REPORT of R.I.P.O.

Regional Register of Orthopaedic Prosthetic Implantology

OVERALL DATA

HIP, KNEE AND SHOULDER ARTHROPLASTY

IN EMILIA-ROMAGNA REGION (ITALY)

2000-2017

VERSION 1, 22nd JULY 2019

SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA

Foreword

During 2017, with Regional Law n.9 of 1st June 2017, RIPO was recognized as a significant regional interest Register, with the aim of guaranteeing an active and systematic collection of health and epidemiological data.
According to these aims, we are now presenting the 17th report, elaborated by the Register of Orthopaedic Prosthetic Implantology (RIPO). It presents the most significant results of the descriptive and survival statistical analyses performed on hip, knee and shoulder arthroplasty surgeries carried out in the Emilia-Romagna region, in Italy, **between 1st January 2000 and 31st December 2017**.
The aim of this report is the presentation of the overall regional data:

- for the hip, total arthroplasty, hemiarthroplasty, resurfacing, revision and removal operations;
- for the knee, uni-, bi- and tricompartmental arthroplasty, revision and removal operations;
- - for the shoulder (since July 2008), anatomical and reverse arthroplasty, resurfacing, partial, revision and removal operations.

Altogether data of approx. 175.000 hip, 105.000 knee and 6.700 shoulder prostheses have been reported from 69 Orthopaedic Units in 62 Hospitals, either public or private.

As in the past, data from the orthopaedic wards were provided on paper forms. Registry staff transferred the data electronically to the databank run by CINECA (Interuniversity Consortium of North-East Italy), which was responsible for computer management and security aspects of the data. Statistical analysis was performed by Registry statistics staff.
The RIPO representatives of each surgical unit actively cooperated in fulfilling the aims by providing clarification and integration of the data transferred, when necessary.
The dissemination of the results of the statistical analysis is carried out through this report that is made available on the web (https://ripo.cineca.it), through scientific publications and through ad hoc reports required by surgeons and health departments. In addition to this, the authorized parties (responsible of Units and Health Management) have access to a system of self-made on-line analysis.

Objectives of the Register

The Register has some fundamental objectives:

- to determine the demographic characteristics and the diagnostic categories of the patients who have undergone replacement surgery;
- to gather detailed information on the use of the different prostheses used in primary and revision surgery;
- to assess the effectiveness of the different types of prostheses;
- to supply orthopaedic surgeons with a very useful tool to give the patient timely information;
- to collaborate in a post-marketing surveillance, allowing surgeons to easily identify patients implanted with a re-called implant; in particular, during 2016, a post-marketing surveillance of Metal-on-Metal hip prostheses was set up in Emilia Romagna Region;
- to compare the regional situation with other national and international situations with this aim; the present edition was designed to facilitate a comparison with the data presented by the Swedish and Australian registers, which were the models that inspired the RIPO analysis;
- to inform the Regional Orthopaedic Commission about those implants that show an abnormal failure rate;
- -to answer to questions coming from the Regional Orthopaedic Commission or from other National or European Institutions.

Methodological notes

As for last year, descriptive analyses are done on all cases, while survival analyses are performed, only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients.
Therefore, all survival analyses presented in this report are based on primary operations in patients resident in Emilia-Romagna region and on revisions of same prostheses, wherever performed.
It is not always possible to known reasons for revision if they are carried out outside the region.

As for last year, the validity of the data reported in the present report is based on the **complete** adhesion to the register and degree of **reliability** of the information given.
The assessment of the **completeness** is made by comparison with the data from the Hospital Discharge database; in the last year the Register has 'captured' 98% of hip, knee and shoulder operations. Through merging with other data-base, has been repeatedly request missing data. So the final results was been postponed for chase the desired completeness.
During 2017, missing data about arthroplasty interventions of past years were requested, in particular for a possible revision. Nevertheless, for this report, not all missing data requested were received. For this, we have an uncertainty about final analysis, equal or lower than other registers.
The continuos updating of Registry implies therefore a few past years data-entry.

As far as concerns the **reliability** of the data given, RIPO handles two types of data: incontrovertible data, that RIPO checks by comparison with other data banks (labels of the components implanted, demographic data of the patients, dates of admission, any date of death), and not verifiable data such as disease that led to replacement or revision or the complications that arose during hospitalization. Reliability is checked by sampling the data, by asking for confirmation of some information.

Explanatory guide for the survival analysis

The survival of the prosthesis is illustrated by tables and graphs.
The **survival curves** are calculated only on patients living in Emilia-Romagna region; on the x-axis is the time expressed in years, on the y-axis the percentage of survival of the prosthesis. The curve starts, by definition, at 100% survival at the moment where the period of follow-up begins. The prosthesis is considered to be 'surviving' up to when it was necessary to replace even a single component.
The revision is, thus, the end-point. Each curve is flanked by a pair of curves symmetrical to it that are the 95% Confidence Interval, which delimits the interval of values where at 95% the possibility falls that a patient with prosthesis in place is found. The range of the interval is closely dependent on the number of operations considered in the analysis. If the number of operations is low, the uncertainty of the analysis is high, which is shown by a wide confidence interval.
Each graph is preceded by a table showing the number of prostheses considered and the number of failed prostheses.
The survival curves are preceded by the **multivariate analysis** performed according to the **Cox** method.
This analysis enables us to check what, if any, independent variables among them may influence the event, in our case the removal of at least one prosthetic component.
In the report both complete hip, knee and shoulder prostheses and single components were compared, if there was a sufficient number of implants (at least 300 cases). The comparison tables show the number of implants and survival rate at 5 and 10 years.

Summary of the main results presented

Hip

During 2017, data on 8.237 primary THA, 31 resurfacing, 2.300 hemiarthroplasty (also with acetabular buffer) and 854 partial or total revision were registered.
Compared to past years, the THA are slightly increasing (+572 casi) while the resurfacing are slightly decreasing (-90 casi) the latter are implanted in three private structures only. The revisions are decreasing too (-40 casi).

During 2017 primary THA was performed to treat pathologies well known, following a distribution percentage unchanged over the years except for a slightly decrease of implants in developmental dysplasia and an slight increase in primary coxarthrosis.
Mean age at surgery is stable (70 yrs for women and 66 yrs for men).

In 2017, as in past years, 100 different types of cup and stem were used, a lot of them are 'new', not implanted in previous year. 22% of the stems had a modular neck, slightly decreasing compared to past years (the highest was 42% in 2011). In progressive and constant increasing the use of double mobility cups (6,6% of primary THA).
Uncemented prostheses were 62% in year 2000 and 96% in year 2017, whilst hybrid fixation was 22% and it is now 2.9%.
The implant of completely cemented prostheses is virtually abandoned decreasing to 0,3% (compared to 15% in past years).

Most common articular coupling is ceramic on ceramic and is preferred ceramic composite (alumina and zirconia) to pure ceramic. Crosslinked Poly is preferred to Standard Poly (10% of cases).

The survival of the hip prostheses is confirmed at very high levels, 89,1% of prostheses implanted in Emilia-Romagna region on resident patients are still in place 17 years after the operation.
Part (74%) of 3.814 revisions is major revisions, where at least one component interfacing with bone, has been revised. The remaining are minor revisions (liner, head, and modular neck).
Revision carried out outside Emilia-Romagna region was considered apart because causes of failure are not always known.
High incidence of prosthesis breakage was observed among causes of failure; this phenomenon, lower than the result of other international registries is partially related to the extensive use of ceramic components and of exchangeable necks.
In all analyses, met-met articular couplings whatever head diameter were included. For large diameter met-met (> 32 mm), with officer regional decree, a specific monitoring procedures have been initiated of all patients.

Partially confirming past years results, multivariate analysis demonstrated that survival is lower for males (1,2 than females) and young patients. Survival is influenced also from diagnosis: is greater if implant was done to treat rare pathology and for femoral fracture or his sequelae and septic coxitis sequelae.
At maximum 17 years of follow up failure seems not to be affected by fixation and articular coupling, but these two variables cannot be introduced in the Cox multivariate analysis, as they are not independent from other variables, such as age at surgery. Survival curves for fixation and coupling are traced without adjusting.

Multivariate analysis demonstrated that survival is higher for types of prostheses more frequently implanted compare to less implante ones.

Survival of resurfacing, at 14 years, is slightly lower than THA (86,7%, statistically significant). This datum is affected by the recall of a particular model of prostheses, the ASR Depuy.
Total revisions are not revised the second time in 81,8% of cases at 17 yrs.

Hemiarthroplasty has an optimal survival of the implant (94,5% at 17 yrs) even if the data is greatly influenced by a high rate of patient's deaths due to age and general conditions of the patients.

Knee

During 2017, data on 7.400 primary knee prostheses and 540 partial or total revision were registered. High percentage of primary knee prostheses is implanted in private structures (66% in 2017 vs 43% in 2000).

In 2017, 13% of implanted prostheses are unicompartmental, 61% are bicompartmental with no patella resurfacing and the remaining 26% have patella resurfacing. The number of prostheses with patella are increasing, in particular in public hospital. Female patients are about twice as many as men.

In 2017, 97,4% of implants are cemented, in the half of them cement is antibiotic loaded. Hybrid fixation is almost completely absent. Posterior Stabilization of insert is slightly increasing (65% during last year) compared to minimally stabilized. Mobile insert are decreasing (21,4% in 2017).

57% of Insert are in Standard Poly and the remainig are in Crosslinked Poly with or without antioxidant. Femoral component with Co-Cr are decreasing, Ceramicised Zirconium alloy and Cobalt alloy treated are preferable.

Types of implanted prostheses are less numerous and more stable during years compared to hip. Survival of bicompartmental is 93,6% at 16 yrs, survival of tricompartmental is 94,1% and survival of unicompartmental is significantly lower (80,9%). In these analyses patella resurfacing after primary TKA is not considered as a failure.
The incidence of revisions due to infection in the prosthesis remains high, in particular in total implants, where it represents approximately a quarter of the causes of failure (24%). At present it is irrelevant the use of antibiotic-loaded cement than conventional one. For total implants, septic loosening represents one-third of causes of failure. Total revisions are not revised the second time in 81,4% of cases at 16 yrs.

Cox multivariate analysis shows that the survival of bi-tricompartmental knee prostheses is negatively influenced by age of the patient (the expectancy of prosthesis survival is lower for patient less than 60 yrs), by gender (survival is lower for male patients) and by type of insert (mobile insert is worse than fixed insert).

In unicompartmental implants, age and gender of the patient influence negatively survival, while type of tibial component seems to be irrelevant (monoblock vs metal-back). Some models of prosthetic have survival slightly below the regional average, as already observed in previous report.

Shoulder

Data refers to a shorter follow-up (9 years and half).
During 2017, about 900 new shoulder total implants carried out, in particular reverse prostheses.
Similar to knee prostheses, high percentage of primary shoulder prostheses is implanted in private structures (51% in 2017 vs 26% in 2008).

Women are more affected than men, either for fracture and for elective surgery.
Mean age at surgery for reverse prostheses is 74 for women and 72 for men. Patients are younger in anatomic prostheses (respectively 66 and 61). In hemiarthroplasty women are much older than men (73 vs 60).

Reverse prosthesis is implanted mainly in arthrosis (eccentric osteoarthritis in particular) and in fracture (19%).
Anatomic prosthesis is implanted in concentric arthrosis (81%), while hemiarthroplasties treat both fractures (63% of implants) and arthrosis.
Fixation is mainly cementless for reverse and anatomic prosthesis, while 35% of hemiarthroplasties are cemented.

Survival of reverse prosthesis at 8 yrs is 95,3%. Instability, glenoid loosening and septic loosening represent the most frequent causes of failure.

Bologna, 22 nd July 2019

Units participating in RIPO, Head of Orthopaedic Surgery Department or Health Manager in the case of Private Hospitals and RIPO representatives inside the unit are listed in the Table below.

The data is updated to July 2019

Province of Piacenza

AZIENDA USL PIACENZA	**Head of Orthopaedic Surgery Department or Health Manager**	**RIPO Representative**
Ospedale di Piacenza	Dr. Pietro Maniscalco	Dr. Giuseppe Ghidoni Dott. Pietro Maniscalco
Pres. Val Tidone, Castel San Giovanni	Dr. Giuseppe Leddi	Dr. Claudio Gheduzzi Sig.ra Raffaella Sorsi
Ospedale privato 'Casa di cura Piacenza'	Dir. San. Prof. Mario Sanna	Sig.ra Brunetta Nazzari

Province of Parma

AZIENDA USL PARMA		
Ospedale Civile Fidenza	Dr. Galeazzo Concari	Sig.ra Sandra Teresa Regnani Dr.ssa Maria Cristina Aliani
Ospedale Borgo Val di Taro	f.f. Dr. Riccardo Cepparulo	Dr.ssa Maria Cristina Cardinali
Ospedale privato casa di cura "Città di Parma"	Dir. San. Dr. Luigi Lagnerini	Sig.ra Rosa Concari
Ospedale privato "Hospital Piccole Figlie"	Dir. San. Dr. Giorgio Bordin	Sig.ra Paola Casalini

Province of Reggio-Emilia

AZIENDA USL REGGIO EMILIA		
Ospedale di Guastalla	Dr. Bruno Panno	Dr. Bruno Panno
Ospedale di Montecchio Emilia	Dr. Norberto Negri	Dr. Antonio Palmieri
Ospedale di Scandiano	Dr. Antonello Salsi	Dr. Orlando Mantovani
Ospedale di Castelnovo Monti	Dr. Claudio Ferraù	Dr. Giuseppe Sciaboni
Ospedale privato "Salus Hospital"	Dir. San. Dr. Giovanni Baldi	Dr. Rodolfo Rocchi Dr. Ivo Tartaglia
Ospedale privato "Villa Verde"	Dir. San. Dr. Sergio Roti	Dott. Uluhogian Sevag Dott. Vezzosi Cesarino Dr. Sergio Roti

Province of Modena

AZIENDA USL MODENA		
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Ospedale di Carpi	Dr. Saverio Luppino	Sig.ra Miriana Dardi
Ospedale di Mirandola	Dr. Franco Boselli	Sig.ra Adriana Cestari Sig.ra Loredana Baruffaldi
Ospedale di Sassuolo	Dr. Luigi Adriano Pederzini	Dr. Mauro Prandini Dr. Claudio Debortoli
Ospedale di Vignola	Dr. Luca Fontana	Dr. Mauro Tisi
Ospedale di Pavullo	Dr. Luca Fontana	Dr. Gianluca Bonanno Bortolani Paola
Ospedale privato "Hesperia Hospital"	Dir. San. Dr. Stefano Reggiani	Dr. ssa Michelina Guerra

Ospedale privato casa di cura "Prof. Fogliani"	Dir. San. Dr. Angelo Rosi	Dr. Angelo Rosi

Province of Bologna

AZIENDA USL BOLOGNA	**Responsabile di Reparto o Direttore Sanitario**	**Referenti RIPO**
Ospedale Maggiore	Dr. Domenico Tigani	Dott. Saverio Comitini Dott.ssa Emanuela Castiello
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Ospedale privato "Villa Erbosa"	Dir. San. Dr. Gianfranco Finzi	Sig.ra Sladjana Karavdic Sig.ra Stefania Volpe
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Ospedale privato "Villa Torri Hospital"	Dir. San. Dr. Carlo Magelli	Dr. Carlo Magelli
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Ospedale del Delta	Dr. Giorgio Massini	Dr. Luigi Sorbilli
Ospedale privato "Salus"	Dott.ssa Lorella Spisani	Dott.ssa Lorella Spisani

Province of Ravenna, Forlì-Cesena and Rimini

AZIENDA USL ROMAGNA		
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Ospedale di Lugo	Dr. Gabriele Zanotti	Dr. Alessandro Soldati Dr. Gabriele Zanotti
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Ospedale di Cesena	Dr. Mauro Monesi	Dr. Franco Calista Dr. Francesco Fanton
Ospedale di Rimini	Dr. Landi Stefano	Dr.ssa Marina Gigli
Ospedale di Riccione	f.f. Dr. Meringolo Renato	Dr. Luigi D'Elia
Ospedale Cervesi Cattolica	f.f. Dr. Paolo Paladini	Dr. Paolo Paladini
Ospedale privato "Domus Nova"	Dir. San. Dr. Eugenio De Liberali	Dr. Massimo De Zerbi Dr. Eugenio De Liberali
Ospedale privato "San Francesco"	Dir. San. Dr. Eugenio De Liberali	Sig.ra Patrizia Bonoli
Ospedale privato "Maria Cecilia Hospital"	Dir. San. Dr.ssa Silvia Rapuano	Dr.ssa Silvia Rapuano
Ospedale privato "San Pier Damiano"	Dir. San. Dr. Roberto Nonni	Sig.ra Elena Ravagli
Ospedale privato "Villa Igea" Ospedale privato "Villa Serena"	Dir. San Dr. Claudio Simoni	Dr. ssa Lorena Sangiorgi
Ospedale privato casa di cura "Malatesta Novello"	Dir. San. Dr. Gianluca Bersani	Dr.ssa Maria Gabriella Pignati
Ospedale privato casa di cura "San Lorenzino"	Dir. San. Dr. Marcello Amadori	Dr. Paolo Pardini
Ospedale privato "Sol et Salus"	Dir. San. Dr. Pier Paolo Balli	Sig.ra Ileana Zucchini Dr. Marco Fravisini
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Technological partner for computer management of the database is CINECA of Bologna.

Bologna, 22 nd July 2019

PART ONE: HIP PROSTHESES

January 2000 – December 2017

1. RIPO data collection

1.1 Percentage of R.I.P.O. data collection

Percentage of R.I.P.O. data collection calculated versus hospital discharge data (S.D.O. – Schede di Dimissione Ospedaliera), is **97,2%** in the year 2017. Data are referred to primary total hip replacements (8151;74;75;76;77;85;86;87), hemiarthroplasties (8152), revision (8153;70;71;72;73) and prosthesis removal (8005).

1.2 Ratio public/private treatment

Percentage of primary total arthroplasties, hemiarthroplasties and revision surgeries of the hip performed in public hospitals.

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)			
Year of surgery	**Total hip arthroplasties**	**Hemiarthroplasties**	**Revisions**
2000	77,0	97,0	78,0
2001	81,0	97,3	77,0
2002	78,0	97,5	79,0
2003	75,1	98,4	76,1
2004	75,3	97,6	76,1
2005	72,9	98,3	77,7
2006	74,8	99,0	74,5
2007	70,8	98,6	73,6
2008	71,6	98,9	76,0
2009	70,9	99,3	76,3
2010	71,8	99,3	76,8
2011	69,9	99,3	78,8
2012	68,1	99,2	75,8
2013	67,4	99,5	74,9
2014	66,8	99,3	77,0
2015	63,3	99,4	77,4
2016	62,7	99,6	75,9
2017	63,3	99,4	75,4

From SDO database

2. Types of surgery

Number of hip surgeries carried out on patients with admission date between 1st January 2000 and 31st December 2017, according to **type of surgery**.

Type of surgery	Number of surgeries	Percentage
Primary THA	111.856	64,0
Hemiarthroplasty	41.485	23,7
Total and partial revision *	16.432	9,4
Resurfacing	2.791	1,6
Prosthesis removal	1.354	0,8
Hemiarthroplasty with buffer°	121	0,1
Other**	733	0,4
Total	**174.772**	**100,0**

°acetabular buffer

*4.339 total revision, 6.602 cup revisions, 3.289 stem revisions, 2.202 revisions of other components.

**195 reduction of dislocation, 160 debridement, 97 spacer exchange, 20 hematoma drainage, 40 *heterotopic* ossification removal.

Number of hip operations carried out with **resurfacing prostheses** by year

Year of operation	N.
2000	3
2001	7
2002	34
2003	79
2004	114
2005	188
2006	229
2007	212
2008	174
2009	177
2010	130
2011	183
2012	337
2013	312
2014	263
2015	197
2016	121
2017	31

Percentage increase of the number of primary and revision operations compared to the previous year.

Year of operation	Primary THA		Revision (total + partial)	
	N.	Increase %	N.	Increase %
2000	4.395		747	
2001	4.620	5,1	860	15,1
2002	4.662	0,9	871	1,3
2003	5.065	8,6	863	-0,9
2004	5.375	6,1	866	0,3
2005	5.579	3,8	828	-4,4
2006	5.848	4,8	947	14,4
2007	6.274	7,3	1.024	8,1
2008	6.357	1,3	988	-3,5
2009	6.708	5,5	995	0,7
2010	6.594	-1,7	1.035	4,0
2011	6.429	-2,5	922	-10,9
2012	6.589	2,5	1.015	10,1
2013	6.728	2,1	930	-8,4
2014	7.190	6,9	871	-6,3
2015	7.541	4,9	922	5,9
2016	7.665	1,6	894	-3,0
2017	8.237	7,5	854	-4,5

3. Descriptive statistics of patients

3.1 Age

Number of hip operations carried out on patients with admission date between 1st January 2000 and 31st December 2017, according to **type of operation** and **age group** of patients at the time of surgery.

Type of operation	<40		40-49		50-59		60-69		70-79		≥80		Total
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	
Primary THA	3.228	2,9	7.121	6,4	16.285	14,6	32.085	28,7	40.269	36,0	12.862	11,5	**111.850**
Hemiarthroplasty	20	0,0	69	0,2	209	0,5	1.175	2,8	8.710	21,0	31.302	75,5	**41.485**
Revision	317	1,9	696	4,2	1.751	10,7	3.977	24,2	6.381	38,8	3.310	20,1	**16.432**
Resurfacing	324	11,6	709	25,4	992	35,5	633	22,7	127	4,6	6	0,2	**2.791**
Prosthesis removal	46	3,4	73	5,4	144	10,6	331	24,4	493	36,4	267	19,7	**1.354**
Hemiarthroplasty with buffer		0,0	2	1,7	3	2,5	16	13,2	38	31,4	62	51,2	**121**
Other	32	4,4	51	7,0	98	13,4	180	24,6	237	32,3	135	18,4	**733**
Total*	**3.967**	**2,3**	**8.721**	**5,0**	**19.482**	**11,1**	**38.397**	**22,0**	**56.255**	**32,2**	**47.944**	**27,4**	**174.766**

*6 missing data

In 2017 percentage of Hemiarthroplasty carried out on patients older than ninety is 23,7%.

Mean age at surgery

Type of operation	Mean age	Range
Primary THA	66,8	12-101
Hemiarthroplasty	83,7	20-109
Resurfacing	52,7	15-83
Revision	70,1	15-100

Mean age of patients, per type of operation, comparison 2000-2017 fot THA and 2003-2017 for Resurfacing

	Year 2000		Year 2017	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Primary THA	66,0	16-99	67,3	12-99
Hemiarthroplasty	82,4	35-104	85,7	41-103
Revision	68,6	22-97	71,3	21-96

	Year 2003		Year 2017	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Resurfacing	50,0	18-72	53,0	34-65

Mean age at surgery of patients affected by coxarthrosis according to gender, comparison 2000-2017

	THA			
	Year 2000		Year 2017	
Gender	**Mean age**	**Range**	**Mean age**	**Range**
Males	67,2	34-92	66,5	25-96
Females	68,9	31-93	70,5	24-94

3.2 Gender

Number of hip operations carried out on patients with admission date between 1st January 2000 and 31st December 2017, according to **type of operation** and **gender of patient**

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Primary THA	45.573	40,7	66.283	59,3	**111.856**
Hemiarthroplasty	10.731	25,9	30.754	74,1	**41.485**
Revision	5.703	34,7	10.729	65,3	**16.432**
Resurfacing	2.106	75,5	685	24,5	**2.791**
Removal	588	43,4	766	56,6	**1.354**
Hemiarthroplasty with buffer	27	22,3	94	77,7	**121**
Other	324	44,2	409	55,8	**733**
Total	**65.052**	**37,2**	**109.720**	**62,8**	**174.772**

3.3 Side of surgery

Coxarthrosis more often affects right hip (58,3%) than left hip (41,7%). The percentage has been calculated on patients affected by primary coxarthrosis, on first side operated. The difference is more accentuated for females.

Percentage of operations carried out on the right or left side, considered by gender

Side	Males	Females
Destro	53,0	62,4
Sinistro	47,0	37,6

The difference is statistically significant (Chi – squared p<0,001).

3.4 Bilateral prosthesis

Between 1st January 2000 and 31st December 2017, 9.874 patients underwent bilateral operations for Coxarthrosis.

8.090 (81,9%) chose to undergo the second operation at the same hospital from where the first one was performed;
503 (5,1%) chose to undergo the second operation at a different hospital from where the first one was performed to follow the surgeon;
1.281 (13,0%) chose to undergo the second operation at a different hospital from where the first one was performed.

In bilateral operations, it was observed that the first hip to be treated was the right one in 54,0%.

3.5 Diseases treated with total hip arthroplasty and hemiarthroplasty

Number of **primary total hip arthroplasty** operations carried out on patients with admission date between 1st January 2000 and 31st December 2017, according to **diagnosis**

Diagnosis in primary arthroplasty	Number	Percentage
Primary arthritis	76.376	68,6
Sequelae of LCA and DCA	10.708	9,6
Femoral neck fracture	10.302	9,3
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	6.539	5,9
Post traumatic arthritis	2.444	2,2
Post traumatic necrosis	1.316	1,2
Rheumatic arthritis	1.142	1,0
Femoral neck fracture sequelae	1.088	1,0
Epiphysiolysis sequelae	303	0,3
Perthes disease sequelae	273	0,2
Septic coxitis sequelae	195	0,2
Tumor	181	0,2
Paget disease	97	0,1
TBC coxitis sequelae	63	0,1
Other	334	0,3
Total**	**111.361**	**100,0**

**495 missing data (0,4%)

Prostheses for bone tumor resection are not registered by R.I.P.O.

In 97,4% of hemiarthroplasties diagnosis was femoral neck fracture.

Percentage distribution of diseases leading to THA according to **year of operation**

Diagnosis in primary arthroplasty	Percentage		
	2000-2011	2012-2014	2015-2017
Primary arthritis	67,3	69,5	71,4
Sequelae of LCA and DCA	10,8	8,5	7,1
Femoral neck fracture	8,9	9,5	10,1
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	5,9	5,9	5,9
Post traumatic arthritis	2,4	2,0	1,7
Post traumatic necrosis	1,4	1,0	0,9
Rheumatic arthritis	1,2	0,9	0,6
Other	2,1	2,6	2,4
Total	**100,0**	**100,0**	**100,0**

Percentage distribution of diseases leading to THA according to **age group**

Diagnosis in primary arthroplasty	Age group					
	<40	40-49	50-59	60-69	70-79	≥80
Primary arthritis	16,6	41,5	60,1	73,3	75,6	73,7
Sequelae of LCA and DCA	28,6	28,8	18,4	8,6	4,3	2,3
Femoral neck fracture	1,9	3,2	5,9	8,5	11,8	12,7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	19,0	11,7	7,1	4,6	4,3	6,0
Post traumatic arthritis	9,2	6,0	3,2	1,8	1,2	1,1
Post traumatic necrosis	7,2	2,3	1,5	0,8	0,7	1,2
Rheumatic arthritis	4,8	1,8	1,2	0,9	0,8	0,5
Femoral neck fracture sequelae	1,4	1,2	0,8	0,6	0,9	2,1
Epiphysiolysis sequelae	3,7	1,2	0,4	0,1	0,0	0,0
Perthes disease sequelae	3,0	0,9	0,3	0,1	0,0	0,0
Septic coxitis sequelae	1,8	0,3	0,3	0,1	0,1	0,0
Tumor	0,4	0,3	0,3	0,2	0,1	0,1
Paget disease	0,0	0,0	0,0	0,1	0,1	0,1
TBC coxitis sequelae	0,2	0,1	0,1	0,1	0,0	0,0
Other	2,1	0,7	0,5	0,2	0,1	0,1
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Diagnosis in primary arthroplasty	Age group						Total
	<40	40-49	50-59	60-69	70-79	≥80	
Primary arthritis	0,7	3,8	12,8	30,6	39,7	12,3	**100,0**
Sequelae of LCA and DCA	8,6	19,0	27,8	25,8	16,0	2,7	**100,0**
Femoral neck fracture	0,6	2,2	9,3	26,3	45,9	15,7	**100,0**
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	9,3	12,7	17,6	22,4	26,2	11,8	**100,0**
Post traumatic arthritis	12,2	17,5	21,0	23,8	19,8	5,7	**100,0**
Post traumatic necrosis	17,7	12,2	18,2	19,9	20,1	11,9	**100,0**
Rheumatic arthritis	13,6	11,3	17,6	25,1	26,8	5,6	**100,0**
Femoral neck fracture sequelae	4,2	8,0	12,1	18,4	32,0	25,3	**100,0**
Epiphysiolysis sequelae	38,9	27,1	18,8	9,2	5,3	0,7	**100,0**
Perthes disease sequelae	35,9	23,4	16,5	15,4	7,0	1,8	**100,0**
Septic coxitis sequelae	29,2	11,3	24,6	17,9	14,9	2,1	**100,0**
Tumor	7,2	13,3	24,3	27,6	23,2	4,4	**100,0**
Paget disease	0,0	0,0	7,2	26,8	51,5	14,4	**100,0**
TBC coxitis sequelae	9,5	15,9	27,0	31,7	14,3	1,6	**100,0**
Other	20,1	14,7	25,4	23,4	12,9	3,6	**100,0**

Number of **resurfacing** operations carried out on patients with admission date between 1st January 2000 and 31st December 2017, according to **diagnosis**

Diagnosis in resurfacing	Number	Percentage
Primary arthritis	2315	83,2
Sequelae of LCA and DCA	186	6,7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	96	3,5
Post traumatic arthritis	91	3,3
Rheumatic arthritis	29	1,0
Post traumatic necrosis	13	0,5
Epiphysiolysis sequelae	13	0,5
Perthes disease sequelae	11	0,4
Femoral neck fracture sequelae	8	0,3
Septic coxitis sequelae	3	0,1
Paget disease	3	0,1
Femoral neck fracture	1	0,04
TBC coxitis sequelae	1	0,04
Other	12	0,4
Total*	**2.782**	**100,0**

* 9 missing data (0,3%)

3.6 Causes for revision

Number of revision operations carried out on patients admitted between 1st January 2000 and 31st December 2017 according to **diagnosis.**

In the Table are reported **all revisions of primary THA** performed in the Region, without taking care of site and date of primary implant. No indication of follow-up time is in these.

