REPORT of R.I.P.O.

Regional Registry of Orthopaedic Prosthetic Implantology

OVERALL DATA

HIP, KNEE AND SHOULDER ARTHROPLASTY

IN EMILIA-ROMAGNA REGION (ITALY)

2000-2018

VERSION 1, 02nd OCTOBER 2020

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 Registry, with the aim of guaranteeing an active and systematic collection of health and epidemiological data.
According to these aims, we are now presenting the 18th report, elaborated by the Registry 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 2018**.

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. 187.000 hip, 114.000 knee and 8.000 shoulder prostheses have been reported from 69 Orthopaedic Units in 63 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 (http://ripo.cineca.it/authzssl/index.htm), 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 Registry

The Registry has some fundamental objectives:

- to determine the demographic characteristics and the diagnostic categories of 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 post-marketing surveillance, allowing surgeons to easily identify patients implanted with a recalled implant; in particular, during 2016, 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 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 residing in the Emilia-Romagna region and on revisions of the 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 Registry 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 Registry has 'captured' 96% of hip, knee and shoulder operations. Through merging with other database, it has been repeatedly requested missing data. So the final results has been postponed to achieve the desired completeness.
During 2018, 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 reason, we have an uncertainty about the final analysis, if it is equal or lower than other registries.
The continuous updating of the 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, and 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 the 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 represent the 95% Confidence Interval. 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 2018, data on 8.533 primary THAs, 18 resurfacing, 2.354 hemiarthroplasties and 879 partial or total revisions were registered.

We went from 4.398 THA in 2000 to 8.533 in 2018. If the trend does not change in the next two years, in the 19th report we will have doubled the number of THA in the last twenty years with an average annual increase of 5%.
If we extrapolate up to 2050, when we assume that the aging of the population will start to reverse, we expect about 15.000 THA per year.

Compared to past years, the THAs are slightly increasing (+284 cases) while the resurfacing are slightly decreasing (-13 cases). The latter have been implanted in two private structures only in 2018.

During 2018 primary THA was performed to treat pathologies well known, following a distribution percentage unchanged over the years, except for a slight decrease of implants in developmental dysplasia and a slight increase in primary coxarthrosis.
Mean age at surgery is stable (70 yrs for women and 66 yrs for men).

In 2018, as in past years, 100 different types of cup and stem were used, a lot of them are 'new', not implanted in previous years. 19% 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 (7,3% of primary THAs).
Uncemented prostheses were 62% in 2000 and 97% in 2018, whilst hybrid fixation was 22% in 2000 and it is 2.5% in 2018.
The implant of completely cemented prostheses is virtually abandoned, with a decrease to 0,3% (compared to 15% in past years).

The most common articular coupling is ceramic on ceramic; composite ceramic (alumina and zirconia) is preferred to pure ceramic. Crosslinked Poly is preferred to Standard Poly (9% of cases).

The survival of the hip prostheses is confirmed at very high levels, 88,0% of THA implanted in the Emilia-Romagna region on resident patients are still in place 18 years after the operation.
The majority (74%) of 4.254 revisions are major revisions, where at least one component interfacing with bone has been revised. The remaining are minor revisions (liner, head, and modular neck).
Revisions carried out outside the Emilia-Romagna region was considered separately because causes of failure are not always known.
A 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 of whatever head diameter were included. Large diameter met-met (> 32 mm) – in compliance with officer regional decree - follow a specific monitoring procedure.

Partially confirming past years' results, multivariate analysis demonstrated that survival is lower for males (1,2% lower than females) and young patients. Survival rate? is influenced

also by diagnosis: it is higher if the implant was done to treat rare pathologies, or for femoral fractures, or for sequelae and septic coxitis sequelae.
At maximum of 18 years of follow-up, failure seems 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 of 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 compared to less implanted ones. Only a couple of models, no longer in use, have a survival below the regional average.

Survival of met-met articular couplings with head diameter >=36mm is lower than the same with <36mm.
The survival of resurfacing, at 15 years, is slightly lower than THA (86,0%, statistically significant). This datum is affected by the recall of a particular model of prostheses, the ASR Depuy.
Total revisions are not revised a second time in 81,0% of cases at 18 yrs.
Hemiarthroplasty has an optimal survival of the implant (94,7% at 18 yrs) even if the data is greatly influenced by a high rate of patients' deaths due to age and general conditions of the patients.

Knee

During 2018, data on 7.881 primary knee prostheses and 584 partial or total revisions were registered, with an increase of 6% of primary knee prostheses and 10% of revisions from the past year. A high percentage of knee prostheses is implanted in private structures: 69% of primary knee prostheses in 2018 (vs 43% in 2000) and 60% of revisions in 2018 (vs 25% in 2000).

In 2018, 13% of implanted prostheses are unicompartmental, 58% are bicompartmental with no patella resurfacing, and the remaining 29% have patella resurfacing. The number of prostheses with patella is increasing, in particular in public hospitals. Female patients are about twice as many as men.

In 2018, 97,4% of implants are cemented, in the half of them, cement is loaded with antibiotic. Hybrid fixation is almost completely absent. Posterior Stabilization of insert is slightly increasing (67% during last year) compared to minimally stabilized. Mobile inserts are decreasing (16,6% in 2018). 57% of inserts is in Standard Poly and the remaining is in Crosslinked Poly with or without antioxidant. Femoral components with Co-Cr are decreasing, Ceramicised Zirconium alloy and Cobalt alloy treated are preferable.

Types of implanted prostheses are less numerous and more stable during years compared to hip. Survival of bicompartmental is 92,5% at 17 yrs, survival of tricompartmental is 91,7% and survival of unicompartmental is significantly lower (76,4%). 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 (25%). For total implants, septic loosening represents one-third of the causes of failure. Total revisions are not revised a second time in 81,6% of cases at 17 yrs.
Cox multivariate analysis shows that the survival of bi-tricompartmental knee prostheses is negatively influenced by the age of the patient (the expectancy of prosthesis survival is lower for patients with less than 60 yrs), by gender (survival is lower for male patients) and by type of insert (mobile insert is worse than fixed insert).
In unicompartmental implants, the age of the patient has negative influence on the survival, while gender and type of tibial component seem to be irrelevant (monoblock vs

metal-back). Some models of prosthesis have a survival slightly below the regional average, as already observed in a previous report.

Shoulder

Data refers to a shorter follow-up (10 years and 6 months).
During 2018, 1.090 new total shoulder implants were carried out (920 were reverse prostheses).
Similarly to knee prostheses, a high percentage of primary shoulder prostheses is implanted in private structures (50% in 2018 vs 26% in 2008).

Women are more affected than men, either for fracture and for elective surgery.
The mean age at surgery for reverse prostheses is 74 for women and 71 for men. Patients are younger in anatomic prostheses (respectively 65 and 60). In hemiarthroplasty women are much older than men (72 vs 58).

The reverse prosthesis is implanted mainly in arthrosis (eccentric osteoarthritis in particular) and in fracture (19%).
The anatomic prosthesis is implanted in concentric arthrosis (81%), while hemiarthroplasties treat both fractures (62% of implants) and arthrosis.
The fixation is mainly cementless for reverse and anatomic prosthesis, while 34% of hemiarthroplasties are cemented.

The survival of reverse prosthesis at 9 yrs is 94,9%. Instability, glenoid loosening and septic loosening represent the most frequent causes of failure.

Bologna, 02 nd October 2020

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 May 2020

Province of Piacenza

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

Provincia di Parma

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

Provincia di 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

Provincia di Modena

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

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

Provincia di Bologna

AZIENDA USL BOLOGNA	**Head of Orthopaedic Surgery Department or Health Manager**	**RIPO Representative**
Ospedale Maggiore	Dr. Domenico Tigani	Dott. Saverio Comitini Dott.ssa Emanuela Castiello
Ospedale di Vergato	Dr. Giovan Battista Scimeca	Dr. Massimo Corlianò
Ospedale di Porretta Terme	Dr. Giovan Battista Scimeca	Monica Zanardi
Ospedale privato "Villa Regina"	f.f. Dott. Alberico Borghi	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"	f.f. Dott. Alberico Borghi	Dr. ssa Mirka Cocconcelli
Ospedale privato "Villa Torri Hospital"	Dir. San. Dr.ssa Martina Rosticci	Dr. Carlo Magelli
Ospedale privato "Villa Laura"	Dir. San. Dott. Luca Arfilli	Dr. ssa Franca Frau
Ospedale privato "Prof. Nobili"	Dir. San. Dr. Niccolò Francioli	Dr. Enzo Zanini
Ospedale privato "Villa Chiara"	Dir. San. Dr. Silvestrin Antonio	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	Sig.Maria Grazia Chiarini Chiara Becattini

AZIENDA USL IMOLA		
Ospedale Civile di Imola	Prof. Carlo Impallomeni	Dr. Michele Macchiagodena Dr. Marco Scardovi

Provincia di Ferrara

AZIENDA USL FERRARA		
Ospedale di Cento	Dr. Michele Mieti	Dr. Raffaele Rossi Dr. Giorgio Massini
Ospedale di Argenta	Dr. Michele Di Scioscio	Dr. Roberto Rossi Dr. Michele Di Scioscio
Ospedale del Delta	Dr. Michele Mieti	Dr. Luigi Sorbilli
Ospedale privato "Salus"	Dr. Stefano Liverani	Dr. Stefano Liverani

Province di Ravenna, Forlì-Cesena e Rimini

AZIENDA USL ROMAGNA		
Ospedale di Ravenna	Dr. Alberto Belluati	Dr. Giovanni Guerra Dr. Raffaele Pezzella
Ospedale di Lugo	f.f. Dr. Massimo Capucci	Dr. Alessandro Soldati

Ospedale di Faenza	f.f. Dr. Andrea Taroni	Dr. Paolo Frontali Dr.ssa Milena Sirri
Ospedale di Forlì	Dr. Casadei Roberto	Dr. Stefano Nardi
Ospedale di Cesena	Dr. Mauro Monesi	Dr. Franco Calista Dr. Francesco Fanton
Ospedale di Rimini	Dr. Landi Stefano	Dr.ssa Marina Gigli
Ospedale di Riccione	Dr. Massimo Pompili	Dr. Massimo Pompili
Ospedale Cervesi Cattolica	f.f. Dr. Paolo Paladini	Dr. Paolo Paladini
Ospedale privato "Domus Nova"	Dir. San. Dr. Eugenio De Liberali	Dr. Massimo De Zerbi Dr. Eugenio De Liberali
Ospedale privato "San Francesco"	Dir. San. Dr. Eugenio De Liberali	Sig.ra Patrizia Bonoli
Ospedale privato "Maria Cecilia Hospital"	Dir. San. Dr.ssa Silvia Rapuano	Dr.ssa Silvia Rapuano
Ospedale privato "San Pier Damiano"	Dir. San. Dr. Roberto Nonni	Sig.ra Elena Ravagli
Ospedale privato "Villa Igea" Ospedale privato "Villa Serena"	Dir. San Dr. Claudio Simoni	Dr. ssa Lorena Sangiorgi
Ospedale privato casa di cura "Malatesta Novello"	Dir. San. Dr. Gianluca Bersani	Dr.ssa Maria Gabriella Pignati
Ospedale privato casa di cura "San Lorenzino"	Dir. San. Dr. Marcello Amadori	Dr. Paolo Pardini
Ospedale privato "Sol et Salus"	Dir. San. Dr. Pier Paolo Balli	Sig.ra Ileana Zucchini Dr. Marco Fravisini
Ospedale privato casa di cura "Prof. E. Montanari"	Dr.ssa Anne Marie Pietrantonio	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	Dr. Enrico Vaienti	Dr. Paolo Perini

Az Osp Arcisp S. Maria Nuova Reggi Emilia	Dr. Ettore Sabetta	Dr.ssa Valentina Montemaggiori

Az. Osp-Univ Policlinico Modena	Prof. Fabio Catani	Dr. Onofrio Laselva Dr. Fabio Catani

Az. Osp-Univ S. Orsola-Malpighi	Dr. Massimiliano De Paolis	Dr. Luigi Brizio Dr. Valerio Bochicchio

Az Osp-Univ Sant Anna Ferrara	Prof. Leo Massari	Dr. Gaetano Caruso Prof. Leo Massari

Istituto Ortopedico Rizzoli	Clinica Ortopedica e Traumatologica I (Prof. Cesare Faldini) Clinica Ortopedica e Traumatologica II (Prof. Stefano Zaffagnini) Ortopedia Bentivoglio (Dr. Mauro Girolami) Chirurgia della spalla e del gomito (Dr. Roberto Rotini) Chirurgia Ortopedica Ricostruttiva Tecniche Innovative (Dr. Dante Dallari) Clinica Ortopedica e Traumatologica III a prevalente indirizzo Oncologico (Prof. Davide Maria Donati) Ortopedia-Traumatologia e Chirurgia protesica e dei reimpianti d'anca e di ginocchio (Prof. Francesco Traina)

The report has been prepared by Dr. Barbara Bordini (responsable for statistics) with the collaboration of Cristina Ancarani, Viridiana Casara, Monica Cosentino, Umberto Santoro, Dalila Caputo, Francesco De Gaetano and Luigi Lena (graphic designer).
RIPO staff belongs to Medical Technology Laboratory (LTM) of Rizzoli Orthopaedic Institutes, directed by Professor Marco Viceconti from January 2020.

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

Bologna, 02 nd October 2020

PART ONE: HIP PROSTHESES

January 2000 – December 2018

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 **96,0%** in the year 2018. Since the early years of the Registry, adhesion has been at excellent levels, never falling below 95%. Data are referred to primary total hip replacements (Major Procedure Related – MPR - 8151;74;75;76;77;85;86;87), hemiarthroplasties (8152), revision (8153;70;71;72;73) and prosthesis removal (8005).

1.2 Ratio public/private treatment

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

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)			
Year of surgery	**Total hip arthroplasties**	**Hemiarthroplasties**	**Revisions**
2000	77,0	97,0	78,0
2001	81,0	97,3	77,0
2002	78,0	97,5	79,0
2003	75,1	98,4	76,1
2004	75,3	97,6	76,1
2005	72,9	98,3	77,7
2006	74,8	99,0	74,5
2007	70,8	98,6	73,6
2008	71,6	98,9	76,0
2009	70,9	99,3	76,3
2010	71,8	99,3	76,8
2011	69,9	99,3	78,8
2012	68,1	99,2	75,8
2013	67,4	99,5	74,9
2014	66,8	99,3	77,0
2015	63,3	99,4	77,4
2016	62,7	99,6	75,9
2017	63,3	99,4	75,4
2018	59,2	99,8	74,5

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 2018, according to **type of surgery**.

Type of surgery	Number of surgeries	Percentage
Primary THA	120.408	64,5
Hemiarthroplasty	43.839	23,5
Total and partial revision*	17.317	9,3
Resurfacing	2.810	1,5
Prosthesis removal	1.449	0,8
Hemiarthroplasty with buffer°	121	0,1
Other**	783	0,4
Total	**186.727**	**100,0**

°acetabular buffer

*4.547 total revision, 6.874 cup revisions, 3.541 stem revisions, 2.355 revisions of other components.

**200 reduction of dislocation, 170 debridement, 160 spacer exchange, 24 hematoma drainage, 40 *heterotopic* ossification removal.

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

Year of operation	N.
2000	3
2001	8
2002	34
2003	79
2004	114
2005	188
2006	229
2007	212
2008	174
2009	177
2010	130
2011	183
2012	337
2013	312
2014	263
2015	197
2016	121
2017	31
2018	18

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	4.398		747	
2001	4.621	5,1	861	15,3
2002	4.665	1,0	871	1,2
2003	5.065	8,6	863	-0,9
2004	5.376	6,1	866	0,3
2005	5.579	3,8	828	-4,4
2006	5.848	4,8	947	14,4
2007	6.274	7,3	1.024	8,1
2008	6.357	1,3	988	-3,5
2009	6.708	5,5	995	0,7
2010	6.594	-1,7	1.035	4,0
2011	6.429	-2,5	923	-10,8
2012	6.588	2,5	1.015	10,0
2013	6.728	2,1	931	-8,3
2014	7.190	6,9	871	-6,4
2015	7.541	4,9	922	5,9
2016	7.665	1,6	894	-3,0
2017	8.249	7,6	857	-4,1
2018	8.533	3,4	879	2,6

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 2018, 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	3.445	2,9	7.690	6,4	17.745	14,7	34.515	28,7	43.098	35,8	13.909	11,6	**120.402**
Hemiarthroplasty	21	0,0	75	0,2	223	0,5	1.222	2,8	9.113	20,8	33.184	75,7	**43.838**
Revision	327	1,9	737	4,3	1.842	10,6	4.186	24,2	6.689	38,6	3.536	20,4	**17.317**
Resurfacing	327	11,6	713	25,4	1.001	35,6	637	22,7	126	4,5	6	0,2	**2.810**
Prosthesis removal	49	3,4	84	5,8	158	10,9	348	24,0	521	36,0	289	19,9	**1.449**
Hemiarthroplasty with buffer	-	-	2	1,7	3	2,5	16	13,2	38	31,4	62	51,2	**121**
Other	37	4,7	58	7,4	106	13,5	187	23,9	256	32,7	139	17,8	**783**
Total*	**4.206**	**2,3**	**9.359**	**5,0**	**21.078**	**11,3**	**41.111**	**22,0**	**59.841**	**32,0**	**51.125**	**27,4**	**186.720**

*7 missing data

In 2018 percentage of Hemiarthroplasty carried out on patients older than ninety is 22,3%.

Mean age at surgery

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

Mean age of patients, per type of operation, comparison 2000-2018 fot THA and 2003-2018 for Resurfacing

	Year 2000		Year 2018	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Primary THA	66,0	16-99	67,0	14-95
Hemiarthroplasty	82,4	35-104	85,3	32-105
Revision	68,6	22-97	71,9	33-96

	Year 2003		Year 2018	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Resurfacing	49,9	18-72	53,5	36-68

Mean age at surgery of patients affected by coxarthrosis according to gender, comparison 2000-2018

	THA			
	Year 2000		Year 2018	
Gender	**Mean age**	**Range**	**Mean age**	**Range**
Males	67,2	34-92	65,9	21-95
Females	68,9	31-93	69,7	22-94

3.2 Gender

Number of hip operations carried out on patients with admission date between 1st January 2000 and 31st December 2018, according to **type of operation** and **gender of patient**

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Primary THA	49.346	41,0	71.062	59,0	120.408
Hemiarthroplasty	11.418	26,0	32.421	74,0	43.839
Revision	6.071	35,1	11.246	64,9	17.317
Resurfacing	2.123	75,6	687	24,4	2.810
Removal	643	44,4	806	55,6	1.449
Hemiarthroplasty with buffer	27	22,3	94	77,7	121
Other	352	45,0	431	55,0	783
Total	**69.980**	**37,5**	**116.747**	**62,5**	**186.727**

3.3 Side of surgery

Coxarthrosis more often affects right hip (58,2%) than left hip (41,8%). 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, by gender

Side	Males	Females
Right	53,0	62,3
Left	47,0	37,7

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

3.4 Bilateral prosthesis

Between 1st January 2000 and 31st December 2018, 10.904 patients underwent bilateral operations for Coxarthrosis.

8.871 (81,4%) chose to undergo the second operation at the same hospital where the first one was performed;
576 (5,3%) chose to undergo the second operation at a different hospital, to follow the surgeon;
1.457 (13,4%) chose to undergo the second operation at a different hospital from where a different surgeon.

In bilateral operations, it was observed that the first hip to be treated was the right one in 54,2%.

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 2018, according to **diagnosis**

Diagnosis in primary arthroplasty	Number	Percentage
Primary arthritis	82.754	69,0
Sequelae of LCA and DCA	11.142	9,3
Femoral neck fracture	11.011	9,2
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	7.061	5,9
Post traumatic arthritis	2.576	2,1
Post traumatic necrosis	1.380	1,2
Femoral neck fracture sequelae	1.198	1,0
Rheumatic arthritis	1.184	1,0
Epiphysiolysis sequelae	314	0,3
Perthes disease sequelae	291	0,2
Tumor	211	0,2
Septic coxitis sequelae	201	0,2
Paget disease	97	0,1
TBC coxitis sequelae	63	0,1
Acetabulum fracture	53	0,0
Other	342	0,3
Total**	**119.878**	**100,0**

**530 missing data (0,4%)

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

In 96,7% of hemiarthroplasties diagnosis was femoral neck fracture.

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

Diagnosis in primary arthroplasty	Percentage		
	2000-2012	2013-2015	2016-2018
Primary arthritis	67,4	70,4	72,9
Sequelae of LCA and DCA	10,7	7,8	6,4
Femoral neck fracture	8,9	9,8	9,5
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	5,9	6,0	5,8
Post traumatic arthritis	2,4	1,9	1,6
Post traumatic necrosis	1,3	0,8	0,9
Rheumatic arthritis	0,9	1,2	1,2
Other	1,2	0,8	0,6
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	17,5	42,9	61,1	73,7	75,8	74,0
Sequelae of LCA and DCA	28,1	27,7	17,6	8,4	4,1	2,2
Femoral neck fracture	1,8	3,1	5,8	8,4	11,8	12,4
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	19,2	11,5	7,1	4,7	4,3	6,0
Post traumatic arthritis	9,1	5,9	3,1	1,8	1,2	1,1
Post traumatic necrosis	7,0	2,2	1,4	0,8	0,6	1,2
Rheumatic arthritis	4,7	1,8	1,2	0,9	0,7	0,5
Femoral neck fracture sequelae	1,6	1,3	0,8	0,6	0,9	2,2
Epiphysiolysis sequelae	3,5	1,1	0,3	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	0,3	0,3	0,1	0,1	0,0
Tumor	0,5	0,3	0,3	0,2	0,1	0,1
Paget disease	0,0	0,0	0,0	0,1	0,1	0,1
TBC coxitis sequelae	0,2	0,1	0,1	0,1	0,0	0,0
Acetabulum fracture	0,0	0,0	0,1	0,0	0,0	0,1
Other	2,1	0,7	0,5	0,2	0,1	0,1
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Diagnosis in primary arthroplasty	Age group						Total
	<40	40-49	50-59	60-69	70-79	≥80	
Primary arthritis	0,7	4,0	13,0	30,6	39,3	12,4	**100,0**
Sequelae of LCA and DCA	8,7	19,0	28,0	25,8	15,8	2,7	**100,0**
Femoral neck fracture	0,6	2,2	9,4	26,2	46,1	15,6	**100,0**
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	9,3	12,5	17,9	22,7	25,8	11,8	**100,0**
Post traumatic arthritis	12,1	17,7	21,1	23,4	20,0	5,7	**100,0**
Post traumatic necrosis	17,3	12,3	18,0	19,7	20,1	12,5	**100,0**
Rheumatic arthritis	13,6	11,4	17,5	25,1	26,7	5,7	**100,0**
Femoral neck fracture sequelae	4,5	8,1	11,7	18,2	32,2	25,3	**100,0**
Epiphysiolysis sequelae	38,2	27,4	18,8	9,9	5,1	0,6	**100,0**
Perthes disease sequelae	35,7	24,1	16,8	15,1	6,5	1,7	**100,0**
Septic coxitis sequelae	29,4	10,9	24,9	17,4	15,4	2,0	**100,0**
Tumor	8,1	11,8	22,7	30,3	22,7	4,3	**100,0**
Paget disease	0,0	0,0	7,2	26,8	51,5	14,4	**100,0**
TBC coxitis sequelae	9,5	15,9	27,0	31,7	14,3	1,6	**100,0**
Acetabulum fracture	1,9	0,0	18,9	15,1	37,7	26,4	**100,0**
Other	21,1	15,8	26,3	20,5	12,9	3,5	**100,0**

Number of **resurfacing** operations carried out on patients with admission date between 1st January 2000 and 31st December 2018, according to **diagnosis**

Diagnosis in resurfacing	Number	Percentage
Primary arthritis	2.335	83,4
Sequelae of LCA and DCA	188	6,7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	96	3,4
Post traumatic arthritis	91	3,2
Rheumatic arthritis	29	1,0
Post traumatic necrosis	13	0,5
Epiphysiolysis sequelae	13	0,5
Perthes disease sequelae	11	0,4
Femoral neck fracture sequelae	8	0,3
Septic coxitis sequelae	3	0,1
Paget disease	3	0,1
Femoral neck fracture	1	0,04
TBC coxitis sequelae	1	0,04
Other	9	0,3
Total*	**2.801**	**100,0**

* 9 missing data (0,3%)

3.6 Causes for revision

Number of revision operations carried out on patients admitted between 1st January 2000 and 31st December 2018 according to **diagnosis.**

In the Table are reported **all revisions of primary THA** performed in the Region, without taking care of site, date of primary implant and follow-up time.

Diagnosis in revision of primary THA	Number	Percentage
Cup aseptic loosening	4.821	30,9
Total aseptic loosening	2.854	18,3
Stem aseptic loosening	2.081	13,3
Prosthesis dislocation	1.436	9,2
Bone fracture	1.102	7,1
Prosthesis breakage*	818	5,2
Two steps prosthesis removal	788	5,0
Poly wear	659	4,2
Pain without loosening	271	1,7
Septic loosening	167	1,1
Metallosis	121	0,8
Primary instability	109	0,7
Heterotopic bone	78	0,5
Trauma	37	0,2
Acetabulum fracture	25	0,2
Other	239	1,5
Total°	**15.606**	**100,0**

° 167 missing data (1,1%)

***** Failure of 281 modular necks, 182 liners, 119 heads, 101 stems, 102 cups, 14 liner and head . 19 failures not specified.

In the Table are reported **all revisions of resurfacing** performed in the Region, without taking care of site, date of primary implant and follow-up time.

Diagnosis in revision of resurfacing	Number	Percentage
Aseptic loosening	81	46,0
Bone fracture	50	28,4
Metallosis	27	15,3
Pain without loosening	11	6,3
Instability	4	2,3
Breakage of prosthesis	3	1,7
Total	**176**	**100,0**

In the Table are reported **all revisions of hemiarthroplasty** performed in the Region, without taking care of site, date of primary implant and follow-up time.

