REPORT of R.I.P.O.

Regional Register of Orthopaedic Prosthetic Implantology

OVERALL DATA

HIP, KNEE AND SHOULDER ARTHROPLASTY

IN EMILIA-ROMAGNA REGION (ITALY)

2000-2016

VERSION 1, 13st APRIL 2018

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 16th 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 2016**.
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. 163.000 hip, 96.000 knee and 5.600 shoulder prostheses have been reported from 70 Orthopaedic Units in 59 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 2016, 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 2016, data on 7.659 primary THA, 121 resurfacing, 2.359 hemiarthroplasty (also with acetabular buffer) and 893 partial or total revision were registered.

Compared to past years, the THA are slightly increasing (+120 cases) while the resurfacing are slightly decreasing (-70 cases); the latter are implanted in private structures only.

During 2016 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 2016, as in past years, 100 different types of cup and stem were used, a lot of them are 'new', not implanted in previous year. 24% 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 (5% of primary THA); the resurfacing are 1,6% of primary THA.
Uncemented prostheses were 62% in year 2000 and 96% in year 2016, whilst hybrid fixation was 22% and it is now 2.7%.
The implant of completely cemented prostheses is virtually abandoned decreasing to 0,5% (compared to 15% in past years.)
The survival of the hip prostheses is confirmed at very high levels, 89,0% of prostheses implanted in Emilia-Romagna region on resident patients are still in place 17 years after the operation.
Part (74%) of 3.445 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 13 years, is slightly lower than THA (86,6%, statistically significant). This datum is affected by the recall of a particular model of prostheses, the ASR Depuy. The most frequently implanted resurfacing, on the contrary, shows survival comparable to conventional THA.
Total revisions are not revised the second time in 81,7% 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 2016, data on 7.400 primary knee prostheses and 530 partial or total revision were registered. High percentage of primary knee prostheses is implanted in private structures (66% in 2016 vs 43% in 2000).

In 2016, 11% of implanted prostheses are unicompartmental, 65% are bicompartmental with no patella resurfacing and the remaining 24% have patella resurfacing. The number of prostheses with patella are increasing, in particular in public hospital.

In 2016, 97,6% of implants are cemented, in the half of them cement is antibiotic loaded.
Posterior Stabilization of insert is slightly increasing (62,9% during last year) compared to minimally stabilized. Mobile insert are decreasing (22,2% in 2016).

Types of implanted prostheses are less numerous and more stable during years compared to hip. Survival of bicompartmental is 93,0% at 16 yrs, survival of tricompartmental is 94,0% and survival of unicompartmental is significantly lower (81,8%). 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.

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) and by type of insert (mobile insert is worse than fixed insert).
In unicompartmental implants, only age 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. None of these models are still used in Emilia-Romagna region.

Shoulder

Data refers to a shorter follow-up (8 years and half).
During 2016, about 800 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 2016 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 36% of hemiarthroplasties are cemented.
Survival at 6 yrs is globally higher than 90%.

Bologna, 30st March 2018

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 March 2018.

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
Pres. Val D'Arda, Fiorenzuola D'Arda	Dr. Luigi Bisogno	Dr. Stefano Cervi Sig.ra Maria Fava
Ospedale privato 'Casa di cura Piacenza'	Dir. San. Gianfranco Agamennone	Sig.ra Brunetta Nazzari

Province of Parma

AZIENDA USL PARMA		
Ospedale Civile Fidenza	f.f. Dr. Galeazzo Concari	Sig.ra Sandra Teresa Regnani
Ospedale Borgo Val di Taro	Dr. Aldo Guardoli	Dr. 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		
Ospedale Baggiovara	Dr. Pier Bruno Squarzina	Dr. Pier Bruno Squarzina
Ospedale di Carpi	Dr. Alberto Ferrari	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	Dir. San. Dr. Angelo Rosi	Dr. Angelo Rosi

"Prof. Fogliani"		

Province of Bologna

AZIENDA USL BOLOGNA	**Head of Orthopaedic Surgery Department or Health Manager**	**RIPO Representative**
Ospedale Maggiore	Dr. Domenico Tigani	Dott. Saverio Comitini
Ospedale di Vergato	Dr. Giovanni Serra	Dr. Massimo Corlianò
Ospedale privato "Villa Regina"	Dir. San. Dr. Sandro Uva	Dr. ssa Mirka Cocconcelli
Ospedale privato "Villa Erbosa"	Dir. San. Dr. Gianfranco Finzi	Sig.ra Sladjana Karavdic Sig.ra Stefania Volpe
Ospedale privato "Villa Nigrisoli"	Dir. San. Dr. Sandro Uva	Dr. ssa Mirka Cocconcelli
Ospedale privato "Villa Torri Hospital"	Dir. San. Dr. Gianluigi Gardini	Dr. Carlo Magelli
Ospedale privato "Villa Laura"	Dir. San. Dott. Luca Arfilli	Dr. ssa Franca Frau
Ospedale privato "Prof. Nobili"	Dir. San Dr. Augusto Nucci	Dr. Enzo Zanini
Ospedale privato "Villa Chiara"	Dir. San. Dr. Giorgio Feliciangeli	Dr. Giorgio Feliciangeli
Ospedale privato casa di cura "Madre Fortunata Toniolo"	Dir. San. Dr.ssa Maria Teresa Malaguti	Dott.ssa Katiuscia Sponsano
Ospedale privato "Villalba"	Dir. San. Dr. Paolo Guelfi	

AZIENDA USL IMOLA		
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Province of Ferrara

AZIENDA USL FERRARA		
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Ospedale di Argenta	Dr. Michele Di Scioscio	Dr. Roberto Rossi Dr. Michele Di Scioscio
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		
Ospedale di Ravenna	Dr. Alberto Belluati	Dr. Giovanni Guerra Dr. Raffaele Pezzella
Ospedale di Lugo	Dr. Gabriele Zanotti	Dr. Alessandro Soldati Dr. Gabriele Zanotti
Ospedale di Faenza	Dr. Maurizio Fontana	Dr. Paolo Frontali Dr.ssa Milena Sirri
Ospedale di Forlì	f.f. Dr. Daniele Donatucci	Dr. Stefano Nardi
Ospedale di Cesena	Dr. Mauro Monesi	Dr. Franco Calista Dr. Francesco Fanton
Ospedale di Rimini	Responsabile ad interim Dr. Lorenzo Ponziani	Dr.ssa Marina Gigli

Ospedale di Riccione	Dr. Lorenzo Ponziani	Dr. Luigi D'Elia
Ospedale Cervesi Cattolica	Dr. Giuseppe Porcellini	Dr. Giuseppe Porcellini
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
Ospedale privato casa di cura "Prof. E. Montanari"	Dir. San. Prof. Marco Bosso	Dr.ssa Lia Montanari
Ospedale privato "Villa Maria Rimini"	Dir. San. Dr.ssa Giuliana Vandi	Dr.ssa Giuliana Vandi Dr. Sandro Vasini

Azienda Osp-Univ di Parma	Dott. Enrico Vaienti	Dr. Paolo Perini

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Technological partner for computer management of the database is CINECA of Bologna.

Bologna, 13th April 2018

PART ONE: HIP PROSTHESES

January 2000 – December 2016

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 **97,1%** in the year 2016. Data are referred to primary total hip replacements (8151;74;75;76;85;86), 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

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 2016, according to **type of surgery**.

Type of surgery	Number of surgeries	Percentage
Primary THA	103.583	63,5
Hemiarthroplasty	39.176	24,0
Total and partial revision*	15.562	9,5
Resurfacing	2.760	1,7
Prosthesis removal	1.251	0,8
Hemiarthroplasty with buffer°	121	0,1
Other**	698	0,4
Total	**163.151**	**100,0**

° acetabular buffer
*4.169 total revision, 6.301 cup revisions, 3.049 stem revisions, 2.076 revisions of other components.
** 188 reduction of dislocation, 150 debridement, 90 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

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	4.393		747	
2001	4.617	5,1	860	15,1
2002	4.659	0,9	871	1,3
2003	5.064	8,7	864	-0,8
2004	5.369	6,0	861	-0,3
2005	5.576	3,9	827	-3,9
2006	5.847	4,9	946	14,4
2007	6.267	7,2	1.021	7,9
2008	6.356	1,4	988	-3,2
2009	6.708	5,5	993	0,5
2010	6.594	-1,7	1.035	4,2
2011	6.429	-2,5	920	-11,1
2012	6.588	2,5	1.015	10,3
2013	6.728	2,1	930	-8,4
2014	7.190	6,9	870	-6,5
2015	7.539	4,9	921	5,9
2016	7.659	1,6	893	-3,0

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 2016, 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	3.040	2,9	6.615	6,4	15.048	14,5	29.754	28,7	37.382	36,1	11.740	11,3	103.579
Hemiarthroplasty	20	0,1	66	0,2	205	0,5	1.134	2,9	8.398	21,4	29.353	74,9	39.176
Revision	299	1,9	657	4,2	1.653	10,6	3.796	24,4	6.095	39,2	3.062	19,7	15.562
Resurfacing	321	11,6	703	25,5	977	35,4	626	22,7	127	4,6	6	0,2	2.760
Prosthesis removal	44	3,5	70	5,6	130	10,4	308	24,6	457	36,5	242	19,3	1.251
Hemiarthroplasty with buffer	-	-	2	1,7	3	2,5	15	12,4	38	31,4	63	52,1	121
Other	30	4,3	47	6,7	90	12,9	170	24,4	227	32,5	134	19,2	698
Total*	**3.754**	**2,3**	**8.160**	**5,0**	**18.106**	**11,1**	**35.803**	**21,9**	**52.724**	**32,3**	**44.600**	**27,3**	**163.147**

*4 missing data

In 2016 percentage of Hemiarthroplasty carried out on patients older than ninety is 20,8%.

Mean age at surgery

Type of operation	Mean age	Range
Primary THA	66,8	12-101
Hemiarthroplasty	83,6	20-109
Resurfacing	52,7	15-83
Revision	70,0	15-100

Mean age of patients, per type of operation, comparison 2000-2016 fot THA and 2003-2016 for Resurfacing

	Year 2000		Year 2016	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Primary THA	66,0	16-99	67,2	14-95
Hemiarthroplasty	82,4	35-104	85,1	43-106
Revision	68,6	22-97	70,6	16-96

	Year 2003		Year 2016	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Resurfacing	50,0	18-72	52,8	32-69

Mean age at surgery of patients affected by coxarthrosis according to gender, comparison 2000-2016

	THA			
	Year 2000		Year 2016	
Gender	**Mean age**	**Range**	**Mean age**	**Range**
Males	67,2	34-92	66,5	23-91
Females	68,9	31-93	70,0	23-92

3.2 Gender

Number of hip operations carried out on patients with admission date between 1st January 2000 and 31st December 2016, according to **type of operation** and **gender of patient**

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Primary THA	41.949	40,5	61.634	59,5	103.583
Hemiarthroplasty	10.061	25,7	29.115	74,3	39.176
Revision	5.345	34,3	10.217	65,7	15.562
Resurfacing	2.077	75,3	683	24,7	2.760
Removal	535	42,8	716	57,2	1.251
Hemiarthroplasty with buffer	26	21,5	95	78,5	121
Other	307	44,0	391	56,0	698
Total	**60.300**	**37,0**	**102.851**	**63,0**	**163.151**

3.3 Side of surgery

Coxarthrosis more often affects right hip (58,4%) than left hip (41,6%). 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
Right	53,1	62,6
Left	46,9	37,4

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

3.4 Bilateral prosthesis

Between 1st January 2000 and 31st December 2016, 8.885 patients underwent bilateral operations for Coxarthrosis.

7.318 (82,4%) chose to undergo the second operation at the same hospital from where the first one was performed;
442 (5,0%) chose to undergo the second operation at a different hospital from where the first one was performed to follow the surgeon;
1.125 (12,7%) 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 2016, according to **diagnosis**

Diagnosis in primary arthroplasty	Number	Percentage
Primary arthritis	70.301	68,2
Sequelae of LCA and DCA	10.135	9,8
Femoral neck fracture	9.376	9,1
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	6.093	5,9
Post traumatic arthritis	2.314	2,2
Post traumatic necrosis	1.244	1,2
Rheumatic arthritis	1.193	1,2
Femoral neck fracture sequelae	927	0,9
Epiphysiolysis sequelae	279	0,3
Perthes disease sequelae	258	0,3
Septic coxitis sequelae	165	0,2
Tumor	110	0,1
Paget disease	89	0,1
TBC coxitis sequelae	61	0,1
Other	587	0,6
Total**	**103.132**	**100,0**

**451 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		
	2000-2010	2011-2013	2014-2016
Primary arthritis	66,9	68,7	71,1
Sequelae of LCA and DCA	11,0	8,9	7,4
Femoral neck fracture	8,9	9,2	9,7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	5,9	6,1	5,9
Post traumatic arthritis	2,4	2,1	1,8
Post traumatic necrosis	1,4	1,1	0,7
Rheumatic arthritis	1,3	1,2	0,8
Other	2,2	2,7	2,6
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	15,2	40,5	59,2	72,8	75,6	73,4
Sequelae of LCA and DCA	28,7	29,3	18,8	8,8	4,4	2,3
Femoral neck fracture	1,7	3,0	5,8	8,5	11,5	12,6
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	18,8	12,0	7,2	4,6	4,2	6,1
Post traumatic arthritis	9,6	6,0	3,2	1,9	1,2	1,1
Post traumatic necrosis	7,4	2,3	1,5	0,8	0,7	1,2
Rheumatic arthritis	5,3	2,0	1,4	1,0	0,9	0,6
Femoral neck fracture sequelae	1,2	1,0	0,8	0,5	0,8	2,1
Epiphysiolysis sequelae	3,7	1,1	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	1,7	0,2	0,3	0,1	0,1	0,0
Tumor	0,2	0,3	0,2	0,1	0,1	0,0
Paget disease	0,0	0,0	0,0	0,1	0,1	0,1
TBC coxitis sequelae	0,2	0,2	0,1	0,1	0,0	0,0
Other	3,3	1,2	0,8	0,5	0,4	0,5
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	12,6	30,7	40,0	12,2	**100,0**
Sequelae of LCA and DCA	8,6	19,0	27,8	25,7	16,2	2,7	**100,0**
Femoral neck fracture	0,5	2,1	9,2	26,7	45,7	15,7	**100,0**
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	9,3	12,9	17,6	22,6	25,9	11,7	**100,0**
Post traumatic arthritis	12,6	17,1	21,0	23,8	19,7	5,7	**100,0**
Post traumatic necrosis	18,0	12,5	18,7	19,5	19,8	11,5	**100,0**
Rheumatic arthritis	13,4	11,0	17,6	24,6	27,4	6,0	**100,0**
Femoral neck fracture sequelae	3,8	7,3	12,3	17,5	32,8	26,3	**100,0**
Epiphysiolysis sequelae	39,8	25,4	20,1	9,3	4,7	0,7	**100,0**
Perthes disease sequelae	35,7	24,0	15,9	15,9	6,6	1,9	**100,0**
Septic coxitis sequelae	32,1	9,7	23,6	17,0	15,2	2,4	**100,0**
Tumor	5,5	15,5	25,5	25,5	23,6	4,5	**100,0**
Paget disease	0,0	0,0	7,9	27,0	49,4	15,7	**100,0**
TBC coxitis sequelae	9,8	16,4	24,6	32,8	14,8	1,6	**100,0**
Other	17,6	13,8	22,2	24,2	17,1	5,0	**100,0**

Number of **resurfacing** operations carried out on patients with admission date between 1st January 2000 and 31st December 2016, according to **diagnosis**

Diagnosis in resurfacing	Number	Percentage
Primary arthritis	2.283	83,0
Sequelae of LCA and DCA	184	6,7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	96	3,5
Post traumatic arthritis	91	3,3
Rheumatic arthritis	29	1,1
Post traumatic necrosis	13	0,5
Epiphysiolysis sequelae	13	0,5
Perthes disease sequelae	11	0,4
Femoral neck fracture sequelae	7	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	15	0,5
Total*	**2.750**	**100,0**

* 10 missing data (0,4%)

3.6 Causes for revision

Number of revision operations carried out on patients admitted between 1st January 2000 and 31st December 2016 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	4.460	32,3
Total aseptic loosening	2.746	19,9
Stem aseptic loosening	1.829	13,2
Prosthesis dislocation	1.266	9,2
Bone fracture	869	6,3
Prosthesis breakage*	725	5,2
Two steps prosthesis removal	677	4,9
Poly wear	561	4,1
Pain without loosening	244	1,8
Septic loosening	160	1,2
Primary instability	98	0,7
Metallosis	88	0,6
Heterotopic bone	66	0,5
Trauma	34	0,2
Acetabulum fracture	36	0,3
Other	151	1,1
Totale°	**13.823**	**100,0**

° 171 missing data (1,2%)

***** Failure of 260 modular necks, 178 liners, 109 heads, 88 stems, 87 cups. 20 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	73	47,7
Bone fracture	48	31,4
Metallosis	15	9,8
Pain without loosening	11	7,2
Instability	3	2,0
Breakage of prosthesis	3	2,0
Total	**153**	**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	426	34,9
Cotiloiditis	330	27,0
Stem aseptic loosening	270	22,1
Periprosthetic bone fracture	119	9,8
Two steps prosthesis removal	24	2,0
Septic loosening	13	1,1
Breakage of prosthesis	7	0,6
Instability	7	0,6
Poly wear	6	0,5
Heterotopic bone	4	0,3
Other	14	1,1
Total*	**1.220**	**100,0**

*8 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 282 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
PE (Muller Protek) Sulzer	443	9,4	54	19,4	34	15,7
REFLECTION ALL-POLY Smith and Nep.	284	6,0	7	2,5	24	11,1
CONTEMPORARY Stryker Howmedica	794	16,8	14	5,0	14	6,5
ZCA Zimmer	629	13,3	20	7,2	12	5,6
MULLER Citieffe	71	1,5	39	14,0	11	5,1
MULLER Lima	240	5,1	8	2,9	9	4,2
PE Adler-Ortho	163	3,4	4	1,4	9	4,2
CUPULE AVANTAGE CEMENTED Biomet	64	1,4	25	9,0	5	2,3
MULLER Smith and Nephew	149	3,2	10	3,6	2	0,9
CCB Mathys	54	1,1	3	1,1	-	-
MULLER Samo	439	9,3	2	0,7	-	-
MULLER Wright Cremascoli	960	20,3	-	-	-	-
LUNA Amplitude	88	1,9	-	-	-	-
MULLER Groupe Lepine	57	1,2	-	-	-	-
Other (< 50 cases)	292	6,2	92	33,1	96	44,4
Total	**4.727**	**100,0**	**278**	**100,0**	**216**	**100,0**

Cementless cup	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
FIXA TI-POR Adler-Ortho	3.679	6,5	5.846	30,1	7.246	32,8
R3 Smith and Nephew	306	0,5	1.359	7,0	2.099	9,5
PINNACLE SECTOR II POROCOAT DePuy	962	1,7	880	4,5	979	4,4
CONTINUUM Zimmer	153	0,3	850	4,4	890	4,0
VERSAFITCUP CC TRIO Medacta	-	-	246	1,3	865	3,9
JUMP Permedica	92	0,2	75	0,4	791	3,6
EP-FIT PLUS Endoplus	3.134	5,5	1.782	9,2	779	3,5
DELTA TT Lima	253	0,4	564	2,9	771	3,5
EXCEED ABT Biomet	594	1,1	842	4,3	688	3,1
ALLOFIT S IT Zimmer	166	0,3	406	2,1	502	2,3
TRIDENT Stryker Howmedica	1.947	3,4	356	1,8	499	2,3
G7 PPS Biomet	-	-	-	-	492	2,2
DELTA PF Lima	1.327	2,3	454	2,3	474	2,1
PINNACLE SECTOR GRIPTION DePuy	-	-	36	0,2	323	1,5
REFLECTION Smith and Nephew	1.540	2,7	267	1,4	258	1,2
ADAPTIVE WINGS Samo	-	-	220	1,1	251	1,1
DELTAMOTION Finsbury	10	0,0	251	1,3	241	1,1
ECOFIT Implantcast	-	-	-	-	239	1,1
AGILIS TI-POR Adler-Ortho	-	-	56	0,3	199	0,9
MAXERA Zimmer	-	-	247	1,3	198	0,9
FIN II Bioimpianti	39	0,1	163	0,8	177	0,8
CUPULE APRIL Symbios	95	0,2	221	1,1	146	0,7
TOP Link	522	0,9	89	0,5	137	0,6
FITMORE Sulzer	2.677	4,7	178	0,9	136	0,6
RM Mathys	34	0,1	145	0,7	126	0,6
SPARKUP Samo	264	0,5	260	1,3	116	0,5
ALLOFIT IT Zimmer	7	0,0	158	0,8	96	0,4
CUPULE RELOAD AVANTAGE Biomet	192	0,3	154	0,8	94	0,4
EXPANSION Mathys	1.198	2,1	330	1,7	89	0,4
POLARCUP Ortho-Id	187	0,3	46	0,2	68	0,3
MALLORY Biomet	231	0,4	70	0,4	67	0,3
BS Citieffe	307	0,5	108	0,6	61	0,3
BETA CUP Link	237	0,4	38	0,2	53	0,2
BICON PLUS Endoplus	1.272	2,2	46	0,2	37	0,2
TRABECULAR METAL Zimmer	502	0,9	60	0,3	36	0,2
ABG II Howmedica	2.620	4,6	116	0,6	35	0,2
ALLOFIT Zimmer	255	0,5	2	0,0	27	0,1
REGENEREX RINGLOC+ Biomet	95	0,2	95	0,5	21	0,1
TRILOGY Zimmer	1.109	2,0	14	0,1	12	0,1
FIXA Adler-Ortho	6.967	12,3	515	2,7	10	0,0
HILOCK LINE Symbios	592	1,0	119	0,6	5	0,0
JUMP COOPER Permedica	236	0,4	15	0,1	4	0,0
DUOFIT PSF Samo	1.371	2,4	4	0,0	2	0,0
VERSAFITCUP CC Medacta	508	0,9	364	1,9	1	0,0
RECAP RESURFACING Biomet	755	1,3	140	0,7	-	-
BHR Smith and Nephew	160	0,3	50	0,3	-	-
CLS Zimmer	3.348	5,9	26	0,1	-	-
EASY Hit Medica	305	0,5	6	0,0	-	-
M2A Biomet	203	0,4	4	0,0	-	-
SELEXYS TH Mathys	580	1,0	3	0,0	-	-
DUOFIT PDT Samo	218	0,4	2	0,0	-	-
TRILOGY AB Zimmer	377	0,7	1	0,0	-	-
AnCA FIT Wright Cremascoli	6.710	11,9	-	-	-	-