Diagnosis in revision of primary THA	Number	Percentage
Cup aseptic loosening	4.650	31,4
Total aseptic loosening	2.777	18,7
Stem aseptic loosening	1.952	13,2
Prosthesis dislocation	1.364	9,2
Bone fracture	985	6,7
Prosthesis breakage*	780	5,3
Two steps prosthesis removal	729	4,9
Poly wear	617	4,2
Pain without loosening	255	1,7
Septic loosening	161	1,1
Metallosis	106	0,7
Primary instability	104	0,7
Heterotopic bone	71	0,5
Trauma	35	0,2
Acetabulum fracture	22	0,1
Other	203	1,4
Total°	**14.811**	**100,0**

° 161 missing data (1,1%)

***** Failure of 268 modular necks, 172 liners, 115 heads, 95 stems, 100 cups, 13 liner and head . 17 failure not specified.

In the Table are reported **all revisions of resurfacing** performed in the Region, without taking care of site and date of primary implant. No indication of follow-up time is in these data.

Diagnosis in revision of resurfacing	Number	Percentage
Aseptic loosening	77	47,5
Bone fracture	49	30,2
Metallosis	18	11,1
Pain without loosening	11	6,8
Instability	4	2,5
Breakage of prosthesis	3	1,9
Total	**162**	**100,0**

In the Table are reported **all revisions of hemiarthroplasty** performed in the Region, without taking care of site and date of primary implant. No indication of follow-up time is in these data.

Diagnosis in revision of hemiarthroplasty	Number	Percentage
Prosthesis dislocation	450	34,9
Cotiloiditis	343	26,6
Stem aseptic loosening	277	21,5
Periprosthetic bone fracture	136	10,6
Two steps prosthesis removal	24	1,9
Septic loosening	13	1,0
Breakage of prosthesis	8	0,6
Instability	7	0,5
Poly wear	6	0,5
Heterotopic bone	5	0,4
Other	20	1,6
Total*	**1.289**	**100,0**

*9 missing data (0,7%)

4. Types of prostheses

The following tables show the types of prostheses (cups, stems) commonly used in the Emilia-Romagna region, according to primary and revision surgery.

4.1 Cups used in primary surgery

In 241 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
PE (Muller Protek) Sulzer	449	9,3	58	20,8	31	16,3
REFLECTION ALL-POLY Smith and Nep.	284	5,9	16	5,7	18	9,5
PE Adler-Ortho	166	3,5	1	0,4	12	6,3
MULLER Citieffe	92	1,9	21	7,5	9	4,7
ZCA Zimmer	639	13,3	16	5,7	9	4,7
CONTEMPORARY Stryker Howmedica	801	16,6	19	6,8	6	3,2
MULLER Lima	244	5,1	9	3,2	6	3,2
CUPULE AVANTAGE CEMENTED Biomet	77	1,6	17	6,1	-	-
MULLER Smith and Nephew	150	3,1	11	3,9	-	-
CCB Mathys	56	1,2	1	0,4	-	-
MULLER Wright Cremascoli	961	20,0	-	-	-	-
MULLER Samo	441	9,2	-	-	-	-
LUNA Amplitude	88	1,8	-	-	-	-
MULLER Groupe Lepine	57	1,2	-	-	-	-
Other (< 50 cases)	306	6,4	110	39,4	99	52,1
Total	**4.811**	**100,0**	**279**	**100,0**	**190**	**100,0**

Cementless cup	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
FIXA Ti-POR Adler-Ortho	5.647	9,0	6.179	30,6	7.578	32,7
R3 Smith and Nephew	692	1,1	1.576	7,8	2.399	10,3
JUMP Permedica	113	0,2	179	0,9	1.125	4,9
VERSAFITCUP CC TRIO Medacta	35	0,1	477	2,4	991	4,3
CONTINUUM Zimmer	402	0,6	873	4,3	974	4,2
DELTA TT Lima	380	0,6	692	3,4	841	3,6
PINNACLE SECTOR II POROCOAT DePuy	1.230	2,0	986	4,9	840	3,6
G7 PPS Biomet	-	-	2	0,0	826	3,6
EP-FIT PLUS Endoplus	3.761	6,0	1.554	7,7	535	2,3
ALLOFIT S IT Zimmer	244	0,4	474	2,3	500	2,2
TRIDENT PSL HA CLUSTER Stryker Howmedica	1.920	3,0	307	1,5	469	2,0
DELTA PF Lima	1.482	2,4	433	2,1	464	2,0
PINNACLE SECTOR GRIPTION DePuy	-	-	107	0,5	390	1,7
EXCEED ABT Biomet	767	1,2	940	4,7	302	1,3
GYROS DePuy	-	-	7	0,0	246	1,1
ADAPTIVE WINGS Samo	19	0,0	307	1,5	214	0,9
MPACT Medacta	2	0,0	44	0,2	207	0,9
FIN II Bioimpianti	110	0,2	123	0,6	205	0,9
ECOFIT Implantcast	-	-	44	0,2	196	0,8
REFLECTION Smith and Nephew	1.655	2,6	239	1,2	173	0,7
ADAPTIVE Samo	14	0,0	50	0,2	170	0,7
DELTAMOTION Finsbury	52	0,1	319	1,6	157	0,7
MAXERA Zimmer	18	0,0	318	1,6	149	0,6
AGILIS TI-POR Adler-Ortho	2	0,0	122	0,6	138	0,6
TRIDENT PSL HA SOLID Stryker Howmedica	119	0,2	109	0,5	136	0,6
TOP Link	527	0,8	150	0,7	103	0,4
FITMORE Sulzer	2.745	4,4	164	0,8	102	0,4
RM Mathys	70	0,1	174	0,9	85	0,4
PINNACLE BANTAM POROCOAT DePuy	73	0,1	63	0,3	84	0,4
CUPULE APRIL Symbios	153	0,2	230	1,1	82	0,4
POLARCUP Ortho-Id	97	0,2	35	0,2	74	0,3
SPARKUP Samo	390	0,6	192	1,0	62	0,3
ALLOFIT IT Zimmer	51	0,1	158	0,8	58	0,3
JUMP SYSTEM PE PERMEDICA	68	0,1	83	0,4	58	0,3
BS Citieffe	346	0,5	105	0,5	39	0,2
BETA CUP Link	248	0,4	50	0,2	36	0,2
MALLORY Biomet	246	0,4	90	0,4	34	0,1
CUPULE RELOAD AVANTAGE Biomet	256	0,4	148	0,7	33	0,1
ALLOFIT Zimmer	255	0,4	6	0,0	33	0,1
TRABECULAR METAL Zimmer	515	0,8	62	0,3	31	0,1
EXPANSION Mathys	1.328	2,1	261	1,3	29	0,1
BICON PLUS Endoplus	1.291	2,1	42	0,2	23	0,1
ABG II Howmedica	2.711	4,3	47	0,2	16	0,1
TRILOGY Zimmer	1.124	1,8	7	0,0	13	0,1
REGENEREX RINGLOC+ Biomet	131	0,2	69	0,3	12	0,1
JUMP COOPER Permedica	243	0,4	10	0,0	3	0,0
DUOFIT PSF Samo	1.375	2,2	1	0,0	2	0,0
CLS Zimmer	3.373	5,4	2	0,0	1	0,0
VERSAFITCUP CC Medacta	608	1,0	267	1,3	-	-

FIXA Adler-Ortho	7.262	11,5	235	1,2	-	-
HILOCK LINE Symbios	636	1,0	80	0,4	-	-
RECAP RESURFACING Biomet	858	1,4	37	0,2	-	-
BHR Smith and Nephew	187	0,3	23	0,1	-	-
EASY Hit Medica	310	0,5	3	0,0	-	-
DUOFIT PDT Samo	219	0,3	1	0,0	-	-
AnCA FIT Wright Cremascoli	6.719	10,7	-	-	-	-
STANDARD CUP Protek Sulzer	1.307	2,1	-	-	-	-
SELEXYS TH Mathys	583	0,9	-	-	-	-
TRABECULAR METAL MONOBLOCK Zimmer	417	0,7	-	-	-	-
TRILOGY AB Zimmer	378	0,6	-	-	-	-
DUROM HIP RESURFACING Zimmer	330	0,5	-	-	-	-
CUPULE AVANTAGE Biomet	300	0,5	-	-	-	-
REFLECTION I Smith and Nephew	248	0,4	-	-	-	-
SPH CONTACT Lima	237	0,4	-	-	-	-
MBA Groupe Lepine	221	0,4	-	-	-	-
ABG Howmedica	219	0,3	-	-	-	-
M2A Biomet	208	0,3	-	-	-	-
SPH BLIND Lima	202	0,3	-	-	-	-
Other (< 200 cases)	5.227	8,3	930	4,6	1.955	8,4
Total	**62.956**	**100,0**	**20.186**	**100,0**	**23.193**	**100,0**

In the table cups designed for resurfacing but implanted in traditional THA are reported.

4.2 Cups used in total revision surgery

In 24 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
POLARCUP CEMENTED Smith and Nephew	1	0,2	4	7,0	6	10,3
MULLER Protek-Sulzer-Centerpulse-Zimmer	169	26,1	11	19,3	4	6,9
MULLER Lima	52	8,0	3	5,3	4	6,9
REFLECTION ALL-POLY Smith and Nephew	8	1,2	2	3,5	4	6,9
CONTEMPORARY Stryker Howmedica	126	19,4	11	19,3	3	5,2
ZCA Zimmer	39	6,0	3	5,3	2	3,4
CUPULE AVANTAGE CEMENTED Biomet	24	3,7	6	10,5	1	1,7
MULLER PCR Samo	11	1,7	2	3,5	-	-
MULLER Wright Cremascoli	58	9,0	-	-	-	-
MULLER Samo	53	8,2	-	-	-	-
CCB Mathys	20	3,1	-	-	-	-
Other (< 10 cases)	87	13,4	15	26,3	34	58,6
Total	**648**	**100,0**	**57**	**100,0**	**58**	**100,0**

Cementless cups	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
FIXA Ti-POR Adler-Ortho	104	4,1	95	17,2	92	20,7
DELTA ONE TT Lima	47	1,8	62	11,2	69	15,5
CONTINUUM Zimmer	20	0,8	47	8,5	44	9,9
DELTA TT Lima	33	1,3	42	7,6	37	8,3
OMNIA Ti-POR Adler-Ortho	9	0,4	25	4,5	35	7,9
DELTA REVISION TT Lima	20	0,8	25	4,5	28	6,3
HERMES BS REV Citieffe	44	1,7	24	4,3	16	3,6
TRABECULAR METAL Zimmer	139	5,4	40	7,2	14	3,2
PINNACLE MULTIHOLE GRIPTION DePuy	-	-	26	4,7	11	2,5
TRITANIUM HEMISPHERICAL Stryker Howmedica	2	0,1	11	2,0	11	2,5
R3 Smith and Nephew	2	0,1	14	2,5	9	2,0
TRIDENT TRITANIUM Stryker Howmedica	4	0,2	10	1,8	6	1,4
TRILOGY IT Zimmer	3	0,1	12	2,2	5	1,1
EP-FIT PLUS Endoplus	36	1,4	3	0,5	5	1,1
TRABECULAR METAL REVISION Zimmer	21	0,8	10	1,8	4	0,9
TRIDENT PSL HA CLUSTER Stryker Howmedica	147	5,8	20	3,6	3	0,7
MC MINN Link	90	3,5	1	0,2	2	0,5
DELTA PF Lima	40	1,6	3	0,5	1	0,2
TRILOGY Zimmer	138	5,4	4	0,7	-	-
FIXA Adler-Ortho	128	5,0	3	0,5	-	-
BOFOR Endoplus	19	0,7	3	0,5	-	-
OMNIA Adler-Ortho	51	2,0	1	0,2	-	-
PINNACLE MULTIHOLE II DePuy	32	1,3	1	0,2	-	-
AnCA FIT Cremascoli	301	11,8	-	-	-	-
STANDARD CUP Protek Sulzer	132	5,2	-	-	-	-
DUOFIT PSF Samo	48	1,9	-	-	-	-
LOR ALLOPRO Protek Sulzer	48	1,9	-	-	-	-
OSTEOLOCK Stryker Howmedica	47	1,8	-	-	-	-
FITMORE Sulzer	44	1,7	-	-	-	-
CLS Zimmer	43	1,7	-	-	-	-
REGENEREX RINGLOC+ Biomet	41	1,6	-	-	-	-
TRIDENT ARC2F Stryker Howmedica	37	1,4	-	-	-	-
PROCOTYL-E Wright Cremascoli	36	1,4	-	-	-	-
REFLECTION Smith and Nephew	30	1,2	-	-	-	-
BICON PLUS Endoplus	25	1,0	-	-	-	-
CONICAL SCREW CUP Protek Sulzer	25	1,0	-	-	-	-
SECUR-FIT Osteonics Howmedica	25	1,0	-	-	-	-
ABGII Stryker Howmedica	21	0,8	-	-	-	-
PROCOTYL-Z-PIVOT Wright Cremascoli	21	0,8	-	-	-	-
Other (< 20 cases)	502	19,6	71	12,8	52	11,7
Total	**2.555**	**100,0**	**553**	**100,0**	**444**	**100,0**

4.3 Stems used in primary surgery

In 314 cases model or stem fixation was not communicated to RIPO.

TIPO DI STELO - CEMENTATO	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
EXETER V40 Stryker Howmedica	1.256	10,8	83	10,0	175	21,4
POLARSTEM CEM Endoplus	7	0,1	42	5,1	105	12,8
PAVI CEM Groupe Lepine	-	-	24	2,9	65	7,9
APTA Adler-Ortho	1.077	9,2	76	9,2	57	7,0
BASIS Smith and Nephew	901	7,7	100	12,1	43	5,3
CORAIL DePuy	12	0,1	12	1,5	43	5,3
CORAE Adler-Ort ho	-	-	42	5,1	41	5,0
HYDRA Adler-Ortho	19	0,2	32	3,9	39	4,8
TAPERLOC CEM Biomet	66	0,6	13	1,6	21	2,6
DUOFIT CKA Samo	51	0,4	3	0,4	18	2,2
LUBINUS SP2 Link	300	2,6	9	1,1	17	2,1
AB Citieffe	153	1,3	67	8,1	13	1,6
CPCS Smith and Nephew	28	0,2	17	2,1	13	1,6
VERSYS ADVOCATE Zimmer	238	2,0	10	1,2	7	0,9
SL Lima	75	0,6	13	1,6	2	0,2
C-STEM AMT DePuy	103	0,9	126	15,3	-	-
CCA Mathys	206	1,8	31	3,8	-	-
VERSYS HERITAGE Zimmer	43	0,4	12	1,5	-	-
LC Samo	403	3,5	9	1,1	-	-
SPECTRON Smith and Nephew	726	6,2	3	0,4	-	-
MULLER AUTOBLOCCANTE Sulzer	54	0,5	3	0,4	-	-
MERCURIUS Adler-Ortho	110	0,9	2	0,2	-	-
JVC Wright Cremascoli	728	6,2	-	-	-	-
P507 Samo	657	5,6	-	-	-	-
MRL Wright Cremascoli	469	4,0	-	-	-	-
AD Samo	388	3,3	-	-	-	-
DEFINITION Stryker Howmedica	347	3,0	-	-	-	-
VERSYS CEMENTED Zimmer	335	2,9	-	-	-	-
ANCA-FIT CLU Wright Cremascoli	314	2,7	-	-	-	-
C STEM DePuy	314	2,7	-	-	-	-
AHS Wright Cremascoli	306	2,6	-	-	-	-
ABG Stryker Howmedica	231	2,0	-	-	-	-
ULTIMA Johnson e Johnson	197	1,7	-	-	-	-
MS 30 Zimmer	187	1,6	-	-	-	-
VERSYS CEMENTED LD Zimmer	133	1,1	-	-	-	-
ANCA Wright Cremascoli	89	0,8	-	-	-	-
MBA Groupe Lepine	88	0,8	-	-	-	-
DUOFIT CFS Samo	75	0,6	-	-	-	-
FULLFIX Mathys	69	0,6	-	-	-	-
ARCAD SO Symbios	66	0,6	-	-	-	-
PERFECTA RA Wright Cremascoli	60	0,5	-	-	-	-
ABGII Stryker Howmedica	53	0,5	-	-	-	-
SL STREAKES Hitmedica	50	0,4	-	-	-	-
Other (< 50 cases)	683	5,9	97	11,7	159	19,4
Total	**11.667**	**100,0**	**826**	**100,0**	**818**	**100,0**

Cementless stem	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
APTA Adler-Ortho	6.102	10,9	2.331	11,9	1.827	8,1
HYDRA Adler-Ortho	1.053	1,9	1.443	7,3	1.757	7,8
CORAE Adler-Ortho	20	0,0	856	4,4	1.524	6,8
POLARSTEM Endoplus	81	0,1	625	3,2	990	4,4
SL PLUS MIA STEM Smith and Nephew	438	0,8	910	4,6	836	3,7
CORAIL DePuy	1.039	1,9	701	3,6	808	3,6
TRI-LOCK DePuy	68	0,1	502	2,6	752	3,3
APTA-FIX Adler-Ortho	-	-	-	-	697	3,1
AMISTEM-H Medacta	26	0,0	359	1,8	653	2,9
TAPERLOC COMPLETE Biomet	-	-	165	0,8	638	2,8
RECTA Adler-Ortho	3.856	6,9	1.161	5,9	617	2,7
EXACTA - Permedica	25	0,0	48	0,2	602	2,7
FITMORE Zimmer	299	0,5	584	3,0	587	2,6
H-MAX S Lima	67	0,1	229	1,2	571	2,5
SYNTHESIS Permedica	-	-	91	0,5	490	2,2
MINIMAX Medacta	235	0,4	354	1,8	461	2,0
CLS Sulzer	3.972	7,1	543	2,8	454	2,0
CONUS Centerpulse	4.435	7,9	685	3,5	427	1,9
ALATA ACUTA S Adler-Ortho	645	1,2	284	1,4	346	1,5
NANOS Endoplant Gmbh	375	0,7	267	1,4	337	1,5
KORUS Bioimpianti	-	-	10	0,1	337	1,5
TAPERLOC COMPLETE MICROPLASTY Biomet	-	-	8	0,0	333	1,5
HYDRA-FIX Adler-Ortho	-	-		0,0	324	1,4
ACCOLADE II Osteonics Howmedica	-	-	64	0,3	322	1,4
ADR Endoplus	464	0,8	473	2,4	308	1,4
SL PLUS Endoplus	3.883	6,9	413	2,1	297	1,3
RECTA-FIX Adler-Ortho	-	-	122	0,6	286	1,3
LCU - Link	-	-	47	0,2	276	1,2
AVENIR MULLER Zimmer	-	-	34	0,2	258	1,1
MODULUS Lima	602	1,1	252	1,3	230	1,0
MISTRAL Samo	4	0,0	127	0,6	211	0,9
SUMMIT DePuy	263	0,5	142	0,7	186	0,8
PROXIPLUS Endoplant	1.145	2,0	304	1,5	147	0,7
SYNERGY Smith and Nephew	580	1,0	179	0,9	142	0,6
SMF FIXED Smith and Nephew	-	-	109	0,6	131	0,6
C2 Lima	908	1,6	125	0,6	121	0,5
TAPERLOC Biomet	2.072	3,7	806	4,1	101	0,4
SAM-FIT Lima	164	0,3	211	1,1	95	0,4
PLS Lima	130	0,2	138	0,7	95	0,4
QUADRA-S Medacta	214	0,4	136	0,7	92	0,4
GTS Biomet	96	0,2	210	1,1	82	0,4
PARVA Adler-Ortho	262	0,5	113	0,6	75	0,3
VERSYS FIBER METAL TAPER Zimmer	1.159	2,1	96	0,5	72	0,3
FIT STEM Lima	296	0,5	13	0,1	70	0,3
TWINSYS Mathys	65	0,1	207	1,1	66	0,3
H-MAX M Lima	21	0,0	166	0,8	64	0,3
MULTIFIT Samo	281	0,5	83	0,4	64	0,3
CLS BREVIUS Zimmer	26	0,0	199	1,0	60	0,3
CBC Mathys	1.852	3,3	393	2,0	57	0,3
DUOFIT RKT Samo	306	0,5	32	0,2	44	0,2
ABGII Stryker Howmedica	3.252	5,8	231	1,2	43	0,2
ACCOLADE Osteonics Howmedica	388	0,7	99	0,5	42	0,2
Z1 Citieffe	294	0,5	78	0,4	37	0,2
S-TAPER Bioimpianti	102	0,2	103	0,5	30	0,1

CFP Link	1.021	1,8	53	0,3	29	0,1
SL REVISION Sulzer	168	0,3	47	0,2	25	0,1
TAPERLOC MICROPLASTY Biomet	320	0,6	162	0,8	17	0,1
DUOFIT RTT Samo	193	0,3	121	0,6	13	0,1
QUADRA-H Medacta	227	0,4	41	0,2	13	0,1
ALLOCLASSIC SL Zimmer	328	0,6	32	0,2	12	0,1
PBF Permedica	332	0,6	96	0,5	8	0,0
PPF Biomet	257	0,5	34	0,2	7	0,0
CONELOCK SHORT Biomet	289	0,5	11	0,1	1	0,0
HIPSTAR Stryker Howmedica	335	0,6	1	0,0	1	0,0
SPS MODULAR Symbios	232	0,4	100	0,5	-	-
PROFEMUR Z Wright Cremascoli	694	1,2	20	0,1	-	-
ARCAD HA Symbios	240	0,4	10	0,1	-	-
SPS Symbios	222	0,4	5	0,0	-	-
HIPSTAR+ Stryker Howmedica	222	0,4	1	0,0	-	-
ANCA FIT Wright Cremascoli	4.505	8,0	-	-	-	-
BHS Smith and Nephew	437	0,8	-	-	-	-
ABG Stryker Howmedica	329	0,6	-	-	-	-
EHS Wright Cremascoli	313	0,6	-	-	-	-
PROXILOCK FT Stratec	304	0,5	-	-	-	-
EASY Hitmedica	229	0,4	-	-	-	-
STEM Wright Cremascoli	211	0,4	-	-	-	-
Other (< 200 cases)	3.073	5,5	1.038	5,3	1.954	8,7
Total	**56.046**	**100,0**	**19.633**	**100,0**	**22.552**	**100,0**

4.4 Stems used in total revision surgery

In 65 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
VERSYS REVISION CALCAR Zimmer	20	4,4	-	-	6	12,5
EXETER V40 Stryker Howmedica	71	15,5	2	5,0	5	10,4
APTA Adler-Ortho	34	7,4	1	2,5	1	2,1
JVC Wright Cremascoli	32	7,0	-	-	-	-
AD Samo	29	6,3	-	-	-	-
ANCA Wright Cremascoli	25	5,5	-	-	-	-
Other (< 20 cases)	247	53,9	37	92,5	36	75,0
Total	**458**	**100,0**	**40**	**100,0**	**48**	**100,0**

Cementless stem	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
REVISION HIP Lima	113	4,2	93	16,3	123	27,2
ALATA AEQUA REVISION Adler-Ortho	152	5,6	71	12,5	79	17,5
SL REVISION Sulzer Centerpulse Zimmer	504	18,6	114	20,0	58	12,8
ALATA ACUTA S Adler-Ortho	47	1,7	38	6,7	35	7,7
RESTORATION Stryker Howmedica	232	8,6	57	10,0	20	4,4
RECLAIM DePuy	-	-	26	4,6	15	3,3
MODULUS HIP SYSTEM Lima	26	1,0	27	4,7	9	2,0
MP RECONSTRUCTION PROSTHESIS Link	55	2,0	9	1,6	9	2,0
CONUS Sulzer Centerpulse Zimmer	85	3,1	4	0,7	6	1,3
CLS Sulzer Centerpulse Zimmer	42	1,6	-	-	6	1,3
ADR Endoplus	8	0,3	15	2,6	4	0,9
APTA Adler-Ortho	24	0,9	6	1,1	2	0,4
MGS Samo	115	4,2	7	1,2	1	0,2
C2 Lima	63	2,3	2	0,4	1	0,2

SLR PLUS Endoplus	28	1,0	2	0,4	1	0,2
CONELOCK REVISION Biomet	123	4,5	14	2,5	-	-
ZMR REVISION TAPER CONE Zimmer	46	1,7	5	0,9	-	-
SL PLUS Endoplus	36	1,3	4	0,7	-	-
VERSYS FIBER METAL TAPER Zimmer	20	0,7	2	0,4	-	-
PROFEMUR R VERS. 4 Wright Cremascoli	413	15,3	1	0,2	-	-
S. ROM Johnson e Johnson	146	5,4	1	0,2	-	-
RESTORATION T3 Stryker Howmedica	74	2,7	-	-	-	-
ANCA FIT Wright Cremascoli	59	2,2	-	-	-	-
ZMR REVISION TAPER Zimmer	30	1,1	-	-	-	-
EMPERION Smith and Nephew	23	0,8	-	-	-	-
CBK REVISION STEM Mathys	20	0,7	-	-	-	-
Other (< 20 cases)	222	8,2	72	12,6	83	18,4
Total	**2.706**	**100,0**	**570**	**100,0**	**452**	**100,0**

4.5 Number of different types of implant

Number of **different types of cups and stems** implanted in primary surgery, according to year of operation.

Year of operation	Primary THA	
	Cups	Stems
2000	87	93
2001	92	98
2002	90	94
2003	94	110
2004	84	99
2005	90	110
2006	87	98
2007	100	113
2008	105	114
2009	95	115
2010	91	109
2011	100	107
2012	90	109
2013	100	125
2014	97	125
2015	100	125
2016	110	140
2017	110	130

In 2017 were implanted 20 different types of cup and 19 stems not used in 2016.

Number of **different types** of cups and stems implanted in revision surgery, according to year of operation.

Year of operation	Total revision	
	Cups	Stems
2000	58	48
2001	64	55
2002	59	48
2003	62	60
2004	46	40

2005	45	44
2006	55	55
2007	60	50
2008	50	49
2009	54	42
2010	49	46
2011	49	49
2012	41	41
2013	37	41
2014	39	36
2015	35	35
2016	43	46
2017	43	42

The marked dispersion of prosthesis types and the wide variability of the combinations between acetabulum and stems enable the comparison of only some types of prosthesis.

When only the brand has changed as a result of acquisitions of companies, such as Sulzer – Centerpulse - Zimmer or Johnson & Johnson – DePuy, Zimmer – Biomet models were not considered different.

4.6 Dual mobility cups

In the following table percentage of primary THA according to types of cups and year of operation.

Year of operation	Primary THA	
	Standard cup	Dual mobility cup
2000	99,6	0,4
2001	98,9	1,1
2002	98,8	1,2
2003	98,8	1,2
2004	98,7	1,3
2005	97,5	2,5
2006	97,4	2,6
2007	96,6	3,4
2008	96,6	3,4
2009	96,3	3,7
2010	96,8	3,2
2011	97,1	2,9
2012	97,7	2,3
2013	97,1	2,9
2014	95,8	4,2
2015	95,4	4,6
2016	95,1	4,9
2017	93,4	6,6

In the following table types of dual mobility cups more present in database are presented.

