Swedish Hip Arthroplasty Register

Annual Report 2007

TOTAL ARTHROPLASTY

284 630
PRIMARIES
1979-2007

34 192
REOPERATIONS
1979-2007
(closed reduction excl.)

27 690
REVISIONS
1979-2007

2 233
ENV./TECH. PROFILES
1979-2007

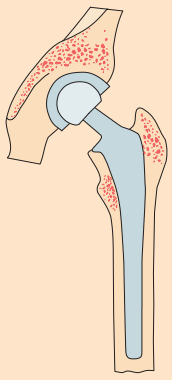
55 799
PATIENT OUTCOME
2002-2007

HEMI ARTHROPLASTY

12 245
PRIMARIES
2005-2007

577
REOPERATIONS
2005-2007

Alingsås
Arvika
Bollnäs
Borås
Carlanderska
Danderyd
Eksjö
Elisabeth-sjukhuset
Enköping
Eskilstuna
Falköping
Falun
Frölunda Specialist-sjukhus
Gothenburg Medical Center
Gällivare
Gävle
Halmstad
Helsingborg
Hudiksvall
Hässleholm-Kristianstad
Jönköping
Kalmar
Karlshamn
Karlskoga
Karlskrona
Karlstad
Katrineholm
KS/Huddinge
KS/Solna
Kungälv
Köping
Lidköping
Lindesberg
Linköping
Ljungby
Lund
Lycksele
Malmö
Mora
Motala
Movement
Nacka Närsjukhus Proxima
Norrköping
Norrtälje
Nyköping
OrthoCenter
Ortopediska Huset
Oskarshamn
Piteå
S:t Göran
Skellefteå
Skene
Skövde
Sollefteå
Sophiahemmet
Spenshult
Stockholms Specialist-vård
SU/Mölndal
SU/Sahlgrenska
SU/Östra
Sunderby
Sundsvall
Södersjukhuset
Södertälje
Torsby
Trelleborg
Uddevalla
Umeå
Uppsala
Varberg
Visby
Värnamo
Västervik
Västerås
Växjö
Ystad
Örebro
Örnsköldsvik
Östersund



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September 2008

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Annual Report 2007

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ISBN 978-91-977112-3-4
ISSN 1654-5982

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Introduction

The Swedish Hip Arthroplasty Register is in its thirtieth year of operation. During its first twenty years the registry focused on results – measured as revision frequency – for different prosthesis types, fixation methods and surgical techniques. The registry's ongoing feedback to the profession has brought national adaptation to optimal technique and the use of few and well-documented implants. This has resulted in continually improved prosthesis survival. This important work is not over, but will continue.

During the past ten years, the registry has increased its interest in the whole course of events for patients with hip disease – from symptom debut with hip pain to the effects on the patient experiences after the operation. This in turn has afforded opportunities for health-economic analyses involving greater focus on efficiency instead of productivity. This type of analysis should meet with greater interest from decision-makers, who still concentrate overmuch on productivity without quality assurance. The structural change in Swedish orthopaedics with the development of few but large elective units and the care guarantee has contributed to the continued interest in budget-steered productivity thinking with its focus on availability measured as time-to-treatment regardless of where the treatment is offered or what result it has. These process measures say nothing of the results as experienced by patients, long-term quality and prosthesis function; or about the cost-effectiveness of the treatment. For these reasons, the work of the Swedish Hip Arthroplasty Register with both early and late measures of results is of great significance for the future quality of Swedish hip arthroplasty surgery.

Public Reporting

The Swedish Hip Arthroplasty Register reports openly eight outcome variables at unit and aggregated county-council levels. Three of these variables, patient-reported health gain (EQ-5D index gain after one year), short-term complications at two years, and ten-year prosthesis survival) are included as national quality indicators in the report 'Regional Comparisons', published by the Swedish Association of Local Authorities and Regions (SALAR) and the National Board of Health and Welfare (SoS), which now includes over one hundred indicators. Two new indicators refer to hip arthroplasty: 'readmission within thirty days' and 'cervical hip fractures and arthroplasty'.

Open reporting of the departments' results is important as a motor for operational development. However, interpretation of the results is sometimes difficult and may lead to oversimplified and unscientific debate. Since quality-registry reporting is increasingly being used for control and planning in the care services, decision-makers desire easily-accessible ways of summarising intractable results in the form of indexing (of several variables) and the ranking of hospitals. This in turn is meant for use in 'accrediting' hospitals and in a 'free-choice-of-care perspective' for the patient. Leading biostatisticians have demonstrated serious statistical methodological problems (primarily dropouts, patient demography and co-morbidity) associated with ranking and indexing and issue warnings against drawing hasty conclusions from these methods. The Swedish Hip Arthroplasty Register avoids ranking outcomes but encourages all departments to analyse their own results as a step in the process of continual improvement.

New this year

Nordic co-operation has been deepened during the year. A common database (Denmark, Norway and Sweden) for hip arthroplasty from 1995 onwards has been created. Preliminary results of a first analysis are going to be presented at international meetings in 2009.

During the year, the registry also intensified its co-operation with the Centre for Epidemiology (EpC, National Board of Health and Welfare). Co-processing with the National Patient Register (PAR) at individual level has been used for analysing the degree of coverage at hospital level.

For the first time we report costs of the intervention at department or clinic level. Unfortunately it has been impossible to create nationally a standardised way of measuring costs, and that the CPP (cost per patient) system has still not been implemented throughout the country.

In-depth analyses

The registry's continuous recording and regular reporting of standard results is important for maintaining the high quality of hip arthroplasty. We have also for many years conducted and reported in-depth analyses of different issues. These analyses not only have clinical improvement as their goal but are important for development and may lead to the publication of scientific reports.

1. This year we analysed the significance of prosthesis fixation, primarily the result of uncemented fixation. Historically, uncemented prosthesis types have shown poor results in Sweden. Internationally speaking, we remain conservative; and cemented fixation entirely dominates. However, there has for some years been a clear but slow trend towards the increased used of uncemented fixation with the employment of more modern implants.

2. Throughout the world, surface replacement prostheses have been marketed and are used to an increasing extent. Their introduction in Sweden has been slow, some 1,000 patients having received them. The result of an analysis with a short follow-up time is disquieting, with a clearly increased revision frequency compared to conventional prostheses.

3. The treatment model for cervical hip fracture has changed during the past six-to-seven years in Sweden. Dislocated cervical hip fractures are now increasingly being treated with total or hemi-arthroplasty. An analysis covering more than 10,000 cases receiving total hip replacement owing to fracture shows no difference in revision frequency in the comparison between primary and secondary (following fracture treatment failure) hip replacement operations.

4. In a study of the now-three-year-old hemi-arthroplasty database we found significantly increased reoperation frequency for bipolar hemi-arthroplasty compared to unipolar.

5. In a health-economic study of 2,700 patients, we calculated the social costs of waiting times for total hip replacement surgery.

Degree of coverage

All units (79 hospitals) public and private, that carry out hip arthroplasty are included in the Register. All 62 hospitals that conduct hemi-arthroplasty report to the registry. The Hip Arthroplasty Register thus enjoys 100% coverage of hospitals. The degree of coverage for primary arthroplasties at individual level has this year been checked via co-processing with the PAR and is reported in detail on page 6. Coverage at national level was 96% for total arthroplasties and 95.8% for hemi-arthroplasties. Unfortunately a few departments show faulty reporting (tables, pages 8-9).

The degree of coverage for reoperations has not yet been checked, but the result of this co-processing will be reported later. One reason for the delay in co-processing is that members of the profession are showing very mixed quality in their use of ICD-10 regarding diagnosis and measure codes. Just as in the previous Annual Report, we wish to urge all colleagues to improve in this area. The utility of high-quality registration cannot be exaggerated.

Patient-reported outcome measure (PROM) was reported during 2007 from 73 of 79 hospitals (92%), and we have high hopes that all units will join the follow-up routine before the end of 2008.

The number of reoperations reported during 2007 increased somewhat (2.7%). No hospital notes any big lag in their reporting of reoperations (except Lund). It is primarily the more severe complications deep infection and dislocation that have occasioned the rise. The trend from earlier years has been a successive decline in reoperations and this trend has now also been broken. The complication rates, however, are so low that a random variability may be present.

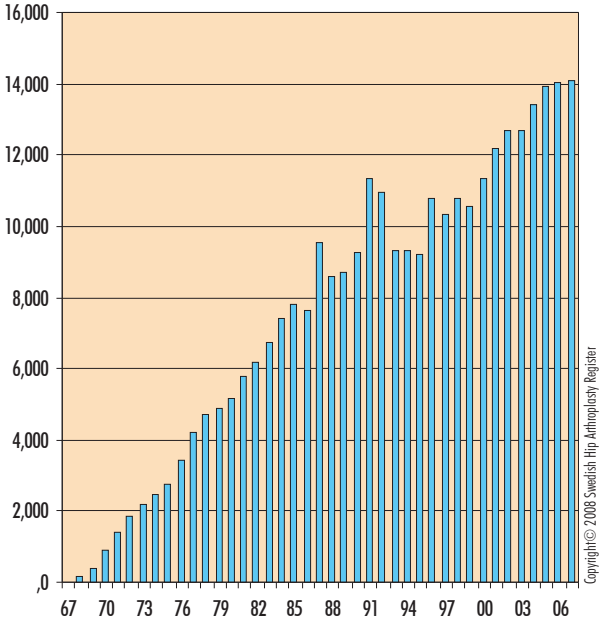
Receiving reports

Most departments report via our web application. Some hospitals in the Skåne Region, however, have chosen their own IT system, which has caused problems for the registry with extra work and a poorer degree of coverage from some hospitals. Copies of medical records from reoperations are sent over the year with varying delays. Study of copies and systematised data collection are necessary for the register analyses.

Reporting

All publications, annual reports and scientific exhibitions are reported on our website. The Annual Report this year has grown further in extent due to the inclusion of more in-depth analyses and above all the expansion of the register with the hemi-arthroplasty database. Under discussion is possible publication of most of the tables via the home page, focusing the printed Report on current in-depth analyses, for example work for clinical improvement and proposals for extension of activities. In cooperation with the Swedish Knee Arthroplasty Register, the Swedish Hip Arthroplasty Register is inviting all departments to an annual users' meeting at Arlanda.

Primary total hip replacement in Sweden



Numbers of primary total hip arthroplasties performed in Sweden between 1967 (6 operations) and 2007 (14,105 operations), inclusive.

Thanks to the Västra Götaland Region. Like many national quality registers, the Hip Arthroplasty Register is under-financed. Despite increasing grants from SALAR the funds allocated have been insufficient during the past three years of activity. The Western Götaland region, which is the formal principal for the registry, has generously contributed funds during this time. In autumn 2008, a register centre will be established at the Nordic School of Public Health (NHV) in Göteborg, with ongoing support from the Region. The centre will be formed of the National Diabetes Register the Centre for Oncology and the Swedish Hip Arthroplasty Register. By using joint IT resources, biostatisticians and premises, we hope to achieve major synergy effects and increased and long-term financial stability.

Thanks to all co-workers! The Hip Arthroplasty Register is based on decentralised data capture, for which reason the contributions of the contact secretaries and contact physicians are invaluable for the Register's function. Very many thanks for all your excellent help during the past year.

Göteborg, September 2008

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Degree of coverage

The Swedish Hip Arthroplasty Register has for many years had 100% coverage of hospitals that perform hip arthroplasty. However, this does not mean that we know for certain whether every hospital reports all patients undergoing surgery there. Before every annual report and before the database in question is analysed, every hospital department or clinic receives a request for local validation of the number of primary operations and reoperations. This type of validation should nowadays be fairly simple since most hospitals today have digital 'operation rosters'. The response frequency for the present Report was only 75%. In 1998, co-processing was undertaken between the In-patient Care Register (now the National Patient Register (PAR)) and the Swedish Hip Arthroplasty Register. This analysis was included in a doctoral dissertation (Peter Södermann, 2000). The degree of coverage for revisions was given there as 94% for the period 1986-1994.

In February 2008 the steering and working group for 'Regional Comparisons' initiated co-processing of various national quality registers and the Patient Register (Centre for Epidemiology/National Board of Health and Welfare) as a measure to achieve better quality assurance for the forthcoming publication of 'Regional Comparisons' 2008 (6/10 2008). Operational year 2006 was analysed. The Swedish Hip Arthroplasty Register was one of ten selected for this type of quality assurance. The registry supplied four databases to the National Board:

- primary total hip arthroplasties 2006
- primary hemi-arthroplasties 2006
- reoperations (including revisions) performed in 2006 – total hip replacements
- reoperations (including revisions carried out in 2006) – hemi-arthroplasties.

Co-processing of the PAR with the first two databases above was carried out before the present Annual Report went to press. The degree of coverage for reoperations has not yet been checked, but the result of this co-processing will be reported later. One cause of the delay of this analysis is that the profession is showing very mixed quality in its use of the ICD-10 regarding diagnosis and measure codes. Just as in last year's report we in the registry management would urge all departments and colleagues to make vigorous improvements in this respect.

Method

The selection criteria in the PAR were individuals undergoing surgery during 2006 with measure codes NFB 29, 39, 49 and 99 (primary total hip arthroplasty) and NFB 09 and 19 (hemi-arthroplasty).

Following co-processing of the registry's databases with the PAR at individual level (personal identification number), three outcomes were obtained:

1. Matching of individuals, i.e. patients registered in both registers
2. Individuals registered only in the Hip Arthroplasty Register
3. Individuals registered only in the PAR.

The degree of coverage of the Hip Arthroplasty Register is given in the following table as the sum of outcomes 1+2, and that of the PAR as the sum of 1+3. We do not know whether these results reflect the true coverage since patients may have received hip implants without the respective care units registering the measure in either register. The number of such cases should be low in Sweden for 2006. The coverage given in the table is thus a 'best-case scenario' – the true figure may be a percent lower. The method also has a number of weak points:

Laterality. In most cases the PAR lacks laterality, i.e. right or left is not given as a unique variable, which it is in the Swedish Hip Arthroplasty Register. Patients treated bilaterally in one session and patients treated in both hips during 2006 may 'disappear' from the PAR with the selection criteria chosen for the co- processing. Most national and local care registers lack laterality; this should be altered so as to improve the quality in these registers if one wishes to analyse diseases/operations involving pair organs.

Time-lag in registration. How the various care units report to the medical quality registers and the Patient Register varies. Some units are 'chronic' laggers – not infrequently even from one year to the next – and this is a great disadvantage in this type of necessary quality assurance. For this reason the present co-processing was carried out for operational year 2006.

Combinations. Structural alterations in Swedish orthopaedics have involved our principals in combining administratively a number of geographically separate operational units. In practice, however, these have continued as separate production units with differing routines for e.g. registration to the various registries. One result is that the Patient Register has a series of unit designations that cover a number of units, all of which report individually to the Hip Arthroplasty Register. This is not only a problem of registration but also affects opportunities for work on local improvement and economic analyses in, for example, the CPP system.

Measure codes. As already mentioned, quality in assigning diagnosis and measure codes varies. The problem is even greater in the analysis of reoperations (including revisions). The registry management and colleagues at the Centre for Epidemiology strongly urge all orthopaedic surgeons to use the ICD system with greater reflection. Giving the correct diagnosis and correct measure is decisive for the quality achievable in statistical analyses from our various registers.

Results

Total arthroplasties. The degree of Hip Arthroplasty Register coverage for total arthroplasties according to the above calculation is 96% throughout the country, with a spread at department level from 59.9% to 100% (see table on next page). Total coverage is very good but can be further improved particularly at certain departments. Coverage in the Patient Register is clearly poorer at 90.7% (0% - 100%). Private hospitals have a generally low frequency of reporting to the Patient Register.

The table shows departments with coverage below the first quartile (95.7%, national average = 98.1%) in red. These departments should analyse local routines concerning reporting to the Hip Arthroplasty Register and the Patient Register. It is disquieting that we found in the analyses some hospitals that had reported under 90% of their production. Worst during 2006 was Köping with 59.9%, while below 90% was reported by Norrtälje, Växjö and Trelleborg. The latter, a highly-productive hospital, reported only 88.5% to the registry but 99.6% to the Patient Register. This hospital is one of few that do not report via the registry's home page but via their own IT system (which causes extensive extra work for the registry yet still results in low coverage).

Hemi-arthroplasties. We are very glad that hemi-arthroplasties after only the second year of operation (register start 1 January 2005) have reached the national degree of coverage – 95.8% (range: 0%-100% - see table on page 9). In the same way as for total hip replacement, the result is given in red for those departments that reported below the first quartile (95.7%, median = 98.1%). For this intervention, too, the degree of reporting is lower for the Patient Register. Some units performed only a very small number of hemi-arthroplasties during 2006. The coverage of these units is of course greatly affected if one registration is missed. Of the departments with more than ten hemi-arthroplasties, seven had reporting below 90%: Norrtälje, Södertälje, Skellefteå, Växjö, S:t Görans, Falun and Umeå.

Discussion

Degree of coverage is an absolutely crucial parameter for all analyses, both from our official national statistical units such as the Centre for Epidemiology (EpC) and Statistics Sweden (SCB) and from the national Swedish medical quality registers. Daily routine medical care is heavily burdened and many of those involved in medical care consider our Swedish passion for registration as a burden in a sector with resource problems. Yet the utility of high-quality reporting cannot be over-estimated. The Swedish Hip Arthroplasty Register has been active for almost thirty years, with a well-established and decentralised infrastructure, and this has resulted in a very good degree of coverage. Since the complication frequency after operation especially with elective total hip replacement is low, even a few missing percents in the database can be very significant in terms of the need for local work on clinical improvement. Moreover, our political decision-makers ('free choice of care') are currently striving to introduce a ranking system for different care units and different medical interventions. A ranking system of this nature is entirely meaningless and misleading unless we have practically 100% coverage in our registers.

Every department should on reading this Report review its reporting routines and adopt a 'zero vision'. Since good data quality gives a clear potential for improvement both in patient morbidity and in costs, it is cost-effective for the departments to employ officials with job descriptions that include responsibility for reporting 100% to the Swedish Hip Arthroplasty Register and to the Patient Register.

In preparation for the introduction of the 'free choice of care' scheme in Stockholm, the Stockholm County Council established a set of rules under which the departments are not paid for their measures until it has been shown that a hip arthroplasty, for example, has been registered in the Hip Arthroplasty Register. For the first time, therefore the relevant care units have been given an obligation and an economic incentive. This development is to some extent diametrically opposed to what the registry has been working for all these years, since we have always seen participation as voluntary. There is much to indicate that we in the future will have an obligatory registration system in Sweden. Hence the profession will gain by optimising its registration already now.

Regulations for the PAR

Incomplete reporting to the National Patient Register is in actual fact a criminal offence – departments and above all private caregivers take note! Extract from the legal text :

All caregivers providing institutional care or specialised open care have a duty to supply information to the registry. The provisions of the National Board of Health and Welfare regarding the obligation to notify the PAR stipulate who has the obligation to notify, what is to be reported and how this shall be reported. The provision is based on paragraph 6 of the PAR Ordinance (2001:707), available via the home page. Note that release of information from PAR is regulated in the Official Secrets Act. Hence special confidentiality governs the particulars reported." (present authors' translation).

Use the correct ICD-10 diagnosis and measure codes!

Degree of coverage for total arthroplasties

registrations during 2006

Hospital	No.[1]	SHAR[2]	PAR[3]
University/Regional Hospitals			
KS/Huddinge	330	98.8%	97.3%
KS/Solna	182	93.3%	99.0%
Lund	81	96.4%	89.3%
Malmö	120	99.2%	97.5%
SU/Sahlgrenska + Mölndal + Östra[4]	336	96.9%	94.3%
Umeå	78	95.1%	98.8%
Uppsala	265	98.5%	97.0%
Örebro	190	99.0%	98.4%
Central Hospitals			
Borås + Skene[5]	277	98.2%	97.5%
Danderyd	361	97.8%	97.3%
Eksjö	189	95.4%	98.4%
Eskilstuna	104	99.0%	88.6%
Falun	239	97.5%	99.5%
Gävle	129	99.3%	93.9%
Halmstad	261	96.7%	95.9%
Helsingborg	84	96.6%	95.4%
Hässleholm-Kristianstad	751	100.0%	98.3%
Jönköping	203	97.2%	94.8%
Kalmar	184	95.8%	99.0%
Karlskrona + Karlshamn[6]	199	91.7%	97.2%
Karlstad	273	97.5%	96.4%
S:t Göran	439	90.3%	92.0%
Skövde + Lidköping + Falköping[7]	575	98.1%	96.4%
Sunderby	82	100.0%	98.8%
Sundsvall	126	97.7%	98.4%
Södersjukhuset	418	95.6%	96.7%
Uddevalla	342	100.0%	98.5%
Varberg	201	100.0%	100.0%
Västerås	156	94.5%	89.7%
Växjö	155	84.7%	97.3%
Ystad	13	92.9%	100.0%
Östersund	204	99.1%	95.7%
Rural Hospitals			
Alingsås	209	99.5%	98.1%
Arvika	97	91.5%	98.1%
Bollnäs	265	96.3%	98.1%
Enköping	180	98.9%	100.0%
Frölunda Specialistsjukhus	52	98.1%	100.0%
Gällivare	137	98.5%	99.2%
Hudiksvall	124	99.2%	100.0%
Karlskoga	100	99.0%	100.0%
Katrineholm	185	98.4%	90.4%
Kungälv	169	100.0%	98.2%
Köping	218	59.9%	59.1%
Lindesberg	147	99.3%	96.6%
Ljungby	121	96.8%	97.6%
Lycksele	241	99.2%	97.1%
Mora	132	97.7%	99.2%
Motala + Linköping + Norrköping[8]	544	99.7%	98.8%
Norrtälje	87	82.9%	98.1%
Nyköping	133	98.5%	79.3%
Oskarshamn	258	99.2%	99.6%
Piteå	335	99.4%	97.9%
Skellefteå	108	100.0%	99.1%
Sollefteå	155	98.1%	98.7%
Södertälje	127	97.7%	98.5%
Torsby	67	97.1%	97.1%
Trelleborg	491	88.5%	99.6%
Visby	121	94.6%	99.3%
Värnamo	150	97.4%	96.1%
Västervik	91	98.9%	100.0%
Örnsköldsvik	176	94.6%	98.4%
Private Hospitals			
Carlanderska	66	100.0%	0.0%
Elisabethsjukhuset	159	100.0%	0.0%
Gothenburg Medical Center	50	100.0%	0.0%
Movement	112	100.0%	0.0%
Nacka Närsjukhus Proxima	54	94.8%	79.0%
Ortopediska Huset	379	95.4%	61.4%
Sophiahemmet	210	99.5%	24.2%
Stockholms Specialistvård	168	100.0%	39.9%
Nation	13,965	96.0%	90.7%

Red marking indicates values below the first quartile (95.7%) of Swedish Hip Arthroplasty Register values for total arthroplasty (median = 98.1%).

*[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'
[8] These departments are in the National Patient Register combined to 'University Hospital in Linköping'.

Degree of coverage for hemi-arthroplasties

registrations during 2006

Hospital	No. [1]	SHPR [2]	PAR [3]
University/Regional Hospitals			
KS/Huddinge	84	96.5%	94.2%
KS/Solna	61	91.1%	97.1%
Lund	179	92.3%	81.4%
Malmö	253	99.6%	96.1%
SU/Sahlgrenska + Mölndal + Östra [4]	373	98.7%	92.6%
Umeå	56	87.5%	98.4%
Uppsala	90	96.8%	97.8%
Örebro	80	98.8%	88.9%
Central Hospitals			
Borås + Skene [5]	81	96.5%	95.3%
Danderyd	123	99.2%	91.1%
Eksjö	53	93.0%	98.2%
Eskilstuna	53	100.0%	88.7%
Falun	115	87.2%	99.3%
Gävle	118	99.2%	17.6%
Halmstad	63	98.5%	95.4%
Helsingborg	169	96.5%	92.5%
Hässleholm-Kristianstad	126	99.2%	87.4%
Jönköping	60	95.2%	92.1%
Kalmar	89	96.7%	95.7%
Karlskrona + Karlshamn [6]	91	97.8%	95.7%
Karlstad	43	97.7%	93.2%
S:t Göran	87	81.3%	94.4%
Skövde + Lidköping + Falköping [7]	89	97.8%	89.0%
Sunderby	120	100.0%	98.3%
Sundsvall	62	95.4%	93.8%
Södersjukhuset	219	96.4%	95.1%
Uddevalla	208	99.0%	96.7%
Varberg	54	96.5%	96.5%
Västerås	127	92.7%	86.9%
Växjö	64	84.2%	92.1%
Ystad	46	95.9%	95.9%
Östersund	80	97.6%	93.9%
Rural Hospitals			
Alingsås	39	100.0%	89.7%
Arvika	0	0.0%	100.0%
Enköping	1	50.0%	100.0%
Gällivare	10	100.0%	90.0%
Hudiksvall	34	100.0%	100.0%
Karlskoga	35	94.6%	91.9%
Katrineholm	1	100.0%	0.0%
Kungälv	45	93.8%	87.6%
Köping	0	0.0%	100.0%
Lindesberg	36	97.3%	89.2%
Ljungby	25	100.0%	96.0%
Mora	29	100.0%	100.0%
Motala + Linköping + Norrköping [8]	174	97.7%	94.3%
Norrtälje	9	64.3%	100.0%
Nyköping	31	100.0%	83.9%
Skellefteå	35	87.5%	90.0%
Sollefteå	42	95.5%	88.6%
Södertälje	10	71.4%	100.0%
Torsby	29	100.0%	100.0%
Visby	33	94.3%	85.7%
Värnamo	46	97.9%	95.7%
Västervik	26	100.0%	96.2%
Örnsköldsvik	34	97.1%	88.6%
Nation	4,240	95.8%	91.2%

Red marking indicates values below the first quartile (95.7%) of Swedish Hip Arthroplasty Register values for total arthroplasty (median = 98.1%).

*[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'
[8] These departments are in the National Patient Register combined to 'University Hospital in Linköping'.

The new home page

The Swedish National Board of Health and Welfare and the Swedish Association of Local Authorities and Regions (SALAR) in Autumn 2005 scrutinised the home pages of the web-based registries regarding readability, accessibility, openness and patient-oriented information. They subsequently published recommendations on how the home pages should be designed. At the turn of the year 2006/2007 the Swedish Hip Arthroplasty Register started extensive modification and modernisation of its home page, introduced back in 1999. Since the registry conducts almost all its data collection and re-reporting via its home page, the work on the new home page has become much more demanding than originally planned, both time-wise and in terms of cost. There are several reasons why the new home page is not yet entirely reorganised.

- The registry has material in a number of databases with differing IT technologies. Several databases were created as long ago as the 1980s and the registry has therefore great need to consolidate its databases with more modern and flexible systems. This was described extensively in last year's Report. The reason why the necessary artwork has not yet started is that the process is not financed.
- During Autumn 2008 the registry will increase its co-operations with the National Diabetes Register and the Centre for Oncology in the Western Region. One purpose of this co-operation is to create a joint IT unit with, it is hoped, synergy effects and increased resources for e.g. database consolidation. The registry is therefore to move to new premises during 2008, entailing a change of servers and web addresses.

Information to patients and decision-makers

One of the recommendations from the National Board of Health and Welfare and the Swedish Association of Local Authorities and Regions was to create a patient information service easily-accessible via the home page. For this reason we have, as the first part of this project, focused on this particular aspect. The registry management consider, however, that register information destined for politicians and officials in health care is also important, and we have since January 2008 published that part of our new home page that contains information to the public and decision-makers. For medical care (input and 'on-line' results) the old home page structure will function in parallel with the new, probably for a further year.

The new home page can be reached at: www.hoftregistret.se or www.hoftprotesregistret.se

Primary total hip replacement

The registry reports primary total hip replacements carried out in Sweden starting in 1979. Up and including 1991, aggregate data were collected from each department. Starting in 1992 data on primary operations were individual-based, using the unique identity number that all citizens in Sweden have. This means that factors such as age, gender, diagnosis, surgical technique and choice of implants and cement types could be recorded for each operation. Up until 1991 the reporting was based partly on estimations. Starting in 1999 two important changes were introduced. The first was that registration via the internet was made possible, and by 2007 this was done by 76 of the 79 departments that conduct hip arthroplasty in Sweden. The remaining departments report via data files.

The other change was that registration was supplemented with article numbers for the various components of the implant used in each individual operation. This means that each patient's implant and its various parts can be identified in detail. A practical example of this opportunity for increased analysis was carried out for the Annual Report in 2005, when we investigated how, among others, factors such as stem size, choice of neck length and offset, affected the outcome for the most frequently used implants. An updated analysis has been completed and a report is planned for inclusion in the next Annual Report.

During the period 1979-2007, 284,630 primary hip implants were registered (1992-2007: 184,020). The number of primary implants during the past ten-year period increased each year except 1998-1999. On average the increase was 334 operations/year (2-3%/year). In Sweden, cemented fixation of both prosthesis parts has predominated. Since 2003, however, there has been a continual increase in, chiefly, uncemented stems and in 2007 these represented more than one-fifth of the total (see figure 1). The fifteen most common implant combinations are reported in table form. During 2007 the fifteen most common cups represented 91% of all types used, while in 1998 the corresponding proportion was 94%. The corresponding proportions regarding stems were 95% and 94%, respectively, (not shown in the tables). Compared with 2006, this proportion also declined for cups and stems alike. It thus seems that there is a slowly increasing and probably warranted diversification on the implant side. The increased proportion of uncemented fixation and the introduction of new plastics (registered as new types of implant in the register) automatically leads to increased diversification since change between two different types most often occurs step-wise and are sometimes not entirely complete before some years have passed.

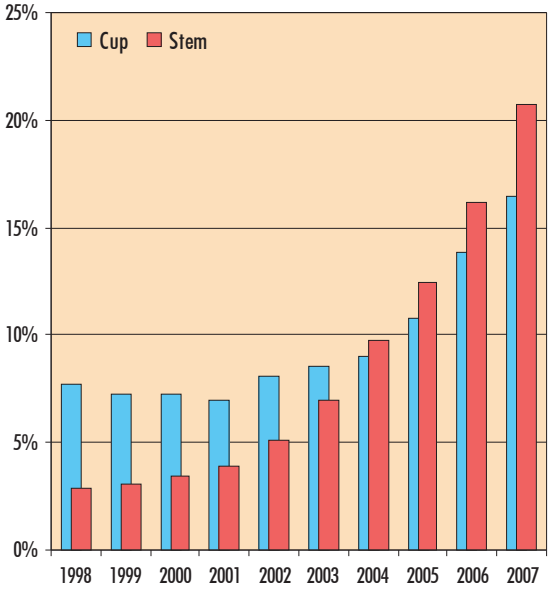


Figure 1. Proportion of uncemented cups and stems during the past ten years.

In this year's Report we have made an important change regarding the classification of implant groups. Earlier, four groups were reported: fully cemented, fully uncemented, hybrid and reversed hybrid. Hence surface replacement implants were included in the hybrid group. Starting this year we are treating this group separately. We have also done this retrospectively so that all surface replacement implants since 1992 are now registered in their own group.

Among the 15 commonest implant combinations there has been a fairly pronounced reduction in numbers for the three most common combinations (Lubinus whole plastic/Lubinus SP II, Exeter Duration/Exeter Polished, Charnley Elite/Exeter Polished). Together however they still represented 51% of all implants during 2007. The largest increase was noted for Contemporary Hooded Duration/Exeter Polished and Trilogy HA/CLS Spotorno which together increased from 6.4% to 7.9% between 2006 and 2007.

Among the 15 commonest uncemented implant combinations, the largest increase was for Trident HA/ABG II, followed by Trology HA/CLS Spotorno and CLS Spotorno/CLS Spotorno. Elsewhere, the changes were relatively insignificant.

Over a five-year period the number of hybrid implants more than halved with a continual decline during the whole period. The reason for this rapid change is probably reports that uncemented stems may be preferable in certain patients (see Annual Reports 2005 and 2006 and the in-depth analysis in the present Report). In addition, there is worry in the profession that new plastic types (highly cross-linked) will not solve the local bone resorption (osteolysis) problems of the uncemented cup. Current studies will answer this question within some years.

Between 2006 and 2007, reversed hybrid increased by 203 implants (+30%). The corresponding increase for all-uncemented fixation was 309 (23%). During 2007 none of the cup/stem combinations was used in more than 100 hips. Six combinations were used in between 50 and 100 cases. Among individual implant components (totalling 1,127 implants) the dominant types were Charnley Elite (n=276), Lubinus all-poly (n=271) and ZCA XLPE (n=166) on the acetabular side and

Bimetric (all variants n=400), CLS Spotorno (n=343) and Corail (n=156) on the stem side.

Between 2006 and 2007 there was an increase in the number of surface replacement implants from 246 in 2006 to 293 in 2007. This increase was largely due to ASR (Articular Surface Replacement) probably because newly-started departments chose this particular prosthesis. Slightly increased diversification of design/ supplier is surely warranted where only two implants, BHR and Durom, previously dominated the Swedish market. International experience and also our analysis in this year's Report of the Swedish cohort suggest that the introduction of these implant types should be slow and that articular surface replacements should be used only with limited and strict indications.

Between 1998 and 2007 the proportions of operations carried out at university/ regional hospitals decreased from 18.2% to 11.2%, and at county hospitals from 45.9% to 38.6%. At the same time the proportions at county district hospitals and at private hospitals increased from 33.6% to 40.4% and from 2.3% to 9.7%, respectively. This trend continued for university/regional and private hospitals between 2006 and 2007, while county hospitals remain unchanged and county district hospitals decreased by under 1%.

During the past five years the proportion of patients meeting the criteria for optimal 'case-mix' (women 60 years or above with primary osteoarthritis) represented 29%, 39%, 44% and 46%, respectively, of the operations at each type of department (university/ regional hospitals, county hospitals, county district hospitals, private hospitals). Corresponding proportions with the most unfavourable 'case-mix' (men under 60 years with secondary osteoarthritis) were 4.1%, 1.6%, 0.8% and 0.6%, respectively. This shows that university/regional hospitals and county hospitals operate on a higher proportion of patients with increased risk of early and late complications.

Since 1998 there has been a change in diagnosis distribution among patients undergoing hip replacement surgery. Primary osteoarthritis increased its proportion from about 76% to 83% in 2007. Inflammatory joint disease and fractures declined from 5.1% and 13.1% to 2% and 9.9%, respectively, of the total number. A certain reduction in the diagnosis group idiopathic necrosis of the femoral head was also noted, from 3.1% to 2.3% during the past ten years. Secondary osteoarthritis following hip disease during childhood or adolescence years showed irregular variations above and below the 2% level.

The concept of revision burden (RB) shown in the bar diagram for each implant group consists of the quotient of number of revisions in the form of exchange or extraction of whole or parts of the prosthesis and the sum of primary operations and revisions. RB is an important key number but must be related to the patient group in question. Length of time for which a certain implant type is used must also be taken into account. Since prosthesis complications leading to loosening often increase appreciably after 5-10 years, newly-introduced implant types have a considerably lower RB than a prosthesis system which has been used in large numbers practically unchanged for a longer period. At hospital level the RB is rather a way of describing the type of surgery performed at the individual department, since patients undergoing primary operations at another hospital may be included. In the report these revision cases are added to the record of revisions belonging to the hospital where the primary operation was performed. Thus, the RB becomes zero for departments that do not undertake revisions at all. In the comparison between large regions or internationally, where primary cases requiring further measures are treated within the same region, the RB concept is relevant. Should one wish to study revision related to an individual department or other factors, one should instead study implant survival in the implant survival diagram and also use regression analysis to compensate for differences in patient selection, surgical technique, choice of implant and other possible causes of misinterpretation.

In summary, a limited number of implant types are used in Sweden, normally with good documentation. At present, however, there is a clear shift in implant selection to uncemented fixation, predominantly on the stem side. The shift to highly cross-linked polyethylene on the cup side is accelerating. Both these developments should be followed carefully not least in view of this year's in-depth analysis of uncemented fixation and the fact that we lack long-term results concerning the new plastic types. There is, however, much to show that the choice between uncemented fixation and cemented can be further optimised. This should be studied in future in-depth analyses when larger patient groups with modern implants have been followed for a longer time. We consider that further expansion of articular surface replacement implants is undesirable, at least until the area of indication for this implant type and possible pros and cons have been better surveyed.

The variable Surgical incision has been individually based since 2000 and has therefore been moved from the section Environmental/Technical Profile. In Sweden a small number of operations have been carried out using what is termed mini-incision (MIS). Following a number of reports on increased complication frequency with this type of surgery, Swedish orthopaedic surgeons have been restrictive with the new technique. In the table below, a higher risk of complications with the use of MIS is indicated.

Type of surgical approach	No. pri.	No. rev.	Share rev.
MIS/2	44	3	6.8%
MIS/1, posterior	64	2	3.1%
OCM	42	1	2.4%
MIS/1, lateral	477	11	2.3%
Direct lateral, supine (Hardinge)	8,270	181	2.2%
Posterior (Moore)	57,650	1 057	1.8%
Posterior, trochanteric osteotomy	170	3	1.8%
Direct lateral, patient on side (Gammer)	34,685	538	1.6%
Lateral, trochanteric osteotomy	138	2	1.4%

Number of revisions by type of surgical approach, 2000-2007.

15 most common implants

most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus All-Poly (Lubinus SP II)	40,720	4,712	5,395	5,705	5,529	5,226	67,287	36.1%
Exeter Duration (Exeter Polished)	5,293	1,418	1,329	1,121	1,122	812	11,095	8.8%
Charnley (Charnley)	55,125	282	81	8	2	3	55,501	6.5%
Charnley Elite (Exeter Polished)	2,353	1,062	998	980	1,163	1,151	7,707	6.1%
Reflection (Spectron EF Primary)	3,726	889	871	788	671	285	7,230	5.2%
FAL (Lubinus SP II)	1,389	831	706	599	534	444	4,503	3.6%
Contemporary Hooded Duration (Exeter Polished)	296	561	514	574	607	762	3,314	2.6%
Charnley (Exeter Polished)	818	281	435	518	282	205	2,539	1.7%
Exeter All-Poly (Exeter Polished)	6,543	8	10	2	2	0	6,565	1.5%
OPTICUP (Scan Hip II Collar)	1,844	125	10	0	1	0	1,980	1.4%
Weber All-Poly cup (Straight-stem standard)	337	137	196	164	125	191	1,150	0.9%
Charnley Elite (Lubinus SP II)	505	140	176	187	124	96	1,228	0.9%
Trilogy HA (Spectron EF Primary)	767	127	107	88	102	24	1,215	0.9%
Charnley (Charnley Elite Plus)	1,516	2	0	0	0	0	1,518	0.8%
Trilogy HA (CLS Spotorno)	29	24	80	178	284	347	942	0.7%
Others (total 1,121)	95,229	2,083	2,486	3,037	3,462	4,559	110,856	
Total	216,490	12,682	13,394	13,949	14,010	14,105	284,630	

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)	1979-2002	2003	2004	2005	2006	2007	Totalt	Andel [1)]
Trilogy HA (CLS Spotorno)	29	24	80	178	284	347	942	13.7%
CLS Spotorno (CLS Spotorno)	490	69	68	110	163	193	1,093	11.7%
Allofit (CLS Spotorno)	126	94	87	127	128	128	690	10.0%
Trilogy (CLS Spotorno)	76	58	78	86	88	93	479	7.0%
Trident HA (Accolade)	0	0	33	70	132	133	368	5.3%
Trilogy HA (Versys stem)	68	80	75	25	9	0	257	3.7%
Trilogy (Wagner Cone Prosthesis)	86	15	35	23	23	37	219	3.2%
ABG II HA (ABG uncem.)	145	19	14	18	2	0	198	2.8%
Trilogy HA (Bi-Metric HA uncem.)	73	61	28	22	4	3	191	2.8%
Trident HA (Symax)	0	0	0	17	68	79	164	2.4%
Trident HA (ABG II HA)	0	0	0	24	30	107	161	2.3%
Romanus HA (Bi-Metric HA uncem.)	253	1	5	3	0	0	262	2.1%
M2a (Bi-Metric HA lat)	0	7	21	26	47	36	137	2.0%
Trilogy (SL plus stam uncem.)	52	17	26	31	9	0	135	1.9%
Trilogy HA (Bi-Metric lat)	0	2	0	19	51	50	122	1.8%
Others (total 226)	5,539	130	203	220	319	460	6,871	
Total	6,937	577	753	999	1,357	1,666	12,289	

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)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Trilogy HA (Spectron EF Primary)	767	127	107	88	102	24	1,215	26.9%
Trilogy HA (Lubinus SP II)	589	144	114	73	51	55	1,026	23.2%
ABG II HA (Lubinus SP II)	197	5	6	0	3	0	211	4.5%
TOP Pressfit HA (Lubinus SP II)	65	24	31	16	5	4	145	3.6%
Reflection HA (Lubinus SP II)	140	15	23	10	1	2	191	3.4%
Biomex HA (Lubinus SP II)	74	30	3	0	0	0	107	2.6%
Trilogy HA (Stanmore mod)	47	15	9	8	7	8	94	2.3%
Allofit (MS30 Polished)	70	4	0	3	2	5	84	2.1%
Reflection HA (Spectron EF Primary)	99	0	0	0	0	0	99	1.7%
Trilogy (Lubinus SP II)	53	3	7	4	1	2	70	1.7%
ABG II HA (Exeter Polished)	60	6	0	1	0	0	67	1.6%
Duralock uncem. (Spectron EF Primary)	115	0	0	0	0	0	115	1.6%
ABG HA (Lubinus SP II)	339	0	0	0	0	0	339	1.4%
Trident HA (ABG II Cemented)	0	0	0	14	20	20	54	1.3%
Mallory-Head uncem. (Lubinus SP II)	95	2	3	2	1	2	105	1.3%
Others (total 228)	4.858	55	39	49	79	80	5,160	
Total	7,568	430	342	268	272	202	9,082	

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

15 most used reversed hybrid implants

most used during the past 10 years

Cemented cup (uncemented stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Charnley Elite (ABG uncem.)	225	128	16	1	0	0	370	8.8%
Charnley Elite (CLS Spotorno)	4	16	48	47	80	89	284	6.8%
Contemporary Hooded Duration (ABG II HA)	0	0	1	56	94	85	236	5.7%
Charnley (ABG II HA)	0	0	93	78	34	22	227	5.4%
Biomet Müller (Bi-Metric HA uncem.)	122	27	27	14	6	2	198	4.7%
Lubinus All-Poly (CLS Spotorno)	0	1	7	27	41	100	176	4.2%
Biomet Müller (Bi-Metric HA lat)	0	9	28	45	58	27	167	4.0%
Charnley Elite (Bi-Metric lat)	0	1	3	12	74	77	167	4.0%
Charnley Elite (Bi-Metric HA uncem.)	40	10	34	43	15	2	144	3.5%
Charnley Elite (ABG II HA)	0	20	56	19	22	20	137	3.3%
Lubinus All-Poly (Bi-Metric HA lat)	0	0	25	34	34	37	130	3.1%
Charnley Elite (Corail stem)	1	0	10	6	43	67	127	3.0%
ZCA (Bi-Metric HA lat)	0	0	11	37	27	47	122	2.9%
ZCA XLPE (CLS Spotorno)	0	0	0	1	19	78	98	2.3%
Contemporary Hooded Duration (CLS Spotorno)	0	2	13	19	27	36	97	2.3%
Others (total 173)	435	95	174	283	290	438	1,715	
Total	827	309	546	722	864	1,127	4,395	

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

15 most common resurfacing implants

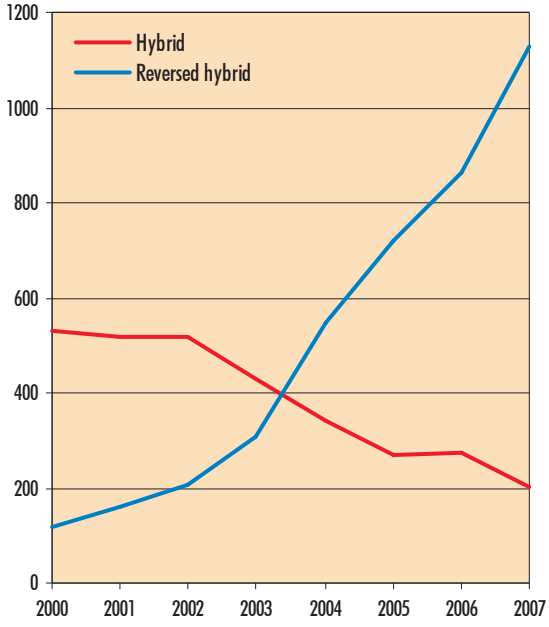
most used during the past 10 years

Cup (stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
BHR Acetabular Cup (BHR Femoral Head)	70	44	74	118	116	111	533	51.3%
Durom (Durom)	23	25	33	75	66	70	292	28.1%
ASR Cup (ASR Head)	0	0	1	22	49	94	166	16.0%
Adept (Adept Resurfacing Head)	0	0	0	0	5	9	14	1.3%
BHR Dysplasia Cup (BHR Femoral Head)	0	2	0	1	3	4	10	1.0%
Durom studiecup (Durom)	0	0	0	0	3	5	8	0.8%
Cormet 2000 resurf (Cormet 2000 resurf)	5	0	0	0	0	0	5	0.5%
McMinn resurf (McMinn resurf)	6	0	0	0	0	0	6	0.4%
ReCap HA Cup (ReCap Head)	0	0	0	0	3	0	3	0.3%
Cormet 2000 resurf (Cormet 2000 HA resurf)	2	0	0	0	0	0	2	0.2%
ASR Cup (BHR Femoral Head)	0	0	0	0	1	0	1	0.1%
ReCap Cup (ReCap Head)	0	0	0	1	0	0	1	0.1%
Others (total 0)	0	0	0	0	0	0	0	
Total	106	71	108	217	246	293	1,041	

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

Hybrid implants

usage over time



The diagram to the right shows the strong increase in what is termed the reversed hybrid (cemented cup and uncemented stem). Following reports of the high frequency of plastic wear and developments of osteolysis in the use uncemented cups with conventional plastic, a start was made around 2000 (primarily in the Stockholm region) to shift, without genuine evidence, to the reversed hybrid.

We show in this year's analysis that 10-year survival is not noticeably better than for the conventional hybrid technique (88% and 91% survival after 10 years – all diagnoses, all reasons for revision). Also disquieting is the large increase in revisions in the past few years (see page 48). The Norwegian Arthroplasty Register has also reported similar results.

15 most common cup components

most used during the past 10 years

Cup	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus All-Poly	62,854	4,745	5,467	5,825	5,684	5,507	90,082	36.7%
Charnley	58,868	617	665	636	330	238	61,354	9.6%
Exeter Duration	5,574	1,533	1,471	1,264	1,282	912	12,036	9.6%
Charnley Elite	5,394	1,502	1,457	1,406	1,639	1,599	12,997	9.4%
Reflection	5,137	913	888	831	708	316	8,793	5.4%
FAL	1,400	842	727	618	558	468	4,613	3.7%
Trilogy HA	1,903	486	467	460	567	618	4,501	3.2%
Contemporary Hooded Duration	296	565	562	690	811	1,016	3,940	3.1%
OPTICUP	3,454	181	91	63	37	9	3,835	2.0%
Biomet Müller	4,567	235	205	211	174	105	5,497	2.0%
Exeter All-Poly	6,771	8	10	2	2	0	6,793	1.5%
Weber All-Poly Cup	453	259	363	197	152	261	1,685	1.3%
Cenator	2,673	3	6	0	0	0	2,682	1.3%
ZCA	279	71	134	478	239	196	1,397	1.0%
Müller All-Poly	5,157	70	89	131	105	135	5,687	0.9%
Others (total 163)	51,710	652	792	1,137	1,722	2,725	58,738	
Total	216,490	12,682	13,394	13,949	14,010	14,105	284,630	

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

15 most common stem components

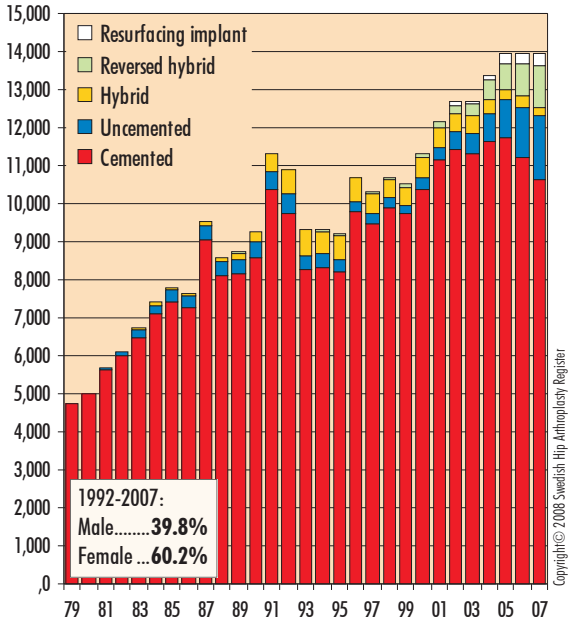
most used during the past 10 years

Stem	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus SP II	47,781	6,086	6,685	6,820	6,475	6,111	79,958	43.8%
Exeter Polished	25,938	3,361	3,301	3,219	3,201	2,963	41,983	21.6%
Spectron EF Primary	5,251	1,077	1,041	928	824	614	9,735	7.0%
Charnley	56,246	282	81	9	2	4	56,624	6.6%
CLS Spotorno	993	309	448	698	925	1,249	4,622	3.4%
Charnley Elite Plus	3,079	2	0	0	1	0	3,082	1.7%
Scan Hip II Collar	2,141	125	10	0	1	0	2,277	1.5%
MS30 Polished	272	141	183	267	287	469	1,619	1.3%
Straight-stem standard	453	145	207	208	172	255	1,440	1.1%
CPT (steel)	1,235	198	48	3	1	0	1,485	1.0%
Stanmore mod	862	91	80	50	71	32	1,186	0.9%
CPT (CoCr)	0	64	224	317	204	188	997	0.8%
ABG II HA	6	63	203	215	221	276	984	0.8%
Müller Straight	4,554	98	98	118	109	92	5,069	0.8%
Bi-Metric HA uncem.	696	114	127	144	51	15	1,147	0.7%
Others (total 177)	66,983	526	658	953	1,465	1,837	72,422	
Total	216,490	12,682	13,394	13,949	14,010	14,105	284,630	

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

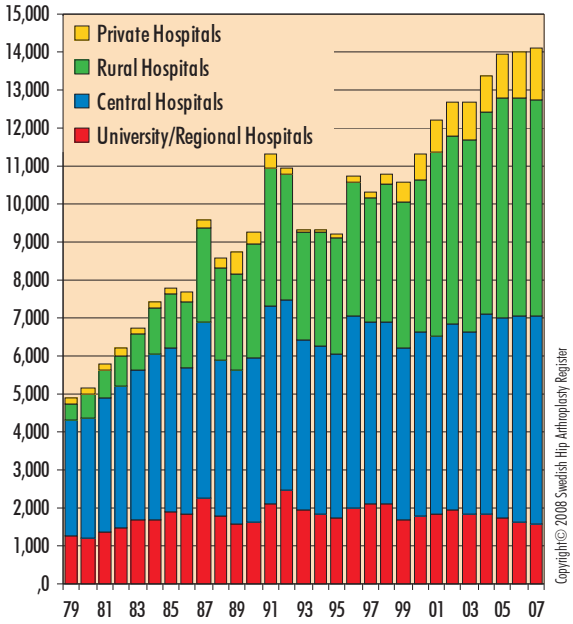
Number of primary THRs

per type of fixation, 1979-2007



Number of primary THRs

per type of hospital, 1979-2007



Number of primary THRs per hospital and year

Hosptial	1979-2002	2003	2004	2005	2006	2007	Total	Share
Alingsås	1,223	98	147	201	209	211	2,089	0.7%
Arvika	867	44	118	145	97	80	1,351	0.5%
Bollnäs	1,127	215	275	253	265	262	2,397	0.8%
Borås	4,304	151	196	234	211	214	5,310	1.9%
Carlanderska	1,020	42	50	56	69	50	1,287	0.5%
Danderyd	5,435	290	268	408	354	417	7,172	2.5%
Eksjö	3,474	151	190	191	189	183	4,378	1.5%
Elisabethsjukhuset	131	71	121	116	159	164	762	0.3%
Enköping	938	163	149	155	181	187	1,773	0.6%
Eskilstuna	3,630	66	65	75	106	76	4,018	1.4%
Falköping	1,460	223	213	227	274	233	2,630	0.9%
Falun	4,419	273	301	231	239	260	5,723	2.0%
Frölunda Specialistsjukhus	1	34	61	48	52	75	271	0.1%
GMC	5	0	17	42	50	11	125	0.0%
Gällivare	1,809	103	94	117	137	70	2,330	0.8%
Gävle	4,446	194	149	140	131	129	5,189	1.8%
Halmstad	3,028	171	164	177	267	238	4,045	1.4%
Helsingborg	3,363	100	102	73	85	60	3,783	1.3%
Hudiksvall	2,117	186	161	129	123	139	2,855	1.0%
Hässleholm-Kristianstad	4,910	581	710	670	751	851	8,473	3.0%
Jönköping	3,217	162	221	185	206	179	4,170	1.5%
Kalmar	3,315	203	225	235	183	173	4,334	1.5%
Karlshamn	1,258	210	174	149	164	196	2,151	0.8%
Karlskoga	1,848	156	111	90	100	106	2,411	0.8%
Karlskrona	2,167	40	44	31	35	36	2,353	0.8%
Karlstad	3,351	216	235	220	282	338	4,642	1.6%
Katrineholm	1,199	203	226	194	185	201	2,208	0.8%
KS/Huddinge	4,310	183	221	238	332	256	5,540	1.9%
KS/Solna	3,276	281	273	297	187	189	4,503	1.6%
Kungälv	1,608	175	124	229	169	225	2,530	0.9%
Köping	1,495	190	210	217	218	179	2,509	0.9%
Lidköping	1,452	102	118	149	140	133	2,094	0.7%
Lindesberg	1,441	138	161	119	147	147	2,153	0.8%
Linköping	4,760	208	122	74	41	52	5,257	1.8%
Ljungby	1,663	96	103	101	120	127	2,210	0.8%
Lund	3,930	103	103	106	83	41	4,366	1.5%
Lycksele	1,554	200	212	274	243	238	2,721	1.0%
Malmö	5,368	109	128	116	126	110	5,957	2.1%
Mora	2,148	139	144	158	132	152	2,873	1.0%
Motala	1,515	161	229	421	431	402	3,159	1.1%
Movement	0	8	6	90	112	98	314	0.1%
Nacka Närsjukhus Proxima	0	0	1	17	54	34	106	0.0%

(continued on next page.)

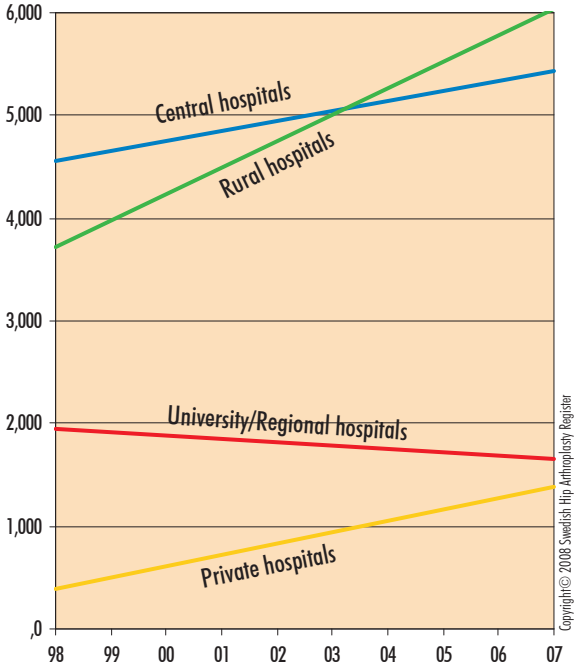
Number of primary THRs per hospital and year (cont.)

Hospital	1979-2002	2003	2004	2005	2006	2007	Total	Share
Norrköping	4,150	177	243	171	70	135	4,946	1.7%
Norrtälje	952	92	87	116	87	98	1,432	0.5%
Nyköping	2,032	121	124	153	138	130	2,698	0.9%
OrthoCenter	0	0	0	0	0	18	18	0.0%
Ortopediska Huset	478	179	244	297	379	534	2,111	0.7%
Oskarshamn	1,312	114	137	176	258	233	2,230	0.8%
Piteå	719	92	137	183	337	363	1,831	0.6%
S:t Göran	7,390	444	509	474	443	299	9,559	3.4%
Skellefteå	1,825	148	119	120	108	86	2,406	0.8%
Skene	701	87	89	71	65	88	1,101	0.4%
Skövde	4,639	173	150	160	160	139	5,421	1.9%
Sollefteå	1,201	123	150	136	154	96	1,860	0.7%
Sophiahemmet	3,884	163	257	348	210	189	5,051	1.8%
Spenshult	0	0	0	0	0	75	75	0.0%
Stockholms Specialistvård	175	130	136	207	168	197	1,013	0.4%
SU/Mölndal	813	118	88	93	37	224	1,373	0.5%
SU/Sahlgrenska	4,167	225	202	204	149	6	4,953	1.7%
SU/Östra	3,823	115	100	92	151	135	4,416	1.6%
Sunderby (including Boden)	4,197	117	151	128	82	58	4,733	1.7%
Sundsvall	4,636	181	161	149	128	136	5,391	1.9%
Södersjukhuset	5,577	216	219	257	417	468	7,154	2.5%
Södertälje	624	145	122	110	127	117	1,245	0.4%
Torsby	1,084	58	71	74	67	96	1,450	0.5%
Trelleborg	2,263	196	167	488	497	476	4,087	1.4%
Uddevalla	3,849	292	256	321	347	326	5,391	1.9%
Umeå	3,796	58	77	77	76	84	4,168	1.5%
Uppsala	4,780	230	328	286	266	290	6,180	2.2%
Varberg	3,152	168	192	182	201	247	4,142	1.5%
Visby	1,690	71	61	102	122	120	2,166	0.8%
Värnamo	1,828	101	127	146	150	130	2,482	0.9%
Västervik	2,095	114	121	106	91	117	2,644	0.9%
Västerås	2,841	87	122	145	158	181	3,534	1.2%
Växjö	2,736	68	129	125	154	109	3,321	1.2%
Ystad	2,173	98	111	66	12	6	2,466	0.9%
Örebro	4,152	194	180	168	190	198	5,082	1.8%
Örnsköldsvik	1,849	102	154	149	168	186	2,608	0.9%
Östersund	3,245	181	158	215	204	193	4,196	1.5%
Others [1)]	23,080	1,065	773	256	0	0	25,174	8.8%
Total	216,490	12,682	13,394	13,949	14,010	14,105	284,630	100%

[1)] Includes hospitals that are no longer active or do not perform primary THRs any more.

