA ≥ III as the country on average while it is about half that in Karlshamn. The variation between the units in case-mix is large and cannot be generalised to university units, privately run units or other units.

A previous operation in the index knee (not an arthroplasty) was reported (not shown in the table) in 20% of the operations. Meniscal surgery is the most common (6.8%), followed by arthroscopy (4.9%), cruciate ligament surgery (2.9%), osteosynthesis (1.1%), osteotomy (0.8%) and other surgery (1%). In 3 % of the operations more than one previous operation was reported. The previous operations reported is not comprehensive but gives a view of what is known at the time of primary replacement.

Prophylactic antibiotics

The choice of variables for the columns in table prophylactic antibiotics (table 6.1.3) are based on the recommendations from the PRISS-project (Prosthetic Related Infections Shall be Stopped) and reported in 2021. Due to the results from a Swedish study (Robertsson et al. 2017), showing that patients receiving Clindamycin as prophylactic antibiotics had a higher risk of revision due to infection than patients who received Cloxacillin, the recommendations for penicillin allergy have been revised. The new recommendation (April 2018) is available at www.patientforsakringen.se

The columns "% that are given Cloxacillin/Cefotaxim/Clindamycin", "% that are given a dose of 2 g x 3/2 g x 2/600 mg x 2" and "% with AB time (45–30 min)" thus show the proportion of operations where antibiotics have been given according to the new PRISS-recommendations. The column "% with AB-time (45–15 minutes)" accounts for the proportion of reported operations, where the preoperative dose is given 45–15 minutes before the start of the operation, which was the previously recommended time-interval that also have been reported in previous annual reports. All units report that they use Cloxacillin or corresponding as their first choice. Clindamycin has decreased as prophylaxis between 2017 and 2021 from 7.5% to 4.3%. Cefotaxim was reported for 1.9% of the operations. Since Cloxacillin has a short half-life, it is important 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 (Stefansdottir A et al. 2009). A gradual improvement was noted since the register started to register time of the first dose in 2009–2011 when 87% were reported to be administrated within the timespan 45–15 min. In 2013–2021 the proportion has however decreased to 79%.

For 2021, it was reported that only 47% of patients received the preoperative AB dose 45–30 minutes before the start of surgery. Only GHP Ortho Center Stockholm, Ljungby and Torsby have succeeded in implementing the latest recommendation. At these units it is reported that 80% or more receive the preoperative dose within 45–30 min before start of the operation. At Akademiska sjukhuset the compliance is low both for the previous and the later recommendation.

Case-mix per unit

Unit	Number of reports	Complete reports %	OA %	Female %	< 55 years %	BMI ≥ 35 %	ASA ≥ III %
Country	**12,739**	**99.2**	**97**	**55**	**7**	**8**	**16**
University units							
Akademiska	39	100	85	64	8	10	44
Karolinska Huddinge	106	87	83	59	9	10	44
Karolinska Solna	19	95	63	58	16	0	53
SU/Mölndal	96	99	90	61	11	8	18
SU/Sahlgrenska	2	100	0	0	100	0	0
SUS/Lund	12	100	58	50	25	8	67
Umeå	46	100	91	57	7	7	26
Private units							
Aleris Specialistvård Nacka	298	99	99	53	8	5	6
Aleris Specialistvård Ängelholm	480	100	97	54	9	8	11
Art Clinic Göteborg	286	99	99	58	7	5	3
Art Clinic Jönköping	210	100	100	50	5	4	1
Capio Artro Clinic	679	99	99	54	14	4	2
Capio Movement	515	100	100	55	10	10	21
Capio Ortopedi Motala	472	100	98	58	6	8	24
Capio Ortopediska Huset	718	100	99	57	8	3	1
Capio S:t Göran	173	99	98	58	2	7	51
Carlanderska	370	99	99	50	3	10	6
Carlanderska – SportsMed	108	96	100	35	10	6	1
Frölundaortopeden	26	96	96	31	23	4	0
GHP Ortho Center Göteborg	281	100	98	46	10	3	10
GHP Ortho Center Stockholm	691	100	99	53	8	5	4
Hermelinen	32	100	100	19	19	9	3
Ortopedisk Center Sophiahemmet	174	98	95	32	14	4	9
Specialistcenter Scandinavia Eskilstuna	71	100	94	55	14	1	4
Specialistcenter Scandinavia Johanniskliniken	13	92	100	31	0	0	0
Other units							
Alingsås	112	100	99	57	5	9	19
Arvika	256	98	99	55	1	2	16
Bollnäs	341	100	95	57	3	3	13
Borås	21	100	86	43	5	24	52
Danderyd	58	97	91	72	3	9	59
Eksjö	283	98	98	58	6	8	17
Enköping	403	100	100	57	5	9	21
Eskilstuna	31	97	77	61	13	19	26
Falun	90	97	96	58	9	12	31
Gällivare	38	97	92	63	3	11	34

The table continues on the next page.

Case-mix per unit, cont.

Unit	Number of reports	Complete reports %	OA %	Female %	< 55 years %	BMI ≥ 35 %	ASA ≥ III %
Gävle	41	100	90	59	0	22	44
Halmstad	139	100	98	60	7	17	20
Helsingborg	146	99	97	56	8	15	36
Hudiksvall	62	100	98	47	0	16	23
Hässleholm	778	100	94	56	6	7	16
Kalmar	34	100	85	53	3	9	26
Karlshamn	186	99	96	52	4	6	7
Karlstad	27	96	85	67	0	0	30
Kullbergska sjukhuset	270	100	98	65	4	13	12
Kungälv	41	100	93	63	5	12	37
Lidköping	27	100	93	59	11	7	37
Lindesberg	273	100	99	55	5	12	22
Ljungby	108	100	99	57	5	10	15
Lycksele	197	99	94	56	9	7	10
Mora	169	100	99	61	6	17	25
Norrköping	83	99	98	68	5	8	20
Norrtälje	107	100	98	50	7	12	36
Nyköping	71	99	97	45	3	6	21
Oskarshamn	203	99	93	58	2	11	19
Piteå	285	100	94	52	4	11	22
Skellefteå	45	100	96	58	2	7	22
Skene	101	99	97	57	4	9	12
Skövde	6	100	100	67	17	33	33
Sollefteå	138	99	98	56	5	0	17
Sundsvall	7	100	100	71	0	14	29
Södersjukhuset	34	100	94	56	12	6	47
Södertälje	78	92	99	60	3	19	50
Torsby	162	99	99	49	7	7	17
Trelleborg	388	100	97	62	7	14	24
Uddevalla	137	99	93	60	4	7	30
Varberg	100	99	92	50	6	10	15
Visby	115	94	97	49	8	13	18
Värnamo	186	100	97	58	4	10	27
Västervik	110	96	99	57	4	7	12
Västerås	170	100	94	69	7	16	33
Växjö	55	98	96	60	4	9	22
Örnsköldsvik	71	100	99	54	6	10	34
Östersund	39	100	97	64	0	15	41

Table 6.1.2. Case-mix per unit 2021.

Prophylactic antibiotics per unit 2021

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim eller Clindamycin %	Percent having dosage 2 g × 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	**12,739**	**98**	**99,6**	**95**	**79**	**47**
University units						
Akademiska	39	97	100	85	56	10
Karolinska Huddinge	106	64	92	62	44	28
Karolinska Solna	19	74	100	74	63	42
SU/Mölndal	96	98	100	95	89	61
SU/Sahlgrenska	2	50	50	0	50	0
SUS/Lund	12	100	92	83	67	50
Umeå	46	80	89	65	70	28
Private units						
Aleris Specialistvård Nacka	298	100	100	96	63	34
Aleris Specialistvård Ängelholm	480	99	100	98	76	7
Art Clinic Göteborg	286	100	100	97	81	6
Art Clinic Jönköping	210	99	100	99	90	18
Capio Artro Clinic	679	99	100	97	85	62
Capio Movement	515	99	100	98	47	41
Capio Ortopedi Motala	472	100	100	95	88	61
Capio Ortopediska Huset	718	99	99	98	75	43
Capio S:t Göran	173	98	99	92	56	40
Carlanderska	370	98	100	97	90	35
Carlanderska – SportsMed	108	93	100	90	87	26
Frölundaortopeden	26	92	96	88	96	4
GHP Ortho Center Göteborg	281	91	100	88	88	79
GHP Ortho Center Stockholm	691	100	100	98	92	88
Hermelinen	32	100	100	100	75	0
Ortopedisk Center Sophiahemmet	174	98	99	98	79	62
Specialistcenter Scandinavia Eskilstuna	71	99	100	94	75	28
Specialistcenter Scandinavia Johanniskliniken	13	99	100	69	69	23
Other units						
Alingsås	112	99	100	99	61	54
Arvika	256	80	99	78	77	50
Bollnäs	341	100	100	97	89	52
Borås	21	100	100	95	62	38
Danderyd	58	88	100	84	59	31
Eksjö	283	98	100	97	82	62
Enköping	403	99	99	98	87	38
Eskilstuna	31	97	100	84	58	42
Falun	90	100	100	97	88	44
Gällivare	38	100	100	100	74	47

The table continues on the next page.

Prophylactic antibiotics per unit 2021, cont.

Unit	Number of reports	Complete reports %	Percent having Cloxacillin, Cefotaxim eller Clindamycin %	Percent having dosage 2 g × 3, 2 g x 2 or 600 mg x 2 %	Percent AB time within (45–15 min) %	Percent AB time within (45–30 min) %
Gävle	41	100	100	95	76	32
Halmstad	139	98	100	92	83	52
Helsingborg	146	99	100	96	78	47
Hudiksvall	62	100	100	95	84	35
Hässleholm	778	100	100	97	75	26
Kalmar	34	100	100	97	85	29
Karlshamn	186	99	99	93	81	54
Karlstad	27	96	100	78	74	63
Kullbergska sjukhuset	270	100	100	96	85	49
Kungälv	41	100	100	88	63	46
Lidköping	27	96	96	96	78	63
Lindesberg	273	100	100	94	84	43
Ljungby	108	100	100	100	94	87
Lycksele	197	100	99	97	74	56
Mora	169	100	100	95	83	69
Norrköping	83	100	99	96	66	48
Norrtälje	107	100	100	97	61	47
Nyköping	71	96	100	87	65	49
Oskarshamn	203	100	100	99	64	57
Piteå	285	99	99	92	92	42
Skellefteå	45	89	100	98	60	42
Skene	101	91	99	78	71	40
Skövde	6	100	100	100	67	50
Sollefteå	138	99	100	95	91	54
Sundsvall	7	86	86	57	86	57
Södersjukhuset	34	97	97	76	68	44
Södertälje	78	97	100	92	76	49
Torsby	162	100	100	96	88	81
Trelleborg	388	99	99	98	78	47
Uddevalla	137	99	99	98	66	50
Varberg	100	95	100	80	78	58
Visby	115	97	99	94	82	44
Värnamo	186	98	100	96	80	49
Västervik	110	99	99	98	70	41
Västerås	170	99	100	89	86	47
Växjö	55	100	100	87	89	33
Örnsköldsvik	71	97	100	93	77	63
Östersund	39	97	100	92	85	56

Table 6.1.3. Prophylactic antibiotics per unit 2021.

Antithrombotic prophylaxis per unit 2021

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Country	**12,739**	**98**	**87**	**52**	**77**
University units					
Akademiska	39	87	79	74	88
Karolinska Huddinge	106	93	84	4	42
Karolinska Solna	19	95	63	11	33
SU/Mölndal	96	98	98	97	91
SU/Sahlgrenska	2	100	100	0	50
SUS/Lund	12	100	67	0	30
Umeå	46	87	93	83	84
Private units					
Aleris Specialistvård Nacka	298	96	96	52	95
Aleris Specialistvård Ängelholm	480	98	91	94	96
Art Clinic Göteborg	286	99	95	99	97
Art Clinic Jönköping	210	100	95	94	95
Capio Artro Clinic	679	99	98	99	96
Capio Movement	515	99	97	0	0
Capio Ortopedi Motala	472	100	75	0	84
Capio Ortopediska Huset	718	99	97	52	98
Capio S:t Göran	173	98	86	16	75
Carlanderska	370	99	95	97	95
Carlanderska – SportsMed	108	100	97	98	97
Frölundaortopeden	26	100	100	100	92
GHP Ortho Center Göteborg	281	99	97	96	95
GHP Ortho Center Stockholm	691	98	98	98	98
Hermelinen	32	100	94	94	84
Ortopedisk Center Sophiahemmet	174	99	97	0	65
Specialistcenter Scandinavia Eskilstuna	71	99	97	97	99
Specialistcenter Scandinavia Johanniskliniken	13	100	85	100	85
Other units					
Alingsås	112	100	98	0	98
Arvika	256	95	89	88	93
Bollnäs	341	97	95	97	95
Borås	21	95	81	95	85
Danderyd	58	90	79	0	58
Eksjö	283	98	19	0	24
Enköping	403	99	93	45	93
Eskilstuna	31	97	94	94	93
Falun	90	100	100	0	2
Gällivare	38	100	97	97	89

The table continues on the next page.

Antithrombotic prophylaxis per unit 2021, cont.

Unit	Number of reports	Complete reports %	Percent starting postop %	Percent having NOAC %	Percent treated for 8–14 days %
Gävle	41	93	85	83	84
Halmstad	139	100	95	0	1
Helsingborg	146	97	81	86	92
Hudiksvall	62	100	82	0	93
Hässleholm	778	99	94	0	19
Kalmar	34	100	56	0	91
Karlshamn	186	97	92	2	93
Karlstad	27	100	89	89	96
Kullbergska sjukhuset	270	99	93	97	95
Kungälv	41	95	93	95	88
Lidköping	27	96	78	93	92
Lindesberg	273	100	88	78	82
Ljungby	108	96	93	95	95
Lycksele	197	100	12	0	97
Mora	169	98	96	96	96
Norrköping	83	98	48	0	80
Norrtälje	107	100	85	0	88
Nyköping	71	97	82	86	93
Oskarshamn	203	100	54	0	74
Piteå	285	67	84	2	100
Skellefteå	45	100	100	100	100
Skene	101	99	92	93	82
Skövde	6	100	83	100	83
Sollefteå	138	99	89	84	91
Sundsvall	7	86	71	71	83
Södersjukhuset	34	97	82	9	80
Södertälje	78	97	86	0	49
Torsby	162	99	97	93	90
Trelleborg	388	99	99	0	4
Uddevalla	137	97	89	81	89
Varberg	100	100	96	0	78
Visby	115	96	85	88	88
Värnamo	186	99	47	0	60
Västervik	110	99	13	0	11
Västerås	170	96	86	81	93
Växjö	55	100	96	91	100
Örnsköldsvik	71	99	85	86	89
Östersund	39	100	59	0	77

Table 6.1.4. Antithrombotic prophylaxis per unit 2021.

Surgical technique 2021

Unit	Number of reports	Complete reports %	Percent having general anesthesia %	Percent drainage %	Percent tourniquet %	Percent LIA %	Median Op time
Country	**12,739**	**98**	**39**	**0.2**	**28**	**97**	**63**
University units							
Akademiska	39	100	31	0	36	85	88
Karolinska Huddinge	106	84	14	1	16	83	110
Karolinska Solna	19	100	21	32	32	79	116
SU/Mölndal	96	97	13	1	6	95	92
SU/Sahlgrenska	2	0	100	0	100	0	
SUS/Lund	12	75	42	0	25	75	113
Umeå	46	91	33	0	78	100	105
Private units							
Aleris Specialistvård Nacka	298	99	100	0	40	95	31
Aleris Specialistvård Ängelholm	480	99	99	0	1	90	41
Art Clinic Göteborg	286	100	100	0	1	99	60
Art Clinic Jönköping	210	100	100	1	6	99	66
Capio Artro Clinic	679	95	94	0	20	97	56
Capio Movement	515	99	1	0	6	100	51
Capio Ortopedi Motala	472	98	3	1	15	98	69
Capio Ortopediska Huset	718	97	6	0	41	98	45
Capio S:t Göran	173	94	14	0	71	93	62
Carlanderska	370	99	7	0	10	99	46
Carlanderska – SportsMed	108	86	7	1	14	99	41
Frölundaortopeden	26	96	100	0	0	96	63
GHP Ortho Center Göteborg	281	99	6	0	3	91	83
GHP Ortho Center Stockholm	691	99	2	0	11	99	59
Hermelinen	32	100	6	0	0	100	62
Ortopedisk Center Sophiahemmet	174	96	97	1	38	94	65
Specialistcenter Scandinavia Eskilstuna	71	100	11	0	77	97	30
Specialistcenter Scandinavia Johanniskliniken	13	85	92	0	100	85	30
Other units							
Alingsås	112	99	6	0	0	99	85
Arvika	256	88	9	0	0	97	61
Bollnäs	341	100	90	0	94	99	60
Borås	21	95	10	0	67	95	102
Danderyd	58	81	16	0	43	88	89
Eksjö	283	99	17	0	13	99	71
Enköping	403	98	83	0	69	97	67
Eskilstuna	31	100	10	0	0	97	99
Falun	90	99	24	0	97	100	68
Gällivare	38	100	3	0	8	100	86

The table continues on the next page.

Surgical technique 2021, cont.

Unit	Number of reports	Complete reports %	Percent having general anesthesia %	Percent drainage %	Percent tourniquet %	Percent LIA %	Median Op time
Gävle	41	98	44	0	95	100	62
Halmstad	139	100	10	1	76	99	84
Helsingborg	146	96	60	0	0	96	76
Hudiksvall	62	100	16	0	0	95	71
Hässleholm	778	99	87	0	0	100	39
Kalmar	34	100	0	0	0	88	90
Karlshamn	186	99	98	1	87	98	73
Karlstad	27	89	15	4	0	81	80
Kullbergska sjukhuset	270	99	6	0	19	87	64
Kungälv	41	90	29	0	12	98	98
Lidköping	27	93	26	0	7	100	84
Lindesberg	273	100	99	0	0	99	68
Ljungby	108	98	94	0	35	94	62
Lycksele	197	98	8	1	98	98	80
Mora	169	100	14	0	97	90	52
Norrköping	83	99	16	0	11	89	99
Norrtälje	107	97	12	0	67	90	80
Nyköping	71	97	11	0	32	94	87
Oskarshamn	203	100	16	0	40	99	83
Piteå	285	98	2	1	96	99	55
Skellefteå	45	84	0	0	100	100	81
Skene	101	94	12	0	97	97	86
Skövde	6	100	67	0	0	100	84
Sollefteå	138	96	7	0	57	96	79
Sundsvall	7	86	14	0	0	86	119
Södersjukhuset	34	88	35	0	0	79	87
Södertälje	78	99	42	3	1	99	71
Torsby	162	100	11	0	4	99	70
Trelleborg	388	97	32	0	34	98	70
Uddevalla	137	99	10	0	2	96	95
Varberg	100	98	30	0	1	87	84
Visby	115	90	20	0	3	99	112
Värnamo	186	99	7	0	0	95	79
Västervik	110	99	25	0	0	97	81
Västerås	170	99	10	0	1	92	66
Växjö	55	96	55	0	9	91	60
Örnsköldsvik	71	97	7	0	96	92	90
Östersund	39	100	33	0	95	100	80

Table 6.1.5. Surgical technique per unit 2021.

Thrombosis prophylaxis

As there are no national or international guidelines/best practice for the start, choice of drug or treatment time of thrombosis prophylaxis the choice of what is presented in table 6.1.4 is based on what was reported as most common at the start of the registration in 2009 with the exception of the proportion of NOAC (Non vitamin-k Oral AntiCoagulants), which has been changed from the proportion of drugs for injection (Dalteparin, Tinzaparin or Enoxaparin) in this year's report. The columns show the proportion of reported knee replacements, where the thrombosis prophylaxis was planned postoperatively, the proportion where NOAC were planned and the proportion of planned treatment time of 8–14 days respectively. In the table we can see that it was most common to start the thrombosis prophylaxis postoperatively and that just a small number of units reported more frequently that they started preoperatively. In 52.1% of the operations, it is reported that the thrombosis prophylaxis is planned as NOAC which is lower than in 2020 (57.7%). A combination of injection and NOAC were reported in 6.8%. For how long thrombosis prophylaxis is planned has remained relatively similar in the years since the variable started to be registered (2009, see previous reports) and about 72–79% of the operations have a planned prophylaxis of 8–14 days. On the other hand, the proportion of operations that are reported to have a shorter prophylaxis (1–7 days) has decreased somewhat from 2020 to 2021, from 16% to 14.6%, while the proportion who is reported to not administrate any prophylaxis at all increased in 2020 compared with 2019 from 4% to 6%, but decreased somewhat in 2021 to 5.1%.

Type of arthrotomy in UKR

Model	Standard incision, n	Mini insision, n	Unknown, n
Ibalance	1	0	0
Link	23	108	0
Oxford	663	410	2
Persona-PK	0	61	0
Sigma-PKR	1	58	0
Triathlon Uni	7	186	0
ZUK	33	83	0
Total	**728**	**906**	**2**

Table 6.1.6. Type of arthrotomy in UKR 2021.

Surgical technique

There are no national or international guidelines/best practice considering the "surgical technique" that are registered. In table 6.1.5 the proportion of operations where general anaesthesia is used, the use of a tourniquet, drainage and LIA (local infiltration anaesthesia) with or without remaining catheter are presented in percentage as well as the median surgical time for each unit. Spinal anaesthesia is the most common type of anaesthesia (59.9%) and general anaesthesia continues to increase from 34.6% in 2020 to 38.9% in 2021. 13 units reported that they performed over 80% of the operations in general anaesthesia. The use of drainage has decreased from 26% in 2011 to 0.2% in 2021. In 2021, more operations were reported to be performed without the use of a tourniquet than before. Thus, the proportion of operations performed using tourniquet has decreased from 90% in 2011 to just over 28 % in 2021. LIA, with or without remaining catheter, was reported as previously for most of the operations. The median time for a primary knee replacement (without considering fixation) varied between the units from 20 to 228 minutes. In the country the median time for a TKR was 65 min, and a UKR 52 min, in patellofemoral prostheses 60 min, in partial prostheses 47.5 min and in hinged/stabilized prostheses 147 min. Since 2009 the median surgery time in TKR has varied between 65 and 82 min and in UKR between 52 and 80 min. Bone grafting is uncommonly used in primary knee replacements and when used it is almost exclusively in form of auto graft. Bone grafting was reported in < 1% of the operations and was somewhat more common in tibia (57.5 %) than femur (37.2%). Computer Assisted Surgery (CAS) was reported in 5 operations from different units. No UKRs were reported performed with CAS.

Custom made instruments/sawing blocks were reported in 18 operations in 2021, which is more than what was reported in 2020 (8). The technique was reported from 7 units whereof Lindesberg reported 8 of them.

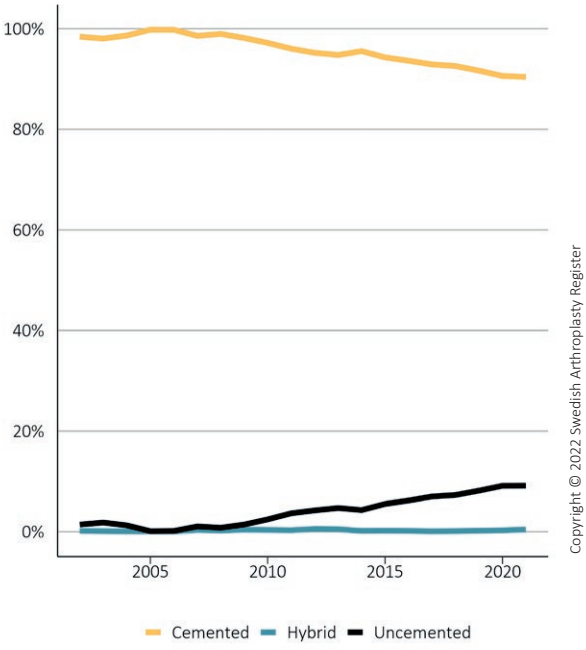


Figure 6.1.1. Time trend for fixation method, TKR/OA.

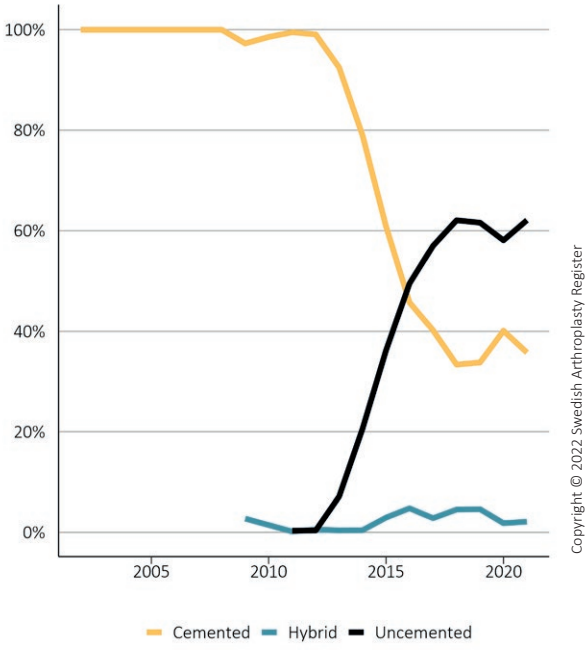


Figure 6.1.2. Time trend for fixation method, UKR/OA.

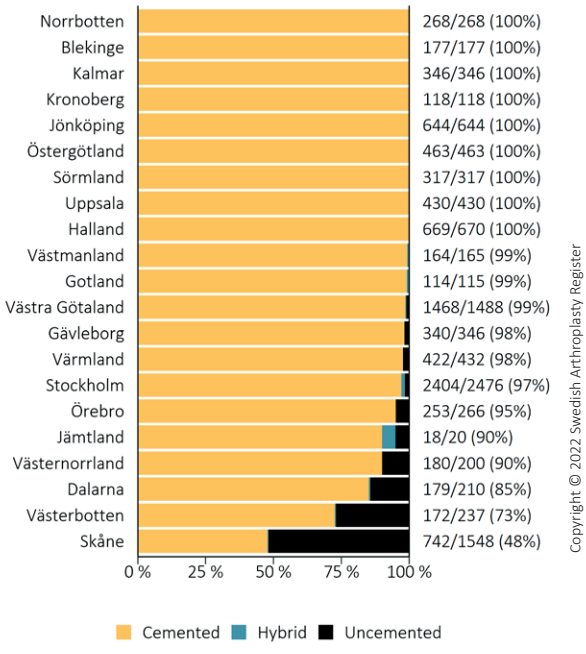


Figure 6.1.3. The relative use of fixation type in TKR/OA. The column on the right shows the number cemented/total number (%).

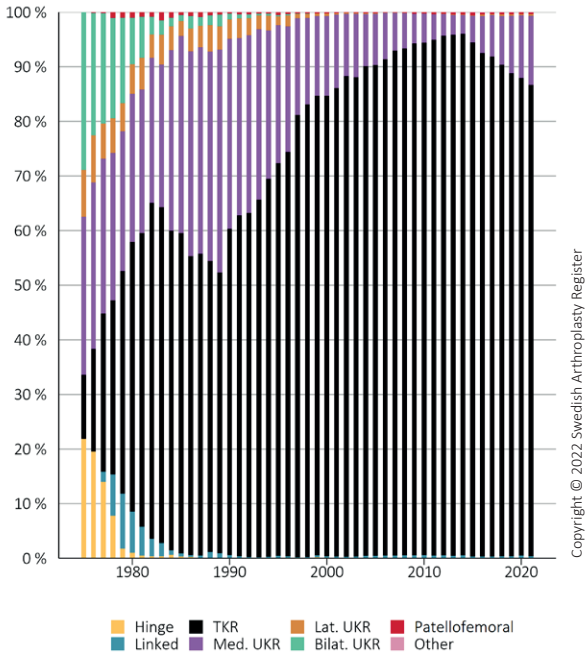


Figure 6.1.4 Distribution of type of prosthesis in primary surgery 1975–2021.

Type of cement

Cement	Number TKR	Proportion TKR %	Number UKR	Proportion UKR %
Optipac Refobacin (prefilled)	5,272	53	181	31
Palacos R+G Pro(prefilled)	3,556	36	243	41
Palacos R+G (gentamicin)	641	6	58	10
Refobacin Bone Cement (genta)	364	4	57	10
Smartset GHV (gentamicin)	97	1	25	4
Refobacin Revision Cement (genta+clinda)	10	0	0	0
Copal (genta + vanco)	8	0	0	0
Copal (genta + clinda)	5	0	0	0
CMW with Gentamicin	1	0	22	4
Other	23	0	1	0
Type unknown	1	0	0	0
Total	**9,978**	**100**	**587**	**100**

Table 6.1.7. Type of cement in TKR and UKR 2021.

Arthrotomy

Since 1999 it is registered if the technique of 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 uncommon, the popularity of MIS in UKR increased rapidly in the end of the 1990s and reached its maximum in 2007 when 61% of all UKRs were reported to be operated on with MIS. Some prosthesis models, especially Oxford, are more often used with MIS than others. In 2021, MIS was reported in 44.3% of the UKRs (table 6.1.6) but just in 0.4% of the TKRs.

Fixation

The use of cement remains by far the most common method of fixating the components to the bone. Cementless fixation, however continues to increase. In 2010, 2.4% of all TKRs were reported to be fixated without cement and in 2021, 9.1% were reported as completely uncemented. In 2021, 0.4% of all TKRs were hybrids (figure 6.1.1). In UKA, the change has been significant the last years. Before 2010 almost all UKRs were cemented but since 2013 this has changed. In 2021, 62.5% of the UKRs were performed without cement and 2.2% were hybrids (figure 6.1.2). The reason for this is mainly the popularity of Oxford's cementless variant that was used in 95% of the Oxford cases. Figure 6.1.3 shows the proportion of type of fixation in each region respectively in TKR 2020. Skåne reports cementless fixation in over half of the TKRs (52%) and Västerbotten in more than one fourth (27%) while most of the regions report no or a smaller proportion of cementless TKRs.

Cement

Since 2007 there have been reported the article number for the cement in almost all operations where cement has been used, why the type of cement can be reliably identified (table 6.1.7). As the type of mixing system may be likely to have an effect on the quality of the cement, we are also interested in the article numbers of these, that is if separate mixing systems with their own article numbers have been used. In practice all the cement that was reported in 2021 in primary operations contained antibiotics of gentamicin type.

Implants

The TKR was developed in the 1970s when there already existed hinged prostheses and UKR's on the market. When the Swedish Knee Arthroplasty Register started registration in 1975, TKR had just been introduced in

Sweden which is why hinged prostheses and UKR were used for the majority of the primary operations at that time (figure 6.1.4). It was also common to combine two UKRs in the same knee (bilateral UKR) in those cases the knee disease affected more than one compartment. When the use of TKR spread, bilateral UKR ceased being used. Nowadays hinged prostheses, linked and stabilized prostheses are mainly used for especially difficult primary cases, trauma, tumours and revisions. For uncomplicated primary cases, TKR is mostly used, but also UKR in some cases of unicompartmental disease. The use of UKR decreased gradually between 1990 and 2015 but has since then increased gradually again. That use of UKR on the lateral side of the knee is since the mid-1990s very uncommon. The reason for the decline in popularity of the UKR may be that compared with TKR, UKR has been shown to have a considerably higher revision rate (see figure 6.4.6). However, it must be considered that in UKR, parts of the knee have not been replaced with a prosthesis and may later be suffering from disease. This means that it may sometimes be tempting to offer revision of UKR to TKR in patients with pain of unclear nature and unclear cause. In favour of UKR, however, is the risk of revision due to infection that is considerably lower than for TKR as is the risk of revision with stabilized implants, arthrodesis or amputation (see tables 6.4.2 a-c).

Prosthesis model

The prosthesis model is probably the factor that generates most interest and is most often related to the outcome after knee replacement. However, it is not only the model/design that determines whether the knee replacement needs to be reoperated, but also the so-called case-mix. The Swedish Arthroplasty Register tries in its analysis to reduce the effect of case-mix by considering factors such as patient's disease, sex, age and the time period in which the operation was performed.

Another important factor that the register is not able to include in its analyses is the surgical experience of the individual surgeon. It is obvious that surgeons can be more or less skilled at operating, which can affect the results of individual implants, especially when the use has been limited to a few surgeons and units. Therefore, it could be discussed if it is fair to report results of specific models when it can be argued that deviant results may be influenced by the skills of the surgeon. To this we can only say that the risk of revision for the individual model is the result of what the users have been able to achieve with

Most common TKR implants

Model	Number	Proportion %
NexGen MBT	5,830	53.0
PFC Sigma TKA MBT	1,766	16.0
Triathlon MBT	1,670	15.2
Persona TKA	536	5.0
Genesis II MBT	226	2.0
Legion/Genesis II Pri MBT	184	2.0
PFC Sigma TKA APT	165	1.5
Persona TKA Trabicular Metal	138	1.2
NexGen Trabecular Metal	137	1.2
Triathlon Total Stabilizer	114	1.0
NexGen Revision	66	0.6
Attune MB TKA	56	0.5
PFC Sigma TC-3 (revision)	48	0.4
Journey TKA	18	0.2
Legion / Genesis II Revision	12	0.1
PFC constrained (rev not TC3)	11	0.1
PFC Sigma TKA Rotating platform	5	0.0
Attune RP TKA	3	0.0
Persona Revision	3	0.0
NexGen Unspecified	2	0.0
Total	**10,990**	**100**

Table 6.1.8 a. Most common TKR implants (including revision models) in primary surgery 2021.

Most common UKR implants

Model	Number	Proportion %
Oxford	1,075	65.7
Triathlon Uni	193	11.9
Link	131	8.0
ZUK	116	7.1
Persona-PK	61	3.7
Sigma-PKR	59	3.6
Ibalance	1	0.0
Total	1,636	100

Table 6.1.8 b. Most common UKR implants in primary surgery 2021.

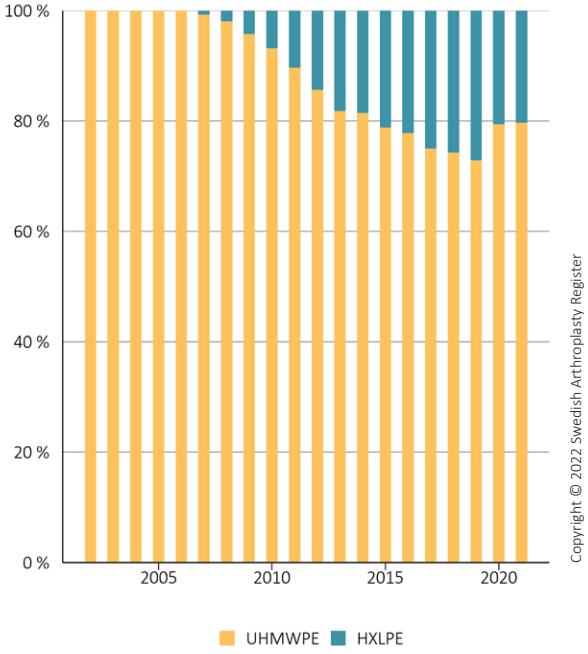


Figure 6.1.5. Distribution of the old UHMWPE polyethylene and the newer cross-linked HXLPE polyethylene types.

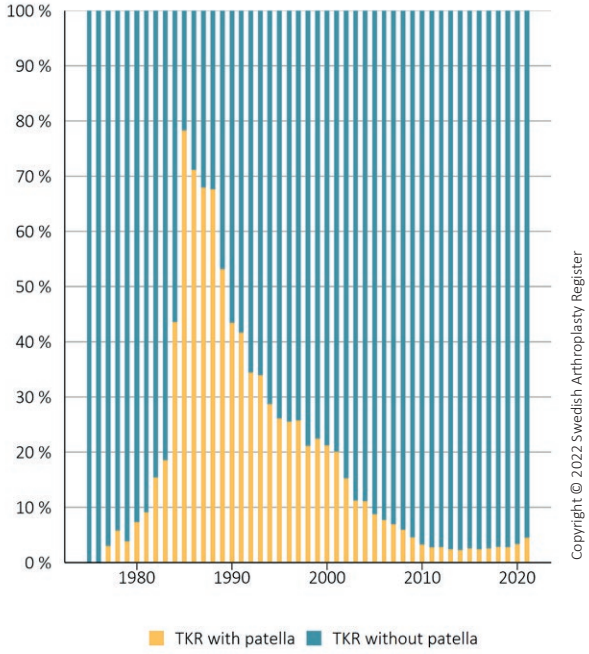


Figure 6.1.6. Distribution of TKR with or without patella component.

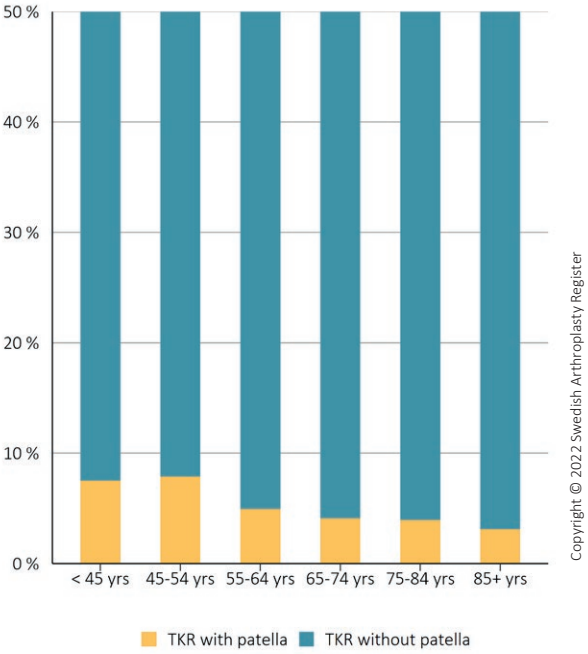


Figure 6.1.7. Distribution of the use of patella component in the different age groups 2021.

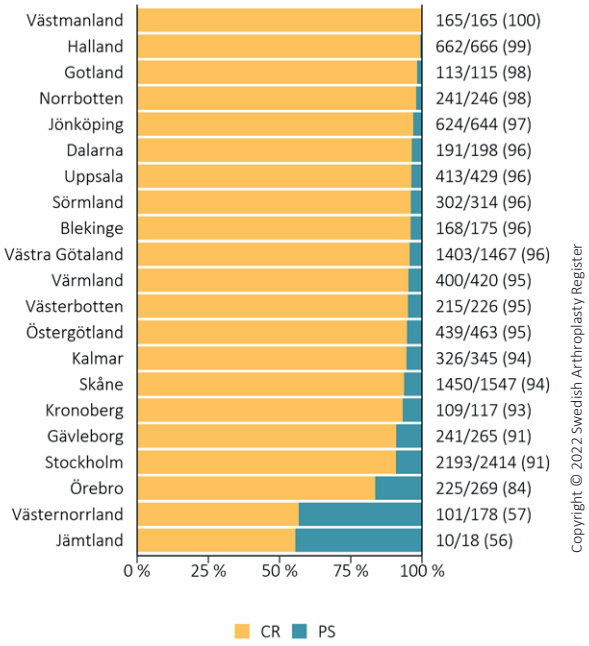


Figure 6.1.8. The relative use of CR and PS TKR respectively in the regions 2021. The column on the right shows the number of CR/total number (%).

that particular model. The final result is determined by the prosthesis design, material, durability, accompanying instruments, ease of use, safety margins (how the prosthesis behaves if it is not inserted in exact position) together with the skills of the surgeon and the training in the use of the instruments/prosthesis and to select appropriate patients for this particular surgery. Producers together with the 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 do not depend solely on design, material and durability.

Historically the most used knee replacement models in Sweden have been among those with the lowest revision rate. This may be due to the fact that surgeons have been able to choose the best models, but also because when the same implants are used frequently, the surgical habits become strong.

The models that showed a significant worse result than the others have mostly disappeared from the Swedish market. An exception was the Oxford UKR, which initially had inferior results, but after modifications and with increased surgical experience recovered. Table 6.1.8 a show TKR (including revision models) and 6.1.8 b UKR implants used in primary surgery 2021. Table 6.1.8 a does not include 46 linked prostheses reported in primary surgery, mainly rotation models (Link Endo, MUTARS, NexGen, S-ROM Noiles, Smith & Nephew and Stryker) for the treatment of malignancies, fractures and other special cases.

Use of patella component

Model	Number TKR with patella	Proportion TKR with patella %	Number TKR without patella	Proportion TKR without patella %
NexGen MBT	120	2.1	5,710	97.9
PFC Sigma TKA MBT	146	8.3	1,620	91.7
Triathlon MBT	117	7.0	1,553	93.0
Persona TKA	14	2.6	522	97.4
Genesis II MBT	8	3.5	218	96.5
Legion/Genesis II Pri MBT	24	13.0	160	87.0
PFC Sigma TKA APT	9	5.5	156	94.5
Persona TKA Trabicular Metal	8	5.8	130	94.2
NexGen Trabecular Metal	8	5.8	129	94.2
Triathlon Total Stabilizer	18	15.8	96	84.2
NexGen Revision	3	4.6	63	95.4
Attune MB TKA	4	7.1	52	92.9
PFC Sigma TC-3 (revision)	6	12.5	42	87.5
Journey TKA	3	16.7	15	83.3
PFC Sigma TKA Rotating platform	0	0.0	5	100.0
Attune RP TKA	0	0.0	3	100.0
Persona Revision	0	0.0	3	100.0
NexGen Unspecified	0	0.0	2	100.0
Other	3	13.0	20	87.0
Total	**491**		**10,499**	

Table 6.1.9. The use of patella component in primary TKR 2021.

The same 3 models as last year dominate. NexGen from Zimmer accounts for just over half (53%) of implants while PFC from DePuy account for 16% and Triathlon from Stryker accounts for 15%.

After several years of decline in the use of UKR its use has increased since 2014. In 2021, UKR accounted for 12.9% of the primary replacements (11.6% in 2020). The Oxford model was used in 65.7% of the procedures in 2021 which is a somewhat higher proportion than in 2020.

Types of polyethylene

Figure 6.1.5 shows that the Swedish orthopaedic surgeons have relatively late started to replace the well-proven UHMWPE polyethylene with the newer highly cross-linked types (HXLPE). In 2006, when the new polyethylene variants started to be used in Sweden these were already being used in Australia in one fourth of cases according to their latest annual report (AOANJRR) (https://aoanjrr.sahmri.com).

The majority of the implants using HXLPE polyethylene in Sweden until 2021 have been Triathlon (X3 polyethylene), PFC (XLK polyethylene) or Persona (Vivacit-E polyethylene). So far, we have not been able to note a reduced revision rate for the Triathlon or PFC implants using HXLPE polyethylene. However, AOANJRR has previously reported lower revision rates for HXLPE polyethylene (Steiger et al. 2015) but that was prosthesis dependent and applied to NexGen and Natural II but not to Triathlon or Scorpio NRG. Data on PFC was not included.

It is important to remember that the methods of increasing the durability of the new polyethylene by radiation and/or addition of antioxidants are very different. In many polyethylene's the effect on revision rate in the longer term remains to be seen.

Patella component in TKA

In the 1980s, a patella component was used in just over half of the TKR cases. Since then, the use has decreased, but in 2021 it has increased somewhat from previous years (barely 3%) to 4.6% of the TKA cases (figure 6.1.6 and table 6.1.9). The use has previously been strongly associated with the prosthesis model used. This association to specific models have decreased as the use of patella component has become more uncommon. In 2021, a patella component was used proportionally more often with Journey and Triathlon Total Stabilizer. In Sweden, females are slightly more likely than males to have their patella resurfaced in TKR. This has been explained by the fact that patellofemoral symptoms were more common in females. In 2021, 3.7% of males had their patella resurfaced compared with 5.1% of females. The relative use of patella component in the different age groups in 2021 shows that the use of patella component is slightly more common in the younger age groups (figure 6.1.7). The proportions, however, has varied slightly due to the relative few number of younger patients. A discussion if it affects the revision rate, whether a patella component is used or not, are available in chapter 6.4 along with CRR-curves (figures 6.4.11 and 6.4.12) showing how the impact has changed over time..

Cruciate ligament retaining and cruciate ligament sacrificing TKR

There are cruciate ligament sacrificing types of TKRs that stabilise the knee, usually 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, however allowing some rotation. 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 a more normal knee movement than the minimally stabilising, posterior cruciate ligament retaining type ("cruciate retaining", CR).

The disadvantages of a PS implant 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 US. However, they have not been used much in Sweden as CR implants have been preferred, at least for those knees that are without major malalignment and that have an intact posterior cruciate ligament.

As figure 6.1.8 shows it differs between the regions how often PS implants are used. In 2021, the type was used relatively often in 3 regions; Jämtland, Västernorrland and Örebro. In 2019, 8% of the primary TKRs were of PS type when revision models and stemmed prostheses were included, however in 2021 the use of PS models has been almost halved to 4% (figure 6.1.8). In the late 90's and early 20's the proportion of PS was slightly more than 1% of the operations.

6.2. Reoperation of knee replacement regardless of diagnosis, cause and previous operations

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Reoperation includes all types of procedures that can be related to a previously inserted knee replacement, regardless of whether components are inserted, replaced, removed (including arthrodesis and amputation) or left untouched. The number of reoperations has increased year by year as the number of primary operations have increased and slightly more from 2013 apart from the pandemic years 2020 and 2021 (figure 6.2.1). The reason for the recent increase is likely to be that prior to 2013 procedures other than those defined as revision (components are replaced, added or removed) were not requested when reporting knee replacement surgery but were registered if they were sent to the register.