STANDARD CUP Protek Sulzer	1.307	2,3	-	-	-	-
TRABECULAR METAL MONOBLOCK Zimmer	417	0,7	-	-	-	-
DUROM HIP RESURFACING Zimmer	330	0,6	-	-	-	-
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	0,4	-	-	-	-
SPH BLIND Lima	202	0,4	-	-	-	-
Other (< 200 cases)	4.750	8,4	1.140	5,9	1.764	8,0
Total	**56.567**	**100,0**	**19.419**	**100,0**	**22.104**	**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 27 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
REFLECTION ALL-POLY Smith and Nephew	8	1,3	-	-	4	7,7
MULLER Protek-Sulzer-Centerpulse-Zimmer	163	26,5	16	22,9	3	5,8
ZCA Zimmer	35	5,7	6	8,6	3	5,8
MULLER Lima	49	8,0	4	5,7	3	5,8
CONTEMPORARY Stryker Howmedica	117	19,0	13	18,6	2	3,8
CUPULE AVANTAGE CEMENTED Biomet	23	3,7	7	10,0	1	1,9
MULLER PCR Samo	9	1,5	3	4,3	1	1,9
CCB Mathys	19	3,1	1	1,4	-	-
MULLER Wright Cremascoli	58	9,4	-	-	-	-
MULLER Samo	53	8,6	-	-	-	-
Other (< 10 cases)	82	13,3	20	28,6	35	67,3
Total	**616**	**100,0**	**70**	**100,0**	**52**	**100,0**

Cementless cups	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
FIXA TI-POR Adler-Ortho	68	2,9	101	16,9	89	19,6
DELTA ONE TT Lima	27	1,1	66	11,1	66	14,5
CONTINUUM Zimmer	3	0,1	52	8,7	41	9,0
DELTA TT Lima	18	0,8	44	7,4	37	8,1
OMNIA TI-POR Adler-Ortho	3	0,1	21	3,5	37	8,1
DELTA REVISION TT Lima	7	0,3	36	6,0	22	4,8
TRABECULAR METAL Zimmer	124	5,3	45	7,5	21	4,6
PINNACLE MULTIHOLE GRIPTION DePuy	-	-	16	2,7	21	4,6
HERMES BS REV Citieffe	37	1,6	24	4,0	19	4,2
TRITANIUM HEMISPHERICAL Stryker Howmedica	1	0,0	9	1,5	12	2,6
R3 Smith and Nephew	2	0,1	13	2,2	8	1,8
TRIDENT Stryker Howmedica	145	6,2	16	2,7	6	1,3
TRABECULAR METAL REVISION Zimmer	15	0,6	15	2,5	5	1,1
EP-FIT PLUS Endoplus	28	1,2	10	1,7	5	1,1
MC MINN Link	87	3,7	3	0,5	2	0,4
DELTA PF Lima	38	1,6	5	0,8	1	0,2
PINNACLE MULTIHOLE II DePuy	31	1,3	1	0,2	1	0,2
TRILOGY Zimmer	131	5,6	10	1,7	-	-
REGENEREX RINGLOC+ Biomet	33	1,4	8	1,3	-	-
FIXA Adler-Ortho	126	5,4	5	0,8	-	-
BOFOR Endoplus	17	0,7	4	0,7	-	-
OMNIA Adler-Ortho	51	2,2	1	0,2	-	-
CLS Zimmer	42	1,8	1	0,2	-	-
AnCA FIT Cremascoli	299	12,7	-	-	-	-
STANDARD CUP Protek Sulzer	132	5,6	-	-	-	-
DUOFIT PSF Samo	48	2,0	-	-	-	-
LOR ALLOPRO Protek Sulzer	48	2,0	-	-	-	-
OSTEOLOCK Stryker Howmedica	47	2,0	-	-	-	-
FITMORE Sulzer	44	1,9	-	-	-	-
TRIDENT ARC2F Stryker Howmedica	37	1,6	-	-	-	-
PROCOTYL-E Wright Cremascoli	36	1,5	-	-	-	-
REFLECTION Smith and Nephew	30	1,3	-	-	-	-
BICON PLUS Endoplus	25	1,1	-	-	-	-
CONICAL SCREW CUP Protek Sulzer	25	1,1	-	-	-	-
SECUR-FIT Osteonics Howmedica	25	1,1	-	-	-	-
ABGII Stryker Howmedica	21	0,9	-	-	-	-
PROCOTYL-Z-PIVOT Wright Cremascoli	21	0,9	-	-	-	-
Other (< 20 cases)	481	20,4	91	15,2	61	13,4
Total	**2.353**	**100,0**	**597**	**100,0**	**454**	**100,0**

4.3 Stems used in primary surgery

In 350 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
EXETER V40 Stryker Howmedica	1.225	10,8	74	9,1	170	20,1
POLARSTEM CEM Endoplus	6	0,1	18	2,2	81	9,6
BASIS Smith and Nephew	850	7,5	121	14,8	71	8,4
CORAE Adler-Ortho	-	-	12	1,5	69	8,2
APTA Adler-Ortho	1.036	9,1	92	11,3	61	7,2
PAVI CEM Groupe Lepine	-	-	8	1,0	59	7,0
HYDRA Adler-Ortho	10	0,1	32	3,9	41	4,9
C-STEM AMT DePuy	65	0,6	130	15,9	34	4,0
CORAIL DePuy	8	0,1	12	1,5	33	3,9
AB Citieffe	126	1,1	78	9,6	27	3,2
CPCS Smith and Nephew	28	0,2	9	1,1	21	2,5
TAPERLOC CEM Biomet	61	0,5	14	1,7	17	2,0
LUBINUS SP2 Link	299	2,6	5	0,6	12	1,4
VERSYS ADVOCATE Zimmer	231	2,0	15	1,8	7	0,8
CCA Mathys	189	1,7	41	5,0	6	0,7
DUOFIT CKA Samo	50	0,4	3	0,4	4	0,5
SL Lima	75	0,7	26	3,2	2	0,2
VERSYS HERITAGE Zimmer	43	0,4	10	1,2	2	0,2
SPECTRON Smith and Nephew	724	6,4	3	0,4	2	0,2
LC Samo	388	3,4	24	2,9	-	-
AD Samo	384	3,4	4	0,5	-	-
MERCURIUS Adler-Ortho	108	0,9	4	0,5	-	-
MULLER AUTOBLOCCANTE Sulzer	54	0,5	3	0,4	-	-
ARCAD SO Symbios	65	0,6	1	0,1	-	-
JVC Wright Cremascoli	727	6,4	-	-	-	-
P507 Samo	657	5,8	-	-	-	-
MRL Wright Cremascoli	469	4,1	-	-	-	-
DEFINITION Stryker Howmedica	347	3,1	-	-	-	-
VERSYS CEMENTED Zimmer	335	2,9	-	-	-	-
ANCA-FIT CLU Wright Cremascoli	314	2,8	-	-	-	-
C STEM DePuy	313	2,8	-	-	-	-
AHS Wright Cremascoli	306	2,7	-	-	-	-
ABG Stryker Howmedica	231	2,0	-	-	-	-
ULTIMA Johnson e Johnson	197	1,7	-	-	-	-
MS 30 Zimmer	187	1,6	-	-	-	-
VERSYS CEMENTED LD Zimmer	133	1,2	-	-	-	-
ANCA Wright Cremascoli	89	0,8	-	-	-	-
MBA Groupe Lepine	88	0,8	-	-	-	-
DUOFIT CFS Samo	74	0,7	-	-	-	-
FULLFIX Mathys	69	0,6	-	-	-	-
PERFECTA RA Wright Cremascoli	60	0,5	-	-	-	-
ABGII Stryker Howmedica	53	0,5	-	-	-	-
SL STREAKES Hitmedica	50	0,4	-	-	-	-
Other (< 50 cases)	648	5,7	77	9,4	125	14,8
Total	**11.372**	**100,0**	**816**	**100,0**	**844**	**100,0**

Cementless stem	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
APTA Adler-Ortho	5.135	10,3	2.547	13,5	2.017	9,4
CORAE Adler-Ortho	8	0,0	251	1,3	1.808	8,4
HYDRA Adler-Ortho	618	1,2	1.401	7,4	1.592	7,4
SL PLUS MIA STEM Smith and Nephew	132	0,3	920	4,9	880	4,1
CORAIL DePuy	847	1,7	631	3,3	790	3,7
TRI-LOCK DePuy	5	0,0	343	1,8	755	3,5
RECTA Adler-Ortho	3.352	6,7	1.354	7,2	748	3,5
POLARSTEM Endoplus	33	0,1	454	2,4	710	3,3
FITMORE Zimmer	197	0,4	543	2,9	591	2,8
CONUS Centerpulse	4.207	8,4	680	3,6	554	2,6
TAPERLOC COMPLETE Biomet	-	-	16	0,1	551	2,6
H-MAX S Lima	50	0,1	125	0,7	535	2,5
CLS Sulzer	3.869	7,8	484	2,6	517	2,4
AMISTEM-H Medacta	-	-	231	1,2	505	2,4
SYNTHESIS Permedica	-	-	9	0,0	402	1,9
MINIMAX Medacta	163	0,3	320	1,7	388	1,8
APTA-FIX Adler-Ortho	-	-	-	-	383	1,8
TAPERLOC Biomet	1.749	3,5	860	4,6	366	1,7
ADR Endoplus	313	0,6	481	2,5	334	1,6
EXACTA - Permedica	14	0,0	30	0,2	318	1,5
SL PLUS Endoplus	3.632	7,3	550	2,9	315	1,5
ALATA ACUTA S Adler-Ortho	538	1,1	308	1,6	305	1,4
NANOS Endoplant Gmbh	247	0,5	322	1,7	273	1,3
MODULUS Lima	514	1,0	263	1,4	225	1,0
SYNERGY Smith and Nephew	517	1,0	166	0,9	218	1,0
RECTA-FIX Adler-Ortho	-	-	96	0,5	217	1,0
LCU - Link	-	-	7	0,0	212	1,0
ACCOLADE II Osteonics Howmedica	-	-	24	0,1	200	0,9
MISTRAL Samo	-	-	90	0,5	197	0,9
SMF FIXED Smith and Nephew	-	-	26	0,1	193	0,9
PROXIPLUS Endoplant	954	1,9	411	2,2	191	0,9
SUMMIT DePuy	236	0,5	106	0,6	186	0,9
CBC Mathys	1.616	3,2	516	2,7	170	0,8
SAM-FIT Lima	98	0,2	203	1,1	148	0,7
C2 Lima	869	1,7	127	0,7	126	0,6
GTS Biomet	2	0,0	252	1,3	119	0,6
QUADRA-S Medacta	187	0,4	122	0,6	115	0,5
ABGII Stryker Howmedica	3.101	6,2	312	1,7	109	0,5
PLS Lima	79	0,2	153	0,8	95	0,4
TWINSYS Mathys	21	0,0	199	1,1	93	0,4
PARVA Adler-Ortho	110	0,2	235	1,2	90	0,4
CLS BREVIUS Zimmer	-	-	187	1,0	83	0,4
MULTIFIT Samo	207	0,4	130	0,7	77	0,4
ACCOLADE Osteonics Howmedica	362	0,7	91	0,5	75	0,3
TAPERLOC MICROPLASTY Biomet	244	0,5	182	1,0	70	0,3
H-MAX M Lima	-	-	153	0,8	69	0,3
Z1 Citieffe	265	0,5	78	0,4	55	0,3
FIT STEM Lima	295	0,6	-	-	55	0,3
VERSYS FIBER METAL TAPER Zimmer	1.104	2,2	135	0,7	48	0,2
S-TAPER Bioimpianti	40	0,1	144	0,8	46	0,2
DUOFIT RTT Samo	147	0,3	136	0,7	39	0,2
CFP Link	1.006	2,0	46	0,2	39	0,2
DUOFIT RKT Samo	303	0,6	21	0,1	35	0,2
SL REVISION Sulzer	156	0,3	49	0,3	31	0,1
PBF Permedica	281	0,6	134	0,7	21	0,1
PPF Biomet	247	0,5	34	0,2	17	0,1
ALLOCLASSIC SL Zimmer	324	0,6	29	0,2	12	0,1
QUADRA-H Medacta	187	0,4	80	0,4	3	0,0

SPS MODULAR Symbios	169	0,3	161	0,9	2	0,0
PROFEMUR Z Wright Cremascoli	679	1,4	31	0,2	2	0,0
ARCAD HA Symbios	224	0,4	24	0,1	2	0,0
CONELOCK SHORT Biomet	280	0,6	18	0,1	1	0,0
HIPSTAR Stryker Howmedica	332	0,7	4	0,0	1	0,0
HIPSTAR+ Stryker Howmedica	214	0,4	9	0,0	-	-
SPS Symbios	220	0,4	6	0,0	-	-
ANCA FIT Wright Cremascoli	4.503	9,0	-	-	-	-
BHS Smith and Nephew	437	0,9	-	-	-	-
ABG Stryker Howmedica	329	0,7	-	-	-	-
EHS Wright Cremascoli	312	0,6	-	-	-	-
PROXILOCK FT Stratec	304	0,6	-	-	-	-
EASY Hitmedica	228	0,5	-	-	-	-
STEM Wright Cremascoli	210	0,4	-	-	-	-
Other (< 200 cases)	2.836	5,7	834	4,4	2.135	9,9
Total	**49.858**	**100,0**	**18.884**	**100,0**	**21.459**	**100,0**

4.4 Stems used in total revision surgery

In 69 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
VERSYS REVISION CALCAR Zimmer	18	4,2	2	3,2	6	14,0
EXETER V40 Stryker Howmedica	68	16,0	4	6,5	3	7,0
APTA Adler-Ortho	33	7,8	2	3,2	1	2,3
JVC Wright Cremascoli	32	7,5	-	-	-	-
AD Samo	29	6,8	-	-	-	-
ANCA Wright Cremascoli	25	5,9	-	-	-	-
Other (< 20 cases)	219	51,7	54	87,1	33	76,7
Total	**424**	**100,0**	**62**	**100,0**	**43**	**100,0**

Cementless stem	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
REVISION HIP Lima	74	3,0	111	18,3	110	24,0
ALATA AEQUA REVISION Adler-Ortho	127	5,1	72	11,9	76	16,6
SL REVISION Sulzer Centerpulse Zimmer	472	18,8	121	20,0	60	13,1
ALATA ACUTA S Adler-Ortho	32	1,3	45	7,4	35	7,6
RESTORATION Stryker Howmedica	219	8,7	53	8,8	33	7,2
RECLAIM DePuy	-	-	15	2,5	24	5,2
MODULUS HIP SYSTEM Lima	20	0,8	23	3,8	16	3,5
MP RECONSTRUCTION PROSTHESIS Link	50	2,0	13	2,1	7	1,5
CONUS Sulzer Centerpulse Zimmer	85	3,4	2	0,3	6	1,3
ADR Endoplus	5	0,2	15	2,5	5	1,1
CLS Sulzer Centerpulse Zimmer	37	1,5	5	0,8	4	0,9
MGS Samo	107	4,3	12	2,0	3	0,7
CONELOCK REVISION Biomet	115	4,6	20	3,3	2	0,4
APTA Adler-Ortho	21	0,8	8	1,3	2	0,4
ZMR REVISION TAPER CONE Zimmer	42	1,7	6	1,0	2	0,4
SLR PLUS Endoplus	24	1,0	6	1,0	1	0,2
SL PLUS Endoplus	34	1,4	6	1,0	-	-
S. ROM Johnson e Johnson	145	5,8	2	0,3	-	-
C2 Lima	62	2,5	2	0,3	-	-
VERSYS FIBER METAL TAPER Zimmer	20	0,8	2	0,3	-	-
PROFEMUR R VERS. 4 Wright Cremascoli	408	16,3	1	0,2	-	-
RESTORATION T3 Stryker Howmedica	74	3,0	-	-	-	-
ANCA FIT Wright Cremascoli	58	2,3	-	-	-	-
ZMR REVISION TAPER Zimmer	30	1,2	-	-	-	-
EMPERION Smith and Nephew	22	0,9	-	-	-	-
CBK REVISION STEM Mathys	20	0,8	-	-	-	-
Other (< 20 cases)	204	8,1	65	10,7%	73	15,9
Total	**2.507**	**100,0**	**605**	**100,0**	**459**	**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	
	Cotili	Steli
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

In 2016 were implanted 23 different types of cup and 20 stems not used in 2015.

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

Year of operation	Total revision	
	Cotili	Steli
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

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, 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

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

Types of cups – dual mobility	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
GYROS DePuy	-	-	6	1,1	143	14,0
TRIDENT Howmedica	14	1,0	19	3,6	117	11,4
CUPULE RELOAD AVANTAGE Biomet	192	13,4	154	29,0	94	9,2
DMX Transysteme	-	-	39	7,3	83	8,1
QUATTRO VPS PF HAP Groupe lepine	-	-	1	0,2	78	7,6
POLARCUP Ortho-ID	187	13,0	48	9,0	69	6,7
VERSAFITCUP DM Medacta	21	1,5	61	11,5	51	5,0
NOVAE E TH Serf	-	-	28	5,3	50	4,9
TRITANIUM HEMISPHERICAL Stryker Howmedica	-	-	1	0,2	47	4,6
STAFIT Zimmer	-	-	6	1,1	24	2,3
POLARCUP CEMENTED Smith and Nephew	3	0,2	8	1,5	23	2,2
DMX CEMENTED Transysteme	-	-	13	2,4	19	1,9
CUPULE AVANTAGE 3P Biomet	84	5,8	43	8,1	17	1,7
CUPULE AVANTAGE CEMENTED Biomet	64	4,5	25	4,7	5	0,5
POLARCUP FLANGES Ortho-ID	17	1,2	11	2,1	5	0,5
EASY Hit Medica	307	21,3	6	1,1	-	-
C2M PF Symbios	80	5,6	1	0,2	-	-
CUPULE AVANTAGE Biomet	300	20,9	-	-	-	-
MOBILIS I Othesio	114	7,9	-	-	-	-
Other (<30 cases)	55	3,8	61	11,5	198	19,4
Total	**1.438**	**100,0**	**531**	**100,0**	**1.023**	**100,0**

4.7 Modular neck

32,1% 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

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

Types of stems with proximal modularity	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
APTA Adler-Ortho	5.144	25,9	2.550	33,9	2.017	34,5
HYDRA Adler-Ortho	618	3,1	1.403	18,6	1.592	27,2
RECTA Adler-Ortho	3.355	16,9	1.356	18,0	753	12,9
ALATA ACUTA S Adler-Ortho	539	2,7	309	4,1	305	5,2
MODULUS HIP SYSTEM Lima	516	2,6	263	3,5	224	3,8
SAM-FIT Lima	98	0,5	203	2,7	148	2,5
PULCHRA Adler-Ortho	-	-	10	0,1	145	2,5
PARVA Adler-Ortho	110	0,6	236	3,1	90	1,5
CLS BREVIUS Zimmer	-	-	187	2,5	83	1,4
MULTIFIT Samo	207	1,0	130	1,7	77	1,3
H-MAX M Lima	-	-	153	2,0	69	1,2
APTA Cem Adler-Ortho	1.036	5,2	92	1,2	61	1,0
HYDRA Cem Adler-Ortho	10	0,1	32	0,4	41	0,7
REVISION HIP Lima	9	0,0	22	0,3	30	0,5
HARMONY Symbios	69	0,3	97	1,3	27	0,5
ALATA AEQUA REVISION Adler-Ortho	13	0,1	20	0,3	24	0,4
VITAE Adler-Ortho	12	0,1	105	1,4	14	0,2
S. ROM Johnson e Johnson	170	0,9	6	0,1	8	0,1
SMF Smith and Nephew	-	-	109	1,4	6	0,1
SPS MODULAR Symbios	169	0,9	161	2,1	2	0,0
PROFEMUR Z Wright Cremascoli	680	3,4	30	0,4	-	-

ABGII MODULAR Stryker Howmedica	59	0,3	7	0,1	-	-
MERCURIUS Adler-Ortho	108	0,5	4	0,1	-	-
ANCA FIT Wright Cremascoli	4.506	22,7	-	-	-	-
JVC Wright Cremascoli	728	3,7	-	-	-	-
ANCA-FIT CLU Wright Cremascoli	314	1,6	-	-	-	-
EHS Wright Cremascoli	311	1,6	-	-	-	-
STEM Wright Cremascoli	210	1,1	-	-	-	-
G3 Citieffe	179	0,9	-	-	-	-
MBA HAP Groupe Lepine	127	0,6	-	-	-	-
PROFEMUR L Wright Cremascoli	96	0,5	-	-	-	-
MBA Groupe Lepine	88	0,4	-	-	-	-
PROFEMUR C Wright Cremascoli	87	0,4	-	-	-	-
STELO MODULARE NDS1 Citieffe	77	0,4	-	-	-	-
Other (< 50 cases)	192	1,0	46	0,6	131	2,2
Total*	**19.837**	**100,0**	**7.531**	**100,0**	**5.847**	**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 61,5% of cases and with various degree of correction necks in the remaining 38,5%.

