Swedish Hip Arthroplasty Register

Annual Report 2010

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Introduction

Interest in the National Quality Registers has continued to increase strongly during the past year among decision-makers, Academia and the various professions.

The national Review of the National Quality Registers presented its final report in October 2010: *The Goldmine in Health and Medical Care. Proposals for joint initiatives 2011-2015.* In spring 2011 the 'Implementation Project' started; its proposals will be presented on 30 September. It is highly probable that the National Quality Registers will receive increased funding starting in 2012.

With more state money in the system and higher requirements on the Registry, however, there are risks of increased central control of the system. The Registry management maintain that registers should be initiated, developed, analysed and reported back via the professions and not via the authorities. The whole idea that the profession should scrutinize its own care quality may be thrown overboard via central control systems. We hope that the final proposal will note these views.

The National Quality Registers have long remained partly unexploited by Swedish clinical research, and in general the interest from our seats of learning has been low. In Academia, too, there is currently a shift towards increased interest in observational studies. The Registry's research activities are more extensive than ever before, with ten doctoral students.

The Swedish Hip Arthroplasty register is entering its thirty-third year of activity. Analysis of various implant types and the importance of surgical techniques for reoperation frequency, in the short and long terms, remains as a central task for the Registry. The Registry's continual feed-back to the profession has brought about national adaptation to optimal technique and the use of few but well-documented implant types. This has resulted in continually improved implant survival.

However the Registry's chief task is to analyse the whole process of arthroplasty – that is, to identify in a multi-dimensional and individual-based manner the predictors for both good and poor outcome. The 10-year survival of our commonest and most documented implants is today over 95% and the potential for improvement lies chiefly among certain patient groups.

There is a greater possibility to improve the outcome from the patient's perspective by optimising work on indications, care processes, pre- and post-operative information and rehabilitation. In addition, to implement non-surgical early care of patients with hip arthritis – that is, operating on the right patient at the right time and with the right technique.

The Swedish Hip Arthroplasty Register is a combination of two registers: one for operations involving total hip arthroplasty with osteoarthritis/arthritis as main indication and one for operations with what are termed hemi-prostheses with hip fracture as main indication. The patient groups differ greatly: a relatively healthy population with an average age of just under 70 years, and a group with an average age of just over 84 years with pronounced medical comorbidity and short life expectation.

Open reporting

The Hip Arthroplasty Registry reports openly a large number of outcome variables at unit and aggregate county-council levels. Five of these variables are included as national quality indicators in *Öppna jämförelser* (Open Comparisons):

- Reported health gain (EQ-5D index gain after one year).
- Patient satisfaction one year after total hip arthroplasty.
- Short-term complications two years after total hip arthroplasty.
- Ten-year implant survival following total hip arthroplasty.
- One-year implant survival following hemi-arthroplasty.

In-depth analyses

We have for many years carried out and reported a number of in-depth analyses of different issues. These analyses aim not only at clinical improvement; they are important for new development and the publication of scientific reports. The route via scientific publications and journals often takes years and does not reach all colleagues. A well-balanced compromise between these two reporting systems is probably the optimum method of disseminating Register results and rapidly implementing 'best practice'.

Degree of coverage

All units (78 hospitals), public and private, that carry out total hip arthroplasty are included in the Register. All 57 hospitals that carry out hemi-arthroplasty also report to the Register, which thus has a 100% degree of coverage regarding hospitals. The degree of coverage for primary arthroplasty at individual level (completeness) has, this year also, been checked by co-processing with the National Board of Health and Welfare Patient Register and is reported in detail in later chapters. Completeness at national level was 98.5% for total arthroplasty, 96% for hemi-arthroplasty.

Patient-reported outcome measures – PROM

Patient-reported outcome was reported during 2010 from all hospitals. The Registry now has a unique national system for capturing patient-reported outcome prospectively and longitudinally for all patients undergoing total hip arthroplasty. The response rate at the one-year follow-up is just over 90%.

Reporting to the Registry

Most departments report via the web application. Copies of medical records from re-operations are sent over the year with varying delay. Reviews of medical-record copies and systemized data collection centrally are necessary for Register analysis regarding reoperations and revisions.

Re-reporting

All publications, annual reports and scientific reports are presented on our website. The Hip Arthroplasty Registry in collaboration with the Swedish Knee Arthroplasty Registry invites all departments to an annual user meeting at Arlanda.

Local activity analysis and development

The Registry has always intended that re-reporting should stimulate participating departments to carry out local analyses of their activity and that this should lead to measures for improvement. The purpose of open comparisons is that they should put increased pressure on this process. In the past few years we have, in each annual report, selected good examples of such work. This year we publish written reports from two departments about their analyses. How to stimulate all departments to carry out similar work is a central problem area for the Registry's work.

This year's production

In 2010 the procedure frequency of total hip arthroplasties increased further to an 'all-time high' (15,935, 170/100,000 inhabitants, adjusted for individuals aged over 40 years: 332/100,000) – see bar diagram. The procedure frequency for hemi-arthroplasties during 2010 was unchanged at about 4,500.

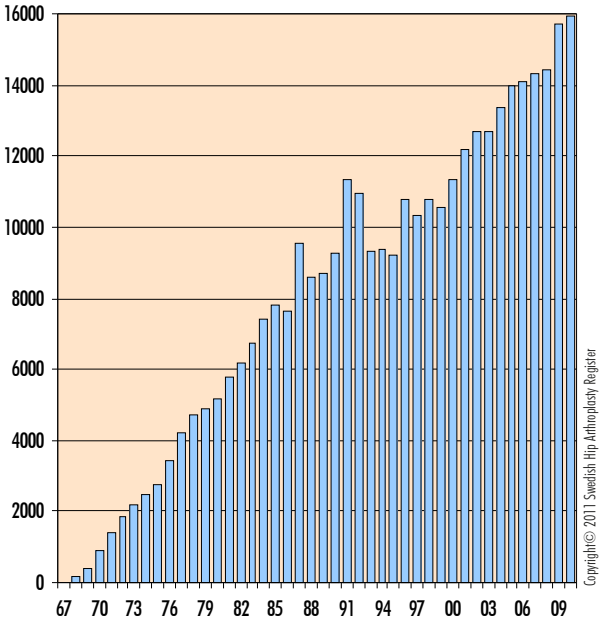
Private enterprise has for some years produced more operations than the university hospitals and this is now further accentuated. These producers have in most cases no R & D and/or educational tasks, either for surgeons or for operating staff. This development can in the long term be serious regarding the maintenance of competence and clinical research.

Distinctions

Peter Herberts, initiator of the Register and former Keeper of the Register, has been awarded the British Orthopaedic Association's highest distinction for his contribution to the development of registries internationally, where the Swedish Hip Arthroplasty Register has been a model.

Ola Rolfson, who defended his thesis on 10 December 2010, summarising the Registry's 10-year patient-related outcome measure experience, was awarded a prize for the year's best doctoral thesis in Swedish orthopaedics.

Primary total hip replacement in Sweden



The number of primary total hip arthroplasties performed in Sweden from 1967 (6 operations) to 2010 (15 935 operations).

This year's report

This year's printed Report is somewhat altered both in design and contents. A number of standard tables which we have published for many years no longer figure in the Report but may be reached via our website.

Our thanks to all our colleagues!

The Hip Arthroplasty Register is based on decentralised data capture, for which reason the contributions of the departments' contact secretaries and contact physicians are absolutely essential and invaluable for the Registry's function. Very many thanks for all contributions during the year!

Göteborg 1 October 2011.

Göran Garellick
Associate Professor

Johan Kärrholm
Professor

Cecilia Rogmark
Associate Professor

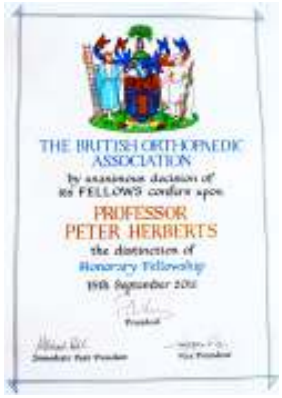
Peter Herberts
Professor Emeritus

Distinctions awarded to the Swedish Hip Arthroplasty Register

During the past year two members of the Registry staff have received prestigious distinctions.

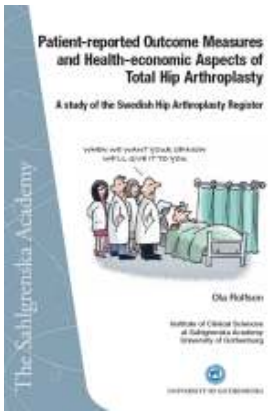
Professor Emeritus Peter Herberts has received from the British Orthopaedic Association an honorary fellowship, the Association's highest distinction, awarded to few orthopaedic surgeons outside the renowned Association. The citation states that this distinction has been awarded for Peter Herberts' contributions *"in particular his achievements in developing the Hip Joint Registry for Sweden which innovated the Western World"*. Peter Herberts received this distinction for initiating the Swedish Hip Arthroplasty Register back in the 1970s and then managing it and heading it. Peter Herberts received the certificate of honorary fellowship at a ceremony in Dublin, Ireland, on 13-16 September 2011.

An unusually proud Peter Herberts receives the certificate of 'Honorary Fellowship' from chairman Peter Kay of the British Orthopaedic Association.



Peter concluded his role as Director of the Register in 2004 but remains as emeritus on the Registry's governing body and is a valuable 'sounding board' with an extensive international network. The present Registry management also feels honoured by this distinction, which is unique in orthopaedics. Leading a Registry the size of the Swedish Hip Arthroplasty Registry is no 'one-man show': the success of the Register is the result of good, far reaching teamwork. All who have co operated with or who are currently working at the Registry have a share in this distinction.

Ola Rolfson presented his thesis on 10 December 2010. It was the tenth Register-based thesis. In a pedagogical and scientific manner he summarizes the first ten years of the Register's existence with the PRO variables included and entitled *'Patient-reported Outcome Measures and Health-economic Aspects of Total Hip Arthroplasty: a Study of the Swedish Hip Arthroplasty Register'*.



At the annual meeting of the Swedish Orthopaedic Association, 30 August to 2 September 2011, Ola's thesis was nominated the year's best orthopaedic thesis (shared prize) with the citation *"With persistence and precision, the patient's own experience after hip arthroplasty is elicited from the small perspective; from the large perspective the socioeconomic value of our contributions is examined. This newly -won knowledge is already contributing to a better and more cost-effective treatment of the large patient group our hip arthritis patients represent"*.

Nor is a thesis a 'one-man show'; it also represents teamwork. Ola's supervisor and deputy supervisor are members of the Registry management, and the Register's co-ordinators contributed greatly to the material of the thesis – as also did all the orthopaedic departments throughout the country. The whole Registry shares in Ola's fine prize.

New Doctor of Medicine Ola Rolfson with the proof that he wrote the best thesis in Swedish orthopaedics for 2010 (shared prize).

Degree of coverage

A high degree of coverage is one of the most important factors in a register's data quality and the possibility of conducting qualitative improvement work and clinical research. The degree of coverage should be noted at individual level (completeness). The coverage regarding participating departments (coverage) is an important variable but if participating units under-report at individual level the analyses and re-reporting become misleading. All hip-arthroplasty-producing units in Sweden have for many years participated in reporting to the Registry so current analyses have as their chief goal to illustrate the degree of completeness at individual level.

Method

Matching the Register's databases with the Patient Register (PAR, National Board of Health and Welfare) (NFB 29, 39, 49, 62 and 99 for total arthroplasty; NFB 09 and NFB 19 for hemi-arthroplasty) at individual level (personal identification number) provides three different outcomes:

- Matching of individuals, i.e. patients recorded in both registers.
- Individuals recorded only in the Hip Arthroplasty Register.
- Individuals recorded only in the PAR.

The completeness for the Hip Arthroplasty Register is given in the following table as the sum of outcomes 1+2 and the completeness for PAR as the sum of 1+3. We do not know whether these results reflect the true completeness since patients may have undergone hip arthroplasty without the care unit in question registering the measure in either register. The number of such cases should be very low in Sweden in 2010.

Weak points in the analysis

Laterality. In most cases the Patient Register lacks laterality, i.e. right or left is not given as a unique variable, as is done in the Hip Arthroplasty Register. Patients operated with one-stage or two-stage bilateral hip replacement during 2010 may 'fall out' from the Patient Register with the selection criteria chosen for matching.

Lag in registration. Certain units are 'chronic' laggards - not so seldom over the new year – which is a great disadvantage with this type of necessary quality check. Experience shows that a further 0.5% to 1.0% are reported to the Registry during the subsequent year.

Administrative fusions of hospitals and the opposite, i.e. operations carried out at 'satellite hospitals'. As described earlier both these examples of structural change in orthopaedics represent a future 'threat' to fair and open reporting. Differences in completeness may then have non-medical logistical reasons ; e.g. that the hospital reports to the PAR via 'the principal hospital' and to the Registry via the unit where the operation was performed. The Swedish Hip Arthroplasty Registry has always and will always state hospital affiliation to the hospital body/operational environment where the actual intervention is performed. This is to enable analysis of complications. The Registry's purpose is not to illustrate the principal's production figures from an organizational unit.

Results

Total hip arthroplasties. The national degree of coverage for 2010 was 98.5%, the highest figure we have had since the analysis became annual. Should the analysis be repeated, the regular lag of 0.5-1.0% would probably mean that over 99% of all primary arthroplasties are registered in Sweden, which is very satisfactory. Departments with values less than one standard deviation below the national mean value are marked in red in the table. Eleven departments got this mark regarding degree of coverage in the Register during 2010 – despite the high national average there is potential for improvement.

Just as in the latest analyses, the private departments were poor at reporting to the PAR – an improvement has, however, has occurred compared to 2009. This is worth noting since registration to the PAR is mandatory. This year, too, surprisingly enough, a number of public departments have also fallen down on their PAR reporting.

Hemi-arthroplasties. Hemi-arthroplasties have only been registered for six years and the degree of coverage at national level is relatively unchanged at 96%. Nine departments have a degree of coverage below this, as above.

Reoperations and revisions. A good degree of coverage for this type of intervention register naturally includes the completeness for reporting possible reoperations/revisions. The analysis of secondary interventions, however, proves to be much more difficult owing to the poor quality of coding, both of diagnosis and of reoperation measures. The Registry management wishes once more to ask all managers at clinic meetings to urge all operating colleagues to give time and thought to coding. This issue is important for statistics and economic compensation and should be included as a defined part of specialist training.

Degree of filling-in of new variables. The degree of completion of BMI and ASA at national level is now up to about 95%. It will not be published in table form in this Annual Report, but can be seen at our website.

The Swedish Hip Arthroplasty Registry has always and will always state hospital affiliation to the hospital body/operational environment where the intervention in question is carried out. This to enable us to analyse complications. The Registry's goal is not to illustrate principal's productivity figures from an organizational unit.

Completeness for total arthroplasties

registrations during 2010

Hospital	No. [1]	SHAR [2]	PAR [3]
University/Regional Hospitals			
KS/Huddinge	236	99.2%	73.1%
KS/Solna	211	99.5%	94.8%
Linköping	59	100.0%	98.3%
Lund	114	95.8%	95.0%
Malmö	107	100.0%	95.3%
SU/Sahlgrenska+Mölndal+Östra [4]	447	96.1%	97.0%
Umeå	93	96.9%	100.0%
Uppsala	364	97.6%	97.6%
Örebro	184	99.5%	87.0%
Central hospitals			
Borås+Skene [5]	278	96.2%	96.5%
Danderyd	301	98.4%	98.7%
Eksjö	192	97.9%	99.4%
Eskilstuna	109	100.0%	97.2%
Falun	323	99.7%	97.8%
Gävle	159	98.2%	93.3%
Halmstad	230	99.6%	97.4%
Helsingborg	70	95.9%	98.6%
Hässleholm-Kristianstad	798	99.8%	99.3%
Jönköping	206	99.5%	98.6%
Kalmar	167	99.4%	99.4%
Karlskrona+Karlshamn [6]	233	99.1%	96.6%
Karlstad	278	97.2%	96.9%
Norrköping	238	99.6%	92.9%
S:t Göran	420	99.2%	99.0%
Skövde+Lidköping+Falköping [7]	478	99.2%	98.3%
Sunderby	38	100.0%	100.0%
Sundsvall	195	96.0%	95.0%
Södersjukhuset	985	98.0%	99.2%
Uddevalla	281	98.6%	97.2%
Varberg	193	99.0%	100.0%
Västerås	413	96.5%	95.8%
Växjö	127	92.7%	95.6%
Ystad	5	100.0%	100.0%
Östersund	234	98.7%	95.4%
Rural hospitals			
Alingsås	205	99.5%	98.1%
Arvika	186	91.7%	98.1%
Bollnäs	330	97.9%	98.5%
Enköping	250	100.0%	99.2%
Frölunda Specialistsjukhus	75	88.2%	100.0%
Gällivare	105	100.0%	99.0%
Hudiksvall	132	98.5%	95.5%
Karlskoga	138	98.6%	99.3%
Katrineholm	237	99.5%	99.1%
Kungälv	195	97.0%	96.0%
Lindesberg	211	100.0%	99.1%
Ljungby	164	99.4%	96.4%
Lycksele	330	100.0%	100.0%
Mora	217	99.1%	97.7%
Motala	437	98.2%	100.0%
Norrtälje	118	100.0%	100.0%
Nyköping	178	98.9%	98.9%
Oskarshamn	198	98.5%	99.5%
Piteå	372	99.5%	99.7%
Skellefteå	93	95.9%	96.9%
Sollefteå	123	93.9%	95.4%
Södertälje	121	97.6%	97.6%
Torsby	105	100.0%	100.0%
Trelleborg	567	100.0%	96.8%
Visby	106	96.4%	89.1%
Värnamo	125	99.2%	100.0%
Västervik	113	97.5%	99.2%
Ängelholm	143	99.3%	96.5%
Örnsköldsvik	184	100.0%	41.8%
Private hospitals			
Aleris Specialistvård Sabbatsberg	150	100.0%	100.0%
Carlanderska	117	100.0%	0.0%
Elisabethsjukhuset	70	100.0%	57.1%
Movement	255	100.0%	0.0%
Nacka Närsjukhus Proxima	122	93.8%	95.4%
Ortho Center Stockholm	432	99.3%	98.9%
OrthoCenter IFK-kliniken	115	100.0%	99.1%
Ortopediska Huset	343	98.0%	79.4%
Sophiahemmet	174	100.0%	0.0%
Spenshult	184	99.0%	96.3%
Nation	15,886	98.5%	92.8%

Red marking indicates values one standard deviation below national average.

[1] Refers to the number of registrations in the Swedish Hip Arthroplasty Register.

[2] Refers to the proportion of registrations in both registers or only in the Swedish Hip Arthroplasty Register.

[3] Refers to proportion of registrations in both registers or only in the National Patient Register.

[4] These departments are in the National Patient Register combined to 'Sahlgrenska University Hospital'.

[5] These departments are in the National Patient Register combined to 'SÄ medical care'.

[6] These departments are in the National Patient Register combined to 'Blekinge Hospital'.

[7] These departments are in the National Patient Register combined to 'Skaraborg Hospital'.

Completeness for hemi-arthroplasties

registrations during 2010

Hospital	No. [1]	SHAR [2]	PAR [3]
University/Regional Hospitals			
KS/Huddinge	87	93.6%	86.1%
KS/Solna	84	98.8%	95.3%
Linköping	78	97.6%	91.3%
Lund	135	97.8%	88.4%
Malmö	197	98.0%	97.0%
SU/Sahlgrenska+Mölndal+Östra [4]	306	98.1%	89.7%
Umeå	71	82.5%	97.6%
Uppsala	110	99.1%	95.5%
Örebro	100	99.1%	95.1%
Central hospitals			
Borås+Skene [5]	73	90.1%	86.4%
Danderyd	161	97.6%	89.1%
Eksjö	48	98.0%	91.8%
Eskilstuna	52	94.5%	85.5%
Falun	114	99.1%	98.3%
Gävle	128	97.7%	96.2%
Halmstad	70	97.2%	97.2%
Helsingborg	180	97.3%	95.7%
Hässleholm-Kristianstad	122	98.3%	94.3%
Jönköping	56	94.9%	93.2%
Kalmar	118	97.5%	97.5%
Karlskrona+Karlshamn [6]	93	100.0%	95.7%
Karlstad	75	91.4%	92.6%
Norrköping	57	100.0%	94.7%
S:t Göran	226	98.7%	97.8%
Skövde+Lidköping+Falköping [7]	119	96.8%	94.4%
Sunderby	111	94.9%	96.6%
Sundsvall	53	98.2%	98.2%
Södersjukhuset	228	95.0%	97.9%
Uddevalla	228	98.7%	94.4%
Varberg	77	100.0%	96.1%
Västerås	83	95.4%	93.1%
Växjö	44	86.3%	90.2%
Ystad	56	98.3%	94.8%
Östersund	104	100.0%	94.2%
Rural hospitals			
Alingsås	47	95.9%	93.9%
Arvika	30	88.2%	79.4%
Gällivare	20	95.2%	100.0%
Hudiksvall	44	100.0%	90.9%
Karlskoga	33	94.3%	85.7%
Kungälv	67	98.5%	91.2%
Lindesberg	22	100.0%	90.9%
Ljungby	22	100.0%	95.5%
Mora	42	93.3%	95.6%
Motala	5	10.6%	100.0%
Norrtälje	37	100.0%	100.0%
Nyköping	26	100.0%	100.0%
Skellefteå	44	100.0%	97.7%
Sollefteå	22	100.0%	86.4%
Södertälje	36	97.3%	94.6%
Torsby	31	100.0%	93.5%
Visby	32	88.9%	91.7%
Värnamo	25	100.0%	84.0%
Västervik	40	95.2%	92.9%
Örnsköldsvik	42	100.0%	45.2%
Riket	4 511	96.0%	93.5%

Red marking indicates values one standard deviation below national average.

[1] Refers to the number of registrations in the Swedish Hip Arthroplasty Register.

[2] Refers to the proportion of registrations in both registers or only in the Swedish Hip Arthroplasty Register.

[3] Refers to proportion of registrations in both registers or only in the National Patient Register.

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[6] These departments are in the National Patient Register combined to 'Blekinge Hospital'.

[7] These departments are in the National Patient Register combined to 'Skaraborg Hospital'.

On coding

Code correctly

Giving the correct diagnosis code and the right code for the measures carried out makes possible a better follow-up of activity, fairer and more correct compensation and more reliable research databases.

That data entered into the quality and other health-data registers is correct is a precondition for the ability of the analysis results to maintain high quality and reliability.

Updated concise guide

The Swedish Orthopaedic Association has recently published an updated version of its *Concise Guide*. Older versions contained several errors that have now been corrected. This compilation explains and clarifies the most frequent and relevant codes in arthroplasty. The Swedish Hip Arthroplasty Registry (SHPR) recommends that the country's departments keep to the coding recommendations in the new Concise Guide.

Sequelae following child diseases of the hip

How should one code residual states following child diseases? Dysplastic arthritis has its own diagnosis number and residual states following Perthe's disease (coxa plana) have likewise. We propose that other residual states following childhood diseases should be coded with secondary arthritis followed by a Z code for other acquired musculoskeletal disorder in the patient's own medical history (Z 87.3) or congenital musculoskeletal deformity/malformation in the patient's medical history (Z87.7).

Complications

Recording complications is hard and often there are no good codes. For registration in the reoperation database to be as correct as possible, it is important to describe clearly in the operation report the causes of reoperations and revisions, together with details of the surgical procedure.

The most common diagnosis codes are mechanical complications (T84.0F) sometimes including implant loosening, dislocation, osteolysis, acetabular erosion and implant fracture. As a supplement, a code is required that specifies the reason. Here code Y83.1 is commonly used (implant complication without relation to adverse events during the procedure) but also Y79.2 (implant-related adverse events, technical error) may be appropriate. Osteolysis with evident cup wear can be an example of this.

Dislocations

A major reason for coding implant dislocation correctly is that closed repositioning is not reported to SHPR. To be able to analyse the occurrence of dislocation in the future, therefore, coding reported to the Patient Register needs to be correct. An earlier version of the Concise Guide gave various combinations of codes for early and late implant dislocation, which was incorrect. Now the use of T84.0F (mechanical complication) and Y83.1 (implant complication not associated to adverse rd during measure taken) are suggested. In repeated dislocations, M24.4F (repeated dislocation) is added.

Infections

Implant infection is coded T84.5F and Y83.1 and it makes no difference for diagnosis coding whether the infection occurs early or late. Typical coding for reoperation for deep implant infection where it is intended to save the implant is NFS 19 (incision/debriding in septic arthritis), NFS 49 (implantation of pharmaceutical preparation in septic arthritis), suitable codes for replacement of caput and possibly liner with addition of NFW 69 (early reoperation for deep infection).

Special codes for early reoperation

The NFW reoperation codes should always be used for early reoperation, within 30 days of original operation. For minor surgical procedures they may be used separately, but for more extensive interventions they should be used as supplementary codes. Among others this gives higher DRG points.

Extraction of implants

Irrespective of whether one intends to reimplant a prosthesis, extraction of the implant is coded NFU 09 for hemiarthroplasty and NFU 19 for total arthroplasty. If a spacer is inserted, NFC 59 should be added. Do not, therefore, use the code for excision arthroplasty, normally termed Girdlestone, in connection with implant surgery.

Periprosthetic fractures

Fractures close to the implant must not be coded with S codes. M96.6F is used supplemented by a suitable cause code (V, W or Y number). This also applies to fractures distally of the implant, Vancouver type C, regardless of whether the implant is loose or not. If there is concurrent implant loosening, codes for this should also be given. For surgical fracture intervention, suitable codes for osteosynthesis are used in combination with codes for possible implant revision and structural graft. Accidental perioperative (or early postoperatively discovered) fractures should be coded with suitable S codes followed by Y60.0 (unintentional injury during operation).

Diagnoses

Osteoarthritis			
Primary bilateral	M16.0		
Primary unilateral	M16.1		
Dysplastic bilateral	M16.2		
Dysplastic unilateral	M16.3		
Post-traumatic bilateral	M16.4		
Post-traumatic unilateral	M16.5		
Secondary bilateral	M16.6		
Secondary unilateral	M16.7		
Coxa plana (Perthe's sequelae)	M91.2		
Sequelae following acquired hip disorder in childhood	M16.7	Z87.3	
Sequelae of congenital hip disorder in childhood	M16.7	Z87.7	
Rheumatic arthritis			
Psoriatic arthritis (+ L40.5)	M07.3F		
RA seropositive	M05.8F		
RA juvenile	M08.0F		
RA UNS	M06.9F		
Fractures			
Cervical femur fracture	S72.00		
Trocanter femur fracture	S72.10		
Pathological fracture	M90.7F		
Tumours			
Skeletal metastases	C79.5		
Skeletal tumour, benign	D16.2		
Skeletal tumour, malign	C40.2		
Other diagnoses			
AVN, idiopathic	M87.0F		
AVN, post traumatic	M87.2F		
Complication diagnoses			
Wound infection superficial	T81.4	Y83.1	
Implant infection	T84.5F	Y83.1	
Implant dislocation	T84.0F	Y83.1	
Implant dislocation, repeated	T84.0F	M24.4F	Y83.1
Ectopic bone formation following op.	M61.4	Y83.1	
Osteolysis, near to implant	M89.5	Y83.1	
Implant failure/break	T84.0F	Y79.2	
Implant loosening	T84.0F	Y83.1	
Fracture close to implant following fall	M96.6F	W-nr	
Acetabular erosion	T84.0F	M16.7	Y83.1
Pseudoarthosis, hip fracture	M84.1F	T93.1	Y86.9
AVN, post-operative fracture	M87.2F	T93.1	Y86.9
Explanation			
Mechanical complication in hip joint	T84.0F		
Implant causing failure	Y79.2		
Implant complication not linked to failure during operation	Y83.1		
Sequelae following fractured femur including hip joint	T93.1		
Late complication following other accident	Y86.9		
Unintentional injury during operation	Y60.0		

Measures

Primary hip implant operations	
NFB 09	Primary hemi-arthroplasty cement-free
NFB 19	Primary hemi-arthroplasty with cement
NFB 29	Primary total arthroplasty cement-free
NFB 39	Primary total arthroplasty hybrid technique
NFB 49	Primary total arthroplasty with cement
NFB 62	Primary total surface replacement implant
NFB 99	Other primary hip implant op.
Revisions (secondary hip implant operations)	
Without cement	
NFC 09	Secondary hemi-arthroplasty cement-free
NFC 20	Secondary total arthroplasty cement-free, total revision
NFC 21	Secondary total arthroplasty cement-free, cup revision
NFC 22	Secondary total arthroplasty cement-free, stem revision
NFC 23	Secondary total arthroplasty cement-free, other component
NFC 29	Secondary total arthroplasty cement-free, other revision
Hybrid	
NFC 30	Secondary total arthroplasty hybrid, total revision
NFC 31	Secondary total arthroplasty hybrid, cup revision
NFC 32	Secondary total arthroplasty hybrid, stem revision
NFC 33	Secondary total arthroplasty hybrid, other component
NFC 39	Secondary total arthroplasty hybrid, other revision
With cement	
NFC 19	Secondary hemi arthroplasty with cement
NFC 40	Secondary total arthroplasty with cement, total revision
NFC 41	Secondary total arthroplasty with cement, cup revision
NFC 42	Secondary total arthroplasty with cement, stem revision
NFC 43	Secondary total arthroplasty with cement, other component
NFC 49	Secondary total arthroplasty with cement, other revision
Other secondary hip-joint operations	
NFC 99	Other secondary hip-implant operations
Supplementary measures	
NFN 09	Autotransplantation of bone
NFN 19	Homotransplantation of bone
NFN 29	Heterotransplantation of bone
TNF 50	Implantation of skeleton markers
NFC 59	Secondary implantation of interposition implant (spacer)
Reoperations	
NFU 09	Extraction of hemi-implant
NFU 19	Extraction of total implant
NFA 12	Open exploration of hip joint
NFH 22	Open reposition of dislocated implant
NFL 49	Suture/reinsertion of tendon muscle insertion
NFS 19	Incision/debriding septic arthritis
NFS 49	Implant medication septic arthritis
NFT 12	Open mobilisation of joint
Code for early reoperation	
NFW 49	Suture of incision rupture
NFW 59	Reoperation for superficial wound infection
NFW 79	Reoperation for wound bleeding/haematoma
NFW 89	Reoperation for deep bleeding
NFW 99	Other reoperation
Closed operations	
NFH 22	Closed reduction of dislocated implant
TNF 10	Arthrocentes
TNF 11	Injection in hip joint
NFA 10	Diagnostic arthrography

Primary total hip arthroplasty

During 2010 the number of primary hip arthroplasties continued to increase. Compared with the previous year when the number rose from 14,456 to 15,736 (+8.9%), the 2010 increase to 15,935 is more modest (+1.3%). Compared with 2000, the number of primary arthroplasties increased by just under 41%.

Demography

Besides a strong increase in the number of primary arthroplasties, there were also several interesting demographical changes between 2000 and 2010. The relative proportion of women undergoing hip surgery declined successively from 61.3% to 58.4%. This can, at least partially, be explained by fact that the proportion of hip arthroplasties undertaken for inflammatory arthritis and fracture/trauma, diagnoses that are more common in women, declined during the most recent 10-year period. Especially clear is the relative decrease in women undergoing operation for fracture/trauma, from 16% in 2000 to 10.7% ten years later. The 'fracture' group includes both treatment of acute fractures and complications following osteosynthesis. The drastic reduction of osteosynthesis in femoral neck fracture in Sweden during the past 10 years largely explains this decrease, and the fact that hemi-arthroplasty has become an established alternative to total arthroplasty in fracture. Generally, however, the declining proportion of secondary arthritis is explained primarily by more patients having primary arthritis (figure 1a-b). During the period there were 2,061 and 2,518 operations on men and women, respectively.

During the most recent ten years the mean age has decreased from 69.6 to 68.4 years and the median age from 71 to 69 years with no differences between men and women. In total the number of arthroplasties has increased in all age groups but the distribution between these groups has changed. In 2000, 4.4% were under 50 at the time of operation (n=501), increasing to 5.4% (n=863 ten years later. The 50-59-year age group has remained relatively unchanged (13.8 and 13.0) while the 60-79-year-olds represented an increasing proportion (48.3-54.4%). The proportion of patients over 75 has declined (33.5-27.2%). The change has been slow and not continual over the most recent decade (figure 2).

Between 2000 and 2010 there was a successive change in patient distribution among various hospital types. Ten years ago 15.7% of primary arthroplasties were carried out at university/regional hospitals and 10.5% at private hospitals. By 2010 the proportion having hip surgery at private hospitals had increased to 17.7%, the highest ever. In 2009 the corresponding proportions were 10.7% and 14% respectively, meaning that the downward trend for university/regional hospitals was temporarily broken. The relative proportion at county hospitals during the period slowly sank from 38.5% to 33.4%, while district hospitals showed a small increase (from 35.3% to 37.5%).

The standard patient

Demographic description of the patient population undergoing hip arthroplasty is important from many aspects. In the long term this description can be matched against a risk profile for different types of complication, so as to facilitate prevention. While this process requires larger data material to be reliable and a longer follow-up to be applicable to risk profiles, 32,446 operations can now be described with complete data for all the variables age, diagnosis, BMI, ASA degree and Charnley class (table 1). These patients were operated on between 2007-20010 and thus represent a current demography.

In the primary osteoarthritis group, 66.3% of the patients were between 60 and 79 years, approximately corresponding to the

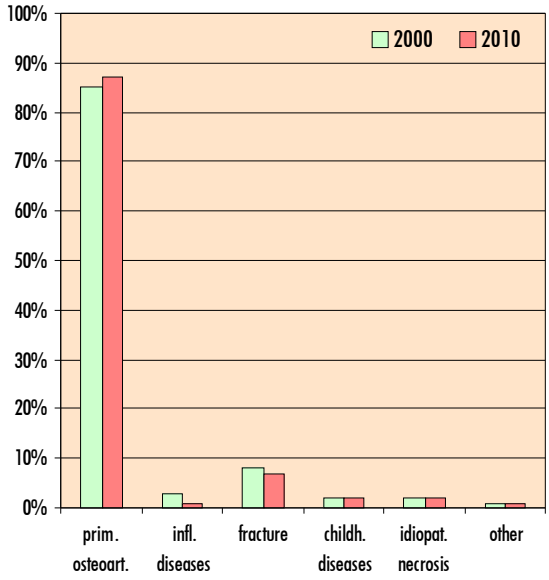


Figure 1a. Change of distribution of diagnoses for men in 2000 compared to 2010.

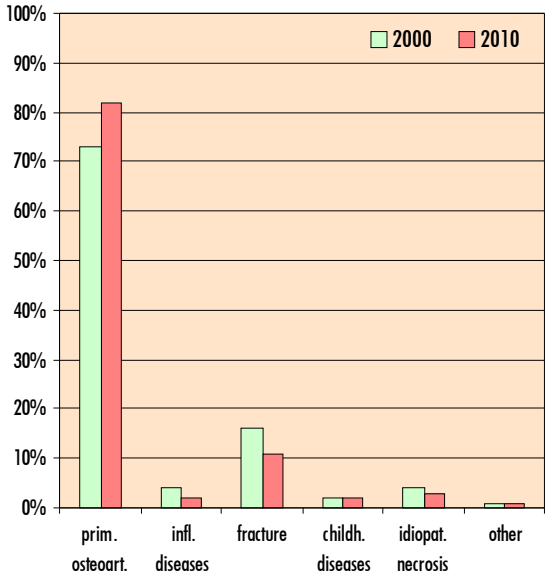


Figure 1a. Change of distribution of diagnoses for women, 2000 compared with 2010.

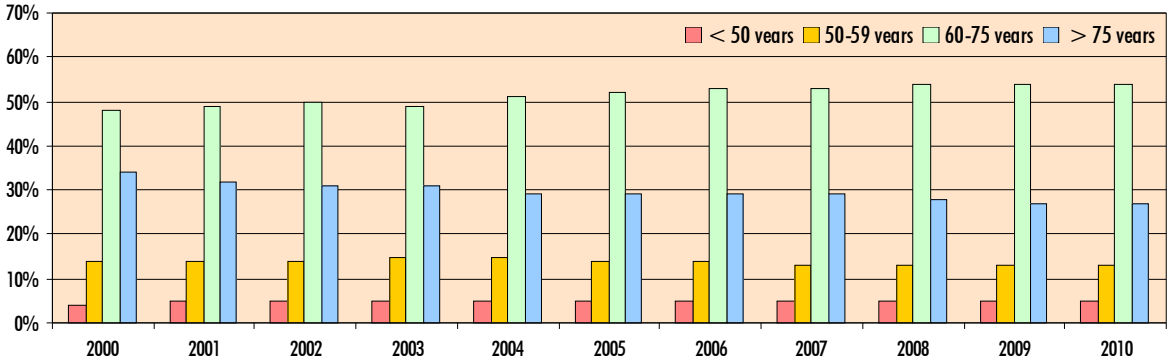


Figure 2. Age distribution, total hip arthroplasties 2000 to 2010.

limit for the 15th percentile (58 years) and the 85th percentile (80 years). This means among other things that there exists approximately the same number of observations below and above the interval. Setting about the same limits for BMI and rounding -off to the nearest whole number, one arrives between 23 (15th percentile = 23.01) and 32 (85th percentile = 31.6). The majority of patients are classed as ASA group 1 or 2 (80%). The Charnley classification is based on the patient's own assessment. Among men classes A and B dominate, i.e. patients without other functional impairments than their hip problems affecting their gait. Women state in over half the cases that other causes than hip disease affect their activity. In general, then, it cannot be said that either Charnley grouping A + B or C dominates.

If a standardised patient group aged 60-79 years, BMI between 22 and 32 and ASA group 1 or 2 is defined, these comprise just over half (54% men/women: 56/52%) of the primary-arthritis group. If the model is adjusted for men (aged 56-78 years, BMI 22-32) and women (59-81, BMI 24-31), respectively, 52% of the men and 57% of the women are included – which better reflects the gender difference in incidence.

The corresponding definition for the group secondary arthritis is hampered by the fact that this group is still small and consists of many diagnoses (idiopathic necrosis 32.1%, sequelae following childhood disorder 27.5%, inflammatory arthritis 22.2%, fractures 17.2%, with great differences regarding demography.

In summary, we have described a standardized patient group now including approximately half of the patients. This patient group corresponds relatively well to the demography which in this and earlier annual reports has proved to be associated with a low risk of short and/or long-term complications. Note that this year's description is preliminary. Limit values can and will be adjusted depending on how large a proportion of the patient population one wishes to include and on the purpose of the classification. It will also be supplemented successively on the basis of increasing data capture and follow-up time.

Decision-makers in Swedish health and medical care are increasingly focusing on the free-choice of care perspective. There is a desire that patients can in a simple and fair manner compare the results of arthroplasty between different departments. Traditionally, our annual reports are written for the profession, and using them as decision-making material supporting patients' choices can be a delicate pedagogical task. The above description of 'the standard patient' is a first attempt to create such an instrument. We plan to continue analysing demography (possibly including socioeconomic indices), and in the next Annual Report tables will be published to illustrate the standard patient's results.

Risk of reoperation within 2 years – operating department

It is well documented that patient demography affects the risk of complications following arthroplasty. In a preliminary analy-

	Men		Women		Totalt	
	mean	S.D	mean	S.D	mean	S.D
Primary osteoarthritis (*number*)	*12,938*		*17,083*		*30,021*	
Age	66.9	10.2	69.3	9.7	68.3	10.0
BMI	27.6	3.9	27.0	4.8	27.3	4.4
ASA 1/2/3-4 %	29/56/15		25/62/13		27/59/14	
Charnley classification (A+B/C) %	64/36		42/58		59/41	
Secondary osteoarthritis (*number*)	*884*		*1,541*		*2,425*	
Age	59.8	14.6	63.1	14.7	61.9	14.8
BMI	26.4	4.3	25.8	5.0	26.0	4.8
ASA 1/2/3-4 %	29/49/22		22/59/19		25/55/20	
Charnley classification (A+B/C) %	58/42		49/51		52/48	

Table 1. Age, BMI, ASA degree and Charnley classification for patients with complete data in the Hip Arthroplasty Register.

	University-/Regional hospital			Central hospital			Rural hospital			Private hospital		
	No.			No.			No.			No.		
Age [1]	1,824	**65.2**	*64.5-65.8*	5,315	**69.6**	*69.3-69.9*	5,969	**68.9**	*68.6-69.1*	2,827	**67.0**	*66.0-67.4*
Prop. >= 80 years %	281	**15.4**		978	**18.4**		857	**14.4**		284	**10.0**	
Share women %	1,054	**57.8**		3,114	**58.6**		3,433	**57.5**		1,704	**60.3**	
BMI [1]	1,332	**26.6**	*26.3-26.9*	5,217	**26.9**	*26.8-27.0*	5,695	**27.4**	*27.3-27.6*	1,736	**26.7**	*26.5-26.9*
Prop. under/over weight %	385	**23.9**		1,107	**23.2**		1,425	**25.7**		551	**20.5**	
ASA [1]	1,766	**2.05**	*2.01-2.08*	5,110	**2.00**	*1.98-2.02*	5,708	**1.89**	*1.88-1.91*	2,749	**1.79**	*1.77-1.81*
Prop. >= degree 3 %	525	**29.7**		1,108	**21.7**		807	**14.1**		278	**10.1**	
Prop. osteoarthritis %	1,090	**59.8**		4,130	**77.7**		5,460	**91.5**		2,827	**95.1**	

Table 2. Age, gender distribution, BMI, ASA and proportion of primary osteoarthritis related to type of operating clinic during 2010. The proportion is given in absolute numbers and percent. Mean values are given for the whole group. The variation in number for one and the same department type is caused by faulty reporting.
[1] Average value ±95% confidence interval of average value, underweight defined as BMI < 18.5; overweight as >30.

sis of the risk of reoperation within two years we can document this on the basis of Register data (see section on reoperation). We find that the risk of early reoperation is greater for men, patients 80 years and over, patients with high (over 30) or low (under 18.5) BMI and for patients with ASA degree 3 or higher. We have noted in previous Annual Reports that patient demography differs between different hospital types. In this year's analysis, it is noted that patients aged 80 or older and those who are under- or overweight tend to have surgery more often at public hospitals, as are patients with high degree of morbidity (ASA 3 or higher), where county and university/regional hospitals take the highest proportion (statistical analysis with non-parametric ANOVA: $p<0.0005$, table 2). At university/regional hospitals, almost every third (29.7%) patient is classed in ASA group 3 or higher, while the corresponding proportion at private hospitals is 10.1%. Male gender also involves a higher risk of early reoperation. Here, however, there are no clear differences between hospital types. Private hospitals tend to operate on more men than district hospitals do (Mann-Whitney test: $p=0.01$) while elsewhere there are no certain differences (non-parametric ANOVA: $p=0.09$).

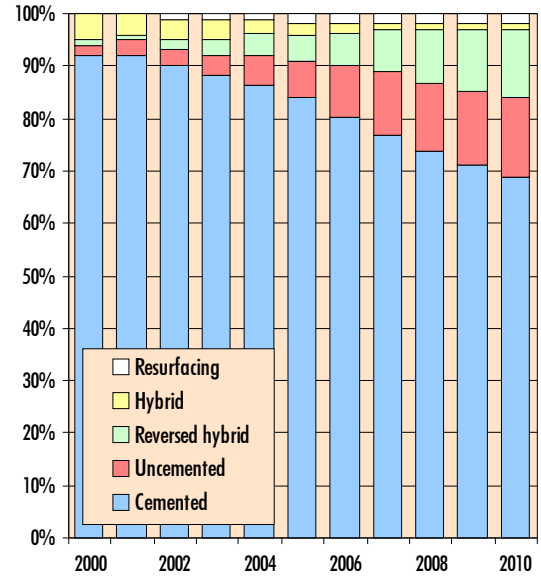


Figure 3. Choice of fixation method 2000-2010.

Fixation and implant selection

The long-term trend towards a reduced proportion of all-cemented and an increased proportion of uncemented and reverse-hybrid arthroplasty continued during 2010. During 2009 and 2010 approximately 11,100 all-cemented implants were inserted, at the same time as their relative proportion sank from 71.7% to 69.7%. The proportion of all-uncemented and reverse hybrids increased by 1% and 1.3%, respectively. Hybrid implants remained at a low level (1.5%) and resurfacing implants declined by 0.3% to 1.3% of the total number (figure 3).

The most frequently used cups in 2010 were Lubinus (45%), ZCA XLPE (16%), Marathon XLPE (15%) and Contemporary Hooded Duration (13%). Together these represent 89% of all cemented hip cups inserted that year. On the stem side, Lubinus SPII (56%), Exeter (29%) and MS30 (11%) together represented 96% of all cemented stems inserted during the same year. Since 2008 the Charnley Elite cup has been replaced by the Marathon XLPE, while on the stem side the Spectron EF declined from 7% to 3% of cemented stems between 2009 and 2010. Changes elsewhere were small.

On the uncemented side, the Trilogy cup with or without hydroxyapatite/calcium phosphate coating represented about 39% (2009: 37%) of all uncemented hip cups. This was followed by the Trident HA (15%) and Pinnacle (10%) with or without ceramic coating. During 2010 the proportion of other cups was relatively large (19 variants corresponding to 36%) partly because of a generation change in several types of design where new cup designs with theoretically perhaps better characteristics were being tested in a small series.

During 2010 three cemented stem types (Corail with or without collar – 38%, CLS – 21%, Bi-Metric with or without HA – 16%) were responsible for 75% of all uncemented stems inserted. Since 2008 the Corail stem proportion has increased from 18% while that of the other two stem types has declined by 20% and 6% respectively.

The commonest all-cemented implant combinations (stem/cup) during 2010 were SPII stem/Lubinus cup (47%) Exeter/Contemporary Hooded Duration (13.4%), MS30/ZCA XLPE (10.4%) and Exeter/Marathon EXPE (10.0%). The commonest corresponding uncemented combinations were CLS/Trilogy (16,8%), Corail/Trilogy (11.4%), Corail/Pinnacle (8.9%) and Accolade/Trident HA (8.8%).

The commonest reverse hybrid implants were Corail/Lubinus cup and Corail/Marathon XLPE (21.4% and 20.4%). These were followed by four combinations: Corail/ZCA, ABG/Contemporary Hooded Duration, Bimetric/Marathon XLPE and Bimetric/Luninus cup, all representing a proportion of about 6%.

During 2010 only 231 hybrid implants were inserted. Exeter/Trident HA, Lubinus SPII/Trilogy or Exeter/Trilogy were commonest, together representing over half (55%). The number of resurfacing implants during 2010 was 214. This is a slight decline from 2007 when 295 implants were registered, which is modest seen from an international perspective. In 2010, the Birmingham Hip Replacement (BHR) represented 64%, Adept 15.9% and ASR 13%. The latter was withdrawn by the manufacturers in August 2010 after 93,000 implants had been sold. The reason was a high revision frequency combined with high concentration of metal ions in the blood, indicating wear. In the previous Annual Report we raised problems related to metal-metal articulations, which are used in Sweden to a relatively limited extent (read more about the ASR implant at www.bmj.com/content/341/bmj.d2905.full; and under 'Resurfacing').

Stem		Cup	
	No.		*No.*
Cemented			
Lubinus SPII	88,433	Lubinus [1)]	78,295
Exeter	41,766	Exeter design [1)]	20,070
Spectron EF Primary	11,174	Charnley design [1)]	19,140
MS30 polished	4,244	Contemporary [1)]	9,703
CPT polished (CoCr)	1,326	Reflection [1)]	9,419
ABG II	244	ZCA [1)]	7,738
Spectron revision	161	FAL	5,922
		Müller design [1)]	1,178
		Avantage	232
Uncemented			
CLS Spotorno	6,886	Trilogy [1)]	7,256
Bimetric [1)]	4,318	Trident	1,885
Corail [1)]	3,731	Allofit	1,558
ABG II	1,814	CLS Spotorno	1,201
Accolade	1,080	Ranawat/Burstein	576
Wagner Cone	696	Pinnacle [1)]	528
Symax	259	Reflection	483
CFP	233	TOP Pressfit	420
Synergy	170	M2a	322
MP revision [1)]	114	TMT modular	282
		Full hemisphere	170
		Mallory head	140
		Regenerex	131

Table 3. Implant design used in comparison with different methods of fixing implants. The analysis includes only combinations in which both cup and stem appear in the above table (166,649 hip operations).
[1)] The group consists of several design variations commonly kept separate in the Hip Arthroplasty Register.

Incision

Between 2000 and 2008 the proportion of patients operated with an anterolateral incision in lateral position (Gammer incision) increased from 28.1% to 42.3%. At the same time the proportion of anterolateral incisions in the supine position (Hardinge incision) sank from 12.3% to 4.6% and the proportion of posterior incisions from 53.3% to 51.8%. In 2010, 42.3% were operated with the anterolateral incision in lateral position, 5.3% with the corresponding incision supine and 51% with a posterior incision. The proportion of others was only 1.5%.

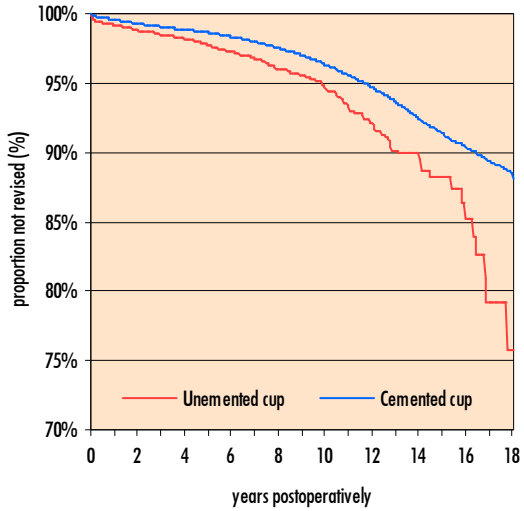


Figure 4. Implant survival based on cup revision irrespective of cause and with or without simultaneous stem revision.

Cemented – uncemented implants

Evaluation of various fixation principles is important but involves certain difficulties. Those groups one wishes to compare may have differences that cannot always be corrected statistically. To optimize the comparisons a long follow-up time is desirable, not least to capture loosening, osteolysis and material problems. At the same time it is important to gain, if possible, an idea of the implants used today, meaning that older implants abandoned simply owing to poor results must be excluded. In this year's analysis we have selected implants used in at least 100 operations during the period 1992-2010 where the implant design was still in use in 2010. In this selection we used the basic design of the implant irrespective of e.g. type of polyethylene or coating. After this selection, 143,382 cemented, 10,986 uncemented, 8,315 hybrid and 3,966 reverse hybrid implants were included (table 3).

In general, considering differences in demography, the risk of cup revision irrespective of cause is higher with the use of

uncemented cups than with cemented (log rank test: $p < 0.0001$, figures 4-5). However the groups are not comparable. Uncemented cups were used at considerably lower ages (57.3±10.4 years, cemented cup: 70.7±9.5) more often in men (51.4%, cemented cup: 39.2) and somewhat less frequently in secondary osteoarthritis (17.4%, cemented cup: 19.9). If these factors are adjusted for, there is no significant difference (cemented/uncemented cup: relative risk = 0.97, 95% confidence interval: 0.86-1.09). The corresponding analysis with stratification by age group <50, 50-59, 60-69 and 70 and older shows no difference, either.

If the analysis is limited to the outcome cup revision for loosening/osteolysis and broken down into age groups as above, we find a tendency towards a reduced risk of cup revision up to 69 years for uncemented cup (RR: <50 years = 1.43 CI: 1.05-1.96; 50-59 years = 1.35 CI: 1.05-1.75; 60-69 years 1.52 CI: 1.04-2.24).

In the group 70 years and older the survival curves cross at 14 years and there are few observations in the uncemented group after 10 years of follow-up. Limiting the analysis to 8 years of follow-up (123 remaining uncemented cups) shows that cemented cups have a reduced risk of revision (RR: 0.43 CI: 0.20-0.91, figure 5a-d).

In summary, we find no significant difference between cemented and uncemented cups. Uncemented cups have a somewhat reduced risk of revision for loosening/osteolysis up to 69 years of age but are associated with other problems that lead to revision, for which reason the total revision risk shows no significant difference.