Trends in primary THR surgery

during the past 10 years by type of hospital



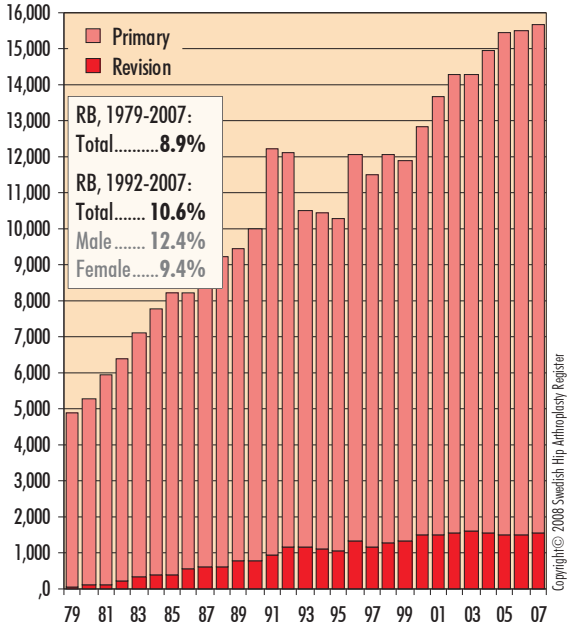
The structural reorganisation in Swedish elective orthopaedics is shown clearly in the figure opposite. Swedish private hospitals in 2007 performed almost as many primary arthroplasties as the university/regional hospitals. This trend has both clear advantages and clear disadvantages. It is possible that the productivity of prosthesis operations is increasing for certain patient groups. Since rural hospitals and above all private hospitals operate on 'more healthy' patients with less co-morbidity and on technically simpler cases, however, it may be that accessibility for the 'more severely ill' and more difficult cases is worsened. Other disadvantages in the long term are:

- Possibility for continual training of surgeons and theatre staff worsened since advanced training is concentrated to university/regional hospitals.
- Material for clinical trials of primary arthroplasties decreases dramatically. This may in the long run slow down the scientific development of hip arthroplasty surgery in Sweden.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	2,130	1,700	1,781	1,838	1,939	1,824	1,822	1,751	1,638	1,585
	4,775	4,500	4,858	4,712	4,893	4,800	5,271	5,263	5,415	5,451
	3,613	3,848	4,002	4,828	4,958	5,058	5,330	5,762	5,756	5,699
	246	515	688	809	882	1,000	971	1,173	1,201	1,370

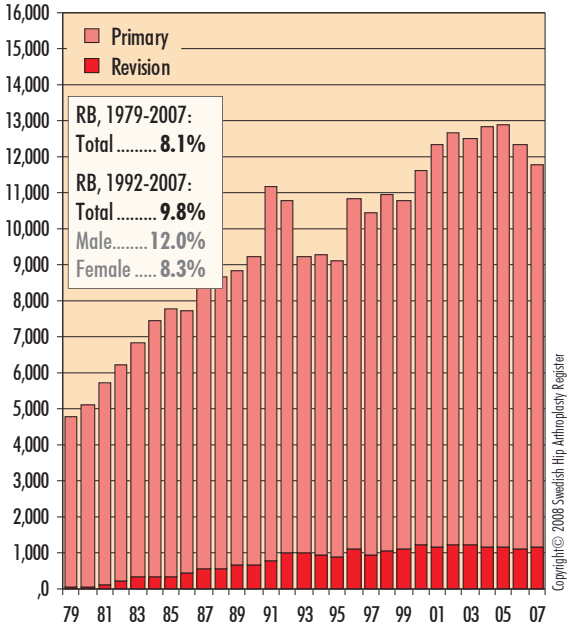
All THRs

284,630 primary THRs, 27,690 revisions, 1979-2007



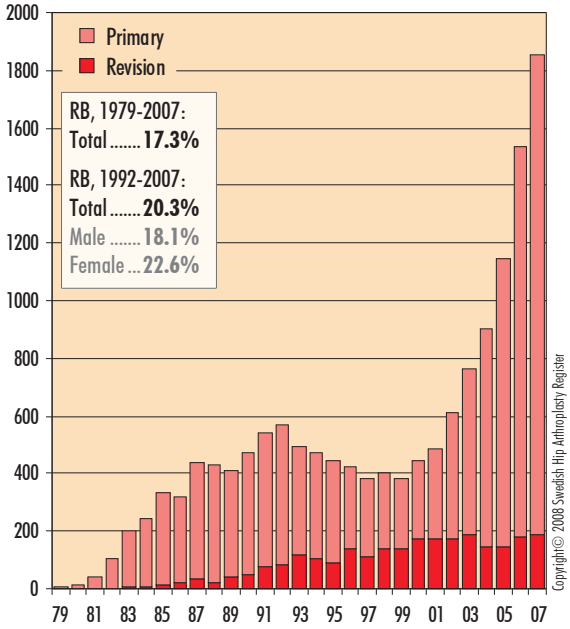
THR with cemented implants

256,689 primar THRs, 22,641 revisions, 1979-2007



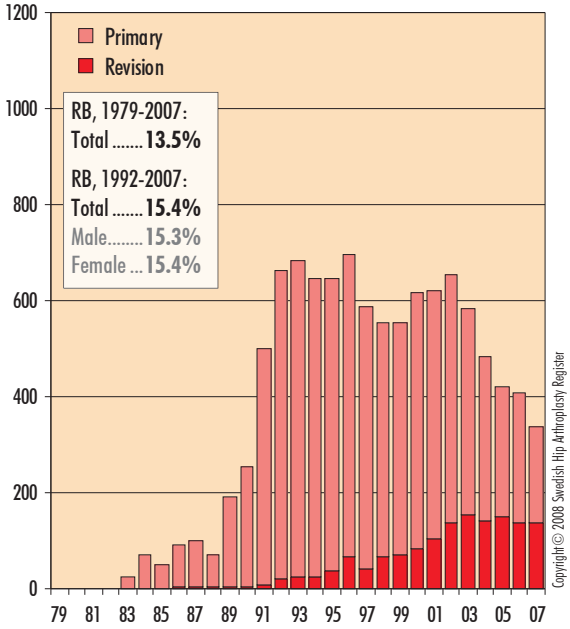
THR with uncemented implants

12,289 primary THRs, 2,569 revisions, 1979-2007



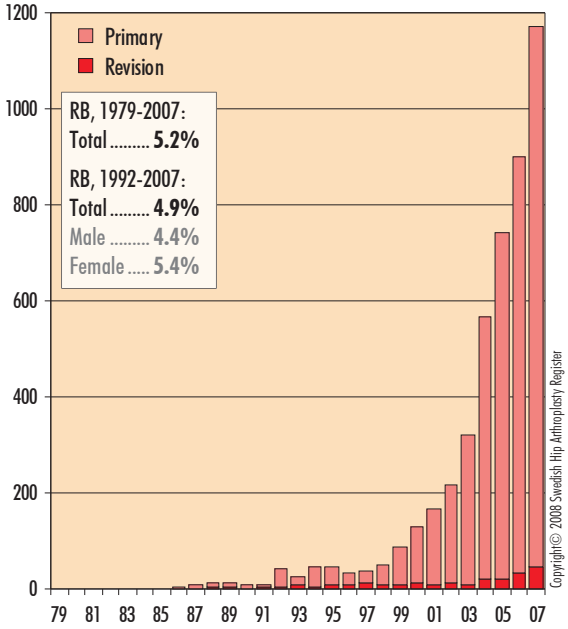
THR with hybrid implants

9,082 primary THRs, 1,421 revisions, 1979-2007



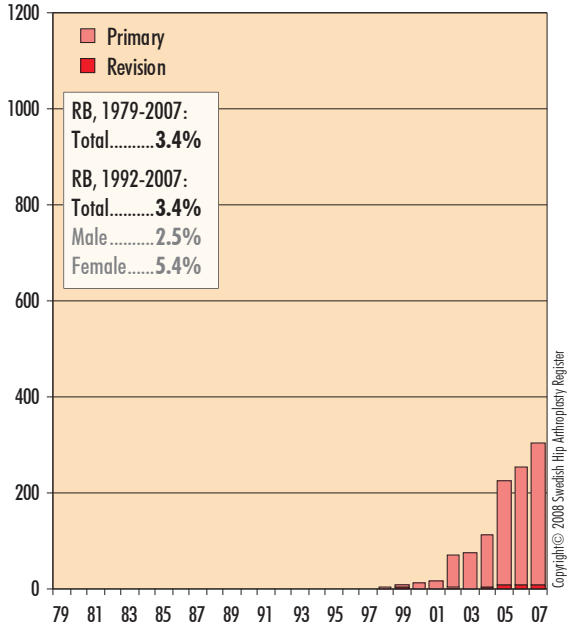
THR with reversed hybrid implants

4,395 primary THRs, 239 revisions, 1979-2007



THR with resurfacing implant

1,041 primary THRs, 37 revisions, 1979-2007



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	87,037	10,115	10,782	11,587	11,708	11,715	142,944	77.7%
Fracture	13,583	1,448	1,465	1,316	1,257	1,391	20,460	11.1%
Inflammatory arthritis	5,743	379	357	325	308	287	7,399	4.0%
Idiopathic femoral head necrosis	3,475	344	344	340	353	328	5,184	2.8%
Childhood disease	1,862	272	322	270	297	291	3,314	1.8%
Secundary osteoarthritis	1,294	3	2	4	2	1	1,306	0.7%
Tumor	554	83	93	89	66	74	959	0.5%
Secondary arthritis after trauma	312	38	29	18	17	18	432	0.2%
(missing)	2,020	0	0	0	2	0	2,022	1.1%
Total	115,880	12,682	13,394	13,949	14,010	14,105	184,020	100%

Number of primary THRs per diagnosis and age

1992-2007

Diagnosis	< 50 years		50-59 years		60-75 years		> 75 years		Total	Share
Primary osteoarthritis	5,018	56.7%	19,772	80.9%	77,726	83.2%	40,428	70.5%	142,944	77.7%
Fracture	277	3.1%	1,021	4.2%	7,489	8.0%	11,673	20.4%	20,460	11.1%
Inflammatory arthritis	1,335	15.1%	1,437	5.9%	3,455	3.7%	1,172	2.0%	7,399	4.0%
Idiopathic femoral head necrosis	549	6.2%	649	2.7%	1,873	2.0%	2,113	3.7%	5,184	2.8%
Childhood disease	1,294	14.6%	1,018	4.2%	828	0.9%	174	0.3%	3,314	1.8%
Secondary osteoarthritis	99	1.1%	112	0.5%	475	0.5%	620	1.1%	1,306	0.7%
Tumor	107	1.2%	202	0.8%	425	0.5%	225	0.4%	959	0.5%
Secondary arthritis after trauma	63	0.7%	61	0.2%	151	0.2%	157	0.3%	432	0.2%
(missing)	112	1.3%	178	0.7%	973	1.0%	759	1.3%	2,022	1.1%
Total	8,854	100%	24,450	100%	93,395	100%	57,321	100%	184,020	100%

Number of primary THRs with uncemented implants per diagnosis and age

1992-2007

Diagnosis	< 50 years		50-59 years		60-75 years		> 75 years		Total	Share
Primary osetoarthritis	1,618	59.5%	3,328	86.2%	2,039	91.0%	100	75.2%	7,085	79.1%
Childhood disease	509	18.7%	256	6.6%	64	2.9%	3	2.3%	832	9.3%
Inflammatory arthritis	279	10.3%	86	2.2%	41	1.8%	4	3.0%	410	4.6%
Idiopathic femoral head necrosis	168	6.2%	93	2.4%	32	1.4%	2	1.5%	295	3.3%
Fracture	61	2.2%	61	1.6%	44	2.0%	22	16.5%	188	2.1%
Secondary osteoarthritis	32	1.2%	7	0.2%	4	0.2%	1	0.8%	44	0.5%
Secondar arthritis after trauma	20	0.7%	3	0.1%	1	0.0%	1	0.8%	25	0.3%
Tumor	1	0.0%	6	0.2%	4	0.2%	0	0.0%	11	0.1%
(missing)	30	1.1%	21	0.5%	12	0.5%	0	0.0%	63	0.7%
Total	2,718	100%	3,861	100%	2,241	100%	133	100%	8,953	100%

Number of primary THRs per type of fixation and age

1992-2006

Type of fixation	< 50 years		50-59 years		60-75 years		> 75 years		Total	Share
Cemented	3,361	38.0%	15,279	62.5%	86,456	92.6%	56,364	98.3%	161,460	87.7%
Uncemented	2,718	30.7%	3,861	15.8%	2,241	2.4%	133	0.2%	8,953	4.9%
Hybrid	1,374	15.5%	3,019	12.3%	2,870	3.1%	406	0.7%	7,669	4.2%
Reversed hybrid	769	8.7%	1,750	7.2%	1,556	1.7%	275	0.5%	4,350	2.4%
Resurfacing implant	496	5.6%	427	1.7%	118	0.1%	0	0.0%	1,041	0.6%
(missing)	136	1.5%	114	0.5%	154	0.2%	143	0.2%	547	0.3%
Total	8,854	100%	24,450	100%	93,395	100%	57,321	100%	184,020	100%

Number of primary THRs per type of fixation and year — younger than 60 years

Type of fixation	1992-2002	2003	2004	2005	2006	2007	Total	Share
Cemented	12,799	1,464	1,437	1,221	937	782	18,640	56.0%
Uncemented	3,036	458	542	700	881	962	6,579	19.8%
Hybrid	3,812	236	172	88	48	37	4,393	13.2%
Reversed hybrid	590	198	366	442	467	456	2,519	7.6%
Resurfacing implant	96	68	98	195	220	246	923	2.8%
(missing)	67	2	7	18	40	116	250	0.8%
Total	20,400	2,426	2,622	2,664	2,593	2,599	33,304	100%

Number of primary THRs per type of fixation and year — 60 years or older

Type of fixation	1992-2002	2003	2004	2005	2006	2007	Total	Share
Cemented	92,175	9,827	10,195	10,498	10,256	9,869	142,820	94.8%
Hybrid	2,343	194	170	180	224	165	3,276	2.2%
Uncemented	565	119	211	299	476	704	2,374	1.6%
Reversed hybrid	192	111	180	280	397	671	1,831	1.2%
Resurfacing implant	10	3	10	22	26	47	118	0.1%
(missing)	195	2	6	6	38	50	297	0.2%
Total	95,480	10,256	10,772	11,285	11,417	11,506	150,716	100%

Number of primary THRs per type of incision and year

Type of incision	2000-2002	2003	2004	2005	2006	2007	Total	Share
Posterior incision, patient on side (Moore)	19,790	7,082	7,605	7,655	7,822	7,696	57,650	55.3%
Anterior incision, patient on side (Gammer)	10,813	4,273	4,292	4,785	5,002	5,520	34,685	33.2%
Anterior incision, patient on back (Hardinge)	3,948	968	1,028	1,015	763	548	8,270	7.9%
Others	162	34	56	92	267	324	935	0.9%
(missing)	1,475	325	413	402	156	17	2,788	2.7%
Total	36,188	12,682	13,394	13,949	14,010	14,105	104,328	100%

Number of primary THRs per brand of cement and year

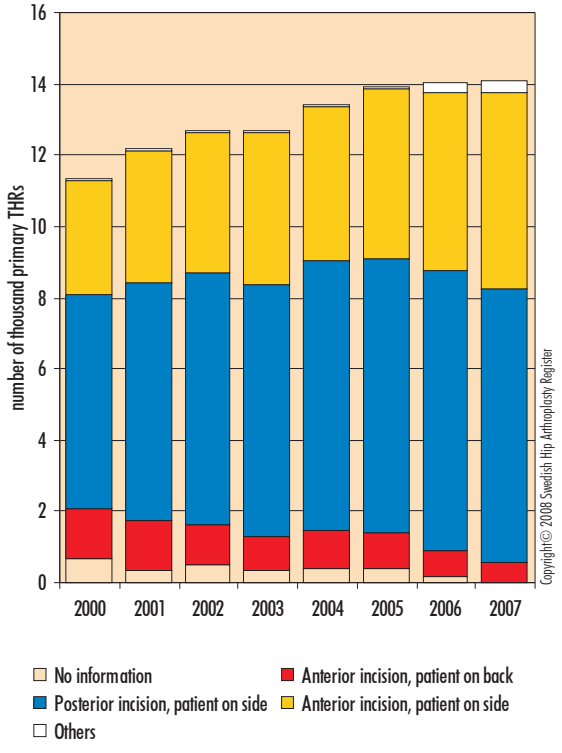
Brand of cement	1992-2002	2003	2004	2005	2006	2007	Total	Share
Palacos cum Gentamycin	84,284	6,389	6,033	4,977	0	0	101,683	55.3%
Refobacin Palacos R	2,724	4,800	5,509	6,575	0	0	19,608	10.7%
Palacos R + G	0	0	0	0	5,546	5,481	11,027	6.0%
Refobacin Bone Cement	0	0	0	0	5,199	4,546	9,745	5.3%
Cemex Genta System Fast	1	0	0	0	221	353	575	0.3%
Cemex Genta System	21	0	1	69	21	120	232	0.1%
Others	13,641	26	30	16	30	20	13,763	7.5%
(completely or partially cementless)	12,233	1,466	1,820	2,310	2,967	3,584	24,380	13.2%
(missing)	2,976	1	1	2	26	1	3,007	1.6%
Total	115,880	12,682	13,394	13,949	14,010	14,105	184,020	100%

Number of primary THRs per type of cement and year

Brand of cement	1999-2002	2003	2004	2005	2006	2007	Total	Share
Palacos cum Gentamycin	38,579	6,389	6,033	4,977	0	0	55,978	48.7%
Refobacin Palacos R	2,723	4,800	5,509	6,575	0	0	19,607	17.1%
Palacos R + G	0	0	0	0	5,546	5,481	11,027	9.6%
Refobacin Bone Cement	0	0	0	0	5,199	4,546	9,745	8.5%
Cemex Genta System Fast	1	0	0	0	221	353	575	0.5%
Cemex Genta System	16	0	1	69	21	120	227	0.2%
Others	1,232	26	30	16	30	20	1,354	1.2%
(completely or partially cementless)	4,194	1,466	1,820	2,310	2,967	3,584	16,341	14.2%
(missing)	6	1	1	2	26	1	37	0.0%
Total	46,751	12,682	13,394	13,949	14,010	14,105	114,891	100%

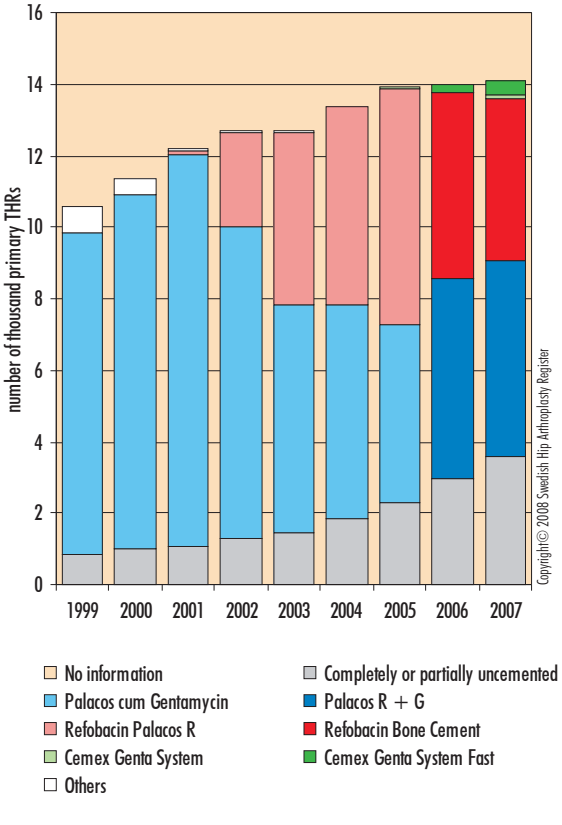
Type of incision

2000-2007



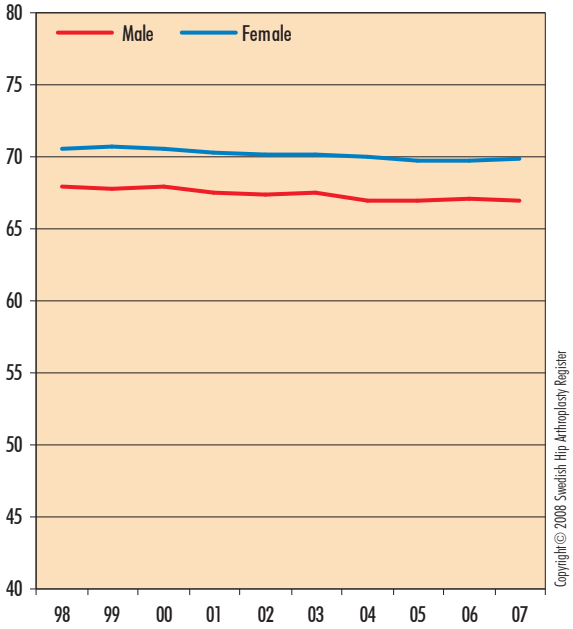
Type of cement

1999-2007



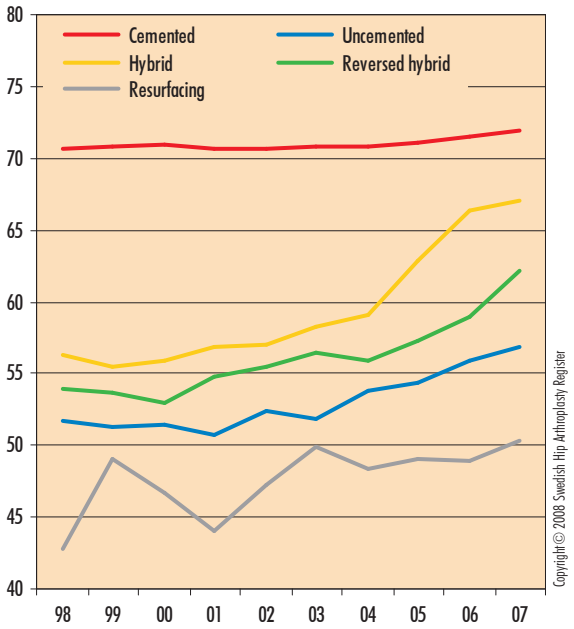
Mean age per gender

the past 10 years, 125,656 primary THRs



Mean age per type of fixation

the past 10 years, 125,233 primary THRs



Average age per diagnosis and gender

the past 10 years

Diagnosis	Male	Female	Total
Fracture	73.6	76.3	75.6
Secondary osteoarthritis after trauma	67.9	73.3	70.5
Primary osteoarthritis	67.4	69.9	68.8
Idiopathic femoral head necrosis	61.5	72.1	68.7
Tumor	69.5	62.4	65.6
Secondary osteoarthritis	65.9	61.9	64.1
Inflammatory arthritis	59.4	61.7	61.1
Childhood disease	54.8	53.7	54.1
Total	67.4	70.2	69.0

Average age per type of hospital and gender

the past 10 years

Type of hospital	Male	Female	Total
Central hospitals	67.8	70.8	69.6
Rural hospitals	68.1	70.4	69.5
University/Regional hospitals	64.7	68.7	67.2
Private hospitals	65.3	67.9	66.8
Total	67.4	70.2	69.0

Resurfacing

Since 1996 1,041 surface replacement implants have been registered. From 2002 a more marked increase has been noted which continued to 2007. This means that the mean follow-up time is short (2.2 years *SD 1.7*). This implant type has been used predominantly in men (68.3% of cases). A man is more than twice as likely to receive an articular surface replacement implant as a woman is (Exp (B) = 2.40 *2.09-2.75*). It is employed at a comparatively low age (mean age 49.1 years compared to 69.3 for other implant types). The surface replacement implant has also been used more in primary osteoarthritis (Exp (B) = 15.15 *10.87-21.28*) and to a somewhat increased extent in secondary osteoarthritis following childhood diseases of the hip joints (Exp (B) = 3.89 *2.53-5.99*).

Thirty-five revisions have been reported. Aseptic loosening (n=11) and fractures (n=11) have been the commonest reason followed by 'technical reason' (n=5) and infection (n=5) and other reasons (n=3). In 19 cases only the stem was exchanged, in five cases only the cup, and in the other cases both components were extracted or exchanged. Evaluation of the risk of revision, excluding infection, from 2002 inclusive (80,812 primary operations) shows more than a threefold increase (3.33 *2.04-5.43*) for the surface replacement implant compared with other types (all-cemented, uncemented, hybrid and reversed hybrid, figures 5a-b) and following adjustment for differences in age, gender, diagnosis and type of incision (Cox regression).

In Sweden mainly three implants have been used (Birmingham Hip Replacement (BHR), Durom and Articular Surface Replacement (ASR)), and these represented 97% of cases. The follow-up time is longest for the BHR (2.6 years *SD 1.8*), 2.2 (*1.6*) years for Durom and only 1 (*0.8*) year for the ASR. Evaluation using a Cox regression model shows that certain limitations must be observed over and above the short and varying observation time, namely that chiefly the diagnoses primary osteoarthritis (n=950), sequelae from childhood diseases (n=49), and chiefly posterior approach (n=719) and anterior lateral approach when lying on the side (n=157) are represented. Against this background, we find that the risk of revision is more than doubled for females (Exp (B) = 2.12 *1.03-4.46*), greater with posterior approach (3.91 *1.82-8.38*) and reduced for the BHR implant compared with all other designs used considered as a group (0.21 *0.09-0.50*).

In the short perspective resurfacing is associated with an increased risk of early complications, mainly due to loosening and fracture. This indicates that this technique should be used only to a limited extent and with detailed follow-up.

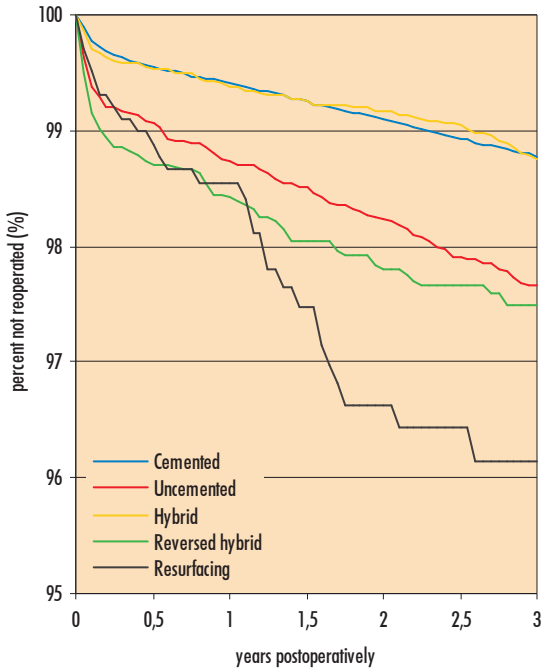


Figure 5a. Implant survival based on revision (excluding infection) for all-cemented, uncemented, hybrid, reversed hybrid and surface replacement implants.

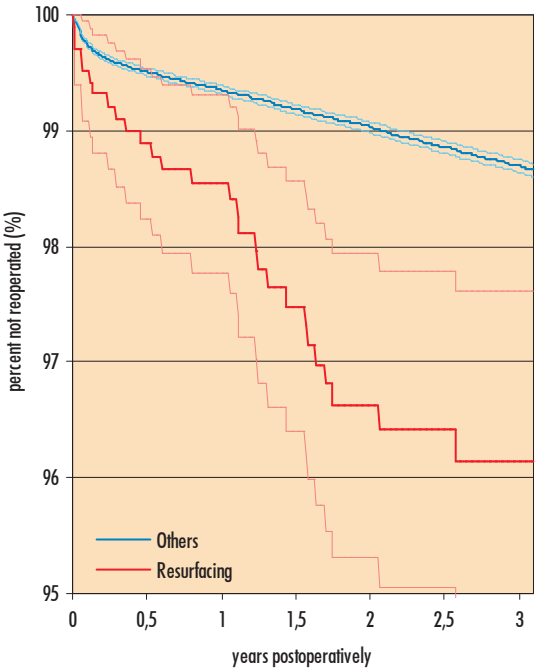


Figure 5b. Implant survival based on revision (excluding infection) compared with all other implant types combined into one group (more correctly according to the conduct of retrogression analyses).

The surface replacement implant involves an increased risk of early revision. As opposed to other implant designs, the risk is higher among women.

Uncemented fixation

In Sweden, fixation with bone cement of both parts of the implant, cup and stem, has been predominant. Since 2001 uncemented fixation has increased from low levels and mainly as wholly uncemented implants (figure 1). This method of fixing the implant increased from 2.6% to 12% between 2001 and 2007. We have therefore carried out an extended analysis, comparing uncemented and cemented fixation. To compensate for possible differences between the groups regarding age, gender, diagnosis, bilaterality, surgical technique (incision) and follow-up, we used Cox regression analysis and in some cases logistic regression. All causes of revision except infection were included. Infection as a revision risk has been evaluated separately.

Wholly uncemented implants have since 1992 been used largely among younger people (average age 53.4 years *SD=10.1*; all-cemented: 71.1 *9.6*). During the period 1992-2007 the average age for uncemented implants has slowly increased from 45 years to 57 years. For cemented implants during the same period there has been an insignificant increase from 71.2 years to 71.9 years. Wholly uncemented implants are chosen about 1.4 times more frequently for men ('relative risk difference' – Exp (B) = 1.37 *1.31-1.45*) and have been used to a significantly greater extent in primary osteoarthritis, in secondary osteoarthritis following hip disease in childhood and as a consequence of avascular caput necrosis.

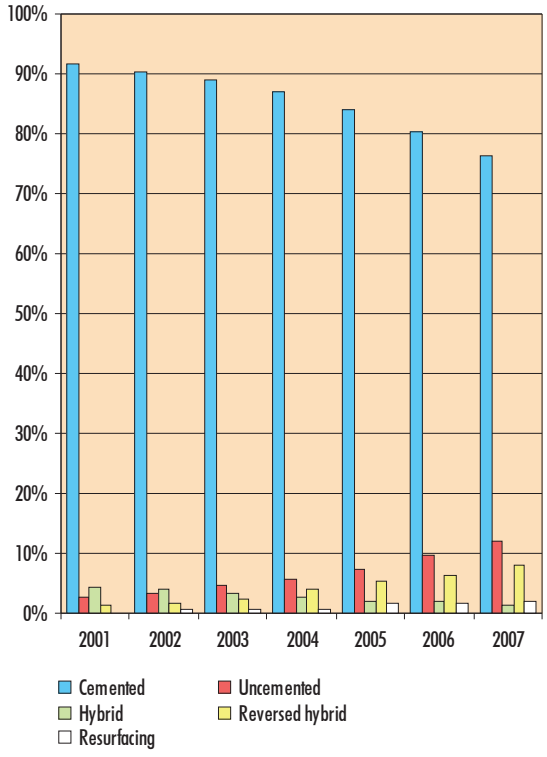


Figure 1. Distribution of method of fixing a hip implant 2001-2007. All-cemented fixation has slowly declined while all-uncemented implants and reversed hybrids have increased.

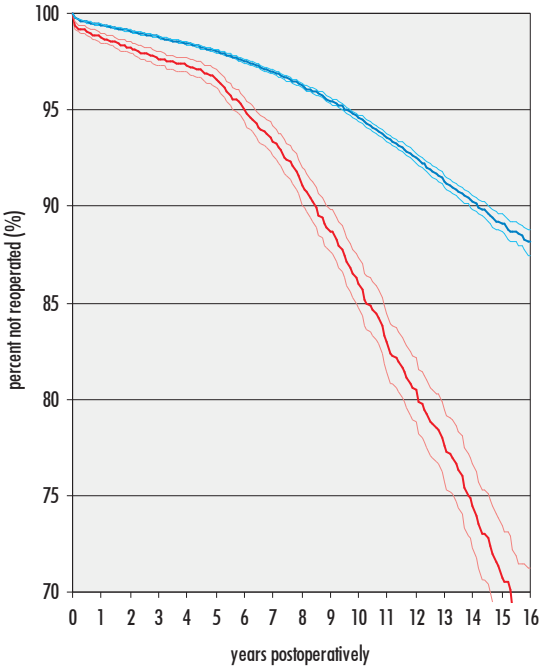


Figure 2a. Implant survival with end-point revision – all causes excluding infection for all-cemented (blue) implants and uncemented (red) implants inserted between 1992 and 2007.

All-cemented versus all-uncemented implants

Evaluation of all wholly cemented and all wholly uncemented hip implants inserted between 1992 and 2007 (n=170,413) with adjustments for the factors named above shows that the choice of the latter alternative increases the revision risk by 33% irrespective of type of measure (relative risk increase for uncemented implant – Exp (B) = 1.33 *1.23-1.41*, see figures 2a-c). If the cohort is limited to operations carried out starting in 1998, which reflects more modern implant design (n=115,959), the outcome remains largely unchanged (Exp (B) = 1.37 *1.13-1.67*).

The risk of early revision (within 2 years) is almost or more than doubled for all-uncemented implants compared with all-cemented depending on whether one includes (Exp (B) = 1.86 *1.55-2.23*) or excludes (Exp (B) = 2.35 *1.55-2.89*) infection as a revision risk. The risk of revision owing to infection alone during the period 1992-2007 does not differ between all-cemented fixation and uncemented fixation after adjustment for differences in entry data between the groups.

In the uncemented group, dislocation, loosening and frac-

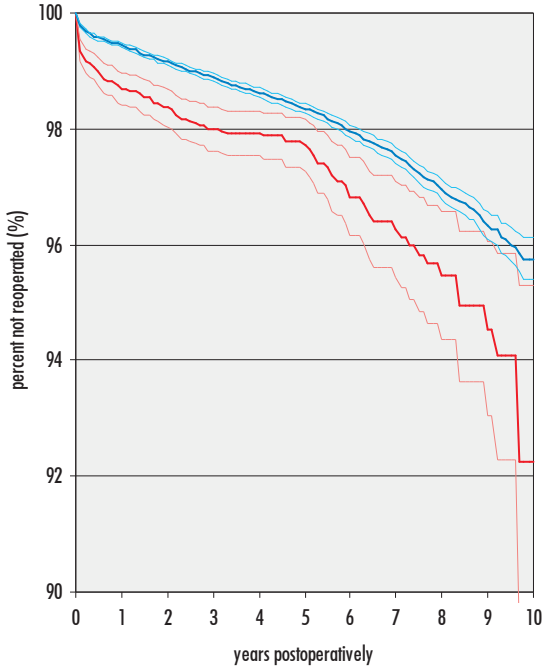


Figure 2b. Implant survival with end point revision – all causes excluding infection for all-cemented (blue) implants and uncemented (red) implants inserted between 1998 and 2007.

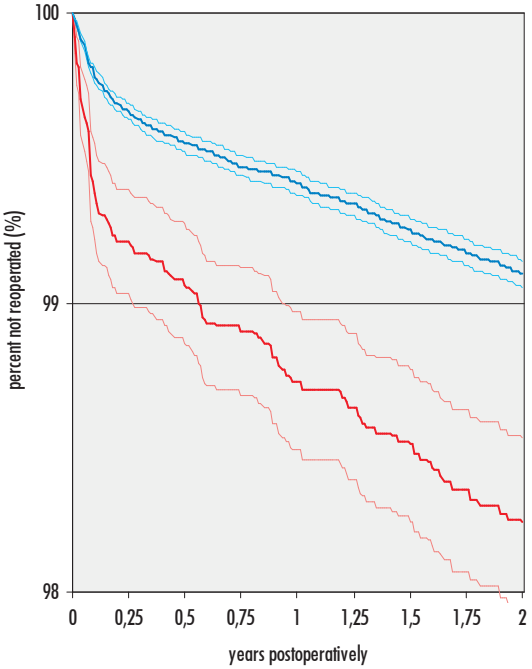


Figure 2c. Implant survival with end-point revision within two years for all-cemented (blue) and wholly uncemented (red) inserted 1992-2007.

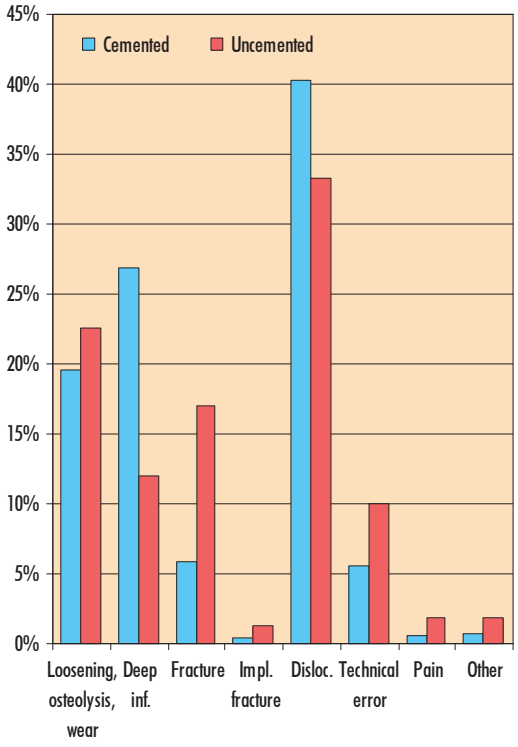


Figure 3. Distribution of revision cause in all-cemented and all-uncemented hip arthroplasty.

ture are the three commonest causes of early revision, followed by infection. In the cemented group, dislocation, infection and loosening are the three commonest causes and fracture moves down to fourth place (figure 3).

Uncemented cup

In the separate analyses of cup and stem respectively, we included all uncemented components except surface replacement implants (see separate chapter). Between 1992 and 2007, 165,810 cemented cups were recorded, of which 4,350 were inserted with uncemented stems. The corresponding number of uncemented fixations is 16,622, of which 7,699 were inserted with cemented stems. Of the cemented cups, therefore, 88.5% were included in all-cemented prostheses while 53.9% of the uncemented were combined with an uncemented stem.

A total of 5,306 cup revisions were carried out during the period (with or without further measures such as stem revision), of which 583 were due to infection. Among the uncemented revisions, the whole cup was exchanged in about two-thirds of the cases (66%, 802 of 1,224 revisions without infection). In the other cases, the plastic insert was exchanged or else a new plastic cup was cemented in a remaining metal shell (figure 4). A socket wall addition was inserted in a few cases with uncemented cups. This measure was most common in those cases of cemented cup where the implant was not replaced.

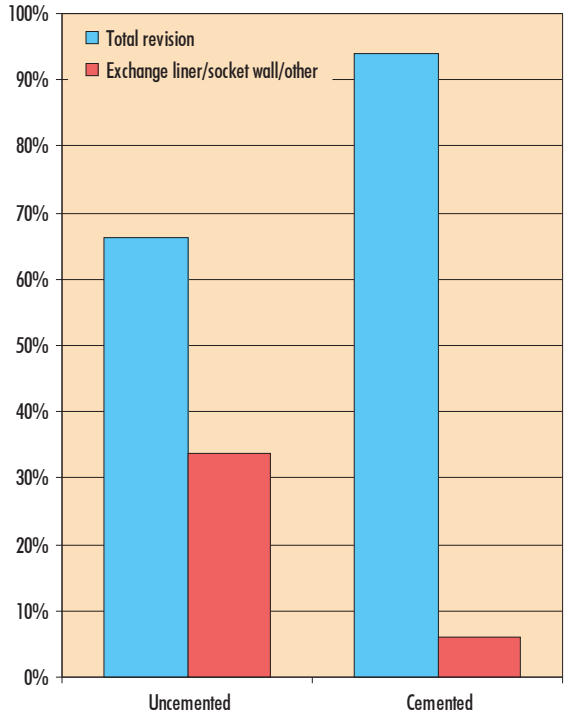


Figure 4. Type of cup revision. In about one-third of all uncemented cup revisions, the liner is changed. This can probably only partly be explained by the liner often being replaced 'prophylactically' during simultaneous stem revision since the liner/caput exchange is registered as the only measure in 67% of cases undergoing this measure.

In a Cox regression analysis of patients undergoing surgery from 1992 the risk of cup revision including infection as cause was evaluated. The mean observation period was 5.9 years, *SD 4.1*. The risk of revision increased with decreasing age and was greater for the diagnoses sequelae of childhood disease, fracture and avascular caput necrosis (table 1). It increased 66% for the use of uncemented fixation.

Analysis of patients undergoing surgery from 1998 (n=124,184, average observation period: 4.24 *SD 2.8*) does not materially alter the picture regarding demographic factors. The outcome still emerges to the disadvantage of the uncemented alternative, with an increased risk of about 40% (ExpB 1.41 *1.19-1.66*).

Among the uncemented cups used in more than 200 operations (12 different designs) a separate evaluation was done to study whether the revision risk on insertion of any of these cups deviated from that of all other uncemented alternatives as a comparison group. Even though in this analysis we also adjusted for bias in the material as above, when interpreting the data account should be taken of the number of observations and the time period during which they were used. Data security increases with increasing observations and observation periods. Note also that certain makes of implant may have undergone some alteration in the quality of the plastic lining during the observation period, which is not wholly known or has not been registered. Nor have we divided the cups used with or without a coating of hydroxylapatite (± tricalcium phosphate) since this analysis is being carried out separately and will be presented later.

Three implant types had an increased risk of revision and four showed a reduced risk. All three with an increased risk have been used since 1992 and were withdrawn in the late 1990s. One of those with a better outcome was used during the whole period (table 2).

Uncemented stems

In the period 1992-2007 there were 169,129 cemented stem implants and 13,303 uncemented ones in the register. In the latter group an uncemented cup was used in about two-thirds of the cases (67.3%). Replacement or extraction of stems with or without further measures such as cup revision was carried out in 4,781 cases. Infection was the cause of 779 cases. The average follow-up time was 4.3 years, 4.1.

Risk factor	Inc./dec. risk (Exp(B))	95% C.I
Cup (n=182,432)		
Increased risk		
Decreasing age (per year)	1.04	1.03 – 1.04
Male	1.22	1.15 – 1.29
Secondary osteoarthritis to:		
• Childhood hip disease	1.38	1.20 – 1.60
• Fracture/Trauma	1.62	1.48 – 1.80
• Idiopathic femoral head necrosis	1.33	1.14 – 1.55
Uncemented cup	1.66	1.53 – 1.79
Stem (n=182,432)		
Increased risk		
Decreasing age (per year)	1.03	1.03 – 1.03
Male	1.89	1.75 – 1.99
Secondary osteoarthritis to:		
• Fracture/Trauma	1.89	1.70 – 2.09
• Idiopathic femoral head necrosis	1.38	1.16 – 1.64
Mini incision	5.23	2.94 – 9.32
Decreased risk		
Posterior incision	0.62	0.57 – 0.67
Anterior incision, patient on side	0.73	0.66 – 0.80
Uncemented stem	0.58	0.50 – 0.67

Table 1. Effect of age, gender, diagnosis, choice of incision and cemented/uncemented fixation on the risk of cup or stem revision (excluding infection and surface replacement implants).

Risk factor	N.	Period	Inc./dec. risk (Exp(B))	95% C.I
Cup (n=16,622)				
Increased risk				
ABG I	1,014	1992-1998	1.28	1.06 – 1.54
Harris-Galante II	975	1992-1999	1.24	1.04 – 1.45
Omnifit	521	1992-1996	2.22	1.89 – 2.63
No change in risk				
ABG II	435	1995-2007	-	-
M2a	258	2003-2007	-	-
Reflection	435	1995-2007	-	-
TOP Pressfit	277	2000-2007	-	-
Trident	888	2003-2007	-	-
Decreased risk				
Allofit	850	1998-2007	0.44	0.21 – 0.93
Biomex	225	1997-2005	0.24	0.08 – 0.75
Spotorno	1,074	1992-2007	0.31	0.20 – 0.50
Trilogy	5,529	1994-2007	0.66	0.54 – 0.81
Stem (n=13,303)				
No change in risk				
ABG I	1,006	1992-2007	-	-
ABG II	984	2002-2007	-	-
Accolade	380	2004-2007	-	-
Corail	465	1993-2007	-	-
Meridian	222	1997-2007	-	-
SL plus	260	1997-2007	-	-
Versys	273	1999-2006	-	-
Decreased risk				
Bi-metric [1)]	3,116	1992-2007	0.36	0.24 – 0.53
CLS Spotorno	4,514	1992-2007	0.36	0.25 – 0.54
Cone	501	1994-2007	0.29	0.11 – 0.79
Omnifit	574	1992-2006	0.56	0.33 – 0.99

Table 2. Comparison of risks of all types of cup (liner) or stem revision including all revision causes except infection. The analysis was used in the segments all uncemented cups (excluding surface replacement) and stems, respectively. Only implants with more than 200 observations were included. Adjustment for differences in age, gender, diagnosis and incision technique using Cox regression. Note that each implant is compared with all others in the groups and that cemented implants are excluded.

1) All Bi-metric excluding 'Fracture Stem'.

All uncemented stems inserted in more than 200 hips have functioned well. In a Cox regression analysis of the group uncemented stems adjusted for age, gender, diagnosis and incision, four of the stem types show a significantly reduced incidence of revision. None of the other seven show poorer results (table 2). In an analysis of the Bi-metric stem, the only one used both with and without hydroxylapatite in sufficiently large numbers to be included in the analysis, we found that ceramic coating of its surface does not affect the result. The choice of standard or extra offset design does not affect the result of this analysis, either.

Summary

In summary, the way of fixing an implant has affected the outcome regarding the risk of revision for reasons other than infection. Wholly uncemented implants have involved increased risk of revision. There was no tendency to improvement in the cohort undergoing surgery during the past ten years. Uncemented fixation also increases the risk of serious problems during the first two years, primarily due to loosening and fracture.

In the separate component analysis the picture changes so that the problem focuses on the uncemented cups, revised to an increasing extent. This is presumably because of the high frequency of complications caused by wear and osteolysis. The development of plastics material is continuous. This material (highly cross-linked polyethylene) did not come into use to any extent until 2005-2006 so that possible expected positive effects in the longer perspective cannot yet be assessed.

Uncemented stems of the types used in Sweden have been considered to function better than the group cemented stems. In earlier analyses (see Annual Report 2005) the smallest sizes of certain otherwise very well-functioning cemented stems have been associated with an increased risk of revision. In these cases an uncemented alternative is preferable. Since our analysis can only take account of known and recorded variables, further evaluation remains before the optimal choice between uncemented and cemented stem fixation can be evaluated. The advent of increased data capture regarding details of individual component parts from and including 1999, and the registration of further patient factors starting in 2007 will promote improved knowledge in this area.

Note also that failures leading to revision may often be related to surgical technique where early revision for fracture is over-represented in uncemented fixation. We also find that the mini-incision is associated with a more-than-five-times greater risk of stem problems leading to revision.

We do not today know what the optimal distribution between cemented and uncemented fixation should look like. The surgeon's experience with the various techniques is of major importance. It is therefore important that all change in selection of implant and method of fixing should occur slowly with plenty of time to gain experience. We have achieved the best results so far, and with very good historical documentation, with implants of certain designs in which both cup and stem are fixed with cement.

Reoperation

The term reoperation comprises all types of new surgical measure following operation for primary arthroplasty. These interventions have been registered since the start in 1979. From the middle of 2000 we stopped registering and reporting closed reduction following dislocation, which must be considered when comparing with annual reports up to and including 2002. Closed reduction has in the latest reports also been excluded in retrospective analyses. Reoperations are divided into three groups: revision with replacement or extraction of implant component and major and minor reoperations without the components or either of them being removed or replaced.

Between 2006 and 2007 the number of reoperations increased by 51 cases (+2.7%). The change was unevenly distributed among the cause groups. The commonest cause, aseptic loosening, declined by 6.2%. The increase came chiefly in the three next-most-common causes: deep infection (+6.6%), dislocation (+14.1%) and fracture (+16.4%). Reoperation for technical reasons, too, has more than doubled since 2006 albeit from low levels, from 15 to 36 operations. Three of these five cause groups, infection, dislocation and technical reasons occur early. Median times from previous operation were 1.9, 3.8 and 1.9 for these three reasons. Reoperation owing to loosening and fracture normally occurs considerably later (median times: 11.9 and 10.6 years). As to reoperation for fracture, the increase in 2006 and 2007 was caused entirely by early reoperations. All occurred within the first four years of previous operation. This finding indicates that faulty surgical technique plays an important part, even though other factors such as patient selection should be observed. Since the number of reoperations for fracture is identical, after four years, there is no support for the hypothesis that poor follow-up and increasing numbers of patients with undiscovered implant loosening followed by fracture is on the increase.

The increase in these early reoperations is disquieting. More than in reoperation for loosening, these complications mean that one problem has not been solved at a first reoperation, or that further problems have been added to an existing one. The infection issue here assumes a special position in which only about every third reoperation is the first reoperation (figure 1). Note that the majority of deep infections are treated in two stages: the infected implant is removed first and the site allowed to heal. Stage 2 in which a new prosthesis is inserted has been excluded from our analysis and therefore does not affect the picture. In the other cause groups combined, patients undergoing reoperation several times represent more than 40% of the cases (figure 1). In the department-specific tables, the individual frequency by department of early reoperations may be read. The statistical security of these data is low at department level. However the aggregate statistics for the whole country strongly indicate that in general there is reason to review clinical routines continuously to minimise the risk of early complications. We consider that continual open reporting of results is one of the best aids to this work.

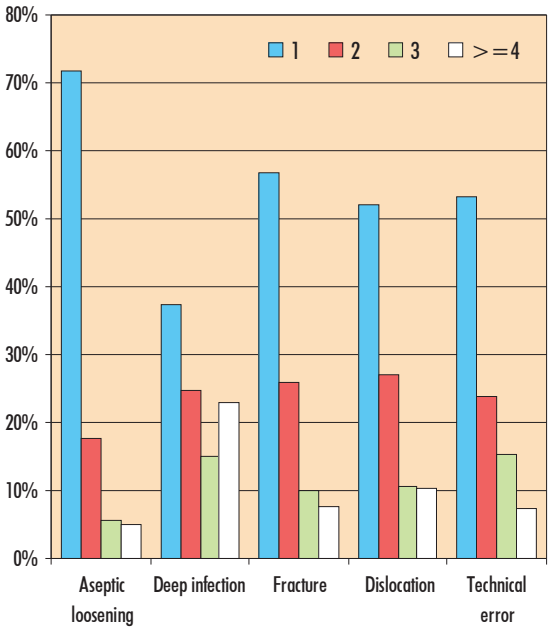


Figure 1. Distribution of first, second, third and fourth-time reoperation within four different reasons to reoperation.

Between 2006 and 2007 reoperation for aseptic loosening declined while the majority of the other cause groups increased. The major part of this increase is related to early reoperations.

Number of reoperations per procedure and year

primary THRs performed 1979-2007

Procedure at reoperation	1979-2002	2003	2004	2005	2006	2007	Total	Share
Revision	21,008	1,695	1,624	1,599	1,582	1,626	29,134	85.2%
Major surgical intervention	2,603	157	168	148	132	135	3,343	9.8%
Minor surgical intervention	954	107	179	157	157	161	1,715	5.0%
(missing)	3	0	0	0	0	0	3	0.0%
Total	24,568	1,959	1,971	1,904	1,871	1,922	34,195	100%

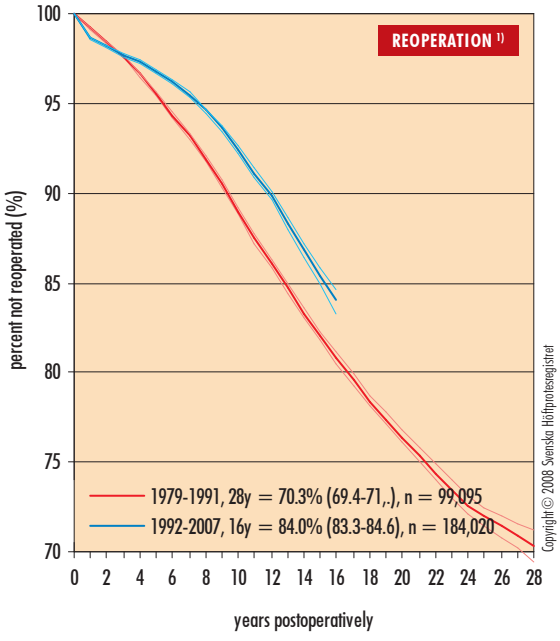
Number of reoperations per reason and year

primary THRs performed 1979-2007

Reason for reoperation	1979-2002	2003	2004	2005	2006	2007	Total	Share
Aseptic loosening	14,869	1,105	988	996	1,018	952	19,928	58.3%
Dislocation	2,584	255	320	265	256	290	3,970	11.6%
Deep infection	2,185	240	288	281	286	305	3,585	10.5%
Fracture	1,666	168	172	181	164	191	2,542	7.4%
2-stage procedure	993	107	99	98	78	80	1,455	4.3%
Technical error	834	17	17	19	15	36	938	2.7%
Miscellaneous	793	21	36	26	15	27	918	2.7%
Implant fracture	338	35	33	23	23	23	475	1.4%
Pain only	270	11	16	8	15	11	331	1.0%
Secondary infection	0	0	1	1	0	3	5	0.0%
(missing)	36	0	1	6	1	4	48	0.1%
Total	24,568	1,959	1,971	1,904	1,871	1,922	34,195	100%

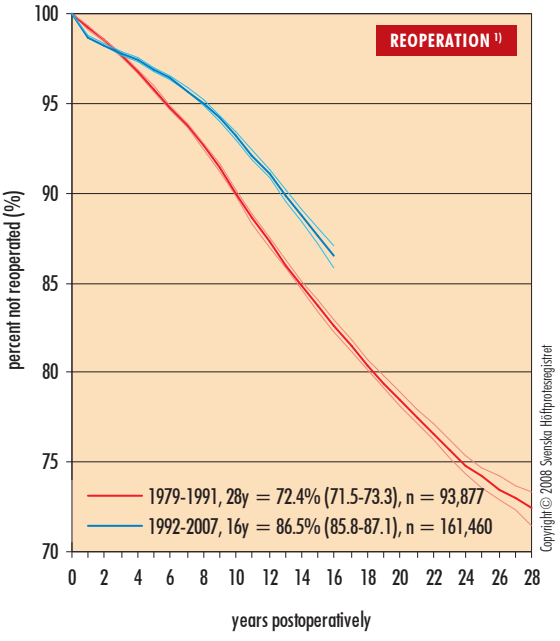
All implants

all diagnoses and all reasons



All cemented implants

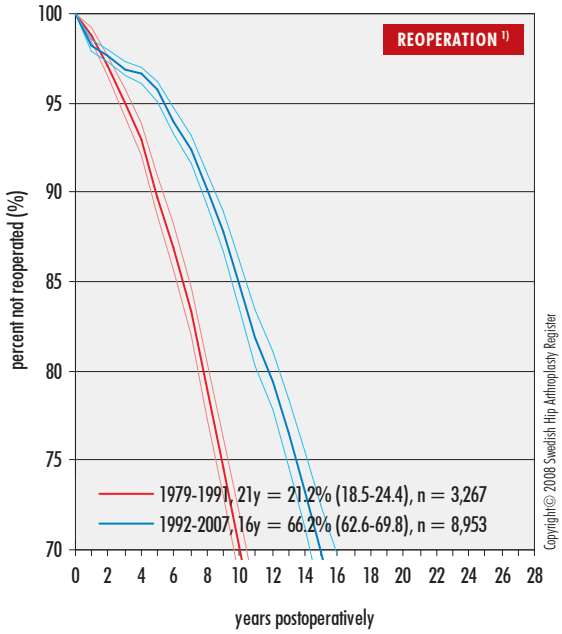
all diagnoses and all reasons



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

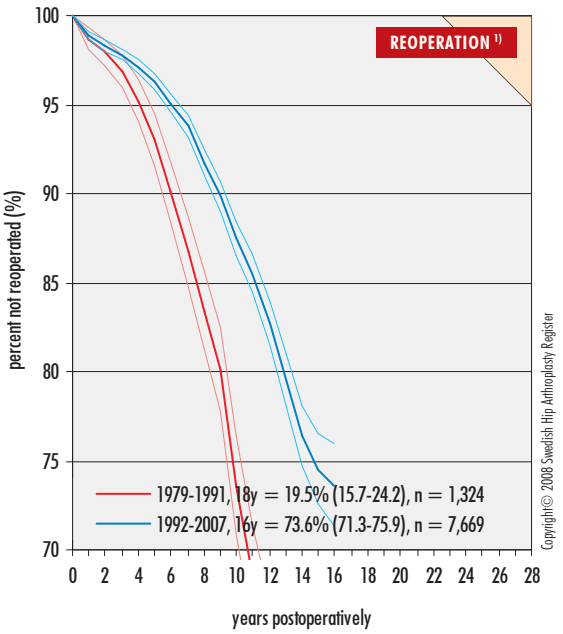
All uncemented implants

all diagnoses and all reasons



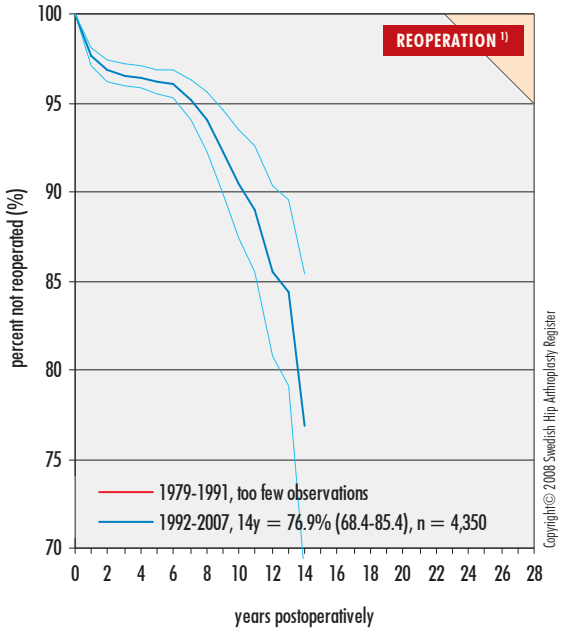
All hybrid implants

all diagnoses and all reasons



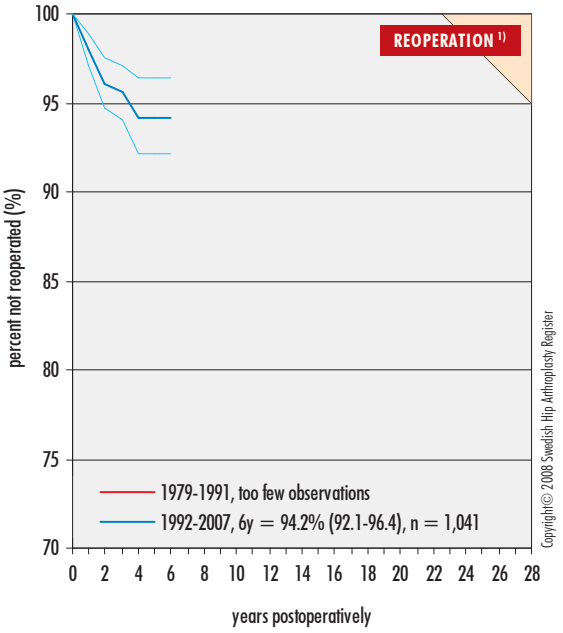
All reversed hybrid implants

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

The definition of failure in traditional survival statistics is exchange of some implant component or the removal of the whole prosthesis. Ten-year survival (Kaplan-Meier) illustrates long-term results with regard primarily to aseptic loosening. Reoperation within 2 years, on the other hand, refers to all forms of further surgery of the hip subsequent to total hip arthroplasty. Reoperation on short-term follow-up reflects mainly early and serious complications such as deep infections and revision due to repeated dislocations. This variable is a quicker quality indicator and easier to use in clinical improvement work than is 10-year survival which is an important but slow and historical indicator. Reoperation within 2 years has been selected by SALAR and the National Board of Health and Welfare as a national quality indicator for hip arthroplasty surgery and is included in 'Regional Comparisons' (see page 118).

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, 2004 up to and including 2007. Note that the Report applies only to complications dealt with surgically. Infections treated with antibiotics and non-surgically-treated dislocations are not captured in the Register. Patients undergoing repeated surgery for the same complication are recorded as one complication. However, a number of patients undergo reoperation for different reasons (then registered as several complications) within a short time. Patients undergoing reoperation at a different department than the primary department are ascribed to the primary department.

Result

The result is given in the following table. Hospital type, numbers undergoing primary surgery during the observation period and proportion of reoperations were recorded. The complication rate varied from 0 to 5.1%. Nine departments had over 3% complications during the period. The national average was 1.6%. The units recording more than 3% complications were three of 11 university/regional hospitals (27%), five of 25 central hospitals (20%), one of 33 rural hospitals (3%) and none of 11 private hospitals (0%). This reflects the varying 'case-mix' and problems of the different hospital types.

The hospitals reporting the highest reoperation frequency during the observation period had mainly dislocation problems. These departments should study the programme of improvement undertaken during 2006 at Sundsvall Hospital (see Annual Report 2006). Two years ago this hospital had the highest reported reoperation frequency for dislocation. They therefore conducted a programme of improvements which drastically reduced the department's dislocation problem.

Discussion

In the interpretation of the results only departments of the same hospital type should be compared in view of the differing problems and patient demographies. Departments treating the most severe cases with greater risks of complication may naturally have a higher frequency. For reasons of space the table does not give the 'case-mix' variables given in other tables and presented graphically in the chapter on follow-up of activities. As well as the different patient compositions, the following must also be taken into account when interpreting these results:

- Complication rates are generally low and a random variability has a large effect on the results.
- This variable can really only be evaluated over time, i.e. if there are clear trends.
- Departments with a different treatment approach (non-surgical treatment of e.g. infection and dislocation) i.e. departments that avoid surgery for these complications, are not recorded in the database.
- If over time a department has a persistently high proportion of short-term complications, an in-depth analysis should be started with a review of indications, routines, surgical technique and possibly choice of implant. Since the study covers patients undergoing surgery over a four-year period, it may be 1-2 years before a successful improvement is reflected in the results table.

The registry management have avoided ranking the various hospitals according to this parameter. Since complication rates are generally low, a failure to register may seriously affect the ranking of a unit (see section 'Degree of coverage' page 7). However, several county councils are seeking to rank and 'accredit' departments and clinics. The registry management is critical of this development partly because some units do not report all reoperations (at least up to 2006), and partly because of the problems of interpreting that may arise as above.

Regardless of hospital category and result, the departments should analyse their complications and investigate whether there are systematic shortcomings – so as to optimise results for the individual patient. To assist in this procedure, in a department-by-department report, the ID numbers and date of operation of the patients in question are attached and sent to each unit.

Reoperation within 2 years per hospital

2004-2007

	Prim. THRs	Patients [1]		Infection		Dislocation		Loosening		Others	
Hospital	number	number	%	number	%	number	%	number	%	number	%
University/Regional hospitals											
KS/Huddinge	1,047	26	2.5%	3	0.3%	9	0.9%	5	0.5%	12	1.1%
KS/Solna	946	34	3.6%	18	1.9%	11	1.2%	3	0.3%	16	1.7%
Linköping	289	3	1.0%	2	0.7%	1	0.3%	0	0.0%	0	0.0%
Lund	333	13	3.9%	3	0.9%	5	1.5%	1	0.3%	8	2.4%
Malmö	480	8	1.7%	2	0.4%	4	0.8%	1	0.2%	2	0.4%
SU/Mölndal	442	11	2.5%	3	0.7%	8	1.8%	0	0.0%	0	0.0%
SU/Sahlgrenska	561	7	1.2%	2	0.4%	2	0.4%	1	0.2%	3	0.5%
SU/Östra	478	8	1.7%	2	0.4%	4	0.8%	1	0.2%	3	0.6%
Umeå	314	4	1.3%	1	0.3%	2	0.6%	0	0.0%	1	0.3%
Uppsala	1,170	37	3.2%	10	0.9%	16	1.4%	3	0.3%	14	1.2%
Örebro	736	11	1.5%	7	1.0%	1	0.1%	0	0.0%	5	0.7%
Central hospitals											
Borås	855	23	2.7%	7	0.8%	14	1.6%	1	0.1%	4	0.5%
Danderyd	1,447	23	1.6%	3	0.2%	8	0.6%	3	0.2%	11	0.8%
Eksjö	753	14	1.9%	6	0.8%	6	0.8%	0	0.0%	3	0.4%
Eskilstuna	322	4	1.2%	0	0.0%	2	0.6%	1	0.3%	2	0.6%
Falun	1,031	8	0.8%	1	0.1%	4	0.4%	1	0.1%	3	0.3%
Gävle	549	28	5.1%	6	1.1%	14	2.6%	2	0.4%	7	1.3%
Halmstad	846	13	1.5%	4	0.5%	3	0.4%	1	0.1%	5	0.6%
Helsingborg	320	8	2.5%	5	1.6%	1	0.3%	0	0.0%	4	1.3%
Hässleholm-Kristianstad	2,982	34	1.1%	15	0.5%	9	0.3%	3	0.1%	12	0.4%
Jönköping	791	10	1.3%	4	0.5%	3	0.4%	0	0.0%	4	0.5%
Kalmar	816	21	2.6%	14	1.7%	7	0.9%	0	0.0%	2	0.2%
Karlskrona	146	6	4.1%	1	0.7%	4	2.7%	1	0.7%	0	0.0%
Karlstad	1,075	26	2.4%	19	1.8%	2	0.2%	1	0.1%	5	0.5%
Norrköping	619	3	0.5%	0	0.0%	2	0.3%	0	0.0%	1	0.2%
S:t Göran	1,725	26	1.5%	7	0.4%	14	0.8%	6	0.3%	6	0.3%
Skövde	609	6	1.0%	1	0.2%	2	0.3%	1	0.2%	2	0.3%
Sunderby (incl. Boden)	419	19	4.5%	7	1.7%	12	2.9%	0	0.0%	1	0.2%
Sundsvall	574	24	4.2%	16	2.8%	8	1.4%	0	0.0%	3	0.5%
Södersjukhuset	1,361	35	2.6%	26	1.9%	5	0.4%	1	0.1%	8	0.6%
Uddevalla	1,250	22	1.8%	11	0.9%	4	0.3%	3	0.2%	8	0.6%
Varberg	822	18	2.2%	12	1.5%	2	0.2%	1	0.1%	3	0.4%
Västerås	606	8	1.3%	2	0.3%	4	0.7%	0	0.0%	1	0.2%
Växjö	517	2	0.4%	0	0.0%	1	0.2%	0	0.0%	1	0.2%
Ystad	195	6	3.1%	1	0.5%	5	2.6%	0	0.0%	0	0.0%
Östersund	770	14	1.8%	2	0.3%	8	1.0%	0	0.0%	4	0.5%
Rural hospitals											
Alingsås	768	8	1.0%	3	0.4%	4	0.5%	1	0.1%	0	0.0%
Arvika	440	9	2.0%	6	1.4%	0	0.0%	2	0.5%	4	0.9%
Bollnäs	1,055	15	1.4%	4	0.4%	7	0.7%	1	0.1%	4	0.4%
Enköping	672	8	1.2%	1	0.1%	5	0.7%	1	0.1%	2	0.3%
Falköping	947	2	0.2%	1	0.1%	1	0.1%	0	0.0%	0	0.0%
Frölunda Specialistsjukhus	236	3	1.3%	1	0.4%	2	0.8%	0	0.0%	1	0.4%

Reoperation within 2 years per hospital (cont.)