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

*R*esurfacing arthroplasty used between **01/01/2000** and **31/12/2016**

Type	N.	%
BHR – Smith & Nephew	1.753	63,5
ADEPT – Finsbury	437	15,8
BMHR* – Smith & Nephew	198	7,2
MITCH TRH – Finsbury	89	3,2
ASR – DePuy	77	2,8
RECAP – Biomet	65	2,4
MRS* – Lima	44	1,6
ROMAX – Medacta	33	1,2
CONSERVE PLUS – Wright	22	0,8
ICON – International Orthopaedics	21	0,8
DUROM Hip Resurfacing – Zimmer	8	0,3
CONSERVE PLUS - Microport	6	0,2
WAGNER METASUL - Protek	3	0,1
CORMET – Corin	1	0,0
ACCIS - Implantcast	1	0,0
TRIBOFIT – Active Implants	1	0,0
Total**	**2.759**	**100,0**

** 1 missing data (0,01%).
* considered similar to resurfacing.

In 2016 were implanted 115 BHR - Smith and Nephew, 6 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 2016, 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	31.497	31,4	602	15,1
Met - UHMWPE	12.664	12,6	734	18,4
Alumina - alumina	11.031	11,0	327	8,2
Alumina - UHMWPE	9.772	9,7	666	16,7
Composite ceramic - XLPE	8.881	8,9	414	10,4
Met - XLPE	7.242	7,2	554	13,9
Met - met	3.309	3,3	65	1,6
Met - UHMWPE+met	2.981	3,0	31	0,8
Alumina - XLPE	1.771	1,8	126	3,2
Allumina - Composite ceramic	1.815	1,8	58	1,5
Composite ceramic - XLPE+vitamin E	1.789	1,8	49	1,2
Composite ceramic - UHMWPE	1.466	1,5	73	1,8
Ceramicised metal-XLPE	1.434	1,4	22	0,6
Met – undefined PE*	791	0,8	53	1,3
Alumina - UHMWPE+Alumina	791	0,8	13	0,3
Composite ceramic - Alumina	466	0,5	11	0,3
Alumina - Undefined PE*	403	0,4	29	0,7
Revision composite ceramic - Composite ceramic	385	0,4	10	0,3
Ceramicised metal - UHMWPE	368	0,4	15	0,4
Alumina - Met+Alumina	302	0,3	60	1,5
Composite ceramic - Met+XLPE+vitamin E	241	0,2	-	-
Composite ceramic - metal	221	0,2	-	-
Zirconia - UHMWPE	175	0,2	13	0,3
Other (< 100 cases)	507	0,5	66	1,7
Total^	**100.302**	**100,0**	**3.991**	**100,0**

* missing label did not allow classification of poly.
^ 289 missing data in primary surgery and 14 in total revision.

Percentage of total hip arthroplasty interventions between 2001 and 2016, 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	-

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

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

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2016, 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	-	-	-	-	3.247	7,5	15.561	65,3	21.548	76,5	4.559	60,5
Alumina	1	0,2	-	-	17.402	40,3	5.292	22,2	3.510	12,5	-	-
Cr-Co	471	85,9	23	79,3	18.337	42,5	2.401	10,1	1.950	6,9	2.493	33,1
Stainless steel	74	13,5	5	17,2	3.367	7,8	181	0,8	28	0,1	-	-
Ceramicised metal	1	0,2	-	-	499	1,1	322	1,4	1.057	3,8	89	1,1
Revision ceramic	-	-	-	-	3	0,01	11	0,05	7	0,02	390	5,2
Zirconia	1	0,2	1	3,4	305	0,7	51	0,2	52	0,2	-	-
Total*	**548**	**100,0**	**29**	**100,0**	**43.160**	**100,0**	**23.819**	**100,0**	**28.152**	**100,0**	**7.531**	**100,0**

*344 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

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 2016, according to **type of operation** and **fixation**

Fixation	Primary THA	%	Total revision	%
Cementless	89.932	87,0	3.112	74,9
Hybrid (cemented stem and cementless cup)	8.168	7,9	310	7,5
Cemented	4.577	4,4	208	5,0
Reverse hybrid (cementless stem and cemented cup)	644	0,6	526	12,7
Total*	**103.321**	**100,0**	**4.156**	**100,0**

* 262 primary THA and 13 total revision missing data.

Percentage of total hip arthroplasties **according to fixation**, during the years 2000–2016

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

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

Age class	Elective primary THA year 2000-2016			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0,6	98,3	0,7	0,4
40-49	0,3	98,7	0,7	0,3
50-59	0,5	97,5	1,7	0,3
60-69	1,3	92,4	5,9	0,4
70-79	5,8	81,8	11,7	0,7
≥80	16,3	67,0	15,0	1,7

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	0,4	96,1	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 2016

Age class	Elective primary surgery year 2016			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0,0	99,4	0,0	0,6
40-49	0,2	99,4	0,4	0,0
50-59	0,3	99,5	0,2	0,0
60-69	0,1	98,9	0,8	0,2
70-79	0,1	96,6	3,0	0,3
≥80	1,9	89,2	8,1	0,8

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

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

Age class	Total revision			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	1,3	93,6	1,3	3,8
40-49	3,2	89,7	2,6	4,5
50-59	1,3	88,0	2,7	8,0
60-69	2,9	79,3	5,7	12,1
70-79	4,5	72,3	8,4	14,8
≥80	12,4	61,0	12,5	14,1

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	35,5	36,6	33,9
Cemex System - Tecres	11,4	23,3	1,1
Smartset Hv - Depuy	6,3	8,3	2,4
Antibiotic Simplex - Howmedica	**6,1**	**2,9**	**54,8**
Palacos R - Biomet	5,5	1,2	0,9
Amplicem 3 - Amplimedical	3,5	3,0	-
Cemex Rx - Tecres	2,2	4,6	0,1
Cemex + Cemex System - Tecres	1,9	-	-
Exolent High - Elmdown	1,5	0,6	-
Smartset Mv - Depuy	1,5	3,7	0,04
Palacos R - Heraeus Medical	1,5	2,7	0,1
Cemex Rx + Cemex System - Tecres	1,5	-	-
Amplicem 1 + Amplicem 3 - Amplimedical	1,3	0,004	-
Cmw 3 - Depuy	1,3	0,8	-
Cemex Sys. -Tecres+Surgical Simplex P-How	1,3	0,01	-
Amplicem1-Amplimedl+SmartsetHv-Depuy	1,2	-	-
Cemex - Tecres	1,2	1,4	0,1
Cemfix 1 - Teknimed	1,2	0,5	-
Versabond - Smith and Nephew	1,1	0,02	2,1
Cemex Genta + Cemex Genta System - Tecres	**1,0**	**0,004**	**-**
Sulcem 3 - Centerpulse	1,0	0,9	0,04
Cemfix 3 - Teknimed	0,8	0,2	-
Aminofix 1 - Groupe Lepine	**0,8**	**0,02**	**-**
Cemex Genta - Tecres	**0,6**	**0,3**	**0,04**
Palacos R 40 - Sp Europe	0,6	0,1	-
Palacos R+G - Heraeus Medical	**0,6**	**0,5**	**0,04**
Vacu Mix Plus Cmw 3 - Depuy	0,6	1,6	-
Bone Cement R - Biomet	0,5	0,1	0,8
Cemex Genta System - Tecres	**0,5**	**2,0**	**1,0**
Refobacin Bone Cement R - Biomet	**0,4**	**0,01**	**-**
Cemsys 1 - Mathys	0,3	0,03	-
Amplicem 1 - Amplimedical	0,3	0,02	0,04
A. Simplex + S. Simplex P - Howmedica	**0,3**	**0,05**	**0,1**
Hi-Fatigue - Zimmer	0,3	0,02	0,5
Amplicem 3G - Amplimedical	**0,3**	**-**	**-**
Cemex XL - Tecres	0,2	0,5	-
Palamed G - Heraeus Medical	**0,2**	**0,1**	**0,04**
Osteobond - Zimmer	0,2	0,01	0,9
Smartset GHV - Depuy	**0,2**	**0,02**	**0,04**
Other without antibiotic	1,6	2,8	0,6
Other with antibiotic	**1,4**	**1,0**	**0,2**
Total	**100,0**	**100,0**	**100,0**

Antibiotic-loaded cement was chosen in 12,4% of THA, in 7,0% of hemi and in 56,3% of resurfacing.
Surgical Simplex P – Howmedica in 2015-2016 was chosen in 33,7% of THA and in 40,6% of hemi with at least one cemented component.

5. Types of hemiarthroplasty

5.1 Hemiarthroplasty cup and stem

Monoblock	2000-2010		2011-2013		2014-2016	
	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	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
TESTA ELLITTICA – Samo	422	99,3	-	-	-	-
Other	3	0,7	-	-	-	-
Total	**213**	**100,0**	**-**	**-**	**-**	**-**

Biarticular	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
JANUS Bioimpianti	1.115	4,7	1.028	13,8	2.621	36,0
C1 - Citieffe	3.344	14,0	2.127	28,5	1.815	24,9
SPHERI-LOCK - Hit Medica	4.672	19,6	863	11,6	757	10,4
TESTA BIARTICOLARE LOCK Lima	1.559	6,5	479	6,4	519	7,1
CUPOLA MOBILE MODULARE-Wright Cremascoli	1.198	5,0	98	1,3	394	5,4
UHR Osteonics Stryker Howmedica	2.355	9,9	772	10,4	350	4,8
BI-POLAR DePuy	546	2,3	1.229	16,5	253	3,5
TESTA BIPOLARE Samo	122	0,5	54	0,7	205	2,8
TESTA BIPOLARE Smith and Nephew	2	0,0	106	1,4	92	1,3
BI-POLAR Biomet	381	1,6	89	1,2	66	0,9
CUPOLA NEMAUSUS Transysteme	424	1,8	440	5,9	61	0,8
CUPOLA MOBILE BIBOP Symbios	34	0,1	22	0,3	46	0,6
CUPOLA BIPOLARE Zimmer	440	1,8	13	0,2	10	0,1
CUPOLA BIPOLARE Mathys	656	2,7	55	0,7	4	0,1
CUPOLA MOBILE Medacta	188	0,8	4	0,1	2	0,0
CUPOLA MOBILE BIARTICOLARE - Permedica	720	3,0	3	0,0	-	-
MODULAR BIPOLAR - Protek	886	3,7	1	0,0	-	-
CORON Tantum	189	0,8	1	0,0	-	-
ULTIMA MONK DePuy	1.004	4,2	-	-	-	-
CUPOLA SEM - D.M.O.	731	3,1	-	-	-	-
TESTA BIARTICOLARE - Lima	613	2,6	-	-	-	-
CUPOLA MOBILE Zimmer	607	2,5	-	-	-	-
CENTRAX - Stryker Howmedica	543	2,3	-	-	-	-
SPHERIC Amplitude	352	1,5	-	-	-	-
RETENTIVE MOBILE CUP - Cedior	292	1,2	-	-	-	-
BICENTRIC - Stryker Howmedica	236	1,0	-	-	-	-
TESTA BIPOLARE -Amplimedical	193	0,8	-	-	-	-
Other (< 100 cases)	340	1,4	44	0,6	31	0,4
Total*	**23.897**	**100,0**	**7.456**	**100,0**	**7.284**	**100,0**

*241 missing data (0,6%)

In 221 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
AB Citieffe	3.008	14,6	1.958	36,8	1.681	33,1
KORUS Bioimpianti	-	-	-	-	1.172	23,1
SL Lima	847	4,1	424	8,0	483	9,5
PROFEMUR GLADIATOR Wright Cremascoli	-	-	98	1,8	374	7,4
EXETER V40 Stryker Howmedica	612	3,0	292	5,5	302	5,9
SL STREAKES Hitmedica	1378	6,7	348	6,5	215	4,2
DUOFIT CKA Samo	169	0,8	51	1,0	187	3,7
CORAIL DePuy	-	-	402	7,6	175	3,4
SPHERI-SYSTEM II Hitmedica	2.115	10,3	255	4,8	123	2,4
VERSYS ADVOCATE Zimmer	25	0,1	71	1,3	60	1,2
S-TAPER Bioimpianti	94	0,5	293	5,5	47	0,9
C-STEM AMT DePuy	38	0,2	105	2,0	28	0,6
LOGICA MIRROR Lima	519	2,5	10	0,2	13	0,3
MERCURIUS Adler-Ortho	56	0,3	39	0,7	4	0,1
CCA Mathys	615	3,0	27	0,5	3	0,1
APTA Adler-Ortho	710	3,5	324	6,1	2	0,0
QUADRA-C Medacta	174	0,8	2	0,0	1	0,0
VERSYS HERITAGE Zimmer	138	0,7	1	0,0	1	0,0
G2 DePuy	996	4,8	511	9,6	-	-
LC - Samo	421	2,0	2	0,0	-	-
SL Permedica	679	3,3	1	0,0	-	-
VERSYS LD/FX- Zimmer	545	2,6	1	0,0	-	-
ORTHO-FIT Zimmer	830	4,0	-	-	-	-
STANDARD STRAIGHT Zimmer	778	3,8	-	-	-	-
SL -Hit Medica	737	3,6	-	-	-	-
SEM II DMO	638	3,1	-	-	-	-
RELIANCE HOWMEDICA	623	3,0	-	-	-	-
FIN Bioimpianti	524	2,5	-	-	-	-
JVC Wright Cremascoli	481	2,3	-	-	-	-
ULTIMA LX Johnson And Johnson	317	1,5	-	-	-	-
AHS Wright Cremascoli	312	1,5	-	-	-	-
MRL Wright Cremascoli	270	1,3	-	-	-	-
LOGICA Lima	249	1,2	-	-	-	-
DEFINITION Stryker Howmedica	240	1,2	-	-	-	-
SL Amplimedical	158	0,8	-	-	-	-
ULTIMA STRAIGHT DePuy	156	0,8	-	-	-	-
ALBI PTC Wright Cremascoli	149	0,7	-	-	-	-
Other (< 100 cases)	970	4,7	105	2,0	208	4,1
Total	**20.571**	**100,0**	**5.320**	**100,0**	**5.079**	**100,0**

Cementless stem	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
KORUS Bioimpianti	-	-	156	7,4	1.074	49,8
S-TAPER Bioimpianti	381	10,6	559	26,5	285	13,2
LOGICA CS Lima	91	2,5	169	8,0	204	9,5
SL Lima	257	7,1	63	3,0	97	4,5
POLARSTEM Endoplus	-	-	62	2,9	80	3,7
Z1 Citieffe	11	0,3	69	3,3	72	3,3
TAPERLOC Biomet	12	0,3	81	3,8	55	2,5
HARMONY SYMBIOS	-	-	4	0,2	42	1,9
ACCOLADE Osteonics Stryker Howmedica	1.297	36,0	475	22,5	34	1,6
HYDRA Adler-Ortho	23	0,6	38	1,8	32	1,5
CORAE Adler-Ortho	-	-	12	0,6	26	1,2
H-MAX S Lima	-	-	2	0,1	24	1,1
APTA Adler-Ortho	89	2,5	37	1,8	22	1,0
CORAIL De Puy	6	0,2	41	1,9	15	0,7
REVISION HIP Lima	3	0,1	10	0,5	14	0,6
ADR Endoplus	14	0,4	6	0,3	10	0,5
SUMMIT De Puy	7	0,2	31	1,5	8	0,4
CONUS Centerpulse	23	0,6	13	0,6	8	0,4
RECTA Adler-Ortho	76	2,1	59	2,8	3	0,1
SL REVISION Sulzer	27	0,7	4	0,2	2	0,1
TWINSYS Mathys	28	0,8	27	1,3	1	0,0
G2 De Puy	11	0,3	81	3,8	-	-
C2 Lima	19	0,5	13	0,6	-	-
SPS MODULAR Symbios	28	0,8	9	0,4	-	-
COXAFIT HIP STEM FGL ARGE	19	0,5	5	0,2	-	-
SL PLUS Endoplus	21	0,6	4	0,2	-	-
PORO-LOCK II Hit Medica	72	2,0	2	0,1	-	-
ENDON Tantum	187	5,2	1	0,0	-	-
HIP FRACTURE - Howmedica	269	7,5	-	-	-	-
PPF Biomet	266	7,4	-	-	-	-
H-AC STEM FURLONG Jri	69	1,9	-	-	-	-
VERSYS FIBER METAL TAPER Zimmer	45	1,2	-	-	-	-
EURO HIP SYSTEM Wright Cremascoli	41	1,1	-	-	-	-
PROFEMUR Z Wright Cremascoli	23	0,6	-	-	-	-
Other (< 20 cases)	187	5,2	80	3,8	50	2,3
Total	**3.602**	**100,0**	**2.113**	**100,0**	**2.158**	**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	37.537	95,8
Bipolar head – preassembled	1.102	2,8
Monoarticular	425	1,1
Monoblock prosthesis	112	0,3
Total	**39.176**	**100,0**

Stem was cemented in 66,8% and stem had a modular neck in 7,3%.
In year 2016 1,0% 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 2016 **according to type of operation and transfusion**

Type of surgery	None	Autologous (recovery)	Autologous (predeposit)	Homologous	Autologous and homologous
Emergency primary	29,5	9,5	-	55,0	6,0
Elective primary	21,1	25,0	27,7	17,0	9,2
Revision	13,9	14,7	13,2	45,2	13,0

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	33,1	2,6	63,9	0,4
Private	10,3	36,9	27,6	25,2
AUSL	38,6	4,5	53,8	3,1
IOR	5,6	0,4	94,0	0,0

Artroprotesi d'elezione				
Hospital	**None**	**Autologous**	**Homologous**	**Autologous and homologous**
AOSP	29,3	46,9	21,1	2,7
Private	11,2	70,6	4,6	13,6
AUSL	27,3	42,1	20,6	10,0
IOR	21,0	46,2	28,3	4,5

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 2016.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Calcar fracture	431	*0,4*	Deep vein thromb	107	*0,1*
Diaphysis fracture	332	*0,3*			
Greater troch. fracture	230	*0,2*			
Acetabulum fracture	158	*0,1*	Early infection	90	*0,1*
Anaesthesiolog. complications	145	*0,1*			
Hemorragia	53	*0,05*			
Instability	23	*0,02*			
Other	100	*0,1*			
Total	**1.472**	***1,4***	**Total**	**197**	***0,2***

The rate of complications in **revision surgery** carried out on patients hospitalized between January 1st 2000 and December 31st 2016.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Diaphysis fracture	222	*1,4*	Early infection	53	*0,3*
Calcar fracture	77	*0,5*			
Anaesthesiolog. complications	55	*0,4*			
Greater troch. fracture	55	*0,4*	Deep vein thromb	21	*0,1*
Acetabulum fracture	26	*0,2*			
Hemorragia	24	*0,1*			
Other	33	*0,2*			
Total	**492**	***3,2***	**Total**	**74**	***0,5***

The rate of complications in **hemiarthroplasty** carried out on patients hospitalized between January 1st 2000 and December 31st 2016.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Calcar fracture	183	*0,5*	Deep vein thromb	70	*0,2*
Anaesthesiolog. complications	138	*0,4*			
Greater troch. fracture	121	*0,3*			
Diaphysis fracture	68	*0,2*	Early infection	59	*0,2*
Anaemia	26	*0,1*			
Hemorragia	20	*0,1*			
Acetabulum fracture	5	*0,01*			
Other	54	*0,1*			
Total	**615**	***1,6***	**Total**	**129**	***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 2016.
The deaths recorded are those that occurred during hospitalization.

Years 2000-2016			
Type of surgery	**Deaths**	**n. of operations**	**Percentage**
Primary THA	246	103.583	0,2
Hemiarthroplasty	1.769	39.176	4,5
Partial and total Revision	106	15.562	0,7
Resurfacing prostheses	0	2.760	-
Prosthesis removal	31	1.251	2,5

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.

Deaths occurred within 90 days after Hemiarthroplasty			
Year of surgery	**Deaths**	**n. of operations**	**Percentage**
2000	247	1.762	14,0
2001	291	2.130	13,7
2002	241	1.951	12,4
2003	276	2.045	13,5
2004	285	2.236	12,7
2005	302	2.307	13,1
2006	286	2.378	12,0
2007	278	2.150	12,9
2008	343	2.468	13,9
2009	323	2.496	12,9
2010	356	2.516	14,1
2011	381	2.519	15,1
2012	314	2.461	12,8
2013	306	2.476	12,4
2014	285	2.408	11,8
2015	347	2.514	13,8
2016	327	2.359	13,9
Total	**5.188**	**39.176**	**13,2**

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 2016			
Type of operation	**N.**	**Mean pre-op.**	**Range**
Primary THA	7.659	1,3	0-88
Hemiarthroplasty	2.359	2,3	0-41
Revision	893	2,6	0-51
Resurfacing	121	1,0	0-4
Prosthesis removal	112	4,5	0-45

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 2016 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 75.739
Non revised: 72.294
Revised: 3.445

Chi-square: 183,78 *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 17 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 2016 **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	75.739	2.126	1.145	174	6,7
Hemy*	37.865	612	157	20	3,4
Total revision	2.657	195	89	9	7,0

*hemiarthroplasties with acetabular buffer are not considered, 20 failures were observed in 113 implants

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	862	47	19	8	7,1

In Primary THA, **38,3%** of Revisions was performed in a different hospital, in Hemiarthroplasty **22,4%** and in total revision **33,4%.**

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

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:

Type of operation	N° major revisions	N° minor revisions	N° of unclassified revisions^	Revision rate
Primary THA	2.541	730	174	3.445/75.739
Hemiarthroplasty*	584	185	20	789/37.865
Resurfacing	65	1	8	74/862
Total revision	232	52	9	293/2.657

* Minor revision included revision of head, while implant of acetabular component is considered major revision.
^ Revisions not classify because performed outside Region.