2020 was the first year the variable reoperation was reported. It should be noted that other procedures are not well-defined as opposed to revision. It is difficult to determine to what extent these are reported and thus may affect outcome and disadvantage units that are good at reporting other interventions than revisions. The relative proportion of reoperations has decreased since the early 1990s and then increased again in 2012–2014 (figure 6.2.2). The reason is probably the same that has been described above, as well as the fact that the proportion of primary operations has increased considerably. Figure 6.2.3 shows the distribution of primary operations and reoperations reported per unit in 2021. 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 per unit varies from SUS/Lund where more than half of the operations are reported as reoperations to units that have reported no reoperations at all. The variation may be due, for example, to primary operations being performed at one/several units in a region while the reoperations are concentrated in another unit in the region.

In reoperations, the mean age and the proportion of males was more or less the same as for primary operation in 2021 (table 6.2.1). The age groups 75 years and older were somewhat higher represented in reoperation in comparison with primary operation. In reoperation, the pro-

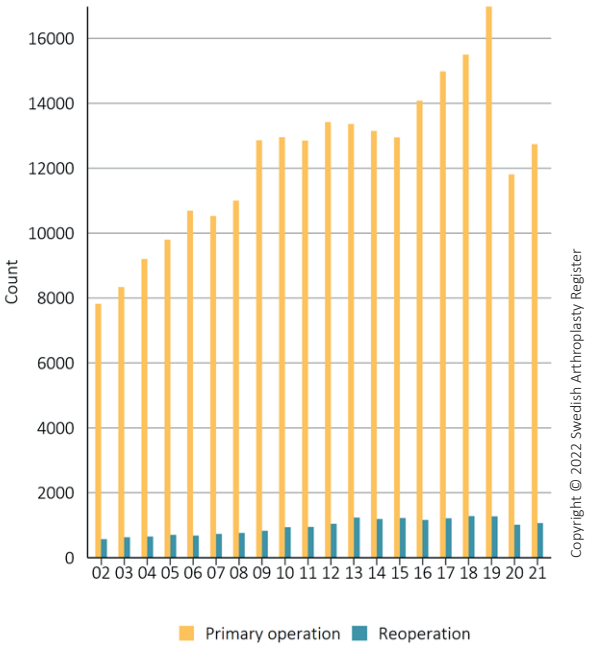

Figure 6.2.1. Number of primary and reoperations per year 2002–2021.

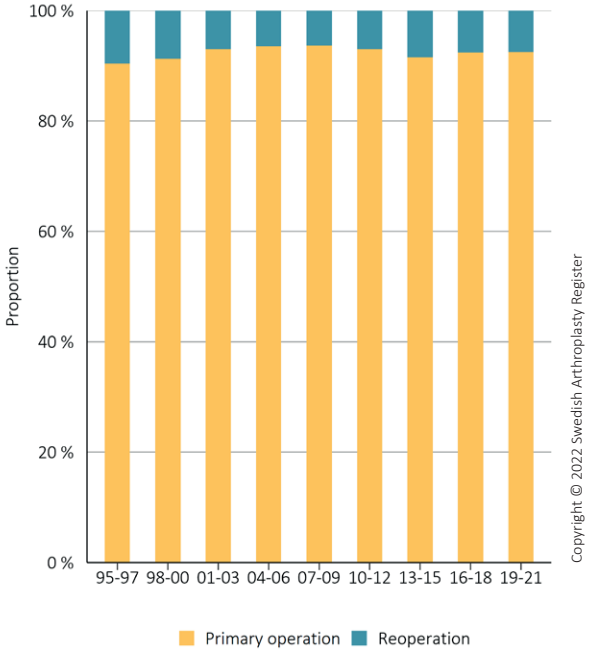

Figure 6.2.1. Distribution of primary knee replacements and reoperations (revision + other procedures) 1995–2021 divided in three-year periods.

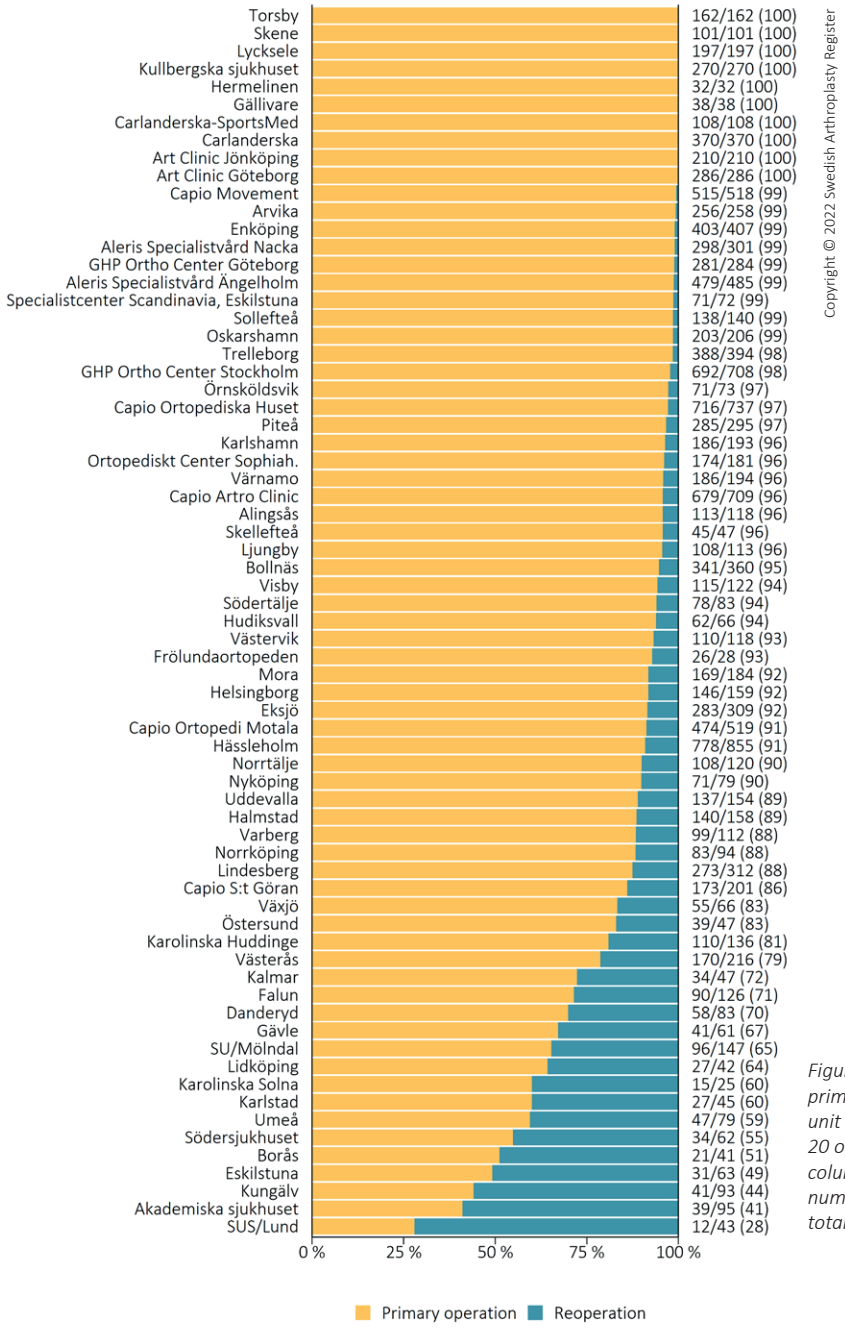

Figure 6.2.3. Distribution of primary and reoperations per unit 2020. Units with fewer than 20 operations are excluded. The column on the right shows the number of primary operations/ total number of operations (%).

portion increases in those BMI classes that are defined as obese (≥ 30), in ASA ≥ III and other diagnoses than osteoarthritis (diagnosis from the primary operation).

The most common reasons for reoperation in the last 10 years for TKR/OA and UKR/OA are shown in figure 6.2.4. In TKR/OA infection is nowadays the single most common reason for reoperation (more common than loosening). The reason "progress" for reoperation in TKR refers to, in principle, patellofemoral osteoarthritis. The reason "patella" for reoperation includes all kinds of patellar problems in replacements inserted both with and without patella component (however not loosening or wear of the patella component). Note that the distribution of reasons for reoperation not necessarily reflects the risk of these complications. Since the number of primaries in TKR/OA has increased considerably over time, early reoperations are overrepresented, such as infections and joint stiffness. In UKR/OA progression of osteoarthritis is the most common reason for reoperation and the proportion of reoperations due to loosening is higher than in TKR/OA, while infection is uncommon.

Demography in reoperation

	Reoperation	Primary operation
Number	1,068	12,742
Age mean (SD)	68.8 (10.7)	68.7 (9.2)
Age group (%)		
< 45 years	9 (0.8)	61 (0.5)
45–54 years	100 (9.4)	804 (6.3)
55–64 years	258 (24.2)	3,309 (26.0)
65–74 years	344 (32.2)	4,809 (37.7)
75–84 years	295 (27.6)	3,414 (26.8)
85+ years	62 (5.8)	345 (2.7)
Females (%)	589 (55.1)	7,057 (55.4)
BMI (%)		
< 18.5	2 (0.2)	24 (0.2)
18.5–24.9	195 (21.0)	2,422 (19.1)
25–29.9	354 (38.1)	5,611 (44.3)
30–34.5	268 (28.8)	3,580 (28.3)
35–39.9	83 (8.9)	924 (7.3)
≥ 40	28 (3.0)	94 (0.7)
ASA class (%)		
I	99 (10.5)	2,082 (16.4)
II	516 (54.8)	8,571 (67.4)
III–V	326 (34.6)	2,064 (16.2)
Diagnosis (%)		
Osteoarthritis	984 (94.0)	12,353 (97.1)
Osteonecrosis	19 (1.8)	97 (0.8)
Inflamatory joint disease	18 (1.7)	161 (1.3)
Sequele fracture/trauma	14 (1.3)	78 (0.6)
Tumor	7 (0.7)	8 (0.1)
Acute trauma	5 (0.5)	26 (0.2)
Other joint diseases	0 (0.0)	4 (0.0)

Table 6.2.1. Demography in reoperations (with diagnosis from previous primary operation). Primary operations performed in 2021 for comparison.

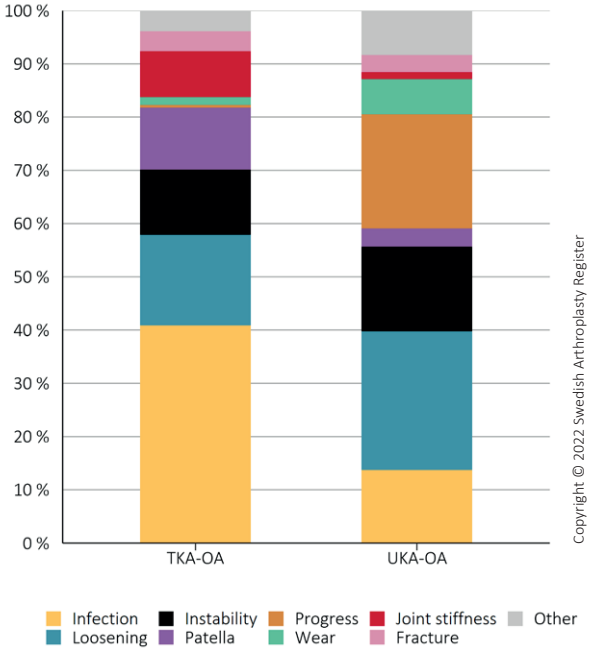

Figure 6.2.4. The most common reasons for reoperation in the last 10 years per type of operation/diagnosis.

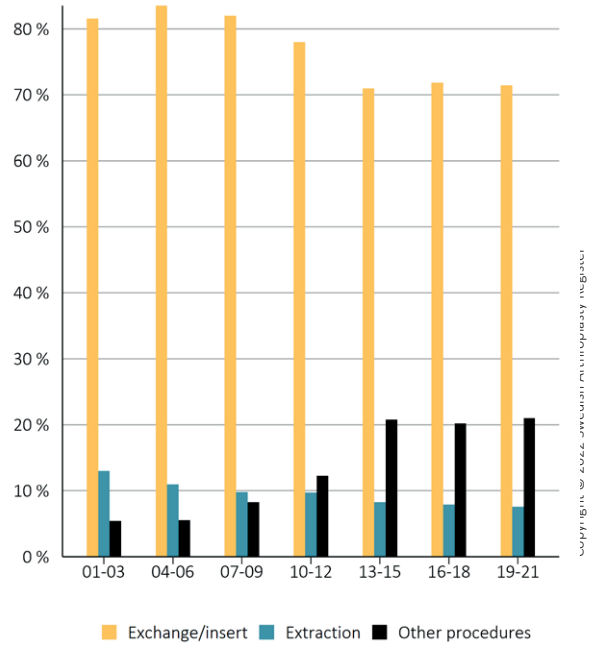

Figure 6.2.5. Distribution of the main procedures exchange/insertion, extraction and other procedures where the implant is not affected in three-year periods 2002–2021.

Figure 6.2.5 shows the distribution of the main interventions exchange/insertion, extraction and other interventions not affected the implant in three-year periods 2002–2021. Exchange/insertion of prosthesis components has been the predominant intervention. However, in the last three-year periods the proportion has decreased due to an increased reporting of other procedures. The most commonly reported procedures where the prosthesis is not affected are infection treatment/examination and manipulation under anaesthesia.

6.3. Reoperation within two years in TKR/OA

Authors: Annette W-Dahl and Martin Sundberg

Reoperations within two years after a primary operation has been used as a quality indicator in hip replacement surgery for several years and is selected by the Swedish Association of Local Authorities and Regions and the National Board of Health and Welfare as a national quality indicator. The variable is included in "Vården i siffror" (www.vardenisiffror.se). Reoperation within two years include all forms of additional surgery after the primary surgery. This outcome measure is intended to reflect mainly early and serious complications. The indicator is therefore considered important, readily available and easier to use for clinical improvement efforts, compared to risk of revision at five or ten years.

As previously described in chapter 6.2 we began systematically requesting other procedures than revisions from the units in 2013 and onwards for knee replacement surgery. The reason why two year-reoperations were not reported previously is partly because the reliability in the reporting of other procedures is uncertain, and partly because there are few reoperations per unit per year. Therefore, several years of reporting is needed to obtain a reasonable number for a meaningful analysis at unit level. In addition, it is difficult to determine to what extent other procedures are reported and thus this may affect outcome and disadvantage units that are good at reporting other procedures than prosthesis procedures. An indicator further assumes that the reporting is reliable, which we currently believe is not the case for knee replacement surgery.

As a part of the harmonisation in reporting data for the Swedish Arthroplasty Register, two-years reoperation after TKR for OA is presented also in this year's report, but in a slightly different form than for total hip replacements (see chapter 5.3 for hip). The aim is to show the situation for TKR in the number of reoperations within two years, and to encourage the reporting of procedures other than revisions in order to present a more reliable analysis in the future.

The most common reasons for reoperation within two years were infection, patella problems and loosening until 2008 with an increased proportion of infection 2008–2009 (figure 6.3.1). This increase coincides in time with the adoption of a more surgically aggressive treatment of suspected early infections. After 2013, infection remains the most common reason for reoperation within two years but the proportion of joint stiffness and fracture, as reason for reoperation, has increased, probably due to a change in reporting routines.

For TKR with OA, two-year reoperations 2018–2021 are presented for each unit (university hospital, privately run units and other units in alphabetical order) and refers to first-time events (number and proportion) within two years from the primary operation (table 6.3.1). Due to the few reoperations reported within two years only infection (suspected or verified) is presented as a single group while other reasons for reoperation are combined into one group, "other reason". The number of revisions (and the percentage of the number of reoperations) is provided to give an idea of the respective unit's reporting of other interventions than revision. The result of the aggregation is currently uncertain and do not give a fair picture of the proportion of reoperations within two years at national or unit level.

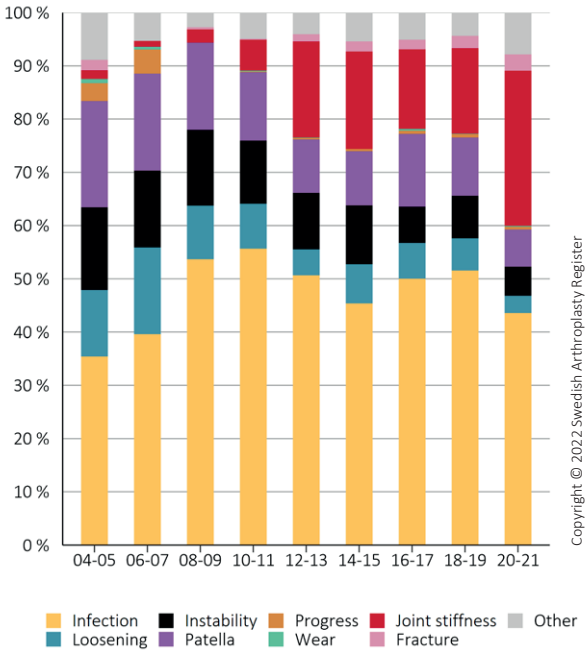

Figure 6.3.1. Distribution of reason for reoperation within two years after the primary operation in TKR/OA.

Number and proportion of reoperations within two years after the primary operation per unit 2018–2021

Unit	Number primary	Number reoperation	Whereof revisions	Revisions %	Infection number	Infection %	Other reason number	Other reason %
University units								
Akademiska sjukhuset	207	15	6	40	5	2.42	10	4.83
Karolinska Huddinge	398	7	5	71	1	0.25	6	1.51
Karolinska Solna	67	2	1	50	2	3	0	0
SU/Mölndal	924	9	9	100	6	0.65	3	0.32
SUS/Lund	74	0	0					
Umeå	397	15	14	93	8	2.01	7	1.76
Private units								
Aleris Specialistvård Nacka	668	6	6	100	2	0.3	4	0.6
Aleris Specialistvård Ängelholm	780	16	16	100	5	0.64	11	1.41
Art Clinic Göteborg	646	5	3	60	4	0.62	1	0.15
Art Clinic Jönköping	756	3	3	100	1	0.13	2	0.26
Båstad Active Motion	23	0	0					
Capio Artro Clinic	1,818	40	11	28	12	0.66	28	1.5
Capio Movement	1,792	16	12	75	9	0.5	7	0.39
Capio Ortopedi Motala	1,427	28	27	96	9	0.63	19	0.013
Capio Ortopediska Huset	2 474	110	21	19	11	0.44	99	4.04
Capio S:t Göran	992	12	11	92	5	0.5	7	0.71
Carlanderska	1,158	7	5	71	2	0.17	5	0.43
Carlanderska – SportsMed	407	3	1	33	1	0.25	2	0.5
Frölundaortopeden	71	2	2	100	0	0	2	2.82
GHP Ortho Center Göteborg	950	11	11	100	4	0.42	7	0.74
GHP Ortho Center Stockholm	2,161	53	29	55	14	0.65	39	1.8
Hermelinen	83	1	1	100	1	1.2	0	0
Ortopedisk Center Sophiahemmet	211	4	4	100	4	1.9	0	0
Sophiahemmet	208	7	6	86	1	0.48	6	2.89
Specialistcenter Scandinavia, Eskilstuna	26	0	0					

The table continues on the next page.

Number and proportion of reoperations within two years after the primary operation per unit 2018–2021, cont.

Unit	Number primary	Number reoperation	Whereof revisions	Revisions %	Infection number	Infection %	Other reason number	Other reason %
Other units								
Alingsås	612	11	2	18	6	0.98	5	0.82
Arvika	846	11	8	73	6	0.71	5	0.6
Bollnäs	1,077	14	10	71	7	0.65	7	0.65
Borås	272	3	1	33	1	0.37	2	0.74
Danderyd	259	10	8	80	8	3.09	2	0.77
Eksjö	1,056	29	24	83	9	0.85	20	1.89
Enköping	1,529	45	19	42	11	0.72	34	2.29
Eskilstuna	193	9	3	33	1	0.52	8	4.15
Falköping	63	0	0					
Falun	390	12	4	33	2	0.51	10	2.56
Gällivare	278	0	0					
Gävle	271	6	5	83	5	1.84	1	0.37
Halmstad	517	1	1	100	1	0.19	0	0
Helsingborg	724	9	9	100	6	0.83	3	0.41
Hudiksvall	215	3	3	100	2	0.93	1	0.47
Hässleholm	2,941	51	48	92	22	0.75	29	0.99
Kalmar	261	1	1	100	1	0.38	0	0
Karlshamn	804	5	5	100	3	0.37	2	0.25
Karlstad	283	4	4	100	3	1.06	1	0.35
Kullbergska sjukhuset	756	19	15	79	9	1.19	10	1.32
Kungälv	446	31	10	32	17	0.38	14	3.14
Lidköping	513	11	10	91	3	0.58	8	1.56
Lindesberg	1,396	24	18	75	13	0.93	11	0.79
Ljungby	322	5	3	60	2	0.62	3	0.93
Lycksele	446	10	9	90	6	1.35	4	0.9
Mora	652	24	4	17	4	0.61	20	3.07
Norrköping	412	13	13	100	5	1.21	8	1.94

The table continues on the next page.

Number and proportion of reoperations within two years after the primary operation per unit 2018–2021, cont.

Unit	Number primary	Number reoperation	Whereof revisions	Revisions %	Infection number	Infection %	Other reason number	Other reason %
Norrtälje	566	9	8	89	5	0.88	4	0.71
Nyköping	268	4	4	100	2	0.75	2	0.75
Oskarshamn	1,187	31	14	45	9	0.76	22	1.85
Piteå	935	11	7	64	7	0.75	4	0.43
Skellefteå	310	7	5	71	4	1.29	3	0.97
Skene	466	3	3	100	2	0.43	1	0.21
Skövde	54	2	2	100	1	1.85	1	1.85
Sollefteå	612	13	12	92	9	1.47	4	0.65
Sundsvall	79	5	4	80	4	5.06	1	1.27
Södersjukhuset	512	12	6	50	9	1.76	3	0.59
Södertälje	442	4	3	75	2	0.45	2	0.47
Torsby	441	6	5	83	5	1.13	1	0.23
Trelleborg	2,194	30	29	97	20	0.91	10	0.46
Uddevalla	749	11	10	91	7	0.93	4	0.53
Varberg	496	9	8	89	6	1.21	3	0.6
Visby	388	6	4	67	1	0.26	5	1.29
Värnamo	692	11	9	82	5	0.72	6	0.87
Västervik	379	9	9	100	5	1.32	4	1.06
Västerås	775	20	20	100	13	1.68	7	0.9
Växjö	250	10	9	90	5	2	5	2
Örnsköldsvik	336	6	3	50	2	0.6	4	1.19
Östersund	433	10	9	90	8	1.85	2	0.46
Country	**48,847**	**963**	**625**	**65**	**391**	**0.8**	**571**	**1.17**

Table 6.3.1. Number and proportion of first reoperations (suspected or verified infection or other reason) within two years after primary operation 2018–2021 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 arthroplasty

Authors: Martin Sundberg and Annette W-Dahl

Revision is defined as only those reoperations of a knee replacement which means that components are inserted (added), exchanged or removed (including arthrodesis and amputation). This means that soft tissue procedures 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 (an individual may be included with both right and left knee). As seen in figure 6.4.1 almost 80% of the patients operated in 1980 have not been revised in their lifetime. One fifth of the then operated have undergone revision and of the few that are still alive more than half have been revised.

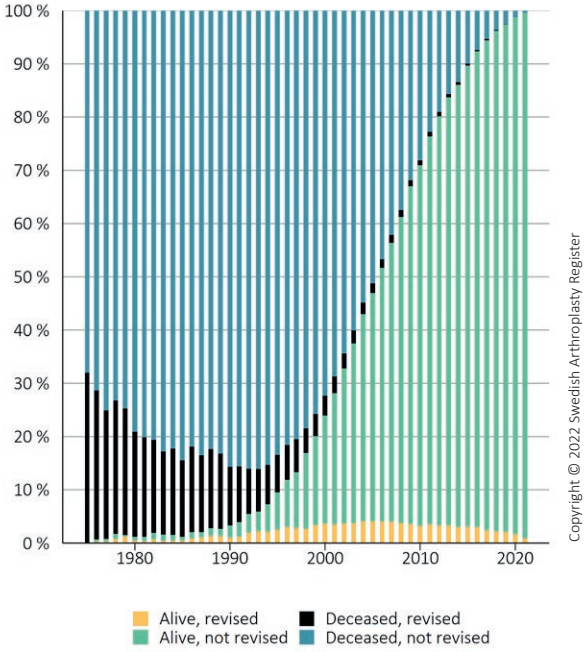

Figure 6.4.1. Current status per surgical year in patients having knee replacements.

Demography

There was barely one-year difference in mean age in first-time revision of TKR in 2021 compared with primary TKR in 2021 (table 6.4.1). The mean age in first-time revisions of UKR in 2021 was three years higher compared to primary UKR. Slightly higher proportions of females were revised in the TKR and UKR groups compared to the proportions of females operated on with primary TKR and UKR. At revision in both the TKR and the UKR group both the proportion of obese (BMI ≥ 30) and those classified as ASA ≥ III was higher than in primary surgery.

Figure 6.4.2 shows the distribution of primary surgeries and revisions reported per unit in 2021. The number and the proportion of primary operations are shown in the column to the right. Units with fewer than 20 operations have been excluded. The proportion of revisions per unit varies from SUS/Lund where about 65% of the operations were reported as revisions to units that have reported no revisions at all. The variation may for example depend on that primary operations are performed in one or more units in a region while the revisions are concentrated to other units in the region.

Reason for revision

The most common reasons for revision in the last ten years in TKR/OA and UKR/OA are shown in figure 6.4.3. In TKR/OA, infection has been the most common reason for revision in the last few years compared with previously when loosening dominated as reason for revision. The reason for revision "progress" in TKR refers mainly patellofemoral osteoarthritis. The reason for revision "patella" includes all kinds of patellar problems in patients with replacements both with and without a patellar component (but not loosening or wear of the patella component). Note that the distribution of reasons for revision not necessarily reflects the risk of having these complications. Since the number of primary operations in TKR/OA has increased substantially over time, early revisions are overrepresented and thereby infections. In UKR/OA progression of osteoarthritis is the most common reason for revision while the proportion of revisions due to loosening is higher and the proportion of revisions due to infection is lower than for TKR/OA.

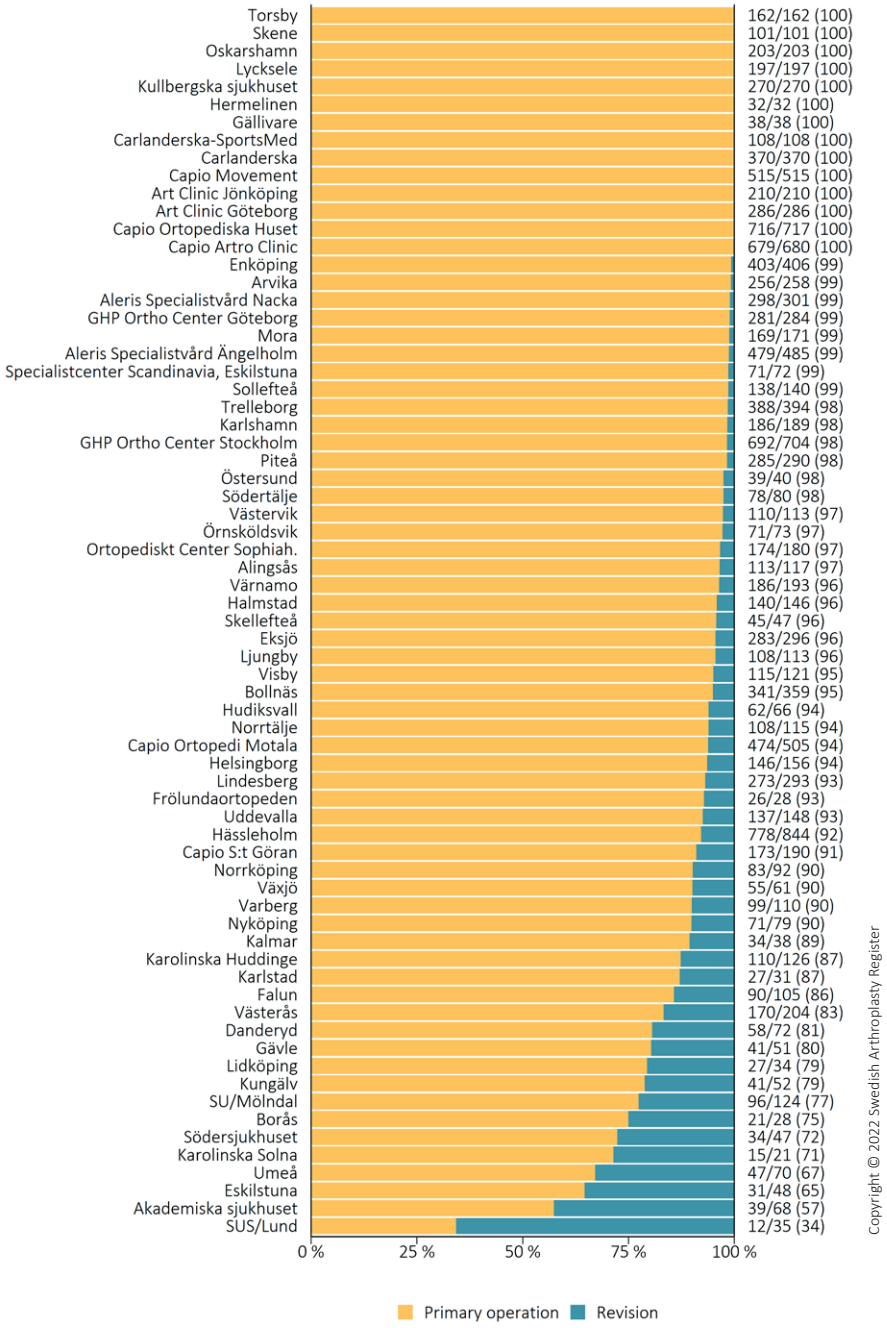

Figure 6.4.2. Revisions per unit 2020. The column on the right shows the number of primary operations/total number (%).

Demography in revisions 2021

	TKR revision	UKR revision	Primary operation TKR	Primary operation UKR
Number	**443**	**139**	**10,995**	**1,651**
Age mean (SD)	**70.0 (9.9)**	**68.6 (8.2)**	**69.1 (9.0)**	**65.9 (9.1)**
Age group (%)				
< 45 years	1 (0.2)	0 (0.0)	40 (0.4)	10 (0.6)
45–54 years	31 (7.0)	7 (5.0)	622 (5.7)	167 (10.1)
55–64 years	95 (21.4)	36 (25.9)	2,744 (25.0)	546 (33.1)
65–74 years	161 (36.3)	55 (39.6)	4,178 (38.0)	608 (36.8)
75–years	128 (28.9)	40 (28.8)	3,090 (28.1)	298 (18.0)
85+ years	27 (6.1)	1 (0.7)	321 (2.9)	22 (1.3)
Females (%)	261 (58.9)	76 (54.7)	6,196 (56.4)	793 (48.0)
BMI (%)				
18.5–24.9	88 (20.4)	27 (19.7)	2,083 (19.1)	304 (18.5)
25–29.9	170 (39.4)	55 (40.1)	4,770 (43.7)	802 (48.9)
30–34.5	124 (28.7)	40 (29.2)	3,121 (28.6)	446 (27.2)
35–39.9	41 (9.5)	13 (9.5)	839 (7.7)	82 (5.0)
≥ 40	9 (2.1)	2 (1.5)	87 (0.8)	5 (0.3)
ASA class (%)				
ASA I	46 (10.6)	17 (12.3)	1,671 (15.2)	397 (24.1)
ASA II	245 (56.2)	87 (63.0)	7,440 (67.8)	1,072 (65.1)
ASA III–V	145 (33.3)	34 (24.6)	1 ,863 (17.0)	178 (10.8)

Table 6.4.1. Demography in revisions 2021 divided in TKR and UKR with primary operation for comparison.

Revision procedures

Tables 6.4.2 a-b show the different types of first-time revisions performed in 2012–2021, divided in type of primary operation (TKR/OA and UKR/OA).

It should be noted that the type of revision is exclusive (only one type is allowed for each revision) which means that, for example, in case of patella surgery with a simultaneous exchange of polyethylene/meniscal bearing only the patella procedure is presented.

For TKR/OA we see that revisions where polyethylene/meniscal bearing is exchanged has stagnated and is somewhat lower than in the period that was reported in the previous annual report. For UKA it is encouraging that no one is revised with a new UKA as this type of revision has been shown to have a high re-revision rate.

Factors affecting the revision rate

How implants affect the revision rate has been given its own section (chapter 6.5 Evaluation of implants) in this year's report as a part of the harmonisation of the reporting of knee and hip replacements.

Underlying disease

Early on, it was realized that patients with different underlying disease such as RA and OA could have different postoperative outcome with different revision rate. Therefore, it has always been reported separate curves for these diagnoses. The modern treatment of RA has, however, decreased the need for knee replacements in this group and it has become increasingly difficult to see statistically significant differences. In this year's report we have therefore chosen not to present RA separately due to too few reported cases.

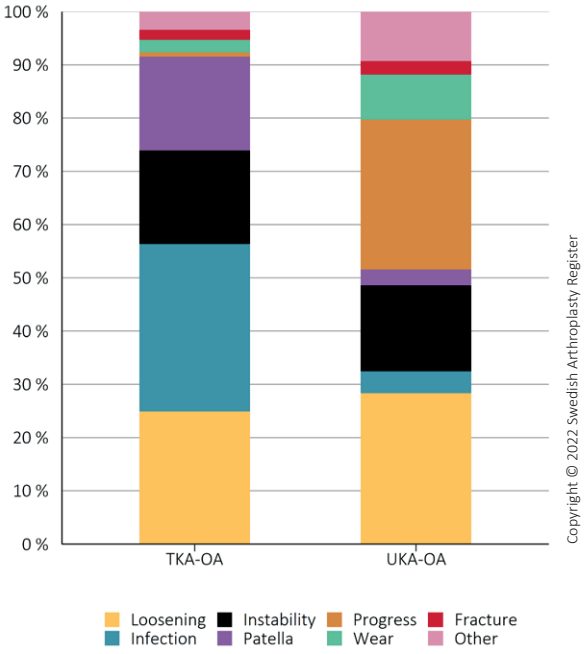

Figure 6.4.3. Distribution of reason for revision 2012–2021.

Age

The effect of age at primary surgery can be illustrated by dividing the patients into different age groups. It is shown that in both TKR and UKR the risk of revision is higher in those having knee replacement surgery in younger age (figure 6.4.4). Possible explanations are that the younger have a higher level of physical activity, greater demand for pain relief and function, and that they have a health status that more readily allows revision.

Surgical year

For TKA we saw a decrease in the risk of revision in the first three decades from the start of the register, which has not been as evident for UKA (figure 6.4.5). In the period 2006–2015 the number of early revisions of TKR increased, a trend that has continued in the most recent period 2016–2021. This has been mainly due to an increase in the number of early revisions due to infection (figure 6.4.6).

For UKR the improvement over the first three decades was not as marked as for TKR. But even, for UKR the early revision rate increased in the period 2006–2015 and 2016–2021. However, the explanation here is mainly that since the late 1990s the relative proportion of younger patients receiving UKR has increased, and they have a higher risk of revision. On the other hand, we can see a decrease of the revision rate in UKR in the last period as compared with 2006–2015 (figure 6.4.5).

When the Swedish Arthroplasty Register reports the risk of revision due to infection this means the risk of being revised due to infection at some point (first-time or a later revision) (figure 6.4.6). This risk decreased in the first decades for OA. In the period 2006–2015, for TKR, we saw a significant increase in the risk of revision for infection compared with the past which continues in 2016–2021 and now also for UKA. The increase is mainly due to early polyethylene exchanges due to infections or suspected infections. The increase is probably due to that fact that treatment for infection in the recent years has been more surgically aggressive with early intervention.

Sex

The effect of sex on revision risk is complex because males and females have different revision patterns. Revision for early infection is overrepresented in males while for females loosening and patella problems are the ones that dominate early. The difference between the sexes is even greater when the breaking point only includes revisions for infection (figure 6.4.7). Why males more often get revised for infection than females are unclear.

Patella component in TKR

How the use of a patella component affects the risk of revision is complex. The use is different depending on the prosthesis model, while at the same time it has decreased over the years. In the 2002 annual report we noted for the first time that TKR with patella component (inserted 1991–2000) had a lower risk of revision than those without (figure 6.4.8). In this period TKR without patella component had a significantly higher revision rate than those with patella component (HR 1.3 (CI 1.1–1.4)). An analysis of the period 2001–2010 (figure 6.4.9) shows on the contrary, that TKR without patella component have a significantly lower revision rate (HR 0.8 (CI 0.7–0.9)). In the current period 2012–2021 the risk continues to be lower for those without a patella component, but the difference is no longer significant (HR 0.8 (CI 0.7–1.04)).

Procedure in revision of primary TKR/OA

Procedure	Number	Proportion %
Exchange of meniscal bearing/insert	1,424	28.6
TKR without patella	1,191	23.9
Patella addition	876	17.6
Linked (rot. Hinge) without patella	452	9.1
TKR with patella	292	5.9
Exchange tibia	218	4.4
Extraction (two-staged)	164	3.3
Extraction	107	2.1
Exchange femur	69	1.3
Linked (rot. Hinge) with patella	52	1.0
Femoral amputation	48	1.0
Exchange patella	18	0.4
Arthrodesis	15	0.3
Extraction + prostesis spacer (2016)	14	0.3
Patella extraction	7	0.1
Reposition of the same insert (2016)	5	0.1
Exchange of hinge part	3	0.0
Hinged without patella	1	0.0
Addition of screw/hinge part	1	0.0
Unknown	29	0.6
Total	**4,986**	**100**

Table 6.4.2 a. Reason for revision in primary TKR/OA 2012–2021.

Procedure in revision of primary UKR/OA

Procedure	Number	Proportion %
TKR without patella	1,160	77.9
Exchange of meniscal bearing/insert	139	9.3
TKR with patella	87	5.8
Linked (rot. Hinge) without patella	40	2.7
Exchange tibia	13	0.9
Extraction (two-staged)	8	0.5
Patella addition	6	0.4
UKR medial	4	0.3
Exchange femur	4	0.3
Femoral amputation	4	0.3
Arthrodesis	3	0.2
Linked (rot. Hinge) with patella	2	0.1
Patellofemoral prosthesis	2	0.1
Extraction	2	0.1
Reposition of the same insert (2016)	1	0.1
Extraction + prosthesis spacer (2016)	1	0.1
Unknown	14	0.9
Total	**1,490**	**100**

Table 6.4.2 b. Reason for revision in primary UKR/OA 2012–2021.

The reasons for this can only be speculated. The insertion of the patella component takes extra time at surgery and involves an extra prosthesis component to be fixed to bone and that can wear. Hence there is an increased risk of infection, prosthesis loosening and wear. Therefore, modifications in the quality and fixation of the patella components may be the reason for the change in the risk of revision over time. On the other hand, a proportion of the TKRs without a primary patella component are secondarily operated with such a component. The fact that the femoral components have become more "patella-friendly" and/or the surgeons' enthusiasm for secondary patella resurfacing has changed, are also possible explanations for these inconstant outcomes.

It can be discussed whether the use of a patella component should be considered when assessing the risk of revision for units and implants respectively. We have chosen to present the implant's total risk of revision (both with and without patella component). This gives a comprehensive view of the situation in certain patient groups and implants. When we compare HR for implants (table 6.5.3 and 6.5.4) we present results separately for TKR with and without patella component and when we assess revision risk in different units, we take into consideration, in the regression analysis, whether a patella component has been used or not.

Use of cement

Cement has been used in the large majority of the operations since the mid-1990s, although with an increase in uncemented cases in recent years. We have previously shown in an analysis in TKRs inserted in the period 1985–1994, when the use of uncemented implants was slightly more common, that these had a higher risk of revision. Also, in the last ten-year period we now see a significantly higher risk of revision in uncemented implants compared with cemented (figure 6.4.10). See also chapter 9 "In-depth analysis" where Triathlon MBT, cemented and uncemented, are analysed.

Risk of revision per unit

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

The Swedish Arthroplasty Register has harmonised in selection, methods and how the results are presented in order to be equivalent for both knee and hip replacement surgery, however it is not completely consistent yet. Traditionally operations in a ten-year period with one-year delay (for example 2011–2020) have been included when the cumulative revision rate (CRR) has been estimated. In the analyses that follows an additional year has been included (11-year period), so also the most recent year, so the period becomes 2011–2021. The change means that operations can be followed for more than ten years instead for more than nine years. Including the most recent year's revisions may result in missing revisions, as we know from experience that revisions will be reported in the coming year.

Table 6.4.3 shows for each unit the number of primary surgeries (TKR) performed for OA in the analysed six-year period (2016–2021) and how many of these that have been revised. Table 6.4.4 shows the corresponding numbers but for an eleven-year period (2012–2021). This is followed by the RR (relative revision risk) with a 95% confidence interval. This estimates the unit effects on revision risk relative to the national average and has been calculated as in previous years using the "shared gamma frailty model". Finally, the observed rank of the unit is shown together with a 95 % confidence interval for the rank. The calculation has been performed using the Monte Carlo method.

It is the unit that decides where the operation is registered and not the location (hospital), as a part of the harmonization of the knee and hip registers. Also, the naming of the units has been harmonised. This does not represent a considerable difference from the past, as the Swedish Knee Arthroplasty Register has registered both location and unit of the operations in the last ten years.

Only units, where more than 50 primary operations have been performed in the period are included in the analysis, which includes all TKRs performed due to OA. The results have been adjusted for differences in sex and age distribution as well as for differences in the distribution of prostheses with and without a patella component. The 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 CRR after five and ten years respectively (primary operations 2016–2021 and 2011–2021 included). Units with fewer than 50 primary operations in the last five and ten years respectively are not presented but are included in the national data.

Relative risk of revision per unit, five years

Unit	Number TKR	TKR revised	RR	RR 95% CI	Rank	Rank 95% CI
Kalmar	**434**	**1**	**0.47**	**0.22; 0.97**	**1**	**1–38**
Art Clinic Jönköping	**851**	**4**	**0.47**	**0.26; 0.88**	**2**	**1–31**
Carlanderska	**1,317**	**8**	**0.49**	**0.29; 0.82**	**3**	**1–26**
Halmstad	**863**	**6**	**0.5**	**0.29; 0.88**	**4**	**1–31**
Karlshamn	**1,346**	**14**	**0.59**	**0.38; 0.91**	**5**	**2–33**
Gällivare	381	2	0.59	0.30; 1.17	6	1–52
Capio Artro Clinic	**2,033**	**18**	**0.59**	**0.40; 0.89**	**7**	**2–32**
Aleris Specialistvård Nacka	**989**	**10**	**0.61**	**0.37; 0.99**	**8**	**2–39**
Alingsås	**971**	**10**	**0.61**	**0.38; 1.00**	**9**	**2–40**
Skene	676	7	0.66	0.38; 1.14	10	2–50
Mora	1,041	12	0.66	0.42; 1.05	11	2–44
Carlanderska – SportsMed	619	7	0.66	0.39; 1.14	12	2–50
Capio Movement	2,596	33	0.68	0.49; 0.93	13	5–35
Borås	402	4	0.68	0.37; 1.26	14	2–56
Piteå	1,427	18	0.69	0.46; 1.02	15	4–42
Karolinska Solna	165	1	0.71	0.34; 1.47	16	1–64
Jönköping	140	1	0.71	0.34; 1.49	17	1–65
Bollnäs	1,66	26	0.77	0.54; 1.09	18	7–47
Uddevalla	1,163	17	0.78	0.52; 1.17	19	6–52
Capio Ortopediska Huset	3,773	59	0.78	0.61; 1.00	20	10–41
GHP Ortho Center Göteborg	1,235	18	0.8	0.54; 1.20	21	7–53
GHP Ortho Center Stockholm	3,012	47	0.81	0.62; 1.06	22	10–45
Karolinska Huddinge	613	9	0.81	0.49; 1.34	23	5–60
Värnamo	1,013	15	0.81	0.53; 1.25	24	6–56
Art Clinic Göteborg	789	10	0.83	0.51; 1.36	25	6–61
Capio S:t Göran	1,841	33	0.84	0.61; 1.16	26	10–51
Falköping	63		0.85	0.39; 1.87	27	2–72
Nyköping	398	6	0.86	0.49; 1.52	28	5–66
Falun	851	17	0.9	0.60; 1.35	29	10–60
Södertälje	750	14	0.91	0.58; 1.40	30	9–62
Trelleborg	3,78	75	0.91	0.73; 1.14	31	18–50
Södersjukhuset	1,041	22	0.92	0.63; 1.33	32	12–60
Lindesberg	2,081	39	0.93	0.69; 1.24	33	15–56
Hudiksvall	340	6	0.93	0.53; 1.64	34	7–69
Varberg	816	16	0.94	0.62; 1.43	35	11–63
Ljungby	526	10	0.94	0.58; 1.53	36	9–66
Oskarshamn	1,849	36	0.94	0.69; 1.28	37	16–57
SU/Mölndal	1,718	37	0.95	0.70; 1.29	38	16–58

The table continues on the next page.