Diagnosis in revision of hemiarthroplasty	Number	Percentage
Prosthesis dislocation	477	35,1
Cotiloiditis	355	26,1
Stem aseptic loosening	274	20,2
Periprosthetic bone fracture	149	11,0
Two steps prosthesis removal	25	1,8
Septic loosening	25	1,8
Breakage of prosthesis	8	0,6
Instability	7	0,5
Poly wear	7	0,5
Heterotopic bone	5	0,4
Other	26	1,9
Total*	**1.358**	**100,0**

*10 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 262 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
PE (Muller Protek) Sulzer	469	7,4	51	19,2	25	15,0
REFLECTION ALL-POLY Smith and Nep.	287	6,1	22	9,0	15	8,7
ZCA Zimmer	648	14,0	7	2,8	11	6,1
PE Adler-Ortho	167	5,2	4	1,7	9	5,0
MULLER Citieffe	98	3,4	17	6,7	8	4,8
CUPULE AVANTAGE CEMENTED Biomet	82	3,0	12	4,7	7	4,1
CONTEMPORARY Stryker Howmedica	806	17,6	17	6,2	5	2,7
MULLER Lima	247	5,6	11	4,4	2	1,2
MULLER Smith and Nephew	150	3,3	11	4,3	-	-
MULLER Wright Cremascoli	961	14,2	-	-	-	-
MULLER Samo	441	6,7	-	-	-	-
LUNA Amplitude	88	2,5	-	-	-	-
CCB Mathys	57	0,9	-	-	-	-
MULLER Groupe Lepine	57	1,3	-	-	-	-
Other (< 50 cases)	342	8,8	106	41,0	92	52,4
Total	**4.900**	**100,0**	**258**	**100,0**	**174**	**100,0**

Cementless cup	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
FIXA Ti-POR Adler-Ortho	7.597	10,9	6.752	31,9	7.718	31,9
R3 THREE-HOLE Smith and Nephew	1.156	1,7	1.778	8,4	2.812	11,6
JUMP Permedica	141	0,2	432	2,0	1.289	5,3
VERSAFITCUP CC TRIO Medacta	122	0,2	702	3,3	1.288	5,3
CONTINUUM Zimmer	679	1,0	925	4,4	1.073	4,4
DELTA TT Lima	603	0,9	708	3,3	963	4,0
G7 PPS Biomet	-	-	205	1,0	953	3,9
PINNACLE SECTOR II POROCOAT DePuy	1.502	2,2	1.032	4,9	733	3,0
TRIDENT PSL HA CLUSTER Stryker Howmedica	2.022	2,9	359	1,7	486	2,0
PINNACLE SECTOR GRIPTION DePuy	14	0,0	189	0,9	484	2,0
EP-FIT PLUS Endoplus	4.309	6,2	1.220	5,8	469	1,9
ALLOFIT S IT Zimmer	406	0,6	470	2,2	469	1,9
DELTA PF Lima	1.628	2,3	446	2,1	412	1,7
JUMP SYSTEM TRASER Permedica	-	-	-	-	323	1,3
GYROS DePuy	6	0,0	45	0,2	294	1,2
MPACT Medacta	14	0,0	49	0,2	272	1,1
EXCEED ABT Biomet	885	1,3	802	3,8	233	1,0
ADAPTIVE WINGS Samo	126	0,2	280	1,3	193	0,8
FIN II Bioimpianti	173	0,2	133	0,6	157	0,6
MAXERA Zimmer	150	0,2	259	1,2	132	0,5
TRIDENT PSL HA SOLID Stryker Howmedica	158	0,2	87	0,4	127	0,5
FITMORE Sulzer	2.804	4,0	143	0,7	88	0,4
DELTAMOTION Finsbury	114	0,2	330	1,6	86	0,4
TOP Link	547	0,8	169	0,8	86	0,4
REFLECTION Smith and Nephew	1.731	2,5	258	1,2	79	0,3
RM Mathys	122	0,2	162	0,8	72	0,3
MALLORY Biomet	277	0,4	83	0,4	38	0,2
TRABECULAR METAL Zimmer	543	0,8	52	0,2	32	0,1
SPARKUP Samo	465	0,7	149	0,7	30	0,1
BS Citieffe	380	0,5	83	0,4	30	0,1
CUPULE APRIL Symbios	220	0,3	226	1,1	19	0,1
BETA CUP Link	264	0,4	55	0,3	15	0,1
BICON PLUS Endoplus	1.312	1,9	36	0,2	11	0,0
ABG II Howmedica	2.732	3,9	33	0,2	9	0,0
TRILOGY Zimmer	1.127	1,6	11	0,1	8	0,0
EXPANSYS Mathys	1.449	2,1	164	0,8	5	0,0
DUOFIT PSF Samo	1.375	2,0	2	0,0	1	0,0
CLS Zimmer	3.375	4,9	0	0,0	1	0,0
CUPULE RELOAD AVANTAGE Biomet	292	0,4	145	0,7	-	-
FIXA Adler-Ortho	7.386	10,6	111	0,5	-	-
VERSAFITCUP CC Medacta	770	1,1	105	0,5	-	-
HILOCK LINE Symbios	674	1,0	42	0,2	-	-
AnCA FIT Wright Cremascoli	6.720	9,7	-	-	-	-
STANDARD CUP Protek Sulzer	1.306	1,9	-	-	-	-
RECAP RESURFACING Biomet	895	1,3	-	-	-	-
SELEXYS TH Mathys	583	0,8	-	-	-	-
TRABECULAR METAL MONOBLOCK Zimmer	417	0,6	-	-	-	-
TRILOGY AB Zimmer	378	0,5	-	-	-	-
DUROM HIP RESURFACING Zimmer	330	0,5	-	-	-	-

EASY Hit Medica	313	0,5	-	-	-	-
CUPULE AVANTAGE Biomet	300	0,4	-	-	-	-
Other (< 300 cases)	8.554	12,3	1.928	9,1	2.718	11,2
Total	**69.446**	**100,0**	**21.160**	**100,0**	**24.208**	**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 29 cases model or cup fixation was not communicated to RIPO

Cemented cups	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
MULLER Protek-Sulzer-Centerpulse-Zimmer	175	26,2	6	11,8	6	9,1
POLARCUP CEMENTED Smith and Nephew	2	0,3	4	7,8	6	9,1
REFLECTION ALL-POLY Smith and Nephew	8	1,2	3	5,9	5	7,6
CUPULE AVANTAGE CEMENTED Biomet	25	3,7	5	9,8	4	6,1
MULLER Lima	54	8,1	1	2,0	4	6,1
CONTEMPORARY Stryker Howmedica	131	19,6	7	13,7	2	3,0
Muller Adler-Ortho	8	1,2	-	-	2	3,0
ZCA Zimmer	41	6,1	2	3,9	1	1,5
MULLER PCR Samo	11	1,6	2	3,9	-	-
MULLER Wright Cremascoli	58	8,7	-	-	-	-
MULLER Samo	53	7,9	-	-	-	-
CCB Mathys	20	3,0	-	-	-	-
Other (< 10 cases)	82	12,3	21	41,2	36	54,5
Total	**668**	**100,0**	**51**	**100,0**	**66**	**100,0**

Cementless cups	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
FIXA Ti-POR Adler-Ortho	137	5,0	91	18,2	96	20,4
DELTA ONE TT Lima	72	2,6	67	13,4	63	13,4
DELTA TT Lima	42	1,5	45	9,0	45	9,6
CONTINUUM Zimmer	33	1,2	52	10,4	43	9,1
OMNIA Ti-POR Adler-Ortho	15	0,5	28	5,6	38	8,1
DELTA REVISION TT Lima	34	1,2	18	3,6	30	6,4
HERMES BS REV Citieffe	56	2,0	18	3,6	17	3,6
TRABECULAR METAL Zimmer	159	5,8	26	5,2	11	2,3
R3 THREE-HOLE Smith and Nephew	6	0,2	14	2,8	9	1,9
TRIDENT PSL HA CLUSTER Stryker Howmedica	157	5,7	11	2,2	6	1,3
PINNACLE MULTIHOLE GRIPTION DePuy	1	0,0	32	6,4	5	1,1
TRIDENT TRITANIUM Stryker Howmedica	7	0,3	10	2,0	5	1,1
EP-FIT PLUS Endoplus	38	1,4	3	0,6	5	1,1
TRITANIUM HEMISPHERICAL Stryker Howmedica	5	0,2	16	3,2	3	0,6
TRILOGY IT Zimmer	9	0,3	10	2,0	2	0,4
TRABECULAR METAL REVISION Zimmer	26	0,9	7	1,4	2	0,4
MC MINN Link	91	3,3	1	0,2	1	0,2
DELTA PF Lima	43	1,6	0	0,0	1	0,2
FIXA Adler-Ortho	130	4,7	1	0,2	-	-
PINNACLE MULTIHOLE II DePuy	32	1,2	1	0,2	-	-
AnCA FIT Cremascoli	301	10,9	-	-	-	-

TRILOGY Zimmer	142	5,1	-	-	-	-
STANDARD CUP Protek Sulzer	132	4,8	-	-	-	-
OMNIA Adler-Ortho	52	1,9	-	-	-	-
DUOFIT PSF Samo	48	1,7	-	-	-	-
LOR ALLOPRO Protek Sulzer	48	1,7	-	-	-	-
OSTEOLOCK Stryker Howmedica	47	1,7	-	-	-	-
FITMORE Sulzer	44	1,6	-	-	-	-
REGENEREX RINGLOC+ Biomet	41	1,5	-	-	-	-
TRIDENT ARC2F Stryker Howmedica	37	1,3	-	-	-	-
PROCOTYL-E Wright Cremascoli	36	1,3	-	-	-	-
CLS Zimmer	34	1,2	-	-	-	-
REFLECTION Smith and Nephew	30	1,1	-	-	-	-
BICON PLUS Endoplus	25	0,9	-	-	-	-
CONICAL SCREW CUP Protek Sulzer	25	0,9	-	-	-	-
SECUR-FIT Osteonics Howmedica	25	0,9	-	-	-	-
BOFOR Endoplus	22	0,8	-	-	-	-
ABGII Stryker Howmedica	21	0,8	-	-	-	-
PROCOTYL-Z-PIVOT Wright Cremascoli	21	0,8	-	-	-	-
Other (< 20 cases)	539	19,5	49	9,8	88	18,7
Total	**2.763**	**100,0**	**500**	**100,0**	**470**	**100,0**

4.3 Stems used in primary surgery

In 330 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
EXETER V40 Stryker Howmedica	1.283	10,8	131	15,0	142	19,0
POLARSTEM CEM Endoplus	15	0,1	68	7,8	102	13,6
PAVI CEM Groupe Lepine	-	-	47	5,4	67	8,9
KORUS Bioimpianti	-	-	15	1,7	58	7,7
APTA Adler-Ortho	1.109	9,3	64	7,3	57	7,6
CORAIL DePuy	15	0,1	23	2,6	41	5,5
HYDRA Adler-Ortho	31	0,3	38	4,4	25	3,3
TAPERLOC CEM Biomet	68	0,6	14	1,6	24	3,2
DUOFIT CKA Samo	53	0,4	2	0,2	21	2,8
BASIS Smith and Nephew	938	7,9	91	10,4	17	2,3
CORAE Adler-Ort	-	-	68	7,8	16	2,1
LUBINUS SP2 Link	302	2,5	10	1,1	14	1,9
AB Citieffe	167	1,4	57	6,5	10	1,3
CPCS Smith and Nephew	30	0,3	22	2,5	9	1,2
VERSYS ADVOCATE Zimmer	243	2,0	6	0,7	6	0,8
SL Lima	83	0,7	6	0,7	2	0,3
C-STEM AMT DePuy	151	1,3	78	9,0	-	-
CCA Mathys	220	1,8	17	2,0	-	-
VERSYS HERITAGE Zimmer	49	0,4	6	0,7	-	-
SPECTRON Smith and Nephew	725	6,1	2	0,2	-	-
MERCURIUS Adler-Ortho	110	0,9	2	0,2	-	-
MULLER AUTOBLOCCANTE Sulzer	55	0,5	2	0,2	-	-
LC Samo	411	3,4	1	0,1	-	-
JVC Wright Cremascoli	728	6,1	-	-	-	-
P507 Samo	657	5,5	-	-	-	-
MRL Wright Cremascoli	467	3,9	-	-	-	-
AD Samo	388	3,3	-	-	-	-
DEFINITION Stryker Howmedica	347	2,9	-	-	-	-
VERSYS CEMENTED Zimmer	335	2,8	-	-	-	-
ANCA-FIT CLU Wright Cremascoli	314	2,6	-	-	-	-
C STEM DePuy	313	2,6	-	-	-	-
AHS Wright Cremascoli	306	2,6	-	-	-	-
ABG Stryker Howmedica	231	1,9	-	-	-	-
ULTIMA Johnson e Johnson	197	1,7	-	-	-	-
MS 30 Zimmer	187	1,6	-	-	-	-
VERSYS CEMENTED LD Zimmer	133	1,1	-	-	-	-
MBA Groupe Lepine	88	0,7	-	-	-	-
ANCA Wright Cremascoli	87	0,7	-	-	-	-
DUOFIT CFS Samo	75	0,6	-	-	-	-
FULLFIX Mathys	69	0,6	-	-	-	-
ARCAD SO Symbios	66	0,6	-	-	-	-
PERFECTA RA Wright Cremascoli	60	0,5	-	-	-	-
ABGII Stryker Howmedica	53	0,4	-	-	-	-
SL STREAKES Hitmedica	50	0,4	-	-	-	-
Other (< 50 cases)	723	6,1	101	11,6	138	18,4
Total	**11.932**	**100,0**	**871**	**100,0**	**749**	**100,0**

Cementless stem	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
HYDRA Adler-Ortho	1.557	2,5	1.516	7,4	1.725	7,3
APTA Adler-Ortho	6.933	11,1	2.196	10,7	1.619	6,9
POLARSTEM Endoplus	219	0,4	650	3,2	1.468	6,2
AMISTEM-H Medacta	109	0,2	439	2,1	989	4,2
APTA-FIX Adler-Ortho	-	-	142	0,7	979	4,1
HYDRA-FIX Adler-Ortho	-	-	-	-	927	3,9
CORAE Adler-Ortho	100	0,2	1.457	7,1	863	3,7
CORAIL DePuy	1.264	2,0	712	3,5	843	3,6
EXACTA - Permedica	31	0,0	168	0,8	817	3,5
SL PLUS MIA STEM Smith and Nephew	745	1,2	926	4,5	724	3,1
TRI-LOCK DePuy	123	0,2	690	3,4	723	3,1
TAPERLOC COMPLETE Biomet	-	-	338	1,6	655	2,8
H-MAX S Lima	92	0,1	380	1,9	595	2,5
RECTA Adler-Ortho	4.297	6,9	954	4,6	551	2,3
MINIMAX Medacta	377	0,6	346	1,7	521	2,2
SYNTHESIS Permedica	-	-	248	1,2	488	2,1
KORUS Bioimpianti	2	0,0	75	0,4	476	2,0
TAPERLOC COMPLETE MICROPLASTY Biomet	-	-	75	0,4	439	1,9
FITMORE B EXT. Zimmer	134	0,2	266	1,3	389	1,6
NANOS Endoplant Gmbh	491	0,8	237	1,2	386	1,6
ACCOLADE II Osteonics Howmedica	3	0,0	117	0,6	383	1,6
ALATA ACUTA S Adler-Ortho	741	1,2	291	1,4	365	1,5
CONUS Centerpulse	4.665	7,5	622	3,0	361	1,5
LCU - Link	2	0,0	117	0,6	356	1,5
CLS Sulzer	4.142	6,6	573	2,8	354	1,5
PULCHRA-FIX Adler-Ortho	-	-	-	-	315	1,3
ADR Endoplus	621	1,0	403	2,0	312	1,3
AVENIR MULLER Zimmer	2	0,0	108	0,5	291	1,2
RECTA-FIX Adler-Ortho	25	0,0	184	0,9	283	1,2
SL PLUS Endoplus	4.051	6,5	336	1,6	248	1,0
MODULUS Lima	710	1,1	218	1,1	236	1,0
FITMORE B Zimmer	359	0,6	343	1,7	199	0,8
MISTRAL Samo	52	0,1	160	0,8	175	0,7
SUMMIT DePuy	298	0,5	182	0,9	174	0,7
PROXIPLUS Endoplant	1.282	2,1	226	1,1	91	0,4
C2 Lima	959	1,5	115	0,6	87	0,4
PLS Lima	191	0,3	115	0,6	82	0,3
VERSYS FIBER METAL TAPER Zimmer	1.207	1,9	61	0,3	82	0,3
SAM-FIT Lima	231	0,4	182	0,9	78	0,3
GTS Biomet	186	0,3	166	0,8	77	0,3
TWINSYS Mathys	144	0,2	149	0,7	76	0,3
FIT STEM Lima	296	0,5	41	0,2	76	0,3
QUADRA-S Medacta	270	0,4	121	0,6	66	0,3
SYNERGY Smith and Nephew	627	1,0	213	1,0	61	0,3
PARVA Adler-Ortho	305	0,5	93	0,5	59	0,2
MULTIFIT Samo	311	0,5	75	0,4	51	0,2
ALLOCLASSIC SL Zimmer	347	0,6	17	0,1	44	0,2
DUOFIT RKT Samo	312	0,5	36	0,2	43	0,2
Z1 Citieffe	319	0,5	64	0,3	27	0,1
CFP Link	1.033	1,7	50	0,2	23	0,1
TAPERLOC MICROPLASTY Biomet	377	0,6	115	0,6	11	0,0
DUOFIT RTT Samo	242	0,4	76	0,4	11	0,0
ABGII Stryker Howmedica	3.347	5,4	169	0,8	10	0,0
TAPERLOC Biomet	2.331	3,7	642	3,1	6	0,0

CBC Mathys	2.005	3,2	291	1,4	6	0,0
ACCOLADE Osteonics Howmedica	425	0,7	100	0,5	4	0,0
PBF Permedica	392	0,6	41	0,2	4	0,0
SPS MODULAR Symbios	299	0,5	33	0,2	-	-
PROFEMUR Z Wright Cremascoli	710	1,1	5	0,0	-	-
CONELOCK SHORT Biomet	297	0,5	4	0,0	-	-
HIPSTAR Stryker Howmedica	336	0,5	1	0,0	-	-
ANCA FIT Wright Cremascoli	4.506	7,2	-	-	-	-
BHS Smith and Nephew	438	0,7	-	-	-	-
ABG Stryker Howmedica	329	0,5	-	-	-	-
EHS Wright Cremascoli	313	0,5	-	-	-	-
PROXILOCK FT Stratec	304	0,5	-	-	-	-
Other (< 300 cases)	5.545	8,9	1.865	9,1	2.326	9,8
Total	**62.361**	**100,0**	**20.535**	**100,0**	**23.630**	**100,0**

4.4 Stems used in total revision surgery

In 70 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
EXETER V40 Stryker Howmedica	72	15,4	3	6,4	4	7,8
VERSYS REVISION CALCAR Zimmer	20	4,3	4	8,5	4	7,8
APTA Adler-Ortho	34	7,2	1	2,1	2	3,9
JVC Wright Cremascoli	32	6,8	-	-	-	-
AD Samo	29	6,2	-	-	-	-
ANCA Wright Cremascoli	25	5,3	-	-	-	-
Other (< 20 cases)	257	54,8	39	83,0	41	80,4
Total	**469**	**100,0**	**47**	**100,0**	**51**	**100,0**

Cementless stem	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
REVISION HIP Lima	150	5,1	102	20,1	125	25,9
ALATA AEQUA REVISION Adler-Ortho	182	6,2	62	12,2	84	17,4
SL REVISION Sulzer Centerpulse Zimmer	550	18,8	83	16,4	73	15,1
ALATA ACUTA S Adler-Ortho	62	2,1	38	7,5	24	5,0
RESTORATION Stryker Howmedica	255	8,7	46	9,1	14	2,9
RECLAIM DePuy	1	0,0	32	6,3	14	2,9
MODULUS HIP SYSTEM Lima	33	1,1	25	4,9	9	1,9
MP RECONSTRUCTION PROSTHESIS Link	57	2,0	11	2,2	6	1,2
CONUS Sulzer Centerpulse Zimmer	87	3,0	4	0,8	6	1,2
APTA Adler-Ortho	27	0,9	3	0,6	6	1,2
ADR Endoplus	14	0,5	11	2,2	4	0,8
CLS Sulzer Centerpulse Zimmer	42	1,4	4	0,8	2	0,4
MGS Samo	117	4,0	5	1,0	1	0,2
C2 Lima	65	2,2	-	-	1	0,2
CONELOCK REVISION Biomet	126	4,3	11	2,2	-	-
ZMR REVISION TAPER CONE Zimmer	47	1,6	4	0,8	-	-
SL PLUS Endoplus	38	1,3	2	0,4	-	-
SLR PLUS Endoplus	29	1,0	2	0,4	-	-
S. ROM Johnson e Johnson	146	5,0	1	0,2	-	-
PROFEMUR R VERS. 4 Wright Cremascoli	414	14,2	-	-	-	-
RESTORATION T3 Stryker Howmedica	74	2,5	-	-	-	-
ANCA FIT Wright Cremascoli	59	2,0	-	-	-	-
ZMR REVISION TAPER Zimmer	30	1,0	-	-	-	-
EMPERION Smith and Nephew	23	0,8	-	-	-	-

VERSYS FIBER METAL TAPER Zimmer	22	0,8	-	-	-	-
CBK REVISION STEM Mathys	20	0,7	-	-	-	-
Other (< 20 cases)	251	8,6	61	12,0	113	23,4
Total	**2.921**	**100,0**	**507**	**100,0**	**482**	**100,0**

4.5 Number of different types of implant

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

Year of operation	Primary THA	
	Cups	Stems
2000	87	93
2001	92	98
2002	90	94
2003	94	110
2004	84	99
2005	90	110
2006	87	98
2007	100	113
2008	105	114
2009	95	115
2010	91	109
2011	100	107
2012	90	109
2013	100	125
2014	97	125
2015	100	125
2016	110	140
2017	110	130
2018	100	130

In 2018, 14 different types of cup and 11 stems not used in 2017 were implanted.

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

Year of operation	Total revision	
	Cups	Stems
2000	58	48
2001	64	55
2002	59	48
2003	62	60
2004	46	40
2005	45	44
2006	55	55
2007	60	50
2008	50	49
2009	54	42
2010	49	46

2011	49	49
2012	41	41
2013	37	41
2014	39	36
2015	35	35
2016	43	46
2017	43	42
2018	45	40

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

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

4.6 Dual mobility cups

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

Year of operation	Primary THA	
	Standard cup	Dual mobility cup
2000	99,6	0,4
2001	98,9	1,1
2002	98,8	1,2
2003	98,8	1,2
2004	98,7	1,3
2005	97,5	2,5
2006	97,4	2,6
2007	96,6	3,4
2008	96,6	3,4
2009	96,3	3,7
2010	96,8	3,2
2011	97,1	2,9
2012	97,7	2,3
2013	97,1	2,9
2014	95,8	4,2
2015	95,4	4,6
2016	95,1	4,9
2017	93,4	6,6
2018	92,7	7,3

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

Types of cups – dual mobility	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
GYROS Depuy	6	0,3	45	5,3	293	19,0
DUALIS Bioimpianti	-	-	12	1,4	174	11,3
QUATTRO VPS PF HAP PNP Groupe Lep.	-	-	-	-	141	9,2
TRIDENT PSL HA CLUSTER Howmedica	14	0,8	76	9,0	135	8,8
FIXA DUPLEX Adler-Ortho	-	-	1	0,1	96	6,2
POLARCUP TI-PLASMA Ortho-Id	103	5,8	51	6,0	86	5,6
ACORN Permedica	-	-	5	0,6	78	5,1
JUMP SYSTEM TRASER Permedica	-	-	-	-	53	3,4
TRITANIUM HEMISPHERICAL Stryker How.	1	0,1	28	3,3	44	2,9
FIXA Ti-POR Adler-Ortho	-	-	-	-	43	2,8
ADES Dedienne Sante	-	-	19	2,2	28	1,8
QUATTRO VPS PF HAP Groupe Lepine	-	-	62	7,3	27	1,8
DELTA TT Lima	8	0,5	8	0,9	26	1,7
DMX Transysteme	18	1,0	82	9,7	24	1,6
VERSAFITCUP DM Medacta	61	3,4	61	7,2	22	1,4
NOVAE E TH Serf	13	0,7	54	6,4	19	1,2
POLARCUP CEMENTED Smith and Nep.	5	0,3	24	2,8	10	0,6
AVANTAGE CEMENTED Biomet	82	4,6	12	1,4	7	0,5
DMX CEMENTED Transysteme	3	0,2	28	3,3	2	0,1
AVANTAGE 3P Biomet	114	6,4	30	3,5	1	0,1
POLARCUP Ortho-Id	73	4,1	-	-	1	0,1
RELOAD AVANTAGE Biomet	292	16,5	145	17,1	-	-
STAFIT Zimmer	-	-	30	3,5	-	-
POLARCUP TI-PLASMA Endoplus	47	2,7	1	0,1	-	-
EASY HIT Medica	313	17,7	-	-	-	-
AVANTAGE Biomet	300	16,9	-	-	-	-
MOBILIS I Othesio	114	6,4	-	-	-	-
C2M PF Symbios	81	4,6	-	-	-	-
Other (<30 cases)	125	7,1	73	8,6	229	14,9
Total	**1.773**	**100,0**	**847**	**100,0**	**1.539**	**100,0**

4.7 Modular neck

30,5% of stems implanted in primary surgery have modular neck.