Types of cups – dual mobility	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
GYROS Depuy	-	-	7	1,1	246	19,5
TRIDENT PSL HA CLUSTER Howmedica	14	0,9	41	6,3	135	10,7
DUALIS Bioimpianti	-	-	4	0,6	109	8,6
POLARCUP TI-PLASMA Ortho-Id	97	6,0	38	5,9	74	5,9
QUATTRO VPS PF HAP PNP Groupe Lep.	-	-	-	-	73	5,8
QUATTRO VPS PF HAP Groupe Lepine	-	-	29	4,5	60	4,8
TRITANIUM HEMISPHERICAL Stryker How.	-	-	5	0,8	57	4,5
FIXA DUPLEX Adler-Ortho	-	-	-	-	52	4,1
DMX Transysteme	1	0,1	73	11,2	50	4,0
NOVAE E TH Serf	6	0,4	40	6,2	40	3,2
ADES Dedienne Sante	-	-	5	0,8	40	3,2
VERSAFITCUP DM Medacta	43	2,6	61	9,4	39	3,1
RELOAD AVANTAGE Biomet	256	15,8	148	22,8	33	2,6
ACORN Permedica	-	-	2	0,3	29	2,3
POLARCUP CEMENTED Smith and Nep.	3	0,2	18	2,8	16	1,3
DMX CEMENTED Transysteme	-	-	21	3,2	12	1,0
AVANTAGE 3P Biomet	103	6,3	38	5,9	4	0,3
STAFIT Zimmer	-	-	28	4,3	2	0,2
POLARCUP Ortho-Id	73	4,5	-	-	1	0,1
AVANTAGE CEMENTED Biomet	77	4,7	17	2,6	-	-
EASY HIT Medica	310	19,1	3	0,5	-	-
POLARCUP TI-PLASMA Endoplus	47	2,9	1	0,2	-	-
AVANTAGE Biomet	300	18,5	-	-	-	-
MOBILIS I Othesio	114	7,0	-	-	-	-
C2M PF Symbios	81	5,0	-	-	-	-
Other (<30 cases)	98	6,0	70	10,8	190	15,1
Total	**1.623**	**100,0**	**649**	**100,0**	**1.262**	**100,0**

4.7 Modular neck

31,4% of stems implanted in primary surgery have modular neck.

In the following table percentage of standard and modular neck in primary surgery.

Year of surgery	Primary surgery	
	Standard neck	Modular neck
2000	78,2	21,8
2001	74,8	25,2
2002	70,9	29,1
2003	72,5	27,5
2004	69,4	30,6
2005	67,1	32,9
2006	63,9	36,1
2007	65,4	34,6
2008	64,4	35,6
2009	64,2	35,8
2010	60,5	39,5

2011	58,2	41,8
2012	61,1	38,9
2013	65,7	34,3
2014	71,3	28,7
2015	74,1	25,9
2016	76,0	24,0
2017	77,9	22,1

In the following table Types of stems with proximal modularity more present in database.

Types of stems with proximal modularity	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
APTA Adler-Ortho	6.108	27,1	2.332	33,7	1.827	32,6
HYDRA Adler-Ortho	1.053	4,7	1.444	20,9	1.757	31,4
RECTA Adler-Ortho	3.857	17,1	1.161	16,8	618	11,0
ALATA ACUTA S Adler-Ortho	646	2,9	285	4,1	346	6,2
MODULUS HIP SYSTEM Lima	602	2,7	252	3,6	230	4,1
PULCHRA Adler-Ortho	-	-	56	0,8	119	2,1
SAM-FIT Lima	164	0,7	211	3,1	96	1,7
PARVA Adler-Ortho	262	1,2	114	1,6	75	1,3
H-MAX M Lima	21	0,1	166	2,4	65	1,2
MULTIFIT Samo	281	1,2	83	1,2	64	1,1
MINIFIT Samo	-	-	11	0,2	64	1,1
CLS BREVIUS Zimmer	26	0,1	199	2,9	60	1,1
APTA Cem Adler-Ortho	1.077	4,8	76	1,1	57	1,0
REVISION HIP Lima	15	0,1	26	0,4	40	0,7
HYDRA Cem Adler-Ortho	19	0,1	32	0,5	39	0,7
ALATA AEQUA REVISION Adler-Ortho	19	0,1	20	0,3	29	0,5
S. ROM Johnson e Johnson	171	0,8	8	0,1	7	0,1
HARMONY Symbios	94	0,4	94	1,4	5	0,1
VITAE Adler-Ortho	54	0,2	73	1,1	4	0,1
SMF Smith and Nephew	13	0,1	100	1,4	2	0,0
PROFEMUR L Wright Cremascoli	99	0,4	-	-	1	0,0
SPS MODULAR Symbios	232	1,0	100	1,4	-	-
PROFEMUR Z Wright Cremascoli	694	3,1	17	0,2	-	-
ABGII MODULAR Stryker Howmedica	63	0,3	3	0,0	-	-
MERCURIUS Adler-Ortho	110	0,5	2	0,0	-	-
ANCA Fit Wright Cremascoli	4.506	20,0	-	-	-	-
JVC Wright Cremascoli	728	3,2	-	-	-	-
ANCA-Fit CLU Wright Cremascoli	314	1,4	-	-	-	-
EHS Wright Cremascoli	312	1,4	-	-	-	-
STEM Wright Cremascoli	211	0,9	-	-	-	-
G3 Citieffe	179	0,8	-	-	-	-
MBA HAP Groupe Lepine	127	0,6	-	-	-	-
MBA Groupe Lepine	88	0,4	-	-	-	-
PROFEMUR C Wright Cremascoli	87	0,4	-	-	-	-
STELO MODULARE NDS1 Citieffe	77	0,3	-	-	-	-
Other (< 50 cases)	209	0,9	52	0,8	99	1,8
Total*	**22.518**	**100,0**	**6.917**	**100,0**	**5.604**	**100,0**

*36 missing data (0,1%)

ANCA-Fit stem was implanted with short necks in 65% of cases and with long necks in 35%.

The straight neck is used in 38,4% of surgery, the anti-retroverted with 8° or 15° in 34,1% and the varus-valgus in 24,7%.
APTA stem, the most used in the region, was implanted with neutral necks in 61,7% of cases and with various degree of correction necks in the remaining 38,3%.

4.8 Resurfacing arthroplasty

In the following table percentage of standard primary arthroplasty and resurfacing are presented.

Year of operation	primary arthroplasty	
	Standard	Resurfacing
2000	99,9	0,1
2001	99,8	0,2
2002	99,3	0,7
2003	98,5	1,5
2004	97,9	2,1
2005	96,7	3,3
2006	96,2	3,8
2007	96,7	3,3
2008	97,3	2,7
2009	97,4	2,6
2010	98,1	1,9
2011	97,2	2,8
2012	95,1	4,9
2013	95,6	4,4
2014	96,5	3,5
2015	97,5	2,5
2016	98,4	1,6
2017	99,6	0,4

Resurfacing arthroplasty used between **01/01/2000** and **31/12/2017**

Type	N.	%
BHR – Smith & Nephew	1782	63,9
ADEPT – Finsbury	437	15,7
BMHR* – Smith & Nephew	198	7,1
MITCH TRH – Finsbury	89	3,2
ASR – DePuy	77	2,8
RECAP – Biomet	65	2,3
MRS* – Lima	44	1,6
ROMAX – Medacta	33	1,2
CONSERVE PLUS – Wright	30	1,1
ICON – International Orthopaedics	21	0,8
DUROM Hip Resurfacing – Zimmer	8	0,3
WAGNER METASUL - Protek	3	0,1
CORMET – Corin	1	0,0
ACCIS - Implantcast	1	0,0
TRIBOFIT – Active Implants	1	0,0
Total**	**2.790**	**100,0**

** 1 missing data (0,04%).
* considered similar to resurfacing.

In 2017 were implanted 29 BHR - Smith and Nephew, 2 CONSERVE PLUS – Wright.

4.9 Articular couplings and head diameters

Number of primary total hip arthroplasty operations carried out on patients with admission date between 1st January 2000 and 31st December 2017, according to the **type of operation** and **articular coupling**. **Dual mobility cups are excluded.**

Polyethylene has been called cross-linked (XLPE) from Manufacturer Company directions.

Articular coupling (head-liner)	Primary		Total revision	
	N.	%	N.	%
Composite ceramic -Composite ceramic.	35.473	32,8	650	15,7
Met -UHMWPE	12.694	11,8	740	17,9
Allumina-Allumina	11.033	10,2	327	7,9
Composite ceramic -XLPE	10.805	10,0	466	11,3
Alumina -UHMWPE	9.780	9,1	668	16,2
Met -XLPE	7.611	7,0	565	13,7
Met-met	3.312	3,1	65	1,6
Met -UHMWPE+met	2.981	2,8	31	0,8
Composite ceramic -XLPE+vitamin E	2.540	2,4	54	1,3
Alumina -XLPE	1.780	1,6	128	3,1
Ceramicised metal-XLPE	1.865	1,7	23	0,6
Allumina-Composite ceramic	1.817	1,7	58	1,4
Composite ceramic -UHMWPE	1.571	1,5	78	1,9
Met –undefined PE*	791	0,7	53	1,3
Alumina -UHMWPE+Alumina	791	0,7	13	0,3
Composite ceramic -Alumina	466	0,4	11	0,3
Alumina -Undefined PE*	403	0,4	29	0,7
Revision composite ceramic -Composite ceramic	411	0,4	10	0,2
Ceramicised metal -UHMWPE	386	0,4	16	0,4
Alumina -Met+Alumina	302	0,3	60	1,5
Composite ceramic -Met+XLPE+vitamin E	260	0,2	-	-
Composite ceramic -metal	221	0,2	-	-
Zirconia -UHMWPE	175	0,2	13	0,3
Other (< 100 cases)	537	0,5	69	1,7
Total^	**108.005**	**100,0**	**4.127**	**100,0**

* missing label did not allow classification of poly.
^317 missing data in primary surgery and 19 in total revision.

Percentage of total hip arthroplasty interventions between 2001 and 2017, according to the **type of polyethylene** used. All types of poly (with or without **anti-luxation lip**, constrained) are considered.

Year of surgery	Primary surgery		
	Standard poly	Crosslinked poly	Undefined poly
2001	76,4	18,3	5,3
2002	82,1	15,7	2,3
2003	81,3	17,3	1,4
2004	77,9	21,5	0,6
2005	74,8	24,1	1,1
2006	75,2	24,6	0,2
2007	71,6	28,2	0,2
2008	64,5	35,3	0,1
2009	50,9	49,1	-
2010	39,8	60,2	-
2011	33,3	66,7	-
2012	22,7	77,3	-
2013	20,8	79,2	-
2014	16,5	83,5	-
2015	12,6	87,4	-
2016	10,9	89,1	-
2017	10,5	89,5	-

missing label did not allow classification of poly.

The following table shows percentage of Primary surgery with Alumina o Composite ceramic **liner**

Year of surgery	Primary surgery	
	Alumina liner	Composite ceramic liner
2000	100,0	-
2001	100,0	-
2002	100,0	-
2003	99,1	0,9
2004	96,9	3,1
2005	90,6	9,4
2006	85,3	14,7
2007	67,4	32,6
2008	22,2	77,8
2009	14,9	85,1
2010	7,0	93,0
2011	3,4	96,6
2012	0,8	99,2
2013	1,1	98,9
2014	1,1	98,9
2015	0,2	99,8
2016	0,2	99,8
2017	-	100,0

The following table shows percentage of Primary surgery with Alumina o Composite ceramic **head**

Year of surgery	Primary surgery	
	Alumina head	Composite ceramic head
2001	100,0	-
2002	100,0	-
2003	100,0	-
2004	99,8	0,2
2005	99,2	0,8
2006	96,4	3,6
2007	88,6	11,4
2008	46,0	54,0
2009	27,3	72,7
2010	10,3	89,7
2011	5,3	94,7
2012	4,3	95,7
2013	4,4	95,6
2014	2,5	97,5
2015	1,0	99,0
2016	1,1	98,9
2017	0,9	99,1

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2017, according to **material** and **diameter of the head**

Head material	Diameter of the head (mm) in THA											
	22		26		28		32		36		>=38	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
Composite ceramic	-	-	-	-	3.767	8,5	18.521	68,4	24.682	77,9	4.923	62,1
Alumina	1	0,2	-	-	17.463	39,6	5.301	19,6	3.507	11,1	-	-
Cr-Co	549	85,4	24	80,0	18.566	42,1	2.523	9,3	2.081	6,6	2.494	31,4
Stainless steel	90	14,0	5	16,7	3.451	7,8	183	0,7	28	0,1	-	-
Stainless steel	2	0,3	-	-	550	1,2	478	1,8	1.322	4,2	99	1,2
Revision ceramic	-	-	-	-	3	0,0	12	0,0	7	0,0	415	5,2
Zirconia	1	0,2	1	3,3	307	0,7	60	0,2	77	0,2	-	-
Total*	**643**	**100,0**	**30**	**100,0**	**44.107**	**100,0**	**27.078**	**100,0**	**31.704**	**100,0**	**7.931**	**100,0**

*363 missing data (0,3%)

Year of surgery	Diameter of the head (mm) in THA								
	<=28 cer	<=28 met	<=28 other	32 cer	32 met	32 other	>=36 cer	>=36 met	>=36 other
2000	45,5	49,8	1,1	1,1	1,4	0,0	0,0	1,1	0,0
2001	49,8	46,6	1,1	0,7	0,3	0,0	0,0	1,4	0,0
2002	51,7	45,7	0,8	0,9	0,1	0,0	0,0	0,8	0,0
2003	50,5	46,4	0,7	0,9	0,1	0,0	0,3	1,2	0,0
2004	50,7	41,3	0,8	3,2	0,6	0,0	1,3	2,2	0,0
2005	33,9	38,0	0,5	16,5	1,6	0,0	5,5	4,0	0,0
2006	23,1	33,5	0,5	18,9	2,0	0,1	14,8	7,2	0,0
2007	15,7	28,2	0,9	20,5	3,8	0,1	21,6	9,1	0,0
2008	14,3	21,7	0,4	20,4	3,8	0,1	29,6	9,8	0,0
2009	11,5	17,6	0,1	21,7	3,1	0,0	36,7	9,1	0,1
2010	8,6	10,0	0,1	23,8	4,6	0,2	44,2	7,7	0,9
2011	6,3	8,0	0,2	27,0	4,7	0,5	45,6	4,9	2,8
2012	6,8	5,4	0,1	28,2	3,7	0,3	50,0	3,0	2,7
2013	6,0	5,0	0,2	29,6	2,8	0,6	50,3	2,7	2,8
2014	6,1	5,3	0,3	32,5	2,6	0,8	47,7	2,6	2,2
2015	5,6	4,7	0,5	33,1	2,4	0,7	49,0	2,2	2,0
2016	6,5	4,2	0,6	33,9	2,0	1,3	46,5	1,9	3,1
2017	7,0	4,8	0,6	36,2	1,5	1,9	43,0	1,6	3,3

Cer: alumina, zirconia and composite (alumina+zirconia)
Met: cobalt-based alloy and stainless steel
Other: Surface-treated metal and ceramicised metal.

4.10 Prosthesis fixation

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2017, according to **type of operation** and **fixation**

Fixation	Primary THA	%	Total revision	%
Cementless	97.880	87,7	3.238	74,9
Hybrid (cemented stem and cementless cup)	8.409	7,5	316	7,3
Cemented	4.606	4,1	214	5,0
Reverse hybrid (cementless stem and cemented cup)	681	0,6	553	12,8
Total*	**111.576**	**100,0**	**4.321**	**100,0**

* 280 primary THA and 18 total revision missing data.

Percentage of total hip arthroplasties **according to fixation**, during the years 2000–2017

Year of surgery	Primary THA			
	Cemented	Cementless	Hybrid	Reverse hybrid
2000	15,2	61,8	22,1	1,0
2001	14,3	66,5	18,5	0,8
2002	12,1	71,3	15,8	0,8
2003	11,0	73,3	15,0	0,7
2004	8,6	78,3	12,4	0,7
2005	7,0	80,5	11,6	0,8
2006	6,1	83,1	10,2	0,6
2007	4,3	87,1	8,0	0,6
2008	2,5	90,4	6,5	0,6
2009	2,0	91,4	5,8	0,8
2010	1,2	94,1	4,1	0,6
2011	0,8	95,1	3,5	0,6
2012	0,6	95,3	3,3	0,7
2013	1,0	95,5	3,0	0,5
2014	0,8	95,5	3,3	0,5
2015	0,5	95,5	3,6	0,4
2016	0,5	96,5	2,7	0,3
2017	0,3	96,4	2,9	0,4

Percentage of elective total hip arthroplasties according to **fixation**, by **age of patient**.

Age class	Elective primary THA 2000-2017			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0,5	98,4	0,6	0,5
40-49	0,3	98,9	0,6	0,2
50-59	0,4	97,9	1,5	0,2
60-69	1,0	93,4	5,2	0,3
70-79	4,7	83,7	10,9	0,7
≥80	13,3	70,8	14,3	1,5

Percentage of elective total hip arthroplasties according to **fixation and class of age** – year 2000.

Age class	Elective primary THA year 2000			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0,9	93,1	5,2	0,9
40-49	0,8	95,7	3,1	0,4
50-59	1,5	88,6	9,5	0,3
60-69	5,9	70,2	23,3	0,6
70-79	21,6	46,4	30,6	1,4
≥80	54,3	27,3	16,7	1,6

Percentage of elective total hip arthroplasties **according to fixation and class of age** - year 2017

Age class	Elective primary THA year 2017			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0,6	97,8	0,0	1,7
40-49	0,2	99,2	0,4	0,2
50-59	0,3	99,1	0,5	0,0
60-69	0,1	98,8	0,9	0,2
70-79	0,2	96,9	2,3	0,5
≥80	0,6	89,6	9,1	0,7

Percentage of total revision surgery according to **fixation** and **year**

Year	Total revision			
	Cemented	Cementless	Hybrid	Reverse hybrid
2000	9,4	62,5	9,4	18,8
2001	7,9	64,0	8,5	19,6
2002	6,0	66,0	7,3	20,7
2003	7,2	69,1	6,8	16,9
2004	7,1	68,8	7,9	16,2
2005	7,5	68,3	8,4	15,9
2006	6,2	73,0	9,9	10,9
2007	4,0	74,1	9,5	12,4
2008	3,1	78,2	8,4	10,2
2009	1,8	82,1	7,2	9,0
2010	1,7	84,0	5,9	8,4
2011	5,0	80,1	7,2	7,7
2012	1,3	88,2	3,5	7,0
2013	2,3	82,6	7,8	7,3
2014	0,6	88,5	4,2	6,7
2015	3,5	85,9	5,9	4,7
2016	4,1	83,1	5,2	7,6
2017	3,8	82,3	3,8	10,1

Percentage of total revision surgery according to **fixation** and **class of age.**

Age class	Total revision			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	1,2	94,0	1,2	3,6
40-49	3,1	90,2	2,5	4,3
50-59	1,5	88,2	2,7	7,6
60-69	2,8	79,4	5,5	12,2
70-79	4,5	72,4	8,1	15,0
≥80	12,1	60,9	12,5	14,6

4.11 Bone cement

Type of cement used in primary surgery, in hemiarthroplasty, with at least one cemented component, and in resurfacing (information recorded in RIPO from 30st September 2001). In **bold** cements with antibiotics

Cement	% in THA	% in Hemi	% in Resurf
Surgical Simplex P - Howmedica	35,4	36,3	34,2
Cemex System - Tecres	11,2	22,5	1,1
Smartset Hv - Depuy	6,4	8,1	2,4
Antibiotic Simplex - Howmedica	**6,2**	**2,9**	**54,6**
Palacos R - Biomet	5,4	1,1	0,9
Amplicem 3 - Amplimedical	3,4	2,8	-
Cemex Rx - Tecres	2,1	4,4	0,1
Cemex + Cemex System - Tecres	1,9	-	-
Smartset Mv - Depuy	1,7	4,3	0,0
Palacos R - Heraeus Medical	1,5	3,0	0,1
Exolent High - Elmdown	1,5	0,5	0,0
Cemex Rx + Cemex System - Tecres	1,4	0,0	0,0
Amplicem 1 + Amplicem 3 - Amplimedical	1,3	0,0	0,0
Cmw 3 - Depuy	1,3	0,8	0,0
Cemex Sys. -Tecres+Surgical Simplex P-How	1,3	0,0	0,0
Cemfix 1 - Teknimed	1,2	1,1	0,0
Amplicem1-Amplimedl+SmartsetHv-Depuy	1,2	0,0	0,0
Cemex - Tecres	1,2	1,3	0,1
Versabond - Smith and Nephew	1,1	0,0	2,1
Sulcem 3 - Centerpulse	1,0	0,9	0,0
Cemex Genta + Cemex Genta Sys.- Tecres	**1,0**	**0,0**	**0,0**
Cemfix 3 - Teknimed	0,8	0,3	0,0
Vacu Mix Plus Cmw 3 - Depuy	0,8	2,0	0,0
Aminofix 1 - Groupe Lepine	**0,8**	**0,0**	**0,0**
Cemex Genta - Tecres	**0,6**	**0,3**	**0,0**
Palacos R 40 - Sp Europe	0,6	0,1	0,0
Palacos R+G - Heraeus Medical	**0,6**	**0,7**	**0,0**
Bone Cement R - Biomet	0,5	0,1	0,8
Cemex Genta System - Tecres	**0,5**	**1,9**	**1,0**
Refobacin Bone Cement R - Biomet	**0,5**	**0,0**	**0,0**
Hi-Fatigue - Zimmer	0,4	0,0	0,5
Cemsys 1 - Mathys	0,3	0,0	0,0
Amplicem 1 - Amplimedical	0,3	0,0	0,0
A. Simplex + S. Simplex P - Howmedica	**0,3**	**0,0**	**0,1**
Amplicem 3G - Amplimedical	**0,3**	**0,0**	**0,0**
Palamed G - Heraeus Medical	**0,2**	**0,1**	**0,0**
Cemex XL - Tecres	0,2	0,5	0,0
Hi-Fatigue G - Zimmer	**0,2**	**0,0**	**0,0**
Osteobond - Zimmer	0,2	0,0	0,9
Smartset GHV - Depuy	**0,2**	**0,0**	**0,0**
Other without antibiotic	1,6	2,8	0,6
Other with antibiotic	**1,4**	**1,1**	**0,2**
Total	**100,0**	**100,0**	**100,0**

Antibiotic-loaded cement was chosen in 12,6% of THA, in 7,0% of hemi and in 56,1% of resurfacing.

Surgical Simplex P – Howmedica in 2016-2017 was chosen in 29,3% of THA and in 31,3% of hemi with at least one cemented component.

5. Types of hemiarthroplasty

5.1 Hemiarthroplasty cup and stem

Monoblock	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
THOMPSON - Corin	76	67,9	-	-	-	-
AUSTIN MOORE - Amplimedical	16	14,3	-	-	-	-
THOMPSON - Amplimedical	14	12,5	-	-	-	-
THOMPSON -Stryker Howmedica	4	3,6	-	-	-	-
THOMPSON - Bioimpianti	1	0,9	-	-	-	-
THOMPSON - Surgival	1	0,9	-	-	-	-
Total	**112**	**100,0**	**-**	**-**	**-**	**-**

Monoarticular	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
TESTA ELLITTICA - Samo	422	99,3	-	-	-	-
Other	3	0,7	-	-	-	-
Total	**425**	**100,0**	**-**	**-**	**-**	**-**

Biarticular	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
JANUS Bioimpianti	1.408	5,4	1.422	19,4	2.818	39,6
C1 - Citieffe	4.043	15,4	2.131	29,1	1.122	15,8
TESTA BIPOLARE Samo	140	0,5	37	0,5	831	11,7
TESTA BIARTICOLARE LOCK Lima	1.759	6,7	394	5,4	706	9,9
SPHERI-LOCK Lima	4.999	19,0	825	11,3	544	7,6
CUPOLA MOBILE MODULARE-Wright Cremascoli	1.198	4,6	230	3,1	395	5,6
UHR Osteonics Stryker Howmedica	2.625	10,0	629	8,6	338	4,8
TESTA BIPOLARE Smith and Nephew	29	0,1	108	1,5	104	1,5
BI-POLAR Biomet	390	1,5	106	1,4	70	1,0
CUPOLA NEMAUSUS Transysteme	622	2,4	269	3,7	51	0,7
CUPOLA MOBILE BIBOP Symbios	40	0,2	19	0,3	51	0,7
CUPOLA MOBILE BIARTICOLARE - Permedica	720	2,7	3	0,0	29	0,4
CUPOLA MOBILE Medacta	192	0,7	-	-	13	0,2
BI-POLAR DePuy	961	3,7	1.057	14,5	11	0,2
CUPOLA BIPOLARE Zimmer	448	1,7	10	0,1	8	0,1
CUPOLA BIPOLARE Mathys	682	2,6	32	0,4	1	0,0
MODULAR BIPOLAR - Protek	611	2,3	1	0,0	-	-
ULTIMA MONK DePuy	1.004	3,8	-	-	-	-
CUPOLA MOBILE Zimmer	882	3,4	-	-	-	-
CUPOLA SEM - D.M.O.	731	2,8	-	-	-	-
TESTA BIARTICOLARE - Lima	613	2,3	-	-	-	-
CENTRAX - Stryker Howmedica	543	2,1	-	-	-	-
SPHERIC Amplitude	352	1,3	-	-	-	-
RETENTIVE MOBILE CUP - Cedior	292	1,1	-	-	-	-

BICENTRIC - Stryker Howmedica	236	0,9	-	-	-	-
TESTA BIPOLARE - Amplimedical	193	0,7	-	-	-	-
CORON Tantum	190	0,7	-	-	-	-
Other (< 100 cases)	358	1,4	41	0,6	22	0,3
Total*	**26.261**	**100,0**	**7.314**	**100,0**	**7.114**	**100,0**

*259 missing data (0,6%)

In 235 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
KORUS Bioimpianti	-	-	196	3,8	1.371	28,5
AB Citieffe	3.667	16,3	1.962	37,7	1.026	21,3
DUOFIT CKA Samo	186	0,8	35	0,7	736	15,3
SL Lima	1.005	4,5	433	8,3	476	9,9
PROFEMUR GLADIATOR Wright	-	-	230	4,4	363	7,5
EXETER V40 Stryker Howmedica	715	3,2	281	5,4	320	6,7
SL STREAKES Hitmedica	1.530	6,8	299	5,7	222	4,6
SPHERI-SYSTEM II Hitmedica	2.214	9,8	215	4,1	67	1,4
VERSYS ADVOCATE Zimmer	38	0,2	82	1,6	58	1,2
SL Permedica	678	3,0	1	0,0	24	0,5
LOGICA MIRROR Lima	525	2,3	11	0,2	9	0,2
APTA Adler-Ortho	865	3,8	169	3,2	2	0,0
S-TAPER Bioimpianti	185	0,8	248	4,8	1	0,0
QUADRA-C Medacta	175	0,8	1	0,0	1	0,0
CORAIL DePuy	1	0,0	576	11,1	-	-
G2 DePuy	1.290	5,7	217	4,2	-	-
C-STEM AMT DePuy	73	0,3	98	1,9	-	-
MERCURIUS Adler-Ortho	69	0,3	30	0,6	-	-
CCA Mathys	616	2,7	29	0,6	-	-
VERSYS HERITAGE Zimmer	138	0,6	2	0,0	-	-
LC - Samo	422	1,9	1	0,0	-	-
ORTHO-FIT Zimmer	830	3,7	-	-	-	-
STANDARD STRAIGHT Zimmer	778	3,5	-	-	-	-
SL -Hit Medica	737	3,3	-	-	-	-
SEM II DMO	638	2,8	-	-	-	-
RELIANCE HOWMEDICA	623	2,8	-	-	-	-
VERSYS LD/FX- Zimmer	546	2,4	-	-	-	-
FIN Bioimpianti	526	2,3	-	-	-	-
JVC Wright Cremascoli	481	2,1	-	-	-	-
ULTIMA LX Johnson And Johnson	317	1,4	-	-	-	-
AHS Wright Cremascoli	312	1,4	-	-	-	-
MRL Wright Cremascoli	270	1,2	-	-	-	-
LOGICA Lima	249	1,1	-	-	-	-
DEFINITION Stryker Howmedica	240	1,1	-	-	-	-
SL Amplimedical	158	0,7	-	-	-	-
ULTIMA STRAIGHT DePuy	156	0,7	-	-	-	-
ALBI PTC Wright Cremascoli	149	0,7	-	-	-	-
Other (< 100 cases)	1.077	4,8	85	1,6	135	2,8
Total	**22.479**	**100,0**	**5.201**	**100,0**	**4.811**	**100,0**

Cementless stem	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
KORUS Bioimpianti	-	-	441	20,8	1.234	53,4
LOGICA CS Lima	151	3,5	170	8,0	201	8,7
SL Lima	286	6,6	41	1,9	199	8,6
S-TAPER Bioimpianti	576	13,3	515	24,2	146	6,3
POLARSTEM Endoplus	1	0,0	89	4,2	91	3,9
Z1 Citieffe	34	0,8	64	3,0	70	3,0
TAPERLOC Biomet	21	0,5	92	4,3	66	2,9
HARMONY SYMBIOS	-	-	5	0,2	48	2,1
APTA Adler-Ortho	116	2,7	13	0,6	34	1,5
HYDRA Adler-Ortho	35	0,8	36	1,7	32	1,4
H-MAX S Lima	-	-	2	0,1	28	1,2
DUOFIT RKT Samo	2	0,0	-	-	28	1,2
REVISION HIP Lima	6	0,1	8	0,4	16	0,7
H-MAX M Lima	-	-	11	0,5	13	0,6
CORAE Adler-Ortho	1	0,0	31	1,5	12	0,5
ADR Endoplus	15	0,3	8	0,4	7	0,3
CORAIL De Puy	8	0,2	49	2,3	6	0,3
QUADRA-H Medacta	15	0,3	-	-	5	0,2
SUMMIT De Puy	24	0,6	18	0,8	4	0,2
CONUS Centerpulse	26	0,6	14	0,7	4	0,2
MRP Bioimpianti	25	0,6	3	0,1	4	0,2
RECTA Adler-Ortho	104	2,4	34	1,6	2	0,1
C2 Lima	21	0,5	11	0,5	1	0,0
SL REVISION Sulzer	27	0,6	5	0,2	1	0,0
TWINSYS Mathys	52	1,2	3	0,1	1	0,0
ACCOLADE Osteonics Stryker Howmedica	1.463	33,9	343	16,1	-	-
G2 De Puy	50	1,2	42	2,0	-	-
SPS MODULAR Symbios	31	0,7	6	0,3	-	-
SL PLUS Endoplus	22	0,5	3	0,1	-	-
COXAFIT HIP STEM FGL ARGE	23	0,5	1	0,0	-	-
HIP FRACTURE - Howmedica	283	6,5	-	-	-	-
PPF Biomet	266	6,2	-	-	-	-
ENDON Tantum	188	4,3	-	-	-	-
PORO-LOCK II Hit Medica	74	1,7	-	-	-	-
H-AC STEM FURLONG Jri	69	1,6	-	-	-	-
VERSYS FIBER METAL TAPER Zimmer	46	1,1	-	-	-	-
EURO HIP SYSTEM Wright Cremascoli	41	0,9	-	-	-	-
PROFEMUR Z Wright Cremascoli	23	0,5	-	-	-	-
Other (< 20 cases)	197	4,6	66	3,1	60	2,6
Total	**4.322**	**100,0**	**2.124**	**100,0**	**2.313**	**100,0**

5.2 Other characteristics of hemiarthroplasties

Number of surgeries according to **hemihead type**

Hemihead type	N.	%
Bipolar head – to be assembled in the operating theatre	39.846	96,0
Bipolar head – preassembled	1.102	2,7
Monoarticular	425	1,0
Monoblock prosthesis	112	0,3
Total	**41.485**	**100,0**

Stem was cemented in 63,8% and stem had a modular neck in 7,8%.
In year 2017 1,4% of hemi has ceramic heads, the other has metal head.

