# The Swedish Hip Arthroplasty Register

## *Annual Report 2005*

**256,298**
PRIMARY THRs
1979-2005

**30,052**
REOPERATIONS
1979-2005
(closed reduction excl.)

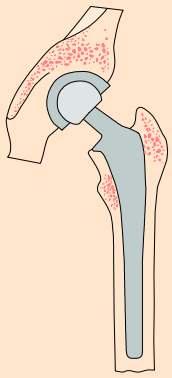
**24,476**
REVISIONS
1979-2005

**2,079**
ENVIRONMENTAL/
TECHNICAL PROFILES
1979-2005

**24,192**
PATIENT OUTCOME
2002-2005

www.jru.orthop.gu.se

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



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*August 2006*

# Contents

# *Foreword*

The national quality registers are facing major changes when it comes to openness, the role of principals, financing and the increasing call for standardised information structures and internet applications. There are a number of reasons why the National Hip Arthroplasty Register is now entering a new era. Its pioneer, Peter Herberts, is now withdrawing as the person responsible for keeping the register and he has handed over this role to Johan Kärrholm who, with the assistance of Göran Garellick, will be leading the register. Peter's importance for the development of the register and Swedish hip replacement surgery cannot be overstated. With a great deal of assistance on the part of Lennart Ahnfelt and Henrik Malchau, Peter has put the register's name on the global map. In the future, with his large-scale experience and contact network, Peter will be involved in the management of the register as a consultant and adviser.

The openness of the national quality registers, when it comes to the presentation of results, has been an area of focus for several years. This year's report sees an increase in the number of openly reported variables for each hospital. The five- and ten-year survival of prostheses has been presented in the annual report since 1999 and, starting with this report, patient-related results (a pain and satisfaction VAS and the EQ-5D index) and short-term complications (re-operation within two years) will also be presented. These "quality indicators" have also been selected by the Swedish Board of Health and Welfare and the The Swedish Association of Local Authorities and Regions (SALAR) as national quality indicators.

On 19 June 2006, the report entitled "Open comparisons of the quality and efficiency of the health and medical service – comparisons between county councils in 2006" was published. This report presents 57 national indicators of quality and efficiency in different parts of the health and medical service. County councils are ranked for each indicator using diagrams in which the results for the whole country and differences between county councils are presented. The aim of this report is to present possible differences in quality, results, patient experience and costs and, as a result, stimulate county councils and the health service to implement improvements.

For several years, the operating costs for the quality registers have been covered either wholly or in part by funds from the Dagmar system, which are distributed by the so-called Decision-Making Group comprising representatives from the Swedish Board of Health and Welfare, the SALAR, the Swedish Medical Society and the Swedish Association of Nurses. Like a large number of the other national registers, this register has been "chronically underfunded" for many years. For a number of years, the operating costs, including salaries and systems development, have been covered by external funding, such as ALF funding and research funds. For various reasons, the opportunity for this kind of external funding has declined sharply during the past two years, while the operating costs, primarily those relating to salaries and IT, have increased.

From the start of next year, the principal responsibility for the national registers will be transferred from the Swedish Board of Health and Welfare to the SALAR. An investigation is currently in progress to determine whether responsibility for the cost of operating these registers should be placed with the county councils. For many years, the county council at which the person responsible for keeping a register is employed has been regarded as the principal of that register. To date, this has not, however, involved any financial responsibility.

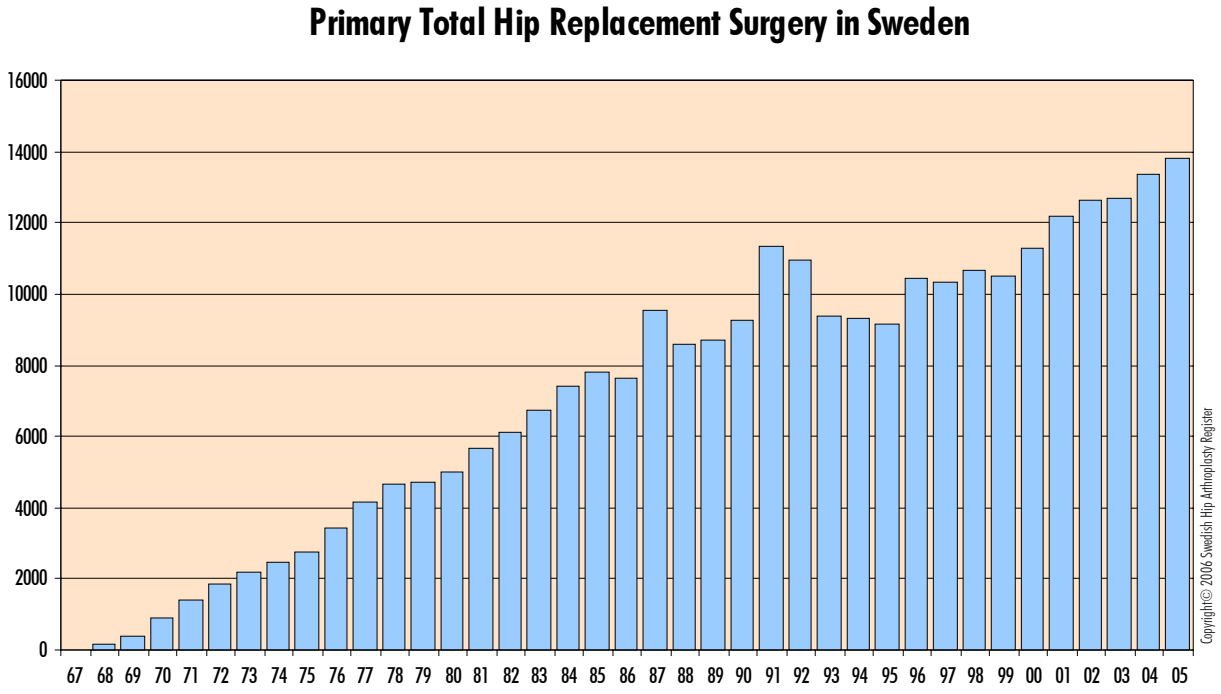
On 10 March 2006, the Swedish Government approved a new national IT strategy for care and welfare. As a result, the SALAR has initiated a project, the so-called IFK project (a Swedish acronym standing for information structure for quality registers), which is designed to create a uniform information structure for the national quality registers and the existing digital patient record system. In the future, this could facilitate the merger of different registers and create the opportunity for transfers between computer records and registers and vice versa. Within the foreseeable future, this will also facilitate the collection of data for the different registers – in other words, data will only be entered once in records or registers. When it comes to the implant-related registers (hips and knees), a development of this kind will primarily enable some supplementary medical variables to be incorporated in the register database without any additional work.

During the year, the Swedish Board of Health and Welfare and the SALAR have reviewed the web-based registers' websites in terms of readability, availability, openness and patient-oriented information and have then put forward recommendations for the design of these websites. As a result, the register website and internet application will be re-designed during the autumn to include a "popular scientific" presentation of results for both patients and the principal and ownership structure of the health service. In addition, the openly presented variables will be put on the website and this will result in a change to future annual reports. Most results will be on line on the website and a shorter, printed annual report will focus on in-depth analyses.

The members of the register steering committee are appointed by the board of the Swedish Orthopaedic Society. During the year, the previous steering committee, Lars Linder, Arne Lundberg and Anders Wykman, retired. The register management would like to thank them for many years of committed work and welcomes the new members, André Stark, Uldis Kesteris and Krister Djerf, who, in addition to the register management, are members of the steering committee.

Starting with this annual report, we shall also be changing our name to the Swedish Hip Arthroplasty Register. There are several reasons for this change of name; the confusion with the National Hip (hip fracture register) and the recently initiated Swedish Hemi-arthroplasty Register (which is kept by Cecilia Rogmark), which is a joint-venture project between the Hip Prosthesis Register and National Hip.

All the units (79 hospitals in 2005), both public and private, which perform total hip replacement (THR) participate in the register. The coverage is complete. The individually based registration of primary THR was introduced in 1992. Re-operations including revisions have been registered on an individual basis since the start in 1979.




*Development of primary THRs performed in Sweden between 1967 (6 operations) and 2005 (13,822 operations).*

Demographic data from primary THR are reported in the form of age, gender and diagnosis. The choice of implant and fixation method, together with the surgical technique, is analysed to enable an ongoing discussion about suitable developments and trends in this area. This information also acts as the basis for the learning process feedback data generate for each unit.

Individually based health outcomes are now documented from 75% of the country's clinics. The introduction of CPP (cost per patient) at every clinic, combined with measurements of health-related quality of life (EQ-5D), will create a nationwide opportunity to introduce the register's health-economy model.

The total number of re-operations and revisions continues to decline. This applies in particular in the Stockholm region. No hospital reports any large-scale delay in the reports of re-operations (as there was last year). As yet, we are unable to establish whether this reduction is due to a real reduction in the need for re-operations or whether it is a resource problem (more re-operations on the waiting list).

## *Receiving reports*

All the clinics but three report via the web application. Copies of records from re-operations have been submitted with varying delays during the year. They are necessary for the analyses included in the report and for in-depth studies.

## *Reporting*

All publications, annual reports and scientific exhibitions are shown on our website For more information, go to www.jru.orthop.gu.se.

This annual report has been delayed for a number of reasons and we would like to apologise for this. In recent years, the report has grown in scope as a result of an increase in the number of in-depth analyses. In the coming years, more results will be openly published on the website and, as a result, the scope of the annual report will once again decline.

The hip arthroplasty register is based on decentralised data collection and the work that is done by the contact secretaries and physicians at the clinics is therefore vital for the register to function. We extend our grateful thanks to all of you for the work you have done during the past year.

Göteborg, August 2006

Johan Kärrholm
Professor, MD, PhD

Göran Garellick
MD, PhD

Peter Herberts
Professor Emeritus, MD, PhD

# The case-mix factor

## Background

Starting with this year's report, the Register is increasing the number of openly reported parameters at county council, regional and clinic level. Open reporting offers many advantages and both decision-makers and register managers agree that the registers should be developed in a manner that promotes more openness.

The principal disadvantage, however, is the interpretation problems that occur when the results are evaluated by non-professionals and perhaps first and foremost by the mass media. Not infrequently, the misinterpreted mass-media reporting of treatment results impacts patients in the form of increased and often unnecessary anxiety.

## Case-mix problem

The case-mix factor is the largest individual factor that leads to misinterpretations of register results which are difficult to interpret both within and outside the profession. Over the years, decision-makers in the Swedish Health service have criticised our register managers for not reporting all the results openly. The reason for this is not simply an unwillingness to report possibly poor and/or varying results. It is also due to interpretation problems.

Every register should develop some form of case-mix indicator and the most optimal solution would naturally be if we could find some part of it that was generally applicable to all disease groups.

Whenever reporting takes place, it is necessary to present the patients' demographic profile – the case-mix – in detail. Individual studies normally comprise more homogeneous patient material, depending on the inclusion criteria specified in the study protocol. A nationwide register study includes all patients, with a wide distribution of risk factors and a large difference between hospital profiles. More serious cases are referred to larger clinics and special units, which perform surgery on patients running higher surgical risks, when it comes to both short-term and long-term complications.

## Case-mix and patient-related outcome

Back in 1972, Sir John Charnley wrote about the need to describe the demographic profile of a studied patient group and he then published his straightforward patient classification: Charnley A – unilateral hip disease, B – bilateral hip disease and C – multiple joint disease or intercurrent disease. The Charnley classification has a major impact on the outcome following hip replacement, measured using both disease-specific and generic instruments. C patients generally experience poorer results. This applies primarily to total values. The values that are obtained (the difference between pre- and post-operative results) in a prospective follow-up do not differ substantially. Age and gender also affect the result.

## Case-mix and prosthesis survival

One of the principal interpretation problems is the fact that younger, "healthier" patients (i.e. Charnley A and B) usually obtain better values when it comes to patient-related outcome, but at the same time many of them also run a higher risk of long-term loosening and a need for revisions.

For this reason, we published a number of tables in last year's report showing the percentage of patients with primary OA in the 60-75 year age group. These patients represent the average of what can be expected when it comes to the burden on the health service in the form of care, level of surgical difficulty, post-operative course, costs and expected results. This group accounts for 41% of all THR operations in Sweden between 1992 and 2004 (n=141,703). During the same period, 3.2% of these patients underwent revisions, independent of cause. This incidence is 0.5% lower than that in the remaining group, which comprises all other patient categories.

In a Cox regression, the risk of revision is approximately 27% higher among patients outside this age group or with a diagnosis other than primary osteoarthritis. If the gender distribution is also specified, male gender represents a further increase in the risk of long-term complications. During the year, the register management will be focusing more heavily on the case-mix factor, with the aim of creating an index (a figure – dependent on gender, diagnosis and age), which can be given for each clinic and county council/region.

## Discussion

To summarise, all interpretations of the register results should be correlated to the case-mix of the study group. We must also take account of what is to some degree an opposite effect on patient-related outcome and long-term loosening.

An effective, satisfactory analysis of the material in the register is essential to enable fair comparisons. It is the result at clinic level that is interesting to patients and decision-makers. The principals should be able to present good information about the detailed content of their activities in order to explain their position in national comparisons.

# *Primary THR*

The register shows primary total hip replacements performed in Sweden since 1979. Up to 1991, the data were collected from individual clinics. Since 1992, individual-based information on the primary procedure has been used. This means that factors such as age, gender, diagnosis, surgical technique and the choice of cup and stem could be registered for every operation. Up to 1991, the reports were partially based on estimates. In 1999, two important changes were made. The first was that registration via the internet was made possible and, in 2005, this option was utilised by 76 of the 79 clinics which perform hip replacements in Sweden. The other three report using data files. The other change was that the registration was supplemented with article numbers for the different implant components that were used in each operation. As a result, each patient's implant and its various components can be identified in detail, thereby also improving the opportunity substantially to improve the analysis. Measures designed to enhance quality in the form of material and design changes can be monitored and any clinical problems can be traced in a way that was previously impossible.

During the period 1979-2005, 256,298 primary hip arthroplasties were registered. In 2005, the number of primary procedures increased by 457 compared with 2004 and totalled 13,848. The 15 most common implant combinations during the last 10 years are presented in tabular form. In the acetabulum, 92% of the components were cemented and 8% were uncemented during this period. On the femoral side, more were cemented (94%).

Between 2000 and 2005, the percentage of uncemented cups increased slowly from 7.2% to 10.8%. On the femoral side, uncemented fixation increased more sharply from 3.5% to 12.5%.

The first table (page 7) shows the most common implant combinations and their market shares. The figures are based on use during the past 10 years. All 15 of the most frequently used implant systems during the last 10 years are fully cemented.

Five implant systems dominate the cemented market: Lubinus (34.4%), Charnley (12.9% – three combinations), Exeter (11.3% – two combinations), Spectron EF Primary (5.3%) and the combination of the Charnley Elite cup and polished Exeter stem (4.5%). Among the stem components, Lubinus SP II dominates heavily and continues to increase, to 6,742 cases in 2005. It is followed by the Exeter stem in 3,213 cases and the Spectron stem in 923 cases. The CLS Spotorno increased successively to 695 in 2005 and is now by far the most frequently used stem that is implanted without cement.

The most common cup, the Lubinus increased to 5,764, the Exeter Duration declined to 1,264, while the Charnley Elite is used on more or less the same scale (n=1,401). The cup and stem components are often combined in different ways and even between different implant systems and manufacturers. The Exeter (polished stem) implanted with different types of Charnley cup has become by far the most common combination of this type.

Among the 15 most common uncemented prosthesis systems, use is primarily concentrated on those with well-documented function in the medium-term perspective. The CLS Spotorno with the Trilogy cup (with or without hydroxyapatite – HA) was the most common combination and was used in 262 cases. Both the CLS stem and the Trilogy cup are used in five of 15 of the most common uncemented combinations of the cup and stem design. In 2005, various versions of the Bi-Metric stem were the second most common uncemented stem (n=441), after the CLS (n=695), followed by the ABG (n=214). Of the uncemented cups, the Trilogy, with or without HA, was by far the most common and was used in 602 cases. It was followed by the Trident HA (n=165), Allofit (n=146), BHR (n=121) and CLS Spotorno (n=113).

Since 1999, the number of hip replacement operations in which the stem has been anchored without cement and the cup with cement (so-called reversed hybrid) has increased sharply. Until 2003, it was more common for the stem to be cemented, while the cup was implanted without cement ("classical" hybrid prosthesis). In 2004, the number of reversed hybrids exceeded the number of hybrids. This difference was further accentuated in 2005. Different versions of the Bi-Metric stem were the design that was most frequently used for the reversed hybrid (n=302). It was followed by the ABG (n=172) and CLS Spotorno (n=143). When it came to cups, the Charnley and Charnley Elite (n=245) dominated, followed by the Lubinus snap-fit (n=112) and Contemporary Hooded Duration (n=92).

Prostheses of the resurfacing type have been used conservatively. An increase has been noted since 2003 (n=71) and it continued in 2005 (n=189). The market is completely dominated by two implants, BHR (n=114) and Durom (n=74).

Hip replacement operations are more common among women. Since 1992, the women/men ratio has fluctuated around 60%/40%. Since 2003, we have seen a slight tendency towards equalisation. In 2005, 59.3% of patients were women. During the past 10 years, the average age of both genders has fallen from just above 70 years of age to just below among women and just above 68 years of age to around 67 among men. Between 2004 and 2005, the average age continued to decline among women, but appears to be levelling out among men.

In the group aged 60 and below, the number of uncemented implants primarily increased at the expense of the number of fully cemented implants. In the group aged 60, an increase in the number of all types of fixation has taken place. In relative terms, this increase is greatest among reversed hybrids. It is important to monitor and feed back these demo-

graphic changes. They reflect a combination of ongoing changes. In addition, the patient group as a whole has higher expectations and there is probably also an increase in belief in the quality of the procedure within the profession. More and more studies reporting high implant survival after long observation periods are being presented and the introduction of more wear-resistant joint surfaces has increased the potential for operating on younger patients. In theory, these demographic changes could also be caused by an earlier disease onset, but this hypothesis currently appears to be less likely.

Rural hospitals, central hospitals and private hospitals are performing an increasing number of primary operations and the tendency for fewer and fewer operations to be performed at university and regional hospitals in continuing. The sharp increase in operations at rural hospitals reflects the political aim of concentrating implant surgery at elective units. During the past 10 years, this type of hospital has almost doubled the number of these operations.

This trend has obvious advantages, but there are also some major disadvantages and risks. University/regional hospitals are responsible for research, development and teaching. When the frequency of standard procedures decreases sharply at this type of hospital, the basis for important R&D assignments also declines and this can then result in future stagnation and a reduction in resources in this area.

As yet, the majority of the elective units are not linked to the register follow-up routine (see the sections on patient-related outcome and free choice of care) and this is having a negative impact on the potential for open comparisons. A large number of the revisions that follow primary hip replacements at small elective units are performed at other clinics. In other words, primary surgeons are rarely required to perform re-operations on their patients. This represents another risk in relation to future quality, as the important individual learning process is lost.

The total number of primary hip arthroplasties and revisions a year using the four fixation principles, fully cemented, fully uncemented, hybrid and reversed hybrid, is shown in four diagrams on page 13. The diagram showing the total number (independent of fixation type) has been deleted. The histogram shows that the number of cemented and hybrid implants has been relatively constant during the past four years. Since 1999, the number of fully uncemented prostheses has almost tripled and the number of reversed hybrids has increased almost ten-fold. In spite of this, their relative share is fairly small, which is reasonable in the light of the fact that they have a limited indication area and that many designs lack sufficient long-term documentation.

RB in the figures stands for revision burden. This represents the ratio between the number of revisions in the form of the replacement or extraction of all or part of the implant and the total number of primary operations and revisions. The revision burden is a key figure in national and international comparisons. The total revision burden for the period 1992-2005 was 7.9% for fully cemented implants, 19.9% for fully uncemented implants, 11.3% for hybrids and 6.2% for reversed hybrids. The low figure for cemented implants in international terms can be regarded as being relatively representative of the production figures over the last few years. Some changes have, however, taken place (the Charnley stem has, for example, declined sharply) and they may impact the revision burden in the years to come.

As mentioned above, the RB is an important key figure in terms of comparison. In spite of this, it has obvious limitations. As many revisions are performed at clinics other than primary clinics, RB can really only be used as a quality variable in comparisons between different regions and counties. RB reports at clinic level do not provide a basis for fair comparison.

The RB for cemented and hybrid prostheses is relatively constant, in spite of an increase in the number of patients with hip implants in the population. When it comes to uncemented implants, there has even been a slight decrease, probably as a result of selecting better implants, even if other factors may also have had some effect. As reversed hybrids have been primarily used during the past five to six years and follow-up times are lacking, it would not be fair to use the concept of RB for this implant combination.

As before, the RB is higher for men in the large group of cemented prostheses, but it is far higher among women in the young patient group. The reason for this is not known, but different diagnosis distributions between men and women in the younger age groups may have some effect, something that was emphasised in last year's report.

The diagnosis distribution for primary operations has been surprisingly constant in recent years. Primary osteoarthritis has increased marginally and accounts for 76.3% during the entire study period. The number of primary hip fractures has not increased, which means that most cervical hip fractures in Sweden are operated upon using hemi-prostheses. In the younger age groups, primary osteoarthritis accounts for only 54.5% and in this group 16.5% are operated upon owing to inflammatory joint diseases and 14.1% owing to the sequelae of childhood disease.

Younger patients, below 50 years, are increasingly treated with uncemented implant systems (27.8%), hybrid fixation (21.5%) or reversed hybrids (7.1%). In this group, reversed hybrids account for only one third of cases. The tendency to avoid reversed hybrids in this young group can be seen in every diagnosis group.

## 15 Most Common Implants

most used during the past 10 years

| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share[1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-Poly (Lubinus SP II) | 31,921 | 4,213 | 4,587 | 4,708 | 5,396 | 5,645 | 56,470 | 34.4% |
| Charnley (Charnley) | 52,508 | 1,600 | 926 | 281 | 81 | 7 | 55,403 | 10.6% |
| Exeter Duration (Exeter Polished) | 2,230 | 1,514 | 1,547 | 1,418 | 1,329 | 1,122 | 9,160 | 7.7% |
| Reflection All-Poly (Spectron EF Primary) | 2,329 | 676 | 693 | 889 | 871 | 784 | 6,242 | 5.3% |
| Charnley Elite (Exeter Polished) | 837 | 601 | 912 | 1,060 | 996 | 975 | 5,381 | 4.5% |
| Exeter All-Poly (Exeter Polished) | 6,501 | 24 | 23 | 8 | 10 | 2 | 6,568 | 3.6% |
| FAL (Lubinus SP II) | 232 | 347 | 810 | 832 | 707 | 579 | 3,507 | 3.0% |
| OPTICUP (Scan Hip II Collar) | 1,183 | 383 | 279 | 125 | 10 | 0 | 1,980 | 1.7% |
| Contemporary Hooded Duration (Exeter Polished) | 1 | 17 | 277 | 561 | 514 | 569 | 1,939 | 1.6% |
| Charnley (Exeter Polished) | 555 | 103 | 159 | 281 | 433 | 517 | 2,048 | 1.5% |
| Charnley (Charnley Elite Plus) | 1,396 | 105 | 14 | 2 | 0 | 0 | 1,517 | 1.3% |
| Charnley Elite (Charnley Elite Plus) | 1,005 | 151 | 10 | 0 | 0 | 0 | 1,166 | 1.0% |
| Trilogy HA (Spectron EF Primary) | 410 | 177 | 173 | 127 | 107 | 87 | 1,081 | 0.9% |
| Biomet Müller (RX90-S) | 1,445 | 7 | 0 | 0 | 0 | 0 | 1,452 | 0.9% |
| Charnley Elite (Lubinus SP II) | 325 | 103 | 76 | 140 | 176 | 186 | 1,006 | 0.8% |
| Others (total 994) | 88,580 | 2,196 | 2,212 | 2,254 | 2,761 | 3,375 | 101,378 | |
| Total | 191,458 | 12,217 | 12,698 | 12,686 | 13,391 | 13,848 | 256,298 | |

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



## 15 Most Common Uncemented Implants

most used during the past 10 years

| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share[1)] |
|---|---|---|---|---|---|---|---|---|
| CLS Spotorno (CLS Spotorno) | 397 | 37 | 56 | 69 | 68 | 110 | 737 | 11.9% |
| Allofit (CLS Spotorno) | 0 | 35 | 91 | 94 | 87 | 127 | 434 | 9.9% |
| Trilogy HA (CLS Spotorno) | 4 | 6 | 19 | 24 | 80 | 177 | 310 | 7.0% |
| Trilogy (CLS Spotorno) | 37 | 15 | 24 | 58 | 78 | 85 | 297 | 6.7% |
| Trilogy HA (Versys stem) | 11 | 16 | 41 | 80 | 75 | 25 | 248 | 5,6% |
| Romanus HA (Bi-Metric HA uncem.) | 227 | 18 | 4 | 1 | 5 | 3 | 258 | 5.4% |
| ABG II HA (ABG uncem.) | 60 | 31 | 53 | 19 | 14 | 18 | 195 | 4.4% |
| Trilogy HA (Bi-Metric HA uncem.) | 13 | 18 | 31 | 61 | 28 | 22 | 173 | 3.9% |
| Trilogy (Cone uncem.) | 53 | 18 | 15 | 15 | 35 | 22 | 158 | 3.6% |
| Trilogy (SL plus stem uncem.) | 27 | 10 | 15 | 17 | 26 | 30 | 125 | 2.8% |
| ABG II HA (Meridian) | 22 | 20 | 31 | 32 | 9 | 0 | 114 | 2.6% |
| ABG HA (ABG uncem.) | 304 | 0 | 0 | 0 | 0 | 0 | 304 | 2.4% |
| Secur-Fit (Omnifit) | 104 | 0 | 0 | 0 | 0 | 0 | 104 | 2.4% |
| Trident HA (Accolade) | 0 | 0 | 0 | 0 | 33 | 69 | 102 | 2.3% |
| SL Ti cup (CLS Spotorno) | 24 | 15 | 5 | 13 | 9 | 12 | 78 | 1.8% |
| Others (total 197) | 4,870 | 77 | 42 | 94 | 211 | 308 | 5,602 | |
| Total | 6,153 | 316 | 427 | 577 | 758 | 1,008 | 9,239 | |

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

## 15 Most Common Hybrid Implants

most used during the past 10 years

| Uncemented cup (cemented stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1] |
|---|---|---|---|---|---|---|---|---|
| Trilogy HA (Spectron EF Primary) | 410 | 177 | 173 | 127 | 107 | 87 | 1,081 | 20.7% |
| Trilogy HA (Lubinus SP II) | 320 | 140 | 131 | 144 | 114 | 73 | 922 | 17.2% |
| BHR Acetabular Cup (BHR Femoral Head) | 9 | 16 | 45 | 44 | 74 | 113 | 301 | 5.8% |
| ABG II HA (Lubinus SP II) | 149 | 31 | 14 | 5 | 6 | 0 | 205 | 3.9% |
| ABG HA (Lubinus SP II) | 338 | 0 | 0 | 0 | 0 | 0 | 338 | 3.3% |
| Reflection HA (Lubinus SP II) | 107 | 12 | 19 | 15 | 23 | 10 | 186 | 3.3% |
| Durom (Durom) | 0 | 0 | 23 | 25 | 33 | 74 | 155 | 3.0% |
| TOP Pressfit HA (Lubinus SP II) | 8 | 25 | 32 | 24 | 31 | 16 | 136 | 2.6% |
| Duralock (uncem.) (Spectron EF Primary) | 114 | 0 | 0 | 0 | 0 | 0 | 114 | 2.2% |
| Biomex HA (Lubinus SP II) | 19 | 20 | 33 | 30 | 3 | 0 | 105 | 2.0% |
| Reflection HA (Spectron EF Primary) | 98 | 0 | 0 | 0 | 0 | 0 | 98 | 1.9% |
| Romanus (Bi-Metric cem.) | 550 | 0 | 0 | 0 | 0 | 0 | 550 | 1.8% |
| Trilogy HA (Optima) | 96 | 0 | 0 | 0 | 0 | 0 | 96 | 1.8% |
| Mallory-Head uncem. (Lubinus SP II) | 81 | 4 | 6 | 2 | 3 | 2 | 98 | 1.7% |
| Romanus (RX90-S) | 181 | 0 | 0 | 0 | 0 | 0 | 181 | 1.7% |
| Others (total 222) | 4,045 | 106 | 105 | 85 | 57 | 103 | 4,501 | |
| Total | 6,525 | 531 | 581 | 501 | 451 | 478 | 9,067 | |

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



## 15 Most Common Cup Components

most used during the past 10 years

| Cup | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-Poly | 54,029 | 4,227 | 4,601 | 4,741 | 5,467 | 5,764 | 78,829 | 34.8% |
| Charnley | 55,710 | 1,862 | 1,202 | 616 | 663 | 635 | 60,688 | 14.1% |
| Exeter Duration | 2,350 | 1,592 | 1,630 | 1,534 | 1,470 | 1,264 | 9,840 | 8.3% |
| Charnley Elite | 3,059 | 1,073 | 1,255 | 1,501 | 1,454 | 1,401 | 9,743 | 7.7% |
| Reflection All-Poly | 3,685 | 704 | 718 | 913 | 888 | 826 | 7,734 | 5.5% |
| Exeter All-Poly | 6,727 | 24 | 25 | 8 | 10 | 2 | 6,796 | 3.8% |
| FAL | 233 | 348 | 819 | 843 | 728 | 597 | 3,568 | 3.0% |
| OPTICUP | 2,720 | 422 | 312 | 181 | 91 | 62 | 3,788 | 2.9% |
| Trilogy HA | 1,057 | 388 | 439 | 486 | 467 | 458 | 3,295 | 2.7% |
| Biomet Müller | 4,024 | 286 | 256 | 236 | 205 | 211 | 5,218 | 2.3% |
| Cenator | 2,445 | 194 | 3 | 3 | 6 | 0 | 2,651 | 1.9% |
| Contemporary Hooded Duration | 1 | 17 | 277 | 565 | 561 | 684 | 2,105 | 1.8% |
| Weber All-Poly | 183 | 120 | 150 | 259 | 362 | 197 | 1,271 | 1.1% |
| Scan Hip Cup | 8,468 | 13 | 2 | 0 | 0 | 0 | 8,483 | 1.0% |
| Müller All-Poly | 4,970 | 116 | 72 | 70 | 89 | 127 | 5,444 | 1.0% |
| Others (total 156) | 41,797 | 831 | 937 | 730 | 930 | 1,620 | 46,845 | |
| Total | 191,458 | 12,217 | 12,698 | 12,686 | 13,391 | 13,848 | 256,298 | |

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

## 15 Most Common Stem Components

most used during the past 10 years

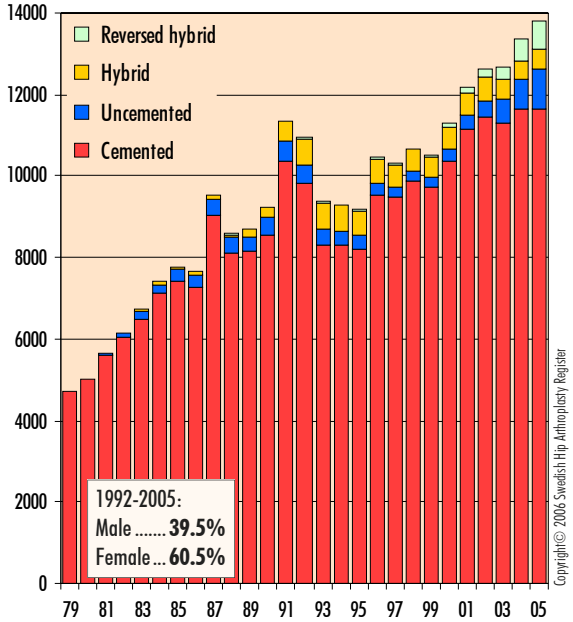
| Stem | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus SP II | 36,964 | 4,981 | 5,818 | 6,086 | 6,686 | 6,742 | 67,277 | 42.0% |
| Exeter Polished | 20,494 | 2,515 | 2,972 | 3,364 | 3,299 | 3,213 | 35,857 | 20.2% |
| Charnley | 53,625 | 1,606 | 927 | 281 | 81 | 8 | 56,528 | 10.7% |
| Spectron EF Primary | 3,334 | 943 | 965 | 1,077 | 1,041 | 923 | 8,283 | 7.0% |
| Charnley Elite Plus | 2,763 | 284 | 30 | 2 | 0 | 0 | 3,079 | 2.5% |
| Scan Hip II Collar | 1,434 | 429 | 281 | 125 | 10 | 0 | 2,279 | 1.9% |
| CLS Spotorno | 622 | 151 | 220 | 309 | 448 | 695 | 2,445 | 1.8% |
| CPT (steel) | 662 | 293 | 279 | 198 | 48 | 3 | 1,483 | 1.2% |
| RX90-S | 1,692 | 7 | 2 | 0 | 1 | 0 | 1,702 | 1.0% |
| Stanmore modular | 272 | 285 | 303 | 91 | 80 | 50 | 1,081 | 0.9% |
| Müller Straight | 4,341 | 110 | 103 | 98 | 98 | 114 | 4,864 | 0.9% |
| Straight-stem standard | 216 | 117 | 120 | 145 | 207 | 208 | 1,013 | 0.9% |
| Cenator | 1,245 | 0 | 0 | 0 | 0 | 0 | 1,245 | 0.8% |
| Bi-Metric HA uncem. | 517 | 92 | 81 | 114 | 127 | 144 | 1,075 | 0.8% |
| Optima | 1,438 | 1 | 0 | 0 | 0 | 0 | 1,439 | 0.7% |
| Others (total 167) | 61,839 | 403 | 597 | 796 | 1,265 | 1,748 | 66,648 | |
| Total | 191,458 | 12,217 | 12,698 | 12,686 | 13,391 | 13,848 | 256,298 | |



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

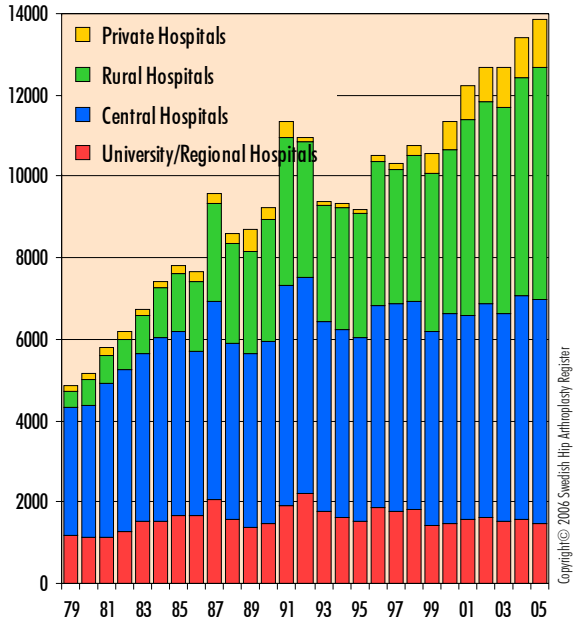
## Number of Primary THRs

per type of fixation, 1979-2005




## Number of Primary THRs

per type of hospital, 1979-2005



# Number of Primary THRs per Hospital and Year

| Hospital | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Alingsås | 990 | 119 | 114 | 98 | 147 | 201 | 1,669 | 0.7% |
| Arvika | 826 | 20 | 21 | 43 | 118 | 145 | 1,173 | 0.5% |
| Bollnäs | 911 | 106 | 110 | 215 | 275 | 251 | 1,868 | 0.7% |
| Borås | 4,006 | 169 | 127 | 151 | 198 | 234 | 4,885 | 1.9% |
| Carlanderska | 866 | 83 | 73 | 42 | 50 | 56 | 1,170 | 0.5% |
| Danderyd | 4,779 | 330 | 327 | 291 | 268 | 409 | 6,404 | 2.5% |
| Eksjö | 3,134 | 162 | 177 | 150 | 190 | 191 | 4,004 | 1.6% |
| Elisabethsjukhuset | 65 | 35 | 30 | 71 | 121 | 116 | 438 | 0.2% |
| Enköping | 698 | 105 | 134 | 163 | 149 | 155 | 1,404 | 0.5% |
| Eskilstuna | 3,443 | 112 | 75 | 66 | 65 | 75 | 3,836 | 1.5% |
| Falköping | 948 | 252 | 260 | 223 | 213 | 227 | 2,123 | 0.8% |
| Falun | 4,023 | 206 | 180 | 273 | 301 | 230 | 5,213 | 2.0% |
| Frölunda Specialistsjukhus | 0 | 0 | 1 | 34 | 61 | 48 | 144 | 0.1% |
| GMC | 5 | 0 | 0 | 0 | 17 | 42 | 64 | 0.0% |
| Gällivare | 1,611 | 111 | 86 | 103 | 94 | 117 | 2,122 | 0.8% |
| Gävle | 4,021 | 195 | 218 | 194 | 149 | 140 | 4,917 | 1.9% |
| Halmstad | 2,600 | 221 | 203 | 171 | 164 | 175 | 3,534 | 1.4% |
| Helsingborg | 3,034 | 152 | 176 | 100 | 102 | 71 | 3,635 | 1.4% |
| Huddinge | 3,969 | 147 | 202 | 183 | 221 | 239 | 4,961 | 1.9% |
| Hudiksvall | 1,817 | 138 | 165 | 186 | 160 | 129 | 2,595 | 1.0% |
| Hässleholm-Kristianstad | 4,095 | 333 | 483 | 581 | 710 | 670 | 6,872 | 2.7% |
| Jönköping | 2,861 | 196 | 163 | 162 | 221 | 185 | 3,788 | 1.5% |
| Kalmar | 2,965 | 161 | 189 | 203 | 225 | 232 | 3,975 | 1.6% |
| Karlshamn | 1,004 | 132 | 122 | 210 | 174 | 148 | 1,790 | 0.7% |
| Karlskoga | 1,587 | 126 | 135 | 156 | 111 | 90 | 2,205 | 0.9% |
| Karlskrona | 2,073 | 42 | 50 | 40 | 44 | 31 | 2,280 | 0.9% |
| Karlstad | 3,096 | 92 | 163 | 216 | 235 | 220 | 4,022 | 1.6% |
| Karolinska | 2,638 | 342 | 293 | 281 | 273 | 297 | 4,124 | 1.6% |
| Katrineholm | 861 | 132 | 207 | 203 | 226 | 194 | 1,823 | 0.7% |
| Kungälv | 1,219 | 191 | 198 | 175 | 124 | 229 | 2,136 | 0.8% |
| Köping | 1,073 | 228 | 190 | 190 | 210 | 216 | 2,107 | 0.8% |
| Lidköping | 1,188 | 152 | 111 | 102 | 118 | 149 | 1,820 | 0.7% |
| Lindesberg | 1,225 | 83 | 133 | 138 | 161 | 120 | 1,860 | 0.7% |
| Linköping | 4,371 | 134 | 250 | 207 | 122 | 76 | 5,160 | 2.0% |
| Ljungby | 1,388 | 138 | 138 | 96 | 103 | 101 | 1,964 | 0.8% |

*(continued on next page)*

## Number of Primary THRs per Hospital and Year (cont.)

| Hospital | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Lund | 3,747 | 106 | 75 | 103 | 103 | 105 | 4,239 | 1.7% |
| Lycksele | 1,203 | 155 | 196 | 200 | 212 | 274 | 2,240 | 0.9% |
| Malmö | 5,055 | 176 | 135 | 109 | 128 | 116 | 5,719 | 2.2% |
| Mora | 1,845 | 169 | 133 | 139 | 144 | 158 | 2,588 | 1.0% |
| Motala | 1,245 | 123 | 147 | 161 | 229 | 421 | 2,326 | 0.9% |
| Movement | 0 | 0 | 0 | 8 | 6 | 90 | 104 | 0.0% |
| Nacka Närsjukhus Proxima | 0 | 0 | 0 | 0 | 0 | 17 | 17 | 0.0% |
| Norrköping | 3,717 | 214 | 219 | 177 | 243 | 171 | 4,741 | 1.8% |
| Norrtälje | 744 | 101 | 107 | 92 | 87 | 116 | 1,247 | 0.5% |
| Nyköping | 1,781 | 127 | 125 | 121 | 124 | 150 | 2,428 | 0.9% |
| Ortopediska Huset | 216 | 117 | 144 | 179 | 244 | 297 | 1,197 | 0.5% |
| Oskarshamn | 1,087 | 113 | 112 | 114 | 137 | 178 | 1,741 | 0.7% |
| Piteå | 549 | 72 | 98 | 92 | 137 | 183 | 1,131 | 0.4% |
| S:t Göran | 6,267 | 549 | 463 | 443 | 507 | 474 | 8,703 | 3.4% |
| Simrishamn | 661 | 29 | 153 | 187 | 214 | 205 | 1,449 | 0.6% |
| Skellefteå | 1,517 | 147 | 160 | 148 | 119 | 120 | 2,211 | 0.9% |
| Skene | 529 | 89 | 83 | 87 | 89 | 71 | 948 | 0.4% |
| Skövde | 4,356 | 137 | 143 | 172 | 150 | 161 | 5,119 | 2.0% |
| Sollefteå | 966 | 104 | 130 | 123 | 150 | 137 | 1,610 | 0.6% |
| Sophiahemmet | 3,462 | 245 | 175 | 163 | 257 | 348 | 4,650 | 1.8% |
| Stockholms Specialistvård | 6 | 70 | 99 | 130 | 136 | 207 | 648 | 0.3% |
| SU/Mölndal | 2,010 | 149 | 123 | 118 | 88 | 92 | 2,580 | 1.0% |
| SU/Sahlgrenska | 3,773 | 192 | 201 | 225 | 202 | 203 | 4,796 | 1.9% |
| SU/Östra | 3,518 | 129 | 173 | 115 | 100 | 92 | 4,127 | 1.6% |
| Sunderby | 3,919 | 151 | 127 | 117 | 151 | 130 | 4,595 | 1.8% |
| Sundsvall | 4,237 | 200 | 198 | 181 | 161 | 148 | 5,125 | 2.0% |
| Södersjukhuset | 5,134 | 237 | 257 | 222 | 219 | 256 | 6,325 | 2.5% |
| Södertälje | 364 | 136 | 125 | 145 | 122 | 110 | 1,002 | 0.4% |
| Torsby | 879 | 132 | 74 | 58 | 71 | 75 | 1,289 | 0.5% |
| Trelleborg | 1,906 | 193 | 165 | 196 | 167 | 487 | 3,114 | 1.2% |
| Uddevalla | 3,355 | 202 | 289 | 292 | 256 | 321 | 4,715 | 1.8% |
| Umeå | 3,681 | 72 | 44 | 58 | 77 | 76 | 4,008 | 1.6% |
| Uppsala | 4,261 | 258 | 259 | 230 | 328 | 285 | 5,621 | 2.2% |
| Varberg | 2,713 | 219 | 219 | 168 | 192 | 179 | 3,690 | 1.4% |
| Visby | 1,521 | 85 | 83 | 71 | 61 | 39 | 1,860 | 0.7% |

*(continued on next page)*

## Number of Primary THRs per Hospital and Year (cont.)

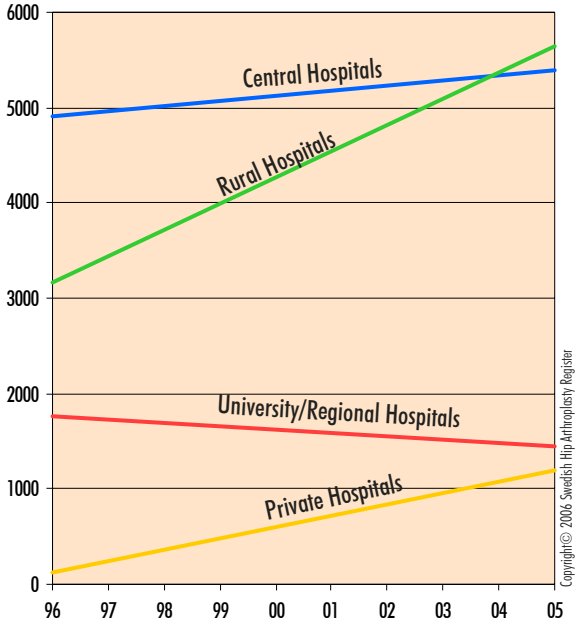
| Hospital | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Värnamo | 1,639 | 98 | 92 | 101 | 127 | 146 | 2,203 | 0.8% |
| Västervik | 1,889 | 92 | 114 | 114 | 121 | 105 | 2,435 | 0.9% |
| Västerås | 2,598 | 121 | 122 | 88 | 122 | 130 | 3,181 | 1.2% |
| Växjö | 2,524 | 106 | 106 | 68 | 129 | 122 | 3,055 | 1.1% |
| Ystad | 1,944 | 121 | 108 | 98 | 111 | 63 | 2,445 | 0.9% |
| Ängelholm | 2,152 | 184 | 186 | 151 | 105 | 51 | 2,829 | 1.0% |
| Örebro | 3,828 | 134 | 190 | 195 | 179 | 168 | 4,694 | 1.7% |
| Örnsköldsvik | 1,631 | 90 | 127 | 102 | 154 | 148 | 2,252 | 0.8% |
| Östersund | 3,004 | 113 | 128 | 181 | 158 | 214 | 3,798 | 1.4% |
| Others [1)] | 16,635 | 815 | 787 | 727 | 454 | 0 | 19,418 | 7.6% |
| Total | 191,458 | 12,217 | 12,698 | 12,686 | 13,391 | 13,848 | 256,298 | 100% |



*1) Includes hospitals that are no longer active or do not perform primary THRs anymore.*