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

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

2008	64,4	35,6
2009	64,2	35,8
2010	60,5	39,5
2011	58,2	41,8
2012	61,1	38,9
2013	65,7	34,3
2014	71,3	28,7
2015	74,1	25,9
2016	76,0	24,0
2017	77,9	22,1
2018	81,4	18,6

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

Types of stems with proximal modularity	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
HYDRA Adler-Ortho	1.558	6,2	1.516	24,0	1.725	32,9
APTA Adler-Ortho	6.939	27,7	2.197	34,8	1.619	30,9
RECTA Adler-Ortho	4.298	17,1	954	15,1	552	10,5
ALATA ACUTA S Adler-Ortho	742	3,0	292	4,6	365	7,0
MODULUS HIP SYSTEM Lima	710	2,8	218	3,5	236	4,5
PULCHRA Adler-Ortho	-	-	88	1,4	95	1,8
SAM-FIT Lima	231	0,9	182	2,9	79	1,5
MINIFIT Samo	4	0,0	19	0,3	67	1,3
H-MAX M Lima	102	0,4	106	1,7	64	1,2
PARVA Adler-Ortho	306	1,2	93	1,5	59	1,1
APTA Cem Adler-Ortho	1.109	4,4	64	1,0	56	1,1
MULTIFIT Samo	311	1,2	75	1,2	51	1,0
REVISION HIP Lima	24	0,1	27	0,4	43	0,8
CLS BREVIUS Zimmer	117	0,5	135	2,1	35	0,7
ALATA AEQUA REVISION Adler-Ortho	23	0,1	25	0,4	32	0,6
HYDRA Cem Adler-Ortho	31	0,1	38	0,6	25	0,5
S. ROM Johnson e Johnson	174	0,7	6	0,1	8	0,2
HARMONY Symbios	124	0,5	67	1,1	2	0,0
PROFEMUR L Wright Cremascoli	99	0,4	-	-	1	0,0
SMF Smith and Nephew	47	0,2	68	1,1	-	-
VITAE Adler-Ortho	96	0,4	35	0,6	-	-
SPS MODULAR Symbios	299	1,2	33	0,5	-	-
PROFEMUR Z Wright Cremascoli	710	2,8	2	0,0	-	-
MERCURIUS Adler-Ortho	110	0,4	2	0,0	-	-
ANCA Fit Wright Cremascoli	4.507	18,0	-	-	-	-
JVC Wright Cremascoli	728	2,9	-	-	-	-
ANCA-Fit CLU Wright Cremascoli	314	1,3	-	-	-	-
EHS Wright Cremascoli	312	1,2	-	-	-	-
STEM Wright Cremascoli	211	0,8	-	-	-	-
G3 Citieffe	179	0,7	-	-	-	-
MBA HAP Groupe Lepine	127	0,5	-	-	-	-
MBA Groupe Lepine	88	0,4	-	-	-	-
PROFEMUR C Wright Cremascoli	87	0,3	-	-	-	-
STELO MODULARE NDS1 Citieffe	77	0,3	-	-	-	-
ABGII MODULAR Stryker Howmedica	66	0,3	-	-	-	-

Other (< 50 cases)	215	0,9	72	1,1	122	2,3
Total*	**25.075**	**100,0**	**6.314**	**100,0**	**5.236**	**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 surgeries, 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 62,0% of cases and with various degree of correction necks in the remaining 38,0%.

4.8 Resurfacing arthroplasty

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

Year of operation	primary arthroplasty	
	Standard	***Resurfacing***
2000	99,9	0,1
2001	99,8	0,2
2002	99,3	0,7
2003	98,5	1,5
2004	97,9	2,1
2005	96,7	3,3
2006	96,2	3,8
2007	96,7	3,3
2008	97,3	2,7
2009	97,4	2,6
2010	98,1	1,9
2011	97,2	2,8
2012	95,1	4,9
2013	95,6	4,4
2014	96,5	3,5
2015	97,5	2,5
2016	98,4	1,6
2017	99,6	0,4
2018	99,8	0,2

*Resurfacing arthroplasty used between **01/01/2000** and **31/12/2018***

Type	N.	%
BHR – Smith & Nephew	1.800	64,1
ADEPT – Finsbury	437	15,6
BMHR* – Smith & Nephew	198	7,0
MITCH TRH – Finsbury	89	3,2
ASR – DePuy	77	2,7
RECAP – Biomet	65	2,3
MRS* – Lima	44	1,6
ROMAX – Medacta	33	1,2
CONSERVE PLUS – Wright	31	1,1
ICON – International Orthopaedics	21	0,7

DUROM Hip Resurfacing – Zimmer	8	0,3
WAGNER METASUL - Protek	3	0,1
CORMET – Corin	1	0,0
ACCIS - Implantcast	1	0,0
TRIBOFIT – Active Implants	1	0,0
Total**	**2.810**	**100,0**

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

In 2018 were implanted 17 BHR - Smith and Nephew and 1 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 2018, 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	39.526	34,1	705	16,4
Metal - UHMWPE	12.715	11,0	743	17,3
Composite Ceramic - XLPE	12.834	11,1	532	12,4
Alumina - Alumina	11.034	9,5	327	7,6
Alumina - UHMWPE	9.782	8,4	668	15,5
Metal - XLPE	7.895	6,8	579	13,5
Metal - Metal	3.314	2,9	65	1,5
Composite Ceramic - XLPE+Vit.E	3.304	2,9	58	1,4
Metal - UHMWPE+Metal	2.981	2,6	31	0,7
Ceramicised Metal - XLPE	2.320	2,0	28	0,7
Alumina - XLPE	1.793	1,5	128	3,0
Alumina - Composite Ceramic	1.817	1,6	58	1,4
Composite Ceramic - UHMWPE	1.683	1,5	86	2,0
Metal - undefined Poly*	791	0,7	53	1,2
Alumina - UHMWPE+Alumina	791	0,7	13	0,3
Composite Ceramic - Alumina	466	0,4	11	0,3
Revision Composite Ceramic - Composite Ceramic	457	0,4	10	0,2
Alumina- undefined Poly*	403	0,3	29	0,7
Ceramicised Metal - UHMWPE	391	0,3	20	0,5
Alumina - Metal+Alumina	302	0,3	60	1,4
Composite Ceramic - Metal+XLPE+Vit.E	281	0,2	-	-
Composite Ceramic - Metal	221	0,2	-	-
Zirconia Ceramic - UHMWPE	175	0,2	13	0,3
Other (< 100 cases)	623	0,5	79	1,8
Total^	**115.899**	**100,0**	**4.296**	**100,0**

* missing label did not allow classification of poly.
^350 missing data in primary surgery and 21 in total revision.

Percentage of total hip arthroplasty interventions between 2001 and 2018, according to the **type of polyethylene** used. All types of poly (with or without **anti-luxation lip**, constrained) are considered.

Year of surgery	Primary surgery		
	Standard poly	Crosslinked poly	Undefined poly
2001	76,4	18,3	5,3
2002	82,1	15,7	2,3
2003	81,3	17,3	1,4
2004	77,9	21,5	0,6
2005	74,8	24,1	1,1
2006	75,2	24,6	0,2
2007	71,6	28,2	0,2
2008	64,5	35,3	0,1
2009	50,9	49,1	-
2010	39,8	60,2	-
2011	33,3	66,7	-
2012	22,7	77,3	-
2013	20,8	79,2	-
2014	16,5	83,5	-
2015	12,6	87,4	-
2016	10,9	89,1	-
2017	10,5	89,5	-
2018	9,4	90,6	

Sometimes, missing label did not allow classification of poly.

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

Year of surgery	Primary surgery	
	Alumina liner	Composite ceramic liner
2000	100,0	-
2001	100,0	-
2002	100,0	-
2003	99,1	0,9
2004	96,9	3,1
2005	90,6	9,4
2006	85,3	14,7
2007	67,4	32,6
2008	22,2	77,8
2009	14,9	85,1
2010	7,0	93,0
2011	3,4	96,6
2012	0,8	99,2
2013	1,1	98,9
2014	1,1	98,9
2015	0,2	99,8
2016	0,2	99,8
2017	-	100,0
2018	-	100,0

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

Year of surgery	Primary surgery	
	Alumina head	**Composite ceramic head**
2001	100,0	-
2002	100,0	-
2003	100,0	-
2004	99,8	0,2
2005	99,2	0,8
2006	96,4	3,6
2007	88,6	11,4
2008	46,0	54,0
2009	27,3	72,7
2010	10,3	89,7
2011	5,3	94,7
2012	4,3	95,7
2013	4,4	95,6
2014	2,5	97,5
2015	1,0	99,0
2016	1,1	98,9
2017	0,9	99,1
2018	1,0	99,0

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2018, 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	-	-	-	-	4.344	9,6	21.651	71,0	27.981	79,0	5.226	62,7
Cr-Co	619	84,1	24	80,0	18.786	41,7	2.631	8,6	2.180	6,2	2.517	30,2
Alumina	1	0,1	-	-	17.532	38,9	5.315	17,4	3.507	9,9	30	0,4
Stainless steel	113	15,4	5	16,7	3.473	7,7	187	0,6	29	0,1	-	-
Ceramicised Metal	2	0,3		0,0	606	1,3	632	2,1	1.598	4,5	106	1,3
Revision ceramic	-	-	-	-	5	0,0	17	0,1	10	0,0	459	5,5
Zirconia	1	0,1	1	3,3	308	0,7	73	0,2	106	0,3	-	-
Total*	**643**	**100,0**	**30**	**100,0**	**44.107**	**100,0**	**27.078**	**100,0**	**31.704**	**100,0**	**7.931**	**100,0**

*333 missing data (0,3%)

Year of surgery	Diameter of the head (mm) in THA								
	<=28 cer	<=28 met	<=28 other	32 cer	32 met	32 other	>=36 cer	>=36 met	>=36 other
2000	45,5	49,8	1,1	1,1	1,4	0,0	0,0	1,1	0,0
2001	49,8	46,6	1,1	0,7	0,3	0,0	0,0	1,4	0,0

2002	51,7	45,7	0,8	0,9	0,1	0,0	0,0	0,8	0,0
2003	50,5	46,4	0,7	0,9	0,1	0,0	0,3	1,2	0,0
2004	50,7	41,3	0,8	3,2	0,6	0,0	1,3	2,2	0,0
2005	33,9	38,0	0,5	16,5	1,6	0,0	5,5	4,0	0,0
2006	23,1	33,5	0,5	18,9	2,0	0,1	14,8	7,2	0,0
2007	15,7	28,2	0,9	20,5	3,8	0,1	21,6	9,1	0,0
2008	14,3	21,7	0,4	20,4	3,8	0,1	29,6	9,8	0,0
2009	11,5	17,6	0,1	21,7	3,1	0,0	36,7	9,1	0,1
2010	8,6	10,0	0,1	23,8	4,6	0,2	44,2	7,7	0,9
2011	6,3	8,0	0,2	27,0	4,7	0,5	45,6	4,9	2,8
2012	6,8	5,4	0,1	28,2	3,7	0,3	50,0	3,0	2,7
2013	6,0	5,0	0,2	29,6	2,8	0,6	50,3	2,7	2,8
2014	6,1	5,3	0,3	32,5	2,6	0,8	47,7	2,6	2,2
2015	5,6	4,7	0,5	33,1	2,4	0,7	49,0	2,2	2,0
2016	6,5	4,2	0,6	33,9	2,0	1,3	46,5	1,9	3,1
2017	7,0	4,8	0,6	36,2	1,5	1,9	43,0	1,6	3,3
2018	7,6	3,9	0,7	37,1	1,3	1,8	43,1	1,2	3,3

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

4.10 Prosthesis fixation

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2018, according to **type of operation** and **fixation**

Fixation	Primary THA	%	Total revision	%
Cementless	105.829	88,1	3.386	74,8
Hybrid (cemented stem and cementless cup)	8.935	7,4	350	7,7
Cemented	4.640	3,9	226	5,0
Reverse hybrid (cementless stem and cemented cup)	700	0,6	562	12,4
Total*	**120.104**	**100,0**	**4.524**	**100,0**

* 304 primary THA and 23 total revision missing data.

Percentage of total hip arthroplasties **according to fixation**, during the years 2000–2018

Year of surgery	Primary THA			
	Cemented	Cementless	Hybrid	Reverse hybrid
2000	15,2	61,8	22,1	1,0
2001	14,3	66,5	18,5	0,8
2002	12,1	71,3	15,8	0,8
2003	11,0	73,3	15,0	0,7
2004	8,6	78,3	12,4	0,7
2005	7,0	80,5	11,6	0,8
2006	6,1	83,1	10,2	0,6
2007	4,3	87,1	8,0	0,6
2008	2,5	90,4	6,5	0,6
2009	2,0	91,4	5,8	0,8
2010	1,2	94,1	4,1	0,6
2011	0,8	95,1	3,5	0,6
2012	0,6	95,3	3,3	0,7
2013	1,0	95,5	3,0	0,5
2014	0,8	95,5	3,3	0,5
2015	0,5	95,5	3,6	0,4
2016	0,5	96,5	2,7	0,3
2017	0,3	96,4	2,9	0,4
2018	0,3	96,6	2,5	0,3

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

Age class	Elective primary THA 2000-2018			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0,5	98,5	0,6	0,4
40-49	0,2	99,1	0,5	0,2
50-59	0,3	98,1	1,4	0,2
60-69	0,9	93,7	5,1	0,3
70-79	4,4	84,3	10,7	0,6
≥80	12,2	72,5	14,0	1,3

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

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

Percentage of elective total hip arthroplasties **according to fixation and class of age** - year 2018

Age class	Elective primary THA year 2018			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	-	100,0	-	-
40-49	-	100,0	-	-
50-59	-	99,4	0,5	0,1
60-69	-	99,5	0,4	-
70-79	0,2	97,2	2,5	-
≥80	0,7	91,0	7,3	1,0

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

Year	Total revision			
	Cemented	Cementless	Hybrid	Reverse hybrid
2000	9,4	62,5	9,4	18,8
2001	7,9	64,0	8,5	19,6
2002	6,0	66,0	7,3	20,7
2003	7,2	69,1	6,8	16,9
2004	7,1	68,8	7,9	16,2
2005	7,5	68,3	8,4	15,9
2006	6,2	73,0	9,9	10,9
2007	4,0	74,1	9,5	12,4
2008	3,1	78,2	8,4	10,2
2009	1,8	82,1	7,2	9,0
2010	1,7	84,0	5,9	8,4
2011	5,0	80,1	7,2	7,7
2012	1,3	88,2	3,5	7,0
2013	2,3	82,6	7,8	7,3
2014	0,6	88,5	4,2	6,7
2015	3,5	85,9	5,9	4,7
2016	4,1	83,1	5,2	7,6
2017	3,8	82,3	3,8	10,1
2018	4,3	80,8	5,8	6,3

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

Age class	Total revision			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	1,2	94,0	1,2	3,6
40-49	2,9	89,1	4,0	4,0
50-59	1,4	88,5	3,0	7,1
60-69	2,9	79,4	6,1	11,7
70-79	4,6	72,6	8,4	14,4
≥80	12,1	59,9	13,0	15,0

4.11 Bone cement

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

Cement	% in THA	% in Hemi	% in Resurf
Surgical Simplex P - Howmedica	35,4	36,1	34,3
Cemex System - Tecres	10,9	21,8	1,1
Smartset Hv - Depuy	6,3	7,9	2,4
Antibiotic Simplex - Howmedica	**6,3**	**2,8**	**54,6**
Palacos R - Biomet	5,2	1,0	0,9
Amplicem 3 - Amplimedical	3,2	2,7	0,0
Smartset Mv - Depuy	2,0	5,1	0,0
Cemex Rx - Tecres	2,0	4,1	0,1
Cemex + Cemex System - Tecres	1,8	0,0	0,0
Cemex - Tecres	1,6	1,3	0,1
Palacos R - Heraeus Medical	1,5	3,0	0,1
Exolent High - Elmdown	1,4	0,5	0,0
Cemex Rx + Cemex System - Tecres	1,4	0,0	0,0
Cemfix 1 - Teknimed	1,3	1,6	0,0
Cmw 3 - Depuy	1,3	0,8	0,0
Amplicem 1 + Amplicem 3 - Amplimedical	1,3	0,0	0,0
Cemex Sys. -Tecres+Surgical Simplex P-How	1,2	0,0	0,0
Amplicem1-Amplim.+Smartset Hv-Depuy	1,2	0,0	0,0
Versabond - Smith and Nephew	1,1	0,0	2,1
Sulcem 3 - Centerpulse	1,0	0,8	0,0
Cemex Genta + Cemex Genta Sys.- Tecres	**0,9**	**0,0**	**0,0**
Vacu Mix Plus Cmw 3 - Depuy	0,9	2,4	0,0
Cemfix 3 - Teknimed	0,8	0,3	0,0
Aminofix 1 - Groupe Lepine	**0,7**	**0,0**	**0,0**
Palacos R+G - Heraeus Medical	**0,6**	**0,7**	**0,0**
Cemex Genta - Tecres	**0,6**	**0,3**	**0,0**
Palacos R 40 - Sp Europe	0,6	0,1	0,0
Bone Cement R - Biomet	0,5	0,1	0,8
Refobacin Bone Cement R - Biomet	**0,5**	**0,0**	**0,0**
Hi-Fatigue - Zimmer	0,5	0,0	0,5
Cemex Genta System - Tecres	**0,5**	**1,8**	**1,0**
A. Simplex + S. Simplex P - Howmedica	**0,3**	**0,0**	**0,1**
Cemsys 1 - Mathys	0,3	0,0	0,0
Amplicem 1 - Amplimedical	0,3	0,0	0,0
Smartset GMV - Depuy	**0,3**	**0,0**	**0,0**
Amplicem 3G - Amplimedical	**0,3**	**0,0**	**0,0**
Hi-Fatigue G - Zimmer	**0,2**	**0,0**	**0,0**
Cemex XL - Tecres	0,2	0,5	0,0
Palamed G - Heraeus Medical	**0,2**	**0,1**	**0,0**
Osteobond - Zimmer	0,2	0,0	0,8
Smartset GHV - Depuy	**0,2**	**0,0**	**0,0**
Other without antibiotic	1,7	2,8	0,6
Other with antibiotic	**1,5**	**1,3**	**0,2**
Total	**100,0**	**100,0**	**100,0**

Antibiotic-loaded cement was chosen in 13,0% of THA, in 7,1% of hemi and in 56,1% of resurfacing.
Surgical Simplex P – Howmedica in 2017-2018 was chosen in 32,8% of THA and in 30,7% of hemi with at least one cemented component.

5. Types of hemiarthroplasty

5.1 Hemiarthroplasty cup and stem

Monoblock	2000-2012		2013-2015		2016-2018	
	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	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
TESTA ELLITTICA - Samo	422	99,3	-	-	-	-
Other	3	0,7	-	-	-	-
Total	**425**	**100,0**	**-**	**-**	**-**	**-**

Biarticular	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
JANUS Bioimpianti	1.736	6,0	2.089	28,4	2.700	38,8
TESTA BIPOLARE Samo	160	0,6	18	0,2	1.395	20,1
TESTA BIARTICOLARE LOCK Lima	1.918	6,7	427	5,8	944	13,6
C1 - Citieffe	4.772	16,6	2.080	28,2	451	6,5
CUPOLA MOBILE MODULARE-Wright Cremascoli	1.198	4,2	359	4,9	413	5,9
UHR Osteonics Stryker Howmedica	2.881	10,0	508	6,9	240	3,5
SPHERI-LOCK LSM-MED	-	-	5	0,1	207	3,0
CUPOLA MOBILE BIARTICOLARE - Permedica	723	2,5		0,0	164	2,4
TESTA BIPOLARE Smith and Nephew	73	0,3	97	1,3	94	1,4
SPHERI-LOCK Lima	5.246	18,3	834	11,3	77	1,1
BI-POLAR Biomet	420	1,5	95	1,3	76	1,1
CUPOLA MOBILE Medacta	192	0,7	2	0,0	47	0,7
CUPOLA NEMAUSUS Transysteme	805	2,8	107	1,5	34	0,5
CUPOLA MOBILE BIBOP Symbios	49	0,2	29	0,4	32	0,5
BI-POLAR DePuy	1.367	4,8	658	8,9	31	0,4
CUPOLA BIPOLARE Zimmer	452	1,6	9	0,1	12	0,2
CUPOLA BIPOLARE Mathys	704	2,5	12	0,2	1	0,0
TESTA BIARTICOLARE - Lima	613	2,1	-	-	1	0,0
MODULAR BIPOLAR - Protek	611	2,1	1	0,0	-	-
ULTIMA MONK DePuy	1.004	3,5	-	-	-	-
CUPOLA MOBILE Zimmer	882	3,1	-	-	-	-
CUPOLA SEM - D.M.O.	731	2,5	-	-	-	-
CENTRAX - Stryker Howmedica	543	1,9	-	-	-	-

SPHERIC Amplitude	352	1,2	-	-	-	-
RETENTIVE MOBILE CUP - Cedior	292	1,0	-	-	-	-
BICENTRIC - Stryker Howmedica	236	0,8	-	-	-	-
TESTA BIPOLARE - Amplimedical	193	0,7	-	-	-	-
CORON Tantum	190	0,7	-	-	-	-
Other (< 100 cases)	372	1,3	37	0,5	31	0,4
Total*	**28.715**	**100,0**	**7.367**	**100,0**	**6.950**	**100,0**

*270 missing data (0,6%)

In 243 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
KORUS Bioimpianti	-	-	699	13,4	1.279	28,5
DUOFIT CKA Samo	205	0,8	17	0,3	1.227	27,4
SL Lima	1.125	4,6	486	9,3	463	10,3
AB Citieffe	4.324	17,8	1.930	36,9	407	9,1
PROFEMUR GLADIATOR Wright	-	-	349	6,7	381	8,5
EXETER V40 Stryker Howmedica	812	3,4	315	6,0	227	5,1
SL Permedica	679	2,8	-	-	126	2,8
SL STREAKES Lima	1.630	6,7	313	6,0	108	2,4
VERSYS ADVOCATE Zimmer	64	0,3	71	1,4	59	1,3
SPHERI-SYSTEM II Lima	2.305	9,5	181	3,5	10	0,2
LOGICA MIRROR Lima	528	2,2	12	0,2	7	0,2
CORAIL DePuy	93	0,4	484	9,3	3	0,1
APTA Adler-Ortho	1.019	4,2	15	0,3	2	0,0
S-TAPER Bioimpianti	273	1,1	161	3,1	-	-
C-STEM AMT DePuy	112	0,5	59	1,1	-	-
MERCURIUS Adler-Ortho	79	0,3	20	0,4	-	-
CCA Mathys	635	2,6	12	0,2	-	-
G2 DePuy	1.498	6,2	9	0,2	-	-
VERSYS HERITAGE Zimmer	138	0,6	2	0,0	-	-
QUADRA-C Medacta	176	0,7	1	0,0	-	-
ORTHO-FIT Zimmer	830	3,4	-	-	-	-
STANDARD STRAIGHT Zimmer	778	3,2	-	-	-	-
SL - Hit Medica	737	3,0	-	-	-	-
SEM II DMO	638	2,6	-	-	-	-
RELIANCE HOWMEDICA	623	2,6	-	-	-	-
VERSYS LD/FX- Zimmer	546	2,3	-	-	-	-
FIN Bioimpianti	526	2,2	-	-	-	-
JVC Wright Cremascoli	481	2,0	-	-	-	-
LC - Samo	423	1,7	-	-	-	-
ULTIMA LX Johnson And Johnson	317	1,3	-	-	-	-
AHS Wright Cremascoli	312	1,3	-	-	-	-
MRL Wright Cremascoli	270	1,1	-	-	-	-
LOGICA Lima	249	1,0	-	-	-	-
DEFINITION Stryker Howmedica	240	1,0	-	-	-	-
SL Amplimedical	158	0,7	-	-	-	-
ULTIMA STRAIGHT DePuy	156	0,6	-	-	-	-
ALBI PTC Wright Cremascoli	149	0,6	-	-	-	-
Other (< 100 cases)	1.108	4,6	95	1,8	186	4,1
Total	**24.236**	**100,0**	**5.231**	**100,0**	**4.485**	**100,0**

Cementless stem	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
KORUS Bioimpianti	59	1,2	766	35,8	1.281	51,6
SL Lima	299	6,0	37	1,7	317	12,8
LOGICA CS Lima	197	3,9	201	9,4	194	7,8
POLARSTEM Endoplus	30	0,6	87	4,1	86	3,5
TAPERLOC Biomet	48	1,0	80	3,7	74	3,0
Z1 Citieffe	72	1,4	57	2,7	67	2,7
S-TAPER Bioimpianti	751	14,9	420	19,7	66	2,7
DUOFIT RKT Samo	2	0,0	-	-	50	2,0
AMISTEM-H Medacta	-	-	-	-	40	1,6
HYDRA-FIX Adler-Ortho	-	-	-	-	38	1,5
APTA Adler-Ortho	120	2,4	13	0,6	33	1,3
HARMONY SYMBIOS	-	-	22	1,0	31	1,2
HYDRA Adler-Ortho	50	1,0	36	1,7	29	1,2
CORAIL De Puy	13	0,3	46	2,2	28	1,1
SL X-PORE Permedica	-	-	-	-	25	1,0
H-MAX S Lima	-	-	14	0,7	17	0,7
H-MAX M Lima	2	0,0	9	0,4	16	0,6
REVISION HIP Lima	8	0,2	11	0,5	14	0,6
CORAE Adler-Ortho	4	0,1	32	1,5	11	0,4
MRP Bioimpianti	26	0,5	3	0,1	6	0,2
ADR Endoplus	17	0,3	8	0,4	5	0,2
QUADRA-H Medacta	15	0,3	-	-	5	0,2
CONUS Centerpulse	30	0,6	13	0,6	2	0,1
RECTA Adler-Ortho	127	2,5	11	0,5	2	0,1
SL REVISION Sulzer	29	0,6	4	0,2	2	0,1
C2 Lima	27	0,5	5	0,2	1	0,0
TWINSYS Mathys	55	1,1	-	-	1	0,0
ACCOLADE Osteonics Stryker Howmedica	1.619	32,2	187	8,8	-	-
SUMMIT De Puy	32	0,6	14	0,7	-	-
G2 De Puy	91	1,8	1	0,0	-	-
SL PLUS Endoplus	24	0,5	1	0,0	-	-
HIP FRACTURE - Howmedica	283	5,6	-	-	-	-
PPF Biomet	266	5,3	-	-	-	-
ENDON Tantum	188	3,7	-	-	-	-
PORO-LOCK II Hit Medica	74	1,5	-	-	-	-
H-AC STEM FURLONG Jri	71	1,4	-	-	-	-
VERSYS FIBER METAL TAPER Zimmer	46	0,9	-	-	-	-
EURO HIP SYSTEM Wright Cremascoli	41	0,8	-	-	-	-
SPS MODULAR Symbios	37	0,7	-	-	-	-
COXAFIT HIP STEM FGL ARGE	24	0,5	-	-	-	-
PROFEMUR Z Wright Cremascoli	23	0,5	-	-	-	-
Other (< 20 cases)	224	4,5	59	2,8	42	1,7
Total	**5.024**	**100,0**	**2.137**	**100,0**	**2.483**	**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	42200	96,3
Bipolar head – preassembled	1102	2,5
Monoarticular	425	1,0
Monoblock prosthesis	112	0,2
Total	**43.839**	**100,0**

Stem was cemented in 62,5% and stem had a modular neck in 7,7%.
In year 2018 2,2% of hemi has ceramic heads, the other has metal head.