6. Blood transfusion

Percentage of operations performed on patients admitted between 1st January 2003 and 31st December 2017 **according to type of operation and transfusion**

Type of surgery	None	Autologous (recovery)	Autologous (predeposit)	Homologous	Autologous and homologous
Emergency primary	31,5	9,3	-	53,6	5,6
Elective primary	23,5	25,5	25,5	16,8	8,8
Revision	15,0	14,9	12,5	45,2	12,4

In the following tables the analysis is repeated according to **type of surgery** and **type of hospital**

Emergency primary THA and hemiarthroplasty				
Hospital	**None**	**Autologous (recovery)**	**Homologous**	**Autologous and homologous**
AOSP	34,4	2,6	62,6	0,4
Privato	11,4	36,0	27,1	24,6
AUSL	39,4	4,5	53,1	3,0
IOR	7,4	0,5	92,1	0,0

Elective primary				
Hospital	**None**	**Autologous (recovery)**	**Homologous**	**Autologous and homologous**
AOSP	32,0	44,2	21,1	2,6
Privato	13,2	69,7	4,4	12,8
AUSL	29,0	40,7	20,7	9,6
IOR	25,4	42,6	27,8	4,1

Percentage of Elective primary **according to type of transfusion and year**

Elective primary					
Year	**None**	**Autologous (recovery)**	**Autologous (predeposit)**	**Homologous**	**Autologous and homologous**
2003	13,5	9,3	50,8	18,1	8,4
2017	50,9	30,9	0,8	14,1	3,3

7. Complications occurred during hospitalization

RIPO registers all kind of complications occurred during hospitalization. In the following tables only intra-operative and post-operative local complications are presented.

The rate of complications in **primary surgery** carried out on patients hospitalized between January 1st 2000 and December 31st 2017.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	*%*		**N.**	*%*
Calcar fracture	458	*0,4*	Deep vein thromb	108	*0,1*
Diaphysis fracture	364	*0,3*			
Greater troch. fracture	241	*0,2*			
Acetabulum fracture	163	*0,1*	Early infection	92	*0,1*
Anaesthesiolog. complications	153	*0,1*			
Hemorragia	57	*0,1*			
Instability	24	*0,02*			
Other	100	*0,1*			
Total	**1.560**	***1,4***	**Total**	**200**	***0,2***

The rate of complications in **revision surgery** carried out on patients hospitalized between January 1st 2000 and December 31st 2017.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	*%*		**N.**	*%*
Diaphysis fracture	233	*1,4*	Early infection	54	*0,3*
Calcar fracture	79	*0,5*			
Anaesthesiolog. complications	58	*0,4*			
Greater troch. fracture	56	*0,3*	Deep vein thromb	21	*0,1*
Acetabulum fracture	26	*0,2*			
Hemorragia	24	*0,1*			
Other	39	*0,2*			
Total	**515**	***3,1***	**Total**	**75**	***0,5***

The rate of complications in **hemiarthroplasty** carried out on patients hospitalized between January 1st 2000 and December 31st 2017.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Calcar fracture	199	*0,5*	Deep vein thromb	73	*0,2*
Anaesthesiolog. complications	149	*0,4*			
Greater troch. fracture	129	*0,3*			
Diaphysis fracture	73	*0,2*	Early infection	65	*0,2*
Hemorragia	21	*0,1*			
Acetabulum fracture	5	*0,01*			
Other	53	*0,1*			
Total	**629**	***1,5***	**Total**	**138**	***0,3***

Complications recorded are those that occurred during hospitalization.

7.1 Deaths during hospitalization

Number of deaths in prosthetic surgery on patients hospitalized between January 1st 2000 and December 31st 2017.
The deaths recorded are those that occurred during hospitalization.

Years 2000-2017			
Type of surgery	**Deaths**	**n. of operations**	**Percentage**
Primary THA	253	111.856	0,2
Hemiarthroplasty	1.836	41.485	4,4
Partial and total Revision	112	16.432	0,7
Resurfacing prostheses	0	2.791	-
Prosthesis removal	32	1.354	2,4

Number of deaths occurred **within 90 days** from the date of intervention. This data are resulted from through merging with other data-base. Only patients living in Emilia Romagna are considered. Following table includes deaths of previous table.

% of Deaths occurred within 90 days after Hemiarthroplasty, by gender		
Year of surgery	**Females**	**Males**
2000	10,7	24,3
2001	10,2	22,3
2002	9,6	19,3
2003	10,4	23,3
2004	9,7	20,7
2005	10,1	22,1
2006	9,3	20,1
2007	9,6	20,8
2008	10,4	22,0
2009	10,8	18,9
2010	11,0	21,6
2011	12,8	21,5
2012	9,0	21,1
2013	9,0	21,8

2014	9,5	19,2
2015	11,7	18,5
2016	10,7	21,6
2017	10,1	22,9

8. Duration of pre-operative hospitalization

Days of pre-operative hospitalization (mean, minimum, maximum) according to type and year of operation

Year 2000			
Type of operation	**N.**	**Mean pre-op.**	**Range**
Primary THA	4.388	2,4	0-61
Hemiarthroplasty	1.761	3,6	0-44
Revision	747	3,9	0-52
Prosthesis removal	42	5,1	1-20
Year 2017			
Type of operation	**N.**	**Mean pre-op.**	**Range**
Primary THA	8.237	1,2	0-28
Hemiarthroplasty	2.296	2,3	0-34
Revision	854	3,1	0-41
Resurfacing	31	1,0	0-1
Prosthesis removal	96	4,7	0-41

9. *Analysis of survival of primary surgery*

9.1 Cox multivariate analysis

The Cox multivariate analysis identifies any variables that are independent from each other that can influence the event, in our case the removal of at least one prosthesis component. Analysis was performed on three independent variables, sex, age at surgery and pathology.
Other variables that might influence the outcome of surgery, such as the method of fixing the prosthesis, or joint coupling, were not introduced into the analysis because they were not independent (for example, prosthesis fixation depends on the patient's age).
All primary hip arthroplasties performed in the Region between 2000 and 2017 were analysed.
As in past year, this analysis was limited to patients resident in Emilia-Romagna region. In such a way the bias due to lost to follow up of non-resident patients is avoided.

COX PROPORTIONAL RISK MODEL

Variables

Dependent: Follow-up
Independent: age, gender, diagnosis

Number of valid observations 81.530
Non revised: 77.716
Revised: 3.814

Chi-square: 192,2088 *p*= 0,0001

VARIABLE	SIGNIFICANCE (p)
Gender	**S** (0,001)
Age	**S** (0,001)
Diagnosis	**S** (0,001)

The chi-square test, used to test globally the model applied, was significant, which suggested that, on the whole, the variables inserted in the model influenced the outcome of prosthetic surgery.
The effect of each variable was compared to the others when equal.
At this point we tested how it acts, either by reducing or increasing the risk.

To analyse the influence of the disease, the patients were divided into 7 groups:
- coxarthrosis
- rheumatic arthritis (rheumatoid arthritis, psoriasis, rhizomelic spondylitis)
- femoral fractures and sequelae (necrosis and post-traumatic arthrosis)
- idiopathic necrosis of the femoral head
- sequelae of congenital and infantile diseases (LCA, DCA, Perthes, epiphysiolysis)
- "other" that include sequelae of septic coxitis, coxitis from TBC, ankyloses, and metastasis

The rate of relative risk was expressed with respect to the risk rate presented by the patients affected by coxarthrosis. A relative risk rate below 1 indicated a reduced risk of prosthesis revision, a relative risk rate over 1 indicated an increased risk of prosthesis revision.

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Patients of the group 'Other pathologies' had a 1,9-fold greater risk of failure. In this heterogeneous group, sequelae of congenital and infantile septic coxitis, although the low numerosity, represent the higher risk pathology.
Also patients treated due to femoral neck fracture and sequelae, the risk of loosening had a 1,3-fold greater risk of than in patients treated for coxarthrosis.

Conversely, in patients treated by arthroplasty due to necrosis, or to correct sequelae of congenital and childhood diseases the risk of loosening was not significantly higher than in patients treated for coxarthrosis.

Concerning gender and age, males have a higher risk of 1,2 compared to women, and with increasing age of the patient decreases the risk of revision surgery.

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.2 Rate of failure

Prosthesis failure is defined as the revision of even one prosthetic component.

As already mentioned in the introduction of this report the recovery of data of operations not reported to RIPO is in progress. The uncertainty due to 10% of missing reports, over 18 yrs, may lead to an underestimation of the revision rate that is not quantifiable at the moment.

The following table shows in the first column the number of primary joint arthroplasty operations performed in the period from 1st January 2000 to 31st December 2017 **on resident in Emilia-Romagna region**, the second, third and fourth columns show the number of revision operations performed on the same patients.
Some revision operations were performed in the same hospital as the primary operation while others were performed at other hospitals (also outside Emilia Romagna Region).

Type of operation	Number of operations	N. of revisions performed in the same hospital	N. of revisions performed in a different hospital	N. of revisions performed in an Hospital outside Emilia-Romagna region	Mean Follow-up
Primary THA	81.530	2.335	1.281	198	6,9
Hemy *	40.104	664	176	21	3,5
Total revision	2.785	209	98	9	7,3

* hemiarthroplasties with acetabular buffer are not considered

The following table shows the number of resurfacing prostheses performed in Emilia-Romagna. Resurfacing prosthesis has been used significantly only since 2002.

Type of operation	Number of operations	N. of revisions performed in the same hospital	N. of revisions performed in a different hospital	N. of revisions performed in an Hospital outside Emilia-Romagna region	Mean Follow-up
Resurfacing	870	50	21	8	7,9

In Primary THA, **38,8%** of Revisions was performed in a different hospital, in Hemiarthroplasty **22,9%** and in total revision **33,9%.**

As for other registries, revision surgery has been divided in two classes: major if one of both bone-fixed components has been revised (cup or stem), and minor if liner, and/or head, and/or modular neck have been exchanged.

The following table shows the rate of revision according to type of surgery:

The following table shows the rate of revision according to type of surgery:

Type of operation	N° major revisions	N° minor revisions	N° of unclassified revisions^	Revision rate
Primary THA	2.816	800	198	3.814/81.530
Hemiarthroplasty*	649	191	21	861/40.104
Resurfacing	70	1	8	79/870
Total revision	254	53	9	316/2.785

* Minor revision included revision of head, while implant of acetabular component is considered major revision.
^ Revisions not classify because performed outside Region.
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.3 Survival curves according to Kaplan Meier

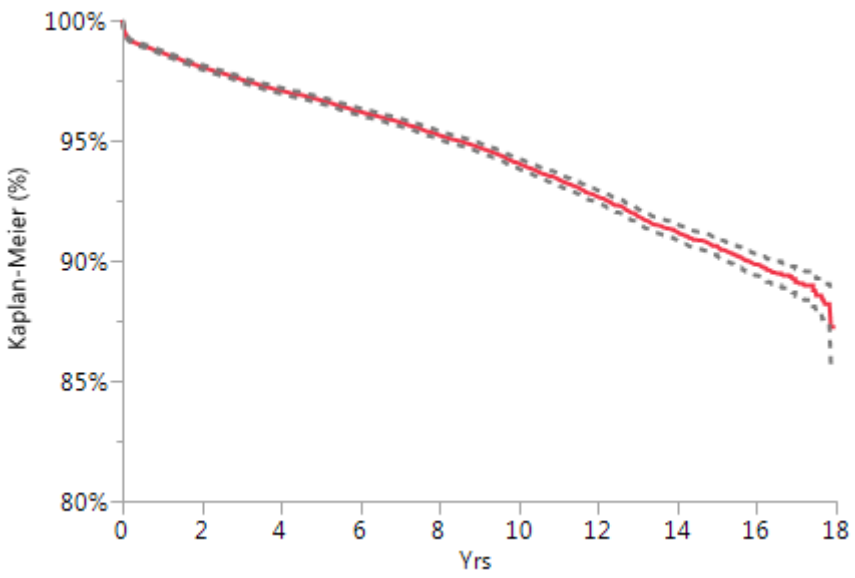
The survival curve calculated by the Kaplan Meier method enables an estimation of the probability that each individual has of maintaining its initial condition (prosthesis in place) over time.
The following paragraphs show the survival curves calculated separately for primary prosthesis, endoprosthesis, and total joint revision.
The influence of fixation and articular coupling was assessed only for primary prosthesis.

9.4 Analysis of survival in primary total hip arthroplasty

81.530 primary arthroprostheses are under observation. Of these, 3.814 volte revisions were carried out.

Number of arthroprostheses	n. revisions	% survival at 17 yrs	Confidence Interval 95%	Mean Follow-up
81.530	3.814	89,1	88,5-89,7	6,9

Survival curve



Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

The following table shows the rate of revision in total joint arthroplasty according **to cause of revision**: the **% distribution** of the causes of failure is shown.

Cause of revision	Rate	%	% Distribution failure causes
Aseptic loosening of the stem	**617**/81.530	0,8	16,2
Aseptic loosening of the cup	**568**/81.530	0,7	14,9
Recurrent prosthesis dislocation	**548**/81.530	0,7	14,4
Periprosthetic bone fracture	**511**/81.530	0,6	13,4
Breakage of prosthesis	**383**/81.530	0,5	10,0
Global aseptic loosening	**225**/81.530	0,3	5,9
Septic loosening	**224**/81.530	0,3	5,9
Pain without loosening	**84**/81.530	0,1	2,2
Poly wear	**84**/81.530	0,1	2,2
Primary instability	**77**/81.530	0,1	2,0
Heterotopic bone	**34**/81.530	0,04	0,9
Metallosis	**34**/81.530	0,04	0,9
Other	**77**/81.530	0,1	2,0
Unknown*	**348**/81.530	0,4	9,1
Total	**3.814/81.530**	**4,7**	**100,0**

*196 unknown because performed outside region

Percentage of causes of revision according to follow-up

Cause of revision	0-2 Years	3-4 Years	>=5 Years
Prosthesis dislocation	25,2	8,1	5,2
Aseptic loosening of the stem	15,1	22,2	15,3
prosthesis dislocation	13,1	9,7	15,0
Aseptic loosening of the cup	10,3	15,8	19,4
Septic loosening	7,4	6,4	4,0
Breakage of prosthesis	5,9	15,8	12,3
Primary instability	4,5	0,4	0,0
Unknown	3,6	2,6	4,9
Global aseptic loosening	3,0	7,0	8,5
Pain without loosening	2,8	2,8	1,4
Heterotopic bone	1,4	0,9	0,4
Poly wear	0,4	0,9	4,5
Metallosis	0,1	0,6	1,9
Unknown (performed outside Emilia Romagna Region)	4,0	5,9	6,1
Other	3,3	0,9	1,1

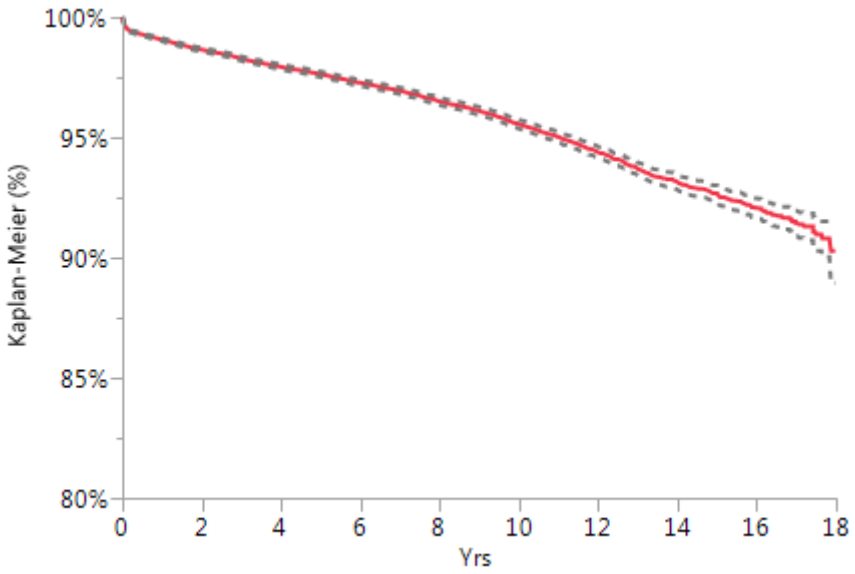
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.5 Analysis of survival in primary total hip arthroplasty – major revisions

81.530 primary arthroprostheses are under observation. Of these, 2.816 revisions were carried out to remove cup and/or stem.

Number of arthroprostheses	N. revisions	% survival at 17 yrs	Confidence Interval 95%	Mean Follow-up
81.530	2.816	91,4	90,9-91,9	6,9

Survival curve



9.6 Analysis of survival according to model of prosthesis

Survival analysis has been calculated either for association of cup and stems.
In the following table the prosthesis is considered 'failed' when even a single component has been revised.
Neither articular coupling nor case mix are considered. These two parameters may be differently distributed among groups.
Cemented cup and stem in bold
Survival analysis was not calculated if prostheses at risk are below 20 cases.

Cup (stem) Manufacturer	From years	N.	n. revisions	% survival 5 yrs	N. at risk at 5 yrs	% survival 10 yrs	N. at risk at 10 yrs
Fixa Ti-POR (Apta) Adler-Ortho	2007	4.732	82	98,2 (97,7-98,6)	2.323	97,4 (96,6-98,0)	34
Fixa Ti-POR (Hydra) Adler-Ortho	2007	3.169	77	96,9 (96,0-97,6)	989	-	-
AnCA Fit (AnCA Fit) Wright Cremascoli	2000	2.875	250	95,9 (95,1-96,6)	2.596	93,2 (92,2-94,1)	2.227
FIXA (RECTA) Adler-Ortho	2004	2.725	157	96,4	2.379	93,3	731

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

				(95,6-97,0)		(92,1-94,3)	
EP-FIT PLUS (SL PLUS) ENDOPLUS	2003	1.963	77	96,8 (95,9-97,5)	1.554	95,4 (94,2-96,4)	407
ABGII (ABGII) Stryker Howmedica	2000	1.960	100	97,8 (97,0-98,3)	1.719	95,2 (94,0-96,2)	946
Fixa Ti-POR (CORAE) Adler-Ortho	2010	1.901	20	98,7 (97,9-99,2)	63	-	-
FIXA (APTA) Adler-Ortho	2004	1.712	97	96,7 (95,8-97,5)	1.574	94,2 (92,9-95,2)	1.096
Fixa Ti-POR (RECTA) Adler-Ortho	2007	1.570	52	96,6 (95,5-97,5)	691	-	-
R3 (SL PLUS MIA) Smith & Nephew	2010	1563	21	98,3 (97,4-98,9)	428	-	-
CLS (CLS) Sulzer Centerpulse Zimmer	2000	1.516	107	97,5 (96,6-98,2)	1.342	94,4 (93,1-95,6)	1.034
FITMORE (CONUS) SulzerCenterpulse Zimmer	2000	1.219	54	97,3 (96,2-98,1)	941	95,6 (94,1-96,8)	479
EXPANSION (CBC) Mathys	2003	1.194	78	94,7 (93,2-95,8)	898	92,3 (90,3-93,9)	260
Exceed ABT (TAPERLOC) Biomet	2006	1.115	18	98,4 (97,5-99,0)	499	97,8 (96,0-98,9)	34
EP-FIT PLUS (PROXYPLUS) Smith & Nephew	2005	1.098	29	98,1 (97,1-98,8)	803	95,9 (93,9-97,3)	212
BICON PLUS (SL PLUS) Smith & Nephew	2000	929	79	95,9 (94,4-97,0)	802	93,1 (91,2-94,7)	509
FITMORE (CLS) SulzerCenterpulse Zimmer	2000	769	36	97,1 (95,6-98,1)	685	95,5 (93,6-96,8)	494
R3 (POLARSTEM) Smith & Nephew	2012	686	9	-	-	-	-
PINNACLE SECTOR II (CORAIL) DePuy	2002	675	34	96,0 (94,2-97,3)	448	92,6 (89,1-95,1)	107
REFLECTION (**BASIS**) Smith & Nephew	2001	626	43	96,3 (94,4-97,6)	467	91,5 (88,3-93,8)	218
CLS (CONUS) SulzerCenterpulse Zimmer	2000	595	48	97,1 (95,3-98,2)	534	93,9 (91,6-95,7)	438
Ep-fit (Polarstem) Endoplus	2008	584	9	98,3 (96,8-99,1)	138	-	-
FIXA (**APTA**) Adler-Ortho	2005	573	22	97,1 (95,4-98,2)	479	96,4 (94,4-97,7)	280
Versafitcup CC (Amistem) Medacta	2011	541	17	96,3 (93,9-97,8)	47	-	-
REFLECTION (**SYNERGY**) Smith & Nephew	2000	522	22	98,3 (96,5-99,2)	313	94,0 (90,2-96,3)	131
TRILOGY (VERSYS FIBER) Zimmer	2000	505	28	96,4 (94,3-97,7)	449	94,9 (92,5-96,6)	348
TRIDENT PSL HA CLUSTER (ABGII) Stryker Howmedica	2002	498	32	95,3 (93,0-96,9)	383	93,2 (90,3-95,3)	168
DUOFIT PSF (**P507**) Samo	2000	492	28	98,1 (96,3-99,0)	434	96,3 (94,0-97,7)	342
CONTEMPORARY (EXETER V40) Stryker Howmedica	2000	488	25	96,1 (93,8-97,6)	360	94,3 (91,4-96,3)	202
RECAP RESURFACING (TAPERLOC) Biomet	2005	486	27	95,8 (93,6-97,3)	439	93,7 (90,7-95,8)	129
TRIDENT PSL HA CLUSTER (**EXETER V40**) Howmedica	2002	486	4	99,4 (98,0-99,8)	269	99,4 (98,0-99,8)	136
DELTA TT (H-MAX S) Lima	2009	458	6	-	-	-	-
JUMP SYSTEM (SYNTHESIS) Permedica	2013	450	4	-	-	-	-

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

JUMP SYSTEM (EXACTA) Permedica	2010	449	2	-	-	-	-
PINNACLE SECTOR II (SUMMIT) DePuy	2003	444	7	98,0 (95,6-99,1)	195	98,0 (95,6-99,1)	58
SELEXYS TH (CBC) MATHYS	2006	435	48	92,0 (89,0-94,3)	352	85,8 (81,0-89,5)	89
AnCA Fit (PROFEMUR Z) Wright Cremascoli	2002	421	41	93,8 (91,0-95,7)	382	91,7 (88,5-94,0)	327
DELTA TT (MODULUS HIP SYSTEM) Lima	2007	417	13	97,1 (94,8-98,4)	185	-	-
Fixa Ti-POR (Alata Acuta) Adler-Ortho	2007	402	8	97,6 (95,3-98,8)	172	-	-
TOP (CFP) Link	2000	400	15	97,7 (95,6-98,8)	356	95,8 (93,2-97,5)	272
DELTA PF (MODULUS HIP SYSTEM) Lima	2003	398	10	97,9 (95,9-99,0)	304	97,1 (94,6-98,4)	162
R3 (SL PLUS) Smith & Nephew	2009	395	11	96,8 (93,7-98,3)	128	-	-
G7 PPS (TAPERLOC COMPLETE) Biomet	2014	384	7	-	-	-	-
FIXA TI-POR (APTA-FIX) Adler-Ortho	2015	371	7	-	-	-	-
CONTINUUM (CLS) Zimmer	2010	365	4	98,3 (94,9-99,5)	84	-	-
Versafitcup CC (Minimax) Medacta	2007	363	16	96,6 (94,1-98,1)	263	-	-
CUPULE RELOAD AVANTAGE (TAPERLOC) Biomet	2008	348	11	97,0 (94,6-98,4)	204	-	-
R3 (ADR) Smith & Nephew	2009	336	16	94,6 (91,1-96,7)	121	-	-
MULLER (JVC) Wright Cremascoli	2000	326	14	98,4 (96,2-99,3)	269	96,1 (92,8-97,9)	159
STANDARD CUP (CLS) Sulzer Centerpulse Zimmer	2000	322	14	98,4 (96,2-99,3)	296	96,9 (94,2-98,4)	243
VERSAFITCUP CC TRIO (MINIMAX) Medacta	2012	315	4	-	-	-	-
CLS Zimmer (SL PLUS) Smith & Nephew	2001	311	17	96,6 (93,8-98,2)	269	94,9 (91,5-97,0)	145
MULLER (MRL) Wright Cremascoli	2000	305	19	96,5 (93,6-98,1)	245	94,8 (91,3-96,9)	172
Other (< 300 cases)	2000	33.011	1.807	96,2 (96,0-96,4)	19.340	93,2 (92,9-93,6)	9.487
Unknow	2000	337	31	94,2 (90,9-96,3)	188	89,1 (84,2-92,7)	113
All models	**2000**	**81.530**	**3.814**	**96,7 (96,5-96,8)**	**48.419**	**94,0 (93,8-94,3)**	**22.199**

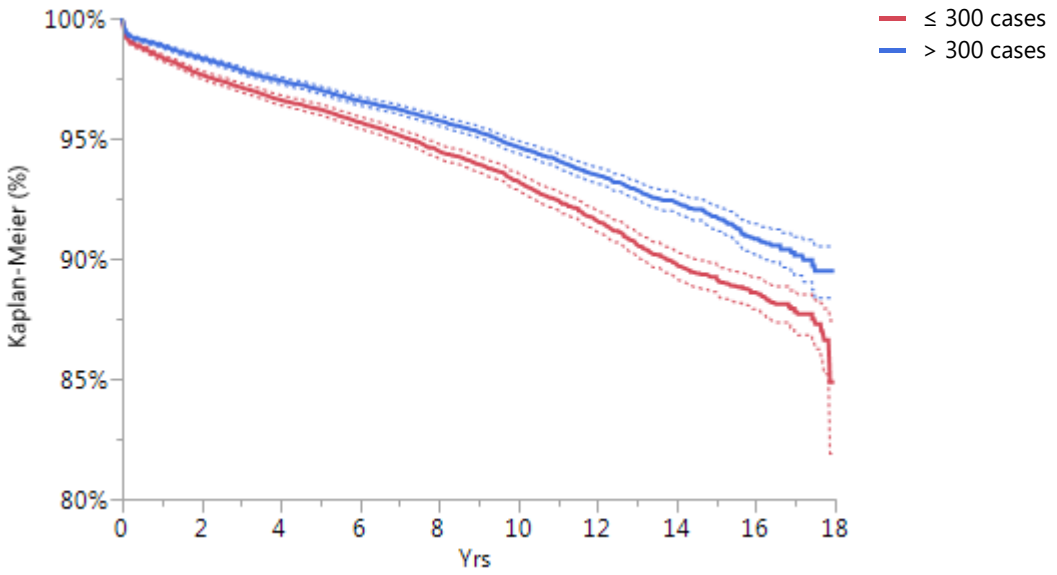
The marked dispersion of prosthesis types and the wide variability of the combinations between acetabulum and stems enable the comparison of only some types of prosthesis.
To provide, anyway, an indication of the survival of the prosthesis types less represented in data banks, they were grouped together to make a class of prostheses of which less than 300 were implanted in 2000-2017.
They were compared with the prosthesis types of which more than 300 were implanted (those of the previous table), also grouped into a single class.
Survival is not adjusted for articular coupling.

