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REVIEW OF THE ANNUAL REPORT OF THE SLOVAKIAN ARTHROPLASTY REGISTER – 2010

L. NEČAS, S. KATINA, S. KŘIVÁNEK, J. UHLÁROVÁ
C. L. COLTON
English language editor to SAR

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Slovakian Arthroplasty Register

Review of the annual report of the Slovakian Arthroplasty Register – 2010

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Introduction

The Slovakian Arthroplasty Register sets a fine example of how the devoted work of a small group of dedicated individuals, often battling against a degree of resistance to change, can create and incrementally modernise an extremely valuable resource in a relatively short span of time. From the most humble beginnings in 2003, Dr. Libor Nečas and his team have brought the SAR into the forefront of the brotherhood of international arthroplasty registers. This summary of the SAR's annual report for 2010 demonstrates unequivocally how, in collaboration with government agencies, the Slovakian orthopaedic community and interested parties in the surgical industry, a modern resource, harnessing imaginative technological innovations has evolved into a valuable statistical tool It is always a challenge to précis a complex statistical exercise, as is embodied in the full report in the Slovakian language, but this summary seeks to present to the English-speaking world the important elements in a digestible format. The text is clear and the attractive graphics make it as pleasurable as is in the full report in the Slovakian language, but this summary seeks to present to the English-speaking world the important elements in a digestible format possible to study. That endeavour has undoubtedly succeeded. Important trends, desirable and otherwise can be picked up, thereby navigating and informing the process of change into advantageous directions, constituting evidence-based progress. It is not for this author to comment on the conclusions reached and their relevance to the practice of joint arthroplasty, that is for those active in the specific fields covered by the report, but to congratulate those responsible on their industrious perseverance and utter dedication, which together have created, and continue to improve, this invaluable project.

Professor Christopher L. Colton,
English language editor to SAR

Summary

This annual report of Slovakian Arthroplasty Register (SAR) is an official document dealing with all arthroplasty procedures performed in Slovakia from January 1st until December 30th, 2010. During that period the population of Slovakia reached 5,435,273. During the observed period 4,970 primary arthroplasties and 457 revision arthroplasties were performed. In general, the number of arthroplasty procedures depends on the demographic growth of the population. This annual report is divided into two main parts – arthroplasty of the hip joint and the arthroplasty of the knee joint: it contains summary statistics from all surgical departments performing arthroplasty procedures. In the hip joint section, it evaluates data from 40 orthopaedic and traumatology departments in 2010, the incidence of primary total hip arthroplasty (THA) was 91.42 per 100,000 inhabitants. From the year 2003, when the incidence was 39.39 per 100,000 inhabitants, the percentage growth has been 232%. In 2010, the revision rate reached 9.20%, representing annual increase of 1.1%. The revision rate in whole observed period 2003–2010 reached 9.15%.The mean age of all patients undergoing primary THA was 64.66 years. Sixty percent were female and 40% male. Primary coxarthrosis was the main indication for the surgery in 57.75%. Compared to 2003, when it was 54.33% the increase was minimal. In 2003, dysplasia was as the main indication in 10.01% and in 2010 this figure reached 11.39%. In 19.68% the indication was femoral neck fracture. Regarding the type of the arthroplasty, total hip arthroplasty was used in 86.78% of all cases, unipolar hemiarthroplasty was used in 12.45% cases and bipolar hemiarthroplasty accounted for only 0.76% of all cases. Cement was used for all components in 35.45% of all arthoplasties, 53.25% were uncemented and 11.28% were hybrids. We have observed significat growth in the uncemented type of fixation. In 2003, the uncemented type of fixation was used in only 23.07% of all cases. The SAR started with data collection in total knee arthroplasty (TKA) on January 1st, 2006. In 2010, TKA was practised in 28 surgical departments, in which 2,198 primary and 97 revision arthroplasties were performed. Females comprised 67.38% and males 32.62%. The incidence of TKA was 40.44 per 100,000 of population. In 2010, the revision rate reached 4.41%, representing an annual growth of 0.04% compared to 2009. During the period 2003–2010, the overall TKA revision rate was 3.62%. In 2010, primary bicondylar arthroplasty was the chosen TKA technique in 85.53% of all cases: 97.04% of all implants were fixed with bone cement, 1.36% were uncemented and 1.59% of all knees were hybrids.

History of SAR

The main goals of the SAR are: the demographic evaluation of the patients undergoing arthroplasty procedures, analyses of the risk factors, providing as much information as possible about the implants used in the defined territory, observing the correlation of the survival rate with the different diagnostic and technical factors, and, finally, identifying those implants associated with inferior outcomes. The Slovakian Orthopedic and Traumatology Society (SOTS) decided, in 2001, to follow the Scandinavian model and create a national implant registry. In 2002, the project became a reality; the SAR was officially launched on January 1st 2003 and became a member of the new European Arthroplasty Register (EAR). The seat of the SAR is University Hospital Martin. From 2010, the SAR has been a full member of the International Society of Arthroplasty Registers (ISAR). The SAR initially covered 26 surgical departments and acquired 2,412 THA protocols. From the beginning, participation was voluntary and by 2004 the number of participating departments reached 36 orthopaedic and traumatology clinics. During 2006, the SAR changed the recording of protocols from paper forms to on-line. More than 90% of all orthopaedic departments, but only 50% of traumatology departments were contributing to the registry. Based on these data and on negotiations with the Slovakian Ministry of Health, the new regulation No.20758/2004-OSZS, came into force on October 1st 2004 this regulation requires that each participating unit must report its statistics every two weeks.

Statistical methods of SAR

Descriptive statistics of SAR data, implants and their components, are built up based on a breakdown of the THA and TKA database into the following four groups in eight time intervals in total, year-by-year (January 1st, 2003 to December 31st, 2010):

1. alive and not revised,
2. alive and revised,
3. dead and not revised, and
4. dead and revised.

Considering the very low numbers of all deceased patients, 2.08% only, this part of the database will not be analysed further. Additionally, based on the SAR analysis 2003–2008 (Chart 17), the survival rates of the whole database (including dead) and of living patients are almost identical.

The SAR database consists of the contribution of 40 departments – 12 performing THA and 28 both THA and TKA. The departments are characterised basically by the numbers of primary and revision THA and TKA performed.

For the particular year (2003–2010), the frequencies of THA and TKA are recorded and compared with the databases of Ministry of Health of the Slovak Republic and the databases of component/implant distributors

Since 2009, an Implant Tracking System (ITS), based on Global Trade Item Number (GTIN) barcodes and the Health Industry Business Communications Council (HIBCC) system, has been used to identify the implants.

The database is divided into two sub-databases, THA and TKA, respectively, each of which is further divided into primary and revised subgroups. Basic characteristics are summarized in frequency tables and bar plots as follows:

- implantation frequency,
- gender,
- age groups at five-year intervals (16 in total),
- diagnosis as indication for THA/TKA,
- THA/TKA type,
- THA/TKA surgical approach,
- type of fixation,
- type of bone cement for arthroplasty and
- technique of cementing.

In addition, for secondary operations:

- type of fixation of revised implant,
- reason for revision THA/TKA,
- revised components, and
- type of revised component

are recorded for revised operations.

Basic survival characteristics of primary implants and their components in the SAR database

Statistical analyses were performed, using R software, as eight-year follow up (from January 1st, 2003 to December 31st, 2010) with censored date equal to December 31st, 2010. The following basic characteristics:

1. Revision Rate (RR),
2. Survival Rate (SR),
3. Hazard Rate (HR), and
4. Revision Burden (RB)

are used to describe the failure and survival of implants/components. Of the above-mentioned four basic characteristics, only the frequencies of failed and survived implants/components were used, but not the time to failure or censorship, which are necessary to describe implant/component survival completely. Therefore, in addition to (1) to (4),

5. crude (specific) incidence,
6. mean survival time (in years),
7. standard deviation of mean survival time and
8. 95% confidence interval (CI) of mean survival time characterized by its lower and upper bounds (LB and UB, respectively)

were also used.

For the particular implant/component groups and their combinations, Kaplan-Meier survival curves are derived as follows:

1. for five most frequent acetabular components,
2. for five most frequent femoral components,
3. for five most frequent uncemented component combinations,
4. for five most frequent cemented component combinations and
5. for five most frequent hybrid component combinations.

Testing of hypotheses about differences in mean time of survival between groups of primary implants and their components in SAR database

Testing of hypotheses about differences in mean time of survival between groups of primary implants and their components is done for following groups:

1. component type – acetabular and femoral,
2. interaction of the first order – component type (acetabular and femoral) vs type of fixation (uncemented and cemented),
3. type of the component fixation (uncemented, cemented, hybrid, reverse hybrid, cemented and uncemented hemiartroplasty),
4. gender – females and males,
5. age groups – less than 55 years [min, 55], from 55 to 65 years (55,65], from 65 to 75 years (65,75], and more than 75 years (75,max],
6. interaction of the first order – gender vs age groups,
7. interaction of the first order – gender vs type of fixation,
8. interaction of the first order – age groups vs type of fixation,
9. interaction of the second order – age groups vs gender vs type of fixation.

The results are presented as Kaplan-Meier survival curves and p-values (to simplify the outputs, test statistics are omitted), using the following terminology

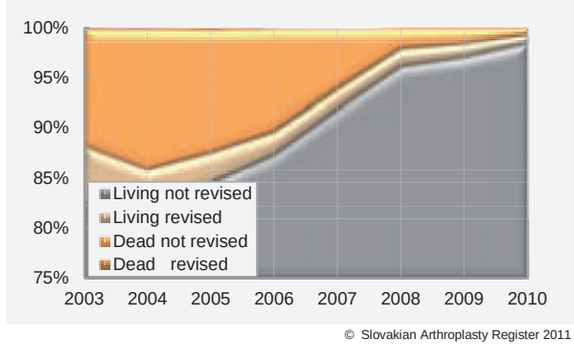
A. significance, if p-value fails to the interval [0,0.05),
B. marginal significance, if p-value fails to the interval [0.05,0.1).

A revision procedure is defined as any operation replacing any component. Therefore, the Kaplan-Meier survival curve is used to calculate the time from primary insertion to the first revision. A survival time is characterized by implementing both failed and censored implants into the calculation. In this paper, we focus mainly on the type of fixation and the cumulative revision rate, i.e., an additional basic characteristic. Survival analysis is used to describe the time to revision (failure) where the frequency of revisions increases with time. Therefore, the break-down of the database into four subgroups – alive and not revised, alive and revised, dead and not revised, and dead and revised, is important (Tab. 1 and Chart 1).

Tab. 1. THA database break-down

Year	Living not revised	Living revised	Dead not revised	Dead revised
2003	1 750	120	247	2
2004	2 536	114	432	4
2005	2 514	92	364	6
2006	3 141	82	369	3
2007	3 914	86	258	2
2008	4 240	79	92	0
2009	4 627	64	76	0
2010	4 893	42	34	1

Chart 1. THA database break-down

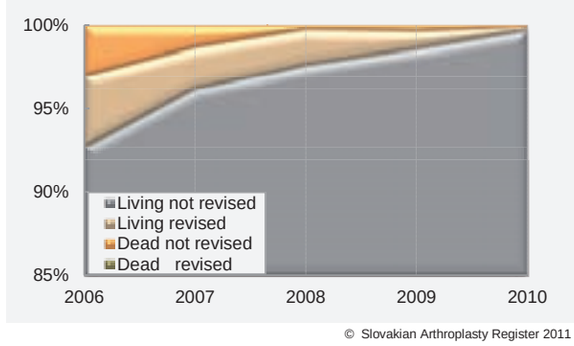


The same structure can also be seen for TKA (Tab. 2, Chart 2), where the differences between THA and TKA are due to the shorter TKA follow-up. We presume that both databases will follow the same trend in the next few years.

Tab. 2. TKA database break-down

Year	Living not revised	Living revised	Dead not revised	Dead revised
2006	827	38	27	0
2007	1 312	34	18	0
2008	1 573	34	4	0
2009	2 000	21	7	0
2010	2 192	4	2	0

Chart 2. TKA database break-down



SAR results in 2010

By 30th December 2010 we had received 32,942 THA protocols, of which 30,183 were primary and 2,759 were revision procedures. The annual increase was 5.30%. In both the following Tab. 3 and Chart 3 the annual increases in primary and revision THA are shown.

Tab. 3. Annual growth of THA

Year	Primary THA	Revision THA	%
2003	2 119	293	
2004	3 086	333	41,75%
2005	2 976	270	-5,06%
2006	3 595	335	21,07%
2007	4 260	346	17,20%
2008	4 411	339	3,13%
2009	4 767	386	8,48%
2010	4 970	457	5,30%

Chart 3. Annual growth of THA

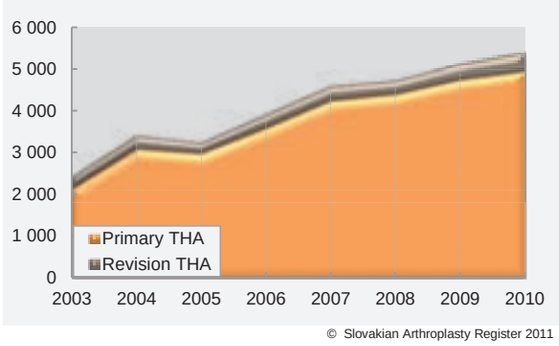


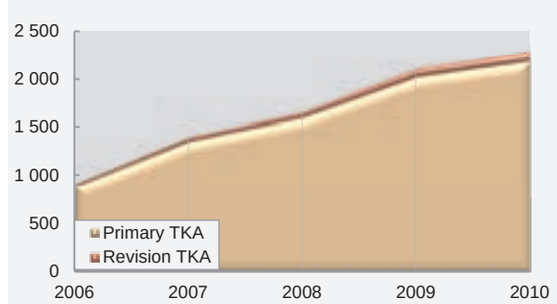
Chart 3 shows that the increase of primary THA procedures is not linked to revision THA. From both Tab. 4 and Chart 4, it is clear that the annual growth in TKA in 2007 was 54%, compared to 2006.

In 2010 there was less growth (8.66%), compared to 2009. The number of revision TKAs follows the trend of the primary TKA, as shown in the Chart No. 4

Tab. 4. Annual growth of TKA

Year	Primary TKA	Revision TKA	%
2006	892	20	
2007	1 364	41	54,06%
2008	1 611	51	18,29%
2009	2 028	84	27,08%
2010	2 198	97	8,66%

Chart 4. Annual growth of TKA



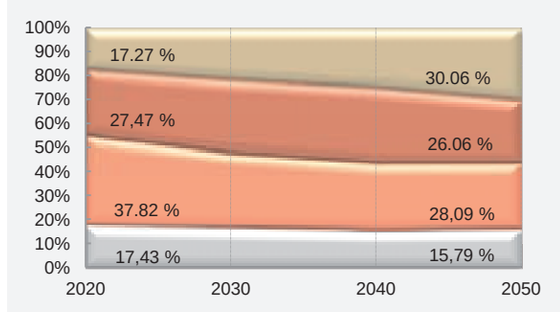
Demographic evolution in Slovakia

In this report, we have used the predictions of Slovakian population 2020–2050 published by the Slovak Statistical Office. Accordingly, the age groups 45–64 and 65+, which are potentially the main constituencies for arthroplasty procedures, will grow over the next 30 years. This is demonstrated in the Tab. 5 and Chart 5.

Tab. 5. Prognosis of Slovak population 2020–2050

Year	Age groups			
	0-17	18-44	45-64	65+
2020	944 490	2 048 787	1 488 018	935 593
2030	876 435	1 678 101	1 631 935	1 153 779
2040	787 502	1 456 177	1 609 760	1 285 931
2050	770 490	1 370 926	1 271 850	1 466 923

Chart 5. Prognosis of Slovak population 2020–2050



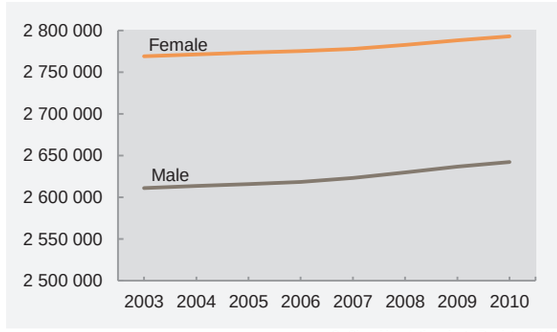
The most age group increasing most will be the group 65+, this group growing from 17.27% in 2020 to 30.06% in 2050. This growth will drive the demand for arthroplasty in the future.

The number of inhabitants in Slovakia by 31st December, 2010 reached 5,435,273.

Tab. 6. Slovakian population 2003–2010

Year	Male	Female	Total
2003	2 611 124	2 768 929	5 380 053
2004	2 613 490	2 771 332	5 384 822
2005	2 615 872	2 773 308	5 389 180
2006	2 618 284	2 775 353	5 393 637
2007	2 623 127	2 777 871	5 400 998
2008	2 629 804	2 782 450	5 412 254
2009	2 636 938	2 787 987	5 424 925
2010	2 642 240	2 793 033	5 435 273

Chart 6. No. of inhabitants in Slovakia 2003–2010



Tab. 7. Mean age, gender, type of fixation for primary THA

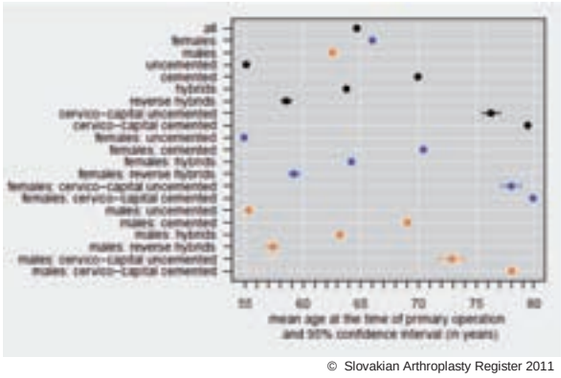
Groups	n	mean	LB	UB	sd	min	25%	median	75%	max
All	30152	64,66	64,62	64,70	12,37	9	56	66	74	100
F	18449	66,00	65,95	66,05	12,56	9	58	67	75	100
M	11703	62,54	62,48	62,60	11,74	14	55	63	71	99
Uncemented	11520	55,09	55,03	55,15	10,22	9	49	55	61	87
Cemented	9471	69,95	69,90	70,01	7,25	20	66	71	75	98
Hybrids	4339	63,76	63,67	63,84	7,96	20	59	64	69	93
Reverse hybrids	340	58,57	58,20	58,94	12,23	22	50	57	68	87
Hemiarthroplasty uncemented	91	76,27	75,55	77,00	12,53	35	72	80	85	95
Hemiarthroplasty cemented	4391	79,45	79,37	79,54	7,71	14	76	80	84	100
F: uncemented	6154	54,91	54,83	54,99	10,49	9	49	55	61	87
F: cemented	6248	70,42	70,36	70,49	7,08	20	67	71	75	98
F: hybrids	2472	64,19	64,08	64,30	8,00	20	59	65	70	89
F: reverse hybrids	218	59,23	58,76	59,71	12,86	22	51	59	70	87
F: hemiarthroplasty uncemented	60	78,02	77,12	78,92	12,66	35	76	81	85	95
F: hemiarthroplasty cemented	3297	79,91	79,82	80,00	7,27	14	76	80	84	100
M: uncemented	5366	55,30	55,21	55,38	9,89	14	50	56	61	85
M: cemented	3223	69,05	68,95	69,14	7,48	28	65	70	74	97
M: hybrids	1867	63,19	63,06	63,31	7,89	21	58	64	68	93
M: reverse hybrids	122	57,39	56,80	57,97	10,95	30	50	56	65	83
M: hemiarthroplasty uncemented	31	72,90	71,70	74,11	11,73	49	64	75	82	89
M: hemiarthroplasty cemented	1094	78,08	77,90	78,25	8,77	35	73	79	84	99

color	**mean age gradation**
	about 75-80
	about 70
	about 65
	about 60
	about 55
n	number of components
mean	mean age at the time of primary operation

CI	confidence interval (of the mean age)
LB	lower bound of 95% CI
UB	upper bound of 95% CI
min	minimal age
25%	first quartile
50%	second quartile (median)
75%	third quartile
max	maximal age

As shown in the Tab. 6 and in the Chart 6, the gender ratio stays virtually unchanged. In 2003, it was 48.53% male to 51.47% female. In 2010, it was 48.61% male to 51.39% female. During the period 2003–2010, the mean age for primary THA was 64.66 (male 62.54 and female 66.00), as in Chart 7. Tab. 7 shows the mean age of operated patients according to gender and type of fixation. From this table we can conclude that, in all age groups, women have a higher mean age than men. The biggest difference is in uncemented hemiarthroplasty, where the mean age of operated males was in 5.12 years lower than females.

Chart 7. Mean age of the patients with the primary THA and confidence interval 95%



In hip arthroplasty, we have observed an increase in patients aged less than 55 years, from 10.71% in 2003 to 20.24% in 2010. Very similar results were recorded in the age group 55–65 years, from 21.29% in 2003 to 28.37% in 2010. In the age group 65–75 years, there was no significant increase. Significant decrease was observed in the age group over 75, from 38.42% to 21.45% in this year. One of the explanations for this could be the enhanced success of arthroplasty surgery in general and extension of the indication for this procedure to younger age groups. The age of the patient and gender determine the type of the fixation. In Slovakia generally, the majority of patients under 50–55 years of age receive uncemented implants, whereas, for the other age groups, the hybrid or cemented types of fixation were used. As shown in Chart 7, the mean age for uncemented fixation was 55 years, for the hybrid it was 63 years and for the cemented type of fixation it was 70 years. These data support the above-mentioned guidelines. In TKA we have the possibility to compare the years 2006 and 2010. In patients less than 55 years of age, we have observed an increase of performed TKA from 4.25% to 9.11%. In the age group 55–65 years the growth was from 27.47% to 32.66%. In the age group 65–75 we have recorded a mild decrease from 43.61% in 2006 to 42.58% in 2010. Significant decrease was recorded in patients over 75, from 24.66% in 2006 to 15.60% in 2010. This decrease could be explained with the success of the TKA, which is even higher than THA, and the age limit restriction for TKA is becoming lower.

Departments

The first parameter for department selection is the number of arthroplasties performed per annum. This parameter does not discriminate between primary and revision arthroplasties. According to the number of surgeries performed, we divide all departments in four groups: Departments performing more than 200, between 200 and 100, between 99 and 50, and departments performing less than 50 arthroplasties per annum.

Tab. 8. Departments according to the No. of performed THA

Department	Primary THA	Revision THA	Total
Bratislava – I.Orth.-traum.	399	106	505
Ružomberok – Traum.-orth.	446	28	474
Bratislava – II.Orth.	326	44	370
Prešov – Orth.	287	40	327
B. Bystrica – Orth.	271	44	315
Martin – Orth.-traum.	267	45	312
Košice – Orth.-traum.	249	10	259
Žilina – Orth.	191	13	204
Nitra – Traum.-orth.	195	6	201
Poprad – Orth.	146	16	162
N. Zámky – Orth.	157	4	161
Trnava – Traum.-orth.	142	3	145
Topoľčany – Orth.	140	3	143
Košice – Šaca - Orth.	114	14	128
Bojnice – Orth.	115	10	125
Košice ŽZ - Orth.	111	11	122
Michalovce – Orth.	111	8	119
Skalica – Orth.-traum.	102	13	115
B. Bystrica – Traum.	109	2	111
Bratislava – Traum.	97	7	104
N. Zámky – Traum.	92	4	96
D. Kubín – Orth.-traum.	92	0	92
Trenčín – Orth.	75	9	84
Bratislava S & E - Orth.	80	0	80
D. Streda – Traum.	76	0	76
Trenčín – Traum.	72	1	73
Piešťany – Orth.	71	0	71
Galanta – Traum.-orth.	68	2	70
Lučenec – Orth.-traum.	58	2	60
Žilina - Traum.	60	0	60
Košice – Traum.	45	8	53
Humenné - Orth.	41	0	41
L. Mikuláš – Traum.-orth.	38	1	39
P. Bystrica – Orth.	39	0	39
Michalovce – Traum.	35	0	35
Topoľčany – Traum.	31	2	33
Vranov n. Topľou - Traum.	11	1	12
Trstená – Traum.	7	0	7
Partizánske – Traum.	3	0	3
Bratislava DFNsP - Orth.	1	0	1
Total	4 970	457	5 427

Tab. 9. Departments according to the No. of performed TKA

Department	Primary TKA	Revision TKA	Total
Ružomberok – Traum.-orth.	261	15	276
Prešov – Orth.	202	11	213
Bratislava – I.Orth.-traum.	175	28	203
Martin – Orth.-traum.	178	12	190
Bratislava – II.Orth.-traum.	162	10	172
B. Bystrica – Orth.	161	4	165
Topoľčany – Orth	109	1	110
Nitra – Traum.-orth.	100	2	102
Žilina – Orth.	98	1	99
N. Zámky – Orth.	97	0	97
Poprad – Orth.	92	4	96
Košice – Orth.-traum.	94	1	95
Košice – Šaca - Orth.	87	2	89
Piešťany – Orth.	51	0	51
D. Streda – Traum.	46	0	46
Skalica – Orth.-traum.	41	3	44
Bojnice – Orth.	42	1	43
Trnava – Traum.-orth.	42	0	42
Trenčín – Orth.	39	1	40
Bratislava – Traum.	26	0	26
Košice ŽZ – Orth.	25	1	26
Bratislava S & E - Orth.	24	0	24
D. Kubín – Orth.-traum.	24	0	24
Košice – Traum.	8	0	8
Humenné - Orth.	5	0	5
B. Bystrica – Traum.	3	0	3
Bratislava DFNsP - Orth.	3	0	3
Žilina - Traum.	3	0	3
Total	2 198	97	2 295

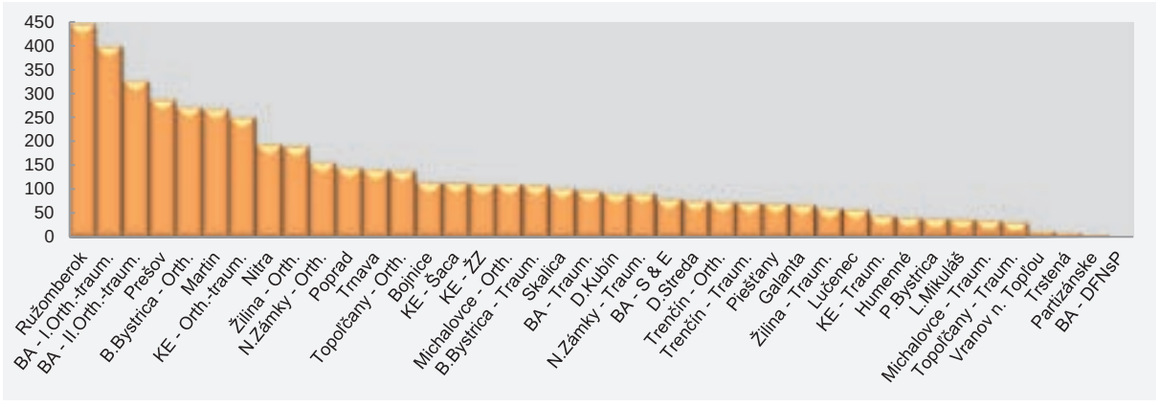
The next parameter for sorting the departments is the specialty. In Slovakia, arthroplasty such procedures are performed in orthopaedic, orthopaedic-traumatology, traumatology and, in some regions, general surgery departments perform hemiarthroplasties. Therefore, the number of departments performing arthroplasty procedures is not stable and depends on the contractual relationships between the hospitals and health insurance organisations. Another selection is according to the health care provider.