The average age for the use of uncemented stem is somewhat higher than uncemented cup in this material (uncemented/cemented stem: 58.8/71.0 years). Of those who received

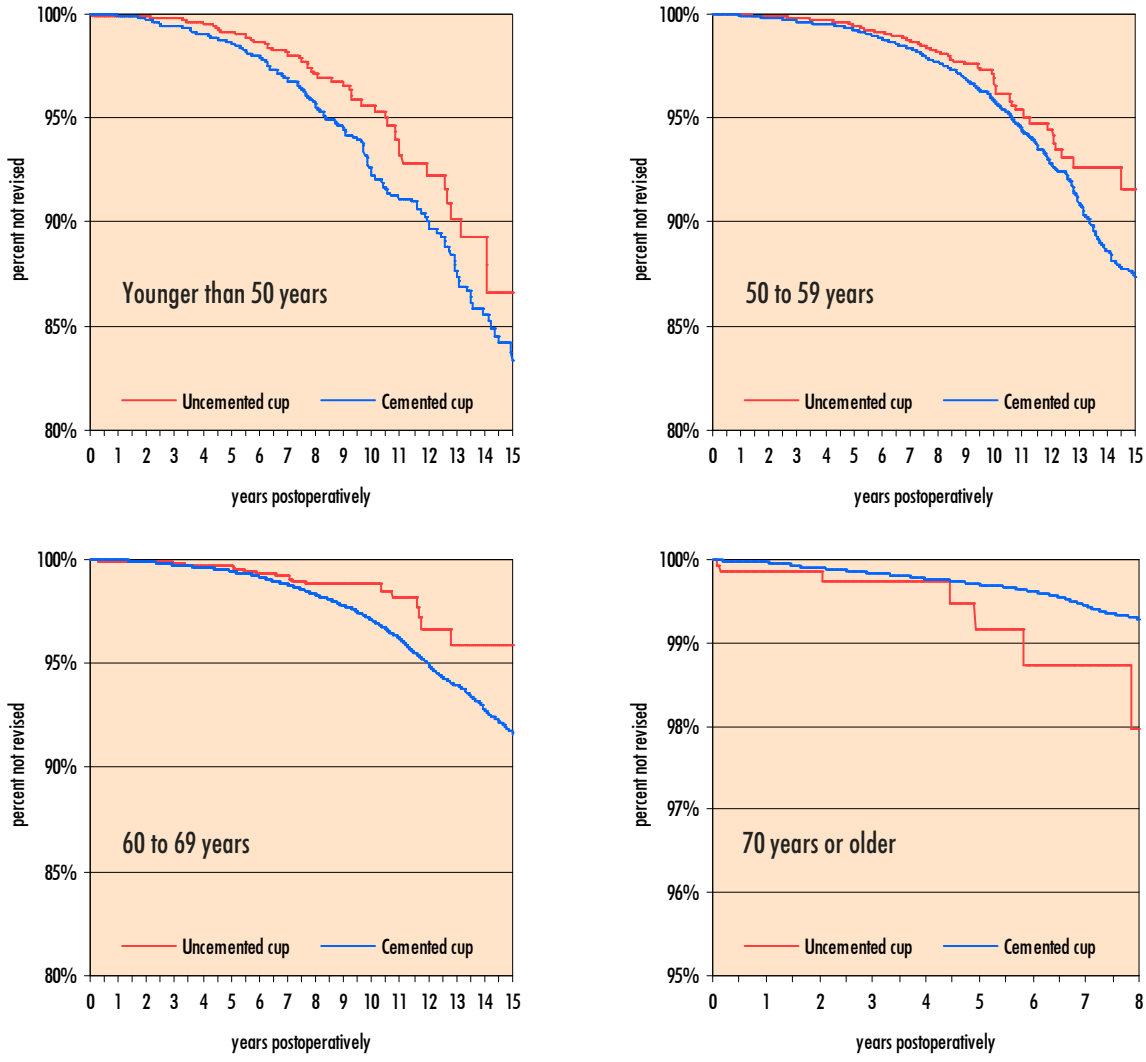


Figure 5a-d. Implant survival divided into four age groups regarding cup revision for loosening/osteolysis with or without simultaneous stem revision.

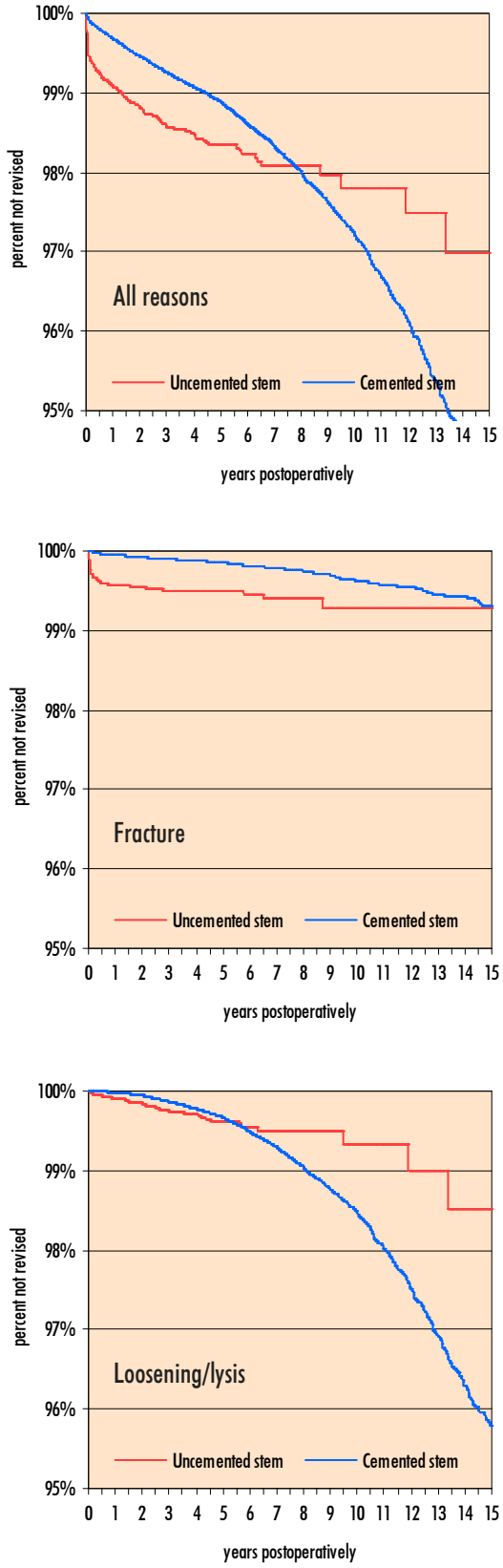


Figure 6a-c. Implant survival regarding stem revision with or without simultaneous cup revision.

uncemented stems, 85.3% had primary osteoarthritis. In the cemented group this proportion was somewhat lower (79.7%).

During the first period after operation the risk of stem revision is greater if an uncemented stem is used. We have noted among other things in earlier Annual Reports that the reason for this difference is primarily revision for periprosthetic fracture (figure 6). With the present selection of stem types the risk was 8.8 (CI: 6.41-12.04, $p < 0.0001$) times greater for revision owing to periprosthetic fracture within 2 years if an uncemented stem instead of a cemented stem was used (Cox regression adjusted for age, gender and diagnosis).

The survival diagram based on stem revision for loosening/osteolysis shows that in the early stage uncemented stems run an increased risk. After adjustment for age, gender and diagnosis we find that the risk of stem revision within 2 years after operation is greater for uncemented stems (3.00 CI: 1.78-5.08). If instead the implants that have survived 7 years (55,124 cemented, 1,445 uncemented) are examined, we find an appreciably reduced relative risk of revision for osteolysis or loosening where uncemented stems were used (0.09 CI: 0.03-0.27).

Separate analyses based on revision regardless of cause and adjusted for diagnosis in eight sub groups (men and women in age groups up to 50 years, 50-59, 60-69 and 70+) show that the revision risk for cemented and uncemented fixation varies over time in many of the groups. The three in which this phenomenon does not occur are men under 50 years and men and women, respectively 70 years and older. In men under 50 years the revision risk is higher (2.50 CI: 1.44-4.34) for the use of cemented stems while this alternative shows a clearly reduced risk of revision both in men (0.39 CI: 0.24-0.62) and women (0.23 CI: 0.15-0.34) from the age of 70. This better survival for uncemented stems among men under 50 is explained by a lower risk of revision for loosening/osteolysis.

In summary we find no clear differences between cemented and uncemented fixation regarding risk of revision irrespective of cause. The different ways of fixing an implant are associated with different types of complications. When choosing fixation, many factors are involved such as the patient's individual bone quality, the surgeon's normal practice and the risk of general influences in the use of bone cement in seriously ill patients. However the data indicate extra caution and careful weighing of these factors one against another if one consider uncemented fixation an older patient. The data also indicate that uncemented stems are preferable in men under 50 years of age.

Spectron EF versus EF Primary Stems

The Spectron stem was introduced into Sweden at the beginning of the 1980s. It was then of the monoblock type, had a matt surface and was normally combined with a cemented polyethylene cup with a metal back. In the 1999 Annual Report, a 14-year survival of 78.8%, was given for primary osteoarthritis, based on revision for loosening. In a prospective randomized study a smaller risk of loosening of the original Spectron stem

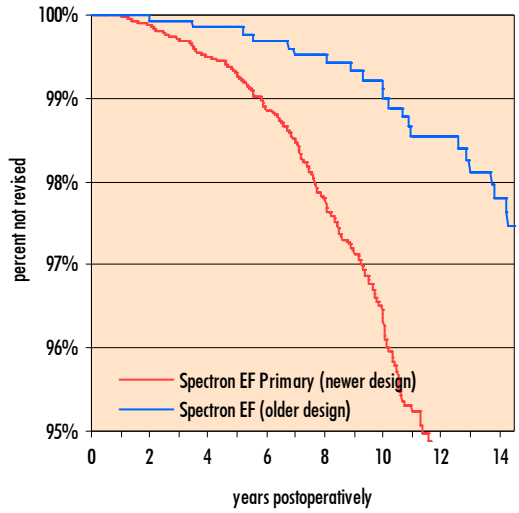


Figure 7. Implant survival regarding stem revision for loosening/ osteolysis with or without simultaneous cup revision.

was observed but more cup loosenings compared with the Charnley prosthesis (Garellick G, Malchau H, Herberts H: J Arthroplasty 1999;14:407-13). In the early 1990s the design of the stem was altered. It was given primarily a coarser surface structure proximally and was renamed Spectron EF. In these first two versions all stem sizes were of the same length. The next version (Spectron EF Primary) was introduced in 1995. Now the stem became narrower and shorter, with the smallest sizes. In addition a version with an increased offset, smaller sizes, a polished neck and a narrower cone was introduced. As early as the 2005 Annual Report (Truike T, Kärrholm J, Acta Orthop 2010; 81:407-13) we noted an increased risk of revision for loosening for this design compared with Exeter and Lubinus stems, particularly for smaller implant sizes. An increased risk of revision of the Spectron EF Primary stem has also be reported from the Norwegian Hip Arthroplasty Register (Espehaug B, Furnes O, Engsaeter LB, Havelin LL, Acta Orthop; 80:402-12).

The Hip Arthroplasty Registry has since 1992 registered the Primary separately from the original EF variant. Until 1996 when the Spectron EF was entirely replaced y the Primary, 1,494 operations with the first EF design had been registered, of which 70.1% used the cemented cup and the rest the uncemented. Even if the Primary variant was used during the whole of the 2000s up to and including 2010, we have in this comparison included only operations up to 2000, corresponding to 3,633 Spectron EF Primary prostheses, of which 77.3% used cemented cups. Following adjustment (Cox regression) for age, gender, diagnosis and cup fixation we find no significant difference regarding revision risk irrespective of cause (EF/EF Primary: 0.81 CI: 0.65-1.01). The risk of revision for loosening irrespective of revision reason is, however, lower for the older variant (0.65 CI: 0.50-0.85). The difference becomes even clearer if one only analyses reasons that include stem revision (0.27 0.17-0.44, figure 7).

In summary, the 'modernization' undergone by the Spectron EF during the mid-1990s worsened its performance. The pathophysiology behind this finding has not been established but probably the contact surface with the cement mantle in the smaller stem sizes means that the risk of separation between stem and cement increases, with abrasive wear as consequence.

High-molecular polyethylene

Towards the end of the 1990s a new type of polyethylene was introduced in cemented joint cups and as a PE lining in uncemented cups. Irradiation has long been used for sterilizing PEs used in joint implants, but not consistently. Other alternatives are sterilization with ionized gas (gas-plasma sterilization) and ethylene oxide which, particularly earlier on but also still to some extent, is used for implants on the Swedish market. This type of sterilization does not affect the degree of cross-binding of the PE. By irradiating the PE with higher doses than those normally used for sterilization, increased cross-bonding is obtained between the long polyethylene molecules and hence improved wear characteristics (XLPE). At the same time free radicals are formed which unless neutralized accelerate the aging of the PE (oxidization). The free radicals are commonly removed with heat treatment of the PE. Recently, other methods have also been launched. The high wear resistance of the new PE materials has great theoretical advantages but they also involve a degree of uncertainty since long-term documentation is largely lacking. The first generations of this new polymer also had somewhat poorer mechanical characteristics. In some cases disquiet has been expressed over the fact that the PE particles actually formed in wear are smaller and have a more aggressive biological effect.

The introduction of this PE type in Sweden was delayed particularly regarding cemented cups partly because the profession was awaiting a longer follow-up of studies then in progress. This

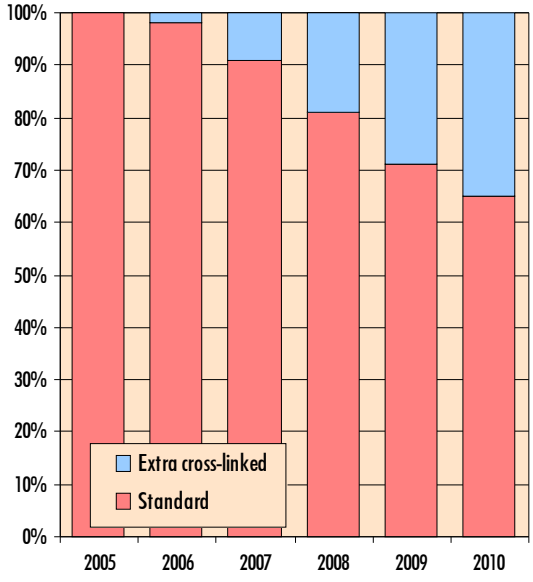


Figure 8. Relative distribution of standard PE/extra cross-bonded PE in the use of cemented cups (dual-mobility and constrained type excluded).

may also have been the reason why it was not until 2010 that all suppliers could offer the new PE quality. High-molecular PE liners were also introduced late in Sweden but generally earlier than in cemented fixation. During 2010, 34.2% of the cemented cups were manufactured of high-molecular PE (figure 8). The corresponding proportion for uncemented cups was 89.0%. Only 5.7% of the liners were made of the older PE types, 2.6% of ceramics, 1.5% of metal and 1.2% other (constrained liner, dual-mobility).

Two cemented cup types, ZCA and Reflection have now a maximum follow-up of both the older variant with standard PE and the newer variant with XLPE of at least 4-5 years. This means that 4,738 Reflection (3,137 with ETO-sterilized PE, 1,601 XLPE) and 7,915 ZCA (1,058 gamma-sterilized at 2.5 mrad, 6,857 XLPE) cups inserted between 2005 and 2010 were included in the analyses. In this preliminary evaluation of these two designs we find no difference in the risk of revision regardless of cause and after adjustment for age, gender and diagnosis (Cox-regression, data not shown). In the Reflection group there were 40 cup revisions with or without simultaneous stem revision, of which only one in the XLPE group. Even if the risk ratio turns out in favour of the XLPE, the difference is not statistically secure (older PE/XLPE=3.91 CI: 0.51-30.0). In the ZCA group seven (0.7%) of the cups of older type and eight XLPE cups (0.1%) were revised for loosening. Nor do we find here any difference between the groups after adjustment for age, gender and diagnosis (older PE/XLPE: RR=1.45 CI:0.49-4.31).

Regarding PE liners in uncemented cups two designs have sufficient follow-up and sufficiently large numbers for a meaningful analysis of the revision risk. High-molecular PE started being used in the Trilogy cup in 2000 and in the Allofit cup in 2005. In total 2,398 liners with the older type of PE and 5,125 XLPE liners have been used with the Trilogy. The corresponding distribution in the Allofit group is 461/903. In a preliminary analysis we examined whether there was any difference in risk of revision depending on choice of PE. This analysis is limited to operations performed from 2000 on. To render the groups more comparable we excluded patients operated on with mini incisions and trochanterosteotomy. In addition only operations using joint heads with diameters of 28 or 32 were included (the 36 head has not been used with older PE). After this selection, 7,933 operations were covered. Adjustment was made for age, gender and diagnosis, the three types of cup used (Trilogy with or without HA/TCP, Allofit), incision and size of joint head.

The use of high-molecular PE does not affect the risk of revision regardless of cause and measure (data not shown). Cup revision for loosening/osteolysis was carried out in 32 cases in the group of older PE and in 9 cases with XLPE. Implant survival analysis shows that the curves cross one another after five years when the implant survival for XLPE remains stationary (figure 9). The statistical analysis therefore reaches only five years after operation. After adjustment for differences in the composition of the groups we find no certain difference (older PE/XLPE: RR=0.69 CI: 0.23-2.10).

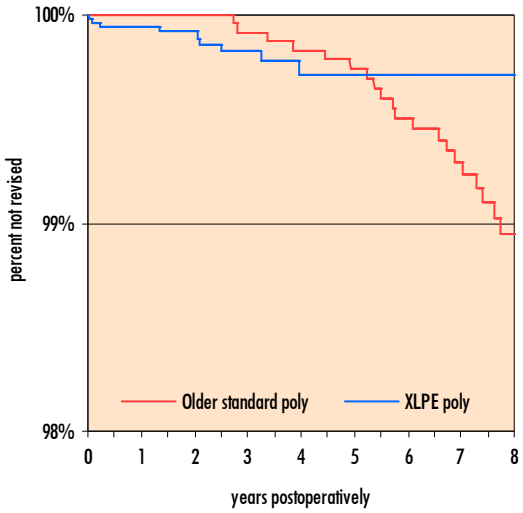


Figure 9. Survival of Trilogy/Allofit cups based on cup/liner revision with or without simultaneous stem revision for loosening/osteolysis.

In summary we, as opposed to the Australian Registry, have not been able to show any reduced risk of revision in the use of the new PEs. The follow-up time is still short and during the first few years only a limited number of patients underwent the operation. So far we can state that the new XLPE does not appear to have any unexpected negative characteristics.

Metal/metal

In the previous Annual Report we calculated that in Sweden up to 2009 at least 2,632 implants had been inserted with metal/metal articulation since 1999 when the component database was started. During 2010, 257 resurfacing cups were inserted, of which 214 were complete resurfacing implants. The remaining 43 were resurfacing cups combined with a stem implant with a large head, probably owing to expected problems of joint instability or because the planned operation with a resurfacing implant could not be completed after insertion of the cup. Since 1999 at least some 2,900 metal/metal articulations have been inserted in Sweden. Experience from earlier trials of this implant type (e.g. McKee-Farrar) has shown good functionality for long periods for certain patient groups, and with no established increased risk of contracting cancer. The size of the patient groups studied has, however, been limited not least as compared with the large number of metal/metal implants used internationally during the past 10 years. In addition, these data are based on implants with comparatively small joint heads.

Metal/metal can more seldom cause pseudo-tumours or granulomata that can be hard to treat and give lasting invalidity. This complication occurs considerably more often among women and the risk increases if the implant is not optimally positioned. Continual follow-up of these patients so as to be able to intervene early if the patient has signs of complications has therefore been recommended (read more in the New York Times 'In medicine, new isn't always improved' by Barry Meier; www.nytimes.com/2011/06/26/health/26innovate.html).

Resurfacing implants

In Sweden the number of resurfacing implants increased until 2007, when it was 295 (2.1% of the total number of implants inserted). There has subsequently been a slow reduction to 214 in 2010. The proportion of women in 2007 was 28.8%, sinking to 10.3% in 2010. The majority of patients receiving resurfacing implants between 2009 and 2010 have been younger than 60 years (men 85.6%, women 86.2%).

This year's evaluation of resurfacing implants is confined to the most used standard implants (920 BHR, 395 ASR, 376 Durom and 49 Adept). Since only a few (n=10) resurfacing implants were inserted before 2000, only the period 2000-2010 has been studied. To obtain a more relevant comparison group, the control group consists only of patients up to 69 years of age. Moreover, the control group includes only the five most used stems and cups during the period when these were used in various combinations (Lubinus SPII, Exeter, CLS, Spectron EF Primary, Corail; Lubinus cup, Charnley Elite, Exeter Duration, Trilogy HA, Contemporary Hooded Duration). This selection resulted in a control group of 34,671 all-cemented, 2,399 all-uncemented, 1,699 hybrid and 1,805 reverse hybrid implants.

From the study group with resurfacing implants 77 implants were excluded since they in one way or another represent special variants of the resurfacing implants. This means that only standard implants used in relatively large volumes are included. Lastly, the analysis was limited to revisions dealing with the first five years following operation owing to the limited number of resurfacing implants with a longer follow-up time.

In a Cox regression analysis adjusted for age, gender and diagnosis we find that the risk of revision with resurfacing is doubled (2.39 CI: 1.80-3.18). Separate analyses for men and women, respectively, show that the risk is particularly high for women 4.88 (CI: 3.27-7.24), but also elevated for men to 1.60 (CI: 1.06-2.39).

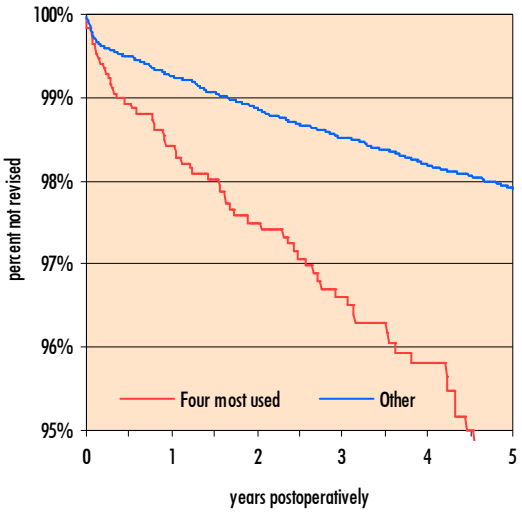


Figure 10. Implant survival based on all causes of revision of the four most used resurfacing implants (red line) compared with the most used conventional implant types in patients up to 69 years. Primary operations 2000-2010.

A comparison between different designs of resurfacing implant must be limited to BHR, ASR and Durom since the others have been used in too few cases with too short an observation period for a comparison to be meaningful. Adjusted for age, gender and diagnosis both exhibit an almost or more than three times greater risk of revision (ASR: 2.76 CI: 1.39-5.50; Durom 3.34 CI: 1.85 -6.02). In a separate comparison between the BHR and the control group we find no statistically significant increase in risk (BHR/control group: 1.34 CI: 0.82-2.17). In a gender breakdown, the risk of revision is about equal for men (1.02 CI: 0.51-2.04), but greater for women (2.43 CI: 1.20-4.98).

In summary we find that the risk of revision within five years and irrespective of cause is more than doubled in the use of resurfacing. The best-functioning design, BHR, involved no definite disadvantage regarding the risk of revision if used in men; but neither are there any clear advantages among these patients, either. Possible continued use of this implant concept should take place under strict control and be offered only to younger men. Several studies have shown that good surgical competence is important for the result. This means that the intervention should be performed only at a limited number of units that can maintain sufficiently large volumes to maintain their competence.

Given the uncertainty prevailing regarding long-term results of modern resurfacing implants, the limited area of indication, absence of definite advantages and the high price of implants it may be questioned whether the method is cost-effective.

Dual-mobility cup

The common method of improving the stability of a hip implant is to increase the size of the joint head. In many cases, however, a constraint is that the size of the cup and the thickness of the material limit this possibility for anatomical reasons. In certain cases this method is also insufficient. For this reason various types of joint cup have been developed with high built-in stability. One of these types used to a relatively large extent in Sweden is the dual-mobility cup. This design has been used primarily in France with relatively good results for up to seven years. Dual-mobility cups are marketed in Sweden by several manufacturers but so far the market has been entirely dominated by one type, the Avantage. Together with Nils Hailer, Akademiska Sjukhuset, Uppsala we are planning an in-depth analysis of these implants and give here a preliminary first report.

The Avantage cup was introduced into Sweden in 2004. Up and including 2010 it has been used in 287 primary hip arthroplasties and 328 revisions (table 4).

The majority of primary implants were cemented (275 of 287). They were commonly combined with a Lubinus SPII stem (54%) followed by uncemented Wagner Revision or Cone stem (16.7%). After a mean follow-up time of 1.5 years (5.8) nine hips have been revised, of which one of six cup revisions was for dislocation.

	Primary THR			Revision THR		
	No.			No.		
Age (median,range)	287	74	25 -100	328	76	38-95
Prop. women %	196	68.3		202	61.6	
Diagnosis %						
- Osteoarthritis	68	23.7		224	68.3	
- Fracture	174	60.6		45	13.7	
- Other	45	15.7		59	18.0	
Reason for revision % [1)]						
- Dislocation	-	-		228	69.5	
- Loosening	-	-		55	16.8	
- Fracture	-	-		20	6.1	
- Other	-	-		25	7.6	
Reason for ev. next revision % [1)]						
- Dislocation	1	0.3		3	0.9	
- Loosening	0	0		4	1.2	
- Fracture	1	0.3		3	0.9	
- Other	4	1.4		10	3.0	

Table 4. Primary and revision operations using dual- mobility cups. Patient demography and causes of revision.
[1)] Unadjusted revision frequency, only cup with or without simultaneous stem revision/extraction included.

The Register contains 328 revisions in which the Avantage cup was used. 247 were first-time revisions and 61 second-time revisions. In 20 cases the hip in question had been revised twice or even more times previously. In the revision cases, too, chiefly cemented fixation was used (n=299). In most cases (72.8%) a dual-mobility cup was inserted to solve an existing problem of dislocation. After a mean follow-up time of 2.1 years (max 6.1) 20 revisions of the cup part have been carried out, of which three for dislocation problems.

The risk of revision for dislocation is greatest during the first two years after an operation (see Revision). In this short perspective a dual-mobility cup appears to address the dislocation problem well. A few studies indicate that this type of implant can also function relatively well in the longer term. Since this is poorly investigated, until there is better evidence the use of dual -mobility cups should be limited to cases where there is a dislocation problem or one is seriously feared, so as to avoid a possibly increased revision burden in the longer perspective owing to loosening or wear.

Uncemented stem with or without hydroxyapatite

In collaboration with Stergious Lazarinidis and Nils Hailer at Akademiska Sjukhuset in Uppsala, we earlier found that the use of an hydroxyapatite coating on cups of Romanus, Harris-Galante and Trilogy type had little effect on the risk of revision and in certain cases raised it. One stem design in the Hip Arthroplasty Register, the Bi-Metric, has been used in this manner in sufficiently large numbers (2,419 patients and porous surfaces covered with hydroxyapatite on the stem and 4,154 with porous surfaces without apatite coating) to make an appropriate analysis possible. After ten years follow-up we find an implant survival of about 98% for both groups irrespective of cause of revision. The corresponding analysis of this use regarding the risk of revision for loosening/proteolysis, infection, fracture or dislocation as cause of revision shows no difference either.

15 most common implants

most used during the past 10 years

Cup (Stem)	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1)]
Lubinus All-poly (Lubinus SP II)	56,549	5,547	5,267	4,917	4,941	5,164	82,385	36.2%
Exeter Duration (Exeter Polished)	9,160	1,122	812	227	208	183	11,712	6.8%
Charnley Elite (Exeter Polished)	5,393	1,169	1,211	1,030	520	133	9,456	6.2%
Contemporary Hooded Duration (Exeter Polished)	1,950	638	785	1,396	1,733	1,491	7,993	5.7%
FAL (Lubinus SP II)	3,529	534	448	419	438	397	5,765	4.0%
Reflection (Spectron EF Primary)	6,274	672	285	160	127	29	7,547	3.7%
ZCA XLPE (MS30 Polished)	9	222	403	862	993	1,153	3,642	2.6%
Charnley (Charnley)	55,506	2	3	1	0	0	55,512	2.1%
Trilogy HA (CLS Spotorno)	312	284	347	380	379	380	2,082	1.5%
Charnley (Exeter Polished)	2,052	282	206	78	2	3	2,623	1.5%
Marathon XLPE (Exeter Polished)	1	1	0	45	690	1,104	1,841	1.3%
Reflection XLPE (Spectron EF Primary)	6	6	242	460	508	220	1,442	1.0%
Allofit (CLS Spotorno)	434	129	131	294	221	140	1,349	1.0%
ZCA XLPE (Lubinus SP II)	1	0	115	269	460	480	1,325	1.0%
Lubinus all-poly (Corail Collarless)	5	14	69	170	406	401	1,065	0.8%
Others (1,297)	115,466	3,445	3,986	3,748	4,110	4,657	135,412	
Total	256,647	14,067	14,310	14,456	15,736	15,935	331,151	

[1)] Refers to the proportion of the total number of primary THRs performed during the past 10 years.

15 most common uncemented implants

most used during the past 10 years

Cup (Stem)	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1)]
Trilogy HA (CLS Spotorno)	312	284	347	380	379	380	2,082	16.8%
Allofit (CLS Spotorno)	434	129	131	294	221	140	1,349	10.9%
Trident HA (Accolade)	103	133	147	164	235	201	983	8.0%
CLS Spotorno (CLS Spotorno)	739	163	194	69	45	36	1,246	6.9%
Trilogy (CLS Spotorno)	297	88	93	80	27	4	589	4.5%
Trilogy HA (Corail Collarless)	1	2	47	80	155	212	497	4.0%
Trident HA (ABG II HA)	24	30	107	79	107	69	416	3.4%
Ranawat/Burstein (Bi-Metric lat)	5	28	26	55	122	132	368	3.0%
Pinnacle HA (Corail Collarless)	0	7	17	93	100	130	347	2.8%
Trilogy HA (Bi-Metric lat)	21	51	51	70	59	67	319	2.6%
Trilogy HA (Versys stem)	248	9	0	0	0	0	257	2.0%
Trident HA (Symax)	17	68	79	45	29	3	241	2.0%
Trilogy HA (Wagner Cone Prosthesis)	16	4	9	34	71	96	230	1.8%
TOP Pressfit HA (CFP stem HA)	41	7	32	55	55	29	219	1.6%
Trilogy (Wagner Cone Prosthesis)	159	23	37	19	2	3	243	1.5%
Others (301)	6,904	334	369	330	471	785	9,193	
Total	9,321	1,360	1,686	1,847	2,078	2,287	18,579	

[1)] Refers to the proportion of the total number of primary THRs performed during the past 10 years.

15 most common hybrid implants

most used during the past 10 years

Uncemented cup (cemented stem)	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1]
Trilogy HA (Lubinus SP II)	921	51	55	66	56	47	1,196	27.2%
Trilogy HA (Spectron EF Primary)	1,089	102	24	18	8	2	1,243	25.8%
TOP Pressfit HA (Lubinus SP II)	136	5	4	1	9	3	158	4.7%
Trilogy HA (Exeter Polished)	31	9	13	17	28	23	121	3.4%
Trilogy HA (Stanmore mod)	79	7	8	2	1	0	97	3.0%
Reflection HA (Lubinus SP II)	187	1	2	11	3	0	204	3.0%
Biomex HA (Lubinus SP II)	107	0	0	0	0	0	107	2.7%
Trilogy HA (MS30 Polished)	0	3	18	27	19	17	84	2.6%
Trident HA (Exeter Polished)	6	0	2	1	15	56	80	2.5%
Ranawat/Burstein (Lubinus SP II)	2	14	9	21	16	12	74	2.3%
Trident HA (ABG II Cemented)	14	21	21	5	0	2	63	2.0%
ABG II HA (Lubinus SP II)	210	3	0	0	0	0	213	1.8%
Allofit (MS30 Polished)	77	2	5	1	3	5	93	1.8%
Trident HA (Lubinus SP II)	5	15	6	3	14	6	49	1.5%
Trilogy HA (CPT (CoCr))	3	4	3	3	6	12	31	1.0%
Others (247)	5,746	35	33	30	52	46	5,942	
Total	8,613	272	203	206	230	231	9,755	

[1] Refers to the proportion of the total number of primary THRs performed during the past 10 years.

15 most common reversed hybrid implants

most used during the past 10 years

Cemented cup (uncemented stem)	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1]
Lubinus All-poly (Corail Collarless)	5	14	69	170	406	401	1,065	11.5%
Contemporary Hooded Duration (ABG II HA)	57	94	85	100	156	123	615	6.6%
Marathon XLPE (Corail Collarless)	0	0	0	15	186	382	583	6.3%
Charnley Elite (Corail Collarless)	17	43	70	147	79	60	416	4.5%
Charnley Elite (CLS Spotorno)	115	80	90	90	19	4	398	4.3%
Lubinus All-poly (CLS Spotorno)	35	41	100	100	54	68	398	4.3%
Lubinus All-poly (Bi-Metric HA lat)	59	34	37	51	72	72	325	3.5%
Charnley Elite (ABG uncem)	370	0	0	0	0	0	370	3.4%
ZCA XLPE (Bi-Metric HA lat)	0	0	43	118	102	32	295	3.2%
ZCA XLPE (CLS Spotorno)	1	19	83	64	59	60	286	3.1%
Charnley Elite (ABG II HA)	95	23	20	61	41	5	245	2.6%
Charnley (ABG II HA)	171	34	22	7	0	0	234	2.5%
ZCA XLPE (Corail Collarless)	0	0	6	34	68	106	214	2.3%
Biomet Müller (Bi-Metric HA lat)	82	58	28	19	23	0	210	2.3%
Charnley Elite (Bi-Metric lat)	16	74	77	31	1	0	199	2.1%
Others (228)	1,380	358	412	396	569	763	3,878	
Total	2,403	872	1,142	1,403	1,835	2,076	9,731	

[1] Refers to the proportion of the total number of primary THRs performed during the past 10 years.

15 most common resurfacing implants

most used during the past 10 years

Cup (stem)	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1)]
BHR Acetabular Cup (BHR Femoral Head)	307	117	111	111	137	137	920	51.4%
ASR Cup (ASR Head)	23	50	94	118	82	28	395	22.3%
Durom (Durom)	158	66	70	34	28	5	361	20.4%
Adept (Adept Resurfacing Head)	0	5	9	1	0	34	49	2.8%
Durom studiecup (Durom)	0	3	5	5	2	0	15	0.8%
BHR Dysplasia Cup (BHR Femoral Head)	3	3	4	0	1	1	12	0.7%
ReCap Cup (ReCap Head)	1	0	0	6	0	2	9	0.5%
BHR Acetabular Cup (BMHR VS)	0	0	0	0	2	6	8	0.5%
BHR Acetabular Cup (BMHR)	0	0	2	3	0	0	5	0.3%
ReCap HA Cup (ReCap Head)	0	3	0	0	0	0	3	0.2%
Cormet 2000 resurf (Cormet 2000 resurf)	5	0	0	0	0	0	5	0.1%
BHR Dysplasia Cup (BMHR VS)	0	0	0	0	0	1	1	0.1%
ASR Cup (BHR Femoral Head)	0	1	0	0	0	0	1	0.1%
McMinn resurf (McMinn resurf)	6	0	0	0	0	0	6	0.0%
Cormet 2000 resurf (Cormet 2000 HA resurf)	2	0	0	0	0	0	2	0.0%
Others (0)	0	0	0	0	0	0	0	
Total	505	248	295	278	252	214	1,792	

[1)] Refers to the proportion of the total number of primary THRs performed during the past 10 years.

15 most common cup components

most used during the past 10 years

Cup	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1)]
Lubinus All-poly	78,909	5,702	5,548	5,310	5,559	5,840	106,868	37.9%
Charnley Elite	9,771	1,645	1,662	1,513	716	284	15,591	9.0%
Exeter Duration	9,841	1,282	912	243	230	189	12,697	7.4%
Contemporary Hooded Duration	2,118	846	1,040	1,615	1,988	1,702	9,309	6.7%
ZCA XLPE	13	269	778	1,682	1,999	2,118	6,859	4.9%
Trilogy HA	3,318	567	619	753	827	980	7,064	4.3%
FAL	3,591	558	472	441	480	448	5,990	4.1%
Charnley	60,799	330	239	88	4	3	61,463	4.0%
Reflection	7,768	709	316	182	167	44	9,186	3.9%
Marathon XLPE	1	1	0	80	1,099	1,927	3,108	2.2%
Trident HA	236	294	374	298	440	371	2,013	1.4%
Reflection XLPE	7	7	251	490	573	275	1,603	1.1%
Biomet Müller	5,247	174	106	45	39	1	5,612	1.1%
Allofit	566	145	145	308	242	169	1,575	1.1%
Weber All-poly cup	1,272	153	262	18	0	0	1,705	1.1%
Others (183)	73,190	1,385	1,586	1 390	1,373	1,584	80,508	
Total	256,647	14,067	14,310	14,456	15,736	15,935	331,151	

[1)] Refers to the proportion of the total number of primary THRs performed during the past 10 years.

15 most common stem components

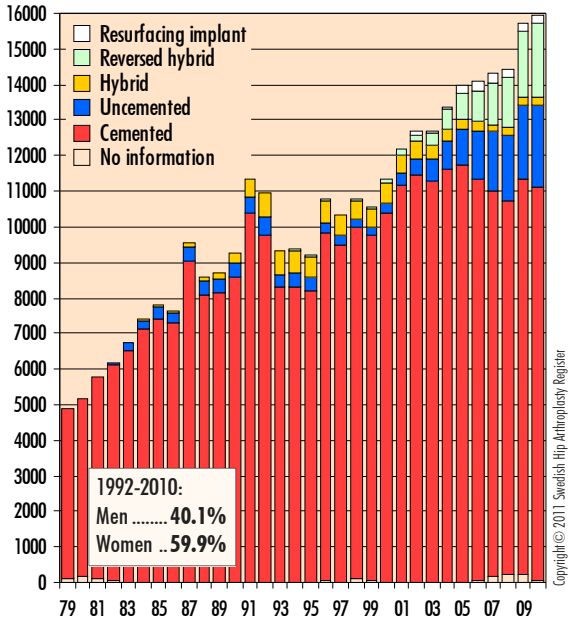
most used during the past 10 years

Stem	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1]
Lubinus SP II	67,401	6,492	6,165	5,837	6,121	6,375	98,391	44.0%
Exeter Polished	35,841	3,233	3,060	2,888	3,297	3,272	51,591	22.3%
Spectron EF Primary	8,304	825	614	742	740	319	11,544	5.9%
CLS Spotorno	2,450	927	1,260	1,251	1,010	915	7,813	5.2%
MS30 Polished	871	297	497	924	1,035	1,211	4,835	3.4%
Corail Collarless	37	123	259	618	1,204	1,492	3,733	2.7%
Charnley	56,636	2	4	1	0	0	56,643	2.1%
Bi-Metric lat	128	281	344	382	453	438	2,026	1.5%
ABG II HA	487	222	276	277	371	369	2,002	1.4%
Bi-Metric HA lat	325	242	273	352	371	284	1,847	1.3%
CPT (CoCr)	603	204	188	102	128	115	1,340	1.0%
Straight-stem standard	1,013	175	256	16	0	0	1,460	0.9%
Accolade	111	134	148	213	258	231	1,095	0.8%
Stanmore mod	1,083	71	32	37	11	0	1,234	0.7%
BHR Femoral Head	310	121	115	111	138	138	933	0.7%
Others (190)	81,047	718	819	705	599	776	84,664	
Total	256,647	14,067	14,310	14,456	15,736	15,935	331,151	

[1] *Refers to the proportion of the total number of primary THRs performed during the past 10 years.*

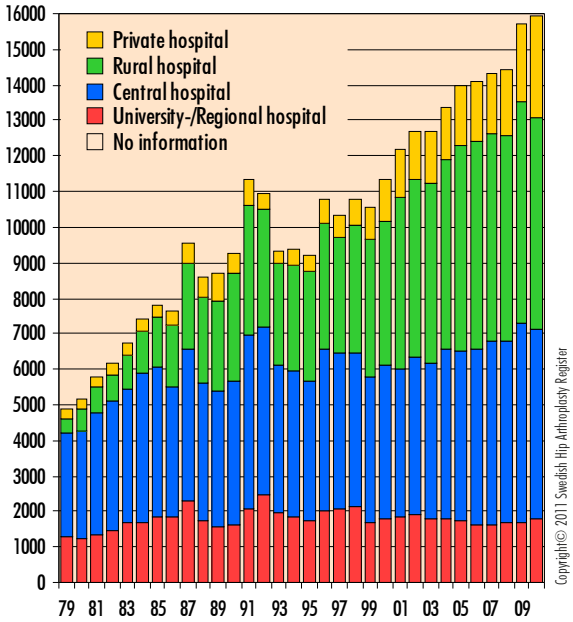
Number of primary THRs

per type of fixation, 1979-2010



Number of primary THRs

per type of hospital, 1979-2010



Number of primary THRs per hospital and year

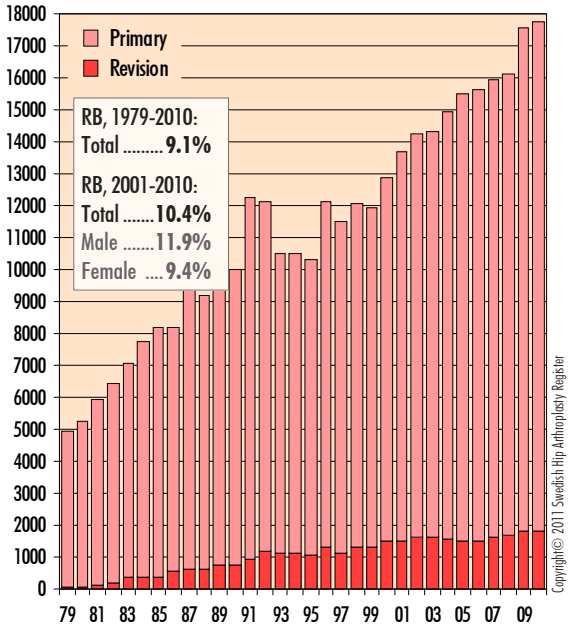
Hospital	1979-2005	2006	2007	2008	2009	2010	Total	Prop. [1)]
Aleris Specialistvård Sabbatsberg	1,517	0	0	0	131	150	1,798	0.5%
Alingsås	1,669	209	211	207	223	201	2,720	0.8%
Arvika	1,176	98	88	148	166	182	1,858	0.6%
Bollnäs	1,874	266	262	243	303	331	3,279	1.0%
Borås	4,885	211	214	192	202	171	5,875	1.8%
Capio S:t Göran	8,817	442	300	360	418	424	10,761	3.2%
Carlanderska	1,167	69	50	44	44	118	1,492	0.5%
Danderyd	6,401	354	418	404	377	299	8,253	2.5%
Eksjö	4,006	190	183	208	211	192	4,990	1.5%
Elisabethsjukhuset	439	159	164	143	84	70	1,059	0.3%
Enköping	1,405	181	187	222	235	257	2,487	0.8%
Eskilstuna	3,836	106	76	103	110	110	4,341	1.3%
Falköping	2,123	274	233	212	262	220	3,324	1.0%
Falun	5,242	239	260	289	326	322	6,678	2.0%
Frölunda Specialistsjukhus	144	52	75	79	81	75	506	0.2%
Gällivare	2,121	137	70	102	86	105	2,621	0.8%
Gävle	4,941	131	129	136	175	164	5,676	1.7%
Halmstad	3,542	267	238	202	218	229	4,696	1.4%
Helsingborg	3,640	85	60	49	73	70	3,977	1.2%
Hudiksvall	2,593	123	139	111	138	138	3,242	1.0%
Hässleholm-Kristianstad	6,871	751	851	853	894	797	11,017	3.3%
Jönköping	3,786	206	179	204	208	210	4,793	1.4%
Kalmar	3,979	183	173	165	193	165	4,858	1.5%
Karlshamn	1,792	164	196	182	221	188	2,743	0.8%
Karlskoga	2,207	100	106	100	141	138	2,792	0.8%
Karlskrona	2,284	35	35	17	16	46	2,433	0.7%
Karlstad	4,023	282	335	243	252	287	5,422	1.6%
Karolinska/Huddinge	4,948	314	257	216	253	234	6,222	1.9%
Karolinska/Solna	4,107	187	189	257	186	208	5,134	1.6%
Katrineholm	1,821	185	201	255	234	239	2,935	0.9%
Kungälv	2,137	169	225	191	178	193	3,093	0.9%
Lidköping	1,828	140	133	134	123	123	2,481	0.7%
Lindesberg	1,862	147	147	153	208	210	2,727	0.8%
Linköping	5,163	41	51	57	70	58	5,440	1.6%
Ljungby	1,963	120	127	104	194	164	2,672	0.8%
Lund	4,253	83	85	99	85	114	4,719	1.4%
Lycksele	2,240	243	238	230	322	330	3,603	1.1%
Malmö	5,722	117	105	98	92	109	6,243	1.9%
Mora	2,589	132	152	195	217	216	3,501	1.1%
Movement	105	112	98	190	193	256	954	0.3%
Nacka Närsjukhus Proxima	19	54	34	13	100	122	342	0.1%
Norrköping	4,741	70	135	265	234	238	5,683	1.7%

Norrtälje	1,247	87	105	120	131	118	1,808	0.5%
Nyköping	2,430	138	131	177	158	184	3,218	1.0%
Ortho Center Stockholm	673	172	197	213	410	432	2,097	0.6%
OrthoCenter IFK-kliniken	0	0	18	94	103	117	332	0.1%
Ortopediska Huset	1,200	383	536	500	441	343	3,403	1.0%
Oskarshamn	1,740	258	233	217	198	198	2,844	0.9%
Piteå	1,131	337	363	334	352	373	2,890	0.9%
Proxima Spec.vård Motala	0	0	0	0	0	437	437	0.1%
Skellefteå	2,214	108	86	91	94	93	2,686	0.8%
Skene	948	65	88	78	87	105	1,371	0.4%
Skövde	5,123	160	140	98	100	134	5,755	1.7%
Sollefteå	1,610	154	97	116	116	123	2,216	0.7%
Sophiahemmet	4,654	210	190	178	172	174	5,578	1.7%
Spenshult	0	0	75	153	104	184	516	0.2%
SU/Mölndal	1,112	38	224	294	342	444	2,454	0.7%
SU/Sahlgrenska	4,799	149	6	8	4	8	4,974	1.5%
Sunderby (incl. Boden)	4,597	82	58	45	42	38	4,862	1.5%
Sundsvall	5,128	128	136	114	215	203	5,924	1.8%
Södersjukhuset	6,267	415	468	431	383	384	8,348	2.5%
Södertälje	1,007	127	117	107	136	118	1,612	0.5%
Torsby	1,287	67	96	79	100	105	1,734	0.5%
Trelleborg	3,154	580	622	599	582	572	6,109	1.8%
Uddevalla	4,720	347	326	309	364	284	6,350	1.9%
Umeå	4,008	76	84	83	108	93	4,452	1.3%
Uppsala	5,622	266	290	288	321	372	7,159	2.2%
Varberg	3,697	201	247	203	264	193	4,805	1.5%
Visby	1,924	123	120	132	139	105	2,543	0.8%
Värnamo	2,202	150	130	150	144	124	2,900	0.9%
Västervik	2,436	91	117	110	109	113	2,976	0.9%
Västerås	3,198	156	181	239	433	414	4,621	1.4%
Växjö	3,058	154	108	142	100	127	3,689	1.1%
Ystad	2,422	5	6	7	3	5	2,448	0.7%
Ängelholm	2,831	0	0	6	45	143	3,025	0.9%
Örebro	4,694	190	198	164	177	184	5,607	1.7%
Örnsköldsvik	2,254	168	188	189	166	185	3,150	1.0%
Östersund	3,802	204	193	185	237	233	4,854	1.5%
Others [2)]	29,480	850	727	528	379	0	31,964	9.7%
Total	256,647	14,067	14,310	14,456	15,736	15,935	331,151	

[1)] Proportion of the total number of primary THRs performed during 1979-2010.
[2)] Hospitals that are missing registrations during 2010 are included here.