9.3 Survival curves according to Kaplan Meier

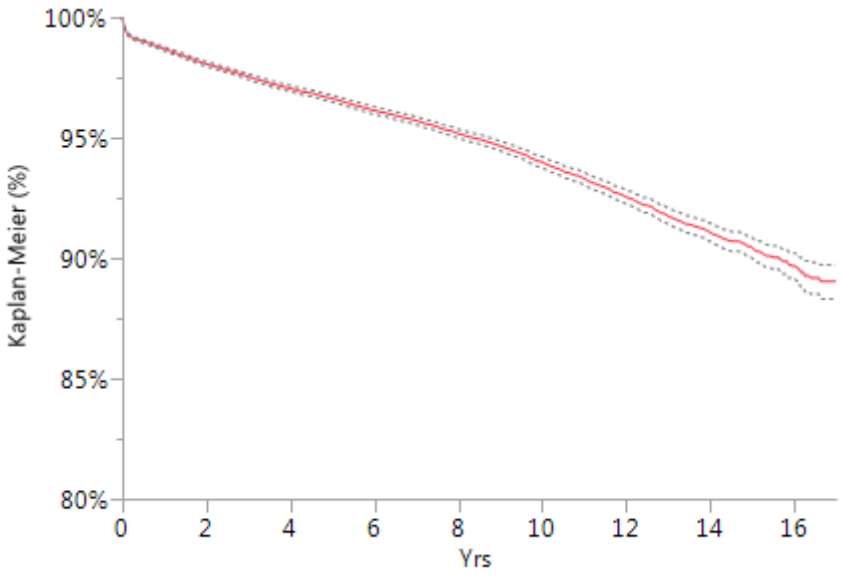
The survival curve calculated by the Kaplan Meier method enables an estimation of the probability that each individual has of maintaining its initial condition (prosthesis in place) over time.
The following paragraphs show the survival curves calculated separately for primary prosthesis, endoprosthesis, 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

75.739 primary arthroprostheses are under observation. Of these, 3.445 revisions were carried out.

Number of arthroprostheses	n. revisions	% survival at 17 yrs	Confidence Interval 95%	Mean Follow-up
75.739	3.445	89,0	88,3-89,7	6,7

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	**550**/75.739	0,7	16,0
within 60 days	*19/75.739*		
over 60 days	*531/75.739*		
Aseptic loosening of the cup	**536**/75.739	0,7	15,6
within 60 days	*41/75.739*		
over 60 days	*495/75.739*		
Recurrent prosthesis dislocation	**513**/75.739	0,7	14,9
within 60 days	*258/75.739*		
over 60 days	*255/75.739*		
Periprosthetic bone fracture	**432**/75.739	0,6	12,5
within 60 days	*112/75.739*		
over 60 days	*320/75.739*		
Breakage of prosthesis	**351**/75.739	0,5	10,2
Septic loosening	**212**/75.739	0,3	6,2
within 60 days	*27/75.739*		
over 60 days	*185/75.739*		
Global aseptic loosening	**211**/75.739	0,3	6,1
within 60 days	*3/75.739*		
over 60 days	*208/75.739*		
Pain without loosening	**79**/75.739	0,1	2,3
Poly wear	**72**/75.739	0,1	2,1
Primary instability	**71**/75.739	0,1	2,1
Heterotopic bone	**31**/75.739	0,04	0,9
Metallosis	**24**/75.739	0,03	0,7
Other	**53**/75.739	0,1	1,5
Unknown*	**310**/75.739	0,4	9,0
Total	**3.445/75.739**	**4,5**	**100,0**

*174 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	23,5	8,9	5,7
Aseptic loosening of the stem	15,8	20,7	14,4
Periprosthetic bone fracture	12,1	9,9	14,1
Aseptic loosening of the cup	11,0	16,9	21,2
Septic loosening	8,0	4,9	4,2
Breakage of prosthesis	7,5	16,3	11,5
Primary instability	4,1	0,2	0,0
Unknown	3,5	2,5	5,0
Global aseptic loosening	3,2	8,7	9,1
Pain without loosening	2,9	2,3	1,4
Heterotopic bone	1,4	1,1	0,2
Poly wear	0,5	0,8	4,7
Metallosis	0,1	0,8	1,4
Unknown (performed outside Emilia Romagna Region)	4,3	5,3	6,0
Other	2,2	0,6	0,9

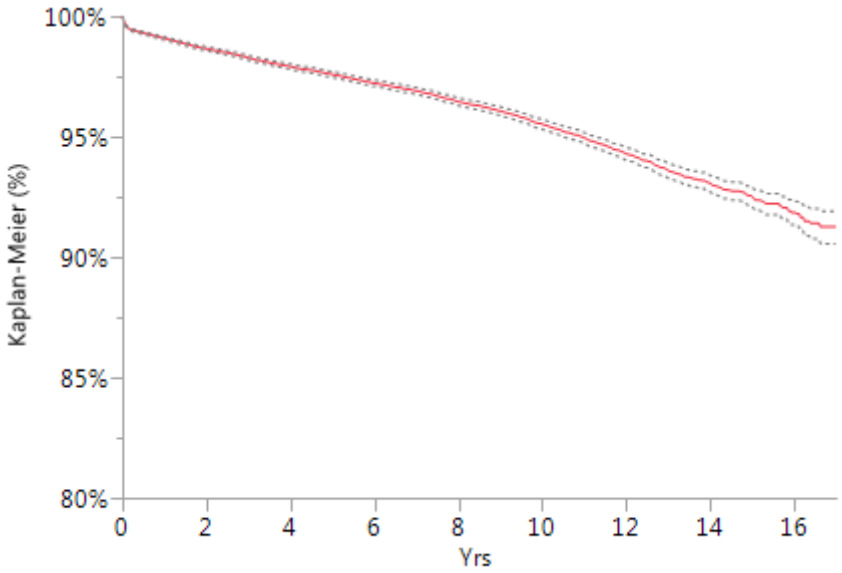
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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

75.739, primary arthroprostheses are under observation. Of these, 2.541 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
75.739	2.541	91,3	90,6-91,9	6,7

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

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	c.i. at 95%	% survival 10 yrs	c.i. at 95%
Fixa TI-por (Apta) Adler-Ortho	2007	4.370	74	98,1	97,6-98,5	-	-
AnCA Fit (AnCA Fit) Wright Cremascoli	2000	2.875	232	95,9	95,2-96,6	93,2	92,2-94,1
FIXA (RECTA) Adler-Ortho	2004	2.725	149	96,4	95,6-97,0	93,2	91,9-94,3
Fixa TI-por (Hydra) Adler-Ortho	2007	2.683	62	96,4	95,3-97,2	-	-
ABGII (ABGII) Stryker Howmedica	2000	1.959	93	97,7	96,9-98,3	95,1	93,9-96,1
EP-FIT PLUS (SL PLUS) ENDOPLUS	2003	1.958	75	96,6	95,7-97,4	94,9	93,3-96,1
FIXA (APTA) Adler-Ortho	2004	1.712	94	96,7	95,8-97,5	94,1	92,8-95,2
Fixa TI-por (CORAE) Adler-Ortho	2010	1.612	16	-	-	-	-
CLS (CLS) Sulzer Centerpulse Zimmer	2000	1.516	99	97,5	96,6-98,2	94,4	93,0-95,5
Fixa TI-por (RECTA) Adler-Ortho	2007	1.465	47	96,6	95,3-97,5	-	-
R3 (SL PLUS MIA) Smith & Nephew	2010	1.378	20	98,0	96,8-98,8	-	-
FITMORE (CONUS) SulzerCenterpulse Zimmer	2000	1.202	53	97,2	96,1-98,0	95,3	93,6-96,6
EXPANSION (CBC) Mathys	2003	1.194	71	94,6	93,1-95,8	92,8	90,8-94,3
EP-FIT PLUS (PROXYPLUS) Smith & Nephew	2005	1.069	27	98,0	96,9-98,7	95,1	91,9-97,0
Exceed ABT (TAPERLOC) Biomet	2006	936	15	98,4	97,3-99,0	-	-
BICON PLUS (SL PLUS) Smith & Nephew	2000	928	70	95,9	94,4-97,0	93,3	91,4-94,9
FITMORE (CLS) SulzerCenterpulse Zimmer	2000	768	33	97,2	95,8-98,2	95,7	93,9-97,0
PINNACLE SECTOR II (CORAIL) DePuy	2002	658	35	95,7	93,7-97,1	91,4	87,1-94,3
REFLECTION (**BASIS**) Smith & Nephew	2001	626	40	96,2	94,2-97,5	91,5	88,2-94,0
CLS (CONUS) SulzerCenterpulse Zimmer	2000	595	46	97,1	95,3-98,2	93,9	91,5-95,6
TRIDENT (ABGII) Stryker Howmedica	2002	592	32	95,4	93,2-96,9	93,5	90,7-95,5
FIXA (**APTA**) Adler-Ortho	2005	573	20	97,1	95,4-98,2	96,3	94,3-97,7
Ep-fit (Polarstem) Endoplus	2008	529	9	98,2	96,5-99,1	-	-
REFLECTION (**SYNERGY**) Smith & Nephew	2000	522	18	98,2	96,2-99,2	94,1	89,9-96,6

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

TRILOGY (VERSYS FIBER)Zimmer	2000	503	27	96,4	94,3-97,7	94,9	92,5-96,6
DUOFIT PSF (**P507**) Samo	2000	492	25	98,1	96,3-99,0	96,3	94,0-97,7
CONTEMPORARY (EXETER V40) Stryker Howmedica	2000	486	24	96,3	94,0-97,7	94,4	91,4-96,4
RECAP RESURFACING (TAPERLOC) Biomet	2005	486	25	95,8	93,6-97,3	93,7	89,8-96,2
TRIDENT (**EXETER V40**) Howmedica	2002	455	3	99,5	98,2-99,9	99,5	98,2-99,9
SELEXYS TH (CBC) MATHYS	2006	435	39	92,0	89,0-94,3	-	-
AnCA Fit (PROFEMUR Z) Wright Cremascoli	2002	420	37	94,0	91,3-95,9	91,9	88,8-94,2
Versafitcup CC (Amistem) Medacta	2011	410	9	-	-	-	-
R3 (POLARSTEM) Smith & Nephew	2012	401	4	-	-	-	-
PINNACLE SECTOR II (SUMMIT) DePuy	2003	400	5	97,9	95,1-99,2	97,9	95,1-99,2
TOP (CFP) Link	2000	399	15	97,7	95,6-98,8	95,7	93,0-97,4
DELTA PF (MODULUS HIP SYSTEM) Lima	2003	380	9	97,8	95,7-98,9	97,3	94,9-98,6
DELTA TT (MODULUS HIP SYSTEM) Lima	2007	380	10	97,2	94,6-98,6	-	-
Versafitcup CC (Minimax) Medacta	2007	363	13	96,9	94,6-98,3	-	-
DELTA TT (H-MAX S) Lima	2009	348	5	-	-	-	-
Fixa TI-por (Alata Acuta) Adler-Ortho	2007	347	6	97,8	95,1-99,0	-	-
R3 (SL PLUS) Smith & Nephew	2009	343	8	97,4	94,9-98,7	-	-
CUPULE RELOAD AVANTAGE (TAPERLOC) Biomet	2008	337	11	96,8	94,2-98,3	-	-
CONTINUUM (CLS) Zimmer	2010	330	3	97,6	90,1-99,5	-	-
MULLER (JVC) Wright Cremascoli	2000	326	13	98,4	96,2-99,3	96,1	92,8-97,9
JUMP SYSTEM (SYNTHESIS) Permedica	2013	322	2	-	-	-	-
STANDARD CUP (CLS) Sulzer Centerpulse Zimmer	2000	322	13	98,4	96,2-99,3	96,9	94,2-98,4
CLS Zimmer (SL PLUS) Smith & Nephew	2001	311	16	96,6	93,8-98,2	95,0	91,4-97,1
MULLER (MRL) Wright Cremascoli	2000	305	18	96,5	93,6-98,1	94,8	91,3-96,9
Other (< 300 cases)	2000	31.677	1.649	96,2	96,0-96,4	93,2	92,9-93,6
Unknow	2000	316	26	94,9	91,5-97,0	89,4	84,0-93,1
All models	**2000**	**75.739**	**3.445**	**96,6**	**96,5-96,8**	**94,0**	**93,8-94,2**

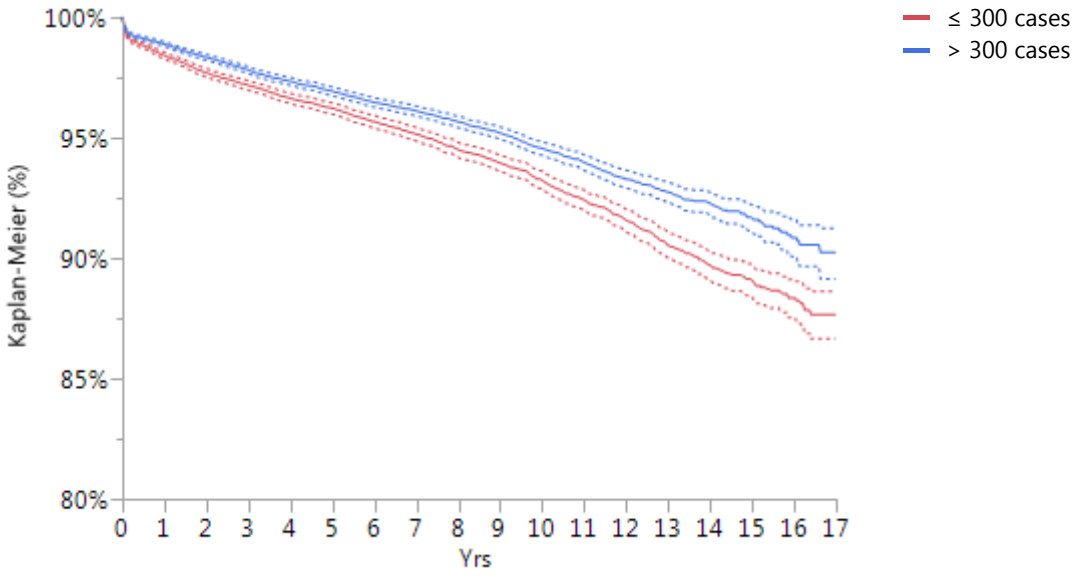
The marked dispersion of prosthesis types and the wide variability of the combinations between acetabulum and stems enable the comparison of only some types of prosthesis.
To provide, anyway, an indication of the survival of the prosthesis types less represented in data banks, they were grouped together to make a class of prostheses of which less than 300 were implanted in 2000-2016.
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 16 yrs	Confidence Interval 95%	Mean Follow-up
Models > 300 cases	43.746	1.770	90,8	90,0-91,6	6,6
Models < 300 cases	31.677	1.649	88,3	87,5-89,1	6,7

Survival curve



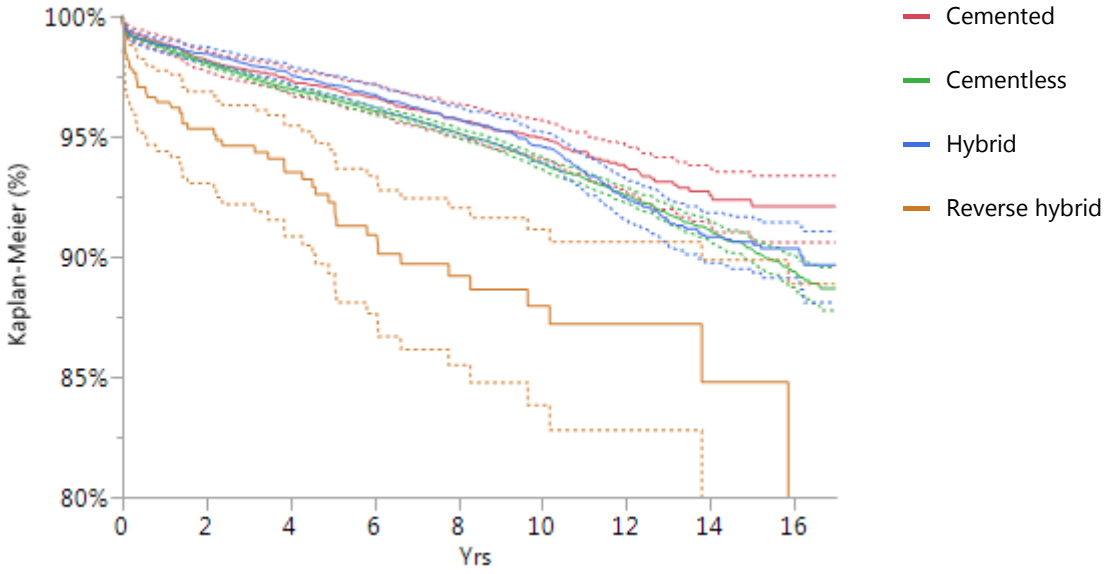
Curves are significantly different (p=0.001, Wilcoxon test)

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 16 yrs (c.i. at 95%)	Mean Follow-up
Cementless	64.309	2.836	89,4 (88,7-90,0)	6,4
Hybrid (cemented stem, cementless cup)	6.589	358	90,3 (89,1-91,4)	8,6
Cemented	4.102	190	92,1 (90,6-93,4)	8,3
Reverse hybrid (cementless stem, cemented cup)	517	47	77,7 (60,3-88,9)	6,3



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

Cemented			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**60**/4.102	1,5	31,6
Global aseptic loosening	**33**/4.102	0,8	17,4
Recurrent prosthesis dislocation	**26**/4.102	0,6	13,7
Aseptic loosening of the stem	**20**/4.102	0,5	10,5
Septic loosening	**19**/4.102	0,5	10,0
Periprosthetic bone fracture	**14**/4.102	0,3	7,4
Primary instability	**4**/4.102	0,1	2,1
Breakage of prosthesis	**2**/4.102	0,0	1,1
Unknown *(6 performed outside region)*	**12**/4.102	0,3	6,3
Total	**190/4.102**	**4,6**	**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 cup	**424**/64.309	0,7	15,0
Aseptic loosening of the stem	**418**/64.309	0,6	14,7
Recurrent prosthesis dislocation	**402**/64.309	0,6	14,2
Periprosthetic bone fracture	**382**/64.309	0,6	13,5
Breakage of prosthesis	**341**/64.309	0,5	12,0
Septic loosening	**165**/64.309	0,3	5,8
Global aseptic loosening	**132**/64.309	0,2	4,7
Pain without loosening	**78**/64.309	0,1	2,8
Primary instability	**66**/64.309	0,1	2,3
Poly wear	**57**/64.309	0,1	2,0
Heterotopic bone	**27**/64.309	0,0	1,0
Metallosis	**23**/64.309	0,0	0,8
Other	**48**/64.309	0,1	1,7
Unknown *(154 performed outside region)*	**273**/64.309	0,4	9,6
Total	**2.836/64.309**	**4,4**	**100,0**
Hybrid			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**103**/6.589	1,6	28,8
Recurrent prosthesis dislocation	**74**/6.589	1,1	20,7
Global aseptic loosening	**42**/6.589	0,6	11,7
Aseptic loosening of the cup	**33**/6.589	0,5	9,2
Periprosthetic bone fracture	**31**/6.589	0,5	8,7
Septic loosening	**27**/6.589	0,4	7,5
Poly wear	**12**/6.589	0,2	3,4
Breakage of prosthesis	**6**/6.589	0,1	1,7
Heterotopic bone	**3**/6.589	0,0	0,8
Pain without loosening	**1**/6.589	0,0	0,3
Primary instability	**1**/6.589	0,0	0,3
Other	**5**/6.589	0,1	1,4
Unknown *(9 performed outside region)*	**20**/6.589	0,3	5,6
Total	**358/6.589**	**5,4**	**100,0**
Reverse hybrid			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**17**/517	3,3	36,2
Aseptic loosening of the stem	**7**/517	1,4	14,9
Recurrent prosthesis dislocation	**7**/517	1,4	14,9
Periprosthetic bone fracture	**5**/517	1,0	10,6
Global aseptic loosening	**3**/517	0,6	6,4
Breakage of prosthesis	**2**/517	0,4	4,3
Septic loosening	**1**/517	0,2	2,1
Unknown *(5 performed outside region)*	**5**/517	1,0	10,6
Total	**47/517**	**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

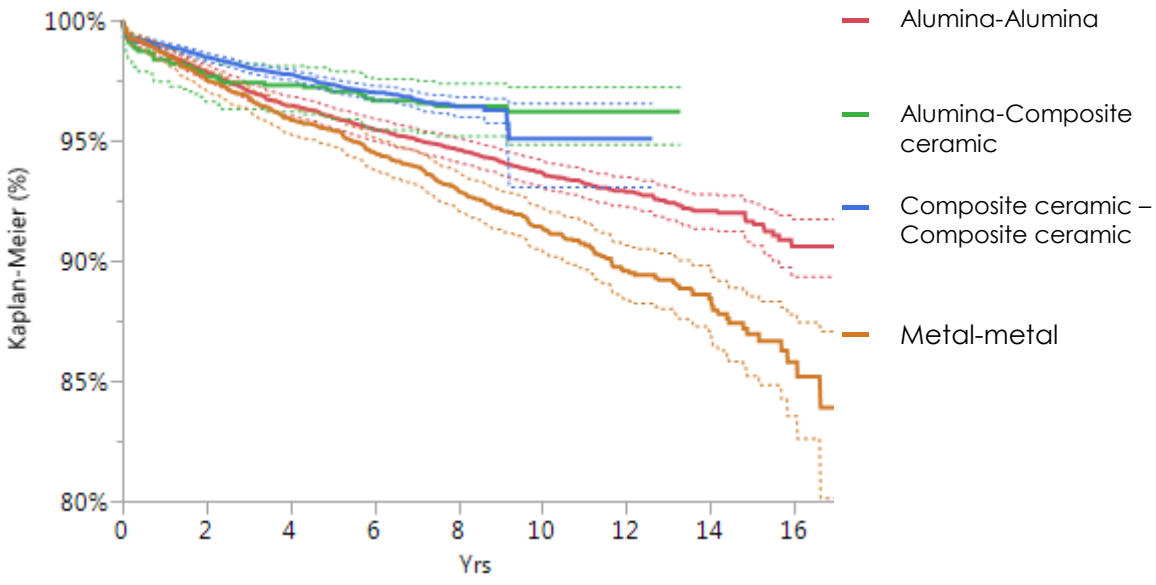
9.8 Analysis of survival in primary total hip arthroplasty according to coupling

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.

