Swedish Hip Arthroplasty Register

Annual Report 2012

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Contents

Footnote. A number of descriptive tables have been moved from our printed annual report and are published only on our website. This also applies to the chapter ”Environmental and Technology Profile”. The register’s website is at www.shpr.se.

Introduction

This year's annual report is, for many reasons, extremely delayed. Some of the reasons for this are; we revised all the statistical scripts; formation of the report was carried out by new employees; and cross-referencing with the Swedish National Board of Health and Welfare was delayed by about six weeks. We sincerely hope that next year's annual report can be published by early fall 2014.

The Swedish Hip Arthroplasty Register is the fusion of two registers: one for surgery with total hip replacement with arthrosis/arthritis as the primary indication, and one for surgery with so-called hemi-arthroplasty with hip fracture as the main indication. Patient groups vary considerably: a relatively healthy population with an average age of just under 70, and a group of patients with a mean age of approximately 85, with severe medical comorbidity and short expected survival.

The Swedish Hip Arthroplasty Register is in its 34th year of activities. Analysing the importance of different types of prostheses and techniques to reoperation frequency, in both the short and long run, remain a central task of the the Register. The Register's continual feedback to the profession has led to a nationwide adjustment to optimal technique and the use of few but well-documented types of prostheses, resulting in continually improved implant survival.

The Register's main task, however, is to analyze the entire process surrounding hip replacement surgery – that is, to identify predictors of both good and poor outcomes in a multidimensional and individual-based manner. The 10-year survival of our most common and well-documented implants is currently over 95%, and the potential for improvement exists chiefly within certain patient groups. There is probably a greater possibility for outcome improvement from a patient perspective through optimizing indications, care processes, pre- and postoperative information, rehabilitation and implementation of non-surgical, early management of patients with osteoarthritis of the hip – in other words, surgery for the right patient at the right time with the right technique.

This year's news

Increasing numbers of patients with hip fracture undergo surgery with total hip replacement. As part of a more equitable comparison of results, we have now analyzed the results of fracture patients separately - whether operated by total or hemiprosthesis. Since "choice of care" for patients is being gradually introduced throughout the country, we have continued to adapt the annual report to such care choices by further developing the concept of the "standard" patient via statistical analyses of our large database. Comparisons of the results of this "case-mix"-adjusted population may later facilitate the pedagogy of the annual report concerning the choice of care perspective. We have, therefore, also added a set of value compasses regarding outcomes based on the group we call the "standard" patient.

The register has completed its first qualitative study (an in-depth analysis of individual patients). Patients indicating uncertainty or disappointment with outcomes were interviewed one year after surgery. The study is presented in this report, and the register is planning more studies of this nature.

In-depth analyses

The register's ongoing registration and regular reporting of standard results are important for maintaining high quality hip arthroplasty. We have, for several years, also carried out and reported a number of in-depth analyses from different perspectives. These analyses are not only intended for clinical improvement but for new developments and publication of scientific reports as well. The road to scientific publication often takes years, and does not always reach all colleagues. A carefully considered alternative to both these reporting systems is probably the optimal means of spreading register results.

The Swedish Hip Arthroplasty Register and clinical research

National Quality Registers have long been poorly exploited in clinical research. We now see a shift within register research toward an increased interest in observational studies from the remainder of the medical research world. The Register's research activity is more extensive than ever before with 14 doctoral students from 4 universities. In order to broaden research fields and operational analyses we have, throughout the year, implemented a number of interconnecting projects with health data registers at the National Board of Health and Welfare and Statistics Sweden. During 2012 and 2013 the Register has published 28 articles with 6 in press in peer-reviewed journals. An additional 8 manuscripts have been submitted during this period.

Three doctoral theses are planned for 2014.

International cooperation

The Register's international collaboration has intensified during the year. The Register is a member of three international associations which concurrently run their databases with the goal of creating common research databases and to create an international system of early warnings of potentially more poorly functioning and newly introduced prostheses. International cooperation culminated in May 2013 when ISAR organized the 2nd International Congress for Arthroplasty Registries at Stratford-upon-Avon with 200 participants.

User Questionnaire

At this time the so-called user questionnaire is under way. The questionnaire was initiated by the Swedish Association of Local

	Percentage
0	15%
1–2	45%
3–4	35%
5–9	3%
10 or more	3%
Total	100%

Example question: How many times during the last twelve months have you within your area of reponsibility used quality register data to identify local improvement areas.

Authorities and Regions and aims to identify the utility of the Register's results of operational analyses, improvement and clinical research. A majority of the nation's orthopedic clinics have responded and the questionnaire is in continual use. It is very gratifying for the Registry management to see that about 85% of the country's arthroplasty unit heads report using register data several times yearly to identify areas for improvement. The questionnaire results will be published in the next report.

Coverage

All units, public and private, that carry out total hip replacement are included in the Register. All hospitals where hemi-arthroplasty is carried out also report to the Register. The Swedish Hip Arthroplasty Register thus has a 100% degree of coverage for hospitals. Coverage for primary hip replacement on an individual basis (completeness) has also been controlled by co-processing with the National Patient Register at the Swedish National Board of Health and Welfare, and is accounted for in detail in a later chapter. The degree of coverage on a national level was 97.5% for total hip replacement, and 96.2% for hemiarthroplasty.

Patient-reported outcome measures – PROM

Patient-reported outcome measures were reported from all hospitals during 2012. The Register now has a nationwide system to prospectively and longitudinally capture patient-reported outcomes for all patients with total hip replacement. The response frequency for one-year follow-ups is slightly higher than 90%.

Reporting

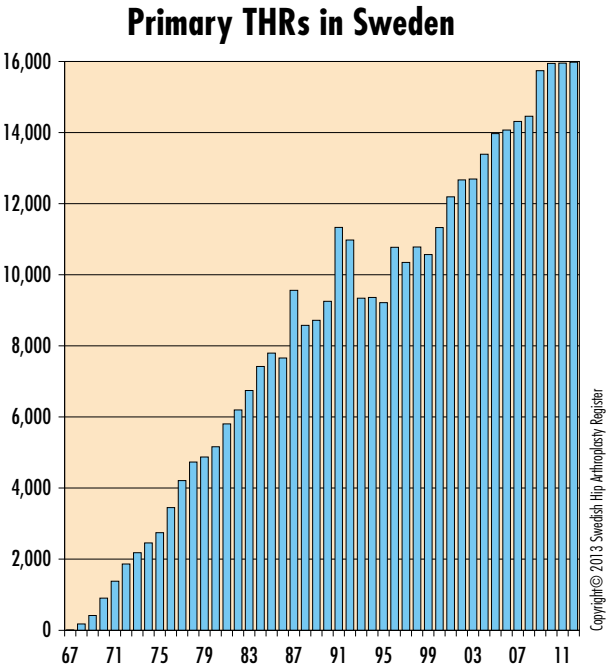
Most of the clinics report via the web application. Medical record copies from reoperations are sent during the year with varying delay. Reviews of journal copies and systematic central data collection is a necessity for register analyses regarding reoperations and revisions.

Feedback data

All publications, annual reports and scientific reports are presented on our website. The Swedish Hip Arthroplasty Registry calls, in cooperation with the Swedish Knee Arthroplasty Registry all clinics to a yearly user meeting in Arlanda. A number of "site visits" are carried out during the year.

Local activity analysis and development

The Register has, throughout the years, worked for feedback and transparency to stimulate participating units to local activity analyses to lead to measures of improvement. During the last years we have, in each annual report, chosen to pick out positive examples of such efforts. This year we are publishing a number of medical student and residency projects that highlight local operational analyses, which will also be seen as the start of local improvements.



The number of primary total hip arthroplasties performed in Sweden from 1967 (6 operations) to 2012 (15 978 operations).

The year's production

During 2012 the annual production of total hip replacements was unchanged compared to 2011. Approximately 16,000 operations were carried out, which is 167/100,000 inhabitants. The production of hemiarthroplasties was unchanged as well with approximately 4,500 operations. The number of reoperations was 2,350 and 319, respectively. A total of 23,025 operations during 2012 were reported to the Swedish Hip Arthroplasty Register.

Our thanks to all contributors!

The Swedish Hip Arthroplasty Register is based on decentralized data capture, which is why the clinics' contact secretary and physician contributions are highly necessary to the Register's function. Many thanks for all contributions during the past year! The Register would also like to express its thanks for the tremendous support from the region of Western Götaland and The Registry Center of the region of Western Götaland.

Gothenburg in December 2013

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Notes

Incidence and prevalence of total hip replacement in Sweden

Incidens

Since the Swedish Hip Arthroplasty Register began the incidence of total hip replacement has steadily increased. In 2012, 15,978 total hip replacements were performed in Sweden, which represents 326 procedures per 100,000 inhabitants, 40 years and older. In an international comparison of the countries reporting procedure frequency in national quality registers Sweden has among the highest incidence. A natural explanation for the increasing incidence is that life expectancy is increasing. However, the last 15 years' increase in the incidence of total hip replacement cannot explain an increase in the number of operations due to acute hip fracture: the rate of fracture patients has, instead, fallen from 13% in 1998 to 9% in 2012. Furthermore, the proportion of operations due to inflammatory arthritis decreased from 5 to 1.5%. During the same period, life expectancy increased from 79.3 to 81.5, but the median and mean age at surgery has dropped, with no tendency toward a change in variation in age. This suggests that the indication for hip arthroplasty has been extended for patients with hip osteoarthritis: we operate earlier in the disease process.

The U.S. has forecasted an increase in the number of hip arthroplasties by 174% by 2030. None of the predictions regarding hip arthroplasty that have been published have been able to show a leveling off of incidence.

Based on the annual number of hip arthroplasties 1967-2012 and age population data including future forecasts from Statistics Sweden's population statistics, we could predict the incidence of hip arthroplasties per 100,000 aged 40 or older. An asymptotic regression model was used for calculation. The analysis showed that the incidence is leveling off. In 2020, the incidence was estimated to reach 341 (95% CI, 327-353) and 358 in 2030, (95% CI 339-376). If the population increases in accordance with Statistics Sweden's forecast the annual number of hip arthroplasties in Sweden is estimated to increase to 17,850 operations in 2020, and 20,140 operations in 2030.

Prevalence

We have also studied how prevalence has changed over the years. Since calculation requires information on the possible death date, we have not been able to include those who had surgery before 1992 when registration was on an individual level. In the analysis, we have therefore included all patients after total hip replacement since 1992. We present partly the prevalence of prosthesis bearers either unilaterally or bilaterally and partly the prevalence of bilateral prosthesis bearers. Prevalence is expressed as the number of prosthesis bearers per 100,000, aged 40 years or older at the end of each year.

At the end of 2012, 146,124 people had had at least one total hip replacement performed after 1991, implying that 3.0% of the population 40 years or older had total hip replacement. 34,883 (24%) of these had bilateral prostheses. 1.5% of the Swedish population had undergone at least one total hip replacement after 1991.

Prevalence was lower for men (2.5%) compared to women (4.6%). It was slightly more common that women were operated bilaterally; 23% for men compared to 25% for women.

Of those who had undergone surgery on one hip between 1992 and 1997, 36% were alive at the end of 2012. The later the years studied the more accurately the numbers reflect the "true" prevalence. The number of people who had surgery before 1992 and were still alive in the late 2012 was, if not negligible, relatively low. Since the incidence has steadily increased prevalence has also increased. As an example, the prevalence per 100,000, 40 years or older has increased by 21% between 2007 and 2012.

Number of individuals with at least one total hip replacement in Sweden*

Numbers per age group	1997	2002	2007	2012
<40	489	718	880	913
40–49	1,294	1,822	2,612	3,503
50–59	4,749	7,962	9,507	11,270
60–69	11,084	17,980	27,487	35,492
70–79	19,207	29,763	38,629	49,160
80–89	10,413	21,829	31,418	38,153
90 +	805	2,464	4,674	7,633
Total numbers	48,041	82,538	115,207	146,124
Prevalence per 100,000 ≥ 40 yrs	1,117	1,861	2,466	2,985

*surgeries performed after 1991

Nuber of individuals with biltareal total hip replavements in Sweden*

Numbers per age group	1997	2002	2007	2012
<40	83	169	185	196
40–49	181	298	506	710
50–59	643	1,412	1,990	2,396
60–69	1,302	3,356	6,197	8,701
70–79	1,896	4,602	8,152	12,852
80–89	664	2,643	5,620	8,644
90 +	41	198	563	1,384
Total numbers	4,810	12,678	23,213	34,883
Prevalens per 100,000 ≥ 40 year	112	286	497	713

*surgeries performed after 1991

Degree of coverage

A high degree of coverage is one of the most important factors for a register's data qualtity and the possibility to carry out operational analyses and clinical research. Coverage should be indicated on an individual level (*completeness*). Coverage concerning participating units is an important variable, but if each participating unit underreports on an individual basis, analyses and feedback will be misleading. All hip arthroplasty-producing units in Sweden have participated for many years by reporting to the Register, so that the primary goal of current analyses is to illuminate completeness.

Method

After combining the Register's databases with the Patient Register (PAR) (Code: NFB29, 39, 49, 62 for total hip replacement; NFB09 and NFB19 for hemiarthroplasty) on an individual level (personal indentity number) results in three outcomes:

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

Coverage for hip arthroplasty

The completeness of the Swedish Hip Arthroplasty Register is presented in the following table as the sum of outcomes 1+2 and the completeness for PAR as the sum of 1+3. We do not know whether these results reflect true completeness since patients may have undergone hip arthroplasty without the unit in question entering data in either register. The number of such cases should be very low in Sweden in 2012.

Weaknesses in the analyses

1. *Laterality.* In most cases the patient register lacks laterality, i.e. right or left is not indicated as a unique variable, as in the Hip Arthroplasty Register. Patients operated with one-stage or two-stage bilateral total hip replacement during 2012 may 'drop out' of the patient register with the selection criteria chosen for matching. This explains why the country's total can vary between result tables compared with coverage tables.

   During 2012, 100 patients were operated on in Sweden, with one-stage bilateral total hip replacement. These 200 operations were registered as such in the Register but only as 100 procedures in PAR. The Register's leadership has for many years wondered at the fact that more or less all of Sweden's PAS-systems lack the laterality variable, subsequently leading to suboptimal statistical utility of these databases for illnesses involving paired organs. We have, for several years, tried to persuade The Swedish National Board of Health and Welfare of the necessity of introducing a requirement to use the classification and treatment procedure codes (KVÅ) code for laterality, but interest has been weak for such a necessary measure.

2. *Lag in registration*. Certain units are 'chronic' laggards - not so seldom after New Year, which is a great disadvantage with this type of necessary quality control. Experience has shown that another 0.5% to 1.0% are reported to the Register during the subsequent year.

3. *Administrative fusions of hospitals as well as the opposite, i.e. operations carried out at "satellite hospitals".* As described earlier both these examples of structural change in orthopaedics represent a future 'threat' to fair and open reporting. Differences in completeness may consequently have non-medical logistical causes; e.g. that hospitals report to the PAR via 'the principal hospital' and to the Register via the unit where the operation was performed. The Swedish Hip Arthroplasty Register has always and will always state hospital affiliation to the hospital /operational environment where the actual intervention is performed. This is to enable analyses of complications.

Results

Total hip replacements. Coverage for the country at large for 2012 was 97.5%. Should the analysis be repeated, the regular lag of 0.5-1.0% would probably mean that over 98-99% of all primary total hip replacements are registered in Sweden, which is very satisfying. Departments with values less than one standard deviation below the national mean are marked with red in the table. Twenty-one clinics received this marking regarding degree of coverage in the register during 2012 – despite the high national average there is potential for improvement.

Hemiarthroplasties. Hemiarthroplasty registration has been going on for 8 years and coverage on a national level is relatively unchanged at 96.2%. Here are also possibilities for improvement at a number of clinics, chiefly regarding reporting to the Register.

Reoperations and revisions. A high degree of coverage for this type of intervention register naturally includes completeness for reporting possible reoperations/revisions. The analysis of secondary interventions, however, proves to be much more difficult owing to the poor quality of coding; both for diagnosis and for reoperation measures. The Registry now maintains a strategy which includes several methods of checking incomplete registration of reoperations (please see page 46 under the heading "Underreporting").

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

Completeness for THRs 2012

Hospital	No[1)]	SHAR[2)]	PAR[3)]
University/Regional hospitals			
Karolinska/Huddinge	240	100	97.9
Karolinska/Solna	197	94.7	99.5
Linköping	59	95.2	100
SU/Mölndal	375	88.7	97.4
SUS/Lund-SUS/Malmö	213	97.7	94.0
Umeå	63	95.4	98.4
Uppsala	225	91.4	98.3
Örebro	115	99.1	98.3
Central hospital			
Borås-Skene[4)]	293	94.2	95.8
Danderyd	306	97.5	98.7
Eksjö	216	96.0	97.8
Eskilstuna	127	97.0	97.8
Falun	396	97.7	98.7
Gävle	195	96.6	97.1
Halmstad	238	97.1	98.0
Helsingborg	240	98.0	95.1
Hässleholm-Kristianstad[4)]	673	99.7	98.5
Jönköping	191	96.9	98.4
Kalmar	122	98.4	97.6
Karlskrona-Karlshamn[4)]	253	98.8	96.9
Karlstad	228	97.0	98.3
Lidköping-Skövde[4)]	439	97.8	95.5
Norrköping	229	98.7	99.1
Sunderbyn	36	97.3	97.3
Sundsvall	182	100	98.4
Södersjukhuset	412	94.5	95.9
Uddevalla	338	99.7	96.8
Varberg	242	99.5	98.3
Västerås	504	93.6	97.7
Växjö	153	96.2	95.6
Ystad	8	100	87.5
Östersund	301	96.5	96.8
Rural hospitals			
Alingsås	209	98.1	97.7
Arvika	189	96.9	96.4
Enköping	324	99.4	100
Frölunda Specialistsjukhus	81	98.8	96.3
Gällivare	110	100	100
Hudiksvall	100	95.2	96.2
Karlskoga	166	100	100
Katrineholm	208	97.7	96.7
Kungälv	135	96.4	94.3
Lindesberg	211	100	100
Ljungby	175	97.8	97.2
Lycksele	275	98.9	99.3
Mora	203	96.7	98.1
Norrtälje	106	100	96.2
Nyköping	164	97.1	97.1
Oskarshamn	203	99.5	99.5
Piteå	389	99.8	99.8
SUS/Trelleborg	628	99.9	99.9
Skellefteå	98	99.0	99.0
Sollefteå	123	95.4	98.5
Södertälje	109	98.2	99.1
Torsby	122	99.2	99.2
Visby	118	94.4	97.6
Värnamo	147	98.6	97.9
Västervik	109	99.1	98.2
Örnsköldsvik	139	97.9	97.9
Private hospitals			
Aleris Specialistsjukvård i Motala	438	97.1	99.1
Aleris Specialistsjukvård Elisabethsjukhuset	65	100	100
Aleris Specialistsjukvård Nacka	134	97.8	95.6
Aleris Specialistsjukvård Sabbatsberg	162	100	97.5
Art Clinic	10	100	100
Bollnäs-Aleris Specialist-sjukvård Bollnäs	330	98.5	97.9
Capio S:t Göran	397	99.3	98.6
Carema Ortopediska Huset	332	95.4	75.9
Carlanderska	119	100	0
Movement	176	93.2	99.0
Ortho Center Stockholm	435	99.7	99.7
OrthoCenter IFK-kliniken	130	97.0	98.5
Sophiahemmet	193	97.0	99.5
Spenshult	316	98.4	99.4
Nation	15,887	97.5	96.8

Red marking indicates values one standard deviation below nation-al average.

[1)] Refers to the number of registrations in the Swedish Hip Arthro-plasty 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)] Mergers

Completeness for hemi-arthroplasties 2012

Hospital	No[1)]	SHAR[2)]	PAR[3)]
University/Regional hospitals			
Karolinska/Huddinge	106	99.1	94.4
Karolinska/Solna	63	100	79.4
Linköping	74	89.1	95.1
SU/Mölndal	261	97.4	84.3
SUS/Lund-SUS/Malmö	382	98.9	94.5
Umeå	95	93.1	96.1
Uppsala	115	89.9	95.4
Örebro	71	94.7	96.0
Central hospitals			
Borås-Skene[4)]	66	89.2	95.9
Danderyd	150	98.1	90.9
Eksjö	37	92.5	92.5
Eskilstuna	74	98.7	92.0
Falun	125	99.3	94.5
Gävle	96	95.0	93.1
Halmstad	45	95.7	100
Helsingborg	181	96.8	95.2
Hässleholm-Kristianstad[4)]	99	96.1	94.2
Jönköping	46	100	97.8
Kalmar	63	96.9	92.3
Karlskrona-Karlshamn[4)]	87	95.6	91.2
Karlstad	72	93.5	90.9
Lidköping-Skövde[4)]	139	95.2	91.8
Norrköping	60	100	91.7
Sunderbyn	134	97.8	95.6
Sundsvall	77	97.5	94.9
Södersjukhuset	265	94.3	92.9
Uddevalla	196	98.0	92.0
Varberg	75	98.7	97.4
Västerås	21	77.8	85.2
Växjö	57	90.5	90.5
Ystad	68	100	98.5
Östersund	60	96.7	96.7
Rural hospitals			
Alingsås	34	97.1	88.6
Arvika	15	100	100
Gällivare	31	100	96.8
Hudiksvall	60	96.8	87.1
Karlskoga	29	100	96.6
Kungälv	50	98.0	92.2
Lindesberg	24	100	100
Ljungby	25	96.1	96.1
Lycksele	2	100	50.0
Mora	43	97.7	86.4
Norrtälje	35	100	97.1
Nyköping	6	85.8	57.2
Piteå	2	100	100
Skellefteå	38	97.4	94.9
Sollefteå	41	100	87.8
Södertälje	32	94.1	91.2
Torsby	18	100	94.4
Visby	20	100	85.0
Värnamo	16	94.1	82.4
Västervik	44	100	90.9
Örnsköldsvik	40	95.3	95.3
Private hospitals			
Aleris Spec.vyeard i Motala	48	75.1	93.8
Capio S:t Göran	210	99.5	95.3
Nation	4,323	96.2	92.8

Red marking indicates values one standard deviation below nation-al average. This average is calculated from the reporting of total hip arthroplasties since the registration logistics is assumed not to differ between total hip arthroplasties and hemiarthroplasties.

[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)] Mergers

Primary total hip replacement

News and results

Last year we began the work of restructuring the databases in order to facilitate future analyses.

The first step was to create the basis for integrating the component database with the primary and reoperation databases. This implied that detailed information concerning the various implant component characteristics such as choice of material and size would be easier to analyze. More detailed information is now available, for example for the choice of material and cup size, liner and shell, reflected in this year's annual report. This project will be completed during 2013–2014.

The Register's report is built upon a large number of analyses. For the sake of clarity they are not always presented in their entirety. The results from regression analyses are presented as risk ratio (RR) with a 95% confidence interval (C.I.) and one decimal. When the value lies above 1 but close to 0, that is, statistical significance, it is presented with two decimals.

Demography

During the last three years the number of primary total hip replacements has been surprisingly constant, and varied only between 15,945 (2010) and 15,978 (2012). Since 1998 the proportion of total hip replacements in women decreased from 61.7% to 58.1% in 2012. In the database with primary total hip replacements 20.3% had undergone bilateral surgery. Here, distribution between the sexes is quite similar. Between 1992 and 2012 20.0% of men and 20.6% of women had bilateral surgery. The proportion of female patients operated on one or both sides during the same period dropped from 61.9 to 57.6%.

During the period 1992-1999, the average age for men was 68.1 (median 69) and for women 70.5 (median 72). Subsequently, both the average and median ages have declined. Between 2011 and 2012 the average age had increased slightly, from 66.9 to 67.2 in men and from 69.2 to 69.9 in women. The median age is unchanged in both sexes, 68 and 70 for both sexes. The increase cannot be explained by the fact that we operate more patients at the more advanced age because of hip fracture or other types of secondary osteoarthritis. In the group with primary osteoarthritis, the average age increased from 66.9 to 67.1 years for men and from 69.1 to 69.7 years for women.

Since 1995, the proportion of men under 60 has increased from 19.4% to just over 20% (21.2% in 2012, Figure 1). For women, there has been a corresponding decrease from 16.1 to 14.5%. The differences are relatively small. Since 1995, the total number of primary total hip replacements increased by 92% in men and 69% in women. In absolute terms, this implies that the proportion of young people who undergo total hip replacement has increased. In relative terms, we see a slight increase in men but not in women, possibly due to the fact that fewer patients with inflammatory joint diseases suffer from debilitating hip disease. During the period, a significantly greater redistribution occurred between the three age groups 60 years or older. The relative proportion of patients 60-69 has increased, while the proportion 70 years and older has declined. The increase that occurred in the 2000s seems to have leveled off between 2011 and 2012 in women but not in men (see also the section "Gender").

Women undergo hip arthroplasty more often than men, but the gender gap is diminishing. Men are younger than women at the time of surgery.

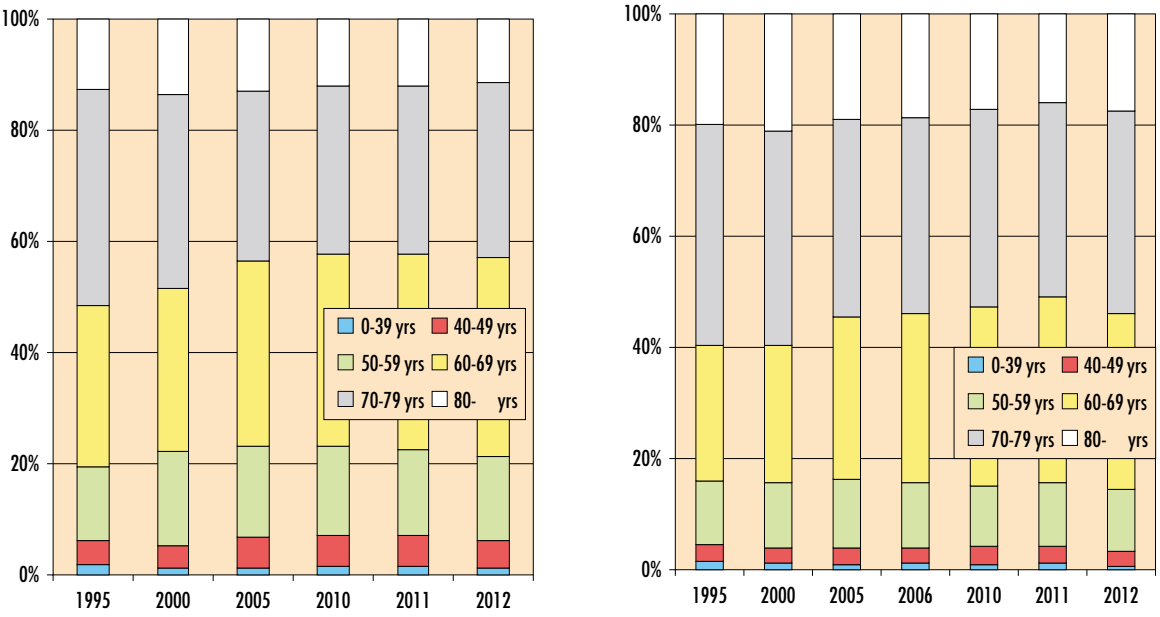


Figure 1. Grouped age distribution in men and females, respectively.. Since 1995, the proportion in the group 60-69 years of age has increased markedly and the proportion of 70 years and older has decreased. The proportion of patients under 50 years has stayed relatively constant.

Diagnosis

The most common reason for total hip replacement is primary osteoarthritis. Since 1995 the proportion with this diagnosis increased from 83% to 86% in men and 69% to 81% in women (Table 1). This can be interpreted as the increase in primary total hip replacements observed during the period mainly affected the diagnosis of primary osteoarthritis. Other factors, however, are instrumental, and the number of patients who undergo surgery because of inflammatory joint disease has decreased for both sexes. The relatively large number in the group "other" in 1995 consisted of 90-94% with the diagnosis of Paget's disease, a diagnosis that has been greatly reduced in the late 1990s only to almost completely disappear. The diagnosis group "fracture" increased in absolute terms in both men and women but in relative terms only in men. This group consists mainly of patients who have suffered a hip fracture. During the period 1995–2012 the diagnoses acute hip fracture and sequelae after hip fracture made up 96.1% of the current group. During the period 1995-2012 redistribution occurred within this group as more and more patients with acute hip fracture underwent surgery with primary total hip replacement (Figure 2).

The proportion of patients with a diagnosis of primary osteoarthritis increased until 2005, but has since then stabilized at 80-81% for women and 86-87% for men.

Distribution of diagnoses for THR

	Year of surgery				
Diagnosis *numbers %*	**1995**	**2000**	**2005**	**2011**	**2012**
Primary osteoarthritis					
Men	2,874 *82.6*	3,706 *84.5*	4,979 *87.7*	5,739 *8.4*	5,750 *86.0*
Females	3,786 *69.0*	5,081 *73.2*	6,616 *79.8*	7,517 *80.7*	7,564 *81.4*
Inflammatory arthritis					
Men	133 *3.8*	118 *2.7*	85 *1.5*	66 *1.0*	66 *1.0*
Females	361 *6.6*	283 *4.1*	242 *2.9*	176 *1.9*	129 *1.4*
Fractures (acute or sequele)					
Men	226 *6.5*	361 *8.2*	359 *6.3*	479 *7.2*	486 *7.3*
Females	805 *14.7*	1,112 *16.0*	976 *11.8*	1,052 *11.3*	1,055 *11.4*
Childhood disease					
Men	37 *1.1*	65 *1.5*	104 *1.8*	135 *2.0*	126 *1.9*
Females	69 *1.3*	159 *2.3*	170 *2.1*	203 *2.2*	199 *2.1*
Femoral head necrosis					
Men	100 *2.9*	100 *2.3*	108 *1.9*	184 *2.8*	215 *3.2*
Females	189 *3.4*	261 *3.8*	236 *2.8*	323 *3.5*	307 *3.3*
Other diagnoses					
Men	110 *3.2**	37 *0.8*	45 *0.8*	38 *0.6*	45 *0.7*
Females	276 *5.0**	46 *0.7*	48 *0.6*	39 *0.4*	36 *0.4*

*>=90% Mb Paget

Table 1. Distributiuon of diagnoses during selected years from1995 to 2012. The proportion primary osteoarthritis and sequele after childhood disease has increased and inflammatory arthritis and other diagnoses have decreased. In the latter group mainly due to the fact that the diagnosis Mb Paget almost has disappeared.

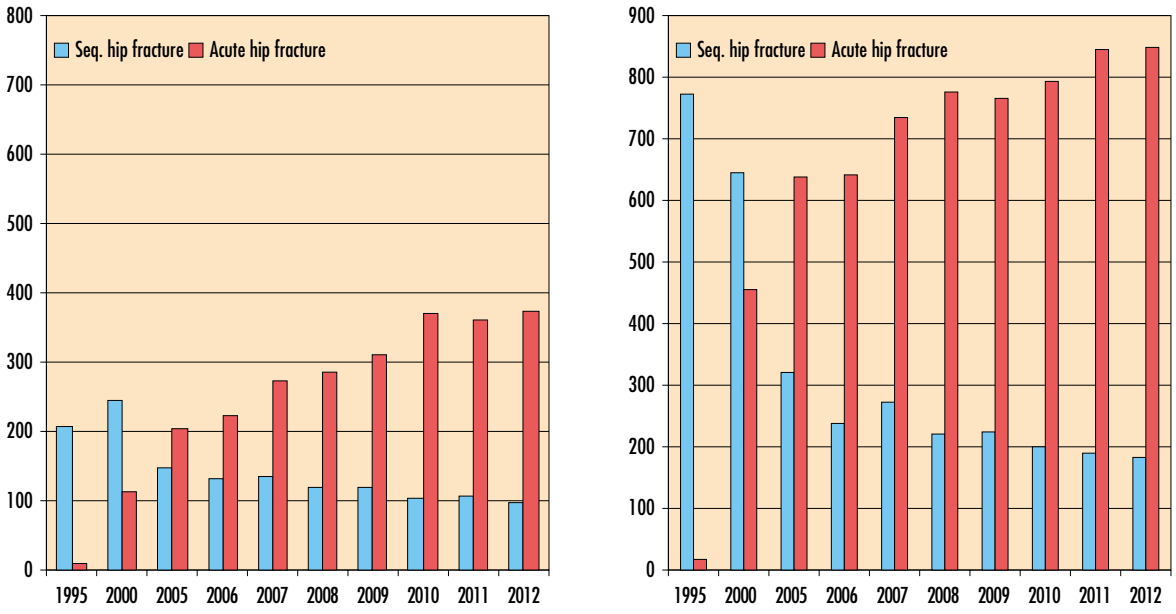


Figure 2. Numbers of total hip replacements on men (to the left) and females (to the right) due to sequele after hip fracture and acute fracture during 1995 to 2012.

BMI and ASA classification

Reporting of BMI (Body Mass Index) and ASA class (classification of morbidity) to the Swedish Hip Arthroplasty Register began on a larger scale in 2008, and has become increasingly comprehensive. In 2008, data was missing for BMI for 17.7% of all primary operations. In 2012 this proportion dropped to 5.3%, a proportion we hope will be further reduced. Regarding ASA reporting is more complete. In 2012, data was missing for 2.5% of the operations.

Both BMI and ASA classification influence the results of total hip replacement. A high BMI and probably even limited comorbity increase the risk for early reoperation (see section on the ”standard” patient). A high ASA classification and BMI correlate with several other factors increasing the risk of early prosthesis complications, such as infection and dislocation. Many studies indicate that one can expect that BMI influences long-term results, with possible variations for differing choices of prosthesis. This is an important issue which will be evaluated when follow-up time increases.

During the period 2008-2012, BMI increased for both sexes (Table 2). In men, the proportion with varying degrees of obesity (BMI> = 30) increased; there has also been an increase for women in the overweight group (BMI = 25-29.9). In the year 2012 only 26.3% of men and 38.2% of women were classified as having normal weight (18.5-24.9). Being underweight is relatively uncommon particularly in the male part of the population undergoing total hip replacement.

In 2008 27.8% of the men were classified as healthy (ASA class I), as compared to 24.3% in 2012. The proportion classified in Group III or higher increased from 17.3 to 21.1%. In 2008, the proportion of healthy women was lower than for men (22.7%). In 2012 this proportions had dropped to 21.3%. Even among women there was an increase of patients with ASA class III or higher, although not as pronounced as for men.

Since 2008, the proportion of overweight/obese and unhealthy patients slowly increased.

BMI och ASA classification

	2008	2009	2010	2011	2012
BMI					
Valid obs./missing obs.	*11,897/2,559*	*14,055/1,683*	*14,643/1,302*	*14,929/1,022*	*15,119/859*
Mean *median*					
Males	27.4 *26.8*	27.6 *26.9*	27.4 *26.9*	27.6 *27.0*	27.7 *27.1*
Females	26.6 *26.0*	26.8 *26.2*	26.8 *26.1*	26.8 *26.2*	26.8 *26.2*
Group %					
Underweight <18.5					
Males	0.4	0.3	0.5	0.4	0.5
Females	1.9	2.0	1.8	2.1	1.6
Normal weight 18.5–24.9					
Males	28.8	27.9	28.5	27.5	26.3
Females	39.9	38.2	38.3	37.5	38.2
Overweight *25–29.9*					
Males	49.0	49.8	49.2	48.0	48.9
Females	36.3	36.5	36.9	37.0	37.1
Obesity class I 30–34.9					
Males	17.0	17.5	17.2	19.3	18.9
Females	16.3	17.3	16.9	17.6	16.9
Obesity class II–III 35–					
Males	4.7	4.4	4.6	4.8	5.3
Females	5.6	5.9	6.1	5.9	6.3
ASA class					
Valid obs./missing obs.	*12,977/1,479*	*14,926/812*	*15,340/605*	*15,474/477*	*15,571/407*
Proportions %					
Healthy (I)					
Men	27.8	28.5	27.2	24.8	24.3
Females	22.7	23.4	22.8	22.2	21.3
Mild systemic disease (II)					
Men	54.8	53.6	54.3	56.2	54.6
Females	60.2	60.5	60.0	60.4	60.4
Severe systemic disease (III–V)					
Men	17.3	17.9	18.5	19.1	21.1
Females	17.1	16.2	17.2	17.5	18.3

Table 2. Changes in BMI and ASA class between 2008 and 2012.

Bilaterality

If an otherwise healthy patient has problems with both hip joints, one-stage surgery can be considered. Of the 262,546 primary total hip replacements reported between 1992 and 2012, 44,351 were indicated as bilateral, where both hips were operated on within the interselection. This implies that the number of patients was 218,196 during the same period. The majority of those with bilaterality were subjected to arthroplasty on two separate occasions (96.1%). One-stage bilateral operations were performed on 1,732 patients (Table 3). The number of bilateral total hip replacements during one year has varied between 33 and 115, tending to increase around the year 2000. Patients undergoing bilateral operations on two occasions are more likely to be of female gender and younger than those undergoing unilateral surgery when the first hip surgery is performed, regardless of whether traumatic cases are excluded or not. Patients subject to bilateral one-stage surgery form a select group. The group is younger, has a higher incidence of inflammatory joint disease, and consists of relatively more men compared to the group operated bilaterally on separate occasions.

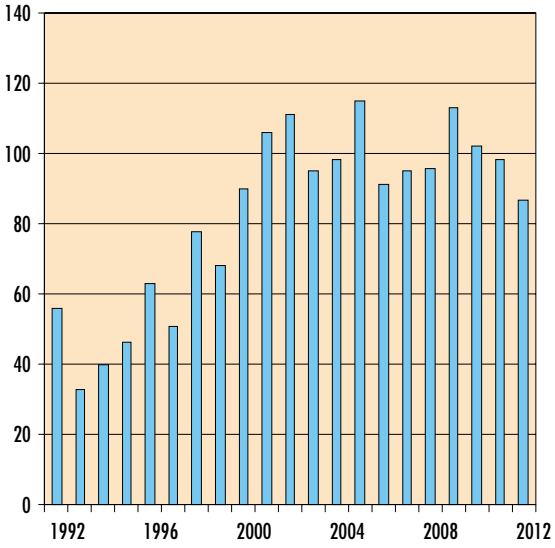


Figure 3. Numbers of patients with one-stage total hip arthroplasty from 1992 to 2012.

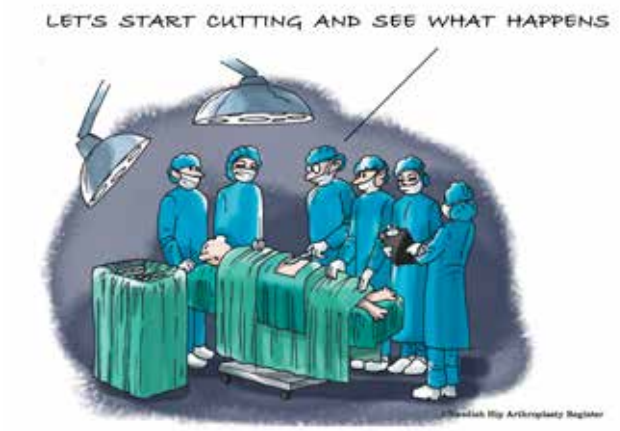
Uni- och bilateral THRs

	Unilat. operation	Bilat. operation, 2-stage	Bilat. operation, 1-stage
All diagnoses			
Number %	173,845 *79.7*	42,619 *19.5*	1,732 *0.8*
Mean age *SD*	70.0 *10.9*	65.3 *10.1*	60.5 *13.0*
Proportion females %	59.4	60.5	54.8
Diagnos			
Primary osteoarthritis	75.1	87.8	77.9
Inflammatory arthritis	2.7	4.3	11.2
Acute fracture	14.7	2.8	2.4
Childhood disease	1.8	2.2	3.4
Femoral head necrosis	3.4	1.8	4.2
Others	2.2	1.1	0.9
All diagnoses excl. trauma			
Number %	148,203 *77.5*	41,427 *21.7*	1,691 *0.9*
Mean age *SD*	69.1 *10.9*	60.1 *10.1*	60.1 *12.9*
Proportion females %	57.1	60.5	54.3
Diagnosis			
Primary osteoarthritis	88.1	90.3	79.8
Inflammatory arthritis	3.2	4.4	11.5
Childhood disease	2.1	2.2	3.5
Femoral head necrosis	4.0	1.9	4.3
Other	2.6	1.1	0.9

Table 3. Demography for unilateral, one-stage and two-stage procedures (first procedure for bilateral procedures).

Surgical approach

During 2012 more than half of all operations used a posterior surgical approach (Moore approach) (52.0%). Since 2003 when the proportion was 55.9%, the proportion of posterior approaches has diminished (Figure 4). Direct lateral incision in the supine position has also declined steadily from 12.3% to a plateau of about 5%. Within the group of "others" different types of mini-incisions dominated by a maximum 302 operations in 2007, and now only 21 operations in 2012. The anterior Watson-Jones approach "arrived" in 2008 and increased to 52 operations. "Other approaches" made up less than 1% of the operations. Trochanteric osteotomy is still performed, but in only 29 cases in 2012.



Prosthesis selection

Cemented fixation is more common than in other Scandinavian countries. Poor results with uncemented fixation during the1990s resulted in totally cemented fixation reaching a peak of 91.8% in 2000 (Figure 5). Hereafter, cemented fixation has declined, although more slowly than in other Nordic countries. Between 2011 and 2012, the percentage of all-cemented prostheses changed slightly, from 68.2 to 68.0% (Figure 5). The relative proportion of all-uncemented fixation began to increase during the early 2000s, an increase that continued until 2011-2012. In both years, the proportion of uncemented fixation reached 15.7%. In 1997 hybrid prostheses (uncemented cup, cemented stem) made up 7% of the total. Up until 2007-2008 their share was reduced to 1.4% only to subsequently increase to a still modest level of 2.1% in 2012. Reverse hybrid prostheses (cemented cup, uncemented stem) show an increasing popularity. Since 1997, their share increased for every year elapsed and represented 13.7% in 2012. Resurfacing prostheses have only been used on a small scale in Sweden. During the peak year of 2007, 297 resurfacing prostheses were inserted. Subsequently, their proportion gradually decreased from 2.1 to 0.5% in 2012. Increased risk of revision and serious complications, especially in women of all ages and older men are the reasons why resurfacing prostheses are disappearing completely (see Annual Report 2011).

The distribution between posterior and direct lateral incisions has, in recent years, been relatively unchanged.

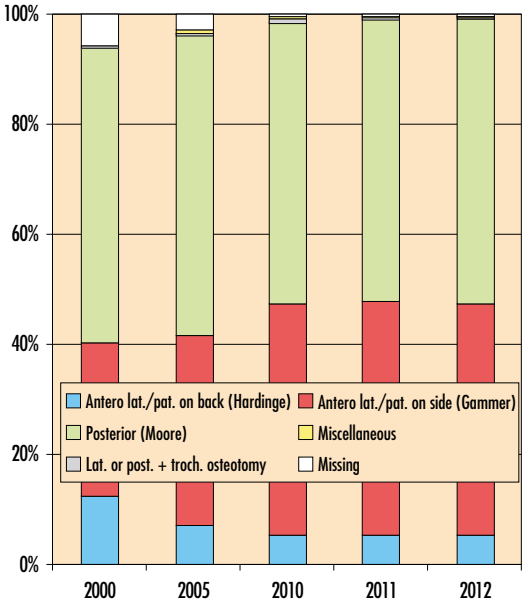


Figure 4. Surgical approaches 2000, 2005 and during the last three years

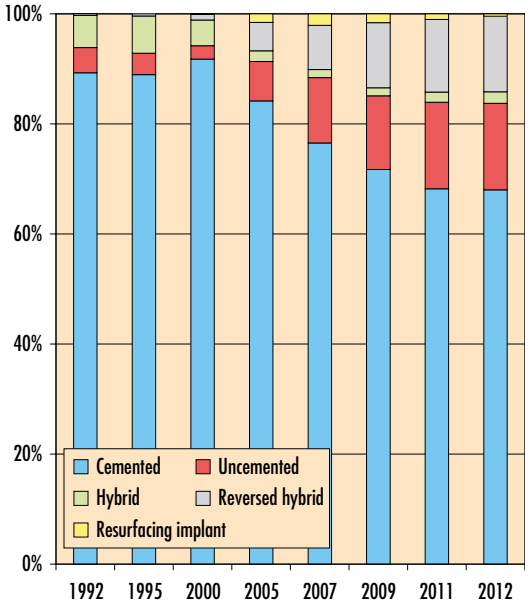


Figure 5. Distribution of main groups based on type of fixation with resurfacing hip replacements shown separately. Between 2011 and 2012 has the changes been minor, 0.5 % or less.

Most commonly used implants 2011–2012

	2012	2011
Cemented cup		
Lubinus	5,731 *43.9*	5,720 *44.1*
Marathon	2,497 *19.1*	2,295 *17.7*
ZCA	1,984 *15.2*	1,912 *14.7*
Exeter Rim-fit	1,397 *10.7*	1,258 *9.7*
Contemporary Hooded Duration	656 *5.0*	729 *5.6*
Cemented stem		
Lubinus SP II	6,136 *54.8*	6,147 *55.1*
Exeter polished	3,455 *30.9*	3,414 *30.6*
MS30 polished	1,467 *13.1*	1,324 *11.9*
CPT	121 *1.1*	130 *1.2*
Spectron EF Primary	8 *0.1*	10 *0.1*
Uncemented cup		
Trilogy	705 *24.8*	933 *33.2*
Continuum	402 *14.1*	229 *8.2*
Pinnacle 100	307 *10.8*	232 *8.3*
Trident hemi	248 *8.7*	230 *8.2*
Exceed Ringloc	195 *6.9*	112 *4.0*
Uncemented stem		
Corail	2,275 *48.3*	2,025 *43.8*
Bi-Metric	769 *16.3*	739 *16.0*
CLS	734 *15.6*	861 *18.6*
Accolade	271 *5.8*	252 *5.5*
ABG II HA	201 *4.3*	277 *6.0*
Cemented implants		
Lubinus – Lubinus	5,024 *46.3*	5,020 *46.3*
Exeter – Marathon	1,399 *12.9*	1,260 *11.6*
MS30 – ZCA	1,222 *11.3*	1,150 *10.6*

	2012	2011
Uncemented prosthesis		
Corail – Pinnacle 100	302 *12.0*	223 *8.9*
CLS – Trilogy	255 *10.1*	372 *14.8*
Corail – Trilogy	200 *8.0*	248 *9.9*
Hybrid		
Exeter – Trident hemi	83 *24.5*	70 *23.6*
Lubinus – Trilogy	65 *19.6*	70 *23.6*
MS30 – Continuum/ CLS – Trilogy	17/17 *5.1/5.1*	5/15 *1.7/5.1*
Reversed hybrid		
Corail – Marathon	541 *24.7*	491 *23.8*
Corail – Lubinus	487 *22.2*	484 *23.1*
Bi-Metric – Marathon	178 *8.1*	177 *8.4*
Resurfacing implants		
BHR all variants	69 *95.8*	139 *81.4*
Adept	1 *1.4*	25 *15.0*
Durom	1 *1.4*	3 *1.8*
Head material		
Metal	13,781 *86.2*	13,621 *85.4*
Ceramic (all variants)	2,094 *13.1*	2,163 *13.6*
Missing data	103 *0.6*	167 *1.0*
Head diameter		
28	4,656 *29.1*	5,877 *36.8*
32	9,836 *61.6*	8,593 *53.9*
36	1,247 *7.8*	1,157 *7.3*
Other/missing data	239 *1.5*	324 *2.0*

Table 4. Most commonly used implants (number, %), head type, and implant combinations during 2012. The corresponding proportions for 2011 is shown for comparison.

Selection of prosthesis components and articulation

The five most frequently used cemented cups have a relatively stable market share compared with 2011 (Table 4). Three have increased slightly and two have decreased. During 2012 they jointly comprised 93.9% of all inserted cemented cups. The majority of all cemented cups (58.4%) were highly cross-linked polyethylene. Cemented metal shells of dual articulation cups increased from 0.9 (116 total hip replacements) to 1.3% (175 operations) between 2011 and 2012.

As for stems, three types represent 98.8% of all stems fixated with cement (Lubinus SP II, Exeter, MS30). During 2011the corresponding proportion was somewhat lower (97.6%). Between 2011 and 2012 the choice of cemented stems has been further reduced.

The choice of uncemented cup and stem varies more from year to year. The five most frequently used implants make up a smaller proportion of the total. As for cups they represent 65.3% and for stems 74.7%, which are to be compared with 93.9 and almost 100% for corresponding cemented implants. The most distinct change was that Corail stems were more

frequently used in Sweden and that the Trilogy cup was replaced by the Continuum cup. Between 2006 and 2012 the Corail stem increased from 123 to 2,275 implanted prostheses yearly. Between 2010 and 2012 Continuum has increased from 65 to 402 and Trilogy has been reduced from 987 to 705 implanted cups yearly (see in-depth analysis). The majority of the uncemented cups were equipped druing 2012 with a liner of highly cross-linked polyethylene (92.3%), the older type of polyethylene is only used in 2.2% of cases. Ceramic inserts are used in 2.9% of cases, and metal inserts were used in two operations.

Reliable data is missing for the remaining cases (2.5%). Table 4 also indicates the three most common combinations of cup and stem for the five main groups: cemented, uncemented, hybrid, reverse hybrid and resurfacing prosthesis.

A continuing increase from the previous year can be seen in both head diameters of 32 and 36 mm (Figure 6) as well as an increased use of metal heads. During 2012, 86.2% of hip arthroplasties used metal heads, and the majority (61.6%) used a head with a diameter of 32 mm. Changes in the artificial joint dimensions and material are associated with the fact that the scientific documentation of highly cross-linked polyethylene has improved.

Large heads provide, if the prosthetic components are correctly placed, better joint stability. On the other hand, a large joint surface implies a greater number of released particles, a problem that can be reduced by the use of durable material such as highly cross-linked polyethylene or ceramics. Since 2005 the use of chiefly 32-millimeter and even 36-millimeter heads increased, from 1.1 to 69.7% during 2012 (Figure 6). At the same time the use of highly cross-linked polyethylene increased from 4.9 to 64.5% during the same period (Figure 7). The proportions of metal-on-metal joints culminated at 4.2% during 2007 to gradually diminish to 0.5% during 2012, and were composed almost exclusively of resurfacing prostheses.

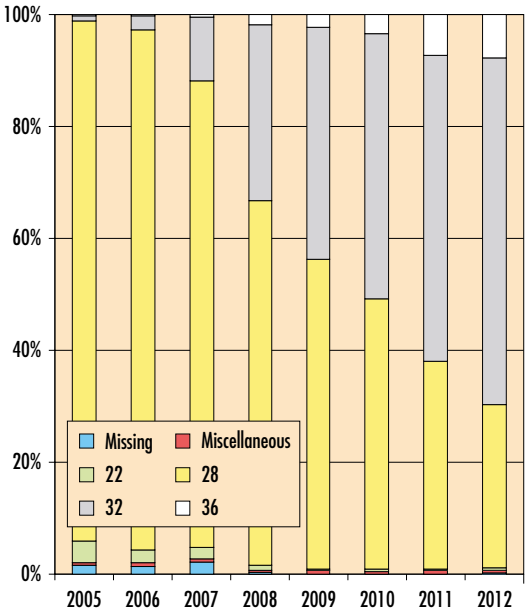


Figure 6. Head size 2005–2012.

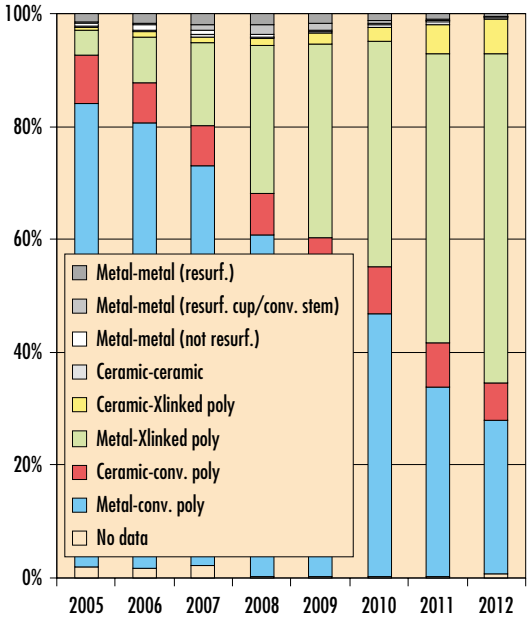


Figure 7. Articulations 2005–2012.

The distribution between different methods of fixation has been relatively unchanged betwwen 2011 and 2012. Resurfacing implants have almost disappeared and. Head size with diameter 32 mm is more often used. Metal on poly is the predominating articulation, where highly cross-linked polyethyelene is used more often.

Primary total hip replacements: in-depth analyses

Young patients

More than half the patients subjected to total hip replacement in Sweden 1992–2012 were between 65 and 74 (52.1%). Barely 5% were under 50 with only 799 (0.3%) under 30, and 130 younger than 20 (0.05%, Figure 1, left image). Since 1992 the proportion of patients up to the age of 39 has been relatively constant, while the group 40–49 has increased somewhat (Figure 1, right image). The aim of this analysis is to describe in greater detail demographics, implant selection and revisions as outcomes for patients under 50. In order to relate this data to the greater majority of patients certain data is presented for these groups as well.

More than 60% of the patients up to 29 years of age are women (Table 1). Hereafter the proportion of women with increasing age up to 50 decreases, only to later increase with age. The most common diagnosis in the youngest group (<30) is inflammatory arthritis followed by primary osteoarthritis, which comprises only slightly more than 25%. Hereafter the proportion with primary osteoarthritis increases with age up to 50–64 only to later decrease, mainly due to an increasing number of hip fractures in the elderly. During 1992–2012 uncemented prostheses were the most commonly selected for patients under 30 followed by all-cemented prostheses. Presently, prosthesis selection has partially changed. During the past three years 72.5% of the patients in the group up to 29 received all-uncemented prostheses, followed by reverse hybrid (18.3%). Only 6.9% of the cases used both cemented cups and stems.

Follow-up for this evaluation was determined at 15 years, whereafter the number of observations were less than 100 for the youngest (and smallest) group. The youngest group also showed the highest proportion of revisions and poorest prosthesis survival after 15 years. The proportion of non-revisions reached 63.9% in comparison with the reference group's 89.7% (Figure 2). Calculation of revision risk has been divided into two periods, up to two years and greater than 2 to15 years following primary total hip replacement. The results are described without adjustment for covariation with other factors, and after adjustment for gender, diagnosis and selection of cemented and uncemented stem and cup, respectively. Resurfacing prostheses are excluded from this analysis, and therefore do not appear in two of the age groups.

During the first two years the risk for revision is somewhat greater for the groups 30–39, 40–49 and over 80. After adjustment for diagnoses, gender distribution and fixation the risk is significantly lower for ages 30 to 64 but still higher for the group 80 and above. The youngest (0–29) do not differ significantly from the reference group. Several factors probably contribute to the younger patient's lower risk for early revision. These patients are also probably operated on more frequently by the clinic's most experienced surgeons.

During the period of 2–15 years the risk for revision for all age groups differs from the reference group regardless of whether one adjusts for covariance. The oldest age group displays a reduced risk compared to the control group aged 70-79 years. For those younger than the control group the risk increases with declining age and the youngest age group reaches 4.5 times greater risk without adjustment and 4.0 times the risk if consideration is taken to gender differences, diagnosis, and selection of fixation.

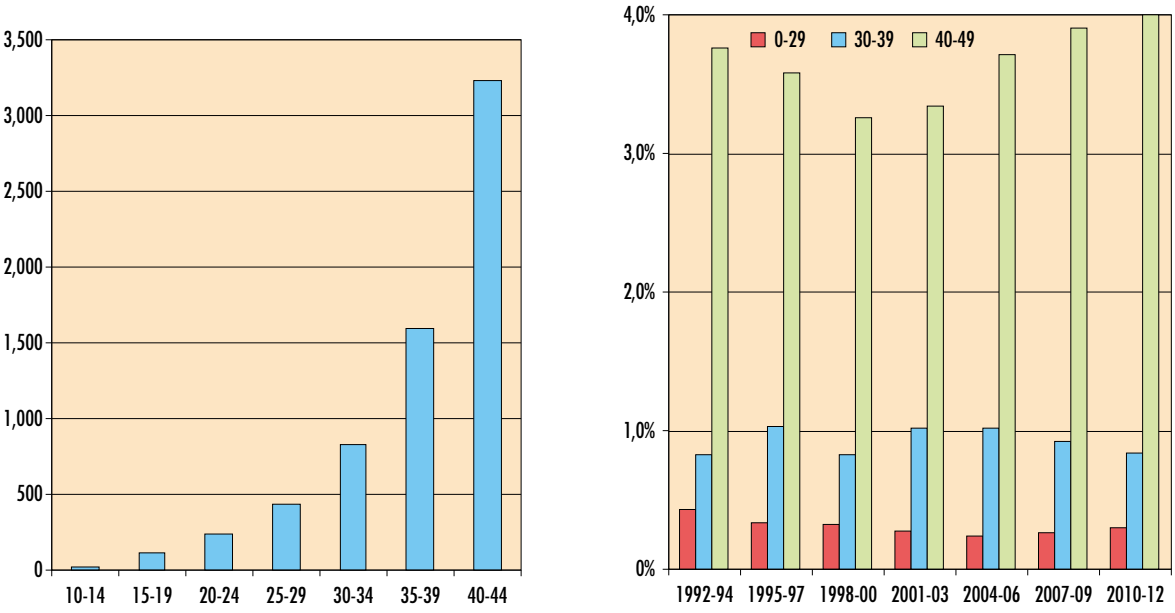


Figure 1. Number of patients in age groups between 10 to 44 years (to the left). Those 45 years and above have been excluded for clarity. The distribution of total hip arthroplasties in relation to the total number in three age groups in patients under 50 years between 1992-2012 (to the right).

Demography and implant survival in different age groups

	0–29 yrs	30–39 yrs	40–49 yrs	50–64 yrs	65–79 yrs	>=80 yrs
Number	799	2,426	9,649	77,265	136,840	35,567
Females %	61.0	51.7	48.0	53.7	61.3	70.0
Diagnosis %						
Primary osteoarthritis	25.8	43.9	67.5	84.9	82.3	67.4
Inflammatory arthritis	37.2	18.7	8.5	4.1	2.6	1.2
Fracture	1.3	3.1	2.8	4.8	11.0	25.0
Posttraumatic osteoarthr.	1.6	0.9	0.4	0.2	0.2	0.3
Childhood disease	16.3	21.5	13.7	2.8	0.6	0.2
Femoral head necrosis	14.0	10.2	5.2	2.4	2.4	4.5
Tumours	1.3	1.0	1.2	0.6	0.6	0.4
Other	2.5	0.7	0.6	0.3	0.5	1.0
Type of fixation %						
Cemented	26.4	27.2	30.1	65.4	93.6	96.9
Uncemented	45.1	43.4	38.0	16.2	2.0	0.5
Hybrid	14.6	11.1	11.6	6.9	1.4	0.9
Reversed hybrid	8.7	9.8	12.6	10.2	3.0	1.7
Resurfacing prosthesis	5.2	8.4	7.6	1.3	0.0	0.0
Follow up *0–15 years*	8.1 *4.8*	7.8 *4.7*	7.5 *4.9*	7.4 *4.7*	6.9 *4.6*	5.0 *3.6*
Proportion revised after 15 years	18.5	13.0	10.0	6.6	3.5	2.0
Implant survival ± 95% C.I*.	64.0±5.2	70.5±3.2	76.9±1.5	83.7±0.5	91.9±0.3	96.0±0.7
Relative risk of revision#						
unadjusted 0–2 yrs	0.7 *0.3–1.6*	1.4 *1.0–2.0*	1.2 *1.0–1.5*	1.0 *0.96–1.1*	1 (ref.)	1.2 *1.1–1.3*
unadjusted >2–15 yrs	4.5 *3.0–6.9*	3.0 *2.2–3.9*	2.2 *1.8–2.6*	1.7 *1.5–1.8*	1 (ref.)	0.7 *0.6–0.8*
adjusted 0–2 yrs	0.5 *0.2–1.1*	0.5 *0.3–0.8*	0.6 *0.5–0.8*	0.8 *0.7–0.9*	1 (ref.)	1.2 *1.05–1.4*
adjusted >2–15 yrs	4.0 *2.6–6.2*	2.6 *1.9–3.5*	2.0 *1.7–2.4*	1.6 *1.5–1.8*	1 (ref.)	0.7 *0.6–0.8*

* Calculated up to 15 years; # RR±95% C.I., ¤adjusted for gender, diagnosis, and fixation (see text)

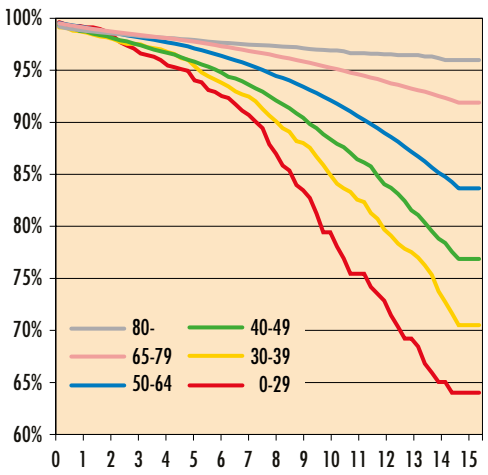


Figure 2. Implant survival based on revision as endpoint for six different age groups.

Summary: The group of patients younger than 30 years constitute less than 0.5% of all THRs. They are more often operated due to other reasons than primary osteoarthritis. Adjusting for gender, diagnosis, and method of fixation the risk of revision in patients under 50 years is doubled and for patients under 30 years there is four times higher risk. Data from this analysis can be used for discussion with younger patients eligible for THR. Nota bene, the analyses include some implants that are not in use any longer, often – but not alwasy – due to poor previous results.

Cross-linked polyethylene

The use of cemented highly cross-linked polyethylene has slowly increased since 2005. The increase was seen first for the ZCA cup followed by the Reflection XLPE and Marathon. The two latter began being used in Sweden in 2006 and 2008, respectively. Liners with the highly cross-linked polyethylene were introduced earlier, but only a few types of uncemented cups have been used with both the older and newer type of polyethylene. Clinical evaluation of diverse polyethylene qualities, should, as far as possible, be based on implants where different polyethylenes are used for the same or similar cup designs. The risk is otherwise great that eventual differences will be masked by design differences other than the quality of polyethylene. We have therefore based our evaluation of the highly cross-linked polyethylene quality on selected designs that we believe will result in a fair comparison. In order to optimize comparison the analysis of the respective design is initiated during the year when the highly cross-linked polyethylene began to be used in Sweden. This implies that the maximum follow-up period is the same for one and the same type of cup. Since several cups with older types of polyethylenes were used at the start of the period the mean follow-up times differ, which can influence the results negatively for the older type of polyethylenes. Only metal caputs with a diameter of 28 and 32 mm, respectively are included since these sizes have been used for both the older and newer polyethylenes. In this year's analysis we have included an additional comparison between the Elite-Ogee and Marathon cup, where the Elite-Ogee represents the older type of polyethylene. The polyethyelen characteristic of the Marathon cup is radiated with 5 Mrad, often considered being the lower limit for a polyethylene to be classified as highly crosslinked. Only an uncemented cup has been used sufficiently with both higly crosslinked and older for a fair comparison. In order to refine the analysis we added another two designs meeting the basic conditions for use with both types of polyethylenes but where outcomes in the form of revision due to loosening/osteolysis are too few for individual analysis. We have made two comparisons in this way; one for the Trilogy cup as well as one where Trilogy, Allofit and Trident are grouped together. The outcome in both the cemented and uncemented group is cup revision due to loosening or osteolysis with or without simultaneous stem revision.

The use of highly cross-linked polyethylene can be expected to reduce the risk for revision due to wear and possible secondary effects of wear such as osteolysis and loosening. In this year's analysis we find a tendency to an increased number of revisions for the Reflection cup with the older ethylenoxide-sterilised polyethylene based on a log rank tests. Further analysis based on Cox-regressions adjusted for age, gender, diagnosis and head size was made where methodologically possible but showing no certain difference in any of the comparisons.

Frequency of cup revision in conventional vs highly crosslinked polyethylene

	Number	Follow-up time mean, *SD (max)*	Cup/liner revision *all reasons* n, %	Cup/liner revision *loosening-osteolysis* n, %	Log Rank test *all reasons/ loosening-osteolysis*
Cemented cup					
ZCA					
Conventional PE	921	6.3 *2.0* (*10*)	17 *1.8*	7 *0.8*	0.3/0.3
XLPE	10,368	1.7 *1.6* (*10*)	110 *1.1*	16 *0.2*	
Reflection all-poly					
Conventional PE	1,365	4.9 *1.7* (*7*)	48 *3.5*	26 *1.9*	0.008/0.02
XLPE	1,660	3.7 *1.2* (*6*)	19 *1.1*	5 *0.3*	
Elite/Ogee-Marathon					
Conventional PE	2,318	3.6 *1.3* (*5*)	22 *0.9*	6 *0.0*	0.09/0.10
XLPE	7,524	1.6 *1.1* (*4*)	22 *0.3*	2 *0.0*	
Uncemented cup					
Trilogy					
Conventional PE	770	8.3 *2.0* (*10*)	19 *2.5*	4 *0.5*	0.90/0.65
XLPE	6,033	3.8 2.4 (*10*)	96 *1.6*	10 *0.2*	
Trilogy, Allofit, Trident					
Conventional PE	1,062	7.7 2.2 (*10*)	26 *2.4*	6 *0.6*	0.90/0.61
XLPE	8,293	3.8 2.3 (*10*)	136 *1.6*	17 *0.2*	

Table 1. Comparison on the frequency of cup revision between conventional polythylene (PE) and highly crosslinked polyethylene (XLPE)

Our analysis shows that highly cross-linked polyethylene has neither unexpected disadvantages nor sure advantages in the form of reduced risk for cup revision depending on loosening or osteolysis. Several studies have, however, clearly shown that highly cross-linked polyethylene significantly reduces wear. The effect of reduced wear can be expected to result in clinical effects in the form of reduced revision risk after seven years or more. Only a few patients in Sweden have reached this length of observation, which is why we will continually evaluate the new plastic during the coming year.