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

Unit	Number TKR	TKR revised	RR	RR 95% CI	Rank	Rank 95% CI
Örnsköldsvik	627	13	0.96	0.61; 1.51	39	11–66
Karlskoga	123	3	0.96	0.50; 1.84	40	5–71
Hermelinen	112	2	0.98	0.49; 1.95	41	5–72
Lidköping	976	22	1.01	0.69; 1.46	42	16–64
Sophiahemmet	424	12	1.02	0.64; 1.62	43	12–68
Gävle	449	11	1.06	0.66; 1.71	44	14–70
Torsby	633	13	1.07	0.68; 1.67	45	15–69
Karlstad	571	15	1.09	0.71; 1.68	46	17–69
Västerås	1,214	28	1.1	0.78; 1.54	47	22–66
Sollefteå	909	20	1.1	0.75; 1.62	48	20–68
Östersund	714	18	1.12	0.75; 1.66	49	20–69
SUS/Lund	139	4	1.12	0.60; 2.07	50	10–73
Arvika	1,223	27	1.14	0.81; 1.60	51	24–68
Enköping	2,221	50	1.15	0.88; 1.50	52	30–65
Ortopedisk Center Sophiahemmet	211	4	1.15	0.62; 2.12	53	11–73
Skellefteå	465	12	1.15	0.73; 1.83	54	18–71
Helsingborg	914	21	1.17	0.80; 1.70	55	24–70
Visby	560	14	1.19	0.77; 1.85	56	22–72
Frölundaortopeden	84	3	1.19	0.62; 2.28	57	12–74
Akademiska sjukhuset	362	11	1.19	0.74; 1.92	58	19–72
Aleris Specialistvård Ängelholm	1,223	29	1.2	0.86; 1.68	59	29–70
Växjö	386	11	1.23	0.77; 1.98	60	21–73
Capio Ortopedi Motala	2,088	54	1.29	1.00; 1.67	61	39–69
Umeå	592	19	1.3	0.88; 1.93	62	31–72
Danderyd	467	15	1.31	0.86; 2.02	63	29–73
Eksjö	**1,441**	**39**	**1.36**	**1.01; 1.82**	**64**	**41–72**
Norrtälje	817	25	1.39	0.98; 1.98	65	38–73
Sundsvall	95	5	1.41	0.78; 2.53	66	23–74
Västervik	557	18	1.44	0.97; 2.15	67	37–73
Skövde	230	11	1.46	0.91; 2.34	68	33–74
Lycksele	**697**	**23**	**1.47**	**1.02; 2.12**	**69**	**42–73**
Hässleholm	**4,508**	**139**	**1.51**	**1.27; 1.78**	**70**	**56–72**
Norrköping	**720**	**27**	**1.55**	**1.10; 2.19**	**71**	**47–74**
Kullbergska sjukhuset	**1,116**	**39**	**1.66**	**1.24; 2.23**	**72**	**55–74**
Kungälv	**768**	**36**	**1.85**	**1.36; 2.50**	**73**	**60–74**
Eskilstuna	**309**	**20**	**2.06**	**1.40; 3.03**	**74**	**62–74**

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

Unit	Number TKR	TKR revised	RR	RR 95% CI	Rank	Rank 95% CI
Art Clinic Jönköping	**898**	**4**	**0.41**	**0.21; 0.78**	**1**	**1–24**
Alingsås	**1,945**	**19**	**0.41**	**0.28; 0.62**	**2**	**1–11**
Kalmar	**852**	**8**	**0.48**	**0.28; 0.82**	**3**	**1–28**
Carlanderska	**1,734**	**18**	**0.53**	**0.35; 0.80**	**4**	**1–26**
Aleris Specialistvård Nacka	**1,642**	**21**	**0.54**	**0.37; 0.79**	**5**	**1–25**
Carlanderska – SportsMed	**845**	**11**	**0.55**	**0.34; 0.90**	**6**	**1–36**
Capio Artro Clinic	**2,034**	**18**	**0.57**	**0.38; 0.86**	**7**	**2–32**
Karolinska Huddinge	**1,205**	**17**	**0.59**	**0.39; 0.89**	**8**	**2–35**
Jönköping	**885**	**16**	**0.62**	**0.41; 0.95**	**9**	**2–41**
Karlshamn	**2,513**	**42**	**0.66**	**0.49; 0.87**	**10**	**5–33**
Karolinska Solna	598	11	0.66	0.41; 1.08	11	2–51
Gällivare	733	11	0.67	0.41; 1.09	12	2–52
Sabbatsberg	512	11	0.69	0.42; 1.12	13	3–54
Halmstad	**1,869**	**35**	**0.69**	**0.51; 0.94**	**14**	**5–40**
Skene	1,181	20	0.7	0.47; 1.03	15	4–47
GHP Ortho Center Göteborg	**1,751**	**30**	**0.7**	**0.50; 0.98**	**16**	**5–43**
Spenshult	933	23	0.72	0.49; 1.04	17	5–48
Capio Movement	**3,932**	**73**	**0.75**	**0.60; 0.94**	**18**	**10–39**
Hudiksvall	689	13	0.77	0.49; 1.22	19	5–61
Värnamo	1,655	31	0.78	0.56; 1.08	20	8–51
GHP Ortho Center Stockholm	**5,059**	**103**	**0.78**	**0.65; 0.95**	**21**	**12–41**
Piteå	2,694	55	0.79	0.62; 1.02	22	11–47
Art Clinic Göteborg	804	10	0.8	0.48; 1.32	23	5–65
Trelleborg	**7,241**	**158**	**0.8**	**0.68; 0.94**	**24**	**15–40**
Karlskoga	731	18	0.81	0.54; 1.22	25	7–61
Nyköping	837	17	0.81	0.54; 1.23	26	7–61
Falköping	63		0.83	0.35; 1.96	27	1–79
Uddevalla	2,029	41	0.84	0.62; 1.12	28	11–54
Mora	1,886	40	0.84	0.63; 1.12	29	11–54
Capio Ortopediska Huset	5,717	128	0.87	0.73; 1.03	30	19–48
Borås	809	18	0.87	0.58; 1.31	31	9–65
Oskarshamn	3,103	70	0.87	0.69; 1.09	32	16–53
Ängelholm	182	5	0.88	0.48; 1.63	33	4–76
Hermelinen	128	2	0.89	0.43; 1.85	34	3–79
Arvika	2,010	43	0.9	0.68; 1.20	35	15–59
Lindesberg	2,915	62	0.9	0.71; 1.15	36	17–56
Capio S:t Göran	3,499	84	0.9	0.73; 1.11	37	19–54
Torsby	1,200	27	0.91	0.64; 1.29	38	13–64
Frölunda Specialistsjukhus	590	18	0.92	0.61; 1.38	39	10–68
Båstad Active Motion	58	1	0.92	0.42; 2.02	40	3–80
Örnsköldsvik	1,137	28	0.93	0.66; 1.30	41	14–65

The table continues on the next page.

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

Unit	Number TKR	TKR revised	RR	RR 95% CI	Rank	Rank 95% CI
Västerås	2,371	59	0.93	0.73; 1.19	42	19–59
Varberg	1,567	41	0.97	0.72; 1.29	43	19–64
Skellefteå	944	25	0.97	0.68; 1.39	44	15–69
Sundsvall	534	16	1	0.66; 1.54	45	14–73
Växjö	875	24	1.01	0.70; 1.45	46	17–71
Södersjukhuset	2,310	68	1.01	0.80; 1.27	47	25–63
Karlstad	1,441	43	1.02	0.77; 1.36	48	23–67
Enköping	4,020	105	1.04	0.86; 1.25	49	31–63
Capio Ortopedi Motala	4,148	113	1.04	0.86; 1.25	50	32–62
SU/Mölndal	3,043	87	1.05	0.85; 1.29	51	31–65
Elisabethsjukhuset	162	7	1.06	0.60; 1.85	52	10–79
Östersund	1,379	40	1.09	0.81; 1.46	53	27–71
Bollnäs	3,158	93	1.1	0.90; 1.34	54	35–67
Sophiahemmet	757	29	1.12	0.80; 1.57	55	26–74
Aleris Specialistvård Ängelholm	1,752	46	1.13	0.86; 1.49	56	31–72
Akademiska sjukhuset	769	28	1.14	0.81; 1.61	57	27–75
Ortopedisk Center Sophiahemmet	211	4	1.15	0.60; 2.19	58	10–80
Lidköping	1,878	59	1.15	0.90; 1.47	59	35–71
Danderyd	1,109	36	1.18	0.87; 1.61	60	33–75
Falun	2,362	85	1.19	0.97; 1.47	61	41–72
Frölundaortopeden	84	3	1.2	0.61; 2.39	62	11–81
Södertälje	1,255	41	1.21	0.90; 1.61	63	36–75
Eksjö	2,280	66	1.21	0.96; 1.53	64	41–73
Örebro	307	14	1.21	0.78; 1.90	65	23–79
Ljungby	1,047	35	1.23	0.90; 1.67	66	35–76
Skövde	916	38	1.31	0.97; 1.77	67	42–78
Norrköping	**1,392**	**50**	**1.32**	**1.01; 1.72**	**68**	**45–77**
Helsingborg	**1,291**	**41**	**1.34**	**1.01; 1.80**	**69**	**45–78**
Visby	961	35	1.37	1.00; 1.87	70	45–79
Sollefteå	**1,370**	**49**	**1.45**	**1.11; 1.89**	**71**	**53–79**
Västervik	**1,030**	**39**	**1.45**	**1.08; 1.95**	**72**	**51–80**
Gävle	**997**	**43**	**1.48**	**1.11; 1.96**	**73**	**54–80**
Kullbergska sjukhuset	**2,128**	**83**	**1.48**	**1.20; 1.83**	**74**	**59–79**
Lycksele	**1,018**	**38**	**1.5**	**1.11; 2.02**	**75**	**53–80**
SUS/Lund	350	16	1.51	0.98; 2.31	76	43–81
Norrtälje	**1,186**	**44**	**1.52**	**1.15; 2.01**	**77**	**56–80**
Umeå	**1,203**	**55**	**1.55**	**1.20; 2.00**	**78**	**59–80**
Hässleholm	**7,717**	**335**	**1.68**	**1.50; 1.88**	**79**	**71–80**
Kungälv	**1,540**	**88**	**1.99**	**1.62; 2.44**	**80**	**75–81**
Eskilstuna	**478**	**31**	**2.13**	**1.53; 2.95**	**81**	**73–81**

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.

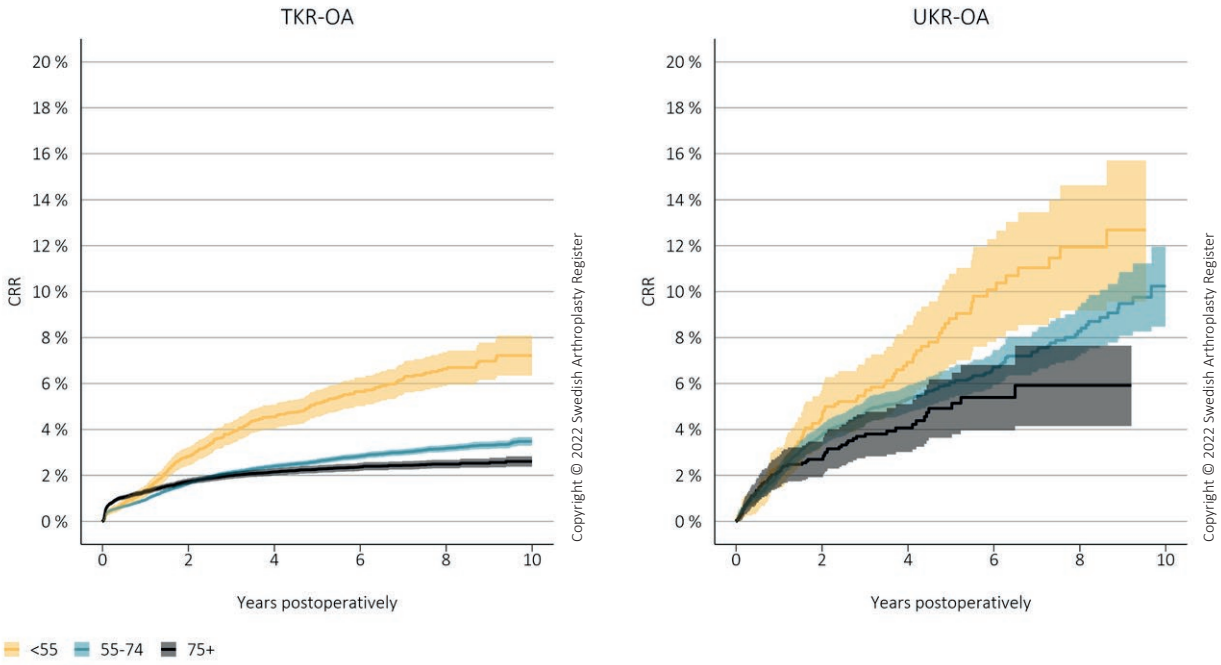

Figure 6.4.4. CRR in different age groups TKR/OA (left) and UKR/OA (right) inserted in the period 2012–2021.

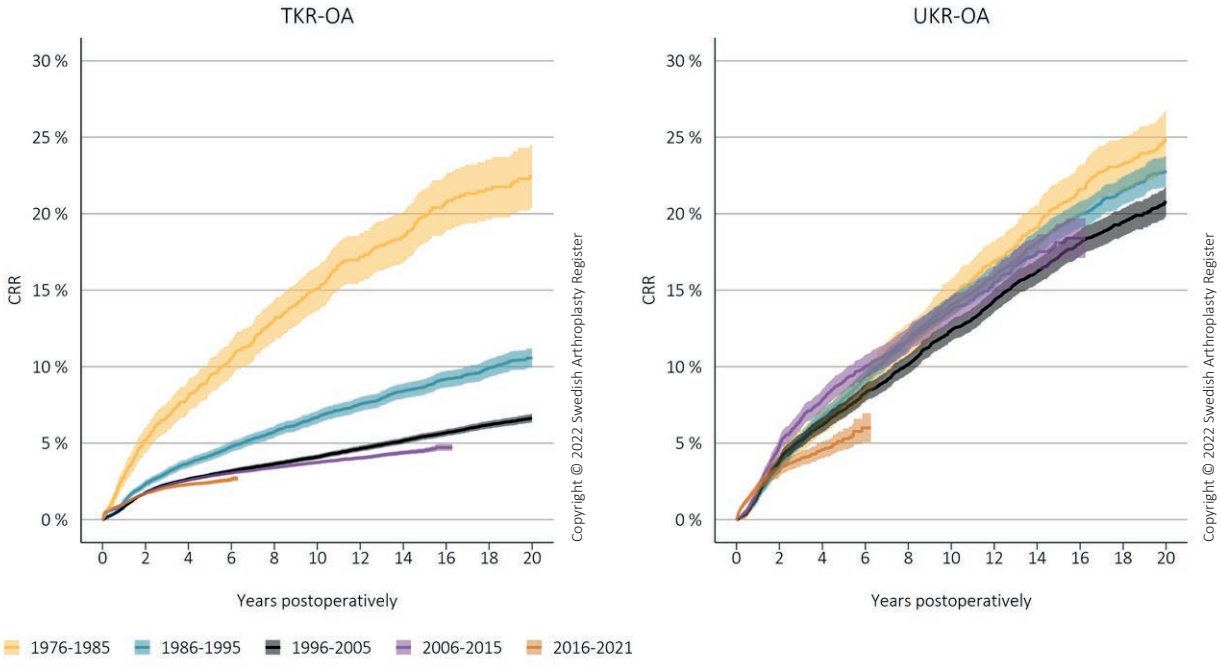

Figure 6.4.5. CRR in different periods up to 20 years in TKR/OA (left) and UKR/OA (right).

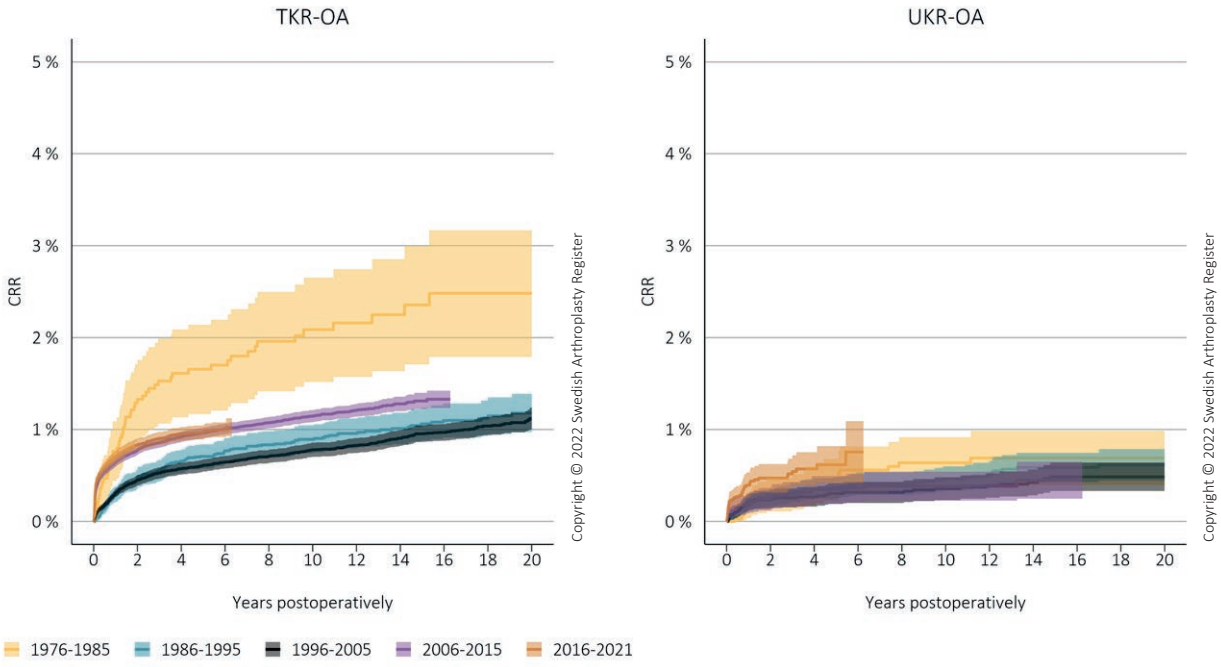

Figure 6.4.6. CRR due to infection in different periods up to 20 years in TKR/OA (left) and UKR/OA (right).

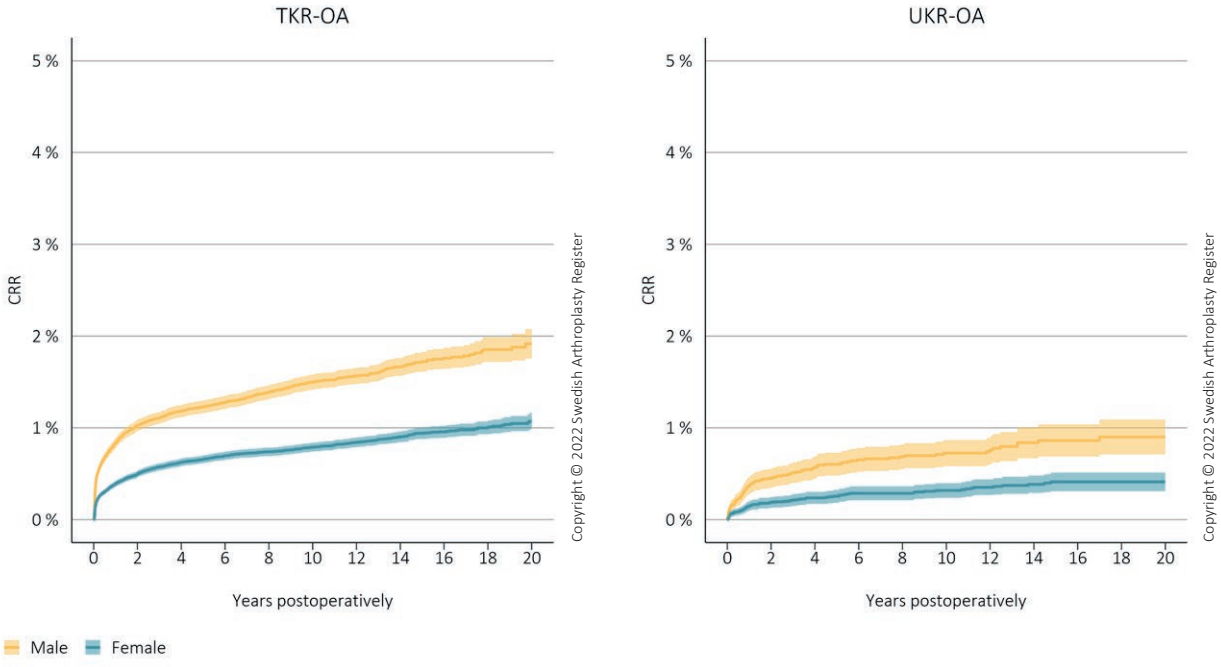

Figure 6.4.7. CRR du to infection by sex up to 20 years in TKR/OA (left) and UKR/OA (right).

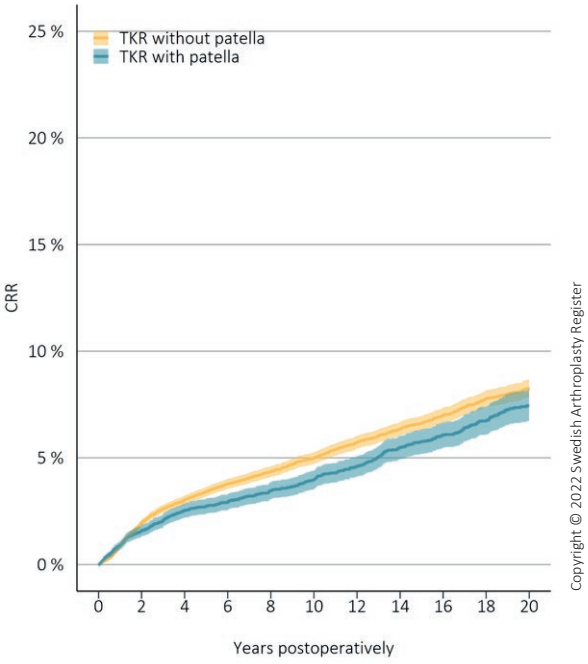

Figure 6.4.8. CRR in TKR/OA inserted in the ten-year period 1991–2000, with or without patella component respectively.

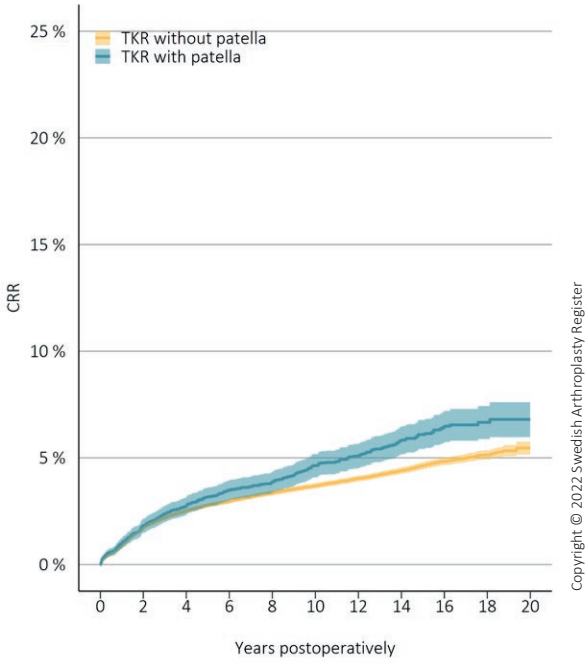

Figure 6.4.9. CRR in TKR/OA inserted in the ten-year period 2001–2010, with or without patella component respectively.

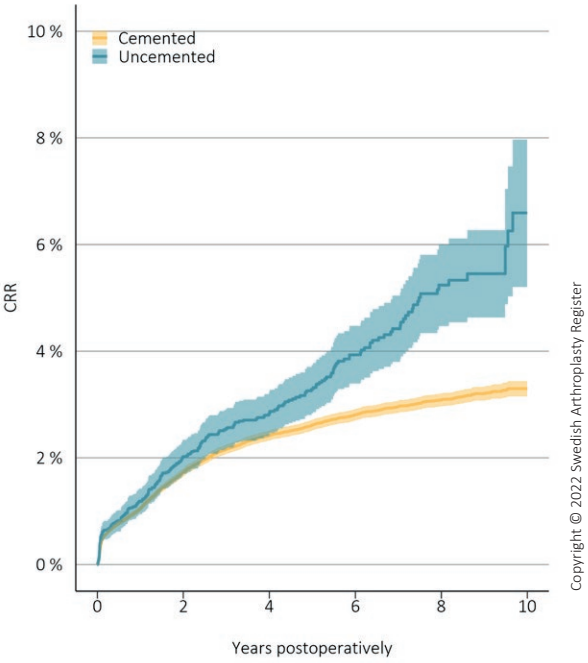

Figure 6.4.10. CRR in cemented and uncemented TKR/OA inserted in the ten-year period 2012–2021.

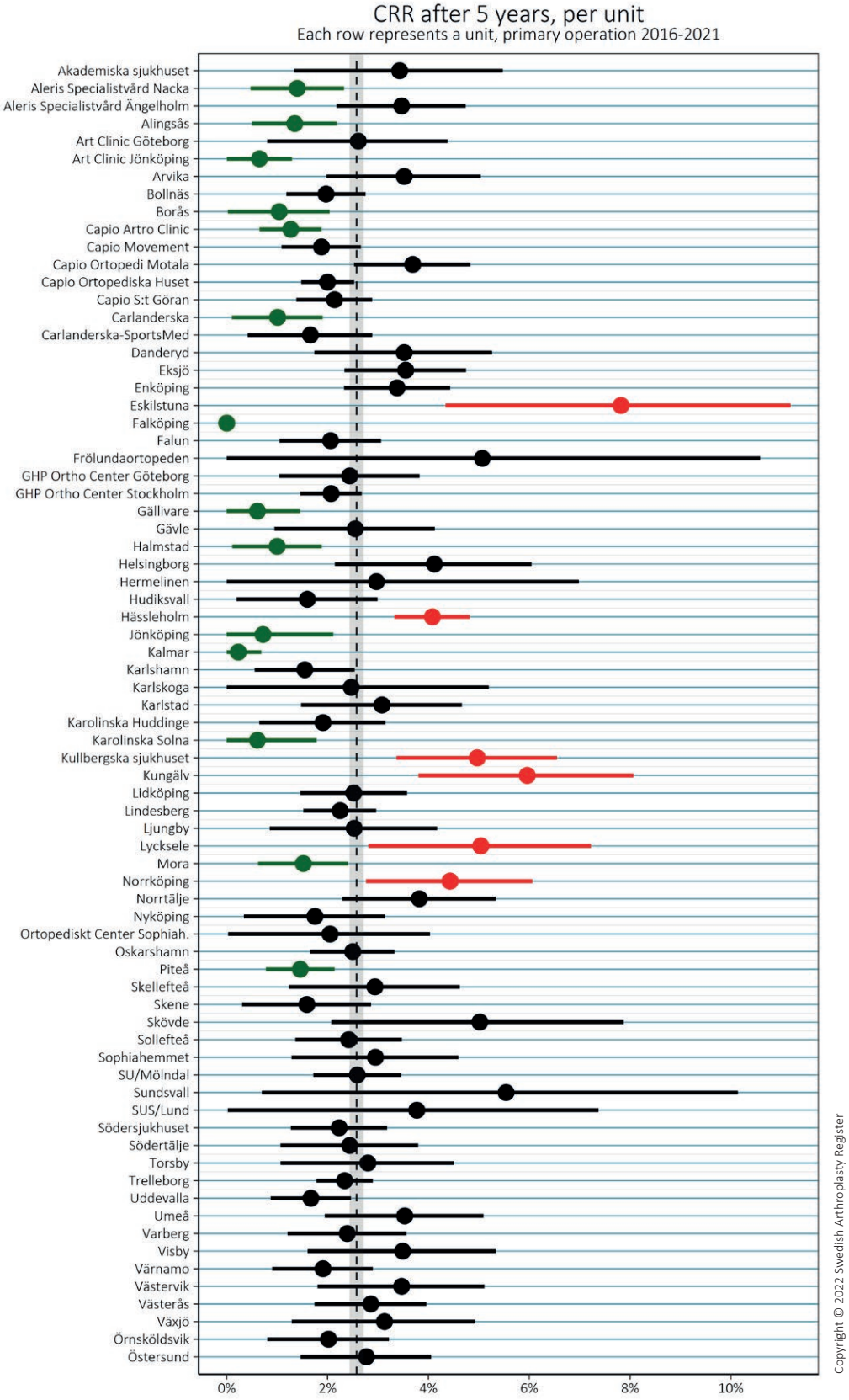

Figure 6.4.11. CRR after five years per unit (primary operation 2016–2021).
Units with fewer than 50 primary operations in the last five years are not presented.

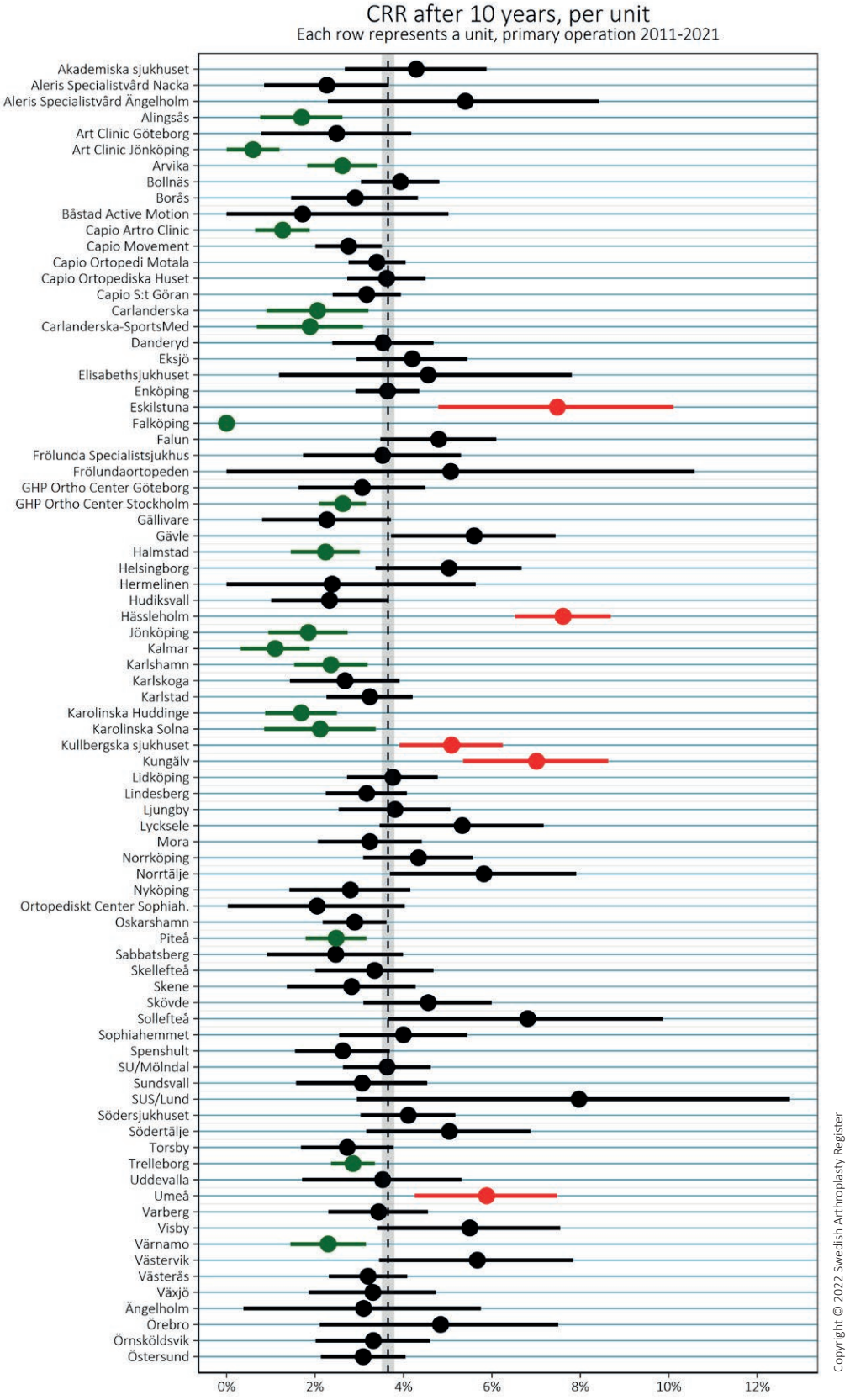

Figure 6.4.12. CRR after ten years per unit (primary operation 2011–2021).
Units with fewer than 50 primary operations in the last five years are not presented.

6.5. Evaluation of implants

Authors: Martin Sundberg and Annette W-Dahl

In order to present the results for relatively modern types of prosthesis, but with reasonably long follow-up time, the most recent ten-year period available has been chosen for analysis. A model is reported even after it has ceased to be used as long as there are reasonable numbers available for analysis. Note that the individual prosthesis models, as for example for the group NexGen, may represent different prosthesis variants, depending on modularity and marketing, among other factors, but within each model a few combinations tend to dominate.

In this year's report models reported in 100 or more operations 2012–2021 have been included. This also includes revision models that are used in primary surgery. The Triathlon MBT is reported divided into cemented and uncemented version as Triathlon is the most reported uncemented prosthesis in Sweden. The hazard ratio (HR) is adjusted for sex, age and surgical year (table 6.5.1).

As before, the PFC-Sigma MBT is used as a reference for TKR because it is a relatively well-defined prosthesis, i.e. most of it consists of the same type of femur, tibial plateau and plastic insert.

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

Implant	Number	Number revised	HR (95% CI)	p-value
PFC Sigma TKA MBT	22,992	650	(ref.)	
NexGen APT	498	5	0.24 (0.10. 0.58)	< 0.01
PFC Sigma TKA APT	7,252	142	0.61 (0.51. 0.73)	< 0.01
Genesis II MBT	2,553	41	0.63 (0.46. 0.86)	< 0.01
NexGen Trabecular Metal	2,160	51	0.64 (0.48. 0.85)	< 0.01
Vanguard I-Beam Modular	3,792	105	0.69 (0.56. 0.85)	< 0.01
NexGen MBT	60,237	1 289	0.77 (0.70. 0.85)	< 0.01
Triathlon MBT Cemented	9,077	213	0.89 (0.76. 1.03)	0.13
Profix	199	7	0.91 (0.43. 1.92)	0.81
NexGen Revision	409	13	1.16 (0.67. 2.00)	0.61
Vanguard Finned Stem Modular	1,960	81	1.18 (0.93. 1.48)	0.17
Triathlon MBT Uncemented	5,909	198	1.27 (1.08. 1.49)	< 0.01
Persona	1,870	35	1.32 (0.93. 1.86)	0.12
Attune MB TKA	185	6	1.57 (0.70. 3.52)	0.27
Legion/Genesis II Pri MBT	1,977	74	1.70 (1.34. 2.17)	< 0.01
PFC Sigma TC-3 (revision)	254	11	1.89 (1.04. 3.44)	0.04
Triathlon Total Stabilizer	656	33	2.21 (1.56. 3.14)	< 0.01
Journey TKA	145	15	4.24 (2.54. 7.08)	< 0.01
Other	704	34	1.44 (1.02. 2.04)	0.04
Sex = female			0.91 (0.85. 0.98)	0.01
Surgical year			0.96 (0.95. 0.98)	< 0.01
Age			0.98 (0.97. 0.98)	< 0.01

Table 6.5.1. Hazard ratio for revision with 95% confidence interval in TKR/OA 2012–2021. Units with significantly better or worse results than the national average are shown in green and red respectively.

Legion/Genesis II MBT, Triathlon MBT uncemented and Journey TKR have a significantly higher risk of revision (higher HR) than the reference PFC-MBT. Journey and Legion/Genesis II MBT were introduced in 2008 and 2013 in Sweden and are still in use like Triathlon in its uncemented version.

At the other end it is Genesis II MBT, NexGen APT, NexGen MBT, NexGen TM, PFC-Sigma APT and Vanguard I-Beam that have lower HR than the reference. AGC Anatomica MBT has disappeared from the list and Triathlon MBT cemented has no longer significantly higher HR than the reference.

Like last year we have chosen to also include revision models if they are reported to a sufficient extent. We are aware of that these are used in primaries with more advanced osteoarthritis/malalignments and in patients with more severe conditions but we still think it is of interest to show how these groups are performing. Of the revision models Triathlon Total Stabilizer and PFC Sigma TC-3 have a higher HR than the reference while the others show no significant difference.

Two different variants of the Vanguard-prosthesis are presented, one using a tibial tray with a beamed stem (I-Beam) while the other uses a tibial tray with a winged stem (finned), that started to be used in 2010. In the 2018 report, the finned version had a significantly higher risk than the reference model PFC-MBT, but last year as well as this year the difference is not significant. In contrast, the Vanguard I-Beam shows significantly lower HR in this year's report. As Vanguard is no longer used in Sweden this is mostly of 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 postoperatively. As in previous years, the risk decreases with increasing age. And this year the risk is lower with increasing year of surgery, which may due to the fact that the number of revisions where the plastic insert is exchanged in connection with treatment of a verified or suspected infection, does not increase with the same rate as before.

As in previous years Link is the reference in UKR (table 6.5.2). In the case of UKR due to OA there are two models, Oxford and Link, that account for 78% of the operations. None of the UKR-models except for Persona PK have a significantly different HR compared with the Link reference prosthesis. The risk of revision is decreasing with increasing age and increasing year of surgery.

The risk for revision is only one of several measures of the outcome of the prosthesis models. The type of revision should also be considered, although it is not reported here. Consequently, a deliberate sparse use of patella component, with a readiness to secondarily resurface if necessary, increases the revision rate. We therefore report

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

Implant	Number	Number revised	HR (95% CI)	p-value
Link	1	81	(ref.)	
Sigma-PKR	302	8	0.55 (0.27. 1.15)	0.11
ZUK	1	49	0.83 (0.58. 1.19)	0.31
Oxford	7	304	1.03 (0.80. 1.32)	0.83
Triathlon Uni	716	39	1.35 (0.92. 1.99)	0.12
Persona-PK	**163**	**11**	**2.87 (1.51. 5.45)**	**< 0.01**
Other	100	9	1.29 (0.65. 2.57)	0.47
Surgical year			**0.93 (0.89. 0.96)**	**< 0.01**
Age			**0.98 (0.97. 0.99)**	**< 0.01**
Sex = female			1.05 (0.88. 1.26)	0.56

Table 6.5.2. Hazard ratio for revision with 95% confidence interval in UKR/OA 2012–2021. 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 without patella component

Implant	Number	Number revised	HR (95% CI)	p-value
PFC Sigma TKA MBT	22,054	637	(ref.)	
PFC Sigma TKA APT	**6,867**	**134**	**0.60 (0.50; 0.73)**	**< 0.01**
Vanguard I-Beam Modular	**3,613**	**107**	**0.75 (0.61; 0.92)**	**< 0.01**
NexGen MBT	**59,289**	**1296**	**0.77 (0.70; 0.85)**	**< 0.01**
Triathlon MBT Cemented	8,888	216	0.89 (0.77; 1.04)	0.15
Triathlon MBT Uncemented	**5,741**	**206**	**1.30 (1.11; 1.53)**	**< 0.01**
Legion/Genesis II Pri MBT	**1,830**	**70**	**1.66 (1.29; 2.13)**	**< 0.01**
Other	11,222	339	1.03 (0.90; 1.18)	0.63
Sex = female			0.94 (0.87; 1.00)	0.07
Surgical year			**0.97 (0.95; 0.98)**	**< 0.01**
Age			**0.98 (0.98; 0.98)**	**< 0.01**

Table 6.5.3. Hazard ratio for revision with 95% confidence interval in TKR/OA without patella component 2012–2021. Units with significantly better or worse results than the national average are shown in green and red respectively.

TKR/OA separately for those with and without patellar component. The tables report models that appear both with and without patella. All other models (including revision models) are included as others. We have divided TKR/OA in those used without patella component (table 6.5.3) and those with patella component (table 6.5.4). This reduces the number of implants that can be analysed, especially in the group where a patella component has been used. We have also merged some groups compared to table 6.5.1 in order to be able to analyse comparable groups.

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

Implant	Number	Number revised	HR (95% CI)	p-value
PFC Sigma TKA MBT	938	25	(ref.)	
PFC Sigma TKA APT	385	8	0.67 (0.30; 1.50)	0.33
Vanguard I-Beam Modular	179	2	0.25 (0.06; 1.10)	0.07
NexGen MBT	948	32	1.21 (0.72; 2.06)	0.47
Triathlon MBT Uncemented	168		none revised	0.99
Triathlon MBT Cemented	189	7	1.50 (0.65; 3.47)	0.34
Legion/Genesis II Pri MBT	147	6	1.91 (0.78; 4.70)	0.16
Other	367	12	1.14 (0.57; 2.28)	0.71
Sex = female			**0.43 (0.28; 0.65)**	**< 0.01**
Age			**0.97 (0.95; 0.99)**	**0.01**
Surgical year			0.98 (0.90; 1.06)	0.59

Table 6.5.4. Hazard ratio for revision with 95% confidence interval in TKR/OA with patella component 2012–2021. 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.
Exchange of insert, in case of infection, is not considered to be revision.

Implant	Number	Number revised	HR (95% CI)	p-value
PFC Sigma TKA MBT	22,992	486	(ref.)	
NexGen APT	**498**	**6**	**0.38 (0.17; 0.86)**	**0.02**
Genesis II MBT	**2,553**	**25**	**0.52 (0.35; 0.78)**	**< 0.01**
NexGen Trabecular Metal	**2,160**	**52**	**0.75 (0.56; 1.00)**	**0.05**
Vanguard I-Beam Modular	**3,792**	**88**	**0.77 (0.61; 0.97)**	**0.02**
NexGen MBT	**60,237**	**974**	**0.78 (0.70; 0.87)**	**< 0.01**
PFC Sigma TKA APT	**7,252**	**141**	**0.81 (0.67; 0.98)**	**0.03**
Triathlon MBT Cemented	**9,077**	**149**	**0.83 (0.69; 1.00)**	**0.05**
Profix	199	5	0.89 (0.37; 2.14)	0.79
Attune MB TKA	185	3	1.07 (0.35; 3.34)	0.9
NexGen Revision	409	10	1.20 (0.64; 2.24)	0.57
Vanguard Finned Stem Modular	1,960	64	1.25 (0.96; 1.62)	0.1
Triathlon MBT Uncemented	**5,909**	**163**	**1.38 (1.16; 1.65)**	**< 0.01**
Persona	**1,870**	**29**	**1.55 (1.06; 2.27)**	**0.02**
Triathlon Total Stabilizer	**656**	**21**	**1.80 (1.16; 2.79)**	**< 0.01**
Legion/Genesis II Pri MBT	**1,977**	**59**	**1.88 (1.44; 2.47)**	**< 0.01**
PFC Sigma TC-3 (revision)	**254**	**10**	**2.28 (1.22; 4.26)**	**0.01**
Journey TKA	**145**	**14**	**5.16 (3.03; 8.80)**	**< 0.01**
Other	700	26	1.40 (0.95; 2.08)	0.09
Surgical year			**0.96 (0.94; 0.97)**	**< 0.01**
Age			**0.96 (0.96; 0.97)**	**< 0.01**
Sex = female			**1.17 (1.08; 1.27)**	**< 0.01**

Table 6.5.5. Hazard ratio for revision with 95% confidence interval in TKR/OA 2012–2021. 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.

Compared with the table 6.5.1 where all TKRs, with and without patella component are analysed, when no patella component is used, it is still the same models that have a significantly higher or lower HR than the reference PFC-Sigma MPT.

Where a patella component is used, the number of operated knees is small and it becomes more difficult to show and even interpret significant differences. None of the prostheses have significantly better or worse result than the reference if a patella component has been used. Effects of sex, age and increasing year of surgery are unchanged whether all TKRs are included or only those without patella component but when only those without patella component are included surgical year is no longer significant.

As before we also present separate tables (6.5.5 and 6.5.6) where exchange of insert for infection has not been defined to be a revision. It has been argued that in case of infection the register's definition may disfavour different implant types. The reason is that almost half of all revisions for infection are synovectomies where the plastic insert is exchanged (which makes them revisions). A synovectomy in a knee where the plastic insert cannot be changed is however not considered as a revision, some-

thing that could favour that type, and therefore it has been argued that exchanging the plastic insert in case of infection should not be considered as a revision but as a soft tissue procedure. On the other hand, it can be argued that implants where the insert cannot be exchanged should usually be treated with total revision (because a complete cleaning is not considered possible), which would lead to the reverse bias if exchange of the insert was not considered as revision. Without being able to answer with certainty what is most reasonable to do we have chosen to also present the risk when exchange of insert in case of infection is not considered as revision. It must be remembered that such an exclusion reduces the number of revisions, which in turn reduces the sensitivity of the statistical calculations.

For TKR/OA without considering patella resurfacing (table 6.5.5) one can see, compared with table 6.5.1, that it is the same prostheses that have an increased HR compared to the reference except for Triathlon MBT cemented, which now has a significantly lower HR than the reference. Exchange of plastic insert is not possible for NexGen APT, PFC-Sigma APT and the monobloc variant of NexGen TM and these can therefore not take advantage of the fact that insert changes are being excluded. Compared with the reference PFC MBT (with polyethylene that can be exchanged) these are still better than the reference.

Females have before exclusion of exchange of insert in case of infection a lower risk of revision than males but higher risk after exclusion. This may indicate that their risk of revision is higher for reasons other than verified or suspected infection.

Persona PK that had a significantly higher HR when all revisions were included still has it when exchange of insert in case of infection was excluded in UKR/OA (table 6.5.6).