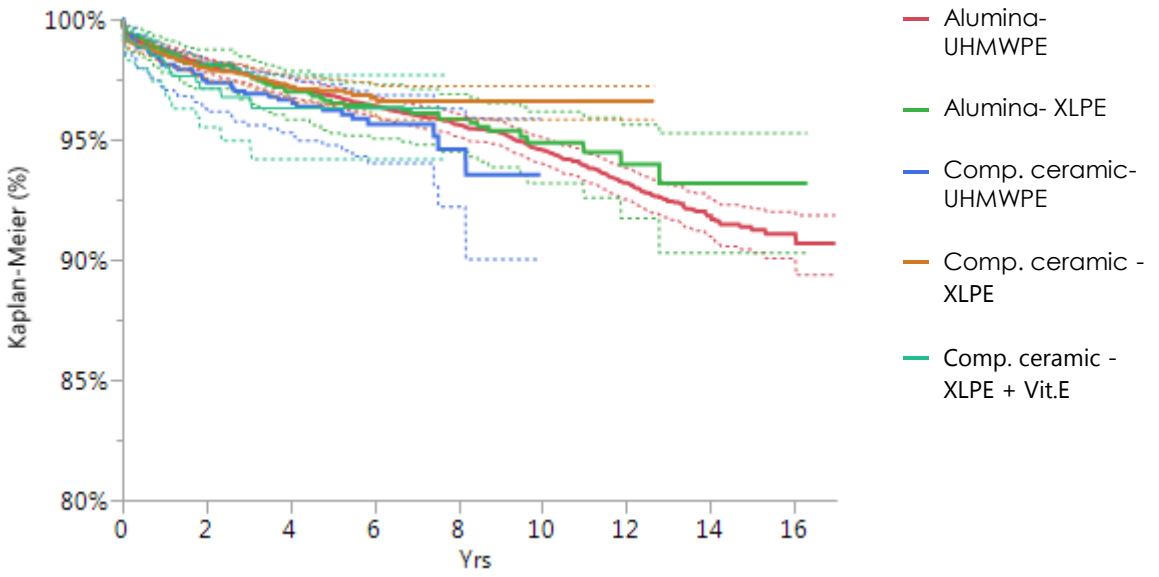
The survival curve are shown in three separate figures, to have better graphics.

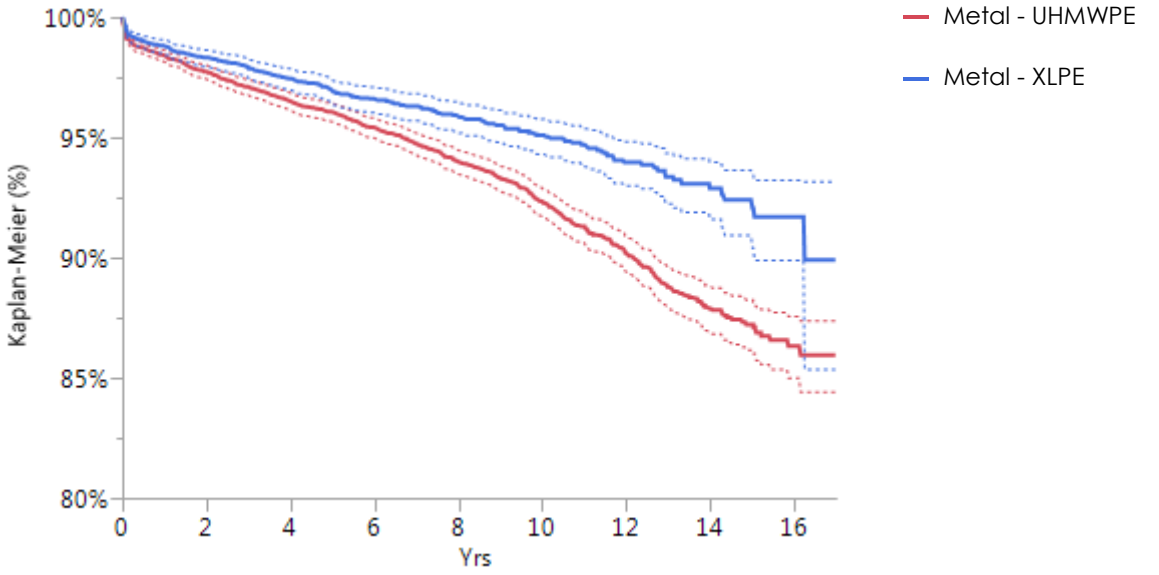
Articular coupling	Mean Follow-up	N.	Removals	% survival at 5 yrs	c.i. at 95%	% survival at 10 yrs	c.i. at 95%
Comp. ceramic – Comp. ceramic	3,9	21.874	486	97,3	97,1-97,6	95,1	93,1-96,5
Metal-UHMWPE	8,8	10.971	793	96,1	95,7-96,4	92,3	91,7-92,9
Alumina-Alumina	10,3	8.156	538	97,3	95,5-96,4	93,7	93,1-94,2
Alumina-UHMWPE	9,9	7.832	460	96,8	96,4-97,2	94,6	94,0-95,1
Composite ceramic - XLPE	3,0	6.401	143	97,0	96,4-97,5	96,6	95,8-97,2
Metal-XLPE	7,0	5.616	222	96,9	96,4-97,4	95,1	94,3-95,8
Metal-metal	9,1	4.666	393	95,4	94,8-96,0	91,4	90,4-92,2
Alumina-XLPE	8,3	1.185	53	96,5	95,3-97,4	94,9	93,2-96,2
Alumina-Comp. ceramic	8,3	1.163	41	97,0	95,9-97,9	96,2	94,8-97,2
Comp. ceramic - UHMWPE	5,1	1.037	41	96,2	94,8-97,3	-	-
Comp. ceramic - XLPE + Vit.E	2,0	1.018	23	96,3	94,2-97,7	-	-

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





Difference is statistically significant (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	**99**/4.666	2,1	25,2
Aseptic loosening of the stem	**53**/4.666	1,1	13,5
Global aseptic loosening	**34**/4.666	0,7	8,7
Septic loosening	**33**/4.666	0,7	8,4
Prosthesis dislocation	**28**/4.666	0,6	7,1
Breakage of prosthesis (15 stems and 13 cups)	**28**/4.666	0,6	7,1
Periprosthetic bone fracture	**22**/4.666	0,5	5,6
Metallosis	**21**/4.666	0,5	5,3
Pain without loosening	**10**/4.666	0,2	2,5
Primary instability	**5**/4.666	0,1	1,3
Heterotopic bone	**3**/4.666	0,1	0,8
Other	**4**/4.666	0,1	1,0
Unknown *(41 performed outside region)*	**53**/4.666	1,1	13,5
Total	**393/4.666**	**8,4**	**100,0**
Metal - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**180**/10.971	1,6	22,7
Prosthesis dislocation	**138**/10.971	1,3	17,4
Aseptic loosening of the stem	**138**/10.971	1,3	17,4
Global aseptic loosening	**85**/10.971	0,8	10,7
Periprosthetic bone fracture	**64**/10.971	0,6	8,1
Poly wear	**46**/10.971	0,4	5,8
Septic loosening	**39**/10.971	0,4	4,9
Pain without loosening	**15**/10.971	0,1	1,9
Breakage of prosthesis (9 stems, 1 insert and 1 cup)	**11**/10.971	0,1	1,4
Primary instability	**6**/10.971	0,1	0,8
Heterotopic bone	**1**/10.971	0,0	0,1
Other	**6**/10.971	0,1	0,8
Unknown *(32 performed outside region)*	**64**/10.971	0,6	8,1
Total	**793/10.971**	**7,2**	**100,0**
Metal - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Periprosthetic bone fracture	**71**/5.616	1,3	32,0
Prosthesis dislocation	**34**/5.616	0,6	15,3
Aseptic loosening of the cup	**27**/5.616	0,5	12,2
Aseptic loosening of the stem	**25**/5.616	0,4	11,3
Global aseptic loosening	**16**/5.616	0,3	7,2
Septic loosening	**15**/5.616	0,3	6,8
Primary instability	**7**/5.616	0,1	3,2
Pain without loosening	**5**/5.616	0,1	2,3
Poly wear	**2**/5.616	0,0	0,9
Heterotopic bone	**1**/5.616	0,0	0,5
Breakage of stem	**1**/5.616	0,0	0,5
Other	**5**/5.616	0,1	2,3
Unknown *(6 performed outside region)*	**13**/5.616	0,2	5,9
Total	**222/5.616**	**4,0**	**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

Alumina - Alumina			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (64 stems, 47 inserts, 49 heads, 2 cups and 4 insert+head)	**166**/8.156	2,0	30,9
Periprosthetic bone fracture	**88**/8.156	1,1	16,4
Prosthesis dislocation	**65**/8.156	0,8	12,1
Aseptic loosening of the stem	**64**/8.156	0,8	11,9
Aseptic loosening of the cup	**39**/8.156	0,5	7,2
Septic loosening	**19**/8.156	0,2	3,5
Pain without loosening	**14**/8.156	0,2	2,6
Global aseptic loosening	**12**/8.156	0,1	2,2
Primary instability	**5**/8.156	0,1	0,9
Heterotopic bone	**5**/8.156	0,1	0,9
Poly wear	**1**/8.156	0,0	0,2
Other	**10**/8.156	0,1	1,9
Unknown *(29 performed outside region)*	**50**/8.156	0,6	9,3
Total	**538/8.156**	**6,6**	**100,0**
Alumina - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**100**/7.832	1,3	21,7
Prosthesis dislocation	**79**/7.832	1,0	17,2
Aseptic loosening of the cup	**70**/7.832	0,9	15,2
Periprosthetic bone fracture	**57**/7.832	0,7	12,4
Global aseptic loosening	**30**/7.832	0,4	6,5
Septic loosening	**28**/7.832	0,4	6,1
Breakage of prosthesis (12 stems, 5 cups, 4 heads and 1 insert)	**22**/7.832	0,3	4,8
Poly wear	**14**/7.832	0,2	3,0
Pain without loosening	**7**/7.832	0,1	1,5
Primary instability	**6**/7.832	0,1	1,3
Heterotopic bone	**5**/7.832	0,1	1,1
Metallosis	**1**/7.832	0,0	0,2
Other	**3**/7.832	0,0	0,7
Unknown *(21 performed outside region)*	**38**/7.832	0,5	8,3
Total	**460/7.832**	**5,9**	**100,0**
Alumina - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**12**/1.185	1,0	22,6
Aseptic loosening of the cup	**8**/1.185	0,7	15,1
Periprosthetic bone fracture	**7**/1.185	0,6	13,2
Prosthesis dislocation	**5**/1.185	0,4	9,4
Septic loosening	**5**/1.185	0,4	9,4
Primary instability	**3**/1.185	0,3	5,7
Global aseptic loosening	**3**/1.185	0,3	5,7
Pain without loosening	**1**/1.185	0,1	1,9
Breakage of stem	**1**/1.185	0,1	1,9
Poly wear	**1**/1.185	0,1	1,9
Unknown *(3 performed outside region)*	**7**/1.185	0,6	13,2
Total	**53/1.185**	**4,5**	**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

Alumina - Composite ceramic			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**11**/1.163	0,9	26,8
Breakage of prosthesis (7 stems and 4 inserts)	**11**/1.163	0,9	26,8
Aseptic loosening of the stem	**5**/1.163	0,4	12,2
Periprosthetic bone fracture	**4**/1.163	0,3	9,8
Aseptic loosening of the cup	**2**/1.163	0,2	4,9
Septic loosening	**2**/1.163	0,2	4,9
Heterotopic bone	**1**/1.163	0,1	2,4
Other	**2**/1.163	0,2	4,9
Unknown *(2 performed outside region)*	**3**/1.163	0,3	7,3
Total	**41/1.163**	**3,5**	**100,0**
Composite ceramic - Composite ceramic			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (80 stems, 12 inserts and 3 heads)	**95**/21.874	0,4	19,5
Aseptic loosening of the stem	**81**/21.874	0,4	16,7
Prosthesis dislocation	**70**/21.874	0,3	14,4
Periprosthetic bone fracture	**60**/21.874	0,3	12,3
Septic loosening	**36**/21.874	0,2	7,4
Aseptic loosening of the cup	**33**/21.874	0,2	6,8
Primary instability	**23**/21.874	0,1	4,7
Pain without loosening	**16**/21.874	0,1	3,3
Heterotopic bone	**11**/21.874	0,1	2,3
Global aseptic loosening	**4**/21.874	0,0	0,8
Metallosis	**1**/21.874	0,0	0,2
Other	**16**/21.874	0,1	3,3
Unknown *(25 performed outside region)*	**40**/21.874	0,2	8,2
Total	**486/21.874**	**2,2**	**100,0**
Composite ceramic - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**15**/1.037	1,4	36,6
Aseptic loosening of the stem	**8**/1.037	0,8	19,5
Breakage of prosthesis (3 stems and 1 unknow)	**4**/1.037	0,4	9,8
Pain without loosening	**3**/1.037	0,3	7,3
Periprosthetic bone fracture	**2**/1.037	0,2	4,9
Global aseptic loosening	**2**/1.037	0,2	4,9
Septic loosening	**2**/1.037	0,2	4,9
Poly wear	**2**/1.037	0,2	4,9
Primary instability	**1**/1.037	0,1	2,4
Aseptic loosening of the cup	**1**/1.037	0,1	2,4
Unknown	**1**/1.037	0,1	2,4
Total	**41/1.037**	**4,0**	**100,0**
Composite ceramic - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**33**/6.401	0,5	23,1
Aseptic loosening of the cup	**21**/6.401	0,3	14,7
Aseptic loosening of the stem	**20**/6.401	0,3	14,0
Periprosthetic bone fracture	**19**/6.401	0,3	13,3
Primary instability	**8**/6.401	0,1	5,6
Septic loosening	**7**/6.401	0,1	4,9

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

Global aseptic loosening	**6**/6.401	0,1	4,2
Breakage of prosthesis (2 stems and 2 cups)	**4**/6.401	0,1	2,8
Pain without loosening	**2**/6.401	0,0	1,4
Heterotopic bone	**2**/6.401	0,0	1,4
Other	**2**/6.401	0,0	1,4
Unknown *(7 performed outside region)*	**19**/6.401	0,3	13,3
Total	**143/6.401**	**2,2**	**100,0**
Comp. ceramic - XLPE + Vit.E			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**4**/1.018	0,4	17,4
Aseptic loosening of the cup	**4**/1.018	0,4	17,4
Primary instability	**3**/1.018	0,3	13,0
Periprosthetic bone fracture	**2**/1.018	0,2	8,7
Aseptic loosening of the stem	**2**/1.018	0,2	8,7
Septic loosening	**2**/1.018	0,2	8,7
Pain without loosening	**1**/1.018	0,1	4,3
Global aseptic loosening	**1**/1.018	0,1	4,3
Heterotopic bone	**1**/1.018	0,1	4,3
Breakage of prosthesis	**1**/1.018	0,1	4,3
Unknown	**2**/1.018	0,2	8,7
Total	**23/1.018**	**2,3**	**100,0**

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

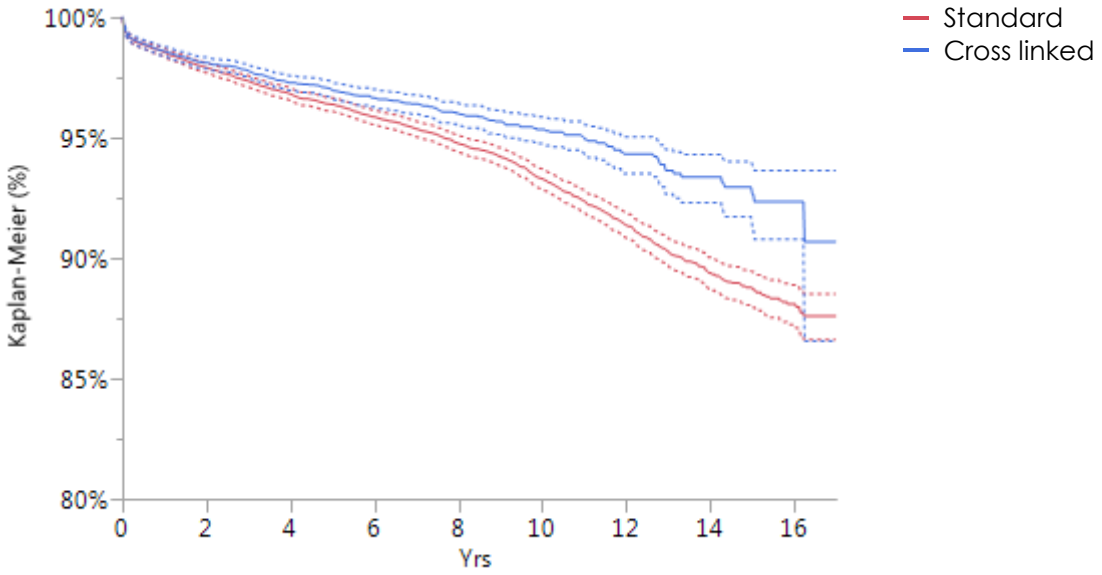
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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	18.556	1.254	88,1	87,2-88,9	9,0
Cross linked	13.651	407	92,3	90,8-93,6	4,9

Survival curve



Difference is statistically significant (p=0,003, 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.

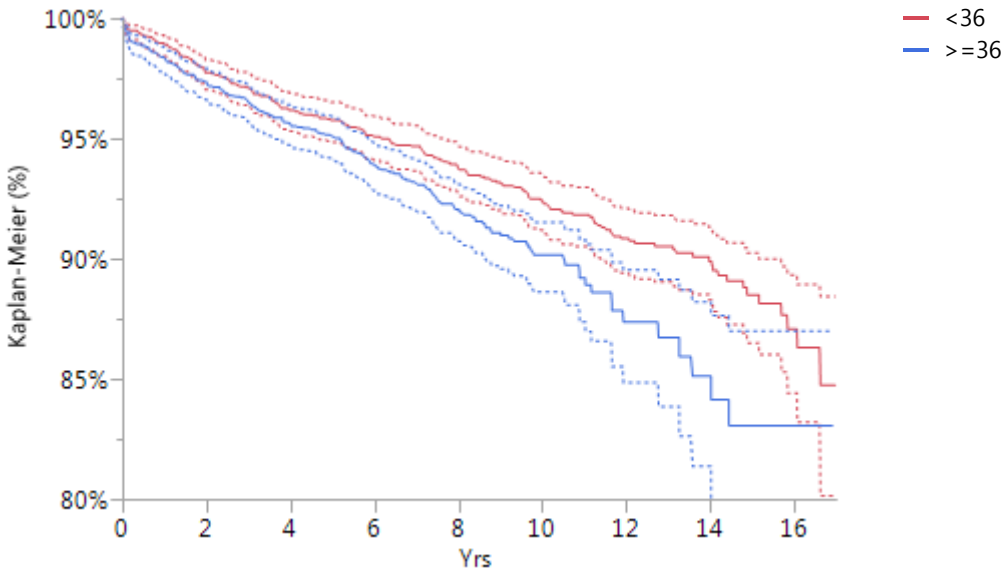
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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 to head diameters.

head diameters, met-met	N.	Removals	% survival at 16 yrs	Confidence Interval 95%	Mean Follow-up
<36 mm	2.312	193	87,1	84,4-89,3	10,3
>=36 mm	2.354	200	83,1	78,3-87,0	8,0

Survival curve



Difference is statistically significant (p=0,018, Wilcoxon test).