6. 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 between 1st January 2000 and 31st December 2018.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	*%*		**N.**	*%*
Calcar fracture	491	*0,4*	Deep vein thromb	110	*0,1*
Diaphysis fracture	384	*0,3*			
Greater troch. fracture	252	*0,2*			
Acetabulum fracture	169	*0,1*	Early infection	94	*0,1*
Anaesthesiolog. complications	157	*0,1*			
Hemorragia	58	*0,05*			
Instability	26	*0,02*			
Other	108	*0,1*			
Total	**1.645**	***1,4***	**Total**	**204**	***0,2***

The rate of complications in **revision surgery** carried out on patients hospitalized between 1st January 2000 and 31st December 2018.

Complications observed during hospitalization					
Intra-operative			**Post-operative local**		
	N.	*%*		**N.**	*%*
Diaphysis fracture	243	*1,4*	Early infection	58	*0,3*
Calcar fracture	80	*0,5*			
Greater troch. fracture	61	*0,4*			
Anaesthesiolog. complications	59	*0,3*	Deep vein thromb	24	*0,1*
Acetabulum fracture	27	*0,2*			
Hemorragia	29	*0,2*			
Other	39	*0,2*			
Total	**538**	***3,1***	**Total**	**82**	***0,5***

The rate of complications in **hemiarthroplasty** carried out on patients hospitalized between 1st January 2000 and 31st December 2018.

Complications observed during hospitalization					
Intra-operatorie			**Post-operatorie locali**		
	N.	**%**		**N.**	**%**
Calcar fracture	215	*0,5*	Deep vein thromb	75	*0,2*
Anaesthesiolog. complications	155	*0,4*			
Greater troch. fracture	134	*0,3*			
Diaphysis fracture	74	*0,2*	Early infection	65	*0,1*
Hemorragia	23	*0,1*			
Acetabulum fracture	6	*0,01*			
Other	56	*0,1*			
Total	**663**	***1,5***	**Total**	**140**	***0,3***

Complications recorded are those that occurred during hospitalization.

6.1 Deaths during hospitalization

Number of deaths in prosthetic surgery on patients hospitalized between 1st January 2000 and 31st December 2018.
The deaths recorded are those that occurred during hospitalization.

Years 2000-2018			
Type of surgery	**Deaths**	**n. of operations**	**Percentage**
Primary THA	289	120.408	0,2
Hemiarthroplasty	1.967	43.839	4,5
Partial and total Revision	127	17.317	0,7
Resurfacing prostheses	1	2.810	-
Prosthesis removal	38	1.449	2,6

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

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

2014	9,5	19,2
2015	11,7	18,5
2016	10,7	21,6
2017	10,1	22,9
2018	9,0	18,6

7. 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 2018			
Type of operation	**N.**	**Mean pre-op.**	**Range**
Primary THA	8.533	1,2	0-36
Hemiarthroplasty	2.336	2,4	0-49
Revision	879	3,2	0-58
Prosthesis removal	92	5,5	0-40

8. Analysis of survival of primary surgery

8.1 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 2018 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 87.388
Non revised: 83.134
Revised: 4.254

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

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

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

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

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

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

Patients of the group 'Other pathologies' had a 1,8-fold greater risk of failure compared to coxarthrosis. In this heterogeneous group, sequelae of congenital and infantile septic coxitis, although the low numerosity, have the higher of failure.
Also patients treated for femoral neck fracture and sequelae have an increased risk of failure (1,4-fold) than patients treated for coxarthrosis.

Conversely, in patients treated by arthroplasty due to necrosis or sequelae of congenital and childhood diseases, the risk of failure 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

8.2 Rate of failure

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

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

The following table shows in the first column the number of primary joint arthroplasty operations performed in the period from 1st January 2000 to 31st December 2018 **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	87.388	2.573	1.458	223	7,2
Hemy *	42.383	715	189	23	3,6
Total revision	2.942	212	117	9	7,4

* hemiarthroplasties with acetabular buffer are not considered

The following table shows the number of resurfacing prostheses performed in Emilia-Romagna. Resurfacing prosthesis has been significantly used 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	877	56	21	10	8,7

In Primary THA, **39,5%** of Revisions was performed in a different hospital, in Hemiarthroplasty **22,9%** and in total revision **37,5%.**
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	3.162	869	223	4.254/87.388
Hemiarthroplasty*	666	238	23	927/42.383
Resurfacing	76	1	10	87/877
Total revision	274	55	10	339/2.942

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

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

8.3 Survival curves according to Kaplan Meier

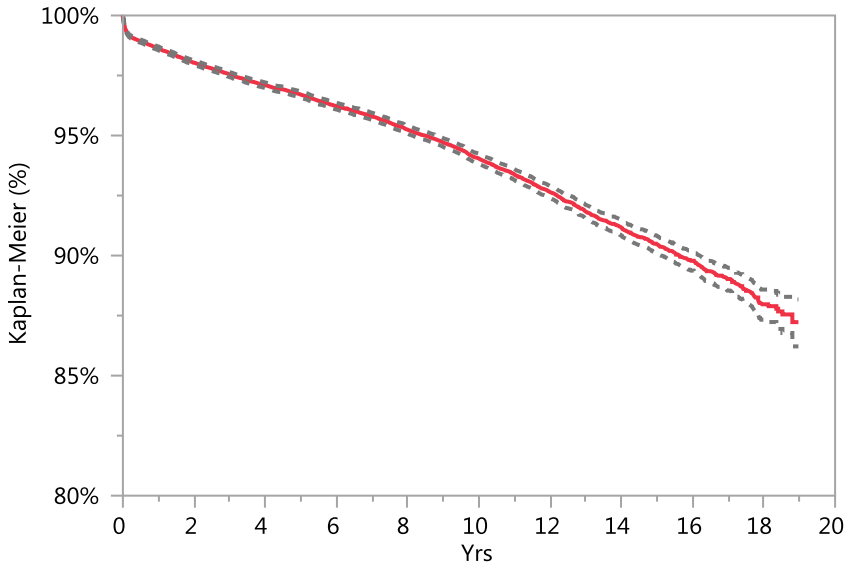
The survival curve calculated by the Kaplan Meier method enables an estimation of the probability that each individual has of maintaining its initial condition (prosthesis in place) over time.
The following paragraphs show the survival curves calculated separately for primary prosthesis, endoprosthesis,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

8.4 Analysis of survival in primary total hip arthroplasty

87.388 primary arthroprostheses are under observation. On these, 4.254 volte revisions were carried out.

Number of arthroprostheses	n. revisions	% survival at 18 yrs	Confidence Interval 95%	Mean Follow-up
87.388	4.254	88,0	87,3-88,6	7,2

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	**680**/87.388	0,8	16,0
Aseptic loosening of the cup	**626**/87.388	0,7	14,7
Periprosthetic bone fracture	**602**/87.388	0,7	14,2
Recurrent prosthesis dislocation	**586**/87.388	0,7	13,8
Breakage of prosthesis	**405**/87.388	0,5	9,5
Septic loosening	**250**/87.388	0,3	5,9
Global aseptic loosening	**249**/87.388	0,3	5,9
Poly wear	**98**/87.388	0,1	2,3
Pain without loosening	**88**/87.388	0,1	2,1
Primary instability	**81**/87.388	0,1	1,9
Metallosis	**41**/87.388	0,05	1,0
Heterotopic bone	**37**/87.388	0,04	0,9
Other	**92**/87.388	0,1	2,2
Unknown*	**419**/87.388	0,5	9,8
Total	**4.254/87.388**	**4,9**	**100,0**

*223 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	24,7	8,0	5,0
Aseptic loosening of the stem	15,0	22,3	15,0
Periprosthetic bone fracture	13,4	10,8	15,9
Aseptic loosening of the cup	10,5	15,6	18,5
Septic loosening	7,5	6,7	4,1
Breakage of prosthesis	5,5	15,4	11,6
Primary instability	4,4	0,4	0,0
Unknown	4,2	2,5	5,7
Global aseptic loosening	2,8	6,7	8,5
Pain without loosening	2,7	2,7	1,3
Heterotopic bone	1,4	0,9	0,4
Poly wear	0,3	0,9	4,6
Metallosis	0,1	0,5	2,0
Unknown (performed outside Emilia Romagna Region)	3,9	5,8	6,4
Other	3,7	0,9	1,1

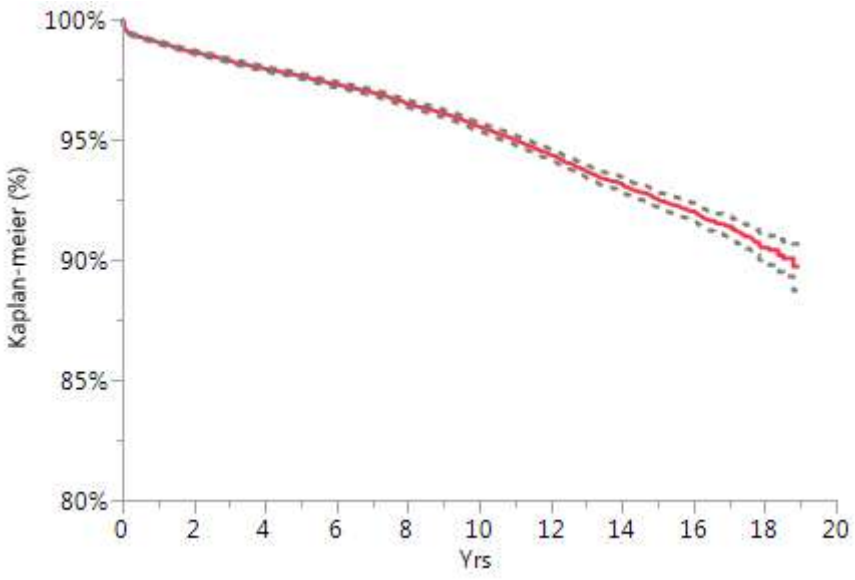
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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

87.388 primary arthroprostheses are under observation. Of these, 3.162 revisions were carried out to remove cup and/or stem.

Number of arthroprostheses	N. revisions	% survival at 18 yrs	Confidence Interval 95%	Mean Follow-up
87.388	3.162	90,5	89,9-91,1	7,2

Survival curve



8.6 Analysis of survival according to model of prosthesis

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

Cup (stem) Manufacturer	From years	N.	n. revisions	% survival 5 yrs	N. at risk at 5 yrs	% survival 10 yrs	N. at risk at 10 yrs
Fixa Ti-POR (Apta) Adler-Ortho	2007	5.033	99	98,2 (97,8-98,6)	2.789	96,4 (95,2-97,4)	211
Fixa Ti-POR (Hydra) Adler-Ortho	2007	3.565	88	97,1 (96,3-97,7)	1.316	95,6 (94,3-96,6)	44
AnCA Fit (AnCA Fit) Wright Cremascoli	2000	2.875	262	95,9 (95,1-96,6)	2.596	93,2 (92,2-94,1)	2.251
FIXA (RECTA) Adler-Ortho	2004	2.725	165	96,4 (95,6-97,0)	2.444	93,4 (92,3-94,4)	1.143
EP-FIT PLUS (SL PLUS)	2003	1.968	84	96,7	1.618	95,3	623

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

ENDOPLUS				(95,8-97,4)		(94,1-96,3)	
ABGII (ABGII) Stryker Howmedica	2000	1.960	112	97,7 (96,9-98,3)	1.723	95,1 (94,0-96,0)	1.069
Fixa Ti-POR (CORAE) Adler-Ortho	2010	1.912	29	97,9 (96,7-98,6)	159	-	-
FIXA (APTA) Adler-Ortho	2004	1.712	103	96,7 (95,8-97,5)	1.575	94,3 (93,0-95,3)	1.267
Fixa Ti-POR (RECTA) Adler-Ortho	2007	1.660	58	96,7 (95,7-97,6)	884	95,0 (93,1-96,4)	45
R3 (SL PLUS MIA) Smith & Nephew	2010	1.631	24	98,4 (97,6-99,0)	611	-	-
CLS (CLS) Sulzer Centerpulse Zimmer	2000	1.516	111	97,5 (96,6-98,2)	1.342	94,5 (93,1-95,6)	1.043
FITMORE (CONUS) SulzerCenterpulse Zimmer	2000	1.242	61	97,2 (96,1-98,0)	980	95,7 (94,3-96,8)	566
EXPANSION (CBC) Mathys	2003	1.194	88	94,7 (93,3-95,9)	946	91,3 (89,2-93,0)	381
Exceed ABT (TAPERLOC) Biomet	2006	1.143	19	98,4 (97,4-99,0)	650	98,0 (96,7-98,8)	72
EP-FIT PLUS (PROXYPLUS) Smith & Nephew	2005	1.099	36	98,2 (97,2-98,8)	863	95,5 (93,6-96,9)	320
BICON PLUS (SL PLUS) Smith & Nephew	2000	932	84	95,8 (94,3-96,9)	805	93,0 (91,1-94,6)	585
R3 (POLARSTEM) Smith & Nephew	2012	868	11	98,7 (97,6-99,3)	25	-	-
Fixa Ti-POR (HYDRA-FIX) Adler-Ortho	2016	819	16	-	-	-	-
FITMORE (CLS) SulzerCenterpulse Zimmer	2000	768	37	97,2 (95,8-98,2)	685	95,5 (93,6-96,8)	520
Versafitcup CC (Amistem) Medacta	2011	749	20	96,5 (94,4-97,8)	102	-	-
PINNACLE SECTOR II (CORAIL) DePuy	2002	688	39	96,0 (94,2-97,3)	502	92,2 (89,1-94,5)	157
Ep-fit (Polarstem) Endoplus	2008	653	11	98,5 (97,1-99,2)	339	-	-
JUMP SYSTEM (EXACTA) Permedica	2010	652	7	-		-	-
REFLECTION (**BASIS**) Smith & Nephew	2001	626	49	96,4 (94,5-97,6)	492	91,3 (88,3-93,7)	258
CLS (CONUS) SulzerCenterpulse Zimmer	2000	595	53	97,1 (95,3-98,2)	534	94,0 (91,6-95,7)	442
FIXA TI-POR (APTA-FIX) Adler-Ortho	2015	590	8	-	-	-	-
FIXA (**APTA**) Adler-Ortho	2005	573	22	97,1 (95,4-98,2)	479	96,4 (94,4-97,7)	311
JUMP SYSTEM (SYNTHESIS) Permedica	2013	557	10	-	-	-	-
DELTA TT (H-MAX S) Lima	2009	556	6	98,6 (96,5-99,4)	54	-	-
REFLECTION (**SYNERGY**) Smith & Nephew	2000	522	26	98,5 (96,8-99,3)	343	94,1 (90,7-96,4)	160
TRILOGY (VERSYS FIBER) Zimmer	2000	505	28	96,4 (94,3-97,7)	448	94,9 (92,6-96,6)	354
TRIDENT PSL HA CLUSTER (ABGII) Stryker Howmedica	2002	498	35	95,4 (93,1-96,9)	410	93,4 (90,6-95,4)	196
DUOFIT PSF (**P507**) Samo	2000	492	31	98,1 (96,3-99,0)	434	96,3 (94,0-97,7)	342
G7 PPS (TAPERLOC	2014	492	8	-	-	-	-

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

COMPLETE) Biomet							
PINNACLE SECTOR II (SUMMIT) DePuy	2003	489	8	98,1 (96,0-99,1)	227	98,1 (96,0-99,1)	75
CONTEMPORARY (EXETER V40) Stryker Howmedica	2000	488	25	96,1 (93,9-97,6)	361	94,4 (91,5-96,3)	209
RECAP RESURFACING (TAPERLOC) Biomet	2005	486	29	95,8 (93,6-97,3)	439	94,2 (91,5-96,0)	209
Fixa Ti-POR (Alata Acuta) Adler-Ortho	2007	465	11	97,2 (95,0-98,5)	201	-	-
DELTA TT (MODULUS HIP SYSTEM) Lima	2007	459	15	96,9 (94,8-98,2)	231	96,0 (93,3-97,6)	20
SELEXYS TH (CBC) MATHYS	2006	435	52	92,0 (89,0-94,3)	352	86,8 (82,8-89,9)	176
VERSAFITCUP CC TRIO (MINIMAX) Medacta	2012	431	8	-	-	-	-
AnCA Fit (PROFEMUR Z) Wright Cremascoli	2002	421	46	93,8 (91,0-95,7)	382	91,7 (88,5-94,0)	327
DELTA PF (MODULUS HIP SYSTEM) Lima	2003	416	12	97,8 (95,7-98,8)	316	97,0 (94,6-98,4)	191
G7 PPS (TAPERLOC COMPLETE MICROPLASTY) Biomet	2015	402	4	-	-	-	-
TOP (CFP) Link	2000	401	15	97,7 (95,6-98,8)	363	95,8 (93,2-97,5)	285
CONTINUUM (CLS) Zimmer	2010	399	5	98,2 (95,4-99,3)	147	-	-
R3 (SL PLUS) Smith & Nephew	2009	398	13	96,5 (93,7-98,1)	154	-	-
Versafitcup CC (Minimax) Medacta	2007	363	19	96,6 (94,2-98,1)	316	90,4 (82,1-95,1)	26
R3 (ADR) Smith & Nephew	2009	352	18	95,1 (92,1-97,1)	170	-	-
CUPULE RELOAD AVANTAGE (TAPERLOC) Biomet	2008	348	11	97,1 (94,7-98,4)	244	96,6 (93,9-98,1)	26
MULLER (JVC) Wright Cremascoli	2000	326	14	98,4 (96,2-99,3)	269	96,1 (92,8-97,9)	159
STANDARD CUP (CLS) Sulzer Centerpulse Zimmer	2000	322	15	98,4 (96,2-99,3)	296	96,9 (94,2-98,4)	243
TRIDENT PSL HA CLUSTER (**EXETER V40**) Howmedica	2002	519	5	99,4 (98,2-99,8)	277	98,9 (96,8-99,6)	174
CLS Zimmer (SL PLUS) Smith & Nephew	2001	311	17	96,6 (93,8-98,2)	269	95,0 (91,6-97,0)	188
MULLER (MRL) Wright Cremascoli	2000	308	19	96,5 (93,7-98,1)	246	94,8 (91,4-96,9)	173
EP-FIT PLUS Endoplus (NANOS) Endoplant Gmbh	2005	300	8	97,5 (94,9-98,8)	226	96,8 (93,5-98,4)	44
Other (< 300 cases)	2000	34.763	1.948	96,3 (96,0-96,5)	20.955	93,3 (92,9-93,6)	10.409
Unknow	2000	338	29	-	-	-	-
All models	**2000**	**87.388**	**4.254**	**96,7 (96,6-96,8)**	**52.650**	**94,0 (93,8-94,2)**	**25.450**

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 with less than 300 cases in 2000-2018.

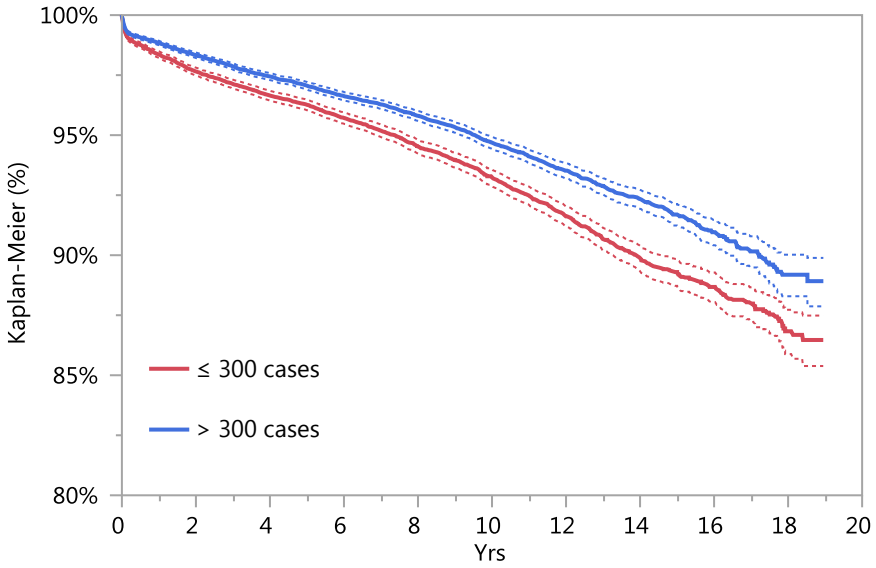
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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.

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

	Number of implants	n. revisions	% survival at 18 yrs	Confidence Interval 95%	Mean Follow-up
Models > 300 cases	52.206	2.210	89,2	88,3-90,0	7,2
Models < 300 cases	34.763	1.948	86,8	85,9-87,7	7,3

Survival curve



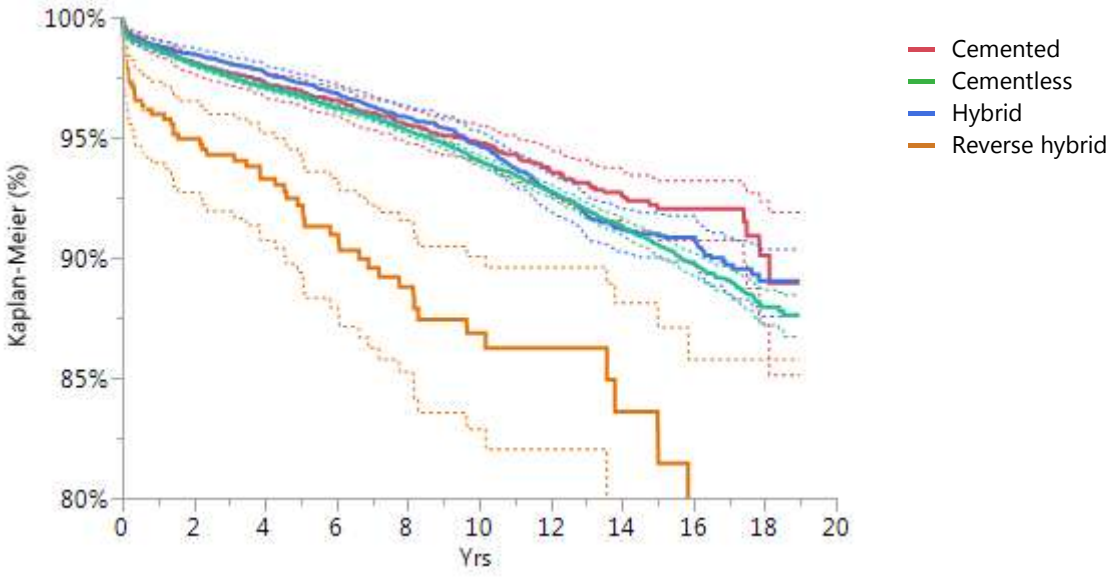
Curves are significantly different (p=0,001, Wilcoxon test)

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

8.7 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 18 yrs (c.i. at 95%)	Mean Follow-up
Cementless	75.196	3.496	87,9 (87,2-88,7)	6,9
Hybrid (cemented stem, cementless cup)	7.163	409	89,0 (87,6-90,4)	9,3
Cemented	4.143	207	90,1 (87,3-92,3)	8,8
Reverse hybrid (cementless stem, cemented cup)	562	57	77,9 (67,4-85,8)	6,7



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

Cemented			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	62/4.143	1,5	30,0
Global aseptic loosening	39/4.143	0,9	18,8
Recurrent prosthesis dislocation	28/4.143	0,7	13,5
Aseptic loosening of the stem	20/4.143	0,5	9,7
Septic loosening	19/4.143	0,5	9,2
Periprosthetic bone fracture	17/4.143	0,4	8,2
Primary instability	4/4.143	0,1	1,9
Breakage of prosthesis	2/4.143	0,05	1,0
Other	1/4.143	0,02	0,5
Unknown *(6 performed outside region)*	15/4.143	0,4	7,2
Total	**207/4.143**	**5,0**	**100,0**
Cementless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Periprosthetic bone fracture	**527**/75.196	0,7	15,1
Aseptic loosening of the stem	**521**/75.196	0,7	14,9
Aseptic loosening of the cup	**496**/75.196	0,7	14,2
Recurrent prosthesis dislocation	**459**/75.196	0,6	13,1
Breakage of prosthesis	**394**/75.196	0,5	11,3
Septic loosening	**195**/75.196	0,3	5,6
Global aseptic loosening	**148**/75.196	0,2	4,2
Pain without loosening	**87**/75.196	0,1	2,5
Poly wear	**77**/75.196	0,1	2,2
Primary instability	**74**/75.196	0,1	2,1
Metallosis	**40**/75.196	0,05	1,1
Heterotopic bone	**33**/75.196	0,04	0,9
Other	**85**/75.196	0,1	2,4
Unknown *(198 performed outside region)*	**360**/75.196	0,5	10,3
Total	**3.496/75.196**	**4,6**	**100,0**
Hybrid			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**118**/7.163	1,6	28,9
Recurrent prosthesis dislocation	**77**/7.163	1,1	18,8
Global aseptic loosening	**49**/7.163	0,7	12,0
Periprosthetic bone fracture	**46**/7.163	0,6	11,2
Aseptic loosening of the cup	**35**/7.163	0,5	8,6
Septic loosening	**31**/7.163	0,4	7,6
Poly wear	**14**/7.163	0,2	3,4
Breakage of prosthesis	**6**/7.163	0,1	1,5
Heterotopic bone	**3**/7.163	0,04	0,7
Primary instability	**2**/7.163	0,03	0,5
Pain without loosening	**1**/7.163	0,01	0,2
Other	**6**/7.163	0,1	1,5
Unknown *(9 performed outside region)*	**21**/7.163	0,3	5,1
Total	**409/7.163**	**5,7**	**100,0**
Reverse hybrid			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**18**/562	3,2	31,6
Recurrent prosthesis dislocation	**8**/562	1,4	14,0

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

Periprosthetic bone fracture	**7**/562	1,2	12,3
Aseptic loosening of the stem	**7**/562	1,2	12,3
Global aseptic loosening	**5**/562	0,9	8,8
Septic loosening	**3**/562	0,5	5,3
Breakage of prosthesis	**2**/562	0,4	3,5
Unknown *(6 performed outside region)*	**7**/562	1,2	12,3
Total	**57/562**	**10,1**	**100,0**

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

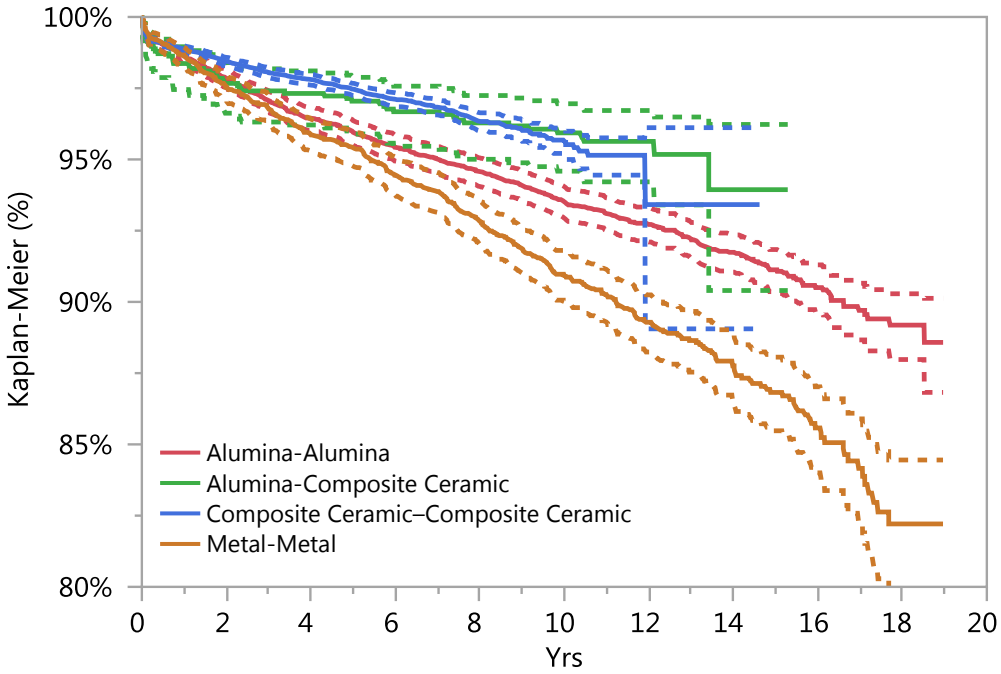
The following table shows survival of prosthesis according to coupling. Only couplings with more than 1000 casese are presented. Dual mobility cups are excluded.
The articular coupling is defined about characteristics of the sliding surface, regardless if insert is made of a single material or two.