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Analysis of the survivorship of the prosthesis according to commercial type (cup + stem)

	Number of implants	n. revisions	% survival at 17 yrs	Confidence Interval 95%	Mean Follow-up
Models > 300 cases	48.182	1.976	90,1	89,3-90,9	6,9
Models < 300 cases	33.011	1.807	87,8	87,0-88,6	7,0

Survival curve



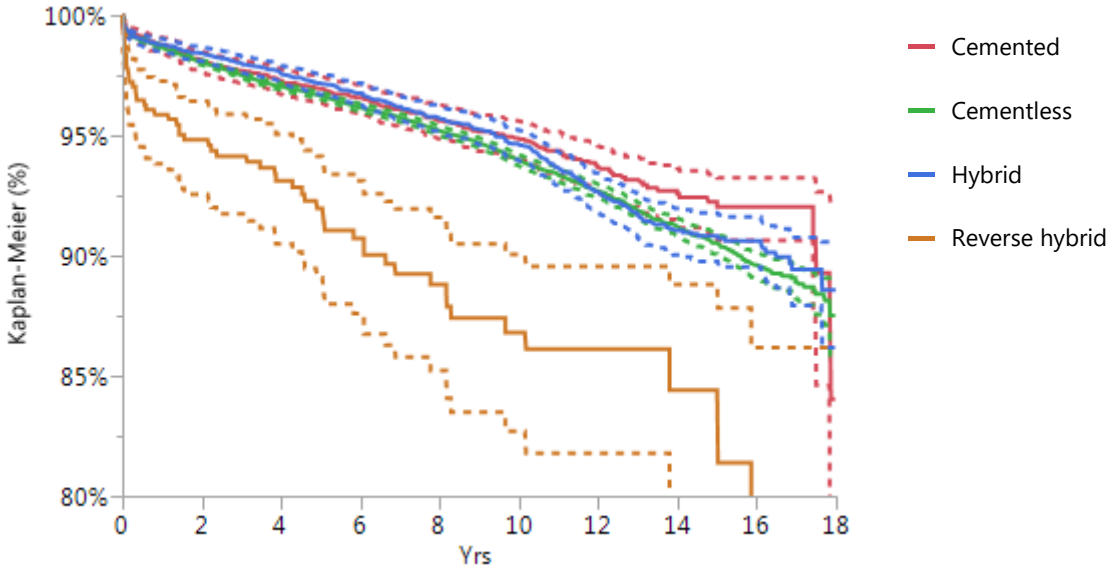
Curves are significantly different (p=0.001, Wilcoxon test)

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.7 Analysis of survival in primary total hip arthroplasty according to fixation

In the following table cemented, cementless and hybrid prosthesis fixation are consiedered separately.

Fixation	N.	Removals	% survival at 17 yrs (c.i. at 95%)	Mean Follow-up
Cementless	69.848	3.163	88,9 (88,2-89,6)	6,7
Hybrid (cemented stem, cementless cup)	6.789	379	89,4 (87,9-90,8)	8,9
Cemented	4.118	200	92,0 (90,6-93,2)	8,5
Reverse hybrid (cementless stem, cemented cup)	546	55	77,3 (65,1-86,2)	6,5



Curves are significantly different (p=0.001, Wilcoxon test)

Cemented			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**61**/4.118	1,5	30,5
Global aseptic loosening	**37**/4.118	0,9	18,5
Recurrent prosthesis dislocation	**28**/4.118	0,7	14,0
Aseptic loosening of the stem	**20**/4.118	0,5	10,0
Septic loosening	**19**/4.118	0,5	9,5
Periprosthetic bone fracture	**15**/4.118	0,4	7,5
Primary instability	**4**/4.118	0,1	2,0
Breakage of prosthesis	**2**/4.118	0,05	1,0
Other	**1**/4.118	0,02	0,5
Unknown *(6 performed outside region)*	**13**/4.118	0,3	6,5
Total	**200/4.118**	**4,9**	**100,0**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Cementless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**475**/69.848	0,7	15,0
Periprosthetic bone fracture	**454**/69.848	0,6	14,4
Aseptic loosening of the cup	**452**/69.848	0,6	14,3
Recurrent prosthesis dislocation	**433**/69.848	0,6	13,7
Breakage of prosthesis	**373**/69.848	0,5	11,8
Septic loosening	**173**/69.848	0,2	5,5
Global aseptic loosening	**138**/69.848	0,2	4,4
Pain without loosening	**83**/69.848	0,1	2,6
Primary instability	**71**/69.848	0,1	2,2
Poly wear	**68**/69.848	0,1	2,1
Metallosis	**33**/69.848	0,05	1,0
Heterotopic bone	**30**/69.848	0,04	0,9
Other	**71**/69.848	0,1	2,2
Unknown *(176 performed outside region)*	**309**/69.848	0,4	9,8
Total	**3.163/69.848**	**4,5**	**100,0**
Hybrid			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**112**/6.789	1,6	29,6
Recurrent prosthesis dislocation	**75**/6.789	1,1	19,8
Global aseptic loosening	**44**/6.789	0,6	11,6
Periprosthetic bone fracture	**35**/6.789	0,5	9,2
Aseptic loosening of the cup	**35**/6.789	0,5	9,2
Septic loosening	**30**/6.789	0,4	7,9
Poly wear	**12**/6.789	0,2	3,2
Breakage of prosthesis	**6**/6.789	0,1	1,6
Heterotopic bone	**3**/6.789	0,04	0,8
Primary instability	**2**/6.789	0,03	0,5
Pain without loosening	**1**/6.789	0,01	0,3
Other	**5**/6.789	0,1	1,3
Unknown *(8 performed outside region)*	**19**/6.789	0,3	5,0
Total	**379/6.789**	**5,6**	**100,0**
Reverse hybrid			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**18**/546	3,3	32,7
Recurrent prosthesis dislocation	**8**/546	1,5	14,5
Periprosthetic bone fracture	**7**/546	1,3	12,7
Aseptic loosening of the stem	**7**/546	1,3	12,7
Global aseptic loosening	**5**/546	0,9	9,1
Septic loosening	**2**/546	0,4	3,6
Breakage of prosthesis	**2**/546	0,4	3,6
Unknown *(5 performed outside region)*	**6**/546	1,1	10,9
Total	**55/546**	**10,1**	**100,0**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

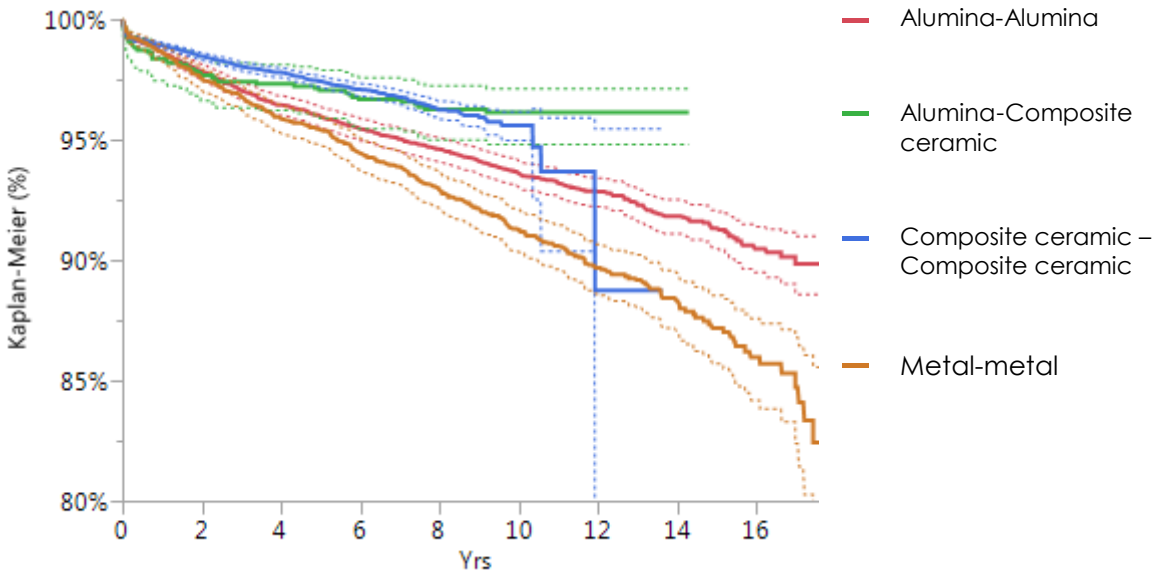
9.8 Analysis of survival in primary total hip arthroplasty according to coupling

The following table shows survival of prosthesis according to coupling, Only couplings implanted more than 1000 are presented. Dual mobility cups are excluded.
The articular coupling is defined about characteristics of the sliding surface, regardless of insert is made of a single material or two.

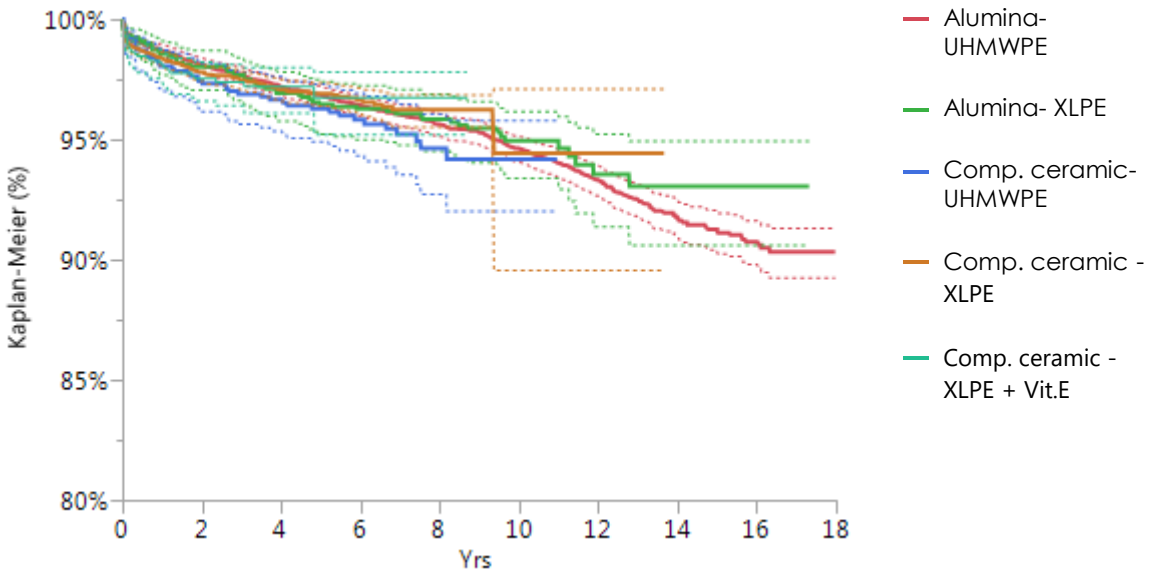
The survival curve are shown in three separate figures, to have better graphics.

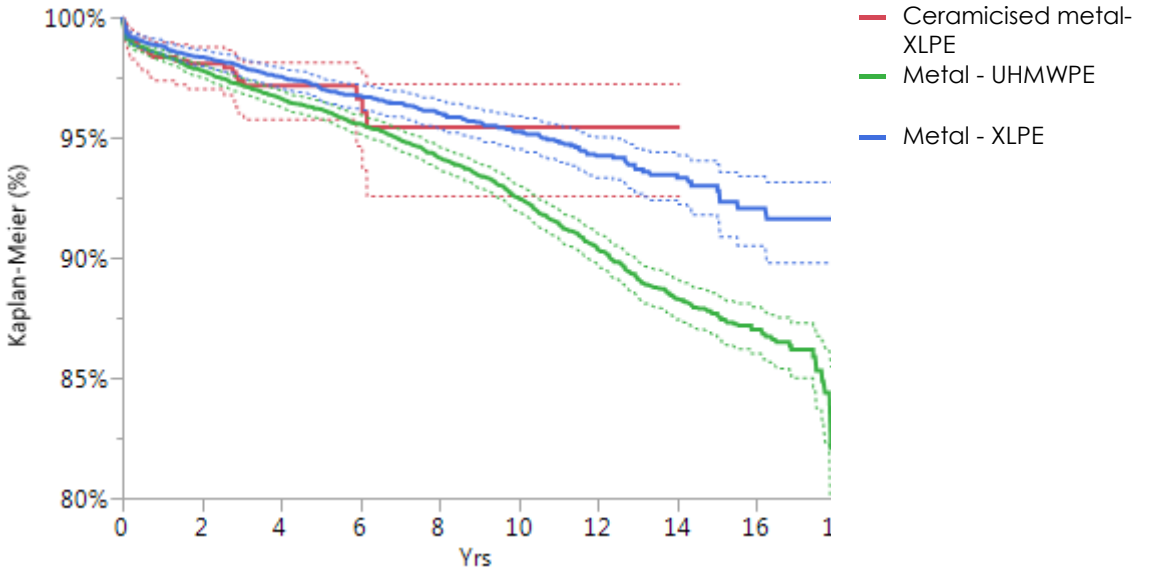
Articular coupling	Mean Follow-up	N.	Removals	% survival at 5 yrs	c.i. at 95%	% survival at 10 yrs	c.i. at 95%
Composite ceramic – Composite ceramic	4,4	24.593	587	97,4	97,2-97,6	95,6	95,0-96,2
Metal - UHMWPE	9,5	11.190	899	96,2	95,8-96,5	92,5	91,9-93,0
Allumina-Allumina	11,0	8.156	576	96,0	95,5-96,4	93,6	93,0-94,1
Alumina-UHMWPE	10,5	7.891	498	96,8	96,4-97,2	94,6	94,1-95,1
Comp. ceramic -XLPE	3,3	7.747	193	96,9	96,4-97,3	94,4	89,5-97,1
Metal-XLPE	7,3	5.901	233	97,0	96,5-97,5	95,2	94,5-95,9
Metal-Metal	9,9	4.666	428	95,4	94,8-96,0	91,3	90,3-92,1
Comp. ceramic - XLPE + Vit.E	2,2	1.833	41	96,7	95,2-97,8	-	-
Allumina-XLPE	9,0	1.185	57	96,5	95,2-97,4	94,9	93,4-96,2
Alumina-Composite ceramic	9,1	1.165	43	97,0	95,9-97,9	96,1	94,8-97,1
Ceramicised metal-XLPE	3,3	1.162	28	97,2	95,7-98,1	95,4	92,6-97,2
Comp. ceramic-UHMWPE	5,6	1.105	46	96,3	94,9-97,3	94,2	92,0-95,8

Survival Curve



Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients





Curves are significantly different (p=0.010, Wilcoxon test)

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Metal - Metal			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**104**/4.666	2,2	24,3
Aseptic loosening of the stem	**54**/4.666	1,2	12,6
Global aseptic loosening	**36**/4.666	0,8	8,4
Septic loosening	**34**/4.666	0,7	7,9
Breakage of prosthesis (16 stems and 16 cups)	**32**/4.666	0,7	7,5
Metallosis	**31**/4.666	0,7	7,2
Prosthesis dislocation	**28**/4.666	0,6	6,5
Periprosthetic bone fracture	**27**/4.666	0,6	6,3
Pain without loosening	**13**/4.666	0,3	3,0
Primary instability	**5**/4.666	0,1	1,2
Heterotopic bone	**3**/4.666	0,1	0,7
Other	**5**/4.666	0,1	1,2
Unknown *(44 performed outside region)*	**56**/4.666	1,2	13,1
Total	**428/4.666**	**9,2**	**100,0**
Metal - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**208**/11.190	1,9	23,1
Aseptic loosening of the stem	**161**/11.190	1,4	17,9
Prosthesis dislocation	**147**/11.190	1,3	16,4
Global aseptic loosening	**96**/11.190	0,9	10,7
Periprosthetic bone fracture	**73**/11.190	0,7	8,1
Poly wear	**56**/11.190	0,5	6,2
Septic loosening	**43**/11.190	0,4	4,8
Pain without loosening	**16**/11.190	0,1	1,8
Breakage of prosthesis (9 stems, 2 cups, 1 insert and 1 unknown)	**13**/11.190	0,1	1,4
Primary instability	**8**/11.190	0,1	0,9
Heterotopic bone	**1**/11.190	0,0	0,1
Other	**6**/11.190	0,1	0,7
Unknown *(36 performed outside region)*	**71**/11.190	0,6	7,9
Total	**899/11.190**	**8,0**	**100,0**
Metal - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Periprosthetic bone fracture	**75**/5.901	1,3	32,2
Prosthesis dislocation	**36**/5.901	0,6	15,5
Aseptic loosening of the cup	**28**/5.901	0,5	12,0
Aseptic loosening of the stem	**27**/5.901	0,5	11,6
Global aseptic loosening	**16**/5.901	0,3	6,9
Septic loosening	**16**/5.901	0,3	6,9
Primary instability	**7**/5.901	0,1	3,0
Pain without loosening	**5**/5.901	0,1	2,1
Poly wear	**2**/5.901	0,0	0,9
Heterotopic bone	**1**/5.901	0,0	0,4
Breakage of stem	**1**/5.901	0,0	0,4
Other	**6**/5.901	0,1	2,6
Unknown *(6 performed outside region)*	**13**/5.901	0,2	5,6

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Total	233/5.901	3,9	100,0
Alumina - Alumina			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (67 stems, 48 inserts, 50 heads, 2 cups and 6 insert+head)	**173**/8.156	2,1	30,0
Periprosthetic bone fracture	**99**/8.156	1,2	17,2
Aseptic loosening of the stem	**72**/8.156	0,9	12,5
Prosthesis dislocation	**66**/8.156	0,8	11,5
Aseptic loosening of the cup	**43**/8.156	0,5	7,5
Septic loosening	**18**/8.156	0,2	3,1
Pain without loosening	**14**/8.156	0,2	2,4
Global aseptic loosening	**12**/8.156	0,1	2,1
Primary instability	**5**/8.156	0,1	0,9
Heterotopic bone	**5**/8.156	0,1	0,9
Poly wear	**3**/8.156	0,0	0,5
Other	**11**/8.156	0,1	1,9
Unknown *(33 performed outside region)*	**55**/8.156	0,7	9,5
Total	**576/8.156**	**7,1**	**100,0**
Alumina - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**105**/7.891	1,3	21,1
Prosthesis dislocation	**84**/7.891	1,1	16,9
Aseptic loosening of the cup	**74**/7.891	0,9	14,9
Periprosthetic bone fracture	**68**/7.891	0,9	13,7
Global aseptic loosening	**36**/7.891	0,5	7,2
Septic loosening	**28**/7.891	0,4	5,6
Breakage of prosthesis (12 stems, 5 cups, 5 heads, 1 insert)	**23**/7.891	0,3	4,6
Poly wear	**15**/7.891	0,2	3,0
Pain without loosening	**7**/7.891	0,1	1,4
Primary instability	**6**/7.891	0,1	1,2
Heterotopic bone	**6**/7.891	0,1	1,2
Metallosis	**1**/7.891	0,0	0,2
Other	**3**/7.891	0,0	0,6
Unknown *(23 performed outside region)*	**42**/7.891	0,5	8,4
Total	**498/7.891**	**6,3**	**100,0**
Alumina - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**12**/1.185	1,0	21,1
Periprosthetic bone fracture	**10**/1.185	0,8	17,5
Aseptic loosening of the cup	**9**/1.185	0,8	15,8
Septic loosening	**5**/1.185	0,4	8,8
Prosthesis dislocation	**4**/1.185	0,3	7,0
Primary instability	**3**/1.185	0,3	5,3
Global aseptic loosening	**3**/1.185	0,3	5,3
Pain without loosening	**1**/1.185	0,1	1,8
Breakage of stem	**1**/1.185	0,1	1,8
Poly wear	**1**/1.185	0,1	1,8

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Other	**1**/1.185	0,1	1,8
Unknown *(3 performed outside region)*	**7**/1.185	0,6	12,3
Total	**57/1.185**	**4,8**	**100,0**
Alumina - Composite ceramic			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (8 stems, 4 inserts)	**12**/1.165	1,0	27,9
Prosthesis dislocation	**11**/1.165	0,9	25,6
Aseptic loosening of the stem	**5**/1.165	0,4	11,6
Periprosthetic bone fracture	**4**/1.165	0,3	9,3
Aseptic loosening of the cup	**2**/1.165	0,2	4,7
Septic loosening	**2**/1.165	0,2	4,7
Heterotopic bone	**1**/1.165	0,1	2,3
Other	**2**/1.165	0,2	4,7
Unknown *(3 performed outside region)*	**4**/1.165	0,3	9,3
Total	**43/1.165**	**3,7**	**100,0**
Composite ceramic - Composite ceramic			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (93 stems, 16 inserts, 3 heads)	**112**/24.593	0,5	19,1
Aseptic loosening of the stem	**101**/24.593	0,4	17,2
Periprosthetic bone fracture	**82**/24.593	0,3	14,0
Prosthesis dislocation	**78**/24.593	0,3	13,3
Septic loosening	**42**/24.593	0,2	7,2
Aseptic loosening of the cup	**36**/24.593	0,1	6,1
Primary instability	**27**/24.593	0,1	4,6
Pain without loosening	**15**/24.593	0,1	2,6
Heterotopic bone	**12**/24.593	0,0	2,0
Global aseptic loosening	**5**/24.593	0,0	0,9
Metallosis	**1**/24.593	0,0	0,2
Other	**25**/24.593	0,1	4,3
Unknown *(29 performed outside region)*	**51**/24.593	0,2	8,7
Total	**587/24.593**	**2,4**	**100,0**
Composite ceramic - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**16**/1.105	1,4	34,8
Aseptic loosening of the stem	**8**/1.105	0,7	17,4
Breakage of prosthesis (4 stems, 1 unknown)	**5**/1.105	0,5	10,9
Pain without loosening	**3**/1.105	0,3	6,5
Septic loosening	**3**/1.105	0,3	6,5
Poly wear	**3**/1.105	0,3	6,5
Periprosthetic bone fracture	**2**/1.105	0,2	4,3
Global aseptic loosening	**2**/1.105	0,2	4,3
Primary instability	**1**/1.105	0,1	2,2
Aseptic loosening of the cup	**1**/1.105	0,1	2,2
Unknown *(1 performed outside region)*	**2**/1.105	0,2	4,3
Total	**46/1.105**	**4,2**	**100,0**
Composite ceramic - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure**

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			causes
Prosthesis dislocation	**47**/7.747	0,6	24,4
Aseptic loosening of the stem	**32**/7.747	0,4	16,6
Periprosthetic bone fracture	**26**/7.747	0,3	13,5
Aseptic loosening of the cup	**24**/7.747	0,3	12,4
Septic loosening	**10**/7.747	0,1	5,2
Primary instability	**8**/7.747	0,1	4,1
Global aseptic loosening	**5**/7.747	0,1	2,6
Breakage of prosthesis (3 stems, 2 cups)	**5**/7.747	0,1	2,6
Pain without loosening	**3**/7.747	0,0	1,6
Heterotopic bone	**2**/7.747	0,0	1,0
Poly wear	**1**/7.747	0,0	0,5
Other	**6**/7.747	0,1	3,1
Unknown *(8 performed outside region)*	**24**/7.747	0,3	12,4
Total	**193/7.747**	**2,5**	**100,0**
Composite ceramic - XLPE + Vit. E			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**10**/1.833	0,5	24,4
Aseptic loosening of the cup	**6**/1.833	0,3	14,6
Periprosthetic bone fracture	**5**/1.833	0,3	12,2
Primary instability	**5**/1.833	0,3	12,2
Aseptic loosening of the stem	**4**/1.833	0,2	9,8
Septic loosening	**2**/1.833	0,1	4,9
Pain without loosening	**1**/1.833	0,1	2,4
Global aseptic loosening	**1**/1.833	0,1	2,4
Heterotopic bone	**1**/1.833	0,1	2,4
Breakage of prosthesis (unknown)	**1**/1.833	0,1	2,4
Poly wear	**1**/1.833	0,1	2,4
Other	**2**/1.833	0,1	4,9
Unknown	**2**/1.833	0,1	4,9
Total	**41/1.833**	**2,2**	**100,0**
Ceramicised metal-XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**5**/1.162	0,4	17,9
Septic loosening	**5**/1.162	0,4	17,9
Pain without loosening	**3**/1.162	0,3	10,7
Periprosthetic bone fracture	**3**/1.162	0,3	10,7
Prosthesis dislocation	**3**/1.162	0,3	10,7
Heterotopic bone	**2**/1.162	0,2	7,1
Aseptic loosening of the cup	**1**/1.162	0,1	3,6
Other	**3**/1.162	0,3	10,7
Unknown *(1 performed outside region)*	**3**/1.162	0,3	10,7
Total	**28/1.162**	**2,4**	**100,0**

Breakage of stem group includes breackage of modular neck and proximal parts.

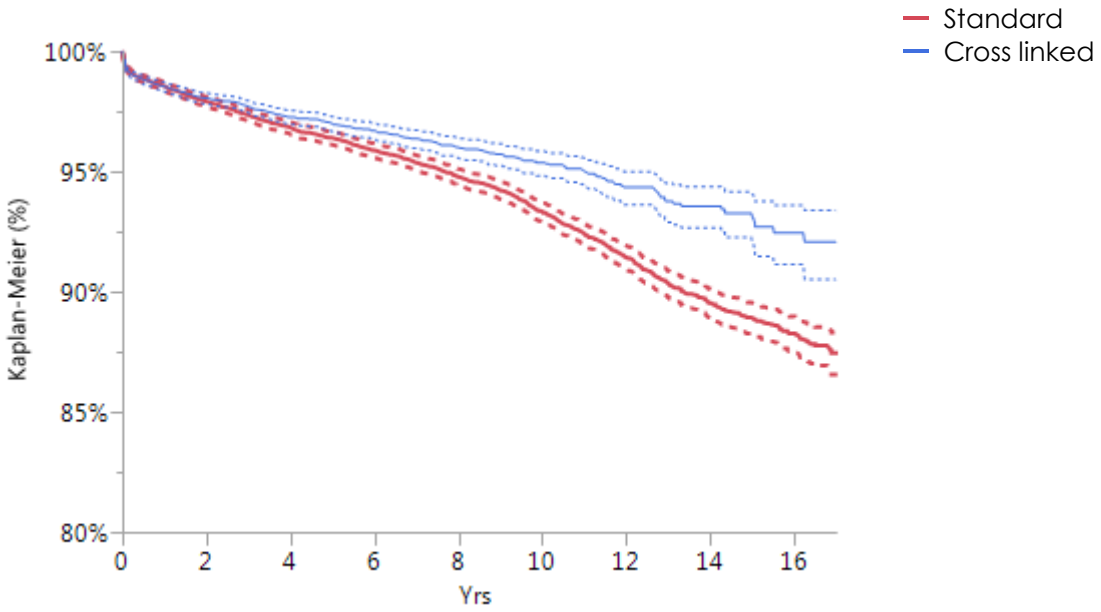
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.9 Analysis of survival in primary total hip arthroplasty according to insert

Standard poly (UHMWPE) and cross -linked poly inserts independently from the articular coupling are considered in the following analysis. Monoblock polyethylene cups are excluded.

Polyethylene	N.	Removals	% survival at 16 yrs	Confidence Interval 95%	Mean Follow-up
Standard	18.879	1338	88,3	87,5-89,0	9,4
Cross linked	15.664	479	92,5	91,1-93,6	5,1

Survival curve



Difference is statistically significant (p=0,002, Wilcoxon test).

The Cox multivariate analysis identifies any variables that are independent from each other that can influence the event, in our case the removal of at least one prosthesis component. Analysis was performed on four independent variables: sex, age at surgery, head diameter and types of poly.

Concerning type of polyethylene, standard poly have a higher risk of failure of 1,4 compared to cross linked poly.

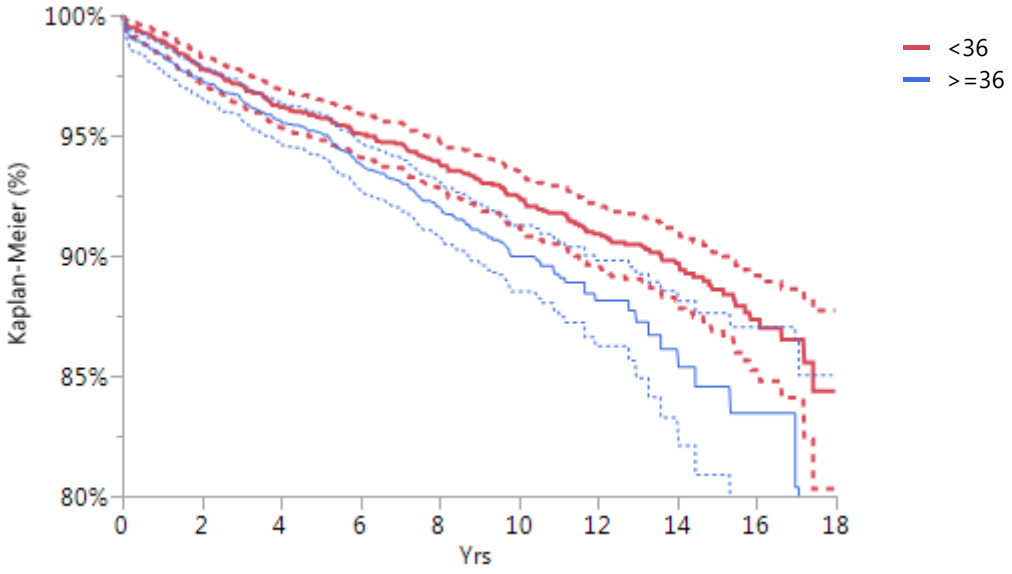
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.10 Analysis of survival in primary total hip arthroplasty, for met-met articular couplings, according to head diameters

Survival was calculated only for met-met articular couplings according to head diameters.

head diameters, met-met	N.	Removals	% survival at 16 yrs	Confidence Interval 95%	Mean Follow-up
<36 mm	2.312	208	87,3	85,2-89,2	11,0
>=36 mm	2.354	220	83,4	79,1-87,0	8,8

Survival curve



Difference is statistically significant (p=0,01, Wilcoxon test).