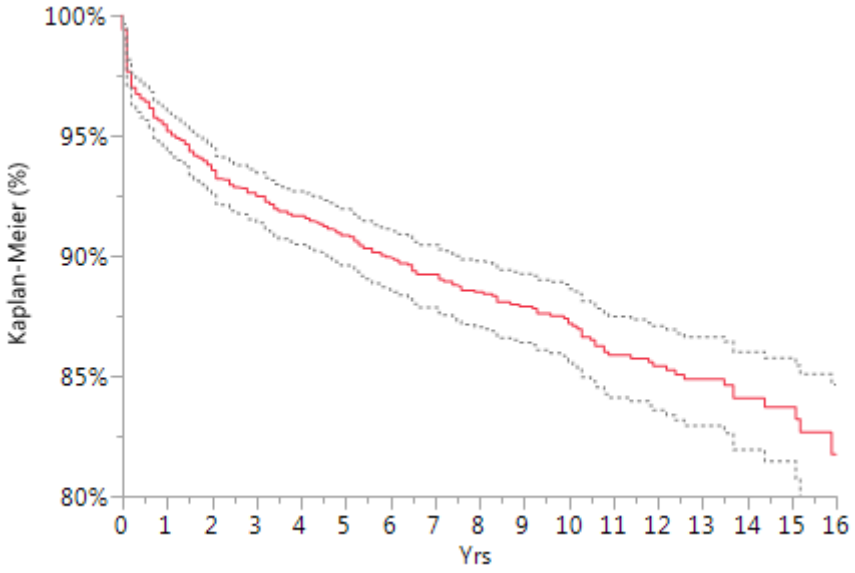
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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 16 yrs	Confidence Interval 95%	Mean Follow-up
2.657	293	81,7	78,4-84,6	7,0

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	**59**/2.657	2,2	20,1
Aseptic loosening of the cup	**57**/2.657	2,1	19,5
Aseptic loosening of the stem	**46**/2.657	1,7	15,7
Septic loosening	**41**/2.657	1,5	14,0
Global aseptic loosening	**24**/2.657	0,9	8,2
Periprosthetic bone fracture	**17**/2.657	0,6	5,8
Breakage of prosthesis	**5**/2.657	0,2	1,7
Pain without loosening	**4**/2.657	0,2	1,4
Primary instability	**4**/2.657	0,2	1,4
Poly wear	**3**/2.657	0,1	1,0
Other	**3**/2.657	0,1	1,0
Unknown *(9 performed outside region)*	**30**/2.657	1,1	10,2
Total	**293/2.657**	**11,0**	**100,0**

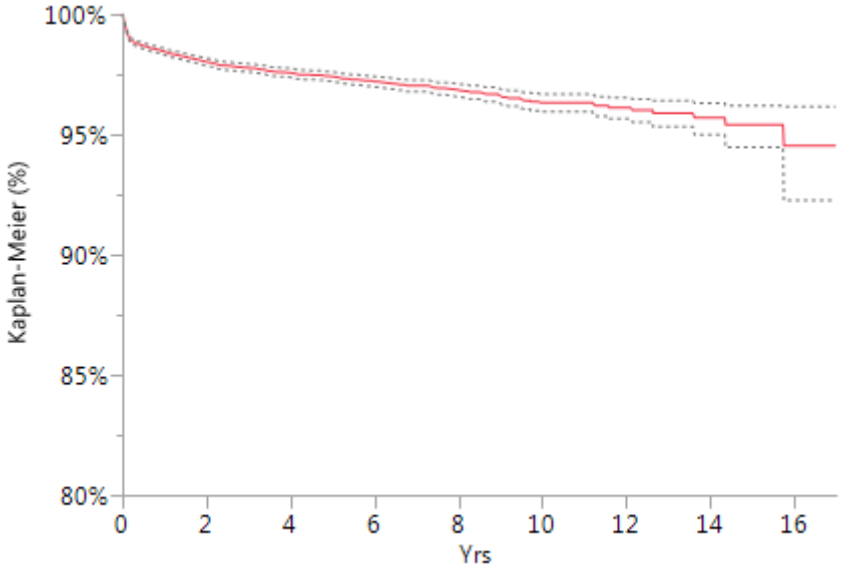
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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 16 yrs	Confidence Interval 95%	Mean Follow-up
37.865	789	94,5	92,2-96,2	3,4

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	**356**/37.865	0,9	45,1
Cotyloiditis	**115**/37.865	0,3	14,6
Aseptic loosening of the stem	**104**/37.865	0,3	13,2
Periprosthetic bone fracture	**78**/37.865	0,2	9,9
Septic loosening	**66**/37.865	0,2	8,4
Primary instability	**7**/37.865	0,0	0,9
Other	**14**/37.865	0,0	1,8
Unknown *(16 performed outside region)*	**49**/37.865	0,1	6,2
Total	**789/37.865**	**2,1**	**100,0**

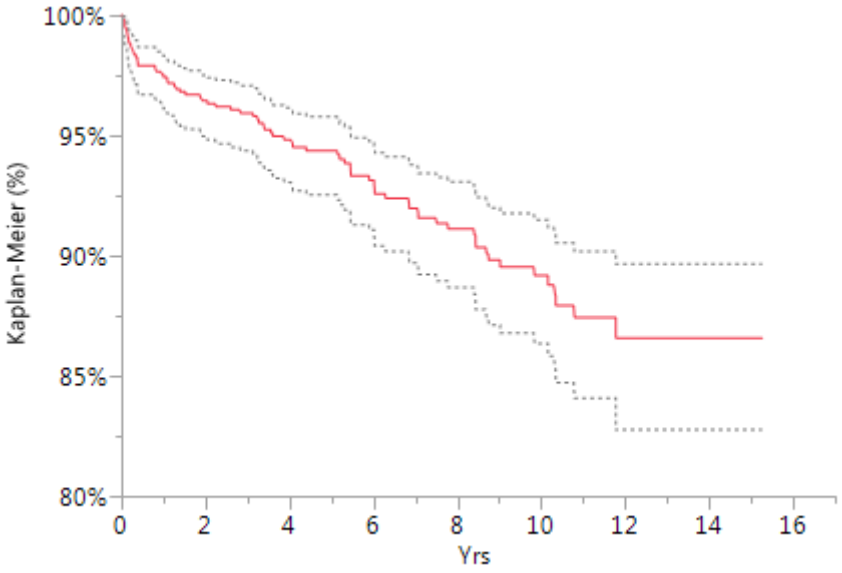
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

9.13 Survival analysis of resurfacing

Analysis was performed only on patients resident in Emilia-Romagna region. This reduced the number of observed subjects.
The number of implants for which survival is calculated **is obviously lower (13 years)** than the amount present in the database (17 years).

N. of resurfacing	Removal	% survival at 13 yrs	Confidence Interval 95%	Mean Follow-up
862	74	86,6	82,8-89,7	7,1

Survival curve



Type of prosthesis	From years	N.	Revisions	% survival at 5 yrs	Confidence Interval 95%	Mean Follow-up
BHR – Smith & Nephew	2001	493	26	97,0	94,8-98,2	7,1 (0-15,3)
ADEPT – Finsbury	2005	121	3	97,5	92,6-99,2	6,7 (0,1- 11,6)
ASR – DePuy	2004	65	21	78,5	66,8-86,8	7,6 (0,1-12,3)
BMHR – Smith & Nephew	2007	75	4	98,7	91,1-99,8	5,8 (0,3-9,6)
MRS – Lima	2005	42	10	78,6	63,7-88,5	8,6 (0,2-11,6)
Other (< 40 cases)	2003	66	10	89,2	79,0-94,8	8,0 (0-13,8)
Total	**2001**	**862**	**74**	**94,4**	**92,5-95,8**	**7,1 (0-15,3)**

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 resurfacing according to **cause of revision**

Cause of revision	Rate	%	% distribution of failure causes
Aseptic loosening	**20**/862	2,3	27,0
Periprosthetic bone fracture	**19**/862	2,2	25,7
Metal sensitization	**9**/862	1,0	12,2
Pain without loosening	**9**/862	1,0	12,2
Septic loosening	**3**/862	0,3	4,1
Breakage of prosthesis	**2**/862	0,2	2,7
Prosthesis dislocation	**1**/862	0,1	1,4
Unknown *(8 performed outside region)*	**11**/862	1,3	14,9
Total	**74/862**	**8,6**	**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 2016

10. RIPO capture

10.1 Percentuale di adesione

Percentage of R.I.P.O. capture calculated versus Schede di Dimissione Ospedaliera (S.D.O.), according to Agency was **98,1**% for year 2016. 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 arthroprostheses and hemiarthroplasties of the knee 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

From database SDO

During 2016 percentage of primary THA performed in public hospitals is 62,7%.

Percentage of primary total knee arthroprostheses and revision performed in public and private hospitals, in year 2016.

Type of operation	Public	Private
	%	%
Primary bicompartmental	50,8	63,9
Primary tricompartmental	31,9	16,5
Primary unicompartmental	7,5	11,6
Revision	7,2	6,1
Prosthesis removal	1,7	0,9
Implant of patella	0,9	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 2016, according to **type**

Type of operation	Number	Percentage
Primary bicompartmental	62.590	64,7
Primary tricompartmental	14.840	15,3
Primary unicompartmental	10.004	10,3
Revision^	5.993	6,2
Prosthesis removal	1.348	1,4
Implant of patella	784	0,8
Other prostheses*	448	0,5
Other operations°	794	0,8
Total	**96.801**	**100,0**

*51 Hemicap–Arthrosurface, 30 Hemicap patello_femoral–Arthrosurface, 65 Avon-Patello-Femoral Joint Stryker, 81 Gender-Patello-Femoral Joint System Zimmer, 47 Journey-PFJ-Patellofemoral Smith&Nephew, 38 other patella-femoral, 53 Unicompartimental Plus+patella

°of which 354 spacer exchange, 73 stiff knee loosening, 98 debridement's, 5 dislocation reductions

^545 liner, 12 femoral component, 2 tibial component, 123 femoral component and liner, 346 tibial component and liner, 4929 total, 36 patella.

Percentage of different prostheses in the years

Years of operation	% unicompartim	% bicompartim	% tricompartim
2001	10,2	81,3	8,5
2002	12,7	80,1	7,2
2003	12,8	78,6	8,7
2004	12,9	75,7	11,3
2005	12,4	75,6	12,0
2006	10,8	69,9	19,2
2007	11,6	69,3	19,2
2008	11,5	72,2	16,3
2009	13,0	72,3	14,8
2010	12,5	71,5	16,0
2011	9,8	73,4	16,8
2012	10,5	72,3	17,2
2013	12,1	69,1	18,8
2014	10,9	68,1	21,0
2015	10,1	67,8	22,1
2016	11,1	65,1	23,8

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 2016, 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	253	0,3	1.030	1,3	5.783	7,5	23.766	30,7	37.850	48,9	8.741	11,3	77.423
Unicomp	31	0,3	339	3,4	1.892	18,9	4.112	41,1	3.026	30,3	603	6,0	10.003
Revision	26	0,4	157	2,6	627	10,5	1.828	30,5	2.624	43,8	731	12,2	5.993
Prosthesis removal	15	1,1	41	3,0	153	11,4	447	33,2	544	40,4	148	11,0	1.348
Patella only	7	0,9	19	2,4	63	8,0	222	28,3	393	50,1	80	10,2	784
Total*	**332**	**0,3**	**1.586**	**1,7**	**8.518**	**8,9**	**30.375**	**31,8**	**44.437**	**46,5**	**10.303**	**10,8**	**95.551**

*8 missing data (0,01%)

Mean age at surgery, according to type of operation - years 2000-2016

Type of operation	Mean age	Range
Primary bi/tricompartmental	70,6	13–96
Primary unicompartmental	66,1	23-92
Revision	69,6	18-92
Total	**70,0**	**13-96**

Mean age at surgery, according to type of operation - years 2001-2016

Type of operation	Year 2001		Year 2016	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental°	71,3	23-92	70,5	26-92
Primary unicompartmental*	69,1	45-87	66,7	28-91
Revision^	71,8	26-87	69,1	30-88

° statistically different (t-test, p<0,001)
* statistically different (t-test, p<0,001)
^ statistically different (t-test, p<0,01)

Mean age at surgery, according to type of operation - years 2000-2016 - according to **private or public hospital**

Type of operation	Public		Private	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental*	71,0	13-92	70,4	20-96
Primary unicompartmental^	67,1	23-89	65,5	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 2016, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Bi/tricompartmental	22.414	23,5	55.016	57,6	77.430
Unicompartmental	3.407	3,6	6.597	6,9	10.004
Revision	1.645	1,7	4.348	4,6	5.993
Prosthesis removal	516	0,5	832	0,9	1.348
Patella only	205	0,2	579	0,6	784
Total	**28.187**	**29,5**	**67.372**	**70,5**	**95.559**

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	51,2	56,5
Left	48,8	43,5

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

12.4 Bilateral arthroplasty

In the period of registry observation (17 years), 14.191 patients underwent bilateral operations.
11.870 (83,6%) chose to undergo the second operation at the same hospital from where the first one was performed.
754 (5,3%) chose to undergo the second operation at a different hospital from where the first one was performed to follow the surgeon.
1.567 (11,0%) 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 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 2016, according to **diagnosis**

Diagnosis in unicompartimental knee prosthesis	Number	Percentage
Primary arthritis	8.415	84,4
Deformity	710	7,1
Necrosis of the condyle	516	5,2
Post-traumatic arthritis	93	0,9
Post-traumatic necrosis	77	0,8
Sequelae of fracture	63	0,6
Idiopathic necrosis	34	0,3
Rheumatic arthritis	16	0,2
Post meniscectomy	12	0,1
Sequelae of osteotomy	11	0,1
Other	24	0,2
Total*	**9.971**	**100,0**

*33 missing data (0,3%)

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 2016, according to **diagnosis**.

Diagnosis in bi/tricompartmental knee prosthesis	Number	Percentage
Primary arthritis	65.808	85,3
Deformity	6.542	8,5
Post-traumatic arthritis	1.204	1,6
Rheumatic arthritis	1.047	1,4
Sequelae of fracture	1.015	1,3
Necrosis of the condyle	517	0,7
Sequelae of osteotomy	431	0,6
Post-traumatic necrosis	101	0,1
Sequelae of septic arthritis	77	0,1
Sequelae of poliomyelitis	60	0,1
Idiopathic necrosis	41	0,1
Post meniscectomy	36	0,05
Chondrocalcinosis	26	0,03
Tumor	18	0,02
Paget disease	14	0,02
Other	226	0,3
Total*	**77.163**	**100,0**

*267 missing data (0,3%)

12.7 Reasons for revisions and removal

Number of **revision operations** carried out on patients admitted between 1st July 2000 and 31st December 2016, 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	2.378	40,1
Two steps prosthesis removal	1.115	18,8
Aseptic loosening of tibial component	565	9,5
Pain without loosening	552	9,3
Insert wear	237	4,0
Aseptic loosening of femoral component	160	2,7
Septic loosening	152	2,6
Prosthesis dislocation	120	2,0
Instability	104	1,8
Periprosthetic bone fracture	95	1,6
Stiffness	61	1,0
Progression of disease	43	0,7
Breakage of prosthesis	35	0,6
Other	311	5,2
Total*	**5.928**	**100,0**

*65 missing data (1,1%)

Number of **prosthesis removal** carried out on patients admitted between 1st July 2000 and 31st December 2016, according to **diagnosis**.

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

Diagnosi negli espianti	Number	Percentage
Septic loosening	1.164	88,2
Total aseptic loosening	79	6,0
Early infection	21	1,6
Pain without loosening	13	1,0
Aseptic loosening of tibial component	12	0,9
Periprosthetic bone fracture	8	0,6
Prosthesis dislocation	6	0,5
Other	16	1,2
Total*	**1.319**	**100,0**

*29 missing data (2,2%)

13. Types of knee prosthesis

13.1 Unicompartmental prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2016, primary unicompartmental surgery.
All poly tibial components in **bold.**

Type of Prosthesis	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
JOURNEY UNI - Smith & Nephew	-	-	183	8,7	462	20,5
UNI SIGMA HP - De Puy Johnson & Johnson	59	1,0	342	16,3	415	18,4
ZIMMER UNI - Zimmer	471	8,3	309	14,7	361	16,0
GENESIS UNI - Smith & Nephew	771	13,6	252	12,0	148	6,6
GKS - ONE - ALL POLY - Permedica	141	2,5	116	5,5	109	4,8
MITUS - ENDO-MODEL UNI - ALL POLY - Link	342	6,0	61	2,9	94	4,2
RESTORIS MCK UNI - Mako	-	-	-	-	88	3,9
JOURNEY UNI - ALL POLY - Smith & Nephew	28	0,5	212	10,1	75	3,3
UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	5	0,1	76	3,6	71	3,2
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	1.192	21,1	162	7,7	51	2,3
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	-	-	-	-	49	2,2
ALLEGRETTO UNI - Protek-Sulzer	268	4,7	48	2,3	45	2,0
GKS - ONE - Permedica	-	-	14	0,7	42	1,9
HERMES UNI - Ceraver	-	-	-	-	37	1,6
GENUS UNI - Adler	-	-	31	1,5	33	1,5
UNIVATION F - B.Braun	5	0,1	-	-	33	1,5
IBALANCE UNI - Arthrex	-	-	5	0,2	24	1,1
BALANSYS - UNI - Mathys	79	1,4	61	2,9	22	1,0
TRIATHLON - PKR - Howmedica Osteonics	16	0,3	10	0,5	21	0,9
GENUS UNI - ALL POLY - Adler	-	-	8	0,4	14	0,6
VANGUARD - M PARTIAL KNEE - Biomet Orthopedics	-	-	1	0,05	13	0,6
GENESIS UNI - ALL POLY - Smith & Nephew	168	3,0	126	6,0	10	0,4
ACS UNI - Implantcast		-	11	0,5	5	0,2
OPTETRAK - UNI - ALL POLY - Exactech	171	3,0	1	0,05	4	0,2
HLS - UNI EVOLUTION - ALL POLY - Tornier	153	2,7	1	0,05	2	0,1
UC-PLUS SOLUTION - ALL POLY - Endoplus	112	2,0	32	1,5	-	-
EFDIOS - Citieffe	463	8,2	14	0,7	-	-
GKS - ONE - CUSTOM MADE - Permedica	12	0,2	12	0,6	-	-
PRESERVATION UNI - ALL POLY - Depuy	379	6,7	-	-	-	-
UC-PLUS SOLUTION - Endoplus	243	4,3	-	-	-	-
MILLER GALANTE UNI - Zimmer	179	3,2	-	-	-	-
MAIOR - Finceramica	154	2,7	-	-	-	-
EIUS UNI - ALL POLY - Stryker Howmedica	59	1,0	-	-	-	-
PFC - UNI - De Puy Johnson & Johnson	56	1,0	-	-	-	-
PRESERVATION UNI - Depuy	27	0,5	-	-	-	-
UNICIA - VECTEUR ORTHOPEDIC - Stratec	27	0,5	-	-	-	-
OPTETRAK - ARTHROFOCUS - Exactech	10	0,2	-	-	-	-
Other (<10 cases)	45	0,8	7	0,3	23	1,0
Unknown	21	0,4	-	-	2	0,1
Total	**5.656**	**100,0**	**2.095**	**100,0**	**2.253**	**100,0**

13.2 Bi-tricompartmental knee prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2016, primary bi/tricompartmental surgery.

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).