## Trends in Primary THR Surgery

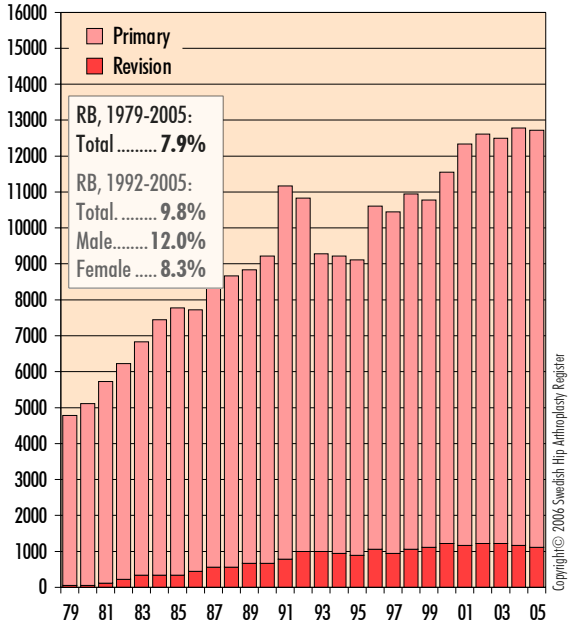
During the last 10 years divided per type of hospital




| Year | | | | |
|---|---|---|---|---|
| 1996 | 1,860 | 4,966 | 3,527 | 156 |
| 1997 | 1,792 | 5,103 | 3,252 | 180 |
| 1998 | 1,823 | 5,082 | 3,610 | 246 |
| 1999 | 1,428 | 4,773 | 3,850 | 515 |
| 2000 | 1,477 | 5,169 | 4,005 | 688 |
| 2001 | 1,556 | 5,024 | 4,830 | 807 |
| 2002 | 1,632 | 5,223 | 4,960 | 883 |
| 2003 | 1,511 | 5,118 | 5,057 | 1,000 |
| 2004 | 1,554 | 5,538 | 5,329 | 970 |
| 2005 | 1,489 | 5,492 | 5,694 | 1,173 |

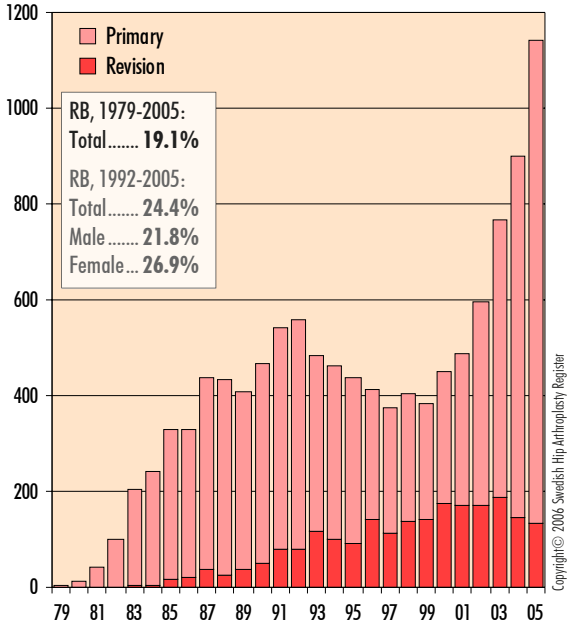
## THR with Cemented Implants

234,584 primary THRs, 20,244 revisions, 1979-2005



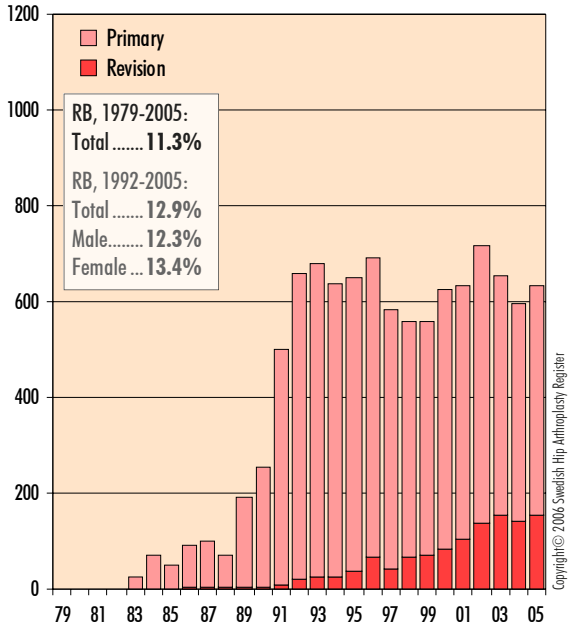

## THR with Uncemented Implants

9,239 primary THRs, 2,179 revisions, 1979-2005



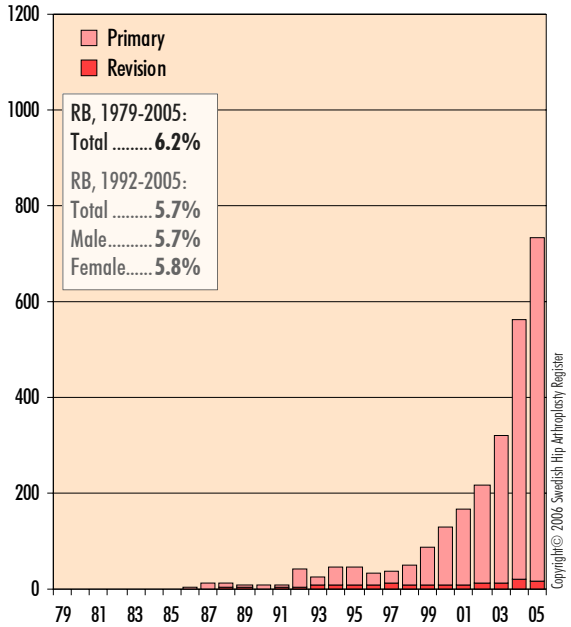

## THR with Hybrid Implants

9,067 primary THRs, 1,157 revisions, 1979-2005




## THR with Reversed Hybrid Implants

2,395 primary THRs, 157 revisions, 1979-2005



## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 66,625 | 9,562 | 10,188 | 10,115 | 10,784 | 11,508 | 118,782 | 76.3% |
| Fracture | 10,637 | 1,522 | 1,433 | 1,473 | 1,482 | 1,314 | 17,861 | 11.5% |
| Inflammatory arthritis | 4,893 | 426 | 374 | 377 | 354 | 323 | 6,747 | 4.3% |
| Idiopathic femoral head necrosis | 2,716 | 363 | 331 | 343 | 343 | 338 | 4,434 | 2.8% |
| Childhood disease | 1,277 | 255 | 289 | 272 | 322 | 268 | 2,683 | 1.7% |
| Secondary osteoarthritis | 1,295 | 0 | 1 | 3 | 2 | 4 | 1,305 | 0.8% |
| Tumor | 360 | 72 | 69 | 66 | 76 | 77 | 720 | 0.5% |
| Secondary arthritis after trauma | 274 | 17 | 13 | 37 | 28 | 16 | 385 | 0.2% |
| (missing) | 2,692 | 0 | 0 | 0 | 0 | 0 | 2,692 | 1.7% |
| Total | 90,769 | 12,217 | 12,698 | 12,686 | 13,391 | 13,848 | 155,609 | 100% |



## Number of Primary THRs per Diagnosis and Year

1992-2005

| Diagnosis | < 50 years | | 50-59 years | | 60-75 years | | > 75 years | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 4,026 | 54.5% | 16,492 | 79.9% | 64,408 | 82.1% | 33,856 | 68.9% | 118,782 | 76.3% |
| Fracture | 252 | 3.4% | 870 | 4.2% | 6,384 | 8.1% | 10,355 | 21.1% | 17,861 | 11.5% |
| Inflammatory arthritis | 1,218 | 16.5% | 1,314 | 6.4% | 3,152 | 4.0% | 1,063 | 2.2% | 6,747 | 4.3% |
| Idiopathic femoral head necrosis | 452 | 6.1% | 553 | 2.7% | 1,590 | 2.0% | 1,839 | 3.7% | 4,434 | 2.8% |
| Childhood disease | 1,043 | 14.1% | 835 | 4.0% | 659 | 0.8% | 146 | 0.3% | 2,683 | 1.7% |
| Secondary arthritis | 99 | 1.3% | 112 | 0.5% | 473 | 0.6% | 621 | 1.3% | 1,305 | 0.8% |
| Tumor | 86 | 1.2% | 164 | 0.8% | 312 | 0.4% | 158 | 0.3% | 720 | 0.5% |
| Secondary arthritis after trauma | 57 | 0.8% | 54 | 0.3% | 136 | 0.2% | 138 | 0.3% | 385 | 0.2% |
| (missing) | 151 | 2.0% | 240 | 1.2% | 1,316 | 1.7% | 985 | 2.0% | 2,692 | 1.7% |
| Total | 7,384 | 100% | 20,634 | 100% | 78,430 | 100% | 49,161 | 100% | 155,609 | 100% |



## Number of Primary Uncemented Implants per Diagnosis and Age

1992-2005

| Diagnosis | < 50 years | | 50-59 years | | 60-75 years | | > 75 years | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 1,182 | 57.6% | 2,251 | 84.8% | 1,024 | 89.2% | 29 | 69.0% | 4,486 | 76.1% |
| Childhood disease | 373 | 18.2% | 185 | 7.0% | 38 | 3.3% | 3 | 7.1% | 599 | 10.2% |
| Inflammatory arthritis | 224 | 10.9% | 62 | 2.3% | 24 | 2.1% | 2 | 4.8% | 312 | 5.3% |
| Idiopathic femoral head necrosis | 125 | 6.1% | 67 | 2.5% | 22 | 1.9% | 1 | 2.4% | 215 | 3.6% |
| Fracture | 46 | 2.2% | 36 | 1.4% | 19 | 1.7% | 5 | 11.9% | 106 | 1.8% |
| Secondary arthritis | 32 | 1.6% | 7 | 0.3% | 4 | 0.3% | 1 | 2.4% | 44 | 0.7% |
| Secondary arthritis after trauma | 18 | 0.9% | 3 | 0.1% | 0 | 0.0% | 1 | 2.4% | 22 | 0.4% |
| Tumor | 1 | 0.0% | 4 | 0.2% | 0 | 0.0% | 0 | 0.0% | 5 | 0.1% |
| (missing) | 51 | 2.5% | 38 | 1.4% | 17 | 1.5% | 0 | 0.0% | 106 | 1.8% |
| Total | 2,052 | 100% | 2,653 | 100% | 1,148 | 100% | 42 | 100% | 5,895 | 100% |

## Number of Primary THRs per Type of Fixation and Age

1992-2005

| Type of fixation | < 50 years | | 50-59 years | | 60-75 years | | > 75 years | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Cemented | 3,176 | 43.0% | 13,704 | 66.4% | 73,882 | 94.2% | 48,521 | 98.% | 139,283 | 89.5% |
| Hybrid | 1,590 | 21.5% | 3,150 | 15.3% | 2,596 | 3.3% | 321 | 0.7% | 7,657 | 4.9% |
| Uncemented | 2,052 | 27.8% | 2,653 | 12.9% | 1,148 | 1.5% | 42 | 0.1% | 5,895 | 3.8% |
| Reversed Hybrid | 522 | 7.1% | 1,070 | 5.2% | 677 | 0.9% | 81 | 0.2% | 2,350 | 1.5% |
| (missing) | 44 | 0.6% | 57 | 0.3% | 127 | 0.2% | 196 | 0.4% | 424 | 0.3% |
| Total | 7,384 | 100% | 20,634 | 100% | 78,430 | 100% | 49,161 | 100% | 155,609 | 100% |



## Number of Primary THRs per Type of Fixation and Year — Younger Than 60 Years

| Type of fixation | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Cemented | 9,707 | 1,540 | 1,526 | 1,463 | 1,436 | 1,208 | 16,880 | 60.2% |
| Hybrid | 3,181 | 321 | 386 | 304 | 271 | 277 | 4,740 | 16.9% |
| Uncemented | 2,386 | 264 | 341 | 458 | 546 | 710 | 4,705 | 16.8% |
| Reversed Hybrid | 320 | 119 | 149 | 198 | 366 | 440 | 1,592 | 5.7% |
| (missing) | 64 | 7 | 18 | 3 | 2 | 7 | 101 | 0.4% |
| Total | 15,658 | 2,251 | 2,420 | 2,426 | 2,621 | 2,642 | 28,018 | 100% |



## Number of Primary THRs per Type of Fixation and Year — 60 Years or Older

| Type of fixation | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Cemented | 72,445 | 9,631 | 9,900 | 9,824 | 10,192 | 10,411 | 122,403 | 95.9% |
| Hybrid | 1,934 | 210 | 195 | 197 | 180 | 201 | 2,917 | 2.3% |
| Uncemented | 423 | 52 | 86 | 119 | 212 | 298 | 1,190 | 0.9% |
| Reversed Hybrid | 95 | 39 | 58 | 111 | 178 | 277 | 758 | 0.6% |
| (missing) | 214 | 34 | 39 | 9 | 8 | 19 | 323 | 0.3% |
| Total | 75,111 | 9,966 | 10,278 | 10,260 | 10,770 | 11,206 | 127,591 | 100% |

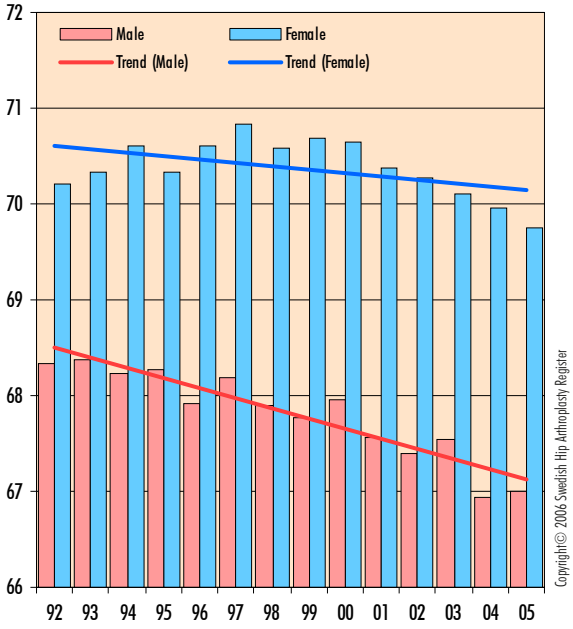


## Number of Primary THRs per Brand of Cement and Year

| Brand of cement | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Palacos R + G (Gentamycin) | 64,508 | 10,977 | 8,705 | 6,388 | 6,031 | 4,888 | 101,497 | 65.2% |
| Refobacin Bone Cement | 1 | 95 | 2,629 | 4,799 | 5,509 | 6,567 | 19,600 | 12.6% |
| Palacos R | 8,024 | 7 | 5 | 2 | 8 | 1 | 8,047 | 5.2% |
| Others | 4,722 | 17 | 3 | 0 | 5 | 73 | 4,820 | 3.1% |
| CMW with Gentamycin | 716 | 35 | 13 | 6 | 7 | 1 | 778 | 0.5% |
| Copal | 2 | 6 | 5 | 9 | 7 | 10 | 39 | 0.0% |
| SulCem 1 with Gentamycin | 6 | 3 | 4 | 9 | 4 | 0 | 26 | 0.0% |
| (completely or partly cementless) | 9,793 | 1,044 | 1,288 | 1,466 | 1,817 | 2,292 | 17,700 | 11.4% |
| (missing) | 2,997 | 33 | 46 | 7 | 3 | 16 | 3,102 | 2.0% |
| Total | 90,769 | 12,217 | 12,698 | 12,686 | 13,391 | 13,848 | 155,609 | 100% |

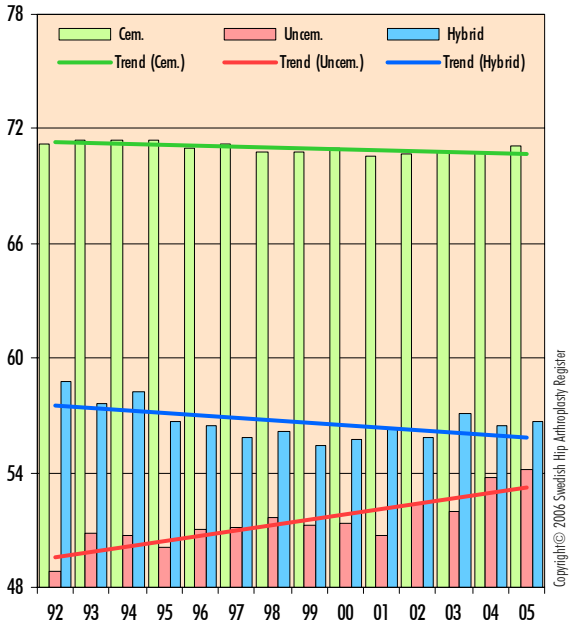
## Average Age per Gender

155,185 primary THRs, 1992-2004




## Average Age per Type of Fixation

155,185 primary THRs, 1992-2004




## Average Age per Diagnosis and Gender

1992-2005

| Diagnosis | Male | Female | Total |
|---|---|---|---|
| Fracture | 73.7 | 76.6 | 75.9 |
| Secondary osteoarthritis | 67.6 | 73.1 | 71.5 |
| Idiopathic femoral head necrosis | 62.1 | 72.7 | 69.5 |
| Primary osteoarthritis | 67.9 | 70.0 | 69.1 |
| Secondary osteoarthritis after trauma | 64.2 | 69.8 | 67.1 |
| Tumor | 68.4 | 61.7 | 64.6 |
| Inflammatory arthritis | 60.4 | 62.4 | 61.9 |
| Childhood disease | 54.7 | 52.8 | 53.4 |
| Total | 67.7 | 70.4 | 69.3 |



## Average Age per Type of Hospital and Gender

1992-2005

| Type of hospital | Male | Female | Total |
|---|---|---|---|
| Rural Hospitals | 68.6 | 70.8 | 69.9 |
| Central Hospitals | 67.9 | 70.7 | 69.6 |
| University/Regional Hospitals | 65.5 | 68.9 | 67.7 |
| Private Hospitals | 65.9 | 68.3 | 67.4 |
| Total | 67.7 | 70.4 | 69.3 |

# Follow-up model for patient-related outcome

## THR follow-up after four years

The standardised follow-up of all patients undergoing primary THR began on 1 January 2002. Since then, the follow-up routine has been introduced successively at more and more county councils/regions. At the present time, 53 hospitals are using the system and a further six (59 of 79 active clinics) will begin on 1 September this year. The target is that the remaining clinics will join the system before the 2006/2007 year-end. The hospitals that are and are not included are listed in the table on page 18. Unfortunately, of the ten largest THR producers, only three clinics are linked to the follow-up routine. Of eight private clinics, only one is included.

### *Summary of the logistics and method*

As some clinics have still not joined the system, the method and objectives are repeated here. All patients complete a pre-operative questionnaire with 10 questions (Charnley category, pain VAS and EQ-5D). The same questionnaire with an additional question about satisfaction (VAS) is sent to the patient after one year. The same procedure is repeated after six and 10 years, when X-rays are also taken. A short questionnaire with six questions has been created for the radiological examination (see Annual Report 2002-2004).

### *Overall objectives*

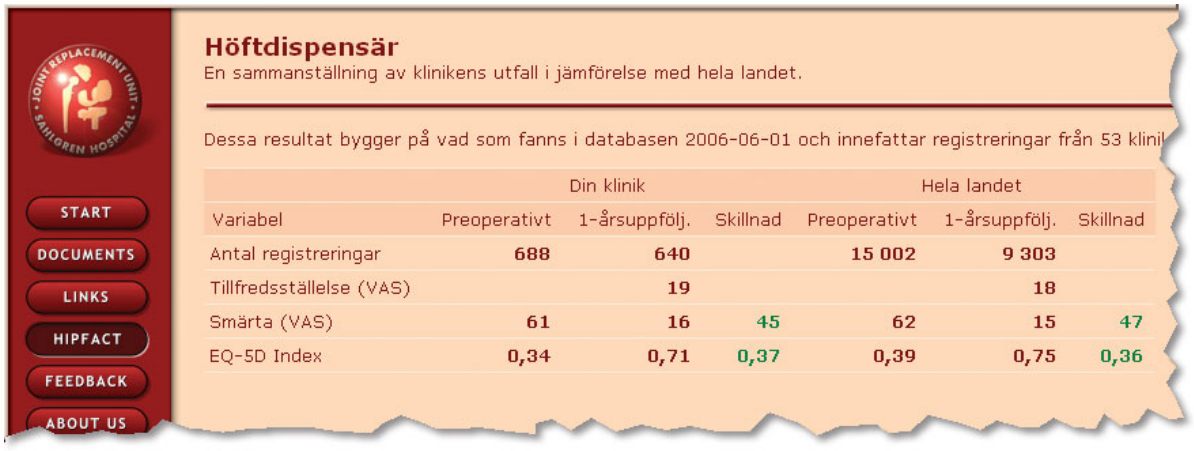
- To include patient-related outcome in the register, which will be included in national quality indicators for THR surgery
- To increase the sensitivity of the register analysis
- To identify clinically "silent" radiological changes in order to be able to intervene surgically in the event of threatening loosening and/or development of osteolysis
- To create a methodologically adequate health-economy instrument for cost-effectiveness analysis and resource allocation
- To reduce the number of routine controls after THR

## Results

In June 2006, the prospective pre-operative database (53 clinics) contained 15,002 patients. The one-year follow-up comprised 9,303 patients. The prospective function is reported on line on the website. Each clinic can log in with a password and obtain its results in real time and compare them with the rest of the country. At present, mean values for all patients are reported. In the following tables (from the homepage on 1 June 2006: Sahlgrenska's results compared with the national results), the mean values for VAS pain (0-100, no pain-unbearable) and VAS satisfaction (0-100, satisfied-dissatisfied) are presented. The EQ-5D index is a weighted total value for health with a lowest value of -0.594 and a highest value of 1.0. As before, the results show that most patients are satisfied with the results and have good pain relief and that their health-related quality of life has improved considerably one year after THR.

In last year's annual report, we stated that the patient-related outcome for each clinic would be reported openly when all the units were connected to the follow-up model. We have, however, chosen to present this result this year, even though the routine is still not being used on a nationwide basis. There are several reasons for this:

1. The Swedish National Board of Health and Welfare and the SALAR are calling for greater openness from registers.
2. Pain relief, satisfaction and health benefits are the "fastest" quality indicators among the variables the register captures. For their clinical improvement programmes, the Swedish National Board of Health and Welfare and the SALAR have in fact asked the register to present faster indicators than the traditional survival analyses.
3. The EQ-5D index benefit has been selected as a national quality indicator. When all the productive units are participating, there will be an opportunity to conduct comparative health-economy analyses in which we shall be able to calculate the cost effectiveness of the participating units. Being able to calculate the cost /QALY gained for all clinics would provide an interesting future quality indicator. This could have a decisive impact on the necessary work of prioritisation and allocation.




| | Din klinik | | | Hela landet | | |
|---|---|---|---|---|---|---|
| Variabel | Preoperativt | 1-årsuppfölj. | Skillnad | Preoperativt | 1-årsuppfölj. | Skillnad |
| Antal registreringar | 688 | 640 | | 15 002 | 9 303 | |
| Tillfredsställelse (VAS) | | 19 | | | 18 | |
| Smärta (VAS) | 61 | 16 | 45 | 62 | 15 | 47 |
| EQ-5D Index | 0,34 | 0,71 | 0,37 | 0,39 | 0,75 | 0,36 |

# Patient-related Outcome per Hospital

2002-2005

| Hospital | Preoperative | | | | Follow-up after 1 year | | | | EQ-5D index gained[3] | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | C-cat.[1] | EQ-5D | Pain | No. | EQ-5D | Pain | Satisf.[2] | | |
| **University/Regional Hospitals** | | | | | | | | | | |
| Huddinge | | | | | | | | | | Will join Sep. 1, 2006 |
| Karolinska | | | | | | | | | | Will join Sep. 1, 2006 |
| Linköping | | | | | | | | | | Not joined yet |
| Lund | 124 | 48% | 0.28 | 64 | 70 | 0.72 | 14 | 13 | 0.44 | |
| Malmö | 79 | 46% | 0.26 | 66 | 72 | 0.66 | 22 | 19 | 0.40 | |
| SU/Sahlgrenska | 653 | 49% | 0.34 | 61 | 565 | 0.71 | 16 | 19 | 0.37 | |
| SU/Östra | 390 | 43% | 0.34 | 64 | 358 | 0.72 | 19 | 23 | 0.38 | |
| Umeå | 137 | 49% | 0.28 | 67 | 85 | 0.71 | 17 | 18 | 0.43 | |
| Uppsala | | | | | | | | | | Will join Sep. 1, 2006 |
| **Central Hospitals** | | | | | | | | | | |
| Borås | 528 | 47% | 0.41 | 59 | 402 | 0.74 | 15 | 19 | 0.33 | |
| Danderyd | 43 | 44% | 0.44 | 60 | | | | | | |
| Eksjö | 141 | 43% | 0.43 | 62 | | | | | | |
| Eskilstuna | 40 | 50% | 0.22 | 67 | | | | | | |
| Falun | | | | | | | | | | Not joined yet |
| Gävle | | | | | | | | | | Joined Jan. 1, 2006 |
| Halmstad | 107 | 34% | 0.36 | 65 | | | | | | |
| Helsingborg | | | | | | | | | | Not joined yet |
| Hässleholm-Kristianstad | | | | | | | | | | Not joined yet |
| Jönköping | 184 | 22% | 0.37 | 64 | | | | | | |
| Kalmar | | | | | | | | | | Joined Jan. 1, 2006 |
| Karlskrona | 8 | 25% | 0.33 | 43 | | | | | | |
| Karlstad | | | | | | | | | | Not joined yet |
| Norrköping | | | | | | | | | | Not joined yet |
| S:t Göran | | | | | | | | | | Not joined yet |
| Skövde | 320 | 46% | 0.33 | 63 | 374 | 0.68 | 18 | 21 | 0.35 | |
| SU/Mölndal | 254 | 38% | 0.37 | 62 | 284 | 0.71 | 17 | 22 | 0.34 | |
| Sunderby | 247 | 43% | 0.28 | 68 | 180 | 0.72 | 16 | 19 | 0.44 | |
| Sundsvall | 270 | 43% | 0.38 | 64 | 210 | 0.73 | 18 | 21 | 0.35 | |
| Södersjukhuset | 136 | 46% | 0.34 | 64 | | | | | | |
| Uddevalla | 788 | 46% | 0.36 | 62 | 732 | 0.70 | 16 | 21 | 0.34 | |
| Varberg | 158 | 65% | 0.46 | 57 | | | | | | |
| Västerås | 110 | 43% | 0.28 | 69 | | | | | | |
| Växjö | 45 | 44% | 0.38 | 55 | | | | | | |
| Ystad | | | | | | | | | | Not relevant |
| Örebro | 16 | 44% | 0.30 | 61 | | | | | | |
| Östersund | 454 | 31% | 0.35 | 63 | 243 | 0.77 | 12 | 14 | 0.42 | |
| **Rural Hospitals** | | | | | | | | | | |
| Alingsås | 458 | 46% | 0.45 | 58 | 331 | 0.79 | 14 | 18 | 0.34 | |
| Arvika | | | | | | | | | | Not joined yet |
| Bollnäs | 16 | 50% | 0.43 | 68 | | | | | | |
| Enköping | | | | | | | | | | Will join Sep. 1, 2006 |
| Falköping | 920 | 35% | 0.44 | 59 | 671 | 0.81 | 12 | 13 | 0.37 | |
| Frölunda Specialistsjukhus | 142 | 35% | 0.37 | 65 | 94 | 0.79 | 15 | 18 | 0.42 | |

*(continued on next page)*

# Patient-related Outcome per Hospital (cont.)

2002-2005

| Hospital | Preoperative | | | | Follow-up after 1 year | | | | EQ-5D index gained[3] | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | C-cat.[1] | EQ-5D | Pain | No. | EQ-5D | Pain | Satisf.[2] | | |
| Gällivare | 203 | 43% | 0.38 | 64 | 127 | 0.75 | 17 | 20 | 0.37 | |
| Hudiksvall | 6 | 67% | 0.64 | 52 | | | | | | |
| Kalix | 112 | 47% | 0.33 | 65 | 67 | 0.79 | 13 | 16 | 0.46 | |
| Karlshamn | 45 | 44% | 0.36 | 62 | | | | | | |
| Karlskoga | | | | | | | | | | Not joined yet |
| Katrineholm | 98 | 45% | 0.35 | 64 | | | | | | |
| Kungälv | 678 | 48% | 0.42 | 58 | 468 | 0.75 | 14 | 18 | 0.33 | |
| Köping | 165 | 31% | 0.36 | 67 | | | | | | |
| Landskrona | 203 | 34% | 0.41 | 64 | 201 | 0.81 | 12 | 13 | 0.40 | |
| Lidköping | 457 | 43% | 0.41 | 58 | 296 | 0.77 | 14 | 18 | 0.36 | |
| Lindesberg | 149 | 33% | 0.47 | 58 | 45 | 0.89 | 9 | 9 | 0.42 | |
| Ljungby | 30 | 27% | 0.40 | 60 | | | | | | |
| Lycksele | 460 | 46% | 0.37 | 65 | 257 | 0.79 | 13 | 14 | 0.42 | |
| Mora | | | | | | | | | | Not joined yet |
| Motala | | | | | | | | | | Not joined yet |
| Norrtälje | | | | | | | | | | Not joined yet |
| Nyköping | | | | | | | | | | Not joined yet |
| Oskarshamn | | | | | | | | | | Joined Jan. 1, 2006 |
| Piteå | 324 | 49% | 0.35 | 66 | 165 | 0.73 | 16 | 23 | 0.38 | |
| Simrishamn | | | | | | | | | | Not relevant |
| Skellefteå | 274 | 43% | 0.38 | 64 | 168 | 0.75 | 13 | 14 | 0.37 | |
| Skene | 296 | 39% | 0.40 | 61 | 238 | 0.78 | 14 | 18 | 0.38 | |
| Sollefteå | 295 | 40% | 0.44 | 63 | 183 | 0.81 | 12 | 16 | 0.37 | |
| Södertälje | | | | | | | | | | Not joined yet |
| Torsby | | | | | | | | | | Not joined yet |
| Trelleborg | 691 | 44% | 0.39 | 63 | 106 | 0.73 | 17 | 19 | 0.34 | |
| Visby | | | | | | | | | | Not joined yet |
| Värnamo | 116 | 59% | 0.46 | 57 | | | | | | |
| Västervik | | | | | | | | | | Joined Jan. 1, 2006 |
| Ängelholm | | | | | | | | | | Not relevant |
| Örnsköldsvik | 301 | 47% | 0.37 | 63 | 193 | 0.77 | 14 | 16 | 0.40 | |
| **Private Hospitals** | | | | | | | | | | |
| Carlanderska | 57 | 28% | 0.37 | 62 | | | | | | |
| Elisabethsjukhuset | | | | | | | | | | Will join Sep. 1, 2006 |
| Gothenburg Medical Center | | | | | | | | | | Not joined yet |
| Movement | | | | | | | | | | Will join Sep. 1, 2006 |
| Nacka Närsjukhus Proxima AB | | | | | | | | | | Not joined yet |
| Ortopediska Huset | | | | | | | | | | Not joined yet |
| Sophiahemmet | | | | | | | | | | Not joined yet |
| Stockholms Specialistvård AB | | | | | | | | | | Not joined yet |
| Total | 11,730 | 43% | 0.38 | 62 | 7,185 | 0.75 | 15 | 18 | 0.37 | |

*[1] Share of Charnley category C.*
*[2] Satisfaction (VAS).*
*[3] Difference in EQ-5D after 1 year and preoperatively.*

*The result is presented as number of patients, mean values of pain-VAS and EQ-5D index preoperatively as well as the percentage of Charnley category C patients (i.e. patients with multiple joint disease and/or comorbidity). Hospitals with a high percentage of C-patients generally report poorer outcome both preoperatively and after 1 year. Although, the prospectively values gained are not as much affected.*

# *Follow-up after THR – "Starting afresh"*

## *Collaborative project with the Western Region*

In last year's report, the pilot project entitled "Starting afresh" was described. It is the result of a joint venture between the Register and the Department of Strategic Development of the Western Region (WR). The final report was published in January 2006 and distributed to all the heads of departments of orthopaedics, contact physicians and decision-makers at county councils, the National Board of Health and Welfare and the SALAR. This report is available as a PDF file on the register website (in Swedish) (www.jru.orthop.gu.se). A short summary of the background, objectives, method, results and final discussion now follows.

### *Background*

The county councils and regions have traditionally followed up their activities using productivity measurements and economic (cost) measurements. No systematic connection has been found between the actual outcome and the patient utility of activities. To enable the control and management of health and medical care, basic documentation that defines efficiency and quality is needed. The problem when it comes to Swedish health and medical care is that there is a gap between the medical and economic developments. As the financial resources available for health care are finite, prioritisation and allocation are becoming increasingly important and increasingly difficult. Cost effectiveness and the qualitative outcome of a medical intervention must be included as principles in the essential work of local, national and regional prioritisation.

### *Objectives*

The objectives for this pilot project were to define procedure frequency, patient demographics at each hospital in the WR, complication frequency, patient utility and satisfaction, costs and cost-utility effect (cost/QALY gained) for patients undergoing THR. The ultimate objective of the project was to comply with all four cardinals of the so-called Value Compass, by following up activities in detail. For the first time ever in Sweden, this compass can be used in full to describe the outcome after treating a well-defined disease group in a region, thereby revealing the opportunities for increasing the value of the efforts health care makes on behalf of patients in the longer term; in other words, it may lead to a programme of clinical improvements.

The Strategic Development Unit in the WR has another objective. The project should be regarded as a possible model for a complete follow-up of activities. The region has expressed a wish to implement this model in other priority disease groups.

### *Method*

The project has been carried out by merging the following databases on an encrypted individual and hospital level:

- The Register's primary database (WR part)
- The Register's re-operation database (WR part)
- The standardised follow-up database (WR part)
- VEGA (WR's case database)
- CPP (cost per patient) databases from seven of 11 hospitals

CPP stands for Cost Per Patient and is a method for calculating the cost for each individual patient and care contact. The care services and the cost of each of them are also presented. Since 1999, the SALAR has been running a programme to support the introduction of so-called CPP reporting in the health service generally and at national level. The WR has long experience of CPP reporting. The system was introduced at Sahlgrenska University Hospital back in 1985. The WR has decided to implement the complete system in the near future (2006 for institutional care). At the present time, the system has been introduced at seven of the hospitals analysed in the report. The analysis is performed on an annual basis for the years 2002-2004.

As the follow-up and early complications take between one and two years to identify and the CPP analysis is reported in complete form with a delay of more than a year, the report contains a follow-up of 2002 and 2003 in the form of a two-year aggregate. For 2004, only the procedure frequency, demographics, care data and costs are presented. This project focuses on a follow-up of the patient group which underwent total hip replacements; in other words, operations involving so-called hemi-arthroplasties (action code – ICD-10: NFB 09 and 19) are not included.

A summary of the quality indicators in the report:

- Procedure frequency/100,000 inhabitants at regional level
- Prosthesis survival at clinic and regional level – five- and ten-year results
- Short-term complications (one to two years after primary operation) per hospital which required re-operation
- Patient satisfaction and pain relief at clinic and regional level
- Patient-related health benefit one year after operation at clinic and regional level (EQ-5D index gained)
- Cost per QALY gained one year after THR operation at clinic and regional level

Availability, i.e. waiting times and the number of patients on the waiting list at each hospital, is not included as an indicator. The procedure frequency provides a good indication of the availability in the region. For several years, availability has been a focal point in Swedish health care. It is, however, only a quality indicator if the quality of availability is measured.

### *Results*

The complete results can be found on the website (www.jru.orthop.gu.se). This summary only gives part of the results.

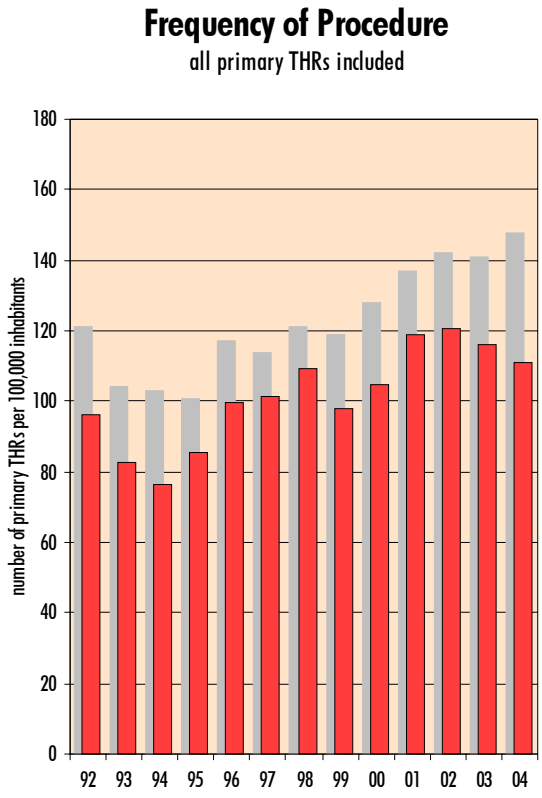
**Procedure frequency.** Compared with the country as a whole, the Western Region has had a low procedure frequency/100,000 inhabitants for many years. This trend has

been accentuated in recent years. The lack of resources in this important part of orthopaedics resulted in turn in the WR being the largest purchaser when it came to the free choice of care for THR surgery in 2002 and 2003. This region accounted for 32% (Annual Report 2004, page 62) of the patients who took advantage of the free choice of care during this period of time. For many years, the register has presented some central results for regions in comparison with national results. It should be noted that, in other annual reports, the WR has included northern Halland (a division that was made many years before the creation of the WR). In this report, the production of hip replacements in northern Halland (Varberg Hospital) has been excluded for the first time and the results therefore correspond, even historically, to the current WR results.

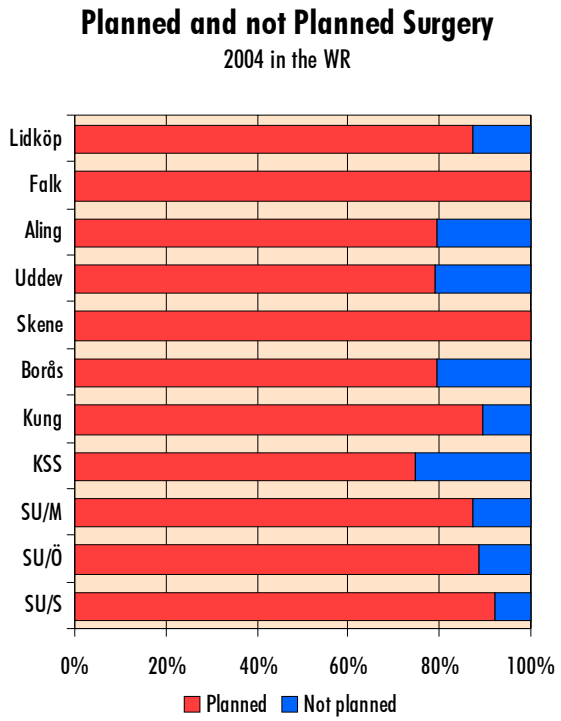
The national average for procedure frequency/100,000 inhabitants is given in the form of grey bars in the histogram. The variation in procedure frequency can be explained by an actual difference in the incidence of osteoarthritis requiring treatment, but availability probably plays a greater part. In the Western Region, the gap to the national average has been marked for many years, but it has also increased steadily in recent years.

**Inclusion of hemi-arthroplasties produces incorrect statistics.** Since the start in 1979, the Register has only registered operations involving total hip replacements (action codes: NFB 29, 39 and 49). The frequency of operations involving hemi-arthroplasties has increased sharply in Sweden, as a result of a new care programme for hip fractures. A dislocated cervical hip fracture is the main indication for surgery using this type of implant. The number of hemi-arthroplasties operations in Sweden has increased from around 500 a year to some 3,500 a year. In order to follow-up the quality of this surgery more effectively, the Swedish Hemi-arthroplasty Register has been initiated, as a joint venture between National Hip and the Hip Arthroplasty Register.

In conjunction with the establishment of a purchase function within Swedish health care, a number of clinics began including hemi-arthroplasties operations in their production statistics a few years ago. This “incorrect” registration has since spread to a large number of clinics and has then been included in nationwide statistics at the National Board of Health and Welfare and the SALAR. In the region’s statistics, the production of THRs in 2005 was given as just over 2,000 operations. The register reported the 2005 production of total hip replacements as 1,675. The difference is accounted for by hemi-arthroplasties, but this has now been adjusted. Following the publication of the report in January, the SALAR has also modified its statistics. Operating on patients with a dislocated cervical hip fracture primarily using a prosthesis is cost effec-




*Frequency of procedure (number of operations per 100,000 inhabitants) of primary THRs in the WR 1992-2004. During the whole period the region has had a lower frequency of procedures than the rest of Sweden.*




*Number of planned vs. not planned primary THRs at different hospitals in the WR 2004. ”Not planned” THRs are mostly patients operated due to the diagnosis (ICD10) S72.00, i.e. patients with cervical hip fracture. This procedure constitutes 20-30% of the whole production at some hospitals in the WR. Hip fracture as an indication for THR surgery in the rest of Sweden was 11% 2004.*

tive and often helps patients avoid fracture complications and the need for re-operations. This has been demonstrated in a number of Swedish doctoral dissertations. In spite of this, it has still not been established whether hemi-arthroplasties or total hip replacements are the optimal method. A number of clinics in the Western Region have extended the indication of acute ***total*** hip replacement as a treatment method for dislocated hip fractures.

The above discussion about THRs in connection with hip fractures and the inclusion of hemi-arthroplasties in the procedure statistics clearly demonstrates that the region has "pushed aside" patients with chronic hip disease from availability in the region.

**Patient-related outcome, short-term complications and prosthesis survival.** These variables are reported for the entire country in separate tables. In the WR, three clinics had more than 2% short-term complications, which led to in-depth analyses at these units.

**Cost and QALY analysis.** A table presenting the cost result (charging) for THR operations (by care period, i.e. any aftercare is included) for the different hospitals in the WR in 2004 follows.

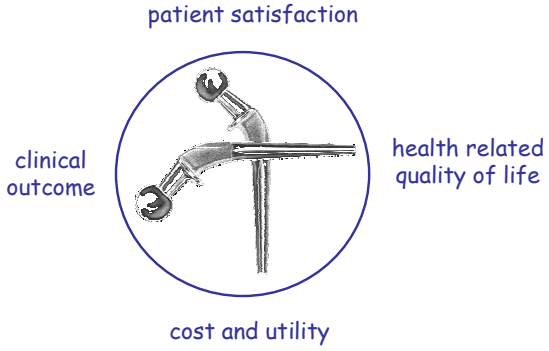
The CPP result (mean value) varied from SEK 89,793 to SEK 115,672 between the different hospitals. This variability was largely due to the varying patient demographics at the hospitals. Clinics that operate on a large percentage of problem cases and patients who are more ill obtain a high CPP mean value, i.e. co-morbidity drives up costs (see the section on case-mix).

The QALY calculations (see the report for details) reveal what is in principle perhaps the most important result in the report: it is not always the "least expensive" clinics that have the best cost effectiveness. A high value on the EQ-5D index can compensate for a high CPP value (cost), which in turn means that the utility of the expensive intervention must be measured to produce a fair picture of a follow-up.

## *Summary*

Merging different databases within health and medical care should be easier in the future, as centrally controlled projects, designed to create a common, standardised information structure, are in progress. During the project, it has become increasingly obvious that it is essential for both representatives of the profession and the owners (WR) should have the right to make interpretations before reports of this type are published.

The delay in the presentation of the results can be criticised, but a follow-up in this medical area, with the selected quality indicators (patient-related outcome, short-term complications and CPP), takes between one and two years. If an attempt is made to present a report on the previous year in January, it is only possible, in the case of THR surgery, to report the procedure frequency without capturing the outcome. This pilot project has been run to demonstrate the potential and benefit of using existing databases and then merging them to produce a more satisfactory follow-up than has previously been possible. The project has been able to produce results in all the cardinals on the Value Compass and a "hip compass" has been created for THR surgery in the WR.




## *Improvements*

The value compass is comparable to a balanced score card. In other words, there is theoretical improvement potential in all four "cardinals". The additional development of surgical techniques and prosthesis design could further improve the long-term survival of the implanted prosthesis (west). The benefit for standard patients, however, may be only marginal, as 10-year survival is already around 95%. Patient satisfaction (north) and health benefits (east) could definitely be improved if well-planned, standardised patient information about the expected results and the time perspective in terms of optimal post-operative function were introduced. Optimised post-operative pain relief and standardised rehabilitation would also improve the level of satisfaction and self-assessed health benefits. Finally, it goes without saying that costs (south) could be reduced in many areas using rational measures (even if they must not be allowed to affect the quality of the results). If the outcome in both the "easterly" and "southerly" directions could be improved in the future, this would produce an obvious improvement in cost utility.

