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THE NATIONAL REGISTER OF JOINT REPLACEMENTS OF THE CZECH REPUBLIC

Hip Joint Replacements
Selected Outputs and Their Analysis for the Period 2003–2012

P. VAVŘÍK, I. LANDOR, S. POPELKA, R. FIALKA, J. HACH

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The National Register of Joint Replacements of the Czech Republic

Hip Joint Replacements
Selected Outputs and Their Analysis for the Period 2003–2012

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SUMMARY

The National Register of Joint Replacements of the Czech Republic was established as part of the National Health Information System in 2002. The register's administrator is the Institute of Health Information and Statistics of the Czech Republic, the Czech Society for Orthopaedics and Traumatology acts as its guarantor of scientific quality. The register is financed from governmental sources. It was launched into full operation in 2003 and it currently focuses on hip joint replacements. Register of knee and shoulder joint replacements is in the process of preparation.

The register provides aggregate epidemiological data and other statistics, including the Revision Rate (RR) and curves of cumulative survival probability (Kaplan-Meier) for the main monitored groups of patients and implants used.

In years 2003–2012 there were 101,734 primary implantations and 13,459 revision surgeries registered. In terms of gender distribution there is a predominance of females amounting to 59.4% in primary implantations and to 63.49% in revision surgeries. The age structure covers the entire range of adult population; however, more than 50% of the replacements are being implanted between 60–74 years of age. Most frequent indications for primary implantation are primary coxarthrosis (69.85%), post-fracture conditions (13.41%) and post-dysplasia arthritis (8.73%). The most frequent indications for revision surgery are aseptic loosening of acetabular component (38.15%), aseptic loosening of femoral component (22.01%) and recurrent dislocation (6.5%).

45,450 (44.68%) of primary implantations were cemented, 36,477 (35.86%) uncemented, 16,559 (16.28%) hybrid with cemented femur and 656 (0.64%) hybrid with cemented acetabulum. There were also records of 2,592 cervicocapital prostheses (2.55%). Most commonly used is the classic anterolateral approach 75.86% in primary implantations and 50.06% in revision surgeries. Mini-invasive approaches in primary implantations did not exceed 3.2% of all cases. Bone grafts were used in 23.89% of primary implantations and 39.55% of revisions.

Most widely used implants in primary implantations were cemented PE cup type Muller (Aesculap) 14,000 pcs, original Czech cemented steel Stem with conical neck 12/14 AK (Beznoska) 13,433 pcs, from uncemented models Plasmacup SC (Aesculap) 9,762 pcs and Stem SL "Zweymüller Alloclassic" (Zimmer) 4,337 pcs. Generally most widely used implants in revision surgeries are uncemented Czech Oval cup MO (Medin) with titanium & hydroxyapatite porous coat 956 pcs and uncemented Stem SL WAGNER, lateralised, cone 12/14 (Zimmer) 712 pcs.

The Revision Rate for primary implants due to infection for period 2003–2012 represented 0.06% at the end of the follow-up as of June 30, 2013. Cumulative survival probability (Kaplan-Meier) in year 11 of the follow-up is 95.69% in cemented implants, 94.55% in uncemented, 92.90% in hybrids with cemented femur and 84.11% in hybrids with cemented cup.

Key words: National Register of Joint Replacements of the Czech Republic, hip revisions, hip arthroplasty survival curve, hip arthroplasty revision rate.

HISTORY AND CURRENT STATUS OF THE NATIONAL REGISTER OF JOINT REPLACEMENTS (NRJR) OF THE CZECH REPUBLIC

First idea about establishing a register of joint replacements sprang up at the end of the nineties of the 20th century and in year 2000 the Board of the Czech Society for Orthopaedics and Traumatology (CSOT) charged Assoc. Prof. Václav Štědrý, MD, CSc. with the guidance of a working group consisting of two more members, Assoc. Prof. Pavel Vavřík, MD, CSc. and Senior Consultant Jiří Kubeš, MD. It was resolved to start first by establishing the register of hip joint replacements as these were at that time by far the most frequent implants, and later, when methodology was managed, extend the register to knee joint replacements and perhaps even other implants.

In 2002, following an agreement reached between the CSOT and the Ministry of Health of the Czech Republic (MH CR), it was resolved that the NRJR CR would be included in the National Health Information System and financed from state resources.

The administrator of the register is the Institute of Health Information and Statistics of the Czech Republic (IHIS CR) and its processor the Coordination Centre for Departmental Health Information Systems (CCDHIS). Through its representatives, the CSOT subsequently acts in the role of a scientific guarantor of the NRJR CR. The register is fully financed from state resources. Operational activities of the register are managed by its nine-member Board, appointed by the MH CR. The Board consists of representatives of the CSOT, the register's administrator – IHIS, its processor CCDHIS and the MH CR. Chairman of the NRJR Board is Prof. Pavel Vavřík, MD, CSc, MBA. Senior Consultant Jan Hach, MD is the administrator of the implant database, consistently maintaining it and constantly updating it with particular care. It is to his great merit that this database has been functional and relevant.

The register officially started operating on September 1, 2002. After a short period of pilot operation, regular operation was launched as of January 1, 2003, aimed at hip joint replacements. First software had been developed to this end, which by and large served the purpose of data insertion, but which turned out very cumbersome in terms of data processing and data mining. The Business Objects program format is still being provisionally used for data insertion, allowing even limited data mining to authorized users at the address: https://snzr.ksrzis.cz/snzr/rkn/.

In 2006, modern data mining software on the principle of a "data block" was launched in a pilot run. It enables quick multilateral processing of large mass of data, operates based on the generally well-known program Microsoft Excel and thus allows the users familiar with the basics of work with pivot table to prepare their respective output formats. Moreover, the data may easily be exported and further processed in Excel or other programs.

The program is currently running on a test server operated by the CCDHIS and is accessible to authorized users, who should participate in verifying its operation. The data block software is processing data that are further entered on-line to the original database by all users involved. The data will be made available to all authorized users once some legal issues associated with data protection in all registers of the MH CR have been successfully resolved. Yet heads of orthopaedic departments participating in the register's activities, or by them delegated physicians, may already apply for authorization with the CCDHIS administrator. Contact to register administratorse-mail: admin.nrkn@ksrzis.cz

A little over 20 orthopaedic departments participated in the operation of the register initially, but their numbers were rapidly increasing, as well as the number of records. By the end of 2013 there were 77 orthopaedic departments contributing to the register and the number of surgeries on record exceeded 130 000. The register's database was interconnected with the Death Register database in 2006, which provided for developing survivorship curves of monitored implants.

All registers governed by the Ministry of Health of the Czech Republic are presently switching to unified operational and organisational platform. Financial problems and complex and lengthy tendering procedure for the contractor of the needed software have so far been impeding data mining from the hip joint register in form of prefabricated outputs, and also preventing the launch of sub-registers of knee, shoulder and elbow replacements, which in professional terms have been ready for several years. Being concurrently prepared at the CCDHIS operated portal are also prefabricated outputs (tables and graphs) of the most important indicators from the NRJR, designated for quick orientation of users who either have no time or zero possibility to formulate the outputs individually. Some of the outputs are meant for the widest layman community and include aggregate nation-wide epidemiological data from the field of endoprosthetics. For professional users we prepare more in-depth, aggregate nation-wide data, furthermore extended to include identically processed outputs from the department of a particular inquirer, thus enabling their fast comparison.

Major problems of the NRJR CR

The fundamental problem of the joint replacement register is that so far it has been only called a register. While in fact it is merely a broadly founded multi-centric study from materials submitted by involved departments. Giving birth to a veritable register worthy of its name is being inhibited by the incompleteness of the two types of entered data.

a) Not all the departments and hospitals performing hip joint replacement contribute to the register, although data gathering for the NRJR is pursuant to the Bulletin of the MH CR No. 6/2002 a mandatory component of health documentation upon total hip joint replacement procedure (THR). Yet, no manner and form of

control or penalties have been determined for contingent default. By comparing data from the register with other published data (IHIS, NRC and other) this fact is easily verifiable.

b) It is clearly evident from data analysis and the summary of the number of contributions, that not all the departments and hospitals involved in the register's activity provide all data for the years of their participation. Causes vary from hospital to hospital.

Therefore, as the first step towards improvement and with consent of the CSOT Board and to begin with, we have published two tables showing the particular numbers of contributions into the register from individual hospitals (Tables 1 and 2). Their purpose is not a "who contributes more" contest, but to provide aggregate data that will allow the department heads an easy control and give the orthopaedic community the opportunity to assess the quality of involvement of a hospital in the register's activities.

Sustained efforts must be exerted to secure funding not for ordinary function of the register but for its further advancement, i.e. the development and installation of a software application enabling the launch of sub-registers of other joint replacements.

Another area requiring incessant attention is the improvement of possibilities and of the quality of mining large mass of already collected data, this to be achieved not only by means of descriptive statistics but through modern analytical statistical procedures that will allow the largest possible objectification of results and will be comprehensible and applicable for the broadest professional community. Here we need to work not only on software development but also organize training for authorized users to work with it. It all calls for organization, time and significant funding.

Absolutely essential is systematic care for quality of entered data and error rate control. We are presently seeking mechanisms that will provide for quality control of individual entries; allow retrieving and correcting defective records, and perhaps even blocking their insertion upon data entry. Some processes are already functional, however new types of errors continue to emerge, which require to be resolved in cooperation with the administrators.

Prospects of NRJR development

Specifically for the NRJR we anticipate this year the prospect of commencing the works on the knee, shoulder and elbow joint replacement register. Defining the structure of entered data encumbering the registrar as little as possible but allowing at a later time for optimum data mining is the most difficult phase of the register's technical setup. This phase has already largely taken place.

Basic parameters were proposed by Prof. Vavřík for the register of knee joint replacements, by Prof. Pokorný for the register of shoulder replacements and by Prof. Landor the register of elbow replacements. All the data were part and parcel of the tender assignment for new software. Once the tendering procedure for software contractor is over and works are commenced on its development, we envisage establishing a smaller work group of orthopaedists who will take part in fine-tuning individual sub-registers. Senior Consultant Hach has already been working on the database of astounding amount of several thousands of primary and revision knee replacements, which are currently available on our market.

The most relevant task into the future is to prepare "data mining" from the entered records. The long-term problem of health registers is their low utilization of entered data. Hereinafter published outputs represent only a small example of what may be extracted from already entered data. Current outputs are mostly only very simple descriptive statistical data. The objective is to switch over to more complex systems enabling analysis and statistically correct comparison of various types of files. Selecting suitable methods will require further testing as well as professional debate.

One last and substantial objective is cross-border presentation of the Czech register at an international forum. This year EFORT issued requirements for minimum datasets that the national hip and knee arthroplasty registers should contain so that it enabled collective processing and comparing of their results. It is gratifying that we have been monitoring all of the required information in our hip register for over ten years, and setting the knee register also conforms in this respect. Part of the assignment for the creator of the new software includes also the claim for automated generation of outputs into periodical annual report, approximately in the extent of this publication. Economically most reasonable appears its presentation on the Internet in PDF format both in Czech and English. It remains the task of the CSOT Board to put the NRJR CR link through to the EFFORT website.

Finally, words of thanks need to be expressed to all those who have contributed and are contributing their entries into the register database. For they have the utmost credit for its scope, quality, function and its future. It is also primarily to their merit that in this stage of development, when compared with other European and international registers, we basically do not lag behind. Their efforts shall shortly start paying off to the contributors in form of valid data exploitable in strategic direction and running of their department, increasing the quality of professional care and in publishing activities and scientific research.

OUTPUTS SECTION

The outputs section is divided into several theme areas that present the major selected outputs from the register and demonstrate also various forms and options of their processing. In our annotation/commentary we have preferably featured also individual problems associated with data outputs evaluation and the way as to how to interpret them.

The introductory tables (Tables 1 and 2) are devoted to the number of primary implantations and revision surgeries that the participating hospitals submitted to the register in individual years. Pursuant to a qualified assessment and comparison with other data sources (IHIS, NRC etc.) they do not, in a number of hospitals, necessarily reflect the actual number of performed surgery procedures. Publication of these tables is the only exception to the applied full anonymity of provided data. The purport is to motivate individual hospitals to continuous data improvement and integrity. Here it is to be remarked that data of a preceding year can be entered retroactively only by the end of February of the subsequent year. The reason behind this is to ensure that the data processed in previous years with reference to the NRJR, e.g. for publication purposes or annual reports, remain already stable and without further changes. Complementary to the data are a table and a graph (Table 3 and Graph 1), featuring aggregate figures of primary implantations and revision surgeries as processed by the register in individual years.

Basic epidemiological data relative to the individual patient

Gender distribution in primary implantations (Table 4 and Graph .2) and revision surgeries (Table 5 and Graph 3) is, quite as expected, markedly in favour of female patients. Additional data shows the structure of all patients at the time of primary implantation (Table 6, Graph 4) and revision surgery (Table 7 a Graph 5) classified by age into age groups of five years each. It demonstrates how the gap continues to deepen with increasing age, shifting to higher proportion of women. An overview of basic diagnoses in primary implantations (Table 8, Graph 6) and in revision surgeries (Table 9 and Graph 7) represents a key input parameter and may significantly affect survival curves. The incidence of various causes of hip injuries leading to its replacement is certainly interesting in itself. The knowledge of entry diagnosis allows us to use it as a filter. We can thus isolate some risk groups such as rheumatic destructions, post-fracture conditions, and post-congenital hip abnormality conditions and study them separately.

A certain signal is also whether the individual groups are represented in the number of primary implantations and revision surgeries in approximately the same ratio (Table 10, Graph 8). A simple comparison of percentages of individual diagnoses for primary implantations and revision surgeries reveals that patients with endoprostheses indicated for traumatic injuries have, contrary to universally accepted belief, lower share in revision surgeries than they should according to their involvement in primary operations. It is probably due to patients' overall health status at the time of operation and factors affecting life expectancy. In primary osteoarthritis, by contrast, the increased ratio of patients with this diagnosis in revision surgeries is statistically significant, yet the cause is not apparent at first sight. This phenomenon deserves further research. Gender proportion, the fact that replacements are being indicated at still lower age, their type, their fixation etc., all this can play role. It is quite surprising that this difference is not distinct in post-dysplastic indications, where anatomical conditions for implant anchoring are being prevalently adverse, as well as the age is usually lower, which represents risk of wear and tear of the endoprosthesis in itself.

Interconnecting the NRJR with the Deaths Register was a considerable move. Data in both registers is being compared and synchronized quarterly. This function in its simplest form allows us to find out how many and what patients of the monitored group died during the entire period of monitoring without association to the surgery, both for the sets of primary implantations (Table 11, Graph 9) and revision surgeries (Table 12 and Graph 10). This information is essential for the ascertainment of the number of censored operations upon construction of curves and tables of cumulative survival probabilities.

Under regular operation this information is for local users with smaller monitored sets serviceable e.g. for determining the number of patients that need to be checked or invited. Upon different construction setup of the table it is possible to obtain a printout of particular deceased persons and contingently remove these from further evidence of invitees in the research itself. It stands to reason, that a patient can not be removed directly from the register.

Natural removal of patients from the register takes place as follows: Provided the time elapsed from the patient's passing away has exceeded 5 years, his original identification number (the policyholder number) is, in compliance with the Act No. 101/2000 Coll. on the protection of personal data, replaced with a random unique code. The patient can not be thereafter identified but his data remain under the assigned code in the register's database and may be used for cumulative assessments for 20 more years.

The death-date parameter may be combined with various filters. The Deaths Register, however, provides the NRJR also with the exact date of the patient' decease and when correct parameter of the data block is set, available is also the major cause of death and other data from the death certificate. A respective group of operated may be thus studied e.g. in terms of incidence of mortal embolisms and their occurrence in relation to time interval from surgery.

Still, the register can provide on the set of the operated also other, interesting and otherwise rarely featured data. As an example may serve the distribution ratio of right and left hip joint defects in a set of primary implan-

tations and revision surgeries (Tables 16 and 17, Graphs 16 and 17). It is intriguing that even with the application of additional contingent filters right side is always operated on more often.

Yet, exploiting the aforesaid descriptive data does have its boundaries. This data only delimits relevant "suspect" groups of patients in the register and identifies them. Should we need to subject them to further analyses, further detailed processing is necessary. This procedure is very laborious and requires critical assessment of obtained outputs. Prospectively instrumental in this respect should be the upcoming analytical tools that we will endeavour to install into the newly prepared software, if financial resources allow.

Epidemiological and other data relative to the hospital

As an introductory word to this section it needs to be stated that one of the register's principles is data anonymity regarding both the patient and the orthopaedic surgeon, as well as with regard to the hospital providing the data. The surgeon is never mentioned. Only an authorized user of the given hospital who has registered and after having complied with applicable legal terms has been granted access to the NRJR holds the authority to access particular records as well as any sub-outputs for a respective hospital. All users have access to anonymized aggregate data for the entire CR and their respective data processed in a similar way. That allows all to compare their respective data in all parameters with nationwide data.

The reason for this arrangement is to restrict the efforts for "improving" outputs on behalf of a hospital. For here it misses the point. Who would not present correct data depreciates the evaluability assessment of data for his own uses in the first place, without anybody else seeing his "improved" result. However, a single person can distort the aggregate data for the CR in its current volume, as we have verified through tests, merely in hundredths or tenths of a percent at maximum.

A useful function in reference to a particular hospital is also an informative overview of correlation between the site (hospital) of primary implantation or preceding revision surgery and the site of the subsequent revision procedure. To a registered user from that particular hospital it becomes evident how many revisions, or re-revision surgeries, were performed on locally performed primary implantations and revisions, how many arrived from other hospitals and how many revisions of operations carried out in their respective hospital were performed elsewhere.

Another piece of useful information retrievable from the register is the list of patients from the respective hospital who were re-operated elsewhere. With respect to the principle of preserving anonymity the enquirer shall only learn about patients originally operated in his respective (XY) hospital, then their identification data, and date and mode of re-operation. He shall learn neither by whom, nor where the operation was performed. The purpose is to prevent patient losses from the research file statistics and complicated, sometimes even bothersome quest for their further fate.

Such data is available for registered users so far only in the older Business Objects format at https://snzr.ksrzis.cz/snzr/rkn/. (Bookmark: overviewsdynamic outputs – RKN ADM – item 5 – hospital related data).

As the data is predominantly related to the needs of a particular hospital, we do not present it in this annual report in more detail. Perhaps just for the purpose of completeness, out of the 13,459 revision surgeries registered during the period 2003–2012 there were 9,429 surgeries performed at the same place as the previous one and 4,030 at a different one. It seemingly manifests low average migration of Czech patients among individual hospitals, nevertheless, the situation at particular departments may vary significantly from the average and we recommend seeking the information on your own hospital.

Outputs relative to the method of surgery procedure

The data that fall within this section relate to surgical technique and the method of surgery procedure. It may be used as monitored values or as filters for more accurate specification of the study population.

Table 13 and Graph 11 show the frequency of use of 2,598 cervicocapital prostheses implanted in primary and revision surgeries divided by age groups. Their use during the said decade and proportional representation in consideration of other types of joint replacements according to type of fixation can be seen in Table 14 and bar Graph 12 for primary implantations and Table 15 and bar Graph 14 for revisions. Tables and graphs are rather elaborate and call for exploration in more detail. The trends in the use of individual types of replacements during the said decade are better indicated in linear Graph 13 for primary implantations and identical Graph 15 for revisions. According to proportional representation of individual types of joint replacements over the years there is a noticeable continued decrease in the use of cemented implants in primary implantations in favour of uncemented replacements. There are only minimal changes in the use of hybrid combinations and cervicocapital prostheses over time. For revision implants, the situation is more complex. Here it is necessary to realize that the data refers to final condition of an implant after revision surgery and does not reflect the fact which implant components have been replaced. We get far better information about this from the outputs focused on the method of revision surgery procedure set forth below, and which can be further processed also with a view to the type of fixation used. None the less, in revision surgeries, over the said decade there has been evident considerable increase in the use of uncemented implants, which are presently being employed in 55% of all revisions. The data shows a steady, progressive reduction in the number of fully cemented implants for revision surgeries, currently representing approximately 25% of all revisions. Both types of hybrid implants constantly fluctuate around 10%. The majority represent replacements

of individual components. Cervicocapital prostheses are obviously minimally used in revision surgeries, most of the cases being a matter of exchanging unstable prostheses of the same type.

Figures and types of used operational approaches in primary implantations (Table 18, Graph 18) and in revision surgeries (Table 19, Graph 19) evince the absolute predominance of classic anterolateral approach (75.86%), followed with large distance by transgluteal approach (18.58%). Mini-invasive approaches have not yet gained greater popularity and their total representation does not even reach 3% of all primary implantations for the decade in question. A kind of challenging task for the administrator and the professional management of the register represent the 1,500 accesses listed under section "Other". Evidently, the current structure with items of the dropdown list for accesses is not perfectly convenient and will require to be amended. Anterolateral approach also prevails in revision surgeries (50.06%), rather closely followed by transgluteal approach (44.62%) used nearly 2.5x more frequently than in primary implantations.

Frequency of use of grafts in primary implantations (Table 20, Graph 20) is yet another aspect of surgical technique. Grafts are used here roughly in just under a quarter of all cases (23.47%), with practically all grafts used being autogenous. In revision surgeries (Table 21, Graph 21) a certain form of bone graft was used in 39.55% of cases. More than twice as frequently allogeneic grafts (25.19%) were preferred to autogenous (12.04%).

Special outputs and revision surgeries analysis

One of the fundamental questions that demanded to be resolved upon establishing the register was the mode of data insertion for revision surgeries. It was a question of whether to enter only joint replacement revision surgeries, the primary implantations of which have been kept in the register from the beginning, or all revision surgeries for the given period, irrespective of whether or not does the given revision already have an existing record of primary implantation or previous revision of the respective joint replacement. Both methods have their advantages and disadvantages and different registers deal with them diversely.

The decision has been made to enter all revision surgeries. The disadvantage of this policy is that especially in the first years of operation of the register majority of the revision operations is lacking valid, objective data about previous primary implantation, which inhibits evaluation of some outputs. We dismissed the idea of additional entering of medical history data because finding it out would be laborious for the registrar and considering the frequently subjective and inaccurate interpretation of preceding events by the patients, it would be encumbered with large error rate. Another drawback of this solution is the necessity of software differentiation of revision operations with linkage to registered primary implantation from revision operations without such linkage, because upon some assessments all revisions may be processed, whereas at other times the evaluation necessitates exact knowledge of the primary-implantation data.

In spite of this we eventually acceded to the second option because series of data such as the revision burden of hospitals or revision causes etc. may be processed in high quality even without the knowledge of the primary-implantation data. The assessment of other data, such as time intervals from occurrence of cause (dislocation, infection) can be processed solely within a revision subfile.

Accordingly, in the text to follow we will distinguish evaluation of revision operations with a linkage (i.e. an existing record of primary implantation or previous revision) and evaluation of revisions without linkage (having no related records of primary implantation) and evaluation of all revision operations as a whole. Over time, the size of the revisions set without linkage will become reduced in favour of revisions with linkage, as the table and the column graph show, which at the same time feature the numbers of individual types of operations by year and for the entire period under consideration (Table 22, Graph 22).

The situation is further complicated by the fact that the set of revision operations with linkage includes also a set of re-revisions, which, although they have no record of primary implantation, do have a record of one previous revision or of more repeated revision operations (Table 23 and Graph 23). It is evident that re-revisions represent a little over 10% of all revision surgeries. This group needs to be accurately identified, e.g. for research purposes of causes of repeated revisions or the use of various materials during re-revision operations. We are seeking ways to differentiate and specify all these categories with even more accuracy in future.

For most of the entered revision operations with linkage it is also possible to find out the time interval from primary or previous revision operation (Table 24, Graph 24). The cell reading time interval "unknown" comprises surgical interventions without linkage to previous operation, i.e. in vast majority revision operations of replacement implants implanted prior to the establishment of the register. Forming the small remainder are erroneous or incomplete entries, which the register's administrator will gradually have to seek out and correct where possible. Time intervals were chosen pursuant to usual scheme used for infections but they can be set arbitrarily for the future.

Next information retrievable from the register is the method of the revision procedure. The data entry form allows entering multiple methods for one revision (e.g. ossification removal + head replacement + inlay replacement); so as to intercept all aspects of the operation and so that it could be evaluated from various viewpoints. As a result, a simple synoptic table and a graph for the entire register feature 17,723 surgical interventions in 13,459 assessed revision surgeries (Table 25, Graph 25). Most frequent in revision surgery is acetabular component replacement (25.5%), followed by head replacement

(19.53%), replacement of all components (18.77%) and femoral stem replacements (16.32%). The numbers of other interventions are lower by orders.

If we take a look upon causes leading to a revision operation, we will find out that there are 17,850 revision causes listed in 13,459 revision operations (Table 26, Graph 26). Here too, the data entry form allows entering multiple causes as the first cause leading to a revision does not necessarily have to be evident at the time, or the causes may combine. It is apparently a rather frequent situation, as the number of revision causes significantly exceeds the number of revision surgeries. This system has been chosen in order to minimize subjective attitude of the person entering the data or the operator, to prevent data losses and to allow for a repeated data analysis from various viewpoints at a later date.

We can see at first sight, that absolutely most common cause of revision is loosening of the acetabular component (38.15%), followed by loosening of the femoral component (22.01%). A simple glimpse into the register enables you to ascertain that most of these cases are associated with revision operations of naturally worn out implants that fall within the category of revisions without linkage to primary implantation maintained in the register (6,220 out of 6,809 acetabular component loosening and 3,269 out of 3,929 femoral component loosening).

Worth mentioning is also the third cause in line, i.e. recurrent dislocation (6.5%). If we add revision surgeries of dislocations that cannot be reduced in closed way (0.9%) and take into account the amount of conservatively performed reduction that are not recorded in the register, here we apparently have by far the most frequent complication of hip replacement ever. Let us take a closer look at this phenomenon and simultaneously attempt to demonstrate possible angles of viewing the data in the register. The number of 1,302 of all revision surgeries with the cause mentioned being one of the recorded types of dislocations are featured in the table and graph (Table 27, Graph 27). At the same time they show distribution by the time interval from the intervention and the table indicates also incidence in individual years of monitoring. Since it includes all revisions, i.e. even revision surgeries without linkage to previous operation recorded in the register, the largest number of entries is on line "interval unknown" because the time interval calculation formula lacks the date of primary implantation.

It is evident from the summary, that the highest risk of dislocation is within 6 weeks after previous surgery, gradually decreasing quickly, but it is never fully eliminated. Absolute numbers of these complications do not change much in individual years; we can rather say that they show a relative drop in consideration of the number of operations recorded in the register. Slightly different perspective is provided in a quite complex Table 28, which divides dislocations not only according to time interval from the operation but also according to whether it is a dislocation after primary implantation or after revision surgery with linkage or, as the case may be, without linkage to previous intervention recorded in the register. In the lower part of the table it is then possible to find out what is the incidence rate of dislocations from a total number of 101,734 primary implantations on file. The comparatively optimistic 0.13% rate of revisions after primary implantations for dislocation should be viewed cautiously, as vast majority of bloodless reductions of dislocations are not recorded by the register.

From the lower part of the table (Table 28) we can see that in the entire register during the period 2003–2012 there were altogether 1,302 interventions performed for either of the type of dislocation. Of this number, in 726 operations we do not have further details on previous surgery, 447 operations dealt with dislocation after previous revision and only 124 interventions were revisions for dislocation in primary implantations kept on the register's record. The magnitude of the problem becomes manifest only at the last two lines of the table. They show the dislocation rate in causes leading to revisions in individual categories of interventions. Dislocations represent 23.54% of all causes for surgical revision in a total of 548 revised primary implantations. The middle column then shows that out of a total of 2,104 re-revisions with linkage to previous revision surgery on record in the register, dislocations represented 21.25% of all causes. In the rest, not so perfectly monitored 10,807 revision operations without linkage to previous surgery dislocations represented 6.72% of all causes for revision. Here the lower ratio can be probably explained by the fact that these were mostly revisions of implants with longer time interval from previous operation where the risk of dislocation is falling and, instead, causes for revisions due to implant wear dominate.

Often discussed is also the influence of the diameter of the head used on dislocation incidence. We have therefore compared the numbers of dislocations in primary implantations and revisions for the most common head sizes (Table 29). Yet, presented data is of informational character only and no major conclusions may be drawn thereof because the sets vary diametrically in size and the monitoring period is not identical either.

Another much observed item is the incidence of infection in primary implantations. We are often confronted with the enquiry: „What is the infection rate for this type of surgery?" There is no answer to a query raised this way.

For correct evaluation of infection occurrence we have to define the group of interventions (primary implantations or revision surgeries) and determine the monitored set by particular time of its creation (2003–2012 or for individual years). We may also apply other filters (type of dislocation, age, primary diagnosis, implant etc.) and we have to define the period for which this set is to be monitored. The following table (Table 30) shows the incidence of infections in groups of individual categories of interventions (columns) with indicated time interval of infection occurrence from the date of primary implantation (also Graph 28) or previous revision. Lower part of the table provides infection ratio as cause for revision both in relation to all primary implantations recorded

and as a share in revision causes in individual categories of revision surgeries for the entire monitoring period 2003–2012. Information in this table may be affected by accuracy of the inserted data as diagnosis of mitigated infection does have its pitfalls.

Moreover, aggregate data monitored in terms of time interval always suffer from the varying size of the monitored set and different time of monitoring its segments. For evaluation of each individual department or type of intervention it is in practice better to monitor the process of infection incidence in time to come, in closed sets of primary implantations performed in individual years. Only with lapse of several years do individual sets gradually particularize also the representation of late infections and data can be compared to each other. Another option is to use more sophisticated analytical methods.

From the above data we can only observe that during the covered period the revision rate for infection was at 0.06% of 101,734 primary implantations performed at the time. Aggregate data on the occurrence of all infections in the register for the period 2003–2012 reveals 1,137 cases and 6.37% share in causes for all types of revision procedures. Regarded as fairly correct can also be the statement that the share of infections in all causes leading to revision surgery after primary operation in said period was 10.58%, and 16.49% in causes leading to re-revision with linkage.

Outputs relative to implants and materials used

Presented in the introduction to this section are summaries of individual types of materials categorized according to application method, i.e. for primary implantation or revision, then according to the type of fixation and component positioning – femoral and acetabular. The names are used as provided by individual manufacturers or suppliers. Inasmuch as the implants can often be with difficulties unambiguously identified by these names, we have also assigned the manufacturer's name. However, it has sometimes changed over time and that is why two or more manufacturers are named occasionally. At other times the new company assigned a different catalogue number to an implant and it has therefore been registered separately.

For processing and analytical purposes individual components in the database are identified with the manufacturer's catalogue numbers, which are the only ones explicitly specifying the component type and size. General Health Insurance Company (VZP) codes have been assigned solely to facilitate search for groups of components upon entering records and we do not mention these codes in the output section. VZP codes are insufficient in terms of processing as they often include many different components and in some cases the entire endoprosthesis. It is thus impossible to determine from the codes, which component, its construction or size range fail.

Processing a database with tens of thousands items required immense efforts and it took several years. The database has to be continuously maintained (changes in design, manufacturers, and types) and complemented (new implants). Validity of the material results and the possibilities of its detailed analysis further depend on the diligence of the data registrars, id est. that they always, indeed correctly, enter the implanted component, its type and size, with correct catalogue number presented on the label, because in practice error data can not be identified, searched out and corrected.

What we have not so far managed, chiefly for economic reasons, is to integrate into the system the option of entering data by means of barcode scanners directly from the labels, which would substantially improve the situation. We have not abandoned the idea and we continue to strive for its implementation.

Presented first are the summaries of materials most commonly recorded in the register. For practical reasons limiting the scope of this publication it was not feasible to name all implants used. We have included only those, for which the number reached at least 100 of applications of a particular implant for primary implantations and 50 for revisions. In addition to total numbers for given period the tables always specify usage frequency of an implant in individual years, which very well indicates the dynamics of changes in popularity of using different types of replacements. The tables and graphs for primary implantations always present separately uncemented stem brands (Table 31, Graph 29), uncemented cup brands (Table 32, Graph 30), cemented stem brands (Table 33, Graph 31) and cemented cups (Table 34, Graph 32). For revisions they are again divided to uncemented stems (Table 35, Graph 33), uncemented cups (Table 36, Graph 34), cemented stems (Table 37, Graph 35) and cemented cups (Table 38, Graph 36). Separate table and graph (Table 39, Graph 37) provide also information on auxiliary materials and augmentations used for acetabular reinforcement in revision procedures. Overview of sizes of modular heads used for primary implantations and revisions is in another separate table and graph (Table 40, Graph 38.) The synopsis of materials is completed with overview of the most commonly used types of cement in primary implantations and revision procedures (Table 41, Graph 39).

For subsequent more detailed evaluation and further subdivision of the above-mentioned implants it is necessary to realize that the success of a particular acetabular component in consideration of revision rate (RR) or survival curves is significantly affected also by the causes leading to femoral component revision and vice versa.

Implants divided into the aforesaid groups according to position (cup, stem) and the type of fixation used in primary implantation are this time arranged by calculated revision rate (RR) for the decade in question, or for a shorter period. Included have been all replacements of which no less than 100 were used. That is to say, determining and comparing revision rates (RR) in smaller sets does not make sense because the result is overburdened with the error of small numbers. Just as inevitable is to acknowledge that comparisons may be drawn between at least approximately equally large sets, and to check in the foregoing Tables 31–34 that they have been implanted and monitored for about the same

period of time. The tables and graphs given below have only indicative role. Every table indicates highlighted mean revision rate values for a given set. Graphs serve as quick reference and to convey the difference. Strikingly increased RR of a particular implant substantially exceeding the group's average should direct the departments, where such implant is being applied, to an in-depth analysis of this phenomenon. First of all, it is essential to verify whether this phenomenon pertains to one's own department, i.e. whether local RR for a given implant is lower, the same or higher than the overall RR for the implant with regard to the entire register. Provided it is higher, it may be a sign of specific, local issues (type of cement used, surgical technique, surgical approach, incompatible component combination, and the like). Nevertheless, increased overall RR is cautionary even in situations where local RR is better, because problems may occur only with time and it is advisable to monitor patients with such particular implant more often and more carefully.

The set evaluated first consists of the most widely used uncemented stems (Table 42, Graph 40), followed by uncemented cups (Table 43, Graph 41), cemented stems (Table 44, Graph 42) and at last cemented cups (Table 45, Graph 43).

This evaluation is not very appropriate for implants used in revision procedures as the outcome here is furthermore affected by additional factors that are hard to grasp. For instance, it does not tell us anything about the conditions, indication and physical status, under which each particular revision implant was used. And these factors may fundamentally differ in revision surgeries.

Survival curves of the most frequently used materials

Survival probability of an observed phenomenon in time (implant, component) can be processed in a number of methods, each having its advantages and drawbacks and it is quite hard to decide which one to apply in the register.

Most frequently used in orthopaedic surgery for purposes of registers and professional publications in the field of prosthetics are calculations of cumulative survival probability curve by the Kaplan-Meier (KM) or their simplified versions.

When applying the original KM method on data from the NRJR CR we have encountered a problem with calculation complexity and representation of the calculated curve in large data files (>1000 cases). With the original KM method the censored events are always indicated on the curve, even if they do not change curve continuity, whereas the observed events cause the curve to break at a given, particular point in time. The amount of data thus gets cumulated very densely, indicators and breakpoints on the curve coincide, and the curve becomes difficult to read or requires enormous space upon presentation.

When calculating cumulative probability in format for public outputs with the aid of a data block we have decided to combine both the observed and censored events into independent annual intervals.