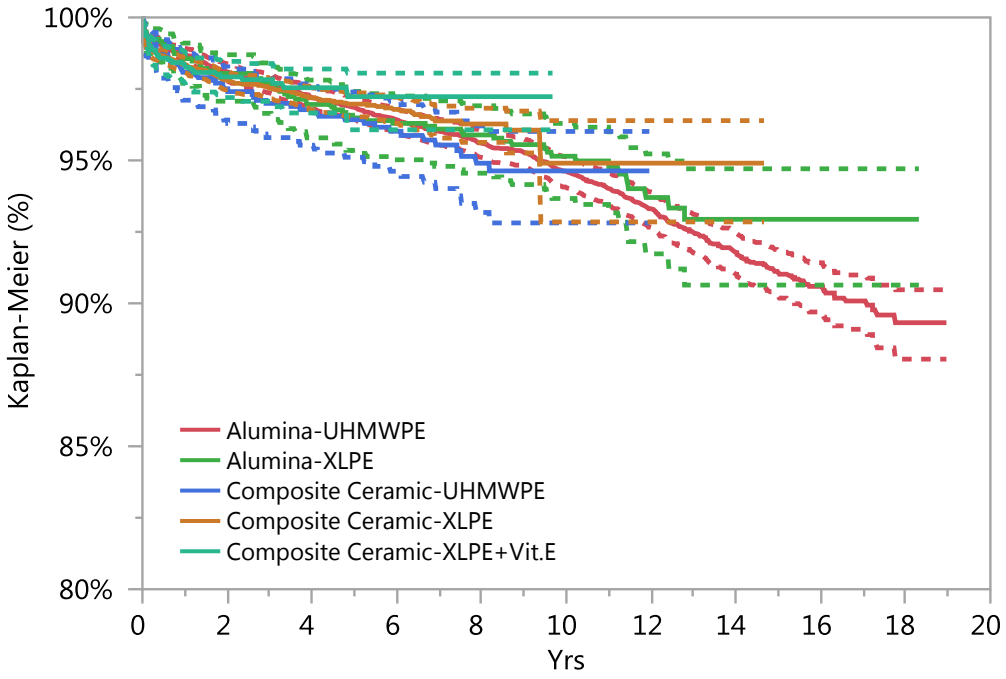
The survival curve are shown in three separate figures, to have better graphics.

Articular coupling	Mean Follow-up	N.	Removals	% survival at 5 yrs	c.i. at 95%	% survival at 10 yrs	c.i. at 95%
Composite ceramic – Composite ceramic	4,8	27.232	687	97,5	97,3-97,7	95,7	95,2-96,1
Metal - UHMWPE	9,9	11.207	941	96,2	95,8-96,5	92,5	91,9-93,0
Comp. ceramic - XLPE	3,6	9.210	234	97,0	96,5-97,4	94,9	92,8-96,4
Allumina-Allumina	11,7	8.157	617	96,0	95,5-96,4	93,5	92,9-94,0
Alumina-UHMWPE	11,1	7.893	530	96,8	96,4-97,2	94,6	94,1-95,1
Metal-XLPE	7,7	6.116	255	97,1	96,6-97,5	95,1	94,4-95,7
Metal-Metal	10,6	4.667	477	95,4	94,8-96,0	90,9	90,0-91,7
Comp. ceramic - XLPE + Vit.E	2,6	2.334	47	97,2	96,1-98,1		
Ceramicised metal-XLPE	3,4	1.473	35	97,2	96,0-98,0	95,8	93,7-97,2
Allumina-XLPE	9,7	1.193	60	96,5	95,2-97,4	95,1	93,7-96,3
Comp. ceramic-UHMWPE	6,0	1.185	48	96,4	95,1-97,4	94,6	92,8-96,0
Alumina-Composite ceramic	9,9	1.165	49	97,0	95,9-97,9	95,9	94,6-97,0

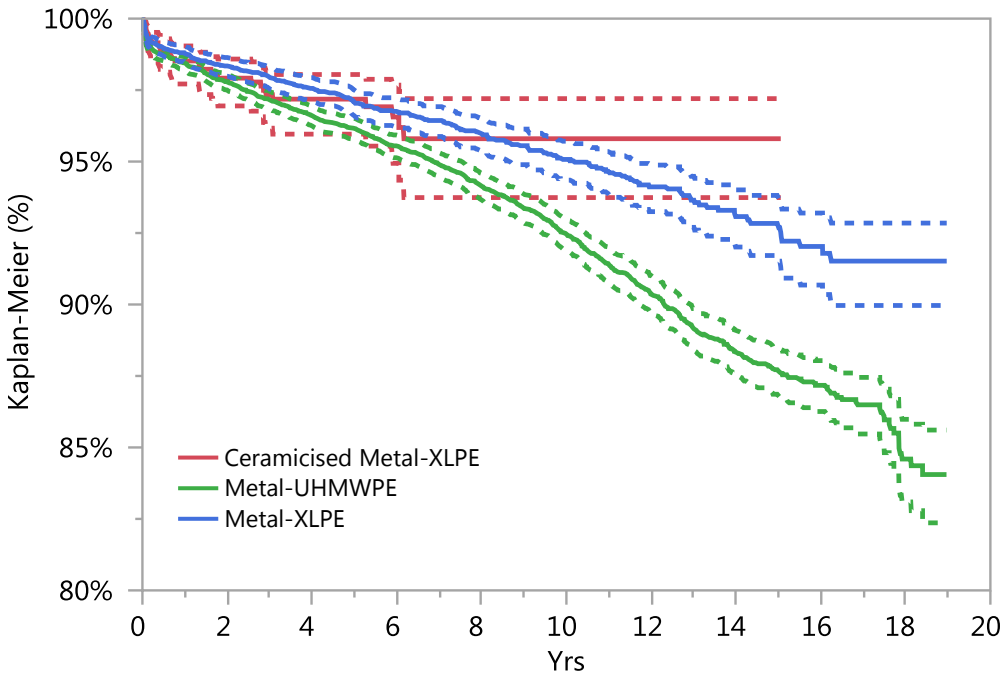
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Survival Curve





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



Curves are significantly different (p=0,01, Wilcoxon test)

Metal - Metal			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**113**/4.667	2,4	23,7
Aseptic loosening of the stem	**60**/4.667	1,3	12,6
Global aseptic loosening	**40**/4.667	0,9	8,4
Septic loosening	**38**/4.667	0,8	8,0
Metallosis	**36**/4.667	0,8	7,5
Breakage of prosthesis (17 stems and 17 cups)	**34**/4.667	0,7	7,1
Periprosthetic bone fracture	**33**/4.667	0,7	6,9
Prosthesis dislocation	**28**/4.667	0,6	5,9
Pain without loosening	**13**/4.667	0,3	2,7
Primary instability	**5**/4.667	0,1	1,0
Heterotopic bone	**3**/4.667	0,1	0,6
Poly wear	**1**/4.667	0,0	0,2
Other	**5**/4.667	0,1	1,0
Unknown *(49 performed outside region)*	**68**/4.667	1,5	14,3
Total	**477/4.667**	**10,2**	**100,0**
Metal - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the cup	**217**/11.207	1,9	23,1
Aseptic loosening of the stem	**166**/11.207	1,5	17,6
Prosthesis dislocation	**148**/11.207	1,3	15,7
Global aseptic loosening	**100**/11.207	0,9	10,6
Periprosthetic bone fracture	**80**/11.207	0,7	8,5
Poly wear	**62**/11.207	0,6	6,6
Septic loosening	**43**/11.207	0,4	4,6
Pain without loosening	**16**/11.207	0,1	1,7

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

Breakage of prosthesis (9 stems, 3 cups, 2 inserts and 1 unknown)	**15**/11.207	0,1	1,6
Primary instability	**8**/11.207	0,1	0,9
Heterotopic bone	**1**/11.207	0,0	0,1
Other	**7**/11.207	0,1	0,7
Unknown *(40 performed outside region)*	**78**/11.207	0,7	8,3
Total	**941/11.207**	**8,4**	**100,0**
Metal - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Periprosthetic bone fracture	**81**/6.116	1,3	31,8
Prosthesis dislocation	**42**/6.116	0,7	16,5
Aseptic loosening of the stem	**30**/6.116	0,5	11,8
Aseptic loosening of the cup	**29**/6.116	0,5	11,4
Septic loosening	**17**/6.116	0,3	6,7
Global aseptic loosening	**16**/6.116	0,3	6,3
Primary instability	**7**/6.116	0,1	2,7
Pain without loosening	**5**/6.116	0,1	2,0
Poly wear	**2**/6.116	0,0	0,8
Heterotopic bone	**1**/6.116	0,0	0,4
Breakage of stem	**1**/6.116	0,0	0,4
Other	**8**/6.116	0,1	3,1
Unknown *(8 performed outside region)*	**16**/6.116	0,3	6,3
Total	**255/6.116**	**4,2**	**100,0**
Alumina - Alumina			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (67 stems, 52 inserts, 51 heads, 2 cups and 7 insert+head)	**179**/8.157	2,2	29,0
Periprosthetic bone fracture	**112**/8.157	1,4	18,2
Aseptic loosening of the stem	**77**/8.157	0,9	12,5
Prosthesis dislocation	**67**/8.157	0,8	10,9
Aseptic loosening of the cup	**47**/8.157	0,6	7,6
Septic loosening	**19**/8.157	0,2	3,1
Global aseptic loosening	**16**/8.157	0,2	2,6
Pain without loosening	**14**/8.157	0,2	2,3
Primary instability	**5**/8.157	0,1	0,8
Heterotopic bone	**5**/8.157	0,1	0,8
Poly wear	**3**/8.157	0,0	0,5
Other	**11**/8.157	0,1	1,8
Unknown *(37 performed outside region)*	**62**/8.157	0,8	10,0
Total	**617/8.157**	**7,6**	**100,0**
Alumina - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**107**/7.893	1,4	20,2
Prosthesis dislocation	**85**/7.893	1,1	16,0
Aseptic loosening of the cup	**78**/7.893	1,0	14,7
Periprosthetic bone fracture	**76**/7.893	1,0	14,3
Global aseptic loosening	**40**/7.893	0,5	7,5
Septic loosening	**29**/7.893	0,4	5,5

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

Breakage of prosthesis (14 stems, 5 cups, 5 heads, 1 insert)	**25**/7.893	0,3	4,7
Poly wear	**19**/7.893	0,2	3,6
Pain without loosening	**7**/7.893	0,1	1,3
Primary instability	**6**/7.893	0,1	1,1
Heterotopic bone	**6**/7.893	0,1	1,1
Metallosis	**1**/7.893	0,0	0,2
Other	**4**/7.893	0,1	0,8
Unknown *(24 performed outside region)*	**47**/7.893	0,6	8,9
Total	**530/7.893**	**6,7**	**100,0**
Alumina - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Periprosthetic bone fracture	**12**/1.193	1,0	20,0
Aseptic loosening of the stem	**12**/1.193	1,0	20,0
Aseptic loosening of the cup	**9**/1.193	0,8	15,0
Prosthesis dislocation	**5**/1.193	0,4	8,3
Septic loosening	**5**/1.193	0,4	8,3
Primary instability	**3**/1.193	0,3	5,0
Global aseptic loosening	**3**/1.193	0,3	5,0
Pain without loosening	**1**/1.193	0,1	1,7
Breakage of stem	**1**/1.193	0,1	1,7
Poly wear	**1**/1.193	0,1	1,7
Other	**1**/1.193	0,1	1,7
Unknown *(3 performed outside region)*	**7**/1.193	0,6	11,7
Total	**60/1.193**	**5,0**	**100,0**
Alumina - Composite ceramic			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Breakage of prosthesis (10 stems, 4 inserts, 3 heads)	14/1.165	1,2	28,6
Prosthesis dislocation	11/1.165	0,9	22,4
Aseptic loosening of the stem	8/1.165	0,7	16,3
Periprosthetic bone fracture	4/1.165	0,3	8,2
Aseptic loosening of the cup	3/1.165	0,3	6,1
Septic loosening	2/1.165	0,2	4,1
Heterotopic bone	1/1.165	0,1	2,0
Other	2/1.165	0,2	4,1
Unknown *(3 performed outside region)*	4/1.165	0,3	8,2
Total	**49/1.165**	**4,2**	**100,0**
Composite ceramic - Composite ceramic			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**120**/27.232	0,4	17,5
Breakage of prosthesis (98 stems, 18 inserts, 4 heads)	**120**/27.232	0,4	17,5
Periprosthetic bone fracture	**106**/27.232	0,4	15,4
Prosthesis dislocation	**84**/27.232	0,3	12,2
Septic loosening	**52**/27.232	0,2	7,6
Aseptic loosening of the cup	**42**/27.232	0,2	6,1
Primary instability	**28**/27.232	0,1	4,1

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

Pain without loosening	**17**/27.232	0,1	2,5
Heterotopic bone	**13**/27.232	0,0	1,9
Global aseptic loosening	**6**/27.232	0,0	0,9
Metallosis	**1**/27.232	0,0	0,1
Other	**33**/27.232	0,1	4,8
Unknown *(35 performed outside region)*	**65**/27.232	0,2	9,5
Total	**687/27.232**	**2,5**	**100,0**
Composite ceramic - UHMWPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**16**/1.185	1,4	33,3
Aseptic loosening of the stem	**8**/1.185	0,7	16,7
Breakage of prosthesis (4 stems, 1 unknown)	**5**/1.185	0,4	10,4
Pain without loosening	**3**/1.185	0,3	6,3
Periprosthetic bone fracture	**3**/1.185	0,3	6,3
Septic loosening	**3**/1.185	0,3	6,3
Poly wear	**3**/1.185	0,3	6,3
Global aseptic loosening	**2**/1.185	0,2	4,2
Primary instability	**1**/1.185	0,1	2,1
Aseptic loosening of the cup	**1**/1.185	0,1	2,1
Other	**1**/1.185	0,1	2,1
Unknown *(1 performed outside region)*	**2**/1.185	0,2	4,2
Total	**48/1.185**	**4,1**	**100,0**
Composite ceramic - XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**59**/9.210	0,6	25,2
Periprosthetic bone fracture	**36**/9.210	0,4	15,4
Aseptic loosening of the stem	**36**/9.210	0,4	15,4
Aseptic loosening of the cup	**29**/9.210	0,3	12,4
Septic loosening	**13**/9.210	0,1	5,6
Primary instability	**9**/9.210	0,1	3,8
Global aseptic loosening	**5**/9.210	0,1	2,1
Breakage of prosthesis (3 stems, 2 cups)	**5**/9.210	0,1	2,1
Heterotopic bone	**4**/9.210	0,0	1,7
Pain without loosening	**3**/9.210	0,0	1,3
Poly wear	**1**/9.210	0,0	0,4
Other	**6**/9.210	0,1	2,6
Unknown *(8 performed outside region)*	**28**/9.210	0,3	12,0
Total	**234/9.210**	**2,5**	**100,0**
Composite ceramic - XLPE + Vit. E			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Prosthesis dislocation	**10**/2.334	0,4	21,3
Aseptic loosening of the cup	**8**/2.334	0,3	17,0
Periprosthetic bone fracture	**7**/2.334	0,3	14,9
Primary instability	**4**/2.334	0,2	8,5
Aseptic loosening of the stem	**4**/2.334	0,2	8,5
Septic loosening	**3**/2.334	0,1	6,4
Pain without loosening	**2**/2.334	0,1	4,3
Global aseptic loosening	**1**/2.334	0,04	2,1

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

Heterotopic bone	**1**/2.334	0,04	2,1
Breakage of prosthesis (unknown)	**1**/2.334	0,04	2,1
Poly wear	**1**/2.334	0,04	2,1
Other	**4**/2.334	0,2	8,5
Unknown	**1**/2.334	0,04	2,1
Total	**47/2.334**	**2,0**	**100,0**
Ceramicised metal-XLPE			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Aseptic loosening of the stem	**8**/1473	0,5	22,9
Septic loosening	**6**/1473	0,4	17,1
Periprosthetic bone fracture	**5**/1473	0,3	14,3
Pain without loosening	3/1473	0,2	8,6
Prosthesis dislocation	**3**/1473	0,2	8,6
Heterotopic bone	**2**/1473	0,1	5,7
Aseptic loosening of the cup	**1**/1473	0,1	2,9
Other	**3**/1473	0,2	8,6
Unknown *(1 performed outside region)*	**4**/1473	0,3	11,4
Total	**35/1473**	**2,4**	**100,0**

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

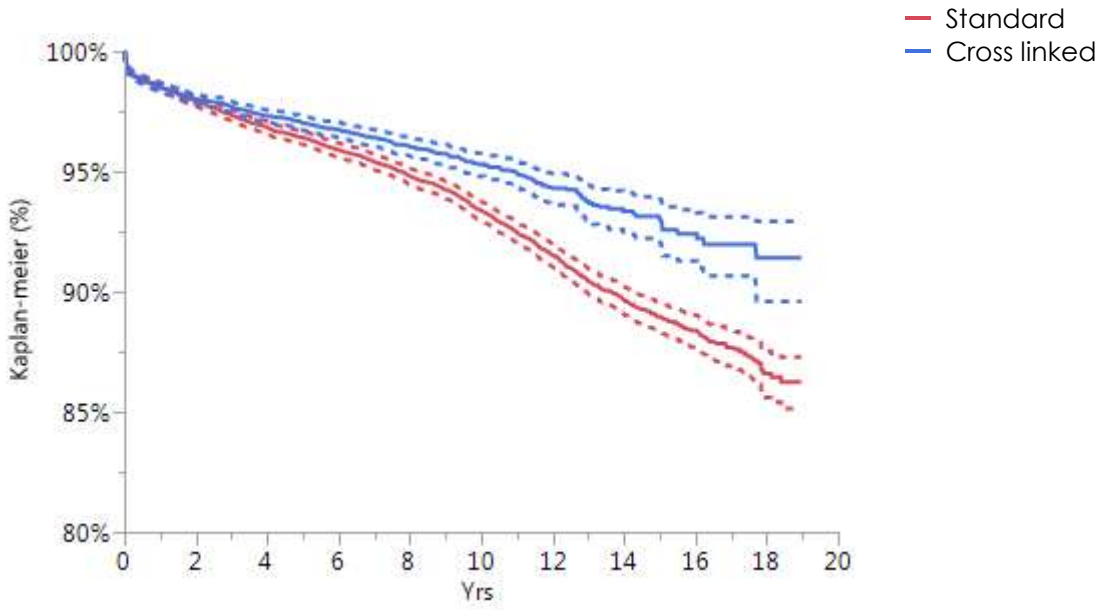
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

8.9 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 18 yrs	Confidence Interval 95%	Mean Follow-up
Standard	19.162	1415	86,6	85,6-87,5	9,8
Cross linked	17.735	555	91,4	89,6-92,9	5,2

Survival curve



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

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

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

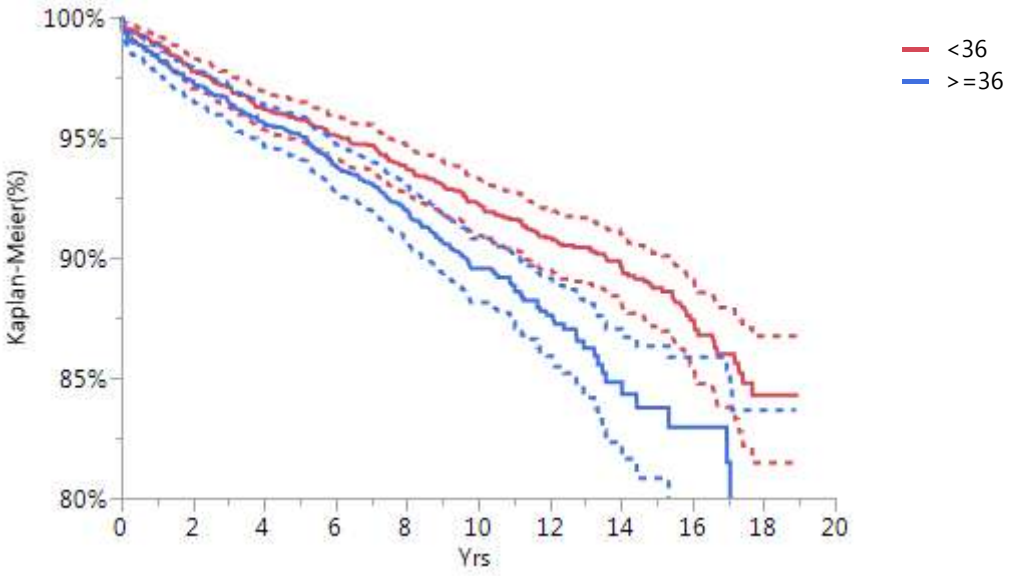
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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

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

head diameters, met-met	N.	Removals	% survival at 18 yrs	Confidence Interval 95%	Mean Follow-up
<36 mm	2.312	226	86,0	83,8-87,9	11,7
>=36 mm	2.354	250	81,5	76,9-85,3	9,5

Survival curve



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

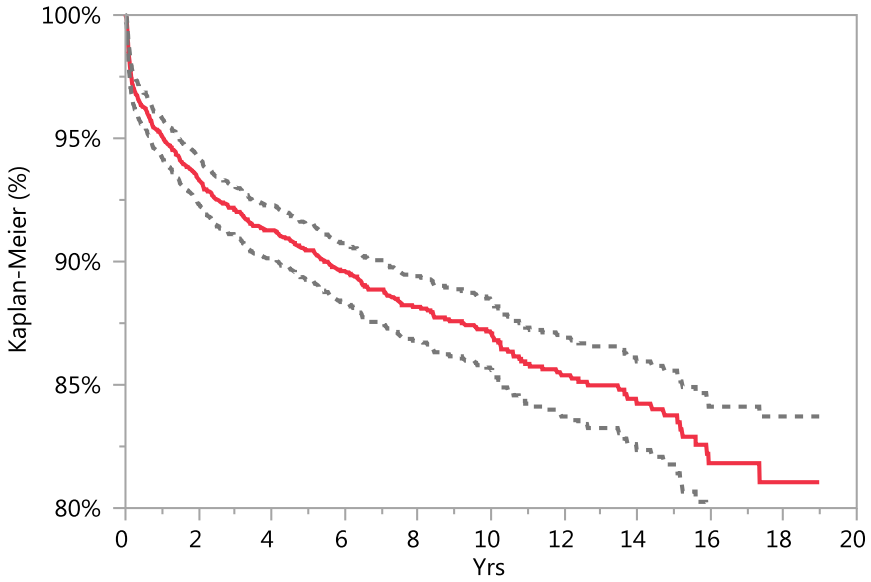
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

8.11 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 18 yrs	Confidence Interval 95%	Mean Follow-up
2.942	339	81,0	78,1-83,7	7,4

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
Aseptic loosening of the cup	**67**/2.942	2,3	19,8
Recurrent prosthesis dislocation	**63**/2.942	2,1	18,6
Septic loosening	**52**/2.942	1,8	15,3
Aseptic loosening of the stem	**49**/2.942	1,7	14,5
Global aseptic loosening	**31**/2.942	1,1	9,1
Periprosthetic bone fracture	**22**/2.942	0,7	6,5
Breakage of prosthesis	**7**/2.942	0,2	2,1
Primary instability	**5**/2.942	0,2	1,5
Pain without loosening	**4**/2.942	0,1	1,2
Poly wear	**3**/2.942	0,1	0,9
Other	**5**/2.942	0,2	1,5
Unknown *(10 performed outside region)*	**31**/2.942	1,1	9,1
Total	**339/2.942**	**11,5**	**100,0**