Tab. 10. Departments according to region, specialty and volume of joint replacements

Region	Type of hospital	Hospital	Department	Primary THA (%)	Revision THA (%)	Primary TKA (%)	Revision TKA (%)
Bratislava	University	University Hospital Bratislava	I.Orth.-traum.	8,00	23,20	8,00	28,90
			II.Orth.-traum	6,60	9,60	7,40	10,30
			Traum.	2,00	1,50	1,20	0,00
	Faculty	Children´s Faculty Hospital	Orth.	0,00	0,00	0,10	0,00
	Private	Sport & Endo Clinic	Orth.	1,60	0,00	1,10	0,00
Trnava	Faculty	Faculty Hospital Trnava	Traum.-orth.	2,90	0,70	1,90	0,00
	Regional	Public Hospital Piešťany	Orth.	1,40	0,00	2,30	0,00
		Public Hospital Skalica	Orth.-traum.	2,10	2,80	1,90	3,10
		Public Hospital Galanta	Traum.-orth.	1,40	0,40	0,00	0,00
		Public Hospital Dunajská Streda	Traum.	1,50	0,00	2,10	0,00
Trenčín	Faculty	Faculty Hospital Trenčín	Orth.	1,50	2,00	1,80	1,00
			Traum.	1,40	0,20	0,00	0,00
	Regional	Public Hospital Považská Bystrica	Orth.	0,80	0,00	0,00	0,00
		Public Hospital Bojnice	Orth.	2,30	2,20	1,90	1,00
		Public Hospital Partizánske	Traum.	0,10	0,00	0,00	0,00
Nitra	Faculty	Faculty Hospital Nitra	Traum.-orth.	3,90	1,30	4,50	2,10
		Faculty Hospital Nové Zámky	Orth.	3,20	0,90	4,40	0,00
			Traum.	1,90	0,90	0,00	0,00
	Regional	Hospital Topoľčany	Orth.	2,80	0,70	5,00	1,00
			Traum.	0,60	0,40	0,00	0,00
Žilina	University	University Hospital Martin	Orth.-traum.	5,40	9,80	8,10	12,40
	Faculty	Faculty Hospital Žilina	Orth.	3,80	2,80	4,50	1,00
			Traum.	1,20	0,00	0,10	0,00
		Central Military Hospital Ružomberok	Traum.-orth.	9,00	6,10	11,90	15,50
	Regional	Public Hospital Dolný Kubín	Orth.-traum.	1,90	0,00	1,10	0,00
		Public Hospital Liptovský Mikuláš	Traum.-orth.	0,80	0,20	0,00	0,00
		Public Hospital Trstená	Traum.	0,10	0,00	0,00	0,00
B. Bystrica	Faculty	Faculty Hospital Banská Bystrica	Orth.	5,50	9,60	7,30	4,10
			Traum.	2,20	0,40	0,10	0,00
	Regional	Public Hospital Lučenec	Orth.-traum.	1,20	0,40	0,00	0,00
Prešov	Faculty	Faculty Hospital Prešov	Orth.	5,80	8,80	9,20	11,30
	Regional	Hospital Poprad	Orth.	2,90	3,50	4,20	4,10
		Public Hospital Humenné	Orth.	0,80	0,00	0,20	0,00
		Public Hospital Vranov n.Topľou	Traum.	0,20	0,20	0,00	0,00
Košice	University	University Hospital Košice	Orth.-traum.	5,00	2,20	4,30	1,00
			Traum.	0,90	1,80	0,40	0,00
	Regional	Railways Hospital Košice	Orth.	2,20	2,40	1,10	1,00
		Public Hospital Michalovce	Orth.	2,20	1,80	0,00	0,00
			Traum.	0,70	0,00	0,00	0,00
	Private	1st. Private Hospital Košice-Šaca	Orth.	2,30	3,10	4,00	2,10

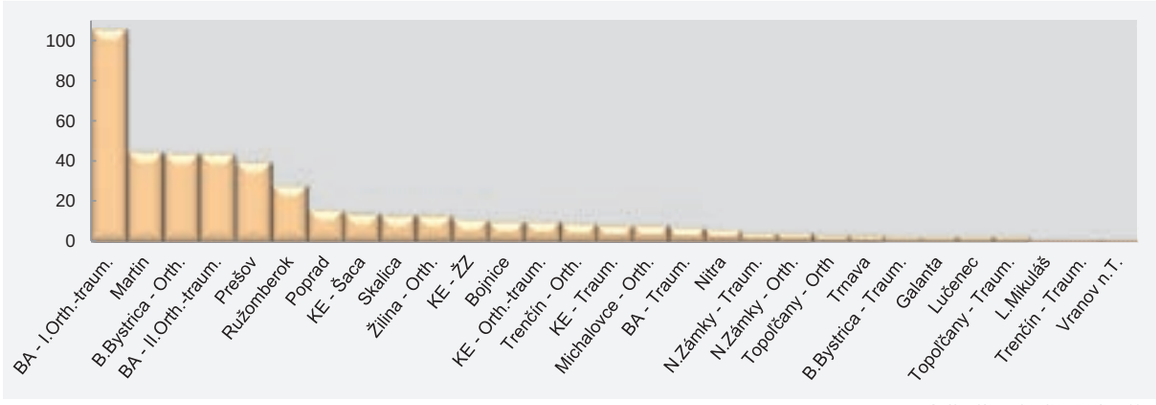
The hospitals with our study departments can be divided into these groups: university, faculty, regional and private departments. In Slovakia we have three university departments, 15 faculty, 25 regional and two private hospitals. Departments according to region, type of hospital and specialty are shown in the Tab. 10. Last four columns in Tab. 10 are show the percentage participation of each department on the total numbers of primary and revision THA, and also primary and revision TKA. In 2010, 40 departments performed 4,970 primary and 457 revision total hip joint replacements. Arthroplasty of the knee joint was contracted for the 28 departments and they performed 2,198 primary and 97 revision total knee joint replacements during the same period. Charts 8 and 9 show the ranking of the departments according to the numbers of primary

Chart 8. Departments according the volume of primary THA



and revision THA performed. There is no correlation between the primary and revision replacement, either in volume or by department. The first five departments have performed 34.90% of all primary and 61.00% of all revision surgeries.

Chart 9. Departments according the volume of revision THA



Charts 10 and 11 show these figures for TKAs. The first five departments performed 44.60% of all primary and 78.40% of all revision TKAs. In relation to TKA, the first five departments ranked for primary procedures, are not the same five when departments are ranked for numbers of revision procedures. Only five departments performed more than 10 revision knee arthroplasties per annum, but nine departments performed between 1 and 4 revision knee joint arthroplasties.

Chart 10. Departments according the volume of primary TKA

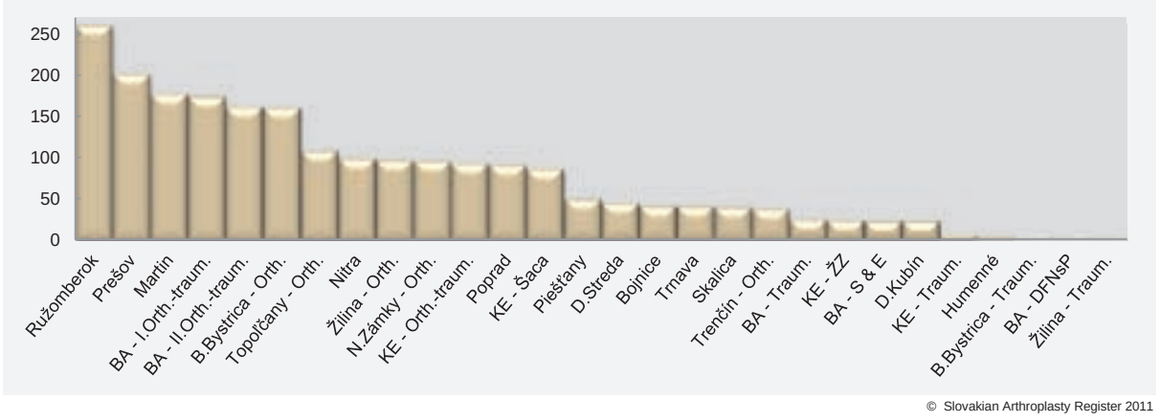
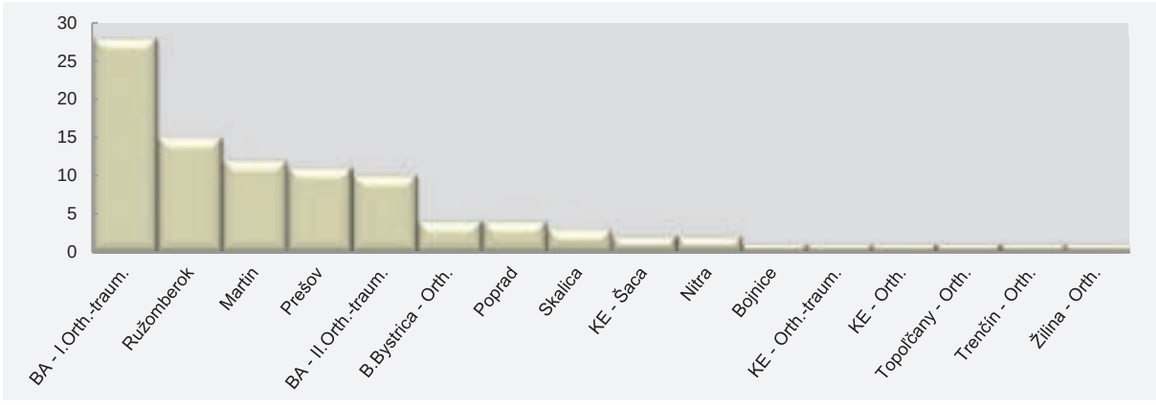


Chart 11. Departments according the volume of revision TKA

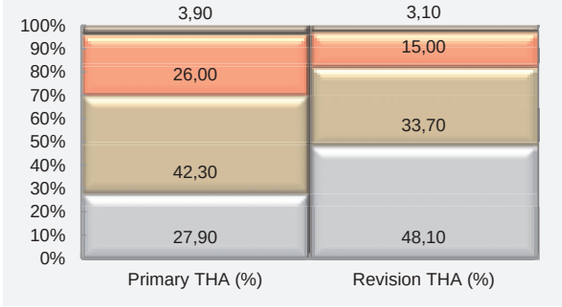


University and faculty departments have performed 70.20% of all primary and 81.80% of all revision total hip arthroplasties, as shown in Tab. 11 and Chart 12. For total knee joints the corresponding figures are 75.02% of all primary and 87.60% of all revisions – Tab. 12 and Chart 13.

Tab. 11. Volume of primary and revision THA according to the type of department

Type of hospital	Primary THA (%)	Revision THA (%)
University	27,90	48,10
Faculty	42,30	33,70
Regional	26,00	15,00
Private	3,90	3,10

Chart 12. Volume of primary and revision THA according to the type of department

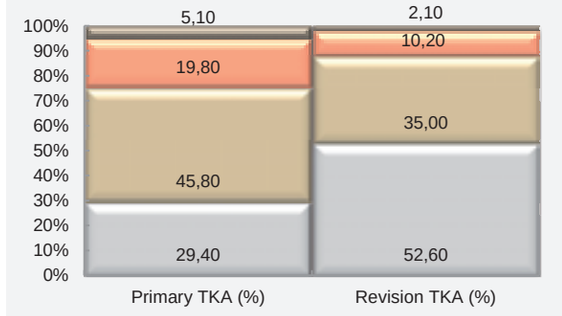


As it is clear from Chart 12, majority of hip revision arthroplasties were performed in university or faculty departments. Fifteen per cent of revisions were performed in regional departments, and only 3.10% of all revisions were performed in private departments and primary/revision ratio in these departments was 1.25:1. With regard to knee arthroplasty, regional and private departments performed only 12.30% of all revision procedures. A very sensitive parameter for arthroplasty results is the volume of performed revisions in by department. To evaluate this figure precisely we have to consider the provenance of patients requiring revision. According to this, each department has two groups of patients. The first group are the revisions of the primary implantation performed in the same department. The second group are those revision patients referred whose primary implantations had been performed in other departments. Tab. 13 presents the departments ordered according to this parameter. Most departments are performing the majority of revisions in cases in which the primary replacement was performed in the same department.

Tab. 12. Volume of primary and revision TKA according to the type of department

Type of hospital	Primary TKA (%)	Revision TKA (%)
University	29,40	52,60
Faculty	45,80	35,00
Regional	19,80	10,20
Private	5,10	2,10

Chart 13. Volume of performed primary and revision THA according to the type of department



There are only three departments that have performed more revisions from the second group. Among departments performing more than 10 revisions per annum, two were doing only their own revisions.

Tab. 13. Departments according the origin of THA revision

Department	Own revision	Foreign revision	Total
Bratislava – I.Orth.-traum.	94	12	106
Martin – Orth.-traum.	31	14	45
B. Bystrica – Orth.	25	19	44
Bratislava – II.Orth.-traum.	28	16	44
Prešov – Orth.	25	15	40
Ružomberok – Traum.-orth.	18	10	28
Poprad – Orth.	16	0	16
Košice – Šaca - Orth.	11	3	14
Skalica – Orth.-traum.	9	4	13
Žilina – Orth.	11	2	13
Košice ŽZ – Orth.	3	8	11
Bojnice – Orth.	10	0	10
Košice – Orth.-traum.	8	2	10
Trenčín – Orth.	2	7	9
Košice – Traum.	7	1	8
Michalovce – Orth.	5	3	8
Bratislava – Traum.	2	5	7
Nitra – Traum.-orth.	4	2	6
N. Zámky – Orth.	4	0	4
N. Zámky – Traum.	4	0	4
Topoľčany – Orth.	3	0	3
Trnava – Traum.-orth.	3	0	3
B. Bystrica – Traum.	2	0	2
Galanta – Traum.	2	0	2
Lučenec – Orth.-traum.	2	0	2
Topoľčany – Traum.	1	1	2
L. Mikuláš – Traum.-orth.	1	0	1
Trenčín – Traum.	1	0	1
Vranov n. Topľou - Traum.	1	0	1
Total	333	124	457

It is to be noted that, during 2010, 16 departments performed less than 10 revisions, which was 13.78% of all revisions and the other 13 departments 86.21% The biggest volume of revisions was done in the Bratislava I. Orthopaedic and Traumatology Clinic and the participation of this clinic was nearly a quarter of all revisions (23.19%).

Chart 14. Departments according the origin of THA revision

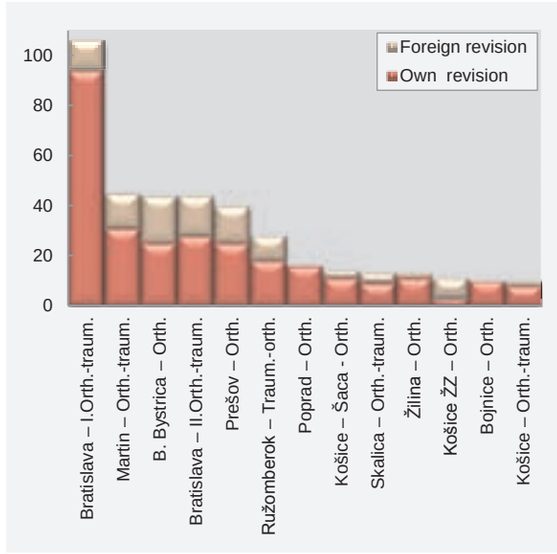
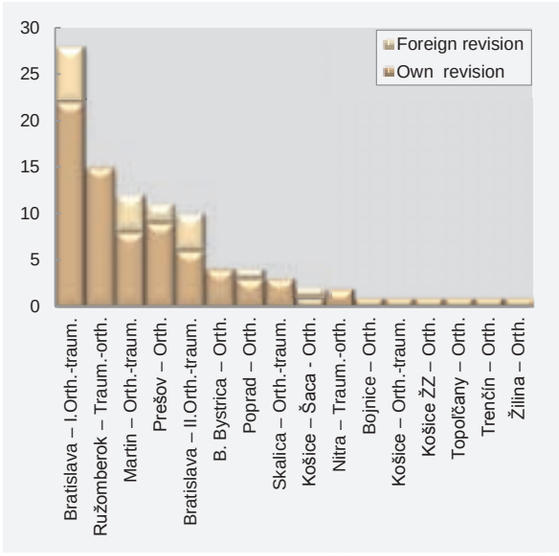


Chart 14 shows the departments according to the origin of the revision patients. For total knee joint replacement the situation is different. The TKA revisions were performed in fewer departments. Only five departments performed more than 10 revisions in the year. Tab. 14 and Chart 15 show departments ordered according to these parameters. The top five departments performed 78.35% of all knee revision.

Tab. 14. Departments according the origin of THA revision

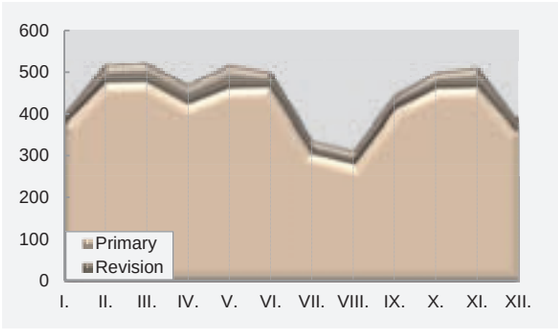
Department	Own revision	Foreign revision	Total
Bratislava – I.Orth.-traum.	22	6	28
Ružomberok – Traum.-orth.	15	0	15
Martin – Orth.-traum.	8	4	12
Prešov – Orth.	9	2	11
Bratislava – II.Orth.-traum.	6	4	10
B. Bystrica – Orth.	4	0	4
Poprad – Orth.	3	1	4
Skalica – Orth.-traum.	3	0	3
Košice – Šaca - Orth.	1	1	2
Nitra – Traum.-orth.	2	0	2
Bojnice – Orth.	1	0	1
Košice – Orth.-traum.	1	0	1
Košice ŽZ – Orth.	1	0	1
Topoľčany – Orth.	1	0	1
Trenčín – Orth.	1	0	1
Žilina – Orth.	1	0	1
Total	79	18	97

Chart 15. Departments according the origin of THA revision



The difference between the first and second departments is not as big as in the THA statistics, which could be explained by the shorter existence of the knee register. We have introduced another parameter for the register follow-up, based on the hypothesis, that the period of the year in which the arthroplasty procedure was performed could influence the survival of the implants. In 2010, we started recording primary and revision surgeries according to the month in which the surgery was performed. From this first observation it became clear, that the volume of the operations is not even throughout the year. Chart 16 shows the number of primary and revision THAs in each month during the year.

Chart 16. Volume of the performed THA during the year



On the curve there are two dips in primary THAs, one in December and January and the other one in August. The biggest volume of revisions was performed in May.

Chart 17. Volume of the performed TKA during the year

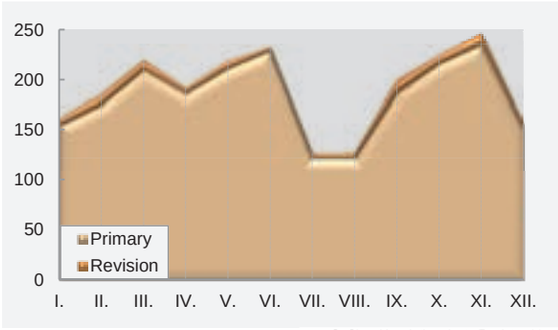
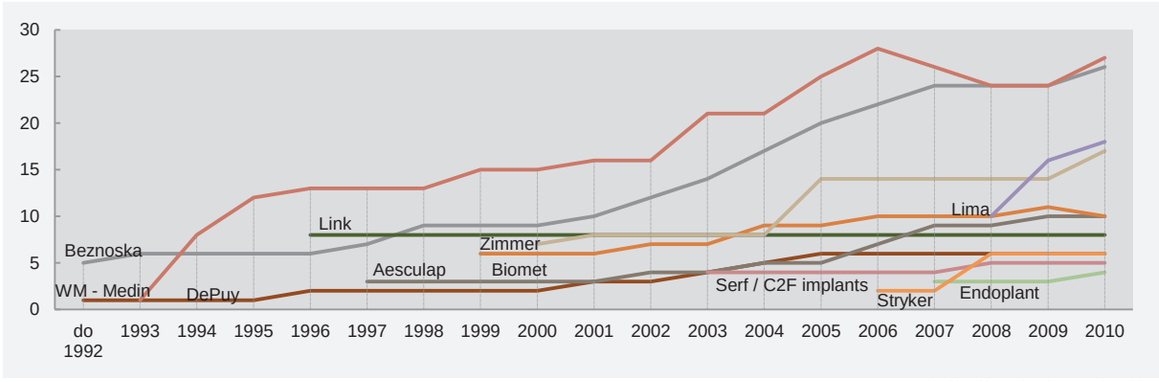


Chart 17 shows the distribution of primary and revision TKAs for each month of the year. The shape of the curve is similar to the THA curve. This parameter will be statistically evaluated in later SAR reports.

Implant brands

Chart 18. No. of components on Slovakian market according to manufacturer and year



The evolution of the implant market in Slovakia can be divided into two periods. The first period began in the 1970s, when arthroplasty started at the main departments and ended in the 1990s. From the historical records available, during this period of time, the main suppliers were the Czech companies *Poldi* and, later, *Walter–Motorlet* with their own implants. Foreign brands of implants were seen only rarely. The boom of the orthopaedic companies started in the second period – after the 1990s. In 1993, *Johnson & Johnson* arrived on the Slovakian market and its *DePuy* division became one of the main orthopaedic suppliers. From 1996 until 2008, six other main orthopaedic companies were introduced onto the market. The last two were *Stryker* in 2006 and the Italian company *Lima Ltd* in 2008. We started with the registry's implant inventory in 2003. In that year, we recorded 65 different brands of stems and acetabular components. During eight years, the number of different types of stem increased from 35 to 79 and number of acetabular components increased from 30 to 47.

Tab. 15. No. of components in SAR inventory

Year	Acetabular cemented	Acetabular uncemented	Femoral cemented	Femoral uncemented	Total
2003	12	18	17	18	65
2010	14	33	33	46	126

The knee implant inventory is more complex. Until now, we have divides implants according to the name of the knee implant system. However, all knee implant systems have CR, PS, CCK and hinge model options, with the possibility of mobile or fixed tibial components. All such variations are found under the same name of the knee implant system. This problem is partially solved by the implementation of the Implant Tracking System (ITS) and we believe that, by the end of 2011, the structure of the knee inventory will reflect completely manage above complexity. In 2003, there were probably 17 knee systems on the Slovakian market, but the knee inventory started only in 2006. By the end of 2010, we had records of 42 different systems in the SAR knee inventory.

Registry databases

The main issue for every database is the data quality. Therefore, an important goal for every register is the validation of the databases. In Slovakia, we have three implant databases. The first one is the database maintained by the Chief orthopaedic surgeon to the Ministry of Health. This is a questionnaire-based database. Only orthopaedic departments reporting their data to the Chief surgeon contribute to this database. The other two databases are implant-based. Companies sales data comprise the second one and reimbursement data from the health's insurance companies make up the third database. In the SAR report 2003–2008, we published a comparison of the SAR database with the main health's insurance companies' data. The results were that the SAR database had 2.9% more records compared with the biggest public health insurance company – *VšZP*.

Tab. 16. Comparison THA database of Chief surgeon of Min. of Health and SAR

Year	Primary THA			Revision THA		
	MH	SAR	Linkage rate	MH	SAR	Linkage rate
2003	2 266	2 119	93,51%	392	293	74,74%
2004	2 736	3 086	112,79%	339	333	98,23%
2005	2 868	2 976	103,77%	334	270	80,84%
2006	3 306	3 595	108,74%	325	335	103,08%
2007	3 769	4 260	113,03%	336	346	102,98%
2008	3 855	4 411	114,42%	357	339	94,96%
2009	4 420	4 767	107,85%	322	386	119,88%
2010	4 434	4 970	112,09%	393	457	116,28%

Comparisons of the registry database with those of the Chief orthopaedic surgeon of the Ministry of Health and the databases of suppliers and distributors are in Tab. 16, 17 & 18. In order to validate the SAR database, we have considered these databases to be 100%. The first comparison was the Chief orthopaedic surgeon's data and those of the SAR. The linkage rate for the primary THA was higher than 100% in all years, except 2003. In 2009, the SAR database contained 7.85% more data and 12.09% more in 2010 for primary THA. The database of revision THA had lower linkage rate in 2003–2005. The reason for this could be the fact that, during the first years, not all departments were allowed to perform the revision procedures and declared them for the reimbursement reasons as the primary arthroplasty. In 2009, the SAR database recorded 64 revisions more, which is plus 19.88% and in 2010 the difference was also 64 revision cases, which is plus 16.28%. Similar validation was performed for the TKA database. We have obtained 3.19% more data for primary TKA and 4.30% more for revision TKA.

Tab. 17. Comparison TKA database of chief surgeon of Min. of Health and SAR

Year	Primary TKA			Revision TKA		
	MH	SAR	Linkage rate	MH	SAR	Linkage rate
2006	905	892	98,56%	40	20	50,00%
2007	1 358	1 364	100,44%	46	41	89,13%
2008	1 586	1 611	101,58%	60	51	85,00%
2009	1 938	2 028	104,64%	69	84	121,74%
2010	2 130	2 198	103,19%	93	97	104,30%

These results were unexpected and, therefore, we have decided to perform the validation with the companies' and distributors' databases. Eight out of twelve main orthopaedic manufacturers and distributors took a part in this project. This databases validation was implant-based. We have compared all implant data registered during 2010. We assume that the sales data from the companies are exact and that this comparison could give us two types of answers: how is the coverage of SAR in departments and how precise is the information on market share of the implants. The results are in Tab. 18.

Tab. 18. Comparison of SAR and distributors' databases

Implant brands	SAR	Distributor	Linkage rate
Serf	1 225	1 278	95,85%
Beznoska	2 619	3 118	84,00%
DePuy	3 308	3 347	98,83%
Lima	1 276	1 348	94,66%
W-Link	67	79	84,81%
Biomet	479	590	81,19%
Stryker	349	391	89,26%
Zimmer	944	997	94,68%
Total	10 267	11 148	92,10%

The correspondence of individual databases with the SAR database was between 81.19% and 98.83%, although the match was 100% for some departments. These results were encouraging. In general, the correspondence was 92.10% and we have cross-checked 11,000 components. Following these validations, we conclude that SAR databases are reliable, because the match in all comparisons was higher than the expected 90%.

Implant Tracking System – ITS

Until 2009, we collected only a limited amount of information about the implants themselves. The name of the implant alone yields a minimal set of information to identify precisely the implant, and the only possible solution was to introduce a system for scanning the implant bar codes. We started with a pilot project in August 2009 in two university departments and we fine-tuned this system for five months. During autumn 2009, we distributed bar-code scanners to all contributing departments and from the January 1st 2010 started bar-code scanning of all the implants used. Tab. 19 shows all departments and the percentage of implants entered to the SAR database with both bar-code scanning and manually.