Having compared the calculation results with the employment of real data from the register in a simplified procedure selected for the „data block" and matching them with results obtained after having processed identical data by several types of commercial software, we have found out that results for larger sets vary in hundredths, exceptionally in tenths of a percent. Accordingly, the simplified calculation procedure was used for all outputs presented herein.

Summarized simplified calculations, however, do not have to be sufficiently precise where it is necessary to process a smaller set of cases (<100) with short follow-up period (<5 years). For their processing, needed especially for individual publications, data have to be exported from the "data block" in Excel table format, applicable in various commercial and freeware programs.

For purposes of this publication we have in the end selected two slightly different solutions for curve representation. For scientific outputs reflecting the processing of nationwide data we have used simple black-and-white alignment graphs with marked values achieved in individual years because these are easily generated directly by Microsoft Excel and they meet the required informative purpose with low levels of labour input and publication costs.

For public on-line outputs the data was processed by add-on software, which in addition to more sophisticated colour graphics also provides for highlighting changes in individual years by corresponding step break of the graph.

Detailed analysis of the construction issue and publication of KM curves exceeds the framework of this work and we assume that it will become subject of an independent publication in the near future.

As interesting and representative outputs from the register we have selected tables of cumulative survival probability (CSP) always for 5 most widely used components in the following categories – uncemented stems (Table 46), uncemented cups (Table 47), cemented stems (Table 48) and cemented cups (Table 49) always for a set of primary implantations. In addition, in each category we have added 1–2 most commonly used original Czech implants, provided they were not already included among the first 5. In the table, the first column always shows ranking of an implant in given category according to the frequency of use, second column states the component name, third the number of primary implantations for the follow-up period, fourth the number of years for which the survival probability curve has been calculated, fifth gives the final survival probability value at the end of the follow-up.

For every implant presented in the respective table, there is a separate graph constructed, showing cumulative survival probability values in individual years of the follow-up. For most frequently used uncemented-stems: 7 curves (Graphs 44–50), foruncemented cups: also 7 curves (Graphs 51–57), for cemented stems: 5 curves (Graphs 58–62) and for cemented cups: 5 curves (Graphs 63–67).

Major pre-assembled outputs for public web portal

For the prepared public web portal the basic epidemiological nationwide data is processed into colour, online outputs in the form of tables and subsequent graphs. Control is directly on the portal from menus of the dropdown list enabling easy definition of a time period in years and specification of basic filters (diagnosis, age, sex, type of implant).

Similarly prepared will soon as well be the fundamental outputs accessible to registered professionals, which outputs will in addition present data also for their respective hospitals and thus replace current data available in the Business Objects format. Indeed, the menus of the dropdown list do limit the means of precise file specification and these outputs will serve the professionals solely for quick orientation.

As an illustration we have chosen the following examples of outputs presented here only in black-and-white concept – cumulative survival probability curves by the type of fixation – for all uncemented implants (Table 50, Graph 68), hybrid implants with cemented acetabular component (Table 51, Graph 69), hybrid implants with cemented femoral component (Table 52, Graph 70) and fully cemented implants (Table 53, Graph 71). Cumulative survival probability curve has also been added for separate category of cervicocapital prostheses (Table 54, Graph 72).

Other graphs illustrate the influence on implant survival and survival curves in some basic entry diagnoses regarded as hazardous. Presented first for comparison is the cumulative survival probability and its curve in patients with primary coxarthrosis (Table 55, Graph 73) and then analogous data for patients with either of the form of congenital hip displacement (Table 56, Graph 74), rheumatoid arthritis (Table 57, Graph 75) and post fracture condition (Table 58, Graph 76). Appropriate filter settings allow further evaluation of the latter data for men (Table 59, Graph 77) and women (Table 60, Graph 78).

Conclusion

The presented outputs exploit data collected during a ten-year period in the NRJR CR. In the future, these outputs will need to be further cultivated with care of the input database quality and through employing modern analytical procedures in data processing. The structure and character of outputs selected for publication in periodical annual reports will also have to be optimized. The Board of the Register welcomes any suggestions and observations of the professional public in this respect.

Further development will still require considerable professional endeavour as well as financial means essential to turn the NRJR CR into a truly effective, readily available tool, efficient for the improvement of health care quality and applicable in the management of activities of an orthopaedic department. We are still at the outset of the journey, but we do believe solid foundations have been laid for further development.

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Table 1. Number of primary implantations entered into the register by individual hospitals in 2003–2012

Hospital	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Fakultní nemocnice v Motole 1. LF UK	674	701	646	573	598	636	660	580	539	620	**6227**
Fakultní nemocnice Plzeň	219	272	255	385	347	463	417	433	398	461	**3650**
Fakultní nemocnice Brno	355	320	325	290	370	319	356	374	333	342	**3384**
Fakultní nemocnice v Motole 2. LF UK	293	278	279	275	275	330	305	361	305	335	**3036**
Fakultní nemocnice Olomouc	106	34	240	228	313	285	256	317	354	387	**2520**
Oblastní nemocnice Mladá Boleslav, a.s.	63	1	208	304	260	322	281	293	296	306	**2334**
Fakultní nemocnice Hradec Králové	81	62	127	170	223	303	328	340	318	318	**2270**
Ústřední vojenská nemocnice Praha		170	130	255	228	259	302	292	317	294	**2247**
Nemocnice České Budějovice, a.s.			170	255	235	279	283	307	315	318	**2162**
Fakultní nemocnice Královské Vinohrady	187	190	194	155	151	208	266	235	261	283	**2130**
Šumperská nemocnice a.s.	137	157	180	191	219	208	256	263	211	294	**2116**
Fakultní nemocnice Na Bulovce	191	213	257	197	258	179	150	1	295	373	**2114**
Krajská nemocnice Pardubice	155	193	212	199	218	214	206	225	206	212	**2040**
Nemocnice s poliklinikou Karviná-Ráj	8	230	213	204	188	210	154	185	188	173	**1753**
Nemocnice Litomyšl	141	162	179	134	149	185	210	210	173	196	**1739**
Nemocnice Znojmo	127	186	163	152	166	184	181	161	178	199	**1697**
Nemocnice sv.Zdislavy, a.s. – Mostiště			176	178	233	255	264	255	142	160	**1663**
Oblastní nemocnice Kolín	113	124	117	147	94	171	170	232	214	266	**1648**
Fakultní nemocnice Ostrava	134	143	153	154	185	171	164	163	185	194	**1646**
Krajská nemocnice Liberec, a.s.	124	119	128	117	125	202	284	211	151	173	**1634**
Kroměřížská nemocnice, a.s.	12	5	229	200	185	194	203	176	206	208	**1618**
Nemocnice Havlíčkův Brod	48	46	250	249	98	116	39	236	267	247	**1596**
Krajská nemocnice T. Bati, a. s.			149	142	179	222	229	218	228	214	**1581**
Fakultní nemocnice u sv. Anny v Brně		228	377	90		143			337	299	**1474**
Oblastní nemocnice Kladno, a.s.	98	161	146	113	144	75	156	172	166	183	**1414**
o.z. Nemocnice Přerov	22	161	149	138	107	157	164	182	147	184	**1411**
Nemocnice Kyjov	112	124	127	131	130	135	154	157	157	144	**1371**
Uherskohradišťská nemocnice, a.s.	115	145	181	150	119	172	134	121	131	93	**1361**
Městská nemocnice v Litoměřicích		134	149	133	127	162	148	152	162	165	**1332**
NH Hospital a.s., Nemocnice Hořovice				1	5	146	291	288	316	274	**1321**
Karlovarská krajská nemocnice, a.s.		67	151	146	150	157	130	196	143	179	**1319**
Oblastní nemocnice Náchod, a.s.	89	95	109	130	114	140	140	150	173	168	**1308**
Městská nemocnice Ostrava	150	139	130	109	51	140	142	163	120	156	**1300**
Nemocnice Třebíč	125	126	137	139	123	139	103	125	146	137	**1300**
Nemocnice Rudolfa a Stefanie Benešov, a.s.	145	134	130	142	149	177		150	94	151	**1272**
Nemocnice ve Frýdku-Místku	118	166	83	91	87	125	136	119	139	155	**1219**
Nemocnice s poliklinikou Česká Lípa, a.s.	59	107	97	141	110	143	134	136	150	136	**1213**
Slezská nemocnice v Opavě,	68	87	107	118	122	147	136	138	127	147	**1197**
Nemocnice Jindřichův Hradec, a.s.	97	102	105	118	83	134	151	141	127	123	**1181**
Nemocnice Pelhřimov	88	97	111	117	118	134	133	118	128	137	**1181**
Klatovská nemocnice, a.s.	84	115	128	82	109	113	98	135	140	135	**1139**
Středomoravská nem. a.s., Nemocnice Prostějov	77	93	107	95	83	111	110	128	142	152	**1098**
Oblastní nemocnice Rychnov nad Kněžnou, a.s.	83	103	93	95	89	117	129	120	115	148	**1092**
Nemocnice s poliklinikou v Novém Jičíně	88	110	75	75	94	137	150	106	133	118	**1086**
Nemocnice Jihlava	88	118	115	75	92	79	124	123	126	133	**1073**
Nemocnice Písek, a.s.	7	1	132	113	109	150	138	145	137	132	**1064**
Karlovarská krajská nemocnice, a.s., nem. v Sokolově			196	177	127	194	179	168			**1041**
Krajská zdravotní, a.s. – Masarykova nemocnice v Ústí n.L.	22		120	99	115	192	201	9	147	110	**1015**
Nemocnice Most, p.o.					2	228	169	199	159	212	**969**
Vsetínská nemocnice, a.s.	94	59	89	82	100	113	128	116	91	95	**967**
Sdružené zdravotnické zařízení Krnov			113	91	97	132	121	137	132	135	**958**
Nemocnice Tábor, a.s.	74	68	68	64	89	94	88	124	106	110	**885**
Centrum léčby pohybového aparátu, s.r.o.	79	67	77	82	88	85	103	95	100	101	**877**
Karvinská hornická nemocnice, a.s							104	234	276	226	**840**

Hospital	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Nemocnice Třinec	1	31	118	111	130	124	113	37	99	67	**831**
Nemocnice Na Františku s poliklinikou	61	75	82	71	81	86	88	82	107	87	**820**
Oblastní nemocnice Trutnov, a.s.	33	1	45	55	57	115	122	118	125	133	**804**
Nemocnice Břeclav, p.o.	93	19	94	68	83		98	131	115	91	**792**
Nemocnice Nové Město na Moravě	118	39	143	73	10	10	55	36	147	133	**764**
Nemocnice s poliklinikou Semily	106	128	110	103	104	104	1			92	**748**
ORTHES, s r.o. – Rožnov pod Radhoštěm					100	122	134	118	107	115	**696**
Nemocnice Boskovice, s.r.o.	36	34	36	43	68	80	118	105	87	82	**689**
Nemocnice s poliklinikou na Praze 5 – Na Homolce						128	131	126	120	119	**624**
Vojenská nemocnice Brno			48	83	72	86	104	108	31	20	**552**
Mělnická zdravotní, a.s.	3	1	5	3	2	59	95	111	117	137	**533**
MEDITERRA, s.r.o. – nemocnice Malvazinky		2	5	3		103	50	98	114	133	**508**
Úrazová nemocnice v Brně				244	249						**493**
Nemocnice Kadaň, s.r.o.		43	53	47	56	62	55	55	62	55	**488**
NEMOS Sokolov, s.r.o.									248	213	**461**
Nemocnice Slaný							102	105	116	116	**439**
Mulačova nemocnice, s.r.o.			62	75	82	92	87	6			**404**
Oblastní nemocnice Příbram, a.s.						108	70	81		132	**391**
P-P Klinika Kladno, spol. s r.o.						83	103	83	59	57	**385**
Krajská zdravotní, a.s. – Nemocnice Teplice, o.z.	19	75	56	37	29	7			59	96	**378**
Oblastní nemocnice Příbram, a.s.	20		86	107	98						**311**
Nemocnice Prachatice, a.s.						65	59	50	73	41	**288**
Nemocnice Chrudim		41	45	44	44	38	38	2			**252**
Total	**5640**	**6902**	**9570**	**9458**	**9495**	**11558**	**11681**	**11867**	**12433**	**13130**	**101 734**

Table 2. Number of revision surgeries entered into the register by individual hospitals in 2003–2012

Hospital	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Fakultní nemocnice v Motole 1. LF UK	242	228	201	161	169	144	159	173	151	169	**1797**
Ústřední vojenská nemocnice Praha		37	19	88	73	75	65	59	67	31	**514**
Fakultní nemocnice v Motole 2. LF UK	56	69	49	45	59	58	46	32	41	45	**500**
Fakultní nemocnice Brno	70	64	51	59	53	53	27	46	33	37	**493**
Fakultní nemocnice Olomouc	48		43	51	57	47	42	57	54	69	**468**
Fakultní nemocnice Královské Vinohrady	47	29	15	49	33	26	60	56	79	54	**448**
Oblastní nemocnice Kladno, a.s.	46	43	34	48	49	63	19	41	32	34	**409**
Nemocnice s poliklinikou Karviná-Ráj		41	54	56	64	36	34	27	33	16	**361**
Fakultní nemocnice Plzeň	25	22	32	31	40	39	43	40	29	47	**348**
Fakultní nemocnice Hradec Králové	18	13	6	24	43	58	31	39	47	55	**334**
Krajská nemocnice Liberec, a.s.	28	49	29	25	34	28	30	36	34	33	**326**
Nemocnice České Budějovice, a.s.			17	36	29	34	44	50	55	55	**320**
Krajská nemocnice Pardubice	27	28	39	32	34	27	34	28	30	16	**295**
Fakultní nemocnice Na Bulovce	36	38	30	29	33	20	23		29	55	**293**
Krajská nemocnice T. Bati, a. s.			36	33	31	50	37	34	35	27	**283**
Nemocnice Znojmo, příspěvková organizace	18	27	17	26	36	34	32	20	24	19	**253**
Městská nemocnice v Litoměřicích		34	13	14	23	35	35	30	25	33	**242**
Městská nemocnice Ostrava	27	27	41	24	13	24	32	21	20	12	**241**
Krajská zdravotní, a.s. – Masarykova nemocnice v Ústí n.L	3		41	35	41	20	37	1	25	23	**226**
Oblastní nemocnice Mladá Boleslav, a.s	7		14	28	30	31	34	36	28	14	**222**
Fakultní nemocnice u sv. Anny v Brně		8	60	9		26			53	53	**209**
Nemocnice Havlíčkův Brod, příspěvková organizace	4	5	36	48	11	10		28	27	30	**199**
Fakultní nemocnice Ostrava	8	11	19	14	22	26	24	18	28	26	**196**
Oblastní nemocnice Kolín, a.s.	18	12	10	18	26	19	20	27	23	21	**194**
Nemocnice Pelhřimov	15	32	25	18	24	16	12	14	10	20	**186**

Hospital	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Nemocnice Litomyšl	16	16	9	11	19	10	26	35	17	17	**176**
Nemocnice Jihlava	19	24	25	15	16	10	10	23	14	18	**174**
Nemocnice s poliklinikou Semily	28	24	28	22	25	31				15	**173**
Karlovarská krajská nemocnice a.s., nem. v Sokolově		1	1	39	25	32	30	41			**169**
Středomoravská nem. a.s., Nemocnice Prostějov	18	10	8	20	17	13	18	16	23	21	**164**
Nemocnice Tábor, a.s.	28	29	12	22	28	13	8	3	3	10	**156**
Karlovarská krajská nemocnice a.s.		8	9	13	21	26	14	29	16	18	**154**
Šumperská nemocnice, a.s.	10	11	16	19	16	15	14	12	14	24	**151**
Oblastní nemocnice Náchod, a.s.	15	17	12	11	10	16	19	15	12	20	**147**
Kroměřížská nemocnice, a.s.	3		21	24	22	13	12	17	19	9	**140**
Oblastní nemocnice Rychnov nad Kněžnou, a.s.	7	14	14	12	25	11	12	18	12	4	**129**
Nemocnice s poliklinikou Česká Lípa, a.s.	9	12	7	6	3	20	17	15	15	20	**124**
Nemocnice sv.Zdislavy, a.s. – Mostiště			4	11	10	23	22	17	16	13	**116**
Uherskohradišťská nemocnice, a.s.	22	12	18	16	10	4	11	11	5	2	**111**
Nemocnice Jindřichův Hradec, a.s.	13	13	10	10	7	10	8	11	12	13	**107**
NH Hospital a.s., Nemocnice Hořovice					1	18	19	12	26	29	**105**
Klatovská nemocnice, a.s.	10	9	5	6	10	9	15	10	17	11	**102**
Nemocnice Písek, a.s.			14	7	23	13	16	2	12	10	**97**
Nemocnice ve Frýdku-Místku	4	1	9	5	15	11	16	7	11	16	**95**
o.z. Nemocnice Přerov	1	5	6	12	9	7	13	5	17	15	**90**
Nemocnice Rudolfa a Stefanie Benešov, a.s.	5	9	16	13	5			15	3	16	**82**
Nemocnice Kyjov	18	15	12	8	3	1	1		5	14	**77**
Nemocnice Třebíč	15	12	11	5	5	8	11	2		7	**76**
Slezská nemocnice v Opavě	6	3	6	7	7	8	16	4	12	7	**76**
Karvinská hornická nemocnice, a.s.							7	8	27	33	**75**
Sdružené zdravotnické zařízení Krnov			7	9	5	10		18	12	10	**71**
Nemocnice Most, p.o.						22	16	8	9	13	**68**
Vsetínská nemocnice, a.s.	4	4	6	10	3	6	5	10	12	6	**66**
NEMOS Sokolov, s.r.o.									35	26	**61**
Nemocnice Nové Město na Moravě, p.o.	14	2	19	10			1	1		13	**60**
Nemocnice s poliklinikou na Praze 5 – Na Homolce						11	10	11	18	10	**60**
Nemocnice Kadaň, s.r.o.		8	6	6	9	3	11	3	6	5	**57**
Nemocnice Břeclav, p.o.	10	2	8	6	3		4	7	12	3	**55**
ORTHES, s r.o. – Rožnov pod Radhoštěm					10	4	9	4	7	15	**49**
Nemocnice Slaný							6	12	11	18	**47**
Nemocnice Na Františku s poliklinikou	2	4	2	4	7	1	6	5	7	8	**46**
Nemocnice Prachatice, a.s.						11	6	10	4	14	**45**
Úrazová nemocnice v Brně				23	16						**39**
Nemocnice Boskovice, s.r.o.	1		1	3	5	4	5	8	2	4	**33**
Oblastní nemocnice Příbram, a.s.			16	8	9						**33**
Mělnická zdravotní , a.s.			1			1	1	3	15	10	**31**
Vojenská nemocnice Brno			6	7	7	3	5	1			**29**
Oblastní nemocnice Trutnov, a.s.	1			3	3	5	1	4	4	6	**27**
Centrum léčby pohybového aparátu, s.r.o.	2	1	4	1	4	2	2	3	5		**24**
Nemocnice Třinec			4	3	6	11					**24**
Nemocnice s poliklinikou v Novém Jičíně		1						4	3	15	**23**
Mulačova nemocnice, s.r.o.			2	4	4	6	4	2			**22**
Krajská zdravotní, a.s. – Nemocnice Teplice, o.z.	1	4	3	4	1				2	6	**21**
MEDITERRA, s.r.o. – nemocnice Malvazinky						3	3	4	3	3	**16**
Oblastní nemocnice Příbram, a.s.						1				15	**16**
Nemocnice Chrudim		2			1	2	2				**7**
P-P Klinika Kladno, spol. s r.o.						1	2	1	1	1	**6**
Total	**1025**	**1090**	**1289**	**1416**	**1452**	**1428**	**1354**	**1360**	**1488**	**1557**	**13459**

Table 3. Aggregate number of primary implantations and revision surgeries processed by the register in 2003–2012

Year	Primary	Revision
2003	5 640	1 025
2004	6 902	1 090
2005	9 570	1 289
2006	9 458	1 416
2007	9 495	1 452
2008	11 558	1 428
2009	11 681	1 354
2010	11 867	1 360
2011	12 433	1 488
2012	13 130	1 557
Total	**101 734**	**13 459**

Table 4 Number of primary implantations in individual years by gender

Year	Male	Female	Total
2003	2 184	3 456	5 640
2004	2 698	4 204	6 902
2005	3 776	5 794	9 570
2006	3 699	5 759	9 458
2007	3 815	5 680	9 495
2008	4 739	6 819	11 558
2009	4 854	6 827	11 681
2010	4 819	7 048	11 867
2011	5 233	7 200	12 433
2012	5 451	7 679	13 130
Total	**41 267**	**60 467**	**101 734**

Table 5. Number of revision surgeries in individual years by gender

Year	Male	Female	Total
2003	304	721	1 025
2004	371	719	1 090
2005	423	866	1 289
2006	525	891	1 416
2007	537	915	1 452
2008	526	902	1 428
2009	513	841	1 354
2010	550	810	1 360
2011	540	948	1 488
2012	624	933	1 557
Total	**4 913**	**8 546**	**13 459**

Table 6. Frequency of primary implantations by gender and age at the time of operation

Age	Male	Female	Total
0–19	14	23	37
20–24	51	57	108
25–29	113	106	219
30–34	255	185	440
35–39	433	397	830
40–44	853	742	1 595
45–49	1 713	1 497	3 210
50–54	3 395	3 305	6 700
55–59	6 356	6 264	12 620
60–64	7 877	8 609	16 486
65–69	7 079	10 570	17 649
70–74	5 920	11 308	17 228
75–79	4 583	10 256	14 839
80–84	2 007	5 202	7 209
85–89	493	1 558	2 051
90+	23	68	91
Unknown	**103**	**319**	**422**
Total	**41 265**	**60 464**	**101 734**

Table 7. Frequency of revisions by gender and age at the time of operation

Age	Male	Female	Revisions
0–19		3	3
20–24	2	4	6
25–29	11	11	22
30–34	25	27	52
35–39	37	65	102
40–44	74	82	156
45–49	140	165	305
50–54	292	373	665
55–59	579	696	1275
60–64	757	1060	1817
65–69	818	1408	2226
70–74	849	1669	2518
75–79	792	1670	2462
80–84	421	940	1361
85–89	96	314	410
90+	3	4	7
Unknown	**17**	**55**	**72**
Total	**4913**	**8546**	**13459**

Table 8. Share of basic (original) diagnoses in the total number of registered primary implantations

Basic (original) diagnosis	Primary implantations	
	Cases	%
Primary osteoarthritis	71 062	69.85
Hip trauma or posttraum. OA	13 642	13.41
Postdysplastic osteoarthritis	8 886	8.73
Femoral head necrosis	5 329	5.24
Other	1 342	1.32
Rheumatoid arthritis	683	0.67
M. Perthes or coxa vara adolesc.	280	0.28
Developmental dysplasia of the hip	243	0.24
Ankylosing spondylitis	202	0.20
Femoral head resection	52	0.05
Unknown	13	0.01
Total	**101 734**	**100.00**

Table 9. Share of basic (original) diagnoses in the total number of registered revisions

Basic (original) diagnosis	Revisions	
	Cases	%
Primary osteoarthritis	9 934	73.81
Hip trauma or posttraum. OA	1 181	8.77
Postdysplastic osteoarthritis	1 172	8.71
Other	521	3.87
Femoral head necrosis	205	1.52
Rheumatoid arthritis	191	1.42
Unknown	90	0.67
Developmental dysplasia of the hip	67	0.50
Ankylosing spondylitis	45	0.33
M. Perthes or coxa vara adolesc.	32	0.24
Femoral head resection	21	0.16
Total	**13 459**	**100.00**

Table 10. Rate of percentage share of basic diagnoses in primary implantations and revisions and its difference (B-A)

Basic (original) diagnosis	% in primary implantations (A)	% in revisions (B)	=B-A
Primary osteoarthritis	69.85	73.81	3.96
Other	1.32	3.87	2.55
Rheumatoid arthritis	0.67	1.42	0.75
Unknown	0.01	0.67	0.66
Developmental dysplasia of the hip	0.24	0.50	0.26
Ankylosing spondylitis	0.20	0.33	0.13
Femoral head resection	0.05	0.16	0.11
Postdysplastic osteoarthritis	8.73	8.71	-0.02
M. Perthes or coxa vara adolesc.	0.28	0.24	-0.04
Femoral head necrosis	5.24	1.52	-3.72
Stp. trauma or posttraum OA	13.41	8.77	-4.64
Total	**100.00**	**100.00**	

Table 11. Share of all deceased (w/o relation to operation) in individual categories of primary implantations by the type of implant for the period 2003–2012

Primary implantations	Cases	Surviving	%	Deceased	%
Cemented	45 426	38 590	84.95	6 836	15.05
Hybrid cemented AC	656	577	87.96	79	12.04
Hybrid cemented FC	16 599	15 386	92.69	1 213	7.31
Uncemented	36 461	34 974	95.92	1 487	4.08
CCP	2 592	1 276	49.23	1 316	50.77
Total	**101 734**	**90 803**	**89.26**	**10 931**	**10.74**

Table 12. Share of all deceased (w/o relation to operation) in individual categories of revisions by the type of implant for the period 2003–2012

Revisions	Cases	Surviving	%	Deceased	%
Cemented	4 174	3 540	82.09	634	17.91
Hybrid cemented AC	1 129	991	86.07	138	13.93
Hybrid cemented FC	1 564	1 368	85.67	196	14.33
Uncemented	6 575	5 321	76.43	1 254	23.57
CCP	17	14	78.57	3	21.43
Total	**13 459**	**11 234**	**83.47**	**2 225**	**16.53**

Table 13. Age structure in patients with CC prosthesis at the time of implantation or its revision

Age	Primary implantations	Number of revised cases
20–24	1	
30–34	1	
35–39	1	
40–44	2	
45–49	1	
50–54	11	
55–59	18	
60–64	40	1
65–69	68	1
70–74	159	1
75–79	359	
80–84	858	2
85–89	714	
90–94	288	1
95+	71	
Total	**2592**	**6**

Table 14. Number and percentage share of primary operations divided by the type of implant in individual years

Implant type Year	Cemented	%	Hybrid – cemented acetabular component	%	Hybrid – cemented femoral component	%	Uncemented	%	Cervico-capital prosthesis	%	Total	%
2003	2 788	49.43	43	0.76	821	14.56	1 919	34.02	69	1.22	5 640	100.00
2004	3 287	47.62	67	0.97	1 107	16.04	2 339	33.89	102	1.48	6 902	100.00
2005	4 588	47.94	63	0.66	1 638	17.12	3 079	32.17	202	2.11	9 570	100.00
2006	4 367	46.17	72	0.76	1 581	16.72	3 162	33.43	276	2.92	9 458	100.00
2007	4 460	46.97	64	0.67	1 561	16.44	3 132	32.99	278	2.93	9 495	100.00
2008	5 076	43.92	66	0.57	1 841	15.93	4 267	36.92	308	2.66	11 558	100.00
2009	4 765	40.79	64	0.55	2 031	17.39	4 551	38.96	270	2.31	11 681	100.00
2010	5 006	42.18	73	0.62	1 953	16.46	4 509	38.00	326	2.75	11 867	100.00
2011	5 487	44.13	72	0.58	1 958	15.75	4 593	36.94	323	2.60	12 433	100.00
2012	5 626	42.85	72	0.55	2 068	15.75	4 926	37.52	438	3.34	13 130	100.00
Total	**45 450**	**44.68**	**656**	**0.64**	**16 559**	**16.28**	**36 477**	**35.86**	**2 592**	**2.55**	**101 734**	**100.00**

Table 15 Number and percentage share of revisions divided by the type of implant in individual years

Implant type Year	Cemented	%	Hybrid – cemented acetabular component	%	Hybrid – cemented femoral component	%	Uncemented	%	Cervico-capital prosthesis	%	Total	%
2003	358	34.93	67	6.54	162	15.80	437	42.63	1	0.10	1 025	100.00
2004	424	38.90	68	6.24	137	12.57	459	42.11	2	0.18	1 090	100.00
2005	471	36.54	119	9.23	172	13.34	526	40.81	1	0.08	1 289	100.00
2006	456	32.20	101	7.13	178	12.57	679	47.95	2	0.14	1 416	100.00
2007	465	32.02	138	9.50	174	11.98	675	46.49		0.00	1 452	100.00
2008	447	31.30	110	7.70	164	11.48	704	49.30	3	0.21	1 428	100.00
2009	382	28.21	133	9.82	132	9.75	704	51.99	3	0.22	1 354	100.00
2010	355	26.10	128	9.41	144	10.59	730	53.68	3	0.22	1 360	100.00
2011	400	26.88	137	9.21	147	9.88	803	53.97	1	0.07	1 488	100.00
2012	418	26.85	128	8.22	154	9.89	856	54.98	1	0.06	1 557	100.00
Total	**4 176**	**31.03**	**1 129**	**8.39**	**1 564**	**11.62**	**6 573**	**48.84**	**17**	**0.13**	**13 459**	**100.00**

Table 16. Ratio of lateral (right-left) involvement in primary implantations

Localization	Primary hip replacement	%
Left	47 601	46.79
Right	54 133	53.21
Total	**101 734**	**100.00**

Table 17. Ratio of lateral (right-left) involvement in revisions

Localization	Revisions	%
Left	6 283	46.68
Right	7 176	53.32
Total	**13 459**	**100.00**

Table 18. Number and types of surgical approaches in primary implantations

Surgical approach	Primary implantation	%
Anterolateral	77180	75.86
Transgluteal	18902	18.58
MIS – anterolateral	2928	2.88
Other	1543	1.52
Posterolateral	846	0.83
MIS – lateral	238	0.23
MIS – 2 approaches	42	0.04
Transtrochanterical (trochanter osteotomy)	32	0.03
Transfemoral	23	0.02
Total	**101734**	**100.00**

Table 19. Number and types of surgical approaches in revisions

Surgical approach	Revisions	%
Anterolateral	6737	50.06
Transgluteal	6005	44.62
Posterolateral	277	2.06
Other	203	1.51
Transfemoral	166	1.23
Transtrochanterical (trochanter osteotomy)	34	0.25
MIS – anterolateral	32	0.24
MIS – lateral	3	0.02
MIS – 2 approaches	2	0.01
Total	**13459**	**100.00**

Table 20 Grafts used in primary implantations

Graft	Primary implantations	%
Frozen alogenous	278	0.27
Autologous	23 871	23.47
Autologous + alogenous	152	0.15
None	77 433	76.11
Total	**101 734**	**100.00**

Table 21 Grafts used in revisions

Graft	Revisions	%
Frozen alogenous	3390	25.19
Autologous	1 621	12.04
Autologous + alogenous	312	2.32
None	8 136	60.45
Total	**13 459**	**100.00**

Table 22. Number of revision surgeries according to relation to previous surgery recorded in the register and their development in 2003–2012

Year	Revisions w/o linkage	Revisions with linkage
2003	1 020	5
2004	1 036	54
2005	1 150	139
2006	1 218	198
2007	1 221	231
2008	1 125	303
2009	1 007	347
2010	982	378
2011	1 023	465
2012	1 025	532
Total	**10 807**	**2 652**

Table 23. Number of re-revisions

Revisions	Number	%
1.	11 923	88.59
Re-revised (x) times		
2.	1 256	9.33
3.	206	1.53
4.	54	0.40
5.+	20	0.15
Total	**13 459**	**100.00**

Table 24. Revision surgeries divided by the time interval from previous surgery

Time interval from previous surgery	Revisions	%
< 6 weeks	424	3.15
7–16 weeks	152	1.13
17 weeks – 1 year	452	3.36
2 years	305	2.27
3 years	237	1.76
4 years	176	1.31
5 years	133	0.99
6 years	118	0.88
7 years	100	0.74
8 years	78	0.58
9 years	42	0.31
10 years	6	0.04
Unknown	**11 236**	**83.48**
Total	**13 459**	**100.00**

Table 25. Surgical techniques used in revisions

Surgical technique of revision	Number	%
Exchange of complete acetabular component	4 520	25.50
Exchange of head	3 461	19.53
Exchange of all components	3 326	18.77
Exchange of femoral stem	2 893	16.32
Exchange of acetabular cup inlay	873	4.93
Osteosynthesis	492	2.78
Reimplantation – second step	485	2.74
Removal of all components +spacer	462	2.61
Removal of periarticular ossifications	444	2.51
Removal of all components only	431	2.43
Revision only	336	1.90
Evaluated number of revisions	**13 459**	
Total*	**17 723**	**100.00**

**to register several methods at once is allowed*

Table 26. Summary of reasons for revision surgeries

Reason for revision*	Number	%
Loosening of acetabular component	6 809	38.15
Loosening of femoral component	3 929	22.01
Reccurent luxation	1 160	6.50
Deep infection	1 137	6.37
Periprosthetic fracture	763	4.27
Periacetabular osteolysis	758	4.25
Fade of PE acetabular cup or inlay	658	3.69
Femoral osteolysis	569	3.19
Mechanic failure of implant	499	2.80
Reimplanatation – second step	452	2.53
Other	397	2.22
Periarticular ossifications	346	1.94
Irreducible luxation	160	0.90
Pain w/o evident loosening	143	0.80
Haematoma	70	0.39
Evaluated number of revisions	**13 459**	
Registered number of reasons*	**17 850**	**100.00**

**to register multiple reasons at once are allowed*

Table 27. Number of all revision surgeries after luxation during 2003–2012 by years and by time interval from previous surgery

Interval/Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total	%
< 6 weeks	2	8	35	25	19	29	33	27	22	26	**226**	**17.36**
7–16 weeks	1	8	9	9	12	10	12	11	6	13	**91**	**6.99**
17 weeks – 1 year		9	6	6	12	12	11	12	10	8	**86**	**6.61**
2 years				3	2	1	4	4	6	2	**22**	**1.69**
3 years				4	3	3	6	2			**18**	**1.38**
4 years					1		4	1		3	**9**	**0.69**
5 years					1	2	1	2	1	2	**9**	**0.69**
6 years							2	1	2	1	**6**	**0.46**
7 years									1	2	**3**	**0.23**
8 years									2		**2**	**0.15**
9 years										4	**4**	**0.31**
Unknown	**70**	**59**	**82**	**87**	**92**	**91**	**90**	**81**	**91**	**83**	**826**	**63.44**
Celkový součet	**73**	**84**	**132**	**134**	**142**	**148**	**163**	**141**	**141**	**144**	**1 302**	**100.00**

Table 28. Number of luxations during 2003–2012 by years and by category of revision

	Category of surgical intervention			
Interval	**Primary implantations revised for luxation**	**Revisions w. linkage re-revised for luxation**	**Revisions w/o linkage re-revised for luxation**	**All revisions for luxation**
< 6 weeks	56	170		226
7–16 weeks	19	72		91
17 weeks – 1 year	28	58		86
2 years	9	13		22
3 years	1	17		18
4 years	4	5		9
5 years	4	5		9
6 years	2	4		6
7 years	3	0		3
8 years	1	1		2
9 years	2	2		4
Re-revisions		100	726	826
Number of luxations	**129**	**447**	**726**	**1302**
Share of luxations from all registered primary implantations (101734 cases)	**0.13%**	**xxxxxxx**	**xxxxxxxx**	**xxxxxx**
Number of surgeries in category for all of reasons for revision	**548**	**2104**	**10807**	**13459**
Share of luxations from all of reasons for revision in category	**23.54%**	**21.25%**	**6.72%**	**7.40%**

Table 29. Number of luxations by size of used modular head

***Head diameter**	**Primary implantations**	**Revised primary implantations**	**RE-revisions (all)**
22.00	276	1	3
28.00	74 733	106	711
32.00	17 094	20	201
36.00	5 901	0	49
Other	3 148	2	11