## *Validation*

Merging the Hip Arthroplasty Register with the VEGA database produced a spin-off – the validation of the individual databases. For many years, this has been a nationwide register. Previous validations have revealed that almost 100% of primary THRs have been reported. During the three-year study period, some 1% of cases have been missing from the VEGA database. This is illustrated by the fact that 1,741 total hip replacements were registered in 2003 in the register database, of which 1,720 were in VEGA (i.e. a difference of 21 cases (1,2%). An analysis revealed that one hospital accounted for the majority of "incorrectly registered cases" during the entire three-year period. The most common reason was the wrong action code in the surgical report.

| Hospital | Share C-patients 1 year (%) | Relief of pain VAS | EQ-5D – index value gained | CPP median | QALY cost 1 year | QALY cost 10 years |
|---|---|---|---|---|---|---|
| SU/Sahlgrenska | 48 | 46 | 0.40 | 100,700 | 251,700 | 25,170 |
| SU/Östra | 51 | 41 | 0.35 | 83,400 | 238,300 | 23,830 |
| SU/Mölndal | 48 | 46 | 0.43 | 94,100 | 218,800 | 21,880 |
| Skövde | 62 | 52 | 0.46 | 89,100 | 193,700 | 19,370 |
| Kungälv | 46 | 43 | 0.34 | 72,400 | 212,900 | 21,290 |
| Falköping | 38 | 47 | 0.40 | 79,500 | 198,750 | 19,875 |
| Lidköping | 47 | 42 | 0.34 | 83,200 | 244,700 | 24,470 |

*Patient-related outcome 1 year postoperatively indicated as gained value for VAS-pain (pain relief) and EQ-5D-index as well as CPP (median) and cost per QALY gained. 10-year QALY-cost is not discounted (revisions not included). Study years 2002 and 2003.*

| Hospital | Share C-patients 1 year (%) | Relief of pain VAS | EQ-5D – index value gained | DRG-price | QALY cost 1 year | QALY cost 10 years |
|---|---|---|---|---|---|---|
| Borås | 47 | 46 | 0.40 | *99,000* | *247,500* | *24,750* |
| Skene | 46 | 45 | 0.38 | *99,000* | *260,500* | *26,500* |
| Uddevalla | 54 | 47 | 0.38 | *97,200* | *255,800* | *25,580* |
| Alingsås | 44 | 47 | 0.34 | *97,100* | *285,600* | *28,560* |

*Patient-related outcome 1 year postoperatively indicated as pain relief (delta value for pain-VAS) and EQ-5D-index gained as well as DRG-price and cost per QALY gained. During the study years these hospitals had not implemented CPP. Study years 2002 and 2003.*

| Hospital | Numbers operated | CPP median | CPP mean value | Distribution | Invoiced amount (replaces DRG) |
|---|---|---|---|---|---|
| Western Region | 1,675 | 95,310 | 103,755 | 41,230 – 482,082 | - |
| SU/Sahlgrenska | 201 | 102,209 | 114,488 | 68,678 – 280,307 | 94,000 |
| SU/Östra | 98 | 86,543 | 97,002 | 46,695 – 238,020 | 94,000 |
| SU/Mölndal | 88 | 97,610 | 115,050 | 41,229 – 482,082 | 94,000 |
| Skövde | 149 | 102,947 | 115,672 | 70,368 – 311,564 | 90,547 |
| Kungälv | 123 | 86,133 | 89,793 | 59,329 – 150,666 | 95,000 |
| Borås | 198 | not CPP | not CPP | - | 93,613 |
| Skene | 87 | not CPP | not CPP | - | 93,613 |
| Uddevalla | 255 | not CPP | not CPP | - | 95,400 |
| Alingsås | 146 | not CPP | not CPP | - | 97,000 |
| Falköping | 213 | 93,698 | 96,236 | 68,841 – 200,490 | 90,547 |
| Lidköping | 117 | 97,899 | 101,440 | 72,808 – 197,299 | 90,547 |

*Cost results – charging for operated hip prosthesis by care period per hospital in the WR 2004.*

# *Implant survival as a quality indicator*

Implant survival as a quality indicator has been presented in the last few annual reports. As 10-year survival per county council/region is now being used as a national quality indicator (see the separate section), we have changed the graphic presentation so that it matches the presentation the Swedish Board of Health and Welfare and the SALAR publish in the report entitled *"Open comparisons in 2006 of health care quality and effectiveness"*.

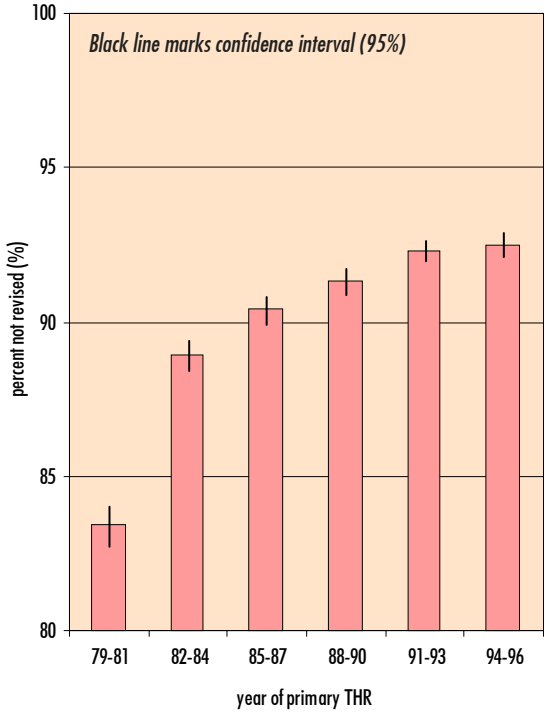
The following table shows the national 10-year survival for all patients undergoing surgery involving primary THRs. The definition of failure is the revision of one or both prosthesis components and the extraction of the prosthesis. All causes of revision are included.

As the histogram and the table clearly show, the 10-year survival of hip implants has improved successively in Sweden since the Register was introduced.

The following histogram shows the 10-year survival for each hospital. The table comprises the 70 clinics (the active clinics that had 10-year results on 31 December 2005). The histogram is a graphical presentation of the 10-year results from the table on pages 54-55. The observation period is 1992-2005. The national average was 92.7% ± 0.3%.

The red bars are clinics whose upper confidence interval is below the national lower confidence interval; in other words, clinics which with 95% confidence had poorer implant survival after 10 years than the national average. Thirteen clinics therefore had a result that was poorer than the national average, which means that the 10-year survival of prostheses at 81% of the clinics was as good as or better than the national average. When interpreting these figures, every clinic's patient demographics – case-mix – should be taken into account (see the separate section).

**Implant Survival after 10 Years in Different Time Periods**

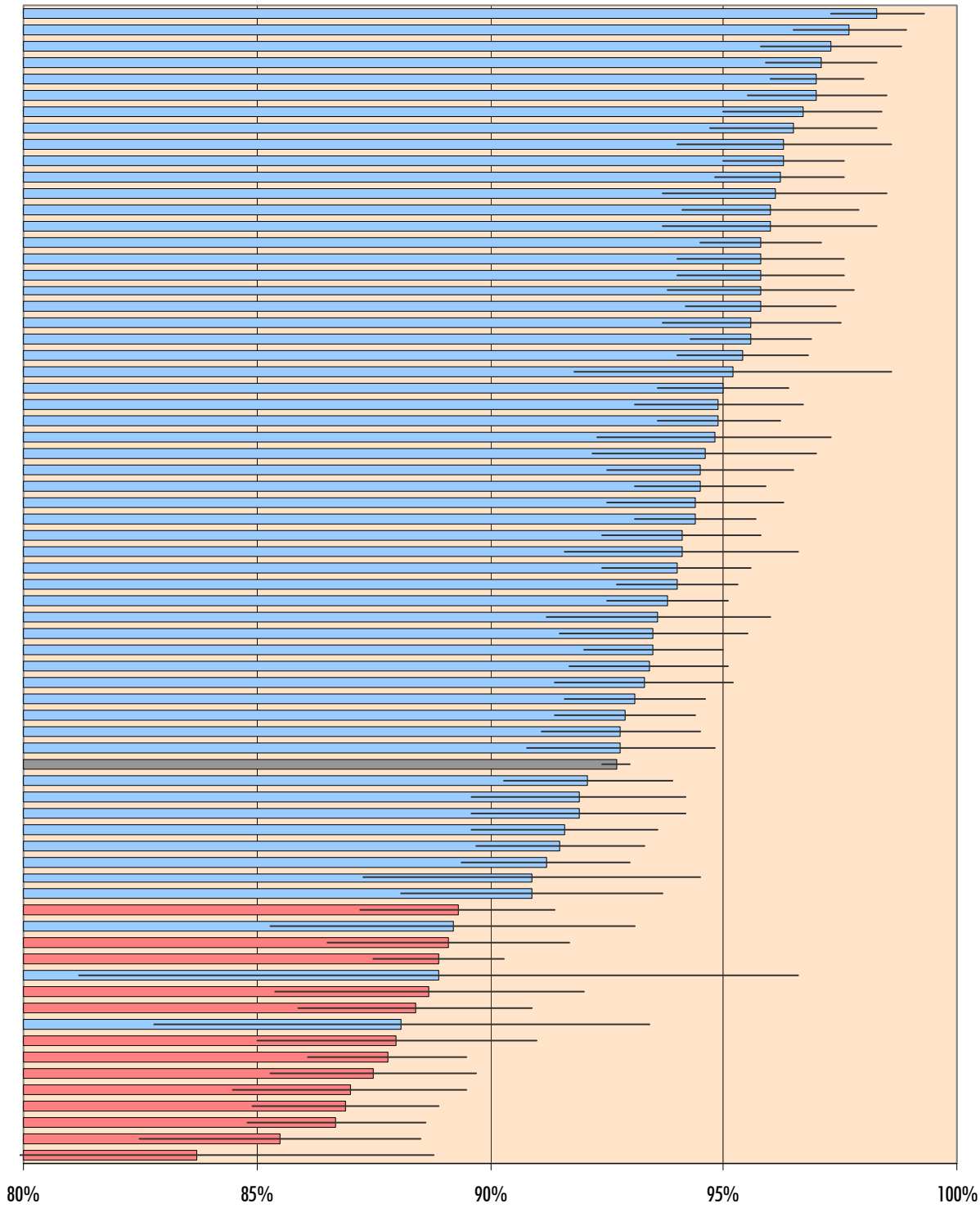



| Time period | 10 years | 95% CI |
|---|---|---|
| 1979-1981 | 83.4% | ±0.7% |
| 1982-1984 | 88.9% | ±0.5% |
| 1985-1987 | 90.4% | ±0.5% |
| 1988-1990 | 91.3% | ±0.4% |
| 1991-1993 | 92.3% | ±0.3% |
| 1994-1996 | 92.5% | ±0.4% |

*Average 10-year implant survival for all hospitals being active in each time period. Each time period comprises all primary THRs performed during the 3-year-period. All types of revisions are included. The analysis goes to December 31, 2005.*

## Implant Survival after 10 Years

each bar represents one hospital, primary THRs 1992-2005




*10-year implant survival per hospital. The grey bar represents the national average. Red bars represent hospitals with significantly worse results.*

# *Re-operation*

The term re-operation comprises all types of surgical procedure after the primary operation. These procedures have been registered since the start in 1979. In the middle of 2000, we stopped registering and reporting closed reduction after implant dislocation and this must be borne in mind when making comparisons with reports up to 2002. Re-operations have been categorised in three groups: revision involving the exchange or extraction of implant components, major surgical intervention and minor surgical intervention without the extraction of the implant or any of its components.

Since 2003 and first and foremost in 2004, the number of re-operations was reduced by just under 200 procedures (approximately 11%). Between 2003 and 2004, the reduction was primarily caused by the fact that fewer cases of implant loosening without simultaneous infection were the subject of re-operation, while the reduction between 2004 and 2005 was mainly due to fewer re-operations as a result of dislocation. Early re-operations as a result of dislocation are an important quality indicator. Last year, we therefore conducted a separate analysis to find the causes of this problem (see Annual Report 2004). In 2005, we noted a decline in these re-operations and this indicates that the profession is taking the problem seriously and is taking effective action. As before, aseptic loosening is still the dominant reason for re-operations, but, since the peak in 2002, the number of re-operations due to loosening has fallen by 202 procedures (18%), which is a strikingly large decrease. Provided that this reflects a true decline in the number of mechanical complications requiring re-operation, this indicates that the overall quality of the procedure has been improved, with significant cost savings for both society and the health service. It is important that the quality of this information is assured in the future using data from the follow-up model in order to avoid the possibility of shifts in indication. Since 2001, the number of re-operations as a result of fractures has been surprisingly constant (161-165 operations a year). This indicates that we do not generally keep patients waiting an excessively long time. Increasing bone loss around loose implants which are not revised in time would otherwise have resulted in an increase in the number of re-operations due to fractures, but as yet this is not the case. The number of re-operations for technical reasons almost doubled in 2004, but it has declined slightly, but not to the same levels as those that were seen before 2004.

## Number of Reoperations per Procedure and Year

primary THRs 1979-2005

| Procedure at reoperation | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Exchange of cup and/or stem or extraction | 17,715 | 1,571 | 1,656 | 1,691 | 1,591 | 1,523 | 25,747 | 85.6% |
| Major surgical intervention | 2,245 | 158 | 168 | 149 | 151 | 122 | 2,993 | 10.0% |
| Minor surgical intervention | 758 | 90 | 97 | 104 | 157 | 106 | 1,312 | 4.4% |
| (missing) | 9 | 0 | 2 | 1 | 3 | 0 | 15 | 0.0% |
| Total | 20,727 | 1,819 | 1,923 | 1,945 | 1,902 | 1,751 | 30,067 | 100% |



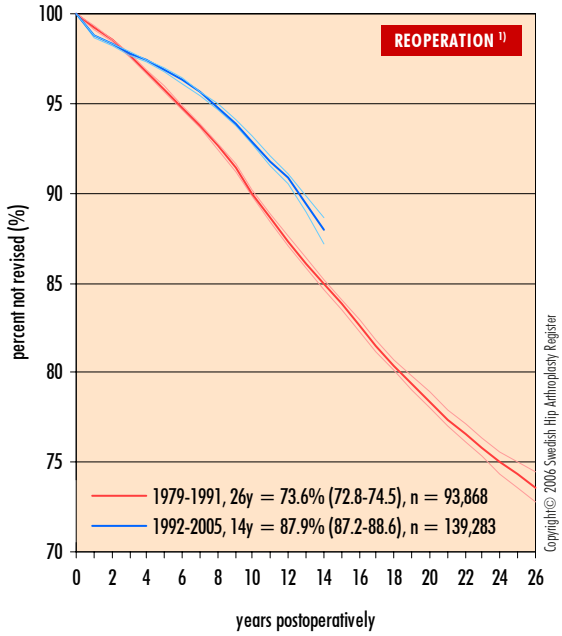
## Number of Reoperations per Reason and Year

primary THRs 1979-2005

| Reason for reoperation | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Aseptic loosening | 12,592 | 1,091 | 1,138 | 1,093 | 938 | 936 | 17,788 | 59.2% |
| Dislocation | 2,101 | 234 | 242 | 255 | 309 | 243 | 3,384 | 11.3% |
| Deep infection | 1,710 | 124 | 180 | 220 | 243 | 201 | 2,678 | 8.9% |
| Fracture | 1,324 | 164 | 161 | 165 | 165 | 162 | 2,141 | 7.1% |
| 2-stage procedure | 823 | 76 | 83 | 105 | 98 | 92 | 1,277 | 4.2% |
| Miscellaneous | 811 | 78 | 64 | 36 | 49 | 46 | 1,084 | 3.6% |
| Technical error | 789 | 16 | 26 | 27 | 51 | 40 | 949 | 3.2% |
| Implant fracture | 288 | 30 | 20 | 34 | 33 | 19 | 424 | 1.4% |
| Pain only | 254 | 6 | 8 | 9 | 15 | 8 | 300 | 1.0% |
| Secondary infection | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0.0% |
| (missing) | 35 | 0 | 1 | 1 | 0 | 3 | 40 | 0.1% |
| Total | 20,727 | 1,819 | 1,923 | 1,945 | 1,902 | 1,751 | 30,067 | 100% |

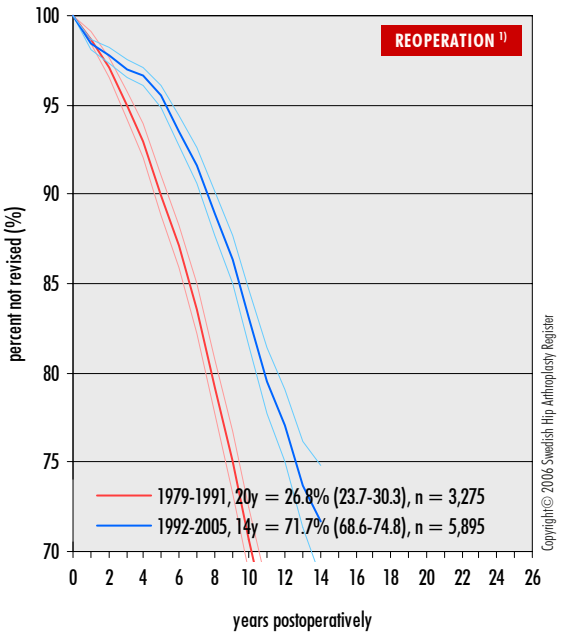
## All Cemented Implants

all diagnoses and all reasons



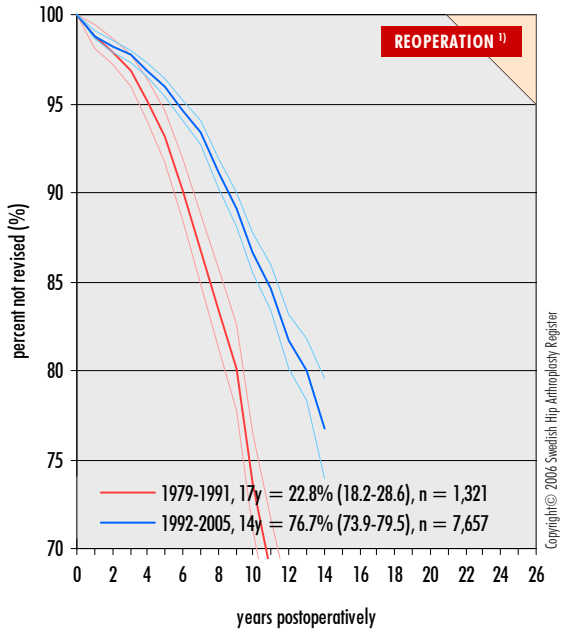

## All Uncemented Implants

all diagnoses and all reasons



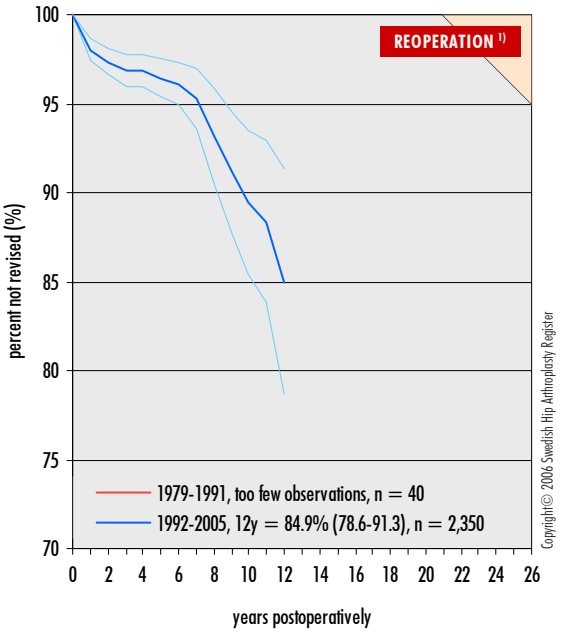

## All Hybrid Implants

all diagnoses and all reasons




## All Reversed Hybrid Implants

all diagnoses and all reasons




*1) Survival statistics according to Kaplan-Meier with revision and removal as end-point for failure.*

# *Short-term complications – a new openly reported variable*

## *Background*

In every report, the register has reported prosthesis survival using what is known as survival analysis. The definition of "failure" is the replacement of some prosthesis components or the extraction of the entire prosthesis. For many years, this parameter has been used both internationally and nationally within implant surgery, first and foremost as a comparative variable in long-term follow-up. One of the disadvantages of this methodology is its slowness combined with the historical perspective. All registers search for variables that can provide rapid feedback to individual clinics and can initiate clinical improvement programmes without excessively long delays.

Starting with this report, short-term complications will be published as a faster variable. All the heads of clinics and contact physicians have been informed of this and the National Board of Health and Welfare has chosen short-term complications at each county council as a national quality indicator following hip replacement surgery.

## *Definition*

Short-term complications are every form of open re-operation (i.e. not just revisions or prosthesis extractions) within two years of the primary operation. The last four-year period is studied – in this report, from 2002 up to and including 2005.

The number of early re-operations per clinic is presented both in total and in four main groups: infection, dislocation, loosening and other causes. This information should be seen against the background of the clinic's assignment when it comes to patient selection or case-mix and the scope of any training programmes. These data enable comparisons between clinics with a similar profile and improve the opportunity for continuous improvements.

The follow-up period is short and primarily reflects early and serious post-operative complications, such as deep infection and revision as a result of recurring dislocations. It should be noted that the report refers to complications that are treated surgically. Infections treated with antibiotics and conservatively (non-surgically) treated dislocations are not included in the register. Patients who undergo surgery on several occasions, as a result of the same complication, are listed as one complication. However, a number of patients undergo re-operations for different reasons within a short period. Patients undergoing re-operations at clinics other than the primary clinic are nonetheless ascribed to the primary clinic.

## *Results*

The results are given in the following table. Hospital type, number of primary operations during the observation period and the number of re-operations are given. The rate of complications varies from 0-4.8%.

It should be noted that case-mix factors are not included in this table. As has previously been stated, we are planning to further develop a case-mix factor that can be expressed as a value which will be included in next year's table.

## *Discussion*

The number of complications is small and should be evaluated with care. This variable can actually only be evaluated over time; in other words, if there are clear trends. Clinics that adopt a wait-and-see policy – in other words, avoid operating on these complications – will not be registered in the database.

Patient demographics probably influence the number of short-term complications. Clinics that operate on the most serious cases with a higher risk of complications may have a higher frequency of short-term complications. If a clinic continues to report a high rate of short-term complications over a longer period, an in-depth analysis reviewing routines, surgical techniques and possible implant selection should be initiated.

The main aim of this openly reported indicator is not to "accuse" individual clinics but to initiate rapid improvement programmes. Experience from the National HIA (Register of Information and Knowledge about Swedish Heart Intensive care Admissions) and NDR (National Diabetes Register) is excellent and has produced a rapid improvement effect at the clinics that have had deviating and poorer results.

# Reoperation within 2 Years per Hospital

2002-2005

| | Prim. THRs | Patients [1)] | | Infection | | Dislocation | | Loosening | | Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hospital | number | number | % | number | % | number | % | number | % | number | % |
| **University/Regional Hospitals** | | | | | | | | | | | |
| Huddinge | 845 | 12 | 1.4% | 0 | 0.0% | 6 | 0.7% | 2 | 0.2% | 5 | 0.6% |
| Karolinska | 1,144 | 38 | 3.3% | 17 | 1.5% | 14 | 1.2% | 3 | 0.3% | 16 | 1.4% |
| Linköping | 655 | 5 | 0.8% | 3 | 0.5% | 1 | 0.2% | 0 | 0.0% | 2 | 0.3% |
| Lund | 386 | 9 | 2.3% | 1 | 0.3% | 4 | 1.0% | 1 | 0.3% | 4 | 1.0% |
| Malmö | 488 | 9 | 1.8% | 2 | 0.4% | 6 | 1.2% | 0 | 0.0% | 1 | 0.2% |
| SU/Sahlgrenska | 831 | 16 | 1.9% | 7 | 0.8% | 1 | 0.1% | 3 | 0.4% | 9 | 1.1% |
| SU/Östra | 480 | 2 | 0.4% | 0 | 0.0% | 2 | 0.4% | 0 | 0.0% | 0 | 0.0% |
| Umeå | 255 | 5 | 2.0% | 0 | 0.0% | 2 | 0.8% | 0 | 0.0% | 4 | 1.6% |
| Uppsala | 1,102 | 33 | 3.0% | 13 | 1.2% | 10 | 0.9% | 2 | 0.2% | 12 | 1.1% |
| **Central Hospitals** | | | | | | | | | | | |
| Borås | 710 | 22 | 3.1% | 4 | 0.6% | 15 | 2.1% | 0 | 0.0% | 6 | 0.8% |
| Danderyd | 1,295 | 28 | 2.2% | 4 | 0.3% | 14 | 1.1% | 4 | 0.3% | 11 | 0.8% |
| Eksjö | 708 | 16 | 2.3% | 4 | 0.6% | 4 | 0.6% | 1 | 0.1% | 9 | 1.3% |
| Eskilstuna | 281 | 2 | 0.7% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 2 | 0.7% |
| Falun | 984 | 7 | 0.7% | 1 | 0.1% | 3 | 0.3% | 2 | 0.2% | 1 | 0.1% |
| Gävle | 701 | 21 | 3.0% | 3 | 0.4% | 11 | 1.6% | 1 | 0.1% | 6 | 0.9% |
| Halmstad | 713 | 17 | 2.4% | 9 | 1.3% | 7 | 1.0% | 0 | 0.0% | 7 | 1.0% |
| Helsingborg | 449 | 2 | 0.4% | 1 | 0.2% | 0 | 0.0% | 0 | 0.0% | 2 | 0.4% |
| Hässleholm-Kristianstad | 2,444 | 24 | 1.0% | 15 | 0.6% | 4 | 0.2% | 2 | 0.1% | 16 | 0.7% |
| Jönköping | 731 | 14 | 1.9% | 1 | 0.1% | 12 | 1.6% | 0 | 0.0% | 2 | 0.3% |
| Kalmar | 849 | 14 | 1.6% | 8 | 0.9% | 6 | 0.7% | 0 | 0.0% | 3 | 0.4% |
| Karlskrona | 165 | 1 | 0.6% | 0 | 0.0% | 0 | 0.0% | 1 | 0.6% | 0 | 0.0% |
| Karlstad | 834 | 22 | 2.6% | 16 | 1.9% | 4 | 0.5% | 2 | 0.2% | 7 | 0.8% |
| Norrköping | 810 | 7 | 0.9% | 0 | 0.0% | 5 | 0.6% | 1 | 0.1% | 1 | 0.1% |
| S:t Göran | 1,887 | 47 | 2.5% | 20 | 1.1% | 15 | 0.8% | 9 | 0.5% | 15 | 0.8% |
| Skövde | 626 | 7 | 1.1% | 2 | 0.3% | 1 | 0.2% | 0 | 0.0% | 5 | 0.8% |
| SU/Mölndal | 421 | 5 | 1.2% | 1 | 0,.% | 2 | 0.5% | 0 | 0.0% | 3 | 0.7% |
| Sunderby | 525 | 15 | 2.9% | 9 | 1.7% | 5 | 1.0% | 1 | 0.2% | 3 | 0.6% |
| Sundsvall | 688 | 33 | 4.8% | 9 | 1.3% | 19 | 2.8% | 1 | 0.1% | 7 | 1.0% |
| Södersjukhuset | 954 | 9 | 0.9% | 0 | 0.0% | 4 | 0.4% | 2 | 0.2% | 3 | 0.3% |
| Uddevalla | 1,158 | 20 | 1.7% | 8 | 0.7% | 9 | 0.8% | 2 | 0.2% | 5 | 0.4% |
| Varberg | 758 | 17 | 2.2% | 15 | 2.0% | 0 | 0.0% | 1 | 0.1% | 4 | 0.5% |
| Västerås | 462 | 4 | 0.9% | 0 | 0.0% | 3 | 0.6% | 0 | 0.0% | 1 | 0.2% |
| Växjö | 425 | 3 | 0.7% | 0 | 0.0% | 2 | 0.5% | 0 | 0.0% | 1 | 0.2% |
| Ystad | 380 | 10 | 2.6% | 1 | 0.3% | 8 | 2.1% | 0 | 0.0% | 1 | 0.3% |
| Örebro | 732 | 7 | 1.0% | 4 | 0.5% | 0 | 0.0% | 0 | 0.0% | 3 | 0.4% |
| Östersund | 681 | 9 | 1.3% | 2 | 0.3% | 3 | 0.4% | 0 | 0.0% | 4 | 0.6% |
| **Rural Hospitals** | | | | | | | | | | | |
| Alingsås | 560 | 3 | 0.5% | 1 | 0.2% | 2 | 0.4% | 0 | 0.0% | 0 | 0.0% |
| Arvika | 327 | 5 | 1.5% | 4 | 1.2% | 0 | 0.0% | 0 | 0.0% | 2 | 0.6% |
| Bollnäs | 851 | 13 | 1.5% | 1 | 0.1% | 6 | 0.7% | 2 | 0.2% | 4 | 0.5% |
| Enköping | 601 | 14 | 2.3% | 8 | 1.3% | 5 | 0.8% | 2 | 0.3% | 3 | 0.5% |
| Falköping | 923 | 6 | 0.7% | 1 | 0.1% | 3 | 0.3% | 1 | 0.1% | 2 | 0.2% |
| Frölunda Specialistsjukhus | 144 | 2 | 1.4% | 1 | 0.7% | 1 | 0.7% | 0 | 0.0% | 1 | 0.7% |

*(continued on next page)*

# Reoperation within 2 Years per Hospital (cont.)

2002-2005

| | Prim. THRs | Patients [1] | | Infection | | Dislocation | | Loosening | | Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hospital | number | number | % | number | % | number | % | number | % | number | % |
| Gällivare | 400 | 8 | 2.0% | 4 | 1.0% | 3 | 0.8% | 0 | 0.0% | 2 | 0.5% |
| Hudiksvall | 640 | 20 | 3.1% | 9 | 1.4% | 11 | 1.7% | 0 | 0.0% | 3 | 0.5% |
| Karlshamn | 654 | 7 | 1.1% | 0 | 0.0% | 5 | 0.8% | 1 | 0.2% | 1 | 0.2% |
| Karlskoga | 492 | 7 | 1.4% | 2 | 0.4% | 4 | 0.8% | 1 | 0.2% | 3 | 0.6% |
| Katrineholm | 830 | 7 | 0.8% | 2 | 0.2% | 1 | 0.1% | 4 | 0.5% | 4 | 0.5% |
| Kungälv | 726 | 1 | 0.1% | 1 | 0.1% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Köping | 806 | 1 | 0.1% | 0 | 0.0% | 1 | 0.1% | 0 | 0.0% | 1 | 0.1% |
| Lidköping | 480 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Lindesberg | 552 | 7 | 1.3% | 2 | 0.4% | 4 | 0.7% | 0 | 0.0% | 2 | 0.4% |
| Ljungby | 438 | 2 | 0.5% | 0 | 0.0% | 0 | 0.0% | 1 | 0.2% | 1 | 0.2% |
| Lycksele | 882 | 1 | 0.1% | 0 | 0.0% | 0 | 0.0% | 1 | 0.1% | 0 | 0.0% |
| Mora | 574 | 6 | 1.0% | 2 | 0.3% | 3 | 0.5% | 0 | 0.0% | 1 | 0.2% |
| Motala | 958 | 8 | 0.8% | 1 | 0.1% | 6 | 0.6% | 0 | 0.0% | 1 | 0.1% |
| Norrtälje | 402 | 9 | 2.2% | 4 | 1.0% | 6 | 1.5% | 0 | 0.0% | 4 | 1.0% |
| Nyköping | 520 | 11 | 2.1% | 4 | 0.8% | 6 | 1.2% | 0 | 0.0% | 5 | 1.0% |
| Oskarshamn | 541 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Piteå | 510 | 5 | 1.0% | 2 | 0.4% | 1 | 0.2% | 0 | 0.0% | 2 | 0.4% |
| Simrishamn | 759 | 7 | 0.9% | 1 | 0.1% | 3 | 0.4% | 1 | 0.1% | 2 | 0.3% |
| Skellefteå | 547 | 6 | 1.1% | 2 | 0.4% | 3 | 0.5% | 1 | 0.2% | 3 | 0.5% |
| Skene | 330 | 1 | 0.3% | 0 | 0.0% | 1 | 0.3% | 1 | 0.3% | 0 | 0.0% |
| Sollefteå | 540 | 6 | 1.1% | 3 | 0.6% | 1 | 0.2% | 0 | 0.0% | 4 | 0.7% |
| Södertälje | 502 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Torsby | 278 | 1 | 0.4% | 0 | 0.0% | 1 | 0.4% | 0 | 0.0% | 0 | 0.0% |
| Trelleborg | 1,015 | 13 | 1.3% | 1 | 0.1% | 6 | 0.6% | 3 | 0.3% | 3 | 0.3% |
| Visby | 254 | 4 | 1.6% | 0 | 0.0% | 1 | 0.4% | 1 | 0.4% | 2 | 0.8% |
| Värnamo | 466 | 4 | 0.9% | 2 | 0.4% | 3 | 0.6% | 0 | 0.0% | 2 | 0.4% |
| Västervik | 454 | 10 | 2.2% | 5 | 1.1% | 5 | 1.1% | 0 | 0.0% | 3 | 0.7% |
| Ängelholm | 493 | 4 | 0.8% | 1 | 0.2% | 1 | 0.2% | 0 | 0.0% | 2 | 0.4% |
| Örnsköldsvik | 531 | 7 | 1.3% | 3 | 0.6% | 3 | 0.6% | 0 | 0.0% | 2 | 0.4% |
| **Private Hospitals** | | | | | | | | | | | |
| Carlanderska | 221 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Elisabethsjukhuset | 338 | 4 | 1.2% | 1 | 0.3% | 0 | 0.0% | 0 | 0.0% | 3 | 0.9% |
| Gothenburg Medical Center | 59 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Movement | 104 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Nacka Närsjukhus Proxima | 17 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Ortopediska Huset | 864 | 5 | 0.6% | 1 | 0.1% | 1 | 0.1% | 3 | 0.3% | 1 | 0.1% |
| Sophiahemmet | 943 | 9 | 1.0% | 1 | 0.1% | 5 | 0.5% | 1 | 0.1% | 2 | 0.2% |
| Stockholms Specialistvård | 572 | 9 | 1.6% | 3 | 0.5% | 5 | 0.9% | 1 | 0.2% | 2 | 0.3% |
| Sweden | 52,623 | 763 | 1.4% | 259 | 0.5% | 313 | 0.6% | 69 | 0.1% | 266 | 0.5% |

*1) The number of patients with short-term complications can differ from the number of complications, as each patient can have more than one type of complication.*

# *Revision*

In contrast to re-operation, which is a broader concept, the term "revision" is used for the exchange or extraction of one, several or all the parts of the prosthesis. During the period 1979-1991, the data for primary hip arthroplasty were registered as an aggregate for each hospital and were not based on the patients' personal identity numbers. Approximations for diagnosis, gender and age distribution and mortality risk statistics were therefore used for survival calculations, which demonstrated a high level of validity (Söderman et al. 2000). In 1992, a more precise system based on the patient's personal identity number was introduced. Using this system, more information about each primary procedure is also registered, making a more complete analysis possible.

In this year's report, we have conducted an in-depth analysis of two areas. In the first, we have taken advantage of the opportunity to relate outcome to the final prosthesis design, as every implant component has been registered using an article number. As this registration began in 1999, the analysis covers the period 1999 to 2005 and can only comprise the early outcome. Only the three most common cemented stem types (Lubinus SP II, Exeter polished and Spectron EF Primary) have been included to obtain sufficiently extensive material for reliable conclusions. During every operation, the size of the stem, the length of the neck and, in some cases, also the offset angle are adjusted for every patient. This creates the potential for a very large number of implant component combinations for one and the same basic prosthesis model. Important information, such as the fact that some implant sizes or combinations represent an increased risk of early problems which could lead to re-operations, may be concealed behind the survival curve. In this year's report, we have attempted to analyse whether any of these design-related factors impact the risk of early re-operation caused by the mechanical loosening of cups and/or stems.

Patients undergoing revision for the first time constitute the other area that has been the subject of an in-depth analysis. The aim here was to investigate the degree to which these patients' problems can be resolved using a new surgical intervention.

In the overall reports, we can see that the reduction in the number of re-operations due to dislocation in 2005 was also reflected in the form of a reduction in the procedure frequency of revisions. When it comes to the other reasons for revision, no striking changes have taken place. Since 2000, the number of patients undergoing multiple revisions – i.e. those who had previously undergone a revision and then underwent another – has been relatively constant, just over 300 a year. These are primarily patients with inflammatory joint disease and sequelae from childhood illness, as well as patients experiencing deep infection and dislocation.

During the past three years, the procedure frequency for the revision of primary fully cemented and uncemented implants has declined. As expected, the number of revisions due to dislocation, deep infection and technical problems has decreased with time following the primary operation when the whole period (1979-2005) is studied. The risk of revision as a result of mechanical loosening reaches a plateau when seven to ten years have passed following the primary operation. The relative percentage of revisions as a result of fractures presents another picture and is relatively constant at 5-6% up to 10 years, after which it increases. This pattern could be due to the fact that many patients with loose prostheses are not detected in time. There may also be other reasons. In the future, thanks to our follow-up programmes, we shall have a better grasp of this problem and will probably be able to reduce the need for complicated revisions of periprosthetic fractures.

Prosthesis survival related to fixation type reveals an unchanged pattern compared with previous years and regardless of whether all diagnoses are included or whether patients who undergo primary surgery as a result of osteoarthritis are analysed. These diagrams should be regarded as a description of the current situation in Sweden. A 26-year survival of 77.6% of 69,462 cemented prostheses constitutes important documentation on the procedure as such and is a reference for both ongoing and future studies. It should be pointed out that these data are not sufficient for a more detailed comparison of the different ways of fixing prostheses, as many factors, such as demographic differences between groups, changes in indication over time and changes in implant design, have not been taken into account. The survival diagram for reversed hybrids reveals a sharp increase in the number of revisions after eight years. This should be seen against the background of the fact that, in 1992-1998, a total of just 218 reversed hybrid operations were performed, an uncertainty that is reflected in the large confidence interval.

As before, the overall results have improved during the past 12-13 years. In the event of a successive improvement in uncemented implants, the peak in the curve, which currently occurs at around four to five years, should shift to the right and signify that modern, relatively recently inserted prosthesis designs are less frequently the subject of revision. A tendency in this direction can already be seen, which is encouraging. When interpreting the survival curve for reversed hybrids, the fact that few hybrids have been followed up for more than six to seven years should be taken into account.

The implant-specific survival diagrams (pages 42-45) are based on revisions regardless of cause and independent of diagnosis. Four survival curves showing the risk of stem and/or cup revision are only shown for the four most frequently used cemented implants. In the other diagrams, cups and stems are shown separately. The analysis is completed when the number of observations is less than 50. A more detailed presentation of different implants is given in tabular form, starting on page 50. The continuous feedback from the register has resulted in an increasingly narrow implant selection. As a result, we are now standing on safer ground when it comes to the documentation of some cemented/uncemented prosthesis

concepts. Recurring analyses of how the choice of cemented/uncemented prosthesis influences the outcome for different patient categories are needed in order to determine whether this is an important factor and, if so, to define the optimal indicators for each fixation method.

The results for different gender and age groups are presented in four intervals: younger than 50 years, 50-59 years, 60-75 years and older than 75 years. For each age interval, all observations, cemented, uncemented and hybrid implants, are presented for each gender. All the reasons for revision are included for the period on which the report is based (1992-2005).

In the age group younger than 50 years, women have poorer results than men, probably owing to the dominance of women in the diagnostic groups sequelae from childhood diseases and inflammatory joint disease, two diagnoses with an increased revision rate. For both men and women, the results improve if cemented fixation is used instead of uncemented or hybrid fixation. In the 50-59 age group, cemented fixation still represents a lower risk of revision among women. In men, 14-year prosthesis survival is highest for uncemented fixation, but the confidence intervals for fully uncemented and cemented fixation overlap one another. In the next age interval (60-75), it is difficult to evaluate the comparison, as a result of the relatively small number of observations in the uncemented group. The choice of hybrid prostheses does not produce any improvement, regardless of age group. In women in the 60-75 age group, hybrids appear to be far worse, but a more in-depth analysis is needed to confirm this difference.

In last year's report, we introduced a so-called patient profile or case-mix indicator, based on the age of patients in conjunction with the primary operation and diagnosis. We found that patients in the 60-75 age group who underwent surgery because of primary osteoarthritis experienced a more favourable outcome than other age groups with the same diagnosis, together with patients who underwent surgery for diagnoses other than primary osteoarthritis, regardless of age. A simple definition of patient profile is needed in order to understand how much of the health service's resources in the form of care, degree of surgical difficulty and post-operative course are consumed in conjunction with the intervention and how the anticipated result is affected. We believe that the patient profile can be defined even more effectively and are planning to present an updated analysis in the next report. On pages 54-55 in this year's report, we show the percentage of patients operated on for primary osteoarthritis and the percentage of patients in the 60-75 age group for each clinic. As the table shows, these patient categories are most common at private and rural hospitals and less common at central and university/regional hospitals. The differences between hospitals in the three largest categories are large and lie between 22% and 26%. In the case of private hospitals, there is less variation, but it is still 12%.

For three of the four most frequently used cemented cup/stem combinations during the period 1992-2005, the stem has a better result than the corresponding cup. The Charnley implant breaks this pattern and this is probably one of the contributory factors that has led to the Charnley cup being used almost exclusively with other stem designs and the Charnley stem disappearing almost completely from the Swedish market. The reason why the survival of the Reflection cup (all polyethylene) is somewhat poorer is unclear. Increased wear (in RSA studies) to the specific polyethylene cup that has been used in the majority of cases has been demonstrated and this could be one of the reasons.

For the four most frequently used uncemented implant combinations, the stem is functioning effectively, with a nine- to 13-year survival of 96.7% or more. In the case of the uncemented cups, survival declines towards the end of the interval, probably as a result of wear problems and osteolysis. During the first half of the 1990s, the liner for the Trilogy was supplied in some cases with an older type of sterilisation and the addition of stearate and this may have affected the outcome. The introduction of high-molecular plastic (highly cross linked) in recent years can be expected to have a positive impact on outcome. There are now two different studies with five-year follow-up that report a sharp reduction in wear using two different types of high-molecular plastic. This may be one of the most important advances in prosthesis surgery for many years. It should, however, be pointed out that there are many different types of this polyethylene and that some have no clinical documentation whatsoever. As these plastics often have somewhat poorer strength, the use of implants that are thinner than 6-8 mm should definitely be avoided until long-term documentation is available. We feel that high-molecular plastic can be used in patients in whom a high level of wear is expected. In spite of this, the follow-up period is short and there is still no basis for a general recommendation.

## *Cemented stem design and early aseptic loosening*

During the 1990s, a number of implant manufacturers changed their standard implants, sometimes by simply adding more sizes, but other variation opportunities, such as the choice of neck angle (CCD) and offset, were often also introduced. Some manufacturers also decided to abandon a fixed standard length regardless of thickness and instead scaled down the stem symmetrically, as the size was reduced. On the basis of previous experience, we know that small changes to an implant could result in major differences when it comes to the risk of revision. One well-known example is the Exeter implant, which demonstrated far poorer results when it was given a matt surface. Preliminary studies using radiostereometry indicate that stem migration can differ depending on the implant size that has been used. In several parts of Sweden, anxiety has also been expressed about the fact that the relatively recently introduced small prosthesis sizes that have been cemented in place have experienced early mechanical loosing to an increasing degree.

Since 1999, the Hip Arthroplasty Register has collected more detailed data on the implants that have been used. Informa-

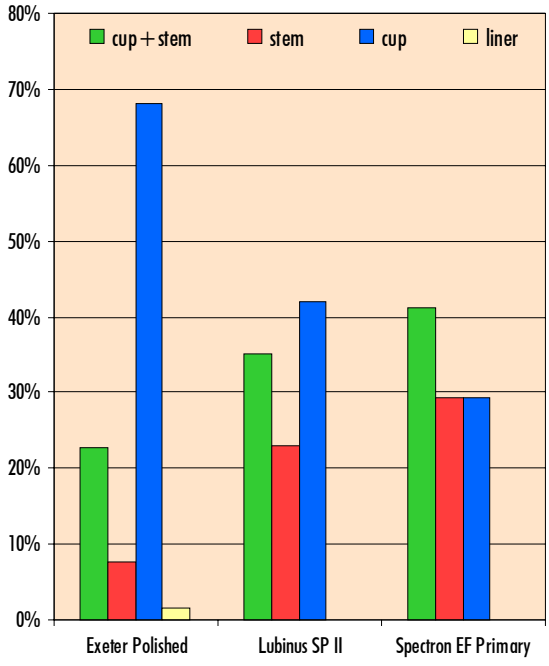
tion about implant size (thickness, length, neck angle) has been noted. In this year's report, we have used this information to investigate whether these design-related factors play any role in the risk of early revision as a result of loosening. To obtain sufficiently extensive material, only the three most frequently used stems have been studied (Lubinus SP II, Exeter polished, Spectron EF Primary). As article numbers have only been registered for the past seven years, the average follow-up period is short (Lubinus SP II = 3.0 ± 1.9 years, Exeter polished = 2.9 ± 1.9 years, Spectron EF Primary = 3.1 ± 1.9 years). The analysis has been based on revisions as a result of aseptic loosening of the stem or cup. As the diagram shows, exchanges or extractions of the cup in the Exeter group dominated, while exchange or extraction for the stem was more common in relative terms in the Lubinus and Spectron groups.

The early incidence of revision is low and extensive material is therefore required for analysis. During the period 1999-2005, Lubinus SP II (n = 38,360), Exeter polished (n = 19,436) and Spectron EF Primary (n = 6,525) were the cemented implants that were used most frequently. On an annual basis, about the same number of Exeter polished and Spectron EF Primary have been installed, while the Lubinus SP II has increased.

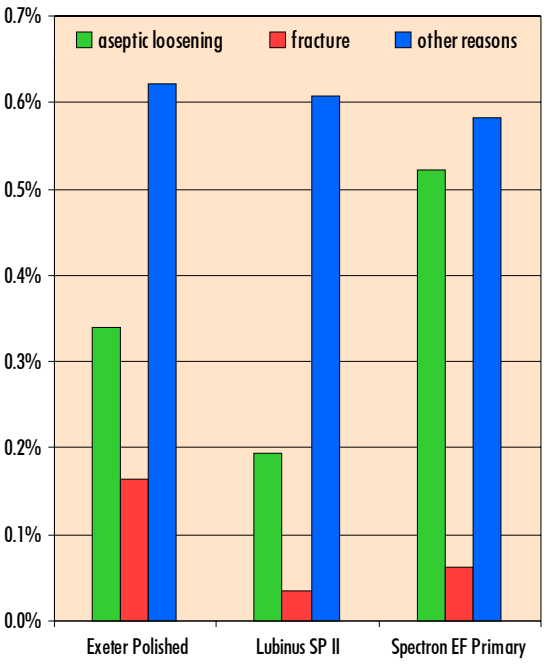
Prior to the analysis, the article numbers of both the stem and joint head were re-coded to create variables which describe parameters such as stem size (thickness), stem length, neck angle (Lubinus SP II), offset and neck length incorporated in the design of the joint head cone in a logical manner.

The selected implant types have some design-specific characteristics which had to be handled separately. Wherever possible, the analysis is based on standard sizes. This means that specially designed implants or implants that are used on a relatively small scale, such as dysplasia implants and stems longer than 150 mm, have been excluded. The Spectron stem has been analysed in terms of stem size (thickness), the incidence or not of extra offset and neck length. The Exeter implant has been analysed in terms of stem size (thickness), offset incorporated in the stem (37.5, 44 and 50) and neck length. The Lubinus SP II stem has been analysed in terms of stem size, CCD angle, the incidence of an extended neck and caput (femoral head) length. An offset parameter corresponding to a combination of offset incorporated in the stem and caput length was constructed for all three implant types. It should be pointed out that this variable does not take account of the way implant offset changes with the varying size class of the actual stem.

All three implant designs were analysed in separate regression models with adjustments for gender, age, diagnosis and incision. During the period 1999-2005, 0.2% (Lubinis SP II), 0.3% (Exeter polished) and 0.5% (Spectron EF Primary) of implants were revised as a result of aseptic loosening in these




*The distribution of reason to reoperation for the 3 different stems is included in the analysis. Change/extraction of cup and/or stem was performed i all cases but one. The distribution within the groups differ ($p=0.003$, $X^2$-test), above all between the polished and the two matte/blasted stems concerning frequency of change of cup and stem.*




*The distribution of non-aseptic reoperations in relation to the total number of operated stems during the period 1999-2005 divided in aseptic loosening, fracture and other reasons. A small amount of stems that do not fulfill the criteria in the analysis (special design, length >150 mm, indistinct codes) have been excluded.*

three groups. The distribution of revision causes in the individual groups (excluding infection) varied in such a way that, compared with the other two groups, aseptic loosening was relatively more common in the Spectron EF Primary group, while the Exeter implant was the subject of more revisions as a result of fracture than the other two. The total incidence of revision due to fracture excluding infection, based on all the implants installed in the individual groups, was 0.03% (Lubinis SP II), 0.06% (Spectron Primary) and 0.16% (Exeter polished), while the other causes were dominated by dislocation problems, which resulted in 0.5%-0.6% of the stems in the individual groups being revised during the period, regardless of design.

The analysis reveals that design factors have a significant impact on the risk of revision due to aseptic loosening. There are, however, interesting differences between the three stem types.

In the case of the Spectron implant, the risk is reduced by more than 50% for every increase in size. This variable has been determined with great reliability, with a confidence interval relatively far from 1 and a low p-value. There is also a 50% increase in the risk with every increase in total offset, calculated as the sum of the extra offset incorporated in the stem and neck length determined by the location of the joint head cone. In this case, the confidence interval is closer to 1 – in other words, this factor is less reliable. There is also a greater risk among men.

The polished Exeter prosthesis presents an entirely different picture. The risk of revision as a result of aseptic loosening is reduced as offset increases. It also declines with increasing age, but it increases if a posterior incision is used.

The risk profile for the Lubinus implant resembles that of the Spectron stem to some degree. The risk of revision due to aseptic loosening declines as the stem thickness increases and if an extra long stem neck is avoided. The combined offset factor, the length of the neck of the stem combined with the length of the neck of the joint head, does not produce a significant result. Other factors that increase the risk of revision due to aseptic loosening are male gender, operations using a lateral incision in the supine position (Hardinge incision) and operations due to necrosis of the femoral head.

An extended analysis based exclusively on stem revision as the outcome parameter is also of interest. However, we feel that the results are unreliable, owing to the relatively small number of revisions of this type and the short observation period. We are therefore planning to return to this topic in a later report.

After an average observation period of three years, we find that the design of the stem influences the risk of re-operation due to loosening. In every case but one, this means that the stem and/or cup were replaced or extracted. Men are particularly vulnerable when a matt or blasted implant of small size is used and, in these groups, the risk increases as offset is increased. The polished Exeter implant, on the other hand, appears to be more sensitive to a small offset angle. This finding is difficult to interpret, but it could perhaps be related to the fact that cup problems are more common in this group.

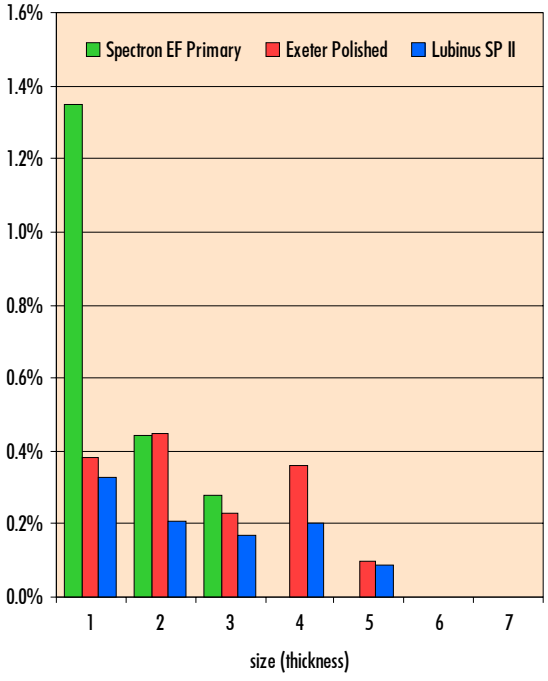
| | **Relative risk [Exp(B)]** | **95% confidence interval** | | ***p-value*** |
|---|---|---|---|---|
| | | lower | upper | |
| **Spectron EF Primary** *(n=6,489)* | | | | |
| ***Stem size*** | **0.36** | 0.21 | 0.61 | *0.0002* |
| ***Total offset**** | **1.47** | 1.08 | 2.00 | *0.013* |
| Male gender | **2.35** | 1.10 | 5.01 | *0.027* |
| | | | | |
| **Exeter polished** *(n=18,869)* | | | | |
| ***Stem offset*** | **0.49** | 0.30 | 0.80 | *0.004* |
| Age | **0.95** | 0.93 | 0.97 | *0.000003* |
| Posterior incision | **2.77** | 1.45 | 5.26 | *0.002* |
| | | | | |
| **Lubinus SP II** *(n=37,426)* | | | | |
| ***Stem thickness*** | **0.66** | 0.52 | 0.84 | *0.0006* |
| ***Extra neck length*** | **2.63** | 1.14 | 6.25 | *0.02* |
| Male gender | **2.64** | 1.60 | 4.35 | *0.0001* |
| Diagnosis (idop. femoral head necrosis) | **4.54** | 1.96 | 11.11 | *0.0004* |
| Anterior incision, patient on back | **2.63** | 1.04 | 6.67 | *0.04* |

**The sum of neck length and stem offset (standard/extra offset).*
*Outcome of Cox regression analysis for the three different typs of cemented stems have been studied. The number of observations have been reduced as some odd stems have been excluded and due to inadequate codes. For the sake of clarity, design related variables has been placed first (bold-italics text).*

In view of the fact that the number of actual revisions due to aseptic loosening is low, it should be pointed out that factors that prove to be of low significance should be evaluated with caution and should not be directly applied in clinical practice. Any assessment of the impact of the offset factor should be based on the fact that we do not know the extent to which the registered offset means that the normal anatomy was or was not restored. The analysis also indicates that the smallest sizes of the Spectron and Lubinus implants represent an increased risk of re-operation due to early loosening. With this analysis as the starting point, it is not possible to determine whether this is solely due to the implant that is chosen or whether patients with a narrow primary marrow space and/or narrow femur automatically run a greater risk of stem loosening. The findings do, however, speak in favour of using alternative implants, such as uncemented prostheses or cemented polished stems, but as yet we have no reliable data to confirm this.

## *Patients undergoing early re-operations constitute a high-risk group*

The scientific support for surgical treatment strategies in hip revision surgery is limited. This is probably due to the fact that most observations are based on results from highly specialised clinics. We have therefore examined the national results following hip revision surgery in order systematically to study the risk factors for new revisions (re-revisions).




*Distribution of stem sizes being revised due to aseptic loosening within each group respectively. The smallest stem size has been coded as 1 independent of the manufacturer's term.*

We analysed the production of initial revisions (n = 13,424) between 1 January 1979 and 31 December 2000 in the Hip Arthroplasty Register. Revision was defined as the exchange of a cup and/or stem. Stems that were re-cemented in the same cement shell and exchanges of implant heads and/or liners were excluded. The cases that were treated using resection arthroplasty and which were not given a new implant during the period in question were also excluded.

A new revision involves installing or replacing a cup and/or stem. The database was also matched with the Swedish register of deaths in order to be able to combine the definition of failure with the fact that the patient had died in the analysis. It is not possible to exclude the possibility that revision patients have a higher mortality rate compared with the normal population and it is also important to take account of the fact that the deceased person's implant may have been loose.

Almost 60% of all revisions were performed at central hospitals and in almost 50% of cases all the implant components were replaced.

The majority of cup revisions were performed using cement containing antibiotics, but an increase in the number of uncemented cup revisions can be seen. One third of cemented cup revisions and almost 60% of all uncemented cup revisions are performed using some kind of bone transplantation, normally allografts. In the majority of cup revisions, re-cementing was performed without any type of transplantation. Between 1990 and 2000, however, the number of bone-packed cups regardless of fixation type increased to 17%.

When it comes to stem revisions, a clearer increase can be seen in uncemented fixation, normally in the form of distally anchored prostheses. In about a quarter of the stem revisions, some form of allograft was used (primarily bone-bank bone) and, since 1990, using the bone-packing technique on an increasing scale. At the end of the observation period, the frequency of bone packing was around 15%. The majority (around 80%) were, however, performed using conventional re-cementing.

Re-revisions were performed on 1,750 (13%) of hips. The percentage of young patients (40-60 years of age) in this group almost doubled compared with initial revisions. As expected, the frequency of deep infections, dislocations and resection interventions was far higher.

The most important finding was that early revisions (≤ 5-7 years after the primary operation) ran a considerable over-risk of being revised and the effect was most pronounced among younger men who had undergone revisions due to aseptic stem loosening. A reduction in risk (8% a year) could be found as the survival of the primary implant increased and also as the age of the patient rose. We found that the high risk remained even after the first revision. It was therefore impossible to reduce the risk of a second revision, which is disappointing. Aseptic loosening and osteolysis were the most common indications for new revisions.

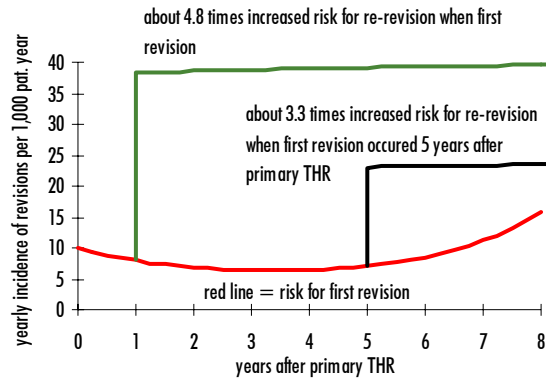
Generally speaking, the prognosis for revisions was somewhat better if the revisions were performed at a university or regional hospital rather than a central or rural hospital. In the same way, revisions that were performed at a central hospital ran a smaller risk of re-revision compared with those performed at rural hospitals. Cemented revisions (both cup and stem) also ran a higher risk of revision in relation to uncemented ones.

The general 10-year survival after the initial revision in Sweden was 88% for cups and around 78% for stems. The uncemented cups tended to run a smaller risk of re-revision than the cemented ones and, in the latter group, a smaller risk was found for the Charnley cup compared with the Exeter cup. When it came to stem revisions, the 10-year survival of the uncemented Wagner SL and the cemented Lubinus SP II was similar and they were both also statistically slightly better than both the Charnley and Exeter stems.

Bone packing did not result in any dramatic reduction in risk when it came to either the cemented or uncemented technique in relation to conventional re-cementing and uncemented prostheses without allografts in conjunction with stem or cup revisions.

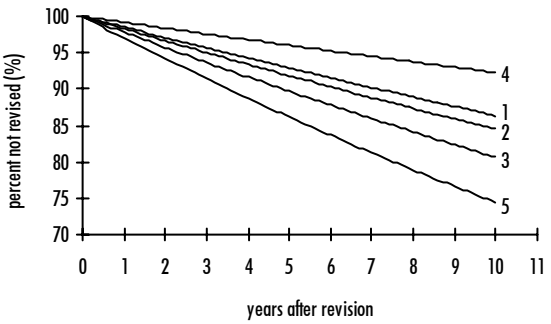
This study reveals that the result after primary hip arthroplasty follows the patient. Early aseptic loosening involves not only the risks that are associated with the actual revision but also an increased risk of needing to undergo one or more additional and probably fairly difficult revisions as a result of aseptic loosening/osteolysis. To some degree, early revision after a primary implant can be related to patient-associated factors. In the majority of cases, however, technique-related factors play a decisive part, which means that this is something that is easier to influence. Interest must focus on top-quality primary arthroplasty when it comes to the choice of implant design and surgical technique. This information is important, as the revision of early implant failure cannot be regarded as a reliable solution for the patient. The advances we have seen in revision surgery in the past 10 years cannot therefore be regarded as justification for offering a young, active patient with a degenerative hip disease, for example, modern techniques that have not been studied in sufficient detail for primary hip arthroplasty. Quite the reverse; it appears that the quality of revisions among patients with early implant loosening must be improved.

The suggestion that the treatment of patients with deep infections or advanced bone loss should be centralised is not controversial. The current results add yet another risk group, early initial revisions. Some of these patients, particularly those in the younger age groups, should probably be offered the opportunity for a re-operation at more highly specialised centres.

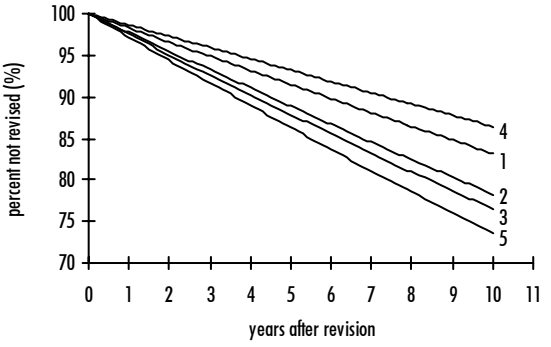



*Risk for first revision and re-revision for a 65-year old male patient with osteoarthritis operated upon with primary THR. The patient runs a 7% risk to be revised within 8 years after primary THR. If the patient is revised within 1 year the risk increases for re-revision to 28% (green line). If the re-revision occurs 5 years after the primary THR the risk for re-revision is still enhanced, but considerably lower than if a revision already at 1 year (black line). Data are calculated for a mean value of the different types of hospitals.*

**First-time revision of the cup**




**First-time revision of the stem**




| Curve | Hospital | Fixation | Year between primary THR and first revision |
|---|---|---|---|
| 1 | university/regional | uncemented | 2 |
| 2 | university/regional | cemented | 2 |
| 3 | rural | uncemented | 2 |
| 4 | university/regional | uncemented | 8 |
| 5 | rural | cemented | 0.25 |

*Survival of cup (upper diagram) and stem (lower diagram) in relation to hospital type, fixation and time to first revision of the primary implant. Poisson regression.*

## Number of Revisions per Reason and Years of Revisions

only the first revision, primary THRs 1979-2005

| Reason for revision | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Aseptic loosening | 10,921 | 882 | 947 | 900 | 761 | 784 | 15,195 | 74.9% |
| Dislocation | 835 | 107 | 123 | 126 | 166 | 127 | 1,484 | 7.3% |
| Deep infection | 1,086 | 54 | 74 | 87 | 73 | 79 | 1,453 | 7.2% |
| Fracture | 730 | 79 | 75 | 95 | 92 | 90 | 1,161 | 5.7% |
| Technical error | 427 | 7 | 10 | 13 | 42 | 26 | 525 | 2.6% |
| Implant fracture | 220 | 24 | 12 | 21 | 16 | 13 | 306 | 1.5% |
| Miscellaneous | 60 | 10 | 11 | 6 | 13 | 9 | 109 | 0.5% |
| Pain only | 47 | 2 | 5 | 4 | 5 | 3 | 66 | 0.3% |
| Total | 14,326 | 1,165 | 1,257 | 1,252 | 1,168 | 1,131 | 20,299 | 100% |



## Number of Revisions per Reason and Number of Previous Revisions

primary THRs 1979-2005

| Reason for revision | 0 | | 1 | | 2 | | > 2 | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Aseptic loosening | 15,195 | 74.9% | 2,109 | 62,7% | 363 | 56.9% | 74 | 42.8% | 17,741 | 72.5% |
| Dislocation | 1,484 | 7.3% | 434 | 12,9% | 100 | 15.7% | 45 | 26.0% | 2,063 | 8.4% |
| Deep infection | 1,453 | 7.2% | 365 | 10,8% | 87 | 13.6% | 32 | 18.5% | 1,937 | 7.9% |
| Fracture | 1,161 | 5.7% | 267 | 7,9% | 51 | 8.0% | 6 | 3.5% | 1,485 | 6.1% |
| Technical error | 525 | 2.6% | 85 | 2,5% | 18 | 2.8% | 2 | 1.2% | 630 | 2.6% |
| Implant fracture | 306 | 1.5% | 61 | 1,8% | 10 | 1.6% | 6 | 3.5% | 383 | 1.6% |
| Miscellaneous | 109 | 0.5% | 31 | 0,9% | 6 | 0.9% | 6 | 3.5% | 152 | 0.6% |
| Pain only | 66 | 0.3% | 13 | 0,4% | 3 | 0.5% | 2 | 1.2% | 84 | 0.3% |
| Secondary infection | 0 | 0.0% | 1 | 0,0% | 0 | 0.0% | 0 | 0.0% | 1 | 0.0% |
| Total | 20,299 | 100% | 3,366 | 100% | 638 | 100% | 173 | 100% | 24,476 | 100% |



## Number of Revisions per Diagnosis and Number of Previous Revisions

primary THRs 1979-2005

| Diagnosis at primary THR | 0 | | 1 | | 2 | | > 2 | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 14,981 | 73.8% | 2,370 | 70.4% | 432 | 67.7% | 112 | 64.7% | 17,895 | 73.1% |
| Fracture | 1,899 | 9.4% | 287 | 8.5% | 44 | 6.9% | 6 | 3.5% | 2,236 | 9.1% |
| Inflammatory arthritis | 1,631 | 8.0% | 334 | 9.9% | 76 | 11.9% | 22 | 12.7% | 2,063 | 8.4% |
| Childhood disease | 996 | 4.9% | 233 | 6.9% | 50 | 7.8% | 20 | 11.6% | 1,299 | 5.3% |
| Idiopathic femoral head necrosis | 359 | 1.8% | 57 | 1.7% | 14 | 2.2% | 4 | 2.3% | 434 | 1.8% |
| Secondary arthritis after trauma | 166 | 0.8% | 49 | 1.5% | 13 | 2.0% | 9 | 5.2% | 237 | 1.0% |
| Secondary osteoarthritis | 62 | 0.3% | 7 | 0.2% | 1 | 0.2% | 0 | 0.0% | 70 | 0.3% |
| Tumor | 32 | 0.2% | 7 | 0.2% | 4 | 0.6% | 0 | 0.0% | 43 | 0.2% |
| (missing) | 173 | 0.9% | 22 | 0.7% | 4 | 0.6% | 0 | 0.0% | 199 | 0.8% |
| Total | 20,299 | 100% | 3,366 | 100% | 638 | 100% | 173 | 100% | 24,476 | 100% |

## Number of Revisions per Year of Revision and Number of Previous Revisions

primary THRs 1979-2005

| Year of revision | 0 | | 1 | | 2 | | > 2 | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| 1979-2000 | 14,326 | 70.6% | 2,131 | 63.3% | 356 | 55.8% | 69 | 39.9% | 16,882 | 69.0% |
| 2001 | 1,165 | 5.7% | 252 | 7.5% | 57 | 8.9% | 23 | 13.3% | 1,497 | 6.1% |
| 2002 | 1,257 | 6.2% | 236 | 7.0% | 60 | 9.4% | 20 | 11.6% | 1,573 | 6.4% |
| 2003 | 1,252 | 6.2% | 259 | 7.7% | 57 | 8.9% | 20 | 11.6% | 1,588 | 6.5% |
| 2004 | 1,168 | 5.8% | 261 | 7.8% | 51 | 8.0% | 18 | 10.4% | 1,498 | 6.1% |
| 2005 | 1,131 | 5.6% | 227 | 6.7% | 57 | 8.9% | 23 | 13.3% | 1,438 | 5.9% |
| Total | 20,299 | 100% | 3,366 | 100% | 638 | 100% | 173 | 100% | 24,476 | 100% |



## Number of Revisions per Type of Fixation at Primary THRs and Year of Revision

only the first revision, primary THRs 1979-2005

| Type of fixation at primary THR | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Cemented | 12,276 | 934 | 985 | 959 | 923 | 890 | 16,967 | 83.6% |
| Uncemented | 1,138 | 126 | 136 | 143 | 105 | 86 | 1,734 | 8.5% |
| Hybrid | 399 | 79 | 103 | 124 | 111 | 122 | 938 | 4.6% |
| Reversed Hybrid | 71 | 5 | 8 | 10 | 18 | 17 | 129 | 0.6% |
| (missing) | 442 | 21 | 25 | 16 | 11 | 16 | 531 | 2.6% |
| Total | 14,326 | 1,165 | 1,257 | 1,252 | 1,168 | 1,131 | 20,299 | 100% |



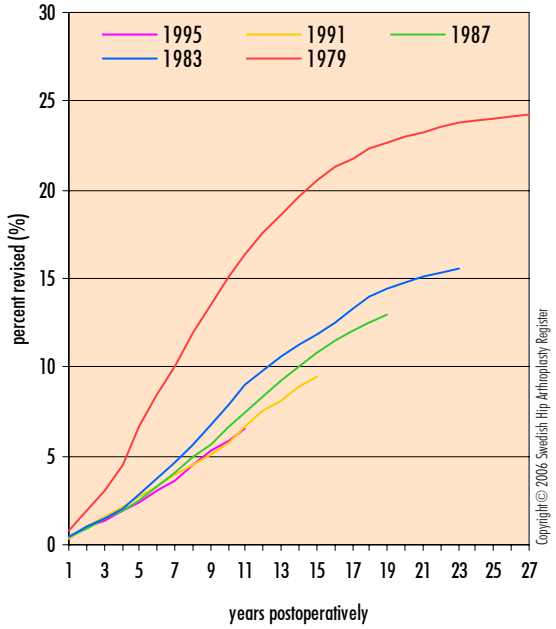
## Number of Revisions per Reason and Time to Revision

only the first revision, primary THRs 1979-2005

| Reason for revision | 0 – 3 years | | 4 – 6 years | | 7 – 10 years | | > 10 years | | Total | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Aseptic loosening | 2,638 | 47.0% | 3,376 | 83.4% | 4,553 | 86.4% | 4,628 | 86.1% | 15,195 | 74.9% |
| Dislocation | 1,016 | 18.1% | 157 | 3.9% | 148 | 2.8% | 163 | 3.0% | 1,484 | 7.3% |
| Deep infection | 1,075 | 19.2% | 185 | 4.6% | 123 | 2.3% | 70 | 1.3% | 1,453 | 7.2% |
| Fracture | 295 | 5.3% | 208 | 5.1% | 293 | 5.6% | 365 | 6.8% | 1,161 | 5.7% |
| Technical error | 423 | 7.5% | 35 | 0.9% | 35 | 0.7% | 32 | 0.6% | 525 | 2.6% |
| Implant fracture | 48 | 0.9% | 60 | 1.5% | 100 | 1.9% | 98 | 1.8% | 306 | 1.5% |
| Miscellaneous | 65 | 1.2% | 17 | 0.4% | 12 | 0.2% | 15 | 0.3% | 109 | 0.5% |
| Pain only | 50 | 0.9% | 8 | 0.2% | 3 | 0.1% | 5 | 0.1% | 66 | 0.3% |
| Total | 5,610 | 100% | 4,046 | 100% | 5,267 | 100% | 5,376 | 100% | 20,299 | 100% |

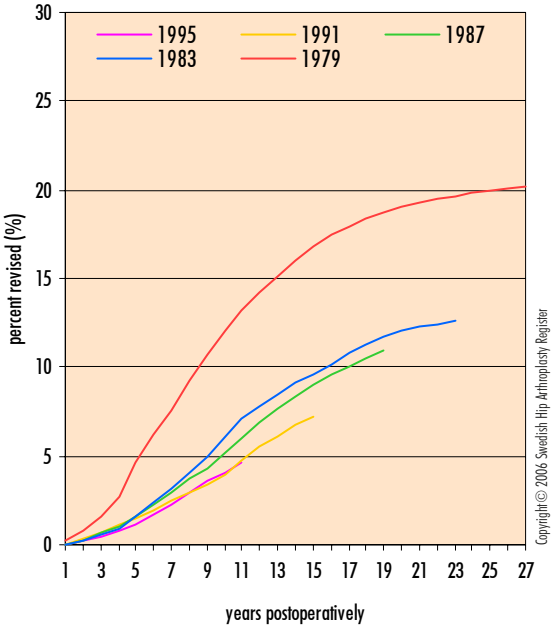
## All Diagnoses and All Reasons

cumulative frequency of revision



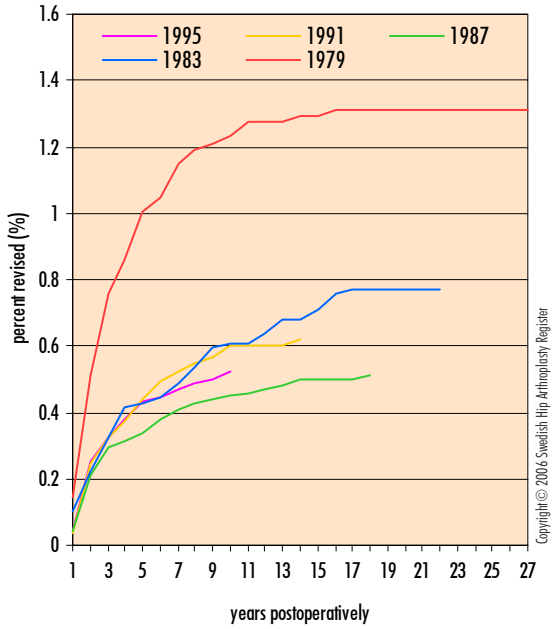

## Aseptic Loosening

cumulative frequency of revision



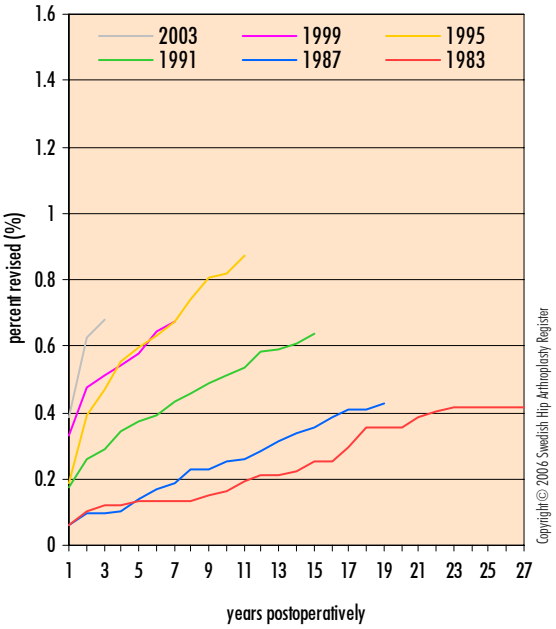

## Deep Infection

cumulative frequency of revision



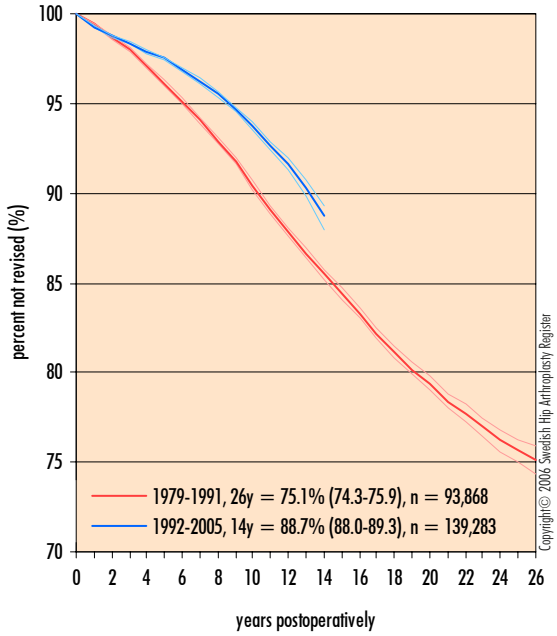

## Dislocation

cumulative frequency of revision



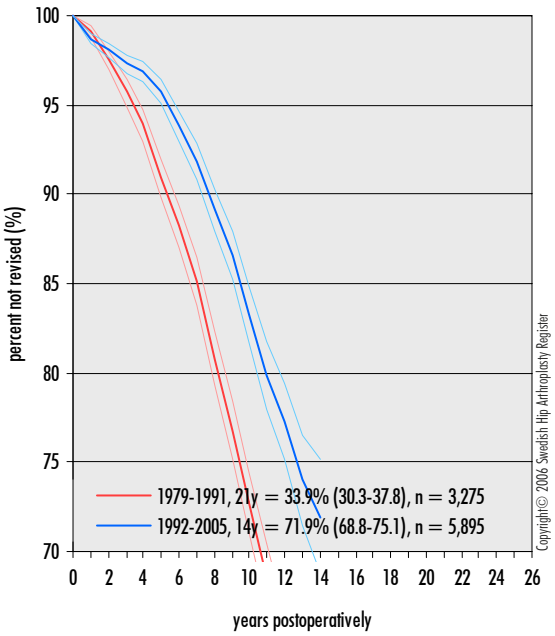
## All Cemented Implants

all diagnoses and all reasons for revision



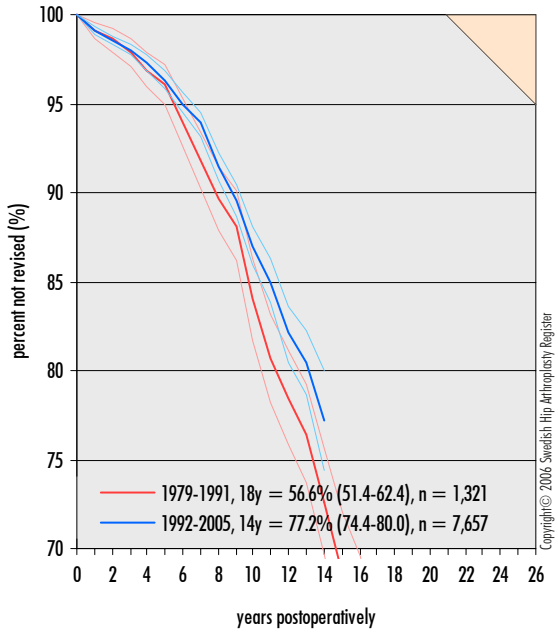

## All Uncemented Implants

all diagnoses and all reasons for revision



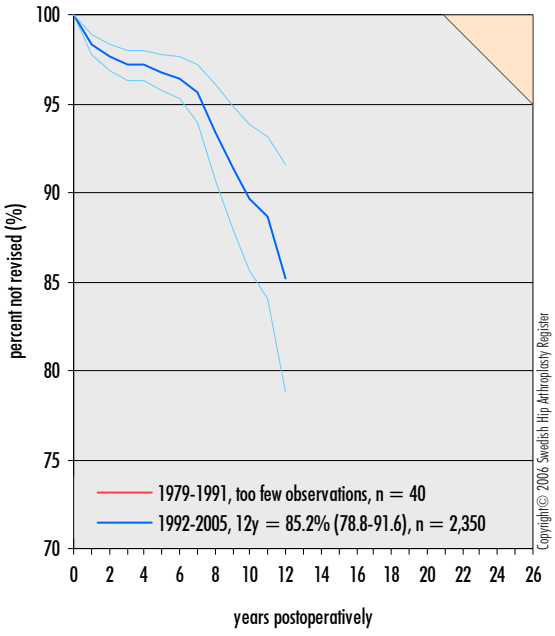

## All Hybrid Implants

all diagnoses and all reasons for revision



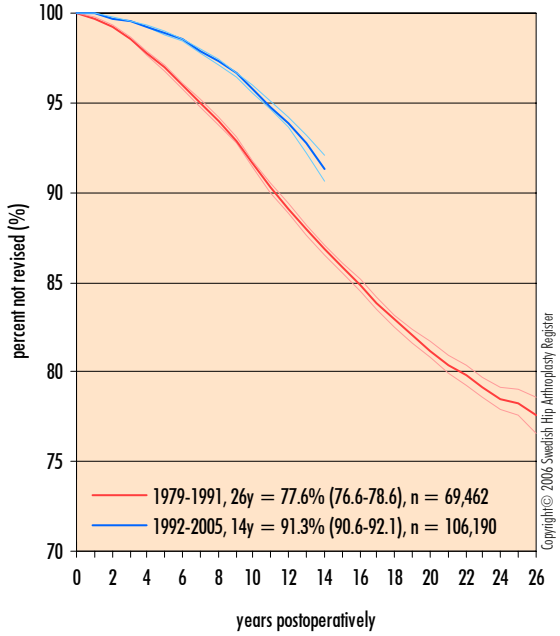

## All Reversed Hybrid Implants

all diagnoses and all reasons for revision



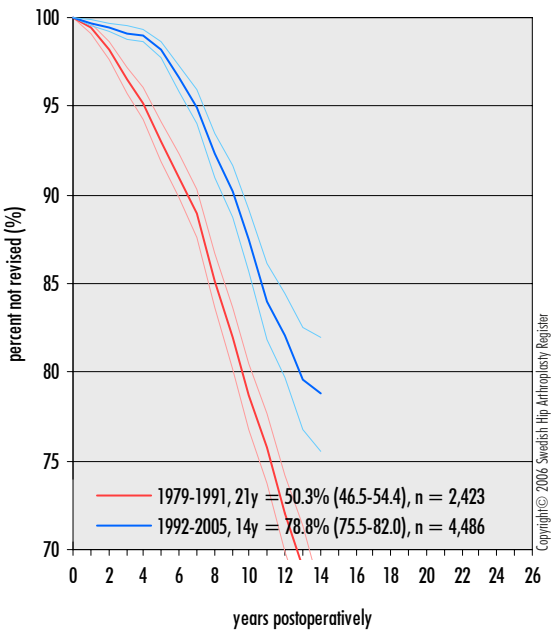
## All Cemented Implants

osteoarthritis and aseptic loosening



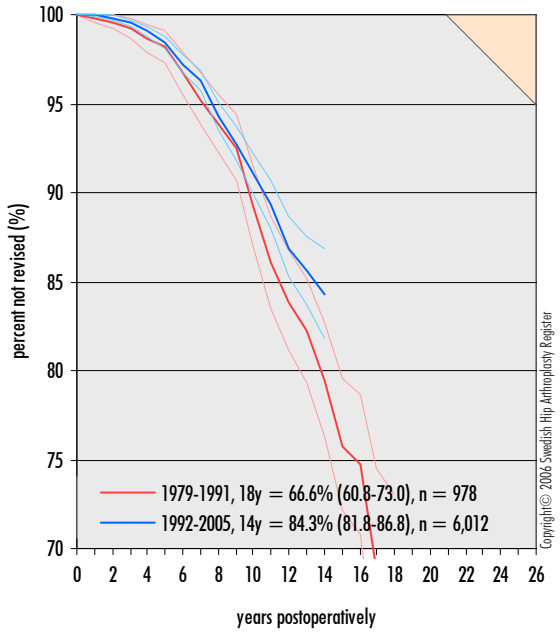

## All Uncemented Implants

osteoarthritis and aseptic loosening



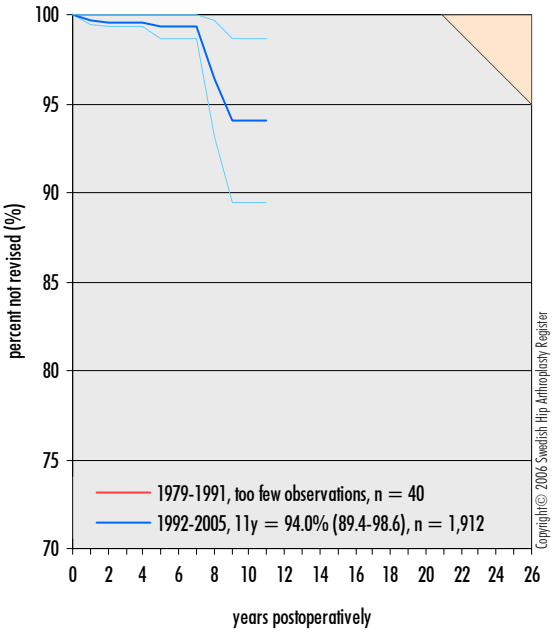

## All Hybrid Implants

osteoarthritis and aseptic loosening



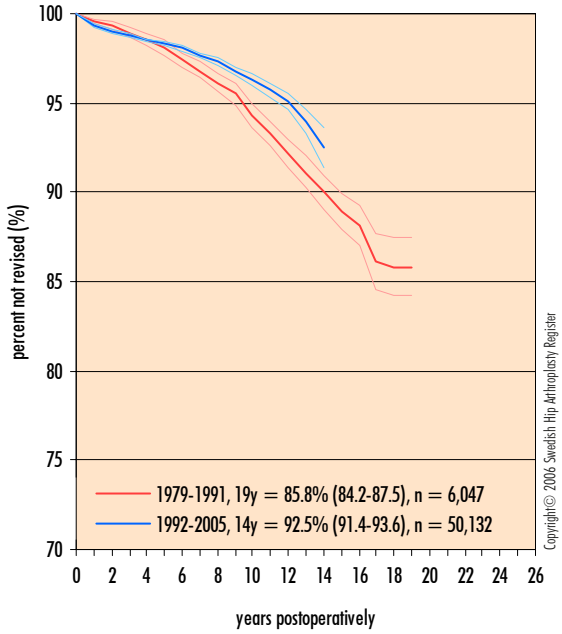

## All Reversed Hybrid Implants

osteoarthritis and aseptic loosening



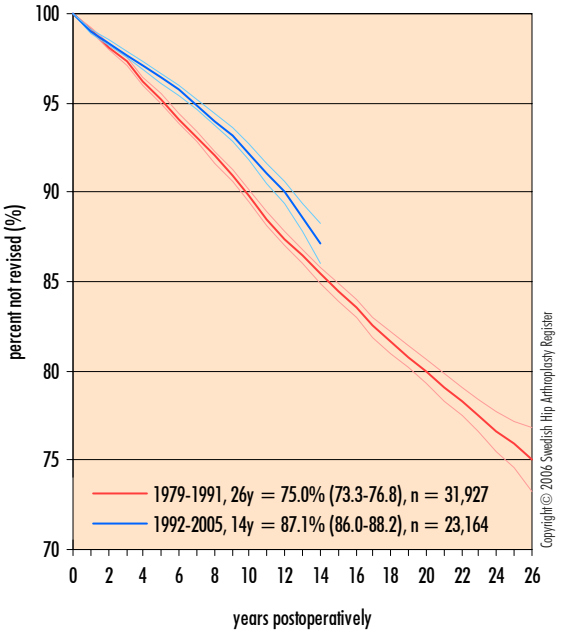
## Lubinus SP II

all diagnoses and all reasons for revision



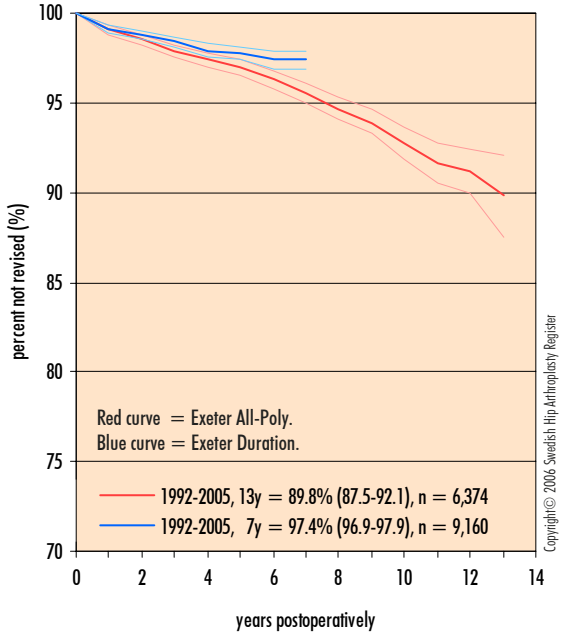

## Charnley

all diagnoses and all reasons for revision



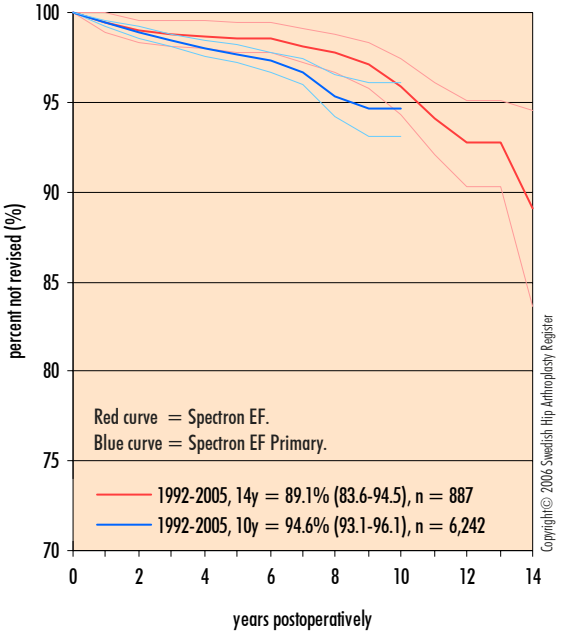

## Exeter (Exeter Polished)

all diagnoses and all reasons for revision



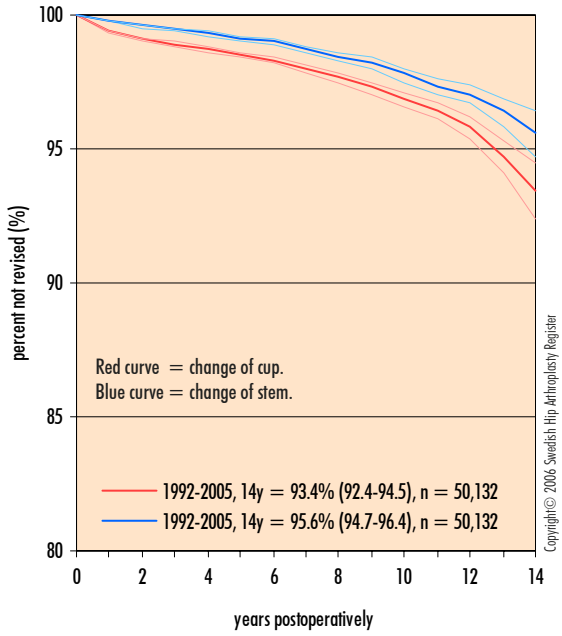

## Reflection All-Poly (Spectron)

all diagnoses and all reasons for revision



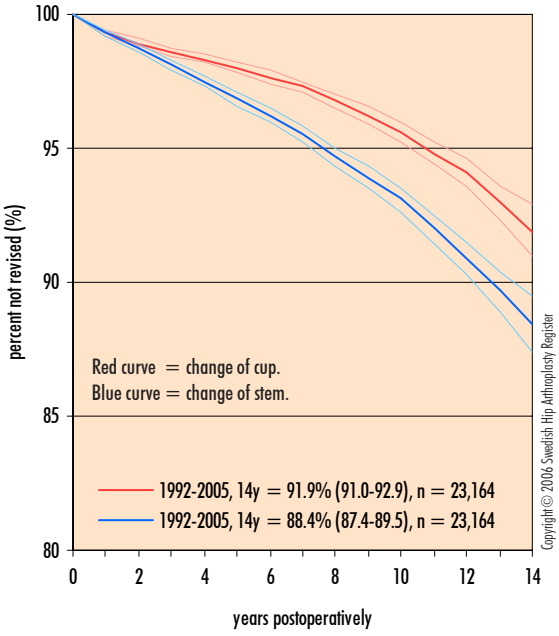
## Lubinus SP II

all diagnoses and all reasons for revision



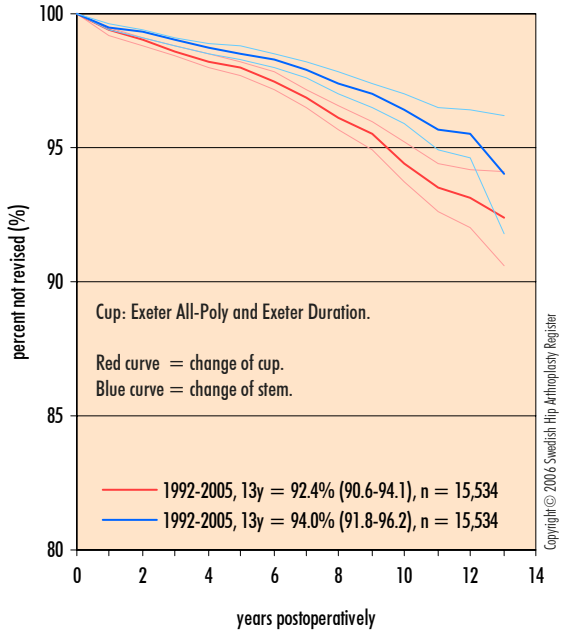

## Charnley

all diagnoses and all reasons for revision



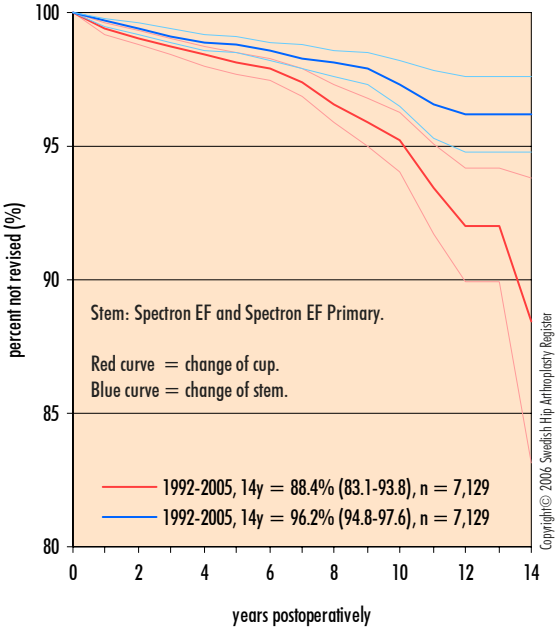

## Exeter (Exeter Polished)

all diagnoses and all reasons for revision



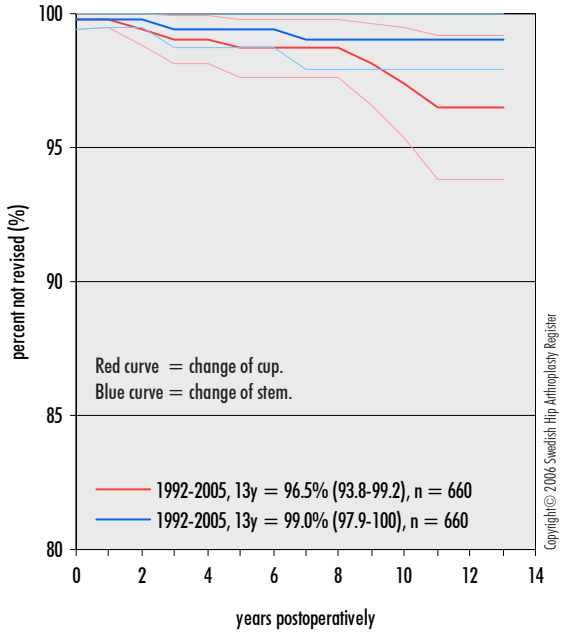

## Reflection All-Poly (Spectron)

all diagnoses and all reasons for revision



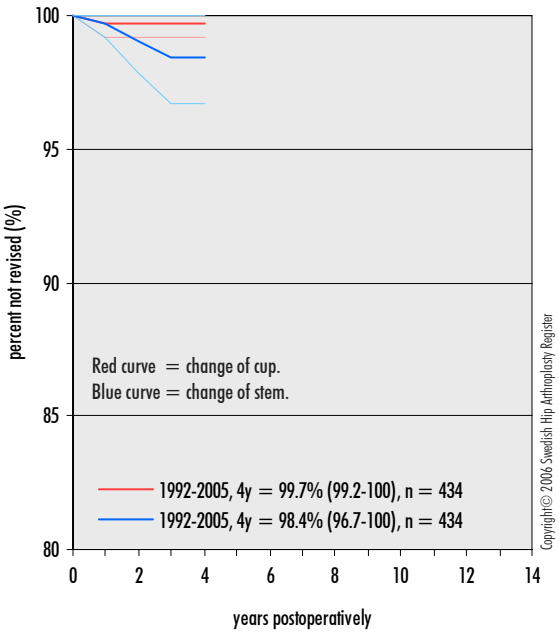
## CLS Spotorno

all diagnoses and all reasons for revision



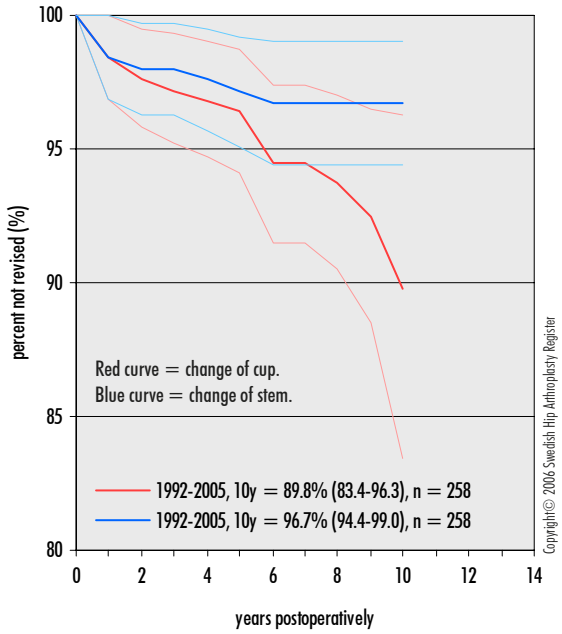

## Allofit (CLS Spotorno)

all diagnoses and all reasons for revision



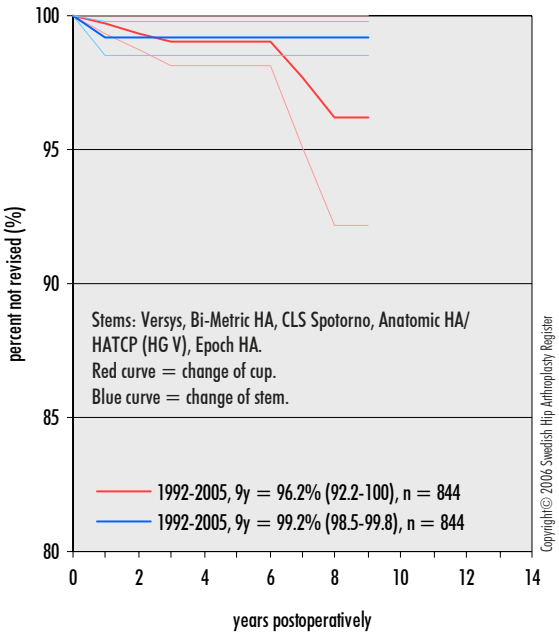

## Romanus HA (Bi-Metric HA uncem.)

all diagnoses and all reasons for revision



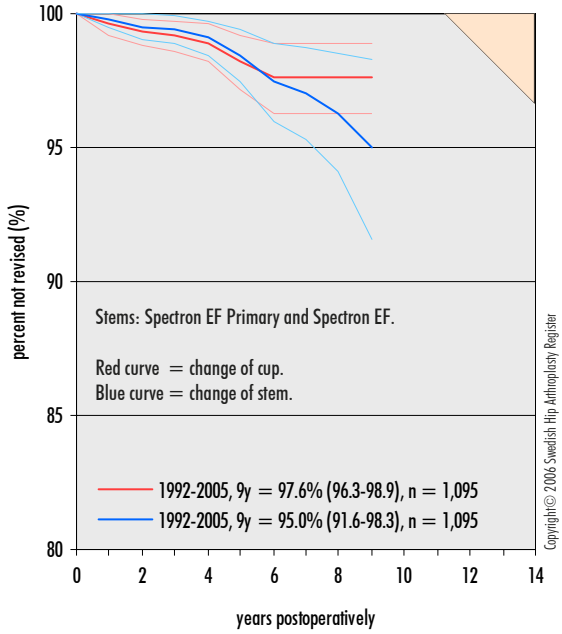

## Trilogy HA

all diagnoses and all reasons for revision



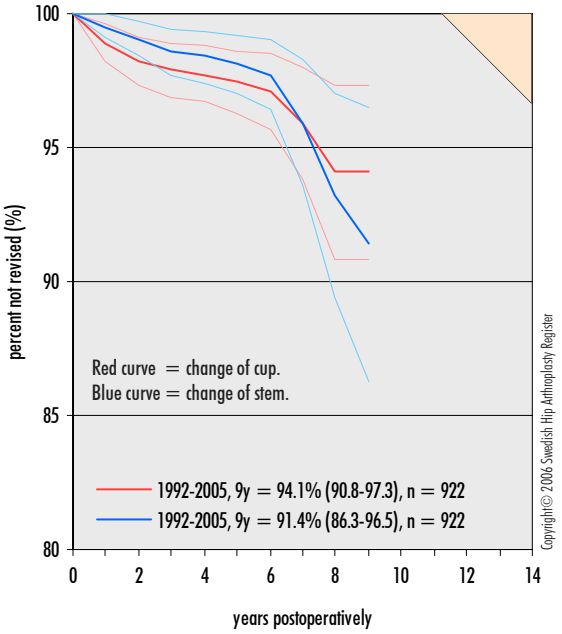
## Trilogy HA (Spectron)

all diagnoses and all reasons for revision



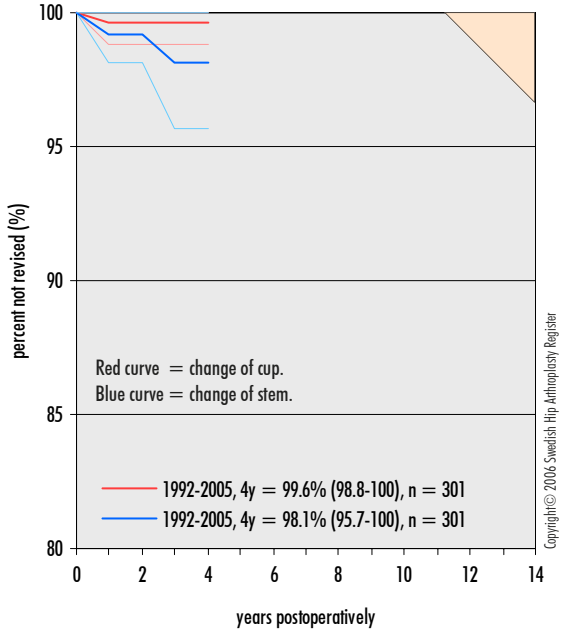

## Trilogy HA (Lubinus SP II)

all diagnoses and all reasons for revision



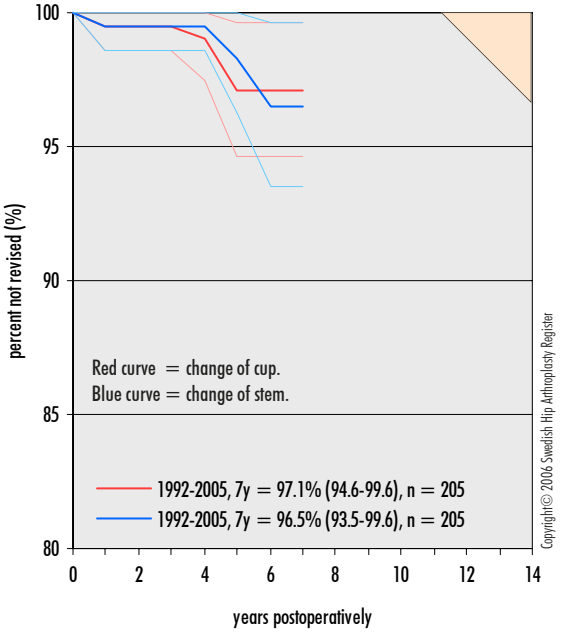

## BHR

all diagnoses and all reasons for revision

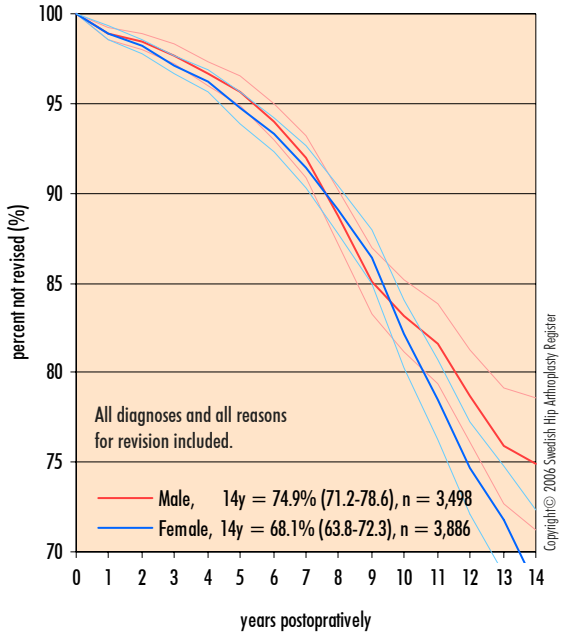



## ABG II HA (Lubinus SP II)

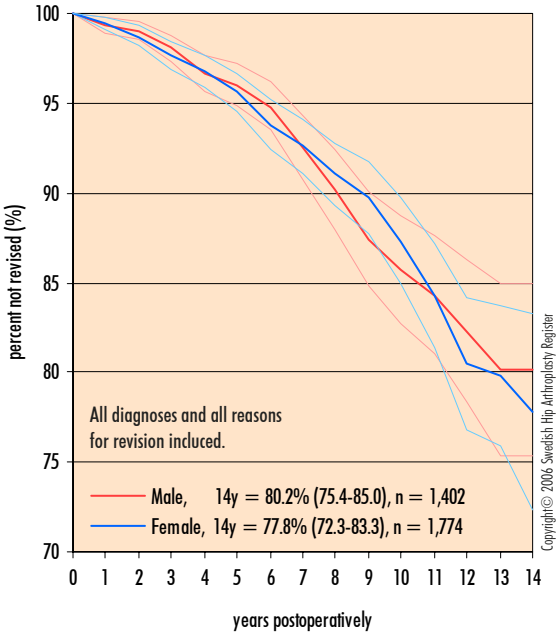
all diagnoses and all reasons for revision



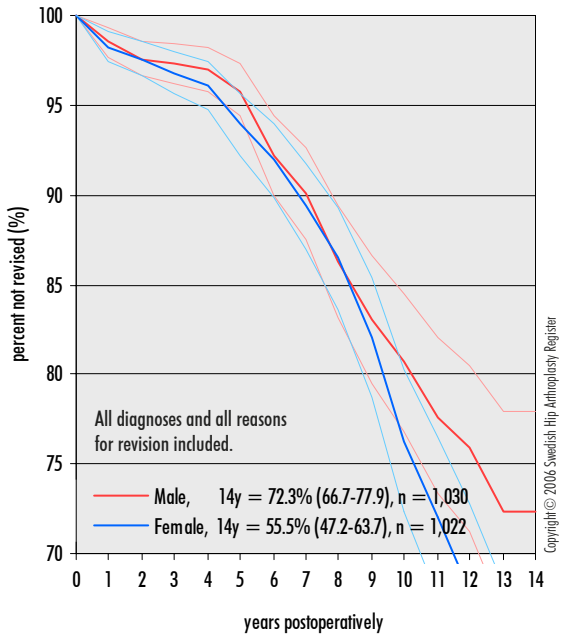
## Younger than 50 years
all observations, 1992-2005



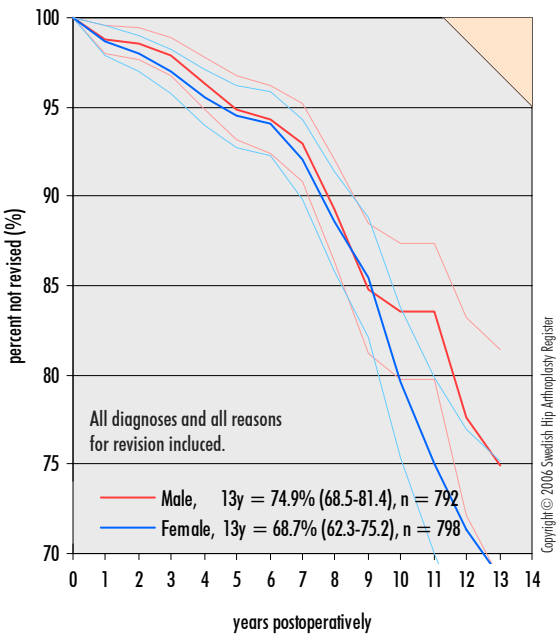

## Younger than 50 years
cemented implants, 1992-2005




## Younger than 50 years
uncemented implants, 1992-2005

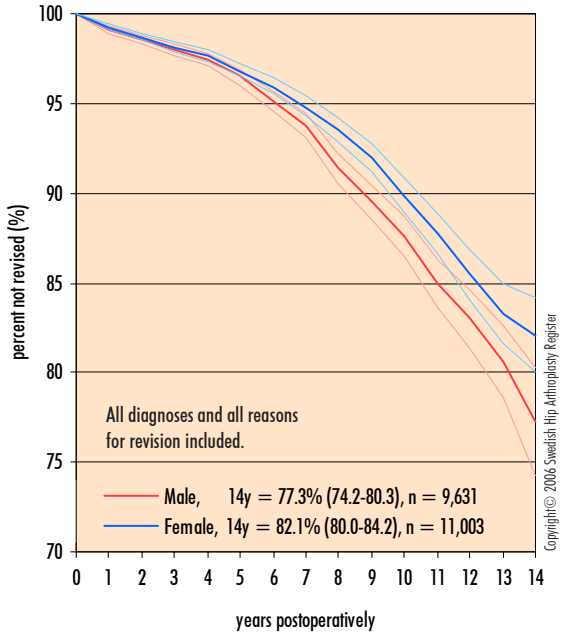



## Younger than 50 years
hybrid implants, 1992-2005



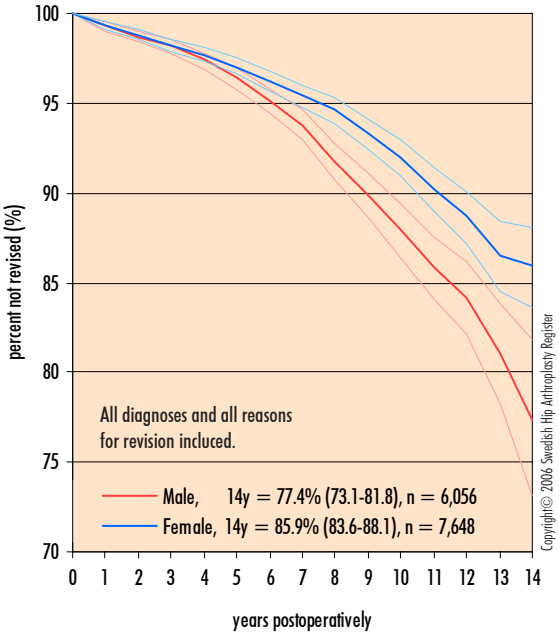
## Between 50 and 59 years

all observations, 1992-2005



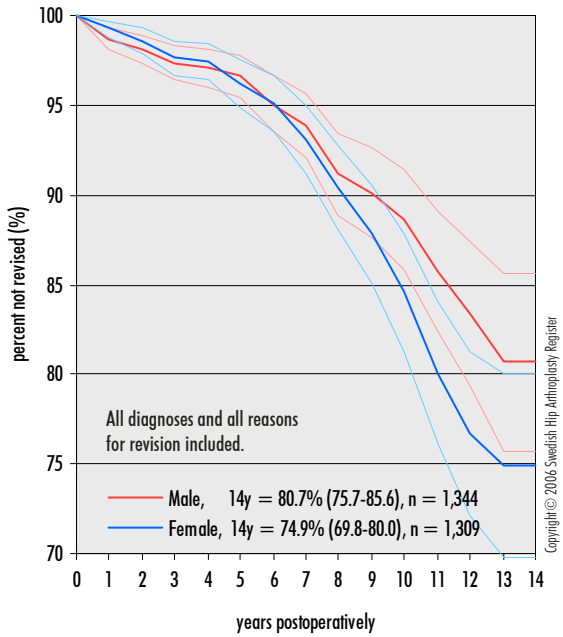

## Between 50 and 59 years

cemented implants, 1992-2005



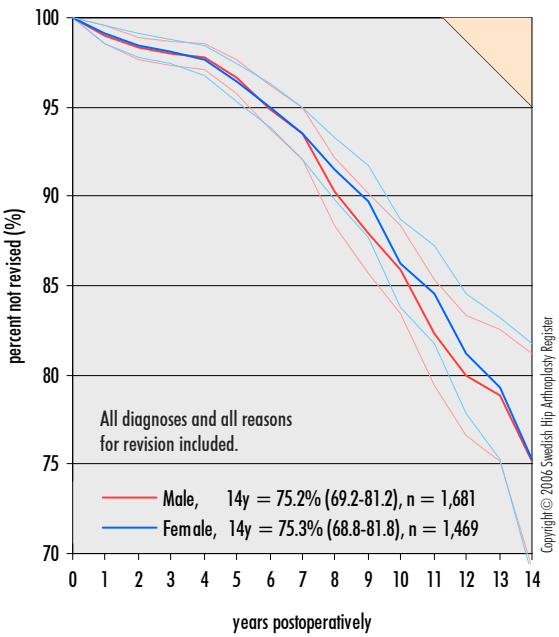

## Between 50 and 59 years

uncemented implants, 1992-2005



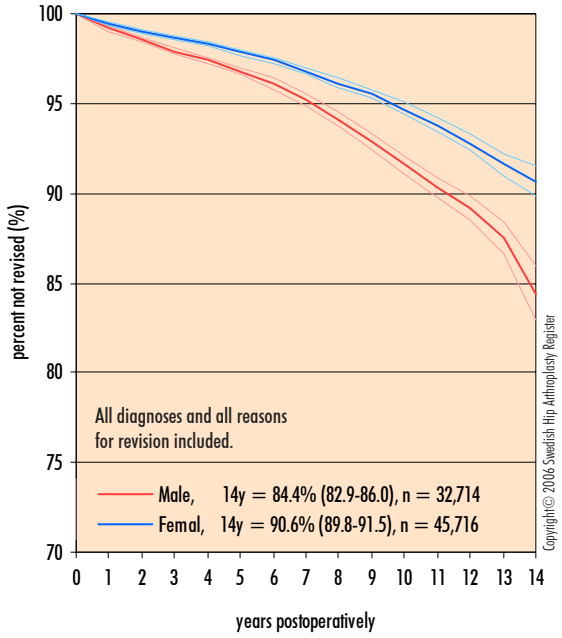

## Between 50 and 59 years

hybrid implants, 1992-2005



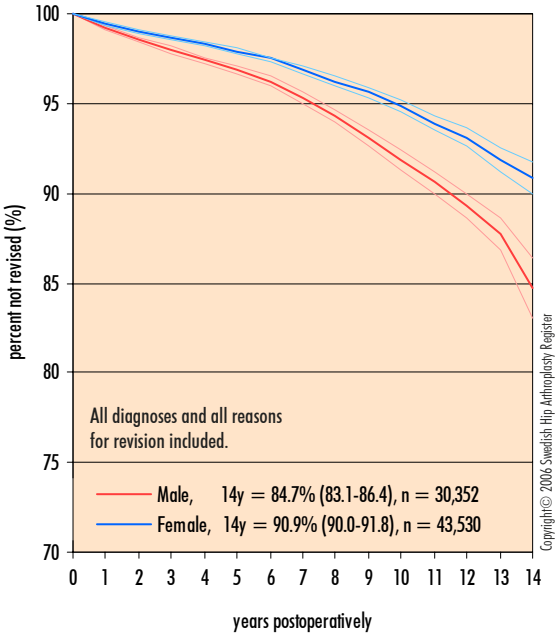
## Between 60 and 75 years

all observations, 1992-2005



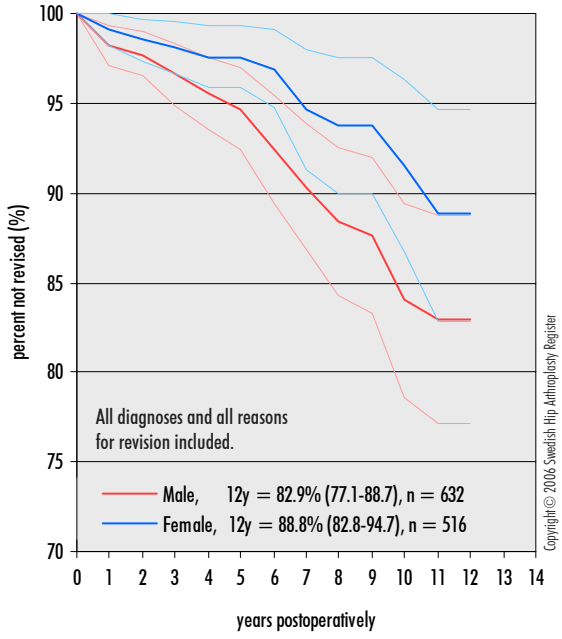

## Between 60 and 75 years

cemented implants, 1992-2005



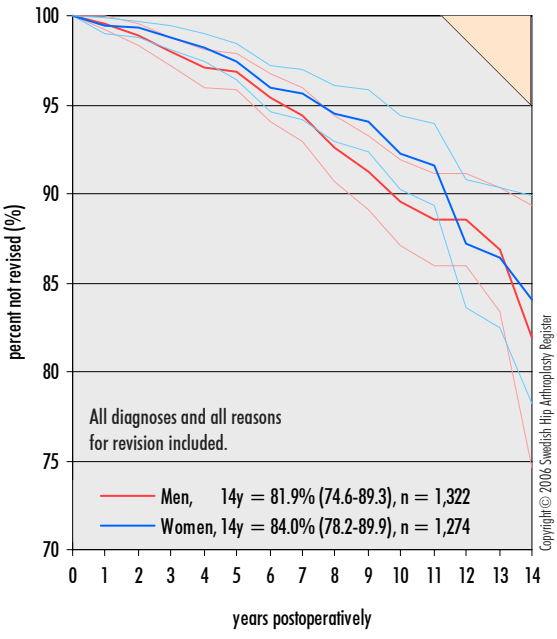

## Between 60 and 75 years

uncemented implants, 1992-2005

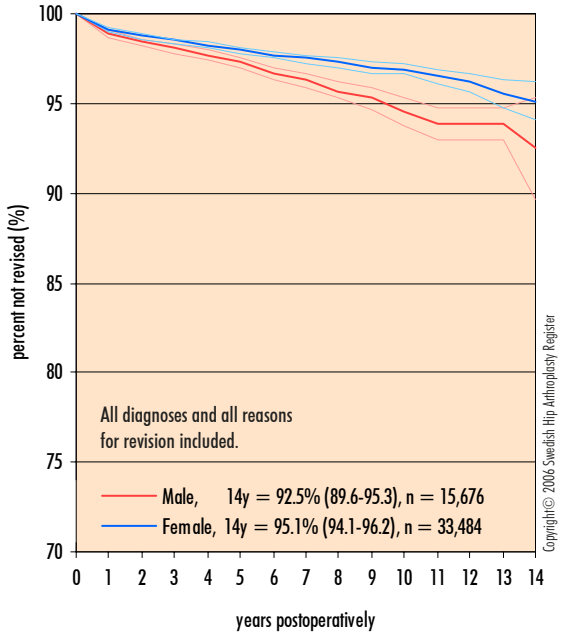



## Between 60 and 75 years

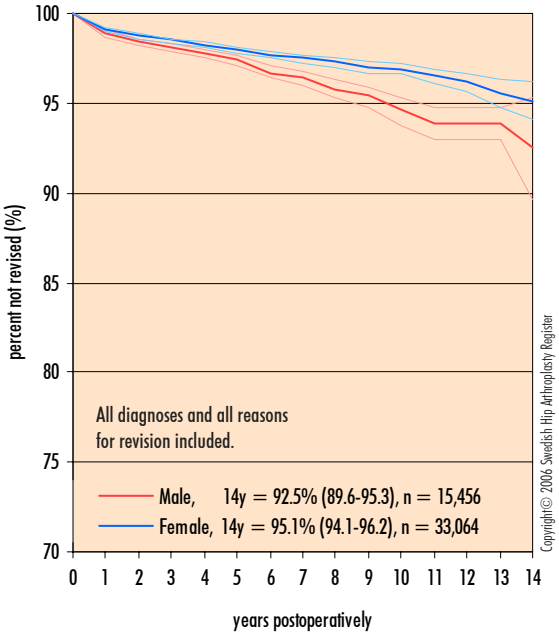
hybrid implants, 1992-2005



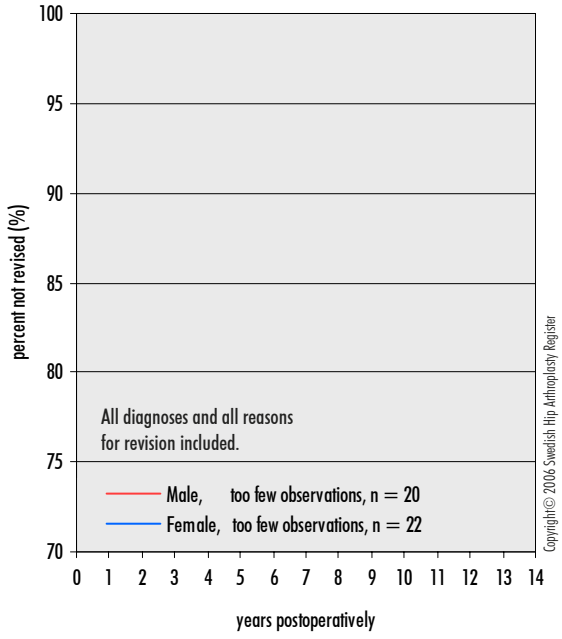
## Older than 75 years
all observations, 1992-2005



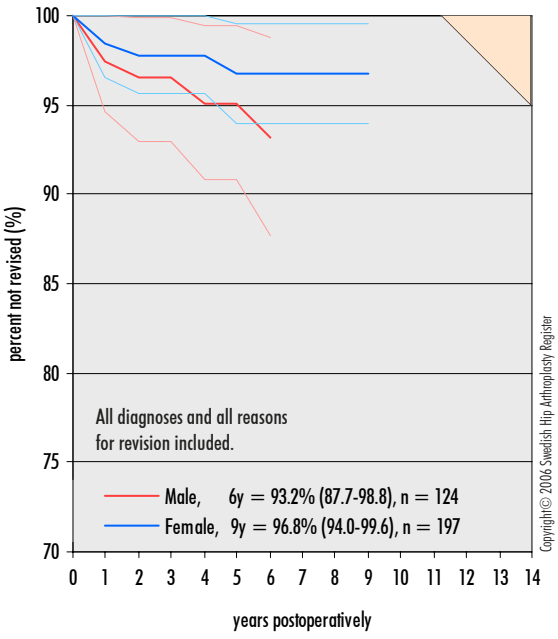

## Older than 75 years
cemented implants, 1992-2005




## Older than 75 years
uncemented implants, 1992-2005




## Older than 75 years
hybrid implants, 1992-2005



# Implant Survival per Type

all diagnoses and all reasons for revision, 1992-2005

| Cup (Stem) | Period [1] | Number [2] | OA [3] | 60-75 yrs [4] | 5 yrs | 95% CI | 10 yrs | 95% CI |
|---|---|---|---|---|---|---|---|---|
| ABG HA (ABG cem.) | 1992–1998 | 241 | 58.9% | 27.0% | 98.2% | ±1.8% | 92.7% | ±4.1% |
| ABG HA (ABG uncem.) | 1992–1998 | 281 | 79.4% | 5.3% | 97.1% | ±1.9% | 82.5% | ±4.7% |
| ABG HA (Lubinus SP II) | 1992–1998 | 335 | 80.6% | 39.4% | 96.9% | ±1.9% | 86.2% | ±4.3% |
| ABG II HA (ABG uncem.) | 1993–2005 | 195 | 80.5% | 7.7% | 97.7% | ±2.3% | | |
| ABG II HA (Exeter Polished) | 1997–2005 | 67 | 82.1% | 14.9% | 96.8% | ±3.8% | | |
| ABG II HA (Lubinus SP II) | 1997–2004 | 205 | 81.5% | 30.7% | 97.1% | ±2.5% | | |
| Biomet Müller (Bi-Metric cem.) | 1992–1996 | 1,098 | 66.6% | 57.5% | 96.2% | ±1.2% | 90.5% | ±2.0% |
| Biomet Müller (Bi-Metric HA uncem.) | 1995–2005 | 188 | 95.7% | 31.4% | 99.4% | ±0.8% | | |
| Biomet Müller (CPT steel) | 1997–2004 | 948 | 94.7% | 46.9% | 96.3% | ±1.3% | | |
| Biomet Müller (RX90-S) | 1994–2001 | 1,452 | 76.8% | 51.2% | 97.8% | ±0.8% | 93.9% | ±1.8% |
| Biomet Müller (Stanmore modular) | 1997–2002 | 94 | 95.7% | 44.7% | 98.9% | ±1.6% | | |
| Cenator (Bi-Metric cem.) | 1993–1999 | 293 | 70.6% | 39.6% | 97.1% | ±2.0% | 91.3% | ±3.9% |
| Cenator (Cenator) | 1993–2000 | 1,221 | 60.0% | 44.6% | 92.8% | ±1.6% | 83.9% | ±3.0% |
| Cenator (Charnley Elite Plus) | 1996–2000 | 320 | 83.8% | 48.8% | 96.7% | ±2.0% | | |
| Cenator (Cone uncem.) | 1994–2000 | 56 | 60.7% | 10.7% | 96.4% | ±4.3% | | |
| Cenator (Exeter Polished) | 1998–2003 | 660 | 84.5% | 54.1% | 99.5% | ±0.5% | | |
| Cenator (Lubinus SP II) | 1997–2000 | 63 | 50.8% | 63.5% | 94.2% | ±6.0% | | |
| Charnley (Bi-Metric cem.) | 1992–1998 | 58 | 48.3% | 32.8% | 96.1% | ±4.6% | | |
| Charnley (CAD) | 1992–1996 | 225 | 62.7% | 51.6% | 97.2% | ±2.2% | 95.4% | ±3.0% |
| Charnley (Charnley Elite Plus) | 1994–2003 | 1,407 | 69.5% | 49.3% | 96.5% | ±1.0% | 91.3% | ±2.3% |
| Charnley (Charnley) | 1992–2005 | 23,164 | 75.5% | 53.6% | 96.4% | ±0.3% | 92.2% | ±0.5% |
| Charnley (CPT steel) | 1996–2004 | 193 | 72.5% | 50.8% | 98.1% | ±2.0% | | |
| Charnley (Exeter Polished) | 1992–2005 | 1,920 | 79.2% | 56.6% | 98.3% | ±0.7% | 97.1% | ±1.4% |
| Charnley (Lubinus SP II) | 1992–2005 | 335 | 83.% | 59.1% | 97.5% | ±1.8% | 95.2% | ±2.6% |
| Charnley (Müller Straight) | 1992–1998 | 104 | 87.5% | 71.2% | 96.9% | ±3.3% | 95.7% | ±4.1% |
| Charnley (PCA E-series Textured) | 1992–1996 | 129 | 82.2% | 53.5% | 96.8% | ±3.1% | 83.4% | ±7.0% |
| Charnley Elite (ABG uncem.) | 1994–2005 | 369 | 90.8% | 22.2% | 97.7% | ±1.5% | | |
| Charnley Elite (Charnley Elite Plus) | 1992–2002 | 943 | 67.6% | 48.7% | 94.7% | ±1.6% | | |
| Charnley Elite (Charnley) | 1992–2001 | 337 | 60.5% | 52.2% | 95.6% | ±2.3% | 88.5% | ±4.1% |
| Charnley Elite (CPT steel) | 1997–2003 | 115 | 73.0% | 47.0% | 93.7% | ±4.6% | | |
| Charnley Elite (Exeter Polished) | 1996–2005 | 5,381 | 71.0% | 50.8% | 98.9% | ±0.4% | | |
| Charnley Elite (Lubinus SP II) | 1992–2005 | 1,006 | 81.9% | 55.2% | 97.6% | ±1.4% | 91.4% | ±5.9% |
| Charnley Elite (Müller Straight) | 1999–2005 | 219 | 79.5% | 58.9% | 98.7% | ±1.5% | | |
| Charnley Elite (PCA E-series Textured) | 1992–1997 | 214 | 79.9% | 56.5% | 96.9% | ±2.4% | 88.3% | ±4.9% |
| Charnley Elite (Spectron EF Primary) | 1998–2005 | 278 | 89.6% | 54.0% | 97.6% | ±2.1% | | |
| CLS Spotorno (CLS Spotorno) | 1992–2005 | 660 | 87.1% | 26.1% | 98.7% | ±1.1% | 97.0% | ±2.2% |
| Contemporary (Exeter Polished) | 1995–2005 | 324 | 88.0% | 53.1% | 96.8% | ±2.0% | | |
| Contemporary (Lubinus SP II) | 1994–2001 | 102 | 66.7% | 57.8% | 96.9% | ±3.3% | | |
| Duralock (uncem) (Spectron EF Primary) | 1995–2000 | 114 | 87.7% | 52.6% | 97.4% | ±2.8% | | |
| Exeter Duration (Exeter Polished) | 1999–2005 | 9,160 | 83.5% | 52.2% | 97.8% | ±0.3% | | |
| Exeter Duration (Lubinus SP II) | 1999–2005 | 563 | 76.6% | 50.4% | 100.0% | ±0.0% | | |
| Exeter Metal-backed (Exeter Polished) | 1992–1994 | 588 | 68.4% | 64.3% | 98.7% | ±1.0% | 95.2% | ±2.0% |
| Exeter All-Poly (Exeter Polished) | 1992–2005 | 6,374 | 73.0% | 51.1% | 97.0% | ±0.5% | 92.7% | ±0.8% |
| Exeter All-Poly (Lubinus SP II) | 1992–2002 | 202 | 79.2% | 47.0% | 96.7% | ±2.6% | | |
| Exeter Polished (Exeter Polished) | 1992–1995 | 669 | 68.8% | 51.3% | 95.9% | ±1.5% | 92.5% | ±2.3% |
| FAL (Lubinus SP II) | 1999–2005 | 3,507 | 78.7% | 52.7% | 98.9% | ±0.4% | | |
| Harris-Galante I (Lubinus SP II) | 1992–1997 | 72 | 76.4% | 19.4% | 97.2% | ±3.4% | 92.2% | ±6.6% |
| Harris-Galante II (Charnley) | 1992–1996 | 143 | 85.3% | 28.0% | 92.9% | ±4.3% | 86.1% | ±5.8% |
| Harris-Galante II (Lubinus SP II) | 1992–1997 | 237 | 62.4% | 27.8% | 94.9% | ±2.8% | 84.0% | ±4.8% |

*(continued on next page)*

# Implant Survival per Type (cont.)

all diagnoses and reasons for revision, 1992-2005

| Cup (Stem) | Period [1] | Number [2] | OA [3] | 60-75 yrs [4] | 5 yrs | 95% CI | 10 yrs | 95% CI |
|---|---|---|---|---|---|---|---|---|
| Harris-Galante II (Spectron EF) | 1992–1996 | 161 | 73.3% | 56.5% | 96.2% | ±3.0% | 87.8% | ±5.3% |
| HGPII/HATCP (HG III) (Spectron EF) | 1992–1995 | 93 | 52.7% | 47.3% | 100.0% | ±0.0% | 96.6% | ±3.6% |
| Inter-op cup (CLS Spotorno) | 1999–2001 | 58 | 86.2% | 22.4% | 96.6% | ±4.0% | | |
| ITH (ITH) | 1992–1997 | 314 | 58,3% | 38.2% | 98.5% | ±1.5% | 96.4% | ±2.6% |
| LINK Pressfit (Lubinus SP II) | 1996–2000 | 61 | 62.3% | 8.2% | 100.0% | ±0.0% | | |
| Lubinus All-Poly (Lubinus IP) | 1992–1998 | 826 | 55.6% | 41.4% | 99.3% | ±0.6% | 98.4% | ±1.1% |
| Lubinus All-Poly (Lubinus SP II) | 1992–2005 | 50,132 | 77.8% | 54.8% | 98.3% | ±0.1% | 96.3% | ±0.3% |
| Mallory-Head uncem (Lubinus SP II) | 1995–2005 | 98 | 82.7% | 9.2% | 96.7% | ±3.5% | | |
| Müller All-Poly (Bi-Metric cem) | 1992–1994 | 64 | 82.8% | 56.3% | 98.4% | ±2.3% | | |
| Müller All-Poly (MS30 Unpolished) | 1992–2001 | 113 | 58.4% | 57.5% | 94.2% | ±4.6% | | |
| Müller All-Poly (Müller Straight) | 1992–2005 | 1,628 | 73.8% | 59.1% | 97.3% | ±0.9% | 96.3% | ±1.1% |
| Müller All-Poly (Straight-stem standard) | 1996–2005 | 178 | 93.3% | 56.2% | 95.4% | ±4.0% | | |
| Omnifit (Lubinus SP II) | 1992–1995 | 171 | 80.1% | 28.7% | 95.9% | ±3.0% | 77.4% | ±6.4% |
| Omnifit (Omnifit) | 1992–1996 | 319 | 57.7% | 11.9% | 91.8% | ±3.0% | 65.5% | ±5.3% |
| OPTICUP (Lubinus SP II) | 1995–2005 | 649 | 57.9% | 49.8% | 98.5% | ±1.0% | | |
| OPTICUP (NOVA Scan Hip) | 1993–2000 | 156 | 66.0% | 41.7% | 91.0% | ±4.7% | 72.4% | ±9.1% |
| OPTICUP (Optima) | 1993–2000 | 756 | 73.7% | 50.1% | 96.6% | ±1.4% | 88.6% | ±2.9% |
| OPTICUP (Scan Hip II Collar) | 1996–2004 | 1,980 | 76.0% | 48.4% | 96.6% | ±0.9% | | |
| OPTICUP (Scan Hip Collar) | 1995–1996 | 82 | 79.3% | 51.2% | 97.0% | ±3.5% | | |
| PCA (PCA) | 1992–1994 | 70 | 70.0% | 22.9% | 95.7% | ±4.5% | 85.0% | ±8.6% |
| Reflection (Spectron EF Primary) | 1996–2005 | 6,242 | 74.5% | 51.6% | 97.7% | ±0.5% | 94.6% | ±1.5% |
| Reflection (Spectron EF) | 1992–1996 | 887 | 66.2% | 55.9% | 98.6% | ±0.8% | 95.9% | ±1.6% |
| Reflection HA (Lubinus SP II) | 1995–2005 | 186 | 86.6% | 13.4% | 94.6% | ±3.9% | | |
| Reflection HA (Spectron EF Primary) | 1996–2000 | 98 | 80.6% | 24.5% | 93.7% | ±4.9% | | |
| Romanus (Bi-Metric cem.) | 1992–1998 | 369 | 76.4% | 30.4% | 95.8% | ±2.1% | 85.3% | ±3.9% |
| Romanus (Bi-Metric HA uncem.) | 1992–1999 | 141 | 83.0% | 16.3% | 99.3% | ±1.0% | 92.5% | ±4.5% |
| Romanus (Bi-Metric uncem.) | 1992–1997 | 259 | 70.7% | 10.0% | 96.5% | ±2.3% | 87.0% | ±4.2% |
| Romanus (Lubinus SP II) | 1992–1996 | 97 | 73.2% | 18.6% | 97.9% | ±2.5% | 89.1% | ±6.4% |
| Romanus (RX90-S) | 1994–2000 | 181 | 90.6% | 38.7% | 96.1% | ±2.9% | 84.7% | ±5.8% |
| Romanus HA (Bi-Metric HA uncem.) | 1992–2005 | 258 | 74.8% | 10.5% | 96.0% | ±2.4% | 89.5% | ±6.5% |
| Romanus HA (Bi-Metric uncem.) | 1992–1999 | 53 | 79.2% | 13.2% | 96.2% | ±4.5% | | |
| Scan Hip Cup (Lubinus SP II) | 1992–2002 | 91 | 56.0% | 46.2% | 95.3% | ±4.5% | | |
| Scan Hip Cup (Optima) | 1993–2001 | 505 | 70.5% | 56.4% | 98.5% | ±1.1% | 92.8% | ±3.3% |
| Scan Hip Cup (Scan Hip II Collar) | 1996–2001 | 207 | 75.8% | 39.6% | 96.8% | ±2.5% | | |
| Scan Hip Cup (Scan Hip Collar) | 1992–2000 | 2,874 | 71.0% | 49.9% | 97.8% | ±0.5% | 91.9% | ±1.3% |
| Scan Hip Cup (Scan Hip Collarless) | 1992–1999 | 136 | 67.6% | 48.5% | 98.5% | ±1.8% | 90.6% | ±6.0% |
| Secur-Fit (Omnifit) | 1996–1999 | 104 | 72.1% | 2.9% | 89.1% | ±6.1% | | |
| SHP (Lubinus SP II) | 1994–2005 | 612 | 80.6% | 52.5% | 99.4% | ±0.6% | 96.9% | ±2.4% |
| SLS (CLS Spotorno) | 1992–1998 | 66 | 81.8% | 33.3% | 96.9% | ±3.6% | | |
| Spectron Metal-backed (Spectron EF) | 1992–1993 | 113 | 77.0% | 62.8% | 99.1% | ±1.3% | 99.1% | ±1.3% |
| Stanmore (Stanmore mod) | 1994–2005 | 610 | 48.0% | 46.9% | 98.6% | ±1.0% | | |
| Stanmore (Stanmore) | 1992–1998 | 104 | 87.5% | 54.8% | 96.8% | ±3.4% | 89.6% | ±6.9% |
| Trilogy (CLS Spotorno) | 1998–2005 | 297 | 79.5% | 31.6% | 96.4% | ±4.1% | | |
| Trilogy (Cone uncem) | 1998–2005 | 158 | 43.0% | 20.3% | 94.3% | ±4.5% | | |
| Trilogy HA (Anatomic HA/HATCP (HG V)) | 1994–1999 | 57 | 82.5% | 22.8% | 94.7% | ±5.6% | | |
| Trilogy HA (Lubinus SP II) | 1995–2005 | 922 | 84.2% | 43.1% | 96.8% | ±1.3% | | |
| Trilogy HA (Optima) | 1995–1999 | 96 | 94.8% | 43.8% | 96.8% | ±3.4% | | |
| Trilogy HA (Spectron EF Primary) | 1996–2005 | 1,081 | 74.5% | 47.7% | 98.0% | ±1.1% | | |
| Weber All-poly (Straight-stem standard) | 1999–2005 | 833 | 99.4% | 65.9% | 98.6% | ±0.9% | | |
| ZCA (CPT steel) | 1993–2005 | 114 | 77.2% | 43.9% | 94.3% | ±4.4% | | |

# Implant Survival per Type

osteoarthritis and aseptic loosening, 1992-2005

| Cup (Stem) | Period [1] | Number [2] | 60-75 yrs [4] | 5 yrs | 95% CI | 10 yrs | 95% CI |
|---|---|---|---|---|---|---|---|
| ABG HA (ABG cem.) | 1992–1998 | 142 | 24.6% | 100.0% | ±0.0% | 93.5% | ±5.0% |
| ABG HA (ABG uncem.) | 1992–1998 | 223 | 5.8% | 98.6% | ±1.5% | 83.3% | ±5.3% |
| ABG HA (Lubinus SP II) | 1992–1998 | 270 | 46.7% | 99.6% | ±0.6% | 92.4% | ±3.8% |
| ABG II HA (ABG uncem.) | 1997–2005 | 157 | 8.3% | 100.0% | ±0.0% | | |
| ABG II HA (Lubinus SP II) | 1997–2004 | 167 | 32.3% | 99.2% | ±1.1% | | |
| Biomet Müller (Bi-Metric cem.) | 1992–1995 | 731 | 59.8% | 97.2% | ±1.3% | 91.5% | ±2.3% |
| Biomet Müller (Bi-Metric HA uncem.) | 1995–2005 | 180 | 32.2% | 100.0% | ±0.0% | | |
| Biomet Müller (CPT steel) | 1997–2003 | 898 | 47.7% | 99.5% | ±0.5% | | |
| Biomet Müller (RX90-S) | 1994–2001 | 1,115 | 54.9% | 99.1% | ±0.6% | 95.4% | ±1.9% |
| Biomet Müller (Stanmore modular) | 1997–2002 | 90 | 44.4% | 98.9% | ±1.6% | | |
| Cenator (Bi-Metric cem.) | 1993–1999 | 207 | 45.9% | 98.5% | ±1.6% | 92.8% | ±4.4% |
| Cenator (Cenator) | 1993–2000 | 732 | 53.4% | 94.5% | ±1.8% | 86.6% | ±3.4% |
| Cenator (Charnley Elite Plus) | 1997–2000 | 268 | 52.6% | 98.4% | ±1.6% | | |
| Cenator (Exeter Polished) | 1998–2003 | 558 | 56.3% | 99.8% | ±0.3% | | |
| Charnley (CAD) | 1992–1996 | 141 | 61.7% | 98.5% | ±1.8% | 95.8% | ±3.7% |
| Charnley (Charnley Elite Plus) | 1994–2002 | 978 | 52.7% | 98.5% | ±0.8% | 93.1% | ±2.5% |
| Charnley (Charnley) | 1992–2005 | 17,495 | 57.0% | 98.0% | ±0.2% | 94.4% | ±0.5% |
| Charnley (Exeter Polished) | 1992–2005 | 1,520 | 61.3% | 100.0% | ±0.0% | 99.1% | ±1.1% |
| Charnley (Lubinus SP II) | 1992–2004 | 278 | 62.2% | 99.2% | ±1.0% | 97.7% | ±2.1% |
| Charnley (Müller Straight) | 1992–1998 | 91 | 73.6% | 98.8% | ±1.8% | 97.3% | ±3.2% |
| Charnley (PCA E-series Textured) | 1992–1996 | 106 | 57.5% | 97.1% | ±3.1% | 83.5% | ±7.7% |
| Charnley Elite (ABG uncem) | 1994–2005 | 335 | 24.2% | 99.7% | ±0.5% | | |
| Charnley Elite (Charnley Elite Plus) | 1992–2002 | 637 | 51.2% | 96.1% | ±1.6% | | |
| Charnley Elite (Charnley) | 1992–2001 | 204 | 59.3% | 94.7% | ±3.2% | 90.6% | ±4.4% |
| Charnley Elite (CPT steel) | 1997–2003 | 84 | 48.8% | 97.5% | ±3.0% | | |
| Charnley Elite (Exeter Polished) | 1996–2005 | 3,823 | 55.5% | 99.9% | ±0.1% | | |
| Charnley Elite (Lubinus SP II) | 1992–2005 | 824 | 58.1% | 98.6% | ±1.3% | 95.1% | ±4.3% |
| Charnley Elite (Müller Straight) | 1999–2005 | 174 | 60.9% | 100.0% | ±0.0% | | |
| Charnley Elite (PCA E-series Textured) | 1992–1997 | 171 | 57.9% | 98.2% | ±2.0% | 89.0% | ±5.3% |
| Charnley Elite (Spectron EF Primary) | 1998–2005 | 249 | 57.8% | 98.9% | ±1.3% | | |
| CLS Spotorno (CLS Spotorno) | 1992–2005 | 575 | 28.5% | 100.0% | ±0.0% | 98.8% | ±1.5% |
| Contemporary (Exeter Polished) | 1995–2004 | 285 | 54.4% | 98.5% | ±1.5% | | |
| Contemporary (Lubinus SP II) | 1994–2001 | 68 | 64.7% | 100.0% | ±0.0% | | |
| Duralock (uncem) (Spectron EF Primary) | 1995–2000 | 100 | 55.0% | 98.0% | ±2.4% | | |
| Exeter Duration (Exeter Polished) | 1999–2005 | 7,650 | 54.4% | 99.5% | ±0.3% | | |
| Exeter Duration (Lubinus SP II) | 1999–2005 | 431 | 54.1% | 100.0% | ±0.0% | | |
| Exeter Metal-backed (Exeter Polished) | 1992–1994 | 402 | 67.7% | 99.2% | ±0.9% | 95.6% | ±2.3% |
| Exeter All-Poly (Exeter Polished) | 1992–2005 | 4,655 | 55.9% | 98.8% | ±0.3% | 95.7% | ±0.8% |
| Exeter All-Poly (Lubinus SP II) | 1992–2002 | 160 | 48.1% | 97.2% | ±2.7% | | |
| Exeter Polished (Exeter Polished) | 1992–1995 | 460 | 55.7% | 97.7% | ±1.4% | 94.8% | ±2.3% |
| FAL (Lubinus SP II) | 1999–2005 | 2,760 | 56.4% | 100.0% | ±0.1% | | |
| Harris-Galante I (Lubinus SP II) | 1992–1997 | 55 | 25.5% | 100.0% | ±0.0% | | |
| Harris-Galante II (Charnley) | 1992–1996 | 122 | 30.3% | 98.3% | ±2.0% | 95.6% | ±3.9% |
| Harris-Galante II (Lubinus SP II) | 1992–1997 | 148 | 22.3% | 98.6% | ±1.6% | 88.1% | ±5.5% |
| Harris-Galante II (Spectron EF) | 1992–1996 | 118 | 61.0% | 100.0% | ±0.0% | 95.1% | ±4.2% |
| ITH (ITH) | 1992–1996 | 183 | 45.4% | 98.8% | ±1.5% | 97.3% | ±2.6% |

*(continued on next page)*

# Implant Survival per Type (cont.)

osteoarthritis and aseptic loosening, 1992-2005

| Cup (Stem) | Period [1] | Number [2] | 60-75 yrs [4] | 5 yrs | 95% CI | 10 yrs | 95% CI |
|---|---|---|---|---|---|---|---|
| Lubinus All-Poly (Lubinus IP) | 1992–1998 | 459 | 49.5% | 99.3% | ±0.8% | 98.4% | ±1.4% |
| Lubinus All-Poly (Lubinus SP II) | 1992–2005 | 39,006 | 58.7% | 99.6% | ±0.1% | 98.0% | ±0.3% |
| Mallory-Head uncem. (Lubinus SP II) | 1995–2005 | 81 | 8.6% | 100.0% | ±0.0% | | |
| Müller All-Poly (MS30 Unpolished) | 1992–2001 | 66 | 71.2% | 98.4% | ±2.4% | | |
| Müller All-Poly (Müller Straight) | 1992–2005 | 1,202 | 65.6% | 99.6% | ±0.4% | 98.5% | ±1.0% |
| Müller All-Poly (Straight-stem standard) | 1996–2005 | 166 | 56.0% | 97.7% | ±2.7% | | |
| Omnifit (Lubinus SP II) | 1992–1995 | 137 | 28.5% | 97.8% | ±2.4% | 77.4% | ±7.3% |
| Omnifit (Omnifit) | 1992–1996 | 184 | 17.4% | 92.8% | ±3.8% | 66.1% | ±7.0% |
| OPTICUP (Lubinus SP II) | 1995–2005 | 376 | 53.7% | 99.4% | ±0.8% | | |
| OPTICUP (NOVA Scan Hip) | 1993–2000 | 103 | 49.5% | 90.7% | ±5.8% | | |
| OPTICUP (Optima) | 1994–2000 | 557 | 56.4% | 97.6% | ±1.4% | 90.4% | ±3.0% |
| OPTICUP (Scan Hip II Collar) | 1996–2004 | 1,504 | 52.3% | 98.2% | ±0.8% | | |
| OPTICUP (Scan Hip Collar) | 1995–1996 | 65 | 58.5% | 98.2% | ±2.6% | | |
| Reflection (Spectron EF Primary) | 1996–2005 | 4,652 | 54.7% | 99.1% | ±0.4% | 96.7% | ±1.4% |
| Reflection (Spectron EF) | 1992–1996 | 587 | 58.9% | 99.6% | ±0.5% | 97.8% | ±1.5% |
| Reflection HA (Lubinus SP II) | 1995–2005 | 161 | 13.0% | 95.9% | ±4.0% | | |
| Reflection HA (Spectron EF Primary) | 1996–2000 | 79 | 29.1% | 96.0% | ±4.2% | | |
| Romanus (Bi-Metric cem.) | 1992–1998 | 282 | 33.7% | 97.1% | ±2.0% | 89.0% | ±4.0% |
| Romanus (Bi-Metric HA uncem.) | 1992–1999 | 117 | 19.7% | 100.0% | ±0.0% | 92.6% | ±4.9% |
| Romanus (Bi-Metric uncem.) | 1992–1997 | 183 | 12.0% | 99.4% | ±0.9% | 92.8% | ±3.9% |
| Romanus (Lubinus SP II) | 1992–1996 | 71 | 22.5% | 98.6% | ±2.1% | 90.9% | ±7.0% |
| Romanus (RX90-S) | 1994–2000 | 164 | 40.9% | 96.9% | ±2.7% | 87.0% | ±5.8% |
| Romanus HA (Bi-Metric HA uncem.) | 1992–2005 | 193 | 12.4% | 100.0% | ±0.0% | | |
| Scan Hip Cup (Optima) | 1993–2001 | 356 | 62.4% | 99.7% | ±0.5% | 97.6% | ±2.1% |
| Scan Hip Cup (Scan Hip II Collar) | 1996–2001 | 157 | 45.2% | 99.3% | ±1.0% | | |
| Scan Hip Cup (Scan Hip Collar) | 1992–2000 | 2,041 | 55.2% | 98.8% | ±0.5% | 93.3% | ±1.3% |
| Scan Hip Cup (Scan Hip Collarless) | 1992–1995 | 92 | 58.7% | 100.0% | ±0.0% | 91.1% | ±6.9% |
| Secur-Fit (Omnifit) | 1996–1999 | 75 | 2.7% | 95.8% | ±4.5% | | |
| SHP (Lubinus SP II) | 1994–2005 | 493 | 56.2% | 100.0% | ±0.0% | 98.3% | ±2.0% |
| Spectron Metal-backed (Spectron EF) | 1992–1993 | 87 | 66.7% | 100.0% | ±0.0% | 100.0% | ±0.0% |
| Stanmore (Stanmore mod.) | 1994–2005 | 293 | 60.8% | 100.0% | ±0.0% | | |
| Stanmore (Stanmore) | 1992–1998 | 91 | 58.2% | 97.6% | ±2.9% | 91.2% | ±6.8% |
| Trilogy HA (Lubinus SP II) | 1995–2005 | 776 | 45.9% | 99.3% | ±0.8% | | |
| Trilogy HA (Optima) | 1995–1999 | 91 | 44.0% | 97.8% | ±2.6% | | |
| Trilogy HA (Spectron EF Primary) | 1996–2005 | 805 | 55.0% | 99.2% | ±0.9% | | |
| Weber All-poly cup (Straight-stem standard) | 1999–2005 | 828 | 66.3% | 99.6% | ±0.5% | | |
| ZCA (CPT steel) | 1993–2004 | 88 | 50.0% | 96.2% | ±4.0% | | |

*[1] First and last observed year of primary THR.*
*[2] Number of primary THRs during the period with the conditions specified in the table heading.*
*[3] Percentage of primary THRs performed due to primary osteoarthritis.*
*[4] Percentage of primary THRs in the age-group 60-75 years (age at primary operation).*

*Certain implants do not have a sufficient number of primary operations during the period to give a 10-year implant survival value. To be able to calculate the 10-year survival, the longest observed time between the primary operation and revision must be at least 10 years. A condition which has consistently been applied in the survival statistics from the register is that only values where at least 50 patients "at risk" remain are shown. Implants with smaller production may therefore lack values for this reason. Only implants with a 5-year survival are included in the table.*

# Implant Survival per Hospital

all diagnoses, all reasons for revision and all types of implants, 1992-2005

| Cup (Stem) | Period [1] | Number [2] | OA [3] | 60-75 yrs [4] | 5 yrs | 95% CI | 10 yrs | 95% CI |
|---|---|---|---|---|---|---|---|---|
| **University/Regional Hospitals** | | | | | | | | |
| Huddinge | 1992–2005 | 2,856 | 64.4% | 44.9% | 95.4% | ±1.0% | 86.9% | ±2.0% |
| Karolinska | 1992–2005 | 2,584 | 58.1% | 44.8% | 95.3% | ±1.0% | 88.4% | ±2.5% |
| Linköping | 1992–2005 | 2,553 | 67.5% | 43.8% | 99.1% | ±0.5% | 96.3% | ±1.3% |
| Lund | 1992–2005 | 2,064 | 49.2% | 40.9% | 96.7% | ±0.9% | 87.5% | ±2.2% |
| Malmö | 1992–2005 | 2,949 | 50.9% | 45.3% | 95.7% | ±0.8% | 87.8% | ±1.7% |
| SU/Sahlgrenska | 1992–2005 | 2,798 | 60.9% | 40.4% | 97.8% | ±0.6% | 91.5% | ±1.8% |
| SU/Östra | 1992–2005 | 2,204 | 75.8% | 49.5% | 97.6% | ±0.7% | 93.5% | ±1.5% |
| Umeå | 1992–2005 | 1,620 | 70.4% | 48.5% | 97.5% | ±0.8% | 95.0% | ±1.4% |
| Uppsala | 1992–2005 | 3,648 | 54.9% | 39.2% | 94.7% | ±0.9% | 86.7% | ±1.9% |
| **Central Hospitals** | | | | | | | | |
| Borås | 1992–2005 | 2,541 | 68.2% | 48.2% | 97.5% | ±0.6% | 94.9% | ±1.3% |
| Danderyd | 1992–2005 | 4,008 | 85.5% | 44.4% | 96.8% | ±0.6% | 93.8% | ±1.3% |
| Eksjö | 1992–2005 | 2,422 | 84.3% | 53.8% | 96.8% | ±0.8% | 93.1% | ±1.5% |
| Eskilstuna | 1992–2005 | 1,890 | 59.5% | 47.4% | 97.9% | ±0.7% | 95.6% | ±1.3% |
| Falun | 1992–2005 | 2,065 | 82.6% | 51.8% | 96.6% | ±1.1% | | |
| Gävle | 1992–2005 | 2,063 | 70.5% | 47.3% | 96.6% | ±0.9% | 88.7% | ±3.3% |
| Halmstad | 1992–2005 | 2,297 | 65.2% | 47.8% | 97.3% | ±0.8% | 92.8% | ±2.0% |
| Helsingborg | 1992–2005 | 1,978 | 72.4% | 49.8% | 96.5% | ±0.9% | 87.0% | ±2.5% |
| Hässleholm-Kristianstad | 1992–2005 | 4,882 | 84.8% | 53.8% | 97.9% | ±0.6% | 94.0% | ±1.3% |
| Jönköping | 1992–2005 | 2,288 | 80.6% | 50.8% | 97.2% | ±0.8% | 94.5% | ±1.4% |
| Kalmar | 1992–2005 | 2,518 | 65.1% | 48.5% | 98.2% | ±0.6% | 95.4% | ±1.4% |
| Karlskrona | 1992–2005 | 1,100 | 71.0% | 47.8% | 95.5% | ±1.3% | 89.1% | ±2.6% |
| Karlstad | 1992–2005 | 2,031 | 68.9% | 48.3% | 97.4% | ±0.8% | 93.3% | ±1.9% |
| Norrköping | 1992–2005 | 2,847 | 67.3% | 47.9% | 98.2% | ±0.5% | 92.1% | ±1.8% |
| S:t Göran | 1992–2005 | 5,966 | 73.6% | 45.7% | 94.8% | ±0.6% | 88.9% | ±1.4% |
| Skövde | 1992–2005 | 2,283 | 71.5% | 45.6% | 96.6% | ±0.9% | 89.3% | ±2.1% |
| SU/Mölndal | 1992–2005 | 1,661 | 75.8% | 51.7% | 97.1% | ±0.9% | 91.9% | ±2.3% |
| Sunderby | 1992–2005 | 2,104 | 63.0% | 48.5% | 97.0% | ±0.8% | 91.2% | ±1.8% |
| Sundsvall | 1992–2005 | 2,554 | 82.8% | 52.0% | 96.2% | ±0.8% | 92.9% | ±1.5% |
| Södersjukhuset | 1992–2005 | 3,806 | 57.8% | 41.1% | 98.2% | ±0.5% | 94.4% | ±1.3% |
| Uddevalla | 1992–2005 | 2,925 | 69.5% | 49.7% | 97.6% | ±0.7% | 92.8% | ±1.7% |
| Varberg | 1992–2005 | 2,337 | 84.0% | 52.1% | 97.2% | ±0.8% | 91.6% | ±2.0% |
| Västerås | 1992–2005 | 1,677 | 67.4% | 51.6% | 97.7% | ±0.8% | 93.5% | ±2.0% |
| Växjö | 1992–2005 | 1,454 | 82.9% | 53.9% | 97.7% | ±0.9% | 94.4% | ±1.9% |
| Ystad | 1992–2005 | 1,459 | 78.1% | 49.2% | 97.1% | ±0.9% | 94.9% | ±1.8% |
| Örebro | 1992–2005 | 2,496 | 72.1% | 49.7% | 98.6% | ±0.5% | 95.8% | ±1.3% |
| Östersund | 1992–2005 | 2,098 | 81.0% | 52.9% | 97.5% | ±0.8% | 94.0% | ±1.6% |
| **Rural Hospitals** | | | | | | | | |
| Alingsås | 1992–2005 | 1,381 | 84.1% | 58.9% | 98.8% | ±0.7% | 97.0% | ±1.5% |
| Arvika | 1992–2005 | 715 | 83.9% | 56.6% | 92.4% | ±2.5% | 83.7% | ±5.1% |
| Bollnäs | 1992–2005 | 1,652 | 84.7% | 56.4% | 98.0% | ±0.8% | 94.6% | ±2.4% |
| Enköping | 1992–2005 | 1,080 | 94.2% | 59.7% | 97.1% | ±1.3% | 88.1% | ±5.3% |
| Falköping | 1992–2005 | 1,828 | 86.1% | 57.3% | 97.6% | ±0.9% | 90.9% | ±2.8% |
| Frölunda Specialistsjukhus | 2002–2005 | 144 | 99.3% | 61.1% | | | | |

*(continued on next page)*

# Implant Survival per Hospital (cont.)

all diagnoses, all reasons for revision and all types of implants, 1992-2005

| Cup (Stem) | Period [1] | Number [2] | OA [3] | 60-75 yrs [4] | 5 yrs | 95% CI | 10 yrs | 95% CI |
|---|---|---|---|---|---|---|---|---|
| Gällivare | 1992–2005 | 1,243 | 80.0% | 55.5% | 98.7% | ±0.7% | 96.7% | ±1.7% |
| Hudiksvall | 1992–2005 | 1,669 | 75.5% | 53.4% | 97.7% | ±0.8% | 96.2% | ±1.4% |
| Karlshamn | 1992–2005 | 1,377 | 90.2% | 49.4% | 97.8% | ±0.9% | 95.6% | ±1.9% |
| Karlskoga | 1992–2005 | 1,365 | 86.7% | 51.9% | 98.0% | ±0.9% | 94.1% | ±2.5% |
| Katrineholm | 1992–2005 | 1,659 | 88.4% | 53.3% | 98.8% | ±0.7% | 97.7% | ±1.2% |
| Kungälv | 1992–2005 | 1,925 | 86.7% | 56.3% | 99.2% | ±0.5% | 96.0% | ±2.3% |
| Köping | 1992–2005 | 1,900 | 92.3% | 57.5% | 99.1% | ±0.6% | 96.1% | ±2.4% |
| Lidköping | 1992–2005 | 1,181 | 89.2% | 51.7% | 98.5% | ±0.8% | 88.9% | ±7.7% |
| Lindesberg | 1992–2005 | 1,359 | 81.2% | 52.7% | 98.1% | ±0.9% | 96.0% | ±1.9% |
| Ljungby | 1992–2005 | 1,428 | 87.7% | 53.9% | 98.3% | ±0.8% | 95.8% | ±1.6% |
| Lycksele | 1992–2005 | 1,837 | 81.5% | 57.8% | 98.8% | ±0.6% | 97.3% | ±1.5% |
| Mora | 1992–2005 | 1,820 | 85.8% | 54.2% | 97.3% | ±0.9% | 94.1% | ±1.7% |
| Motala | 1992–2005 | 2,023 | 79.1% | 50.5% | 99.0% | ±0.6% | 95.8% | ±2.0% |
| Norrtälje | 1992–2005 | 1,127 | 75.1% | 49.9% | 96.7% | ±1.2% | 95.8% | ±1.8% |
| Nyköping | 1992–2005 | 1,544 | 81.4% | 56.2% | 98.0% | ±0.8% | 97.1% | ±1.2% |
| Oskarshamn | 1992–2005 | 1,249 | 82.2% | 53.6% | 99.4% | ±0.6% | 96.3% | ±2.3% |
| Piteå | 1992–2005 | 1,131 | 84.3% | 55.5% | 98.2% | ±1.0% | 96.5% | ±1.8% |
| Simrishamn | 1992–2005 | 1,082 | 92.8% | 59.6% | 98.3% | ±1.2% | 90.9% | ±3.6% |
| Skellefteå | 1992–2005 | 1,633 | 75.7% | 53.5% | 97.8% | ±0.8% | 97.0% | ±1.0% |
| Skene | 1992–2005 | 948 | 91.7% | 56.5% | 98.4% | ±1.0% | 94.8% | ±2.5% |
| Sollefteå | 1992–2005 | 1,248 | 86.9% | 54.6% | 97.5% | ±1.0% | 93.6% | ±2.4% |
| Södertälje | 1995–2005 | 1,002 | 83.9% | 53.6% | 99.2% | ±0.7% | | |
| Torsby | 1992–2005 | 885 | 81.5% | 57.1% | 97.2% | ±1.3% | 89.2% | ±3.9% |
| Trelleborg | 1992–2005 | 2,376 | 79.5% | 47.9% | 96.5% | ±1.0% | 93.4% | ±1.7% |
| Visby | 1992–2005 | 1,053 | 82.2% | 53.6% | 94.3% | ±1.6% | 88.0% | ±3.0% |
| Värnamo | 1992–2005 | 1,352 | 83.1% | 53.5% | 98.6% | ±0.8% | 95.8% | ±1.8% |
| Västervik | 1992–2005 | 1,390 | 79.8% | 52.6% | 97.7% | ±0.8% | 94.5% | ±2.0% |
| Ängelholm | 1992–2005 | 1,810 | 75.9% | 49.0% | 97.4% | ±0.9% | 91.9% | ±2.3% |
| Örnsköldsvik | 1992–2005 | 1,533 | 81.2% | 55.5% | 99.3% | ±0.5% | 98.3% | ±1.0% |
| **Private Hospitals** | | | | | | | | |
| Carlanderska | 1992–2005 | 589 | 93.4% | 49.6% | 98.6% | ±1.1% | 95.2% | ±3.4% |
| Elisabethsjukhuset | 1999–2005 | 438 | 88.4% | 58.4% | 96.7% | ±3.3% | | |
| Gothenburg Medical Center | 2004–2005 | 59 | 100.0% | 61.0% | | | | |
| Movement | 2003–2005 | 104 | 98.1% | 58.7% | | | | |
| Nacka Närsjukhus Proxima AB | 2005–2005 | 17 | 94.1% | 35.3% | | | | |
| Ortopediska Huset | 1996–2005 | 1,197 | 98.5% | 58.1% | 97.4% | ±1.5% | | |
| Sophiahemmet | 1992–2005 | 2,276 | 97.2% | 53.7% | 95.1% | ±1.1% | 85.5% | ±3.0% |
| Stockholms Specialistvård AB | 2000–2005 | 648 | 96.9% | 59.0% | 98.2% | ±1.2% | | |

*[1] First and last observed year of primary THR.*
*[2] Number of primary THRs during the period with the conditions specified in the table heading.*
*[3] Percentage of primary THRs performed due to primary osteoarthritis.*
*[4] Percentage of primary THRs in the age-group 60-75 years (age at primary operation).*

*Certain hospitals do not have a sufficient number of primary operations during the period to give a 10-year implant survival value. To be able to calculate the 10-year survival, the longest observed time between the primary operation and revision must be at least 10 years. We have therefore chosen to present the 5-year survival as well. A condition which has consistently been applied in the survival statistics from the register is that only values where at least 50 patients "at risk" remain are shown. Hospitals with smaller production may therefore lack values for this reason. All hospitals that have reported to the register during 2005 are included in the table, even if values are lacking.*

# *Environmental and technical profile*

In the environmental profile, the units report their surgical technique and surgical environment every year. It is important to be aware that each hospital must update its environmental profile via the website. If it does not, it is assumed that the environmental profile/surgical technique is unchanged from the previous year. Since the environmental profile is based on aggregated data per hospital per year, this leads to uncertainty in statistical analyses of the database. The primary and revision databases are based on the individual operation, the patient's personal identity number and the side as unique variables.

In 2005, the brand names of the dominant cement types that are used in Sweden were changed:

- **Palacos with gentamycin** has changed its name to **Palacos R+G.**
- **Rebofacin Palacos** has changed its name to **Rebofacin Bone Cement.**

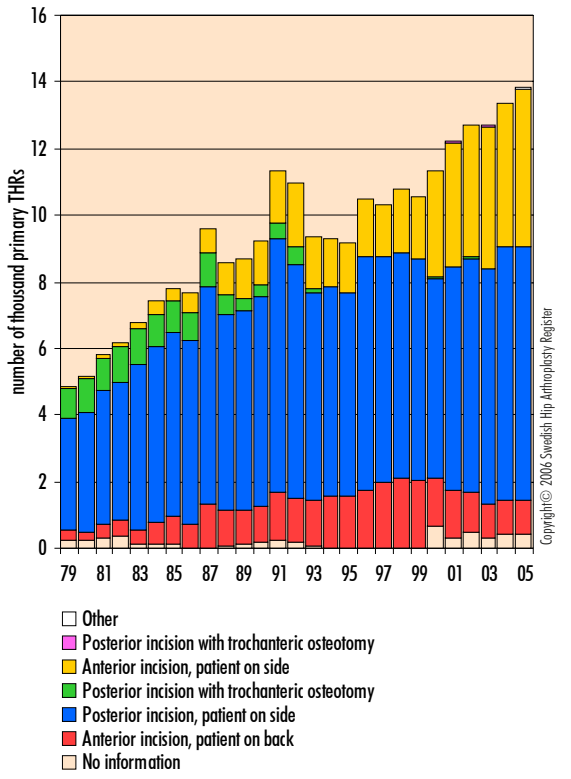
The characteristics and similarities/differences between the "new" cements and the "old" ones are currently being investigated using polymer-chemical and durability studies. The "new" cements were introduced successively and with some variability between different clinics during the autumn of 2005. At the start of the year (1/1/2006), the change had been fully implemented at all units and all the cement packaging types will therefore be registered in the environmental profile using the new designations. The historical materials will retain the previous designations.

For many years, most hospitals have been using a very similar technique. When it comes to cementing techniques, there are currently two clear-cut trends.

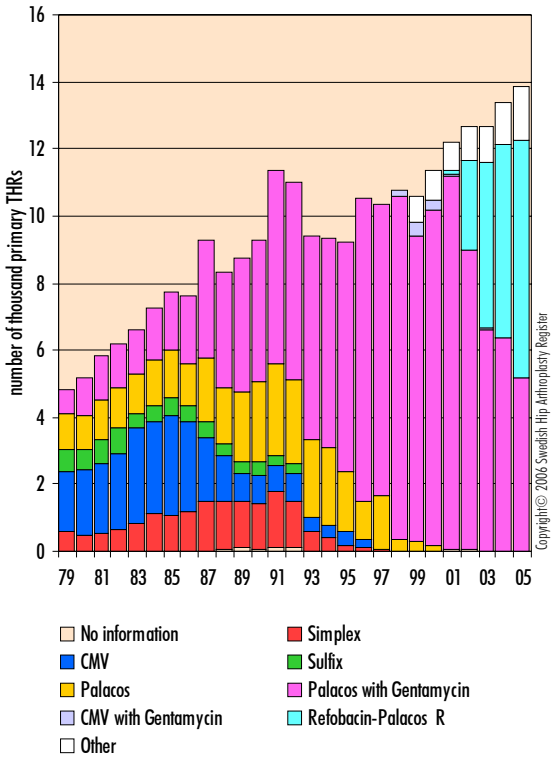
The use of brushes declined for the fifth year in succession. In previous multivariate analyses, we have not found that the use of brushes produces any positive effects. When it comes to the cleaning of the cement bed, meticulous, repeated high-pressure lavage probably has a better effect.

The use of a proximal femoral seal is once again increasing. In 2004, more than 15% of the clinics stated that they did not use this technique. In 2005, this percentage fell to 8%. If a proximal plug is not used, the opportunity for good cement penetration, which is an important

**Type of Incision**
1979-2005

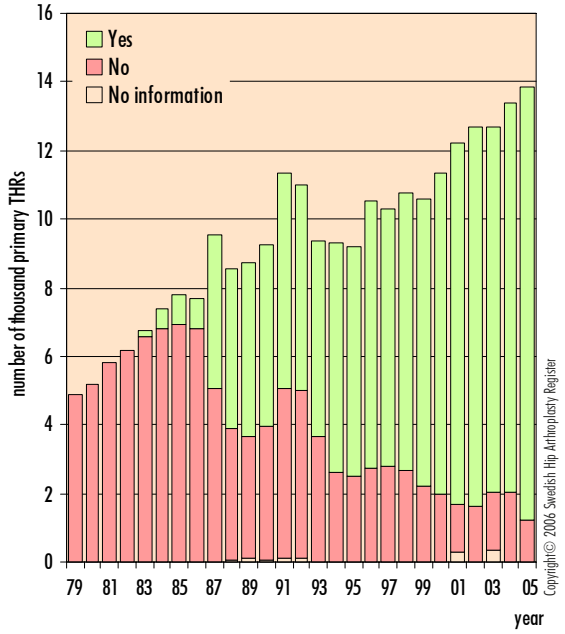



**Type of Cement**
1979-2005



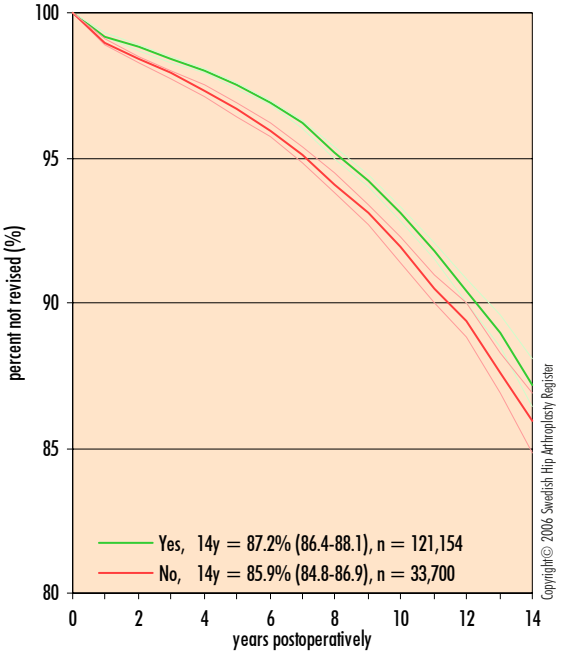
## Proximal Femoral Sealing

1979-2005




## Proximal Femoral Sealing

all diagnoses and all reasons, 1992-2005




part of the so-called modern cementing technique, is not utilised. Poisson analyses have shown that the use of a proximal plug reduces the long-term risk of aseptic loosening. The reason why some clinics hesitate about using the technique is probably based on anxiety about the increased risk of thromboembolic complications. This risk can, however, be reduced by the careful cleaning of the bone bed (high-pulsatile lavage) prior to cementing. This has been scientifically tested in a number of studies. The recommendation is clear cut: the use of a proximal seal with high-pulsatile lavage both before and after the application of the distal femoral restrictor is essential for both cement penetration and a lower risk of embolism.

A Kaplan-Meier analysis of 155,000 patients operated on during the period 1992-2005 revealed a 14-year survival for the patients operated on using high-pressure techniques of 87.2 ± 0.9%, while the corresponding implant survival for those operated on without this technique was 85.9 ± 1.0%. The difference is statistically significant ($p < 0.001$, Log Rank Test).

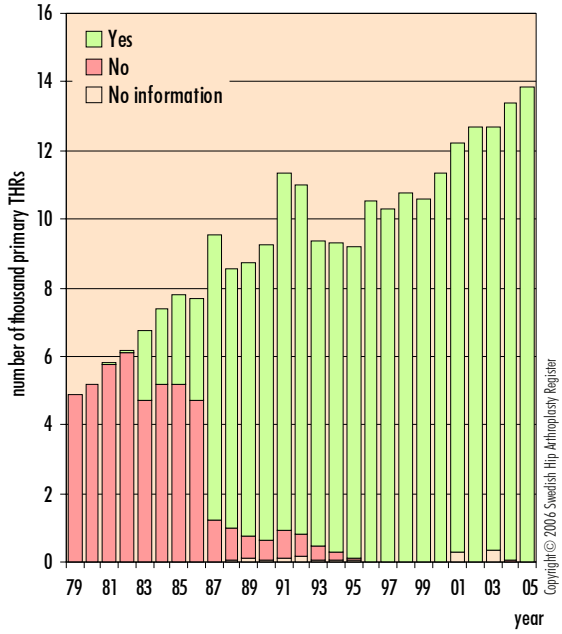
The most common incisions are posterior and anterior incisions in the lateral position. Some 57% of patients are operated on using a posterior incision in the lateral position (Moore) and 33% using an anterior, transgluteal incision. Since 2003, the number of possible incision types has increased on the report page. Three types of mini-incision have been included. Since 2003, 101 patients have undergone surgery using some form of mini-incision (see the following table), which indicates that this type of incision has not succeeded in making itself particularly popular in Sweden. The small number and the short observation period for the patients who have been operated on using a mini-incision do not permit a satisfactory register analysis. The relatively high number of revisions is, however, worrying. This applies in particular to MIS/2 (see the table). A large number of complications for MIS/2 have also been reported internationally.

| Incision | No. THR | No. rev. | Share rev. |
|---|---|---|---|
| MIS/2-incision | 19 | 3 | 15.8% |
| Ant. incision, pat. on back (Hardinge) | 20,512 | 1,098 | 5.4% |
| MIS/1-incision, posterior | 27 | 1 | 3.7% |
| MIS/1-incision, anterior | 55 | 2 | 3.6% |
| Post. incision, patient on side (Moore) | 94,572 | 3,411 | 3.6% |
| (Missing – Incision not specified) | 2,929 | 92 | 3.1% |
| Ant. incision, patient on side (Gammer) | 36,563 | 1,139 | 3.1% |

*Share of revisions divided on type of incision.*

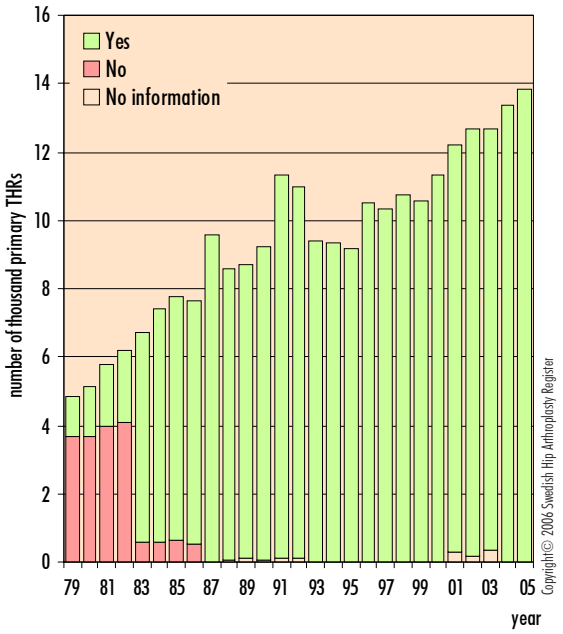
## Cleansing by Lavage

1979-2005



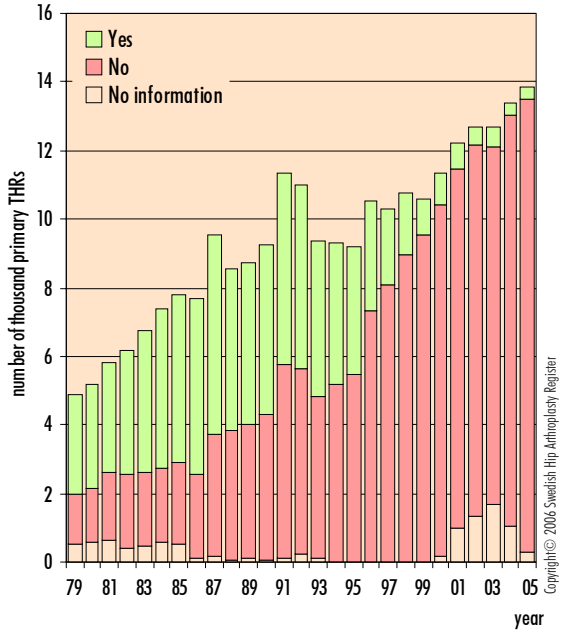

## Distal Femoral Plug

1979-2005



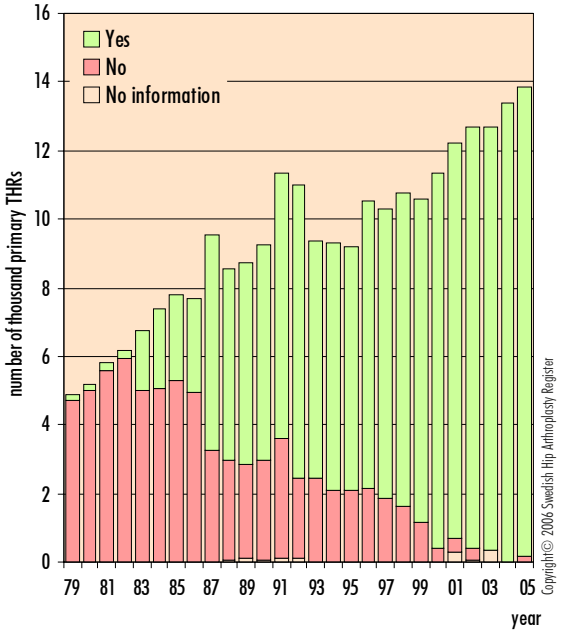

## Per Oral Antibiotics

1979-2005



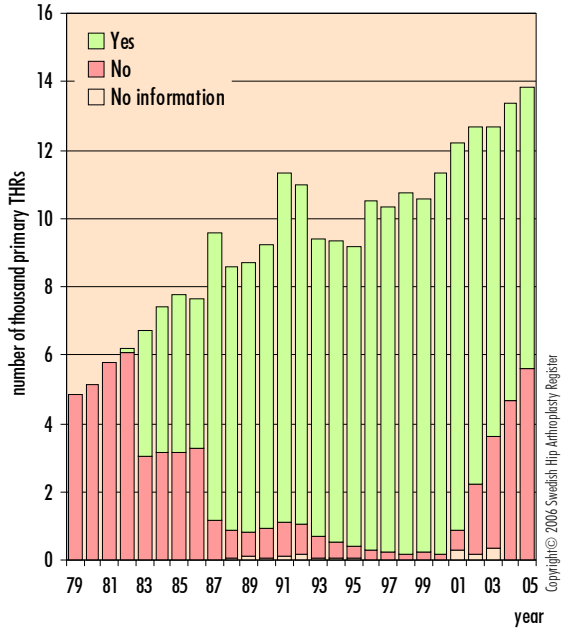

## Acetabular Compression

1979-2005



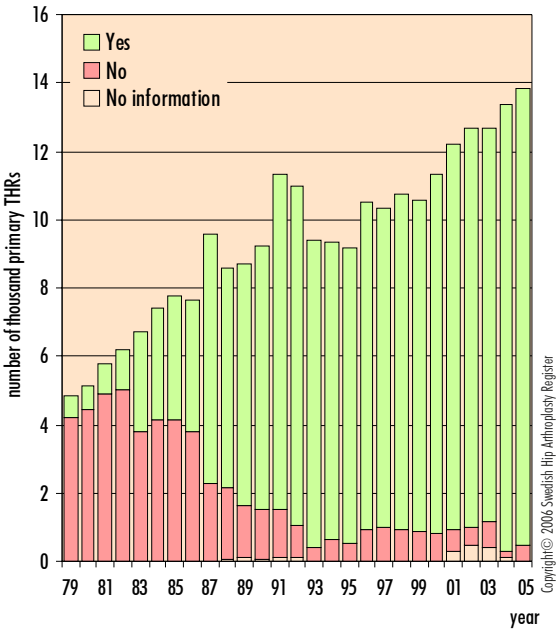
## Cleansing by Brush

1979-2005



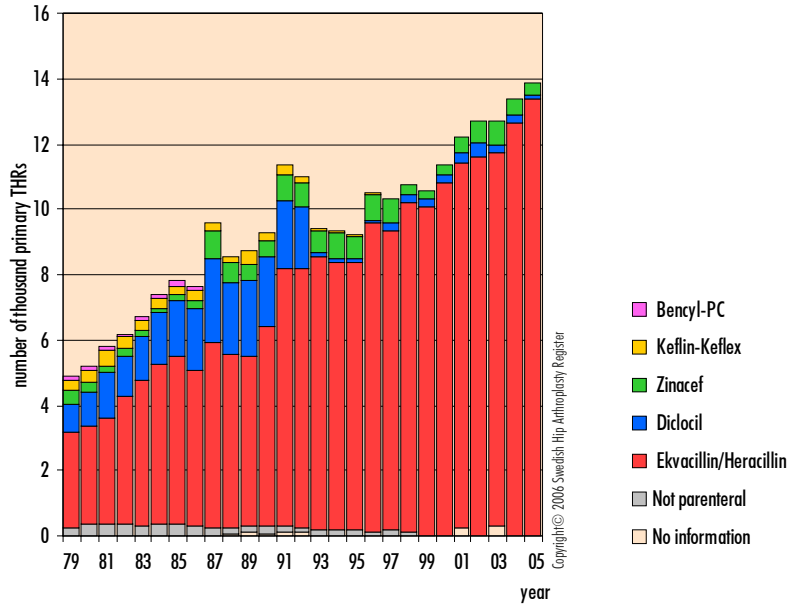

## Retrograde Cement-fillning of Femur

1979-2005




## Parenteral Brand of Antibiotics

1979-2005



# *Free choice of care and hip arthroplasty*

The structural changes that are currently taking place within Swedish orthopaedics and the introduction of the care guarantee has resulted in an increased flow of patients between different county councils. A number of clinics with surplus capacity and a number of private contractors have produced more rapid access to hip arthroplasty than patients' "home clinics" have been able to offer in many cases. Good, rapid access that has not been quality controlled can, however, hardly be regarded as a satisfactory quality variable.

Prior to last year's annual report, we conducted an analysis of the short-term results for patients undergoing surgery outside their home region between 2002-2003 (see Annual Report 2004, page 52). A short summary of the investigation that formed the basis of the continuation of this analysis now follows:

- To avoid the inclusion of referred patients, only "standard patients", i.e. those with primary osteoarthritis as a diagnosis and undergoing surgery with a cemented THR outside university clinics, were analysed.
- Operated on within the county: 14,785 hips, operated on outside the county: 1,964 hips
- Those patients who took advantage of "the free care choice" had lower co-morbidity (percentage of Charnley C patients) ($p = 0.001$).
- The frequency of re-operation within the county 1.2% and outside the county 1.5% ($p = 0.33$)
- Some 80% of the patients who underwent surgery outside their home region and required a re-operation were dealt with at their home clinic but with a significantly longer waiting time compared with patients who underwent re-operations at their primary clinic.
- Patient-related outcome measured using a pain VAS, satisfaction VAS and EQ-5D index did not reveal any significant difference between the two groups, even if it should be noted that the free-flow patients had a different demographic profile. They should therefore have had a slightly higher EQ-5D index and be somewhat more satisfied, as the percentage of C patients was significantly lower compared with the comparison group.

To summarise, the analysis did not reveal any statistically confirmed difference in quality measured in terms of short-term re-operation frequency between patients undergoing surgery at their "home clinic" and those utilising the "free flow". Only after five to 10 years of follow-up is it possible to analyse possible differences in quality in terms of aseptic loosening and revision frequency with any real certainty. We did, however, find factors – questions we felt were worrying from a quality angle.

The patients using the "free flow" were somewhat younger and there were fewer women compared with the national average and they also had a significantly lower co-morbidity and short-term mortality. What happens to the group that is "more ill"? Do they have to wait longer for adequate treatment? Is this fair health care characterised by the concept of solidarity?

Most patients requiring re-operation were sent back to their home clinics, with longer waiting times. Should county councils that sign agreements with independent contractors not demand responsibility when it comes to dealing with complications?

Follow-up: the majority of the most highly productive units in the free care choice system are not linked to the register follow-up routines. How are these patients followed up? What happens to these patients in the long term – where should they turn with problems now that some of the producers from 2002 and 2003 have stopped performing THR?