Tab. 19. Bar-code scanning and ITS usage by department

Department	No. of surgeries	Manually	%	ITS	%
B. Bystrica – Orth.	480	129	26,88%	351	73,13%
B. Bystrica – Traum.	114	114	100,00%	0	0,00%
Bojnice – Orth.	168	3	1,79%	165	98,21%
Bratislava DFNsP - Orth.	4	1	25,00%	3	75,00%
Bratislava S & E - Orth.	104	11	10,58%	93	89,42%
Bratislava – I.Orth.-traum.	708	38	5,37%	670	94,63%
Bratislava – II.Orth.-traum.	542	287	52,95%	255	47,05%
Bratislava – Traum.	130	52	40,00%	78	60,00%
D. Kubín – Orth.-traum.	116	116	100,00%	0	0,00%
D. Streda – Traum.	122	105	86,07%	17	13,93%
Galanta – Traum.-orth.	70	5	7,14%	65	92,86%
Humenné - Orth.	46	33	71,74%	13	28,26%
Košice – Orth.-traum.	354	145	40,96%	209	59,04%
Košice – Traum.	61	9	14,75%	52	85,25%
Košice ŽZ - Orth.	148	7	4,73%	141	95,27%
Košice – Šaca - Orth.	217	81	37,33%	136	62,67%
L. Mikuláš – Traum.-orth.	39	2	5,13%	37	94,87%
Lučenec – Orth.-traum.	60	60	100,00%	0	0,00%
Martin – Orth.-traum.	502	17	3,39%	485	96,61%
Michalovce – Orth.	119	0	0,00%	119	100,00%
Michalovce – Traum.	35	11	31,43%	24	68,57%
N. Zámky – Orth.	258	57	22,09%	201	77,91%
N. Zámky – Traum.	96	26	27,08%	70	72,92%
Nitra – Traum.-orth.	303	303	100,00%	0	0,00%
P. Bystrica – Orth.	39	39	100,00%	0	0,00%
Partizánske – Traum.	3	2	66,67%	1	33,33%
Piešťany – Orth.	122	6	4,92%	116	95,08%
Poprad – Orth.	258	16	6,20%	242	93,80%
Prešov – Orth.	540	13	2,41%	527	97,59%
Ružomberok – Traum.-orth.	750	208	27,73%	542	72,27%
Skalica – Orth.-traum.	159	2	1,26%	157	98,74%
Topoľčany – Orth.	253	0	0,00%	253	100,00%
Topoľčany – Traum.	33	8	24,24%	25	75,76%
Trenčín – Orth	124	21	16,94%	103	83,06%
Trenčín – Traum.	73	13	17,81%	60	82,19%
Trnava – Traum.-orth.	187	5	2,67%	182	97,33%
Trstená – Traum.	7	1	14,29%	6	85,71%
Vranov n. Topľou - Traum.	12	12	100,00%	0	0,00%
Žilina - Traum.	63	34	53,97%	29	46,03%
Žilina – Orth.	303	15	4,95%	288	95,05%
Total	7 722	2 007	25,99%	5 715	74,01%

In 2010, 74.00% of all implants were recorded with this system and 26.00% manually. This manual option is still available on our web site. The usage of ITS is more effective for the knee implants database. This system is able to distinguish the different models (CR, PS, CCK) of implants with the same name. Our goal is to reach 90% coverage with the ITS as soon as possible, and we expect to have achieved that by the end of the year 2011. The other problem was the variety of the bar-codes and symbology used in medical field.

Tab. 20. No. of bar-codes of the implants according to the manufacturer

Manufacturer	Lima	DePuy	Aesculap	W-Link	Beznoska	Zimmer	WM - Medin	Endoplant	Serf	Biomet	unknown
No. of barcodes	3 741	2 542	2 340	1 895	1 403	695	644	641	246	136	165

In SAR ITS we are working with various types of bar codes. The *Global Trade Item Number (GTIN)* is one identifier among several of the former EAN International and Uniform Code Council using code 128, which is very high-density barcode symbology. The other system used is: *Health Industry Business Communications Council (HIBCC)*, which was founded in 1993 as an industry-sponsored, non-profit standards development organisation, maintaining global supplier and provider labelling standards for the health care industry, also using code 128. The project was based on a common database of all products on the Slovakian orthopaedic market. The creation of this database took SAR almost 2 years. Databases were received from the manufacturers, but the selection of only those products registered for the Slovakian market was necessary. Programming for the unknown barcodes was needed as not all manufacturers and suppliers were enthusiastic about the project and some of them are still supplying the departments with uncoded implants. There is still a small group of implants without bar-code stickers. By the end of 2010, the database contained 14,448 barcodes from the manufacturers shown in Tab. 20.

Primary THA

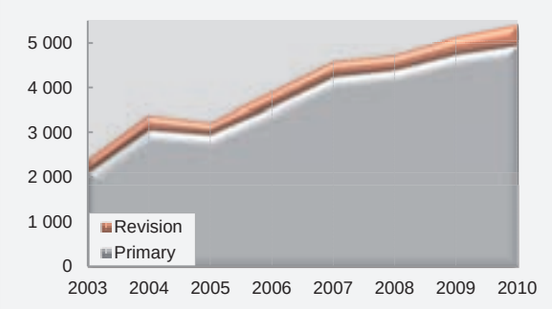
In 2010, we received THA data from 40 departments. These 40 departments performed 4,970 primary and 457 revision implantations.

Tab. 21. No. of primary and revision THAs

Year	Primary	Revision
2003	2 119	293
2004	3 086	333
2005	2 976	270
2006	3 595	335
2007	4 260	346
2008	4 411	339
2009	4 767	386
2010	4 970	457

In comparison with 2003, there was a 134.45% increase in primary THA. In 2010, primary THA accounted for 87.85% and revision arthroplasty 12.15% of all hip arthroplasties. Tab. 21 and Chart 19 show the year-by-year evolution of these figures.

Chart 19. No. of primary and revision THAs



In 2010, the RR reached 9.20%, which represents an increase of 1.10% compared to the previous year. Chart 20 shows the evolution of RR and the relationship of the value of RR to primary THA is clear from the shape of the curve. RR is the only parameter reflecting all revisions. Because these included primary implantations done before the founding the register in 2003, our statistical methodology does not allow the use of incomplete data for survival evaluation. For all other global and demographic parameters these data were used.

Chart 20. Primary THA – revision rate

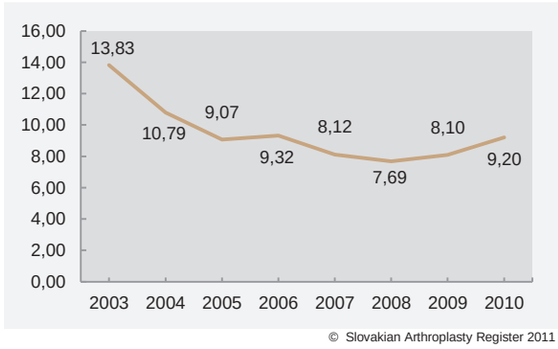
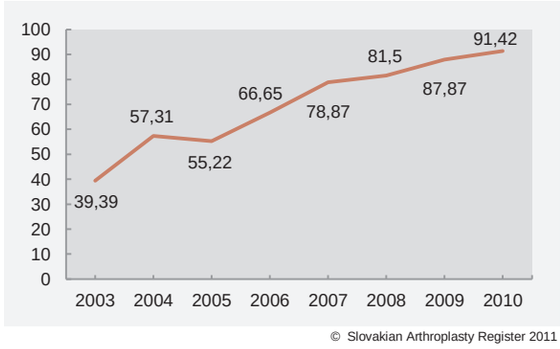


Chart 21. Primary THA – incidence

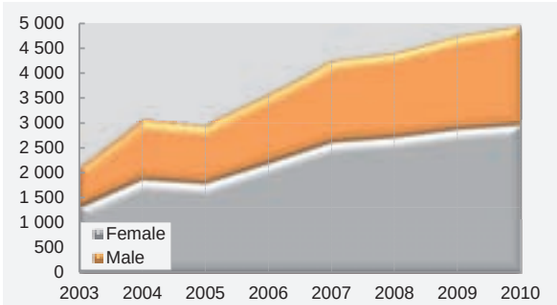


By the time of the founding the registry, the incidence of primary THA was 39.39 per 100,000 inhabitants. In 2010, that value reached 91.42 per 100 000 inhabitants. The growth in this incidence over the period 2003–2010 was 232.00%. The gender distribution in 2010 was 3:2 (60% female to 40% male) as compared to the 2003, when it was 62.48% female to 37.51% male. There has been only a slight movement towards the female gender.

Tab. 22. Primary THA – gender distribution

Year	Female	Male
2003	1 324	795
2004	1 885	1 201
2005	1 808	1 168
2006	2 215	1 380
2007	2 632	1 628
2008	2 730	1 681
2009	2 892	1 875
2010	2 982	1 988

Chart 22. Primary THA – gender distribution



Tab. 22 and Chart 22 show the numbers of primary THA according to gender. When implant survival is regarded through the prism of gender, as Tab. 23 shows, RR for males is 2.34 compared to females, in whom the RR is 1.85. As Chart 23 shows, after the fourth year of survival, the curves for the males are doing worse than those for females. The next set of observations was made on the whole population, divided into four age groups, comparing RR between these groups. Tab. 24 shows RRs and SRs of the four age groups. The interactions of gender and age are shown in Table 25. The highest RR was observed in males in the age range 55–65 years (RR 2.65) and males in the age range 66–75 years (RR 2.58). The lowest RR was in males over 75 years RR 1.25 and the RR for females in the same age range (1.26). .

Tab. 23. Primary THA – revision rate and survival rate according to gender

Groups	Parameters									Statistics	
Gender	n	e	RR	SR	HR	mean	se	LB	UB	p-values	beteween-group comparisons
F	18451	341	1,85	98,15	0,91	7,82	0,010	7,80	7,84		
M	11705	274	2,34	97,66	1,15	7,76	0,014	7,73	7,79		
All	**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**	**0,0029**	gender

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value			
	zero or one failures	0	(group,8]			**RR**	revision rate
		(0,mean]	(7,mean]			**SR**	survival rate
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	**HR**	hazard rate
	<50 components	(10,100]	(1,2]	< 0.05	significance	**mean**	mean survival
	mean values					**se**	standard error (of mean survival)
	highest number of components used (acet/fem, each 5)					**CI**	confidence interval
	having more than 2 or more failures					**LB**	lower bound of 95% CI
n	number of components					**UB**	upper bound of 95% CI
e	number of failures						

Tab. 24. Primary THA – age groups, revision rate and survival rate

Groups	Parameters									Statistics	
Age groups	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
[min,55]	6946	134	1,93	98,07	0,95	7,82	0,016	7,79	7,85		
(55,65]	8017	207	2,58	97,42	1,26	7,74	0,018	7,70	7,78		
(65,75]	9283	200	2,15	97,85	1,05	7,79	0,014	7,76	7,82		
(75,max]	5906	74	1,25	98,75	0,61	7,87	0,015	7,84	7,90		
All	**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**	**0,0003**	age groups

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value			
	zero or one failures	0	(group,8]			**RR**	revision rate
		(0,mean]	(7,mean]			**SR**	survival rate
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	**HR**	hazard rate
	<50 components	(10,100]	(1,2]	< 0.05	significance	**mean**	mean survival
	mean values					**se**	standard error (of mean survival)
	highest number of components used (acet/fem, each 5)					**CI**	confidence interval
	having more than 2 or more failures					**LB**	lower bound of 95% CI
n	number of components					**UB**	upper bound of 95% CI
e	number of failures						

Chart 23. Primary THA – probability of survival according to gender

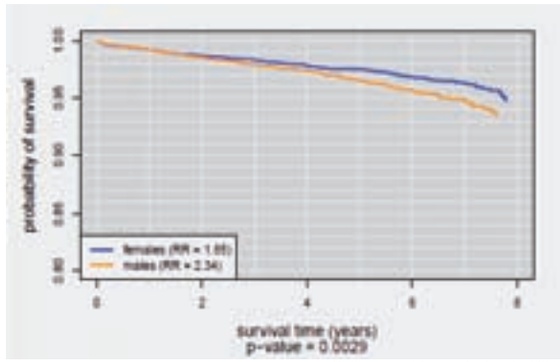
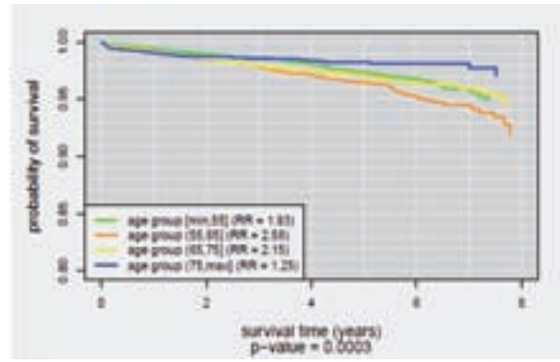


Chart 24. Primary THA – probability of survival according to the age groups



Tab. 25. Primary THA – interaction of gender, age groups, revision rates and survival rates

Groups	Subgroups	Parameters									Statistics	
Gender	*Age groups*	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
F	[min,55]	3833	64	1,67	98,33	0,90	7,83	0,019	7,79	7,85		
F	(55,65]	4323	109	2,52	97,48	1,36	7,75	0,023	7,70	7,78		
F	(65,75]	5912	113	1,91	98,09	1,03	7,82	0,017	7,76	7,82		
F	(75,max]	4381	55	1,26	98,74	0,68	7,88	0,016	7,84	7,90		
F		**18451**	**341**	**1,85**	**98,15**	**0,91**	**7,82**	**0,010**	**7,80**	**7,84**	**0,0035**	F: age groups
M	[min,55]	3113	70	2,25	97,75	0,96	7,78	0,025	7,73	7,83	**0,0560**	[min,55]: gender
M	(55,65]	3694	98	2,65	97,35	1,13	7,73	0,027	7,68	7,78	0,5540	(55,65]: gender
M	(65,75]	3371	87	2,58	97,42	1,10	7,75	0,026	7,70	7,80	**0,0232**	(65,75]: gender
M	(75,max]	1525	19	1,25	98,75	0,53	7,82	0,039	7,74	7,90	0,9170	(75,max]: gender
M		**11705**	**274**	**2,34**	**97,66**	**1,15**	**7,76**	**0,014**	**7,73**	**7,79**	0,1340	M: age groups
All		**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**	**0,0003**	gender and age groups

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value		
	zero or one failures	0	(group,8]			
		(0,mean]	(7,mean]			
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	
	<50 components	(10,100]	(1,2]	< 0.05	significance	
	mean values					
	highest number of components used (acet/fem, each 5)					
	having more than 2 or more failures					
n	number of components					
e	number of failures					

RR	revision rate
SR	survival rate
HR	hazard rate
mean	mean survival
se	standard error (of mean survival)
CI	confidence interval
LB	lower bound of 95% CI
UB	upper bound of 95% CI

Chart 25. Primary THA – probability of survival of females in the various age groups

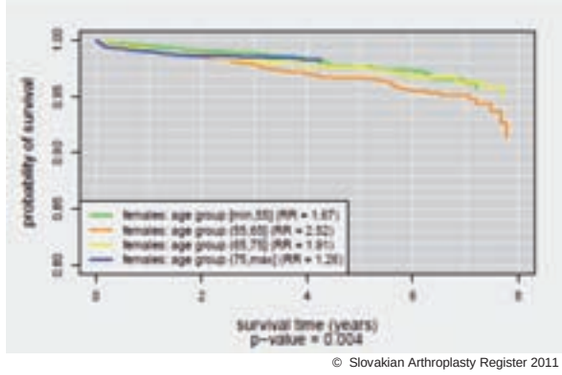
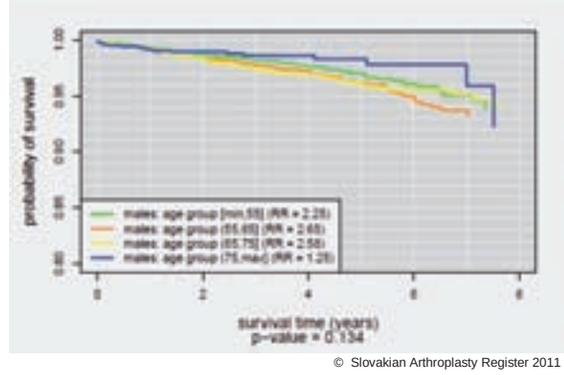


Chart 26. Primary THA – probability of survival of males in the various age groups



From the interaction of gender and age, it is evident, that the best-surviving implants are in men over 75. The second best surviving group of implants are those in females over 75. The two

worst-surviving groups of implants are in males in the age group 55–65 and 66–75. These results could be explained by the higher physical activity of these groups of the population. Mean survival time of all implants in female was 7.82 years with RR 1.85. By the male we have mean survival time of all implants 7.76 years and RR 2.34. By not respecting the gender the mean survival time of all implants was 7.80 years and RR reached value 2.04.

Age groups

Tab. 26. Primary THA – age groups

Year	-15	15-19	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+	Not Identif.
2003	0	0	0	4	6	13	33	50	121	232	219	278	349	356	239	219	0
2004	0	1	2	6	15	24	56	98	208	364	390	403	468	484	294	273	0
2005	0	2	1	9	18	29	45	95	192	300	353	410	492	451	313	266	0
2006	0	2	3	7	16	50	72	156	271	413	450	553	569	491	303	236	3
2007	0	1	8	11	28	57	113	164	343	508	555	656	645	602	323	246	0
2008	0	7	7	17	30	68	100	222	397	547	620	713	650	547	291	195	0
2009	0	1	8	22	41	59	105	226	475	633	673	746	688	575	317	197	1
2010	1	4	11	19	41	71	146	227	486	706	704	779	708	570	333	163	1

The whole population was divided into five-year age groups, according to the methodology of the Slovakian Statistical Office as in Tab. 26. This analysis demonstrates a trend to THA in younger age groups over recent years. In the age groups less than 25 years, only 6 implantations were recorded during the years 2003–2005. In the years 2006–2008, there were 28 implantations in this young population and in 2009 and 2010 the total was 24. Similar increases were observed in all age groups younger than the group 75–79. By contrast, in the age group over 85, a decrease was observed. In 2003, 9,219 arthroplasties were performed in this group and in 2010 this fell to 163. One of the explanations could be that, of late, these operations were performed in the younger age groups. This theory is supported by the increase in THA procedures in the lower age groups.

Diagnoses

Tab. 27. Primary THA - diagnoses

Year	Primary Coxarthrosis	Dysplastic Coxarthrosis	Posttraumatic Coxarthrosis	Avascular Necrosis	M.Perthes	Rheumatoid Arthritis	Fracture of Femoral Neck	Other Causes
2003	1 134	209	274	134	1	25	0	310
2004	1 600	359	498	201	3	40	1	365
2005	1 487	298	557	207	6	32	36	328
2006	1 968	432	169	241	1	31	680	55
2007	2 396	490	183	221	5	38	872	35
2008	2 360	557	224	259	11	56	879	43
2009	2 734	552	176	223	6	39	969	56
2010	2 870	566	178	241	4	40	978	92

In 2010, primary coxarthrosis was still the main indication for THA. In 2003, 54.33% of all indications for THA were for primary coxarthrosis. Dysplastic coxarthrosis was the reason in 10.01% and avascular necrosis of femoral head (AVN) in 6.42%. The increase in primary coxarthrosis as the indication, in 2010, was minimal (from 54.33% in 2003 to 57.75%) and dysplastic coxarthrosis increased only from 10.01% to 11.39% of all cases. For a diagnosis of AVN, there was a decrease of 4.85%. Very interesting is the emergence of the diagnoses posttraumatic coxarthrosis and femoral neck fracture. Femoral neck fracture as an optional indication was introduced to the protocol only in 2005, so it is only possible to compare the years 2006 and 2010. During 2005, a decrease of the posttraumatic coxarthrosis and an increase in femoral neck fracture diagnoses

were observed. In 2006, THAs for femoral neck fracture constituted 19.01% and in 2010 19.66% of all patients. In conclusion, apart from femoral neck fracture, there was only minor movement in the percentage of different indications for primary THA over these years

Operative approaches

The three most commonly used operative approaches are the anterolateral, lateral and posterior approaches. The anterior, minimally-invasive approach (MIS) and osteotomy of the great trochanter were used in only 12 cases, as seen in Tab. 28. The anterolateral approach was used in 52.59% of all cases in 2010.

Tab. 28. Primary THA – surgical approaches

Year	Ante-rior	Antero-lat.	Lateral	Poster.	T-tomy	MIS	Not Identif.
2003	2	815	936	334	0	0	32
2004	13	1 297	1 173	579	0	4	20
2005	20	1 380	894	634	0	24	24
2006	8	1 560	1 314	680	4	9	20
2007	10	1 855	1 544	816	4	11	20
2008	5	2 116	1 434	829	3	2	22
2009	6	2 151	1 745	850	2	1	12
2010	5	2 614	1 434	909	5	2	1

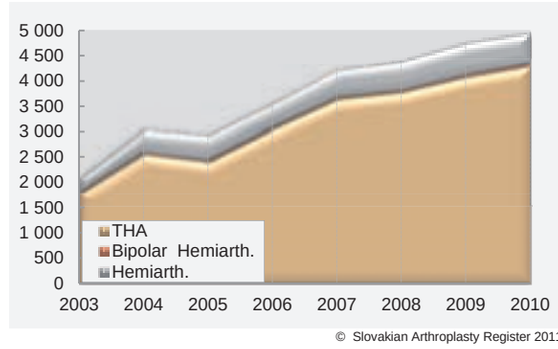
Types of implants used

In the THA database, data are collected about all types of implants, both total joint replacements and hemiarthroplasties. From Tab. 29, it is clear that the predominant type of implant was total hip arthroplasty, which was, even in 2003, used in 84.23% of all cases. In 2010, total joint replacement increased to 86.78%. Bipolar hemiarthroplasty was used in only 0.76% of all cases. In the whole history of the SAR, the bipolar hemiarthropasty was used in only 0.46% of all cases.

Tab. 29. Primary THA – types of implant

Year	THA	Bipolar Hemiarth.	Hemiarth.
2003	1 785	4	330
2004	2 580	10	496
2005	2 425	14	537
2006	3 063	13	516
2007	3 644	20	596
2008	3 785	18	608
2009	4 089	22	656
2010	4 313	38	619

Chart 27. Primary THA – types of implant



Types of the fixation

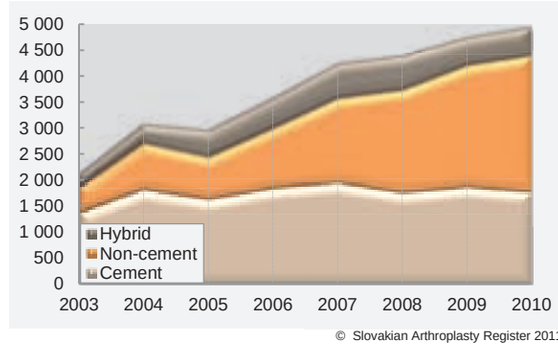
Three types of fixation are distinguished: non-cemented, cemented and hybrid fixations. In 2003, the distribution was as follows: 63.99 % cemented, 23.07% non-cemented and 12.93 % hybrid fixation.

Tab. 30. Primary THA – types of fixation

Year	Cement	Non-cement	Hybrid
2003	1 356	489	274
2004	1 812	904	369
2005	1 619	826	531
2006	1 837	1 167	589
2007	1 937	1 643	680
2008	1 747	1 997	667
2009	1 862	2 361	544
2010	1 762	2 647	561

During the period of observation, 2003–2010, significant changes occurred in the type of fixation. In 2010, the percentage distribution of the different types of fixation was 35.45% cemented, 53.25% non-cemented and 11.28% hybrid fixations.

Chart 28. Primary THA – types of fixation



Tab. 31. Primary THA – type of fixation, revision rates and survival rates

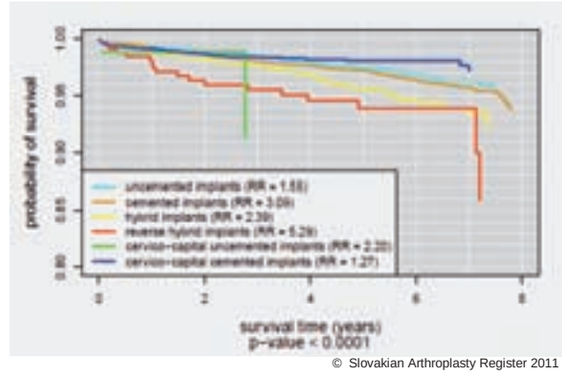
Groups	Parameters									Statistics	
Fixation	n	e	RR	SR	HR	mean	se	LB	UB	p-values	beteween-group comparisons
Uncemented	11521	179	1,55	98,45	0,76	7,82	0,013	7,79	7,85		
Cemented	9471	226	2,39	97,61	1,17	7,80	0,013	7,77	7,83		
Hybrids	4339	134	3,09	96,91	1,51	7,70	0,025	7,65	7,75		
Reverse hybrids	340	18	5,29	94,71	2,59	7,53	0,098	7,34	7,72		
Hemiarthr. uncemented	91	2	2,20	97,80	1,08	7,06	0,356	6,36	7,76		
Hemiarthr. cemented	4394	56	1,27	98,73	0,62	7,85	0,018	7,81	7,89		
All	**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**	**<0.00001**	fixation

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value		
	zero or one failures	0	(group,8]			
		(0,mean]	(7,mean]			
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	
	<50 components	(10,100]	(1,2]	< 0.05	significance	
	mean values					
	highest number of components used (acet/fem, each 5)					
	having more than 2 or more failures					
n	number of components					
e	number of failures					

RR	revision rate
SR	survival rate
HR	hazard rate
mean	mean survival
se	standard error (of mean survival)
CI	confidence interval
LB	lower bound of 95% CI
UB	upper bound of 95% CI

During the observed period, 2003–2010, the best surviving types of fixation and implants are cemented and uncemented hemiarthroplasties. The RR of cemented was 1.27 and RR of uncemented hemiarthroplasties was 2.20. The interpretation of uncemented hemiarthroplasty data must consider the low number of observed components – 91 uncemented against 4,394 cemented hemiarthroplasties. Very good SR results for hemiarthroplasties should be regarded through the prism of the short observation period and low physical activity of the patients in these age groups. The highest RR was observed in the group of reverse hybrids (Tab. 31 and Chart 29).

Chart 29. Primary THA – probability of survival according to the type of fixation



Tab. 32. Primary THA – interaction of gender, type of fixation, revision rate and survival rate

Groups	Subgroups	Parameters									Statistics	
Gender	*Fixation*	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
F	Uncemented	6154	91	1,48	98,52	0,80	7,80	0,018	7,76	7,84		
F	Cemented	6248	128	2,05	97,95	1,11	7,83	0,015	7,80	7,86		
F	Hybrids	2472	74	2,99	97,01	1,62	7,71	0,033	7,65	7,77		
F	Reverse hybrids	218	8	3,67	96,33	1,98	7,61	0,105	7,40	7,82		
F	Hemiarthr. uncut.	60	0	0,00	100,00	0,00	7,51	NA	NA	NA		
F	Hemiarthr. cem.	3299	40	1,21	98,79	0,65	7,87	0,019	7,83	7,91		
F		**18451**	**341**	**1,85**	**98,15**	**0,91**	**7,82**	**0,010**	**7,80**	**7,84**	**0,0008**	F: fixation
M	Uncemented	5367	88	1,64	98,36	0,70	7,82	0,020	7,78	7,86	0,4990	uncemented: gender
M	Cemented	3223	98	3,04	96,96	1,30	7,74	0,026	7,69	7,79	**0,0036**	cemented: gender
M	Hybrids	1867	60	3,21	96,79	1,37	7,69	0,038	7,62	7,76	0,8240	hybrids: gender
M	Reverse hybrids	122	10	8,20	91,80	3,50	7,34	0,186	6,98	7,70	0,1100	reverse hybrids: gender
M	Hemiarthr. uncem.	31	2	6,45	93,55	2,76	5,94	0,961	4,06	7,82	**0,0428**	hemiarthr. uncem: gender
M	Hemiarthr. cem.	1095	16	1,46	98,54	0,62	7,80	0,048	7,71	7,89	0,3960	hemiarthr. cem: gender
M		**11705**	**274**	**2,34**	**97,66**	**1,15**	**7,76**	**0,014**	**7,73**	**7,79**	**<0.00001**	M: fixation: gender
All		**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**	**<0.00001**	gender and fixation

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value			
	zero or one failures	0	(group,8]			**RR**	revision rate
		(0,mean]	(7,mean]			**SR**	survival rate
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	**HR**	hazard rate
	<50 components	(10,100]	(1,2]	< 0.05	significance	**mean**	mean survival
	mean values					**se**	standard error (of mean survival)
	highest number of components used (acet/fem, each 5)					**CI**	confidence interval
	having more than 2 or more failures					**LB**	lower bound of 95% CI
n	number of components					**UB**	upper bound of 95% CI
e	number of failures						

In the interaction of the type of fixation and gender, the survival of hemiartroplasties is still better. In females uncemented hemiarthroplasty was used in 60 cases and in the observed period no failure was recorded. In males, this type of implant and fixation was used in 31 cases with two failures and the RR reached 6.45. Only uncemented fixation had a RR below 2.00. In females, is the corresponding data were 1.48 and, in males, 1.64.

The worst RR results were in males with reverse hybrids (8.20). The curves of the probability of survival in females are similar for all types of fixation until fourth year from implantation (Chart 30). The mean survival time for all types of fixation in females was 7.82. In contrast to the male group, the curves are more divergent from very beginning of survival and the differences in the mean survival time for different types of fixation are greater (Chart 31).

Chart 30. Primary THA – probability of survival in females according to the type of fixation

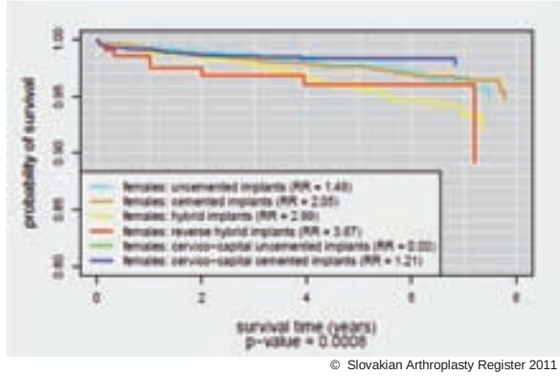
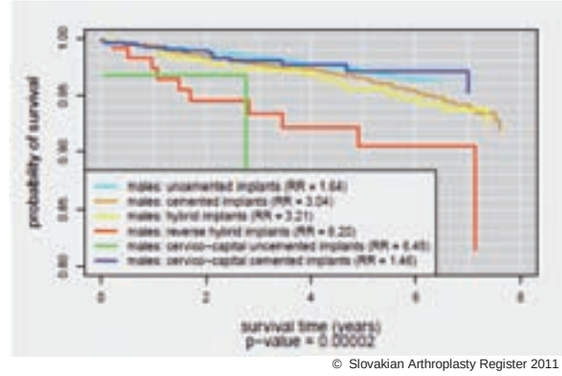


Chart 31. Primary THA – probability of survival in males according to the type of fixation



Tab. 33. Primary THA – interaction of the age groups, types of fixation, revision rates and survival rates

Groups	Subgroups	Parameters									Statistics	
Age groups	*Fixation*	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
[min,55]	Uncemented	5799	80	1,38	98,62	0,72	7,86	0,015	7,83	7,89		
[min,55]	Cemented	361	13	3,60	96,40	1,87	7,73	0,064	7,60	7,86		
[min,55]	Hybrids	585	31	5,30	94,70	2,75	7,58	0,070	7,44	7,72		
[min,55]	Reverse hybrids	149	8	5,37	94,63	2,78	7,53	0,148	7,24	7,82		
[min,55]	Hemiarthr. uncem	8	0	0,00	100,00	0,00	5,65	NA	NA	NA		
[min,55]	Hemiarthr. cem	44	2	4,55	95,45	2,36	6,97	0,288	6,41	7,53		
[min,55]		**6946**	**134**	**1,93**	**98,07**	**0,95**	**7,82**	**0,016**	**7,79**	**7,85**	**<0.00001**	[min,55]: fixation
(55,65]	Uncemented	4057	68	1,68	98,32	0,65	7,70	0,030	7,64	7,76		
(55,65]	Cemented	1821	71	3,90	96,10	1,51	7,72	0,032	7,66	7,78		
(55,65]	Hybrids	1897	57	3,00	97,00	1,16	7,73	0,034	7,66	7,80		
(55,65]	Reverse hybrids	82	6	7,32	92,68	2,84	7,21	0,236	6,75	7,67		
(55,65]	Hemiarthr. uncem	9	0	0,00	100,00	0,00	7,50	NA	NA	NA		
(55,65]	Hemiarthr. cem	151	5	3,31	96,69	1,28	7,44	0,157	7,13	7,75		
(55,65]		**8017**	**207**	**2,58**	**97,42**	**1,26**	**7,74**	**0,018**	**7,70**	**7,78**	**0,0538**	(55,65]: fixation

Tab. 33. (cont.)

Groups	Subgroups	Parameters									Statistics	
Age groups	*Fixation*	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
(65,75]	Uncemented	1433	27	1,88	98,12	0,87	7,63	0,085	7,46	7,80		
(65,75]	Cemented	5261	117	2,22	97,78	1,03	7,81	0,017	7,78	7,84		
(65,75]	Hybrids	1603	36	2,25	97,75	1,05	7,76	0,040	7,68	7,84		
(65,75]	Reverse hybrids	80	4	5,00	95,00	2,33	7,27	0,210	6,86	7,68		
(65,75]	Hemiarthr. uncem	14	0	0,00	100,00	0,00	7,29	NA	NA	NA		
(65,75]	Hemiarthr. cem	892	16	1,79	98,21	0,83	7,80	0,046	7,71	7,89		
(65,75]		**9283**	**200**	**2,15**	**97,85**	**1,05**	**7,79**	**0,014**	**7,76**	**7,82**	0,2320	(65,75]: fixation
(75,max]	Uncemented	231	4	1,73	98,27	1,38	7,74	0,085	7,57	7,91	**0,0005**	uncemented: age groups
(75,max]	Cemented	2028	25	1,23	98,77	0,98	7,87	0,026	7,82	7,92	**0,0022**	cemented: age groups
(75,max]	Hybrids	254	10	3,94	96,06	3,15	7,61	0,106	7,40	7,82	**0,0374**	hybrids: age groups
(75,max]	Reverse hybrids	29	0	0,00	100,00	0,00	7,91	NA	NA	NA	0,4520	reverse hybrids: age groups
(75,max]	Hemiarthr. uncem	60	2	3,33	96,67	2,66	6,61	0,719	5,20	8,02	0,6540	hemiarthr. uncem: age groups
(75,max]	Hemiarthr. cem	3304	33	1,00	99,00	0,80	7,89	NA	NA	NA	**0,0130**	hemiarthr. cem: age groups
(75,max]		**5906**	**74**	**1,25**	**98,75**	**0,61**	**7,87**	**0,015**	**7,84**	**7,90**	**0,0007**	(75,max]: fixation
All		**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**	**<0.00001**	age and fixation

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value			
	zero or one failures	0	(group,8]			**RR**	revision rate
		(0,mean]	(7,mean]			**SR**	survival rate
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	**HR**	hazard rate
	<50 components	(10,100]	(1,2]	< 0.05	significance	**mean**	mean survival
	mean values					**se**	standard error (of mean survival)
	highest number of components used (acet/fem, each 5)					**CI**	confidence interval
	having more than 2 or more failures					**LB**	lower bound of 95% CI
n	number of components					**UB**	upper bound of 95% CI
e	number of failures						

Chart 32. Primary THA – type of fixation and probability of survival in the age group less than 55

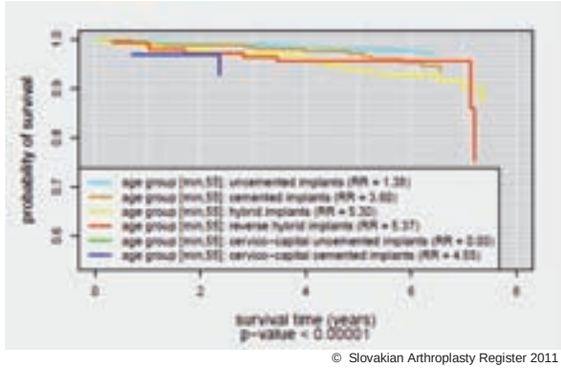


Chart 33. Primary THA – type of fixation and probability of survival in the age group 55-65

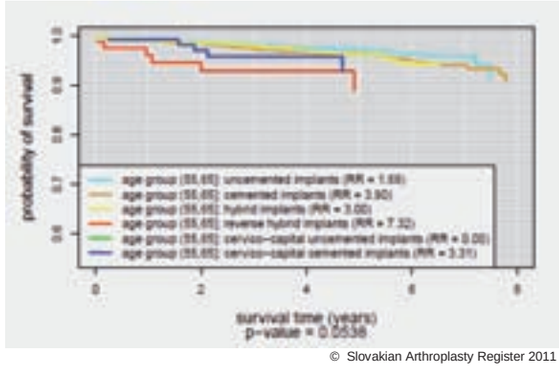


Chart 34. Primary THA – type of fixation and probability of survival in the age group 66-75

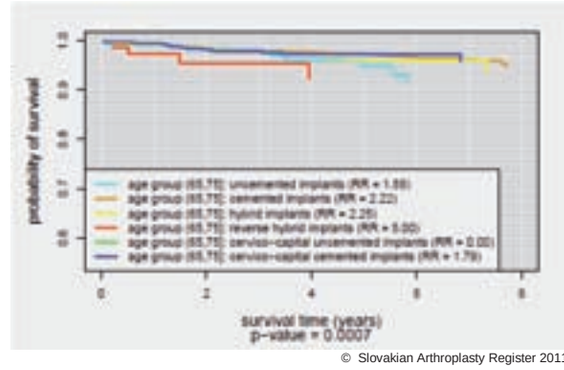
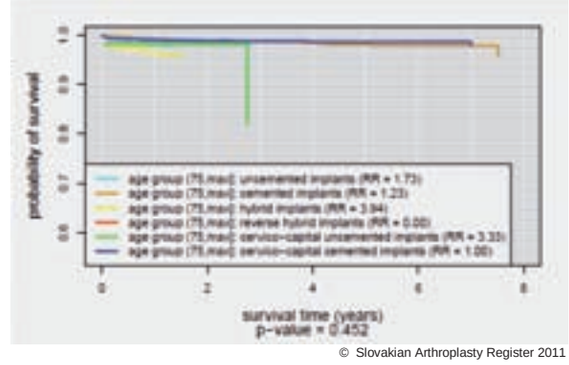


Chart 35. Primary THA – type of fixation and probability of survival in the age group more than 75



Interaction analyses of age, gender and type of fixation is shown in Tab. 34. In ten groups in this table was no failure, but there were not enough events for statistical observation (n<50). The age group 75 and more has the best survival for all types of fixation, except uncemented hemiarthroplasty, which is the worst one, but with a very low number of events (n=15). The best-surviving group is cemented hemiarthroplasty over 75 and the likely explanation is low physical activity in these patients and consequently low demands on the implants. Except for these groups the best results in RR were achieved in females with uncemented type of implants, have achieved an RR of 1.16 with 3,187 implantations. This group is ranked 13th in the table. The same age and fixation group in males is 18th, with an RR of 1.65 for 2,612 implantations.

Tab. 34. Primary THA – interaction of age groups, gender, type of fixation, revision rates and survival rates

Groups	Sub-groups	Subsubgroups	Parameters									Statistics	
Age	*Gender*	*Fixation*	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
[min,55]	F	Uncemented	3187	37	1,16	98,84	0,69	7,86	0,018	7,82	7,90		
[min,55]	F	Cemented	197	5	2,54	97,46	1,52	7,78	0,070	7,64	7,92		
[min,55]	F	Hybrids	328	17	5,18	94,82	3,10	7,60	0,090	7,42	7,78		
[min,55]	F	Reverse hybrids	92	4	4,35	95,65	2,60	7,20	0,156	6,89	7,51		
[min,55]	F	Hemiarthr. uncem	4	0	0,00	100,00	0,00	5,65	NA	NA	NA		
[min,55]	F	Hemiarthr. cem	25	1	4,00	96,00	2,40	6,56	0,336	5,90	7,22		
[min,55]	**F**		**3833**	**64**	**1,67**	**98,33**	**0,87**	**7,83**	**0,019**	**7,79**	**7,85**	**0,0003**	[min,55], F: type
[min,55]	M	Uncemented	2612	43	1,65	98,35	0,73	7,83	0,025	7,78	7,88		
[min,55]	M	Cemented	164	8	4,88	95,12	2,17	7,64	0,112	7,42	7,86		
[min,55]	M	Hybrids	257	14	5,45	94,55	2,42	7,52	0,108	7,31	7,73		
[min,55]	M	Reverse hybrids	57	4	7,02	92,98	3,12	7,53	0,203	7,13	7,93		
[min,55]	M	Hemiarthr. uncem	4	0	0,00	100,00	0,00	1,88	NA	NA	NA		
[min,55]	M	Hemiarthr. cem	19	1	5,26	94,74	2,34	6,97	0,405	6,18	7,76		
[min,55]	**M**		**3113**	**70**	**2,25**	**97,75**	**1,17**	**7,78**	**0,025**	**7,79**	**7,85**	**0,0080**	[min,55], M: type
[min,55]			**6946**	**134**	**1,93**	**98,07**	**0,95**	**7,82**	**0,016**	**7,79**	**7,85**	**0,0560**	[min,55]: gender
(55,65]	F	Uncemented	2048	31	1,51	98,49	0,60	7,69	0,047	7,60	7,78		
(55,65]	F	Cemented	1117	43	3,85	96,15	1,53	7,72	0,042	7,64	7,80		
(55,65]	F	Hybrids	1030	30	2,91	97,09	1,15	7,73	0,047	7,64	7,82		
(55,65]	F	Reverse hybrids	47	3	6,38	93,62	2,53	7,22	0,280	6,67	7,77		
(55,65]	F	Hemiarthr. uncem	4	0	0,00	100,00	0,00	7,50	NA	NA	NA		
(55,65]	F	Hemiarthr. cem	77	2	2,60	97,40	1,03	7,25	0,163	6,93	7,57		
(55,65]	**F**		**4323**	**109**	**2,52**	**97,48**	**0,98**	**7,75**	**0,023**	**7,70**	**7,78**	0,3370	(55,65], F: type
(55,65]	M	Uncemented	2009	37	1,84	98,16	0,69	7,70	0,034	7,63	7,77		
(55,65]	M	Cemented	704	28	3,98	96,02	1,50	7,71	0,052	7,61	7,81		
(55,65]	M	Hybrids	867	27	3,11	96,89	1,17	7,72	0,050	7,62	7,82		
(55,65]	M	Reverse hybrids	35	3	8,57	91,43	3,23	7,11	0,376	6,37	7,85		
(55,65]	M	Hemiarthr. uncem	5	0	0,00	100,00	0,00	1,49	NA	NA	NA		
(55,65]	M	Hemiarthr. cem	74	3	4,05	95,95	1,53	7,28	0,289	6,71	7,85		
(55,65]	**M**		**3694**	**98**	**2,65**	**97,35**	**1,03**	**7,73**	**0,027**	**7,70**	**7,78**	0,3140	(55,65], M: type
(55,65]			**8017**	**207**	**2,58**	**97,42**	**1,26**	**7,74**	**0,018**	**7,70**	**7,78**	0,5540	(55,65]: gender
(65,75]	F	Uncemented	782	19	2,43	97,57	1,27	7,30	0,155	7,00	7,60		
(65,75]	F	Cemented	3489	63	1,81	98,19	0,95	7,85	0,019	7,81	7,89		
(65,75]	F	Hybrids	952	19	2,00	98,00	1,05	7,76	0,056	7,65	7,87		
(65,75]	F	Reverse hybrids	56	1	1,79	98,21	0,94	7,52	0,174	7,18	7,86		
(65,75]	F	Hemiarthr. uncem	7	0	0,00	100,00	0,00	7,29	NA	NA	NA		
(65,75]	F	Hemiarthr. cem	626	11	1,76	98,24	0,92	7,81	0,053	7,71	7,91		
(65,75]	**F**		**5912**	**113**	**1,91**	**98,09**	**0,74**	**7,82**	**0,017**	**7,76**	**7,82**	**0,0470**	(65,75], F: type
(65,75]	M	Uncemented	651	8	1,23	98,77	0,48	7,76	0,086	7,59	7,93		
(65,75]	M	Cemented	1772	54	3,05	96,95	1,18	7,74	0,034	7,67	7,81		
(65,75]	M	Hybrids	651	17	2,61	97,39	1,01	7,72	0,060	7,60	7,84		
(65,75]	M	Reverse hybrids	24	3	12,50	87,50	4,84	6,77	0,490	5,81	7,73		
(65,75]	M	Hemiarthr. uncem	7	0	0,00	100,00	0,00	3,82	NA	NA	NA		
(65,75]	M	Hemiarthr. cem	266	5	1,88	98,12	0,73	7,77	0,095	7,58	7,96		
(65,75]	**M**		**3371**	**87**	**2,58**	**97,42**	**1,20**	**7,75**	**0,026**	**7,76**	**7,82**	**0,0816**	(65,75], M: type
(65,75]			**9283**	**200**	**2,15**	**97,85**	**1,05**	**7,79**	**0,014**	**7,76**	**7,82**	**0,0232**	(65,75]: gender

Tab. 34. (Cont.)

Groups	Sub-groups	Subsubgroups	Parameters									Statistics	
Age	*Gender*	*Fixation*	n	e	RR	SR	HR	mean	se	LB	UB	p-values	comparisons
(75,max]	F	Uncemented	137	4	2,92	97,08	2,32	6,44	0,120	6,20	6,68	**<0.00001**	F: uncemented
(75,max]	F	Cemented	1445	17	1,18	98,82	0,94	7,89	0,028	7,84	7,94	**0,0030**	F: cemented
(75,max]	F	Hybrids	162	8	4,94	95,06	3,92	7,52	0,150	7,23	7,81	**0,0336**	F: hybrids
(75,max]	F	Reverse hybrids	23	0	0,00	100,00	0,00	7,91	NA	NA	NA	0,4190	F: reverse hybrids
(75,max]	F	Hemiarthr. uncem	45	0	0,00	100,00	0,00	7,51	NA	NA	NA	NA	F: hemiarthr. uncem.
(75,max]	F	Hemiarthr. cem	2569	26	1,01	98,99	0,80	7,89	0,019	7,85	7,93	0,2230	F: hemiarthr. cem.
(75,max]	**F**		**4381**	**55**	**1,26**	**98,74**	**1,01**	**7,88**	**0,016**	**7,84**	**7,90**	**0,0002**	(75,max], F: type
(75,max]	M	Uncemented	94	0	0,00	100,00	0,00	7,91	NA	NA	NA	0,3850	M: uncemented
(75,max]	M	Cemented	583	8	1,37	98,63	1,10	7,71	0,084	7,55	7,87	0,3720	M: cemented
(75,max]	M	Hybrids	92	2	2,17	97,83	1,74	7,28	0,120	7,04	7,52	0,5040	M: hybrids
(75,max]	M	Reverse hybrids	6	0	0,00	100,00	0,00	1,85	NA	NA	NA	0,6650	M: reverse hybrids
(75,max]	M	Hemiarthr. uncem	15	2	13,33	86,67	10,66	5,38	1,199	3,03	7,73	0,7160	M: hemiarthr. uncem.
(75,max]	M	Hemiarthr. cem	735	7	0,95	99,05	0,76	7,86	0,046	7,77	7,95	0,1470	M: hemiarthr. cem.
(75,max]	**M**		**1525**	**19**	**1,25**	**98,75**	**1,00**	**7,82**	**0,039**	**7,84**	**7,90**	**<0.0001**	(75,max], M: type
(75,max]			**5906**	**74**	**1,25**	**98,75**	**0,61**	**7,87**	**0,015**	**7,84**	**7,90**	0,9170	(75,max]: gender
All			**30156**	**615**	**2,04**	**99,98**	**1,00**	**7,80**	**0,008**	**7,78**	**7,82**		

colour	failure/component	RR [incl. SR, HR]	mean survival	p-value		
	zero or one failures	0	(group,8]			
		(0,mean]	(7,mean]			
		(mean,10]	(2,7]	[0.05,0.1)	marginal significance	
	<50 components	(10,100]	(1,2]	< 0.05	significance	
	mean values					
	highest number of components used (acet/fem, each 5)					
	having more than 2 or more failures					
n	number of components					
e	number of failures					

RR	revision rate
SR	survival rate
HR	hazard rate
mean	mean survival
se	standard error (of mean survival)
CI	confidence interval
LB	lower bound of 95% CI
UB	upper bound of 95% CI

Chart 36. Primary THA – probability of survival in the female group less than 55 according to the type of fixation

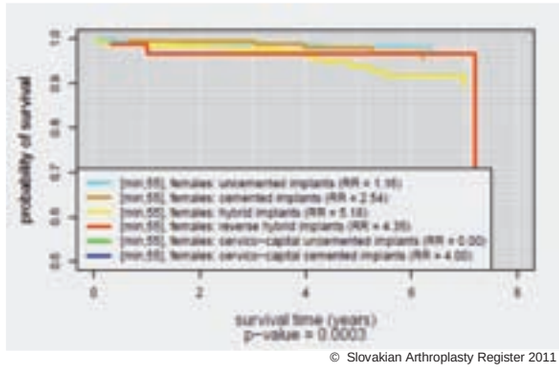


Chart 37. Primary THA – probability of survival in the female group 55–65 according to the type of fixation

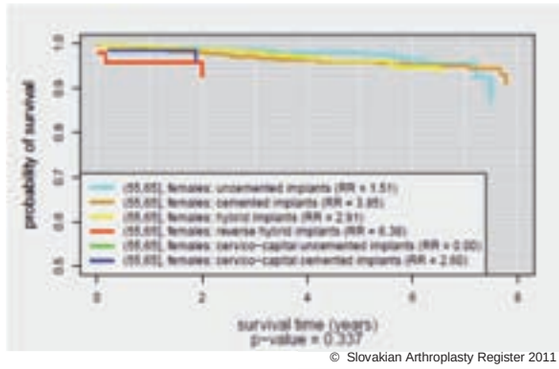


Chart 38. Primary THA – probability of survival in the female group 65–75 according to the type of fixation

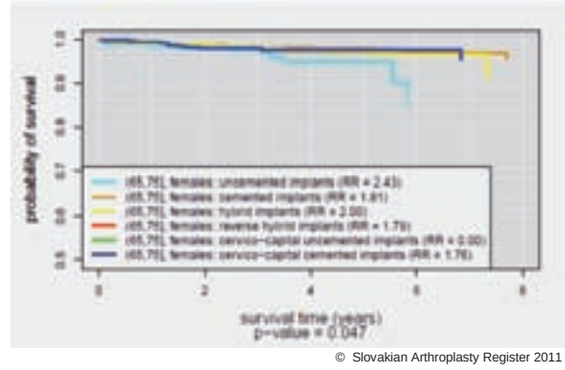


Chart 39. Primary THA – probability of survival in the female group over 75 according to the type of fixation

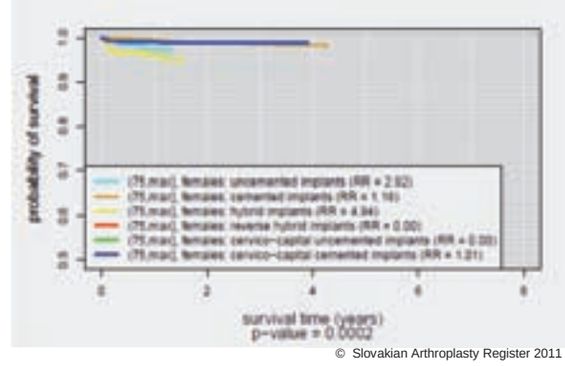


Chart 40. Primary THA – probability of survival in the male group less than 55 according to the type of fixation

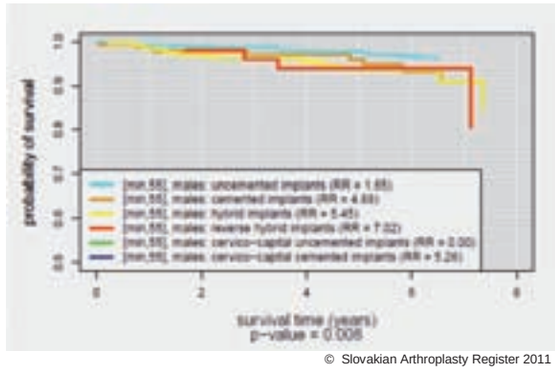


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Chart 41. Primary THA – probability of survival in the male group 55–65 according to the type of fixation

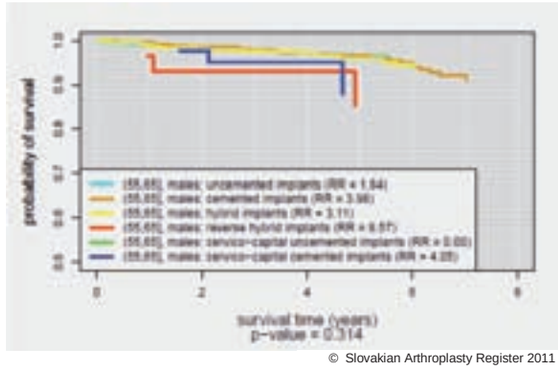

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Chart 42. Primary THA – probability of survival in the male group 65–75 according to the type of fixation

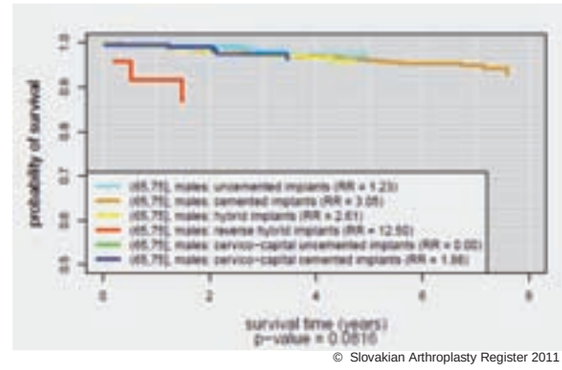

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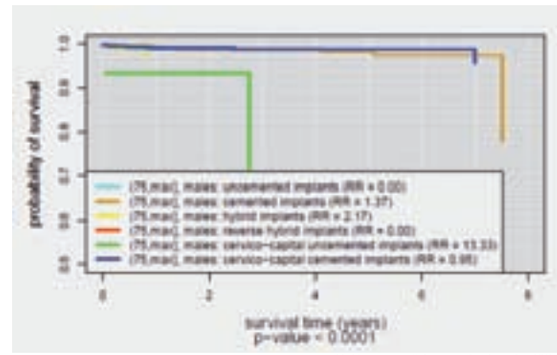
Chart 43. Primary THA – probability of survival in the male group over 75 according to the type of fixation



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Brand of bone cement used

In the period 2003–2010, only five brands of bone cement reached more than a 5% share on the total. *Palacos R* reached 32.82%, *SmartSet HV* 26.94%, *CMW* 17.65% *SmartSet GHV* 6.93% and *Palacos R Gentamycin* 6.79% of all bone cement brands. Tab. 35 shows the numbers of cement packages used after years 2003–2010. In 2010, *Palacos R* was still the most-used bone cement at 29.07%, followed by *SmartSet HV* (27.09%), *Palacos R Gentamycin* (19.58%), *SmartSet GHV* (9.20%) and then *CMW* with 6.23% of all bone cement types. There was increase in use of bone cement incorporating gentamycin. In the whole period 2003–2010, it accounted for 24.58%, but in 2010 the bone cements with gentamycin reached 28.70%.