** Modular heads only*

Table 30. Number of infections by time interval from previous surgery and by type of surgery. Period 2003–2012. Evaluation on June 30, 2013

	Category of surgical intervention			
Interval	**Primary implantations revised for infection**	**Revisions w. linkage re-revised for infection**	**Revisions w/o linkage revised for infection**	**All revisions for infection**
< 6 weeks	2	23		25
7–16 weeks	7	11		18
17 weeks – 1 year	14	80		94
2 years	8	47		55
3 years	9	40		49
4 years	10	21		31
5 years	3	9		12
6 years		8		8
7 years	4	3		7
8 years	1	2		3
9 years		1		1
10 years				0
Re-revisions		102	732	834
Number of infections	**58**	**347**	**732**	**1 137**
Share of infections from all registered primary implantations (101 734 cases)	**0.06%**	**xxxxxxx**	**xxxxxxxx**	**xxxxxx**
Number of surgeries in category for all of reasons for revision	**548**	**2 104**	**10 807**	**13 459**
Share of infections from all of reasons for revision in category	**10.58%**	**16.49%**	**6.72%**	**6.37%**

Table 31. Most widely used uncemented stems in primary implantations (>100)

	Primoimplantations										
Material – Uncemented stems > 100 implantations	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Stem SL „Zweymüller Alloclassic“ Zimmer	255	267	424	403	384	567	521	462	563	491	4 337
Stem Zweymüller SL PLUS Smith & Nephew	220	265	441	416	306	224	264	329	273	220	2 958
Stem Bicontact Aesculap	181	244	329	355	359	477	305	293	226	24	2 793
Stem Taperloc Ti porocoat standard 12/14 Biomet			1	5	7	75	521	628	638	681	2 556
Stem CLS 135° – cone 12/14 Zimmer	54	88	214	272	224	224	328	298	341	304	2 347
Stem CLS 145°, cone 12/14 Sulzer	111	106	139	150	230	327	310	298	211	159	2 041
Stem Corail w/o collar (older type) Johnson&Johnson	93	136	168	110	128	281	340	313	251	149	1 969
Stem Excia Plasmapore, cone 12/14 Aesculap						363	303	350	356	225	1 597
Stem Antega Aesculap	166	244	367	359	169	44	15	7	2		1 373
Stem C2 standard Lima	11	38	44	97	163	176	190	142	218	248	1 327
Stem S.F./S Beznoska	165	154	206	141	136	122	95	115	78	57	1 269
Stem S.F./ML Beznoska	118	155	192	120	102	61	69	54	36	44	951
Stem Antega – CaP sprayed Aesculap					85	229	174	146	135	122	891
Stem Versys uncemented Zimmer	123	160	114	97	48	34	32	3	8	101	720
Stem Profemur – Z Wright Medical Tech.				10	38	125	163	156	141	78	711
Stem SL-Twin straight Endoplant				37	201	200	101	84	9	24	656
Stem Bi-Metric w/o collar – porocoat Biomet		7	46	42	45	70	106	82	59	54	511
Stem AML, cone 12/14 Johnson&Johnson	119	118	90	55	38	20	17	13			470
Stem Metha – Aesculap			2	54	74	84	71	83	56	10	434
Stem TRJ Aesculap									118	277	395
Stem SL (SELF LOCKING) Titan+Porocoat Lima				30	36	58	53	98	66	51	392
Stem Bicontact S Aesculap							3		42	325	370
Cylindrical cementless stem MC-T (Ti) Medin			1	10	28	48	76	77	55	63	358
Hip stem MT (older type) (HA) Medin	74	89	49	46	14	17	11	4	5	8	317
Stem Bi-metric Ti porous 12/14 Biomet Merck	42	52	14	4	5	5	8	41	49	49	269
Stem Fit (older type) Lima				9	16	25	47	68	53	30	248
Hip stem cementles 12/14 Ti Al6V4 Biomet Merck	19	29	23	17	9	2	39	41	22	39	240
Stem Trio ,cementless, monobloc Beznoska								1	103	120	224
Modular femoral comp. Ana.Nova MII – Intraplant					36	62	55	58	2		213
Stem DiaLoc cementless – standard Implantcast									33	160	193
Femoral uncemented stem Sulzer	14	32	26	42	20	25	16	13	3	2	193
Stem C2 lateralised Lima						18	25	12	54	77	186
Stem Versys Tapered standard Zimmer				14	23	25	32	35	15	13	157
Stem LOGICA CS – TI Lima				1	14	25	24	49	26	18	157
Stem Anca-Fit w. HA 1/3 prox. Wright Medical Tech.					10	30	48	5	33	3	129
Femoral comp. Proxima STD offset Johnson&Johnson				17	33	32	12	11	7	7	119
Stem Bicontact SD Aesculap	3	3	13	25	26	16	10	5	7	9	117
Stem Avenir Müller Zimmer								4	44	63	111

Table 32. Most widely used uncemented cups in primary implantations (>100)

	Primoimplantations										
Material – Uncemented cups >100	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Cup Plasmacup SC (3 holes) Aesculap	523	724	1083	1132	1024	1390	970	934	1023	959	9762
Acetabular cup Allofit – Sulzer	77	109	324	472	422	671	932	1018	1127	1274	6426
Cup CLS-Spotorno – Sulzer	316	385	576	566	567	629	691	581	525	418	5254
Cup Bicon Plus – Smith & Nephew Medical			182	391	412	325	373	469	374	301	2827
Cup CSF „Zweymüller Alloclassic“ – Sulzer	197	196	293	246	254	398	362	270	260	201	2677
Cup Delta PF HA – Lima				30	116	291	378	505	490	486	2296
Cup L-Cup Ti porocoat – Biomet Merck	96	113	112	96	81	116	283	314	334	327	1872
Spherical cup MSF (HA) – Medin	212	225	202	186	201	210	196	158	111	120	1821
Cup Bicon Plus (older type) – Plus Endoprothetik AG	328	420	437	258	168	104	30	16	21	15	1797
Cup Exceed ABT porocoat for PE inlay – Biomet Merck						2	322	367	458	576	1725
Cup Trilogy – for PE inlay – Zimmer	125	177	155	176	135	160	115	94	44	108	1289
Screwcup SC – Aesculap	3	10	155	147	90	133	150	132	213	231	1264
Cup S.F./II/B3 – Beznoska						222	229	242	251	255	1199
Cup S.F/B3 – Beznoska	76	108	304	242	271	29		1			1031
Cup Plasmacup NSC (w/o holes) – Aesculap					62	150	110	131	142	316	911
Cup Duraloc Sector – porocoat – Johnson &Johnson	79	141	168	64	36	98	115	120	47	24	892
Cup Pinnacle Sector – HA – Johnson &Johnson				77	143	130	164	134	85	62	795
Cup „Poldi X“ – Ti – Beznoska	65	133	170	102	96	110	44	21	5	13	759
Cup Exceed ABT porocoat for ceram./metal inlay – Biomet Merck						38	156	209	150	149	702
Cup Procotyl L – Ti – Wright Medical Tech.						112	256	167	161	2	698
Cup Ana.Nova MII – Intraplant					121	179	158	143	12	78	691
Cup Pinnacle 100 – HA – Johnson &Johnson				30	61	119	106	115	149	54	634
Cup S.F./A – Beznoska	234	226	109	14	4	1					588
Cup SPH-Contact – Lima	10	32	42	91	89	51	45	4	82	125	571
Cup Allofit-S – Sulzer	53	20	11	39	27	69	103	52	44	31	449
Cup Duraloc 100 – porocoat – Johnson &Johnson	61	86	58	38	6	11	16	31	36		343
Cup SPH-BLIND – Lima				38	57	39	33	19	20	22	228
Cup EcoFit NH spherical(w/o holes) – Implantcast									30	179	209
Cup Duraloc Option – Johnson &Johnson	51	22	33	10	13	16	9	6	5	2	167
Cup Mallory-Head Ti porocoat – Biomet Merck	11	28	13	26	16	31	23	3			151
Cup Duraloc 1200 – porocoat – Johnson &Johnson	51	42	30	9	5	2					139
Cup Duraloc 300 – porocoat-Johnson &Johnson	7	44	62	10		1					124
Cup Allofit IT – Zimmer								6	56	57	119
Cup Procotyl O (porocoat) Ti – Wright Medical Tech.									24	78	102

Table 33. Most widely used cemented stems in primary implantations (>100)

	Primoimplantations										
Material – Cemented stems > 100 implantations	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Stem with conical neck 12/14 – AK Beznoska	1227	1566	1904	1454	1393	1493	1024	983	1167	1222	13433
Centrament stem Aesculap	1136	1654	2307	1912	1539	1757	914	534	556	654	12963
Stem Geradschaft, cone 12/14 Sukzer	390	463	988	1152	1120	1406	1471	1650	1645	1411	11696
Stem MS-30 polished(Protasul – FeCrN Sulzer+Zimmer	143	156	269	410	468	579	753	822	879	834	5313
Stem SM-Geradschaft, cone 12/14 Aesculap		1		77	359	354	448	536	690	681	3146
Stem Taperloc CoCr standard 12/14 Biomet Merck			8	67	103	154	583	673	568	837	2993
Stem Bi-metric CoCr 12/14 Biomet Merck	256	234	188	185	207	190	357	396	420	345	2778
Stem LOGICA MIRROR (polished) Lima		10	31	174	268	308	359	339	334	276	2099
Cemented stem CSC Beznoska	6	28	110	143	188	189	163	161	96	67	1151
Stem Trilliance Aesculap								167	295	363	825
FJORD cemented Stem 12/14 Johnson & Johnson				19	93	159	273	88	2		634
Stem SL (SELF LOCKING) AISI Lima				20				58	173	176	427
C-Stem Johnson & Johnson	44	96	118	111	1	10			21	8	409
Stem Excia cemented cone 12/14 Aesculap						65	52	106	71	101	395
Cylindrical cemented stem MC-S Medin		5	2	1	18	5	130	111	61	60	393
Stem Corail cemented Johnson & Johnson							72	167	121	28	388
Stem Trio cemented Beznoska								8	117	221	346
Stem Saphir cemented M.I.L.	89	56	77	45	27	4	4				302
Stem VarioLock polished AAP Mebio							8	45	82	80	215
Stem H-MOOS Lima				15	46	32	34	19	20	20	186
Stem CCA steel Mathys Bettlach									26	146	172
Stem revisional conical neck 12/14 Beznoska	26	11	19	17	20	16	14	11	15	20	169
Stem VERSYS-LD cemented Zimmer		27	33	37	40	17					154
Stem VERSYS HERITAGE polished Zimmer	16	47	47	27	8	1	4				150
Stem TMF polished Wright Medical Tech						25	49	18	27	3	122
Stem CL TRAUMA Lima				12	23	14	19	11	9	14	102
Stem MS-30 matt(Protasul – FeCrNi...)Sulzer	9	1			6	16	6	14	37	12	101

Table 34. Most widely used cemented cups in primary implantations (>100)

	Primoimplantations										
Material – Cemented cups >100	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
PE Cup typ Müller – Aesculap	863	1333	1889	1620	1613	1781	1272	1149	1184	1296	14000
Cup SPC PE – Sulzer	420	476	755	905	969	1217	805	208	153	85	5993
Cup type 02 cross – Beznoska						475	594	778	1130	1330	4307
Cup ZCA – Zimmer	74	95	240	248	172	176	450	753	734	613	3555
Cup Standard – Beznoska	670	563	529	263	217	324	191	151	107	111	3126
Cup typ 02 standard N – Beznoska	86	276	518	478	590	230	83	55	40	39	2395
Cup PE typ Müller – Biomet Merck							174	743	693	674	2284
Cup cemented Müller ZZ – Biomet Merck	306	250	285	320	342	320	440	8			2271
Cup PE (Durasul low profile) – Sulzer	2	2	2	46	4	2	144	524	643	547	1916
Ultima – Cemented cup UCC 28 – Johnson &Johnson	206	180	199	224	177	216	347	110	12		1671
Cup PE Standard – Lima		8	24	183	209	197	162	199	328	323	1633
Cup antilux. – Beznoska	30	38	61	63	53	36	36	34	48	63	462
Cup PE Advance typ Müller – AAP MEBIO								111	205	96	412
Cup PE Offset 20 – Lima		4	13	17	30	56	69	68	80	50	387
Cup PE type Charnley – M.I.L:	86	58	99	49	28	6	9	2			337
Cup PE PLUS Cemented – Smith&Nephew Medical								106	86	84	276
Cup ZCA OFFSET 10° – Zimmer	21	28	34	23	47	26	22	7	15	11	234
Cup type 97 – Beznoska	73	72	58	20	6	2					231
Cup PE Triloc II – Johnson &Johnson								74	68	9	151
Cup PE flat – Lima				8	41	21	21	9	19	12	131
Cup Apollo cemented – Biomet Merck										126	126
Cup PE CCB cemented – Mathys Bettlach									14	106	120

Table 35. Most widely used uncemented stems in revisions (>50)

	Revisions										
Material – Uncemented stems > 50 implantations	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Stem SL WAGNER, lateralised, cone 12/14 Zimmer	3	21	50	84	82	74	97	82	121	98	712
Revisional femoral component Lima		1	3	9	29	54	76	93	119	84	468
Stem S.F. revisional Beznoska	26	31	49	56	47	32	23	27	21	35	347
Stem SLL „Zweymüller Alloclassic“ revisional Zimmer	22	29	19	44	30	40	45	34	20	21	304
Stem SL „Zweymüller Alloclassic“ Zimmer	26	16	17	39	34	37	30	21	24	14	258
Stem femoral Sulzer	50	18	28	30	11	15	28	21	18	12	231
Stem ZWEYMÜLLER SLR PLUS (REV) Plus Endoprotetik	32	25	21	18	18	11	14	18	21	23	201
Stem Bicontact revisional Aesculap	17	20	25	24	32	22	22	8	7	4	181
Modular fem. component RMD Beznoska		1	8	9	22	28	17	27	23	40	175
Stem ZWEYMÜLLER SL PLUS Smith &Nephew Med.	11	12	13	17	6	17	11	9	12	11	119
Revisional hip stem 12/14 Ti Al6V4 Biomet Merck	14	12	13	13	15	13	6	8	4	1	99
Revisional fem. comp. Versys Large Junction Zimmer	20	15	18	13	9	7	5				87
Hip stem uncemented 12/14 Ti Al6V4 Biomet Merck	13	7	9	6	13	7	9	13	2	1	80
Revisional stem ConeLock Biomet Merck	10	17	7	9	9	3	4	8	7	1	75
Stem Bicontact Aesculap	3		10	12	11	2	5	8	8	7	66
Revis. anatomical Ti porocoat w. collar Biomet Merck	14	7	8	8	5	9	6	3	4		64

Table 36. Most widely used uncemented cups in revisions (>50)

	Revisions										
Material – Uncemented cups >50	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Oval cup MO (HA) – Medin	112	130	91	121	104	94	92	96	64	52	956
Cup CLS-Spotorno – Sulzer	66	60	68	110	88	94	72	77	99	84	818
Cup Bicon Plus – Smith&Nephew Medical			14	44	53	50	51	49	44	48	353
Cup Plasmacup SC (3 holes) – Aesculap	8	25	42	33	30	29	23	31	28	13	262
Cup Bicon Plus – (older type) Plus Endoprothetik AG	79	46	36	14	20	11	4	3	6	15	234
Cup CSF „Zweymüller Alloclassic“ – Sulzer	12	12	14	23	27	16	28	17	9	8	166
Cup Delta TT One – Lima								22	42	46	110
Cup Balgrist – Sulzer	46	27	8	14	6	2	2				105
Cup Delta PF (HA) – Lima					7	11	21	20	16	24	99
Cup Plasmacup MSC – Aesculap					23	10	22	2	18	16	91
TC oval cup – older type – Beznoska			12	21	19	15	11	7	3	1	89
Screwcup SC – Aesculap			6	22	6	8	9	8	12	12	83
Cup Allofit-S – Sulzer	7	9	11	9	7	14	6	6	2	7	78
Oval cup LOR – Sulzer	14	6	13	9	14	14	5	1			76
Cup Delta TT revisional – Lima								9	24	39	72
Cup S.F./II/B3 – Beznoska						18	17	12	10	9	66
Cup „Poldi X“ – Ti – Beznoska	17	18	10	8	4	1				1	59
Cup L-Cup Ti porocoat – Biomet Merck	14	7	9	5	4	5	4	1	4	5	58
Spherical cup MSF (HA) – Medin	7	5	12	7	11	3	2	2	4	4	57
Oval cup MO Modular (HA) – Medin		4	9	12	7	6	8	2		2	50

Table 37. Most widely used cemented stems in revisions (>50)

	Revisions										
Material – Cemented stems > 50 implantations	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Stem with conical neck 12/14 – AK Beznoska	105	118	178	153	159	174	116	126	117	125	1 371
Stem Centrament Aesculap	47	40	50	61	39	36	21	11	25	15	345
Stem revisional conical neck 12/14 AK Beznoska	10	20	17	23	37	23	19	14	28	45	236
Stem Geradschaft, cone 12/14 Sulzer	4	1	5	14	14	20	20	17	20	14	129
Stem MS-30 polished (Protasul – FeCrNi...) Sulzer	1		4	7	3	11	17	25	22	24	114
Stem Bi-metric CoCr 12/14 Biomet Merck	14	17	5	5	3	6	10	5	8	7	80

Table 38. Most widely used cemented cups in revisions (>50)

	Revisions										
Material – Cemented cups > 50	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
PE Cup typ Müller – Aesculap	77	92	94	104	117	109	94	70	62	61	880
Cup SPC PE – Sulzer	63	53	68	85	100	60	52	10	5	4	500
Cup Standard – Beznoska	85	83	86	39	39	41	44	22	19	29	487
Cup PE (Durasul low profile) – Sulzer	9	14	17	19	14	25	36	65	87	70	356
Cup cemented Müller ZZ – Biomet Merck	58	62	50	46	36	31	28				311
Cup type 02 cross – Beznoska						38	34	41	83	84	280
Cup ZCA – Zimmer	7	4	12	11	4	1	25	39	55	31	189
Cup antilux. – Beznoska	6	25	32	34	29	10	15	11	10	9	181
Cup typ 02 standard N – Beznoska	4	12	31	23	42	24	12	9	6	5	168
Cup ZCA OFFSET 10° – Zimmer	12	15	16	20	15	10	11	6	4	7	116
Cup PE typ Müller – Biomet Merck					2		13	42	32	26	115
Cup PE Offset 20 – Lima			2	3	18	22	16	24	17	12	114
Ultima – Cemented cup UCC 28 – Johnson &Johnson	22	7	8	20	14	17	4				92
Cup with collar – Beznoska	3	3	15	7	9	3	3		8	6	57

Table 39. Cages used for acetabular reinforcement in revisions

	Revisions										
Material – acetabular supporting devices	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total**
Burch-Schneider cage Sulzer	41	45	55	56	50	14	19	9	13	3	305
Burch-Schneider cage Zimmer					20	59	67	66	72	69	353
Acetabular mesh Medin	12	14	41	47	30	12	20	25	25	22	248
Burch-Schneider cage Beznoska	3	26	17	21	18	24	17	12	12	19	169
Roof reinforcement ring Sulzer	7	17	25	21	16	17	3	2	5	3	116
Eichler ring Beznoska	8	3	12	24	22	11	5	1			86
Reinforcement ring with hook Sulzer	20	9	18	15	11	1	2		4	4	84
Acetabular reconstruction shell Aesculap	2	4	6	3	4	7	15	4	11	10	66
Octopus ring Johnson & Johnson	5	2	5	9	6	4	1	3	1	2	38
Acetabular basket – type II/A – AK Beznoska						5	7	2	1		15
Acetabular basket Beznoska							5	1	1		7
Basket for acetabular protrusion Medin					1			2	1		4
TMARS – Short/long cage Zimmer										3	3
Acetabular cross plate Beznoska							1				1

Table 40. Modular heads used in primary implantations and revisions sorted by their diameter

Head diameter	Number of primary implantations	%	Number of revisions	%
22.00	189	0.19	23	0.20
22.20	50	0.05	8	0.07
22.22	6	0.01		0.00
22.23	31	0.03	3	0.03
26.00	10	0.01		0.00
28.00	74 733	73.73	7 177	63.28
32.00	17 094	16.86	4 099	36.14
36.00	5 901	5.82	349	3.08
38.00	5	0.00		0.00
39.00	1	0.00		0.00
40.00	33	0.03	2	0.02
41.00	4	0.00	1	0.01
42.00	163	0.16	3	0.03
43.00	19	0.02		0.00
44.00	470	0.46	4	0.04
44.50	26	0.03		0.00
45.00	21	0.02		0.00
46.00	722	0.71	4	0.04
47.00	37	0.04	2	0.02
47.50	29	0.03		0.00
48.00	515	0.51	4	0.04
49.00	47	0.05	2	0.02
50.00	340	0.34	5	0.04
51.00	56	0.06	1	0.01
52.00	236	0.23	5	0.04
52.50	15	0.01		0.00
53.00	44	0.04		0.00
54.00	212	0.21	4	0.04
55.00	29	0.03	1	0.01
55.50	2	0.00		0.00
56.00	81	0.08	2	0.02
57.00	14	0.01		0.00
58.00	11	0.01		0.00
59.00	2	0.00		0.00
60.00	2	0.00		0.00
61.00	2	0.00		0.00
***Total**	**101 361**	**100.00**	**11 341**	**100.00**

** Modular heads only*

Table 41. Overview of bone cement types used in primary implantations and revisions (2003–2012)

Material	Number of primary implantations	%	Number of revisions	%
Cement Palacos R	27784	44.91	885	16.59
Bone cement CMW 2	9042	14.62	265	4.97
Cement Palacos R with gentamycin	7301	11.80	2400	44.98
Cement Biomet	6748	10.91	184	3.45
Bone cement Smartset HV	4145	6.70	100	1.87
Cement Biomet Refobacin (vacuum mixing)	2108	3.41	121	2.27
Bone cement CMW 1	1590	2.57	103	1.93
Cement Hi-Fatigue (low viscosity)	1096	1.77	9	0.17
Cement Biomet Refobacin	1061	1.71	300	5.62
Bone cement CMW 2 with gentamycin	917	1.48	134	2.51
Bone cement Simplex	862	1.39	40	0.75
Cement Hi-Fatigue (low viscosity) with gentamycin	785	1.27	41	0.77
Cement Biomet (vacuum mixing)	687	1.11	18	0.34
Bone cement Smartset GHV (with gentamycin)	675	1.09	344	6.45
Bone cement Palamed	573	0.93	6	0.11
Smartmix HV – cartridge	486	0.79	19	0.36
Bone cement „C-ment“, standard viscosity	373	0.60	88	1.65
Cement Palacos R (vacuum mixing)	137	0.22	9	0.17
Bone cement CMW 1 with gentamycin	137	0.22	53	0.99
Bone cement PALACOS E Flow	48	0.08	4	0.07
Cement Biomet Revision Refobacin	44	0.07	97	1.82
Cement Copal with gentamycin + clindamycin	37	0.06	190	3.56
Bone cement Palamed with gentamycin	29	0.05	97	1.82
Bone cement CMW 2000	18	0.03		0.00
Bone cement CMT-1	9	0.01	1	0.02
Cement Biomet LV Refobacin	7	0.01	12	0.22
Cement Palacos R with gentamycin (vacuum mixing)	7	0.01	6	0.11
Bone cement CMW 2000 with gentamycin	5	0.01	20	0.37
Cement Palacos LV with gentamycin	4	0.01		0.00
Bone cement CMW 3	4	0.01		0.00
Cement Vancogenx with vankomycin + gentamycin	3	0.00	19	0.36
Bone cement „C-ment“, (low viscosity)	3	0.00		0.00
Bone cement CMT-3	2	0.00		0.00
Cement Palacos LV	2	0.00	1	0.02
Bone cement Osteobond	2	0.00		0.00
Bone cement CMW 3 with gentamycin	1	0.00	1	0.02
Cement Palacos with gentamycin (vacuum mixing)	1	0.00		0.00
Bone cement Profitt (low viscosity)		0.00	2	0.04
Total	**61866**	**100.00**	**5336**	**100.00**

Table 42. Revision rate for the period 2003–2012 – uncemented stems used in primary implantations

Material – Uncemented stems >100	Primary implantations	Number of revised cases	Revision rate RR
Stem Antega Aesculap	1 373	28	2.04
Hip stem MT (older type) (HA) Medin	317	6	1.89
Hip stem cementless 12/14 Ti Al6V4 Biomet Merck	240	4	1.67
Stem LOGICA CS – TI Lima	157	2	1.27
Stem S.F./ML Beznoska	951	11	1.16
Stem C2 lateralised Lima	186	2	1.08
Stem S.F./S Beznoska	1 269	13	1.02
Stem Profemur – Z Wright Medical Tech.	711	7	0.98
Modular femoral comp. Ana.Nova MII – Intraplant	213	2	0.94
Stem Trio ,cementless, monobloc Beznoska	224	2	0.89
Stem Bicontact SD Aesculap	117	1	0.85
Stem Bicontact Aesculap	2 793	23	0.82
Stem Antega – CaP sprayed Aesculap	891	7	0.79
Stem Anca-Fit w. HA 1/3 prox. Wright Medical Tech.	129	1	0.78
Stem SL-Twin straight Endoplant	656	5	0.76
Stem Bi-metric Ti porous 12/14 Biomet Merck	269	2	0.74
Stem Metha – Aesculap	434	3	0.69
Stem Zweymüller SL PLUS Smith & Nephew	2 958	20	0.68
Stem SL (SELF LOCKING) Titan+Porocoat Lima	392	1	0.62
Average RR for all uncemented stems in register-primoimplantations	**35 704**	**209**	**0.59**
Stem Corail w/o collar (older type) Johnson&Johnson	1 969	11	0.56
Stem DiaLoc cementless – standard Implantcast	193	1	0.52
Stem Excia Plasmapore, cone 12/14 Aesculap	1 597	8	0.50
Stem CLS 145°, cone 12/14 Sulzer	2 041	10	0.49
Stem AML, konus 12/14 Johnson&Johnson	470	2	0.43
Stem Versys uncemented Zimmer	720	3	0.42
Stem Fit (older type) Lima	248	1	0.40
Stem Bi-Metric w/o collar – porocoat Biomet	511	2	0.39
Stem SL „Zweymüller Alloclassic“ Zimmer	4 337	12	0.28
Stem Taperloc Ti porocoat standard 12/14 Biomet	2 556	7	0.27
Stem Bicontact S Aesculap	370	1	0.27
Stem CLS 135° – cone 12/14 Zimmer	2 347	4	0.17
Stem C2 standard Lima	1 327	2	0.15
Stem TRJ Aesculap	395		0.00
Cylindrical cementless stem MC-T (Ti) Medin	358		0.00
Femoral uncemented stem Sukzer	193		0.00
Stem Versys Tapered standard Zimmer	157		0.00
Femoral comp. Proxima STD offset Johnson&Johnson	119		0.00
Stem Avenir Müller Zimmer	111		0.00

Table 43. Revision rate for the period 2003–2012 – uncemented cups used in primary implantations

Material – Uncemented cups >100	Primary implantations	Number of revised cases	Revision rate RR
Cup SPH-BLIND – Lima	228	11	4.82
Cup Procotyl O (porocoat) Ti – Wright Medical Tech.	102	2	1.96
Cup S.F./A – Beznoska	588	9	1.53
Cup S.F/B3 – Beznoska	1 031	13	1.26
Screwcup SC – Aesculap	1 264	13	1.03
Cup Bicon Plus (older type) – Plus Endoprothetik AG	1 797	18	1.00
Cup Plasmacup SC (3 holes) Aesculap	9 762	89	0.91
Cup Duraloc 300 – porocoat – Johnson &Johnson	124	1	0.81
Cup „Poldi X“ – Ti – Beznoska	759	6	0.79
Cup Bicon Plus – Smith & Nephew Medical	2 827	21	0.74
Cup Ana.Nova MII – Intraplant	691	5	0.72
Cup Procotyl L – Ti – Wright Medical Tech.	698	5	0.72
Spherical cup MSF (HA) – Medin	1821	13	0.71
Cup Mallory-Head Ti porocoat – Biomet Merck	151	1	0.66
Average RR for all uncemented cups in register-primoimplantations	**52 433**	**323**	**0.62**
Cup Duraloc Option – Johnson &Johnson	167	1	0.60
Cup S.F./II/B3 – Beznoska	1 199	7	0.58
Cup Trilogy – for PE inlay – Zimmer	1 289	6	0.47
Cup CLS-Spotorno – Sulzer	5 254	24	0.46
Cup Delta PF HA – Lima	2 296	10	0.44
Cup L-Cup Ti porocoat – Biomet Merck	1 872	8	0.43
Cup Pinnacle Sector – HA – Johnson &Johnson	795	3	0.38
Acetabular cup Allofit – Sulzer	6 426	24	0.37
Cup Duraloc Sector – porocoat – Johnson &Johnson	892	3	0.34
Cup Pinnacle 100 – HA – Johnson &Johnson	634	2	0.32
Cup Duraloc 100 – porocoat – Johnson &Johnson	343	1	0.29
Cup Allofit-S – Sulzer	449	1	0.22
Cup Plasmacup NSC (w/o holes) – Aesculap	911	2	0.22
Cup CSF „Zweymüller Alloclassic“ – Sulzer	2 677	5	0.19
Cup SPH-Contact – Lima	571	1	0.18
Cup Exceed ABT porocoat for ceram./metal inlay – Biomet Merck	702	1	0.14
Cup Exceed ABT porocoat for PE inlay – Biomet Merck	1 725	2	0.12
Cup EcoFit NH spherical(w/o holes) – Implantcast	209		0.00
Cup Duraloc 1200 – porocoat – Johnson &Johnson	139		0.00
Cup Allofit IT – Zimmer	119		0.00

Table 44. Revision rate for the period 2003–2012 – cemented stems used in primary implantations

Material – Cemented stems >100	Primary implantations	Number of revised cases	Revision rate RR
Stem CL TRAUMA Lima	102	2	1.96
Stem VERSYS-LD cemented Zimmer	154	2	1.30
Stem Excia cemented cone 12/14 Aesculap	395	4	1.01
Stem Saphir cemented M.I.L.	302	3	0.99
Centrament stem Aesculap	12 963	113	0.87
Stem TMF polished Wright Medical Tech	122	1	0.82
FJORD cemented Stem 12/14 Johnson & Johnson	634	4	0.63
Stem Trilliance Aesculap	825	5	0.61
Stem revisional conical neck 12/14 Beznoska	169	1	0.59
Average RR for all cemented stems in register-primoimplantations	**62 265**	**329**	**0.53**
Cemented stem CSC Beznoska	1 151	6	0.52
C-Stem Johnson & Johnson	409	2	0.49
Stem Geradschaft, cone 12/14 Sukzer	11 696	56	0.48
Stem LOGICA MIRROR (polished) Lima	2 099	10	0.48
Stem Bi-metric CoCr 12/14 Biomet Merck	2 778	13	0.47
Stem VarioLock polished AAP Mebio	215	1	0.47
Stem with conical neck 12/14 – AK Beznoska	13 433	52	0.39
Stem SM-Geradschaft, cone 12/14 Aesculap	3 146	11	0.35
Stem MS-30 polished(Protasul – FeCrN Sulzer+Zimmer	5 313	16	0.30
Stem Trio cemented Beznoska	346	1	0.29
Cylindrical cemented stem MC-S Medin	393	1	0.25
Stem Taperloc CoCr standard 12/14 Biomet Merck	2 993	3	0.10
Stem SL (SELF LOCKING) AISI Lima	427		0.00
Stem Corail cemented Johnson & Johnson	388		0.00
Stem H-MOOS Lima	186		0.00
Stem CCA steel Mathys Bettlach	172		0.00
Stem VERSYS HERITAGE polished Zimmer	150		0.00
Stem MS-30 matt(Protasul – FeCrNi...)Sulzer	101		0.00

Table 45. Revision rate for the period 2003–2012 – cemented cups used in primary implantations

Material – Cemented cups >100	Primary implantations	Number of revised cases	Revision rate RR
Cup PE flat – Lima	131	2	1.53
Cup PE PLUS Cemented – Smith&Nephew Medical	276	3	1.09
Cup type 97 – Beznoska	231	2	0.87
Cup Apollo cemented – Biomet Merck	126	1	0.79
PE Cup typ Müller – Aesculap	14 000	90	0.64
Cup PE type Charnley – M.I.L:	337	2	0.59
Cup Standard – Beznoska	3 126	17	0.54
Ultima – Cemented cup UCC 28 – Johnson &Johnson	1 671	8	0.48
Average RR for all cemented cups in register-primoimplantations	**46 383**	**217**	**0.47**
Cup typ 02 standard N – Beznoska	2 395	11	0.46
Cup SPC PE – Sulzer	5 993	27	0.45
Cup cemented Müller ZZ – Biomet Merck	2 271	10	0.44
Cup antilux. – Beznoska	462	2	0.43
Cup PE Standard – Lima	1 633	7	0.43
Cup ZCA OFFSET 10° – Zimmer	234	1	0.43
Cup ZCA – Zimmer	3 555	14	0.39
Cup PE typ Müller – Biomet Merck	2 284	5	0.22
Cup type 02 cross – Beznoska	4 307	9	0.21
Cup PE (Durasul low profile) – Sulzer	1 916	1	0.05
Cup PE Advance typ Müller – AAP MEBIO	412		0.00
Cup PE Triloc II – Johnson &Johnson	151		0.00
Cup PE Offset 20 – Lima	387		0.00
Cup PE CCB cemented – Mathys Bettlach	120		0.00

Table 46. Cumulative survival probability – most widely used uncemented stems

Position	Material – Uncemented stems	Number of evaluated primoimplantations	Follow-up time (years)	Cumulative survival probability*
1.	Stem SL „Zweymüller Alloclassic“ Zimmer	4 337	11	96.42%
2.	Stem Zweymüller SL PLUS Smith & Nephew	2 958	11	95.76%
3.	Stem Bicontact Aesculap	2 793	11	93.71%
4.	Stem Taperloc Ti porocoat standard 12/14 Biomet	2 556	9	94.66%
5.	Stem CLS 135° – cone 12/14 Zimmer	2 347	11	96.55%
:	:	:	:	:
11	Stem S.F./S Beznoska**	1269	11	93.59%
:	:	:	:	:
23	Cylindrical cementless stem MC-T (Ti) Medin**	358	9	97.18%

** see graphs*
*** the most common original Czech implants*

Table 47. Cumulative survival probability – most widely used uncemented cups

Position	Material – Uncemented cups	Number of evaluated primoimplantations	Follow-up time (years)	Cumulative survival probability*
1.	Cup Plasmacup SC (3 holes) Aesculap	9 762	11	93.80%
2.	Acetabular cup Allofit – Sulzer	6 426	11	95.95%
3.	Cup CLS-Spotorno – Sulzer	5 254	11	96.14%
4.	Cup Bicon Plus – Smith & Nephew Medical	2 827	9	91.98%
5.	Cup CSF „Zweymüller Alloclassic“ – Sulzer	2 677	11	96.52%
:	:	:	:	:
8.	Spherical cup MSF (HA) – Medin**	1 821	11	85.76%
:	:	:	:	:
15.	Cup S.F./II/B3 – Beznoska**	1 199	6	96.57%

** see graphs*
*** the most common original Czech implants*

Table 48. Cumulative survival probability – most widely used cemented stems

Position	Material – Cemented stems	Number of evaluated primoimplantations	Follow-up time (years)	Cumulative survival probability*
1.	Stem with conical neck 12/14 – AK Beznoska**	13 433	11	96.09%
2.	Centrament stem Aesculap	12 963	11	93.06%
3.	Stem Geradschaft, cone 12/14 Sulzer	11 696	11	96.10%
4.	Stem MS-30 polished(Protasul – FeCrN Sulzer+Zimmer	5 313	11	96.90%
5.	Stem SM-Geradschaft, cone 12/14 Aesculap	3 146	10	98.32%

** see graphs*
*** the most common original Czech implants*

Table 49. Cumulative survival probability – most widely used cemented cups

Position	Material – Cemented cups	Number of evaluated primoimplantations	Follow-up time (years)	Cumulative survival probability*
1.	PE Cup typ Müller – Aesculap	14 000	11	94.36%
2.	Cup SPC PE – Sulzer	5 993	11	97.06%
3.	Cup type 02 cross – Beznoska**	4 307	6	97.84%
4.	Cup ZCA – Zimmer	3 555	11	96.31%
5.	Cup Standard – Beznoska**	3 126	11	94.80%

** see graphs*
*** the most common original Czech implants*

Table 50. Cumulative survival probability of all completely uncemented hip replacements

Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Uncemented
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			36 464
1	99.39%	99.39%	223	147	36 464
2	99.60%	98.99%	134	5 060	36 094
3	99.62%	98.62%	108	4 723	30 900
4	99.60%	98.22%	95	4 559	26 069
5	99.68%	97.90%	62	4 545	21 415
6	99.70%	97.61%	44	4 177	16 808
7	99.48%	97.10%	58	3 030	12 587
8	99.39%	96.51%	49	2 958	9 499
9	99.24%	95.77%	39	2 746	6 492
10	99.33%	95.13%	18	2 052	3 707
11	99.39%	94.55%	5	1 632	1 637

Table 51. Cumulative survival probability of all hybrid hip replacements with cemented acetabular component

Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Hybrid – cemented acetabular component
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			656
1	97.69%	97.69%	15	12	656
2	99.49%	97.20%	3	78	629
3	99.02%	96.24%	5	79	548
4	100.00%	96.24%		82	464
5	99.43%	95.69%	2	66	382
6	99.30%	95.02%	2	56	314
7	99.13%	94.19%	2	53	256
8	100.00%	94.19%		61	201
9	97.37%	91.71%	3	52	140
10	98.26%	90.12%	1	55	85
11	93.33%	84.11%	1	28	29

Table 52. Cumulative survival probability of all hybrid hip replacements with cemented femoral component

Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Hybrid – cemented femoral component
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			16 550
1	99.47%	99.47%	87	148	16 550
2	99.45%	98.92%	84	2 208	16 315
3	99.48%	98.41%	67	2 062	14 023
4	99.53%	97.95%	51	1 986	11 894
5	99.50%	97.47%	44	2 001	9 857
6	99.31%	96.79%	48	1 780	7 812
7	99.60%	96.40%	21	1 461	5 984
8	99.28%	95.71%	27	1 464	4 502
9	99.17%	94.92%	19	1 433	3 011
10	98.82%	93.80%	13	920	1 559
11	99.05%	92.90%	3	623	626

Table 53. Cumulative survival probability of all completely cemented hip replacements

Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Cemented
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			45 406
1	99.38%	99.38%	278	1 061	45 406
2	99.59%	98.97%	169	6 424	44 067
3	99.62%	98.59%	131	6 057	37 474
4	99.62%	98.22%	108	5 428	31 286
5	99.68%	97.91%	74	4 924	25 750
6	99.70%	97.61%	55	4 912	20 752
7	99.69%	97.31%	43	4 114	15 785
8	99.63%	96.95%	36	3 794	11 628
9	99.48%	96.45%	31	3 565	7 798
10	99.54%	96.00%	14	2 357	4 202
11	99.67%	95.69%	3	1 828	1 831

Table 54. Cumulative survival probability of all cemented cervico-capital prostheses

Gender	All
Joint	Hip
Diagnosis	All
Type	Cemented – CC prosthesis
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			2 588
1	98.79%	98.79%	28	552	2 588
2	99.53%	98.32%	8	638	2 008
3	99.83%	98.16%	2	349	1 362
4	100.00%	98.16%		276	1 011
5	99.84%	98.00%	1	198	735
6	99.78%	97.79%	1	160	536
7	100.00%	97.79%		103	375
8	100.00%	97.79%		140	272
9	100.00%	97.79%		81	132
10	100.00%	97.79%		35	51
11	100.00%	97.79%		16	16

Table 55. Cumulative survival probability in patients with primary osteoarthritis

Gender	All
Joint	Hip
Diagnosis	Primary osteoarthritis
Type	All
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			71 015
1	99.56%	99.56%	314	562	71 015
2	99.62%	99.18%	247	9 946	70 139
3	99.61%	98.79%	216	9 447	59 946
4	99.63%	98.43%	169	8 802	50 283
5	99.66%	98.09%	125	8 539	41 312
6	99.63%	97.74%	105	7 913	32 648
7	99.64%	97.38%	78	6 219	24 630
8	99.54%	96.93%	71	5 842	18 333
9	99.41%	96.36%	57	5 650	12 420
10	99.35%	95.73%	31	3 827	6 713
11	99.44%	95.20%	8	2 847	2 855

Table 56. Cumulative survival probability in patients after congenital hip dislocation

Gender	All
Joint	Hip
Diagnosis	Congenital hip dislocation
Fixation type	All
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			9 124
1	99.39%	99.39%	56	32	9 124
2	99.69%	99.08%	26	1 028	9 036
3	99.65%	98.74%	26	976	7 982
4	99.55%	98.30%	29	1 035	6 980
5	99.61%	97.91%	21	1 039	5 916
6	99.61%	97.53%	17	1 075	4 856
7	99.61%	97.15%	13	866	3 764
8	98.98%	96.15%	25	877	2 885
9	98.91%	95.10%	17	855	1 983
10	99.25%	94.39%	6	626	1 111
11	98.76%	93.21%	3	476	479

Table 57. Cumulative survival probability in patients with rheumatoid arthritis

Gender	All
Joint	Hip
Diagnosis	Rheumatoid arthritis
Type	All
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			683
1	99.27%	99.27%	5	3	683
2	99.37%	98.64%	4	78	675
3	100.00%	98.64%		74	593
4	99.79%	98.44%	1	73	519
5	99.52%	97.96%	2	64	445
6	99.10%	97.08%	3	89	379
7	98.41%	95.54%	4	72	287
8	100.00%	95.54%		62	211
9	100.00%	95.54%		48	149
10	100.00%	95.54%		57	101
11	100.00%	95.54%		44	44

Table 58. Cumulative survival probability in status post fracture in general

Gender	All
Joint	Hip
Diagnosis	Post-fracture
Fixation type	All
Follow-up time	2003–2012

Year	Survival probability	Cumulative survival probability	Number of revised cases	Number of censored cases	Number of non-revised cases
0	100.00%	100.00%			13 626
1	98.58%	98.58%	186	1 132	13 626
2	99.27%	97.86%	81	2 305	12 308
3	99.49%	97.36%	46	1 817	9 922
4	99.67%	97.04%	24	1 627	8 059
5	99.60%	96.65%	23	1 339	6 408
6	99.71%	96.37%	13	1 164	5 046
7	99.53%	95.91%	16	949	3 869
8	99.62%	95.55%	9	1 072	2 904
9	99.57%	95.14%	6	842	1 823
10	99.58%	94.74%	3	526	975
11	99.55%	94.32%	1	445	446

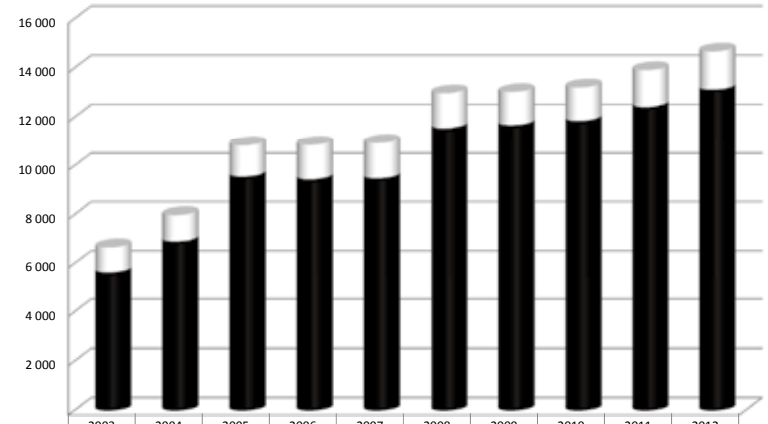
Table 59. Cumulative survival probability in status post fracture in men

Gender	Males				
Joint	Hip				
Diagnosis	Post-fracture				
Fixation type	All				
Follow-up time	2003–2012				
Year	**Survival probability**	**Cumulative survival probability**	**Number of revised cases**	**Number of censored cases**	**Number of non--revised cases**
0	100.00%	100.00%			4 759
1	98.26%	98.26%	79	432	4 759
2	99.12%	97.40%	34	780	4 248
3	99.39%	96.80%	19	644	3 434
4	99.56%	96.37%	11	561	2 771
5	99.44%	95.83%	11	461	2 199
6	99.80%	95.65%	3	393	1 727
7	99.57%	95.24%	5	325	1 331
8	99.15%	94.43%	7	348	1 001
9	99.41%	93.88%	3	273	646
10	99.63%	93.53%	1	200	370
11	100.00%	93.53%		169	169

Table 60. Cumulative survival probability in status post fracture in women

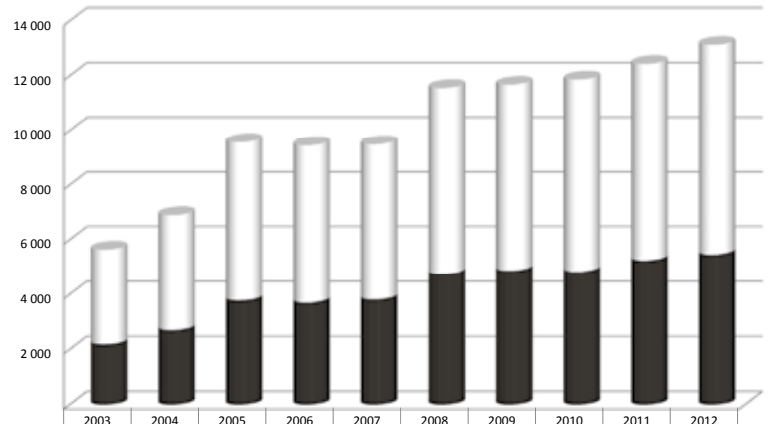
Gender	Females				
Joint	Hip				
Diagnosis	Post-fracture				
Fixation type	All				
Follow-up time	2003–2012				
Year	**Survival probability**	**Cumulative survival probability**	**Number of revised cases**	**Number of censored cases**	**Number of non--revised cases**
0	100.00%	100.00%			8 867
1	98.74%	98.74%	107	700	8 867
2	99.36%	98.11%	47	1 525	8 060
3	99.54%	97.66%	27	1 173	6 488
4	99.73%	97.39%	13	1 066	5 288
5	99.68%	97.08%	12	878	4 209
6	99.66%	96.75%	10	771	3 319
7	99.51%	96.27%	11	624	2 538
8	99.87%	96.15%	2	724	1 903
9	99.66%	95.82%	3	569	1 177
10	99.55%	95.39%	2	326	605
11	99.28%	94.70%	1	276	277

Graph 1. Aggregate number of primary implantations and revision surgeries processed by the register in 2003–2012



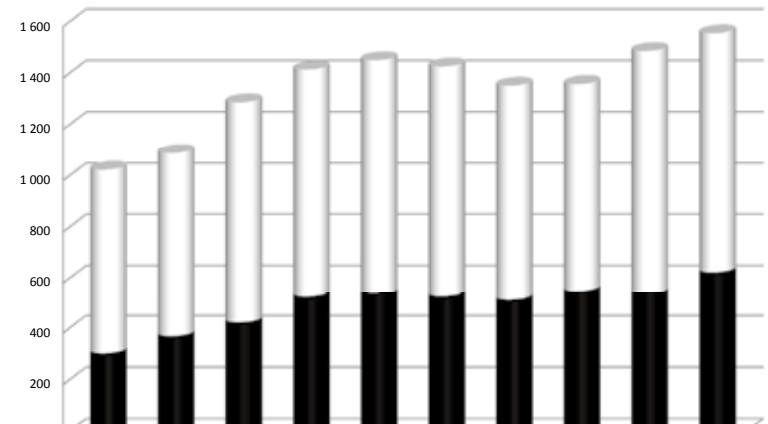
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Revision	1 025	1 090	1 289	1 416	1 452	1 428	1 354	1 360	1 488	1 557
Primary	5 640	6 902	9 570	9 458	9 495	11 558	11 681	11 867	12 433	13 130

Graph 2. Number of primary implantations in individual years by gender



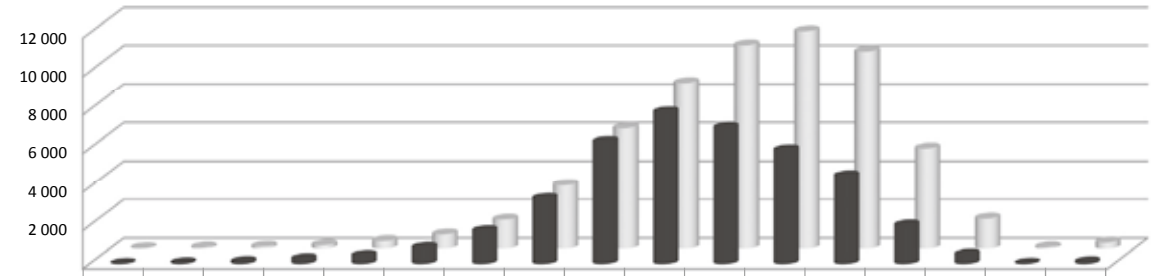
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Female	3 456	4 204	5 794	5 759	5 680	6 819	6 827	7 048	7 200	7 679
Male	2 184	2 698	3 776	3 699	3 815	4 739	4 854	4 819	5 233	5 451

Graph 3. Number of revisions in individual years by gender



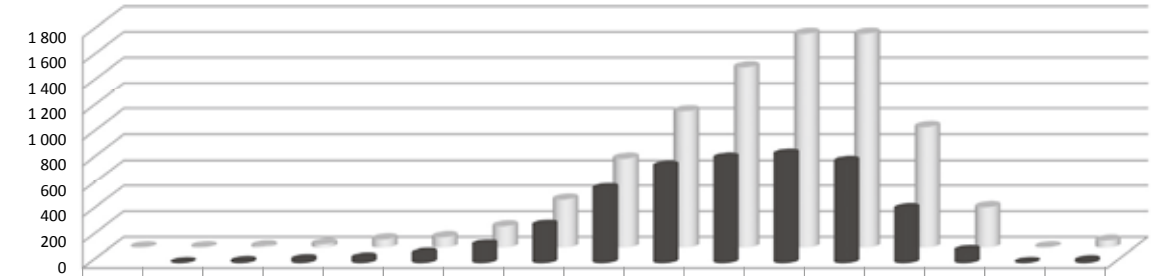
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Female	721	719	866	891	915	902	841	810	948	933
Male	304	371	423	525	537	526	513	550	540	624

Graph 4. Frequency of primary implantations by gender and age at the time of operation



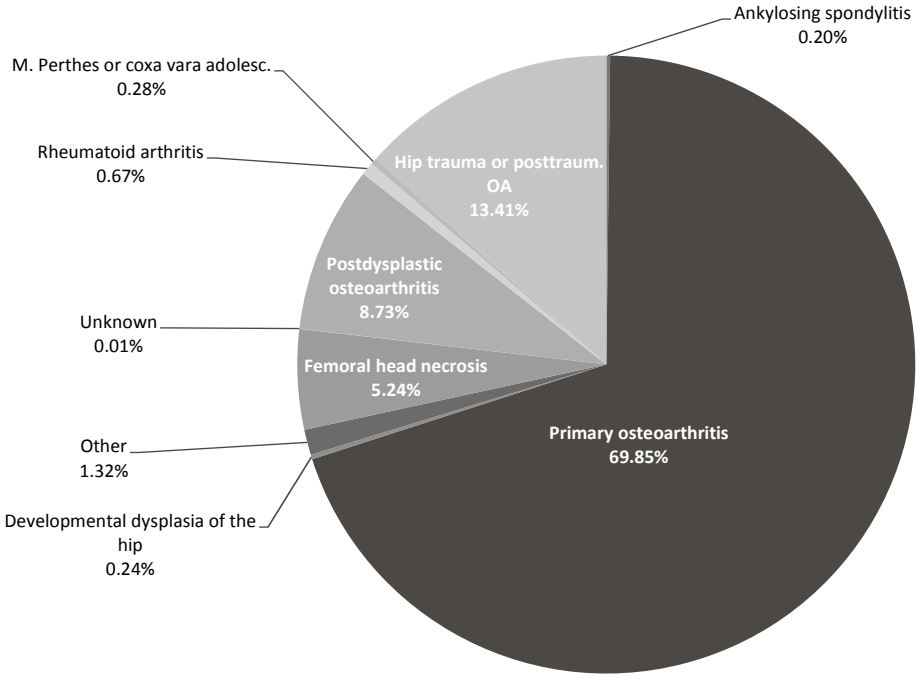
	0-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+	Un-known
Male	14	51	113	255	433	853	1 713	3 395	6 356	7 877	7 079	5 920	4 583	2 007	493	23	103
Female	23	57	106	185	397	742	1 497	3 305	6 264	8 609	10 570	11 308	10 256	5 202	1 558	68	319

Graph 5. Frequency of revisions by gender and age at the time of operation

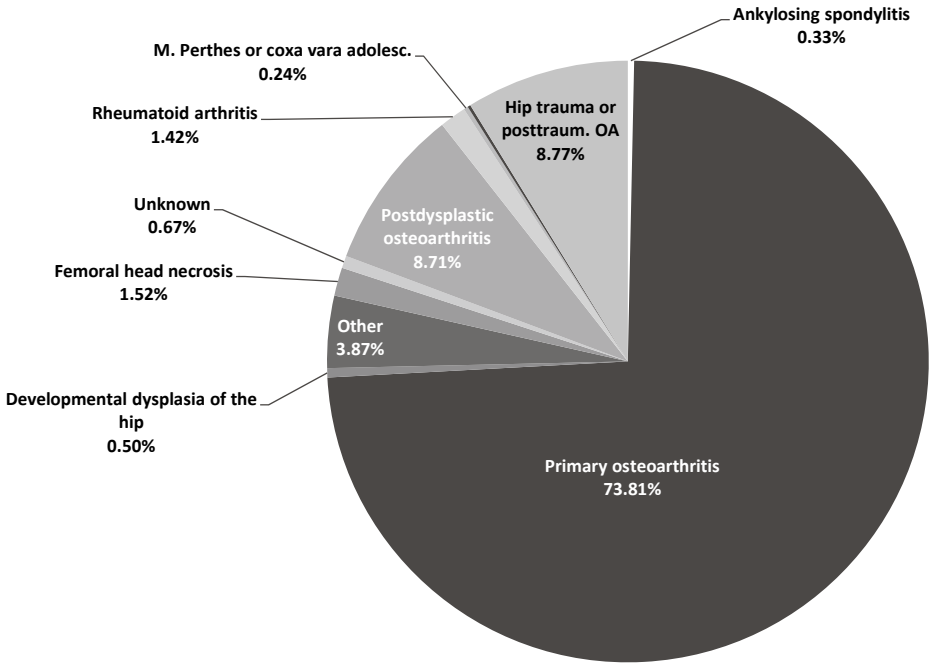


	0-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+	Un-known
Male		2	11	25	37	74	140	292	579	757	818	849	792	421	96	3	17
Female	3	4	11	27	65	82	165	373	696	1 060	1 408	1 669	1 670	940	314	4	55

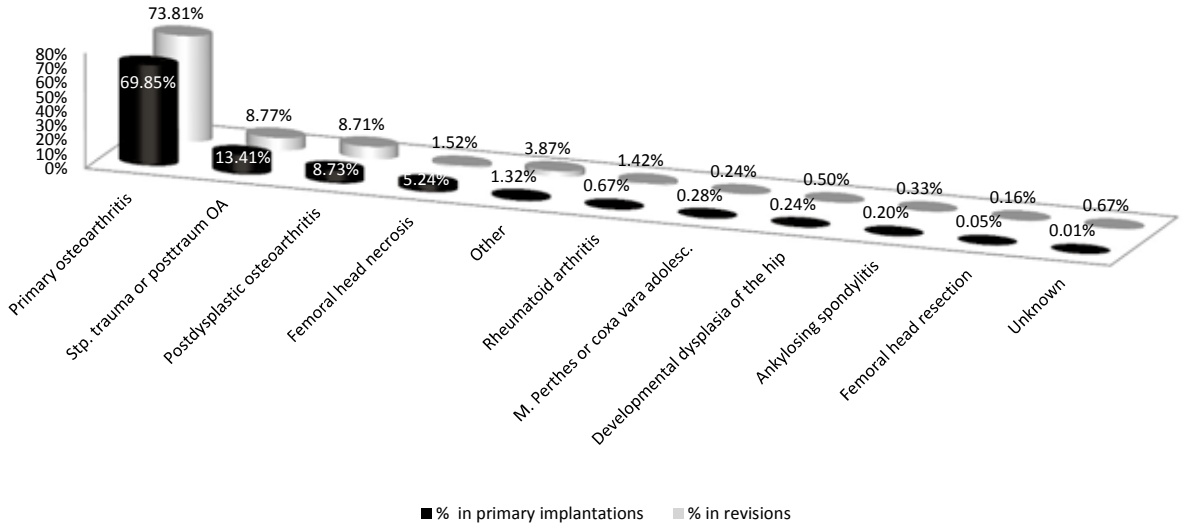
Graph 6. Share of basic (original) diagnoses in the total number of registered primary implantations



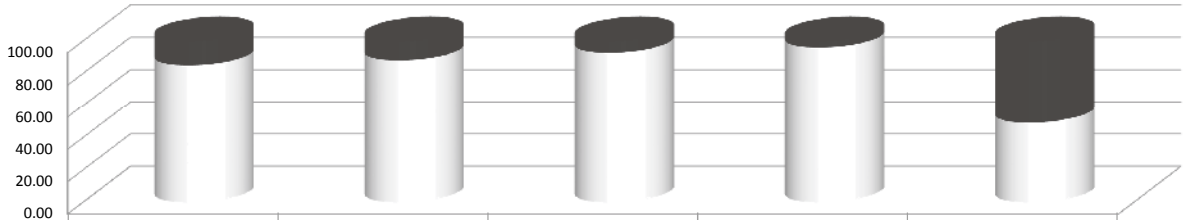
Graph 7. Share of basic (original) diagnoses in the total number of registered revisions



Graph 8. Rate of percentage share of basic diagnoses in primary implantations and revisions

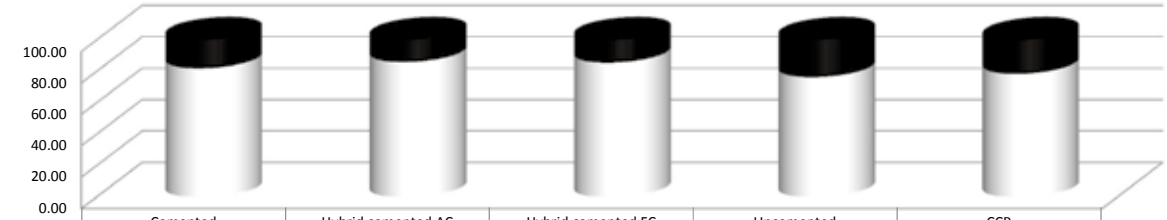


Graph 9. Share of all deceased (w/o relation to operation) in individual categories of primary implantations by the type of implant for the period 2003–20012



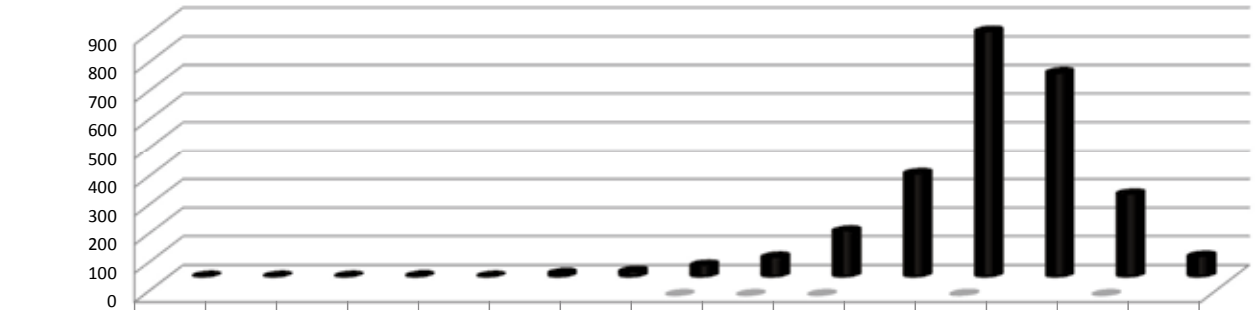
	Cemented	Hybrid cemented AC	Hybrid cemented FC	Uncemented	CCP
Deceased %	15.05	12.04	7.31	4.08	50.77
Surviving %	84.95	87.96	92.69	95.92	49.23

Graph 10. Share of all deceased (w/o relation to operation) in individual categories of revisions by the type of implant for the period 2003–20012



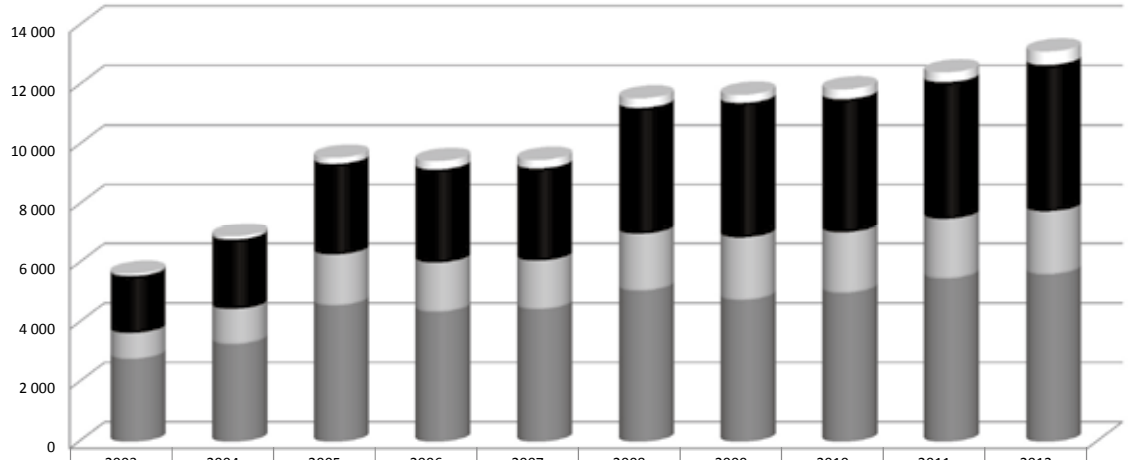
	Cemented	Hybrid cemented AC	Hybrid cemented FC	Uncemented	CCP
Deceased %	17.91	13.93	14.33	23.57	21.43
Surviving %	82.09	86.07	85.67	76.43	78.57

Graph 11. Age structure in patients with CC prosthesis at the time of implantation or its revision



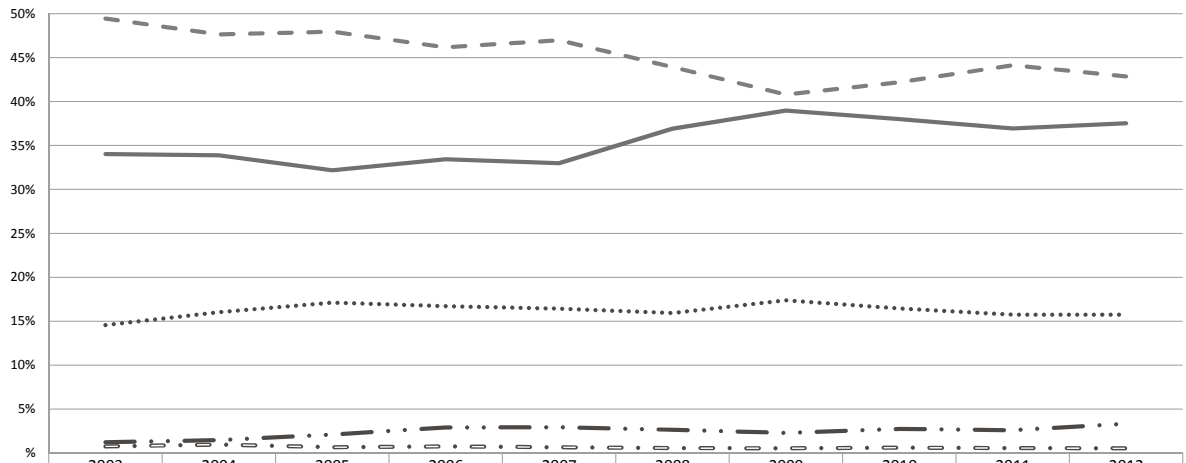
	20-24	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95+
Revised cases								1	1	1		2		1	
Primary impl.	1	1	1	2	1	11	18	40	68	159	359	858	714	288	71

Graph 12. Summary of primary implantations divdided by the type of implant in individual years



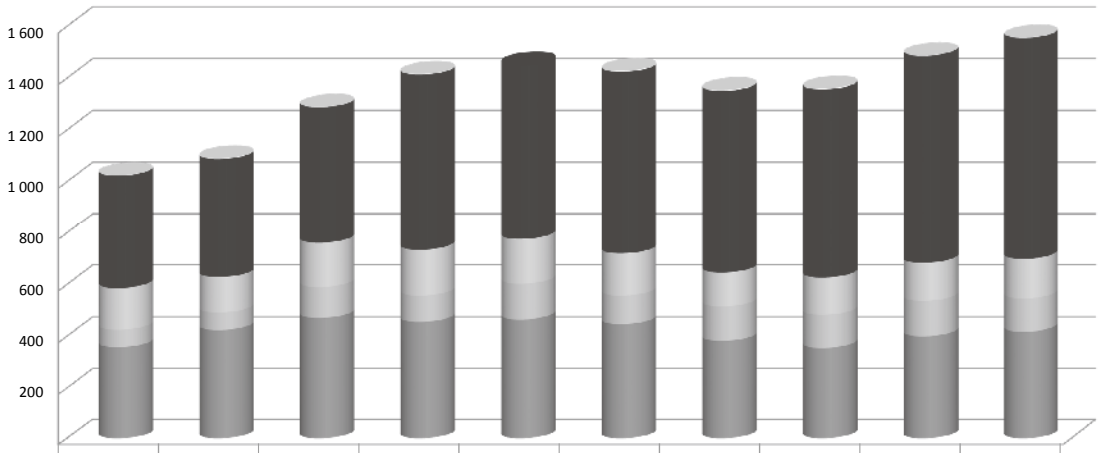
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
CC prosthesis	69	102	202	276	278	308	270	326	323	438
Uncemented	1 919	2 339	3 079	3 162	3 132	4 267	4 551	4 509	4 593	4 926
Hybrid cem.FC	821	1 107	1 638	1 581	1 561	1 841	2 031	1 953	1 958	2 068
Hybrid cem.AC	43	67	63	72	64	66	64	73	72	72
Cemented	2 788	3 287	4 588	4 367	4 460	5 076	4 765	5 006	5 487	5 626

Graph 13. Developmental trends in various types of implants in primary implantations



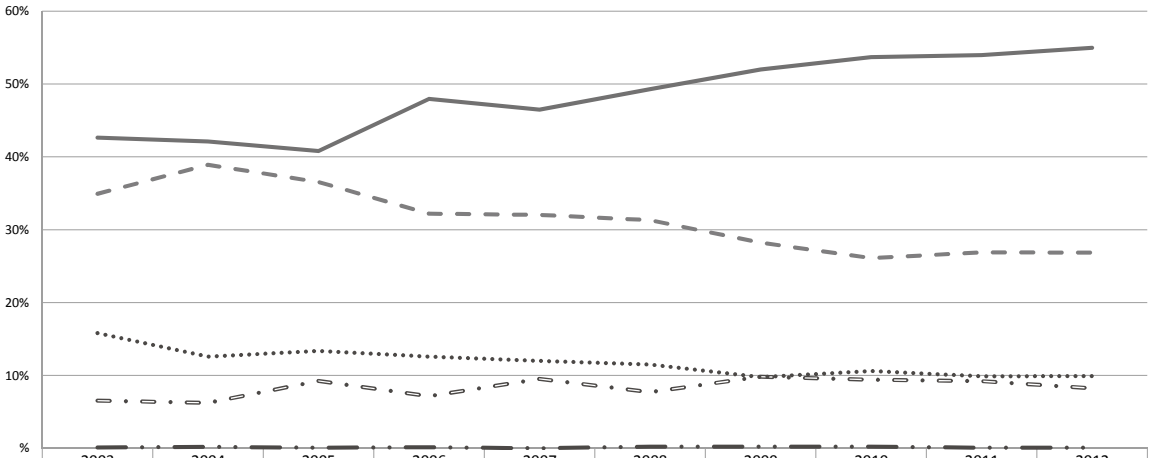
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cemented	49.43	47.62	47.94	46.17	46.97	43.92	40.79	42.18	44.13	42.85
Hybrid cem.AC	0.76	0.97	0.66	0.76	0.67	0.57	0.55	0.62	0.58	0.55
Hybrid cem.FC	14.56	16.04	17.12	16.72	16.44	15.93	17.39	16.46	15.75	15.75
Uncemented	34.02	33.89	32.17	33.43	32.99	36.92	38.96	38.00	36.94	37.52
CC prosthesis	1.22	1.48	2.11	2.92	2.93	2.66	2.31	2.75	2.60	3.34

Graph 14. Summary of revisions divdided by the type of implant in individual years



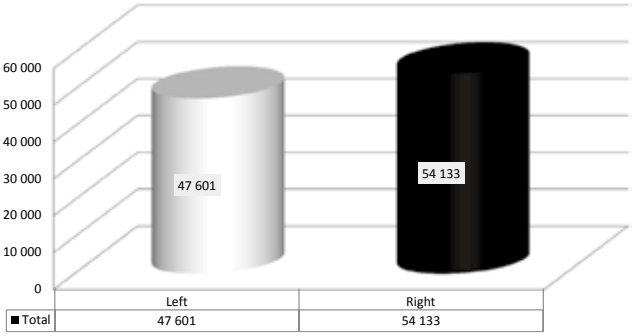
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
CC prosthesis	1	2	1	2		3	3	3	1	1
Uncemented	437	459	526	679	675	704	704	730	803	856
Hybrid cem.FC	162	137	172	178	174	164	132	144	147	154
Hybrid cem.AC	67	68	119	101	138	110	133	128	137	128
Cemented	358	424	471	456	465	447	382	355	400	418

Graph 15. Developmental trends in various types of implants in revisions

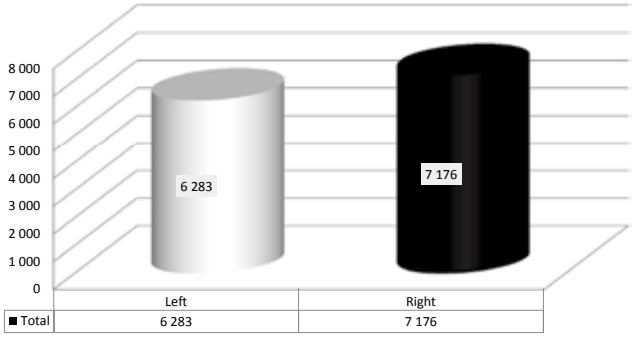


	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cemented	34.93	38.90	36.54	32.20	32.02	31.30	28.21	26.10	26.88	26.85
Hybrid cem.AC	6.54	6.24	9.23	7.13	9.50	7.70	9.82	9.41	9.21	8.22
Hybrid cem.FC	15.80	12.57	13.34	12.57	11.98	11.48	9.75	10.59	9.88	9.89
Uncemented	42.63	42.11	40.81	47.95	46.49	49.30	51.99	53.68	53.97	54.98
CC prosthesis	0.10	0.18	0.08	0.14	0.00	0.21	0.22	0.22	0.07	0.06

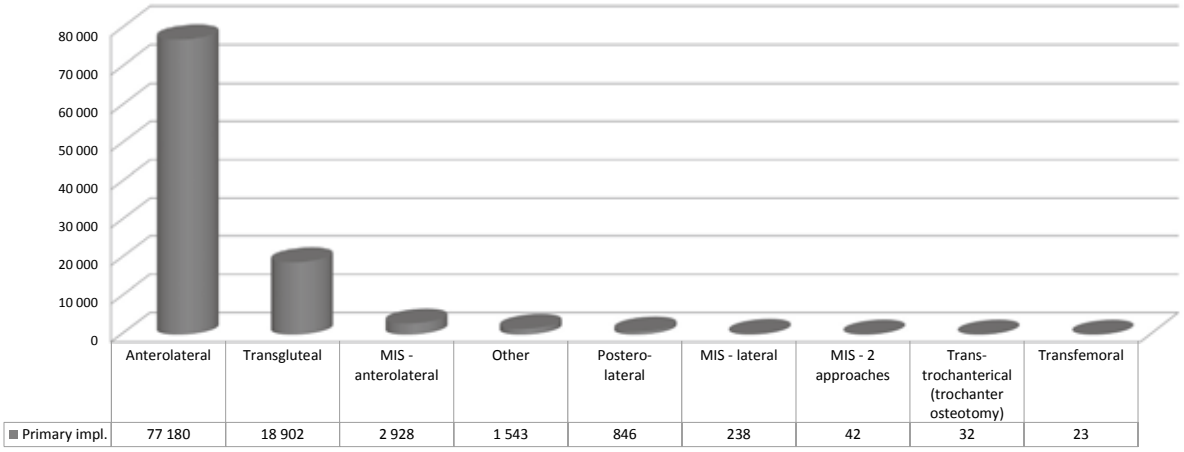
Graph 16. Ratio of lateral (right-left) involvement in primary implantations



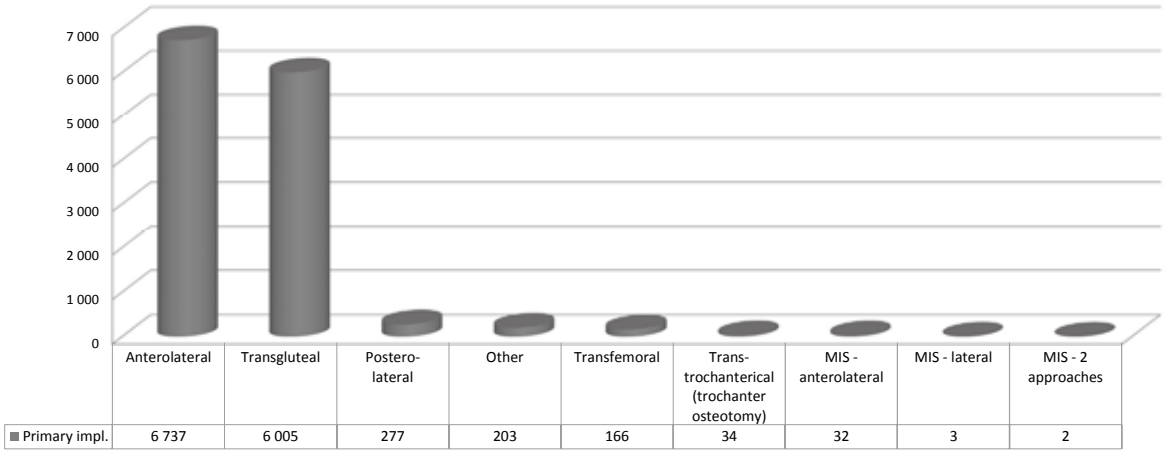
Graph 17. Ratio of lateral (right-left) involvement in revisions



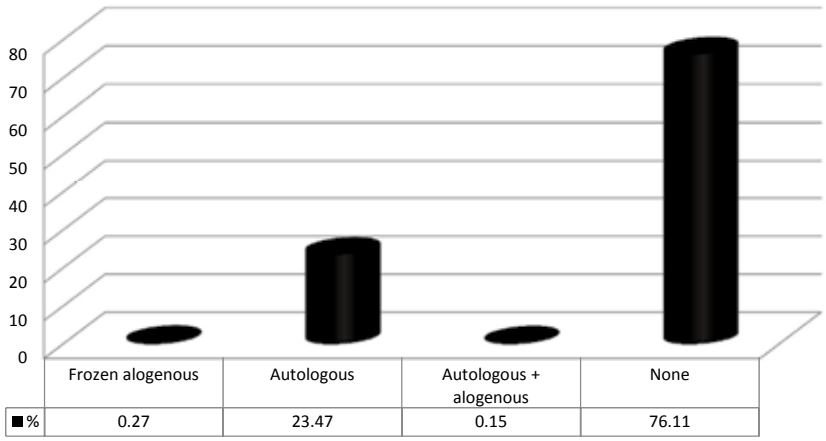
Graph 18. Number and types of surgical approaches in primary implantations



Graph 19. Number and types of surgical approaches in revisions

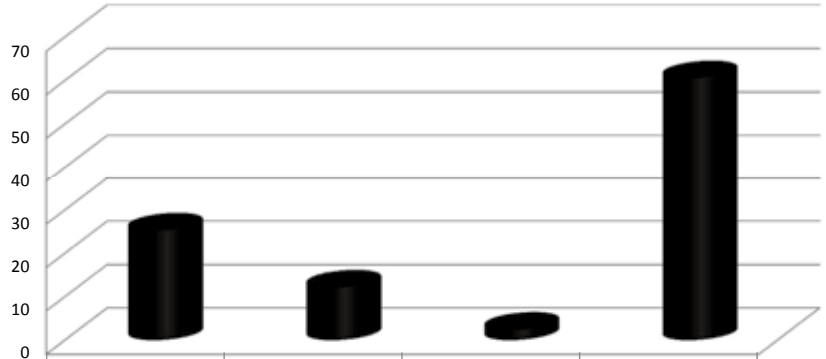


Graph 20. Grafts used in primary implantations



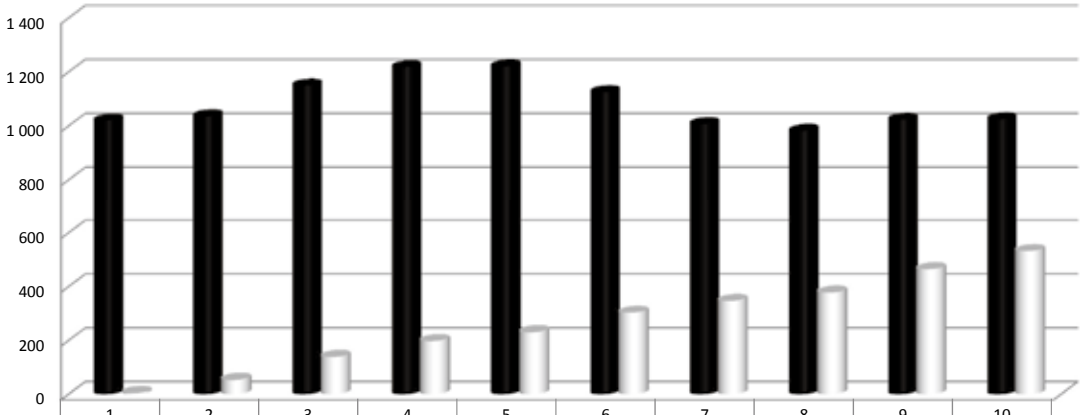
	Frozen alogenous	Autologous	Autologous + alogenous	None
%	0.27	23.47	0.15	76.11

Graph 21. Grafts used in revisions



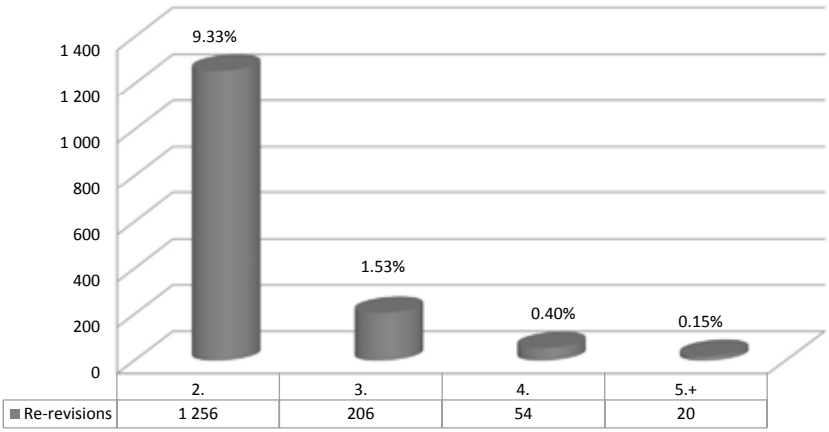
	Frozen alogenous	Autologous	Autologous + alogenous	None
%	25.19	12.04	2.32	60.45

Graph 22. Number of revision surgeries according to relation to previous surgery recorded in the register and their development in 2003–2012

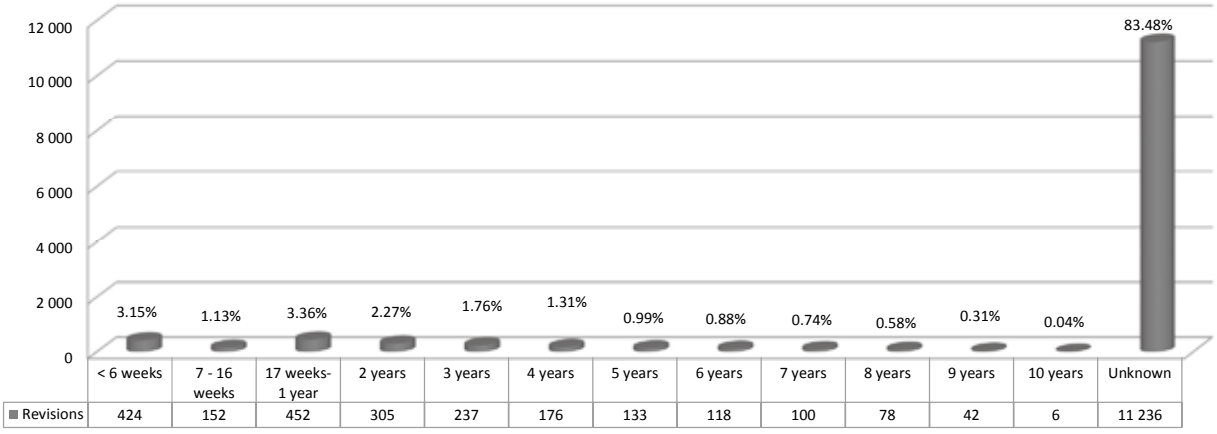


	1	2	3	4	5	6	7	8	9	10
Revisions w/o linkage	1 020	1 036	1 150	1 218	1 221	1 125	1 007	982	1 023	1 025
Revisions with linkage	5	54	139	198	231	303	347	378	465	532

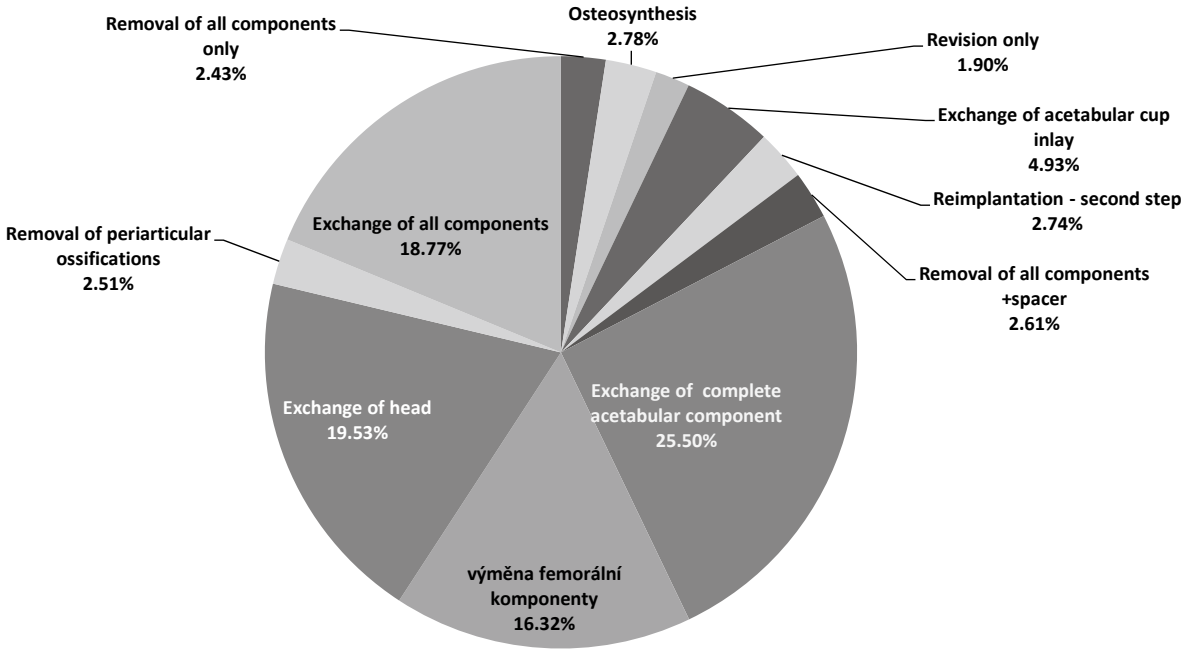
Graph 23. Number of re-revisions



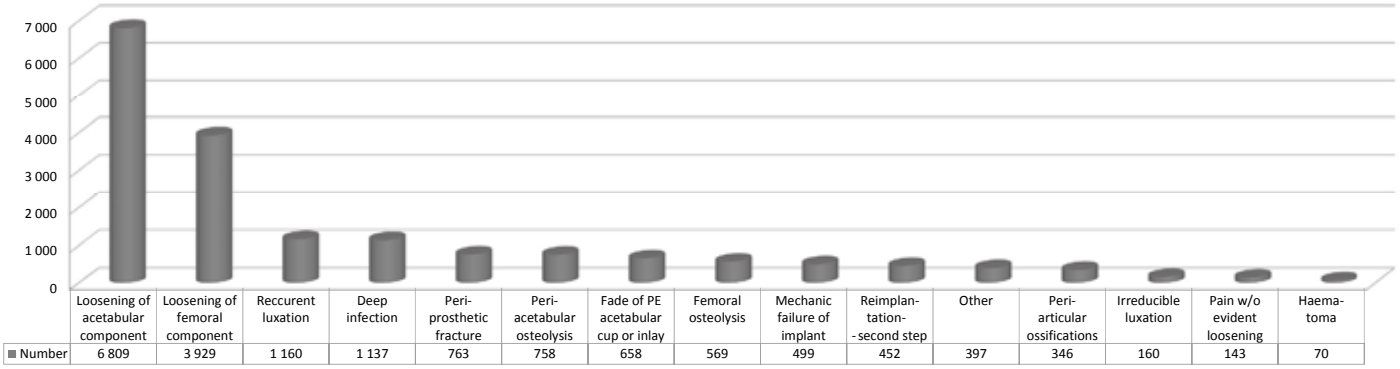
Graph 24. Revision surgeries divided by the time interval from previous surgery



Graph 25. Surgical techniques used in revisions

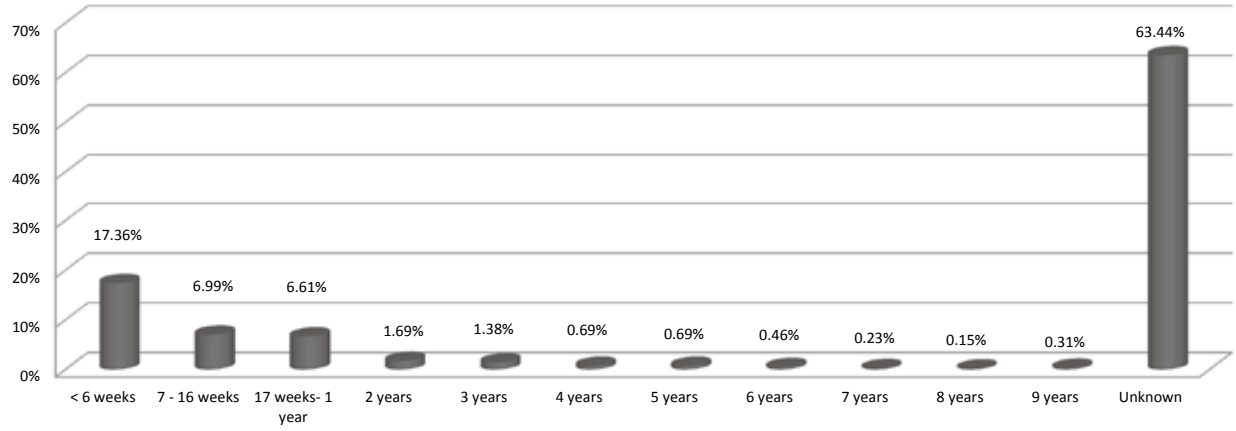


Graph 26. Summary of reasons for revision surgeries

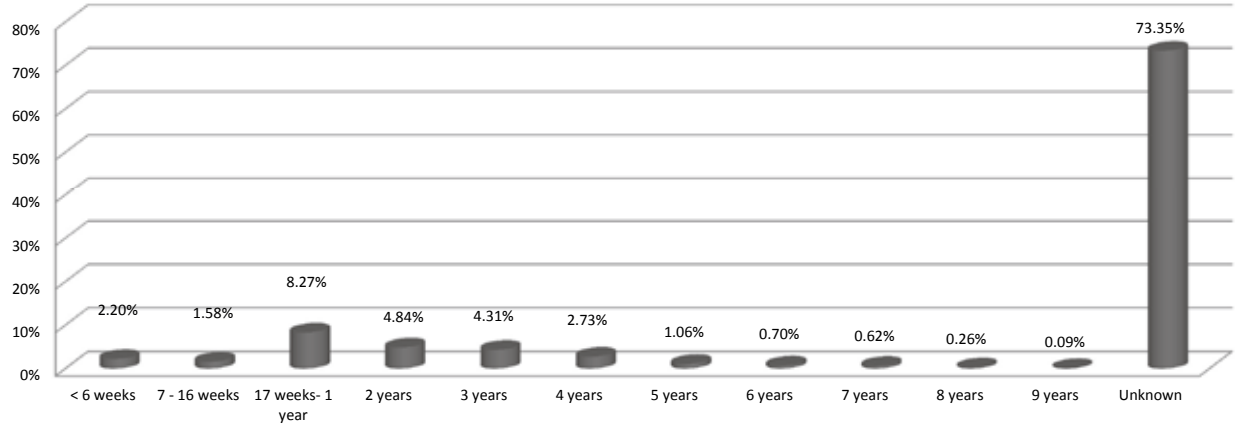


	Loosening of acetabular component	Loosening of femoral component	Reccurent luxation	Deep infection	Peri-prosthetic fracture	Peri-acetabular osteolysis	Fade of PE acetabular cup or inlay	Femoral osteolysis	Mechanic failure of implant	Reimplan-tation- - second step	Other	Peri-articular ossifications	Irreducible luxation	Pain w/o evident loosening	Haema-toma
Number	6 809	3 929	1 160	1 137	763	758	658	569	499	452	397	346	160	143	70

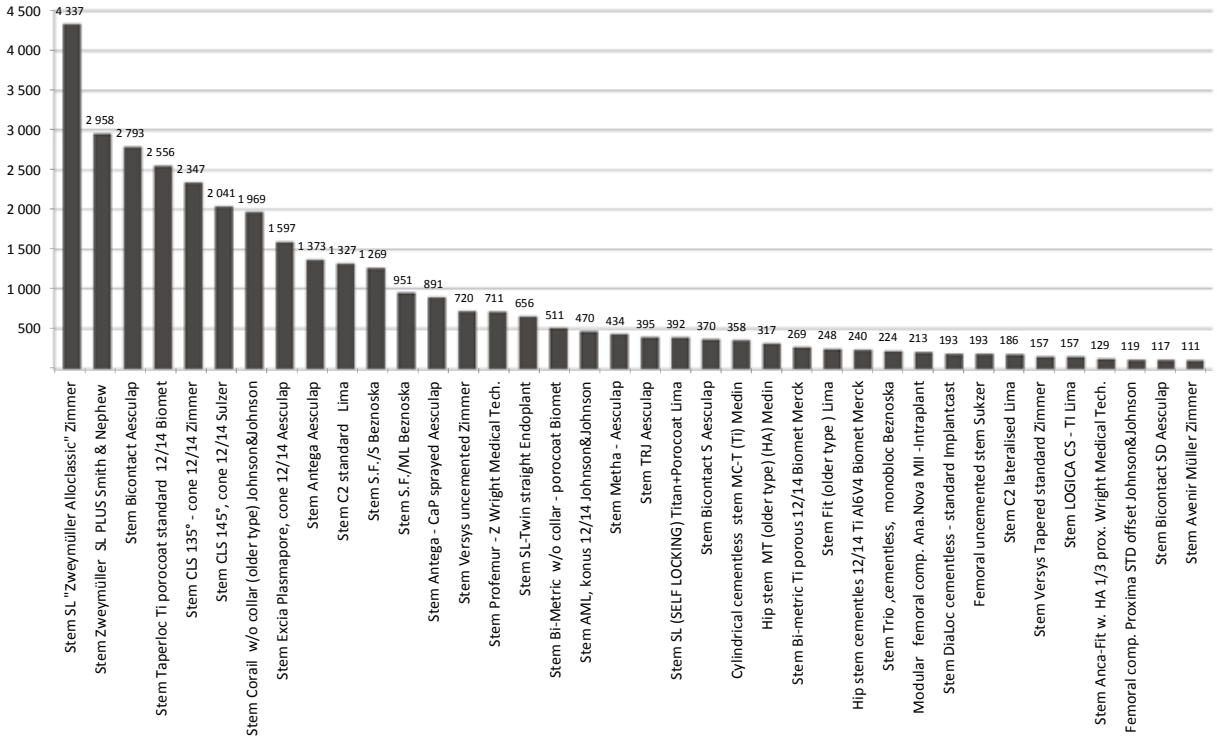
Graph 27. Number of all revision surgeries after luxation during 2003–2012 by time interval from previous surgery



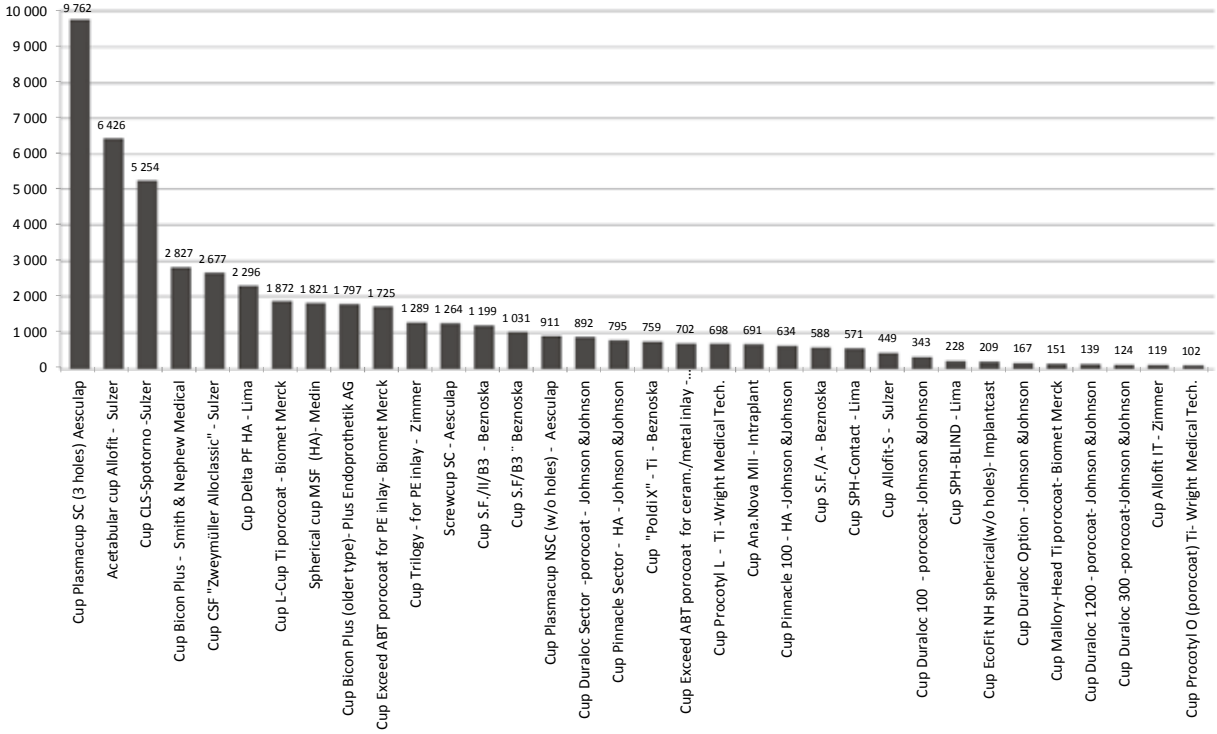
Graph 28. Infections resulting in revision or re-revision divided by the time interval from previous surgery. Period 2003–2012. Evaluation on June 30, 2013



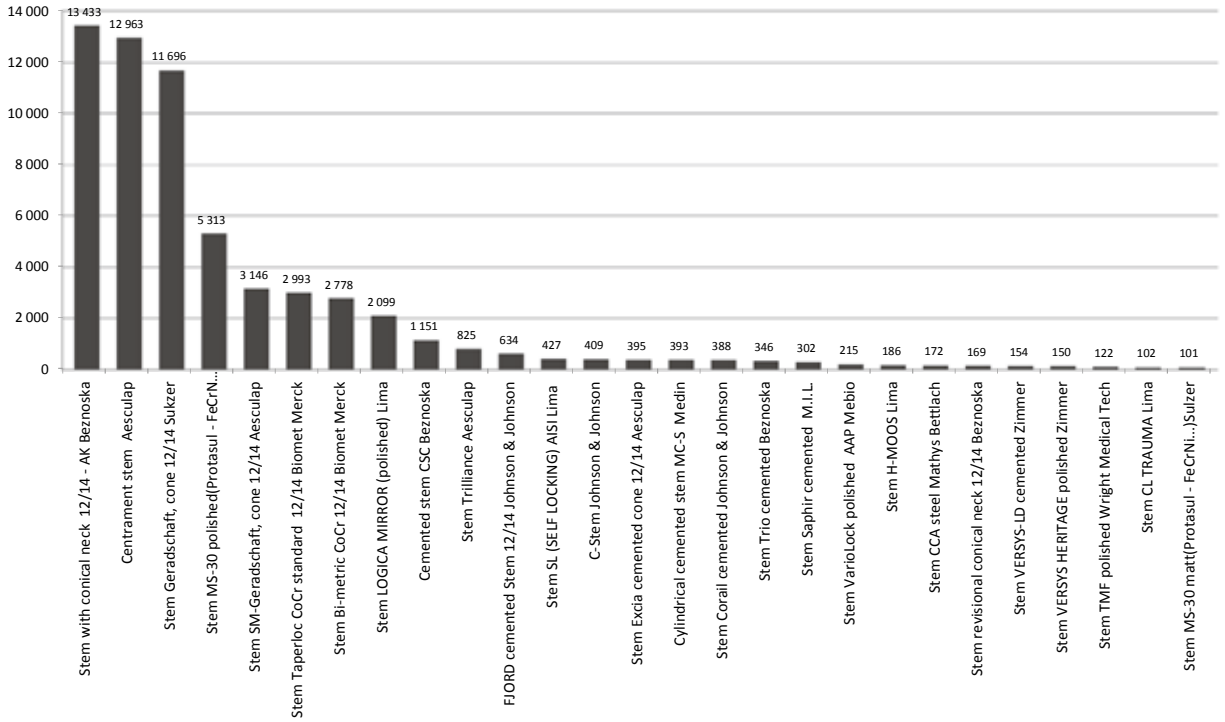
Graph 29. Most widely used uncemented stems in primary implantations (>100)



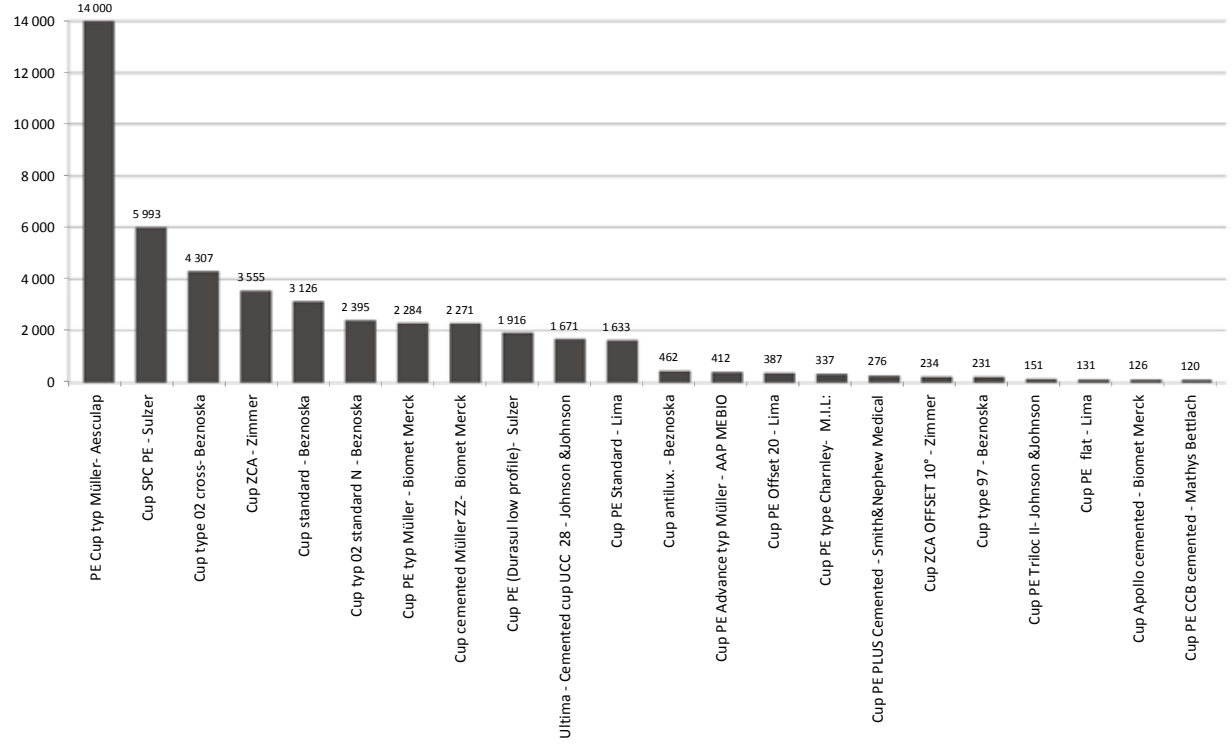
Graph 30. Most widely used uncemented cups in primary implantations (>100)



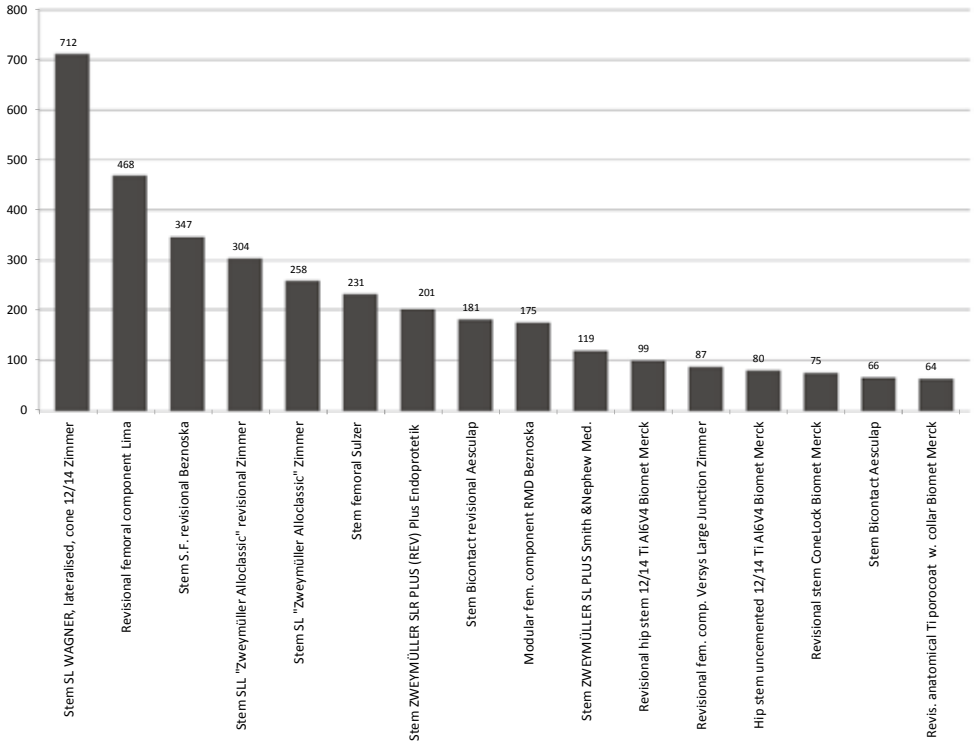
Graph 31. Most widely used cemented stems in primary implantations (>100)



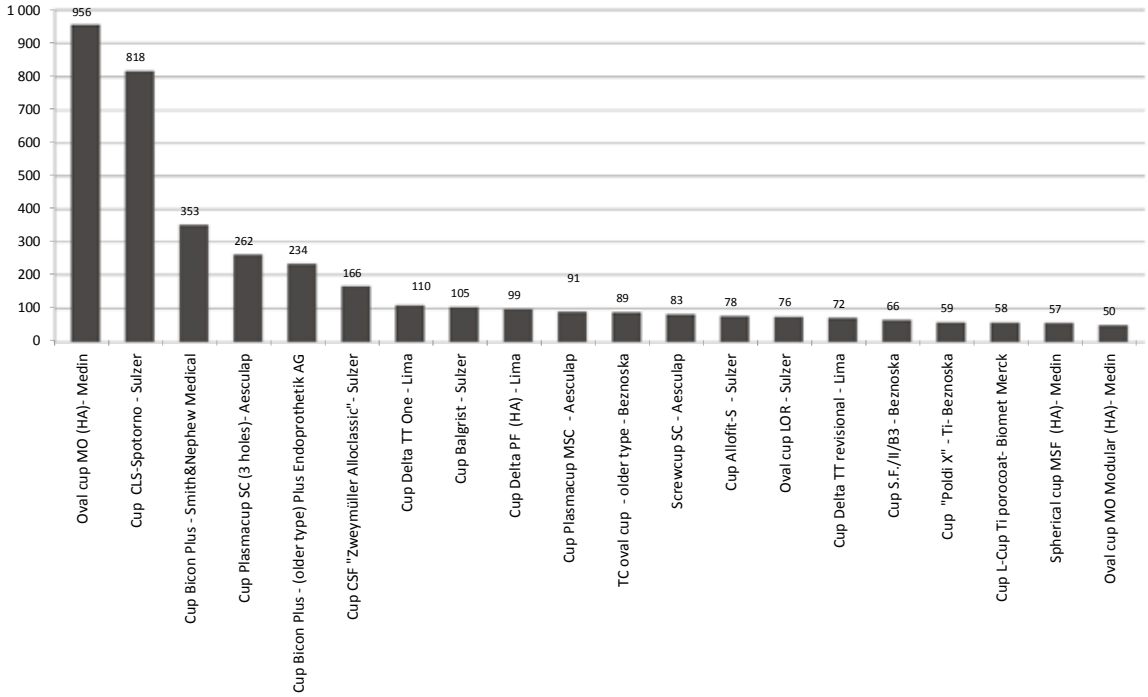
Graph 32. Most widely used cemented cups in primary implantations (>100)