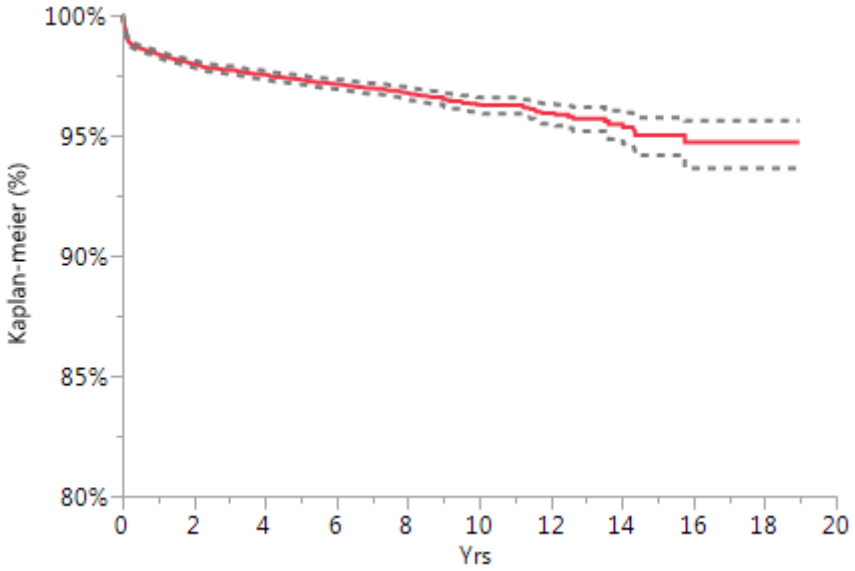
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

8.12 Survival analysis of hemiarthroplasty

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

N. of hemiarthroplasty	N. revisions	% survival at 18 yrs	Confidence Interval 95%	Mean Follow-up
42.383	927	94,7	93,6-95,6	3,6

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	**406**/42.383	1,0	43,8
Cotyloiditis	**126**/42.383	0,3	13,6
Aseptic loosening of the stem	**113**/42.383	0,3	12,2
Periprosthetic bone fracture	**105**/42.383	0,2	11,3
Septic loosening	**76**/42.383	0,2	8,2
Primary instability	**7**/42.383	0,02	0,8
Other	**26**/42.383	0,1	2,8
Unknown *(23 performed outside region)*	**68**/42.383	0,2	7,3
Total	**927/42.383**	**2,2**	**100,0**

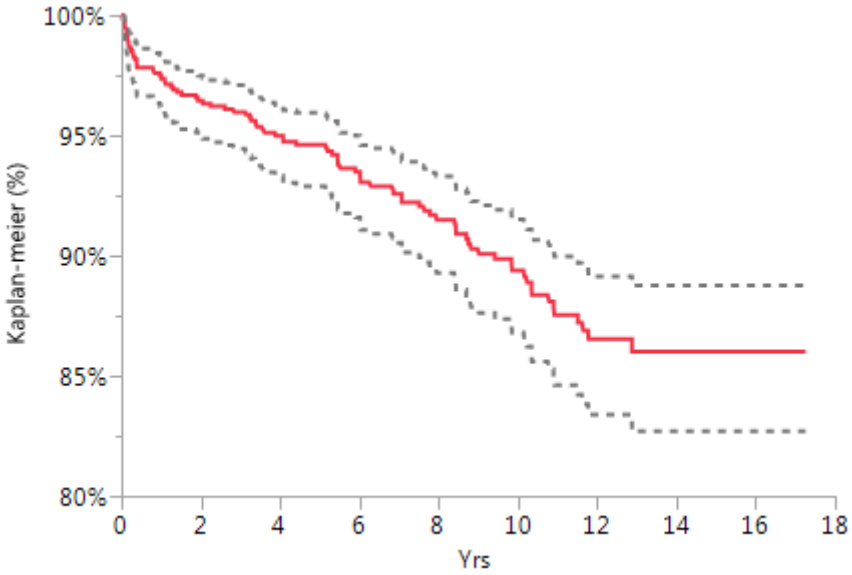
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

8.13 Survival analysis of resurfacing

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

N. of resurfacing	Removal	% survival at 15 yrs	Confidence Interval 95%	Mean Follow-up
877	87	86,0	82,7-88,8	8.7

Survival curve



Type of prosthesis	From years	N.	Revisions	% survival at 5 yrs (C.I. 95%)	N. at risk at 5 yrs	Mean Follow-up
BHR – Smith & Nephew	2001	506	32	97,3 (95,4-98,4)	366	8,7 (0-17,3)
ADEPT – Finsbury	2005	121	3	97,5 (92,6-99,2)	116	8,6 (0,1- 13,6)
ASR – DePuy	2004	65	23	78,5 (66,8-86,8)	52	8,9 (0,1-14,3)
BMHR – Smith & Nephew	2007	75	4	98,7 (91,1-99,8)	71	7,6 (0,3-11,6)
MRS – Lima	2005	42	11	78,6 (63,7-88,5)	34	10,1 (0,2-13,6)
Other (< 40 cases)	2003	68	12	-	-	9,4 (0,1-15,8)
Total	**2001**	**877**	**87**	**94,6 (92,9-95,9)**	**696**	**8,7 (0-17,3)**

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	**24**/877	2,7	27,6
Periprosthetic bone fracture	**20**/877	2,3	23,0
Metal sensitization	**14**/877	1,6	16,1
Pain without loosening	**9**/877	1,0	10,3
Septic loosening	**3**/877	0,3	3,4
Breakage of prosthesis	**2**/877	0,2	2,3
Prosthesis dislocation	**1**/877	0,1	1,1
Unknown *(10 performed outside region)*	**14**/877	1,6	16,1
Total	**87/877**	**9,9**	**100,0**

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

PART TWO: KNEE PROSTHESIS

July 2000 – December 2018

9. *RIPO capture*

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

Percentage of R.I.P.O. capture calculated versus Schede di Dimissione Ospedaliera (S.D.O.), according to Agency was **96,3**% for year 2018. Data are referred to primary knee prosthesis (Major Procedure Related – MPR - 8154), revision (8155;80;81;82;83;84) and prosthesis removal (8006).

9.2 Ratio public/private treatment

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

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)		
Year of operation	**Primary**	**Revision**
2000	57,0	75,0
2001	59,0	71,0
2002	53,0	70,0
2003	49,0	68,0
2004	47,1	58,3
2005	45,3	60,2
2006	42,9	54,3
2007	42,3	49,9
2008	40,6	55,0
2009	37,7	49,8
2010	37,3	50,9
2011	35,9	45,5
2012	33,8	43,9
2013	34,7	38,5
2014	34,1	37,5
2015	33,9	42,8
2016	34,6	43,8
2017	34,1	42,0
2018	31,3	39,7

From database SDO

We can observe a steady shift in knee prosthetic surgery from public to private hospitals. This is especially true for revision surgery, despite their usually high index of surgical complexity.

During 2018 percentage of primary THA and revisions performed in public hospitals is respectively 59,2% and 74,5%.

Percentage of primary total knee arthroprostheses and revision performed in public and private hospitals, in year 2018.

Type of operation	Public	Private
	%	%
Primary bicompartmental	49,1	54,2
Primary tricompartmental	32,1	23,4
Primary unicompartmental	6,9	14,4
Revision	7,9	6,2
Prosthesis removal	3,4	0,8
Implant of patella	0,5	0,9
Total	**100,0**	**100,0**

From database RIPO

10. 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 2018, according to **type**

Type of operation	Number	Percentage
Primary bicompartmental	71.717	63,0
Primary tricompartmental	19.040	16,7
Primary unicompartmental	12.029	10,6
Revision^	7.220	6,3
Prosthesis removal	1.616	1,4
Implant of patella	880	0,8
Other prostheses*	511	0,4
Other operations°	868	0,8
Total	**113.881**	**100,0**

*51 Hemicap–Arthrosurface, 31 Hemicap patello_femoral–Arthrosurface, 65 Avon-Patello-Femoral Joint Stryker, 88 Gender-Patello-Femoral Joint System Zimmer, 74 Journey-PFJ-Patellofemoral Smith&Nephew, 41 other patella-femoral, 53 Unicompartimental Plus+patella

°of which 443 spacer exchange, 73 stiff knee loosening, 75 debridement's, 6 dislocation reductions

^814 liner, 12 femoral component, 3 tibial component, 144 femoral component and liner, 397 tibial component and liner, 5.809 total, 41 patella.

Percentage of different type of operation in the years

Years of operation	% unicompartim	% bicompartim	% tricompartim
2001	10,5	81,1	8,4
2002	12,9	79,9	7,1
2003	12,7	78,6	8,6
2004	12,9	75,8	11,3
2005	12,4	75,5	12,1
2006	10,8	70,0	19,2
2007	11,6	69,2	19,2
2008	11,5	72,1	16,4
2009	13,0	72,3	14,8
2010	12,5	71,5	16,0
2011	9,8	73,4	16,8
2012	10,4	72,4	17,2
2013	12,1	69,1	18,9
2014	10,9	68,1	21,0
2015	10,1	67,8	22,1
2016	11,2	65,1	23,8
2017	13,0	61,0	26,0
2018	13,3	57,9	28,8

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

Years of operation	Primary bi/tricompartmental		Primary unicompartmental		Revision (total+partial)	
	N.	Increase %	N.	Increase %	N.	Increase %
2000	716		68		41	
2001	2.008		235		145	
2002	2.375	18,3	353	50,2	155	6,9
2003	2.788	17,4	407	15,3	194	25,2
2004	3.355	20,3	497	22,1	215	10,8
2005	3.877	15,6	548	10,3	282	31,2
2006	4.370	12,7	530	-3,3	312	10,6
2007	5.136	17,5	671	26,6	380	21,8
2008	5.571	8,5	727	8,3	414	8,9
2009	5.515	-1,0	821	12,9	467	12,8
2010	5.625	2,0	803	-2,2	454	-2,8
2011	5.928	5,4	643	-19,9	477	5,1
2012	5.821	-1,8	678	5,4	502	5,2
2013	5.641	-3,1	774	14,2	499	-0,6
2014	5.974	5,9	732	-5,4	484	-3,0
2015	6.130	2,6	689	-5,9	527	8,9
2016	6.631	8,2	834	21,0	544	3,2
2017	6.465	-2,5	969	16,2	544	0,0
2018	6.831	5,7	1.050	8,4	584	7,4

11. Descriptive statistics of patients with knee prosthesis

11.1 Age

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2018, 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	273	0,3	1.230	1,4	7.055	7,8	27.853	30,7	44.018	48,5	10.320	11,4	**90.749**
Unicomp	37	0,3	413	3,4	2.308	19,2	4.845	40,3	3.676	30,6	749	6,2	**12.028**
Revision	32	0,4	194	2,7	758	10,5	2179	30,2	3171	43,9	886	12,3	**7220**
Prosthesis removal	21	1,3	48	3,0	181	11,2	517	32,0	666	41,2	183	11,3	**1616**
Patella only	10	1,1	23	2,6	77	8,8	254	28,9	433	49,2	83	9,4	**880**
Total*	**373**	**0,3**	**1.908**	**1,7**	**10.379**	**9,2**	**35.648**	**31,7**	**51.964**	**46,2**	**12.221**	**10,9**	**112.493**

*9 missing data (0,01%)

Mean age at surgery, according to type of operation - years 2000-2018

Type of operation	Mean age	Range
Primary bi/tricompartmental	70,5	13–96
Primary unicompartmental	66,1	23-93
Revision	69,6	18-95
Total	**69,9**	**13-96**

Mean age at surgery, according to type of operation - years 2001-2018

Type of operation	Year 2001		Year 2018	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental°	71,2	23-92	70,5	25-94
Primary unicompartmental*	69,1	45-87	66,4	39-93
Revision^	71,8	26-87	70,2	27-95

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

Mean age at surgery, according to type of operation - years 2000-2018 - according to **private or public hospital**

Type of operation	Public		Private	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental*	70,9	13-94	70,3	19-96
Primary unicompartmental^	67,1	23-89	65,6	28-93

*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)

11.2 Gender

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2018, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Bi/tricompartmental	26.741	29,5	64.016	70,5	**90.757**
Unicompartmental	4.204	34,9	7.825	65,1	**12.029**
Revision	2.062	28,6	5.158	71,4	**7.220**
Prosthesis removal	634	39,2	982	60,8	**1.616**
Patella only	221	25,1	659	74,9	**880**
Total	**33.862**	**30,1**	**78.640**	**69,9**	**112.502**

11.3 Side of surgery

There is a prevalence of operations performed on the right side (54,8%) in comparison with the left side (45,2%). 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	51,1	56,5
Left	48,9	43,5

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

11.4 Bilateral arthroplasty

In the period of registry observation (19 years), 17.113 patients underwent bilateral operations.
14.158 (82,7%) chose to undergo the second operation at the same hospital from where the first one was performed.
986 (5,8%) chose to undergo the second operation at a different hospital from where the first one was performed to follow the surgeon.
1.969 (11,5%) 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 54,0% of cases.

11.5 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 2018, according to **diagnosis**

Diagnosis in unicompartimental knee prosthesis	Number	Percentage
Primary arthritis	9.979	83,3
Deformity	1.002	8,4
Necrosis of the condyle	610	5,1
Post-traumatic arthritis	113	0,9
Post-traumatic necrosis	85	0,7
Sequelae of fracture	82	0,7

Idiopathic necrosis	34	0,3
Rheumatic arthritis	17	0,1
Post meniscectomy	16	0,1
Sequelae of osteotomy	14	0,1
Other	32	0,3
Total*	**11.984**	**100,0**

*45 missing data (0,4%)

11.6 Diseases treated with bi-tricompartmental knee prosthesis

Number of primary bi-tricompartmental knee prosthesis operations carried out on patients with admission date between 1st uly 2000 and 31st December 2018, according to **diagnosis**.

Diagnosis in bi/tricompartmental knee prosthesis	Number	Percentage
Primary arthritis	76.436	84,6
Deformity	8.412	9,3
Post-traumatic arthritis	1.370	1,5
Sequelae of fracture	1.178	1,3
Rheumatic arthritis	1.138	1,3
Necrosis of the condyle	646	0,7
Sequelae of osteotomy	483	0,5
Post-traumatic necrosis	110	0,1
Sequelae of septic arthritis	87	0,1
Post meniscectomy	81	0,1
Sequelae of poliomyelitis	67	0,1
Idiopathic necrosis	41	0,05
Chondrocalcinosis	28	0,03
Tumor	23	0,03
TBC coxitis sequelae	17	0,02
Paget disease	14	0,02
Other	272	0,3
Total*	**90.403**	**100,0**

*354 missing data (0,4%)

11.7 Reasons for revisions and removal

Number of **revision operations** carried out on patients admitted between 1st July 2000 and 31st December 2018, 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	2.740	38,4
Two steps prosthesis removal	1.313	18,4
Pain without loosening	705	9,9
Aseptic loosening of tibial component	686	9,6
Insert wear	261	3,7
Septic loosening	188	2,6
Aseptic loosening of femoral component	184	2,6
Prosthesis dislocation	158	2,2
Instability	130	1,8
Periprosthetic bone fracture	119	1,7
Stiffness	73	1,0
Progression of disease	61	0,9
Breakage of prosthesis	36	0,5
Trauma	36	0,5
Other	446	6,3
Total*	**7.136**	**100,0**

* 84 missing data (1,2%)

Number of **prosthesis removal** carried out on patients admitted between 1st July 2000 and 31st December 2018, according to **diagnosis**.

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

Diagnosis in prosthesis removal	Number	Percentage
Septic loosening	1.401	88,3
Total aseptic loosening	87	5,5
Early infection	36	2,3
Pain without loosening	16	1,0
Aseptic loosening of tibial component	15	0,9
Periprosthetic bone fracture	9	0,6
Prosthesis dislocation	6	0,4
Other	16	1,0
Total*	**1.586**	**100,0**

* 30 missing data (1,9%)

12. Types of knee prosthesis

12.1 Unicompartmental prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2018, primary unicompartmental surgery. All poly tibial components in **bold.**

Type of Prosthesis	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
JOURNEY UNI - Smith & Nephew	89	1,3	312	14,2	842	29,5
PHYSICA ZUK - Lima	643	9,2	377	17,2	557	19,5
MITUS - ENDO-MODEL UNI - ALL POLY - Link	**380**	**5,4**	**63**	**2,9**	**204**	**7,2**
UNI SIGMA HP - De Puy Johnson & Johnson	268	3,8	435	19,8	196	6,9
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	-	-	12	0,5	175	6,1
RESTORIS MCK UNI - Mako	-	-	43	2,0	126	4,4
UNIVATION F - B.Braun	5	0,1	6	0,3	83	2,9
JOURNEY II - UNI XLPE - Smith & Nephew	-	-	-	-	82	2,9
JOURNEY UNI - ALL POLY - Smith & Nephew	**189**	**2,7**	**106**	**4,8**	**75**	**2,6**
HERMES UNI - Ceraver		0,0	8	0,4	64	2,2
ALLEGRETTO UNI - Protek-Sulzer	**299**	**4,3**	**44**	**2,0**	**56**	**2,0**
UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	**45**	**0,6**	**87**	**4,0**	**55**	**1,9**
GENUS UNI - Adler-Ortho	4	0,1	47	2,1	54	1,9
PERSONA UNI - Biomet	-	-	-	-	54	1,9
GKS - ONE - Permedica	4	0,1	32	1,5	52	1,8
GENESIS UNI - Smith & Nephew	946	13,6	213	9,7	33	1,2
GKS - ONE - ALL POLY - Permedica	**192**	**2,8**	**157**	**7,2**	**33**	**1,2**
BALANSYS - UNI - Mathys	126	1,8	30	1,4	28	1,0
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	1.310	18,8	79	3,6	17	0,6
IBALANCE UNI - Arthrex	1	0,0	28	1,3	7	0,2
TRIATHLON - PKR - Howmedica Osteonics	23	0,3	21	1,0	5	0,2
OPTETRAK - UNI - ALL POLY - Exactech	**172**	**2,5**	**4**	**0,2**	**2**	**0,1**
GENESIS UNI - ALL POLY - Smith & Nephew	**283**	**4,1**	**21**	**1,0**	**-**	**-**
EFDIOS - Citieffe	474	6,8	3	0,1	-	-
HLS - UNI EVOLUTION - ALL POLY - Tornier	**154**	**2,2**	**2**	**0,1**	**-**	**-**
PRESERVATION UNI - ALL POLY - Depuy	**379**	**5,4**	**-**	**-**	**-**	**-**
UC-PLUS SOLUTION - Endoplus	243	3,5	-	-	-	-
MILLER GALANTE UNI - Zimmer	179	2,6	-	-	-	-
MAIOR - Finceramica	154	2,2	-	-	-	-
UC-PLUS SOLUTION - ALL POLY - Endoplus	**144**	**2,1**	**-**	**-**	**-**	**-**
EIUS UNI - ALL POLY - Stryker Howmedica	**59**	**0,8**	**-**	**-**	**-**	**-**
PFC - UNI - De Puy Johnson & Johnson	56	0,8	-	-	-	-
UNICIA - VECTEUR ORTHOPEDIC - Stratec	27	0,4	-	-	-	-
PRESERVATION UNI - Depuy	27	0,4	-	-	-	-
Other (<25 cases)	85	1,2	65	3,0	50	1,8
Unknown	21	0,3	-	-	3	0,1
Total	**6.981**	**100,0**	**2.195**	**100,0**	**2.853**	**100,0**

12.2 Bi-tricompartmental knee prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2018, primary bi/tricompartmental surgery.

Type of Prosthesis	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
LEGION - Smith & Nephew	120	0,2	1.154	6,5	3.524	17,7
ATTUNE – DePuy	2	0,0	1.513	8,5	3.013	15,1
NEXGEN – Zimmer	12.014	22,6	2.420	13,6	1.690	8,5
VANGUARD – Biomet Merck France	3.764	7,1	2.037	11,5	1.368	6,9
PERSONA - Zimmer	-	-	728	4,1	978	4,9
GENESIS - Smith & Nephew	3.850	7,3	1.861	10,5	950	4,8
PHYSICA - Lima	-	-	52	0,3	932	4,7
OPTETRACK – Exactech	1.142	2,2	393	2,2	825	4,1
TRIATHLON – Stryker Howmedica Osteonics	1.186	2,2	791	4,5	783	3,9
G.K.S. – Permedica	801	1,5	251	1,4	740	3,7
GENUS – Adler-Ortho	1.084	2,0	535	3,0	599	3,0
GEMINI - Link	1.885	3,6	859	4,8	581	2,9
P.F.C – DePuy	5.108	9,6	1.422	8,0	439	2,2
GSP - TREKKING - Samo	636	1,2	533	3,0	378	1,9
BALANSYS - Mathys	594	1,1	324	1,8	350	1,8
JOURNEY – Smith & Nephew	258	0,5	141	0,8	303	1,5
GMK - Medacta	62	0,1	91	0,5	293	1,5
APEX - Omnilife Science	120	0,2	185	1,0	269	1,3
TC-PLUS - SOLUTION - Smith & Nephew	2.239	4,2	680	3,8	256	1,3
UNITY KNEE - Corin Medical	-	-	17	0,1	232	1,2
INNEX - Protek Sulzer	239	0,5	276	1,6	230	1,2
K-MOD - Gruppo Biompianti	3	0,0	9	0,1	227	1,1
COLUMBUS - B.Braun	299	0,6	148	0,8	196	1,0
ACS - Implantcast	6	0,0	389	2,2	184	0,9
ADVANCE - Wright	871	1,6	143	0,8	128	0,6
LCS – DePuy	929	1,8	15	0,1	80	0,4
SKS - DEEP DISH - Aston Medical	2	0,0	55	0,3	71	0,4
ENDO-MODEL - Link	338	0,6	61	0,3	59	0,3
SCORPIO – Stryker Howmedica	2.591	4,9	148	0,8	55	0,3
RT-PLUS - Smith & Nephew	175	0,3	59	0,3	54	0,3
SIGMA RP - TC3 - DePuy	74	0,1	50	0,3	45	0,2
GENIUS TRICCC - Dedienne Sante	635	1,2	42	0,2	8	0,0
ROTAGLIDE – Corin Medical	810	1,5	40	0,2	6	0,0
FIRST - Symbios Orthopedie SA	894	1,7	96	0,5	5	0,0
MULTIGEN - Lima	435	0,8	13	0,1	3	0,0
SCORE – Amplitude	580	1,1	4	0,0	1	0,0
PROFIX – Smith & Nephew	5.051	9,5	99	0,6	-	-
HLS – Tornier	374	0,7	14	0,1	-	-
AGC - Biomet Merck France	592	1,1	1	0,0	-	-
INTERAX - Stryker Howmedica	737	1,4	-	-	-	-
T.A.C.K. – Link	636	1,2	-	-	-	-
913 – Wright Cremascoli	358	0,7	-	-	-	-
PERFORMANCE – Kirschner Biomet Merck	281	0,5	-	-	-	-
DURACON – Stryker Howmedica	267	0,5	-	-	-	-

E.MOTION - B.Braun	181	0,3	-	-	-	-
CONTINUUM KNEE SYSTEM – Stratec Medical	166	0,3	-	-	-	-
RO.C.C. – Biomet Merck France	163	0,3	-	-	-	-
CINETIQUE - Medacta	100	0,2	-	-	-	-
Other (<100 cases)	368	0,7	91	0,5	65	0,3
Unknown	65	0,1	5	0,0	7	0,0
Total	**53.085**	**100,0**	**17.745**	**100,0**	**19.927**	**100,0**

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

12.3 Revision prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2018, in total revision surgery.

Type of Prosthesis	2000-2012		2013-2015		2016-2018	
	N.	%	N.	%	N.	%
LEGION - Smith & Nephew	172	5,2	266	22,1	426	32,6
NEXGEN – Zimmer	904	27,4	260	21,6	223	17,1
ENDO-MODEL - Link	313	9,5	87	7,2	126	9,6
SIGMA RP - TC3 - DePuy	152	4,6	125	10,4	63	4,8
P.F.C – DePuy	252	7,6	80	6,7	52	4,0
ATTUNE – DePuy	-	-	16	1,3	46	3,5
RT-PLUS - Smith & Nephew	231	7,0	34	2,8	39	3,0
VANGUARD – Biomet Merck France	85	2,6	23	1,9	36	2,8
G.K.S. – Permedica	103	3,1	29	2,4	34	2,6
TRIATHLON – Stryker Howmedica Osteonics	31	0,9	37	3,1	30	2,3
OPTETRACK – Exactech	85	2,6	10	0,8	29	2,2
COLUMBUS - B.Braun	5	0,2	4	0,3	21	1,6
GENESIS - Smith & Nephew	114	3,5	64	5,3	17	1,3
ACS - Implantcast	8	0,2	33	2,7	17	1,3
GSP - TREKKING - Samo	10	0,3	24	2,0	15	1,1
LPS - HINGE - DePuy	8	0,2	17	1,4	12	0,9
BALANSYS - Mathys	16	0,5	11	0,9	12	0,9
DURATION MRH - Osteonics	110	3,3	17	1,4	11	0,8
GEMINI - Link	24	0,7	11	0,9	9	0,7
TC-PLUS - SOLUTION - Smith & Nephew	35	1,1	2	0,2	1	0,1
SCORPIO – Stryker Howmedica	86	2,6	8	0,7	-	-
AGC - Biomet Merck France	127	3,8	-	-	-	-
PROFIX – Smith & Nephew	122	3,7	-	-	-	-
S-ROM NRH - Johnson & Johnson	47	1,4	-	-	-	-
INTERAX - Stryker Howmedica	35	1,1	-	-	-	-
Other (<25 cases)	211	6,4	43	3,6	87	6,7
Unknown	13	0,4	2	0,2	1	0,1
Total	**3.299**	**100,0**	**1.203**	**100,0**	**1.307**	**100,0**

12.4 Prosthesis fixation

Number of knee prosthesis arthroplasty performed on patients admitted to hospital between 1st July 2000 and 31st December 2018, according to **prosthesis fixation**

Fixation	Primary unicomp.		Primary bi/tricomp.		Total revision		Total	
	N.	%	N.	%	N.	%	N.	%
Cemented	11.270	93,8	85.106	93,8	5.723	98,7	**102.099**	**94,1**
Cementless	572	4,8	3.695	4,1	47	0,8	**4.314**	**4,0**
Femur cementless + Tibia cemented	161	1,3	1.305	1,4	17	0,3	**1.483**	**1,4**
Femur cemented + Tibia cementless	15	0,1	616	0,7	13	0,2	**644**	**0,6**
Total*	**12.018**	**100,0**	**90.722**	**100,0**	**5.800**	**100,0**	**108.540**	**100,0**