Tab. 35. Primary THA – brands of bone cement

Year	Biomet Plus	CMW	CMW-G	Copal	Osteobond	Palacos LV genta	Palacos R	Palacos R genta	Palamed	Palamed - G	Refobacin Plus	Refobacin Revision	Simplex	Simplex ABC	SmartSet GHV	SmartSet HV	Synicem 1	Synicem G
2003	0	1 617	162	0	80	0	504	45	214	10	0	0	0	0	0	7	0	0
2004	0	1 552	108	0	35	2	860	79	329	41	0	0	0	0	30	452	0	0
2005	2	337	53	0	19	0	1 105	123	97	145	0	0	0	0	200	1 131	0	0
2006	2	222	2	0	14	2	1 599	91	116	67	0	0	0	0	288	1 303	0	0
2007	0	364	5	0	30	9	1 586	135	146	39	0	0	0	0	238	1 422	0	0
2008	0	272	9	0	19	16	1 310	241	129	13	5	0	0	0	411	1 140	0	0
2009	34	303	18	13	8	11	1 110	485	0	0	111	2	0	30	433	1 062	0	0
2010	73	216	16	17	0	0	1 008	679	0	0	42	1	2	118	319	937	39	1

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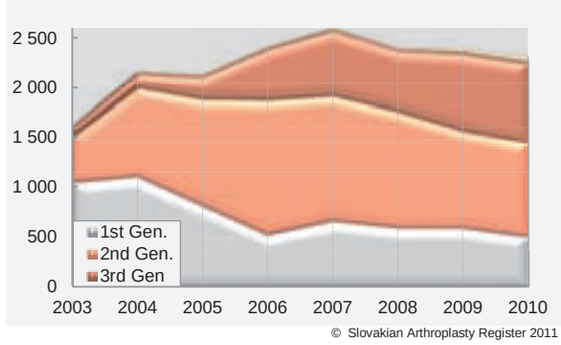
Cementing techniques

During the life of the registry cementing techniques made dramatic progress. Modern cementing, known as third generation cementing technique, was introduced. Tab. 36 shows the evolution of cementing techniques. Second generation technique comprised 44.86% of all applications during the time period 2003–2010. Only in 32.13% were first generation techniques used, and in 21.34% third generation techniques were used. In 2010, the ratio was as follows: 21.52% 1st generation, 4.59% 2nd and 34.78% 3rd generation cementing techniques. Only 3.10% were not identified. The trends of improvements in cementing techniques continue. Chart 44 shows the evolution of cementing techniques. The introduction of the third generation techniques in the 2005 represents the biggest growth. The further evolution of modern cementing techniques will hopefully improve the survival of cemented implants, in the future.

Tab. 36. Primary THA – cementing techniques

Year	1st Gen.	2nd Gen.	3rd Gen	Not Identif.
2003	1 044	457	102	27
2004	1 108	897	145	31
2005	812	1 078	229	31
2006	523	1 358	518	27
2007	662	1 262	662	31
2008	592	1 169	623	30
2009	589	976	785	56
2010	500	943	808	72

Chart 44. Primary THA – cementing techniques



Components and their combinations

In comparison to 2003, the number of components implanted in 2010 increased by 94.00%. As expected, the biggest growth was in uncemented femoral stems (UFS) – 156.00%. Cemented femoral stems (CFSs) increased, compared to 2003, by 94.00%. Uncemented acetabular cups (UACs) increased by 83%. The main quantitative parameter for the evaluation of implant components is the number of insertions per annum. The following tables reflect the situation in 2010. Each component type is divided into four groups. In the first group are those with more implantations than 10.00% of all components implanted. In the second group are components accounting for between 9.99% and 5.00%, then the group between 4.99% and 1.00% and finally those component types accounting for less than 1.00% of all procedures. Tab. 37 shows UACs and their share in 2010. The top four UACs, being group one, represent 60.65% of all of this type of component. Over the period of observation 2003–2010, the number of UACs fulfilling the criteria for inclusion in group one increased, by 2010, from three to four types, that is growth from 52.96% to 60.65% of all UACs. In group four – components representing less than 1.00% of all implantations of UACs – there were 25 implantations, their share being 4.97%. Types of cemented acetabular cups (CACs) used in more than 10.00% (group one), in 2010, account for 67.9% of all CAC sand the growth compared to the whole period 2003–2010 was only 1.50%. For UFSs there was only one component brand that was implanted in more than 10.00% of cases – *Corail* – and its use was 25.52% of all UFSs. Throughout the whole observed time period, that group one UFS represented 49.59% of all UFSs implanted. The ratio brands of the stems from groups one, two and three to the group four is 17:20. The ratio of the numbers of components in the top three groups, compared with the fourth group is 2,446:152 (94.15% to 5.85%).The group four UFSs were excluded from the long-term follow-up, because, in the whole observed period, these 31 brands represent only 5.85%.

Tab. 37. Uncemented acetabular cups

Name	n	%
PINNACLE	721	23,51%
NOVAE EVOLUTION	504	16,43%
DELTA - PF	321	10,47%
DURALOC	314	10,24%
PLASMACUP	272	8,87%
SF	259	8,44%
CLS SPOTORNO	158	5,15%
DELTA	78	2,54%
BEZNOSKA (uncem)	61	1,99%
M-H-shell	55	1,79%
TRILOGY	49	1,60%
ZWEYMULLER-ALLOCLASSIC CSF	47	1,53%
ANA.NOVA	44	1,43%
DELTA - FINS	44	1,43%
TRIDENT HEMISPHERICAL SOLID	35	1,14%
TRIDENT HEMISPHERICAL CLUSTER	24	0,78%
T.O.P.	20	0,65%
DELTA - TT	18	0,59%
DELTA - ST - C	10	0,33%
COPTOS	9	0,29%
L-CUP	6	0,20%
WM oval	5	0,16%
RINGLOC - HIGH WALL	3	0,10%
OCTOPUS	3	0,10%
ACETABULAR PLATES	2	0,07%
DURALOC OPTION	1	0,03%
ASR	1	0,03%
NNC - Titan	1	0,03%
RSC - revision	1	0,03%
WM sferical	1	0,03%
Uncemented	3 067	100,00%

Tab. 38. Cemented acetabular cups

Name	n	%
O2	359	29,60%
BEZNOSKA (cem)	281	23,17%
PE-CUP	181	14,92%
ELITE PLUS	98	8,08%
MUELLER	78	6,43%
CHARNLEY	73	6,02%
EXETER Contemporary Cup	47	3,87%
ZCA	35	2,89%
MULLER	20	1,65%
EXETER Duration Cup	20	1,65%
ULTIMA MK2	10	0,82%
TRILOC	9	0,74%
BURCH-SCHNEIDER CAGE	1	0,08%
MULLER LOW PROFILE	1	0,08%
Cemented	1 213	100,00%

Tab. 39. Uncemented femoral stems

Name	n	%
CORAIL	663	25,52%
SAGITA EVOLUTION HA	254	9,78%
FIT	239	9,20%
BICONTACT	228	8,78%
LIBRA HA	195	7,51%
SF	194	7,47%
CLS SPOTORNO	128	4,93%
LOGICA (uncem)	115	4,43%
PROXIMA	101	3,89%
BIMETRIC (uncem)	87	3,35%
ZWEYMULLER-ALLOCLASICS SL	45	1,73%
ABGII V40	44	1,69%
ANA.NOVA MII	35	1,35%
S-ROM	34	1,31%
AML	31	1,19%
VERSYS FMT	27	1,04%
SL (uncem)	26	1,00%
AUSTIN-MOORE hemiarthropl. (uncem)	21	0,81%
TRI-LOCK BPS	18	0,69%
METHA	17	0,65%
SAM - FIT	15	0,58%
COLLO - MIS	13	0,50%
C.F.P.	12	0,46%
BETA CONE	10	0,38%
ANA.NOVA MII double stem couted	8	0,31%
MODULUS	8	0,31%
TRIO (uncem)	5	0,19%
SOLUTION	4	0,15%
REVISION	4	0,15%
TRIO modular (uncem)	4	0,15%
RMD revision	3	0,12%
H - MAX M	3	0,12%
H - MAX S	3	0,12%
SF - revision	1	0,04%
ZMR	1	0,04%
ANTEGA	1	0,04%
SL-TWIN	1	0,04%
Uncemented	2 598	100,00%

In CFSs, the group one implants represent more than half of all CFSs. In 2010 these components represents 53.99%, which was a decrease from 57.18% over the whole time period. Ten implants from group four, in 2010, representing 3.37%. In the whole period there were only 22 group four implants (4.83%). From the point of view of the long term follow-up, it is important to minimise the share of the group four components.

Tab. 40. Cemented femoral stems

Name	**n**	%
BEZNOSKA	563	24,05%
BEZNOSKA hemiarthropl.	465	19,86%
CSC	236	10,08%
CHARNLEY	158	6,75%
C-STEM	154	6,58%
CENTRAMENT	109	4,66%
LOGICA (cem)	90	3,84%
TRILLIANCE	86	3,67%
EXETER V40	80	3,42%
SAGITA EVOLUTION	70	2,99%
CPT	68	2,90%
CSC CCEP	51	2,18%
BIMETRIC (cem)	50	2,14%
SL (cem)	42	1,79%
AUSTIN-MOORE hemiarthropl. (cem)	40	1,71%
FJORD	15	0,64%
AAP	12	0,51%
CHARNLEY MODULAR	11	0,47%
BEZNOSKA - custom-made, tumor.	10	0,43%
CL TRAUMA – hemiarthropl.	9	0,38%
AUTOBLOQAUATE	9	0,38%
LIBRA	6	0,26%
CORAIL (cem)	3	0,13%
ELITE PLUS	2	0,09%
TRIO (cem)	2	0,09%
Cemented	2 341	100,00%

The unique feature of total hip arthroplasty is the possibility of the combination of different components from different manufacturers. For the evaluation component group mode is used, also considering the type of fixation. Another possibility would be the evaluation of individual acetabular and femoral components. Because of the combination potential of THA implants, there exists a unique opportunity to compare the probability of survival of one component in combination with a range of other compatible components. The component combinations recommended by the manufacturers predominate. The highest variability observed is in the hybrid group, but with very few observations. Variability of the component combinations in this group is so high, that even after eight years of the SAR, not all combinations have reached the minimal number of records needed for the statistical methodology (n=50). These combinations are displayed in all the following tables.

Survival of the primary implants

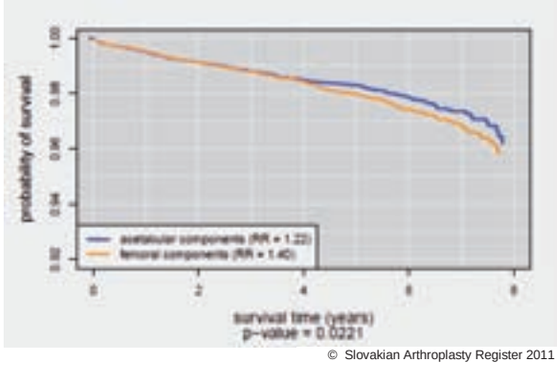
During 2010, 14 CACs, 30 UACs and 25 CFSs and 37 UFSs from the register inventory were used, as Tab. 41 shows.

Tab. 41. Number of used component types from the SAR inventory

Year	Acet. comp. cemented	Acet. comp. uncemented	Fem. comp. cemented	Fem. comp. uncemented	Total
2003	12	18	17	18	65
2003-2010	14	33	33	46	126
2010	14	30	25	37	106
%	100	90,9	75,75	80,43	84,12

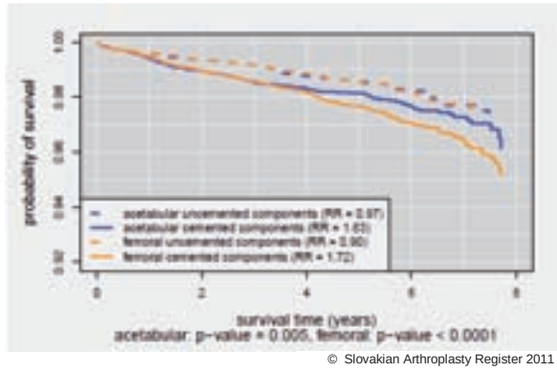
In 2010, 84.12% of all component brands registered in the inventory of SAR were used. There was a decrease in the ranges of brands of all types of components used, except CACs. The biggest decrease was observed in the range of FCSs. In the FCS group, only 25 brands were implanted in 2010, representing 75% of the whole range of brands of FCSs registered in the inventory from 2003–2010. In the next part of the report, analysis will be undertaken of the probability of survival of all types of components, with respect to gender, type of fixation and the age groups.

Chart 45. Probability of survival of acetabular and femoral components



Statistical analyses confirmed significant differences between the survival of acetabular and femoral components, where p-value=0.0221. Chart 45 shows that the survival after four years of acetabular components is significantly better than the survival of femoral components.

Chart 46. Probability of survival of acetabular and femoral components and the type of fixation



When type of fixation of components is considered, there is also a statistically significant difference between cemented and uncemented acetabular component, where p-value=0.005 and survival of UACs is better, as shown chart 46. Very similar results were noted for the comparison of cemented and uncemented femoral components, with a p-value<0.0001 and, again, the uncemented components survive better. The difference between the survival of the types of femoral components is greater than between the survival of the types of acetabular components.

Acetabular components

CACs are the oldest components used, but only three brands of them reached more than 1,000 applications during the observed period 2003–2010. These three most used brands are: *Beznoska cup*, the *Charnley* from *DePuy* and the *PE-cup* from *Aesculap*. CACs have a mean RR of 1.63%, as Tab. 42 shows. UACs account for twice as many implantations as CACs. The following brands of uncemented cup – *Duraloc* and *Pinnacle (DePuy)*, *Novae Evolution* (*Serf*), *Trilogy* (*Zimmer*) and the *Beznoska cup* reached more than a thousand implantations during the 2003–2010 period. The RR of UACs is lower than the cemented cups, with a value of 0.97%. The whole database of acetabular components had an RR of 1.32%.

Tab. 42. Primary THA – cemented acetabular cups

Name	n	e	RR	SR	HR	mean	se	LB	UB
MUELLER	231	0	0,00	100,00	0,00	2,75	NA	NA	NA
SF/A	146	0	0,00	100,00	0,00	7,79	NA	NA	NA
ZWEYMULLER-ALLOCLASSIC	37	0	0,00	100,00	0,00	7,81	NA	NA	NA
EXETER Duration Cup	28	0	0,00	100,00	0,00	1,14	NA	NA	NA
TRILOC	9	0	0,00	100,00	0,00	0,97	NA	NA	NA
BURCH-SCHNEIDER CAGE	7	0	0,00	100,00	0,00	6,18	NA	NA	NA
MULLER	1	0	0,00	100,00	0,00	4,64	NA	NA	NA
O2	535	1	0,19	99,81	0,11	3,94	0,018	3,91	3,98
ZCA	261	1	0,38	99,62	0,23	7,93	0,030	7,87	7,99
ELITE PLUS	550	3	0,55	99,45	0,33	7,89	0,031	7,83	7,96
MULLER	753	6	0,80	99,20	0,49	7,94	0,022	7,90	7,99
CHARNLEY	1854	22	1,19	98,81	0,73	7,92	0,018	7,88	7,95
PE-CUP	1225	22	1,80	98,20	1,10	7,81	0,039	7,74	7,89
EXETER Contemporary Cup	53	1	1,89	98,11	1,16	3,62	NA	NA	NA
ULTIMA MK2	314	7	2,23	97,77	1,37	7,80	0,063	7,68	7,92
BEZNOSKA (cem)	3660	93	2,54	97,46	1,56	7,75	0,026	7,70	7,81
LUBINUS CLASSIC PLUS	70	2	2,86	97,14	1,75	7,74	0,125	7,49	7,98
MULLER LOW PROFILE	6	1	16,67	83,33	10,21	6,57	1,244	4,13	9,01
Cemented	**9740**	**159**	**1,63**	**98,37**	**1,34**	**7,86**	**0,011**	**7,84**	**7,88**
Acetetabular components	**25321**	**310**	**1,22**	**98,78**	**1,22**	**7,88**	**0,007**	**7,87**	**7,89**
Whole database	**55094**	**727**	**1,32**	**98,68**	**1,00**	**7,87**	**0,005**	**7,86**	**7,88**

color	failure/component	RR [incl. SR, HR]	mean survival
	zero or one failures	0	(group mean,8]
		(0,group mean]	(7,group mean]
		(group mean,10]	(5,7]
	<50 components	(10,100]	[0,5]
	mean values		
	highest number of components used (acet/fem, each 5)		
	having more than 2 or more failures		

n number of components
e number of failures

RR	revision rate
SR	survival rate
HR	hazard rate
mean	mean survival
se	standard error (of mean survival)
CI	confidence interval
LB	lower bound of 95% CI
UB	upper bound of 95% CI

Tab. 43. Primary THA – uncemented acetabular cups

Name	n	e	RR	SR	HR	mean	se	LB	UB
ANA.NOVA	146	0	0,00	100,00	0,00	2,94	NA	NA	NA
DELTA - FINS	46	0	0,00	100,00	0,00	2,96	NA	NA	NA
ULTIMA UTC	44	0	0,00	100,00	0,00	5,24	NA	NA	NA
RINGLOC - HIGH WALL	44	0	0,00	100,00	0,00	3,65	NA	NA	NA
Y-AXIS II	39	0	0,00	100,00	0,00	7,94	NA	NA	NA
TRIDENT HEMISPHERICAL SOLID	37	0	0,00	100,00	0,00	1,10	NA	NA	NA
TRIDENT HEMISPHERICAL CLUSTER	24	0	0,00	100,00	0,00	0,87	NA	NA	NA
BS - revision	11	0	0,00	100,00	0,00	5,95	NA	NA	NA
DELTA - ST - C	10	0	0,00	100,00	0,00	0,83	NA	NA	NA
TRILOGY AB - ceramic	6	0	0,00	100,00	0,00	4,66	NA	NA	NA
TC - revision	5	0	0,00	100,00	0,00	1,56	NA	NA	NA
WM oval	5	0	0,00	100,00	0,00	0,72	NA	NA	NA
NNC - Titan	2	0	0,00	100,00	0,00	4,15	NA	NA	NA
ACETABULAR PLATES	2	0	0,00	100,00	0,00	0,61	NA	NA	NA
RSC - revision	1	0	0,00	100,00	0,00	1,80	NA	NA	NA
PINNACLE	2791	9	0,32	99,68	0,33	6,25	0,009	6,23	6,26
M-H-shell	287	1	0,35	99,65	0,36	4,56	0,015	4,53	4,59

Tab. 43. (cont.)

Name	n	e	RR	SR	HR	mean	se	LB	UB
SF	800	4	0,50	99,50	0,52	7,77	0,041	7,69	7,85
DELTA - PF	325	2	0,62	99,38	0,63	1,79	0,031	1,73	1,85
DELTA	599	4	0,67	99,33	0,69	2,87	0,012	2,85	2,89
NOVAE EVOLUTION	2533	18	0,71	99,29	0,73	7,92	0,019	7,88	7,96
TRILOGY	1109	8	0,72	99,28	0,74	7,94	0,019	7,90	7,98
CLS SPOTORNO	564	5	0,89	99,11	0,91	5,82	0,049	5,72	5,91
DURALOC	2929	27	0,92	99,08	0,95	7,90	0,014	7,87	7,92
L-CUP	645	6	0,93	99,07	0,96	7,93	0,020	7,89	7,97
CENTRAMENT	87	1	1,15	98,85	1,19	6,40	0,073	6,26	6,54
T.O.P.	84	1	1,19	98,81	1,23	5,09	0,068	4,96	5,23
PLASMACUP	997	16	1,60	98,40	1,66	7,65	0,051	7,55	7,75
COPTOS	47	1	2,13	97,87	2,20	6,39	0,391	5,62	7,16
BICON-PLUS	43	1	2,33	97,67	2,40	7,83	0,101	7,63	8,02
BEZNOSKA (uncement)	1009	25	2,48	97,52	2,56	7,72	0,038	7,64	7,79
DURALOC OPTION	25	1	4,00	96,00	4,13	7,26	0,259	6,75	7,77
ASR	22	1	4,55	95,45	4,69	5,43	0,239	4,97	5,90
ZWEYMULLER-ALLOCLASSIC CSF	219	12	5,48	94,52	5,65	6,54	0,368	5,82	7,26
DELTA - TT	18	1	5,56	94,44	5,73	0,67	0,038	0,59	0,75
OCTOPUS	23	4	17,39	82,61	17,95	6,35	0,615	5,14	7,55
WM conical	2	2	100,00	0,00	103,19	2,58	1,018	0,59	4,58
WM sferical	1	1	100,00	0,00	103,19	0,33	NA	NA	NA
Uncemented	**15581**	**151**	**0,97**	**99,03**	**0,80**	**7,90**	**0,009**	**7,88**	**7,92**
Acetetabular components	**25321**	**310**	**1,22**	**98,78**	**1,22**	**7,88**	**0,007**	**7,87**	**7,89**
Whole database	**55094**	**727**	**1,32**	**98,68**	**1,00**	**7,87**	**0,005**	**7,86**	**7,88**

color	failure/component	RR [incl. SR, HR]	mean survival
	zero or one failures	0	(group mean,8]
		(0,group mean]	(7,group mean]
		(group mean,10]	(5,7]
	<50 components	(10,100]	[0,5]
	mean values		
	highest number of components used (acet/fem, each 5)		
	having more than 2 or more failures		

n number of components
e number of failures

RR	revision rate
SR	survival rate
HR	hazard rate
mean	mean survival
se	standard error (of mean survival)
CI	confidence interval
LB	lower bound of 95% CI
UB	upper bound of 95% CI

Chart 47. Probability of survival of Beznoska cemented acetabular cup

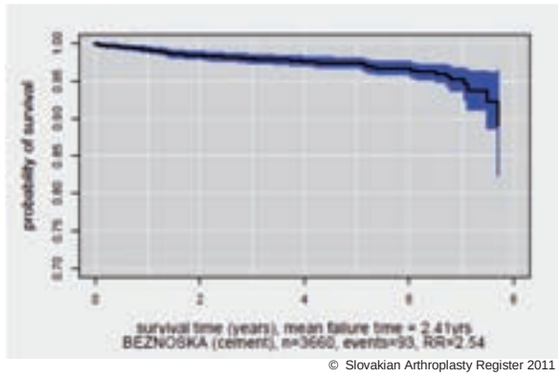


Chart 48. Probability of survival of Duraloc uncemented acetabular cup

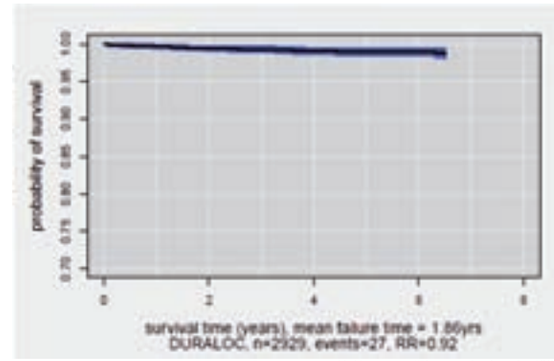


Chart 49. Probability of survival of Pinnacle uncemented acetabular cup

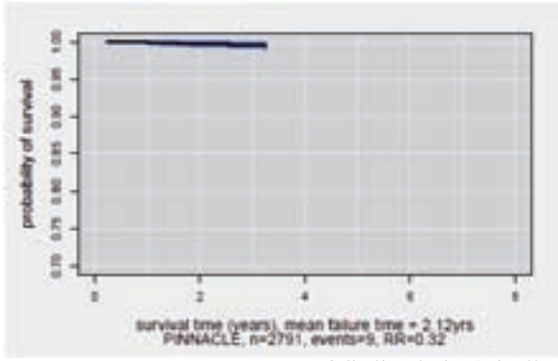


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Chart 50. Probability of survival of Novae Evolution uncemented acetabular cup

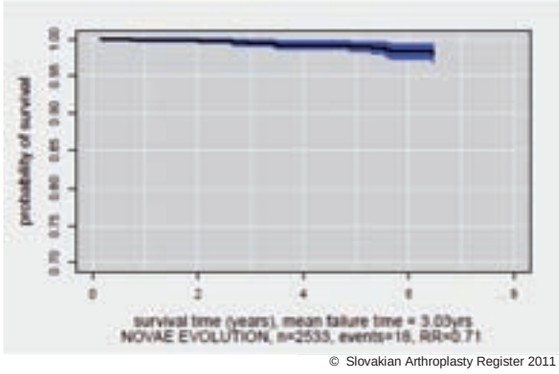

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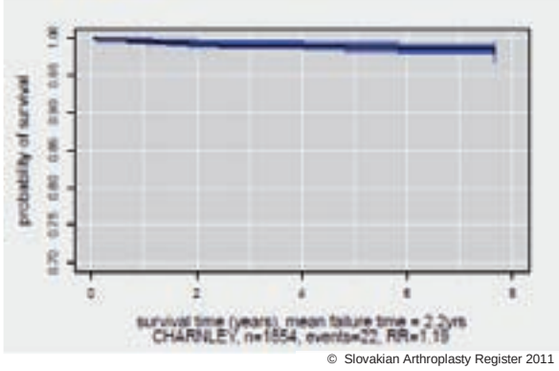
Chart 51. Probability of survival of Charnley (DePuy) cemented acetabular cup



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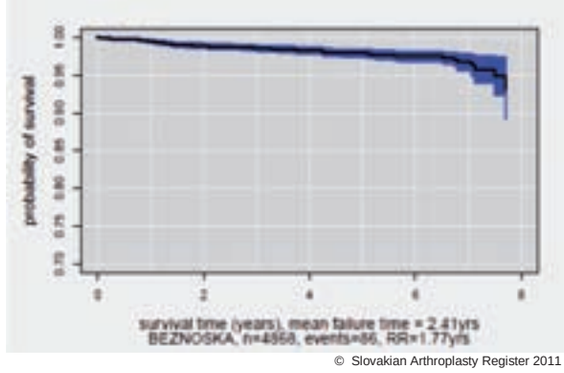
Charts 47 to 51 show the probabilities of survival of the five most commonly used acetabular components, regardless of the fixation type.