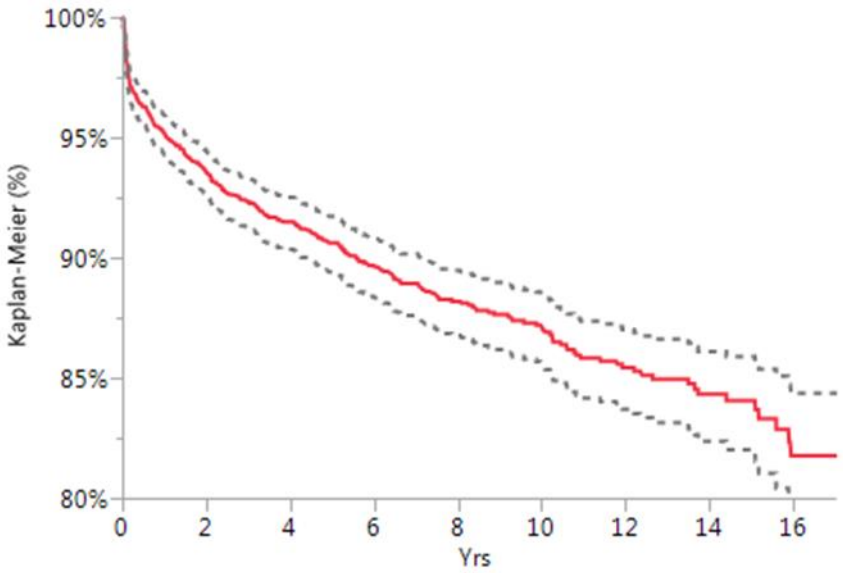
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.11 Survival analysis of total revision

In the present analysis the survival of the total revision operations was calculated. These operations were considered as "surviving" up to the moment when it was not necessary to perform a second revision of any component (even just a bearing or modular neck).

Number of total revision	Second revision	% survival at 17 yrs	Confidence Interval 95%	Mean Follow-up
2.785	316	81,8	78,9-84,4	7,3

Survival curve



The following table shows the cause of **second revision** in total revisions according to **cause of revision**; percentage distribution of causes for revision is also reported.

Cause of second revision	Rate	%	% distribution of failure causes
Recurrent prosthesis dislocation	**61**/2.785	2,2	19,3
Aseptic loosening of the cup	**61**/2.785	2,2	19,3
Aseptic loosening of the stem	**47**/2.785	1,7	14,9
Septic loosening	**47**/2.785	1,7	14,9
Global aseptic loosening	**28**/2.785	1,0	8,9
Periprosthetic bone fracture	**18**/2.785	0,6	5,7
Breakage of prosthesis	**6**/2.785	0,2	1,9
Pain without loosening	**4**/2.785	0,1	1,3
Primary instability	**4**/2.785	0,1	1,3
Poly wear	**3**/2.785	0,1	0,9
Other	**5**/2.785	0,2	1,6
Unknown *(9 performed outside region)*	**32**/2.785	1,1	10,1
Total	**316/2.785**	**11,3**	**100,0**

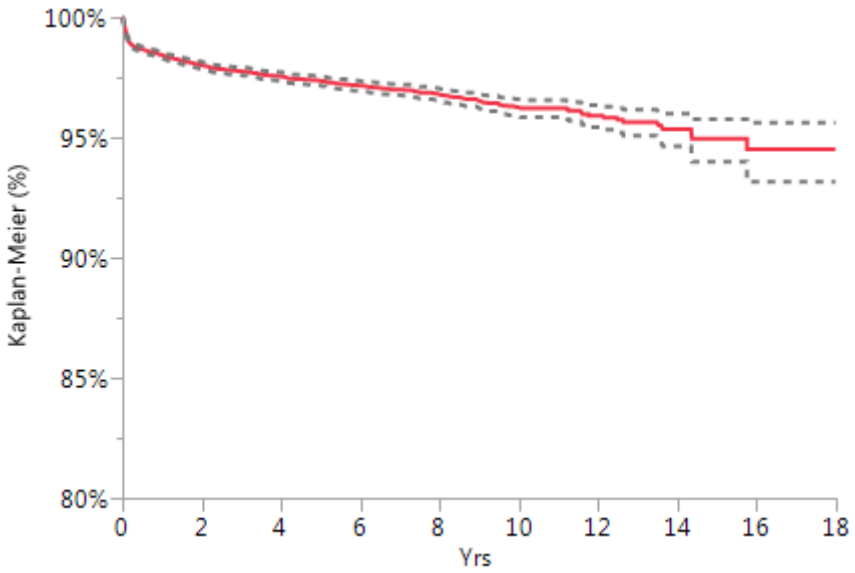
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.12 Survival analysis of hemiarthroplasty

Survival of hemiarthroplasty was calculated considering end point either head revision and implant of a cup to transform hemiarthroplasty to total hip prosthesis.

N. of hemiarthroplasty	N. revisions	% survival at 17 yrs	Confidence Interval 95%	Mean Follow-up
40.104	861	94,5	93,1-95,6	3,5

Survival curve



The following table shows the rate of revision in hemiarthroplasty according to **cause of revision**; percentage distribution of causes for revision is also reported.

Cause of revision	Rate	%	% distribution of failure causes
Dislocation	**381**/40.104	1,0	44,3
Cotyloiditis	**121**/40.104	0,3	14,1
Aseptic loosening of the stem	**112**/40.104	0,3	13,0
Periprosthetic bone fracture	**96**/40.104	0,2	11,1
Septic loosening	**71**/40.104	0,2	8,2
Primary instability	**7**/40.104	0,02	0,8
Other	**20**/40.104	0,05	2,3
Unknown *(17 performed outside region)*	**53**/40.104	0,1	6,2
Total	**861/40.104**	**2,1**	**100,0**

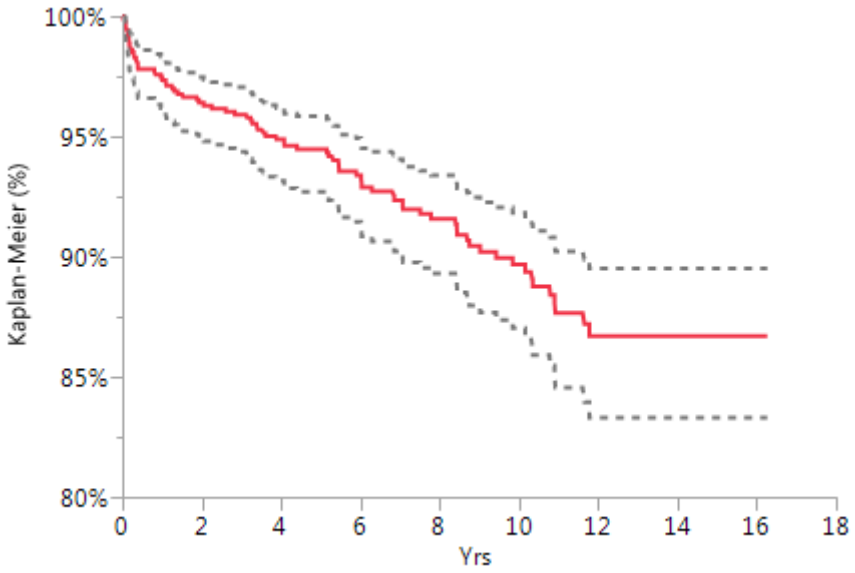
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.13 Survival analysis of resurfacing

Analysis was performed only on patients resident in Emilia-Romagna region. This reduced the number of observed subjects.

N. of resurfacing	Removal	% survival at 14 yrs	Confidence Interval 95%	Mean Follow-up
870	79	86,7	83,3-89,5	7,9

Survival curve



Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Type of prosthesis	From years	N.	Revisions	% survival at 5 yrs (C.I. 95%)	N. at risk at 5 yrs	Mean Follow-up
BHR – Smith & Nephew	2001	500	28	97,2 (95,2-98,4)	322	7,9 (0-16,3)
ADEPT – Finsbury	2005	121	3	97,5 (92,6-99,2)	104	7,7 (0,1- 12,6)
ASR – DePuy	2004	65	22	78,5 (66,8-86,8)	52	8,3 (0,1-13,3)
BMHR – Smith & Nephew	2007	75	4	98,7 (91,1-99,8)	69	6,7 (0,3-10,6)
MRS – Lima	2005	42	11	78,6 (63,7-88,5)	34	9,3 (0,2-12,6)
Other (< 40 cases)	2003	67	11	88,0 (77,7-93,9)	57	8,7 (0,1-14,8)
Total	**2001**	**870**	**79**	**94,5 (92,7-95,8)**	**636**	**7,9 (0-16,3)**

The following table shows the rate of revision in resurfacing according to **cause of revision**

Cause of revision	Rate	%	% distribution of failure causes
Aseptic loosening	24/870	2,8	30,4
Periprosthetic bone fracture	19/870	2,2	24,1
Metal sensitization	10/870	1,1	12,7
Pain without loosening	9/870	1,0	11,4
Septic loosening	3/870	0,3	3,8
Breakage of prosthesis	2/870	0,2	2,5
Prosthesis dislocation	1/870	0,1	1,3
Unknown *(8 performed outside region)*	11/870	1,3	13,9
Total	**79/870**	**9,1**	**100,0**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

PART TWO: KNEE PROSTHESIS

July 2000 – December 2017

10. RIPO capture

10.1 Percentage of R.I.P.O. data collection

Percentage of R.I.P.O. capture calculated versus Schede di Dimissione Ospedaliera (S.D.O.), according to Agency was **97,8**% for year 2017. Data are referred to primary knee prosthesis (8154), revision (8155;80;81;82;83;84) and prosthesis removal (8006).

10.2 Ratio public/private treatment

Percentage of primary total and unicondilar knee arthroplasties performed in public hospitals

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)		
Year of operation	**Primary**	**Revision**
2000	57,0	75,0
2001	59,0	71,0
2002	53,0	70,0
2003	49,0	68,0
2004	47,1	58,3
2005	45,3	60,2
2006	42,9	54,3
2007	42,3	49,9
2008	40,6	55,0
2009	37,7	49,8
2010	37,3	50,9
2011	35,9	45,5
2012	33,8	43,9
2013	34,7	38,5
2014	34,1	37,5
2015	33,9	42,8
2016	34,6	43,8
2017	34,1	42,0

From database SDO

During 2017 percentage of primary THA performed in public hospitals is 63,3%.

Percentage of primary total knee arthroprostheses and revision performed in public and private hospitals, in year 2017.

Type of operation	**Public**	**Private**
	%	**%**
Primary bicompartmental	51,1	57,9
Primary tricompartmental	30,6	20,1
Primary unicompartmental	8,3	13,6
Revision	7,2	6,4
Prosthesis removal	2,2	1,0
Implant of patella	0,7	1,0
Total	**100,0**	**100,0**

From database RIPO

11. Type of operation

Bicompartmental implant has only femoral and tibial component, whilst tricompartmental one has patella too.
Implant of patella occurs when a bicompartmental knee prosthesis is transformed into tricompartmental with a second surgery. This is not considered a failure of primary bi-compartimental.

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2017, according to **type**

Type of operation	Number	Percentage
Primary bicompartmental	67.118	63,9
Primary tricompartmental	16.751	15,9
Primary unicompartmental	10.971	10,4
Revision^	6.550	6,2
Prosthesis removal	1.469	1,4
Implant of patella	848	0,8
Other prostheses*	484	0,5
Other operations°	844	0,8
Total	**105.035**	**100,0**

*51 Hemicap–Arthrosurface, 31 Hemicap patello_femoral–Arthrosurface, 65 Avon-Patello-Femoral Joint Stryker, 87 Gender-Patello-Femoral Joint System Zimmer, 59 Journey-PFJ-Patellofemoral Smith&Nephew, 40 other patella-femoral, 53 Unicompartimental Plus+patella

°of which 395 spacer exchange, 74 stiff knee loosening, 95 debridement's, 6 dislocation reductions

^641 liner, 12 femoral component, 3 tibial component, 136 femoral component and liner, 364 tibial component and liner, 5.355 total, 39 patella.

Percentage of different type of operation in the years

Years of operation	% unicompartim	% bicompartim	% tricompartim
2001	10,5	81,1	8,4
2002	12,9	79,9	7,1
2003	12,7	78,6	8,6
2004	12,9	75,8	11,3
2005	12,4	75,5	12,1
2006	10,8	70,0	19,2
2007	11,6	69,2	19,2
2008	11,5	72,1	16,4
2009	13,0	72,3	14,8
2010	12,5	71,5	16,0
2011	9,8	73,4	16,8
2012	10,4	72,4	17,2
2013	12,1	69,1	18,9
2014	10,9	68,1	21,0
2015	10,1	67,8	22,1
2016	11,2	65,1	23,8
2017	13,0	61,1	25,8

Percentage of different type of operation compared to the previous year.

Years of operation	Primary bi/tricompartmental		Primary unicompartmental		Revision (total+partial)	
	N.	Increase %	N.	Increase %	N.	Increase %
2000	712		68		41	
2001	2.003		235		145	
2002	2.375	18,6	353	50,2	155	6,9
2003	2.787	17,3	406	15,0	194	25,2
2004	3.355	20,4	497	22,4	215	10,8
2005	3.877	15,6	548	10,3	281	30,7
2006	4.370	12,7	530	-3,3	308	9,6
2007	5.136	17,5	671	26,6	376	22,1
2008	5.571	8,5	727	8,3	412	9,6
2009	5.515	-1,0	821	12,9	459	11,4
2010	5.625	2,0	803	-2,2	450	-2,0
2011	5.927	5,4	643	-19,9	471	4,7
2012	5.822	-1,8	678	5,4	493	4,7
2013	5.641	-3,1	774	14,2	483	-2,0
2014	5.973	5,9	732	-5,4	475	-1,7
2015	6.130	2,6	689	-5,9	521	9,7
2016	6.631	8,2	833	20,9	531	1,9
2017	6.419	-3,2	963	15,6	540	1,7

12. Descriptive statistics of patients with knee prosthesis

12.1 Age

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2017, according to **type of operation** and **age group** of patients at the time of surgery

Type of operation	<40		40-49		50-59		60-69		70-79		≥80		Total
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	
Bi-tricomp	265	0,3	1.118	1,3	6.363	7,6	25.725	30,7	40.862	48,7	9.528	11,4	**83.861**
Unicomp	36	0,3	379	3,5	2.063	18,8	4.467	40,7	3.346	30,5	679	6,2	**10.970**
Revision	29	0,4	172	2,6	685	10,5	1.983	30,3	2.880	44,0	801	12,2	**6.550**
Prosthesis removal	18	1,2	43	2,9	167	11,4	480	32,7	595	40,5	166	11,3	**1.469**
Patella only	9	1,1	21	2,5	74	8,7	239	28,2	422	49,8	83	9,8	**848**
Total*	**357**	**0,3**	**1.733**	**1,7**	**9.352**	**9,0**	**32.894**	**31,7**	**48.105**	**46,4**	**11.257**	**10,9**	**103.698**

*9 missing data (0,01%)

Mean age at surgery, according to type of operation - years 2000-2017

Type of operation	Mean age	Range
Primary bi/tricompartmental	69,6	13–96
Primary unicompartmental	66,0	23-92
Revision	69,5	18-92
Total	**69,1**	**13-96**

Mean age at surgery, according to type of operation - years 2001-2017

Type of operation	Year 2001		Year 2017	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental°	71,2	23-92	70,5	19-92
Primary unicompartmental*	69,1	45-87	66,3	33-92
Revision^	71,8	26-87	70,0	30-91

° statistically different (t-test, p<0,001)
* statistically different (t-test, p<0,001)
^ statistically different (t-test, p<0,05)

Mean age at surgery, according to type of operation - years 2000-2017 - according to **private or public hospital**

Type of operation	Public		Private	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental*	71,0	13-92	70,3	19-96
Primary unicompartmental^	67,1	23-89	65,6	28-92

*mean age for bicompartmental in public and private hospital is significantly different (t-test, p<0.001)
^mean age for unicompartmental in public and private hospital is significantly different (t-test, p<0.001)

12.2 Gender

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2017, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Bi/tricompartmental	24.526	29,2	59.343	70,8	**83.869**
Unicompartmental	3.784	34,5	7.187	65,5	**10.971**
Revision	1.820	27,8	4.730	72,2	**6.550**
Prosthesis removal	575	39,1	894	60,9	**1.469**
Patella only	220	25,9	628	74,1	**848**
Total	**30.925**	**29,8**	**72.782**	**70,2**	**103.707**

12.3 Side of surgery

There is a prevalence of operations performed on the right side (54,9%) in comparison with the left side (45,1%). The percentage was calculated on patients affected by primary arthritis, on first side operated.

Percentage of operation carried out on each of two sides, according to gender

Side	Males	Females
Right	51,0	56,5
Left	49,0	43,5

Difference is statistically significant (Chi – squared p<0.001).

12.4 Bilateral arthroplasty

In the period of registry observation (18 years), 15.667 patients underwent bilateral operations.
13.048 (83,3%) chose to undergo the second operation at the same hospital from where the first one was performed.
850 (5,4%) chose to undergo the second operation at a different hospital from where the first one was performed to follow the surgeon.
1.769 (11,3%) chose to undergo the second operation at a different hospital from where the first one was performed.
In bilateral operations, it was observed that the first knee to be treated was the right one in 53,9% of cases.

12.5 Diseases treated with unicompartmental knee prosthesis

Number of primary unicompartmental knee prosthesis operations carried out on patients with admission date between 1st July 2000 and 31st December 2017, according to **diagnosis**

Diagnosis in unicompartimental knee prosthesis	Number	Percentage
Primary arthritis	9.167	83,9
Deformity	854	7,8
Necrosis of the condyle	551	5,0
Post-traumatic arthritis	100	0,9
Post-traumatic necrosis	82	0,8
Sequelae of fracture	72	0,7
Idiopathic necrosis	34	0,3
Rheumatic arthritis	17	0,2
Post meniscectomy	14	0,1
Sequelae of osteotomy	14	0,1
Other	26	0,2
Total*	**10.931**	**100,0**

*40 missing data (0,4%)

12.6 Diseases treated with bi-tricompartmental knee prosthesis

Number of primary bi-tricompartmental knee prosthesis operations carried out on patients with admission date between 1st July 2000 and 31st December 2017, according to **diagnosis**.

Diagnosis in bi/tricompartmental knee prosthesis	Number	Percentage
Primary arthritis	70.942	84,9
Deformity	7.445	8,9
Post-traumatic arthritis	1.298	1,6
Sequelae of fracture	1.086	1,3
Rheumatic arthritis	1.084	1,3
Necrosis of the condyle	582	0,7
Sequelae of osteotomy	456	0,5
Post-traumatic necrosis	104	0,1
Sequelae of septic arthritis	79	0,1
Sequelae of poliomyelitis	66	0,1
Post meniscectomy	52	0,1
Idiopathic necrosis	41	0,05
Chondrocalcinosis	28	0,03

Tumor	21	0,03
Paget disease	14	0,02
Other	254	0,3
Total*	**83.552**	**100,0**

* 317 missing data (0,4%)

12.7 Reasons for revisions and removal

Number of **revision operations** carried out on patients admitted between 1st July 2000 and 31st December 2017, according to **diagnosis**.

In the Table all revisions performed in the Region, without taking care of site and date of primary implant, are reported.

Diagnosis in revision	Number	Percentage
Total aseptic loosening	2548	39,3
Two steps prosthesis removal	1204	18,6
Pain without loosening	621	9,6
Aseptic loosening of tibial component	620	9,6
Insert wear	251	3,9
Aseptic loosening of femoral component	171	2,6
Septic loosening	167	2,6
Prosthesis dislocation	130	2,0
Instability	114	1,8
Periprosthetic bone fracture	110	1,7
Stiffness	64	1,0
Progression of disease	55	0,8
Breakage of prosthesis	35	0,5
Trauma	34	0,5
Other	356	5,5
Total*	**6.480**	**100,0**

*70 missing data (1,1%)

Number of **prosthesis removal** carried out on patients admitted between 1st July 2000 and 31st December 2017, according to **diagnosis**.

In the Table all removals performed in the Region, without taking care of site and date of primary implant are reported.

Diagnosis in prosthesis removal	Number	Percentage
Septic loosening	1.274	88,4
Total aseptic loosening	82	5,7
Early infection	27	1,9
Aseptic loosening of tibial component	14	1,0
Pain without loosening	13	0,9
Periprosthetic bone fracture	8	0,6
Prosthesis dislocation	6	0,4
Other	17	1,2
Total*	**1.441**	**100,0**

* 28 missing data (1,9%)

13. Types of knee prosthesis

13.1 Unicompartmental prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2017, primary unicompartmental surgery. All poly tibial components in **bold.**

Type of Prosthesis	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
JOURNEY UNI - Smith & Nephew	3	0,0	251	11,5	687	27,6
PHYSICA ZUK - Lima	535	8,5	405	18,5	417	16,8
UNI SIGMA HP - De Puy Johnson & Johnson	157	2,5	402	18,4	296	11,9
MITUS - ENDO-MODEL UNI - ALL POLY - Link	**359**	**5,7**	**57**	**2,6**	**143**	**5,8**
RESTORIS MCK UNI - Mako	-	-	10	0,5	138	5,6
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	-	-	3	0,1	121	4,9
JOURNEY UNI - ALL POLY - Smith & Nephew	**122**	**1,9**	**145**	**6,6**	**87**	**3,5**
GENESIS UNI - Smith & Nephew	875	13,9	228	10,4	79	3,2
HERMES UNI - Ceraver	-	-	2	0,1	70	2,8
UNIVATION F - B.Braun	5	0,1	3	0,1	63	2,5
UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	**28**	**0,4**	**83**	**3,8**	**53**	**2,1**
GKS - ONE - ALL POLY - Permedica	**170**	**2,7**	**158**	**7,2**	**49**	**2,0**
GENUS UNI - Adler-Ortho	1	0,0	36	1,6	48	1,9
ALLEGRETTO UNI - Protek-Sulzer	**273**	**4,3**	**57**	**2,6**	**48**	**1,9**
GKS - ONE - Permedica	-	-	19	0,9	47	1,9
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	1.248	19,8	134	6,1	24	1,0
TRIATHLON - PKR - Howmedica Osteonics	21	0,3	11	0,5	16	0,6
BALANSYS - UNI - Mathys	105	1,7	43	2,0	16	0,6
IBALANCE UNI - Arthrex	-	-	16	0,7	16	0,6
GENUS UNI - ALL POLY - Adler-Ortho	**-**	**-**	**11**	**0,5**	**13**	**0,5**
VANGUARD - M PARTIAL KNEE - Biomet Orthopedics	**-**	**-**	**6**	**0,3**	**8**	**0,3**
GENESIS UNI - ALL POLY - Smith & Nephew	**246**	**3,9**	**52**	**2,4**	**6**	**0,2**
MITUS - ENDO-MODEL UNICONDYLAR SLED - Link	**6**	**0,1**	**1**	**0,0**	**6**	**0,2**
OPTETRAK - UNI - ALL POLY - Exactech	**172**	**2,7**	**-**	**-**	**5**	**0,2**
ACS UNI - Implantcast	-	-	14	0,6	2	0,1
UC-PLUS SOLUTION - ALL POLY - Endoplus	**137**	**2,2**	**7**	**0,3**	**-**	**-**
EFDIOS - Citieffe	472	7,5	5	0,2	-	-
GKS - ONE - CUSTOM MADE - Permedica	20	0,3	4	0,2	-	-
HLS - UNI EVOLUTION - ALL POLY - Tornier	**153**	**2,4**	**3**	**0,1**	**-**	**-**
PRESERVATION UNI - ALL POLY - Depuy	**379**	**6,0**	**-**	**-**	**-**	**-**
UC-PLUS SOLUTION - Endoplus	243	3,9	-	-	-	-
MILLER GALANTE UNI - Zimmer	179	2,8	-	-	-	-
MAIOR - Finceramica	154	2,4	-	-	-	-
EIUS UNI - ALL POLY - Stryker Howmedica	**59**	**0,9**	**-**	**-**	**-**	**-**
PFC - UNI - De Puy Johnson & Johnson	56	0,9	-	-	-	-
UNICIA - VECTEUR ORTHOPEDIC - Stratec	27	0,4	-	-	-	-
PRESERVATION UNI - Depuy	27	0,4	-	-	-	-
OPTETRAK - ARTHROFOCUS - Exactech	**10**	**0,2**	**-**	**-**	**-**	**-**
Other (<10 cases)	39	0,6	18	0,8	24	1,0
Unknown	21	0,3	-	-	3	0,1
Total	**6.302**	**100,0**	**2.184**	**100,0**	**2.485**	**100,0**

13.2 Bi-tricompartmental knee prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2017, primary bi/tricompartmental surgery.

Type of Prosthesis	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
ATTUNE – DePuy	-	-	666	3,8	2.938	15,3
LEGION - Smith & Nephew	56	0,1	660	3,8	2.624	13,7
NEXGEN – Zimmer	10.957	23,2	2.794	16,0	1.846	9,6
VANGUARD – Biomet Merck France	2.893	6,1	2.283	13,1	1.462	7,6
GENESIS - Smith & Nephew	3.231	6,8	1.881	10,8	1.399	7,3
PERSONA - Zimmer	-	-	399	2,3	994	5,2
TRIATHLON – Stryker Howmedica Osteonics	850	1,8	842	4,8	877	4,6
OPTETRACK – Exactech	1.099	2,3	239	1,4	760	4,0
GEMINI - Link	1.597	3,4	884	5,1	658	3,4
PHYSICA - Lima	-	-	10	0,1	586	3,1
P.F.C – DePuy	4.272	9,0	2.009	11,5	573	3,0
GENUS – Adler-Ortho	937	2,0	501	2,9	571	3,0
G.K.S. – Permedica	621	1,3	341	2,0	527	2,7
GSP - TREKKING - Samo	466	1,0	546	3,1	425	2,2
TC-PLUS - SOLUTION - Smith & Nephew	1.945	4,1	804	4,6	374	1,9
ACS - Implantcast	1	0,0	215	1,2	333	1,7
BALANSYS - Mathys	476	1,0	333	1,9	306	1,6
INNEX - Protek Sulzer	140	0,3	295	1,7	249	1,3
JOURNEY – Smith & Nephew	237	0,5	80	0,5	230	1,2
APEX - Omnilife Science	60	0,1	176	1,0	223	1,2
COLUMBUS - B.Braun	275	0,6	110	0,6	210	1,1
GMK - Medacta	42	0,1	77	0,4	171	0,9
ADVANCE - Wright	790	1,7	187	1,1	118	0,6
SCORPIO – Stryker Howmedica	2.520	5,3	162	0,9	111	0,6
K-MOD - Gruppo Biompianti	-	-	7	0,0	106	0,6
UNITY KNEE - Corin Medical	-	-	13	0,1	93	0,5
SKS - DEEP DISH - Aston Medical	2	0,0	33	0,2	74	0,4
ENDO-MODEL - Link	320	0,7	56	0,3	64	0,3
SIGMA RP - TC3 - DePuy	60	0,1	40	0,2	55	0,3
RT-PLUS - Smith & Nephew	160	0,3	58	0,3	47	0,2
LCS – DePuy	891	1,9	49	0,3	45	0,2
GENIUS TRICCC - Dedienne Sante	613	1,3	43	0,2	29	0,2
ROTAGLIDE – Corin Medical	776	1,6	64	0,4	16	0,1
FIRST - Symbios Orthopedie SA	768	1,6	222	1,3	5	0,0
SCORE – Amplitude	580	1,2	-	-	5	0,0
MULTIGEN - Lima	430	0,9	15	0,1	4	0,0
PROFIX – Smith & Nephew	4.966	10,5	170	1,0	-	-
HLS – Tornier	347	0,7	41	0,2	-	-
AGC - Biomet Merck France	590	1,2	3	0,0	-	-
E.MOTION - B.Braun	179	0,4	2	0,0	-	-
INTERAX - Stryker Howmedica	737	1,6	-	-	-	-
T.A.C.K. – Link	636	1,3	-	-	-	-
913 – Wright Cremascoli	357	0,8	-	-	-	-

PERFORMANCE – Kirschner Biomet Merck	279	0,6	-	-	-	-
DURACON – Stryker Howmedica	267	0,6	-	-	-	-
CONTINUUM KNEE SYSTEM – Stratec Medical	166	0,4	-	-	-	-
RO.C.C. – Biomet Merck France	163	0,3	-	-	-	-
CINETIQUE - Medacta	100	0,2	-	-	-	-
Altro (modelli con meno di 100 casi)	325	0,7	121	0,7	66	0,3
Non nota	76	0,2	5	0,0	6	0,0
Totale complessivo	**47.253**	**100,0**	**17.436**	**100,0**	**19.180**	**100,0**

Prosthesis system are reported in the Table, even if they are analytically registered (E.g.: NEXGEN - CR – Zimmer; NEXGEN - LCCK – Zimmer; NEXGEN – LPS – Zimmer; NEXGEN - RHK – Zimmer).