In summary, it can be noted that also in this year's report it does not seem to affect the overall results when exchange of insert in case of infection is not considered as a true revision as it did in previous annual reports. HR certainly decreases slightly for the modular models and for those with a non-modular tibial component HR increases slightly with this adjustment. One reason for this difference may be that a number of synovectomies without plastic insert exchange are successful in curing infections in the non-modular (if they had not been successful the revision would probably have been reported), but unfortunately, we cannot report this because synovectomies are reported inconsistently to the register. Another possible explanation is that surgeons are more liberal about opening and debriding knees when the plastic insert can be exchanged, which might have led to knees being revised that may not have needed it.

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

Implant	Number	Number revised	HR (95% CI)	p-value
Link	1 359	81	(ref)	
Sigma-PKR	302	8	0.56 (0.27. 1.15)	0.12
ZUK	1 007	47	0.80 (0.56. 1.15)	0.23
Oxford	6 602	291	0.99 (0.77. 1.28)	0.96
Triathlon Uni	716	38	1.34 (0.91. 1.98)	0.14
Persona-PK	**163**	**10**	**2.66 (1.36. 5.20)**	**< 0.01**
Other	100	9	1.28 (0.64. 2.56)	0.48
Surgical year			**0.91 (0.88. 0.95)**	**< 0.01**
Age			**0.98 (0.97. 0.99)**	**< 0.01**
Sex = female			1.08 (0.90. 1.29)	0.4

Table 6.5.6. Hazard ratio for revision with 95% confidence interval in UKR/OA 2012–2021. 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.

6.6. Knee osteotomy

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Joint preserving surgery – knee osteotomy

Tibial osteotomy was introduced in Sweden in 1969 by professor Göran Bauer in Lund as a standard operation for unicompartmental knee osteoarthritis. After the introduction of the modern knee prosthesis in the mid-1970s these instead became relatively quickly the most common surgical treatment of knee osteoarthritis.

The number of osteotomies has since steadily decreased. In 1981, Björn Tjörnstrand estimated in his dissertation "Tibial osteotomy for medial gonarthrosis" that one third of the knee reconstructive surgery was consisted of tibial osteotomies while the Swedish Knee Arthroplasty Register in 1994 indicated that osteotomies only accounted for 20% of the knee reconstructive surgeries.

Of the osteotomies that is performed around the knee joint, tibial osteotomy is by far the most common method. Most often being used for medial osteoarthritis while its use for lateral osteoarthritis is less common. Osteotomies of the femur are less common in Sweden and are mostly performed in more severe deformities, congenital or acquired, and in lateral osteoarthritis.

There are several different techniques for knee osteotomy and the initial fixation of the osteotomy is done in different ways depending on the method used. Closed wedge osteotomy is a "minus osteotomy" where a bone wedge, in size related to the determined degree of correction, is removed. The osteotomy can be fixated with a staple, a plate with screws, or with an external frame. Open wedge osteotomy is a "plus osteotomy" where a wedge is opened up to achieve the decided degree of correction. The fixation of the osteotomy can consist of an internal fixation, with plate and screws, with staples or with an external frame. An internal fixation includes a plate with screws or a staple and sometimes a bone graft or a bone substitute (artificial bone). In open wedge osteotomy with an external fixation it is possible to gradually open the osteotomy over a few weeks which is the biological procedure used for bone lengthening also known as hemicallostasis. Finally, there is also the curved, or "dome" osteotomy which is rare in Sweden. The results after knee osteotomy are related to the ability of achieve and maintain the predetermined correction of the malalignment, which requires achieving the predetermined degree of correction during surgery and to have a stable fixation of the correction until the bone is healed.

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

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

Sweden was the first country in the world to start a national knee osteotomy registry as a complement to the knee replacement registration (W-Dahl et al. 2014). Australia started in autumn 2016 and New Zeeland is planning to launch a comparable registration and, together with their joint replacement registers respectively have harmonised the report questionnaire after Sweden's to facilitate comparisons and collaboration in the future. The UK started its osteotomy registration in autumn 2014 and is funded by the industry and independent of the joint replacement register (Elson et al. 2015).

In total, 82 primary osteotomies were reported from 15 units in 2021. As shown in figure 6.6.1, there was only two units that reported that they had performed ten or more osteotomies in the year. The unit which reported the most was Capio Ortopedi Motala with 17 procedures. In the second year of the pandemic 2021, barely 10% more knee osteotomies have been reported than in 2020 and 50% fewer than in 2019 from somewhat fewer units.

It is difficult to know how many of the osteotomies performed in the country that are captured by the register. The surgical codes NGK59 and NFK59, which are used

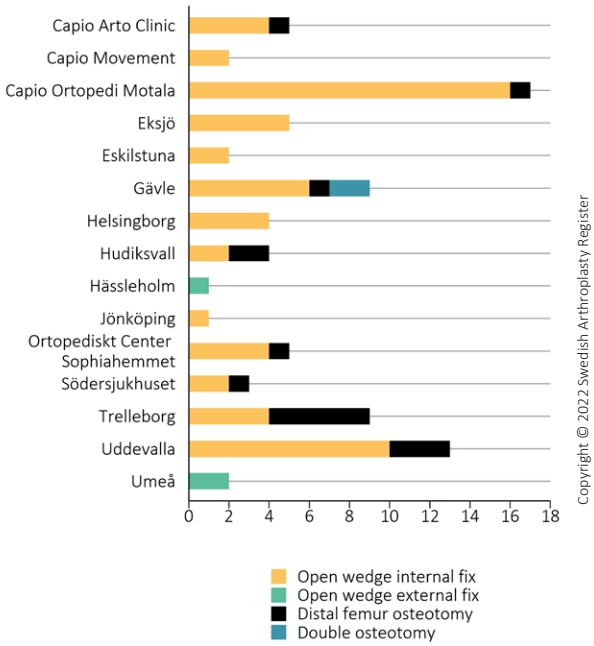

Figure 6.6.1. Number of knee osteotomies and methods per unit 2021.

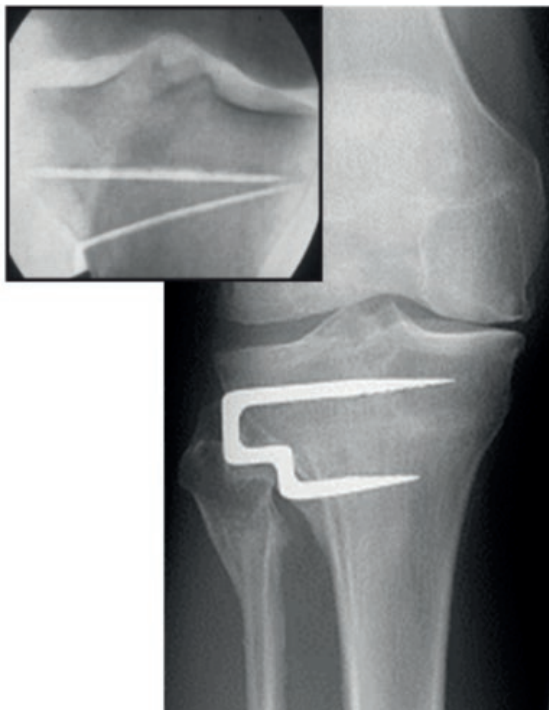

Figure 6.6.2. Closed wedge osteotomy fixed with a staple. The inserted picture above shows the wedge that is removed before the osteotomy is closed.

Figure 6.6.3. Open wedge osteotomy with internal fixation.

Figure 6.6.4. Open wedge osteotomy with external fixation.

Demography in knee osteotomy

	All	Proximal Tibia	Distal Femur
Number	**82**	**65**	**15**
Age			
Median (range)	49 (18–66)	51 (19–66)	39 (18–54)
< 45 year, n	29	18	11
45–54 year, n	34	29	4
55–64 year, n	18	17	0
65–74 year, n	1	1	0
75–84 year, n	0	0	0
≥ 85 year, n	0	0	0
Sex			
Female, n	30	20	8
BMI			
Median (range)	28 (20–48)	28 (20–41)	27 (22-48)
< 18.5, n	0	0	0
18.5–24.9, n	18	15	2
25–29.9, n	42	33	9
30–34.5, n	19	15	2
35–40, n	1	1	0
>40, n	2	1	1
ASA-class			
I, n	45	35	8
II, n	31	25	6
III-V, n	6	5	1
Diagnosis OA			
Number	69	56	11
Ahlbäck 1, n	27	20	7
Ahlbäck 2, n	34	29	3
Ahlbäck 3–4, n	7	6	1
Missing	1	1	0
Compartment			
Number	69	56	11
Medial, n	58	56	0
Lateral, n	11	0	11
Preop HKA-angle			
Number	81	64	8
Median (range)	7 (0–15)	7 (0–15)	6 (1–15)

Table 6.6.1. Demography in knee osteotomies 2021.

for osteotomies performed on the femur and tibia, also apply to osteotomies performed for other reasons than disease or damage in the knee. Data from the National Board of Health and Welfare in an earlier analysis showed that about 400 different diagnoses of which 148 were main diagnoses had been registered for the procedure code NGK59 in the National Patient Register (NPR). 65% of the surgeries could be attributed to osteoarthritis and instability diagnoses. We extracted the number of NGK59s from the National Board of Health and Welfare's statistics for the years 2014–2019 and compared these with all primary osteotomies operated for osteoarthritis or instability in the knee osteotomy register in the corresponding years. Assuming that the osteotomy register mainly capture osteoarthritis and instability diagnoses we estimate that the completeness of the knee osteotomy register was 75–87% in the period 2014–2020.

Results

The knee osteotomy register collects the corresponding variables as for knee replacement in the Swedish Arthroplasty Register concerning the patients (BMI, ASA, previous surgery), antibiotics, thrombosis prophylaxis and the surgical technique. In knee osteotomies information is also collected on malalignment measured by the HKA-angle and grade of osteoarthritis according to the Ahlbäck classification. The result is presented without percentages as the knee osteotomies was relatively few in 2021.

Demography

Almost two thirds of the patients were males and the median age was 49 years, which can be compared with the median age for TKR (69.1 years) and UKR (66 years) in 2021. More than half of the patients were reported to be healthy (ASA 1) and had a median BMI of 28. Most of the patients were reported to have a medial osteoarthritis, grade 1–2 according to the Ahlbäck's classification and a median malalignment of 7 degrees varus or valgus. Patients operated on with a distal femoral osteotomy were younger, more of them were females compared to those operated on with a proximal tibial osteotomy but had a similar degree of preoperative malalignment.

Surgery	Number
None	34
Fracture surgery	3
Meniscal surgery	21
Cruciate surgery	5
Arthroscopi	15
Other	4
Missing	0
Total	**82**

Table 6.6.2. Previous surgery in the index knee.

Diagnosis	Number
Osteoarthritis	69
Acquired deformity	1
Congenital deformity	5
Instability	3
Local cartilage injury	0
Osteonecrosis	0
Other	4
Missing	0
Total	**82**

Table 6.6.3. Reason for surgery.

Type	Number
Open wedge internal fixation	62
Open wedge external fixation	3
Distal femur osteotomy	15
Double osteotomy	2
Missing	0
Total	**82**

Table 6.6.4. Type of osteotomy.

Typ	Number
Tomofix	36
Puddo	12
PEEKPower	7
iBalance	5
Activmotion	1
Missing	0
Total	**62**

Table 6.6.5. Type of fixation in open wedge osteotomy with internal fixation.

Bone graft	Number
None	42
Auto graft	2
Bank bone	2
Synthetic bone	14
Missing	2
Total	**62**
Synthetic bone	
ChronOS	4
INNOTERE	6
Osferion	3
Missing	1
Total	**14**

Table 6.6.6. The use of bone graft in open wedge osteotomy with internal fixation.

Type	Number
Tomofix	5
Puddo	5
Arthrex Femoral Plate	2
Other	2
Missing	1
Total	**15**

Table 6.6.7. Type of fixation in distal femur osteotomy.

Previous surgery

When reporting previous surgery in the index knee it is possible to mark more than one alternative. More than half of the patients were reported to have had some knee operation before the current osteotomy and one fifth more than one. This can be compared with the corresponding numbers in knee replacement patients were less than 20% were reported to have had previous surgery in the index knee and 3% more than one. What is reported does not give any comprehensive description of the previous surgery that have been performed, but illustrates what was known at the time of the primary osteotomy.

Reason for and type of osteotomy

The majority of the surgeries were performed due to osteoarthritis. The most common method was open wedge osteotomy with internal fixation followed by distal femoral osteotomy. No closed wedge osteotomies were reported in 2021.

Open wedge osteotomy with internal fixation

Several different plates for fixation of the osteotomy have been reported. The Tomofix-plate is the most frequently reported in open wedge osteotomy with internal fixation. Five different types of plate fixation have been used for the osteotomies with this technique.

Open wedge osteotomy with external fixation

For open wedge osteotomy with external fixation only use of Orthofix was reported in 2021.

Bone grafting

In two thirds of open wedge osteotomies with internal fixation, no bone grafting was reported to have been used. When bone grafting was used, synthetic bone was reported as the most frequently, most often in the form of Innotere.

Surgery	Number
None	54
Arthroscopi	17
Cruciate surgery	4
Meniscal surgery	5
Other	2
Missing	0
Total	**82**

Table 6.6.8. Concomitant surgery with the knee osteotomy.

Type	Number
General	51
Spinal	30
Epidural	0
Missing	1
Total	**82**

Table 6.6.9. Type of anesthesia.

Type of osteotomy	Minutes	Range
Open wedge internal	57	30–240
Open wedge external	96	31–99
Distal femur	98	40–23
Double osteotomi	120	106–133

Table 6.6.10. Surgical time including concomitant surgery.

Distal femoral osteotomy

In distal femur osteotomies different types of fixations were reported and Tomofix and Puddo were the most common.

Coincidental Surgery

At the same time as the knee osteotomy, it was reported that an additional procedure was performed in 38 out of the 82 operations. Arthroscopy was the most reported.

Type of anaesthesia

General anaesthesia was the most reported type of anaesthesia and was reported in less than two thirds of the cases.

Operating time

The median operating time, where the osteotomies with a concomitant surgery were excluded, was shorter in open wedge osteotomies with internal fixation (52 min, 30–99 min) than in external fixation (96 min, 31–99). The median time for distal femoral osteotomy was 91 min (40–243) and in double osteotomy it was 119.5 min (106–133). Table 6.6.10 shows the median operating times including those osteotomies done with concomitant surgery.

Computer-aided operations (CAS)

None of the osteotomies were reported to be performed with the help of navigation.

Prophylaxis – time	Number
No prophylaxis	3
Dalteparin preop	2
Dalteparin postop	27
Tinzaparin preop	2
Tinzaparin postop	33
Enoxaparin postop	8
Apixaban	5
Combination of inj and NOAC	1
Long-term treatment	1
Missing	0
Total	**82**

Table 6.6.11. Antithrombotic prophylaxis.

Days	Number
No prophylaxis	3
0–7	6
8–14	64
15–21	0
22–28	5
29–35	1
>35	1
Long-term treatment	1
Missing	1
Total	**82**

Table 6.6.12. Antithrombotic prophylaxis – planned duration of treatment.

Drug	Number
Cloxacillin	78
Clindamycin	2
Cefotaxim	2
Missing	0
Total	**82**

Table 6.6.13. Prophylactic antibiotics – drug.

Thrombosis prophylaxis

Tinzaparin and Dalteparin were the most commonly reported antithrombotic drugs and NOAC was only used in few operations. This could be compared with the knee replacements where more than 50% received NOAC as prophylaxis. Prophylaxis with Dalteparin, Tinzaparin and Enoxaparin started more often postoperatively. In three of the operations, it was reported that no thrombosis prophylaxis had been used (table 6.6.11). The duration of prophylaxis varied but in more than three fourths of the operations the prophylaxis was planned for 8–14 days (table 6.6.12).

Prophylactic antibiotics

Cloxacillin has been reported as infection prophylaxis in the majority of the knee osteotomies 2021. Clindamycin has been reported in two of the surgeries (table 6.6.13). The corresponding numbers of Clindamycin for knee replacements was almost 5%. Since Clindamycin has been shown to have a higher risk of revision due to infection in knee replacement surgery (Robertsson et al. 2017) the PRISS-recommendations have been updated in April 2018 (www.patientforsakringen.se). In almost half of the operations 2 g x 3 was planned to be used in the first day of surgery as prophylaxis while a little more than one third was planned as a single dose of 2 g (table 6.6.14). At the time of surgery, the concentration of antibiotics in the tissues should be sufficient to counteract any bacteria in the area. Since Cloxacillin has a short half-life, it is important that it is administered within the correct time-interval.

In the updated recommendations from the PRISS-project in April 2018 (www.patientforsakringen.se) the optimal time is 45–30 min before the start of surgery, a narrower range than previously has been recommended (45–15 min). In just more than one third of the osteotomies, the preoperative dose was reported to be given according to the PRISS-recommendations (table 6.6.15) and somewhat more (50/82) within the previously recommended range.

Dosage	Number
2 g x 1	30
2 g x 2	6
2 g x 3	36
Other	1
Missing	5
Total	**78**

Table 6.6.14. Dosage of Cloxacillin.

Minutes before surgery	Number
0–29	20
30–45	36
>45	21
Given postop	3
Missing	2
Total	**82**

Table 6.6.15. Prophylactic antibiotics – time of administration (number of minutes before surgery) (PRISS recommendation).

Tourniquet	Number
Yes	54
No	25
Missing	3
Total	**82**

Drainage	Number
Yes	0
No	81
Missing	1
Total	**82**

Table 6.6.16. The use of tourniquet and drainage.

Tourniquet and drainage

The use of tourniquet has decreased among Swedish orthopaedic surgeons but is reported slightly more frequently in knee osteotomies (two thirds) than in knee replacement (28%). To use drainage has become rarer. All osteotomies were reported to be performed without the use of drainage and corresponding numbers in knee replacements was< 0.5 %.

Reoperation

Since the start of the knee osteotomy register in 2013 almost 90 reoperations have been reported. The most common reasons for reoperation have been pain/irritation from the plate, pseudoarthrosis/delayed healing and over or under correction.

Conversion to TKA

The cumulative revision rate (CRR) at seven years in open wedge osteotomies performed in 2013–2021 and followed until the 31st of December 2021 with internal and external fixation respectively was 11.3% (95% CI 8.7–13.9) and 12.2% (95% CI 7.7–16.6) (figure 6.6.5).

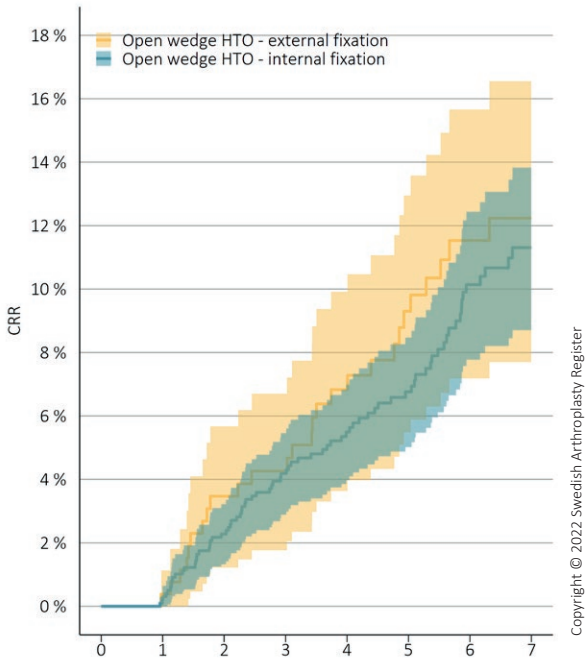

Figure 6.6.5. CRR for conversion to TKR after open wedge osteotomy.


An adverse event is any unfavorable medical problem that happens after treatment, either with or without causal relationship with the treatment.

7. Adverse events

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

7.1 Mortality within 90 days

90-days mortality is often used to assess risks with different medical treatments and is an openly reported variable. This year, we report mortality after hip fracture at unit level and after primary hip and knee replacements at regional level. The Swedish Arthroplasty Register's database is updated each night regarding any dates of death from the Swedish Tax Agency. The presentation includes the last three years (2019–2021) to compensate for the risk of a random variation.

A planned orthopaedic operation is usually performed when the health of the individual is in such a stable state as possible. When the risks of surgery outweigh the benefits surgery will be postponed or avoided. This selection and optimisation of patients having joint replacement surgery results in a low mortality low; mortality within 90 days after primary elective total hip replacement is 1.9‰ (table 7.1.1). However, the mortality differs between the regions. Two regions have nil within 90 days while another region has a mortality of 3.8‰. The mortality after knee replacement is even lower, 1.1‰ (table 7.1.1). There is the great variation between regions after knee replacement surgery as well. It is noteworthy that also this year Halland, Gotland, Uppsala and Västra Götaland have a comparatively high mortality after hip replacement, while they are among the lowest in the country after knee replacement.

Joint replacement surgery is associated with an increased risk of potentially life-threatening complications, such as infections and thromboembolic events. Accurate information is an important part of the decision to undergo a planned surgery, and although if the mortality appears to be low, there are room for improvement. It is also of utmost importance that other units caring for patients with complications in connection with the replacement surgery inform the operating unit about these cases. If the orthopaedic surgeon does not see these very serious events, it is easy to believe that they do not occur.

The person who fractures the hip is in an acute condition and will have surgery, in most cases, regardless of comorbidity. Mortality rate within 90 days after hip fracture surgery is therefore high, with an unchanged national level of 13%. Some units are even higher, above 15%. Even if it can be explained by a large proportion of very sick patients and male patients respectively (male sex carries a higher risk of death after fracture) and more elderly patients the figures should prompt internal analysis. The units with significantly low mortality rates perform less frequent emergency surgeries, their "fracture patients" undergo to a larger extent planned secondary surgery due to fracture complications.

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

	Hip			Knee		
Region	Number of operations	Number of deaths	Mortality ‰	Number of operations	Number of deaths	Mortality ‰
Blekinge	730	0	0	622	0	0
Dalarna	931	2	2.1	878	2	2.3
Gotland	375	1	2.7	296	0	0
Gävleborg	1,433	4	2.8	1,411	2	1.4
Halland	2,258	6	2.7	2,360	1	0.4
Jämtland	504	1	2	340	1	2.9
Jönköping	1,969	1	0.5	2,055	1	0.5
Kalmar	1,616	1	0.6	1,344	0	0
Kronoberg	708	2	2.8	573	1	1.7
Norrbotten	1,487	2	1.3	1,238	3	2.4
Skåne	5,159	9	1.7	5,600	8	1.4
Stockholm	11,077	24	2.2	9,764	10	1
Sörmland	1,496	2	1.3	1,327	1	0.8
Uppsala	1,578	6	3.8	1,360	1	0.7
Värmland	1,202	2	1.7	1,234	0	0
Västerbotten	1,217	1	0.8	1,011	2	2
Västernorrland	1,245	1	0.8	826	2	2.4
Västmanland	900	2	2.2	676	1	1.5
Västra Götaland	6,916	20	2.9	5,887	4	0.7
Örebro	1,339	1	0.7	971	1	1
Östergötland	1,823	0	0	1,763	3	1.7
Country	**45,963**	**88**	**1.9**	**41,536**	**44**	**1.1**

Table 7.1.1. 90-day mortality after primary elective hip and knee replacement per region 2019–2021.

90-days mortality after hip fracture

Unit	Number of operations [1]	>80 year [2]	Males [3]	ASA III [4]	ASA IV [5]	Acute fracture [6]	Mortality [7]
Country	**26,098**	**55.8**	**36.4**	**53.1**	**6.3**	**87.5**	**12.9**
Akademiska sjukhuset	964	57.2	35.3	61.7	5.3	94.5	12.3
Aleris Specialistvård Motala	49	69.4	49	68.1	0	73.5	18.4
Alingsås	211	57.8	38.9	52.7	9.4	96.7	13.3
Borås	551	62.1	36.8	50.7	5.6	98.2	15.1
Capio S:t Göran	832	62.6	37.3	63.2	11.1	90.3	11.4
Danderyd	1,130	61.5	31.2	65.5	4.7	88.1	12.4
Eksjö	247	53.8	33.6	50.4	4.3	96.4	7.7
Eskilstuna	449	53.5	32.7	51	5.6	92.7	16.7
Falun	537	57.2	37.2	56.2	8.1	94	10.2
Gällivare	197	54.3	40.1	51	7.7	94.9	10.7
Gävle	648	53.7	38.7	43.4	5.5	96.9	11.4
Halmstad	442	61.8	34.4	45.3	7.8	92.8	12
Helsingborg	801	59.4	35.7	49.2	3	94.4	12
Hudiksvall	364	59.3	34.1	48.6	5	93.4	14.6
Hässleholm	67	25.4	25.4	47.6	0	6	3
Jönköping	357	59.9	34.2	58.9	11.3	96.4	11.5
Kalmar	390	54.6	35.4	49.9	6.5	97.4	11.5
Karlskoga	380	60	33.7	56.6	11.4	100	17.6
Karlskrona	564	64.2	37.1	45.3	4.7	97.2	13.3
Karlstad	745	60.9	36.9	55.5	7.6	96.8	15.3
Karolinska Huddinge	539	53.8	36.2	63.1	9	90.5	12.2
Karolinska Solna	85	36.5	41.2	64.6	6.2	71.8	11.8
Kristianstad	604	63.6	35.4	60.4	5.1	98.2	15.7
Kungälv	332	58.7	30.4	47.6	5.7	95.5	12.7
Lidköping	245	58.8	33.9	49.2	1.6	86.5	11
Lindesberg	275	35.6	34.9	46.5	6.9	79.6	7.3
Linköping	556	60.6	35.1	50.2	9.3	94.1	12.1
Ljungby	173	61.8	30.6	59.8	1.2	93.1	9.8
Lycksele	124	58.1	33.9	53.1	2.7	94.4	12.9
Mora	317	58	37.2	45.4	10.2	94	10.1
Norrköping	456	57.2	33.6	48.1	8.3	93	11.6
Norrtälje	204	58.3	39.2	63.2	12.3	96.1	14.7
Nyköping	264	62.5	37.1	49.8	4.6	91.3	13.6
NÄL	995	61.8	35.5	61.2	8.8	98.7	15.2

The table continues on the next page.

90-days mortality after hip fracture, cont.

Unit	Number of operations [1]	>80 year [2]	Males [3]	ASA III [4]	ASA IV [5]	Acute fracture [6]	Mortality [7]
Piteå	33	21.2	42.4	30.3	0	6.1	0
Skellefteå	260	58.8	41.5	46.2	5.7	95.4	13.5
Skövde	512	55.5	35.9	43.6	3.7	95.7	14.1
SU/Mölndal	1,593	59.9	34.3	50.3	5.6	95.5	15.5
Sunderby sjukhus	613	62.2	39.8	58.8	9.7	98.7	13.4
Sundsvall	460	60.2	36.3	55	9.2	96.5	15.4
SUS/Lund	833	55.7	38.8	53.3	4.7	93.4	11
SUS/Malmö	910	61	36	69.3	5.5	98.4	14.4
Södersjukhuset	1,316	57.8	35	63.4	5.4	90.8	10.9
Södertälje	290	54.1	34.5	66.2	5.9	94.8	8.6
Torsby	116	61.2	50	61.7	7	99.1	9.5
Trelleborg	48	27.1	35.4	23.4	0	2.1	0
Uddevalla	26	26.9	34.6	38.5	7.7	0	7.7
Umeå	430	56.3	38.4	56.4	9.6	96	13.3
Varberg	474	62	33.1	45.4	4.7	94.7	11
Visby	188	51.1	34.6	46.1	3.6	95.2	8
Värnamo	202	60.4	35.1	49	6.1	95.5	12.4
Västervik	287	57.8	32.1	44.4	2.3	92	8
Västerås	744	56	39	59.9	5.9	95.2	12.8
Växjö	373	61.4	41.6	54.8	14.8	94.1	15.3
Ystad	309	63.1	37.2	57.6	4.3	99.7	14.6
Örebro	216	59.3	37	58.7	10.2	92.1	13.4
Örnsköldsvik	341	58.9	36.7	61.4	10.2	96.2	12.9
Östersund	430	54.7	39.8	50.5	9	93	13

Table 7.1.2. 90-day mortality after hip fracture per unit.

1) Number of primary surgeries in the current period 2019–2021. Units with less than 20 primary surgeries in the current period are excluded.

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

Due to changes in the rules of the National Board of Health and Welfare regarding confidentiality, the register's ability to present adverse events has been affected. It is no longer allowed to present the number of adverse events if they are three or fewer per unit. Although we have suggested to add a few years to the three years we have previously reported, the National Board of Health and Welfare has not been able to produce data on adverse events, either at unit or regional level. We continue the work with the National Board of Health and Welfare and hope to find a solution for the next annual report.

Codes for adverse events

			HIP ICD-10 and NOMESCO codes		KNEE ICD-10 and NOMESCO codes
Unit	**Used for primary surgeries**	**Used for reoperations and revisions**	**Additional codes for fractures**		
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 proucedure 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

The table continues on the next page.

			HIP ICD-10 and NOMESCO codes		KNEE ICD-10 and NOMESCO codes
Unit	**Used for primary surgeries**	**Used for reoperations and revisions**	**Additional codes for fractures**		
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
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.*


Joint replacement surgery
aims to decreased pain,
improved function and increased
health-related quality of life.

8. Patient-reported outcome measures

Authors: Annette W-Dahl and Ola Rolfson

Patient-reported outcome measures (PROMs), are tools used to measuring the patient's own experience of health and health-related aspects. The tools or instruments that are used to measure patient-reported outcomes consists of standardized questionnaires that are answered by the patient without the interference of or the interpretation by anyone else. The main goal with most hip and knee replacements is to decrease pain and improve function, thereby improving the individual's health-related quality of life.

Development of PROMs collection for hip and knee replacements

The PROM-routine for hip replacement surgery started in 2002 as a pilot project in Norrland and in the Region of Västra Götaland. Gradually more units joined and since 2008 all units participate in the follow-up routine.

For knee replacement surgery the PROM collection started in 2008 as a pilot project with data from Trelleborg. Then the rest of the Region of Skåne was included in the coming years. Units that wanted to participate in the project were invited and at end of 2012, Norrköping, Motala and Oskarshamn joined the project. Then successively more units have joined and in 2021 PROM was registered in more than 50 % of all primary surgeries. The units have been able to choose if they want to collect all the PROMs included in the project or parts of it. When the Swedish Knee Arthroplasty Register and the Swedish Hip Arthroplasty Register merged into the Swedish Arthroplasty Register, we harmonized the PROMs program and the collection of PROMs for knee replacements was extended to cover all units, just as for the hip replacements.

Outcome measures

All patients scheduled for elective total hip or knee replacement surgery are asked before the surgery to answer a questionnaire including 25 questions (previously 12 questions) for hip and 24 questions for knee (previously 60 questions) preoperatively and one additional question on satisfaction with the surgery postoperatively on a 5-point Likert scale. The questionnaires include questions on comorbidity and walking ability in order to decide Charnley class, questions on hip pain (right and left) and knee pain respectively (current knee) on a 5-point Likert scale and the EQ-5D-instrument that measures general health status. In 2017, the new version of the EQ-5D-instrument (EQ-5D-5L) started to be used instead of the previous EQ-5D-3L for elective total hips and with the merger we have started to use it for knee replacements as

well. EQ-5D-5L consists of two parts; the first part includes five general questions with five response alternatives each that gives a health profile which can be translated into an index. The second part of the EQ-5D-questionnaire consists of a thermometer, EQ VAS (analogue visual scale), where the patient marks the current health status on a scale from 0–100. We present EQ-5D-index calculated with Swedish value-sets, that is the algorithms that is used to calculate the index. There is one that calculates values into VAS-units (from worst to best possible health 0–100) and one that can be translated to the scale dead to full health that goes from 0 to 1.

The question on smoking has existed for hips since 2013 and has now been added for the knee. New from the merger in 2021 is also two questions regarding how much time that is devoted to physical training and everyday exercise, respectively, each week as recommended by the National Board of Health and Welfare. As a part of the harmonization of PROMs, the hip-specific questionnaire HOOS-12 has been added to the questionnaire. For knee replacements the full-scale KOOS (Knee injury and Osteoarthritis Outcome Score) that consists of 42 questions has been replaced by KOOS-12. Both HOOS-12 and KOOS-12 include three sub-scales; pain, function in daily life living (ADL) and quality of life (QoL). A KOOS/HOOS-12 total score can also be calculated as the mean of the three sub-scales.

Until the merger of the registries, there was a question in the hip questionnaire regarding if the patient had met a physical therapist and/or participated in the "Supported Osteoarthritis Self-Management Programme". The question has now been removed from the questionnaire. Instead, we link the Swedish Arthroplasty Register with the BOA-register (Better management of patients with osteoarthritis register) in order to find out how large proportion of hip and knee replacement surgeries that have a registration in the BOA-register.

Collection methods

The methods for collecting PROMs differ somewhat for hip and knee replacement surgeries. While the knee replacements are followed per surgery (both right and left), i.e. all primary surgeries and reoperations are followed-up after 1 year, the latest performed hip surgery is followed-up after one, six and ten years. There are two different follow-up questionnaires for knee; one for a unilateral knee replacement and one for patients that undergo surgery in both knees at the same time. Also, for hip there are two different follow-up questionnaires; one for those that only have one prosthesis in a hip (unilateral) and one for those that have prostheses in both hips (bilateral). The follow-up routine is managed by the contact secretaries that send out questionnaires, enter the answers in the PROM-database and send a reminder if there is no answer after about two months. For those patients that have provided an e-mail address preoperatively receive the follow-up questionnaire by e-mail. It is now also possible for the units to collect PROM digitally preoperatively.

Because the EQ-5D-3L has been collected for knee replacements until the merger and thereafter the EQ-5D-5L, we have chosen not to present EQ-5D for the knee replacements in this year's report. Knee pain and satisfaction with the result of the surgery was previously measured with a VAS. We have transposed old VAS values for knee replacement into the new 5-point Likert scale using a distribution-based method for conversion. The same method was used for converting pain and satisfaction for hip replacements when the Likert scale replaced VAS some years ago.

PROMs in hip replacement surgery 2018–2021

Table 8.1 is a summary of all PROM-answers received in 2018–2021 divided into preoperative, one, six, and ten years postoperatively for primary surgeries and pre- and one year postoperatively for reoperations. Note that the summary includes cross-sectional data for patients who responded during the respective time-period and not longitudinal data. In 95 % of the cases, the patients reported moderate or severe pain in the affected hip preoperatively. In the one-year follow-up, 76 % reported no or very mild pain in the operated hip. Even if the proportion of problem free was lower at the six- and ten-year follow-ups, most appear to maintain a relatively good general health status in the long-term follow-ups.

There are considerably more one-year follow-ups after revision of hip replacements compared with preoperative answers. The routine for collecting preoperative PROMs in reoperations does not seem to be established as well as for primary hip replacements. On the other hand, the follow-up seems to function satisfactorily. Some of the loss may of course be explained by the fact that many reoperations are performed sub-acutely and the patients therefore do not undergo the elective enrolment process.

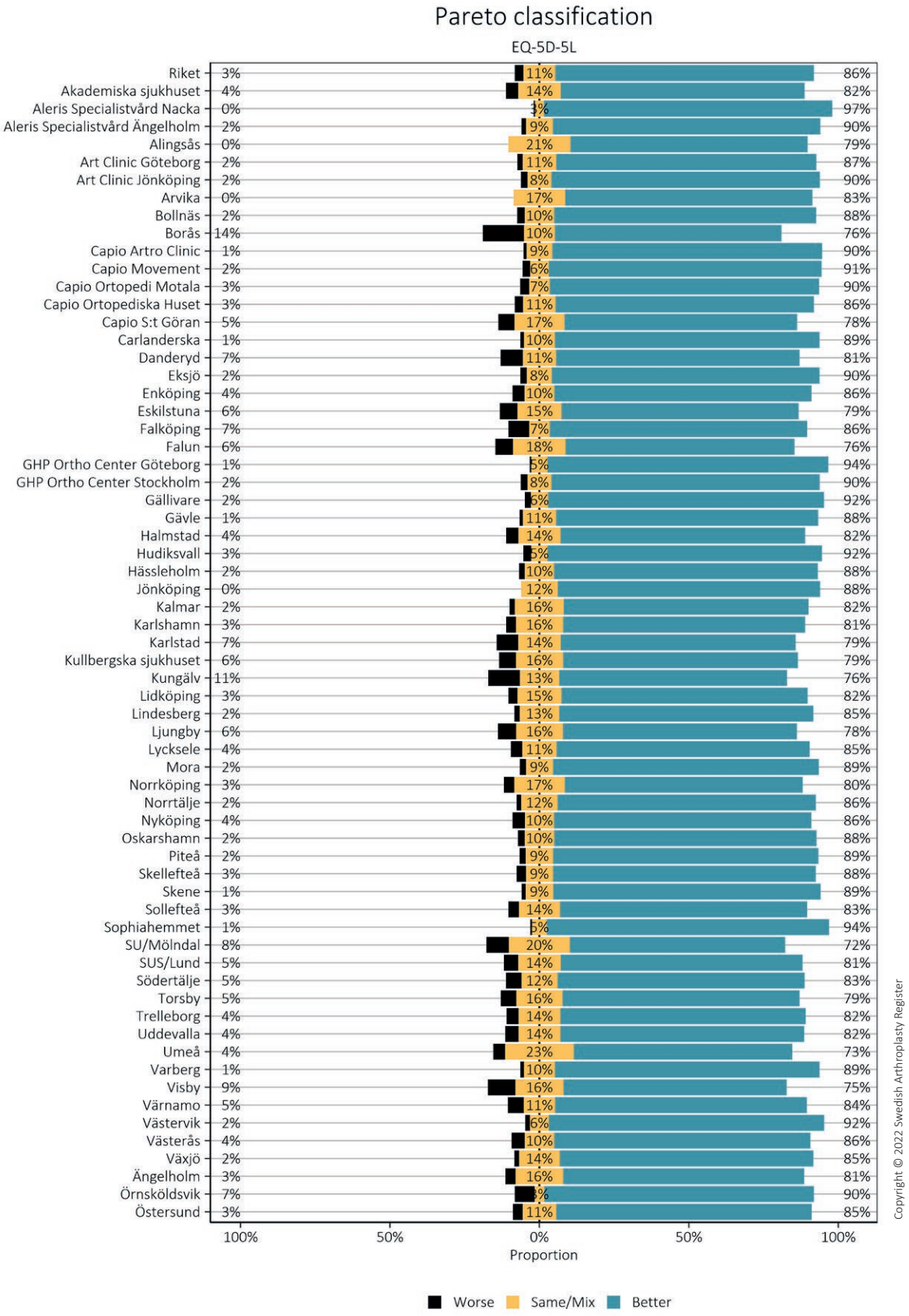

Figure 8.1. Pareto classification EQ-5D-5L, elective total hip replacement 2020.

PROMs in hip replacement 2018–2021

	Primary operation				Revision	
	Preoperatively	Postoperatively			Preoperatively	Postoperatively
		1 year	6 years	10 years		1 year
Number	**49,583**	**57,397**	**44,581**	**32,485**	**1,610**	**5,338**
Hip pain in the operated hip, n (%)						
None	385 (1)	29,875 (52)	24,742 (56)	17,419 (54)	70 (5)	1,744 (33)
Very mild	449 (1)	13,567 (24)	8,175 (18)	5,865 (18)	86 (5)	1,200 (22)
Mild	1,463 (3)	6,715 (12)	5,042 (11)	3,993 (12)	150 (9)	878 (17)
Moderate	16,648 (33)	5,499 (10)	4,855 (11)	3,898 (12)	600 (37)	1,073 (20)
Severe	30,477 (62)	1,498 (2)	1,548 (4)	1,128 (4)	702 (44)	415 (8)
Mobility, n (%)						
I have no problems in walking about	1,291 (3)	28,208 (49)	21,030 (47)	14,073 (43)	124 (8)	1,459 (27)
I have slight problems in walking about	5,036 (10)	14,361 (25)	9,822 (22)	7,278 (23)	223 (14)	1,371 (26)
I have moderate problems in walking about	16,575 (33)	9,724 (17)	8,346 (19)	6,431 (20)	538 (33)	1,380 (26)
I have severe problems in walking about	25,026 (51)	4,513 (8)	4,653 (10)	3,920 (12)	603 (37)	878 (16)
I am unable to walk about	1,655 (3)	591 (1)	730 (2)	783 (2)	122 (8)	250 (5)
Self-care, n (%)						
I have no problems washing or dressing myself	13,750 (28)	41,935 (73)	32,760 (73)	22,711 (70)	660 (41)	2,991 (56)
I have slight problems washing or dressing myself	15,794 (32)	10,574 (18)	7,097 (16)	5,546 (17)	448 (28)	1,280 (24)
I have moderate problems washing or dressing myself	14,924 (30)	3,782 (7)	3,358 (8)	2,870 (9)	353 (22)	733 (14)
I have severe problems washing or dressing myself	4,915 (10)	875 (2)	965 (2)	938 (3)	127 (8)	226 (4)
I am unable to wash or dress myself	200 (0)	231 (0)	401 (1)	420 (1)	21 (1)	102 (2)
Usual activities, n (%)						
I have no problems doing my usual activities	2,326 (5)	27,815 (48)	21,543 (48)	14,700 (45)	172 (11)	1,502 (28)
I have slight problems doing my usual activities	8,059 (16)	16,537 (29)	11,434 (25)	8,278 (26)	341 (21)	1,564 (29)
I have moderate problems doing my usual activities	16,056 (32)	8,447 (15)	7,045 (16)	5,613 (17)	465 (29)	1,265 (24)
I have severe problems doing my usual activities	18,354 (37)	3,551 (6)	3,411 (8)	2,765 (9)	430 (27)	676 (13)
I am unable to do my usual activities	4,788 (10)	1047 (2)	1,148 (3)	1,129 (3)	201 (12)	324 (6)
Pain/discomfort, n (%)						
I have no pain or discomfort	108 (0)	20,889 (36)	15,579 (35)	10,757 (33)	56 (3)	1,100 (21)
I have slight pain or discomfort	1,446 (3)	19,737 (34)	13,399 (30)	9,529 (30)	181 (11)	1,753 (33)
I have moderate pain or discomfort	17,878 (36)	12,571 (22)	11,361 (26)	8,842 (27)	662 (41)	1,717 (32)
I have severe pain or discomfort	26,796 (54)	3,896 (7)	3,848 (8)	3,036 (9)	617 (39)	671 (12)
I have extreme pain or discomfort	3,355 (7)	304 (1)	394 (1)	321 (1)	94 (6)	89 (2)

The table continues on the next page.

PROMs in hip replacement 2018–2021, cont.

	Primary operation				Revision	
	Preoperatively	Postoperatively			Preoperatively	Postoperatively
		1 year	6 years	10 years		1 year
Anxiety/depression, n (%)						
I am not anxious or depressed	17,808 (36)	39,597 (69,0)	29,603 (66)	20,618 (63)	634 (39,5)	2,809 (53)
I am slightly anxious or depressed	19,602 (39)	12,756 (22,2)	10,518 (25)	8,243 (25)	616 (38,3)	1,566 (29)
I am moderately anxious or depressed	8,729 (18)	3,605 (6,3)	3,175 (7)	2,605 (8)	231 (14,4)	655 (12)
I am severely anxious or depressed	2,934 (6)	1,208 (2,1)	1,085 (2)	864 (3)	105 (6,5)	255 (5)
I am extremely anxious or depressed	510 (1)	231 (0,4)	200 (0)	155 (1)	21 (1,3)	48 (1)
EQ VAS, mean (SD)	56 (22)	75 (19)	72 (21)	70 (22)	57 (23)	66 (22)
Satisfaction with the surgery, n (%)						
Very dissatisfied		1,113 (2)	1,221 (3)	800 (3)		367 (7)
Dissatisfied		2,152 (3)	1,929 (4)	1,271 (4)		539 (10)
Neither satisfied nor dissatisfied		4,428 (8)	3,591 (8)	2,667 (8)		879 (17)
Satisfied		12,972 (23)	10,305 (24)	8,019 (25)		1,599 (30)
Very satisfied		36,063 (64)	26,930 (61)	19,281 (60)		1,922 (36)
EQ5D-index TTO, mean (SD)	0.64 (0.14)	0.86 (0.13)	0.85 (0.14)	0.84 (0.15)	0.68 (0.15)	0.79 (0.16)
EQ5D-index VAS, mean (SD)	46.99 (13.23)	72.96 (16.03)	71.46 (17.08)	69.97 (17.58)	51.27 (15.87)	63.74 (18.37)

Table 8.1. PROMs in hip replacements 2018–2021.

The Swedish Arthroplasty Register appeals to the units to review the routines for collecting preoperative PROMs also for reoperations, not least in view of the fact that patient-reported health one year after reoperation is considerably worse compared to the situation after the primary prosthesis. More than 17 % were dissatisfied or very dissatisfied and 28 % reported moderate or severe pain in the operated hip one year after the reoperation.

PROMs for hip replacement in 2020

Table 8.2 shows data for those operated with a hip replacement in 2020 with complete pre- and one-year postoperative PROMs. 89 % reported that they were satisfied or very satisfied with the surgery and more than 79 % reported no or very mild pain in the hip. It is 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 everyday activities had improved the most.

Change in the EQ-5D dimensions can be described by the so-called Pareto-classification. If there is an improvement in one or several dimensions without worsening in any other, it is classified as "better". If there is a worsening in one or more dimensions without improvement in any other, it is classified as "worse". No change is classified as "same" and change in different directions is classified as "mix". Figure 8.1 shows how the EQ-5D-dimensions change on different units. In the country 86 % were better and only 3 % worse. However, there was a wide variation across the country. The highest proportion of patients that had improved was at Aleris Specialistvård Nacka (97 %) while 72 % had improved at SU/Mölndal. At several units none or only 1 % became worse while 14 % of the patients in Borås and 11 % in Kungälv became worse. There was also a wide variation in the proportion of patients who had the same or mixed change (3–23 %).