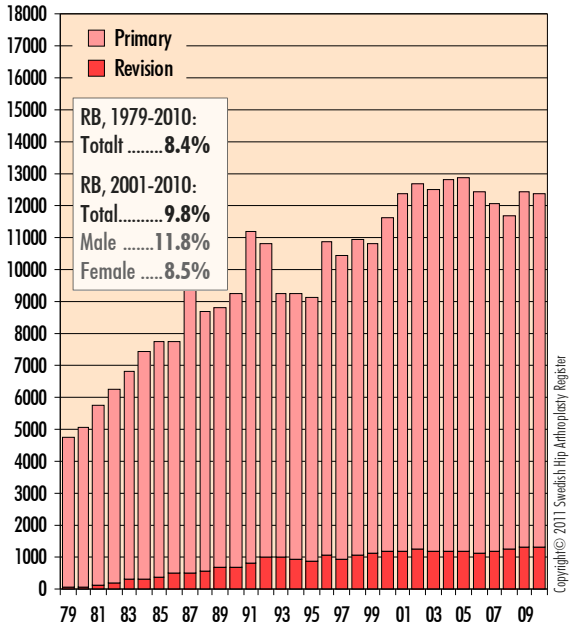
All THRs

331,151 primary THRs, 33,302 revisions, 1979-2010



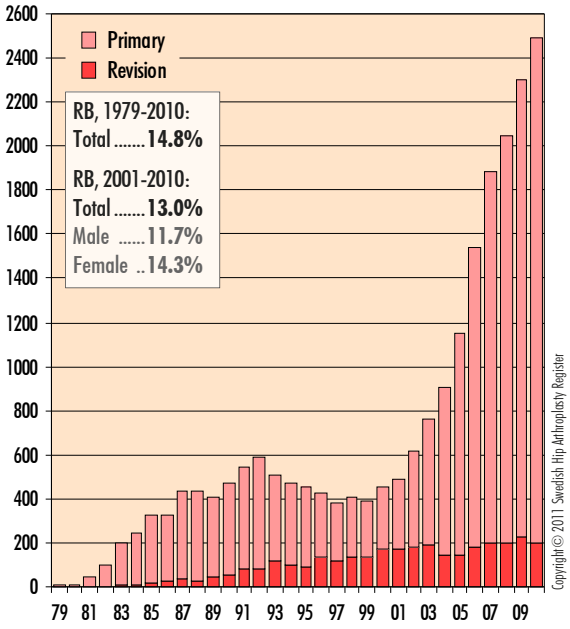
THRs with cemented implants

289,730 primary THRs, 26,641, 1979-2010



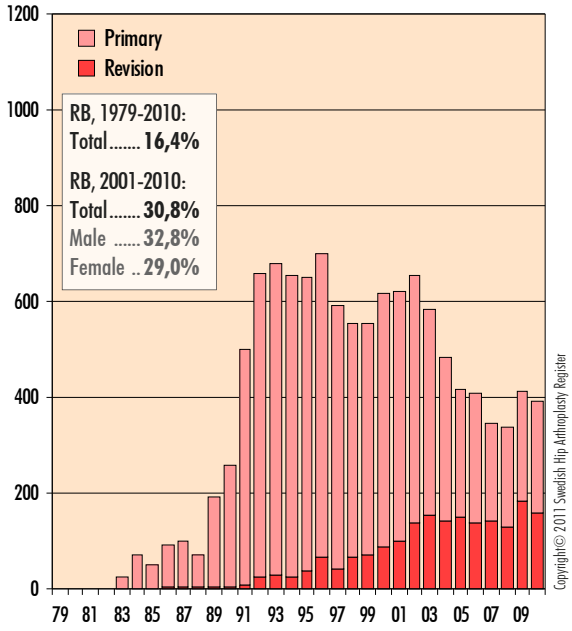
THRs with uncemented implants

18,579 primary THRs, 3,234 revisions, 1979-2010



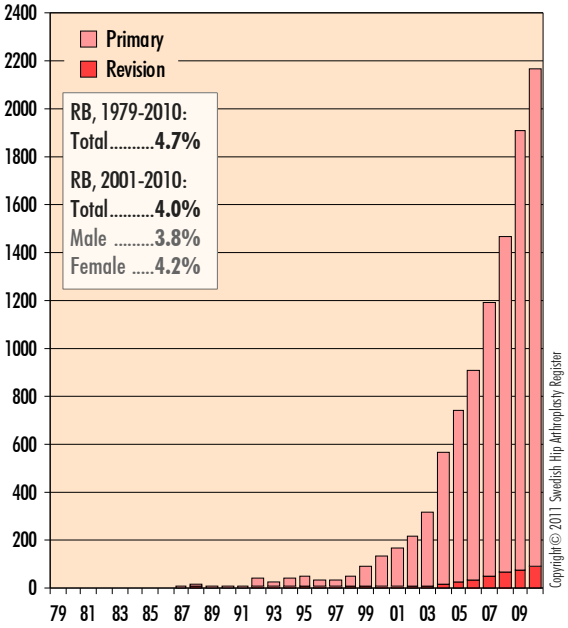
THRs with hybrid implants

9,775 primary THRs, 1,917 revisions, 1979-2010



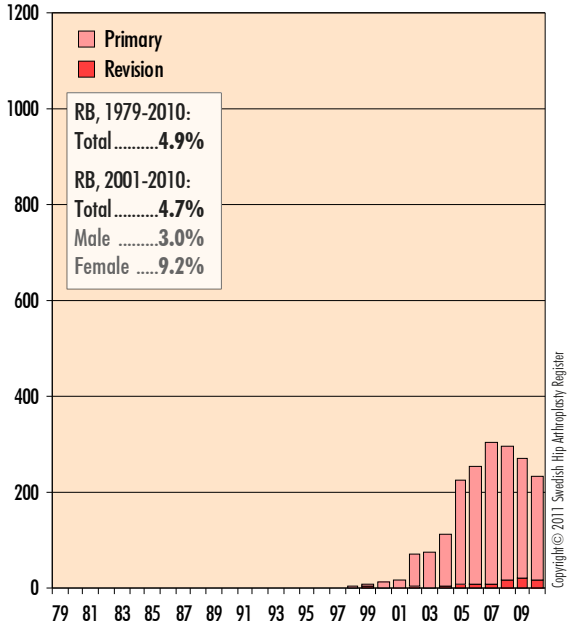
THRs with reversed hybrid implants

9,731 primary THRs, 476 revisions, 1979-2010



THRs with resurfacing implants

1,792 primary THRs, 92 revisions, 1979-2010



Number of primary THRs per diagnosis and year

Diagnosis	1992-2005	2006	2007	2008	2009	2010	Total	Prop.
Primary osteoarthritis	119,697	11,773	11,854	11,984	13,245	13,368	181,921	78.9%
Fracture	17,825	1,241	1,417	1,403	1,421	1,470	24,777	10.7%
Inflammatory arthritis	6,827	308	298	271	284	234	8,222	3.6%
Idiopathic femoral head necrosis	4,535	357	338	394	407	445	6,476	2.8%
Childhood disease	2,765	297	294	289	286	307	4,238	1.8%
Secondary osteoarthritis	1,296	2	1	0	4	3	1,306	0.6%
Tumour (malignancy)	820	68	88	93	78	81	1,228	0.5%
Secondary arthritis after trauma	401	19	18	22	11	26	497	0.2%
(missing)	1,872	2	2	0	0	1	1,877	0.8%
Total	156,038	14,067	14,310	14,456	15,736	15,935	230,542	100%

Number of primary THRs per diagnosis and age

1992-2010

Diagnosis	< 50 years		50-59 years		60-75 years		> 75 years		Total	Prop.
Primary osteoarthritis	6,608	58.7%	25,073	81.9%	99,645	84.0%	50,595	72.2%	181,921	78.9%
Fracture	328	2.9%	1,261	4.1%	9,476	8.0%	13,712	19.6%	24,777	10.7%
Inflammatory arthritis	1,478	13.1%	1,578	5.2%	3,880	3.3%	1,286	1.8%	8,222	3.6%
Idiopathic femoral head necrosis	731	6.5%	834	2.7%	2,417	2.0%	2,494	3.6%	6,476	2.8%
Childhood disease	1,707	15.2%	1,282	4.2%	1,038	0.9%	211	0.3%	4,238	1.8%
Secondary osteoarthritis	99	0.9%	113	0.4%	475	0.4%	619	0.9%	1,306	0.6%
Tumour (malignancy)	133	1.2%	246	0.8%	560	0.5%	289	0.4%	1,228	0.5%
Secondary arthritis after trauma	71	0.6%	69	0.2%	175	0.1%	182	0.3%	497	0.2%
(missing)	107	1.0%	170	0.6%	890	0.8%	710	1.0%	1,877	0.8%
Total	11,262	100%	30,626	100%	118,556	100%	70,098	100%	230,542	100%

Number of primary THRs with uncemented implants per diagnosis and age

1992-2010

Diagnosis	< 50 years		50-59 years		60-75 years		> 75 years		Total	Prop.
Primary osteoarthritis	2,420	61.0%	5,426	87.2%	4,354	91.7%	236	76.1%	12,436	81.6%
Childhood disease	761	19.2%	387	6.2%	103	2.2%	8	2.6%	1,259	8.3%
Inflammatory arthritis	343	8.6%	131	2.1%	88	1.9%	8	2.6%	570	3.7%
Idiopathic femoral head necrosis	286	7.2%	144	2.3%	80	1.7%	9	2.9%	519	3.4%
Fracture	68	1.7%	92	1.5%	100	2.1%	46	14.8%	306	2.0%
Secondary osteoarthritis	33	0.8%	8	0.1%	4	0.1%	1	0.3%	46	0.3%
Secondary arthritis after trauma	25	0.6%	5	0.1%	2	0.0%	2	0.6%	34	0.2%
Tumour (malignancy)	3	0.1%	7	0.1%	4	0.1%	0	0.0%	14	0.1%
(missing)	28	0.7%	20	0.3%	11	0.2%	0	0.0%	59	0.4%
Total	3,967	100%	6,220	100%	4,746	100%	310	100%	15,243	100%

Number of primary THRs per type of fixation and age

1992-2010

Diagnosis	< 50 years		50-59 years		60-75 years		> 75 years		Total	Prop.
Cemented	3,559	31.6%	17,067	55.7%	105,709	89.2%	68,167	97.2%	194,502	84.4%
Uncemented	3,967	35.2%	6,220	20.3%	4,746	4.0%	310	0.4%	15,243	6.6%
Hybrid	1,427	12.7%	3,146	10.3%	3,213	2.7%	556	0.8%	8,342	3.6%
Reversed hybrid	1,150	10.2%	3,141	10.3%	4,441	3.7%	954	1.4%	9,686	4.2%
Resurfacing implant	835	7.4%	738	2.4%	217	0.2%	2	0.0%	1,792	0.8%
(missing)	324	2.9%	314	1.0%	230	0.2%	109	0.2%	977	0.4%
Total	11,262	100%	30,626	100%	118,556	100%	70,098	100%	230,542	100%

Number of primary THRs per type of incision and year

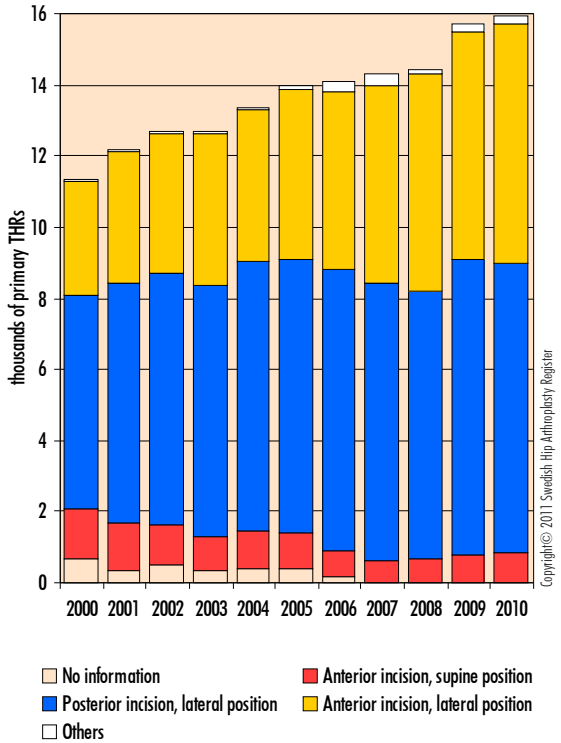
Type of incision	2000-2005	2006	2007	2008	2009	2010	Total	Prop.
Posterior incision, lateral position (Moore)	42,151	7,883	7,815	7,508	8,301	8,124	81,782	54.3%
Anterior incision, lateral position (Gammer)	24,172	5,006	5,544	6,118	6,421	6,742	54,003	35.8%
Anterior incision, supine position (Hardinge)	6,954	761	606	671	792	837	10,621	7.0%
Others	345	268	327	142	221	228	1,531	1.0%
(missing)	2,610	149	18	17	1	4	2,799	1.9%
Total	76,232	14,067	14,310	14,456	15,736	15,935	150,736	100%

Number of primary THRs per type of cement and year

Brand of cement	1992-2005	2006	2007	2008	2009	2010	Total	Prop.
Palacos cum Gentamycin	55,994	0	0	0	0	0	55,994	34.7%
Palacos R + G	0	5,549	5,500	4,556	5,220	5,064	25,889	16.0%
Refobacin Bone Cement	1	5,260	4,696	5,359	5,164	5,335	25,815	12.2%
Refobacin Palacos R	19,611	0	0	0	0	0	19,611	11.5%
Cemex Genta System Fast	1	222	354	413	569	430	1,989	1.2%
Cemex Genta System	86	25	120	0	0	0	231	0.1%
Others	1,305	30	10	15	20	33	1,413	5.3%
(completely or partially uncemented)	9,798	2,981	3,630	4,113	4,762	5,073	30,357	18.8%
(missing)	3	0	0	0	1	0	4	0.0%
Total	86,799	14,067	14,310	14,456	15,736	15,935	161,303	100%

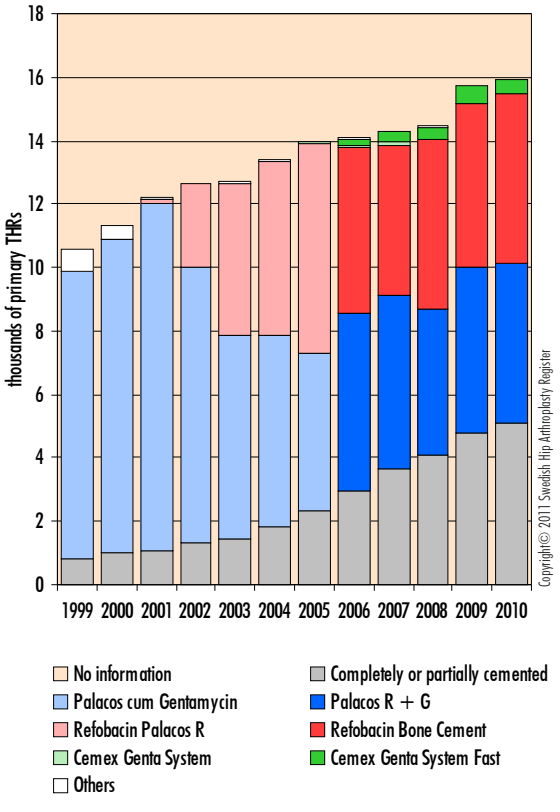
Type of incision

2000-2010



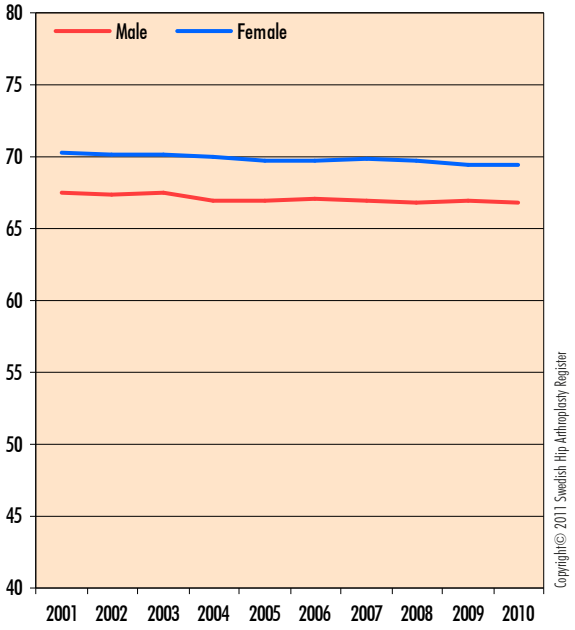
Type of cement

1999-2010



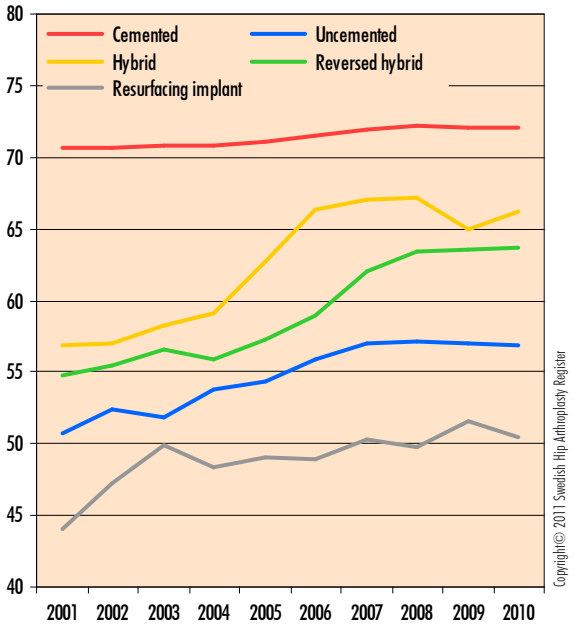
Mean age per gender

the past 10 years, 139,404 primary THRs



Mean age per type of fixation

the past 10 years, 138,661 primary THRs



Average age per diagnosis and gender

the past 10 years

Diagnosis	Male	Female	Total
Fracture	73.2	75.4	74.8
Secondary arthritis after trauma	69.4	72.6	70.8
Primary osteoarthritis	67.1	69.7	68.6
Idiopathic femoral head necrosis	61.5	70.8	67.5
Tumour (malignancy)	70.0	63.1	66.3
Secondary osteoarthritis	64.9	66.3	65.6
Inflammatory arthritis	59.3	62.0	61.3
Childhood disease	54.1	53.2	53.6
(missing)	75.0	70.4	71.5
Total	67.1	69.8	68.7

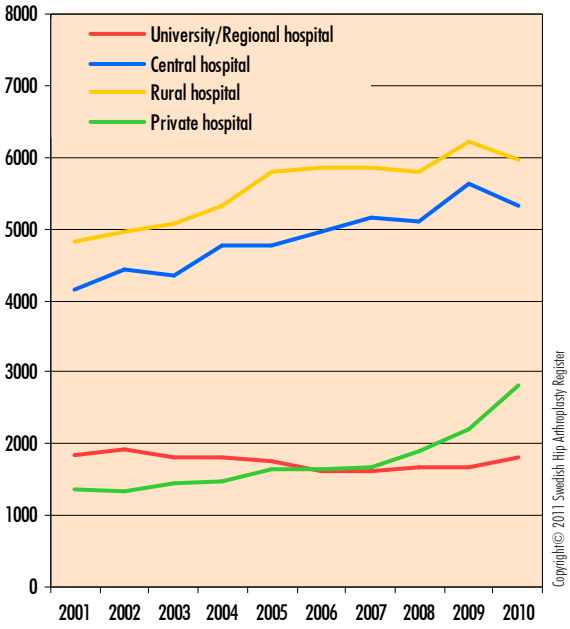
Average age per type of hospital and gender

the past 10 years

Type of hospital	Male	Female	Total
Central hospitals	67.9	70.7	69.6
Rural hospitals	67.9	70.1	69.2
University/Regional hospitals	63.8	68.1	66.5
Private hospitals	65.0	68.4	67.0
Total	67.1	69.8	68.7

Trend in number of primary THRs

the past 10 years, by type of hospital



Effect of increased proportion of private operations

In 2009, Swedish private hospitals for the first time performed more primary arthroplasties than the university and regional hospitals. This difference was further accentuated during 2010.

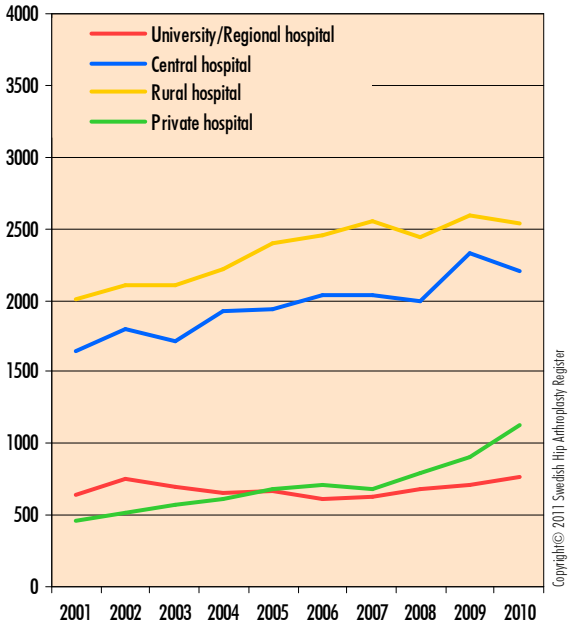
Since rural hospitals and above all private hospitals operate on 'healthier' patients with less comorbidity and technically simpler cases, this can mean that accessibility for the 'more sick' and more complicated cases is worsened. Other disadvantages in the long term:

- Possibilities for continual training of physicians and theatre staff worsen since training is concentrated to university and regional hospitals.
- Material for clinical studies of primary arthroplasties decreases dramatically.

This can in time affect possibilities for transferring competence to physicians during specialist training, and the trend should definitely be broken. One alternative is that the private actors undertake training responsibility, which can only be effective if their compensation level can be raised in future public contracts.

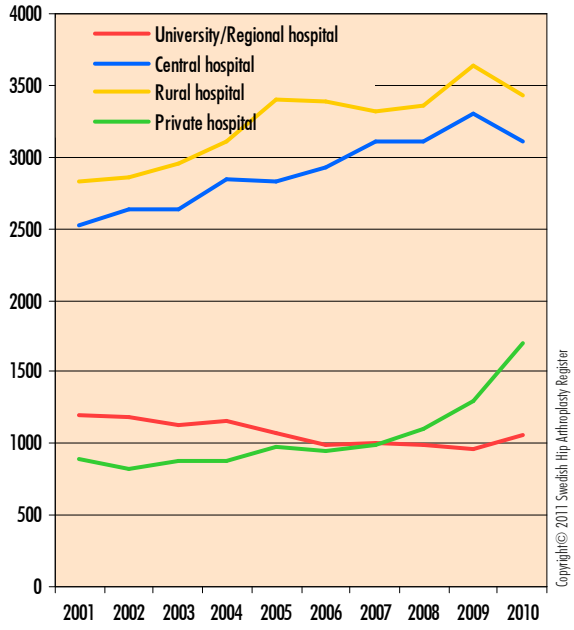
Trend in number of primary THRs

the past 10 years - males only



Trend in number of primary THRs

the past 10 years - females only



Notes

Reoperation

Reoperation comprises all types of surgical intervention relating directly to an inserted hip implant. It may be that the implant is left untouched, or revised, when the whole implant or at least one of its components is changed or extracted. For 2005-2010 'major surgical intervention' without exchange of hip components involved one or more of the following measures: fracture reconstruction (35%), supplementation of cup with augment or exchange of augment (19%), open reduction (10%), synoviecotomy (7%), muscle/soft tissue surgery (4%), cement extraction (3%) and exchange or extraction of spacer (3%). Minor surgical interventions commonly involve some form of wound revision or secondary suture.

During the most recent three years the relative proportion of reoperations in which the implant has been left untouched has declined (figure 1). The reason for this may be a trend to more active treatment of suspected or verified deep infections which often leads to exchange of modular implant components such as PE linings and joint heads. Among the revisions, liner revisions and the group 'other' occupy an increasing proportion. Between 2005 and 2010 all cases in this group consisted of interventions combined with exchange of head (449 of 552). Almost half the cases (45.3%) were occasioned by infection and in others chiefly by dislocation (43.5%). During this period the number of liner exchanges with retained stem components almost doubled (from 51 to 98, 3.4-5.5 of the total number) not least in the treatment of dislocation, but also of infection. Together these data indicate a more strenuous attempt to rescue an infected hip implant with open debriding and change of modular implant components (figure 2).

Early reoperation and demography

The relative proportion of primary arthroplasties reoperated within two years represents an important quality indicator, not least considering that they are caused by dislocation and infection. However, these complications are not equally distributed among patients receiving hip implants but are affected by, among other things, the patient's general health. In this year's analyses we have therefore studied more closely how gender, age, primary diagnosis, presence of other mobility impairments (Charnley category C), ASA classification and BMI affect the risk of operation within two years. Data on these variables exists chiefly from 2008 onwards. This means that not all patients included in the analysis have yet been observed for two years. The population with complete data consists of 32,412 hip arthroplasties and 292 reoperations within two years. The intention is to update the analysis successively as data capture and follow-up time increase.

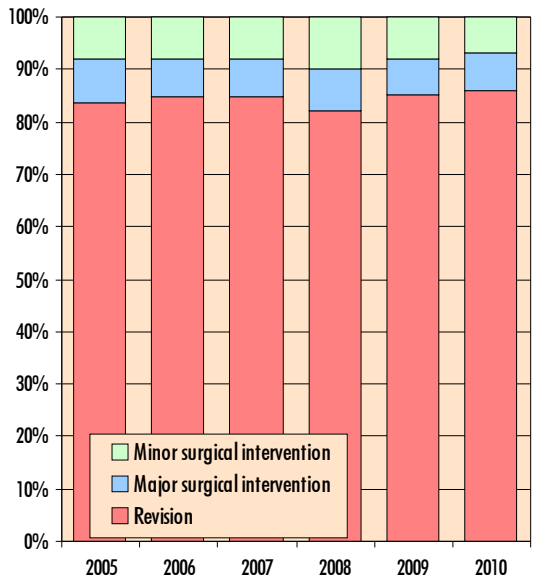


Figure 1. Distribution of reoperations 2005-2010

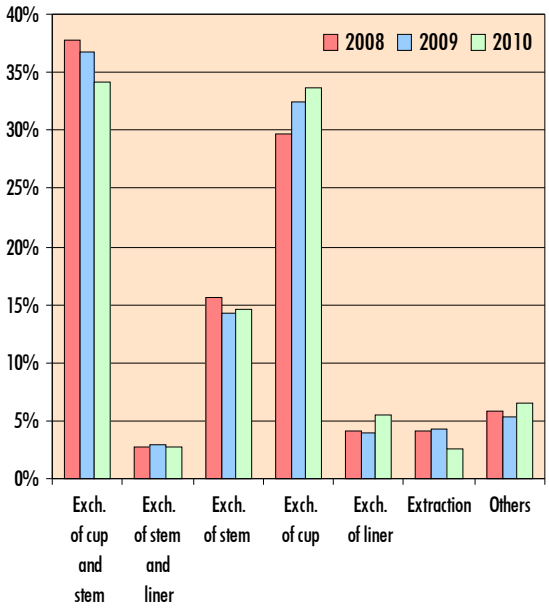


Figure 2. Relative distribution of measures in reoperations 2008-2010.

In the analysis (Cox regression) we find that patients with high BMI (>=30) run an increased risk of early reoperation compared with those with normal BMI (18.5-24.9). The increased risk also applies to patients with low BMI (<18.5). Underweight and overweight people treated as a group exhibit a doubled risk compared with those of normal weight (Relative Risk = 2.08, 95% confidence interval: 1.52-2.84). In the same analysis it is noted that the risk is greater for men (1.51, CI: 1.19-1.91), for patients classified in ASA class 3 or higher (1.56, CI: 1.06-2.31) and for patients aged 80 or above (compared with the group 60-69 years: RR=1.48 CI: 1.02-2.15). Most evident is the increased risk for men and for patients who are over- or underweight. For the other risk factors the confidence interval is nearer 1, which implies a lower degree of certainty in the analysis.

Number of reoperations per procedure and year

primary THRs performed 1979-2010

Procedure at reoperation	1979-2005	2006	2007	2008	2009	2010	Total	Prop.
Revision	26,054	1,604	1,712	1,730	1,929	1,894	34,923	84.9%
Major surgical intervention	3,143	142	152	157	167	146	3,907	9.5%
Minor surgical intervention	1,417	158	171	201	183	157	2,287	5.6%
(missing)	1	0	0	0	1	0	2	0.0%
Total	30,615	1,904	2,035	2,088	2,280	2,197	41,119	100%

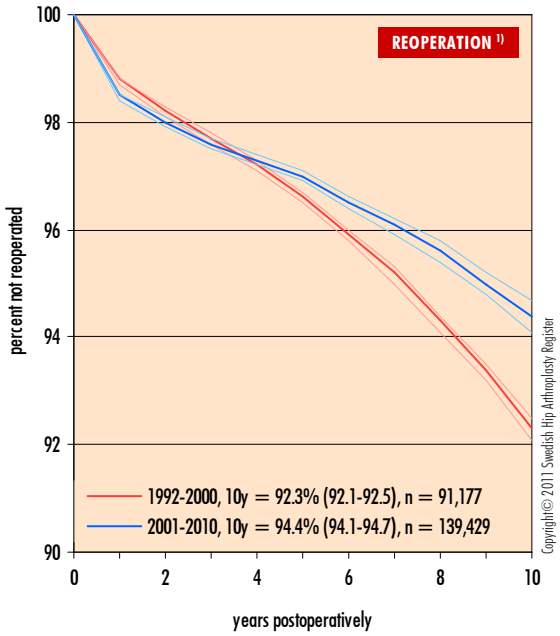
Number of reoperations per reason and year

primary THRs performed 1979-2010

Reason for reoperation	1979-2002	2003	2004	2005	2006	2007	Total	Prop.
Aseptic loosening	18,028	1,029	1,003	1,002	1,114	1,050	23,226	56.5%
Dislocation	3,453	264	305	302	285	295	4,904	11.9%
Deep infection	3,025	292	321	394	420	386	4,838	11.8%
Fracture	2,228	169	209	217	224	238	3,285	8.0%
2-stage procedure	1,311	78	83	73	95	103	1,743	4.2%
Technical error	895	18	39	43	57	58	1,110	2.7%
Miscellaneous	898	15	35	20	34	29	1,031	2.5%
Implant fracture	429	23	24	18	37	22	553	1.3%
Pain only	311	16	13	18	14	16	388	0.9%
Secondary infection	2	0	3	0	0	0	5	0.0%
(missing)	35	0	0	1	0	0	36	0.1%
Total	30,615	1,904	2,035	2,088	2,280	2,197	41,119	100%

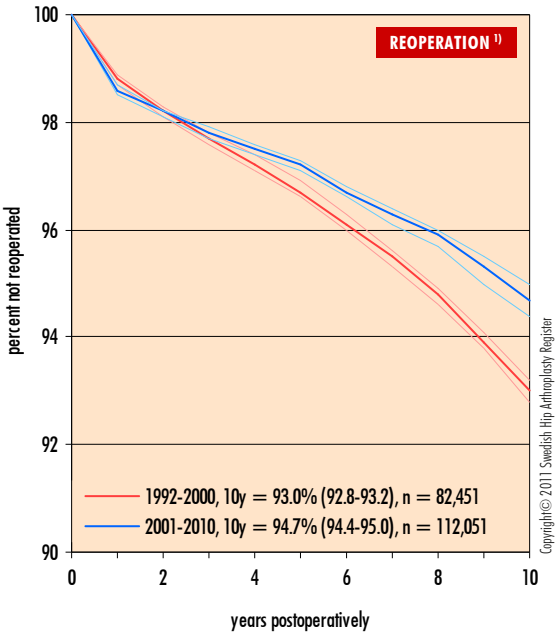
All implants

all diagnoses and all reasons

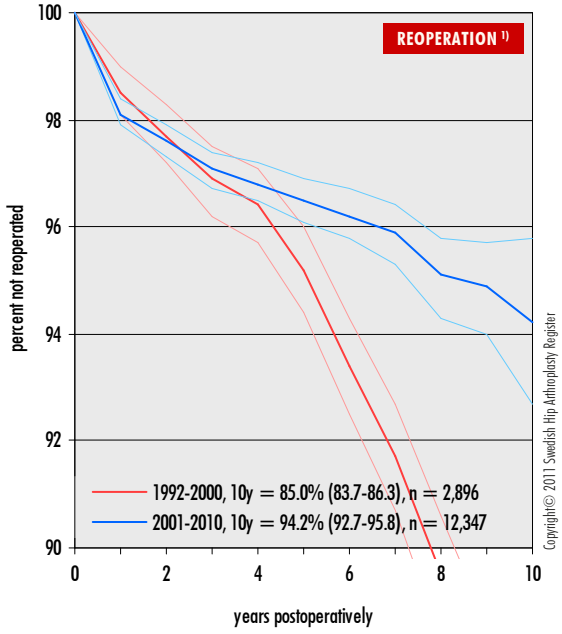


All cemented implants

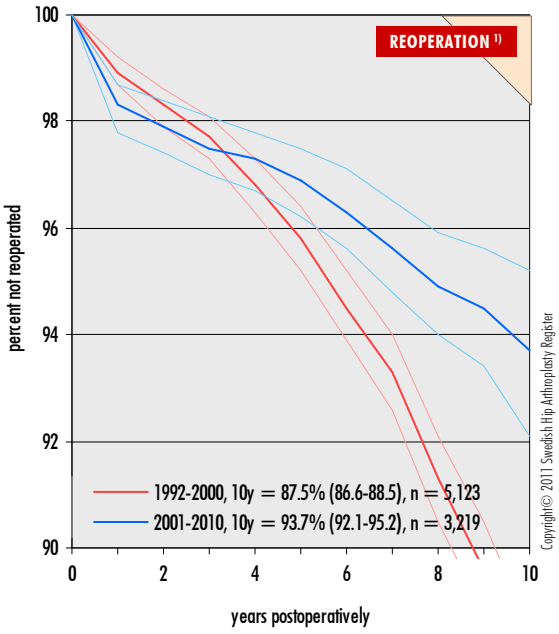
all diagnoses and all reasons



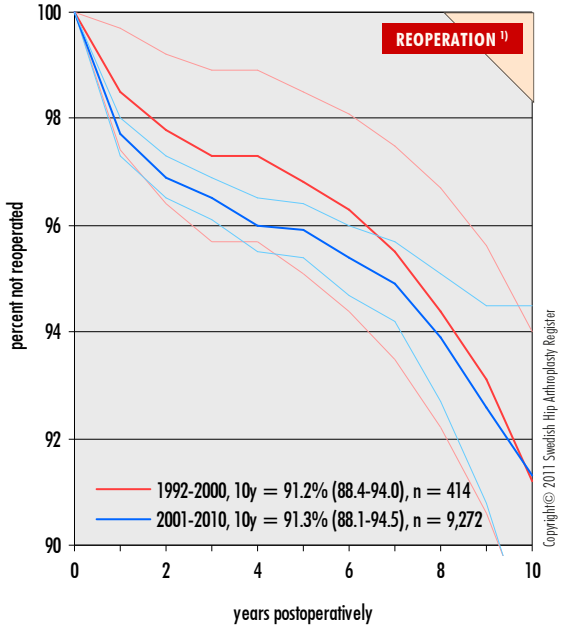
All uncemented implants
all diagnoses and all reasons



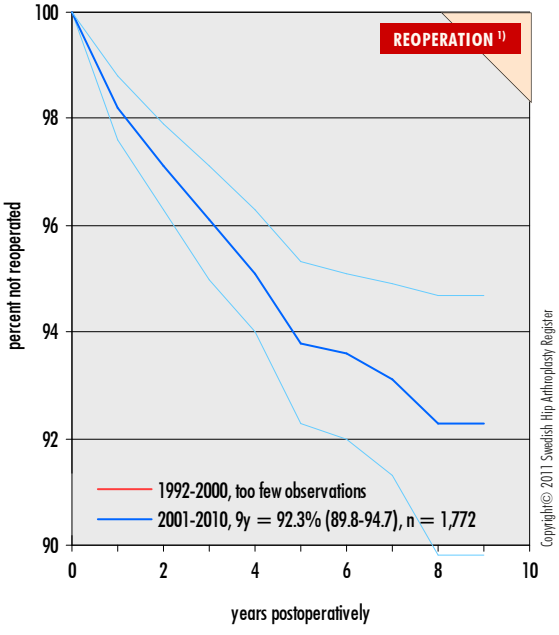
All hybrid implants
all diagnoses and all reasons



All reversed hybrid implants
all diagnoses and all reasons



All resurfacing implants
all diagnoses and all reasons



1) Survival statistics according to Kaplan-Meier with reoperation (all form of further surgery, including revision) as end-point definition.

Short-term complications – reoperation within 2 years

In traditional survival statistics (Kaplan-Meier), exchange of some component or removal of the whole implant is the definition of failure. Five- or 10-year survival illustrates long-term results regarding chiefly aseptic loosening. Reoperation within two years, on the other hand, refers to all forms of further surgery (not only interventions in which implant components are exchanged) to the hip following insertion of a total hip prosthesis. This variable chiefly reflects early and serious complications such as deep infection and dislocation. The variable is therefore a faster indicator and easier to use for clinical improvement work than is ten-year survival, which is important, but a slow and partly historical indicator.

Reoperation within two years has been selected by the Swedish Association of Local Authorities and Regions and the National Board of Health and Welfare as a national quality indicator for this type of surgery and is included in *Öppna jämförelser* (Open Comparisons). The indicator may be seen as one of the most important and most easily influenced result measures that the Swedish Hip Arthroplasty Registry reports.

Definition

By short-term complication is meant all forms of open surgery within two years of the primary operation. The most recent four-year period is studied – in this Report, 2007 up to and including 2010. Note that the Report refers only to complications dealt with surgically. Infections treated with antibiotics, and non-surgically treated dislocations, are not captured by the Registry. Patients undergoing repeated operations for the same complication are reported as one complication. A number of patients, however, undergo reoperation for different reasons (then recorded as several complications) within a short period. Patients reoperated at another department than their primary one, however, are ascribed to the primary department.

Results

Results by clinic are given in the following table. Hospital type, number of primary operated patients during the observation period, and proportion of reoperated patients, are given. The national mean value during the observation time was 1.8% (unchanged since last year). The complication rate varied from 0.2% to 5.0%. Departments with a frequency one SD over the mean value are given in red. Twelve (of 78) departments exceeded this value. The hospitals reporting the highest reoperation frequency during the observation period had by turns a predominance of infections or dislocations. During previous years, chiefly the dislocation problem dominated among the hospitals reporting high complication figures, but it is now more common for infections to dominate. Considerable local improvement work during the past few years has been directed to the problem of dislocation.

Underreporting

For many years we have published our annual analysis of completeness. This does not, however, include secondary interventions. This is disturbing considering the data quality of the Register. The reason is unfortunately the continued low quality of surgeons' coding (ICD-10) and giving measure codes (KVÅ) for secondary interventions. Despite several attempts we have found up to 30 different (and often inadequate) measure codes used for various types of reoperation. Since the Patient Register also lacks laterality in its database, comprehensive system development is required for a coverage analysis of secondary interventions – at present we lack the resources for such a development.

Some units report extremely low complication figures for 2007-2010. That certain high-producing units should not have more than one or two complications according to the above definition – and over four years – appears improbable. An ongoing study matching the Register with the Pharmaceuticals Register regarding post-operative antibiotics prescriptions (in the first post-operative year), and a subsequent analysis of medical records, show clear underreporting of implant-related infections at a number of the hospitals studied. The study will be reported in full during spring 2012.

The Registry will now start the following measures:

- Monitoring of hospitals. The Registry's coordinators will visit a number of hospitals per year to 'validate' the Registry's database via local patient-administrative and medical-records systems. Some national quality registers use this type of validation. The system has been approved by the Data Inspectorate but requires preparation (PDL) before the visit.
- Creation of resources for coverage analyses of secondary interventions as above.
- Open publication of the infection study as above.
- Renewed appeal to all managers to act locally to improve coding culture at our surgical units, via meetings or even with local courses on the subject.
- Each unit should review its routines for reporting reoperation, which is thus a broader concept than revision – 'any kind of further surgery'.
- Renewed appeal to, above all, the country's private actors to follow the law and report not only to the Swedish Hip Arthroplasty Registry (voluntarily) but also to the Patient Register at the National Board of Health & Welfare (this is mandatory!).

Discussion

When interpreting results one should compare only departments of the same hospital type in view of varying patient demography. Departments that undertake the most severe

cases with greater risks of complication may naturally have a higher frequency. Apart from the hospitals' varying risk profiles, the following should also be taken into account when interpreting these results:

- Under-reporting – see above.
- The complication rate is generally low and random variability has great affects upon the result. This variable can really only be evaluated over time, i.e. if there are clear trends – see separate trend table.
- Departments with a differing approach (non-surgical treatment of, for example, infections and dislocation); that is, that avoid operating on these complications, are not registered in the databases.
- As opposed to this, departments that are surgically 'aggressive' both on suspicion of early infection and following first-time dislocation get high frequencies of early complication. The treatment algorithm in early suspected deep infection both for knee and hip arthroplasty has changed during the past few years. It is increasingly common to intervene early with surgery using 'debriding' with or without change of modular components. It is therefore very important not only to report classical revisions but also reoperations of all types.
- Since the study covers patients undergoing operation during a four-year period, it can take 1-2 years before a successful improvement is reflected in the results table.

The Registry management has entirely avoided ranking, and will never rank, the various hospitals regarding this important result indicator. Since complication rates generally are low, missed registration can seriously affect a unit's ranking. Regardless of hospital category and result, the departments should analyse their own complications (without glancing at the national mean) and investigate whether there are any systematic shortcomings – this to avoid serious complications for the individual patient.

This quality work can to advantage be conducted continuously during the year and on many occasions. In this way departments are stimulated to work regularly with their complication material.

When interpreting the variable 'reoperation within two years' the following factors must be observed:

- **Hospital type.**
- **Patient demography.**
- **Complication rates are generally low and random variability has a large effect on the result.**
- **This variable can only be evaluated over time, i.e. if there are clear trends.**
- **Note that the Report refers only to complications dealt with surgically.**

By *reoperation* is meant all forms of further surgery following implant operation in the hip joint.

By *revision*, which is a form of reoperation, is meant interventions in which one or more implant components are replaced or the whole implant is removed.

The Swedish Hip Arthroplasty Registry started to register hemi-arthroplasties on 1 January 2005.

- ***Before* 1 January 2005 a possible conversion from hemi- to total arthroplasty was recorded as a primary total arthroplasty.**
- ***After* 1 January 2005 reoperated hemi-arthroplasties have always been recorded in the hemi-prosthesis database.**
- **A total arthroplasty always remains in the total arthroplasty database regardless of type of reoperation.**
- **A hemi-arthroplasty always remains in the hemi-prosthesis data base regardless of type of operation.**

Reoperation within 2 years per hospital

2007-2010

	Prim.THRs	Patients [1]		Infection		Dislocation		Loosening		Others	
Hospital	number	number	%	number	%	number	%	number	%	number	%
University/Regional hospitals											
Karolinska/Huddinge	960	22	2.3%	3	0.3%	8	0.8%	1	0.1%	13	1.4%
Karolinska/Solna	840	21	2.5%	13	1.5%	3	0.4%	0	0.0%	7	0.8%
Linköping	236	2	0.8%	0	0.0%	1	0.4%	0	0.0%	1	0.4%
Lund	383	7	1.8%	4	1.0%	2	0.5%	0	0.0%	2	0.5%
Malmö	404	8	2.0%	3	0.7%	1	0.2%	0	0.0%	4	1.0%
SU/Mölndal	1,304	41	3.1%	18	1.4%	14	1.1%	0	0.0%	15	1.2%
SU/Östra	280	8	2.9%	5	1.8%	0	0.0%	0	0.0%	4	1.4%
Umeå	368	4	1.1%	1	0.3%	2	0.5%	0	0.0%	1	0.3%
Uppsala	1,271	32	2.5%	14	1.1%	14	1.1%	1	0.1%	11	0.9%
Örebro	723	11	1.5%	7	1.0%	1	0.1%	1	0.1%	4	0.6%
Central hospitals											
Borås	779	17	2.2%	8	1.0%	5	0.6%	0	0.0%	6	0.8%
Danderyd	1,498	49	3.3%	18	1.2%	15	1.0%	3	0.2%	24	1.6%
Eksjö	794	18	2.3%	13	1.6%	4	0.5%	0	0.0%	2	0.3%
Eskilstuna	399	6	1.5%	4	1.0%	2	0.5%	0	0.0%	1	0.3%
Falun	1,197	23	1.9%	16	1.3%	4	0.3%	0	0.0%	5	0.4%
Gävle	604	30	5.0%	10	1.7%	7	1.2%	1	0.2%	14	2.3%
Halmstad	887	22	2.5%	10	1.1%	8	0.9%	0	0.0%	6	0.7%
Helsingborg	252	4	1.6%	1	0.4%	1	0.4%	0	0.0%	2	0.8%
Hässleholm-Kristianstad	3,395	54	1.6%	30	0.9%	5	0.1%	7	0.2%	22	0.6%
Jönköping	801	10	1.2%	6	0.7%	4	0.5%	0	0.0%	2	0.2%
Kalmar	696	13	1.9%	5	0.7%	6	0.9%	0	0.0%	3	0.4%
Karlskrona	114	2	1.8%	0	0.0%	2	1.8%	0	0.0%	0	0.0%
Karlstad	1,117	38	3.4%	30	2.7%	4	0.4%	0	0.0%	8	0.7%
Norrköping	872	9	1.0%	4	0.5%	2	0.2%	0	0.0%	3	0.3%
Skövde	472	4	0.8%	2	0.4%	1	0.2%	0	0.0%	2	0.4%
Sunderby (incl. Boden)	183	8	4.4%	4	2.2%	4	2.2%	0	0.0%	0	0.0%
Sundsvall	668	26	3.9%	18	2.7%	6	0.9%	2	0.3%	8	1.2%
Södersjukhuset	1,666	30	1.8%	17	1.0%	2	0.1%	0	0.0%	13	0.8%
Uddevalla	1,283	19	1.5%	6	0.5%	6	0.5%	2	0.2%	7	0.5%
Varberg	907	14	1.5%	6	0.7%	3	0.3%	2	0.2%	4	0.4%
Västerås	1,267	43	3.4%	17	1.3%	13	1.0%	0	0.0%	17	1.3%
Växjö	477	1	0.2%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
Östersund	848	20	2.4%	8	0.9%	4	0.5%	1	0.1%	10	1.2%
Rural hospitals											
Alingsås	842	15	1.8%	9	1.1%	5	0.6%	1	0.1%	1	0.1%
Arvika	584	12	2.1%	5	0.9%	2	0.3%	0	0.0%	6	1.0%
Bollnäs	1,139	12	1.1%	6	0.5%	3	0.3%	0	0.0%	3	0.3%
Enköping	901	30	3.3%	8	0.9%	20	2.2%	0	0.0%	6	0.7%
Falköping	927	4	0.4%	1	0.1%	2	0.2%	1	0.1%	1	0.1%
Frölunda Specialistsjukhus	310	9	2.9%	3	1.0%	1	0.3%	1	0.3%	5	1.6%

Reoperation within 2 years per hospital (cont.)

2007-2010

	Prim.THRs	Patients [1]		Infection		Dislocation		Loosening		Others	
Hospital	number	number	%	number	%	number	%	number	%	number	%
Gällivare	363	1	0.3%	1	0.3%	0	0.0%	0	0.0%	0	0.0%
Hudiksvall	526	13	2.5%	7	1.3%	2	0.4%	0	0.0%	5	1.0%
Karlshamn	787	7	0.9%	1	0.1%	4	0.5%	0	0.0%	2	0.3%
Karlskoga	485	5	1.0%	3	0.6%	1	0.2%	0	0.0%	1	0.2%
Katrineholm	929	12	1.3%	7	0.8%	3	0.3%	2	0.2%	3	0.3%
Kungälv	787	13	1.7%	11	1.4%	1	0.1%	0	0.0%	4	0.5%
Köping	249	5	2.0%	3	1.2%	2	0.8%	0	0.0%	0	0.0%
Lidköping	513	1	0.2%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
Lindesberg	718	11	1.5%	4	0.6%	2	0.3%	0	0.0%	6	0.8%
Ljungby	589	6	1.0%	1	0.2%	3	0.5%	1	0.2%	3	0.5%
Lycksele	1,120	14	1.3%	9	0.8%	3	0.3%	0	0.0%	6	0.5%
Mora	780	8	1.0%	1	0.1%	4	0.5%	0	0.0%	3	0.4%
Motala (up to 2009)	1,094	25	2.3%	10	0.9%	11	1.0%	0	0.0%	6	0.5%
Norrtälje	474	10	2.1%	4	0.8%	4	0.8%	0	0.0%	2	0.4%
Nyköping	650	21	3.2%	17	2.6%	2	0.3%	0	0.0%	3	0.5%
Oskarshamn	846	11	1.3%	8	0.9%	3	0.4%	0	0.0%	0	0.0%
Piteå	1,422	15	1.1%	9	0.6%	3	0.2%	1	0.1%	4	0.3%
Skellefteå	364	2	0.5%	1	0.3%	1	0.3%	0	0.0%	1	0.3%
Skene	358	3	0.8%	2	0.6%	1	0.3%	0	0.0%	1	0.3%
Sollefteå	452	5	1.1%	2	0.4%	2	0.4%	0	0.0%	2	0.4%
Södertälje	478	4	0.8%	3	0.6%	1	0.2%	0	0.0%	2	0.4%
Torsby	380	7	1.8%	5	1.3%	1	0.3%	0	0.0%	5	1.3%
Trelleborg	2,375	29	1.2%	7	0.3%	4	0.2%	4	0.2%	19	0.8%
Visby	496	6	1.2%	1	0.2%	1	0.2%	0	0.0%	4	0.8%
Värnamo	548	6	1.1%	2	0.4%	2	0.4%	0	0.0%	3	0.5%
Västervik	449	16	3.6%	12	2.7%	2	0.4%	0	0.0%	3	0.7%
Ängelholm	194	2	1.0%	1	0.5%	0	0.0%	1	0.5%	0	0.0%
Örnsköldsvik	728	6	0.8%	1	0.1%	3	0.4%	0	0.0%	2	0.3%
Private hospitals											
Aleris Specialistvård Sabbatsberg	281	4	1.4%	1	0.4%	1	0.4%	0	0.0%	2	0.7%
Capio S:t Göran	1,502	15	1.0%	6	0.4%	5	0.3%	0	0.0%	11	0.7%
Carlanderska	256	3	1.2%	1	0.4%	2	0.8%	0	0.0%	0	0.0%
Elisabethsjukhuset	461	4	0.9%	2	0.4%	0	0.0%	0	0.0%	2	0.4%
Movement	737	8	1.1%	2	0.3%	4	0.5%	0	0.0%	3	0.4%
Nacka Närsjukhus Proxima	269	2	0.7%	1	0.4%	0	0.0%	0	0.0%	2	0.7%
Ortho Center Stockholm	1,252	28	2.2%	7	0.6%	10	0.8%	3	0.2%	11	0.9%
OrthoCenter IFK-kliniken	332	2	0.6%	1	0.3%	0	0.0%	0	0.0%	1	0.3%
Ortopediska Huset	1,820	38	2.1%	12	0.7%	13	0.7%	5	0.3%	16	0.9%
Proxima Spec.vård Motala	437	4	0.9%	2	0.5%	0	0.0%	0	0.0%	2	0.5%
Sophiahemmet	714	15	2.1%	3	0.4%	2	0.3%	1	0.1%	9	1.3%
Spenshult	516	11	2.1%	7	1.4%	3	0.6%	0	0.0%	5	1.0%
Nation	60,437	1,098	1.8%	511	0.8%	297	0.5%	42	0.1%	397	0.7%

[1] Refers to number of patients with short-term complications which may differ from the sum of complications since each patient may have more than one type of complication.

Reoperation within 2 years per hospital - trend

2003-2010

Hospital	2003-2006	2004-2007	2005-2008	2006-2009	2007-2010
University/Regional hospitals					
Karolinska/Huddinge	2.8%	3.0%	3.3%	3.0%	2.3%
Karolinska/Solna	3.9%	3.4%	3.1%	3.2%	2.5%
Linköping	1.6%	1.4%	0.9%	1.4%	0.8%
Lund	4.0%	4.5%	4.0%	3.1%	1.8%
Malmö	2.1%	2.1%	1.6%	1.2%	2.0%
SU/Mölndal	2.4%	3.4%	4.5%	4.2%	3.1%
SU/Sahlgrenska	1.5%	1.2%	1.1%	1.2%	7.7%
SU/Östra	1.1%	2.3%	2.7%	3.0%	2.9%
Umeå	1.0%	1.3%	0.9%	1.1%	1.1%
Uppsala	3.6%	3.4%	3.4%	2.9%	2.5%
Örebro	1.0%	1.5%	1.3%	1.4%	1.5%
Central hospitals					
Borås	3.4%	2.7%	2.4%	2.7%	2.2%
Danderyd	2.5%	2.0%	2.6%	3.0%	3.2%
Eksjö	2.4%	2.0%	2.5%	2.8%	2.3%
Eskilstuna	1.3%	1.9%	1.4%	1.5%	1.5%
Falun	0.8%	0.8%	1.3%	1.6%	1.9%
Gävle	4.2%	5.8%	5.0%	5.3%	5.0%
Halmstad	2.6%	1.9%	2.4%	2.6%	2.5%
Helsingborg	1.7%	2.5%	3.4%	3.4%	1.6%
Hässleholm-Kristianstad	1.3%	1.4%	1.7%	1.9%	1.6%
Jönköping	2.1%	1.4%	1.3%	1.8%	1.2%
Kalmar	2.8%	2.7%	2.5%	2.9%	1.9%
Karlskrona	3.3%	4.1%	5.1%	2.9%	1.8%
Karlstad	2.6%	2.7%	2.9%	3.1%	3.4%
Norrköping	0.6%	0.5%	1.1%	1.1%	1.0%
Skövde	1.4%	1.0%	0.7%	0.8%	0.8%
Sunderby (incl. Boden)	4.0%	4.8%	5.4%	5.7%	4.4%
Sundsvall	4.7%	4.5%	5.3%	4.4%	3.9%
Södersjukhuset	2.4%	2.6%	2.2%	2.1%	1.8%
Uddevalla	2.6%	2.1%	2.1%	1.9%	1.5%
Varberg	2.7%	2.7%	1.6%	2.0%	1.5%
Västerås	0.8%	1.8%	2.8%	3.2%	3.4%
Växjö	0.6%	0.4%	0.4%	0.0%	0.2%
Ystad	3.9%	3.7%	4.8%	0.0%	0.0%
Östersund	1.8%	2.1%	2.3%	2.0%	2.4%
Rural hospitals					
Alingsås	1.2%	1.3%	1.6%	1.9%	1.8%
Arvika	2.5%	2.4%	2.7%	2.0%	2.1%
Bollnäs	1.4%	1.7%	1.4%	1.2%	1.1%
Enköping	1.9%	1.6%	3.2%	3.3%	3.3%
Falköping	0.4%	0.2%	0.2%	0.4%	0.4%
Frölunda Specialistsjukhus	1.5%	2.5%	2.0%	2.4%	2.9%

Reoperation within 2 years per hospital - trend (cont.)

2003-2010

Hospital	2003-2006	2004-2007	2005-2008	2006-2009	2007-2010
Gällivare	2.2%	1.7%	0.9%	0.5%	0.3%
Hudiksvall	3.7%	3.1%	3.2%	3.1%	2.5%
Karlshamn	1.9%	1.9%	1.7%	1.4%	0.9%
Karlskoga	1.5%	1.5%	1.3%	1.1%	1.0%
Katrineholm	0.9%	1.0%	0.7%	0.9%	1.3%
Kungälv	1.0%	1.6%	2.0%	2.0%	1.7%
Köping	1.0%	1.3%	1.8%	1.9%	2.0%
Lidköping	0.6%	0.7%	0.7%	0.6%	0.2%
Lindesberg	1.8%	2.4%	1.9%	2.1%	1.5%
Ljungby	0.7%	1.1%	1.1%	1.1%	1.0%
Lycksele	0.2%	0.5%	0.6%	1.1%	1.3%
Mora	1.2%	1.4%	2.0%	1.4%	1.0%
Motala (to 2009)	1.8%	1.8%	1.9%	2.3%	2.3%
Norrtälje	2.1%	1.0%	1.2%	2.3%	2.1%
Nyköping	2.1%	1.6%	1.7%	1.7%	3.2%
Oskarshamn	0.4%	0.5%	0.9%	0.9%	1.3%
Piteå	1.9%	1.8%	1.6%	1.4%	1.1%
Skellefteå	1.0%	0.7%	0.7%	0.5%	0.5%
Skene	0.6%	1.3%	1.3%	1.6%	0.8%
Sollefteå	1.4%	1.5%	1.8%	1.0%	1.1%
Södertälje	0.2%	0.6%	0.9%	1.0%	0.8%
Torsby	1.5%	2.6%	2.2%	2.6%	1.8%
Trelleborg	1.9%	1.8%	1.6%	1.5%	1.2%
Visby	4.2%	3.0%	2.9%	1.9%	1.2%
Värnamo	0.8%	0.7%	0.7%	1.0%	1.1%
Västervik	2.3%	3.4%	2.8%	3.5%	3.6%
Ängelholm	1.0%	1.3%	0.0%	3.9%	1.0%
Örnsköldsvik	0.9%	0.6%	0.6%	0.7%	0.8%
Private hospitals					
Aleris Specialistvård Sabbatsberg	0.6%	0.7%		0.8%	1.4%
Capio S:t Göran	2.6%	1.9%	1.4%	1.1%	1.0%
Carlanderska	0.5%	0.9%	1.4%	1.9%	1.2%
Elisabethsjukhuset	0.6%	0.5%	0.5%	0.4%	0.9%
GMC	2.7%	2.5%	1.9%	1.6%	0.0%
Movement	2.8%	2.0%	1.6%	1.9%	1.1%
Nacka Närsjukhus Proxima	4.1%	3.7%	4.2%	2.5%	0.7%
Ortho Center Stockholm	3.4%	3.2%	4.0%	2.9%	2.2%
OrthoCenter IFK-kliniken		0.0%	0.0%	0.9%	0.6%
Ortopediska Huset	1.1%	1.8%	2.0%	2.3%	2.1%
Sophiahemmet	1.2%	1.2%	1.9%	2.1%	2.1%
Spenshult		2.7%	2.6%	2.4%	2.1%
Nation	1.9%	1.9%	2.0%	2.0%	1.8%

Adverse events within 30 days

The Swedish Arthroplasty Registry has during the past few years established continual co-operation with the Patient Register at the National Board of Health and Welfare. In *Öppna jämförelser*, a national quality indicator has been created via the Patient Register: 'Adverse events following hip and knee replacements'. The Registry has used this analysis to conduct a separate analysis only for hip arthroplasty, which is presented at county-council level.

Foreign studies have shown that the number of adverse events within 30 days of discharge varies between hospitals and that increased association has been seen with shorter care times. In Sweden, too, mean care times have shortened during the past ten years from about 10 days (1998) to 5.6 days (2010). The endeavour to reduce care times is prompted both by productivity and availability. A possible reduction in cost would, however, disappear immediately if readmission should at the same time increase because of shorter hospitalization.

Material and methods

All patients undergoing total hip arthroplasty during 2008-2010 (NFB 29, 39, 49, 62 and 99) form the basic material. 'Adverse events' comprises all local (depending on surgery in the hip) and general complications (cardio- and cerebrovascular, pneumonia, ulcer, urine retention) and death within 30 days.

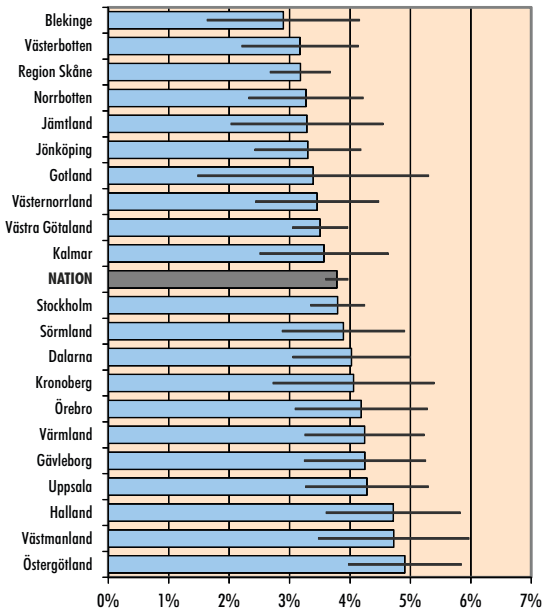
Results

See bar diagram below. The national mean value was 3.8%, i.e. four of 100 patients undergoing surgery were readmitted with some form of complication, or died (some few promille). There was a relatively large spread between county councils, 2.9% to 4.9%. On analysis we found, unlike other studies, no clear connection between shorter care times and frequency of readmission (see figure below). However patients requiring readmission have had a primary care time exceeding the mean value by 1-2 days (constant during the whole ten-year period). This fact indicates that the population requiring readmission within 30 days was 'sicker' from the beginning.

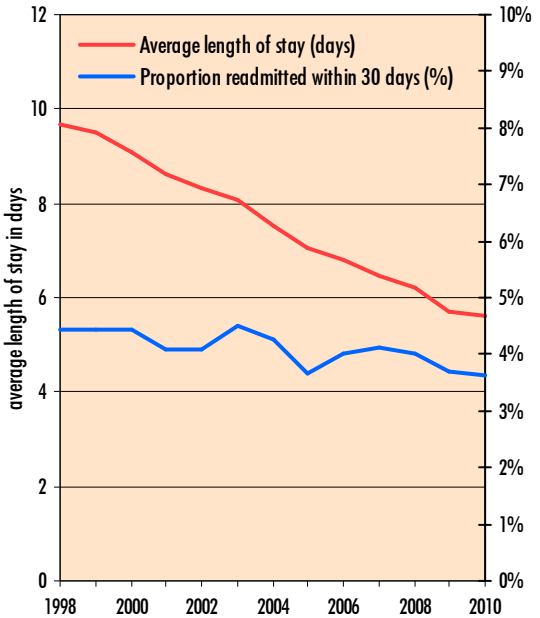
Problems

This type of analysis from the Patient Register (PAR) can in the future be of great significance for the continued quality development of Swedish hip arthroplasty. In the PAR we can capture variables which we do not register in our normal Registry routines. However, there are at present sources of error, which are illustrated under 'Degree of coverage'. The Patient Register has a lower degree of coverage than the Hip Arthroplasty Register (92.8% compared with 98.5%) and a number of hospital fusions have been carried out with joint reporting to the Patient Register despite surgery at different hospitals. The largest source of error, however, is probably suboptimal coding and the fact that many patients have numerous sub-diagnoses on discharge where the most relevant diagnosis for that care occasion is not always given as first diagnosis. These factors probably mean that the analysis shows values that are too low.

Adverse events within 30 days
2008-2010



Average length of stay vs. Proportion readmitted
within 30 days after THR



Notes

Revision

The number of revisions since 2002 has steadily increased from 1,591 to 1,929 in 2009 with no sizeable change in 2010 when 1,894 were registered. In relation to the number of primary implants, however, the proportion of revisions remains relatively constant at about 10%-12% (figure 1). During the past five years the proportion of first-time revisions has been between 75.8% (2010) and 81.1% (2006). The relative proportion of revisions for loosening continues to decline and in 2010 represented just over half the total number. The number of revisions for infection has more than doubled since 2000 and its relative proportion rose successively from 6.0% to 11.5% during 2010. Revision for dislocation also increased but not so dramatically, from 163 (10.2%) in 2000 to 257 operations in 2010 (13.6%) (figure 2).

The reasons for revision vary with the time after primary operation (figure 3). The analysis covers the years 1979 to 2000 so that the shortest observation period may be at least 10 years. Evaluation of the first-time measures conducted in these patients shows that the majority of revisions for dislocation were carried out during the first few years after the primary intervention. More than half (52.6%) were performed within five years. Revision for infection is also an early complication, the relative proportion of which during the first year is somewhat lower. This measure is probably performed with a certain delay after a suspected or established diagnosis. During the first five years, 70.5% of these revisions were carried out. Regarding aseptic loosening/osteolysis (75.6%) more than half of the revisions were first conducted within 10 years and this is in reality probably a lower proportion of the total since more annual production, for example those receiving primary operations between 1990 and 2000, have not yet been observed for longer than 10-20 years. While this remark applies to all causes of revision, the effect is greatest on the causes occurring late in the course of events. The same goes for revisions for periprosthetic fracture (5.8%). Here however there is an incidence top in the first post-

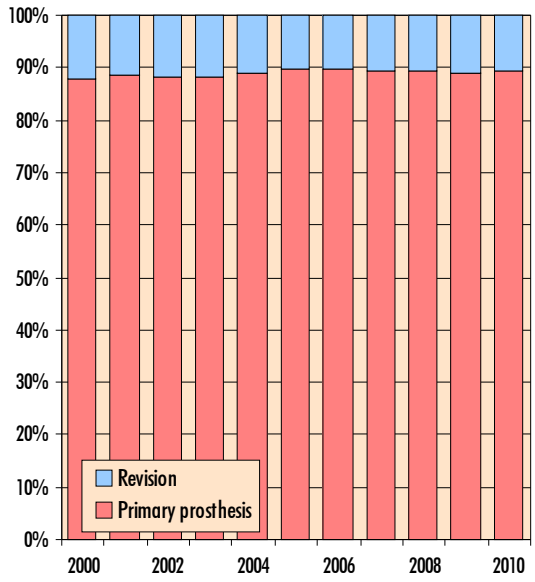


Figure 1. Distribution between primary operations and revisions 2000-2010.

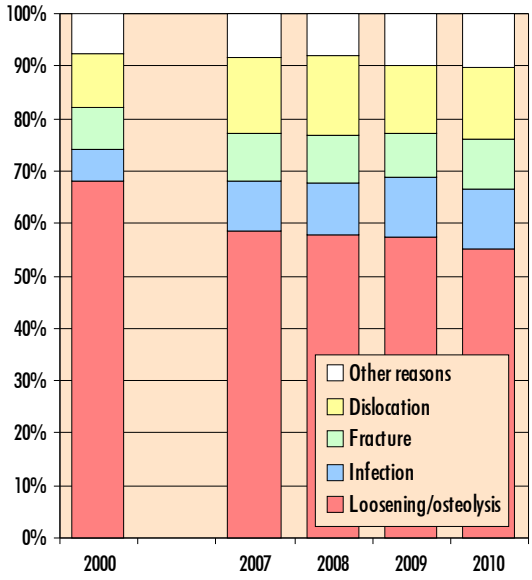


Figure 2. Relative distribution of revision causes and total number of revisions during 2000 and 2000-2010.

operative year owing to early fracture complication following the use of uncemented stems.

Uncemented fixation is being used more and more often in revision. Since 2000 the proportion of cemented revision cups has sunk from 86% to 53% in 2010. On the stem side the change is even more appreciable, with a corresponding reduction from 87% to 49% (figure 4). In 2010 Contemporary Hooded Duration, Lubinus All-poly, Marathon XLPE and Avantage were the most popular cemented alternatives (together 63.1% of all cemented revision cups inserted). In uncemented fixation Trilogy HA, TMT, TMT revision cup and Trident HA, in that order, were the most frequent, together representing 78% of all uncemented revision cups. The corresponding most-used stems were Exeter, Lubinus SPII, CPT and MS30 (together 92.7%) and MP, Restoration, Revitan and Corail/KAR (87.7%).

Implant survival as a quality indicator

In the calculation of implant survival related to department the result is always referred to the department carrying out the primary operation even if the patient is revised at another department. Implant survival is an important quality measure reflecting several factors with more or less pronounced interaction. Risk factors that can be ascribed to patient selection at the department in question are one such factor. Selection of relatively healthy patients without deviant anatomy to certain hospitals and corresponding selection of patients with residual states following hip joint disorders and impaired muscle function or impaired resistance to infection to other hospitals affects the ex-

pected outcome. Variations in surgical technique and choice of implant are also important factors. Lastly the presence of long-term follow-up and the inclination to carry out a revision operation for, e.g. an asymptomatic osteolysis play a large part.

Since 1979, 10-year survival measured as a risk of undergoing revision has been successively improved. Initially the rate of improvement was high. During more recent periods and as implant survival approaches 100%, the improvement rate levels off for natural reasons. No operation is entirely free of complications but the minimal complication frequency leading to revision within a 10-year perspective, considered nationally, is unknown.

The background to the initial increase up to the early 1990s is very probably a successive improvement in cementing technique, which we have earlier demonstrated in a number of Register reports. Knowledge of optimal cementing technique is disseminated relatively quickly, partly through comprehensive work from the profession and industry in the form of active course organization and partly through continual feedback to the profession of data from the Hip Arthroplasty Register.

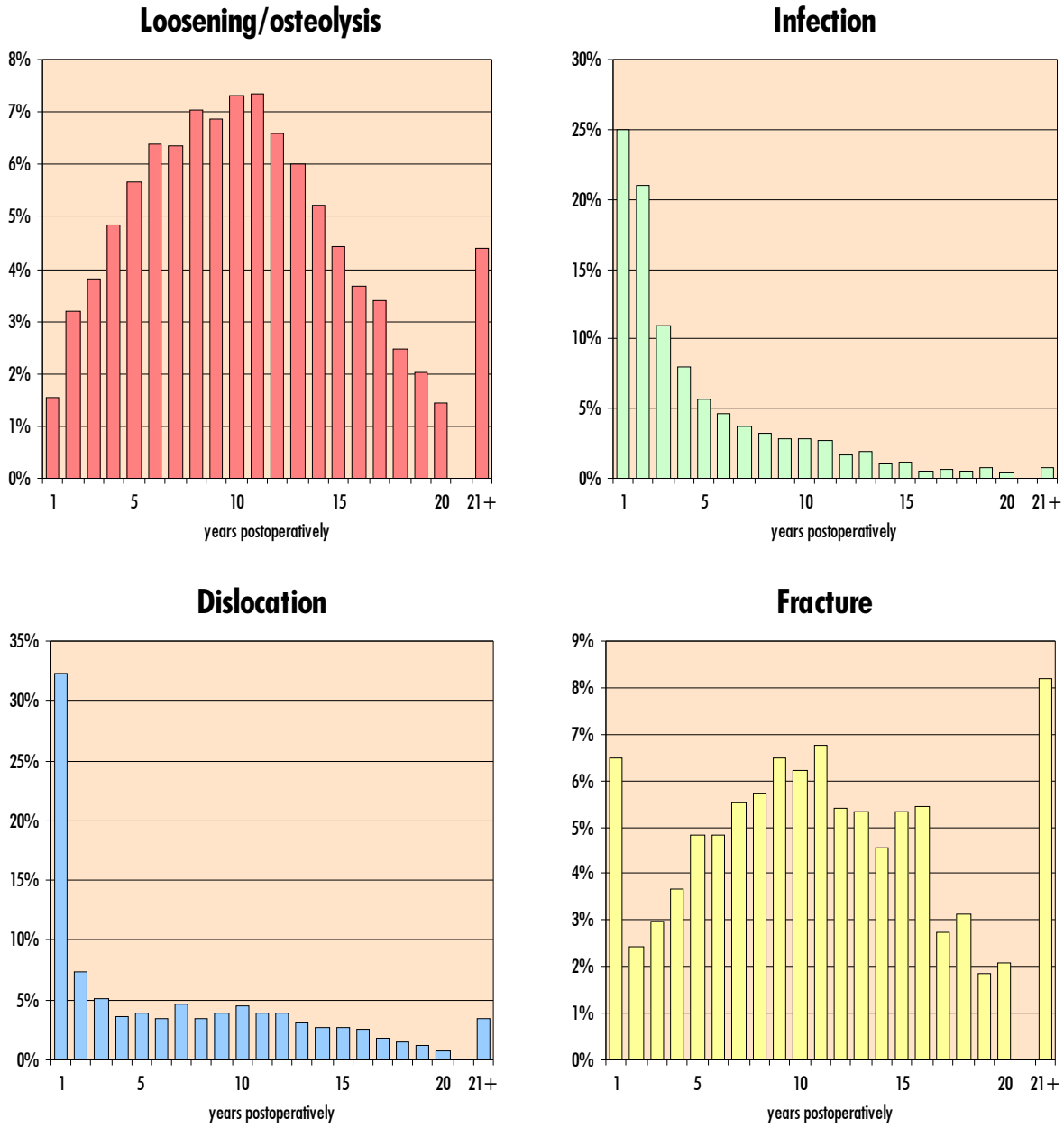


Figure 3a-c. Time after primary operation for first-time revision related to cause of revision.

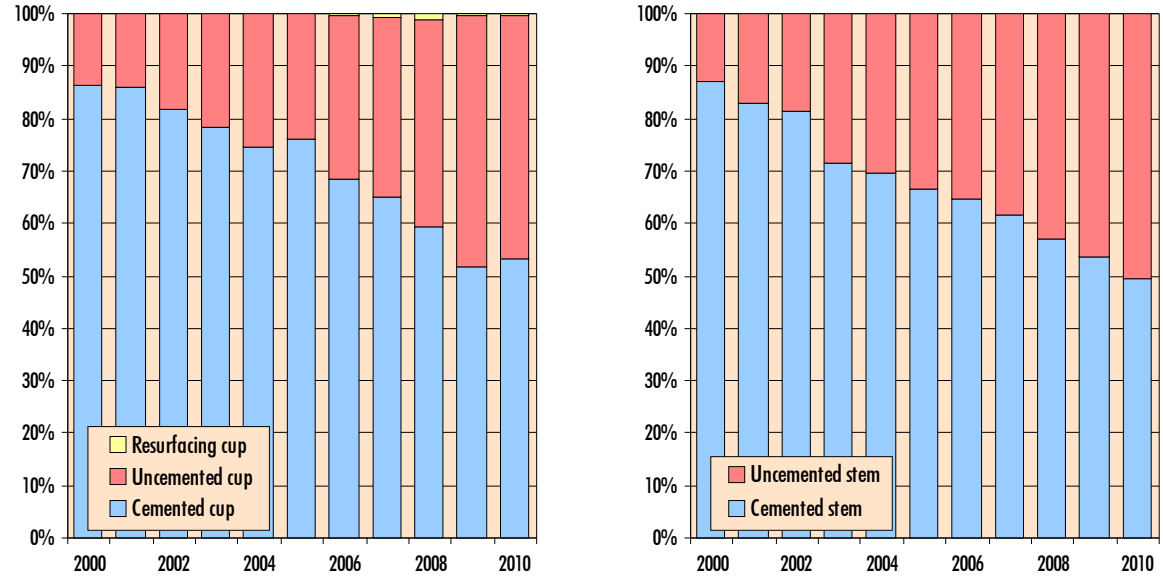


Figure 4a-b. Choice of fixation in revision operations 2000-2010.

The past few decades have seen comprehensive development of the design of implants. This has applied among other things to new types of surface treatment, increased selection of sizes, design adaptation to differing anatomical conditions, new types of material and a pronounced tendency to replace complete prostheses with modular parts combined during surgery to a final hip prosthesis. The effect of this development has been somewhat ambiguous. Many implants have proved to have considerably poorer survival than those already established, while other innovations, for example certain types of surface coating used on uncemented, and their ability to form biological fixation, have often brought improvement of the survival of these prostheses.

Among Swedish orthopaedic surgeons there is great awareness of the problems of new implants. A critical evaluation, moreover, takes a long time since revisions for implant-related problems often do not appear until after 5-10 years of observation. Experience from less successful implant modifications, particularly during the 1980s and early 1990s, has meant that Sweden as a country has become one of the most conservative in the world regarding the introduction of new prostheses. This attitude is in general positive but also involves certain negative effects. The introduction of new technology with documented positive effects can take unnecessarily long. To counter this problem we have initiated co- operation among the Nordic countries. This permits us to survey a greater variation not only of patient demography and surgical technique but also provides an opportunity to increase the observation material for different, less common and newly introduced, implants.

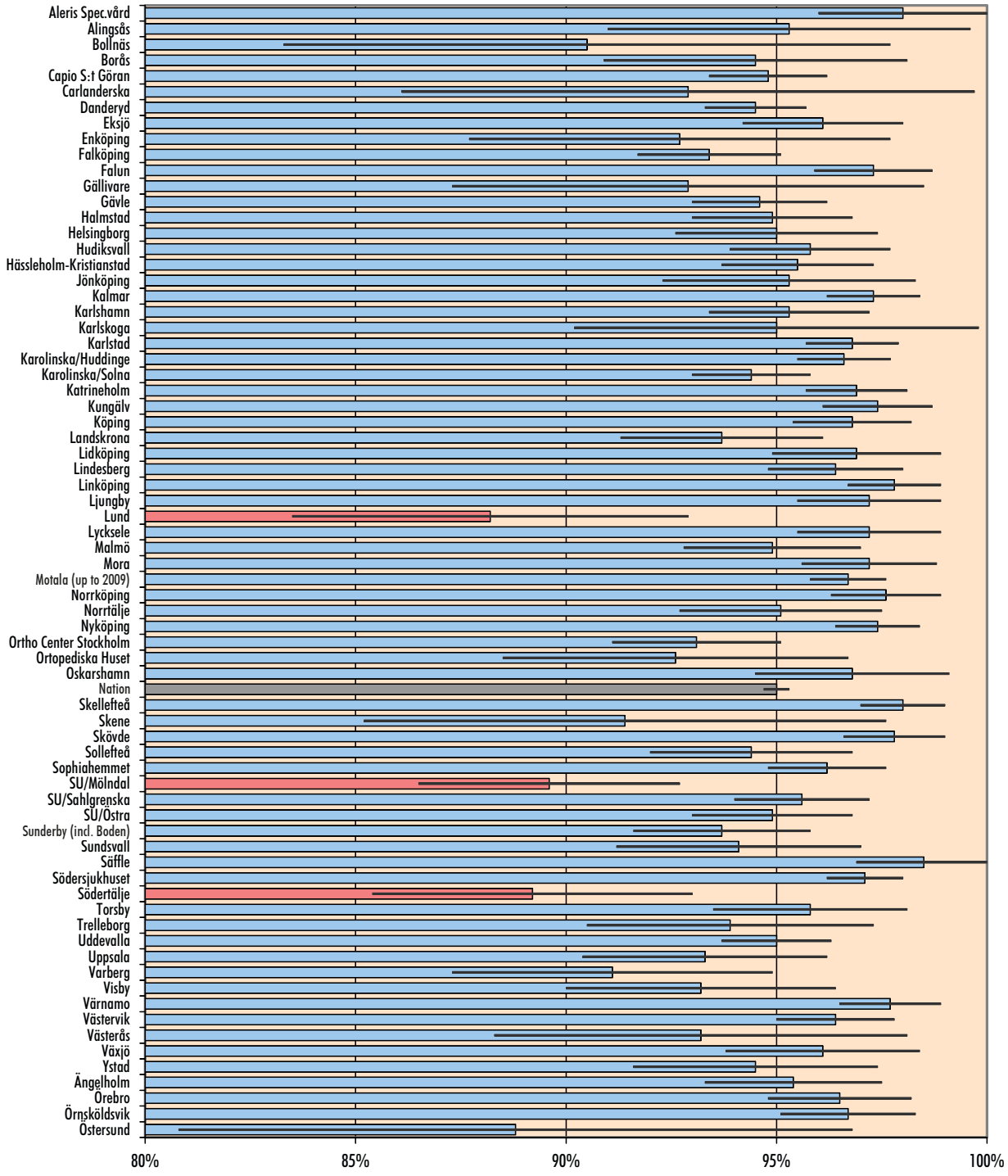
As a component of clinical improvement work we also publish 10-year survival by department. These figures give a certain insight into the quality of operations conducted but should be treated with a certain caution. To be able to consider that a department is performing better or worse than the average, it is necessary that the statistically calculated confidence intervals do not overlap. If they do, the difference can be entirely random. Another factor is the effects of combining departments. There are several examples where a smaller department has been absorbed into a larger one, where several departments have been combined or where patients who are to undergo hip operations are transferred from one or more departments to a central operating department for hip implants. Such examples are Bollanäs in Hälsingland, Hässleholm in Skåne and Mölndal in Göteborg. The department at which a certain hip operation was performed ten years earlier can thus on evaluation have an entirely different character and may even no longer do hip arthroplasties.

In summary we find that implant survival based on the proportion of primary implants inserted during the most recent 10-year period and revised within that period has successively improved. The risk for the patient to need to undergo a further operation, irrespective of whether the implant is exchanged, is today about 95% in a national perspective. The variation between departments over the years has declined but a small number still exhibit poorer results. From the Registry we urge those departments that are below or nearly below the expected outcome to investigate the reasons for this in detail and decide whether there are opportunities for initiating work for improvement.

In all survival analyses according to Kaplan-Meier the analysis is concluded when the number of patients 'at risk' is lower than 50.

Implant survival after 10 years

each bar represents a hospital, primary operation 2001-2010



Implant survival after 10 years by department. Grey bar indicates national average. Red bars represent departments whose upper confidence interval is below the national lower competence interval, i.e. departments which with 95% probability have poorer implant survival after 10 years than the average for the country. The primary operations were conducted during the most recent 10-year period.

Number of revisions per diagnosis and number of previous revisions

primary THRs 1979-2010

Diagnosis at primary THR	0		1		2		> 2		Total	Prop.
Primary osteoarthritis	20,065	73.9%	3,330	69.9%	645	64.2%	185	61.3%	24,225	73.0%
Fracture	2,374	8.7%	391	8.2%	77	7.7%	16	5.3%	2,858	8.6%
Inflammatory arthritis	2,113	7.8%	456	9.6%	131	13.0%	41	13.6%	2,741	8.3%
Childhood disease	1,358	5.0%	344	7.2%	83	8.3%	34	11.3%	1,819	5.5%
Idiopathic femoral head necrosis	627	2.3%	118	2.5%	32	3.2%	9	3.0%	786	2.4%
Secondary arthritis after trauma	220	0.8%	66	1.4%	24	2.4%	16	5.3%	326	1.0%
Secundary osteoarthritis	100	0.4%	14	0.3%	3	0.3%	0	0.0%	117	0.4%
Tumour (malignancy)	53	0.2%	14	0.3%	5	0.5%	1	0.3%	73	0.2%
(missing)	224	0.8%	29	0.6%	4	0.4%	0	0.0%	257	0.8%
Total	27,134	100%	4,762	100%	1,004	100%	302	100%	33,202	100%

Number of revisions per reason and number of previous revisions

primary THRs 1979-2010

Reason for revision	0		1		2		> 2		Total	Prop.
Aseptic loosening	19,686	72.6%	2,856	60.0%	516	51.4%	112	37.1%	23,170	69.8%
Dislocation	2,352	8.7%	702	14.7%	190	18.9%	88	29.1%	3,332	10.0%
Deep infection	2,105	7.8%	596	12.5%	163	16.2%	72	23.8%	2,936	8.8%
Fracture	1,816	6.7%	391	8.2%	82	8.2%	13	4.3%	2,302	6.9%
Technical error	591	2.2%	100	2.1%	28	2.8%	7	2.3%	726	2.2%
Implant fracture	397	1.5%	80	1.7%	18	1.8%	7	2.3%	502	1.5%
Pain only	103	0.4%	21	0.4%	4	0.4%	2	0.7%	130	0.4%
Miscellaneous	84	0.3%	15	0.3%	2	0.2%	1	0.3%	102	0.3%
Secondary infection	0	0.0%	1	0.0%	1	0.1%	0	0.0%	2	0.0%
Total	27,134	100%	4,762	100%	1,004	100%	302	100%	33,202	100%

Number of revisions per year of revision and number of previous revisions

primary THRs 1979-2010

Year of revision	0		1		2		> 2		Total	Prop.
1979-2005	20,501	75.6%	3,425	71.9%	648	64.5%	180	59.6%	24,754	74.6%
2006	1,247	4.6%	207	4.3%	55	5.5%	19	6.3%	1,528	4.6%
2007	1,286	4.7%	265	5.6%	58	5.8%	22	7.3%	1,631	4.9%
2008	1,297	4.8%	255	5.4%	80	8.0%	27	8.9%	1,659	5.0%
2009	1,430	5.3%	304	6.4%	81	8.1%	23	7.6%	1,838	5.5%
2010	1,373	5.1%	306	6.4%	82	8.2%	31	10.3%	1,792	5.4%
Total	27,134	100%	4,762	100%	1,004	100%	302	100%	33,202	100%

Number of revisions per reason and year of revision

first revision only, primary THRs 1979-2010

Reason for revision	1979-2005	2006	2007	2008	2009	2010	Total	Prop.
Aseptic loosening	15,397	874	829	816	912	858	19,686	72.6%
Dislocation	1,504	149	179	190	169	161	2,352	8.7%
Deep infection	1,520	84	111	110	141	139	2,105	7.8%
Fracture	1,187	107	119	126	132	145	1,816	6.7%
Technical error	464	8	19	29	36	35	591	2.2%
Implant fracture	310	15	14	16	25	17	397	1.5%
Pain only	66	7	7	8	8	7	103	0.4%
Miscellaneous	53	3	8	2	7	11	84	0.3%
Total	20,501	1,247	1,286	1,297	1,430	1,373	27,134	100%

Number of revisions per type of fixation at primary THR and year of revision

first revision only, primary THRs 1979-2010

Type of fixation at primary THR	1979-2002	2003	2004	2005	2006	2007	Total	Prop.
Cemented	17,107	931	962	971	1,060	1,021	22,052	81.3%
Uncemented	1,774	139	146	139	150	141	2,489	9.2%
Hybrid	942	121	115	100	142	111	1,531	5.6%
Reversed hybrid	132	32	39	58	51	74	386	1.4%
Resurfacing implant	18	7	10	16	16	15	82	0.3%
(missing)	528	17	14	13	11	11	594	2.2%
Total	20,501	1,247	1,286	1,297	1,430	1,373	27,134	100%

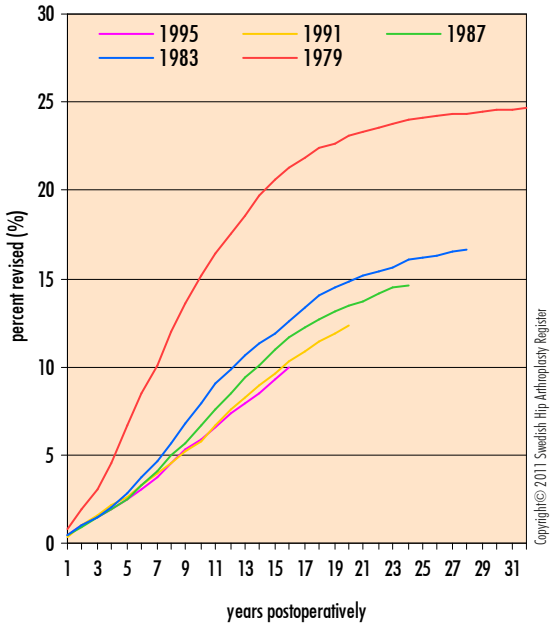
Number of revisions per reason and time to revision

first revision only, primary THRs 1979-2010

Reason for revision	0 – 3 år		4 – 6 år		7 – 10 år		> 10 år		Total	Prop.
Aseptic loosening	2,940	40.6%	3,790	80.3%	5,523	85.4%	7,433	85.4%	19,686	72.6%
Dislocation	1,488	20.5%	279	5.9%	249	3.8%	336	3.9%	2,352	8.7%
Deep infection	1,572	21.7%	236	5.0%	167	2.6%	130	1.5%	2,105	7.8%
Fracture	517	7.1%	270	5.7%	391	6.0%	638	7.3%	1,816	6.7%
Technical error	531	7.3%	26	0.6%	19	0.3%	15	0.2%	591	2.2%
Implant fracture	63	0.9%	95	2.0%	113	1.7%	126	1.4%	397	1.5%
Pain only	79	1.1%	12	0.3%	3	0.0%	9	0.1%	103	0.4%
Miscellaneous	55	0.8%	12	0.3%	5	0.1%	12	0.1%	84	0.3%
Total	7,245	100%	4,720	100%	6,470	100%	8,699	100%	27,134	100%

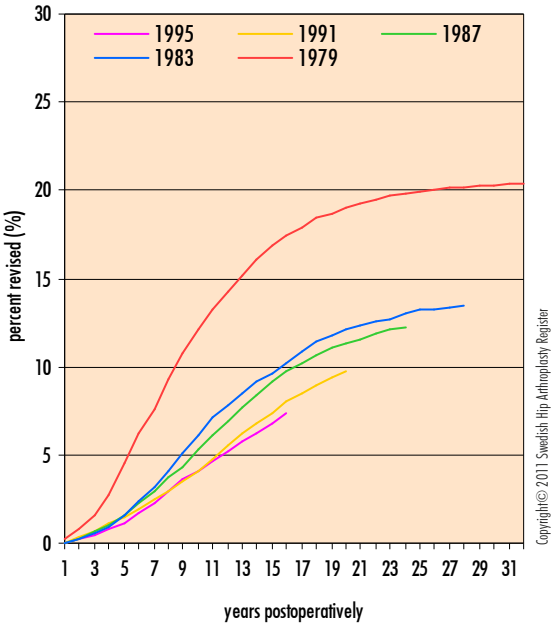
All diagnoses and all reasons

cumulative frequency of revision



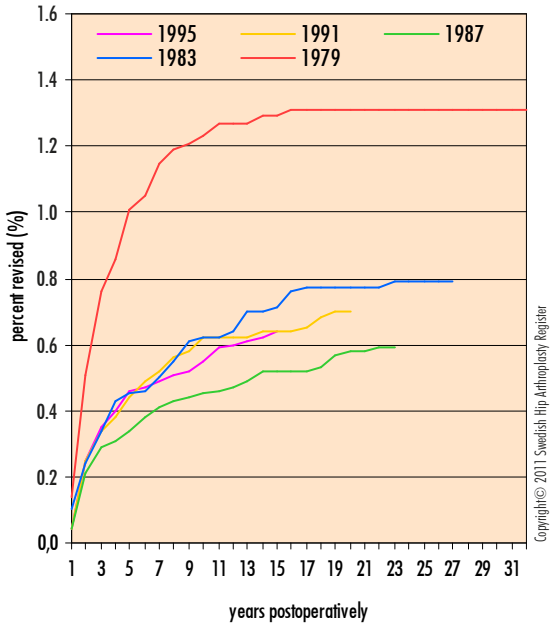
Aseptic loosening

cumulative frequency of revision



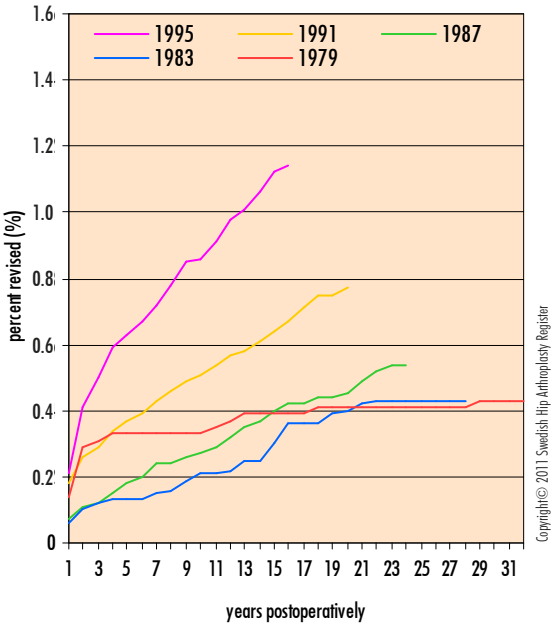
Deep infection

cumulative frequency of revision



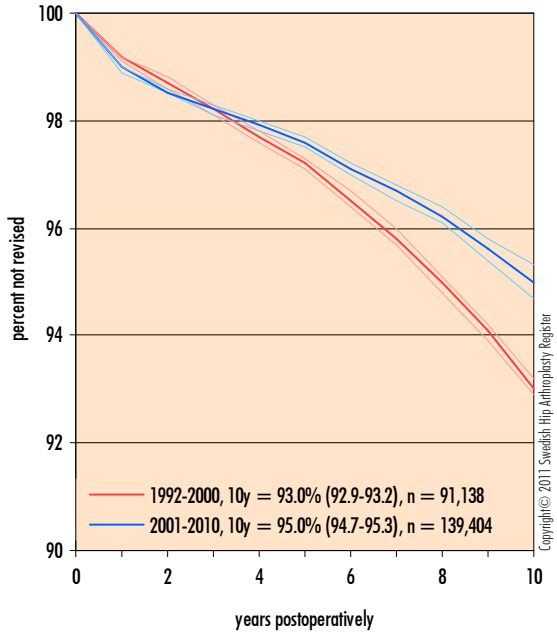
Dislocation

cumulative frequency of revision



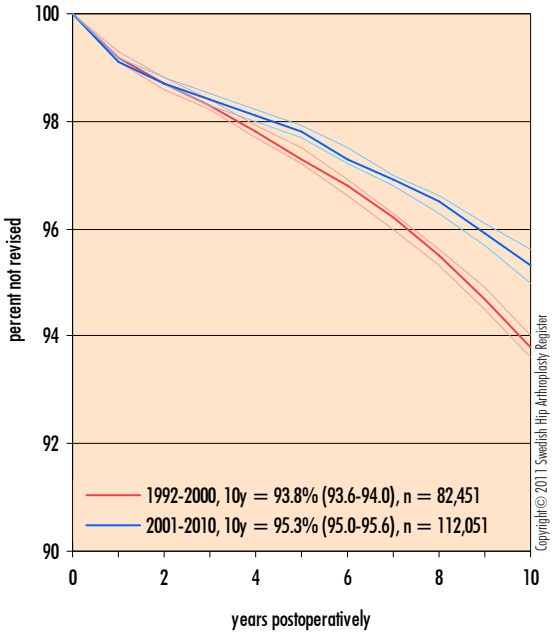
All implants

all diagnoses and all reasons for revision



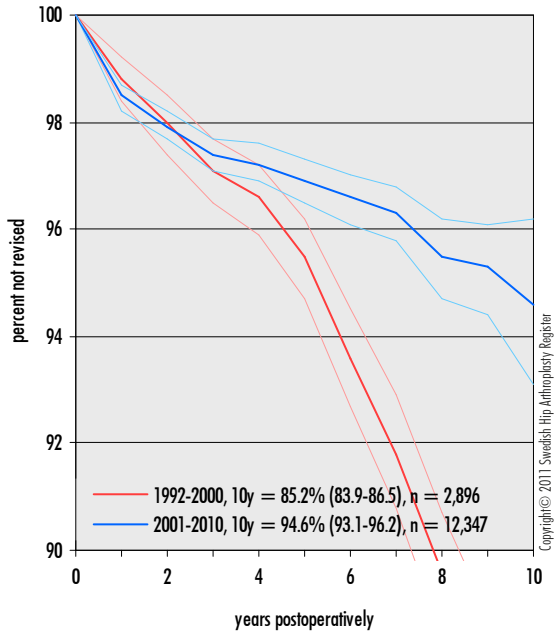
All cemented implants

all diagnoses and all reasons for revision



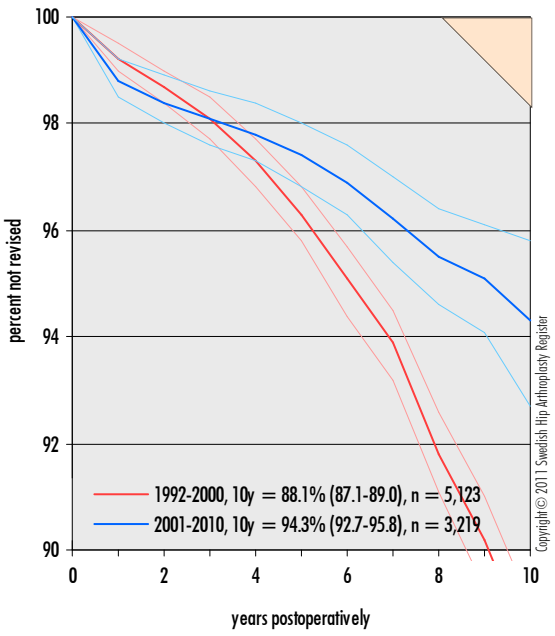
All uncemented implants

all diagnoses and all reasons for revision



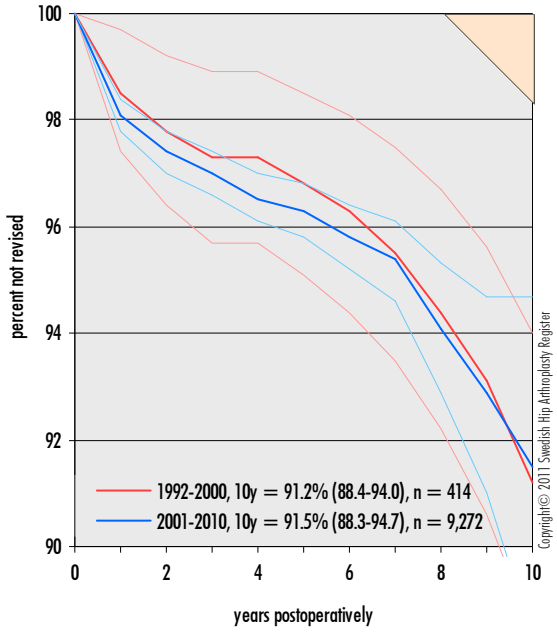
All hybrid implants

all diagnoses and all reasons for revision



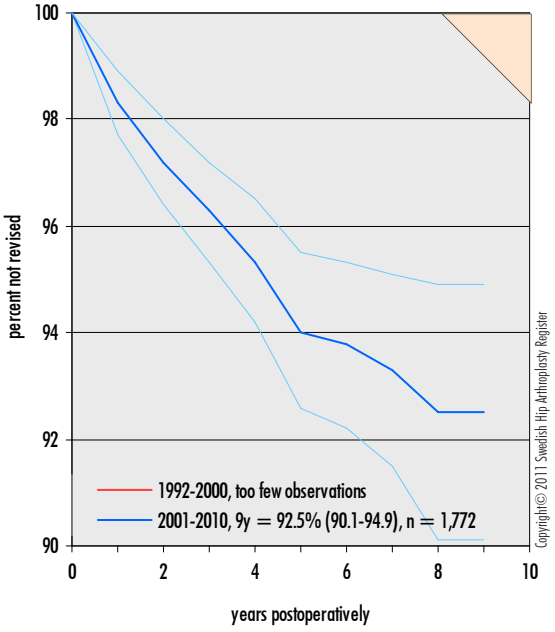
All reversed hybrid implants

all diagnoses and all reasons for revision



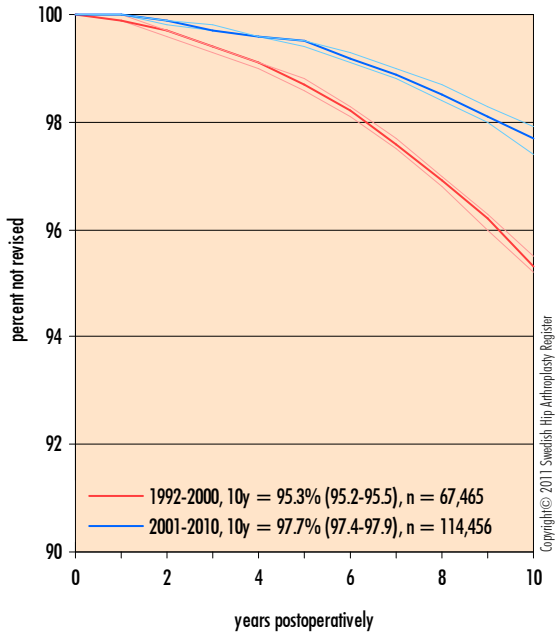
All resurfacing implants

all diagnoses and all reasons for revision



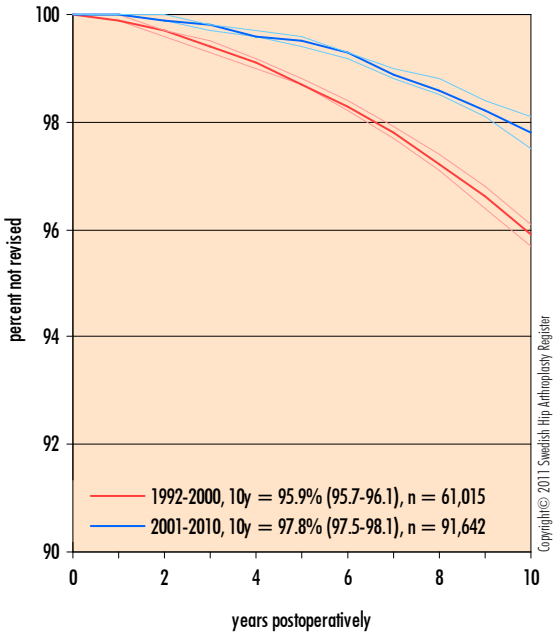
All implants

primary osteoarthritis and aseptic loosening



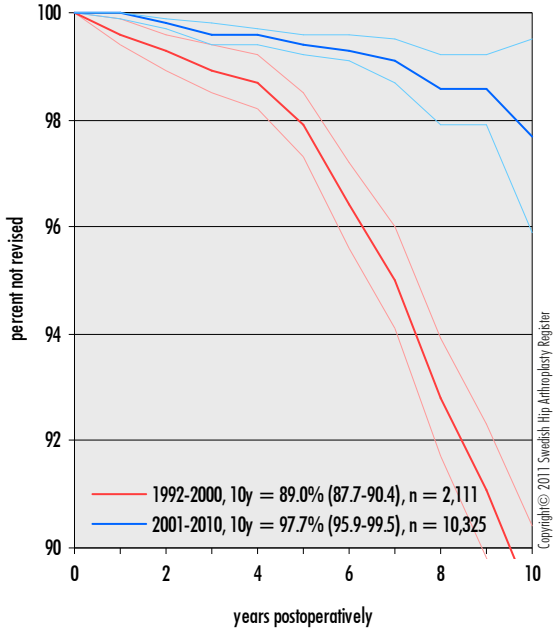
All cemented implants

primary osteoarthritis and aseptic loosening



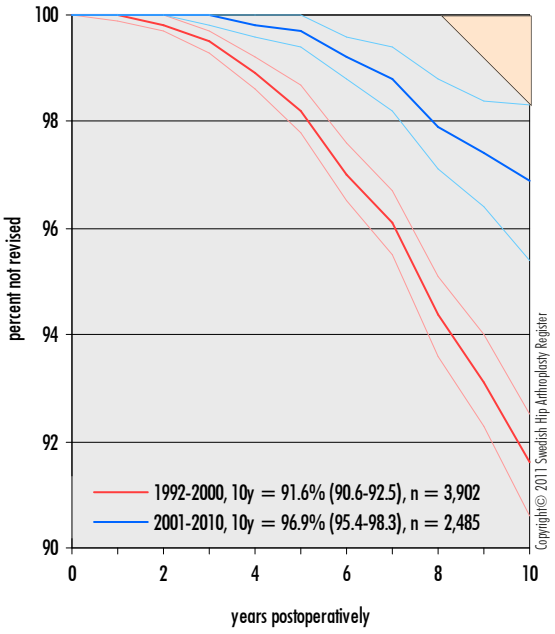
All uncemented implants

primary osteoarthritis and aseptic loosening



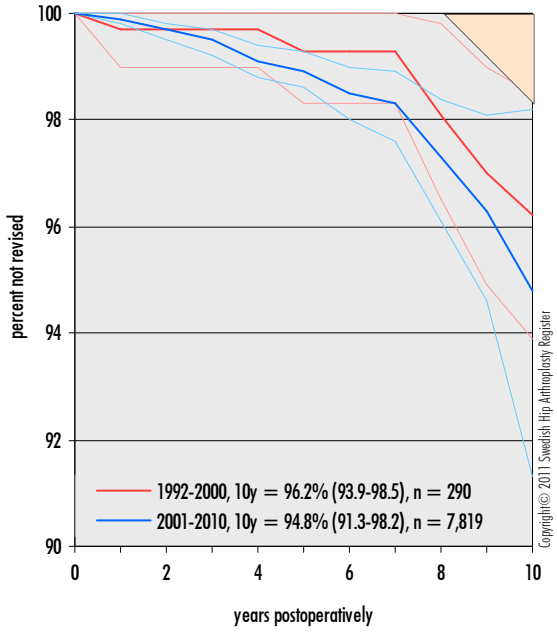
All hybrid implants

primary osteoarthritis and aseptic loosening



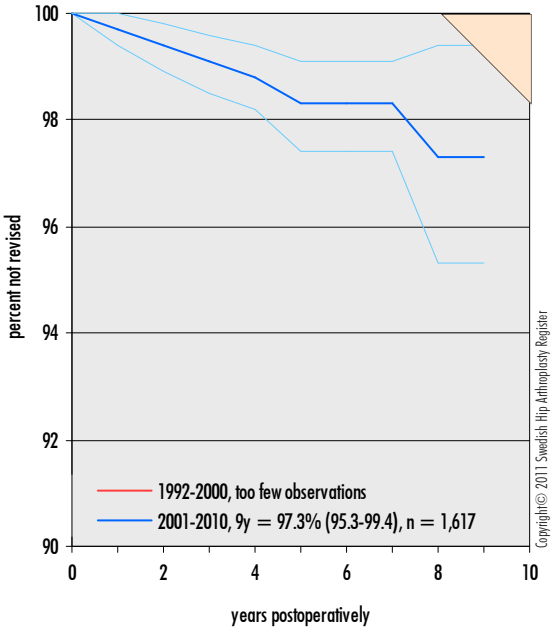
All reversed hybrid implants

primary osteoarthritis and aseptic loosening



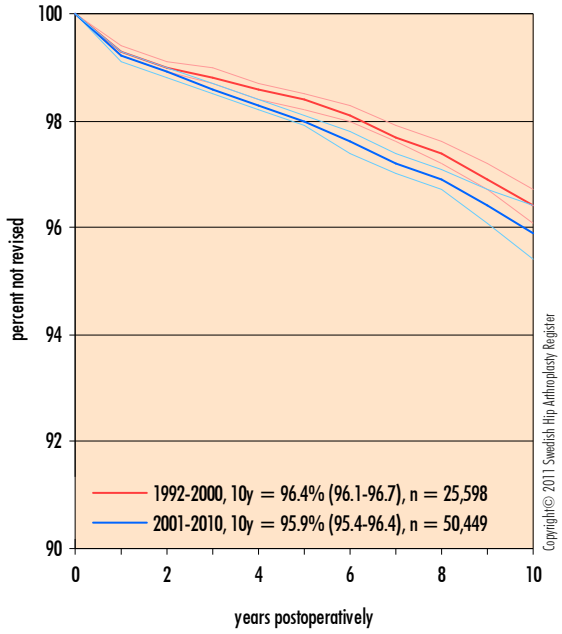
All resurfacing implants

primary osteoarthritis and aseptic loosening



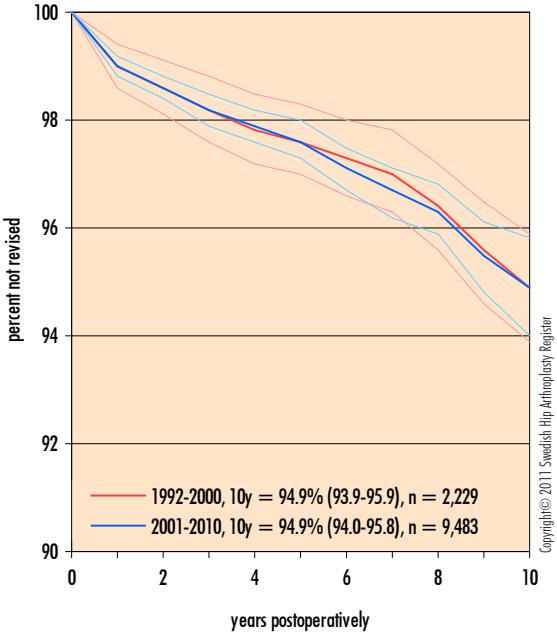
Lubinus SP II

all diagnoses and all reasons for revision



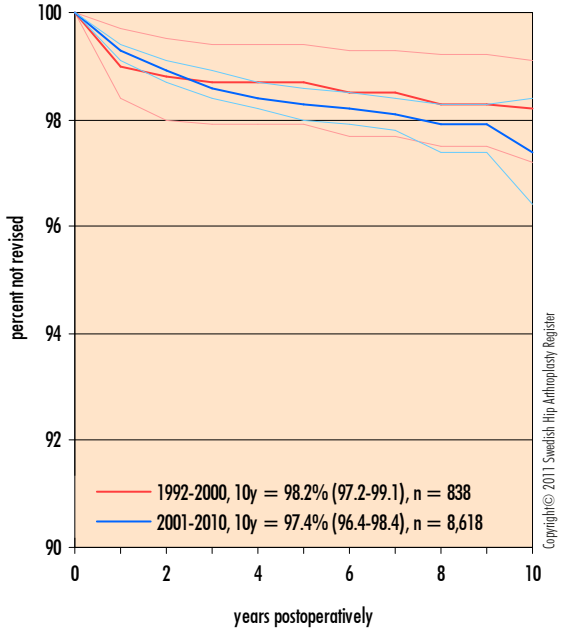
Exeter Duration (Exeter Polished)

all diagnoses and all reasons for revision



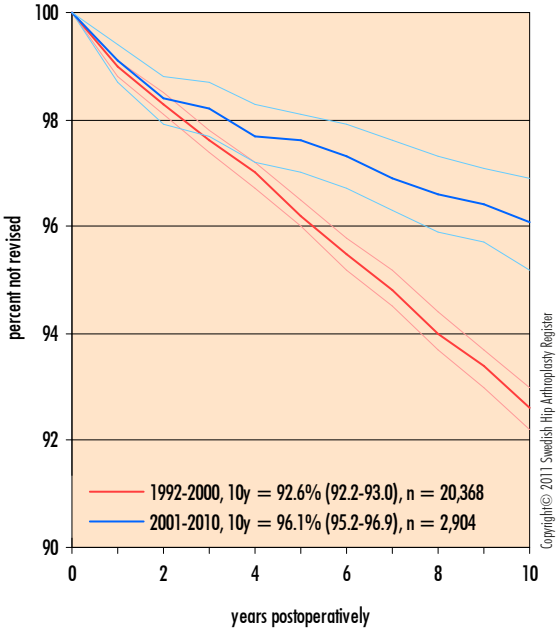
Charnley Elite (Exeter Polished)

all diagnoses and all reasons for revision



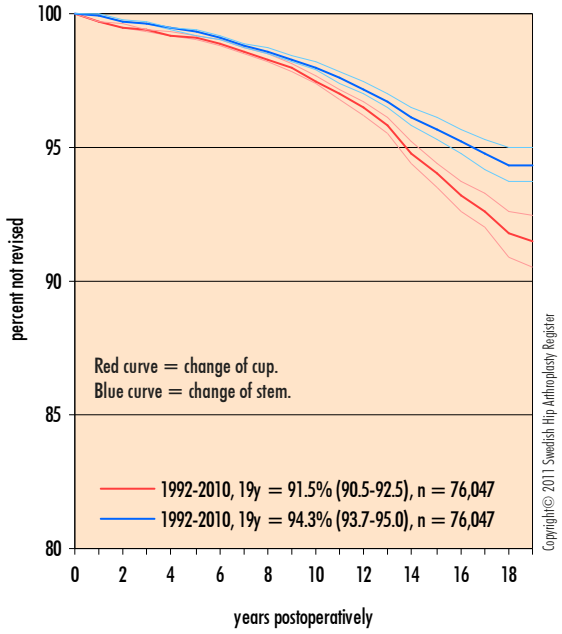
Charnley

all diagnoses and all reasons for revision



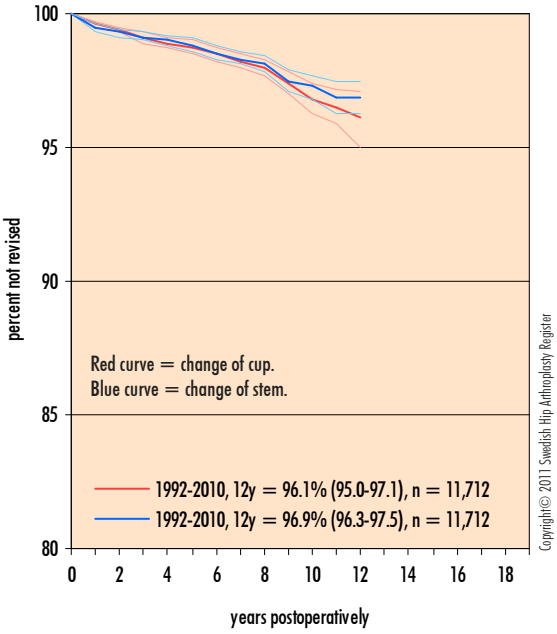
Lubinus SP II

cup-/stemrevision – all diagnoses and all reasons for revision



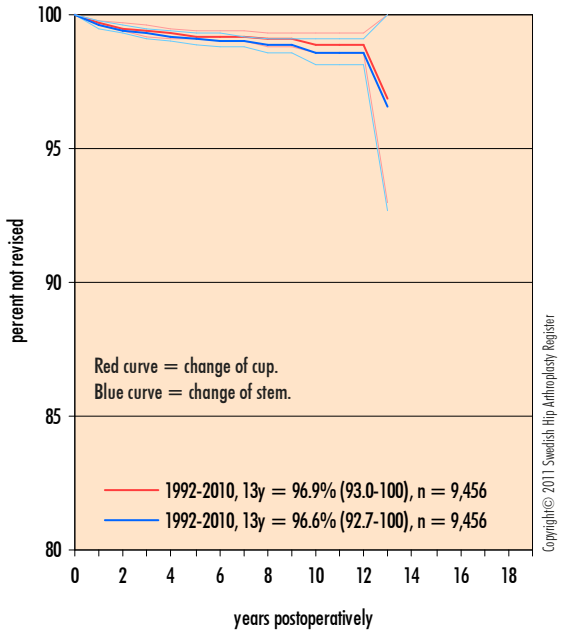
Exeter Duration (Exeter Polished)

cup-/stemrevision – all diagnoses and all reasons for revision



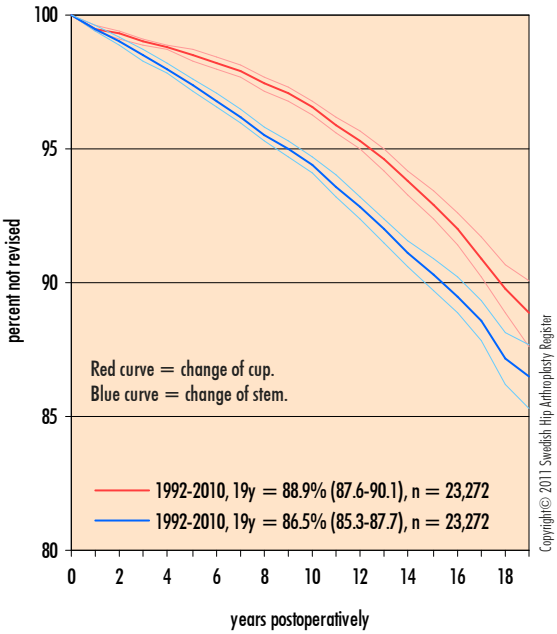
Charnley Elite (Exeter Polished)

cup-/stemrevision – all diagnoses and all reasons for revision



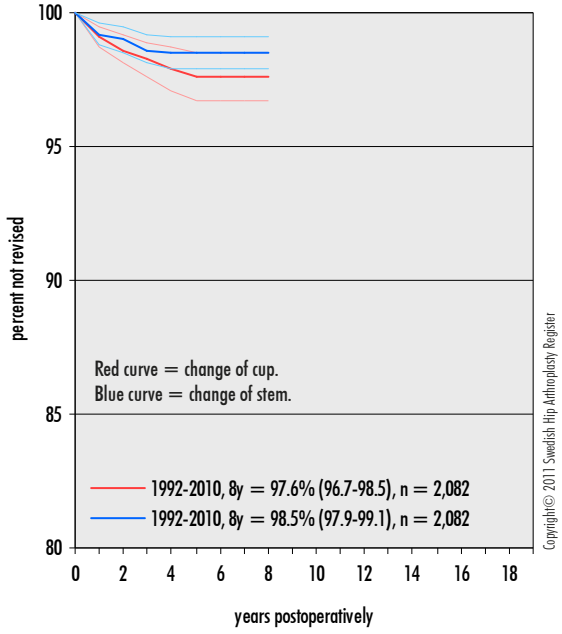
Charnley

cup-/stemrevision – all diagnoses and all reasons for revision



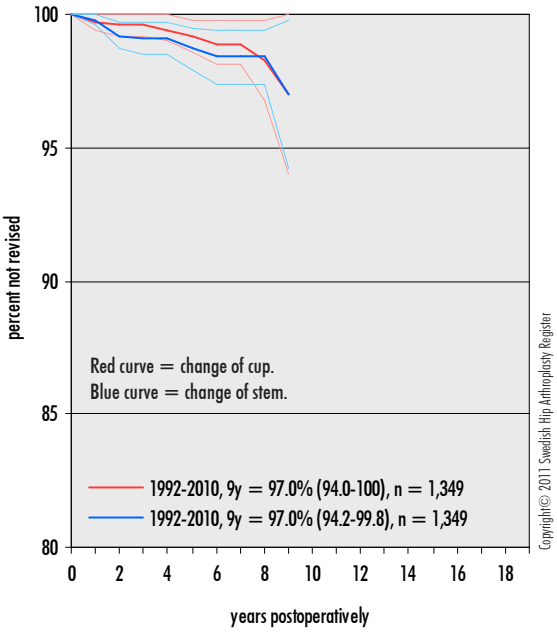
Trilogy HA (CLS Spotorno)

cup-/stemrevision – all diagnoses and all reasons for revision



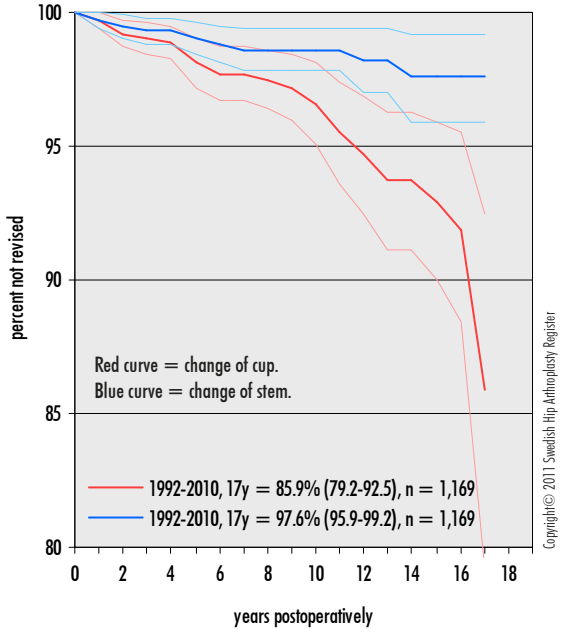
Allofit (CLS Spotorno)

cup-/stemrevision – all diagnoses and all reasons for revision



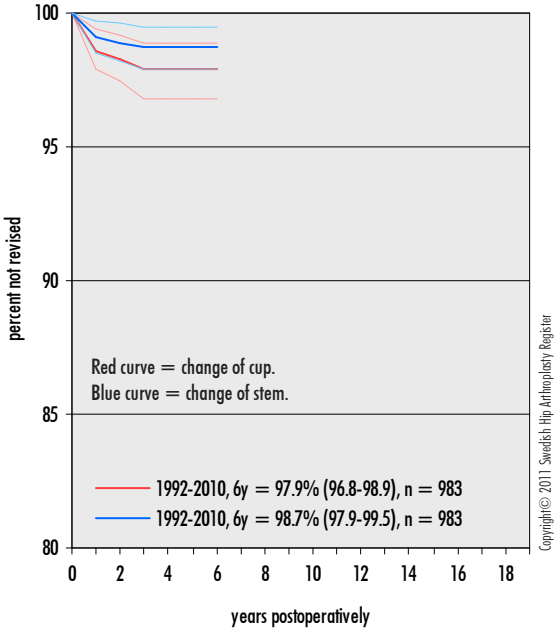
CLS Spotorno

cup-/stemrevision – all diagnoses and all reasons for revision



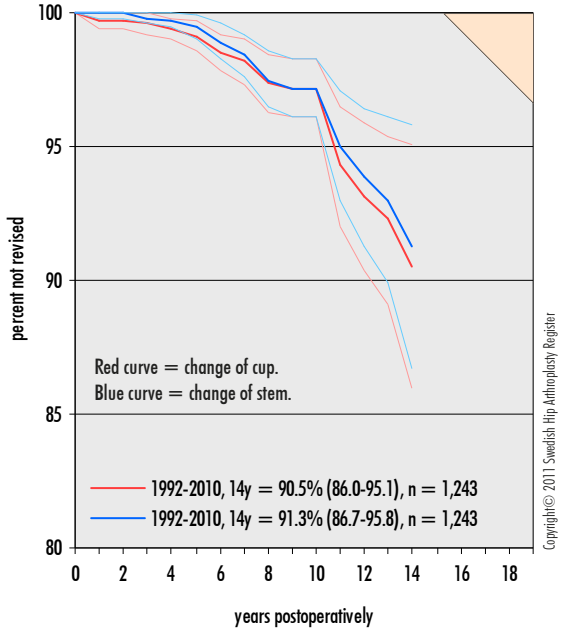
Trident HA (Accolade)

cup-/stemrevision – all diagnoses and all reasons for revision



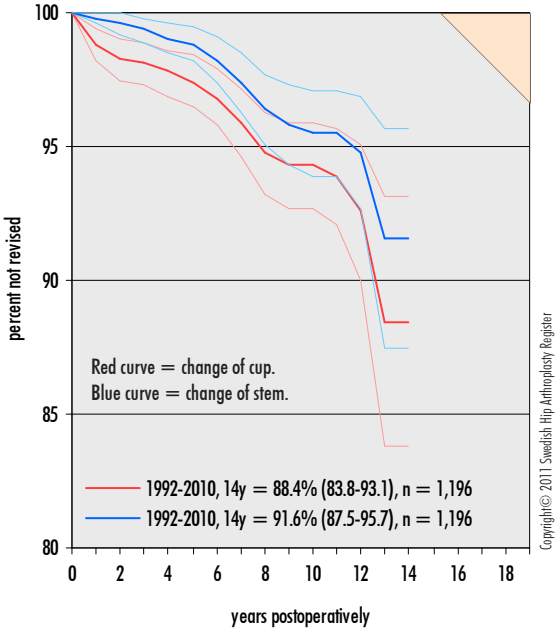
Lubinus SP II

cup-/stemrevision – all diagnoses and all reasons for revision



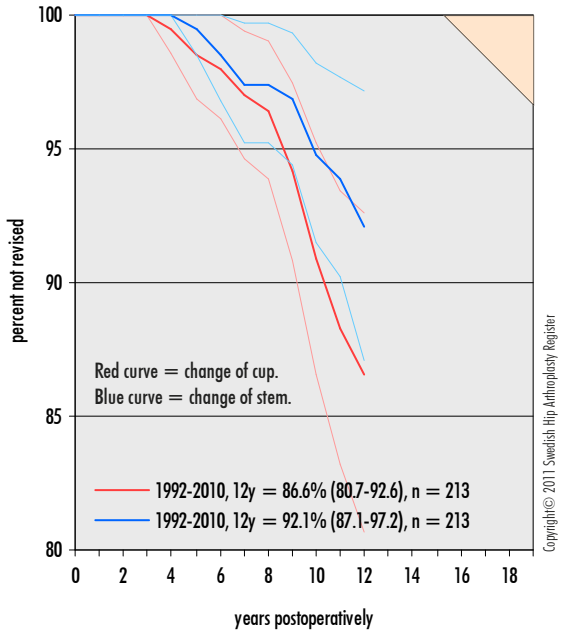
Trilogy HA (Lubinus SP II)

cup-/stemrevision – all diagnoses and all reasons for revision



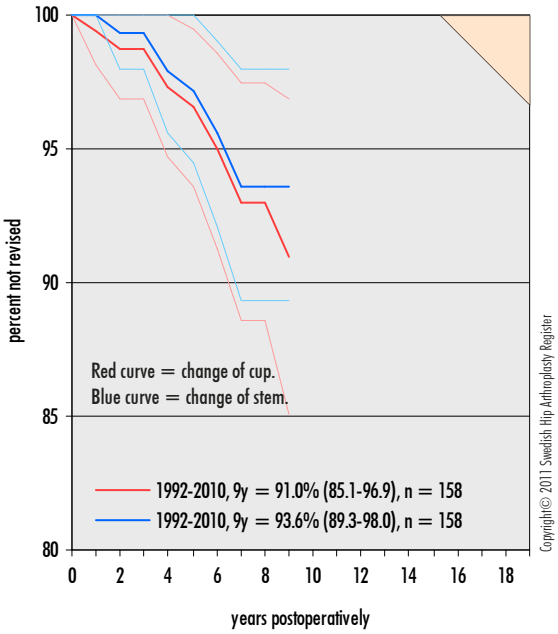
ABG II HA (Lubinus SP II)

cup-/stemrevision – all diagnoses and all reasons for revision



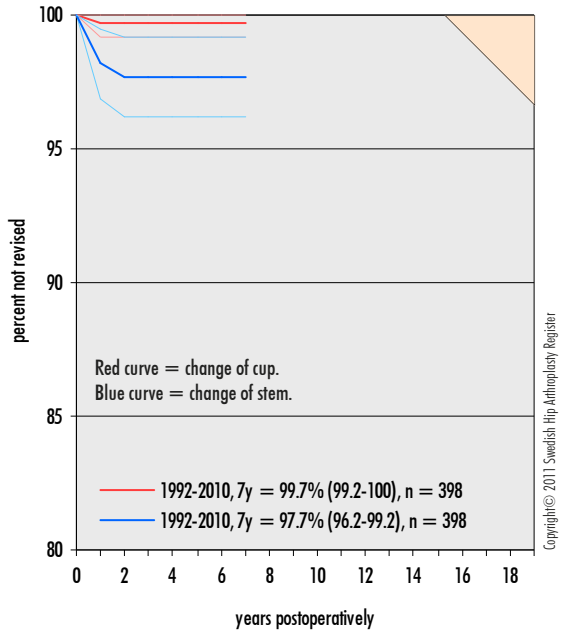
TOP Pressfit HA (Lubinus PS II)

cup-/stemrevision – all diagnoses and all reasons for revision



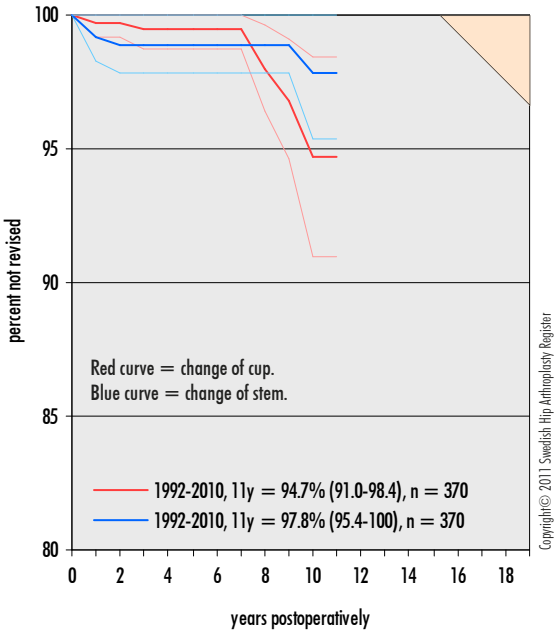
Charnley Elite (CLS Spotorno)

cup-/stemrevision – all diagnoses and all reasons for revision



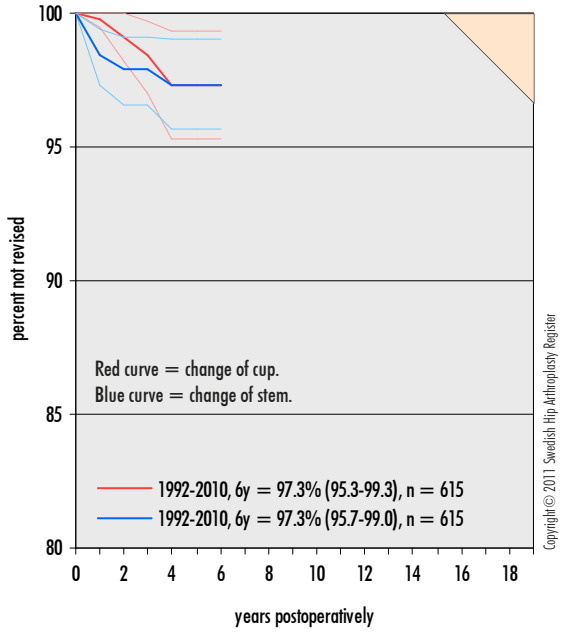
Charnley Elite (ABG)

cup-/stemrevision – all diagnoses and all reasons for revision



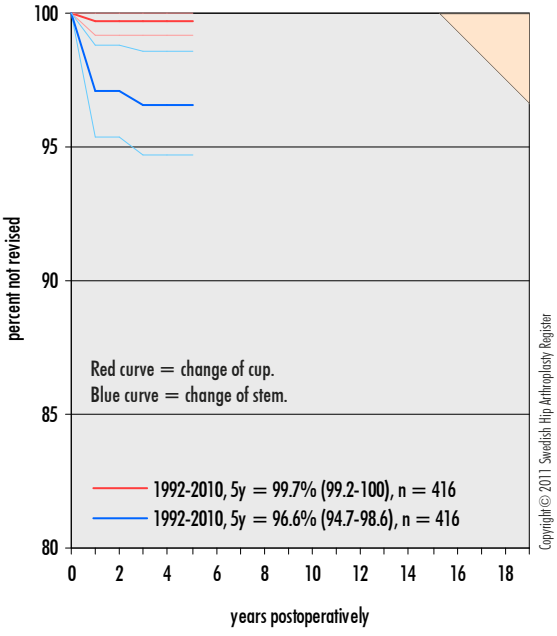
Contemporary H.D. (ABG II HA)

cup-/stemrevision – all diagnoses and all reasons for revision



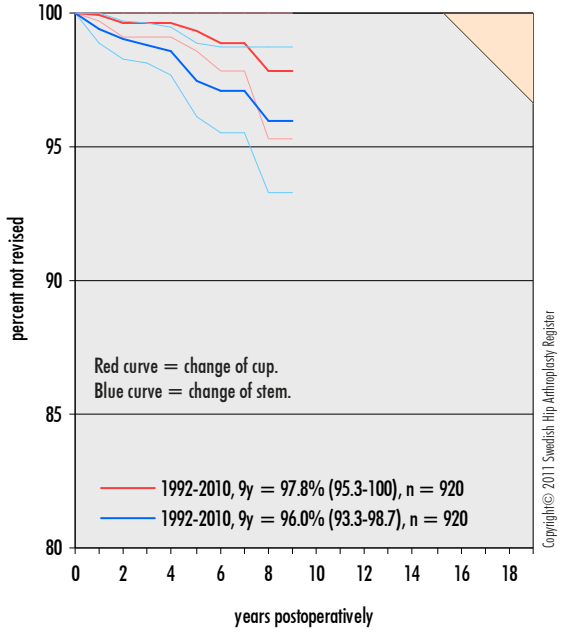
Charnley Elite (Corail)

cup-/stemrevision – all diagnoses and all reasons for revision



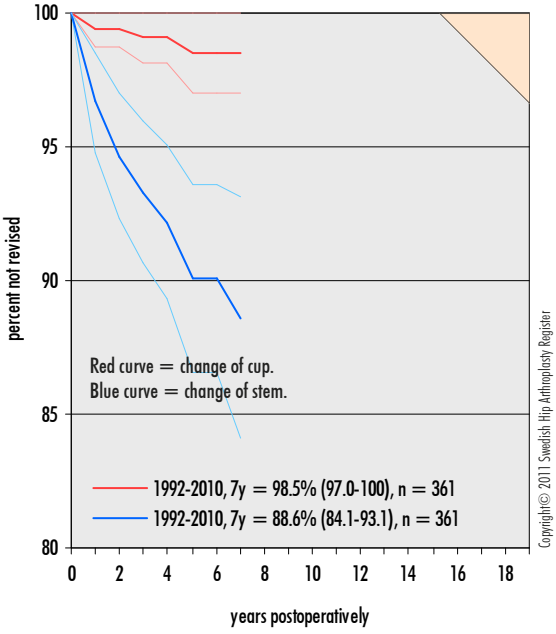
BHR

cup-/stemrevision – all diagnoses and all reasons for revision



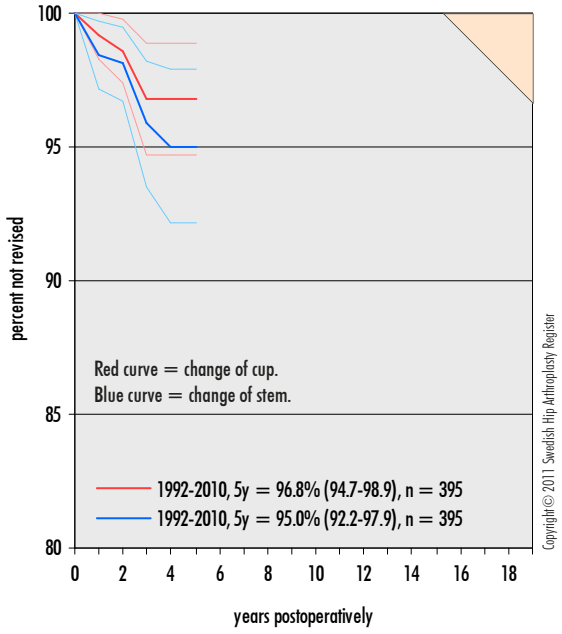
Durom

cup-/stemrevision – all diagnoses and all reasons for revision



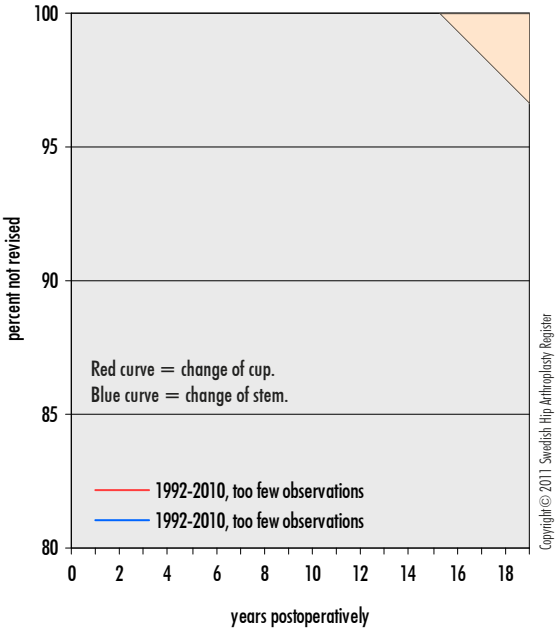
ASR

cup-/stemrevision – all diagnoses and all reasons for revision



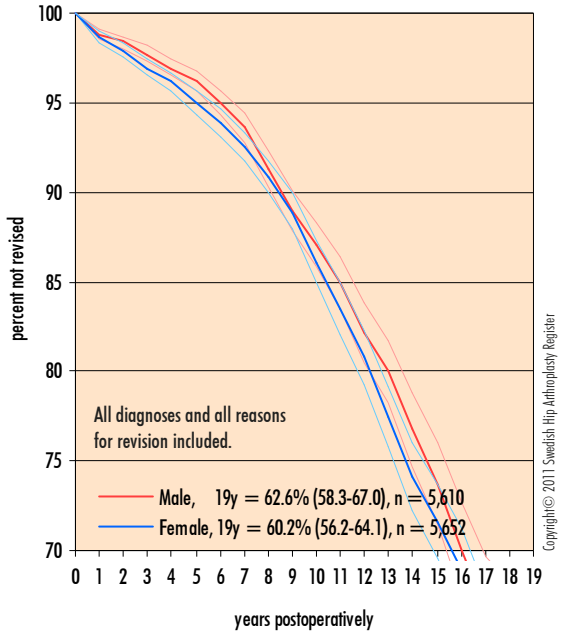
Adept

cup-/stemrevision – all diagnoses and all reasons for revision



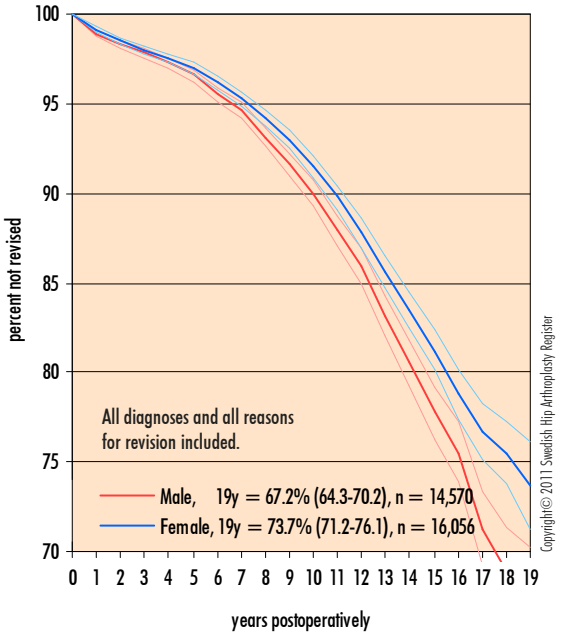
Younger than 50 years

all observations, 1992-2010



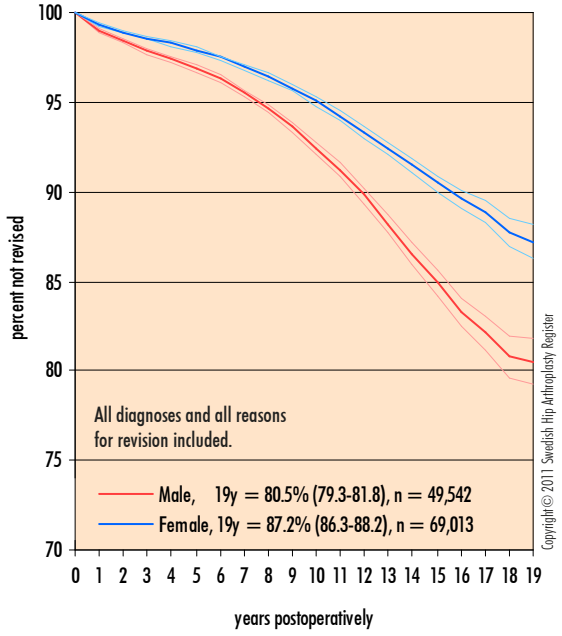
Between 50 and 59 years

all observations, 1992-2010



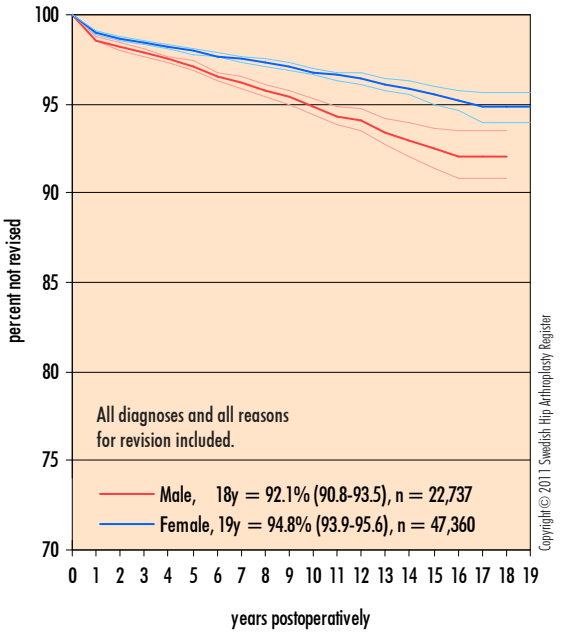
Between 60 and 75 years

all observations, 1992-2010



Older than 75 years

all observations, 1992-2010



Patient-reported outcome

The results of implant surgery have historically – both nationally and internationally – been reported as implant survival. It remains important to report this variable regarding long-term surgical/technical results. The main indications for hip arthroplasty, however, are subjectively-experienced pain and low health-related quality of life. For this reason it is important to measure these variables prospectively during the course of the disease.

For many years there has been increased focus on the patient-reported outcome measure (PROM) both in activity analysis and in clinical research.

PROM program after nine years ("Höftdispensären")

The Swedish Hip Arthroplasty Register started including patient-reported variables via the patient-reported outcome measure on 1 January 2002 in the Västra Göteland region. The routine has been successively introduced throughout the country. During Spring 2010 this part of the Register became fully national. Two variables (EQ-5D index gain and patient satisfaction) from the PROM database have been selected by the Swedish Association of Local Authorities and Regions (SKL) and the National Board of Health and Welfare as national quality indicators in their report *Öppna jämförelser (Open Comparisons)*.

Summary of logistics and methods

Intentionally, some patients are asked to answer a preoperative questionnaire with ten questions (Charnley categories, pain VAS and EQ-5D). The same questionnaire with a supplementary question on satisfaction (VAS) is sent to all patients after one year. The procedure is repeated after six and ten years. For other details see earlier Annual Reports.

Overall objective

- Report outcome after total hip arthroplasty multidimensionally.
- Create an opportunity for the departments to work on activity analysis and improvement, starting from patients' needs and reported outcomes.
- Create a methodologically adequate health-economic instrument for cost-effectiveness analysis and resource allocation.

Results

On 18 July 2010 the prospective pre-operative database (82 departments, of which four closed down) contained records of about 74,000 patients. The one-year follow-up contained 66,000 records and the sixth-year ditto 8,000. The national mean values for the variables included have varied little over the years during which we have collected data. The variation between the different hospitals, however, is more appreciable. See table.

The cause of this variability is multifaceted: patient demography including socioeconomic parameters, gender distribution, age distribution, differing indications for surgery, accessibility and a degree of adequate information and patient expectations are factors that may affect these subjective and individually-reported variables.

General results

In last year's Report we presented an extensive general analysis of the Register's PROM function and in December 2010 Ola Rolfson defended the Registry's first doctoral dissertation on the subject. This thesis well summarizes the first decade of the Register with the PRO variables included. Interested readers are referred to the web version on the link: http://gupea.ub.gu.se/bitstream/2077/23722/1/gupea_2077_23722_1.pdf.

Patient satisfaction

The variable patient satisfaction does not correlate entirely to the EQ-5D result; a low EQ-5D index gain may be linked to a high degree of satisfaction and vice versa – depending on what EQ-5D index the patient reported pre-operatively.

An important find in the above thesis was that 11% of all patients with primary arthritis stated one year after surgery that they were uncertain about or dissatisfied with the result. Satisfaction is measured on a hundred-graded modified VAS (0=satisfied, 100=dissatisfied). "Satisfied" is defined as a score of 40 or less and "uncertain/dissatisfied between 41 and 100 on the VAS scale. After one year the reported reoperation frequency was under 1%. In this year's *Öppna jämförelser* (Open Comparisons) patient satisfaction is included as a new national quality indicator.

The result at national level shows that 16% (all primary diagnoses included) were uncertain or dissatisfied. This group of patients that answered sub-optimally regarding the surgical intervention will now be studied in detail. It is important for the profession that a minority of patients in their subjective evaluation do not discredit a recognized successful and cost-effective surgical treatment. This may in turn influence decision-makers to lower the priority of this type of treatment! In England, the National Health Service measures PROM outcome after knee and hip arthroplasty in a manner similar (but as early as six months post-operatively) to what the Hip Arthroplasty Registry in Sweden does. Six months after knee arthroplasty, 20% of their patients state that they did not experience any greater value after surgery. This finding has started animated discussion as above. However, the English study has been much criticized – primarily because the outcome was measured as early as six months post-operatively. Hardly any implant patient has achieved optimum function after this short period.

The patients that report uncertainty or dissatisfaction represent a group on which the Registry in its continued analyses and clinical research will now focus. The reasons for a patient not to report satisfaction one year post-operatively (if there have been no complications) are doubtless multifactorial and in many cases different factors can interact:

- Absence of early-initiated non-surgical treatment and established fear of movement
- Doubtful indication for surgery
- Too short follow-up time
- Medical co-morbidity and Charnley class C
- Mental ill health
- Poor information on expected result and length of rehabilitation
- Inadequate expectations on final result
- Socioeconomic background variables such as low educational level, country of birth, language difficulties etc. – requiring special information
- Differing leg length
- Problems near the trochanter
- Simultaneous undiagnosed spinal stenosis
- Long waiting times.

The list of factors above is doubtless incomplete but many of them may be changed through thought-out care programmes and processes. Swedish orthopaedics needs to find predictors for both good and poor outcomes in an attempt to further improve the results following arthroplasty. In this medical field it is hard to improve classical objective parameters such as implant survival after ten years, which at national level is now just over 95% for all primary diagnoses. There is probably, however, a clear potential for improvement in most prosthesis-producing units regarding patient-reported outcome.

'It's about
doing the right thing,
doing the thing right
and doing it at the right time'

Ola Rolfson, 2010.

Do not forget the patient-reported variables when reviewing the departments' results. Poorer results regarding satisfaction, health gain and pain relief may be a sign of a department's sub-optimal care of patients outside the operating theatre. Factors such as indication for surgery, adequate pre- and post-operative information and possibly inadequate expectations among patients are things that can be altered via the department's care programme.

Patient satisfaction 1 year after total hip replacement

2009-2010

Hospital	No.	Sat. [1]
Aleris Specialistvård Sabbatsberg	117	93.2%
Alingsås	397	85.6%
Arvika	281	89.3%
Bollnäs	519	89.6%
Borås	331	83.1%
Carlanderska	73	93.2%
Danderyd	685	82.8%
Eksjö	385	89.9%
Elisabethsjukhuset	219	94.1%
Enköping	387	80.6%
Eskilstuna	192	87.5%
Falköping	462	87.5%
Falun	587	88.9%
Frölunda Specialistsjukhus	151	82.8%
Gällivare	172	90.7%
Gävle	274	82.9%
Halmstad	336	81.6%
Helsingborg	87	83.9%
Hudiksvall	233	84.6%
Hässleholm-Kristianstad	1,561	89.4%
Jönköping	370	88.9%
Kalmar	333	91.0%
Karlshamn	379	89.2%
Karlskoga	211	90.1%
Karlskrona	24	83.3%
Karlstad	429	80.7%
Katrineholm	471	83.7%
KS/Huddinge	414	85.3%
KS/Solna	389	85.1%
Kungälv	338	83.1%
Lidköping	236	88.6%
Lindesberg	339	91.5%
Ljungby	260	86.5%
Lund	114	85.1%
Lycksele	480	90.8%
Malmö	129	79.8%
Mora	357	84.3%
Motala	565	86.6%
Movement	343	88.6%
Nacka Närsjukhus Proxima	102	90.2%
Norrköping	294	78.2%
Norrtälje	222	89.2%
Nyköping	161	80.1%
OrthoCenter	181	90.1%
Ortopediska Huset	907	86.6%
Oskarshamn	396	90.2%
Piteå	614	90.4%
S:t Göran	699	83.8%
Skellefteå	156	84.6%
Skene	138	79.0%
Skövde	149	85.9%
Sollefteå	123	86.2%
Spenshult	230	92.6%
Stockholms Specialistvård	572	80.6%
SU/Mölndal	533	75.4%
SU/Östra	124	85.5%
Sunderby	71	76.1%
Sundsvall	303	80.9%
Södersjukhuset	638	81.7%
Södertälje	218	73.4%
Torsby	165	81.8%
Trelleborg	1,051	88.4%
Uddevalla	598	84.0%
Umeå	166	86.1%
Uppsala	468	84.2%
Varberg	439	86.8%
Visby	244	78.7%
Värnamo	251	88.8%
Västervik	197	88.8%
Västerås	531	87.4%
Växjö	213	88.3%
Ängelholm	35	91.4%
Örebro	311	89.7%
Örnsköldsvik	236	83.1%
Östersund	374	89.0%

[1] *Proportion of patients with satisfaction value between 0 and 40 on VAS.*

Patient-reported outcome per hospital

2009-2010

Klinik	Preoperatively				Follow-up after 1 year				Gain [3]	Follow-up after 6 years				Gain [3]
	No.	C-cat.[1]	EQ-5D	Pain	No.	EQ-5D	Pain	Sat.[2]		No.	EQ-5D	Pain	Sat.[2]	
University/Regional hospitals														
KS/Huddinge	434	61%	0.41	78	425	0.70	16	18	0.30					
KS/Solna	252	44%	0.35	65	416	0.75	15	18	0.39					
SU/Mölndal	513	50%	0.34	64	543	0.66	20	25	0.32	151	0.69	20	24	0.35
SUS/Lund	102	54%	0.28	60	246	0.67	21	25	0.39	56	0.68	15	17	0.40
SUS/Malmö	82	51%	0.28	64	218	0.66	20	22	0.37	65	0.62	20	21	0.33
Umeå	135	47%	0.30	65	170	0.75	14	16	0.44	72	0.68	18	20	0.37
Uppsala	373	53%	0.42	58	546	0.72	15	18	0.30					
Örebro	306	56%	0.41	57	341	0.77	12	14	0.36					
Central hospitals														
Borås	256	50%	0.38	61	336	0.70	16	21	0.32	234	0.72	17	19	0.34
Danderyd	493	46%	0.35	64	694	0.74	15	19	0.39					
Eksjö	364	30%	0.41	62	393	0.79	14	17	0.37					
Eskilstuna	100	57%	0.29	66	192	0.72	16	18	0.43					
Falun	579	42%	0.39	60	590	0.78	12	14	0.39					
Gävle	272	46%	0.36	63	280	0.73	13	19	0.37					
Halmstad	338	35%	0.40	65	357	0.75	17	21	0.34					
Helsingborg	81	37%	0.24	67	87	0.71	17	18	0.47					
Hässleholm-Kristianstad	1,611	47%	0.40	60	1,566	0.80	14	14	0.40					
Jönköping	333	46%	0.40	62	373	0.77	13	15	0.37					
Kalmar	302	42%	0.42	62	340	0.78	13	15	0.36					
Karlstad	350	47%	0.41	61	463	0.71	17	21	0.30					
Norrköping	407	44%	0.41	62	297	0.72	16	22	0.32					
Skövde	206	49%	0.37	63	153	0.72	17	19	0.35	186	0.69	17	18	0.32
Sundsvall	357	43%	0.35	64	359	0.74	15	20	0.38	177	0.75	16	19	0.40
Södersjukhuset	527	40%	0.41	61	728	0.72	16	21	0.31					
Uddevalla	510	47%	0.38	62	606	0.77	16	19	0.38	330	0.66	19	21	0.28
Varberg	383	36%	0.45	64	457	0.79	13	15	0.34					
Västerås	422	41%	0.34	67	542	0.76	14	16	0.43					
Växjö	137	59%	0.44	56	216	0.78	16	16	0.34					
Östersund	409	37%	0.42	60	386	0.77	12	14	0.35	182	0.78	13	15	0.36
Rural hospitals														
Alingsås	426	43%	0.44	59	433	0.78	12	16	0.34	185	0.72	15	17	0.28
Arvika	349	42%	0.42	63	299	0.79	15	15	0.36					
Bollnäs	626	38%	0.41	64	528	0.81	12	14	0.40					
Enköping	464	48%	0.44	59	398	0.77	16	22	0.32					
Falköping	481	35%	0.46	62	474	0.80	12	16	0.34	385	0.75	14	15	0.29
Frölunda Specialistsjukhus	163	37%	0.48	57	154	0.80	16	20	0.32	81	0.75	21	24	0.27
Gällivare	119	39%	0.40	65	177	0.74	16	17	0.34	97	0.73	15	19	0.34
Hudiksvall	214	49%	0.38	61	259	0.76	15	18	0.38					
Kalix										94	0.74	16	18	
Karlshamn	390	34%	0.42	60	408	0.80	13	16	0.38					
Karlskoga	242	35%	0.44	63	223	0.77	13	16	0.33					

(continued on next page)

Patient-reported outcome per hospital (cont.)

2009-2010

Klinik	Preoperatively				Follow-up after 1 year				Gain [3]	Follow-up after 6 years				Gain [3]
	No.	C-cat.[1]	EQ-5D	Pain	No.	EQ-5D	Pain	Sat.[2]		No.	EQ-5D	Pain	Sat.[2]	
Katrineholm	397	42%	0.42	60	475	0.78	14	18	0.36					
Kungälv	306	55%	0.46	56	347	0.75	17	20	0.28	241	0.74	17	17	0.28
Köping					2	0.50	15	15						
Landskrona										173	0.78	16	16	
Lidköping	241	50%	0.41	58	260	0.76	14	18	0.34	199	0.74	13	18	0.33
Lindesberg	388	39%	0.41	64	365	0.80	11	12	0.39	42	0.85	10	11	0.45
Ljungby	328	44%	0.49	58	277	0.80	13	16	0.30					
Lycksele	493	40%	0.40	64	505	0.80	15	16	0.40	229	0.76	15	15	0.36
Mora	378	42%	0.37	67	371	0.76	16	20	0.38					
Motala (to 2009)	312	47%	0.46	61	581	0.78	15	17	0.31					
Norrtälje	208	43%	0.42	63	235	0.76	16	18	0.34					
Nyköping	303	36%	0.39	64	163	0.74	15	23	0.34					
Oskarshamn	393	32%	0.51	56	398	0.81	11	13	0.30					
Piteå	609	39%	0.38	66	721	0.79	13	16	0.41	143	0.72	17	22	0.34
Skellefteå	157	48%	0.38	63	163	0.74	17	18	0.36	125	0.75	15	14	0.37
Skene	180	43%	0.41	64	140	0.77	18	22	0.37	131	0.75	14	18	0.34
Sollefteå	231	39%	0.45	63	130	0.78	14	17	0.34	66	0.76	20	19	0.31
Södertälje	219	38%	0.41	62	233	0.69	22	26	0.28					
Torsby	177	43%	0.37	66	219	0.74	17	21	0.38					
SUS/Trelleborg	1,155	41%	0.42	64	1,062	0.80	15	16	0.38	106	0.71	20	23	0.29
Visby	192	48%	0.42	61	249	0.75	16	22	0.32					
Värnamo	236	31%	0.53	59	283	0.78	16	17	0.25					
Västervik	199	43%	0.49	59	213	0.78	14	17	0.28					
Ängelholm	171	33%	0.33	69	38	0.82	8	8	0.49					
Örnsköldsvik	295	44%	0.39	64	252	0.76	15	18	0.37	88	0.76	15	17	0.37
Private hospitals														
Aleris Specialistvård Sabbatsberg	199	29%	0.40	63	120	0.84	11	12	0.44					
Capio S:t Göran	605	42%	0.40	61	702	0.75	16	20	0.36					
Carlanderska	135	22%	0.40	62	80	0.86	10	14	0.47					
Elisabethsjukhuset	154	33%	0.48	62	223	0.85	11	10	0.38					
Movement	391	30%	0.43	63	355	0.82	11	13	0.39					
Nacka Närsjukhus Proxima	218	34%	0.43	65	110	0.83	12	12	0.40					
Ortho Center Stockholm	813	40%	0.39	66	584	0.79	12	15	0.40					
OrthoCenter IFK-kliniken	220	27%	0.42	63	188	0.83	10	13	0.41					
Ortopediska Huset	790	34%	0.44	62	913	0.79	13	16	0.35					
Proxima Spec.vård Motala	421	40%	0.48	60										
Spenshult	206	40%	0.45	61	244	0.80	11	12	0.36					
Nation	25,919	42%	0.41	62	27,136	0.77	15	17	0.36	4 448	0.73	16	18	0.32

[1] Proportion of Charnley category C.
[2] Satisfaction (VAS, 0 = Completely satisfied, 100 = Completely unsatisfied).
[3] Difference in EQ-5D after 1 year and pre-operatively. Note that this reflects the difference between mean values after 1 year and preoperatively, as opposed to the value compass where the gain in EQ-5D index is calculated as the average value of the individual differences.

The table gives the result in the form of number of patients, mean values of pain VAS and EQ-5D index pre-operatively, together with the proportion of Charnley category C patients (i.e. patients with multiple joint disease and/or co-morbidity). Departments with a high proportion of C patients most frequently have lower average values for all parameters both pre-operatively and after one year. However, the prospectively gained values are most often not equally affected by C affiliation.

Notes

Follow-up of activities after total hip arthroplasty

The Swedish Hip Arthroplasty Register started open reporting of hospital results in 1999. The number of variables reported in this way has increased over the years and they are presented in table form in various places in this Report. These tables are necessarily extensive and sometimes hard to interpret. In addition, it is hard via the table system to gain a rapid overview of the departments' results in several dimensions. This is the fifth year we have used what is termed the value compass, which contains eight variables (points of the compass). The compasses have been produced only with the intention of providing a quick and pedagogical review. A deviant result in one value compass only states whether a department has a problem area. The compass can be seen as a simplified signal system.

Using this follow-up model the results are presented this year for all the departments associated with the patient-reported outcome measure for more than one year and with at least 50 patients followed. The limit values are set to the largest and the smallest value plus/minus one standard deviation for that variable. This means that the norm values (red area) vary from year to year. The poorest value (0.0) for the variables is given as origo and the best value (1.0) is at the periphery. This value compass may be viewed as a balanced control card. The greater the surface area the better the multi-dimensional total result for that department.

The national mean values are given in each figure and the department in question can thus compare itself with the national result for that year of activity. Note that the observation times for the variables differ. Result variables:

- **Patient satisfaction**. Measured on VAS. Can only, like variables 2 and 3, be given if the department has been active with the PROM routine for more than one year.
- **Pain relief**. Measured by subtracting the pre-operative VAS value from the follow-up value, i.e. the value gained after one year.
- **Gained health-related life quality (gain in EQ-5D index)**. The prospective gain on the EQ-5D index, i.e. health gain after one year.
- **90-day mortality**. In international literature this variable is used to illustrate mortality after hip arthroplasty.
- **Completeness**. Completeness at individual level according to latest matching with the Patient Register at the National Board of Health and Welfare.
- **Reoperation within two years**. States all forms of reoperation within 2 years of the primary operation and during the most recent four-year period.
- **Five-year implant survival**. Implant survival after five years using Kaplan- Meier statistics.
- **Ten-year implant survival**. Same variable as above but with a longer follow-up time.

Linked to each department's value compass is a graphic presentation of that department's 'case-mix'. This part is designed in the same way as the value compass and includes the variables that on analysis of the Registry's database proved to be decisive demographic parameters for both patient-reported outcome and long-term results regarding need for revision. The greater the surface in this figure the more favourable the patient profile for the department in question.

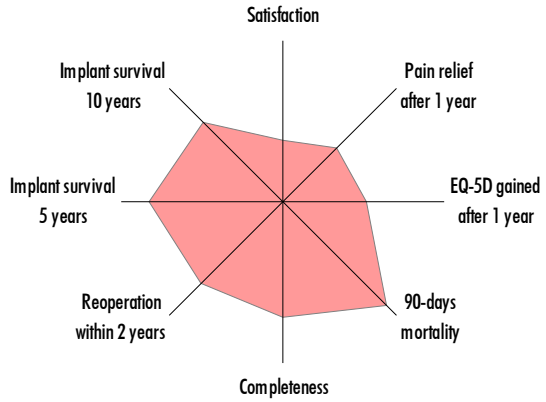
- **Charnley classification**. The figure shows the department's proportion of patients classifying themselves as Charnley class A or B, i.e. patients without multiple joint disorders and/or intercurrent diseases affecting the patient's gait.
- **Proportion of primary arthritis**. The more patients the clinic operates on with the diagnosis of primary arthritis the better the long-term results according to the Registry's regression analysis of the database.
- **Proportion of patients 60 years or older**. Departments operating on many patients aged over 60 years obtain, in the same way as with the above variable, better results.
- **Proportion of women**. Women have generally better long-term results than men regarding need for revision, chiefly because of aseptic loosening.

Discussion

There is a strong wish from decision-makers in medical care for easily available and summarizing presentations of departments'/county councils' results for follow-up of activities. Another way of meeting this desire is to create an index as a total sum comprising a number of variables. The greatest risk with indexing is that good results in one variable may be cancelled out by poor results in another variable or vice versa. Such an index thus does not prompt in-depth analysis or work for improvement. Varying degrees of completeness of reported variables may also affect indexing, with misleading results in consequence.

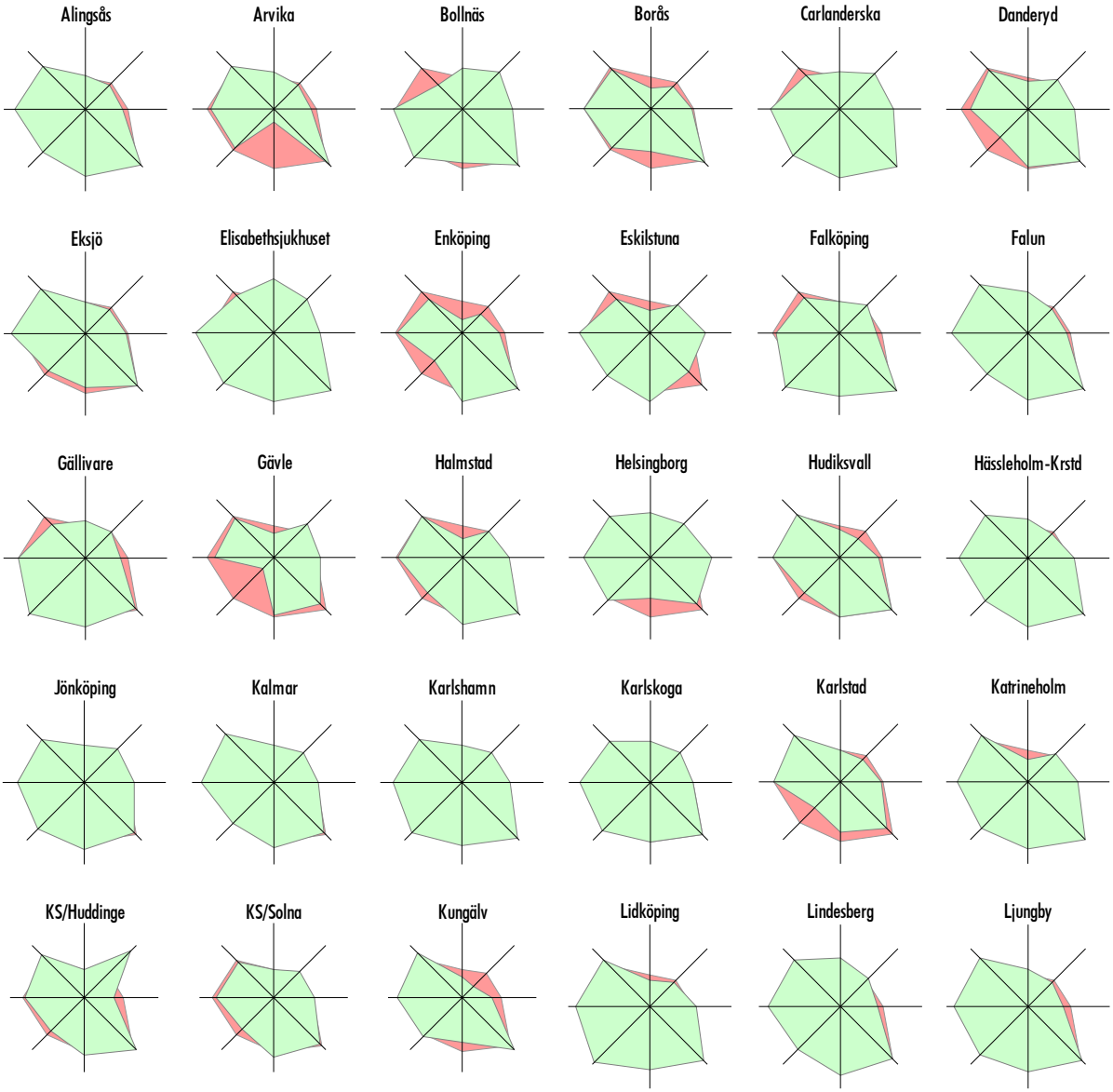
Quality indicators

clinical value compass - national averages



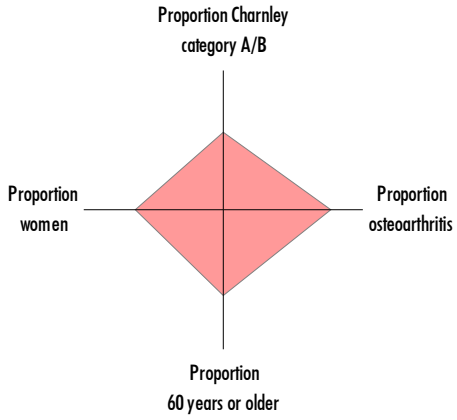
The value compasses show national results for the eight variables included, in red. Each department's corresponding values are shown in green. Limit values are set to the greatest and the lowest value of each variable ± 1SD. The poorest value for the variables is origo and the best value is at the periphery.

The departments where red fields are visible have a poorer value than the national average for that variable. The outcome can be studied in detail in each table.

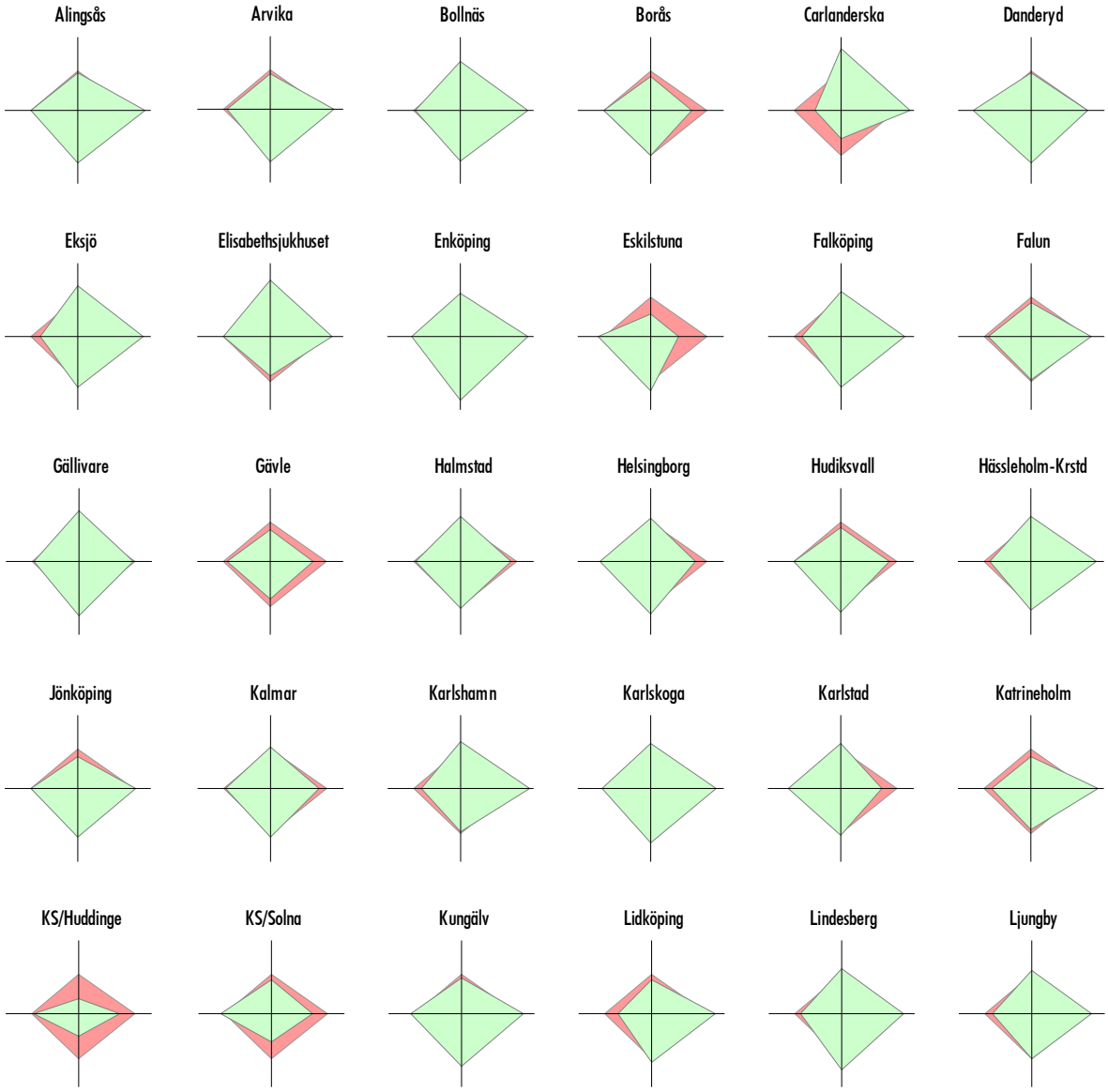


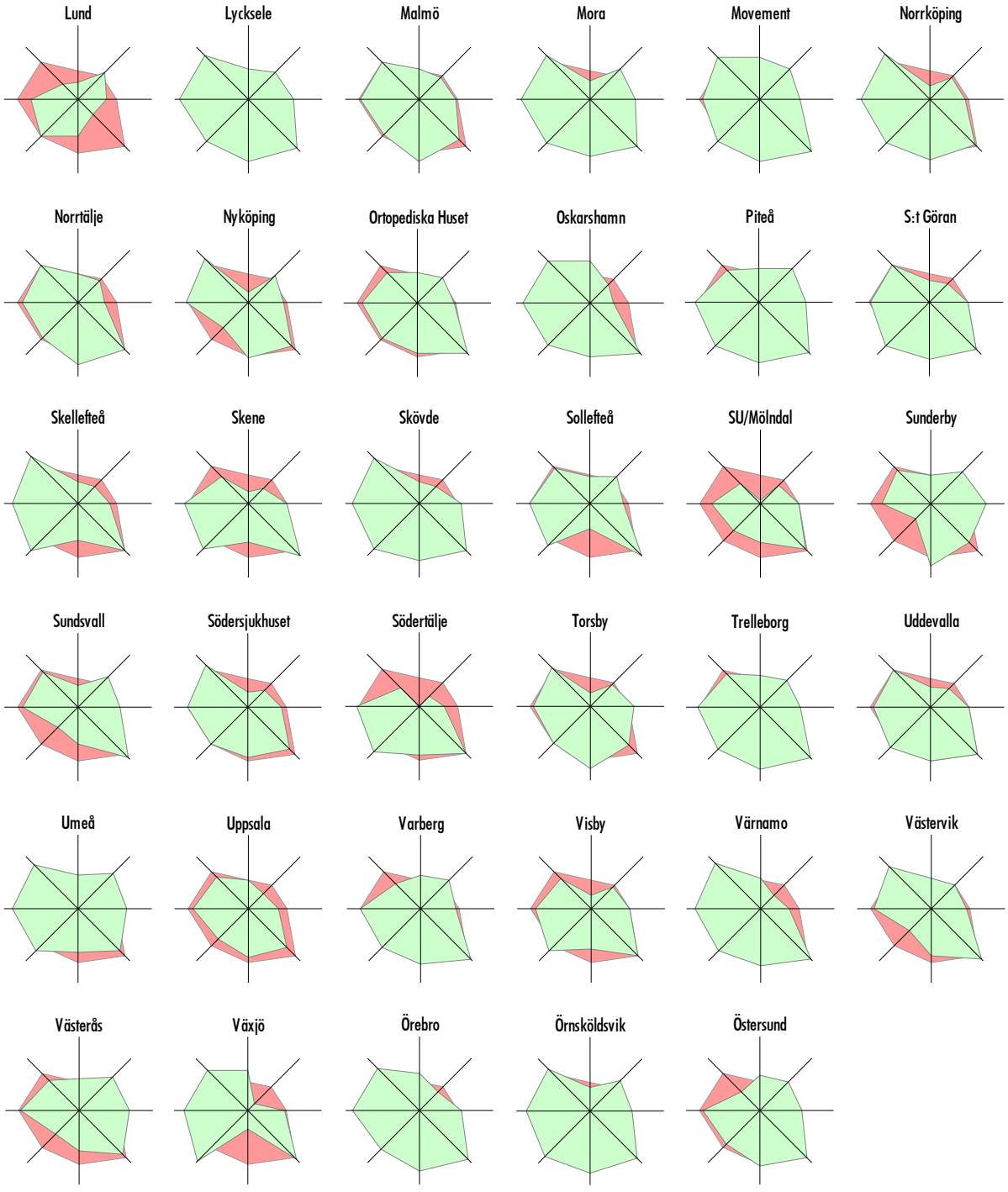
Case-mix factors

national averages

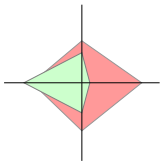


In the graphic presentation of patient demography ('case-mix') the national result is shown regarding the four variables included, in red. The corresponding values for each clinic are shown in green. Limit values are set to the greatest and the smallest value of each variable ± 1 SD. The poorest value for the variables is origo and the best value is at the periphery.

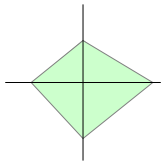



Lund
Lycksele
Malmö
Mora
Movement
Norrköping
Norrtälje
Nyköping
Ortopediska Huset
Oskarshamn
Piteå
S:t Göran
Skellefteå
Skene
Skövde
Sollefteå
SU/Mölndal
Sunderby
Sundsvall
Södersjukhuset
Södertälje
Torsby
Trelleborg
Uddevalla
Umeå
Uppsala
Varberg
Visby
Värnamo
Västervik
Västerås
Växjö
Örebro
Örnsköldsvik
Östersund

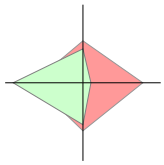
Lund



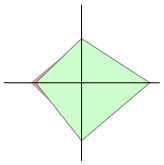
Lycksele



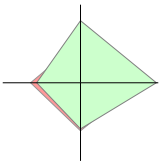
Malmö



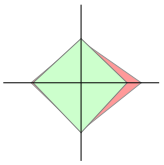
Mora



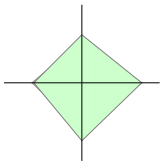
Movement



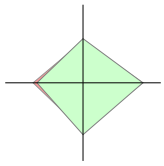
Norrköping



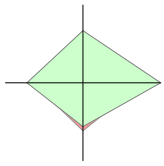
Norrtälje



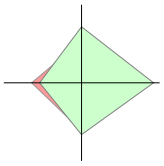
Nyköping



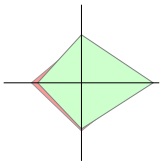
Ortopediska Huset



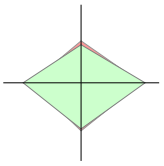
Oskarshamn



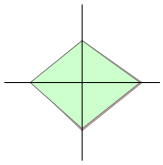
Piteå



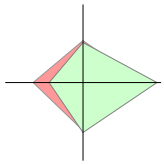
S:t Göran



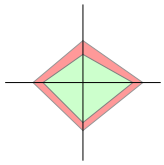
Skellefteå



Skene



Skövde



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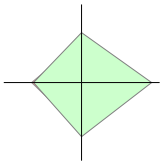

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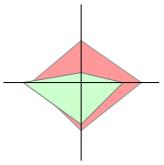

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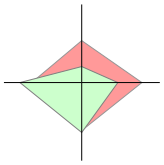

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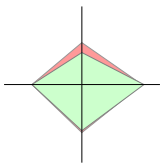

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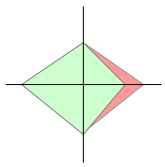

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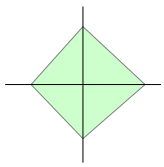

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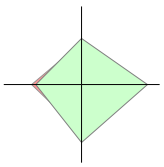

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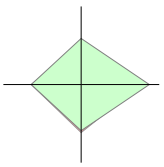

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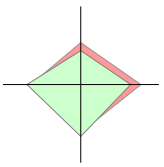

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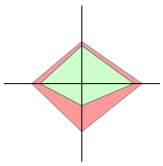

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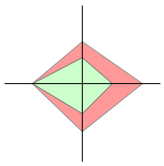

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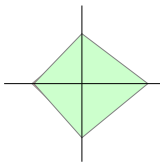

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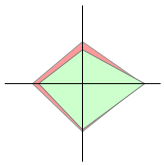

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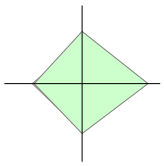

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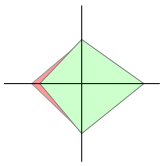

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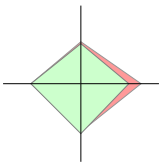

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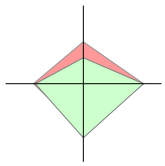

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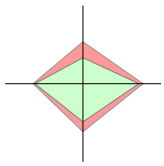

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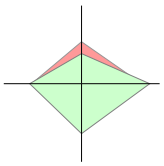

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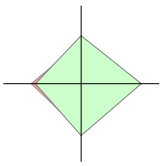


Analysis of activities and work for improvement

One of the Registry's main tasks is via analyses and open reporting to encourage individual units to perform local in-depth analyses and to work continually for improvement.

To get each department to analyse its results as a step in the analysis of activities, development and work for improvement, we propose the following:

- Focus on one's own result and its time trend.
- Do not focus on the national mean value – many departments are satisfied as long as they have better values than the reported mean value and then 'slow down' in their own development. In addition, mean values in one result variable at national level can be a poor result needing general national improvement.
- Discuss 'on-line' results and the Annual Report – primarily the department's complications – continually at internal meetings. Only then can one identify problem areas and discover systematic shortcomings in the whole process of hip arthroplasty.
- Do not forget the patient-reported variables when reviewing the department's results. Poor results regarding satisfaction, health gain and pain relief may be a sign of a department's sub-optimal care of patients outside theatre. Factors such as indication for surgery, adequate pre- and post-operative information and possibly inadequate expectations among patients are things that can be changed via the department's care programme.

For several years we have published examples of local analyses and improvement work from several departments. This year we report Södertälje's and Mölndal's in-depth analyses of the outcome of their value compasses from 2009 (figure 1). Such reviews are important for improvement in the department but are also a validation and control of the Register's data quality. Note that the Registry can report that something that has happened but not always why!

If every orthopaedics unit producing arthroplasty carried out similar activity analyses based on result measures, the Registry management is convinced that the quality of Swedish arthroplasty could be further improved.

Analyse the department's results and complication cases in detail and discuss at clinic meetings with all involved – a sure way to improvement!

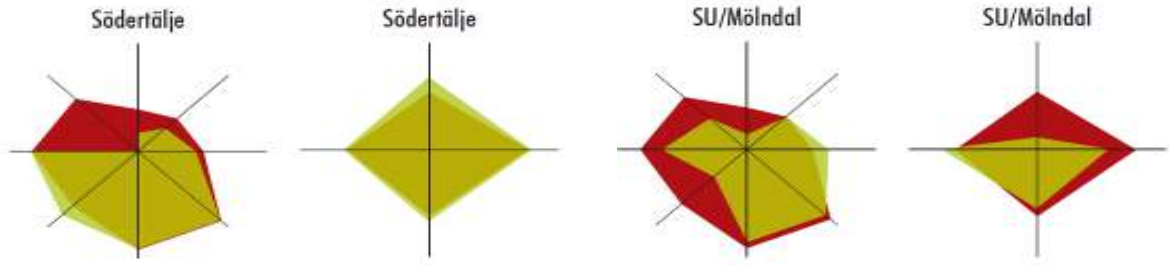


Figure 1. Södertäljes and SU/Mölndals value compasses and "case-mix" profiles in last years annual report.

Activity analysis – Södertälje hospital

At Södertälje hospital some 125 arthroplasties are performed annually. The Swedish Hip Arthroplasty Register showed for operational year 2009 a very good result regarding short-term complications with lower than 1% reoperations. As against this the 10-year implant survival was just under 80% and we therefore determined to perform an in-depth analysis of our hip arthroplasty work.

Using the revision list we identified 88 patients that had undergone revision operations during this 10-year period. Data regarding age, gender, ASA class and complicating diseases was obtained through a review of their medical records. X-rays post-operatively after the primary operation and pre-operatively before the revision operation were requisitioned.

Dr Göran Garellick from the Swedish Hip Arthroplasty Registry then spent a whole day together with the department's orthopaedic surgeons reviewing the patient group, choice of implant, surgical technique, cementing technique and X-rays. Owing to the large turnover of orthopaedic specialists at the department during the past few years, only 20% of the department's present orthopaedic surgeons had participated in the primary operations during the 10-year period analysed.

'Case-mix'

At the primary operation the average age of the patients was 64 years and 50% of them were women. Operations on the right side were somewhat commoner than on the left.

The ASA classification was as follows: 33% ASA 1, 59% ASA 2, 2% ASA 3 and 0% ASA 4. Overweight was common with an average BMI of 28 and 16% of the patients had a BMI over 30. The patients exhibited few complicating diseases.

Analysis of revision operations

Among the revised patients there was one with RA but none with dementia or malignant disease. The patients undergoing revision operations were somewhat younger and more often overweight, but otherwise did not differ notably from the patients undergoing primary hip arthroplasties in Sweden.

The entirely predominant cause, 80%, of revision operation was aseptic implant loosening, and it was above all the cup that loosened and was changed in 73% of the patients in connection with the revision operation. Other indications for revision were infection 10%, dislocation 7% and periprosthetic femur fracture 2%.

The majority of the revision patients, 90%, had been operated on using the same cemented implant, a Spectron EF Primary stem and a Reflection cup. Cement containing gentamycin had been used in all operations.

The Swedish Arthroplasty Register shows that the implant type used has clearly poorer implant survival at 5 and 10 years than other implants used in Sweden.

All patients had been operated on with incisions according to Gammer with the patient in the lateral position, anterior access to the hip joint.

Review of the X-rays of the patients undergoing revision showed on the cup side shortcomings in the reaming. This was sometimes insufficient, and there was also a less excellent cementing technique, which led to the cement not penetrating the trabecular area sufficiently well to obtain good fixation. On the femur side the stems in some cases were under-dimensioned and sub-optimally placed so that the tip was not centred in the marrow orifice. In several cases in the lateral projection we could see a femur stem in contact with the anterior corticalis proximally and with the posterior corticalis distally (termed the C2 position). Shortcomings in cementing technique were also seen on the femur side.

Conclusions from the analysis

The frequency of revision operations following hip arthroplasty is unacceptably high. The reason for the high frequency of revision operations is not differences in the patient group. On the other hand the choice of an implant type with poorer long-term results in the Register compared with the majority of available implants is judged to be a contributory factor to the number of revision operations, as are a sub-optimal operation and cementing technique.

Measures decided upon and planned

To improve the quality of hip arthroplasty and increase implant survival, decisions have been taken regarding:

- **Change of cemented implant.**
- **A two-day course for all orthopaedic surgeons at the department during September, with focus on operational and cementing technique.**
- **Always two operators for the intervention and, to a greater extent than previously, two specialists operate together.**

Björn Cars
Överläkare

Analysis of activities - SU/Mölndal

In the Swedish Hip Arthroplasty Register results of total arthroplasty are measured, among other things, in the form of patient satisfaction, pain relief, health-related life quality gained (EQ-5D gain), 90-day mortality, degree of completeness, reoperation within two years and implant survival after five and 10 years. The results of arthroplasty at Sahlgrenska University Hospital/ Mölndal showed poorer patient satisfaction and pain relief and more reoperations within two years. Implant survival during the most recent 10-year period was also poorer than expected.

The purpose of this report is to present and examine possible causes where the outcome has been other than expected. The Report should represent an aid in continual work for improvement.

Background

At SU/Mölndal until November 2006 patients were operated on mainly from Mölndal's local catchment area. During November/December 2006 almost all hip and also knee arthroplasty was transferred from SU/Sahlgrenska to SU/Mölndal. At the same time all more complicated arthroplasty was moved from SU/Eastern to SU/Mölndal together with almost all revision surgery. In April 2009 remaining implant surgery at SU/Östra was transferred to SU/Mölndal. For SU/Mölndal the transfer involved comprehensive organizational changes with very great expansion of the volume of activity and modification of its contents. It also involved recruitment of new staff in all staff categories involved in the treatment of patients undergoing implant surgery. The change may be illustrated by the fact that in 2005 93 primary hip arthroplasties were carried out at SU/ Mölndal, which in 2009 had increased to 342. Between the same years the number of reoperations of hip arthroplasties rose from 22 to 190.

Patient demography

The present analysis covers 2008 and 2009. Compared with the rest of the country relatively fewer patients with primary osteoarthritis underwent surgery (56%-57% compared with 84% for the whole country). At SU/Mölndal more patients with secondary osteoarthritis received implants. The largest relative difference was for patients with fracture diagnoses and sequelae after hip disorders during their growth years, for which the number of patients was approximately three times that for the rest of the country (figure 1).

The predominance of fracture diagnosis and sequelae after child disorders, and also inflammatory joint disease, probably explains why the relative proportion of women was higher (63%, 59% for the rest of the country). The proportion of patients in Charnley category C (patients who apart from hip disorders have other contributory causes of their mobility impairment) was larger (figure 2). In general these patients also have a higher degree of associated diseases that can affect the risk of complications. The proportion of patients with ASA class 3 or higher was almost double that for patients operated on at SU/Mölndal compared with the rest of the country (figure 3).

Patient satisfaction (VAS)

Patients undergoing operations at SU/Mölndal are less satisfied after one year than the national average. On a visual analogue

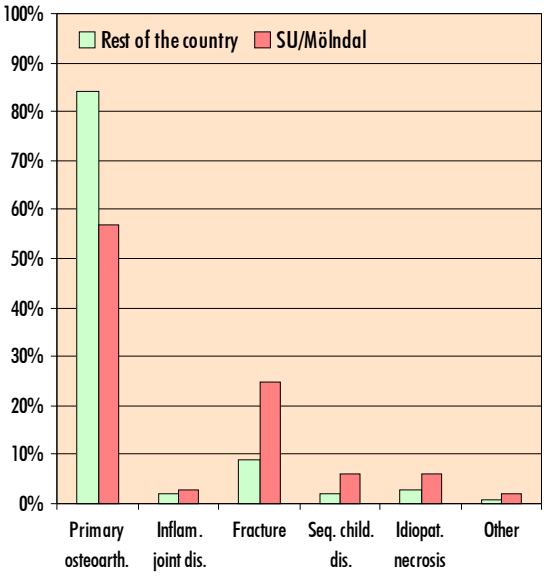


Figure 1. Distribution of diagnoses SU/Mölndal compared with the rest of Sweden.

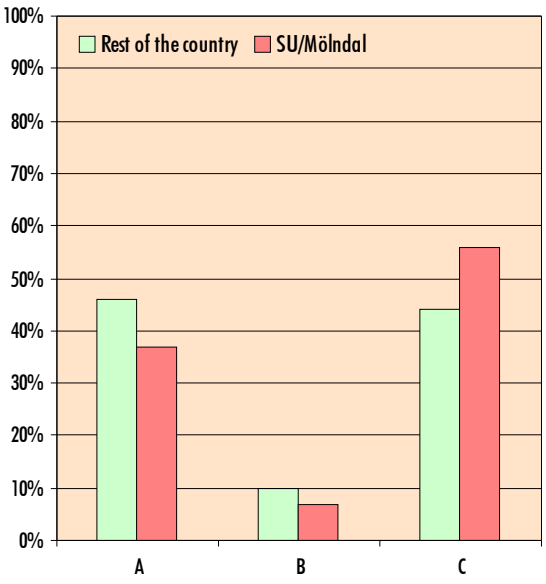


Figure 2. Distribution by Charnley category. A = unilateral hip disorder, B = disorder in both hip joints, C = mobility affected by other disorders as well as hip disease.

scale the patients gave a mean value of 25. The national average is 17. The lower the value the more satisfied the patient. In this analysis operations conducted up to and including 2010 have been included so as to obtain a larger data material.

Factors influencing patient satisfaction

The degree of patient satisfaction is affected by several factors. In a linear regression analysis including age, gender, diagnosis (primary/secondary osteoarthritis), Charnley category (category A + B/ category C) and ASA grade (ASA categories 1 -2/3 or higher) we find that all these affect the results; but that Charnley category, age, ASA class and gender in that order are the most important. Thus poorer patient satisfaction can be expected for patients in Charnley category C, i.e. patients in whom more different diseases affect physical activity level, less satisfaction with increasing age and poorer patient satisfaction for patients with secondary arthroses. Even when one adjusts for these variables in the analysis, it turns out that patients undergoing operation at SU/Mölndal were not as satisfied as the national average.

Comparison of the least affected ('most healthy') group, those in Charnley category A or B with ASA class 1-2 showed a mean value of satisfaction after one year for patients operated on at SU/Mölndal of 19 (SD=21) and for the rest of the country 14 (SD=19, p=0.2). For the group of patients who were most sick, those in ASA class 3 or higher and who also belonged in Charnley category C, the corresponding values were 33 (standard deviation, SD=27) and 21 (SD=23, p=0.02), respectively.

Assessment

In summary we find that the low degree of patient satisfaction among patients undergoing operation at SU/Mölndal can only partly be explained by patient demography. There may be several causes of this dissatisfaction that could be ascribed to shortcomings in the care process. Information to patients can probably be improved so that the patient's expectations of the intervention are as realistic as possible. We are now evaluating this in a separate project.

Another possible cause could be our care on the patient ward. This cause has been further investigated. Patients undergoing operations for hip implants at our department are gathered on two wards that care chiefly for this patient category. During 2008 a patient questionnaire was introduced on these wards. The intention was for patients to judge the quality of care received, contact with physicians and postoperative pain relief. During autumn 2010 over 99% of the patients judged that the care was good or very good. Information from physicians was judged as good or very good in more than 95% of cases, as was pain relief. One-third of the patients, however, stated that they were not able to meet the operating surgeon after the operation, which is a shortcoming in quality.

Pain (VAS) and health-related quality of life index (EQ-5D)

Compared with the national average, patients undergoing operation at SU/Mölndal reported more pain on VAS one year after operation. They also stated more pain prior to the operation. The average pain reduction (1 year minus value before the operation) was -46.5 for SU/Mölndal compared with -47.8 for the rest of the country, without statistical significance. If the analysis is conducted separately for the relevant Charnley category we find that patients in category C have a somewhat greater pain reduction if operated on at SU/Mölndal (p=0.01), while categories A and B exhibit an improvement approximately corresponding to the national average.

Patients undergoing surgery at SU/Mölndal had lower health-related quality of life before and one year after the operation. The difference between the two questionnaire occasions was fairly similar for SU/Mölndal patients (0.38, SD=0.36) compared to the rest of the country (0.37, SD=0.34).

Assessment

Patients receiving arthroplasties at SU/Mölndal tended to have more pain and poorer health-related quality of life than the national average, a difference which to some extent persisted one year after the operation. The effect of the information is as expected when measured as EQ-5D gain. The reason for the differences demonstrated is unclear. It may possibly be that patients having operations at SU/Mölndal had different expectations and found it more difficult to apply to other hospitals. There may also be a larger proportion referred from other hospitals.

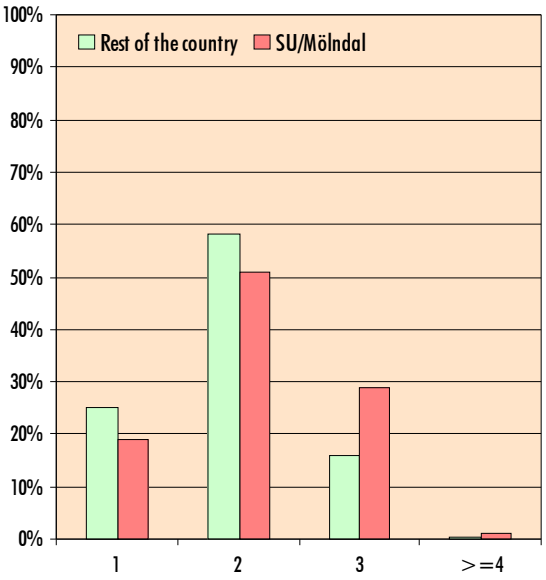


Figure 3. ASA classification (ASA = American Society of Anesthesiologists). Class 1 = healthy, 2 = systemic disease not life-threatening, 3 = serious systemic disease involving limited mobility for activity, potentially life-threatening, 4 = serious systemic disease constantly life-threatening.

Age [1)]	69 *43-89*
Man/Woman	15/21
Diagnosis	
- Primary osteoarthristis	14
- Acute hip fracture	7
- Sequele hip fracture	8
- Tumour (malignancy)	4
- Idiopatic caput necrosis	2
- Sequele childhood disease	1
BMI [1)]	26,8 *16,6-37,3*
ASA 1/2/3	1/18/17

Table 1. Patients undergoing reoperation within two years. Demographic data. [1)] Median, min-max.

Reoperation within 2 years

Of the patients receiving their primary operation at SU/Mölndal between 2006 and 2009, 41% had had reoperations up to an including 31/12/2009. Thirty-six of these reoperations fulfilled both the criteria that reoperation took place within 2 years of the primary operation and that the primary operation had taken place after fusion between the two orthopaedics clinics Mölndal and Sahlgrenska. These 36 reoperations provide the material for data in the Annual Report.

The patients undergoing early reoperation distinguished themselves in that the proportion with the diagnosis hip fracture was relatively large and just under half were classified as seriously ill (table). The higher degree of morbidity is illustrated in the fact that seven of the 36 patients had died when this compilation was made.

Reason for reoperation

Infection (n = 12). In a subsequent surgical intervention four additional cases were operated on for infection. Sometimes it was hard to determine whether the infection was pre-existing or occurred during the first reoperation.

In four of the primarily infected cases we found reasons that may have contributed to the occurrence of infection (treatment with immuno-suppression, metastasising skeletal tumours, dementia or problems of substance abuse and multiple organ failure). In 10 of these 12 the infection had probably healed by the time of the final medical-record evaluation (January 2011). Two had residual infection and one had, in addition, problems of repeated dislocation.

Dislocation (n=12). Three of these 12 cases were later assessed as infected. This infection may have been primary but may also have arisen in connection with the first reoperation. In a review of the X-ray examinations we judged that unfavourable positioning of the joint cup (high inclination, pronounced ante- or retroversion) represented a contributory cause of the hip joint instability. Where the hip cup was judged to be incorrectly positioned there were further contributory factors in three cases (serious neurological disease, psychosis). Of the three in whom the prosthesis components were judged to be well placed, two had problems of substance abuse. In the final assessment, seven of the patients had residual problems in the form of instability or infection, of whom one had been treated with extraction of the prosthesis. In five cases one or more reoperations resulted in an apparently well-functioning hip joint.

Fracture (n=6). The patients underwent reoperation for fracture in connection with the implant. Three of these cases had received uncemented implants and one a resurfacing implant. Two patients had osteoporosis that could be related to metabolic disturbances, one had a psychosis disorder and one had problems of substance abuse. One further patient had multiple skeletal metastases. Following reoperation, deep infection was diagnosed in one of the patients.

Technical errors (n=2). Two patients underwent reoperation owing to 'technical errors'. In both cases there was early loosening of the joint cup. One patient had received a trial implant (resurfacing prosthesis with a new type of fixation surface) and in the other case an uncemented cup loosened within the first two months of operation. Nothing definite was noted at the post-operative examination other than these patients' primary operation, and the cause of the early loosening is unclear. To date neither of these patients has undergone further reoperation.

Different causes (n=3). In two cases attempts were made to reconstruct a muscle/tendon insertion (medius plastic) owing to lameness and in one of these cases the joint cup was also exchanged. In the third case the reoperation was undertaken owing to a primary skeletal tumour undiagnosed during the primary operation.

Comments

Compared with the national average SU/Mölndal has had a more than doubled risk of reoperation. The main problems have been infection and dislocation. Even if the four cases afflicted by both these complications are removed, the infection frequency remains high. This can partly be explained by a high proportion of patients with serious associated diseases. Seven of the sixteen patients afflicted by deep infection were classed ASA class 3. The sixteen cases were distributed evenly in time between December 2006 and October 2009 (figure 4). Fourteen different surgeons had been involved in these sixteen cases in the primary operation. In thirteen of the fourteen cases for which operation time is available it varied between 90 and 140 minutes. In one case it was about four hours. In the majority of cases (12 of 14) another operation had been conducted in the same theatre previously. It is hard to point to any individual cause of the increased incidence of infection. To counter this problem the department took part in the PRISS project with the intention of reviewing the whole process. Seven of the operations are noted as acute which should be taken into account in the PRISS project.

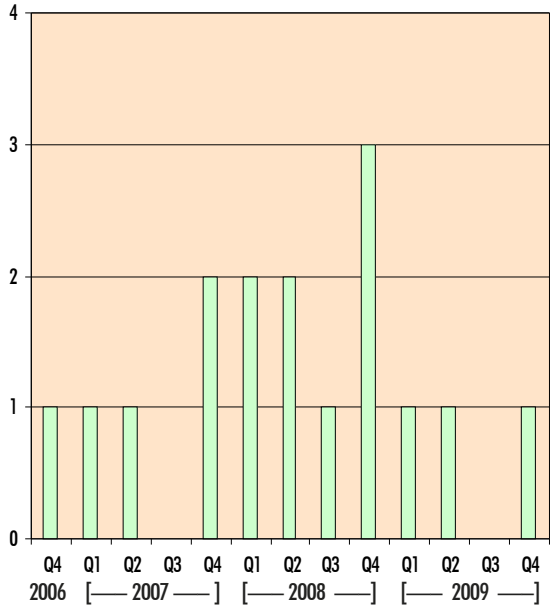


Figure 4. Incidence of reoperation for infection quarterly from 4th quarter 2006-2009. Four cases included in which primary reason for reoperation not considered to be infection.

Half the patients undergoing reoperation for dislocation had the diagnosis hip fracture and were classified as ASA class 3. Ten different surgeons performed the twelve operations. In the majority of cases (9 of 12) we judge that a poorly placed acetabular cup may have contributed. Here there are possibilities for improvement partly in the form of surgical technique and, regarding risk patients, one may consider even in the primary operation choosing an implant type with greater built-in stability (for example with a larger joint head or with dual mobility).

Six of the patients underwent reoperation owing to fractures at the connection with the implant. By being more restrictive in the choice of uncemented stems in cases with clearly poor bone quality this complication could probably be reduced.

Regarding the other causes of reoperation, in two cases they concern an implant type under trial (resurfacing). Owing to the poor results with this type of implant in which the cup component was a new development with a modified surface, the study was stopped and the implant is no longer used.

10-year implant survival

10-year implant survival is based on the number of revisions performed during the period 2000 to 2009. By revision is meant that the whole or parts of the implant are replaced or that the whole implant (or parts thereof) is extracted. During the most recent 10-year period implant survival at SU/Mölndal has been just under 90%, compared with the national average which is just under 95%. The difference is statistically significant.

The reasons for this outcome are hard to analyse against the background of the changes the fusions of the three hospitals have involved in the form of patient flow and patient demography. At SU/Mölndal the number of primary implant operations declined from 150 in 2000 to 33 in 2006. There was subsequently a successive increase up to 342 in 2009. The revisions performed on the basis of primary implants from the combined units are reported above, apart from two patients (revision of resurfacing implant, exchange of joint head in connection with soft-tissue intervention owing to lameness) who had passed the two-year limit used for reporting in connection with early reoperation. Concerning the patients having their primary operation at Mölndal hospital before the fusion and later being revised, the cause of revision was loosening in sixteen cases, dislocation in six and deep infection in five. Compared with the rest of the country the incidence of aseptic loosening is somewhat high (47% compared with 36% of all revisions). In view of the facts that the organization the Mölndal department then represented no longer exists and that data are hard to interpret owing to the large change in patient composition, we consider that these data cannot be used for further improvement work regarding today's situation.

Summary and action plan

At SU/Mölndal there is over-representation of cases with increased risk of complication. In spite of this the outcome is poorer than expected for several parameters. The following measures have been adopted to improve patient-reported outcome and reduce the number of complications:

- **Introduction of checklists on admission to ensure compliance with routines in force.**
- **Work for improvement for increased knowledge of experienced care quality and better patient preparation for operation in form of patient questionnaire with continual feed-back to caregiver plus specific development/research projects.**
- **Continual registration of number of changes of wound dressing during care period.**
- **Preoperative identification of risk patients needing implants that reduce risk of dislocation.**
- **Review of operational environment including introduction of checklists and measurement of particle content in operating theatres.**
- **Participation in PRIS.**

Mölndal 2011-01-24

Johan Kärrholm	*Jonas Thanner*	*Magnus Karlsson*
Team leader Prosthetic surgery 2006 – 2010	Team leader Prosthetic surgery 2010 –	Head of department

Follow-up of Free-Choice-of-Care scheme

Accessibility under the present care guarantee and in the previous 'free-choice-of-care' scheme is judged almost exclusively as a time variable. However, the Registry management has maintained for several years that availability must be systematically linked to outcome both in the short term and in the long term. This involves a requirement that decision-makers show greater endurance before calling for shorter waiting times for surgery as an established quality gain for the patient.

The question is whether the result of a surgical intervention is poorer if the surgeons encounter operating environments and implant types that are most often new and unknown to them or, alternatively, if patients are listed for operation at a different place than their home department and indications are given by an orthopaedic surgeon who does not then perform the operation. The highly-productive elective departments often employ surgeons from other departments to be able to meet the requirements of high production. A possible scenario can therefore be that both surgeon and patient, when they meet in theatre, come from different directions and subsequently never meet again.

Hip arthroplasty may be viewed as a standard intervention which, however, requires experience and technical competence on the part of the orthopaedic surgeon. Such simple things as positioning of the patient on the operating table, theatre logistics, local routines for antibiotic prophylaxis and different implants can sub-optimise the otherwise competent surgeon's technical result.

Since many county councils have been unable to attain the objectives of the care guarantee, we have been compelled to adopt short-term solutions with separate agreements with both public and private entrepreneurs. In this way waiting times have been shortened for the patients who have accepted operations at other hospitals than their own.

Against this background, the Registry in its Annual Report 2004 initiated analysis of patients receiving total hip arthroplasty outside their home regions during 2002 and 2003. As shown in previous reports we followed this group of patients continually. Below is a brief summary of the investigation as a basis for this year's follow-up (for details see Annual Reports 2004-2007).

Reason for reperation	Op. in home county (n = 14,785)		Free choice of care (n = 1,964)	
	No.	%	No.	%
Aseptic loosening	158	1.1	34	1.7
Deep infection	88	0.6	18	0.9
Fracture	42	0.3	4	0.2
Implant fracture	10	0.1	3	0.2
Dislocation	112	0.8	14	0.7
Technical error	11	0.1	2	0.1
Pain only	8	0.1		
Miscellaneous	20	0.1	2	0.1
Total	449	3.0	77	3.9

Table 1. Frequency of reoperation by cause for patients undergoing surgery in their county of residence and in the 'free flow'. Reoperations up to and including 2010.

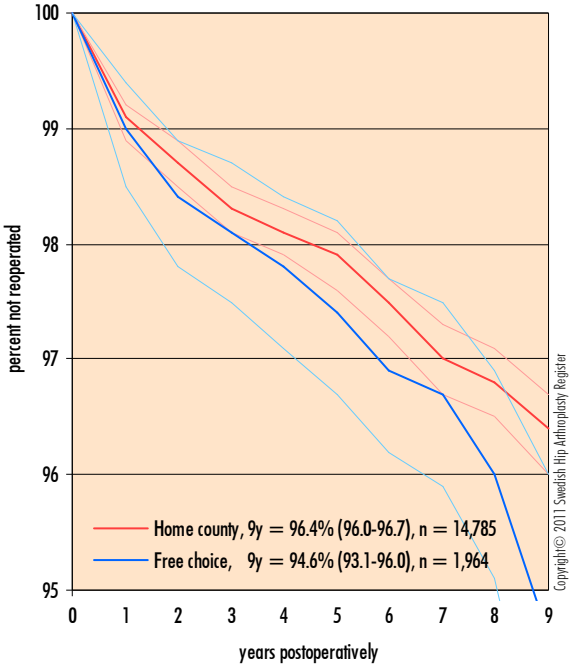


Figure 1. Implant survival for those who had surgery by "free choice of care" and those operated within the county, respectively. The difference is close to being significant according to Log Rank test (p = 0.053).

Material

- The analysis included only 'standard patients', i.e. with primary osteoarthritis as diagnosis and receiving cemented total arthroplasties outside university hospital departments (so as to avoid referred cases).
- Operated on within the county: 14,785 hips; outside the county 1,964 hips (2002 and 2003).

Earlier results

- Those who used the free choice of care were younger, with fewer women, than the national average.
- After a mean follow-up of 60 months we found a significantly increased reoperation frequency for infection among those operated on outside their county.
- Reoperation for other reasons showed no statistical difference between the two groups.
- About 85% of patients undergoing operations outside their home region and who needed reoperation were dealt with at their home departments.

This year's comparison

The mean follow-up time for this year's analysis was 96 months. In both groups a number of further reoperations were performed during 2010. The difference between the groups regarding all causes of reoperation is 0.9%. In the group that had surgery within their county, 3% have now been reoperated on. In the free-choice-of-care group the corresponding figure was 3.9%. In a Kaplan-Meier analysis the difference is now almost significant (log rank test, $p=0.053$). In the earliest analyses of this patient group we found a statistical difference regarding deep infection (see earlier Annual Reports). This difference has now no longer been significant for the past three years ($p=0.09$).

In this material, revision for aseptic loosening is now the most common cause of replacement operations. In the group within the county, 158 hips (1.1%) were revised for aseptic loosening and in the free-choice-of-care group the corresponding figure was 34 (1.7%). There is thus now a trend towards more loosening in the latter group.

Discussion

The follow-up time is now medium-long-to-long (eight years) and is starting to reflect revision for aseptic loosening to a greater extent. For many years the majority of Register analyses have shown that this type of long-term complication starts to become frequent only after 7-8 years of follow-up.

Many can criticize this increasingly historical follow-up and the fact that the groups studied do not reflect the results after today's situation – however it takes 8-10 years to detect differences regarding frequency of revision for aseptic loosening. Unfortunately the Registry lacks resources to follow a more recent cohort – primarily for an analysis of early complications. It would, however, be possible to follow continually those patients not undergoing primary surgery at their 'home department' via the National Board of Health and Welfare Patient Register (PAR). Such a follow-up is, however, limited by three factors:

- Low quality of coding regarding both diagnosis and measure. This does not affect the Register since the diagnoses and measures are grouped in the Registry's databases and all operation reports are read via the co-ordinators at the Registry.
- The PAR lacks laterality (right/left).
- Private care units have a low reporting frequency to the PAR.

For every surgeon/department to be able to retain and develop competence, the Registry management considers that they should follow their own patients and also deal with their possible complications. Many 'external' commissions under the care guarantee, however, lack such a design of contract – that is, there is no opportunity to 'learn by one's own mistakes'.

Planned analysis of the Care Guarantee

As described earlier, the procedure frequency for total hip arthroplasty has increased in Sweden by just over 8% in two years and 40% in ten years. Does this increase signify a damned-up need or a shift in indications, which in turn may depend upon the rapid-treatment requirement under the care guarantee? Operation within three months is a political decision which in reality lacks medical evidence. During the past year a discussion has arisen as to whether the care guarantee can give rise to a 'shoving-out effect' – that healthier patients obtain surgery earlier than sicker. The Registry plans, and has obtained ethical approval for, the following data matching studies:

- All primary arthroplasties conducted in Sweden during 2007 up to and including 2010 with the diagnosis primary arthritis (from the Hip Arthroplasty Register).
- The same individuals' socioeconomic index from Statistics Sweden.
- These patient's co-morbidity according to the PAR.

With this new database we will be able to describe patients' demography in detail both for those undergoing surgery 'at home' and those using the care guarantee. This in turn makes it possible to decide whether there is a 'shoving-out effect'. The result of this important analysis will be presented during 2012.

Since we consider that a time variable while awaiting operation is incomplete as a quality indicator we feel that accessibility should include the following part-parameters for a patient with hip arthritis:

- **Early-started osteoarthritis school – complete non-surgical treatment – in primary care (according to future guidelines for diseases of the locomotive organs).**
- **Short waiting time to orthopaedic surgeon and possible operation when indications exist.**
- **Follow-up by surgeon who him- or herself deals with possible complications.**

Mortality following total hip arthroplasty

Ninety-day mortality was introduced five years ago as an open variable at department level. The variable is also included as one of eight parameters in the value compass. While hip arthroplasty today is to be considered as routine it is in fact a major surgical intervention which is not entirely risk-free for the patient. Indications for implant surgery have been extended during the past few years – both nationally and internationally. More both younger and older patients are undergoing this surgery now than during the 1970s and 1980s. Above all the latter group naturally runs a greater risk of serious complications. Today, particularly at larger departments, more risk patients are undergoing surgery than formerly.

The Swedish Hip Arthroplasty Register updates its databases several times a year regarding the possible dates of death of individuals included (via the Inland Revenue).

Short-term mortality (90-day mortality)

Ninety-day mortality is an indicator frequently used in the literature and applied in many medical areas. The reasons for a patient to die in connection with or within 90 days of a hip arthroplasty (and related to the intervention) may be many but the dominant reasons are probably cardio-, cerebrovascular or thromboembolic disorders.

Owing to the low death rate the production of the most recent four years is analysed to compensate to some degree for the risk of random variability.

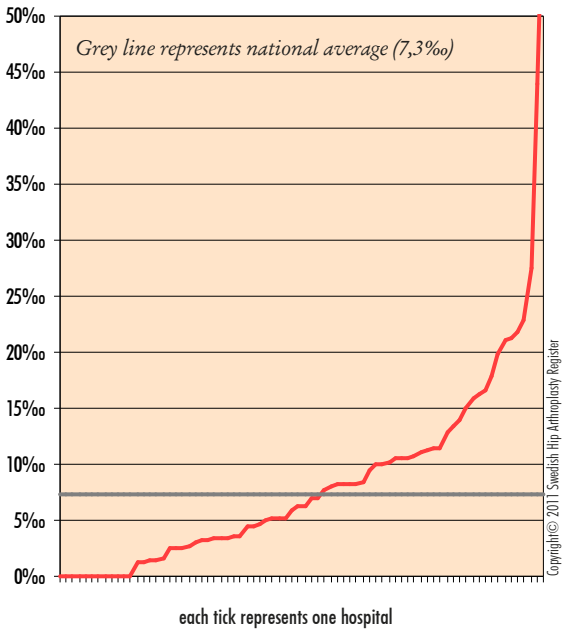
Ninety-day mortality varies among Swedish hospitals during the years of observation: from 0‰-62.7‰ with a mean value throughout the country of 7.3‰. This means at national level that one patient in about 130 undergoing arthroplasty died within three months after the operation between 2007 and 2010. As expected, 90-day mortality is higher after operations at university/regional hospitals and county hospitals than at district hospitals and particularly in comparison with private care units. This reflects the various hospitals' patient material – 'case-mix'.

Ninety-day mortality after hemi-arthroplasty is more than 20-fold higher (143‰) than for total arthroplasty. These are two entirely different groups mainly operated on using different methods. The hemi-arthroplasty patients are older, generally sicker and more often undergo an acute operation. For details and tables see the section on hemi-arthroplasty.

We recommend the departments to analyse their death rates as a step in patient security work. Patients have an expected risk of dying at the age in question, but a high-quality preoperative medicine risk assessment is something all units should strive to carry out. In such a development it is important to know how many patients have died. It is not self-evident that an orthopaedic department receives feedback as to whether a patient, for example, died from a cardiovascular complaint three weeks after the operation at another department or even at another hospital.

90-days mortality

primary THR performed during the past four years



each tick represents one hospital

The mortality rate is generally low and should be assessed with the same caution as the variable "reoperation within two years", i.e. it should be assessed as a possible trend over time.

90-days mortality

proportion deceased within three months after primary THR, 2007-2010

Hospital	No. [1]	OA [2]	≥60 years [3]	Women [4]	Mortality [5]
University/Regional hospital					
KS/Huddinge	960	69%	62%	57%	3.1‰
KS/Solna	840	69%	66%	57%	9.5‰
Linköping	236	45%	63%	56%	**21.2‰**
SUS/Lund	383	19%	74%	63%	**62.7‰**
SUS/Malmö	404	25%	77%	67%	**19.8‰**
SU/Mölndal	1,304	59%	75%	62%	11.5‰
Umeå	368	77%	64%	51%	16.3‰
Uppsala	1,271	57%	69%	56%	**22.8‰**
Örebro	723	80%	70%	57%	6.9‰
Central hospital					
Borås	779	68%	82%	59%	5.1‰
Danderyd	1,498	76%	88%	66%	8.0‰
Eksjö	794	93%	84%	52%	10.1‰
Eskilstuna	399	59%	91%	66%	**27.6‰**
Falun	1,197	89%	79%	57%	2.5‰
Gävle	604	65%	71%	52%	16.6‰
Halmstad	887	78%	86%	58%	3.4‰
Helsingborg	252	59%	88%	64%	15.9‰
Hässleholm-Kristianstad	3,395	90%	85%	57%	3.5‰
Jönköping	801	82%	83%	60%	11.2‰
Kalmar	696	78%	85%	58%	12.9‰
Karlskrona	114	26%	93%	63%	**43.9‰**
Karlstad	1,117	63%	83%	63%	**17.9‰**
Norrköping	872	71%	84%	57%	11.5‰
Skövde	472	72%	74%	54%	10.6‰
Sunderby	183	22%	86%	74%	**21.9‰**
Sundsvall	668	81%	81%	58%	1.5‰
Södersjukhuset	1,666	72%	84%	65%	15.0‰
Uddevalla	1,283	82%	82%	59%	7.0‰
Varberg	907	89%	85%	60%	4.4‰
Västerås	1,267	75%	84%	60%	13.4‰
Växjö	477	79%	86%	59%	6.3‰
Östersund	848	80%	85%	60%	8.3‰
Rural hospital					
Alingsås	842	94%	86%	61%	1.2‰
Arvika	584	90%	88%	57%	3.4‰
Bollnäs	1,139	96%	86%	58%	2.6‰
Enköping	901	94%	90%	61%	3.3‰
Falköping	927	93%	87%	54%	0.0‰
Frölunda Specialistsjukhus	310	99%	90%	65%	3.2‰
Gällivare	363	77%	89%	57%	11.0‰
Hudiksvall	526	74%	81%	58%	7.6‰
Karlshamn	787	97%	82%	54%	2.5‰
Karlskoga	485	93%	90%	59%	8.2‰

(continued on next page)

90-days mortality

proportion deceased within three months after primary THR, 2007-2010

Hospital	No. [1]	OA [2]	≥60 years [3]	Women [4]	Mortality [5]
Katrineholm	929	96%	78%	53%	0.0‰
Kungälv	787	88%	85%	60%	1.3‰
Lidköping	513	88%	85%	53%	5.8‰
Lindesberg	718	89%	91%	55%	8.4‰
Ljungby	589	86%	80%	56%	5.1‰
Lycksele	1,120	95%	87%	58%	6.3‰
Mora	780	90%	90%	57%	10.3‰
Norrtälje	474	82%	89%	64%	10.5‰
Nyköping	650	84%	82%	57%	13.8‰
Oskarshamn	846	98%	83%	54%	4.7‰
Piteå	1,422	95%	81%	57%	4.9‰
Skellefteå	364	76%	82%	59%	8.2‰
Skene	358	96%	81%	53%	0.0‰
Sollefteå	452	93%	88%	57%	0.0‰
Södertälje	478	87%	86%	60%	10.5‰
Torsby	380	87%	87%	63%	21.1‰
SUS/Trelleborg	2,375	92%	79%	58%	2.5‰
Visby	496	84%	79%	56%	10.1‰
Värnamo	548	88%	86%	61%	3.6‰
Västervik	449	83%	83%	54%	4.5‰
Ängelholm	194	97%	87%	61%	5.2‰
Örnsköldsvik	728	91%	84%	61%	8.2‰
Private hospital					
Aleris Specialistvård Sabbatsberg	281	95%	78%	66%	0.0‰
Capio S:t Göran	1,502	85%	82%	64%	10.7‰
Carlanderska	256	96%	68%	43%	0.0‰
Elisabethsjukhuset	461	90%	81%	62%	0.0‰
Movement	737	98%	80%	57%	0.0‰
Nacka Närsjukhus Proxima	269	99%	88%	62%	0.0‰
Ortho Center Stockholm	1,252	97%	83%	63%	3.2‰
OrthoCenter IFK-kliniken	332	93%	64%	43%	0.0‰
Ortopediska Huset	1,820	100%	79%	63%	1.6‰
Proxima Spec.vård Motala	437	98%	89%	58%	0.0‰
Sophiahemmet	714	100%	62%	44%	1.4‰
Spenshult	516	80%	76%	60%	0.0‰
Nation	60,437	83.5%	81.6%	58.7%	7.3‰

[1] The number of primary THRs during the current period.
[2] Proportion of primary THRs performed on patients with primary osteoarthritis.
[3] Proportion of primary THRs performed on patients 60 years or older.
[4] Proportion of primary THRs performed on women.
[5] 90-days mortality (number of patients deceased within three months after primary THR/ total number of primary THRs).