New implants 2003–2011

In Sweden the selection of cemented implants is considerably stable with small changes and a limited selection of prostheses with good documentation. Practically all cemented cups have been replaced or have been replaced with a more resistant polyethylene (see in-depth analysis " Highly cross-linked polyethylene"). Variation is greater on the uncemented side. In the majority of cases changes occur to well-documented prosthetic components, often supported by other national registers. In certain cases undocumented prostheses are used, usually in connection with studies. Previous studies from the Finnish Arthroplasty Register has shown that implant change, even to well-documented implants, imply a risk for a transient increase of the number of revisions. This is probably a factor of the learning curve. Some of the implants introduced on the Swedish market lack long-term documentation. Table 2 shows a collection of new implants in Sweden since 2003 that have been used in at least 90 operations during the last three years. The intention is, as early as possible, to identify implants that in some way deviate, but not to perform a more thorough scientific evaluation. In the event of an eventual non-conforming event an in-depth analysis is needed.

Defining a new implant is complicated. One example is the Bi-Metric stem, which has been in Sweden for some time. The so-called X-series was introduced in 2003 and, according to the supplier, only differs from previous versions by changes in the place, tools and machines of production. We have therefore chosen to include this stem. It should be noted that no cemented stem has been introduced meeting the inclusion criteria for this analysis during the last 10 years.

Assessment of the number of revisions and prosthesis survival shall be made by taking into account the duration of the observation period. Prostheses with a shorter observation time than the group "others" should have fewer revisions and better implant survival at two years. An example is the Trident AD LW and WHA. Despite the proximity of the observation period to the control group the number of revisions is greater. A closer analysis shows that 24 of these 31 revisions were performed due to infection, dislocation or in connection with periprosthetic fractures, causes which probably cannot be associated with implant selection. Seven of eight revisions of the TMT modular cup were caused by dislocation or infection.

Among cemented cups the Avantage cup stands out with an apparently higher frequency of early revisions. Seven of 11 cases are caused by deep infection. The apparently poorer result for the Avantage cup is probably caused by this implant being actively selected for patients with an increased risk for dislocation, which often also involves an increased risk for other complications. The majority of the patients operated with the Avantage cup have been diagnosed for fracture (63.8%). Only 21.7% have a diagnosis of primary osteoarthritis. The corresponding distribution in the entire database is 10.6% for a fracture and 79.4% primary osteoarthritis.

Among the uncemented stems the Fitmore and ABGII show a slightly higher risk for revision than the group "others". Regarding Fitmore the reason for early revision is fracture/penetration (three cases) or early loosening (two cases). In a combined project with the other Nordic hip arthroplasty registers (Nordic Arthroplasty Register Association, NARA) we have found that the ABGII-stem is associated with more early periprosthetic fractures than expected. An analysis of the 61 revisions in our material shows that the reasons were periprosthestic fracture in 19 cases, technical causes/loosening in 19 cases, deep infection in eleven cases, dislocation in 10 cases, and other causes in 2 cases.

Results in terms of risk for revision for newly introduced implants are, as a whole, as expected. A more complete assessment also requires patient-reported outcomes, longer follow-up and more advanced statistical analyses. Whether a new implant replaces or competes with well-established prostheses, continuous monitoring of the number of revisions, however, is of value as an early warning signal.

Reverse hybrid

During the early 1990s the hybrid prosthesis with cemented stem and uncemented cups were considered the optimal solution for total hip replacement. Extensive problems with loosening of cemented cups during the previous decade were thought solvable by selecting an uncemented cup, especially in younger cases. Increased use of uncemented cups led, however, to unseen complications due to greater wear, poor fixation of the liner and the development of periprosthetic osteolysis. Improved cementing techniques and good long term results with uncemented stems resulted in the testing of a reversed concept with uncemented stem and cemented cup, the reverse hybrid. From having only been used in about 10 cases yearly in the 1990s the number of implanted reverse hybrids increased from 1999 and onward to be used in more than 1000 cases from 2007, and more than 2000 cases yearly from 2010 (Figure 3). The reverse hybrid is a concept that has become popular in Sweden and Norway but is relatively unknown in other countries. The proportion in Norway was 36.2% in 2011 (Sweden 13.2%), and in Denmark and Finland only 1.2 and 2.9%, respectively.

2-year survival of implants introduced 2003 or later

	First year*	Number		Follow-up mean *max*	Number (%) cup revisions all reasons		2-yr survival cup/liner, *SE*
		total	2-yr f.u.	years	total	2-yr f.u.	
Cup uncemented							
Continuum	2010	698	63	0.9 *3.2*	14 *2.0*	14 *2.0*	–
Delta Motion	2011	92	7	1.1 *2.3*	0 *0*	0 *0*	–
Pinnacle 100	2007	893	349	1.8 *8.8*	7 *0.8*	3 *0.3*	99.4 *0.3*
Pinnacle sector	2006	367	224	3.0 *7.0*	10 *2.7*	4 *1.1*	98.7 *0.6*
TMT modular	2006	469	278	2.7 6.7	9 *1.9*	7 *1.5*	98.5 *0.6*
Trident AD LW	2004	568	423	3.6 *8.9*	15 *2.6*	8 *1.4*	98.4 *0.6*
Trident AD WHA	2004	1,043	812	4.2 *8.8*	24 *2.3*	14 *1.3*	98.6 *0.4*
Trident hemi	2005	1,208	711	2.8 *7.6*	15 *1.2*	8 *0.6*	99.2 *0.3*
Tritanium	2010	278	85	1.5 *3.1*	2 *0.7*	2 *0.7*	–
All others	2004	12,852	9,446	4.0 *8.9*	211 *1.6*	133 *1.0*	98.8 *0.1*
Cup cemented							
Avantage	2006	564	209	1.8 *9.8*	18 *3.2*	16 *2.8*	96.3 *1.0*
Exceed	2011	122	0	0.8 *1.8*	0 *0*	0 *0*	–
Exeter Rim-fit	2010	2,793	135	1.0 *2.4*	3 *0.1*	3 *0.1*	99.9 *0.09*
Marathon	2008	7,900	2,906	1.7 *6.7*	23 *0.3*	22 *0.3*	99.5 *0.1*
Polarcup	2010	156	30	1.1 *3.6*	1 *0.6*	0 *0*	–
All others	2003	112,904	83,900	4.7 *10*	1,522 *1.3*	625 *0.6*	99.4 *0.02*
	First year*	**Number**		**Follow-up mean *max***	**Number (%) stem revisions all reasons**		**2-yr survival cup/liner, *SE***
		total	**2-yr f.u.**	**years**	**total**	**2-yr f.u.**	
Stem uncemented							
ABG II HA	2003	2,359	1,819	4.1 *9.9*	61 *2.6*	49 *2.1*	97.8 *0.3*
Accolade straight	2004	1,570	1,050	3.3 *8.9*	24 *1.5*	18 *1.1*	98.7 *0.3*
Bi-Metric X Por HA	2003	5,076	3,457	3.4 *9.9*	74 *1.5*	60 *1.2*	98.7 *0.2*
Corail	2005	8,185	3,732	2.1 *8.2*	87 *1.1*	76 *0.9*	98.9 *0.1*
Fitmore	2009	177	41	1.5 *4.0*	5 *2.8*	5 *2.8*	–
Symax	2005	385	292	4.1 *7.6*	5 *1.3*	1 *0.3*	99.7 *0.3*
Synergy	2007	234	174	3.1 *7.3*	0 *0*	0 *0*	100 *0.0*
All others	2003	12,493	9,806	4.6 *10.0*	192 *1.5*	131 *1.0*	98.8 *0.1*

*First year when more than 10 implants were used. (First year for the group "All others" has arbitrarily been set to 2003.)

Table 2. Implants introduced to the Swedish market since 2003 and that has been used in more than 90 total hip replacements during the last three years. 2-year inmplant survival has been calculated if the number of operations at two years exceed 100.

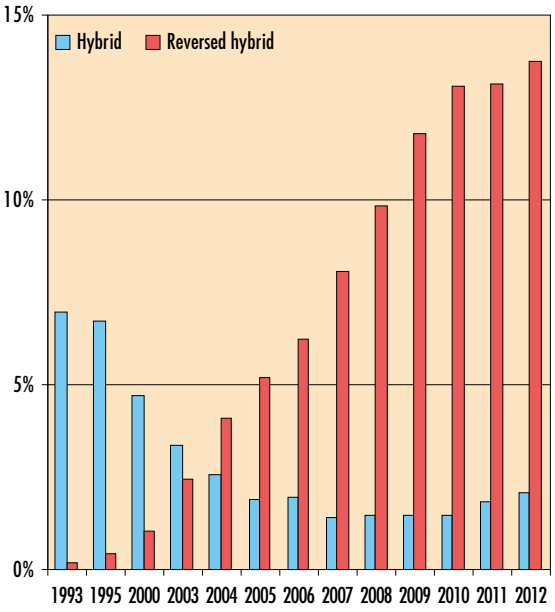


Figure 3. Relative proportion hybrids and reversed hybrids 1993–2012.

The conditions that existed when the reverse hybrid began to become popular have been partially changed. Quality improvements of uncemented cups such as more resistant polyethylene and better liner fixation have appeared, which will most likely also affect long-term results. Since it is still unclear if reverse hybrids imply an improvement compared with all-cemented or uncemented prostheses we have updated last year's analysis. The time limit for the current evaluation has been set at nine years since the number of observations in the group of reverse hybrids hereafter is under 100 total hip replacements.

Furthermore, only modern implants, defined as implants used in at least 100 operations during the period 2010 to 2012, have been included (Table 3). The Spectron EF Primary stem was used in more than 100 cases at the beginning of the period but has now almost completely disappeared from the market, and has therefore been excluded. In the current year's analysis only reverse hybrid, cemented and uncemented prostheses have been included. Hybrid prostheses and resurfacing prostheses have, for the sake of clarity, been excluded. After the selection of "modern" prostheses, 11,250 out of 13,979 reverse hybrids have been included, as well as 142,924 out of 216,220 cemented and 14,011 out of 20,283 uncemented prostheses, corresponding to 67.1% of all cases in these three groups. The proportion of women was greatest in the cemented group (61.0%), followed by the reverse hybrid group (54.3%) and uncemented prostheses (45.8%). The equivalent quotas of primary osteoarthritis were 80.7, 87.2 and 86.0%, respectively.

Analysis of survival curves shows a higher rate of prosthesis survival for all-cemented compared with reverse hybrids during the period of 0 to 9 years if revision irrespective of cause or component has the specified outcome (p<0,0005, log rank test, Figure 4). In contrast, there is no certain difference between reverse hybrids and uncemented prostheses (p=0.08). The cup on reverse hybrids has approximately the same surival as a cemented cup used with a cemented stem (p=0.5), in an equivalent analysis with use of a cup with or without simultaneous stem revision as the outcome. Uncemented cups have slightly inferior survival during the period (uncemented cup *vs.* cemented cup in reverse hybrid (p=0.03). The survival curve for the stem shows another pattern. The uncemented stems are revised more than the cemented, especially during the first postoperative months. An analysis using a log rank test shows the difference between reverse hybrid and cemented stem (p<0.0005), but not between reverse hybrid and the all-uncemented group.

Implant components used in different types of fixation

	Cemented	Uncemented	Cemented	Uncemented
Cup			*Stem*	
	Avantage	Allofit	CPT	ABGII HA
	Charnley Elite	CLS Spotorno	Exeter	Accolade
	Contemporary Hooded Duration	Continuum	Lubinus SP II	Bi-Metric
	Exceed ABT ArCom	Exceed ABT	MS30	CFP HA
	Exeter (Duration+Rim-fit)	Pinnacle±HA		CLS Spotorno
	FAL±x-link	Ranawat/Burstein		Corail
	Lubinus ±x-link	Reflection HA		Fitmore
	Marathon	Regenerex		Synergy HA
	Polarcup	TMT modular/revision		Symax
	Reflection XLPE	Trident		Wagner Cone
	ZCA XLPE	Tritanium		

Table 3. Implant components used in 100 operations or more 2010–2012 that are used for the analysis of reversed hybrids, cemented and uncemented prostheses.

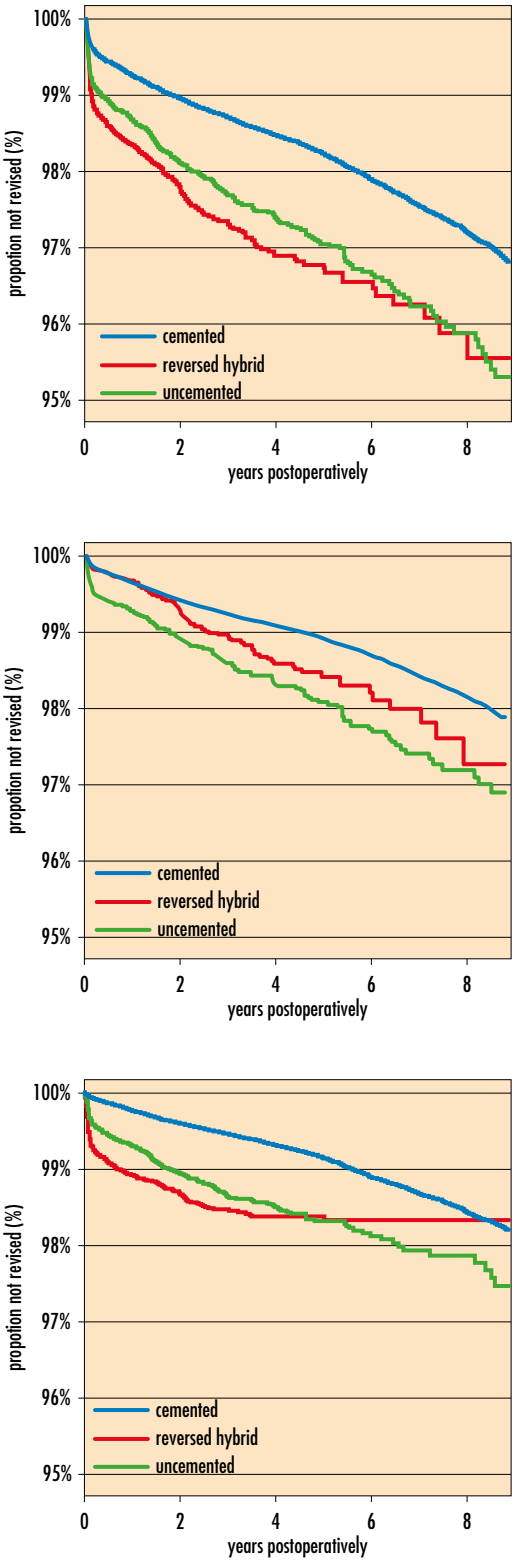


Figure 4. Implant survival based on all reasons for revision regardless of revised component (at the top), cup revision with or without simultaneous stem revision (in the middle), and stem revision with or without simultaneous cup revision (at the bottom).

A simple analysis of causes leading to revision during the first two years after operation show that the proportion of reverse hybrid prostheses is more often revised than the cemented, but not more than the uncemented prostheses (x^2-test: p<0.0005 and p=0.1 respectively). It is above all early complications in the form of periprosthetic fractures, early loosening and probably mal-positioned components that cause these early revisions. The equivalent analysis of the period of more than two to nine years is more difficult to evaluate. This depends on the fact that only 1% of the patients in the reverse hybrid group were followed up for at least nine years (median observation time = 3.0 years *SD=2,6*). In the uncemented group, the equivalent proportion is 9% and in the cemented group it amounts to 30% (median observation time =3.5 years 3.1; 5.3 years *5.4*). Although we had limited follow-up to nine years, the exposition time is longer for these groups and therefore the risk of having had time to be revised is greater. This bias can be avoided to a certain degree with a Cox regression analysis.

Three separate Cox regression analyses have been carried out with patients divided into three age groups: <55, 55–69 and 70 years of age or older (Table 4). Adjustment has been made for gender and diagnosis. The analysis has been divided into two periods, 0–2 years and more than 2 to 9 years' observation time, to ensure proportionality (essential in statistical analysis) and for increased clarity. Only revision irrespective of cause or component has been studied. During the first two years, the risk for revision of reverse hybrid prostheses is more than doubled in the age group 55 to 69 and the group 70 years of age or older compared with the all-cemented prosthesis. During the following period, 2 to 9 years, there is no ascertainable difference. The equivalent analysis using the all-uncemented prosthesis as the reference group shows no ascertainable differences between the reverse hybrid and the all-uncemented prostheses (no data shown). The uncemented prostheses have an ascertainable higher risk for revision than the cemented during the first two years (1.7 *1.2–2.4*), but a lower risk during the later interval (OR=0.6 *0.4–0.9*).

Based on nine years' follow-up of modern implants, we find no ascertainable advantages in using a reverse hybrid prosthesis, in comparison with either a cemented or an uncemented prosthesis. Our data indicates that all-cemented prostheses should be selected for older patients. For patients younger than 55 years of age, a completely uncemented prosthesis may also be considered, especially if the risk for stem loosening is assessed as being great. Chronological age is, however, only an arbitrary limit. In clinical practice, other factors such as biological age and level of activity are also taken into account.

Analysis of reversed hybrids – reasons for and risk of revision

	0–2 yrs postop			*2–9 yrs postop*		
	Reversed hybrid	**Uncemented**	**Cemented**	**Reversed hybrid**	**Uncemented**	**Cemented**
Reason %						
Loosening/osteolysis	0.15	0.13	0.06	0.52	0.51	0.72
Infection	0.44	0.45	0.35	0.11	0.22	0.13
Dislocation	0.40	0.40	0.38	0.12	0.14	0.24
Periprosthetic fracture	0.58	0.37	0.07	0.12	0.10	0.11
Technical reasons	0.32	0.29	0.07	0.01	0.06	0.02
Other reasons	0.05	0.06	0.01	0.06	0.19	0.08
Non-revised	**98.1**	**98.3**	**99.1**	**99.1**	**98.8**	**98.7**
*Risk of revision**						
<55 yrs	1.5 *0.98–2.4*	**1.7** *1.2–2.4*	1 (ref.)	0.9 *0.6–1.4*	**0.6** *0.4–0.9*	1 (ref.)
55–69 yrs	**2.4** *2.0–2.9*	**2.3** *1.9–2.8*	1 (ref.)	1.2 *0.8–1.7*	1.2 *0.9–1.6*	1 (ref.)
>= 70 yrs	**3.1** *2.4–3.9*	**2.1** *1.3–3.2*	1 (ref.)	1.7 *0.8–3.4*	1.4 *0.5–3.7*	1 (ref.)
Numbers per group						
<55 yrs	2,262	5,091	5,037	1,470	3,512	4,443
55–69 yrs	6,484	7,811	52,225	3,927	5,201	42,927
>= 70 yrs	2,504	1,109	85,662	1,391	635	66,490

*Table 4. The distribution of reasons for revision and risk of revision based on *Cox regression analysis adjusting for differences in gender and diagnoses between groups. Risk ratios significantly differing from 1.0 are marked in bold.*

Resurfacing prosthesis and resurfacing cup with standard prosthesis

Increased risk of revision on installation of a resurfacing prosthesis was already established in the Annual Report of 2008 in a follow-up to and including 2007. During 2007 the number of implants installed reached a maximum (n=297) after which it sank successively (Figure 5). During 2012 the number of resurfacing prostheses installed has been reduced to below100. Simultaneously, other metal-on-metal articulations have almost completely disappeared. Pretty well all resurfacing prostheses used during 2012 have been of type BHR.

The problems with metal-on-metal articulations are well documented and have initiated standardized follow-up programmes for these patients in order to discover complications at an early stage. Examples of risk factors are large shells (small shells when using surface replacement prostheses however), abrupt cup position, female gender and age. Large shells have also been used in Sweden, apart from when using a resurfacing prosthesis, when a resurfacing cup has been combined with a standard stem. Metal-on-metal articulations have also been used on conventional prostheses. Since 1999 when single components began to be registered, 788 operations with metal-on-metal joints have been registered, not including complete resurfacing prostheses. In more than half of these cases (479) a condyle with a diameter of 36 mm or more has been used. These are not included in the current annual analysis.

In this year's analysis, we focus on patients who have received a resurfacing prosthesis or alternatively a resurfacing cup combined with a conventional stem. The control group is selectioned so that it will make up the most commonly used alternatives in Sweden during the period: namely an all-cemented or all-uncemented prosthesis with metal shell articulating with polyethylene irrespective of polyethylene quality. Patients over 79 years of age have been excluded, representing the oldest age group in the resurface replacement group, as have all operations carried out before 1996, the first year that resurfacing prostheses were used.

Follow-up time has been set to five years for resurfacing replacement cups combined with standard stems and to 10 years for resurfacing prostheses based on the number of observations available in each respective group (117 for resurfacing cups at five years, 92 for resurfacing prostheses at 10 years). In the Cox

regression, an unadjusted risk ratio is presented and after adjustment for age, gender and diagnosis and only in the group younger men, after adjustment for diagnosis (Table 5).

After five years the number revised is more than twice as large in groups with resurfacing components and metal-on-metal joints, corresponding to a reduction of prosthesis survival of 2–3% compared with the control group (Table 5, Figure 6). The causes for revision vary greatly from group to group. As was expected, resurfacing prostheses are not as often affected by dislocation, but they are, however, subject to fractures, technical problems and loosening, among other causes. The relatively high proportion of fractures in the group with resurfacing cups with standard stems can probably be explained by the fact that almost all the stems in this group were uncemented (Figure 7).

After 10 years the difference remains for resurfacing prostheses. In the evaluation of the group men under 55 years of age who showed the best results after operation in earlier studies with resurfacing prostheses we can find no definite difference in relation to the control group. The differences in risk för revision within five years can be seen in Table 5.

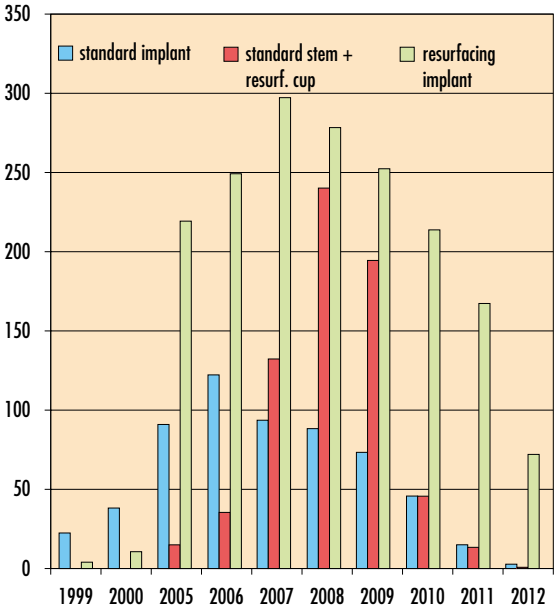


Figure 5. Use of metal-on-metal articulations in THR in 1999, 2000, and 2005–2012.

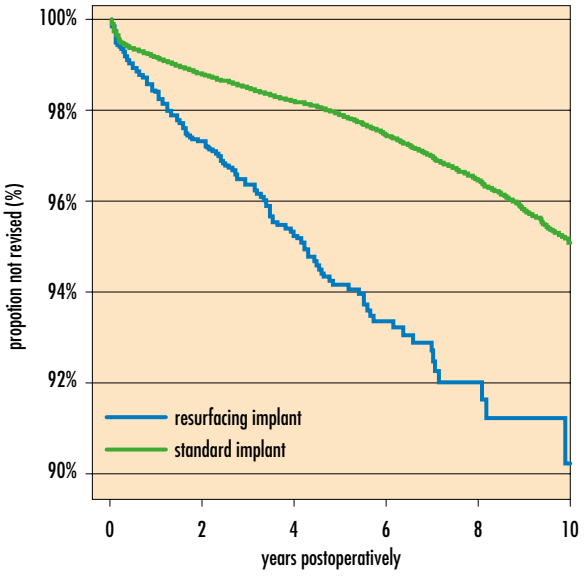


Figure 6. Implant survival for resurfacing hip replacements and in a control group of selected standard implants with cemented or uncemented fixation.

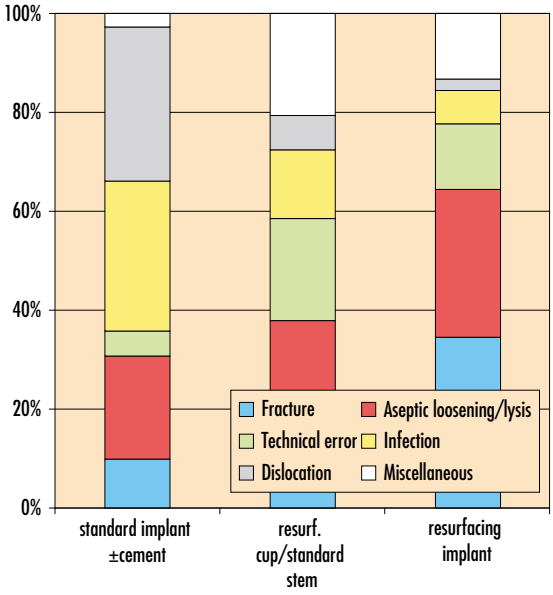


Figure 7. Reasons for revision up to five years postoperative.

Resurfacing prostheses show up to twice the risk of revision compared with standard prostheses, first and foremost on account of complications during the first five years. Younger men, considered to be the target group for this type of prosthesis, run a higher risk of revision than when a standard prosthesis is used. Thus far it has not been possible in other studies to demonstrate definite advantages with resurfacing prostheses. Against this background, the panorama of complications recognized for this type of prosthesis and the uncertainty concerning the risk for future problems should lead to physicians primarily choosing alternative prostheses with better documentation.

Analysis of resurfacing prosthesis and resurfacing cup with conventional stem

	Resurfacing prosthesis	Resurfacing cup/ conventional stem	Cemented or uncemented standard prosthesis
Number	2,035	677	116,852
Follow-up time mean *SD*			
Within 5 yrs	3.9 *1.4*	4.0 *1.0*	3.7 *1.7*
Within 10 yrs	4.9 *2.5*	–	5.2 *3.2*
Mean age SD	49.8 *8.7*	51.6 *10.3*	67.7 *8.6*
Proportion females %	23.6	30.6	58.9
Proportion primary osteoarthritis %	91.3	82.7	82.8
Proportion revised %			
5-year	4.8	6.4	1.8
10-year	5.7	–	2.7
Implants survival ±95% *C.I.*			
5-year	94.0±*1.2*	89.2±*3.6*	97.7±*1.0*
10-year	90.3±*2.7*		94.7±0.2
Risk of revision *RR±95% C.I.*			
5-year unadjusted	**2.7** *2.2–3.3*	**3.4** *2.5–4.7*	1 (ref.)
5-year adjusted	**2.2** *1.8–2.8*	**2.7** *2.0–3.7*	1 (ref.)
10-year unadjusted	**2.2** *1.8–2.7*	–	1 (ref.)
10-year adjusted	**1.6** *1.3–1.9*	–	1 (ref.)
Only men < 55 yrs			
10-year unadjusted	1.0 *0.7–1.4*	–	1 (ref.)
10-year adjusted*	1.1 *0.8–1.6*	–	1 (ref.)
	Durom	**ASR**	**BHR**
Number	381	396	1,157
Implants survival ±95% *C.I.*			
5-year	89.0±3.2	92.0±2.9	97.6±1.1
Risk for revision *RR±95% C.I.*			
5-year unadjusted	**4.7** *2.8–8.1*	**3.5** *2.0–6.2*	1 (ref.)
5-year adjusted	**4.5** *2.6–7.6*	**3.9** *2.2–6.9*	1 (ref.)

* Only adjusting for diagnosis

Table 5. Comparison between resurfacing hip replacement and total hip replacement using resurfacing cup with a standard stem and a control group comprising total hip replacements using cemented or uncemented stem fixation. Only patients under 80 years with surgery from 1996 and onwards are included (see text for details). Risk ratios significantly differing from 1.0 are marked in bold.

BHR, ASR and Durom are the resurfacing prostheses that have been used most in Sweden. Together they add up to 95.4% of the total number. Follow-up time is shortest for ASR. After five years, 154 implants are still in place. Of these three, BHR shows best prosthesis survival followed by ASR and Durom.

15 most common components

(most used the past 10 years)

Cup (Stem)	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Lubinus helplast (Lubinus SP II)	67,366	4,917	4,943	5,166	4,347	3,606	90,345	33.9%
Contemporary Hooded Duration (Exeter Polished)	3,374	1,396	1,734	1,490	632	565	9,191	6.1%
Charnley Elite (Exeter Polished)	7,773	1,030	520	133	49	6	9,511	4.9%
Exeter Duration (Exeter Polished)	11,095	227	208	183	72	0	11,785	4.4%
ZCA XLPE (MS30 Polished)	634	862	994	1,155	1,150	1,222	6,017	4.1%
FAL (Lubinus SP II)	4,512	419	438	397	266	163	6,195	3.3%
Marathon XLPE (Exeter Polished)	2	45	690	1,105	1,260	1,399	4,501	3.1%
Reflection (Spectron EF Primary)	7,205	160	127	29	4	3	7,528	2.6%
Trilogy HA (CLS Spotorno)	943	380	379	380	372	255	2,709	1.8%
Exeter X3 Rim Fit (Exeter Polished)	0	0	0	106	1,021	1,069	2,196	1.5%
Lubinus X-linked (Lubinus SP II)	0	0	0	23	687	1,456	2,166	1.5%
ZCA XLPE (Lubinus SP II)	116	269	462	480	334	328	1,989	1.4%
Charnley (Exeter Polished)	2,540	78	2	3	0	0	2,623	1.2%
Lubinus all-poly (Corail Collarless)	88	170	406	401	356	316	1,737	1.2%
Marathon XLPE (Corail Collarless)	0	15	186	382	387	423	1,393	1.0%
Other (1,443)	179,440	4,488	4,649	4,512	5,014	5,167	203,270	
Total	285,088	14,456	15,738	15,945	15,951	15,978	363,156	

[1)] *Refers to the proportion of the total number primary total hip replacements performed during the last ten years.*

15 most common cemented components

(most used the past 10 years)

Cup (Stem)	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Lubinus all-poly (Lubinus SP II)	67,366	4,917	4,943	5,166	4,347	3,606	90,345	44.6%
Contemporary Hooded Duration (Exeter Polished)	3,374	1,396	1,734	1,490	632	565	9,191	8.0%
Charnley Elite (Exeter Polished)	7,773	1,030	520	133	49	6	9,511	6.4%
Exeter Duration (Exeter Polished)	11,095	227	208	183	72	0	11,785	5.8%
ZCA XLPE (MS30 Polished)	634	862	994	1,155	1,150	1,222	6,017	5.4%
FAL (Lubinus SP II)	4,512	419	438	397	266	163	6,195	4.3%
Marathon XLPE (Exeter Polished)	2	45	690	1,105	1,260	1,399	4,501	4.0%
Reflection (Spectron EF Primary)	7,205	160	127	29	4	3	7,528	3.4%
Exeter X3 Rim Fit (Exeter Polished)	0	0	0	106	1,021	1,069	2,196	2.0%
Lubinus X-linked (Lubinus SP II)	0	0	0	23	687	1,456	2,166	1.9%
ZCA XLPE (Lubinus SP II)	116	269	462	480	334	328	1,989	1.8%
Charnley (Exeter Polished)	2,540	78	2	3	0	0	2,623	1.6%
Reflection XLPE (Spectron EF Primary)	251	460	507	220	97	0	1,535	1.4%
Charnley Elite (Lubinus SP II)	1,229	52	21	58	95	63	1,518	0.9%
ZCA XLPE (Exeter Polished)	24	77	78	141	237	225	782	0.7%
Other (344)	150,910	483	416	392	610	756	153,567	
Total	257,031	10,475	11,140	11,081	10,861	10,861	311,449	

[1)] *Refers to the proportion of the total number primary total hip replacements performed during the last ten years.*

15 most common uncemented components

(most used the past 10 years)

Cup (Stem)	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Trilogy HA (CLS Spotorno)	943	380	379	380	372	255	2,709	16.1%
Trident HA (Accolade)	383	164	235	201	201	178	1,362	8.2%
Allofit (CLS Spotorno)	694	294	221	140	80	43	1,472	8.1%
CLS Spotorno (CLS Spotorno)	1,098	69	45	36	38	27	1,313	4.9%
Trilogy HA (Corail Collarless)	50	80	155	212	159	82	738	4.4%
Pinnacle HA (Corail Collarless)	24	93	100	130	123	189	659	4.0%
Trident HA (ABG II HA)	161	79	107	70	83	49	549	3.3%
Trilogy (CLS Spotorno)	478	80	27	4	0	0	589	3.1%
Ranawat/Burstein (Bi-Metric HA std)	59	55	126	134	44	32	450	2.7%
Trilogy HA (Bi-Metric HA std)	125	70	61	68	53	50	427	2.6%
Trilogy HA (Wagner Cone Prosthesis)	29	34	71	96	70	27	327	1.9%
Pinnacle (Corail Collarless)	54	4	27	49	79	90	303	1.8%
Continuum (CLS Spotorno)	0	0	0	37	94	156	287	1.7%
Trilogy HA (Bi-Metric HA lat)	61	38	31	34	56	66	286	1.7%
Trident HA (Symax)	164	45	29	3	3	2	246	1.5%
Other (360)	8,059	362	464	696	1,053	1,268	11,902	
Total	12,382	1,847	2,078	2,290	2,508	2,514	23,619	

1) Refers to the proportion of the total number primary total hip replacements performed during the last ten years.

15 most common hybrid components

(most used the past 10 years)

Uncemented cup (Cemented stem)	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Trilogy HA (Lubinus SP II)	1,027	66	56	47	70	65	1,331	26.4%
Trilogy HA (Spectron EF Primary)	1,215	18	8	2	2	0	1,245	17.0%
Trident HA (Exeter Polished)	8	1	15	56	82	92	254	9.0%
Trilogy HA (Exeter Polished)	53	17	28	23	7	1	129	3.9%
Ranawat/Burstein (Lubinus SP II)	25	21	16	12	18	15	107	3.8%
Trilogy HA (MS30 Polished)	21	27	19	17	15	4	103	3.7%
TOP Pressfit HA (Lubinus SP II)	145	1	9	3	1	3	162	3.5%
Reflection HA (Lubinus SP II)	193	11	3	0	1	1	209	2.4%
Trident HA (ABG II Cemented)	56	5	0	2	0	0	63	2.2%
Trilogy HA (CPT (CoCr))	10	3	6	12	15	17	63	2.2%
Trident HA (Lubinus SP II)	26	3	14	6	5	3	57	2.0%
Trilogy HA (Stanmoremod)	94	2	1	0	0	0	97	1.8%
Biomex HA (Lubinus SP II)	107	0	0	0	0	0	107	1.2%
Allofit (MS30 Polished)	84	1	3	5	2	1	96	0.9%
Mallory-Headocem (Lubinus SP II)	108	3	6	1	1	3	122	0.9%
Others (265)	5,975	27	47	45	77	126	6,297	
Total	9,147	206	231	231	296	331	10,442	

1) Refers to the proportion of the total number primary total hip replacements performed during the last ten years.

15 most common reversed hybrid components

(most used the past 10 years)

Cemented cup (Uncemented stem)	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Lubinus all-poly (Corail Collarless)	88	170	406	401	356	316	1,737	13.2%
Marathon XLPE (Corail Collarless)	0	15	186	382	387	423	1393	10.6%
Contemporary Hooded Duration (ABG II HA)	236	100	156	123	25	6	646	4.9%
Lubinus helplast (CLS Spotorno)	176	100	54	68	34	47	479	3.6%
Charnley Elite (Corail Collarless)	130	147	79	60	20	5	441	3.3%
Lubinus helplast (Bi-Metric HA lat)	128	51	72	72	81	22	426	3.2%
ZCA XLPE (CLS Spotorno)	103	64	59	60	66	59	411	3.1%
Charnley Elite (CLS Spotorno)	285	90	19	4	3	3	404	3.0%
Marathon XLPE (Bi-Metric HA std)	0	5	53	76	102	101	337	2.6%
ZCA XLPE (Corail Collarless)	6	34	68	106	51	84	349	2.6%
Contemporary Hooded Duration (Corail Collarless)	5	8	22	25	105	146	311	2.4%
ZCA XLPE (Bi-Metric HA lat)	43	118	100	32	3	6	302	2.3%
Marathon XLPE (ABG II HA)	0	0	21	74	85	115	295	2.2%
Marathon XLPE (CLS Spotorno)	0	10	84	79	57	52	282	2.1%
Marathon XLPE (Corail Collared)	0	0	1	42	104	117	264	2.0%
Other (279)	3,219	490	455	472	619	692	5,947	
Total	4,419	1,402	1,835	2,076	2,098	2,194	14,024	

1) Refers to the proportion of the total number primary total hip replacements performed during the last ten years.

15 most common resurfacing components

(most used the past 10 years)

Cup (Head or stem)	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
BHR Acetabular Cup (BHR Femoral Head)	536	111	137	137	125	60	1,106	53.7%
ASR Cup (ASR Head)	168	118	82	28	0	0	396	20.5%
Durom (Durom)	295	34	28	5	0	0	362	17.6%
Adept (Adept Resurfacing Head)	14	1	0	34	25	1	75	3.9%
BHR Acetabular Cup (BMHR VS)	0	0	2	6	11	9	28	1.5%
BHR Dysplasia Cup (BHR Femoral Head)	10	0	1	1	3	1	16	0.8%
Durom studycup (Durom)	8	5	2	0	0	0	15	0.8%
ReCap Cup (ReCap Head)	1	6	0	2	0	0	9	0.5%
BHR Acetabular Cup (BMHR)	2	3	0	0	0	0	5	0.3%
ReCap HA Cup (ReCap Head)	3	0	0	0	0	0	3	0.2%
Zimmer MMC Cup (Durom)	0	0	0	0	3	1	4	0.2%
ASR Cup (BHR Femoral Head)	1	0	0	0	0	0	1	0.1%
BHR Dysplasia Cup (BMHR VS)	0	0	0	1	0	0	1	0.1%
Unknown resurfacing cup (Unknown resurfacing head)	1	0	0	0	0	0	1	0.1%
Cormet 2000 resurf (Cormet 2000 HA resurf)	2	0	0	0	0	0	2	0%
Others (2)	11	0	0	0	0	0	11	
Total	1,052	278	252	214	167	72	2,035	

1) Refers to the proportion of the total number primary total hip replacements performed during the last ten years.

15 most common cup components

(most used the past 10 years)

Cup	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Lubinus all poly	90,162	5,309	5,561	5,842	5,006	4,140	116,020	36.3%
ZCA XLPE	1,059	1,683	2,002	2,120	1,912	1,984	10,760	7.3%
Contemporary Hooded Duration	4,006	1,615	1,989	1,701	802	752	10,865	7.2%
Charnley Elite	13,084	1,513	716	284	172	82	15,851	7.1%
Marathon XLPE	2	80	1,099	1,928	2,295	2,497	7,901	5.4%
Exeter Duration	12,037	243	230	189	79	0	12,778	4.9%
Trilogy HA	4,503	753	827	980	932	705	8,700	4.6%
FAL	4,622	441	480	448	290	170	6,451	3.4%
Reflection	8,748	182	167	44	8	10	9,159	2.8%
Trident HA	904	298	440	372	407	386	2,807	1.9%
Exeter X3 RimFit	0	0	0	138	1,258	1,398	2,794	1.9%
Charnley	61,376	88	4	3	0	0	61,471	1.8%
Lubinus X-linked	0	0	0	24	735	1,634	2,393	1.6%
Reflection XLPE	262	490	571	276	123	1	1,723	1.2%
Allofit	856	308	242	169	88	46	1,709	1.0%
Others	83,467	1,453	1,410	1,427	1,844	2,173	91,774	
Total	285,088	14,456	15,738	15,945	15,951	15,978	363,156	

1) Refers to the proportion of the total number primary total hip replacements performed during the last ten years.

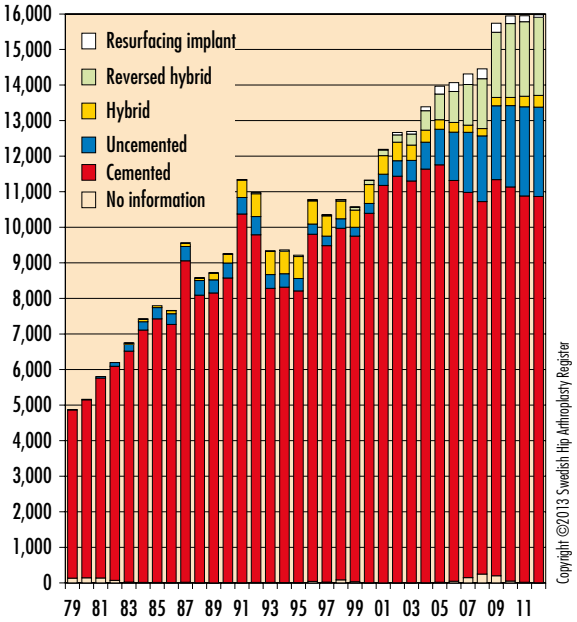
15 most common stem components

(most used the past 10 years)

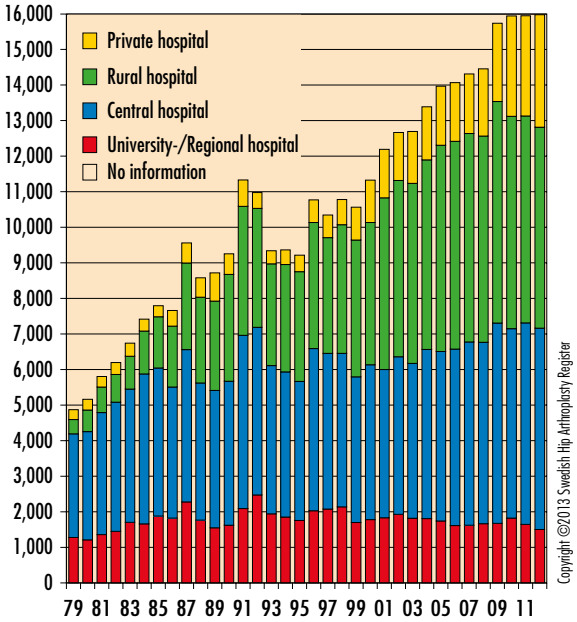
Stem	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Lubinus SP II	80,077	5,837	6,125	6,378	6,147	6,136	110,700	42.9%
Exeter Polished	42,139	2,888	3,298	3,273	3,414	3,455	58,467	22.2%
CLS Spotorno	4,639	1,251	1,010	915	861	735	9,411	5.7%
MS30 Polished	1,666	924	1,035	1,213	1,324	1,467	7,629	5.0%
Corail Collarless	417	618	1,203	1,493	1,525	1,672	6,928	4.7%
Spectron EF Primary	9,742	743	739	319	132	8	11,683	4.4%
Bi-Metric HA std	767	386	465	443	424	429	2,914	2.0%
ABG II HA	986	277	371	370	277	201	2,482	1.7%
Bi-Metric HA lat	827	348	359	280	309	338	2,461	1.7%
CPT (CoCr)	995	102	128	115	130	121	1,591	1.1%
Accolade	392	213	258	231	252	224	1,570	1.1%
Corail collared	1	1	2	183	500	601	1,288	0.9%
BHR Femoral Head	547	111	138	138	128	61	1,123	0.7%
Straight-stem standard	1,445	16	0	0	0	0	1,461	0.7%
Wagner Cone Prosthesis	501	87	119	165	135	127	1,134	0.6%
Others	139,947	654	488	429	393	403	142,314	
Total	285,088	14,456	15,738	15,945	15,951	15,978	363,156	

1) Refers to the proportion of the total number primary total hip replacements performed during the last ten years.

Number of primary THRs
per type of fixation, 1979–2012



Number of primary THRs
per type of hospital, 1979–2012



Number of primary THRs per hospital and year

Hospital	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Aleris Specialistsjukvård Bollnäs	0	0	0	0	0	241	241	0.1%
Aleris Specialistsjukvård Elisabethsjukhuset	762	143	84	70	60	65	1,184	0.3%
Aleris Specialistsjukvård Motala	0	0	0	437	429	438	1,304	0.4%
Aleris Specialistsjukvård Nacka	106	13	100	121	133	134	607	0.2%
Aleris Specialistsjukvård Sabbatsberg	1,517	0	131	150	145	162	2,105	0.6%
Aleris Specialistsjukvård Ängelholm	0	0	0	0	2	5	7	0%
Alingsås	2,089	207	223	201	210	209	3,139	0.9%
Art Clinic	0	0	0	0	0	10	10	0%
Arvika	1,362	148	166	182	184	190	2,232	0.6%
Bollnäs	2,402	243	304	331	281	90	3,651	1.0%
Borås	5,311	192	202	172	188	180	6,245	1.7%
Capio Movement	314	190	193	256	253	176	1,382	0.4%
Capio S:t Göran	9,562	360	418	422	454	405	11,621	3.2%
Carema Ortopediska Huset	2,120	500	441	342	316	332	4,051	1.1%
Carlanderska	1,285	44	44	118	158	120	1,769	0.5%
Danderyd	7,175	404	377	299	338	306	8,899	2.5%
Eksjö	4,379	207	211	193	183	216	5,389	1.5%
Enköping	1,773	222	235	257	295	327	3,109	0.9%
Eskilstuna	4,018	103	110	110	128	129	4,598	1.3%
Falun	5,749	289	326	322	367	396	7,449	2.1%
Frölunda Specialistsjukhus	270	80	81	78	82	81	672	0.2%
Gällivare	2,329	102	86	105	86	111	2,819	0.8%
Gävle	5,204	136	175	164	203	198	6,080	1.7%
Halmstad	4,047	202	218	229	227	238	5,161	1.4%
Helsingborg	3,786	49	73	70	59	69	4,106	1.1%
Hudiksvall	2,855	111	138	138	129	100	3,471	1.0%
Hässleholm-Kristianstad	8,472	853	894	797	775	674	12,465	3.4%
Jönköping	4,174	204	208	210	211	194	5,201	1.4%
Kalmar	4,335	165	193	165	184	122	5,164	1.4%
Karlshamn	2,154	182	221	188	235	217	3,197	0.9%
Karlskoga	2,413	100	141	138	120	166	3,078	0.8%
Karlskrona	2,355	17	16	46	36	36	2,506	0.7%
Karlstad	4,641	243	252	287	259	237	5,919	1.6%
Karolinska/Huddinge	5,518	216	253	234	283	241	6,745	1.9%
Karolinska/Solna	4,468	254	185	208	206	198	5,519	1.5%
Katrineholm	2,207	255	234	239	239	208	3,382	0.9%
Kungälv	2,532	191	178	193	171	135	3,400	0.9%
Lidköping	2,102	134	123	123	186	196	2,864	0.8%
Lindesberg	2,156	153	208	210	234	211	3,172	0.9%
Linköping	5,257	57	70	58	68	58	5,568	1.5%
Ljungby	2,210	104	194	164	165	176	3,013	0.8%

(Continued on nex page.)

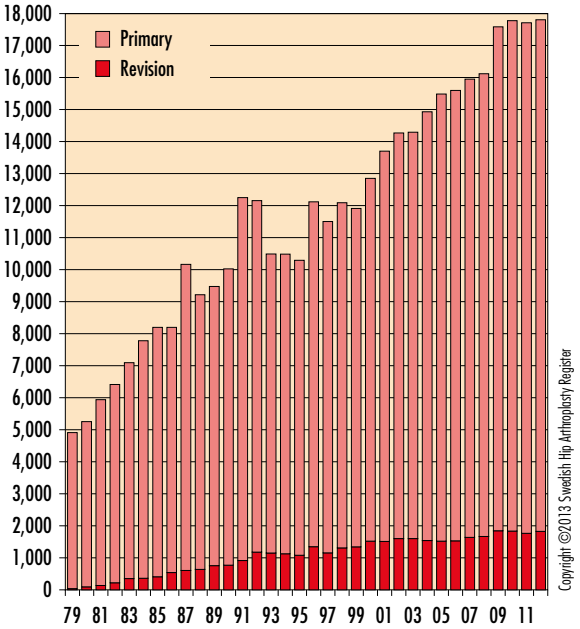
Number of primary THRs per hospital and year (continued)

Hospital	1979–2007	2008	2009	2010	2011	2012	Total	Proportion[1)]
Lycksele	2,721	230	322	330	309	275	4,187	1.2%
Mora	2,873	195	217	216	222	203	3,926	1.1%
Norrköping	4,946	265	234	238	245	230	6,158	1.7%
Norrtälje	1,442	120	131	118	101	106	2,018	0.6%
Nyköping	2,700	177	158	184	171	166	3,556	1.0%
Ortho Center Stockholm	1,059	216	411	432	400	435	2,953	0.8%
OrthoCenter IFK-kliniken	18	94	103	117	150	131	613	0.2%
Oskarshamn	2,231	217	198	198	210	204	3,258	0.9%
Piteå	1,832	334	352	373	373	389	3,653	1.0%
SU/Mölndal	1,375	294	343	444	405	382	3,243	0.9%
SU/Sahlgrenska	4,954	8	4	8	4	3	4,981	1.4%
SUS/Lund	4,428	99	85	114	100	140	4,966	1.4%
SUS/Malmö	5,944	98	92	109	83	74	6,400	1.8%
SUS/Trelleborg	4,357	599	582	572	598	642	7,350	2.0%
Skellefteå	2,408	91	94	94	79	98	2,864	0.8%
Skene	1,101	78	87	105	106	113	1,590	0.4%
Skövde	5,426	98	100	134	198	243	6,199	1.7%
Sollefteå	1,862	116	116	123	125	123	2,465	0.7%
Sophiahemmet	5,056	178	172	175	166	193	5,940	1.6%
Spenshult	75	153	104	184	156	317	989	0.3%
Sunderby (incl. Boden)	4,738	45	42	38	30	36	4,929	1.4%
Sundsvall	5,392	114	216	203	229	184	6,338	1.7%
Södersjukhuset	7,153	431	383	387	337	415	9,106	2.5%
Södertälje	1,255	107	136	118	119	109	1,844	0.5%
Torsby	1,450	79	100	105	106	122	1,962	0.5%
Uddevalla	5,394	309	364	284	337	342	7,030	1.9%
Umeå	4,169	83	107	95	63	64	4,581	1.3%
Uppsala	6,177	288	321	371	257	226	7,640	2.1%
Varberg	4,141	203	263	193	241	242	5,283	1.5%
Visby	2,169	132	139	105	118	121	2,784	0.8%
Värnamo	2,482	150	144	124	146	148	3,194	0.9%
Västervik	2,644	110	109	113	120	109	3,205	0.9%
Västerås	3,538	239	433	416	460	511	5,597	1.5%
Växjö	3,321	142	100	127	146	154	3,990	1.1%
Ystad	2,434	7	3	5	8	8	2,465	0.7%
Ängelholm	2,832	6	46	143	156	166	3,349	0.9%
Örebro	5,083	164	177	184	177	116	5,901	1.6%
Örnsköldsvik	2,610	189	166	185	140	140	3,430	0.9%
Östersund	4,200	185	237	234	278	301	5,435	1.5%
Other	33,689	740	641	220	0	0	35,290	9.7%
Total	285,088	14,456	15,738	15,945	15,951	15,978	363,156	

[1)] Refers to the proportion of the total number of total hip replacements performed 1979–2010.

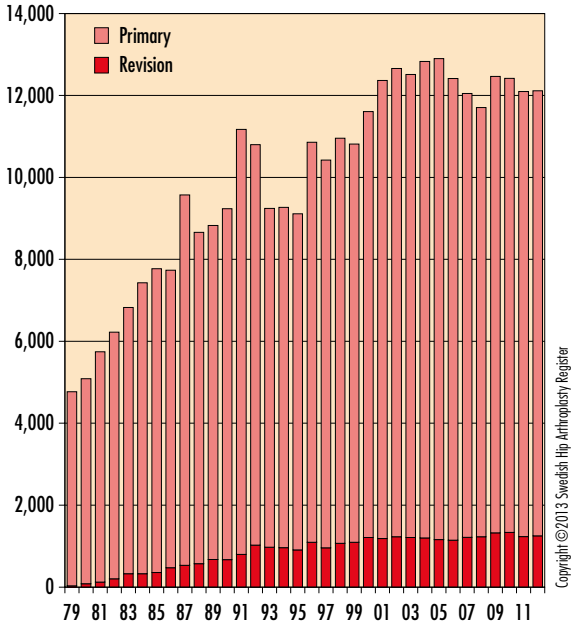
All THRs

363,156 primary THRs, 36,877 revisions, 1979–2012



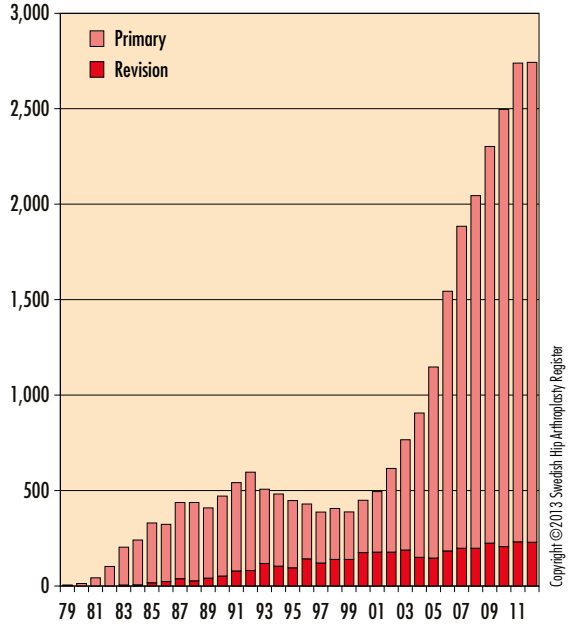
THRs with cemented implants

311,449 primary THRs, 29,185 revisions, 1979–2012



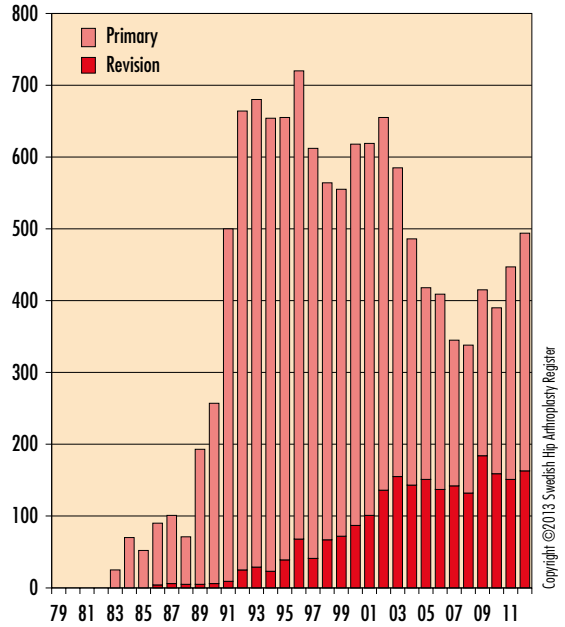
THRs with uncemented implants

23,619 primary THRs, 3,709 revisions, 1979–2012



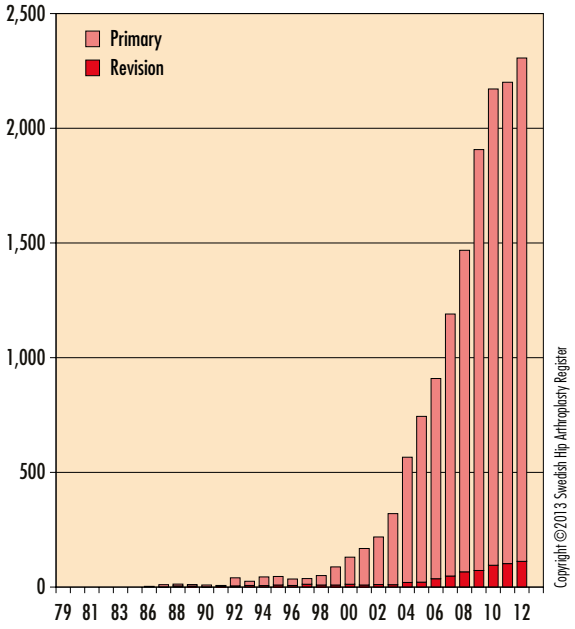
THRs with hybrid implants

10,442 primary THRs, 2,240 revisions, 1979–2012



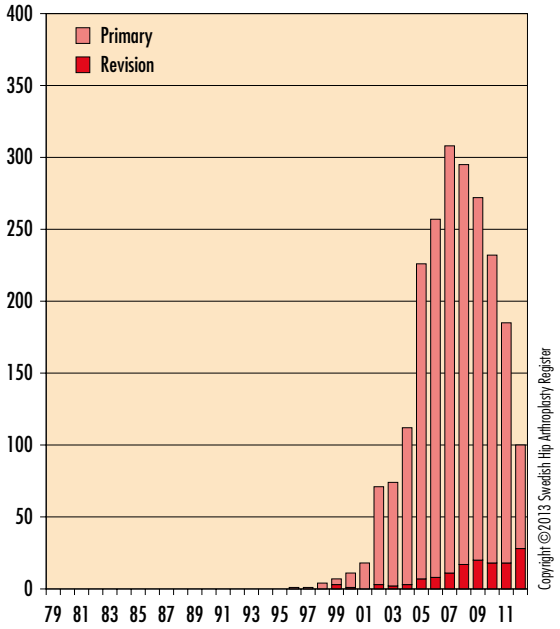
THRs with reversed hybrid implants

14,024 primary THRS, 693 revisions, 1979–2012



THRs with resurfacing implants

2,035 primary THRs, 139 revisions, 1979–2012



Number of primary THRs per diagnosis and year

Diagnosis	1992–2007	2008	2009	2010	2011	2012	Total	Proportion
Primary osteoarthritis	143,334	11,981	13,244	13,371	13,256	13,314	208,500	79.4%
Fracture	20,490	1,403	1,421	1474	1,510	1,518	27,816	10.6%
Inflammatory arthritis	7,447	271	285	234	242	195	8,674	3.3%
Femoral head necrosis	5,253	395	409	448	507	522	7,534	2.9%
Childhood disease	3,393	290	286	308	338	325	4,940	1.9%
Tumour	977	93	78	81	75	80	1,384	0.5%
Other secondary osteoarthritis	1,294	0	4	3	2	1	1,304	0.5%
Posttraumatic osteoarthritis	440	23	11	26	21	23	544	0.2%
(missing)	1,851	0	0	0	0	0	1,851	0.7%
Total	184,479	14,456	15,738	15,945	15,951	15,978	262,547	100%

Number of primary THRs per diagnosis and age group

(1992–2012)

Diagnosis	<50 yrs		50–59 yrs		60–75 yrs		>75 yrs		Total	Proportion
Primary osteoarthritis	7,723	60%	28,651	82.3%	114,797	84.3%	57,329	72.8%	208,500	79.4%
Fracture	351	2.7%	1,392	4%	10,964	8.1%	15,109	19.2%	27,816	10.6%
Inflammatory arthritis	1,559	12.1%	1,642	4.7%	4,118	3%	1,355	1.7%	8,674	3.3%
Femoral head necrosis	858	6.7%	985	2.8%	2,865	2.1%	2,826	3.6%	7,534	2.9%
Childhood disease	1,961	15.2%	1,506	4.3%	1,234	0.9%	239	0.3%	4,940	1.9%
Tumour	147	1.1%	272	0.8%	642	0.5%	323	0.4%	1,384	0.5%
Other secondary osteoarthritis	100	0.8%	110	0.3%	475	0.3%	619	0.8%	1,304	0.5%
Posttraumatic osteoarthritis	73	0.6%	70	0.2%	193	0.1%	208	0.3%	544	0.2%
(missing)	102	0.8%	165	0.5%	880	0.6%	704	0.9%	1,851	0.7%
Total	12,874	100%	34,793	100%	136,168	100%	78,712	100%	262,547	100%

Number of uncemented primary THRs per diagnosis and age group

(1992–2012)

Diagnosis	<50 yrs		50–59 yrs		60–75 yrs		>75 yrs		Total	Proportion
Primary osteoarthritis	3,114	63%	6,934	87.4%	6,347	91.5%	364	77%	16,759	82.6%
Childhood disease	929	18.8%	508	6.4%	166	2.4%	12	2.5%	1,615	8.0%
Femoral head necrosis	351	7.1%	205	2.6%	129	1.9%	18	3.8%	703	3.5%
Inflammatory arthritis	382	7.7%	143	1.8%	126	1.8%	12	2.5%	663	3.3%
Fracture	75	1.5%	100	1.3%	146	2.1%	63	13.3%	384	1.9%
Other secondary osteoarthritis	34	0.7%	7	0.1%	4	0.1%	1	0.2%	46	0.2%
Posttraumatic osteoarthritis	27	0.5%	6	0.1%	3	0%	3	0.6%	39	0.2%
Tumour	4	0.1%	8	0.1%	4	0.1%	0	0%	16	0.1%
(missing)	27	0.5%	20	0.3%	11	0.2%	0	0%	58	0.3%
Total	4,943	100%	7,931	100%	6,936	100%	473	100%	20,283	100%

Number of primary THRs per type of fixation and age group

(1992–2012)

Type of fixation	<50 yrs		50–59 yrs		60–75 yrs		>75 yrs		Total	Proportion
Cemented	3,680	28.6%	18,187	52.3%	118,395	86.9%	75,959	96.5%	216,221	82.4%
Uncemented	4,943	38.4%	7,931	22.8%	6,936	5.1%	473	0.6%	20,283	7.7%
Reversed hybrid	1,490	11.6%	4,268	12.3%	6,795	5%	1,426	1.8%	13,979	5.3%
Hybrid	1,465	11.4%	3,254	9.4%	3,568	2.6%	742	0.9%	9,029	3.4%
Resurfacing	958	7.4%	831	2.4%	244	0.2%	2	0%	2,035	0.8%
(missing)	338	2.6%	322	0.9%	230	0.2%	110	0.1%	1,000	0.4%
Total	12,874	100%	34,793	100%	136,168	100%	78,712	100%	262,547	100%

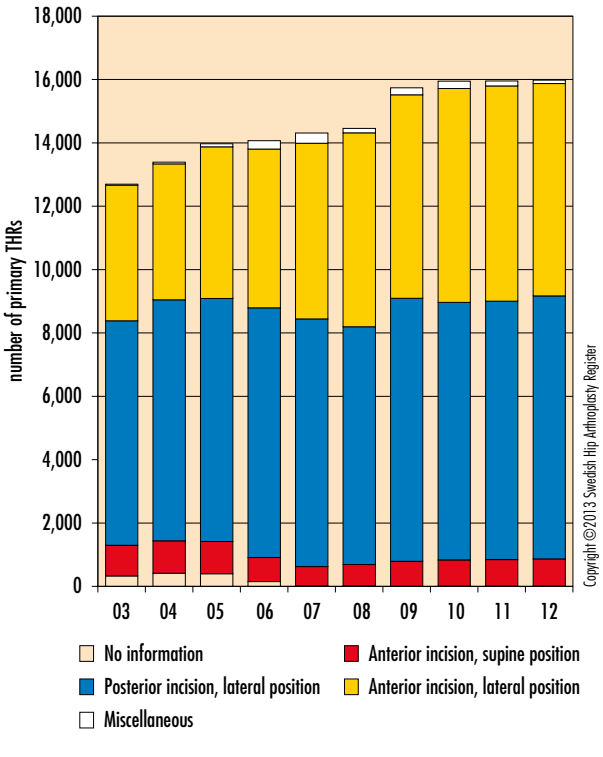
Number of primary THRs per type of surgical approach and year

Surgical approach	2000–2007	2008	2009	2010	2011	2012	Total	Proportion
Posterior approach (Moore)	57,862	7,507	8,301	8,128	8,160	8,303	98,261	53.8%
Direct lateral approach, lateral position (Gammer)	34,719	6,118	6,423	6,750	6,793	6,704	67,507	37.0%
Direct lateral approach, supine position (Hardinge)	8,321	671	793	830	839	861	12,315	6.7%
Other	943	143	220	231	155	105	1,797	1.0%
(missing)	2,778	17	1	6	4	5	2,811	1.5%
Total	104,623	14,456	15,738	15,945	15,951	15,978	182,691	100%

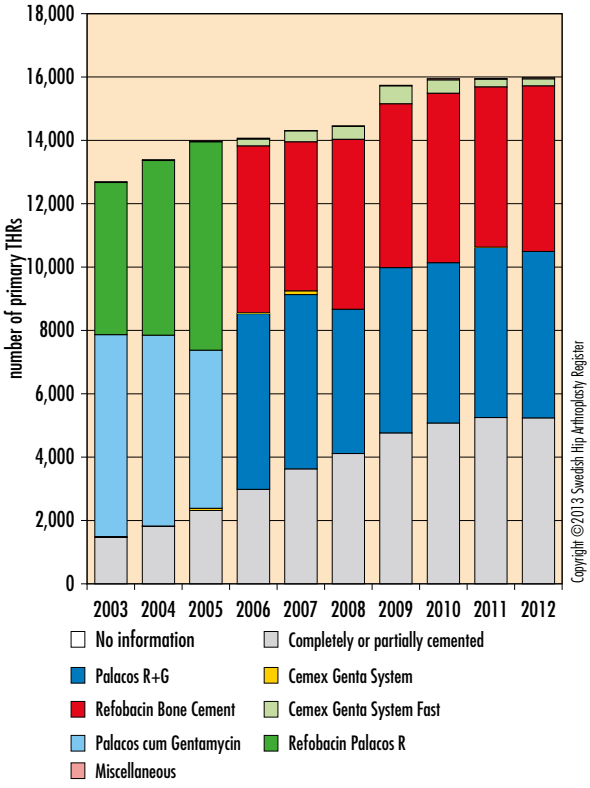
Number primary THRs per type of cement and year

Type of cement	1999–2007	2008	2009	2010	2011	2012	Total	Proportion
Palacos cum Gentamycin	55,985	0	0	0	0	0	55,985	29.0%
Palacos R+G	11,051	4,557	5,221	5,062	5,376	5,254	36,521	18.9%
Refobacin Palacos R	19,612	0	0	0	0	0	19,612	10.1%
Refobacin Bone Cement	9,964	5,359	5,165	5,345	5,056	5,222	36,111	18.7%
Cemex Genta System Fast	577	413	569	429	247	225	2,460	1.3%
Cemex Genta System	231	0	0	0	1	0	232	0.1%
Other	1,346	15	21	34	21	37	1,474	0.8%
(all or partly uncemented)	16,421	4,112	4,762	5,075	5,250	5,240	40,860	21.1%
(missing)	4	0	0	0	0	0	4	0%
Total	115,191	14,456	15,738	15,945	15,951	15,978	193,259	100%

Surgical approach
2003–2012

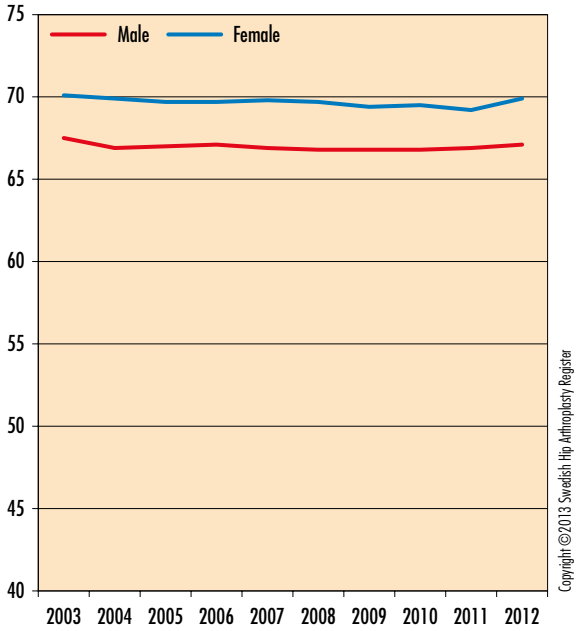


Type of cement
2003–2012



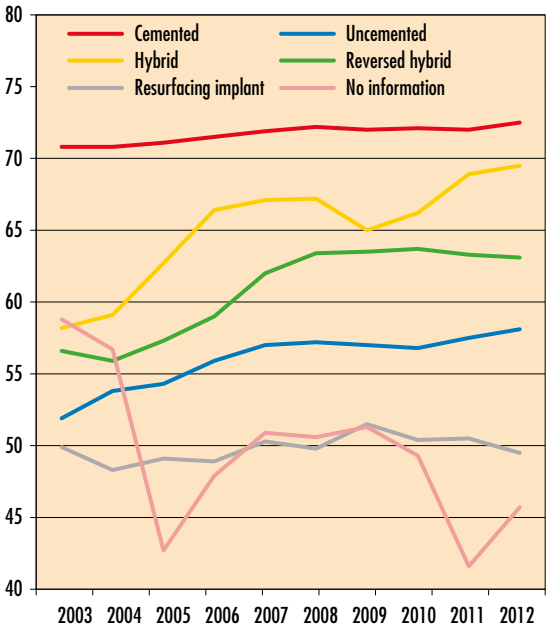
Mean age per gender

the past 10 years, 146,503 primary THRs



Mean age per type of fixation

the past 10 years, 146,503 primary THRs



Mean age per diagnosis and gender

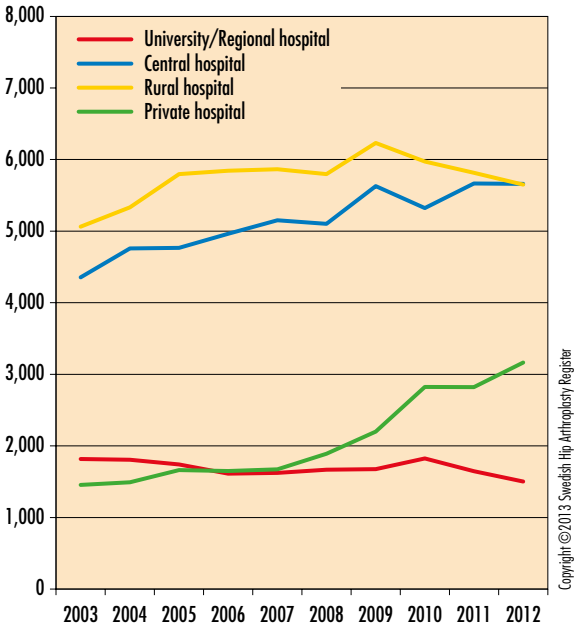
Diagnosis	Men	Females	Total
Fracture	73.1	75.0	74.5
Posttraumatic osteoarthritis	71.1	73.9	72.3
Primary osteoarthritis	67.0	69.6	68.5
Femoral head necrosis	62.0	70.1	67.1
Tumour	69.7	63.0	66.2
Other secondary osteoarthritis	61.4	66.3	63.6
Inflammatory arthritis	59.4	62.4	61.6
Childhood disease	53.8	53.3	53.5
(missing)	73.0	80.0	76.5
Total	6.07	69.7	68.6

Mean age per hospital type and gender

Hospital type	Men	Females	Total
Central hospitals	68.0	70.6	69.5
Rural hospitals	67.9	70.0	69.1
Private hospitals	65.0	68.2	66.8
University or regional hospitals	63.4	67.9	66.1
Total	67.0	69.7	68.6

Trend in number of primary THRs

the past 10 years, per type of hospital



The effects of an increased proportion of private operations

In 2007 for the first time Swedish private hospitals performed comparatively more primary total hip replacements than the university and regional hospitals.