Femoral components

During the period 2003–2010, five brands of femoral cemented stems reached more than 1,000 implantations. The most frequently used was the *Beznoska CFS* with 4,868 implantations, the second most commonly used CFS was the *Beznoska hemiarthroplasty* with 3,446 records. Fourteen CFCs had less than 50 recordes. The probabilities of survival of the four most used CFSs are shown charts 52–56. In the observed time period 2003–2010, we identify only four CFS brands were identified with more than 50 records 50 without any failure – *Logica*, *Trilliance*, *Fjord*, and *CL Trauma hemiarthroplasty*. In the group of the UFSs there were 28 brands with less than 50 implantations each. The probability of survival of most used UFS – *Corail* with 2,746 applications – is shown in chart 54. In the UFS group there are only two implants without any failures – *Proxima* and *Ana.Nova MII*.

Chart 52. Probability of survival of Beznoska cemented femoral stem



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Tab. 44. Primary THA – cemented femoral stems

Name	n	e	RR	SR	HR	mean	se	LB	UB
LOGICA (cem)	256	0	0,00	100,00	0,00	2,75	NA	NA	NA
TRILLIANCE	87	0	0,00	100,00	0,00	2,27	NA	NA	NA
FJORD	54	0	0,00	100,00	0,00	3,92	NA	NA	NA
CL TRAUMA – hemiarthropl.	51	0	0,00	100,00	0,00	2,56	NA	NA	NA
LIBRA	26	0	0,00	100,00	0,00	2,25	NA	NA	NA
Z-AXIS	14	0	0,00	100,00	0,00	7,94	NA	NA	NA
AUTOBLOQAUATE	9	0	0,00	100,00	0,00	0,37	NA	NA	NA
FRIENDLY	4	0	0,00	100,00	0,00	2,35	NA	NA	NA
CORAIL (cem)	3	0	0,00	100,00	0,00	0,23	NA	NA	NA

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Tab. 44. (cont)

Name	n	e	RR	SR	HR	mean	se	LB	UB
MS-30	2	0	0,00	100,00	0,00	3,16	NA	NA	NA
TRIO (cem)	2	0	0,00	100,00	0,00	0,38	NA	NA	NA
ENDO-MODELL saddle	1	0	0,00	100,00	0,00	1,20	NA	NA	NA
C-STEM	957	6	0,63	99,37	0,36	6,79	0,031	6,73	6,85
CPT	711	7	0,98	99,02	0,57	7,90	0,031	7,84	7,96
BEZNOSKA hemiarthropl.	3446	38	1,10	98,90	0,64	7,88	0,019	7,84	7,91
AUSTIN-MOORE hemiarthropl.	501	6	1,20	98,80	0,70	7,86	0,047	7,77	7,95
SAGITA EVOLUTION	244	3	1,23	98,77	0,71	7,83	0,085	7,67	8,00
CENTRAMENT	1559	23	1,48	98,52	0,86	7,74	0,028	7,68	7,79
BIMETRIC (cem)	1102	18	1,63	98,37	0,95	7,88	0,027	7,83	7,93
CSC	977	16	1,64	98,36	0,95	7,68	0,041	7,60	7,77
BEZNOSKA	4868	86	1,77	98,23	1,03	7,83	0,019	7,79	7,86
SL (cem)	108	2	1,85	98,15	1,08	2,70	0,035	2,63	2,77
CHARNLEY	2061	43	2,09	97,91	1,21	7,86	0,021	7,82	7,90
CHARNLEY MODULAR	237	5	2,11	97,89	1,23	4,92	0,402	4,13	5,70
EXETER V40	93	2	2,15	97,85	1,25	3,51	0,115	3,28	3,73
LUBINUS CLASSIC PLUS	79	2	2,53	97,47	1,47	7,79	0,086	7,62	7,96
CSC hemiarthropl.	168	5	2,98	97,02	1,73	6,81	0,095	6,62	7,00
AUSTIN-MOORE hemiarthropl. (cem)	26	1	3,85	96,15	2,24	3,07	NA	NA	NA
AAP	25	1	4,00	96,00	2,33	3,06	NA	NA	NA
BEZNOSKA - custom-made, tumor.	30	2	6,67	93,33	3,88	5,86	0,990	3,92	7,80
ELITE PLUS	347	32	9,22	90,78	5,36	7,47	0,087	7,30	7,64
ULTIMA-HOWSE II	69	8	11,59	88,41	6,74	6,28	0,216	5,85	6,70
MULLER GERADSCHAFT	16	3	18,75	81,25	10,90	5,83	0,477	4,89	6,76
ULTIMA-STREIGHT STEM	6	2	33,33	66,67	19,38	5,81	1,138	3,58	8,04
ASR	3	1	33,33	66,67	19,38	2,84	0,538	1,79	3,90
Cemented	**18142**	**312**	**1,72**	**98,28**	**1,23**	**7,84**	**0,009**	**7,82**	**7,86**
Femoral components	**29773**	**417**	**1,40**	**98,60**	**1,40**	**7,86**	**0,007**	**7,85**	**7,87**
Whole database	**55094**	**727**	**1,32**	**98,68**	**1,00**	**7,87**	**0,005**	**7,86**	**7,88**

color	failure/component	RR [incl. SR, HR]	mean survival
	zero or one failures	0	(group mean,8]
		(0,group mean]	(7,group mean]
		(group mean,10]	(5,7]
	<50 components	(10,100]	[0,5]
	mean values		
	highest number of components used (acet/fem, each 5)		
	having more than 2 or more failures		
n	number of components		
e	number of failures		

RR	revision rate
SR	survival rate
HR	hazard rate
mean	mean survival
se	standard error (of mean survival)
CI	confidence interval
LB	lower bound of 95% CI
UB	upper bound of 95% CI

Tab. 45. Primary THA – uncemented femoral stems

Name	n	e	RR	SR	HR	mean	se	LB	UB
PROXIMA	385	0	0,00	100,00	0,00	4,89	NA	NA	NA
ANA.NOVA MII	137	0	0,00	100,00	0,00	2,94	NA	NA	NA
ABGII V40	46	0	0,00	100,00	0,00	1,10	NA	NA	NA
SL-PLUS	43	0	0,00	100,00	0,00	7,93	NA	NA	NA
SAM - FIT	34	0	0,00	100,00	0,00	2,52	NA	NA	NA
X-AXIS	25	0	0,00	100,00	0,00	7,81	NA	NA	NA
METHA	20	0	0,00	100,00	0,00	3,84	NA	NA	NA
TRI-LOCK BPS	18	0	0,00	100,00	0,00	0,24	NA	NA	NA
COLLO - MIS	13	0	0,00	100,00	0,00	0,53	NA	NA	NA

Tab. 45. (cont)

Name	n	e	RR	SR	HR	mean	se	LB	UB
SF - revision	10	0	0,00	100,00	0,00	4,81	NA	NA	NA
ANA.NOVA MII double stem couted	9	0	0,00	100,00	0,00	1,14	NA	NA	NA
MODULUS	8	0	0,00	100,00	0,00	0,50	NA	NA	NA
REVISION	6	0	0,00	100,00	0,00	1,94	NA	NA	NA
TRIO modular (uncem)	4	0	0,00	100,00	0,00	0,11	NA	NA	NA
H - MAX M	3	0	0,00	100,00	0,00	0,83	NA	NA	NA
H - MAX S	3	0	0,00	100,00	0,00	0,62	NA	NA	NA
SL-TWIN	2	0	0,00	100,00	0,00	1,56	NA	NA	NA
Y-AXIS	1	0	0,00	100,00	0,00	6,61	NA	NA	NA
ANA.NOVA NANOS	1	0	0,00	100,00	0,00	1,39	NA	NA	NA
CLS SPOTORNO	441	1	0,23	99,77	0,25	3,60	0,008	3,58	3,62
BICONTACT	610	2	0,33	99,67	0,36	6,66	0,044	6,58	6,75
SAGITA EVOLUTION HA	1918	8	0,42	99,58	0,46	7,96	0,013	7,94	7,99
LIBRA HA	422	3	0,71	99,29	0,79	5,44	0,811	3,85	7,03
LOGICA (uncem)	252	2	0,79	99,21	0,88	4,05	0,029	3,99	4,11
BIMETRIC (uncem)	740	6	0,81	99,19	0,90	7,91	0,026	7,86	7,96
CORAIL	2743	24	0,87	99,13	0,97	7,67	0,041	7,59	7,75
AML	1223	11	0,90	99,10	1,00	7,91	0,017	7,87	7,94
VERSYS	519	5	0,96	99,04	1,07	7,84	0,033	7,77	7,90
SF	694	8	1,15	98,85	1,28	7,76	0,056	7,66	7,87
S-ROM	79	1	1,27	98,73	1,40	7,58	0,243	7,10	8,05
FIT	515	7	1,36	98,64	1,51	2,92	0,015	2,89	2,95
ZWEYMULLER-ALLOCLASICS SL	246	4	1,63	98,37	1,80	7,82	0,068	7,69	7,96
VERSYS FMT	180	4	2,22	97,78	2,46	5,98	0,056	5,87	6,09
BETA CONE	63	2	3,17	96,83	3,52	4,42	0,088	4,25	4,59
VERSYS FMMC	28	1	3,57	96,43	3,96	6,62	0,208	6,21	7,03
SL (uncem)	54	2	3,70	96,30	4,10	2,58	0,077	2,43	2,73
C.F.P.	22	1	4,55	95,45	5,04	4,97	0,179	4,62	5,32
AUSTIN-MOORE hemiarthropl. (uncem)	22	1	4,55	95,45	5,04	2,76	NA	NA	NA
RMD revision	16	1	6,25	93,75	6,92	4,91	NA	NA	NA
SOLUTION	25	2	8,00	92,00	8,86	7,25	0,377	6,51	7,98
ASR	23	2	8,70	91,30	9,63	6,84	0,280	6,30	7,39
MP	6	1	16,67	83,33	18,46	6,66	1,193	4,32	8,99
TRIO (uncem)	6	1	16,67	83,33	18,46	3,50	NA	NA	NA
ZMR	10	3	30,00	70,00	33,23	4,05	0,296	3,47	4,64
WM HA	3	1	33,33	66,67	36,92	4,55	1,722	1,18	7,93
ANTEGA	3	1	33,33	66,67	36,92	1,22	0,481	0,28	2,16
Uncemented	**11631**	**105**	**0,90**	**99,10**	**0,64**	**7,90**	**0,010**	**7,88**	**7,92**
Femoral components	**29773**	**417**	**1,40**	**98,60**	**1,40**	**7,86**	**0,007**	**7,85**	**7,87**
Whole database	**55094**	**727**	**1,32**	**98,68**	**1,00**	**7,87**	**0,005**	**7,86**	**7,88**

color	failure/component	RR [incl. SR, HR]	mean survival
	zero or one failures	0	(group mean,8]
		(0,group mean]	(7,group mean]
		(group mean,10]	(5,7]
	<50 components	(10,100]	[0,5]
	mean values		
	highest number of components used (acet/fem, each 5)		
	having more than 2 or more failures		

n number of components
e number of failures

RR revision rate
SR survival rate
HR hazard rate
mean mean survival
se standard error (of mean survival)
CI confidence interval
LB lower bound of 95% CI
UB upper bound of 95% CI

Chart 53. Probability of survival of Beznoska cemented femoral hemiarthroplasty

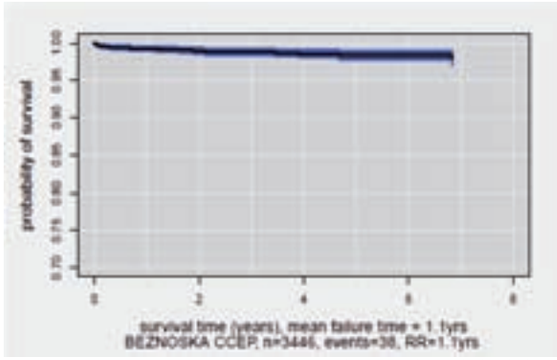


Chart 54. Probability of survival of Corail uncemented femoral stem

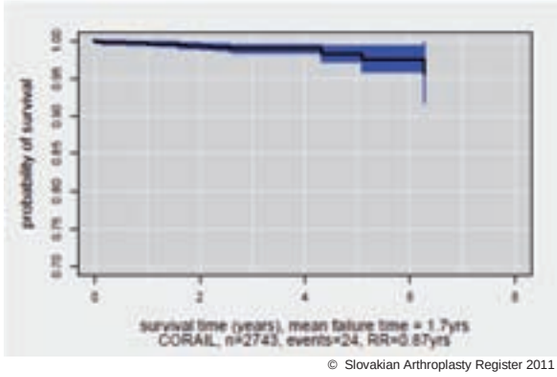


Chart 55. Probability of survival of Charnley (DePuy) cemented femoral stem

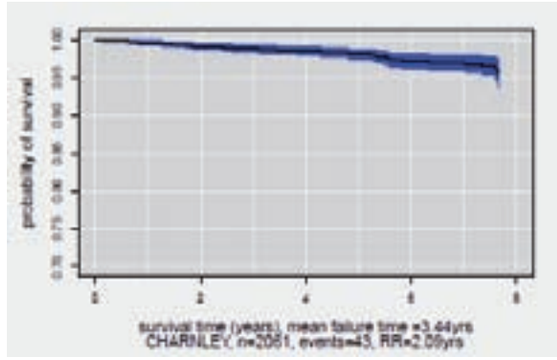
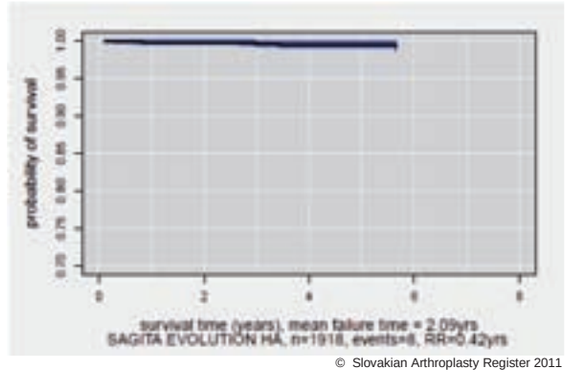


Chart 56. Probability of survival of Sagita Evolution HA uncemented femoral stem



Component combinations

As mentioned previously, the THA offers the possibility of combinations, either with recommended components from the same manufacturer, or with components from other manufacturers, even with different types of fixation – hybrid implants. In the next section, these combinations will be analysed. From the historical point of view, the oldest and most commonly used combinations are those of cemented components.

Tab. 46. Primary THA – combinations of the cemented components

Cemented		Implants					Acetabular components					Femoral components				
Acetabular	Femoral	n	e	RR	SR	HR	n	e	RR	SR	HR	n	e	RR	SR	HR
Mueller	Logica (c)	178	0	0,00	100,00	0,00	178	0	0,00	100,00	0,00	178	0	0,00	100,00	0,00
SF/A	Beznoska	83	0	0,00	100,00	0,00	83	0	0,00	100,00	0,00	83	0	0,00	100,00	0,00
PE-Cup	Trilliance	75	0	0,00	100,00	0,00	75	0	0,00	100,00	0,00	75	0	0,00	100,00	0,00
Beznoska (c)	C-Stem	71	0	0,00	100,00	0,00	71	0	0,00	100,00	0,00	71	0	0,00	100,00	0,00
Lubinus	Lubinus	65	0	0,00	100,00	0,00	65	0	0,00	100,00	0,00	65	0	0,00	100,00	0,00
Elite Plus	C-Stem	54	0	0,00	100,00	0,00	54	0	0,00	100,00	0,00	54	0	0,00	100,00	0,00
O2	CSC	274	1	0,36	99,64	0,33	274	0	0,00	100,00	0,00	274	1	0,36	99,64	0,50
ZCA	CPT	246	1	0,41	99,59	0,36	246	1	0,41	99,59	0,61	246	0	0,00	100,00	0,00
O2	Beznoska	217	1	0,46	99,54	0,41	217	0	0,00	100,00	0,00	217	1	0,46	99,54	0,63
Elite Plus	Charnley	186	1	0,54	99,46	0,48	186	0	0,00	100,00	0,00	186	1	0,54	99,46	0,73
Elite Plus	Charnley Modul.	182	1	0,55	99,45	0,49	182	1	0,55	99,45	0,83	182	1	0,55	99,45	0,75
Beznoska (c)	CSC	402	6	1,49	98,51	1,33	402	2	0,50	99,50	0,75	402	5	1,24	98,76	1,70
Ultima MK2	C-Stem	165	3	1,82	98,18	1,62	165	3	1,82	98,18	2,74	165	1	0,61	99,39	0,83

Tab. 46. (cont.)

Cemented		Implants					Acetabular components					Femoral components				
Acetabular	Femoral	n	e	RR	SR	HR	n	e	RR	SR	HR	n	e	RR	SR	HR
Charnley	Charnley	1823	39	2,14	97,86	1,91	1823	18	0,99	99,01	1,49	1823	35	1,92	98,08	2,62
PE-Cup	Centrament	1080	26	2,41	97,59	2,15	1080	22	2,04	97,96	3,07	1080	16	1,48	98,52	2,02
Beznoska (c)	Beznoska	3023	98	3,24	96,76	2,89	3023	81	2,68	97,32	4,04	3023	62	2,05	97,95	2,80
Exeter	Exeter V40	53	2	3,77	96,23	3,36	53	1	1,89	98,11	2,84	53	2	3,77	96,23	5,16
Ultima MK2	Elite Plus	51	2	3,92	96,08	3,50	51	2	3,92	96,08	5,91	51	1	1,96	98,04	2,68
Elite Plus	Elite Plus	76	4	5,26	94,74	4,69	76	0	0,00	100,00	0,00	76	4	5,26	94,74	7,19
Cemented		**8304**	**185**	**2,23**	**97,77**	**1,24**	**8304**	**131**	**1,58**	**98,42**	**1,45**	**8304**	**130**	**1,57**	**98,43**	**1,24**
Whole database (n> 50)		**22157**	**399**	**1,80**	**98,20**	**1,00**	**22157**	**242**	**1,09**	**98,91**	**1,00**	**22157**	**281**	**1,27**	**98,73**	**1,00**

color	failure/component	RR [incl. SR, HR]
	zero or one failures	0
		(0,group mean]
		(group mean,10]
	<50 components	(10,100]
	group/grand mean values	
	highest number of components used (acet/fem, each 5)	
	having more than 2 or more failures	

n	number of components
e	number of failures
RR	revision rate
SR	survival rate
HR	hazard rate
c	cemented
uc	uncemented

Combinations of cemented components

In 2010, the most commonly used combination of cemented components was the *Beznoska CFS* with the *Beznoska* CAC. The *Beznoska CFS* is found in two more combinations as shown in Tab. 46. The mean RR of all cemented implants was 2.23%. Charts 57 to 61 show the probability of survival of commonest CFS/CAC combinations.

Chart 57. Probability of survival of cemented Beznoska CAC/ Beznoska CFS combination

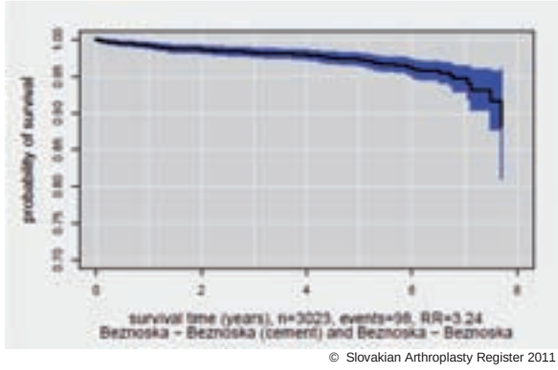


Chart 58. Probability of survival of cemented Charnley CAC/ Charnley CFS combination

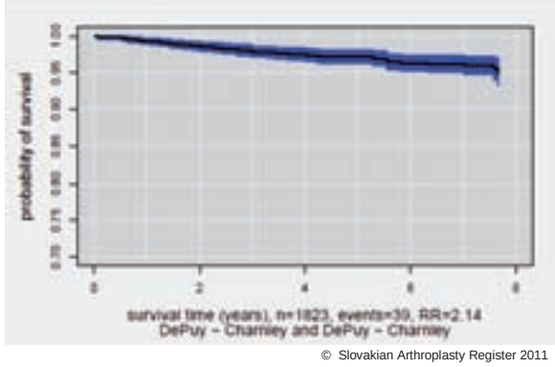


Chart 59. Probability of survival of cemented PE-cup/ Centrament combination

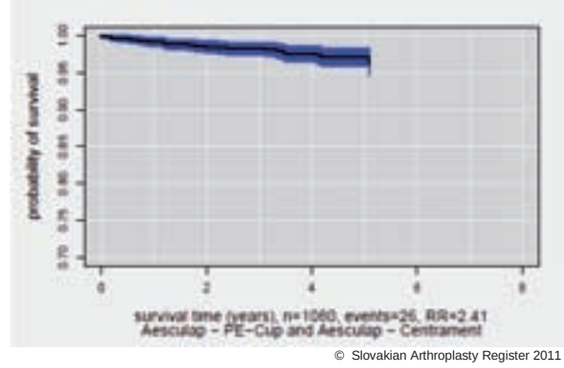


Chart 60. Probability of survival of cemented Beznoska CAC/ CSC combination

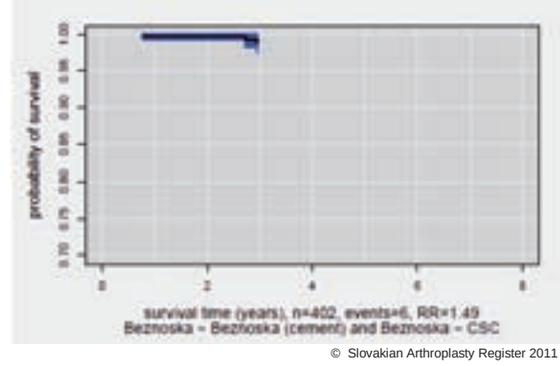
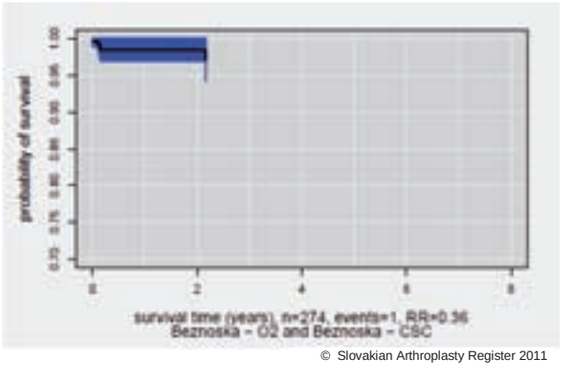


Chart 61. Probability of survival of cemented O2/CSC combination



Combinations of uncemented components

There are 22 different combinations of uncemented combinations. The most commonly used combination of UAC and UFS, in 2010, was *Novae Evolution*/*Sagitta Evolution HA*. The most commonly used UAC was the *Pinnacle* with 2,276 implantations, in combinations with three different UFSs, as seen in Tab. 47. The mean RR of all uncemented implants was 1.2% compared with whole database where it was 1.80%, being the best-surviving group of implants.

Tab. 47. Primary THA – combinations of uncemented components

Uncemented		Implants					Acetabular components					Femoral components				
Acetabular	Femoral	n	e	RR	SR	HR	n	e	RR	SR	HR	n	e	RR	SR	HR
Ana.Nova	Ana.Nova MII	131	0	0,00	100,00	0,00	131	0	0,00	100,00	0,00	131	0	0,00	100,00	0,00
CLS Spotorno	CLS Spotorno	415	1	0,24	99,76	0,21	415	0	0,00	100,00	0,00	415	1	0,24	99,76	0,33
Delta	Fit	318	1	0,31	99,69	0,28	318	1	0,31	99,69	0,47	318	1	0,31	99,69	0,43
Pinnacle	AML	414	2	0,48	99,52	0,43	414	2	0,48	99,52	0,73	414	1	0,24	99,76	0,33
Pinnacle	Proxima	379	2	0,53	99,47	0,47	379	2	0,53	99,47	0,80	379	0	0,00	100,00	0,00
Pinnacle	Corail	1483	9	0,61	99,39	0,54	1483	4	0,27	99,73	0,41	1483	8	0,54	99,46	0,74
Trilogy	Versys	494	3	0,61	99,39	0,54	494	1	0,20	99,80	0,31	494	3	0,61	99,39	0,83
Novae Evol.	Libra HA	414	3	0,72	99,28	0,65	414	2	0,48	99,52	0,73	414	2	0,48	99,52	0,66
SF	SF	493	4	0,81	99,19	0,72	493	3	0,61	99,39	0,92	493	3	0,61	99,39	0,83
Novae Evol.	Sagita Evol.HA	1874	18	0,96	99,04	0,86	1874	15	0,80	99,20	1,21	1874	8	0,43	99,57	0,58
M-H-shell	Bimetric (uc)	208	2	0,96	99,04	0,86	208	1	0,48	99,52	0,72	208	1	0,48	99,52	0,66
Delta - PF	Logica (uc)	93	1	1,08	98,92	0,96	93	0	0,00	100,00	0,00	93	1	1,08	98,92	1,47
L-Cup	Bimetric (uc)	410	6	1,46	98,54	1,30	410	4	0,98	99,02	1,47	410	4	0,98	99,02	1,33
Plasmacup	Bicontact	583	9	1,54	98,46	1,38	583	7	1,20	98,80	1,81	583	2	0,34	99,66	0,47
Duraloc	Corail	1099	18	1,64	98,36	1,46	1099	9	0,82	99,18	1,23	1099	14	1,27	98,73	1,74
Duraloc	AML	756	14	1,85	98,15	1,65	756	9	1,19	98,81	1,79	756	9	1,19	98,81	1,63
Delta	Logica (uc)	136	3	2,21	97,79	1,97	136	2	1,47	98,53	2,22	136	1	0,74	99,26	1,00
Trilogy	Versys FMT	166	4	2,41	97,59	2,15	166	2	1,20	98,80	1,82	166	4	2,41	97,59	3,29
T.O.P	Beta Cone	59	2	3,39	96,61	3,02	59	1	1,69	98,31	2,56	59	2	3,39	96,61	4,63
CLS Spotorno	Corail	58	2	3,45	96,55	3,07	58	2	3,45	96,55	5,20	58	0	0,00	100,00	0,00
Delta - PF	Fit	156	6	3,85	96,15	3,43	156	0	0,00	100,00	0,00	156	6	3,85	96,15	5,26
Beznoska (uc)	SF	112	5	4,46	95,54	3,98	112	1	0,89	99,11	1,35	112	4	3,57	96,43	4,88
Uncemented		**10251**	**115**	**1,12**	**98,88**	**0,62**	**10251**	**68**	**0,66**	**99,34**	**0,60**	**10251**	**75**	**0,73**	**99,27**	**0,58**
Whole database (n> 50)		**22157**	**399**	**1,80**	**98,20**	**1,00**	**22157**	**242**	**1,09**	**98,91**	**1,00**	**22157**	**281**	**1,27**	**98,73**	**1,00**

color	failure/component	RR [incl. SR, HR]
	zero or one failures	0
		(0,group mean]
		(group mean,10]
	<50 components	(10,100]
	group/grand mean values	
	highest number of components used (acet/fem, each 5)	
	having more than 2 or more failures	

n	number of components
e	number of failures
RR	revision rate
SR	survival rate
HR	hazard rate
c	cemented
uc	uncemented

Chart 62. Probability of survival of uncemented Novae Evolution/Sagita Evolution HA combination

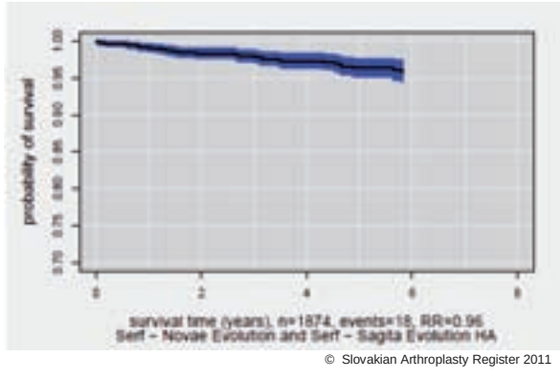


Chart 63. Probability of survival of uncemented Pinnacle/ Corail combination

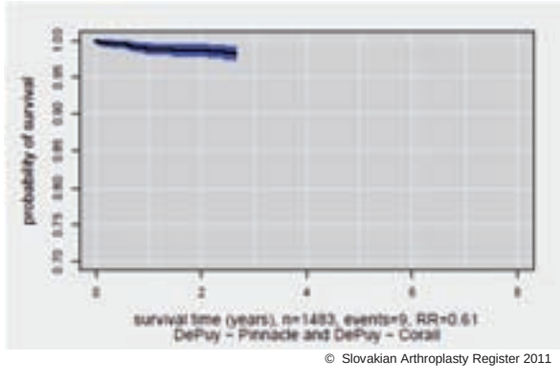


Chart 64. Probability of survival of uncemented Duraloc/Corail combination

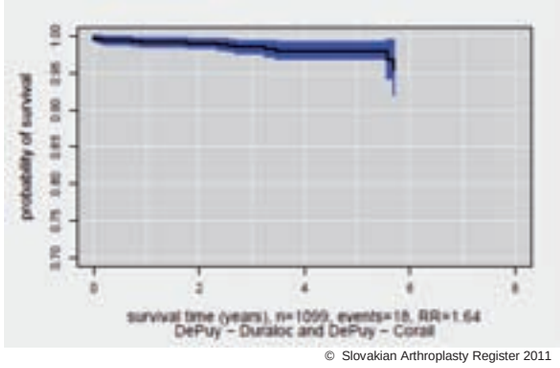


Chart 65. Probability of survival of uncemented Duraloc/AML combination

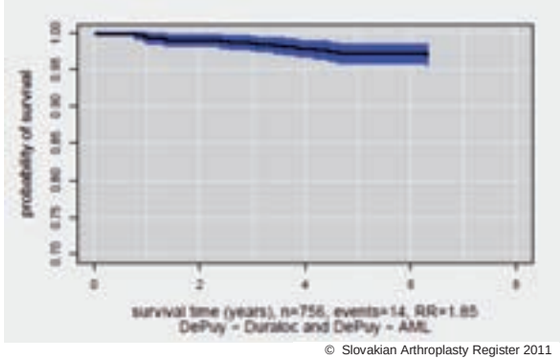
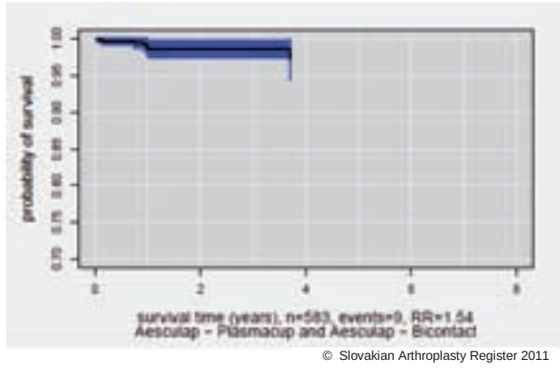


Chart 66. Probability of survival of uncemented Plasmacup/ Bicontact combination



Combinations of cemented and uncemented components

The group of hybrid implants, combining cemented and uncemented components, is the most problematic one. The definition of standard hybrid implants is a combination of a UAC and a CFS. The reverse hybrid is defined as a combination of s CAC and a UFS. Of the low usage of hybrid implants during the observed period, 2003–2010, only 18 standard hybrid combinations have been identified, as shown in Tab. 48. None of the reverse hybrids reached 50 implantations and, therefore, they are not included in any table or chart. In the standard combinations there are two stems that were used in three different combinations – *Bimetric* and *Beznoska* – and three stems used in two different combinations – *CPT*, *C-Stem*, and *Centrament*. With regard to acetabular components, the most commonly used was the *Duraloc* in five different combinations. The *Beznoska* and *SF* acetabular components were used in two different combinations. The mean RR of the whole group is 2.75% and these comprise the worst results in the whole combination database. However, it must be emphasised that, from the whole THA database which totals 22,157 implants, the share of hybrids and reverse hybrids was 3,062 implants (16.25%). The conclusion is reached that hybrid implants, in the SAR database, do not produce the expected performance in terms of RR and SR. Tab. 48 shows the results of hybrid combinations, and charts 67 to 71 show the probability of survival of five of the most commonly used standard hybrid implants.

Tab. 48. Primary THA – combinations of uncemented and cemented components

Hybrids		Implants					Acetabular components					Femoral components				
Acetabular	Femoral	n	e	RR	SR	HR	n	e	RR	SR	HR	n	e	RR	SR	HR
SF	CSC	78	0	0,00	100,00	0,00	78	0	0,00	100,00	0,00	78	0	0,00	100,00	0,00
M-H-shell	Bimetric (c)	71	0	0,00	100,00	0,00	71	0	0,00	100,00	0,00	71	0	0,00	100,00	0,00
Duraloc	CPT	62	0	0,00	100,00	0,00	62	0	0,00	100,00	0,00	62	0	0,00	100,00	0,00
Delta	Logica (c)	54	0	0,00	100,00	0,00	54	0	0,00	100,00	0,00	54	0	0,00	100,00	0,00
Pinnacle	C-Stem	279	1	0,36	99,64	0,32	279	1	0,36	99,64	0,54	279	0	0,00	100,00	0,00
Duraloc	Beznoska	273	3	1,10	98,90	0,98	273	1	0,37	99,63	0,55	273	2	0,73	99,27	1,00
Centrament	Centrament	84	1	1,19	98,81	1,06	84	1	1,19	98,81	1,79	84	1	1,19	98,81	1,63
Duraloc	C-Stem	326	4	1,23	98,77	1,09	326	1	0,31	99,69	0,46	326	4	1,23	98,77	1,68
Novae Evol.	Sagita Evol.	204	3	1,47	98,53	1,31	204	1	0,49	99,51	0,74	204	2	0,98	99,02	1,34
Trilogy	CPT	333	6	1,80	98,20	1,61	333	2	0,60	99,40	0,91	333	6	1,80	98,20	2,46
L-Cup	Bimetric (c)	189	4	2,12	97,88	1,89	189	1	0,53	99,47	0,80	189	4	2,12	97,88	2,89
Beznoska (uc)	Bimetric (c)	126	3	2,38	97,62	2,12	126	3	2,38	97,62	3,59	126	1	0,79	99,21	1,08
Plasmacup	Centrament	352	10	2,84	97,16	2,53	352	8	2,27	97,73	3,43	352	6	1,70	98,30	2,33
SF	Beznoska	201	6	2,99	97,01	2,66	201	1	0,50	99,50	0,75	201	5	2,49	97,51	3,40
Beznoska (uc)	Beznoska	580	18	3,10	96,90	2,77	580	15	2,59	97,41	3,90	580	6	1,03	98,97	1,41
Beznoska (uc)	CSC	146	7	4,79	95,21	4,27	146	4	2,74	97,26	4,13	146	6	4,11	95,89	5,62
Duraloc	Elite Plus	191	25	13,09	86,91	11,67	191	2	1,05	98,95	1,58	191	25	13,09	86,91	17,89
Duraloc	Ultima-H.II	53	8	15,09	84,91	13,45	53	2	3,77	96,23	5,69	53	8	15,09	84,91	20,63
Hybrids		**3602**	**99**	**2,75**	**97,25**	**1,53**	**3602**	**43**	**1,19**	**98,81**	**1,09**	**3602**	**76**	**2,11**	**97,89**	**1,66**
Whole database (n> 50)		**22157**	**399**	**1,80**	**98,20**	**1,00**	**22157**	**242**	**1,09**	**98,91**	**1,00**	**22157**	**281**	**1,27**	**98,73**	**1,00**

color	failure/component	RR [incl. SR, HR]
	zero or one failures	0
		(0,group mean]
		(group mean,10]
	<50 components	(10,100]
	group/grand mean values	
	highest number of components used (acet/fem, each 5)	
	having more than 2 or more failures	

n	number of components
e	number of failures
RR	revision rate
SR	survival rate
HR	hazard rate
c	cemented
uc	uncemented

Chart 67. Probability of survival of the uncemented and cemented Beznoska UAC/Beznoska CFS combination

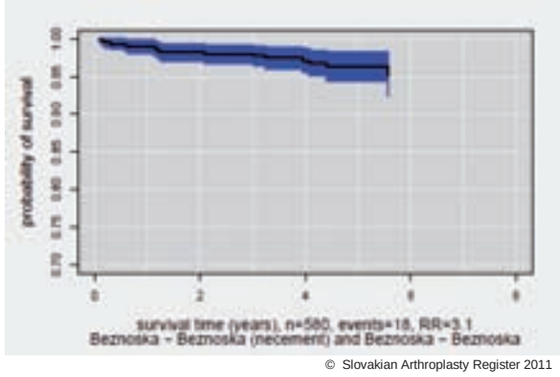


Chart 68. Probability of survival of the uncemented and cemented Plasmacup/Centrament combination

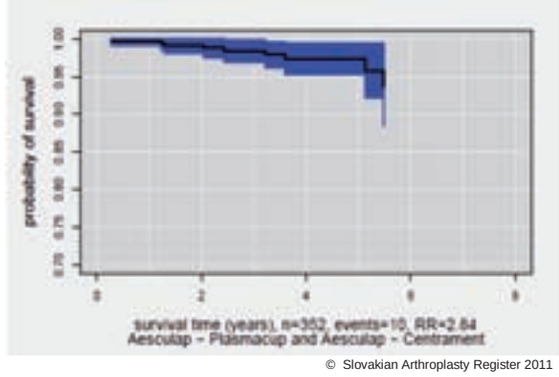


Chart 69. Probability of survival of the uncemented and cemented Trilogy/CPT combination

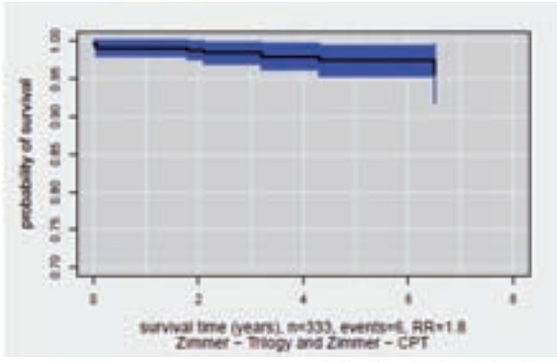


Chart 70. Probability of survival of the uncemented and cemented Duraloc/C-Stem combination

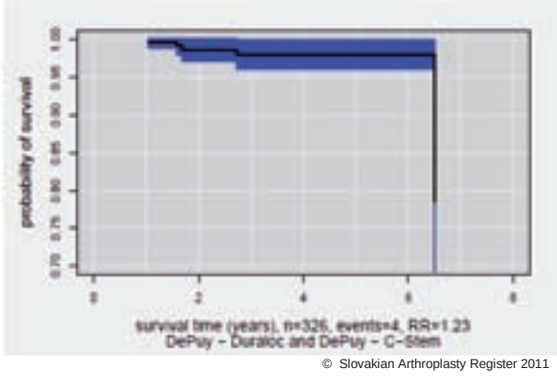
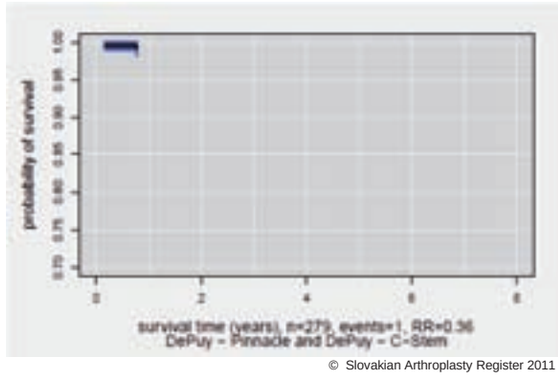


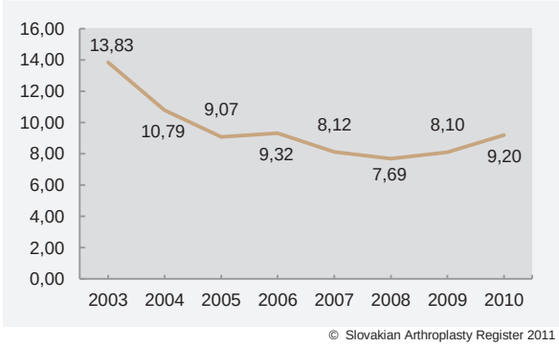
Chart 71. Probability of survival of the uncemented and cemented Pinnacle/C-Stem combination



Revision THA

The annual growth in revision THA, compared to 2009, was 71 cases, as shows Tab. 21. Compared to the primary THA, in the increase in revision THA was higher. The RR in 2010 reached value 9.20%. Chart 72 shows annual growth of RR.

Chart 72. Revision THA – revision rate

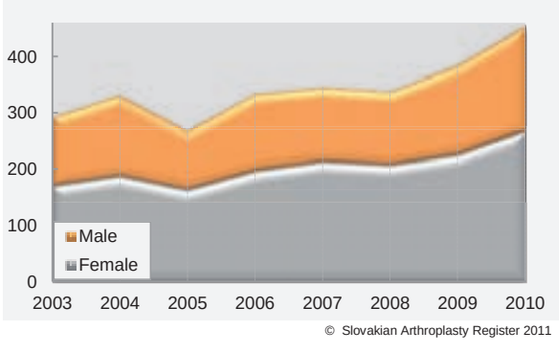


The gender ratio is shown Tab. 49 and Chart 73, remaining stable, with more revision procedures in women than men. In 2010, 58.86% of revision THAs were in women, virtually the amount as in 2003 (58.36%).

Tab. 49. Revision THA – gender distribution

Year	Female	Male
2003	171	122
2004	189	144
2005	164	106
2006	198	137
2007	214	132
2008	208	131
2009	226	160
2010	269	188

Chart 73. Revision THA – gender distribution



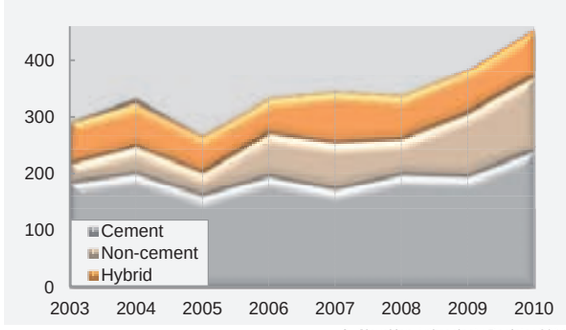
Types of fixations of primary THA

From 2005, there was observed an increase in the numbers of revisions of primary uncemented implants, but the slight increase of revisions of cemented implants was not significant. Tab. 50 and Chart 74 show the evolution of the types of primary fixations of revised THAs over the years.

Tab. 50. Revision THA – types of fixation of primary implants

Year	Cement	Non-cement	Hybrid	Not Identif.
2003	184	34	74	1
2004	201	48	78	6
2005	162	41	66	1
2006	196	76	62	1
2007	173	82	91	0
2008	199	63	77	0
2009	196	112	78	0
2010	242	131	84	0

Chart 74. Revision THA – types of primary fixation



In 2005, 60.00% of all revised implants were cemented, 15.19% were uncemented and 24.44% were hybrids. In contrast, in 2010, were 52.95% of all revised implants had been primarily cemented, 28.67% uncemented and 18.38% were hybrids.

Age groups

The biggest increase in revision THAs was observed in the age group less than 55, from 6.47% in 2003 to 12.69% in 2010. In the age group 55 to 64 the increase was from 14.33% to 23.64%. A reverse tendency was observed in the age group 65 to 74, where there was a decrease from 39.59% in 2003 to 39.39% in 2010.

Tab. 51. Revision THA – age groups

Year	15-19	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+
2003	0	0	0	3	2	0	6	8	17	25	53	63	60	42	14
2004	0	1	0	1	1	2	5	14	36	36	43	55	79	40	20
2005	0	0	1	2	1	1	5	11	20	32	33	50	76	27	11
2006	0	1	0	2	2	1	9	13	33	41	55	67	79	23	9
2007	1	0	0	3	4	5	11	23	33	45	56	69	64	27	5
2008	0	0	0	0	1	4	12	12	41	52	60	83	47	18	9
2009	0	0	0	0	5	6	12	33	58	47	76	58	64	19	8
2010	0	0	2	3	1	5	17	30	46	62	87	93	65	37	9

The biggest decrease was in the age group over 75, from 39.59% in 2003 to 24.29% in 2010. A detailed break-down of age groups of revision THA after years is shown in Tab. 51.

Reasons for the revision

Analyses of the reasons of revisions are complicated with the multiple-choice in the revision protocol, which means that each revision THA could potentially have more than one reason for revision. Therefore, the total number of reasons for revision doesn´t respect the total number of performed revision THAs. The most frequent reason for revision remains aseptic loosening of the acetabular and femoral components, but there is a reduced tendency for aseptic loosening of only the acetabular component from 31.37% in 2003 to 20.36% in 2010, and for aseptic loosening of only the femoral component from 24.61% in 2003 to 19.28% in 2010. The biggest increase – four times – was found in the dislocation of the THA. In 2003 dislocation was the reason for revision in 2.43% of all reasons and, in 2010, it was already 10.09%. A similar trend was observed for chronic infection from 2.27% in 2003 to 6.13% in 2010. The third most common reason with a significant increase was periprosthetic fracture, rising from from 3.47% in 2003 to 6.31% in 2010.

Chart 75. Revision THA – reasons for revision

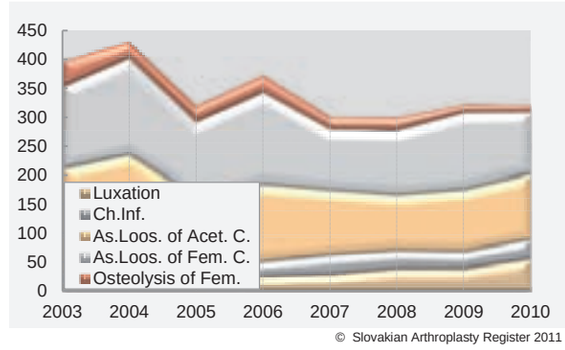


Chart 75 shows the five most frequent reasons for revision and Tab. 52 shows all reasons for revision year by year.

Tab. 52. Revision THA – reasons for revision

Year	Paraarticular Ossifications	Luxation	Polyethylene Wear	Early Infection	Chronic Infection	Acetabulary Protrusis	Aseptic Loosening of Both Components	Aseptic Loosening of Acetab. Component	Aseptic Loosening of Femoral Component	Osteolysis of Acetabulum	Osteolysis of Femur	Big Bone Defect of Acetabulum	Big Bone Defect of Femur	Periprosthesis Fracture	Fracture of Implant	Spacer to THA	Girdlestone to THA	Other
2003	5	14	8	6	16	28	0	181	142	39	45	14	5	20	39	0	0	15
2004	10	20	18	3	20	17	0	196	167	29	28	21	9	11	32	0	1	15
2005	4	19	12	1	12	17	0	130	132	31	28	14	5	13	16	0	0	22
2006	10	25	28	8	26	32	1	134	159	40	30	12	10	16	11	0	1	16
2007	12	28	14	6	34	20	39	113	105	13	22	6	6	24	18	0	1	5
2008	3	38	15	4	32	11	49	97	111	13	23	12	4	13	11	0	1	11
2009	4	38	28	3	30	22	52	108	133	13	14	13	5	12	19	0	1	13
2010	11	56	21	4	34	27	58	113	107	15	12	12	2	35	17	9	3	19

Revised elements of implants

Tab. 53. Revision THA – revised elements of implants

Year	Whole System	Acetabular Component	Femoral Component	Head	Inlay	Total Replacement of Bipolar Hemiarthropl.	Osteosynthesis	Girdlestone	Spacer	Other
2003	130	93	69	3	0	0	1	1	0	0
2004	141	93	77	8	2	1	0	12	0	0
2005	91	76	89	7	1	1	0	10	0	0
2006	136	79	92	14	8	0	0	16	0	0
2007	131	94	95	8	1	1	0	16	0	0
2008	120	86	102	7	0	1	1	21	0	1
2009	149	76	111	17	4	1	1	19	4	4
2010	165	94	123	29	4	1	1	22	17	1

The revision protocol has ten options for revised components. In comparison to 2003, the whole system was revised in 43.77% of all cases, in 2010 replacement of the whole system was undertaken in 36.11% of all revisions. A further decrease was observed in the revision of acetabular component alone, from 31.31% to 20.57% over the same period. On the other hand, revision of the femoral component was performed more often in 2010, rising from 23.61% of all cases in 2003 to 26.91% in 2010. Conversions of bipolar hemiarthroplasties and of ostheosyntheses were performed only six times during the whole observation period from 2003 to 2010. A small increase of conversion of Girdlestone excision arthroplasties was recorded. This reason for revision was only added to the protocol in 2008, so there are insufficient data for any attempt at interpretation.

Antibiotic prophylaxis in primary and revision THA

ATB brand	Vulmizolin	Axetine	Unasyn	Climicin	Bitamon	Amoksiklav	Ciphin	Zinacef	Cefalotin	Xorim	Kefzol	Edicin	Augmentin	Lendacín	Abaktal	Dalacin
Primary THA	2 633	829	325	281	143	149	79	64	51	54	68	5	48	52	32	35
Revision THA	268	42	26	28	4	3	13	1	0	2	2	45	0	2	1	5

Tab. 54. Revision THA – antibiotic prophylaxis in primary and revision THAs

In 2010, antibiotic prophylaxis was used in 99.82% of all primary THAs and in 98.69% of all revision THAs. Antibiotic prophylaxis is the standard in all units in Slovakia and the most-used types of antibiotics are cephalosporins. *Vulmizolin* was the most-used brand, administered in 53.06% of all primary THAs and in 59.42% of all revision THAs. The second mostly used brand of antibiotic was *Axetine*, in 16.70% of all primary THAs and in 9.31% of all revision THAs. Tab. 54 shows all those brands of antibiotics used in 2010 more than 50 times.

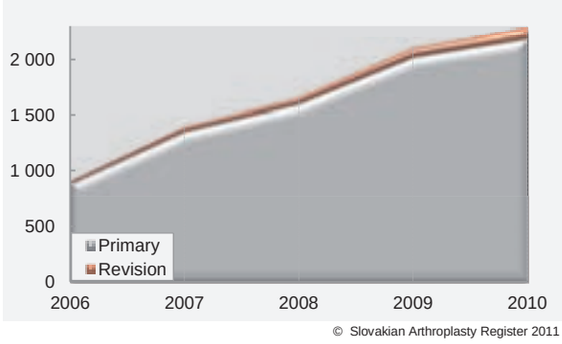
Primary TKA

The history of the TKA in Slovakia is shorter than that of THA. Probably the first clinically successful knee implant used was the anatomical knee implant *Walter-Motorlet*, which was introduced into the Czechoslovakian market in 1984. The first TKAs with this implant were performed in 1986. Only big units, mostly university or faculty departments, were performing this type of surgery. Thanks to good results of TKA during the eighties, more foreign knee implants were introduced to the Slovakian market. Not all units were contracted with health insurance companies to perform this type of surgery. The TKA register was officially launched on the 1st January 2006. Because of the short period of observation, from 2006 to 2010, the knee register did not reach five years until 1st the January 2011. The statistical method that SAR uses did not permit evaluations, in this report, according to the gender, type of fixation and age groups. These evaluations will be published for the first time in the 2011 report.

Tab. 55. No.of primary and revision TKAs

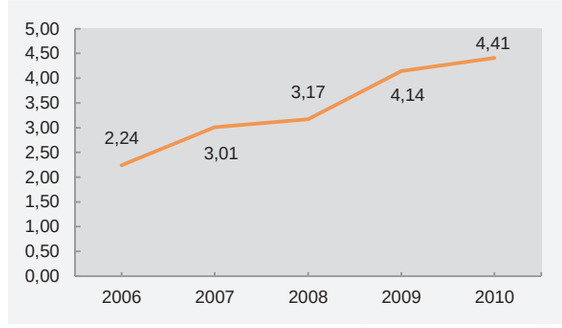
Year	Primary	Revision
2006	892	20
2007	1 364	41
2008	1 611	51
2009	2 028	84
2010	2 198	97

Chart 76. No. of primary and revision TKAs



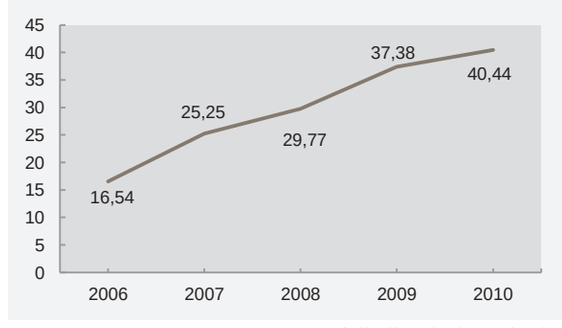
The growth of TKAs is shown in Tab. 55 and Chart 76. In 2010, 28 units performed 2,198 primary and 97 revision knee arthroplasties. In 2006, 97.81% were primary and only 2.19% were revision arthroplasties. In 2010 primary TKAs accounted for 95.77% and revision TKA increased to 4.23%. The number of primary TKAs was 2.5 times more than in 2004, but revision TKA was 4.9 times more than in 2006.

Chart 77. Primary TKA – revision rate



In 2010, the RR was almost twice as high as in 2006, increasing from 2.21% to 4.41%.

Chart 78. Primary TKA – incidence



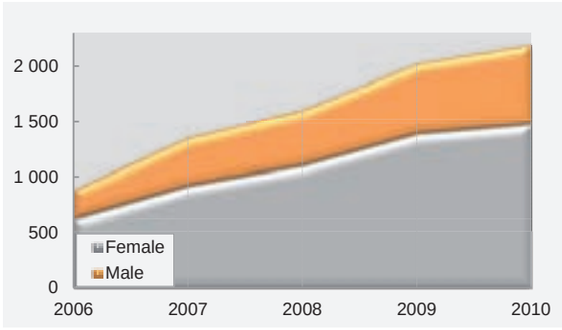
The incidence of primary TKA grow by 144% and in 2010 reached 40.44 per 100,000 inhabitants, as shown in Chart 78.

Tab. 56. Primary TKA – gender distribution

Year	Female	Male
2006	627	265
2007	921	443
2008	1 107	504
2009	1 393	635
2010	1 481	717

In Tab. 56 and Chart 79, it is possible to observe gender distribution of patients with the TKA. In 2006 it was 70.29% females to 29.71% males, the ratio being 2.3:1. In 2010, the number of male patients increased to 32.62% of all patients and the female/male ratio reached 2.1:1.

Chart 79. Primary TKA – gender distribution



The percentage increase in primary TKA was 146.41% compared to the 2006. The increase was much higher for revision TKA reaching 385.00% compared with 2006. Annual growth in revision TKA was 15.47%, very is similar to the annual growth in revision THA, which was 13.86**%**. The increase in the numbers of revision TKAs has led to an increase of RR, which reached 4.41% in 2010, but still it is half that of the RR of primary THA (9.20).

Age groups

Tab. 57. Primary TKA – age groups

Year	-15	15-19	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+
2006	0	0	0	0	0	2	1	11	24	93	152	206	183	167	46	7
2007	0	1	0	0	2	7	10	8	65	128	212	305	333	212	70	11
2008	1	1	1	2	5	5	7	23	74	179	297	391	339	228	52	6
2009	0	0	3	1	2	4	11	29	124	272	357	539	359	273	43	11
2010	1	2	0	5	0	9	7	38	139	281	437	510	426	282	55	6

The situation in the distribution of TKAs among the age groups is different from THAs as in Tab. 57. Apart from the age groups 25–29 and 35–39, in which there were only five (0.23%) and nine (0.41%) respectively, the whole group less than 50 years of age grew from 4.25% of all TKAs in 2006 to 9.11% in 2010. The main growth was observed in the age group 55–64, in which, compared to 2006, the share rose from 27.47% to 32.66% in 2010. There was a decrease in the age group 65 to 74 from 43.61% in 2006 to 42.58% in 2010. The most significant decrease was observed in the age group more than 75 years, from 24.66% to 15.60%. The explanation for this decrease could be that TKAs are being performed in younger age groups, similar to the trend in THAs. A similar trend is not expected in 2011.

Diagnoses

Tab. 58. Primary TKA – indicative diagnoses

Year	Primary Mono-condylar Arthrosis	Primary Bicondy-lar Arthrosis	Posttraumatic Arthrosis	Aseptic Necrosis	Rheumatoid Arthritis	Other
2006	52	762	29	5	26	3
2007	76	1 152	80	7	30	12
2008	77	1 374	91	8	49	9
2009	116	1 788	71	7	33	8
2010	190	1 879	73	4	31	20

The main diagnosis for primary TKA is still primary bicondylar degenerative joint disease (DJD) of the knee. There are six diagnostic options in the primary TKA protocol and the primary bicondylar DJD accounted for a share of 85.53% in 2010. In comparison to the 2006, there was no significant shift, the share for this diagnosis being 86.89% in 2010. The biggest increase was recorded in primary monocondylar DJD, where the increase was from 5.93% in 2006 to 8.65% in 2010 observed. The second most common diagnosis, posttraumatic DJD reached a share of 3.32%, only 0.01% more than in 2006. Rheumatoid arthritis accounted for only 1.41% and unidentified diagnosis was only 0.91% of all recorded TKAs in 2010, as in Tab. 58. Of interest is the increase in the diagnosis monocondylar DJD, despite a very low number of knee hemiartroplasties used generally in Slovakia.

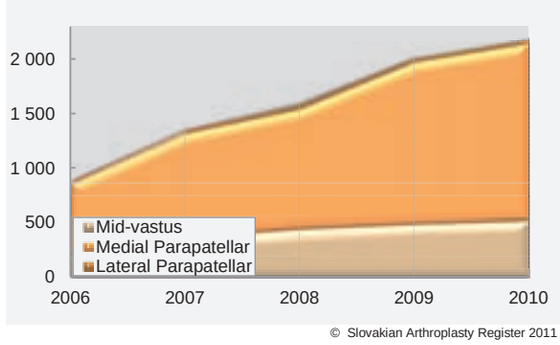
Surgical approaches

Tab. 59. Primary TKA – surgical approaches

Year	Mid-vastus	Medial Parapatellar	Lateral Parapatellar	Subvastus	Tubercle Osteotomy	Other	Not. Identif
2006	195	668	4	9	1	0	15
2007	364	964	18	7	3	1	7
2008	444	1 105	30	25	0	4	3
2009	492	1 489	19	12	0	11	5
2010	521	1 632	28	14	1	1	1

Two of the approaches, medial parapatellar and mid-vastus, were predominant with a combined share of 97.95% of all approaches used for primary TKA. There was a decrease of only 0.64% of medial parapatellar approach compared to 2006. The use of the mid-vastus approach increased slightly from 21.86% in 2006 to 23.70% in 2010. The biggest increase was observed in the lateral parapatellar approach, from 0.45% to 1.27%. This increase is demonstrated in Chart 80.

Chart 80. Primary TKA – surgical approaches



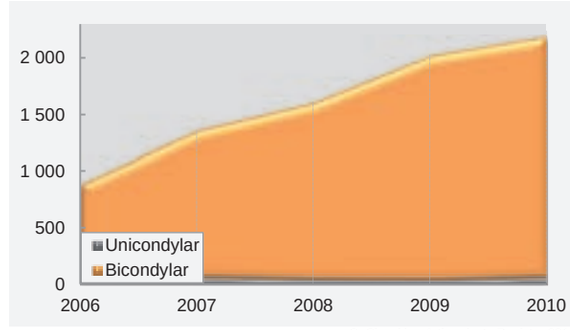
Types of implants used

Tab. 60. Primary TKA – types of implants used

Year	Unicondylar	Bicondylar
2006	29	863
2007	59	1 305
2008	41	1 570
2009	35	1 993
2010	60	2 138

Tab. 60 and Chart 81 show the types of implants used. The commonest were bicondylar implants, used in 2010 in 97.27% of cases in 2010, compared to 96.75% in 2006. Hemiarthroplasty of the knee was used in 60 cases, only 2.72%. There was a significant decrease, compared to 2006, when the share of hemiarthroplasty was 3.25%. The conclusion is that the decrease in hemiarthroplasty and the increase in the indicative diagnosis the monocondylar DJD of the knee are connected and the majority of these patients have received bicondylar TKAs.

Chart 81. Primary TKA – types of implants used



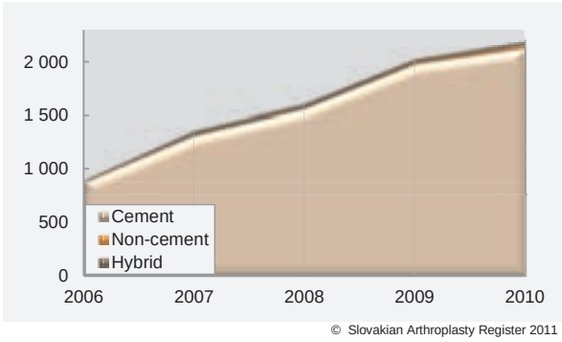
Types of the fixation

Tab. 61. Primary TKA – types of the fixation

	Cement	Non-cement	Hybrid
2006	878	4	10
2007	1 319	10	35
2008	1 565	5	41
2009	1 980	18	30
2010	2 133	30	35

A similar situation exists in the type of fixation. In 97.04% of all TKAs, bone cement was used for fixation of both components. This represents a slight decrease compared with 2006 when cement fixation was used in 98.43%. There has been a small increase in uncemented and hybrid types of fixation. In 2006, uncemented fixation was used in only four patients (0.45%), whereas in 2010 it was used in 30 patients (1.36% of all cases). There was an increase in hybrid fixation from 1.12% in 2006 to 1.59% in 2010. Tab. 61 and Chart 82 show the evolution of the type of fixation over the years. The observed increase in uncemented and hybrid TKAs over the whole period 2006–2010 resulted in a combined share for these two types of fixations of only 2.95% of all TKAs.

Chart 82. Primary TKA – types of the fixation



Brands of implants

Knee implants can not be combined as can hip joint implants. The problem with knee implants is that under the same implant name can be CR, PS and sometimes CCK variants of the implant. To increase the complexity, the tibial component could be fixed or mobile. The SAR inventory of the knee implants was completed during 2010 and all brands with possible different models and types of tibial components are in Tab. 63. Only an ITS could solve this problem. All implants are ranked according to the numbers of components used in 2010. From 2006, the *PFC Sigma* (*DePuy*) dominated the Slovakian market and in 2010 this implant reached 35.21% of all used TKAs. For long term follow-up, there is difficulty distinguishing between the variants of this implant, before the introduction of the ITS. Under the brand *PFC Sigma,* with a share of 32.83%, are probably both CR and PS variants and under the *PFC Sigma RP* brand*,* with a 1.85% share are the CR rotating implants *PFC Sigma CR-RP* and also PS rotating implants *PFC Sigma PS-RP.* Under the brand name *PFC Sigma Revision,* with only a 0.45% share of all implants could also be PS and CCK variants. Only the model *PFC Sigma ALL POLY* a CR model, is clearly, uniquely distinguishable. The only possible solution is a clear identifier, namely the bar code of the implant. For the knee implants, identification using the ITS is essential. In Tab. 62 the brands of implants are divided into four groups according to the percentage share of all implanted TKAs. Two implants from group one reached 45.36% and of the four implants within the group, two accounted for 72.38%. Nineteen brands from group four – each under 1.00% of all implants – reached a combined share of only 5.51% of all implants in 2010.

Tab. 62. Primary TKA – ranking of the implants

Name	n	%
PFC SIGMA	722	32,85%
COLUMBUS	275	12,51%
NEX-GEN CR	162	7,37%
AGC - universal knee	153	6,96%
NEX-GEN LPS	140	6,37%
MC2	139	6,32%
SVL	108	4,91%
MULTIGEN PLUS - CR - fix.	104	4,73%
SCORPIO NRG	82	3,73%
PFC SIGMA RP	40	1,82%
ROCC	35	1,59%
E-MOTION	33	1,50%
SVL/RP	31	1,41%
LSC	26	1,18%
SOLUTION EPP	22	1,00%
MULTIGEN PLUS - CR	18	0,82%
SLED PROSTHESIS	17	0,77%
MULTIGEN PLUS - PS - fix.	15	0,68%
ENDO-MODELL	10	0,45%
PFC SIGMA REVISION	10	0,45%
MULTIGEN PLUS - CR - rot.	9	0,41%
UNI Oxford-hemiarthroplasty	8	0,36%
EPP PIVOT	6	0,27%
NEX-GEN LCCK	6	0,27%
GEMINI	5	0,23%
ROTASURF	4	0,18%
SVS	4	0,18%
CMS - hinge	2	0,09%
PFC SIGMA ALL POLY	2	0,09%
AMK	1	0,05%
BEZNOSKA - tumor	1	0,05%
MULTIGEN PLUS - PS - rot.	1	0,05%
NEX-GEN RHK	1	0,05%
PRESERVATION UNI	1	0,05%
Total	2 193	99,77%

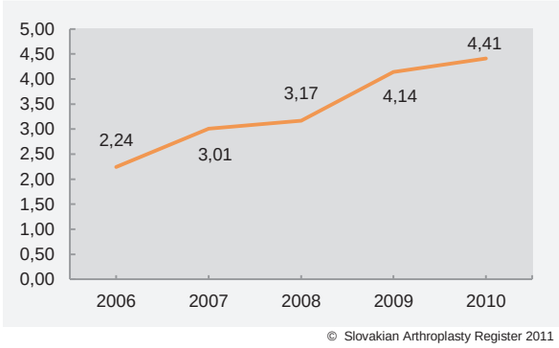
Tab. 63. Primary TKA – implants according to the manufacturers, model and type of fixation

	Implantat	Cemented	Hybrid	Uncemented	Revision	Other
Lima	Multigen Plus Biolox Delta Multigen Plus-CR-Fix Multigen Plus-CR-Rot Multigen Plus-PS-Fix Multigen Plus-PS-Rot Multigen Plus-CCK Multigen Plus-H	CR PS CR-ROT PS-ROT	CR PS CR-ROT PS-ROT	CR PS CR-ROT PS-ROT	CCK Hinged	Ceramic-CR,ALL-Poly
Zimmer	Nex-Gen CR Nex-Gen PS Nex-Gen LCCK Nex Gen RHK Nex Gen Segmental	CR PS PS-ROT	CR PS PS-ROT		CCK Hinged Segmental	Gender CR Gender PS High Flex CR High Flex PS
DePuy	AMK PFC Sigma PFC Sigma RP PFC Sigma ALL Poly PFC Sigma Revision MBT/C3 Sigma Revision Stab.Plus Preservation-Uni LCS S-ROM Noil Hinged Knee	CR PS PS-ROT PS-High Flex	CR PS PS-ROT PS-High Flex	CR PS PS-ROT PS-High Flex	CCK Hinged	All-poly tibia High Flex
Biomet	AGC TMK-ROT Uni Oxford ROCC	CR PS ROT	CR			
Serf	Rotasurf C2F Implants	CR-ROT	CR-ROT	CR-ROT	Hinged	
Beznoska	SVL SVL/RP SVS SVR-Revizne CMS	CR PS CR-ROT PS-ROT			CCK Hinged Individual-R Individual-Tumor	
Aesculap	Search Evolution Columbus E-Motion	CR PS CR-ROT PS-ROT	CR PS CR-ROT PS-ROT	CR PS CR-ROT PS-ROT	CCK Hinged	
W-Link	Endo-Modell Sled Prosthesis Gemini	CR PS CR-ROT	CR PS CR-ROT	CR PS CR-ROT	CCK Hinged Individual-R Individual-Tumor	
W-M - Medin	WM Universal WM modular Medin Ortopaedic	CR,PS				
Stryker	Scorpio NRG Scorpio TS					
Endoplant	EPP Pivot Solution EPP	CR PS CR-ROT PS-ROT				
Ceraver		PS PS-ROT				

Revision TKA

Of the 28 Slovakian units performing primary TKA in 2010, only 16 units performed at least one revision TKA, and only five units performed more than 10 revision TKAs. These five units performed 78.35% of all revisions. The RR of primary TKAs reached a 2010 value 4.41%, an increase of 96.87% compared to 2006. Chart 26 shows the evolution of the RR.

Chart 83. Revision TKA – revision rate



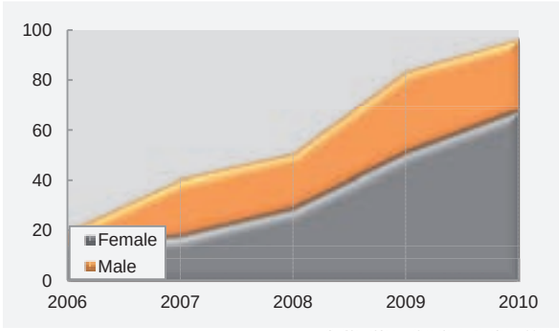
The gender distribution of revised patients is different from that for THA. In 2006 females accounted for 70.00% and in 2010 it was 70.10% of all revised patients.

Tab. 64. Revision TKA – gender distribution

Year	Female	Male
2006	14	6
2007	18	23
2008	29	22
2009	51	33
2010	68	29

During the whole period of observation, 2006–2010, the ration of genders was not stable, but two thirds of all revised patients were female.

Chart 84. Revision TKA – gender distribution



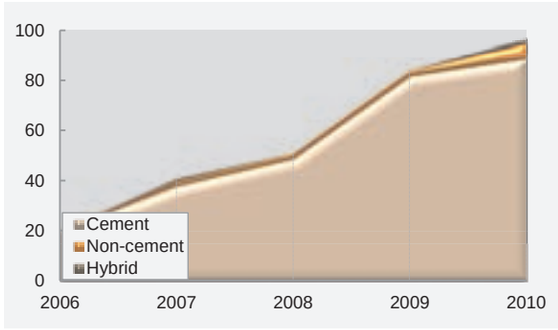
Types of fixation of revised TKAs

In 2006, all revisions were performed on cemented primary TKAs. Due to the increase in uncemented and hybrid types of fixation in 2010, 91.75% of all performed revisions were performed on cemented primary TKAs, 6.18% on uncemented and 2.06% on hybrids. Tab. 65 and Chart 69 show the types of fixation of revised TKAs.

Tab. 65. Revision TKA – types of fixation of revised TKAs

Year	Cement	Non-cement	Hybrid
2006	20	0	0
2007	38	2	1
2008	49	2	0
2009	82	2	0
2010	89	6	2

Chart 85. Revision TKA – types of fixation of revised TKAs



Age groups

In 2006, the age group less than 55 years constituted 10.00% of all revised patients. The age groups 55–64 was 60.00% and the age groups 65–75 and over 75 each accounted for 15.00% of all revised patients. The situation in 2010 was different, insomuch as 6.10% of revision TKAs were under 55 and the age group 55–64 represented 37.11%, the age group 65–74 39.17% and over 75 17.52% of all revised patients. In 2010, the distribution through the age groups was more equal and the middle age groups are more presented. Tab. 66 presents the age group distribution. Due to low numbers of cases, any attempt at interpretation would speculative.

Tab. 66. Revision TKA – age groups

Year	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84
2006	0	1	3	9	2	1	3	0
2007	1	1	4	14	10	8	3	0
2008	1	0	9	5	12	12	9	2
2009	3	4	10	20	18	16	11	1
2010	3	2	12	24	27	11	13	4

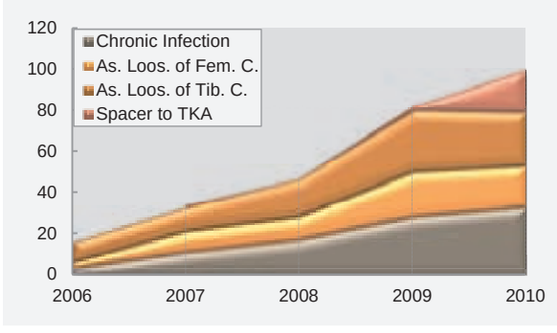
Reasons for the revision

The revision TKA protocol has the same features as the THA protocol. There is a multiple choice option for the diagnoses leading to revision and total number of diagnoses doesn´t correspond to the total number of revisions. The most common reason for the revision in 2010 was chronic infection, constituting 25.78% of all diagnoses. By contrast, acute infection was the diagnosis in 2.34%. Aseptic loosening of femoral component was mentioned in 15.62% of all cases and aseptic loosening of tibial component in 20.31% of all diagnoses. Chart 70 shows four most common reasons for revision TKA. During 2009, a new reason for revision – conversion from spacer to TKA – was introduced. In 2010 this reason achieved 16.40%. Two-step revision is clearly method of choice in a growing number of units.

Tab. 67. Revision TKA – reasons for revision

Year	Early Infection	Chronic Infection	Aseptic Loosening of Femoral Component	Aseptic Loosening of Tibial Component	Aseptic Loosening of Patellar Component	Patellar Pain	Periprosthesis Fracture	Colateral Ligaments Instability	Instability of PCL	Luxation	Polyethylene Wear	Fracture of Implant	Stifness	Malposition	Knee Pain Without Loosening	Spacer to TKA	Other
2006	4	3	3	10	1	0	1	2	0	0	1	1	0	1	1	0	0
2007	4	11	10	12	1	2	1	7	1	1	2	0	2	1	3	1	3
2008	6	17	11	19	0	0	1	1	1	1	3	1	3	1	1	0	6
2009	7	28	22	30	1	0	0	3	2	1	3	4	1	1	2	2	4
2010	3	33	20	26	0	4	1	2	1	0	3	5	1	1	3	21	4

Chart 86. Revision TKA – reasons for revision



Revised elements implants

Tab. 68. Revision TKA – revised elements of implants

Year	Soft Tissue Revision	Whole System	Femoral Component	Tibial Component	Patella	Inlay	Explantation	Spacer	Other
2006	1	14	0	1	0	1	3	0	0
2007	2	24	1	2	0	5	4	1	2
2008	3	33	0	4	1	1	5	3	0
2009	0	51	1	5	0	4	2	19	0
2010	2	63	2	4	1	6	0	16	1

In revision TKA the implants and their components are considered – this additionally includes the soft tissues, hence the use of the wider term “elements”. Revision protocol has nine options for the revised elements. In 2010, the whole system was revised in 66.31% of all revisions. Isolated revision of femoral component was undertaken in only two patients (2.06%) and isolated revision of the tibial component was in only four patients (4.21% of all cases). An insert was exchanged in four patients, also 4.21%. Two-staged revision – conversion from spacer to TKA – was performed in 16.84%.In comparison, whole system revision in 2006 represented two thirds of all revisions (70.00%) and the decrease was minimal.

Antibiotic prophylaxis in primary and revision TKA

Tab. 69. Antibiotic prophylaxis in primary and revision TKAs

ATB brand	Vulmizolin	Axetine	Unasyn	Climicin	Bitamon	Amoksi-klav	Ciphin	Zinacef	Cefalotin	Xorim	Kefzol	Edicin	Augmentin	Lendacín	Abaktal	Dalacin
Primary TKA	1 145	440	167	138	88	26	17	36	37	30	0	2	9	0	17	10
Revision TKA	47	5	6	5	8	0	0	0	0	0	0	11	1	0	1	0

In 2010, antibiotic prophylaxis was used in 99.86% of primary TKAs and paradoxically only in 96.90% of revision TKAs. *Vulmizolin* was the most-used brand of antibiotic and was administered in 52.16% of all primary TKAs. The second commonest was *Axetine* in 20.04% of all cases. In the revision TKA *Vulmizolin* was also the most-used brand of antibiotic (50.00% of all cases). The second commonest was *Edicin* in 11.70% of all cases.

Glossary

Arthroplasty – surgical exchange of all or part of any joint of human body with an artificial joint replacement

Bipolar hemiarthroplasty – partial joint replacement with head-neck articulation

CAC – cemented acetabular cup

CCEP – cervicocapital endoprosthesis

CCK (condylar constrained knee) – total knee joint replacement with increased constrain

Censoring time – time point when the follow-up is terminated (here December 31st, 2010); implant/component was censored if it did not fail by this time point

CFS – cemented femoral stem

Cohort – group having one or more similar characteristics and monitored during the study period

Component – part of the implant

CR implant (cruciate retaining) – total knee joint replacement allowing retention of the posterior cruciate ligament

Crude (specific) incidence (implant-time or component-time incidence) – the ratio of the number of new revisions divided by total time-at-risk (sum of all component-years/implant-years) throughout the follow up period

Cumulative revision rate (CRR) – rate of revised implants/components divided by total number of implants/components × 100, calculated for following time periods: 2003, 2003–2004, 2003–2010

Demographic analysis – methods for observing and interpreting the state and movement of a population

Demographic characteristics – numerical characteristics of the state and movement of a population

Empirical survival function – rate of surviving implants/components and total number of implants/components, where censored observations are calculated as failures

Expected value (mean) – weighted arithmetic average of all possible values of a random variable; its estimate is called arithmetic average and is calculated from a random sample

Hazard Rate (HR) – rate of RR (q.v.) of any component (component combination or group of components) and RR of a reference group, where the reference group is always the group hierarchically superior to it, e.g. for acetabular and femoral components, the whole database

Hemiartroplasty – partial joint replacement

Significance level – the probability, fixed ahead of testing of statistical hypotheses; upper boundary of null hypothesis rejection (e.g., equal to 0.05 or 0.1)

Hinge implant – total knee joint replacement with constrained hinge articulation

Implant – any surgically implanted device: here a joint replacement component, or components of the hip, or knee

Implant-year, or component-year – time interval when implant/component had been at risk (of revision); it is number of days from primary operation to the first revision, death or termination of the study divided by 365.25

Incidence THA/TKA – the frequency of primary THP/TKA per 100,000 inhabitants with which new revisions appear within a particular time period

Kaplan-Meier survival curve – non-increasing step function of probability of survival, with jumps in observed event times; its length is positively correlated with the length of time-intervals to failure, or censorship

Median survival – the time at which half of the implants/components fail

Mean age – weighted arithmetic average of number of years of a random sample survived up to a time point

Mean survival – generalized mean for censored data; the volume under the K-M survival curve calculated using survived, censored and failed observations

Monocondylar knee replacement – hemiarthroplasty of the knee joint

Null hypothesis – the statement in the form of a hypothesis about the equality of an unknown parameter and some constant, the validity of which is tested by statistical testing; in our case, the parameter is the difference of expected (mean) survival times of two groups and the constant is zero; we are testing if the difference of expected survival times is equal to zero

P-value – minimal significance level at which the null hypothesis can be rejected; if p-value is smaller than significance level the null hypothesis is rejected; smaller p-value refers to a greater evidence about null hypothesis rejection

Population – is a set of organisms in which any pair of members can breed together. This implies that all members belong to the same species.

Population prognosis – a scientific calculation of how many people, in which age and gender structure, will be living in a country, or in a town, at some point in the future

Probability of survival – empirical probability of survival at time *t* adjusted for censoring; ratio of survived implants/components at time *t* and number of implants/components at risk in an infinitely small time period before time *t*, where the number of survived implants/components at time *t* is equal to the difference of number of implants/components at risk in an infinitely small time period before time *t* and the number of failed implants/components in an infinitely small time period before time *t*

Prevalency – see **Revision Rate**

Primary implantation – first surgical procedure when total- or hemi-artroplasty was implanted

PS implant (posterior stabilised) – total knee joint replacement with sacrificing the posterior cruciate ligament PCL

Rate – is a ratio that compares two quantities of different units in the time.

Revision Rate (RR) – rate of revision surgery in a defined follow up period – number of revisions divided by total number of primary arthroplasties included in the evaluation sample × 100

Revision Burden (RB) – ratio between primary and revision surgery – the number of revisions in a time period divided by the number of all arthroplasties (primary and revision) in the same period

Revision surgery of soft tissue – any surgery after the primary implantation where only soft tissues are revised

Standardisation – technique of adjustment for confounding variables, e.g., age, sex, etc.

Survival Rate (SR) – rate of survived components at a defined follow up time – the number of survived components divided by the total number of primary arthroplasties included in the sample ×100, *SR = 100 – RR*

Testing of statistical hypotheses – testing of the validity of a null hypothesis, where this hypothesis is rejected, or not; if the null hypothesis is not rejected, there is not enough statistical evidence in the data for rejection

THA – total hip arthroplasty

TKA – total knee arthroplasty

Total implant-time, or component-time – sum of all implant-times, or component-times (implant-years, or component-years) characterising total follow-up time; the number of implants /components with a follow-up time equal to one year (the unit of implant-years, or component-years)

UAC – uncemented acetabular cup

UFS – uncemented femoral stem

95% confidence interval (CI) for mean survival time – expected value of mean survival time of implant/component group fails to this interval with 95% confidence

95% CI for K-M survival curve – expected K-M curve of implant/component group fails to this interval with 95% confidence