Higher values denotes lower risk for serious complication (death) for the variables [2] [3] and [4].

Notes

The gender perspective

Operations involving hip implants are more common among women. The total number of women increased between 2000 and 2010 from 6,942 to 9,305 operations/year, but their relative proportion declined from 61.3% to 58.4%. Between 2009 and 2010 the change was negligible.

Men more frequently receive all uncemented fixation. The dramatic increase in this alternative since 2000 has not occurred in both genders. In men it corresponds to a change from 3.3 to 19.0, in women from 1.9 to 11.2 (figure 1). In revision, regardless of cause the proportion of uncemented fixation also increased between 2000 and 2010 irrespective of gender. Here too the increase was more pronounced among men. The hybrid concept was used somewhat more frequently in women while the use of reverse hybrid was about equal.

Revision

In general, men are afflicted more often than women by revision regardless of choice of fixation and cause of revision following primary hip arthroplasty (men/women, relative risk = 1.43, 95% CI: 1.38-1.49: analysis of all hip arthroplasties between 1992-2010 adjusted for age, side, bilaterality and diagnosis). Men dominate the cause groups revision for infection, where the risk is more than doubled (2.03 CI: 1.81-2.27), revision for fracture (1.85 CI: 1.62-2.12) and revision for loosening (1.41 CI: 1.34-1.48). Regarding risk of revision for dislocation there is no difference (1.09 CI: 0.99-1.20).

In the use of cemented cups and stems the general risk of revision regardless of cause and measure is just under 50% higher in men (RR = 1.49 CI: 1.42-1.55). If the implant is all uncemented or of reverse hybrid type, we see no certain differences (0.91 CI: 0.80-1.03 and 1.08 CI: 0.87-1.35, respectively). In the use of hybrid implants, it is somewhat increased for men (1.14 CI: 1.02-1.29). Against this background it may be of interest to analyse how different components are revised depending on choice of fixation.

Men run a generally greater risk of cup/liner revision (including extraction) regardless of cause and with or without simultaneous stem revision. This applies primarily in the use of cemented cups (man/woman: RR = 1.46 CI: 1.38-1.53). In the use of uncemented cups this difference disappears (RR = 1.01 CI: 0.93-1.11). Isolated cup/liner revision (not extraction) in which the stem is left untouched is used more often in women (man/woman: cemented cup: 0.61 CI: 0.56-0.67; uncemented cup: 0.69 CI: 0.62-0.77).

Turning to stem revision (regardless of cause, including extraction) with or without revision of the cup, men run almost double the risk compared to women (1.91 CI: 1.83-2.02). Separate analysis of cemented and uncemented stems shows that the difference is greater in the use of cemented stem (man/woman: 1.95 CI: 1.85-2.05) and smaller in the use of uncemented (1.50 CI: 1.24-1.81). The corresponding evaluation based on isolated stem revision (excluding extraction) shows that the gender differences tend to decline (cemented stem: 1.88 CI: 1.72-2.07; uncemented stem: 1.33 CI: 1.03-1.72). All the above analyses are adjusted for age, diagnosis, side, bilaterality and where relevant, fixation of stem and cup respectively. Resurfacing prostheses have been excluded and are reported separately.

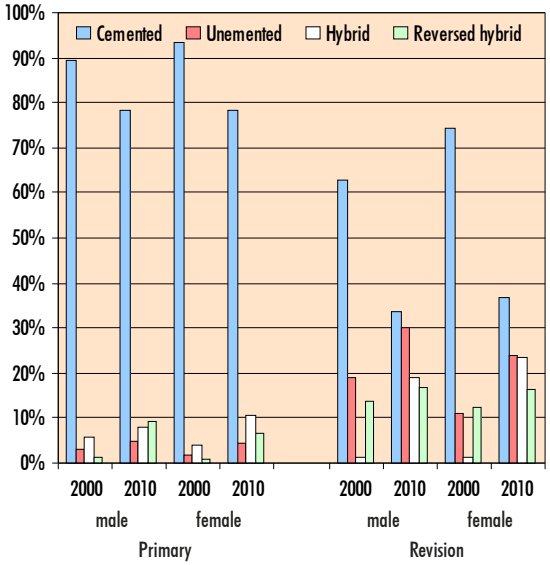


Figure 1. Choice of fixation 2000 and 2010, respectively at primary and revision surgery. Resurfacing implants is excluded (2,9% men, 0,2% women 2010).

The gender difference in choice of measure can partly be affected by the fact that this is governed by the underlying causes of revision, where there are gender differences as above. Increased risk for men to suffer combined stem/cup loosening is an example of such an explanation.

In summary women have a generally smaller risk of being affected by both cup and stem revision. The difference is pronounced in the use of cemented components and less so regarding the risk of revision of uncemented stems. The risk of revision of uncemented cups regardless of measure does not differ between the sexes. Isolated cup revision is conducted more often in women. Gender-related differences in bone quality, the anatomical form of the thigh bone and the acetabular region, and the choice of type and degree of activity following the implant operation, could at least partly explain why choice of fixation can result in differing outcomes between women and men.

Patient-reported outcome

Before primary hip arthroplasties women reported lower health-related quality of life and a somewhat higher degree of pain on a VAS (see table on next page). One year after operation women stated a better effect of the intervention, measured both as improvements in health-related quality of life and reduction in pain. Despite this women still reported somewhat lower health-related quality of life and more pain and less satisfaction one year after the intervention ($p < 0.0005$; logical regression with correction for age, diag-

	No.	Mean (median) *S.D.*
EQ-5D index		
Before surgery:		
- Male	27,073	0.45 (0.62) *0.31*
- Female	37,006	0.37 (0.26) *0.32*
1 year:		
- Male	23,693	0.79 (0.80) *0.24*
- Female	34,541	0.74 (0.76) *0.26*
6 years:		
- Male	2,273	0.77 (0.80) *0.26*
- Female	3,439	0.70 (0.73) *0.29*
Change		
Before surgery - 1 year:		
- Male	19,576	0.35 (0.28) *0.34*
- Female	26,969	0.38 (0.34) *0.35*
1 year - 6 years:		
- Male	2,203	-0.03 (0.00) *0.26*
- Female	3,321	-0.06 (0.00) *0.28*
Satisfaction VAS		
1 year:		
- Male	23,699	16 (10) *20*
- Female	34,546	19 (10) *22*
6 years:		
- Male	2,273	16 (10) *20*
- Female	3,437	20 (10) *22*
Change		
1 year - 6 years:		
- Male	2,203	1 (0) *19*
- Female	3,319	1 (0) *21*
Pain VAS		
Before surgery:		
- Male	27,079	59 (60) *17*
- Female	37,014	64 (69) *16*
1 year:		
- Male	23,702	14 (7) *18*
- Female	34,545	15 (10) *19*
6 years:		
- Male	2,273	15 (8) *19*
- Female	3,439	17 (10) *21*
Change		
Before surgery - 1 year:		
- Male	19,588	-46 (-49) *23*
- Female	26,973	-49 (-50) *23*
1 year - 6 years:		
- Male	2,203	2 (0) *20*
- Female	3,321	2 (0) *22*

nosis, choice of incision and Charnley category).

Six years after the operation women had lost more in health-related quality of life ($p < 0.0001$) and also had a lower EQ-5D index ($p = 0.004$). Even though the change in pain and satisfaction between one- and six-year follow-ups is negligible and is the same between the sexes, we find no certain difference between men and women for the values measured at six years, following adjustment for age, diagnosis and incision.

Hemi-arthroplasty in primary treatment of fracture

The major indications for hemi-arthroplasty are acute cervical hip fracture, representing 93.6% of cases during 2005-2010 (n=24,241). In this year's Report, as earlier, we have limited the analysis of gender perspective to this group. The majority of patients receiving hemi-arthroplasty for primary fracture are women (2005-2010: 71.6%). In 2005, 73.3% were women. Their relative proportion subsequently declined slowly to 69.5% during 2010.

During the whole period 2005-2010 approximately equal proportions of men and women received cemented stems (94.6% and 94.5%, respectively). At the beginning of this period women, however, more frequently received monoblock implants (men/women 2005-2010: 7.4/9.0%), while men somewhat more often received a more modern uncemented stem (3.1%/2.8%), normally of Corail type (73.9%) or some variant of the Bi-Metric (19.6%). During 2010, monoblock stems practically disappeared (four stems registered). Modern uncemented stems are also used sparingly. In 2010, 3.5% of the men and 3.2% of the women received this type of implant.

Almost all operations were conducted with a posterior (2005-2010: 47.7%) or anterior incision in the lateral position (41.5%) or supine (10.2%) position. During 2005 the proportion of patients operated on using anterolateral access, which is preferable to avoid problems of dislocation, increased from 45.0% in 2005 to 64.0% in 2010 among men. Among women the increase was not so large, from 46.5% to 61.4%.

Men more often undergo reoperation irrespective of cause than women do (1.28 CI: 1.11-1.48) after adjustment for age, side, choice of incision and type of stem used (modern cemented, modern uncemented, monoblock). Among the three most common reasons for reoperation, dislocation 1.10 CI: 0.88-1.37), infection (1.17 CI: 0.89-1.54) and periprosthetic fracture (2.10 CI: 1.51-2.94), there was a statistically established risk only for the latter.

The risk of revision (exchange or extraction of the whole, or components, of the prosthesis) is also greater among men (1.28 CI: 1.09-1.50). The risk of revision for dislocation (1.14 CI: 0.91-1.44) and infection (1.17 CI: 0.83-1.65) does not differ significantly. On the other hand men run a greater risk of revision for fracture (2.06 CI: 1.38-3.07).

Hip fracture and implant surgery

Method and material

The material was taken from the Patient Register (National Board of Health and Welfare) and is one of the national quality indicators for diseases of the locomotive system, included in this year's edition of Öppna jämförelser (Open Comparisons).

The selection criterion was cervical hip fracture (ICD-10: S72.00) in patients aged over 64 years. The observation time was 2009 and 2010. The indicator shows the proportion of patients treated primarily with hemi-arthroplasty (NFB 09 and 19) or total arthroplasty (NFB 29, 39, 49, 62 and 99). Hemi-arthroplasty dominated with about 79% of the material. In last year's analyses hemi-arthroplasty represented 85% of the material, i.e. there is a trend towards an increase in the proportion of total arthroplasty for hip-fracture patients.

Results

Please see the table and bar diagram below. The results of the analysis show a large spread between the various county councils of 44% - 69% and a national mean value of 60.6%. The variation at unit level is, as expected, larger: 34.3% - 77%.

Discussion

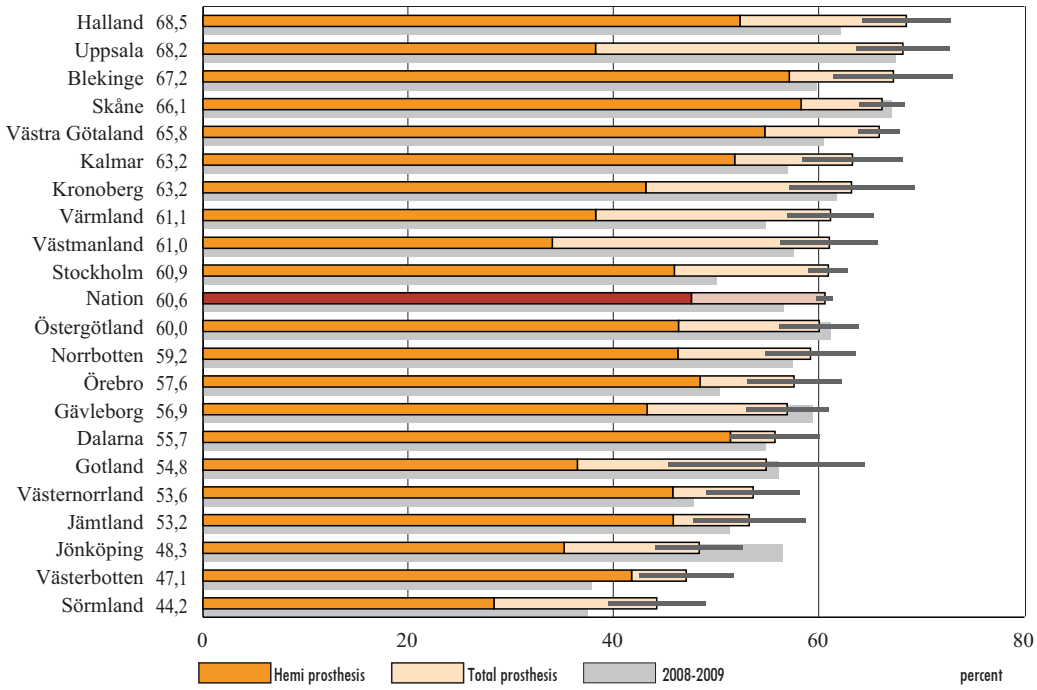
Cervical hip fracture can be treated either with osteosynthesis or with hip implants. The present research has shown that hip implants used for a dislocated fracture (Garden III and IV) give a considerably better result with fewer than 10% failed cases compared with 40%-50% after osteosynthesis. This information has led to a change in the treatment model in Sweden during the past ten years. The proportion of patients receiving implants has increased appreciably during the past ten years, from 11% to 60.6%, in the country as a whole.

A proportion of 65%-70% should be given hip implants in the first instance, primarily following an evidence-based treatment algorithm. Approximately 30%-35% of cervical fractures, however, must still be treated with osteosynthesis since they are not misaligned, or else they occur in younger individuals (where there may be advantages with osteosynthesis). In addition acute life-threatening disease may mean that the more limited osteosynthesis operation is selected.

In view of the present research results the large variability found between county councils and above all at unit level is surprising. However, this year's analysis shows that we are nevertheless starting to approach the target level nationally.

Proportion hip replacements after hip fracture

65 years or older, 2009-2010



Hopsital	Number of prostheses 2009-2010	Primary prosthesis surgery after cervical hip fracture	C.I
Akademiska sjukhuset	280	69.2%	±4.5%
Alingsås lasarett	59	56.2%	±9.2%
Arvika sjukhus	49	70.9%	±10.6%
Blekingesjukhuset	168	67.2%	±5.9%
Danderyds sjukhus	287	57.1%	±4.4%
Falu lasarett	204	56.3%	±5.2%
Gällivare lasarett	45	37.9%	±8.6%
Gävle sjukhus	241	64.4%	±4.8%
Halmstads sjukhus	155	73.1%	±6.1%
Helsingborgs lasarett	278	63.9%	±4.7%
Huddinge sjukhus	169	57.2%	±5.7%
Hudiksvalls sjukhus	101	45.3%	±6.6%
Hässleholms sjukhus	290	64.4%	±4.5%
Höglandssjukhuset	81	44.7%	±7.0%
Karlskoga lasarett	40	34.3%	±9.2%
Karlstads sjukhus	203	62.3%	±5.2%
Karolinska sjukhuset	108	54.3%	±7.0%
Kungälvs sjukhus	147	77.0%	±5.8%
Lindesbergs lasarett	59	66.0%	±10.3%
Ljungby lasarett	52	67.4%	±10.3%
Lycksele lasarett	1	1.3%	±2.5%
Länssjukhuset Kalmar	191	76.3%	±5.5%
Mora lasarett	86	56.4%	±7.8%
Motala lasarett	68	61.0%	±7.7%
Mälarsjukhuset	122	42.9%	±5.9%
Norrlands Universitetssjukhus	129	57.8%	±6.4%
Norrtälje sjukhus	82	58.3%	±8.2%
NU-sjukvården	396	71.1%	±3.7%
Nyköpings sjukhus	71	48.2%	±8.1%
Ryhov länssjukhus	128	56.9%	±6.5%
S:t Görans sjukhus	375	69.7%	±4.1%
Sahlgrenska universitetssjukhus	579	65.2%	±3.2%
Skaraborgs sjukhus	28	59.7%	±14.4%
Skellefteå lasarett	84	49.7%	±7.7%
Sollefteå sjukhus	49	50.9%	±10.1%
Sunderbyns sjukhus	234	65.9%	±5.0%
Sundsvalls sjukhus	134	47.9%	±5.9%
SÄ-sjukvården	154	53.7%	±5.9%
Södersjukhuset	482	62.7%	±3.5%
Södertälje sjukhus	71	50.5%	±8.5%
Torsby sjukhus	53	61.1%	±10.2%
Universitetssjukhuset i Linköping	144	63.6%	±6.3%
Universitetssjukhuset i Lund	260	68.5%	±4.8%
Universitetssjukhuset MAS	406	67.2%	±3.7%
Universitetssjukhuset Örebro	174	59.9%	±5.6%
Varbergs sjukhus	156	64.5%	±6.1%
Visby lasarett	51	56.1%	±9.5%
Vrinnevisjukhuset	140	57.0%	±5.9%
Värnamo sjukhus	50	37.0%	±8.1%
Västerviks sjukhus	63	44.3%	±8.2%
Västerås lasarett	251	60.5%	±4.8%
Växjö lasarett	99	61.0%	±7.3%
Ystads lasarett	12	68.5%	±23.0%
Örnsköldsviks sjukhus	63	70.9%	±9.2%
Östersunds sjukhus	170	52.6%	±5.4%
Nation	8,575	60.6%	±0.8%

Operating on 65% to 70% of all cervical fractures with implants, however, places great demands upon the departments, with reorganization of on-call work and requirements for greater surgical competence. One reason for hesitating in certain departments/county councils before fully implementing the new model is the proposition that prolonged operation times and implant costs make the care of hip fractures more expensive.

This treatment model probably makes the first care occasion more expensive but since it results in a five-fold reduced reoperation frequency it is on the contrary very cost-effective. Primary hip implants also lead to less pain, simpler rehabilitation and better health-related life quality for the patient.

Hemi-arthroplasty

Demography and mortality

2010 was the sixth year in which hemi-arthroplasties have been registered. The number of registered operations (4,502) was at the same level as the two previous years. In total there are now 25,913 operations registered. Acute fracture is still clearly the most common cause (93.6%), followed by complications after osteosynthesis (4.9%) and malignancy (1.3%). A few patients had other diagnoses (0.2%). Though small, the two latter groups are made up of individuals with completely different circumstances than fracture patients and are therefore excluded from our analyses.

The proportion of men and older individuals appears to have stabilized – in 2010, 31% were men and 47% over 85 years (figure 1). Most had other diseases leading to functional limitations (ASA 3: 54%) or life-threatening disease states (ASA 4: 6%). It is therefore a vulnerable group that is treated with hemi-arthroplasty, and this is reflected in the mortality figures. One-year mortality is 24%, with an even poorer prognosis for men (33%) than for women (20%). Dementia, ASA grade 3 or higher, and greater age, also increase the risk of death, while fixation type – cemented or uncemented stem – do not affect mortality (Cox regression analysis). After five years 45% had died, 55% of the men and 41% of the women.

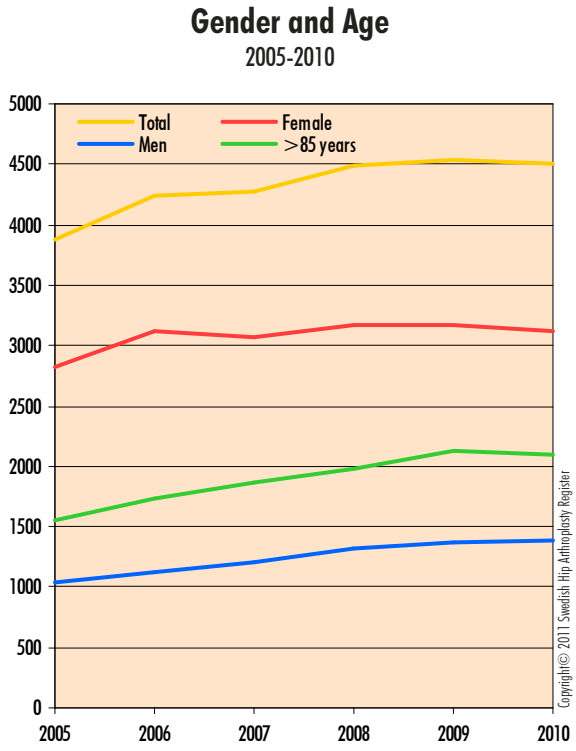


Figure 1.

Early mortality

Early mortality is affected appreciably by the care given in connection with the hip fracture. Mortality during the 90 post-operative days is therefore used as a quality variable. The national average is 14.3% and the hospitals' results vary between 7% and 21% (see table page 97). However, mortality is also appreciably affected by the department's treatment principles and possible patient selection. If the very oldest, frailest and the demented receive osteosynthesis – a inferior treatment – instead of hemi-arthroplasty, the mortality figures for hemi-arthroplasty can be 'improved'. If a department is inclined to go up in age with total arthroplasty – probably a better treatment – instead of hemi-arthroplasty, the mean age in the remaining group receiving hemi-arthroplasty increases, and the mortality figures can also be expected to rise.

Each hospital must use its mortality figures as a tool for quality improvement. Even if changes are noted from the previous Annual Report, such as that Linköping decreased its mortality from 25% to 19% and Helsingborg from 18% to 12%, while Uppsala increased from 16% to 22%, the differences are not significant (chi-2 test).

Early reoperation

There is a large variation among hospitals for reoperation within six months (see table page xx), between 0 and 10.7% of patients undergoing reoperation. An underreporting can of course lie concealed behind the figures. Annually, hospi-

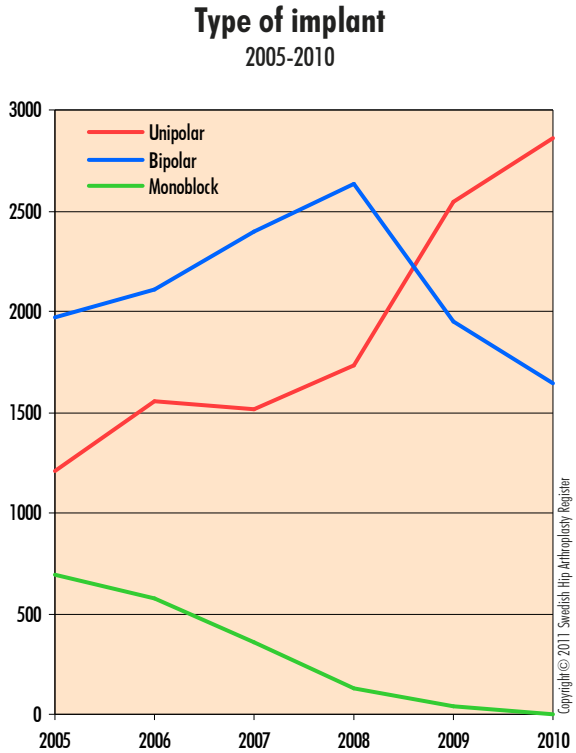


Figure 2.

tals receive a compilation of in-reported operations and re-operations, and the secretaries are urged to check that this is correct. An in-depth analysis to elucidate completeness for reoperations is planned.

The figures reported to the Registry, however, are an important tool for local improvement work. Hospitals with high reoperation frequencies should analyse their care chains and surgical techniques.

Karolinska/Solnas's high reoperation frequency is probably explained by an entirely different 'case-mix', with younger patients and many cancer-related interventions. Other larger departments with a high proportion of reoperations have a conventional distribution of diagnoses and age groups. Some of these departments used bipolar heads and posterior incisions, which results in more open interventions for dislocation. An increased number of infection cases is also seen. Regardless of the nature of the complications, the causes must be analysed locally.

The department's attitude to complications affects the variable, as does the fact that the Registry notes open surgery only in the case of dislocation. An active approach e.g. to dislocation can lead to revision surgery after just a few dislocations, while in other cases it may be decided to refrain from reoperation. The same applies to the other complications.

Implant and operation technique

A few implants dominate – the Lubinus and Exeter stems and the Vario Cup unipolar implant head (former Mega Caput) and the UHR (see tables on pages 94). The seven most common stems and the ten most common heads are used in more than 90% of operations. That a small number of implants are used in large volumes simplifies evaluation and quality assurance via the Registry. Using proven implants benefits the patients. The disadvantage, however, may be that this tradition makes it harder for new implants to enter the Swedish market.

However, Swedish orthopaedic surgeons have modified their way of operating, probably because of the Registry's earlier Annual Reports and other research results. As noted earlier the 'monoblock' implants have now disappeared; in 2010 only one Moore and one Thompson implant of monoblock model were inserted. The proportion of bipolar implants and posterior incisions, respectively, continues to decrease. In 2010 they were used in 36% and 37% of cases, respectively (figures 2 and 3). The proportion of uncemented implants remains unchanged at an internationally very low level (3.5%). All these implants and techniques have been identified by the Registry as having increased risks of reoperation and reduction and the reduction is probably a clinical breakthrough for our reporting.

Reason for reoperation
2005-2010

Reason	No.	% of prim. op.	% of reop.
Dislocation	437	1.7	44.3
Infection	289	1.1	29.3
Fracture	155	0.6	15.7
Erosion	45	0.2	4.6
Aseptic loosening	12	0.0	1.2
Others	49	0.2	4.9
Total	987	3.8	100

Table 1.

Type of approach
2005-2010

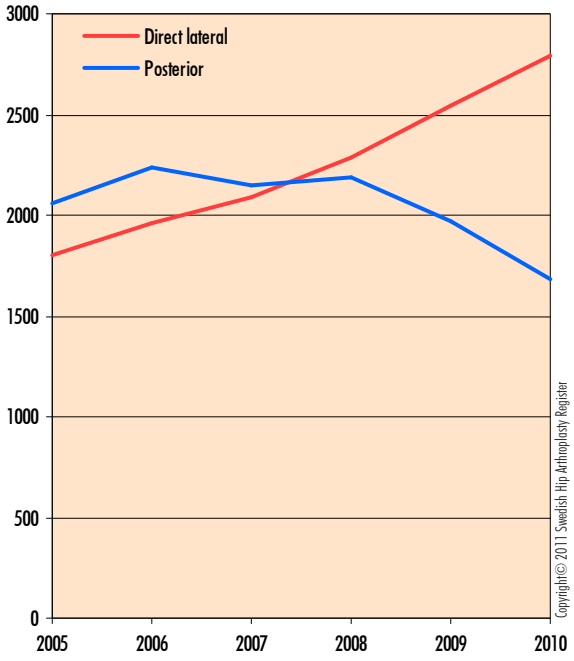


Figure 3.

Reoperations and revisions

The Register includes reoperations in the form of open surgery (thus not close reduction of dislocation). Some reoperations are revisions, i.e. interventions where some implant component is exchanged. According to the reporting to the Registry, 987 hips (3.8%) have undergone reoperation since 2005, of which 792 (3.1%) with revision. The commonest causes are dislocation, infection and periprosthetic fractures (table 1).

Risk factors for reoperation

A current analysis in progress includes the individuals who had primary surgery with modular implants via one of the three standard incisions for acute fracture or fracture complications. This means that interventions caused by malignity, monoblock implants and mini-incisions are not included.

In total 23,509 hips are undergoing a Cox regression analysis. Preliminary data indicates that male gender, secondary arthroplasty, uncemented stems and bipolar heads increases the risk of reoperation. The elderly (over 85 years) had lower risk of reoperation of any kind, and particularly due to infection (Figure 4 and 5). Different causes of reoperation were influenced by different risk factors. For example, dislocation related reoperations were more common after dorsal approach and in younger patients. For reoperation of any kind, the approach seems not to influence the risk (Figure 6). Uncemented stem carries a greater risk of periprosthetic fractures, and so do males.

With a longer follow-up, risk factors for reoperation caused by erosion can now also be identified. Unipolar head and younger age increases the risk. However, there are very few cases, totally 41 reoperations for erosion.

Understanding how an individual's health state affects the risks of – and decisions about – reoperation is particularly important. For this reason, the ASA grade and degree of dementia are noted, to describe health state in a simple manner. Neither of these variables affects the risk of reoperation, either in general or for specific causes when they are included in a regression analysis.

How should the results be interpreted?

The risk of complications and reoperations is affected by many factors, of which most cannot be measured and registered in any simple way. The interactions between a number of factors determines the final result. An individual or at least a group-based balance must be struck when the decision on the most suitable treatment is taken.

Direct lateral incision is to be recommended to reduce the risk of dislocation, the most common and early-appearing complication. In the long run, however, the incision makes no difference regarding risk of reoperation. Uncemented stems appear unsuitable for all fracture patients owing to an increased risk of periprosthetic fracture. Most hip fracture patients have osteoporosis and/or increased risk of falls, which adds to the risk of fracture near the implant. There are differences within the group of cemented stems; a straight polished stem has an increased risk of periprosthetic fracture compared with curved, matt stems. The latter have practically no such fractures, which is why the relative increase in risk for other stem types is so noticeable. A matt stem in Sweden usually means a Lubinus SPII stem, the Vario Cup bipolar head of which, in the other hand, increases dislocation problems (see earlier Annual Reports). Dislocation is more common than fractures near the implant. Perhaps we should not use bipolar heads at all since they entail an increased risk of reoperation in general, and of dislocation and infection in particular. Against this is our finding, after a sufficiently long follow-up, that the unipolar head increases the risk of reoperation for erosion.

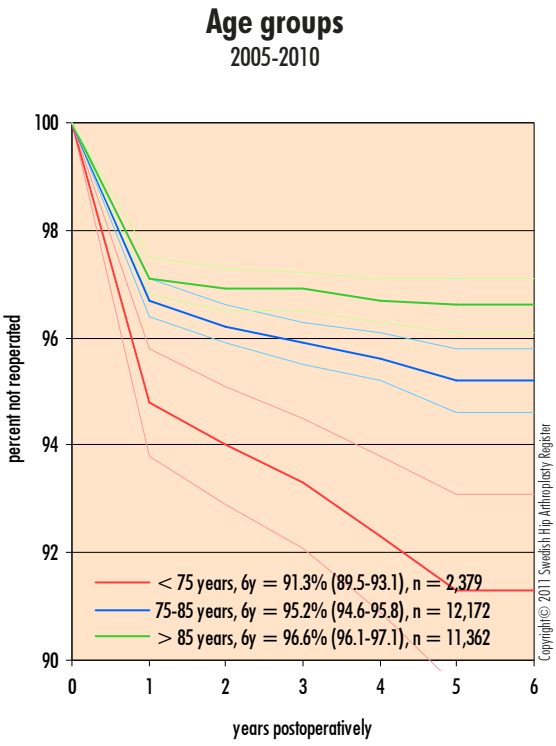


Figure 4.

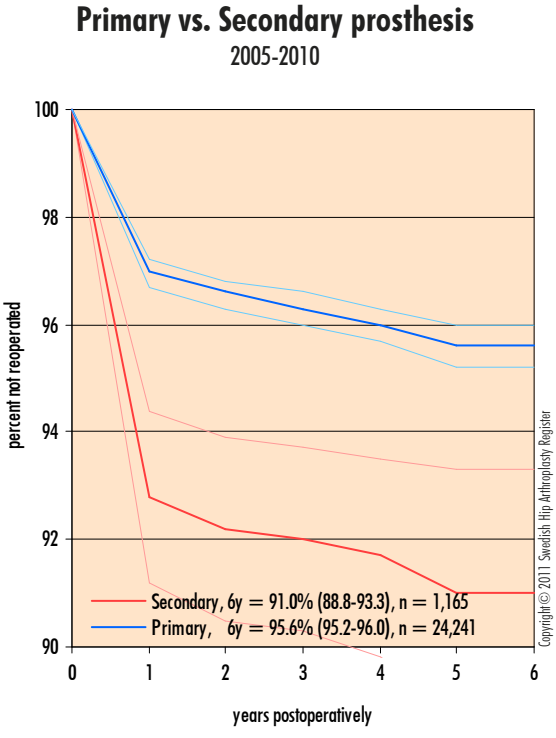


Figure 5.

We have also feared that reoperation as a result measure is affected by the patient's age and health state. Perhaps a very old or ill patient is advised not to undergo reoperation when there is a complication and is treated non-operatively instead? For this reason it is of value to see that neither high ASA grade nor dementia affected the risk of reoperation. But the fact that the oldest people ran a smaller risk of reoperation is probably a combined effect of the fact that they survived for a shorter time and were less active (i.e. did not have time to develop long-term complications) and they were possibly advised not to undertake reoperation or refrained from the operation where such was not imperative, e.g. for erosion or dislocation.

In summary, the patient's biological age – i.e. probable remaining life expectation – functional ability and specific risk factors must be weighed in. An aged individual with a limited walking range can receive a unipolar head without evident risk of developing erosion. An active 'younger' fracture patient should at least receive a bipolar head but probably has the best result with a total arthroplasty. The use of total arthroplasty in those without cognitive impairment is well supported in randomized studies, and a comparison between total implants and hemi-arthroplasties of different types is a future project for the Registry.

If a patient falls frequently, which often applies to demented individuals living in institutions, a curved, matt stem should be used to reduce the risk of femur fracture. A small number of fracture patients are of working age and have perhaps 30-40 years of remaining life. For this group information should be obtained as soon as possible from the total arthroplasty data base and its osteoarthritis patients – uncemented stem and posterior incision may be an alternative.

Having a robust treatment algorithm, with defined operation methods for the basic types of hip fracture and structured supervision for inexperienced colleagues, has proved in studies to reduce the risk of reoperation.

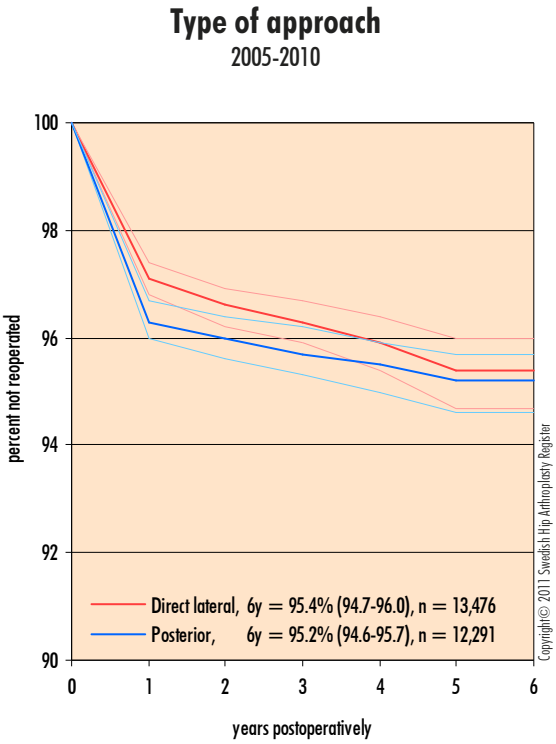


Figure 6.

15 most common stem types

2005-2010

Stem	2005	2006	2007	2008	2009	2010	Total	Prop. [1]
Lubinus SP II	1,469	1,665	1,966	2,095	1,970	1,931	11,096	42.8%
Exeter Polished	870	936	1,040	1,205	1,401	1,443	6,895	26.6%
CPT (CoCr)	187	211	240	275	336	342	1,591	6.1%
Spectron EF Primary	351	409	182	107	169	159	1,377	5.3%
Thompson	354	360	244	168	44	2	1,172	4.5%
Covision straight	0	0	24	152	240	275	691	2.7%
Austin Moore (Anatomica)	329	220	78	23	28	2	680	2.6%
MS30 Polished	0	1	111	177	168	167	624	2.4%
Corail Collarless	26	96	92	109	94	95	512	2.0%
ETS Endo	98	104	129	48	0	0	379	1.5%
Müller Straight	101	84	60	25	0	0	270	1.0%
Basis	0	41	50	54	62	19	226	0.9%
Bi-Metric Fracture Stem	42	53	19	13	2	0	129	0.5%
Charnley	26	31	3	0	0	0	60	0.2%
Spectron Revision	6	10	2	8	7	4	37	0.1%
Other (24)	15	23	26	28	17	63	172	0.0%
Missing	0	0	1	1	0	0	2	0.0%
Total	3,874	4,244	4,267	4,488	4,538	4,502	25,913	100%

[1] Proportion of the total number of operations with hemi-prosthesis performed 2005-2010.

15 most common head types

2005-2010

Head	2005	2006	2007	2008	2009	2010	Total	Prop. [1]
Vario Cup	1,015	1,053	1,320	1,381	802	550	6,121	23.6%
Unipolar head	463	655	681	705	1,180	1,413	5,097	19.7%
UHR Universal Head	604	583	638	709	683	685	3,902	15.1%
V40 Uni polar	277	333	377	498	725	766	2,976	11.5%
Ultima Monk	317	435	388	429	325	281	2,175	8.4%
Unipolar head	337	451	228	152	181	136	1,485	5.7%
Unipolarhuvud	95	57	120	106	92	94	564	2.2%
Versys endo	5	5	61	105	123	159	458	1.8%
Covision unipolar head for sleeves	0	0	7	33	153	165	358	1.4%
Covision unipolar head	0	0	19	125	87	111	342	1.3%
Multipolar cup	0	1	37	73	71	70	252	1.0%
Tandem bipolar	0	0	0	14	62	51	127	0.5%
Moore modular hemi-head (Anatomica)	33	51	13	4	0	0	101	0.4%
Hastings	26	31	3	0	0	0	60	0.2%
Scan bipolar head	10	3	6	9	2	0	30	0.1%
Other (8)	1	8	15	15	8	18	65	0.3%
Missing	1	1	0	0	2	0	4	0.0%
Monoblock	690	577	354	130	42	3	1,796	6.9%
Total	3,874	4,244	4,267	4,488	4,538	4,502	25,913	100%

[1] Proportion of the total number of operations with hemi-prosthesis performed 2005-2010.

Reoperation within 6 months per hospital

2009-2010

Hospital	No. of prim.op. [1]	No. of reop. [2]	Prop. [3]
Universitety/Regional hospital			
Karolinska/Huddinge	195	2	1.0%
Karolinska/Solna	161	13	8.1%
Linköping	165	2	1.2%
Lund	301	12	4.0%
Malmö	432	19	4.4%
SU/Mölndal	625	9	1.4%
Umeå	147	1	0.7%
Uppsala	200	7	3.5%
Örebro	207	7	3.4%
Central hospital			
Borås	146	3	2.1%
Danderyd	282	12	4.3%
Eksjö	98	5	5.1%
Eskilstuna	123	5	4.1%
Falun	238	15	6.3%
Gävle	244	5	2.0%
Halmstad	141	6	4.3%
Helsingborg	331	11	3.3%
Hässleholm-Kristianstad	244	8	3.3%
Jönköping	114	7	6.1%
Kalmar	211	14	6.6%
Karlskrona	179	3	1.7%
Karlstad	134	8	6.0%
Norrköping	122	1	0.8%
Skövde	166	0	0.0%
Sunderby (incl. Boden)	250	6	2.4%
Sundsvall	128	9	7.0%
Södersjukhuset	463	10	2.2%
Uddevalla	450	9	2.0%
Varberg	153	4	2.6%
Västerås	167	11	6.6%
Växjö	83	1	1.2%
Ystad	107	2	1.9%
Östersund	176	5	2.8%
Rural hospital			
Alingsås	76	2	2.6%
Arvika	54	0	0.0%
Hudiksvall	84	2	2.4%
Karlskoga	63	0	0.0%
Kungälv	138	1	0.7%
Lidköping	73	2	2.7%
Mora	85	1	1.2%
Norrtälje	83	3	3.6%

(continued on next page)

Reoperation within 6 months per hospital (cont.)

2009-2010

Hospital	No. of prim.op. [1]	No. of reop. [2]	Prop. [3]
Nyköping	56	6	10.7%
Skellefteå	87	6	6.9%
Sollefteå	62	3	4.8%
Södertälje	65	5	7.7%
Torsby	61	0	0.0%
Visby	66	3	4.5%
Västervik	73	4	5.5%
Örnsköldsvik	91	2	2.2%
Private hospital			
Capio S:t Göran	425	3	0.7%
Nation	9,040	287	3.2%

[1] The number of primary operations during current period.
[2] The number of reoperations within 6 months of [1].
[3] The quotient between [2] and [1] in percent.

Red text denotes values one standard deviation above national average. Hospitals with fewer than 50 hemi-arthroplasties 2009-2010 is excluded.

90-days mortality after hemi-artroplasty per hospital

proportion deceased within three months after hemi-arthroplasty, 2009-2010

Hospital	No. [1]	>80 years [2]	Male [3]	ASA=3 [4]	ASA=4 [5]	Primary prostheses [6]	Surgery within 24h [7]	Mortality [8]
University/Regional hospital								
Karolinska/Huddinge	195	71%	36%	63%	16%	94%	52%	14.4%
Karolinska/Solna	161	57%	39%	68%	13%	94%	64%	21.1%
Linköping	165	71%	27%	34%	8%	96%	50%	19.4%
Lund	301	78%	33%	63%	4%	96%	56%	15.0%
Malmö	432	77%	32%	76%	7%	94%	47%	15.5%
SU/Mölndal	625	75%	32%	54%	5%	95%	48%	14.1%
Umeå	147	59%	31%	83%	0%	98%	86%	17.0%
Uppsala	200	80%	34%	61%	5%	95%	40%	22.0%
Örebro	207	73%	30%	44%	3%	94%	55%	12.1%
Central hospital								
Borås	146	82%	31%	62%	6%	94%	47%	17.1%
Danderyd	282	81%	29%	62%	10%	96%	66%	16.7%
Eksjö	98	74%	24%	52%	2%	90%	74%	17.3%
Eskilstuna	123	78%	28%	50%	5%	95%	51%	14.6%
Falun	238	66%	28%	42%	3%	97%	62%	10.9%
Gävle	244	75%	25%	53%	6%	97%		16.0%
Halmstad	141	79%	33%	42%	6%	94%	49%	21.3%
Helsingborg	331	70%	31%	41%	5%	95%	65%	11.8%
Hässleholm-Kristianstad	244	73%	28%	45%	5%	97%		16.8%
Jönköping	114	82%	28%	43%	1%	94%	61%	11.4%
Kalmar	211	73%	28%	34%	1%	95%	74%	11.4%
Karlskrona	179	74%	27%	37%	8%	96%	64%	15.1%
Karlstad	134	79%	31%	60%	2%	96%	69%	19.4%
Norrköping	122	87%	34%	47%	3%	96%	59%	19.7%
Skövde	166	66%	34%	39%	2%	96%	52%	12.7%
Sunderby (incl. Boden)	250	65%	32%	67%	6%	95%	76%	15.2%
Sundsvall	128	72%	36%	54%	0%	97%	88%	11.7%
Södersjukhuset	463	76%	30%	58%	13%	95%	64%	12.7%
Uddevalla	450	74%	36%	50%	6%	94%	49%	15.8%
Varberg	153	74%	37%	26%	1%	99%	55%	10.5%
Västerås	167	80%	22%	47%	5%	95%		18.6%
Växjö	83	80%	33%	38%	19%	96%	62%	13.3%
Ystad	107	72%	33%			97%	71%	11.2%
Östersund	176	76%	24%	50%	3%	97%	63%	9.7%
Rural hospital								
Alingsås	76	59%	30%	42%	1%	93%	77%	9.2%
Arvika	54	83%	30%	57%	7%	96%	54%	9.3%
Hudiksvall	84	61%	31%	49%	4%	99%	78%	14.3%
Karlskoga	63	78%	27%	30%	2%	95%	63%	15.9%
Kungälv	138	71%	35%	66%	6%	99%	62%	13.8%
Lidköping	73	68%	29%	49%	3%	92%	72%	12.3%
Mora	85	82%	28%	24%	0%	94%	80%	10.6%
Norrtälje	83	73%	31%	61%	11%	98%	82%	18.1%

(continued on next page)

90-days mortality after hemi-artroplasty per hospital (cont.)

proportion deceased within three months after hemi-arthroplasty, 2009-2010

Hospital	No. [1]	>80 years [2]	Male [3]	ASA=3 [4]	ASA=4 [5]	Primary prostheses [6]	Surgery within 24h [7]	Mortality [8]
Rural hospital								
Nyköping	56	88%	21%	40%	6%	96%	48%	14,3%
Skellefteå	87	72%	26%	52%	2%	94%	81%	18,4%
Sollefteå	62	76%	31%	43%	0%	92%		16,1%
Södertälje	65	63%	34%	79%	3%	94%	58%	18,5%
Torsby	61	75%	26%	48%	2%	98%	60%	14,8%
Visby	66	79%	26%	57%	3%	92%	64%	10,6%
Västervik	73	70%	26%	30%	4%	99%	88%	8,2%
Örnsköldsvik	91	67%	34%	60%	9%	92%		18,7%
Privatsjukhus								
Capio S:t Göran	425	81%	27%	61%	3%	94%	55%	17,6%
Nation	9 040	74%	31%	52%	6%	95%	63%	14,9%

[1] The number of primary hemi-arthroplasties during current period.
[2] Proportion of primary hemi-arthroplasties performed on patients above 80 years of age.
[3] Proportion of primary hemi-arthroplasties performed on men.
[4] Proportion of primary hemi-arthroplasties performed on patients with ASA class 3.
[5] Proportion of primary hemi-arthroplasties performed on patients with ASA class 4.
[6] Proportion of primary hemi-arthroplasties performed due to acute fracture (not secondary).
[7] Proportion of patients operated within 24 hours (from Rikshöft 2009-2010).
[8] 90-days mortality (100(number of patients deceased within three months from primary surgery / number of operations performed during current period)).*

Hospitals with fewer than 50 hemi-arthroplasties 2009-2010 has been excluded.

Follow-up of activities after hemi-arthroplasty

This year for the first time the Registry is showing the departments' results of hemi-arthroplasty as value compasses. Since the Registry is not yet receiving patient-reported information regarding hemi-arthroplasty, these value compasses contain only four variables (compass points).

In this overall presentation each hospital can compare itself with the national mean value and see whether there is a problem area that can prompt local work for improvement. The result must be seen in a context in which many factors play a part. The value compass may be seen as a balanced control card. The greater the surface is, the better the multidimensional total result each department has.

The result is presented in this follow-up model for departments that conducted at least 50 operations during 2009-2010 and which also reported satisfactorily the degree of dementia. Owing to shortcomings in the latter, value compasses for certain hospitals cannot be shown.

The result variables for hemi-arthroplasty are somewhat different from those for total arthroplasty. Individuals undergoing hemi-arthroplasty often have a hip fracture, a condition associated with general morbidity and relatively short survival. Most reoperations take place within some months and long-term complications are unusual. Observation times for reoperation and implant survival are therefore shorter than for total arthroplasty.

- **90 day mortality**. In international literature this variable is used to illustrate mortality following hip arthroplasty.
- **Completeness**. Completeness at individual level according to the latest matching with the Patient Register at the National Board of Health and Welfare.
- **Reoperation within 6 months**. Gives all forms of reoperation within two years of the primary operation and during the most recent four-year period.
- **One-year implant survival**. Implant survival after one year using Kaplan-Meier statistics.

Since the groups undergoing hemi-arthroplasty differ at different hospitals, each department's 'case-mix' must be studied together with its value compass. The picture of the 'case-mix' is designed in the same way as the value compass and includes the variables which in the Register and other research have proved to be decisive demographic parameters for reoperation risk and, to some degree, mortality. The larger the surface in this figure, the more favourable the patient profile the department has.

Proportion of patients 85 years or older. High age protects against reoperation and revision. The causes can be many: reduced activity reduces the risk of e.g. erosion and probably also dislocation. Short remaining life expectancy means that loosening has not had time to set in. On the other hand this 'risk reduction' that we see may be because an older individual nevertheless is affected by complications but is advised not to undergo reoperation or revision for medical reasons. Departments due to treating many patients aged over 85 years obtain better results regarding reoperation/revision but poorer regarding mortality.

- **Proportion of acute fractures (diagnosis S72.0)**. The more patients the department treats with hemi-arthroplasty due to acute fracture the better the long-term result is according to the Registry's regression analysis of the data base.
- **Proportion of non-demented patients**. The figure shows the department's proportion of patients judged to be cognitively intact. Dementia does not affect the risk of reoperation/revision according to the Registry's analysis but demented people have higher mortality following hip fracture. If a department has a large share of non-demented people their mortality figures improve.
- **Proportion of women**. Women have generally better results than men regarding need for reoperation/revision.

Discussion

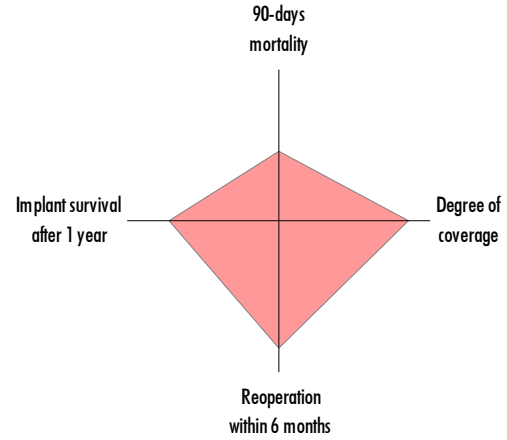
The hospitals whose value compasses signal problems in some area should conduct a local analysis to map all the factors that affect their clinical results. The Registry's staff are happy to support this work practically and can share experience of corresponding analyses of other hospitals.

Given hemi-arthroplasty patients' poorer health and high age compared with osteoarthritis patients receiving total arthroplasty, there is reason to believe that it is more often decided not to reoperate a patient affected by complications than in the case of total arthroplasty. An infection, for example, can instead be treated with life-long antibiotics. For repeated dislocations, the department may confine itself to repeated closed repositioning instead of revision. A fracture near the implant may be treated with avoiding weight-bearing in a wheelchair. In special cases, non-operative treatment may be most suitable, and when assessing the value compasses this circumstance should be taken into account. To a certain limit the occurrence of reoperations and revisions can indicate an active approach to complications.

When interpreting the department's value compass, and above all in comparisons, the 'case-mix' profile must always be taken into account!

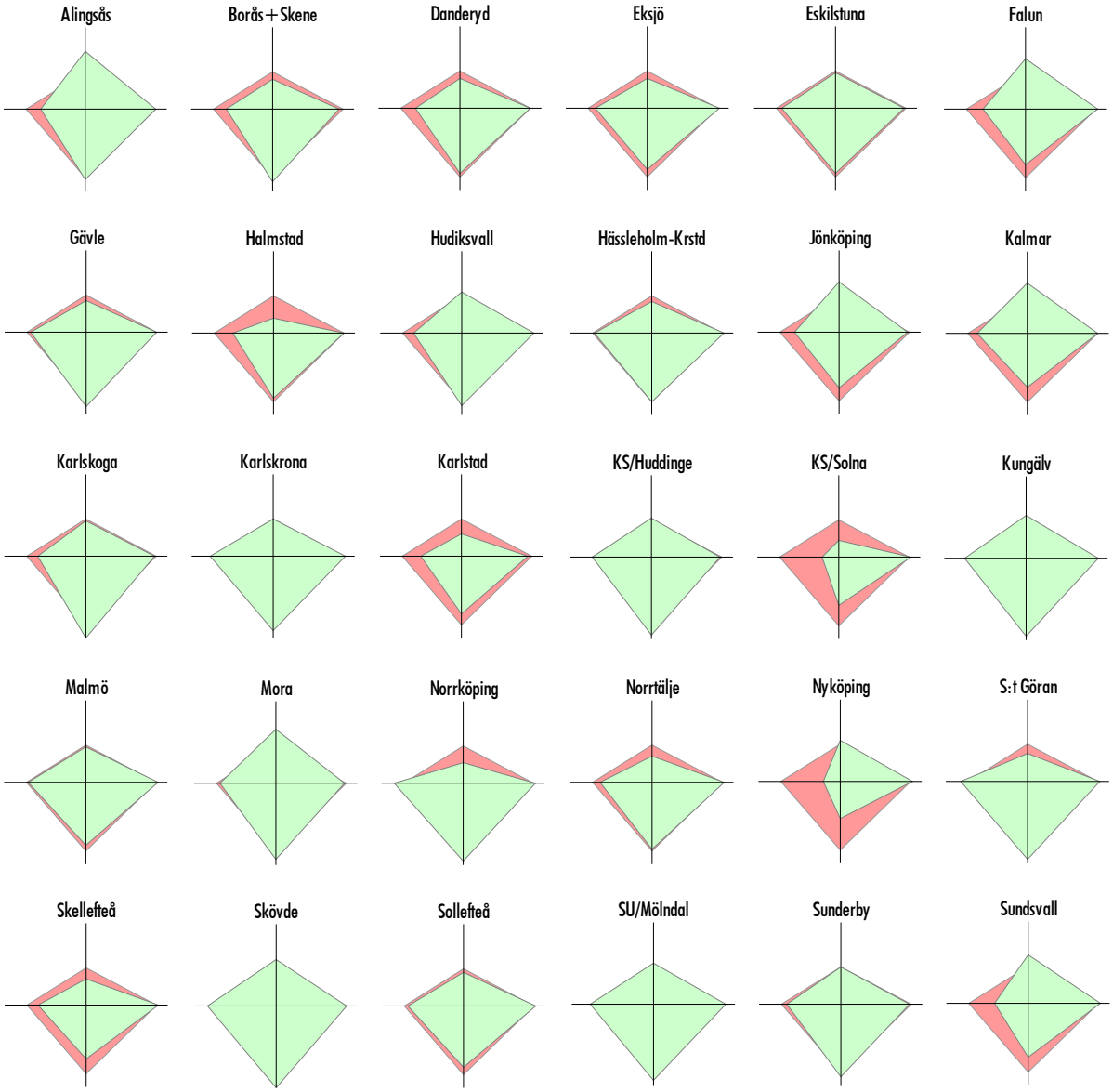
Quality indicators

clinical value compass - national averages

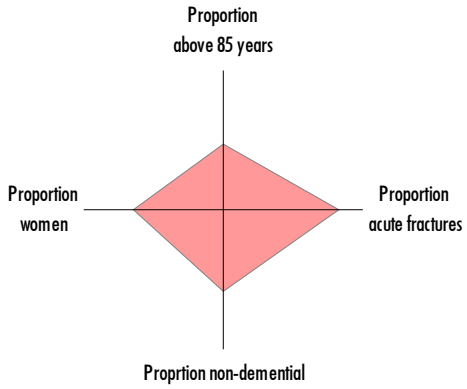


In the value compasses the national results regarding the four variables included are shown in red. Each department's corresponding values are shown in green. Limit values are set to the largest and the smallest value of the variable in question ±1 SD. The worst value for the variables is origo and the best value is at the periphery.

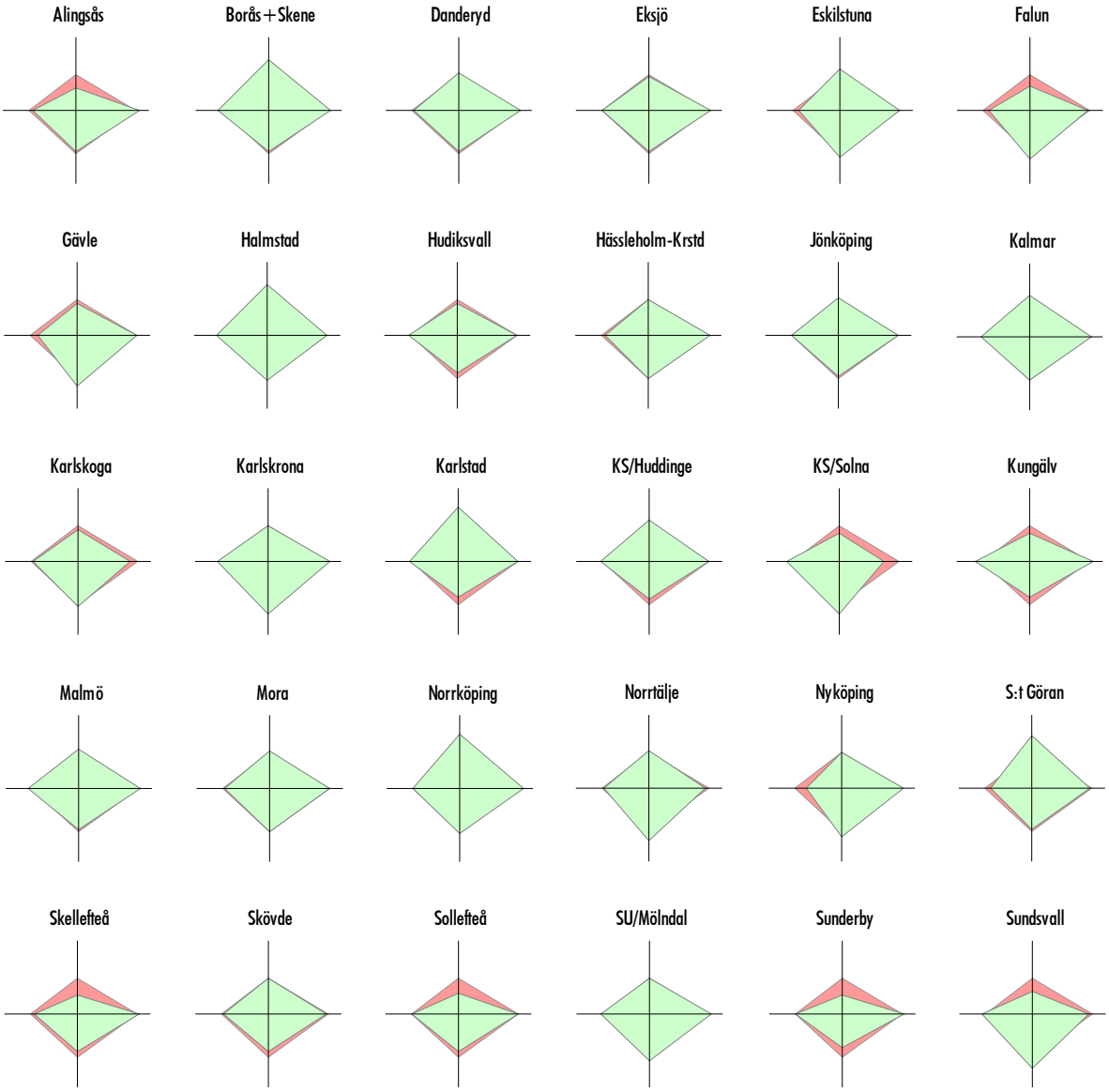
The departments where red fields are visible have a poorer value than the national average for that variable. This can be studied in detail in the relevant table.

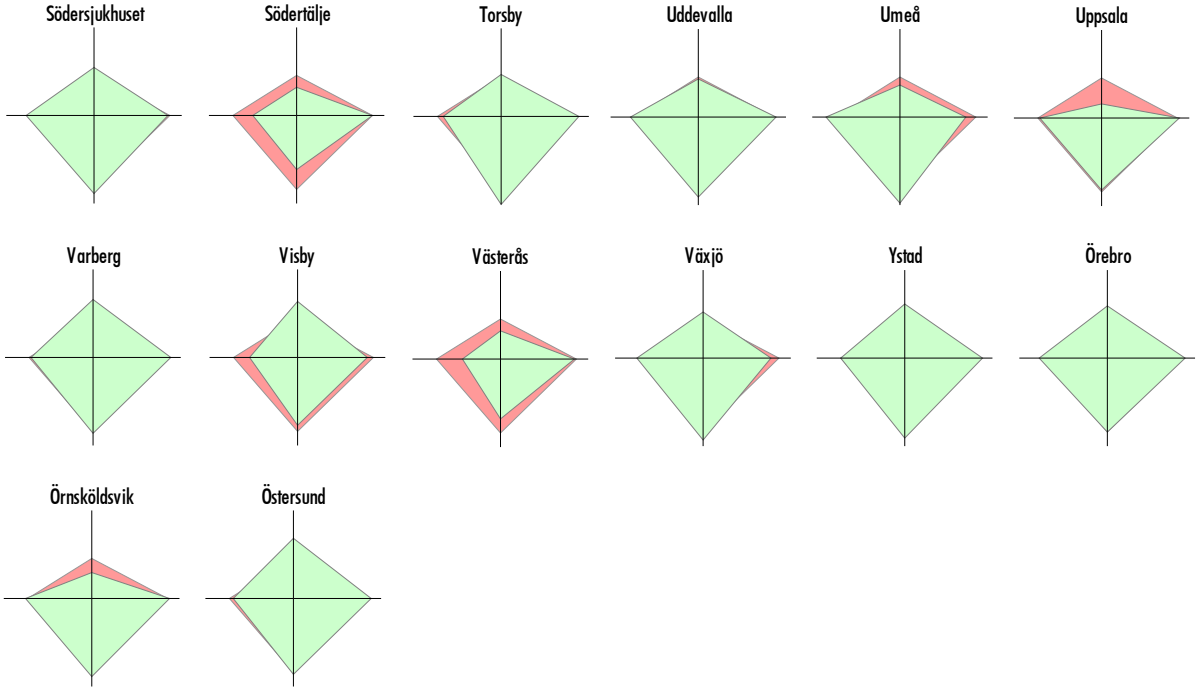


Case-mix factors
national averages

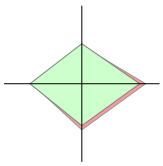


In the graphic presentation of patient demography ('case-mix') the national result is shown for the four variables included, in red. Each department's corresponding variables are shown in green. Limit values are set to the largest and the smallest value of that variable ±1 SD. The poorest value for the variable is origo and the best value is at the periphery. When interpreting the department's value compass, and above all in comparisons, the 'case-mix' profile must always be taken into account.

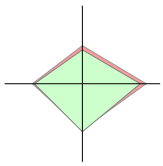



Södersjukhuset
Södertälje
Torsby
Uddevalla
Umeå
Uppsala
Varberg
Visby
Västerås
Växjö
Ystad
Örebro
Örnsköldsvik
Östersund

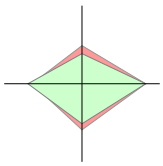
Södersjukhuset



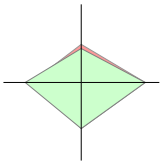
Södertälje



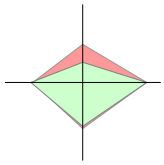
Torsby



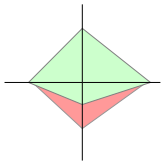
Uddevalla



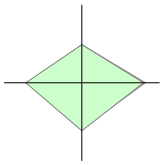
Umeå



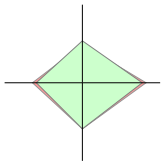
Uppsala



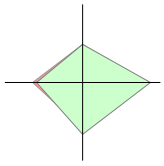
Varberg



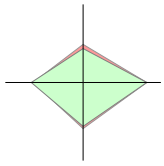
Visby



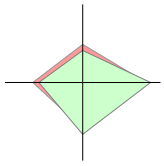
Västerås



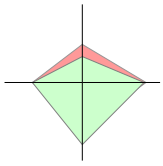
Växjö



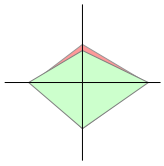
Ystad



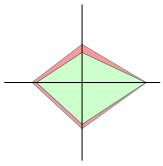
Örebro



Örnsköldsvik



Östersund



The BOA project

The initials BOA stand for "Bättre Omhändertagande av Artrospatienten", meaning "Better care of the Osteoarthritis Patient".

In the 2007 Annual Report we described what we termed the BOA register in detail. This project aims to become a national diagnosis register for patients with hip and knee osteoarthritis. At present, about 110 units are connected to it. As the only Register wholly dedicated to physiotherapy, it was classified as a national quality Register in December 2010.

The National Board of Health and Welfare (SoS) guidelines regarding diseases of the locomotive organs, to be published shortly, give complete non-surgical treatment (osteoarthritis school) as the first and early treatment of hip and knee osteoarthritis. The Board will also propose a new national quality indicator: each operating department shall in future state how large a proportion of their patients undergoing surgery have earlier in the course of the disease attended osteoarthritis school.

The Hip Arthroplasty Registry has, for this reason, extended its area of interest during the past few years to include the whole course of the disease, predominantly among patients with osteoarthritis. When co-processing with BOA we can soon map the path of the osteoarthritis patient throughout the care chain. The operation, with a selection of good operating technique and well-documented implant types, has long been analysed in detail by the Registry. However there are a number of factors that are not dependent on operation, that affect the subjective, patient-reported results and the cost-effectiveness of the intervention.

Examples of such factors are:

- Early care of the osteoarthritis patient with adequate non-surgical treatment.
- Avoidance of unnecessary sicklisting.
- Right indication for surgery.
- Information on condition and correct expectations after surgery.
- Correct information post-operatively.
- Standardised rehabilitation measures.
- Adequate follow-up with early intervention after both short-term and long-term complications.

The BOA organization with osteoarthritis schools seeks to influence many of these factors.

International co-operation

The Swedish Hip Arthroplasty Registry continues both to intensify and extend its international co-operation. Interest throughout the world in harmonized and combined databases has increased – perhaps most because these have a greater potential for what is termed 'post-market surveillance' and 'early-warning signs' (results after an implant has been released on the open market) than what the Swedish Register has. This area of application of a Register has partly been lost in Sweden since six long-established implants represent more than 90% of the Swedish market.

NARA

In earlier Annual Reports we have described in detail the co-operation among the established Nordic implant registries that resulted in the formation of the Nordic Arthroplasty Register Association (NARA). During 2010 Finland became a full member and is included in the most recent combined database. This has further broadened NARA's opportunities for analysis. The NARA group has now published six scientific papers and several further manuscripts are being produced.

www.nordicarthroplasty.org

ISAR

The International Society of Arthroplasty Registers started in 2005 as an interest association for the established international implant registers. The aim of ISAR is to improve the outcome of patients all over the world undergoing knee and hip arthroplasty and to stimulate international co-operation both for established registers and for those under development.

www.isarhome.org

ICOR

As yet there is no functioning federal American implant register – despite several years of preparation and negotiation. The Food and Drug Administration (FDA) which among other things approves implants for American clinical use, during 2010 and in co-operation with the Kaiser Permanente and the Hospital for Special Surgery/Cornell Medical College, took the initiative for new international co-operation that resulted in the formation of the International Consortium of Orthopaedic Registries (ICOR). The first ICOR meeting was held in Washington in May this year. Apart from the established registries, Cochrane Collaboration (Musculoskeletal Group) also took part. The objective of the organization is to harmonize the contents of variables in the existing registers so as to be able to create in turn a mega-database for an international meta-analysis based on observational studies. In December 2011, 14 'review' articles were published from this meeting in a supplement to the American edition of Journal of Bone and Joint Surgery.

ISAR First International Congress of Arthroplasty Registries

The above organizations are now co-operating to arrange the first international congress on arthroplasty registers, on 20-22 May 2012 in Bergen. All interested parties can follow link: http://www.ksci.no/a/pEvent.cfm?id=25.

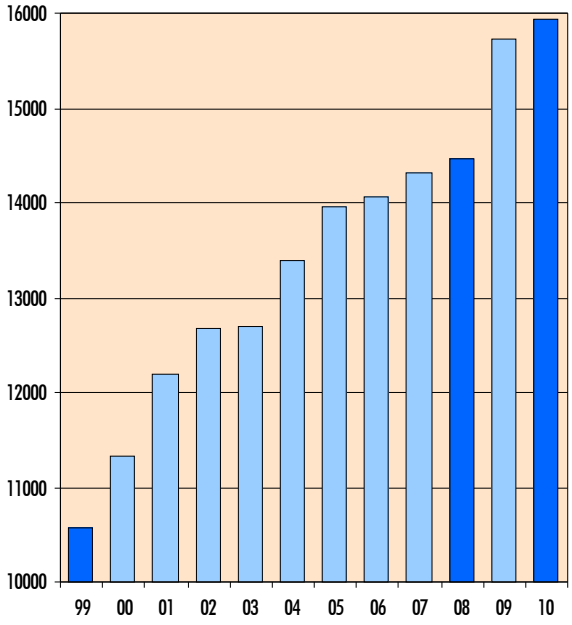
County-council results

In earlier Annual Reports we have published procedure frequencies and implant survival analyses at regional level (older regional division). Since *Öppna jämförelser* (Open Comparisons) reports at county-council level we have reworked this section with reporting of procedure level and the Registry's national quality indicators by county council.

Procedure frequencies nationally and by county council

The procedure frequency of total hip arthroplasties continues to increase in Sweden and we are now up to 170 operations per 100,000 inhabitants. This figure refers to the whole population and is based on the Statistics Sweden (SCB) population statistics of 31 December 2010 (9,415,570 inhabitants). This signifies an increase in the number of procedures by 10.3% during the past two years, and 51.0% since the beginning of 2000. A more correct picture is to state the number of procedures by 1,000 inhabitants over 40 years of age: in 1999, 243, in 2008, 306, in 2010, 332. Via this population-adjusted calculation the increase becomes 8.3% for the past two years and 37.0% since the beginning of 2000. Note that many national and international comparative reports are based on statistics from the National Board of Health and Welfare (PAR) which, since 2000 has had a degree of completeness of 5%-6% lower than the Registry's. The large increase is not fully understandable, do the present figures reflect a dammed-up need or is Sweden's changed age profile the cause? Against the latter is the fact that the average for primary operation is sinking every year. Another explanation is of course that we possibly increase the indication for operation – such an alteration of indications need not be seen as inadequate since the long-term result is continually improving for younger people and the operation is being made increasingly safe for older.

Primary total hip replacement in Sweden



The increase may also be an unfavourable effect of the Care Guarantee which is a political but not medically-evidence-based decision. The Care Guarantee may unfortunately set waiting times and production above need and result and can naturally as a side-effect result in a 'suppression effect' whereby the 'healthiest' patients use the Guarantee at a higher frequency than older people with a number of diseases. As earlier described in this Report, a Register study is in hand seeking to map this issue.

Production versus consumption per 100,000 inhabitants per county council

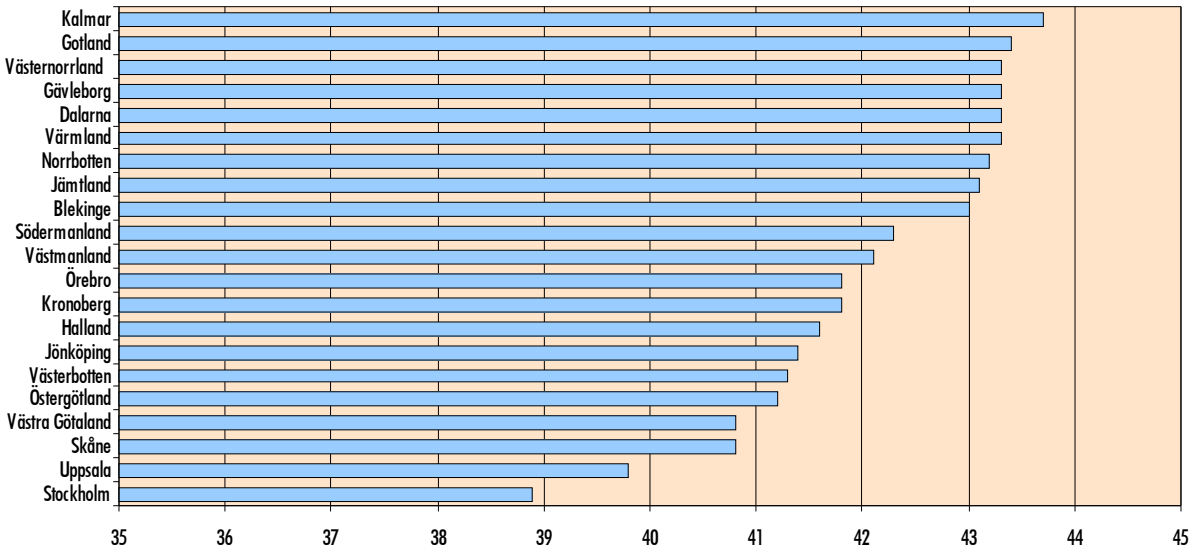
Decision-makers are, naturally enough, chiefly interested in what are termed consumption figures by county council – while the profession and the quality registers (particularly those that check a surgical intervention) have, instead, focused on 'production figures'.

Consumption means that the county councils'/regions' inhabitants have access to hip arthroplasty regardless of whether the intervention is carried out in the home county or elsewhere. These figures are of significance for management and control. They can also be used for activity analysis and clinical improvement work, which is a large component of the quality registries' task.

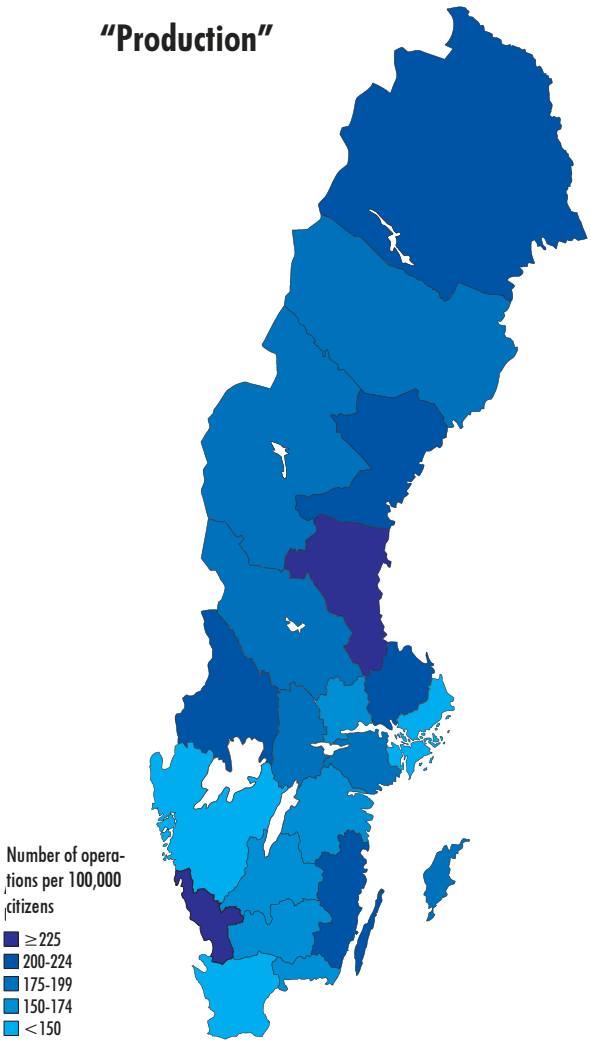
Dissemination of both production and consumption figures per 100,000 inhabitants (not age-adjusted) shows a large variation between principals (the private entrepreneurs are included geographically); production: 139-288 and consumption 125-220/100,000 inhabitants. That is, consumption is almost double between county councils with the lowest consumption and those county councils/regions with the highest. The reason for this large variation needs to be studied – the present situation indicates that we do not have equal medical care regarding the treatment of hip osteoarthritis in Sweden.

The mean age in the various county councils/regions varies from 38.9-43.7 years (Statistics Sweden population statistics, 31 December 2010); Stockholm has the lowest mean age, 38.9 years and Kalmar the highest with 43.7 years. Other interesting areas, Västra Götaland 40.8 and Västerbotten 41.3 years. Thus population demography can hardly explain the large variation nor can the incidence of primary osteoarthritis between the various areas. Unfortunately the Registry management believes that non-medical and local 'political' management decisions are one of perhaps many causes of the large variation found. The Registry will focus largely on this issue for the next few years – both in regional activity analyses and in clinical research. The primary tool for such an analysis is the comprehensive matching databases we have created and plan to create (SHPR, SoS, SCB and FK). Such processes are unwieldy since they require ethical scrutiny and expensive use of Registry resources. For this reason there is always a lag in such an analysis – most often at least two years if analysis is also to include the short-term result of elective operations for total hip arthroplasty.

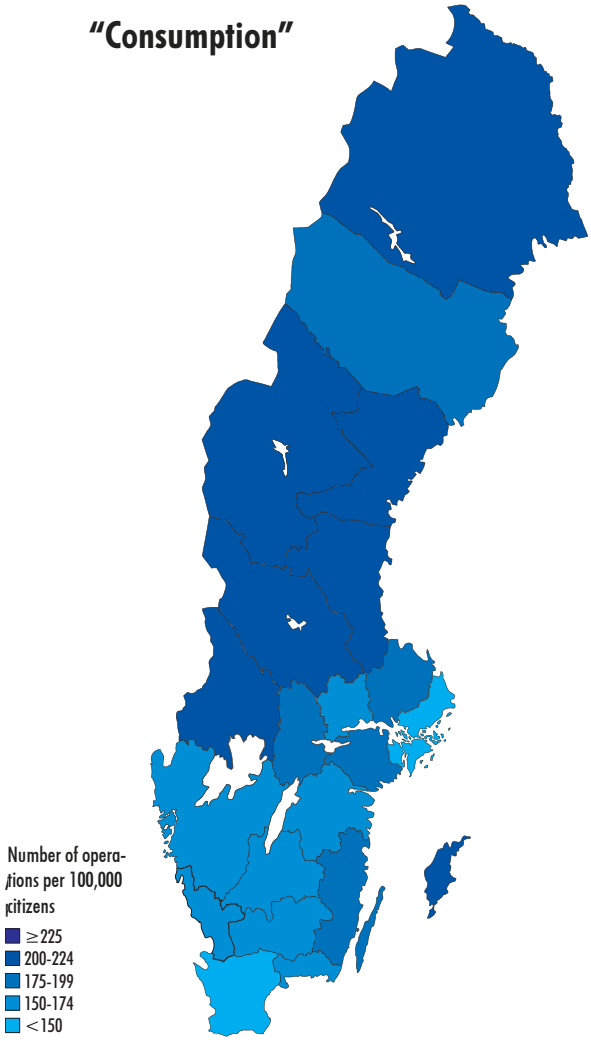
Average age in Sweden by county



"Production"



"Consumption"



National quality indicators

In November 2011 the seventh report *Öppna jämförelser* (Open Comparisons), was published. The report is a collaborative project between the National Board of Health and Welfare and the Swedish Association of Local Authorities and Regions (SKL). This year, too, the number of national quality indicators has increased now to about 190, of which about half are taken from national quality registers. The report should be considered as a paradigm shift regarding control of health and medical care in Sweden. County councils and regions have long governed medical care on the basis of cost and production analyses – the shift consists of an increasing focus on medical results. The quality registers have for many years published medical result measures but it is only when they are gathered in a common national report that medical quality has gained a clear breakthrough in the strategic management and control of health and medical care.

The report is not a scientific one. It is based on available data and should be viewed as a signalling system, preferably resulting in local analyses at county-council and local levels, i.e. it has about the same task as the individual registries. Everyone working on the report agrees that it is a developing product which in future years will definitely develop further.

The Swedish Hip Arthroplasty Registry is one of the National Quality Register that supply data to *Öppna jämförelser* (Open Comparisons). The Registry is responsible for five indicators. These are also shown at unit level, which is becoming increasingly common for indicators supplied from the quality registries. Two further indicators elucidate hip arthroplasty with data from the Patient Registry: hip arthroplasty after cervical hip fracture and 'adverse events' within 30 days; and these indicators are also shown in Open Comparisons.

Short-term complications, that is, reoperations (of all types) within two years of the primary operation. Reported for the most recent four years. This variable in this connection should be considered as a 'rapid' quality indicator. Note that the report applies to complications dealt with surgically.

10-year survival of total arthroplasties according to traditional Kaplan-Meier statistics. The definition of failure is exchange of one or both components, or definitive removal of the implant. All primary diagnoses and all causes of revision operations are included. The result covers the operational period 2001 to 2010 inclusive. This variable should be considered as 'slow' but in the long-term is an important quality indicator.

EQ-5D index gain 1 year after operation. Part of the Registry's brief is 'that indicators reflecting patient-experienced quality should be included'. Patient-reported outcome with health gain is an important variable for this patient group undergoing operations with low health-related life quality as an indication for the measure. This variable should also be considered as a 'rapid' quality indicator.

Proportion of patients satisfied with the result of their operation one year after operation. The definition of satisfied is whether patients marked, on a VAS, 0 up to and including 40 (0=satisfied, 100=dissatisfied). This indicator does not completely correlate to the previous indicator: a low EQ-5D index gain can be linked to a high degree of satisfaction and vice-versa.

One-year survival of hemi-arthroplasties according to traditional Kaplan-Meier statistics. The definition of implant survival is the same as for total arthroplasties. All primary diagnoses and all causes of revision operations are included. The results for failure of operation 2008-2010 inclusive. Since this group of patients are older and more mult-sick with high one-year mortality, this survival statistic is a more rapid indicator than the corresponding 10-year analysis for total implants.

Results

When interpreting these results the confidence intervals clearly shown in the illustrations must be taken into account. If the confidence intervals overlap one can say simply that there is probably no statistical difference between the results given.

Short-term complications. As stated the complication rates are low and should be assessed with caution. This quality indicator can really only be evaluated over time, i.e. if there are clear trends in the analyses of the previous two years. For the past few years this indicator has been steady at 1.6% to 1.8%. The spread at hospital level is 0.2% to 5.0%.

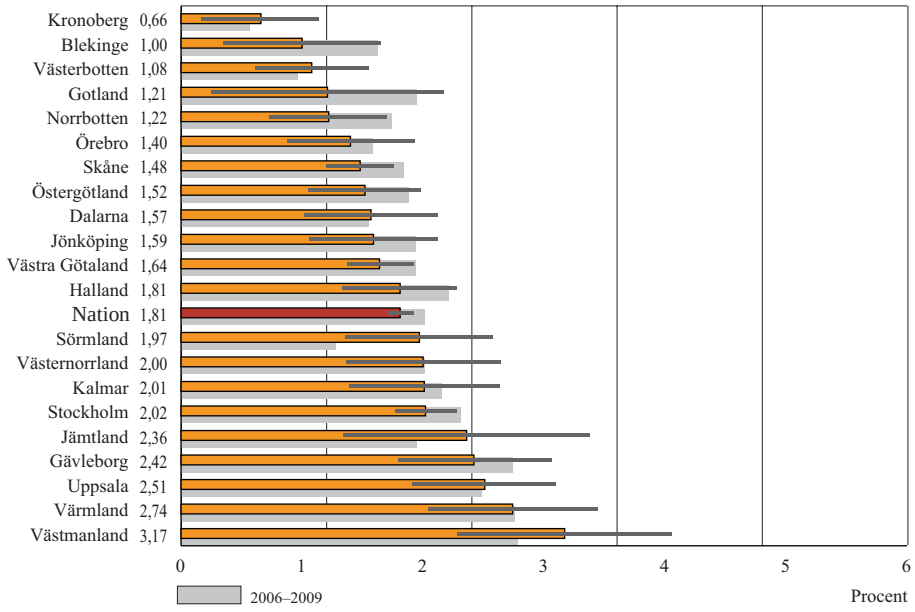
Ten-year survival. Sweden has the world's highest reported 10-year survival of total hip arthroplasties in international comparisons. At county council level there are no large and significant differences which are detectable at unit level.

EQ-5D index gain. The routine for patient-reported outcome is now implemented throughout the country. Variations at county-council level are relatively large and should prompt analysis regarding indications and waiting times for the intervention.

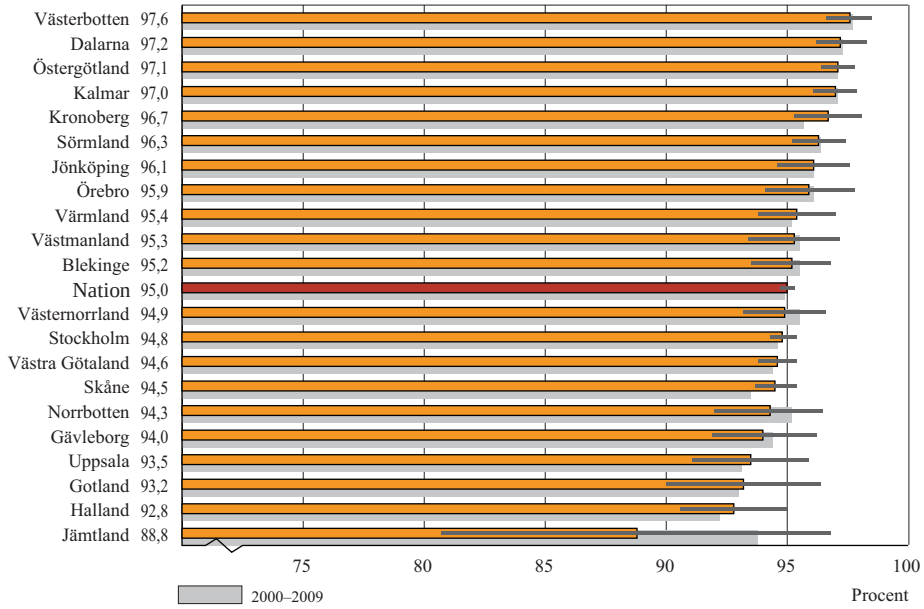
Proportion of patients satisfied with the operation result one year after operation. This year's analysis shows at national level that 16% of all patients undergoing surgery between 2008 and 2009 and one year after operation were unsure or directly dissatisfied. During this period fewer than 1% of cases underwent reoperation. This group of 'non-responders' is an important future target group for clinical improvement work and clinical research.

1-year survival of hemi-arthroplasies according to traditional Kaplan-Meier statistics. The variation for this indicator as soon as after one year is somewhat larger than the corresponding for total hip arthroplasties after 10 years, with a county-council variation of 86%-98%. The variation can partly be because the treatment algorithm for dislocated cervical hip fractures has been implemented differently in the various county councils, with varying indicators for both hemi- and total arthroplasties following hip fracture.

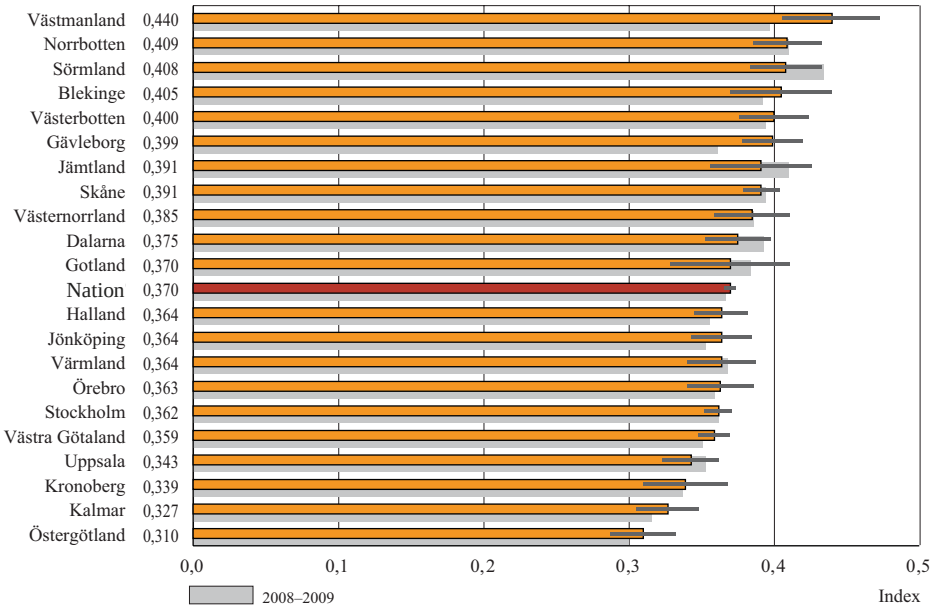
Proportion reoperations within 2 years after total hip arthtroplasty
2007-2010



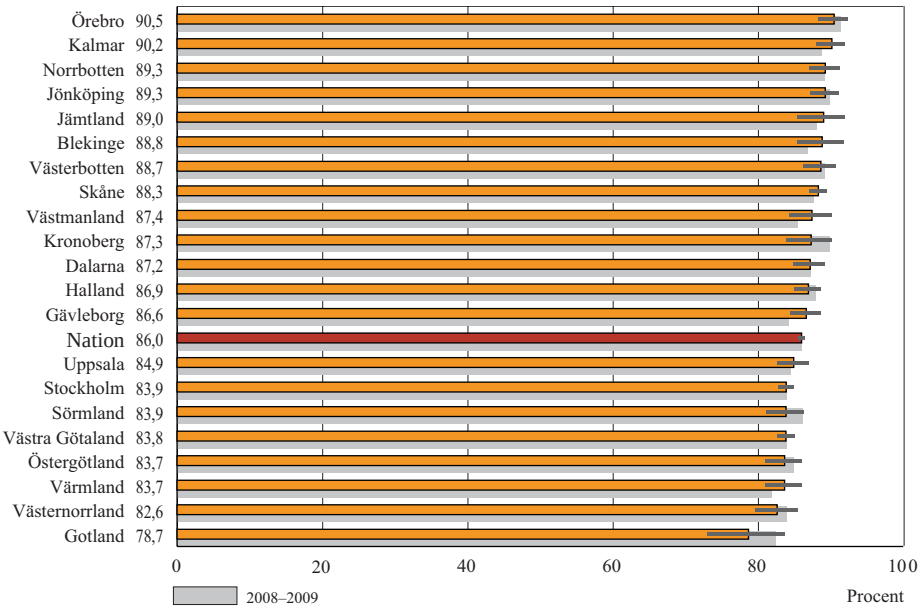
Probability to not be reoperated within 10 years after total hip arthroplasty
2001-2010



Gain in EQ-5D index 1 year after total hip arthroplasty
2009-2010

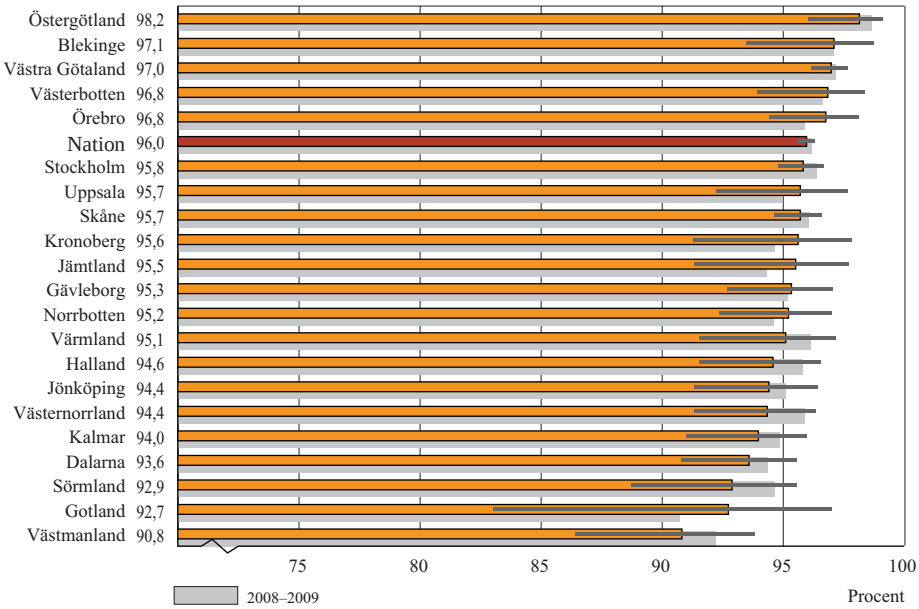


Patient satisfaction 1 year after total hip arthroplasty
2008-2009



Probability to not be reoperated within 1 year after hemi arthroplasty

2009-2010



Conclusion

The purpose of the Swedish Hip Arthroplasty Registers Annual Report is to give an all-round picture of hip arthroplasty in Sweden. The multi-dimensional and open reporting of a number of result measures will, we hope, lead to increased pressure for change among the departments. Even though Sweden has the lowest reported frequency of revision, there are clearly defined problem areas which can be influenced with systematic local analyses and subsequent work for improvement.

Work on the Register and the Annual Report is becoming successively more demanding of resources every year. In addition the Register has for the past six years also included hemi-arthroplasties presented separately in the Report. This printed Report is somewhat modified this year, both in design and in content. A number of standard tables that we have published for many years are missing from the report but can be reached via our home page.

In 2010, 15,935 primary total hip arthroplasties were performed in Sweden, which is a certain increased compared with the previous year when a dramatic increase of just over 8% was registered, compared with 2008. Procedure frequency during 2010 then becomes 170 total hip arthroplasties per 100,000 inhabitants. A fairer picture is to state the number of procedures per 100,000 over 40 years of age: in 1999, 243; 2008, 306; 2010, 332. Using this calculation adjusted for population the increase becomes 8.3% over the past two years and 37.0% since the beginning of 2000.

Despite the lack of large demographic differences between the 21 different counties/regions the differences were remarkably great in procedure frequency measured both as production figures and as consumption figures (139-288/100,000 and 125-220/100,000 inhabitants). Thus geographically speaking there is no equality of care in the medical field.

During the year 2,197 reoperations were reported, of which 1,894 were revisions. This is largely unchanged since the previous year. The relative proportion of revisions for loosening continues to sink and in 2010 represented just over half the total number.

The number of revisions for infection has more than doubled since 2,000 and their relative proportion has successively risen from 6.0 to 11.5% during 2010. Revision for dislocation has also increased but not so dramatically, from 163 operations (10.2%) in 2000 to 257 in 2010 (13.6%).

During the year 4,502 hemiprostheses and 295 reoperations were registered. Thus, altogether 22,929 operations were reported to the Swedish Hip Arthroplasty Registry in 2010.

Development areas

In earlier annual reports we have described in detail collaboration among the established Nordic implant registers that resulted in the formation of the Nordic Arthroplasty Register Association (NARA). During the year, Finland has become a full member and is included in the latest combined database, which has further broadened NARA's opportunities for carrying out analyses. The NARA group has published six scientific articles, and many further manuscripts are in preparation.

The Registry has during the year continued its cooperation with the National Board of Health and Welfare. Co-processing with the Patient Register at individual level has been used, as last year, for a detailed completeness analysis at hospital level. This type of analysis of co-processing with the health data registers at the National Board and with Statistics Sweden has so far been under-exploited and can in the future be of great significance for continued quality development for Swedish hip arthroplasty. In the health data registers and in population statistics we can capture important background variables that we do not register in our normal registry routine. This type of data base opens up new fields for improvement and research in the area.

This year's in-depth analyses

This year we report on a number of specific analyses, of which several are follow-ups of last year's.

Completeness. Completeness at individual level is important for a register's data quality and credibility. Without a high degree of completeness all analyses suffer from great statistical uncertainty. This year's analysis has shown good completeness of about 98.5% for registration of primary total arthroplasties and 96% for hemi-arthroplasties. However, one or two hospitals have a poorer registration frequency and the Registry management requests the departments in question to review their routine to achieve better registration.

Total arthroplasties

Primary total arthroplasties. In sum, increasing numbers of patients are receiving primary total hip arthroplasty. The proportion receiving implants for fracture has changed very little during the past six years.

Operating department. More and more patients are having their operations at private clinics, predominantly at the expense of those at university/regional departments. The difference became greater during 2010.

Choice of fixation and implant. Briefly, the relative decline in

all cemented hip implants continued during 2010. Reverse hybrids and all uncemented fixation continued to increase. During 2010, 30% of all primary operations had one or both components with uncemented fixation. The majority of the implants used have good clinical documentation.

Cross-linked high-molecular polyethylenes. Here, too, the Registry cannot demonstrate any advantages or disadvantages with the new polyethylenes. This was not expected in view of the fact that the primary problem the new polyethylene was intended to address is not expected to lead to higher revision frequency until after 7-10 years.

Resurfacing implants. Several unclarities still remain regarding the resurfacing implant. The early risk of revision is still high in Sweden. The long-term effects of metal/metal articulations are also unclear and serious soft-tissue complications have been observed, chiefly in women. On the basis of observations from the Registry, the NARA database and other international registers and clinical studies, we consider that if resurfacing implants are to be used this should be in controlled forms. The operation must be performed at centres with sufficiently large volumes to maintain good surgical competence and the patients should be followed up continually. Operations on women should be avoided.

Revisions. The Registry still finds a clear trend towards greater use of uncemented revision implants. Uncemented and particularly modular implants facilitate reconstruction of the original anatomy, and the absence of cement may also ease healing of bone tissue, specially in revision of fractures near the implant.

Hemi-arthroplasties

Risk of reoperation. Male gender, hemi-arthroplasties following fracture complication (secondary prosthesis), uncemented stem and bipolar head increased the risk of reoperation.

Patient-reported outcome

Patient satisfaction. The routine collection of patient-reported outcome now has national coverage. The Registry is this year supplying a further national quality indicator to Open Comparisons: patient satisfaction. This variable does not fully correlate with the EQ-5D result; a low gain in EQ-5D can be linked with a high degree of satisfaction and vice-versa.

The result at national level regarding patient satisfaction shows that 14% were uncertain or dissatisfied. We will now be studying in detail this group of patients who answered sub-optimally regarding the surgical intervention. It is important for the profession that a minority of patients do not, in their subjective evaluations, discredit a recognizably successful and cost-effective surgical treatment.

Clinical improvement work

Nationally

Sweden still enjoys the world's lowest revision frequency. One explanation is that we in Sweden use few and well-documented implant types and similar technique. We have also been cautious in the introduction of prosthesis technology and new operating techniques. The continual national improvement can in all probability be explained by the facts that the Registry has been active for many years and that Swedish orthopaedic surgeons receive the recurrent feedback the Registry supplies via its home page, the annual reports and orthopaedic meetings. Since during the past ten years we have approached a ten-year implant survival of 95% we must expect results to improve more slowly regarding revision frequencies at national level. The variation between departments and among certain patient groups is, however, more evident, and for this reason there is clearly a remaining, realistic but small, potential for improvement.

Locally

This year the Registry presents extensive local analyses carried out by the orthopaedic departments in Södertälje and SU/Mölndal following last year's open reporting. Both departments have now sketched local improvement projects. It will take a few years, though, before we can assess the results of these projects.

The inclusion of patient-reported outcome allows departments to analyse their outcomes on the basis of patients' needs. Here there is a tool that can be used for improvements in programmes for the care of patients with hip disease; that is, measures that can raise the patient's degree of satisfaction and health gain and do not need to be directly linked to the surgical intervention.

Problem areas

The problem of reduced procedure frequency at university hospitals remains, and has been further accentuated. This trend must be broken, for otherwise there is a great risk that the quality of hip arthroplasty will sink owing to poorer opportunities for training and clinical research.

The number of reoperations for early and serious complications such as dislocation, fracture near the implant and above all infection is increasing somewhat. The statistical certainty in these data is low at department level, but the aggregates statistics from

the whole country indicate a reason for continually reviewing routines and care programmes so as to minimise the risk of early complications.

We have for many years published our annual analysis of degree of completeness, but this has not included secondary interventions. This is disturbing regarding the data quality of the register. A number of units during 2007-2010 show extremely low complication figures. That certain high-production units should have no more than one or two complications according to the definition above, over four years, appears unlikely. A current study in which we are matching the register with the Register of Pharmaceuticals regarding post-operative prescribing of antibiotics (within the first post-operative year) and a subsequent analysis of patients' medical records shows a clear underreporting of implant-related infections at a number of hospitals.

The Registry now has a plan of action with the objective of mapping this probable under-reporting. This includes monitoring 5-8 hospitals per year.

Current trends

The greatest change in implant selection is a continuing trend towards increasing use of uncemented implants. The 'reversed hybrid' with an uncemented stem and a cemented cup continues to increase.

A final word

The Registry management wish to thank all departments for good cooperation during the past year. The joint task is becoming more and more interactive and therefore stimulates the re-reporting of results in a more active and constructive manner. Together we can, both in the profession and among decision-makers, further improve the quality of Swedish hip implant surgery and gain increasing numbers of satisfied patients.

Photo: Göran Garellick

Current research projects

The chief tasks of a National Quality Register are analysis of activities, work for improvement and clinical research. Our very extensive databases possess a large and unexploited potential for research. Combination databases using official databases such as the Health Data Register, the National Insurance Office, Statistics Sweden and regional patient-administration systems can result in globally unique databases for observational studies.

In research and evidence-based medicine the randomised controlled study (RCT) is considered the research gold standard. However we have no possibility of running this type of study in all areas – perhaps least of all within the surgical disciplines. The randomisation process does not include the role of the surgeon, her or his experience and competence. What is termed 'single-surgeon' material seldom manages to attain statistical power. A national prospective observational study (register study) has characteristics unreachable with an RCT. Large materials afford above all possibilities to analyse unusual complications with great statistical power. Another big advantage is that generalisable results can be achieved – a result measured within the whole profession. In an RCT what is termed 'performance bias' can easily arise , that is, this type of study often reflects an intervention at a special unit and/or by the innovator of a method.

Clinical research and above all register-based research have for many years had low status in Sweden. However, there has been a clear break in the trend during the past few years. It is also very gratifying that Cochrane Collaboration (Musculoskeletal Group) is considering including register results in its reviews, which will then enhance the evidence value of this type of study.

Ten doctoral dissertations and some hundred scientific articles have been published, wholly or partly based on analyses from the Swedish Hip Arthroplasty Register.

The Registry wishes to stress that the Register's databases are not only a matter for Registry colleagues in Göteborg. All researchers in this country and elsewhere can, if there are adequate question areas, use the Register for research.

Research projects within the Registry

The Registry's management and its governing body include a number of postdoc researchers who are supervisors and deputy supervisors for a number of doctoral students. In this group, research is going on into implant fixation, hip fractures and implant surgery, periprosthetic fractures, revision surgery and patient-reported outcome. This group consists of:

- Johan Kärrholm, Göteborg
- Göran Garellick, Göteborg
- Cecilia Rogmark, Malmö
- Leif Dahlberg, Malmö
- Andre Stark, Stockholm
- Per Wretenberg, Stockholm
- Nils Hailer, Uppsala
- Hans Lindahl, Trollhättan
- Peter Herberts, Göteborg
- Rudiger Weiss, Stockholm
- Lars Weidenhielm, Stockholm
- Ola Rolfson, Göteborg
- Truike Thien, Göteborg

Doctoral students with all or parts of their thesis material from the Register:

Buster Sandgren, Stockholm
Computed tomography of patients receiving an uncemented acetabular component in connection with a hip arthroplasty.

Ferid Krupic, Göteborg
The significance of socioeconomic variables for outcome following hip arthroplasty.

Olof Leonardsson, Malmö
Hip fracture treatment with hip arthroses.

Oskar Ström, Stockholm
Health-economic aspects of hip implant operations and the treatment of osteoporosis.

Viktor Lindgren, Stockholm
Complications and outcome following hip Arthroplasty, with special emphasis on infections and the significance of the surgical incision.

Max Gordon, Stockholm
The significance of comorbidity and socioeconomic variables for outcome following hip arthroplasty.

Per-Erik Johanson, Göteborg
Hip implants for the younger patient. Evaluation of different prosthesis designs.

Meredith Greene, Boston and Göteborg
Predictors of patient-reported outcome following hip arthroplasty.

Georgios Chatziagorou, Göteborg
Early and late fractures near the femur.

Jonas Wohlin, Stockholm
Effects of the Free Choice of Care on results and costs of hip arthroplasty.

The Registry is now collaborating intensively in NARA, and the group's first six scientific articles have been published: further manuscripts are in preparation. The Registry is also a member of the new international collaboration in the International Consortium for Orthopedic Registries (ICOR) and has taken part in two international review articles.

The Swedish Hip Arthroplasty Registry's databases are still under-exploited for research. The management invites cooperation from all interested researchers with adequate subjects of study. The NARA databases are also available to Swedish researchers.

Publications

Scientific articles

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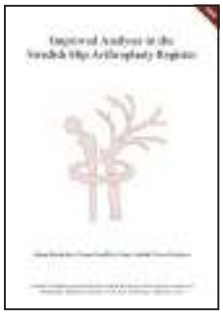

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2.2 Operative Steps: Femur, pages 28-36
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6.1 Optimal Cementing Technique – The Evidence: What Is Modern Cementing Technique?, pages 146-149
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11 The Evidence from the Swedish Hip Register, pages 291-299
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19 Economic Evaluation of THA, pages 360-366
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20 The Future Role of Cemented Total Hip Arthroplasty, pages 367-369
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