Type of Prosthesis	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
ATTUNE – DePuy	-	-	132	0,8	2.479	13,2
NEXGEN – Zimmer	10.074	24,4	2.818	16,2	2.145	11,5
LEGION - Smith & Nephew	17	0,0	228	1,3	1.896	10,1
GENESIS - Smith & Nephew	2.504	6,1	1.986	11,4	1.766	9,4
VANGUARD – Biomet Merck France	2.218	5,4	2.303	13,2	1.690	9,0
P.F.C – DePuy	3.470	8,4	2.349	13,5	907	4,8
PERSONA - Zimmer	-	-	169	1,0	898	4,8
TRIATHLON – Stryker Howmedica Osteonics	563	1,4	873	5,0	831	4,4
GEMINI - Link	1.398	3,4	809	4,7	737	3,9
OPTETRACK – Exactech	1.071	2,6	151	0,9	560	3,0
GENUS – Adler-Ortho	631	1,5	647	3,7	556	3,0
TC-PLUS - SOLUTION - Smith & Nephew	1.435	3,5	1.092	6,3	512	2,7
ACS - Implantcast	-	-	40	0,2	478	2,6
GSP - TREKKING - Samo	362	0,9	466	2,7	476	2,5
G.K.S. – Permedica	457	1,1	431	2,5	344	1,8
PHYSICA - Lima	-	-	-	-	323	1,7
BALANSYS - Mathys	298	0,7	417	2,4	296	1,6
INNEX - Protek Sulzer	74	0,2	264	1,5	273	1,5
JOURNEY – Smith & Nephew	204	0,5	68	0,4	214	1,1
APEX - Omnilife Science	-	-	181	1,0	186	1,0
COLUMBUS - B.Braun	242	0,6	98	0,6	180	1,0
SCORPIO – Stryker Howmedica	2.381	5,8	257	1,5	152	0,8
ADVANCE - Wright	731	1,8	196	1,1	122	0,7
GMK - Medacta	7	0,0	86	0,5	110	0,6
ENDO-MODEL - Link	302	0,7	54	0,3	65	0,3
SIGMA RP - TC3 - DePuy	42	0,1	44	0,3	54	0,3
RT-PLUS - Smith & Nephew	121	0,3	79	0,5	46	0,2
GENIUS TRICCC - Dedienne Sante	587	1,4	59	0,3	39	0,2
LCS – DePuy	840	2,0	98	0,6	32	0,2
PROFIX – Smith & Nephew	4.849	11,7	255	1,5	32	0,2
FIRST - Symbios Orthopedie SA	563	1,4	399	2,3	31	0,2
ROTAGLIDE – Corin Medical	726	1,8	102	0,6	28	0,1
MULTIGEN - Lima	417	1,0	22	0,1	9	0,0
SCORE – Amplitude	580	1,4	-	-	5	0,0
HLS – Tornier	319	0,8	67	0,4	2	0,0
E.MOTION - B.Braun	160	0,4	21	0,1	-	-
AGC - Biomet Merck France	589	1,4	4	0,0	-	-
INTERAX - Stryker Howmedica	737	1,8	-	-	-	-
T.A.C.K. – Link	634	1,5	-	-	-	-
913 – Wright Cremascoli	357	0,9	-	-	-	-
PERFORMANCE – Kirschner Biomet	279	0,7	-	-	-	-

Merck						
DURACON – Stryker Howmedica	267	0,6	-	-	-	-
CONTINUUM KNEE SYSTEM – Stratec Medical	166	0,4	-	-	-	-
RO.C.C. – Biomet Merck France	163	0,4	-	-	-	-
CINETIQUE - Medacta	100	0,2	-	-	-	-
Other (<100 cases)	318	0,8	119	0,7	248	1,3
Unknown	57	0,1	6	0,0	8	0,0
Total	**41.310**	**100,0**	**17.390**	**100,0**	**18.730**	**100,0**

13.3 Revision prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2016, in total revision surgery.

Type of Prosthesis	2000-2010		2011-2013		2014-2016	
	N.	%	N.	%	N.	%
LEGION - Smith & Nephew	70	2,8	182	15,0	326	26,6
NEXGEN – Zimmer	712	28,6	289	23,8	239	19,5
SIGMA RP - TC3 - DePuy	73	2,9	134	11,0	97	7,9
ENDO-MODEL - Link	241	9,7	97	8,0	95	7,7
P.F.C – DePuy	206	8,3	71	5,8	75	6,1
GENESIS - Smith & Nephew	82	3,3	71	5,8	57	4,6
TRIATHLON – Stryker Howmedica Osteonics	15	0,6	20	1,6	46	3,7
ACS - Implantcast	3	0,1	13	1,1	36	2,9
RT-PLUS - Smith & Nephew	174	7,0	70	5,8	35	2,9
ATTUNE – DePuy	-	-	-	-	28	2,3
G.K.S. – Permedica	71	2,9	47	3,9	24	2,0
VANGUARD – Biomet Merck France	57	2,3	38	3,1	23	1,9
GSP - TREKKING - Samo	1	0,0	18	1,5	22	1,8
DURATION - Osteonics	97	3,9	14	1,2	20	1,6
OPTETRACK – Exactech	79	3,2	11	0,9	16	1,3
GEMINI - Link	15	0,6	12	1,0	10	0,8
LPS - HINGE - DePuy	-	-	21	1,7	9	0,7
COLUMBUS - B.Braun	2	0,1	3	0,2	9	0,7
MUTARS - Implantcast	4	0,2	6	0,5	7	0,6
BALANSYS - Mathys	9	0,4	13	1,1	5	0,4
SCORPIO – Stryker Howmedica	79	3,2	10	0,8	5	0,4
TC-PLUS - SOLUTION - Smith & Nephew	28	1,1	7	0,6	2	0,2
FIRST - Symbios Orthopedie SA	10	0,4	10	0,8	1	0,1
S-ROM NRH - JOHNSON & JOHNSON	35	1,4	12	1,0	-	-
E.MOTION - B.Braun	18	0,7	6	0,5	-	-
AGC - Biomet Merck France	124	5,0	3	0,2	-	-
PROFIX – Smith & Nephew	118	4,7	3	0,2	-	-
ADVANCE - Wright	14	0,6	2	0,2	-	-
LCS – DePuy	9	0,4	2	0,2	-	-
INTERAX - Stryker Howmedica	35	1,4	-	-	-	-
DURACON – Stryker Howmedica	18	0,7	-	-	-	-
GENIUS TRICCC - Dedienne Sante	12	0,5	-	-	-	-
Other (<10 cases)	63	2,5	29	2,4	36	2,9
Unknown	13	0,5	1	0,1	4	0,3
Total	**2.487**	**100,0**	**1.215**	**100,0**	**1.227**	**100,0**

13.4 Prosthesis fixation

Number of knee prosthesis arthroplasty performed on patients admitted to hospital between 1st July 2000 and 31st December 2016, according to **prosthesis fixation**

Fixation	Primary unicomp.		Primary bi/tricomp.		Total revision		Total	
	N.	%	N.	%	N.	%	N.	%
Cemented	9.305	93,1	71.777	92,7	4.841	98,4	85.923	93,1
Cementless	514	5,1	3.401	4,4	46	0,9	3.961	4,3
Femur cementless + Tibia cemented	158	1,6	1.636	2,1	19	0,4	1.813	2,0
Femur cemented + Tibia cementless	13	0,1	577	0,7	13	0,3	603	0,7
Total*	**9.990**	**100,0**	**77.391**	**100,0**	**4.919**	**100,0**	**92.300**	**100,0**

*63 missing data (0,1%)

Prosthesis fixation according to year of operation

Years of operation	% Cemented	% Cementless	% Cemented Tibia	% Cemented Femur
2001	82,7	7,9	8,7	0,7
2002	79,9	9,0	10,7	0,4
2003	83,5	7,6	8,5	0,4
2004	88,0	7,4	4,0	0,6
2005	89,9	6,2	3,3	0,6
2006	90,7	5,3	3,6	0,4
2007	91,1	4,5	3,1	1,3
2008	91,2	4,2	2,2	2,4
2009	91,5	4,5	1,5	2,5
2010	93,5	4,5	0,9	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	97,8	2,0	0,2	0,0
2016	97,6	2,2	0,2	0,0

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	47,9	50,1	2,0
2002	51,8	45,7	2,5
2003	46,3	51,4	2,3
2004	45,7	52,6	1,7
2005	42,6	55,9	1,5
2006	40,5	57,8	1,7
2007	40,8	57,2	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	49,0	2,0
2012	44,4	53,5	2,1
2013	40,9	56,1	3,0
2014	35,2	61,5	3,3
2015	36,2	60,9	2,9
2016	34,2	62,9	2,8

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

Years of operation	% fixed insert	% mobile insert
2001	73,9	26,1
2002	72,1	27,9
2003	69,7	30,3
2004	67,9	32,1
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	55,4	44,6
2012	58,9	41,1
2013	64,4	35,6
2014	73,4	26,6
2015	75,6	24,4
2016	77,8	22,2

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

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

Between 1st July 2000 and 31st December 2016, 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.

Cement	%
Surgical Simplex P - Howmedica	19,7
Antibiotic Simplex - Howmedica	**14,8**
Palacos R - Heraeus Medical	10,5
Palacos R+G - Heraeus Medical	**8,7**
Hi-Fatigue G - Zimmer	**5,4**
Hi-Fatigue - Zimmer	3,1
Osteobond - Zimmer	2,9
Versabond - Smith&Nephew	2,9
Versabond AB - Smith&Nephew	**2,6**
Aminofix 1 - Groupe Lepine	**2,1**
Cemex System - Tecres	2,0
Palamed G - Heraeus Medical	**2,0**
Palamed - Heraeus Medical	1,7
Cemex Genta System - Tecres	**1,7**
Smartset GHV - Depuy	**1,5**
Refobacin Bone Cement R - Biomet	**1,5**
Smartset MV - Depuy	1,4
Palacos R - Biomet	1,4
Refobacin Revision - Biomet	**1,2**
Cemex - Tecres	1,0
Smartset HV - Depuy	1,0
Other bone cement loaded with antibiotic	**5,5**
Other bone cement without antibiotic	5,2
Total	**100,0**

Bone cement loaded with antibiotic is used in 47,1% 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 2016

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Tibial fracture	8	*0,1*	Early infection	4	*0,04*
Femoral fracture	7	*0,1*			
Anaesthesiologic	2	*0,02*			
Tibial tuberosity fracture	1	*0,01*			
Ligament lesion	1	*0,01*	Deep venous thrombosis	6	*0,06*
Other	6	*0,1*			
Total	**25**	***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 2016

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Femoral fracture	67	0,1	Deep venous thrombosis	126	*0,2*
Ligament lesion	35	0,05			
Tibial fracture	34	0,04			
Rupture patellar tendon	32	0,04			
Anaesthesiologic	28	0,04			
Hemorragia	24	0,03	Early infection	35	*0,05*
Vascular lesion	13	0,02			
Tibial tuberosity fracture	7	0,01			
Other	33	0,04			
Total	**273**	**0,4**	**Total**	**161**	***0,2***

The rate of complications in **revision surgery** carried out on patients hospitalized between July 1st 2000 and December 31st 2016

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Tibial fracture	23	0,4	Early infection	14	*0,2*
Femoral fracture	22	0,4			
Rupture patellar tendon	18	0,3			
Anaesthesiologic	8	0,1			
Tibial tuberosity fracture	8	0,1	Deep venous thrombosis	6	*0,1*
Ligament lesion	1	0,02			
Other	13	0,2			
Total	**93**	**1,6**	**Total**	**20**	***0,3***

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 2016.

Registered deaths occurred during hospitalization.

Type of operation			
Type of operation	**Deaths**	**Number of surgery**	**Percentage**
Primary bi/tricompartmental	62	77.430	0,08
Primary unicompartmental	1	10.004	0,01
Revision	8	5.993	0,13
Prosthesis removal	3	1.348	0,22

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 2016 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: 49.880
Non revised: 48.185
Revised: 1.695

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

VARIABLE	SIGNIFICANCE (p)
Gender (Males vs females)	**S** (0,006)
Age (less than 60 yrs vs more than 60 yrs)	**S** (0,001)
Diagnosis (arthrosis vs other)	**NS** (0,1452)
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 (reference: more than 60 yrs)	2,25	1,97	2,56	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 (reference: fixed)	1,3	1,1	1,4	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 (reference: females)	1.16	1,04	1,28	0,006

Unicompartmental

All primary unicompartmental knee arthroplasties performed in the Region between July 2000 and December 2016 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 (reference: more than 60 yrs)	1,6	1,3	1,95	0,001

Other variables do not influence the risk (Gender p=0,08; Type of tibial component p=0,89)

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	40.231	744	574	90	6,3	1.408/40.231
Primary tricompartmental	9.649	196	76	15	5,2	287/9.649
Primary unicompartmental	5.894	296	220	34	6,6	550/5.894
Total revision	2.640	189	109	14	5,4	312/2.640

In Primary knee arthroplasties, **44,9%** of Revisions was performed in a different hospital.

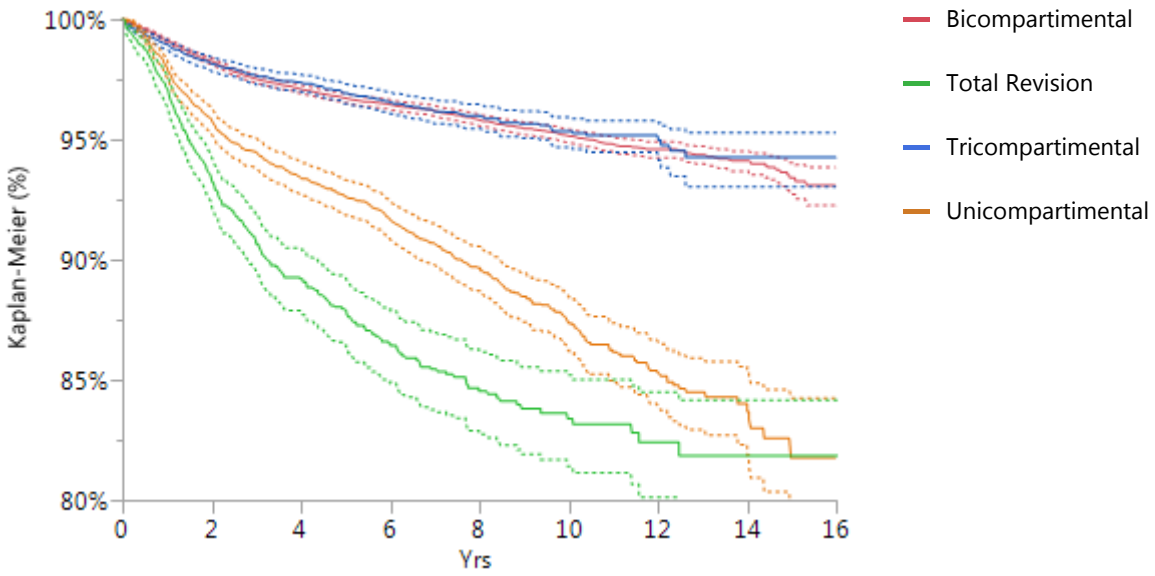
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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	40.231	1.149	169	90	1.408/40.231	93,1 (92,3-93,8)
Primary tricompartmental	9.649	215	57	15	287/9.649	94,3 (93,0-95,3)
Primary unicompartmental	5.894	502	14	34	550/5.894	81,8 (79,0-84,2)
Total revision	2.640	248	50	14	312/2.640	81,8 (79,3-84,1)

Survival curve



Survivorship of unicompartmental prostheses is significantly different at 13 years follow-up 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	**211**/5.894	3,6	38,4
Pain without loosening	**108**/5.894	1,8	19,6
Tibial aseptic loosening	**69**/5.894	1,2	12,5
Septic loosening	**41**/5.894	0,7	7,5
Femoral aseptic loosening	**18**/5.894	0,3	3,3
Insert wear	**14**/5.894	0,2	2,5
Breakage of prosthesis	**12**/5.894	0,2	2,2
Dislocation	**10**/5.894	0,2	1,8
Bone fracture	**5**/5.894	0,1	0,9
Instability	**2**/5.894	0,0	0,4
Other	**9**/5.894	0,2	1,6
Unknown *(34 performed outside region)*	**51**/5.894	0,9	9,3
Total	**550/5.894**	**9,3**	**100,0**

Primary bi-tricompartmental

Cause of revision	Rate	Percentage	% distribut. of failure causes
Total aseptic loosening	**484**/49.880	1,0	28,6
Septic loosening	**400**/49.880	0,8	23,6
Pain without loosening	**164**/49.880	0,3	9,7
Tibial aseptic loosening	**157**/49.880	0,3	9,3
Dislocation	**56**/49.880	0,1	3,3
Insert wear	**48**/49.880	0,1	2,8
Femoral aseptic loosening	**39**/49.880	0,1	2,3
Bone fracture	**36**/49.880	0,1	2,1
Instability	**35**/49.880	0,1	2,1
Stiffness	**27**/49.880	0,1	1,6
Breakage of prosthesis	**16**/49.880	0,0	0,9
Other	**56**/49.880	0,1	3,3
Unknown *(105 performed outside region)*	**177**/49.880	0,4	10,4
Total	**1.695/49.880**	**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

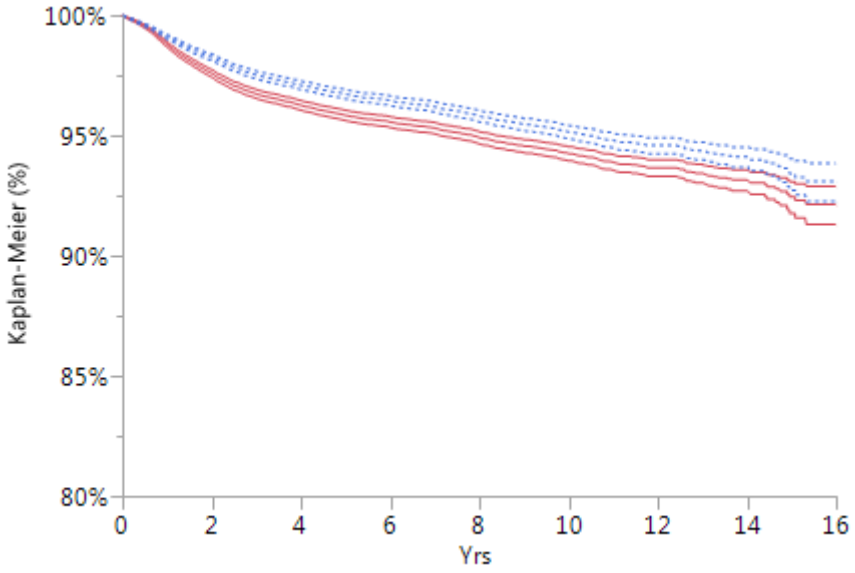
Total revision

Cause of second revision	Rate	Percentage	% distribut. of failure causes
Septic loosening	**100**/2.640	3,8	32,1
Total aseptic loosening	**77**/2.640	2,9	24,7
Tibial aseptic loosening	**33**/2.640	1,3	10,6
Pain without loosening	**21**/2.640	0,8	6,7
Dislocation	**11**/2.640	0,4	3,5
Femoral aseptic loosening	**8**/2.640	0,3	2,6
Insert wear	**7**/2.640	0,3	2,2
Instability	**5**/2.640	0,2	1,6
Stiffness	**5**/2.640	0,2	1,6
Breakage of prosthesis	**5**/2.640	0,2	1,6
Periprosthetic bone fracture	**3**/2.640	0,1	1,0
Other	**8**/2.640	0,3	2,6
Unknown *(14 performed outside region)*	**29**/2.640	1,1	9,3
Total	**312/2640**	**11,8**	**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 395 cases (out 40.231 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 1,8-2,1).
These 395 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 16 yrs is 92,1% (91,3-92,9) and 93,1%(92,3-93,8) respectively.
15,4% of the 395 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	C.I. at 95%	% survival at 10	C.I. at 95%
OXFORD UNICOMPARTIMENTAL PHASE 3 - Biomet Merck	2000	861	126	90,7	88,6-92,5	85,5	82,8-87,9
ZIMMER UNI - Zimmer	2005	672	30	94,7	92,1-96,5	90,6	84,8-94,4
GENESIS UNI - Smith & Nephew	2000	666	64	92,7	90,4-94,4	87,4	83,6-90,4
UNI SIGMA HP - DePuy	2009	474	16	95,0	91,7-97,0	-	-
MITUS - ENDO-MODEL UNI – ALL POLY - Link	2003	325	33	91,9	87,9-94,6	87,5	82,5-91,2
EFDIOS - Citieffe	2000	314	47	92,7	89,2-95,2	84,0	78,9-88,1
ALLEGRETTO UNI - Protek-Sulzer	2000	266	29	92,4	88,3-95,2	89,6	84,8-93,1
JOURNEY UNI - Smith & Nephew	2011	261	9	-	-	-	-
JOURNEY UNI - ALL POLY - Smith & Nephew	2010	227	10	95,4	90,9-97,7	-	-
GKS - ONE – ALL POLY Permedica	2006	209	17	92,5	87,4-95,6	-	-
PRESERVATION UNI – ALL POLY - DePuy	2002	187	22	91,7	86,8-95,0	88,0	82,2-92,1
UC-PLUS SOLUTION - Smith & Nephew	2000	176	10	97,7	94,0-99,1	95,1	90,5-97,5
HLS - UNI EVOLUTION - ALL POLY - Tornier	2001	144	12	94,9	89,6-97,5	91,1	84,9-94,9
UC-PLUS SOLUTION – ALL POLY - Smith & Nephew	2003	140	21	88,3	81,7-92,7	-	-
OPTETRAK UNI – ALL POLY -Exactech	2005	129	4	98,4	93,9-99,6	-	-
MILLER GALANTE UNI - Zimmer	2001	118	10	95,7	90,1-98,2	92,8	86,3-96,4
BALANSYS - UNI - MATHYS	2005	106	13	86,4	77,8-92,0	-	-
Other (<100 cases)	2000	599	76	87,7	84,3-90,5	77,4	71,3-82,5
Unknown	2001	20	1	-	-	-	-
Total	**2000**	**5894**	**550**	**92,6**	**91,8-93,3**	**87,4**	**86,2-88,5**

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	C.I. at 95%	% survival at 10	C.I. at 95%
NEXGEN - LPS - FLEX FISSO - Zimmer	2002	5.392	109	98,1	97,7-98,5	97,1	96,3-97,7
GENESIS II - PS HIGH FLEXION - Smith & Nephew	2004	2.837	45	98,0	97,3-98,6	97,5	96,2-98,3
VANGUARD - PS - Biomet Orthopedics	2005	2.582	50	97,8	97,0-98,3	96,6	94,6-97,8
GEMINI MK II – Link	2002	2.173	61	97,4	96,5-98,0	95,3	93,7-96,6
TC-PLUS - SB SOLUTION - Endoplus	2002	2.073	43	97,9	97,1-98,5	96,5	94,8-97,7
PROFIX - CONFORMING - Smith & Nephew	2000	2.035	82	96,9	96,0-97,6	95,7	94,6-96,5
NEXGEN - LPS - Zimmer	2000	2.006	85	97,4	96,6-98,0	95,9	94,8-96,7
PFC - RP - PS - De Puy Johnson & Johnson	2000	1.732	69	96,5	95,5-97,3	95,2	93,8-96,3
NEXGEN - CR FLEX FISSO - Zimmer	2004	1.319	29	97,5	96,3-98,3	96,1	93,5-97,7
TRIATHLON - CR - Howmedica Osteonics	2005	1.131	18	98,3	97,2-99,0	-	-
GENESIS II - C R - Smith & Nephew	2001	1.070	34	96,7	95,3-97,7	95,6	93,7-97,0
LEGION - PS XLPE HIGH FLEXION - Smith & Nephew	2011	1.070	20	-	-	-	-
GENUS PE - Adler-Ortho	2008	918	26	97,1	95,7-98,0	-	-
ATTUNE - PS FIXED – De Puy Johnson & Johnson	2012	872	13	-	-	-	-
NEXGEN - LPS - FLEX MOBILE - Zimmer	2002	837	33	96,4	94,8-97,6	95,2	93,1-96,7
VANGUARD - CR-LIPPED - Biomet Orthopedics	2006	790	24	96,5	94,8-97,7	-	-
FIRST - Symbios Orthopedie	2006	649	31	95,5	93,5-96,9	-	-
ROTAGLIDE - Corin Medical	2000	637	68	92,3	89,8-94,1	89,3	86,3-91,7
PFC - PS - De Puy J.&J.	2000	599	30	95,4	93,3-96,9	92,8	89,4-95,2
GENIUS TRICCC - Dedienne Sante	2000	598	54	93,6	91,2-95,3	89,7	86,6-92,1
PROFIX - P S - Smith & Nep.	2002	589	18	97,4	95,7-98,4	96,8	94,9-98,0
ADVANCE Medial Pivot - Wright	2000	586	20	96,5	94,6-97,8	96,3	94,3-97,6
PFC - RP - CVD - De Puy Johnson & Johnson	2001	579	27	95,7	93,5-97,2	93,7	90,7-95,8
SCORPIO - NRG - PS – Howmedica Osteonics	2004	550	28	95,6	93,4-97,0	93,9	91,1-95,9
SCORPIO - NRG - CR - Howmedica Osteonics	2007	530	17	95,7	93,2-97,4	-	-
T.A.C.K. - Link	2000	530	56	93,6	91,1-95,4	90,7	87,8-93,0
PERSONA - PS- Zimmer	2013	499	6	-	-	-	-
LCS - UNIVERSAL - RP - De Puy Johnson &	2000	487	20	96,4	94,4-97,8	96,2	94,1-97,6