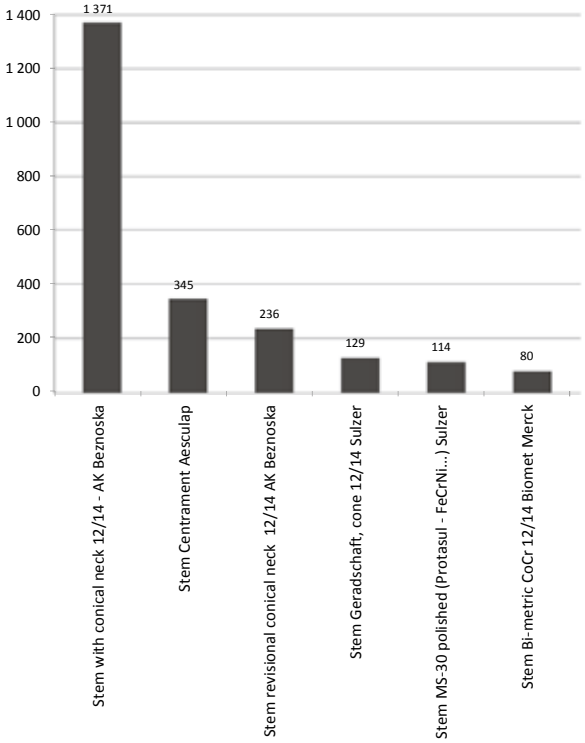
Graph 33. Most widely used uncemented stems in revisions (>50)



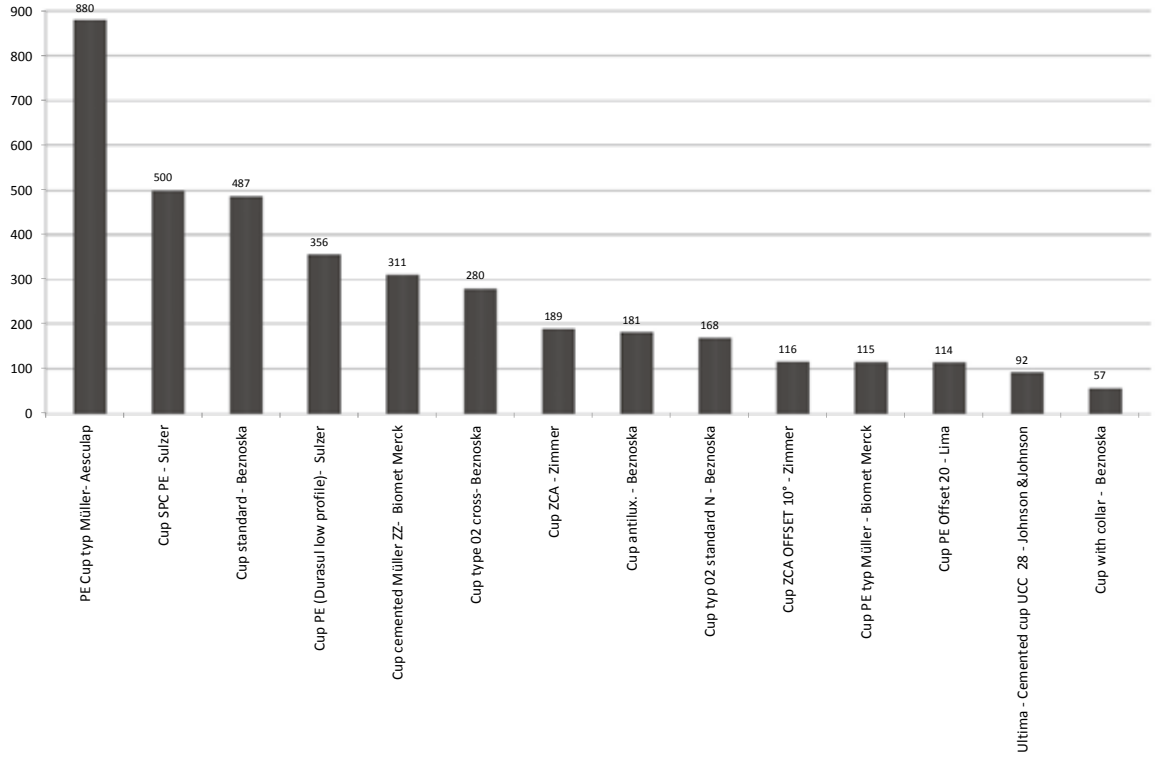
Graph 34. Most widely used uncemented cups in revisions (>50)



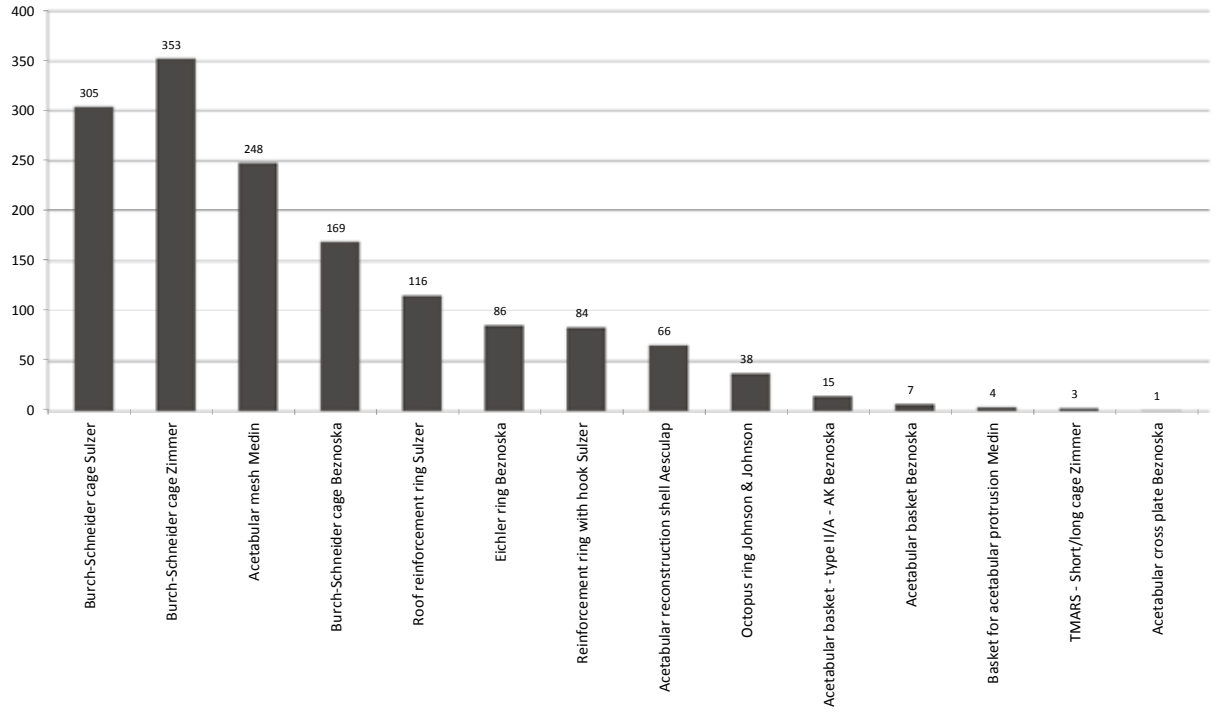
Graph 35. Most widely used cemented stems in revisions (>50)



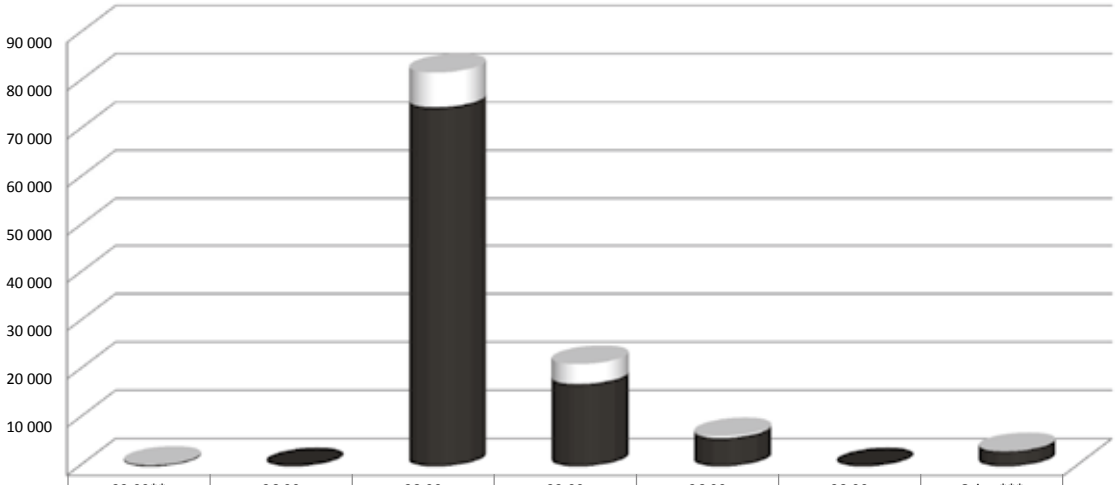
Graph 36. Most widely used cemented cups in revisions (>50)



Graph 37. Cages used for acetabular reinforcement in revisions



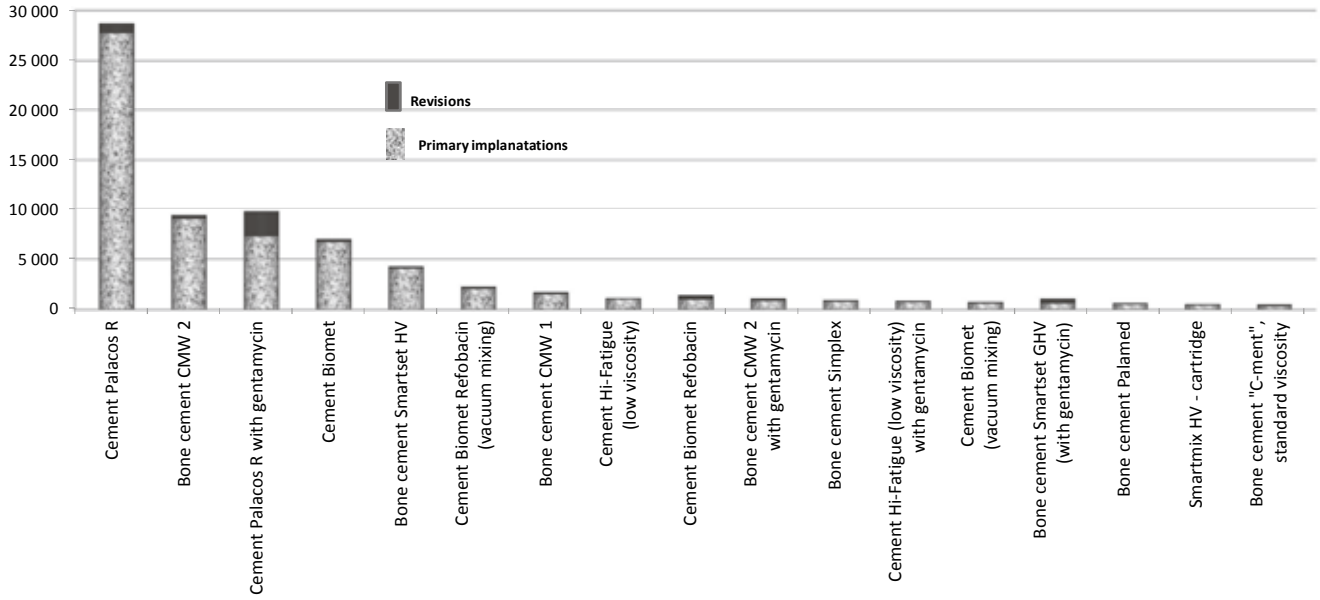
Graph 38. Modular heads used in primary implantations and revisions sorted by their diameter



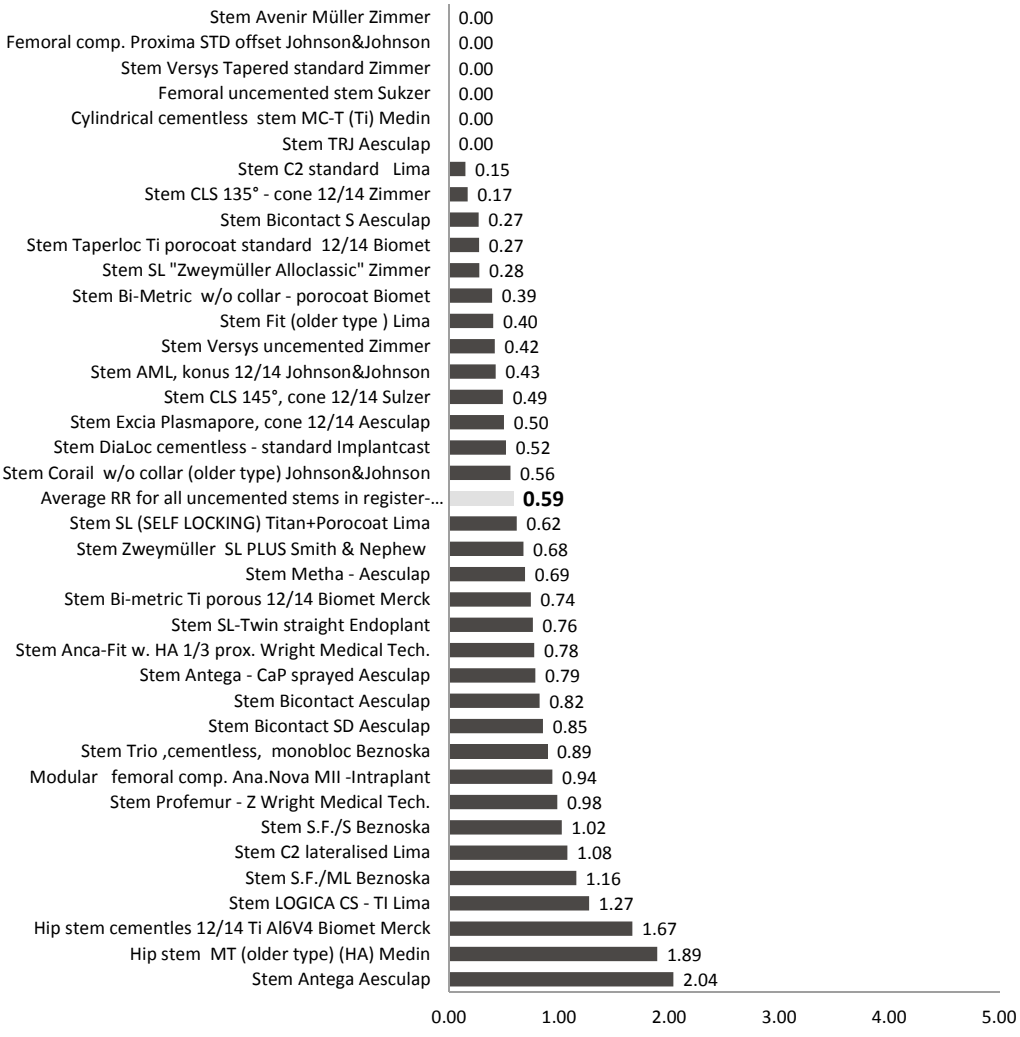
	22.00**	26.00	28.00	32.00	36.00	38.00	Other***
*Revisions	34		7 177	4 099	349		40
■ *Primoimplantations	276	10	74 733	17 094	5 901	5	3 133

** Modular heads only **Sizes 22.00-22.23 *** Sizes 39-61*

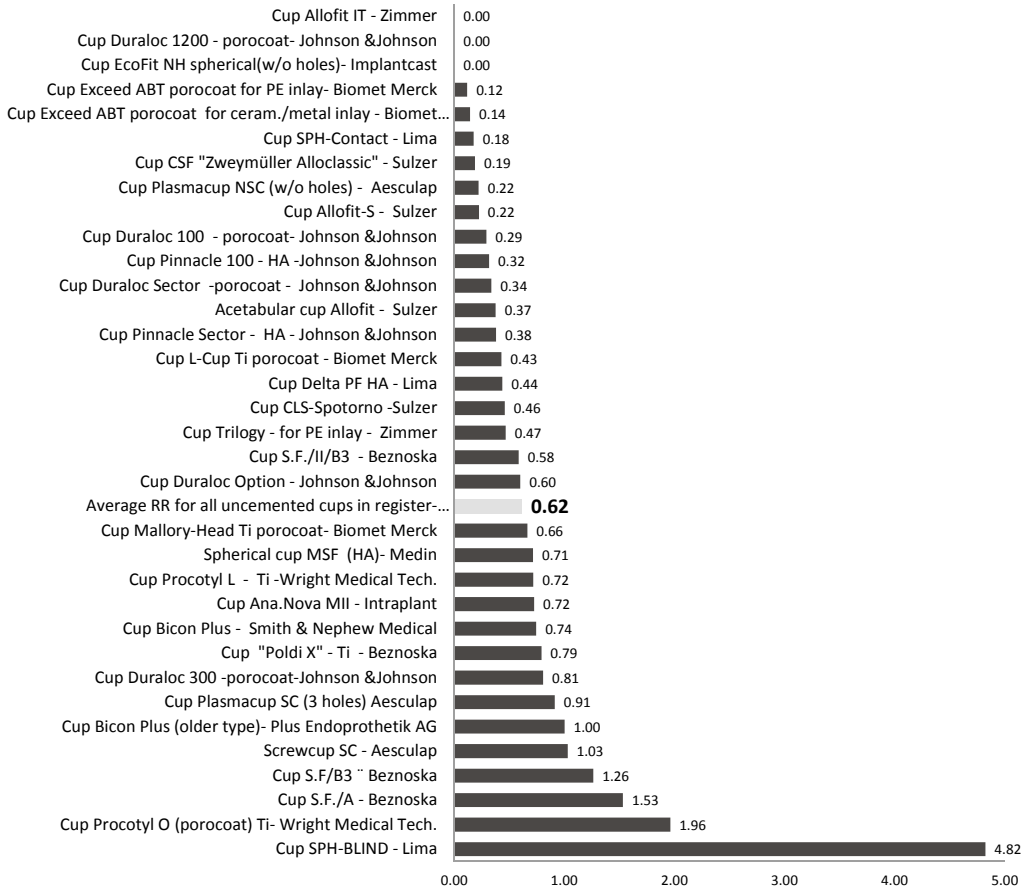
Graph 39. Overview of bone cement types used in primary implantations and revisions. (>300 applications)



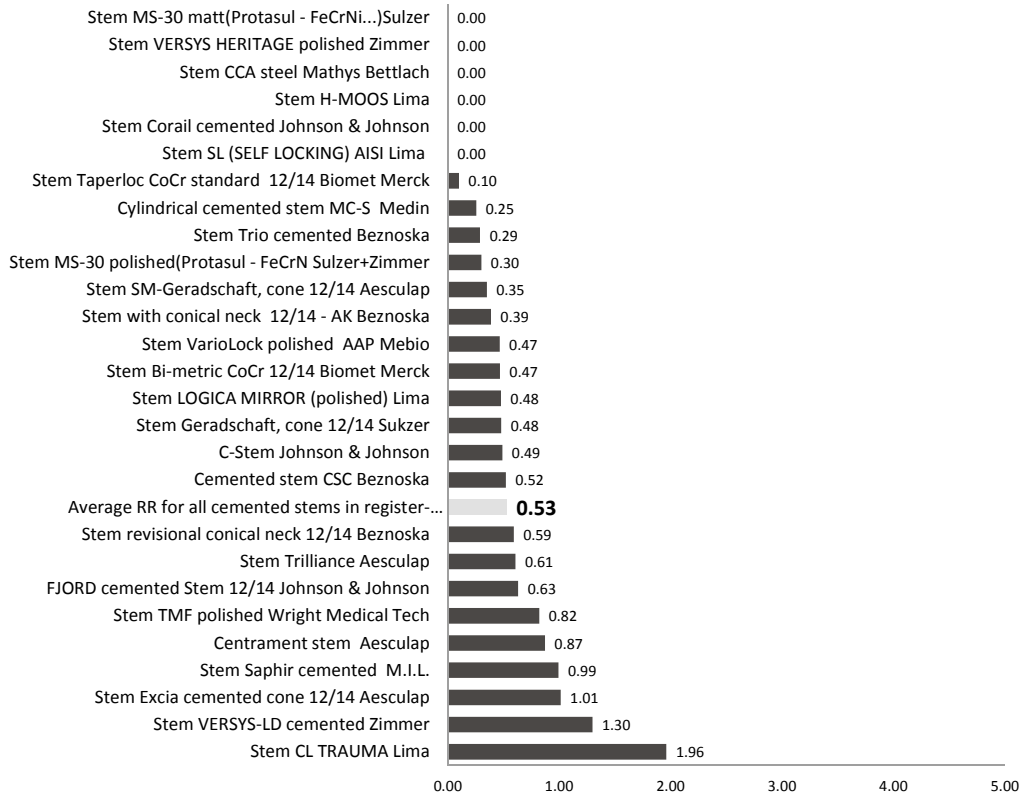
Graph 40. Revision rate for the period 2003–2012 – uncemented stems used in primary implantations



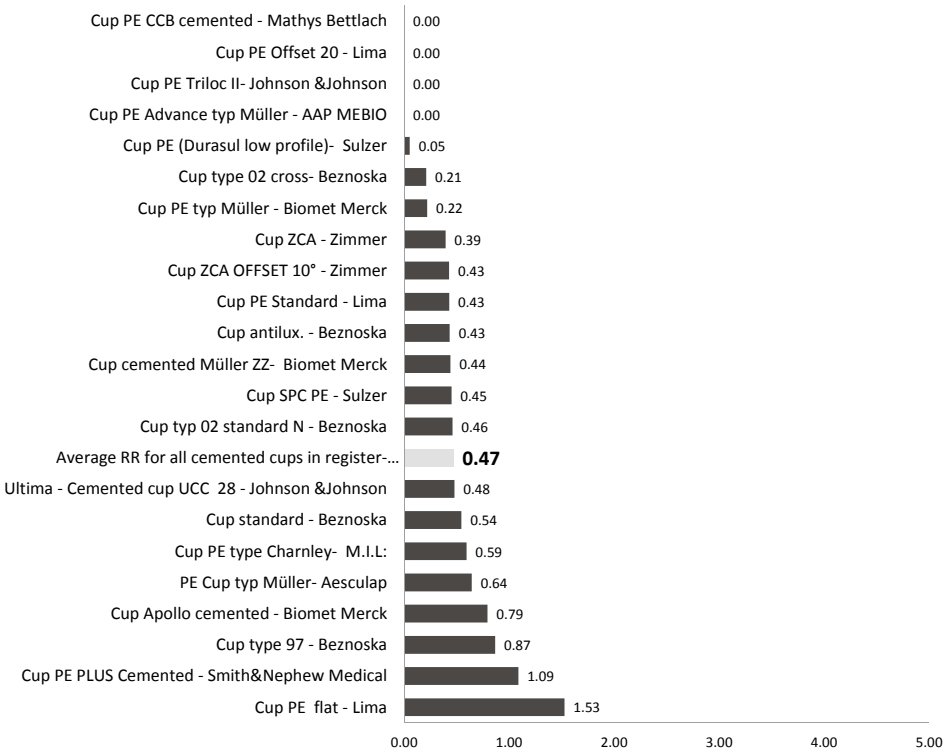
Graph 41. Revision rate for the period 2003–2012 – uncemented cups used in primary implantations



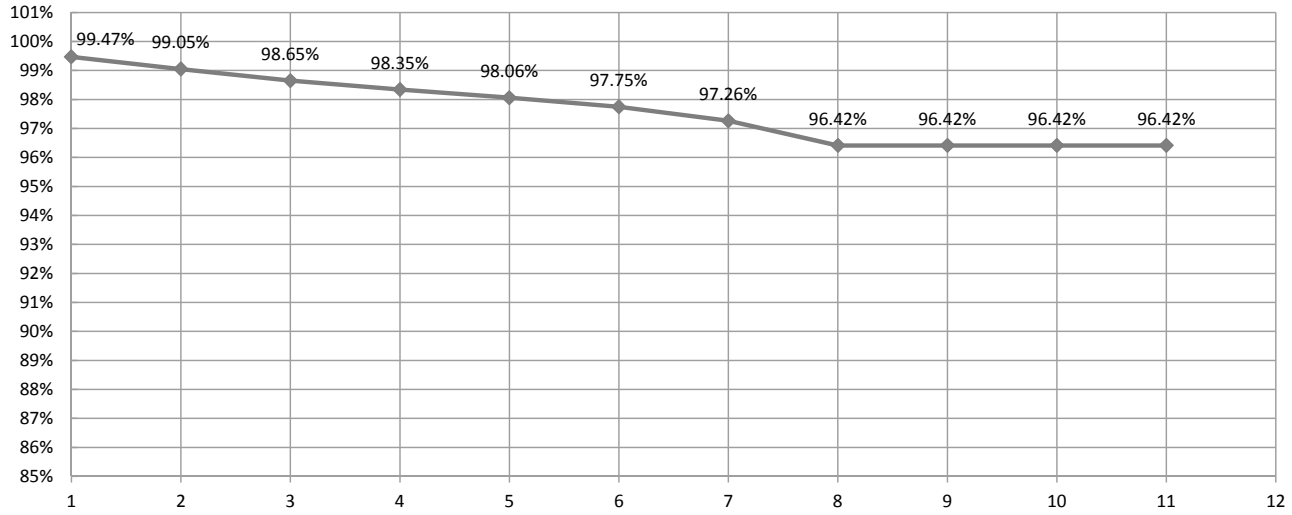
Graph 42. Revision rate for the period 2003–2012 – cemented stems used in primary implantations



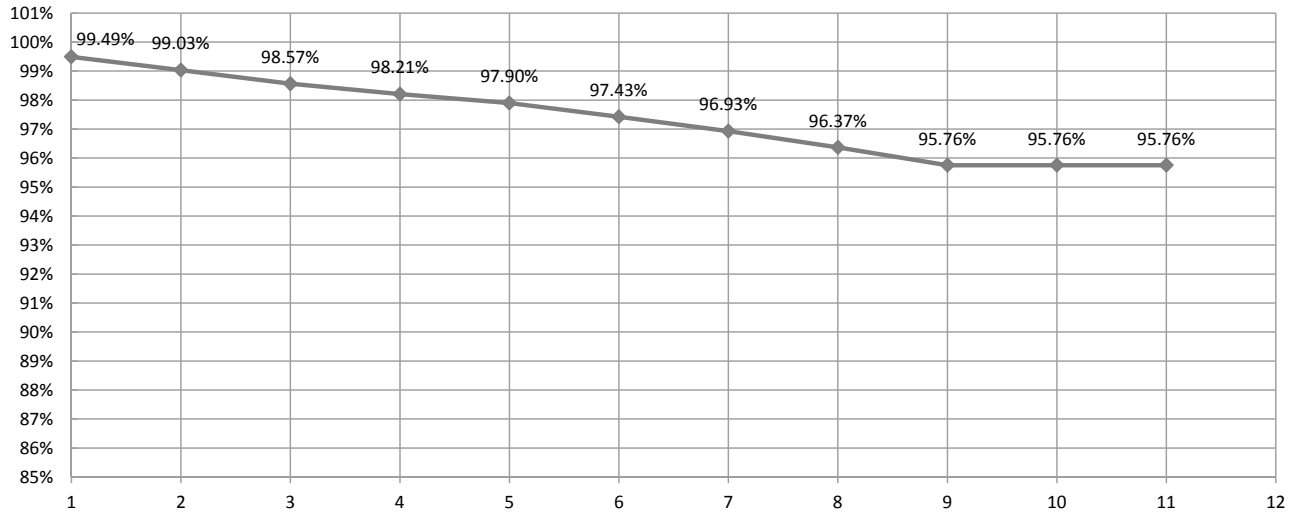
Graph 43. Revision rate for the period 2003–2012 – cemented cups used in primary implantations



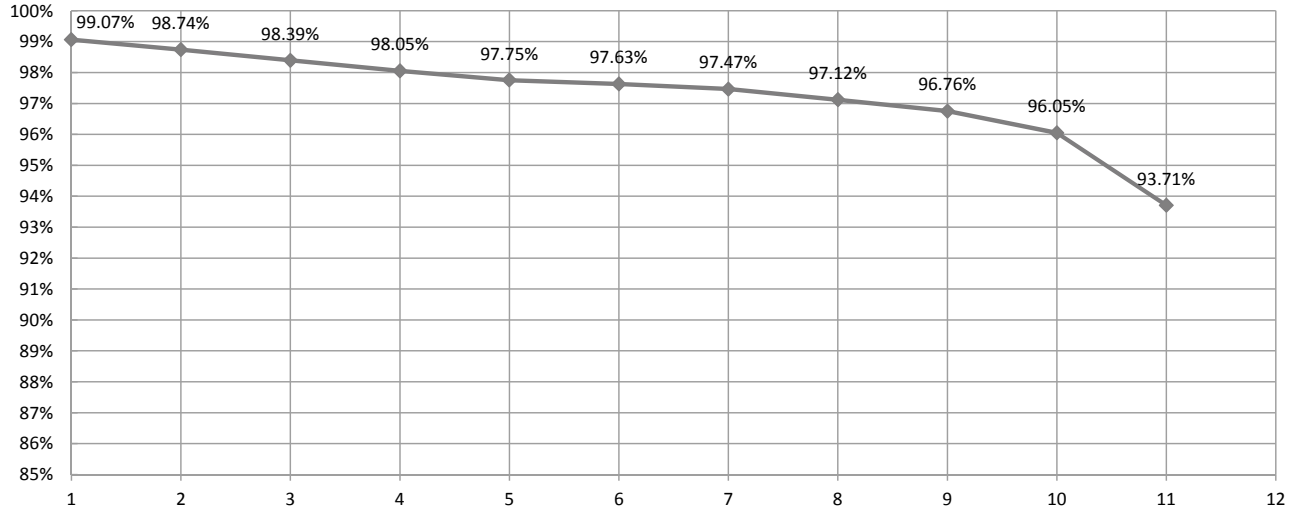
Graph 44. Cumulative survival probability curve of uncemented stems SL „Zweymüller Alloclassic“ Zimmer



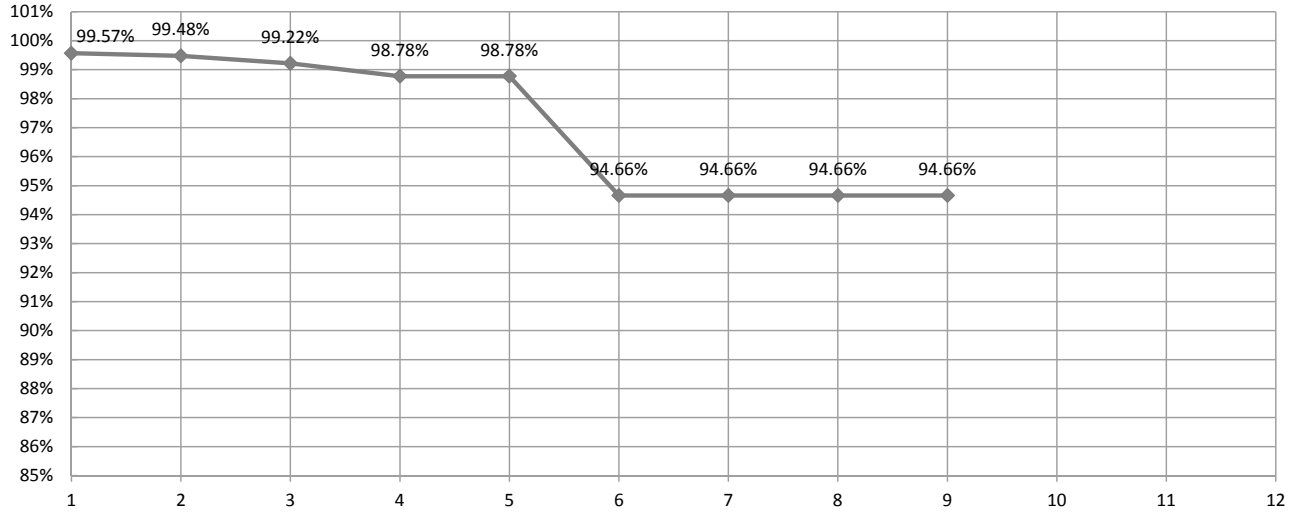
Graph 45. Cumulative survival probability curve of uncemented stems Zweymüller SL PLUS Smith & Nephew



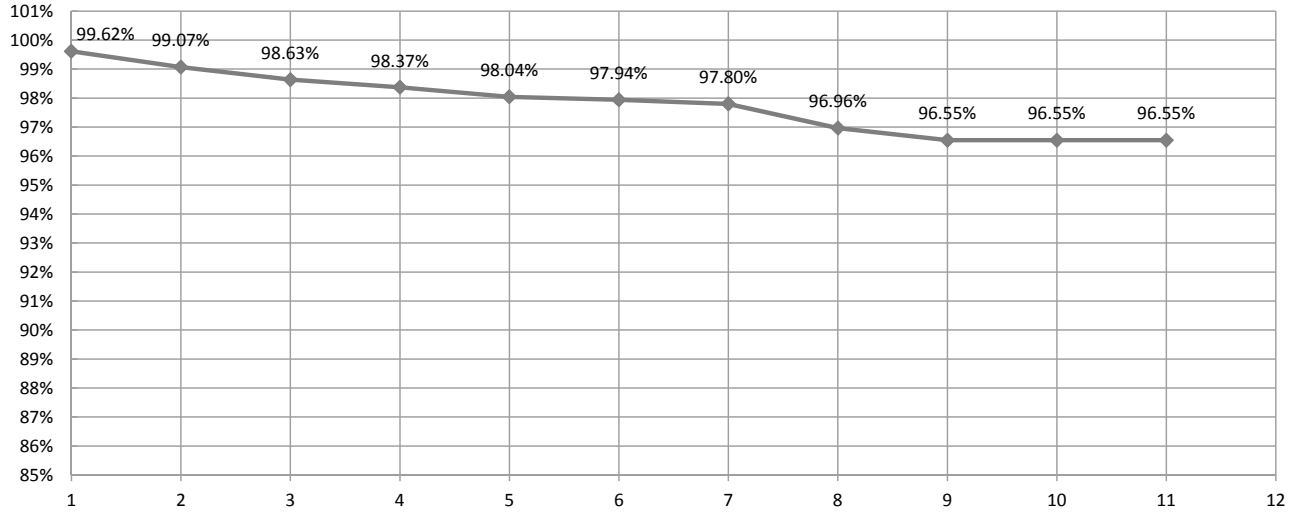
Graph 46. Cumulative survival probability curve of uncemented stems Bicontact Aesculap