*55 missing data (0,05%)

Prosthesis fixation according to year of operation

Years of operation	% Cemented	% Cementless	% Cemented Tibia	% Cemented Femur
2001	86,6	6,7	6,0	0,6
2002	84,1	9,1	6,4	0,4
2003	87,8	7,6	4,2	0,4
2004	89,5	7,5	2,3	0,7
2005	90,5	6,2	2,6	0,6
2006	90,7	5,3	3,7	0,4
2007	91,1	4,4	3,1	1,4
2008	91,0	4,2	2,4	2,4
2009	91,5	4,5	1,5	2,5
2010	93,5	4,5	0,8	1,2
2011	94,8	4,1	0,4	0,6
2012	95,1	4,2	0,3	0,4
2013	96,6	3,0	0,2	0,2
2014	97,3	2,5	0,1	0,1
2015	97,7	2,0	0,2	0,0
2016	97,6	2,2	0,2	0,1
2017	97,5	2,4	0,0	0,1
2018	97,4	2,5	0,0	0,1

12.5 Type of insert

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

Years of operation	% Minimally stabilized	% Posterior stabilized	% Hinged
2001	47,8	50,2	2,0
2002	51,7	45,8	2,5
2003	46,4	51,3	2,3
2004	45,6	52,7	1,7
2005	42,6	55,9	1,5
2006	40,5	57,8	1,6
2007	40,8	57,1	2,0
2008	45,8	52,5	1,7
2009	51,3	46,9	1,8
2010	46,9	50,6	2,5
2011	49,0	48,9	2,1
2012	44,5	53,3	2,2
2013	40,9	56,1	3,0
2014	35,2	61,4	3,3
2015	36,2	60,9	2,9
2016	34,3	62,9	2,8
2017	31,7	65,2	3,1
2018	30,1	66,8	3,1

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

Years of operation	% fixed insert	% mobile insert
2001	74,0	26,0
2002	72,0	28,0
2003	69,8	30,2
2004	68,0	32,0
2005	66,0	34,0
2006	58,4	41,6
2007	62,2	37,8
2008	60,6	39,4
2009	59,3	40,7
2010	54,7	45,3
2011	55,3	44,7
2012	58,9	41,1
2013	64,4	35,6
2014	73,4	26,6
2015	75,6	24,4
2016	77,8	22,2
2017	78,7	21,3
2018	83,4	16,6

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

Years of operation	% Standard poly	% Crosslinked poly	% Crosslinked antioxidant poly
2001	100,0	-	-
2002	100,0	-	-
2003	100,0	-	-
2004	100,0	-	-
2005	100,0	-	-
2006	100,0	-	-
2007	99,4	0,6	-
2008	96,1	3,9	-
2009	94,4	5,6	-
2010	94,3	5,7	-
2011	91,4	7,4	1,2
2012	89,3	8,0	2,7
2013	88,3	7,7	4,1
2014	77,1	12,6	10,3
2015	69,9	15,2	14,9
2016	62,6	18,8	18,6
2017	57,1	23,5	19,4
2018	57,5	25,3	17,2

12.6 Type of femur

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

Years of operation	% cr-co	% ceramicised zirconium	% ceramicised cr-co	% ceramicised titanium
2001	99,6	0,4	-	-
2002	99,7	0,3	-	-
2003	99,5	0,5	-	-
2004	98,8	1,2	-	-
2005	98,6	1,3	0,03	0,03
2006	98,1	1,8	0,05	0,1
2007	96,7	3,0	0,1	0,2
2008	96,4	2,5	0,5	0,6
2009	96,4	2,1	1,0	0,5
2010	95,5	2,9	1,3	0,3
2011	92,8	4,3	2,5	0,4
2012	90,0	4,3	5,2	0,5
2013	87,0	6,1	6,0	0,9
2014	80,1	9,9	9,2	0,8
2015	79,7	10,3	9,4	0,6
2016	77,5	13,2	8,5	0,8
2017	75,3	14,3	9,6	0,8
2018	70,8	17,5	10,9	0,8

Between 1st July 2000 and 31st December 2018, 22 cases of composite ceramic are observed.

12.7 Bone Cement

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

Cement	%
Surgical Simplex P - Howmedica	17,9
Antibiotic Simplex - Howmedica	13,2
Palacos R - Heraeus Medical	9,9
Palacos R+G - Heraeus Medical	8,7
Hi-Fatigue G - Zimmer	6,3
Hi-Fatigue - Zimmer	3,7
Versabond - Smith&Nephew	2,8
Osteobond - Zimmer	2,5
Palamed G - Heraeus Medical	2,2
Versabond AB - Smith&Nephew	2,2
Refobacin Bone Cement R - Biomet	2,0
Aminofix 1 - Groupe Lepine	1,9
Smartset GHV - Depuy	1,8
Smartset MV - Depuy	1,8
Cemex System - Tecres	1,7
Palamed - Heraeus Medical	1,7
Cemex Genta System - Tecres	1,6
Smartset GMV - Depuy	1,4
Refobacin Revision - Biomet	1,2
Palacos R - Biomet	1,2
Cemfix 1 - Teknimed	1,1
Other bone cement without antibiotic	7,0
Other bone cement loaded with antibiotic	6,1
Total	17,9

Bone cement loaded with antibiotic is used in 48,8% of cases.

13. 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 1st July 2000 and 31st December 2018.

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Tibial fracture	11	*0,1*	Early infection	4	*0,03*
Femoral fracture	10	*0,1*			
Anaesthesiologic	2	*0,02*			
Tibial tuberosity fracture	1	*0,01*			
Ligament lesion	1	*0,01*	Deep venous thrombosis	6	*0,05*
Other	6	*0,05*			
Total	**31**	***0,3***	**Total**	**10**	***0,1***

The rate of complications in **primary bi-tricompartmental surgery** carried out on patients hospitalized between 1st July 2000 and 31st December 2018

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Femoral fracture	75	0,1	Deep venous thrombosis	147	*0,2*
Ligament lesion	35	0,04			
Tibial fracture	35	0,04			
Rupture patellar tendon	35	0,04			
Anaesthesiologic	30	0,02			
Hemorragia	25	0,03	Early infection	38	*0,04*
Vascular lesion	13	0,01			
Tibial tuberosity fracture	9	0,01			
Other	45	0,05			
Total	**302**	**0,3**	**Total**	**185**	***0,2***

The rate of complications in **revision surgery** carried out on patients hospitalized between 1st July 2000 and 31st December 2018

Complications occurred during hospitalization					
Intra-operative			**Local post-operative**		
	N.	**%**		**N.**	**%**
Tibial fracture	27	0,4	Early infection	17	*0,2*
Femoral fracture	26	0,4			
Rupture patellar tendon	19	0,3			
Anaesthesiologic	9	0,1			
Tibial tuberosity fracture	8	0,1	Deep venous thrombosis	10	*0,1*
Vascular lesion	5	0,1			
Hemorragia	4	0,1			
Ligament lesion	1	0,01			
Other	13	0,2			
Total	**112**	**1,6**	**Total**	**27**	***0,4***

13.1 Deaths occurred during hospitalization

Rate of deaths in knee prosthetic surgery carried out on patients hospitalized between 1st July 2000 and 31st December 2018

The deaths recorded are those that occurred during hospitalization.

Year 2000-2018			
Type of operation	**Deaths**	**Number of surgery**	**Percentage**
Primary bi/tricompartmental	68	90.757	0,07
Primary unicompartmental	1	12.029	0,008
Revision	11	7.220	0,15
Prosthesis removal	5	1.616	0,31

14. Analysis of survival of primary surgery

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 2018 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 58.203
Non revised: 55.982
Revised: 2.221

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

VARIABLE	SIGNIFICANCE (p)
Gender (Males vs females)	**S** (<0,0001)
Age (less than 60 yrs vs more than 60 yrs)	**S** (<0,0001)
Diagnosis (arthrosis vs other)	**NS** (0,1736)
Type of insert (Mobile vs fix)	**S** (<0,0001)

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.

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'.

Age	Relative risk rate	Confidence interval 95%		Significance (p)
Less than 60 yrs	2,18	1,94	2,44	<0,001

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

Insert	Relative risk rate	Confidence interval 95%		Significance (p)
Mobile	1,28	1,17	1,39	<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'.

Gender	Relative risk rate	Confidence interval 95%		Significance (p)
Males	1,21	1,11	1,33	<0,0001

Unicompartmental

All primary unicompartmental knee arthroplasties performed in the Region between July 2000 and December 2018 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'.

Age	Relative risk rate	Confidence interval 95%		Significance (p)
Less than 60 yrs	1,9	1,6	2,3	<0,0001

Type of tibial component do not influence the risk (p=0,89).
Gender do not influence the risk (p=0,18).

14.2 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 of 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	45.709	888	777	117	7,0	1.782/45.709
Primary tricompartmental	12.494	284	124	31	5,6	439/12.494
Primary unicompartmental	7.038	351	328	49	7,0	728/7.038
Total revision	3.097	220	149	25	5,9	394/3.097

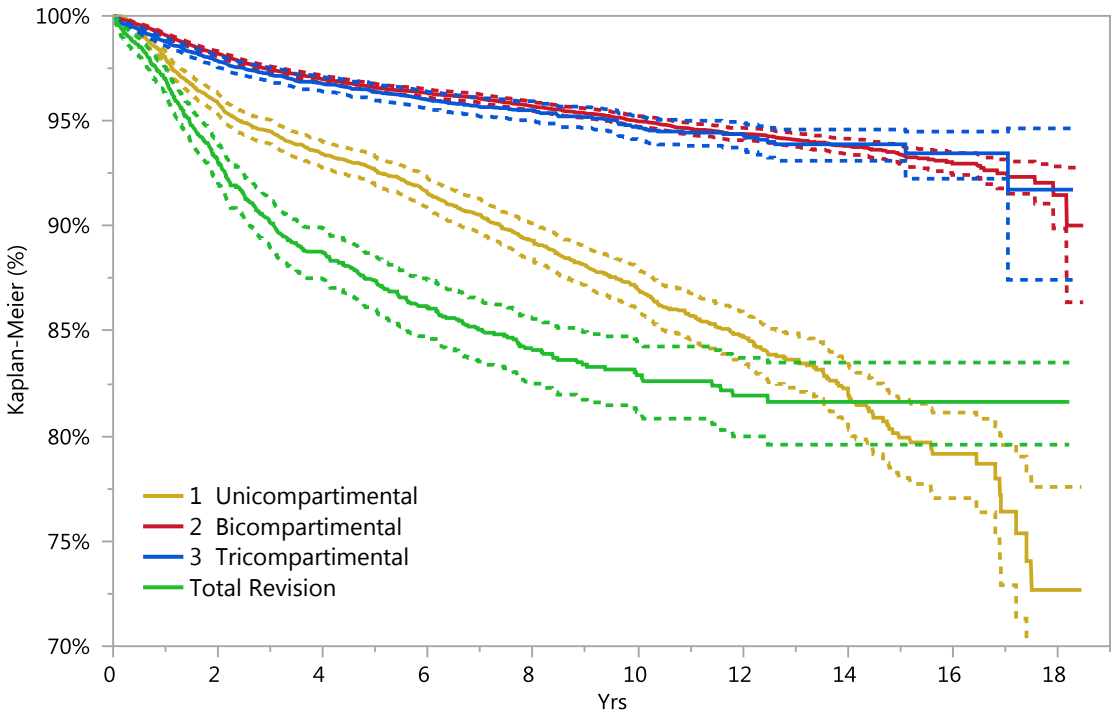
In Primary knee arthroplasties, **48,3%** of Revisions was performed in a different hospital.

14.3 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	45.709	1446	219	117	1.782/45.709	92,5 (91,8-93,2)
Primary tricompartmental	12.494	318	90	31	439/12.494	91,7 (87,4-94,6)
Primary unicompartmental	7.038	659	20	49	728/7.038	76,4 (72,9-79,6)
Total revision	3.097	304	65	25	394/3.097	81,6 (79,6-83,5)

Survival curve



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

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	**287**/7.038	4,1	39,4
Pain without loosening	**139**/7.038	2,0	19,1
Tibial aseptic loosening	**92**/7.038	1,3	12,6
Septic loosening	**51**/7.038	0,7	7,0
Femoral aseptic loosening	**23**/7.038	0,3	3,2
Insert wear	**23**/7.038	0,3	3,2
Breakage of prosthesis	**14**/7.038	0,2	1,9
Dislocation	**13**/7.038	0,2	1,8
Bone fracture	**7**/7.038	0,1	1,0
Instability	**3**/7.038	0,0	0,4
Other	**9**/7.038	0,1	1,2
Unknown *(49 performed outside region)*	**67**/7.038	1,0	9,2
Total	**728/7.038**	**10,3**	**100,0**

Primary bi-tricompartmental

Cause of revision	Rate	Percentage	% distribut. of failure causes
Total aseptic loosening	**618**/58.203	1,1	27,8
Septic loosening	**554**/58.203	1,0	24,9
Pain without loosening	**207**/58.203	0,4	9,3
Tibial aseptic loosening	**202**/58.203	0,3	9,1
Dislocation	**68**/58.203	0,1	3,1
Insert wear	**57**/58.203	0,1	2,6
Bone fracture	**49**/58.203	0,1	2,2
Instability	**49**/58.203	0,1	2,2
Femoral aseptic loosening	**44**/58.203	0,1	2,0
Stiffness	**29**/58.203	0,0	1,3
Breakage of prosthesis	**21**/58.203	0,0	0,9
Other	**72**/58.203	0,1	3,2
Unknown *(141 performed outside region)*	**251**/58.203	0,4	11,3
Total	**2.221/58.203**	**3,8**	**100,0**

Total revision

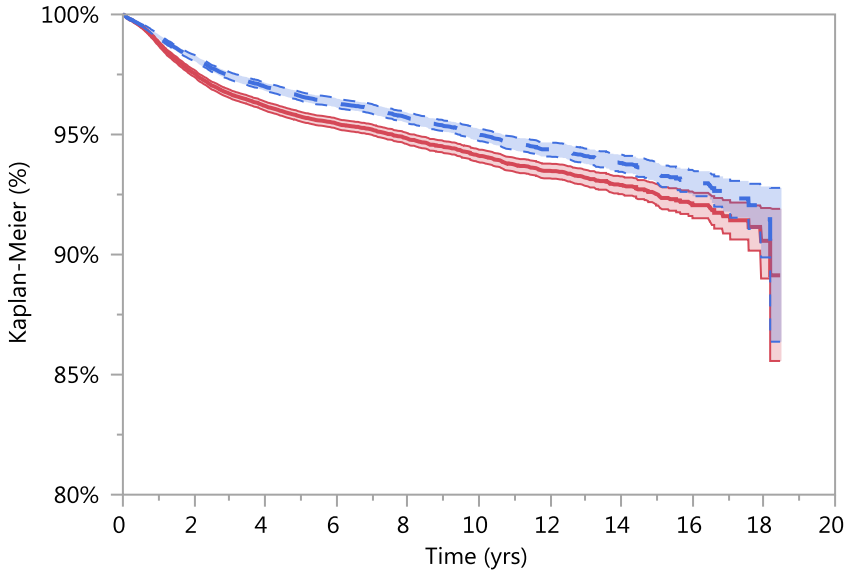
Cause of revision	Rate	Percentage	% distribut. of failure causes
Septic loosening	**130**/3.097	4,2	33,0
Total aseptic loosening	**90**/3.097	2,9	22,8
Tibial aseptic loosening	**39**/3.097	1,3	9,9
Pain without loosening	**28**/3.097	0,9	7,1
Dislocation	**11**/3.097	0,4	2,8
Stiffness	**5**/3.097	0,2	1,3
Femoral aseptic loosening	**8**/3.097	0,3	2,0
Insert wear	**8**/3.097	0,3	2,0
Instability	**9**/3.097	0,3	2,3
Breakage of prosthesis	**5**/3.097	0,2	1,3
Periprosthetic bone fracture	**5**/3.097	0,2	1,3
Other	**11**/3.097	0,4	2,8
Unknown *(25 performed outside region)*	**45**/3.097	1,5	11,4
Total	**394/3.097**	**12,7**	**100,0**

14.4 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 432 cases (out 45.709 bicompartmental prostheses recorded in the RIPO). The mean time lapse between primary bicompartmental arthroplasty and implanting the patella was 2,1 years (I.C. at 95 1,9-2,2).
These 432 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 18 yrs is 90,6% (89,0-91,9) and 91,5% (89,9-92,8) respectively.
17,8% of the 432 cases that underwent the addition of patella resurfacing, have been successively revised.



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

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

In **bold** Monoblock Prosthesis

Type	From years	N.	N. failures	% survival at 5 (I.C. at 95%)	N. at risk at 5 yrs	% survival at 10 (I.C. at 95%)	N. at risk at 10 yrs
PHYSICA ZUK - Lima	2005	1012	46	95,1 (93,1-96,5)	378	90,6 (86,7-93,4)	94
OXFORD UNICOMPARTIMENTAL PHASE 3 - Biomet Merck	2000	862	146	90,6 (88,4-92,4)	727	85,6 (82,9-87,8)	483
GENESIS UNI - Smith & Nephew	2000	673	86	92,2 (89,9-94,1)	565	86,3 (83,1-89,0)	249
JOURNEY UNI - Smith & Nephew	2011	521	23	93,4 (89,8-95,8)	65	-	-
UNI SIGMA HP - DePuy	2009	488	23	95,0 (92,5-96,7)	191	-	-
MITUS - ENDO-MODEL UNI – ALL POLY - Link	**2003**	**415**	**43**	**91,6 (88,1-94,2)**	**231**	**86,9 (82,3-90,4)**	**145**
EFDIOS - Citieffe	2000	314	57	92,7 (89,2-95,2)	272	83,2 (78,3-87,2)	160
ALLEGRETTO UNI - Protek-Sulzer	**2000**	**283**	**33**	**92,7 (88,8-95,3)**	**215**	**89,5 (84,8-92,9)**	**146**
JOURNEY UNI - ALL POLY - Smith & Nephew	**2010**	**275**	**21**	**93,1 (88,6-95,9)**	**149**	**-**	**-**
GKS - ONE – ALL POLY Permedica	**2006**	**214**	**21**	**93,5 (89,2-96,2)**	**135**	**86,5 (79,1-91,6)**	**37**
PRESERVATION UNI – ALL POLY - DePuy	**2002**	**187**	**26**	**91,7 (86,8-95,0)**	**163**	**86,8 (80,8-91,1)**	**114**
UC-PLUS SOLUTION - Smith & Nephew	2000	176	13	97,7 (94,0-99,1)	164	95,2 (90,7-97,6)	145
HLS - UNI EVOLUTION - ALL POLY - Tornier	**2001**	**144**	**15**	**94,9 (89,7-97,6)**	**128**	**90,3 (84,0-94,3)**	**82**
RESTORIS MCK UNI - Mako	2014	142	1	-	-	-	-
UC-PLUS SOLUTION – ALL POLY - Smith & Nephew	**2003**	**140**	**23**	**88,3 (81,8-92,7)**	**117**	**82,4 (74,8-88,0)**	**35**
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	2014	140	6	-	-	-	-
OPTETRAK UNI – ALL POLY -Exactech	**2005**	**131**	**6**	**98,4 (94,0-99,6)**	**120**	**95,9 (90,4-98,3)**	**49**
MILLER GALANTE UNI – Zimmer	2001	118	14	95,7 (90,1-98,2)	108	91,9 (85,1-95,7)	91
BALANSYS - UNI - Mathys	2005	107	16	85,6 (77,5-91,2)	74	83,3 (73,8-89,8)	31
Other (<100 cases)	2000	664	96	87,9 (84,7-90,5)	316	79,1 (74,3-83,2)	132
Unknown	2001	32	13	-	-	-	-
Total	**2000**	**7038**	**728**	**92,6 (91,9-93,3)**	**4.142**	**87,0 (85,9-88,0)**	**2.008**

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

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

Type	From years	N.	N. failures	% survival at 5 (I.C. at 95%)	N. at risk at 5 yrs	% survival at 10 (I.C. at 95%)	N. at risk at 10 yrs
NEXGEN - LPS - FLEX FISSO - Zimmer	2002	5.896	144	97,8 (97,4-98,2)	4.055	97,0 (96,5-97,5)	1.542
VANGUARD - PS - Biomet Orthopedics	2005	3.081	70	97,7 (97,0-98,2)	1.648	96,0 (94,7-97,1)	371
GENESIS II - PS HIGH FLEXION - Smith & Nephew	2004	2.950	64	97,9 (97,3-98,4)	1.633	96,9 (95,6-97,8)	212
LEGION - PS XLPE HIGH FLEXION - Smith & Nephew	2011	2.508	66	94,6 (92,8-96,0)	92	-	-
GEMINI MK II – Link	2002	2.446	78	97,2 (96,4-97,8)	1.529	95,1 (93,7-96,2)	470
TC-PLUS - SB SOLUTION - Endoplus	2002	2.158	60	97,9 (97,1-98,4)	1.535	95,5 (93,7-96,8)	249
PROFIX - CONFORMING - Smith & Nephew	2000	2.035	89	96,9 (96,0-97,6)	1.824	95,6 (94,5-96,4)	1.230
NEXGEN - LPS - Zimmer	2000	2.012	91	97,3 (96,5-97,9)	1.802	95,8 (94,8-96,6)	1.434
PFC - RP - PS - De Puy Johnson & Johnson	2000	1.735	77	96,5 (95,5-97,3)	1.463	95,2 (94,0-96,2)	516
NEXGEN - CR FLEX FISSO - Zimmer	2004	1.505	35	97,5 (96,4-98,2)	847	96,7 (95,2-97,7)	237
TRIATHLON - CR - Howmedica Osteonics	2005	1.325	25	98,1 (97,1-98,8)	731	96,7 (94,1-98,2)	56
ATTUNE - PS FIXED – De Puy Johnson & Johnson	2012	1.283	37	95,2 (93,1-96,7)	67	-	-
GENESIS II - C R - Smith & Nephew	2001	1.206	42	96,7 (95,4-97,6)	785	95,9 (94,3-97,0)	262
GENUS PE - Adler-Ortho	2008	946	37	97,0 (95,6-97,9)	699	94,0 (91,0-96,0)	24
VANGUARD - CR-LIPPED - Biomet Orthopedics	2006	926	28	96,7 (95,1-97,8)	552	95,9 (94,0-97,2)	125
ATTUNE - PS MOBILE - De Puy Johnson & Johnson	2014	898	21	-	-	-	-
NEXGEN - LPS - FLEX MOBILE - Zimmer	2002	846	37	96,7 (95,2-97,8)	668	95,4 (93,5-96,7)	320
PERSONA - PS- Zimmer	2013	821	21	95,1 (92,2-96,9)	77	-	-
PHYSICA - PS FIXED - Lima	2014	760	10	-	-	-	-
OPTETRAK - LOGIC PS - Exactech	2011	679	21	94,8 (91,5-96,9)	37	-	-
FIRST - Symbios Orthopedie	2006	649	35	95,4 (93,5-96,8)	555	93,9 (91,5-95,6)	112
ROTAGLIDE - Corin Medical	2000	637	74	92,2 (89,8-94,1)	519	89,3 (86,4-91,6)	289
PFC - RP - CVD - De Puy Johnson & Johnson	2001	620	31	95,6 (93,6-97,0)	458	94,2 (91,7-95,9)	120
PFC - PS - De Puy J.&J.	2000	616	37	94,9 (92,8-96,4)	357	92,5 (89,4-94,7)	155
ADVANCE Medial Pivot - Wright	2000	613	22	96,5 (94,7-97,7)	481	96,3 (94,4-97,6)	295
GENIUS TRICCC - Dedienne Sante	2000	598	57	93,9 (91,6-95,6)	500	90,1 (87,2-92,4)	271

PROFIX - P S - Smith & Nep.	2002	589	21	97,4 (95,7-98,4)	527	96,2 (94,2-97,5)	397
INNEX - MOBILE BEARING - UCOR - Protek Sulzer	2002	550	15	97,0 (95,0-98,2)	225	-	-
SCORPIO - NRG - PS – Howmedica Osteonics	2004	550	37	95,5 (93,3-96,9)	475	92,7 (89,8-94,8)	167
SCORPIO - NRG - CR - Howmedica Osteonics	2007	534	21	95,6 (93,2-97,2)	359	95,6 (93,2-97,2)	66
T.A.C.K. - Link	2000	530	63	93,6 (91,1-95,4)	457	90,7 (87,8-93,0)	366
LCS - UNIVERSAL - RP - De Puy Johnson & Johnson	2000	488	20	96,5 (94,4-97,8)	433	96,2 (94,1-97,6)	353
TRIATHLON - PS - Howmedica Osteonics	2007	474	8	98,3 (96,4-99,2)	139	-	-
LEGION - CR XLPE HIGH FLEXION - Smith & Nephew	2012	464	10	-	-	-	-
PFC - SIGMA RPF - De Puy Johnson & Johnson	2005	449	24	96,2 (93,9-97,6)	401	93,3 (89,8-95,7)	135
SCORE - Amplitude	2004	437	12	98,1 (96,3-99,1)	394	97,0 (94,8-98,3)	307
LEGION - CONSTRAINED - Smith & Nephew	2008	409	16	94,5 (90,9-96,7)	68	-	-
OPTETRAK - RBK - HI-FLEX - Exactech	2006	399	15	96,4 (94,1-97,9)	364	95,9 (93,2-97,6)	151
GSP - TREKKING - MBH PS - Samo	2007	375	10	97,1 (94,4-98,5)	160	95,8 (91,2-98,0)	28
GENESIS II - MOBILE BEARING - Smith & Nephew	2001	359	15	97,1 (94,8-98,5)	314	95,4 (92,2-97,3)	97
BALANSYS - MOBILE BEARING - Mathys	2005	341	9	97,1 (94,5-98,5)	184	97,1 (94,5-98,5)	21
PFC - CVD - De Puy J.&J.	2000	332	9	98,1 (95,8-99,1)	266	98,1 (95,8-99,1)	156
LCS - COMPLETE - RP - De Puy Johnson & Johnson	2004	304	16	95,5 (92,4-97,4)	262	94,1 (90,6-96,4)	89
Altro (modelli con meno di 300 casi)	2000	10.681	572	95,3 (94,8-95,7)	6.114	93,0 (92,4-93,6)	3.419
Non noto	2000	189	19	95,5 (91,3-97,8)	145	89,6 (83,5-93,6)	105
Totale	**2000**	**58.203**	**2.221**	**96,5 (96,4-96,7)**	**34.203**	**94,9 (94,7-95,2)**	**14.168**

PART THREE: SHOULDER PROSTHESIS

July 2008 – December 2018

15. RIPO capture

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

Percentage of R.I.P.O. capture calculated versus Discharge Records (S.D.O.) was **94,1** in 2018. Data are referred to primary total prosthesis (Major Procedure Related – MPR - 8180), hemiarthroplasty (8181), revision (8197) and prosthesis removal (8001).