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

Johnson							
INNEX - MOBILE BEARING - UCOR - Protek Sulzer	2002	450	11	97,1	94,6-98,4	-	-
PFC - SIGMA RPF - De Puy Johnson & Johnson	2005	449	20	95,8	93,4-97,3	94,8	91,9-96,7
SCORE - Amplitude	2004	437	12	98,1	96,3-99,1	96,6	93,9-98,2
OPTETRAK - RBK - HI-FLEX - Exactech	2006	399	12	96,9	94,7-98,2	96,9	94,7-98,2
ATTUNE - PS MOBILE - De Puy Johnson & Johnson	2014	397	2	-	-	-	-
GENESIS II - MOBILE BEARING - Smith & Nephew	2001	359	12	97,1	94,8-98,5	95,2	90,8-97,6
TRIATHLON - PS - Howmedica Osteonics	2007	349	4	98,4	95,7-99,4	-	-
PFC - CVD - De Puy J.&J.	2000	329	8	98,0	95,6-99,1	98,0	95,6-99,1
OPTETRAK - LOGIC PS - Exactech	2011	327	6	-	-	-	-
BALANSYS - MOBILE BEARING - Mathys	2005	315	6	97,6	94,8-98,9	-	-
LCS - COMPLETE - RP - De Puy Johnson & Johnson	2004	301	13	95,8	92,8-97,6	95,3	92,1-97,3
Other (<300 cases)	2000	9.937	468	95,6	95,1-96,0	93,4	92,8-94,0
Unknown	2000	161	5	98,7	94,9-99,7	96,1	90,9-98,4
Total	**2000**	**49.880**	**1695**	**96,8**	**96,6-96,9**	95,2	94,9-95,4

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

PART THREE: SHOULDER PROSTHESIS

July 2008 – December 2016

16. RIPO capture

16.1 Capture for RIPO

Percentage of R.I.P.O. capture calculated versus Discharge Records (S.D.O.) was **98,1** in 2016. 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

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 2016, according to **type of operation**

Type of operation	Number of operation	Percentage
Reverse prosthesis	3.683	64,7
Hemiarthroplasty	835	14,7
Anatomical prosthesis	420	7,4
Revisions	359	6,3
Stemless emi	124	2,2
Resurfacing**	122	2,1
Prosthesis removal	78	1,4
Anatomical Stemless	30	0,5
Reverse Stemless	8	0,1
Other*	31	0,5
Total	**5.690**	**100,0**

*7 interposition prostheses and 5 osteomyelitis spacers
**110 resurfacing and 12 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 2016, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Reverse prosthesis	843	22,9	2.840	77,1	3.683
Hemiarthroplasty	249	29,8	586	70,2	835
Anatomical prosthesis	183	43,6	237	56,4	420
Revisions	140	39,0	219	61,0	359
Stemless emi	56	45,2	68	54,8	124
Resurfacing	74	60,7	48	39,3	122
Prosthesis removal	36	46,2	42	53,8	78
Anatomical Stemless	14	46,7	16	53,3	30
Reverse Stemless	2	25,0	6	75,0	8
Total	**1.597**	**28,2**	**4.062**	**71,8**	**5.659**

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	72,0	34-92	74,0	31-100
Hemiarthroplasty	59,8	15-92	72,8	32-98
Anatomical prosthesis	61,1	33-80	65,5	30-101
Revisions	64,6	26-89	69,3	43-86
Stemless emi	55,8	26-77	64,0	33-86
Resurfacing	50,8	24-80	56,8	21-80
Prosthesis removal	64,3	26-89	71,6	51-87
Anatomical Stemless	57,8	38-74	67,0	53-80
Reverse Stemless	69,2	67-71	77,3	72-82

18.3 Pathologies

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

Diagnosis	Total reverse arthroplasty	
	N.	%
Eccentric osteoarthritis	1.924	52,2
Fracture	713	19,4
Concentric osteoarthritis	538	14,6
Cuff arthropathy	101	2,7
Necrosis	91	2,5
Sequelae of fracture	88	2,4
Non specified osteoarthritis	68	1,8
Inveterate dislocation	35	1,0
Rheumatic arthritis	32	0,9
Fracture+Dislocation	12	0,3
Post-traumatic necrosis	11	0,3
Post-traumatic arthritis	10	0,3
Recurrent dislocation	9	0,2
Pain	3	0,1
Sequelae of septic arthritis	3	0,1
Other	18	0,5
Unknown	27	0,7
Total	**3.683**	**100,0**

Diagnosis	Total anatomical prosthesis	
	N.	%
Concentric osteoarthritis	338	80,5
Necrosis	26	6,2
Eccentric osteoarthritis	23	5,5
Sequelae of fracture	9	2,1
Rheumatic arthritis	7	1,7
Non specified osteoarthritis	6	1,4
Fracture	5	1,2
Post-traumatic arthritis	2	0,5
Synovial chondromatosis	1	0,2
Unknown	3	0,7
Total	**420**	**100,0**

Diagnosis	Hemiarthroplasty	
	N.	%
Fracture	527	63,1
Concentric osteoarthritis	83	9,9
Eccentric osteoarthritis	69	8,3
Necrosis	58	6,9
Sequelae of fracture	38	4,6
Rheumatic arthritis	9	1,1
Inveterate dislocation	9	1,1
Post-traumatic necrosis	5	0,6
Post-traumatic arthritis	4	0,5
Sequelae of septic arthritis	3	0,4

Non specified osteoarthritis	3	0,4
Tumor	3	0,4
Idiopathic homer head Necrosis	2	0,2
Sequelae of spacer in Osteomyelitis	2	0,2
Pathological fracture	2	0,2
Sequelae of spacer in septic arthritis	2	0,2
Recurrent dislocation	1	0,1
Other	10	1,2
Unknown	5	0,6
Total	**835**	**100,0**

Diagnosis	**Resurfacing**	
	N.	**%**
Concentric osteoarthritis	64	52,5
Necrosis	29	23,8
Eccentric osteoarthritis	8	6,6
Sequelae of fracture	3	2,5
Non specified osteoarthritis	3	2,5
Rheumatic arthritis	3	2,5
Fracture	3	2,5
Inveterate dislocation	2	1,6
Cuff arthropathy	1	0,8
idiopathic homer head Necrosis	1	0,8
Other	5	4,1
Total	**122**	**100,0**

Diagnosis	**Stemless emi**	
	N.	**%**
Concentric osteoarthritis	65	52,4
Eccentric osteoarthritis	22	17,7
Necrosis	19	15,3
Sequelae of fracture	5	4,0
Non specified osteoarthritis	3	2,4
Fracture	2	1,6
Steroid-induced necrosis	2	1,6
Post-traumatic necrosis	2	1,6
Recurrent dislocation	1	0,8
Sequelae of septic arthritis	1	0,8
Cuff arthropathy	1	0,8
Unknown	1	0,8
Total	**124**	**100,0**

Diagnosis	**Anatomical Stemless**	
	N.	**%**
Concentric osteoarthritis	21	70,0
Eccentric osteoarthritis	4	13,3
Non specified osteoarthritis	2	6,7
Post-traumatic arthritis	1	3,3
Necrosis	1	3,3
Synovial chondromatosis	1	3,3
Total	**30**	**100,0**

Diagnosis	Stemless reverse	
	N.	%
Eccentric osteoarthritis	6	75,0
Concentric osteoarthritis in sequelae of fracture	1	12,5
Non specified osteoarthritis	1	12,5
Total	**8**	**100,0**

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

Diagnosis	N.	%
Glenoid erosion	80	22,3
Two steps revision	50	13,9
Humeral loosening	41	11,4
Glenoid loosening	35	9,7
Anterior instability	28	7,8
Pain	22	6,1
Superior instability	18	5,0
Dislocation	16	4,5
Other instability	12	3,3
Glenoid and humerale aseptic loosening	9	2,5
Periprosthetic bone fracture	8	2,2
Cuff lesion	7	1,9
Septic loosening	7	1,9
Bone lysis	4	1,1
Total aseptic loosening	3	0,8
Poly wear	3	0,8
Breackage of insert	3	0,8
Other	6	1,7
Unknown	7	1,9
Total	**359**	**100,0**

Type of revision	N.	%
From hemi to reverse	105	29,2
From reverse to reverse	71	19,8
Implant after removal	50	13,9
From anatomic to reverse	31	8,6
From reverse to anatomic CTA	20	5,6
From hemi to anatomic	17	4,7
From hemi to hemi	16	4,5
From resurfacing to reverse	15	4,2
From anatomic to anatomic	6	1,7
From resurfacing to anatomic	3	0,8
From reverse to hemi	2	0,6
Other	11	3,1
Unknown	12	3,3
Total	**359**	**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 2016, according to **surgical approach.**

Type of operation	Deltoid-pectoral	Trans-deltoid	Superior lateral	Other
Reverse prosthesis	3.082	380	46	117
Hemiarthroplasty	798	22	1	6
Anatomical prosthesis	412	3	-	-
Revision	336	14	-	2
Stemless hemi	114	6	1	-
Resurfacing	118	1	-	1
Prosthesis removal	71	2	-	-
Anatomical stemless	29	-	-	-
Reverse stemless	6	1	-	-
Total*	**4.966**	**429**	**48**	**126**

*90 missing data (1.6%)

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

Anaesthesia	N.	%
General	2.582	49,9
Mixed	2.333	45,1
Loco-regional	258	5,0
Total*	**5.173**	**100,0**

*486 missing data (8,6%)

Antithromboembolic prophylaxis

Heparin is used in 82,3% of primary surgery, oral prophylaxis in 3,6% and no prophylaxis in 14,1%,.

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 2016, according to **stem fixation** and **type of operation**

Stem fixation	Anatomical prosthesis	%	Reverse prosthesis	%	Hemiarthroplasty	%
Cemented	34	8,1	731	19,8	302	36,2
Cementless	386	91,9	2.952	80,2	533	63,8
Total	**420**	**100,0**	**3.683**	**100,0**	**835**	**100,0**

20.2 Material, form and fixation of glenoid in Anatomical prosthesis

Material of glenoid	Anatomical prosthesis	%
Metal backed	220	52,4
Polyethylene	200	47,6
Total	**420**	**100,0**

Form of glenoid	Anatomical prosthesis	%
Pegs	285	67,9
Screws	131	31,2
Keel	4	0,9
Total	**420**	**100,0**

Fixation of glenoid	Anatomical prosthesis	%
Cementless	220	52,4
Cemented	200	47,6
Total	**420**	**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 2016, according to the **type of prosthesis**.

Model of prosthesis	Reverse prosthesis		Anatomical prosthesis + Hemiarthroplasty	
	N	%	N	%
DELTA XTEND - Depuy	1.309	35,5	-	-
SMR - Lima	734	19,9	560	44,6
SMR INVERSA HP - Lima	484	13,1	-	-
AEQUALIS REVERSED II - Tornier	270	7,3	-	-
TRABECULAR METAL REVERSE - Zimmer	216	5,9	-	-
AEQUALIS REVERSED - Tornier	192	5,2	-	-
BIGLIANI/FLATOW - Zimmer	-	-	164	13,1
EQUINOXE REVERSE - Exactech	120	3,3	-	-
AEQUALIS ASCEND FLEX - Tornier	-	-	103	8,2
AFFINIS INVERSE - Mathys	88	2,4	-	-
COMPREHENSIVE REVERSE VERSA-DIAL-Biomet	76	2,1	-	-
DUOCENTRIC - Aston Medical	64	1,7	-	-
SMR CTA - Lima	-	-	55	4,4
DELTA XTEND CTA - Depuy	-	-	53	4,2
GLOBAL ADVANTAGE - Depuy	-	-	51	4,1
ANATOMICAL SHOULDER - Zimmer	-	-	46	3,7
RANDELLI – LTO - Lima	-	-	36	2,9
AEQUALIS ASCEND - Tornier	-	-	36	2,9
ANATOMICAL SHOULDER INVERSE/REVERSE - Zimmer	34	0,9	-	-
ANATOMICAL SHOULDER FRACTURE - Zimmer	-	-	32	2,5
DELTA CTA - Depuy	21	0,6	-	-
AEQUALIS - Tornier	-	-	19	1,5
PROMOS REVERSE - Smith&Nephew	17	0,5	-	-
AFFINIS FRACTURE - Mathys	-	-	16	1,3
AGILON - Implantcast	14	0,4	1	0,1
GLOBAL UNITE - Depuy	-	-	13	1,0
AEQUALIS ASCEND FLEX PYC - Tornier	-	-	12	1,0
Other (models < 10 cases)	40	1,1	55	4,4
Unknown	4	0,1	3	0,2
Total	**3.683**	**100,0**	**1.255**	**100,0**

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

Model of prosthesis	Resurfacing	
	N	%
SMR - Lima	50	41,0
EPOCA RH - Synthes	21	17,2
COPELAND - Biomet	17	13,9
GLOBAL CAP – DePuy	14	11,5
PYROTITAN - Ascension Orthopedics	8	6,6
AEQUALIS RESURFACING - Tornier	5	4,1
DUROM SHOULDER - Zimmer	4	3,3
COPELAND TS - Biomet	2	1,6
CAPICA - Implantcast	1	0,8
Total	**122**	**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	26,7	68	54,8	-	-
ECLIPSE - Arthrex	7	23,3	20	16,1	-	-
SIDUS - Zimmer	2	6,7	19	15,3	-	-
AFFINIS SHORT - Mathys	5	16,7	9	7,3	-	-
COMPREHENSIVE VERSA -DIAL- Biomet	-	-	6	4,8	-	-
T.E.S.S. INVERSA - Biomet	-	-	-	-	5	62,5
AFFINIS FRACTURE - Mathys	3	10,0	-	-	-	-
BIGLIANI/FLATOW - Zimmer	3	10,0	-	-	-	-
SMR - Lima	2	6,7	1	0,8	-	-
VERSO - Biomet	-	-	-	-	2	25,0
SMR INVERSA HP - Lima	-	-	-	-	1	12,5
SIMPLICITI - Tornier	-	-	1	0,8	-	-
Total	**30**	**100,0**	**124**	**100,0**	**8**	**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 2016.

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	20	0,5	Dislocation	9	*0,2*
Tendon lesion	2	0,05			
Vascular lesion	1	0,02			
Fracture	29	0,7	Early Infection	-	-
Other	6	0,1			
Total	**58**	***1,4***	**Total**	**9**	***0,2***

The rate of complications in **primary Hemiarthroplasty** carried out on patients hospitalized between July 1st 2000 and December 31st 2016.

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	5	0,6	Early Infection	2	*0,2*
Tendon lesion	2	0,2			
Vascular lesion	1	0,1			
Fracture	10	1,2	Dislocation	-	-
Other	2	0,2			
Total	**20**	**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 and post-operative hospitalization

Year 2016			
Type of operation	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Reverse prosthesis	755	1,4 (0-21)	4,8 (1-63)
Hemiarthroplasty	55	2,9 (0-20)	5,4 (2-24)
Revisions	54	1,0 (0-12)	4,6 (2-22)
Anatomical prosthesis	42	0,3 (0-2)	3,5 (1-9)
Prosthesis removal	15	0,2 (0-2)	5,1 (1-17)

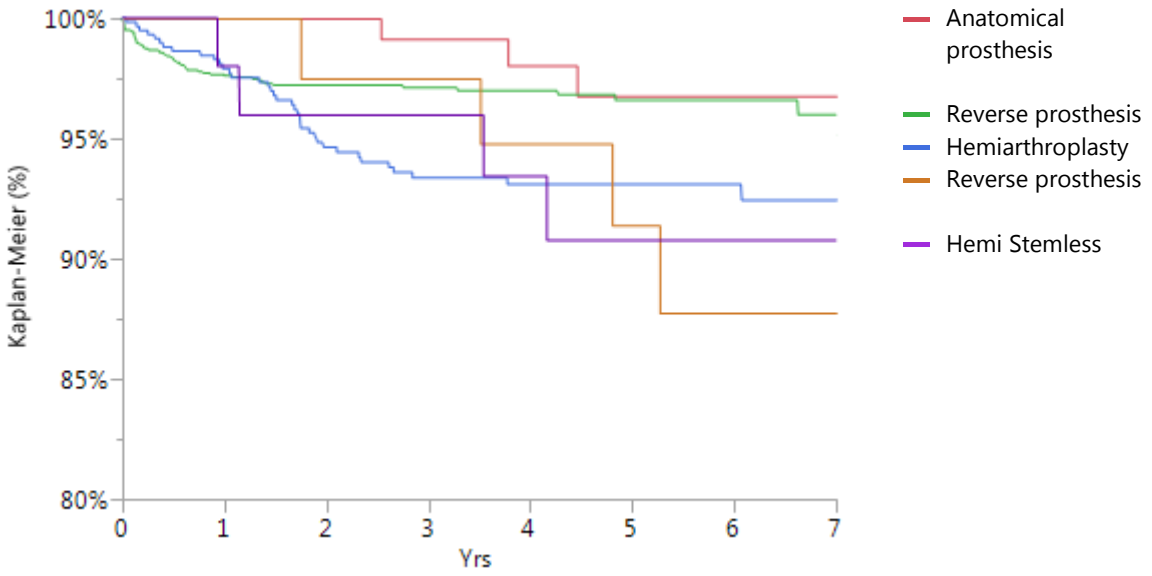
Year 2016			
Type of operation	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Elective	693	0,8 (0-19)	4,4 (1-19)
Emergency	180	3,9 (0-21)	6,3 (2-63)

23. Survival analysis

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.

Analysis was performed on all patients, and not only on the resident in Emilia-Romagna region.

Type of operation	Number of implants	Number of revisions	Mean Follow-up	Survival at 7 yrs (C.I. 95%)	N. at risk at 7 yrs
Anatomical prosthesis	175	3	4,0	96,8 (90,4-99,0)	21
Reverse prosthesis	2.088	59	2,9	95,2 (92,5-97,0)	121
Hemiarthroplasty	602	39	4,2	92,4 (89,5-94,6)	79
Resurfacing	42	4	5,4	87,8 (71,2-95,4)	12
Anatomical Stemless	14	5	-	-	-
Hemi Stemless	52	5	4,8	79,4 (49,9-93,7)	8
Reverse Stemless	5	-	-	-	-



Difference is statistically significant (p=0,0493 Wilcoxon Test).

Survival 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.

Anatomical prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**1**/175	0,6	33,3
Breakage of insert	**1**/175	0,6	33,3
Septic loosening	**1**/175	0,6	33,3
Total	**3/175**	**1,7**	**100,0**
Reverse prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Instability	**17**/2.088	0,8	28,8
Septic loosening	**12**/2.088	0,6	20,3
Glenoid loosening	**10**/2.088	0,5	16,9
Dislocation	**7**/2.088	0,3	11,9
Periprosthetic bone fracture	**2**/2.088	0,1	3,4
Humeral component loosening	**2**/2.088	0,1	3,4
Pain	**1**/2.088	0,0	1,7
Glenoid erosion	**1**/2.088	0,0	1,7
Other	**1**/2.088	0,0	1,7
Unknown *(1 performed outside region)*	**6**/2.088	0,3	10,2
Total	**59/2.088**	**2,8**	**100,0**
Hemiarthroplasty			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**10**/602	1,7	25,6
Instability	**6**/602	1,0	15,4
Septic loosening	**5**/602	0,8	12,8
Periprosthetic bone fracture	**3**/602	0,5	7,7
Humeral component loosening	**3**/602	0,5	7,7
Cuff arthropathy	**2**/602	0,3	5,1
Pain	**2**/602	0,3	5,1
Dislocation	**1**/602	0,2	2,6
Total aseptic loosening	**1**/602	0,2	2,6
Other	**2**/602	0,3	5,1
Unknown *(3 performed outside region)*	**4**/602	0,7	10,3
Total	**39/602**	**6,5**	**100,0**
Resurfacing			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**3**/42	7,1	75,0
Glenoid loosening	**1**/42	2,4	25,0
Total	**4/42**	**9,5**	**100,0**
Anatomical Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Pain	**1**/14	7,1	20,0
Glenoid loosening	**1**/14	7,1	20,0
Instability	**1**/14	7,1	20,0
Dislocation	**1**/14	7,1	20,0
Poly wear	**1**/14	7,1	20,0
Total	**5/14**	**35,7**	**100,0**
Hemi Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**

Survival 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.

Pain	**2**/52	3,8	40,0
Glenoid erosion	**1**/52	1,9	20,0
Humeral component loosening	**1**/52	1,9	20,0
Unknown *(1 performed outside region)*	**1**/52	1,9	20,0
Total	**5/52**	**9,6**	**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%	% survival at 10	C.I. at 95%
DELTA XTEND - Depuy	2008	583	8	99,5	96,8-99,9	-	-
SMR - Lima	2008	492	22	94,5	91,5-96,5	-	-
SMR INVERSA HP - Lima	2008	364	9	97,1	94,4-98,5	-	-

Survival 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.