During 2012 this difference has been further accentuated, and it is a distinct trend that the ”gap” is going to increase even more.

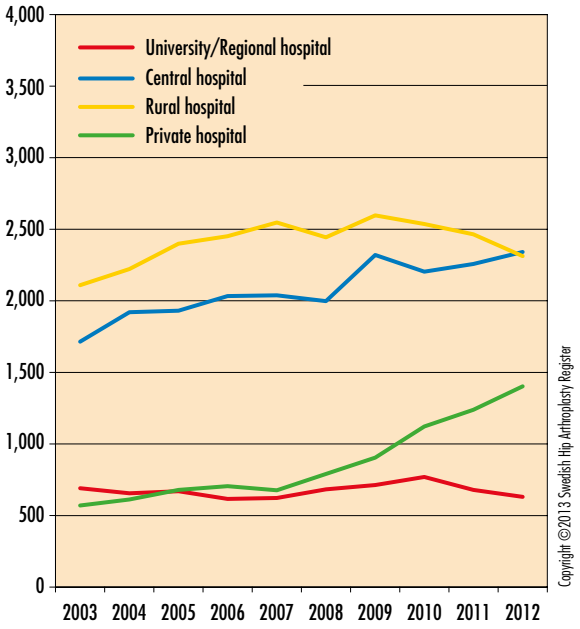
Since county hospitals and above all private hospitals opererate on ”healthier” patients with less comorbidity and technically simpler cases this can mean that accessibility for the ”sicker” and more complicated cases deteriorates, and a displacement effect may arise. Other obvious disadvantages in the near future:

- Possibilities for continuously training doctors and surgical staff deteriorate since training is concentrated to university and regional hospitals.
- The base for clinical studies of primary total hip replacements is radically diminished.

In the near future this may affect the possibilities of transmitting competence to doctors during their specialist education and the trend must absolutely be broken. One demand is for private operators to undertake responsibility for medical education and be paid for it. This issue is the subject of intense discussion in the specialist association and has been highlighted by the records management’s representatives in the national project: ”Free healthcare choices and care episode compensation”.

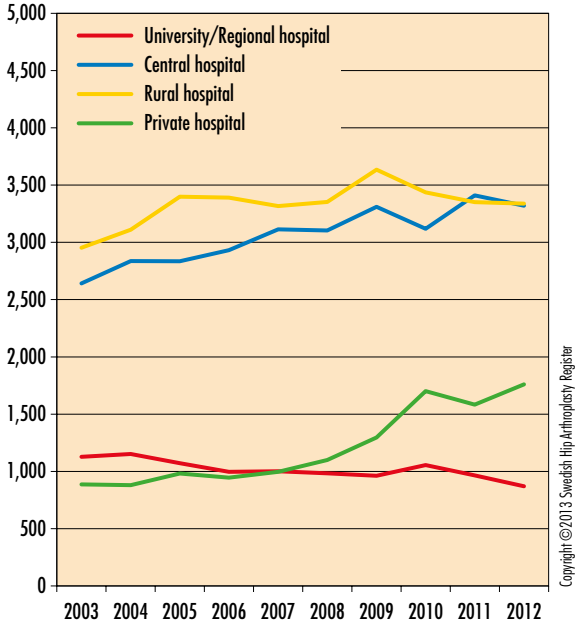
Trend in number of primary THRs

the past 10 years - males only



Trend in number of primary THRs

the past 10 years - females only



Reoperation

Reoperation includes all kinds of surgical intervention that can be directly related to an inserted hip arthroplasty irrespective of whether the prosthesis or one of its parts has been exchanged, extracted or left untouched. The proportion of reoperations in relation to the total number of primary total hip replacements performed plus the number of reoperations during one year has in the past three years varied between 11.6 and 12.5% (Figure 1). This quota indicates the extent to which reoperations burden healthcare resources for total hip replacement in a country or within a region, but it is not suitable for other purposes on account of its sensitivity to occasional oscillations in the number of primary operations performed. It is also affected by many other factors such as patient flow between healthcare departments, the medical profession's attitude to performing revision surgery as well as the period of time that total hip replacement has been practised in a certain healthcare department. The reporting of reoperations is probably inferior to that of primary operations. In the previous annual report we gave an account of this problem concerning infections. There is every reason to suspect a considerable underreporting of certain periprosthesis fractures, not least of those that are not revised but treated with osteosynthesis (see "Operational analysis of the organization").

Reoperation without changing the implant/extraction

In the Register reoperations in which the implant is left untouched are divided into "minor" and "major" surgical interventions. The most common "minor" surgical intervention is various types of wound revision that during the past three years have corresponded to 85.2% followed by drill biopsy (5.4%). The "major" interventions are more varied. One third (33.5%) entail fracture reconstruction followed by insertion, exchange or adjustment of an additional augment on the cup (21.8%) to counteract dislocation. This measure has been classified in the reoperation database as reoperation, but has despite this been recoded in certain analyses to revision.

The causes of the "major interventions" have varied over time. Since 2002 the proportion of this type of measure implemented due to dislocation has diminished, which also applies to those measures implemented due to fracture. Fracture treatment remains, however, the most common of the major interventions, accounting for about half the cases. The proportion of reoperations without changing the prosthesis due to dislocation has diminished, mainly due to reduced use of the so-called cup augment. During 2012 this intervention was carried out (insertion or change) in 15 cases. During 2003, when this measure was at its most popular, 57 similar operations were carried out. An interesting major reoperation without prosthesis change is muscle/tendon reconstruction. This operation can probably be related to gluteus medius reconstruction attempts. A modest increase has occurred, via isolated operations earlier on, and in 2012 about ten muscle plasties were carried out. Since the Hip Arthroplasty Register started, reoperation without adverse effects to the implant due to infection has successively increased to include more than half of the cases (Figure 2).

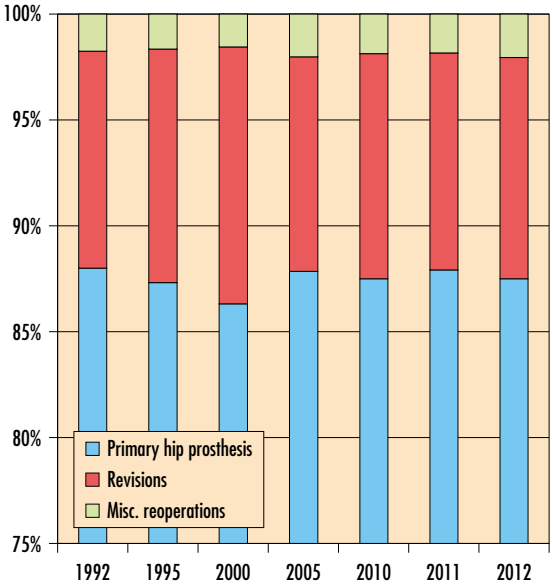


Figure 1. Proportion of patients with reoperation (green+red bars) in relation to the total number of THR-related operations during selected years from 1992–2009 and 2010–2012.

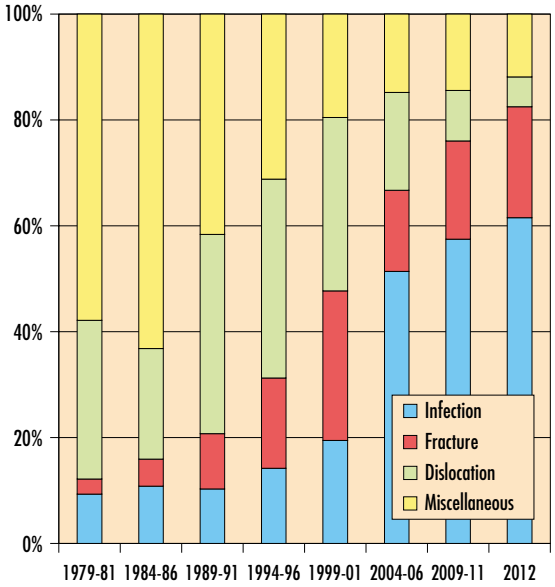


Figure 2. The three most common reasons for reoperations ("minor" and "major" surgeries) without implant component replacement or extraction during selected 3-year periods up to 2011 och separately for year 2012. Infection has become the most common reason for these surgeries.

Reoperation within 2 years

The proportion of reoperations within two years for primary total hip replacement was reduced from 3.5% during the early 1990s to 1.8% during the early 2000s and has thereafter been variable at around 2.0% (Figure 3). The most common cause during the mid-1990s was dislocation (Figure 4). Insertion of a cup augment, a relatively simple intervention, increased in popularity up to 2003, after which it diminished in use due to ineffectivity. This might be able to explain part of the reduction in early reoperation due to dislocation. This is probably not the only explanation since revision due to dislocation has also diminished (see "Revision"). Early reoperation due to infection with or without change/extraction of the prosthesis or parts of it is absolutely the most common cause of early reoperation of primary prostheses. In the corresponding analysis of patients who have earlier been revised, infection as the cause of early reoperation is even more dominant and accounts for 71.4% of cases.

The proportion of total hip replacements to be reoperated within two years diminished during the 1990s and has since 2001 been about 2%. The proportion of reoperations due to infection has increased and is especially high if the patient has previously been subjected to a secondary surgical measure. That the number of reoperations due to infection increased may depend partly on more recent studies showing that early surgical intervention increases the chances of healing.

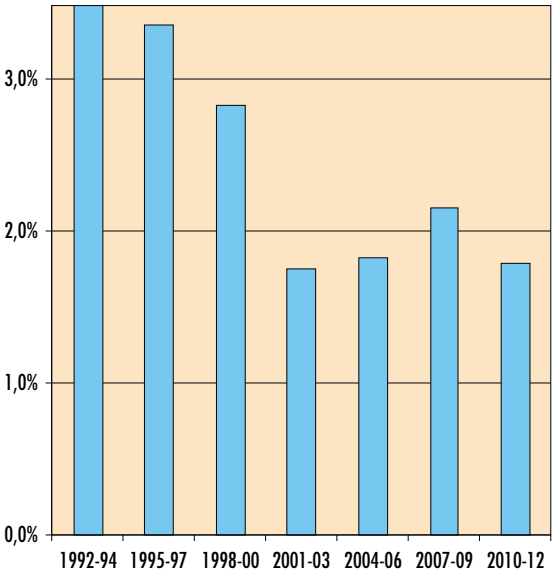


Figure 3. Proportion of reoperations within two years 1992–2012 divided in 3-year periods.

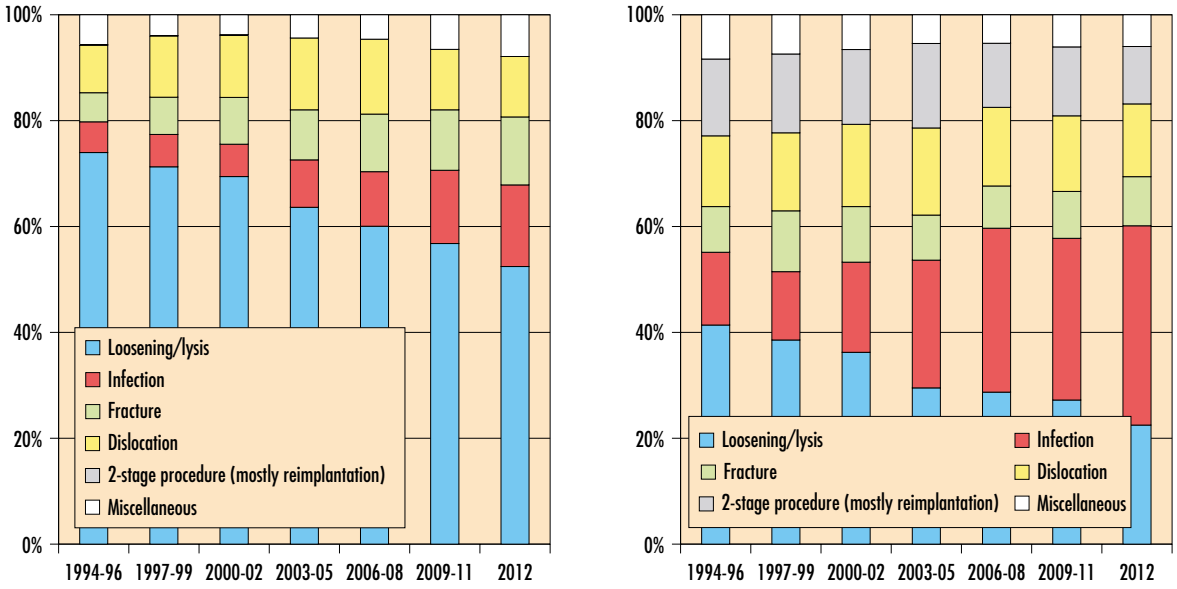


Figure 4. Reasons for first reoperation (left graph) and for reoperations with one or more reoperations after primary THR (right graph). Distribution in 3-year periods from 1994 . 2012 is presented separately.

Number of reoperations per procedure and year

primary THRs performed 1979–2012

Procedure at reoperation	1979–2007	2008	2009	2010	2011	2012	Total	Proportion
Revision	29,406	1,736	1,937	1,936	1,858	1,906	38,779	84.7%
Major surgical intervention	3,461	162	178	164	146	153	4,264	9.3%
Minor surgical intervention	1,755	209	193	177	187	224	2,745	6.0%
Missing	1	0	0	0	0	0	1	0%
Total	34,623	2,107	2,308	2,277	2,191	2,283	45,789	100%

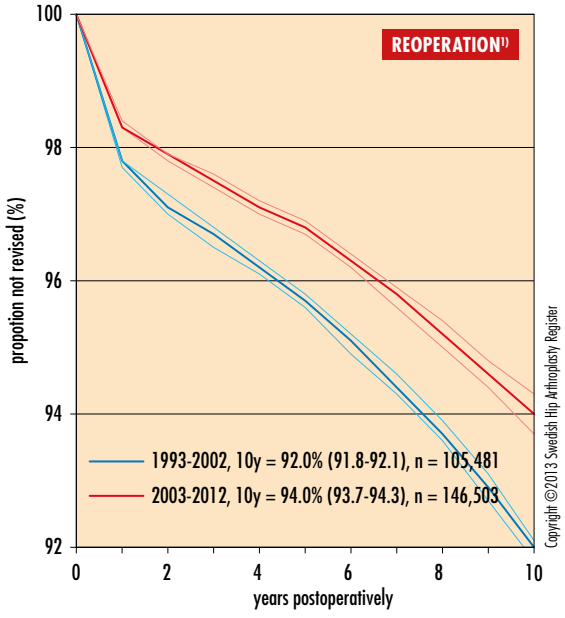
Number of reoperations per reason and year

primary THRs performed 1979–2012

Reason for reoperation	1979–2007	2008	2009	2010	2011	2012	Total	Proportion
Aseptic loosening	20,080	1,004	1,116	1,068	988	968	25,224	55.1%
Deep infection	3,649	405	431	420	468	522	5,895	12.9%
Dislocation	4,033	302	287	299	252	278	5,451	11.9%
Fracture	2,617	220	231	255	230	266	3,819	8.3%
2-stage procedure	1,476	73	97	103	97	83	1,929	4.2%
Technical error	955	43	58	61	69	64	1,250	2.7%
Miscellaneous	951	21	35	31	36	45	1,119	2.4%
Implant fracture	477	18	38	22	32	27	614	1.3%
Pain only	345	20	15	18	17	28	443	1.0%
Sekunday infection	5	0	0	0	1	0	6	0%
Missing	35	1	0	0	1	2	39	0.1%
Total	34,623	2,107	2,308	2,277	2,191	2,283	45,789	100%

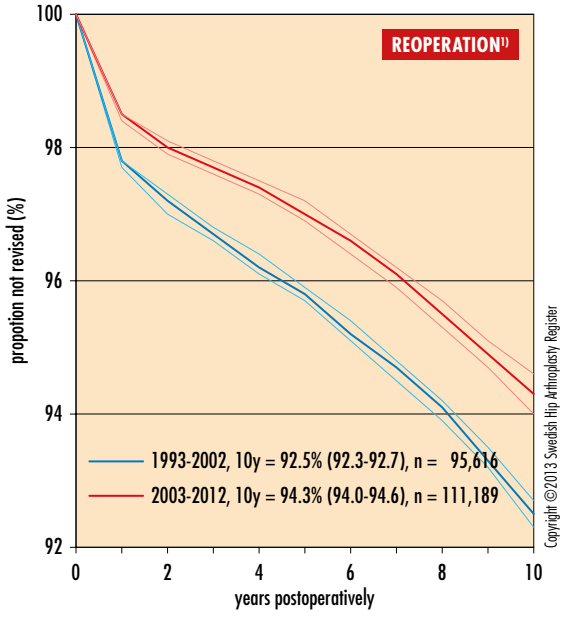
All implants

All diagnoses and all reasons



All cemented implants

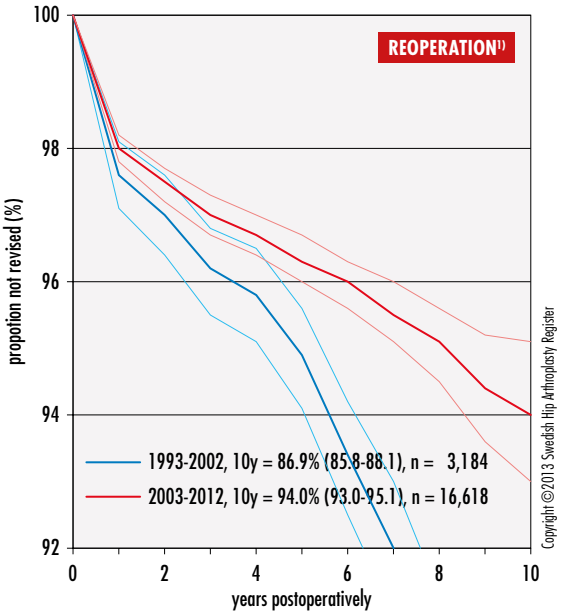
All diagnoses and all reasons



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

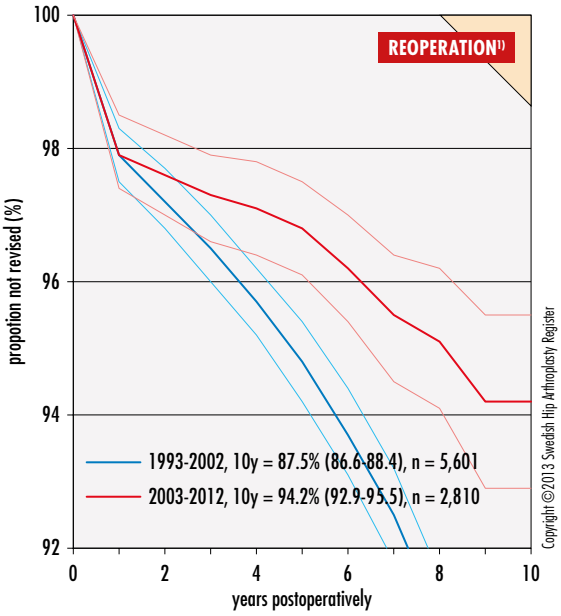
All uncemented implants

All diagnoses and all reasons



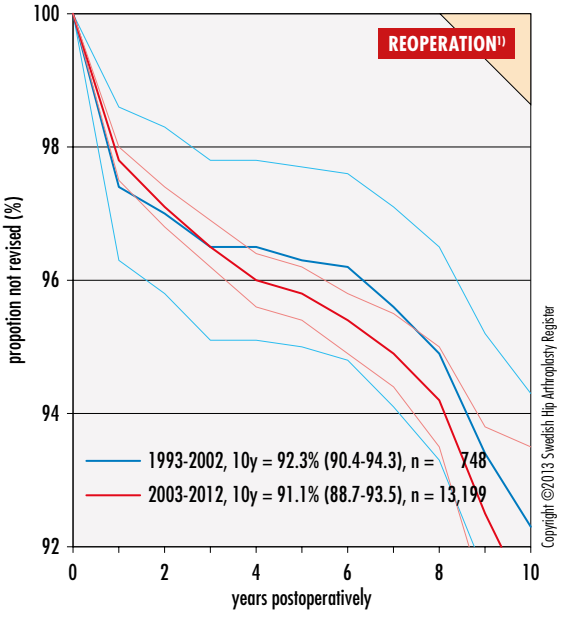
All hybrid implants

All diagnoses and all reasons



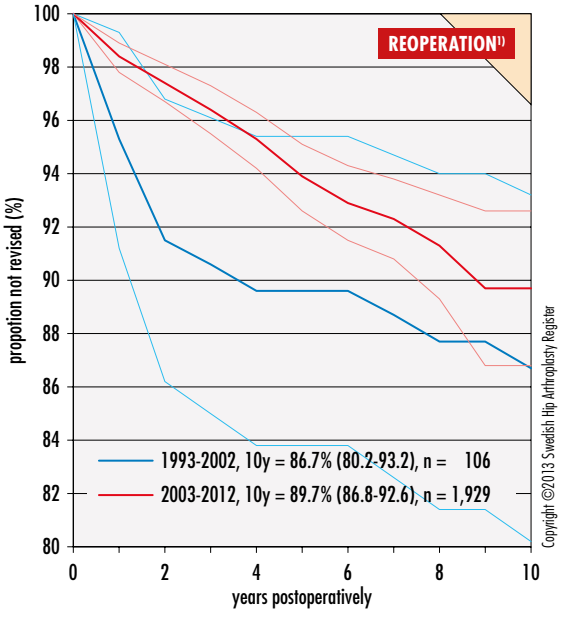
All reversed hybrid implants

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

In traditional survival statistics (Kaplan-Meier), the exchange of any prosthesis component or removal of the entire prosthesis is the definition of failure. Five or ten year survival denotes long-term results with respect to aseptic loosening first and foremost. Reoperation within 2 years refers to all forms of subsequent surgery (not only interventions to replace prosthesis components) to the hip after initiating total hip replacement. This variable reflects mainly early and serious complications such as deep infection and dislocation. This variable is therefore a faster indicator and easier to use for working on clinical improvement compared with 10-year survival, which is important, but a slow and, to some extent, historical indicator.

Reoperation within 2 years has been selectioned out by SALAR and the Swedish National Board of Health and Welfare as a national quality indicator for this type of surgery and it has been included in *Regional comparisons (Öppna jämförelser)*. This indicator should be seen as one of the most important and most responsive endpoints reported by the Swedish Hip Arthroplasty Register.

Definition

By short-term complication we mean all forms of open surgery within two years after the primary operation. The latest 4-year period is studied – in this report 2009 up to and including 2012. Please note that the report only concerns complications that have been surgically dealt with. Infections treated with antibiotics and non-surgically treated dislocations are not captured in the Register. Patients who have been repeatedly operated on because of the same complication are presented as one complication. A number of patients are, however, operated on for different reasons within a short time (registered in those cases as several complications). **Patients who undergo reoperation at a clinic that is not the primary clinic are nonethess counted as belonging to the primary clinic.**

Results – all patients

The results per unit are presented in the following table. Type of hospital, number of primary operation patients during the observation period and number of reoperations is presented. The national average during the observation period was 1.9% (2011: 1.8%). Complication figures vary from 0.6 to 5.2%. The number of complications is marginally increased but this may be an effect of better registration after the Register's intensified selection processes. The number of infections has somewhat increased but is now well in line with the incidence figure we found in last year's linking and matching with the Prescribed Drugs Register, which is to say that infection figures reported earlier were affected by the hidden statistics that we gave an account of then. Gratifyingly, no unit now accounts for 0% reoperation within 2 years – not to need reoperation on a single patient during a 4-year period would appear to be biologically impossible! Clinics with frequencies that are a standard deviation over the average rates are designated in red. Eight (8/79) clinics exceeded this rate. In previous years, the dislocation problem above all has been dominant among the hospitals with high figures for complications but it is now more common for infections to dominate. A number of local undertakings for improvement have during recent years been directed towards dislocation problems.

Results – the "standard" patient

New for this year is that we publish reoperation within 2 years for the so-called "standard" patient (see definition on page 105). This "case-mix" adjustment permits a fairer comparison between the different units. In this analysis, clinics are excluded that have operated fewer than 50 patients during the 4-year period of observation and also clinics with low response frequency with regard to ASA, height and weight (BMI) which are variables describing the "standard" patient. As expected, the reoperation frequency is lower in this group of patients with lower risk and the national average is about half (1.0% versus 1.9%) if one compares the results for all patients. The variation is from 0.3% to 3.4%. In the table, the registration frequency of ASA and BMI is also presented. Some clinics have a relatively low response frequency with respect to these variables for which reason these units' results must be interpreted with certain caution. The Register's administration encourages units to review and improve their reporting.

Under-reporting

For several years we have published our annual coverages analysis, which does not, however, include secondary interventions. This fact is disturbing in respect to the Register's data quality. The reason is unfortunately the remaining low quality of the surgeons' diagnoses (ICD-10) and specification of the classification and treatment procedure codes in secondary interventions. We have made several attempts but found up to 30 different (and often inadequate) intervention codes used for different types of reoperation. Since the Patient Register also lacks laterality in its database, comprehensive system development is necessary to do a coverage analysis of secondary interventions, and at present we do not have the resources required for such development.

The following plan of action was undertaken by the register two years ago in order to gain better coverage with respect to secondary interventions:

- Monitoring of the hospitals.
- Creation of resources for coverages analyses of secondary interventions according to the above.

Patients who have been reoperated at a clinic other than the primary clinic are regarded as belonging to the primary clinic.

- A renewed appeal to all operational managers to work locally towards a better code-setting culture in our units, via meetings or even local courses in the subject.
- Each and every unit should review its routines for reporting reoperations, which is a broader concept than revision – ”any kind of further surgery”.
- A renewed appeal to first and foremost the country’s private operators to follow the law and report not only to the Swedish Hip Arthroplasty Register (voluntary) but also to the Patient Register at the Swedish National Board of Health and Welfare (this is statutory!).

Discussion

When interpreting results one should only compare units from the same type of hospital due to different patient demography. Clinics that operate the more difficult cases with the greatest risk for complications may, of course, have a higher frequency. Apart from the hospitals’ different risk profiles, the following factors must also be weighed into the interpretation of these results:

- Underreporting – see above!
- The number of complications is generally low with chance variability having great impact on the results. This variable can really only be evaluated over time, that is to say if distinct trends exist - see separate trend table!
- Clinics that take a cautious stance (non-surgical treatment of for example infection and dislocation), which is to say that they avoid operation for these complications, are not registered in the database.
- Conversely, clinics that are surgically ”aggressive” both at the suspicion of early infection and on initial dislocation, have high frequencies of early complications.
- The treatment algorithm in case of early suspicion of deep infection has changed during recent years, for both knee and hip arthroplasty. It is more and more common to intervene surgically with debridement with or without exchanging modular components. It is therefore of great importance not only to report classical revisions but also reoperation of all types.

The Register’s management has completely avoided ranking and will never rank the various hospitals with consideration to this important result indicator. Since the number of complications in general is so low, a loss in registration can powerfully affect a unit’s ranking position. Irrespective of hospital category and result, clinics should analyze their own complications (without sneaking a peek at the national average) and investigate whether or not systematic deficiencies exist – all to avoid serious complications for the individual patients.

Reoperations within 2 years per hospital[1)]

2009–2012

	Prim THRs.	Patients[2)]		Infection		Dislocation		Loosening		Others	
Hospital	**Number**	**Number**	**Proportion**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
University or regional hospitals											
Karolinska/Huddinge	1,011	14	1.4%	3	0.3%	5	0.5%	1	0.1%	6	0.6%
Karolinska/Solna	797	18	2.3%	6	0.8%	2	0.3%	3	0.4%	9	1.1%
Linköping	254	5	2.0%	4	1.6%	2	0.8%	0	0%	2	0.8%
SU/Mölndal	1,574	40	2.5%	19	1.2%	10	0.6%	1	0.1%	15	1.0%
SUS/Lund	439	12	2.7%	6	1.4%	2	0.5%	1	0.2%	4	0.9%
SUS/Malmö	358	4	1.1%	3	0.8%	0	0%	0	0%	1	0.3%
Umeå	329	11	3.3%	7	2.1%	1	0.3%	0	0%	4	1.2%
Uppsala	1,175	32	2.7%	13	1.1%	9	0.8%	1	0.1%	15	1.3%
Örebro	654	13	2.0%	8	1.2%	3	0.5%	0	0%	4	0.6%
Central hospitals											
Borås	742	21	2.8%	11	1.5%	5	0.7%	0	0%	8	1.1%
Danderyd	1,320	41	3.1%	22	1.7%	7	0.5%	0	0%	23	1.7%
Eksjö	803	18	2.2%	16	2.0%	0	0%	0	0%	3	0.4%
Eskilstuna	477	11	2.3%	8	1.7%	3	0.6%	0	0%	2	0.4%
Falun	1,411	23	1.6%	17	1.2%	3	0.2%	0	0%	6	0.4%
Gävle	740	35	4.7%	10	1.4%	6	0.8%	1	0.1%	21	2.8%
Halmstad	912	24	2.6%	13	1.4%	5	0.5%	0	0%	8	0.9%
Helsingborg	271	3	1.1%	1	0.4%	1	0.4%	0	0%	1	0.4%
Hässleholm-Kristianstad	3,140	58	1.8%	37	1.2%	3	0.1%	8	0.3%	21	0.7%
Jönköping	823	11	1.3%	7	0.9%	3	0.4%	0	0%	4	0.5%
Kalmar	664	10	1.5%	6	0.9%	5	0.8%	0	0%	0	0%
Karlskrona	134	2	1.5%	0	0%	2	1.5%	0	0%	0	0%
Karlstad	1,035	49	4.7%	42	4.1%	2	0.2%	0	0%	8	0.8%
Norrköping	947	7	0.7%	4	0.4%	2	0.2%	0	0%	2	0.2%
Skövde	675	6	0.9%	6	0.9%	0	0%	0	0%	2	0.3%
Sunderby (inclusivel Boden)	146	5	3.4%	2	1.4%	3	2.1%	0	0%	0	0%
Sundsvall	832	25	3.0%	17	2.0%	10	1.2%	1	0.1%	2	0.2%
Södersjukhuset	1,522	29	1.9%	17	1.1%	2	0.1%	0	0%	17	1.1%
Uddevalla	1,327	16	1.2%	6	0.5%	3	0.2%	1	0.1%	7	0.5%
Varberg	939	12	1.3%	6	0.6%	2	0.2%	0	0%	6	0.6%
Västerås	1,820	64	3.5%	40	2.2%	11	0.6%	0	0%	22	1.2%
Växjö	527	8	1.5%	2	0.4%	5	0.9%	0	0%	2	0.4%
Ystad	24	2	8.3%	2	8.3%	0	0%	0	0%	1	4.2%
Östersund	1050	26	2.5%	15	1.4%	1	0.1%	0	0%	13	1.2%

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Reoperations within 2 years per hospital[1)] (cont.)

2009–2012

	Prim THRs.	Patients[2)]		Infection		Dislocation		Loosening		Others	
Hospital	Number	Number	Proportion	Number	%	Number	%	Number	%	Number	%
Rural hospitals											
Alingsås	843	16	1.9%	12	1.4%	2	0.2%	0	0%	4	0.5%
Arvika	722	14	1.9%	7	1.0%	2	0.3%	1	0.1%	6	0.8%
Bollnäs	1,006	14	1.4%	11	1.1%	1	0.1%	0	0%	3	0.3%
Enköping	1,114	17	1.5%	7	0.6%	8	0.7%	0	0%	5	0.4%
Falköping	482	3	0.6%	1	0.2%	2	0.4%	0	0%	1	0.2%
Frölunda Specialistsjukhus	322	6	1.9%	2	0.6%	1	0.3%	1	0.3%	2	0.6%
Gällivare	388	5	1.3%	3	0.8%	2	0.5%	0	0%	1	0.3%
Hudiksvall	505	12	2.4%	9	1.8%	1	0.2%	0	0%	4	0.8%
Karlshamn	861	8	0.9%	2	0.2%	3	0.3%	0	0%	3	0.3%
Karlskoga	565	4	0.7%	3	0.5%	1	0.2%	0	0%	1	0.2%
Katrineholm	920	18	2.0%	12	1.3%	2	0.2%	3	0.3%	6	0.7%
Kungälv	677	13	1.9%	10	1.5%	0	0%	0	0%	7	1.0%
Lidköping	628	5	0.8%	3	0.5%	0	0%	0	0%	3	0.5%
Lindesberg	863	7	0.8%	1	0.1%	2	0.2%	0	0%	4	0.5%
Ljungby	699	6	0.9%	1	0.1%	4	0.6%	1	0.1%	3	0.4%
Lycksele	1,236	15	1.2%	8	0.6%	4	0.3%	1	0.1%	2	0.2%
Mora	858	6	0.7%	2	0.2%	4	0.5%	0	0%	2	0.2%
Motala (up to 2009)	340	11	3.2%	8	2.4%	3	0.9%	0	0%	0	0%
Norrtälje	456	15	3.3%	7	1.5%	4	0.9%	0	0%	5	1.1%
Nyköping	679	35	5.2%	31	4.6%	3	0.4%	0	0%	3	0.4%
Oskarshamn	810	11	1.4%	10	1.2%	1	0.1%	0	0%	1	0.1%
Piteå	1,487	14	0.9%	9	0.6%	2	0.1%	0	0%	5	0.3%
SUS/Trelleborg	2,394	32	1.3%	13	0.5%	1	0%	1	0%	21	0.9%
Skellefteå	365	3	0.8%	2	0.5%	0	0%	1	0.3%	1	0.3%
Skene	411	7	1.7%	2	0.5%	1	0.2%	0	0%	6	1.5%
Sollefteå	487	3	0.6%	2	0.4%	1	0.2%	0	0%	1	0.2%
Södertälje	482	5	1.0%	2	0.4%	0	0%	0	0%	3	0.6%
Torsby	433	8	1.8%	7	1.6%	2	0.5%	0	0%	6	1.4%
Visby	483	3	0.6%	0	0%	1	0.2%	1	0.2%	1	0.2%
Värnamo	562	8	1.4%	3	0.5%	2	0.4%	0	0%	5	0.9%
Västervik	451	14	3.1%	8	1.8%	3	0.7%	0	0%	4	0.9%
Ängelholm	511	3	0.6%	2	0.4%	0	0%	1	0.2%	2	0.4%
Örnsköldsvik	631	4	0.6%	2	0.3%	2	0.3%	0	0%	1	0.2%

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Reoperations within 2 years per hospital[1)] (cont.)

2009–2012

	Prim THRs.	Patients[2)]		Infection		Dislocation		Loosening		Others	
Hospital	**Number**	**Number**	**Proportion**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Private hospitals											
Aleris Specialistsjukvård Bollnäs	241	4	1.7%	4	1.7%	0	0%	0	0%	0	0%
Aleris Specialistsjukvård Elisabeth-sjukhuset	279	4	1.4%	2	0.7%	1	0.4%	0	0%	1	0.4%
Aleris Specialistsjukvård Motala	1,304	26	2%	17	1.3%	5	0.4%	0	0%	7	0.5%
Aleris Specialistsjukvård Nacka	488	5	1%	4	0.8%	0	0%	0	0%	2	0.4%
Aleris Specialistsjukvård Sabbatsberg	588	5	0.9%	3	0.5%	1	0.2%	0	0%	3	0.5%
Capio Movement	878	20	2.3%	6	0.7%	4	0.5%	0	0%	13	1.5%
Capio S:t Göran	1,699	34	2%	16	0.9%	7	0.4%	0	0%	18	1.1%
Carema Ortopediska Huset	1,431	20	1.4%	10	0.7%	2	0.1%	2	0.1%	11	0.8%
Carlanderska	440	4	0.9%	1	0.2%	1	0.2%	0	0%	2	0.5%
Ortho Center Stockholm	1,678	30	1.8%	20	1.2%	5	0.3%	0	0%	9	0.5%
OrthoCenter IFK-kliniken	501	3	0.6%	1	0.2%	0	0%	0	0%	2	0.4%
Sophiahemmet	706	11	1.6%	6	0.8%	2	0.3%	0	0%	3	0.4%
Spenshult	761	20	2.6%	11	1.4%	8	1.1%	0	0%	5	0.7%
Others	75	1	1.3%	0	0%	1	1.3%	0	0%	0	0%
Nation	63,612	1187	1.9%	679	1.1%	220	0.3%	31	0%	437	0.7%

Red marking denotes values one standard deviation above the national average.

1) Aleris Specialistsjukvård Ängelholm, Art Clinic, SU/Östra and SU/Sahlgrenska have been excluded due to few operations performed or discontinued activity.

2) 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.

Reoperations within 2 years per hospital[1)] – trend

Hospital	2005–2008	2006–2009	2007–2010	2008–2011	2009–2012
University or regional hospitals					
Karolinska/Huddinge	3.3%	3.0%	2.5%	2.2%	1.4%
Karolinska/Solna	3.5%	3.6%	3.2%	2.5%	2.3%
Linköping	0.9%	1.4%	1.3%	1.6%	2.0%
SU/Mölndal	4.5%	4.4%	3.7%	3.4%	2.5%
SUS/Lund	4.2%	4.0%	3.1%	3.0%	2.7%
SUS/Malmö	1.8%	1.5%	2.2%	1.6%	1.1%
Umeå	0.9%	1.4%	1.9%	3.2%	3.3%
Uppsala	3.4%	3.0%	2.8%	2.8%	2.7%
Örebro	1.3%	1.4%	1.8%	1.7%	2.0%
Central hospitals					
Borås	2.4%	2.7%	2.4%	2.8%	2.8%
Danderyd	2.9%	3.3%	3.7%	3.9%	3.1%
Eksjö	2.5%	2.9%	2.5%	2.3%	2.2%
Eskilstuna	1.4%	1.5%	2.0%	1.8%	2.3%
Falun	1.3%	1.6%	2.2%	2.1%	1.6%
Gävle	5.0%	5.4%	5.3%	5.5%	4.7%
Halmstad	2.5%	2.6%	2.7%	3.1%	2.6%
Helsingborg	3.4%	3.7%	2.0%	1.2%	1.1%
Hässleholm-Kristianstad	1.7%	2.1%	2.0%	2.0%	1.8%
Jönköping	1.3%	1.8%	1.5%	1.6%	1.3%
Kalmar	2.5%	2.9%	1.9%	1.7%	1.5%
Karlskrona	5.1%	2.9%	1.8%	0.9%	1.5%
Karlstad	2.9%	3.1%	3.8%	4.6%	4.7%
Norrköping	1.1%	1.3%	1.1%	1.1%	0.7%
Skövde	0.7%	1.0%	1.1%	0.8%	0.9%
Sunderby (inclusive Boden)	5.4%	5.7%	4.4%	3.9%	3.4%
Sundsvall	5.5%	4.5%	4.2%	4.3%	3.0%
Södersjukhuset	2.2%	2.1%	2.1%	1.8%	1.9%
Uddevalla	2.1%	1.9%	1.9%	1.5%	1.2%
Varberg	1.6%	2.0%	1.5%	1.3%	1.3%
Västerås	3.1%	3.4%	4.0%	3.9%	3.5%
Växjö	0.4%	0.2%	0.8%	1.4%	1.5%
Ystad	4.8%	0%	4.5%	8.7%	8.3%
Östersund	2.5%	2.1%	2.8%	2.7%	2.5%

[1)] *Köping, Simrishamn, Aleris Specialistsjukvård Ängelholm, Art Clinic, GMC and SU/Östra have been excluded due to too few operations performed or discontinued activity.*

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Reoperations within 2 years per hospital[1)] – trend (cont.)

Hospital	2005–2008	2006–2009	2007–2010	2008–2011	2009–2012
Rural hospitals					
Alingsås	1.6%	1.9%	1.9%	2.3%	1.9%
Arvika	2.7%	2.0%	2.9%	2.6%	1.9%
Bollnäs	1.4%	1.3%	1.2%	1.3%	1.4%
Enköping	3.2%	3.3%	3.3%	2.7%	1.5%
Falköping	0.3%	0.5%	0.5%	0.7%	0.6%
Frölunda Specialistsjukhus	2.4%	2.8%	3.5%	2.2%	1.9%
Gällivare	0.9%	0.8%	0.8%	1.3%	1.3%
Hudiksvall	3.2%	3.1%	2.9%	2.5%	2.4%
Karlshamn	1.7%	1.6%	1.3%	1.1%	0.9%
Karlskoga	1.3%	1.1%	1.0%	1.0%	0.7%
Katrineholm	0.7%	1.0%	1.4%	1.8%	2.0%
Kungälv	2.0%	2.0%	1.8%	1.8%	1.9%
Lidköping	0.7%	0.6%	0.2%	0.5%	0.8%
Lindesberg	1.9%	2.1%	1.7%	0.9%	0.8%
Ljungby	1.1%	1.1%	1.2%	1.1%	0.9%
Lycksele	0.6%	1.1%	1.3%	1.3%	1.2%
Mora	2.0%	1.6%	1.3%	1.1%	0.7%
Motala (up to 2009)	1.9%	2.5%	2.6%	3.0%	3.2%
Norrtälje	1.2%	2.3%	2.3%	3.2%	3.3%
Nyköping	1.7%	1.7%	3.4%	4.5%	5.2%
Oskarshamn	0.9%	1.1%	1.5%	1.6%	1.4%
Piteå	1.6%	1.5%	1.2%	1.0%	0.9%
SUS/Trelleborg	1.6%	1.6%	1.6%	1.5%	1.3%
Skellefteå	0.7%	0.5%	0.5%	0.8%	0.8%
Skene	1.7%	1.9%	2.2%	1.6%	1.7%
Sollefteå	1.8%	1.2%	1.3%	1.0%	0.6%
Södertälje	0.9%	1.0%	0.8%	0.6%	1.0%
Torsby	2.5%	2.9%	2.4%	1.3%	1.8%
Visby	3.1%	2.1%	1.2%	1.8%	0.6%
Värnamo	0.7%	1.0%	1.1%	1.1%	1.4%
Västervik	2.8%	3.7%	3.8%	4.0%	3.1%
Ängelholm	0%	3.8%	1.0%	0.9%	0.6%
Örnsköldsvik	0.6%	0.7%	0.8%	0.7%	0.6%

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Reoperations within 2 years per hospital[1)] – trend (cont.)

Hospital	2005–2008	2006–2009	2007–2010	2008–2011	2009–2012
Private hospitals					
Aleris Specialistsjukvård Bollnäs	0%	0%	0%	0%	1.7%
Aleris Specialistsjukvård Elisabethsjukhuset	0.5%	0.5%	1.1%	0.8%	1.4%
Aleris Specialistsjukvård Motala	0%	0%	2.3%	2.5%	2.0%
Aleris Specialistsjukvård Nacka	4.2%	2.5%	0.7%	0.8%	1.0%
Aleris Specialistsjukvård Sabbatsberg	0%	0.8%	1.4%	1.2%	0.9%
Capio Movement	1.6%	2.0%	2.4%	2.4%	2.3%
Capio S:t Göran	1.5%	1.2%	1.3%	1.5%	2.0%
Carema Ortopediska Huset	2.0%	2.5%	2.4%	2.0%	1.4%
Carlanderska	1.4%	1.9%	1.2%	1.4%	0.9%
Ortho Center Stockholm	4.1%	2.9%	2.5%	2.3%	1.8%
OrthoCenter IFK-kliniken	0%	0.9%	0.9%	0.6%	0.6%
Sophiahemmet	1.9%	2.1%	2.1%	1.7%	1.6%
Spenshult	2.6%	2.4%	2.7%	2.7%	2.6%
Others	1.7%	2.2%	2.7%	1.7%	1.3%
Nation	2.0%	2.1%	2.1%	2.1%	1.9%

Reoperations, "standard patient", within 2 years per hospital[1)]

2009–2012

	Prim THR.	Patients[2)]		Infection		Dislocation		Loosening		Others		No	Proportion with data on ASA&BMI
Hospital	**Number**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**		
University or regional hospitals													
Karolinska/Huddinge	244	5	2.0%	0	0%	1	0.4%	1	0.4%	3	1.2%	1,011	97.4%
Karolinska/Solna	147	1	0.7%	0	0%	0	0%	0	0%	1	0.7%	797	92.5%
SU/Mölndal	414	6	1.4%	2	0.5%	1	0.2%	0	0%	3	0.7%	1,574	94.0%
Umeå	71	1	1.4%	0	0%	0	0%	0	0%	1	1.4%	329	69.3%
Uppsala	262	4	1.5%	0	0%	1	0.4%	0	0%	3	1.1%	1,175	82.3%
Örebro	223	4	1.8%	3	1.3%	0	0%	0	0%	2	0.9%	654	98.5%
Central hospitals													
Borås	245	4	1.6%	2	0.8%	0	0%	0	0%	2	0.8%	742	97.0%
Danderyd	443	5	1.1%	1	0.2%	1	0.2%	0	0%	3	0.7%	1,320	98.0%
Eksjö	463	5	1.1%	4	0.9%	0	0%	0	0%	1	0.2%	803	79.0%
Falun	669	7	1.0%	6	0.9%	0	0%	0	0%	2	0.3%	1,411	98.0%
Gävle	218	6	2.8%	1	0.5%	0	0%	0	0%	5	2.3%	740	93.0%
Halmstad	444	12	2.7%	7	1.6%	1	0.2%	0	0%	5	1.1%	912	91.4%
Hässleholm-Kristianstad	1,495	7	0.5%	3	0.2%	0	0%	3	0.2%	1	0.1%	3,140	91.1%
Jönköping	381	3	0.8%	1	0.3%	1	0.3%	0	0%	2	0.5%	823	94.7%
Kalmar	307	2	0.7%	1	0.3%	1	0.3%	0	0%	0	0%	664	95.0%
Karlstad	293	7	2.4%	5	1.7%	0	0%	0	0%	2	0.7%	1,035	78.1%
Norrköping	362	2	0.6%	1	0.3%	1	0.3%	0	0%	0	0%	947	84.5%
Skövde	243	1	0.4%	1	0.4%	0	0%	0	0%	0	0%	675	87.4%
Sundsvall	350	4	1.1%	3	0.9%	2	0.6%	1	0.3%	0	0%	832	89.2%
Södersjukhuset	480	5	1.0%	4	0.8%	0	0%	0	0%	1	0.2%	1,522	98.2%
Uddevalla	428	3	0.7%	0	0%	0	0%	0	0%	3	0.7%	1,327	63.9%
Varberg	546	5	0.9%	1	0.2%	1	0.2%	0	0%	4	0.7%	939	91.7%
Västerås	600	9	1.5%	5	0.8%	1	0.2%	0	0%	4	0.7%	1,820	84.5%
Östersund	443	5	1.1%	2	0.5%	0	0%	0	0%	3	0.7%	1,050	95.7%
Rural hospitals													
Alingsås	507	6	1.2%	4	0.8%	1	0.2%	0	0%	1	0.2%	843	99.1%
Arvika	344	4	1.2%	1	0.3%	0	0%	0	0%	3	0.9%	722	86.4%
Bollnäs	541	3	0.6%	2	0.4%	0	0%	0	0%	1	0.2%	1,006	99.4%
Enköping	590	6	1.0%	3	0.5%	2	0.3%	0	0%	2	0.3%	1,114	99.9%
Falköping	286	2	0.7%	0	0%	2	0.7%	0	0%	0	0%	482	99.0%
Gällivare	153	2	1.3%	0	0%	1	0.7%	0	0%	1	0.7%	388	90.7%
Hudiksvall	193	2	1.0%	2	1.0%	0	0%	0	0%	0	0%	505	91.5%
Karlshamn	501	5	1.0%	0	0%	3	0.6%	0	0%	2	0.4%	861	88.5%
Karlskoga	307	1	0.3%	1	0.3%	0	0%	0	0%	1	0.3%	565	98.4%
Katrineholm	585	10	1.7%	7	1.2%	1	0.2%	2	0.3%	3	0.5%	920	100%

(Continued on next page.)

Reoperations, "standard patient", within 2 years per hospital[1] (cont.)

2009–2012

	Prim THR.	Patients[2]		Infection		Dislocation		Loosening		Others		No	Proportion with data on ASA&BMI
Hospital	Number	Number	%	Number	%	Number	%	Number	%	Number	%		
Kungälv	324	4	1.2%	2	0.6%	0	0%	0	0%	2	0.6%	677	97.3%
Lindesberg	462	4	0.9%	1	0.2%	0	0%	0	0%	3	0.6%	863	98.0%
Ljungby	386	2	0.5%	0	0%	1	0.3%	1	0.3%	0	0%	699	99.7%
Lycksele	682	4	0.6%	0	0%	1	0.1%	1	0.1%	2	0.3%	1,236	93.2%
Mora	459	2	0.4%	0	0%	1	0.2%	0	0%	1	0.2%	858	90.2%
Motala (up to 2009)	189	1	0.5%	1	0.5%	0	0%	0	0%	0	0%	340	87.4%
Norrtälje	166	3	1.8%	0	0%	0	0%	0	0%	3	1.8%	456	97.6%
Nyköping	263	9	3.4%	8	3.0%	1	0.4%	0	0%	1	0.4%	679	76.9%
Oskarshamn	414	4	1.0%	4	1.0%	0	0%	0	0%	0	0%	810	99.9%
Piteå	720	1	0.1%	1	0.1%	0	0%	0	0%	0	0%	1,487	99.9%
SUS/Trelleborg	1,181	6	0.5%	2	0.2%	0	0%	0	0%	4	0.3%	2,394	90.6%
Skene	278	5	1.8%	1	0.4%	1	0.4%	0	0%	4	1.4%	411	98.8%
Södertälje	220	2	0.9%	0	0%	0	0%	0	0%	2	0.9%	482	93.8%
Visby	251	2	0.8%	0	0%	0	0%	1	0.4%	1	0.4%	483	96.3%
Värnamo	259	2	0.8%	0	0%	0	0%	0	0%	2	0.8%	562	75.3%
Västervik	222	3	1.4%	1	0.5%	0	0%	0	0%	2	0.9%	451	91.4%
Ängelholm	314	1	0.3%	0	0%	0	0%	0	0%	1	0.3%	511	95.3%
Örnsköldsvik	279	1	0.4%	1	0.4%	0	0%	0	0%	0	0%	631	85.6%
Private hospitals													
Aleris Specialistsjukvård Elisabethsjukhuset	207	2	1.0%	1	0.5%	0	0%	0	0%	1	0.5%	279	99.3%
Aleris Specialistsjukvård Motala	606	8	1.3%	4	0.7%	2	0.3%	0	0%	3	0.5%	1,304	73.6%
Aleris Specialistsjukvård Nacka	342	3	0.9%	2	0.6%	0	0%	0	0%	1	0.3%	488	96.7%
Aleris Specialistsjukvård Sabbatsberg	414	3	0.7%	1	0.2%	1	0.2%	0	0%	1	0.2%	588	95.6%
Capio Movement	531	11	2.1%	3	0.6%	2	0.4%	0	0%	8	1.5%	878	97.9%
Capio S:t Göran	699	9	1.3%	4	0.6%	0	0%	0	0%	6	0.9%	1,699	93.3%
Carema Ortopediska Huset	991	10	1.0%	4	0.4%	0	0%	2	0.2%	6	0.6%	1,431	98.6%
Carlanderska	275	2	0.7%	1	0.4%	1	0.4%	0	0%	0	0%	440	97.3%
Ortho Center Stockholm	1,140	11	1.0%	8	0.7%	1	0.1%	0	0%	5	0.4%	1,678	99.8%
OrthoCenter IFK-kliniken	304	1	0.3%	0	0%	0	0%	0	0%	1	0.3%	501	99.6%
Sophiahemmet	430	5	1.2%	4	0.9%	0	0%	0	0%	1	0.2%	706	99.3%
Spenshult	406	7	1.7%	3	0.7%	3	0.7%	0	0%	2	0.5%	761	98.4%
Others	1,522	4	0.3%	0	0%	1	0.1%	0	0%	3	0.2%	5,181	78.8%
Nation	28,714	286	1.0%	130	0.5%	38	0.1%	12	0%	131	0.5%	63,612	91.1%

[1] *Several hospitals have been excluded due to few operations performed on the "standard patient" or discontinued activity during the period. Some hospitals have been excluded due to absent information on ASA and BMI.*

[2] *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.*

Red marking denotes values one standard deviation above the national average.

”Adverse events” within 30 and 90 days

The Swedish Hip Arthroplasty Register has, in recent years, established continuous cooperation with the Patient Register at the Swedish National Board of Health and Welfare. In *Regional Comparisons (Öppna jämförelser)* a national quality indicator has been created via the Patient Register: ”Adverse events after total hip or knee arthroplasty”. The Register has used this analysis to carry out a separate analysis for total hip replacement alone. This has now been published at hospital level for the second time.

Since the care period for a total hip replacement has been considerably reduced, nationally as well as internationally during the most recent ten-year period, the focus on adverse events after this elected intervention has increased. By the concept ”adverse events” is meant all forms of rehospitalization that may have depended upon the intervention that was carried out – and in that case not only local complications but general medical complications and death as well.

The Register’s and the Swedish National Board of Health and Welfare’s definition of ”adverse events” after hip arthroplasty surgery: all forms of reoperation of the hip in question as well as cardiovascular, cerebrovascular and thromboembolic complications, pneumonia, GI bleeding and urine retention if these complications have resulted in hospitalization, plus death. The analysis took as its point of departure the register’s database for primary total hip replacements during 2010 up to and including September 2012 (43,023 operations) and this database was coordinated with the National Patient Register.

Results

See table below. The national average is 3.6% after 30 days and 5.7 % after 90 days. There were significantly more adverse events at both 30 and 90 days. The frequency of adverse events varies considerably between hospitals: 30 days; 0.8–14.3%, 90 days; 1.2–16.1%. Hospitals differing from the average with a standard deviation or more are marked in red in the table.

Problems and discussion

This type of analysis from the Patient Register (PAR) may in the future be of great significance for continued development of quality for Swedish hip arthroplasty. We can capture variables in PAR that our ordinary routines do not register. At present there are however a number of sources of error described in the section entitled ”Coverage”. A number of hospital amalgamations have been carried out with shared reporting to the Patient Register despite the surgery being performed at different hospitals. The greatest source of error, however, is probably sub-optimal code setting, and that many patients have a large number of side diagnoses when discharged, where the most relevant diagnosis for that particular care occurrence is not always the first diagnosis in the report. These factors give rise to the probability that the analysis will present values that are too low.

Generally speaking, the striving to shorten the length of stay for this type of surgery is ongoing. The concept ”fast track” with ultra-short care periods among other thing is winning more and more attention in Europe and North America alike. Length of Stay is often put forward as utterly decisive in analyses of cost effectivity. Such analyses must, however, include adverse events both in short- and long-term perspectives, which most studies of length of stay do not do. Any possible cost reduction would, however, disappear directly should readmissions simultaneously increase dependence on shorter periods of hospitalization.

The great variation between hospitals suggests that an improvement potential within this sphere. Of course various case-mixes can explain some of the differences, but differences in preoperative medical assessment/optimization and indications, etc. should be discussed at the clinics when these figures are interpreted locally.

Planned study

The Register will in future have increased focus on adverse events after hip arthroplasty, both in its analysis of work activity and clinical research. In the autumn of 2013 we are starting a countrywide project in which we aim to gather about 2,500 journals from different clinics in the country. The objective of this comprehensive research project at a national level for patients undergoing prosthesis surgery is to: (1) Select ICD-coding for complications/adverse events, (2) identify a simpler and more reliable model for discovering adverse events and (3) study the true dislocation frequency in Sweden after total hip replacement.

Background: (1) There is strong interest in using ICD codes for evaluation of hip and knee prosthesis surgery. Despite the fact that *Regional Comparisons* provide annual accounts of complication codes, there is no research that clarifies how high the specificity/sensitivity offered by this type of method is. Apart from problems of precision with the codes, there is the risk that coding-based replacement and evaluation systems affect how coding is implemented. For example, between 1997 and 2007 we have observed a doubling of comorbidity codes in hip arthroplasty-operated patients despite the fact the age incidence has remained unchanged during this period. For this reason selectioning of the codes in connection with prosthesis surgical interventions is necessary.

(2) In addition to code selectioning, the project aims to present an alternative model for estimating complications after arthroplasty. It has been adequately demonstrated that average length of stay increases with complications, and there is reason to believe that there is a strong relationship between a high degree of standardized care in connection with prosthesis surgery. Our hypothesis is that patients with an unusually long length of stay or earlier readmissions constitute some form of complication and should be considered as such irrespective of whether or not a code for complications exists.

(3) We will also select codes in connection with hip arthroplasty dislocations. The objective is to develop an implement for estimating the occurrence of closed reductions, that is to see the ones that do not undergo reoperation. This would open up for new studies in which the causes behind dislocations can be mapped in greater detail since we have reason to believe there are hidden statistics here, especially among older and more fragile patients who do not undergo reopereration.

Workplan: We will review the journals according to the guidelines drawn up by SALAR for the review of journals, so-called marker-based journal reviewing. All journal reviewers will undergo a short course on marker-based journal reviewing in order to ensure a homogeneous assessment.

We intend to ask clinics to help us with data collection in order to be able to carry out this work effectively. Every clinic will receive a list of patients and care events of interest, of which they will be requested to send us medical record copies. Marker-based record reviewing demands that a proportion of these records be re-reviewed in order to selection the results and ensure quality.

Basic selection of records will be carried out with the help of an algorithm where several records will be chosen with long term care events to maximize the number of care incidents. For practical reasons, we have selectioned the choice of records from four different university cities including their surrounding environment. University hospitals as well as rural hospitals and private care providers will be chosen in the different locations in order to achieve maximal scope.

After data collection, predictive statistical models will be developed in which we will use care days, gender, age etc. in order to see how well we can predict care damage based on LoS. These models will be compared with present code-based methods such as those used by *Regional Comparisons*. The objective is to find an equivalent or better model as an alternative to present day measurement methods.

Apart from the above-mentioned selectioning and model building, we will look at coding in connection with closed reduction of hip arthroplasty dislocation. By mapping coding errors and lack of coding etc., we will be able to develop an implement so that future studies can identify patients in risk of dislocation, and who have only undergone closed reduction and not undergone surgery anew.

Significance: Even though reoperation is a very undesirable event, there is reason to look at other events as well, even those not entailing reoperation. From a socioeconomic perspective as well as from a patient-centred perspective there are strong incentives for gaining a better understanding of the frequency of other adverse events, and for achieving a better identification of groups at risk in order to establish a foundation upon which to structure the work of improvement.

Adverse events
2010–2012

	Patients	Adverse events within 30 days			Adverse events within 90 days		
Hospital	**Number**	**Number**	**%**	**±**	**Number**	**%**	**±**
University or regional hospitals							
Karolinska/Huddinge	687	22	3.2	1.3	37	5.4	1.7
Karolinska/Solna	554	30	5.4	1.9	44	7.9	2.3
Linköping	169	11	6.5	3.7	16	9.5	4.4
SU/Mölndal	1,131	49	4.3	1.2	82	7.3	1.5
Lund	299	28	9.4	3.3	44	14.7	4.0
Malmö	255	8	3.1	2.1	22	8.6	3.5
Umeå	207	8	3.9	2.6	14	6.8	3.4
Uppsala	773	36	4.7	1.5	68	8.8	2.0
Örebro	446	16	3.6	1.7	28	6.3	2.3
Central hospitals							
Borås	487	20	4.1	1.8	38	7.8	2.4
Danderyd	839	47	5.6	1.6	66	7.9	1.8
Eksjö	531	23	4.3	1.7	38	7.2	2.2
Eskilstuna	323	18	5.6	2.5	26	8.0	3.0
Falun	965	28	2.9	1.1	47	4.9	1.4
Gävle	488	26	5.3	2.0	37	7.6	2.4
Halmstad	633	26	4.1	1.5	36	5.7	1.8
Helsingborg	180	15	8.3	4.0	20	11.1	4.6
Hässleholm-Kristianstad	2,045	73	3.6	0.8	110	5.4	1.0
Jönköping	556	10	1.8	1.1	28	5.0	1.8
Kalmar	437	10	2.3	1.4	16	3.7	1.8
Karlskrona	103	5	4.9	4.2	11	10.7	6.0
Karlstad	688	50	7.3	1.9	71	10.3	2.3
Norrköping	654	32	4.9	1.7	46	7.0	2.0
Skövde	504	19	3.8	1.7	28	5.6	2.0
Sunderby	93	12	12.9	6.8	15	16.1	7.5
Sundsvall	547	41	7.5	2.2	57	10.4	2.6
Södersjukhuset	1,011	51	5.0	1.4	81	8.0	1.7
Uddevalla	839	25	3.0	1.2	46	5.5	1.5
Varberg	610	20	3.3	1.4	28	4.6	1.7
Västerås	1,239	104	8.4	1.5	142	11.5	1.8
Växjö	387	15	3.9	1.9	25	6.5	2.5
Ystad	21	3	14.3	15.0	3	14.3	15.0
Östersund	723	18	2.5	1.1	31	4.3	1.5

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Adverse events (cont.)

2010–2012

	Patients	Adverse events within 30 days			Adverse events within 90 days		
Hospital	Number	Number	%	±	Number	%	±
Rural hospitals							
Alingsås	572	23	4.0	1.6	39	6.8	2.1
Arvika	502	15	3.0	1.5	28	5.6	2.0
Bollnäs	701	17	2.4	1.1	26	3.7	1.4
Enköping	781	36	4.6	1.5	48	6.1	1.7
Falköping	220	8	3.6	2.5	12	5.5	3.0
Frölunda Specialistsjukhus	219	4	1.8	1.8	7	3.2	2.3
Gällivare	264	16	6.1	2.9	19	7.2	3.1
Hudiksvall	325	15	4.6	2.3	19	5.8	2.6
Karlshamn	579	19	3.3	1.5	29	5.0	1.8
Karlskoga	372	15	4.0	2.0	22	5.9	2.4
Katrineholm	614	17	2.8	1.3	28	4.6	1.7
Kungälv	465	17	3.7	1.7	24	5.2	2.0
Lidköping	451	8	1.8	1.2	15	3.3	1.7
Lindesberg	592	10	1.7	1.0	18	3.0	1.4
Ljungby	471	13	2.8	1.5	23	4.9	2.0
Lycksele	820	23	2.8	1.1	36	4.4	1.4
Mora	571	16	2.8	1.4	26	4.6	1.7
Norrtälje	296	20	6.8	2.9	25	8.4	3.2
Nyköping	459	30	6.5	2.3	44	9.6	2.7
Oskarshamn	542	8	1.5	1.0	19	3.5	1.6
Piteå	1,033	15	1.5	0.7	30	2.9	1.0
Skellefteå	233	8	3.4	2.3	10	4.3	2.6
Skene	279	5	1.8	1.6	9	3.2	2.1
Sollefteå	337	4	1.2	1.2	9	2.7	1.7
Trelleborg	1,602	26	1.6	0.6	47	2.9	0.8
Södertälje	308	10	3.2	2.0	17	5.5	2.6
Torsby	304	13	4.3	2.3	19	6.3	2.7
Visby	310	15	4.8	2.4	20	6.5	2.7
Värnamo	372	14	3.8	1.9	24	6.5	2.5
Västervik	312	18	5.8	2.6	21	6.7	2.8
Ängelholm	407	12	2.9	1.6	22	5.4	2.2
Örnsköldsvik	423	6	1.4	1.1	12	2.8	1.6

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Adverse events (cont.)

2010–2012

	Patients	Adverse events within 30 days			Adverse events within 90 days		
Hospital	**Number**	**Number**	**%**	**±**	**Number**	**%**	**±**
Private hospitals							
Aleris Spec.vyeard i Motala	1,178	39	3.3	1.0	72	6.1	1.4
Aleris Specialistsjukvård Bollnäs	166	2	1.2	1.7	2	1.2	1.7
Aleris Specialistsjukvård Elisabethsjukhuset	180	3	1.7	1.9	6	3.3	2.6
Aleris Specialistsjukvård Nacka	355	8	2.3	1.5	12	3.4	1.9
Aleris Specialistsjukvård Sabbatsberg	395	5	1.3	1.1	8	2.0	1.4
Capio Movement	632	18	2.8	1.3	21	3.3	1.4
Capio S:t Göran	1,131	39	3.4	1.1	61	5.4	1.3
Carema Ortopediska Huset	891	22	2.5	1.0	27	3.0	1.1
Carlanderska	366	3	0.8	0.9	8	2.2	1.5
Ortho Center Stockholm	1,168	25	2.1	0.8	47	4.0	1.1
OrthoCenter IFK-kliniken	367	3	0.8	0.9	6	1.6	1.3
Sophiahemmet	475	12	2.5	1.4	18	3.8	1.7
Spenshult	559	14	2.5	1.3	23	4.1	1.7
Nation	43,023	1,569	3.6	0.2	2,460	5.7	0.2

Hospitals with less than 10 patients during the period have not been presented!

Red marking denotes values one standard deviation above the national average.

Revision

Revision means that a hip arthroplasty-opererated patient undergoes a further operation in which a section or the whole prosthesis is replaced or extracted. From the start of the Register in 1979, the proportion of multiple-time revisions increased up until the early 2000s. This is a result first and foremost of the fact that the number of hip arthroplasty patients in the population has increased combined with an increasing average length of life. Improved possibilities to perform advanced prosthesis surgery has certainly also contributed. Since 2000–2003 the proportion of multiple-time revisions has been relatively constant at about 22–25% (Figure 1).

Since 1992 the number of revisions performed per year has increased from 1,440 to 2,283 in 2012. From 2008 to 2012 the number has varied between 2,107 and 2,308. Between 2011 and 2012 the number of reported revisions increased by 92 (4%). The proportion of revisions related to the total of primary total hip replacements and revisions performed since 1992 has varied between 12.0 and 13.7%. Between 2011 and 2012 this proportion increased from 12.1 to 12.5%.

During the past three years, the average age in mean at the time of their revision has been 4–5 years higher than in those patients who were operated with primary prosthesis during the same period. In women, the difference is smaller (Table 1). The proportion of women decreased successively in comparison between primary prostheses, initial and multiple revisions. The more revisions performed, the more likely it concerns a man. A shift in the incidence of diagnoses occurs so that patients with secondary osteoarthritis are more often affected by multiple-time revisions. This does not, however, concern the diagnoses of fracture and sequele after trauma.

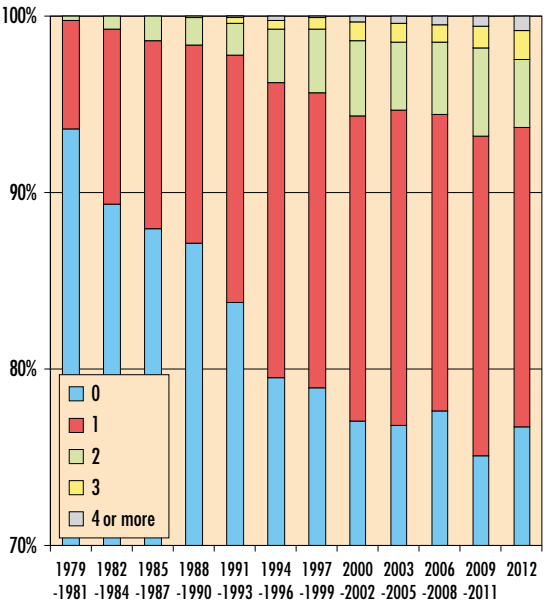


Figure 1. The distribution of first-time and multiple revisions in 3-year periods since the start of the Swedish Hip Athroplasty Register. The proportion first-time revisions have decreased from above 90 to below 80% partly due to the fact that only primary THRs performed 1979 and later have been included but also due to other reasons.

Demography

	Prim. THR	Revision	
		First	*>= 1 previously*
Number	47,874	3,978	1,215
Age mean *SD*			
Males	66.9 *10.9*	71.0 *11.0*	71.4 *10.9*
Females	69.5 *10.5*	71.9 *11.9*	71.0 *12.3*
Proportion Females %	58.3	53.2	50.4
Diagnos %			
Primary osteoarthritis	83.4	76.3	68.2
Inflammatory arthritis	1.4	6.1	8.8
Fracture/seq. trauma	9.6	7.5	8.4
Childhood disease	2.0	4.7	7.5
Femoral head necrosis	3.1	3.9	4.7
Others	0.5	0.7	1.4

Table 1. Demography of patients revised 2010–2012. Data for primary THRs for comparison.

Causes leading to revision

In Sweden, aseptic loosening, also including osteolysis, is the commonest cause of initial as well as multiple-time revisions. During the last 10 years, this proportion has decreased in initial revisions from 74.2% to 58.5% (Figure 2 on the left). In 2003, dislocation was the second most common cause of initial revision followed by periprosthesis fracture (here abbreviated to fracture). After this, the relative proportion of revisions due to infection increased and is about as great as the proportion revised due to dislocation (11.7 and 11.6%, respectively). Between 2011 and 2012 the proportion of initial revisions due to infection has been relatively constant. Since 2010 the proportion of dislocations has slowly increased by barely 1%, which in numbers is equivalent to an increase of about 10 revisions per year.

In the group that had undergone at least one earlier revision, slightly less than 40% of revisions were performed due to loosening and/or osteolysis, 24% due to infection and 22% to dislocation (Figure 2 on the right). The last-named causes are thus considerably more common in multiple-time revision. Even here is a tendency towards increase in the proportion of infections. The variations during the last four years of between 18.9 and 23.7% are equivalent to a change in absolute numbers of 19 operations per year.

The cause of revision varies depending on age. Although loosening /osteolysis dominates in all age groups the proportion

of initial revisions due to dislocation and fracture in the group aged 80 and older increased (Figure 3 on the left). The same is true of patients who had undergone at least one earlier revision first and foremost due to dislocation, which causes more than every fourth multiple-time revision in the oldest group (Figure 3 on the right). The proportion of revisions due to infections tends to decrease with age. This is true of initial as well as multiple-time revisions.

Multiple revisions

Among initial revisions in the database (n=12,342) 17% have been revised at least once. The majority of these are revised within one year (43%, Figure 4). If all initial revisions from 2003 and onwards are excluded (which thus have an observation time of less than 10 years) the picture looks similar, even though the proportion of revisions within the first three years decreased

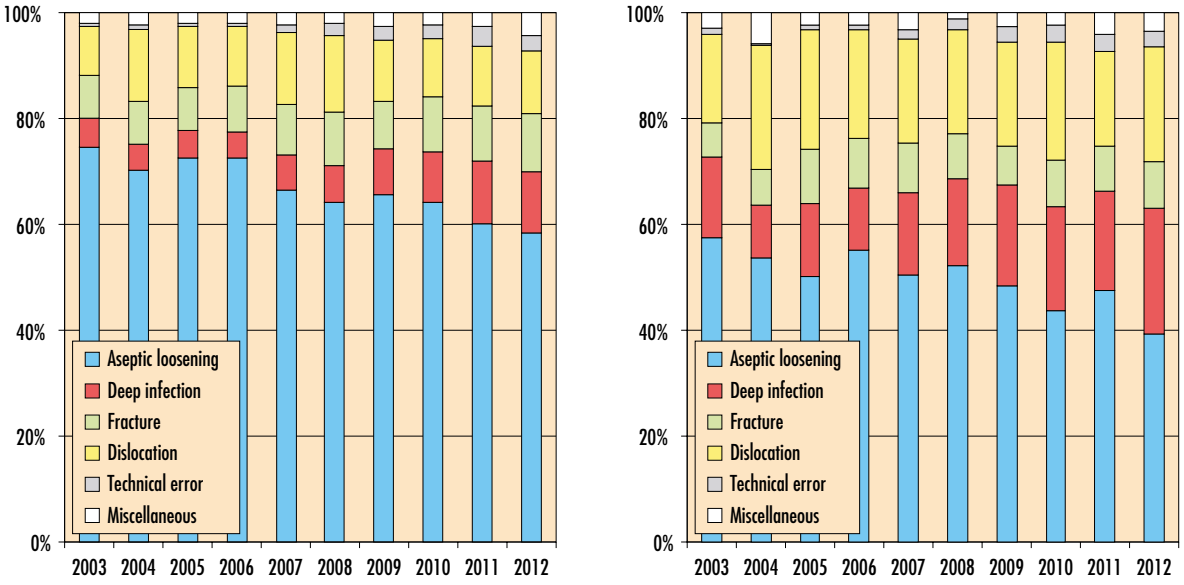


Figure 2. Distribution of reasons for revisions for primary revision (left) and multiple revisions (right) between 2003 and 2012.

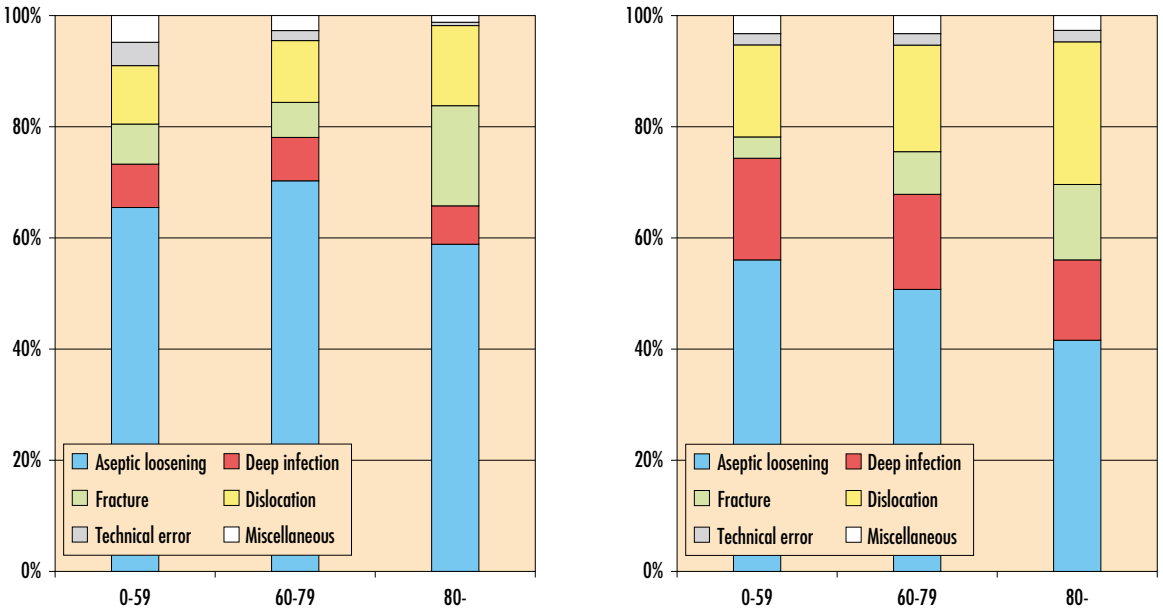


Figure 3. Distribution of reasons for revision divided in three age groups at primary revision (left) and multiple revision (right).

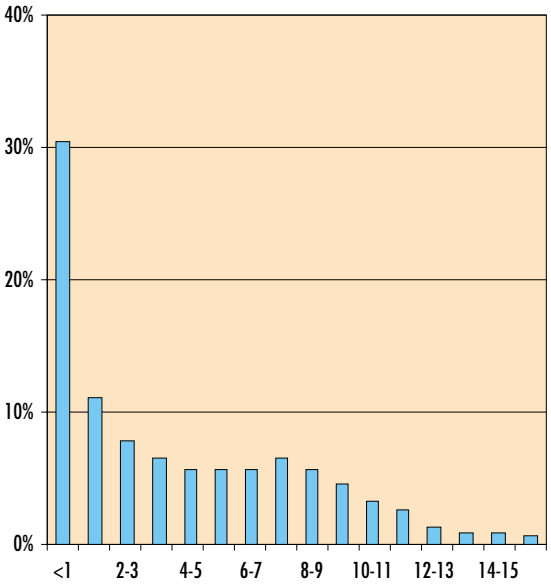


Figure 4. Time to rerevision for patients who have been revised previously during 1992-2003. Almost half of these rerevisions occur within three years. The last bar represents 15 years or more.

from 65 to 49%. For the more common causes of revision, loosening/osteolysis, infection and dislocation are the causes of the next revision in most of the cases, just as in initial revision. If a patient is first revised due to periprosthetic fracture then the probability is greatest that the next revision will be performed due to dislocation, which has implications for decisions about simultaneous cup revision in these patients (Table 2).

The significance of age, gender and diagnosis in order to have to undergo more than one revision has been studied with logistic regression analysis (Table 3). The objective has been to investigate the extent to which it is possible to use demographic data to assess whether or not a patient to be operated with a primary prosthesis has an increased risk of being affected by several future revisions: an assessment that is important since implant failure with subsequent revision involves considerable suffering for the patient and great costs to healthcare. The analysis shows that male gender increases the risk by 50% irrespective of whether the evaluation only includes the primary operation as well as second occasion revisions performed up until 2003 or 2012. The risk increases likewise the lower the age and especially in the group with an observation period of at least 10 years. Secondary osteoarthritis is also a risk factor. All the most common causes in this group increase the risk if all patients are included. In the patient population that underwent surgery up until 2003 there is no difference between avascular necrosis and primary osteoarthritis when it comes to the risk of having to undergo more than one revision.

Measures at revision

The most common measures at revision, regardless of whether or not the prosthesis has been revised earlier, is change of stem and cup or liner, as well as change of cup alone (Figure 5). During 2012 these both amounted to 70% of all measures for primary revisions, and 48% of all multiple revisions. Changing the prosthetic modular parts has become more and more common, especially if the implant has been revised earlier. The most common revision measure in case of infection is prosthetic extraction, followed by change of liner and/or joint head in connection with soft tissue lavage (Figure 6). During 2012 a complete implant change was performed in 4.0% of infection cases (n=21). In 24 cases (4.7%) some prosthetic component was retained.

Selection of implant

Selection of uncemented fixation has a longer tradition in revision than in operations with primary prostheses. However, cemented fixation also dominated in cases of revision 10 years ago. During the last 10 years uncemented fixation has increased in primary as well as multiple revisions and now used in about half of all operations. During 2012 there was a tendency to use uncemented stems more often in multiple

Reason for 1st and 2nd revisions

First/second	Loosening/lysis	Infection	Periprosthetic fracture	Dislocation	Others	Non-revised
Loosening/osteolysis	**14.8**	2.3	2.7	3.6	1.2	75.4
Infection	6.9	**8.8**	3.5	4.5	1.7	74.6
Periprosthetic fracture	5.9	2.0	5.1	**10.2**	3.2	73.6
Dislocation	4.7	4.0	,9	**12.6**	1.7	76.2
Others	**8.6**	5.6	1.5	5.1	5.0	74.2

Table 2. Relative proprotion of first time revisions with a second revision divided by the four most common reasons. Only first time revisions during 1992–2003 are included in order to have a minimum 10 year follow-up. The most common reason for rerevision in each group are marked in bold.

Risk factors for multiple revisions

	Period for primary THR and eventual first-time revision	
	1992–2003	*1992–2012*
Number total/revised >1 time	*124,020/1,823*	*260,329/2,930*
Gender		
Male	1.5 *1.3–1.7*	1.5 *1.3–1.7*
Females	1 *(reference)*	1 *(reference)*
Age		
0–54	4.0 *3.4–4.7*	3.0 *2.6–3.4*
55–64	1.9 *1.7–2.3*	1.6 *1.4–1.8*
65–75	1 *(reference)*	1 *(reference)*
75–	0.5 *0.4–0.6*	0.5 *0.5–0.6*
Diagnosis		
Primary osteoarthritis	1 *(reference)*	1 *(reference)*
Inflammatory arthritis	1.3 *1.1–1.7*	1.9 *1.6–2.3*
Fracture, sequele trauma	1.5 *1.2–1.8*	1.7 *1.5–2.0*
Childhood hip disease	1.9 *1.4–2.4*	1.5 *1.2–1.9*
Femoral head necrosis	0.9 *0.6–1.4*	1.6 *1.3–2.0*
Others	1.2 *0.8–1.9*	1.6 *1.1–2.2*

Table 3. The risk of having more than one subsequent revision related to age, gender and diagnosis.

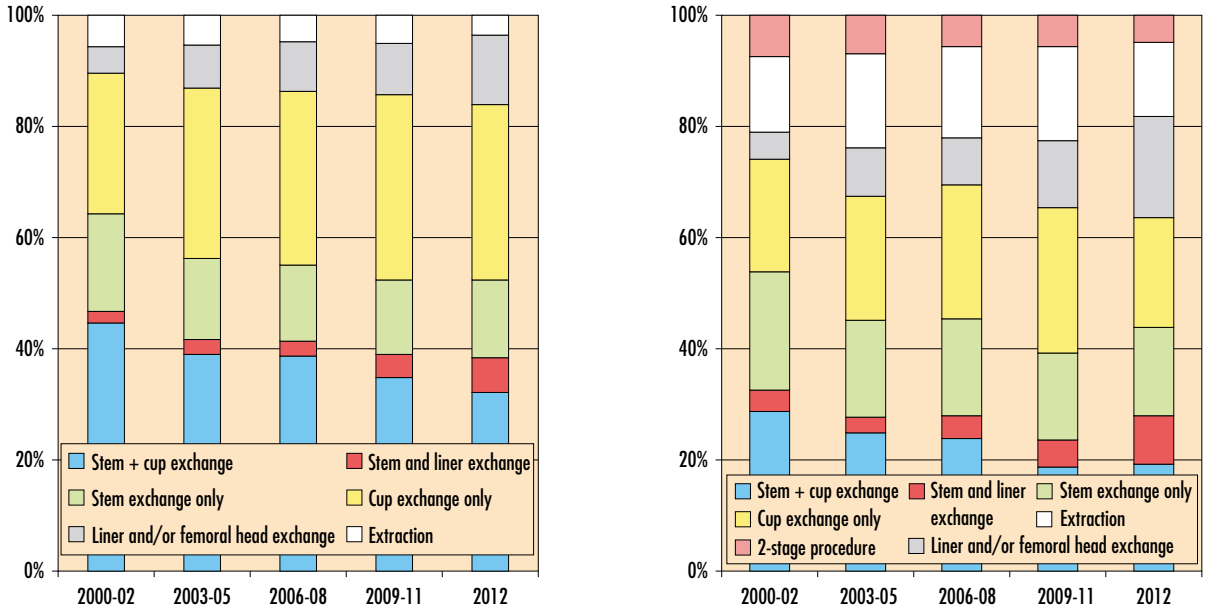


Figure 5. Distribution of causes at primary revision (left) and multiple revision (right).

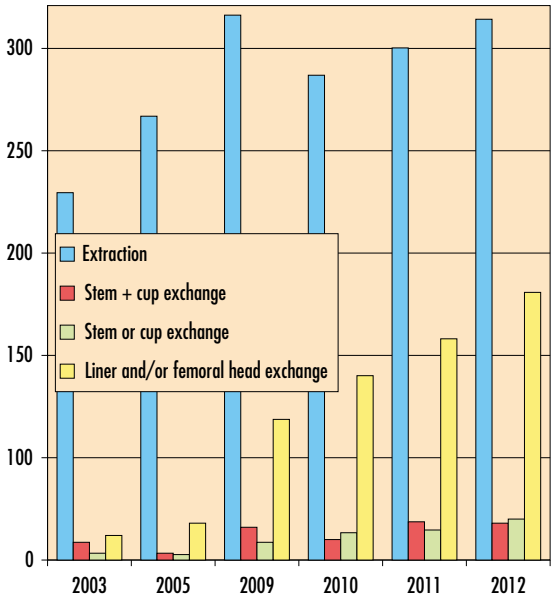
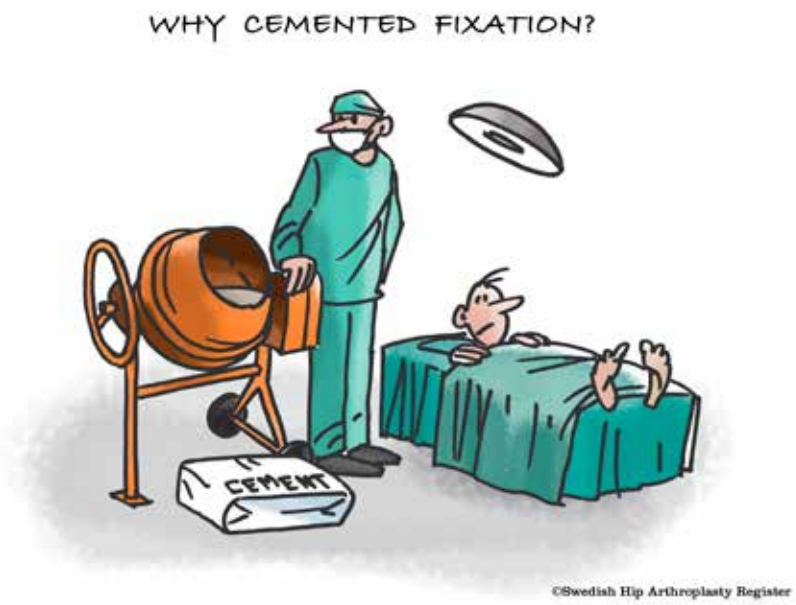


Figure 6. Type of procedures performed in infected cases 2003, 2005, and 2009–2012. Number of procedures are indicated on y-axis.

revisions compared with first revisions. In cup revision the proportion of cemented fixation was as large as the proportion of uncemented, irrespective of the occurrence of earlier revisions (Figure 7).

During the last 10 years the selection of implants for revision has varied. In order to illustrate this we present the five most frequently used cemented and uncemented cups and stems for 2012 as well as for five and ten years ago. The proportion of other implants gives some idea of how diversified prosthesis selection has been, but is also affected by how detailed a classification of implants is used. The selection of cemented cups has been relatively constant (Table 4). During 2012 a dual articular cup (Avantage) has been added. The selection of uncemented cups shows the greatest variation. The trilogy cup that dominated the market in 2003 and 2007 has has been partially replaced, first and foremost with several varieties of acetabular cups or covered by trabecular metal. In the uncemented group of acetabular cups, the proportion of "others" increases markedly between 2007 and 2012, when several new designs with trabecular metal entered the market. We have started an analysis of two of these; TMT revision and TMT modular (see "Deep analysis of cup revisions"). Among the five most common cemented stems, a model arrived in 2007 intended for recementing in older cement mantles, and it became the third most used cemented stem in 2012. One interesting observation is that cemented stems of standard length are used most. It was reported to the Register that bone transplantation of the femur was used in 38% of these cases. In stem revision uncemented implants with two-part stems have dominated. During 2012 more than 80% were of this type.

The proportion of revisions due to dislocation increases for multiple revisions. After initial revision the probability is great that a possible further revision will take place during the first year after the index revision. If the first revision is performed due to loosening, infection or dislocation, then the cause for the next revision is, in most cases, the same. If the first revision is caused by periprosthetic fracture then the probability is greatest that revision will be due to dislocation, which is important to know before making a decision on simultaneous cup revisions in these patients.



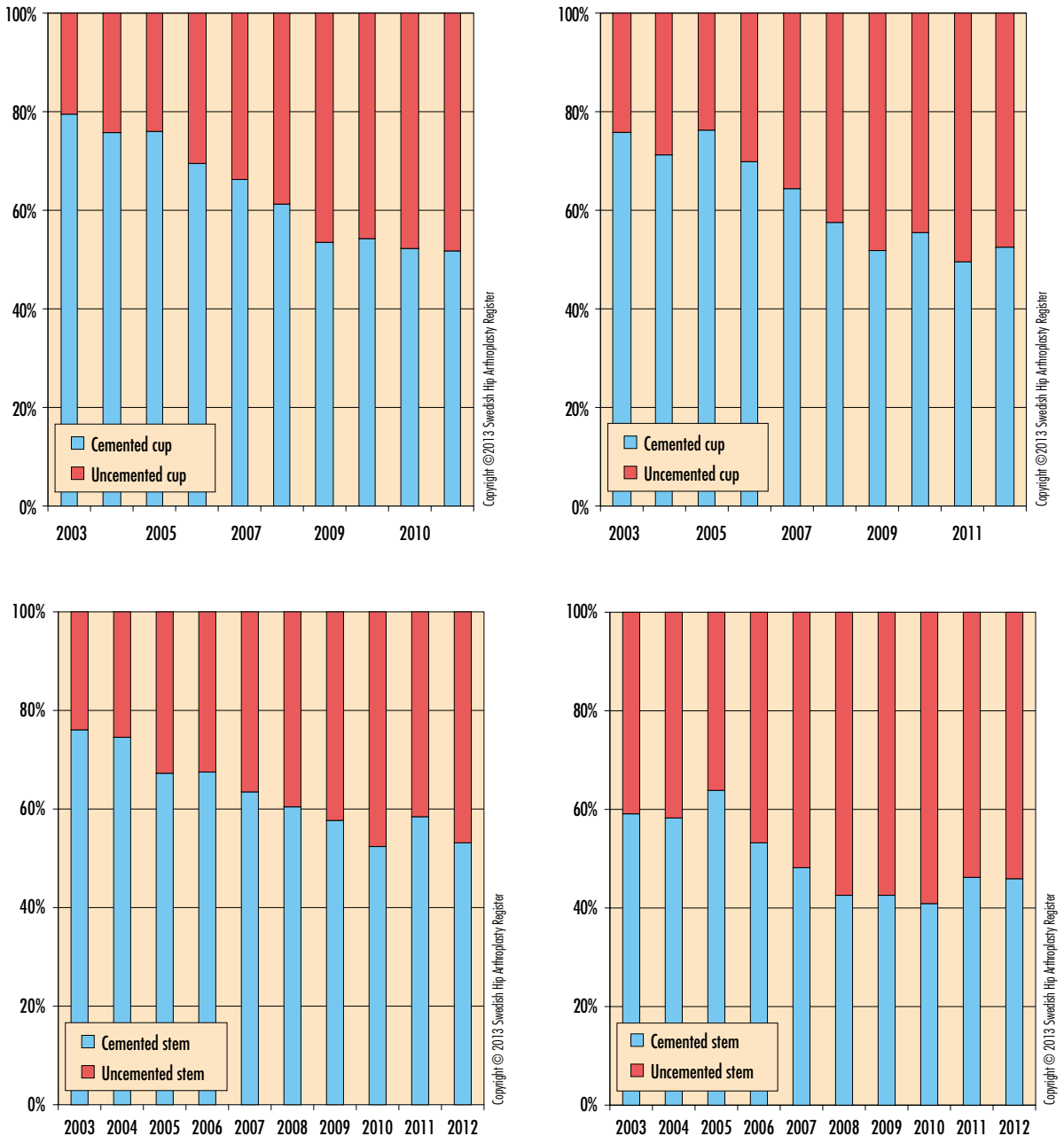


Figure 7. Distribution of cemented and uncemented cup (top figures) and stem (bottom figures). Primary revisons to the left and multiple revisions to the right. During the last years the distribution of cemeted and uncemented fixation has been relatively unchenged irrespective of previous revision or not.

Most common revision implants 2003, 2007, and 2012

2003		2007		2012	
Cup at revision					
Cemented number	903		756		619
Lubinus	25.8	Lubinus	25.3	Exeter Rim-fit	22.3
Elite OGEE	17.3	ZCA	13.5	Avantage	21.0
Exeter	14.4	Exeter	10.8	Lubinus	17.0
FAL	7.5	Elite OGEE	10.4	Marathon	16.3
Charnley OGEE	6.2	CHD*	9.4	ZCA	5.7
Others	*28.2*	Others	*30.6*	Others	*17.7*
Uncemented number	251		397		592
Trilogy±HA	64.9	Trilogy±HA	50.9	TMT revision	23.5
Mallory Head	10.0	TMT revision	12.3	Continuum	20.3
Reflection SP3 HA	5.6	TMT modular	10.8	Trilogy	16.9
TOP pressfit	5.6	Mallory Head	7.8	TMT modular	9.6
Romanus Ringloc	2.8	Trident AD LW	5.5	Mallory head	4.1
Others	*10.1*	Others	*12.7*	Others	*25.6*
Stem at revision					
Cemented number	690		560		513
SP II standard	33.8	SP II standard	32.1	Exeter standard	29.4
Exeter standard	31.2	Exeter standard	26.6	SP II standard	27.6
Exeter long	9.4	CPT	11.4	Exeter short rev- stem	14.3
CPT	8.3	Exeter long	6.8	CPT	11.7
Specton EF long	4.1	Exeter short rev-stem	5.7	Exeter long	6.8
Others	*13.2*	Others	*17.4*	Others	*10.2*
Uncemented number	275		346		490
MP	38.5	MP	37.8	MP	38.9
Wagner SL Revision	25.5	Revitan cylinder	22.4	Restoration	23.9
PFMR	9.1	Wagner SL Revision	13.6	Revitan cylinder	14.0
Revitan cylinder	5.5	Restoration	9.4	Arcos	3.8
Epoch	4.4	CLS/Corail	2.8/2.8	Corail standard/KAR	3.4/3.4
Others	*17.0*	Others	*11.2*	Others	*12.6*

*Contemporary Hooded Duration

Table 4. The five most used cemented and uncemented cups and stems in revision surgery given in i percentage of total number reported revisions during 2003, 2007, and 2012.

Number of revisions per diagnosis and number of previous revisions

primary THR 1979–2012

Diagnosis vid primary THR	0		1		2		>2		Total	Proportion
Primary osteoarthritis	22,251	74.1%	3,755	70.1%	725	65.3%	216	61.4%	26,947	73.2%
Fracture	2,597	8.7%	430	8.0%	79	7.1%	17	4.8%	3,123	8.5%
Inflammatory arthritis	2,267	7.6%	492	9.2%	142	12.8%	49	13.9%	2,950	8.0%
Childhood disease	1,503	5.0%	390	7.3%	92	8.3%	38	10.8%	2,023	5.5%
Femoral head necrosis	738	2.5%	142	2.7%	35	3.2%	11	3.1%	926	2.5%
Posttraumatic osteoarthritis	237	0.8%	74	1.4%	25	2.3%	19	5.4%	355	1.0%
Other secondary osteoarthritis	109	0.4%	21	0.4%	3	0.3%	1	0.3%	134	0.4%
Tumour	65	0.2%	16	0.3%	5	0.5%	1	0.3%	87	0.2%
(missing)	256	0.9%	33	0.6%	4	0.4%	0	0	293	0.8%
Total	30,023	100%	5,353	100%	1,110	100%	352	100%	36,838	100%

Number of revisions per reason and number of previous revisions

primärt opererade 1979–2012

Reason for revision	0		1		2		>2		Total	Proportion
Aseptic loosening	21,358	71.1%	3,107	58.0%	540	48.6%	128	36.4%	25133	68.2%
Dislocation	2,680	8.9%	821	15.3%	217	19.5%	102	29.0%	3820	10.4%
Deep infection	2,505	8.3%	724	13.5%	201	18.1%	87	24.7%	3517	9.5%
Fracture	2,117	7.1%	438	8.2%	95	8.6%	16	4.5%	2666	7.2%
Technical error	682	2.3%	123	2.3%	26	2.3%	10	2.8%	841	2.3%
Implant fracture	439	1.5%	93	1.7%	21	1.9%	7	2.0%	560	1.5%
Pain only	121	0.4%	26	0.5%	6	0.5%	1	0.3%	154	0.4%
Miscellaneous	121	0.4%	19	0.4%	4	0.4%	1	0.3%	145	0.4%
Secondary infection	0	0%	2	0%	0	0%	0	0%	2	0%
Total	30,023	100%	5,353	100%	1,110	100%	352	100%	36,838	100%

Number of revisions per revision year and number of previous revisions

primary THR 1979–2012

Year of revision	0		1		2		>2		Total	Proportion
1979–2007	23,091	76.9%	3,857	72.1%	738	66.5%	221	62.8%	27,907	75.8%
2008	1,300	4.3%	260	4.9%	79	7.1%	26	7.4%	1,665	4.5%
2009	1,441	4.8%	303	5.7%	80	7.2%	21	6.0%	1,845	5.0%
2010	1,409	4.7%	312	5.8%	82	7.4%	31	8.8%	1,834	5.0%
2011	1,363	4.5%	307	5.7%	64	5.8%	28	8.0%	1,762	4.8%
2012	1,419	4.7%	314	5.9%	67	6.0%	25	7.1%	1,825	5.0%
Total	30,023	100%	5,353	100%	1,110	100%	352	100%	36,838	100%

Number of revisions per reason and revision year

first revision only, primary THR 1979–2012

Reason for revision	1979–2007	2008	2009	2010	2011	2012	Total	Proportion
Aseptic loosening	17,149	815	919	877	794	804	21,358	71.1%
Dislocation	1,840	191	170	162	153	164	2,680	8.9%
Deep infection	1,712	113	143	152	191	194	2,505	8.3%
Fracture	1,418	126	133	147	141	152	2,117	7.1%
Technical error	489	29	36	37	47	44	682	2.3%
Implant fracture	339	16	25	17	23	19	439	1.5%
Pain only	80	8	8	6	5	14	121	0.4%
Miscellaneous	64	2	7	11	9	28	121	0.4%
Total	23,091	1,300	1,441	1409	1,363	1,419	30,023	100%

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

first revision only, primary THR 1979–2012

Fixationstyp vid primary THR	1979–2007	2008	2009	2010	2011	2012	Total	Proportion
Cemented	19,034	972	1,064	1,050	976	990	24,086	80.2%
Uncemented	2,069	140	153	146	160	172	2,840	9.5%
Hybrid	1,180	101	144	111	108	107	1,751	5.8%
Reversed hybrid	204	58	52	75	88	90	567	1.9%
Resurfacing implants	36	16	16	15	14	24	121	0.4%
(missing)	568	13	12	12	17	36	658	2.2%
Total	23,091	1,300	1,441	1,409	1,363	1,419	30,023	100%

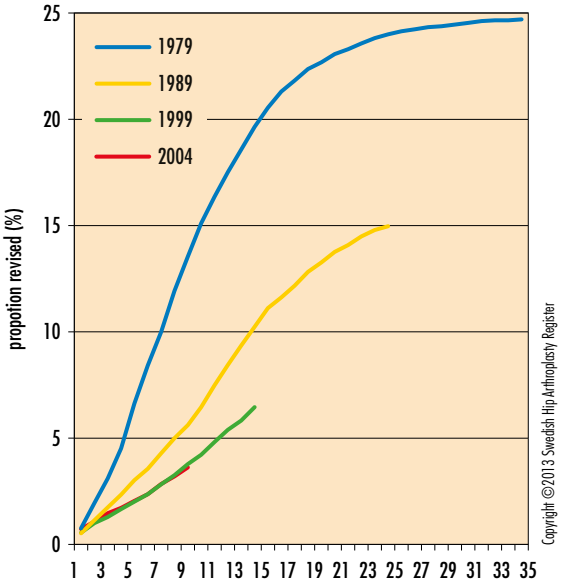
Number of revisions per reason and time to revision

first revision only, primary THR 1979–2012

Orsak till revision	0–3 year		4–6 year		7–10 year		>10 year		Total	Proportion
Aseptic loosening	3,047	38.0%	3,979	78.7%	5,864	84.5%	8,468	84.7%	21,358	71.1%
Dislocation	1,619	20.2%	334	6.6%	299	4.3%	428	4.3%	2,680	8.9%
Deep infection	1,905	23.7%	259	5.1%	180	2.6%	161	1.6%	2,505	8.3%
Fracture	607	7.6%	303	6.0%	443	6.4%	764	7.6%	2,117	7.1%
Technical error	618	7.7%	27	0.5%	21	0.3%	16	0.2%	682	2.3%
Implant fracture	69	0.9%	110	2.2%	123	1.8%	137	1.4%	439	1.5%
Pain only	91	1.1%	16	0.3%	4	0.1%	10	0.1%	121	0.4%
Miscellaneous	71	0.9%	27	0.5%	8	0.1%	15	0.2%	121	0.4%
Total	8,027	100%	5,055	100%	6,942	100%	9,999	100%	30,023	100%

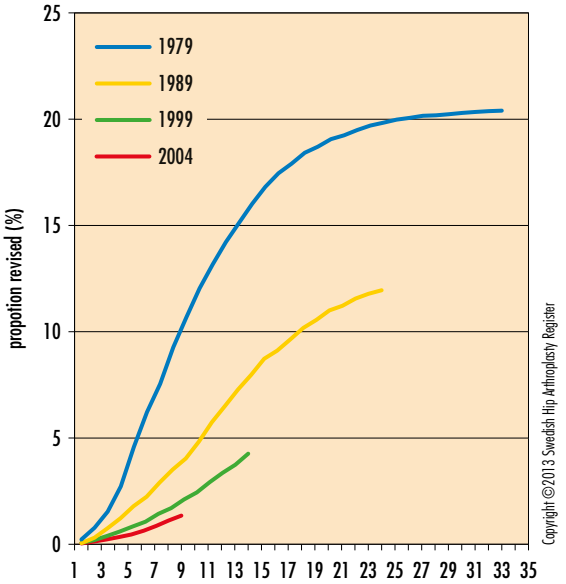
All diagnoses and reasons

cumulative revision frequency



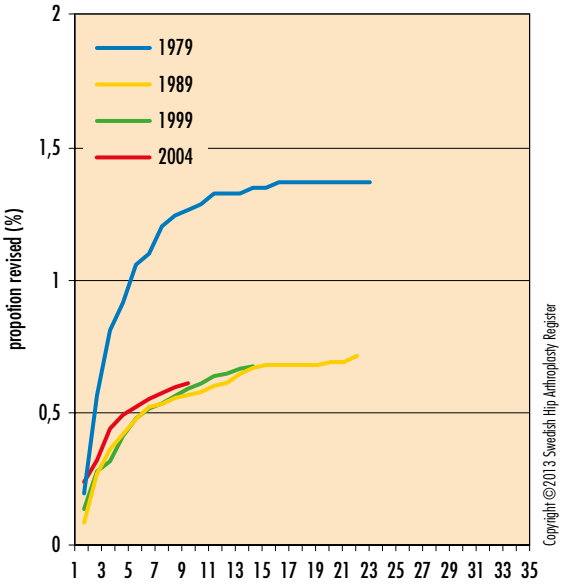
Aseptic loosening

cumulative revision frequency



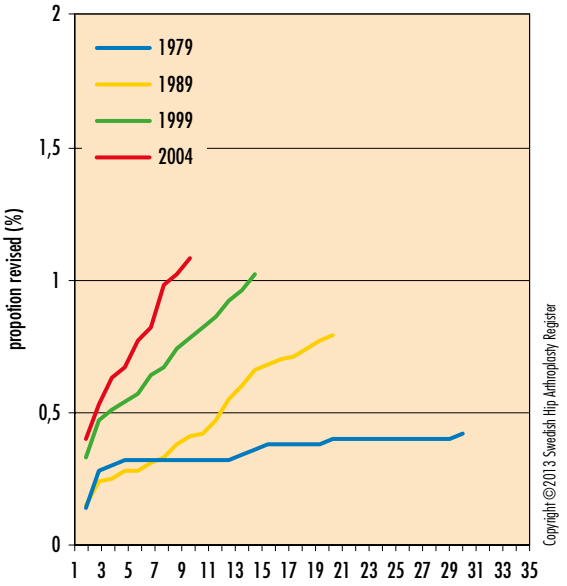
Deep infection

cumulativ revision frequency



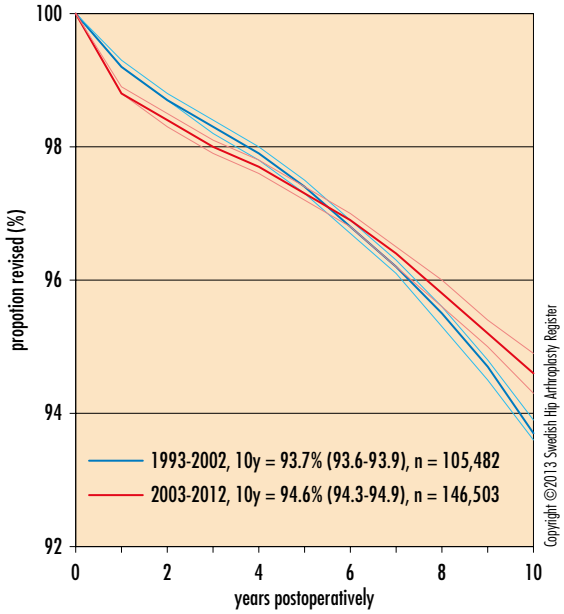
Dislocation

cumulative revision frequency



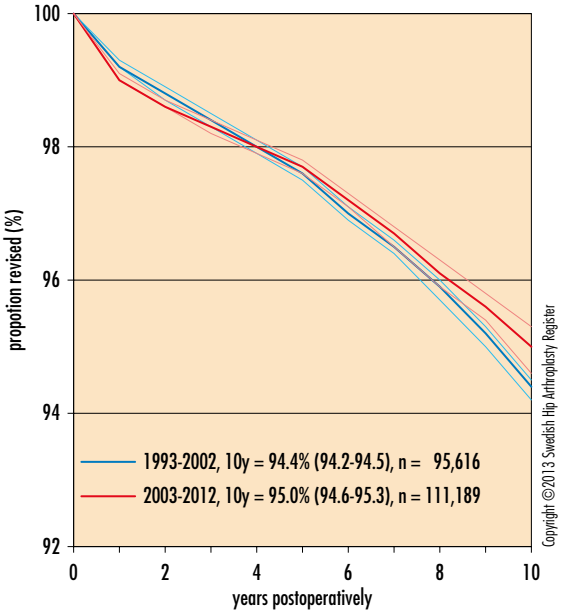
All implants

All diagnoses and all reasons



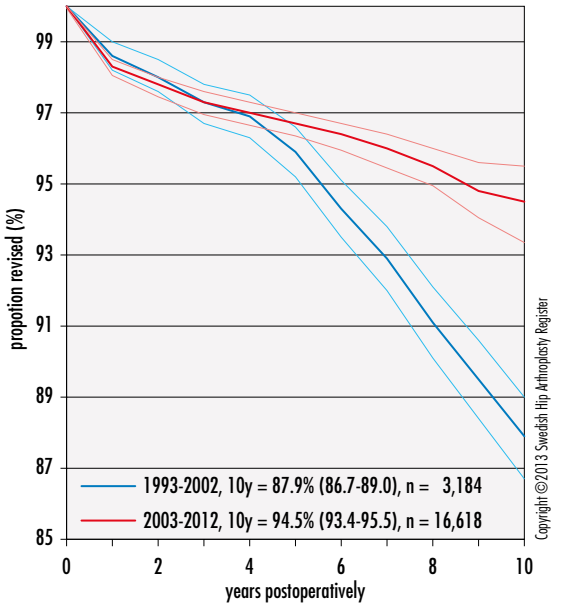
All cemented implants

All diagnoses and all reasons



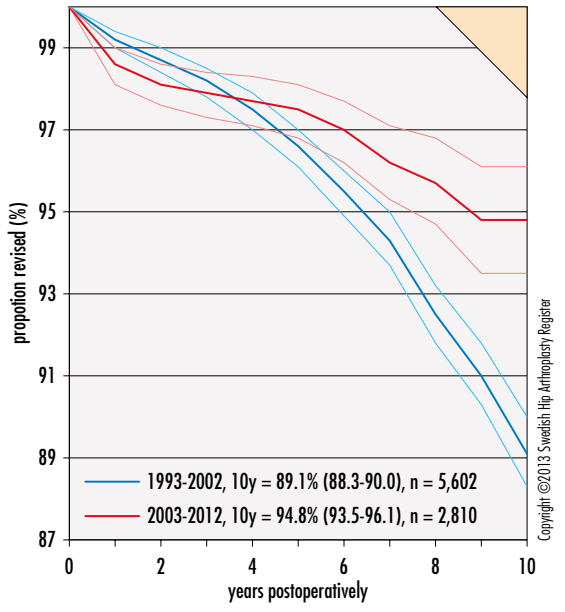
All uncemented implants

All diagnoses and all reasons



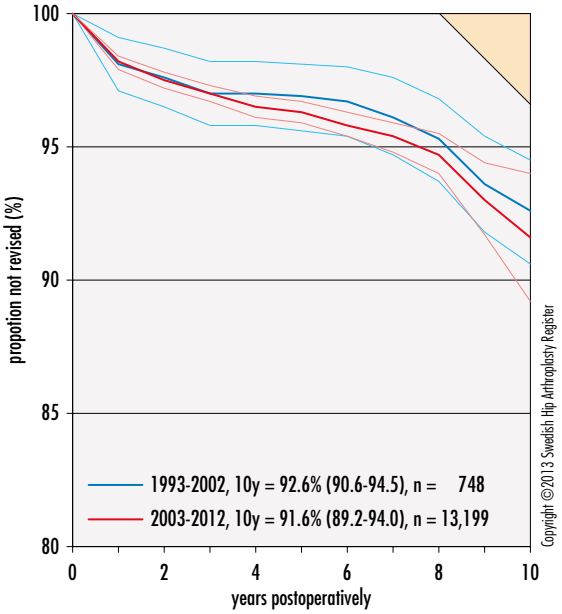
All hybrid implants

All diagnoses and all reasons



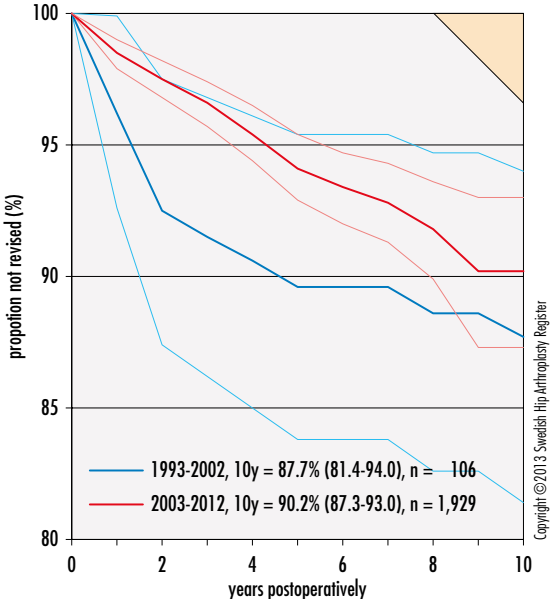
All reversed hybrids implants

All diagnoses and all reasons



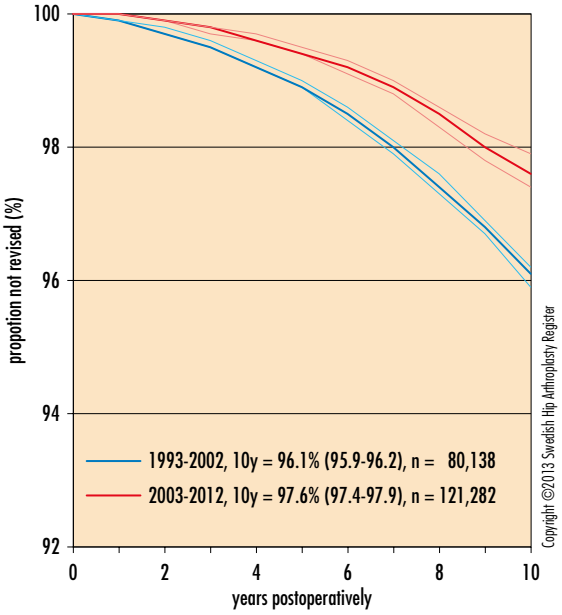
All resurfacing implants

All diagnoses and all reasons



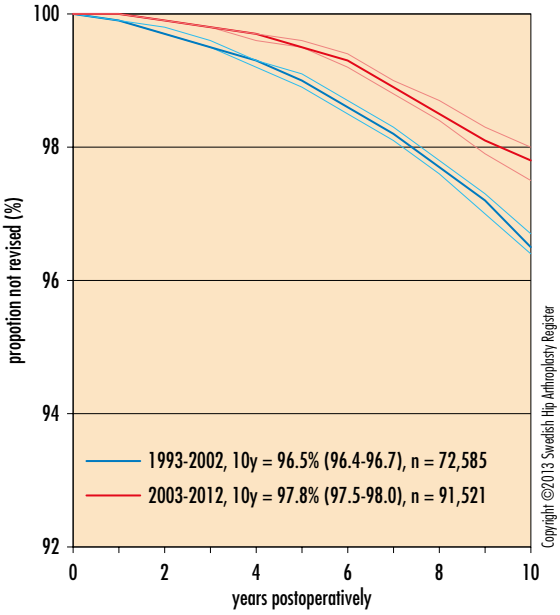
All implants

Primary osteoarthritis and aseptic loosening



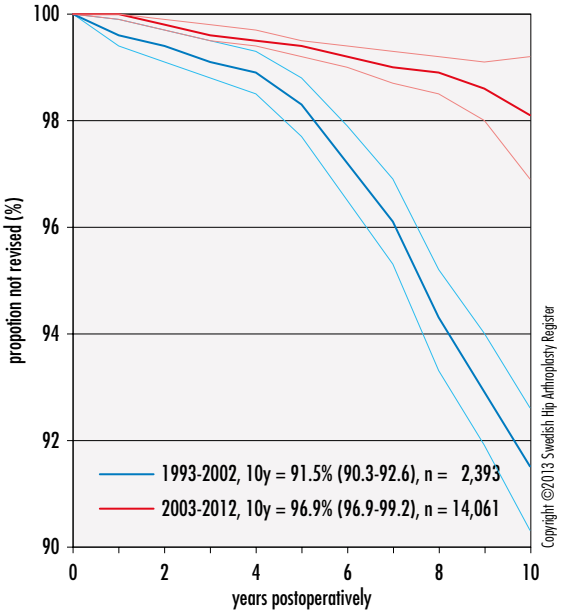
All cemented implants

Primary osteoarthritis and aseptic loosening



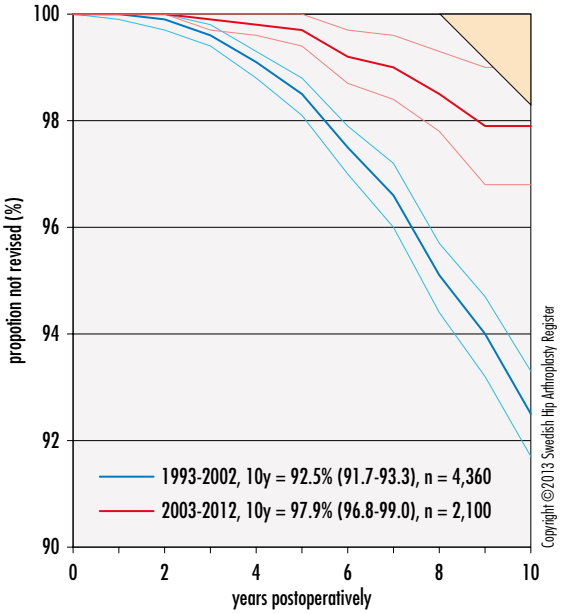
All uncemented implants

Primary osteoarthritis and aseptic loosening



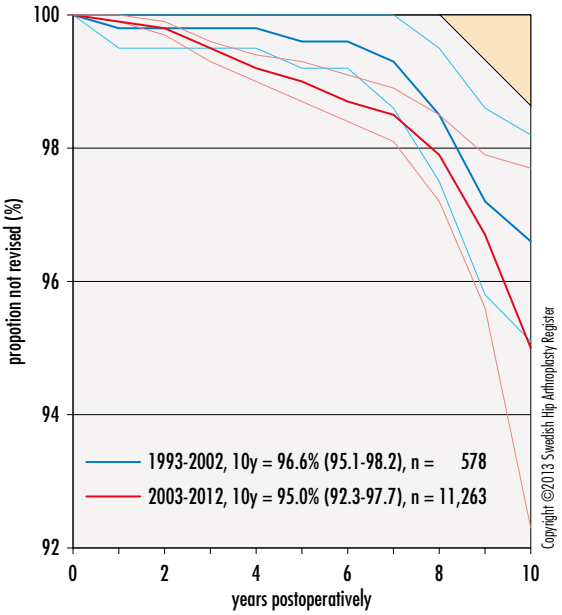
Alla hybrid implants

Primary osteoarthritis and aseptic loosening



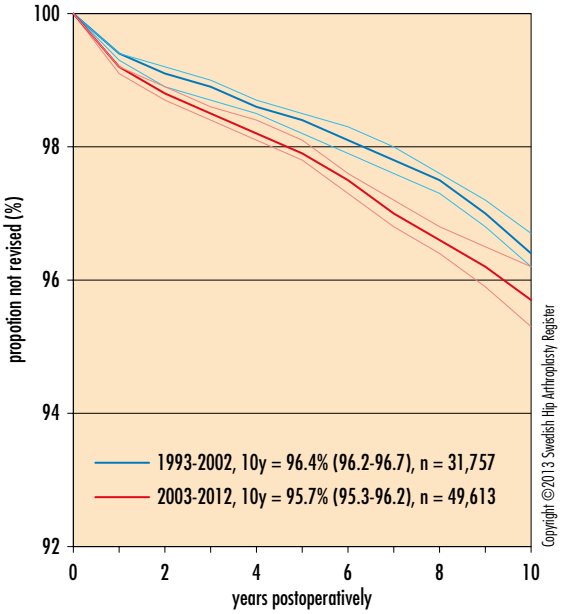
All reverse hybrid implants

Primary osteoarthritis and aseptic loosening



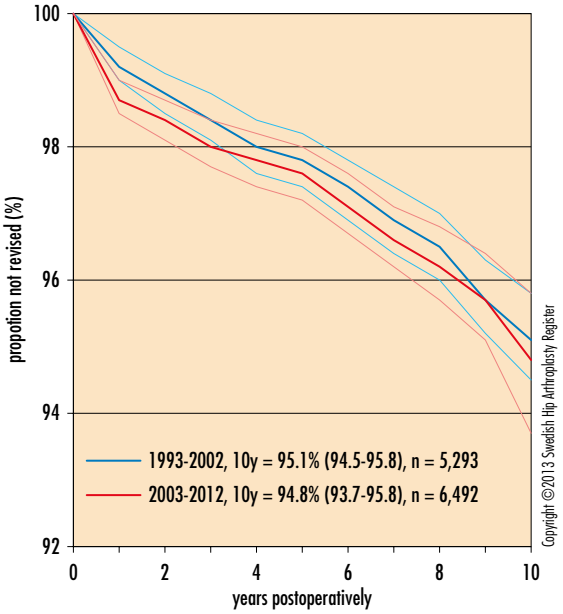
Lubinus SP II

All diagnoses and all reasons



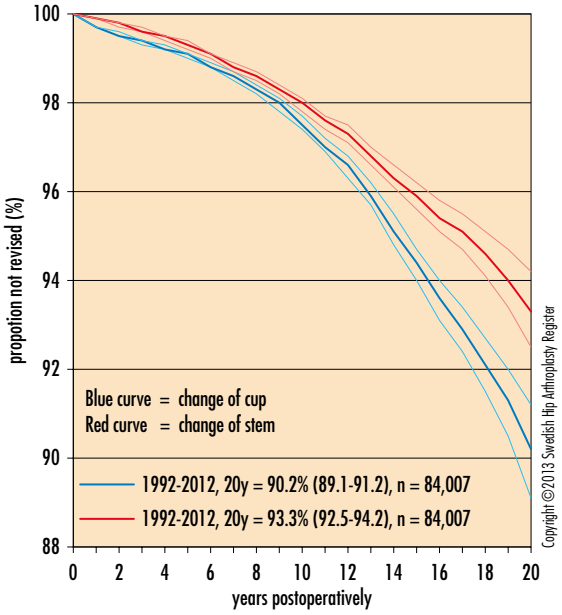
Exeter Duration (Exeter Polished)

All diagnoses and all reasons



Lubinus SP II

cup-/stem revision - all diagnoses and all reasons



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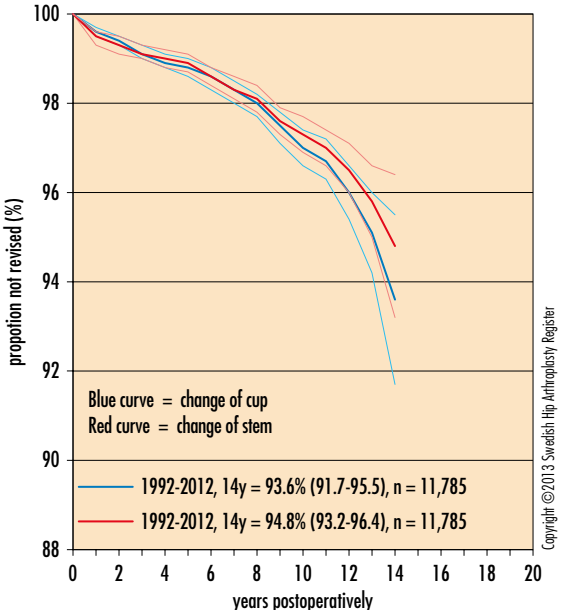
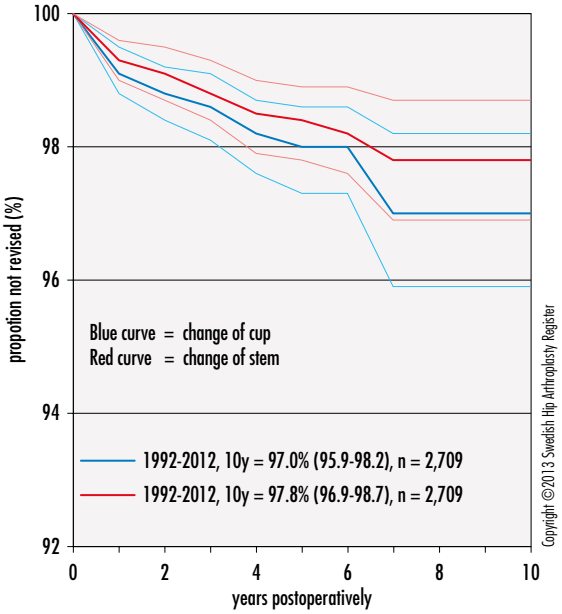
cup-/stemrevision - all diagnoses and all reasons



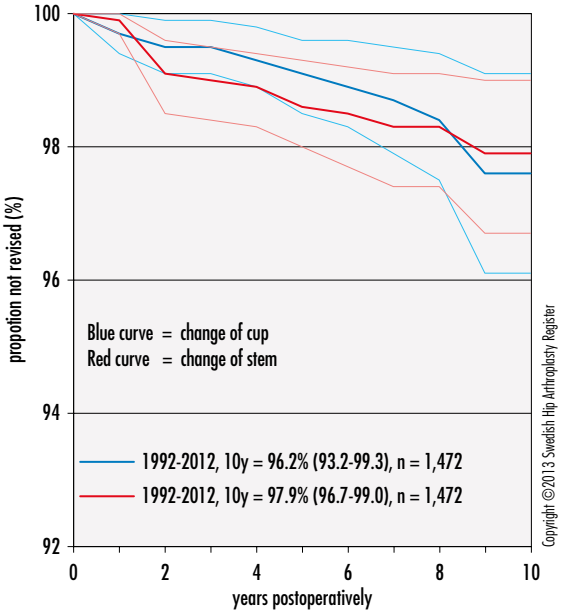
Trilogy HA (CLS Spotorno)

cup-/stem revision - all diagnoses and all reasons



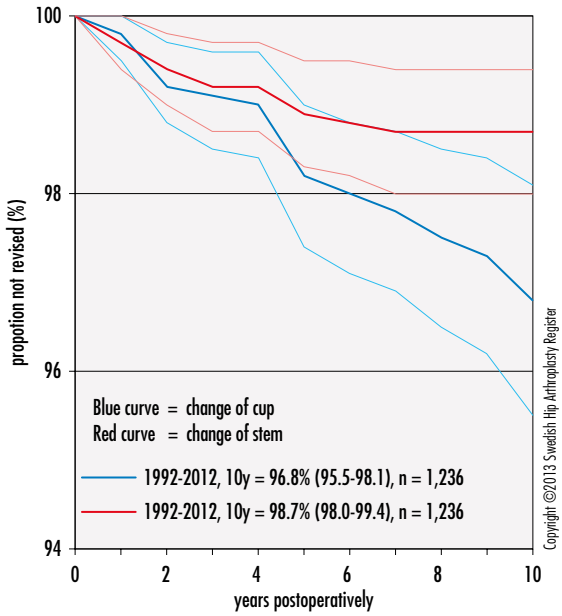
Allofit (CLS Spotorno)

cup-/stemrevision - all diagnoses and all orsaker



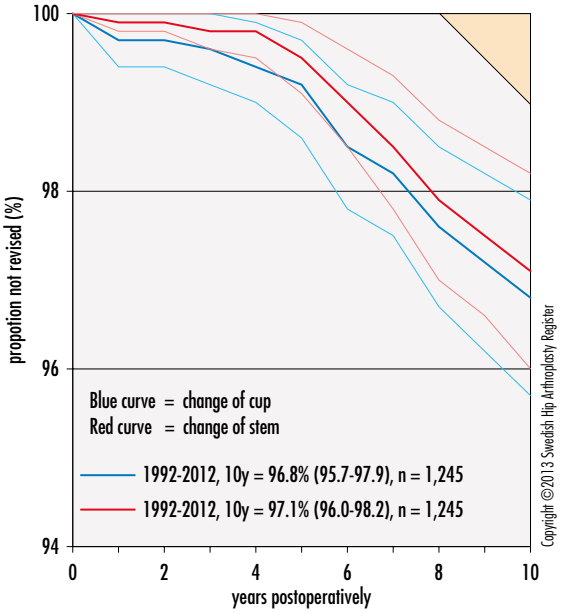
CLS Spotorno

cup-/stemrevision - all diagnoses and all reasons



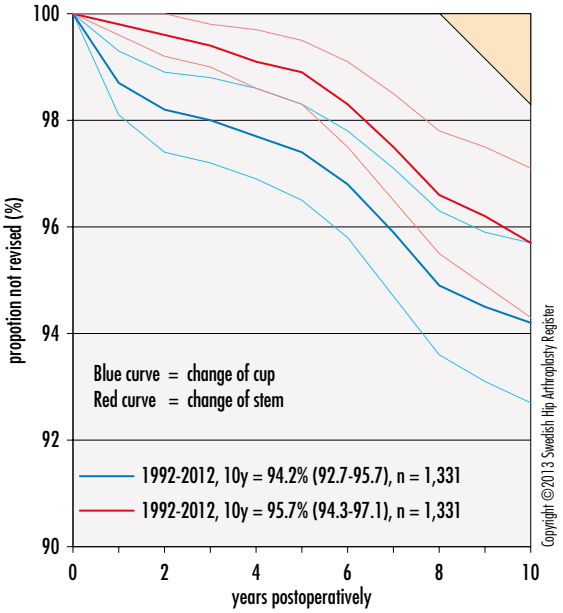
Trilogy HA (Spectron EF Primary)

cup-/stemrevision - all diagnoses and all reasons



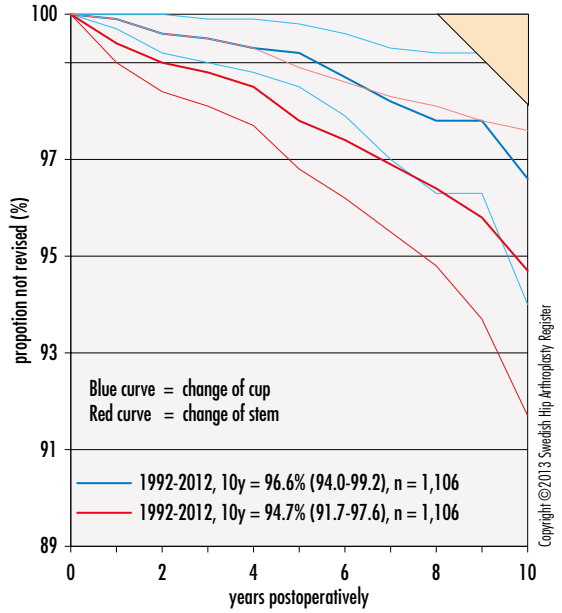
Trilogy HA (Lubinus SP II)

cup-/stemrevision - all diagnoses and all reasons



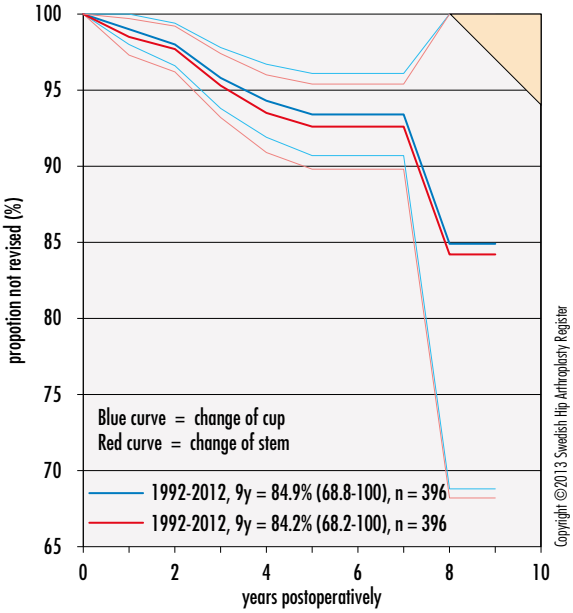
BHR

cup-/stemrevision - all diagnoses and all reasons



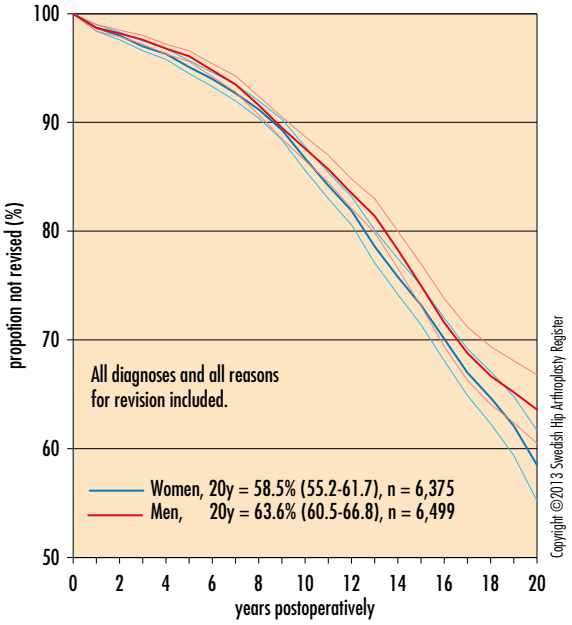
ASR

cup-/stemrevision - all diagnoses and all reasons



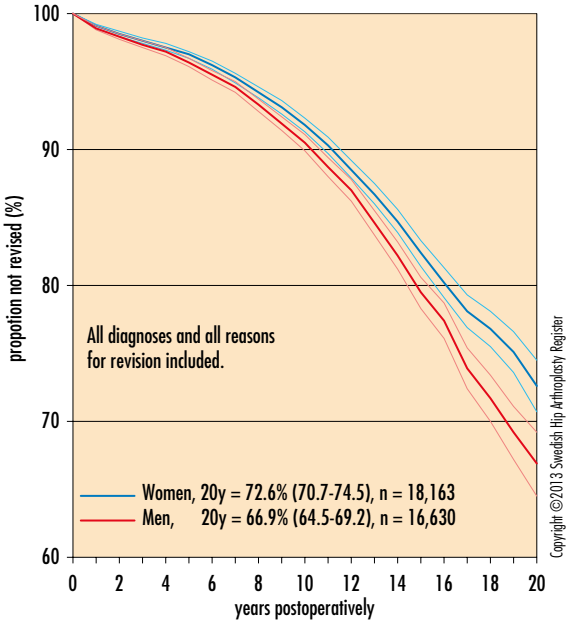
Younger than 50 years

all observations, 1992–2012



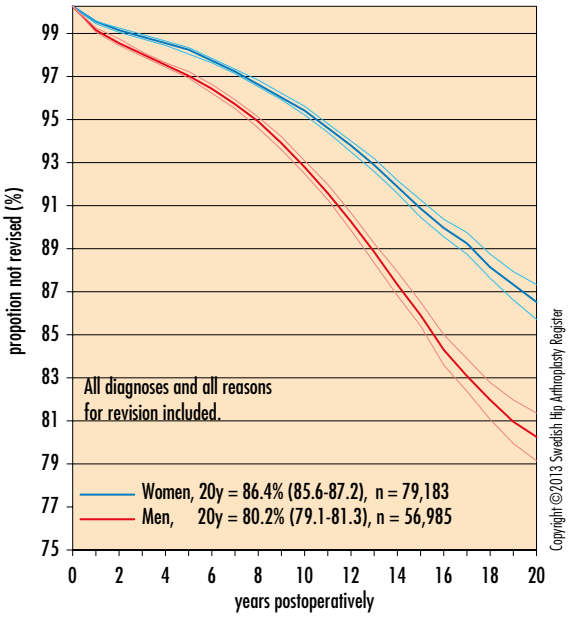
Between 50 and 59 years

all observations, 1992–2012



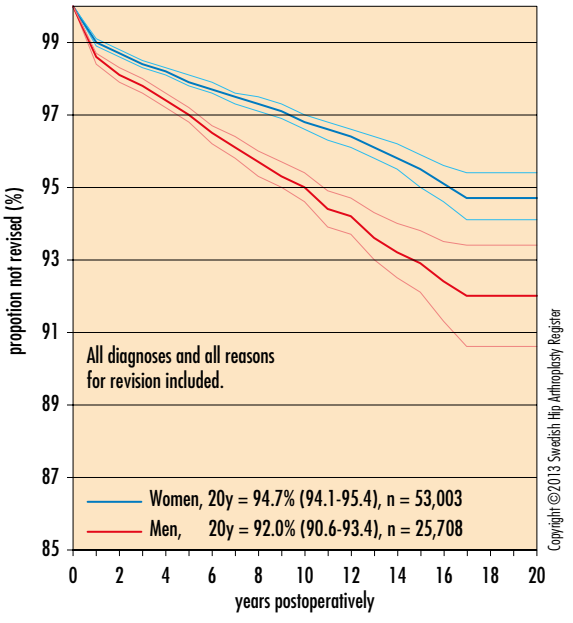
Between 60 and 75 years

all observations, 1992–2012



Older than 75 years

all observations, 1992–2012



In-depth analysis – revision

Cemented compared with uncemented cup for primary revision 1979–2010

Internationally, uncemented cups are used more and more frequently for revisions, and also in connection with more serious bone defects. The trend has been the same in Sweden. During 2012 uncemented cups were used in almost half of all initial revisions. There are, however, no studies comparing long-term survival for cemented and uncemented fixation in cup revision. In an ongoing doctoral research project by Maziar Mohaddes we therefore analysed the risk of re-revision after initial revisions in the Swedish Hip Arthroplasty Register's revision database. During 1979–2010, 19,342 initial cup revisions were performed in Sweden. In 928 cases only liner replacements were carried out. Two-stage revisions, operations with resurfacing and tumour prostheses as well as revisions with incomplete data were excluded. Among the remaining 18,593, 54% were women. The average age at index revision was 69 (17–101). The time from primary prosthesis to initial revision was 9.7 years (0–31). In 38% of the cases only the cup had been revised, and in 62% stem revision had also been performed. The most common cause of cup revision was aseptic loosening (80%), followed by dislocation (8%) and deep infection (4%). 38% of the patients were opererated using direct lateral and 49% posterior approaches (for the others, information was lacking). Cemented fixation had been used in the majority of operations (73%).

Apart from the comparison between cemented and uncemented fixation, a comparison was also made concerning the risk for re-revision, between revision av uncemented to uncemented cup and revision where only the liner was replaced. Cox regression analysis, adjusted for age, gender, primary diagnosis, fixation method at primary operation and simultaneous stem revision, showed no differences in risk for re-revision between the cemented and uncemented groups (RR: 0.9; 95% K.I. *0.9–1.3*). We found that aseptic loosening was a more common cause for revision of cemented revision cups (RR: 1.1, *1.0–1.2*) but that these cups were re-revised less often due to dislocation (RR=0.5, *0.4–0.6*). We also found that isolated cup revision compared with simultaneous cup and stem revision involved an almost doubled risk of re-revision (RR: 1.9, *1.7–2.1*).

Comparison between uncemented to uncemented cup revision and liner revision alone showed that the latter intervention involved, in relative terms, an increased risk for re-revision (1.7, *1.3–2.1*), especially due to dislocation (2.9, *1.7–5.0,* Figure 1). In a separate analysis the significance of type of approach was investigated. We found no differences in the risk for re-revision between the direct lateral and the posterior approach (1.0, *0.9–1.1*). Re-revision due to dislocation was equally common in both groups (0.9, *0.7–1.2*).

Our analysis of initial revisions, the most extensive thus far, includes operations over a long period of time. This implies that several older types of acetabular cups are included that are no longer used, most often due to inferior clinical results. Furthermore, the Register data is uncertain concerning the incidence of possible bone transplantation, which is why this factor could not be investigated. Despite this, results are interesting since they reflect the actual outcome of several decades of revision surgery in Sweden. (Mohaddes M, Garellick G, Kärrholm J. Fixation method does not influence the overall risk of re-revision in primary cup revisions. Clin Orthop Relat Res 2013).

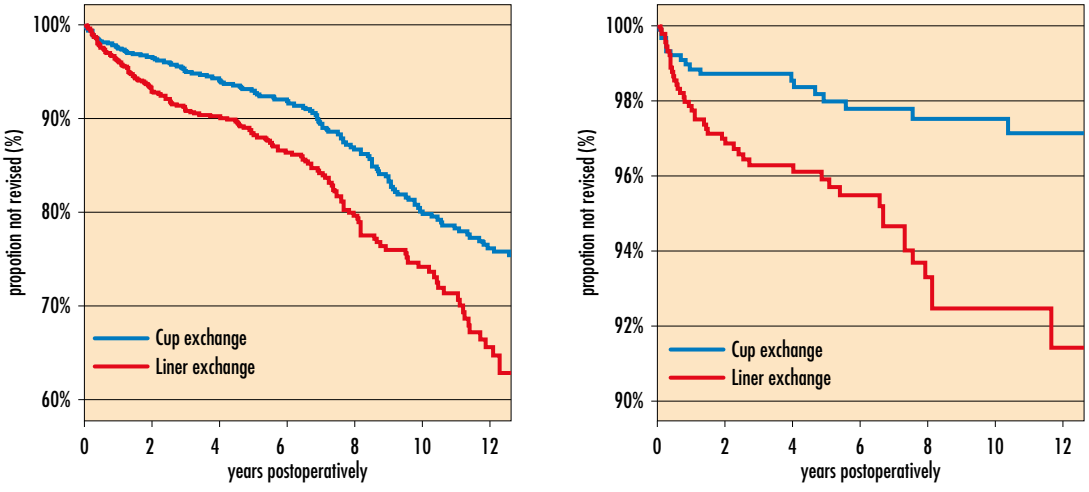


Figure 1. Implant survival measured as cup revision regardless of reason (left) and due to dislocation (right) when exchange of uncemented cup to uncemented cup compared to liner revision.

Implant survival within ten years

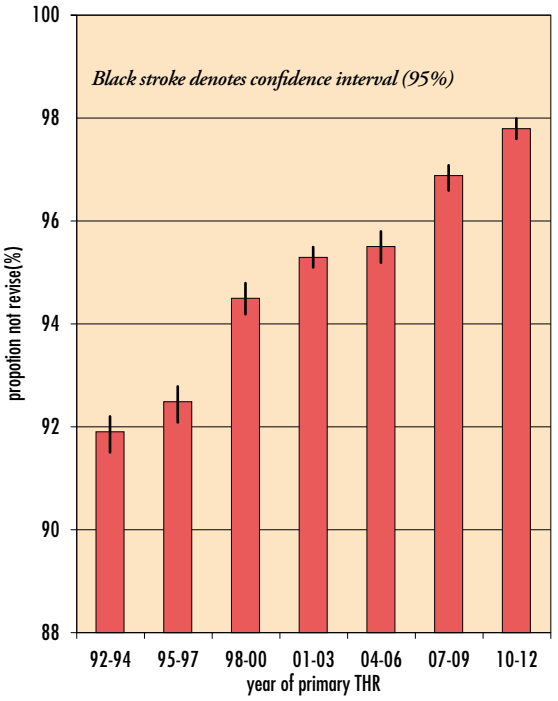
Implant survival within ten years is based on total hip replacements performed during the past ten years. This means that the observation period attains a nine- to ten-year interval only for patients operated in the first year of observation, that is, patients operated 2003 or later. Since more and more total hip replacements were performed during 2003–2012 the average observation period is shorter than five years (4.3 years, median = 4.0). Despite the relatively short observation period, aseptic loosening including osteolysis is the most common cause of revision (28% of all revisions within the interval) followed by dislocation (26%), infection (22%) and periprosthetic fracture (13%).

This variable is of great value especially for those clinics with a relatively intact organisation without extensive changes in the operation process including selection of standard prosthesis during the past ten years. The outcomes dislocation and infection reflect both the process surrounding primary total hip replacement and the clinic's case-mix. Revision due to periprosthetic fracture has doubled compared with the previous ten-year period (1993–2002) from 6.8 to 12.9%. This may depend upon an increased use of uncemented stems, which have a greater risk for periprosthetic fracture in the postoperative phase. The frequency of revision due to loosening provides relatively good information about how prosthesis selection and surgical technology/technique influence outcome. For clinics that have undergone organizational transformations during the past ten years or that have changed their standard prosthesis, implant survival within ten years becomes more difficult to interpret since it reflects to a lesser extent the current organisation and current prosthesis selection.

In this year's analysis, five clinics (Sahlgrenska Universitet hospital, Mölndal; Karolinska Hospital; Södertälje Hospital; Skåne's University Hospital, Lund, Södertälje Hospital and OrthoCenter Stockholm) display a higher revision frequency than expected. The distribution of causes for revision varies, however, between units. Mölndal and Lund display a distribution of causes that is more or less equivalent to the national average according to the above. There is an overrepresentation of patients with secondary osteoarthritis (36–74% as opposed to the national average of 17%) at all three university hospitals. Other risk factors, such as high ASA designation and high or low BMI, have not been registered for the entire period and thus cannot be correctly assessed. All three hospitals have used prosthetic systems with expected inferior outcomes (Spectron EF Primary, Durom, ASR), which may have influenced results. Nonetheless, this data should give rise to an in-depth study of the outcome and its possible causes (see Annual Report 2010, published in 2011).

The two other hospitals have a lower proportion of patients with secondary osteoarthritis, which is to say a lower proportion of high-risk patients compared with the national average (proportion secondary osteoarthritis: 15 and 3.2%, respectively). Both hospitals have a greater proportion of revision due to loosening (76 and 42%, respectively) with a distinct overrepresentation of revision of Spectron EF Primary. One of the hospitals carried out a follow-up of work activities (see Annual Report 2010) that resulted in replacing the prosthesis system, among other things. Clinics with high frequency of revisions, even if not differing significantly from the national average, should also take the opportunity of carrying out an operative analysis. The first step is to select data published here and thereafter decide whether further improvement measures are motivated.

Implant survival in different time periods

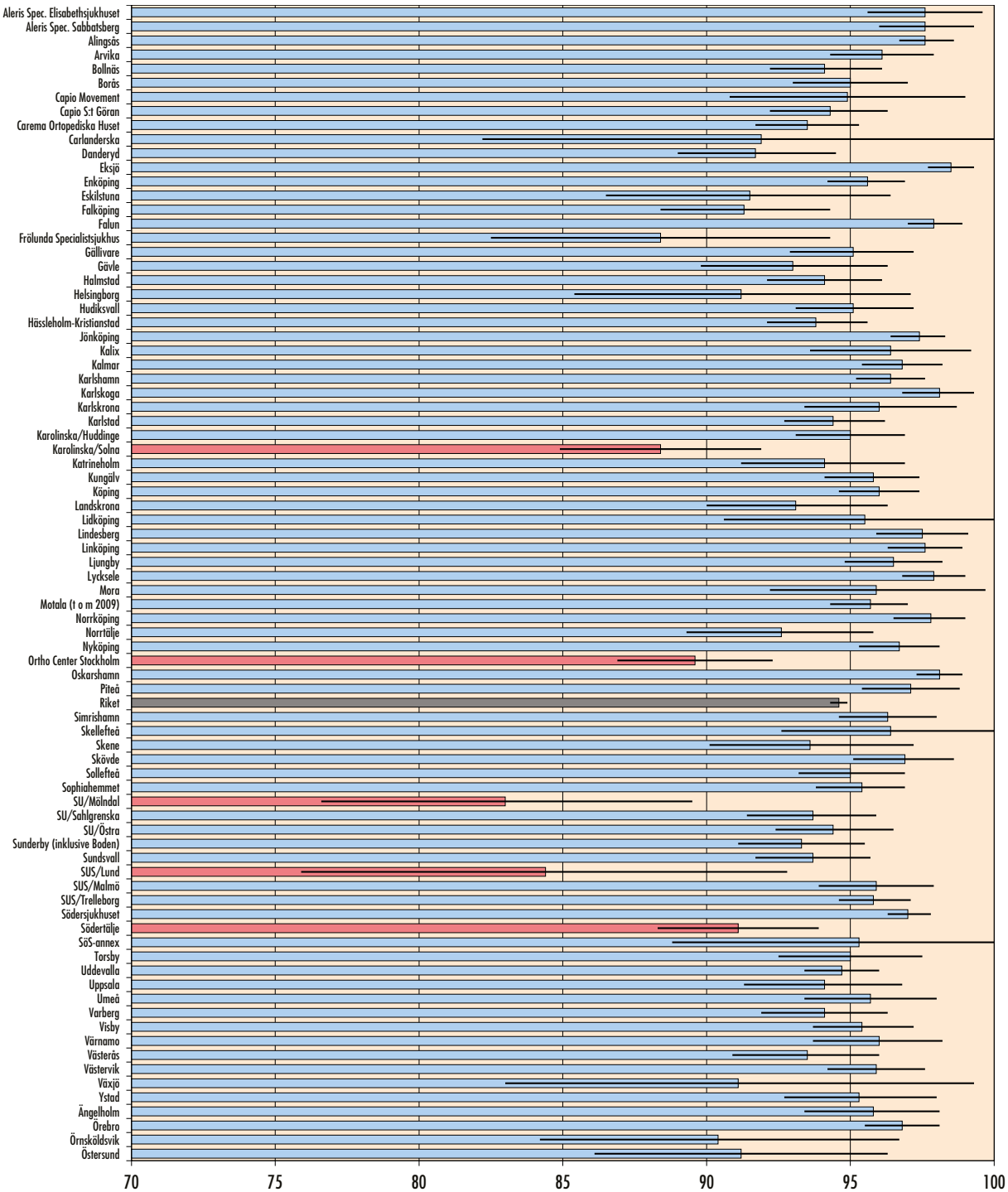


Period		Implant survival	± %
1992–1994	10	91.9%	0.4%
1995–1997	10	92.5%	0.4%
1998–2000	10	94.5%	0.3%
2001–2003	10	95.3%	0.2%
2004–2006	9	95.5%	0.3%
2007–2009	6	96.9%	0.3%
2010–2012	3	97.8%	0.2%

Average implant survival after 10 years for all active clinics in the respective time period. Each period encompasses all primary total hip arthroplasties performed during the three-year period. All revisions of these primary operations are included. Tables show the values behind the bar graph on the left. The three last time periods have varying follow up time of 9, 6, and 3 years respectively. The values are included in order to show the trend during the last three year period.

Implant survival after 10 years

each bar represents a hospital, primary THR 2003–2012



Implant survival after 10 years divided by clinic. Grey bar indicates the national average. Red bars are clinics with an upper confidence interval under the nation's lower confidence interval, that is, clinics with 95% certainty have poorer implant survival after 10 years than the national average. Primary operation was performed during the last 10-year period.

Note that implant survival at Ortho Center Stockholm is negatively affected by incorrect registration of operations that have been performed by orthopaedic surgeons from Södersjukhuset and Karolinska/Solna. Those primary THRs have not been registered at the correct hospital (Ortho Center Stockholm). The Registry direction has tried to correct this but has not been provided a list of operations with incorrect registration of hospital for the primary THR.

Notes

Patient-reported outcomes – the PROMs Programme

Interest for patient-reported outcomes continues to grow. Decision-makers, representatives of the profession, clinically active physicians, researchers, patients and patient organizations enquire about PROMs (Patient-Reported Outcome Measures). These outcome measures are highly relevant for arthroplasty – pain, deterioration in health-related life quality of life and affected joint function, adding up to indications for intervention, and can therefore be postulated as primary outcome variables. The well-established structure that exists for reporting to the Swedish Hip Arthroplasty Register has made it possible for the Register to be able to introduce a unique nationwide follow-up programme for patient-reported outcomes. The Programme was launched under the name *Höftdispensären* (The Hip Dispensary) but we have now come to calling it the *PROM Programme.* Since 2010 all clinics report patient-reported variables where the response frequency is 85% preoperatively, and almost 90% at the one-year follow-up.

The PROM Programme's logistics

Prior to surgery all patients are requested to respond voluntarily to a form containing twelve questions. The survey includes questions about comorbidity and walking capacity in order to decide musculoskeletal comorbidity according to the Charnley classification, a Visual Analogue Scale (VAS) for pain estimation and the EQ-5D instrument that measures health-related quality of life. The EQ-5D consists of two parts. The first of five general questions each with three alternatives providing a health profile that can be translated into an index. The other part consists of a thermometer, the EQ VAS, where the patient marks her/his current health status on a 100-degree scale. Since 2012, a question has been included asking whether or not the patient has participated in an osteoarthritis school preoperatively, and this year a question was included about smoking. The same PROM form with a complementary estimation of satisfaction according to VAS is sent to patients after one, six and ten years.

The Register's coordinators send out a list every month to all clinics for the patients who are to be followed up. Thereafter the follow-up routine is managed by local administrators who send out the forms, enter survey responses to the PROM database and send out reminders about missing responses within about two months.

The objectives of the PROMs Programme

The PROMs Programme's three overall objectives are:

- to complement the traditional outcome variables with PROMs in order to make a multidimensional analysis of total hip replacement possible
- to create an opportunity for clinics to analyze their activities and improvements with the patient's needs and reported outcomes as their point of departure
- to create a methodologically adequate health economic instrument for cost effectivity analyses and resource allocation

Weaknesses in previous PROM auditings

The Annual Report has previously shown the average values for each measurement, that is to say preoperatively, at a one-year follow-up and for some clinics at six years. Criticism may, with every right, be directed against reporting average values for all those responding, since dropouts appear different at the different measurement sessions. The unadjusted values in this year's report include only registrations that have preoperative values where individual differences at one and six years, respectively, have been calculated.

Patient demography partly decisive for results

Since patient demography varies between clinics, the PROM results have been difficult to interpret and compare. Certain clinics perform surgery on a relatively large proportion of healthy patients who have only been partly affected, and where pain has been manageable, perhaps as a result of thorough care during the course of the joint disease. For such patients, the difference between the pre- and postoperative measurements is generally not that great. The patients are, however, often completely pain-free, and their health-related quality life is completely restored as measured with the instruments used by us. For a clinic that has a large proportion of such patients, the average improvement may be lower than the national average, and there is a danger that this is interpreted as a problem relating to quality. The instrument's makeup with a distinct ceiling effect must be taken in consideration. Other clinics have a greater proportion of patients with Charnley Class C or patients with complications to earlier hip fractures and patients with avascular necrosis. One would then expect these clinics to have a worse average outcome at follow-ups, but since the space for improvement is great, the average improvement with respect to pain and health-related quality of life may be as great as or even greater than the national average. There may be faults or weaknesses in health-care quality concealed here. The objective for care of patients with hip illness should be to minimize pain and effects on health-related quality of life before as well as after a possible arthroplasty.

This year's account contains both adjusted and unadjusted PROM values

New for this year is that we present the extent of each clinic's deviation from the expected values with respect to each of the four PROM variables: EQ-5D index, EQ VAS, pain and satisfaction. At a clinical level the expected average values for the PROM variables at the one-year follow-up have been estimated by adjusting for age, gender, Charnley class and diagnosis. The estimate is based on regression models that include all patients nationwide with PROM values for 2010

and 2011. By producing regression coefficients for age, gender, the three Charnley classes and six diagnosis groups (those operated due to acute fracture or tumour have been excluded) one can then estimate expected values for every patient after one year. Since the input values for the EQ-5D index, EQ VAS and pain best explain how one is expected to improve in health-related quality of life, these baseline values have been included in each respective regression model. At the clinical level one can then decide the difference between the expected average value and the actual average value. In this way we can present how much each clinic deviates from the expected average value in Sweden based on the clinic's case-mix. For the EQ-5D index and the EQ VAS deviations exceeding zero indicate that the result is better than expected, and for pain and satisfaction negative values are better than expected. One can say in any case that a clinic's deviation does not depend on any difference in case-mix with regard to age, gender, Charnley class distribution, diagnoses or preoperative values.

Great differences between various clinics despite adjustment

When studying the sets of tables for the PROM results one will find that the adjusted deviations for the EQ-5D index at one year span from –0.084 to 0.071, and for the EQ VAS from –9 to 6. The adjusted difference between best and worst clinics is thus 0.15 and 15 units, respectively, for the one-year values for the EQ-5D index and the EQ VAS. This can, of course, be seen as a large variation considering the fact that the average improvement is 0.36 and 20, respectively. Furthermore, the breadth of the interval for deviations from pain after one year is 14 VAS units, and for satisfaction 18 VAS units. It is thus other factors than demographic variables we can adjust for that decide patient-reported results after one year.

Innovation number two: Improvement index

We have also chosen to give an account of how much each PROM variable is improved on average at each clinic. The columns presenting the improvement percentage per clinic for the different outcome variables take consideration to the preoperative values. The percentage must be compared with the national average. The average improvement should be divided by the total scope for improvement according to the following:

Improvement percentage EQ – 5D index =

$$= \frac{(\text{EQ} - 5\text{D index}^1 - \text{EQ} - 5\text{D index}^0)}{(1 - \text{EQ} - 5\text{D index}^0)} \times 100$$

Improvement percentage EQ VAS =

$$= \frac{(\text{EQ VAS}^1 - \text{EQ VAS}^0)}{(100 - \text{EQ VAS}^0)} \times 100$$

Improvement percentage pain – VAS =

$$= \frac{(\text{PainVAS}^0 - \text{PainVAS}^1)}{(0 - \text{PainVAS}^0)} \times 100$$

Clinics with particularly good PROM results

Here is the place to highlight some clinics that constantly show advantageous patient-reported results for the fiscal years 2010–2011. The private clinics Sophiahemmet, Aleris Sabbatsberg and Nacka all have constantly better outcomes for pain, health-related quality of life and satisfaction than the country as a whole when one adjusts for case-mix. Likewise, SUS/Malmö and Ängelholm show constantly advantageous results. The major producer Hässleholm also shows good patient-reported results. These clinics are encouraged to share their experiences of how the process around arthroplasty is organized.

Clinics with improvement potential

This year's altered form of auditing from the Register's PROM Programme should give rise to in-depth analyses for many clinics and that measures are taken to improve patient-reported results. Some that can especially be mentioned in this connection are Södertälje, Norrtälje, Karlstad, Borås, Södersjukhuset, SU/Mölndal and Karolinska/Huddinge that all constantly deviate for the worse. Eskilstuna, Gävle, SUS/Lund, Arvika, Torsby, Växjö, Skene, Linköping, St Göran and Karolinska/Solna also have manifest improvement potential.

What can the new method of auditing for PROM contribute?

One can gain a deeper understanding of individual clinics' results by giving an account of deviation from expected profits. Naturally the analysis does not adjust for all differences in patient demography between clinics. We know that level of education, cultural factors, other socioeconomic factors and medical comorbidity not covered by the Charnley classification all have significance for the outcome. Furthermore, there are probably regional differences in responses to the PROM instruments.

What can be improved?

So, what can be improved? Surgical techniques have significance for outcome. Among other things, we have shown that posterior approach gives a somewhat better patient-reported outcome than the direct lateral approach. The effect is, however, not so extensive that it causes us to recommend changing routines for approach since such a change may also cause undesirable consequences for the frequency of reoperations due to dislocation. Experiences from the development of a fast-track programme at Hvidoevre in Copenhagen speaks for the fact that meticulousness in decisions to operate, sound preoperative information, optimization of patients, continuity in contact with physicians and other caregiver categories, a well-planned care process, ultra-early mobilization, a short care period and optimized pain treatment lead to better patient-reported outcomes.

The PROM database is also used for research

There is a handful of published work based on the PROM database, and many PROM studies are ongoing. Through simultaneous processing of the PROM and other health databases, investigations are being made into how socioeconomic, cultural, comorbidity-related, technical and careprocess-related factors affect the patient-reported results. A number of methodological studies are also being carried out to investigate how PROM data should best be analyzed, how the way of gathering in PROM data can be improved and whether or not other/improved PROM instruments can provide more information without negatively affecting response frequency. It is worth mentioning that data processing from a qualitative study is ongoing, using a randomly selected group of patients who have declared their uncertainty or dissatisfaction with the results of their operation at the one-year follow-up. A brief account of this study with some preliminary results is presented in this year's report.

Cinnamon buns for hip-implanted patients

This year's trend analysis indicates a positive development for PROM results in Sweden during 2007–2011. A register analysis cannot, of course, provide the answer as to why we are improving, but if we had not measured we would not have been aware of the positive trend. There are colleagues who are dubious about the value of measuring PROM. There are also colleagues who believe that we can improve patient-reported outcomes by treating patients to cinnamon buns. Reception and care probably influence the patient's capacity for rehabilitation after a prosthesis operation. Of course there is uncertainty and variability in PROM variables on an individual level. However, that is no different from the uncertainty prevailing for traditional variables. The risk that the patient will come up against prosthetic-related or other serious complications is small in relation to the risk of not attaining the pain relief intended, or being pleased with the result of the operation. Multidimensional evaluation of prosthetic surgery demands patient-reported outcomes. *"An implant still in place is not a complete definition of success".*

Thanks to all the contributors in the PROM Programme

Finally, the Register directors would like to address heartfelt thanks to all contact secreteraries, contact physicians, institutional directors, and not least all patients who, in various ways, are participating in and contributing to the PROM Programme.

Patient satisfaction 1 year after primary THR

primary THR 2010–2011

Hospital	Number	Proportion[1)]
Aleris Specialistsjukvård i Motala	795	90.2%
Aleris Specialistsjukvård Elisabethsjukhuset	118	90.7%
Aleris Specialistsjukvård Nacka	245	94.7%
Aleris Specialistsjukvård Sabbatsberg	276	93.8%
Alingsås	360	89.4%
Arvika	248	84.3%
Bollnäs	582	86.8%
Borås	238	82.4%
Capio Movement	436	88.3%
Capio S:t Göran	581	84.2%
Carema Ortopediska Huset	605	84.1%
Carlanderska	245	93.9%
Danderyd	418	91.4%
Eksjö	347	90.2%
Enköping	460	84.6%
Eskilstuna	131	87.0%
Falköping	216	88.9%
Falun	610	88.4%
Frölunda Specialistsjukhus	146	88.4%
Gällivare	140	88.6%
Gävle	264	79.5%
Halmstad	345	82.9%
Helsingborg	82	90.2%
Hudiksvall	185	88.6%
Hässleholm-Kristianstad	1,389	92.9%
Jönköping	334	91.9%
Kalmar	258	89.5%
Karlshamn	333	91.0%
Karlskoga	205	88.8%
Karlstad	337	80.4%
Karolinska/Huddinge	391	84.7%
Karolinska/Solna	299	83.9%
Katrineholm	414	85.0%
Kungälv	312	81.4%
Lidköping	270	88.1%
Lindesberg	331	90.9%
Linköping	71	88.7%
Ljungby	278	92.1%
Lycksele	525	91.8%
Mora	340	86.8%
Norrköping	343	87.8%
Norrtälje	166	75.3%
Nyköping	276	85.9%
Ortho Center Stockholm	725	87.3%
OrthoCenter IFK-kliniken	235	89.8%
Oskarshamn	368	91.8%
Piteå	644	94.6%
SU/Mölndal	545	80.9%
SUS/Lund	75	86.7%
SUS/Malmö	86	90.7%
SUS/Trelleborg	1,033	89.2%
Skellefteå	126	91.3%
Skene	194	78.9%
Skövde	231	89.2%
Sollefteå	180	89.4%
Sophiahemmet	128	97.7%
Spenshult	291	90.4%
Sundsvall	226	83.2%
Södersjukhuset	454	82.8%
Södertälje	187	79.7%
Torsby	148	85.8%
Uddevalla	472	85.0%
Umeå	119	93.3%
Uppsala	350	87.4%
Varberg	351	92.6%
Visby	176	86.9%
Värnamo	196	88.8%
Västervik	156	90.4%
Västerås	528	89.4%
Växjö	200	88.0%
Ängelholm	263	92.0%
Örebro	293	91.8%
Örnsköldsvik	254	87.4%
Östersund	408	91.9%
Nation	24,587	88.2%

1) Proportion patients with satisfaction between 0 and 40 on a VAS. Hospitals with less than 50 registrations are not displayed.

Patient-reported outcome per hospital

2010–2011

	Preop, 2010–2011					One-year postop, 2011–2012					Six-year postop, 2011–2012				
	Number	C-cat[1)]	Pain	EQ VAS	EQ-5D	Number	Satisf.[2)]	Pain	EQ VAS	EQ-5D	Number	Satisf.[2)]	Pain	EQ VAS	EQ-5D
University or regional hospitals															
Karolinska/Huddinge	402	57%	79	59	0.42	391	19	17	73	0.73					
Karolinska/Solna	275	51%	64	48	0.33	299	19	16	72	0.73					
Linköping	46	35%	69	46	0.33	71	16	12	74	0.75					
SU/Mölndal	463	49%	65	56	0.34	545	22	18	71	0.71	66	21	20	66	0.65
SU/Sahlgrenska											206	19	16	68	0.69
SU/Östra											147	24	20	71	0.75
SUS/Lund	78	54%	69	49	0.27	75	16	16	65	0.67	79	14	13	66	0.65
SUS/Malmö	70	47%	67	46	0.19	86	13	13	77	0.78	81	19	21	70	0.69
Umeå	81	51%	67	46	0.25	119	14	14	71	0.74	95	18	16	64	0.68
Uppsala	256	51%	62	56	0.34	350	18	14	74	0.76					
Örebro	226	43%	61	52	0.38	293	14	13	76	0.76	167	15	12	72	0.76
Central hospitals															
Borås	223	44%	62	57	0.39	238	21	15	72	0.71	261	19	16	70	0.72
Danderyd	389	40%	64	52	0.38	418	14	12	75	0.78	262	16	12	72	0.73
Eksjö	319	32%	62	60	0.46	347	16	13	78	0.82	283	15	15	71	0.76
Eskilstuna	101	43%	69	55	0.33	131	18	13	70	0.70	52	22	23	62	0.61
Falun	694	40%	60	60	0.42	610	15	13	74	0.77					
Gävle	270	44%	63	50	0.39	264	22	17	71	0.71	79	18	17	71	0.73
Halmstad	277	38%	63	52	0.42	345	21	17	74	0.76	280	21	19	70	0.70
Helsingborg	96	51%	73	51	0.18	82	12	11	71	0.72					
Hässleholm-Kristianstad	1,344	44%	60	57	0.41	1,389	12	12	78	0.81	581	15	15	75	0.79
Jönköping	333	46%	66	54	0.37	334	15	13	77	0.79	267	17	13	73	0.77
Kalmar	244	40%	62	54	0.39	258	16	13	76	0.80	116	17	14	69	0.72
Karlskrona										0.76					
Karlstad	320	49%	62	55	0.31	337	23	18	69	0.71					
Norrköping	374	36%	63	55	0.40	343	16	14	76	0.77					
Skövde	351	45%	64	56	0.40	231	17	13	76	0.78	174	18	15	68	0.72
Sunderby (inclusive Boden)											85	20	13	71	0.72
Sundsvall	199	33%	63	55	0.42	226	20	17	74	0.76	151	19	18	68	0.73
Södersjukhuset	446	44%	61	54	0.40	454	20	16	71	0.72	301	18	14	69	0.72
Uddevalla	485	49%	63	53	0.39	472	20	16	74	0.75	403	19	18	70	0.73
Varberg	365	40%	61	61	0.47	351	13	10	78	0.82	255	15	14	76	0.78
Västerås	536	40%	66	53	0.40	528	16	13	76	0.80	107	16	17	68	0.73
Växjö	218	42%	59	58	0.50	200	19	18	73	0.74	121	20	18	70	0.69
Ystad															
Östersund	492	38%	62	58	0.42	408	14	13	78	0.82	316	14	14	74	0.78

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Patient-reported outcomes per hospital (continued)
2010–2011

	Preop, 2010–2011					One-year postop, 2011–2012					Six-year postop, 2011–2012				
	Number	C-cat[1)]	Pain	EQ VAS	EQ-5D	Number	Satisf.[2)]	Pain	EQ VAS	EQ-5D	Number	Satisf.[2)]	Pain	EQ VAS	EQ-5D
Rural hospitals															
Alingsås	382	38%	61	58	0.45	360	16	12	77	0.78	311	15	14	74	0.76
Arvika	331	37%	65	55	0.40	248	20	18	74	0.74					
Bollnäs	356	38%	64	51	0.43	582	16	14	75	0.78	218	18	16	72	0.72
Enköping	563	49%	60	51	0.41	460	20	16	73	0.79					
Falköping						216	17	12	79	0.82	410	15	13	73	0.78
Frölunda Specialistsjukhus	156	36%	60	64	0.47	146	17	13	79	0.78	78	28	25	65	0.68
Gällivare	103	44%	64	49	0.39	140	18	15	75	0.77	185	20	19	70	0.76
Hudiksvall	175	48%	63	52	0.41	185	16	13	74	0.79	75	23	21	61	0.61
Karlshamn	406	35%	57	57	0.46	333	14	13	76	0.81	124	17	16	72	0.72
Karlskoga	223	32%	64	57	0.41	205	15	12	78	0.81					
Katrineholm	403	38%	58	54	0.45	414	18	14	77	0.80	210	15	12	73	0.78
Kungälv	257	74%	58	58	0.43	312	23	19	73	0.72	284	18	17	70	0.72
Köping											241	19	16	72	0.75
Lidköping	345	33%	60	59	0.44	270	17	14	75	0.79	208	15	13	73	0.76
Lindesberg	418	34%	67	51	0.36	331	13	11	78	0.81	161	14	14	73	0.74
Ljungby	296	41%	60	63	0.51	278	12	11	78	0.84	103	12	12	78	0.82
Lycksele	426	42%	64	56	0.41	525	14	13	77	0.81	361	13	14	72	0.78
Mora	294	39%	65	49	0.38	340	18	15	78	0.79					
Motala (up to 2009)											110	22	18	72	0.76
Norrtälje	163	44%	63	55	0.42	166	26	21	71	0.71					
Nyköping	224	37%	65	53	0.38	276	20	16	76	0.77					
Oskarshamn	398	45%	64	51	0.40	368	13	12	78	0.80	193	11	12	75	0.80
Piteå	457	38%	67	51	0.39	644	11	11	79	0.82	368	13	12	74	0.78
SUS/Trelleborg	1,174	38%	64	58	0.42	1,033	15	14	78	0.79	777	16	15	74	0.76
Skellefteå	142	41%	64	52	0.40	126	17	14	74	0.78	135	18	16	73	0.77
Skene	206	38%	63	57	0.46	194	23	18	75	0.76	112	22	19	69	0.73
Sollefteå	219	37%	63	57	0.41	180	14	12	75	0.78	187	17	15	72	0.76
Södertälje	148	39%	63	56	0.41	187	23	19	72	0.71					
Torsby	182	31%	65	56	0.39	148	19	17	74	0.74					
Visby	130	38%	62	59	0.46	176	18	16	77	0.78					
Värnamo	249	39%	59	64	0.50	196	16	14	79	0.81	193	15	14	75	0.77
Västervik	178	37%	61	60	0.43	156	18	14	77	0.79	45	18	15	72	0.77
Ängelholm	313	36%	67	58	0.39	263	13	12	77	0.82					
Örnsköldsvik	235	44%	66	52	0.45	254	17	14	75	0.77	143	17	15	69	0.75

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Patient-reported outcome per hospital (cont.)
2010–2011

	Preop, 2010–2011					One-year postop, 2011–2012					Six-year postop, 2011–2012				
	Number	C-cat[1)]	Pain	EQ VAS	EQ-5D	Number	Satisf.[2)]	Pain	EQ VAS	EQ-5D	Number	Satisf.[2)]	Pain	EQ VAS	EQ-5D
Private hospitals															
Aleris Spec.vyeard i Motala	749	33%	60	59	0.49	795	15	13	78	0.82					
Aleris Specialistsjukvård Bollnäs	225	44%	64	50	0.40										
Aleris Specialistsjukvård Elisabeth-sjukhuset	123	27%	60	60	0.52	118	13	12	79	0.85					
Aleris Specialistsjukvård Nacka	256	33%	66	49	0.45	245	11	10	80	0.86					
Aleris Specialistsjukvård Sabbatsberg	299	30%	61	62	0.47	276	10	9	81	0.84					
Capio Movement	375	28%	63	56	0.44	436	15	12	78	0.80					
Capio S:t Göran	605	37%	62	58	0.41	581	19	16	74	0.74					
Carema Ortopediska Huset	627	35%	62	56	0.48	605	19	15	78	0.80					
Carlanderska	247	27%	62	55	0.46	245	13	12	82	0.83	86	13	11	84	0.86
Ortho Center Stockholm	793	39%	67	56	0.41	725	15	11	77	0.78					
OrthoCenter IFK-kliniken	274	30%	62	56	0.46	235	12	11	82	0.83					
Sophiahemmet	306	27%	58	62	0.50	128	5	4	87	0.91					
Spenshult	348	35%	63	58	0.45	291	13	12	79	0.80					
Nation	24,782	40%	63	56	0.42	24,632	16	14	76	0.78	10,333	17	15	72	0.75

1) Proportion Charnley class C.
2) Satisfaction (VAS, 0 = Completely satisfied, 100 = Dissatisfied).

The table presents 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 class C patients (i.e. patients with multiple joint disease and/or co-morbidity). Departments with a high proportion of C patients most frequently show 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.Results are presented for units with 40 or more registrations.

Expected outcome and improvement index per hospital
2010–2011

Hospital	Satisfaction VAS 1 year			EQ-5D index 1 year			
	Number (Tillf)	Actual	Deviation from expected	Number (EQ-5D, EQ VAS, Pain)	Actual	Deviation from expected	Improvement index
University or regional hospitals							
Karolinska/Huddinge	391	19.2	3.9	356	0.733	–0.055	54.60
Karolinska/Solna	299	19.4	3.0	249	0.732	–0.031	59.65
Linköping	71	15.7	2.2	35	0.750	–0.052	56.41
SU/Mölndal	545	22.3	5.8	432	0.711	–0.064	58.39
SUS/Lund	75	15.9	–1.1	55	0.673	–0.061	58.45
SUS/Malmö	86	13.3	–4.3	79	0.780	0.053	71.82
Umeå	119	13.7	–1.9	100	0.744	–0.028	64.66
Uppsala	350	17.7	2.3	281	0.755	–0.025	61.45
Örebro	293	13.8	–2.2	255	0.760	–0.013	61.91
Central hospitals							
Borås	238	21.1	3.9	196	0.709	–0.059	53.80
Danderyd	418	14.2	–2.7	346	0.778	0.006	65.02
Eksjö	347	15.9	0.3	308	0.819	0.020	69.03
Eskilstuna	131	18.0	1.8	65	0.701	–0.080	63.23
Falun	610	15.4	–0.8	548	0.770	–0.011	60.77
Gävle	264	22.0	5.6	244	0.707	–0.063	51.98
Halmstad	345	20.5	4.3	266	0.760	–0.026	60.37
Helsingborg	82	12.4	–6.5	73	0.715	–0.015	62.92
Hässleholm-Kristianstad	1,389	12.4	–4.1	1,341	0.805	0.025	67.54
Jönköping	334	14.9	–1.2	304	0.790	0.002	64.56
Kalmar	258	16.0	0.1	248	0.801	0.007	65.44
Karlstad	337	22.7	6.0	296	0.705	–0.059	51.34
Norrköping	343	16.0	–0.2	330	0.769	–0.009	60.83
Skövde	231	16.8	0.1	226	0.780	0.005	64.88
Sundsvall	226	20.3	4.5	169	0.757	–0.026	60.17
Södersjukhuset	454	20.0	3.3	355	0.718	–0.057	53.15
Uddevalla	472	20.4	3.5	371	0.746	–0.024	60.34
Varberg	351	12.6	–3.3	311	0.818	0.021	64.78
Västerås	528	15.9	–0.3	330	0.796	0.013	68.26
Växjö	200	19.0	2.2	171	0.742	–0.040	57.29
Östersund	408	14.0	–2.1	395	0.815	0.029	68.41

Number (Satisf.) = Number of registrations per hospital with satisfaction VAS one year postoperatively.

Actual = Mean outcome one year postoperatively

Deviation from expected = Difference between the actual mean value and the expected value calculated using regression coefficients in a modell that includes age, gender, Charnley class, and preoperative level of the respective PROM variable.

For EQ-5D index and EQ VAS values above zero indicate better outcome than expected and for satisfaction and pain negative values indicate better outcomes than expected.

Number (EQ-5D index, EQ VAS, Pain)= Number of registrations per hospital with EQ-5D index, EQ VAS and Pain-VAS both pre- and one year postoperative.

Improvement index = The ratio between the mean improvement divided by the maximum possible improvement (see text for details).

	EQ VAS 1 year			Pain VAS 1 year		
	Actual	Deviation from expected	Improvement index	Actual	Deviation from expected	Improvement index
University or regional hospitals						
Karolinska/Huddinge	72.7	–4.9	29.63	16.7	1.8	79.55
Karolinska/Solna	71.9	–3.6	44.6	16.4	2.2	75.92
Linköping	73.9	–6.1	39.27	12.1	0	78.95
SU/Mölndal	70.9	–5.0	39.49	18.1	3.7	73.86
SUS/Lund	64.9	–9.3	39.13	16.5	1.3	75.75
SUS/Malmö	76.5	2.4	54.96	13.3	–2.3	79.04
Umeå	71.3	–3.2	52.06	13.8	0.2	81.05
Uppsala	74.1	–2.9	43.51	13.8	0.4	77.86
Örebro	75.8	0.1	51.59	13.1	–0.5	78.14
Central hospitals						
Borås	72.1	–3.6	38.69	15.4	1.3	74.61
Danderyd	75.1	0	51.45	11.8	–2.4	81.65
Eksjö	78	–0.2	45.78	12.7	–0.3	79.71
Eskilstuna	70.5	–5.5	45.57	13.2	–0.6	80.19
Falun	74.1	–2.4	41.64	13.1	–0.5	78.66
Gävle	70.7	–4.3	45.09	17.2	3.2	72.52
Halmstad	73.8	–2.6	46.33	16.9	3.2	74.49
Helsingborg	70.9	–3.5	39.94	10.6	–5.6	84.53
Hässleholm-Kristianstad	78.4	2.5	52.46	11.6	–2.1	80.91
Jönköping	76.5	0.6	49.04	12.9	–0.8	80.00
Kalmar	76.2	–0.9	44.11	12.9	–0.4	78.93
Karlstad	69.4	–4.8	37.55	18.3	4.2	69.38
Norrköping	75.7	–0.6	47.66	14.0	0.3	77.45
Skövde	75.7	–0.1	47.85	13.1		78.97
Sundsvall	73.8	–3.1	40.18	16.5	3.0	74.41
Södersjukhuset	71.4	–4.6	41.82	15.5	1.8	74.48
Uddevalla	74.1	–1.2	47.33	16.2	1.9	74.59
Varberg	78.2	0.4	43.80	10.3	–3.0	83.43
Västerås	75.5	–0.4	53.22	13.5	–0.4	81.58
Växjö	72.9	–2.5	43.02	17.7	3.7	71.01
Östersund	77.8	1.2	50.55	13.4	0	78.43

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Expected outcome and improvement index per hospital (cont.)

2010–2011

Hospital	Satisfaction VAS 1 year			EQ-5D index 1 year			
	Number (Tillf)	Actual	Deviation from expected	Number (EQ-5D, EQ VAS, Pain)	Actual	Deviation from expected	Improvement index
Rural hospitals							
Alingsås	360	15.5	–0.6	339	0.781	–0.015	58.56
Arvika	248	20.0	3.6	236	0.736	–0.049	55.07
Bollnäs	582	16.2	0	559	0.778	–0.007	62.01
Enköping	460	20.4	3.1	428	0.786	0.009	61.72
Falköping	216	16.6	0.7	211	0.820	0.024	67.58
Frölunda Specialistsjukhus	146	16.9	1.1	143	0.781	–0.024	55.46
Gällivare	140	18.2	1.4	96	0.773	0.005	64.66
Hudiksvall	185	15.6	–0.6	173	0.788	0.017	66.08
Karlshamn	333	14.0	–1.5	316	0.814	0.010	65.12
Karlskoga	205	15.0	–0.4	171	0.806	0.003	67.27
Katrineholm	414	17.8	2.1	379	0.796	0	62.60
Kungälv	312	22.6	4.9	284	0.723	–0.042	48.62
Lidköping	270	16.7	0.6	264	0.792	0.001	62.81
Lindesberg	331	12.7	–3.6	329	0.811	0.030	69.61
Ljungby	278	12.0	–3.6	267	0.836	0.028	65.38
Lycksele	525	14.5	–1.3	406	0.808	0.013	65.73
Mora	340	18.0	1.6	299	0.786	0.004	65.16
Norrtälje	166	26.2	9.4	156	0.713	–0.061	50.6
Nyköping	276	20.4	4.6	255	0.770	–0.020	60.66
Oskarshamn	368	12.5	–3.2	359	0.804	0.008	64.52
Piteå	644	11.2	–4.5	454	0.817	0.028	71.65
SUS/Trelleborg	1,033	15.3	–1.1	995	0.787	0.002	62.07
Skellefteå	126	16.7	0.1	116	0.781	0.009	64.46
Skene	194	23.1	7.4	185	0.757	–0.038	57.21
Sollefteå	180	14.3	–1.9	147	0.777	–0.010	62.90
Södertälje	187	23.4	6.9	159	0.705	–0.084	49.92
Torsby	148	19.0	2.6	140	0.739	–0.043	60.04
Visby	176	17.7	1.5	131	0.781	–0.004	64.55
Värnamo	196	15.6	0.2	185	0.813	–0.005	55.68
Västervik	156	18.4	2.8	128	0.786	–0.012	62.69
Ängelholm	263	12.6	–4.1	257	0.815	0.036	70.04
Örnsköldsvik	254	16.8	0.5	207	0.774	–0.014	55.68

	EQ VAS 1 year			Pain VAS 1 year		
	Actual	Deviation from expected	Improvement index	Actual	Deviation from expected	Improvement index
Rural hospitals						
Alingsås	76.7	–0.1	47.34	12.1	–1.1	79.86
Arvika	74.1	–1.9	44.32	17.6	3.8	72.60
Bollnäs	75.2	–0.4	51.26	13.7	–0.1	78.63
Enköping	73.4	–0.9	45.16	16.4	2.3	71.92
Falköping	78.8	1.2	49.97	12.1	–1.2	80.71
Frölunda Specialistsjukhus	79.3	0.6	41.19	13.1	0.4	77.51
Gällivare	75.2	1.2	55.08	15.3	1.0	75.91
Hudiksvall	74.2	–0.9	51.24	13.4	–0.5	78.75
Karlshamn	76.5	–1.1	46.73	13.2	0.5	77.48
Karlskoga	78.4	0.7	52.83	11.9	–1.1	81.68
Katrineholm	77.5	0.8	52.00	14.0	1.1	76.00
Kungälv	73.3	–1.1	36.64	18.5	4.0	67.74
Lidköping	75.3	–1.7	40.99	14.4	1.4	74.82
Lindesberg	78.3	2.4	55.78	11.0	–3.0	83.31
Ljungby	78.4	0.6	44.03	10.9	–2.0	81.57
Lycksele	77	0.3	50.11	13.2	–0.1	79.29
Mora	77.7	2.0	55.91	14.8	0.8	78.29
Norrtälje	70.7	–4.6	40.57	21.3	7.2	66.44
Nyköping	76.1	–0.8	47.99	15.8	2.4	74.94
Oskarshamn	77.8	1.2	51.55	12.4	–0.6	79.63
Piteå	79.5	3.4	60.32	11.1	–2.3	82.89
SUS/Trelleborg	78.3	1.5	49.11	14.4	0.6	77.12
Skellefteå	74.5	–0.3	51.10	13.7	–0.3	78.54
Skene	74.9	–2.4	43.7	18.0	4.7	72.23
Sollefteå	75.3	–1.4	45.51	11.7	–1.8	82.32
Södertälje	71.8	–5.1	34.71	18.9	5.5	69.21
Torsby	73.7	–2.2	45.44	17.2	3.1	74.04
Visby	77	0.5	47.84	15.6	1.9	75.47
Värnamo	78.7	0.4	43.01	13.5	1.1	76.39
Västervik	77.2	–0.5	46.67	14.0	0.6	77.35
Ängelholm	77.5	0.8	48.20	11.6	–2.6	82.51
Örnsköldsvik	74.8	–0.2	49.13	13.6	–0.2	78.47

(Continued on next page.)

Expected outcome and improvement index per hospital (cont.)
2010–2011

Hospital	Satisfaction VAS 1 year			EQ-5D index 1 year			
	Number (Tillf)	Actual	Deviation from expected	Number (EQ-5D, EQ VAS, Pain)	Actual	Deviation from expected	Improvement index
Private hospitals							
Aleris Specialistsjukvård i Motala	795	15.4	–0.5	707	0.819	0.017	65.39
Aleris Specialistsjukvård Elisabeth-sjukhuset	118	12.9	–1.5	117	0.846	0.034	70.44
Aleris Specialistsjukvård Nacka	245	10.6	–4.9	231	0.857	0.057	74.47
Aleris Specialistsjukvård Sabbatsberg	276	9.6	–6.0	246	0.842	0.044	72.69
Capio Movement	436	15.3	0.4	388	0.804	–0.004	64.72
Capio S:t Göran	581	19.4	3.0	433	0.742	–0.038	58.77
Carema Ortopediska Huset	605	18.6	3.1	600	0.800	–0.001	63.12
Carlanderska	245	12.9	–1.2	223	0.835	0.019	71.09
Ortho Center Stockholm	725	15.5	–0.8	698	0.778	–0.003	62.70
OrthoCenter IFK-kliniken	235	12.4	–1.8	232	0.830	0.016	68.10
Sophiahemmet	128	4.6	–8.5	118	0.913	0.071	81.18
Spenshult	291	13.4	–2.0	193	0.805	0.011	62.87
Nation	24,632	16.3		21,724	0.781		

Notes

	EQ VAS 1 year			Pain VAS 1 year		
	Actual	Deviation from expected	Improvement index	Actual	Deviation from expected	Improvement index
Private hospitals						
Aleris Specialistsjukvård i Motala	78.1	1.2	50.79	12.9	–0.1	78.82
Aleris Specialistsjukvård Elisabethsjukhuset	79.5	1.1	53.28	12.0	–0.3	80.62
Aleris Specialistsjukvård Nacka	80.3	3.5	60.41	9.6	–3.5	84.91
Aleris Specialistsjukvård Sabbatsberg	81.5	3.3	57.74	9.1	–3.9	84.68
Capio Movement	78.4	0.2	50.56	12.1	–0.5	80.27
Capio S:t Göran	73.9	–3.3	40.18	16.3	2.6	74.26
Carema Ortopediska Huset	78.4	0.8	52.04	14.6	1.6	76.15
Carlanderska	81.8	2.9	61.03	12.0	–0.3	81.12
Ortho Center Stockholm	77.4	0.8	52.15	11.4	–2.6	83.19
OrthoCenter IFK-kliniken	82.2	3.9	62.25	10.7	–1.6	82.33
Sophiahemmet	87.1	6.2	66.41	4.2	–6.8	92.98
Spenshult	78.5	0.9	48.20	12.1	–1.1	80.96
Nation	76.1			13.8		

Notes

Trend analysis:

Is there any improvement in patient-reported outcomes?

Ten years have passed since the Register's PROM Programme began. From 2008 all clinics are involved and patients have been very keen to participate. Only 15% of survey responses of those to be operated electively with total hip replacement before operation are missing, and at the one-year follow-up the response frequency is nearly 90%. Part of the preoperative data loss is related to faulty routines for requesting participation in the follow-up programme.

The quality register's main assignment is to promote the improvement of quality in healthcare. Historically we have been able to show that implant survival has been successively improved since the Register was activated. Patient-reported outcomes such as say pain relief, improved function and satisfaction with the results of the operation, constitute the main measures of outcome. How these outcome measures have changed in time has not yet been studied in detail since the basic data for such analyses has previously been too sparse. For this year's report we have, however, been able to investigate trends for how patient-reported outcomes have changed over time for those operated in 2007 to 2011.

All reportings to the PROM database are included in the analysis for those patients who were operated during the years in question, irrespective of diagnosis. Certain patients appear twice if they had operated both hips and responded to the surveys during this period. We used ANOVA trend analyses to test whether or not changes during the five-year period were statistically significant.

Gratifyingly enough one can establish that there was a positive trend for all PROM variables. The trend showed an improvement in the measures for health-related life quality of life, EQ-5D index and EQ VAS both pre- and postoperatively. This means that patients on average have less effected health-related quality of life when they undergo surgery, and that after one year they indicate better quality of life on average. One may speculate as to the causes of these changes observed over time. Healthcare itself has undergone changes during the period with investments in accessibility and to reduce hospital waitings lists. This may in its turn have led to a certain widening of indications, and that the trend is an effect of our operating on more patients who do not have such pronounced hip disease. That the pain level preoperatively has not changed speaks, however, against the idea that it is a matter of indication slippage. Resources have, moreover, also been invested in improving the care of patients with osteoarthritis at an earlier stage in the course of treatment. The introduction of osteoarthritis schools, the BOA Register's activities and the work of the Association of Rheumatics (Reumatikerförbundet) for patients with osteoarthritis may all have contributed to a development where more patients with osteoarthritis can better manage their disease. Furthermore, many clinics have invested in improving routines and processes around prosthetic surgery. They have practiced the "fast-track" concept's ideas to varying degrees, which have been shown as linked to better patient-reported results. Another explanation, quite independent of hip problems, is that changes in economic and social conditions in a country can lead to deteriorated health-related life quality of life in the population at large. However the trend towards a higher degree of patient satisfaction can probably not be explained by such a change in societal conditions. Measuring care quality, analyzing the effect of different interventions and openly accounting for the results for all of the country's caregivers all propel the work of improvement and quality forward.

In conclusion, we note a statistically significant positive trend for patient-reported outcomes for total hip replacement after one year. Hopefully, the PROM Programme contributes to facilitating analyses of the total functions and activities of caregivers, thus enabling initiation of local improvement efforts.

Trends in PROM results from 2007 to 2011

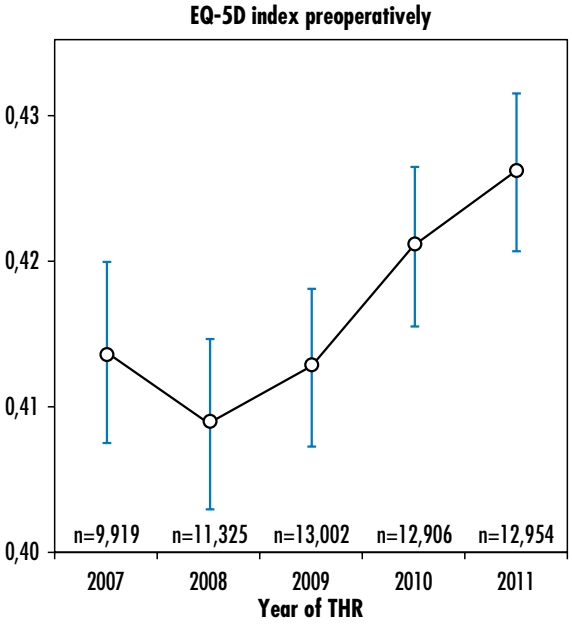


Figure 1. Development of mean EQ-5D index preoperatively from 2007 to 2011. There is a significant trend to a higher mean value.

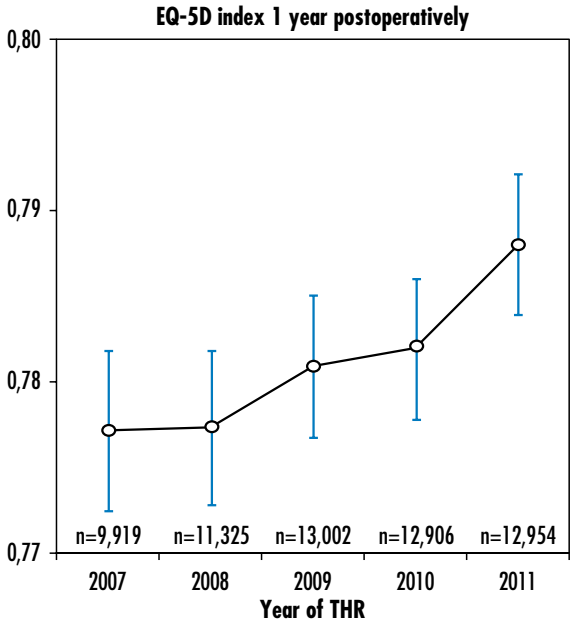


Figure 2. Development of mean EQ-5D index one year postoperatively from 2007 to 2011. There is a significant trend to a higher mean value.

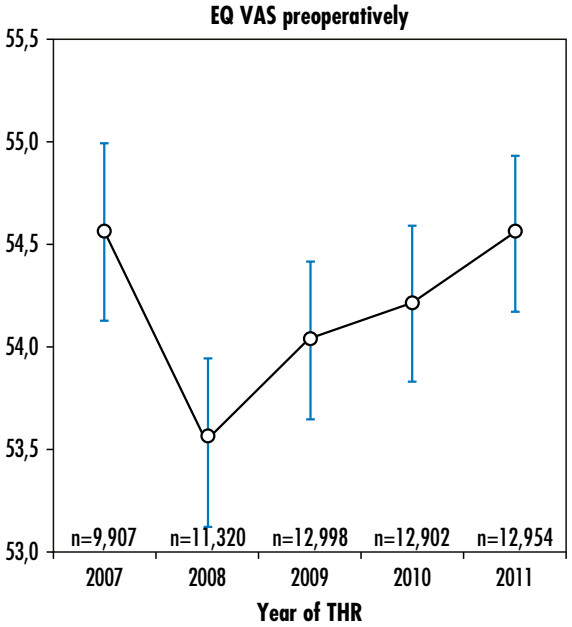


Figure 3. Development of mean EQ VAS preoperatively from 2007 to 2011. There is a significant trend to a higher mean value.

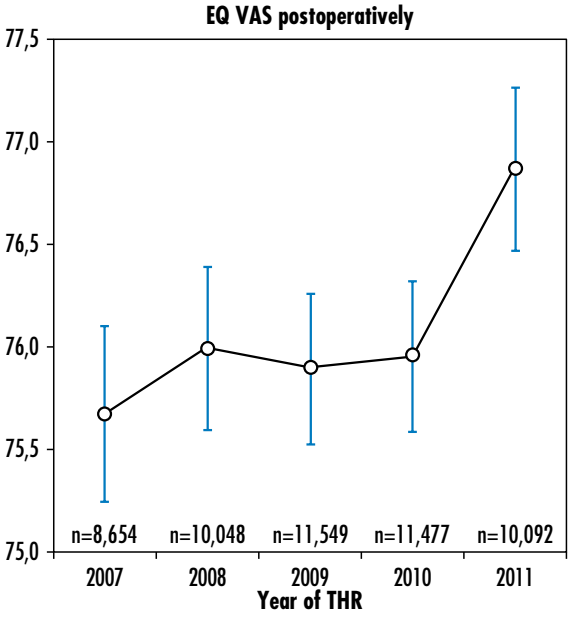


Figure 4. Development of mean EQ VAS one year postoperatively from 2007 to 2011. There is a significant trend to a higher mean value.

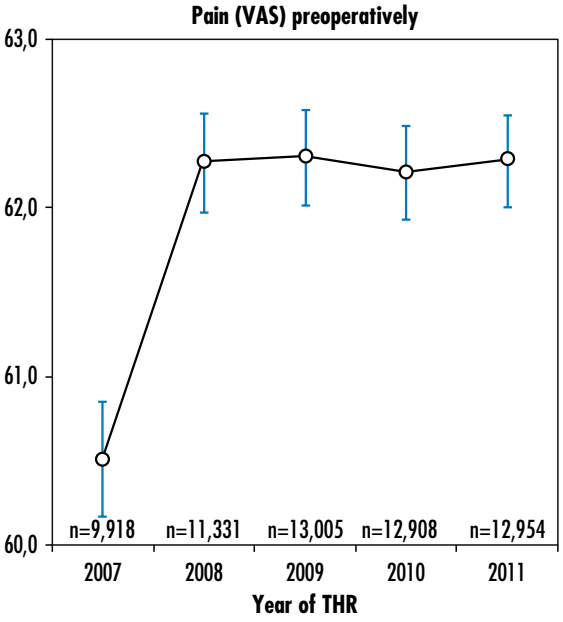


Figure 5. Development of mean pain VAS one year postoperatively from 2007 to 2011. There is a significant trend to a higher mean value from 2007 to 2008 but it then level off.

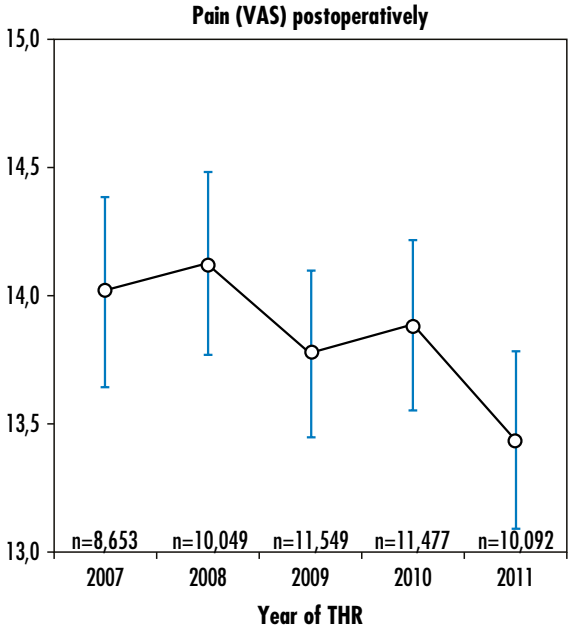


Figure 6. Development of mean pain VAS one year postoperatively from 2007 to 2011. There is a significant trend to a lowe mean value (=less pain).

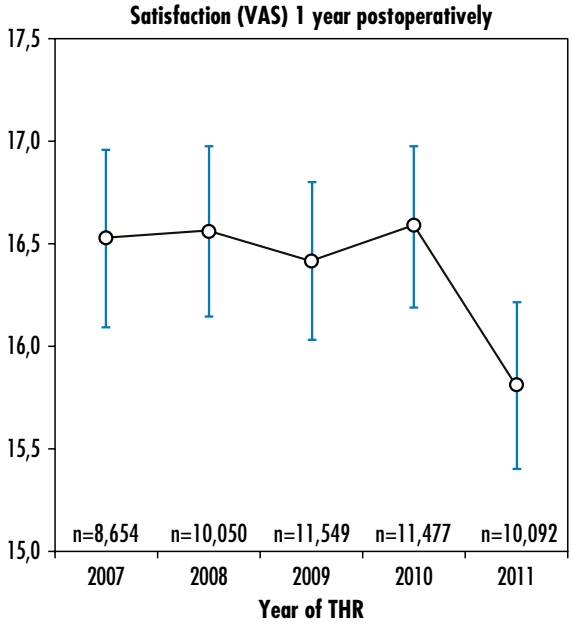


Figure 7. Development of mean satisfaction VAS one year postoperatively from 2007 to 2011. There is a significant trend to a higher mean value (=higher satisfaction).

Follow-up of caregiver functions and activities after total arthroplasty

The Hip Arthroplasty Register began openly reporting hospital results in 1999. The number of variables reported in this way has increased over the years and is presented in tables in this report. These tables are of necessity comprehensive and sometimes difficult to interpret. It is also difficult to gain a fast overview of the clinics' results in several dimensions via the tables alone. This is the seventh year of using so-called value compasses consisting of eight variables (points of the compass). The compasses have been produced with the sole intention of providing a fast and pedagogical overview. A deviating result in a value compass only indicates whether a clinic has a problem area. The compass can be regarded as a simplified signal system.

With this method results are presented for all clinics connected with the PROM Programme for more than one year, and with at least 50 patients being followed up. The value limits have been set at the highest and lowest values, respectively, plus/minus one standard deviation for the variable in focus. This means that the norm values (red field) vary from year to year. The worst value (0.0) for variables was assigned to the origo and the best value (1.0) to the periphery. This value compass can be seen as a proportioned navigational map; the larger the area the better and more multidimensional total result for each respective clinic.

The national average is presented in each figure and the clinic in focus can thus compare itself with the results for the entire country during the current fiscal year. Please note that the observation period for the variables varies.

Result variables:

- **Patient satisfaction.** Measured with VAS.
- **Pain relief.** Measured by subtracting the preoperative VAS value from the follow-up value, that is to say, the value gained after one year.
- **Health-related quality of life gained** (gain in EQ-5D index). This cardinal point is being calculated this year in a new way – see page 84 – that is, to present the deviation from the expected gain.
- **90-day mortality.** In international literature this variable is used to cast light upon mortality after total hip replacement.
- **Coverage.** Coverage (completeness) at the level of the individual according to the latest cross-referencing with the Patient Register at the Swedish National Board of Health and Welfare.
- **Reoperation within 2 years.** Lists all forms of reoperation within 2 years after primary operation and during the latest 4-year period.
- **5-year implant survival.** Prosthetic survival after 5 years with Kaplan-Meier statistics.
- **10-year implant survival.** The same variable as above but with a longer follow-up period.

Linked to each clinic's value compass is a graphic presentation of the clinic's "case-mix". This is constructed in the same way as the value compass. It includes the variables that have been shown upon analysis of the Register's database to be decisive demographic parameters for both patient-reported outcomes and long-term results with respect to revision needs. The greater the area in this figure the more favourable the patient profile owned by the clinic in focus.

- **Charnley classification.** The Figure shows the clinic's proportion of patients who have classified themselves as Charnley class A or B, which is to say patients without multiple joint disease and/or diseases affecting the patient's walking ability.
- **The proportion of primary osteoarthritis.** The more patients operated by the clinic for the diagnosis primary osteoarthritis the better the long-term results will be, according to the Register's regression analysis of the database.
- **The proportion of patients aged 60 or older.** Clinics that operate many patients over the age of 60 achieve better results in the same way as the variable above.
- **The proportion of women.** Women generally have better long-term results than men with respect to the need for revision depending first and foremost on aseptic loosening.

Discussion

Healthcare decision-makers express a strong wish to easily access summaries presenting clinics' and county councils' results with regard to the follow-up of the organization's total functions and activities. Another way of meeting this wish is to create an index, such as a total summing-up, to include a majority of variables. The greatest risk with indexing is that good results for one variable can be weighed up by bad results for another and vice versa. Such an index would then not provide an incentive to in-depth analysis and the work of improvement. Varying coverage of reported variables can also affect indexing with misleading results as a consequence.

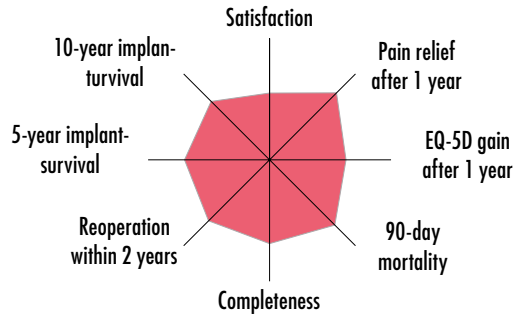
In the value compasses the national result with respect to the eight input variables is shown in red. The corresponding values of the respective clinics are shown in green. The units with red panels have values for the variables in focus that are inferior to the national average. The outcome can be studied in detail in the respective tables.

The graphic presentation of patient demography ("case-mix") shows the national results with regard to the four input variables in red. Each respective unit's corresponding value is shown in green. The value limit is set to the highest and lowest value ±1 SD of the variable in focus. When interpreting each clinic's value compass and, above all, when making comparisons, the "case-mix" profile must be always kept in mind!

This year we are also publishing value compasses for the so-called "standard" patient on page 110. Please note that these compasses only have seven "points of the compass". Since the basic selection of the "standard" patient builds on BMI and ASA grading, which we included in our data catchment five years ago, the 10-year survival of implants is not relevant. These compasses are also case-mix-adjusted via the basic selection, which is why the graphic illustration of case-mixes is also irrelevant.

Quality indicators

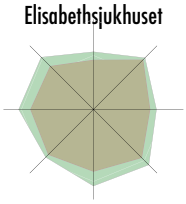
value compass – national average



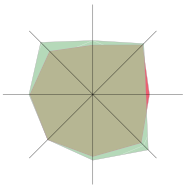
The value compasses show in red national results for the eight variables included. Each department's corresponding values are shown in green. Limit values are set to the highest and lowest value for each variable ± 1SD. The poorest value for the variables is at the origo and the best on the periphery.

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

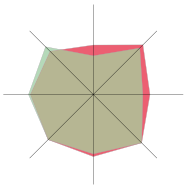
Aleris Spec. vård Elisabethsjukhuset



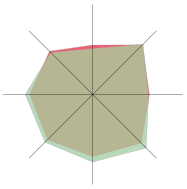
Alingsås



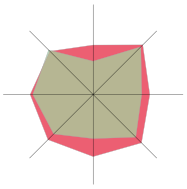
Arvika



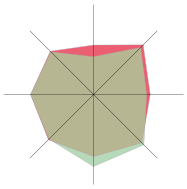
Bollnäs



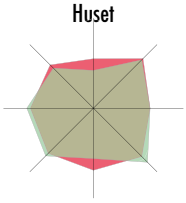
Borås



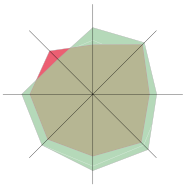
Capio S:t Göran



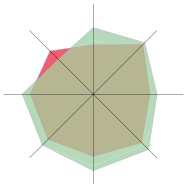
Carema Ortopediska Huset



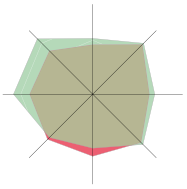
Carlanderska



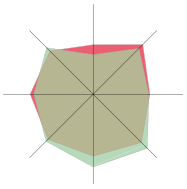
Danderyd



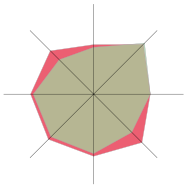
Eksjö



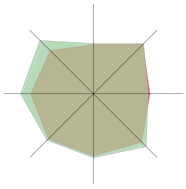
Enköping



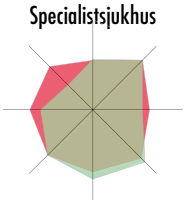
Eskilstuna



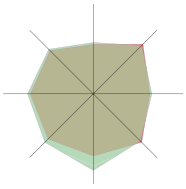
Falun



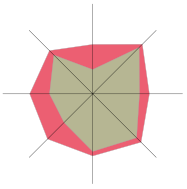
Frölunda Specialistsjukhus



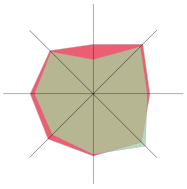
Gällivare



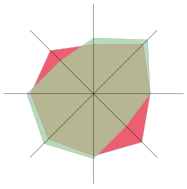
Gävle



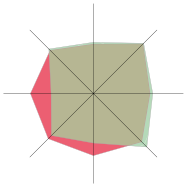
Halmstad



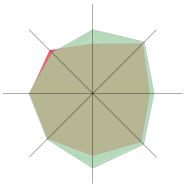
Helsingborg



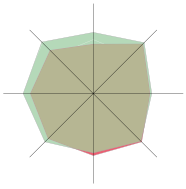
Hudiksvall



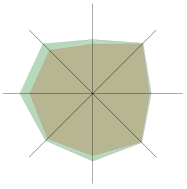
Hässleholm-Kristianstad



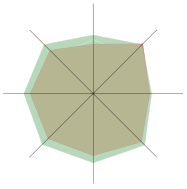
Jönköping



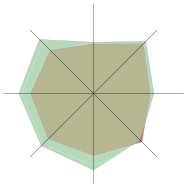
Kalmar



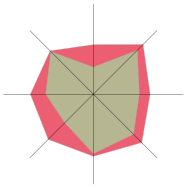
Karlshamn



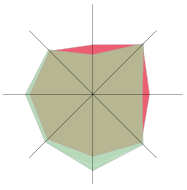
Karlskoga



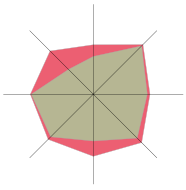
Karlstad



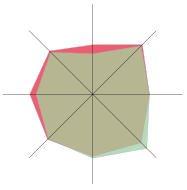
Karolinska/Huddinge



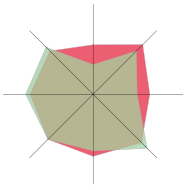
Karolinska/Solna



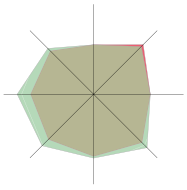
Katrineholm

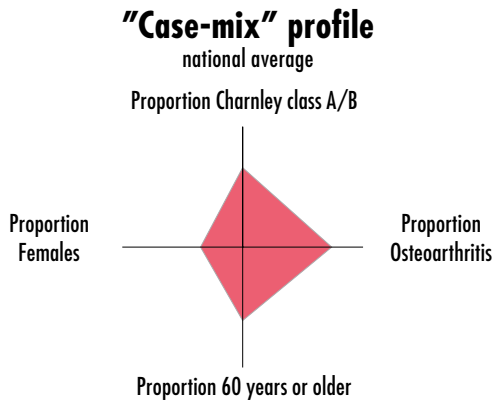


Kungälv



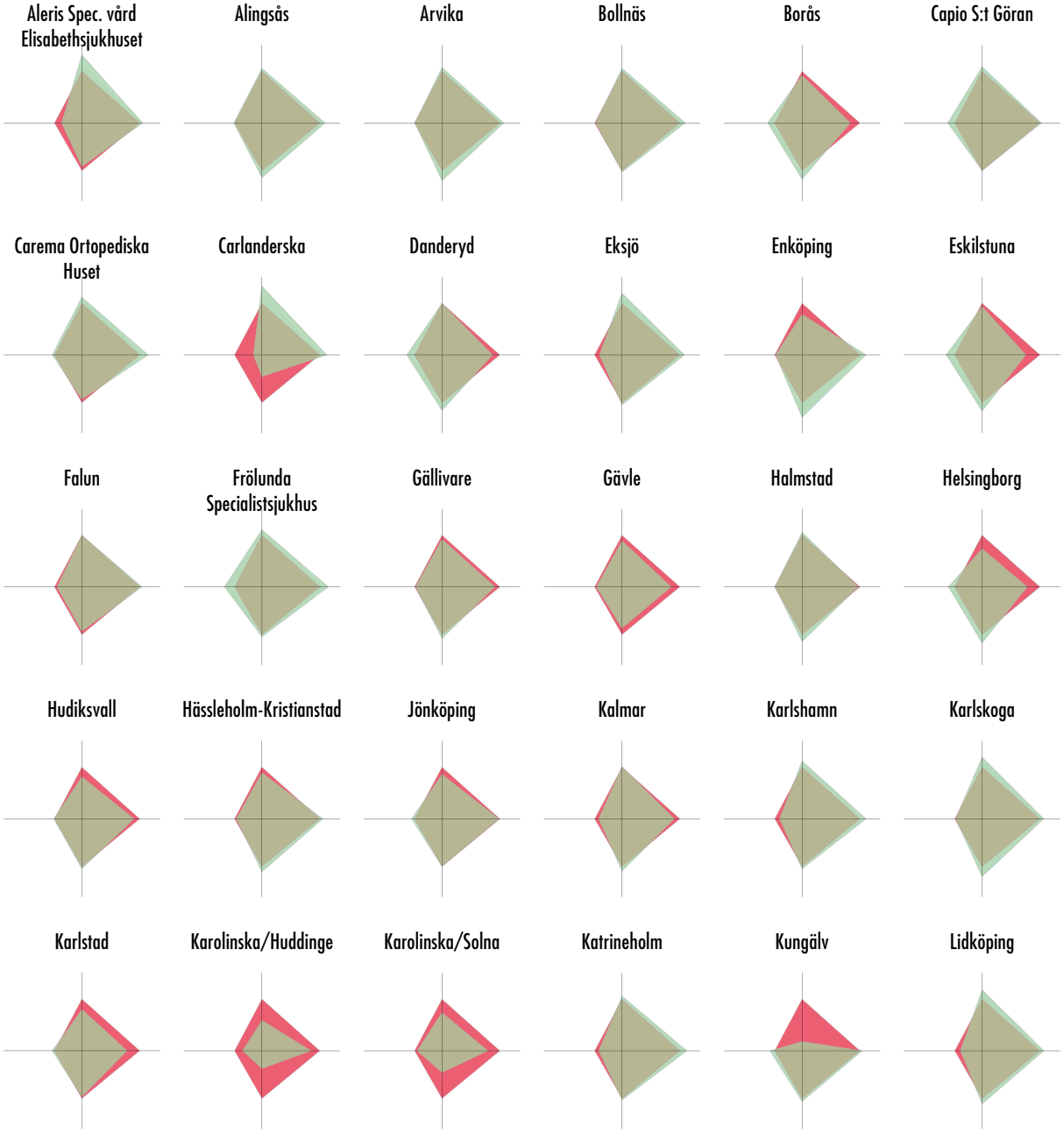
Lidköping





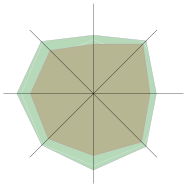
In the graphic presentation of patient demographics (`case-mix') the national result is shown regarding the four varia-bles included, in red. The corresponding values for each clinic are shown in green. Limit values are set to the greatest and the smallest value of each variable ± 1 SD. The poorest value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

The case-mix profile should always be considered when interpreting and comparing different hospitals value compasses.

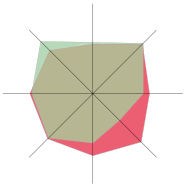


Value compasses (continued)

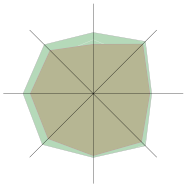
Lindesberg



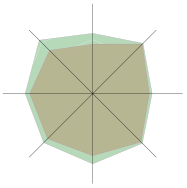
Linköping



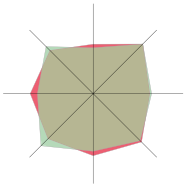
Ljungby



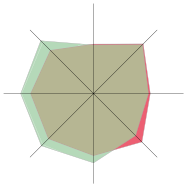
Lycksele



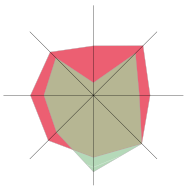
Mora



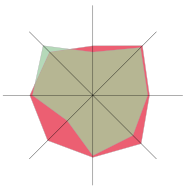
Norrköping



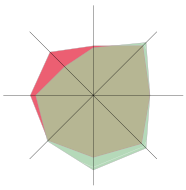
Norrtälje



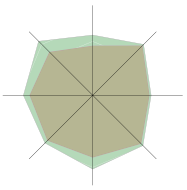
Nyköping



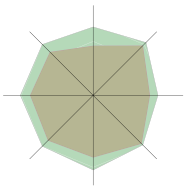
Ortho Center Stockholm



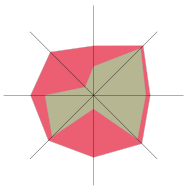
Oskarshamn



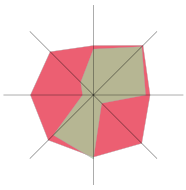
Piteå



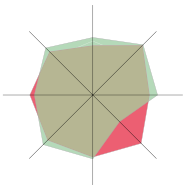
SU/Mölndal



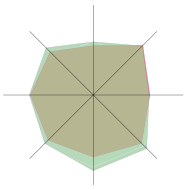
SUS/Lund



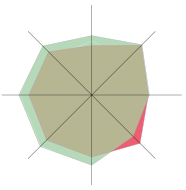
SUS/Malmö



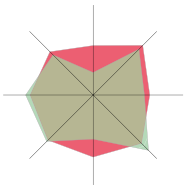
SUS/Trelleborg



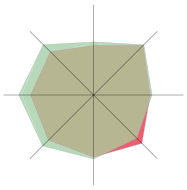
Skellefteå



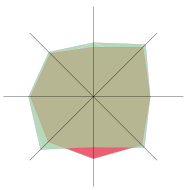
Skene



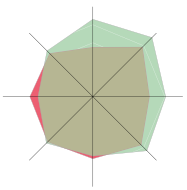
Skövde



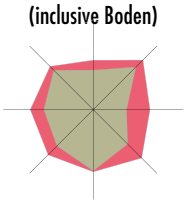
Sollefteå



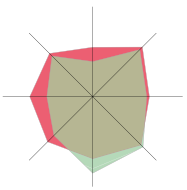
Sophiahemmet



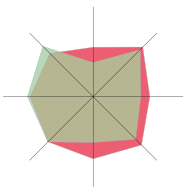
Sunderby (inclusive Boden)



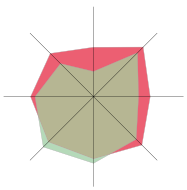
Sundsvall



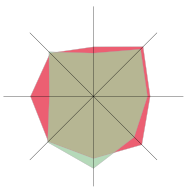
Södersjukhuset



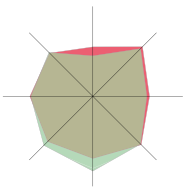
Södertälje



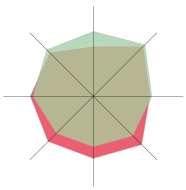
Torsby



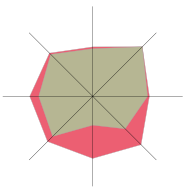
Uddevalla



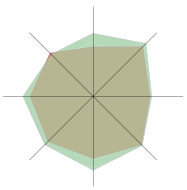
Umeå



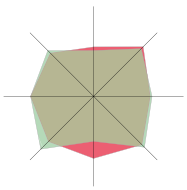
Uppsala



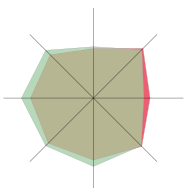
Varberg



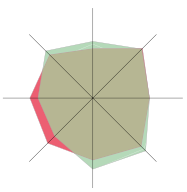
Visby



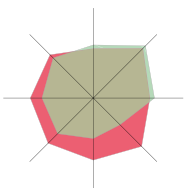
Värnamo



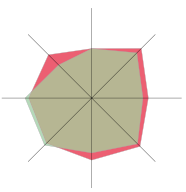
Västervik



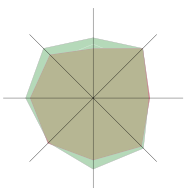
Västerås



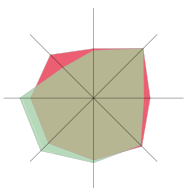
Växjö



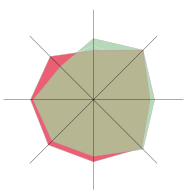
Örebro



Örnsköldsvik

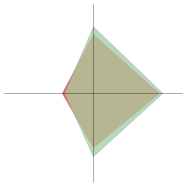


Östersund

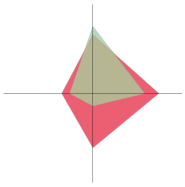


"Case-mix" profiles (continued)

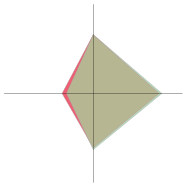
Lindesberg



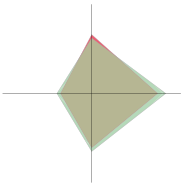
Linköping



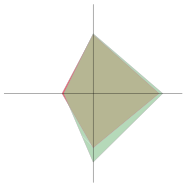
Ljungby



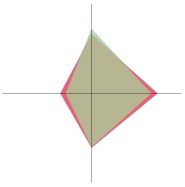
Lycksele



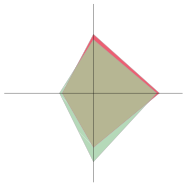
Mora



Norrköping



Norrtälje



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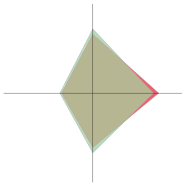

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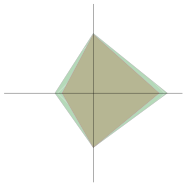

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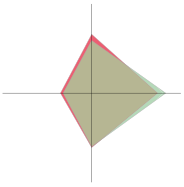

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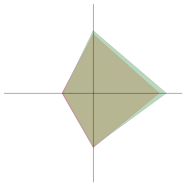

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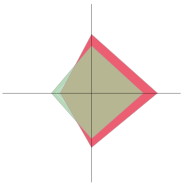

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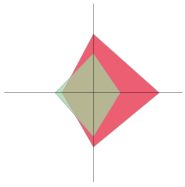

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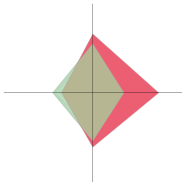

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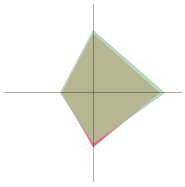

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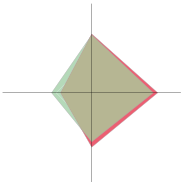

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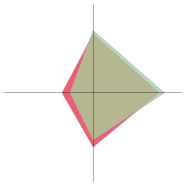

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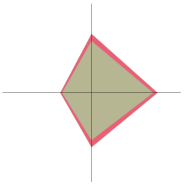

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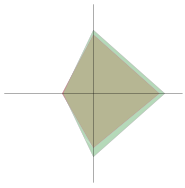

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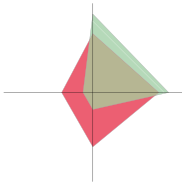

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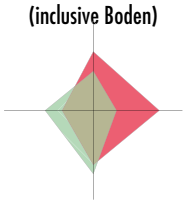

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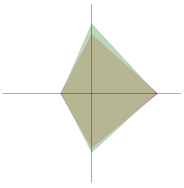

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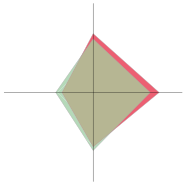

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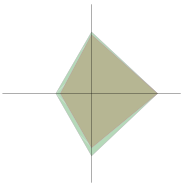

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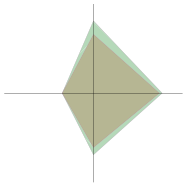

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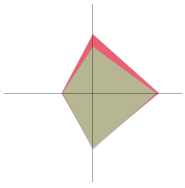

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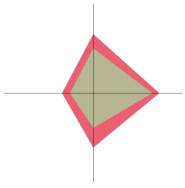

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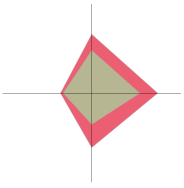

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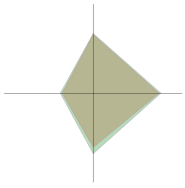

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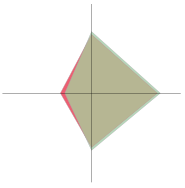

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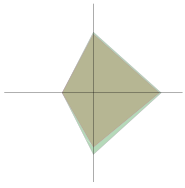

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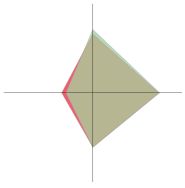

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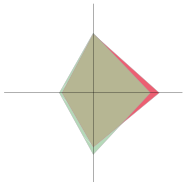

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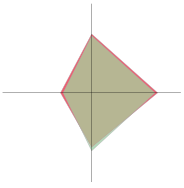

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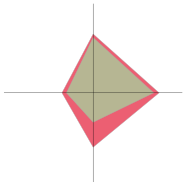

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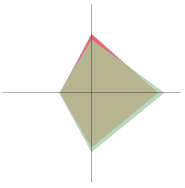

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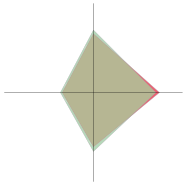


Notes

The "standard" patient

Reoperation within 2 years is one of the quality indicators that the Swedish Hip Arthroplasty Register reports and that is used for continual work towards improvement. This parameter must, however, be interpreted against the background of several factors. Especially important is the factor of background which can mean that patients with risk factors for early complications are concentrated to certain hospitals with the capacity to handle these complications should they arise. In order to facilitate an assessment of a particular hospital's performance and also possible comparisons, we have constructed the "standard" patient. The presumption has been that the "standard" patient might be a woman or a man, that about half the patients to be operated each year should be included, and that the "standard" patient be represented at the majority of those hospitals that perform primary total hip replacement.

The Swedish Hip Arthroplasty Register's data catch is limited for a number of reasons. Certain variables to be registered before surgery directly or indirectly influence the risk that the patient will be affected by an early complication. BMI and ASA class are two such variables introduced in 2007, and where registration became relatively complete during 2008. Apart from these two variables, gender, age, diagnosis and Charnley class are also included. The diagnosis has been divided into primary and secondary. A further division of the secondary group into inflammatory joint disease, acute fracture/residual condition after fracture, idiopathic necrosis, residual condition after hip disease during childhood/adolescence and others shows that all these groups have an increased risk apart from patients who have a residual condition after hip disease since childhood. We have not separated out this group. The reasons are that the group is still relatively small and often demands specific surgical competence, in other words to be concentrated to a very few hospitals.

In this year's analysis, 69,531 hip operations with complete data for all variables except for Charnley class (n=56 452) are included. In contrast to previous years' analyses, we have divided the age group 80 years old and older into two groups, 80–84 and 85 years old and above. The increased risk for the group 80 years of age and over mainly concerns the patients aged 85 and older (Table 1). As can be seen from the same table, patients younger than 55 do not run any increased risk of having to undergo early reoperation, either. We have however selectioned this group out of our definition of the "standard" patient since these patients can be expected to have an increased risk for reoperation/revision in a more long-term perspective (see in-depth analysis "Young patients").

In the first analysis we find that male gender, age 85 years and above, secondary osteoarthritis, BMI 25 kg/m^2 or higher, ASA class II or more constitute risk factors whether one investigates every possible risk factor separately (Table 1) or takes into consideration possible covariation. If patients with secondary osteoarthritis are excluded, the same risk factors remain (Table 2). When defining the "standard" patient, apart from patients with secondary osteoarthritis we have excluded ages groups below 55 as well as 85 years and above, BMI <18.5 as well as 30 and above, and ASA class III without taking into consideration possible covariation between variables. After this 34,226 operations remain, corresponding to about half of the 69,531 on whom the initial analysis is based.

In the third evaluation only two factors with increased risk remain, namely male gender and the group with BMI 25–29 (Table 3). The results do not change much if one adjusts for covariation. The first risk group male gender will be included according to the input criteria stated. The second group, BMI 25–29 remains so that the group will not be too small. This group is the largest and constitutes 42% of all patients in the original analysis, while patients with normal weight (18.5–24) are in second place (33.8%).

Our definition of the "standard" patient is a woman or man aged 55–84.9 with primary osteoarthritis, BMI 18.5–29 and ASA I or II. As can be seen in Table 4, "survival" based on some form of secondary hip-linked intervention is 97.9% in the entire patient group, and 98.7% for the "standard" patient. The "standard" patient is operated mainly at county, sub-county or private hospitals. The greatest proportion of this patient category is to be found at private hospitals (62.3%) followed by sub-county hospitals (53.5%, Table 5). The distribution of patients between different types of hospital can now be discussed against the background of changes in principal directorship that occurs continually.

Reoperation within 2 years is, however, a relatively short period of time when it comes to evaluating results after hip arthroplasty. To illustrate the effects of the so-called "case-mix" factor, we have also made a comparison between the main groups of hospitals in the Hip Register. If the analysis includes all patients then the risk of reoperation is lowest for those patients who are operated at sub-county hospitals followed by those operated at private hospitals (Table 5, top). If the analysis is limited to the "standard" patient then the risk is still lowest for patients operated at sub-county hospitals, while the highest risk is run by patients operated at private hospitals. If one also adjusts for the risk factors that we identified in the group of "standard" patients, then the difference is even clearer.

Our definition of the "standard" patient is a woman or man aged 55–84.9 with primary osteoarthritis, BMI 18.5–29 and ASA I eller II. This group of patients has a reduced risk of complications leading to reoperation within 2 years of primary total hip replacement, compared with other patients. Comparison of the results for this group over time and between different operating healthcare units provides a fairer picture of the results.

Analysis of risk factors for reoperation within 2 years

Variable		n	RR	95% C.I.	p-value
Gender					
Male		29,245	**1.38**	1.23–1.53	*<0.0005*
Females*		40,286	1.00		
Age years					
<50		3,664	1.03	0.78–1.35	*0.85*
50–54		3,490	1.12	0.86–1.47	*0.41*
55–59		5,865	1.06	0.84–1.33	*0.64*
60–64		10,454	0.96	0.79–1.16	*0.66*
65–69*		13,134	1.00		
70–74		12,401	0.94	0.78–1.13	*0.49*
75–79		10,718	1.10	0.92–1.33	*0.30*
80–84		6,614	1.14	0.92–1.41	*0.24*
>=85		3,191	**1.67**	1.31–2.13	*<0.0005*
Diagnosis					
Secondary osteoarthritis		9,498	**2.17**	1.92–2.47	*<0.0005*
Primary osteoarthritis*		60,033	1.00		
Charnley class					
A or B*		33,215	1.00		
C		23,237	1.12	0.98–1.27	*0.09*
BMI					
<18.5	underweight	890	1.49	0.94–2.37	*0.09*
18.5–24	normal*	23,504	1.00		
25–29	overweight	29,213	**1.18**	1.03–1.35	*0.02*
30–34	obesity	12,141	**1.65**	1.41–1.92	*<0.0005*
>=35	severe obesity	3,779	**2.24**	1.82–2.75	*<0.0005*
ASA					
I	healthy*	17,005	1.00		
II	mild systemic disease.	40,577	**1.43**	1.22–1.66	*<0.0005*
III–V	severe/lifethreatening systemic disease	11,949	**2.56**	2.17–3.04	*<0.0005*

*Reference group

Table 1. Analysis of risk factors for reoperation within 2 years without adjustment of covariation between variables. All patients with complete data except from Charnley class (n=56 452) are included. Risk ratios different from 1.0 are indicated in bold.

Primary osteoarthritis: risk factors for reoperation within 2 years

Variabel		n	RR	95% C.I.	p value
Gender					
Males		25,967	**1.44**	1.27–1.64	*<0.0005*
Females*		34,066	1.00		
Age year					
<50		2,550	1.05	0.74–1.48	*0.79*
50–54		2,981	1.23	0.90–1.67	*0.20*
55–59		5,207	1.26	0.98–1.62	*0.07*
60–64		9,442	1.01	0.80–1.26	*0.95*
65–69*		11,645	1.00		
70–74		10,931	1.04	0.84–1.28	*0.75*
75–79		9,251	1.14	0.91–1.42	*0.25*
80–84		5,601	1.20	0.94–1.54	*0.15*
>=85		2,425	**1.74**	1.29–2.33	*<0.0005*
Charnley class					
A or B*		30,929	1.00		
C		21,231	1.12	0.97–1.27	*0.14*
BMI					
<18.5	underweight	470	1.67	0.86–3.26	*0.13*
18.5–24	normal*	18,923	1.00		
25–29	overweight	26,070	**1.27**	1.08–1.51	*0.004*
30–34	obesity	11,115	**2.01**	1.68–2.41	*<0.0005*
>=35	severe obesity	3,451	**2.75**	2.18–3.46	*<0.0005*
ASA					
I	healthy*	15,423	1.00		
II	mild systemic disease	35,520	**1.35**	1.14–1.59	*<0.0005*
III–V	severe/lifethreatening systemic disease	9,090	**2.23**	1.84–2.71	*<0.0005*

*Reference group

Table 2. Analysis of risk factors for reoperation within 2 years without adjustment of covariation between variables. The analysis only includes patients with osteoarthritis. Primary THRs performed in 2008-2012. There are missing registrations on Charnley class. Risk ratios different from 1.0 are indicated in bold.

The "standard" patient – risk factors for reoperation within 2 year

Variable	N	RR	95% C.I.	p-value
Gender				
Males	14,426	**1.61**	1.32–1.97	*<0.0005*
Females*	19,800	1.00		
Age year				
55–59	3,467	1.24	0.86–1.79	*0.25*
60–64	6,375	1.07	0.78–1.48	*0.66*
65–69*	7,768	1.00		
70–74	7,204	1.14	0.84–1.55	*0.40*
75–79	5,893	1.10	0.80–1.52	*0.57*
80–84	3,519	1.32	0.93–1.90	*0.12*
Charnley class				
A or B*	19,968	1.00		
C	11,059	1.06	0.85–1.32	*0.63*
BMI				
18.5–24 normal*	14,342	1.00		
25–29 overwieght	19,884	**1.33**	1.09–1.64	*0.006*
ASA				
I healthy*	10,506	1.00		
II mild systemic disease	23,720	1.17	0.94–1.45	*0.17*

*Referencegrupp

Table 3. Analysis of risk factors for reoperation within 2 years without adjustment of covariation between variables. Only "standard patients" are included. Primary THRs performed 2008–2012. There are missing registrations on Charnley class.

Reoperation within 2 years – "survival" for different patient categories

	n	Proportion not reoperated	Reoperated *Proportion in %*
All THRs - all diagnoses	69,531	97.91±0.12	*1.9*
Primary osteoarthritis only	60,033	98.18±0.12	*1.6*
"Standard patient" only	34,226	98.67±0.14	*1.2*

Table 4. Implant survival for THRs performed 2008–2012 with complete data on gender, age, diagnosis, BMI, and ASA class.

Risk of reoperation within 2 years for different patient groups

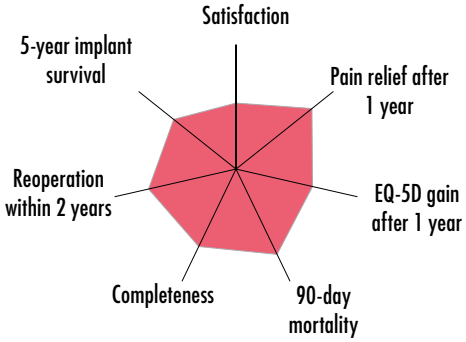
	N	RR, 95% C.I.	p-value	Proportion "standard patients" *(%)*
All THRs¤				
Rural hospitals *	26,547	1.00		53.5
Central hospitals	23,822	1.57 *1.30–1.89*	*<0.0005*	44.0
University or regional hospitals	6,978	1.59 *1.40–1.82*	*<0.0005*	26.5
Private hospitals	12,184	1.28 *1.08–1.51*	*0.004*	62.3
Only "standard patients"¤				
Rural hospitals *	14,305	1.00		
Central hospitals	10,483	1.34 1.05–1.70	*0.02*	
Universitetssjukhus	1,850	1.28 *0.82–1.98*	*0.28*	
Private hospitals	7,588	1.47 *1.14–1.90*	*0.003*	
Only "standard patients"#				
Rural hospitals *	14,305	1.00		
Central hospitals	10,483	1.35 *1.07–1.72*	*0.01*	
Universitetssjukhus	1,850	1.29 *0.83–2.01*	*0.26*	
Private hospitals	7,588	1.53 *1.30–1.95*	*<0.0005*	

¤ without adjusting for risk factors in table 1 och 2; * reference group; # adjusted for variation in gender, age, BMI, and ASA class within the group (Table 3)

Table 5. The risk of reoperation within 2 years for primary THRs 2008–2012 where rural hospitals is the reference. Types of hospitals have differing proportion of standard patinets which affects the outcomes

Quality indicators for the "standard patient"

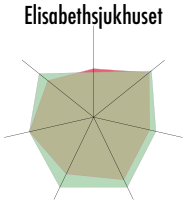
value compass – national average



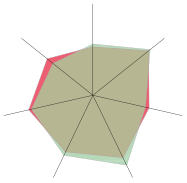
The value compasses show in red national results for the seven variables included. Each department's corresponding values are shown in green. Limit values are set to the highest and lowest value for each variable ± 1SD. The poorest value for the variables is at the origo and the best on the periphery.

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

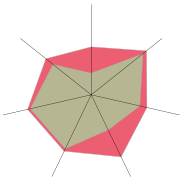
Aleris Spec.vyeard Elisabethsjukhuset



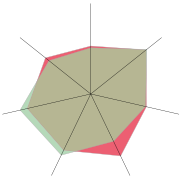
Alingsås



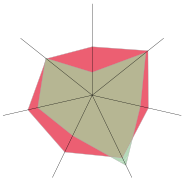
Arvika



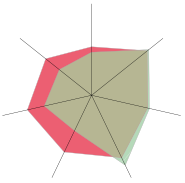
Bollnäs



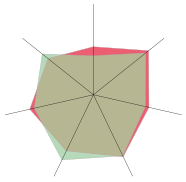
Borås



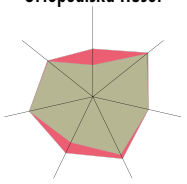
Capio Movement



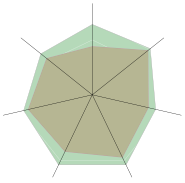
Capio S:t Göran



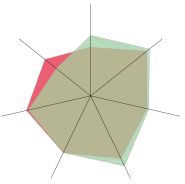
Carema Ortopediska Huset



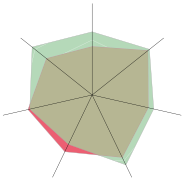
Carlanderska



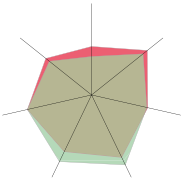
Danderyd



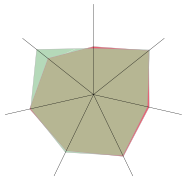
Eksjö



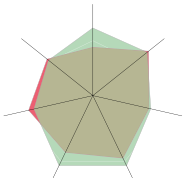
Enköping



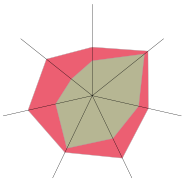
Falun



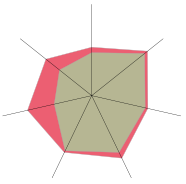
Gällivare



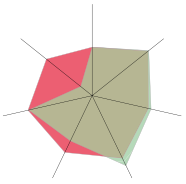
Gävle



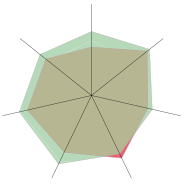
Halmstad



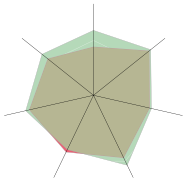
Hudiksvall



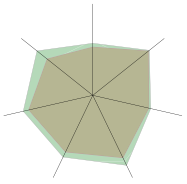
Hässleholm-Kristianstad



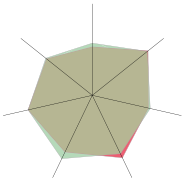
Jönköping



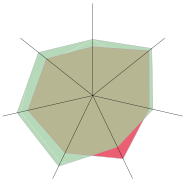
Kalmar



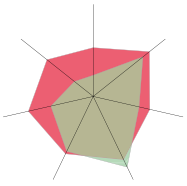
Karlshamn



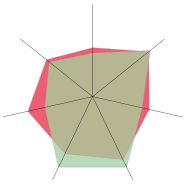
Karlskoga



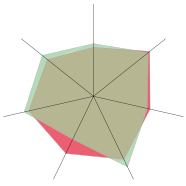
Karlstad



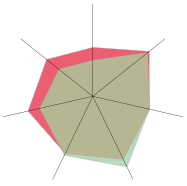
Karolinska/Huddinge



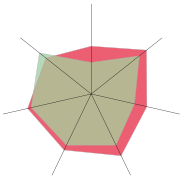
Karolinska/Solna



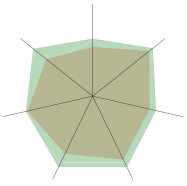
Katrineholm



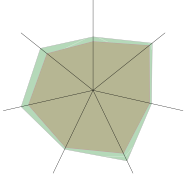
Kungälv



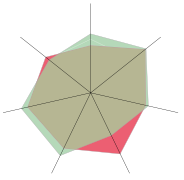
Lindesberg



Ljungby

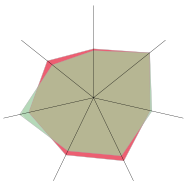


Lycksele

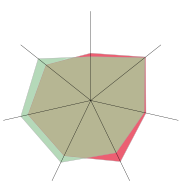


Value compasses (continued)

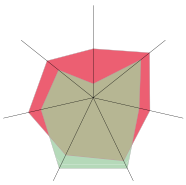
Mora



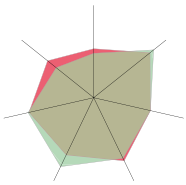
Norrköping



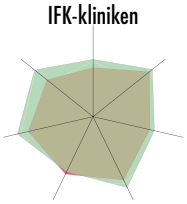
Norrtälje



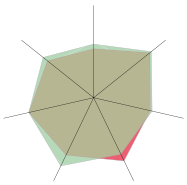
Ortho Center Stockholm



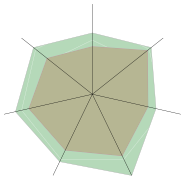
Ortho Center IFK-kliniken



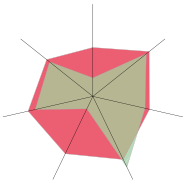
Oskarshamn



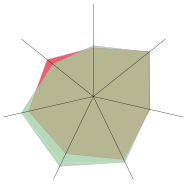
Piteå



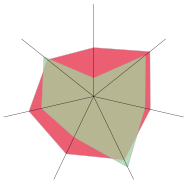
SU/Mölndal



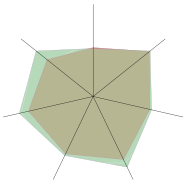
SUS/Trelleborg



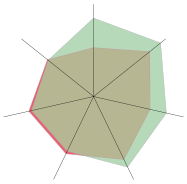
Skene



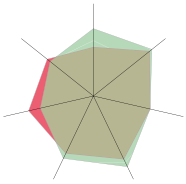
Skövde



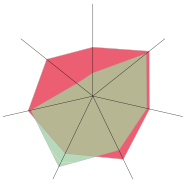
Sophiahemmet



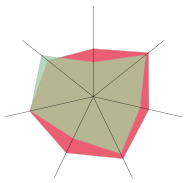
Spenshult



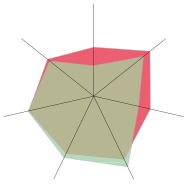
Sundsvall



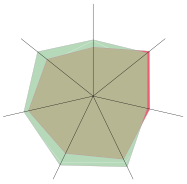
Södersjukhuset



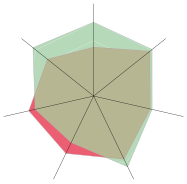
Södertälje



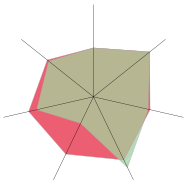
Uddevalla



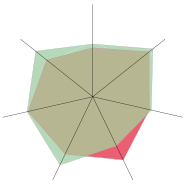
Umeå



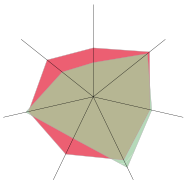
Uppsala



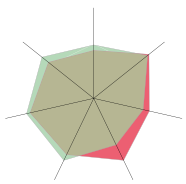
Varberg



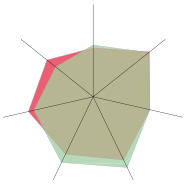
Visby



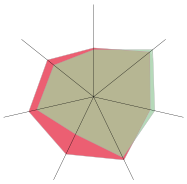
Värnamo



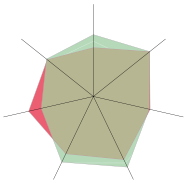
Västervik



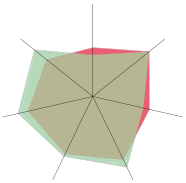
Västerås



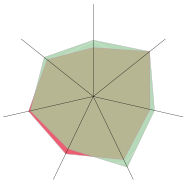
Örebro



Örnsköldsvik



Östersund



Follow-up of free care choice

Accessibility, in both the present care guarantee and in the previous "free care choice", is assessed, almost exclusively, as a time variable. The Register's directorship asserts that accessibility must be linked to both long-term and short-term outcomes, in a systematic way. This means demanding that decision-makers show increased perseverance before pleading for shorter waiting times for surgery as a secured quality gain for the patient.

The issue is whether or not results after a surgical intervention are worse when surgeons meet operation environments and types of prostheses that are most often new and unfamiliar to them or the reverse, that patients are listed in an operation queue at a place other than their home clinic and the indication is diagnosed by an orthopedic specialist who does not perform the surgery. The highly productive elective units often use surgeons from other clinics to meet the demand for high production rates. One conceivable scenario might therefore be that both surgeon and patient, when they meet in the operating theatre, come from different places and thereafter never meet again!

With this as background the Register, in the Annual Report 2004, initiated an analysis of patients who had been operated for total hip replacement away from their home region during the years 2002 and 2003. As is clear from earlier reports, we follow this group of patients continually. Below is a brief summary of the investigation serving as basic data for this year's follow-up (for details see the Annual Reports for 2004–2010).

Material

- The analysis included only the "standard" patient, that is to say, with primary osteoarthritis as the diagnosis and operated with cemented total prosthesis elsewhere than university clinics (to avoid referral cases).
- Operated within the county: 14,785 hips; operated outside the county: 1,964 hips (2002 and 2003).

Reoperation frequency

	THR in county council (n = 14,785)		Free-choice-of-care (n = 1,964)	
Reason	**Number**	**Proportion %**	**Number**	**Proportion %**
Aseptic loosening	239	1.6%	51	2.6%
Deep infection	97	0.7%	18	0.9%
Fracture	62	0.4%	5	0.3%
Implant fracture	13	0.1%	3	0.2%
Dislocation	125	0.8%	18	0.9%
Technical error	12	0.1%	2	0.1%
Pain only	8	0.1%	0	0%
Miscellaneous	20	0.1%	2	0.1%
Total	576	3.9%	99	5.0%

Table 1. Reoperaion frequency per reason for patients with THR within their county council and for those with THR in"free choice of care". Reoperations up to 2011.

This year's comparison

The average follow-up at this year's analysis was 120 months. In both groups, an additional number of reoperations were performed during 2012. The difference between the groups with regard to the causes for reoperation is 1.1%. In the in-county group, 3.9% are now reoperated, and in the free care choice group the corresponding figure is 5.0%. In a Kaplan-Meier analysis the difference is significant (LogRank test, p=0.03). In this material, revision due to aseptic loosening is now the most common cause of substitution operation.

Discussion

The follow-up period can now be considered long (10 years) and is beginning, to a greater extent, to reflect revision due to aseptic loosening. Many might criticize this more and more historical follow-up and the fact that the group studied does not reflect results for the current situation, however it takes 8–10 years to detect the differences with regard to the frequency of revisions due to aseptic loosening. Now that we have followed up this cohort for 10 years we can conclude this follow-up. A new group will now be followed up instead. The patients in this group were operated between 2007 and 2011. The Register's database from this period has been cross-referenced with Statistics Sweden (Statistiska centralbyrån) and the Patient Register of the Swedish National Board of Health and Welfare. A first analysis is under way and an account will be given in the next report.

In conclusion we now find a significantly poorer result for those operated outside the county in the earlier form of "free choice of health care" after 10 years. We cannot analyse the reason for this but the discovery is ominous and shows clearly that accessibility measured in time to operation is a process measure and not an adequate and comprehensive result measurement.

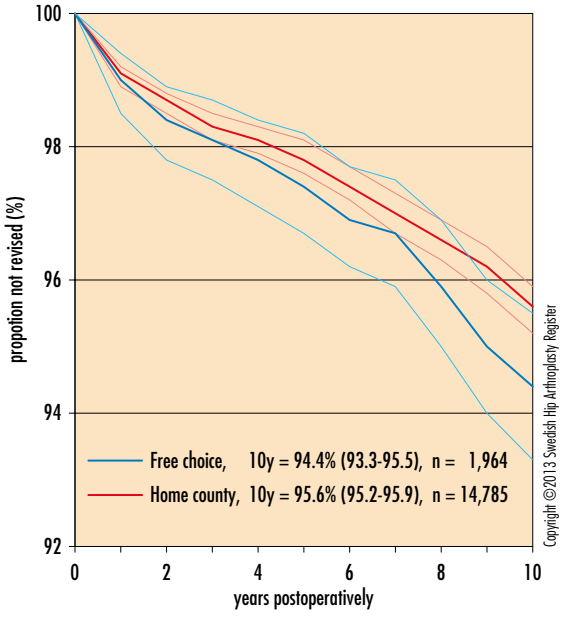


Figure 1. Implant survival for those with THR according to"free-choice-of-care" and those with THR within the county council. The difference is significant according to LogRank test (p = 0.03).

Mortality after total hip replacement

Background

90-day mortality was introduced seven years ago as an open variable on a unit level. This variable is also included as one of eight parameters in the value compass. Even if hip arthroplasty today is considered routine surgery, it is a major surgical intervention and by no means risk-free. The indications for arthroplasty have been expanded during recent years – nationally as well as internationally. More patients, both younger and old are operated now than during the 80s and 90s. The latter group runs a particularly greater natural risk of serious complications. Nowadays, and mainly at larger units, more high-risk patients undergo operation than previously.

The Swedish Hip Arthroplasty Register updates its database several times a year with respect to the input of dates of death via the Swedish tax authorities (Skatteverket).

Short-term mortality (90-day mortality)

90-day mortality is an indicator frequently used in the literature and applied in several medical fields. The causes for a patient's death in connection with or within 90 days from a hip arthroplasty (and related to the intervention) can be many, but the dominant causes seem to be cardiac, cerebrovascular or thromboembolic illnesses.

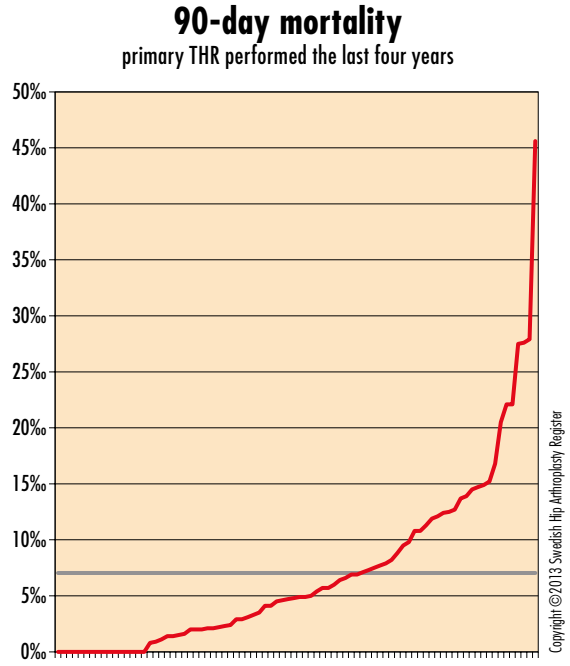
Due to the low death toll, the last four years' production will be analyzed to partially compensate for the risk of chance variability.

90-day mortality varies between Swedish hospitals during the years of observation: from 0%–45.6% and with an average value for the country of 6.9%. As expected, 90-day mortality is higher after surgery at university/regional hospitals and county hospitals compared with sub-county hospitals, and above all compared with private care units. This reflects the hospitals' patient base or "case-mix".

We recommend clinics to analyze their deaths as a link in this work for patient safety. Patients have an expected risk to die at the age in question, but a high qualitative preoperative medical risk assessment is something all units should strive to attain. In such a development it is important to know the number of patients who have died. It is not self-evident for an orthopaedic clinic to receive feedback that a patient has, for example, died of a cardiovascular condition three weeks postoperatively at another clinic or even at another hospital.

The Register plans an in-depth analysis and research project with respect to mortality after total hip replacement. In this study we will include the Cause of Death Register and a number of variables such as diagnosis, gender, fixation method, preoperative comorbidity, socioeconomic variables, etc.

The figures for mortality are generally low and must be assessed with the same exactitude as the variable "reoperation within 2 years", that is to say it must be assessed as a possible trend over time.



The grey curve represents national average 6.9‰.

Each subscale indicator represents one hospital.

90-day mortality

Proportion desease within three months after primary THR, 2009–2012

Hospital	Number[1)]	OA[2)]	≥60[3)]	Females[4)]	Mortality[5)]
University or regional hospitals					
Karolinska/Huddinge	1,011	69%	62%	52%	4.9‰
Karolinska/Solna	797	63%	65%	56%	11.3‰
Linköping	254	62%	58%	52%	**27.6‰**
SU/Mölndal	1,574	62%	77%	64%	10.8‰
SU/Sahlgrenska	19	5%	68%	56%	0‰
SU/Östra	39	90%	82%	79%	0‰
SUS/Lund	439	22%	76%	63%	**45.6‰**
SUS/Malmö	358	28%	78%	64%	**27.9‰**
Umeå	329	73%	71%	53%	**15.2‰**
Uppsala	1,175	56%	69%	56%	**22.1‰**
Örebro	654	76%	68%	55%	4.6‰
Central hospitals					
Borås	742	67%	88%	63%	12.1‰
Danderyd	1,320	71%	87%	64%	9.8‰
Eksjö	803	93%	83%	54%	5.0‰
Eskilstuna	477	58%	88%	65%	**16.8‰**
Falun	1,411	88%	80%	57%	2.1‰
Gävle	740	68%	78%	57%	10.8‰
Halmstad	912	81%	86%	58%	3.3‰
Helsingborg	271	61%	88%	64%	**22.1‰**
Hässleholm-Kristianstad	3,140	89%	85%	57%	4.5‰
Jönköping	823	82%	82%	61%	7.3‰
Kalmar	664	75%	85%	55%	6.0‰
Karlskrona	134	23%	95%	55%	14.9‰
Karlstad	1,035	61%	81%	60%	14.5‰
Norrköping	947	74%	82%	55%	12.7‰
Skövde	675	77%	78%	57%	11.9‰
Sunderby	146	15%	87%	70%	**20.5‰**
Sundsvall	832	82%	84%	57%	4.8‰
Södersjukhuset	1,522	69%	84%	63%	12.5‰
Uddevalla	1,327	80%	83%	58%	7.5‰
Varberg	939	87%	86%	60%	6.4‰
Västerås	1,820	70%	86%	60%	**27.5‰**
Växjö	527	80%	84%	56%	9.5‰
Ystad	24	0%	88%	92%	0‰
Östersund	1,050	78%	84%	60%	5.7‰

(Continued on next page.)

90-day mortality (cont.)

Proportion deseased within three months after primary THR, 2009–2012

Hospital	Number[1)]	OA[2)]	≥60[3)]	Females[4)]	Mortality[5)]
Rural hospitals					
Alingsås	843	94%	87%	59%	0‰
Arvika	722	91%	89%	58%	6.9‰
Bollnäs	1,006	95%	83%	58%	2.0‰
Enköping	1,114	95%	92%	58%	0.9‰
Falköping	482	94%	88%	55%	0‰
Frölunda Specialistsjukhus	322	99%	84%	66%	3.1‰
Gällivare	388	76%	85%	58%	7.7‰
Hudiksvall	505	75%	84%	58%	2‰
Karlshamn	861	95%	83%	54%	3.5‰
Karlskoga	565	92%	89%	58%	8.8‰
Katrineholm	920	98%	83%	55%	1.1‰
Kungälv	677	89%	84%	62%	1.5‰
Lidköping	628	91%	86%	54%	1.6‰
Lindesberg	863	89%	87%	56%	2.3‰
Ljungby	699	88%	83%	55%	2.9‰
Lycksele	1,236	98%	84%	60%	5.7‰
Mora	858	91%	90%	57%	8.2‰
Motala (up to 2009)	340	92%	81%	56%	2.9‰
Norrtälje	456	80%	90%	60%	6.6‰
Nyköping	679	76%	85%	59%	14.7‰
Oskarshamn	810	97%	81%	56%	4.9‰
Piteå	1,487	96%	81%	57%	5.4‰
SUS/Trelleborg	2,394	93%	80%	59%	2.1‰
Skellefteå	365	77%	79%	64%	13.7‰
Skene	411	93%	78%	53%	0‰
Sollefteå	487	93%	87%	57%	4.1‰
Södertälje	482	84%	87%	61%	12.4‰
Torsby	433	88%	86%	59%	13.9‰
Visby	483	89%	84%	55%	4.1‰
Värnamo	562	86%	86%	58%	7.1‰
Västervik	451	85%	82%	55%	2.2‰
Ängelholm	511	98%	88%	64%	2.0‰
Örnsköldsvik	631	94%	85%	59%	7.9‰

(Continued on next page.)

90-day mortality (cont.)

Proportion desease within three months after primary THR, 2009–2012

Hospital	Number[1)]	OA[2)]	≥60[3)]	Females[4)]	Mortality[5)]
Private hospitals					
Aleris Ortopedi i Ängelholm	7	100%	71%	43%	0‰
Aleris Spec.vyeard i Motala	1,304	97%	89%	55%	0.8‰
Aleris Specialistsjukvård Bollnäs	241	97%	83%	51%	0‰
Aleris Specialistsjukvård Elisabethsjukhuset	279	90%	80%	52%	0‰
Aleris Specialistsjukvård Nacka	488	99%	83%	58%	0‰
Aleris Specialistsjukvård Sabbatsberg	588	92%	78%	66%	0‰
Art Clinic	10	90%	90%	56%	0‰
Capio Movement	878	98%	77%	55%	0‰
Capio S:t Göran	1,699	87%	82%	63%	4.7‰
Carema Ortopediska Huset	1,431	99%	80%	60%	1.4‰
Carlanderska	440	97%	65%	43%	0‰
Ortho Center Stockholm	1,678	98%	82%	63%	2.4‰
OrthoCenter IFK-kliniken	501	95%	65%	43%	0‰
Sophiahemmet	706	100%	60%	44%	1.4‰
Spenshult	761	85%	77%	58%	0‰
Nation	63,612	84%	82%	58%	6.9‰

[1)] The number of primary THRs during the current period.

2) Proportion of primary THRs performed on patients with primary osteoarthritis.

3) Proportion of primary THRs performed on patients 60 years or older.

4) Proportion of primary THRs performed on women.

5) 90-days mortality (number of patients deceased within three months after primary THR/ total number of primary THRs).

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

Gender

More women than men have total hip replacement in Sweden. In 1992 the proportion of women was 59.4% but has decreased slowly to 58.1%. in 2012. The reduction is due to the decrease in the number of women with secondary osteoarthritis, and above all on the drastic decrease in inflammatory arthritis since the 1990s. In the group primary osteoarthritis the proportion of women has instead increased from 54.4 to 56.8%.

Between 1992 and 2012 the average age for operation has been lowered by 1.3 years for men and 0.8 years for women (Figure 1). Age changes for primary operations can be seen by studying different age groups. Relatively speaking, the group under 55 years of age is largest for men, but the group aged 75 and older is largest for women. In the group younger than 55 there has been a relative increase for both genders. The proportion in the group 55–64 years of age also increased up until 2004–2006 after which it decreased somewhat for both men and women (Figure 2). In the group aged 65–74 we see a successive decrease up until 2007–2009 and 2010–2012 when this proportion increased for both genders. Irrespective of gender, the proportion of patients aged 75 and older has successively decreased. If the analysis is limited to patients operated due to primary osteoarthritis the picture is similar.

The distribution of diagnoses differs between men and women (Figure 3) Inflammatory arthritis, hip fracture and sequele after infantile disorders are more common in women; primary osteoarthritis and avascular necrosis are more common in men. Since the early 1990s the distribution of diagnoses has changed. This applies especially to women where the biggest changes are due to a decrease in the relative proportions of inflammatory arthritis as well as hip fracture and other trauma diagnoses, and a corresponding increase of primary osteoarthritis. The decrease in fracture diagnoses coincides with an increased use of hemiprostheses at the beginning of this century. In men the proportion of inflammatory joint disease as a reason for total hip replacement has decreased by about 4%, corresponding to the increase of primary osteoarthritis during the same period.

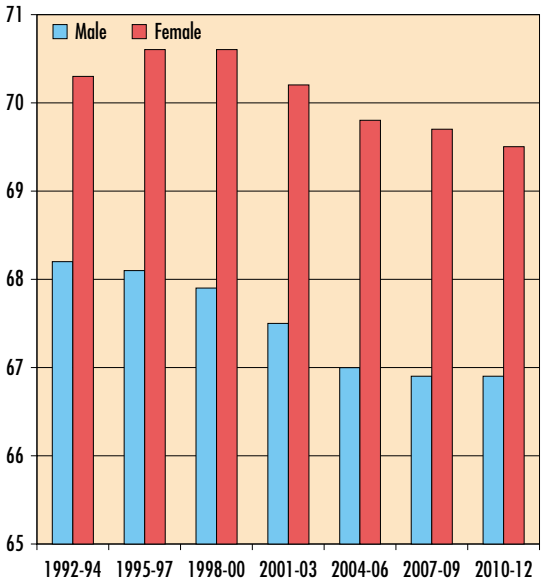


Figure 1. Mean age in males and femalesduring 3-year periods 1992–94 up to 2010–12. Y-axis starts at 65 years.

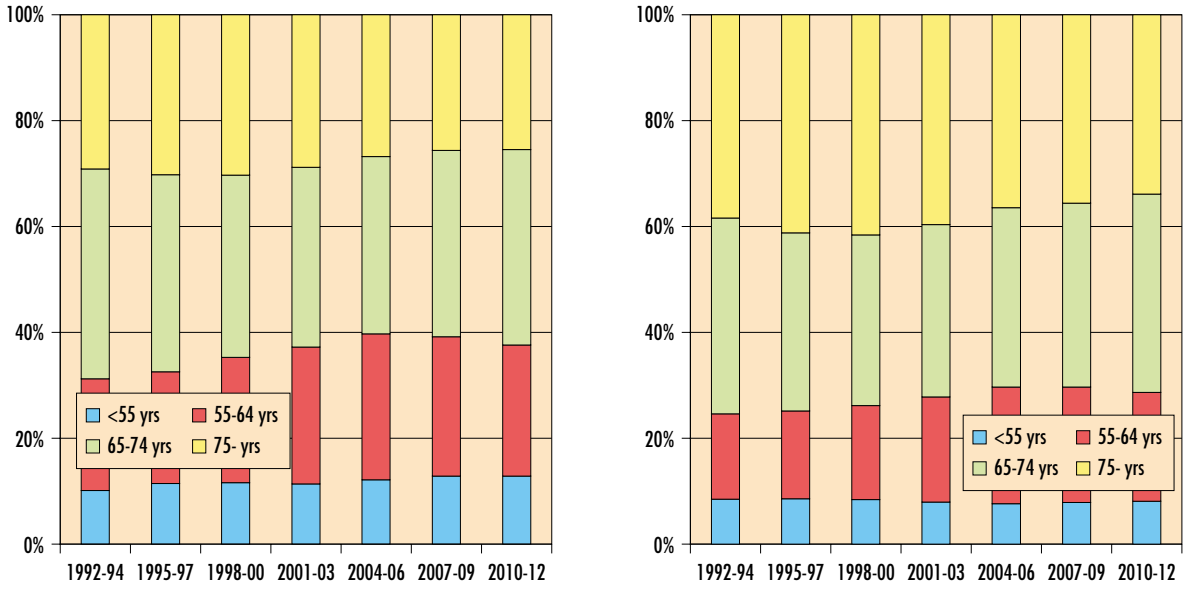


Figure 2. The distribution of males (left) and females (right) in four age groups during different 3-year periods from 1992–2012.

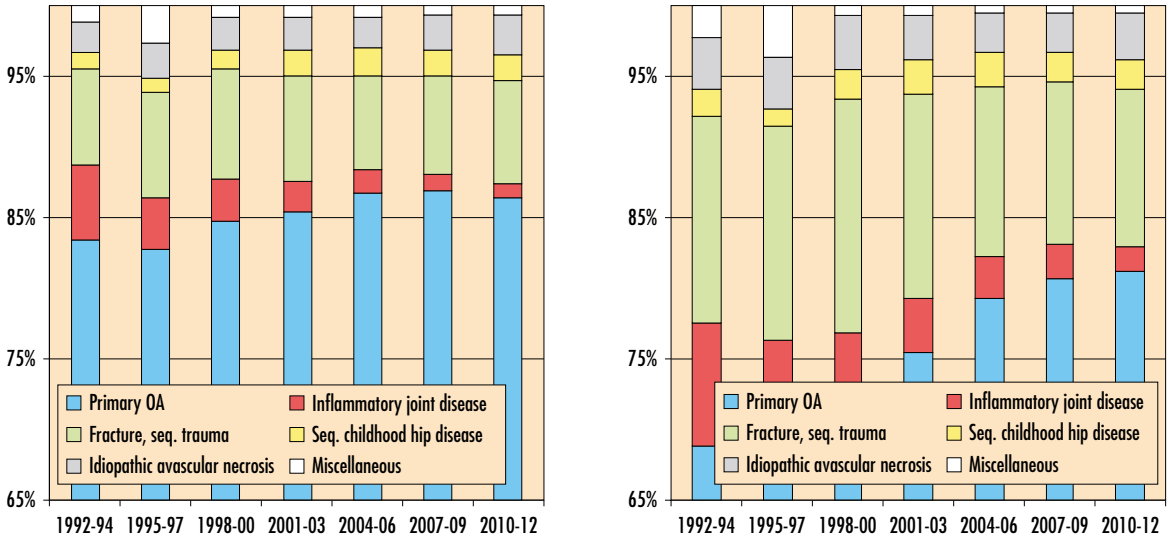


Figure 3. Distribution of diagnoses in males (left) and females (right). Y-axis starts at 65%.

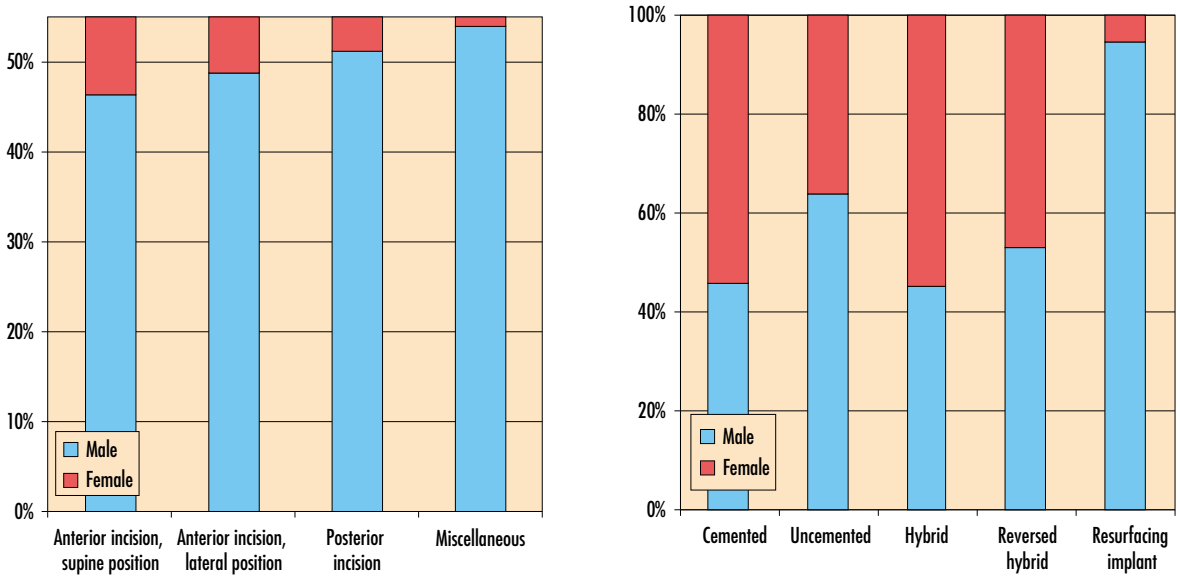


Figure 4. Distribution of surgical approches (left) and implant selection (right) 2010–12. Y-axis ends at 55% in the figure to the left.

During the past three years direct lateral approaches performed in supine or lateral position, have more often been used for women while the more posterior approach is used most often for men (Figure 4). In the subgroup primary osteoarthritis, the distribution is similar. The increased risk for dislocation in women probably plays a role in this selection since the direct lateral approaches in themselves entail less risk of dislocation. Women receive cemented prostheses oftener, and men more often uncemented. The few resurfacing prostheses inserted in 2010–2012 were used mainly on men (Figure 4).

Revision and patient-reported outcomes

Generally speaking, implant survival is better for women than men. Table 1 shows data for primary osteoarthritis. Gender differences do not apply to all the causes of revision, however. Revision due to loosening /osteolysis, infection and periprosthetic fracture are, in a 20-year perspective and without adjustment for possible covariation with other

Implant survival in males and females related to age and fixation

	Number THRs	Implant survival *at 20 years or earlier**		Risk ratio *up to 20 years or earlier*
	Male/female	*Males*	*Females*	*Male/female*
All diagnoses and reasons	78,963/108,230	82.3±1.0	88.0±0.8	**1.5** *1.4–1.5*
Primary osteoarthritis-all reasons				
<55 years				
Cemented	2,721/2,837	73.8±4.0	73.0±4.8	1.1 *0 ,98–1.3*
Uncemented*	3,465/2,689	71.6±4.5	71.6±4.4	0.9 *0.7–1.1*
55–64 years				
Cemented	14,315/17,647	78.5±1.8	83.9±1.5	**1.5** *1.4–1.5*
Uncemented*	4,154/3,397	84.6±4.0	82.4±4.0	1.0 *0.8–1.3*
65–75 years				
Cemented	29,662/40,232	85.1±1.2	90.3±1.0	**1.6** *1.5–1.7*
Uncemented*	1,506/1,085	91.9±4.0	93.5±5	1.7 *0.99–2.8*
75- years				
Cemented	22,899/40,120	91.5±2.0¤	95.7±0.6	**1.7** *1.5–1.9*
Uncemented*	240/223	98.6±1.5	97.0±2.4	0.5 *0.2–1.8*

*Uncemented fixation: <55 years – 18 years; 55–64 years – 15 years; 65–75 years – 10 years; 75 years or older – 2 year

Table 1. Implant survival for males and females in the group primary osteoarthritis divided by age groups and cemented or uncemented fixation. Hybrids, reversed hybrids, and resurfacing implants have been excluded. Follow-up time has been maximized to include at least 50 observations at the end of follow-up per group.

factors, more common in men, while the risk for revision due to dislocation is the same (data not shown). Closer study of the primary osteoarthritis group and divided into age groups shows that the increased risk for revision in men can first and foremost be traced to the age group 55 years of age and older when a cemented prosthesis is used. It should, however, be pointed out that the follow-up period for the uncemented groups is short, above all for the group aged 75 and older which moreover includes few observations.

The corresponding comparison between genders of patient-reported outcomes with a further limitation since only the first operated hip is included shows the pre- and postoperative profile that we described earlier. Women who are operated due to primary osteoarthritis have a lower EQ-5D and more pain according to the pain VAS before operation. The EQ-5D gain and pain reduction are better for women with two exceptions; the youngest group, where there is no difference when a cemented prosthesis is used, and in the groups 65 years of age or older where the effect does not differ for use of an uncemented prosthesis (Table 2). Generally speaking, women are less satisfied than men one year after operation. In this analysis, it appears that this only applies when a cemented prosthesis is used in the groups 55 years of age and older. In the youngest group, as well as all age groups when an uncemented prosthesis is used, we see no difference. It remains to be investigated whether or not this depends on different patient selection for cemented or uncemented fixation, or different characteristics in the two ways of fixating the prosthesis; or if it is only an effect of a limited number of observations in the uncemented group. The observed differences between genders remain at the 6-year follow-up (Table 3).

Women and men differ with respect to demographic variables, surgical approach and fixation of the prostheses. Generally speaking, the risk of revision is higher for men. Men also show poorer effects of surgery measured as EQ-5D gain and reduction of pain-VAS. An interesting observation is that this difference like the reverse difference with respect to satisfaction seems to be related to age at surgery as well as selection of cemented or uncemented prosthesis. So far, however, the number of patients in some of the groups analyzed is too small for definite conclusions to be drawn.

EQ-5D, pain och satisfaction related to age and gender 0–1 year

	Number *only first side*	1-year postop	Difference *0 – 1 yr*	ANOVA *difference*	ANOVA *preop./difference**
<55 yrs *male/female*					
EQ-5D index					
Cemented	286/406	0.36/0.31	0.78/0.74	0.42/0.44	0.02/0.45
Uncemented	1,126/864	0.44/0.32	0.83/0.78	0.40/0.47	<0.0005/<0.0005
Pain VAS					
Cemented	286/406	60/67	16/17	–44/–50	<0.0005/0.001
Uncemented	1,126/864	61/67	12/12	–49/–55	<0.0005/<0.0005
Satisfaction VAS					
Cemented	286/406	–/–	16/15	–/–	0.45*
Uncemented	1,126/864	–/–	11/12	–/–	0.22*
55–64 yrs *males/feales*					
EQ-5D index					
Cemented	3,040/3,962	0.45/0.35	0.81/0.76	0.36/0.41	<0.0005/<0.0005
Uncemented	1,548/1,238	0.47/0.38	0.83/0.79	0.36/0.41	<0.0005/<0.0005
Pain VAS					
Cemented	3,040/3,962	59/65	13/15	–46/–50	<0.0005/<0.0005
Uncemented	1,548/1,238	59/64	11/12	–47/–52	<0.0005/<0.0005
Satisfaction VAS					
Cemented	3,040/3,962	–/–	13/16	–/–	<0.0005*
Uncemented	1,548/1,238	–/–	12/13	–/–	0.40*
65–74 yrs *malew/females*					
EQ-5D index					
Cemented	6,582/9,161	0.48/0.41	0.82/0.77	0.35/0.37	<0.0005/<0.0005
Uncemented	573/364	0.50/0.42	0.83/0.80	0.34/0.37	<0.0005/0.11
Pain VAS					
Cemented	6,582/9,161	58/63	13/15	–46/–48	<0.0005/<0.0005
Uncemented	573/364	59/65	13/12	–46/–52	<0.0005/<0.0005
Satisfaction VAS					
Cemented	6,582/9,161	–/–	15/18	–/–	<0.0005*
Uncemented	573/374	–/–	13/15	–/–	0.26*
75– yrs *male/female*					
EQ-5D index					
Cemented	4,841/8,463	0.48/0.38	0.79/0.74	0.31/0.36	<0.0005/<0.0005
Uncemented	90/71	0.48/0.39	0.80/0.70	0.32/0.31	0.08/0.93
Pain VAS					
Cemented	4,841/8,463	58/64	14/16	–44/–48	<0.0005/<0.0005
Uncemented	90/71	64/69	16/14	–47/–55	0.04/0.04
Satisfaction VAS					
Cemented	4,841/8,463	–/–	17/20	–/–	<0.0005*
Uncemented	90/71	–/–	17/20	–/–	0.43*

* p-value for 1-year postoperative data

Table 2. Gender comparisons of patient-reprted outcomes up to one year postoperatively. Analyses only include patients with osteoarthritis and in if bilateral observations only first hip.

EQ-5D, pain och satisfaction related to age and gender 0–6 year

	Number *only first side*	6-year postop	Difference *1 – 6 yrs*	ANOVA *difference*
<55 yrs *male/female*				
EQ-5D				
Cemented	140/170	0.82/0.73	0.01/0.00	0.70
Uncemented	213/146	0.84/0.76	0.02/–0.03	0.06
Pain VAS				
Cemented	140/170	14/15	–2/–3	0.83
Uncemented	254/165	12/17	0/3	0.13
Satisfaction VAS				
Cemented	140/170	13/14	–2/–1	0.66
Uncemented	254/165	10/13	–1/–1	0.89
55–64 years *male/female*				
EQ-5D index				
Cemented	955/1,197	0.82/0.75	0.00/0.00	0.89
Uncemented	205/179	0.82/0.80	–0.01/–0.00	0.94
Pain VAS				
Cemented	1,164/1,523	13/16	1/1	0.53
Uncemented	205/179	12/11	2/0	0.21
Satisfaction VAS				
Cemented	1,164/1,523	14/17	1/0	0.56
Uncemented	205/179	12/11	2/–1	0.12
65–74 yrs *male/female*				
EQ-5D index				
Cemented	1,549/2,202	0.78/0.73	–0.04/–0.05	0.35
Uncemented	32/28	0.78/0.80	–0.06/0.01	0.17
Pain VAS				
Cemented	1,549/2,202	14/17	2/2	0.57
Uncemented	32/28	17/14	0/2	0.72
Satisfaction VAS				
Cemented	1,549/2,202	15/19	1/1	0.71
Uncemented	32/28	18/17	–1/–1	0.93
75– yrs *male/female*				
EQ-5D index				
Cemented	990/1,888	0.72/0.66	–0.09/–0.09	0.89
Uncemented	4/2	–/–	–/–	–
Pain VAS				
Cemented	1,256/2,445	16/18	2/3	0.53
Uncemented	4/2	–/–	–/–	–
Satisfaction VAS				
Cemented	1,256/2,445	19/21	2/1	0.64
Uncemented	4/2	–/–	–/–	–

Table 3. Comparisons between men and females of pateint-reported outcomes one and six years postoperatively. Only the first hip operated and patients with osteoarthritis are included.

Gender aspects of hip fracture treatment

Women have previously been strongly overrepresented in this group, as a result of women's longer lives and higher incidence of osteoporosis. The proportion of men is increasing continually however, and in 2012 it constituted 31%. Men with hip fracture are generally unhealthier than women which is reflected in a higher ASA class and higher incidence of early mortality. Men are, on the other hand, somewhat younger than women. Twenty-four per cent are 75 years of age or younger, corresponding to 19 % of women. This distribution in the male population can possibly explain that men receive both total prosthesis and unipolar prosthesis to a greater extent than women. These alternatives are usually chosen for the healthiest and the most infirm, respectively. Women are overrepresented in the group bipolar prosthesis. The differences are small but statistically significant. The most common type of revision for men is a total prosthesis that is revised to a new total prosthesis (33% of revisions), while women commonly have a hemiprosthesis that is revised to a total prosthesis (36%).

Men have somewhat more early reoperations (3.8% for men compared with 3.0% within six months for women). Male gender has also been a risk factor for reoperation in the Register's previous analyses with regard to fracture patients. This year we now have a sufficient number of observations to add the ASA class, BMI and dementia to the analysis, where we find that male gender falls away as a risk factor. It seems reasonable that it should be the general state of health rather than gender in itself that influences treatment results.

Gender and implant selection, surgery due to fracture 2005–2012

	Females		Males	
	Number	%	Number	%
Total hip arthroplasty	7,928	24.7%	3,353	25.2%
Bipolar hemiarthroplasty	10,890	34.0%	4,322	32.5%
Unipolar hemiarthroplasty	11,931	37.2%	5,170	38.9%
Monoblock hemiarthroplasty	1,324	4.1%	444	3.3%
Total	32,073	100%	13,289	100%

Hemiprostheses

Diagnoses and demography

The use of hemiprostheses, and in a wider sense treatment of hip fracture, is changing successively. Therefore the larger part of the register data and results are included under the heading ”Hip arthroplasty as fracture treatment” which also includes total prostheses.

Hemiprostheses are also used to a limited extent for other diagnoses, roughly seventy interventions per year caused by malignancy, and somewhat fewer cases of caput necrosis without a fracture background. Hip fracture is, however, the absolutely most common indication. The proportion of acute fractures operated using hemiprosthesis has increased from 91% in 2005 to 95% in 2012, while secondary prostheses (after failed osteosynthesis) decreased to a corresponding degree. In 2012, 4,329 hemiprostheses were reported to the Register. The number has fluctuated with a peak of more than 4,500 operations in 2009, 2010 and 2011. The decrease last year probably depends on an increased number of total prostheses for fracture treatment. The third fracture alternative, osteosynthesis, is not registered in the Swedish Hip Arthroplasty Register.

The trend for older and more poorly patients to be operated using hemiprosthesis is constant. In 2012, half of the patients were over 85 years of age, a third suffered from dementia and two thirds were poorly (ASA class III or higher). A high mortality rate after hemiprosthesis is therefore understandable, but it is of the greatest import that healthcare provides resources to optimize care for this weak patient group.

Prosthesis selection

Fewer and fewer stem types are being used, and in 2012 Lubinus SPII, Exeter polished, CPT and Covision straight were used in more than 90% of operations. The possibility of selection between bi- and unipolar heads means that the number of head types is slightly greater – seven different ones have been used in 90% of cases (Tables page 125).

90-day mortality after hemiprosthesis operation

For patients operated with hemiprostheses in 2011–2012, 90-day mortality was 16%. At hospital level, mortality varies between 9 and 34%. Since mortality is affected by patient selection for hemiprosthesis, a number of factors that can influence the risk for premature death are named in the tables on page 126–127. Other factors are also significant. Västerås, with very high mortality for hemiprosthesis patients, chooses to give eight of ten a total prosthesis, and the two receiving hemiprostheses represent a very frail and aged group. The same prosthesis distribution applies to Nyköping and to a certain extent Torsby, Norrköping, Eskilstuna and Karlstad, also with high figures for mortality. SU/Sahlgrenska’s high mortality reflects the predominant treatment of cancer patients. If one’s own clinic has a greater mortality rate than is to be expected with reference to case-mix then a local analysis of the complete care chain should be carried out.

A majority of those operated with hemiprosthesis are elderly and frail, which is reflected in the high mortality rate.

Reoperation within 6 months

Variation is great within the country as a whole, from 0 to 16%, with a national average of 3.5% (Table, pages 128–129). The figures must be read with reservation for possible underreporting of reoperations and varying treatment strategies. An active attitude in cases of dislocation and infection *can* lead to more reoperations compared with the choice of non-operative treatment of these conditions.

Prosthesis survival

In the figures on page 124, prosthetic survival is shown with respect to different factors. The younger age groups and secondary prostheses have poorer results in this respect, while no difference can be seen with respect to surgical approach. These results are unadjusted. When several factors are analyzed results are affected (see, for example, the analysis including dementia below). Secondary prosthesis is, however, throughout a risk factor, irrespective of method of analysis. When it comes to age as a risk factor, one may assume that older individuals are advised against or refrain from surgical treatment of complications to a greater extent. Since the Register only notes reoperations, we cannot assess whether the elderly have a greater or lesser number of complications in reality.

Dementia

Reporting of dementia has been further improved, 50 of 58 hospitals report for all (19 hospitals) or more than 90% of their patients. Västervik and Motala reported only for half of their patients in 2012.

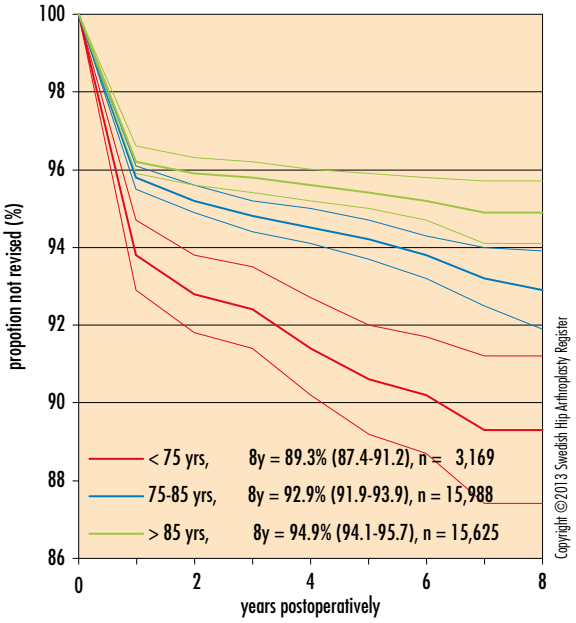
Dementia influences the result after hip fractures in several ways, mainly with respect to general complications and increased mortality. In a Cox regression analysis with respect to dementia as a risk factor for reoperation, 1,119 reoperations were included after 27,770 primary hemiprosthesis operations. The strongest risk factors are then secondary prosthesis and low age. Bipolar prosthesis, male gender and dementia (suspected or verified) also entail increased risk for reoperation, while surgical approach and stem type do not influence risk.

When ASA class and BMI are added, the number of observations decreases to 361 reoperations after 8,433 interventions. With the addition of these patient characteristics, bipolar prosthesis, male gender and dementia no longer constitute increased risks. Secondary prosthesis, lower age, posterior approach and obesity appear here as risk factors for reoperation. The transformed ”risk profile” underlines the importance of reporting the different patient-related factors so that they can be included in the analyses.

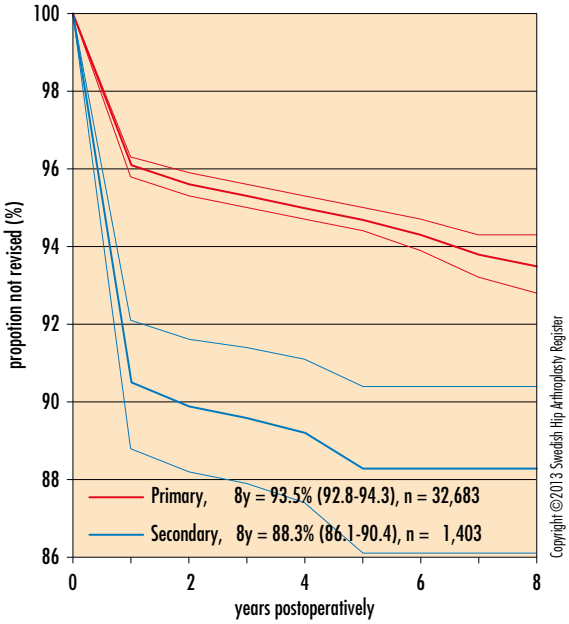
Concerning reoperations and their risk factors – see ”Hip arthroplasty as fracture treatment”.

The patient’s general condition probably influences the selection of prosthesis type and treatment of complications. When dementia, ASA class and BMI are included in the analysis, for example bipolar prosthesis then ”disappears” as a risk factor for reoperation. Secondary prosthesis and low age, however, entail an increased risk throughout.

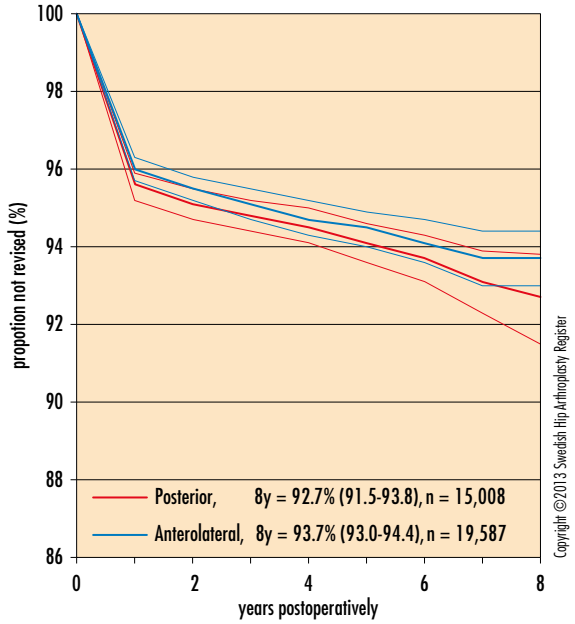
Age groups
2005–2012



Primary and secondary prosthesis
2005–2012



Surgical approach
2005–2012



15 most common stem components in hemiarthroplasty

2005–2012

Stem	2005	2006	2007	2008	2009	2010	2011	2012	Total	Proportion
Lubinus SP II	1,471	1,666	1,966	2,095	1,970	1,934	1,925	1,803	14,830	42.6%
Exeter Polished	870	936	1,040	1,205	1,400	1,449	1,474	1,505	9,879	28.4%
CPT (CoCr)	187	211	240	275	336	342	368	369	2,328	6.7%
Spectron EF Primary	351	409	182	107	169	161	147	19	1,545	4.4%
Covision straight	0	0	24	152	240	273	338	331	1,358	3.9%
Thompson	354	360	244	168	44	2	0	0	1,172	3.4%
MS30 Polished	0	1	111	176	168	167	162	205	990	2.8%
Austin Moore (Anatomica)	329	220	78	23	28	2	0	0	680	2.0%
Corail Collarless	26	96	92	109	94	95	22	9	543	1.6%
ETS Endo	98	104	129	48	0	0	0	0	379	1.1%
Müller Rak	101	84	60	25	0	0	1	0	271	0.8%
Basis	0	41	50	54	62	19	0	0	226	0.6%
Bi-Metric Fracture Stem	42	53	19	13	2	0	0	0	129	0.4%
Corail Krage	0	0	0	0	0	28	56	42	126	0.4%
Charnley	26	31	3	0	0	0	0	0	60	0.2%
Others	22	33	29	36	24	39	37	46	266	0.8%
Total	3,877	4,245	4,267	4,486	4,537	4,511	4,530	4,329	34,782	100%

15 most common head components in hemiarthroplasty

2005–2012

Caput	2005	2006	2007	2008	2009	2010	2011	2012	Total	Proportion
Unipolar head	466	656	681	705	1,180	1,415	1,553	1,452	8,108	23.3%
Vario Cup	1,014	1,053	1,320	1,380	802	551	366	363	6,849	19.7%
UHR Universal Head	605	583	638	709	683	686	647	653	5,204	15.0%
V40 Uni polar	277	333	377	498	724	772	435	289	3,705	10.7%
Ultima Monk	317	435	388	429	325	281	274	262	2,711	7.8%
Tandem Unipolar	337	451	228	152	181	136	94	2	1,581	4.5%
Unitrax	0	0	0	0	2	0	421	580	1,003	2.9%
Covision unipolar head for sleeves	0	0	7	33	153	163	234	283	873	2.5%
Versys endo	5	5	61	105	123	159	158	149	765	2.2%
Unipolarhuvud	95	57	120	106	92	94	69	87	720	2.1%
Covision unipolar head	0	0	19	125	87	111	111	54	507	1.5%
Multipolar cup	0	1	37	73	71	70	89	120	461	1.3%
Tandem Bipolar	0	0	0	14	62	53	61	16	206	0.6%
Moore modular hemi-head (Anatomica)	33	51	13	4	0	0	0	0	101	0.3%
Hastings	26	31	3	0	0	0	0	0	60	0.2%
Monoblock	690	577	354	129	42	2	0	2	1,796	5.2%
Others	12	12	21	24	10	18	18	17	132	0.4%
Total	3,877	4,245	4,267	4,486	4,537	4,511	4,530	4,329	34,782	100%

90-day mortality after hemiarthroplasty per hospital

Proportion deseased patients within 90 days after primary hemiarthroplasty, 2011–2012

Hospital	Number[1)]	>80[2)]	Males[3)]	ASA=3[4)]	ASA=4[5)]	Fracture	Surgery within 24h[7)]	Mortality[8)]
University or regional hospitals								
Karolinska/Huddinge	220	73%	31%	65%	10%	95%	41%	19%
Karolinska/Solna	113	52%	32%	70%	12%	66%	55%	16%
Linköping	168	75%	30%	44%	5%	93%	71%	16%
SU/Mölndal	559	78%	31%	52%	5%	97%	56%	17%
SUS/Lund	304	72%	33%	66%	8%	94%	71%	16%
SUS/Malmö	435	79%	32%	83%	7%	97%	69%	16%
Umeå	180	59%	35%	71%	10%	93%		17%
Uppsala	228	86%	39%	68%	13%	100%	40%	20%
Örebro	153	72%	29%	55%	5%	95%	63%	13%
Central hospitals								
Borås	131	86%	28%	50%	3%	98%	62%	15%
Danderyd	309	76%	29%	64%	16%	94%	66%	17%
Eksjö	102	71%	25%	58%	1%	98%	67%	12%
Eskilstuna	116	76%	28%	55%	5%	93%	53%	25%
Falun	257	65%	32%	39%	4%	89%	68%	12%
Gävle	220	71%	32%	48%	8%	99%		20%
Halmstad	107	83%	25%	50%	4%	95%	76%	19%
Helsingborg	356	65%	31%	40%	8%	95%	70%	19%
Hässleholm-Kristianstad	197	73%	26%	49%	1%	98%	89%	13%
Jönköping	101	76%	30%	58%	1%	98%	67%	10%
Kalmar	167	69%	38%	37%	2%	97%	77%	11%
Karlskrona	155	78%	31%	43%	3%	98%	53%	20%
Karlstad	144	83%	45%	67%	2%	96%	56%	22%
Norrköping	132	94%	32%	56%	4%	97%	56%	25%
Skövde	190	79%	33%	48%	4%	95%	55%	14%
Sunderby (inclusive Boden)	295	73%	32%	67%	7%	98%	73%	16%
Sundsvall	127	76%	28%	51%	1%	87%	74%	11%
Södersjukhuset	525	74%	32%	61%	15%	96%	72%	15%
Uddevalla	421	76%	35%	60%	4%	95%	49%	11%
Varberg	164	76%	33%	38%	3%	96%	69%	13%
Västerås	65	88%	32%	74%	9%	100%		34%
Växjö	95	85%	29%	68%	11%	97%	69%	14%
Ystad	122	70%	35%	53%	9%	97%	87%	19%
Östersund	153	76%	33%	56%	8%	97%	68%	13%

(Continued on next page.)

90-day mortality after hemiarthroplasty per hospital (cont.)

Proportion deseased patients within 90 days after primary hemiarthroplasty, 2011–2012

Hospital	Number[1)]	>80[2)]	Males[3)]	ASA=3[4)]	ASA=4[5)]	Fracture	Surgery within 24h[7)]	Mortality[8)]
Rural hospitals								
Alingsås	80	66%	31%	39%	3%	89%	84%	19%
Arvika	36	75%	36%	61%	8%	92%	39%	19%
Gällivare	47	45%	43%	51%	9%	100%	71%	15%
Hudiksvall	115	83%	32%	45%	3%	100%	87%	21%
Karlskoga	73	71%	26%	45%	5%	82%	71%	12%
Kungälv	120	76%	27%	60%	4%	96%	53%	12%
Lidköping	68	74%	40%	40%	4%	94%	42%	16%
Lindesberg	42	71%	36%	26%	10%	95%	72%	17%
Ljungby	50	86%	26%	62%	2%	98%	84%	12%
Mora	94	77%	30%	31%	0%	93%	82%	13%
Norrtälje	81	79%	33%	73%	10%	94%	72%	26%
Nyköping	32	94%	22%	55%	3%	97%	51%	28%
Skellefteå	76	62%	33%	57%	1%	97%	82%	9%
Sollefteå	74	72%	32%	56%	3%	93%		12%
Södertälje	73	68%	34%	60%	9%	90%	70%	14%
Torsby	41	88%	29%	56%	5%	100%	68%	32%
Visby	52	83%	25%	44%	8%	94%	57%	10%
Värnamo	47	87%	32%	44%	3%	98%	68%	15%
Västervik	104	73%	41%	42%	2%	97%	90%	14%
Örnsköldsvik	75	83%	24%	60%	11%	100%		20%
Private hospitals								
Aleris Specialistsjukvård Motala	49	76%	27%	33%	0%	92%	43%	8%
Capio S:t Göran	399	83%	23%	63%	6%	96%	64%	15%
Nation	8,839	75%	31%	56%	7%	95%	66%	16%

1) The number of primary hemi-arthroplasties during current period.

2) Proportion of primary hemi-arthroplasties performed on patients above 80 years of age.

3) Proportion of primary hemi-arthroplasties performed on men.

4) Proportion of primary hemi-arthroplasties performed on patients with ASA level 3.

5) Proportion of primary hemi-arthroplasties performed on patients with ASA level 4.

6) Proportion of primary hemi-arthroplasties performed due to acute fracture (not secondary).

7) Proportion of patients operated within 24 hours (from Rikshöft).

8) 90-days mortality (100(number of patients deceased within three months from primary surgery / number of operations performed during current period)).*

Hospitals with less than 20 hemi-arthroplasties during the period has been excluded..

Reoperation within 6 months after hemiarthroplasty per hospital

primary hemiarthroplasty, 2011–2012

Hospital	Number primary hemiarthroplasties[1)]	Number of reoperations[2)]	Proportion %[3)]
University or regional hospitals			
Karolinska/Huddinge	220	4	1.8%
Karolinska/Solna	113	7	6.2%
Linköping	168	2	1.2%
SU/Mölndal	559	11	2.0%
SUS/Lund	304	11	3.6%
SUS/Malmö	435	22	5.1%
Umeå	180	1	0.6%
Uppsala	228	7	3.1%
Örebro	153	8	5.2%
Central hospitals			
Borås	131	9	6.9%
Danderyd	309	15	4.9%
Eksjö	102	7	6.9%
Eskilstuna	116	2	1.7%
Falun	257	14	5.4%
Gävle	220	10	4.5%
Halmstad	107	3	2.8%
Helsingborg	356	11	3.1%
Hässleholm-Kristianstad	197	7	3.6%
Jönköping	101	3	3.0%
Kalmar	167	6	3.6%
Karlskrona	155	4	2.6%
Karlstad	144	5	3.5%
Norrköping	132	1	0.8%
Skövde	190	2	1.1%
Sunderby	295	9	3.1%
Sundsvall	127	9	7.1%
Södersjukhuset	525	24	4.6%
Uddevalla	421	4	1.0%
Varberg	164	2	1.2%
Västerås	65	2	3.1%
Växjö	95	1	1.1%
Ystad	122	5	4.1%
Östersund	153	5	3.3%

(Continued on next page.)

Reoperation within 6 months after hemiarthroplasty per hospital (cont.)

primary hemiarthroplasty, 2011–2012

Hospital	Number primary hemiarthroplasties[1)]	Number of reoperations[2)]	Proportion %[3)]
Rural hospitals			
Alingsås	80	2	2.5%
Arvika	36	1	2.8%
Gällivare	47	0	0%
Hudiksvall	115	3	2.6%
Karlskoga	73	3	4.1%
Kungälv	120	2	1.7%
Lidköping	68	2	2.9%
Lindesberg	42	5	**11.9%**
Ljungby	50	0	0%
Mora	94	1	1.1%
Norrtälje	81	3	3.7%
Nyköping	32	5	**15.6%**
Skellefteå	76	4	5.3%
Sollefteå	74	2	2.7%
Södertälje	73	3	4.1%
Torsby	41	0	0%
Visby	52	3	5.8%
Värnamo	47	3	6.4%
Västervik	104	10	**9.6%**
Örnsköldsvik	75	3	4.0%
Private hospitals			
Aleris Spec.vyeard i Motala	49	1	2.0%
Capio S:t Göran	399	17	4.3%
Nation	8,839	308	3.5%

[1)] The number of primary hemi-arthroplasties during current period.

2) The number of reoperations within 6 months of 1).

3) Quotient between 1) and 2) in percent.

Red marking represents values one standard deviation above the national avergae. Hospitals with less than 50 hemi-arthoplasties 2011-2012 have been excluded

Hip arthroplasty as fracture treatment

Background

In consultation with participating clinics, the Register has decided to present an account of all hip arthroplasties undertaken due to hip fracture as one group. In this group both total and hemiprostheses due to acute fracture or due to healing complications after previous osteosynthesis will be included. We consider this grouping important and relevant since use of total prostheses in fracture treatment has increased as well as the fact that fracture patients differ markedly from osteoarthritis patients. The profiles of Swedish orthopaedic clinics are also becoming more and more specialized, and units that mainly treat the more ailing fracture patients with acute need for operation get ”worse” results than those who only treat selected osteoarthritis patients, when total prostheses are accounted for as a group without consideration to background diagnosis.

Demography

45,362 primary, fracture-related hip arthroplasties are registered for the years 2005 to 2012. The number has increased from 5,116 in 2005 to 5,946 in 2011, to decrease to 5,741 last year. The distribution of gender, age and above all surgical approach and implant selection have changed during this perioden. The proportion of men has increased from 27 to 31% and the proportion over 85 years of age from 32 to 39% (Figure 1). Uncemented stems have never been common in the fracture population, and they have decreased from 9 to 4%. Dramatic changes, reflecting scientific findings during the period, have occurred with regard to selection of prosthesis (Figure 2). Both unipolar hemiprosthesis and total prosthesis have increased, at the cost of bipolar and monoblock-hemiprosthesis. A breaking point is noted in 2011, when more total prostheses than bipolar prostheses were used as fracture treatment. Total prosthesis is considered to provide a better result in the long term, and is thus suitable for patients with expected long survival. At the other end of the spectrum, unipolar hemiprosthesis is presumed to give a reliable result for the biologically aged, especially since, in Sweden, ordinary bipolar hemiprostheses have been linked to increased risk for reoperation. The best selection between uni- and bipolar prosthesis must, however, be further elucidated – see below. Monoblock-prostheses have been known for their poor results for decades. Analyzed according to type of hospital, we see that rural hospitals have been more inclined to use total prosthesis for acute fracture, however county hospitals have successively increased their proportion. In 2012 total prostheses constituted 27% of the acute prosthesis operations at rural hospitals, compared with 25% at county hospitals and 19% at university or regional hospitals. The latter treat slightly older and more ailing patients, but even if one takes note of these circumstances, the tendency remains.

90-day mortality after fracture-related prosthesis

We have previously only accounted for 90-day mortality for fracture patients operated with hemiprostheses, and the national average was quite stable then at around 15%. When total prostheses are included as they are now, it is easy to explain why mortality has sunk to 13%, since total prostheses are most often chosen for the somewhat healthier patients. The distribution is quite broad, between 9 and 19% at the larger units. Since mortality is influenced by which patients undergo operation (case-mix), a number of factors that can increase the risk for early mortality are shown in the table on pages 134–135: aged patients, male gender, infirmity and acute fracture operations (as compared to planned secondary prostheses). If the mortality rate at one’s own clinic exceeds the expected rate for the risk profile in question, then the care chain should be analyzed in detail.

Prosthesis selection in detail

”Swedish conservatism” with respect prosthesis selection is reflected even more in the fracture group, where Swedish orthopaedic specialists are particularly restrained when it comes to using uncemented models. This conservatism is based on studies showing increased risk for periprosthetic fracture in uncemented stems in fracture patients. The four stems Lubinus SPII (2,586), Exeter polished (1,880), CPT (409) and Covision straight (329) are used in more than 90% of operations due to fracture in 2012, compared with seven stem types used for total prosthesis generally. The basic selection of cup resembles that for total prosthesis in general, and for hemiprosthesis, two unipolar head types (Lubinus Unipolar head and Unitrax) and one bipolar head type (UHR) clearly dominate. In 2012, 174 dual mobility-cups were used in three cases of four as treatment for acute fracture. In several countries, these cups have gained great popularity since they are considered to minimize the risk for dislocation. For the group of fracture patients specifically there is still no convincing scientific support for the notion that this design is cost-effective. Clinical and register studies are needed first.

Surgical approach

In the selection of surgical approach, the strategy for fracture and osteoarthritis patients should probably differ. Posterior approach has been shown to increase the risk of dislocation for fracture patients in particular. For this group however there is no analysis of patient-reported outcomes linked to approach. For the osteoarthritis group it has actually been shown that patients are more satisfied and suffer less pain after posterior approach. This *may* also be true for fracture patients, but fracture patients’ reduced functional capacity may possibly mean that they do not notice any difference. However this remains to be investigated. Since dislocation is the most common complication, the Swedish orthopaedic specialists’ reduced use of posterior approach from 51 to 32% may be wise (Figure 3).

Other illnesses

ASA class reflects patients’ general health condition. Since 2008, when ASA class is reported for a majority of patients, the proportion of ailing patients (grade III and above) has increased somewhat, from 56 to 62%. The distribution of ASA classes displays large and rather self-evident differences between total prosthesis and hemiprosthesis groups, since state of health is basic to the selection of prosthesis type. However, the proportion of ailing patients is increasing even for total prosthesis (32 to 41%). 64% of those who received unipolar prostheses in 2012 were ailing, compared with 62% of those with bipolar. The uni- and bipolar groups show little difference when it comes to frequency

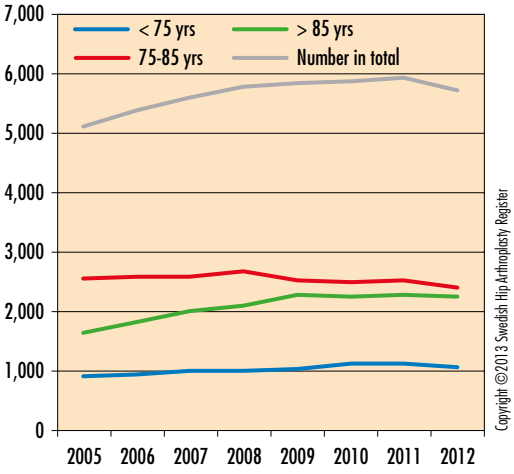


Figure 1. Age groups treated with arthroplasty after hip fracture.

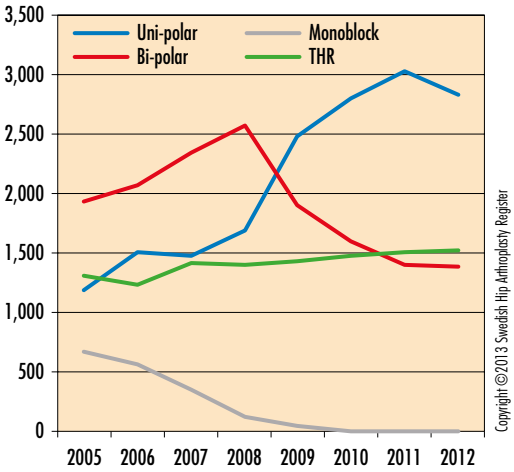


Figure 2. Implant selection in fracture-related arthroplasty.

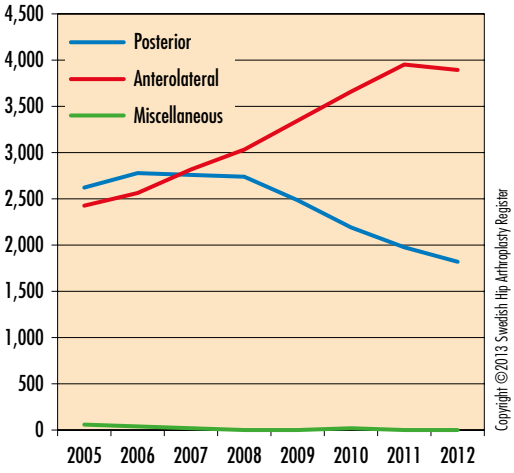


Figure 3. Surgical approach in fracture-related arthroplasty.

of dementia as well. In 2012, 37 and 35%, respectively, had some degree of dementia. The proportion has increased markedly since 2005, when only about 25% of hemiprosthetic patients were assessed as having signs of dementia. For total prostheses the frequency of dementia is not registered at all at present.

Irrespective of type of prosthesis, there is a distinct trend for older and more ailing hip fracture patients to be operated with hip arthroplasty. Men have poorer prognoses, above all with respect to patient survival, and the increased proportion of men also contributes to the fact that the group for which clinics need to provide care is ever more fragile and resource-demanding.

Body mass index (BMI)

Underweight and obesity can respectively influence the risk for different types of complications in cases of joint prosthesis surgery. The Register therefore enquires about height and weight for BMI calculation. The information is obviously more difficult to acquire in the acute context of fracture patients, but the following clinics managed nevertheless to report on more than 95% of them in 2012: Eskilstuna, Danderyd, Jönköping, Karlskrona-Karlshamn, Norrtälje, Ljungby. Many more have a fairly high frequency but the following were noteworthy for their low level of reporting: Ystad, Motala, Umeå, Mora, Sunderbyn, Norrköping, Linköping, Örnsköldsvik, Uddevalla, and Västervik in a sequence from 0 to 20% reported. The Register is dependent upon a high degree of reporting to be able to make fair analyses, and, in extension, well-substantiated clinical recommendations. Extant data shows an even distribution since 2009, with about 85% normal weight patients and 7–8% underweight or obese patients (BMI<18.5) or (BMI>30), respectively. With regard to prosthetic selection, those underweight are slightly overrepresented in the unipolar group compared with the total hip replacement group; and the reverse is true for obese patients (more receive total prostheses).

Reoperation – causes and measures

1,931 patients have undergone one or more reoperations during 2005–2012, corresponding to 4.3%. For 1,394 of them (3.1%) some part of a prosthesis has been replaced or removed – revision operation. Measures are listed in Table A, and causes in Table B. Dislocation and infection are clearly the most dominant complications.

The reoperation frequency for different types of prosthesis varies (Table C), which is influenced to a great extent by how long the patients live after their hip fracture. When the follow-up time came to an end, 84% of those with monoblock-prostheses had died compared with 22% with total prostheses, which reflects selection of the of type of prosthesis based on the patient's general state of health. Increased mortality in a group of patients influences the outcome whereby only a few patients will be affected by late complications.

Reoperation within 6 months

Variation is great within the country, from 0 to 9% at the larger units with a national average of 3.4% (Table pages 136–137). Possible under-reporting of reoperations as well as varying treatment strategies influence the clinics' results. An active attitude in cases of dislocation and infection can lead to more reoperations compared with non-operative treatment for these conditions. A high rate of reoperation should, however, result in local analyses and improvement projects. One such improvement project from Nyköping is presented under *Register-based studies– improvement projects and research [Registerbaserade arbeten – förbättringsprojekt and forskning])*.

Reoperation frequency	Number	Proportion of all operations	Proportion of all reoperations
THR; exchange to THR	380	0.8	19.7
Hemiarthroplasty; exchange to THR	476	1.0	24.7
Hemiarthroplasty; exchange to hemiarthroplasty	347	0.8	18.0
Excision-arthroplasty	191	0.4	9.9
Other reoperations	537	1.2	27.8
Number of reoperation	1,931	4.3	

Table A. Type of reoperation.

	Number	Proportion of all operations	Proportion of all reoperations
Dislocation	738	1.6	38.2
Infection	643	1.4	33.3
Periprosthetic fracture	306	0.7	15.8
Erosion and pain	101	0.2	5.2
Aseptic loosening	87	0.2	4.5
Other reasons	56	0.1	2.9
Number reoperationer	1,931	4.3	

Table B. Reasons for reoperations.

	Total	Number reoperations	%	Number deseased	%
Unipolar prostheses	17,101	607	3.5	8,703	50.9
Bipolar prostheses	15,212	703	4.6	8,744	57.5
THR	11,281	550	4.9	2,492	22.1
Monoblock prostheses	1,768	71	4.0	1,482	83.8
Total	45,362	1,931	4.3		

Table C. Number of reoperations and deseased during follow-up for different implants.

Notes

90-day mortality after total or hemiarthroplasty hip fractures per hospital

2011–2012

Hospital	Number[1)]	>80[2)]	Males[3)]	ASA=III[4)]	ASA=IV[5)]	Fracture	Mortality[6)]
University or regional hospitals							
Karolinska/Huddinge	287	58%	31%	61%	8%	94%	15%
Karolinska/Solna	124	52%	24%	73%	10%	83%	11%
Linköping	182	70%	30%	41%	5%	93%	14%
SU/Mölndal	734	66%	30%	46%	5%	90%	13%
SU/Sahlgrenska	7	43%	57%	50%	0%	71%	29%
SUS/Lund	371	60%	33%	61%	6%	95%	13%
SUS/Malmö	497	68%	31%	81%	6%	96%	14%
Umeå	195	54%	35%	63%	13%	93%	17%
Uppsala	368	66%	35%	60%	9%	96%	16%
Örebro	185	62%	29%	47%	5%	91%	11%
Central hospitals							
Borås	222	63%	29%	39%	2%	93%	11%
Danderyd	427	60%	30%	58%	12%	93%	13%
Eksjö	116	64%	27%	54%	1%	93%	11%
Eskilstuna	189	64%	29%	46%	3%	89%	15%
Falun	266	62%	34%	38%	4%	89%	11%
Gävle	298	59%	31%	43%	7%	95%	15%
Halmstad	174	60%	29%	40%	2%	91%	11%
Helsingborg	368	62%	30%	38%	8%	97%	18%
Hässleholm-Kristianstad	231	67%	26%	49%	1%	90%	13%
Jönköping	148	65%	30%	54%	1%	98%	8%
Kalmar	210	57%	37%	31%	2%	98%	9%
Karlskrona	209	61%	35%	35%	2%	97%	15%
Karlstad	254	62%	40%	53%	2%	92%	14%
Norrköping	211	72%	31%	47%	2%	94%	18%
Skövde	251	62%	31%	39%	4%	96%	12%
Sunderby (inclusive Boden)	341	64%	34%	63%	8%	98%	13%
Sundsvall	184	56%	31%	46%	1%	82%	9%
Södersjukhuset	659	62%	32%	58%	12%	95%	12%
Uddevalla	513	65%	35%	54%	3%	91%	10%
Varberg	211	62%	29%	32%	3%	93%	10%
Västerås	318	64%	32%	63%	6%	96%	18%
Växjö	139	62%	28%	61%	9%	94%	11%
Ystad	136	65%	32%	50%	8%	99%	15%
Östersund	224	61%	33%	47%	6%	96%	9%

(Continued on next page.)

90-day mortality after total or hemiarthroplasty hip fractures per hospital (cont.)

Hospital	Number[1)]	>80[2)]	Males[3)]	ASA=III[4)]	ASA=IV[5)]	Fracture	Mortality[6)]
Rural hospitals							
Alingsås	81	64%	27%	37%	2%	90%	17%
Arvika	45	62%	31%	60%	7%	87%	13%
Bollnäs	1	0%	0%	0%	0%	0%	0%
Gällivare	82	38%	40%	55%	6%	93%	9%
Hudiksvall	151	70%	30%	43%	2%	95%	16%
Karlshamn	11	36%	18%	9%	0%	0%	9%
Karlskoga	88	60%	30%	40%	5%	81%	11%
Katrineholm	2	0%	100%	100%	0%	50%	50%
Kungälv	144	66%	26%	54%	3%	94%	9%
Lidköping	86	63%	37%	36%	4%	92%	13%
Lindesberg	68	53%	31%	28%	6%	94%	10%
Ljungby	78	64%	26%	50%	1%	92%	9%
Lycksele	6	67%	17%	25%	0%	33%	17%
Mora	133	57%	28%	26%	0%	91%	11%
Norrtälje	111	67%	32%	58%	9%	94%	19%
Nyköping	113	60%	23%	46%	2%	88%	11%
Piteå	6	67%	33%	33%	0%	33%	0%
SUS/Trelleborg	7	0%	43%	0%	0%	0%	0%
Skellefteå	91	55%	30%	54%	1%	95%	10%
Sollefteå	76	68%	33%	54%	3%	96%	12%
Södertälje	102	56%	32%	58%	6%	92%	11%
Torsby	68	65%	28%	49%	4%	94%	19%
Visby	71	68%	21%	39%	7%	86%	8%
Värnamo	83	63%	33%	36%	2%	90%	10%
Västervik	129	63%	36%	39%	2%	92%	12%
Ängelholm	2	50%	50%	0%	0%	0%	0%
Örnsköldsvik	86	72%	26%	54%	10%	99%	17%
Private hospitals							
Aleris Specialistsjukvård Motala	53	74%	28%	33%	0%	87%	8%
Capio S:t Göran	467	73%	25%	60%	6%	94%	13%
Carlanderska	1	0%	100%	0%	0%	0%	0%
Ortho Center Stockholm	2	0%	0%	0%	0%	50%	0%
OrthoCenter IFK-kliniken	2	50%	0%	0%	0%	0%	0%
Nation	11,695	63%	31%	51%	5%	93%	13%

[1)] Refers to the number of primary surgeries during the period.
[2)] Refers to the proportion of operations on patients in age groups above 80 years.
[3)] Refers to the proportion of males during the period.
[4)] Proportion of patients with ASA class III.
[5)] Proportion of patients with ASA class IV.
[6)] 90-day mortality (100(number of patients deseased within three months after primary THR / number of operations during the period)).*

Reoperations within 6 months after total or hemiarthroplasty in hip fractures per hospital

2011–2012

Hospital	Number of operations [1]	Number of reoperations [2]	Proportion %[3]
University or regional hospitals			
Karolinska/Huddinge	287	7	2.4%
Karolinska/Solna	124	8	6.5%
Linköping	182	4	2.2%
SU/Mölndal	734	15	2.0%
SU/Sahlgrenska	7	1	14.3%
SUS/Lund	371	13	3.5%
SUS/Malmö	497	22	4.4%
Umeå	195	1	0.5%
Uppsala	368	9	2.4%
Örebro	185	9	4.9%
Central hospitals			
Borås	222	10	4.5%
Danderyd	427	22	5.2%
Eksjö	116	7	6.0%
Eskilstuna	189	3	1.6%
Falun	266	14	5.3%
Gävle	298	12	4.0%
Halmstad	174	4	2.3%
Helsingborg	368	12	3.3%
Hässleholm-Kristianstad	231	9	3.9%
Jönköping	148	3	2.0%
Kalmar	210	7	3.3%
Karlskrona	209	6	2.9%
Karlstad	254	13	5.1%
Norrköping	211	1	0.5%
Skövde	251	2	0.8%
Sunderby (inclusive Boden)	341	10	2.9%
Sundsvall	184	13	7.1%
Södersjukhuset	659	27	4.1%
Uddevalla	513	4	0.8%
Varberg	211	2	0.9%
Västerås	318	16	5.0%
Växjö	139	3	2.2%
Ystad	136	6	4.4%
Östersund	224	7	3.1%

(Continued on next page.)

Reoperations within 6 months after total or hemiarthroplasty in hip fractures per hospital (cont.)

2011–2012

Hospital	Number of operations [1]	Number of reoperations [2]	Proportion % [3]
Rural hospitals			
Alingsås	81	2	2.5%
Arvika	45	1	2.2%
Bollnäs	1	0	0%
Gällivare	82	1	1.2%
Hudiksvall	151	4	2.6%
Karlshamn	11	1	9.1%
Karlskoga	88	3	3.4%
Katrineholm	2	0	0%
Kungälv	144	2	1.4%
Lidköping	86	3	3.5%
Lindesberg	68	6	8.8%
Ljungby	78	1	1.3%
Lycksele	6	1	16.7%
Mora	133	2	1.5%
Norrtälje	111	3	2.7%
Nyköping	113	10	8.8%
Piteå	6	0	0%
SUS/Trelleborg	7	1	14.3%
Skellefteå	91	4	4.4%
Sollefteå	76	2	2.6%
Södertälje	102	4	3.9%
Torsby	68	0	0%
Visby	71	3	4.2%
Värnamo	83	4	4.8%
Västervik	129	11	8.5%
Ängelholm	2	0	0%
Örnsköldsvik	86	3	3.5%
Private hospitals			
Aleris Specialistsjukvård Motala	53	1	1.9%
Capio S:t Göran	467	18	3.9%
Carlanderska	1	0	0%
Ortho Center Stockholm	2	0	0%
OrthoCenter IFK-kliniken	2	0	0%
Nation	11,695	393	3.4%

Red marking denotes values one standard devation above national average.

[1] *Refers to the number of primary arthroplasties during the period.*
[2] *Refers to the number of reoperations within 6 months among 1).*
[3] *Refers to the quotient between 1) and 2) in percentage.*

Notes

Follow-up of institutions' total functions and activities after hip arthroplasty as treatment for hip fracture

Total and hemiprosthesis for hip fracture are also included in the value compasses that reflect the clinics' results. Since many fracture patients are not included in the Register's PROM Programme, the value compasses have four only variables (points of the compass).

The objective with this account is for each hospital to be able to compare with the national average value and identify any problem zones that could lead to local improvement projects. The results must be seen in a context of many factors. The value compass can be seen as a balanced scorecard. The larger the field the better multidimensional total results achieved by each respective clinic.

The result is presented in this follow-up model for clinics that have performed at least 40 operations, with information on the degree of dementia during 2011–2012.

The result variables used for fracture-related prostheses are slightly different from those used for elective total prostheses. Those who suffer a hip fracture often have several other infirmities and an increased risk of death in connection with their injury /operation. Most reoperations occur within a few months and long-term complications are unusual. Observation periods for reoperation and prosthetic survival are therefore shorter than for total prostheses.

- **90-day mortality.** In international literature, this variable is used to cast light on mortality after hip arthroplasty.

- **Coverage.** Coverage (completeness) at the individual level according to the most recent cross-referencing with the Patient Register.

- **Reoperation within 6 months.** Specifies all forms of reoperation within 6 months after primary operation.

- **1-year prosthetic survival.** Prosthetic survival after 1 year using Kaplan-Meier statistics.

The basic selection of fracture patients subject to hip arthroplasty (instead of osteosynthesis) may appear different at different hospitals, and each clinic's "case-mix" must be read parallel to its value compass. The picture of the "case-mix" is constructed in the same way as the value compass and includes the variables that have been shown as decisive demographic parameters for risk of reoperation, and to some extent mortality. The larger the field in this figure the better the patient profile for the clinic in question.

- The proportion of patients aged 85 or older. Greater age protects against reoperation and revision. The reasons may be many: for example, reduced activity decreases the risk of erosion and probably even of dislocation. Short remaining length of life means that loosening does not have time to develop. On the other hand, the "risk decrease" seen may be caused by the elderly individual being affected by complications despite all, but being advised against reoperation or revision for medical reasons. Clinics that operate many patients over 85 get better results with respect to reoperation/revision, but poorer results with respect to mortality.

- **The proportion of acute fractures** (diagnosis S72.0). The more patients with the diagnosis acute fracture to be operated by the clinic the better the long-term results tend to be according to the Register's regression analysis of the database.

- **The proportion of non-dement patients.** The figure shows the clinic's proportion of patients assessed as cognitively intact. Dement patients have higher mortality after hip fracture. If a clinic has a large proportion of non-dement patients, their mortality figures improve.

- **The proportion of women.** Women generally have better results than men with respect to the need for reoperation/ revision, mainly depending on the lower risk for fracture near the prosthesis.

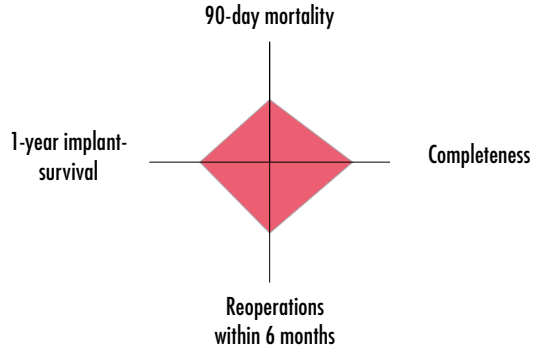
Discussion

A non-conforming result in the clinic's value compass should lead to a local analysis of the various factors influencing the clinical results as well as the implementation of quality improvement. The Register will gladly pass on experience acquired after corresponding analyses at other hospitals, and is prepared to assist with practical help. Some examples are also described under the heading *Register-based projects (Registerbaserade arbeten)*.

Since individuals with hip fracture most often have poorer health and are much older compared with osteoarthritis patients operated with total prostheses, it is possible that non-surgical treatment of complications is more common for fracture patients. Both infections and dislocations can in certain situations be treated so as to relieve symptoms without surgery, for example if a new operation would be linked to considerable medical risks. In that case, a non-operative treatment might be more suitable, and on assessment of the value compasses these circumstances should be taken into account. *To a certain extent, a higher rate of* reoperations and revisions might, on the other hand, indicate an active attitude in case of complications.

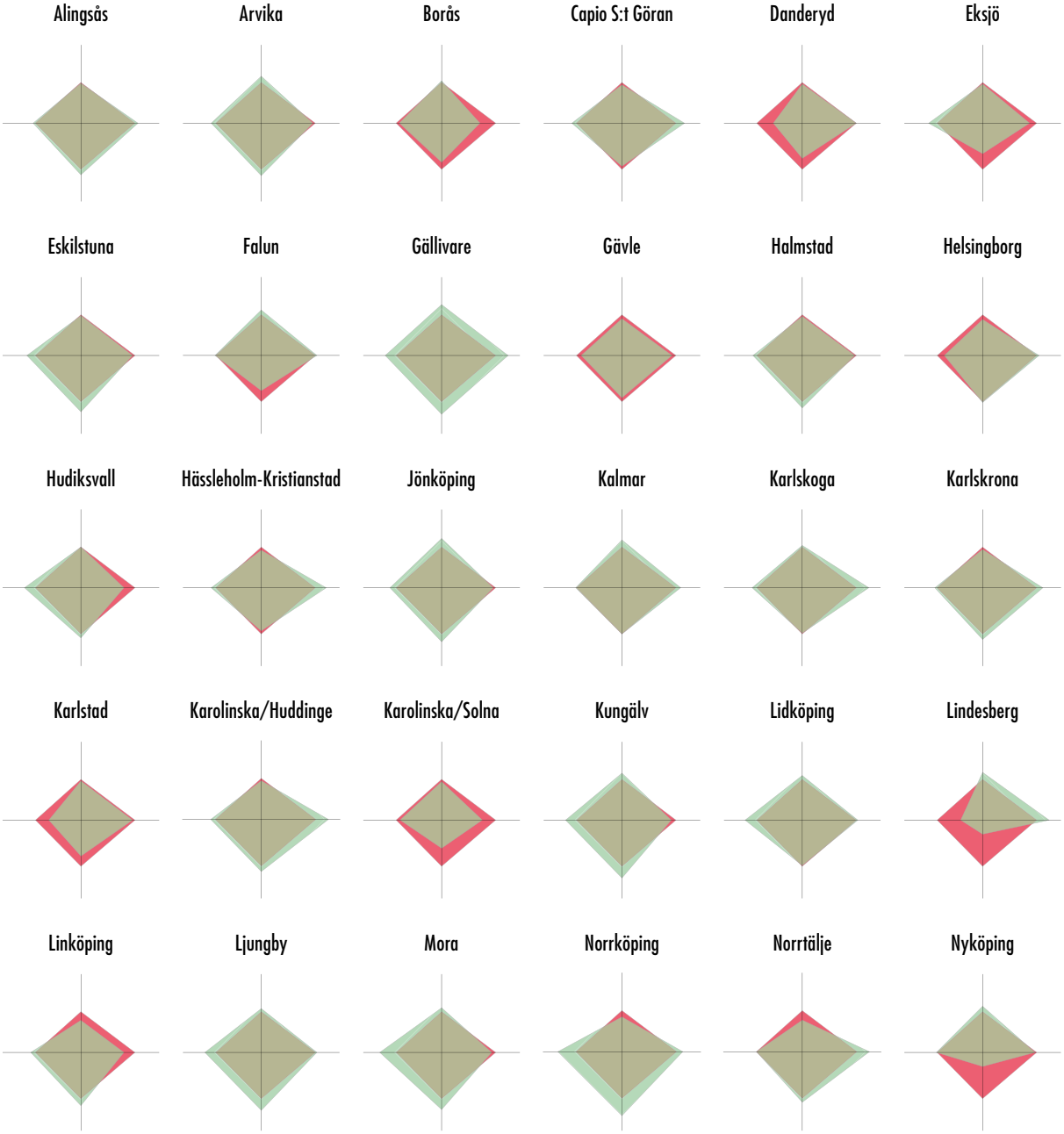
Quality indicator for hip fracture patients

value compass – national average



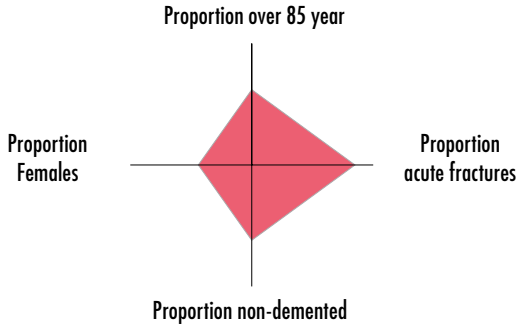
The value compasses show in red national results for the four variables included. Each department's corresponding values are shown in green. Limit values are set to the highest and lowest value for each variable ± 1SD. The poorest value for the variables is at the origo and the best on the periphery.

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



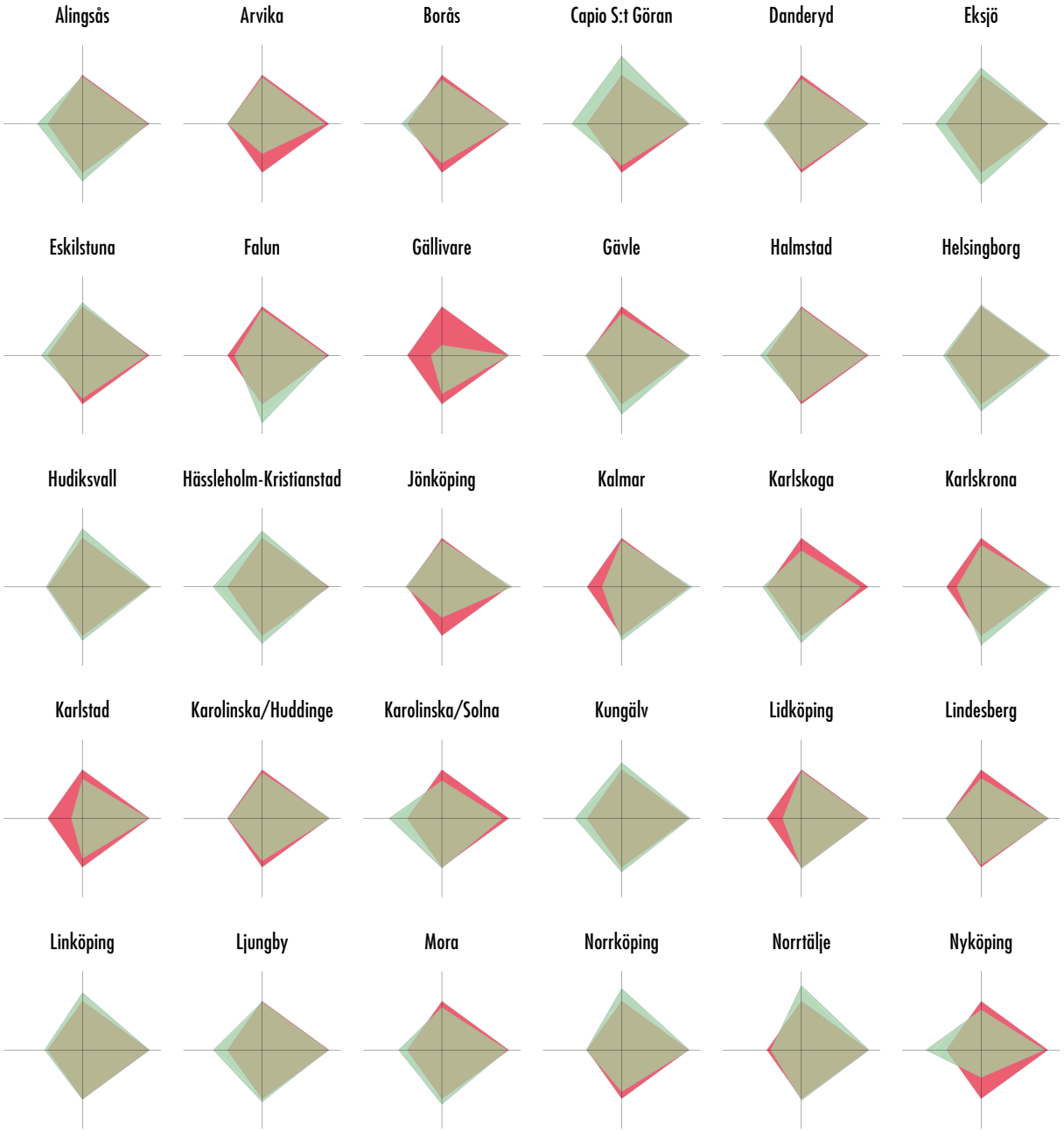
"Case-mix"-profile for fracture patients

national average



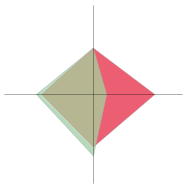
In the graphic presentation of patient demographics ('case-mix') the national result is shown regarding the four variables included, in red. The corresponding values for each clinic are shown in green. Limit values are set to the greatest and the smallest value of each variable ± 1 SD. The poorest value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

The case-mix profile should always be considered when interpreting and comparing different hospitals value compasses.

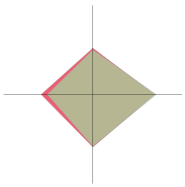


Value compasses (continued)

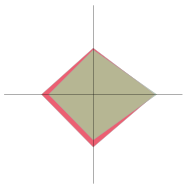
SU/Mölndal



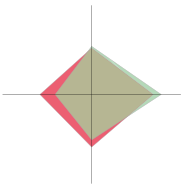
SUS/Lund



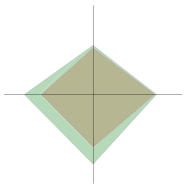
SUS/Malmö



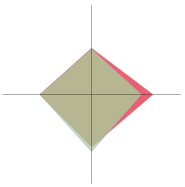
Skellefeå



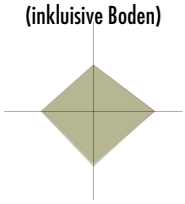
Skövde



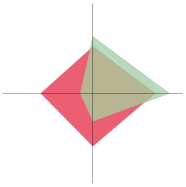
Sollefteå



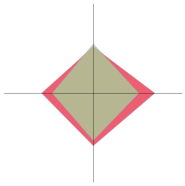
Sunderby (inkluisive Boden)



Sundsvall



Södersjukhuset



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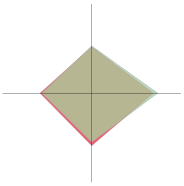

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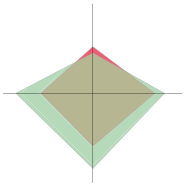
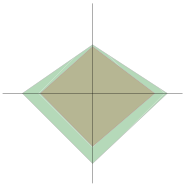


Uddevalla



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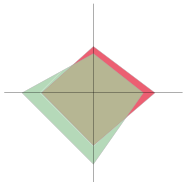

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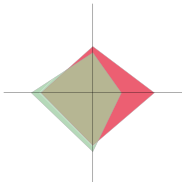

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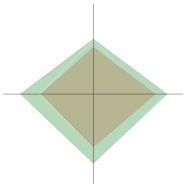
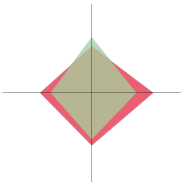
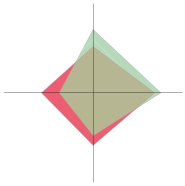


Visby



Värnamo



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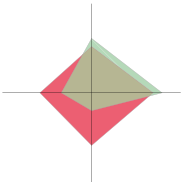

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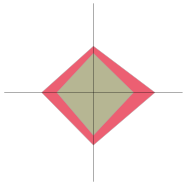

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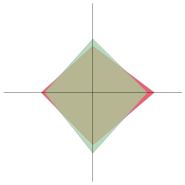
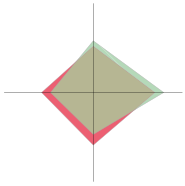


Örebro



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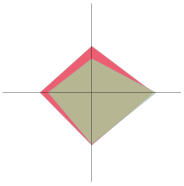

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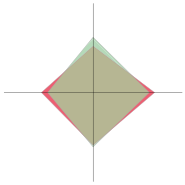
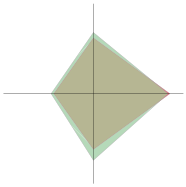


"Case-mix" profiles (continued)

SU/Mölndal



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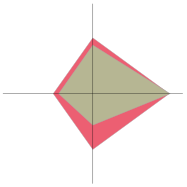

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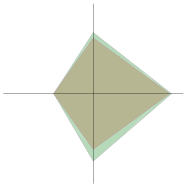

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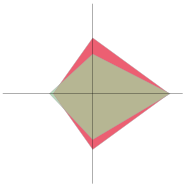
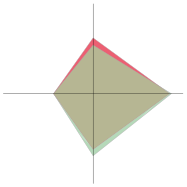


Skövde



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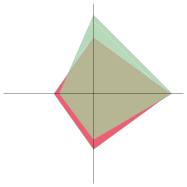

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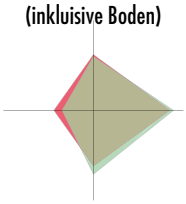

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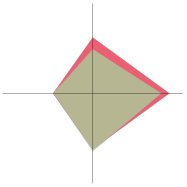

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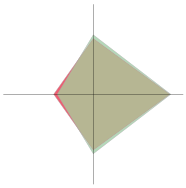

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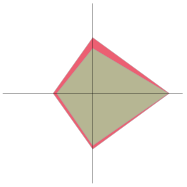

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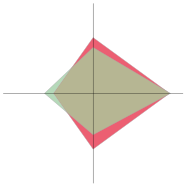

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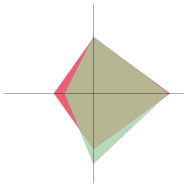
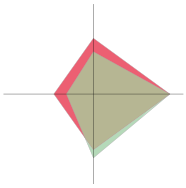
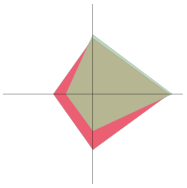


Umeå



Uppsala



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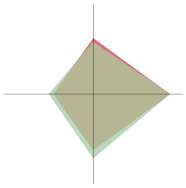
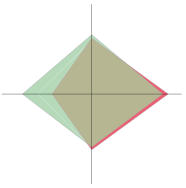


Visby



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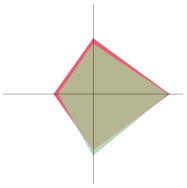

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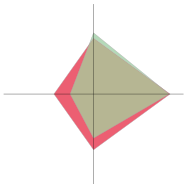

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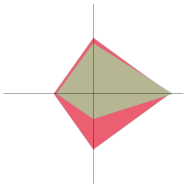

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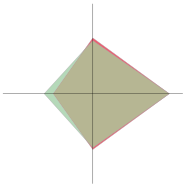

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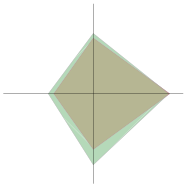

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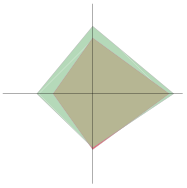

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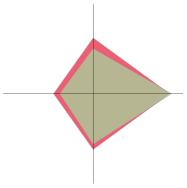


Hip fracture and prosthetic surgery

We used the Patient Register as basic data to download the material below, which is also a national quality indicator in *Regional Comparisons (Öppna jämförelser)*. Patients over 64 with the diagnoses S72.00 and operation codes NFB09 and 19 or NFB29, 39, 49, 62 and 99 have been included, that is to say, cervical fracture operated with some type of hip joint prosthesis during 2011 and 2012.

The diagnosis group includes the cervical fractures without dislocation, for which operation with osteosynthesis (nails or screws) is sufficient. These constitute about a third of the group. Osteosynthesis may also be suitable for isolated patients with acute life-threatening conditions. The objective for using a prosthesis is therefore around 65–70%.

Comparisons between hospitals

62.2% of patients with cervical fracture receive hip arthroplasty compared with 61.4% in 2010–2011 with great differences between hospitals; 42–71% (Lycksele sends their patients for hip arthroplasty to other hospitals).

More and more scientific studies point to total prosthesis as the best alternative for dislocated cervical fracture, at least for healthier and more active patients. The proportion of prosthetic-operated patients who received a total prosthesis, 22%, remains, however, unchanged since last year. The variation is considerable. The use of total prosthesis varied from 1 to 78%, with the greatest proportion in Västerås, Nyköping, Torsby, Karlstad, Södra Älvsborg Hospital, Halmstad, Värnamo, Gällivare and Eskilstuna. Several of these clinics have significantly increased the proportion of total prostheses this past year. Clinics with little use of total prostheses should investigate their indications and prosthetic selection.

The use of hip arthroplasty for fracture has increased discreetly, but several hospitals have significantly decreased their use compared with 2010–2011. This applies to Halmstad (reduction by 20 %), Kungälv (–16), Karlskrona-Karlshamn (–15), Växjö (–14), Örnsköldsvik (–11), and Örebro (–9). To choose osteosynthesis instead for dislocated fractures may possibly indicate short-sighted and erroneous economic considerations. A hip arthroplasty is initially more costly than osteosynthesis, but its long-term cost effectivity has been clearly shown in several studies. Several hospitals have, on the other hand, increased their proportion of prosthetic-operated patients, among them Karlskoga, Sollefteå, Eksjö, Mora, Visby, Västervik and Nyköping.

Future development

Several hospitals have attained a high proportion of total hip replacement, while others probably undertreat their patients when fewer than every tenth operation is a total hip replacement. Prosthetic selection is based on the patient's biological age, so it is difficult to specify the optimal proportion judging only by basic population statistics. Total hip replacement should be used for individuals who live independently, move without walking aids and are cognitively intact, and for those patients with osteoarthritis or inflammatory hip joint disease.

Division into elective units for arthroplasty and emergency hospitals for fracture treatment may possibly result in fewer physicians on call with good qualifications with respect to total arthroplasty. In order to operate fracture patients successfully with total hip replacement, qualified surgeons are required as well as good supervision of younger physicians, to decrease the risk for dislocation. Hemiprosthetic surgery seems more "forgiving" in this respect, which may defend the role of this intervention in acute surgery where the competence of the physicians on call is not always so advanced. Hospitals must weigh the pros and cons of what suits the local organisation, and must carefully follow up their results. Decreasing the proportion of hip arthroplasties and instead increasing the use of osteosynthesis – for economic or other reasons – must, however, be completely avoided.

Dislocerad cervikal höftfracture

Proportion arthroplasties after hip fracture per hospital

Patients 65 years and older, 2011–2012

Hospital	Number of arthroplasties	Proportion arthroplasties	Proportion hemiarthroplasties	Proportion THRs
Akademiska sjukhuset	293	69.4%	68.9%	31.1%
Alingsås lasarett	70	59.8%	91.4%	8.6%
Arvika sjukhus	32	65.3%	87.5%	12.5%
Blekingesjukhuset	157	61.3%	75.8%	24.2%
Danderyds sjukhus	322	60.5%	72.7%	27.3%
Falu lasarett	207	55.9%	98.6%	1.4%
Gällivare lasarett	62	54.9%	64.5%	35.5%
Gävle sjukhus	203	66.3%	76.4%	23.6%
Hallands sjukhus Halmstad	129	53.8%	64.3%	35.7%
Hallands sjukhus Varberg	160	65.6%	81.3%	18.8%
Helsingborgs lasarett	282	64.8%	95.7%	4.3%
Huddinge sjukhus	213	57.9%	78.4%	21.6%
Hudiksvalls sjukhus	94	56.3%	78.7%	21.3%
Hässleholms sjukhus	291	63.5%	92.4%	7.6%
Höglandssjukhuset	106	57.0%	89.6%	10.4%
Karlskoga lasarett	66	56.4%	89.4%	10.6%
Karlstads sjukhus	192	65.8%	58.3%	41.7%
Karolinska sjukhuset	77	50.3%	76.6%	23.4%
Kungälvs sjukhus	98	65.3%	82.7%	17.3%
Lindesbergs lasarett	51	68.0%	66.7%	33.3%
Ljungby lasarett	61	66.3%	65.6%	34.4%
Central hospitalset Kalmar	161	69.1%	80.7%	19.3%
Mora lasarett	89	65.9%	73.0%	27.0%
Motala lasarett	88	68.8%	85.2%	14.8%
Mälarsjukhuset	139	50.4%	64.7%	35.3%
Norrlands Universitetssjukhus	150	68.5%	93.3%	6.7%
Norrtälje sjukhus	83	61.0%	75.9%	24.1%
NU-sjukvyearden	371	70.9%	86.8%	13.2%
Nyköpings lasarett	81	57.0%	28.4%	71.6%
Ryhov, central hospitals	121	60.8%	71.9%	28.1%
S:t Görans sjukhus	360	67.5%	88.6%	11.4%
Sahlgrenska universitetssjukhus	532	63.6%	81.0%	19.0%
Skaraborgs sjukhus	249	61.3%	78.3%	21.7%
Skellefteå lasarett	61	44.5%	88.5%	11.5%
Skånes Universitetssjukhus	338	68.6%	85.2%	14.8%

(Continued on next page.)

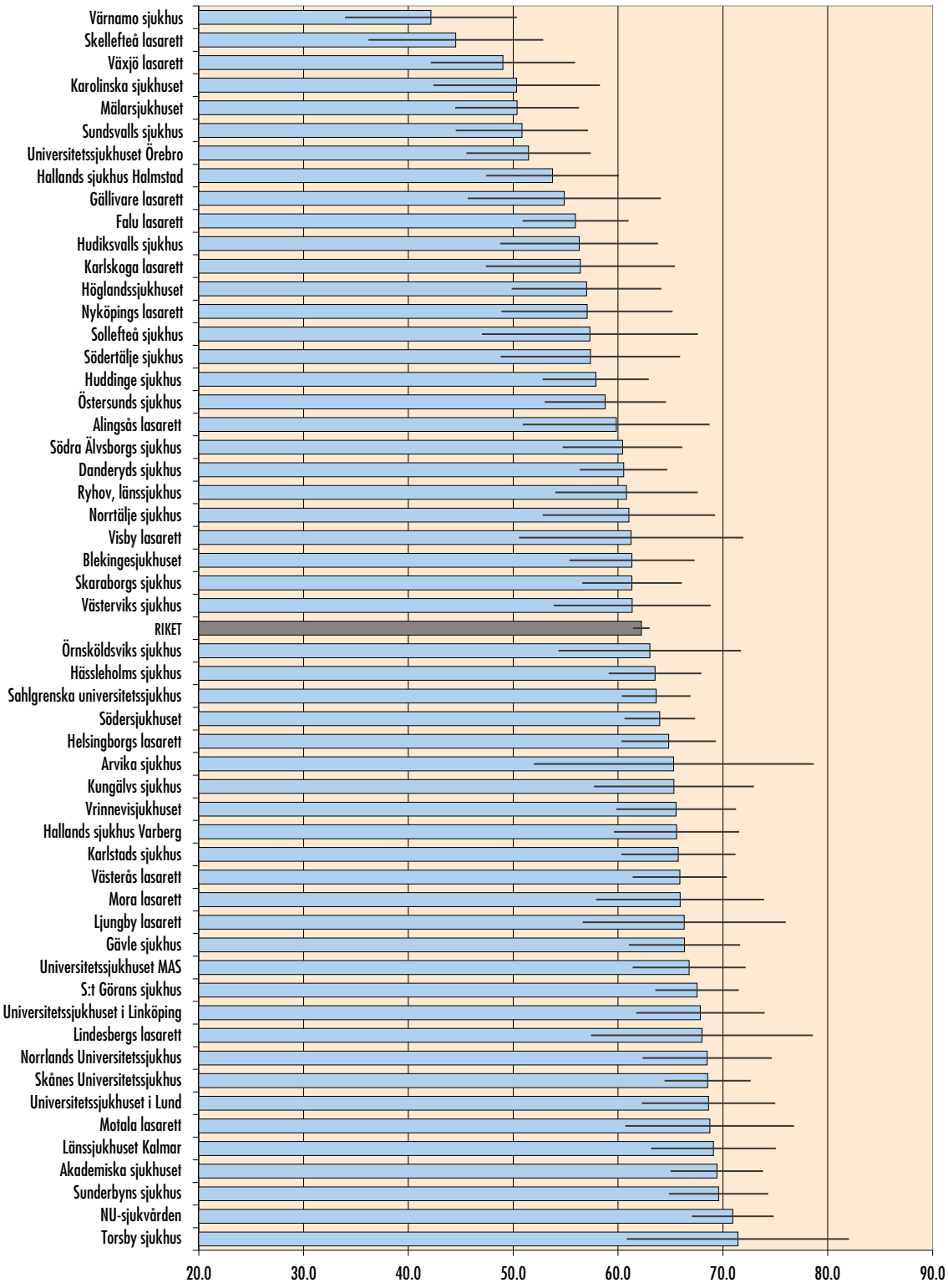
Proportion arthroplasties after hip fracture per hospital (cont.)

Patients 65 years and older, 2011–2012

Hospital	Number of arthroplasties	Proportion arthroplasties	Proportion hemiarthroplasties	Proportion THRs
Sollefteå sjukhus	51	57.3%	92.2%	7.8%
Sunderbyns sjukhus	254	69.6%	89.0%	11.0%
Sundsvalls sjukhus	123	50.8%	76.4%	23.6%
Södersjukhuset	501	64.0%	83.4%	16.6%
Södertälje sjukhus	74	57.4%	67.6%	32.4%
Södra Älvsborgs sjukhus	171	60.4%	62.0%	38.0%
Torsby sjukhus	50	71.4%	58.0%	42.0%
Universitetssjukhuset i Linköping	152	67.9%	93.4%	6.6%
Universitetssjukhuset i Lund	140	68.6%	85.0%	15.0%
Universitetssjukhuset MAS	197	66.8%	88.3%	11.7%
Universitetssjukhuset Örebro	141	51.5%	87.2%	12.8%
Visby lasarett	49	61.3%	81.6%	18.4%
Vrinnevisjukhuset	175	65.5%	65.1%	34.9%
Värnamo sjukhus	59	42.1%	64.4%	35.6%
Västerviks sjukhus	100	61.3%	87.0%	13.0%
Västerås lasarett	284	65.9%	21.5%	78.5%
Växjö lasarett	100	49.0%	78.0%	22.0%
Örnsköldsviks sjukhus	75	63.0%	85.3%	14.7%
Östersunds sjukhus	164	58.8%	70.7%	29.3%
Nation	8,853	62.2%	78.3%	21.7%

Proportion arthroplasties after hip fracture per hospital (cont.)

Patients 65 years and older, 2011–2012



Notes

International cooperation

The world's interest for harmonized and merged databases has increased, perhaps because these databases have greater potential for so-called "post market surveillance" and "early warning signs" (the results after an implant have been released on to the open market) than the Swedish Hip Arthroplasty Register has on its own. This area of use for a register has, to a certain extent, gotten lost in Sweden since six established implants have long stood for more than 90% of the Swedish market.

NARA

In earlier annual reports we have described in detail cooperation between the established Nordic arthroplasty registers that resulted in the founding of NARA (Nordic Arthroplasty Register Association). The NARA group has now published ten scientific studies and more manuscripts have either been submitted or are in progress. The latest merged database contains over 600,000 total hip replacements, and the main strength of this database, compared with the separate countries' databases, is "post market surveillance" (since the Nordic countries have widely different user profiles) as well as the statistical possibility of analyzing very unusual diagnoses and complications.

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ISAR

The International Society of Arthroplasty Registries started in 2004 as a common interest association for established international implant registers. The objective for ISAR is to improve the outcome for patients operated with knee and hip arthroplasty throughout the world and to stimulate international cooperation between established and developing registers. The association has at present 10 full members (national registers with over 80% coverage) as well as about 20 associate members (local and regional registers as well as national registers that have not yet attained 80% coverage). In this association three projects have been started, where one of the projects has as its aim to harmonize generic implant description. One of the three Registers' directors, Göran Garellick, has been the president of the association during 2012 and 2013.

www.isarhome.org

International Society of Arthroplasty Registries, ISAR

The above organizations decided in 2011 they would cooperatively arrange the first international congress on arthroplastic registers, on 20–22 May 2012 in Bergen. The meeting gathered together about 200 participants for an intensive and comprehensive 2-day meeting. Meeting number two was held in Stratford-upon-Avon in May and June 2013. This meeting lasted for three days and was very successful – once again with participants from a large number of countries. At present, meeting number 3 is being planned to take place in Boston from May 31st to 2 June 2nd 2014.

2nd International Congress of Arthroplasty Registries

After the previous year's success in Bergen where the first ISAR congress was held, ISAR decided to arrange a congress again in 2013. The original idea was to hold an international conference for prosthesis registries every other year. The 2013 ISAR congress was held in Stratford-upon-Avon, 1- 3 June. Under the leadership of Keith Tucker and Martyn Porter, the local organization group organized a packed three-day programme. About 200 delegates representing registries, clinically active orthopaedic specialists, national and international interest groups, industry, patient associations and scientific journals participated in the meeting. The congress can be summed up as consisting of about fifty free lectures, of which eight were from the Swedish Hip Arthroplasty Register, as well as eight symposia, a poster exhibition and a Hamlet performance by the Royal Shakespeare Company.

The theme of the congress "Improving outcome of joint replacement surgery – How can arthroplasty registries contribute?" casts light on the subject in a number of ways. The congress started with a half-day symposium on statistics and methodology which attracted more interest than expected. This was followed by symposia concerning how one identifies implants and techniques inferior to others, how industry and registries can be of use to each other in order to improve results, how methods and registration can be standardized and how international cooperation can be developed. There is absolutely no doubt that there is considerable activity going on in the field of register research and development. Participants left Stratford with valuable newly won knowledge and strengthened by Shakespeare quotations like "Ignorance is the curse of God; knowledge is the wing wherewith we fly to heaven".

To judge from the evaluation, most congress delegates were very satisfied and this year's ISAR congress was also a great success. In 2014 the congress will be organized in Cambridge, Boston, 31 May 31st to June 2nd. Notification of participation and submission of abstracts can be carried out on ISAR's website.

County results

In previous annual reports we have published procedure frequency and prosthesis survival analyses at the regional level (the older regional classification). Since *Regional comparisons (Öppna jämförelser)* is a report at county level, we reworked this section in 2010 with an account of procedure level and the Register's national *quality of life* indicators per county.

Procedure frequency in the country as a whole and per county

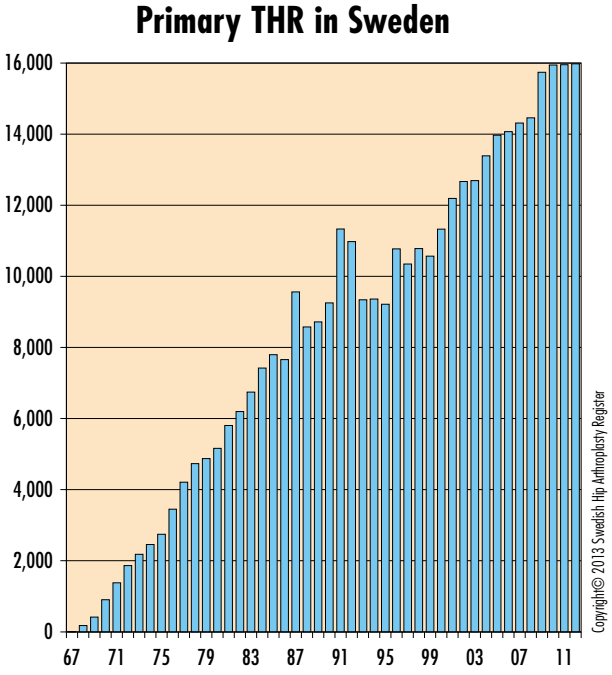
The total procedure frequency of total hip replacements in 2012 in Sweden was mostly unchanged compared with 2011 but sank marginally per 100,000 inhabitants from 168 to 167. This figure is for the whole population and is based on Statistics Sweden's (SCB's) population statistics for 31 December 2012 (9,555,893 inhabitants). Please note that many national and international comparative reports are based on statistics from the Swedish National Board of Health and Welfare (PAR), which since 2000 has had a coverage 3–6% lower than the Register!

Production versus *consumption per 100,000 inhabitants per county*

Decision-makers are first and foremost interested in so-called consumption figures per county – while profession and quality registers (especially those registers that control surgical interventions) have instead had as their focus so-called production figures.

Consumption means that the inhabitants of a county/region have access to hip arthroplasty irrespective of whether the intervention is performed in their home county or elsewhere. These figures are significant for directorship and governing but cannot be used for analysis of institutions and their activities or clinical improvement, which are a large part of the quality registers' assignment.

The distribution of production and consumption figures per 100,000 inhabitants shows great variation between the principals (private entrepreneurs are geographically included): production: 133–320 and consumption 127–250/100,000 inhabitants. That is to say that consumption is almost doubled between the counties with lowest the consumption compared with the counties with the highest. The reason for this very marked variation can only be demographic differences. The present situation speaks for the fact that we have geographically speaking very unequal healthcare with respect to treatment of hip osteoarthritis in Sweden. Unfortunately the directorship of the register believes that non-medical and local "political" administrative decisions are only one of perhaps several causes for the great variation found. The Register will focus sharply on this issue in the near future – both in regional analyses of institutions and their activities and in clinical research. The main implement for such an analysis is the comprehensive



co-referencing databases that we have created and plan to create (SHPR, SoS, SCB and FK). Such processes are sluggish since they demand ethical approval and are weighed down by considerable resource consumption for the Register (competent staff and high costs). On account of this there will always be a delay with regard to this type of analysis – often at least 2–3 years if one also aims to include short-term results after elective operation with total hip replacement in the analysis.

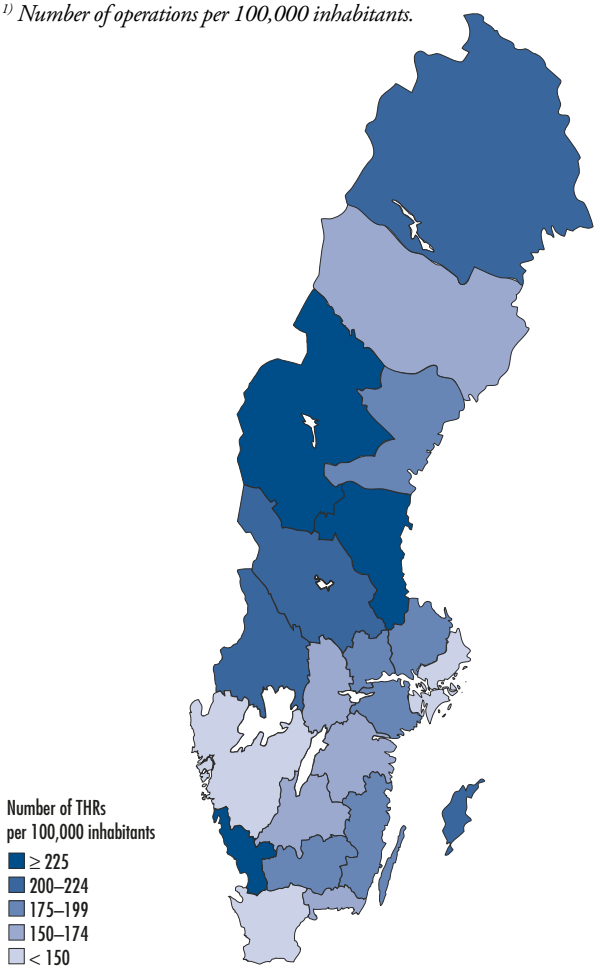
Production versus *consumption per 100,000 inhabitants ≥ 40 years of age per county*

With the aim of compensating for demographic differences between different parts of the country, in this year's report we are using the same analysis per 100,000 inhabitants ≥ 40 years of age. This analysis shows that there continue to be great differences in both production and consumption, despite adjustment for age. (see Table and maps on page 152).

Production

County	Operations	Population	Number[1)]
01 Stockholm	3,036	2,127,006	143
03 Uppsala	618	341,977	181
04 Södermanland	503	274,723	183
05 Östergötland	726	433,784	167
06 Jönköping	568	339,116	167
07 Kronoberg	330	185,887	178
08 Kalmar	435	233,548	186
09 Gotland	121	57,241	211
10 Blekinge	253	152,315	166
12 Region skåne	1,778	1,263,088	141
13 Halland	973	304,116	320
14 Västra Götaland	2,135	1,600,447	133
17 Värmland	549	273,080	201
18 Örebro	493	283,113	174
19 Västmanland	511	256,224	199
20 Dalarna	599	276,555	217
21 Gävleborg	629	276,637	227
22 Västernorrland	447	241,981	185
23 Jämtland	301	126,201	239
24 Västerbotten	437	260,217	168
25 Norrbotten	536	248,637	216
Nation		9,555,893	167

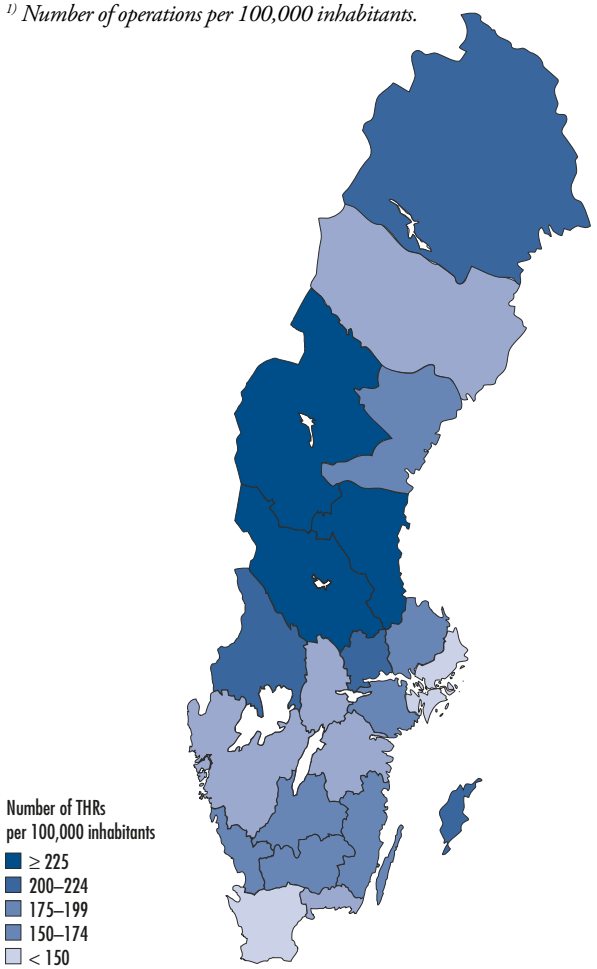
[1)] *Number of operations per 100,000 inhabitants.*



Consumtion

County	Operations	Population	Number[1)]
01 Stockholm	2,698	2,127,006	127
03 Uppsala	621	341,977	182
04 Södermanland	533	274,723	194
05 Östergötland	718	433,784	166
06 Jönköping	594	339,116	175
07 Kronoberg	342	185,887	184
08 Kalmar	387	233,548	166
09 Gotland	123	57,241	215
10 Blekinge	262	152,315	172
12 Region skåne	1,722	1,263,088	136
13 Halland	547	304,116	180
14 Västra Götaland	2,439	1,600,447	152
17 Värmland	600	273,080	220
18 Örebro	482	283,113	170
19 Västmanland	560	256,224	219
20 Dalarna	638	276,555	231
21 Gävleborg	622	276,637	225
22 Västernorrland	457	241,981	189
23 Jämtland	315	126,201	250
24 Västerbotten	449	260,217	173
25 Norrbotten	520	248,637	209
Nation		9,555,893	167

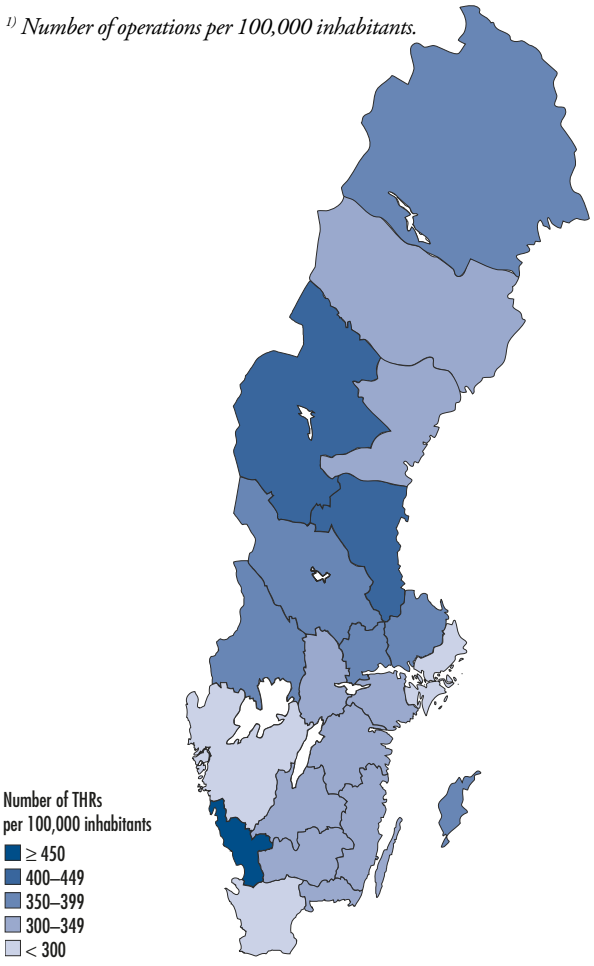
[1)] *Number of operations per 100,000 inhabitants.*



Production ≥40

County	Operations	Population, 40 years and older	Number[1)]
01 Stockholm	2,995	1,000,271	299
03 Uppsala	608	166,083	366
04 Södermanland	500	148,808	336
05 Östergötland	721	222,140	325
06 Jönköping	565	176,273	321
07 Kronoberg	329	97,046	339
08 Kalmar	430	132,281	325
09 Gotland	120	32,656	367
10 Blekinge	253	84,160	301
12 Region skåne	1,756	635,633	276
13 Halland	965	162,205	595
14 Västra Götaland	2,112	810,603	261
17 Värmland	546	152,624	358
18 Örebro	492	148,550	331
19 Västmanland	510	137,382	371
20 Dalarna	596	155,254	384
21 Gävleborg	625	155,195	403
22 Västernorrland	444	135,601	327
23 Jämtland	301	69,775	431
24 Västerbotten	433	132,932	326
25 Norrbotten	532	139,458	381
Nation		4,894,930	323

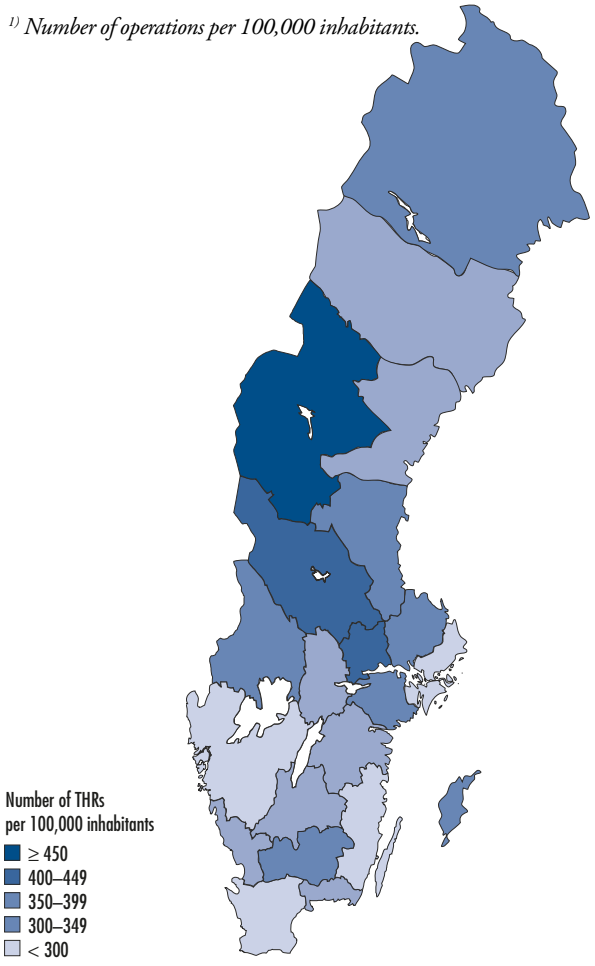
1) Number of operations per 100,000 inhabitants.



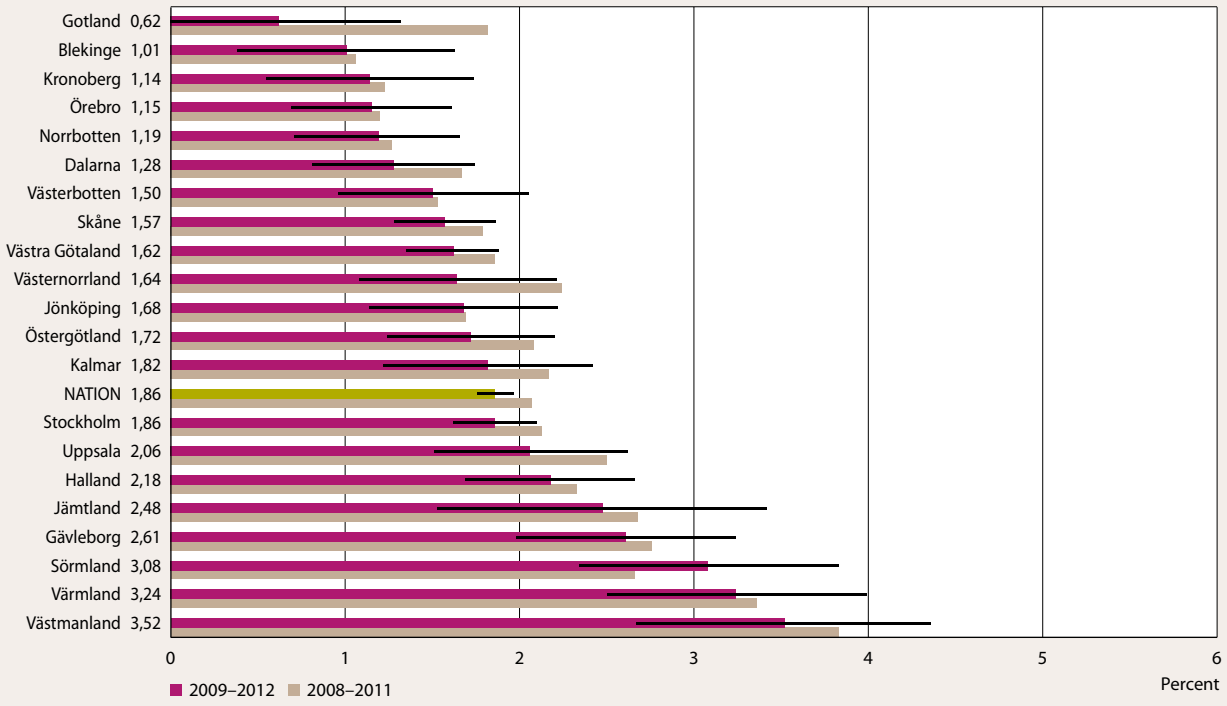
Consumtion ≥40

County	Operations	Population, 40 years and older	Number[1)]
01 Stockholm	2,662	1,000,271	266
03 Uppsala	619	166,083	373
04 Södermanland	527	148,808	354
05 Östergötland	714	222,140	321
06 Jönköping	591	176,273	335
07 Kronoberg	340	97,046	350
08 Kalmar	383	132,281	290
09 Gotland	122	32,656	374
10 Blekinge	261	84,160	310
12 Region skåne	1,703	635,633	268
13 Halland	542	162,205	334
14 Västra Götaland	2,412	810,603	298
17 Värmland	598	152,624	392
18 Örebro	481	148,550	324
19 Västmanland	557	137,382	405
20 Dalarna	633	155,254	408
21 Gävleborg	614	155,195	396
22 Västernorrland	454	135,601	335
23 Jämtland	315	69,775	451
24 Västerbotten	445	132,932	335
25 Norrbotten	514	139,458	369
Nation		4,894,930	323

1) Number of operations per 100,000 inhabitants.

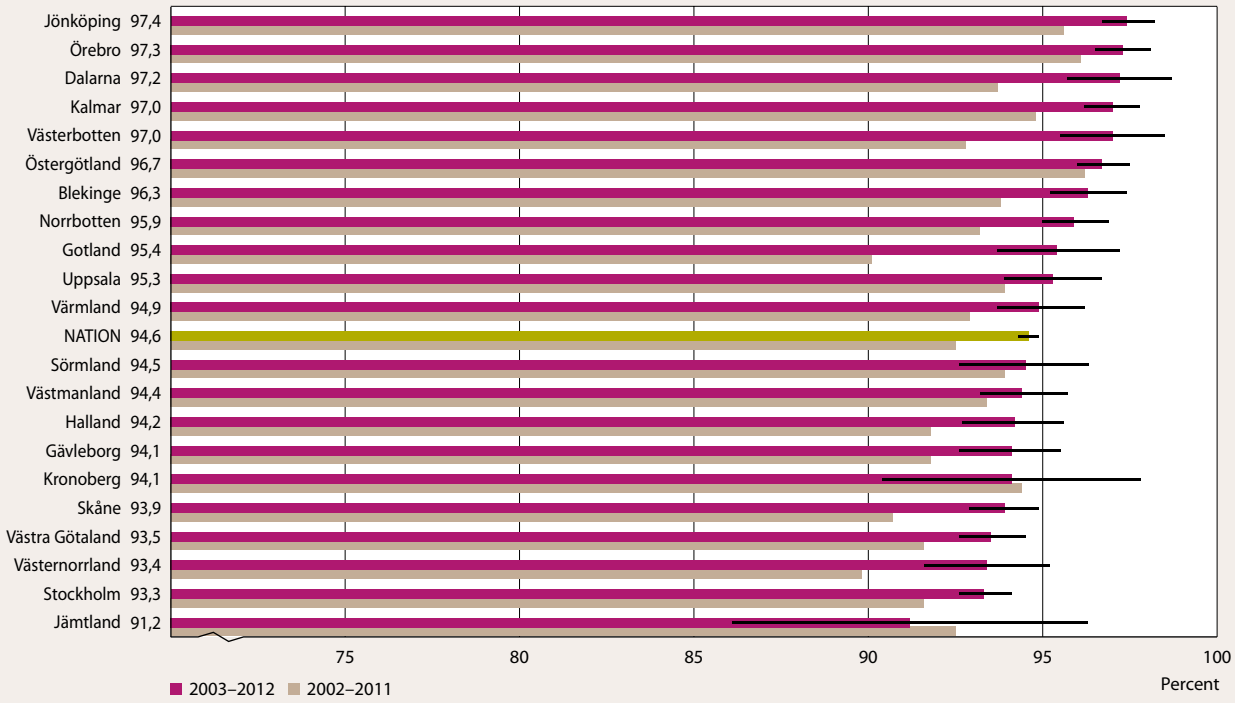


Proportion reoperations within 2 years after THR
2009–2012



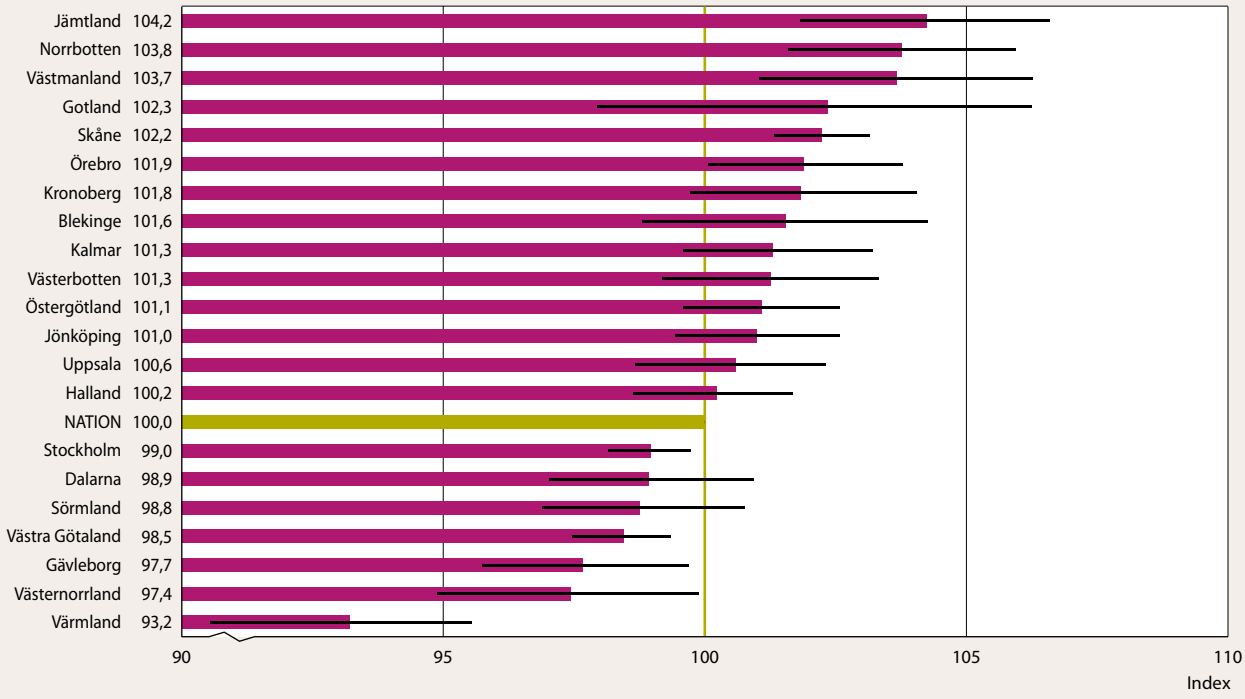
Source: Swedish Hip Arthroplasty Register.

Probability of not having a reoperation within 10 years after THR
2003–2012



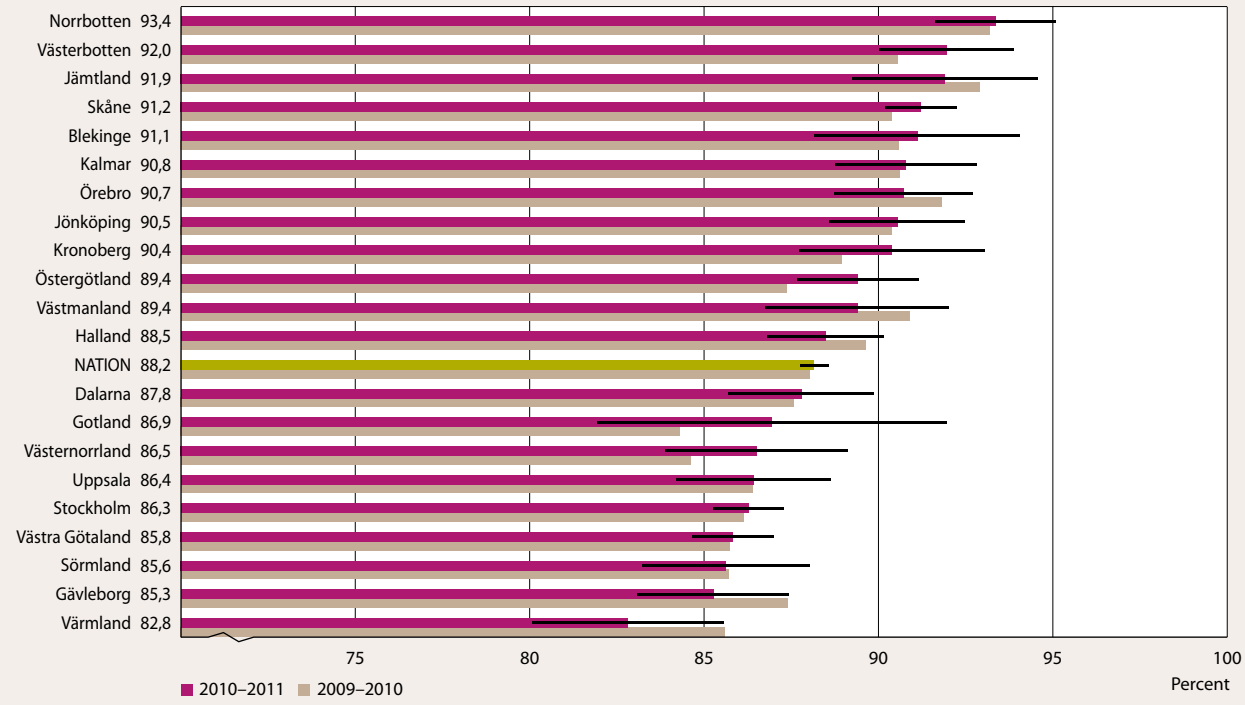
Source: Swedish Hip Arthroplasty Register.

EQ-5D-index gain 1 year after THR
2010–2011



Source: Swedish Hip Arthroplasty Register.

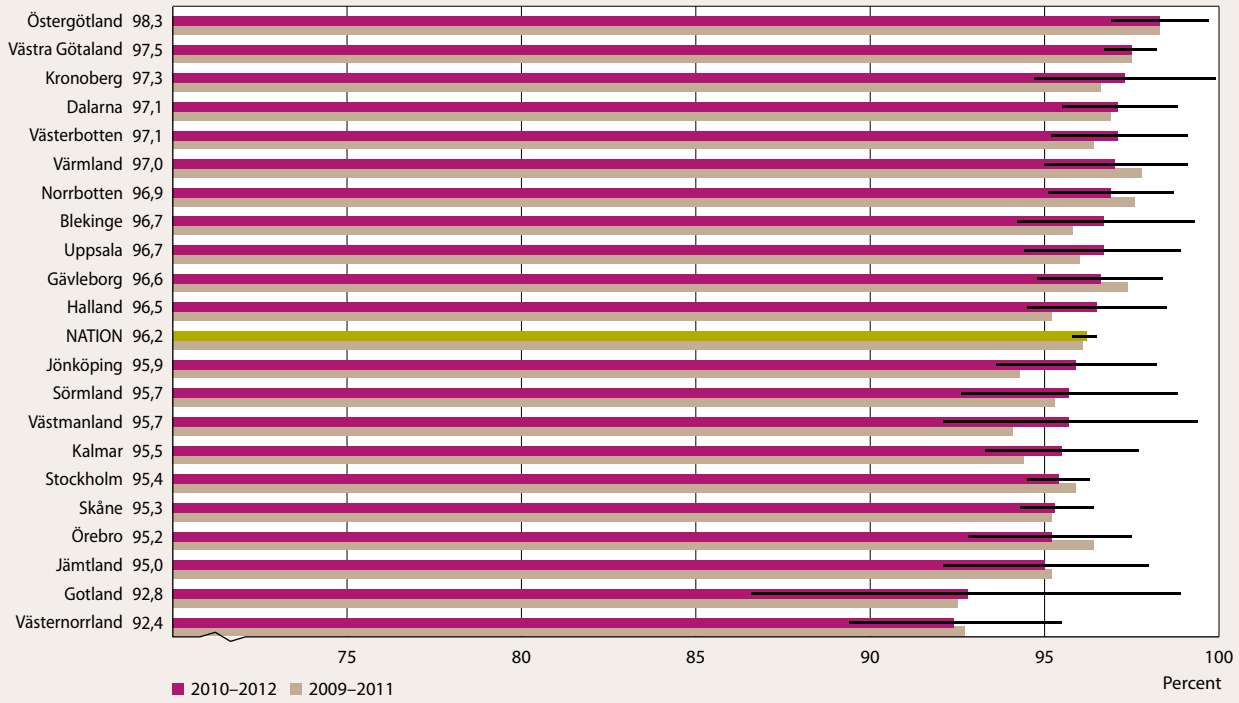
Patient satisfaction 1 year after THR
2010–2011



Source: Swedish Hip Arthroplasty Register.

Probability of not having a reaoperation within 1 year after hemiarthroplasty

2010–2012



Source: Swedish Hip Arthroplasty Register.

Current research projects

The main assignments of a National Quality Register are analyses of institutions and their activities, improvement projects and clinical research. The very comprehensive databases have a large and relatively unexploited research potential. A database merging official databases such as the Swedish National Board of Health and Welfare's Health Data register, the National Insurance Office, Statistics Sweden and regional patient-administrative systems has resulted and can result in databases that are unique with respect to observational studies.

12 doctoral dissertations and about a hundred scientific articles have already been published that are entirely or partly reliant on analyses from the Swedish Hip Arthroplasty Register.

The Register directorship wants to emphasize strongly that the Register's databases are not only available to register collaborators in Gothenburg. All researchers, within as well as outside the country, can exploit the Register for research if adequate questions are presented. This "programme statement" has during recent years resulted in the presence of 14 postgraduate students from 4 Swedish universities, who are currently active with data from the Register. During the past two years, a number of medical student and specialist-training physician projects with analyses of both local and national register data have been carried out. A qualitative analysis of dissatisfied patients has also been carried out as a master's project by a physiotherapist.

Research projects involving the Register

The Register's directorship and governing group include many Swedish postgraduate researchers who are supervisors and assistant supervisors for a number of postgraduate students. Currently within this group research is being carried out concerning prosthesis fixation, health economy, hip fracture and prosthetic surgery, fractures close to the prosthesis, revision surgery and patient-reported outcomes after prosthetic surgery. Members of the group are:

- Johan Kärrholm, Göteborg
- Göran Garellick, Göteborg
- Henrik Malchau, Göteborg
- Cecilia Rogmark, Malmö
- Leif Dahlberg, Malmö
- André Stark, Stockholm
- Per Wretenberg, Stockholm
- Nils Hailer, Uppsala
- Hans Lindahl, Trollhättan
- Peter Herberts, Göteborg
- Rüdiger Weiss, Stockholm
- Lars Weidenhielm, Stockholm
- Ola Rolfson, Göteborg
- Olof Leonardsson, Malmö
- Olof Sköldenberg , Stockholm
- Clas Rehnberg, Stockholm

Postgraduate students with all or part of their dissertation material from the Register:

Buster Sandgren, Stockholm
Datortomography of patients who received an uncemented acetabular component in connection with hip arthroplasty.

Ferid Krupic, Göteborg
Socioeconomic variables' significance for outcome after hip arthroplasty

Viktor Lindgren, Stockholm
Complications and outcome after hip arthroplasty with special focus on infections and the surgical incision's significance

Max Gordon, Stockholm
Comorbidity and socioeconomic variables' significance for outcome after hip arthroplasty

Per-Erik Johanson, Göteborg
Hip arthroplasty for the younger patient. Evaluation of different prosthetic concepts

Maziar Mohaddes, Göteborg
Cup revisions with different fixation methods

Camilla Bergh, Göteborg
Avascular caput necrosis and prosthetic surgery

Meridith Greene, Boston och Göteborg
Predictors for patient-reported outcomes after hip arthroplasty

Georgios Chatziagorou, Göteborg
Early and late femur fractures in proximity of the prosthesis

Ammar Al-Jobory, Lund
Dislocation in fracture-related prostheses

Susanne Hansson, Lund
Comorbidity and outcomes in fracture-related prostheses

Jonas Wohlin, Stockholm
Free care choice's effects on results and costs after hip arthroplasties

Ted Eneqvist, Göteborg
Spine-hip dilemma and further development of the EQ-5D instrument with a Swedish "value-set"

Anne Garland, Visby och Uppsala
Hip arthroplasty and mortality

In 2012, Stergios Lazarinis took his doctoral degree in Uppsala. Three of five sectional articles were studies of the Register's data in his dissertation *Form and Finish of Implants in Uncemented Hip Arthroplasty. Effects of Different Shapes and Surface Treatments on Implant Stability.*

At present the Register also has intensive research projects within NARA and the group's first ten scientific articles have now been published, and work is ongoing on several more manuscripts.

The Swedish Hip Arthroplasty Register's databases are still underexploited in research contexts. The Register's management invites all interested researchers with adequate hypotheses to cooperate. The NARA database is also accessible for Swedish postgraduate students.

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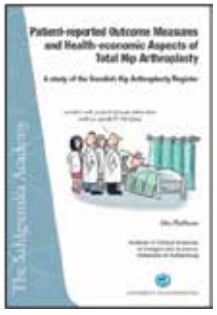

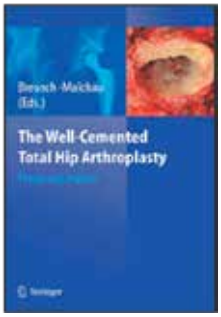

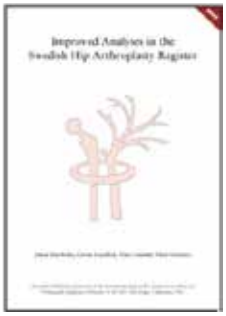

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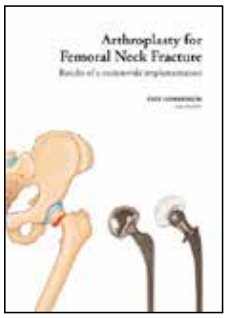

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6.1 Optimal Cementing Technique – The Evidence: What Is Modern Cementing Technique?, pages 146–149
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7.3 Migration Pattern and Outcome of Cemented Stems in Sweden, pages 190–195
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11 The Evidence from the Swedish Hip Register, pages 291–299
Henrik Malchau, Göran Garellick, Peter Herberts

19 Economic Eselectionuation of THA, pages 360–366
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20 The Future Role of Cemented Total hip replacement, pages 367–369
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