13.3 Revision prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2017, in total revision surgery.

Type of Prosthesis	2000-2011		2012-2014		2015-2017	
	N.	%	N.	%	N.	%
LEGION - Smith & Nephew	115	4,0	211	17,6	398	31,3
NEXGEN – Zimmer	784	27,2	308	25,6	222	17,5
ENDO-MODEL - Link	281	9,7	83	6,9	117	9,2
P.F.C – DePuy	231	8,0	69	5,7	73	5,7
SIGMA RP - TC3 - DePuy	106	3,7	143	11,9	68	5,4
GENESIS - Smith & Nephew	113	3,9	58	4,8	43	3,4
TRIATHLON – Stryker Howmedica Osteonics	21	0,7	29	2,4	39	3,1
ATTUNE – DePuy	-	-	3	0,2	38	3,0
RT-PLUS - Smith & Nephew	217	7,5	35	2,9	34	2,7
G.K.S. – Permedica	85	2,9	42	3,5	28	2,2
VANGUARD – Biomet Merck France	73	2,5	30	2,5	27	2,1
ACS - Implantcast	5	0,2	24	2,0	27	2,1
OPTETRACK – Exactech	80	2,8	13	1,1	21	1,7
GSP - TREKKING - Samo	5	0,2	24	2,0	19	1,5
DURATION MRH - Osteonics	106	3,7	12	1,0	17	1,3
COLUMBUS - B.Braun	2	0,1	3	0,2	14	1,1
GEMINI - Link	19	0,7	13	1,1	10	0,8
LPS - HINGE - DePuy	-	-	23	1,9	9	0,7
MUTARS - Implantcast	6	0,2	6	0,5	8	0,6
PERSONA - Zimmer	-	-	3	0,2	7	0,6
APEX - Omnilife Science	1	0,0	7	0,6	7	0,6
BALANSYS - Mathys	12	0,4	13	1,1	6	0,5
ENDURO - B.Braun	2	0,1	5	0,4	4	0,3
SCORPIO – Stryker Howmedica	83	2,9	8	0,7	3	0,2
ADVANCE - Wright	15	0,5	1	0,1	2	0,2
FIRST - Symbios Orthopedie SA	15	0,5	6	0,5	-	-
S-ROM NRH - Johnson & Johnson	44	1,5	3	0,2	-	-
E.MOTION - B.Braun	21	0,7	3	0,2	-	-
TC-PLUS - SOLUTION - Smith & Nephew	35	1,2	2	0,2	-	-
PROFIX – Smith & Nephew	120	4,2	1	0,1	-	-
LCS – DePuy	10	0,3	1	0,1	-	-

AGC - Biomet Merck France	127	4,4	-	-	-	-
INTERAX - Stryker Howmedica	35	1,2	-	-	-	-
DURACON – Stryker Howmedica	18	0,6	-	-	-	-
GENIUS TRICCC - Dedienne Sante	12	0,4	-	-	-	-
Other (<100 cases)	72	2,5	17	1,4	26	2,0
Unknown	13	0,5	2	0,2	3	0,2
Total	**2.884**	**100,0**	**1.201**	**100,0**	**1.270**	**100,0**

13.4 Prosthesis fixation

Number of knee prosthesis arthroplasty performed on patients admitted to hospital between 1st July 2000 and 31st December 2017, according to **prosthesis fixation**

Fixation	Primary unicomp.		Primary bi/tricomp.		Total revision		Total	
	N.	%	N.	%	N.	%	N.	%
Cemented	10.238	93,5	78.025	93,1	5.264	98,5	**93.527**	**93,4**
Cementless	543	5,0	3.561	4,2	46	0,9	**4.150**	**4,1**
Femur cementless + Tibia cemented	160	1,5	1.649	2,0	20	0,4	**1.829**	**1,8**
Femur cemented + Tibia cementless	14	0,1	596	0,7	14	0,3	**624**	**0,6**
Total*	**10.955**	**100,0**	**83.831**	**100,0**	**5.344**	**100,0**	**100.130**	**100,0**

*65 missing data (0,1%)

Prosthesis fixation according to year of operation

Years of operation	% Cemented	% Cementless	% Cemented Tibia	% Cemented Femur
2001	82,6	8,0	8,8	0,7
2002	79,9	9,2	10,5	0,4
2003	83,5	7,6	8,5	0,4
2004	87,9	7,4	4,0	0,7
2005	89,8	6,2	3,4	0,6
2006	90,7	5,3	3,7	0,4
2007	91,0	4,5	3,1	1,4
2008	91,2	4,2	2,3	2,4
2009	91,5	4,5	1,5	2,5
2010	93,5	4,5	0,8	1,1
2011	94,9	4,1	0,4	0,7
2012	95,1	4,2	0,3	0,4
2013	96,7	3,0	0,1	0,2
2014	97,3	2,5	0,1	0,1
2015	97,7	2,0	0,2	0,0
2016	97,6	2,2	0,2	0,0
2017	97,4	2,4	0,0	0,1

13.5 Type of insert

Stabilization of insert in bi-tricompartmental knee prostheses according to year of operation

Years of operation	% Minimally stabilized	% Posterior stabilized	% Hinged
2001	47,8	50,2	2,0
2002	51,7	45,8	2,5
2003	46,4	51,3	2,3
2004	45,6	52,7	1,7
2005	42,6	55,9	1,5
2006	40,5	57,8	1,6
2007	40,8	57,1	2,0
2008	45,8	52,5	1,7
2009	51,3	46,9	1,8
2010	46,9	50,6	2,5
2011	49,0	48,9	2,1
2012	44,5	53,3	2,2
2013	40,9	56,1	3,0
2014	35,2	61,4	3,3
2015	36,2	60,9	2,9
2016	34,3	62,9	2,8
2017	31,9	65,0	3,1

Mobility of insert of bi-tricompartmental knee prosthesis according to year of implant

Years of operation	% fixed insert	% mobile insert
2001	74,0	26,0
2002	72,0	28,0
2003	69,8	30,2
2004	68,0	32,0
2005	66,0	34,0
2006	58,4	41,6
2007	62,2	37,8
2008	60,6	39,4
2009	59,3	40,7
2010	54,7	45,3
2011	55,3	44,7
2012	58,9	41,1
2013	64,4	35,6
2014	73,4	26,6
2015	75,6	24,4
2016	77,7	22,3
2017	78,6	21,4

Materials of insert of bi-tricompartmental knee prosthesis according to year of implant

Years of operation	% Standard poly	% Crosslinked poly	% Crosslinked antioxidant poly
2001	100,0	-	-
2002	100,0	-	-
2003	100,0	-	-
2004	100,0	-	-
2005	100,0	-	-
2006	100,0	-	-
2007	99,4	0,6	-
2008	96,1	3,9	-
2009	94,4	5,6	-
2010	94,3	5,7	-
2011	91,4	7,4	1,2
2012	89,3	8,0	2,7
2013	88,3	7,7	4,1
2014	77,1	12,6	10,3
2015	69,9	15,2	14,9
2016	62,6	18,8	18,6
2017	57,2	23,5	19,3

13.6 Type of femur

Materials of femur of bi-tricompartmental knee prosthesis according to year of implant

Years of operation	% cr-co	% ceramicised zirconium	% ceramicised cr-co	% ceramicised titanium
2001	99,6	0,4	-	-
2002	99,7	0,3	-	-
2003	99,5	0,5	-	-
2004	98,8	1,2	-	-
2005	98,6	1,3	0,03	0,03
2006	98,1	1,8	0,05	0,1
2007	96,7	3,0	0,1	0,2
2008	96,4	2,5	0,5	0,6
2009	96,4	2,1	1,0	0,5
2010	95,5	2,9	1,3	0,3
2011	92,8	4,3	2,5	0,4
2012	90,0	4,3	5,2	0,5
2013	87,0	6,1	6,0	0,9
2014	80,1	9,9	9,2	0,8
2015	79,7	10,3	9,4	0,6
2016	77,5	13,2	8,5	0,8
2017	75,4	14,2	9,7	0,8

Between 1st July 2000 and 31st December 2017, 22 cases of composite ceramic are observed.

13.7 Bone Cement

Types of cement used (since 1-1-2002)
In **bold** bone cement loaded with antibiotic.

Cemento	%
Surgical Simplex P - Howmedica	18,7
Antibiotic Simplex - Howmedica	**14,1**
Palacos R - Heraeus Medical	10,3
Palacos R+G - Heraeus Medical	**8,6**
Hi-Fatigue G - Zimmer	**6,0**
Hi-Fatigue - Zimmer	3,5
Versabond - Smith&Nephew	2,8
Osteobond - Zimmer	2,7
Versabond AB - Smith&Nephew	**2,4**
Palamed G - Heraeus Medical	**2,2**
Aminofix 1 - Groupe Lepine	**2,1**
Cemex System - Tecres	1,9
Cemex Genta System - Tecres	**1,7**
Palamed - Heraeus Medical	1,7
Smartset GHV - Depuy	**1,7**
Refobacin Bone Cement R - Biomet	**1,6**
Smartset MV - Depuy	1,6
Palacos R - Biomet	1,3
Refobacin Revision - Biomet	**1,2**
Smartset GMV - Depuy	***1,1***
Cemex - Tecres	1,0
Other bone cement without antibiotic	6,7
Other bone cement loaded with antibiotic	**5,3**
Total	**100,0**

Bone cement loaded with antibiotic is used in 47,9% of cases.

14. Complications occurred during hospitalization

RIPO registers all kind of complications occurred during hospitalization. In the following tables only intra-operative and post-operative local complications are presented.

The rate of complications in **primary unicompartmental surgery** carried out on patients hospitalized between July 1st 2000 and December 31st 2017

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Tibial fracture	8	*0,1*	Early infection	4	*0,04*
Femoral fracture	8	*0,1*			
Anaesthesiologic	2	*0,02*			
Tibial tuberosity fracture	1	*0,01*			
Ligament lesion	1	*0,01*	Deep venous thrombosis	6	*0,05*
Other	6	*0,1*			
Total	**26**	***0,2***	**Total**	**10**	***0,1***

The rate of complications in **primary bi-tricompartmental surgery** carried out on patients hospitalized between July 1st 2000 and December 31st 201

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Femoral fracture	71	0,1	Deep venous thrombosis	134	*0,2*
Ligament lesion	35	0,04			
Tibial fracture	34	0,04			
Rupture patellar tendon	33	0,04			
Anaesthesiologic	28	0,03			
Hemorragia	24	0,03	Early infection	36	*0,04*
Vascular lesion	13	0,02			
Tibial tuberosity fracture	9	0,01			
Other	40	0,05			
Total	**287**	**0,3**	**Total**	**170**	***0,2***

The rate of complications in **revision surgery** carried out on patients hospitalized between July 1st 2000 and December 31st 2017

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Femoral fracture	26	0,4	Early infection	16	*0,2*
Tibial fracture	24	0,4			
Rupture patellar tendon	19	0,3			
Anaesthesiologic	9	0,1			
Tibial tuberosity fracture	8	0,1	Deep venous thrombosis	9	*0,1*
Ligament lesion	1	0,02			
Other	16	0,2			
Total	**103**	**1,6**	**Total**	**25**	***0,4***

14.1 Deaths occurred during hospitalization

Rate of deaths in knee prosthetic surgery carried out on patients hospitalized between July 1st 2000 and December 31st 2017

Registered deaths occurred during hospitalization.

Year 2000-2017			
Type of operation	**Deaths**	**Number of surgery**	**Percentage**
Primary bi/tricompartmental	65	83.869	0,08
Primary unicompartmental	1	10.971	0,01
Revision	10	6.550	0,15
Prosthesis removal	4	1.469	0,27

15. Analysis of survival of primary surgery

15.1 Cox multivariate analysis

Bi-tri compartmental

The Cox multivariate analysis identifies any variables that are independent from each other that can influence the event, in our case the removal of at least one prosthesis component. Analysis was performed on following independent variables: gender, age at surgery, pathology and type of insert (fix vs mobile). Mobile insert includes all kind of mobility (sliding, rotating).

All primary bi-tri compartmental knee arthroplasties performed in the Region between July 2000 and December 2017 only on patients living in the Region, were analysed.

COX PROPORTIONAL RISK MODEL

Variables

Dependent: Follow-up
Independent: Age, gender, diagnosis, type of insert

Number of valid observations: 54.012
Non revised: 52.185
Revised: 1.827

Chi-square: 182,7518 *p*= 0,0001

VARIABLE	SIGNIFICANCE (p)
Gender (Males vs females)	**S** (0,003)
Age (less than 60 yrs vs more than 60 yrs)	**S** (0,001)
Diagnosis (arthrosis vs other)	**NS** (0,0756)
Type of insert (Mobile vs fix)	**S** (0,001)

The chi-square test, used to test globally the model applied, was significant, which suggested that, on the whole, the variables inserted in the model influenced the outcome of prosthetic surgery. The effect of each variable was compared to the others when equal.

All variables inserted in the model influenced the outcome of prosthetic surgery (except diagnosis). At this point we tested how it acts, either by reducing or increasing the risk.

A relative risk rate below 1 indicated a reduced risk of prosthesis loosening. Conversely, a relative risk rate above 1 indicated an increased risk of prosthesis loosening.

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

The rate of relative risk was expressed with respect to the risk rate presented by the patients more than 60 yrs.

The following table shows that patients of the group 'less than 60 yrs' had a greater risk of failure than patients of the group 'more than 60 yrs' compared to the others variables when equal.

Age	Relative risk rate	Confidence interval 95%		Significance (p)
Less than 60 yrs	2,15	1,89	2,44	0,001

The rate of relative risk was expressed with respect to the risk rate presented by the patients with poly fix insert.
The following table shows that patients of the group 'mobile insert' had a greater risk of failure than patients of the group 'fix insert' compared to the others variables when equal.

Insert	Relative risk rate	Confidence interval 95%		Significance (p)
Mobile	1,31	1,19	1,43	0,001

The rate of relative risk was expressed with respect to the risk rate presented by the females patients.
The following table shows that patients of the group 'males' had a greater risk of failure than patients of the group 'females' compared to the others variables when equal.

Gender	Relative risk rate	Confidence interval 95%		Significance (p)
Males	1,16	1,05	1,28	0,0036

Unicompartmental

All primary unicompartmental knee arthroplasties performed in the Region between July 2000 and December 2017 only on patients living in the Region and affected by arthrosis, were analysed. Variables in the model are: gender, age at surgery and type of tibial component (all poly vs metal back).

The rate of relative risk was expressed with respect to the risk rate presented by the patients more than 60 yrs.

The following table shows that patients of the group 'less than 60 yrs' had a greater risk of failure than patients of the group 'more than 60 yrs' compared to the others variables when equal.

Age	Relative risk rate	Confidence interval 95%		Significance (p)
Less than 60 yrs	1,6	1,35	1,96	0,001

The following table shows that patients of the group 'males' had a lower risk of failure than patients of the group 'females' compared to the others variables when equal.

Gender	Relative risk rate	Confidence interval 95%		Significance (p)
Males	0,8	0,65	0,97	0,0249

Type of tibial component do not influence the risk (p=0,71).

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

15.2 Rate of failure

As already written in hip section, the recovery of data of operations not reported to RIPO is in progress. The uncertainty due to the failure to report about 10% of operations performed in the Region, may lead to an underestimation of the revision rate that is not quantifiable at the moment.

By comparison with other data banks (S.D.O. hospital discharge data)it was determined the number of Revision, also they not communicated to RIPO.
Revisions include:

- revisions performed in the same hospital;
- revisions performed in a different hospital in Emilia-Romagna region;
- revisions performed outside Emilia-Romagna region.

Type of operation	Number of operations	N. of revisions performed in the same hospital	N. of revisions performed in a different hospital in Emilia Romagna region	N. of revisions performed outside Emilia-Romagna region	Mean Follow-up	Rate
Primary bicompartmental	43.011	775	608	96	6,6	1.479/43.011
Primary tricompartmental	11.001	236	89	23	5,4	348/11.001
Primary unicompartmental	6.453	320	257	43	6,8	620/6.453
Total revision	2.888	208	130	17	5,6	355/2.888

In Primary knee arthroplasties, **45,6%** of Revisions was performed in a different hospital.

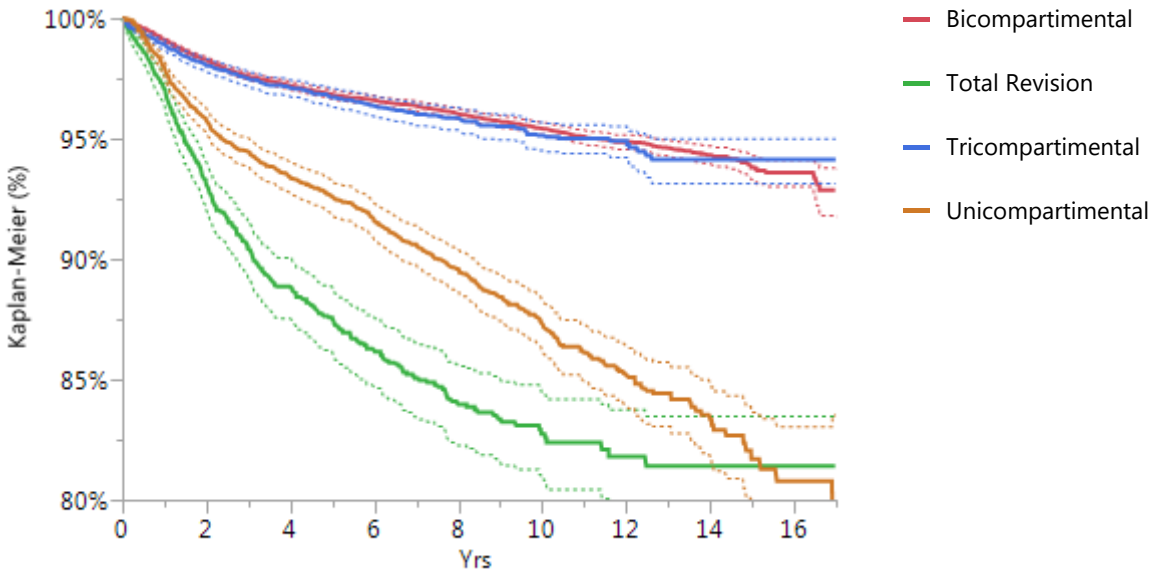
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

15.3 Survival analysis of uni and bicompartmental

Analysis has been separately performed for uni, bi, tricompartmental prosthesis and total revisions. The revision of a single component (even insert) is considered as a failure. Prosthetization of patella, in a second surgery, is not considered as a failure. Major revision is performed when femoral and/or tibial component are revised; minor revision when insert and/or patella are revised.

Type of operation	N. implants	N. major revisions	N. minor revisions	N. of revisions performed outside Emilia-Romagna region	Rate revisions	Survival at 15 Yrs (CI 95%)
Primary bicompartmental	43.011	1.197	186	96	1.479/43.011	93,6 (93,0-94,1)
Primary tricompartmental	11.001	257	68	23	348/11.001	94,1 (93,1-95,0)
Primary unicompartmental	6.453	560	17	43	620/6.453	80,9 (78,4-83,1)
Total revision	2.888	281	57	17	355/2.888	81,4 (79,2-83,5)

Survival curve



Survivorship of unicompartmental prostheses is significantly different from bi and tricompartimental ones. (Wilcoxon, p=0,001).

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

The following table shows the rate of revision in knee arthroplasty according to **cause of revision**

Primary unicompartmental

Cause of revision	Rate	Percentage	% distribut. of failure causes
Total aseptic loosening	**232**/6.453	3,6	37,4
Pain without loosening	**123**/6.453	1,9	19,8
Tibial aseptic loosening	**79**/6.453	1,2	12,7
Septic loosening	**46**/6.453	0,7	7,4
Femoral aseptic loosening	**20**/6.453	0,3	3,2
Insert wear	**16**/6.453	0,2	2,6
Dislocation	**13**/6.453	0,2	2,1
Breakage of prosthesis	**12**/6.453	0,2	1,9
Bone fracture	**6**/6.453	0,1	1,0
Instability	**2**/6.453	0,03	0,3
Other	**10**/6.453	0,2	1,6
Unknown *(43 performed outside region)*	**61**/6.453	0,9	9,8
Total	**620/6.453**	**9,6**	**100,0**

Primary bi-tricompartmental

Cause of revision	Rate	Percentage	% distribut. of failure causes
Total aseptic loosening	**505**/54.012	0,9	27,6
Septic loosening	**444**/54.012	0,8	24,3
Pain without loosening	**174**/54.012	0,3	9,5
Tibial aseptic loosening	**172**/54.012	0,3	9,4
Dislocation	**60**/54.012	0,1	3,3
Insert wear	**52**/54.012	0,1	2,8
Femoral aseptic loosening	**41**/54.012	0,1	2,2
Bone fracture	**41**/54.012	0,1	2,2
Instability	**40**/54.012	0,1	2,2
Stiffness	**29**/54.012	0,1	1,6
Breakage of prosthesis	**15**/54.012	0,03	0,8
Other	**56**/54.012	0,1	3,1
Unknown *(112 performed outside region)*	**198**/54.012	0,4	10,8
Total	**1.827/54.012**	**3,4**	**100,0**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Total revision

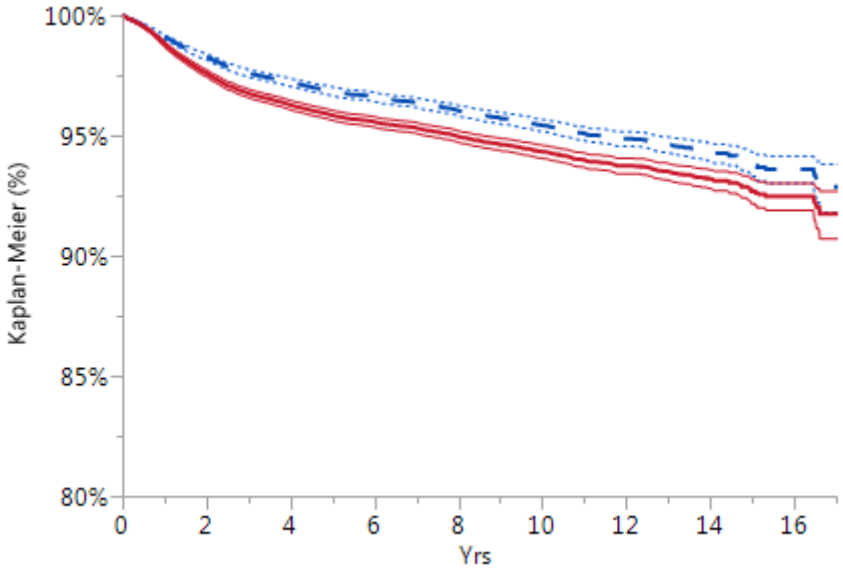
Cause of revision	Rate	Percentage	% distribut. of failure causes
Septic loosening	**115**/2.888	4,0	32,4
Total aseptic loosening	**83**/2.888	2,9	23,4
Tibial aseptic loosening	**39**/2.888	1,4	11,0
Pain without loosening	**26**/2.888	0,9	7,3
Dislocation	**11**/2.888	0,4	3,1
Femoral aseptic loosening	**8**/2.888	0,3	2,3
Insert wear	**7**/2.888	0,2	2,0
Instability	**6**/2.888	0,2	1,7
Stiffness	**5**/2.888	0,2	1,4
Breakage of prosthesis	**5**/2.888	0,2	1,4
Periprosthetic bone fracture	**5**/2.888	0,2	1,4
Other	**10**/2.888	0,3	2,8
Unknown *(17 performed outside region)*	**35**/2.888	1,2	9,9
Total	**355/2.888**	**12,3**	**100,0**

15.4 Re-operation due to replacement of only the patella component

In rare cases bicompartmental prosthesis were transformed into tricompartmental prosthesis, with the addition of the patella component, during a second operation.
That was done in 406 cases (out 43.011 bicompartmental prostheses recorded in the RIPO). The mean time lapse between primary bicompartmental arthroplasty and implanting the patella was 2,0 years (I.C. at 95 1,9-2,2).
These 406 re-operations were not considered as failures of the bicompartmental prosthesis as in dotted line.

For comparison, when resurfacing is considered a failure, the survival is traced as solid line.
Survival at 17 yrs is 91,7 (90,7-92,7) and 92,9 (91,8-93,8) respectively.
17,7% of the 406 cases that underwent the addition of patella resurfacing, have been successively revised.

Survival curve



Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

15.5 Analysis of the survival of unicompartmental prosthesis according to the most widely used commercial type in Emilia-Romagna

Survival analysis was not calculated if prostheses at risk are below 20 cases.

In **bold** Monoblock Prosthesis

Type	From years	N.	N. failures	% survival at 5 (I.C. at 95%)	N. at risk at 5 yrs	% survival at 10 (I.C. at 95%)	N. at risk at 10 yrs
OXFORD UNICOMPARTIMENTAL PHASE 3 - Biomet Merck	2000	862	135	90,8 (88,6-92,6)	717	85,6 (82,9-87,9)	429
PHYSICA ZUK - Lima	2005	846	35	94,9 (92,6-96,5)	299	91,5 (87,3-94,4)	66
GENESIS UNI - Smith & Nephew	2000	668	75	92,4 (90,1-94,2)	544	86,4 (82,9-89,3)	192
UNI SIGMA HP - DePuy	2009	477	20	94,8 (92,0-96,7)	125	-	-
JOURNEY UNI - Smith & Nephew	2011	389	15	93,1 (88,1-96,1)	26	-	-
MITUS - ENDO-MODEL UNI – ALL POLY - Link	2003	372	36	92,0 (88,3-94,6)	217	88,1 (83,4-91,5)	125
EFDIOS - Citieffe	2000	314	52	92,7 (89,2-95,2)	272	82,9 (77,8-87,1)	133
ALLEGRETTO UNI - Protek-Sulzer	2000	276	29	92,8 (88,8-95,4)	204	90,0 (85,3-93,3)	142
JOURNEY UNI - ALL POLY - Smith & Nephew	2010	259	17	93,0 (88,2-96,0)	121	-	-
GKS - ONE – ALL POLY Permedica	2006	211	17	93,2 (88,5-96,0)	117	86,9 (78,1-92,6)	27
PRESERVATION UNI – ALL POLY - DePuy	2002	187	23	91,7 (86,8-95,0)	163	87,3 (81,4-91,5)	105
UC-PLUS SOLUTION - Smith & Nephew	2000	176	13	97,7 (94,0-99,1)	164	95,2 (90,7-97,6)	143
HLS - UNI EVOLUTION - ALL POLY - Tornier	2001	144	13	94,9 (89,7-97,6)	128	90,3 (84,0-94,3)	68
UC-PLUS SOLUTION – ALL POLY - Smith & Nephew	2003	140	22	88,3 (81,8-92,7)	117	-	-
OPTETRAK UNI – ALL POLY -Exactech	2005	130	5	98,4 (93,9-99,6)	120	95,7 (90,0-98,2)	32
RESTORIS MCK UNI - Mako	2014	126	1	-	-	-	-
MILLER GALANTE UNI - Zimmer	2001	118	10	95,7 (90,1-98,2)	108	92,8 (86,3-96,4)	91
BALANSYS - UNI - Mathys	2005	107	15	86,0 (77,7-91,6)	69	83,5 (73,6-90,2)	26
Other (<100 cases)	2000	631	86	87,2 (83,9-90,0)	283	78,9 (73,8-83,2)	95
Unknown	2001	20	1	-	-	-	-
Total	**2000**	**6.453**	**620**	**92,6 (91,8-93,2)**	**3.810**	**87,3 (86,3-88,4)**	**1.687**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

15.6 Analysis of the survival of bi-tricompartmental prosthesis according to the most widely used commercial type in Emilia-Romagna

Survival analysis was not calculated if prostheses at risk are below 20 cases.