Local quality programmes: orthopaedic care is increasingly taking the form of an itinerant consultant from external agencies without any administrative links to the actual workplace. This reduces the potential and incentive to influence activities, their content and quality. The continuity that is absolutely vital is lost when the opportunity to see and learn from one's own mistakes disappears, with reduced motivation and involvement in quality programmes as a whole.

Criticism has been levelled at this investigation, as we analysed the entire group and did not point to the results at individual clinics. As the number of complications is so low, there is an obvious risk of misinterpretation as a result of random variation and the group should be followed up over a long period. Most short-term complications in the form of deep infections and re-operations as a result of recurring dislocations should have been dealt with after two to four years of follow-up and the re-operation frequency should therefore be expected to level out after a few years in the studied cohorts. The final quality assessment cannot be made until several years have passed, as the number of revisions due to aseptic loosening will increase as the observation period continues.

## *This year's comparison*

In this year's continued analysis of the above-mentioned groups, only the re-operation frequency (all open additional surgery, not just revisions) and the Kaplan-Meier analysis with revisions after extractions as the definition of failure have been included. No new patient questionnaire focusing on patient-related outcome has been distributed. The follow-up ended on 31 December 2005. The average follow-up period was therefore 36 months (24-48). The follow-up period is still short and primarily reflects complications such as deep infection and revision due to recurring dislocations.

Re-operations were performed on 231 of 14,785 (1.6%) patients undergoing their primary operation within their

| Reason | Operated in home county (all over Sweden) (n=14,785) | | Free choice (n=1,964) | |
|---|---|---|---|---|
| | Number | Share (%) | Number | Share (%) |
| Aseptic loosening | 30 | 0.2 | 5 | 0.3 |
| Deep infection | 71 | 0.5 | 16 | 0.8 |
| Fracture | 21 | 0.1 | 1 | 0.1 |
| Implant fracture | 0 | 0.0 | 1 | 0.1 |
| Dislocation | 73 | 0.5 | 9 | 0.5 |
| Technical error | 11 | 0.1 | 3 | 0.2 |
| Pain only | 4 | 0.0 | 0 | 0.0 |
| Miscellaneous | 21 | 0.1 | 2 | 0.1 |
| Total | 231 | 1.6 | 37 | 1.9 |

*Table 1. Reasons for reoperation. Statistical analysis of the percentage of different reasons revealed no significant difference between the two groups.*

| Reason | Operated in the WR (n=2,008) | | Free choice (n=1,964) | |
|---|---|---|---|---|
| | Number | Share (%) | Number | Share (%) |
| Aseptic loosening | 5 | 0.2 | 5 | 0.3 |
| Deep infection | 6 | 0.3 | 16 | 0.8* |
| Fracture | 0 | 0.0 | 1 | 0.1 |
| Implant fracture | 0 | 0.0 | 1 | 0.1 |
| Dislocation | 4 | 0.2 | 9 | 0.5 |
| Technical error | 3 | 0.1 | 3 | 0.2 |
| Pain only | 1 | 0.0 | 0 | 0.0 |
| Miscellaneous | 2 | 0.1 | 2 | 0.1 |
| Total | 21 | 1.0 | 37 | 1.9 |

*Table 2. Reasons for reoperation. Statistical analysis of the percentage of different reasons revealed no significant difference between the two groups, except *infection as reason for reoperation (p=0.03, Fischer's Exact Test).*

home county and 37 of 1,964 (1.9%) patients undergoing their primary operation outside their home county (p = 0.29, Fisher's exact test). The number of revisions on 31 December 2005 was 178 of 14,785 (1.2%) and 30 of 1,964 (1.5%) respectively. Implant survival after four years was 98.5 ± 0.2% for the within-county group and 98.0 ± 0.6% for the free flow (Kaplan-Meier analysis, p = 0.2, Log Rank test).

In the "Starting afresh" project (see the section on this topic), a similar analysis was conducted on patients undergoing surgery in the western region during the same period and with the same inclusion criteria as the nationwide study. The reason for conducting this analysis was that, during the study period 2002-2003, the WR was the largest "purchaser" of operations involving hip implants outside its own region – 32% of the flow during the years in question.

The number of patients with the given criteria, who were operated on in the WR, totalled 2,008. The analysis was conducted in 1 December 2005 and the difference in the re-operation frequency compared with the free flow was statistically significant – 14 versus 31 (p = 0.01, Fisher's exact test).

We have conducted an analysis with 31 December 2005 as the final date. The reason for this is that this is a fairer date, as there is some delay in the reporting of re-operations to the register. For results, see the following table. The re-operation frequencies have levelled out to some degree in this new analysis, but they still differ to a statistically significant degree – 21 versus 37 (p = 0.03, Fisher's exact test). We also found a significant difference when it came to deep infection as the cause of re-operations (see Table 2).

## *Discussion*

This year's updated analysis has not changed the results to any marked degree. We are not able to demonstrate any statistically significant difference when the national results are compared with the "free flow" in terms of re-operation frequency and implant survival. In this year's analysis, we were unable to capture patient-related outcome. It should, however, be remembered that the "free flow" patients should have a lower risk of complications than other patients, as this group has a statistically proven lower frequency of co-morbidity.

For many years, the Western Region has had the lowest procedure frequency per 100,000 inhabitants in Sweden. This was the incentive for the separate analysis of the WR compared with the "free flow". We are not able to explain why the difference in this comparison is statistically significant, but this could perhaps initiate an additional in-depth analysis of the material. The result has generated a greater effort within the WR to attempt to increase the "domestic" production of THRs.

As has already been mentioned, the analysed cohorts will be followed up for several years in order to detect any long-term differences in quality. Just like last year, the register management team must unfortunately complain about the fact that the largest players, when it comes to patients undergoing surgery outside their home county, are still not linked to the standardised register follow-up routine. This can naturally impact the opportunity to follow the "free-flow" patients in the future using X-rays and patient-related outcome. Last year's patient questionnaire (which replaced the follow-up control) for the patients in question was initiated and funded by the register.

We feel that quality control of this kind should be included when agreements are signed with players in the free choice of care system or the flow that is dependent on demands to comply with the care guarantee.

# *Notes*

# *Regions*

In Sweden, approximately 125 primary hip arthroplasties per 100,000 inhabitants were performed during the period 1992-2005. The northern and south-eastern regions performed the most operations and the western region and the Stockholm & Gotland region performed the fewest, after adjustments for the number of inhabitants. As different from last year, an increase was seen in both the Stockholm & Gotland region and the west region (not equal to the Western Region, which is a specified county council), with 275 and 300 operations respectively. However, in 2005, both these regions and the west region in particular were clearly under the national average. The number of procedures also increased in the south-eastern region, while the northern and southern regions report insignificant changes. In the Uppsala-Örebro region, the number of procedures declined by just over 200 operations, but the figure here is still above the national average. As the age distribution and probably also the distribution of diagnoses varies between the regions, some variation in the number of primary hip arthroplasties can be expected.

For all six regions, the 15 most common implants during the period 1979-2000 and then every year up to 2005 are reported. In addition, the number of primary operations and the procedure frequency are illustrated, in relation to the national annual average since 1992. The number of primary operations in the region and the revisions they have caused are shown in the form of bar charts. The total revision burden (RB) for 1979-2005 and 1992-2005 is also shown separately for women and men during the latter period. During the latter period, the RB was highest in the Stockholm & Gotland region (11.1%), followed by Uppsala-Örebro and the southern region (10.9%), the west region (10.7%), the south-eastern region (10%) and the northern region (9%). These data reflect to some extent the quality of the operations that were performed in the region, but the percentages are also influenced by the number of primary arthroplasties. The regions that need and at the same time have the potential to perform a large number of primary arthroplasties automatically have a lower relative number of revisions. Other factors, such as variations in case-mix (percentage of high-risk patients) between the regions and the choice of primary implant will also affect the RB. The RB provides information about the level of difficulty and the consumption of resources in the operations that are performed. It also provides some indication of the quality of the operations that are performed, but it says nothing about the specific causes of a revision. The two survival curves show revisions regardless of cause and diagnosis and revision due to aseptic loosening in conjunction with primary osteoarthritis.

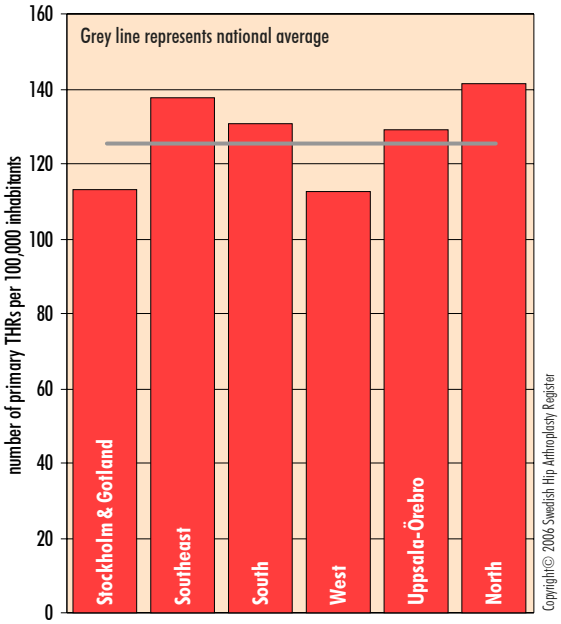
When it comes to the choice of fixation, regional differences caused by the fact that some regions are responsible for development work in the field of prosthetics and therefore use more uncemented, hybrid or reversed hybrid techniques can be seen. It should be noted that the information listed in the tables takes some account of historical data.

In 2005, the percentage of fully cemented implants varied between 76.2% (Stockholm & Gotland region) and 93.6% (northern region). Since 2004, the percentage of fully cemented fixation has declined in all the regions, apart from the northern region. The percentage of fully uncemented fixation increased slowly by up to around 3.5%. In none of the regions did the percentage of fully uncemented fixation exceed 9.6% (Uppsala-Örebro and west regions). When it comes to hybrid implants, the picture is more mixed. In three regions, there has been a slight increase, while a reduction of up to 1.7% in the total number of hip implants has been seen in three regions. This has taken place in the west region, where most hybrid implants are still installed, both in absolute figures and as a relative percentage of the total number (7.0%). The percentage of reversed hybrids is also increasing in all the regions apart from the northern region, where it is unchanged (2.4%). In the west region, the absolute and relative number has more than doubled to 5.1%. In spite of this, by far the largest number of reversed hybrid operations are performed in the Stockholm & Gotland region (13.3%). The observed changes can be partly explained by ongoing studies, but they also correspond to shifts in indication in routine activities. It is important that these changes are monitored and that they are based on evidence from each patient group, while taking account of the cost-benefit perspective and the risk of technique-related complications when changing implants and fixation principles.

The regional differences that can be seen are not simply a reflection of demographic factors. They also reflect implant choice and probably also variables related to surgical techniques. We hope that reporting these data, the individual clinic reports and, whenever appropriate, data from follow-up programmes will help the individual clinics and regions in their development and quality programmes.

**Average Frequency of Procedure**

all primary THRs 1992-2005



# *Region: Stockholm & Gotland*

## 15 Most Common Implants

most used during the past 10 years

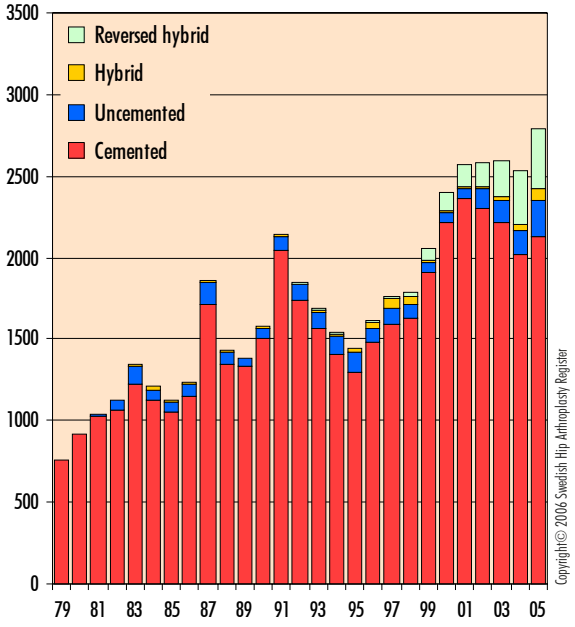
| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Charnley (Charnley) | 20,642 | 996 | 629 | 153 | 71 | 6 | 22,497 | 31.6% |
| Charnley Elite (Exeter Polished) | 589 | 456 | 706 | 772 | 574 | 515 | 3,612 | 15.8% |
| Reflection (Spectron EF Primary) | 204 | 147 | 190 | 387 | 361 | 348 | 1,637 | 7.2% |
| Charnley (Exeter Polished) | 115 | 23 | 86 | 188 | 285 | 325 | 1,022 | 4.5% |
| Biomet Müller (CPT Steel) | 389 | 214 | 211 | 133 | 1 | 0 | 948 | 4.2% |
| Weber All-poly cup (Straight-stem standard) | 123 | 99 | 115 | 137 | 195 | 164 | 833 | 3.7% |
| Lubinus All-poly (Lubinus SP II) | 539 | 135 | 137 | 82 | 77 | 61 | 1,031 | 3.4% |
| Charnley Elite (ABG uncem.) | 58 | 71 | 94 | 127 | 15 | 1 | 366 | 1.6% |
| Biomet Müller (CPT CoCr) | 0 | 0 | 0 | 61 | 145 | 137 | 343 | 1.5% |
| Exeter All-poly (Exeter Polished) | 363 | 1 | 1 | 0 | 0 | 0 | 365 | 1.4% |
| Contemporary Hooded Duration (Exeter Polished) | 0 | 1 | 24 | 69 | 65 | 154 | 313 | 1.4% |
| FAL (Lubinus SP II) | 0 | 0 | 60 | 71 | 68 | 99 | 298 | 1.3% |
| Charnley Elite (Charnley Elite Plus) | 281 | 13 | 1 | 0 | 0 | 0 | 295 | 1.3% |
| Charnley Elite (Lubinus SP II) | 43 | 27 | 7 | 56 | 65 | 80 | 278 | 1.2% |
| Charnley (Charnley Elite Plus) | 150 | 68 | 12 | 0 | 0 | 0 | 230 | 1.0% |
| Others (total 306) | 10,064 | 346 | 359 | 371 | 612 | 919 | 12,671 | |
| Total | 33,560 | 2,597 | 2,632 | 2,607 | 2,534 | 2,809 | 46,739 | |



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

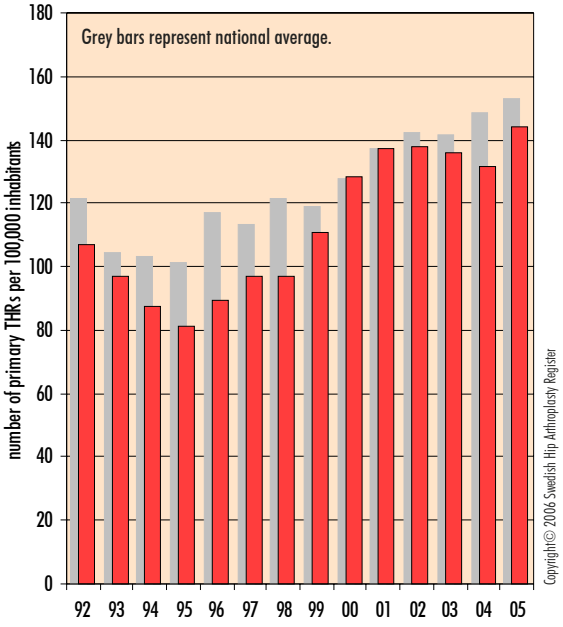
## Number of Primary THRs

per type of fixation, 1979-2005



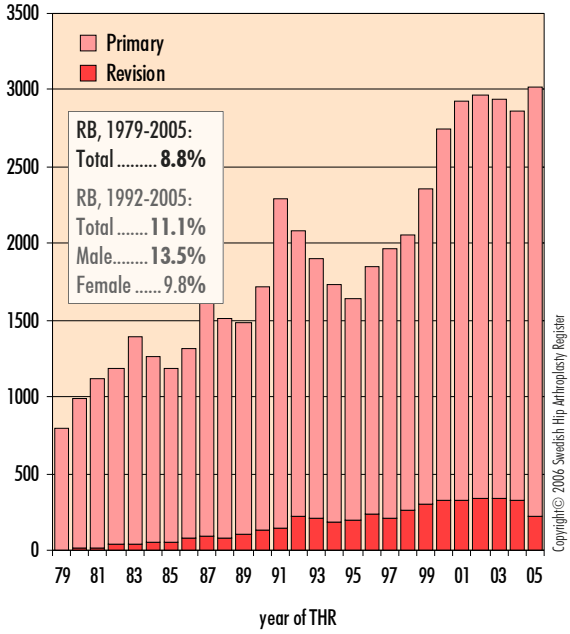

## Frequency of Procedure

all primary THRs included



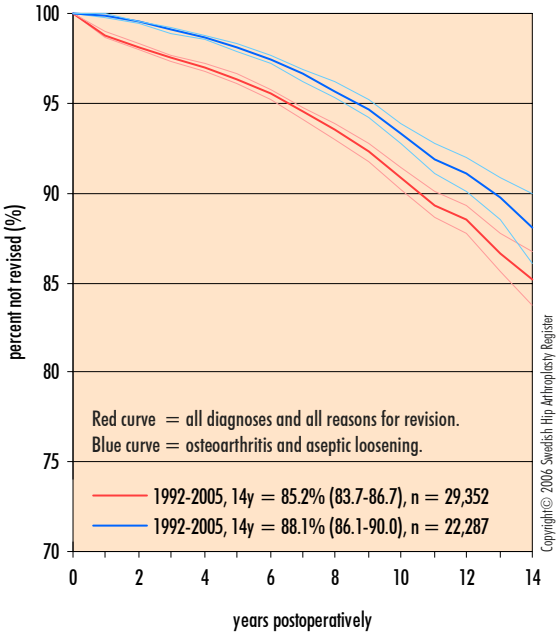
## Number of THRs per Year

46,739 primary THRs, 4,513 revisions, 1979-2005




## Implantat Survival

1992-2005




## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 11,622 | 2,051 | 2,144 | 2,117 | 2,023 | 2,330 | 22,287 | 75.9% |
| Fracture | 1,945 | 286 | 263 | 265 | 308 | 293 | 3,360 | 11.4% |
| Inflammatory arthritis | 657 | 65 | 46 | 55 | 57 | 43 | 923 | 3.1% |
| Idiopathic femoral head necrosis | 496 | 82 | 74 | 64 | 62 | 77 | 855 | 2.9% |
| Childhood disease | 177 | 83 | 85 | 79 | 60 | 51 | 535 | 1.8% |
| Secondary osteoarthritis | 152 | 0 | 1 | 3 | 2 | 0 | 158 | 0.5% |
| Tumor | 74 | 22 | 15 | 12 | 11 | 9 | 143 | 0.5% |
| Secondary arthritis after trauma | 43 | 8 | 4 | 12 | 11 | 6 | 84 | 0.3% |
| (missing) | 1,007 | 0 | 0 | 0 | 0 | 0 | 1 007 | 3.4% |
| Total | 16,173 | 2,597 | 2,632 | 2,607 | 2,534 | 2,809 | 29,352 | 100% |



## Mean Age per Gender and Year

| Gender | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|
| Male | 67.8 | 66.7 | 67.5 | 66.3 | 65.9 | 66.1 | 67.2 |
| Female | 70.7 | 70.1 | 69.9 | 69.8 | 69.9 | 69.6 | 70.3 |
| Total | 69.7 | 68.9 | 69.0 | 68.5 | 68.3 | 68.2 | 69.2 |

# *Region: South-east*

## 15 Most Common Implants

most used during the past 10 years

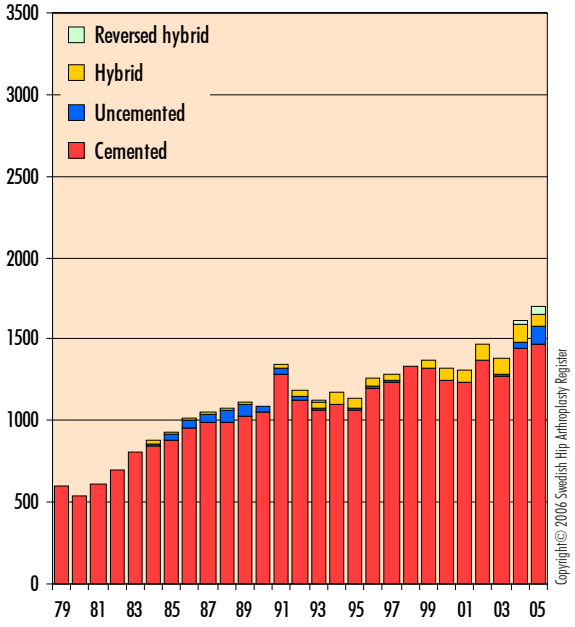
| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-poly (Lubinus SP II) | 7,525 | 744 | 827 | 794 | 1,180 | 1,336 | 12,406 | 61.8% |
| FAL (Lubinus SP II) | 230 | 283 | 315 | 290 | 160 | 66 | 1 344 | 9.5% |
| Exeter Duration (Exeter Polished) | 292 | 140 | 107 | 16 | 1 | 1 | 557 | 4.0% |
| Exeter All-poly (Exeter Polished) | 946 | 1 | 2 | 0 | 0 | 0 | 949 | 3.9% |
| SHP (Lubinus SP II) | 557 | 0 | 5 | 1 | 3 | 3 | 569 | 3.4% |
| Charnley Elite (Exeter Polished) | 203 | 24 | 27 | 20 | 28 | 26 | 328 | 2.3% |
| Contemporary Hooded Duration (Exeter Polished) | 0 | 6 | 67 | 134 | 41 | 12 | 260 | 1.8% |
| OPTICUP (Lubinus SP II) | 231 | 0 | 0 | 0 | 0 | 0 | 231 | 1.6% |
| Charnley Elite (Lubinus SP II) | 208 | 11 | 16 | 7 | 3 | 5 | 250 | 1.4% |
| Trilogy HA (Lubinus SP II) | 31 | 29 | 17 | 40 | 42 | 37 | 196 | 1.4% |
| Lubinus All-poly (Lubinus IP) | 3,296 | 0 | 0 | 0 | 0 | 0 | 3,296 | 0.8% |
| Biomex HA (Lubinus SP II) | 19 | 20 | 33 | 30 | 3 | 0 | 105 | 0.7% |
| Reflection HA (Lubinus SP II) | 25 | 12 | 19 | 15 | 23 | 10 | 104 | 0.7% |
| Mallory-Head uncem. (Lubinus SP II) | 81 | 4 | 6 | 2 | 3 | 2 | 98 | 0.6% |
| Contemporary (Lubinus SP II) | 68 | 0 | 0 | 0 | 0 | 0 | 68 | 0.4% |
| Others (total 158) | 9,280 | 38 | 27 | 40 | 128 | 207 | 9,720 | |
| Total | 22,992 | 1,312 | 1,468 | 1,389 | 1,615 | 1,705 | 30,481 | |

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



## Number of Primary THRs

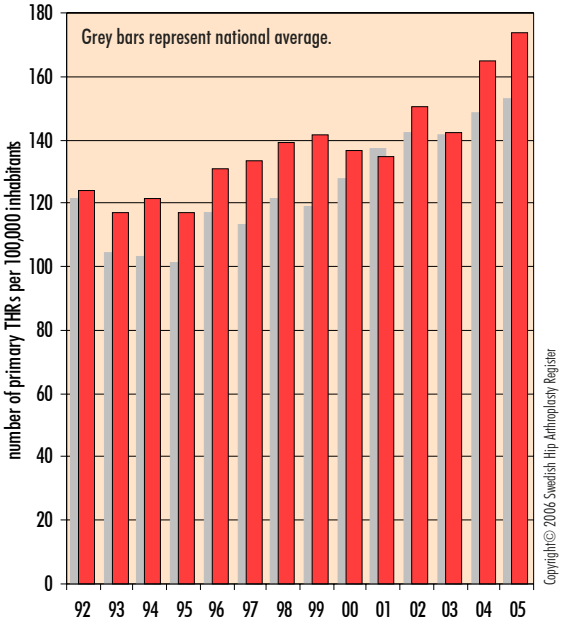
per type of fixation, 1979-2005





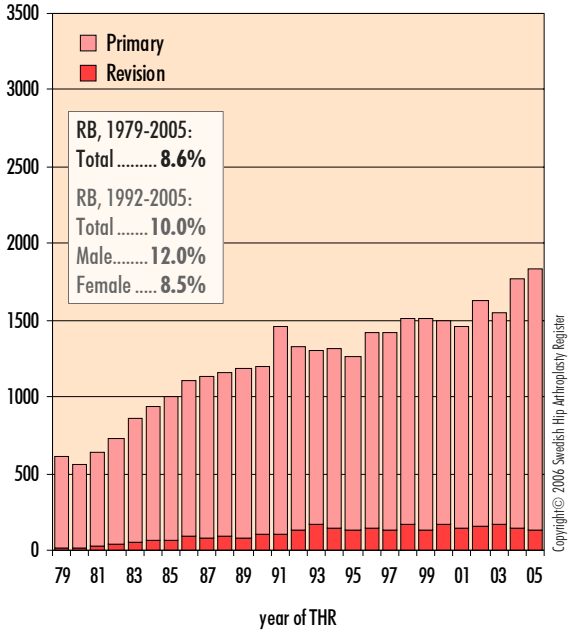

## Frequency of Procedure

all primary THRs included



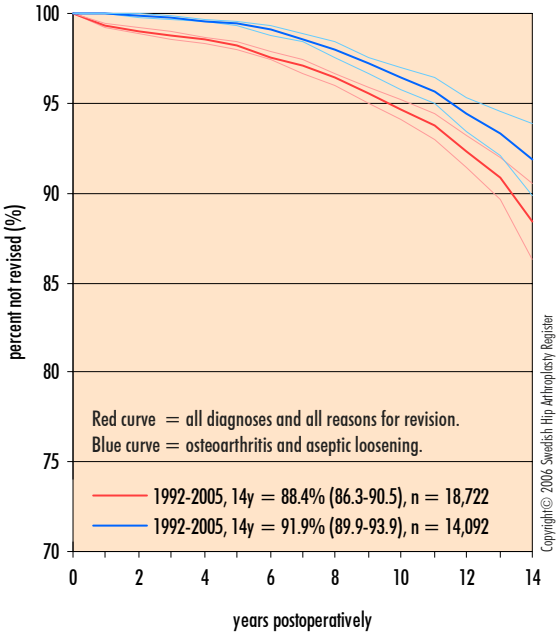
## Number of THRs per Year

30,481 primary THRs, 2,871 revisions, 1979-2005




## Implant Survival

1992-2005




## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 8,091 | 1,032 | 1,152 | 1,101 | 1,302 | 1,414 | 14,092 | 75.3% |
| Fracture | 1,564 | 171 | 206 | 183 | 221 | 197 | 2,542 | 13.6% |
| Inflammatory arthritis | 649 | 46 | 38 | 42 | 27 | 22 | 824 | 4.4% |
| Idiopathic femoral head necrosis | 368 | 35 | 31 | 39 | 30 | 35 | 538 | 2.9% |
| Secondary osteoarthritis | 271 | 0 | 0 | 0 | 0 | 0 | 271 | 1.4% |
| Childhood disease | 112 | 23 | 30 | 12 | 23 | 26 | 226 | 1.2% |
| Tumor | 20 | 4 | 11 | 10 | 10 | 9 | 64 | 0.3% |
| Secondary arthritis after trauma | 34 | 1 | 0 | 2 | 2 | 2 | 41 | 0.2% |
| (missing) | 124 | 0 | 0 | 0 | 0 | 0 | 124 | 0.7% |
| Total | 11,233 | 1,312 | 1,468 | 1,389 | 1,615 | 1,705 | 18,722 | 100% |



## Mean Age per Gender and Year

| Gender | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|
| Male | 69.0 | 68.0 | 68.0 | 68.3 | 68.3 | 68.7 | 68.7 |
| Female | 71.5 | 70.8 | 71.0 | 71.0 | 70.9 | 70.4 | 71.2 |
| Total | 70.5 | 69.6 | 69.7 | 69.9 | 69.9 | 69.7 | 70.2 |

# *Region: South*

## 15 Most Common Implants

most used during the past 10 years

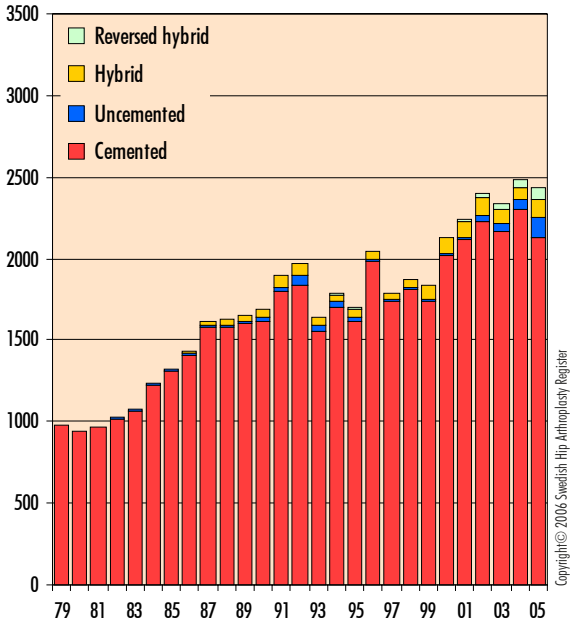
| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-poly (Lubinus SP II) | 4,430 | 627 | 701 | 580 | 697 | 607 | 7,642 | 25.1% |
| Exeter Duration (Exeter Polished) | 946 | 775 | 931 | 963 | 979 | 736 | 5,330 | 24.6% |
| OPTICUP (Scan Hip II Collar) | 1,180 | 365 | 279 | 125 | 10 | 0 | 1,959 | 9.0% |
| Exeter All-poly (Exeter Polished) | 2,677 | 9 | 13 | 6 | 10 | 2 | 2,717 | 8.5% |
| Charnley (Charnley Elite Plus) | 920 | 31 | 0 | 0 | 0 | 0 | 951 | 4.3% |
| Charnley (Charnley) | 6,098 | 20 | 9 | 5 | 3 | 0 | 6,135 | 3.6% |
| Charnley Elite (Exeter Polished) | 5 | 86 | 99 | 158 | 192 | 220 | 760 | 3.5% |
| Scan Hip Cup (Scan Hip Collar) | 5,356 | 0 | 0 | 0 | 0 | 0 | 5,356 | 2.7% |
| Trilogy HA (Lubinus SP II) | 194 | 70 | 53 | 40 | 34 | 28 | 419 | 1.9% |
| Contemporary Hooded Duration (Exeter Polished) | 1 | 0 | 8 | 87 | 120 | 194 | 410 | 1.9% |
| Weber All-poly cup (MS30 Polished) | 10 | 4 | 28 | 114 | 150 | 16 | 322 | 1.5% |
| Charnley Elite (Charnley Elite Plus) | 275 | 44 | 0 | 0 | 0 | 0 | 319 | 1.4% |
| Charnley (Exeter Polished) | 10 | 65 | 51 | 44 | 43 | 50 | 263 | 1.2% |
| ZCA (MS30 Polished) | 0 | 0 | 0 | 0 | 7 | 224 | 231 | 1.1% |
| Scan Hip Cup (Scan Hip II Collar) | 186 | 0 | 0 | 0 | 0 | 0 | 186 | 0.9% |
| Others (total 245) | 12,145 | 138 | 228 | 220 | 246 | 358 | 13,335 | |
| Total | 34,433 | 2,234 | 2,400 | 2,342 | 2,491 | 2,435 | 46,335 | |

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



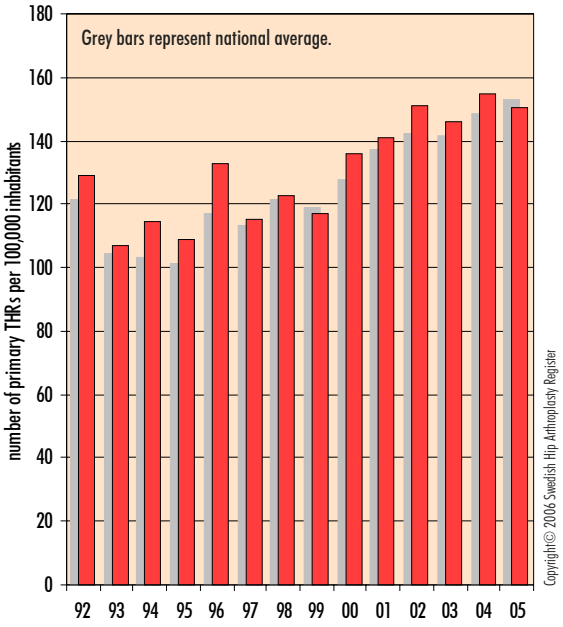
## Number of Primary THRs

per type of fixation, 1979-2005



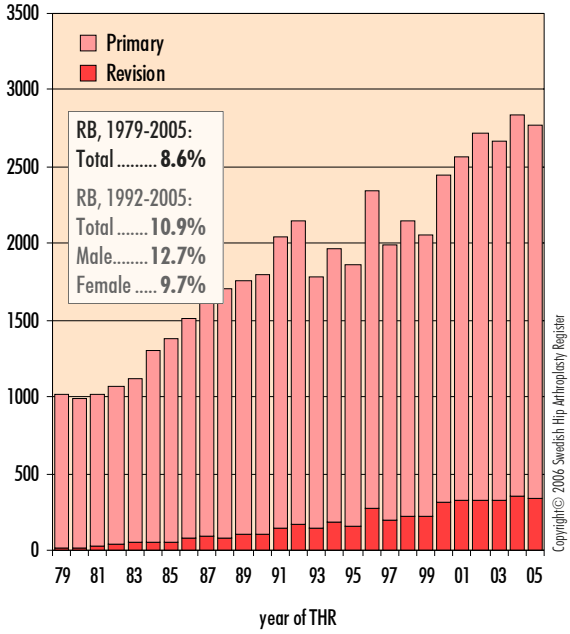

## Frequency of Procedure

all primary THRs included



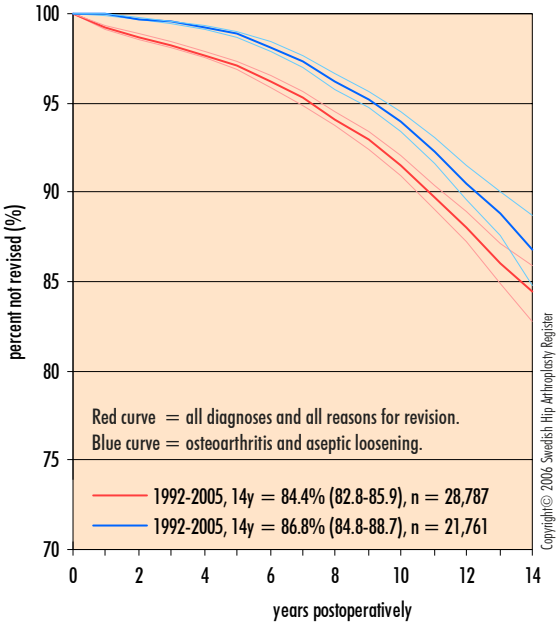
## Number of THRs per Year

46,335 primary THRs, 4,362 revisions, 1979-2005




## Implant Survival

1992-2005




## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 12,062 | 1,766 | 1,958 | 1,857 | 2,053 | 2,065 | 21,761 | 75.6% |
| Fracture | 2,260 | 233 | 224 | 245 | 225 | 178 | 3,365 | 11.7% |
| Inflammatory arthritis | 1,038 | 106 | 80 | 83 | 65 | 68 | 1,440 | 5.0% |
| Idiopathtic femoral head necrosis | 536 | 69 | 77 | 83 | 79 | 61 | 905 | 3.1% |
| Childhood disease | 218 | 44 | 48 | 47 | 44 | 39 | 440 | 1.5% |
| Tumor | 110 | 13 | 9 | 17 | 20 | 17 | 186 | 0.6% |
| Secondary osteoarthritis | 143 | 0 | 0 | 0 | 0 | 4 | 147 | 0.5% |
| Secondary arthritis after trauma | 29 | 3 | 4 | 10 | 5 | 3 | 54 | 0.2% |
| (missing) | 489 | 0 | 0 | 0 | 0 | 0 | 489 | 1.7% |
| Total | 16,885 | 2,234 | 2,400 | 2,342 | 2,491 | 2,435 | 28,787 | 100% |



## Mean Age per Gender and Year

| Gender | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|
| Male | 68.2 | 68.2 | 66.8 | 67.7 | 66.9 | 66.6 | 67.8 |
| Female | 70.8 | 69.9 | 70.0 | 69.9 | 70.3 | 69.6 | 70.4 |
| Total | 69.8 | 69.2 | 68.7 | 69.0 | 68.9 | 68.3 | 69.4 |

# *Region: West*

## 15 Most Common Implants

most used during the 10 years

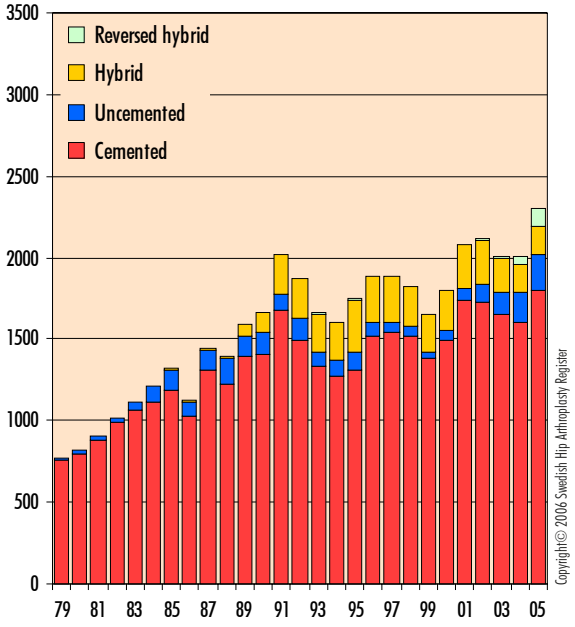
| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-poly (Lubinus SP II) | 5,290 | 1,157 | 1,184 | 1,156 | 1,113 | 1,365 | 11,265 | 47.0% |
| Reflection (Spectron EF Primary) | 1,714 | 442 | 400 | 382 | 356 | 335 | 3,629 | 18.5% |
| Trilogy HA (Spectron EF Primary) | 405 | 176 | 173 | 127 | 107 | 80 | 1,068 | 5.5% |
| Biomet Müller (RX90-S) | 1,355 | 7 | 0 | 0 | 0 | 0 | 1,362 | 5.4% |
| OPTICUP (Optima) | 449 | 0 | 0 | 0 | 0 | 0 | 449 | 1.6% |
| Charnley (Charnley) | 4,672 | 0 | 0 | 0 | 0 | 0 | 4,672 | 1.6% |
| Contemporary (Exeter Polished) | 357 | 2 | 2 | 1 | 0 | 0 | 362 | 1.4% |
| Trilogy HA (CLS Spotorno) | 3 | 4 | 15 | 22 | 65 | 124 | 233 | 1.2% |
| Charnley Elite (Spectron EF Primary) | 76 | 36 | 20 | 36 | 37 | 27 | 232 | 1.2% |
| ZCA (Stanmore mod.) | 14 | 16 | 56 | 53 | 55 | 26 | 220 | 1.1% |
| ABG II HA (Lubinus SP II) | 120 | 21 | 10 | 2 | 3 | 0 | 156 | 0.8% |
| ABG II HA (ABG uncem.) | 48 | 29 | 42 | 12 | 9 | 8 | 148 | 0.8% |
| Trilogy HA (Versys stem) | 1 | 10 | 23 | 53 | 43 | 8 | 138 | 0.7% |
| ABG HA (Lubinus SP II) | 271 | 0 | 0 | 0 | 0 | 0 | 271 | 0.7% |
| Duralock (uncem.) (Spectron EF Primary) | 114 | 0 | 0 | 0 | 0 | 0 | 114 | 0.6% |
| Others (total 305) | 17,569 | 183 | 190 | 158 | 217 | 332 | 18,649 | |
| Total | 32,458 | 2,083 | 2,115 | 2,002 | 2,005 | 2,305 | 42,968 | |



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

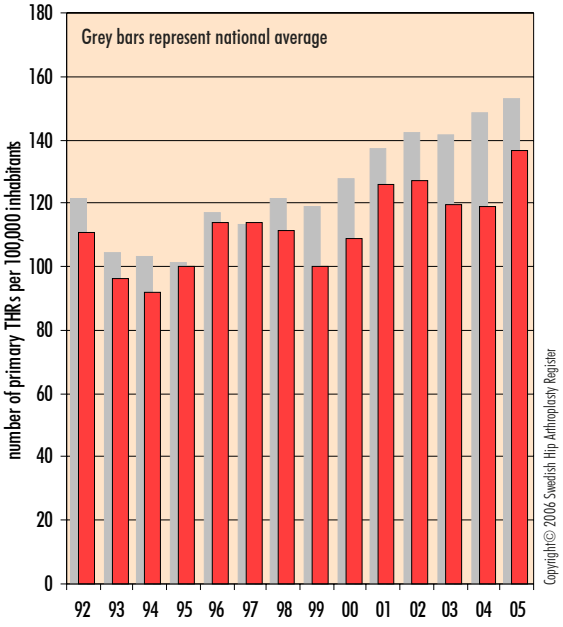
## Number of Primary THRs

per type of fixation, 1979-2005



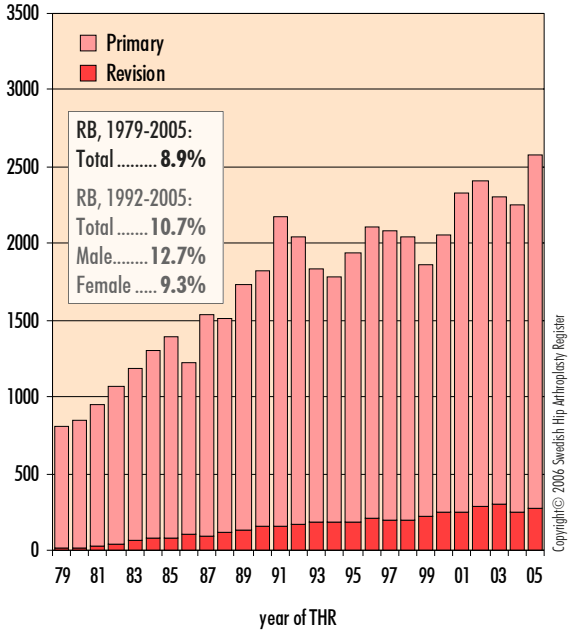

## Frequency of Procedure

all primary THRs included



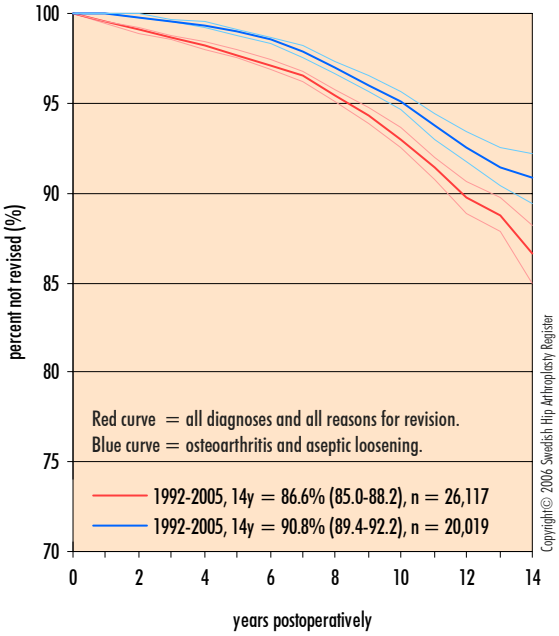
## Number of THRs per Year

42,968 primary THRs, 4,198 revisioner, 1992-2005




## Implant Survival

1992-2005




## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 11,747 | 1,609 | 1,646 | 1,549 | 1,570 | 1,898 | 20,019 | 76.7% |
| Fracture | 1,680 | 323 | 287 | 296 | 242 | 215 | 3,043 | 11.7% |
| Inflammatory arthritis | 792 | 61 | 74 | 65 | 76 | 75 | 1,143 | 4.4% |
| Idiopathic femoral head necrosis | 324 | 39 | 44 | 44 | 50 | 44 | 545 | 2.1% |
| Childhood disease | 303 | 37 | 51 | 33 | 49 | 59 | 532 | 2.0% |
| Secondary osteoarthritis | 269 | 0 | 0 | 0 | 0 | 0 | 269 | 1.0% |
| Tumor | 47 | 14 | 11 | 9 | 12 | 12 | 105 | 0.4% |
| Secondary arthritis after trauma | 27 | 0 | 2 | 6 | 6 | 2 | 43 | 0.2% |
| (missing) | 418 | 0 | 0 | 0 | 0 | 0 | 418 | 1.6% |
| Total | 15,607 | 2,083 | 2,115 | 2,002 | 2,005 | 2,305 | 26,117 | 100% |



## Mean Age per Gender and Year

| Gender | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|
| Male | 67.7 | 67.3 | 67.2 | 68.1 | 66.9 | 66.2 | 67.5 |
| Female | 70.0 | 70.8 | 70.4 | 70.2 | 69.6 | 69.2 | 70.0 |
| Total | 69.1 | 69.4 | 69.1 | 69.4 | 68.5 | 68.0 | 69.0 |

# *Region: Uppsala-Örebro*

## 15 Most Common Implants

most used during the past 10 years

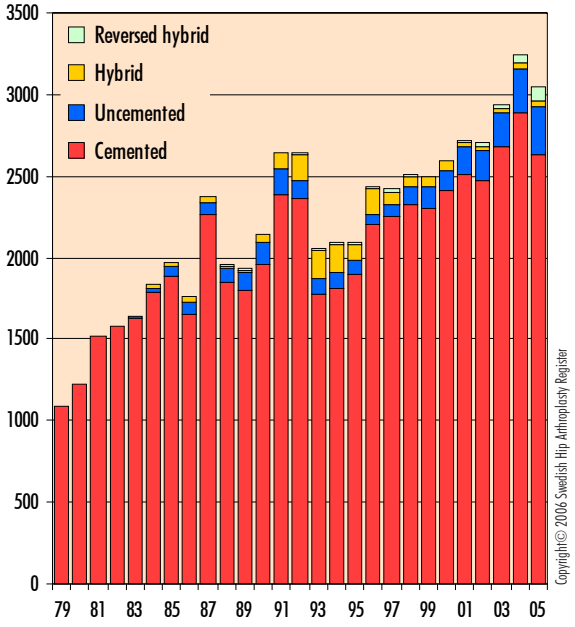
| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-poly (Lubinus SP II) | 5,185 | 681 | 764 | 1,034 | 1,139 | 1,058 | 9,861 | 28.4% |
| Charnley (Charnley) | 14,862 | 583 | 287 | 122 | 7 | 1 | 15,862 | 14.4% |
| Exeter Duration (Exeter Polished) | 567 | 335 | 304 | 212 | 161 | 155 | 1,734 | 6.4% |
| FAL (Lubinus SP II) | 0 | 23 | 295 | 451 | 473 | 413 | 1,655 | 6.1% |
| Contemporary Hooded Duration (Exeter Polished) | 0 | 9 | 177 | 271 | 288 | 209 | 954 | 3.5% |
| Cenator (Cenator) | 1,152 | 0 | 0 | 0 | 0 | 0 | 1,152 | 3.2% |
| Exeter All-poly (Exeter Polished) | 1,316 | 5 | 3 | 0 | 0 | 0 | 1,324 | 3.1% |
| Müller All-poly (Müller Straight) | 3,959 | 72 | 61 | 60 | 77 | 75 | 4,304 | 2.9% |
| Reflection (Spectron EF Primary) | 201 | 85 | 103 | 120 | 154 | 101 | 764 | 2.8% |
| Charnley Elite (Exeter Polished) | 31 | 34 | 80 | 110 | 201 | 214 | 670 | 2.5% |
| Cenator (Exeter Polished) | 462 | 194 | 3 | 1 | 0 | 0 | 660 | 2.4% |
| Exeter Duration (Lubinus SP II) | 99 | 45 | 70 | 110 | 113 | 119 | 556 | 2.0% |
| Charnley Elite (Charnley Elite Plus) | 448 | 94 | 9 | 0 | 0 | 0 | 551 | 2.0% |
| Stanmore (Stanmore modular) | 71 | 212 | 186 | 18 | 0 | 0 | 487 | 1.8% |
| Charnley (Exeter Polished) | 424 | 14 | 22 | 46 | 103 | 142 | 751 | 1.6% |
| Others (total 323) | 16,320 | 329 | 343 | 390 | 533 | 560 | 18,475 | |
| Total | 45,097 | 2,715 | 2,707 | 2,945 | 3,249 | 3,047 | 59,760 | |



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

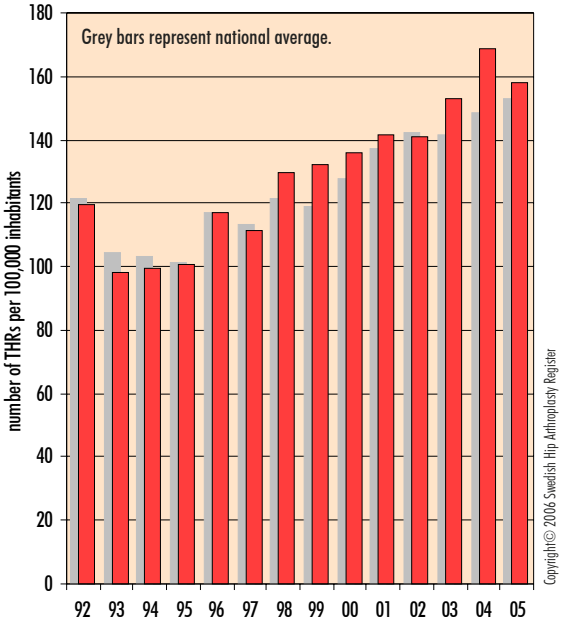
## Number of Primary THRs

per type of fixation, 1979-2005



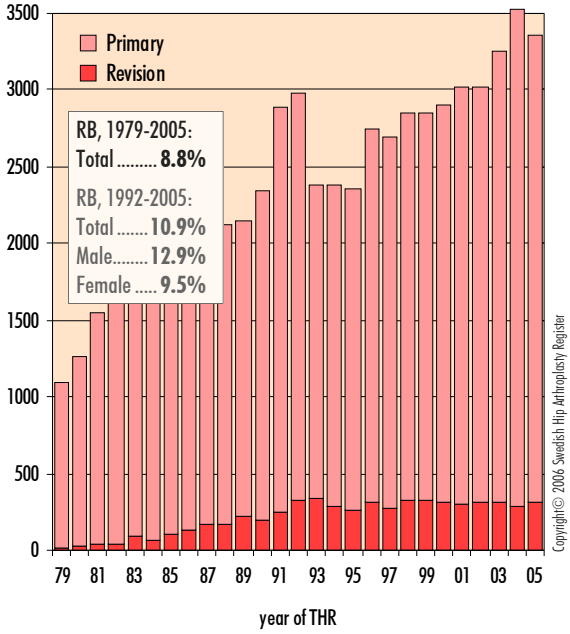

## Frequency of Procedure

all primary THRs included



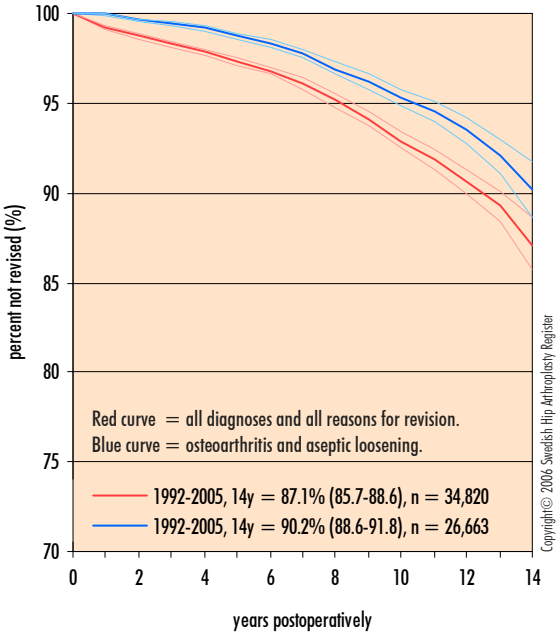
## Number of THRs per Year

59,760 primary THRs, 5,769 revisions, 1979-2005




## Implant Survival

1992-2005




## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 15,092 | 2,073 | 2,127 | 2,303 | 2,607 | 2,461 | 26,663 | 76.6% |
| Fracture | 2,272 | 373 | 335 | 370 | 337 | 328 | 4,015 | 11.5% |
| Inflammatory arthritis | 1,183 | 117 | 99 | 100 | 95 | 84 | 1,678 | 4.8% |
| Idiopathic femoral head necrosis | 647 | 91 | 78 | 83 | 92 | 84 | 1,075 | 3.1% |
| Childhood disease | 338 | 45 | 49 | 69 | 101 | 66 | 668 | 1.9% |
| Secondary osteoarthritis | 193 | 0 | 0 | 0 | 0 | 0 | 193 | 0.6% |
| Tumor | 83 | 12 | 16 | 13 | 14 | 21 | 159 | 0.5% |
| Secondary arthritis after trauma | 53 | 4 | 3 | 7 | 3 | 3 | 73 | 0.2% |
| (missing) | 296 | 0 | 0 | 0 | 0 | 0 | 296 | 0.9% |
| Total | 20,157 | 2,715 | 2,707 | 2,945 | 3,249 | 3,047 | 34,820 | 100% |



## Mean Age per Gender and Year

| Gender | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|
| Male | 68.0 | 67.3 | 67.6 | 68.0 | 66.9 | 67.5 | 67.8 |
| Female | 70.4 | 70.8 | 70.8 | 70.3 | 70.0 | 70.5 | 70.4 |
| Total | 69.4 | 69.4 | 69.5 | 69.4 | 68.7 | 69.3 | 69.3 |

# *Region: North*

## 15 Most Common Implants

most used during the past 10 years

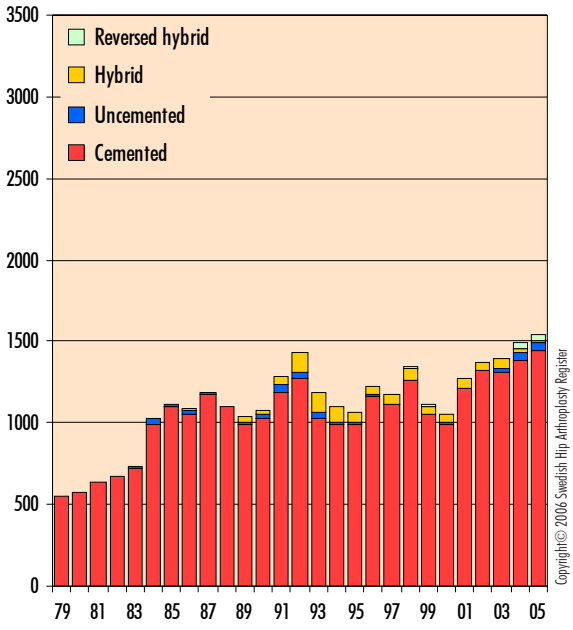
| Cup (Stem) | 1979-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share [1)] |
|---|---|---|---|---|---|---|---|---|
| Lubinus All-poly (Lubinus SP II) | 8,952 | 869 | 974 | 1,062 | 1,190 | 1,218 | 14,265 | 67.8% |
| Exeter Duration (Exeter Polished) | 385 | 249 | 196 | 225 | 187 | 228 | 1,470 | 11.3% |
| Exeter Plast (Exeter Polished) | 1,123 | 8 | 4 | 2 | 0 | 0 | 1,137 | 5.7% |
| Scan Hip Cup (Optima) | 422 | 1 | 0 | 0 | 0 | 0 | 423 | 2.2% |
| Charnley (Charnley) | 2,430 | 1 | 1 | 1 | 0 | 0 | 2,433 | 2.0% |
| Reflection (Spectron EF Primary) | 210 | 2 | 0 | 0 | 0 | 0 | 212 | 1.6% |
| FAL (Lubinus SP II) | 2 | 41 | 140 | 20 | 6 | 1 | 210 | 1.6% |
| Trilogy HA (Lubinus SP II) | 24 | 33 | 53 | 61 | 30 | 5 | 206 | 1.6% |
| Reflection HA (Spectron EF Primary) | 98 | 0 | 0 | 0 | 0 | 0 | 98 | 0.8% |
| Reflection HA (Lubinus SP II) | 82 | 0 | 0 | 0 | 0 | 0 | 82 | 0.5% |
| Scan Hip Cup (Scan Hip Collar) | 765 | 0 | 0 | 0 | 0 | 0 | 765 | 0.5% |
| Exeter Duration (Omnifit) | 5 | 3 | 0 | 0 | 16 | 10 | 34 | 0.3% |
| Trilogy HA (Omnifit) | 0 | 0 | 0 | 0 | 17 | 8 | 25 | 0.2% |
| Spectron (Spectron EF Primary) | 21 | 0 | 0 | 0 | 0 | 0 | 21 | 0.2% |
| OPTICUP (Scan Hip II Collar) | 3 | 18 | 0 | 0 | 0 | 0 | 21 | 0.2% |
| Others (total 171) | 8,389 | 51 | 8 | 30 | 51 | 77 | 8,606 | |
| Total | 22,911 | 1,276 | 1,376 | 1,401 | 1,497 | 1,547 | 30,008 | |



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

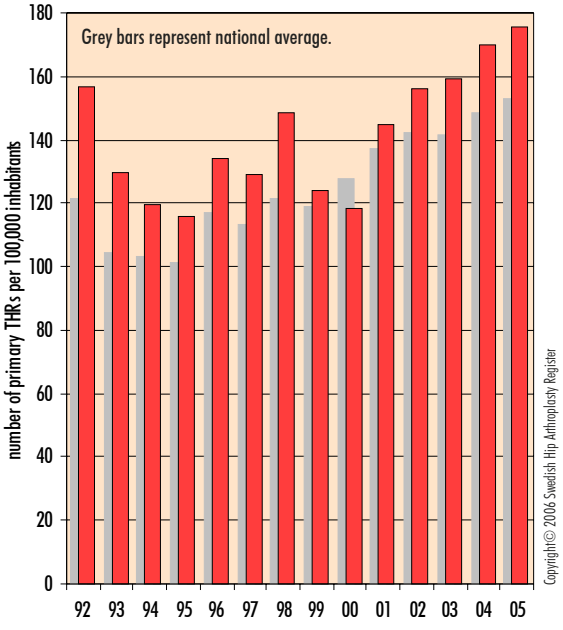
## Number of Primary THRs

per type of fixation, 1979-2005



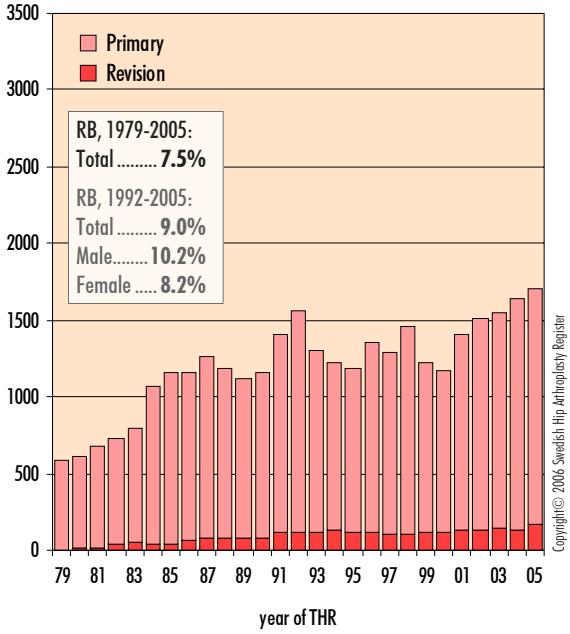

## Frequency of Procedure

all primary THRs included



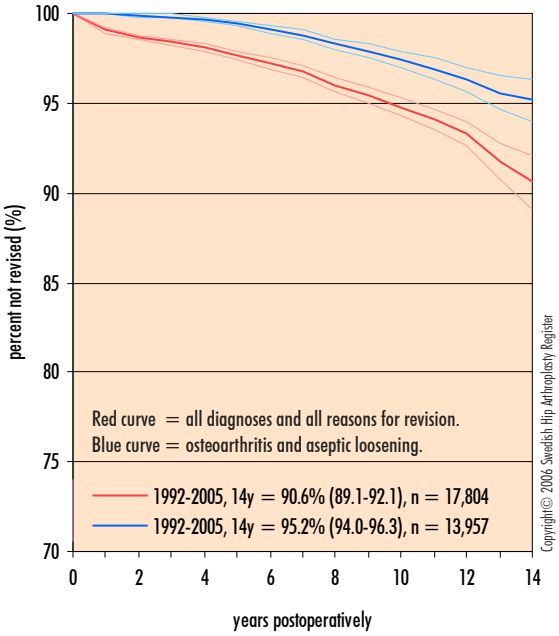
## Number of THRs per Year

30,008 primary THRs, 2,450 revisions, 1979-2005




## Implant Survival

1992-2005




## Number of Primary THRs per Diagnosis and Year

| Diagnosis | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total | Share |
|---|---|---|---|---|---|---|---|---|
| Primary osteoarthritis | 8,008 | 1,031 | 1,161 | 1,188 | 1,229 | 1,340 | 13,957 | 78.4% |
| Fracture | 916 | 136 | 118 | 114 | 149 | 103 | 1,536 | 8.6% |
| Inflammatory arthritis | 574 | 31 | 37 | 32 | 34 | 31 | 739 | 4.2% |
| Idiopathic femoral head necrosis | 345 | 47 | 27 | 30 | 30 | 37 | 516 | 2.9% |
| Childhood disease | 129 | 23 | 26 | 32 | 45 | 27 | 282 | 1.6% |
| Secondary osteoarthritis | 267 | 0 | 0 | 0 | 0 | 0 | 267 | 1.5% |
| Secondary osteoarthritis after trauma | 88 | 1 | 0 | 0 | 1 | 0 | 90 | 0.5% |
| Tumor | 26 | 7 | 7 | 5 | 9 | 9 | 63 | 0.4% |
| (missing) | 354 | 0 | 0 | 0 | 0 | 0 | 354 | 2.0% |
| Total | 10,707 | 1,276 | 1,376 | 1,401 | 1,497 | 1,547 | 17,804 | 100% |



## Mean Age per Gender and Year

| Gender | 1992-2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|---|---|---|---|---|---|---|---|
| Male | 67.9 | 68.4 | 67.5 | 67.2 | 67.3 | 67.5 | 67.8 |
| Female | 70.0 | 69.7 | 69.7 | 69.4 | 68.9 | 69.0 | 69.7 |
| Total | 69.2 | 69.2 | 68.7 | 68.5 | 68.3 | 68.4 | 69.0 |

# National quality indicators

## Background

The Swedish government has assigned the following briefs:

- In consultation with the SALAR, the National Board of Health and Welfare is to formulate national quality indicators which will be able to reflect different aspects of quality within health and medical care. These indicators must be clearly defined, reliable, measurable, accepted and possible to register continuously in management systems such as registers and other sources of data.
- Principals are to run systematic quality programmes and present their results in an open, comparable and accessible manner.
- All care providers are to use nationally established quality indicators when following up their activities and must openly present results, quality and costs as part of ongoing improvement programmes.
- Mission: "Open comparisons in 2006 of health service quality and efficiency" is to be reported no later than 30 June 2006.

## Implementation

Within the medical areas in which national quality registers have already been established, the National Board of Health and Welfare and the SALAR, in collaboration with the registers, have produced satisfactory indicators, starting in the autumn of 2005. One of the basic prerequisites was that these indicators were to be openly reported. To begin with, a request was also made for indicators for each county council/region to make it possible to present the same indicators at hospital level in the future.

Following discussions with the register management, the following indicators have been selected for THR surgery:

- **Ten-year survival of implants according to traditional Kaplan-Meier statistics.** The definition of failure is the replacement of one or both components or the definitive removal of the implant. All primary diagnoses and all reasons for revisions are included. The results relate to the period 1995 up to and including 2005. This variable must be regarded as "slow", but in the long term it is the most important quality indicator.
- **Short-term complications**, i.e. re-operations (of all kinds) within two years following the primary operation. These complications are to be reported for the last four years. The follow-up period is short and primarily reflects early and serious post-operative complications such as deep infection and revision due to recurring dislocations. This variable should be regarded as a "fast" quality indicator. It should be noted that this report relates to complications that are dealt with surgically (see the section on short-term complications).
- **EQ-5D index – benefits one year after surgery**, i.e. the prospective value seen in the EQ-5D index in the follow-up routine. The government assignment stipulates "that indicators that reflect patient-perceived quality should be included". This patient-related outcome with health benefits (value produced by the EQ-5D index) is an important variable for this patient group which undergo surgery with poor quality of life as the indication for surgery. This variable should also be regarded as a "fast" quality indicator.

## Results

When interpreting these results, it is important to take account of the confidence intervals, which are clearly shown in the figure. If the confidence intervals overlap one another, it is obvious that there is no statistically confirmed difference between the stated valued for implant survival. It is, however, important to take account of the percentage of patients with primary osteoarthritis and the percentage of patients in the specified age interval (case-mix).

**Ten-year survival.** Four county councils/regions have statistically lower 10-year survival than the national average, while seven have better 10-year survival. The county council in the County of Uppsala is totally dominated by activity at Akademiska Hospital. This hospital is largely a regional hospital for northern Sweden and operates on a large number of "risk patients", which can be clearly seen in the table, where it has the lowest percentage of patients with primary osteoarthritis and also the smallest number of patients in the specified standard age interval. Real differences in quality may nonetheless exist and each county council/region should naturally analyse its results in order to initiate an improvement programme. Good explanations will be required from all the representatives of county councils/regions that put in the poorest performances.

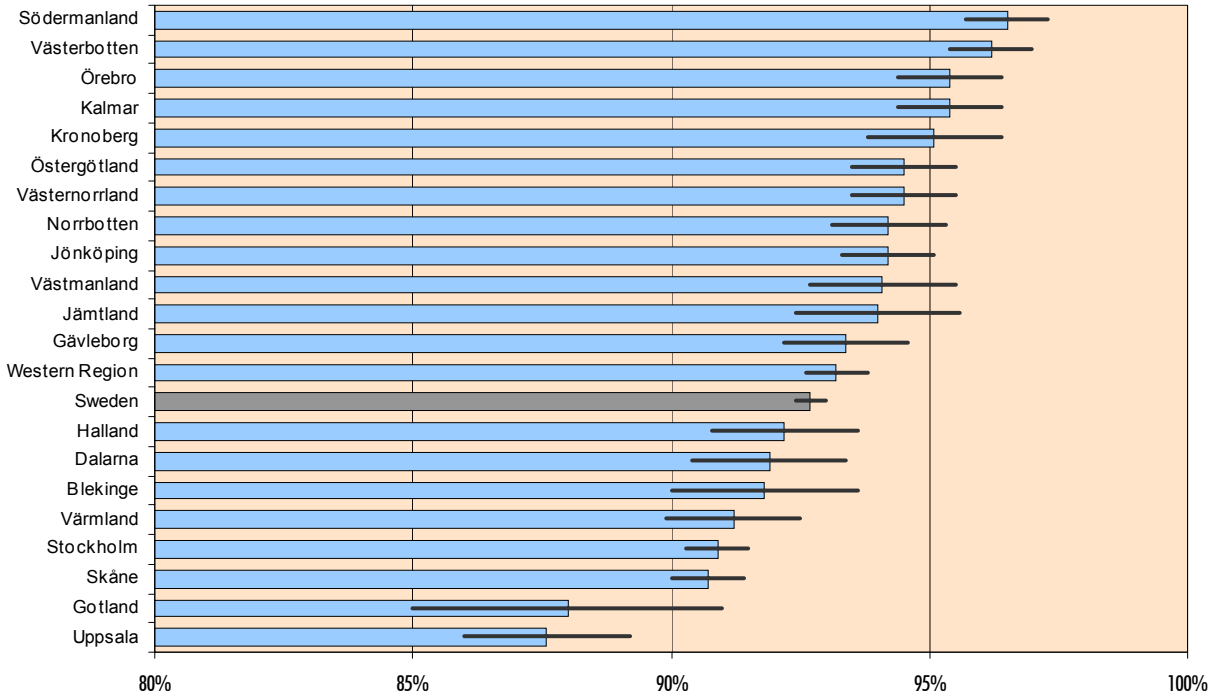
**Short-term complications**. As has already been stated, the number of complications is low and should be evaluated with care. This quality indicator can really only be assessed over time; i.e. if clear trends can be seen. If so, an in-depth analysis should be initiated to enable a programme of continuous improvement with a review of routines, surgical techniques and possible implant selection.

**EQ-5D index benefits**. As this part of the register is still in its introductory phase, any attempt at satisfactory comparisons will fail. It is, however, very important that it is reported in order to support the actual introduction. The patient-related outcome, comprising satisfaction, pain relief and health benefits (value produced by the EQ-5D index), is an important variable for this patient group, which undergo surgery with pain and poor quality of life as the specific indication for surgery. If all the producing units participate, we shall have access both to a "fast" quality indicator and to future opportunities to conduct comparative health-economy analyses in which we can calculate the cost effectiveness of the participating units. Being able to calculate the QALY cost for all clinics could provide an interesting future national quality indicator. This could have a decisive impact on the necessary work of prioritisation and allocation.

In order to enhance the quality of reports from the register and thereby improve the values, more resources for both the register and the individual clinics are, however, needed.

## Implant Survival after 10 Years per County Council

1992-2005

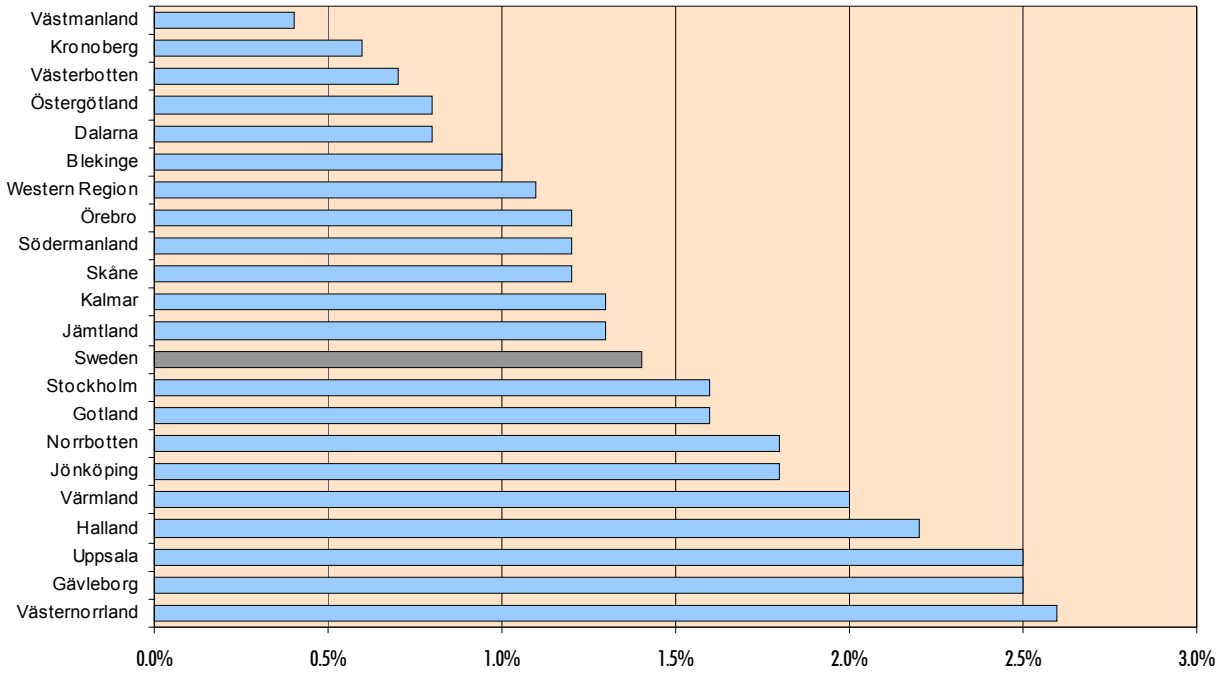



| | Number THRs | OA [1] | 60-75 years [2] | 10-year survival | CI |
|---|---|---|---|---|---|
| Södermanland | 5,093 | 75.6% | 52.0% | 96.5% | ±0.8% |
| Västerbotten | 5,090 | 76.1% | 53.4% | 96.2% | ±0.8% |
| Örebro | 5,220 | 78.3% | 51.1% | 95.4% | ±1.0% |
| Kalmar | 5,157 | 73.2% | 50.8% | 95.4% | ±1.0% |
| Kronoberg | 2,882 | 85.3% | 53.9% | 95.1% | ±1.3% |
| Östergötland | 7,503 | 70.7% | 47.3% | 94.5% | ±1.0% |
| Västernorrland | 5,342 | 83.2% | 53.6% | 94.5% | ±1.0% |
| Norrbotten | 5,274 | 74.6% | 53.2% | 94.2% | ±1.1% |
| Jönköping | 6,062 | 82.6% | 52.6% | 94.2% | ±0.9% |
| Västmanland | 3,843 | 80.8% | 55.0% | 94.1% | ±1.4% |
| Jämtland | 2,098 | 81.0% | 52.9% | 94.0% | ±1.6% |
| Gävleborg | 5,801 | 75.1% | 52.4% | 93.4% | ±1.2% |
| Western Region | 23,780 | 75.9% | 50.5% | 93.2% | ±0.6% |
| Sweden | 155,609 | 76.3% | 50.4% | 92.7% | ±0.3% |
| Halland | 4,738 | 75.2% | 50.2% | 92.2% | ±1.4% |
| Dalarna | 4,425 | 84.0% | 53.4% | 91.9% | ±1.5% |
| Blekinge | 2,477 | 81.7% | 48.7% | 91.8% | ±1.8% |
| Värmland | 5,118 | 78.4% | 54.4% | 91.2% | ±1.3% |
| Stockholm | 28,235 | 75.7% | 47.6% | 90.9% | ±0.6% |
| Skåne | 21,027 | 74.6% | 49.3% | 90.7% | ±0.7% |
| Gotland | 1,053 | 82.2% | 53.6% | 88.0% | ±3.0% |
| Uppsala | 5,320 | 66.4% | 45.3% | 87.6% | ±1.6% |

*[1] Percentage of primary THRs performed due to primary osteoarthritis.*
*[2] Percentage of primary THRs in the age-group 60-75 years (age at primary operation).*

## Reoperation within 2 Years per County Council

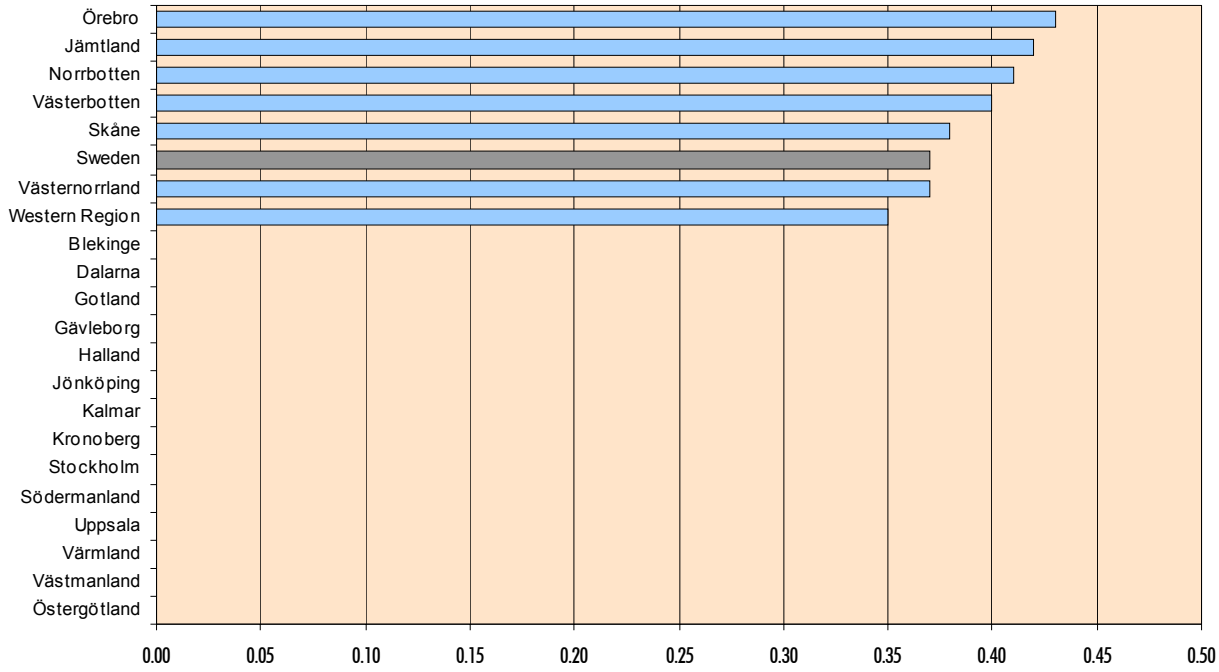
2002-2005




| | Primary THRs | — Total— | | — Infection — | | — Dislocation — | | — Loosening — | | — Others — | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Number | % | Number | % | Number | % | Number | % | Number | % |
| Västmanland | 1,268 | 5 | 0.4% | 0 | 0.0% | 4 | 0.3% | 0 | 0.0% | 2 | 0.2% |
| Kronoberg | 863 | 5 | 0.6% | 0 | 0.0% | 2 | 0.2% | 1 | 0.1% | 2 | 0.2% |
| Västerbotten | 1,684 | 12 | 0.7% | 2 | 0.1% | 5 | 0.3% | 2 | 0.1% | 7 | 0.4% |
| Östergötland | 2,428 | 20 | 0.8% | 4 | 0.2% | 12 | 0.5% | 1 | 0.0% | 4 | 0.2% |
| Dalarna | 1,558 | 13 | 0.8% | 3 | 0.2% | 6 | 0.4% | 2 | 0.1% | 2 | 0.1% |
| Blekinge | 819 | 8 | 1.0% | 0 | 0.0% | 5 | 0.6% | 2 | 0.2% | 1 | 0.1% |
| Western Region | 7,669 | 85 | 1.1% | 26 | 0.3% | 37 | 0.5% | 7 | 0.1% | 31 | 0.4% |
| Örebro | 1,776 | 21 | 1.2% | 8 | 0.5% | 8 | 0.5% | 1 | 0.1% | 8 | 0.5% |
| Södermanland | 1,631 | 20 | 1.2% | 6 | 0.4% | 7 | 0.4% | 4 | 0.2% | 11 | 0.7% |
| Skåne | 7,169 | 88 | 1.2% | 25 | 0.3% | 34 | 0.5% | 10 | 0.1% | 36 | 0.5% |
| Kalmar | 1,844 | 24 | 1.3% | 13 | 0.7% | 11 | 0.6% | 0 | 0.0% | 6 | 0.3% |
| Jämtland | 681 | 9 | 1.3% | 2 | 0.3% | 3 | 0.4% | 0 | 0.0% | 4 | 0.6% |
| Sweden | 52,623 | 763 | 1.4% | 259 | 0.5% | 313 | 0.6% | 69 | 0.1% | 266 | 0.5% |
| Stockholm | 10,264 | 169 | 1.6% | 51 | 0.5% | 70 | 0.7% | 25 | 0.2% | 62 | 0.6% |
| Gotland | 254 | 4 | 1.6% | 0 | 0.0% | 1 | 0.4% | 1 | 0.4% | 2 | 0.8% |
| Norrbotten | 1,697 | 30 | 1.8% | 17 | 1.0% | 9 | 0.5% | 1 | 0.1% | 9 | 0.5% |
| Jönköping | 1,905 | 34 | 1.8% | 7 | 0.4% | 19 | 1.0% | 1 | 0.1% | 13 | 0.7% |
| Värmland | 1,482 | 29 | 2.0% | 20 | 1.3% | 6 | 0.4% | 2 | 0.1% | 10 | 0.7% |
| Halland | 1,575 | 34 | 2.2% | 24 | 1.5% | 7 | 0.4% | 1 | 0.1% | 11 | 0.7% |
| Uppsala | 2,041 | 51 | 2.5% | 22 | 1.1% | 15 | 0.7% | 4 | 0.2% | 18 | 0.9% |
| Gävleborg | 2,192 | 54 | 2.5% | 13 | 0.6% | 28 | 1.3% | 3 | 0.1% | 13 | 0.6% |
| Västernorrland | 1,759 | 46 | 2.6% | 15 | 0.9% | 23 | 1.3% | 1 | 0.1% | 13 | 0.7% |

## Patient-related Outcome per County Council

2002-2005




| | Share of C-pat. preop. | EQ-5D index preop. | EQ-5D index 1 year | EQ-5D index gained | Comments |
|---|---|---|---|---|---|
| Örebro | 34% | 0.46 | 0.89 | 0.43 | Karlskoga has not joined yet. |
| Jämtland | 31% | 0.35 | 0.77 | 0.42 | |
| Norrbotten | 45% | 0.33 | 0.74 | 0.41 | |
| Västerbotten | 46% | 0.36 | 0.76 | 0.40 | |
| Skåne | 42% | 0.37 | 0.75 | 0.38 | Hässleholm and Helsingborg have not joined yet. |
| Sweden | 43% | 0.38 | 0.75 | 0.37 | |
| Västernorrland | 43% | 0.40 | 0.77 | 0.37 | |
| Western Region | 43% | 0.39 | 0.74 | 0.35 | The Western Region joined Jan. 1, 2002. |
| Blekinge | 42% | 0.35 | | | Joined Sep. 1, 2005 - no 1-year results. |
| Dalarna | | | | | Not joined yet. |
| Gotland | | | | | Not joined yet. |
| Gävleborg | 55% | 0.48 | | | No 1-year results. |
| Halland | 52% | 0.42 | | | Joined Jan. 1, 2005 - no 1-year results. |
| Jönköping | 38% | 0.41 | | | Joined Jan. 1, 2005 - no 1-year results. |
| Kalmar | | | | | Joined Jan. 1, 2006 - no results 2005. |
| Kronoberg | 37% | 0.39 | | | Joined Sep. 1, 2005 - no 1-year results. |
| Stockholm | 45% | 0.37 | | | Only Danderyd and SöS joined 2005 - no 1-year results. |
| Södermanland | 46% | 0.31 | | | Eskilstuna and Katrineholm joined in May 2005, Nyköping has not joined yet - no 1-year results. |
| Uppsala | | | | | Will join Sep. 1, 2006. |
| Värmland | | | | | Not joined yet. |
| Västmanland | 36% | 0.33 | | | Joined Jan. 1, 2005 - no 1-year results. |
| Östergötland | | | | | Not joined yet. |

# *Summary*

This year we are changing our name to the Swedish Hip Arthroplasty Register in order clearly to indicate what the register contains. This has been shown to be of major importance not only to the general public but also to our principals.

There is no question that the Register plays a vital role when it comes to enabling the continuous development and improvement of Swedish THR surgery. Sweden's low revision burden in international comparisons is an effect of decades of continuously registering and evaluating the effectiveness of the procedure and any deviations from the expected result. We can now see the effects of this in the form of a reduced frequency of re-operations for the patient group as a whole, with a reduced load on the health service. This is extremely important, not least from a socio-economic angle.

It is important that the restructuring that is currently taking place within orthopaedics, with an increasing concentration on rural hospitals and private players, does not destroy the feedback and learning environment that has been built up by Swedish orthopaedics over a period of decades. The conditions for continuous training, development and feedback and the systematic, gradual introduction of new prosthesis technology must be available. If they are not, the quality of health care will be jeopardised and the costs of the increasing number of re-operations will skyrocket.

## *Clinical improvement programmes*

One important effect that the register has achieved is that the number of implants used for routine interventions has decreased. In this year's report, we find that this trend is continuing. For many years, however, the Register has stressed that it is not only the inherent characteristics of the implant but also the surgical procedures as a whole that have an impact on the result. This means that it is not simply the implant per se but also the surgeon's experience and ability to handle the specific implant and any cementing technique during the operation that have a decisive impact. During the period of almost four decades in which hip implants have been used on an increasing scale, improvements to the surgical technique, with the emphasis on cementing, have been the most significant advance when it comes to improving the end result. This is well documented in previous register reports.

The development of implant technology has not been meaningless, however. There are important differences between different implant designs and they have been documented over the years. In recent years, we have also been able to demonstrate that different implants have different complication profiles when it comes to the risk of periprosthetic fracture. In this year's report, we also find that there are differences in the reasons for re-operation between the three most frequently used cemented stems.

Another new feature this year is that, for the first time, we have been able to evaluate the effect of small design changes related to stem shape. This means that the final design of the implant after the completion of surgery does have an impact on the result.

The reasons for these differences, in which the surface treatment of the stem appears to play a part, are not known in full. We do, however, know, not least as a result of radiostereometry studies, that, regardless of the implant that is used, it is to be expected that a large part of the stems move in one way or another in relation to the cement mantle. Depending on the design and surface treatment of the stem, this will have varying effects on implant survival. In this year's report, we have only studied three different designs and with a relatively short follow-up. As we are aware of the problem, there is good reason to conduct further analyses in the future, even when it comes to uncemented implants.

In recent years, we have seen a clear-cut trend towards a national change in the way implants are fixed in place. There is a slow increase in the number of uncemented implants and, at the same time, the number of hybrid prostheses is declining, while the reverse fixation method, with a cemented cup and uncemented stem, is increasing. The background to this trend is the increasing improvement in the documentation of uncemented stems and more or less pronounced problems associated with osteolysis around joint sockets. As time passes, the follow-up of certain types of uncemented stem is increasing and it is now relatively well established that certain uncemented stems function very well.

When it comes to the acetabulum, the situation is still uncertain. The introduction of new joint surfaces, such as high-molecular plastic, ceramic and perhaps even metal, has the potential to improve the situation, but this is as yet uncertain. Some studies indicate that uncemented cups influence pelvic loading in an unfavourable manner and thereby accelerate and perhaps even induce the formation of periprosthetic osteolysis. The introduction of new uncemented cups with a relatively elastic or thin metal shell has the potential to impact this scenario, something that should be the subject of future studies.

To summarise, the transition from cemented to uncemented technology is progressing very slowly in Sweden, which is pleasing. The excellent results for fully cemented fixation continue and there is every reason to continue selecting cemented fixation for the standard patient for many years to come.

## *Achievement of goals*

This year's register report is characterised by increased openness when it comes to the individual clinics' results.

This increase in openness is in keeping with the times and we hope that it will benefit our patients, the profession and the organisation of principals purchasing these interventions. The ongoing feedback of results is probably one of the best driving forces when it comes to continuous improvements. It is, however, essential that obvious differences between different clinics are analysed to identify the causes. In last year's report, we launched a new index which reflects the patient composition at the individual clinic, which has a decisive effect on the result. In recent decades, a large amount of convincing evidence indicating that the results vary within large intervals, depending on the individual patient's situation, has been gathered. We have developed a so-called case-mix index to describe this phenomenon. We would like to point out that this work has only just begun and will continue in the years to come. It is to be hoped that this index will be continuously improved. As far as the organisation of principals is concerned, the ultimate result of the case-mix index will be that it will not be possible to determine whether there are any real differences in the results between different clinics until the type of patients who have undergone surgery is known. At the present time, we know that university hospitals/regional hospitals and some central hospitals operate on the patients who require the greatest surgical skill and who also suffer more complications. At the same time, extremely meticulous selection takes place at some rural hospitals to ensure that all the patients who are expected to run a higher risk of complications or to require longer post-operative care periods are systematically referred back to regional or central hospitals. In this year's report, we note not only these differences but also a relatively large variation in patient composition between clinics of the same type.

## *Problem areas*

One important observation in one of our in-depth analyses is that patients who undergo an initial re-operation represent a highly specific risk group. This has not previously been so well known. The message is clear, however. Patients who are forced to undergo an early re-operation constitute a risk group in which the actual re-operation has only a limited ability definitively to solve the patient's problem. Even if this observation requires additional studies, it is already very important from a health-care strategy angle and means that at least some of these patients should be operated on at centres with large-scale experience of revision surgery.

For many years, the National Hip Arthroplasty Register was criticised for focusing exclusively on re-operations. The lack of knowledge about patients' perceived experience of the intervention and the occurrence of possible serious radiological complications which have not as yet been dealt with represent important information which is necessary for a satisfactory assessment of the quality of interventions. The follow-up model has addressed this problem in pioneering fashion. Its impact on the orthopaedic profession has been impressive, but its coverage is still not nationwide. As has been pointed out in this report, it is essential that every clinic joins the system. In the current competitive situation, it should be the obvious choice for the largest purchasers of free health care, and not least the private clinics, to join the follow-up routine in order to underline their wish to move towards high-quality health care. Participation in the register and the follow-up routine should be the most optimal proof of quality a hip replacement clinic can present. As has already been pointed out, this participation is a prerequisite for continuous improvement.

## *Current trends*

The creation of the follow-up routine has had several other important effects. It has enabled a pilot study in the Western Region to calculate cost effectiveness – a concept that is going to be increasingly important and a prerequisite for satisfactory prioritisation in the health care of the future.

The registration of early complications in the Register and follow-up activities are also two ideal instruments for measuring changes in Sweden's health care organisation at an early stage and as effectively as possible. The ongoing structural change in orthopaedics and the transfer of hip replacement activities have the potential to have both a positive and a negative effect on results.

In future annual reports, we are planning continuously to improve registration and reporting based on the development of the follow-up routine and in-depth analyses. In the longer term, we hope that the extended registration of patient data based on the uniform information structure the IFK project may produce will further improve the final analysis. We also hope to be able to extend our collaboration with other registers in areas in which this could be justified in order to create a wider platform for our studies.

Over the past few years, the cost of running the Register has slowly increased. The Dagmar funding that has been allocated currently covers only about 40% of the annual total cost. For several years, the "deficit" has been covered by external funding, such as ALF funding and research funds. The potential for this kind of external financing has decreased sharply during the past two years. The Register has not wished to negotiate for "industrial sponsorship" in order to continue operating as a totally independent quality observer. Decision-makers at county councils must act quickly to avoid a financial crisis at quality registers. Full public funding of these activities should be a natural development in view of the fact that the National Hip Arthroplasty Register has helped to give Sweden one of the world's lowest re-operation frequencies, thereby saving the Swedish health service at least SEK 1 billion during the last 10 years.

# Publications

## Scientific Articles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## *Book Chapters*

The Well Cemented Total Hip Arthroplasty in Theory and Practice. Editors Steffen Breusch & Henrik Malchau. Springer Verlag, Berlin, 2005.

2.1 Operative Steps: Acetabulum, page 16-27.
Steffen J. Breusch, Henrik Malchau, John Older

2.2 Operative Steps: Femur, page 28-36.
Steffen J. Breusch, Henrik Malchau

6.1 Optimal Cementing Technique – The Evidence: What Is Modern Cementing Technique?, page 146-149.
Henrik Malchau, Steffen J. Breusch

7.3 Migration Pattern and Outcome of Cemented Stems in Sweden, page 190-195.
Jeffrey Geller, Henrik Malchau, Johan Kärrholm

11 The Evidence from the Swedish Hip Register, page 291-299.
Henrik Malchau, Göran Garellick, Peter Herberts

19 Economic Evaluation of THA, page 360-366.
Marieke Ostendorf, Henrik Malchau

20 The Future Role of Cemented Total Hip Arthroplasty, page 367-369.
Henrik Malchau, Steffen J. Breusch

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