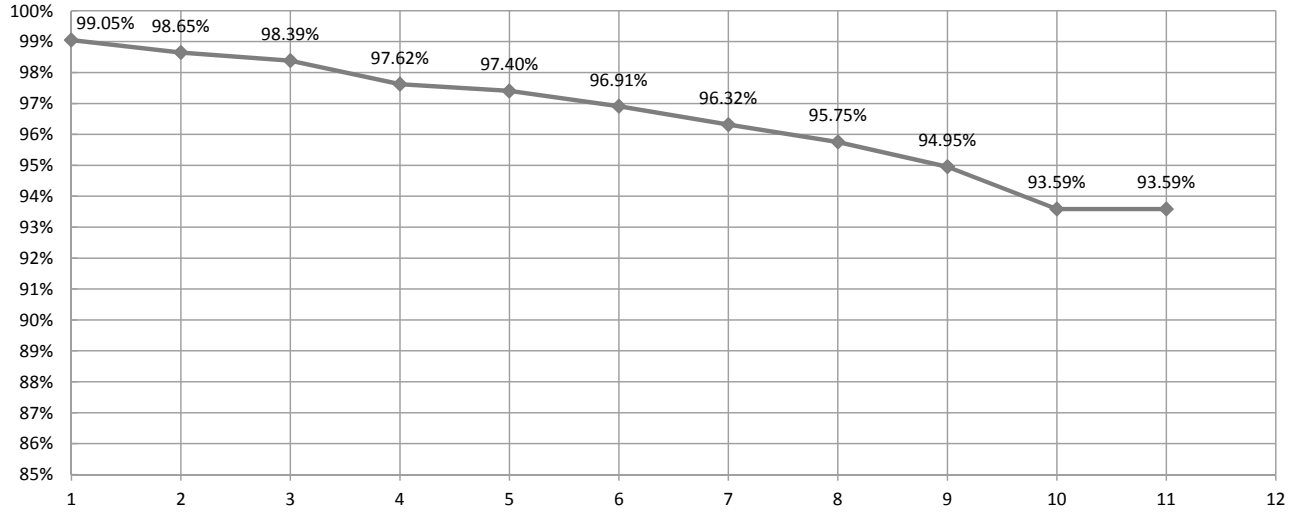
Graph 47. Cumulative survival probability curve of uncemented stems Taperloc Ti porocoat standard 12/14 Biomet



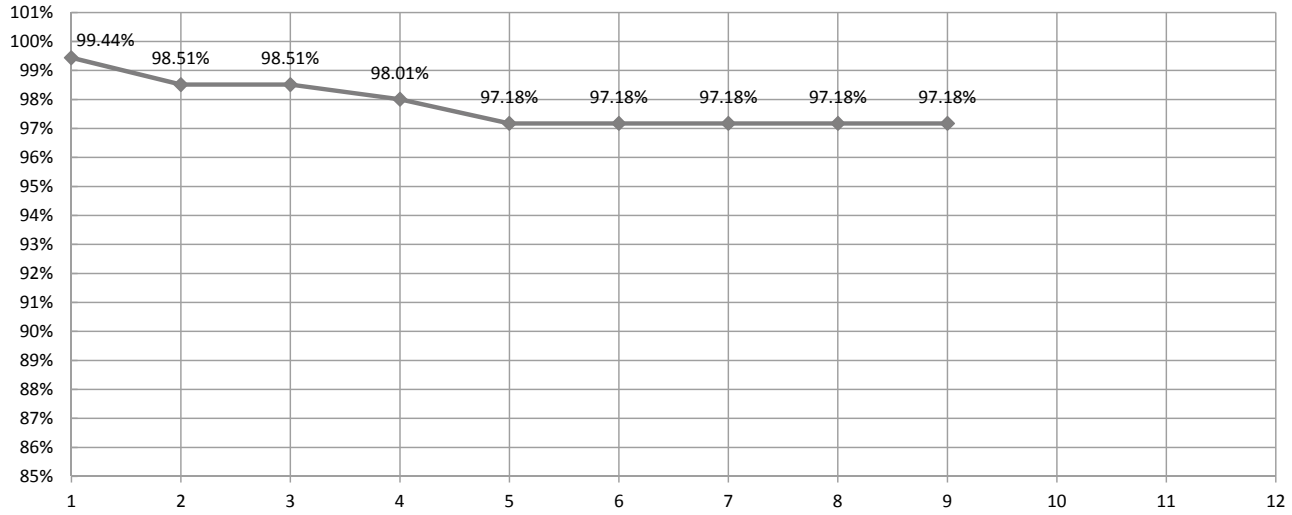
Graph 48. Cumulative survival probability curve of uncemented stems CLS 135° – cone 12/14 Zimmer



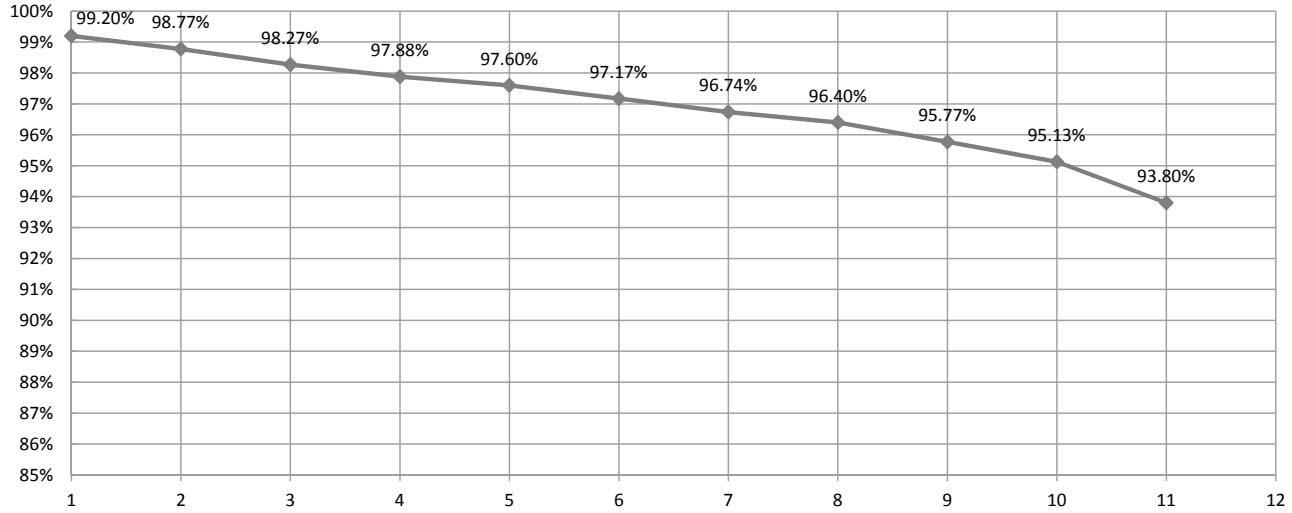
Graph 49. Cumulative survival probability curve of uncemented stems S.F./S Beznoska



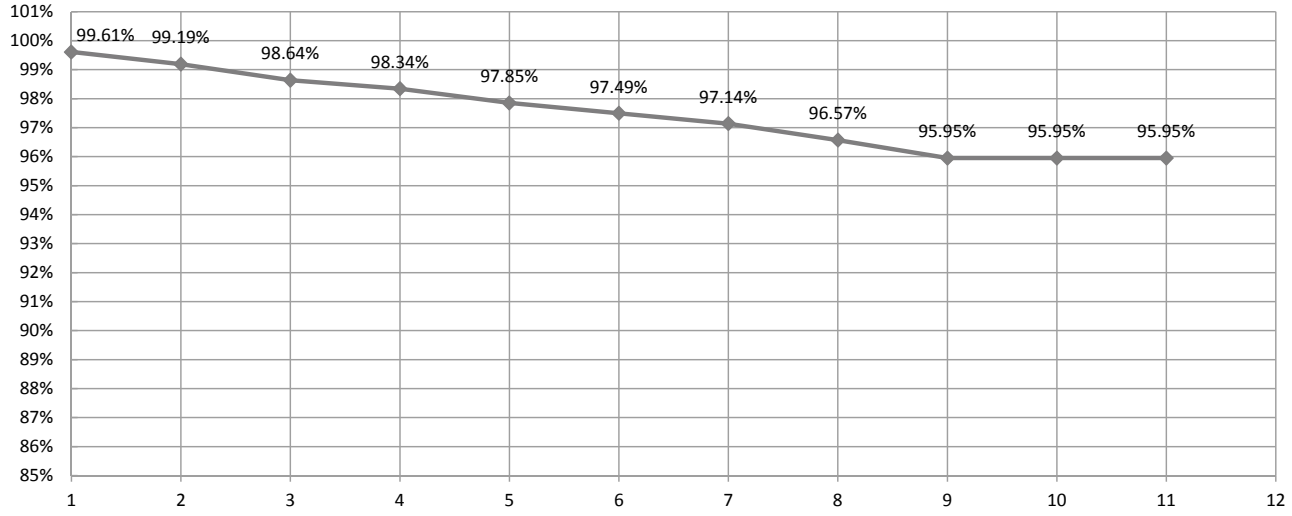
Graph 50. Cumulative survival probability curve of cylindrical cementless stems MC-T (Ti) Medin



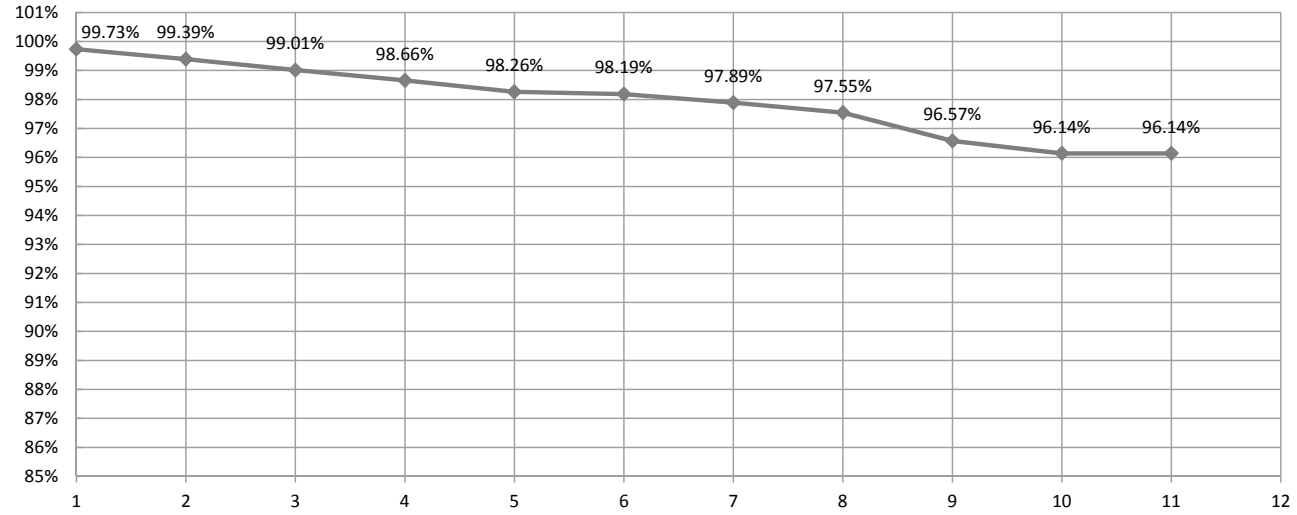
Graph 51. Cumulative survival probability curve of uncemented cups Plasmacup SC (3 holes) Aesculap.



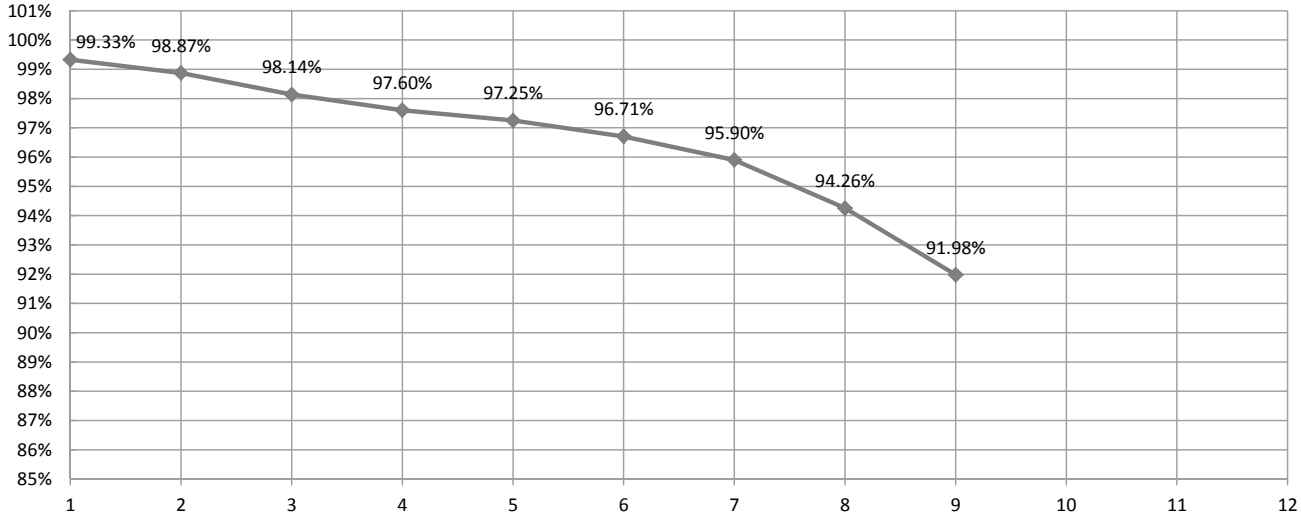
Graph 52. Cumulative survival probability curve of uncemented acetabular cups Allofit – Sulzer



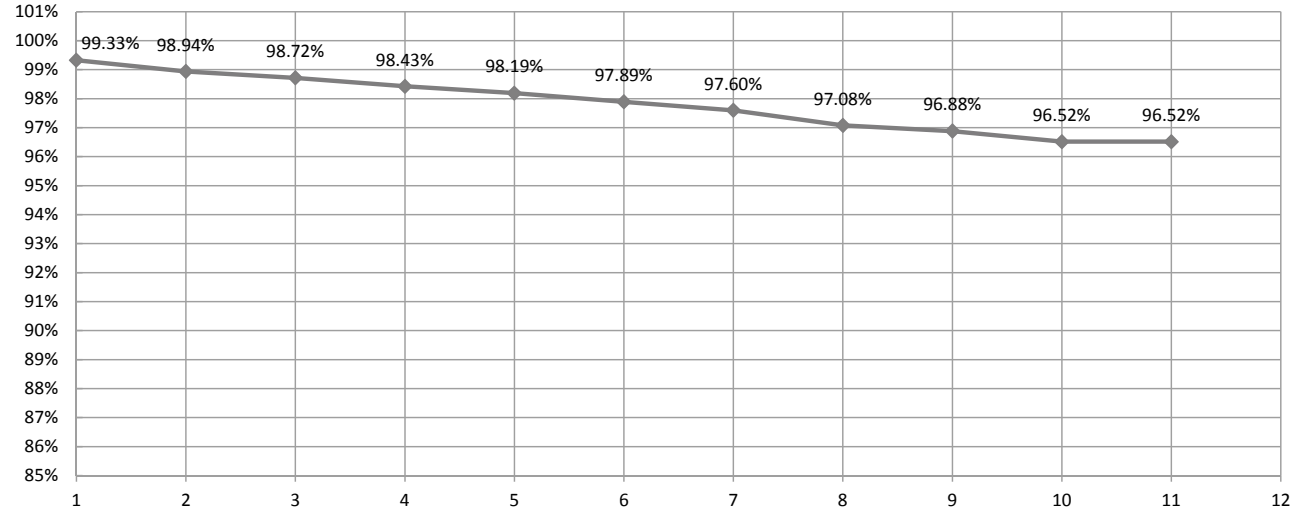
Graph 53. Cumulative survival probability curve of uncemented cups CLS-Spotorno – Sulzer



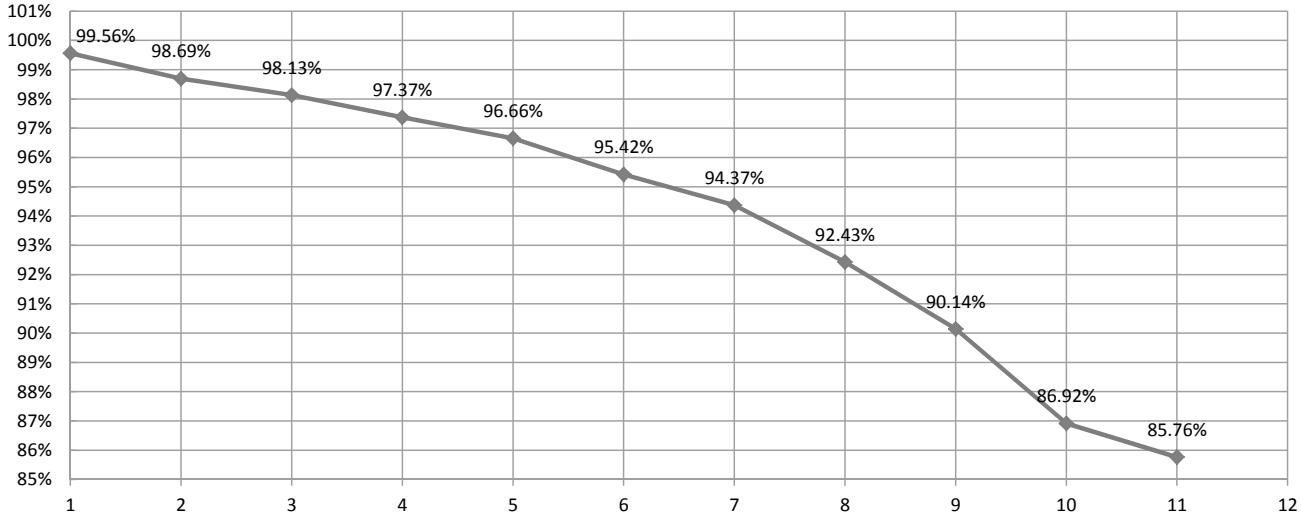
Graph 54. Cumulative survival probability curve of uncemented cups Bicon Plus – Smith & Nephew Medical



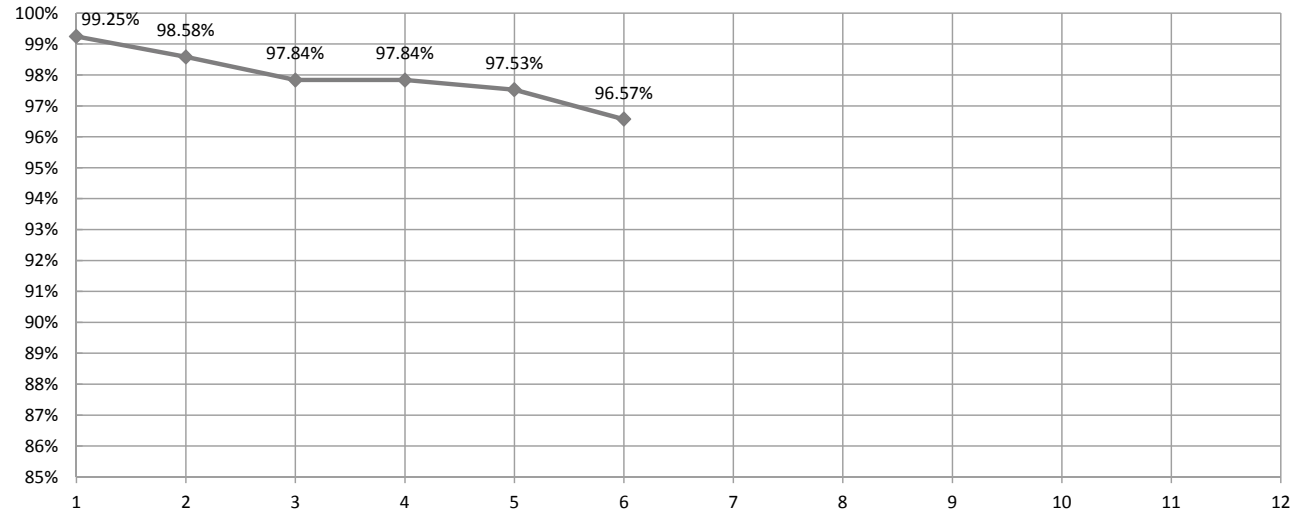
Graph 55. Cumulative survival probability curve of uncemented cups CSF „Zweymüller Alloclassic“ – Sulzer



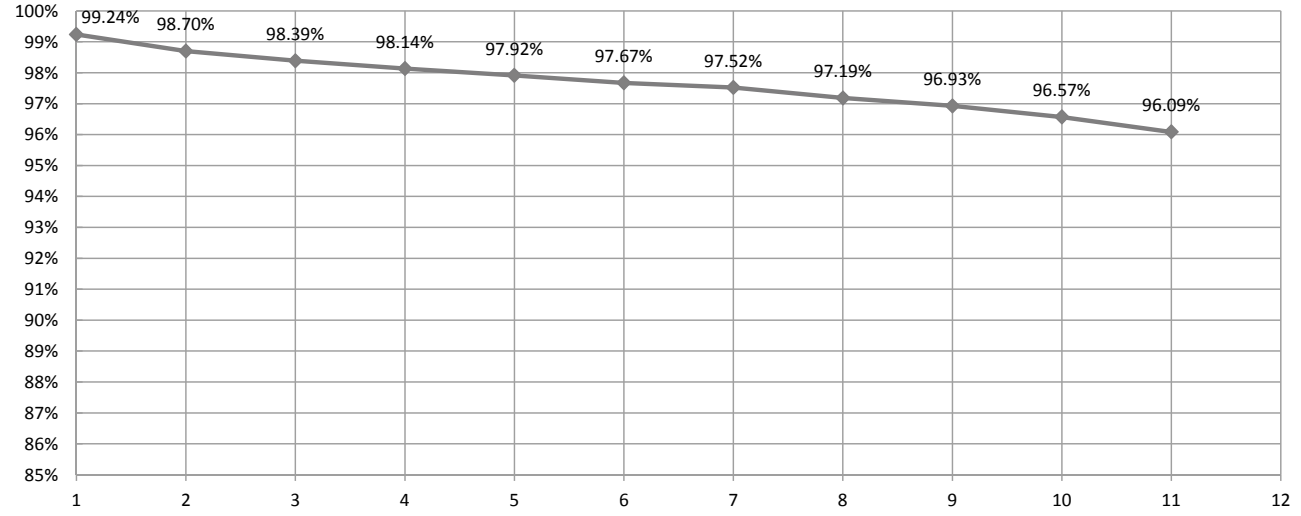
Graph 56. Cumulative survival probability curve of uncemented cups „Spherical cup MSF“ (HA) – Medin



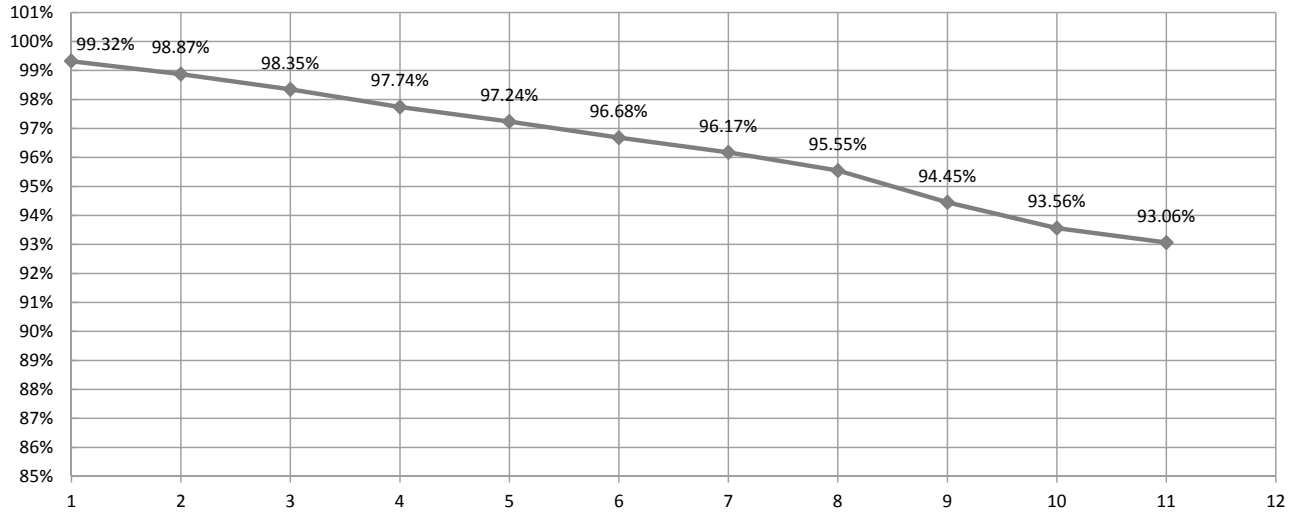
Graph 57. Cumulative survival probability curve of uncemented cups S.F./II/B3 – Beznoska



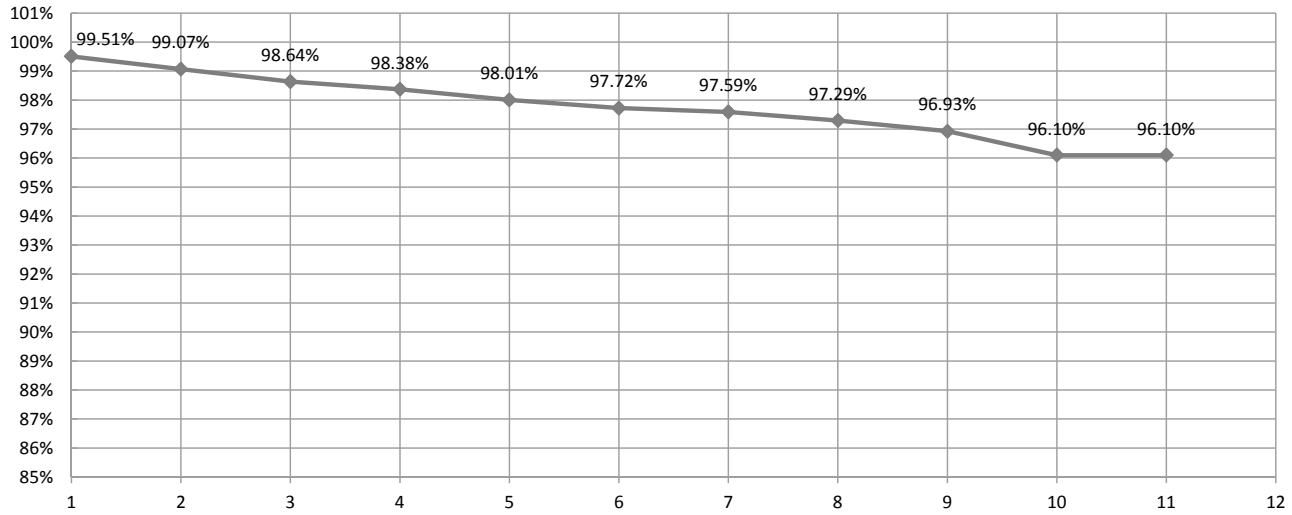
Graph 58. Cumulative survival probability curve of cemented stems with conical neck 12/14 – AK Beznoska



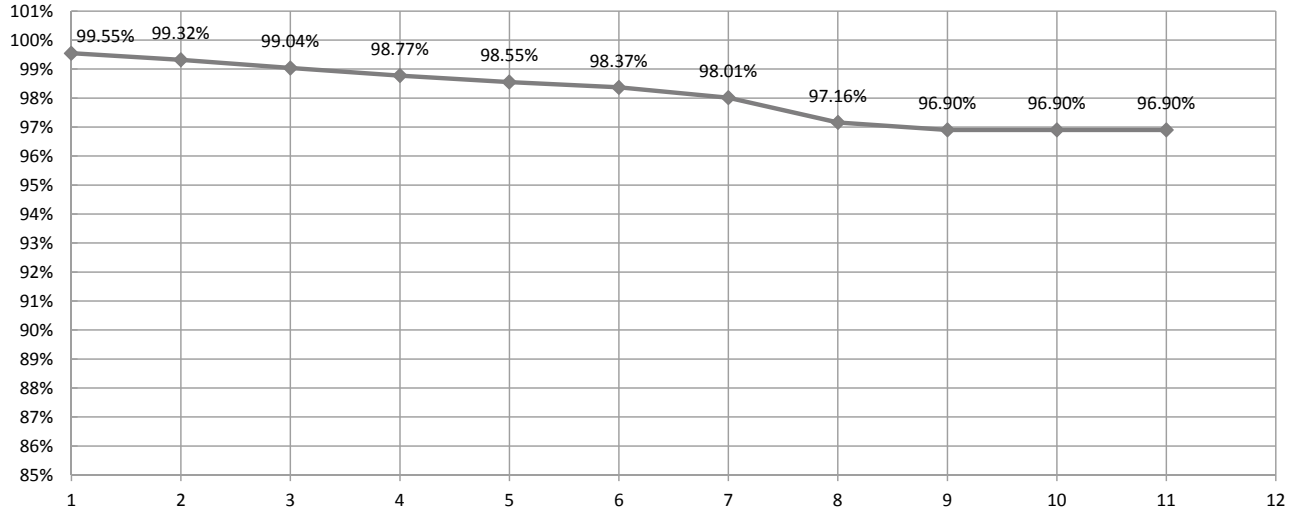
Graph 59. Cumulative survival probability curve of cemented stems Centrament Aesculap



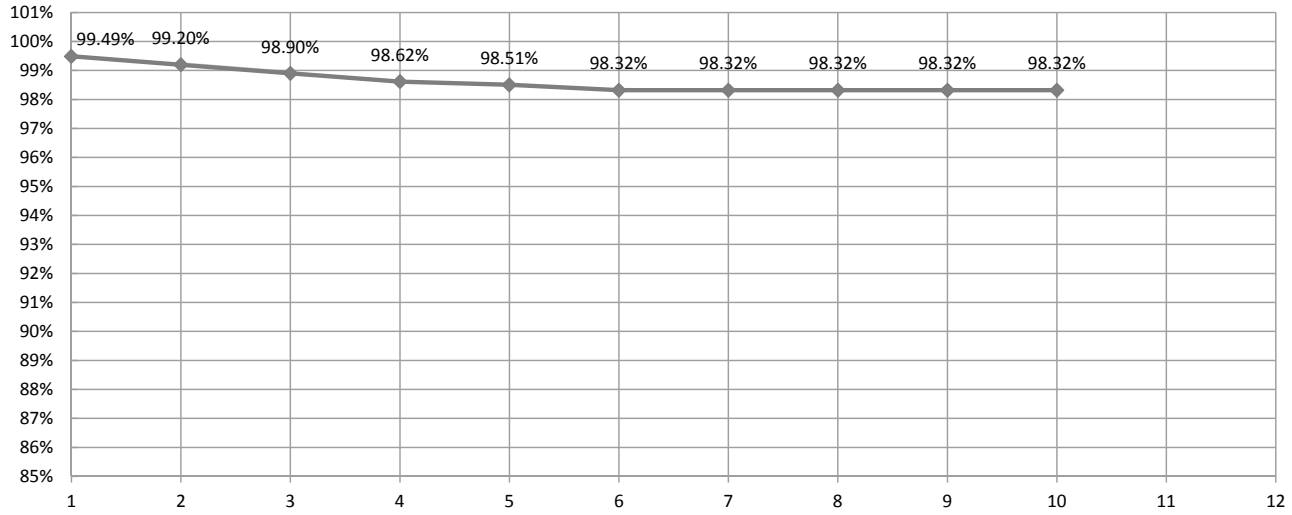
Graph 60. Cumulative survival probability curve of cemented stems Geradschaft, cone 12/14 Sulzer



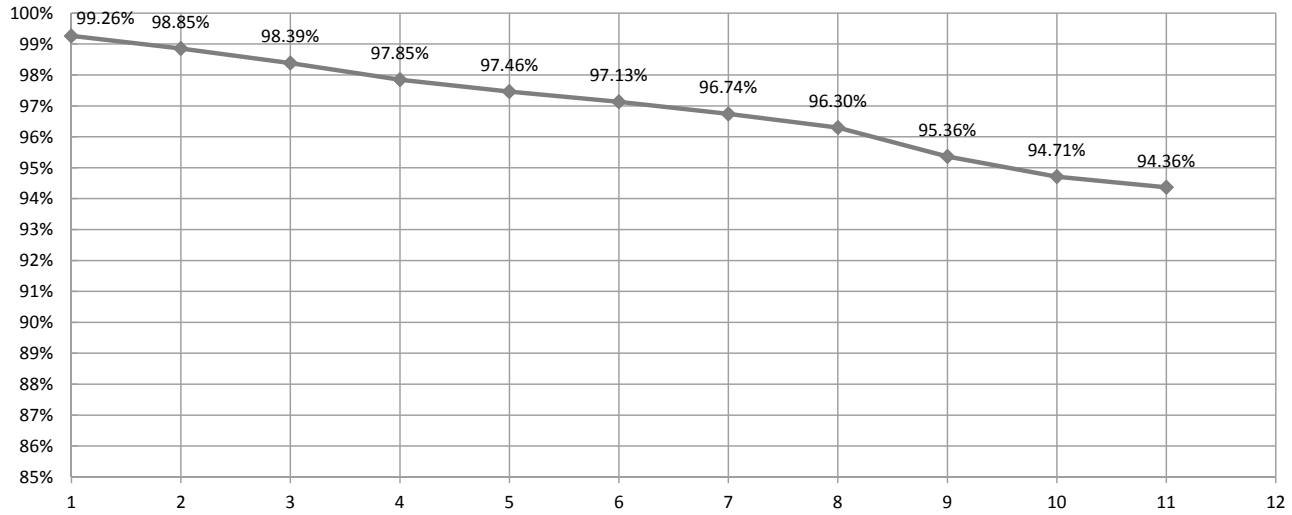
Graph 61. Cumulative survival probability curve of cemented stems MS-30 polished (Protasul – FeCrN) Sulzer+Zimmer



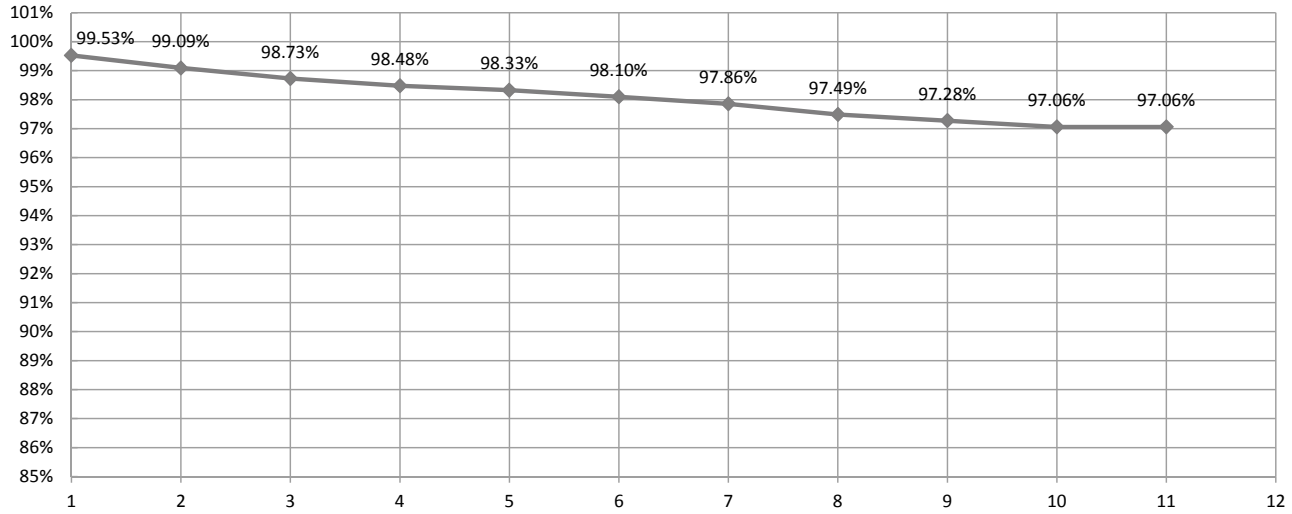
Graph 62. Cumulative survival probability curve of cemented stems SM-Geradschaft, cone 12/14 Aesculap



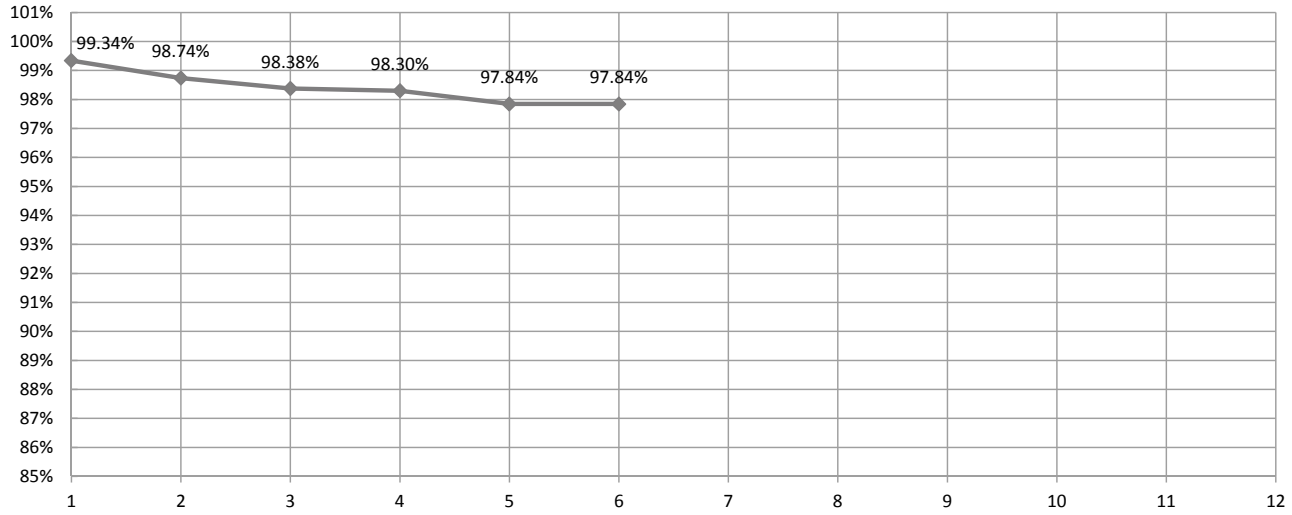
Graph 63. Cumulative survival probability curve of cemented PE Cups typ Müller – Aesculap



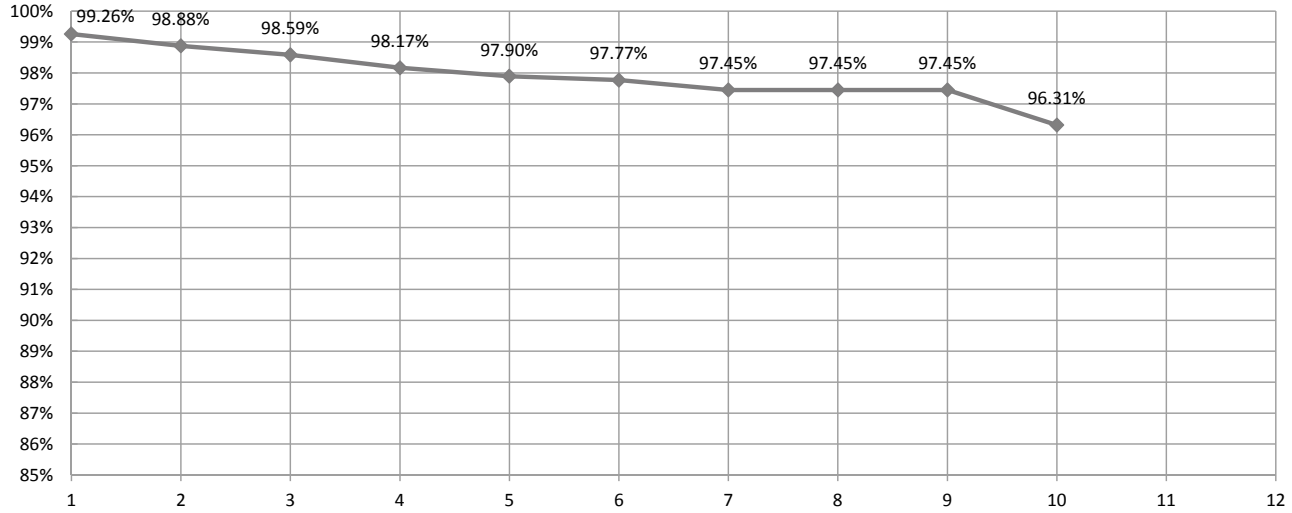
Graph 64. Cumulative survival probability curve of cemented cups SPC PE – Sulzer



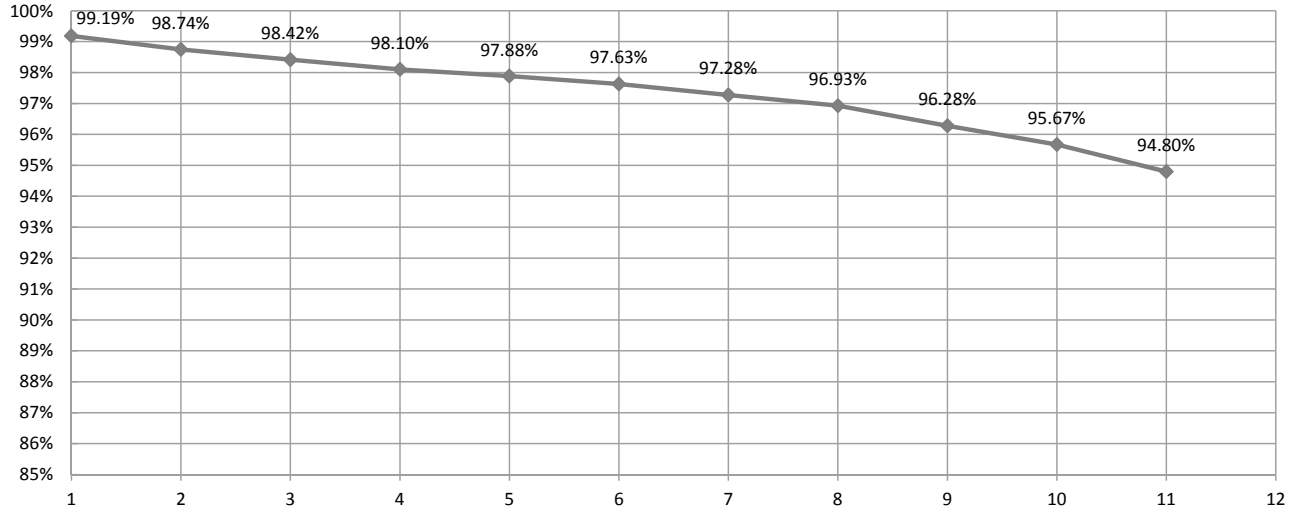
Graph 65 .Cumulative survival probability curve of cemented cups type 02 cross – Beznoska



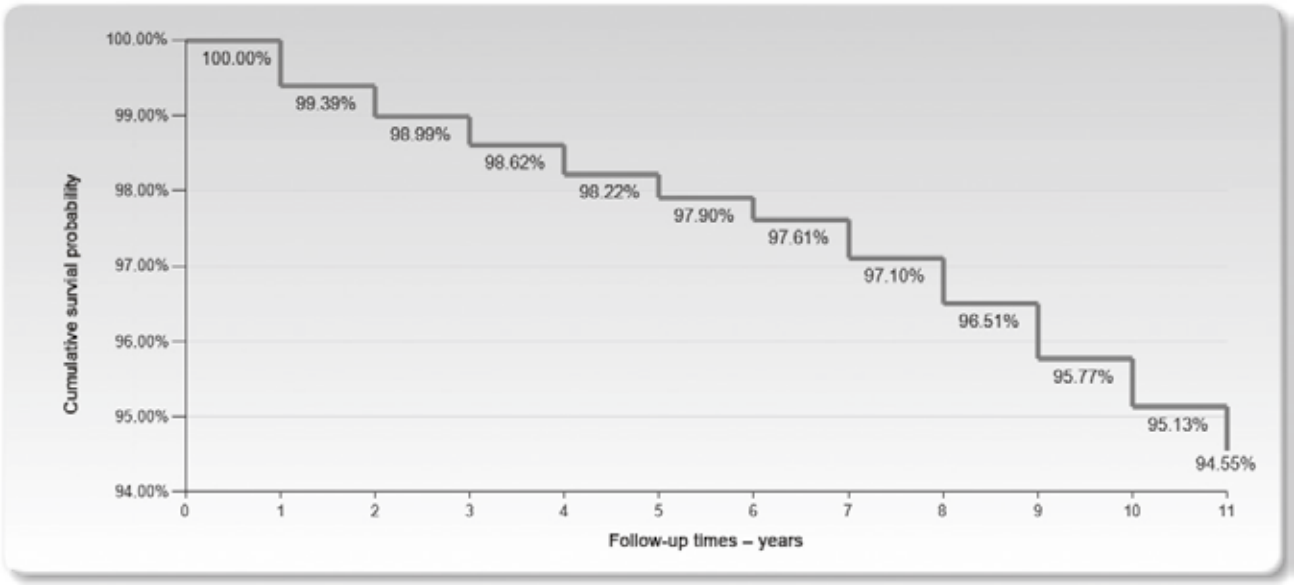
Graph 66. Cumulative survival probability curve of cemented cups ZCA – Zimmer



Graph 67. Cumulative survival probability curve of cemented cups Standard – Beznoska

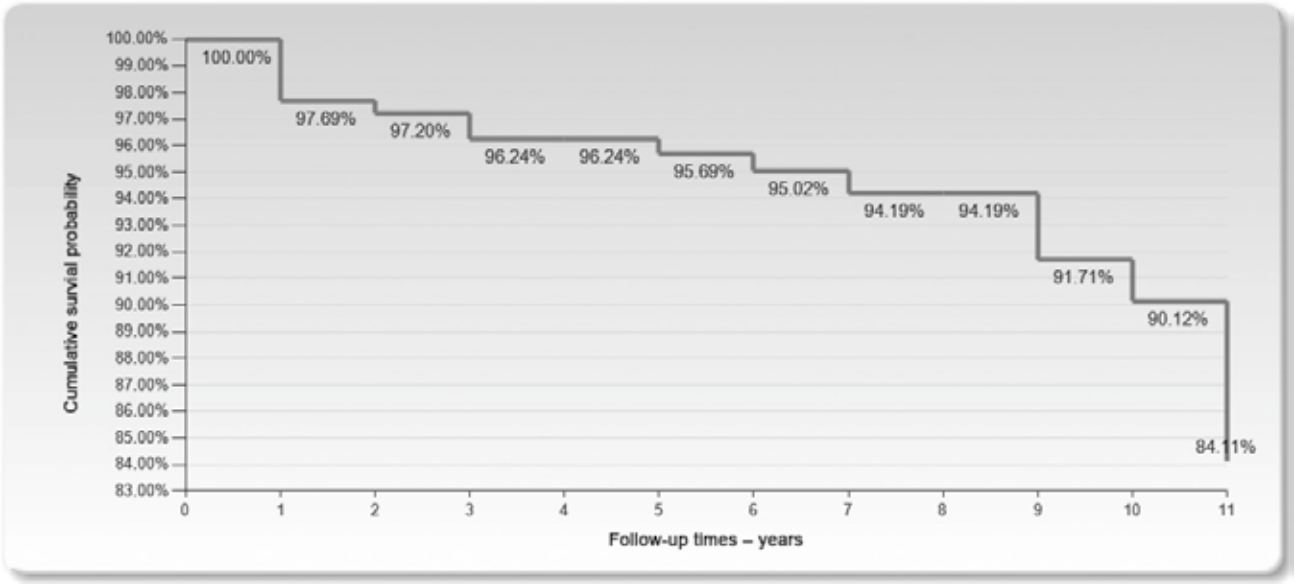


Graph 68 Cumulative survival probability curve of all completely uncemented hip replacements



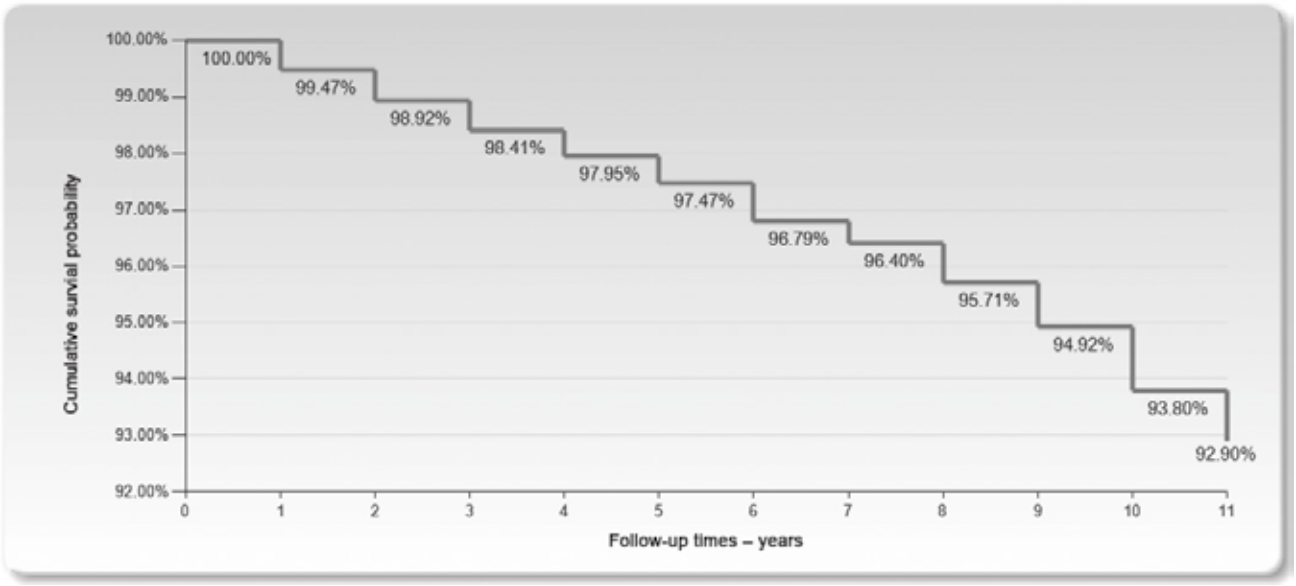
Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Uncemented
Follow-up time	2003–2012

Graph 69. Cumulative survival probability curve of all hybrid hip replacements with cemented acetabular component



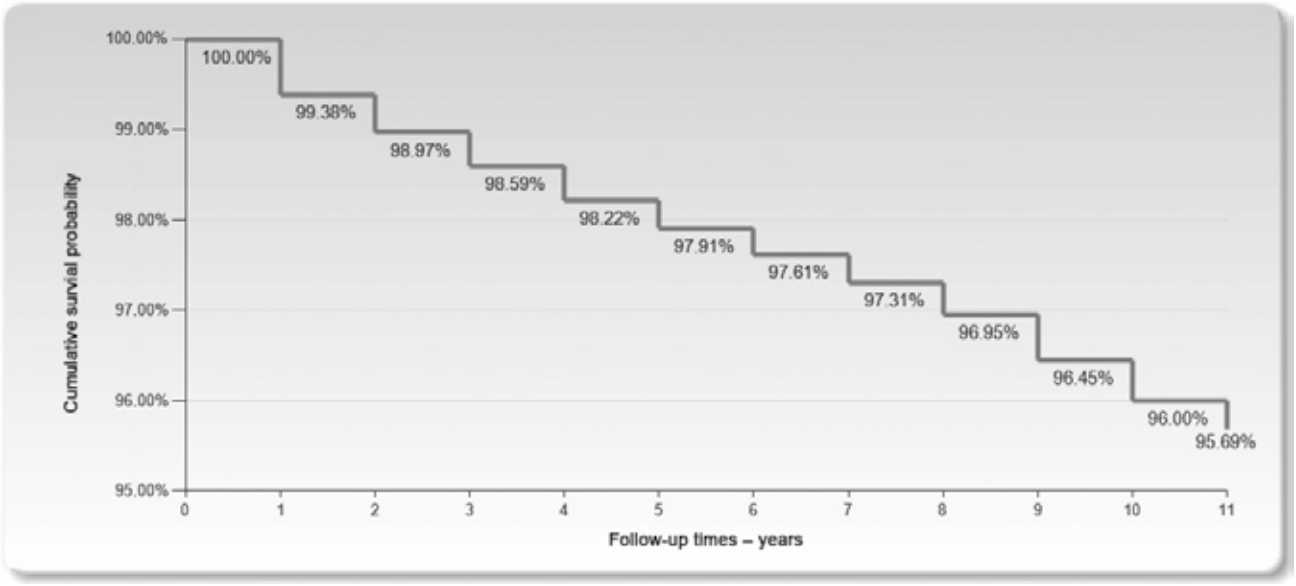
Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Hybrid – cemented acetabular component
Follow-up time	2003–2012

Graph 70. Cumulative survival probability curve of all hybrid hip replacements with cemented femoral component



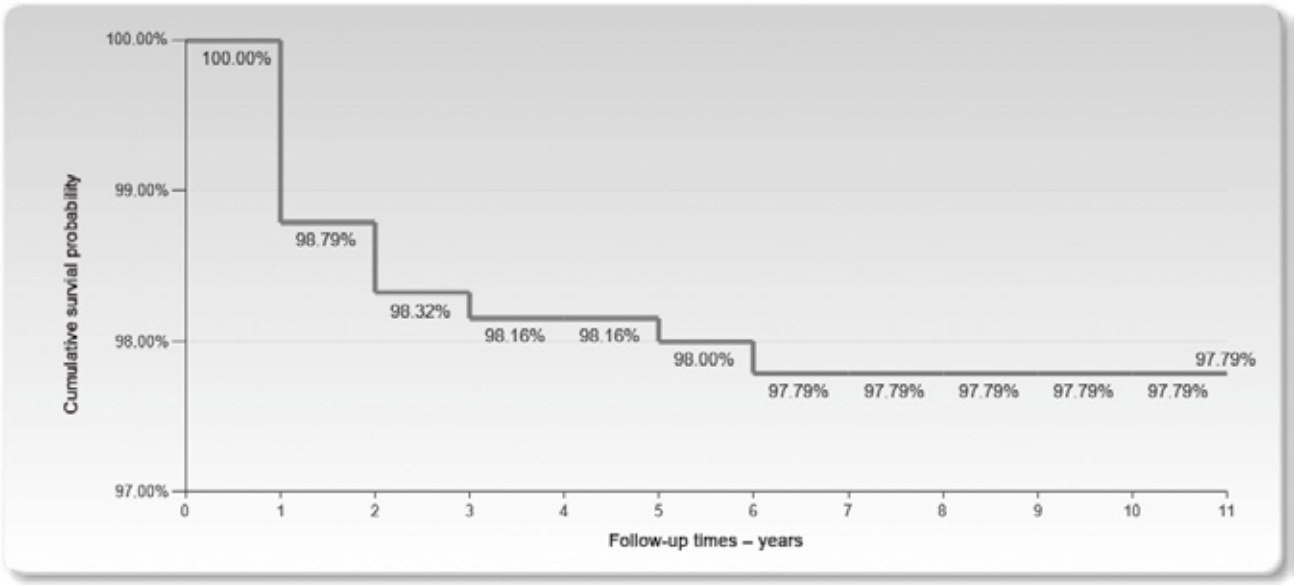
Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Hybrid – cemented femoral component
Follow-up time	2003–2012

Graph 71. Cumulative survival probability curve of all completely cemented hip replacements



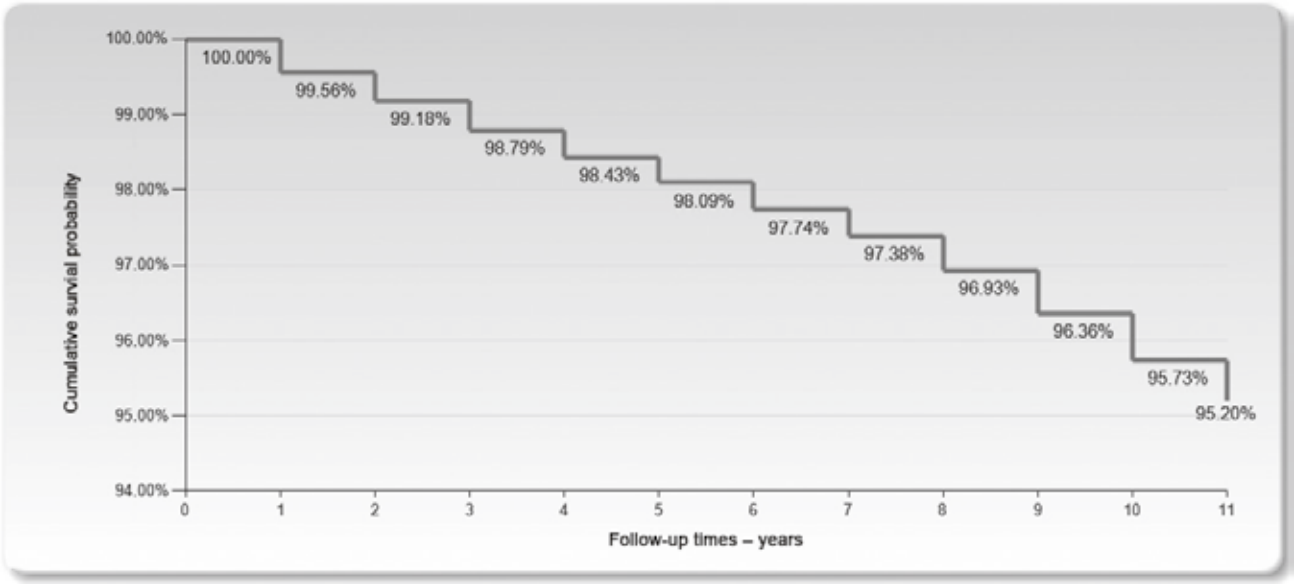
Gender	All
Joint	Hip
Diagnosis	All
Fixation type	Cemented
Follow-up time	2003–2012

Graph 72. Cumulative survival probability curve of all cemented cervico-capital prostheses



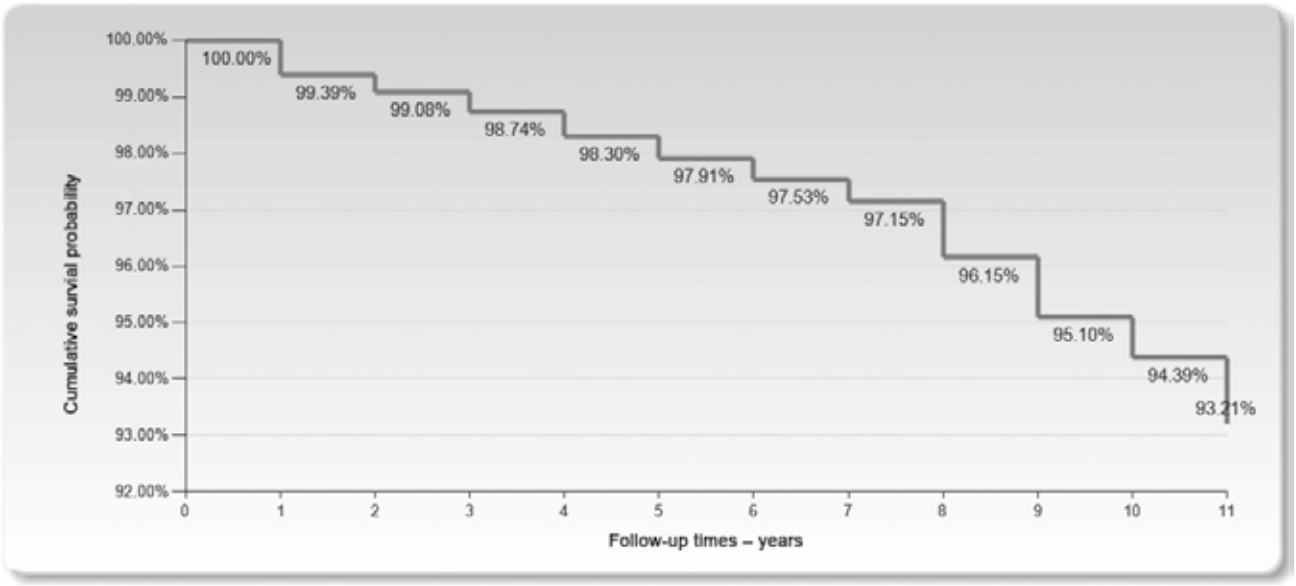
Gender	All
Joint	Hip
Diagnosis	All
Type	Cemented – CC prosthesis
Follow-up time	2003–2012

Graph 73. Cumulative survival probability curve in patients with primary osteoarthritis



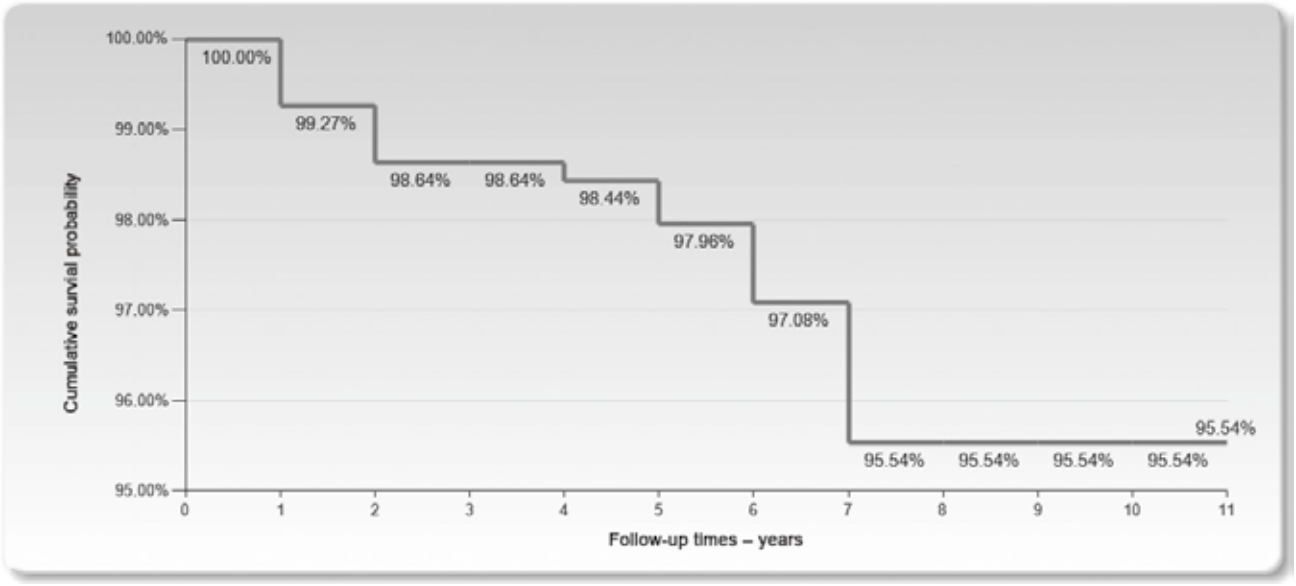
Gender	All
Joint	Hip
Diagnosis	Primary osteoarthritis
Type	All
Follow-up time	2003–2012

Graph. 74. Cumulative survival probability curve in patients after congenital hip dislocation



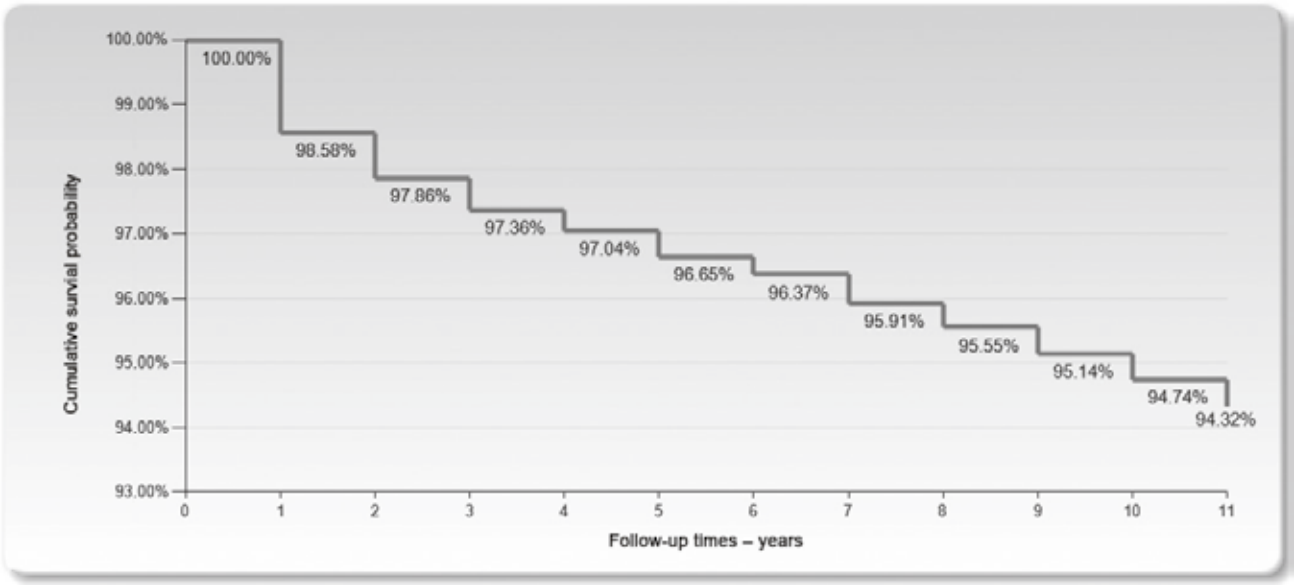
Gender	All
Joint	Hip
Diagnosis	Congenital hip dislocation
Fixation type	All
Follow-up time	2003–2012

Graph 75. Cumulative survival probability curve in patients with rheumatoid arthritis



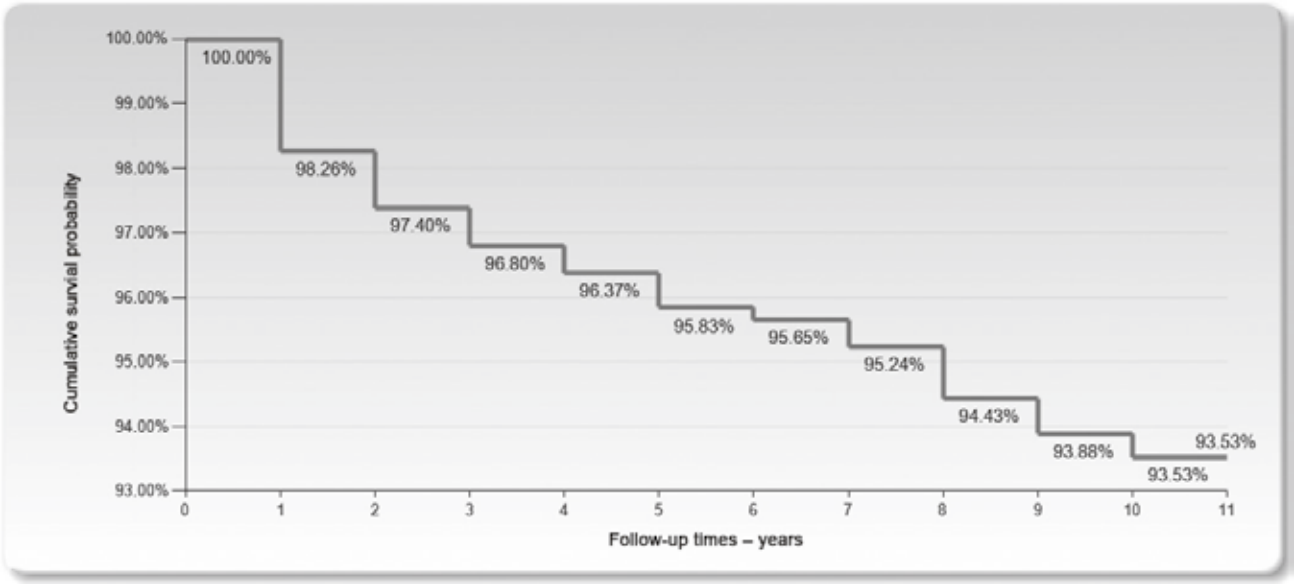
Gender	All
Joint	Hip
Diagnosis	Rheumatoid arthritis
Type	All
Follow-up time	2003–2012

Graph 76. Cumulative survival probability curve in status post fracture in general



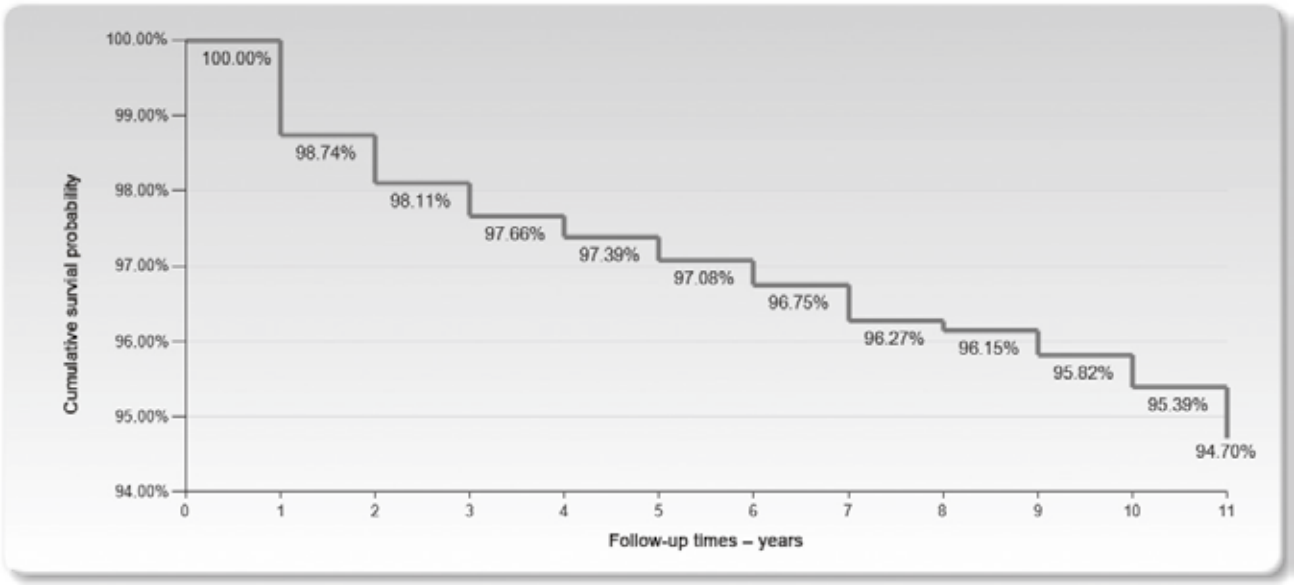
Gender	All
Joint	Hip
Diagnosis	Post-fracture
Fixation type	All
Follow-up time	2003–2012

Graph 77. Cumulative survival probability curve in status post fracture in men



Gender	Males
Joint	Hip
Diagnosis	Post-fracture
Fixation type	All
Follow-up time	2003–2012

Graph 78. Cumulative survival probability curve in status post fracture in women



Gender	Females
Joint	Hip
Diagnosis	Post-fracture
Fixation type	All
Follow-up time	2003–2012