2004-2007

	Prim. THRs	Patients [1]		Infection		Dislocation		Loosening		Others	
Hospital	number	number	%	number	%	number	%	number	%	Number	%
Gällivare	418	7	1.7%	2	0.5%	4	1.0%	1	0.2%	2	0.5%
Hudiksvall	552	15	2.7%	11	2.0%	3	0.5%	0	0.0%	2	0.4%
Karlshamn	683	12	1.8%	0	0.0%	11	1.6%	1	0.1%	1	0.1%
Karlskoga	407	5	1.2%	2	0.5%	1	0.2%	0	0.0%	3	0.7%
Katrineholm	806	7	0.9%	2	0.2%	1	0.1%	2	0.2%	3	0.4%
Kungälv	747	9	1.2%	7	0.9%	1	0.1%	1	0.1%	1	0.1%
Köping	824	10	1.2%	1	0.1%	7	0.8%	2	0.2%	1	0.1%
Lidköping	540	4	0.7%	0	0.0%	3	0.6%	0	0.0%	1	0.2%
Lindesberg	574	13	2.3%	4	0.7%	5	0.9%	0	0.0%	5	0.9%
Ljungby	451	4	0.9%	0	0.0%	1	0.2%	1	0.2%	2	0.4%
Lycksele	967	4	0.4%	4	0.4%	0	0.0%	1	0.1%	0	0.0%
Mora	586	8	1.4%	4	0.7%	3	0.5%	0	0.0%	1	0.2%
Motala	1,483	21	1.4%	4	0.3%	13	0.9%	1	0.1%	8	0.5%
Norrtälje	388	3	0.8%	1	0.3%	2	0.5%	1	0.3%	1	0.3%
Nyköping	545	6	1.1%	1	0.2%	3	0.6%	0	0.0%	3	0.6%
Oskarshamn	804	3	0.4%	2	0.2%	0	0.0%	1	0.1%	1	0.1%
Piteå	1,020	16	1.6%	8	0.8%	3	0.3%	1	0.1%	5	0.5%
Skellefteå	433	3	0.7%	2	0.5%	1	0.2%	0	0.0%	1	0.2%
Skene	313	2	0.6%	2	0.6%	0	0.0%	0	0.0%	0	0.0%
Sollefteå	536	6	1.1%	2	0.4%	3	0.6%	0	0.0%	2	0.4%
Södertälje	476	1	0.2%	1	0.2%	0	0.0%	0	0.0%	0	0.0%
Torsby	308	6	1.9%	4	1.3%	1	0.3%	0	0.0%	3	1.0%
Trelleborg	1,628	22	1.4%	10	0.6%	6	0.4%	1	0.1%	9	0.6%
Visby	405	11	2.7%	3	0.7%	2	0.5%	1	0.2%	5	1.2%
Värnamo	553	4	0.7%	1	0.2%	2	0.4%	1	0.2%	0	0.0%
Västervik	435	13	3.0%	8	1.8%	5	1.1%	0	0.0%	5	1.1%
Örnsköldsvik	657	4	0.6%	1	0.2%	3	0.5%	0	0.0%	1	0.2%
Private hospitals											
Carlanderska	225	2	0.9%	0	0.0%	1	0.4%	0	0.0%	1	0.4%
Elisabethsjukhuset	560	2	0.4%	1	0.2%	0	0.0%	0	0.0%	1	0.2%
GMC	120	2	1.7%	1	0.8%	1	0.8%	1	0.8%	0	0.0%
Movement	306	6	2.0%	4	1.3%	2	0.7%	0	0.0%	1	0.3%
Nacka Närsjukhus Proxima	106	3	2.8%	1	0.9%	1	0.9%	1	0.9%	1	0.9%
OrthoCenter	18	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Ortopediska Huset	1,454	14	1.0%	4	0.3%	5	0.3%	3	0.2%	6	0.4%
Sabbatsberg Närsjukhuset	139	1	0.7%	0	0.0%	0	0.0%	0	0.0%	1	0.7%
Sophiahemmet	1,004	7	0.7%	3	0.3%	0	0.0%	0	0.0%	6	0.6%
Spenshult	75	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Stockholms Specialistvård	708	15	2.1%	2	0.3%	9	1.3%	3	0.4%	2	0.3%
Nation	55,458	887	1.6%	346	0.6%	330	0.6%	70	0.1%	266	0.5%

[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.

When interpreting the variable 'reoperation within 2 years' the following factors must be taken into account:

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

Readmission within 30 days

The Swedish Hip Arthroplasty Register has during the year established co-operation with the Centre for Epidemiology (EpC) at the National Board of Health and Welfare. For this year's 'Regional Comparisons' a new national quality indicator, *Undesirable events following arthroplasty subsequent to hip and knee implant surgery*, has been created via the National Patient Register. The EpC has used this analysis to conduct a separate analysis for hip arthroplasty alone, presented in the present Annual Report at county-council level. It is planned to do the same analysis at hospital level for the next report.

Material from Scotland and Massachusetts (USA) shows that the number of 'adverse events' (complications) within 30 days of discharge varies between hospitals and that an increase has been seen associated with shorter hospital stay. In Sweden, too, the mean care periods have shortened during the past 10 years from about 10 days (1998) to 6.5 days (2007). The attempt to shorten care periods is prompted both by productivity and accessibility. A possible reduction in costs, however, would disappear directly if readmissions should increase at the same time owing to shorter hospital stay.

Material and method

All patients undergoing total hip arthroplasty during 2005-2007 (NFB 29, 39, 49 and 99) are the basic material. 'Adverse events' comprises all local (associated with hip surgery) and general complications (cardiovascular, pneumonia, stroke, ulcers, urine retention) and death within 30 days. Via the Hip Arthroplasty Register, orthopaedics has a relatively good picture of readmission for implant complications. However, in general, we lack knowledge of readmission for other medical complications.

In our analysis we found, as opposed to other studies, no clear connection between shorter hospital stay and frequency of readmission. An in-depth analysis in the form of a research project is planned, however.

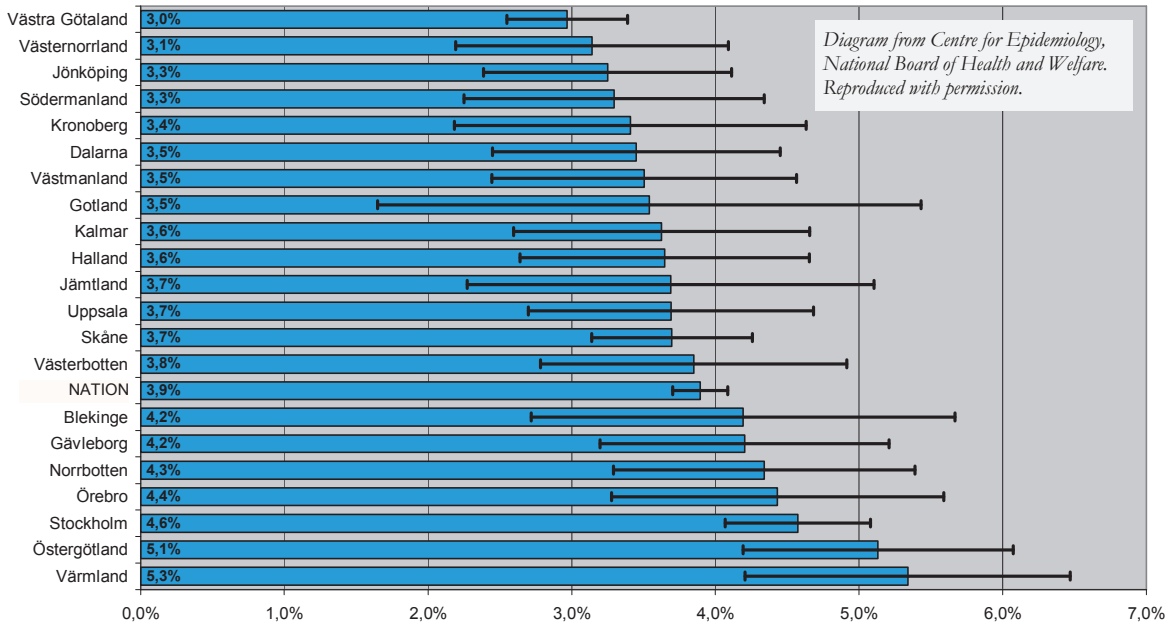
Result

See the histogram below. The national mean value is 3.9%, i.e. 4 of 100 patients undergoing operation are readmitted with some form of complication, or die (some few promille). There is a relatively large spread between county councils, 3% - 5.3%. Statistically, one county council had lower complication frequency and three had higher. Should this indicator be useable for local improvement work, we need to analyse down to hospital level, and this is therefore planned.

Problems

This type of analysis of the National Patient Register (PAR) can in the future be of great importance for continued quality development for Swedish hip arthroplasty surgery. However at present there are a number of sources of error, discussed under 'Degree of coverage' (page 6). The PAR has a lower degree of coverage than the Swedish Hip Arthroplasty Register (90.7% and 96%). A series of hospital mergers has been carried out with joint reporting to the PAR, even though the surgery was performed at different hospitals. However the greatest source of error is probably 'carelessness' in ICD 10 coding and the fact that many patients have many secondary diagnoses when discharged where the diagnosis most relevant for that care occasion is not always given as the first diagnosis. These factors probably cause the analysis to show values that are somewhat too low.

Readmission within 30 days after total hip replacement surgery
2005-2007



Revision

As opposed to reoperation which is a broader concept, the term revision is used for the replacement or extraction of one, several or all parts of the prosthesis. The revision database, as opposed to the primary database has been based on patient ID number ever since 1979. Data capture has also been more detailed and since 1979 based on scrutiny and data collection from patient records. This means that demographic data and details of surgical technique and implant are also more secure for the period 1979-1991 when primary hip prostheses were still registered in the form of aggregate data from each department.

Causes of revision

During 2007 the total number of revisions remains almost unchanged compared with the previous year. Based on statistics of reoperations, however, we find as expected a shift in the distribution in the causes of reoperation. Aseptic loosening declined and as in 2004 we again see an increase primarily in revision for dislocation and also for infection (figures 1-2). 'Technical' causes increased from 7 to 18 for first-time revision, the highest value noted during the most recent ten-year period. If the many-times-revised are added, the shift of revision causes is clearer since aseptic loosening does not cause repeated revision to the same extent that most other cause groups do.

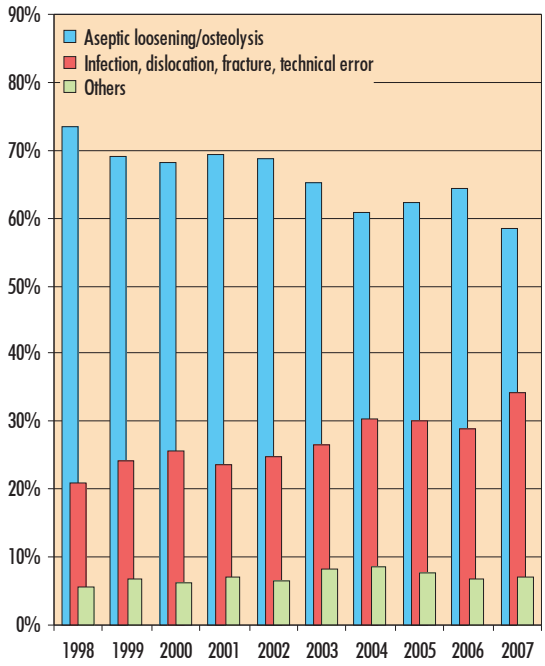


Figure 1. Distribution between cause group aseptic loosening and the aggregate group infection/dislocation/fracture/technical reason for all revisions during the past ten years.

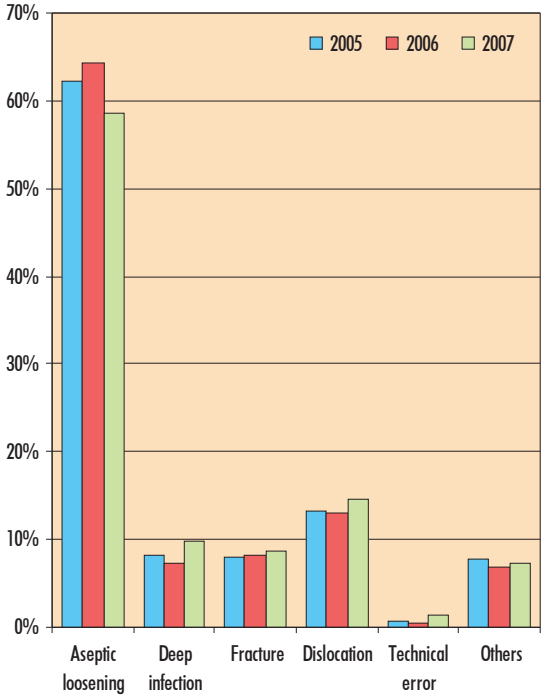


Figure 2. Relative distribution of cause groups for all revisions during the past three years.

Primary diagnosis

'Revised' patients have a different diagnosis distribution from those undergoing primary arthroplasty (figure 3). Primary osteoarthritis is more unusual in the revision group. Instead, inflammatory arthritis, sequelae of childhood diseases and secondary osteoarthritis following femoral head necrosis are commoner. The reason can be derived partly from findings from our in-depth analyses of the young cohort of patients and gender-related factors. The table at the bottom of page 44 shows that the difference in diagnosis distribution increases with increased number of revisions. Patients with these diagnoses thus require extra attention even at the primary operation. They more than other diagnosis groups risk multiple revisions, in which every implant failure and revision involves considerable inconvenience, risk of handicap, complications and major resource requirements.

Type of revision and selection of implant

In most cases both cup and stem are changed (figure 4). With an increasing number of revisions, however, there is a tendency to solve the problem by changing only one component. The proportion of cup liner replacements increased until 2002 but has since remained relatively con-

stant. Starting in 2003 this measure has been carried out in between 5.5% and 7.1% of cases. Most often, it is an isolated measure with or without change of the femoral head (2003-2007: 60% of cases) or else is done in connection with stem replacement (40%).

During the past 10 years uncemented fixation has been used increasingly in revision both on the cup side and on the stem side (figures 5a-b). However, cemented prostheses still dominate. Between 2005 and 2007, some 40 different cup types were used. The three most common cemented components were Lubinus all plastic (16.3% of all cemented and uncemented cups), Charnley Elite (10.1%) and Exeter Duration (9.6%). Corresponding uncemented components were Trilogy with or without hydroxylapatite/calcium phosphate (16.5%), Mallory Head (2.6%) and Trident with hydroxylapatite (2.3%).

Some 50 stem types were used in revision. The three most commonly used cemented stems during the period were Exeter Polish (27.1% of the total), Lubinus SP2 (19.9%) and CPT (7.6%). The most frequently used uncemented stems were MP revision (12.8%), Revitan (7.2%) and Wagner SL revision (6.6%).

During the most recent 3-year period, more than half the cups and stem types used were employed in fewer than 30 cases. In special cases, particularly occasional cup or stem revisions, it may be desirable to match the stem or cup which was not revised with a corresponding implant from the same manufacturer. This can partly explain the low degree of use of certain prosthesis types. Seeing that during the period 2005-2007 around 3,000 cup and stem replacements were carried out, it seems eligible to reduce this relatively wide implant variation.

The survival diagrams (pages 46-49) show that all-cemented implants have given the best results. Noteworthy is the relatively high proportion of revisions of the femur component of the Durom implant. Fifteen of 19 femoral components noted in the register were of this design. We cannot say why, but certain shortcomings of the instrument guides initially used for this implant could be one of many possible causes. In this year's in-depth analysis we have only evaluated revision irrespective of whether it was of cup or femur part. However we are planning an extended analysis in the Nordic common database during the coming year to obtain a more comprehensive material for detailed studies.

Note that statistics on implant survival related to type and department are raw values not adjusted on the basis of 'case-mix'. To simplify interpretation, however, we present the factors included in the calculation of the 'case-mix' variable. It is also important to assess prosthesis survival against the number of implants inserted and the size of the confidence interval. The fewer implants the greater the probability that local factors such as surgical technique have affected the result.

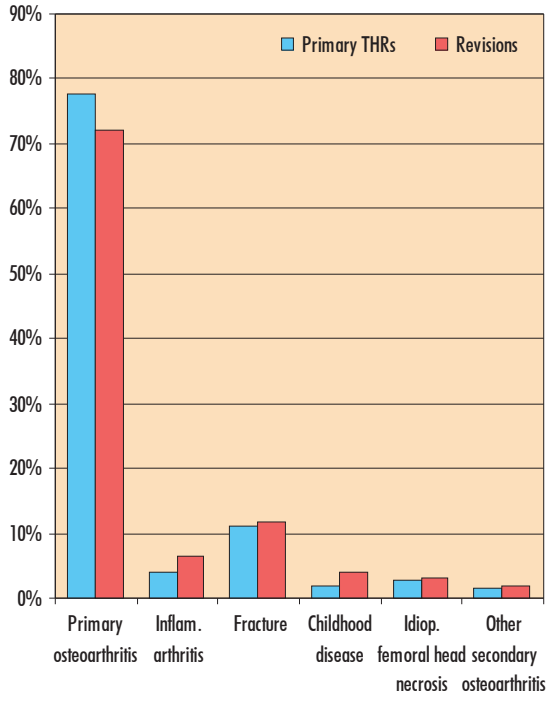


Figure 3. Distribution of diagnoses between primary operations 1992-2007 and all revision operations in which primary prostheses were inserted 1992-2007.

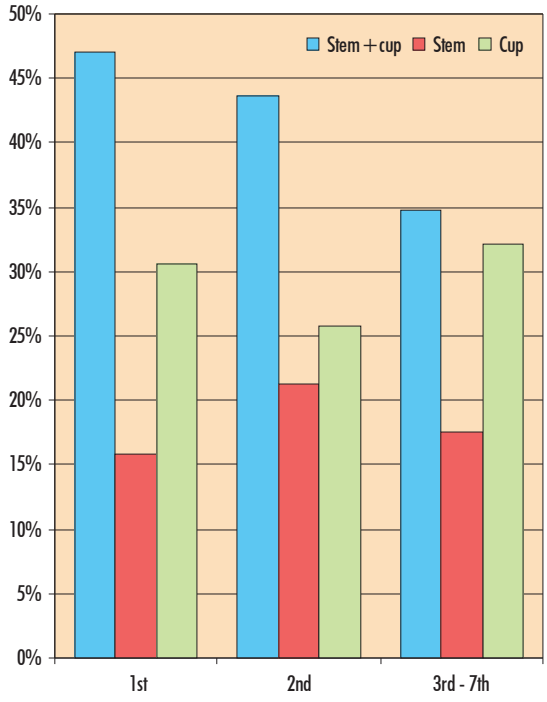


Figure 4. Distribution of measures during revision operations related to first, second or third to seventh revision operation (= maximum number). Replacement of liner is classified as cup revision.

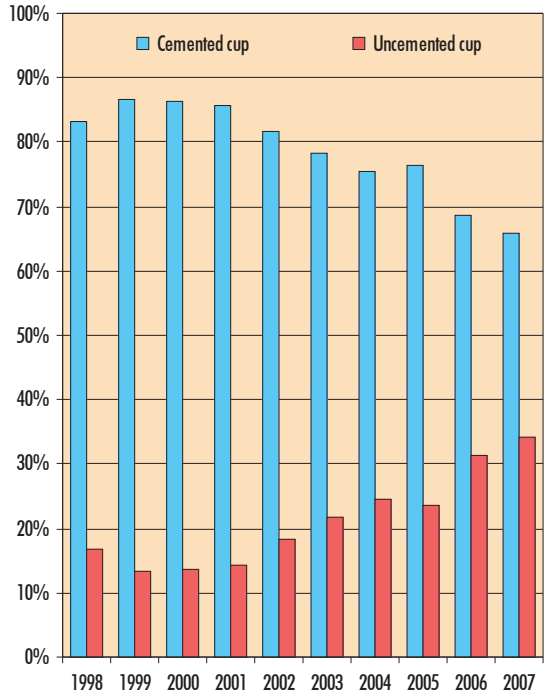


Figure 5a. Choice of fixation or revision prosthesis. Distribution of cemented/uncemented cup during the period 1998-2007.

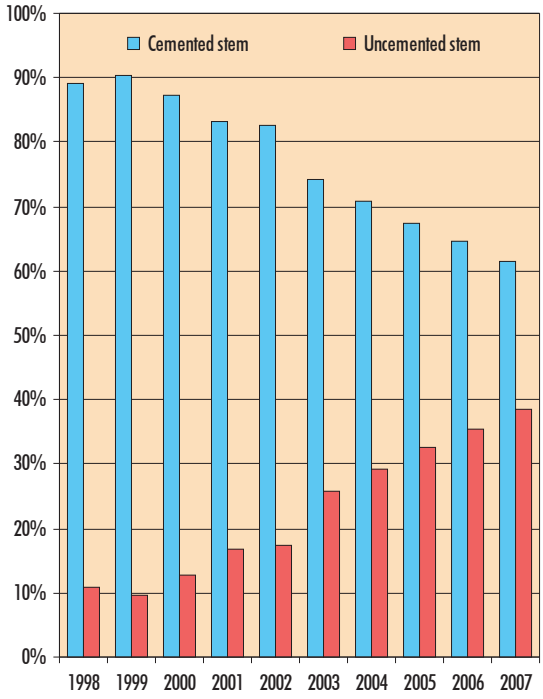


Figure 5b. Choice of fixation for revision prosthesis. Distribution of cemented/uncemented stem during the period 1998-2007.

By *reoperation* is meant all forms of surgery after total hip arthroplasty.

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

Implant survival as a quality indicator

Ten-year prosthesis survival by county council/region has since 2006 been used as a national quality indicator (see separate section). The table below shows national 10-year survival for all patients undergoing primary total arthroplasty. The definition of failure is revision of one or both components or extraction of the prosthesis. All reasons for revision are included. As the histograms and tables clearly show, 10-year survival of total hip prostheses has improved successively in Sweden ever since the start of the Register.

The histogram on the next page shows 10-year survival by hospital (the 70 departments that had been active and had 10-year results at 31/12/2007). The histogram is a graphic presentation of the 10-year results from the tables on pages 65–66. The observation time is 1998-2007. Thus we have this year only a 10-year window, meaning that we have excluded earlier historical results. The national average was 94.7% ± 0.4%. Red bars represent departments whose upper confidence interval was below the national lower confidence interval, i.e. departments which were poorer than the national average, i.e. departments which with 95% probability had poorer implant survival after ten years than the national average. Thus five departments had a result that was below the national average. This is a change from last year's figures, in which 13 departments had a poorer result. This change is explained not only by a possible improvement in quality but also by the smaller observation interval.

In this year's 'Regional Comparisons' (published 6/10 2008) most quality indicators will be presented not only at county council level but also at unit level. We have therefore chosen this year to give department names in the histogram. Note that the bars are not placed as a ranking system but in alphabetical order.

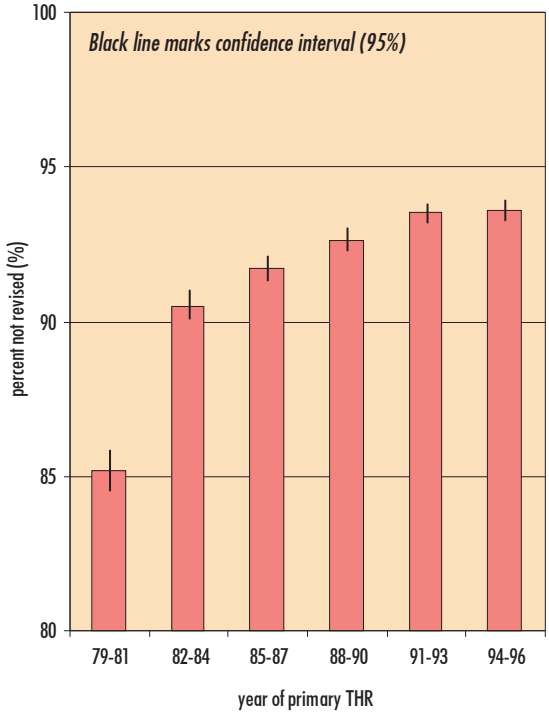
Kaplan-Meier statistics

Prosthesis survival statistics according to Kaplan-Meier are the most common outcome variable in prosthesis research both nationally and internationally. Most common is to publish 10-year results with the failure definition as above.

This measurement method is exact since it is based on the date when the patient underwent revision surgery. It is, however, a limited measurement method since it does not take account of patient-reported outcome, medical contraindications for further surgery, whether the patient him- or herself wishes to abstain from revision surgery and whether the patient is listed. The variable should also be considered as a slow quality indicator which partly describes historical material.

These factors must always be taken into account when interpreting survival statistics which, however, should always be reported since they reflect long-term results following total hip arthroplasty, predominantly regarding aseptic loosening.

Implant survival after 10 years in different time periods



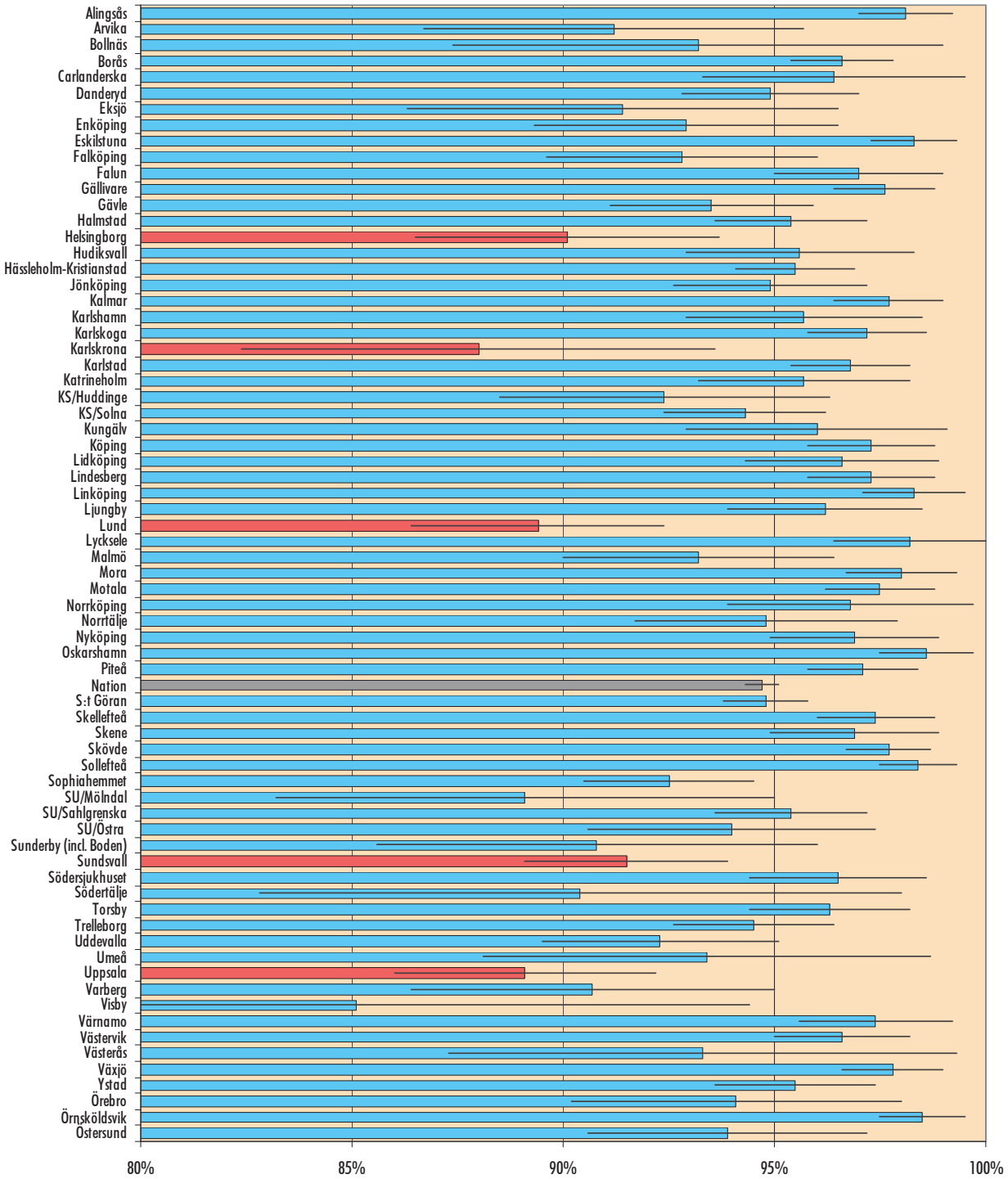
Primary THR during time period	10 years	95% CI
1979-1981	85.2%	±0.7
1982-1984	90.5%	±0.4
1985-1987	91.7%	±0.4
1988-1990	92.6%	±0.3
1991-1993	93.5%	±0.3
1994-1996	93.6%	±0.3

Average implant survival after 10 years for all departments active in each period. Each interval includes all primary hip arthroplasties carried out during the three-year period. All revisions of these primary operations are included. The analysis extends up to and including 31.12.2007. The table shows the values for the bar diagram on the left.

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

Implant survival after 10 years

primary operation 1998-2007



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 reason and year of revision

only the first revision, primary THRs 1979-2007

Reason for revision	1979-2002	2003	2004	2005	2006	2007	Total	Share
Aseptic loosening	12,798	910	809	827	866	794	17,004	74.3%
Dislocation	1,070	125	170	134	146	174	1,819	8.0%
Deep infection	1,254	90	82	85	80	104	1,695	7.4%
Fracture	886	95	95	94	106	110	1,386	6.1%
Technical error	440	6	10	8	7	18	489	2.1%
Implant fracture	256	21	16	17	15	14	339	1.5%
Pain only	54	5	5	3	7	7	81	0.4%
Miscellaneous	38	1	7	5	3	7	61	0.3%
Total	16,796	1,253	1,194	1,173	1,230	1,228	22,874	100%

Number of revisions per reason and number of previous revisions

primary THRs 1979-2007

Reason for revision	0		1		2		> 2		Total	Share
Aseptic loosening	17,004	74.3%	2,379	61.8%	414	55.1%	88	40.9%	19,885	71.8%
Dislocation	1,819	8.0%	521	13.5%	129	17.2%	59	27.4%	2,528	9.1%
Deep infection	1,695	7.4%	458	11.9%	108	14.4%	47	21.9%	2,308	8.3%
Fracture	1,386	6.1%	314	8.2%	61	8.1%	9	4.2%	1,770	6.4%
Technical error	489	2.1%	81	2.1%	18	2.4%	3	1.4%	591	2.1%
Implant fracture	339	1.5%	68	1.8%	16	2.1%	7	3.3%	430	1.6%
Pain only	81	0.4%	15	0.4%	3	0.4%	2	0.9%	101	0.4%
Miscellaneous	61	0.3%	12	0.3%	2	0.3%	0	0.0%	75	0.3%
Secondary infection	0	0.0%	1	0.0%	1	0.1%	0	0.0%	2	0.0%
Total	22,874	100%	3,849	100%	752	100%	215	100%	27,690	100%

Number of revisions per diagnosis and number of previous revisions

primary THRs 1979-2007

Diagnosis at primary THR	0		1		2		> 2		Total	Share
Primary osteoarthritis	16,848	73.7%	2,699	70.1%	505	67.2%	135	62.8%	20,187	72.9%
Fracture	2,092	9.1%	339	8.8%	51	6.8%	10	4.7%	2,492	9.0%
Inflammatory arthritis	1,831	8.0%	376	9.8%	95	12.6%	32	14.9%	2,334	8.4%
Childhood disease	1,149	5.0%	269	7.0%	58	7.7%	24	11.2%	1,500	5.4%
Idiopathic femoral head necrosis	448	2.0%	72	1.9%	17	2.3%	4	1.9%	541	2.0%
Secondary arthritis after trauma	203	0.9%	55	1.4%	17	2.3%	10	4.7%	285	1.0%
Secondary osteoarthritis	73	0.3%	8	0.2%	1	0.1%	0	0.0%	82	0.3%
Tumor	37	0.2%	7	0.2%	4	0.5%	0	0.0%	48	0.2%
(missing)	193	0.8%	24	0.6%	4	0.5%	0	0.0%	221	0.8%
Total	22,874	100%	3,849	100%	752	100%	215	100%	27,690	100%

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

primary THRs 1979-2007

Year of revision	0		1		2		> 2		Total	Share
1979-2002	16,796	73.4%	2,623	68.1%	476	63.3%	113	52.6%	20,008	72.3%
2003	1,253	5.5%	260	6.8%	57	7.6%	20	9.3%	1,590	5.7%
2004	1,194	5.2%	267	6.9%	51	6.8%	18	8.4%	1,530	5.5%
2005	1,173	5.1%	250	6.5%	62	8.2%	24	11.2%	1,509	5.4%
2006	1,230	5.4%	202	5.2%	54	7.2%	19	8.8%	1,505	5.4%
2007	1,228	5.4%	247	6.4%	52	6.9%	21	9.8%	1,548	5.6%
Total	22,874	100%	3,849	100%	752	100%	215	100%	27,690	100%

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

only the first revision, primary THRs 1979-2007

Type of fixation at primary THR	1979-2002	2003	2004	2005	2006	2007	Total	Share
Cemented	14,232	960	942	922	919	914	18,889	82.6%
Uncemented	1,410	143	109	92	136	139	2,029	8.9%
Hybrid	578	124	109	116	121	114	1,162	5.1%
Reversed hybrid	82	9	19	20	30	36	196	0.9%
Resurfacing implant	7	1	3	7	7	10	35	0.2%
(missing)	487	16	12	16	17	15	563	2.5%
Total	16,796	1,253	1,194	1,173	1,230	1,228	22,874	100%

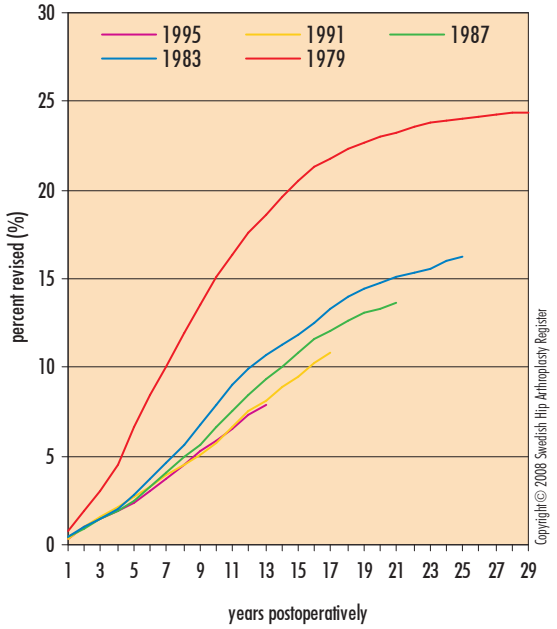
Number of revisions per reason and time to revision

only the first revision, primary THRs 1979-2007

Reason for revision	0 – 3 years		4 – 6 years		7 – 10 years		> 10 years		Total	Share
Aseptic loosening	2,760	44.7%	3,520	82.5%	4,998	86.4%	5,726	86.2%	17,004	74.3%
Dislocation	1,206	19.5%	203	4.8%	186	3.2%	224	3.4%	1,819	8.0%
Deep infection	1,247	20.2%	208	4.9%	146	2.5%	94	1.4%	1,695	7.4%
Fracture	367	5.9%	226	5.3%	328	5.7%	465	7.0%	1,386	6.1%
Technical error	439	7.1%	25	0.6%	16	0.3%	9	0.1%	489	2.1%
Implant fracture	54	0.9%	68	1.6%	106	1.8%	111	1.7%	339	1.5%
Pain only	61	1.0%	10	0.2%	4	0.1%	6	0.1%	81	0.4%
Miscellaneous	39	0.6%	9	0.2%	4	0.1%	9	0.1%	61	0.3%
Total	6,173	100%	4,269	100%	5,788	100%	6,644	100%	22,874	100%

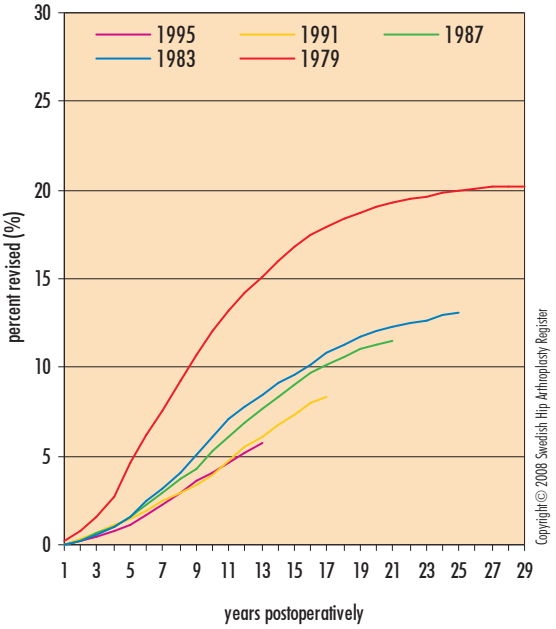
All diagnoses and all reasons

cumulative frequency of revision



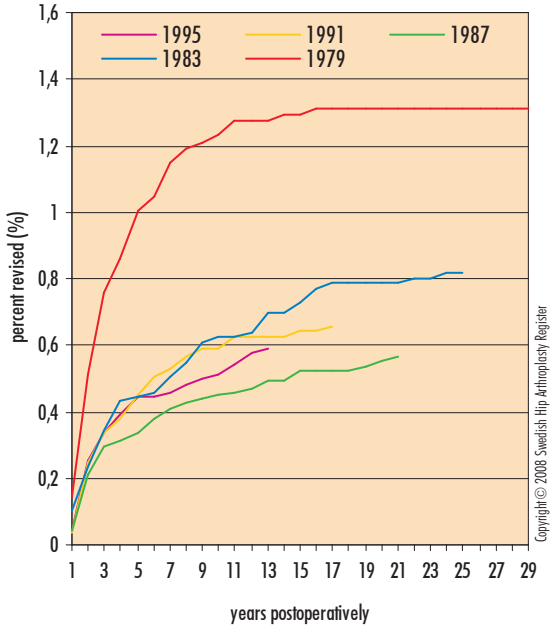
Aseptic loosening

cumulative frequency of revision



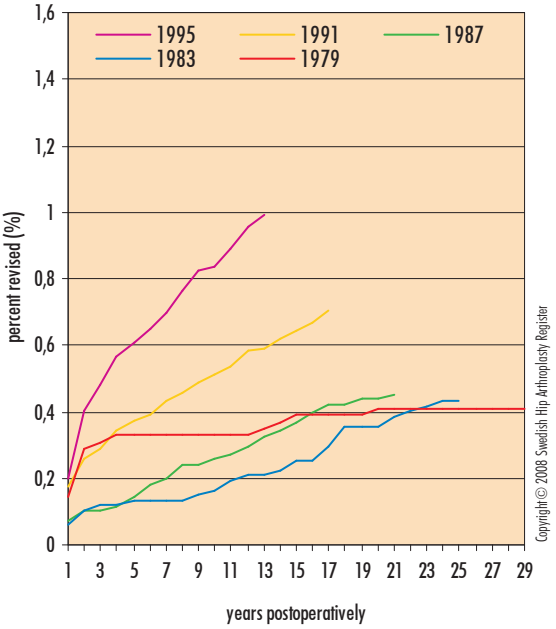
Deep infection

cumulative frequency of revision



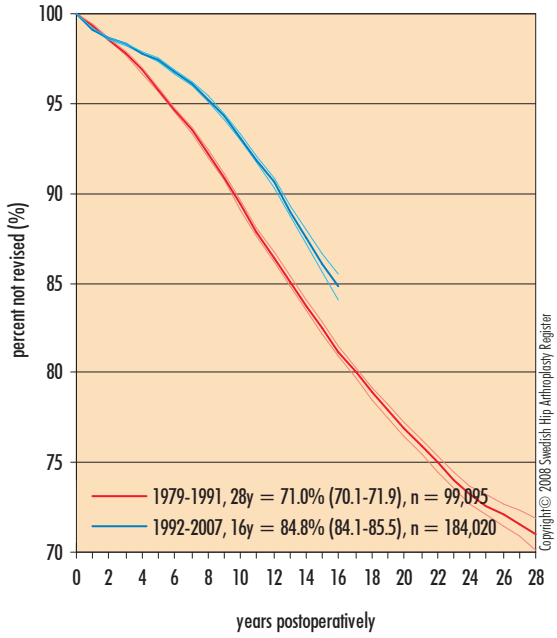
Dislocation

cumulative frequency of revision



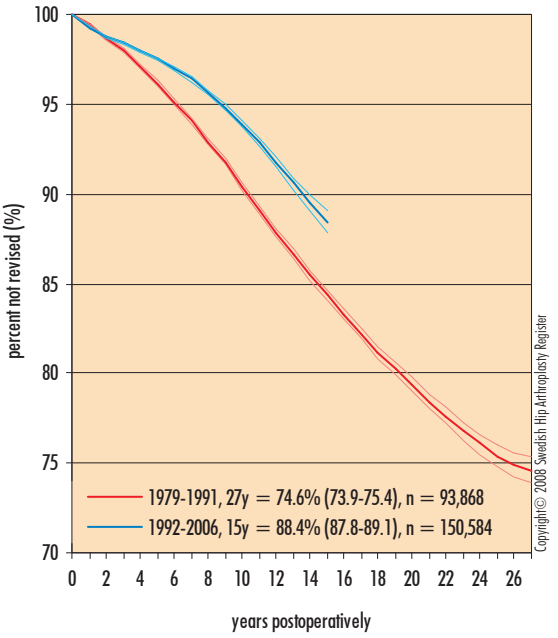
All implants

all diagnoses and all reasons for revision



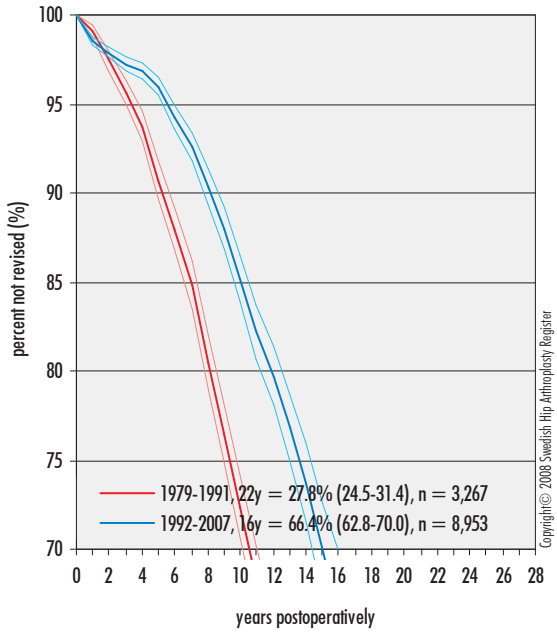
All cemented implants

all diagnoses and all reasons for revision



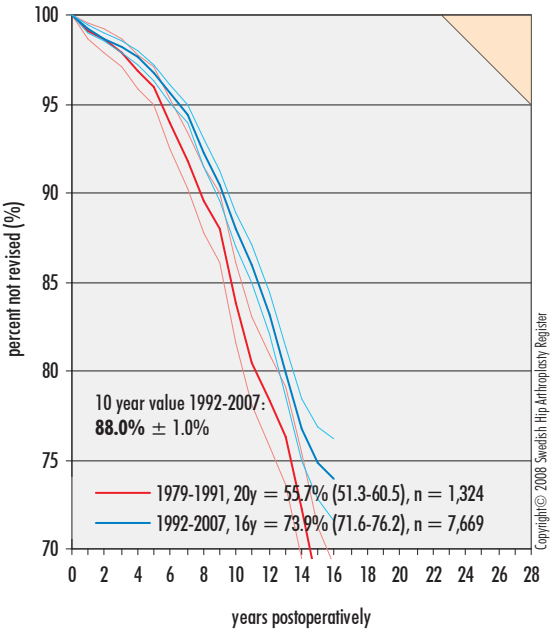
All uncemented implants

all diagnoses and all reasons for revision



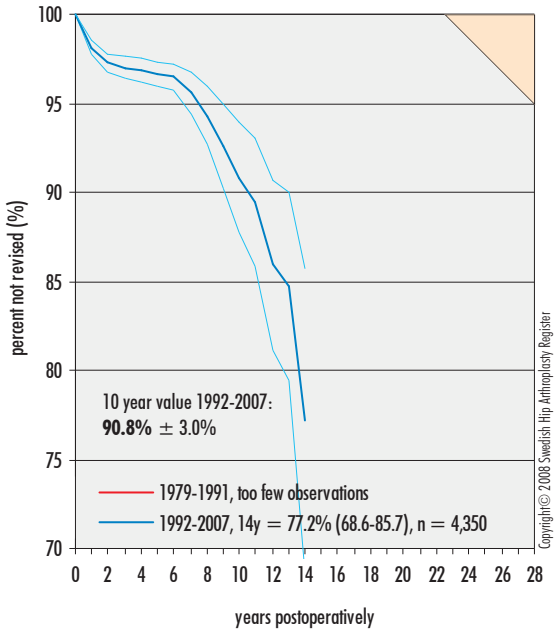
All hybrid implants

all diagnoses and all reasons for revision



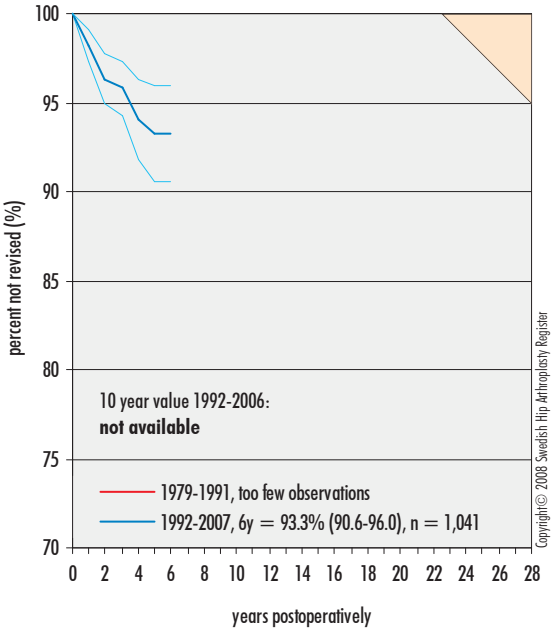
All reversed hybrid implants

all diagnoses and all reasons for revision



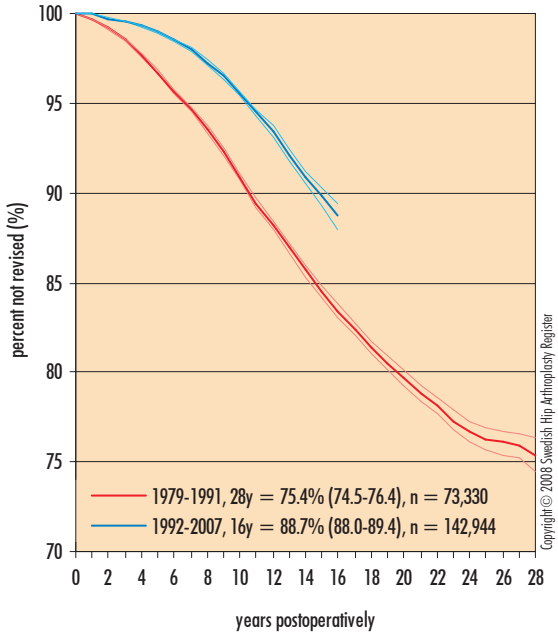
All resurfacing implants

all diagnoses and all reasons for revision



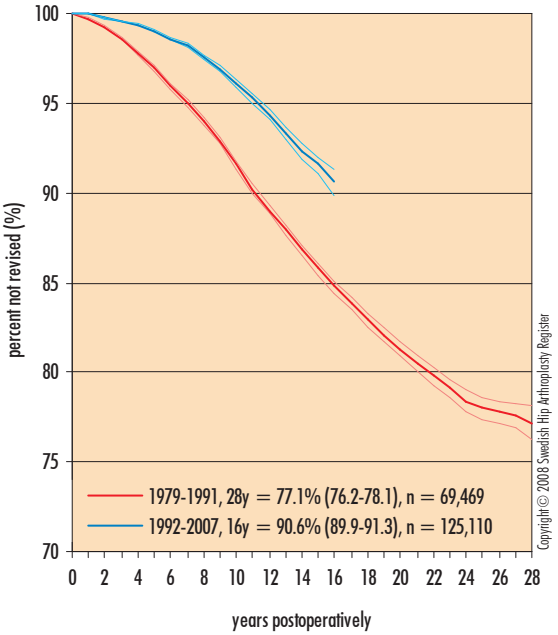
All implants

primary osteoarthritis and aseptic loosening



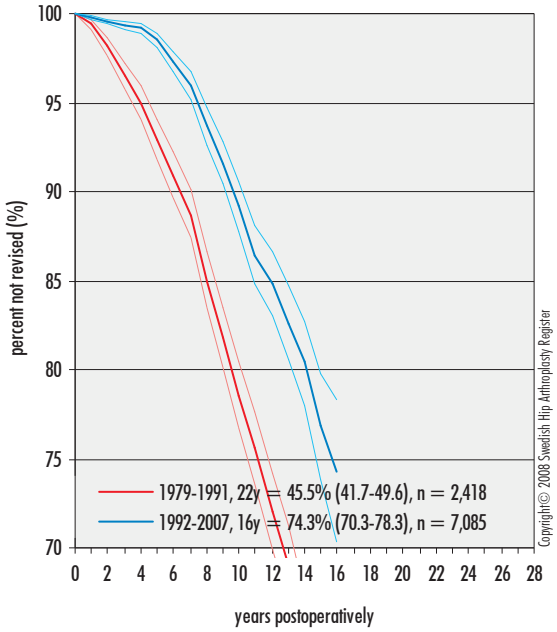
All cemented implants

primary osteoarthritis and aseptic loosening



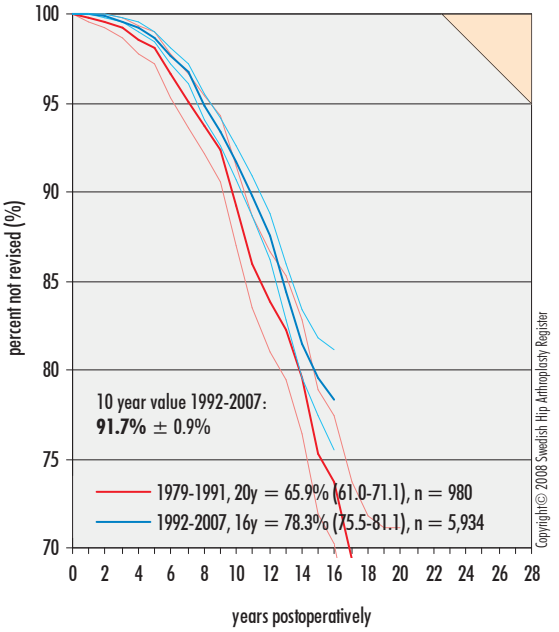
All uncemented implants

primary osteoarthritis and aseptic loosening



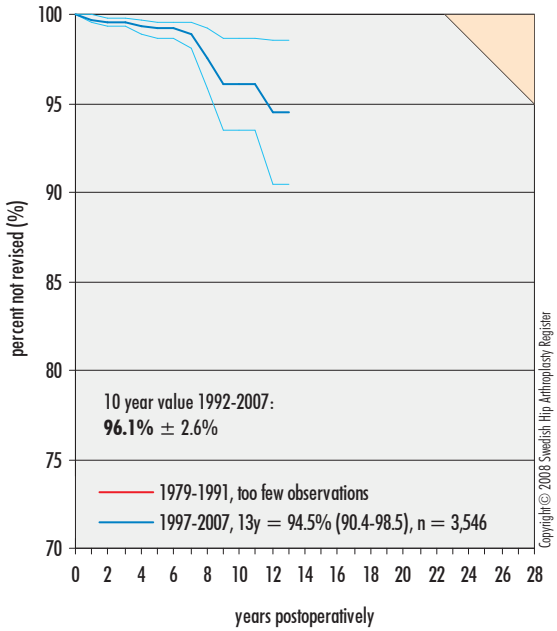
All hybrid implants

primary osteoarthritis and aseptic loosening



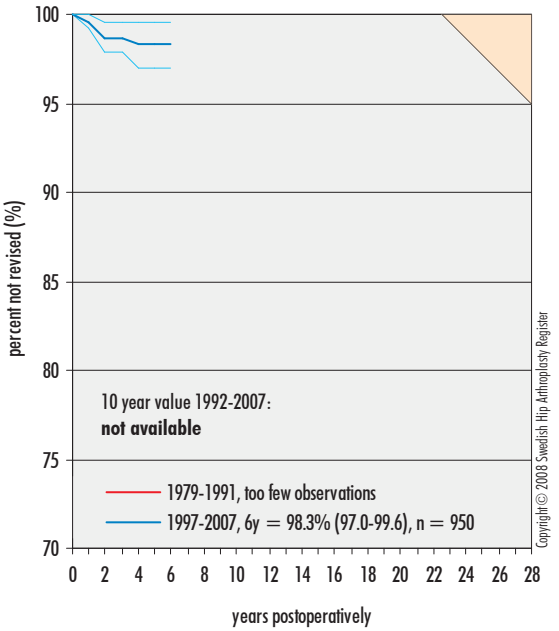
All reversed hybrid implants

primary osteoarthritis and aseptic loosening



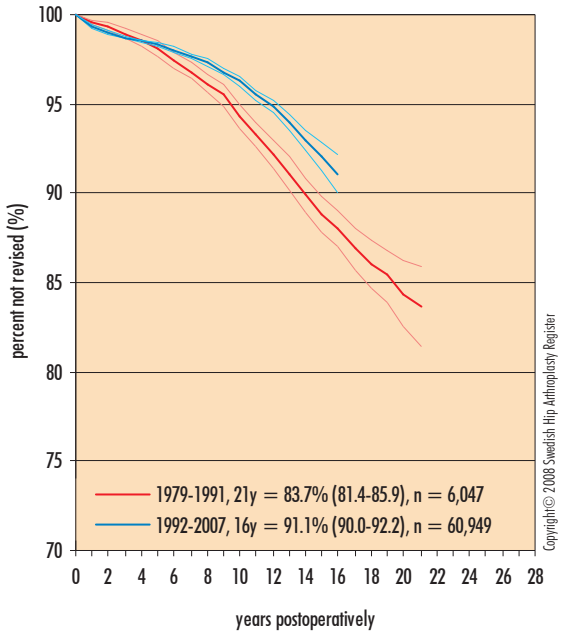
All resurfacing implants

primary osteoarthritis and aseptic loosening



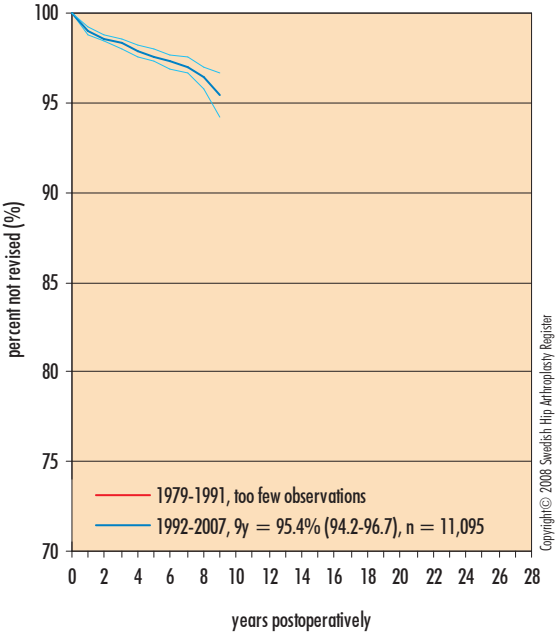
Lubinus SP II

all diagnoses and all reasons for revision



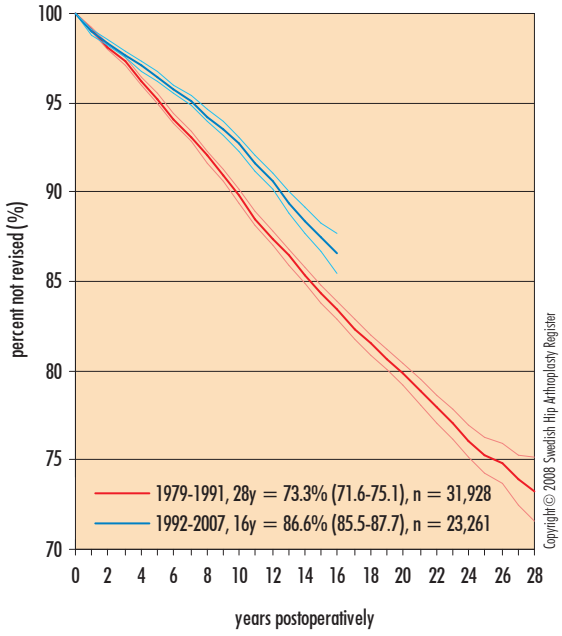
Exeter Duration (Exeter Polished)

all diagnoses and all reasons for revision



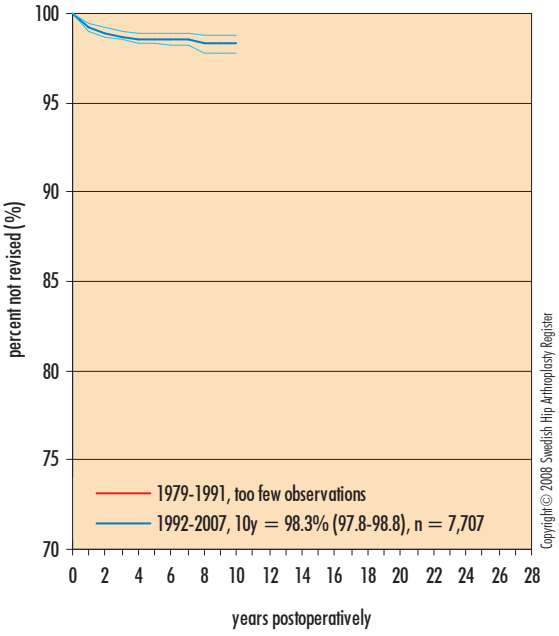
Charnley

all diagnoses and all reasons for revision



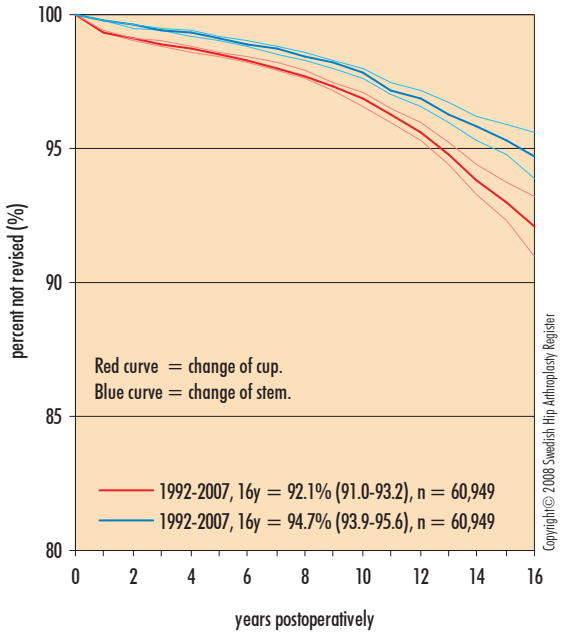
Charnley Elite (Exeter Polished)

all diagnoses and all reasons for revison



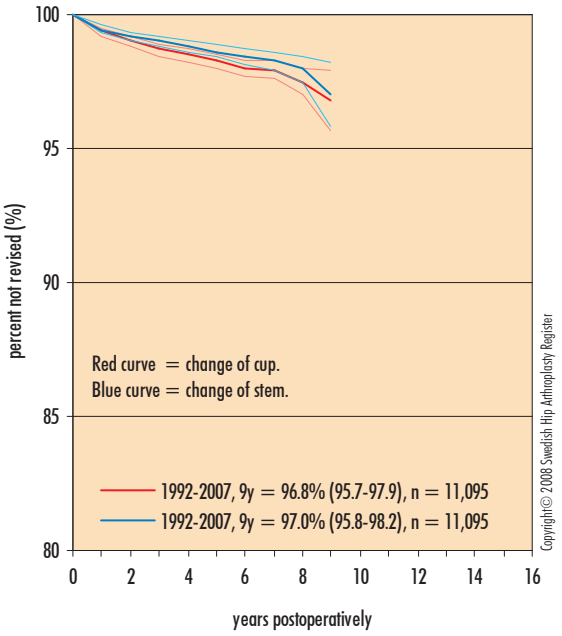
Lubinus SP II

all diagnoses and all reasons for revision



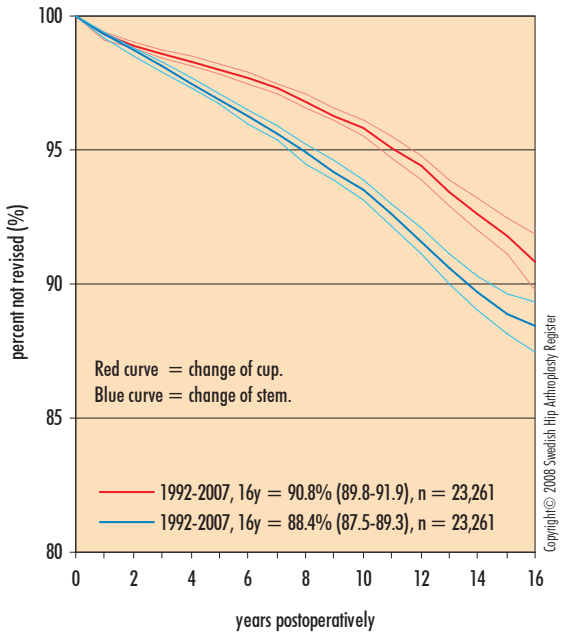
Exeter Duration (Exeter Polished)