PROMs in primary hip replacement surgery 2020

	Primary operation	
	Preoperatively	One-year postoperatively
Number	**8,664**	**8,664**
Hip pain in the operated hip, n (%)		
None	65 (1)	4,715 (55)
Very mild	73 (1)	2,105 (25)
Mild	253 (3)	889 (10)
Moderate	2,919 (34)	685 (8)
Severe	5,328 (61)	203 (2)
Mobility, n (%)		
I have no problems in walking about	237 (3)	4,598 (53)
I have slight problems in walking about	881 (10)	2,124 (24)
I have moderate problems in walking about	2,880 (33)	1,307 (15)
I have severe problems in walking about	4,388 (51)	570 (7)
I am unable to walk about	278 (3)	65 (1)
Self-care, n (%)		
I have no problems washing or dressing myself	2,421 (28)	6,552 (76)
I have slight problems washing or dressing myself	2,803 (32)	1,561 (18)
I have moderate problems washing or dressing myself	2,577 (30)	440 (5)
I have severe problems washing or dressing myself	835 (10)	97 (1)
I am unable to wash or dress myself	28 (0)	14 (0)
Usual activities, n (%)		
I have no problems doing my usual activities	396 (5)	4,637 (54)
I have slight problems doing my usual activities	1,391 (16)	2,386 (27)
I have moderateproblems doing my usual activities	2,859 (33)	1,086 (13)
I have severe problems doing my usual activities	3,246 (37)	451 (5)
I am unable to do my usual activities	772 (9)	104 (1)
Pain/discomfort, n (%)		
I have no pain or discomfort	19 (0)	3,204 (37)
I have slight pain or discomfort	275 (3)	3,094 (36)
I have moderate pain or discomfort	3,147 (31)	1,769 (20)
I have severe pain or discomfort	4,687 (54)	557 (6)
I have extreme pain or discomfort	536 (6)	40 (1)
Anxiety/depression, n (%)		
I am not anxious or depressed	3,138 (36)	6,152 (71)
I am slightly anxious or depressed	3,483 (40)	1,854 (21)
I am moderately anxious or depressed	1,497 (17)	498 (6)
I am severely anxious or depressed	479 (6)	137 (2)
I am extremely anxious or depressed	67 (1)	23 (0)

The table continues on the next page.

PROMs in primary hip replacement surgery 2020, cont.

	Primary operation	
	Preoperatively	One-year postoperatively
EQ VAS, mean (SD)	58 (22)	76 (18)
Satisfaction with the surgery, n (%)		
Very dissatisfied		146 (2)
Dissatisfied		259 (3)
Neither satisfied nor dissatisfied		551 (6)
Satisfied		1,729 (20)
Very satisfied		5,860 (69)
EQ5D-index TTO, mean (SD)	0.64 (0.13)	0.87 (0.12)
EQ5D-index VAS, mean (SD)	47.26 (13.07)	74.37 (15.15)

Table 8.2. PROMs pre- and one-year postoperatively in primary total hip replacements 2020.

Response rate and the proportion of satisfied in primary total hip replacement surgery per unit

Table 8.3 shows the response rate and the satisfaction rate (very satisfied or satisfied) with the outcome of surgery in those operated on with elective primary total hip replacement in 2020 and who completed the one-year follow-up. The results for units with fewer than 5 responses are not presented but are included in "All". There is a wide variation between units with satisfaction rates ranging from 71 to 100 %. 16 units have patient satisfaction rates lower than 80 % and 22 units have rates of 90 % or higher. Among large providers, Hässleholm and Ortho Center Stockholm continue to have a high rate of patient satisfaction.

HOOS-12 – elective total hip replacement surgery

HOOS-12 began to be reported for elective total hip replacements in at the time of the merger. By mid-May 2022 there were more than 3,000 preoperative and almost 6,000 one-year postoperative answers registered. Table 8.4 shows a summary of these responses per unit for those patients who responded preoperatively or one-year postoperatively in 2021 and 2022 on HOOS-12. Note that the summary consists of cross-sectional data for those patients who responded in the time-period and not of longitudinal data.

PROM for primary knee replacement in 2020

In view of the harmonisation of PROMs in the merger, the response rate of the units has been negatively affected. Some units experienced problems with the so-called PROM-manager (especially Capio Ortopedi Motala). In addition, the response rate of the units depends on when each unit started using the new questionnaires and how they were in phase with the entering of the PROM-questionnaires when the registration in the Swedish Knee Arthroplasty Register closed and the Swedish Arthroplasty Register started on 1st of September 2021. In this year's report we have chosen to not report the EQ-5D (except for EQ VAS) at all and knee pain at unit level. Results from units with few operations or a low response rate may be interpreted with caution.

The results are presented for primary total replacements (TKR) and unicompartmental prostheses (UKR) that have both preoperative and one-year postoperative response. Table 8.5 presents results for all TKRs and UKRs while the tables 8.6–8.11 present the results for all TKRs and UKRs in each participating unit. Pain, responders, and satisfaction are presented as numbers and percentages while EQ VAS and KOOS-12 are presented as mean and standard deviation (SD).

Response rate and proportion satisfied after primary total hip replacement per unit 2020

Unit	Number responses	Response rate, %	Proportion satisfied, %
Akademiska sjukhuset	126	74	79
Aleris Specialistvård Nacka	182	60	96
Aleris Specialistvård Ängelholm	221	67	92
Alingsås	86	61	79
Art Clinic Göteborg	164	77	88
Art Clinic Jönköping	149	87	95
Arvika	105	80	88
Bollnäs	181	74	90
Borås	63	88	81
Capio Artro Clinic	376	73	88
Capio Movement	320	75	94
Capio Ortopedi Motala	211	71	84
Capio Ortopediska Huset	463	76	83
Capio S:t Göran	243	66	77
Carlanderska	335	67	92
Danderyd	119	66	82
Eksjö	131	75	91
Enköping	280	68	84
Eskilstuna	73	72	80
Falköping	32	76	84
Falun	52	68	83
GHP Ortho Center Göteborg	220	74	91
GHP Ortho Center Stockholm	524	71	93
Gällivare	78	84	83
Gävle	141	77	87
Halmstad	163	84	88
Helsingborg	58	75	74
Hermelinen	13	59	100
Hudiksvall	61	90	82
Hässleholm	538	86	91
Jönköping	70	78	89
Kalmar	71	80	87
Karlshamn	166	79	89
Karlskrona	30	68	90
Karlstad	68	65	72
Karolinska Huddinge	122	68	81
Karolinska Solna	21	47	71
Kullbergska sjukhuset	173	77	86

The table continues on the next page.

Response rate and proportion satisfied after primary total hip replacement per unit 2020, cont.

Unit	Number responses	Response rate, %	Proportion satisfied, %
Kungälv	60	67	72
Lidköping	141	71	85
Lindesberg	298	73	91
Linköping	72	79	85
Ljungby	80	70	90
Lycksele	196	67	92
Mora	180	76	86
Norrköping	124	71	82
Norrtälje	89	76	88
Nyköping	100	79	79
NÄL	52	87	77
Oskarshamn	240	85	91
Piteå	242	74	86
Skellefteå	105	90	80
Skene	93	77	84
Skövde	37	58	78
Sollefteå	147	72	92
Sophiahemmet	156	73	97
SU/Mölndal	236	68	80
Sundsvall	6	19	50
SUS/Lund	71	69	87
SUS/Malmö	18	72	78
Södersjukhuset	134	74	84
Södertälje	102	59	89
Torsby	60	75	83
Trelleborg	215	72	92
Uddevalla	158	77	86
Umeå	59	87	78
Varberg	125	68	94
Visby	109	81	79
Värnamo	78	69	84
Västervik	91	88	81
Västerås	173	43	83
Växjö	110	74	88
Ängelholm	96	71	91
Örnsköldsvik	89	82	83
Östersund	170	78	90
Country	**10,995**	**72**	**87**

Table 8.3. Response rate and proportion of satisfied after primary total hip replacement per unit 2020.

HOOS-12 per unit 2021 and 2022, elective total hip replacement

	Number responses	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
Unit	preop / 1 year postop	pre	1 year	pre	1 year	pre	1 year
Akademiska sjukhuset	20/68	31 (15)	76 (24)	32 (16)	77 (23)	17 (13)	68 (27)
Aleris Specialistvård Nacka	99/119	30 (16)	88 (17)	36 (19)	88 (16)	21 (14)	78 (20)
Aleris Specialistvård Ängelholm	84/112	31 (14)	89 (16)	36 (17)	87 (17)	21 (15)	82 (18)
Alingsås	45/31	34 (13)	81 (19)	41 (16)	82 (19)	22 (14)	77 (22)
Art Clinic Göteborg	49/129	33 (16)	85 (18)	36 (16)	84 (16)	20 (15)	76 (23)
Art Clinic Jönköping	75/115	30 (14)	88 (17)	38 (15)	86 (17)	20 (12)	81 (20)
Arvika	0/27		92 (12)		89 (10)		84 (18)
Bollnäs	134/141	33 (14)	85 (20)	38 (17)	84 (20)	25 (15)	78 (22)
Borås	0/25		86 (17)		84 (16)		80 (24)
Capio Artro Clinic	121/247	31 (17)	82 (20)	39 (19)	84 (18)	20 (13)	72 (23)
Capio Movement	59/139	36 (16)	89 (17)	43 (17)	88 (16)	24 (13)	82 (19)
Capio Ortopedi Motala	64/128	30 (14)	84 (19)	35 (16)	82 (18)	21 (13)	72 (21)
Caspio Ortopediska huset	0/116		84 (18)		87 (17)		73 (21)
Capio S:t Göran	48/141	31 (14)	77 (24)	35 (15)	77 (24)	21 (12)	66 (27)
Carlanderska	0/92		85 (20)		85 (19)		73 (23)
Danderyd	0/106		82 (22)		83 (21)		73 (25)
Eksjö	65/106	30 (15)	83 (21)	33 (17)	81 (22)	22 (14)	74 (24)
Enköping	30/154	23 (14)	86 (20)	33 (15)	84 (19)	13 (9)	75 (25)
Eskilstuna	34/28	31 (16)	72 (27)	33 (22)	68 (30)	15 (13)	65 (30)
Falun	27/0	33 (15)		36 (17)		19 (16)	
GHP Ortho Center Göteborg	41/155	33 (17)	88 (16)	39 (20)	88 (15)	18 (11)	77 (19)
GHP Ortho Center Stockholm	201/335	32 (15)	87 (18)	40 (19)	87 (18)	21 (13)	78 (20)
Gällivare	31/39	30 (16)	77 (23)	34 (13)	75 (24)	18 (13)	71 (28)
Gävle	25/70	28 (14)	79 (23)	32 (19)	77 (25)	14 (13)	72 (25)
Halmstad	0/106		78 (22)		78 (22)		72 (24)
Helsingborg	0/22		64 (30)		64 (30)		63 (24)
Hudiksvall	0/38		78 (22)		74 (22)		70 (21)
Hässleholm	134/238	33 (15)	87 (18)	38 (18)	86 (19)	24 (14)	81 (18)
Jönköping	22/40	26 (17)	80 (20)	29 (17)	77 (23)	17 (15)	75 (23)
Karlshamn	91/84	34 (17)	88 (17)	39 (19)	83 (19)	25 (17)	80 (20)
Karlstad	0/31		76 (24)		74 (25)		63 (29)
Karolinska Huddinge	30/80	26 (16)	78 (25)	33 (19)	75 (24)	16 (14)	69 (27)
Kullbergska sjukhuset	159/107	32 (15)	78 (23)	39 (19)	81 (19)	22 (13)	70 (23)
Kungälv	0/36		79 (23)		74 (27)		72 (25)

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HOOS-12 per unit 2021 and 2022, elective total hip replacement, cont.

	Number responses	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
Unit	preop / 1 year postop	pre	1 year	pre	1 year	pre	1 year
Lidköping	56/78	26 (12)	82 (21)	32 (16)	80 (21)	17 (13)	72 (24)
Lindesberg	26/149	18 (14)	85 (18)	25 (16)	82 (19)	9 (9)	75 (22)
Linköping	0/53		78 (24)		77 (25)		63 (28)
Ljungby	38/52	32 (17)	84 (22)	40 (20)	80 (23)	27 (15)	80 (24)
Lycksele	85/84	28 (15)	89 (20)	39 (19)	89 (17)	21 (14)	82 (22)
Mora	22/122	30 (14)	83 (21)	34 (15)	80 (21)	20 (18)	76 (22)
Norrköping	50/60	24 (14)	75 (24)	29 (15)	77 (23)	15 (15)	65 (26)
Norrtälje	50/39	31 (13)	78 (23)	38 (18)	80 (23)	20 (14)	67 (27)
Nyköping	37/72	28 (15)	75 (23)	33 (18)	72 (24)	22 (14)	66 (26)
Oskarshamn	94/150	28 (13)	85 (17)	35 (18)	85 (16)	19 (13)	77 (19)
Piteå	152/188	28 (14)	85 (20)	34 (18)	83 (20)	18 (12)	77 (23)
Skellefteå	40/53	42 (19)	85 (17)	59 (18)	86 (16)	27 (17)	73 (19)
Skene	0/22		80 (19)		82 (16)		70 (23)
Skövde	22/0	18 (13)		25 (13)		16 (13)	
Sollefteå	130/119	30 (13)	88 (19)	37 (16)	86 (18)	20 (14)	79 (20)
Sophiahemmet	0/65		95 (10)		94 (11)		85 (16)
Specialistcenter Scandinavia, Eskilstuna	45/0	34 (15)		36 (18)		22 (14)	
SU/Mölndal	28/130	31 (14)	75 (24)	39 (15)	75 (24)	21 (12)	66 (25)
SUS/Lund	0/35		70 (25)		70 (27)		64 (27)
Södersjukhuset	27/43	27 (16)	77 (24)	36 (21)	74 (24)	13 (12)	70 (26)
Södertälje	30/68	32 (19)	79 (21)	41 (20)	79 (21)	22 (17)	74 (25)
Trelleborg	109/134	29 (16)	82 (22)	35 (19)	82 (22)	20 (15)	76 (25)
Uddevalla	96/102	31 (16)	81 (23)	37 (19)	79 (22)	22 (17)	71 (25)
Umeå	0/26		85 (20)		84 (19)		81 (25)
Varberg	21/80	29 (17)	87 (18)	30 (19)	85 (18)	19 (11)	79 (19)
Visby	43/61	31 (18)	78 (21)	37 (20)	77 (21)	19 (13)	73 (25)
Värnamo	0/54		84 (18)		84 (16)		79 (18)
Västervik	38/57	28 (14)	80 (21)	31 (15)	79 (19)	20 (13)	70 (25)
Västerås	0/68		82 (21)		79 (22)		73 (24)
Växjö	31/37	33 (14)	76 (22)	40 (18)	76 (24)	24 (14)	66 (25)
Ängelholm	44/39	33 (15)	83 (20)	41 (17)	84 (19)	24 (13)	81 (20)
Örnsköldsvik	30/37	34 (15)	83 (22)	39 (16)	82 (22)	21 (15)	78 (22)
Östersund	24/121	27 (22)	85 (18)	34 (22)	86 (18)	17 (17)	78 (20)
Country	**3210/5924**	**31 (15)**	**83 (21)**	**37 (18)**	**82 (20)**	**21 (14)**	**75 (23)**

Table 8.4. HOOS-12, elective total hip replacement per unit 2021 and 2022.

PROMs in primary knee replacement 2020 with both pre- and 1 year postoperative responses

	TKR		UKR	
	Preoperatively	1 year postoperatively	Preoperatively	1 year postoperatively
Number	**3,458**	**3,458**	**391**	**391**
EQ VAS, mean (SD)	65 (22)	76 (19)	63 (23)	76 (19)
Knee pain in the operated knee, n (%)	**2,688**	**2,688**	**322**	**322**
None	5 (0)	961 (36)	0 (0)	99 (31)
Very mild	24 (1)	813 (30)	6 (2)	87 (27)
Mild	127 (5)	484 (18)	22 (7)	62 (19)
Moderate	1,183 (44)	250 (13)	135 (42)	54 (17)
Severe	1,349 (50)	80 (3)	159 (49)	20 (6)
Satisfaction with the surgery, n (%)	**3,380**	**3,380**	**383**	**383**
Very dissatisfied		110 (3)		19 (5)
Dissatisfied		204 (6)		23 (6)
Neither satisfied nor dissatisfied		292 (9)		44 (11)
Satisfied		874 (27)		109 (28)
Very satisfied		1,756 (55)		188 (49)
Charnley class, n (%)	**3,575**		**407**	
A	775 (22)		129 (32)	
B	1,317 (37)		154 (38)	
C	1,483 (41)		124 (30)	
Number	**2,878**	**2,878**	**352**	**352**
KOOS-12, mean (SD)				
Pain	38 (15)	80 (20)	39 (15)	77 821)
ADL	35 (17)	76 (21)	39 (16)	76 (21)
QoL	21 (13)	67 (23)	22 (13)	65 (23)

Table 8.5. PROMs in primary knee replacements 2020 with both pre- and one-year postoperative response.

Table 8.5 shows that general health (EQ VAS) was reported to have improved preoperatively to one-year postoperatively. 94 % and 91 % of TKR and UKR patients respectively, reported moderate or severe pain in the current knee preoperatively. One year postoperatively, 66 % of the TKR patients and 58 % of the UKR patients reported no or very mild pain in the operated knee. Knee-related pain, ADL-function and QoL measured by KOOS-12 improved on a group level preoperatively to one-year postoperatively. For general health, knee pain and KOOS-12 three subscales, results were relatively similar in TKR and UKR and a slightly higher proportion reporting satisfaction (very satisfied or satisfied) with the surgical outcome after TKR (82 %) than after UKR (77 %).

Result for participating units

Note that for units with few surgeries and/or a low response rate, results and percentages may be misleading. Results for units with fewer than five TKR or UKR are not presented but included in "All".

The proportion satisfied with the operation

Table 8.6 shows that the proportion of satisfied (very satisfied or satisfied) with the outcome of the surgery in units with a relatively high response rate (≥ 70 %) and ≥ 70 surgeries varies from 71 % in Kungälv to 85 % at Art Clinic Jönköping for TKR. The proportion satisfied with the surgery after UKR varies from 43 % to 92 % but all units have reported PROMs for relatively few surgeries and have a low response rate.

Responder

Since a PROM mean hides both bad and good results, Outcome Measures in Arthritis Clinical Trials – Osteoarthritis Research Society International (OMERACT-OARSI)-criteria have been used in previous annual reports to evaluate the proportion of knee replacement patients who have improved preoperatively to one-year postoperatively. The OMERACT-OARSI responder criteria are based on WOMAC. Since we have moved to KOOS-12 from the full-scale KOOS it is no longer possible to convert to WOMAC. However, the criteria for OMERACT-OARSI responders can also be used for KOOS-12 by using a combination of absolute and relative changes in KOOS-12 pain, ADL and total score one year after knee replacement surgery. A high responder is a patient who has improved 50 % or more and have an absolute improvement of 20 points or more in KOOS-12 pain or ADL. If these criteria are not met, the patient can still be classified as a low responder if the improvement is 20 % or more and the absolute change of 10 points or more in two of KOOS-12 pain, ADL or total score. We classify each patient according to these criteria at one year after surgery as responders (high or low) or non-responders. The proportion of responders is presented in percentage.

Table 8.7 shows that 93 % of the reported TKR and 91 % of the UKR surgeries in 2020 were classified as responders according to our criteria (of which 86 and 8 % respectively as high responders). The proportion of TKA responders ranged from 89 % in Eksjö to 97 % at Art Clinic Jönköping for units with a relatively high response rate (≥ 70 %) and ≥ 70 surgeries. Few units had a reasonable number of UKRs and/or a high response rate. Aleris Specialistvård Ängelholm and GHP Ortho Center Stockholm which reported the most UKRs had 93 % and 94 % responders respectively. For units with fewer TKR and UKR and a lower response rates, the proportion of responders ranged from 66 % and 100 %. General health in primary knee replacement surgery

General health (EQ VAS) in TKR and UKR at each unit respectively is shown in table 8.8. Preoperatively, general health ranged from 59 to 68 and from 72 to 79 postoperatively in TKR at units with a relatively high (≥ 70 %) response rate and ≥ 70 surgeries. In UKA, general health ranged from 59 to 68 preoperatively and from 66 to 84 postoperatively.

KOOS-12 – TKR

Table 8.9 shows the results for the three subscales KOOS-12 and the proportion classified as Charnley C for the TKRs operated in 2020 at each unit respectively. The proportion classified as Charnley class C on in units reporting KOOS was 42 % and varied among the units from 30 % in Hudiksvall to 59 % in Västervik.

The difference in KOOS between subscales varied at most preoperatively with 5 points for the units with a relatively high (≥ 70 %) response rate and ≥ 70 surgeries and between 5 and 8 points postoperatively. The majority of units' scores are a few points above or below the mean for all participating units.

KOOS-12 – UKR

Table 8.10 shows the results for the three KOOS-12 subscales and the proportion classified as Charnley class C for UKR operated 2020 on each unit respectively. The proportion classified as Charnley class C in the units that reported KOOS was 30 % and varied among units from 0 % in Norrtälje to 50 % in Trelleborg and Värnamo.

No units reporting KOOS-12 for UKR have a relatively high response rate (≥ 70 %) and ≥ 70 surgeries. The difference in KOOS-12 between subscales varies widely both preoperatively and postoperatively.

Variation in results between units

Results at group level varies among comparable units, those with a relatively high response rate (≥ 70 %) and ≥ 70 surgeries. When a unit has relatively few operations and/or has a large non-response rate, it is difficult to compare their results with other units. Furthermore, we do not take into account case-mix, which may reduce or increase differences between units, when we present patient reported outcome in this year's report.

Small differences in results since 2009

Since 2009 when patient-reported outcomes were presented for TKR in Trelleborg for the first time up to this year's report which refers to TKRs performed in 2020 from 28 units, the variation has been small. General health one year postoperatively has ranged from 75 to 78. The proportion of OMERACT-OARSI-responders was 85 % in 2009 and has been 89 % in the last years. In 2020 the proportion of responders was 93 % based on KOOS-12. Patient satisfaction has increased since 2009 (Trelleborg patients only) from 81 % to more recently years ranging between 81 % and 88 %. In the full-scale KOOS (42 questions) five subscales, there has been little variation has over the years, between 1 and 4 points. There is little variation between years given that different patients each year reporting. With the KOOS-12 three subscales, we can see that the point is slightly lower overall in ADL-function, which may be due to fewer questions than in the full-scale KOOS. For the pain subscale, there is a smaller difference of three points as in previous years, while the subscale knee-related quality of life (QoL) is the same as in the full-scale KOOS and the difference between surgeries in 2019 and 2020 is two points.

Hip and knee replacement surgeries with one registration in the BOA-register before surgery

The aim with the BOA-register is to monitor and improve first-line treatment for patients with osteoarthritis. First-line treatment consists of information, training and weight control, which patients can get access to by participating in a Supported Osteoarthritis Self-management Programme (SOASP) – an intervention registered in the BOA-register. In this year's report we combined the BOA-register with the Swedish Arthroplasty Register to find out what proportion of patients with hip and knee replacements surgeries performed in 2020 and 2021 due to osteoarthritis who have a registration in the BOA-register. As seen in table 8.11, approximately the same proportion of those with total hip replacement surgeries (21 %) as those with knee replacement surgeries (22 %) have a registration in the BOA-register. The table also shows that the variation between units is large. In Gällivare, only 1 % of the knee replacement surgeries have a registration in SOASP and no registrations for total hip replacements while 47 % of the knee replacement surgeries in Alingsås have a registration and 49 % of the total hip replacements in Falun. Table 8.12 shows similar information but by region. Even at regional level, there is a wide variation from just below 9 % in Norrbotten in both hip and knee replacements to 42 % for hip replacements in Dalarna and 46 % for knee replacements in Västmanland.

The reasons for the relative low proportion and high variability of total hip and knee replacement surgeries registered in the BOA-register in 2020 and in 2021 may be several. The pandemic may be one reason as individuals with osteoarthritis may have avoided contact with the health care system and the health care providers have had limited options. The proportion of registrations in the BOA-register dropped by more than 40 % in 2020. Another reason may be that the units' routines to recommend or require participation in a SOASP before surgery varies and in the regions, policy priorities may be different.

Satisfaction with the surgery per unit in primary knee replacement surgery 2020

	TKR			UKR		
Unit	Number responses	Response rate, %	Proportion satisfied, %	Number responses	Response rate, %	Proportion satisfied, %
Aleris Specialistvård Nacka	79	62	80	19	61	63
Aleris Specialistvård Ängelholm	164	67	85	76	64	86
Alingsås	70	61	86			
Art Clinic Göteborg	115	61	90	8	67	63
Art Clinic Jönköping	159	84	85	13	76	92
Bollnäs	145	77	81	44	73	73
Borås	38	75	76			
Capio Ortopedi Motala	77	28	86	9	13	78
Capio Ortopediska huset	428	80	73	23	59	61
Capio S:t Göran	31	21	81	22	24	82
Eksjö	189	86	82	12	60	75
GHP Ortho Center Stockholm	353	69	89	79	63	82
Helsingborg	81	43	77			
Hudiksvall	28	67	86			
Hässleholm	318	49	76	9	56	78
Kalmar	47	85	87			
Karolinska Huddinge	23	24	83			
Karolinska Solna	5	33	60			
Kungälv	73	87	71	16	76	81
Norrköping	36	51	61			
Norrtälje	93	72	81			
Oskarshamn	236	93	83			
Piteå	119	62	87	32	52	84
Skene	37	40	78			
SUS/Lund	8	31	75			
SU/Mölndal	79	61	72	8	67	50
Södertälje	52	68	85			
Trelleborg	175	50	81	14	61	43
Värnamo	62	47	89			
Västervik	59	80	81			
All	**3,379**	**62**	**81**	**397**	**52**	**77**

Table 8.6. Satisfaction per unit in primary knee replacement 2020.

Responder per unit in primary knee replacement surgery 2020

	TKR					UKR				
Unit	Number responses	Response rate, %	Proportion responders, %	Proportion high responders, %	Proportion low responders, %	Number responses	Response rate, %	Proportion responders, %	Proportion high responders, %	Proportion low responders, %
Aleris Specialistvård Nacka	79	62	94	82	11	22	71	91	77	14
Aleris Specialistvård Ängelholm	158	65	93	89	4	72	61	93	83	10
Alingsås	48	42	98	90	8					
Art Clinic Göteborg	114	60	97	90	7	8	67	75	75	0
Art Clinic Jönköping	161	85	98	90	7	13	77	100	92	8
Bollnäs	145	76	92	88	4	44	73	82	73	9
Borås	35	69	94	89	6					
Capio Ortopedi Motala	77	28	94	86	8	11	16	91	82	9
Eksjö	188	86	89	83	6	13	65	77	62	15
GHP Ortho Center Stockholm	358	70	96	89	7	79	63	95	87	8
Hudiksvall	27	64	89	82	7					
Hässleholm	504	78	91	82	8	14	88	100	93	7
Kalmar	47	86	89	85	4					
Karolinska Huddinge	19	20	95	89	5					
Karolinska Solna	5	33	100	100	0					
Kungälv	71	85	92	89	3	16	76	94	94	0
Norrköping	36	50		81	6	5	63	100	80	20
Norrtälje	88	68	86	83	7					
Oskarshamn	235	93	95	86	8					
Piteå	110	57	91	87	4	30	43	100	93	7
Skene	31	33	83,9	77	7					
SUS/Lund	6	23	100	100	0					
Södertälje	51	67	98	90	8					
Trelleborg	172	49	91	81	9	14	61	71	43	29
Värnamo	52	39	94	89	6					
Västervik	56	76	91	88	4					
All	**2,875**	**65**	**93**	**86**	**7**	**351**	**57**	**91**	**82**	**9**

Table 8.7. Responder per unit in primary knee replacement 2020.

EQ VAS in primary knee replacement 2020

	Number responses	Response rate, %	TKR mean (SD)		Number responses	Response rate, %	UKR mean (SD)	
Unit			**pre**	**1 year**			**pre**	**1 year**
Aleris Specialistvård Nacka	82	65	67 (19)	75 (20)	20	65	60 (20)	67 (19)
Aleris Specialistvård Ängelholm	160	65	61 (24)	76 (19)	71	60	68 (25)	80 (18)
Alingsås	69	60	63 (21)	76 (18)				
Art Clinic Göteborg	112	59	66 (26)	79 (16)	7	58	61 (33)	69 (32)
Art Clinic Jönköping	158	83	63 (22)	79 (17)	13	76	57 (20)	76 (17)
Bollnäs	143	76	59 (24)	73 (18)	44	73	59 (25)	74 (18)
Borås	34	67	59 (19)	72 (15)				
Capio Ortopedi Motala	76	28	61 (22)	75 (18)	9	13	54 (23)	70 (22)
Capio Ortopediska huset	410	77	67 (21)	79 (16)	23	59	67 (19)	77 (14)
Capio S:t Göran	31	21	69 (21)	68 (25)	21	23	65 (19)	72 (20)
Eksjö	168	76	63 (19)	74 (19)	11	50	68 (16)	71 (22)
GHP Ortho Center Stockholm	352	68	67 (20)	78 (16)	76	60	65 (23)	74 (19)
Helsingborg	78	42	64 (21)	72 (20)				
Hudiksvall	28	67	63 (21)	72 (21)				
Hässleholm	503	78	68 (21)	75 (19)	14	88	67 (23)	82 (8)
Kalmar	47	85	61 (22)	73 (20)				
Karolinska Huddinge	23	24	52 (24)	62 (26)				
Karolinska Solna	5	33	39 (20)	57 (23)				
Kungälv	71	85	61 (23)	72 (20)	16	76	52 (21)	81 (16)
Norrköping	35	49	60 (22)	70 (18)	5	63	57 (30)	77 (11)
Norrtälje	88	68	70 (20)	74 (21)				
Oskarshamn	220	87	68 (21)	79 (16)				
Piteå	111	58	62 (22)	74 (18)	30	49	61 (26)	84 (11)
Skene	37	40	62 (20)	72 (18)				
SU/Mölndal	78	66	66 (21)	68 (23)	8	67	66 (15)	66 (25)
SUS/Lund	8	40	54 (27)	63 (27)				
Södertälje	49	64	67 (23)	78 (20)				
Trelleborg	170	49	65 (23)	73 (20)	14	61	63 (24)	72 (28)
Värnamo	55	41	63 (22)	75 (15)				
Västervik	56	76	52 (25)	75 (22)				
All	**3,457**	**64**	**65 (22)**	**77 (19)**	**391**	**52**	**63 (23)**	**76 (19)**

Table 8.8. EQ VAS in primary knee replacement 2020.

KOOS-12 per unit TKR 2020

	Number responses	Response rate, %	Proportion Charnley C, %	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
Unit				pre	1 year	pre	1 year	pre	1 year
Aleris Specialistvård Nacka	79	62	42	40 (15)	82 (20)	39 (18)	77 (24)	20 (12)	67 (23)
Aleris Specialistvård Ängelholm	158	65	41	35 (14)	80 (19)	32 (16)	75 (21)	18 (13)	65 (24)
Alingsås	48	42	33	39 (13)	82 (18)	37 (16)	77 (17)	23 (12)	67 (21)
Art Clinic Göteborg	114	60	31	37 (17)	84 (18)	37 (18)	78 (17)	22 (15)	67 (20)
Art Clinic Jönköping	161	85	40	36 (15)	83 (21)	35 (17)	79 (20)	20 (13)	71 (23)
Bollnäs	145	76	40	41 (14)	84 (19)	38 (17)	78 (20)	21 (12)	67 (25)
Borås	35	69	43	36 (13)	78 (22)	32 (15)	68 (24)	20 (12)	60 (22)
Capio Ortopedi Motala	77	28	49	36 (16)	81 (18)	32 (16)	72 (23)	21 (13)	66 (22)
Eksjö	188	86	39	40 (16)	79 (20)	39 (16)	76 (20)	25 (13)	68 (24)
GHP Ortho Center Stockholm	358	70	39	40 (15)	83 (19)	38 (16)	78 (20)	22 (13)	69 (22)
Hudiksvall	27	64	30	38 (11)	79 (21)	31 (14)	72 (21)	17 (11)	64 (24)
Hässleholm	504	78	43	39 (16)	77 (21)	35 (17)	74 (22)	22 (14)	65 (23)
Kalmar	47	86	43	38 (11)	82 (21)	35 (13)	75 (23)	22 (14)	71 (26)
Karolinska Huddinge	19	20	43	33 (17)	73 (25)	30 (19)	70 (27)	16 (14)	65 (30)
Karolinska Solna	5	33	60	25 (10)	70 (23)	29 (16)	64 (24)	11 (16)	49 (25)
Kungälv	71	85	48	36 (15)	79 (22)	34 (18)	74 (23)	22 (15)	63 (26)
Norrköping	36	50	58	33 (13)	70 (26)	29 (16)	67 (25)	19 (10)	60 (29)
Norrtälje	88	68	40	40 (14)	77 (23)	37 (17)	74 (22)	24 (11)	65 (26)
Oskarshamn	235	93	41	37 (14)	82 (19)	34 (16)	77 (20)	22 (14)	69 (22)
Piteå	110	57	47	36 (15)	85 (19)	32 (16)	76 (20)	18 (13)	69 (23)
Skene	31	33	32	40 (13)	76 (23)	40 (16)	74 (23)	18 (11)	63 (25)
SUS/Lund	6	23	67	34 (13)	77 (25)	28 (20)	66 (21)	17 (16)	65 (26)
Södertälje	51	67	51	37 (17)	83 (21)	31 (15)	77 (22)	19 (12)	71 (25)
Trelleborg	172	49	44	38 (16)	76 (22)	35 (17)	72 (23)	25 (14)	66 (25)
Värnamo	52	39	31	40 (15)	82 (19)	39 (17)	80 (17)	22 (14)	73 (20)
Västervik	56	76	59	35 (13)	80 (21)	34 (17)	75 (20)	20 (12)	68 (23)
All	**2,875**	**65**	**42**	**38 (15)**	**80 (20)**	**35 (17)**	**75 (20)**	**21 (13)**	**67 (23)**

Table 8.9. KOOS-12 per unit TKR 2020.

KOOS-12 per unit UKR 2020

	Number responses	Response rate, %	Proportion Charnley C, %	Pain mean (SD)		ADL mean (SD)		QoL mean (SD)	
Unit				pre	1 year	pre	1 year	pre	1 year
Aleris Specialistvård Nacka	22	71	31.8	37 (16)	73 (22)	36 (15)	69 (24)	23 (14)	63 (26)
Aleris Specialistvård Ängelholm	72	60.5	35.7	35 (13)	79 (23)	36 (15)	76 (34)	22 (14)	68 (24)
Art Clinic Göteborg	8	66.7	12.5	31 (11)	68 (20)	35 (11)	68 (26)	20 (11)	54 (30)
Art Clinic Jönköping	13	76.5	38.5	38 (14)	86 (18)	45 (20)	85 (11)	27 (16)	65 (22)
Bollnäs	44	73.3	25	42 (15)	72 (21)	41 (18)	69 (22)	24 (14)	58 (25)
Capio Ortopedi Motala	11	15.9	45.5	30 (10)	71 (23)	29 (11)	66 (20)	18 (17)	55 (20)
Eksjö	13	65	25	50 (13)	75 (22)	55 (17)	79 (24)	29 (12)	60 (24)
GHP Ortho Center Stockholm	79	62.7	31.7	42 (16)	81 (19)	41 (17)	81 (17)	21 (14)	67 (23)
Hässleholm	14	87.5	21.4	38 (15)	80 (14)	38 (15)	81 (12)	27 (12)	70 (15)
Kungälv	16	76.2	26.7	40 (14)	77 (20)	38 (19)	74 (26)	21 (10)	68 (20)
Norrköping	5	62.5	20	40 (23)	85 (21)	38 (30)	79 (22)	20 (13)	80 (14)
Piteå	30	42.9	20	40 (11)	85 (15)	38 (13)	86 (15)	11 (13)	72 (18)
Trelleborg	56	60.9	50	42 (20)	63 (24)	43 (17)	65 (23)	17 (12)	47 (19)
All	**351**	**57.2**	**30.3**	**39 (15)**	**77 (21)**	**39 (17)**	**76 (21)**	**22 (13)**	**65 (23)**

Table 8.10. KOOS-12 per unit UKR 2020.

Proportion of hip and knee replacements for OA with a registration in the BOA-register before the replacement per unit

	Total hip replacement		Knee replacement	
Unit	Number in SAR	% in BOA	Number in SAR	% in BOA
Akademiska sjukhuset	119	18.5	78	23.1
Aleris Specialistvård Nacka	690	17.7	449	18.3
Aleris Specialistvård Ängelholm	747	15.7	822	14.5
Alingsås	227	44.5	226	47.3
Art Clinic Göteborg	528	35.8	470	32.3
Art Clinic Jönköping	469	22.6	416	24
Arvika	403	28.8	393	38.2
Bollnäs	562	10.9	560	13.6
Borås	57	17.5	68	29.4
Capio Artro Clinic	1,114	14.5	1,225	14
Capio Movement	903	19	1 004	22.2
Capio Ortopedi Motala	641	38.2	807	39.8
Capio Ortopediska Huset	1,345	19	1,279	18.4
Capio S:t Göran	631	18.1	415	18.6
Carlanderska	1,040	24.9	663	30.2
Carlanderska-SportsMed			264	8.7
Danderyd	190	11.1	169	9.5
Eksjö	390	10.3	510	14.3
Enköping	826	17.8	731	16.4
Eskilstuna	106	17.9	66	24.2
Falköping	42	40.5	27	44.4
Falun	139	48.9	137	45.3
Frölundaortopeden	27	18.5	41	12.2
GHP Ortho Center Göteborg	548	20.3	549	17.5
GHP Ortho Center Stockholm	1,512	23.4	1,310	24
Gällivare	115	0	97	1
Gävle	104	8.7	104	5.8
Halmstad	242	12	289	11.4
Helsingborg	76	5.3	325	18.8
Hermelinen	49	2	51	2
Hudiksvall	90	13.3	104	12.5
Hässleholm	1,069	13.2	1,341	17
Jönköping	92	13		
Kalmar	96	31.2	76	28.9

The table continues on the next page.

Proportion of hip and knee replacements for OA with a registration in the BOA-register before the replacement per unit, cont.

	Total hip replacement		Knee replacement	
Unit	Number in SAR	% in BOA	Number in SAR	% in BOA
Karlshamn	359	25.3	347	29.4
Karlstad	54	27.8	48	25
Karolinska Huddinge	242	16.9	194	15.5
Karolinska Solna	20	10	24	8.3
Kullbergska sjukhuset	529	21.9	499	20
Kungälv	107	29	139	35.3
Lidköping	237	28.3	144	34.7
Lindesberg	651	20.3	536	22.9
Linköping	136	30.1		
Ljungby	182	19.8	182	28
Lycksele	502	16.3	322	19.6
Mora	411	39.2	333	43.5
Norrköping	220	44.1	159	44
Norrtälje	225	16.4	237	25.3
Nyköping	176	25	140	17.1
Ortopedisk Center Sophiahemmet			309	8.4
Oskarshamn	572	26.2	434	29
Piteå	617	11	516	10.7
Skellefteå	182	4.9	111	4.5
Skene	218	30.7	195	27.7
Skövde	34	26.5		
Sollefteå	547	13	248	12.1
Sophiahemmet	466	10.3		
Specialistcenter Scandinavia, Eskilstuna	107	25.2	68	19.1
SU/Mölndal	350	31.4	229	33.2
SUS/Lund	39	7.7	35	14.3
Södersjukhuset	115	7	112	20.5
Södertälje	180	8.3	155	8.4
Torsby	235	31.1	252	36.1
Trelleborg	539	15.6	739	15.8
Uddevalla	393	31.3	277	36.8
Umeå	50	20	162	17.9
Varberg	313	9.9	230	7.8
Visby	227	21.6	172	34.3

The table continues on the next page.

Proportion of hip and knee replacements for OA with a registration in the BOA-register before the replacement per unit, cont.

	Total hip replacement		Knee replacement	
Unit	**Number in SAR**	**% in BOA**	**Number in SAR**	**% in BOA**
Värnamo	271	12.5	313	12.5
Västervik	208	18.3	183	23
Västerås	415	37.8	266	45.5
Växjö	181	22.7	113	17.7
Ängelholm	236	19.9		
Örnsköldsvik	162	16	156	16
Östersund	223	39.9	125	36.8
Country	**26,158**	**20.9**	**23,814**	**21.7**

Table 8.11. Proportion of hip and knee replacements for OA with a registration in the BOA-register before the replacement per unit 2020 and 2021. Units with fewer than 20 operations are excluded.

Proportion of hip and kneee replacements for OA with a registration in the BOA-register before the replacement per region

	Total hip replacement		Knee replacement	
Unit	**Number in SAR**	**% in BOA**	**Number in SAR**	**% in BOA**
Blekinge	377	25.7	347	29.4
Dalarna	550	41.6	470	44
Gotland	227	21.6	172	34.3
Gävleborg	756	10.8	768	12.4
Halland	1,458	15.9	1,523	18
Jämtland	223	39.9	125	36.8
Jönköping	1,222	15.7	1,239	17.1
Kalmar	876	24.9	693	27.4
Kronoberg	363	21.2	295	24.1
Norrbotten	786	8.8	666	8.6
Skåne	2,707	14.6	3,263	16.2
Stockholm	6,730	17.5	5,881	17.9
Sörmland	918	22.4	773	19.8
Uppsala	945	17.9	822	17.2
Värmland	692	29.5	693	36.5
Västerbotten	734	13.8	595	16.3
Västernorrland	719	13.6	421	13.5
Västmanland	415	37.8	266	45.5
Västra Götaland	3,812	28.9	3,300	28.7
Örebro	651	20.3	536	22.9
Östergötland	997	38.4	966	40.5
Country	**26,158**	**20.9**	**23,814**	**21.7**

Table 8.12. Proportion of hip and knee replacements for OA with a registration in the BOA-register before the replacement per region 2020 and 2021.

In-depth analyses to gain deeper knowledge in selected topics.

9. In-depth analyses

9.1. Thrombosis prophylaxis

Authors: Maziar Mohaddes and Malin Carling

The registration of thrombosis prophylaxis started in the Swedish Knee Arthroplasty Register in 2009 and in the Swedish Hip Arthroplasty Register in the autumn 2018. It is very gratifying to see that the proportion of reported cases has increased over time and that most of the units had contributed with information about planned use of thrombosis prophylaxis in elective surgeries 2021. In most surgeries, low-molecular heparin (LMWH) or non-vitamin K oral anticoagulants (NOAC) are used (figure 9.1.1 a-b). In a few operations Fondaparinux (Arixtra) has been used. The reporting frequency for thrombosis prophylaxis in hip replacement due to fracture is somewhat lower than for elective surgeries (figure 9.1.1 c).

In this in-depth analysis we have chosen to focus on time trends regarding planned use of thrombosis prophylaxis and analysed if there are differences between the reporting units when it comes to the choice of drug and the planned length of the prophylaxis. The planned length of treatment with thrombosis prophylaxis has been categorised into four groups; no treatment, short-term (1–6 days), mid-term (7–14 days) and prolonged (longer than 14 days).

Data is presented separately for patients operated with knee replacement, elective hip replacement and hip replacement due to fracture. The figures in this chapter present data for knee replacements reported 2009–2021 and hip replacements reported 2018–2021. The information in tables 9.1.1-3 a-c and the presentation of differences between units has been limited to the period 2019–2021, to reflect the last three years reporting.

Knee replacement

Regarding knee replacement surgery, there is a clear trend towards increased use of NOAC over time (figure 9.1.1a). In the last three years, the proportion of surgeries where NOAC has been used has remained relatively unchanged (just over 50 %). There is also a trend toward starting thrombosis prophylaxis postoperatively, and a decrease in the proportion of surgeries where prolonged prophylaxis (more than 14 days) were prescribed (figure 9.1.3 a). The most common planned length of treatment is 7–14 days (60 % of the reported surgeries). There are differences in planned length of treatment between units. Twelve units report a planned length of treatment longer than 14 days and two units report that thrombosis prophylaxis is planned shorter time than seven days in most surgeries. At three units it is reported that more than 50 % of the surgeries have been performed without thrombosis prophylaxis. Detailed information on planned thrombosis prophylaxis in knee replacement surgery at each unit is presented in tables 9.1.1 a-c.

Primary elective total hip replacement

The time trend analysis is more difficult in primary elective total hip replacements due to the short observation period. Possibly, a marginal decrease use of LMWH is noted (figure 9.1.1 b). In the majority of the surgeries, the thrombosis prophylaxis has been reported to start postoperatively (figure 9.1.2 b). Prolonged prophylaxis has been reported in 60 % of the hip replacements (figure 9.1.3 b). There is marked differences in planned length of treatment between units (table 9.1.2 c). Almost half of the units report planned long-term prophylaxis in more than 80 % of the surgeries and five units report that more than 50 % of the surgeries were performed with a planned thrombosis prophylaxis shorter than seven days. Detailed information on planned thrombosis prophylaxis in elective total hip replacement surgery at each unit is presented in tables 9.1.2 a-c.