15.2 Ratio public/private treatment

Percentage of implants performed in public hospitals.

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)		
Year of surgery	**Primary arthroprosthesis**	**Hemiarthroplasty**
2008	73,9	93,0
2009	65,7	83,6
2010	59,6	84,6
2011	49,1	87,1
2012	58,3	90,8
2013	59,8	93,2
2014	54,5	85,6
2015	57,6	94,9
2016	49,4	87,0
2017	48,7	82,9
2018	49,6	79,4

From database SDO

16. Type of operation

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **type of operation**

Type of operation	Number of operation	Percentage
Reverse prosthesis	5.482	68,8
Hemiarthroplasty	956	12,0
Anatomical prosthesis	518	6,5
Revisions	494	6,2
Hemi stemless	138	1,7
Standard resurfacing	119	1,5
Prosthesis removal	116	1,5
Reverse stemless	46	0,6
Anatomical stemless	39	0,5
Anatomical resurfacing	12	0,2
Partial resurfacing	1	0,0
Other*	45	0,6
Total	**7.966**	**100,0**

*7 interposition prostheses, 6 osteomyelitis spacers, 7 balloon arthroplasties

17. Descriptive statistics of patients

17.1 Gender

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Reverse prosthesis	1.326	24,2	4.156	75,8	5.482
Hemiarthroplasty	307	32,2	649	67,8	956
Anatomical prosthesis	229	44,3	289	55,7	518
Revisions	190	38,6	304	61,4	494
Hemi stemless	67	48,9	71	51,1	138
Standard resurfacing	77	64,8	42	35,2	119
Prosthesis removal	56	48,8	60	51,2	116
Reverse stemless	16	35,0	30	65,0	46
Anatomical stemless	19	48,7	20	51,3	39
Anatomical resurfacing	4	33,3	8	66,7	12
Partial resurfacing	1	100,0	-	-	1
Total	**2.313**	**29,1**	**5.653**	**70,9**	**7.966**

17.2 Age

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

	Males		Females	
Type of operation	**Mean age**	**Range**	**Mean age**	**Range**
Reverse prosthesis	71,2	33-92	73,6	30-100
Hemiarthroplasty	58,3	15-91	71,7	18-97
Anatomical prosthesis	60,5	27-83	64,9	30-100
Revisions	64,2	23-88	68,9	43-90
Hemi stemless	55,1	26-78	63,2	32-86
Standard resurfacing	50,4	23-80	55,1	21-78
Prosthesis removal	64,1	25-88	72,2	50-86
Reverse stemless	69,9	55-81	71,3	54-84
Anatomical stemless	55,4	36-73	66,6	53-80
Anatomical resurfacing	71,3	64-76	65,8	51-79
Partial resurfacing	17,0	-	-	-

17.3 Pathologies

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **type of operation** and **diagnosis** of patients.

Diagnosis	Reverse prosthesis	
	N.	%
Eccentric osteoarthritis	2.892	52,8
Fracture	1.052	19,2
Concentric osteoarthritis	785	14,3
Cuff arthropathy	200	3,6
Necrosis	126	2,3
Sequelae of fracture	119	2,2
Non specified osteoarthritis	80	1,5
Inveterate dislocation	45	0,8
Rheumatic arthritis	44	0,8
Post-traumatic necrosis	25	0,5
Post-traumatic arthritis	17	0,3
Eccentric osteoarthritis + Fracture	14	0,3
Recurrent dislocation	14	0,3
Sequelae of septic arthritis	6	0,1
Pain	2	0,0
Other	16	0,3
Unknown	45	0,8
Total	**5.482**	**100,0**

Diagnosis	Anatomical prosthesis	
	N.	%
Concentric osteoarthritis	421	81,3
Eccentric osteoarthritis	34	6,6
Necrosis	27	5,2
Sequelae of fracture	9	1,7
Rheumatic arthritis	8	1,5
Non specified osteoarthritis	6	1,2
Fracture	6	1,2
Post-traumatic arthritis	2	0,4
Synovial chondromatosis	1	0,2
Other	3	0,6
Unknown	1	0,2
Total	**518**	**100,0**

Diagnosis	Hemiarthroplasty	
	N.	%
Fracture	597	62,4
Concentric osteoarthritis	91	9,5
Necrosis	78	8,2
Eccentric osteoarthritis	75	7,8
Sequelae of fracture	38	4,0
Inveterate dislocation	18	1,9
Rheumatic arthritis	10	1,0
Post-traumatic necrosis	9	0,9
Tumor	8	0,8
Sequelae of septic arthritis	5	0,5
Post-traumatic arthritis	4	0,4
Non specified osteoarthritis	3	0,3
Pathological fracture	3	0,3
Idiopathic homer head Necrosis	2	0,2
Cuff arthropathy	1	0,1
Post-traumatic septic necrosis	1	0,1
Sequelae of osteomielitis	1	0,1
Sequelae of capsuloplasty	1	0,1
Other	8	0,8
Unknown	3	0,3
Total	**956**	**100,0**

Diagnosis	Standard Resurfacing		Anatomical Resurfacing		Partial Resurfacing	
	N	%	N	%	N	%
Concentric osteoarthritis	57	47,9	11	91,7	-	-
Necrosis	31	26,1	1	8,3	1	100,0
Eccentric osteoarthritis	10	8,4	-	-	-	-
Sequelae of fracture	3	2,5	-	-	-	-
Sequelae of capsuloplasty	3	2,5	-	-	-	-
Non specified osteoarthritis	3	2,5	-	-	-	-
Rheumatic arthritis	3	2,5	-	-	-	-
Fracture	3	2,5	-	-	-	-
Inveterate dislocation	2	1,7	-	-	-	-
Tumor	1	0,8	-	-	-	-
Cuff arthropathy	1	0,8	-	-	-	-
Pain	1	0,8	-	-	-	-
Idiopathic homer head Necrosis	1	0,8	-	-	-	-
Total	**119**	**100,0**	**12**	**100,0**	**1**	**100,0**

Diagnosis	Anatomical Stemless		Hemi Stemless		Reverse Stemless	
	N	%	N	%	N	%
Concentric osteoarthritis	29	74,4	73	52,9	6	13,0
Eccentric osteoarthritis	4	10,3	27	19,6	34	73,9
Necrosis	1	2,6	20	14,5	1	2,2
Non specified osteoarthritis	2	5,1	3	2,2	1	2,2
Sequelae of fracture	-	-	5	3,6	-	-
Inveterate dislocation	-	-	-	-	2	4,3
Concentric osteoarthritis in sequelae of fracture	1	2,6	-	-	1	2,2
Fracture	-	-	2	1,4	-	-
Steroid-induced necrosis	-	-	2	1,4	-	-
Post-traumatic necrosis	-	-	2	1,4	-	-
Cuff arthropathy	-	-	1	0,7	1	2,2
Sequelae of septic arthritis	-	-	1	0,7	-	-
Post-traumatic arthritis	1	2,6	-	-	-	-
Synovial chondromatosis	1	2,6	-	-	-	-
Recurrent dislocation	-	-	1	0,7	-	-
Unknown	-	-	1	0,7	-	-
Total	**39**	**100,0**	**138**	**100,0**	**46**	**100,0**

Number of **shoulder revisions** carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **diagnosis** and **type of revision.**

Diagnosis	N.	%
Glenoid erosion	99	20,0
Two steps revision	67	13,6
Glenoid loosening	55	11,1
Humeral loosening	52	10,5
Anterior instability	43	8,7
Superior instability	31	6,3
Pain	28	5,7
Dislocation	25	5,1
Other instability	20	4,0
Periprosthetic bone fracture	15	3,0
Total aseptic loosening	10	2,0
Cuff arthropathy	7	1,4
Septic loosening	6	1,2
Poly wear	5	1,0
Tuberosity Reabsorption	4	0,8
Breackage of insert	3	0,6
Other	15	3,0
Unknown	9	1,8
Total	**494**	**100,0**

Type of revision	N.	%
From reverse to reverse	112	22,7
Implant after removal	67	13,6
From anatomic to reverse	42	8,5
From reverse to anatomic CTA	40	8,1
From hemi to hemi	23	4,7
From resurfacing to reverse	16	3,2
From hemi to anatomic	14	2,8
From anatomic to anatomic	6	1,2
From reverse to hemi	4	0,8
From resurfacing to anatomic	3	0,6
Other	20	4,0
Unknown	13	2,6
Total	**494**	**100,0**

18. Surgical technique, anaesthesia and antithromboembolic prophylaxis

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **surgical approach.**

Type of operation	Deltoid-pectoral	Trans-deltoid	Superior lateral	Other
Reverse prosthesis	4.507	613	49	230
Hemiarthroplasty	918	23	1	7
Anatomical prosthesis	512	3	-	-
Revision	457	23	-	6
Hemi stemless	128	6	1	-
Standard resurfacing	114	2	-	1
Prosthesis removal	109	3	-	1
Reverse stemless	20	23	-	2
Anatomical stemless	38	-	-	-
Anatomical resurfacing	12	-	-	-
Partial resurfacing	1	-	-	-
Total*	**6.816**	**696**	**51**	**247**

*111 missing data (1.4%)

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **anaesthesia.**

Anaesthesia	N.	%
General	3.489	47,9
Mixed	3.312	45,5
Loco-regional	480	6,6
Total*	**7.281**	**100,0**

*640 missing data (8,1%)

Antithromboembolic prophylaxis

Heparin is used in 81,2% of primary surgery, and no prophylaxis in 12,0%.

19. Type of prosthesis

19.1 Prosthesis fixation

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to **stem fixation** and **type of operation**

Stem fixation	Anatomical prosthesis	%	Reverse prosthesis	%	Hemiarthroplasty	%
Cemented	36	6,9	925	16,9	321	33,6
Cementless	482	93,1	4.557	83,1	635	66,4
Total	**518**	**100,0**	**5.482**	**100,0**	**956**	**100,0**

19.2 Material, form and fixation of glenoid in Anatomical prosthesis

Material of glenoid	Anatomical prosthesis	%
Metal backed	251	48,5
Polyethylene	267	51,5
Total	**518**	**100,0**

Form of glenoid	Anatomical prosthesis	%
Pegs	356	68,7
Screws	150	29,0
Keel	12	2,3
Total	**518**	**100,0**

Fixation of glenoid	Anatomical prosthesis	%
Cementless	251	48,5
Cemented	267	51,5
Total	**518**	**100,0**

19.3 Type of prosthesis

Number of **primary** shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to the **type of stem**.

Model of Stem	Anatomical prosthesis		Reverse prosthesis		Hemiarthroplasty	
	N	%	N	%	N	%
SMR ALETTATO	170	32,8	1.811	33,0	441	46,1
DELTA XTEND	1	0,2	1.233	22,5	35	3,7
AEQUALIS ASCEND FLEX S PTC	159	30,7	313	5,7	37	3,9
DELTA XTEND CEMENTED	-	-	418	7,6	21	2,2
TRABECULAR METAL REVERSE	-	-	296	5,4	10	1,0
AEQUALIS REVERSED	-	-	300	5,5	1	0,1
SMR CEMENTATO	4	0,8	119	2,2	92	9,6
EQUINOXE PRIMARY	-	-	186	3,4	1	0,1
BIGLIANI/FLATOW	112	21,6	-	-	24	2,5
COMPREHENSIVE MINI	-	-	111	2,0	5	0,5
DUOCENTRIC	-	-	107	2,0	-	-
AEQUALIS REVERSED CEMENTED	-	-	91	1,7	-	-
EQUINOXE PLATFORM FRACTURE	-	-	73	1,3	2	0,2
AFFINIS FRACTURE	-	-	44	0,8	16	1,7
ANATOMICAL SHOULDER	12	2,3	20	0,4	18	1,9
ARROW	1	0,2	45	0,8	2	0,2
SMR REVISIONE	-	-	30	0,5	16	1,7
AFFINIS INVERSE	-	-	45	0,8	-	-
ANATOMICAL SHOULDER CEMENTED	8	1,5	25	0,5	8	0,8
ANATOMICAL SHOULDER FRACTURE	1	0,2	6	0,1	31	3,2
LTO CEMENTATO	2	0,4	-	-	31	3,2
GLOBAL FX	-	-	-	-	33	3,5
TITAN	-	-	27	0,5	-	-
BIGLIANI/FLATOW TRABECULAR METAL	2	0,4	-	-	25	2,6
AEQUALIS ASCEND	21	4,1	-	-	3	0,3
HUMELOCK REVERSED	-	-	24	0,4	-	-
GLOBAL ADVANTAGE	2	0,4	-	-	21	2,2
PROMOS	-	-	17	0,3	6	0,6
Other (models < 20 cases)	22	4,2	130	2,4	76	7,9
Unknown	1	0,2	11	0,2	1	0,1
Total	**518**	**100,0**	**5.482**	**100,0**	**956**	**100,0**

Number of shoulder **Anatomical prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to the **type of glenoid.**

Model of Glenoid	Anatomical prosthesis	
	N	%
AEQUALIS PERFORM	184	35,5
SMR RIVESTITA	146	28,2
BIGLIANI/FLATOW TRABECULAR METAL	73	14,1
BIGLIANI/FLATOW	45	8,7
SMR;SMR PEG TT	28	5,4
ANATOMICAL SHOULDER	16	3,1
Other (models < 10 cases)	25	4,8
Unknown	1	0,2
Total	**518**	**100,0**

Number of shoulder **Reverse prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to the **type of metaglena**

Model of metaglena	Reverse prosthesis	
	N	%
SMR RIVESTITA	1.801	32,9
DELTA XTEND	1.653	30,2
AEQUALIS REVERSED	611	11,1
TRABECULAR METAL REVERSE	285	5,2
EQUINOXE REVERSE	259	4,7
SMR;SMR PEG TT	160	2,9
DUOCENTRIC	123	2,2
AEQUALIS REVERSED II	111	2,0
AFFINIS INVERSE	88	1,6
COMPREHENSIVE REVERSE MINI	80	1,5
COMPREHENSIVE REVERSE	62	1,1
ARROW	45	0,8
ANATOMICAL SHOULDER INVERSE/REVERSE	34	0,6
TITAN REVERSE	27	0,5
HUMELOCK REVERSED	26	0,5
DELTA CTA	21	0,4
PROMOS REVERSE	17	0,3
AGILON	14	0,3
UNIVERS REVERS	11	0,2
T.E.S.S.	10	0,2
Other (models < 10 cases)	37	0,7
Unknown	7	0,1
Total	**5.482**	**100,0**

Number of shoulder Hemiarthroplasty carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to the type of humer head

Model of Humer Head	Hemiarthroplasty	
	N	%
SMR	490	51,3
SMR CTA	59	6,2
BIGLIANI/FLATOW	58	6,1
DELTA XTEND CTA	56	5,9
GLOBAL ADVANTAGE	49	5,1
RANDELLI - LTO	33	3,5
AEQUALIS ASCEND FLEX PYC	31	3,2
ANATOMICAL SHOULDER FRACTURE	31	3,2
ANATOMICAL SHOULDER	26	2,7
AEQUALIS	18	1,9
AFFINIS FRACTURE	16	1,7
GLOBAL UNITE	13	1,4
Other (models < 10 cases)	76	7,9
Total	**956**	**100,0**

Number of shoulder **resurfacing** carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to the **type of prosthesis**.

Model of prosthesis	Standard Resurfacing		Anatomical Resurfacing		Partial Resurfacing	
	N	%	N	%	N	%
SMR - Lima	54	45,4	1	8,3	-	-
EPOCA RH - Synthes	10	8,4	11	91,7	-	-
COPELAND - Biomet	18	15,1	-	-	-	-
GLOBAL CAP – DePuy	14	11,8	-	-	-	-
PYROTITAN - Ascension Orthopedics	8	6,7	-	-	-	-
AEQUALIS RESURFACING - Tornier	6	5,0	-	-	-	-
DUROM SHOULDER - Zimmer	4	3,4	-	-	-	-
COPELAND TS - Biomet	2	1,7	-	-	-	-
CAPICA - Implantcast	1	0,8	-	-	-	-
COPELAND THIN - Biomet	1	0,8	-	-	-	-
HEMICAP - Arthrosurface		0,0	-	-	1	100,0
OVO - Arthrosurface	1	0,8	-	-	-	-
Total	**119**	**100,0**	**12**	**100,0**	**1**	**100,0**

Number of shoulder **stemless** carried out on patients with admission date between 1st July 2008 and 31st December 2018, according to the **type of prosthesis**.

Model of prosthesis	Anatomical Stemless		Hemi Stemless		Reverse Stemless	
	N	%	N	%	N	%
T.E.S.S. - Biomet	8	20,8	68	49,1	-	-
VERSO - Biomet	-	-	-	-	34	73,8
ECLIPSE - Arthrex	7	18,2	25	18,3	-	-
SIDUS - Zimmer	3	7,1	21	15,4	-	-
AFFINIS SHORT - Mathys	5	13,0	9	6,4	-	-
COMPREHENSIVE VERSA -DIAL- Biomet	-	-	11	7,9	-	-
SMR - Lima	6	15,6	1	0,7	-	-
MIRAI - Permedica	1	1,9	-	-	5	10,9
T.E.S.S. INVERSA - Biomet		0,0	-	-	5	10,9
BIGLIANI/FLATOW - Zimmer	4	10,4	-	-	-	-
AFFINIS FRACTURE - Mathys	3	7,8	-	-	-	-
HUMELOCK - Fx Solution	2	5,2	1	0,7	-	-
SMR INVERSA HP - Lima	-	-	-	-	2	4,4
GLOBAL ICON - DePuy	-	-	1	0,7	-	-
SIMPLICITI - Tornier	-	-	1	0,7	-	-
Total	**39**	**100,0**	**138**	**100,0**	**46**	**100,0**

20. 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.

Complications rate in **primary shoulder operations (total reverse prosthesis and total anatomical prosthesis)** carried out on patients hospitalized between July 1st 2008 and December 31st 2018.

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	26	0,4	Dislocation	10	*0,2*
Tendon lesion	3	0,1			
Vascular lesion	1	0,02			
Fracture	40	0,7	Early Infection	1	*0,02*
Other	10	0,2			
Total	**80**	***1,3***	**Total**	**11**	***0,2***

Complications rate in **hemiarthroplasties** carried out on patients hospitalized between July 1st 2008 and December 31st 2018.

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	7	0,7	Early Infection	3	*0,3*
Tendon lesion	2	0,2			
Vascular lesion	1	0,1			
Fracture	10	1,0	Dislocation	-	-
Other	2	0,2			
Total	**22**	**2,3**	**Total**	**3**	***0,3***

They were observed also 3 deaths in hemiarthroplasty and 4 deaths in reverse prosthesis according to fracture diagnosis.

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

Year 2018			
Type of operation	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Reverse prosthesis	929	1,4 (0-29)	4,4 (0-47)
HemiarthroplastY	59	2,4 (0-15)	4,7 (2-20)
Revisions	71	1,1 (0-22)	4,2 (1-11)
Anatomical prosthesis	52	0,3 (0-1)	3,4 (2-6)
Prosthesis removal	23	1,1 (0-10)	8,6 (1-30)

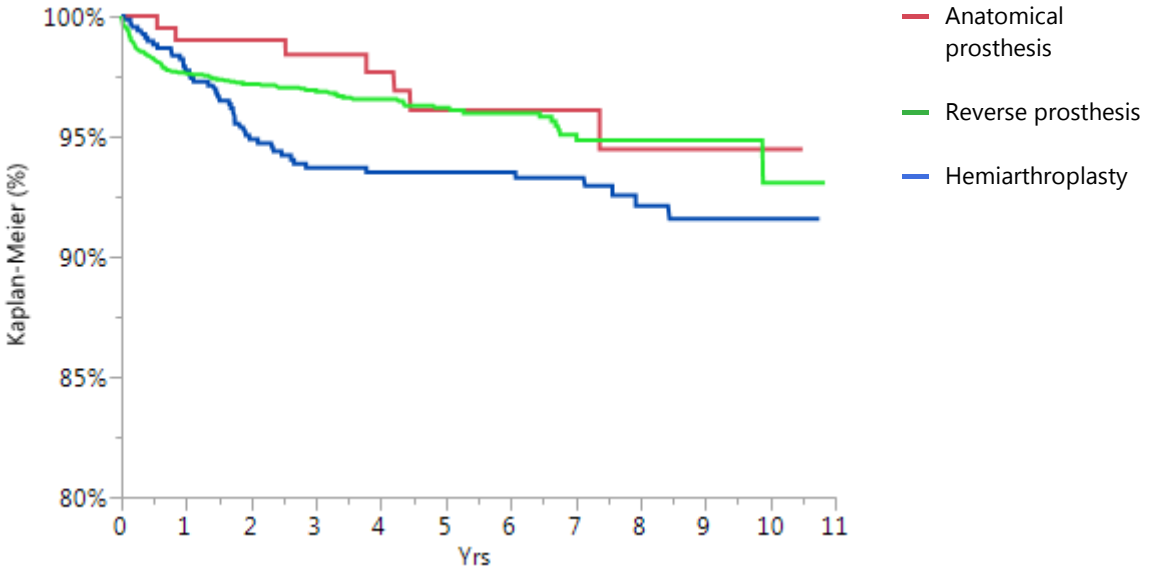
Year 2018			
Type of operation	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Elective	826	0,7 (0-6)	4,0 (0-20)
Emergency	214	4,1 (0-29)	5,8 (0-47)

22. Analysis of survival of primary surgery

Survival curve is used to estimate the probability that each patient to remain in the initial condition (unrevised prosthesis). Following figure shows curves according to Type of operation.

All primary shoulder arthroplasties performed in the Region between July 2008 and December 2018 only on patients living in the Region were analysed.

Type of operation	Number of implants	Number of revisions	Mean Follow-up	Survival at 8 yrs (C.I. 95%)	N. at risk at 9yrs
Anatomical prosthesis	214	7	5,1	94,5 (88,0-97,5)	22
Reverse prosthesis	3.073	104	3,7	94,9 (93,5-96,0)	142
Hemiarthroplasty	686	46	6,0	91,6 (88,6-93,8)	114
Standard resurfacing	41	3	7,4	92,2 (78,5-97,5)	12
Anatomical resurfacing	2	1	-	-	-
Partial resurfacing	1	-	-	-	-
Anatomical stemless	16	5	4,6	-	-
Hemi stemless	57	6	6,3	87,1 (73,4-94,3)	8
Reverse stemless	19	1	2,5	-	-



Difference is statistically significant (p=0,0314 Wilcoxon Test).

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

Anatomical prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Instability	**2**/214	0,9	28,6
Glenoid erosion	**1**/214	0,5	14,3
Pain	**1**/214	0,5	14,3
Poly wear	**1**/214	0,5	14,3
Breakage of insert	**1**/214	0,5	14,3
Septic loosening	**1**/214	0,5	14,3
Total	**7/214**	**3,3**	**100,0**
Reverse prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Septic loosening	**23**/3.073	0,7	22,1
Instability	**22**/3.073	0,7	21,2
Glenoid loosening	**17**/3.073	0,6	16,3
Dislocation	**7**/3.073	0,2	6,7
Humeral component loosening	**6**/3.073	0,2	5,8
Periprosthetic bone fracture	**5**/3.073	0,2	4,8
Glenoid erosion	**3**/3.073	0,1	2,9
Pain	**2**/3.073	0,1	1,9
Other	**6**/3.073	0,2	5,8
Unknown *(5 performed outside region)*	**13**/3.073	0,4	12,5
Total	**104/3.073**	**3,4**	**100,0**
Hemiarthroplasty			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**10**/686	1,5	21,7
Instability	**8**/686	1,2	17,4
Septic loosening	**5**/686	0,7	10,9
Humeral component loosening	**4**/686	0,6	8,7
Periprosthetic bone fracture	**3**/686	0,4	6,5
Cuff arthropathy	**2**/686	0,3	4,3
Pain	**2**/686	0,3	4,3
Total aseptic loosening	**2**/686	0,3	4,3
Dislocation	**1**/686	0,1	2,2
Other	**2**/686	0,3	4,3
Unknown *(5 performed outside region)*	**7**/686	1,0	15,2
Total	**46/686**	**6,7**	**100,0**
Resurfacing			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Glenoid erosion	**3**/41	7,3	100,0
Total	**3/41**	**7,3**	**100,0**
Anatomical Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Pain	**1**/16	6,3	20,0
Septic loosening	**1**/16	6,3	20,0
Instability	**1**/16	6,3	20,0
Dislocation	**1**/16	6,3	20,0
Poly wear	**1**/16	6,3	20,0
Total	**5/16**	**31,3**	**100,0**

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

Hemi Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Pain	**2**/57	3,5	33,3
Glenoid erosion	**1**/57	1,8	16,7
Septic loosening	**1**/57	1,8	16,7
Humeral component loosening	**1**/57	1,8	16,7
Unknown *(1 performed outside region)*	**1**/57	1,8	16,7
Total	**6/57**	**10,5**	**100,0**
Reverse Stemless			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Septic loosening	**1**/19	5,3	100,0
Total	**1/19**	**5,3**	**100,0**

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

Type	From years	N.	N. failures	% survival at 5	C.I. at 95%	N. at risk at 5 yrs	Type
DELTA XTEND - Depuy	2008	727	18	98,2	4,6	96,9-98,9	291
SMR - Lima	2008	713	33	94,7	3,9	92,4-96,3	249
SMR INVERSA HP - Lima	2008	579	17	96,2	3,2	93,8-97,7	130
DELTA XTEND - Depuy	2011	263	8	92,8	2,3	82,5-97,3	15

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