all diagnoses and all reasons for revision



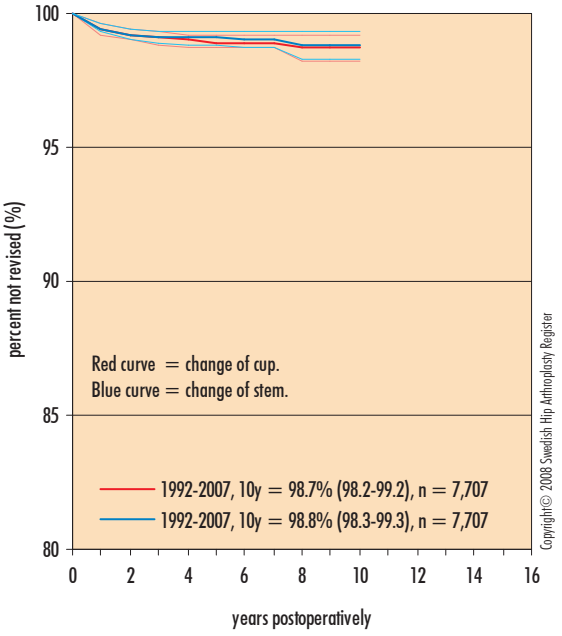
Charnley

all diagnoses and all reasons for revision



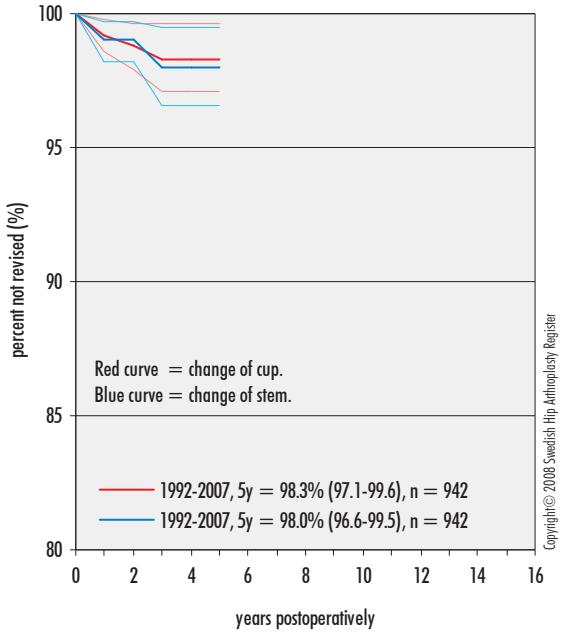
Charnley Elite (Exeter Polished)

all diagnoses and all reasons for revision



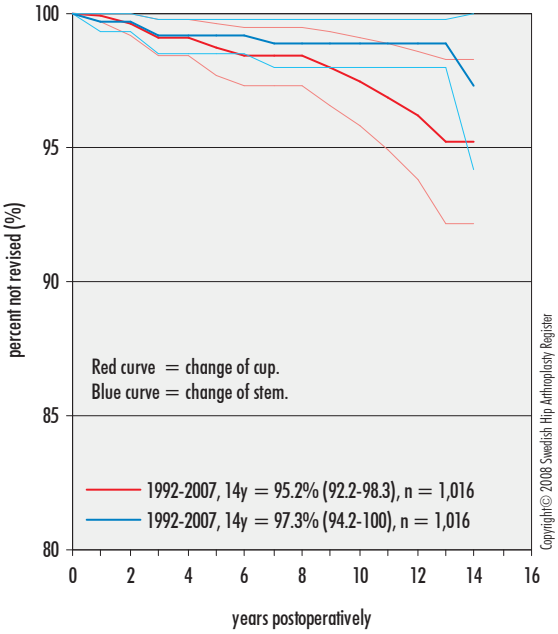
Trilogy HA (CLS Spotorno)

all diagnoses and all reasons for revision



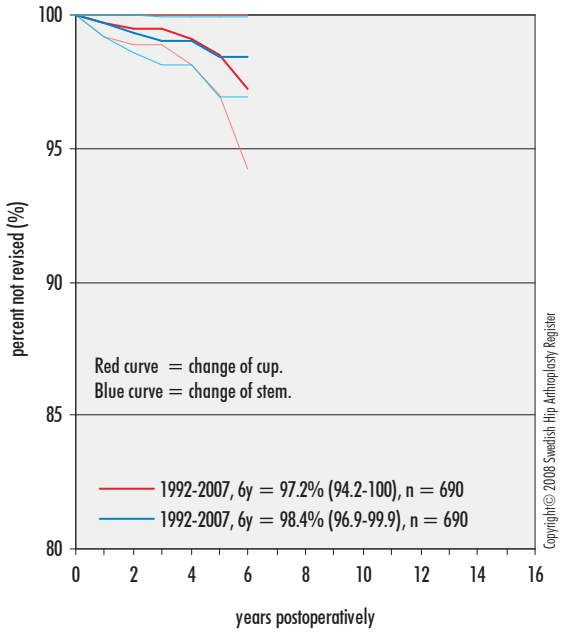
CLS Spotorno

all diagnoses and all reasons for revision



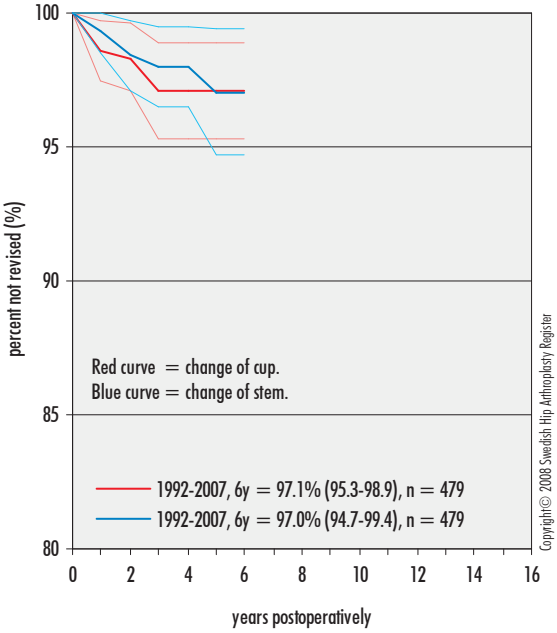
Allofit (CLS Spotorno)

all diagnoses and all reasons for revision



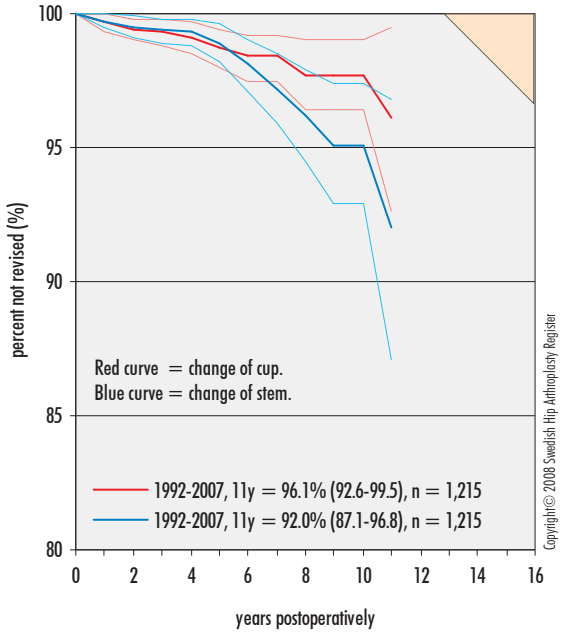
Trident HA

all diagnoses and all reasons for revision



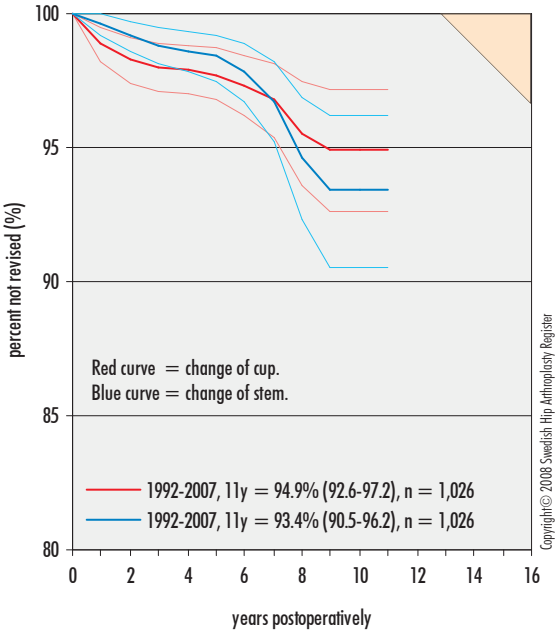
Trilogy HA (Spectron EF Primary)

all diagnoses and all reasons for revision



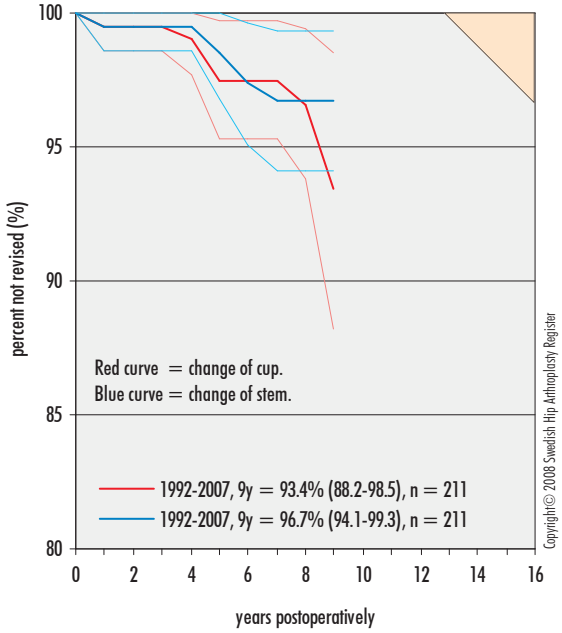
Trilogy HA (Lubinus SP II)

all diagnoses and all reasons for revision



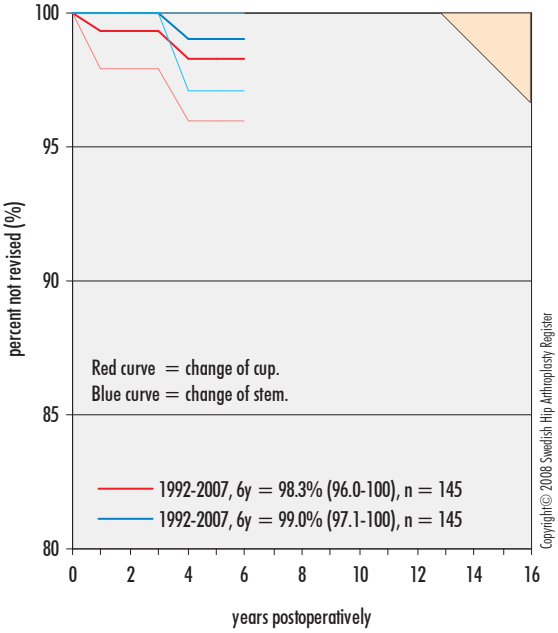
ABG II HA (Lubinus SP II)

all diagnoses and all reasons for revision



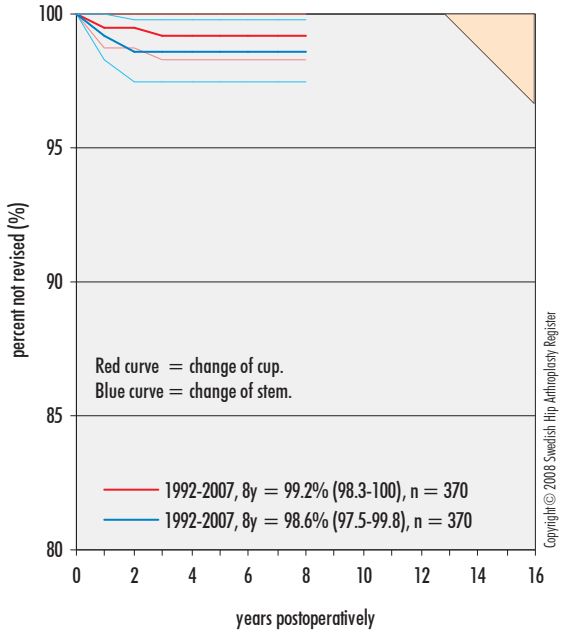
TOP Pressfit HA (Lubinus SP II)

all diagnoses and all reasons for revision



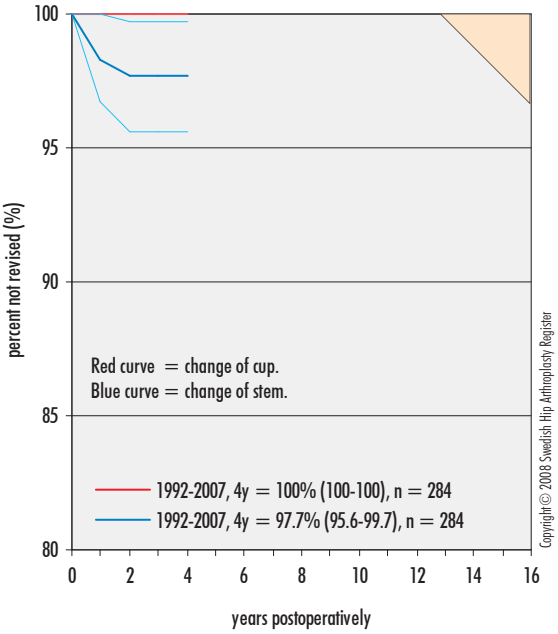
Charnley Elite (ABG)

all diagnoses and all reasons for revision



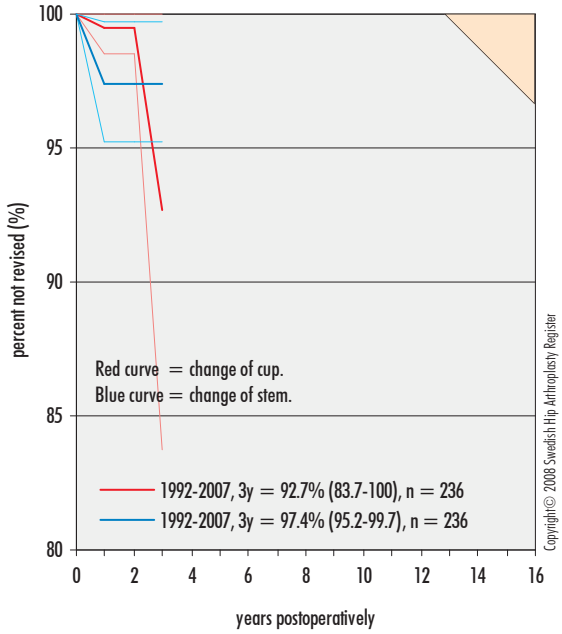
Charnley Elite (CLS Spotorno)

all diagnoses and all reasons for revision



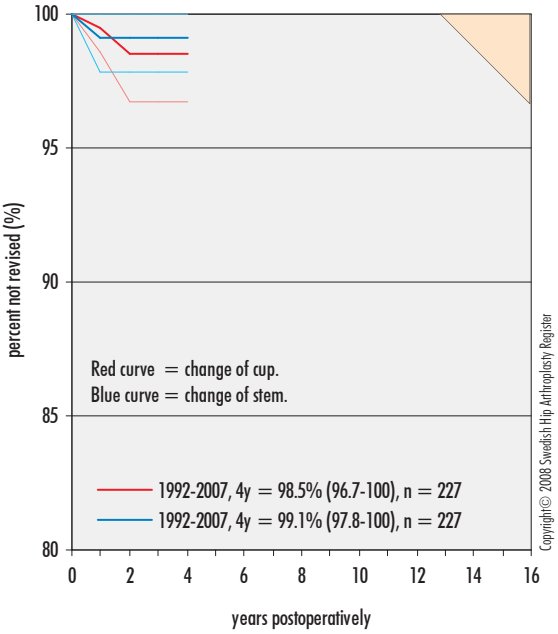
Contemporary H.D. (ABG II HA)

all diagnoses and all resons for revision



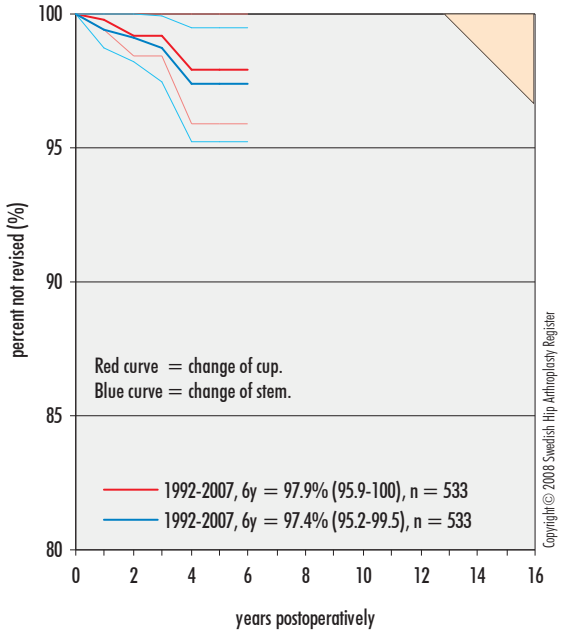
Charnley (ABG II HA)

all diagnoses and all reasons for revision



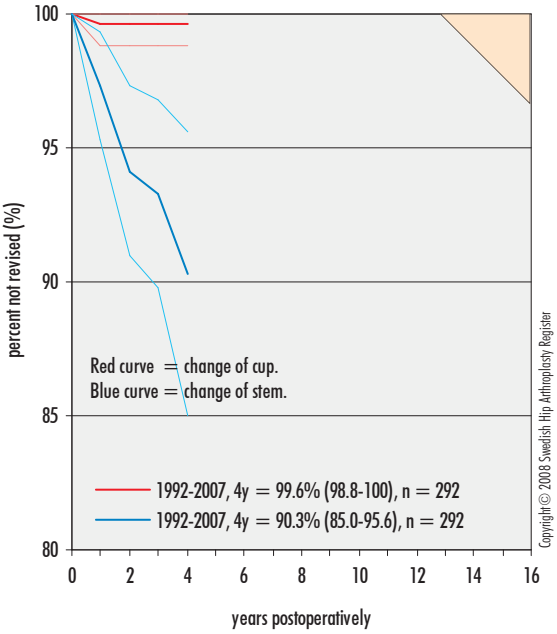
BHR

all diagnoses and all reasons for revision



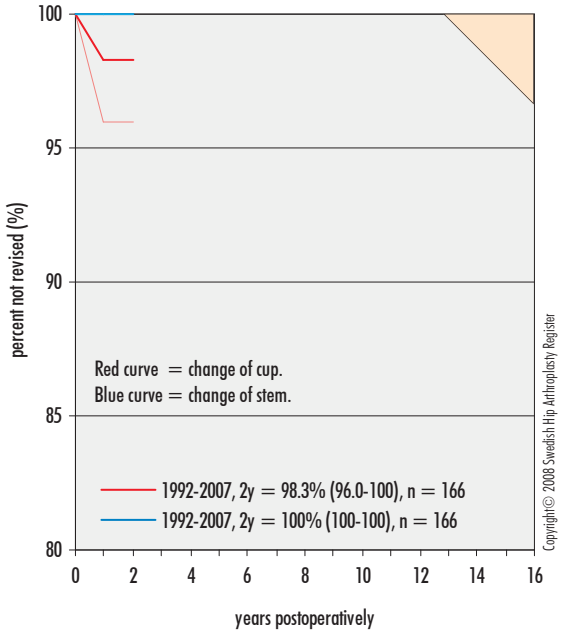
Durom

all diagnoses and all reasons for revision



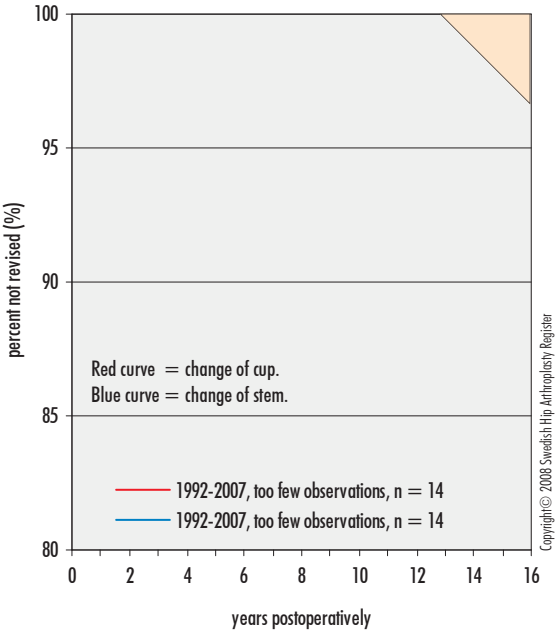
ASR

all diagnoses and all reasons for revision

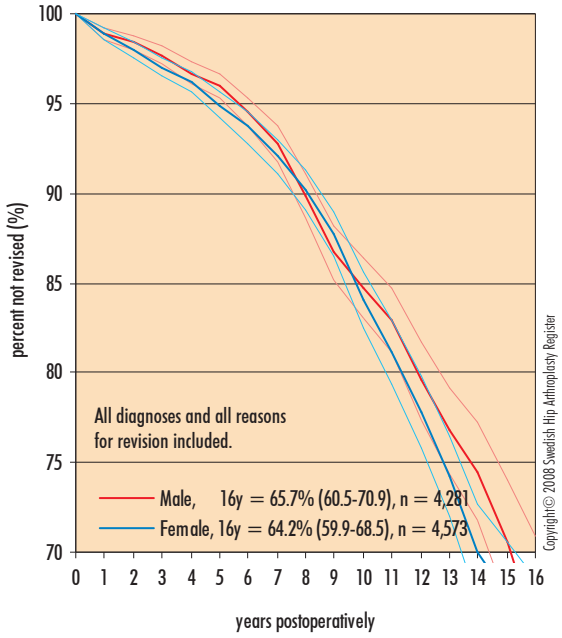


Adept

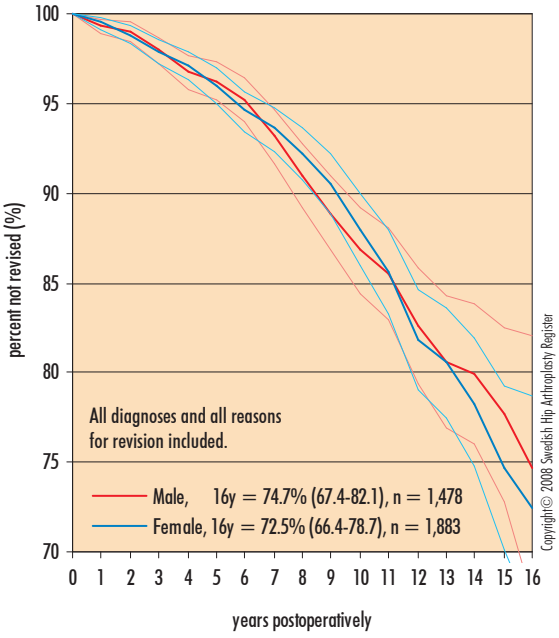
all diagnoses and all reasons for revision



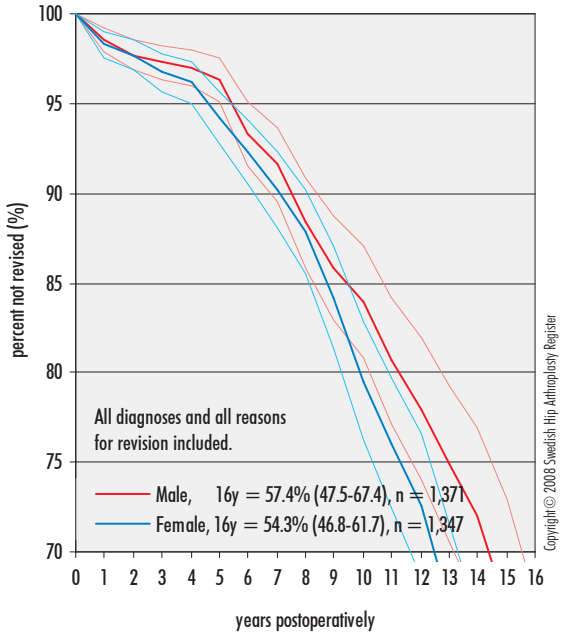
Younger than 50 years
all observations, 1992-2007



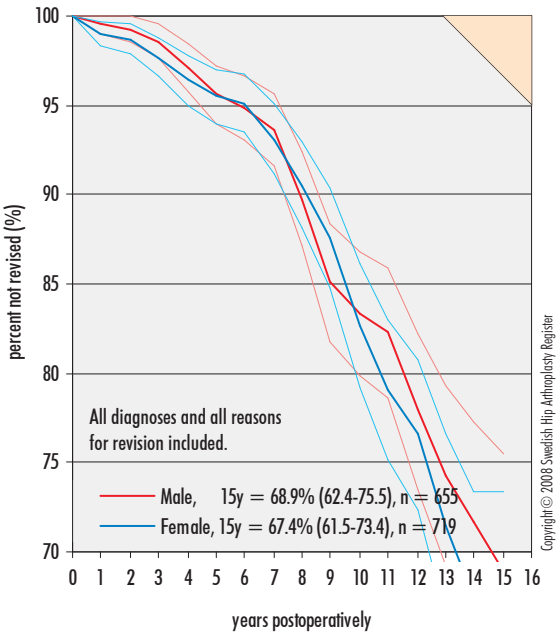
Younger than 50 years
cemented implants, 1992-2007



Younger than 50 years
uncemented implants, 1992-2007

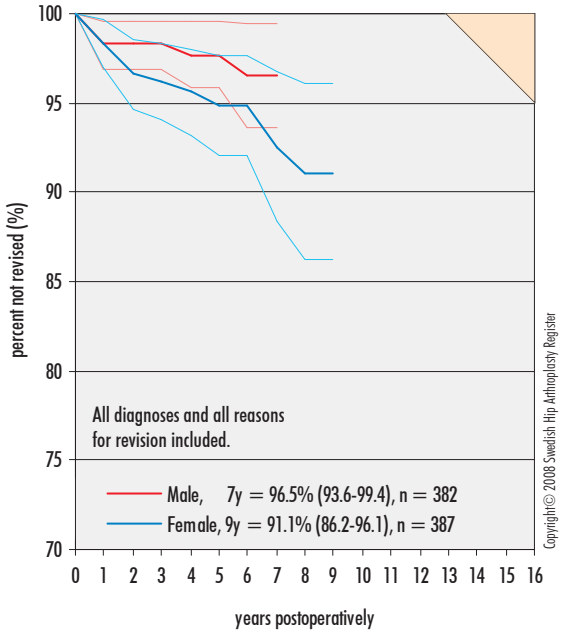


Younger than 50 years
hybrid implants, 1992-2007



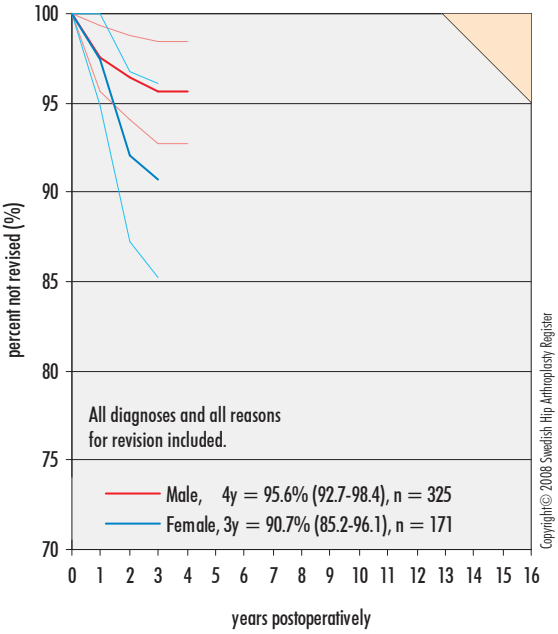
Younger than 50 years

reversed hybrid implants, 1992-2007



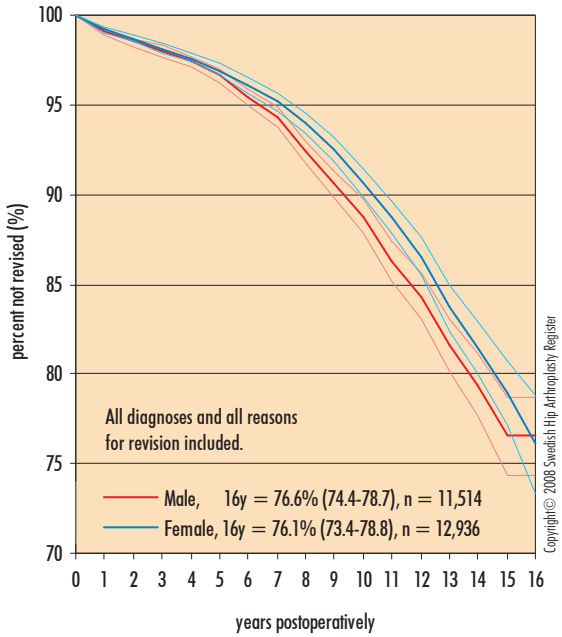
Younger than 50 years

resurfacing implants, 1992-2007



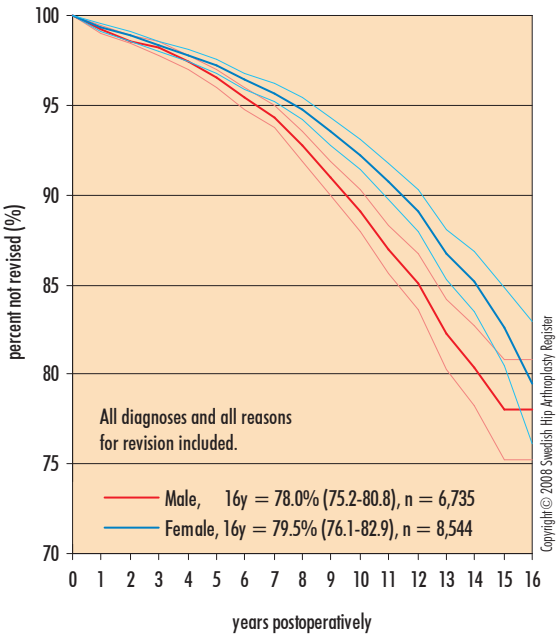
Between 50 and 59 years

all observations, 1992-2007



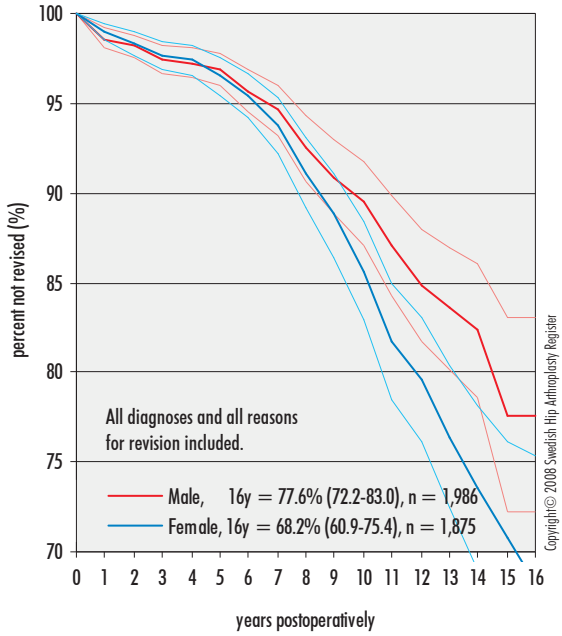
Between 50 and 59 years

cemented implants, 1992-2007



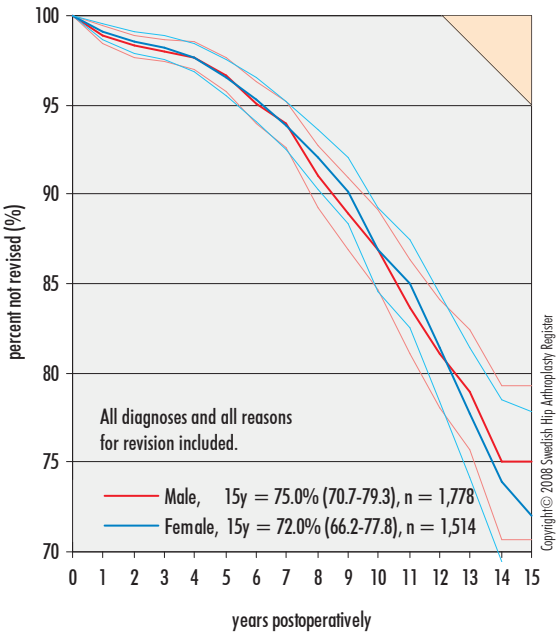
Between 50 and 59 years

uncemented implants, 1992-2007



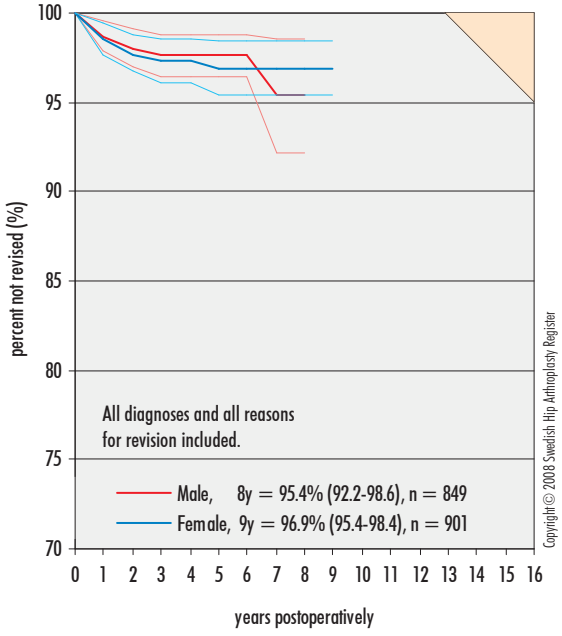
Between 50 and 59 years

hybrid implants, 1992-2006



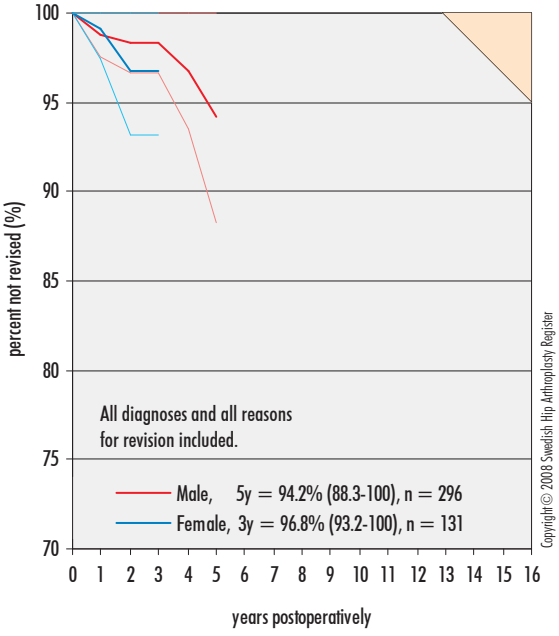
Between 50 and 59 years

reversed hybrid implants, 1992-2007



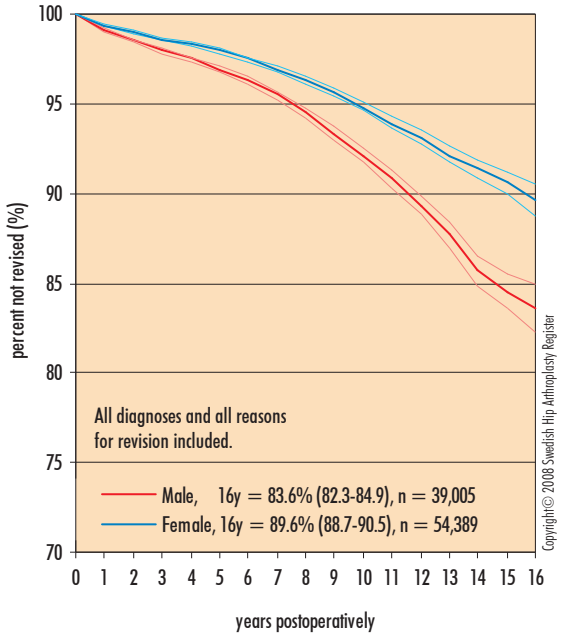
Between 50 and 59 years

resurfacing implants, 1992-2007



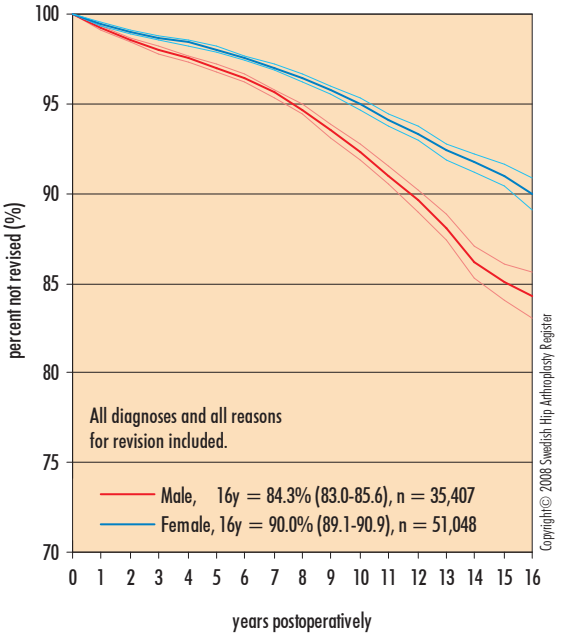
Between 60 and 75 years

all observations, 1992-2007



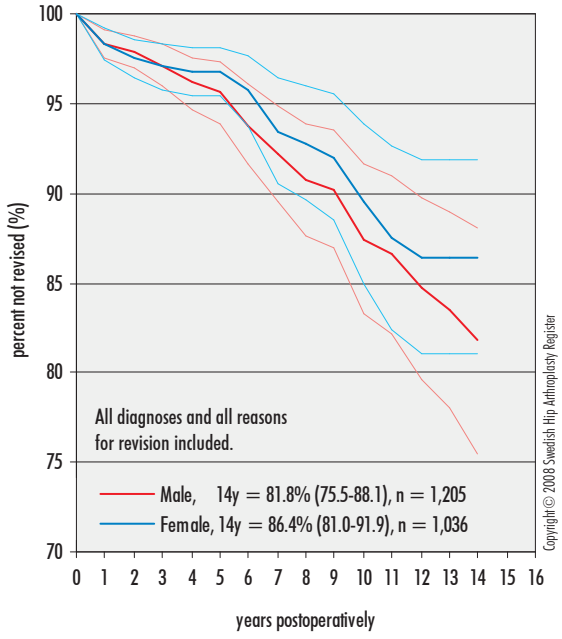
Between 60 and 75 years

cemented implants, 1992-2007



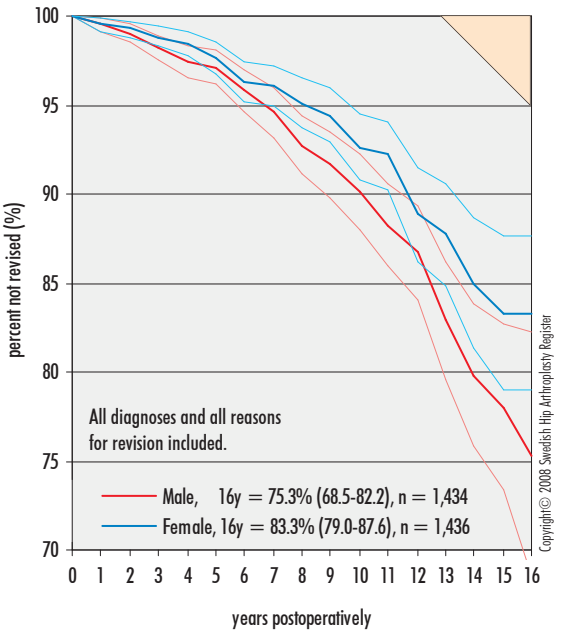
Between 60 and 75 years

uncemented implants, 1992-2007



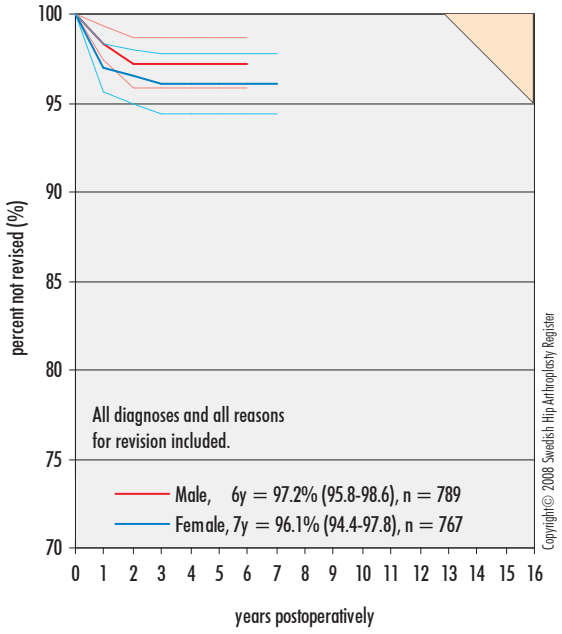
Between 60 and 75 years

hybrid implants, 1992-2007



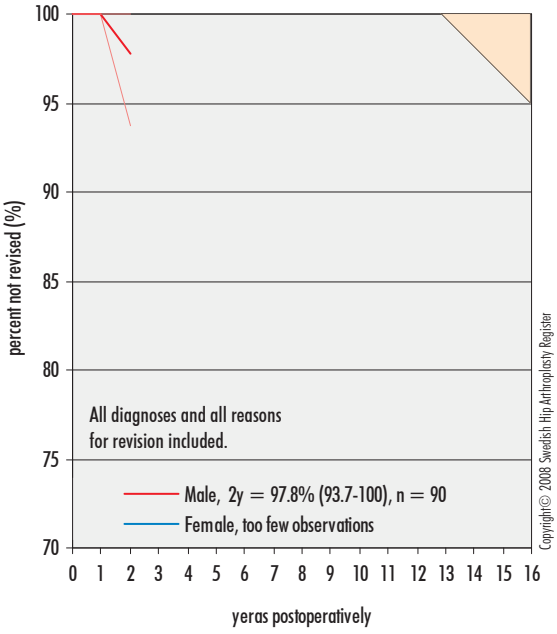
Between 60 and 75 years

reversed hybrid implants, 1992-2007



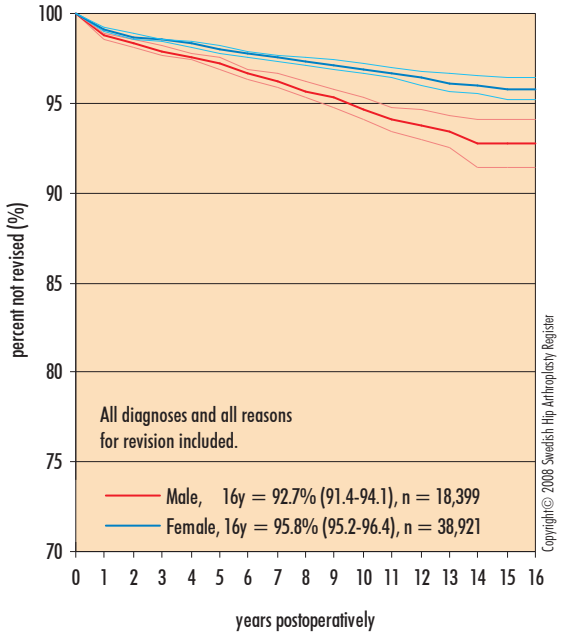
Between 60 and 75 years

resurfacing implants, 1992-2007



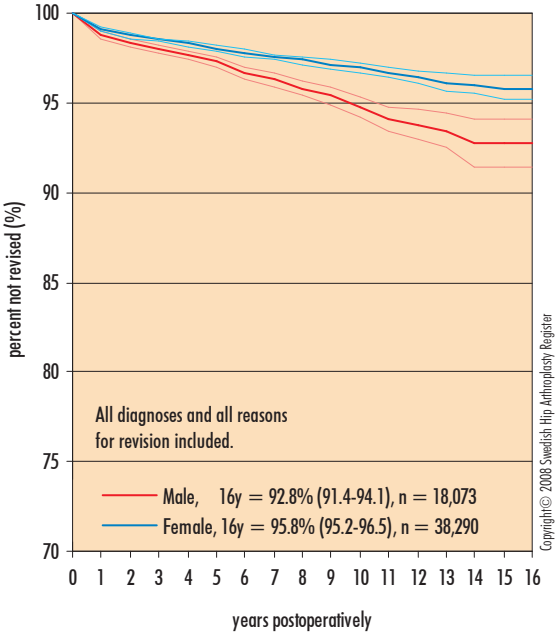
Older than 75 years

all observations, 1992-2007

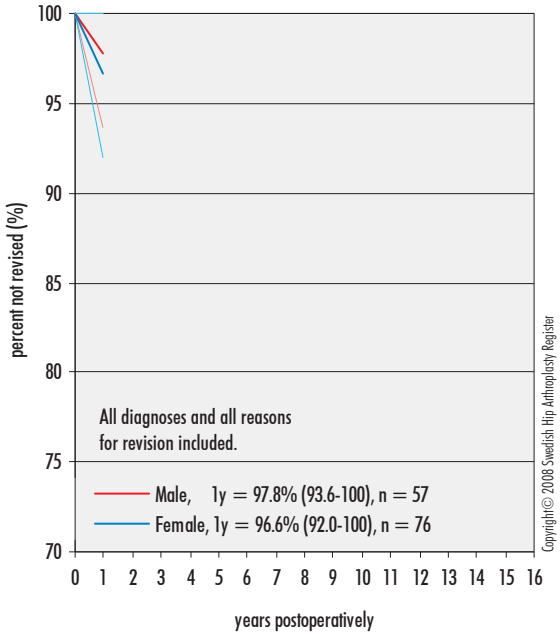


Older than 75 years

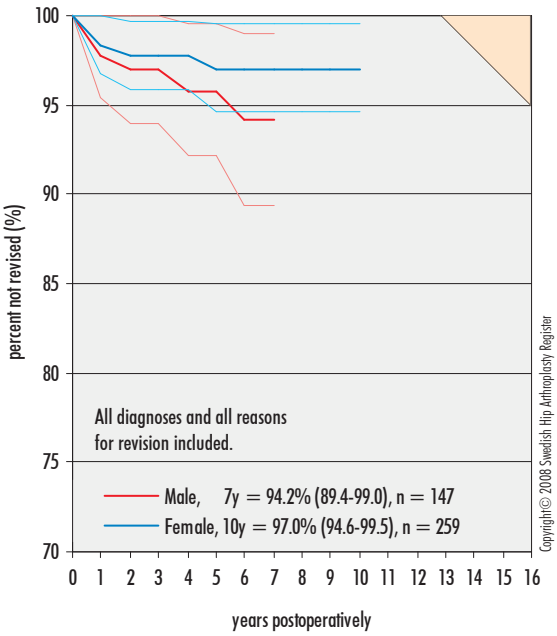
cemented implants, 1992-2007



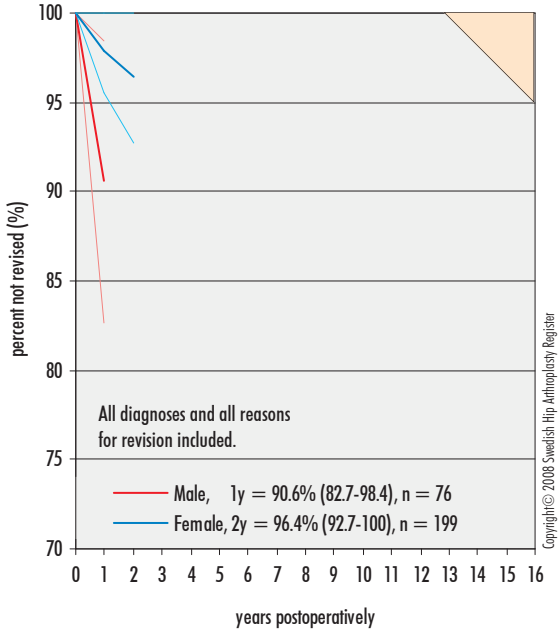
Older than 75 years
uncemented implants, 1992-2007



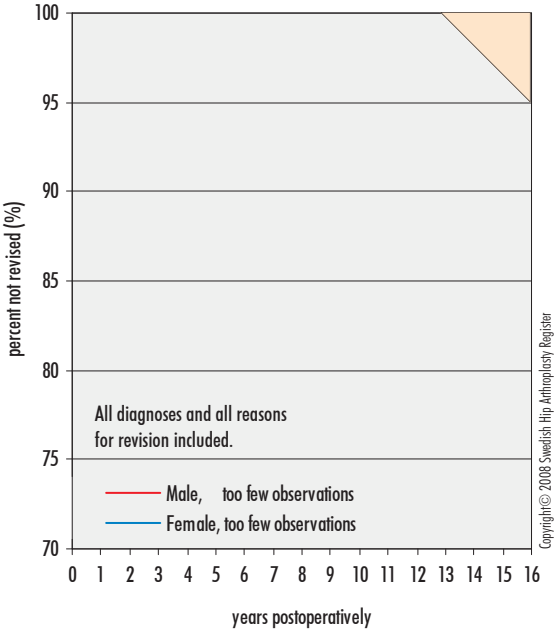
Older than 75 years
hybrid implants, 1992-2007



Older than 75 years
reversed hybrid implants, 1992-2007



Older than 75 years
resurfacing implants, 1992-2007



Implant survival per type

all diagnoses and all reasons for revision, 1992-2007

Cup (Stem)	Period [1]	Number [2]	OA [3]	≥60 yrs [4]	Female [5]	5 yrs	95% CI	10 yrs	95% CI
ABG HA (ABG cem)	1992–1998	241	64.8%	87.1%	63.1%	98.2%	±1.8%	92.7%	±4.0%
ABG HA (ABG uncem)	1992–1998	280	83.1%	5.7%	53.2%	97.1%	±2.0%	80.5%	±4.8%
ABG HA (Exeter Polished)	1992–1998	55	80.0%	27.3%	58.2%	98.1%	±2.8%		
ABG HA (Lubinus SP II)	1992–1998	336	80.1%	40.5%	48.8%	97.0%	±1.9%	85.9%	±3.9%
ABG II HA (ABG uncem)	1993–2006	198	80.3%	7.6%	41.9%	97.3%	±2.3%		
ABG II HA (Exeter Polished)	1997–2005	67	80.6%	16.4%	43.3%	96.9%	±3.6%		
ABG II HA (Lubinus SP II)	1997–2006	211	81.5%	32.2%	48.8%	97.5%	±2.2%		
ABG II HA (Meridian)	1998–2004	114	66.7%	27.2%	47.4%	97.3%	±2.8%		
Allofit (CLS Spotorno)	2001–2007	690	89.7%	35.4%	48.6%	97.7%	±1.8%		
Allofit (MS30 Polished)	1998–2007	84	48.8%	16.7%	51.2%	89.8%	±7.1%		
BHR Acetabular Cup (BHR Femoral Head)	1999–2007	533	94.4%	9.2%	31.9%	96.9%	±2.3%		
Biomet Müller (Bi-Metric cem)	1992–1996	1,097	81.3%	90.0%	59.2%	96.2%	±1.2%	90.5%	±2.0%
Biomet Müller (Bi-Metric HA uncem)	1993–2007	198	94.9%	34.8%	61.1%	98.4%	±1.8%		
Biomet Müller (CPT (steel))	1997–2004	950	94.6%	94.3%	67.9%	96.1%	±1.3%		
Biomet Müller (RX90-S)	1994–2001	1,450	76.9%	88.1%	61.5%	97.8%	±0.8%	94.4%	±1.4%
Biomet Müller (Stanmore mod)	1997–2002	94	95.7%	90.4%	62.8%	98.9%	±1.6%		
Biomex HA (Lubinus SP II)	2000–2004	107	81.3%	8.4%	59.8%	100.0%	±0.0%		
Cenator (Bi-Metric cem)	1993–1999	293	70.9%	46.8%	48.8%	97.1%	±2.0%	90.0%	±3.8%
Cenator (Cenator)	1993–2000	1,251	58.8%	95.3%	67.1%	92.9%	±1.6%	85.4%	±2.4%
Cenator (Charnley Elite Plus)	1996–2000	320	84.0%	78.8%	60.3%	96.7%	±2.0%	93.0%	±4.0%
Cenator (Exeter Polished)	1998–2003	660	84.5%	78.2%	53.3%	99.5%	±0.5%	98.8%	±1.3%
Cenator (Lubinus SP II)	1997–2000	64	51.6%	76.6%	59.4%	94.3%	±6.0%		
Cenator (Wagner Cone Prosthesis)	1994–2000	56	61.8%	10.7%	71.4%	96.4%	±4.3%		
Charnley (Bi-Metric cem)	1992–1998	58	48.3%	43.1%	51.7%	96.1%	±4.6%		
Charnley (CAD)	1992–1996	225	79.8%	89.8%	72.4%	97.2%	±2.2%	95.4%	±3.0%
Charnley (Charnley Elite Plus)	1994–2003	1,408	69.5%	77.3%	65.7%	96.5%	±1.0%	90.4%	±2.0%
Charnley (Charnley)	1992–2007	23,261	79,0%	89.2%	65.4%	96.4%	±0.3%	92.7%	±0.4%
Charnley (CPT (steel))	1996–2004	193	72.5%	80.3%	65.8%	98.4%	±1.7%		
Charnley (C-stem)	2001–2003	70	85.7%	70.0%	65.7%	97.1%	±3.5%		
Charnley (Exeter Polished)	1992–2007	2,411	79.6%	86.7%	67.5%	98.2%	±0.6%	97.3%	±1.2%
Charnley (Lubinus SP II)	1992–2007	342	83.0%	85.4%	60.5%	97.5%	±1.7%	94.1%	±2.9%
Charnley (Müller Straight)	1992–1998	104	87.5%	96.2%	47.1%	96.9%	±3.3%	95.7%	±4.1%
Charnley (PCA E-series Textured)	1992–1996	129	82.8%	72.9%	56.6%	96.8%	±3.1%	83.7%	±6.9%
Charnley Elite (ABG uncem)	1994–2005	370	90.5%	22.2%	45.4%	97.8%	±1.5%		
Charnley Elite (Charnley Elite Plus)	1992–2002	945	67.8%	89.0%	63.0%	94.8%	±1.5%	86.7%	±4.2%
Charnley Elite (Charnley)	1992–2001	338	60.7%	86.7%	63.3%	95.6%	±2.4%	88.6%	±4.1%
Charnley Elite (CPT (steel))	1997–2003	115	73.0%	85.2%	68.7%	93.7%	±4.6%		
Charnley Elite (Exeter Polished)	1996–2007	7,707	71.9%	89.8%	65.4%	98.6%	±0.3%	98.3%	±0.5%
Charnley Elite (Lubinus SP II)	1992–2007	1,228	83.1%	82.9%	62.9%	98.0%	±1.0%	92.9%	±3.9%
Charnley Elite (Müller Straight)	1999–2007	289	81.7%	97.6%	59.2%	99.1%	±1.1%		
Charnley Elite (PCA E-series Textured)	1992–1997	214	81.4%	80.8%	58.4%	96.9%	±2.4%	88.4%	±4.8%
Charnley Elite (Spectron EF Primary)	1998–2007	336	90.8%	88.1%	52.4%	97.0%	±2.1%		
CLS Spotorno (CLS Spotorno)	1992–2007	1,016	91.0%	32.8%	45.0%	98.4%	±1.0%	97.0%	±1.8%
Contemporary (Exeter Polished)	1994–2005	332	87.6%	88.0%	50.9%	96.2%	±2.1%	90.3%	±4.0%
Contemporary (Lubinus SP II)	1994–2001	102	66.7%	75.5%	79.4%	95.9%	±3.9%	90.0%	±6.3%
Contemporary Hooded Duration (Exeter Polished)	2000–2007	3,314	87.4%	87.6%	58.8%	98.0%	±0.6%		
Duralock (uncem) (Spectron EF Primary)	1995–2000	115	87.0%	52.2%	61.7%	97.4%	±2.8%	91.0%	±6.1%
Exeter Duration (Exeter Polished)	1999–2007	11,095	84.2%	85.2%	59.0%	97.6%	±0.4%		
Exeter Duration (Lubinus SP II)	1999–2007	773	78.3%	83.1%	61.6%	99.7%	±0.4%		
Exeter Metal-backed (Exeter Polished)	1992–1994	588	76.7%	94.6%	55.8%	98.7%	±1.0%	95.2%	±2.0%

(continued on next page.)

Implant survival per type (cont.)

all diagnoses and all reasons for revision, 1992-2007

Cup (Stem)	Period [1]	Number [2]	OA [3]	≥60 yrs [4]	Female [5]	5 yrs	95% CI	10 yrs	95% CI
Exeter All-Poly (Exeter Polished)	1992–2006	6,450	73.8%	86.7%	60.7%	97.0%	±0.4%	92.3%	±0.8%
Exeter All-Poly (Lubinus SP II)	1992–2002	202	80.0%	76.2%	65.3%	96.7%	±2.6%	89.3%	±5.0%
Exeter Polished (Exeter Polished)	1992–1995	668	73.1%	88.9%	57.6%	95.9%	±1.5%	92.5%	±2.3%
FAL (Lubinus SP II)	1999–2007	4,503	80.1%	87.4%	63.2%	98.5%	±0.5%		
Harris-Galante I (Lubinus SP II)	1992–1997	73	78.9%	19.2%	37.0%	97.2%	±3.3%	91.3%	±6.6%
Harris-Galante II (Charnley)	1992–1996	144	85.3%	27.8%	50.7%	93.0%	±4.2%	85.6%	±5.9%
Harris-Galante II (Lubinus SP II)	1992–1997	245	77.1%	28.6%	47.3%	95.1%	±2.8%	84.7%	±4.6%
Harris-Galante II (Spectron EF)	1992–1996	172	86.6%	54.7%	51.2%	96.4%	±2.8%	88.1%	±5.0%
HGPII/HATCP (HG III) (Spectron EF)	1992–1995	93	58.3%	48.4%	60.2%	100.0%	±0.0%	96.6%	±3.6%
Inter-op cup (CLS Spotorno)	1999–2001	58	86.2%	22.4%	37.9%	96.6%	±4.0%		
ITH (ITH)	1992–1997	313	62.3%	95.5%	71.9%	98.5%	±1.5%	96.4%	±2.6%
LINK Pressfit (Lubinus SP II)	1996–2000	61	65.5%	8.2%	34.4%	100.0%	±0.0%		
Lubinus All-Poly (Lubinus IP)	1992–1998	826	55.9%	96.5%	66.0%	99.3%	±0.6%	98.4%	±1.0%
Lubinus All-Poly (Lubinus SP II)	1992–2007	60,949	79.8%	89.0%	59.3%	98.3%	±0.1%	96.3%	±0.3%
Mallory-Head uncem (Lubinus SP II)	1993–2007	105	81.0%	11.4%	52.4%	97.0%	±3.1%		
Müller All-Poly (Bi-Metric cem)	1992–1994	64	94.6%	89.1%	67.2%	98.4%	±2.3%		
Müller All-Poly (MS30 Unpolished)	1992–2001	113	59.5%	74.3%	52.2%	93.0%	±5.0%		
Müller All-Poly (Müller Straight)	1992–2007	1,759	74.4%	92.8%	61.7%	97.6%	±0.8%	96.6%	±1.0%
Müller All-Poly (Straight-stem standard)	1996–2007	288	94.8%	87.8%	73.3%	96.4%	±3.2%		
Omnifit (Lubinus SP II)	1992–1995	172	80.7%	29.1%	52.9%	95.9%	±3.0%	77.5%	±6.4%
Omnifit (Omnifit)	1992–1996	322	67.5%	12.4%	53.7%	91.8%	±3.0%	65.8%	±5.3%
OPTICUP (Lubinus SP II)	1995–2007	688	55.6%	85.2%	64.0%	97.8%	±1.1%	91.5%	±3.6%
OPTICUP (NOVA Scan Hip)	1993–2000	156	66.5%	75.6%	54.5%	91.0%	±4.7%	72.5%	±8.0%
OPTICUP (Optima)	1993–2000	757	74.1%	87.3%	60.0%	96.6%	±1.4%	88.6%	±2.6%
OPTICUP (Scan Hip II Collar)	1996–2006	1,980	76.7%	82.7%	60.8%	96.8%	±0.8%	91.0%	±2.1%
OPTICUP (Scan Hip Collar)	1995–1996	82	80.2%	84.1%	58.5%	97.0%	±3.5%		
PCA (PCA)	1992–1994	69	72.7%	23.2%	42.0%	95.6%	±4.6%	84.7%	±8.8%
Reflection (Spectron EF Primary)	1996–2007	7,230	75.2%	92.1%	65.6%	97.5%	±0.5%	92.0%	±1.5%
Reflection (Spectron EF)	1992–1996	890	69.6%	97.9%	66.4%	98.6%	±0.8%	95.9%	±1.5%
Reflection HA (Lubinus SP II)	1995–2007	191	87.4%	16.8%	42.9%	95.0%	±3.4%	91.2%	±5.6%
Reflection HA (Spectron EF Primary)	1996–2000	99	81.6%	24.2%	43.4%	93.7%	±4.9%	79.8%	±8.4%
Romanus (Bi-Metric cem)	1992–1998	359	83.6%	31.5%	47.6%	96.0%	±2.0%	86.0%	±3.7%
Romanus (Bi-Metric HA uncem)	1992–1999	141	83.7%	17.0%	53.2%	99.3%	±1.0%	91.8%	±4.6%
Romanus (Bi-Metric uncem)	1992–1997	251	73.7%	11.6%	51.0%	96.8%	±2.2%	86.6%	±4.4%
Romanus (Lubinus SP II)	1992–1996	86	70.6%	19.8%	30.2%	98.8%	±1.8%	90.0%	±6.5%
Romanus (RX90-S)	1994–2000	180	90.6%	39.4%	52.2%	96.1%	±2.9%	85.4%	±5.4%
Romanus HA (Bi-Metric HA uncem)	1992–2005	262	73.9%	10.3%	59.9%	96.1%	±2.4%	90.4%	±4.1%
Romanus HA (Bi-Metric uncem)	1992–1999	67	73.1%	10.4%	52.2%	94.0%	±5.6%	80.0%	±9.8%
Scan Hip Cup (Lubinus SP II)	1992–2007	92	61.4%	84.8%	75.0%	95.3%	±4.4%		
Scan Hip Cup (Optima)	1993–2001	505	71.2%	89.9%	67.3%	98.5%	±1.1%	93.9%	±2.6%
Scan Hip Cup (Scan Hip II Collar)	1996–2001	206	77.3%	89.8%	63.1%	96.8%	±2.5%	89.6%	±5.1%
Scan Hip Cup (Scan Hip Collar)	1992–2000	2,874	72.7%	89.0%	61.9%	97.8%	±0.6%	91.9%	±1.2%
Scan Hip Cup (Scan Hip Collarless)	1992–1999	139	77.9%	92.8%	64.7%	98.5%	±1.8%	90.9%	±5.8%
Secur-Fit (Omnifit)	1996–1999	115	73.9%	2.6%	51.3%	90.1%	±5.6%	75.3%	±8.1%
SHP (Lubinus SP II)	1994–2007	617	80.7%	88.0%	54.9%	99.2%	±0.8%	97.1%	±1.7%
SL Ti cup (CLS Spotorno)	1999–2007	98	86.7%	51.0%	26.5%	97.8%	±2.6%		
SLS (CLS Spotorno)	1992–1998	66	83.1%	33.3%	33.3%	96.9%	±3.6%	93.7%	±6.0%
Spectron Metal-backed (Spectron EF)	1992–1993	113	82.1%	98.2%	61.9%	99.1%	±1.3%	99.1%	±1.3%
Stanmore (Stanmore mod)	1994–2007	636	50.0%	92.0%	70.8%	98.3%	±1.0%		
Stanmore (Stanmore)	1992–1998	105	89.3%	96.2%	70.5%	96.8%	±3.4%	89.8%	±6.8%

(continued on next page.)

Implant survival per type (cont.)

all diagnoses and all reasons for revision, 1992-2007

Cup (Stem)	Period [1]	Number [2]	OA [3]	≥60 yrs [4]	Female [5]	5 yrs	95% CI	10 yrs	95% CI
TOP Pressfit HA (Lubinus SP II)	2000–2007	145	83.4%	31.0%	40.0%	98.3%	±2.0%		
Trilogy (CLS Spotorno)	1998–2007	479	79.1%	39.7%	45.5%	94.9%	±2.8%		
Trilogy (Lubinus SP II)	1996–2007	70	87.1%	34.3%	37.1%	98.5%	±2.1%		
Trilogy (SL plus stem uncem)	1997–2006	135	70.4%	11.1%	35.6%	100.0%	±0.0%		
Trilogy (Wagner Cone Prosthesis)	1998–2007	219	50.2%	23.3%	67.6%	94.7%	±3.5%		
Trilogy HA (Anatomic HA/HATCP (HG V))	1994–1999	57	80.7%	22.8%	43.9%	94.7%	±5.6%		
Trilogy HA (Bi-Metric HA uncem)	1998–2007	191	85.3%	11.0%	50.3%	98.4%	±1.7%		
Trilogy HA (CLS Spotorno)	2000–2007	942	82.3%	29.7%	44.9%	97.0%	±1.6%		
Trilogy HA (Lubinus SP II)	1995–2007	1,026	83.3%	51.1%	49.6%	97.1%	±1.1%	91.3%	±3.1%
Trilogy HA (Optima)	1995–1999	96	94.8%	46.9%	37.5%	96.8%	±3.4%	92.2%	±5.6%
Trilogy HA (Spectron EF Primary)	1996–2007	1,215	75.3%	57.6%	57.0%	98.5%	±0.8%	94.3%	±2.3%
Trilogy HA (Stanmore mod)	2001–2007	94	94.7%	68.1%	39.4%	100.0%	±0.0%		
Trilogy HA (Versys stem)	1999–2006	257	75.1%	13.6%	45.9%	99.2%	±1.0%		
Weber All-poly cup (MS30 Polished)	1999–2007	434	91.7%	88.5%	59.9%	99.4%	±0.6%		
Weber All-poly cup (Straight-stem standard)	1999–2007	1,150	99.4%	91.1%	65.9%	98.0%	±1.0%		
Weber Poly Metasul cup (MS30 Polished)	1999–2006	100	73.0%	16.0%	52.0%	95.4%	±4.5%		
ZCA (CPT (steel))	1993–2005	114	80.0%	85.1%	62.3%	94.5%	±4.3%		
ZCA (Stanmore mod)	2000–2007	246	75.2%	97.2%	64.2%	98.5%	±1.9%		

[1] Refers to first and last year of observed primary operations.
[2] Refers to number of primary operations during the period using the conditions given in the table headings.
[3] Refers to the proportion of primary operations for primary osteoarthritis.
[4] Refers to the proportion of primary operations in the age group 60 years or older (age on primary operation).
[5] Refers to proportion of women.

Certain types of implant were not used in sufficient numbers during the period to give a 10-year value for implant survival. For the 10-year value to be calculable, the longest observed time between primary operation and revision must be at least 10 years. One condition used consistently in survival statistics from the register is that only values in which at least 50 patients 'at risk' remain are shown. Implants used to a lesser extent may thus be omitted for this reason. Only implants for which the 5-year value can be calculated are included in the table.

Implant survival per hospital

all diagnoses, all reasons for revision and all types of implants, 1998-2007

Cup (Stem)	Period [1]	Number [2]	OA [3]	≥60 yrs [4]	Female [5]	5 yrs	95% CI	10 yrs	95% CI
University/Regional Hospitals									
KS/Huddinge	1998–2007	2,038	61.3%	71.4%	61.7%	96,8%	±1.0%	92.4%	±3.9%
KS/Solna	1998–2007	2,274	62.9%	73.0%	62.6%	96,1%	±0.9%	94.3%	±1.9%
Linköping	1998–2007	1,492	63.8%	78.3%	62.1%	99,2%	±0.5%	98.3%	±1.2%
Lund	1998–2007	1,043	41.9%	68.9%	62.4%	94,4%	±1.7%	89.4%	±3.0%
Malmö	1998–2007	1,541	41.3%	76.2%	69.3%	97,5%	±0.9%	93.2%	±3.2%
SU/Mölndal	1998–2007	1,247	70.9%	80.7%	64.8%	96,8%	±1.1%	89.1%	±5.9%
SU/Sahlgrenska	1998–2007	1,799	62.8%	64.5%	62.0%	98,4%	±0.6%	95.4%	±1.8%
SU/Östra	1998–2007	1,373	75.9%	82.1%	63.9%	98,1%	±0.8%	94.0%	±3.4%
Umeå	1998–2007	809	69.0%	63.9%	60.6%	97,4%	±1.3%	93.4%	±5.3%
Uppsala	1998–2007	2,667	49.5%	72.6%	62.7%	95,5%	±1.0%	89.1%	±3.1%
Örebro	1998–2007	1,725	75.1%	78.0%	59.0%	99,0%	±0.5%	94.1%	±3.9%
Central Hospitals									
Borås	1998–2007	1,830	68.1%	80.1%	58.3%	97,1%	±1.0%	96.6%	±1.2%
Danderyd	1998–2007	3,400	87.8%	84.1%	66.6%	96,8%	±0.7%	94.9%	±2.1%
Eksjö	1998–2007	1,748	89.9%	85.6%	55.7%	98,1%	±0.8%	91.4%	±5.1%
Eskilstuna	1998–2007	1,021	53.3%	81.9%	61.3%	98,8%	±0.8%	98.3%	±1.0%
Falun	1998–2007	2,481	84.1%	80.0%	56.8%	98,9%	±0.5%	97.0%	±2.0%
Gävle	1998–2007	1,806	69.7%	79.1%	60.0%	97.3%	±0.9%	93.5%	±2.4%
Halmstad	1998–2007	2,012	76.2%	81.5%	57.6%	97.6%	±0.8%	95.4%	±1.8%
Helsingborg	1998–2007	1,154	73.5%	83.1%	62.2%	96.5%	±1.2%	90.1%	±3.6%
Hässleholm-Kristianstad	1998–2007	5,168	90.7%	83.7%	56.5%	97.8%	±0.5%	95.5%	±1.4%
Jönköping	1998–2007	1,776	81.4%	83.0%	58.6%	97.7%	±0.9%	94.9%	±2.3%
Kalmar	1998–2007	1,900	69.1%	83.7%	59.5%	98.3%	±0.7%	97.7%	±1.3%
Karlskrona	1998–2007	577	63.3%	80.8%	62.6%	96.4%	±1.7%	88.0%	±5.6%
Karlstad	1998–2007	1,855	69.1%	81.5%	63.2%	97.7%	±0.9%	96.8%	±1.4%
Norrköping	1998–2007	1,889	65.7%	83.3%	60.4%	99.0%	±0.5%	96.8%	±2.9%
S:t Göran	1998–2007	4,556	83.6%	79.8%	65.3%	96.3%	±0.7%	94.8%	±1.0%
Skövde	1998–2007	1,501	69.5%	78.5%	55.6%	98.2%	±0.8%	97.7%	±1.0%
Sunderby (including Boden)	1998–2007	1,186	64.8%	81.2%	65.6%	96.5%	±1.1%	90.8%	±5.2%
Sundsvall	1998–2007	1,700	84.9%	78.5%	60.9%	96.5%	±1.0%	91.5%	±2.4%
Södersjukhuset	1998–2007	2,959	59.1%	82.9%	68.8%	98.1%	±0.6%	96.5%	±2.1%
Uddevalla	1998–2007	2,658	66.7%	84.0%	63.0%	97.3%	±0.8%	92.3%	±2.8%
Varberg	1998–2007	1,903	86.6%	84.8%	58.0%	97.6%	±0.9%	90.7%	±4.3%
Västerås	1998–2007	1,216	61.7%	77.9%	58.8%	98.3%	±0.9%	93.3%	±6.0%
Växjö	1998–2007	1,065	82.6%	83.0%	58.7%	98.0%	±1.0%	97.8%	±1.2%
Ystad	1998–2007	892	80.4%	88.8%	57.4%	97.0%	±1.2%	95.5%	±1.9%
Östersund	1998–2007	1,651	82.3%	81.8%	56.5%	97.0%	±1.0%	93.9%	±3.3%
Rural Hospitals									
Alingsås	1998–2007	1,354	93.4%	85.2%	58.2%	98.8%	±0.8%	98.1%	±1.1%
Arvika	1998–2007	644	88.0%	82.1%	59.0%	95.0%	±2.6%	91.2%	±4.5%
Bollnäs	1998–2007	1,784	90.0%	84.6%	59.0%	98.0%	±0.9%	93.2%	±5.8%
Enköping	1998–2007	1,282	94.7%	93.8%	60.8%	97.8%	±0.9%	92.9%	±3.6%
Falköping	1998–2007	1,860	89.5%	84.2%	56.9%	97.3%	±1.0%	92.8%	±3.2%
Frölunda Specialistsjukhus	2002–2007	271	99.3%	86.0%	70.1%	97.3%	±2.5%		
Gällivare	1998–2007	969	79.9%	86.3%	59.4%	97.9%	±1.0%	97.6%	±1.2%
Hudiksvall	1998–2007	1,374	74.4%	85.4%	60.5%	97.4%	±1.0%	95.6%	±2.7%
Karlshamn	1998–2007	1,381	94.0%	80.5%	57.9%	97.5%	±1.0%	95.7%	±2.8%
Karlskoga	1998–2007	1,147	89.9%	85.8%	62.0%	98.2%	±0.9%	97.2%	±1.4%
Katrineholm	1998–2007	1,680	91.4%	81.5%	57.0%	98.7%	±0.6%	95.7%	±2.5%

(continued on next page.)

Implant survival per hospital (cont.)

all diagnoses, all reasons for revision och alla typer av implantat, 1998-2007

Cup (Stem)	Period [1]	Number [2]	OA [3]	≥60 yrs [4]	Female [5]	5 yrs	95% CI	10 yrs	95% CI
Kungälv	1998–2007	1,899	87.9%	86.3%	62.1%	99.2%	±0.5%	96.0%	±3.1%
Köping	1998–2007	1,989	95.7%	84.8%	55.5%	98.9%	±0.5%	97.3%	±1.5%
Lidköping	1998–2007	1,267	88.1%	83.6%	51.1%	98.7%	±0.8%	96.6%	±2.3%
Lindesberg	1998–2007	1,224	86.9%	85.1%	56.5%	98.2%	±0.8%	97.3%	±1.5%
Ljungby	1998–2007	1,125	86.9%	81.3%	52.6%	98.6%	±0.8%	96.2%	±2.3%
Lycksele	1998–2007	1,830	91.6%	85.7%	61.3%	99.2%	±0.5%	98.2%	±1.8%
Mora	1998–2007	1,430	87.5%	84.5%	58.5%	99.0%	±0.6%	98.0%	±1.3%
Motala	1998–2007	2,295	86.0%	83.5%	59.1%	98.1%	±0.8%	97.5%	±1.3%
Norrtälje	1998–2007	963	80.5%	86.7%	56.8%	96.9%	±1.3%	94.8%	±3.1%
Nyköping	1998–2007	1,204	81.3%	83.6%	57.6%	97.9%	±0.9%	96.9%	±2.0%
Oskarshamn	1998–2007	1,384	90.8%	84.9%	57.7%	99.2%	±0.5%	98.6%	±1.1%
Piteå	1998–2007	1,486	90.6%	80.4%	56.3%	97.5%	±1.1%	97.1%	±1.3%
Skellefteå	1998–2007	1,240	81.2%	81.8%	61.2%	98.4%	±0.8%	97.4%	±1.4%
Skene	1998–2007	740	95.4%	82.4%	49.5%	98.4%	±1.1%	96.9%	±2.0%
Sollefteå	1998–2007	1,078	89.1%	83.5%	59.0%	98.4%	±0.9%	98.4%	±0.9%
Södertälje	1998–2007	1,180	84.8%	84.1%	60.4%	98.8%	±0.8%	90.4%	±7.6%
Torsby	1998–2007	796	87.1%	86.8%	54.6%	97.8%	±1.3%	96.3%	±1.9%
Trelleborg	1998–2007	2,686	85.1%	82.8%	60.6%	96.8%	±0.9%	94.5%	±1.9%
Visby	1998–2007	887	84.7%	81.2%	54.5%	95.4%	±1.6%	85.1%	±9.3%
Värnamo	1998–2007	1,159	85.4%	82.5%	57.3%	99.0%	±0.6%	97.4%	±1.8%
Västervik	1998–2007	1,086	83.7%	83.8%	55.7%	98.0%	±1.0%	96.6%	±1.6%
Örnsköldsvik	1998–2007	1,241	86.4%	82.1%	60.9%	98.8%	±0.8%	98.5%	±1.0%
Private hospitals									
Carlanderska	1998–2007	556	95.7%	72.3%	50.7%	98.7%	±1.2%	96.4%	±3.1%
Elisabethsjukhuset	1999–2007	762	87.1%	77.3%	60.0%	97.8%	±1.9%		
Gothenburg Medical Center	2004–2007	120	99.2%	71.7%	54.2%				
Movement	2003–2007	314	98.4%	78.0%	55.1%				
Nacka Närsjukhus Proxima AB	2004–2007	106	98.1%	70.8%	52.8%				
OrthoCenter	2007–2007	18	88.9%	33.3%	22.2%				
Ortopediska Huset	1999–2007	2,108	99.0%	78.7%	63.6%	97.4%	±1.0%		
Sophiahemmet	1998–2007	2,175	99.1%	74.5%	56.0%	96.2%	±1.0%	92.5%	±2.0%
Spenshult	2007–2007	75	90.7%	78.7%	50.7%				
Stockholms Specialistvård AB	2000–2007	1,013	96.4%	77.6%	55.9%	97.5%	±1.1%		

[1] Refers to first and last observed primary operation year.
[2] Refers to number of primary operations during period using conditions given in table heading.
[3] Refers to proportion of primary operations carried out for primary osteoarthritis.
[4] Refers to proportion of primary operations in age group 60 years or older (age on primary operation).

Certain units lack sufficient primary operations during the period to give a 10-year value for implant survival. For the 10-year value to be calculated, the longest observed time between primary operation and revision must be at least 10 years. We therefore also report 5-year survival. A condition consistently used in survival statistics from the Register is that only values in which 50 patients 'at risk' remain are shown. Units with lower production may therefore lack values for this reason. All departments reporting to the Register during the year in question are included in the table, even where values are missing.

Follow-up model for patient-reported outcome

During the past few years both decision-makers and national and international research have successively increased their focus on patient-reported outcome measurement (PROM) following various medical interventions. The chief indications for hip arthroplasty surgery are severe pain and low health-related quality of life. For this reason it is important to measure and report these variables so as to optimise the treatment of individual patients, to measure the departments' results in several dimensions and to be able to perform health-economic studies.

Follow-up model after six years

The hip follow-up model, with a standardised follow-up of all patients undergoing primary total hip arthroplasty, started in 2002 in the Västra Götaland Region (VGR). Since then the routine has been successively introduced throughout the country. Currently, 73 hospitals are associated (73 of 79 active departments in 2007 = 92%). Four of the remaining units (Helsingborg, Ängelholm, Norrköping and Sophiahemmet) have informed us that they will join in autumn 2008. Linköping and Nyköping have not reported any interest to join.

Several variables from the hip follow-up model are included in the clinical value compass (page 72). The health gain (gained value on the EQ-5D index) has been selected by the National Board of Health and Welfare (SoS) and the Swedish Association of Local Authorities and Regions (SALAR) as a national indicator for hip prosthesis surgery in the publication 'Regional Comparisons'.

The 6-year follow-ups, which include an X-ray investigation, started in the VGR on 1 January 2008 and preliminary results will be presented in the next Annual Report.

For logistics and overall objectives see earlier Annual Reports (2004-2006).

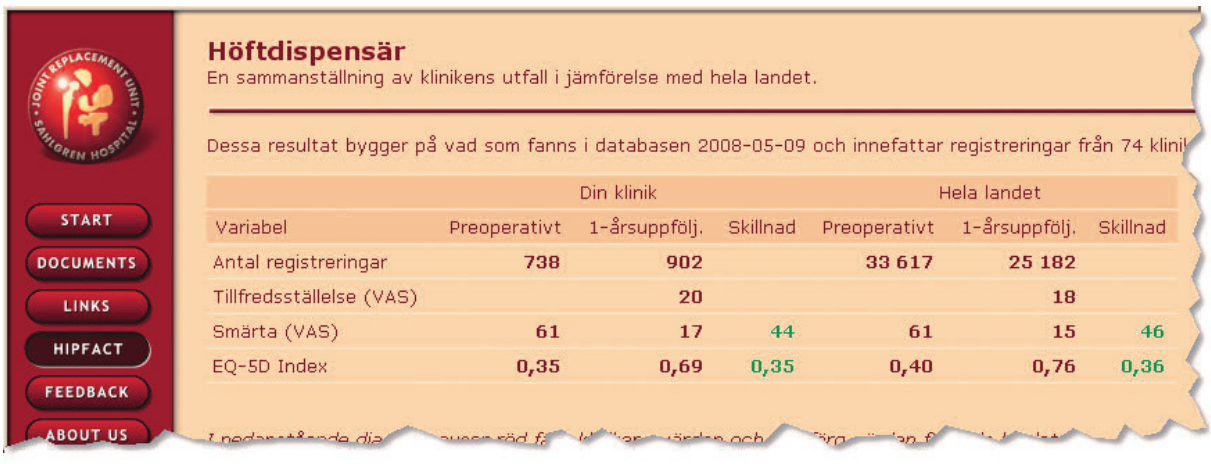
Results

On 4 May 2007 the preoperative database (74 departments) contained 33,617 patients. The one-year follow-up contained 25,182 patients. The national average for the entry variables varied somewhat over the years when we were collecting data. The variation between hospitals, however, is large. The improvement in health-related quality of life (gain in EQ-5D index) over one year varies between 0.30 and 0.46. See table on next page.

The causes of this variability are multifactorial: patient demography including socioeconomic parameters, gender distribution, age distribution, co-morbidity, differing indications for surgery, and accessibility are factors influencing these individual-based variables. An extensive analysis at hospital level is still not relevant since many hospitals during 2007 started a one-year follow-up with small materials around the beginning of 2008.

Future objectives

During autumn 2008 the registry is to run ethically-approved co-processing with Statistics Sweden and the Centre for Epidemiology at the National Board of Health and Welfare. For this co-processing we will have access to a number of supplementary variables such as ethnicity, educational level, income, other socioeconomic variables and medical co-morbidity. One aim of this 'new' and unique database is to be able to conduct an in-depth analysis of patient-reported outcome in relation to these background variables which are probably significant for outcome.



Patient-reported outcome per hospital

2002-2007

Hospital	Preoperative				Follow-up after 1 year				Gain [3]	Comments
	No.	C-cat.[1]	EQ-5D	Pain	No.	EQ-5D	Pain	Satisf.[2]		
University/Regional Hospitals										
KS/Huddinge	45	47%	0.52	68						
KS/Solna	121	55%	0.35	64						
Linköping										Not joined
Lund	179	48%	0.29	64	233	0.66	18	19	0.37	
Malmö	147	51%	0.27	65	335	0.67	22	23	0.40	
SU/Mölndal	447	46%	0.36	62	402	0.70	17	23	0.34	
SU/Sahlgrenska	738	51%	0.35	61	886	0.69	17	20	0.34	
SU/Östra	643	43%	0.36	63	570	0.72	17	21	0.36	
Umeå	247	45%	0.27	67	221	0.73	15	17	0.46	
Uppsala	103	61%	0.37	58						
Örebro	285	52%	0.43	56	191	0.76	14	15	0.33	
Central Hospitals										
Borås	809	48%	0.41	59	796	0.74	16	19	0.33	
Danderyd	694	46%	0.36	63	389	0.77	13	16	0.41	
Eksjö	468	38%	0.41	63	349	0.78	14	15	0.37	
Eskilstuna	187	51%	0.26	66	129	0.63	18	20	0.37	
Falun	248	52%	0.38	61						
Gävle	190	49%	0.32	64	112	0.76	16	17	0.44	
Halmstad	359	35%	0.39	62	369	0.73	16	20	0.34	
Helsingborg										Not joined
Hässleholm-Kristianstad	1,394	42%	0.39	56	685	0.83	14	16	0.44	
Jönköping	481	35%	0.36	63	353	0.76	14	17	0.40	
Kalmar	312	42%	0.47	59	157	0.77	14	15	0.30	
Karlskrona	32	34%	0.39	47	25	0.65	15	20	0.26	
Karlstad	193	47%	0.37	63						
Norrköping										Not joined
S:t Göran	189	64%	0.39	58						
Skövde	597	44%	0.34	63	690	0.72	16	19	0.38	
Sunderby (including Boden)	309	44%	0.29	67	356	0.71	16	21	0.42	
Sundsvall	398	45%	0.35	66	441	0.73	17	22	0.38	
Södersjukhuset	815	43%	0.38	58	437	0.72	20	23	0.34	
Uddevalla	1,266	48%	0.37	62	1,367	0.72	17	20	0.35	
Varberg	580	42%	0.43	62	341	0.78	12	16	0.35	
Västerås	315	41%	0.34	65	108	0.75	13	17	0.41	
Växjö	274	51%	0.44	56	147	0.75	18	20	0.31	
Ystad										THR surgery in Trelleborg
Östersund	833	34%	0.36	63	626	0.77	13	15	0.41	
Rural Hospitals										
Alingsås	826	49%	0.44	58	698	0.79	14	18	0.35	
Arvika	95	44%	0.45	58						
Bollnäs	544	39%	0.42	65	203	0.79	15	18	0.37	
Enköping	163	39%	0.39	61						
Falköping	1,429	35%	0.45	58	1,158	0.81	12	14	0.36	
Frölunda Specialistsjukhus	269	35%	0.40	64	189	0.75	15	19	0.35	
Gällivare	334	45%	0.39	64	368	0.76	17	20	0.37	

(continued on next page.)

Patient-reported outcome per hospital (forts.)

2002-2007

Hospital	Preoperative				Follow-up after 1 year				Gain [3]	Comments
	No.	C-cat.[1]	EQ-5D	Pain	No.	EQ-5D	Pain	Satisf.[2]		
Hudiksvall	215	46%	0.39	63	85	0.69	17	26	0.30	
Kalix	112	47%	0.33	65	117	0.76	16	19	0.43	
Karlshamn	332	40%	0.39	62	194	0.78	15	16	0.39	
Karlskoga	109	38%	0.36	65	26	0.68	18	23	0.32	
Katrineholm	417	47%	0.36	64	243	0.81	13	16	0.45	
Kungälv	1,014	51%	0.43	57	841	0.75	14	18	0.32	
Köping	458	32%	0.39	65	152	0.75	17	18	0.36	
Landskrona	203	34%	0.41	64	203	0.81	13	14	0.40	
Lidköping	712	45%	0.43	57	583	0.77	13	17	0.34	
Lindesberg	424	37%	0.48	57	286	0.80	12	14	0.32	
Ljungby	242	40%	0.46	61	143	0.79	11	14	0.33	
Lycksele	832	45%	0.39	65	733	0.79	14	15	0.40	
Mora	129	42%	0.32	67						
Motala	449	54%	0.44	59	32	0.76	18	24	0.32	
Norrtälje										Joined 2008-01-01
Nyköping										Not joined
Oskarshamn	466	37%	0.49	54	188	0.81	11	12	0.32	
Piteå	826	45%	0.37	65	501	0.77	16	19	0.40	
Skellefteå	449	45%	0.38	63	380	0.77	14	16	0.39	
Skene	433	41%	0.41	60	378	0.77	15	20	0.36	
Sollefteå	463	44%	0.45	62	443	0.80	14	17	0.35	
Södertälje	99	36%	0.38	60						
Torsby	79	42%	0.36	65						
Trelleborg	1,879	41%	0.40	64	1,147	0.78	15	17	0.38	
Visby	34	29%	0.50	64						
Värnamo	348	42%	0.51	53	180	0.79	13	14	0.28	
Västervik	157	41%	0.46	61	67	0.72	18	19	0.26	
Örnsköldsvik	580	47%	0.37	64	496	0.78	14	16	0.41	
Private Hospitals										
Carlanderska	98	28%	0.40	62	107	0.86	18	20	0.46	
Elisabethsjukhuset	206	29%	0.48	60	43	0.85	12	11	0.37	
Movement	125	25%	0.51	62	38	0.79	14	17	0.28	
Nacka Närsjukhus Proxima AB	25	48%	0.26	71						
OrthoCenter	10	50%	0.61	53						
Ortopediska Huset	31	39%	0.38	63						
Sophiahemmet										Not joined
Spenshult	6	50%	0.36	64						
Stockholms Specialistvård AB	64	33%	0.46	63						
Nation	29,584	43%	0.40	61	20,937	0.76	15	18	0.36	

[1] Proportion of Charnley category C.
[2] Satisfaction (VAS).
[3] Difference in EQ-5D after 1 year and pre-operatively. Note that this reflects the difference between mean values after 1 year and pre-operatively, 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 replacement surgery

In last year's Report the clinical value compass was introduced as an instrument for follow-up of activities after hip replacement surgery. The value compass contains eight variables (compass cardinals) which in the Report are openly reported by hospital in separate tables. These tables are necessarily complicated and are hard to interpret. In addition it is hard via tables to gain a rapid overview of the results of each unit in several dimensions. The compasses were produced solely to give such a rapid and easily-grasped overview. A divergent result in a clinical value compass only states whether a unit has a problem area.

Using this follow-up model, results are presented this year for all 51 departments that have been connected to the main follow-up model for more than one year. The limit values are the largest and the smallest value of the variable in question plus/minus one standard deviation. The worst value (0.0) for the variables is given as origo and the best value (1.0) at the periphery. This expanded clinical value compass may be viewed as a balanced control card. The larger the surface, the better the total result for each department. National average values are given in each figure and each unit can thus compare itself with the national result. Note that the observation time for the variables differs. Result variables are:

1. **Patient satisfaction.** Measured on VAS can only, like variables 2 and 3, be given if the department has been active with the follow-up routine for more than one year.
2. **Pain relief.** Measured by subtracting the pre-operative VAS value from the follow-up value, i.e. the value gained after one year is given.
3. **Gained health-related life quality (gain in EQ-5D index).** The prospective EQ-5D index gained value, i.e. health gain after one year, is given.
4. **90-day mortality.** In international literature this variable is used to illustrate mortality following hip arthroplasty. It can be a measure of increased mortality from thromboembolic and cardiovascular diseases subsequent to discharge.
5. **Cost per patient.** Since the CPP system has not yet been fully implemented in all Swedish hospitals (see section "Costs and cost-utility effects" page 77), the spread of this variable is not shown, but is given this year, too, only with the national CPP mean value, SEK 78,535 (based on just over 5,000 operations).
6. **Reoperation within 2 years.** Gives all forms of reoperation within 2 years during the latest 4-year period.
7. **Five-year implant survival.** Implant survival after 5 years with Kaplan-Meier statistics.
8. **Ten-year implant survival.** As above but with a longer follow-up time.

Linked to each department's clinical value compass is a graphic presentation of that department's 'case-mix'. This is designed in the same way as the value compass and includes the variables which analysis of the registry's database proved to be decisive demographic parameters for both patient-reported outcome and long-term results with respect to need for revision. The larger the surface in this figure the more favourable profile the relevant department has.

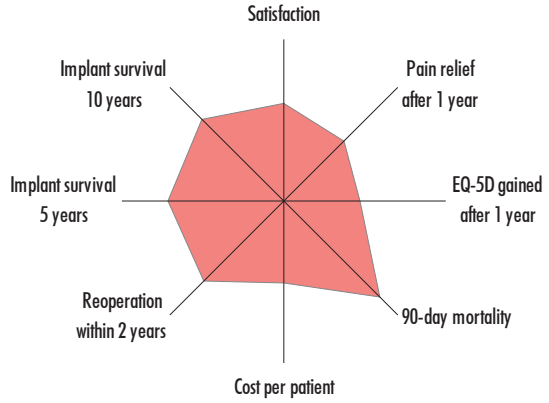
- **Charnley classification.** In the figure the department's proportion of patients classifying themselves as Charnley class A or B, i.e. patients without multiple joint disease and/or intercurrent diseases affecting their walking ability, is given.
- **Proportion of primary osteoarthritis.** The more patients the departments operate on with diagnosed primary osteoarthritis the better the long-term result is according to the registry's regression analysis.
- **Proportion of patients 60 years or older.** Departments operating on many patients over 60 years gain better results in the same way as the variable above.
- **Proportion of women.** Women have generally better long-term results than men regarding need for revision, mainly for aseptic loosening.

Discussion

Although we as yet lack information from all departments, we present this graphic manner of showing department results in several dimensions because we believe in this model. There is a strong desire on the part of decision-makers in medical care for access to easily-accessible, summarised presentations of departments'/county councils' results for follow-up of activities. A different way of fulfilling this requirement is to create indices as a total sum comprising a number of variables. The registry management does not believe in this form of indexing which seeks to summarise in one number different dimensions of the result. The greatest risk with indexing is that good results in one variable may be counterweighed by poor results in another, or vice versa. An index of this nature does not encourage in-depth analysis and improvement. Differing degrees of coverage of reported variables may also influence indexing, with misleading results as a consequence.

Quality indicators

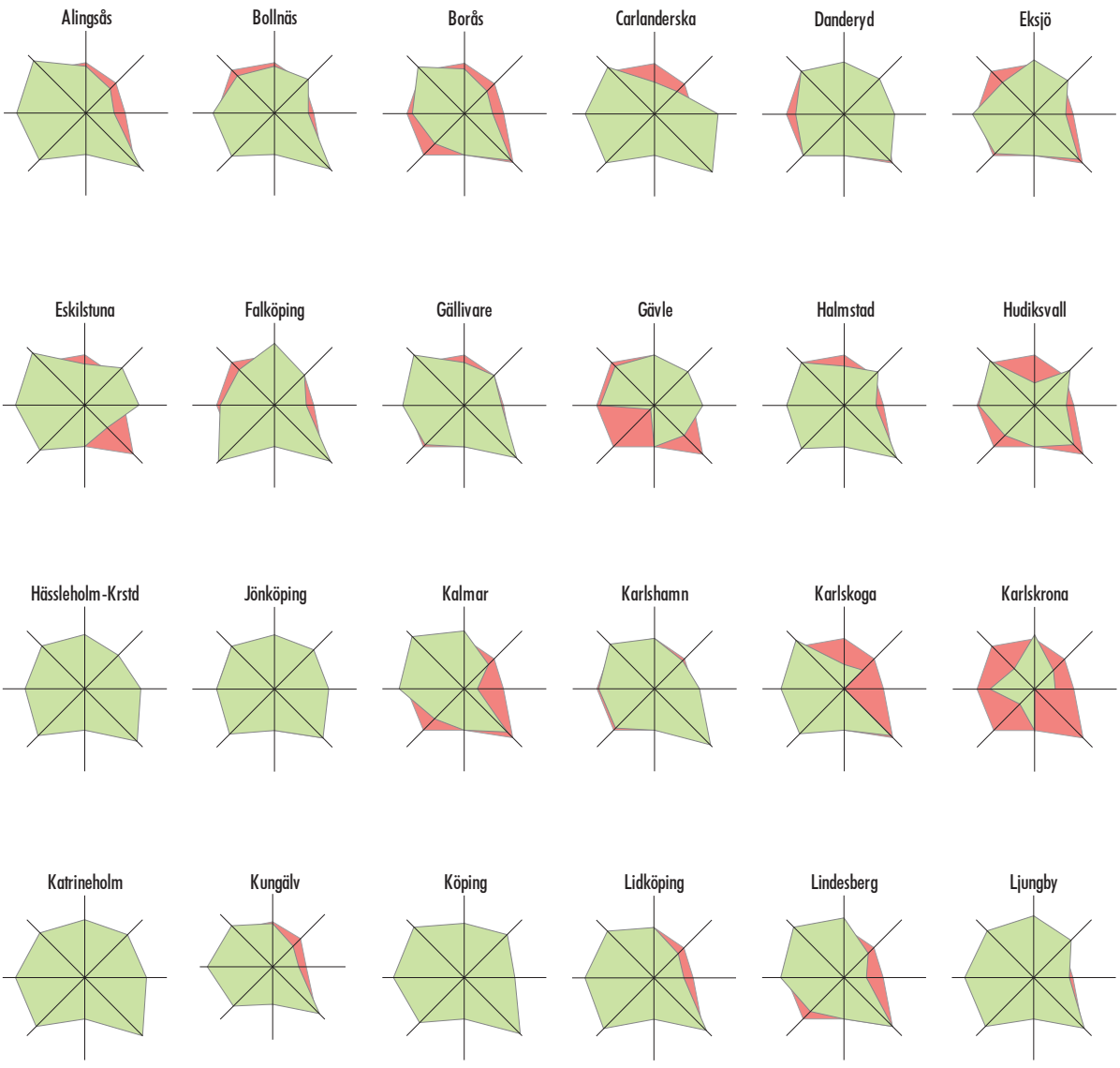
clinical value compass - national averages 2007



The clinical value compasses show in red the national result regarding the eight variables included. The corresponding values for each department are shown in green. The limit values are set to each variable's largest and smallest value ± 1 SD. The poorest result for the variables is origo and the best result is at the periphery.

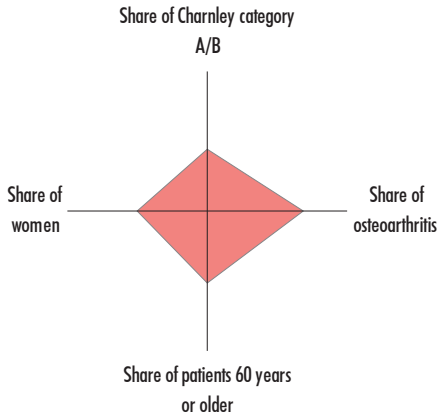
The departments where red fields are shown have a poorer value than the national average for the variable in question. The outcome can be studied in detail in the relevant table.

Note that 'Cost per patient' in this Annual Report cannot be given by department and that all values are set to the middle of the scale (constant).



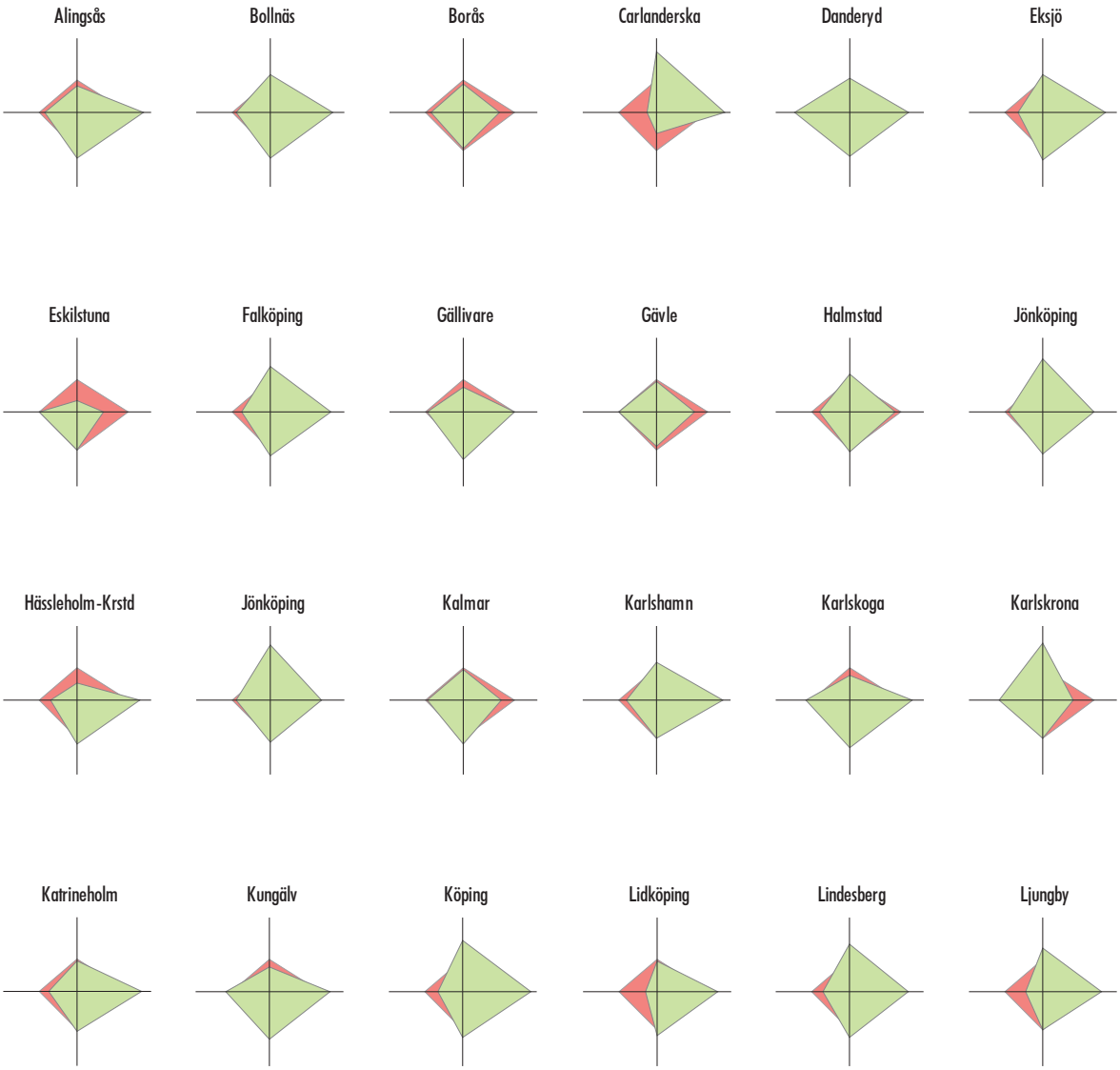
Case-mix factors

national averages 2007

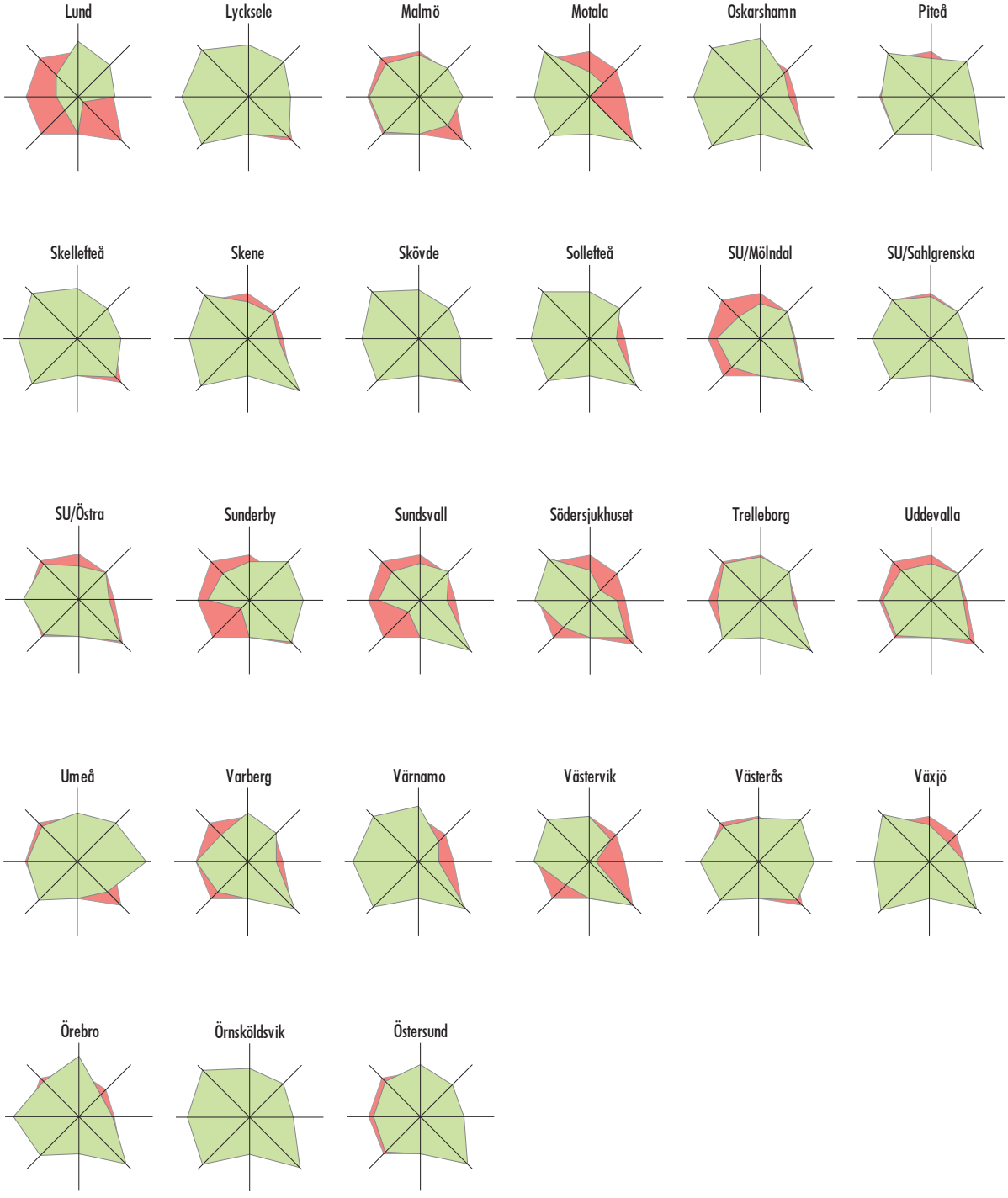


In the graphic presentation of patient demography ('case-mix') the national result is shown for the four variables included, in red. The corresponding values for each department are shown in green. Limit values are set to each variable's greatest and smallest value ± 1 SD. The poorest value for the variables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

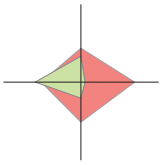


(continuation of clinical value compass)

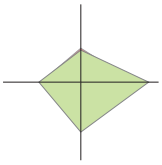


(continuation of 'case-mix' factors)

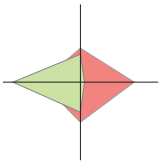
Lund



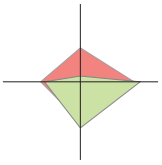
Lycksele



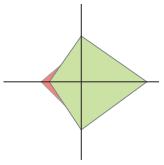
Malmö



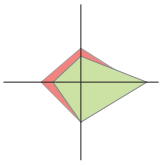
Motala



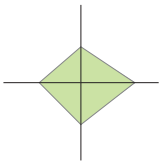
Oskarshamn



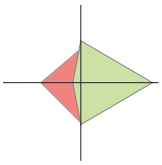
Piteå



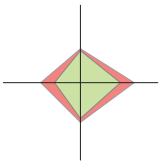
Skellefteå



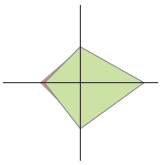
Skene



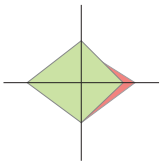
Skövde



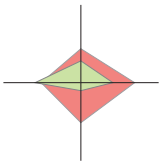
Sollefteå



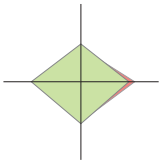
SU/Mölndal



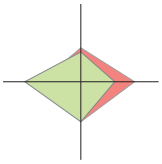
SU/Sahlgrenska



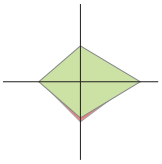
SU/Östra



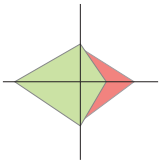
Sunderby



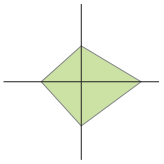
Sundsvall



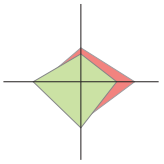
Södersjukhuset



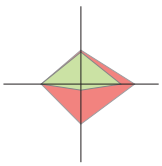
Trelleborg



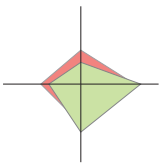
Uddevalla



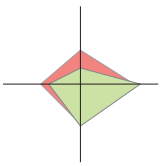
Umeå



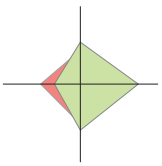
Varberg



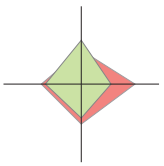
Värnamo



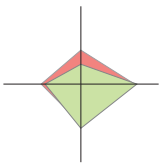
Västervik



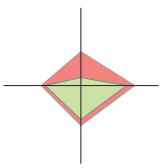
Västerås



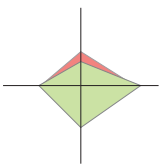
Växjö



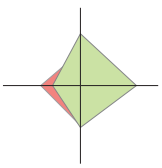
Örebro



Örnsköldsvik



Östersund



Notes

Costs and cost-utility effect

Costs are probably the most discussed variable in contemporary medical care. This is so both among decision-makers and in the profession. In view of this focus, it is almost a paradox that no national and standardised methods of measuring costs have been developed.

An important detail is the definition of cost:

- Direct costs
  - Direct medical costs: care cost
  - Direct non-medical costs: e.g. municipal costs for subsidised transport and home-help services
- Indirect costs: sicklisting, early retirement pension.

For many disease groups, the indirect costs are many times larger than the direct. The social cost of musculoskeletal diseases consists to 80% of indirect costs. A common mistake when measuring costs of a disease state or care event is to calculate only parts of the total cost, i.e. certain cost bearers are 'forgotten' in the analysis.

One attempt at standardised measuring is what is termed the CPP system (cost per patient). The system was introduced back in 1985 at Sahlgrenska University Hospital. The National Board of Health and Welfare (SoS) and the Swedish Association of Local Authorities and Regions (SALAR) have for several years been working on national implementation. The introduction is proceeding slowly and CPP measurement at various care centres also lacks standardisation. Bear in mind, too that this is an estimate from differing tariffs and that the sum will contain only direct medical costs. Large-scale, complete, individual-based cost analyses of both direct and indirect costs are, in practice, with today's socioeconomic distribution, impossible.

Measuring only one cost (use of resources) is not entirely meaningful unless the consequence (utility) of the costable action is measured at the same time, i.e. estimating the cost efficiency of the measure.

Costs of waiting times

A complete health-economic analysis, however, requires that all costs that may be related to the disease and the intervention be known. To identify the costs generated by hip-joint disease before an operation, we ran a questionnaire survey in the Västra Götaland Region (VGR: Skövde did not take part) and Norrland from October 2005 to December 2007. Approximately 3,500 patients (20 hospitals) were requested to answer a questionnaire just before a planned hip arthroplasty. The questions covered cost-generating events/circumstances that could be related to the disease. For each patient, details of waiting time were gathered by the operations coordinator. Follow-up questionnaires were sent out one year postoperatively.

The preoperative questionnaire was answered by 2,712 people. Of the patients, 54% belong to the VGR and 46% to Norrland. The selection was representative with a mean age of 69 years, of whom 33% were under 65. The average waiting time for orthopaedic assessment was 176 days (median 103) and for operation 312 days (median 179).

Eighty-two percent of the patients used painkillers for their hip complaint. Of the patients of working age, about one-third were sicklisted and one-quarter on temporary disability pension. Regarding municipal consumption of resources, 4% of these had home-help services, 9% subsidised transport and 46% some form of handicap adaptation. Twenty-six percent of the patients required help from relatives to varying extents owing to their hip disease. Preliminary cost calculation per patient shows that the total disease-related costs one year before hip arthroplasty are about SEK 73,000 per patient. The chief cost is loss of production (72%), while medical care costs represent 13%, municipal costs 6%, drugs 1.5% and costs for help from relatives 7.5%. Data entry from the one-year follow-up is nearing completion.

Preliminary results confirm that the main disease-related cost of hip implant candidates is loss of production. Despite the introduction of the care guarantee when the investigation started, the waiting time for assessment and operation was unacceptably long. The results describe the costs generated by hip-joint disease but further analysis regarding the effect of hip arthroplasty on disease-related costs cannot be done until the results of the one-year follow-up are ready.

Disease related costs one year before THR (SEK average per patient)	
Medical care	9,500
Municipal services	4,500
Drugs	1,000
Productivity loss	52,500
Informal care	5,500
Sum	**73,000**

Discussion

The above analysis shows that the year before hip arthroplasty costs on average as much as the actual arthroplasty (CPP average value 2007: SEK 78,535). This cost arising in the preoperative phase of the disease is never mentioned in short-term budget or purchaser discussions. The result should also be taken into account when priorities are being set. However, the conclusion should not be drawn that all patients with e.g. primary osteoarthritis should receive surgery as quickly as possible after diagnosis (see the section on the "BOA project", page 100) – but in patients with the right indications for surgery the waiting time is very costly for the community.

Cost per care unit

During the past few years the Swedish Hip Arthroplasty Register has extended its interests in health-economic analyses. It is currently co-operating with health economists at i3 Innovus (Stockholm). One of these health economists is a registered PhD student and is using the registry's databases for his analyses.

Health economics is the science of the application and development of economic theory and analysis to circumstances affecting human health. The most relevant health-economic analyses include both costs of and effects of an intervention. Regarding hip-joint disease and hip arthroplasty the registry follows and reports a number of outcome variables for which the effect of the intervention on the patient's health-related quality of life (EQ-5D) is of great importance. The cost of the intervention is obtained via, among other things, the county council's CPP databases. With these two variables (cost and health-related quality of life gained) it is possible to run health-economic analyses that permit comparisons between different medical interventions. Hip arthroplasty costs relatively little but has a profound effect on the patient's health-related quality of life (high cost-utility effect).

Since the CPP system has been introduced at only about one-third of Swedish hospitals, the registry management in February 2008 asked all 79 total-hip-arthroplasty-producing care units in Sweden for the average value cost (2007) of a total hip arthroplasty carried out at their department. We asked the private units for their prices given for contracts with the various county councils. The costs have been calculated using different systems such as DRG compensation, contract prices and CPP at the departments that had the system in operation during 2007. The details gathered are shown in the table on page 79. At the same time a request was sent to the CPP unit at SALAR which supplied values in June (most CPP databases are not complete until 5-6 months after the concluded year of operation). In 2007 the national CPP database contained 5,621 total hip arthroplasties (about 40% of the total national production) and the average price was SEK 78,535.

Nine of 69 public hospitals did not answer (despite three reminders) or stated that they had no system for cost calculation. Five of 10 private caregivers did not answer the question. Details of cost from the 60 public hospitals varied from SEK 56,724 (Södertälje) to SEK 120,229 (SU/Mölndal). SU/Sahlgrenska, however had an even higher average cost of SEK 147,700; but this unit accepted only tumour cases in 2007, i.e. severely ill patients, not infrequently using special tumour prostheses; and this combination drives up costs considerably. The CPP system is, as stated above, oldest at Sahlgrenska university hospital (Sahlgrenska, Mölndal and Östra Hospital). These three were the only units reporting average costs of over SEK 100,000. The SU CPP system includes possible aftercare and R&D supplements. Several other county councils do not include these costs in their CPP calculation.

The large spread of costs given in all probability depends not only on varying efficiency among the units but probably more on the lack of standardisation of calculation methods – i.e. one is comparing 'apples and oranges'. It is impossible that the true cost variation has such a broad span as the table shows. Average care time for a 'standard hip' is between 4 and 8 days, a cemented hip implant costs an average of SEK 10,000 including cement and cementing equipment and the operation time varies between 60 and 120 minutes. This scope for variation cannot explain the great variation of average costs given. Hässleholm is currently Sweden's largest producer of hip implants with highly developed 'care rationalisation' and productivity. This department has reported a relatively high average care cost of SEK 94,000. Among the private caregivers (5 of 10) the costs given varied from SEK 58,000 to SEK 77,474.

Discussion

The registry management note with regret that we have by no means achieved consensus in Sweden regarding how to measure direct costs for total hip arthroplasty. As stated in the Introduction to this section of the Report, this is paradoxical and unsatisfactory since control and management in medical care today is based largely on cost analyses. One example of this is the introduction of the 'free choice of care' in Stockholm scheme, where Stockholm County Council in a 'tender' to Stockholm's public and private hospitals offered the units SEK 56,000 per hip arthroplasty. This covers patients in ASA classes 1 and 2 (representing 70% - 80% of cases). Given the particulars reported above, the County Council is going below the lowest average value stated. If public hospitals are to produce with this compensation, we wonder what will happen to the quality and outcome of such surgery. In addition, one wonders how the Council calculated this low compensation.

Health-economic analysis – cost-utility effect

That the Swedish Hip Arthroplasty Register has wished to collect costs per operation is chiefly because we in our health-economic analysis wish to calculate the cost-utility effect (cost-effectiveness) of total hip arthroplasty.

The cost-utility effect is often reported as cost per quality adjusted life year (cost/QALY gained). The follow-up model for hip arthroplasty with patient-reported outcome (EQ-5D included) now comprises practically all units in Sweden and one of the main aims for including patient-reported variables was to be able to develop a health-economic model for total hip arthroplasty. The table on page 79 gives not only costs per hospital but also the average value for EQ-5D index gain after one year. If the cost is divided by the index gain, a cost/QALY gained (cost-utility

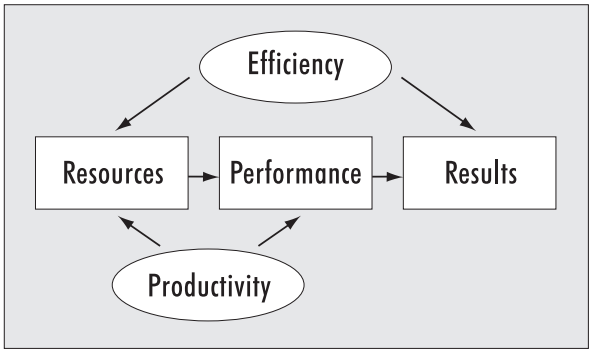


Figure 1. County councils and regions have traditionally followed up their activities using productivity measures and economic (cost) measures. There is often no systematic connection with the actual outcome and utility of the activity, i.e. one is measuring and reporting only 'sticks and money'.

effect) is obtained. The calculation is approximate since it only includes direct costs and assumes that the patient one year post-operatively achieves his stated health gain. The EQ-5D also, however, rises successively during the rehabilitation phase but for reasons of volume and logistics it is not possible to measure EQ-5D more than once during the first year.

Scrutiny of the table shows that the 'cheapest hospital' is not always the most cost-effective, i.e. a low stated cost can nevertheless give a low cost-effectiveness if the EQ-5D gain is also low. The cost/QALY gained can be calculated for 46 departments. There are no values for the others because it has either been impossible to give a cost or else they have not been in the follow-up model long enough to have any or sufficient one-year results. The variable varies from SEK 130,993 to SEK 360,476 (Sahlgrenska with tumour cases only, at SEK 378,718, is excluded). The average national value is SEK 206,671. This average value is of the same order of magnitude as in internationally reported studies. The great variation between departments, however, is not relevant and is due to shortcomings in the cost analyses.

Discussion

This is the first year in which we publish costs and cost-utility effects per care unit. This may be criticised since the results reported show clearly that we in Sweden measure costs in different ways – not only when comparing different county councils but also in comparisons between different hospitals in the same county council/region. The registry management consider that total hip arthroplasty in Sweden should not, as at present, be planned and controlled via productivity measures but, rather, using efficiency measures. This in turn will ensure that this common surgical intervention is followed up with long-term quality assurance.

Swedish medical care lacks relevant measures of cost effectiveness. The reason why we are publishing these somewhat 'shaky' results now is that we wish to stimulate discussion and hasten a necessary standardisation in the area.

Swedish total hip arthroplasty surgery generally maintains a high standard but there is clearly a local potential for improvement in many departments. The registry management is convinced that high quality does not necessarily involve further cost increase; rather, open reporting of standardised costs and cost-utility effects at department level, observing the department's 'case-mix', will further stimulate quality improvement in the area.

Costs are included as a variable in the value compass (page 71). Since the department-specific costs in the present Report are probably not comparable, we are obliged, this year too, to give a mean value cost (CPP 2007, SEK 78,535) as a constant variable in the clinical value compass.

Cost and cost-utility effect

cost for total hip replacement surgery related to gain in EQ-5D index 2007

Hospital	CPP [1]	EQ-5D gain [2]	Cost/QALY [3]	Comments
University/Regional Hospitals				
KS/Huddinge	96,809			Too few observations of EQ-5D.
KS/Solna	74,478			Too few observations of EQ-5D.
Linköping				No response concerning costs.
Lund	90,394	0.38	237,879	
Malmö		0.41		No response concerning costs.
SU/Mölndal	120,229	0.37	324,943	
SU/Sahlgrenska	147,700	0.39	378,718	Only tumour cases. The rest perfomed at Mölndal.
SU/Östra	103,814	0.36	288,372	
Umeå	92,138	0.50	184,276	
Uppsala	86,881			Too few observations of EQ-5D.
Örebro	75,790	0.38	199,447	
Central Hospitals				
Borås	79,630	0.35	227,514	
Danderyd	63,884	0.42	152,105	
Eksjö	73,500	0.35	210,000	
Eskilstuna	84,395	0.43	196,267	
Falun	83,395			Too few observations of EQ-5D.
Gävle	83,395	0.41	203,402	
Halmstad	69,266	0.36	192,406	
Helsingborg	73,031			Too few observations of EQ-5D.
Hässleholm-Kristianstad	94,000	0.43	218,605	
Jönköping	77,396	0.43	179,991	
Kalmar	77,646	0.29	267,745	
Karlskrona	96,751	0.32	302,347	
Karlstad	62,337			Too few observations of EQ-5D.
Norrköping	70,817			Too few observations of EQ-5D.
S:t Göran	64,088			Too few observations of EQ-5D.
Skövde	96,881	0.41	236,295	
Sunderby (including Boden)	87,042	0.45	193,427	
Sundsvall	69,000	0.35	197,143	
Södersjukhuset	58,871	0.35	168,203	
Uddevalla	72,845	0.37	196,878	
Varberg	74,671	0.36	207,419	
Västerås	58,920	0.45	130,933	
Växjö	89,469	0.38	235,445	
Ystad				Ystads joint surgery is performed at Trelleborg.
Östersund		0.41		
Rural Hospitals				
Alingsås	85,982	0.34	252,888	
Arvika				No means of finding costs according to dep. manager.
Bollnäs	74,420	0.36	206,722	
Enköping	63,703			Too few observations of EQ-5D.
Falköping	84,380	0.36	234,389	
Frölunda Specialistsjukhus	78,535	0.37	212,257	
Gällivare	71,946	0.37	194,449	
Hudiksvall		0.35		No response concerning costs.

(continued on next page.)

Cost and cost-utility effect (cont.)

cost for total hip replacement surgery related to gain in EQ-5D index 2007

Hospital	CPP [1]	EQ-5D gain [2]	Cost/QALY [3]	Comments
Karlshamn	96,751	0.39	248,079	
Karlskoga	75,700	0.21	360,476	
Katrineholm	84,395	0.46	183,467	
Kungälv	78,690	0.34	231,441	
Köping	58,920	0.41	143,707	
Lidköping	80,640	0.35	230,400	
Lindesberg	87,647	0.32	273,897	
Ljungby		0.37		No means of finding costs according to responsible physician.
Lycksele	66,209	0.40	165,523	
Mora	84,990			Too few observations of EQ-5D.
Motala	62,945	0.24	262,271	
Norrtälje	56,913			Too few observations of EQ-5D.
Nyköping	74,444			Too few observations of EQ-5D.
Oskarshamn	77,648	0.35	221,851	
Piteå	79,305	0.41	193,427	
Skellefteå		0.41		No means of finding costs according to dep. manager.
Skene	72,327	0.36	200,908	
Sollefteå	74,992	0.35	214,263	
Södertälje	56,724			Too few observations of EQ-5D.
Torsby	62,337			
Trelleborg		0.37		No response concerning costs.
Visby				No response concerning costs.
Värnamo	63,832	0.32	199,475	
Västervik	70,037	0.27	259,396	
Örnsköldsvik	72,200	0.41	176,098	
Private Hospitals				
Carlanderska		0.46		No response concerning costs.
Elisabethsjukhuset		0.34		No response concerning costs.
GMC				Too few observations of EQ-5D.
Movement	77,474	0.36	215,206	
Nacka Närsjukhus Proxima	58,794			Too few observations of EQ-5D.
OrthoCenter	58,500			Too few observations of EQ-5D.
Ortopediska Huset				No response concerning costs.
Sophiahemmet	76,000			Too few observations of EQ-5D.
Spenshult				No response concerning costs.
Stockholms Specialistvård	58,000			Too few observations of EQ-5D.
Nation	78,535	0.38	206,671	

[1] Refers to costs for primary total hip arthroplasty (in SEK).
[2] Refers to gain in EQ-5D index pre-operatively and after one year (matching observations).
[3] Refers to cost/ (1 year × gain in EQ-5D index).

Clinical improvement projects

The registry's main aim is to inform participating units about their results and to stimulate local analysis and continual work for improvement. Use of the eight openly-reported variables has facilitated this process compared to the time when the registry reported chiefly implant survival using Kaplan-Meier statistics.

The goal of open reporting is not to point to individual departments but to initiate local analysis. The registry has not introduced any ranking system in its reports but each department always has a possibility to compare its own result with the national averages. A ranking system is not relevant since it cannot be completely adjusted for 'case-mix' and/ or under-reporting. As mentioned before, there is at present a wish from decision-makers to introduce ranking between different hospitals. The registry management will actively resist such a development.

Reoperation within two years

During the two years in which we have reported Reoperation within two years (short-term complications), some criticism has emerged, predominantly from the departments that have had the highest proportion of short-term complications. Problems of registration at other departments have been pointed out, referring to troublesome 'case-mix' or lack of significant differences. The registry's report has never claimed to be a scientific publication and despite broad confidence intervals for low-frequency complications and troublesome 'case-mixes' there is always a complication and a patient behind each register entry. The registry management urges each department to analyse only its own complications and not comment on others' results. Even the units with a low number of registered complications always have potential for improvement – that is, these departments should always analyse their cases for the purpose of enhancing quality.

Karolinska Hospital/Solna had in the previous Report the next highest frequency of complications within two years and the highest among university/regional hospitals.

After the Report came out, the registry management contacted the official responsible for implants. Deep infections and dislocations dominated as causes of reoperation. An exemplary detailed analysis was initiated and carried out.

Reoperation due to repeated dislocations:

- Of 15 cases, 10 underwent primary operation following fracture, i.e. the patient group with the largest patient risk of implant dislocation.
- No systematic over-representation of physicians with lower competence.

Measure:

- Change to larger head (caput) from 28mm to 32mm as recommended in current literature.
- Appraisal of patient's cognitive function pre-operatively.
- Re-suturing of capsule/rotators in posterior approach.

Reoperation due to infection:

- A majority of the 22 cases had an increased patient-related risk of infection (8 fracture cases and 6 patients with rheumatoid arthritis).
- KS/Solna had mixed orthopaedic departments, i.e. newly-operated-on prosthesis patients may reside on the same ward as trauma and/or infection cases.

Measure:

- General improvement of hygiene rules.
- Altered prophylactic antibiotics: Ekvacillin 2g x 4, the first dose to be given 1 hour before operation.
- Start of local VRISS (care related infection must be stopped, SALAR) project.
- Processing of hospital management to establish a number of entirely clean rooms on a chosen ward.

In this year's analysis, the KS/Solna complication frequency has decreased to 3.6%. The decline may be a random variation, but it is hoped that it is an early result of work for improvement. Since the study concerns patients undergoing operations during a four- year period, it may take 1-3 years before a successful improvement project is reflected in the results table.

	Nr. of patients	Nr. of reops.	Frequency	Infection	Dislocation	Loosening	Others
KS/Solna	1,038	44	4.2%	2.1%	1.4%	0.5%	1.3%
Nation	53,962	819	1.5%	0.6%	0.6%	0.1%	0.4%

Table 1. Karolinska University Hospital, Solna results compared to national average values. Reoperations within 2 years (2003-2006) .

	Number of patients	Primary OA	Share patients ≥ 60 yrs	Share women	Share reopererated
KS/Solna	1,038	62.6%	73.1%	64.1%	4.2%
Nation	53,962	81.8%	80.9%	59.4%	1.5%

Table 2. Patient demography. Karolinska University Hospital,/Solna compared to nationally (2003-2006).

The Sundsvall department's 10-point programme (November 2006) against implant dislocation was described in detail in last year's Report. Since the measurements in 2005, the department had by the time of this year's analysis halved its dislocation problems. Unfortunately it had suffered an increasing problem of infection instead, and in this year's analysis has the highest registered frequency of infection in the country, 2.8%. Even before the present Report, the department had noted, via local registration of complications, the increase. It had reacted with a comprehensive analysis in co-operation with the hospital's hygiene and infection department, starting a local VRISS project. The detailed analysis failed to reveal any systematic connection regarding infection agens, preliminary diagnosis, operating theatre, surgeon, assistants etc. Paradoxically enough the department lacks any simultaneous increased frequency of deeply-infected knee prostheses inserted in the same operation theatres by the same surgeons. During the period of observation the department had an aggressive policy regarding early surgical intervention on suspected infection, and nine of the 16 reoperations were soft-tissue interventions with extensive debridement and synovectomy. All these cases healed without necessity for revision. This surgically active approach is probably completely adequate but can appear to the department's disadvantage in this type of analysis, in which reoperations and not only revisions are registered.

Patient-reported results

When the registry included patient-reported results (the follow-up model) one of several objectives was also to use these relatively rapid quality indicators for development of improvement activities.

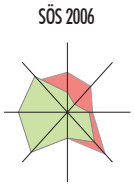
The variables pain relief, satisfaction and health-related life quality are harder to evaluate than for example reoperation frequency. These variables are affected by numerous background variables not continuously measured in the Register, and therefore a local analysis is required if these results are to lead to improvement projects. Background variables that may be relevant are local indication for surgery, socioeconomic variables including ethnicity, age and gender, presence of pre-operative non-surgical treatment, adequate information both pre- and post-operatively, co-morbidity, right level of patient expectations pre-operatively and active post-operative rehabilitation. Patient-reported outcome measure (PROM) thus reflects more the department's care programme and routines (if there are any) than technical results of surgery.

In last year's Report the clinical value compass was introduced as an instrument for rapidly gaining an overview of the department's results in several dimensions. Three basically different units with divergent result profiles for the patient-reported variables were selected (following contact with each unit) for analysis.

Analysis method

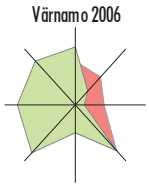
In predictive statistical regression models, patient satisfaction, pain reduction and EQ-5D index gain were used as dependent variables. In the regression analyses, factors such as gender, age, diagnosis, Charnley category, pre- and post-operative pain levels and pre-and post-operative EQ-5D index levels were controlled for. The analysis is reported as odds ratios (OR) followed by 95% confidence intervals in brackets.

Söder Hospital
Regional hospital, Stockholm, catchment area about 500,000 people.



The clinical value compass for Söder Hospital (SÖS) from 2006 indicates a poorer outcome than nationally for the dimensions satisfaction and pain relief. In the statistical analysis these differences were significant ($p < 0.01$). SÖS had a somewhat higher proportion of patients over 60 and a larger proportion of Charnley C patients (other disease than hip diseases affecting gait) than the national (88% compared with 82% and 43% compared with 37%, respectively), i.e. the unit had an unfavourable 'case-mix' regarding patient-reported outcome. At the same time no sizeable difference was found regarding the diagnosis panorama or the patients' pre-operative health-related life quality (EQ-5D index) or pre-operative pain level (VAS).

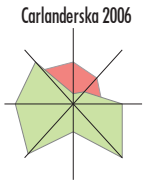
Värnamo Hospital
County rural hospital with catchment area of about 86,000 people.



This department's patients reported a lower gain in health-related quality of life (and hence a probably lower social cost-utility effect from the intervention) and smaller pain reduction from the intervention in 2006 than the national average (EQ-5D index gain, difference 0.29 compared with 0.36 and pain VAS difference 42 compared with 47, respectively), of which the former was significant ($p = 0.01$) and the latter almost so ($p = 0.07$). By contrast, a somewhat higher patient satisfaction than the national level (satisfaction VAS, 13 compared with 19) at $p < 0.001$ was reported.

Gender and age distribution in Värnamo were the same as nationally, and the relationship between Charnley categories A, B and C did not differ either. The indication was entirely dominated by primary osteoarthritis (96%). Regarding patients' pre-operative condition, the EQ-5D index was significantly higher than the national (0.50 compared to 0.39, $p < 0.001$). Patients' pre-operative pain VAS were also significantly lower than the national average (53 compared to 61, $p = 0.001$).

Carlanderska Hospital
Private hospital, Göteborg.



The Carlanderska Hospital (CS) patients reported in 2006 a lower patient satisfaction and pain reduction than the nation average (average VAS 30 compared with VAS 19 and VAS 39 compared with VAS 47, respectively). The former difference was almost statistically significant ($p=0.06$). By contrast CS in 2006 had a larger EQ-5D index gain than the national average (0.46 compared to 0.38), which was significant ($p=0.03$). CS had a more even gender distribution (50% women) than the national (40%) but on the other hand a somewhat younger patient group (63.2 compared to 69.1 years) with less general morbidity in that the number of Charnley C patients was lower (26% compared to 37%). The main indication reported to the Swedish Hip Arthroplasty Register was primary osteoarthritis (96%). Patients' health-related quality of life and pain levels preperatively did not differ from the national. The analysis showed that female gender and less pain reduction from the intervention increased the risk of a lower degree of patient satisfaction at one year, 6.6 (1.0-43.1) and 6.2 (1.0-38.3).

In consultation with operational management at CS a questionnaire was drawn up. On a 5-grade scale, patients were asked to answer questions about the pre-operative information given, their expectations and the degree of fulfillment of the expectations. Response frequency was 89.3% and compilation showed that about 90% considered that they had received information about their hip-joint disease. About 80% stated that they had received information on different treatment alternatives and about 70% had been informed about the risks associated with the intervention. About 75% had discussed rehabilitation time after the intervention, 20% considered that they did not know or had not discussed in any detail how long the rehabilitation normally lasted. Some 80% had been given an opportunity to discuss expectations of the implant intervention and about 90% considered that their expectations had been fulfilled. Lastly, about 90% felt satisfied with the intervention. A statistical analysis of the questionnaire answers (logical regression with patient satisfaction as the dependent variable) showed that the patients who had no, or had only little, opportunity to discuss their pre-operative expectations had an increased risk of being less satisfied with the intervention 9.8 (2.0-47.2).

Discussion

As mentioned above, this type of outcome variable is difficult to analyse with conclusive results. However the same variables are important in this connection since the goal of surgical treatment is to relieve patients' pain so that they have better opportunities of being satisfied and experiencing improved health-related quality of life. That an implant is technically well-performed and remains long in place is not a complete definition of a successful result seen from the patients' perspective.

Southern Hospital. The department, like those in many metropolitan/regional hospitals, has a difficult 'case-mix' regarding patient-reported outcome measurements, and this may suffice to explain their divergent result. However there are in this country a number of departments with similar demographic profiles from which the patients reported a better outcome. Hypothetically there may be shortcomings in the department's care programme for hip arthroplasty.

Värnamo hospital. The analysis of this department's result may indicate a shift in indications for hip arthroplasty. The question has been put to the department management who are to start a local discussion.

Carlanderska hospital. The registry management's own hypothesis when we saw the department's divergent result profile was that there were shortcomings in pre- operative information regarding realistic expectations from the intervention and also regarding the length of rehabilitation. This assumption led to the questionnaire which was kindly mailed from the department. The result partly supports the hypothesis and should lead to improved routines for admission and discharge of the patients in question.

The above analyses were done by the registry management as a guide for the departments in question and it is our hope that colleagues will discuss the outcome locally and review their routines, care programme and indications for surgery.


LEDARE

Sjukvården visar mod när fler gör öppna jämförelser

Öppna jämförelser är effektiva medel för att förbättra vården. Den tid är förbi när kliniker verkade i avskildhet. Bland klinikföreträdare och anställda inser de flesta i dag att öppna uppföljningar av vårdresultat ger positiva effekter – även om de också kan ge upphov till negativ publicitet och interna motsättningar.

Förändringen av attityderna har varit mycket stor och förvånansvärt snabb under senare år. För bara fem år sedan var åsikterna helt annorlunda.

Det är ingen överdrift att påstå att den ändrade synen på öppna vårdresultat är uttryck för ett stort mod. Nu ger man varandra insyn i situationer och verksamheter, som tills för inte länge sedan var insynsskyddade. Och det kan krävas än mer mod för att hantera jämförelser

HÖFTPLASTIK. Svenska höftprotesregistret har samlat data från cirka 2 höftplastiker. Därmed har registret höjt kvaliteten inom höftledskirurgi

Press cutting from leader in Dagens Medicin (in Swedish), October 2007.

Environmental and technical profile

For the environmental profile, departments and clinics report annually on surgical technique and operational environment. It is important that the department update its environmental profile via the web site. If no change is made, it is assumed that the environmental profile/techniques used are unchanged from the previous year. In the profile, aggregate annual data per department are given. This produces an uncertainty in statistical analyses of the database. The primary and reoperation databases on the other hand are based on the individual operation, with personal ID number and side as unique variables. Two variables historically found under environmental profile are type of cement and type of incision. These variables have for the past 7-8 years been individual-based and are now reported in the section Primary total hip arthroplasty (page 11).

Cementing techniques

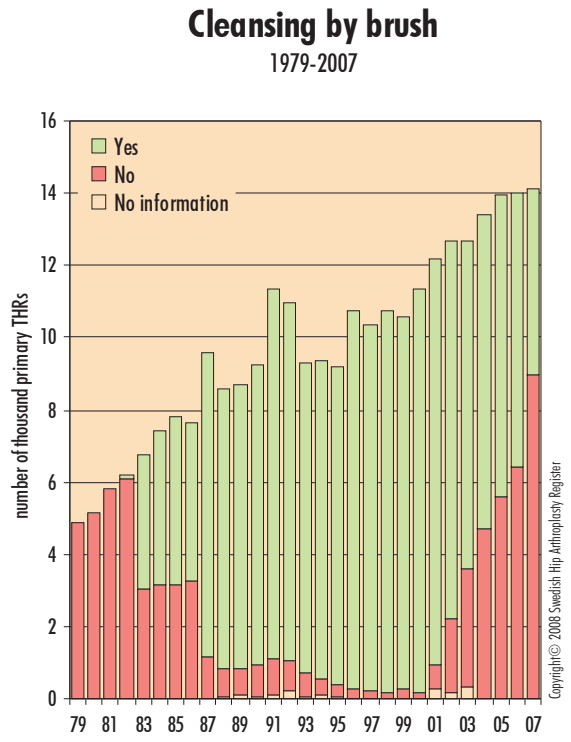
The analysis of cementing techniques is based on annual and department-aggregated results. Most departments state that they use a very similar technique which renders the risk analyses hard to perform on modern material. There have for several years been two trends.

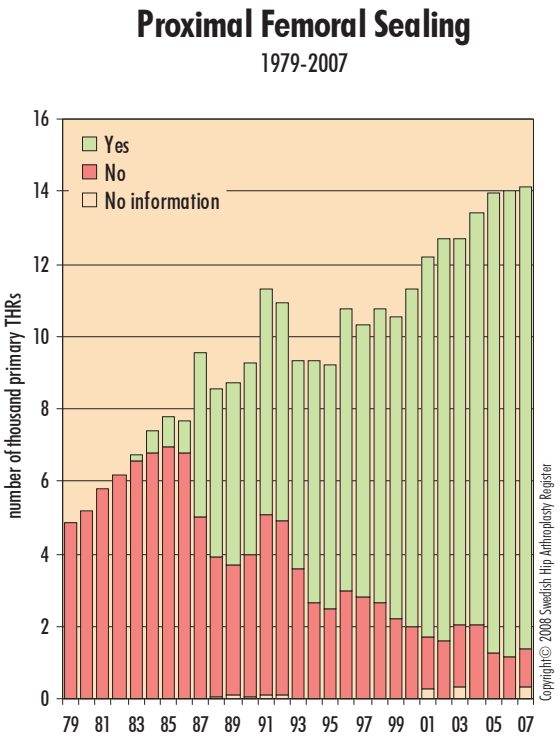
1. The use of brushes declined for seventh year running. In earlier multi-variant analyses we found no positive effect of their use. Brushes can, however, be advantageous in revisions. Regarding cleansing of the cement bed, careful and repeated high-pulsative lavage has a better effect.

2. Proximal sealing plugs for femur cementing should, on strong evidence, be used 100%. This year however 7.5% of departments still state that they do not use this type of equipment. If proximal sealing plugs are not used one loses the advantage of the possibilities of good cement penetration, which is an important aspect of good cementing technique. Earlier Poisson analyses have shown that the use of proximal plugs lowers the risk of aseptic loosening. The reason that some departments hesitate here certainly has its background in fear of thromboembolic complications. This risk, however, can be reduced through meticulous cleansing of the bone bed (high-pulsative lavage) prior to cementing. This has been scientifically tested in a number of studies. The technique should, however, be avoided in operations with hemi-plastic, often used on older and more seriously ill patients.

The recommendation is unambiguous: to use proximal sealing with high-pulsative lavage both before and after application of the distal femur plug. This is important both for cement penetration into the trabecular bone and as a prophylactic measure against embolisation.

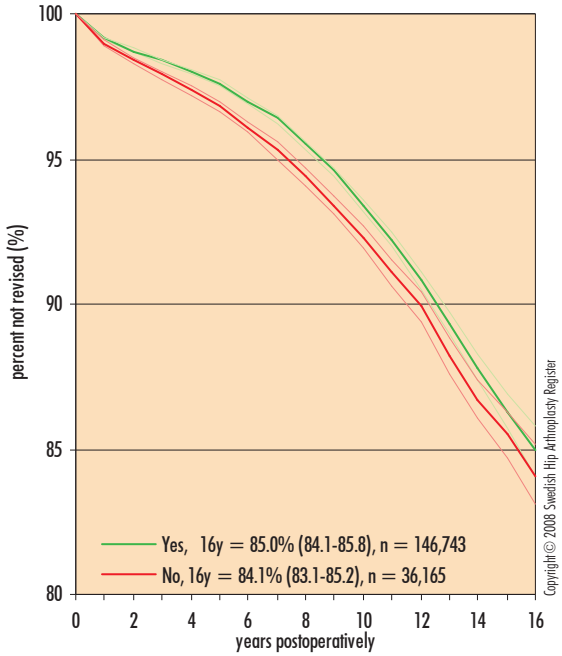
A Kaplan-Meier analysis of 183,000 patients undergoing surgery between 1992 and 2007 gave a 16-year survival for those patients operated on with high-pressure technique of 85% ± 0.9, while those undergoing surgery without this technique had a corresponding prosthesis survival of 84.1% ± 1. The difference is statistically significant ($p < 0.005$, LogRank test).





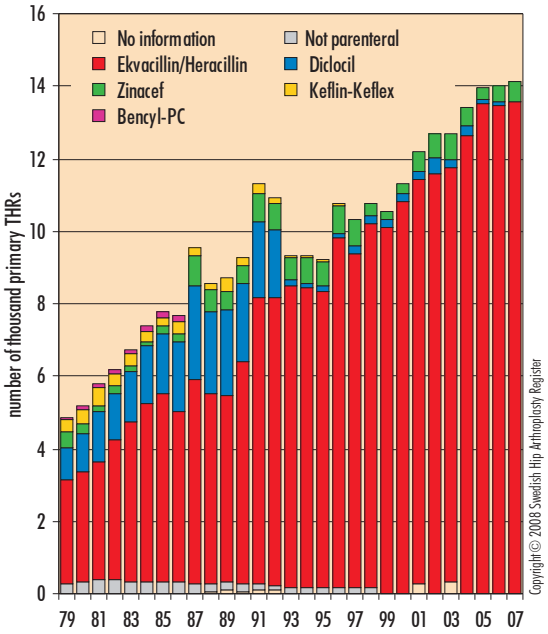
Proximal femoral sealing

all diagnoses and all reasons, 1992-2007



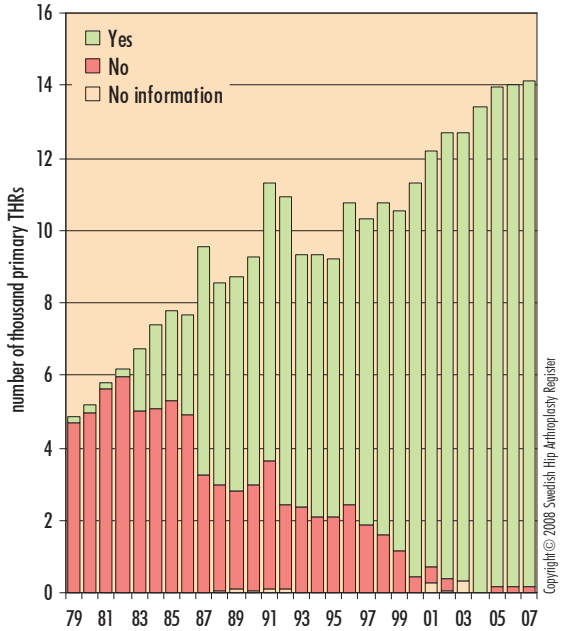
Parenteral brand of antibiotics

1979-2007



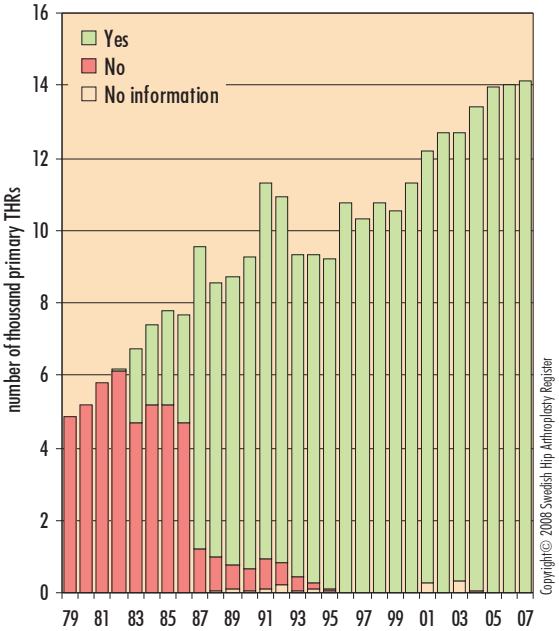
Acetabular compression

1979-2007



Cleansing by lavage

1979-2007



Follow-up of the 'free choice of care' scheme

Discussion of Swedish medical care during the past few years has focused much on accessibility. Both in the care guarantee and in the preceding 'free choice of care' scheme, accessibility is practically always assessed as a time variable. The registry management maintain that accessibility must be subject to quality assurance, with outcome both in the short-term and in the long-term, before it can be invoked as an improvement.

For hip arthroplasty, which has long and in several county councils been burdened with long waiting times, accessibility is therefore judged by how long a waiting time a patient has for surgery. Since many county councils have been unable to achieve the goals of the care guarantee they have been forced to adopt short-term solutions with separate agreements with public and private caregivers. In this way the waiting time has been shortened for those patients who have accepted surgery at a different hospital than their 'own'.

Against this background the registry initiated, for the Annual Report in 2004, an outcome analysis of patients undergoing total hip arthroplasty outside their home regions during 2002 and 2003. As shown in earlier reports we are following this group of patients continuously. Below is a brief summary of the survey as material for this year's follow-up (for details see Annual Reports 2004-2006).

Material

- The analysis included only 'standard patients', i.e. those with primary osteoarthritis as diagnosis and operated on with all-cemented total hip arthroplasty outside university departments or clinics (so as to avoid referrals).

- Operated on within their own county: 14,785 hips; outside their own county 1,964 hips (2002 and 2003).

Earlier results

- Those who used the 'free choice of care' scheme were younger and there were fewer women than the national average.

Reason	Operated in home county (n = 14,785)		Free choice (n = 1,964)	
	number	share (%)	number	share (%)
Aseptic loosening	63	0.4	14	0.7
Deep infection	81	0.5	18	0.9
Fracture	28	0.2	1	0.1
Implant fracture	6	0.0	1	0.1
Dislocation	90	0.6	12	0.6
Technical error	10	0.1	2	0.1
Pain only	5	0.0		0.0
Miscellaneous	19	0.1	2	0.1
Total	302	2.0	50	2.5

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 2007.

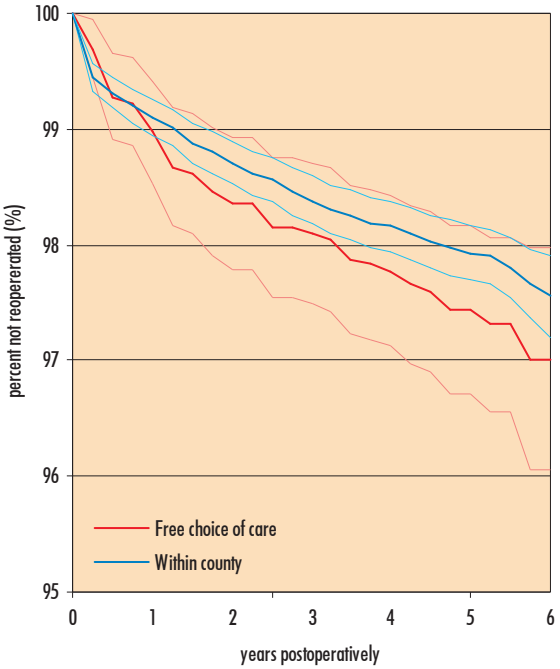


Figure 1. Implant survival for those undergoing surgery under the free-choice-of-care scheme and those operated on within their county of residence, respectively. The difference is not significant according to the LogRank test (p=0.15).

- After an average follow-up of 48 months we found a significantly increased frequency of reoperation due to infection among those undergoing surgery outside their home county. Reoperation for other reasons showed no statistical difference between the two groups.

- Approximately 80% of patients receiving surgery outside their home region and requiring reoperation were treated at their home departments.

This year's comparison

The average follow-up time for this year's analysis was 60 months. In both groups a number of further reoperations were carried out during 2007. The difference between the groups regarding all causes of reoperation was 0.5%. In the within-county group, 2% have now undergone reoperation and in the free-choice-of-care group 2.5%. The difference is not statistically significant. However, as in last year's analysis, there is a significant difference regarding reoperation due to deep infection, with a larger proportion of operations in the 'free choice of care' group (p=0.05, Fischer's exact test).

Unfortunately the registry lacks resources to follow-up a later cohort (after the introduction of the care guarantee). However the Centre for Epidemiology (EpC) at the National Board of Health and Welfare has raised this issue and run an analysis in the Patient Register of production years 2005-2007. The inclusion criteria for this analysis were somewhat

broader than the registry's, comprising all primary arthroplasties. The proportion undergoing reoperation for infection was also larger in the group undergoing surgery outside their home county; but the difference was not significant ($p=0.09$, Fischer's exact test, one year of observation). The Board's analysis was run at department level, which is interesting. However the majority of private caregivers do not report to the Patient Register (see 'degree of coverage', page 6). Thus comparisons at department level are not relevant. County councils concluding contracts with private caregivers should in the contract text require 100% registration to both the Hip Arthroplasty Register and the Patient Register.

Discussion

The follow-up period is now growing to moderate length and still reflects mainly complications such as deep infection and revision for recurrent dislocation. The frequency of this type of short-term complication will now level off and the next few years will become more interesting regarding any difference in reoperation for aseptic loosening.

For each department to be able to retain and develop competence, the registry management consider that it should follow its own patients and also remedy any complications itself. Many undertakings under the care guarantee, however, lack contractual provisions that the individual surgeon follow his or her patients and conduct reoperations himself or herself – i.e. one is not given the opportunity to 'learn from one's own mistakes'. Over time this will lower competence and the opportunity for self-improvement/development.

Optimal accessibility for patients with hip disease should include:

- **Adequate and rapid appraisal by primary care.**
- **Short waiting time for the patient before assessment by an orthopaedic specialist.**
- **Entry to 'osteoarthritis school' – complete non-surgical therapy as first treatment alternative.**
- **Where surgery is indicated – brief waiting time before surgery.**
- **Standardised follow-up, preferably by the operator.**
- **One-year results reported to the Hip Arthroplasty Register.**

Availability is not only a time variable!

Mortality following total hip arthroplasty

Last year we introduced 90-day mortality following total hip arthroplasty/care unit as an openly-reported variable in the Annual Report. This variable is also included as one of eight parameters in the modified clinical value compass (see the section 'Follow-up of activities after total hip replacement surgery', page 71). While the intervention nowadays may be considered as routine surgery, it is in fact a major surgical intervention not without risk for the patient. Modern anaesthesiology, meticulous pre- operative medical investigation and prophylactic infection and thrombosis measures have brought about low complication and mortality frequency. The indications for implant surgery have during the past few years, however, been broadened – both nationally and internationally. More younger and older patients are undergoing surgery now than during the 1970s and 1980s. Today, particularly at larger units, more high-risk patients are undergoing surgery.

The Swedish Hip Arthroplasty Register updates is database many times per year regarding possible dates of death of individuals included (via Skatteverket, the Department of Inland Revenue).

Short-term mortality

Ninety-day mortality is an indicator frequently used in the literature and applied in many different medical areas. The reasons why a patient may die in connection with or within 90 days of hip arthroplasty (and related to the intervention) may be many, but the dominating ones are cardiovascular or thromboembolic diseases.

The variable can in the future be used as an indicator of the quality of the pre- operative medical assessment and the unit's prophylactic measures. To achieve this, co-processing with the Causes of Death Register is required. The new Patient Data Act (1/7 2008) has now made individual-based co-processing with the Causes of Death Register at the Centre for Epidemiology (EpC, National Board of Health and Welfare) easier. Following introduction of the new law, approval from ethical committees is no longer required for co-processing between different national quality registers and the Causes of Death Register.

We had planned this year to include a new variable: number of deaths from cardiovascular and/or thromboembolic diseases. However, the problem is that there is still a lag of approximately two years in the Causes of Death Register database. Following implementation of the new Act, the EpC has now allocated this Register increased resources and the lag will in all probability have disappeared by the time of the next Annual Report. For this reason the table on the next page, as last year, shows only the frequency of mortality.

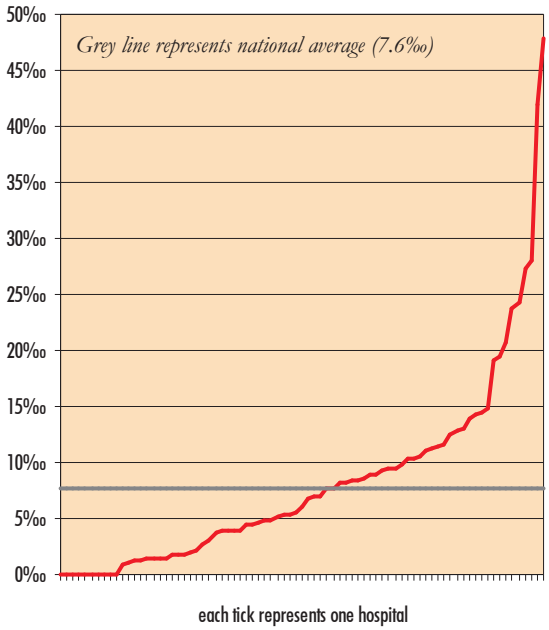
Ninety-day mortality varies fairly widely among Swedish hospitals (see table on next page) over the years of observation: from 0% to 47.9‰ and with a national average value of 7.6‰, and a median value of 6.4‰. This means that at national level one patient per approximately 130 undergoing surgery died within three months of the hip arthroplasty during 2004-2007. Two hospitals (Karlskrona and Lund) had during the observation period an outstandingly high 90-day mortality of more than 40‰. As expected, 90-day mortality is higher after surgery at a university/regional hospital and county hospitals than at a county district hospital and above all compared to private care units. This reflects the patient material at the various hospitals. For this reason we have in this table included the 'case-mix' variables diagnosis, age and gender. Regarding mortality, medical co-morbidity is of course the most important 'case-mix' variable. This year we lack such a variable but after ethical approval we are planning broad co-processing with the EpC Patient Register, and this will give a more adequate co morbidity variable (Charlson's Comorbidity Index) that can be used in future comparative mortality studies.

Ninety-day mortality after hemi-arthroplasty is more than tenfold higher – 12% – than for total hip arthroplasty. Hemi- and total- are two entirely different groups, undergoing operation with different methods. Hemi-arthroplasty patients are older, in general more ill and often undergoing acute surgery. For details and tables see section on hemi-arthroplasty on page 95.

The registry management recommend departments to check their 90-day mortality in the table and, if their results differ from the norm, to initiate a local analysis.

90-day mortality

primary THR performed during the past four years



90-day mortality

proportion deceased within three months after primary THR, 2004-2007

Hospital	Number [1]	OA [2]	≥60 yrs [3]	Female [4]	Mortality [5]
University/Regional Hospitals					
KS/Huddinge	1,047	66.5%	70.4%	59.6%	14.3‰
KS/Solna	946	62.6%	72.0%	64.7%	8.5‰
Linköping	289	44.3%	68.9%	61.9%	24.2‰
Lund	333	34.5%	69.1%	64.9%	42.0‰
Malmö	480	32.1%	77.5%	69.4%	20.8‰
SU/Mölndal	442	62.0%	77.8%	63.6%	9.0‰
SU/Sahlgrenska	561	64.9%	56.0%	59.5%	8.9‰
SU/Östra	478	83.3%	82.4%	64.9%	8.4‰
Umeå	314	70.7%	65.3%	59.2%	19.1‰
Uppsala	1,170	51.5%	70.7%	61.6%	27.4‰
Örebro	736	82.3%	78.9%	58.6%	5.4‰
Central Hospitals					
Borås	855	67.5%	79.6%	59.6%	9.4‰
Danderyd	1,447	79.7%	85.9%	65.4%	8.3‰
Eksjö	753	92.7%	85.9%	56.7%	10.6‰
Eskilstuna	322	55.6%	88.5%	59.0%	28.0‰
Falun	1,031	85.5%	81.1%	56.6%	1.0‰
Gävle	549	58.8%	76.5%	57.0%	23.7‰
Halmstad	846	77.7%	81.0%	58.0%	4.7‰
Helsingborg	320	62.5%	87.2%	59.7%	12.5‰
Hässleholm-Kristianstad	2,982	93.2%	84.5%	56.7%	4.0‰
Jönköping	791	84.3%	82.8%	61.2%	7.6‰
Kalmar	816	72.8%	84.4%	61.8%	11.0‰
Karlskrona	146	34.2%	89.7%	67.8%	47.9‰
Karlstad	1,075	70.8%	82.1%	62.9%	19.5‰
Norrköping	619	59.3%	80.3%	60.3%	12.9‰
S:t Göran	1,725	84.9%	79.8%	64.6%	9.3‰
Skövde	609	72.7%	74.2%	53.2%	8.2‰
Sunderby (including Boden)	419	56.3%	80.2%	64.9%	9.5‰
Sundsvall	574	82.6%	79.3%	59.1%	1.7‰
Södersjukhuset	1,361	67.6%	84.1%	65.2%	14.0‰
Uddevalla	1,250	75.3%	83.3%	60.8%	11.2‰
Varberg	822	87.7%	84.1%	58.0%	4.9‰
Västerås	606	65.8%	77.2%	57.3%	11.6‰
Växjö	517	84.9%	85.9%	58.8%	3.9‰
Ystad	195	81.0%	87.2%	58.5%	10.3‰
Östersund	770	84.2%	80.6%	56.5%	3.9‰
Rural Hospitals					
Alingsås	768	94.9%	85.8%	59.6%	2.6‰
Arvika	440	91.4%	85.0%	56.1%	4.5‰
Bollnäs	1,055	95.0%	86.4%	57.8%	0.9‰
Enköping	672	95.7%	91.8%	60.3%	4.5‰
Falköping	947	89.1%	86.7%	57.1%	2.1‰
Frölunda Specialistsjukhus	236	99.2%	86.0%	69.1%	0.0‰
Gällivare	418	83.0%	86.4%	58.4%	4.8‰
Hudiksvall	552	75.0%	86.8%	61.6%	14.5‰

(continued on next page.)

90-day mortality (cont.)

proportion deceased within three months after primary THR, 2004-2007

Hospitals	Number [1]	OA [2]	≥60 yrs [3]	Female [4]	Mortality [5]
Karlshamn	683	96.5%	80.7%	57.1%	1.5‰
Karlskoga	407	89.2%	85.5%	59.7%	9.8‰
Katrineholm	806	94.4%	78.0%	56.7%	0.0‰
Kungälv	747	88.1%	86.5%	62.2%	4.0‰
Köping	824	95.6%	83.9%	56.9%	1.2‰
Lidköping	540	88.0%	85.6%	48.7%	3.7‰
Lindesberg	574	89.4%	88.0%	54.7%	7.0‰
Ljungby	451	83.4%	79.8%	56.5%	6.7‰
Lycksele	967	91.2%	86.5%	60.6%	10.3‰
Mora	586	89.2%	87.9%	56.5%	5.1‰
Motala	1,483	88.9%	82.8%	60.0%	6.1‰
Norrtälje	388	83.2%	85.3%	57.0%	7.7‰
Nyköping	545	85.5%	84.0%	57.8%	1.8‰
Oskarshamn	804	96.1%	85.9%	53.9%	1.2‰
Piteå	1,020	93.1%	79.0%	55.5%	2.0‰
Skellefteå	433	79.9%	84.1%	62.6%	11.5‰
Skene	313	97.4%	83.7%	49.5%	0.0‰
Sollefteå	536	91.8%	83.2%	61.2%	5.6‰
Södertälje	476	85.1%	86.8%	61.6%	8.4‰
Torsby	308	83.1%	91.2%	58.4%	13.0‰
Trelleborg	1,628	90.7%	78.1%	58.8%	1.8‰
Visby	405	86.2%	79.3%	53.8%	14.8‰
Värnamo	553	87.9%	81.0%	56.8%	5.4‰
Västervik	435	84.1%	85.7%	57.0%	6.9‰
Örnsköldsvik	657	91.2%	78.5%	60.1%	1.5‰
Private Hospitals					
Carlanderska	225	95.1%	65.3%	41.8%	0.0‰
Elisabethsjukhuset	560	84.6%	77.9%	60.7%	0.0‰
GMC	120	99.2%	71.7%	54.2%	0.0‰
Movement	306	98.7%	77.5%	56.2%	0.0‰
Nacka Närsjukhus Proxima	106	98.1%	70.8%	52.8%	0.0‰
OrthoCenter	18	88.9%	33.3%	22.2%	0.0‰
Ortopediska Huset	1,454	99.5%	77.7%	61.4%	1.4‰
Sophiahemmet	1,004	100.0%	72.1%	53.3%	3.0‰
Spenshult	75	90.7%	78.7%	50.7%	0.0‰
Stockholms Specialistvård	708	96.8%	79.8%	55.5%	1.4‰
Nation	55,458	82.6%	81.1%	59.1%	7.6‰

[1] Refers to number of primary operations during period.
[2] Refers to proportion of primary operations for primary osteoarthritis.
[3] Refers to proportion of primary operations for age group 60 years or older (age at primary operation).
[4] Refers to proportion of women receiving primary surgery during period.
[5] 90-day mortality (number of patients dying within three months of primary operation/ number of primary operations during period).

The mortality rates are generally low and should be assessed with the same caution as the variable 'reoperation within 2 years', i.e. as a possible trend over time.

Gender perspective

Total arthroplasty

In the preceding Annual Report we presented a more detailed analysis of differences between genders based on all primary arthroplasties performed between 1992 and 2006. During that period of 15 years forming the basis for the analysis there were changes concerning patient demography and treatment. For this reason we have in the present analysis of total arthroplasties focused on the latest two years so as to better reflect the situation today. In total, 28,115 primary prostheses from 2006 and 2007 were included (women: n=16.536 – 58.8%; men: 11,579 – 41.2%).

To compensate for possible co-variation between variables a logical regression analysis was used including age, side, first or second hip operated on (in cases of bilaterality), diagnosis, incision, choice of prosthesis type (all-cemented, all-uncemented, hybrid, reversed hybrid, surface replacement implant) and choice of component fixation (cemented/uncemented cup, cemented/uncemented stem). Factors emerging from the analysis in a statistically secure manner are presented.

During the past two years women have been operated on at an average age of 69.8 years *SD=10.8*. The average age for men was almost three years lower (67.0 *11.0*). As in the preceding evaluation for 1992-1996, women were more frequently operated on on the right side (55.9%) than men (52.3%). Women also underwent operation on both sides more than men did: of hip implants inserted during 2006/2007, 20.9% were in women who had earlier undergone arthroplasty on the other side. The corresponding proportion in men was thus somewhat lower (19.8%). Note that the first operation on these patients often occurred before 2006, introducing a certain uncertainty and risk of error sources.

Men are operated on for primary osteoarthritis more frequently than women (87.2% and 80.6% of all hip arthroplasties). Posterior incision is used more often on men (56.7% compared with 54.1%) and anterior lateral incision when lying on the side relatively more frequently in women (36.7% compared to 37.9%). Choice of implant type does not differ significantly; however choice of component fixation does. Men more frequently receive uncemented stems (22.6%; women 15.9%).

In general terms, the risk of revision is larger for men. In the combined cohort of all primary operations between 1992 and 2007 and after adjustment for possible differences in the variables mentioned earlier, the risk increase is about 50% (Exp(B) = 1.48 CI: 1.41-1.56) when all causes of revision including infection are taken into account. The reason for this is certainly multifactorial, where degree of activity and possibly also increased morbidity from certain associated diseases that raise the risk of prosthesis-related complications by affecting behaviour, susceptibility to infection and skeleton quality play their part. One interesting exception is the outcome after operation with surface replacement implants. After this operation the risk in the Swedish material is double for women. This finding tallies with international experience. Poorer bone quality in women may be one cause of fractures and loosening. However, certain observations suggest that the risk may be related to the dimensions of the skeleton such as femoral head and neck sizes. The risk increases with decreasing size, which could explain that women with their generally smaller skeletons are more frequently afflicted.

Hemi-prosthesis

Since hemi-prostheses have only been registered for three years, there has been a rapid expansion of the database. We have there again evaluated gender-related differences in terms of patient demography (age, gender, side, bilaterality), surgical technique (incision, method of fixation) and outcome (revision, reoperation) in various regression analyses. Up to and including 2007 there were complete data from 12,245 operations (72.8% women). In this cohort the average age was just over a year higher for women (83.9 years) than for men (82.7 years). Unlike the case in primary total arthroplasty, women mostly undergo hip arthroplasty on the left side (53.2%; men 50.6%). Acute operation for primary fracture is relatively more common in women (93.1%; men 91.3%) than operations for complications of healing after osteosynthesis or for other reasons. In a Cox regression analysis we found that the risk of reoperation was about 30% greater for men (Exp(B) 1.28 CI: 1.03-1.59). The gender difference regarding risk of exchange or extraction of one or all implant components (revision) was about equally great (Exp (B) 1.32 CI: 1.05-1.68).

During the period 2006-2007 there were differences between the genders.

In total hip arthroplasty these concerned:

- **Age on operation.**
- **Side operated on.**
- **Occurrence of bilateral arthroplasty.**
- **Diagnosis.**
- **Choice of incision.**
- **Way of fixing stem.**
- **Risk of revision.**

And in hemi-arthroplasty:

- **Age on operation.**
- **Side operated on.**
- **Diagnosis.**
- **Risk of reoperation and revision.**

Hip fracture and prosthesis surgery, part 1

Every tenth patient in the total arthroplasty database underwent surgery for hip fracture. This diagnosis group has not previously been analysed separately. The patient may be treated primarily with a total implant or with a secondary implant at a later stage owing to complications after internal fixation (pinning/screwing) such as re-dislocation or avascular necrosis.

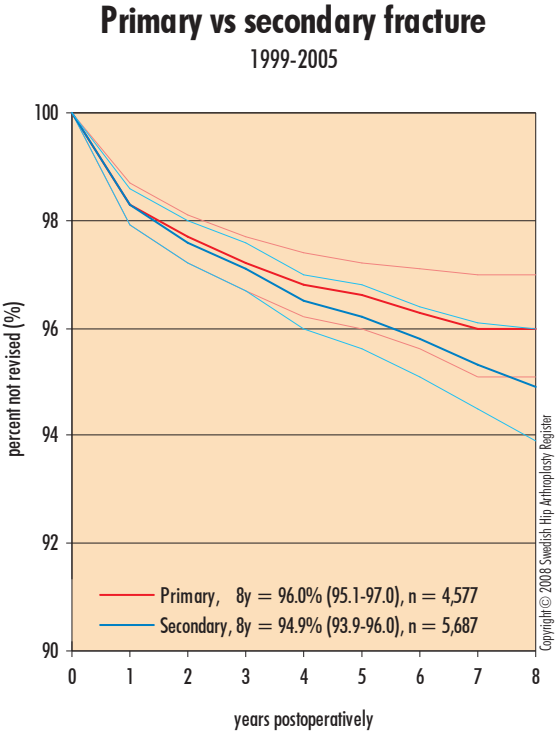
In this study, 10,264 cases of fracture-related prostheses were analysed. The patients underwent surgery during the period 1999-2005, a period when Swedish orthopaedic surgeons were altering their treatment strategy for displaced femoral neck fractures. From having almost exclusively used internal fixation there was a transition to hip arthroplasty, and during 2005 this treatment was employed in 70% of the cases. Hemi-arthroplasty is now commonly used, the proportion of total arthroplasties remaining constant at around 10-15%. With the reduction in internal fixation operations, secondary prostheses became less common, declining from 76% to 43% during the period.

The purpose of the study was to compare the outcomes for primary and secondary total arthroplasties, respectively. The few studies so far have shown increased revision frequency for secondary prostheses. To ensure that the intervention was correctly coded, more than 6,000 operation reports were manually validated. These included all those with the diagnosis S72.00 (acute cervical fracture), a diagnosis that most orthopaedic surgeons know by heart. There was a suspicion that instead of complicated code combinations for secondary prosthesis owing to various hip complications, the simple but incorrect S72.00 had been chosen. And it turned out that 12% of these cases were incorrectly coded, and were corrected prior to analysis. Of the secondary interventions scrutinized, 0.2% were incorrectly coded as primary, for which reason we did not collect and check all the other cases coded as secondary implants.

The study shows that the fracture-related hip prostheses, chiefly among men, were revised to a higher degree than other hip prostheses. The main reason was dislocation and to a certain extent fracture adjacent to the implant. This tallies well with earlier studies and is probably because these fracture patients represent an entirely different patient population from those receiving surgery for osteoarthritis.

There was no significant difference between fracture-related primary and secondary total arthroplasties regarding revision frequency, which contradicts earlier studies. In statistical analyses of fracture patients, male gender was a risk factor for revision regardless of cause.

Anterior incision entailed a lower risk of revision regardless of cause. Posterior incision involved an increased risk of revision owing to dislocation, but a decreased risk of revision for loosening. Loosening is, however, primarily a problem in the long-term and with the high mortality in these patients, few will develop loosening.



The risk of revision for loosening was strongly increased with the ScanHip® stem and somewhat with the Charnley® stem, while the Cenator® stem gave an increased risk of revision for both loosening and fracture adjacent to the implant. These stems are no longer used in Sweden. Both the Exeter® stem and the Lubinus SPII® stem, the clearly most used stems in Sweden, had a lower risk of revision irrespective of cause and the Lubinus SPII® stem also had a lower risk of revision for fracture adjacent to the implant.

In summary we found no differences in revision frequency between primary and secondary arthroplasty for femoral neck fracture. From the patient's point of view a secondary operation is probably more burdensome. Other studies has shown poorer life quality and function and more pain after a hip arthroplasty secondary to failed internal fixation than after a primary arthroplasty.

- **When a fracture patient undergoes hip arthroplasty, an anterior approach and a well-documented implant should be used.**
- **Use the correct ICD-10 code for diagnosis and measure.**

Hip fracture and prosthesis surgery, part 2

The number of national quality indicators increases to over one hundred in the forthcoming third edition of the report 'Regional Comparisons'. One of these new indicators related to hip arthroplasty is presented below.

Method and material

The material was obtained from the Patient Register (EpC, National Board of Health and Welfare). Selection criteria were cervical hip fracture (S72.00) in patients over 64 years of age. The observation time was 2006 and 2007. The indicator (blue bars in the histogram) shows proportion of patients treated primarily with hemi-arthroplasty (NFB09 and 19) or total arthroplasty (NFB29, 39, 49 and 99). Hemi-arthroplasties dominated, with about 80% of the material. The analysis the first year was run only at county-council level.

Result

Please see the figure below. The analysis shows a large spread between the various county councils, 38-68%, and a national average of 55%.

Discussion

Cervical hip fracture can be operated on either with internal fixation or with hip arthroplasty. Current research has shown that hip arthroplasty in displaced fractures (Garden III and IV) gives a considerably better result with fewer than 10% of failed cases compared with 40-50% following internal fixation. This finding has led to changes in the treatment model in Sweden during the past ten years.

A proportion of 60-70% should receive hip arthroplasty primarily in an evidence-based treatment algorithm. About 30-35% of cervical fractures, however, should still be operated on with internal fixation where they are not displaced or occur in younger individuals (where there may be advantages with internal fixation). In addition, acute, life-threatening disease may indicate that the more limited internal fixation should be selected.

In view of current research results, the large variability found between the different county councils is surprising. The registry management had expected a certain spread but not so large as the analysis shows. Providing prosthesis surgery for 70% of all femoral neck fractures, however, places great demands on the departments, with reorganisation of on-duty work and requirements for increased surgical competence. Characteristic of the county councils/regions that have a large proportion of implants is their earlier participation in large clinical multi-centre studies which now underlie the altered treatment model.

One reason for some departments/county councils to hesitate over full implementation of the new model is the fear that prolonged operation times and implant costs may make care of hip fractures more expensive. While the treatment model makes the first care occasion more expensive, it results in a fivefold reduction in reoperation frequency and so it is, on the contrary, very cost-effective. Primary hip arthroplasty thus leads to less pain, easier rehabilitation and better health-related quality of life for the patient.

Hip arthroplasty among first-time cases of hip fracture as main diagnosis 2006-2007
age-standardised values for both genders

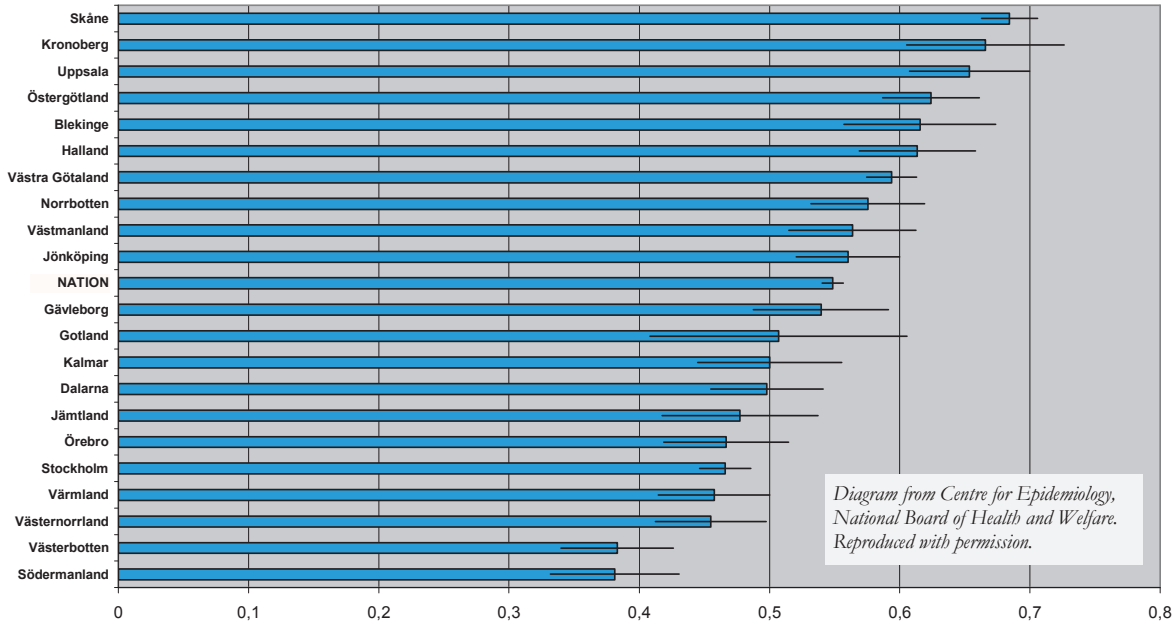


Diagram from Centre for Epidemiology, National Board of Health and Welfare. Reproduced with permission.

Hemi-arthroplasty

Hemi-arthroplasty registration started in 2005. In 2007, 4,181 operations were registered, compared to 4,205 and 3,859 during the years immediately preceding. High average age (84 years) and a larger proportion of women (72%) than in the total arthroplasty database (69 years and 60%) illustrate the fact that hemi-arthroplasty is used chiefly in acute hip fracture (94%) and in complications after pinning/screwing of hip fractures (5%). By way of comparison, only 11% of total arthroplasties are related to fracture.

During the past ten years increasingly few patients with hip fracture have undergone surgery involving pinning/screwing. This method led to reoperation with hip implants at a later stage in almost half the cases, owing to failure of the fracture to heal. For this reason, secondary hip arthroplasties are now declining, from 288 operations in 2005 to 200 operations in 2007.

The Lubinus and Exeter stems dominate (47% and 24% respectively) together with the Vario Cup, Mega Caput and UHR Universal heads (31%, 16%, 14%). Every third patient receives a Lubinus stem with a Vario Cup head. As earlier the proportion of modern uncemented implants is around 3%.

The Austin-Moore prosthesis which both in our own and in the Australian Joint Prosthesis Register showed significantly poorer results than other hemi-prostheses is being used less and less. The proportion declined from 9% to 2% between 2005 and 2007. This indicates that Swedish orthopaedic surgeons have noted the information on increased incidence of reoperations after this prosthesis type in previous registry reports.

Mortality

90-day mortality following hemi-arthroplasty is over tenfold greater – 12% – than in total arthroplasty. The two patient groups are entirely different. Hemi-prosthesis patients are older, generally more ill and most often undergo an emergency operation with little scope for pre-operative measures to stabilise their health state. The opposite applies in all respects for a majority of total arthroplasty patients. They are selected for a planned intervention.

The variation in 90-day mortality is great, from 4.6% to 20.7%. For this reason average age, proportion of women, proportion of primary hemi-prostheses and operated on within 48 hours (waiting time obtained from Rikshöft's Annual Report for 2006) are reported. High age, large proportion of men, large proportion of primary interventions and long waiting time increase the mortality. Hospitals that select osteosynthesis for seriously sick individuals naturally show a lower mortality than those that use hemi-prosthesis routinely. With this reservation, departments with high mortality should scrutinise the entire hip-fracture care to identify risk factors that can be influenced.

Reoperation

Reoperations are registered as revisions (replacement or removal of some prosthesis component) and other reoperations. Closed reduction of dislocation is not registered since experience of total prosthesis registration has been that the grey figure becomes all too large. Since 2005, 577 reoperations have been conducted on 396 individuals. The proportions of hemi-arthroplasty patients afflicted by at least one reoperation or revision during the period 2005 to 2007 were 3.2% and 2.6% respectively. Forty percent of these hips underwent reoperation more than once and 17% more than twice. In particular, hip infection can lead to sequential reoperation in which, for this patient clientele, repeated wound revision is often performed instead of a direct resort to revision surgery.

The most common cause of first reoperation is dislocation (49%) followed by infection (23%) and fracture adjacent to the prosthesis (13%). Repeated reoperations (two or more) are conducted chiefly for infection (51%) and dislocation (29%). Fractures adjacent to the prostheses afflict 0.4% of all hemi-arthroplasties. There have been fears that this complication would occur to a larger extent in view of the poorer bone quality and liability to falls among fracture patients.

In the registration of complications there is always a risk of under-reporting and incorrect coding. For this reason validation is going on in the form of co-processing with the Patient Register regarding readmission after any arthroplasty, so as to map possible under-reporting.

Risk factors for reoperation

Risk factors for reoperation have been analysed for all operations between 2005 and 2007 (Cox regression analysis). The risk of reoperation declines with rising age. This circumstance may be caused by a preference for conservative treatment in older individuals owing to feared greater risks of surgery. Male gender, secondary prostheses and uncemented prostheses increase all risks of reoperation by 1.2, 1.7 and 1.8 times respectively (CI 1.0-1.6, 1.3-2.3 and 1.4-2.5). Uncemented implants are mainly Austin-Moore prostheses (see above) but in a separate analysis of 364 uncemented stems with modern design we also found an increased risk of reoperation, 1.8 times that of cemented prostheses (adjusted for age, gender and secondary intervention) (CI 1.1-2.8).

Incision technique

The proportion of posterior incisions has declined somewhat from 53% in 2005-2006 to 51%. Studies show that posterior incision is associated with more dislocations, at least when the surgeon is inexperienced. Register data now confirm this; in a regression analysis a posterior incision increases the risk of revision for dislocation by 1.6 times

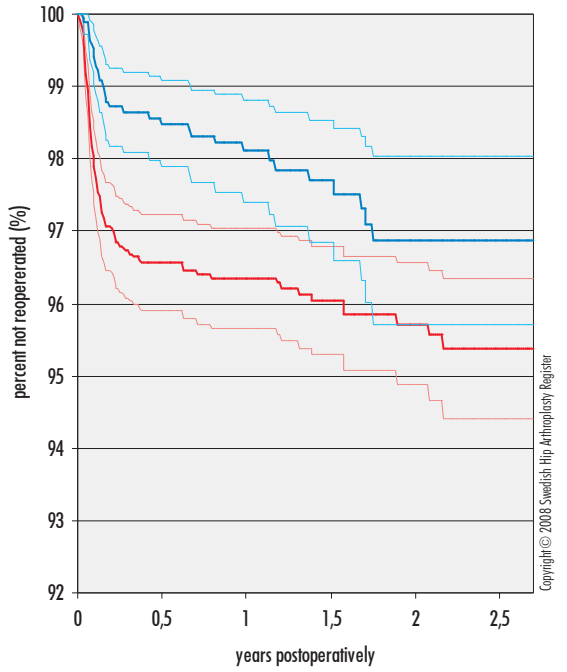


Figure 1a. Prosthesis survival with respect to reoperation for Lubinus SP2 stem in the use of unipolar (blue line) and bipolar (red line) joint heads respectively.

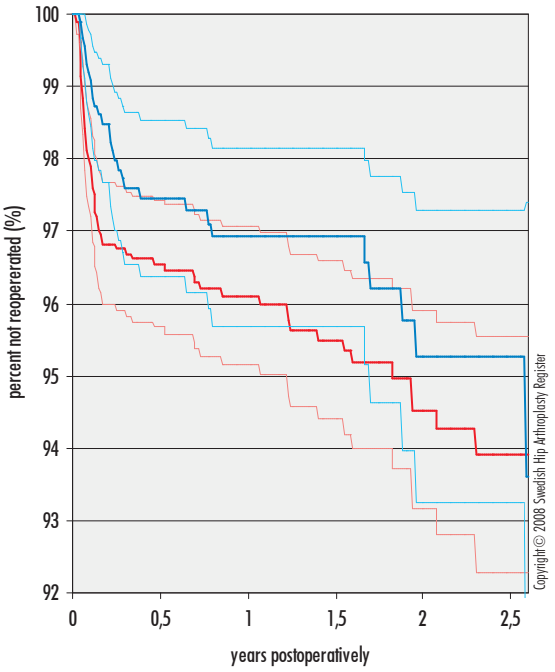


Figure 1b. Prosthesis survival with respect to reoperation for polished Exeter stem in the use of unipolar (blue line) and bipolar (red line) joint heads.

(CI 1.2-2.2). The Austin-Moore and Thompson prostheses also increased the risk of dislocation-related revision, both 1.8 times (CI 1.1-3.1 and 1.5-2.8 respectively).

Fixed or mobile joint head

The absolutely most common implants are Lubinus and Exeter stems. These are combined with two different heads to form uni- or bipolar prostheses (fixed or mobile joint heads). In a risk factor analysis of these two types of stem we find that the bipolar Lubinus Vario Cup is revised 2.2 times more often than the unipolar Lubinus Mega Caput (CI 1.4-3.4). Corresponding values also apply for bipolar joint head on the Exeter stem (UHR universal head) compared with a unipolar solution(Exeter V40 Unipolar) (1.7 times, CI 1.03-2.8). In the analysis adjustment is made for other risk factors such as age, gender, incision and secondary prosthesis.

The reason for this difference is unclear. The data suggests that the bipolar prosthesis is burdened with more complications, but we cannot exclude the possibility that there is a greater inclination to revise bipolar prostheses than unipolar, for other reasons. In a theoretical treatment model, bipolar prostheses are used on quite healthy older people with higher functional demands, while the cheaper unipolar is used in patients with health or functional impairment. If then the presumed healthier and biologically younger individuals with bipolar prostheses are afflicted by complications, the physician may be more inclined to recommend revision. But in the analysis we adjusted for age, and the crude mortality rate where actually higher after bipolar arthroplasty surgery, indicating that they are not 'biologically younger'. It is possible that the extra measures that surgery with a bipolar head involves may increase the risk of operational-technical problems. We found no significant difference between the groups regarding causes of revision.

Until now, no reliable scientific support for a definitive advantage of bi- or unipolar prostheses has been found. If the increased risk of revision with the bipolar prosthesis is a real one and not an effect of other factors for which we cannot correct, the finding signifies a research breakthrough. To see whether this risk is nevertheless an effect of selection bias, co-processing with the Patient Register (EpC, National Board of Health and Welfare) is planned, investigating the significance of general morbidity for selection of method and revision.

Reoperations per reason

number of primary THRs, 2005-2007

Prosthesis type	Total	Share [1]
Revisions	366	63.4%
~ related to infection	87	
~ related to dislocation	198	
~ related to fracture	43	
~ related to osteoarthritis	13	
~ related to loosening	3	
~ other diagnoses	22	
Other reoperations	211	36.6%
~ related to infection	138	
~ related to dislocation	47	
~ related to fracture	17	
~ other diagnoses	9	

[1] share of total number of reoperations performed 2005-2007.

Reoperations per reason

number of individuals, 2005-2007

Prosthesis type	Total	Share [1]
Dislocation	197	49.7%
Infection	114	28.8%
Peri-prosthetic fracture	53	13.3%
Acetabular erosion	13	3.3%
Aseptic loosening	2	0.5%
Others	17	4.3%
Total	396	99.9%

[1] share of total number of re-operated individuals performed 2005-2007.

Prosthesis type	2005	2006	2007	Total	Share [1]
Lubinus SP II	1,455	1,663	1,962	5,080	41.5%
Exeter Polished	870	928	991	2,789	22.8%
Thompson	354	360	243	957	7.8%
Spectron EF Primary	351	408	181	940	7.7%
CPT (CoCr)	187	211	240	638	5.2%
Moore	329	216	75	620	5.1%
ETS Endo	98	86	99	283	2.3%
Müller Straight	101	84	60	245	2.0%
Corail Stem	26	91	91	208	1.7%
Bi-Metric Fracture Stem	42	53	19	114	0.9%
MS30 Polished	0	1	112	113	0.9%
Basis	0	41	50	91	0.7%
Charnley	26	31	3	60	0.5%
Covision Straight	0	0	23	23	0.2%
Others	20	30	29	79	0.7%
Missing	0	2	3	5	0.0%
Total	3,859	4,205	4,181	12,245	100%

Table 1. The most common hemi-arthroplasty stems 2005-2007. 1) Proportion of total number of operations carried out 2005-2007.

Prosthesis type	2005	2006	2007	Total	Share [1]
Vario Cup	1,001	1,051	1,304	3,356	27.4%
Mega Caput	463	655	680	1,798	14.7%
UHR Universal Head	590	577	590	1,757	14.3%
Modular Biarticular	314	431	388	1,133	9.3%
Unipolar Head	337	449	227	1,013	8.3%
V40 Unipolar	277	327	371	975	8.0%
Unipolarhuvud	95	57	120	272	2.2%
Moore Modular Hemi-head (Anatomica)	33	51	13	97	0.8%
Versys Endo	5	5	61	71	0.6%
Hastings	26	31	3	60	0.5%
Others	11	12	65	88	0.7%
Monoblock Prostheses	706	558	359	1,623	13.3%
Missing	1	1	0	2	0.0%
Total	3,859	4,205	4,181	12,245	100%

Table 2. The most common types of joint head 2005-2007. 1) Proportion of total number of operations carried out 2005-2007.

90-day mortality after hemi-prosthesis

proportion deceased within three months after primary THR, 2005-2007

Hospital	Number [1]	>80 yrs [2]	Female [3]	Primary prosthetics [4]	Surgery within 48h [5]	Mortality [6]
University/Regional Hospitals						
KS/Huddinge	182	80%	75%	96%	86%	17.6%
KS/Solna	166	75%	73%	78%		19.3%
Linköping	173	78%	75%	95%	96%	8.7%
Lund	367	66%	71%	95%	96%	13.4%
Malmö	676	81%	71%	94%	93%	11.8%
SU/Sahlgrenska	146	63%	57%	87%		15.1%
SU/Östra	155	74%	75%	95%		8.4%
Umeå	184	61%	73%	92%	90%	9.2%
Uppsala	276	82%	70%	98%		20.7%
Central Hospitals						
Borås	279	84%	67%	94%	92%	17.9%
Danderyd	302	80%	75%	98%		12.6%
Eksjö	150	83%	67%	95%	97%	6.0%
Eskilstuna	163	82%	80%	97%		17.8%
Falun	354	71%	79%	90%	97%	9.0%
Gävle	313	75%	80%	87%		13.1%
Halmstad	198	80%	65%	93%	94%	20.7%
Helsingborg	469	74%	72%	94%	94%	17.9%
Hässleholm-Kristianstad	348	74%	76%	92%	90%	9.8%
Jönköping	181	79%	71%	91%	90%	11.6%
Kalmar	278	82%	71%	96%	94%	15.5%
Karlskrona	267	78%	67%	94%	95%	11.2%
Karlstad	127	81%	72%	86%	94%	15.7%
Norrköping	167	89%	73%	97%	97%	15.6%
S:t Göran	283	86%	84%	83%		13.4%
Skövde	130	77%	78%	86%	94%	4.6%
SU/Mölndal	799	73%	72%	96%	88%	12.4%
Sunderby (including Boden)	382	69%	70%	96%		10.5%
Sundsvall	211	63%	73%	85%	97%	9.0%
Södersjukhuset	660	81%	71%	77%	85%	10.8%
Uddevalla	592	78%	67%	91%	94%	12.7%
Varberg	183	75%	70%	86%		12.0%
Västerås	370	78%	74%	96%		12.4%
Växjö	172	75%	70%	92%	88%	9.9%
Ystad	155	74%	79%	97%		7.7%
Örebro	247	71%	74%	86%	95%	9.3%
Östersund	238	70%	76%	89%	91%	10.1%
Rural Hospitals						
Alingsås	128	70%	76%	99%	98%	10.2%
Gällivare	45	71%	87%	91%		11.1%
Hudiksvall	136	82%	71%	90%	96%	16.9%
Karlskoga	102	72%	73%	88%	96%	9.8%
Kungälv	134	78%	69%	96%	91%	12.7%
Lidköping	111	68%	71%	75%		12.6%
Lindesberg	100	77%	64%	94%	94%	15.0%
Ljungby	81	85%	73%	98%	97%	19.8%

(continued on next page.)

90-day mortality after hemi-prosthesis (cont.)

proportion deceased within three months after primary THR, 2005-2007

Hospital	Number [1]	>80 yrs [2]	Female [3]	Primary prostheses [4]	Surgery within 48h [5]	Mortality [6]
Rural hospitals						
Mora	80	84%	79%	89%		13.8%
Motala	97	77%	77%	94%	94%	9.3%
Norrtälje	29	76%	76%	72%		13.8%
Nyköping	90	91%	81%	96%	96%	5.6%
Skellefteå	116	69%	78%	92%	97%	6.0%
Sollefteå	117	69%	74%	94%		12.0%
Södertälje	47	74%	81%	74%	88%	14.9%
Torsby	73	77%	73%	90%	85%	19.2%
Visby	95	82%	76%	83%	95%	5.3%
Värnamo	130	80%	75%	93%	98%	8.5%
Västervik	78	81%	86%	85%	95%	6.4%
Örnsköldsvik	97	70%	75%	94%		13.4%
Nation	12,245	71%	72%	94%		12.0%

[1] Refers to number of primary and secondary operations during the period.
[2] Refers to proportion of operations on patients aged over 80 years.
[3] Refers to proportion of women during the period
[4] Refers to the proportion of primary operations during the period (not secondary).
[5] Refers to proportion undergoing surgery within 48 hours (from Rikshöft's Annual Report 2006).
[6] 90-day mortality (100 (number of patients dying within three months of primary operation/ number of operations during the period)).*

Hospitals with fewer than ten hemi-arthroplasties 2005-2007 excluded.

The BOA project

BOA – better management of patients with osteoarthritis

The general results of hip arthroplasty in Sweden are very good, both in the short-term and in the long-term. Ten years after operation, about 6-7 patients of 100 have undergone reoperation for a replacement. The registry has certainly, for almost thirty years, contributed to these good results. In continued technical development the results can surely be further improved, but probably only marginally. The large potential for improvement is probably within the dimensions patient-reported results such as gain in health-related quality of life gain, degree of satisfaction and cost-utility effect.

The Swedish Hip Arthroplasty Register has therefore during the past few years broadened its areas of interest to cover the whole course of disease, predominantly among patients with osteoarthritis. Indications for surgery in this dominating disease group are: pronounced pain and low health-related quality of life, i.e. purely subjective experience of disease. There is thus a lack of entirely objective indications. In patients with rheumatoid arthritis (a declining proportion) and patients with fracture sequelae, the indications for surgery are partly different.

The operation with its selection of good surgical technique and well-documented prosthesis types has long been analysed in detail by the registry. Yet a number of factors not dependent on the operation affect subjective, patient-reported results and the cost utility of the intervention. Such factors may include:

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

It is the definite opinion of the registry management that these factors are 'forgotten' if Swedish hip arthroplasty is controlled only via productivity thinking, which, unfortunately, at present and in the wake of the 'new' care guarantee is often the case.

The present basis for treatment of osteoarthritis in national and international treatment recommendations is detailed information, weight control and adapted physical training. In a register study covering 20 hospitals and 2,700 patients undergoing hip arthroplasty (2005-2007) only one-third met a physiotherapist before the operation. In another study covering 1,240 patients (2005) only 11% of the patients had received complete non-surgical treatment (information, meeting with physiotherapist, adapted physical training, walking aids and analgesics as required) pre-operatively. One year post-operatively, these patients had significantly better health gains (EQ-5D), were significantly more satisfied and had better pain relief than the group that had not been given full non-surgical treatment. In addition the cost-utility effect (cost per quality-adjusted life year) was significantly lower for these patients.

We thus know that in Sweden at present the care programmes available for osteoarthritis treatment are not being followed. The osteoarthritis patient management program described below was developed at Spenshult Hospital for Rheumatic Diseases in 2006 and is based on available evidence and patients' wishes and experience of treatment of osteoarthritis. The osteoarthritis patient management program includes information on what osteoarthritis is, possible risk factors, available treatment, tips for self-care and individually adapted training. One information meeting is led by an expert patient, a patient with osteoarthritis who has undergone special teacher training to be able to report on the lived experience with osteoarthritis and his or her experience of non-surgical treatment.

At present the National Board of Health and Welfare is running a project on musculoskeletal disorders. A group has been tasked to produce recommendations for non-surgical osteoarthritis treatment consonant with the international guidelines described above.

The BOA project

Planning for the BOA project was started in autumn 2006. The osteoarthritis patient management program started at ten sites in Västra Götaland, Värmland, Västerbotten and Skåne and was started with standardised treatment and follow-up and with common measurement instruments. These include socioeconomic variables, pain and satisfaction measurement and measurement of health-related quality of life (EQ-5D) before and after treatment. A national and web-based BOA register is under development.

We will be able to merge this register (subsequent to ethical approval) with the Swedish knee and hip arthroplasty registers and other national registers (Statistics Sweden and Centre for Epidemiology, National Board of Health and Welfare). To be able to include treatment costs, co-processing is also planned with existing CPP (cost per patient) databases. It will be possible to study variables that control the medical care process in osteoarthritis so as to optimise care of these patients at the same time as cost-efficiency can be improved.

The plan is, during 2008, to establish routines, logistics

and web function and to consolidate database functions and structure. Expansion with more participating units is not planned until 2009. A multidisciplinary steering group has been linked with the project, consisting of orthopaedic surgeons, rheumatologists, nurses, physiotherapists, representatives from the Swedish Rheumatism Association and register managers from the Swedish Hip Arthroplasty Register.

Summarised aims for the BOA project:

- To intervene early in the course of the disease in patients with hip and knee osteoarthritis,
- To improve health-related quality of life and function for these patients,
- To reduce the ill-health rate – reduce unnecessary sick-listing in this patient group,
- For many patients it is expected that the improvement will be so good that operative treatment can be postponed or rendered unnecessary,
- Standardise indications for surgery – i.e. only patients with therapy failure in non-surgical treatment can be candidates for surgery,
- Improve effects of surgical intervention experienced by the patient,
- Improve cost effectiveness following surgery.

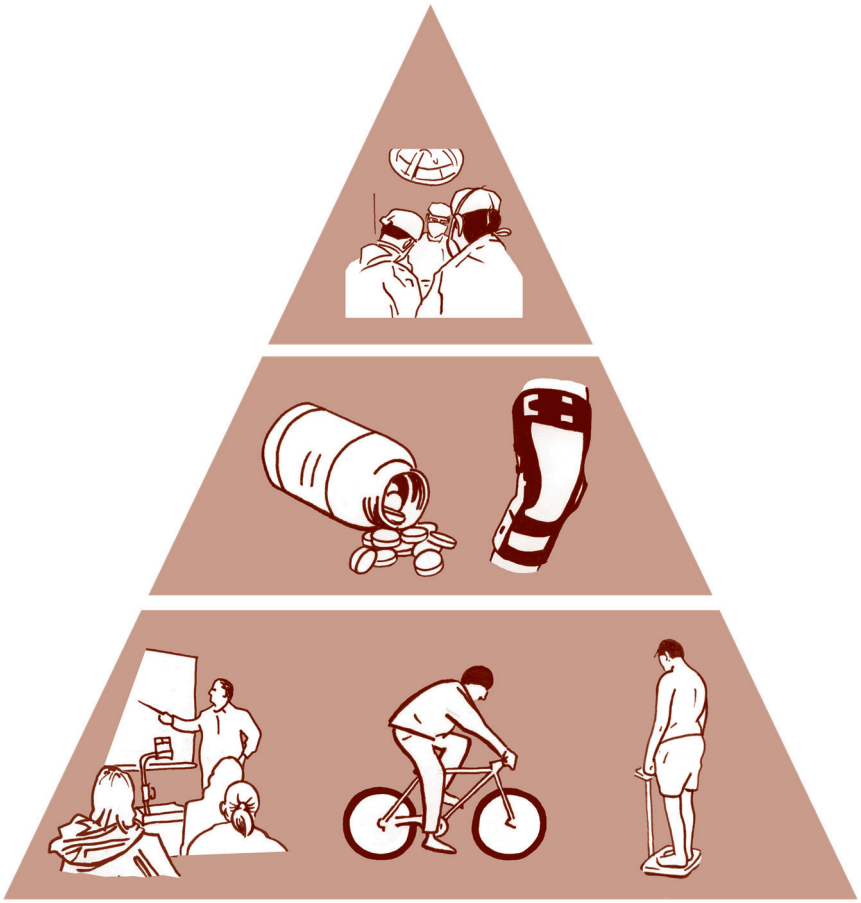


Figure 1. Basic treatment of osteoarthritis according to both Swedish and international treatment recommendations consists of information, training and weight control (www.lakemedelsverket.se). This treatment should be offered to all patients with osteoarthritis as early as possible in the disease course. As a supplement, certain patients may need different types of pain-relieving treatment or aid. At the summit of the treatment pyramid is surgical intervention which, even though it is a very effective treatment, is considered only for a very small proportion of all patients with osteoarthritis.

Illustration taken from and published with the permission of the Spenshult osteoarthritis management course.

Regions – process and result measurements

	Stockholm-Gotland	South-east	South	West	Uppsala-Örebro	North
Share of primary THRs nationwide	20.1%	11.7%	18.0%	16.3%	23.0%	10.9%
Demographics						
Average age *SD*	68.7 *11.3*	69.9 *10.6*	69.0 *11.3*	68.9 *11.3*	69.2 *10.8*	68.6 *10.4*
Share of females	63.0%	58.6%	58.9%	59.1%	59.2%	60.0%
Share of osteoarthritis	81.2%	79.1%	80.5%	79.0%	78.9%	83.2%
Share of optimal case-mix [1)]	41.1%	37.3%	38.6%	37.7%	37.8%	40.1%
Type of fixation						
Cemented	81.6%	90.8%	90.9%	80.0%	88.1%	92.9%
Uncemented	6.8%	3.0%	3.0%	7.3%	7.7%	2.5%
Hybrid	0.8%	4.1%	2.6%	9.3%	1.3%	2.9%
Reversed hybrid	9.1%	1.3%	1.4%	2.4%	2.3%	1.4%
Resurfacing implant	1.1%	0.5%	1.5%	1.0%	0.4%	0.2%

Table 1. Percentual distribution of primary prostheses between regions, and demography and choice of prosthesis fixation/type between 1998 and 2007.
[1)] Woman, >=60 years with primary osteoarthritis.

During the past ten years in Sweden about 140 primary total hip arthroplasties per 100,000 inhabitants have been performed, an increase compared with the first half of the 1990s. Regional differences were about 35 per 100,000 inhabitants. Most operations were performed in Uppsala-Örebro followed by Stockholm and Gotland which together represent 43.1% of all primary operations (see table above). The spread in average age was 1.3 years. Patients in the South-eastern Region had the highest average ages and those in the Northern Region the lowest. The proportion of women varied by up to 4.4% and the proportion of patients with primary osteoarthritis by up to 4.3%. Most patients with optimal 'case-mixes' underwent surgery in Stockholm-Gotland and fewest in the South-eastern Region.

Choice of prosthesis fixation or prosthesis type varied over the country. During the most recent 10-year period the Northern Region inserted the largest proportion of all-cemented prostheses and Uppsala-Örebro the most all-uncemented. The hybrid concept was used primarily in the Western Region and the reversed hybrid in the Stockholm-Gotland region. Surface-replacement implants were used restrictively overall. This concept has been evaluated primarily in the southern Stockholm-Gotland and Western regions.

The trend towards increased use of all uncemented implants emerging in the national statistics was reflected during the period 2005-2007 in four of the regions (Stockholm-Gotland, Southern, Western, Uppsala-Örebro). In the South-eastern and Northern regions a marginal decrease (0.4% and 0.9%) was noted between 2006 and 2007. Reversed hybrids increased in all regions except the South-eastern which is the only region to show an increase in wholly-cemented prostheses (+1.3%) between 2006 and 2007. Against the background of this year's in-depth analyses and the absence of university hospitals evaluating new prosthesis concepts in the region, this conservative attitude appears well warranted.

The proportion of surface replacement prostheses varied, with low figures. Between 2006 and 2007 the Southern Region exhibited the largest increase, from 2.4% to 3.3%. The largest decrease was noted in the Western Region, from 2.3% to 1.7%.

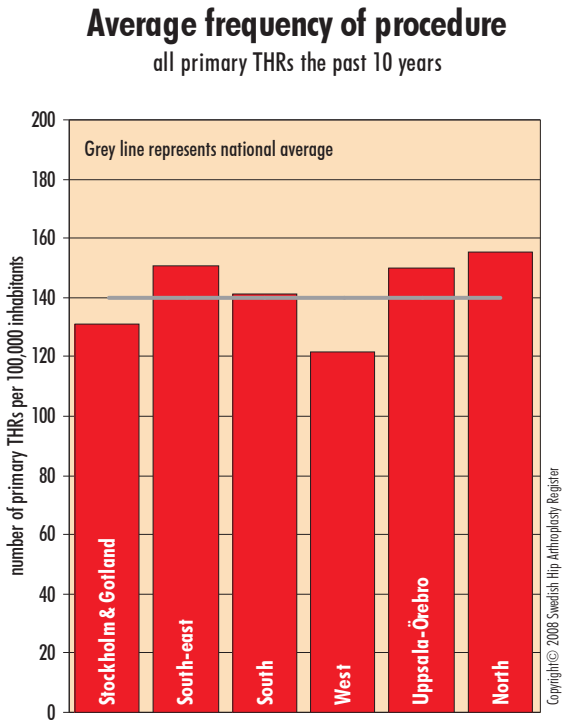


Figure 1. Average procedure frequency in the different regions for primary total hip arthroplasty performed during the past 10 years. Procedure frequency is calculated as a mean value of the procedure frequencies for the units included in each region.

The fifteen most common implants and choices of fixation are reported by region during the periods 1979-2002 and then annually up to 2007. In addition the number of primary operations is illustrated together with the procedure frequency in relation to the national average per year since 1992. The proportion of primary operations in the region and the revisions these entailed are reported in histograms. The aggregate revision burden (RB) for 1979-2007 and 1992 to 2007 are given and also, during the latter period, by gender. During this period the RB varied between 7.8 (Northern Region) and 10.8 (Stockholm-Gotland and Western regions). The variation may reflect many factors. There is a difference in patient demography between the regions as shown in the table and the attitude or indications to carry out a revision may vary locally. In some regions numerous evaluations of new implants and operational methods are evaluated and if these do not live up to expectations this may generate more revisions. In certain regions there is even more extensive follow-up, so that pending clinical complications such as development of osteolysis and wear, are discovered early. This often means that a reoperation is carried out early despite moderate symptoms. In this way more extensive interventions at a later stage may be avoided. Surgical technique and skill also play their part, particularly in those regions that have assumed a relatively larger responsibility for training during the past ten years.

In summary we find that within Swedish hip arthroplasty there are more or less appreciable regional differences. Many of these may be explained by differences in demography. In regions that accept a large number of immigrants from southern Europe and the near East, moreover, the relative need of hip arthroplasty may probably be reduced somewhat, partly owing to lower average ages but also owing to the fact that hip osteoarthritis, at least so far, is not as common in these population groups. Differences in attitudes to surgical intervention may also be an important reason why regional procedure frequencies vary. Notwithstanding, a difference of more than 25% between the regions that do the most procedures per inhabitant and those that do the least is remarkable. Such variations must be noticed by politicians and more resources made available for some regions.

Over 15 years the Western Region has had the lowest accessibility/procedure frequency regarding hip arthroplasty within the region. This has been disadvantageous both for the individual patient and for development of this treatment in western Sweden.

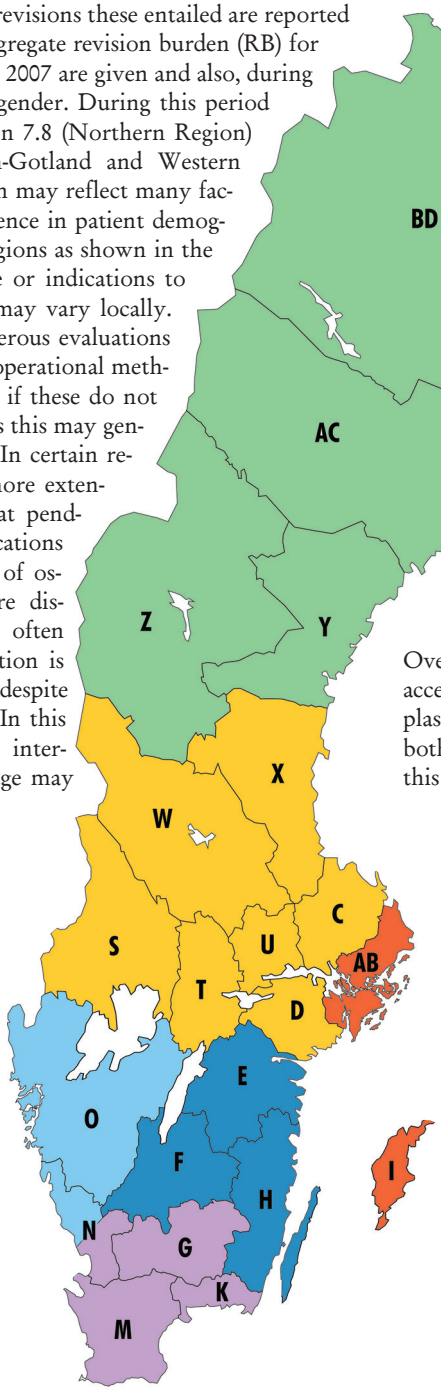


Figure 2. Regional distribution according to the National Board of Health and Welfare. Letters refer to county designations. Subsequent pages include two pages for each region. On these pages, tabs are coded in the same colour as on the map to make them easier to find.

Region Stockholm & Gotland

15 most common implants

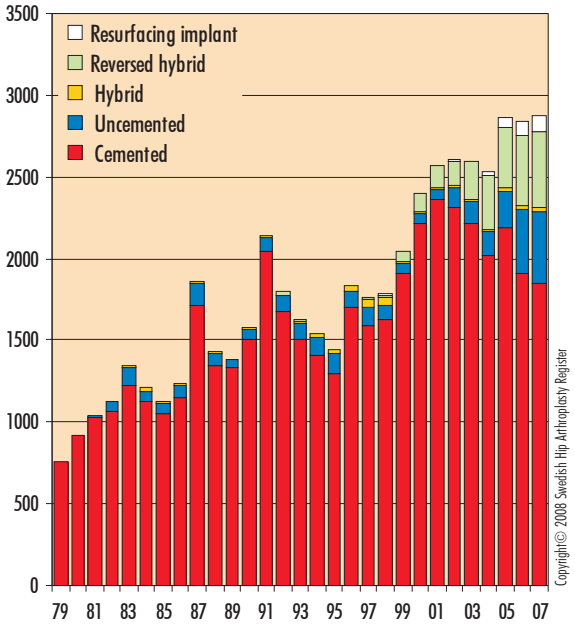
most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Charnley (Charnley)	22,347	154	71	6	1	2	22,581	20.1%
Charnley Elite (Exeter Polished)	1,754	772	574	517	512	496	4,625	18.3%
Reflection (Spectron EF Primary)	569	387	361	348	242	170	2,077	8.2%
Charnley (Exeter Polished)	224	188	287	326	195	189	1,409	5.5%
Weber All-poly Cup (Straight-stem Standard)	337	137	196	164	125	191	1,150	4.6%
Lubinus All-poly (Lubinus SP II)	810	82	77	109	162	112	1,352	4.0%
Biomet Müller (CPT (steel))	816	133	1	0	0	0	950	3.6%
Contemporary Hooded Duration (Exeter Polished)	25	69	65	156	243	226	784	3.1%
Biomet Müller (CPT (CoCr))	0	60	145	137	90	46	478	1.9%
FAL (Lubinus SP II)	60	71	68	109	77	85	470	1.9%
CLS Spotorno (CLS Spotorno)	23	34	37	63	124	147	428	1.7%
ZCA (CPT (CoCr))	0	3	47	136	104	94	384	1.5%
Charnley Elite (ABG Uncem.)	224	127	15	1	0	0	367	1.5%
Trident HA (Accolade)	0	0	24	67	128	133	352	1.4%
Charnley Elite (Lubinus SP II)	77	56	65	80	33	25	336	1.3%
Others (357)	11,580	328	504	652	844	1,002	14,910	
Total	38,846	2,601	2,537	2,871	2,880	2,918	52,653	

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

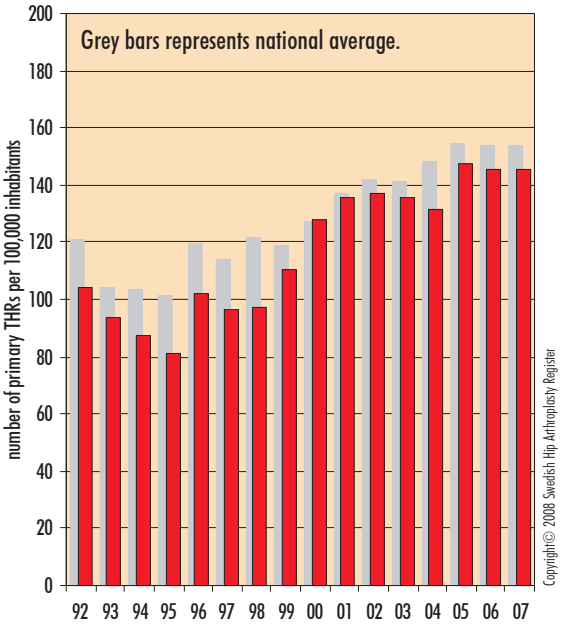
Number of primary THRs

per type of fixation, 1979-2007



Frequency of procedure

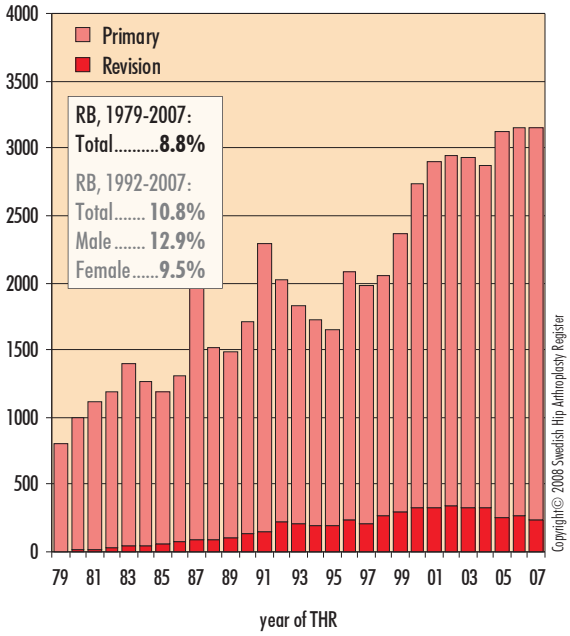
all primary THRs included



Stockholm & Gotland

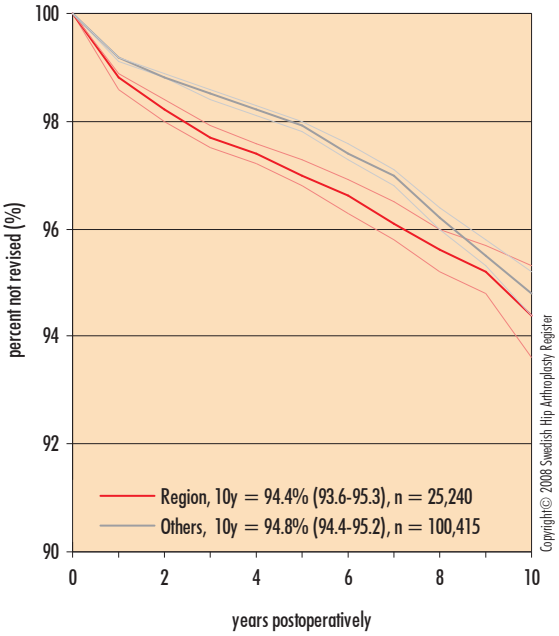
Number of THRs per year

52,653 primary THRs, 5,093 revisions, 1979-2007



Implant survival

all primary THRs the past 10 years



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	16,389	2,117	2,021	2,392	2,397	2,457	27,773	78.8%
Fracture	2,528	257	305	289	269	273	3,921	11.1%
Idiopathic femoral head necrosis	699	64	63	77	81	74	1,058	3.0%
Inflammatory arthritis	798	56	59	43	53	39	1,048	3.0%
Childhood disease	360	79	60	52	62	62	675	1.9%
Tumour	127	13	15	12	10	8	185	0.5%
Other secondary osteoarthritis	153	3	2	0	2	0	160	0.5%
Secondary arthritis after trauma	59	12	12	6	5	5	99	0.3%
(missing)	345	0	0	0	1	0	346	1.0%
Total	21,458	2,601	2,537	2,871	2,880	2,918	35,265	100%

Average age per gender and year

Gender	1992-2002	2003	2004	2005	2006	2007	Total
Male	67.6	66.3	65.9	66.0	65.4	65.9	66.9
Female	70.5	69.8	69.9	69.6	69.3	69.7	70.2
Total	69.5	68.4	68.3	68.2	67.7	68.3	69.0

Region South-east

15 most common implants

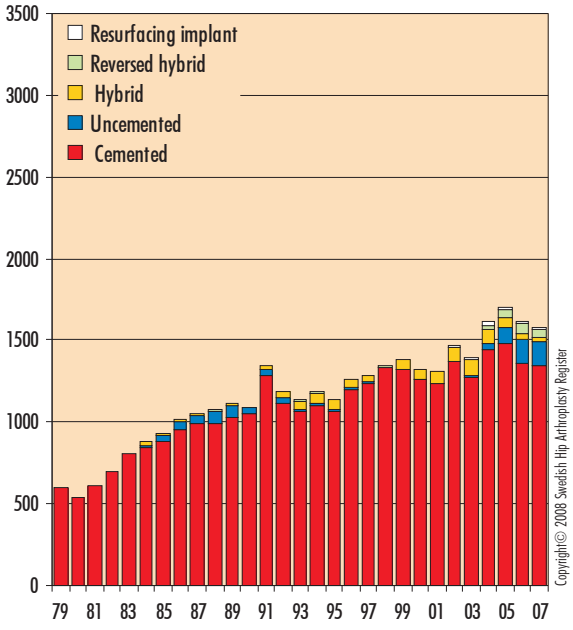
most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus All-poly (Lubinus SP II)	9,098	797	1,180	1,338	1,283	1,249	14,945	66.5%
FAL (Lubinus SP II)	827	290	159	66	31	49	1,422	9.6%
Exeter Duration (Exeter Polished)	539	16	1	1	0	1	558	3.8%
SHP (Lubinus SP II)	562	1	3	3	2	3	574	1.9%
Charnley Elite (Exeter Polished)	254	20	28	26	12	6	346	1.9%
Contemporary Hooded Duration (Exeter Polished)	73	134	41	12	13	9	282	1.9%
Trilogy HA (Lubinus SP II)	76	40	42	37	20	0	215	1.4%
Exeter All-poly (Exeter Polished)	950	0	0	0	0	0	950	1.3%
OPTICUP (Lubinus SP II)	231	0	0	0	0	0	231	1.3%
M2a (Bi-Metric HA lat)	0	7	20	26	46	36	135	0.9%
Charnley Elite (Lubinus SP II)	237	7	3	6	1	5	259	0.9%
Biomex HA (Lubinus SP II)	74	30	3	0	0	0	107	0.7%
Reflection HA (Lubinus SP II)	56	15	23	10	1	1	106	0.7%
Lubinus All-poly (Bi-Metric HA lat)	0	0	21	28	27	24	100	0.7%
Contemporary Hooded Duration (Lubinus SP II)	0	0	23	21	10	10	64	0.4%
Others (total 178)	12,797	34	68	131	173	211	13,414	
Total	25,774	1,391	1,615	1,705	1,619	1,604	33,708	

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

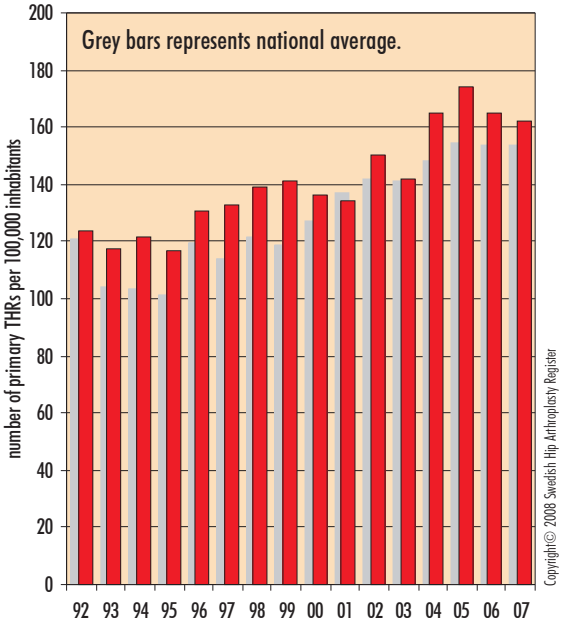
Number of primary THRs

per type of fixation, 1979-2007



Frequency of procedure

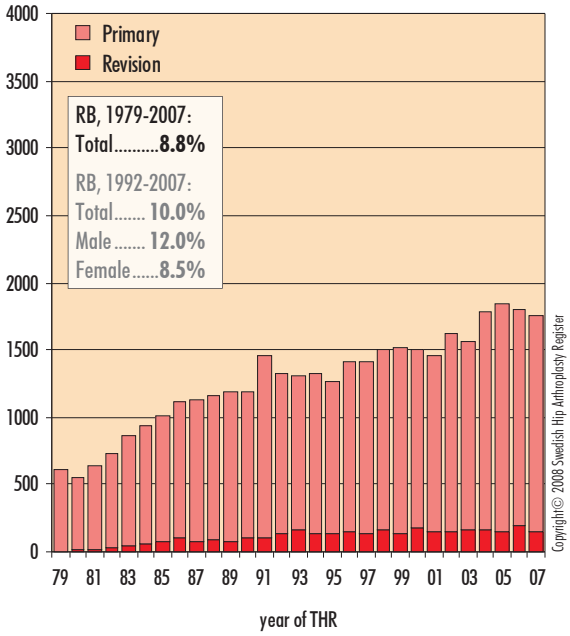
all primary THRs included



South-east

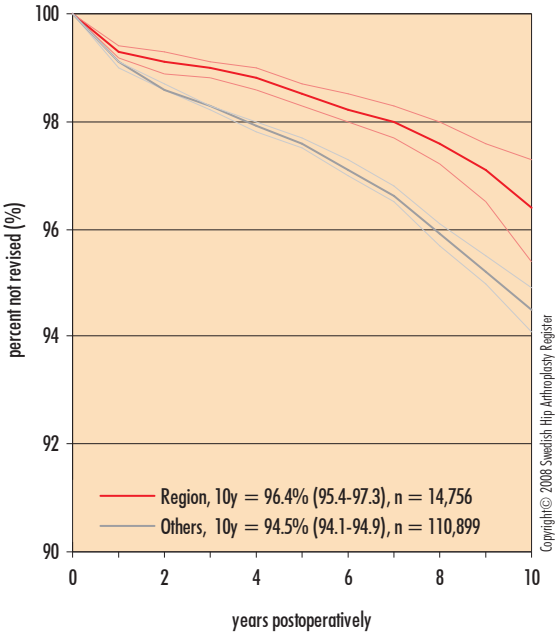
Number of THRs per year

33,708 primary THRs, 3,240 revisions, 1979-2007



Implant survival

all primary THRs the past 10 years



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	10,276	1,101	1,302	1,417	1,360	1,317	16,773	76.4%
Fracture	1,927	180	219	192	174	204	2,896	13.2%
Inflammatory arthritis	736	43	27	22	21	26	875	4.0%
Idiopathic femoral head necrosis	437	39	30	34	29	26	595	2.7%
Childhood disease	167	12	23	26	26	22	276	1.3%
Other secondary osteoarthritis	270	0	0	0	0	0	270	1.2%
Tumour	43	14	12	11	8	8	96	0.4%
Secondary arthritis after trauma	35	2	2	3	0	1	43	0.2%
(missing)	124	0	0	0	1	0	125	0.6%
Total	14,015	1,391	1,615	1,705	1,619	1,604	21,949	100%

Average age per gender and year

Gender	1992-2002	2003	2004	2005	2006	2007	Total
Male	68.8	68.3	68.3	68.7	68.0	68.3	68.6
Female	71.4	71.0	71.0	70.2	70.5	70.6	71.1
Total	70.3	69.9	69.9	69.6	69.5	69.6	70.1

Region South

15 most common implants

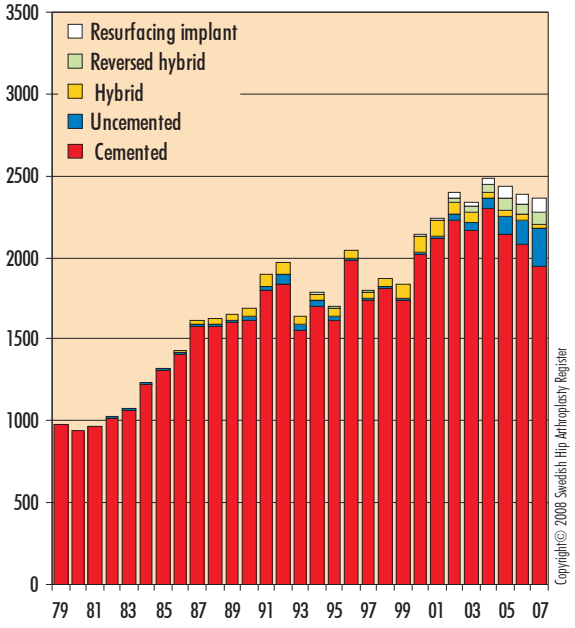
most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1]
Exeter Duration (Exeter Polished)	2,654	963	979	736	812	584	6,728	29.7%
Lubinus All-poly (Lubinus SP II)	5,758	580	697	613	446	359	8,453	24.2%
OPTICUP (Scan Hip II Collar)	1,824	125	10	0	1	0	1,960	7.6%
Charnley Elite (Exeter Polished)	190	158	192	222	285	188	1,235	5.5%
Exeter All-poly (Exeter Polished)	2,700	6	10	2	2	0	2,720	3.7%
Contemporary Hooded Duration (Exeter Polished)	9	87	120	196	126	238	776	3.4%
Charnley (Charnley Elite Plus)	950	0	0	0	0	0	950	3.0%
ZCA XLPE (MS30 Polished)	0	0	0	6	211	376	593	2.6%
Trilogy HA (Lubinus SP II)	317	40	34	28	21	3	443	1.8%
Weber All-poly Cup (MS30 Polished)	42	114	150	16	12	64	398	1.8%
Charnley Elite (Charnley Elite Plus)	320	0	0	0	0	0	320	1.3%
Charnley (Exeter Polished)	126	44	43	50	26	16	305	1.3%
ZCA (MS30 Polished)	0	0	7	223	44	0	274	1.2%
Charnley (Charnley)	6,127	5	3	0	0	0	6,135	1.1%
OPTICUP (Lubinus SP II)	46	33	56	48	30	8	221	1.0%
Others (total 290)	18,013	187	190	308	390	587	19,675	
Total	39,076	2,342	2,491	2,448	2,406	2,423	51,186	

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

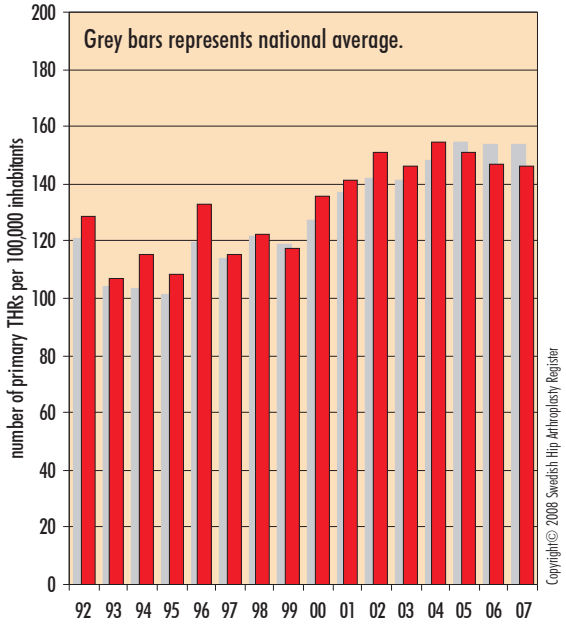
Number of primary THRs

per type of fixation, 1979-2007



Frequeny of procedure

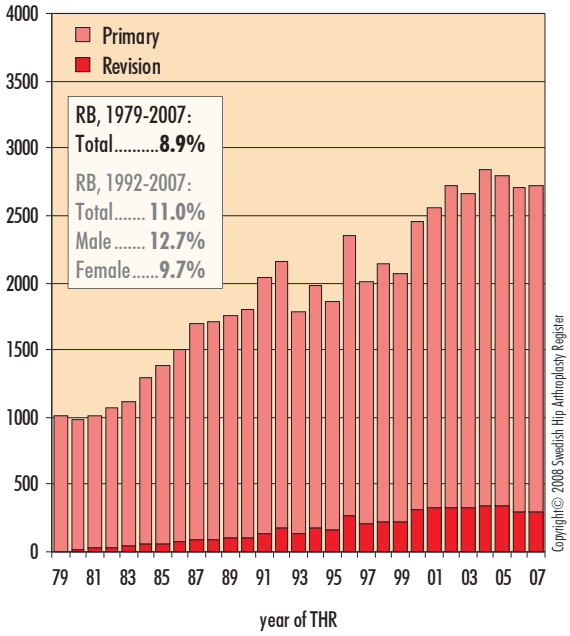
all primary THRs included



South

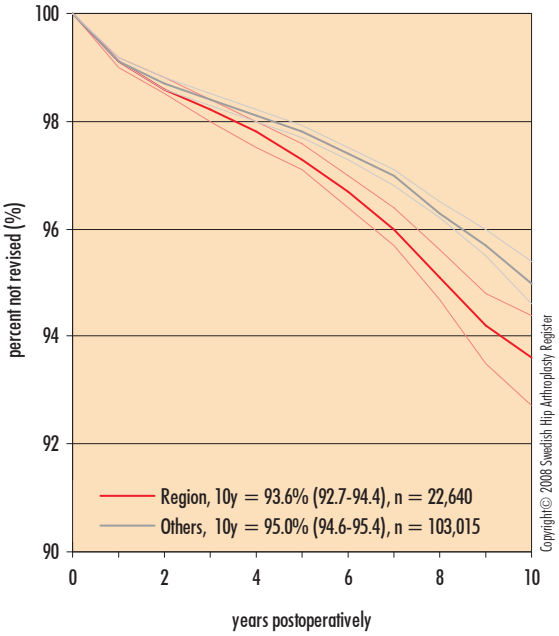
Number of THRs per year

51,186 primary THRs, 4,981 revisions, 1979-2007



Implant survival

all primary THRs the past 10 years



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	15,789	1,856	2,055	2,071	2,016	2,041	25,828	76.8%
Fracture	2,699	245	222	182	214	205	3,767	11.2%
Inflammatory arthritis	1,226	83	65	68	46	56	1,544	4.6%
Idiopathic femoral head necrosis	685	83	79	62	74	70	1,053	3.1%
Childhood disease	313	47	44	40	38	30	512	1.5%
Tumour	147	17	21	18	13	14	230	0.7%
Other secondary osteoarthritis	143	0	0	4	0	1	148	0.4%
Secondary arthritis after trauma	38	11	5	3	5	6	68	0.2%
(missing)	488	0	0	0	0	0	488	1.5%
Total	21,528	2,342	2,491	2,448	2,406	2,423	33,638	100%

Average age per gender and year

Gender	1992-2002	2003	2004	2005	2006	2007	Total
Male	68.1	67.7	66.9	66.7	67.5	66.5	67.7
Female	70.6	69.9	70.3	69.6	69.6	69.7	70.3
Total	69.6	69.0	68.9	68.3	68.8	68.4	69.3

Region West

15 most common implants

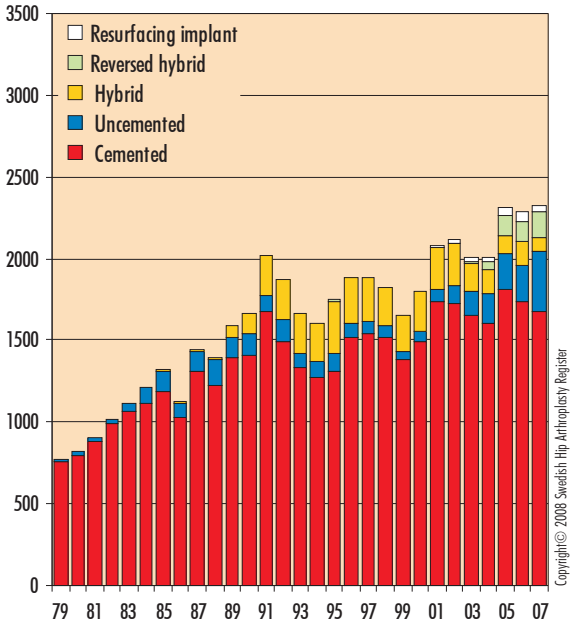
most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus All-poly (Lubinus SP II)	7,634	1,157	1,111	1,364	1,343	1,251	13,860	52.0%
Reflection (Spectron EF Primary)	2,556	382	356	339	266	97	3,996	16.7%
Trilogy HA (Spectron EF Primary)	761	127	107	80	100	23	1,198	5.3%
Biomet Müller (RX90-S)	1,360	0	0	0	0	0	1,360	2.8%
Trilogy HA (CLS Spotorno)	22	22	65	124	126	187	546	2.7%
Charnley Elite (Spectron EF Primary)	132	36	37	27	24	32	288	1.4%
ZCA (Stanmore Mod)	86	53	55	26	23	3	246	1.2%
BHR Acetabular Cup (BHR Femoral Head)	31	17	20	35	36	27	166	0.8%
ABG II HA (ABG Uncem.)	120	12	9	8	0	0	149	0.7%
Trilogy HA (Versys Stem)	34	53	43	8	7	0	145	0.7%
Reflection XLPE (Spectron EF Primary)	0	0	0	0	2	142	144	0.7%
Contemporary (Exeter Polished)	366	1	0	0	0	0	367	0.7%
ABG II HA (Lubinus SP II)	152	2	3	0	3	0	160	0.7%
Stanmore (Stanmore Mod)	72	0	13	15	21	3	124	0.6%
OPTICUP (Optima)	449	0	0	0	0	0	449	0.5%
Others (total 344)	22,899	141	184	283	333	570	24,410	
Total	36,674	2,003	2,003	2,309	2,284	2,335	47,608	

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

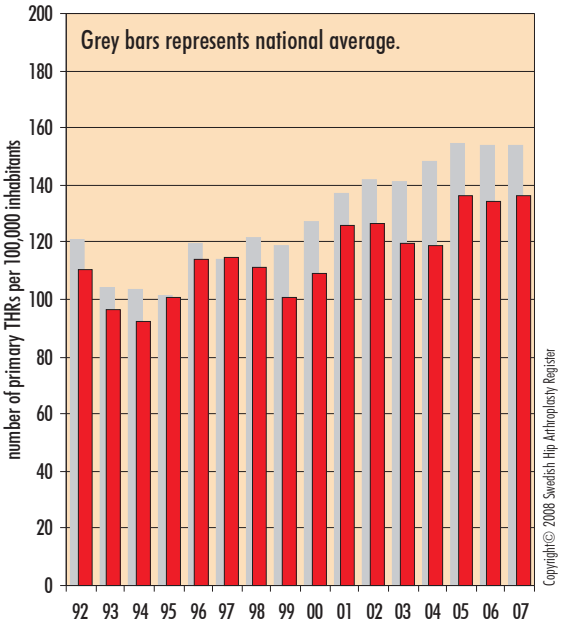
Number of primary THRs

per type of fixation, 1979-2007



Frequency of procedure

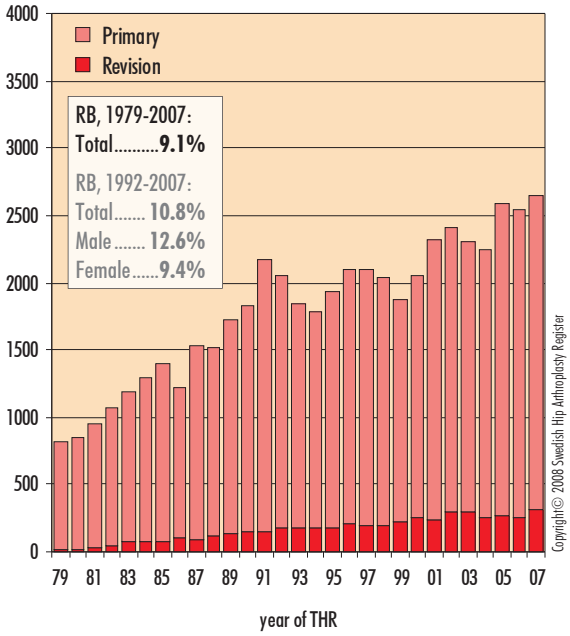
all primary THRs included



West

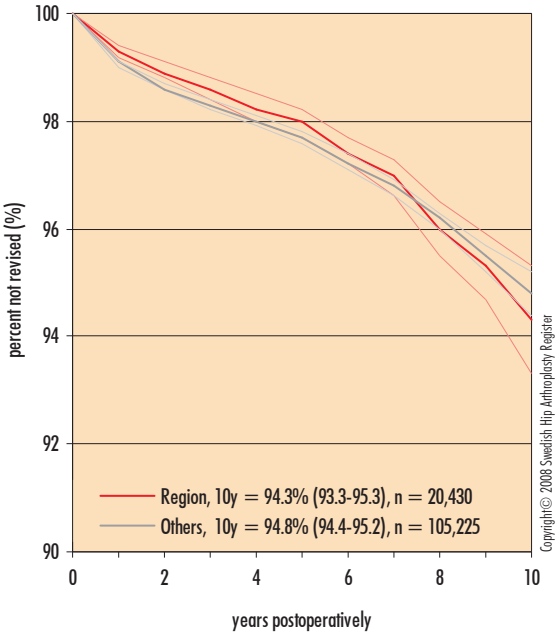
Number of THRs per year

47,608 primary THRs, 4,774 revisions, 1992-2007



Implant survival

all primary THRs the past 10 years



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	15,009	1,550	1,568	1,898	1,912	1,934	23,871	77.6%
Fracture	2,287	292	240	217	202	228	3,466	11.3%
Inflammatory arthritis	930	65	76	75	62	63	1,271	4.1%
Idiopathic femoral head necrosis	411	44	50	45	48	48	646	2.1%
Childhood disease	397	33	49	59	45	49	632	2.1%
Other secondary osteoarthritis	269	0	0	0	0	0	269	0.9%
Tumour	77	13	14	13	12	12	141	0.5%
Secondary arthritis after trauma	30	6	6	2	3	1	48	0.2%
(missing)	414	0	0	0	0	0	414	1.3%
Total	19,824	2,003	2,003	2,309	2,284	2,335	30,758	100%

Average age per gender and year

Gender	1992-2002	2003	2004	2005	2006	2007	Total
Male	67.6	68.1	66.9	66.2	67.0	66.6	67.3
Female	70.1	70.2	69.6	69.2	69.9	70.0	70.0
Total	69.1	69.4	68.5	68.0	68.7	68.5	68.9

Region Uppsala-Örebro

15 most common implants

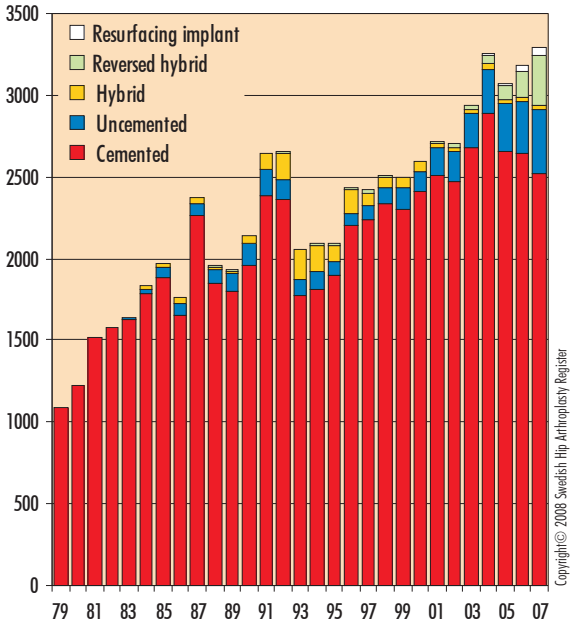
most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus All-poly (Lubinus SP II)	6,626	1,034	1,140	1,064	1,045	1,143	12,052	30.4%
Charnley (Charnley)	15,744	122	7	2	1	1	15,877	9.5%
FAL (Lubinus SP II)	319	450	473	423	411	301	2,377	8.2%
Exeter Duration (Exeter Polished)	1,206	212	161	153	104	55	1,891	6.6%
Charnley Elite (Exeter Polished)	145	112	203	215	353	460	1,488	5.2%
Contemporary Hooded Duration (Exeter Polished)	187	271	288	210	225	282	1,463	5.1%
Reflection (Spectron EF Primary)	389	120	154	101	107	18	889	2.9%
Exeter Duration (Lubinus SP II)	214	109	114	119	128	67	751	2.6%
Müller All-poly (Müller Straight)	4,093	60	77	79	55	71	4,435	2.4%
Cenator (Exeter Polished)	659	1	0	0	0	0	660	2.3%
Charnley Elite (Lubinus SP II)	160	65	95	81	74	57	532	1.8%
Stanmore (Stanmore Mod)	471	18	0	0	0	0	489	1.7%
Trilogy (CLS Spotorno)	76	58	78	83	87	92	474	1.6%
Charnley (Exeter Polished)	461	46	103	142	58	0	810	1.5%
Cenator (Cenator)	1,152	0	0	0	0	0	1,152	1.5%
Others (total 356)	18,645	266	358	396	536	768	20,969	
Total	50,547	2,944	3,251	3,068	3,184	3,315	66,309	

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

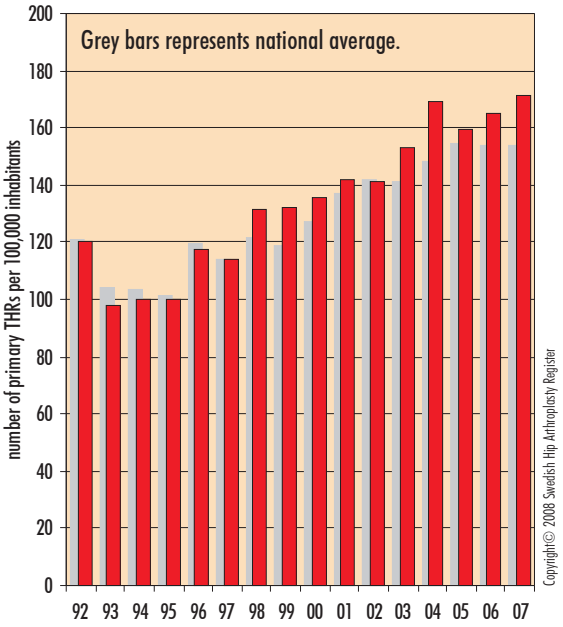
Number of primary THRs

per type of fixation, 1979-2007



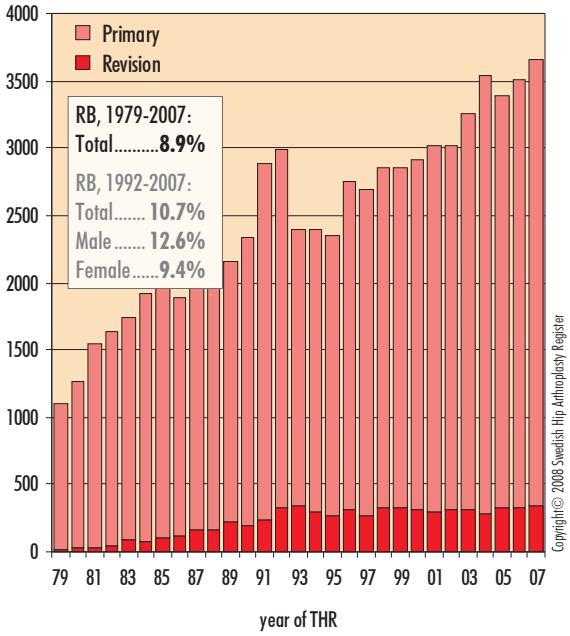
Frequency of procedure

all primary THRs included



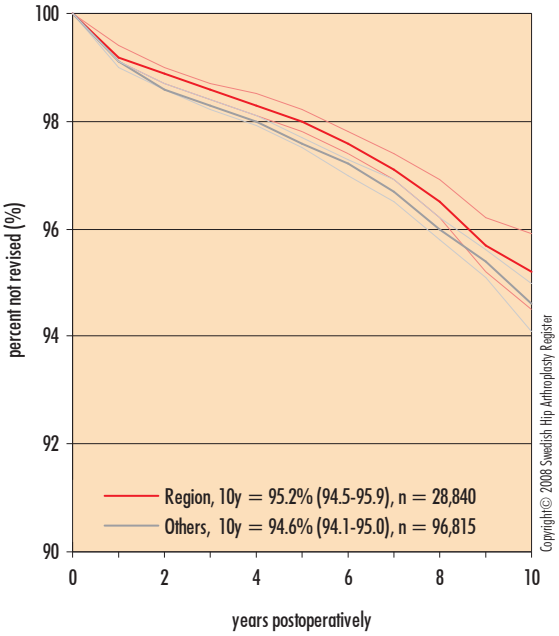
Number of THRs per year

66,309 primary THRs, 6,463 revisions, 1979-2007



Implant survival

all primary THRs the past 10 years



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	19,371	2,304	2,607	2,468	2,587	2,696	32,033	77.3%
Fracture	2,979	361	335	334	312	357	4,678	11.3%
Inflammatory arthritis	1,410	100	95	86	87	67	1,845	4.5%
Idiopathic femoral head necrosis	822	83	92	85	91	71	1,244	3.0%
Childhood disease	442	69	101	66	92	102	872	2.1%
Tumour	115	20	18	25	13	19	210	0.5%
Other secondary osteoarthritis	193	0	0	0	0	0	193	0.5%
Secondary arthritis after trauma	61	7	3	4	2	3	80	0.2%
(missing)	293	0	0	0	0	0	293	0.7%
Total	25,686	2,944	3,251	3,068	3,184	3,315	41,448	100%

Average age per gender and year

Gender	1992-2002	2003	2004	2005	2006	2007	Total
Male	67.9	68.0	66.9	67.5	68.0	67.3	67.8
Female	70.5	70.3	70.0	70.5	70.2	69.9	70.4
Total	69.4	69.4	68.7	69.3	69.3	68.8	69.3

Region North

15 most common implants

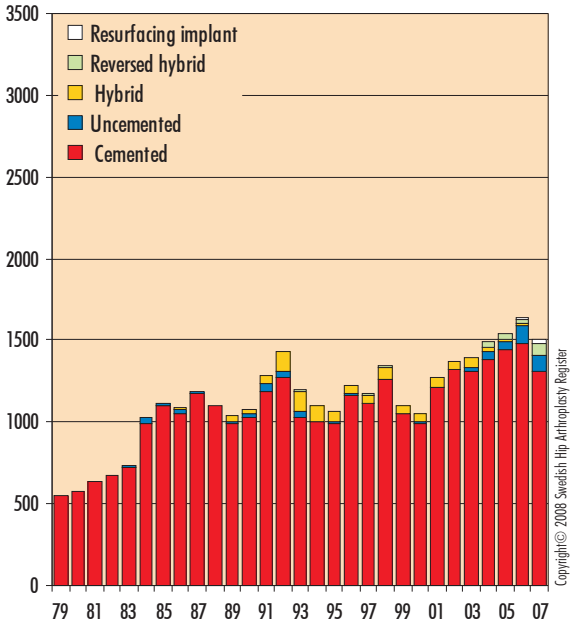
most used during the past 10 years

Cup (Stem)	1979-2002	2003	2004	2005	2006	2007	Total	Share [1)]
Lubinus All-poly (Lubinus SP II)	10,794	1,062	1,190	1,217	1,250	1,112	16,625	70.4%
Exeter Duration (Exeter Polished)	829	225	187	229	204	172	1,846	13.4%
Exeter All-poly (Exeter Polished)	1,136	2	0	0	0	0	1,138	3.0%
FAL (Lubinus SP II)	183	20	6	1	15	6	231	1.7%
Trilogy HA (Lubinus SP II)	110	61	30	5	4	2	212	1.5%
Reflection (Spectron EF Primary)	212	0	0	0	0	0	212	1.3%
Scan Hip Cup (Optima)	423	0	0	0	0	0	423	1.0%
Trilogy HA (CLS Spotorno)	0	2	1	9	54	53	119	0.9%
Charnley (Charnley)	2,432	1	0	0	0	0	2,433	0.9%
Reflection HA (Spectron EF Primary)	99	0	0	0	0	0	99	0.5%
Trident HA (Symax)	0	0	0	8	43	6	57	0.4%
Exeter Duration (Omnifit)	8	0	16	10	1	0	35	0.3%
Lubinus All-poly (CLS Spotorno)	0	0	0	5	5	24	34	0.2%
Reflection HA (Lubinus SP II)	84	0	0	0	0	1	85	0.2%
Reflection HA (Synergy HA)	0	0	0	2	8	22	32	0.2%
Others (total 200)	9,257	28	67	62	53	112	9,579	
Total	25,567	1,401	1,497	1,548	1,637	1,510	33,160	

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

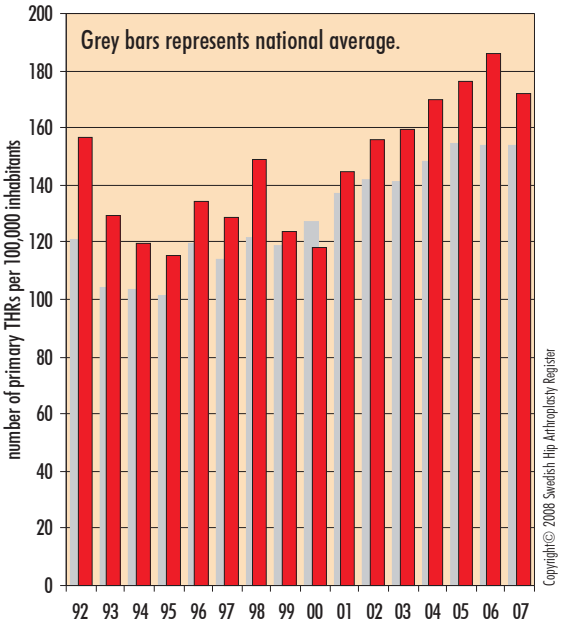
Number of primary THRs

per type of fixation, 1979-2007



Frequency of procedure

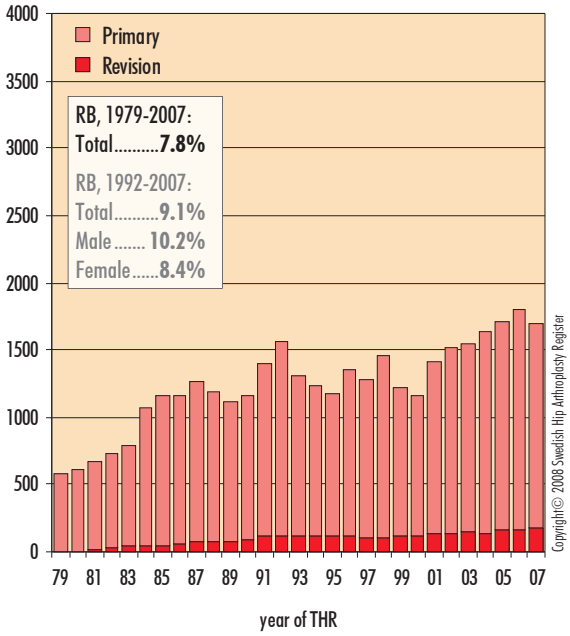
all primary THRs included



North

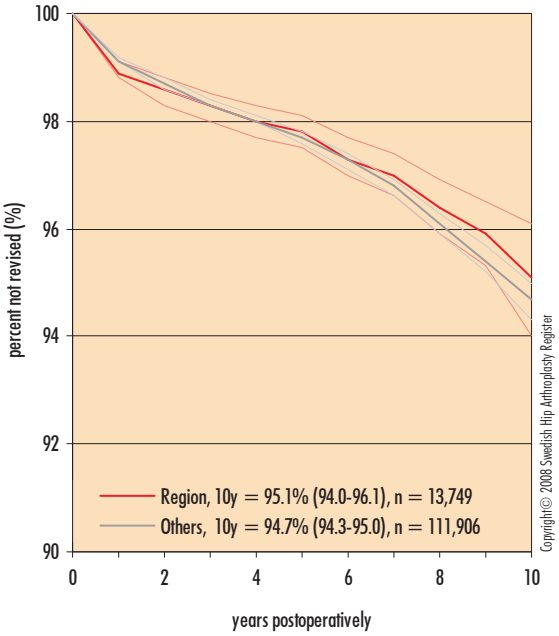
Number of THRs per year

33,160 primary THRs, 2,797 revisions, 1979-2007



Implant survival

all primay THRs the past 10 years



Number of primary THRs per diagnosis and year

Diagnosis	1992-2002	2003	2004	2005	2006	2007	Total	Share
Primary osteoarthritis	10,201	1,187	1,229	1,341	1,436	1,270	16,664	79.5%
Fracture	1,163	113	144	102	86	124	1,732	8.3%
Inflammatory arthritis	643	32	35	31	39	36	816	3.9%
Idiopathic femoral head necrosis	421	31	30	37	30	39	588	2.8%
Childhood disease	183	32	45	27	34	26	347	1.7%
Other secondary osteoarthritis	266	0	0	0	0	0	266	1.3%
Tumour	45	6	13	10	10	13	97	0.5%
Secondary arthritis after trauma	89	0	1	0	2	2	94	0.4%
(missing)	352	0	0	0	0	0	352	1.7%
Total	13,363	1,401	1,497	1,548	1,637	1,510	20,956	100%

Average age per gender and year

Gender	1992-2002	2003	2004	2005	2006	2007	Total
Male	67.9	67.2	67.3	67.5	67.3	67.1	67.7
Female	70.0	69.4	68.9	68.9	68.7	69.3	69.6
Total	69.1	68.5	68.3	68.3	68.1	68.4	68.8

Notes

National quality indicators

Under the heading 'Regional Comparisons' National Board of Health and Welfare and the Swedish Association of Local Authorities and Regions are co-operating to openly report and compare the quality and efficiency of the health and medical services. One purpose of this work is to make the jointly-financed health and medical services open for inspection. The general public and interest groups of different types are entitled to information on the quality and efficiency of the activities. 'Regional Comparisons' also give good factual material for the public and political debate on health and medical care.

An equally important purpose is to contribute to the governance of health and medical care. County councils and regions have better support in the form of knowledge for follow-up and control of their own activities. Comparisons spur county councils and regions to improve and contribute to mutual learning.

In this year's report (published 6/10 2008) the number of quality indicators has been increased from 75 to 101. The indicators are divided into four groups, medical results, patient experience, accessibility and costs. For each indicator the county councils are ranked in diagrams, in which the results for the county council and nationally are reported. Statistics by gender are often presented, while gender differences are commented on in the text,

For this year's report a number of indicators are presented at hospital level so as to stimulate local improvement work. The Swedish Hip Arthroplasty Register is one of 18 national quality registers that supply data to 'Regional Comparisons'. The registry is responsible for three indicators as below. A further two illustrate hip arthroplasty with data from the Patient Register (EpC, National Board of Health and Welfare): 'Hip fractures and arthroplasty, part 2' and 'Readmission within 30 days'. These indicators are shown in this report on pages 94 and 38, respectively.

Implementation

In the medical areas with established national quality registers, the National Board of Health and Welfare and SALAR started co-operation with the registry in autumn 2005 to obtain adequate indicators. One basic requirement was that the indicators should be reported openly. After discussion with the registry management the following indicators were selected from the Hip Arthroplasty Register:

Short-term complications, i.e. reoperation (all kinds of further surgery) within two years of primary operation. Reported for the previous four years. This variable should in this connection be considered as a 'fast' quality indicator. Note that the Report refers to complications dealt with surgically. (See section 'Short-term complications – reoperation within two years', page 35).

Ten-year implant survival according to traditional Kaplan-Meier statistics. The definition of failure is replacement of one or both components or definitive removal of the implant. All primary diagnoses and all causes of revision are included. The result refers to activities from 1998 up to and including 2007. This variable should be considered as a 'slow', but in the long-term important, quality indicator.

EQ-5D index gain one year after operation. The government commission states that 'indicators that reflect patient-reported quality should be included'. The patient-reported outcome measure with health gain is an important variable for this patient group, operated on as they are with poor health-related quality of life as an indication for surgery. This variable should also be considered as a 'fast' quality indicator.

Results

In interpretation of these results the confidence interval clearly shown in the illustrations should be observed. Where confidence intervals overlap one can simply say that there is probably no statistical difference between the results given.

The patient demography ('case-mix', included in the tables) between the various county councils must also be noted. Certain county councils have no university/ regional hospital in their area and may then work with a less risk-burdened patient profile.

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 two latest annual analyses.

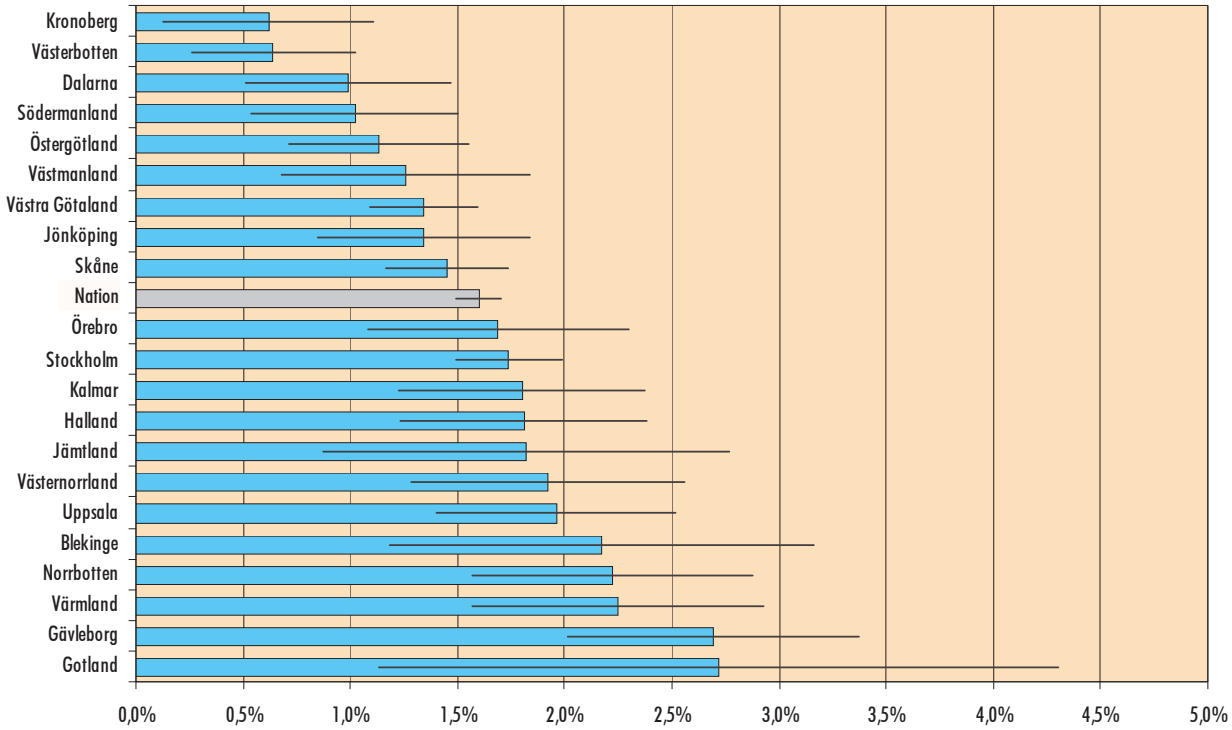
Ten-year survival. This indicator has been modified compared with previous years in that the observation time is now the most recent 10-year period (1998-2007). Earlier it covered 1992 until the current year. This modification can involve reworking county-council results and further confidence intervals.

EQ-5D index gain. Three county councils joined in 1997, for which reason they lack 1-year results and can therefore not be reported in the histograms.

Genus perspective. All three indicators show differences between genders. Many earlier studies showed a generally increased risk of reoperation and revision for men, and the present results confirm these earlier findings. Large population studies (cross-sectional studies) in Sweden have shown that women in general report poorer health-related quality of life than do men of corresponding ages. Gain in the EQ-5D index, however, is the result of a prospective longitudinal study, and women have actually given a marginally better health gain.

Reoperation within 2 years per county

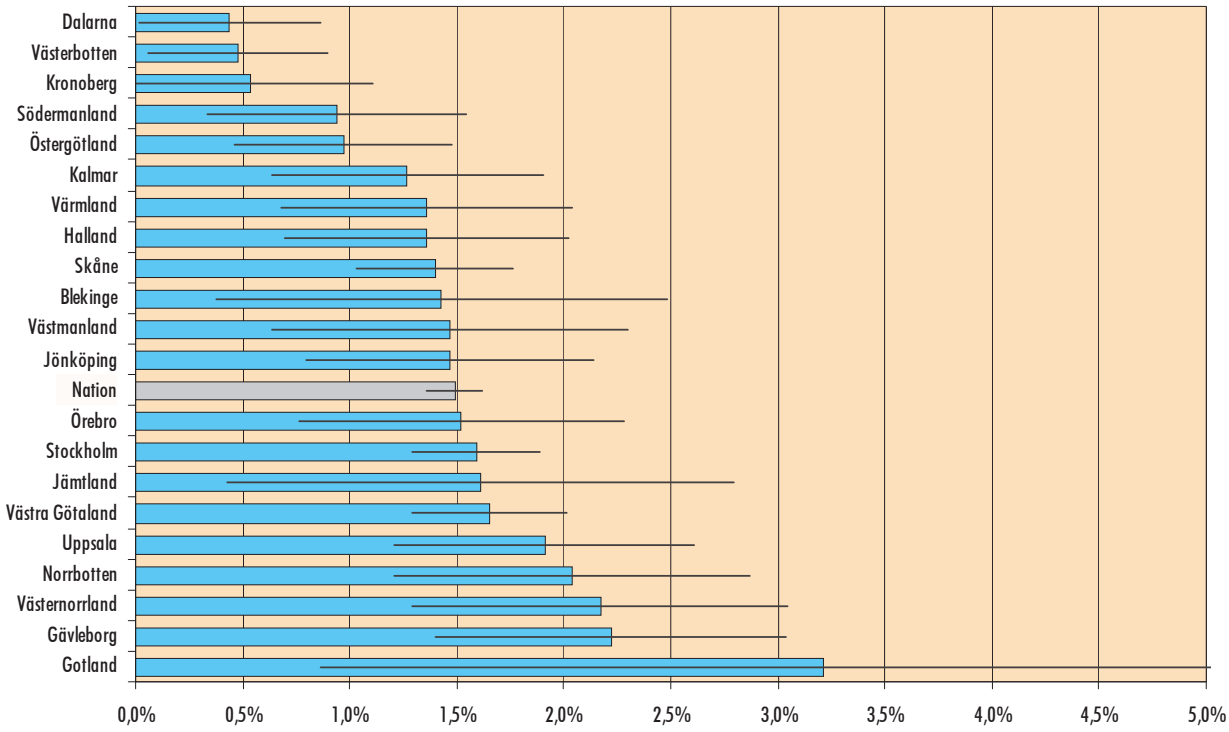
1998-2007



	Primary THRs	— Total —		— Infection —		— Dislocation —		— Loosening —		— Others —	
	Number	Number	%	Number	%	Number	%	Number	%	Number	%
Kronoberg	968	6	0.6%	0	0.0%	2	0.2%	1	0.1%	3	0.3%
Västerbotten	1,714	11	0.6%	7	0.4%	3	0.2%	1	0.1%	2	0.1%
Dalarna	1,617	16	1.0%	5	0.3%	7	0.4%	1	0.1%	4	0.3%
Södermanland	1,673	17	1.0%	3	0.2%	6	0.4%	3	0.2%	8	0.5%
Östergötland	2,391	27	1.1%	6	0.3%	16	0.7%	1	0.0%	9	0.4%
Västmanland	1,430	18	1.3%	3	0.2%	11	0.8%	2	0.1%	2	0.1%
Jönköping	2,097	28	1.3%	11	0.5%	11	0.5%	1	0.1%	7	0.3%
Västra Götaland	8,109	109	1.3%	41	0.5%	47	0.6%	10	0.1%	24	0.3%
Skåne	6,744	98	1.5%	39	0.6%	31	0.5%	6	0.1%	40	0.6%
Nation	55,458	887	1.6%	346	0.6%	330	0.6%	70	0.1%	266	0.5%
Örebro	1,717	29	1.7%	13	0.8%	7	0.4%	0	0.0%	13	0.8%
Stockholm	10,801	188	1.7%	69	0.6%	64	0.6%	26	0.2%	70	0.7%
Kalmar	2,055	37	1.8%	24	1.2%	12	0.6%	1	0.1%	8	0.4%
Halland	2,049	37	1.8%	20	1.0%	7	0.3%	2	0.1%	9	0.4%
Jämtland	770	14	1.8%	2	0.3%	8	1.0%	0	0.0%	4	0.5%
Västernorrland	1,767	34	1.9%	19	1.1%	14	0.8%	0	0.0%	6	0.3%
Uppsala	2,402	47	2.0%	12	0.5%	21	0.9%	4	0.2%	17	0.7%
Blekinge	829	18	2.2%	1	0.1%	15	1.8%	2	0.2%	1	0.1%
Norrbotten	1,941	43	2.2%	18	0.9%	19	1.0%	2	0.1%	9	0.5%
Värmland	1,823	41	2.3%	29	1.6%	3	0.2%	3	0.2%	12	0.7%
Gävleborg	2,156	58	2.7%	21	1.0%	24	1.1%	3	0.1%	13	0.6%
Gotland	405	11	2.7%	3	0.7%	2	0.5%	1	0.3%	5	1.2%

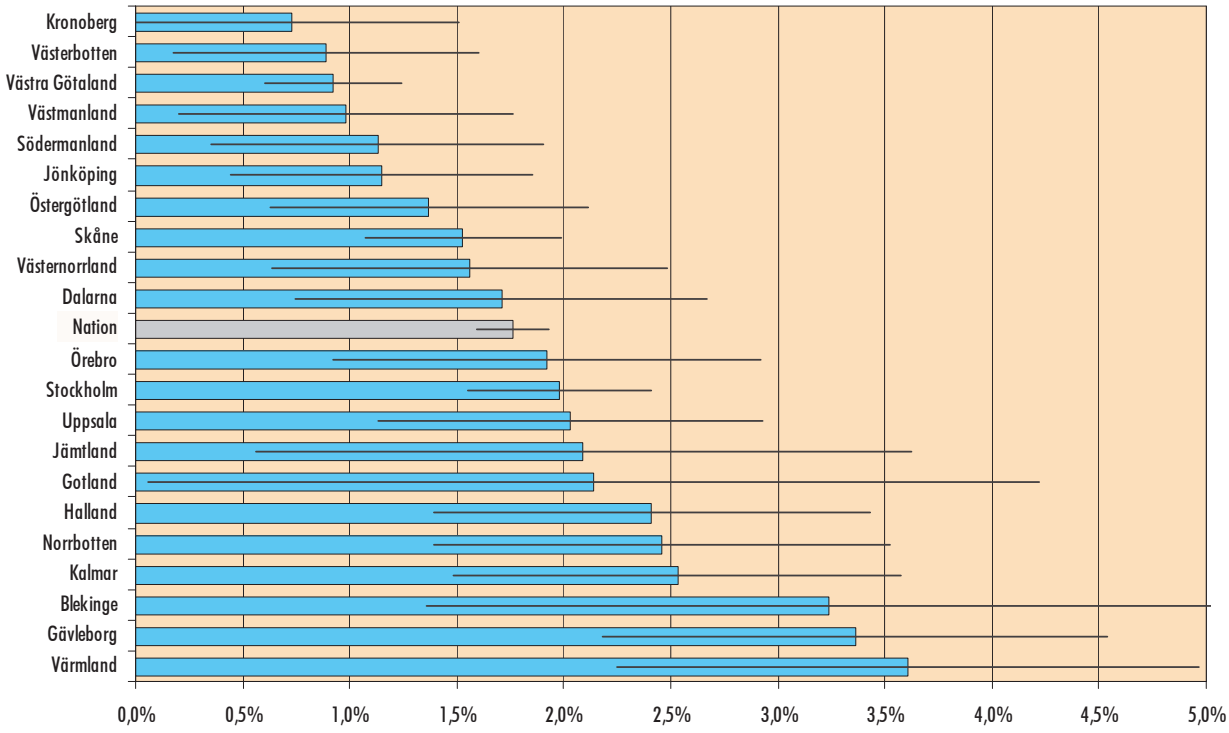
Reoperation within 2 years per county — women only

1998-2007



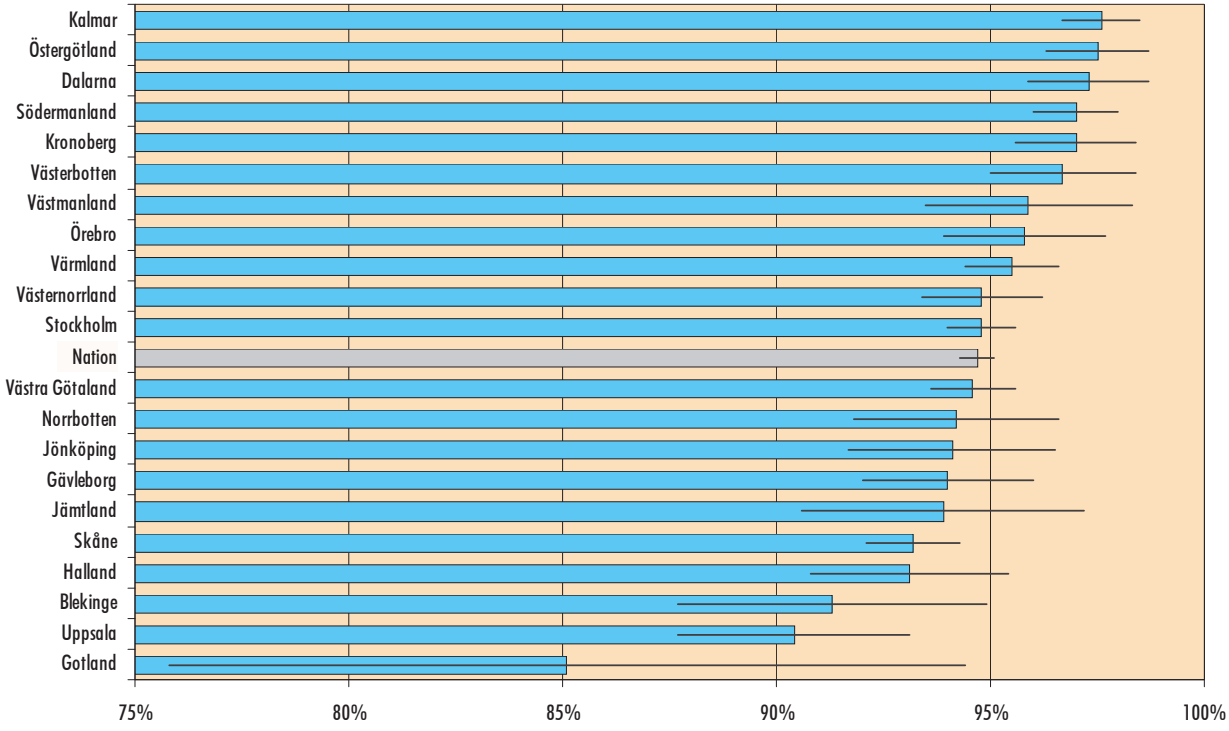
Reoperation within 2 years per county — men only

1998-2007



Implant survival after 10 years per county

1998-2007

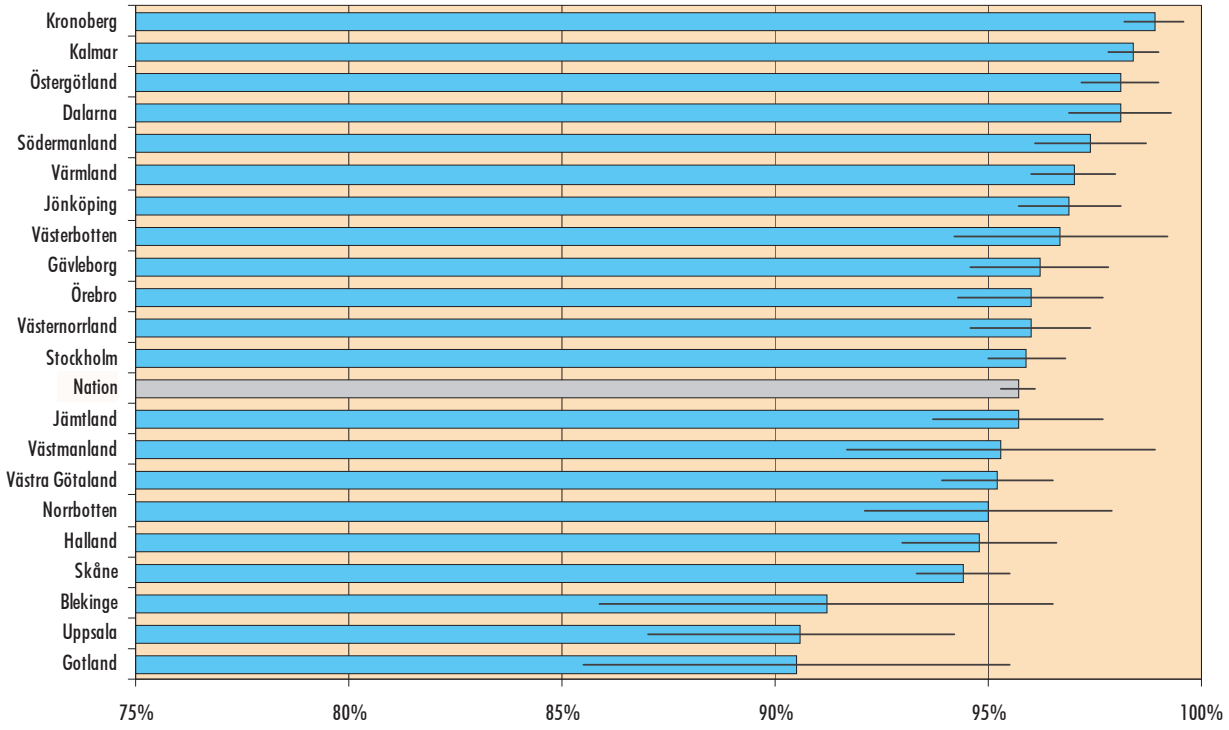


	Number of THRs	OA [1]	≥60 yrs [2]	Female [3]	10 yrs	C.I.
Kalmar	4,370	79.6%	15.9%	58.0%	97.6%	±0.9%
Östergötland	5,703	73.5%	18.0%	60.3%	97.5%	±1.2%
Dalarna	3,911	85.3%	18.4%	57.5%	97.3%	±1.4%
Kronoberg	2,190	84.8%	17.9%	55.6%	97.0%	±1.4%
Södermanland	3,905	78.4%	17.7%	58.3%	97.0%	±1.0%
Västerbotten	3,879	83.6%	20.1%	61.1%	96.7%	±1.7%
Västmanland	3,205	82.8%	17.8%	56.8%	95.9%	±2.4%
Örebro	4,096	82.8%	17.7%	59.1%	95.8%	±1.9%
Värmland	4,048	80.1%	15.7%	60.2%	95.5%	±1.1%
Stockholm	24,353	81.1%	20.6%	63.3%	94.8%	±0.8%
Västernorrland	4,019	86.5%	19.1%	60.4%	94.8%	±1.4%
Nation	125,656	80.2%	18.7%	59.9%	94.7%	±0.4%
Västra Götaland	18,527	78.3%	19.3%	59.2%	94.6%	±1.0%
Norrbotten	4,200	80.3%	17.9%	59.9%	94.2%	±2.4%
Jönköping	4,683	85.6%	16.1%	57.2%	94.1%	±2.4%
Gävleborg	4,964	78.3%	17.2%	59.8%	94.0%	±2.0%
Jämtland	1,651	82.3%	18.2%	56.5%	93.9%	±3.3%
Skåne	16,091	79.6%	18.6%	59.6%	93.2%	±1.1%
Halland	4,304	82.7%	17.4%	57.4%	93.1%	±2.3%
Blekinge	1,958	84.9%	19.4%	59.3%	91.3%	±3.6%
Uppsala	4,711	67.9%	20.9%	61.7%	90.4%	±2.7%
Gotland	887	84.7%	18.8%	54.5%	85.1%	±9.3%

1) Refers to the share of primary THRs performed due to primary osteoarthritis.
2) Refers to the share of primary THRs in the age-group 60 years or older (age at primary operation).
3) Refers to the share of women.

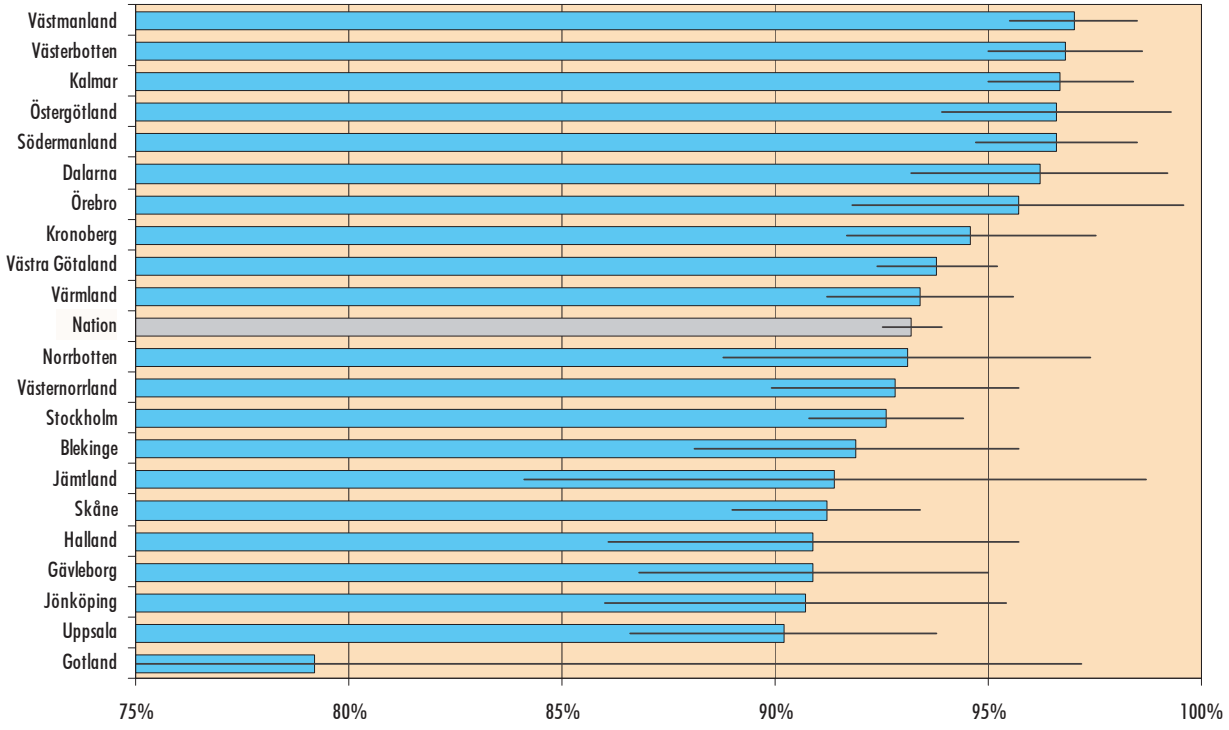
Implant survival after 10 years per county — women only

1998-2007



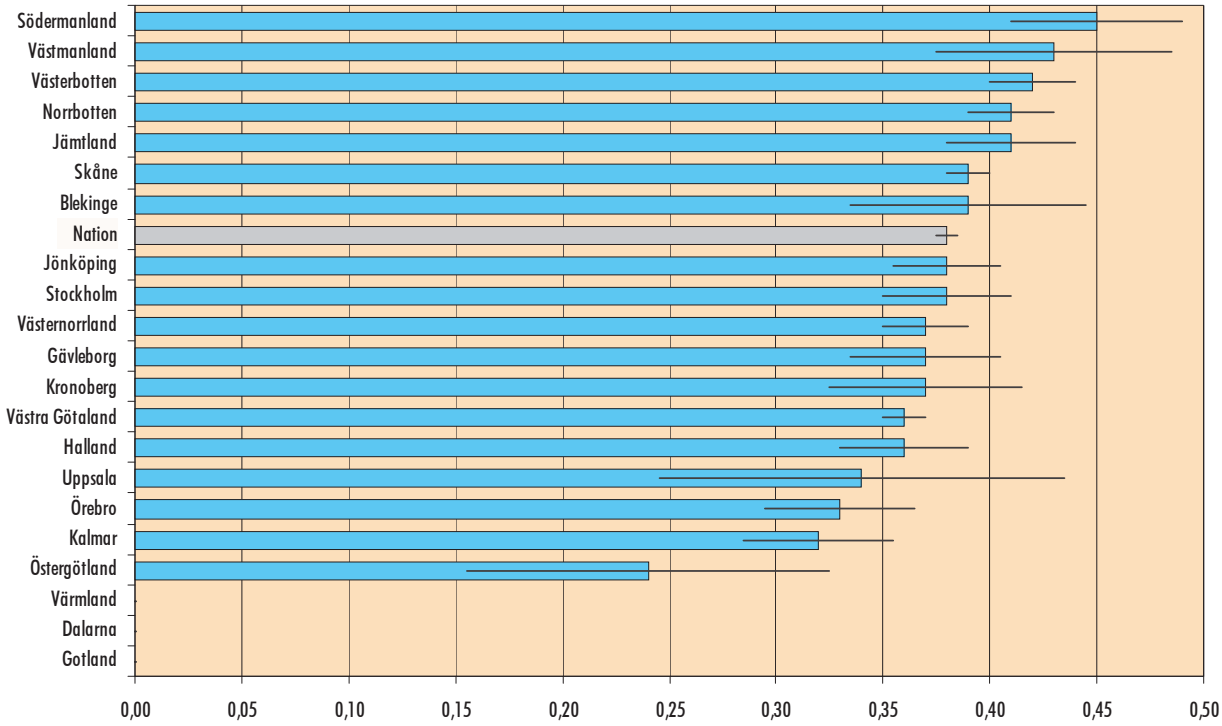
Implant survival after 10 years per county — men only

1998-2007



Gain in EQ-5D index after 1 year per county

1998-2007

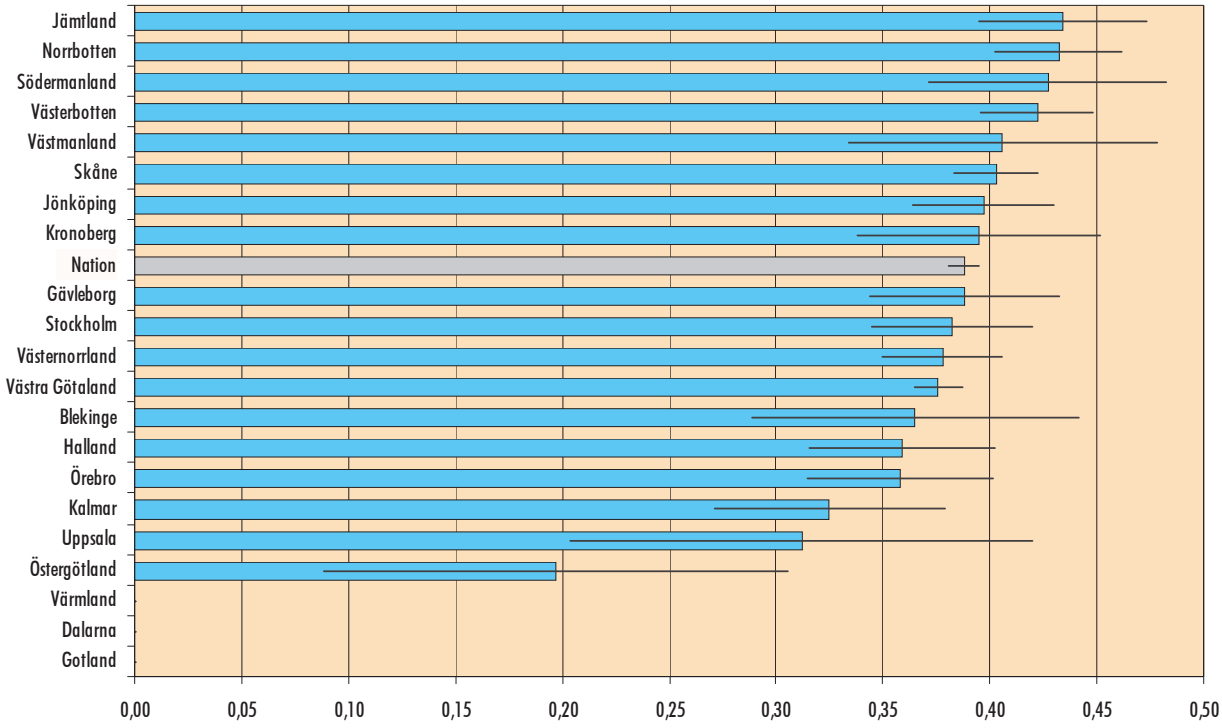


	Number [1)]	Share of C-pat. preop.	EQ-5D-index preop.	EQ-5D-index 1 year	EQ-5D-index gained after 1 year	Comments
Södermanland	278	47%	0.32	0.77	0.45	
Västmanland	195	34%	0.34	0.76	0.43	
Västerbotten	1,059	44%	0.37	0.79	0.42	
Jämtland	604	33%	0.36	0.77	0.41	
Norrbotten	1,009	47%	0.35	0.76	0.41	
Blekinge	156	38%	0.40	0.78	0.39	
Skåne	2,075	45%	0.40	0.79	0.39	
Stockholm	566	42%	0.38	0.76	0.38	
Jönköping	714	39%	0.40	0.77	0.38	
Nation	16,499	43%	0.40	0.77	0.38	
Kronoberg	246	44%	0.41	0.78	0.37	
Gävleborg	346	43%	0.39	0.76	0.37	
Västernorrland	1,044	45%	0.40	0.78	0.37	
Halland	524	46%	0.41	0.76	0.36	
Västra Götaland	6,848	43%	0.40	0.76	0.36	
Uppsala	40	33%	0.51	0.85	0.34	
Örebro	402	43%	0.46	0.79	0.33	
Kalmar	361	40%	0.47	0.79	0.32	
Östergötland	32	59%	0.52	0.76	0.24	
Värmland						Joined 2007 (no 1-year results for 2007)
Dalarna						Joined 2007 (no 1-year results for 2007)
Gotland						Joined 2007 (no 1-year results for 2007)

[1)] Refers to the share of preoperatively examined patients with follow-up after 1 year.

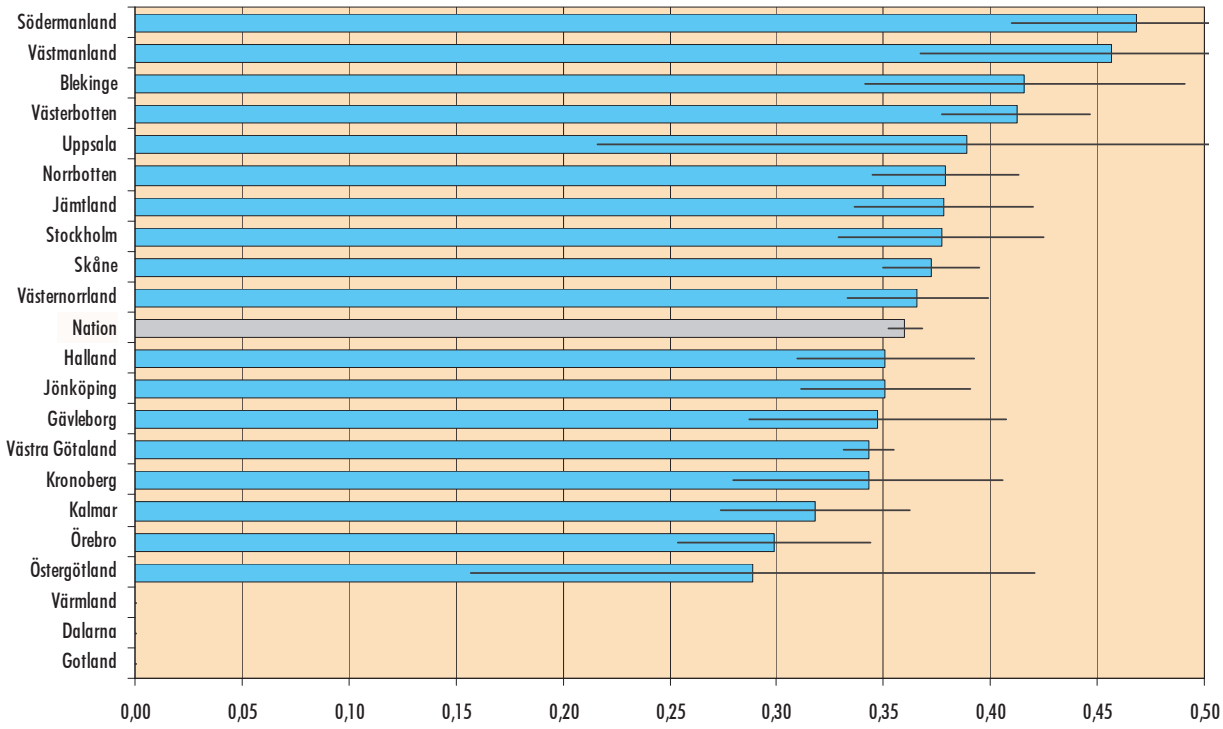
Gain in EQ-5D index after 1 year per county — women only

1998-2007



Gain in EQ-5D index after 1 year per county — men only

1998-2007



Summary

The Swedish Hip Arthroplasty Register's Annual Report seeks to give an open and all-round picture of hip arthroplasty in Sweden, using both process and result measures, and to report back the results to the participating departments to facilitate local improvement.

Work on the Register and the Annual Report is becoming increasingly expensive in both personal and economic resources. This is an affect of increased data capture, more openly-reported outcome variables per department, the supply of national quality indicators to 'Regional Comparisons' and more in-depth analyses. In addition the registry has for the past three years also included hemi-prostheses, reported separately. The register results are being used increasingly in management and control of orthopaedic medical care in which hip arthroplasty in the form of total and hemi-prosthesis surgery represents a large part of this care, both as procedure frequency and as cost.

In Sweden in 2007, 14,161 primary total hip arthroplasties were performed, which is a small increase over the previous year – for the first time the interventions passed the 14,000 mark. Procedure frequency is approximately 140 total hip arthroplasties per 100,000 inhabitants. During the year, 2,038 reoperations were reported which is a certain increase over 2006. During the year, 4,228 hemi-prostheses and 249 reoperations were reported. Thus in total, 20,676 operations were reported to the Swedish Hip Arthroplasty Register during 2007.

New this year

Nordic co-operation has deepened during the year. The Nordic Arthroplasty Register Association (NARA) has been constituted and the registry management is represented on the steering committee. A common database (Denmark, Norway and Sweden) for hip arthroplasty from 1995 onwards has been created. Preliminary results of a first analysis are presented in the Report and more detailed analysis together with continual updating of the database are planned. The goal of this Association is to promote Nordic implant research and possibly produce standardised Nordic quality indicators for hip arthroplasty, which should create interest in the Nordic Council of Ministers. In Sweden there has been a discussion as to whether the considerable success of the Hip Arthroplasty Register regarding quality has also brought with it an obstacle to continued development of new techniques and prosthesis solutions. We have now an instrument which with great statistical power can broaden our possibilities of analysis, not least as an effect of the fact that user profiles differ in the three participating countries.

For more information, see www.nordicarthroplasty.org.

The registry has during the year stepped up its co-operation with the Centre for Epidemiology at the National Board of Health and Welfare. Co-processing with the Patient Register at individual level has been used to produce a detailed analysis of degree of coverage at hospital level. We plan to repeat such analyses every-other-to-every-third year. Detailed co-processing with Statistics Sweden and the EpC is planned, subject to ethical approval. The purpose of this entirely new type of analysis is to supplement the registry's databases with background variables such as socioeconomic parameters and medical co-morbidity. These new variables will be of great significance for future analyses of risk factors for technical and patient-reported failures.

For the first time we are reporting costs of the intervention at department level. We can, unfortunately, note that there has been no success nationally in creating a standardised way of measuring costs, and that the CPP (cost per patient) system is still not implemented throughout the whole country. Since cost analyses underlie control and planning of medical care, the lack of standardised cost measures and adequate cost-efficiency calculations is a matter that should lead to debate both among decision-makers and within the profession.

The registry has since 2002 included patient-reported outcome one year after surgery. For the first time we have used these more subjective outcome parameters for analysis of activities at unit level. These variables are harder to analyse with conclusive results than the more 'exact' reoperation figures are. The registry can merely proffer a hypothesis regarding why a certain department shows results that differ from the norm. This analysis should then be followed by a local evaluation where there are better possibilities of evaluating background variables for assessment of the unit's care programme and possible potential for improvement.

This year's in-depth analyses

In this year's Report a number of specific analyses are presented:

Degree of coverage. Degree of coverage is an absolutely essential part of a register's data quality and credibility. Unless coverage is high, all analyses become burdened with great uncertainty and statistical 'shakiness'. This year's analyses in connection with the EpC's Patient Register have shown good coverage of about 96% regarding registration of primary total hip arthroplasties and hemi-arthroplasties. However, one or two hospitals have poorer registration frequency and the registry management urge the departments in question to review their routines so as to achieve better registration.

The coverage of secondary interventions such as reoperation and revision has not yet been analysed but will be reported later. One reason for the delay is the somewhat doubtful quality in giving the right diagnosis and ICD-10 codes among surgeons and surgical report

writers. The registry management and colleagues at the EpC appeal for improvement on this important point.

Prosthesis fixation. Sweden is one of the world's most conservative countries regarding prosthesis fixation, since the classical all-cemented prosthesis dominates. Even in comparison with our Nordic neighbors, Sweden is the country that uses cemented fixation most. Since 2001, however, there has been a slow but clear trend towards the use of uncemented fixation – with an increase from 2.6% to 12% between 2001 and 2007.

Briefly, the use of all-uncemented prostheses has involved an increased risk of revision. There is no trend towards improvement in the cohort undergoing surgery during the most recent ten years. Uncemented fixation also increases the risk of serious problems during the first two years, predominantly owing to loosening and fracture. The problem is the uncemented cup which has a significantly increased risk of being revised, probably because of liner problems with wear and osteolysis. The new highly cross-linked polyethylene did not start coming into use on a large scale until 2005-2006, for which reason it is too early to determine whether this involves an improvement.

We do not know today what the optimal distribution between cemented and uncemented fixation should look like. The surgeon's experience with the different techniques is here of great importance. It is therefore important that all changes in choice of implant and method of fixing a prosthesis take place slowly, with good time for learning. Note, too, that we have hitherto achieved the best results, and with a very good historic documentation, when we use implants where both cup and stem have been fixed with cement.

Resurfacing prosthesis. Throughout the world surface replacement prostheses are being marketed and used to an increasing extent. Their introduction in Sweden has been slow but they have increased during the past few years and a total of about 1,000 patients have received them. Analysis with a short follow-up time has been conducted and the result is disquieting, with significantly increased revision frequency compared with the conventional hip prostheses. Last year the Australian registry reported the same poor results, for which reason this type of prosthesis should only be used at special centers and with strict indications. NARA is planning to analyse the outcome in the Nordic countries during spring 2009.

Total arthroplasty following hip fracture. The treatment model for cervical hip fracture has changed radically in Sweden over 6-7 years. Dislocated fractures are now being operated on to an increasing extent with total or hemi-prostheses (during 2005-2007 20% and 80%, respectively). During the year, an analysis has been run covering 10,264 cases undergoing total hip arthroplasty for fracture between 1999 and 2005. The purpose of the study was to compare the outcome for primary and secondary total arthroplasties, respectively. The few studies hitherto conducted have shown an increased revision frequency for secondary prostheses. The study shows that fracture-related hip prostheses, above all in men, are revised to a greater extent than other hip arthroplasties. The cause of this is firstly dislocation and to some extent periprosthetic fractures.

We found no significant difference between primary and secondary fracture-related total arthroplasties regarding revision frequency, which contradicts earlier studies. We have not yet studied whether there is any difference regarding patient-reported outcome between the two groups. Hypothetically, there could be such a difference – patients who experience a failure following internal fixation probably have impaired health-related quality of life. A subgroup of patients were included in the follow-up model, so data is available regarding pain relief, satisfaction and EQ-5D. Analysis of these data has been started.

Waiting-time costs. Costs are probably the most discussed variable throughout medical care. In most cost analyses, total social costs are not taken into account and particularly not all non-disease-related costs during a possible waiting time before medical treatment.

In an analysis in connection with health economists, about 3,500 patients (20 hospitals) were requested to answer a questionnaire just before a planned arthroplasty. The questions concerned cost-generating events/circumstances that can be related to the disease. For each patient details were gathered by operation coordinators regarding waiting-time. Follow-up questionnaires were sent out one year post-operatively.

Preliminary cost calculations per patient show that the total disease-related cost one year before hip arthroplasty is about SEK 73,000 per patient. This means that the costs of waiting time were approximately equal in size to those of the operation measured in direct medical care costs (CPP average value for a total hip arthroplasty was in 2007 SEK 78,000). The main cost consists of loss of production (72%) – about 35% of patients undergoing surgery in Sweden since 2000 are under 65 years. Even though the study was carried out after the introduction of the care guarantee, the mean waiting-time before operation was 312 days. One should not, however, conclude that all patients with primary osteoarthritis should be operated on as quickly as possible after diagnosis, but in patients for the right indications for surgery, waiting-time is very costly for both patient and the community.

Unipolar versus bipolar hemi-prostheses. In the first in-depth analysis of the now-three-year-old hemi-arthroplasty database, we found a significantly increased risk of reoperation where bipolar prostheses were used. The results are the same for the two most common bipolar systems, Lubinus and Exeter. The cause of this difference is unclear. Earlier studies found no certain support for a definite

advantage with uni- or bipolar prostheses. To examine whether the difference is nevertheless caused by a selection bias, co-processing with the Patient Register (EpC, National Board of Health and Welfare) is planned. This can elucidate the significance of medical co-morbidity for choice of method and revision.

Work for clinical improvement

Nationally

Sweden has the world's lowest reported revision frequency. In a comparative study between Medicare in USA, the Norwegian Arthroplasty Register and the Swedish Hip Arthroplasty Register, seven-year prosthesis survival was significantly best for the Swedish material (February 2008 JBJS – Am). In the now published material from the first NARA analysis, too, Sweden has the best result. One explanation is that we in Sweden use few and well-documented implant types and similar technique. We have moreover been careful with the introduction of new implant technology and new surgical techniques. The continual national quality improvement may be explained at least partly by the fact that the registry has been operational for many years and that Swedish orthopaedic surgeons note the recurrent feed-back the registry gives via its homepage, annual reports and orthopaedic meetings.

This year's analysis shows, unfortunately, a break in trend from the past few years: the number of reoperations has increased from 1,913 in 2006 to 2,038. Lund University Hospital notified about 60 reoperations in August this year (6 months' delay) and these are not included in the analysis. The difference compared to last year is small and may depend on random variability, but is nevertheless disquieting. It is above all noteworthy that the causes of reoperation change. Reoperation due to infection and dislocation are increasing at the same time as reoperation due to loosening is still declining.

Locally

In the present Report five units have been specially scrutinised due to results that diverge from the norm. The local analyses from these units and their programmes of improvement may be read in detail in the Report. The registry management feel that departments throughout the country have developed an increasingly positive attitude to open reporting. In connection with the Annual Report each department receives a confidential report with personal ID numbers of their reoperations, including revisions; and in many places the Report is accompanied by local studies to map the department's complications and to start up local development. As mentioned above, we have this year for the first time carried out activity analyses of three hospitals with non-normal profiles regarding patient-reported outcome. Here we have a tool that can be used in local improvement regarding care programmes for patients with hip disease, i.e. measures that may improve patients' satisfaction and health gains and that do not need to be directly linked to the surgical intervention.

Achievement of goals

The goal of total hip arthroplasty is satisfied patients with optimal pain relief and satisfaction and an essentially normalised health-related quality of life. The result should also be lasting.

Standardised follow-up of all patients with their own estimation of the result of hip arthroplasty is being expanded continually to the whole country. At present five units still have not joined, but four of these have notified a start in October 2008. Since health gain measured in EQ-5D since 2006 is considered as a national quality indicator, all hospitals and county councils should participate in this routine.

Hemi-prosthesis registration achieved national coverage from the start on 1 January 2005 and the registration has a good degree of coverage of almost 96%. Via the Patient Register analysis of frequency of patients receiving primary prostheses following surgical hip fracture, we know that the new treatment algorithm for these fractures has not been fully implemented throughout the country. Future co-processing with RIKSHÖFT (Hip Fracture Register) and the Patient Register would illustrate this in detail and in a unique manner.

National and international discussion is going on regarding whether patients with dislocated cervical fracture should receive hemi- or total arthroplasty. Since these treatment alternatives are now combined in one and the same register we will be able to analyse this issue in a few years. This national analysis will also include patient-reported outcome measure and will probably have great influence both nationally and internationally.

One-and-a-half years ago the registry started renewing its homepage and consolidating its older databases. This work has continued during the year but has gone slowly owing to lack of resources regarding web designers/system developers, but also because the project has not been financed. However, during the year we have published parts of the new home page – the part that covers patient and decision-maker information. Our goal is that patient information should be a users' tool for physiotherapists, GPs and orthopaedic surgeons. The new part of the home page may be reached via our old web address but also via the new domain name – see page 10.

Problem areas

The problems of declining procedure frequency at university hospitals remain. This trend must be broken, otherwise the risk is great that the quality of hip arthroplasty will sink due to worsened opportunities for training and development.

Since county district hospitals and above all private hospitals operate on more healthy patients with less co-morbidity and on technically

simpler cases, this can paradoxically and under the aegis of the care guarantee mean that accessibility will be worsened for the more severely ill and complicated cases.

For many years total hip arthroplasty has been one of the medical interventions burdened by long waiting times. During the past few years there has been a strong focus in Swedish medical care on issues of accessibility. Unfortunately, this focus has been directed entirely onto accessibility as a time variable: time to surgical treatment. However, the registry management maintain that accessibility for the hip patient should include rapid and adequate care throughout the whole course of the disease, and that any surgery must be followed-up with an outcome analysis before shortened waiting times can be put forward as improved quality. The registry has for some years followed a group of patients receiving surgery outside their own county. The group is now with a five-year follow-up exhibiting a significantly increased reoperation frequency owing to deep infection.

The number of reoperations has increased during this year of activity. This applies primarily to early and serious complications such as dislocation, deep infection and fracture adjacent to the prosthesis. The statistical security, of these data is low at department level, but the aggregate statistics from the whole country strongly indicate that there is generally reason to review clinical routines continuously to minimise the risk of early complications. We consider that continual feedback of results is one of the best aids to this work.

Reoperation owing to implant dislocation remains as a problem in Sweden. If all departments followed the programmes implemented successfully by the Sundsvall clinic following the report in 2005, the registry management is convinced that we would have an appreciable and long-lasting reduction of this problem. Some of the hospitals that in this year's report get high figures for dislocation frequency have been contacted by the registry management. These departments have been encouraged to contact the orthopaedic surgeons in Sundsvall for discussion of improvement programmes.

Current trends

The greatest change regarding choice of implants is a continual trend towards the use of all-uncemented prostheses. Also increasing, particularly in the Stockholm region, is the reversed hybrid with an uncemented stem and a cemented cup.

The use of micro invasive surgery and surface replacement prostheses, which is increasing strongly in the rest of the world, is at a low but slowly increasing level in Sweden. Both these techniques, following short follow-up, have significantly increased revision figures compared with the conventional techniques.

Conclusion

During the past two years the Swedish Hip Arthroplasty Register has received an increased grant allocation from SALAR. Despite this, the registry's financial problems persist – increased allocation is not keeping step with the increasing use of resources.

For the reasons given above, the registry's work is becoming increasingly extensive. Apart from the actual registration, there is an increasing teaching and research activity as a 'spin-off' of increased data capture and major co-processing with official statistics units. These activities must be financed largely from external but inadequate research allocations, but place great demands upon register managers and other staff. In addition, more and more hospitals and county councils have contacted the registry for local special analyses in the wake of the increased open reporting, partly via the registry itself, partly via 'Regional Comparisons'. Continued development and standardisation of the IT side will in the long run make running cheaper, but will require a lot of money to implement. Paradoxically enough, the registry is burdened by its long thirty-year history. The older databases and the home page (the Swedish Hip Arthroplasty Register was the first national quality register to become web-based) is based on obsolescent IT technology and needs to be modernised to give increased data security and accessibility for users. This process of development is costing six-figure sums without the effect being noted by external users.

In the past three years of activity, the Western Götland Region (VGR), the registry's formal principal, has generously contributed finance. In autumn 2008 a register centre is to be formed at the Nordic University for Public Health Sciences (NHV, Göteborg), with ongoing support from VGR. This centre will be formed by the National Diabetes registry, the Centre for Oncology and the Swedish Hip Arthroplasty Register. By using common IT resources, biostaticians, epidemiologists and premises we hope to achieve major synergy effects and increased and long-term financial stability.

The registry management wish to express their thanks for good cooperation during the past year. Our joint work is becoming increasingly interactive and is thereby stimulated by the feedback of results in a more active and constructive manner. Together we can, both within the profession and among decision-makers, further improve the quality of Swedish hip arthroplasty surgery and have more and more satisfied patients.

Photo: Göran Garellick

Current research projects

The chief task of a national quality register is data capture, analysis and feedback, which is to lead to improvement. The very comprehensive databases, however, have a large research potential. Eight dissertations and some 100 scientific articles have been published partly or wholly based on analyses from the Swedish Hip Arthroplasty Register. Clinical research and above all register-based research has for many years had low status in Sweden. This has been reflected in declining funds and a very lean allocation to this type of research from e.g. the Swedish Research Council (VR). During the past six months, however, there has been a change of course, and to the registry management's great delight, one can now read on the VR homepage the following:

During the past few years a number of committees of enquiry within and outside the Research Council have pointed out that today's Swedish registers, covering the whole population, are an under-exploited goldmine for research. In an increasingly internationalised data and research environment, the Swedish registers can increase in significance as valuable sources of new knowledge far outside our borders. From the Swedish point of view it is a matter of urgency to take advantage of these opportunities for better national and international use of Swedish register data.

In all subject areas there are today relatively few researchers and groups with sufficient opportunities and knowledge of data and modern statistical instruments to take full advantage of this unique resource for pioneering research. Potential synergies between research groups, opportunities for interdisciplinary science and for prominent international researchers to gain access to Swedish data, and to take part in Swedish research, are not often grasped to a sufficient extent. To support the development of Swedish register research, the Swedish Research Council is therefore taking the initiative for a serious increase in the direct support to research that uses microdata for research into issues of society and health.

Sweden got a new patient data act on 1 July 2008. This new law will simplify co-processing between national quality registers and public statistical units such as Statistics Sweden and the EpC. This will create internationally unique databases with a number of background variables such as socioeconomics, medical co-morbidity, use of drugs and causes of death, among others. These combined databases will further accentuate the research potential of, for example, the Swedish Hip Arthroplasty Register.

The registry management would strongly stress that the registry's databases are not only a matter for the registry staff in Göteborg. All researchers both in this country and abroad can, given adequate problem areas, use the register for research.

Research projects within the registry

The registry management and the steering group include a number of postgraduate researchers who are supervisors and co-supervisors of a number of PhD-students. Within this group, research is being conducted regarding prosthesis fixation, health economics, hip fractures and prosthesis surgery, periprosthetic fractures, revision surgery and patient-reported outcome after prosthesis surgery. This group consists of :

- Johan Kärrholm, Göteborg
- Göran Garellick, Göteborg
- Cecilia Rogmark, Malmö
- Leif Dahlberg, Malmö
- André Stark, Stockholm
- Thomas Eisler, Göteborg
- Hans Lindahl, Trollhättan
- Peter Herberts, Göteborg

PhD-students with all or parts of their dissertation material from the registry:

Ola Rolfson, Kungälv
Health-economic aspects of total hip arthroplasty.

Buster Sandgren, Stockholm
Computer tomography of patients receiving an uncemented acetabular component inserted in connection with total hip arthroplasty.

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

Olof Leonardsson, Malmö
Hip fracture therapy with hip prosthesis.

Truike Thien, Göteborg
The significance of prosthesis design for outcome.

Oskar Ström, Stockholm
Health-economic aspects of hip arthroplasty.

In addition we have co-operation at Uppsala, where Nils Hailer is conducting a study of cup fixation with or without ceramic coating. Olof Sköldenberg, Stockholm has used data from the registry for long-term follow-up of uncemented prostheses.

The registry is also undertaking research co-operation within NARA. The Nordic organisation is seeking PhD-students in the Nordic countries for work on the common database. Nordic PhD-students have contacted the registry about projects regarding infection and prosthesis surgery following childhood hip diseases. Together with the Swedish Knee Arthroplasty registry and the EpC, the registry is studying mortality and cancer incidence related to implant surgery.

The Swedish Hip Arthroplasty Register databases are still under-exploited in research. The registry management invite all interested researchers with adequate problem areas to seek co-operation with the registry.

Notes

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2.2 Operative Steps: Femur, pages 28-36
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ISBN 978-91-977112-3-4
ISSN 1654-5982

Swedish Hip
Arthroplasty Register

Swedish
Orthopaedic Association

GÖTEBORGS UNIVERSITET

VÄSTRA
GÖTALANDSREGIONEN