Hip fractures

Unfortunately, data on thrombosis prophylaxis is lacking for approximately 25 % of the reported surgeries. In more than half of the surgeries due to a hip fracture, use of prolonged prophylaxis is reported (55 %) (figure 9.1.3 c). Use of LMWH was planned in the majority of the surgeries (figure 9.1.2 c) and the majority were planned to start postoperatively (figure 9.1.1 c). Detailed information on planned thrombosis prophylaxis in hip replacements due to fracture at each unit is presented in tables 9.1.3 a-c.

Summary

There seems to be a difference both of choice of drug and planned length of treatment for thrombosis prophylaxis in knee and hip replacement surgery. These differences may be partly due to the fact that patients operated on at the different units may have different predisposing factors for thrombosis. The differences noted in planned length of treatment is somewhat remarkable and may be due to differences in local and/or regional care programs.

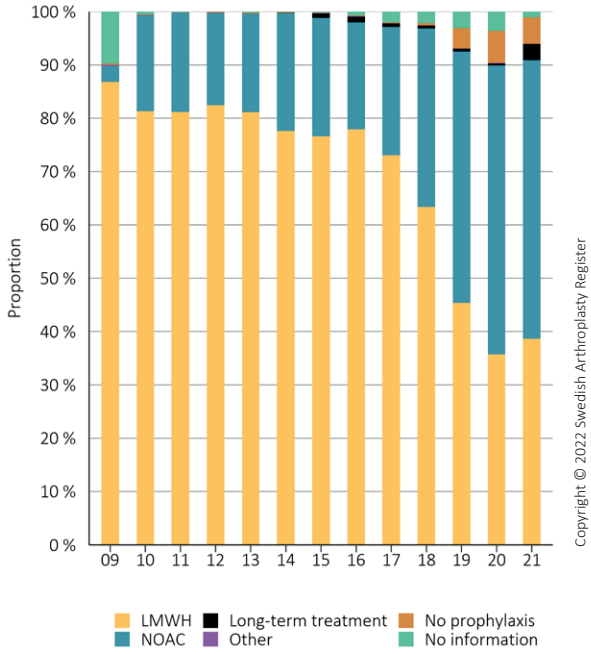

Figure 9.1.1a. Distribution of drugs used as thrombosis prophylaxis, knee replacement.

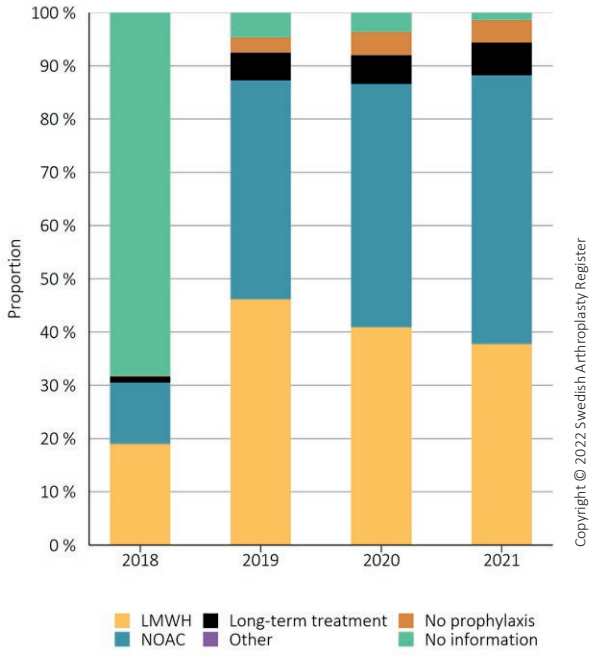

Figure 9.1.1b. Distribution of drugs used as thrombosis prophylaxis, elective hip replacement.

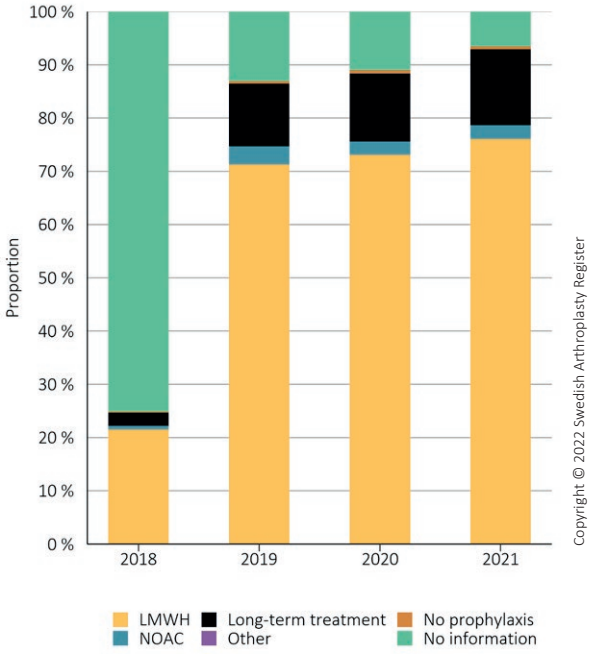

Figure 9.1.1c. Distribution of drugs used as thrombosis prophylaxis, hip fracture.

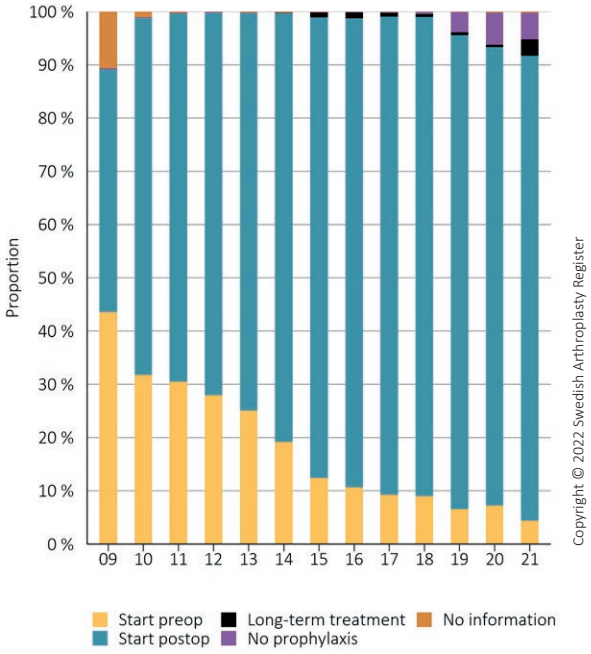

Figure 9.1.2 a. Planned treatment start, thrombosis prophylaxis, knee replacement.

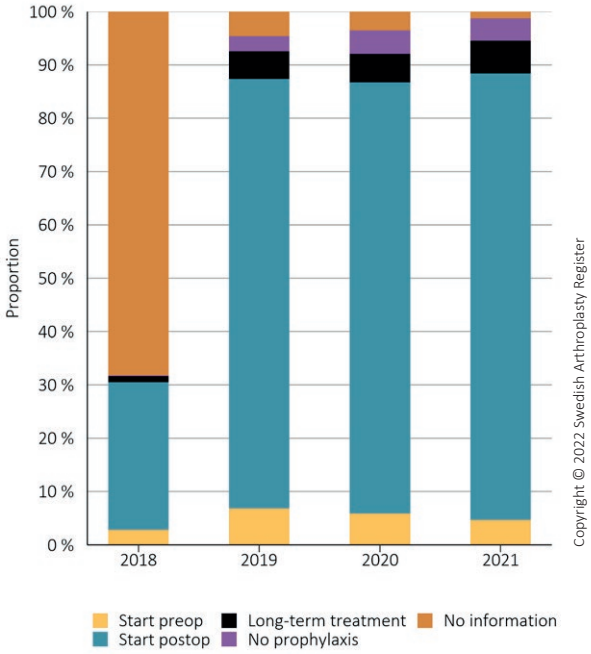

Figure 9.1.2 b. Planned treatment start, thrombosis prophylaxis, elective hip replacement.

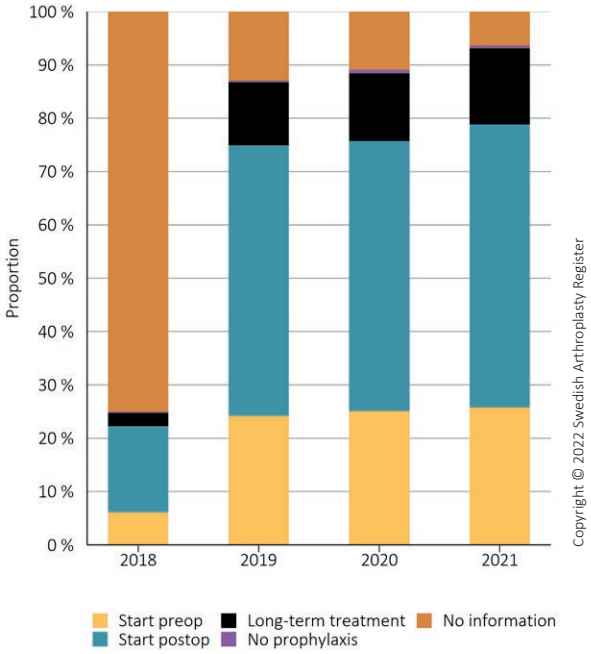

Figure 9.1.2 c. Planned treatment start, thrombosis prophylaxis, hip fracture.

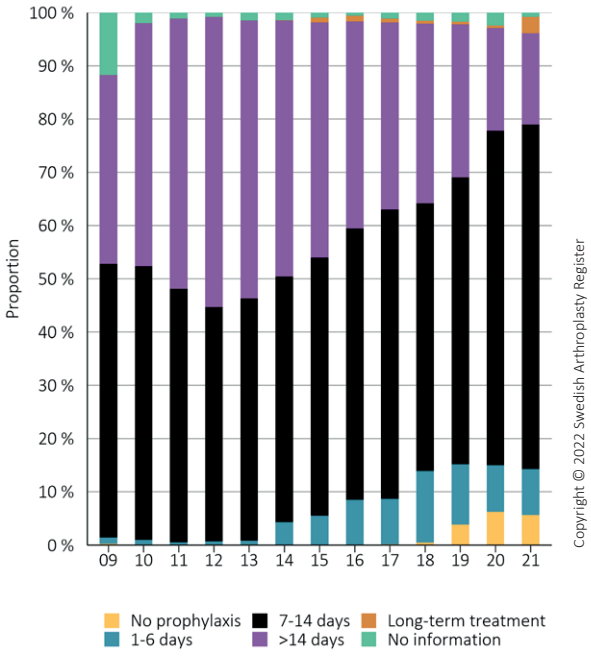

Figure 9.1.3 a. Planned length of treatment, thrombosis prophylaxis, knee replacement.

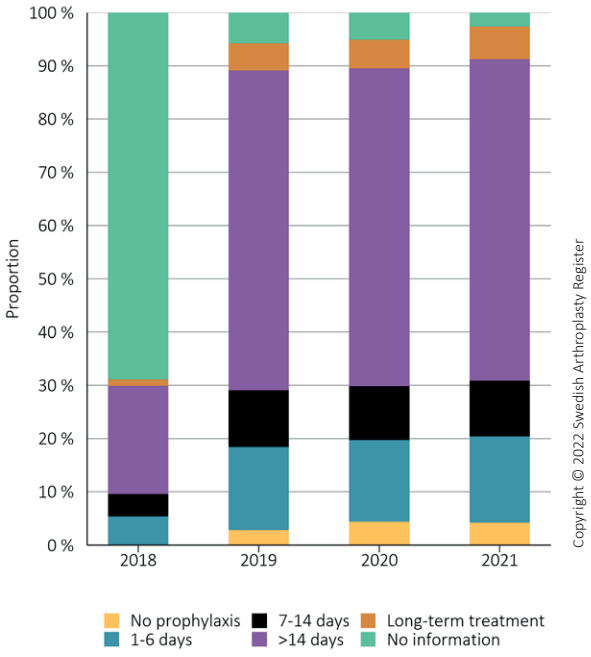

Figure 9.1.3 b. Planned length of treatment, thrombosis prophylaxis, elective hip replacement.

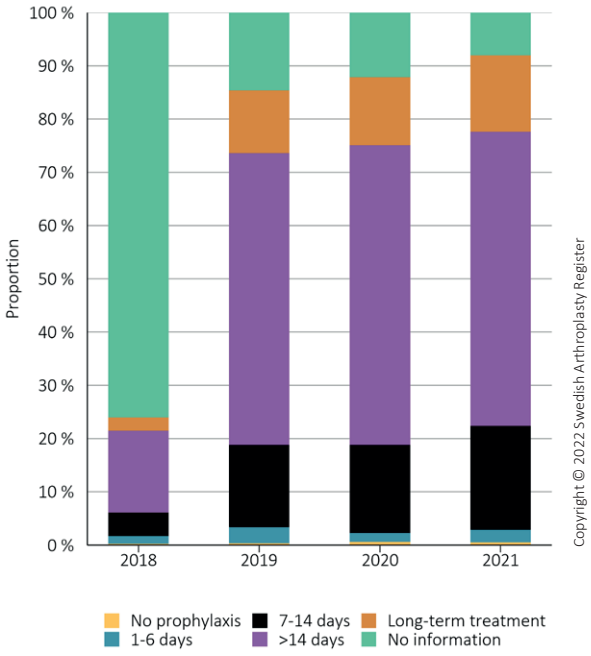

Figure 9.1.3 c. Planned length of treatment, thrombosis prophylaxis, hip fracture.

Thrombosis prophylaxis in elective knee replacement – planned treatment start, per unit

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	16 (9)	148 (85)	7 (4)	1 (1)	2 (1)	174
Aleris Specialistvård Nacka	9 (1)	645 (98)	5 (1)	1 (0)	1 (0)	661
Aleris Specialistvård Ängelholm	74 (7)	959 (91)	22 (2)	0 (0)	1 (0)	1,056
Alingsås	24 (6)	409 (94)	2 (0)	0 (0)	1 (0)	436
Art Clinic Göteborg	36 (6)	518 (93)	3 (1)	0 (0)	0 (0)	557
Art Clinic Jönköping	12 (2)	658 (97)	6 (1)	1 (0)	0 (0)	677
Arvika	26 (4)	620 (92)	22 (3)	1 (0)	4 (1)	673
Bollnäs	23 (2)	941 (96)	16 (2)	0 (0)	1 (0)	981
Borås	13 (7)	169 (91)	1 (1)	2 (1)	0 (0)	185
Capio Artro Clinic	88 (5)	1,643 (95)	1 (0)	0 (0)	1 (0)	1,733
Capio Movement	26 (2)	1,419 (97)	10 (1)	1 (0)	0 (0)	1,456
Capio Ortopedi Motala	32 (2)	1,142 (78)	25 (2)	257 (18)	0 (0)	1,456
Capio Ortopediska Huset	28 (1)	1,922 (98)	9 (0)	0 (0)	1 (0)	1,960
Capio S:t Göran	122 (13)	818 (85)	23 (2)	4 (0)	1 (0)	968
Carlanderska	68 (7)	965 (93)	6 (1)	2 (0)	0 (0)	1,041
CarlanderskaSportsMed	14 (4)	310 (96)	0 (0)	0 (0)	0 (0)	324
Danderyd	33 (10)	300 (87)	9 (3)	3 (1)	1 (0)	346
Eksjö	21 (2)	173 (20)	6 (1)	654 (77)	0 (0)	854
Enköping	44 (4)	1,108 (94)	19 (2)	0 (0)	2 (0)	1,173
Eskilstuna	5 (4)	131 (93)	4 (3)	0 (0)	1 (1)	141
Falköping	2 (3)	66 (97)	0 (0)	0 (0)	0 (0)	68
Falun	14 (4)	310 (96)	0 (0)	0 (0)	0 (0)	324
Frölundaortopeden	5 (7)	66 (93)	0 (0)	0 (0)	0 (0)	71
GHP Ortho Center Göteborg	28 (3)	774 (96)	2 (0)	0 (0)	1 (0)	805
GHP Ortho Center Stockholm	54 (3)	1,968 (97)	10 (0)	0 (0)	2 (0)	2,034
Gällivare	10 (5)	193 (94)	1 (0)	1 (0)	0 (0)	205
Gävle	27 (10)	223 (85)	10 (4)	0 (0)	1 (0)	261
Halmstad	37 (8)	443 (91)	3 (1)	4 (1)	0 (0)	487
Helsingborg	39 (7)	511 (90)	19 (3)	0 (0)	1 (0)	570
Hermelinen	2 (3)	63 (97)	0 (0)	0 (0)	0 (0)	65
Hudiksvall	21 (12)	146 (86)	1 (1)	1 (1)	0 (0)	169
Hässleholm	38 (2)	2,241 (97)	27 (1)	0 (0)	0 (0)	2,306

The table continues on the next page.

Thrombosis prophylaxis in elective knee replacement – planned treatment start, per unit, cont.

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Kalmar	7 (3)	115 (57)	5 (2)	74 (37)	0 (0)	201
Karlshamn	30 (5)	577 (93)	14 (2)	1 (0)	0 (0)	622
Karlskoga	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1
Karlstad	10 (6)	163 (93)	3 (2)	0 (0)	0 (0)	176
Karolinska Huddinge	25 (6)	366 (90)	2 (0)	2 (0)	10 (2)	405
Karolinska Solna	16 (28)	36 (63)	2 (4)	2 (4)	1 (2)	57
Kullbergska sjukhuset	28 (3)	760 (95)	11 (1)	1 (0)	1 (0)	801
Kungälv	26 (7)	354 (93)	2 (1)	0 (0)	0 (0)	382
Lidköping	20 (5)	364 (94)	3 (1)	0 (0)	1 (0)	388
Lindesberg	150 (15)	804 (83)	13 (1)	0 (0)	1 (0)	968
Ljungby	21 (6)	335 (93)	5 (1)	0 (0)	0 (0)	361
Lycksele	398 (90)	44 (10)	1 (0)	0 (0)	0 (0)	443
Mora	33 (6)	515 (93)	6 (1)	0 (0)	0 (0)	554
Norrköping	22 (7)	177 (58)	1 (0)	104 (34)	3 (1)	307
Norrtälje	52 (12)	371 (85)	16 (4)	0 (0)	0 (0)	439
Nyköping	19 (6)	271 (90)	10 (3)	1 (0)	0 (0)	301
Ortopediskt Center Sophiahemmet	11 (3)	364 (95)	3 (1)	0 (0)	4 (1)	382
Oskarshamn	44 (5)	410 (48)	16 (2)	382 (45)	1 (0)	853
Piteå	184 (19)	757 (78)	24 (2)	0 (0)	0 (0)	965
Skellefteå	1 (0)	231 (100)	0 (0)	0 (0)	0 (0)	232
Skene	19 (5)	345 (93)	8 (2)	0 (0)	0 (0)	372
Skövde	2 (5)	34 (92)	1 (3)	0 (0)	0 (0)	37
Sollefteå	26 (6)	430 (91)	12 (3)	1 (0)	2 (0)	471
Sophiahemmet	5 (4)	125 (96)	0 (0)	0 (0)	0 (0)	130
Specialistcenter S:t Johanniskliniken	2 (15)	11 (85)	0 (0)	0 (0)	0 (0)	13
Specialistcenter Scandinavia, Eskilstuna	1 (1)	80 (95)	3 (4)	0 (0)	0 (0)	84
SU/Mölndal	36 (6)	609 (93)	2 (0)	1 (0)	5 (1)	653
SU/Sahlgrenska	0 (0)	2 (67)	0 (0)	0 (0)	1 (33)	3
Sunderby sjukhus	2 (67)	1 (33)	0 (0)	0 (0)	0 (0)	3
Sundsvall	3 (4)	71 (92)	2 (3)	0 (0)	1 (1)	77
SUS/Lund	6 (8)	64 (85)	2 (3)	3 (4)	0 (0)	75

The table continues on the next page.

Thrombosis prophylaxis in elective knee replacement – planned treatment start, per unit, cont.

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Södersjukhuset	22 (6)	307 (91)	9 (3)	0 (0)	1 (0)	339
Södertälje	24 (8)	271 (87)	9 (3)	3 (1)	3 (1)	310
Torsby	17 (4)	366 (95)	2 (1)	0 (0)	0 (0)	385
Trelleborg	42 (3)	1,541 (97)	2 (0)	0 (0)	1 (0)	1,586
Uddevalla	35 (6)	522 (92)	10 (2)	1 (0)	2 (0)	570
Umeå	24 (7)	304 (90)	2 (1)	1 (0)	5 (1)	336
Varberg	24 (6)	389 (93)	2 (0)	2 (0)	0 (0)	417
Visby	22 (7)	263 (89)	10 (3)	0 (0)	1 (0)	296
Värnamo	16 (3)	231 (45)	5 (1)	265 (51)	2 (0)	519
Västervik	4 (1)	91 (31)	1 (0)	194 (67)	0 (0)	290
Västerås	39 (6)	615 (91)	21 (3)	1 (0)	0 (0)	676
Växjö	14 (7)	195 (92)	3 (1)	0 (0)	0 (0)	212
Ängelholm	0 (0)	7 (100)	0 (0)	0 (0)	0 (0)	7
Örebro	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	2
Örnsköldsvik	26 (9)	246 (88)	6 (2)	0 (0)	0 (0)	278
Östersund	24 (7)	285 (84)	7 (2)	24 (7)	0 (0)	340
Country	**2,524 (6)**	**36,423 (88)**	**525 (1)**	**1,996 (5)**	**68 (0)**	**41,536**

Tabell 9.1.1 a. Thrombosis prophylaxis in knee replacement – planned treatment start, per unit, 2019–2021.

Thrombosis prophylaxis in elective knee replacement – type of drug, per unit

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	11 (6)	150 (86)	7 (4)	1 (1)	1 (1)	4 (2)	174
Aleris Specialistvård Nacka	491 (74)	163 (25)	5 (1)	0 (0)	1 (0)	1 (0)	661
Aleris Specialistvård Ängelholm	6 (1)	1,022 (97)	22 (2)	1 (0)	0 (0)	5 (0)	1,056
Alingsås	433 (99)	0 (0)	2 (0)	0 (0)	0 (0)	1 (0)	436
Art Clinic Göteborg	0 (0)	554 (99)	3 (1)	0 (0)	0 (0)	0 (0)	557
Art Clinic Jönköping	8 (1)	662 (98)	6 (1)	0 (0)	1 (0)	0 (0)	677
Arvika	36 (5)	610 (91)	22 (3)	0 (0)	1 (0)	4 (1)	673
Bollnäs	9 (1)	953 (97)	16 (2)	1 (0)	0 (0)	2 (0)	981
Borås	3 (2)	179 (97)	1 (1)	0 (0)	2 (1)	0 (0)	185
Capio Artro Clinic	68 (4)	1,659 (96)	1 (0)	0 (0)	0 (0)	5 (0)	1,733
Capio Movement	1,424 (98)	10 (1)	10 (1)	0 (0)	1 (0)	11 (1)	1,456
Capio Ortopedi Motala	1,165 (80)	7 (0)	25 (2)	0 (0)	257 (18)	2 (0)	1,456
Capio Ortopediska Huset	337 (17)	1,611 (82)	9 (0)	0 (0)	0 (0)	3 (0)	1,960
Capio S:t Göran	534 (55)	46 (5)	23 (2)	361 (37)	4 (0)	0 (0)	968
Carlanderska	38 (4)	992 (95)	6 (1)	0 (0)	2 (0)	3 (0)	1,041
CarlanderskaSportsMed	6 (2)	318 (98)	0 (0)	0 (0)	0 (0)	0 (0)	324
Danderyd	327 (95)	4 (1)	9 (3)	0 (0)	3 (1)	3 (1)	346
Eksjö	187 (22)	2 (0)	6 (1)	0 (0)	654 (77)	5 (1)	854
Enköping	228 (19)	920 (78)	19 (2)	5 (0)	0 (0)	1 (0)	1,173
Eskilstuna	7 (5)	128 (91)	4 (3)	0 (0)	0 (0)	2 (1)	141
Falköping	2 (3)	66 (97)	0 (0)	0 (0)	0 (0)	0 (0)	68
Falun	324 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	324
Frölundaortopeden	1 (1)	70 (99)	0 (0)	0 (0)	0 (0)	0 (0)	71
GHP Ortho Center Göteborg	22 (3)	779 (97)	2 (0)	1 (0)	0 (0)	1 (0)	805
GHP Ortho Center Stockholm	74 (4)	1,948 (96)	10 (0)	0 (0)	0 (0)	2 (0)	2,034
Gällivare	4 (2)	197 (96)	1 (0)	0 (0)	1 (0)	2 (1)	205
Gävle	34 (13)	215 (82)	10 (4)	0 (0)	0 (0)	2 (1)	261
Halmstad	479 (98)	0 (0)	3 (1)	0 (0)	4 (1)	1 (0)	487
Helsingborg	268 (47)	279 (49)	19 (3)	1 (0)	0 (0)	3 (1)	570
Hermelinen	2 (3)	63 (97)	0 (0)	0 (0)	0 (0)	0 (0)	65
Hudiksvall	165 (98)	2 (1)	1 (1)	0 (0)	1 (1)	0 (0)	169
Hässleholm	2,275 (99)	3 (0)	27 (1)	1 (0)	0 (0)	0 (0)	2,306

The table continues on the next page.

Thrombosis prophylaxis in elective knee replacement – type of drug, per unit, cont.

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Kalmar	117 (58)	1 (0)	5 (2)	0 (0)	74 (37)	4 (2)	201
Karlshamn	589 (95)	16 (3)	14 (2)	2 (0)	1 (0)	0 (0)	622
Karlskoga	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1
Karlstad	11 (6)	161 (91)	3 (2)	0 (0)	0 (0)	1 (1)	176
Karolinska Huddinge	376 (93)	11 (3)	2 (0)	1 (0)	2 (0)	13 (3)	405
Karolinska Solna	50 (88)	2 (4)	2 (4)	0 (0)	2 (4)	1 (2)	57
Kullbergska sjukhuset	11 (1)	771 (96)	11 (1)	0 (0)	1 (0)	7 (1)	801
Kungälv	9 (2)	369 (97)	2 (1)	0 (0)	0 (0)	2 (1)	382
Lidköping	6 (2)	378 (97)	3 (1)	0 (0)	0 (0)	1 (0)	388
Lindesberg	216 (22)	739 (76)	13 (1)	0 (0)	0 (0)	0 (0)	968
Ljungby	9 (2)	345 (96)	5 (1)	2 (1)	0 (0)	0 (0)	361
Lycksele	442 (100)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	443
Mora	4 (1)	541 (98)	6 (1)	0 (0)	0 (0)	3 (1)	554
Norrköping	196 (64)	0 (0)	1 (0)	0 (0)	104 (34)	6 (2)	307
Norrtälje	418 (95)	5 (1)	16 (4)	0 (0)	0 (0)	0 (0)	439
Nyköping	1 (0)	289 (96)	10 (3)	0 (0)	1 (0)	0 (0)	301
Ortopediskt Center Sophiahemmet	362 (95)	0 (0)	3 (1)	0 (0)	0 (0)	17 (4)	382
Oskarshamn	449 (53)	4 (0)	16 (2)	0 (0)	382 (45)	2 (0)	853
Piteå	383 (40)	8 (1)	24 (2)	550 (57)	0 (0)	0 (0)	965
Skellefteå	122 (53)	110 (47)	0 (0)	0 (0)	0 (0)	0 (0)	232
Skene	1 (0)	363 (98)	8 (2)	0 (0)	0 (0)	0 (0)	372
Skövde	1 (3)	35 (95)	1 (3)	0 (0)	0 (0)	0 (0)	37
Sollefteå	339 (72)	116 (25)	12 (3)	0 (0)	1 (0)	3 (1)	471
Sophiahemmet	126 (97)	2 (2)	0 (0)	0 (0)	0 (0)	2 (2)	130
Specialistcenter S:t Johanniskliniken	0 (0)	13 (100)	0 (0)	0 (0)	0 (0)	0 (0)	13
Specialistcenter Scandinavia, Eskilstuna	1 (1)	80 (95)	3 (4)	0 (0)	0 (0)	0 (0)	84
SU/Mölndal	29 (4)	613 (94)	2 (0)	0 (0)	1 (0)	8 (1)	653
SU/Sahlgrenska	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	1 (33)	3
Sunderby sjukhus	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	1 (33)	3
Sundsvall	3 (4)	70 (91)	2 (3)	0 (0)	0 (0)	2 (3)	77
SUS/Lund	70 (93)	0 (0)	2 (3)	0 (0)	3 (4)	0 (0)	75

The table continues on the next page.

Thrombosis prophylaxis in elective knee replacement – type of drug, per unit, cont.

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Södersjukhuset	270 (80)	48 (14)	9 (3)	0 (0)	0 (0)	12 (4)	339
Södertälje	288 (93)	5 (2)	9 (3)	0 (0)	3 (1)	5 (2)	310
Torsby	28 (7)	355 (92)	2 (1)	0 (0)	0 (0)	0 (0)	385
Trelleborg	1,581 (100)	1 (0)	2 (0)	1 (0)	0 (0)	1 (0)	1,586
Uddevalla	187 (33)	370 (65)	10 (2)	0 (0)	1 (0)	2 (0)	570
Umeå	38 (11)	288 (86)	2 (1)	0 (0)	1 (0)	7 (2)	336
Varberg	411 (99)	0 (0)	2 (0)	0 (0)	2 (0)	2 (0)	417
Visby	7 (2)	275 (93)	10 (3)	1 (0)	0 (0)	3 (1)	296
Värnamo	243 (47)	3 (1)	5 (1)	0 (0)	265 (51)	3 (1)	519
Västervik	95 (33)	0 (0)	1 (0)	0 (0)	194 (67)	0 (0)	290
Västerås	46 (7)	602 (89)	21 (3)	4 (1)	1 (0)	2 (0)	676
Växjö	18 (8)	191 (90)	3 (1)	0 (0)	0 (0)	0 (0)	212
Ängelholm	3 (43)	4 (57)	0 (0)	0 (0)	0 (0)	0 (0)	7
Örebro	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	2
Örnsköldsvik	23 (8)	247 (89)	6 (2)	1 (0)	0 (0)	1 (0)	278
Östersund	308 (91)	1 (0)	7 (2)	0 (0)	24 (7)	0 (0)	340
Country	**16,860 (41)**	**21,046 (51)**	**525 (1)**	**934 (2)**	**1,996 (5)**	**175 (0)**	**41,536**

Tabell 9.1.1 b. Thrombosis prophylaxis in knee replacement – type of drug, per unit, 2019–2021.

Thrombosis prophylaxis in elective knee replacement – planned length of treatment start per unit

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	3 (2)	3 (2)	57 (33)	78 (45)	7 (4)	26 (15)	174
Aleris Specialistvård Nacka	9 (1)	2 (0)	190 (29)	443 (67)	5 (1)	12 (2)	661
Aleris Specialistvård Ängelholm	3 (0)	7 (1)	975 (92)	22 (2)	22 (2)	27 (3)	1,056
Alingsås	0 (0)	2 (0)	427 (98)	2 (0)	2 (0)	3 (1)	436
Art Clinic Göteborg	1 (0)	7 (1)	529 (95)	11 (2)	3 (1)	6 (1)	557
Art Clinic Jönköping	1 (0)	9 (1)	650 (96)	7 (1)	6 (1)	4 (1)	677
Arvika	10 (1)	14 (2)	615 (91)	4 (1)	22 (3)	8 (1)	673
Bollnäs	1 (0)	6 (1)	869 (89)	63 (6)	16 (2)	26 (3)	981
Borås	2 (1)	2 (1)	159 (86)	13 (7)	1 (1)	8 (4)	185
Capio Artro Clinic	8 (0)	22 (1)	1,648 (95)	49 (3)	1 (0)	5 (0)	1,733
Capio Movement	5 (0)	854 (59)	520 (36)	52 (4)	10 (1)	15 (1)	1,456
Capio Ortopedi Motala	258 (18)	26 (2)	14 (1)	1,121 (77)	25 (2)	12 (1)	1,456
Capio Ortopediska Huset	1 (0)	9 (0)	1,913 (98)	18 (1)	9 (0)	10 (1)	1,960
Capio S:t Göran	4 (0)	210 (22)	680 (70)	38 (4)	23 (2)	13 (1)	968
Carlanderska	7 (1)	39 (4)	913 (88)	58 (6)	6 (1)	18 (2)	1,041
CarlanderskaSportsMed	2 (1)	3 (1)	284 (88)	34 (10)	0 (0)	1 (0)	324
Danderyd	8 (2)	19 (5)	227 (66)	71 (21)	9 (3)	12 (3)	346
Eksjö	657 (77)	15 (2)	18 (2)	151 (18)	6 (1)	7 (1)	854
Enköping	2 (0)	6 (1)	671 (57)	432 (37)	19 (2)	43 (4)	1,173
Eskilstuna	1 (1)	2 (1)	37 (26)	93 (66)	4 (3)	4 (3)	141
Falköping	0 (0)	0 (0)	51 (75)	17 (25)	0 (0)	0 (0)	68
Falun	0 (0)	294 (91)	27 (8)	0 (0)	0 (0)	3 (1)	324
Frölundaortopeden	0 (0)	2 (3)	68 (96)	1 (1)	0 (0)	0 (0)	71
GHP Ortho Center Göteborg	1 (0)	5 (1)	766 (95)	28 (3)	2 (0)	3 (0)	805
GHP Ortho Center Stockholm	9 (0)	44 (2)	1,948 (96)	16 (1)	10 (0)	7 (0)	2,034
Gällivare	1 (0)	2 (1)	67 (33)	123 (60)	1 (0)	11 (5)	205
Gävle	1 (0)	5 (2)	202 (77)	27 (10)	10 (4)	16 (6)	261
Halmstad	4 (1)	7 (1)	464 (95)	8 (2)	3 (1)	1 (0)	487
Helsingborg	3 (1)	20 (4)	492 (86)	22 (4)	19 (3)	14 (2)	570
Hermelinen	0 (0)	0 (0)	1 (2)	64 (98)	0 (0)	0 (0)	65
Hudiksvall	1 (1)	4 (2)	115 (68)	46 (27)	1 (1)	2 (1)	169
Hässleholm	4 (0)	1,875 (81)	335 (15)	55 (2)	27 (1)	10 (0)	2,306

The table continues on the next page.

Thrombosis prophylaxis in elective knee replacement – planned length of treatment start per unit, cont.

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Kalmar	74 (37)	0 (0)	1 (0)	116 (58)	5 (2)	5 (2)	201
Karlshamn	1 (0)	9 (1)	548 (88)	31 (5)	14 (2)	19 (3)	622
Karlskoga	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1
Karlstad	0 (0)	6 (3)	153 (87)	10 (6)	3 (2)	4 (2)	176
Karolinska Huddinge	2 (0)	17 (4)	160 (40)	201 (50)	2 (0)	23 (6)	405
Karolinska Solna	4 (7)	4 (7)	1 (2)	45 (79)	2 (4)	1 (2)	57
Kullbergska sjukhuset	3 (0)	7 (1)	516 (64)	240 (30)	11 (1)	24 (3)	801
Kungälv	0 (0)	8 (2)	346 (91)	16 (4)	2 (1)	10 (3)	382
Lidköping	1 (0)	11 (3)	360 (93)	9 (2)	3 (1)	4 (1)	388
Lindesberg	1 (0)	26 (3)	390 (40)	533 (55)	13 (1)	5 (1)	968
Ljungby	1 (0)	2 (1)	19 (5)	318 (88)	5 (1)	16 (4)	361
Lycksele	2 (0)	0 (0)	170 (38)	253 (57)	1 (0)	17 (4)	443
Mora	2 (0)	2 (0)	517 (93)	8 (1)	6 (1)	19 (3)	554
Norrköping	104 (34)	6 (2)	2 (1)	186 (61)	1 (0)	8 (3)	307
Norrtälje	0 (0)	42 (10)	13 (3)	351 (80)	16 (4)	17 (4)	439
Nyköping	1 (0)	2 (1)	138 (46)	143 (48)	10 (3)	7 (2)	301
Ortopediskt Center Sophiahemmet	3 (1)	25 (7)	245 (64)	99 (26)	3 (1)	7 (2)	382
Oskarshamn	383 (45)	11 (1)	1 (0)	437 (51)	16 (2)	5 (1)	853
Piteå	0 (0)	210 (22)	627 (65)	93 (10)	24 (2)	11 (1)	965
Skellefteå	0 (0)	1 (0)	89 (38)	142 (61)	0 (0)	0 (0)	232
Skene	3 (1)	4 (1)	341 (92)	16 (4)	8 (2)	0 (0)	372
Skövde	0 (0)	0 (0)	30 (81)	5 (14)	1 (3)	1 (3)	37
Sollefteå	3 (1)	3 (1)	16 (3)	428 (91)	12 (3)	9 (2)	471
Sophiahemmet	0 (0)	2 (2)	80 (62)	46 (35)	0 (0)	2 (2)	130
Specialistcenter S:t Johanniskliniken	0 (0)	0 (0)	13 (100)	0 (0)	0 (0)	0 (0)	13
Specialistcenter Scandinavia, Eskilstuna	1 (1)	0 (0)	77 (92)	3 (4)	3 (4)	0 (0)	84
SU/Mölndal	5 (1)	8 (1)	592 (91)	28 (4)	2 (0)	18 (3)	653
SU/Sahlgrenska	0 (0)	0 (0)	1 (33)	1 (33)	0 (0)	1 (33)	3
Sunderby sjukhus	0 (0)	0 (0)	2 (67)	1 (33)	0 (0)	0 (0)	3
Sundsvall	0 (0)	2 (3)	0 (0)	68 (88)	2 (3)	5 (6)	77
SUS/Lund	3 (4)	12 (16)	51 (68)	4 (5)	2 (3)	3 (4)	75

The table continues on the next page.

Thrombosis prophylaxis in elective knee replacement – planned length of treatment start per unit, cont.

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Södersjukhuset	0 (0)	11 (3)	286 (84)	20 (6)	9 (3)	13 (4)	339
Södertälje	3 (1)	4 (1)	21 (7)	266 (86)	9 (3)	7 (2)	310
Torsby	1 (0)	5 (1)	338 (88)	34 (9)	2 (1)	5 (1)	385
Trelleborg	1 (0)	16 (1)	1,372 (87)	193 (12)	2 (0)	2 (0)	1,586
Uddevalla	4 (1)	18 (3)	522 (92)	11 (2)	10 (2)	5 (1)	570
Umeå	7 (2)	1 (0)	31 (9)	288 (86)	2 (1)	7 (2)	336
Varberg	2 (0)	7 (2)	400 (96)	3 (1)	2 (0)	3 (1)	417
Visby	4 (1)	0 (0)	8 (3)	259 (88)	10 (3)	15 (5)	296
Värnamo	265 (51)	10 (2)	28 (5)	205 (39)	5 (1)	6 (1)	519
Västervik	195 (67)	1 (0)	0 (0)	93 (32)	1 (0)	0 (0)	290
Västerås	1 (0)	13 (2)	124 (18)	480 (71)	21 (3)	37 (5)	676
Växjö	0 (0)	1 (0)	20 (9)	184 (87)	3 (1)	4 (2)	212
Ängelholm	0 (0)	1 (14)	6 (86)	0 (0)	0 (0)	0 (0)	7
Örebro	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Örnsköldsvik	2 (1)	19 (7)	4 (1)	239 (86)	6 (2)	8 (3)	278
Östersund	24 (7)	11 (3)	224 (66)	71 (21)	7 (2)	3 (1)	340
Country	**2,113 (5)**	**4,053 (10)**	**24,816 (60)**	**9,346 (23)**	**525 (1)**	**683 (2)**	**41,536**

Tabell 9.1.1 c. Thrombosis prophylaxis in knee replacement – planned length of treatment, per unit, 2019–2021.

Thrombosis prophylaxis in elective hip replacement – planned treatment start, per unit

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	2 (1)	228 (81)	49 (17)	0 (0)	2 (1)	281
Aleris Specialistvård Bollnäs	14 (5)	243 (90)	8 (3)	0 (0)	5 (2)	270
Aleris Specialistvård Motala	0 (0)	102 (97)	2 (2)	0 (0)	1 (1)	105
Aleris Specialistvård Nacka	7 (1)	928 (97)	22 (2)	0 (0)	3 (0)	960
Aleris Specialistvård Ängelholm	11 (1)	933 (93)	53 (5)	1 (0)	8 (1)	1,006
Alingsås	7 (2)	400 (94)	14 (3)	0 (0)	5 (1)	426
Art Clinic Göteborg	20 (3)	583 (94)	11 (2)	0 (0)	9 (1)	623
Art Clinic Jönköping	3 (0)	639 (97)	14 (2)	1 (0)	2 (0)	659
Arvika	8 (1)	603 (93)	30 (5)	0 (0)	9 (1)	650
Bollnäs	3 (0)	633 (96)	19 (3)	0 (0)	6 (1)	661
Borås	20 (10)	173 (84)	13 (6)	0 (0)	1 (0)	207
Capio Artro Clinic	15 (1)	1 521 (98)	3 (0)	1 (0)	13 (1)	1,553
Capio Movement	7 (1)	1 153 (94)	72 (6)	0 (0)	1 (0)	1,233
Capio Ortopedi Motala	9 (1)	583 (58)	70 (7)	318 (32)	24 (2)	1,004
Capio Ortopediska Huset	109 (5)	1,953 (94)	1 (0)	0 (0)	9 (0)	2,072
Capio S:t Göran	102 (8)	1,040 (85)	76 (6)	0 (0)	7 (1)	1,225
Carlanderska	30 (2)	1,361 (94)	50 (3)	0 (0)	10 (1)	1,451
Danderyd	62 (15)	292 (71)	53 (13)	2 (0)	0 (0)	409
Eksjö	62 (10)	364 (57)	19 (3)	181 (29)	9 (1)	635
Enköping	82 (6)	1,121 (86)	85 (7)	0 (0)	9 (1)	1,297
Eskilstuna	0 (0)	149 (81)	36 (19)	0 (0)	0 (0)	185
Falköping	6 (4)	135 (91)	8 (5)	0 (0)	0 (0)	149
Falun	15 (5)	253 (88)	18 (6)	0 (0)	1 (0)	287
Frölundaortopeden	1 (3)	38 (97)	0 (0)	0 (0)	0 (0)	39
GHP Ortho Center Göteborg	6 (1)	901 (98)	13 (1)	0 (0)	1 (0)	921
GHP Ortho Center Stockholm	1 (0)	2,276 (97)	70 (3)	0 (0)	2 (0)	2,349
Gällivare	5 (2)	189 (90)	15 (7)	0 (0)	0 (0)	209
Gävle	14 (4)	243 (78)	53 (17)	1 (0)	1 (0)	312
Halmstad	8 (2)	130 (28)	3 (1)	1 (0)	328 (70)	470
Helsingborg	6 (5)	103 (80)	19 (15)	0 (0)	0 (0)	128
Hermelinen	1 (1)	76 (99)	0 (0)	0 (0)	0 (0)	77
Hudiksvall	14 (7)	165 (86)	11 (6)	1 (1)	0 (0)	191

The table continues on the next page.

Thrombosis prophylaxis in elective hip replacement – planned treatment start, per unit, cont.

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Hässleholm	203 (10)	1,737 (83)	147 (7)	0 (0)	16 (1)	2,103
Jönköping	5 (2)	141 (54)	34 (13)	79 (30)	1 (0)	260
Kalmar	15 (5)	111 (40)	21 (8)	127 (46)	3 (1)	277
Karlshamn	19 (3)	633 (91)	27 (4)	0 (0)	14 (2)	693
Karlskoga	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1
Karlskrona	4 (10)	28 (70)	8 (20)	0 (0)	0 (0)	40
Karlstad	14 (7)	171 (86)	10 (5)	0 (0)	4 (2)	199
Karolinska Huddinge	28 (5)	422 (79)	77 (15)	0 (0)	4 (1)	531
Karolinska Solna	13 (12)	70 (62)	2 (2)	0 (0)	28 (25)	113
Kristianstad	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	3
Kullbergska sjukhuset	3 (0)	803 (92)	62 (7)	0 (0)	2 (0)	870
Kungälv	14 (4)	278 (87)	28 (9)	1 (0)	0 (0)	321
Lidköping	61 (12)	398 (79)	42 (8)	0 (0)	1 (0)	502
Lindesberg	125 (9)	1,069 (81)	132 (10)	0 (0)	0 (0)	1,326
Linköping	1 (0)	98 (38)	15 (6)	87 (34)	57 (22)	258
Ljungby	221 (61)	56 (16)	19 (5)	0 (0)	65 (18)	361
Lycksele	528 (70)	182 (24)	14 (2)	0 (0)	33 (4)	757
Mora	13 (2)	582 (90)	49 (8)	0 (0)	1 (0)	645
Norrköping	157 (34)	117 (26)	31 (7)	152 (33)	1 (0)	458
Norrtälje	54 (13)	306 (75)	46 (11)	0 (0)	3 (1)	409
Nyköping	3 (1)	292 (89)	29 (9)	1 (0)	2 (1)	327
NÄL	1 (8)	0 (0)	0 (0)	0 (0)	12 (92)	13
Oskarshamn	1 (0)	560 (57)	78 (8)	338 (35)	2 (0)	979
Piteå	86 (7)	1,035 (87)	69 (6)	0 (0)	2 (0)	1,192
Skellefteå	1 (0)	303 (100)	0 (0)	0 (0)	0 (0)	304
Skene	15 (3)	399 (93)	11 (3)	0 (0)	5 (1)	430
Skövde	6 (10)	43 (69)	13 (21)	0 (0)	0 (0)	62
Sollefteå	56 (6)	787 (88)	45 (5)	0 (0)	2 (0)	890
Sophiahemmet	4 (1)	729 (99)	5 (1)	0 (0)	0 (0)	738
Specialistcenter Scandinavia, Eskilstuna	6 (5)	102 (89)	6 (5)	0 (0)	0 (0)	114
SU/Mölndal	12 (1)	859 (89)	94 (10)	0 (0)	0 (0)	965

The table continues on the next page.

Thrombosis prophylaxis in elective hip replacement – planned treatment start, per unit, cont.

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Sunderby sjukhus	0 (0)	4 (44)	1 (11)	0 (0)	4 (44)	9
Sundsvall	11 (23)	29 (60)	3 (6)	0 (0)	5 (10)	48
SUS/Lund	35 (26)	81 (60)	18 (13)	0 (0)	0 (0)	134
SUS/Malmö	1 (20)	1 (20)	1 (20)	1 (20)	1 (20)	5
Södersjukhuset	132 (34)	142 (37)	105 (27)	0 (0)	4 (1)	383
Södertälje	6 (2)	301 (89)	32 (9)	0 (0)	0 (0)	339
Torsby	7 (2)	331 (94)	13 (4)	0 (0)	2 (1)	353
Trelleborg	35 (3)	1,293 (97)	6 (0)	0 (0)	1 (0)	1,335
Uddevalla	6 (1)	116 (14)	17 (2)	0 (0)	674 (83)	813
Umeå	19 (12)	111 (71)	1 (1)	0 (0)	26 (17)	157
Varberg	3 (1)	500 (90)	51 (9)	0 (0)	2 (0)	556
Visby	20 (5)	335 (89)	18 (5)	0 (0)	2 (1)	375
Värnamo	13 (3)	101 (24)	43 (10)	259 (62)	0 (0)	416
Västervik	19 (5)	148 (41)	25 (7)	165 (46)	3 (1)	360
Västerås	9 (1)	804 (89)	77 (9)	1 (0)	9 (1)	900
Växjö	30 (9)	303 (87)	13 (4)	0 (0)	2 (1)	348
Ystad	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1
Ängelholm	15 (3)	410 (91)	25 (6)	0 (0)	0 (0)	450
Örebro	2 (15)	5 (38)	6 (46)	0 (0)	0 (0)	13
Örnsköldsvik	7 (2)	266 (86)	35 (11)	0 (0)	0 (0)	308
Östersund	10 (2)	450 (89)	40 (8)	0 (0)	4 (1)	504
Country	**2,700 (6)**	**37,554 (82)**	**2,554 (6)**	**1,718 (4)**	**1,466 (3)**	**45,992**

Tabell 9.1.2 a. Thrombosis prophylaxis in elective hip replacement – planned treatment start, per unit, 2019–2021.

Thrombosis prophylaxis in elective hip replacement – type of drug, per unit

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	30 (11)	197 (70)	49 (17)	3 (1)	0 (0)	2 (1)	281
Aleris Specialistvård Bollnäs	2 (1)	255 (94)	8 (3)	0 (0)	0 (0)	5 (2)	270
Aleris Specialistvård Motala	102 (97)	0 (0)	2 (2)	0 (0)	0 (0)	1 (1)	105
Aleris Specialistvård Nacka	733 (76)	202 (21)	22 (2)	0 (0)	0 (0)	3 (0)	960
Aleris Specialistvård Ängelholm	1 (0)	942 (94)	53 (5)	0 (0)	1 (0)	9 (1)	1,006
Alingsås	406 (95)	1 (0)	14 (3)	0 (0)	0 (0)	5 (1)	426
Art Clinic Göteborg	2 (0)	601 (96)	11 (2)	0 (0)	0 (0)	9 (1)	623
Art Clinic Jönköping	33 (5)	609 (92)	14 (2)	0 (0)	1 (0)	2 (0)	659
Arvika	23 (4)	580 (89)	30 (5)	1 (0)	0 (0)	16 (2)	650
Bollnäs	3 (0)	633 (96)	19 (3)	0 (0)	0 (0)	6 (1)	661
Borås	15 (7)	178 (86)	13 (6)	0 (0)	0 (0)	1 (0)	207
Capio Artro Clinic	388 (25)	1,143 (74)	3 (0)	0 (0)	1 (0)	18 (1)	1,553
Capio Movement	1,147 (93)	11 (1)	72 (6)	0 (0)	0 (0)	3 (0)	1,233
Capio Ortopedi Motala	588 (59)	1 (0)	70 (7)	0 (0)	318 (32)	27 (3)	1,004
Capio Ortopediska Huset	2,062 (100)	0 (0)	1 (0)	0 (0)	0 (0)	9 (0)	2,072
Capio S:t Göran	1,119 (91)	23 (2)	76 (6)	0 (0)	0 (0)	7 (1)	1,225
Carlanderska	22 (2)	1,364 (94)	50 (3)	1 (0)	0 (0)	14 (1)	1,451
Danderyd	350 (86)	4 (1)	53 (13)	0 (0)	2 (0)	0 (0)	409
Eksjö	425 (67)	0 (0)	19 (3)	0 (0)	181 (29)	10 (2)	635
Enköping	242 (19)	956 (74)	85 (7)	5 (0)	0 (0)	9 (1)	1,297
Eskilstuna	16 (9)	133 (72)	36 (19)	0 (0)	0 (0)	0 (0)	185
Falköping	6 (4)	135 (91)	8 (5)	0 (0)	0 (0)	0 (0)	149
Falun	267 (93)	0 (0)	18 (6)	0 (0)	0 (0)	2 (1)	287
Frölundaortopeden	1 (3)	38 (97)	0 (0)	0 (0)	0 (0)	0 (0)	39
GHP Ortho Center Göteborg	9 (1)	898 (98)	13 (1)	0 (0)	0 (0)	1 (0)	921
GHP Ortho Center Stockholm	68 (3)	2,206 (94)	70 (3)	0 (0)	0 (0)	5 (0)	2,349
Gällivare	1 (0)	193 (92)	15 (7)	0 (0)	0 (0)	0 (0)	209
Gävle	22 (7)	234 (75)	53 (17)	0 (0)	1 (0)	2 (1)	312
Halmstad	138 (29)	0 (0)	3 (1)	0 (0)	1 (0)	328 (70)	470
Helsingborg	39 (30)	70 (55)	19 (15)	0 (0)	0 (0)	0 (0)	128
Hermelinen	1 (1)	76 (99)	0 (0)	0 (0)	0 (0)	0 (0)	77
Hudiksvall	178 (93)	1 (1)	11 (6)	0 (0)	1 (1)	0 (0)	191

The table continues on the next page.

Thrombosis prophylaxis in elective hip replacement – type of drug, per unit, cont.

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Hässleholm	1,939 (92)	0 (0)	147 (7)	0 (0)	0 (0)	17 (1)	2,103
Jönköping	145 (56)	1 (0)	34 (13)	0 (0)	79 (30)	1 (0)	260
Kalmar	126 (45)	0 (0)	21 (8)	0 (0)	127 (46)	3 (1)	277
Karlshamn	646 (93)	0 (0)	27 (4)	0 (0)	0 (0)	20 (3)	693
Karlskoga	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
Karlskrona	32 (80)	0 (0)	8 (20)	0 (0)	0 (0)	0 (0)	40
Karlstad	12 (6)	173 (87)	10 (5)	0 (0)	0 (0)	4 (2)	199
Karolinska Huddinge	438 (82)	12 (2)	77 (15)	0 (0)	0 (0)	4 (1)	531
Karolinska Solna	81 (72)	1 (1)	2 (2)	0 (0)	0 (0)	29 (26)	113
Kristianstad	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	3
Kullbergska sjukhuset	3 (0)	803 (92)	62 (7)	0 (0)	0 (0)	2 (0)	870
Kungälv	4 (1)	288 (90)	28 (9)	0 (0)	1 (0)	0 (0)	321
Lidköping	8 (2)	451 (90)	42 (8)	0 (0)	0 (0)	1 (0)	502
Lindesberg	190 (14)	1,004 (76)	132 (10)	0 (0)	0 (0)	0 (0)	1,326
Linköping	99 (38)	0 (0)	15 (6)	0 (0)	87 (34)	57 (22)	258
Ljungby	8 (2)	269 (75)	19 (5)	0 (0)	0 (0)	65 (18)	361
Lycksele	700 (92)	6 (1)	14 (2)	0 (0)	0 (0)	37 (5)	757
Mora	4 (1)	591 (92)	49 (8)	0 (0)	0 (0)	1 (0)	645
Norrköping	273 (60)	1 (0)	31 (7)	0 (0)	152 (33)	1 (0)	458
Norrtälje	357 (87)	3 (1)	46 (11)	0 (0)	0 (0)	3 (1)	409
Nyköping	4 (1)	291 (89)	29 (9)	0 (0)	1 (0)	2 (1)	327
NÄL	1 (8)	0 (0)	0 (0)	0 (0)	0 (0)	12 (92)	13
Oskarshamn	557 (57)	4 (0)	78 (8)	0 (0)	338 (35)	2 (0)	979
Piteå	167 (14)	951 (80)	69 (6)	0 (0)	0 (0)	5 (0)	1,192
Skellefteå	111 (37)	193 (63)	0 (0)	0 (0)	0 (0)	0 (0)	304
Skene	1 (0)	413 (96)	11 (3)	0 (0)	0 (0)	5 (1)	430
Skövde	2 (3)	47 (76)	13 (21)	0 (0)	0 (0)	0 (0)	62
Sollefteå	503 (57)	340 (38)	45 (5)	0 (0)	0 (0)	2 (0)	890
Sophiahemmet	707 (96)	26 (4)	5 (1)	0 (0)	0 (0)	0 (0)	738
Specialistcenter Scandinavia, Eskilstuna	0 (0)	108 (95)	6 (5)	0 (0)	0 (0)	0 (0)	114
SU/Mölndal	73 (8)	798 (83)	94 (10)	0 (0)	0 (0)	0 (0)	965

The table continues on the next page.

Thrombosis prophylaxis in elective hip replacement – type of drug, per unit, cont.

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Sunderby sjukhus	4 (44)	0 (0)	1 (11)	0 (0)	0 (0)	4 (44)	9
Sundsvall	20 (42)	19 (40)	3 (6)	0 (0)	0 (0)	6 (12)	48
SUS/Lund	116 (87)	0 (0)	18 (13)	0 (0)	0 (0)	0 (0)	134
SUS/Malmö	2 (40)	0 (0)	1 (20)	0 (0)	1 (20)	1 (20)	5
Södersjukhuset	190 (50)	84 (22)	105 (27)	0 (0)	0 (0)	4 (1)	383
Södertälje	304 (90)	3 (1)	32 (9)	0 (0)	0 (0)	0 (0)	339
Torsby	22 (6)	316 (90)	13 (4)	0 (0)	0 (0)	2 (1)	353
Trelleborg	1,328 (99)	0 (0)	6 (0)	0 (0)	0 (0)	1 (0)	1 335
Uddevalla	9 (1)	111 (14)	17 (2)	0 (0)	0 (0)	676 (83)	813
Umeå	44 (28)	86 (55)	1 (1)	0 (0)	0 (0)	26 (17)	157
Varberg	501 (90)	0 (0)	51 (9)	0 (0)	0 (0)	4 (1)	556
Visby	7 (2)	348 (93)	18 (5)	0 (0)	0 (0)	2 (1)	375
Värnamo	114 (27)	0 (0)	43 (10)	0 (0)	259 (62)	0 (0)	416
Västervik	164 (46)	3 (1)	25 (7)	0 (0)	165 (46)	3 (1)	360
Västerås	95 (11)	718 (80)	77 (9)	0 (0)	1 (0)	9 (1)	900
Växjö	22 (6)	311 (89)	13 (4)	0 (0)	0 (0)	2 (1)	348
Ystad	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
Ängelholm	206 (46)	219 (49)	25 (6)	0 (0)	0 (0)	0 (0)	450
Örebro	7 (54)	0 (0)	6 (46)	0 (0)	0 (0)	0 (0)	13
Örnsköldsvik	11 (4)	262 (85)	35 (11)	0 (0)	0 (0)	0 (0)	308
Östersund	456 (90)	3 (1)	40 (8)	0 (0)	0 (0)	5 (1)	504
Country	**19,254 (42)**	**20,941 (46)**	**2,554 (6)**	**10 (0)**	**1,718 (4)**	**1,515 (3)**	**45,992**

Tabell 9.1.2 b. Thrombosis prophylaxis in elective hip replacement – type of drug, per unit, 2019–2021.

Thrombosis prophylaxis in elective hip replacement – planned length of treatment start per unit

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	0 (0)	1 (0)	2 (1)	223 (79)	49 (17)	6 (2)	281
Aleris Specialistvård Bollnäs	0 (0)	2 (1)	3 (1)	252 (93)	8 (3)	5 (2)	270
Aleris Specialistvård Motala	0 (0)	2 (2)	0 (0)	100 (95)	2 (2)	1 (1)	105
Aleris Specialistvård Nacka	0 (0)	3 (0)	1 (0)	920 (96)	22 (2)	14 (1)	960
Aleris Specialistvård Ängelholm	1 (0)	3 (0)	917 (91)	16 (2)	53 (5)	16 (2)	1,006
Alingsås	0 (0)	0 (0)	2 (0)	401 (94)	14 (3)	9 (2)	426
Art Clinic Göteborg	0 (0)	0 (0)	3 (0)	599 (96)	11 (2)	10 (2)	623
Art Clinic Jönköping	1 (0)	0 (0)	1 (0)	639 (97)	14 (2)	4 (1)	659
Arvika	0 (0)	8 (1)	11 (2)	493 (76)	30 (5)	108 (17)	650
Bollnäs	0 (0)	0 (0)	3 (0)	633 (96)	19 (3)	6 (1)	661
Borås	0 (0)	2 (1)	3 (1)	186 (90)	13 (6)	3 (1)	207
Capio Artro Clinic	1 (0)	385 (25)	2 (0)	1,132 (73)	3 (0)	30 (2)	1,553
Capio Movement	0 (0)	683 (55)	449 (36)	20 (2)	72 (6)	9 (1)	1,233
Capio Ortopedi Motala	318 (32)	10 (1)	1 (0)	553 (55)	70 (7)	52 (5)	1,004
Capio Ortopediska Huset	0 (0)	1,995 (96)	1 (0)	12 (1)	1 (0)	63 (3)	2,072
Capio S:t Göran	0 (0)	1,025 (84)	89 (7)	27 (2)	76 (6)	8 (1)	1,225
Carlanderska	0 (0)	173 (12)	19 (1)	1 066 (73)	50 (3)	143 (10)	1,451
Danderyd	2 (0)	6 (1)	3 (1)	329 (80)	53 (13)	16 (4)	409
Eksjö	181 (29)	6 (1)	22 (3)	386 (61)	19 (3)	21 (3)	635
Enköping	0 (0)	222 (17)	8 (1)	964 (74)	85 (7)	18 (1)	1,297
Eskilstuna	0 (0)	2 (1)	1 (1)	145 (78)	36 (19)	1 (1)	185
Falköping	0 (0)	1 (1)	1 (1)	139 (93)	8 (5)	0 (0)	149
Falun	0 (0)	87 (30)	177 (62)	2 (1)	18 (6)	3 (1)	287
Frölundaortopeden	0 (0)	0 (0)	4 (10)	33 (85)	0 (0)	2 (5)	39
GHP Ortho Center Göteborg	0 (0)	4 (0)	16 (2)	881 (96)	13 (1)	7 (1)	921
GHP Ortho Center Stockholm	0 (0)	65 (3)	1 (0)	2,205 (94)	70 (3)	8 (0)	2,349
Gällivare	0 (0)	0 (0)	0 (0)	194 (93)	15 (7)	0 (0)	209
Gävle	1 (0)	9 (3)	3 (1)	241 (77)	53 (17)	5 (2)	312
Halmstad	1 (0)	6 (1)	126 (27)	3 (1)	3 (1)	331 (70)	470
Helsingborg	0 (0)	2 (2)	38 (30)	69 (54)	19 (15)	0 (0)	128
Hermelinen	0 (0)	0 (0)	0 (0)	76 (99)	0 (0)	1 (1)	77
Hudiksvall	1 (1)	1 (1)	2 (1)	176 (92)	11 (6)	0 (0)	191

The table continues on the next page.

Thrombosis prophylaxis in elective hip replacement – planned length of treatment start per unit, cont.

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Hässleholm	0 (0)	1,620 (77)	185 (9)	129 (6)	147 (7)	22 (1)	2,103
Jönköping	79 (30)	0 (0)	1 (0)	143 (55)	34 (13)	3 (1)	260
Kalmar	127 (46)	2 (1)	0 (0)	123 (44)	21 (8)	4 (1)	277
Karlshamn	0 (0)	3 (0)	1 (0)	635 (92)	27 (4)	27 (4)	693
Karlskoga	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	1
Karlskrona	0 (0)	0 (0)	0 (0)	31 (78)	8 (20)	1 (2)	40
Karlstad	0 (0)	3 (2)	3 (2)	173 (87)	10 (5)	10 (5)	199
Karolinska Huddinge	0 (0)	3 (1)	1 (0)	441 (83)	77 (15)	9 (2)	531
Karolinska Solna	0 (0)	5 (4)	0 (0)	58 (51)	2 (2)	48 (42)	113
Kristianstad	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	3
Kullbergska sjukhuset	0 (0)	1 (0)	1 (0)	802 (92)	62 (7)	4 (0)	870
Kungälv	1 (0)	2 (1)	2 (1)	287 (89)	28 (9)	1 (0)	321
Lidköping	0 (0)	3 (1)	9 (2)	446 (89)	42 (8)	2 (0)	502
Lindesberg	0 (0)	7 (1)	4 (0)	1,183 (89)	132 (10)	0 (0)	1,326
Linköping	87 (34)	1 (0)	3 (1)	91 (35)	15 (6)	61 (24)	258
Ljungby	0 (0)	3 (1)	0 (0)	274 (76)	19 (5)	65 (18)	361
Lycksele	0 (0)	1 (0)	0 (0)	691 (91)	14 (2)	51 (7)	757
Mora	0 (0)	2 (0)	0 (0)	592 (92)	49 (8)	2 (0)	645
Norrköping	152 (33)	4 (1)	7 (2)	261 (57)	31 (7)	3 (1)	458
Norrtälje	0 (0)	113 (28)	0 (0)	245 (60)	46 (11)	5 (1)	409
Nyköping	1 (0)	3 (1)	0 (0)	291 (89)	29 (9)	3 (1)	327
NÄL	0 (0)	0 (0)	0 (0)	1 (8)	0 (0)	12 (92)	13
Oskarshamn	338 (35)	2 (0)	1 (0)	551 (56)	78 (8)	9 (1)	979
Piteå	0 (0)	134 (11)	0 (0)	976 (82)	69 (6)	13 (1)	1,192
Skellefteå	0 (0)	0 (0)	0 (0)	304 (100)	0 (0)	0 (0)	304
Skene	0 (0)	1 (0)	3 (1)	404 (94)	11 (3)	11 (3)	430
Skövde	0 (0)	1 (2)	0 (0)	47 (76)	13 (21)	1 (2)	62
Sollefteå	0 (0)	7 (1)	47 (5)	787 (88)	45 (5)	4 (0)	890
Sophiahemmet	0 (0)	430 (58)	27 (4)	276 (37)	5 (1)	0 (0)	738
Specialistcenter Scandinavia, Eskilstuna	0 (0)	0 (0)	80 (70)	25 (22)	6 (5)	3 (3)	114
SU/Mölndal	0 (0)	8 (1)	1 (0)	861 (89)	94 (10)	1 (0)	965

The table continues on the next page.

Thrombosis prophylaxis in elective hip replacement – planned length of treatment start per unit, cont.

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Sunderby sjukhus	0 (0)	0 (0)	0 (0)	4 (44)	1 (11)	4 (44)	9
Sundsvall	0 (0)	1 (2)	3 (6)	29 (60)	3 (6)	12 (25)	48
SUS/Lund	0 (0)	5 (4)	97 (72)	14 (10)	18 (13)	0 (0)	134
SUS/Malmö	1 (20)	0 (0)	2 (40)	0 (0)	1 (20)	1 (20)	5
Södersjukhuset	0 (0)	93 (24)	11 (3)	170 (44)	105 (27)	4 (1)	383
Södertälje	0 (0)	3 (1)	2 (1)	301 (89)	32 (9)	1 (0)	339
Torsby	0 (0)	8 (2)	5 (1)	324 (92)	13 (4)	3 (1)	353
Trelleborg	0 (0)	12 (1)	1,274 (95)	41 (3)	6 (0)	2 (0)	1,335
Uddevalla	0 (0)	6 (1)	6 (1)	107 (13)	17 (2)	677 (83)	813
Umeå	0 (0)	0 (0)	1 (1)	124 (79)	1 (1)	31 (20)	157
Varberg	0 (0)	0 (0)	500 (90)	1 (0)	51 (9)	4 (1)	556
Visby	0 (0)	0 (0)	1 (0)	351 (94)	18 (5)	5 (1)	375
Värnamo	259 (62)	0 (0)	3 (1)	110 (26)	43 (10)	1 (0)	416
Västervik	165 (46)	8 (2)	0 (0)	153 (42)	25 (7)	9 (2)	360
Västerås	1 (0)	13 (1)	18 (2)	776 (86)	77 (9)	15 (2)	900
Växjö	0 (0)	2 (1)	1 (0)	326 (94)	13 (4)	6 (2)	348
Ystad	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1
Ängelholm	0 (0)	7 (2)	196 (44)	220 (49)	25 (6)	2 (0)	450
Örebro	0 (0)	0 (0)	0 (0)	6 (46)	6 (46)	1 (8)	13
Örnsköldsvik	0 (0)	2 (1)	0 (0)	271 (88)	35 (11)	0 (0)	308
Östersund	0 (0)	2 (0)	398 (79)	44 (9)	40 (8)	20 (4)	504
Country	**1,718 (4)**	**7,224 (16)**	**4 ,804 (10)**	**27,616 (60)**	**2,554 (6)**	**2,076 (5)**	**45,992**

Tabell 9.1.2 c. Thrombosis prophylaxis in elective hip replacement – planned length of treatment, per unit, 2019–2021.

Thrombosis prophylaxis in hip fracture – planned treatment start, per unit

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	4 (1)	554 (78)	145 (20)	5 (1)	3 (0)	711
Aleris Specialistvård Motala	0 (0)	3 (60)	1 (20)	0 (0)	1 (20)	5
Aleris Specialistvård Ängelholm	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	3
Alingsås	9 (6)	136 (88)	6 (4)	0 (0)	4 (3)	155
Art Clinic Göteborg	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Arvika	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Bollnäs	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Borås	148 (36)	231 (57)	27 (7)	0 (0)	0 (0)	406
Capio Ortopedi Motala	0 (0)	2 (67)	0 (0)	1 (33)	0 (0)	3
Capio Ortopediska Huset	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1
Capio S:t Göran	137 (22)	367 (60)	96 (16)	0 (0)	10 (2)	610
Carlanderska	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Danderyd	262 (30)	509 (59)	89 (10)	1 (0)	6 (1)	867
Eksjö	45 (28)	93 (58)	7 (4)	2 (1)	12 (8)	159
Enköping	2 (33)	4 (67)	0 (0)	0 (0)	0 (0)	6
Eskilstuna	1 (0)	253 (78)	71 (22)	1 (0)	0 (0)	326
Falun	212 (55)	122 (32)	51 (13)	0 (0)	2 (1)	387
GHP Ortho Center Stockholm	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Gällivare	59 (39)	73 (48)	19 (13)	0 (0)	0 (0)	151
Gävle	98 (21)	329 (69)	44 (9)	1 (0)	5 (1)	477
Halmstad	37 (11)	94 (27)	7 (2)	3 (1)	209 (60)	350
Helsingborg	109 (18)	450 (76)	34 (6)	0 (0)	0 (0)	593
Hermelinen	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Hudiksvall	56 (20)	186 (67)	33 (12)	0 (0)	2 (1)	277
Hässleholm	1 (2)	33 (80)	6 (15)	0 (0)	1 (2)	41
Jönköping	69 (28)	123 (49)	52 (21)	3 (1)	3 (1)	250
Kalmar	35 (12)	219 (73)	36 (12)	8 (3)	2 (1)	300
Karlshamn	0 (0)	3 (75)	1 (25)	0 (0)	0 (0)	4
Karlskoga	109 (41)	100 (37)	57 (21)	0 (0)	3 (1)	269
Karlskrona	107 (25)	267 (62)	55 (13)	1 (0)	4 (1)	434
Karlstad	257 (46)	122 (22)	45 (8)	1 (0)	139 (25)	564
Karolinska Huddinge	129 (32)	203 (50)	62 (15)	1 (0)	10 (2)	405

The table continues on the next page.

Thrombosis prophylaxis in hip fracture – planned treatment start, per unit, cont.

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Karolinska Solna	9 (20)	13 (28)	1 (2)	1 (2)	22 (48)	46
Kristianstad	96 (23)	46 (11)	0 (0)	0 (0)	277 (66)	419
Kullbergska sjukhuset	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1
Kungälv	45 (18)	162 (66)	34 (14)	2 (1)	1 (0)	244
Lidköping	100 (57)	63 (36)	10 (6)	1 (1)	1 (1)	175
Lindesberg	127 (55)	60 (26)	44 (19)	1 (0)	1 (0)	233
Linköping	37 (8)	229 (51)	114 (25)	2 (0)	69 (15)	451
Ljungby	23 (18)	64 (50)	17 (13)	1 (1)	22 (17)	127
Lycksele	59 (58)	21 (21)	7 (7)	1 (1)	14 (14)	102
Mora	86 (36)	108 (45)	45 (19)	0 (0)	1 (0)	240
Norrköping	135 (40)	160 (47)	27 (8)	18 (5)	0 (0)	340
Norrtälje	19 (13)	96 (66)	28 (19)	2 (1)	0 (0)	145
Nyköping	5 (3)	153 (78)	30 (15)	2 (1)	7 (4)	197
NÄL	29 (4)	27 (4)	6 (1)	0 (0)	675 (92)	737
Oskarshamn	0 (0)	6 (86)	1 (14)	0 (0)	0 (0)	7
Piteå	3 (11)	21 (78)	3 (11)	0 (0)	0 (0)	27
Skellefteå	2 (1)	198 (99)	0 (0)	0 (0)	0 (0)	200
Skene	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
Skövde	238 (61)	108 (28)	42 (11)	0 (0)	0 (0)	388
Sollefteå	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	2
SU/Mölndal	27 (2)	905 (77)	244 (21)	1 (0)	0 (0)	1,177
Sunderby sjukhus	130 (26)	226 (46)	29 (6)	0 (0)	106 (22)	491
Sundsvall	94 (28)	187 (56)	20 (6)	2 (1)	33 (10)	336
SUS/Lund	252 (42)	246 (41)	103 (17)	0 (0)	2 (0)	603
SUS/Malmö	333 (49)	245 (36)	65 (10)	2 (0)	39 (6)	684
Södersjukhuset	474 (48)	296 (30)	211 (21)	2 (0)	2 (0)	985
Södertälje	18 (8)	184 (82)	23 (10)	0 (0)	0 (0)	225
Torsby	36 (42)	31 (36)	19 (22)	0 (0)	0 (0)	86
Trelleborg	0 (0)	32 (97)	0 (0)	0 (0)	1 (3)	33
Uddevalla	0 (0)	2 (10)	1 (5)	0 (0)	17 (85)	20
Umeå	107 (33)	94 (29)	3 (1)	4 (1)	121 (37)	329
Varberg	1 (0)	254 (70)	107 (29)	0 (0)	2 (1)	364

The table continues on the next page.

Thrombosis prophylaxis in hip fracture – planned treatment start, per unit, cont.

Unit	Start preop Number (%)	Start postop Number (%)	Long-term treatment Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Visby	27 (19)	89 (63)	22 (15)	1 (1)	3 (2)	142
Värnamo	53 (36)	70 (47)	18 (12)	6 (4)	1 (1)	148
Västervik	34 (16)	137 (64)	28 (13)	10 (5)	6 (3)	215
Västerås	1 (0)	441 (79)	97 (17)	6 (1)	13 (2)	558
Växjö	145 (51)	114 (40)	21 (7)	2 (1)	2 (1)	284
Ystad	91 (36)	42 (16)	37 (14)	1 (0)	85 (33)	256
Ängelholm	1 (11)	7 (78)	1 (11)	0 (0)	0 (0)	9
Örebro	22 (15)	82 (57)	27 (19)	3 (2)	9 (6)	143
Örnsköldsvik	14 (6)	174 (70)	56 (23)	1 (0)	2 (1)	247
Östersund	113 (37)	140 (46)	33 (11)	0 (0)	16 (5)	302
Country	**4,872 (25)**	**10,030 (51)**	**2,518 (13)**	**100 (1)**	**1,966 (10)**	**19,486**

Tabell 9.1.3 a. Thrombosis prophylaxis in hip fracture – planned treatment start, per unit, 2019–2021.

Thrombosis prophylaxis in hip fracture – type of drug, per unit

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	524 (74)	34 (5)	145 (20)	0 (0)	5 (1)	3 (0)	711
Aleris Specialistvård Motala	3 (60)	0 (0)	1 (20)	0 (0)	0 (0)	1 (20)	5
Aleris Specialistvård Ängelholm	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	3
Alingsås	145 (94)	0 (0)	6 (4)	0 (0)	0 (0)	4 (3)	155
Art Clinic Göteborg	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	2
Arvika	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	2
Bollnäs	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	2
Borås	347 (85)	29 (7)	27 (7)	0 (0)	0 (0)	3 (1)	406
Capio Ortopedi Motala	2 (67)	0 (0)	0 (0)	0 (0)	1 (33)	0 (0)	3
Capio Ortopediska Huset	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
Capio S:t Göran	497 (81)	6 (1)	96 (16)	0 (0)	0 (0)	11 (2)	610
Carlanderska	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	2
Danderyd	765 (88)	4 (0)	89 (10)	0 (0)	1 (0)	8 (1)	867
Eksjö	135 (85)	2 (1)	7 (4)	0 (0)	2 (1)	13 (8)	159
Enköping	3 (50)	3 (50)	0 (0)	0 (0)	0 (0)	0 (0)	6
Eskilstuna	248 (76)	6 (2)	71 (22)	0 (0)	1 (0)	0 (0)	326
Falun	333 (86)	0 (0)	51 (13)	0 (0)	0 (0)	3 (1)	387
GHP Ortho Center Stockholm	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	2
Gällivare	121 (80)	11 (7)	19 (13)	0 (0)	0 (0)	0 (0)	151
Gävle	405 (85)	22 (5)	44 (9)	0 (0)	1 (0)	5 (1)	477
Halmstad	130 (37)	0 (0)	7 (2)	0 (0)	3 (1)	210 (60)	350
Helsingborg	547 (92)	12 (2)	34 (6)	0 (0)	0 (0)	0 (0)	593
Hermelinen	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	2
Hudiksvall	242 (87)	0 (0)	33 (12)	0 (0)	0 (0)	2 (1)	277
Hässleholm	34 (83)	0 (0)	6 (15)	0 (0)	0 (0)	1 (2)	41
Jönköping	190 (76)	2 (1)	52 (21)	0 (0)	3 (1)	3 (1)	250
Kalmar	254 (85)	0 (0)	36 (12)	0 (0)	8 (3)	2 (1)	300
Karlshamn	3 (75)	0 (0)	1 (25)	0 (0)	0 (0)	0 (0)	4
Karlskoga	209 (78)	0 (0)	57 (21)	0 (0)	0 (0)	3 (1)	269
Karlskrona	373 (86)	1 (0)	55 (13)	0 (0)	1 (0)	4 (1)	434
Karlstad	367 (65)	10 (2)	45 (8)	0 (0)	1 (0)	141 (25)	564
Karolinska Huddinge	332 (82)	0 (0)	62 (15)	0 (0)	1 (0)	10 (2)	405

The table continues on the next page.

Thrombosis prophylaxis in hip fracture – type of drug, per unit, cont.

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Karolinska Solna	19 (41)	2 (4)	1 (2)	0 (0)	1 (2)	23 (50)	46
Kristianstad	142 (34)	0 (0)	0 (0)	0 (0)	0 (0)	277 (66)	419
Kullbergska sjukhuset	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1
Kungälv	148 (61)	59 (24)	34 (14)	0 (0)	2 (1)	1 (0)	244
Lidköping	135 (77)	28 (16)	10 (6)	0 (0)	1 (1)	1 (1)	175
Lindesberg	163 (70)	24 (10)	44 (19)	0 (0)	1 (0)	1 (0)	233
Linköping	266 (59)	0 (0)	114 (25)	0 (0)	2 (0)	69 (15)	451
Ljungby	75 (59)	12 (9)	17 (13)	0 (0)	1 (1)	22 (17)	127
Lycksele	79 (77)	0 (0)	7 (7)	0 (0)	1 (1)	15 (15)	102
Mora	174 (72)	20 (8)	45 (19)	0 (0)	0 (0)	1 (0)	240
Norrköping	295 (87)	0 (0)	27 (8)	0 (0)	18 (5)	0 (0)	340
Norrtälje	114 (79)	1 (1)	28 (19)	0 (0)	2 (1)	0 (0)	145
Nyköping	140 (71)	17 (9)	30 (15)	0 (0)	2 (1)	8 (4)	197
NÄL	56 (8)	0 (0)	6 (1)	0 (0)	0 (0)	675 (92)	737
Oskarshamn	6 (86)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)	7
Piteå	6 (22)	18 (67)	3 (11)	0 (0)	0 (0)	0 (0)	27
Skellefteå	171 (86)	29 (14)	0 (0)	0 (0)	0 (0)	0 (0)	200
Skene	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	2
Skövde	339 (87)	7 (2)	42 (11)	0 (0)	0 (0)	0 (0)	388
Sollefteå	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	2
SU/Mölndal	867 (74)	64 (5)	244 (21)	0 (0)	1 (0)	1 (0)	1,177
Sunderby sjukhus	346 (70)	7 (1)	29 (6)	0 (0)	0 (0)	109 (22)	491
Sundsvall	270 (80)	5 (1)	20 (6)	0 (0)	2 (1)	39 (12)	336
SUS/Lund	497 (82)	0 (0)	103 (17)	0 (0)	0 (0)	3 (0)	603
SUS/Malmö	574 (84)	4 (1)	65 (10)	0 (0)	2 (0)	39 (6)	684
Södersjukhuset	749 (76)	21 (2)	211 (21)	0 (0)	2 (0)	2 (0)	985
Södertälje	202 (90)	0 (0)	23 (10)	0 (0)	0 (0)	0 (0)	225
Torsby	64 (74)	3 (3)	19 (22)	0 (0)	0 (0)	0 (0)	86
Trelleborg	32 (97)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	33
Uddevalla	0 (0)	2 (10)	1 (5)	0 (0)	0 (0)	17 (85)	20
Umeå	189 (57)	10 (3)	3 (1)	0 (0)	4 (1)	123 (37)	329
Varberg	255 (70)	0 (0)	107 (29)	0 (0)	0 (0)	2 (1)	364

The table continues on the next page.

Thrombosis prophylaxis in hip fracture – type of drug, per unit, cont.

Unit	LMWH Number (%)	NOAC Number (%)	Long-term treatment Number (%)	Other Number (%)	No prophylaxis Number (%)	No information Number (%)	Total Number
Visby	96 (68)	18 (13)	22 (15)	0 (0)	1 (1)	5 (4)	142
Värnamo	123 (83)	0 (0)	18 (12)	0 (0)	6 (4)	1 (1)	148
Västervik	167 (78)	4 (2)	28 (13)	0 (0)	10 (5)	6 (3)	215
Västerås	427 (77)	15 (3)	97 (17)	0 (0)	6 (1)	13 (2)	558
Växjö	248 (87)	9 (3)	21 (7)	2 (1)	2 (1)	2 (1)	284
Ystad	133 (52)	0 (0)	37 (14)	0 (0)	1 (0)	85 (33)	256
Ängelholm	6 (67)	2 (22)	1 (11)	0 (0)	0 (0)	0 (0)	9
Örebro	101 (71)	3 (2)	27 (19)	0 (0)	3 (2)	9 (6)	143
Örnsköldsvik	182 (74)	6 (2)	56 (23)	0 (0)	1 (0)	2 (1)	247
Östersund	251 (83)	1 (0)	33 (11)	0 (0)	0 (0)	17 (6)	302
Country	**14,320 (73)**	**550 (3)**	**2,518 (13)**	**2 (0)**	**100 (1)**	**1,996 (10)**	**19,486**

Tabell 9.1.3 b. Thrombosis prophylaxis in hip fracture – type of drug, per unit, 2019–2021.

Thrombosis prophylaxis in hip fracture – planned length of treatment start per unit

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Akademiska sjukhuset	5 (1)	80 (11)	81 (11)	395 (56)	145 (20)	5 (1)	711
Aleris Specialistvård Motala	0 (0)	0 (0)	0 (0)	3 (60)	1 (20)	1 (20)	5
Aleris Specialistvård Ängelholm	0 (0)	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	3
Alingsås	0 (0)	0 (0)	1 (1)	144 (93)	6 (4)	4 (3)	155
Art Clinic Göteborg	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Arvika	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	2
Bollnäs	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Borås	0 (0)	7 (2)	94 (23)	272 (67)	27 (7)	6 (1)	406
Capio Ortopedi Motala	1 (33)	0 (0)	0 (0)	2 (67)	0 (0)	0 (0)	3
Capio Ortopediska Huset	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1
Capio S:t Göran	0 (0)	113 (19)	307 (50)	83 (14)	96 (16)	11 (2)	610
Carlanderska	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Danderyd	1 (0)	11 (1)	91 (10)	605 (70)	89 (10)	70 (8)	867
Eksjö	2 (1)	2 (1)	9 (6)	113 (71)	7 (4)	26 (16)	159
Enköping	0 (0)	0 (0)	0 (0)	4 (67)	0 (0)	2 (33)	6
Eskilstuna	1 (0)	0 (0)	0 (0)	253 (78)	71 (22)	1 (0)	326
Falun	0 (0)	19 (5)	305 (79)	5 (1)	51 (13)	7 (2)	387
GHP Ortho Center Stockholm	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Gällivare	0 (0)	1 (1)	2 (1)	127 (84)	19 (13)	2 (1)	151
Gävle	1 (0)	20 (4)	15 (3)	388 (81)	44 (9)	9 (2)	477
Halmstad	3 (1)	7 (2)	72 (21)	47 (13)	7 (2)	214 (61)	350
Helsingborg	0 (0)	7 (1)	521 (88)	29 (5)	34 (6)	2 (0)	593
Hermelinen	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Hudiksvall	0 (0)	0 (0)	1 (0)	241 (87)	33 (12)	2 (1)	277
Hässleholm	0 (0)	14 (34)	10 (24)	10 (24)	6 (15)	1 (2)	41
Jönköping	3 (1)	0 (0)	0 (0)	189 (76)	52 (21)	6 (2)	250
Kalmar	8 (3)	1 (0)	0 (0)	247 (82)	36 (12)	8 (3)	300
Karlshamn	0 (0)	0 (0)	0 (0)	3 (75)	1 (25)	0 (0)	4
Karlskoga	0 (0)	3 (1)	2 (1)	201 (75)	57 (21)	6 (2)	269
Karlskrona	1 (0)	0 (0)	4 (1)	363 (84)	55 (13)	11 (3)	434
Karlstad	1 (0)	10 (2)	5 (1)	354 (63)	45 (8)	149 (26)	564
Karolinska Huddinge	1 (0)	7 (2)	3 (1)	314 (78)	62 (15)	18 (4)	405

The table continues on the next page.

Thrombosis prophylaxis in hip fracture – planned length of treatment start per unit, cont.

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Karolinska Solna	1 (2)	0 (0)	0 (0)	18 (39)	1 (2)	26 (57)	46
Kristianstad	0 (0)	1 (0)	136 (32)	0 (0)	0 (0)	282 (67)	419
Kullbergska sjukhuset	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	1
Kungälv	2 (1)	2 (1)	3 (1)	199 (82)	34 (14)	4 (2)	244
Lidköping	1 (1)	1 (1)	3 (2)	159 (91)	10 (6)	1 (1)	175
Lindesberg	1 (0)	3 (1)	5 (2)	178 (76)	44 (19)	2 (1)	233
Linköping	2 (0)	0 (0)	8 (2)	249 (55)	114 (25)	78 (17)	451
Ljungby	1 (1)	4 (3)	1 (1)	76 (60)	17 (13)	28 (22)	127
Lycksele	1 (1)	1 (1)	0 (0)	76 (75)	7 (7)	17 (17)	102
Mora	0 (0)	0 (0)	2 (1)	192 (80)	45 (19)	1 (0)	240
Norrköping	18 (5)	5 (1)	10 (3)	277 (81)	27 (8)	3 (1)	340
Norrtälje	2 (1)	15 (10)	6 (4)	94 (65)	28 (19)	0 (0)	145
Nyköping	2 (1)	1 (1)	1 (1)	153 (78)	30 (15)	10 (5)	197
NÄL	0 (0)	0 (0)	7 (1)	46 (6)	6 (1)	678 (92)	737
Oskarshamn	0 (0)	0 (0)	0 (0)	6 (86)	1 (14)	0 (0)	7
Piteå	0 (0)	6 (22)	0 (0)	18 (67)	3 (11)	0 (0)	27
Skellefteå	0 (0)	0 (0)	0 (0)	197 (98)	0 (0)	3 (2)	200
Skene	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
Skövde	0 (0)	6 (2)	11 (3)	323 (83)	42 (11)	6 (2)	388
Sollefteå	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	2
SU/Mölndal	1 (0)	3 (0)	2 (0)	924 (79)	244 (21)	3 (0)	1,177
Sunderby sjukhus	0 (0)	0 (0)	0 (0)	340 (69)	29 (6)	122 (25)	491
Sundsvall	2 (1)	9 (3)	98 (29)	152 (45)	20 (6)	55 (16)	336
SUS/Lund	0 (0)	9 (1)	444 (74)	39 (6)	103 (17)	8 (1)	603
SUS/Malmö	2 (0)	15 (2)	518 (76)	36 (5)	65 (10)	48 (7)	684
Södersjukhuset	2 (0)	30 (3)	79 (8)	661 (67)	211 (21)	2 (0)	985
Södertälje	0 (0)	3 (1)	4 (2)	194 (86)	23 (10)	1 (0)	225
Torsby	0 (0)	7 (8)	2 (2)	56 (65)	19 (22)	2 (2)	86
Trelleborg	0 (0)	1 (3)	30 (91)	1 (3)	0 (0)	1 (3)	33
Uddevalla	0 (0)	0 (0)	0 (0)	2 (10)	1 (5)	17 (85)	20
Umeå	4 (1)	0 (0)	5 (2)	186 (57)	3 (1)	131 (40)	329
Varberg	0 (0)	1 (0)	253 (70)	0 (0)	107 (29)	3 (1)	364

The table continues on the next page.

Thrombosis prophylaxis in hip fracture – planned length of treatment start per unit, cont.

Unit	No prophylaxis Number (%)	1–6 days Number (%)	7–14 days Number (%)	>14 days Number (%)	Long-term treatment Number (%)	No information Number (%)	Total Number
Visby	1 (1)	1 (1)	0 (0)	109 (77)	22 (15)	9 (6)	142
Värnamo	6 (4)	1 (1)	5 (3)	115 (78)	18 (12)	3 (2)	148
Västervik	10 (5)	7 (3)	6 (3)	152 (71)	28 (13)	12 (6)	215
Västerås	6 (1)	4 (1)	1 (0)	433 (78)	97 (17)	17 (3)	558
Växjö	2 (1)	3 (1)	4 (1)	247 (87)	21 (7)	7 (2)	284
Ystad	1 (0)	5 (2)	121 (47)	7 (3)	37 (14)	85 (33)	256
Ängelholm	0 (0)	0 (0)	5 (56)	3 (33)	1 (11)	0 (0)	9
Örebro	3 (2)	4 (3)	11 (8)	88 (62)	27 (19)	10 (7)	143
Örnsköldsvik	1 (0)	3 (1)	0 (0)	184 (74)	56 (23)	3 (1)	247
Östersund	0 (0)	5 (2)	33 (11)	203 (67)	33 (11)	28 (9)	302
Country	**100 (1)**	**460 (2)**	**3,340 (17)**	**10,801 (55)**	**2,518 (13)**	**2,267 (12)**	**19,486**

Tabell 9.1.3 c. Thrombosis prophylaxis in hip fracture – planned length of treatment, per unit, 2019–2021.

9.2. Triathlon and different methods of fixation

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Theoretically, cementless fixation in total knee replacement surgery has advantages such as better fixation to bone, shorter surgical time and a lower risk of complications such as problems related to cement leakage and wear from cement particles. However, an increased risk of revision in cementless total knee replacements (TKR) compared with cemented has been reported from both the UK National Joint Registry as well as the Australian Orthopaedic Association National Joint Replacement Registry. In the last ten-year period, the use of cementless TKRs has markedly increased in Sweden (from 3 % in 2010 to 10 % in 2021) and most of the cementless knee replacements have been performed at the hospital in Hässleholm.

Triathlon is the modern total knee replacement with a cementless alternative which is currently most frequently used in Sweden. Since Triathlon also have a cemented alternative, with a widespread use, it suites well to compare revision outcomes between cementless and cemented Triathlon prostheses. In Australia where Triathlon is the most common total knee replacement, the cemented variant has 10-year cumulative revision rate (CRR) of 3.8 % (95 % CI 3.6–4.0) in just more than 95,000 cases and the cementless variant is used in almost 20,000 cases with CRR of 4.2 % (95 % CI 3.9–4.7). In UK, the corresponding CRRs are 2.9 % (95 % CI 2.7–3.1) in 115,000 cemented and 3.1 % (95 % CI 2.1–4.5) in roughly 4 000 cementless cases.

Method of the in-depth analysis

In this in-depth analysis we included all primary Triathlon TKRs performed with the indication osteoarthritis between 2010 and 2021. We divided the main analysis on type of fixation. The results are also separately presented for the cementless Triathlon prosthesis performed in Hässleholm. The results of NexGen´s cementless version (NexGen Trabecular Metal, NexGen TM) is presented as well for comparison. The primary outcome was the first revision regardless of reason and we followed all prostheses until 31st of December 2021.

In a separate multiple Cox-regression, we compared cementless and cemented fixation and adjusted for age, sex, BMI, ASA class, type of polyethylene, the degree of stability of the tibial polyethylene and the use of patella component. Two types of polyethylene, X3 which is highly cross-linked, and the conventional polyethylene N2-VAC, are used. There are two different types of stability of the tibial polyethylene; the common CR-polyethylene (Cruciate Retaining) and the curved CS-polyethylene (Cruciate Stabilizing).

What did the results show?

The analysis included 10,672 cemented Triathlon and 6,317 cementless whereof 94 % had been performed in Hässleholm. There were 2,504 NexGen TM for comparison. The group with cementless Triathlon-prosthesis were younger, to a greater extent male, had a lower proportion of ASA class ≥III and somewhat lower BMI. The mean follow-up time was somewhat shorter in the cementless Triathlons, 4.7 compared with 5.6 years. There was in total 240 revisions in the cementless Triathlon and 278 in the cemented. Of the 362 cementless Triathlons that had been performed at an another hospital than Hässleholm, there were only four revisions and all due to infection (table 9.2.1).

The CRR at 10 years was 8 % in the cementless Triathlon, considerably higher than in the cemented version with CRR of 3 %. NexGen TM had CRR of 4 %. The CRR for aseptic reason was 6 % in cementless Triathlon, 2 % in cemented and 3 % in NexGen TM. For both cementless and cemented Triathlons, infection was the most common reason for revision, and the incidence did not differ (1 %). The distribution of reasons for revision was however markedly different between the groups. The proportion of instability, patella problems and wear as reason for revision was a considerable higher in the group of cementless Triathlon than among the revisions in the group of cemented Triathlon, presented in table 9.2.1.

Demographics, description and results of Triathlon cemented and uncemented

	Triathlon cemented	Triathlon cementless	Triathlon cement-less Hässleholm	NexGen Trabecular Metal
Number	10,762	6,317	5,955	2,504
Follow-up time, year mean (SD)	5.6 (3.4)	4.7 (3.0)	4.9 (3.0)	5.8 (3.4)
Demography				
Age, mean (SD)	70.1 (8.9)	67.4 (8.7)	67.6 (8.7)	56.9 (7.1)
Females (%)	60.6	49.9	49.6	45.6
BMI, mean (SD)	29.1 (4.5)	28.6 (3.9)	28.5 (3.9)	29.6 (4.5)
ASA ≥III (%)	18.2	12.7	12.3	8.2
Prior surgery (%)	13.3	21.5	21.1	37.2
Surgical variables				
Bilateral simultaneous operation (%)	5.8	25.8	27.3	2.6
Highly cross-linked polyethylene (%)	59.7	82	85.4	0.7
Curved CS polyethylene (%)	18.2	38.8	40.1	N/A
Patella at primary TKR (%)	2.1	2.7	2.8	3.6
Tourniquet (%)	41.4	15.5	15.9	61.6
Revision cause, n (%)				
Infection	122 (43.9)	70 (28.7)	66 (27.5)	15 (22.7)
Loosening	32 (11.5)	16 (6.6)	16 (6.7)	5 (7.6)
Instability	53 (19.1)	58 (23.8)	58 (24.2)	26 (39.4)
Patella	49 (17.6)	68 (27.9)	68 (28.3)	15 (22.7)
Wear	4 (1.4)	21 (8.6)	21 (8.8)	0 (0.0)
Contracture	5 (1.8)	2 (0.8)	2 (0.8)	3 (4.5)
Fracture	7 (2.5)	2 (0.8)	2 (0.8)	0 (0.0)
Other	6 (2.2)	7 (2.8)	7 (2.9)	2 (3.0)
Revision procedure, n (%)				
Stabilized (rotating) prosthesis with/without patella	8 (3.0)	16 (6.9)	16 (7.0)	6 (9.2)
TKR without patella	60 (22.1)	32 (13.7)	31 (13.5)	15 (23.1)
TKR with patella	8 (3.0)	15 (6.4)	15 (6.5)	5 (7.7)
Exchange femur	2 (0.7)	2 (0.9)	2 (0.9)	2 (3.1)
Exchange tibia	10 (3.7)	5 (2.1)	5 (2.2)	5 (7.7)
Exchange insert	130 (48.0)	88 (37.6)	85 (37.0)	12 (18.5)
Patella addition	44 (16.2)	69 (29.5)	69 (30.0)	16 (24.6)
Extraction of prosthesis, arthrodesis, amputation	9 (3.3)	6 (2.5)	6 (2.6)	4 (6.2)
Kaplan-Meier estimate 10 years CRR (95 % CI)				
All causes	97 (96–97)	92 (91–94)	92 (91–94)	96 (96–97)
Minus infection	98 (98–98)	94 (93–95)	94 (93–95)	97 (96–98)
Minus patella addition, infection	99 (98–99)	96 (95–97)	96 (95–97)	98 (97–99)
Minus patella addition, infection, exchange insert	99 (99–99)	98 (97–99)	98 (97–99)	98 (98–99)

Table 9.2.1. Demographics, description and results of Triathlon cemented and cementless TKR for OA with NexGen TM as comparison.

In the Cox-regression with all Triathlon-prostheses, cementless fixation was associated with an increased risk of revision (HR 1.6, 95 % CI 1.3-2.0), see table 9.2.2. Only ASA class ≥ III was found to be associated with an increased risk of revision among the confounding factors included. The hazard ratio for the cross-linked X3-polyethylene was 1.2 (95 % CI 0.9–1.5), however without statistically significant risk (table 9.2.2).

How should these results be interpreted?

The difficulty in interpreting the analysis is that the major proportion of all replacements with the cementless Triathlon-prosthesis were performed at one and the same hospital. This makes it much harder to understand why the risk of revision is 6 % higher as compared with the cemented version of the same prosthesis. Three explanatory models can be discussed. The first explanation could of course be that the cementless version, to a higher extent, leads to complications such as instability, wear and patella problems.

There are however no revisions with aseptic reason for revision in those operated at any other hospital than Hässleholm. That leads to other explanatory models. It may be hospital specific deficiencies in the surgical performance such as soft tissue balancing and component positioning. A third explanation is that the threshold for revision is lower among the orthopaedic surgeons, active in Hässleholm. In all circumstances this in-depth analysis should lead to local improvement work – CRR of 8 % at ten years is far below the standard that can be considered acceptable within modern knee replacement surgery. Our results in combination with register results from UK and Australia urge caution and a controlled introduction of cementless TKR in Sweden.

Hazard ratio with 95 % CI, first revision for any reason

Variable	HR	95 % CI	p-value
Fixation			
Cemented	Ref		
Cementless	1.61	1.33–1.95	<0.001
Age			
< 45 year	Ref		
45–54 year	0.55	0.20–1.54	0.3
55–64 year	0.43	0.16–1.16	0.1
65–74 year	0.4	0.15–1.09	0.074
75–84 year	0.37	0.14–1.00	0.051
≥85 year	0.37	0.12–1.13	0.082
Sex			
Males	Ref		
Females	0.9	0.75–1.07	0.2
BMI	1.01	0.99–1.03	0.5
ASA			
I	Ref		
II	1.13	0.88–1.44	0.3
III–V	1.48	1.09–2.01	0.013
Patella			
Yes	Ref		
No	1.11	0.57–2.16	0.8
Polyethylene			
N2/VAC	Ref		
X3	1.19	0.94–1.51	0.14
Design polyethylene			
CR	Ref		
CS	1.03	0.83–1.27	0.8

Table 9.2.2. Hazard ratio (HR) with 95 % CI, first revision for any reason.

9.3 Reoperation due to periprosthetic fracture and polished stem

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Polished stems have been used more or less continuously throughout the whole history of the cemented hip replacement. The early Charnley and Exeter stems had a polished surface according to the regulations which existed in the UK at the time for their introduction to the market. In Sweden, the Exeter stem has been the most used polished stem since 1992 and probably longer time, but detailed information is lacking as the number of inserted primary prostheses before 1992 was estimated based on the individual unit's most commonly used type of prosthesis.

In recent decades, the proportion of polished stems has increased in the group of stems fixed with cement. In 2002 they accounted for 25.5 %. In 2021 this proportion increased to 42.1%. The reason for this increase is unknown. Polished stems have, compared with matte stems, the advantage that the stem generates less particles in the interface against cement and thus reduce the risk of osteolysis and loosening. Phasing out of certain previously widely used models with a matte or rough surface such as the Spectron EF Primary is likely to have affected the use of polished stems in a positive direction.

A disadvantage of polished stem is the increased risk of periprosthetic fracture, a complication documented in several previous scientific reports not least based on register data. Especially, the Exeter and CPT stem have been studied. In this in-depth analysis, the aim was to compare the risk of periprosthetic fracture between the polished stems that currently used in Sweden in a sufficiently large extent to draw the relevant conclusions.

In the analysis we have chosen implants inserted from 1999, which is the year when a more detailed registration of implant properties started. From this year until 2021 there are a total of 94,394 polished stems registered in the Swedish Arthroplasty Register. Only stems of standard model used in at least 500 operations of known size and without a tumour diagnosis are included in the analysis (figure 9.3.1). Likewise, both cemented and uncemented cups were included and all types of articulations. Both sides were included in cases where the patient had any of the three studied stems inserted on both sides. As shown in table 9.3.1, most of these patients have the same type of stem in both hips and especially in the Exeter group. Operations that have not been performed in a direct lateral or posterior approach have been excluded.

The final analysis includes 85,499 operations, 63,189 with Exeter, 19,358 with MS30 and 2,952 with CPT stem. MS30 was used more often for primary osteoarthritis, more often with a larger femoral head, more often with a cup of high molecular cross-linked polyethylene and the follow-up time is 2 to 3 years shorter than for the other two. The CPT stem has been more frequently used in slightly older patients, preferably with acute hip fracture or with complication after hip fracture.

The frequency of reoperations is highest for prostheses with CPT stem and lowest for MS30 (table 9.3.2). Regarding Exeter and CPT, the most common reason for reoperation has been periprosthetic fracture and for MS30 dislocation. After 18 years of observation and with at least 100 observations remaining in each group, there is a cumulative revision risk of reoperation of 8.6 % (6.4–10.8 %) for MS30 (mean, 95 % confidence interval), 11.2 % (10.6–11.8 %) for Exeter and 15.7 % (13.3–18.1%) for CPT (figure 9.3.2). Corresponding risk of reoperation due to periprosthetic fracture is 2.9 % (1.9–3.9 %) for MS30, 3.6 % (3.2–4.0 %) for Exeter and 7.5 % (3.9–9.1%) for the group with a CPT stem (figure 9.3.3).

Further analysis in a Cox regression model confirms that the risk of reoperation regardless of cause and the risk of reoperation due to periprosthetic fracture is statistically significantly lower for hip replacements with a MS30 stem and higher for hip replacements with CPT stem compared with the Exeter group, both before and after adjustment for potential confounding factors (table 9.3.3).

Exeter and CPT stems are used considerably more than MS30 in the first half of the study period. This means that these implants have been used more often with cups or liners made of older polyethylene types with an increased risk of local osteolysis and loosening. Localised bone resorption and stem loosening also increases the risk of periprosthetic fracture. Similarly, it has been shown that there is an association between certain diagnoses and the risk of periprosthetic fracture.

In the light of other skew distributions between the groups we have performed a sensitivity analysis only including patients with the diagnosis primary osteoarthritis and

only including operations where the cup or inserted liner have been made of high molecular cross-linked polyethylene. Another effect of this selection is that the follow-up time becomes more similar (mean, SD for Exeter: 5.4 3.3; MS30: 5.8 4.2; CPT 6.3 4.1) and better reflects the current replacement surgery. However, the studied groups become smaller however and already after 9.5 years the remaining number in the smallest group is below 100 observations which is about 9 years earlier than in the first analysis with an 18-year follow-up.

We now find that the cumulative risk of reoperation at 9 years is 3.5 ± 0.3% in the Exeter group, 3.6 ± 0.4% for MS30 and considerably higher in the CPT group (8.4 ± 3.5%). Corresponding risk of reoperation due to periprosthetic fracture is 1.2 ± 0.2%, 1.0 ± 0.2% and 5.5 ± 3.1%. In both analyses, the risk changes over time for MS30 and CPT compared with Exeter (figure 9.3.4 and 9.3.5). The regression analysis has therefore been divided into two intervals, one covering the first five years and the next covering the following period. As shown in table 9.3.4 and in figure 9.3.3 most reoperations occur early (1,094 out of 1,300, 84.1%), which means that the results of the analysis in the later period becomes more uncertain due to fewer events.

In the first five years we find, as in the previous analysis of the whole material, the risk of reoperation for any reason and the risk of reoperation due to fracture are statistically significantly lower after insertion of the MS30 stem compared with Exeter. Regarding CPT, we found no statistically significant difference regarding the outcome reoperation regardless of reason but a statistically significant increase of reoperation due to periprosthetic fracture in two of the analyses. In the following period (observation time > 5 years) the risk of reoperation for any reason has now increased for both MS30 and CPT, with statistically significance in two of the three analyses for both these stem types. Regarding the risk of reoperation due to periprosthetic fracture there are no differences between the MS30 and the Exeter groups, while prostheses operated with a CPT stem show a statistically significantly increased risk.

In summary, we find that the risk of reoperation is lower for the MS30 stem compared with the Exeter stem and that this difference mainly due to an increased number of early reoperations. To get a perspective of the clinical relevance of this risk reduction we have made a "post-hoc" comparison with the Lubinus SPII stem based on the same selection criteria as in the sensitivity analysis. Thus, only hip replacements due to osteoarthritis, operated with an articulating surface of high molecular polyethylene and only Lubinus SPII stems of standard type (150 mm) are included.

The cumulative risk of reoperation due to periprosthetic fracture at 14 years when there are at least 100 stems left in each group is 0.7 ± 0.6% for the Lubinus SPII stem and 2.3 ± 1.0% for MS30. In the subsequent regression analysis, we find that the risk of reoperation due to periprosthetic fracture is 4.4 (3.3–6.6) and 4.6 (3.1–6.9) times higher respectively for MS30 before and after adjustment for the same potential confounding factors that have been used in the previous analysis (including femoral head size, table 9.3.4, column to the far right).

Summary

The registration of periprosthetic fractures has been inadequate in a long time, especially regarding fractures not treated with revision. Linkage with the Patient Register and in the last year's co-registration with the Swedish Fracture Register has reduced this problem. However, one must still expect a certain underreporting that however should distribute itself relatively evenly between types of prosthesis studied.

The results of this analysis should be interpreted with caution, especially with regard to reasons for reoperation where the probability is low for that type of stem inserted has had a decisive significance (for example infection or loosening where the stem may have been exchanged to facilitate the exchange of a loose cup).

MS30 is the polished prosthesis with the lowest risk of reoperation due to periprosthetic fracture in the first five years after primary prosthesis when the majority of these fractures occur.

Despite MS30 has a reduced risk of reoperation due to periprosthetic fracture compared with Exeter this observation does not mean that it is the best choice for patients with osteoporosis and increased risk of periprosthetic fracture.

Figure 9.3.1. Flow chart for the present analysis.

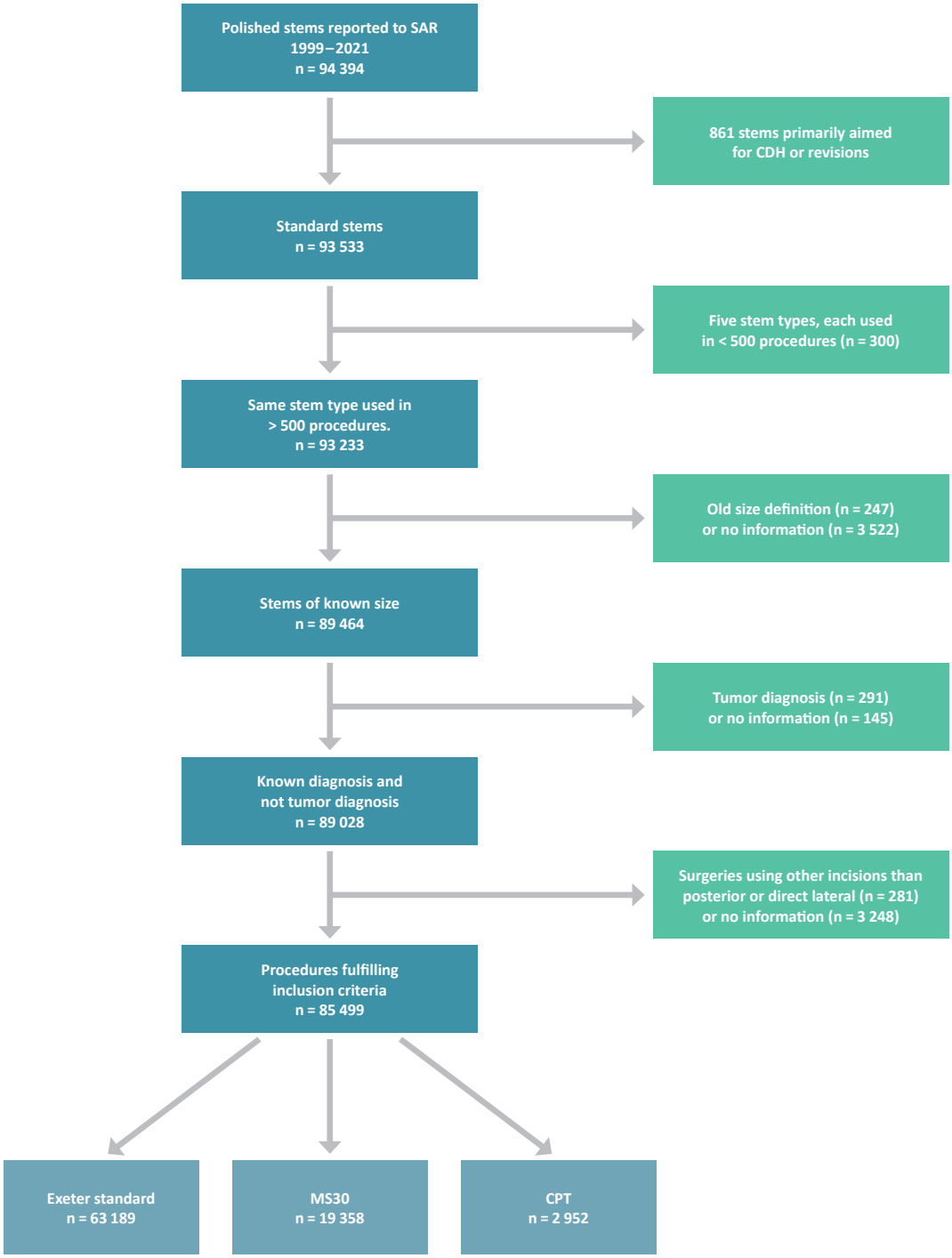


Figure 9.3.1. Flow-chart showing the selection of the polished stems included in the primary analysis.

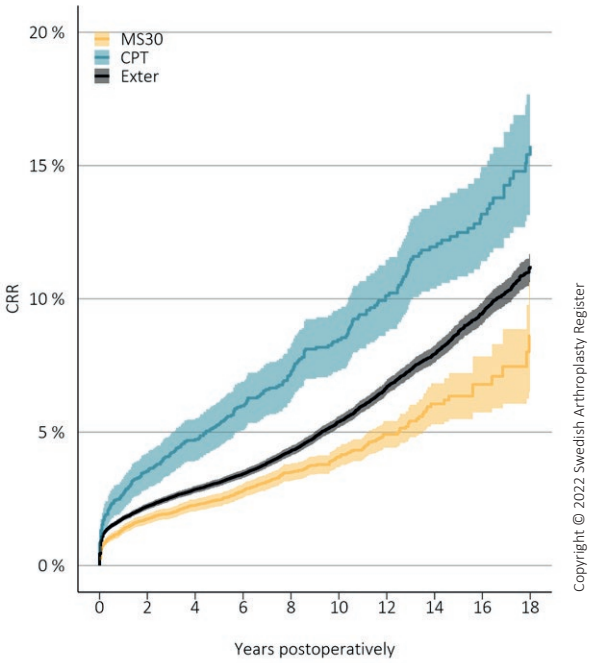


Figure 9.3.2. Cumulative revision rate in reoperations regardless of reason. All selected surgeries according to figure 9.3.1 are included.

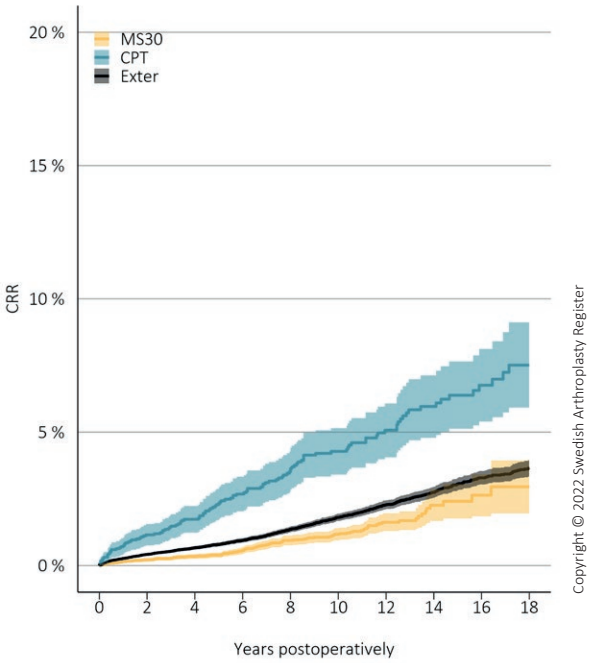


Figure 9.3.3. Cumulative revision rate in reoperations due to periprosthetic fracture. All selected surgeries according to figure 9.3.1 are included.

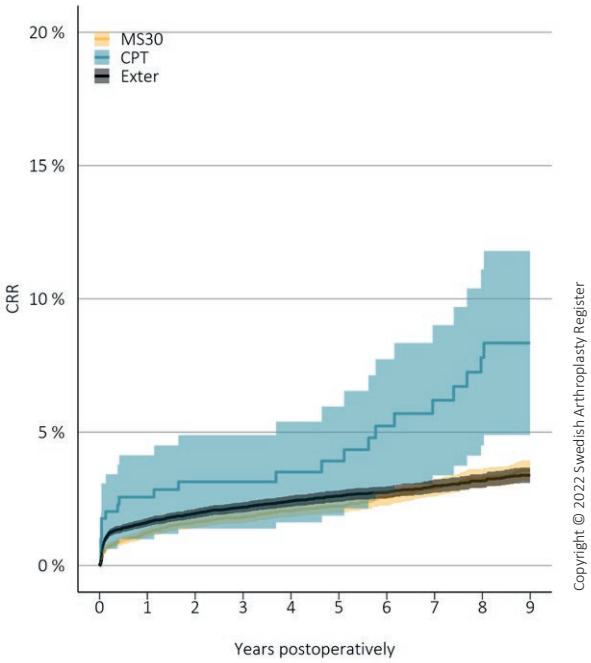


Figure 9.3.4. Cumulative revision rate in reoperations regardless of reason. Only reoperations due to OA and when using cup or liner with high molecular polyethylene are included from the primary cohort of hip replacements described in figure 9.3.1.

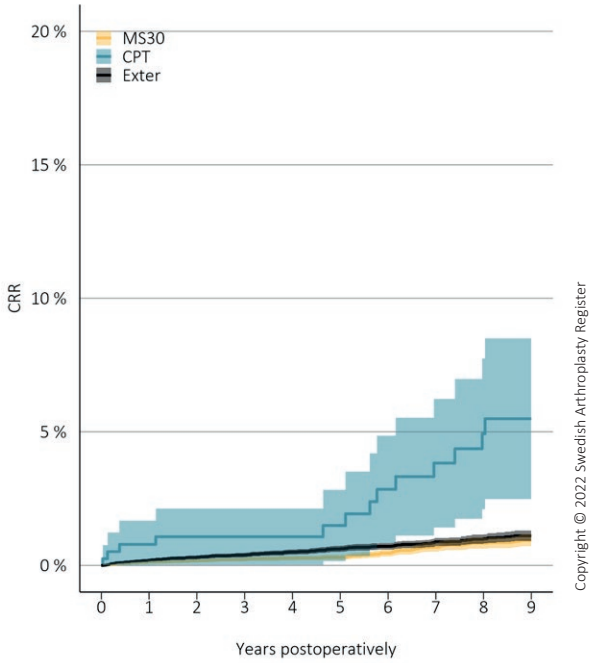


Figure 9.3.5. Cumulative revision rate in reoperations due to periprosthetic fracture. Only reoperations due to OA and when using cup or liner with high molecular polyethylene are included from the primary cohort of hip replacements described in figure 9.3.1.

Demographic data, cup fixation, incision, articulation and bilaterality

	Exeter	MS30	CPT
Numbers	**63**	**19**	**3**
Follow up, mean, (SD)	8.2 (5.4)	6.1 (4.4)	9.1 (5.9)
Mean age, (95% CI)	72.3 (72.2–72.3)	71.9 (71.8–72.0)	74.8 (74.5–75.2)
Age group, n (%)			
<60 years	4,938 (7.8)	1,153 (6.0)	148 (5.0)
60–69 years	17,201 (27.2)	5,827 (30.1)	568 (19.2)
70–79 years	27,951 (44.2)	9,228 (47.7)	1,270 (43.0)
80– years	13,099 (20.7)	3,150 (16.3)	966 (32.7)
Females, %	63	66.4	72.7
Diagnosis, n (%)			
Primary osteoarthritis	49,478 (78.3)	17,211 (88.9)	2,195 (74.4)
Acute fracture, sequel fracture/trauma	8,232 (13.0)	1,218 (6.3)	563 (19.1)
Other diagnoses	5,479 (8.7)	929 (4.8)	194 (6.6)
Cemented cup, n (%)	59,122 (93.6)	17,828 (92.1)	2,682 (90.9)
Incision, n (%)			
Direct lateral, supine	9,118 (14.4)	1,893 (9.8)	269 (9.1)
Direct lateral, side position	24,535 (38.8)	7,372 (38.1)	779 (26.4)
Posterior	29,536 (46.7)	10,093 (52.1)	1,904 (64.5)
Articulation, n (%)			
“Older” polyethylene	30,802 (48.7)	1,668 (8.6)	2,123 (71.9)
Highly cross-linked polyethylene	31,748 (50.2)	17,077 (88.2)	775 (26.3)
Other materials, DMC cup, no information	639 (1.0)	613 (3.2)	54 (1.8)
Head size, n (%)			
< 28 mm	2,142 (3.4)	32 (0.2)	159 (5.4)
28 mm	30,367 (48.1)	1,627 (8.4)	1,743 (59.0)
30 mm	103 (0.2)	1 (0.0)	0
32 mm	24,587 (38.9)	16,255 (84.0)	940 (31.8)
36 mm	5,400 (8.5)	975 (5.0)	58 (2.0)
> 36 mm	33 (0.1)	16 (0.1)	6 (0.2)
Dual mobility cup	496 (0.8)	442 (2.3)	34 (1.2)
No information	61 (0.1)	10 (0.1)	12 (0.4)
Bilateral polished stem, n (%)			
Exeter, MS30 or CPT at 2nd operation	8,820 (14.0)	2,590 (13.4)	299 (10.1)
Same stem bilaterally	8,386 (13.3)	2,217 (11.5)	232 (7.9)

Table 9.3.1. Demographic data, cup fixation, choice of surgical approach, articulation and bilaterality.

Reason for reoperation, all diagnoses, and all types of articulation

	Exter n = 63,189	MS30 n = 19,358	CPT n = 2,952
All reasons, n (%)	3,232 (5.1)	584 (3.0)	257 (8.7)
Specific reasons, n (%)			
Aseptic loosening	790 (1.3)	91 (0.4)	41 (1.4)
Infection	836 (1.3)	143 (0.7)	34 (1.2)
Periprosthetic fracture	971 (1.5)	144 (0.7)	119 (4.0)
Dislocation	439 (0.7)	153 (0.8)	59 (2.0)
Implant fracture	46 (0.1)	5 (0.0)	1 (0.0)
Other reasons	127 (0.2)	52 (0.3)	2 (0.1)
No information about reason	23 (0.0)	6 (0.0)	1 (0.0)
Not reoperated, n (%)	59,957 (94.9)	18,774 (97.0)	2,695 (91.3)

Table 9.3.2. Reason for reoperation grouped due to choice of primary stem.
The table is based on all observation selected according to figure 9.3.1.

Relativ risk (Hazard Ratio (HR)) of reoperation and 95 % confidence interval (CI)

	HR (95% CI)		
All observations, full observation time	**Unadjusted**	**Adjusted [1)]**	**Adjusted [2)]**
All reasons			
Exeter	1	1	1
MS30	0.76 (0.70–0.83)	0.84 (0.76–0.93)	0.82 (0.74–0.90)
CPT	1.52 (1.34–1.73)	1.44 (1.27–1.64)	1.44 (1.26–1.64)
Periprosthetic fracture			
Exeter	1	1	1
MS30	0.66 (0.57–0.79)	0.77 (0.64–0.94)	0.74 (0.61–0.90)
CPT	2.31 (1.91–2.80)	1.89 (1.55–2.29)	1.87 (1.53–2.27)

Table 9.3.3. Relative risk (Hazard Ratio, HR and 95% confidence interval) in reoperations regardless of reason and due to periprosthetic fracture. Confounders included in the adjusted analysis are indicated in the respective footnotes.

1) Adjusted for age, sex, diagnosis, approach, cup fixation and type of surface.

2) Adjusted for all variables according to 1) and for caput size (≤28 mm, 32 mm, ≥36 mm including DM-cup, 187 observations with diameter = 30 mm or missing data are excluded).

Reason for reoperation

Only patients with primary OA operated with cups/liners made of cross-linked polyethylene	Exeter	MS30	CPT
Period 0–5 years, n (%)			
Numbers	24,806	15,949	398
All reasons, n (%)	662 (2.7)	409 (2.6)	23 (5.8)
Specific reasons, n (%)			
Aseptic loosening	42 (0.2)	27 (0.2)	0 (0.0)
Infection	331 (1.3)	103 (0.7)	7 (1.8)
Periprosthetic fracture	121 (0.5)	37 (0.2)	5 (1.3)
Dislocation	43 (0.2)	84 (0.5)	2 (0.5)
Implant fracture	0 (0.0)	0 (0.0)	0 (0.0)
Other reasons	35 (0.1)	41 (0.3)	0 (0.01)
Specific reason is missing	7 (0.0)	3 (0.0)	0 (0.0)
Not reoperated up to 5 years, n (%)	24,227 (97.7)	15,199 (98.1)	384 (96.5)
Period > 5 years, n (%)			
Numbers	12,796	8,049	229
All reasons, n (%)	83 (0.6)	114 (1.4)	9 (5.8)
Specific reasons, n (%)			
Aseptic loosening	14 (0.1)	26 (0.3)	0 (0.0)
Infection	8 (0.1)	6 (0.1)	0 (0.0)
Periprosthetic fracture	54 (0.4)	58 (0.7)	8 (3.5)
Dislocation	5 (0.0)	21 (0.3)	1 (0.4)
Implant fracture	1 (0.0)	0 (0.0)	0 (0.0)
Other reasons	0 (0.0)	2 (0.0)	0 (0.01)
Specific reason is missing	1 (0.0)	1 (0.0)	0 (0.0)
Not reoperated, n (%)	12,713 (99.4)	7,935 (98.6)	220 (96.1)

Table 9.3.4. Reason for reoperation grouped considering choice of primary stem. Only cases with primary OA and only highly cross-linked polyethylene are included. The analyses are divided in two time periods, until five years' observational time and operations with observational time longer than five.

Relativ risk (Hazard Ratio (HR) and 95% confidence interval (CI) of reoperation regardless of reason and due to periprosthetic fracture

Only patients with primary OA operated with cups/liners made of cross-linked polyethylene	HR (95% CI)		
	Unadjusted	Adjusted [1)]	Adjusted [2)]
Period 0–5 years			
All reasons			
Exeter	1	1	1
MS30	0.84 (0.73–0.96)	0.84 (0.73–0.97)	0.84 (0.73–0.97)
CPT	1.53 0.90–2.60	1.67 0.98–2.85	1.64 0.96–2.80
Periprosthetic fracture			
Exeter	1	1	1
MS30	0.51 (0.35–0.74)	0.48 (0.33–0.71)	0.54 (0.37–0.78)
CPT	2.61 (1.07–6.38)	2.10 (0.84–5.25)	2.58 (1.02–6.24)
Period > 5 years			
All reasons			
Exeter	1	1	1
MS30	1.56 (1.17–2.08)	1.46 (1.09–1.97)	1.32 (0.97–1.80)
CPT	1.53 0.90–2.60	3.19 1.56–6.52	2.89 1.40–5.97
Periprosthetic fracture			
Exeter	1	1	1
MS30	1.19 (0.81–1.73)	1.13 (0.76–1.68)	0.98 (0.65–1.47)
CPT	5.60 (2.66–11.82)	3.34 (1.54–7.27)	2.80 (1.26–6.22)

Table 9.3.5. Relative risk (Hazard Ratio (HR) and 95% confidence interval (CI)) in reoperations regardless of reason and due to periprosthetic fracture. Only patients with primary OA operated and only highly cross-linked polyethylene are included. The analyses are divided in two time periods, until five years' observational time and operations with observational time longer than five.

1) Adjusted for age, sex, diagnosis, approach, cup fixation and type of surface.

2) Adjusted for all variables according to 1) and for caput size (≤ 28 mm, 32 mm, ≥36 mm including DM-cup, 187 observations with diameter = 30 mm or missing data are excluded).

The Swedish Arthroplasty Register and clinical research

Author: Ola Rolfson

The government together with the Swedish Association of Local Authorities and Regions have made an agreement about the financing of Swedish national quality registries. The vision is that the registries should be an integrated part in a national system for centralized knowledge management with follow-up of Swedish healthcare. The registries are to contribute to learning and improvement, quality development, saving lives, achieve equal health, research, resource-effective healthcare, improvement work among healthcare providers and as a source of clinical research, including cooperation 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 by other means.

What is research and what is operational analysis?

The line between what is deemed clinical research and operational analysis or improvement work is blurry. All register analysis that has an aim at to feedback results to improve healthcare activities rests on scientific methods. Within the register we make targeted in-depth analyses, validity studies and co-linking of data with other health data registries that are performed according to established register research methods. There is continuous work along scientific principals' in improving and developing the methods that are used in the register work. Even though the central allocations are not meant for research, the Swedish Association of Local Authorities and Regions and the Swedish Agency for Health and Care Services Analysis regularly evaluate the registers' research activity. A high research activity is a criterion to give a register the highest level of certification.

60 dissertations from the Swedish Arthroplasty Register

When all dissertations that are wholly or in part based on data from the Swedish Hip and Knee Arthroplasty registries are taken together it can be said that we have had an impressive research production since we started in the mid-70s. The sum of all research publications from the registries amounts to over 400 and only in the last five-year period we have published 134 articles.

Within the Swedish Arthroplasty Register we will continue the strategic work to maintain the research infrastructure with the aim of maintaining high research activity. It is especially gratifying that the PhD-students that currently have ongoing dissertation work with data from the Swedish Arthroplasty Register represent eight Swedish universities (Uppsala University, Lund University, Göteborg University, Umeå University, Linköping University, Karolinska institutet, Örebro University and the Linnaeus University).

Defences of dissertations in 2021

- Safeguarding from Surgical Site Infections: A mutual responsibility between the patient, caregiver and perioperative healthcare leaders. Maria Qvistgaard 2021-12-10.
- Prosthetic Joint Infection of the Hip: Cause and Effect. Peter Wildeman 2021-10-01.
- Femoroacetabular impingement syndrome. Trends and outcomes after arthroscopic treatment in the general and athlete population. Ida Lindman. 2021-09-17.
- Hips don't lie: the use of benchmarking and register data to assess the performance of orthopaedic care. Fanny Goude 2021-05-28.
- The role of head size in total hip arthroplasty – Dislocation, wear and cup stability. Georgios Tsikandylakis 2021-03-26.

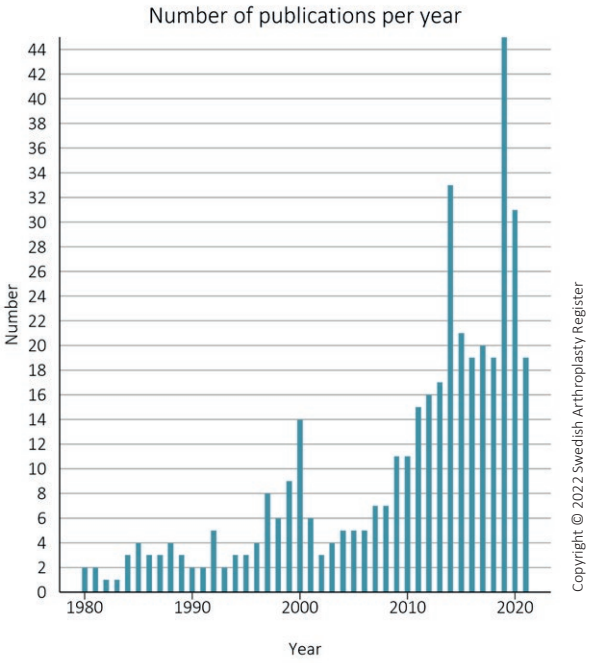
Why is observational research needed?

Register studies and randomised clinical trials (RCT) complement each other. Research within joint replacement surgery demands a long follow-up time and many patients. Some important outcome parameters (reoperations, prosthesis survival and mortality) happen relatively seldom. This makes register studies especially well-suited for research in joint replacement surgery. Register studies have advantages that can be highlighted in this context:

- Register studies represent results in practice. This means that the results have a high degree of generalisability. A register study gives a just picture of how a certain treatment works in routine healthcare in the normal population.
- Regardless of if exposure or outcome are studied, the register study enables, due to its size and long follow-up time, that events which occur seldom can be studied.
- The registration of an individual in a quality register does not require written informed consent. This means that it is easier to collect complete data and that the collection of data can be performed at a low cost.
- The continuous longitudinal collection of data enables analyses of changes in patient demography, treatment and results over time.

What is needed to use register data for research purposes?

All register-based research with individual data requires approval of the Ethics Review Authority (EPM). All information in the register is considered as public but is secrecy-protected according to the Public Access to Information and Secrecy Act (Offentlighet- och sekretesslagen). The Region of Västra Götaland is the central data controlling authority (CPUA) and the head of department at Centre of Registers Västra Götaland has the task to assess secrecy and prejudicial requests for disclosure of data. We use special forms for the data request that can be downloaded from the website of Registercentrum (registercentrum.se/forskning). Rules and regulations considering register research are available at the website of the Swedish Association of Local Authorities and Regions on quality registries (https://skr.se/kvalitetsregister/forskning.43894.html). If you want to discuss a research project, we recommend that you contact the register management. The register management is open for ideas, proposals and discussion on collaboration in new register studies. The database of the register is also well-suited for research projects during residency (ST) and master thesis projects.



Scientific production of publications with data from the Swedish Arthroplasty Register over the years.

Research meeting

Since 2012 we have annually arranged a two-days research meeting. PhD students, supervisors and other researchers that work with register studies within the musculoskeletal disorders and injuries have participated. As well general as specific research questions are discussed in work-shops. In January 2021 the meeting was organized as a virtual meeting due to the pandemic and this year's meeting (2022) had to be cancelled for the same reason.

Many researchers contribute to the register activities

Within the register management and the steering committee there are senior researchers who are supervisors and co-supervisors for PhD students that are affiliated to the register. In addition, there are other researchers who, in collaboration with register management team, conduct research within the area. There are ongoing studies about different implants and type of fixation, epidemiology, health economics, equal care, hip fracture and prosthesis surgery, periprosthetic fractures, revision surgery, statistical methodology, infections and patient-reported outcome after joint replacement.

International research collaborations

The register has an intensive research collaboration within the NARA (Nordic Arthroplasty Register Association), a register collaboration between Finland, Norway, Denmark and Sweden since 2007 and a common database is created annually. The NARA-group has now published almost 50 scientific papers and further manuscripts are in progress. The NARA-data are available for Swedish PhD students. The register has research collaborations with about ten other arthroplasty registers in the world through the International Society of Arthroplasty Registers (ISAR).

International work

Author: Ola Rolfson

Despite merger and pandemic, the Swedish Arthroplasty Register has continued to have high international activity. One important forum for the international work is the NARA-collaboration (Nordic Arthroplasty Register Association). Since 2007 we have regularly combined de-identified hip and knee replacement data from Denmark, Norway, Sweden and Finland to do unique studies. So far, this has resulted in over 50 scientific publications that have contributed in various ways to deepening the evidence in joint replacement. The collaboration has also led to a harmonisation of research methods and the way of analysing and presenting register data.

Another important forum for the international collaboration is the International Society of Arthroplasty Registries (ISAR). From the register management, we participate very actively in the management and working groups of the organization. The ISAR-collaboration has led to several projects where we combine data from several registries. In 2021, we published, among other things a register study with data from seven different registries on how ASA class affects mortality after hip replacement surgery (Silman A et al. International variation in distribution of ASA class in patients undergoing total hip arthroplasty and its influence on mortality: data from an international consortium of arthroplasty registries. Acta Orthop. 2021 Jun;92(3):304-310.).

Another example is Peter Lewis' PhD-work where we study revision after total knee replacement by using information from three arthroplasty registries – Sweden, Australia and Kaiser Permanente in the US (Lewis PL et al. The effect of patient and prosthesis factors on revision rates after total knee replacement using a multi-registry metaanalytic approach. Acta Orthop. 2022 Feb 1;93:284-293.). From one of the working groups in ISAR, we have contributed to international recommendations on PROM in arthroplasty registries (Bohm ER et al. Collection and Reporting of Patient-reported Outcome Measures in Arthroplasty Registries: Multinational Survey and Recommendations. Clin Orthop Relat Res. 2021 Oct 1;479(10):2151-2166.). Together with other registries, we participate in the OECD (Organisation for Economic Co-operation and Development) working group for "Patient-Reported Indicator Surveys (PaRIS) on Hip and Knee Replacement Surgery". The first report was published in 2019 (https://www.oecd.org/health/health-systems/OECD-PaRIS-hip-knee-data-collection-guidelines-en-web.pdf) and a second report will be published shortly.

The Swedish Arthroplasty Register has been represented at several international meetings in 2021, which were organised by, among others The European Federation of National Associations of Orthopaedics and Traumatology, the European Hip Society, the International Society of Arthroplasty Registries and the International Hip Society. At these meetings, research results from the Swedish Arthroplasty Register has been presented.

In addition to producing interesting results, such collaborative projects contribute to the different participants being informed about each other's methods for registration, selection, analyses and reporting. In turn, this also hopefully means that the registries are closer together so that in the future it will be 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 2020–2022

Scientific articles published from 1 January 2020 to 31 July 2022, which have used data from the Swedish Arthroplasty Register or its predecessors, are listed below. For a complete list of publications, please refer to the Register's website.

2022 (until 31 July)

Pyrhönen HS, Lagergren J, Wolf O, Bojan A, Mukka S, Möller M, Rogmark C. No Difference in Conversion Rate to Hip Arthroplasty After Intramedullary Nail or Sliding Hip Screw for Extracapsular Hip Fractures: An Observational Cohort Study of 19,604 Individuals. J Bone Joint Surg Am. 2022 Jul 25.

Goude F, Garellick G, Kittelsen S, Malchau H, Peltola M, Rehnberg C. Effects of competition and bundled payment on the performance of hip replacement surgery in Stockholm, Sweden: results from a quasi-experimental study. BMJ Open. 2022 Jul 14;12(7):e061077.

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Qvistgaard M, Nåtman J, Lovebo J, Almerud-Österberg S, Rolfson O. Risk factors for reoperation due to periprosthetic joint infection after elective total hip arthroplasty: a study of 35,056 patients using linked data of the Swedish Hip Arthroplasty Registry (SHAR) and Swedish Perioperative Registry (SPOR). BMC Musculoskelet Disord. 2022 Mar 23;23(1):275.

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Dissertations

The following theses with data from the Swedish Arthroplasty Register or its predecessors were defended in 2021. For a complete list of dissertations, please refer to the Register's website.

2021-12-10
Safeguarding from Surgical Site Infections: A mutual responsibility between the patient, caregiver and perioperative healthcare leaders.
Maria Qvistgaard, Linné universitetet

2021-10-01
Prosthetic Joint Infection of the Hip: Cause and Effect.
Peter Wildeman, Örebro universitet

2021-09-17
Femoroacetabular impingement syndrome. Trends and outcomes after arthroscopic treatment in the general and athlete population.
Ida Lindman, Göteborgs universitet

2021-05-28
Hips don't lie : the use of benchmarking and register data to assess the performance of orthopaedic care.
Fanny Goude, Karolinska institutet

2021-03-26
The role of head size in total hip arthroplasty – Dislocation, wear and cup stability.
Georgios Tsikandylakis, Göteborgs universitet

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