Type	From years	N.	N. failures	% survival at 5 (I.C. at 95%)	N. at risk at 5 yrs	% survival at 10 (I.C. at 95%)	N. at risk at 10 yrs
NEXGEN - LPS - FLEX FISSO - Zimmer	2002	5.642	120	98,0 (97,6-98,3)	3.689	97,3 (96,7-97,8)	1.074
GENESIS II - PS HIGH FLEXION - Smith & Nephew	2004	2.935	54	97,9 (97,2-98,4)	1.224	97,5 (96,5-98,2)	103
VANGUARD - PS - Biomet Orthopedics	2005	2.825	55	97,9 (97,2-98,4)	1.396	96,8 (95,5-97,7)	199
GEMINI MK II – Link	2002	2.322	63	97,4 (96,6-98,0)	1.328	95,9 (94,5-96,9)	362
TC-PLUS - SB SOLUTION - Endoplus	2002	2.132	46	98,0 (97,3-98,6)	1.320	96,4 (94,8-97,6)	128
PROFIX - CONFORMING - Smith & Nephew	2000	2.035	82	96,9 (96,1-97,6)	1.777	95,7 (94,7-96,6)	1.132
NEXGEN - LPS - Zimmer	2000	2.011	88	97,3 (96,5-98,0)	1.798	95,8 (94,8-96,6)	1.428
LEGION - PS XLPE HIGH FLEXION - Smith & Nephew	2011	1.744	35	96,1 (94,3-97,3)	41	-	-
PFC - RP - PS - De Puy Johnson & Johnson	2000	1.735	68	96,8 (95,8-97,5)	1.274	95,6 (94,3-96,6)	421
NEXGEN - CR FLEX FISSO - Zimmer	2004	1.435	31	97,6 (96,5-98,4)	698	96,6 (94,7-97,8)	158
TRIATHLON - CR - Howmedica Osteonics	2005	1.249	21	98,3 (97,2-98,9)	591	-	-
GENESIS II - C R - Smith & Nephew	2001	1.140	34	96,8 (95,4-97,7)	718	96,1 (94,5-97,2)	179
ATTUNE - PS FIXED – De Puy Johnson & Johnson	2012	1.083	23	-	-	-	-
GENUS PE - Adler-Ortho	2008	941	28	97,2 (95,9-98,1)	597	-	-
VANGUARD - CR-LIPPED - Biomet Orthopedics	2006	860	19	97,6 (96,1-98,5)	500	97,0 (95,3-98,1)	62
NEXGEN - LPS - FLEX MOBILE - Zimmer	2002	843	35	96,6 (95,0-97,7)	614	95,5 (93,6-96,9)	268
PERSONA - PS- Zimmer	2013	657	10	-	-	-	-
ATTUNE - PS MOBILE - De Puy Johnson & Johnson	2014	654	7	-	-	-	-
FIRST - Symbios Orthopedie	2006	649	33	95,5 (93,6-96,9)	510	94,0 (91,5-95,8)	63
ROTAGLIDE - Corin Medical	2000	637	67	92,3 (89,9-94,2)	500	89,7 (86,8-92,0)	253
PFC - PS - De Puy J.&J.	2000	610	34	94,9 (92,7-96,5)	309	92,5 (89,3-94,9)	145
PFC - RP - CVD - De Puy Johnson & Johnson	2001	606	26	95,9 (93,9-97,3)	393	94,5 (91,9-96,3)	80
GENIUS TRICCC - Dedienne Sante	2000	598	51	94,1 (91,8-95,8)	479	90,3 (87,3-92,7)	237
ADVANCE Medial Pivot - Wright	2000	595	21	96,6 (94,7-97,8)	456	96,3 (94,4-97,6)	269
PROFIX - P S - Smith & Nep.	2002	589	19	97,5 (95,9-98,5)	518	96,4 (94,5-97,7)	274
SCORPIO - NRG - PS – Howmedica Osteonics	2004	550	27	95,9 (93,8-97,3)	458	94,3 (91,6-96,2)	138
SCORPIO - NRG - CR - Howmedica Osteonics	2007	534	16	96,3 (94,0-97,7)	327	-	-

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

T.A.C.K. - Link	2000	530	62	93,6 (91,1-95,4)	457	90,7 (87,8-93,0)	366
OPTETRAK - LOGIC PS - Exactech	2011	502	13	-	-	-	-
INNEX - MOBILE BEARING - UCOR - Protek Sulzer	2002	501	12	97,3 (95,1-98,5)	166	-	-
LCS - UNIVERSAL - RP - De Puy Johnson & Johnson	2000	488	20	96,5 (94,4-97,8)	432	96,2 (94,1-97,6)	352
PHYSICA - PS FIXED - Lima	2014	465	4	-	-	-	-
PFC - SIGMA RPF - De Puy Johnson & Johnson	2005	449	20	96,1 (93,9-97,6)	355	94,4 (90,8-96,6)	95
SCORE - Amplitude	2004	437	11	98,1 (96,3-99,1)	390	97,2 (94,9-98,4)	217
TRIATHLON - PS - Howmedica Osteonics	2007	434	5	98,5 (96,3-99,4)	108	-	-
OPTETRAK - RBK - HI-FLEX - Exactech	2006	399	13	96,7 (94,4-98,1)	353	96,7 (94,4-98,1)	93
GENESIS II - MOBILE BEARING - Smith & Nephew	2001	359	13	97,1 (94,7-98,4)	309	95,5 (92,1-97,5)	48
GSP - TREKKING - MBH PS - Samo	2007	343	10	96,6 (93,6-98,2)	112	-	-
PFC - CVD - De Puy J.&J.	2000	331	8	98,4 (96,1-99,3)	245	98,4 (96,1-99,3)	153
LEGION - CONSTRAINED - Smith & Nephew	2008	329	8	96,1 (92,0-98,1)	33	-	-
BALANSYS - MOBILE BEARING - Mathys	2005	327	7	97,4 (94,7-98,8)	162	-	-
LCS - COMPLETE - RP - De Puy Johnson & Johnson	2004	302	11	96,9 (94,1-98,4)	251	96,0 (93,0-97,8)	55
Other (<300 cases)	2000	10.034	492	95,6 (95,2-96,0)	5.733	93,5 (92,9-94,1)	3.012
Unknown	2000	171	5	98,8 (95,2-99,7)	136	96,2 (91,2-98,4)	97
Total	**2000**	**54.012**	**1.827**	**96,8 (96,6-97,0)**	**30.760**	**95,4 (95,1-95,6)**	**11.529**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

PART THREE: SHOULDER PROSTHESIS

July 2008 – December 2017

16. RIPO capture

16.1 Percentage of R.I.P.O. data collection

Percentage of R.I.P.O. capture calculated versus Discharge Records (S.D.O.) was **97,5** in 2017. Data are referred to primary total prosthesis (8180), hemiarthroplasty (8181), revision (8197) and prosthesis removal (8001).

16.2 Ratio public/private treatment

Percentage of implants performed in public hospitals.

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)		
Year of surgery	**Primary arthroprosthesi**	**Hemiarthroplasty**
2008	73,9	93,0
2009	65,7	83,6
2010	59,6	84,6
2011	49,1	87,1
2012	58,3	90,8
2013	59,8	93,2
2014	54,5	85,6
2015	57,6	94,9
2016	49,4	87,0
2017	48,7	82,9

From database SDO

17. Type of operation

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **type of operation**

Type of operation	Number of operation	Percentage
Reverse prosthesis	4.548	67,3
Hemiarthroplasty	893	13,2
Anatomical prosthesis	465	6,9
Revisions	421	6,2
Stemless emi	131	1,9
Resurfacing**	129	1,9
Prosthesis removal	93	1,4
Anatomical Stemless	34	0,5
Reverse Stemless	13	0,2
Other*	34	0,5
Total	**6.761**	**100,0**

*7 interposition prostheses and 5 osteomyelitis spacers
**114 resurfacing and 14 with glenoid

18. Descriptive statistics of patients

18.1 Gender

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Reverse prosthesis	1.088	23,9	3.460	76,1	4.548
Hemiarthroplasty	277	31,0	616	69,0	893
Anatomical prosthesis	199	42,8	266	57,2	465
Revisions	156	37,1	265	62,9	421
Stemless emi	61	46,6	70	53,4	131
Resurfacing	80	62,0	49	38,0	129
Prosthesis removal	46	49,5	47	50,5	93
Anatomical Stemless	17	50,0	17	50,0	34
Reverse Stemless	2	15,4	11	84,6	13
Totale	**1.926**	**28,6**	**4.801**	**71,4**	**6.727**

18.2 Age

Mean age of patients, according to gender and type of operation

	Males		Females	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Reverse prosthesis	71,8	34-92	74,1	31-100
Hemiarthroplasty	59,8	15-92	72,6	23-98
Anatomical prosthesis	60,9	33-80	65,6	30-101
Revisions	64,8	26-89	69,6	43-91
Stemless emi	56,4	26-78	64,0	33-86
Resurfacing	52,0	18-85	57,2	21-80
Prosthesis removal	65,3	26-89	72,1	51-87
Anatomical Stemless	56,2	36-74	66,6	53-80
Reverse Stemless	69,2	67-71	73,0	54-82

18.3 Pathologies

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **type of operation** and **diagnosis** of patients.

Diagnosis	Total reverse arthroplasty	
	N.	%
Eccentric osteoarthritis	2.390	52,6
Fracture	890	19,6
Concentric osteoarthritis	649	14,3
Cuff arthropathy	157	3,5
Necrosis	108	2,4
Sequelae of fracture	104	2,3
Non specified osteoarthritis	76	1,7
Inveterate dislocation	40	0,9
Rheumatic arthritis	35	0,8
Post-traumatic arthritis	15	0,3
Post-traumatic necrosis	13	0,3
Recurrent dislocation	9	0,2
Sequelae of septic arthritis	5	0,1
Pain	3	0,1
Other	17	0,4
Unknown	37	0,8
Total	**4.548**	**100,0**

Diagnosis	Total anatomical prosthesis	
	N.	%
Concentric osteoarthritis	377	81,1
Necrosis	27	5,8
Eccentric osteoarthritis	27	5,8
Sequelae of fracture	9	1,9
Rheumatic arthritis	7	1,5
Non specified osteoarthritis	7	1,5
Fracture	6	1,3
Post-traumatic arthritis	2	0,4
Synovial chondromatosis	1	0,2
Unknown	2	0,4
Total	**465**	**100,0**

Diagnosis	Hemiarthroplasty	
	N.	%
Fracture	567	63,5
Concentric osteoarthritis	87	9,7
Eccentric osteoarthritis	73	8,2
Necrosis	67	7,5
Sequelae of fracture	39	4,4
Inveterate dislocation	12	1,3
Rheumatic arthritis	10	1,1
Post-traumatic necrosis	6	0,7
Sequelae of septic arthritis	5	0,6
Post-traumatic arthritis	4	0,4

Non specified osteoarthritis	4	0,4
Tumor	4	0,4
Pathological fracture	3	0,3
Idiopathic homer head Necrosis	2	0,2
Cuff arthropathy	1	0,1
Other	6	0,7
Unknown	3	0,3
Total	**893**	**100,0**

Diagnosis	**Resurfacing**	
	N.	**%**
Concentric osteoarthritis	66	51,2
Necrosis	32	24,8
Eccentric osteoarthritis	9	7,0
Fracture	4	3,1
Rheumatic arthritis	3	2,3
Sequelae of fracture	3	2,3
Non specified osteoarthritis	3	2,3
Inveterate dislocation	2	1,6
Cuff arthropathy	1	0,8
Idiopathic homer head Necrosis	1	0,8
Other	5	3,9
Total	**129**	**100,0**

Diagnosis	**Stemless emi**	
	N.	**%**
Concentric osteoarthritis	68	51,9
Eccentric osteoarthritis	26	19,8
Necrosis	19	14,5
Sequelae of fracture	5	3,8
Non specified osteoarthritis	3	2,3
Fracture	2	1,5
Steroid-induced necrosis	2	1,5
Post-traumatic necrosis	2	1,5
Recurrent dislocation	1	0,8
Sequelae of septic arthritis	1	0,8
Cuff arthropathy	1	0,8
Unknown	1	0,8
Total	**131**	**100,0**

Diagnosis	**Anatomical Stemless**	
	N.	**%**
Concentric osteoarthritis	25	73,5
Eccentric osteoarthritis	4	11,8
Non specified osteoarthritis	2	5,9
Post-traumatic arthritis	1	2,9
Necrosis	1	2,9
Synovial chondromatosis	1	2,9
Total	**34**	**100,0**

Diagnosis	Stemless reverse	
	N.	%
Eccentric osteoarthritis	10	76,9
Concentric osteoarthritis in sequelae of fracture	1	7,7
Concentric osteoarthritis	1	7,7
Non specified osteoarthritis	1	7,7
Total	**13**	**100,0**

Number of **shoulder revisions** carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **diagnosis** and **type of revision.**

Diagnosis	N.	%
Glenoid erosion	84	20,0
Two steps revision	57	13,5
Glenoid loosening	45	10,7
Humeral loosening	42	10,0
Anterior instability	36	8,6
Pain	28	6,7
Superior instability	27	6,4
Dislocation	18	4,3
Other instability	17	4,0
Tuberosity Reabsorption	4	1,0
Total aseptic loosening	4	1,0
Poly wear	4	1,0
Breackage of insert	3	0,7
Other	7	1,7
Unknown	8	1,9
Total	**421**	**100,0**

Type of revision	N.	%
From hemi to reverse	121	28,7
From reverse to reverse	89	21,1
Implant after removal	57	13,5
From anatomic to reverse	37	8,8
From reverse to anatomic CTA	31	7,4
From hemi to hemi	19	4,5
From hemi to anatomic	17	4,0
From resurfacing to reverse	15	3,6
From anatomic to anatomic	6	1,4
From resurfacing to anatomic	3	0,7
From reverse to hemi	3	0,7
Other	13	3,1
Unknown	10	2,4
Total	**421**	**100,0**

19. Surgical technique, anaesthesia and antithromboembolic prophylaxis

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **surgical approach.**

Type of operation	Deltoid-pectoral	Trans-deltoid	Superior lateral	Other
Reverse prosthesis	3751	488	46	191
Hemiarthroplasty	855	23	1	7
Anatomical prosthesis	459	3	-	-
Revision	394	15	-	5
Stemless hemi	121	6	1	-
Resurfacing	125	1	-	1
Prosthesis removal	87	2	-	1
Anatomical stemless	33	-	-	-
Reverse stemless	9	3	-	-
Total*	**5834**	**541**	**48**	**205**

*90 missing data (1.6%)

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **anaesthesia.**

Anaesthesia	N.	%
General	3.027	49,2
Mixed	2.740	44,5
Loco-regional	391	6,3
Total*	**6.158**	**100,0**

*569 missing data (8,5%)

Antithromboembolic prophylaxis

Heparin is used in 83,8% of primary surgery, oral prophylaxis in 3,2% and no prophylaxis in 13,0%,.

20. Type of prosthesis

20.1 Prosthesis fixation

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to **stem fixation** and **type of operation**

Stem fixation	Anatomical prosthesis	%	Reverse prosthesis	%	Hemiarthroplasty	%
Cemented	34	7,3	836	18,4	310	34,7
Cementless	431	92,7	3.712	81,6	583	65,3
Total	**465**	**100,0**	**4.548**	**100,0**	**893**	**100,0**

20.2 Material, form and fixation of glenoid in Anatomical prosthesis

Material of glenoid	Anatomical prosthesis	%
Metal backed	237	51,0
Polyethylene	228	49,0
Total	**465**	**100,0**

Form of glenoid	Anatomical prosthesis	%
Pegs	312	67,1
Screws	146	31,4
Keel	7	1,5
Total	**465**	**100,0**

Fixation of glenoid	Anatomical prosthesis	%
Cementless	237	51,0
Cemented	228	49,0
Total	**465**	**100,0**

20.3 Type of prosthesis

Number of **primary** shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to the **type of stem**.

Model of Stem	Anatomical prosthesis		Reverse prosthesis		Hemiarthroplasty	
	N	%	N			%
SMR ALETTATO	154	33,1	1.408	31,0	409	45,8
DELTA Xtend	1	0,2	1.114	24,5	35	3,9
DELTA XTEND CEMENTED	-	-	374	8,2	21	2,4
AEQUALIS ASCEND FLEX S PTC	125	26,9	193	4,2	25	2,8
AEQUALIS REVERSED	-	-	292	6,4	1	0,1
TRABECULAR METAL REVERSE	-	-	260	5,7	7	0,8
SMR CEMENTATO	4	0,9	115	2,5	89	10,0
BIGLIANI/FLATOW	111	23,9	-	-	23	2,6
EQUINOXE PRIMARY	-	-	128	2,8	1	0,1
AEQUALIS REVERSED CEMENTED	-	-	92	2,0	-	-
COMPREHENSIVE MINI	-	-	82	1,8	4	0,4
DUOCENTRIC	-	-	86	1,9	-	-
EQUINOXE PLATFORM FRACTURE	-	-	60	1,3	2	0,2
AFFINIS FRACTURE	-	-	44	1,0	16	1,8
ANATOMICAL SHOULDER	12	2,6	20	0,4	18	2,0
AFFINIS INVERSE	-	-	41	0,9	-	-
ANATOMICAL SHOULDER CEMENTED	8	1,7	24	0,5	8	0,9
ANATOMICAL SHOULDER FRACTURE	1	0,2	6	0,1	31	3,5
SMR REVISIONE	-	-	24	0,5	14	1,6
GLOBAL FX	-	-	-	-	33	3,7
LTO CEMENTATO	2	0,4	-	-	31	3,5
BIGLIANI/FLATOW TRABECULAR METAL	2	0,4	-	-	25	2,8
AEQUALIS ASCEND	21	4,5	-	-	3	0,3
ARROW	1	0,2	21	0,5	2	0,2
GLOBAL ADVANTAGE	2	0,4	-	-	21	2,4
PROMOS	-	-	17	0,4	6	0,7
Other (models < 20 cases)	19	4,1	134	2,9	68	7,6
Unknown	2	0,4	13	0,3	-	-
Total	**465**	**100,0**	**4.548**	**100,0**	**893**	**100,0**

Number of shoulder **Anatomical prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to the **type of glenoid.**

Model of Glenoid	Anatomical prosthesis	
	N	%
AEQUALIS PERFORM	151	32,5
SMR RIVESTITA	132	28,4
BIGLIANI/FLATOW TRABECULAR METAL	73	15,7
BIGLIANI/FLATOW	44	9,5
SMR;SMR PEG TT	26	5,6
ANATOMICAL SHOULDER	16	3,4
Other (models < 10 cases)	21	4,5
Unknown	2	0,4
Total	**465**	**100,0**

Number of shoulder **Reverse prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to the **type of metaglena**

Model of metaglena	Reverse prosthesis	
	N	%
DELTA Xtend	1.489	32,7
SMR RIVESTITA	1.419	31,2
AEQUALIS REVERSED	511	11,2
TRABECULAR METAL REVERSE	251	5,5
EQUINOXE REVERSE	188	4,1
SMR;SMR PEG TT	130	2,9
DUOCENTRIC	98	2,2
AEQUALIS REVERSED II	81	1,8
AFFINIS INVERSE	81	1,8
COMPREHENSIVE REVERSE MINI	58	1,3
COMPREHENSIVE REVERSE	52	1,1
ANATOMICAL SHOULDER INVERSE/REVERSE	34	0,7
ARROW	21	0,5
DELTA CTA	21	0,5
HUMELOCK REVERSED	19	0,4
TITAN REVERSE	18	0,4
PROMOS REVERSE	17	0,4
AGILON	14	0,3
T.E.S.S.	10	0,2
Other (models < 10 cases)	32	0,7
Unknown	4	0,1
Total	**4.548**	**100,0**

Number of shoulder Hemiarthroplasty carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to the type of humer head

Model of Humer Head	Hemiarthroplasty	
	N	%
SMR	456	51,1
DELTA XTEND CTA	56	6,3
SMR CTA	56	6,3
BIGLIANI/FLATOW	55	6,2
GLOBAL ADVANTAGE	49	5,5
RANDELLI - LTO	33	3,7
ANATOMICAL SHOULDER FRACTURE	31	3,5
ANATOMICAL SHOULDER	26	2,9
AEQUALIS ASCEND FLEX PYC	21	2,4
AEQUALIS	18	2,0
AFFINIS FRACTURE	16	1,8
GLOBAL UNITE	12	1,3
Other (models < 10 cases)	64	7,2
Total	**893**	**100,0**

Number of shoulder **resurfacing** carried out on patients with admission date between 1st July 2008 and 31st December 2017, according to the **type of prosthesis**.

Model of prosthesis	Resurfacing	
	N	%
SMR - Lima	55	42,6
EPOCA RH - Synthes	21	16,3
COPELAND - Biomet	17	13,2
GLOBAL CAP – DePuy	14	10,9
PYROTITAN - Ascension Orthopedics	8	6,2
AEQUALIS RESURFACING - Tornier	5	3,9
DUROM SHOULDER - Zimmer	4	3,1
COPELAND TS - Biomet	2	1,6
Other	3	2,3
Total	**129**	**100,0**

Number of shoulder **stemless** carried out on patients with admission date between 1st July 2008 and 31st December 2016, according to the **type of prosthesis**.

Model of prosthesis	Anatomical Stemless		Hemi Stemless		Reverse Stemless	
	N	%	N	%	N	%
T.E.S.S. - Biomet	8	23,5	68	51,9	-	-
ECLIPSE - Arthrex	7	20,6	23	17,6	-	-
SIDUS - Zimmer	2	5,9	21	16,0	-	-
AFFINIS SHORT - Mathys	5	14,7	9	6,9	-	-
COMPREHENSIVE VERSA -DIAL- Biomet	-	-	8	6,1	-	-
VERSO - Biomet	-	-	-	-	7	53,8
SMR - Lima	4	11,8	1	0,8	-	-
BIGLIANI/FLATOW - Zimmer	4	11,8	-	-	-	-
AFFINIS FRACTURE - Mathys	3	8,8	-	-	-	-
T.E.S.S. INVERSA - Biomet	-	-	-	-	5	38,5
HUMELOCK - Fx Solution	1	2,9	-	-	-	-
SMR INVERSA HP - Lima	-	-	-	-	1	7,7
SIMPLICITI - Tornier	-	-	1	0,8	-	-
Total	**34**	**100,0**	**131**	**100,0**	**13**	**100,0**

21. Complications occurred during hospitalization

RIPO registers all kind of complications occurred during hospitalization. In the following tables only intra-operative and post-operative local complications are presented.
The rate of complications in **primary shoulder operations (total reverse prosthesis and total anatomical prosthesis)** carried out on patients hospitalized between July 1st 2000 and December 31st 2017.

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	23	0,5	Dislocation	9	*0,2*
Tendon lesion	3	0,06			
Vascular lesion	1	0,02			
Fracture	30	0,6	Early Infection	-	-
Other	9	0,2			
Total	**66**	***1,3***	**Total**	**9**	***0,2***

The rate of complications **in primary Hemiarthroplasty** carried out on patients hospitalized between July 1st 2000 and December 31st 2017

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	6	0,7	Early Infection	2	*0,2*
Tendon lesion	2	0,2			
Vascular lesion	1	0,1			
Fracture	10	1,1	Dislocation	-	-
Other	2	0,2			
Total	**21**	**2,4**	**Total**	**2**	***0,2***

They were observed also 3 deaths in hemiarthroplasty and 3 deaths in reverse prosthesis according to fracture diagnosis.

22. Duration of pre-operative and post-operative hospitalization

Days of pre-operative hospitalization (mean, minimum, maximum) according to type and year of operation.

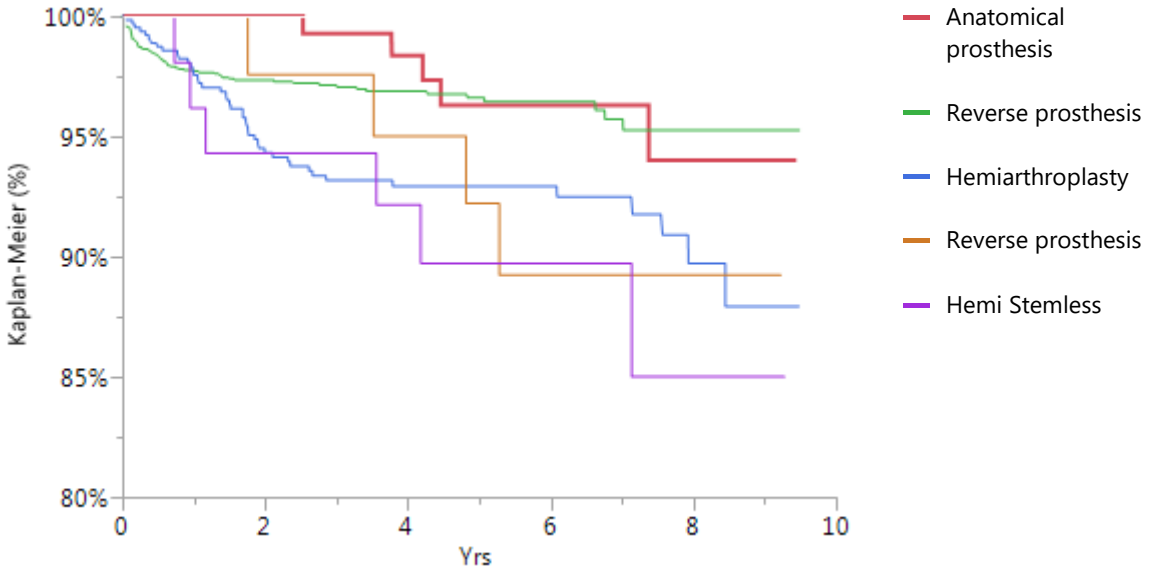
Year 2017			
Type of operation	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Reverse prosthesis	852	1,3 (0-21)	4,3 (0-16)
Hemiarthroplasty	57	2,0 (0-19)	5,7 (2-18)
Revisions	60	1,5 (0-29)	5,5 (2-28)
Anatomical prosthesis	47	0,4 (0-3)	3,8 (2-8)
Prosthesis removal	15	0,7 (0-3)	4,9 (1-11)

Year 2017			
Type of operation	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Elective	782	0,7 (0-10)	4,1 (0-16)
Emergency	195	3,5 (0-21)	5,2 (1-18)

23. Analysis of survival of primary surgery

Survival curve is used to estimate the probability that each patient to remain in the initial condition (unrevised prosthesis). Following figure shows curves according to Type of operation.
All primary shoulder arthroplasties performed in the Region between July 2008 and December 2017 only on patients living in the Region were analysed.

Type of operation	Number of implants	Number of revisions	Mean Follow-up	Survival at 8 yrs (C.I. 95%)	N. at risk at 8 yrs
Anatomical prosthesis	190	5	4,5	94,0 (85,2-97,7)	19
Reverse prosthesis	2.552	74	3,2	95,3 (93,4-96,6)	114
Hemiarthroplasty	643	45	4,7	89,7 (85,2-93,0)	71
Resurfacing	44	4	6,2	89,3 (74,6-95,9)	13
Anatomical Stemless	15	5	-	-	-
Hemi Stemless	54	6	5,6	85,0 (68,7-93,7)	6
Reverse Stemless	6	-	-	-	-



Difference is statistically significant (p=0,005 Wilcoxon Test).

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Anatomical prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**1**/190	0,5	20,0
Pain	**1**/190	0,5	20,0
Poly wear	**1**/190	0,5	20,0
Breakage of insert	**1**/190	0,5	20,0
Septic loosening	**1**/190	0,5	20,0
Total	**5/190**	**2,6**	**100,0**
Reverse prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Instability	**20**/2.552	0,8	27,0
Septic loosening	**14**/2.552	0,5	18,9
Glenoid loosening	**14**/2.552	0,5	18,9
Dislocation	**7**/2.552	0,3	9,5
Periprosthetic bone fracture	**4**/2.552	0,2	5,4
Humeral component loosening	**2**/2.552	0,1	2,7
Glenoid erosion	**2**/2.552	0,1	2,7
Pain	**1**/2.552	0,04	1,4
Other	**2**/2.552	0,1	2,7
Unknown *(3 performed outside region)*	**8**/2.552	0,3	10,8
Total	**74/2.552**	**2,9**	**100,0**
Hemiarthroplasty			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**10**/643	1,6	22,2
Instability	**7**/643	1,1	15,6
Septic loosening	**5**/643	0,8	11,1
Humeral component loosening	**4**/643	0,6	8,9
Periprosthetic bone fracture	**3**/643	0,5	6,7
Cuff arthropathy	**2**/643	0,3	4,4
Pain	**2**/643	0,3	4,4
Total aseptic loosening	**2**/643	0,3	4,4
Other	**1**/643	0,2	2,2
Other	**2**/643	0,3	4,4
Unknown *(5 performed outside region)*	**7**/643	1,1	15,6
Total	**45/643**	**7,0**	**100,0**
Resurfacing			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**3**/44	6,8	75,0
Glenoid loosening	**1**/44	2,3	25,0
Total	**4/44**	**9,1**	**100,0**
Anatomical Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Pain	**1**/15	6,7	20,0
Septic loosening	**1**/15	6,7	20,0
Instability	**1**/15	6,7	20,0
Dislocation	**1**/15	6,7	20,0
Poly wear	**1**/15	6,7	20,0
Total	**5/15**	**33,3**	**100,0**

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Hemi Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Pain	**2**/54	3,7	33,3
Glenoid erosion	**1**/54	1,9	16,7
Septic loosening	**1**/54	1,9	16,7
Humeral component loosening	**1**/54	1,9	16,7
Unknown *(1 performed outside region)*	**1**/54	1,9	16,7
Total	**6/54**	**11,1**	**100,0**

23.1 Analysis of the survival of Reverse prosthesis according to the most widely used commercial type in Emilia-Romagna

Type	From years	N.	N. failures	% survival at 5	C.I. at 95%	N. at risk at 5 yrs
DELTA XTEND - Depuy	2008	652	13	98,4	97,1-99,1	208
SMR - Lima	2008	603	26	94,9	92,4-96,6	149
SMR INVERSA HP - Lima	2008	450	11	97,2	94,9-98,4	82

Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients