REPORT of R.I.P.O.
Regional Register of Orthopaedic Prosthetic Implantology

OVERALL DATA

HIP, KNEE AND SHOULDER ARTHROPLASTY

IN EMILIA-ROMAGNA REGION (ITALY)

2000-2020

VERSION 1 - MAY 2023

SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA

Foreword

During 2017, with Regional Law n.9 of 1st June 2017, RIPO was recognized as a significant regional interest Register, with the aim of guaranteeing an active and systematic collection of demographic, health and epidemiological data.
According to these aims, we are now presenting the 20th report, elaborated by the Register of Orthopaedic Prosthetic Implantology (RIPO). It presents the most significant results of the descriptive and survival statistical analyses performed on hip, knee and shoulder arthroplasty surgeries carried out in the Emilia-Romagna region, in Italy, between 1st January 2000 and 31st December 2020.

This report presents the overall regional data for the following orthopaedic surgeries:
- hip: total arthroplasty, hemiarthroplasty, resurfacing, revision and removal operations;
- knee: uni-, bi- and tricompartmental arthroplasty, revision and removal operations;
- shoulder (since July 2008): anatomical and reverse arthroplasty, resurfacing, partial, revision and removal operations.

Altogether, data of approx. 210000 hip, 131000 knee and 10000 shoulder prostheses have been reported from 69 Orthopaedic Units in 63 Hospitals, either public or private.

Data collection from the orthopaedic wards was made through the use of paper forms. Registry staff then 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 analyses were performed by Registry statistics staff.
When necessary RIPO representatives in each surgical unit gave support to clarify and integrate the data.
The dissemination of the results of the statistical analysis is carried out through: this report (available on the web at http://ripo.cineca.it/authzssl/index.htm), scientific publications and reports required by surgeons and health departments. In addition, 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:
- determine the demographic characteristics and the diagnostic categories of the patients who have undergone replacement surgery;
- gather detailed information on the use of the different prostheses used in primary and revision surgery;
- assess the effectiveness of the different types of prostheses;
- supply orthopaedic surgeons with a very useful tool to give the patient timely information;
- collaborate in a post-marketing surveillance, allowing surgeons to easily identify patients implanted with a recalled implant; in particular, during 2016, a post-marketing surveillance of Metal-on-Metal hip prostheses was set up in Emilia Romagna Region;
- compare the regional results against similar national and international studies; 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;
- inform the Regional Orthopaedic Commission about those implants that show an abnormal failure rate;
- answer to questions coming from the Regional Orthopaedic Commission or from other National or European Institutions.

Methodological notes

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

The validity of the data reported in the present report is based on the complete adhesion to the register and degree of reliability of the information given.
The assessment of the completeness is made by comparison with the data from the Hospital Discharge database; in the last year the Register has 'captured' 96% of hip, knee and shoulder operations. Through merging with other databases missing data is spotted and filled appropriately. This causes delays in the completion of these analyses.
During last year, missing data about previous arthroplasty interventions was requested, looking for possible revisions. Nevertheless, for this report, not all missing data requested was received. As a consequence, we have an uncertainty about final results, equal or lower than other registers.
Registry is under constant update. This implies data-entry about surgeries of recent years.

Concerning the reliability of the data presented, 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, 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 and by asking for confirmation of some information.

Explanatory guide for the survival analysis

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

Summary of the main results presented

Hip

During 2020, data on 7682 primary THAs, 26 resurfacing, 2136 hemiarthroplasties and 719 partial or total revisions were registered, with a decrease of implants due to COVID-19 pandemic.

If 20 years we have doubled the number of THA, 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.

During 2020 primary THA was performed to treat well known pathologies, following a distribution percentage unchanged over the years except for a slightly decrease of implants in developmental dysplasia and an slight increase in primary coxarthrosis.
Mean age at surgery is stable (70 yrs for women and 65 yrs for men).

In 2020, as in past years, 100 different types of cup and stem were used, a lot of them are 'new', never implanted in previous years. 11% of the implanted stems had a modular neck, slightly decreasing compared to past years (the highest was 42% in 2011).
Uncemented prostheses were 62% in year 2000 and 96% in year 2020, whilst hybrid fixation was 22% and now it is 4%.
The implant of completely cemented prostheses is virtually a discontinued practice decreasing to 0.2% (compared to 15% in past years).

The survival of the hip prostheses is confirmed at very high levels: 91.0% of THA implanted in Emilia-Romagna region on resident patients are still in place 15 years after the operation.

A large part (75%) of 4943 revisions are major ones, 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 Emilia-Romagna region were considered separately since the causes of failure are not always known.
High incidence of prosthesis breakage was observed among causes of failure; this phenomenon, lower than the result of other international registries, is partially related to the extensive use of ceramic components and exchangeable necks.
In all analyses, met-met articular couplings, for all head diameters, were included. For large diameter met-met (> 32 mm), with official regional decree, a specific monitoring procedure has been initiated for all patients.

Confirming past years results, multivariate analysis demonstrated that survival is lower for males (risk of failure 1.2 than females) and young patients. Survival is influenced also from diagnosis: implants done to treat rare pathology and femoral fracture or its sequelae and septic coxitis sequelae have lower survival.

At maximum 20 years of follow up, failure seems to be affected by fixation and articular coupling, but these variables cannot be introduced in the Cox multivariate analysis as they are not independent from other variables, such as age at surgery. Survival curves for fixation and coupling are traced without adjusting.
Multivariate analysis demonstrated that survival is higher for types of prostheses more frequently implanted 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 met-met <36mm.
Survival of resurfacing, at 15 years, is slightly lower than THA (85.8%, statistically significant).
Total revisions are not revised the second time in 80,0% (95% CI 77.3-82.8) of cases at 20 yrs.
Hemiarthroplasty has an optimal survival of the implant (94.6, 95% CI 93.7-95.4, at 20 yrs) even if the data is greatly influenced by a high rate of patient's deaths due to age and general conditions of the patients.

Knee

During 2020, data on 5662 primary knee prostheses and 930 partial or total revision were registered, with a decrease of 26% of primary bi-compartmental knee prostheses, 16% unicompartmental and 15% of revisions from the past year, due to COVID-19 pandemic.
High percentage of knee prostheses is implanted in private structures: 77% in 2020 of primary knee prostheses (vs 43% in 2000) and 63% in 2020 of revision (vs 25% in 2000).

In 20120, 14% of implanted prostheses are unicompartmental, 51% are bicompartmental with no patella resurfacing and the remaining 35% have patella resurfacing. The number of prostheses with patella are increasing, in particular in public hospital. Female patients are about twice as many as men.
In 2020, 97% of implants are cemented, in the half of them cement is antibiotic loaded. Hybrid fixation is almost completely absent. Mobile insert are decreasing (10% in 2020). 54% of insert are in Standard Poly and the remainig are in Crosslinked Poly with or without antioxidant. Femoral component with Co-Cr are decreasing, Ceramicised Zirconium alloy and Cobalt alloy treated are preferable.

Types of implanted prostheses are fewer and more stable during years compared to hip implants. Survival of bicompartmental is 93.1% at 15 yrs, survival of tricompartmental is 94.0% and survival of unicompartmental is significantly lower (82.2%). In these analyses patella resurfacing after primary TKA is considered as a failure.

The incidence of revisions due to infection in the prosthesis is high, in particular in total implants, where it represents approximately a quarter of the causes of failure (21%). In total implants, septic loosening represents one-third of causes of failure. Total revisions are not revised the second time in 80.6% of cases at 15 yrs.

Cox multivariate analysis shows that the survival of bi-tricompartmental knee prostheses is negatively influenced by age of the patient (the expectancy of prosthesis survival is lower for patient less than 60 yrs), by gender (survival is lower for male patients) and by type of insert (mobile insert is worse than fixed insert).
In unicompartmental implants, age of the patient influences negatively survival.
Some models of prosthetic have survival slightly below the regional average, as in previous report.

Shoulder

Data refers to a short follow-up (12 years and half).
During 2020, 815 new shoulder total implants were carried out (778 were reverse prostheses).

Similar to knee prostheses, high percentage of primary shoulder prostheses is implanted in private structures (55% in 2020 vs 26% in 2008).

Women are more affected than men, either for fracture and for elective surgery.
Mean age at surgery for reverse prostheses is 74 for women and 71 for men. Patients are younger in anatomic prostheses (respectively 65 and 60). In hemiarthroplasty women are much older than men (71 vs 58).
Reverse prosthesis is implanted mainly in arthrosis (eccentric osteoarthritis in particular) and in fracture (20%).
Anatomic prosthesis is implanted in concentric arthrosis (81%), while hemiarthroplasties treat both fractures (61% of implants) and arthrosis.
Fixation is mainly cementless for reverse and anatomic prosthesis, while 33% of hemiarthroplasties are cemented.

Survival of reverse prosthesis at 10 yrs is 94.0%. Instability, glenoid loosening and septic loosening represent the most frequent causes of failure.

Bologna, 15th August 2023

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.

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
Pres. Val Tidone, Castel San Giovanni	Dr. Giuseppe Barnabei	Dr. Claudio Gheduzzi Sig.ra Raffaella Sorsi
Ospedale privato 'Casa di cura Piacenza'	Dir. San. Prof. Mario Sanna	Sig.ra Laurence Girier

Province of Parma

AZIENDA USL PARMA		
Ospedale Civile Fidenza	Dr. Galeazzo Concari	Sig.ra Sandra Teresa Regnani Dr.ssa Maria Cristina Aliani
Ospedale Borgo Val di Taro	f.f. Dr. Riccardo Cepparulo	Dr.ssa Maria Cristina Cardinali Dr. Alberto Guardoli
Ospedale privato casa di cura "Città di Parma"	Dir. San. Dr. Luigi Lagnerini	Sig.ra Barbara Bonazzi
Ospedale privato "Hospital Piccole Figlie"	Dir. San. Dr. Decembrino Venturino	Sig.ra Nadia Zabelli

Province of Reggio-Emilia

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

Province of Modena

AZIENDA USL MODENA		
Ospedale Baggiovara	Dr.ssa Cristina Zapparoli	Dr. Pier Bruno Squarzina
Ospedale di Carpi	Dr. Saverio Luppino	Sig.ra Miriana Dardi
Ospedale di Mirandola	Dr. Calogero Alfonso	Sig.ra Adriana Cestari Sig.ra Loredana Baruffaldi
Ospedale di Sassuolo	Dr. Luigi Adriano Pederzini	Dr. Mauro Prandini Dr. Claudio Debortoli
Ospedale di Vignola	Dr. Luca Fontana	Dr. Mauro Tisi
Ospedale di Pavullo	Dr. Luca Fontana	Dr. Gianluca Bonanno Bortolani Paola

Ospedale privato "Hesperia Hospital"	Dir. San. Dr. Federico Marzo	Dr. ssa Michelina Guerra
Ospedale privato casa di cura "Prof. Fogliani"	Dir. San. Dr.ssa Elisa Nicoli	Dir. San. Dr.ssa Elisa Nicoli

Province of Bologna

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"	Dir. San. Dr. Gianfranco Finzi	Morena Fauni
Ospedale privato "Villa Erbosa"	Dir. San. Dr. Stefano Liverani	Sig.ra Sladjana Karavdic Sig.ra Stefania Volpe
Ospedale privato "Villa Nigrisoli"	Dir. San. Dr. Gianfranco Finzi	Morena Fauni
Ospedale privato "Villa Torri Hospital"	Dir. San. Dr.ssa Vittoria Lauro	Dr. Giulia Surrente
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. Georgios Vertsonis	Dr. Giorgio Feliciangeli
Ospedale privato casa di cura "Madre Fortunata Toniolo"	Dir. San. Dr.ssa Katiuscia Sponsano	Dott.ssa Katiuscia Sponsano
Ospedale privato "Villalba"	Dir. San. Dr.ssa Vittoria Lauro	Sig.Maria Grazia Chiarini Chiara Becattini
AZIENDA USL IMOLA		
Ospedale Civile di Imola	Prof. Carlo Impallomeni	Dr. Marco Scardovi

Province of Ferrara

Ospedale di Cento	Dr. Luca Castagnini	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.ssa Silvia Gavioli	Dr.ssa Silvia Gavioli

Province of Ravenna, Forlì-Cesena and Rimini

AZIENDA USL ROMAGNA		
Ospedale di Ravenna	Dr. Alberto Belluati	Dr. Giovanni Guerra Dr. Raffaele Pezzella
Ospedale di Lugo	Dr. Andrea Colombelli	Dr. Alessandro Soldati
Ospedale di Faenza	Dr.ssa Alessandra Colozza	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	Dr. Paolo Paladini	Dr. Paolo Paladini
Ospedale privato "Domus Nova"	Dir. San. Dr. Paolo Masperi	Dr. Massimo De Zerbi
Ospedale privato "San Francesco"	Dir. San. Dr. Paolo Masperi	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.ssa Valentina Di Gregori	Sig. Anna Pini
Ospedale privato "Villa Igea" Ospedale privato "Villa Serena"	Dir. San Dr. Davide Dell'Amore	Dir. San Dr. Davide Dell'Amore
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	Dir. San. Dr. Marcello Amadori
Ospedale privato "Sol et Salus"	Dir. San. Dr. Massimo Montesi	Sig. Domenico Ciabò
Ospedale privato casa di cura "Prof. E. Montanari"	Dir. San Dr. Gianfranco Cicchetti	Dr.ssa Lia Montanari
Ospedale privato "Villa Maria Rimini"	Dir. San. Dr.ssa Giuliana Vandi	Dr.ssa Giuliana Vandi

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 (Prof. Cesare Faldini f.f.) Chirurgia della spalla e del gomito (Dr. Enrico Guerra) 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 Total revision 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.

PART ONE: HIP PROSTHESES

January 2000 – December 2020

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 **96.3**% in the year 2020. Since the early years of the Register, 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	**Primary THA**	**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
2019	53.3	99.8	71.1
2020	46.3	99.6	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 2020, according to **type of surgery**.

Type of surgery	N.	%
Primary THA	137612	65.3
Hemiarthroplasties	48550	23.0
Total and partial revision*	19027	9.0
Resurfacing	2849	1.4
Prosthesis removal	1652	0.8
Other**	878	0.4
Hemiarthroplasty with buffer°	121	0.1
Total	**210689**	**100.0**

° acetabular buffer

***** 4884 total revision, 7414 cup revisions, 3996 stem revisions, 2733 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 surgery	N.
2000	3
2001	8
2002	34
2003	79
2004	114
2005	188
2006	230
2007	212
2008	174
2009	177
2010	130
2011	183
2012	337
2013	312
2014	263
2015	197
2016	121
2017	31
2018	18
2019	12
2020	26

The table below shows the year-to-year percentage increase of the number of primary and revision operations.

Year of surgery	Primary THA		Revision (total + partial)	
	N.	Increase %	N.	Increase %
2000	4405	-	747	-
2001	4625	5.0	864	15.7
2002	4666	0.9	871	0.8
2003	5072	8.7	866	-0.6
2004	5389	6.3	869	0.3
2005	5581	3.6	830	-4.5
2006	5856	4.9	951	14.6
2007	6274	7.1	1031	8.4
2008	6361	1.4	990	-4.0
2009	6714	5.5	998	0.8
2010	6595	-1.8	1035	3.7
2011	6435	-2.4	924	-10.7
2012	6590	2.4	1015	9.8
2013	6737	2.2	934	-8.0
2014	7196	6.8	872	-6.6
2015	7562	5.1	923	5.8
2016	7672	1.5	896	-2.9
2017	8259	7.7	863	-3.7
2018	8657	4.8	896	3.8
2019	9284	7.2	933	4.1
2020	7682	-17.3	719	-22.9

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 2020, according to **type of operation** and **age group** of patients at the time of surgery

Type of surgery	<40		40-49		50-59		60-69		70-79		≥80		Total
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	
Primary THA	3822	2.8	8792	6.4	20475	14.9	39268	28.5	48978	35.6	16267	11.8	**137602**
Hemiarthroplasties	31	0.1	82	0.2	246	0.5	1314	2.7	9745	20.1	37131	76.5	**48549**
Revision	354	1.9	822	4.3	2029	10.7	4518	23.7	7265	38.2	4039	21.2	**19027**
Resurfacing	329	11.5	720	25.3	1020	35.8	647	22.7	127	4.5	6	0.2	**2849**
Prosthesis removal	58	3.5	104	6.3	186	11.3	393	23.8	581	35.2	330	20.0	**1652**
Other	42	4.8	72	8.2	115	13.1	209	23.8	283	32.2	157	17.9	**878**
Total*	**4636**	**2.2**	**10592**	**5.0**	**24071**	**11.4**	**46349**	**22.0**	**66979**	**31.8**	**57930**	**27.5**	**210557**

*11 missing data

In 2020 percentage of Hemiarthroplasty carried out on patients older than ninety is 30.8%.
Mean age of patients at surgery

Type of surgery	Mean age	Range
Primary THA	67.2	11-101
Hemiarthroplasties	81.7	14-109
Resurfacing	53.2	15-83
Revision	70.3	15-100

Mean age of patients, per type of operation: comparison 2000-2020 for THA and 2003-2020 for Resurfacing

	Year of surgery 2000		Year of surgery 2020	
Type of surgery	**Mean age**	**Range**	**Mean age**	**Range**
Primary THA	66.0	16-99	67.1	14-95
Hemiarthroplasties	82.4	35-104	85.2	16-104
Revision	68.5	22-97	72.6	20-98

Mean age at surgery of patients affected by coxarthrosis according to gender: comparison 2000-2020

	Primary THA			
	Year of surgery 2000		Year of surgery 2020	
Gender	**Mean age**	**Range**	**Mean age**	**Range**
Males	67.2	34-92	65.3	18-93
Females	68.9	31-93	69.9	16-93

3.2 Gender

Number of hip operations carried out on patients with admission date between 1st January 2000 and 31st December 2020, according to **type of operation** and **gender** of patient

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Primary THA	57124	41.5	80488	58.5	137612
Hemiarthroplasties	12848	26.5	35702	73.5	48550
Revision	6735	35.4	12292	64.6	19027
Resurfacing	2162	75.9	687	24.1	2849
Prosthesis removal	743	45.0	909	55.0	1652
Other	398	45.3	480	54.7	878
Total	**80010**	**38.0**	**130558**	**62.0**	**210568**

3.3 Side of surgery

Coxarthrosis more often affects right hip (58.0%) than left hip (42.0%). 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	52.9	62.1
Left	47.1	37.9

The difference is statistically significant (Chi – squared $p<0.001$).

3.4 Bilateral prosthesis

Between 1st January 2000 and 31st December 2020, 13006 patients underwent bilateral operations for Coxarthrosis.

10425 (80.2%) chose to undergo the second operation at the same hospital where the first one was performed;
760 (5.8%) chose to undergo the second operation at a different hospital, to follow the surgeon;
1821 (14.0%) chose to undergo the second operation at a different hospital with 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 2020, according to **diagnosis**

Diagnosis in THA	**N.**	**%**
Primary arthritis	95331	69.6
Femoral neck fracture	12807	9.3
Sequelae of LCA and DCA	11934	8.7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	8140	5.9
Post-traumatic arthritis	2809	2.1
Post-traumatic necrosis	1503	1.1
Femoral neck fracture sequelae	1442	1.1
Rheumatic arthritis	1252	0.9
Epiphysiolysis sequelae	346	0.3
Perthes disease sequelae	320	0.2
Tumor	262	0.2
Septic coxitis sequelae	189	0.1
Paget disease	105	0.1
Acetabulum fracture	68	0.05
TBC coxitis sequelae	66	0.05
Other	427	0.3
Total**	**119878**	**100.0**

**611 missing data (0.4%)

Prostheses for bone tumor resection are not registered by R.I.P.O.
Diagnosis in 96.8% of hemiarthroplasties was femoral neck fracture.

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

Diagnosis in THA	%		
	2000-2014	**2015-2017**	**2018-2020**
Primary arthritis	67.8	71.4	74.0
Femoral neck fracture	9.0	10.0	9.9
Sequelae of LCA and DCA	10.3	7.1	4.8
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	5.9	5.9	6.1
Post-traumatic arthritis	2.3	1.7	1.4
Post-traumatic necrosis	1.3	0.9	0.7
Femoral neck fracture sequelae	0.9	1.3	1.4
Rheumatic arthritis	1.1	0.6	0.4
Other	1.4	1.2	1.2
Total	**100.0**	**100.0**	**100.0**

Percentage distribution of diseases leading to THA according to **age group** of patients at time of surgery

Diagnosis in THA	Age group					
	<40	**40-49**	**50-59**	**60-69**	**70-79**	**≥80**
Primary arthritis	18.5	45.2	62.6	74.1	75.8	74.1
Femoral neck fracture	2.1	3.2	6.0	8.5	12.1	12.4
Sequelae of LCA and DCA	27.1	25.7	16.3	7.9	3.9	2.1
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	19.6	11.6	7.2	4.7	4.3	6.1
Post-traumatic arthritis	8.6	5.6	2.9	1.7	1.2	1.1
Post-traumatic necrosis	6.7	2.1	1.3	0.8	0.6	1.1
Femoral neck fracture sequelae	1.7	1.4	0.8	0.7	0.9	2.3
Rheumatic arthritis	4.5	1.6	1.1	0.8	0.7	0.5
Epiphysiolysis sequelae	3.2	1.1	0.3	0.1	0.0	0.0
Perthes disease sequelae	3.2	0.8	0.3	0.1	0.0	0.0
Tumor	0.6	0.4	0.3	0.2	0.1	0.0
Septic coxitis sequelae	1.5	0.2	0.2	0.1	0.1	0.0
Paget disease	0.0	0.0	0.0	0.1	0.1	0.1
TBC coxitis sequelae	0.0	0.0	0.1	0.0	0.0	0.1
Acetabulum fracture	0.2	0.1	0.1	0.1	0.0	0.0
Other	2.5	0.8	0.5	0.2	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Diagnosis in THA	Age group						Total
	<40	**40-49**	**50-59**	**60-69**	**70-79**	**≥80**	
Primary arthritis	0.7	4.2	13.4	30.4	38.7	12.6	100.0
Femoral neck fracture	0.6	2.2	9.5	25.9	46.0	15.7	100.0
Sequelae of LCA and DCA	8.6	18.9	27.9	25.8	15.9	2.8	100.0
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	9.2	12.5	17.9	22.6	25.8	12.0	100.0
Post-traumatic arthritis	11.7	17.6	21.1	23.4	20.0	6.2	100.0

Post-traumatic necrosis	17.0	12.4	17.8	19.6	20.7	12.4	100.0
Femoral neck fracture sequelae	4.4	8.4	11.4	18.7	31.5	25.6	100.0
Rheumatic arthritis	13.7	11.4	17.6	24.8	26.4	6.1	100.0
Epiphysiolysis sequelae	35.5	27.7	19.4	11.3	5.5	0.6	100.0
Perthes disease sequelae	38.1	22.8	17.5	14.1	5.9	1.6	100.0
Tumor	8.0	11.8	22.5	31.7	22.9	3.1	100.0
Septic coxitis sequelae	31.2	11.1	22.8	16.9	15.9	2.1	100.0
Paget disease	0.0	0.0	6.7	28.6	49.5	15.2	100.0
Acetabulum fracture	1.5	1.5	16.2	16.2	33.8	30.9	100.0
TBC coxitis sequelae	9.1	16.7	25.8	30.3	15.2	3.0	100.0
Other	22.2	15.5	25.3	19.7	13.8	3.5	100.0

Number of **resurfacing** operations carried out on patients with admission date between 1st January 2000 and 31st December 2020, according to **diagnosis**

Diagnosis in resurfacing	**N.**	**%**
Primary arthritis	2371	83.5
Sequelae of LCA and DCA	189	6.7
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	97	3.4
Post-traumatic arthritis	92	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*	**2840**	**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 2020 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	**N.**	**%**
Cup aseptic loosening	5102	29.9
Total aseptic loosening	2942	17.2
Stem aseptic loosening	2293	13.4
Dislocation	1584	9.3
Periprosthetic bone fracture	1322	7.7
Two steps revision	922	5.4

Breakage of prosthesis	879	5.1
Poly wear	737	4.3
Pain without loosening	315	1.8
Metallosis	191	1.1
Septic loosening	180	1.1
Primary instability	124	0.7
Heterotopic bone	92	0.5
Trauma	39	0.2
Acetabulum fracture	25	0.1
Other	343	2.0
Total°	**17090**	**100.0**

° 192 missing data (1.1%)

* Failure of 296 modular necks, 199 liners, 124 heads, 115 stems, 110 cups, 15 liner and head. 20 failures not specified.

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

Diagnosis in revision of resurfacing	**N.**	**%**
Aseptic loosening	91	45.7
Bone fracture	53	26.6
Metallosis	34	17.1
Pain without loosening	14	7.0
Instability	4	2.0
Breakage of prosthesis	3	1.5
Total	**199**	**100.0**

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

Diagnosis in revision of hemiarthroplasty	**N.**	**%**
Prosthesis dislocation	528	34.4
Cotiloiditis	379	24.7
Stem aseptic loosening	291	19.0
Periprosthetic bone fracture	176	11.5
Septic loosening	34	2.2
Two steps revision	27	1.8
Breakage of prosthesis	10	0.7
Cup aseptic loosening	10	0.7
Instability	9	0.6
Poly wear	7	0.5
Dislocation	6	0.4
Heterotopic bone	5	0.3
Acetabulum fracture	1	0.1
Other	50	3.3
Total*	**1533**	**100.0**

13 missing data (0.8%)

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 THA

In 308 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
CUPULE AVANTAGE CEMENTED Biomet	94	1.8	-	-	21	14.9
PE (Muller Protek) Sulzer	507	9.9	31	16.5	14	9.9
REFLECTION ALL-POLY Smith and Nep.	301	5.9	18	9.6	9	6.4
CONTEMPORARY Stryker Howmedica	824	16.2	6	3.2	4	2.8
POLARCUP CEMENTED Smith and Nep.	21	0.4	17	9.0	3	2.1
PE Adler-Ortho	167	3.3	12	6.4	3	2.1
ZCA Zimmer	655	12.8	9	4.8	3	2.1
MULLER Lima	253	5.0	6	3.2	2	1.4
MULLER Citieffe	113	2.2	9	4.8	1	0.7
MULLER Wright Cremascoli	961	18.8	-	-	-	-
MULLER Samo	441	8.6	-	-	-	-
MULLER Smith and Nephew	161	3.2	-	-	-	-
LUNA Amplitude	88	1.7	-	-	-	-
CCB Mathys	58	1.1	-	-	-	-
MULLER Groupe Lepine	57	1.1	-	-	-	-
Other (< 50 cases)	398	7.8	80	42.6	81	57.4
Total	**5099**	**100.0**	**188**	**100.0**	**141**	**100.0**

Cementless cup	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
FIXA Ti-POR Adler-Ortho	11826	14.2	7585	32.6	6971	27.4
R3 THREE-HOLE Smith and Nephew	2293	2.8	2492	10.7	2752	10.8
CONTINUUM Zimmer	1275	1.5	975	4.2	2089	8.2
VERSAFITCUP CC TRIO Medacta	511	0.6	992	4.3	2074	8.2
DELTA TT Lima	1072	1.3	847	3.6	1417	5.6
JUMP Permedica	292	0.4	1126	4.8	1123	4.4
G7 PPS Biomet	2	0.0	827	3.6	977	3.8
PINNACLE SECTOR GRIPTION DePuy	107	0.1	390	1.7	664	2.6
PINNACLE SECTOR II POROCOAT DePuy	2216	2.7	843	3.6	557	2.2
JUMP SYSTEM TRASER Permedica	-	-	143	0.6	556	2.2
MPACT Medacta	46	0.1	199	0.9	411	1.6
TRIDENT PSL HA CLUSTER Stryker Howmedica	2234	2.7	472	2.0	386	1.5
EP-FIT PLUS Endoplus	5318	6.4	536	2.3	374	1.5
I1CUP Link	-	-	99	0.4	366	1.4
DELTA PF Lima	1941	2.3	473	2.0	257	1.0
ALLOFIT S IT Zimmer	719	0.9	503	2.2	233	0.9
GYROS DePuy	7	0.0	246	1.1	223	0.9
EXCEED ABT Biomet	1558	1.9	299	1.3	177	0.7
TRINITY Corin	10	0.0	137	0.6	155	0.6
PINNACLE BANTAM POROCOAT DePuy	136	0.2	84	0.4	131	0.5

MAXERA Zimmer	336	0.4	149	0.6	103	0.4
RM Mathys	244	0.3	85	0.4	90	0.4
AGILIS TI-POR Adler-Ortho	124	0.1	138	0.6	81	0.3
ADAPTIVE WINGS Samo	326	0.4	214	0.9	78	0.3
FIN II Bioimpianti	233	0.3	205	0.9	73	0.3
TRABECULAR METAL Zimmer	576	0.7	33	0.1	66	0.3
TOP Link	677	0.8	103	0.4	60	0.2
MALLORY Biomet	336	0.4	34	0.1	41	0.2
TRILOGY Zimmer	1131	1.4	13	0.1	39	0.2
FITMORE Sulzer	2910	3.5	103	0.4	38	0.1
TRIDENT PSL HA SOLID Stryker Howmedica	229	0.3	138	0.6	32	0.1
CUPULE RELOAD AVANTAGE Biomet	404	0.5	39	0.2	20	0.1
BS Citieffe	451	0.5	39	0.2	6	0.0
DELTAMOTION Finsbury	371	0.4	157	0.7	2	0.0
BETA CUP Link	298	0.4	36	0.2	2	0.0
REFLECTION Smith and Nephew	1870	2.2	172	0.7	-	-
CUPULE APRIL Symbios	383	0.5	82	0.4	-	-
SPARKUP Samo	581	0.7	62	0.3	-	-
EXPANSYS Mathys	1596	1.9	29	0.1	-	-
BICON PLUS Endoplus	1338	1.6	23	0.1	-	-
ABG II Howmedica	2765	3.3	16	0.1	-	-
DUOFIT PSF Samo	1376	1.7	2	0.0	-	-
CLS Zimmer	3377	4.1	1	0.0	-	-
FIXA Adler-Ortho	7500	9.0	-	-	-	-
AnCA FIT Wright Cremascoli	6720	8.1	-	-	-	-
STANDARD CUP Protek Sulzer	1306	1.6	-	-	-	-
RECAP RESURFACING Biomet	895	1.1	-	-	-	-
VERSAFITCUP CC Medacta	875	1.1	-	-	-	-
HILOCK LINE Symbios	717	0.9	-	-	-	-
SELEXYS TH Mathys	583	0.7	-	-	-	-
TRABECULAR METAL MONOBLOCK Zimmer	417	0.5	-	-	-	-
TRILOGY AB Zimmer	378	0.5	-	-	-	-
DUROM HIP RESURFACING Zimmer	330	0.4	-	-	-	-
EASY Hit Medica	313	0.4	-	-	-	-
CUPULE AVANTAGE Biomet	300	0.4	-	-	-	-
Other (< 300 cases)	9383	11.3	2105	9.1	2794	11.0
Total	**83212**	**100.0**	**23246**	**100.0**	**25418**	**100.0**

Table reports models of cup designed for resurfacing prostheses but implanted in traditional THA.

4.2 Cups used in total revision surgery

In 33 cases model or cup fixation was not communicated to RIPO.

Cemented cups	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
CUPULE AVANTAGE CEMENTED Biomet	30	4.2	1	1.8	6	10.9
MULLER Protek-Sulzer-Centerpulse-Zimmer	180	25.5	4	7.0	5	9.1
POLARCUP CEMENTED Smith and Nephew	5	0.7	6	10.5	4	7.3
REFLECTION ALL-POLY Smith and Nephew	10	1.4	4	7.0	3	5.5
CONTEMPORARY Stryker Howmedica	137	19.4	3	5.3	3	5.5

MULLER Lima	55	7.8	3	5.3	1	1.8
Muller Adler-Ortho	8	1.1	1	1.8	1	1.8
MULLER PCR Samo	13	1.8	-	-	1	1.8
ZCA Zimmer	42	5.9	2	3.5	-	-
MULLER Wright Cremascoli	58	8.2	-	-	-	-
MULLER Samo	53	7.5	-	-	-	-
CCB Mathys	20	2.8	-	-	-	-
Other (< 10 cases)	96	13.6	33	57.9	31	56.4
Total	**707**	**100.0**	**57**	**100.0**	**55**	**100.0**

Cementless cups	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
FIXA Ti-POR Adler-Ortho	199	6.4	92	20.6	97	20.6
DELTA ONE TT Lima	109	3.5	71	15.9	84	17.8
DELTA TT Lima	75	2.4	37	8.3	58	12.3
CONTINUUM Zimmer	67	2.2	44	9.8	35	7.4
DELTA REVISION TT Lima	45	1.4	28	6.3	22	4.7
OMNIA Ti-POR Adler-Ortho	34	1.1	35	7.8	19	4.0
HERMES BS REV Citieffe	68	2.2	16	3.6	17	3.6
PINNACLE REVISION DP GRIPTION DePuy	4	0.1	7	1.6	10	2.1
R3 THREE-HOLE Smith and Nephew	16	0.5	9	2.0	9	1.9
EP-FIT PLUS Endoplus	39	1.3	5	1.1	6	1.3
TRIDENT PSL HA CLUSTER Stryker Howmedica	167	5.4	3	0.7	5	1.1
TRABECULAR METAL Zimmer	180	5.8	15	3.4	4	0.8
TRILOGY IT Zimmer	15	0.5	5	1.1	4	0.8
TRIDENT TRITANIUM Stryker Howmedica	14	0.4	6	1.3	2	0.4
PINNACLE MULTIHOLE GRIPTION DePuy	26	0.8	11	2.5	1	0.2
TRITANIUM HEMISPHERICAL Stryker Howmedica	13	0.4	11	2.5	1	0.2
TRILOGY Zimmer	142	4.6	-	-	1	0.2
TRABECULAR METAL REVISION Zimmer	31	1.0	4	0.9	-	-
MC MINN Link	92	3.0	2	0.4	-	-
DELTA PF Lima	43	1.4	1	0.2	-	-
AnCA FIT Cremascoli	301	9.7	-	-	-	-
STANDARD CUP Protek Sulzer	132	4.2	-	-	-	-
FIXA Adler-Ortho	131	4.2	-	-	-	-
OMNIA Adler-Ortho	52	1.7	-	-	-	-
DUOFIT PSF Samo	48	1.5	-	-	-	-
LOR ALLOPRO Protek Sulzer	48	1.5	-	-	-	-
OSTEOLOCK Stryker Howmedica	47	1.5	-	-	-	-
FITMORE Sulzer	44	1.4	-	-	-	-
CLS Zimmer	43	1.4	-	-	-	-
REGENEREX RINGLOC+ Biomet	41	1.3	-	-	-	-
TRIDENT ARC2F Stryker Howmedica	37	1.2	-	-	-	-
PROCOTYL-E Wright Cremascoli	36	1.2	-	-	-	-
PINNACLE MULTIHOLE II DePuy	33	1.1	-	-	-	-
REFLECTION Smith and Nephew	30	1.0	-	-	-	-
BICON PLUS Endoplus	25	0.8	-	-	-	-
CONICAL SCREW CUP Protek Sulzer	25	0.8	-	-	-	-
SECUR-FIT Osteonics Howmedica	25	0.8	-	-	-	-
BOFOR Endoplus	22	0.7	-	-	-	-

ABGII Stryker Howmedica	21	0.7	-	-	-	-
PROCOTYL-Z-PIVOT Wright Cremascoli	21	0.7	-	-	-	-
Other (< 20 cases)	573	18.4	45	10.1	96	20.4
Total	**3114**	**100.0**	**447**	**100.0**	**471**	**100.0**

4.3 Stems used in primary surgery

In 369 cases model or stem fixation was not communicated to RIPO.

Cemented stem	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
VERSYS HERITAGE Zimmer	55	0.4	-	-	268	28.3
EXETER V40 Stryker Howmedica	1354	10.8	177	21.7	135	14.2
POLARSTEM CEM Endoplus	49	0.4	105	12.9	63	6.6
KORUS Bioimpianti	7	0.1	33	4.0	60	6.3
APTA Adler-Ortho	1153	9.2	57	7.0	60	6.3
EXACTA PLUS Permedica	4	0.0	7	0.9	60	6.3
PAVI CEM Groupe Lepine	24	0.2	65	8.0	48	5.1
CORAIL DePuy	24	0.2	43	5.3	30	3.2
HYDRA Adler-Ortho	51	0.4	39	4.8	29	3.1
VERSYS REVISION CALCAR Zimmer	20	0.2	13	1.6	19	2.0
TAPERLOC CEM Biomet	79	0.6	21	2.6	18	1.9
DUOFIT CKA SAMO	54	0.4	18	2.2	7	0.7
CPCS Smith and Nephew	45	0.4	13	1.6	4	0.4
MS 30 Zimmer	187	1.5	-	-	3	0.3
SL Lima	105	0.8	2	0.2	3	0.3
AB Citieffe	220	1.8	13	1.6	3	0.3
BASIS Smith and Nephew	1002	8.0	43	5.3	1	0.1
CORAE Adler-Ortho	42	0.3	41	5.0	1	0.1
LUBINUS SP2 Link	308	2.5	9	1.1	1	0.1
VERSYS ADVOCATE Zimmer	248	2.0	7	0.9	-	-
SPECTRON Smith and Nephew	730	5.8	-	-	-	-
JVC Wright Cremascoli	728	5.8	-	-	-	-
P507 Samo	657	5.3	-	-	-	-
MRL Wright Cremascoli	469	3.8	-	-	-	-
LC Samo	412	3.3	-	-	-	-
AD Samo	388	3.1	-	-	-	-
DEFINITION Stryker Howmedica	347	2.8	-	-	-	-
VERSYS CEMENTED Zimmer	335	2.7	-	-	-	-
ANCA-FIT CLU Wright Cremascoli	314	2.5	-	-	-	-
C-STEM DePuy	313	2.5	-	-	-	-
AHS Wright Cremascoli	306	2.4	-	-	-	-
CCA Mathys	237	1.9	-	-	-	-
ABG Stryker Howmedica	231	1.8	-	-	-	-
C STEM AMT DePuy	229	1.8	-	-	-	-
ULTIMA Johnson e Johnson	197	1.6	-	-	-	-
VERSYS LD/FX Zimmer	133	1.1	-	-	-	-
MERCURIUS ADLER	112	0.9	-	-	-	-
ANCA Wright Cremascoli	89	0.7	-	-	-	-
MBA Groupe Lepine	88	0.7	-	-	-	-
DUOFIT CFS Samo	75	0.6	-	-	-	-
FULLFIX MATHYS	69	0.6	-	-	-	-
ARCAD SO Symbios	66	0.5	-	-	-	-
PERFECTA RA WRIGHT	60	0.5	-	-	-	-

MULLER AUTOBLOCCANTE Sulzer	57	0.5	-	-	-	-
ABGII Stryker Howmedica	55	0.4	-	-	-	-
SL STREAKES Hitmedica	50	0.4	-	-	-	-
Other (< 50 cases)	728	5.8	110	13.5	135	14.2
Total	**12506**	**100.0**	**816**	**100.0**	**948**	**100.0**

Cementless stem	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	%
POLARSTEM Endoplus	706	0.9	991	4.4	2025	8.2
HYDRA-FIX Adler-Ortho	-	-	324	1.4	1777	7.2
HYDRA Adler-Ortho	2496	3.3	1757	7.8	1557	6.3
AMISTEM-H Medacta	385	0.5	654	2.9	1408	5.7
EXACTA - Permedica	75	0.1	603	2.7	1151	4.7
APTA-FIX Adler-Ortho	-	-	700	3.1	1065	4.3
APTA Adler-Ortho	8433	11.1	1827	8.1	842	3.4
CLS Sulzer	4515	6.0	455	2.0	758	3.1
CORAIL DePuy	1740	2.3	809	3.6	747	3.0
H-MAX S Lima	296	0.4	571	2.5	729	3.0
TRI-LOCK DePuy	570	0.8	754	3.3	637	2.6
MINIMAX Medacta	588	0.8	461	2.0	603	2.4
TAPERLOC COMPLETE MICROPLASTY Biomet	8	0.0	333	1.5	602	2.4
PULCHRA-FIX Adler-Ortho	-	-	93	0.4	596	2.4
FITMORE B EXT. ZIMMER	300	0.4	341	1.5	589	2.4
ACCOLADE II Osteonics Howmedica	64	0.1	327	1.4	566	2.3
SL PLUS MIA STEM Smith and Nephew	1350	1.8	836	3.7	523	2.1
KORUS Bioimpianti	10	0.0	337	1.5	505	2.1
RECTA Adler-Ortho	5020	6.6	617	2.7	501	2.0
TAPERLOC COMPLETE Biomet	165	0.2	638	2.8	481	2.0
LCU - Link	47	0.1	276	1.2	451	1.8
MINIMA S Lima	12	0.0	85	0.4	436	1.8
AMISTEM-P Medacta	-	-	-	-	427	1.7
SYNTHESIS Permedica	91	0.1	491	2.2	311	1.3
AVENIR MULLER Zimmer	34	0.0	258	1.1	298	1.2
CONUS Centerpulse	5120	6.8	428	1.9	278	1.1
NANOS Endoplant Gmbh	643	0.8	337	1.5	278	1.1
TAPERLOC COMPLETE REDUCED DISTAL Biomet	-	-	108	0.5	237	1.0
ALATA ACUTA S Adler-Ortho	929	1.2	346	1.5	234	1.0
MODULUS Lima	854	1.1	231	1.0	231	0.9
EXACTA S Permedica	2	0.0	139	0.6	224	0.9
FITMORE B Zimmer	583	0.8	260	1.2	217	0.9
SUMMIT DePuy	405	0.5	186	0.8	181	0.7
ADR Endoplus	937	1.2	308	1.4	165	0.7
RECTA-FIX Adler-Ortho	122	0.2	287	1.3	164	0.7
SL PLUS Endoplus	4302	5.7	298	1.3	102	0.4
TWINSYS Mathys	272	0.4	66	0.3	93	0.4
GTS Biomet	306	0.4	82	0.4	78	0.3
ALLOCLASSIC SL Zimmer	360	0.5	12	0.1	66	0.3
QUADRA-H Medacta	268	0.4	13	0.1	60	0.2
MISTRAL Samo	131	0.2	211	0.9	59	0.2
PLS Lima	268	0.4	95	0.4	59	0.2
FIT STEM Lima	324	0.4	70	0.3	50	0.2
C2 Lima	1033	1.4	121	0.5	45	0.2
SAM-FIT Lima	386	0.5	111	0.5	34	0.1
VERSYS FIBER METAL TAPER Zimmer	1255	1.7	72	0.3	33	0.1

QUADRA-S Medacta	350	0.5	92	0.4	23	0.1
CORAE Adler-Ortho	876	1.2	1528	6.8	22	0.1
MULTIFIT Samo	364	0.5	64	0.3	19	0.1
CFP Link	1074	1.4	29	0.1	17	0.1
TAPERLOC Biomet	2878	3.8	101	0.4	15	0.1
PARVA Adler-Ortho	375	0.5	75	0.3	11	0.0
DUOFIT RKT Samo	338	0.4	44	0.2	11	0.0
TAPERLOC MICROPLASTY Biomet	482	0.6	17	0.1	5	0.0
PROXIPLUS Endoplant	1450	1.9	147	0.7	3	0.0
Z1 Citieffe	372	0.5	37	0.2	2	0.0
DUOFIT RTT Samo	314	0.4	13	0.1	2	0.0
PBF Permedica	428	0.6	8	0.0	1	0.0
SYNERGY Smith and Nephew	759	1.0	142	0.6	-	-
CBC Mathys	2252	3.0	57	0.3	-	-
ABGII Stryker Howmedica	3495	4.6	43	0.2	-	-
ACCOLADE Osteonics Howmedica	487	0.6	42	0.2	-	-
HIPSTAR Stryker Howmedica	336	0.4	1	0.0	-	-
CONELOCK SHORT Biomet	300	0.4	1	0.0	-	-
ANCA FIT Wright Cremascoli	4506	5.9	-	-	-	-
PROFEMUR Z Wright Cremascoli	715	0.9	-	-	-	-
BHS Smith and Nephew	438	0.6	-	-	-	-
ABG Stryker Howmedica	332	0.4	-	-	-	-
SPS MODULAR Symbios	332	0.4	-	-	-	-
EHS Wright Cremascoli	312	0.4	-	-	-	-
PROXILOCK FT Stratec	304	0.4	-	-	-	-
Other (< 300 cases)	6474	8.5	1847	8.2	2014	8.2
Total	**75748**	**100.0**	**22607**	**100.0**	**24618**	**100.0**

4.4 Stems used in total revision surgery

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

Cemented stem	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
VERSYS REVISION CALCAR Zimmer	20	4.0	6	12.5	11	16.7
APTA Adler-Ortho	35	7.0	1	2.1	7	10.6
EXETER V40 Stryker Howmedica	80	15.9	5	10.4	2	3.0
AD Samo	29	5.8	-	-	1	1.5
JVC Wright Cremascoli	32	6.4	-	-	-	-
ANCA Wright Cremascoli	25	5.0	-	-	-	-
Other (< 20 cases)	281	56.0	36	75.0	45	68.2
Total	**502**	**100.0**	**48**	**100.0**	**66**	**100.0**

Cementless stem	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
REVISION HIP Lima	206	6.3	124	27.3	144	31.1
SL REVISION Sulzer Centerpulse Zimmer	618	18.8	59	13.0	69	14.9
ALATA AEQUA REVISION Adler-Ortho	223	6.8	79	17.4	48	10.4
REDAPT Smith and Nephew	-	-	4	0.9	27	5.8
ALATA ACUTA S Adler-Ortho	85	2.6	35	7.7	19	4.1
RECLAIM DePuy	26	0.8	15	3.3	12	2.6
MODULUS HIP SYSTEM Lima	53	1.6	9	2.0	9	1.9
RESTORATION Stryker Howmedica	289	8.8	20	4.4	8	1.7
MP RECONSTRUCTION PROSTHESIS Link	65	2.0	9	2.0	7	1.5
APTA Adler-Ortho	30	0.9	2	0.4	6	1.3
CONUS Sulzer Centerpulse Zimmer	89	2.7	6	1.3	5	1.1

CLS Sulzer Centerpulse Zimmer	42	1.3	6	1.3	2	0.4
ADR Endoplus	23	0.7	4	0.9	2	0.4
C2 Lima	65	2.0	1	0.2	1	0.2
SLR PLUS Endoplus	30	0.9	1	0.2	1	0.2
MGS Samo	122	3.7	1	0.2	-	-
PROFEMUR R VERS. 4 Wright Cremascoli	415	12.6	-	-	-	-
S. ROM Johnson e Johnson	147	4.5	-	-	-	-
CONELOCK REVISION Biomet	137	4.2	-	-	-	-
RESTORATION T3 Stryker Howmedica	74	2.3	-	-	-	-
ANCA FIT Wright Cremascoli	59	1.8	-	-	-	-
ZMR REVISION TAPER CONE Zimmer	52	1.6	-	-	-	-
SL PLUS Endoplus	40	1.2	-	-	-	-
ZMR REVISION TAPER Zimmer	30	0.9	-	-	-	-
EMPERION Smith and Nephew	23	0.7	-	-	-	-
VERSYS FIBER METAL TAPER Zimmer	22	0.7	-	-	-	-
CBC Mathys	20	0.6	-	-	-	-
CBK REVISION STEM Mathys	20	0.6	-	-	-	-
Other (< 20 cases)	277	8.4	79	17.4	103	22.2
Total	**3282**	**100.0**	**454**	**100.0**	**463**	**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 surgery	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
2019	106	130
2020	102	130

During 2020 20 new types of cup and 20 new types of stem were implanted.

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

Year of surgery	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
2019	42	44
2020	37	39

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 surgery	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	96.5	3.5
2008	96.5	3.5
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	95.7	4.3
2015	95.4	4.6
2016	95.1	4.9
2017	93.4	6.6
2018	93.0	7.0
2019	92.3	7.7
2020	92.3	7.7

Table below shows most used types of dual mobility cups

Types of dual mobility cups	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
FIXA DUPLEX Adler-Ortho	-	-	52	4.1	232	12.1
GYROS Depuy	7	0.3	246	19.4	223	11.6
QUATTRO VPS PF HAP PNP Groupe Lep.	-	-	73	5.8	180	9.4
DUALIS Bioimpianti	4	0.2	109	8.6	178	9.3
ACORN Permedica	2	0.1	29	2.3	151	7.9
TRIDENT PSL HA CLUSTER Howmedica	50	2.2	137	10.8	147	7.7
FIXA Ti-POR Adler-Ortho	-	-	-	-	130	6.8
JUMP SYSTEM TRASER Permedica	-	-	18	1.4	97	5.1
POLARCUP TI-PLASMA Ortho-Id	135	5.9	74	5.8	85	4.4
G7 OSSEO TI Biomet	-	-	2	0.2	82	4.3
DELTA TT Lima	13	0.6	12	0.9	55	2.9
TRITANIUM HEMI HA SOLID Stryker How.	-	-	4	0.3	39	2.0
AVANTAGE CEMENTED Biomet	94	4.1	-	-	22	1.1
RELOAD AVANTAGE Biomet	404	17.7	39	3.1	20	1.0
TRITANIUM HEMISPHERICAL Stryker How.	5	0.2	57	4.5	18	0.9
VERSAFITCUP DM Medacta	107	4.7	39	3.1	3	0.2
POLARCUP CEMENTED Smith and Nep.	21	0.9	17	1.3	3	0.2
NOVAE E TH Serf	46	2.0	40	3.2	2	0.1
ADES Dedienne Sante	5	0.2	40	3.2	2	0.1
QUATTRO VPS PF HAP Groupe Lepine	29	1.3	60	4.7	-	-
DMX Transysteme	74	3.2	50	3.9	-	-
DMX CEMENTED Transysteme	21	0.9	12	0.9	-	-
AVANTAGE 3P Biomet	141	6.2	4	0.3	-	-
STAFIT Zimmer	28	1.2	2	0.2	-	-
POLARCUP Ortho-Id	73	3.2	1	0.1	-	-
EASY HIT Medica	313	13.7	-	-	-	-
AVANTAGE Biomet	300	13.2	-	-	-	-
MOBILIS I Othesio	114	5.0	-	-	-	-
C2M PF Symbios	82	3.6	-	-	-	-
POLARCUP TI-PLASMA Endoplus	49	2.2	-	-	-	-
Other (<30 cases)	162	7.1	149	11.8	249	13.0
Total	**2279**	**100.0**	**1266**	**100.0**	**1918**	**100.0**

4.7 Modular neck

28.3% 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 THA	
	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
2019	85.5	14.5
2020	88.4	11.6

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

Types of stems with proximal modularity	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
HYDRA Adler-Ortho	2497	8.5	1757	31.3	1560	40.7
APTA Adler-Ortho	8440	28.7	1827	32.5	843	22.0
RECTA Adler-Ortho	5021	17.0	618	11.0	501	13.1
ALATA ACUTA S Adler-Ortho	931	3.2	346	6.2	235	6.1
MODULUS HIP SYSTEM Lima	854	2.9	231	4.1	231	6.0
APTA Cem Adler-Ortho	1153	3.9	57	1.0	60	1.6
REVISION HIP Lima	41	0.1	40	0.7	55	1.4
PULCHRA Adler-Ortho	56	0.2	119	2.1	40	1.0
ALATA AEQUA REVISION Adler-Ortho	39	0.1	29	0.5	37	1.0
SAM-FIT Lima	386	1.3	111	2.0	34	0.9
H-MAX M Lima	187	0.6	65	1.2	31	0.8
HYDRA Cem Adler-Ortho	51	0.2	39	0.7	29	0.8
MINIFIT Samo	11	0.0	64	1.1	22	0.6
MULTIFIT Samo	364	1.2	64	1.1	19	0.5
PARVA Adler-Ortho	376	1.3	75	1.3	11	0.3

S. ROM Johnson e Johnson	179	0.6	7	0.1	3	0.1
CLS BREVIUS Zimmer	226	0.8	60	1.1	2	0.1
HARMONY Symbios	189	0.6	5	0.1	-	-
VITAE Adler-Ortho	127	0.4	4	0.1	-	-
SMF Smith and Nephew	113	0.4	2	0.0	-	-
PROFEMUR L Wright Cremascoli	99	0.3	1	0.0	-	-
ANCA Fit Wright Cremascoli	4507	15.3	-	-	-	-
JVC Wright Cremascoli	728	2.5	-	-	-	-
PROFEMUR Z Wright Cremascoli	712	2.4	-	-	-	-
SPS MODULAR Symbios	332	1.1	-	-	-	-
ANCA-Fit CLU Wright Cremascoli	314	1.1	-	-	-	-
EHS Wright Cremascoli	311	1.1	-	-	-	-
STEM Wright Cremascoli	211	0.7	-	-	-	-
G3 Citieffe	179	0.6	-	-	-	-
MBA HAP Groupe Lepine	128	0.4	-	-	-	-
MERCURIUS Adler-Ortho	112	0.4	-	-	-	-
MBA Groupe Lepine	88	0.3	-	-	-	-
PROFEMUR C Wright Cremascoli	87	0.3	-	-	-	-
STELO MODULARE NDS1 Citieffe	77	0.3	-	-	-	-
ABGII MODULAR Stryker Howmedica	66	0.2	-	-	-	-
Other (<50 cases)	261	0.9	100	1.8	116	3.0
Total*	**29453**	**100.0**	**5621**	**100.0**	**3829**	**100.0**

*36 missing data (0.1%)

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 surgery	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
2019	99.9	0.1
2020	99.7	0.3

Resurfacing arthroplasty used between 1st January 2000 and 31st December 2020

Type	N.	%
BHR – Smith & Nephew	1838	64.5
ADEPT – Finsbury	437	15.3
BMHR* – Smith & Nephew	198	7.0
MITCH TRH – Finsbury	89	3.1
ASR – DePuy	77	2.7
RECAP – Biomet	65	2.3
MRS* – Lima	45	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**	**2848**	**100.0**

**1 missing data (0.1%)
*considered similar to resurfacing.

In 2020 were implanted 26 BHR - Smith and Nephew.

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 20120, 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 THA		Total revision	
	N.	%	N.	%
Composite Ceramic-Composite Ceramic	46261	35.1	812	17.9
Composite Ceramic-XLPE	16948	12.9	613	13.5
Metal-UHMWPE	13761	10.5	781	17.2
Alumina-Alumina	11035	8.4	326	7.2
Alumina-UHMWPE	9251	7.0	609	13.4
Metal-XLPE	7817	5.9	573	12.6
Composite Ceramic-XLPE+Vit.E	5626	4.3	85	1.9
Metal-Metal	5408	4.1	91	2.0
Ceramicised Metal-XLPE	3152	2.4	39	0.9
Alumina-XLPE	1855	1.4	128	2.8
Composite Ceramic-UHMWPE	1812	1.4	85	1.9
Alumina-Composite Ceramic	1816	1.4	58	1.3

Composite Ceramic-Alumina	1350	1.0	12	0.3
Alumina-undefined Poly*	900	0.7	85	1.9
Metal-Uhmwpe+Metal	886	0.7	6	0.1
Alumina-Uhmwpe+Alumina	773	0.6	13	0.3
Revision Composite Ceramic-Composite Ceramic	490	0.4	12	0.3
Ceramicised Metal-UHMWPE	429	0.3	21	0.5
Metal- undefined Poly*	326	0.2	48	1.1
Alumina-Metal+Alumina	300	0.2	59	1.3
Composite Ceramic-Metal+ XLPE+Vit.E	309	0.2	-	-
Zirconia Ceramic-XLPE+Vit. E	290	0.2	-	-
Zirconia Ceramic -UHMWPE	206	0.2	18	0.4
Composite Ceramic-Metal	222	0.2	-	-
Other (< 100 cases)	399	0.3	71	1.6
Total^	**131622**	**100.0**	**4545**	**100.0**

*missing label did not allow classification of poly
^0.4% missing data in primary surgery and 0.5% in total revision

Percentage of total hip arthroplasty interventions between 2001 and 2020, according to the **type of polyethylene** used. All types of poly (with or without **anti-luxation lip**, constrained) are considered.

Year of surgery	Primary THA		
	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	8.8	91.2	-
2019	8.8	91.2	-
2020	6.8	93.2	-

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 THA	
	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
2019	-	100.0
2020	-	100.0

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

Year of surgery	Primary THA	
	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
2019	1.2	98.8
2020	0.6	99.4

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2020, 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	-	-	-	-	5694	12.1	27526	74.7	35321	81.1	5638	64.6
Cr-Co	899	84.9	24	77.4	19121	40.7	2735	7.4	2357	5.4	2495	28.6
Alumina	1	0.1	-	-	17638	37.6	5356	14.5	3512	8.1	-	-
Stainless steel	154	14.5	5	16.1	3501	7.5	203	0.6	30	0.1	-	-
Ceramicised Metal	4	0.4	-	-	503	1.1	896	2.4	2124	4.9	31	0.4
Zirconia	1	0.1	2	6.5	317	0.7	98	0.3	190	0.4		0.0
Revision ceramic	-	-	-	-	10	0.0	22	0.1	13	0.0	491	5.6
Surface-treated metal	-	-	-	-	180	0.4	-	-	-	-	78	0.9
Total*	**1059**	**100.0**	**31**	**100.0**	**46964**	**100.0**	**36836**	**100.0**	**43547**	**100.0**	**8733**	**100.0**

*442 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	7.0	4.8	0.6	36.2	1.5	1.9	43.0	1.6	3.3
2019	7.7	4.2	0.7	37.0	1.3	1.8	42.9	1.2	3.3
2020	9.1	3.8	0.5	35.5	0.8	1.6	45.0	1.1	2.7

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 2020, according to **type of operation** and **fixation**

Fixation	Primary THA	%	Total revision	%
Cementless	122208	93.0	3645	78.8
Hybrid (cemented stem and cementless cup)	9611	4.8	389	7.5
Cemented	4680	1.7	235	3.9
Reverse hybrid (cementless stem and cemented cup)	757	0.5	588	9.8
Total*	**137256**	**100.0**	**4857**	**100.0**

*356 missing data in primary THA and 27 in total revision

Percentage of **total hip arthroplasties** according to **fixation during the years** 2000–2020

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
2019	0.2	95.8	3.6	0.4
2020	0.2	95.3	4.3	0.2

Percentage of total hip arthroplasties for coxarthrosis according to **fixation**, by **age of patient**

Age class	Primary THA for coxarthrosis 2000-2020			
	Cemented	Cementless	Hybrid	Reverse hybrid
<40	0.0	99.5	0.2	0.3
40-49	0.2	99.4	0.3	0.1

50-59	0.2	98.5	1.2	0.1
60-69	0.7	94.5	4.6	0.2
70-79	3.6	86.0	10.0	0.4
≥80	10.1	75.5	13.4	1.0

Percentage of total hip arthroplasties for coxarthrosis according to **fixation** and **class of age** – year **2000**

Age class	**Primary THA for coxarthrosis year 2000**			
	Cemented	**Cementless**	**Hybrid**	**Reverse hybrid**
<40	0.0	100.0	0.0	0.0
40-49	0.0	96.2	3.8	0.0
50-59	1.5	86.7	11.5	0.3
60-69	6.0	67.5	26.2	0.3
70-79	20.6	44.3	34.1	1.0
≥80	53.7	26.3	18.0	2.0

Percentage of total hip arthroplasties for coxarthrosis according to **fixation** and **class of age** – year **2020**

Age class	**Primary THA for coxarthrosis year 2020**			
	Cemented	**Cementless**	**Hybrid**	**Reverse hybrid**
<40	0.0	100.0	0.0	0.0
40-49	0.0	99.7	0.0	0.3
50-59	0.0	99.8	0.1	0.1
60-69	0.0	97.9	2.0	0.1
70-79	0.0	94.8	5.1	0.2
≥80	0.3	88.5	11.1	0.1

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

Year of surgery	**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
2019	2.2	77.8	9.4	10.6
2020	2.9	80.6	12.2	4.3

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

Age class	Total revision			
	Cemented	**Cementless**	**Hybrid**	**Reverse hybrid**
<40	1.1	93.3	2.2	3.3
40-49	2.5	90.0	3.5	4.0
50-59	1.8	87.9	3.4	7.0
60-69	2.7	79.8	6.3	11.2
70-79	4.5	72.7	8.8	14.1
≥80	11.7	59.9	13.4	15.0

4.11 Bone cement

Type of cement used in primary THA, 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 Primary THA	% in Hemiarthroplasties	% in Resurf.
Surgical Simplex P - Howmedica	34.3	35.1	34.1
Cemex System - Tecres	10.2	20.9	1.1
Smartset Hv - Depuy	6.5	8.1	2.3
Antibiotic Simplex - Howmedica	**6.0**	**2.7**	**54.6**
Palacos R - Biomet	4.9	1.0	0.9
Cmw 3 - Depuy	3.2	0.7	0.0
Amplicem 3 - Amplimedical	3.0	2.5	0.0
Smartset Mv - Depuy	2.2	6.0	0.0
Cemex Rx - Tecres	1.9	3.8	0.1
Palacos R - Heraeus Medical	1.7	3.3	0.1
Cemex + Cemex System - Tecres	1.7	0.0	0.0
Cemex - Tecres	1.5	1.2	0.1
Cemfix 1 - Teknimed	1.4	2.7	0.0
Exolent High - Elmdown	1.4	0.5	0.0
Cemex Rx + Cemex System - Tecres	1.3	0.0	0.0
Amplicem 1 + Amplicem 3 - Amplimedical	1.2	0.0	0.0
Cemex Sys. -Tecres+Surgical Simplex P-How	1.1	0.0	0.0
Amplicem1-Amplim.+Smartset Hv-Depuy	1.1	0.0	0.0
Versabond - Smith and Nephew	1.0	0.0	2.1
Vacu Mix Plus Cmw 3 - Depuy	1.0	2.9	0.0
Sulcem 3 - Centerpulse	0.9	0.8	0.0
Cemex Genta + Cemex Genta Sys.- Tecres	**0.9**	**0.0**	**0.0**
Cemfix 3 - Teknimed	0.7	0.2	0.0
Palacos R+G - Heraeus Medical	**0.7**	**0.9**	**0.0**
Aminofix 1 - Groupe Lepine	**0.7**	**0.0**	**0.0**
Bone Cement R - Biomet	0.6	0.1	0.8
Hi-Fatigue - Zimmer	0.6	0.0	0.5
Cemex Genta - Tecres	**0.6**	**0.3**	**0.0**

Refobacin Bone Cement R - Biomet	**0.5**	**0.0**	**0.0**
Palacos R 40 - Sp Europe	0.5	0.1	0.0
Smartset GMV - Depuy	**0.5**	**0.0**	**0.0**
Cemex Genta System - Tecres	**0.4**	**1.7**	**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
Refobacin Revision - Biomet	**0.3**	**0.0**	**0.0**
Hi-Fatigue G - Zimmer	**0.2**	**0.0**	**0.1**
Amplicem 3G - Amplimedical	**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
Palacos LV + G - Heraeus Medical	**0.2**	**0.7**	**0.0**
Smartset GHV - Depuy	**0.2**	**0.0**	**0.0**
Other without antibiotic	1.7	2.8	0.6
Other with antibiotic	**1.4**	**0.6**	**0.3**
Total	**100.0**	**100.0**	**100.0**

Antibiotic-loaded cement was chosen in 14.7% of THA, in 7.6% of hemi and in 56.6% of resurfacing.
Surgical Simplex P – Howmedica in 2019-2020 was chosen in 18.9% of THA and in 26.2% of hemi with at least one cemented component.

5. Types of hemiarthroplasty

5.1 Hemiarthroplasty cup and stem

Monoblock	**2000-2014**		**2015-2017**		**2018-2020**	
	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	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
TESTA ELLITTICA - Samo	422	99.3	-	-	-	-
Other	3	0.7	-	-	-	-
Total	**425**	**100.0**	**-**	**-**	**-**	**-**

Biarticular	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
JANUS Bioimpianti	2830	8.4	2821	39.3	2704	39.8
TESTA BIARTICOLARE LOCK Lima	2169	6.4	706	9.8	1111	16.4
CUPOLA MOBILE BIARTICOLARE - Permedica	723	2.1	29	0.4	837	12.3
TESTA BIPOLARE Samo	177	0.5	845	11.8	814	12.0

CUPOLA MOBILE MODULARE-Wright Cremascoli	1428	4.2	393	5.5	466	6.9
UHR Osteonics Stryker Howmedica	3271	9.7	366	5.1	191	2.8
BI-POLAR DePuy	2019	6.0	11	0.2	173	2.5
C1 - Citieffe	6275	18.6	1139	15.9	166	2.4
CUPOLA MOBILE Medacta	192	0.6	13	0.2	133	2.0
TESTA BIPOLARE Smith and Nephew	137	0.4	104	1.4	39	0.6
TANDEM INTL BIPOLAR Smith and Nephew	71	0.2	17	0.2	36	0.5
BI-POLAR Biomet	496	1.5	70	1.0	25	0.4
CUPOLA BIPOLARE Zimmer	458	1.4	8	0.1	25	0.4
CUPOLA NEMAUSUS Transysteme	891	2.6	51	0.7	4	0.1
TESTA BIARTICOLARE - Lima	630	1.9	-	-	1	0.0
RETENTIVE MOBILE CUP - Cedior	292	0.9	-	-	1	0.0
SPHERI-LOCK Lima	5822	17.3	335	4.7	-	-
SPHERI-LOCK LSM-MED	2	0.0	210	2.9	-	-
CUPOLA MOBILE BIBOP Symbios	59	0.2	51	0.7	-	-
CUPOLA BIPOLARE Mathys	716	2.1	1	0.0	-	-
ULTIMA MONK DePuy	1004	3.0	-	-	-	-
CUPOLA MOBILE Zimmer	882	2.6	-	-	-	-
CUPOLA SEM - D.M.O.	731	2.2	-	-	-	-
MODULAR BIPOLAR - Protek	612	1.8	-	-	-	-
CENTRAX - Stryker Howmedica	543	1.6	-	-	-	-
SPHERIC Amplitude	352	1.0	-	-	-	-
BICENTRIC - Stryker Howmedica	236	0.7	-	-	-	-
TESTA BIPOLARE - Amplimedical	193	0.6	-	-	-	-
CORON Tantum	190	0.6	-	-	-	-
Other (< 100 cases)	336	1.0	7	0.1	68	1.0
Total*	**33737**	**100.0**	**7177**	**100.0**	**6794**	**100.0**

*305 missing data (0.6%)

In 270 cases model or stem fixation was not communicated to RIPO.

Cemented stem	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
KORUS Bioimpianti	195	0.7	1367	28.1	1133	27.7
DUOFIT CKA Samo	221	0.8	744	15.3	712	17.4
SL Permedica	679	2.5	24	0.5	686	16.8
SL Lima	1463	5.4	474	9.7	452	11.0
PROFEMUR GLADIATOR Wright	230	0.8	364	7.5	442	10.8
EXETER V40 Stryker Howmedica	1035	3.8	347	7.1	188	4.6
H-MAX C Lima	-	-	38	0.8	162	4.0
AB Citieffe	5691	20.8	1041	21.4	94	2.3
CORAIL DePuy	577	2.1	-	-	64	1.6
VERSYS ADVOCATE Zimmer	120	0.4	60	1.2	45	1.1
LOGICA MIRROR Lima	536	2.0	9	0.2	8	0.2
QUADRA-C Medacta	176	0.6	1	0.0	1	0.0
SL STREAKES Hit Medica	1828	6.7	114	2.3	-	-
SL STREAKES LSM-MED	1	0.0	108	2.2	-	-
SPHERI-SYSTEM II Lima	2425	8.9	56	1.2	-	-
APTA Adler-Ortho	1034	3.8	2	0.0	-	-
S-TAPER Bioimpianti	433	1.6	1	0.0	-	-
G2 DePuy	1507	5.5	-	-	-	-

ORTHO-FIT Zimmer	830	3.0	-	-	-	-
STANDARD STRAIGHT Zimmer	778	2.8	-	-	-	-
SL - Hit Medica	737	2.7	-	-	-	-
CCA Mathys	647	2.4	-	-	-	-
SEM II DMO	638	2.3	-	-	-	-
RELIANCE H Howmedica	623	2.3	-	-	-	-
VERSYS LD/FX- Zimmer	546	2.0	-	-	-	-
FIN Bioimpianti	526	1.9	-	-	-	-
JVC Wright Cremascoli	481	1.8	-	-	-	-
ULTIMA LX Johnson And Johnson	317	1.2	-	-	-	-
AHS Wright Cremascoli	312	1.1	-	-	-	-
MRL Wright Cremascoli	270	1.0	-	-	-	-
LOGICA Lima	249	0.9	-	-	-	-
DEFINITION Stryker Howmedica	240	0.9	-	-	-	-
C-STEM AMT DePuy	171	0.6	-	-	-	-
SL Amplimedical	158	0.6	-	-	-	-
ULTIMA STRAIGHT DePuy	156	0.6	-	-	-	-
ALBI PTC Wright Cremascoli	149	0.5	-	-	-	-
VERSYS HERITAGE Zimmer	140	0.5	-	-	-	-
MERCURIUS Adler-Ortho	99	0.4	-	-	-	-
LC - Samo	5	0.0	-	-	-	-
Total	**27335**	**100.0**	**4868**	**100.0**	**4095**	**100.0**

Cementless stem	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
KORUS Bioimpianti	441	6.9	1235	53.2	1452	53.6
SL Lima	322	5.0	199	8.6	338	12.5
LOGICA CS Lima	321	5.0	202	8.7	128	4.7
AMISTEM-H Medacta	-	-	6	0.3	126	4.6
CORAIL De Puy	57	0.9	6	0.3	111	4.1
Z1 Citieffe	98	1.5	74	3.2	91	3.4
POLARSTEM Endoplus	90	1.4	90	3.9	68	2.5
HYDRA Adler-Ortho	71	1.1	32	1.4	40	1.5
TAPERLOC Biomet	30	0.5	66	2.8	24	0.9
APTA Adler-Ortho	129	2.0	34	1.5	23	0.8
RECTA Adler-Ortho	138	2.1	2	0.1	1	0.0
S-TAPER Bioimpianti	1091	17.0	146	6.3	-	-
ACCOLADE Osteonics Stryker Howmedica	1806	28.1	-	-	-	-
HIP FRACTURE - Howmedica	283	4.4	-	-	-	-
PPF Biomet	266	4.1	-	-	-	-
ENDON Tantum	188	2.9	-	-	-	-
Other (< 100 cases)	1100	17.1	228	9.8	308	11.4
Total	**6431**	**100.0**	**2320**	**100.0**	**2710**	**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	46911	96.6
Bipolar head – preassembled	1102	2.3

Monoarticular	425	0.9
Monoblock prosthesis	112	0.2
Total	**48550**	**100.0**

In 2020 57.2% of stem was cemented, 8.7% had a modular neck and 2.7% had ceramic heds, the others had 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 2020

Complications occurred during hospitalization

Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Calcar fracture	552	0.4	T V P	111	*0.1*
Diaphysis fracture	417	0.3			
Greater troch. fracture	286	0.2			
Acetabulum fracture	190	0.1	Early Infection	102	*0.1*
Anaesthesiolog. complications	161	0.1			
Hemorragia	62	0.05			
Instability	26	0.02			
Other	156	0.1			
Total	**1850**	**1.3**	**Total**	**213**	***0.2***

The rate of complications in **revision surgery** carried out on patients hospitalized between 1st January 2000 and 31st December 2020

Complications occurred during hospitalization

Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Diaphysis fracture	262	1.4	Early Infection	64	*0.3*
Calcar fracture	84	0.4			
Greater troch. fracture	67	0.4			
Anaesthesiolog. complications	60	0.3	T V P	28	*0.2*
Acetabulum fracture	28	0.1			
Hemorragia	33	0.2			
Other	46	0.2			
Total	**580**	**3.0**	**Total**	**92**	***0.5***

The rate of complications in **hemiarthroplasty** carried out on patients hospitalized between 1st January 2000 and 31st December 2020

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Calcar fracture	244	0.5			
Anaesthesiolog. complications	166	0.3	T V P	77	*0.2*
Greater troch. fracture	151	0.3			
Diaphysis fracture	85	0.2			
Hemorragia	23	0.05	Early Infection	70	*0.2*
Acetabulum fracture	7	0.01			
Other	66	0.1			
Total	**742**	**1.5**	**Total**	**147**	***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 2020. Only deaths occurred during hospitalization are recorded.

Year 2000-2020			
Type of surgery	**Deaths**	**Number of surgeries**	**%**
Primary THA	300	137612	0.2
Hemiarthroplasties	2104	48550	4.3
Partial and total revision	134	19027	0.7
Resurfacing	-	2849	-
Prosthesis removal	39	1652	2.4

Number of deaths occurred within 90 days from the date of intervention. This data is known thanks merging RIPO data with other database. Only patients living in Emilia Romagna are considered. Following table describes by year and gender 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	9.9	19.8
2019	10.5	21.6
2020	12.8	22.9

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 surgery	**N.**	**Mean pre-op.**	**Range**
Primary THA	4405	2.5	0-61
Hemiarthroplasties	1786	3.6	0-44
Revision	747	4.1	0-71
Prosthesis removal	44	4.9	0-20
		Year 2020	
Type of surgery	**N.**	**Mean pre-op.**	**Range**
Primary THA	7682	1.1	0-79
Hemiarthroplasties	2136	2.4	0-65
Revision	719	3.2	0-50
Prosthesis removal	67	4.9	0-58

8. Analysis of survival of primary surgery

8.1 Cox multivariate analysis

The Cox multivariate model analyzes if some variables (independent of each other) can influence the event, in our case the removal of at least one prosthetic 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 2020 were analysed.
The 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.

		N	Hazard ratio	p
Age		97954	0.99 (0.99, 0.99)	<0.001
Sex	F	59070	Reference	
	M	38884	1.20 (1.13, 1.27)	<0.001
Diagnosis	Coxarthrosis	68208	Reference	
	Femoral fractures and sequelae	15280	1.38 (1.28, 1.49)	<0.001
	Sequelae of congenital and infantile diseases	7518	0.90 (0.81, 1.00)	0.047
	Idiopathic necrosis of the femoral head	5277	1.19 (1.05, 1.34)	0.005
	Rheumatic arthritis	721	1.07 (0.78, 1.46)	0.668
	Other	950	1.69 (1.32, 2.16)	<0.001

The effect of each variable was compared to the others when equal.

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.

Patients of the group 'Other pathologies' had a 1.7-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.

Concerning gender and age, males have a higher risk of 1.2 compared to women, and with increasing age of the patient the risk of revision surgery decreases.

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 20 yrs, may lead to an underestimation of the revision rate that is not quantifiable at the moment.

The following table shows in the second column the number of primary joint arthroplasty operations performed in the period from 1st January 2000 to 31st December 2020 **on resident in Emilia-Romagna region**; the following columns show the number of revision interventions 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	Mean Follow-up
Primary THA	98500	2908	1774	258	7.8
Hemiarthroplasty*	46924	832	221	25	3.7
Total revision	3189	258	122	17	7.9

*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	Mean Follow-up
Resurfacing	886	61	25	10	10.3

41.2% of Revisions after primary THA was performed in a different hospital, **22.8%** after Hemiarthroplasty and **35.0%** after total revision.
As for other registries, revision surgery has been classified 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	3697	988	258	4943/98500
Hemiarthroplasty*	778	275	25	1078/46924
Resurfacing	85	1	10	96/886
Total revision	310	70	17	397/3189

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

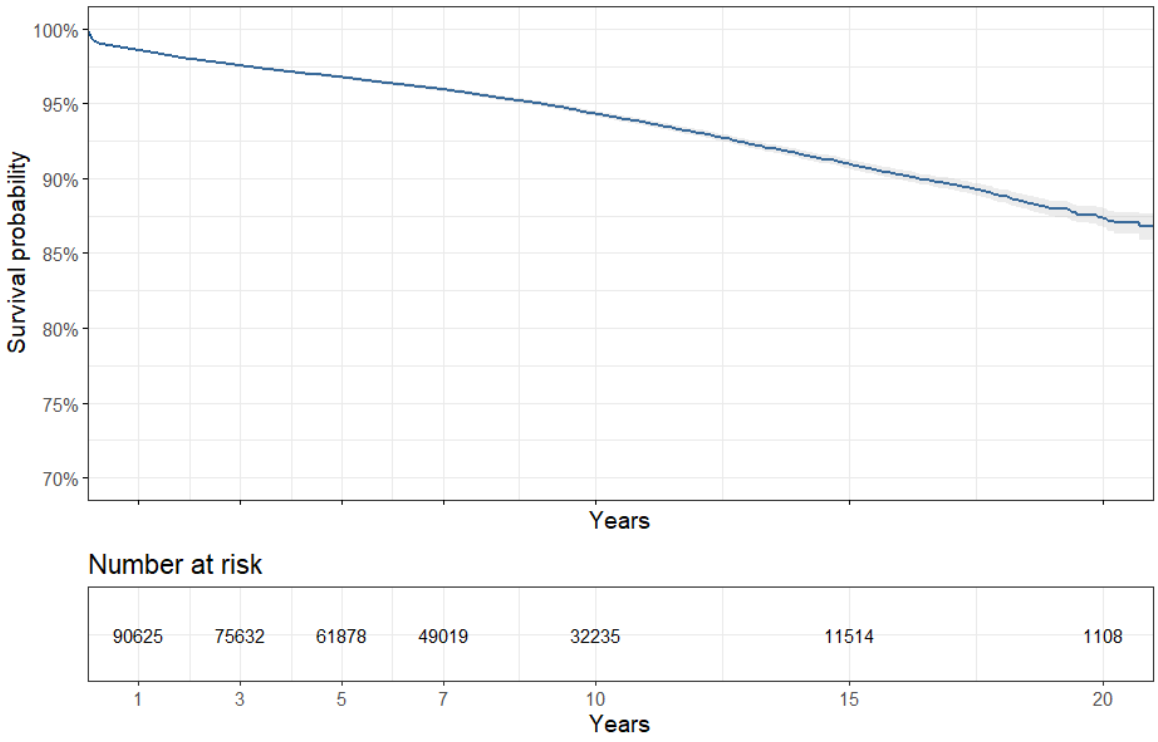
* Minor revision included revision of head, while implant of acetabular component is considered major revision.
^ Revisions not classify because performed outside Region.

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

98500 primary arthroprostheses are under observation. On these, 4943 revisions were carried out.



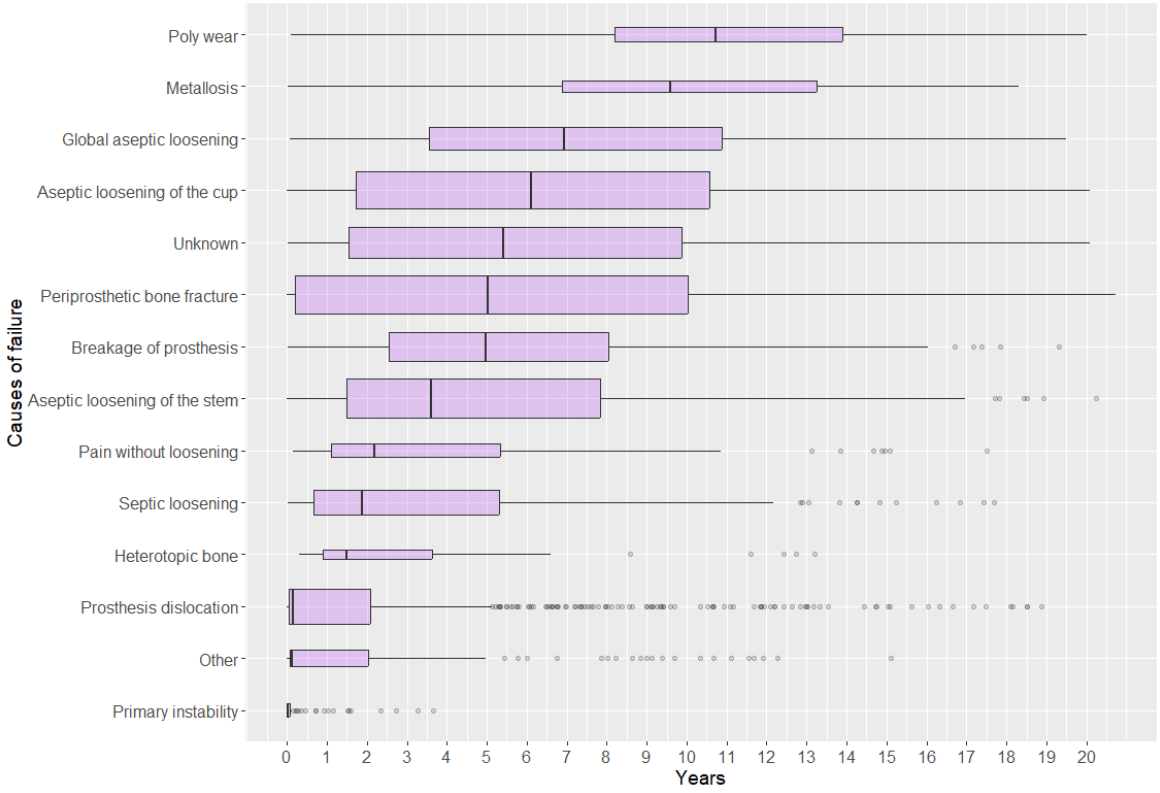
1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	20 Years
98.6 [98.5,98.6]	97.5 [97.4,97.6]	96.8 [96.6,96.9]	95.9 [95.8,96.1]	94.3 [94.2,94.5]	91.0 [90.7,91.3]	87.4 [86.8,88.0]

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

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	n/N	IR (%)	% Distribution failure causes
Stem aseptic loosening	785/98500	0.8	15.9
Periprosthetic bone fracture	758/98500	0.8	15.3
Cup aseptic loosening	714/98500	0.7	14.4
Dislocation	639/98500	0.6	12.9
Unknown (258 performed outside region)	482/98500	0.5	9.8
Breakage of prosthesis	436/98500	0.4	8.8
Septic loosening	301/98500	0.3	6.1
Total aseptic loosening	273/98500	0.3	5.5
Other	137/98500	0.1	2.8
Poly wear	119/98500	0.1	2.4
Pain without loosening	100/98500	0.1	2.0
Primary instability	98/98500	0.1	2.0
Metallosis	60/98500	0.1	1.2
Heterotopic bone	41/98500	0.0	0.8
Total	4943/98500	5.0	100.0

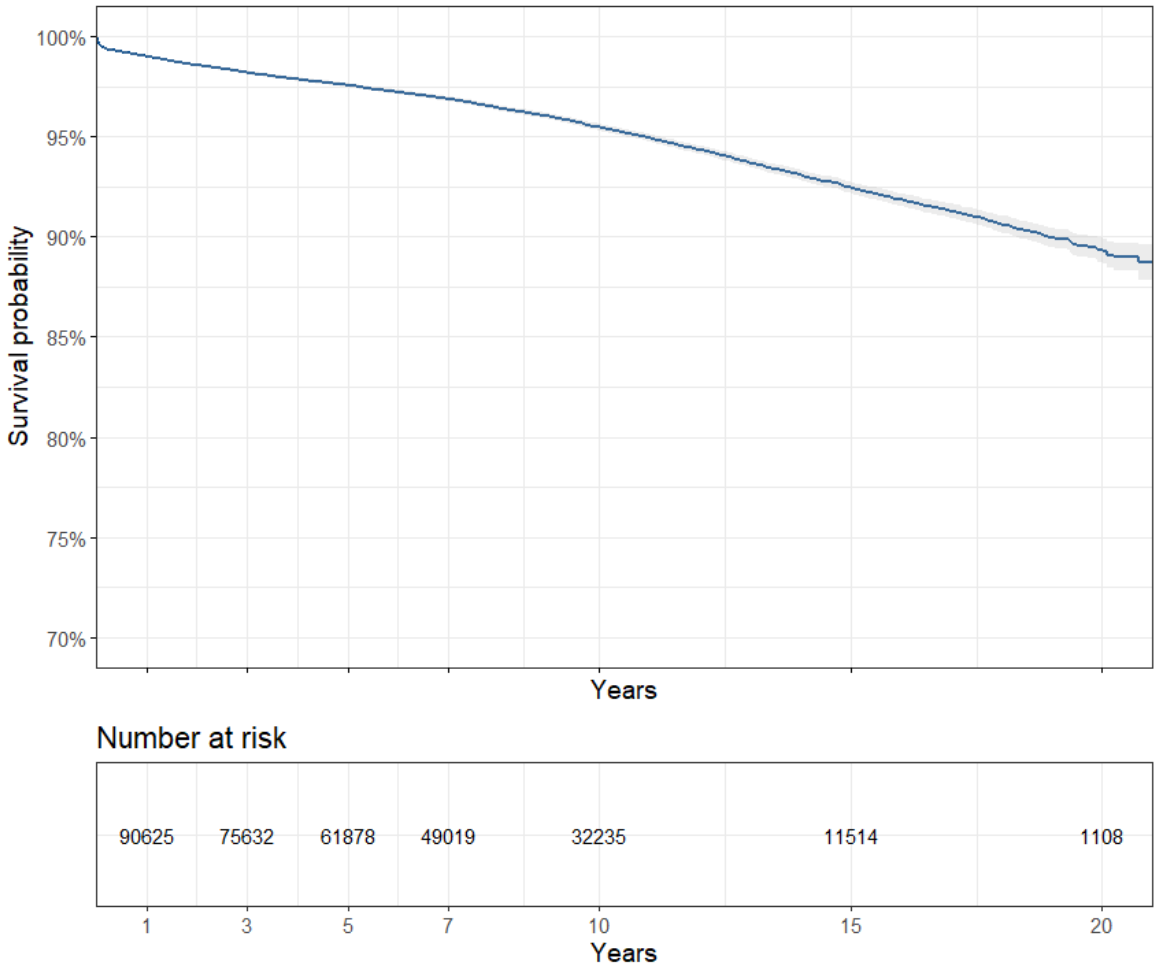
Percentage of causes of revision according to follow-up



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

98500 primary arthroprostheses are under observation. Of these, 3930 revisions were carried out to remove cup and/or stem.



1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	20 Years
99.0 [98.9,99.1]	98.2 [98.1,98.2]	97.5 [97.4,97.6]	96.8 [96.7,96.9]	95.3 [95.2,95.5]	92.0 [91.7,92.3]	88.2 [87.5,88.9]

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

8.6 Survival analysis 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

Cup (stem) Manufacturer	From year	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs
Fixa TI-por (Apta) Adler-Ortho	2007	5277	120	98.3 [97.9,98.7]	3671	97.0 [96.4,97.6]	1083
Fixa TI-por (Hydra) Adler-Ortho	2007	4340	109	97.4 [96.8,97.9]	2055	96.3 [95.5,97.1]	292
AnCA Fit (AnCA Fit) Wright Cremascoli	2000	2875	289	95.9 [95.2,96.6]	2595	93.2 [92.3,94.2]	2262
FIXA (RECTA) Adler-Ortho	2004	2727	185	96.4 [95.7,97.1]	2448	93.6 [92.6,94.6]	1721
EP-FIT PLUS (SL PLUS) Endoplus	2003	1989	100	96.7 [95.9,97.5]	1682	95.0 [94.0,96.0]	1047
ABGII (ABGII) Stryker Howmedica	2000	1965	130	97.7 [97.0,98.4]	1749	95.2 [94.1,96.2]	1353
R3 (SL PLUS MIA) Smith & Nephew	2010	1959	36	98.2 [97.6,98.9]	1053	97.4 [96.4,98.4]	51
Fixa TI-por (CORAE) Adler-Ortho	2010	1916	39	97.9 [97.3,98.6]	1036	97.6 [96.8,98.4]	6
R3 (POLARSTEM) Smith & Nephew	2012	1880	23	98.5 [97.8,99.2]	161	— [—,—]	0
Fixa TI-por (RECTA) Adler-Ortho	2007	1864	66	96.9 [96.1,97.7]	1179	95.7 [94.6,96.8]	243
Fixa Ti-por (HYDRA-FIX) Adler-Ortho	2016	1736	31	— [—,—]	0	— [—,—]	0
Fixa (APTA) Adler-Ortho	2004	1712	110	96.8 [95.9,97.6]	1576	94.3 [93.1,95.4]	1337
CLS (CLS) Sulzer Centerpulse Zimmer	2000	1516	118	97.5 [96.7,98.3]	1342	94.5 [93.3,95.7]	1081
FITMORE (CONUS) SulzerCenterpulse Zimmer	2000	1257	65	97.3 [96.4,98.2]	1051	96.0 [94.8,97.2]	744
Exceed ABT (TAPERLOC) Biomet	2006	1201	21	98.4 [97.7,99.1]	905	98.0 [97.1,98.9]	200
EXPANSION (CBC) Mathys	2003	1200	102	94.7 [93.4,96.0]	1003	91.0 [89.2,92.8]	565
JUMP SYSTEM (EXACTA) Permedica	2010	1125	11	98.9 [98.2,99.6]	119	— [—,—]	0
EP-FIT PLUS (PROXYPLUS) Smith & Nephew	2005	1099	40	98.2 [97.4,99.0]	950	96.1 [94.8,97.4]	488
Versafitcup CC (Amistem H) Medacta	2011	1073	27	97.2 [96.1,98.4]	291	— [—,—]	0
FIXA TI-por (APTA-FIX) Adler-Ortho	2015	937	20	97.1 [95.5,98.8]	69	— [—,—]	0
BICON PLUS (SL PLUS) Smith & Nephew	2000	935	91	95.7 [94.4,97.0]	808	92.8 [91.1,94.6]	628
DELTA TT (H-MAX S) Lima	2009	868	15	97.9 [96.9,99.0]	216	97.9 [96.9,99.0]	2
FITMORE (CLS) SulzerCenterpulse Zimmer	2000	769	41	96.9 [95.7,98.2]	684	95.2 [93.7,96.8]	558
Ep-fit (Polarstem) Endoplus	2008	759	12	98.6 [97.8,99.5]	464	98.1 [97.1,99.2]	11
PINNACLE SECTOR II (CORAIL) DePuy	2002	719	45	95.9 [94.4,97.4]	561	92.3 [90.0,94.6]	268
G7 PPS (TAPERLOC COMPLETE MICROPLASTY) Biomet	2015	716	9	98.5 [97.4,99.5]	53	— [—,—]	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

G7 PPS (TAPERLOC COMPLETE) Biomet	2014	657	10	98.2 [97.1,99.4]	93	— [—,—]	0
VERSAFITCUP CC TRIO (MINIMAX) Medacta	2012	646	19	96.2 [94.3,98.1]	117	— [—,—]	0
JUMP SYSTEM (SYNTHESIS) Permedica	2013	636	20	96.1 [94.3,97.9]	153	— [—,—]	0
REFLECTION (**BASIS**) Smith & Nephew	2001	622	54	96.6 [95.2,98.1]	523	92.0 [89.6,94.5]	320
TRIDENT PSL HA CLUSTER (EXETER V40) Howmedica	2002	599	8	99.0 [98.1,99.9]	337	98.5 [97.2,99.8]	197
CLS (CONUS) SulzerCenterpulse Zimmer	2000	595	61	97.1 [95.7,98.4]	534	94.0 [92.0,96.0]	453
Fixa (**APTA)** Adler-Ortho	2005	573	23	97.1 [95.8,98.5]	479	96.4 [94.9,98.0]	336
PINNACLE SECTOR II (SUMMIT) DePuy	2003	549	13	97.4 [95.9,98.9]	315	97.4 [95.9,98.9]	127
REFLECTION (**SYNERGY**) Smith & Nephew	2000	531	29	98.6 [97.6,99.6]	442	94.5 [92.1,97.0]	211
DELTA TT (MODULUS HIP SYSTEM) Lima	2007	524	18	96.8 [95.3,98.4]	306	96.1 [94.3,97.9]	80
Fixa TI-por (Alata Acuta) Adler-Ortho	2007	518	15	96.9 [95.4,98.5]	268	96.9 [95.4,98.5]	81
TRILOGY (VERSYS FIBER) Zimmer	2000	505	28	96.4 [94.7,98.0]	448	94.9 [93.0,96.9]	358
TRIDENT PSL HA CLUSTER (ABGII) Stryker Howmedica	2002	502	41	95.7 [93.9,97.5]	448	93.2 [90.9,95.6]	265
CONTEMPORARY (EXETER V40) Stryker Howmedica	2000	497	28	95.8 [93.9,97.7]	373	94.0 [91.7,96.5]	218
DUOFIT PSF (**P507**) Samo	2000	492	35	98.1 [96.8,99.3]	434	96.3 [94.5,98.1]	342
RECAP RESURFACING (TAPERLOC) Biomet	2005	486	35	96.0 [94.3,97.8]	439	93.9 [91.7,96.1]	346
Unknown	2000	484	106	88.7 [85.7,91.8]	286	80.6 [76.4,85.0]	168
R3 (SL PLUS) Smith & Nephew	2009	459	19	96.3 [94.5,98.1]	238	94.4 [91.3,97.6]	53
CONTINUUM (CLS) Zimmer	2010	446	7	98.1 [96.7,99.5]	251	98.1 [96.7,99.5]	13
DELTA PF (MODULUS HIP SYSTEM) Lima	2003	439	15	97.6 [96.2,99.1]	346	97.0 [95.3,98.7]	236
SELEXYS TH (CBC) Mathys	2006	435	56	92.0 [89.4,94.7]	352	86.7 [83.3,90.2]	267
AnCA Fit (PROFEMUR Z) Wright Cremascoli	2002	421	50	94.0 [91.8,96.3]	382	91.7 [89.0,94.4]	327
R3 (ADR) Smith & Nephew	2009	417	18	96.1 [94.2,98.1]	223	94.4 [91.6,97.2]	26
TOP (CFP) Link	2000	403	17	97.7 [96.2,99.2]	367	95.9 [93.8,98.0]	291
R3 THREE-HOLE Smith and Nephew (NANOS) Endoplant	2010	400	7	98.2 [96.7,99.7]	112	94.9 [88.6,100.0]	7
CONTINUUM (AVENIR) Zimmer	2014	392	8	97.5 [95.7,99.3]	67	— [—,—]	0
Fixa TI-por (Pulchra-fix) Adler-Ortho	2016	381	13	— [—,—]	0	— [—,—]	0
TRIDENT PSL HA CLUSTER (ACCOLADE II) Howmedica	2012	374	8	98.0 [96.5,99.5]	48	— [—,—]	0
Versafitcup CC (Minimax) Medacta	2007	363	21	96.6 [94.8,98.5]	317	92.7 [89.6,96.0]	109
CONTINUUM (CONUS) Zimmer	2010	355	10	97.6 [95.9,99.3]	225	95.4 [91.7,99.2]	32
CUPULE RELOAD AVANTAGE (TAPERLOC) Biomet	2008	354	13	96.9 [95.0,98.7]	310	96.5 [94.6,98.5]	102

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

PINNACLE SECTOR GRIPTION (CORAIL) DePuy	2012	346	9	96.4 [93.7,99.2]	71	— [—,—]	0
EP-FIT PLUS (SL PLUS MIA) Smith & Nephew	2009	342	15	96.6 [94.6,98.8]	192	92.9 [88.9,97.0]	22
MULLER (JVC) Wright Cremascoli	2000	326	15	98.4 [97.0,99.8]	269	96.1 [93.7,98.5]	158
STANDARD CUP (CLS) Sulzer Centerpulse Zimmer	2000	322	18	98.7 [97.5,100.0]	296	96.9 [95.0,98.9]	243
CLS Zimmer (SL PLUS) Smith & Nephew	2001	311	18	96.6 [94.5,98.7]	269	95.0 [92.4,97.6]	213
EP-FIT PLUS Endoplus (NANOS) Endoplant	2005	309	9	97.7 [95.9,99.4]	258	97.2 [95.3,99.1]	108
MULLER (MRL) Wright Cremascoli	2000	308	19	96.5 [94.4,98.7]	246	94.8 [92.2,97.5]	173
I1CUP (LCU)-Link	2016	300	2	— [—,—]	0	— [—,—]	0
Other (< 300 cases)	2000	36467	2178	96.3 [96.0,96.5]	23323	93.5 [93.2,93.8]	12413
Total	2000	98500	4943	96.8 [96.6,96.9]	61878	94.3 [94,2,94.5]	32235

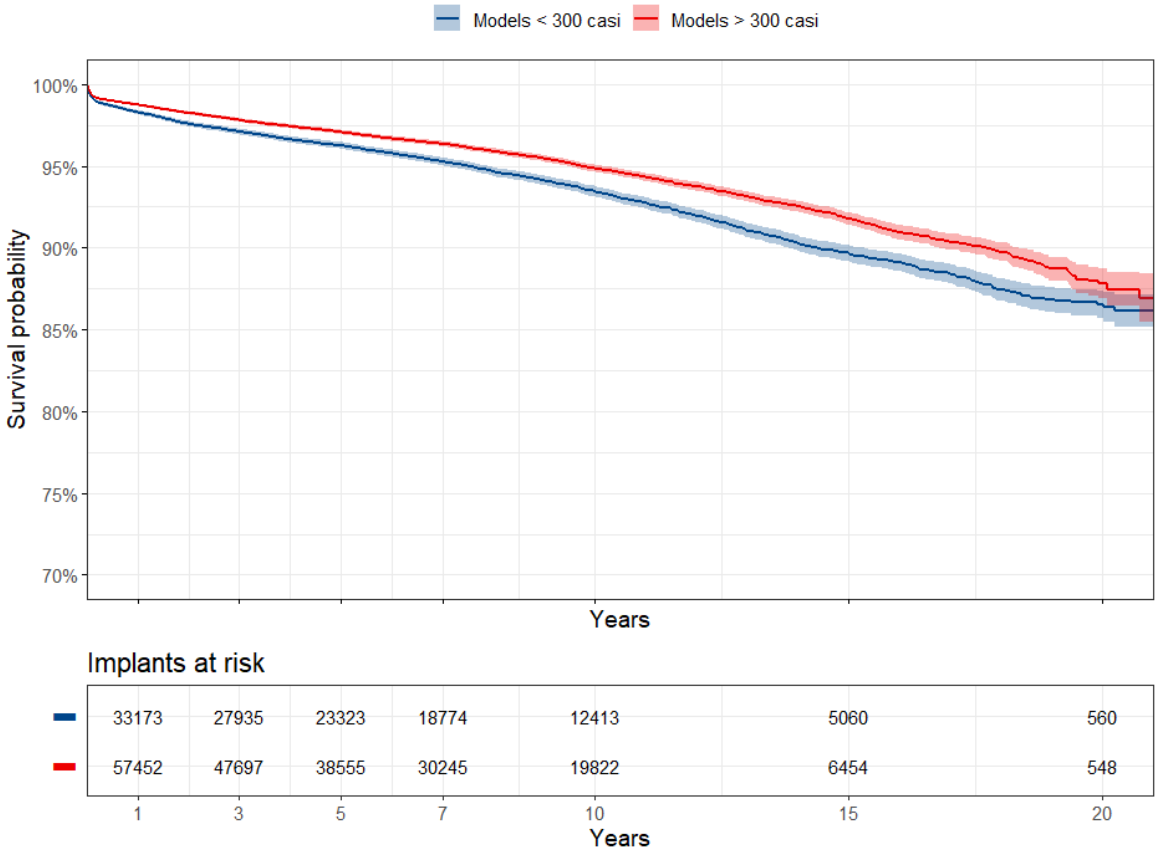
The marked dispersion of prosthesis types and the wide variability of the combinations between acetabulum and stems enable the comparison of only some types of prosthesis. To provide, anyway, an indication of the survival of the prosthesis types less represented in databanks, they were grouped together to make a class of prostheses of with less than 300 cases in 2000-2020.

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

Type of Prosthesis	Mean Follow-up (years)	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs	p-value[1]
								<0.001
Models > 300 cases	8.0	36467	2178	96.3 [96.0,96.5]	23323	93.5 [93.2,93.8]	12413	
Models < 300 cases	7.6	62033	2765	97.1 [96.9,97.2]	38555	94.9 [94.6,95.1]	19822	

[1] Log-rank 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



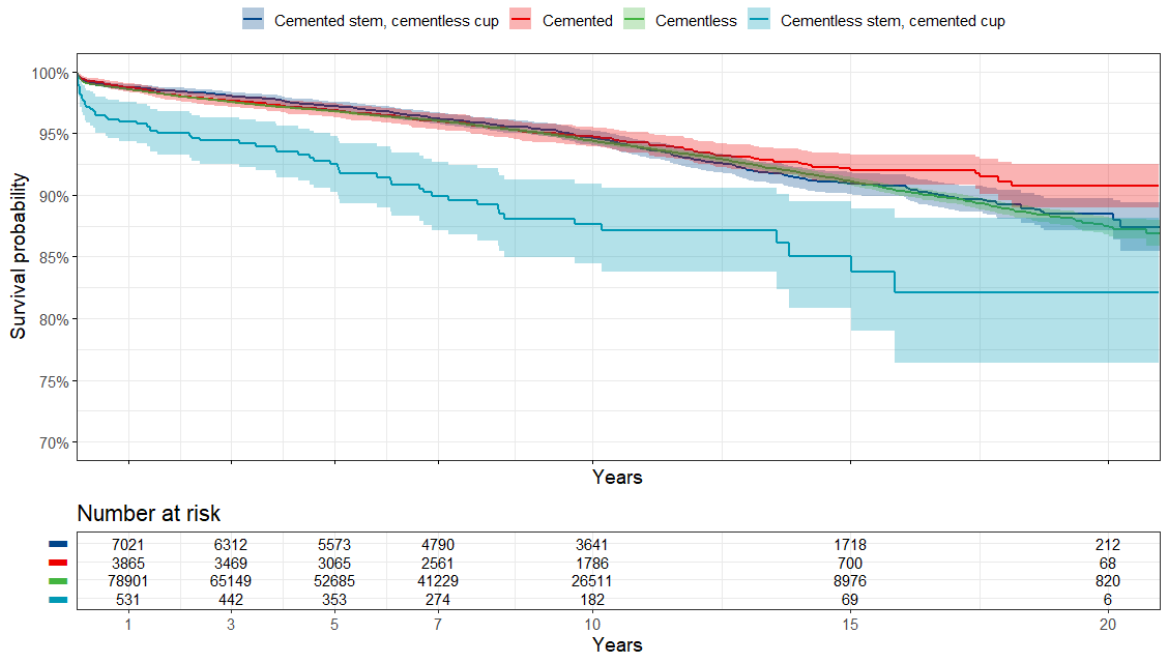
8.7 Analysis of survival in primary total hip arthroplasty according to fixation

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

Fixation	Mean Follow-up (years)	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs	p-value[1]
								<0.001
Hybrid (cemented stem, cementless cup)	9,8	7483	452	97.2 [96.8,97.6]	5573	94.6 [94.1,95.2]	3641	
Cemented	9.1	4168	213	96.9 [96.3,97.4]	3065	94.8 [94.0,95.5]	1786	
Cementless	7.5	85876	4124	96.8 [96.7,96.9]	52685	94.4 [94.2,94.6]	26511	
Reverse hybrid (cementless stem, cemented cup)	7.2	606	60	92.5 [90.3,94.8]	353	87.6 [84.4,90.9]	182	

[1] Log-rank 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



Cause of revision	n/N	IR (%)	% Distribution failure causes
Cemented			
Cup aseptic loosening	64/4168	1.5	30.0
Total aseptic loosening	39/4168	0.9	18.3
Dislocation	28/4168	0.7	13.1
Stem aseptic loosening	20/4168	0.5	9.4
Septic loosening	20/4168	0.5	9.4
Periprosthetic bone fracture	18/4168	0.4	8.5
Unknown (7 performed outside region)	17/4168	0.4	8.0
Primary instability	4/4168	0.1	1.9
Breakage of prosthesis	2/4168	0.0	0.9
Other	1/4168	0.0	0.5
Total	213/4168	5.1	100.0
Cementless			
Periprosthetic bone fracture	672/85876	0.8	16.3
Stem aseptic loosening	614/85876	0.7	14.9
Cup aseptic loosening	572/85876	0.7	13.9
Dislocation	507/85876	0.6	12.3
Breakage of prosthesis	424/85876	0.5	10.3

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

Unknown (231 performed outside region)	417/85876	0.5	10.1
Septic loosening	242/85876	0.3	5.9
Total aseptic loosening	169/85876	0.2	4.1
Other	128/85876	0.1	3.1
Pain without loosening	99/85876	0.1	2.4
Poly wear	96/85876	0.1	2.3
Primary instability	91/85876	0.1	2.2
Metallosis	57/85876	0.1	1.4
Heterotopic bone	36/85876	0.0	0.9
Total	4124/85876	4.8	100.0
Hybrid			
Stem aseptic loosening	130/7483	1.7	28.8
Dislocation	80/7483	1.1	17.7
Periprosthetic bone fracture	55/7483	0.7	12.2
Total aseptic loosening	51/7483	0.7	11.3
Cup aseptic loosening	38/7483	0.5	8.4
Septic loosening	34/7483	0.5	7.5
Unknown (10 performed outside region)	28/7483	0.4	6.2
Poly wear	16/7483	0.2	3.5
Other	7/7483	0.1	1.5
Breakage of prosthesis	7/7483	0.1	1.5
Heterotopic bone	3/7483	0.0	0.7
Primary instability	2/7483	0.0	0.4
Pain without loosening	1/7483	0.0	0.2
Total	452/7483	6.0	100.0
Reverse hybrid			
Cup aseptic loosening	19/606	3.1	31.7
Dislocation	9/606	1.5	15.0
Periprosthetic bone fracture	8/606	1.3	13.3
Stem aseptic loosening	7/606	1.2	11.7
Unknown (6 performed outside region)	6/606	1.0	10.0
Total aseptic loosening	5/606	0.8	8.3

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

Septic loosening	3/606	0.5	5.0
Breakage of prosthesis	2/606	0.3	3.3
Metallosis	1/606	0.2	1.7
Total	60/606	9.9	100.0

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

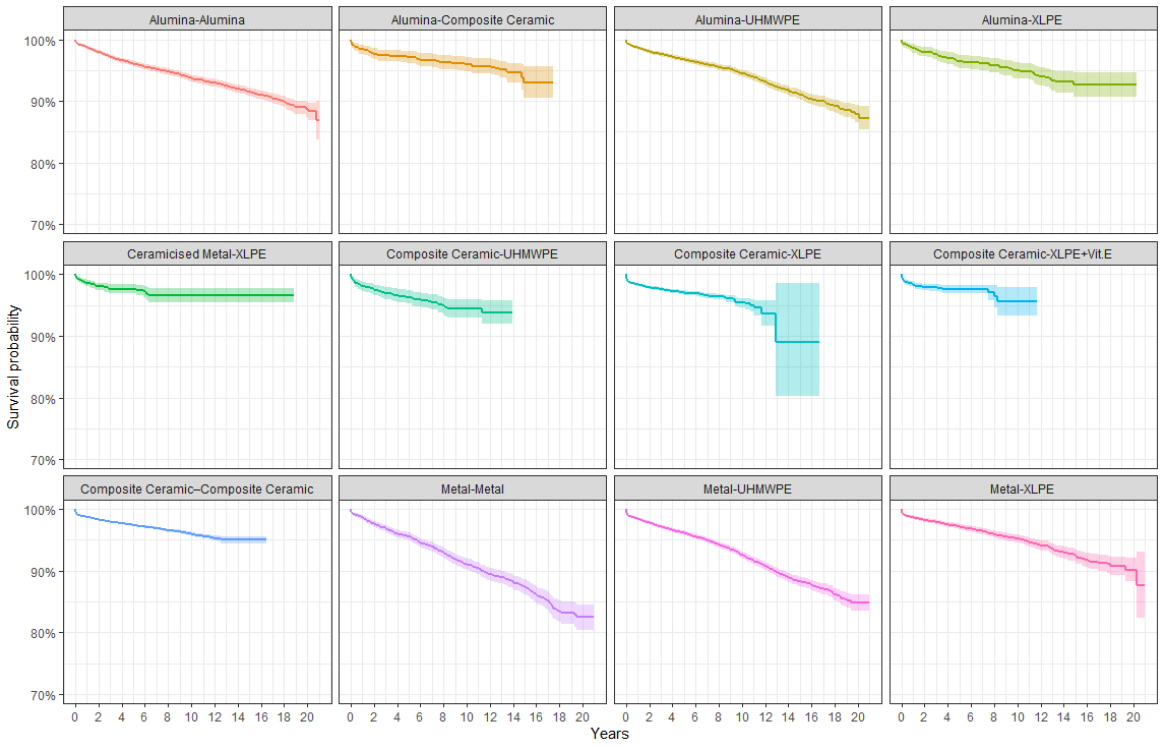
The following table shows survival details of prosthesis according to articular coupling. Only couplings with more than 1000 casese are presented. Dual mobility cups are excluded. The articular coupling is defined about characteristics of the sliding surface, regardless if insert is made of a single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

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

Articular coupling	Mean Follow-up (years)	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs	p-value[1]
								<0.001
Composite Ceramic-Composite Ceramic	5.7	31705	879	97.4 [97.3,97.6]	17209	96.1 [95.8,96.4]	4341	
Composite Ceramic-XLPE	4.2	12161	333	97.0 [96.7,97.3]	4440	95.4 [94.6,96.2]	605	
Metal-UHMWPE	10.5	11465	977	96.2 [95.8,96.5]	9297	92.6 [92.1,93.1]	6301	
Alumina-Alumina	13.0	7555	602	96.1 [95.6,96.5]	6870	93.7 [93.1,94.3]	5850	
Alumina-UHMWPE	11.9	7305	541	96.8 [96.4,97.2]	6332	94.5 [94.0,95.1]	4751	
Metal-XLPE	8.5	5966	272	97.2 [96.7,97.6]	4169	95.2 [94.6,95.9]	2126	
Metal-Metal	12.4	3840	445	95.6 [94.9,96.3]	3480	91.1 [90.2,92.0]	2862	
Composite Ceramic-XLPE + Vit.E	2.9	3169	66	97.6 [97.0,98.2]	481	95.6 [93.4,98.0]	50	
Ceramicised Metal-XLPE	4.1	1996	46	97.6 [96.8,98.3]	620	96.6 [95.5,97.7]	83	
Composite Ceramic-UHMWPE	7.0	1284	58	96.3 [95.3,97.4]	857	94.4 [93.0,95.9]	336	
Alumina-XLPE	10.7	1238	68	96.4 [95.4,97.5]	1046	95.0 [93.7,96.3]	810	
Alumina-Composite Ceramic	11.4	1168	55	97.0 [96.1,98.0]	1073	96.0 [94.9,97.2]	908	

[1] Log-rank 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



Cause of revision	n/N	IR (%)	% Distribution failure causes
Composite Ceramic-Composite Ceramic			
Stem aseptic loosening	155/31705	0.5	17.6
Periprosthetic bone fracture	149/31705	0.5	17.0
Breakage of prosthesis (105 stems, 25 inserts and 2 heads)	132/31705	0.4	15.0
Dislocation	102/31705	0.3	11.6
Unknown (4 performed outside region)	72/31705	0.2	8.2
Septic loosening	72/31705	0.2	8.2
Cup aseptic loosening	59/31705	0.2	6.7
Other	52/31705	0.2	5.9
Primary instability	38/31705	0.1	4.3
Pain without loosening	22/31705	0.1	2.5
Heterotopic bone	14/31705	0.0	1.6
Total aseptic loosening	9/31705	0.0	1.0
Metallosis	2/31705	0.0	0.2
Poly wear	1/31705	0.0	0.1
Total	879/31705	2.8	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

Composite Ceramic -XLPE			
Dislocation	70/12161	0.6	21.0
Periprosthetic bone fracture	61/12161	0.5	18.3
Stem aseptic loosening	49/12161	0.4	14.7
Unknown (11 performed outside region)	39/12161	0.3	11.7
Cup aseptic loosening	37/12161	0.3	11.1
Septic loosening	25/12161	0.2	7.5
Other	18/12161	0.1	5.4
Primary instability	11/12161	0.1	3.3
Breakage of prosthesis (4 stems, 1 head and 2 cups)	7/12161	0.1	2.1
Total aseptic loosening	5/12161	0.0	1.5
Heterotopic bone	5/12161	0.0	1.5
Pain without loosening	3/12161	0.0	0.9
Poly wear	3/12161	0.0	0.9
Total	333/12161	2.7	100.0
Metal-UHMWPE			
Cup aseptic loosening	222/11465	1.9	22.7
Stem aseptic loosening	169/11465	1.5	17.3
Dislocation	149/11465	1.3	15.3
Total aseptic loosening	107/11465	0.9	11.0
Unknown (44 performed outside region)	87/11465	0.8	8.9
Periprosthetic bone fracture	85/11465	0.7	8.7
Poly wear	67/11465	0.6	6.9
Septic loosening	41/11465	0.4	4.2
Breakage of prosthesis (11 stems, 2 cups and 4 inserts)	17/11465	0.1	1.7
Pain without loosening	16/11465	0.1	1.6
Primary instability	9/11465	0.1	0.9
Other	6/11465	0.1	0.6
Heterotopic bone	2/11465	0.0	0.2
Total	977/11465	8.5	100.0
Alumina-Alumina			
Breakage of prosthesis (70 stems, 45 inserts, 47 heads, 1 insert and 5 inserts+heads)	168/7555	2.2	27.9

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

Periprosthetic bone fracture	122/7555	1.6	20.3
Stem aseptic loosening	80/7555	1.1	13.3
Unknown (41 performed outside region)	63/7555	0.8	10.5
Dislocation	58/7555	0.8	9.6
Cup aseptic loosening	47/7555	0.6	7.8
Septic loosening	16/7555	0.2	2.7
Total aseptic loosening	15/7555	0.2	2.5
Pain without loosening	11/7555	0.1	1.8
Other	10/7555	0.1	1.7
Primary instability	5/7555	0.1	0.8
Heterotopic bone	5/7555	0.1	0.8
Poly wear	2/7555	0.0	0.3
Total	602/7555	8.0	100.0
Alumina-UHMWPE			
Stem aseptic loosening	110/7305	1.5	20.3
Periprosthetic bone fracture	81/7305	1.1	15.0
Dislocation	80/7305	1.1	14.8
Cup aseptic loosening	78/7305	1.1	14.4
Unknown (23 performed outside region)	50/7305	0.7	9.2
Total aseptic loosening	39/7305	0.5	7.2
Septic loosening	28/7305	0.4	5.2
Breakage of prosthesis (14 stems, 5 cups and 5 heads)	24/7305	0.3	4.4
Poly wear	24/7305	0.3	4.4
Pain without loosening	9/7305	0.1	1.7
Primary instability	6/7305	0.1	1.1
Heterotopic bone	6/7305	0.1	1.1
Other	4/7305	0.1	0.7
Metallosis	2/7305	0.0	0.4
Total	541/7305	7.4	100.0
Metal-XLPE			
Periprosthetic bone fracture	93/5966	1.6	34.2
Dislocation	43/5966	0.7	15.8

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

Stem aseptic loosening	31/5966	0.5	11.4
Cup aseptic loosening	23/5966	0.4	8.5
Septic loosening	21/5966	0.4	7.7
Unknown (8 performed outside region)	18/5966	0.3	6.6
Total aseptic loosening	13/5966	0.2	4.8
Other	10/5966	0.2	3.7
Pain without loosening	7/5966	0.1	2.6
Primary instability	6/5966	0.1	2.2
Poly wear	4/5966	0.1	1.5
Breakage of prosthesis (1 stem and 1 insert)	2/5966	0.0	0.7
Heterotopic bone	1/5966	0.0	0.4
Total	272/5966	4.6	100.0
Metal-Metal			
Cup aseptic loosening	105/3840	2.7	23.6
Unknown (45 performed outside region)	61/3840	1.6	13.7
Metallosis	49/3840	1.3	11.0
Stem aseptic loosening	46/3840	1.2	10.3
Total aseptic loosening	36/3840	0.9	8.1
Septic loosening	31/3840	0.8	7.0
Breakage of prosthesis (17 stems and 14 cups)	31/3840	0.8	7.0
Periprosthetic bone fracture	28/3840	0.7	6.3
Dislocation	28/3840	0.7	6.3
Pain without loosening	16/3840	0.4	3.6
Other	7/3840	0.2	1.6
Primary instability	5/3840	0.1	1.1
Heterotopic bone	2/3840	0.1	0.4
Total	445/3840	11.6	100.0
Composite Ceramic-XLPE+Vit.E			
Periprosthetic bone fracture	14/3169	0.4	21.2
Dislocation	9/3169	0.3	13.6
Septic loosening	9/3169	0.3	13.6
Cup aseptic loosening	8/3169	0.3	12.1

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

Stem aseptic loosening	8/3169	0.3	12.1
Other	4/3169	0.1	6.1
Primary instability	4/3169	0.1	6.1
Unknown (1 performed outside region)	4/3169	0.1	6.1
Pain without loosening	2/3169	0.1	3.0
Total aseptic loosening	2/3169	0.1	3.0
Heterotopic bone	1/3169	0.0	1.5
Breakage of prosthesis (not specified)	1/3169	0.0	1.5
Total	66/3169	2.1	100.0
Ceramicised Metal-XLPE			
Stem aseptic loosening	10/1996	0.5	21.7
Periprosthetic bone fracture	8/1996	0.4	17.4
Septic loosening	6/1996	0.3	13.0
Dislocation	5/1996	0.3	10.9
Unknown (2 performed outside region)	5/1996	0.3	10.9
Other	3/1996	0.2	6.5
Pain without loosening	3/1996	0.2	6.5
Cup aseptic loosening	3/1996	0.2	6.5
Heterotopic bone	2/1996	0.1	4.3
Total aseptic loosening	1/1996	0.1	2.2
Total	46/1996	2.3	100.0
Composite Ceramic-UHMWPE			
Dislocation	16/1284	1.2	27.6
Stem aseptic loosening	9/1284	0.7	15.5
Periprosthetic bone fracture	5/1284	0.4	8.6
Unknown (2 performed outside region)	5/1284	0.4	8.6
Breakage of prosthesis (4 stems e 1 not specified)	5/1284	0.4	8.6
Cup aseptic loosening	4/1284	0.3	6.9
Other	3/1284	0.2	5.2
Pain without loosening	3/1284	0.2	5.2
Poly wear	3/1284	0.2	5.2
Total aseptic loosening	2/1284	0.2	3.4

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

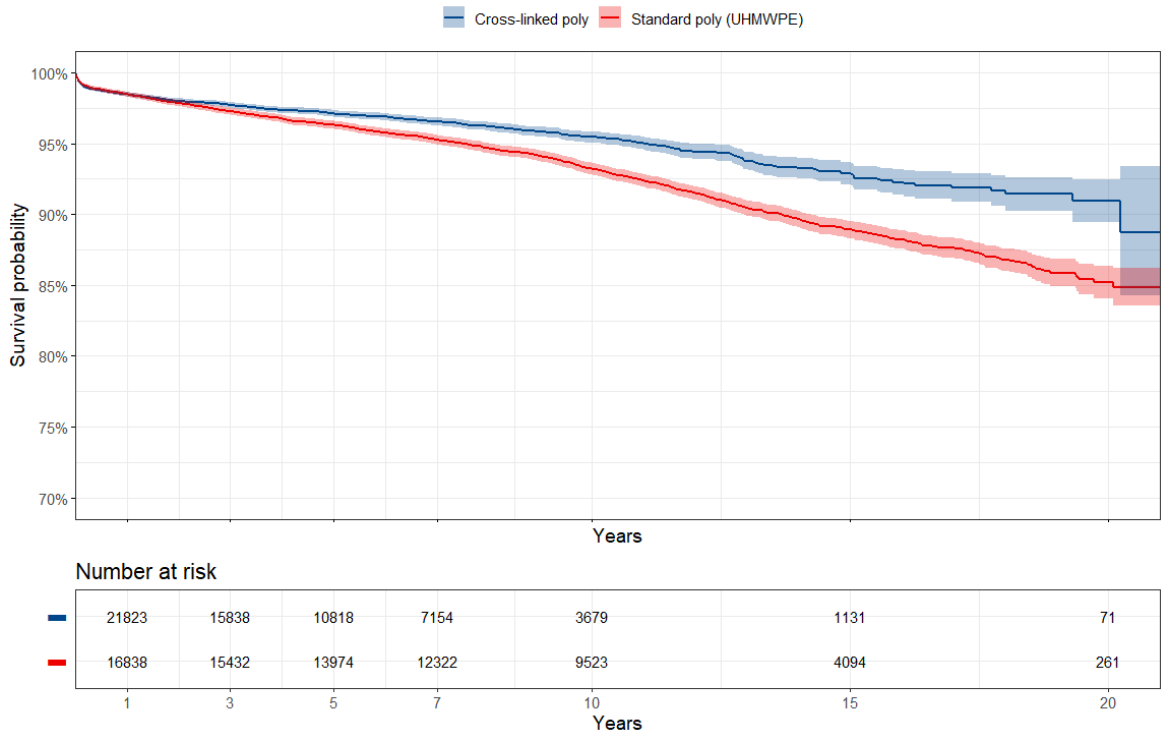
Septic loosening	2/1284	0.2	3.4
Primary instability	1/1284	0.1	1.7
Total	58/1284	4.5	100.0
Alumina-XLPE			
Stem aseptic loosening	17/1238	1.4	25.0
Periprosthetic bone fracture	13/1238	1.1	19.1
Cup aseptic loosening	9/1238	0.7	13.2
Unknown (3 performed outside region)	8/1238	0.6	11.8
Dislocation	5/1238	0.4	7.4
Septic loosening	5/1238	0.4	7.4
Primary instability	3/1238	0.2	4.4
Total aseptic loosening	3/1238	0.2	4.4
Other	2/1238	0.2	2.9
Pain without loosening	1/1238	0.1	1.5
Breakage of stem	1/1238	0.1	1.5
Poly wear	1/1238	0.1	1.5
Total	68/1238	5.5	100.0
Alumina-Composite Ceramic			
Breakage of prosthesis (11 stems e 4 inserts)	15/1168	1.3	27.3
Dislocation	13/1168	1.1	23.6
Stem aseptic loosening	9/1168	0.8	16.4
Unknown (5 performed outside region)	6/1168	0.5	10.9
Periprosthetic bone fracture	4/1168	0.3	7.3
Cup aseptic loosening	3/1168	0.3	5.5
Other	2/1168	0.2	3.6
Septic loosening	2/1168	0.2	3.6
Heterotopic bone	1/1168	0.1	1.8
Total	55/1168	4.7	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	1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	p-value[1]
							<0.001
Crosslinked	98.5 [98.3,98.6]	97.7 [97.5,97.9]	97.1 [96.9,97.3]	96.5 [96.3,96.8]	95.4 [95.1,95.8]	92.9 [92.1,93.7]	
Standard (UHMWPE)	98.5 [98.3,98.7]	97.3 [97.0,97.5]	96.3 [96.0,96.6]	95.2 [94.9,95.6]	93.2 [92.8,93.6]	88.9 [88.3,89.5]	

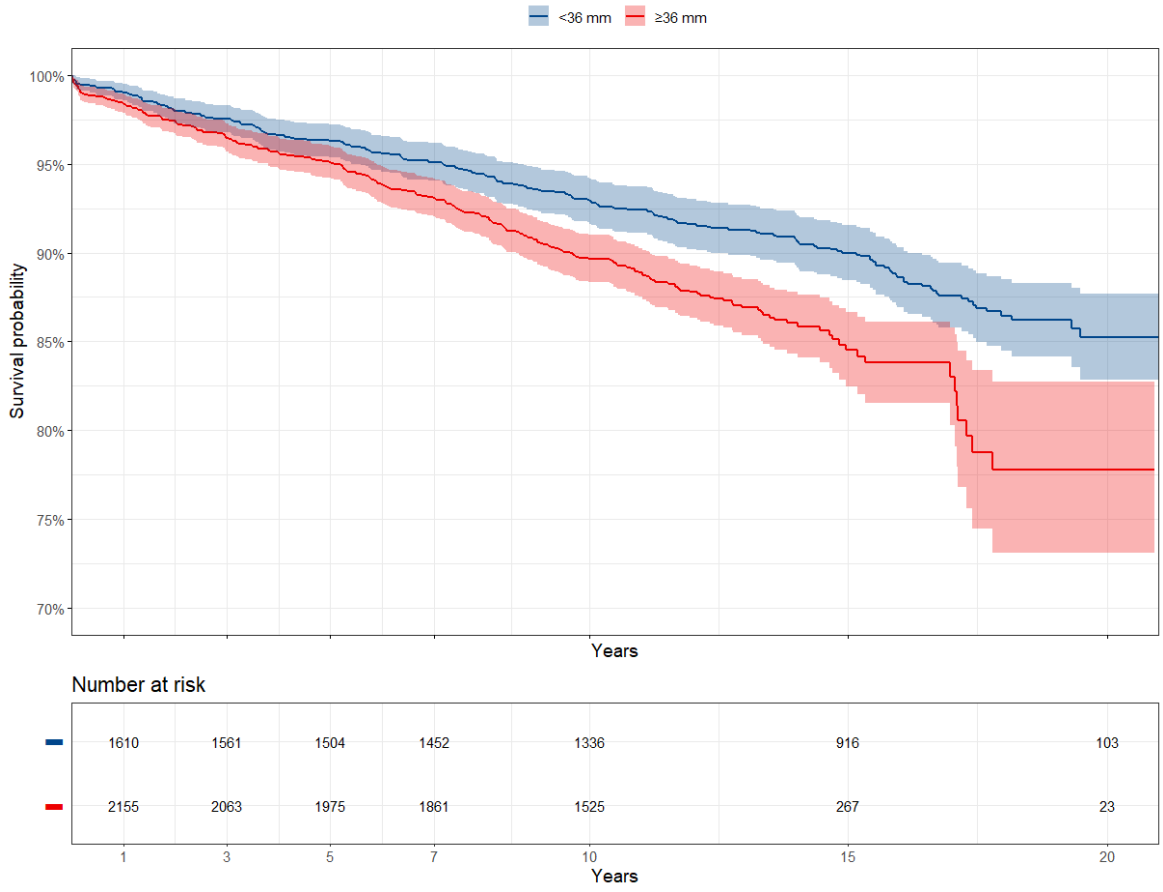
[1] Log-rank test

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

The Cox multivariate analysis identifies any variables (independent of 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 1.5 (95% C.I. 1.3-1.6) compared to cross-linked poly.

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



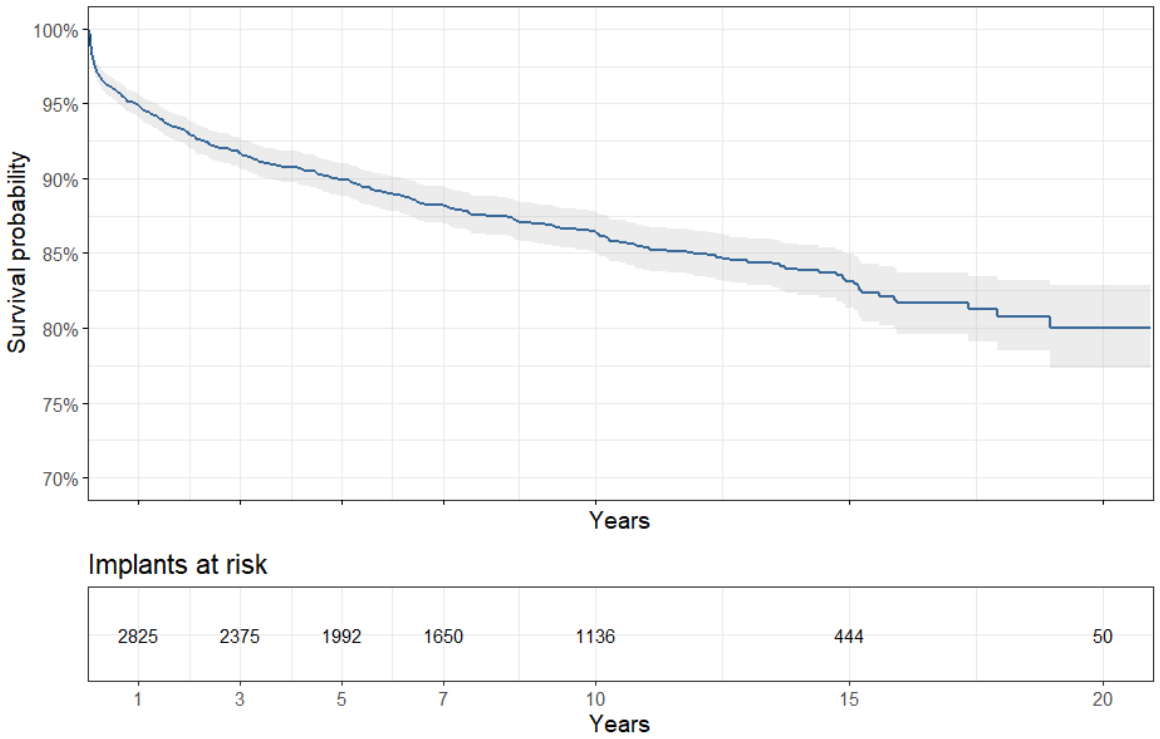
Head diameters, met-met	1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	p-value[1]
							<0.001
<36 mm	99.0 [98.5,99.5]	97.5 [96.8,98.3]	96.3 [95.3,97.2]	95.1 [94.1,96.2]	93.0 [91.7,94.2]	90.0 [88.5,91.5]	
≥36 mm	99.0 [98.5,99.5]	97.5 [96.8,98.3]	96.3 [95.3,97.2]	95.1 [94.1,96.2]	93.0 [91.7,94.2]	90.0 [88.5,91.5]	

[1] Log-rank 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).



1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	20 Years
94.9 [94.1,95.6]	91.7 [90.7,92.7]	89.9 [88.8,91.0]	88.2 [87.0,89.5]	86.5 [85.1,87.8]	83.1 [81.4,84.9]	80.0 [77.3,82.8]

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

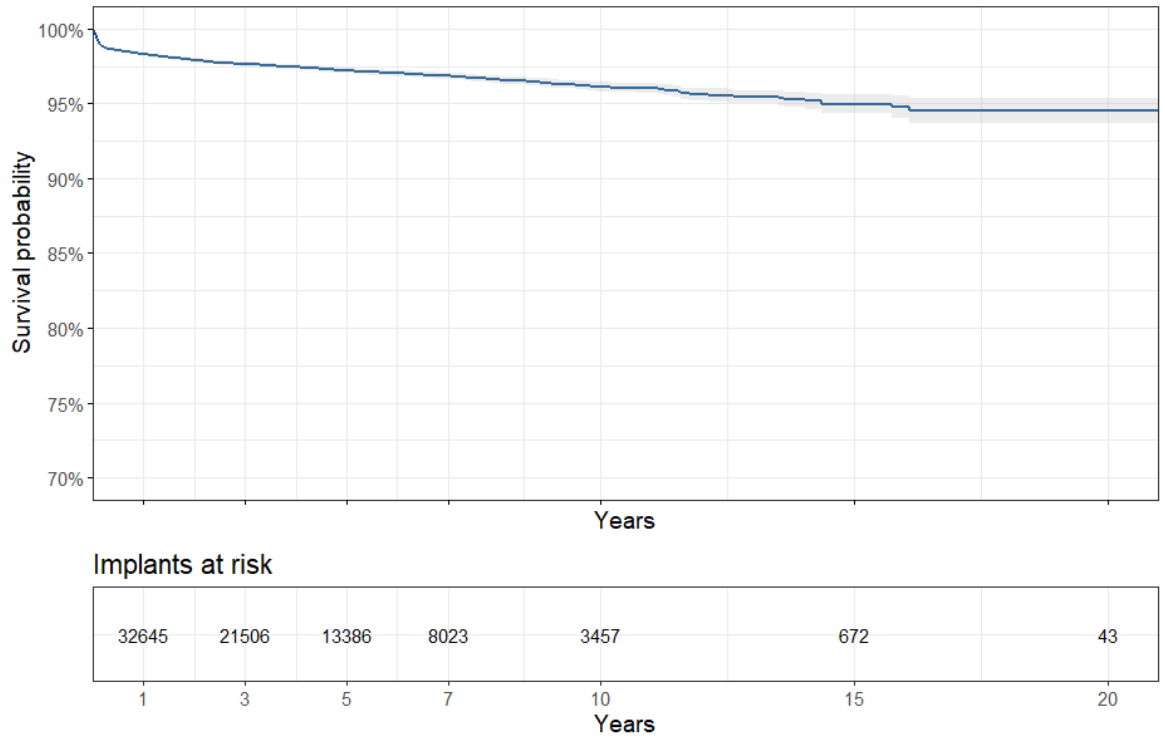
Cause of revision	n/N	IR (%)	% Distribution failure causes
Cup aseptic loosening	77/3189	2.4	19.4
Dislocation	70/3189	2.2	17.6
Septic loosening	62/3189	1.9	15.6
Stem aseptic loosening	56/3189	1.8	14.1
Unknown (17 performed outside region)	42/3189	1.3	10.6
Total aseptic loosening	31/3189	1.0	7.8
Periprosthetic bone fracture	22/3189	0.7	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

Other	12/3189	0.4	3.0
Breakage of prosthesis	7/3189	0.2	1.8
Pain without loosening	6/3189	0.2	1.5
Primary instability	4/3189	0.1	1.0
Metallosis	3/3189	0.1	0.8
Poly wear	3/3189	0.1	0.8
Two steps revision	3/3189	0.1	0.5
Total	397/3189	12.4	100.0

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.



1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	20 Years
98.3 [98.2,98.4]	97.7 [97.5,97.8]	97.2 [97.0,97.4]	96.8 [96.6,97.1]	96.1 [95.8,96.5]	95.0 [94.3,95.6]	94.6 [93.7,95.4]

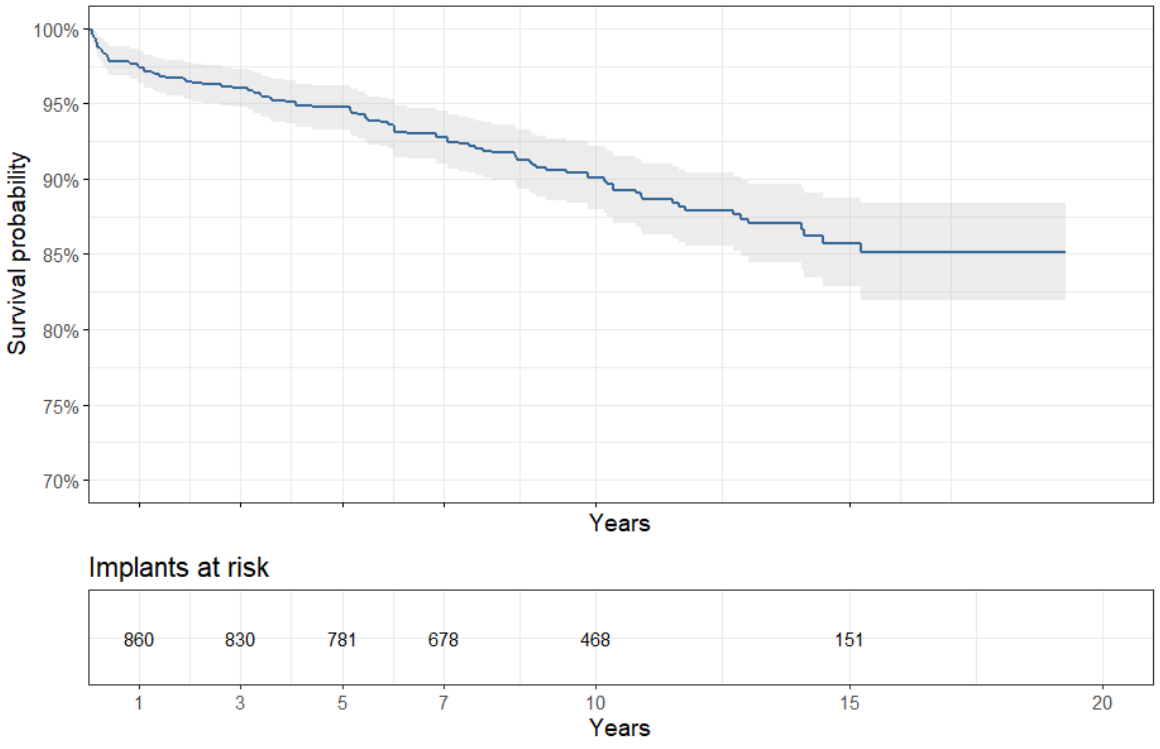
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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	n/N	IR (%)	% Distribution failure causes
Dislocation	457/46924	1.0	42.4
Periprosthetic bone fracture	143/46924	0.3	13.3
Cotiloiditis	136/46924	0.3	12.6
Stem aseptic loosening	128/46924	0.3	11.9
Septic loosening	85/46924	0.2	7.9
Unknown (25 performed outside region)	79/46924	0.2	7.3
Early Infection	22/46924	0.0	2.0
Primary instability	17/46924	0.0	1.6
Other	11/46924	0.0	1.0
Total	1078/46924	2.3	100.0

8.13 Survival analysis of resurfacing

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



1 Years	3 Years	5 Years	7 Years	10 Years	15 Years
97.5 [96.5,98.5]	96.0 [94.7,97.3]	94.7 [93.3,96.2]	92.7 [91.0,94.5]	90.1 [88.0,92.2]	85.8 [82.8,88.8]

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

Model of prosthesis	From year	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs
BHR - Smith And Nephew	2001	513	37	97.4 [96.0,98.8]	446	93.9 [91.6,96.2]	248
ADEPT - Finsbury	2005	121	4	97.5 [94.8,100.0]	118	97.5 [94.8,100.0]	70
BMHR SMITH AND NEPHEW	2007	75	4	98.7 [96.1,100.0]	72	94.4 [89.2,99.9]	25
Asr - Depuy	2004	65	25	80.0 [70.8,90.3]	52	66.1 [55.5,78.7]	42
Mrs - Lima	2005	44	13	81.8 [71.2,94.0]	36	75.0 [63.2,89.0]	33
Other (< 40 cases)	2000	68	13	88.2 [80.8,96.2]	57	80.4 [71.3,90.5]	50
Total	2000	886	96	94.7 [93,3-96,2]	781	90.1 [88.0-92.2]	468

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

Cause of revision	n/N	IR (%)	% Distribution failure causes
Aseptic loosening	29/886	3.3	30.2
Periprosthetic bone fracture	21/886	2.4	21.9
Metal sensitization	16/886	1.8	16.7
Unknown (10 performed outside region)	13/886	1.5	13.5
Pain without loosening	10/886	1.1	10.4
Septic loosening	4/886	0.5	4.2
Breakage of prosthesis	2/886	0.2	2.1
Dislocation	1/886	0.1	1.0
Total	96/886	10.8	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 2020

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 **96,6**% for year 2020. 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 and revisions performed in public hospitals

% of operations performed in public hospitals (AUSL, AOSP, IRCCS)		
Year of surgery	**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
2019	28.7	40.6
2020	22.9	37.1

From database SDO

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

In hips, during 2020 percentage of primary THA and revisions performed in public hospitals is respectively 46,3% and 74,5%.

Percentage of primary total knee arthroprostheses and revision performed in public and private hospitals, in year 2020

Type of surgery	Public	Private
	%	%
Primary bicompartmental	45.6	46.4
Primary tricompartmental	30.5	31.6
Primary unicompartmental	8.5	14.0
Revision	11.0	6.6
Prosthesis removal	3.6	0.8
Implant of patella	0.8	0.6
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 considered as a failure of primary bi-compartimental.

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2020, according to **type**

Type of surgery	N.	%
Primary bicompartmental	80135	61.1
Primary tricompartmental	24091	18.4
Primary unicompartmental	14116	10.8
Revision^	8465	6.4
Prosthesis removal	1859	1.4
Implant of patella	1012	0.8
Other prostheses *	589	0.4
Other operations °	986	0.8
Total	**131253**	**100.0**

*53 Hemicap–Arthrosurface, 31 Hemicap patello_femoral–Arthrosurface, 67 Avon-Patello-Femoral Joint Stryker, 105 Gender-Patello-Femoral Joint System Zimmer, 103 Journey-PFJ-Patellofemoral Smith&Nephew, 54 other patella-femoral, 53 Unicompartimental Plus+patella

°of which 513 spacer exchange, 73 stiff knee loosening, 78 debridement's, 6 dislocation reductions

^1.032 liner revisions, 13 femoral component revisions, 5 tibial component revisions, 161 femoral component and liner revisions, 460 tibial component and liner revisions, 6.737 total revisions, 57 patella revisions

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	7.2
2003	12.7	78.6	8.6
2004	12.9	75.8	11.3
2005	12.4	75.6	12.1
2006	10.9	69.9	19.2
2007	11.6	69.2	19.2
2008	11.5	72.1	16.4
2009	12.9	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	18.8
2014	10.9	68.1	21.0
2015	10.1	67.8	22.1
2016	11.2	65.1	23.7
2017	13.1	60.9	26.0
2018	13.7	57.5	28.9
2019	12.6	56.5	30.9
2020	14.1	51.2	34.7

Table below shows the year-to-year percentage variation of different types of knee operations.

Year of surgery	Primary bi/tricompartmental		Primary unicompartmental		Revision (total+partial)	
	N.	% Increase	N.	% Increase	N.	% Increase
2000	716		68		41	
2001	2015		236		145	
2002	2377	18.0	353	49.6	158	9.0
2003	2790	17.4	407	15.3	196	24.1
2004	3365	20.6	498	22.4	215	9.7
2005	3878	15.2	548	10.0	283	31.6
2006	4374	12.8	533	-2.7	312	10.2
2007	5138	17.5	671	25.9	380	21.8
2008	5574	8.5	727	8.3	415	9.2
2009	5520	-1.0	821	12.9	467	12.5
2010	5626	1.9	803	-2.2	455	-2.6
2011	5929	5.4	643	-19.9	477	4.8
2012	5824	-1.8	678	5.4	502	5.2
2013	5647	-3.0	774	14.2	501	-0.2
2014	5976	5.8	732	-5.4	485	-3.2
2015	6136	2.7	691	-5.6	529	9.1
2016	6634	8.1	835	20.8	545	3.0
2017	6476	-2.4	973	16.5	547	0.4
2018	6911	6.7	1093	12.3	600	9.7
2019	7658	10.8	1102	0.8	654	9.0
2020	5662	-26.1	930	-15.6	558	-14.7

11. Descriptive statistics of patients

11.1 Age

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2020, according to **type of surgery** and **age group** of patients at the time of surgery

Type of surgery	<40		40-49		50-59		60-69		70-79		≥80		Total
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%	
Bi-tricomp	302	0.3	1407	1.4	8445	8.1	31730	30.4	50162	48.1	12166	11.7	104212
Unicomp	43	0.3	476	3.4	2750	19.5	5595	39.6	4309	30.5	942	6.7	14115
Revision	44	0.5	234	2.8	900	10.6	2567	30.3	3649	43.1	1071	12.7	8465
Prosthesis removal	21	1.1	57	3.1	224	12.0	577	31.0	764	41.1	216	11.6	1859
Patella only	10	1.0	24	2.4	93	9.2	290	28.7	490	48.4	105	10.4	1012
Total*	**420**	**0.3**	**2198**	**1.7**	**12412**	**9.6**	**40759**	**31.4**	**59374**	**45.8**	**14500**	**11.2**	**129663**

*15 missing data (0,01%)

Mean age at surgery, according to type of operation - years 2000-2020

Type of surgery	Mean age	Range
Primary bi/tricompartmental	70.5	13–96
Primary unicompartmental	66.2	23-93
Revision	69.6	18-95
Total	**70.0**	**13-96**

Mean age at surgery, according to type of operation - years 2001 and 2020

Type of surgery	Year of surgery 2001		Year of surgery 2020	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental°	71.2	23-92	70.3	19-95
Primary unicompartmental*	69.0	45-87	66.4	36-91
Revision^	71.8	26-87	68.9	27-90

° 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 2000-2020 - according to **private or public hospital**

Type of surgery	Public		Private	
	Mean age	Range	Mean age	Range
Primary bi/tricompartmental*	70.9	13-94	70.3	19-96
Primary unicompartmental^	67.2	23-89	65.7	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 2020, according to **type of operation** and **gender** of patients

Type of operation	Males		Females		Total
	N.	%	N.	%	N.
Bi/tricompar-timental	31170	78.5	73056	81.2	104226
Unicompartimental	5068	12.8	9048	10.1	14116
Revision	2453	6.2	6012	6.7	8465
Prosthesis removal	747	1.9	1112	1.2	1859
Patella only	259	0.7	753	0.8	1012
Total	**39697**	**100.0**	**89981**	**100.0**	**129678**

11.3 Side of surgery

There is a prevalence of operations performed on the right side (54.6%) in comparison with the left side (45.4%). 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	51.3	56.0
Left	48.7	44.0

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

11.4 Bilateral arthroplasty

In the period of registry observation (21 years), 19982 patients underwent bilateral operations.
16305 (81.6%) chose to undergo the second operation at the same hospital where the first one was performed;
1262 (6.3%) chose to undergo the second operation at a different hospital to follow the surgeon;
2415 (12.1%) chose to undergo the second operation at a different hospital with a different surgeon.
In bilateral operations, it was observed that the first knee to be treated was the right one in 53.7% 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 2020, according to **diagnosis**

Diagnosis in unicompartimental knee prosthesis	N.	%
Primary arthritis	11693	83.2
Deformity	1204	8.6
Necrosis of the condyle	717	5.1
Post-traumatic arthritis	124	0.9
Sequelae of fracture	94	0.7
Post-traumatic necrosis	93	0.7

Idiopathic necrosis	35	0.2
Post meniscectomy	24	0.2
Rheumatic arthritis	18	0.1
Sequelae of osteotomy	15	0.1
Other	43	0.3
Total*	**14060**	**100.0**

*56 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 2020, according to **diagnosis**

Diagnosis in bi/tricompartmental knee prosthesis	N.	%
Primary arthritis	87507	84.3
Deformity	10043	9.7
Post-traumatic arthritis	1501	1.4
Sequelae of fracture	1362	1.3
Rheumatic arthritis	1206	1.2
Necrosis of the condyle	771	0.7
Sequelae of osteotomy	511	0.5
Post-traumatic necrosis	119	0.1
Sequelae of septic arthritis	103	0.1
Post meniscectomy	101	0.1
Sequelae of poliomyelitis	72	0.1
Idiopathic necrosis	41	0.04
Tumor	37	0.04
Chondrocalcinosis	29	0.03
TBC coxitis sequelae	17	0.02
Paget disease	15	0.01
Other	372	0.4
Total*	**103807**	**100.0**

*419 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 2020, according to **diagnosis**

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

Diagnosis in revision	N.	%
Total aseptic loosening	3079	36.8
Two steps revision	1551	18.5
Pain without loosening	865	10.3
Aseptic loosening of tibial component	832	9.9
Other	574	6.9
Insert wear	292	3.5
Aseptic loosening of femoral component	213	2.5
Septic loosening	204	2.4

Prosthesis dislocation	195	2.3
Instability	172	2.1
Periprosthetic bone fracture	151	1.8
Stiffness	86	1.0
Progression of disease	72	0.9
Breakage of prosthesis	40	0.5
Trauma	36	0.4
Total*	**8362**	**100.0**

*103 missing data (1.2%)

Number of **prosthesis removal** carried out on patients admitted between 1st July 2000 and 31st December 2020, according to **diagnosis**.

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

Diagnosis in prosthesis removal	**N.**	**%**
Septic loosening	1584	86.6
Total aseptic loosening	100	5.5
Early Infection	64	3.5
Other	27	1.5
Pain without loosening	21	1.1
Aseptic loosening of tibial component	18	1.0
Periprosthetic bone fracture	9	0.5
Prosthesis dislocation	6	0.3
Total*	**1829**	**100.0**

*30 missing data (1.6%)

12. Types of knee prosthesis

12.1 Unicompartmental prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2020, primary unicompartmental surgery. All poly tibial components in **bold**.

Type of Prosthesis	**2000-2014**		**2015-2017**		**2018-2020**	
	N.	**%**	**N.**	**%**	**N.**	**%**
PHYSICA ZUK - Lima	940	11.1	421	16.8	675	21.6
JOURNEY UNI - Smith & Nephew	254	3.0	688	27.5	637	20.4
JOURNEY II - UNI XLPE - Smith & Nephew	-	-	5	0.2	309	9.9
RESTORIS MCK UNI - Mako	10	0.1	142	5.7	287	9.2
MITUS - ENDO-MODEL UNI - ALL POLY - Link	416	4.9	143	5.7	179	5.7
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	3	0.0	124	5.0	158	5.1
PERSONA UNI - Biomet	-	-	8	0.3	157	5.0
UNI SIGMA HP - De Puy Johnson & Johnson	559	6.6	298	11.9	139	4.4
UNIVATION F - B.Braun	8	0.1	63	2.5	112	3.6
GENUS UNI - Adler-Ortho	37	0.4	48	1.9	67	2.1
GKS - ONE - Permedica	19	0.2	47	1.9	62	2.0

UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	111	1.3	53	2.1	57	1.8
BALANSYS - UNI - Mathys	148	1.7	16	0.6	55	1.8
ALLEGRETTO UNI - Protek-Sulzer	330	3.9	48	1.9	48	1.5
JOURNEY UNI - ALL POLY - Smith & Nephew	267	3.1	87	3.5	43	1.4
GMK - UNI - FIXED - Medacta	1	0.0	5	0.2	36	1.2
UNIGLIDE MOBILE - Corin Medical	4	0.0	1	0.0	33	1.1
MITUS - ENDO-MODEL UNI - METAL-BACKED - Link	7	0.1	6	0.2	27	0.9
GENESIS UNI - Smith & Nephew	1107	13.0	79	3.2	9	0.3
IBALANCE UNI - Arthrex	16	0.2	16	0.6	6	0.2
GKS - ONE - ALL POLY - Permedica	328	3.9	49	2.0	5	0.2
TRIATHLON - PKR - Howmedica Osteonics	32	0.4	16	0.6	3	0.1
OPTETRAK - UNI - ALL POLY - Exactech	172	2.0	5	0.2	1	0.0
HERMES UNI - Ceraver	2	0.0	70	2.8	-	-
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	1384	16.3	24	1.0	-	-
GENESIS UNI - ALL POLY - Smith & Nephew	298	3.5	6	0.2	-	-
EFDIOS - Citieffe	477	5.6	-	-	-	-
PRESERVATION UNI - ALL POLY - Depuy	379	4.5	-	-	-	-
UC-PLUS SOLUTION - Endoplus	243	2.9	-	-	-	-
MILLER GALANTE UNI - Zimmer	179	2.1	-	-	-	-
HLS - UNI EVOLUTION - ALL POLY - Tornier	156	1.8	-	-	-	-
MAIOR - Finceramica	154	1.8	-	-	-	-
UC-PLUS SOLUTION - ALL POLY - Endoplus	144	1.7	-	-	-	-
EIUS UNI - ALL POLY - Stryker Howmedica	59	0.7	-	-	-	-
PFC - UNI - De Puy Johnson & Johnson	56	0.7	-	-	-	-
PRESERVATION UNI - Depuy	27	0.3	-	-	-	-
UNICIA - VECTEUR ORTHOPEDIC - Stratec	27	0.3	-	-	-	-
Other (<25 cases)	117	1.4	28	1.1	20	0.6
Unknown	21	0.2	3	0.1	-	-
Total	**8492**	**100.0**	**2499**	**100.0**	**3125**	**100.0**

12.2 Bi-tricompartmental knee prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2020, primary bi/tricompartmental surgery

Type of Prosthesis	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
LEGION - Smith & Nephew	717	1.1	2635	13.7	4188	20.7
ATTUNE – DePuy	666	1.0	2952	15.3	2870	14.2
PERSONA - Zimmer	399	0.6	997	5.2	1584	7.8
PHYSICA - Lima	10	0.0	586	3.0	1321	6.5
VANGUARD – Biomet Merck France	5177	8.0	1463	7.6	1314	6.5
NEXGEN – Zimmer	13757	21.2	1848	9.6	1100	5.4
G.K.S. – Permedica	962	1.5	528	2.7	818	4.0
TRIATHLON – Stryker Howmedica Osteonics	1692	2.6	886	4.6	728	3.6
GMK - Medacta	119	0.2	171	0.9	716	3.5
OPTETRACK – Exactech	1338	2.1	761	4.0	686	3.4

GEMINI - Link	2481	3.8	658	3.4	586	2.9
GENUS – Adler-Ortho	1438	2.2	571	3.0	577	2.9
JOURNEY – Smith & Nephew	311	0.5	224	1.2	469	2.3
UNITY KNEE - Corin Medical	13	0.0	93	0.5	437	2.2
GENESIS - Smith & Nephew	5116	7.9	1407	7.3	367	1.8
BALANSYS - Mathys	809	1.2	312	1.6	367	1.8
P.F.C – DePuy	6281	9.7	573	3.0	318	1.6
K-MOD - Gruppo Biompianti	7	0.0	106	0.6	315	1.6
APEX - Omnilife Science	235	0.4	223	1.2	313	1.5
GSP - TREKKING - Samo	1012	1.6	425	2.2	156	0.8
COLUMBUS - B.Braun	385	0.6	210	1.1	120	0.6
LCS – DePuy	941	1.5	48	0.2	105	0.5
INNEX - Protek Sulzer	435	0.7	249	1.3	101	0.5
U2 - United Orthopedic Corporation	62	0.1	1	0.0	100	0.5
ADVANCE - Wright	980	1.5	118	0.6	92	0.5
TC-PLUS - SOLUTION - Smith & Nephew	2750	4.2	376	2.0	81	0.4
RT-PLUS - Smith & Nephew	218	0.3	47	0.2	73	0.4
SKS - DEEP DISH - Aston Medical	35	0.1	74	0.4	61	0.3
ENDO-MODEL - Link	380	0.6	64	0.3	58	0.3
ACS - Implantcast	216	0.3	333	1.7	45	0.2
SIGMA RP - TC3 - DePuy	100	0.2	55	0.3	32	0.2
MULTIGEN - Lima	445	0.7	4	0.0	5	0.0
SCORPIO – Stryker Howmedica	2683	4.1	111	0.6	-	-
GENIUS TRICCC - Dedienne Sante	656	1.0	29	0.2	-	-
ROTAGLIDE – Corin Medical	858	1.3	17	0.1	-	-
FIRST - Symbios Orthopedie SA	990	1.5	5	0.0	-	-
SCORE – Amplitude	580	0.9	5	0.0	-	-
PROFIX – Smith & Nephew	5159	8.0	-	-	-	-
INTERAX - Stryker Howmedica	737	1.1	-	-	-	-
T.A.C.K. – Link	636	1.0	-	-	-	-
AGC - Biomet Merck France	593	0.9	-	-	-	-
HLS – Tornier	388	0.6	-	-	-	-
913 – Wright Cremascoli	358	0.6	-	-	-	-
PERFORMANCE – Kirschner Biomet Merck	281	0.4	-	-	-	-
DURACON – Stryker Howmedica	267	0.4	-	-	-	-
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)	400	0.6	75	0.4	121	0.6
Unknown	66	0.1	6	0.0	7	0.0
Total	**64749**	**100.0**	**19246**	**100.0**	**20231**	**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 2020 in total revision surgery.

Type of Prosthesis	2000-2014		2015-2017		2018-2020	
	N.	%	N.	%	N.	%
LEGION - Smith & Nephew	326	8.0	400	31.4	506	36.8
NEXGEN – Zimmer	1092	26.7	223	17.5	164	11.9
ENDO-MODEL - Link	363	8.9	119	9.3	128	9.3
ATTUNE – DePuy	3	0.1	38	3.0	98	7.1
SIGMA RP - TC3 - DePuy	249	6.1	68	5.3	66	4.8
RT-PLUS - Smith & Nephew	252	6.2	34	2.7	45	3.3
OPTETRACK – Exactech	92	2.3	21	1.6	43	3.1
VANGUARD – Biomet Merck France	103	2.5	27	2.1	38	2.8
COLUMBUS - B.Braun	5	0.1	14	1.1	33	2.4
G.K.S. – Permedica	127	3.1	28	2.2	25	1.8
LPS - HINGE - DePuy	23	0.6	9	0.7	23	1.7
TRIATHLON – Stryker Howmedica Osteonics	50	1.2	40	3.1	22	1.6
BALANSYS - Mathys	25	0.6	6	0.5	20	1.5
P.F.C – DePuy	300	7.3	73	5.7	13	0.9
ACS - Implantcast	29	0.7	27	2.1	12	0.9
GEMINI - Link	32	0.8	10	0.8	11	0.8
DURATION MRH - Osteonics	119	2.9	17	1.3	10	0.7
APEX - Omnilife Science	9	0.2	7	0.5	10	0.7
GENESIS - Smith & Nephew	152	3.7	41	3.2	7	0.5
MUTARS - IMPLANTCAST	12	0.3	8	0.6	6	0.4
GSP - TREKKING - Samo	29	0.7	19	1.5	2	0.1
TC-PLUS - SOLUTION - Smith & Nephew	37	0.9	-	-	1	0.1
SCORPIO – Stryker Howmedica	91	2.2	3	0.2	-	-
AGC - Biomet Merck France	127	3.1	-	-	-	-
PROFIX – Smith & Nephew	122	3.0	-	-	-	-
S-ROM NRH - Johnson & Johnson	47	1.2	-	-	-	-
INTERAX - Stryker Howmedica	35	0.9	-	-	-	-
Other (<25 cases)	219	5.4	41	3.2	89	6.5
Unknown	16	0.4	2	0.2	4	0.3
Total	**4086**	**100.0**	**1275**	**100.0**	**1376**	**100.0**

12.4 Prosthesis fixation

Number of knee prosthesis arthroplasty performed on patients admitted to hospital between 1st July 2000 and 31st December 2020 according to **prosthesis fixation**

Fixation	Primary unicomp.		Primary bi/tricomp.		Total revision		Total	
	N.	%	N.	%	N.	%	N.	%
Cemented	98238	94.3	13294	94.3	6648	98.9	118180	94.5
Cementless	4013	3.9	627	4.4	47	0.7	4687	3.7

Femur cementless + Tibia cemented	1316	1.3	161	1.1	17	0.3	1494	1.2
Femur cemented + Tibia cementless	620	0.6	23	0.2	12	0.2	655	0.5
Total*	**104187**	**100.0**	**14105**	**100.0**	**6724**	**100.0**	**125016**	**100.0**

*63 missing data (0,05%)

Prosthesis fixation according to year of operation, primary bi/tricompartmental surgery

Years of operation	% Cemented	% Cementless	% Femur cementless + Tibia cemented	% Femur cemented + Tibia cementless
2001	86.7	6.7	6.0	0.6
2002	84.0	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	91.0	4.5	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	97.8	2.0	0.2	0.0
2016	97.6	2.2	0.2	0.1
2017	97.5	2.3	0.0	0.2
2018	97.4	2.5	0.0	0.1
2019	97.8	2.1	0.0	0.0
2020	97.2	2.7	0.1	0.0

12.5 Type of insert

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

Years of operation	% Minimally stabilized	% Posterior stabilized	% Pivot+Hinged
2001	47.7	50.1	2.2
2002	51.7	45.7	2.6
2003	46.4	51.3	2.3
2004	45.7	52.6	1.7
2005	42.6	55.8	1.5
2006	40.6	57.7	1.6
2007	40.8	57.1	2.0
2008	45.8	52.5	1.7
2009	51.3	46.8	1.8

2010	46.9	50.6	2.5
2011	49.0	48.9	2.1
2012	44.5	53.3	2.2
2013	41.0	56.1	3.0
2014	35.2	61.4	3.4
2015	36.2	60.9	2.9
2016	34.3	62.9	2.8
2017	31.7	65.2	3.1
2018	29.8	67.0	3.2
2019	28.8	67.5	3.7
2020	30.1	65.0	4.9

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

Years of operation	% fixed insert	% mobile insert
2001	74.1	25.9
2002	72.1	27.9
2003	69.7	30.3
2004	67.8	32.2
2005	66.0	34.0
2006	58.5	41.5
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	83.6	16.4
2019	87.2	12.8
2020	90.0	10.0

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

Years of operation	% Standard poly	% Crosslinked poly	% 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	57.0	23.6	19.4
2018	56.9	26.0	17.0
2019	57.6	25.7	16.6
2020	53.6	24.3	22.1

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	1.1	0.5
2010	95.4	2.9	1.3	0.3
2011	92.8	4.3	2.5	0.4
2012	90.0	4.3	5.3	0.5
2013	87.0	6.1	6.0	0.9
2014	80.1	9.8	9.2	0.8
2015	79.7	10.3	9.4	0.6
2016	77.5	13.1	8.5	0.8
2017	75.4	14.3	9.6	0.8
2018	70.9	17.5	10.9	0.8
2019	71.6	17.9	9.8	0.7
2020	72.6	18.6	8.3	0.5

Between 1st July 2000 and 31st December 2020, 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	16.8
Antibiotic Simplex - Howmedica	11.9
Palacos R+G - Heraeus Medical	9.3
Palacos R - Heraeus Medical	9.2
Hi-Fatigue G - Zimmer	6.7
Hi-Fatigue - Zimmer	4.1
Refobacin Bone Cement R - Biomet	3.0

Versabond - Smith&Nephew	2.4
Osteobond - Zimmer	2.1
Palamed G - Heraeus Medical	2.0
Smartset MV - Depuy	2.0
Smartset GMV - Depuy	1.9
Smartset GHV - Depuy	1.9
Versabond AB - Smith&Nephew	1.9
Aminofix 1 - Groupe Lepine	1.8
Palamed - Heraeus Medical	1.5
Cemex System - Tecres	1.5
Cemfix 1 - Teknimed	1.5
Cemex Genta System - Tecres	1.4
Bone Cement R - Biomet	1.4
Refobacin Revision - Biomet	1.2
Other bone cement loaded with antibiotic	7.1
Other bone cement without antibiotic	7.2
Total	**100.0**

Bone cement loaded with antibiotic is used in 50.2% 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 2020.

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Tibial fracture	13	*0.1*	Early Infection	4	*0.03*
Femoral fracture	10	*0.1*			
Anaesthesiologic	2	*0.01*			
Tibial tuberosity fracture	2	*0.01*			
Ligament lesion	1	*0.01*	Deep venous thrombosis	6	*0.04*
Other	6	*0.04*			
Total	**34**	***0.2***	**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 2020

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Femoral fracture	86	*0.1*	Deep venous thrombosis	178	*0.2*
Tibial fracture	45	*0.04*			
Patellar tendon rupture	38	*0.04*			
Ligament lesion	37	*0.04*			
Anaesthesiologic	32	*0.03*			
Hemorragia	25	*0.02*	Early Infection	41	*0.2*
Vascular lesion	18	*0.02*			
Tibial tuberosity fracture	9	*0.01*			
Other	49	*0.05*			
Total	**339**	***0.3***	**Total**	**219**	***0.4***

The rate of complications in **revision surgery** carried out on patients hospitalized between 1st July 2000 and 31st December 2020

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Femoral fracture	29	*0.3*	Early Infection	17	*0.2*
Tibial fracture	28	*0.3*			
Patellar tendon rupture	24	*0.3*			
Anaesthesiologic	10	*0.1*			
Tibial tuberosity fracture	9	*0.1*	Deep venous thrombosis	15	*0.1*
Vascular lesion	6	*0.1*			
Hemorragia	4	*0.1*			
Ligament lesion	1	*0.01*			
Other	14	*0.2*			
Total	**125**	***1.5***	**Total**	**32**	***0.3***

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 2020. Only deaths occurred during hospitalization are recorded.

Year 2000-2020			
Type of surgery	**Deaths**	**Number of surgeries**	**%**
Primary bi/tricompartmental	73	104226	0.07
Primary unicompartmental	1	14116	0.01
Revision	14	8465	0.17
Prosthesis removal	6	1859	0.32

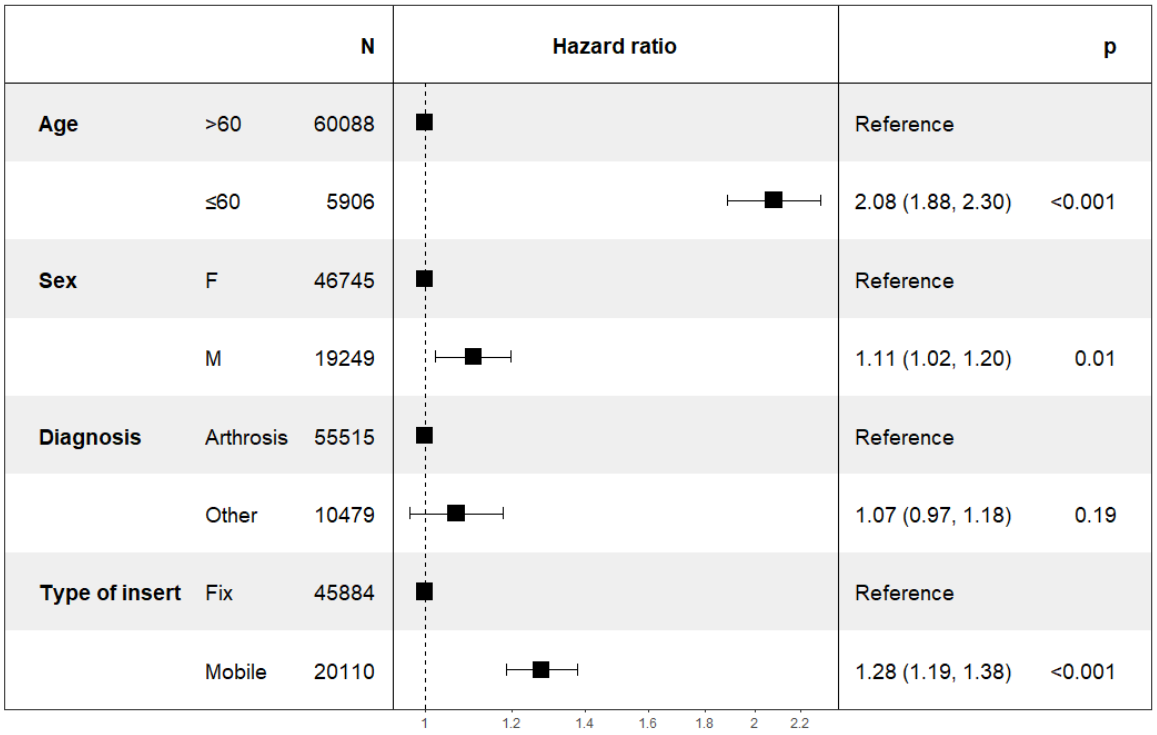
14. Analysis of survival of primary surgery

14.1 Cox multivariate analysis

Bi-tri compartmental

The Cox multivariate analysis identifies any variables (independent of each other) that can influence the event, in our case the removal of at least one prosthestic 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 2020 only on patients living in the Region, were analysed.



The chi-square test, used to test globally the model applied, was significant. This 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.

Patients of the group 'less than 60 yrs' had a greater risk (2.1) of failure than patients of the group 'more than 60 yrs'.
Patients of the group 'mobile insert' had a greater risk (1.3) of failure than patients of the group 'fix insert.
Concerning gender, males have a higher risk of 1.1 compared to women.

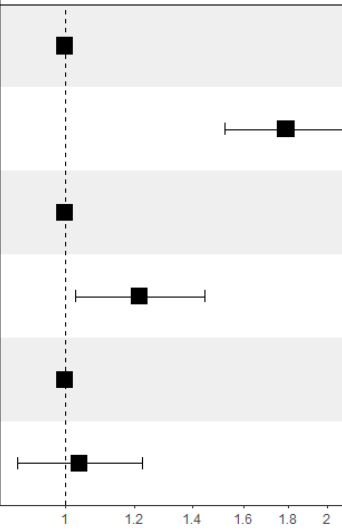
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Unicompartmental

All primary unicompartmental knee arthroplasties performed in the Region between July 2000 and December 2020 only on patients living in the Region and affected by arthrosis, were analysed. Variables analysed in the model are: gender, age at surgery and type of tibial component (all poly vs metal back).

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'. Concerning gender, females have a higher risk of 1.2 compared to women.

		N	Hazard ratio	p
Age	>60	5388	Reference	
	≤60	1501	1.79 (1.52, 2.10)	<0.001
Sex	M	2296	Reference	
	F	4593	1.22 (1.03, 1.44)	0.02
Tibial component	All poly	1815	Reference	
	Metal backed	5074	1.04 (0.88, 1.23)	0.65



Type of tibial component do not influence the risk (p=0.65).

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.

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

Type of surgery	N.	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	Revision rate
Primary bicompartmental	50825	1307	937	138	7.3	2382/50825
Primary tricompartmental	15207	359	139	44	5.8	542/15207
Primary unicompartmental	8265	402	351	71	7.2	824/8265
Total revision	3608	293	186	30	6.3	509/3608

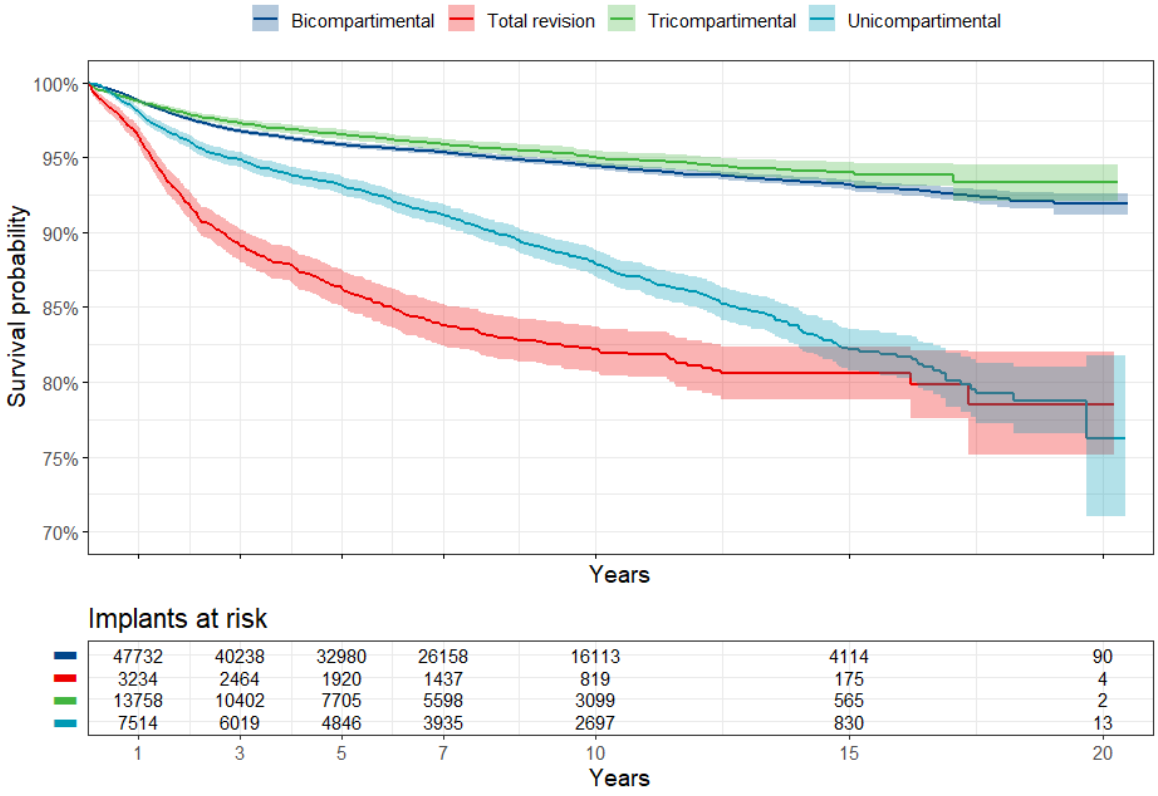
In Primary knee arthroplasties, **44.8%** of Revisions was performed in a different hospital.

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 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 surgery	N.	N. major revisions	N. minor revisions	N. of revisions performed outside Emilia-Romagna region	Revision rate
Primary bicompartmental	50825	1511	733	138	2382/50825
Primary tricompartmental	15207	378	120	44	542/15207
Primary unicompartmental	8265	730	23	71	824/8265
Total revision	3608	351	128	30	509/3608

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



Type of surgery	1 Year	3 Years	5 Years	7 Years	10 Years	15 Years	p-value[1]
							<0.001
Tricompartimental	98.7 [98.6,98.9]	97.3 [97.0,97.5]	96.5 [96.2,96.8]	95.9 [95.5,96.2]	95.0 [94.6,95.5]	94.0 [93.3,94.7]	
Bicompartimental	98.8 [98.7,98.9]	96.8 [96.6,96.9]	95.9 [95.7,96.1]	95.4 [95.2,95.6]	94.4 [94.2,94.7]	93.1 [92.8,93.5]	
Unicompartimental	98.0 [97.7,98.4]	94.9 [94.4,95.4]	93.1 [92.5,93.7]	91.2 [90.5,91.9]	87.9 [87.0,88.8]	82.2 [80.8,83.6]	
Total revision	96.4 [95.8,97.0]	89.1 [88.0,90.2]	86.3 [85.1,87.6]	83.8 [82.4,85.2]	82.1 [80.7,83.7]	80.6 [78.8,82.3]	

[1] Log-rank test

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

Primary Unicompartmental

Cause of revision	n/N	IR (%)	% Distribution failure causes
Total aseptic loosening	320/8265	3.9	38.8
Pain without loosening	127/8265	1.5	15.4
Aseptic loosening of tibial component	99/8265	1.2	12.0
Septic loosening	57/8265	0.7	6.9
Progression of disease	29/8265	0.4	3.5
Aseptic loosening of femoral component	26/8265	0.3	3.2

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

Insert wear	26/8265	0.3	3.2
Breakage of prosthesis	18/8265	0.2	2.2
Prosthesis dislocation	14/8265	0.2	1.7
Periprosthetic bone fracture	10/8265	0.1	1.2
Instability	3/8265	0.0	0.4
Trauma	2/8265	0.0	0.2
Other	9/8265	0.1	1.1
Unknown (52 performed outside region)	84/8265	1.0	10.2
Total	824/8265	10.0	100.0

Primary bi-tricompartmental

Cause of revision	n/N	IR (%)	% Distribution failure causes
Total aseptic loosening	642/66032	1.0	21.9
Septic loosening	617/66032	0.9	21.1
Pain without loosening	391/66032	0.6	13.4
Aseptic loosening of tibial component	237/66032	0.4	8.1
Progression of disease	143/66032	0.2	4.9
Patellar pain	128/66032	0.2	4.4
Prosthesis dislocation	87/66032	0.1	3.0
Periprosthetic bone fracture	64/66032	0.1	2.2
Instability	63/66032	0.1	2.2
Insert wear	63/66032	0.1	2.2
Aseptic loosening of femoral component	52/66032	0.1	1.8
Stiffness	45/66032	0.1	1.5
Breakage of prosthesis	25/66032	0.0	0.9
Trauma	8/66032	0.0	0.3
Patellar chondropathy	7/66032	0.0	0.2
Other	81/66032	0.1	2.8
Unknown (163 performed outside region)	271/66032	0.4	9.3
Total	2924/66032	4.4	100.0

Total revision

Cause of re-revision	n/N	IR (%)	% Distribution failure causes
Septic loosening	138/3608	3.8	27.1
Total aseptic loosening	95/3608	2.6	18.7
Pain without loosening	52/3608	1.4	10.2
Aseptic loosening of tibial component	44/3608	1.2	8.6
Patellar pain	15/3608	0.4	2.9
Early Infection	15/3608	0.4	2.9
Prosthesis dislocation	12/3608	0.3	2.4
Aseptic loosening of femoral component	12/3608	0.3	2.4
Instability	10/3608	0.3	2.0
Progression of disease	9/3608	0.2	1.8
Insert wear	9/3608	0.2	1.8
Periprosthetic bone fracture	8/3608	0.2	1.6
Stiffness	5/3608	0.1	1.0
Breakage of prosthesis	5/3608	0.1	1.0
Other	26/3608	0.7	5.1

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

Unknown (27 performed outside region)	54/3608	1.5	10.6
Total	509/3608	14.1	100.0

14.4 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

Model of prosthesis	From year	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs
PHYSICA ZUK - Lima	2005	1359	55	96.2 [95.0-97.4]	525	92.4 [90.0-94.8]	181
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	2000	864	155	90.7 [88.8-92.7]	743	85.5 [83.1-87.9]	572
JOURNEY UNI - Smith & Nephew	2011	682	40	92.7 [90.2-95.2]	160	-	-
GENESIS UNI - Smith & Nephew	2000	675	95	92.3 [90.3-94.4]	597	87.4 [84.9-90.1]	393
UNI SIGMA HP - De Puy Johnson & Johnson	2009	516	24	95.5 [93.7-97.4]	375	94.4 [91.9-96.8]	38
MITUS - ENDO-MODEL UNI - ALL POLY - Link	**2003**	**468**	**46**	**92.6 [90.1-95.2]**	**257**	**88.3 [84.7-92.0]**	**170**
EFDIOS - Citieffe	2000	314	60	92.7 [89.9-95.7]	272	83.9 [79.8-88.3]	211
ALLEGRETTO UNI - Protek-Sulzer	**2000**	**302**	**35**	**93.5 [90.6-96.4]**	**228**	**89.6 [85.8-93.5]**	**158**
JOURNEY UNI - ALL POLY - Smith & Nephew	**2010**	**300**	**24**	**94.1 [91.2-97.1]**	**185**	**-**	**-**
RESTORIS MCK UNI - Mako	2014	299	2	99.2 [98.1-100.0]	33	-	-
GKS - ONE - ALL POLY - Permedica	**2006**	**214**	**24**	**93.8 [90.6-97.1]**	**180**	**86.7 [81.6-92.2]**	**72**
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	2014	214	10	-	-	-	-
JOURNEY II - UNI XLPE - Smith & Nephew	2017	202	3	-	-	-	-
PRESERVATION UNI - ALL POLY - Depuy	**2002**	**187**	**26**	**92.3 [88.5-96.3]**	**163**	**87.0 [82.2-92.1]**	**137**
UC-PLUS SOLUTION - Smith & Nephew	2000	177	17	97.1 [94.7-99.6]	164	94.7 [91.3-98.1]	145
HLS - UNI EVOLUTION - ALL POLY - Tornier	**2001**	**144**	**15**	**95.7 [92.3-99.1]**	**128**	**90.4 [85.5-95.5]**	**97**
UC-PLUS SOLUTION – ALL POLY - Smith & Nephew	**2003**	**140**	**26**	**88.3 [83.1-93.9]**	**117**	**81.6 [75.2-88.6]**	**71**
OPTETRAK - UNI - ALL POLY - Exactech	**2005**	**131**	**7**	**98.5 [96.4-100.0]**	**120**	**95.9 [92.4-99.5]**	**104**
MILLER GALANTE UNI - Zimmer	2001	118	14	95.7 [92.1-99.5]	108	91.9 [86.9-97.1]	90
UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	**2010**	**115**	**10**	**91.0 [85.4-96.9]**	**60**	**-**	**-**
BALANSYS - UNI - Mathys	2005	108	17	85.9 [79.5-92.8]	85	83.1 [76.0-90.9]	47
Other (<100 cases)	2000	704	106	87.7 [84.9-90.5]	314	79.8 [75.9-83.9]	181
Unknown	2000	32	13	87.5 [76.8-99.7]	24	-	-
Total	**2000**	**8265**	**824**	**93.1 [92.5-93.7]**	**4846**	**89.9 [87.0-88.8]**	**2697**

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

14.5 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.

Model of prosthesis	From year	N.	N. revisions	% 5 year survival (95% CI)	N. at risk at 5 yrs	% 10 year survival (95% CI)	N. at risk at 10 yrs
NEXGEN - LPS - FLEX FISSO - ZIMMER	2002	6126	202	97.2 [96.8-97.6]	4621	96.4 [95.9-96.9]	2337
LEGION - PS XLPE HIGH FLEXION - SMITH & NEPHEW	2011	3788	125	95.3 [94.4-96.2]	559	-	-
VANGUARD - PS - BIOMET ORTHOPEDICS	2005	3470	96	97.2 [96.7-97.8]	2159	96.3 [95.5-97.1]	687
GENESIS II - PS HIGH FLEXION - SMITH & NEPHEW	2004	2972	104	96.9 [96.3-97.6]	2243	96.0 [95.1-96.8]	496
GEMINI MK II - LINK	2002	2683	111	96.2 [95.5-97.0]	1809	94.7 [93.7-95.7]	780
TC-PLUS - SB SOLUTION - ENDOPLUS	2002	2170	73	97.5 [96.8-98.2]	1790	96.0 [95.0-97.0]	611
PROFIX-CONFORMING Smith&Nephew	2000	2034	104	96.2 [95.4-97.1]	1828	94.9 [94.0-95.9]	1346
NEXGEN-LPS Zimmer	2000	1950	96	97.1 [96.3-97.8]	1740	95.5 [94.5-96.5]	1381
ATTUNE - PS FIXED – De Puy Johnson & Johnson	2012	1816	60	95.9 [94.8-97.0]	513	-	-
PFC - RP - PS - De Puy Johnson & Johnson	2000	1737	97	95.8 [94.8-96.7]	1536	94.4 [93.3-95.5]	714
NEXGEN - CR FLEX FISSO - ZIMMER	2004	1572	48	97.1 [96.2-98.0]	1082	96.3 [95.2-97.4]	370
TRIATHLON - CR - HOWMEDICA OSTEONICS	2005	1492	31	97.9 [97.1-98.7]	922	97.3 [96.2-98.4]	193
PHYSICA - PS FIXED - LIMA	2014	1400	17	98.5 [97.8-99.2]	33	-	-
PERSONA - PS - ZIMMER	2013	1360	34	95.9 [94.4-97.3]	311	-	-
GENESIS II - C R - Smith & Nephew	2001	1340	70	95.2 [94.0-96.4]	902	94.2 [92.8-95.6]	438
ATTUNE - PS MOBILE – De Puy Johnson & Johnson	2014	1185	52	94.4 [92.9-95.9]	190	-	-
VANGUARD - CR-LIPPED - BIOMET ORTHOPEDICS	2006	1040	46	95.6 [94.3-96.9]	637	94.8 [93.3-96.3]	344
OPTETRAK - LOGIC PS - EXACTECH	2011	964	34	95.3 [93.6-97.1]	170	-	-
GENUS PE - Adler-Ortho	2008	946	44	96.6 [95.5-97.8]	815	94.6 [93.0-96.2]	284
NEXGEN - LPS - FLEX MOBILE - ZIMMER	2002	846	41	96.7 [95.5-97.9]	727	95.3 [93.8-96.8]	400
LEGION - CR XLPE HIGH FLEXION - Smith & Nephew	2012	791	22	95.3 [93.3-97.5]	81	-	-
FIRST - SYMBIOS ORTHOPEDIE SA	2006	649	40	94.8 [93.1-96.5]	568	93.7 [91.8-95.6]	258
ADVANCE Medial Pivot - Wright	2000	634	30	95.4 [93.7-97.1]	503	95.2 [93.5-96.9]	327
PFC-RP-CVD De Puy Johnson&Johnson	2001	620	37	95.4 [93.7-97.1]	500	94.1 [92.1-96.0]	227
TRIATHLON - PS - HOWMEDICA OSTEONICS	2007	617	13	98.0 [96.9-99.2]	253	96.7 [93.9-99.6]	38
PFC-PS De Puy Johnson&Johnson	2000	616	39	94.7 [92.9-96.5]	513	92.9 [90.7-95.2]	170
ROTAGLIDE Corin Medical	2000	603	82	90.7 [88.3-93.0]	495	87.7 [84.9-90.5]	311
LEGION - CONSTRAINED - SMITH & NEPHEW	2008	598	20	95.9 [94.1-97.8]	155	-	-
GENIUS TRICCC Dedienne Sante	2000	594	69	91.8 [89.6-94.1]	493	88.6 [86.0-91.4]	319
PROFIX-PS Smith&Nephew	2002	589	30	96.0	519	94.6	420

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

				[94.4-97.6]		[92.7-96.5]	
INNEX - MOBILE BEARING - UCOR - PROTEK SULZER	2002	580	18	97.1 [95.8-98.5]	344	95.6 [93.1-98.2]	30
SCORPIO - NRG - PS – Howmedica Osteonics	2004	550	48	93.7 [91.6-95.7]	479	91.4 [88.9-93.8]	310
SCORPIO - NRG - CR – Howmedica Osteonics	2007	534	24	95.9 [94.2-97.6]	429	95.4 [93.5-97.3]	181
JOURNEY II - BCS XLPE - SMITH & NEPHEW	2012	532	23	93.9 [91.3-96.6]	112	-	-
LCS - UNIVERSAL - RP - De Puy Johnson & Johnson	2000	488	21	96.2 [94.6-98.0]	432	96.0 [94.3-97.8]	352
PFC - SIGMA RPF - DE PUY JOHNSON & JOHNSON	2005	449	28	95.7 [93.9-97.6]	405	93.0 [90.4-95.6]	194
SCORE - AMPLITUDE	2004	437	16	97.2 [95.7-98.8]	390	96.1 [94.3-98.0]	306
OPTETRAK - RBK - HI-FLEX - EXACTECH	2006	399	19	95.9 [94.0-97.9]	362	95.0 [92.9-97.2]	258
APEX - PS - OMNILIFE SCIENCE	2011	396	13	95.5 [93.0-98.1]	79	-	-
GSP - TREKKING - MBH PS - SAMO	2007	396	22	94.8 [92.6-97.1]	220	93.1 [90.2-96.1]	40
GENESIS II - MOBILE BEARING - Smith & Nephew	2001	359	22	95.7 [93.6-97.9]	310	94.0 [91.5-96.6]	184
BALANSYS - MOBILE BEARING - MATHYS	2005	351	11	96.7 [94.8-98.7]	253	96.7 [94.8-98.7]	82
PFC - CVD - De Puy J.&J.	2000	332	9	98.1 [96.6-99.6]	283	98.1 [96.6-99.6]	184
T.A.C.K. - Link	2000	315	43	93.1 [90.4-96.0]	271	89.5 [86.0-93.1]	212
LCS - COMPLETE - RP - DEPUY JOHNSON & JOHNSON	2004	311	17	95.6 [93.3-98.0]	261	94.1 [91.4-96.9]	172
GENESIS II - DISHED - SMITH & NEPHEW	2001	308	17	95.3 [92.9-97.7]	239	93.8 [90.9-96.7]	140
Other (<300 cases)	2000	11897	689	95.0 [94.6-95.4]	6995	92.8 [92.2-93.4]	3998
Unknown	2000	196	17	96.2 [93.5-99.0]	154	91.1 [86.7-95.7]	112
Total	**2000**	**66032**	**2924**	**96.0 [95.8-96-2]**	**40685**	**94.6 [94.3-94.8]**	**19212**

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

PART THREE: SHOULDER PROSTHESIS

July 2008 – December 2020

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

15. 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 **97.2%** in 2020. 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
2019	48.7	51.5
2020	45.3	70.3

From database SDO

16. Type of surgery

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2020 according to **type of surgery**

Type of surgery	Number of surgeries	%
Reverse prosthesis	7381	70.9
Hemiarthroplasty	1063	10.2
Anatomical prosthesis	625	6.0
Revisions	678	6.5
Hemi stemless	145	1.4
Standard resurfacing	125	1.2
Prosthesis removal	172	1.7
Reverse stemless	109	1.0
Anatomical stemless	45	0.4
Anatomical resurfacing	12	0.1
Partial resurfacing	1	0.0
Other*	60	0.6
Total	**10416**	**100.0**

*7 interposition prostheses, 7 balloon arthroplasties, 8 osteomyelitis spacers

Number of Reverse prosthesis and Anatomical prosthesis according to **year of implant**

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

Year of surgery	Reverse prosthesis	Anatomical prosthesis
	N.	N.
2008	63	17
2009	188	40
2010	232	56
2011	361	42
2012	435	59
2013	453	44
2014	548	72
2015	671	51
2016	755	42
2017	863	48
2018	974	52
2019	1060	65
2020	778	37
Total	**7381**	**625**

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 2020 according to **type of surgery** and **gender** of patients

Type of surgery	Males		Females		Total
	N.	%	N.	%	N.
Reverse prosthesis	1840	60.5	5541	75.8	7381
Hemiarthroplasty	357	11.7	706	9.7	1063
Anatomical prosthesis	285	9.4	340	4.6	625
Revisions	267	8.8	411	5.6	678
Hemi stemless	68	2.2	77	1.1	145
Standard resurfacing	78	2.6	47	0.6	125
Prosthesis removal	77	2.5	95	1.3	172
Reverse stemless	43	1.4	66	0.9	109
Anatomical stemless	22	0.7	23	0.3	45
Anatomical resurfacing	4	0.1	8	0.1	12
Partial resurfacing	1	0.0	-	-	1
Total	**3042**	**100.0**	**7314**	**100.0**	**10356**

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

17.2 Age

Mean age of patients, according to **gender** and **type of surgery**

	Males		Females	
Type of surgery	**Mean age**	**Range**	**Mean age**	**Range**
Reverse prosthesis	70.9	33-92	73.5	30-100
Hemiarthroplasty	58.4	15-94	71.4	18-97
Anatomical prosthesis	60.3	27-83	64.8	30-100
Revisions	64.6	23-88	69.0	32-90
Hemi stemless	55.2	26-78	63.2	32-86
Standard resurfacing	50.5	23-80	55.0	21-78
Prosthesis removal	63.8	25-88	71.1	47-86
Reverse stemless	70.0	55-82	71.8	52-85
Anatomical stemless	57.1	36-73	66.7	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 2020 according to **type of surgery** and **diagnosis** of patients

Diagnosis	**Reverse prosthesis**	
	N.	**%**
Eccentric osteoarthritis	4122	55.9
Fracture	1501	20.3
Concentric osteoarthritis	1065	14.4
Necrosis	167	2.3
Sequelae of fracture	153	2.1
Non specified osteoarthritis	88	1.2
Inveterate dislocation	53	0.7
Rheumatic arthritis	53	0.7
Post-traumatic necrosis	30	0.4
Post-traumatic arthritis	27	0.4
Recurrent dislocation	18	0.2
Other	44	0.6
Unknown	60	0.8
Total	**7381**	**100.0**

Diagnosis	**Anatomical prosthesis**	
	N.	**%**
Concentric osteoarthritis	507	81.1
Eccentric osteoarthritis	44	7.0
Necrosis	31	5.0
Rheumatic arthritis	11	1.8
Sequelae of fracture	8	1.3
Non specified osteoarthritis	7	1.1
Fracture	7	1.1
Other	5	0.8
Unknown	5	0.8
Total	**625**	**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

Diagnosis	Hemiarthroplasty	
	N.	%
Fracture	644	60.6
Concentric osteoarthritis	98	9.2
Eccentric osteoarthritis	90	8.5
Necrosis	88	8.3
Sequelae of fracture	45	4.2
Inveterate dislocation	15	1.4
Tumor	13	1.2
Rheumatic arthritis	12	1.1
Post-traumatic necrosis	11	1.0
Other	41	3.9
Unknown	6	0.6
Total	**1063**	**100.0**

Diagnosis	Standard resurfacing		Anatomical resurfacing		Partial resurfacing	
	N	%	N	%	N	%
Concentric osteoarthritis	61	48.8	11	91.7	-	-
Necrosis	31	27.2	1	8.3	1	100.0
Eccentric osteoarthritis	12	7.2	-	-	-	-
Sequelae of capsuloplasty	3	2.4	-	-	-	-
Non specified osteoarthritis	3	2.4	-	-	-	-
Rheumatic arthritis	3	2.4	-	-	-	-
Sequelae of fracture	3	2.4	-	-	-	-
Fracture	3	2.4	-	-	-	-
Tumor	2	1.6	-	-	-	-
Inveterate dislocation	2	1.6	-	-	-	-
Pain	1	0.8	-	-	-	-
Idiopathic homer head necrosis	1	0.8	-	-	-	-
Total	**125**	**100.0**	**12**	**100.0**	**1**	**100.0**

Diagnosis	Anatomical stemless		Hemi stemless		Reverse stemless	
	N	%	N	%	N	%
Concentric osteoarthritis	34	75.6	76	52.4	29	26.6
Eccentric osteoarthritis	6	13.3	33	22.7	73	66.9
Necrosis	1	2.2	20	13.8	1	0.9
Non specified osteoarthritis	2	4.2	3	2.1	2	1.8
Sequelae of fracture	-	-	4	2.8	-	-
Fracture	-	-	2	1.4	-	-
Steroid-induced necrosis	-	-	2	1.4	-	-
Post-traumatic necrosis	-	-	2	1.4	-	-
Inveterate dislocation	-	-	-	-	2	1.8
Synovial chondromatosis	1	2.2	-	-	-	-
Post-traumatic arthritis	1	2.2	-	-	-	-
Sequelae of septic arthritis	-	-	1	0.7	-	-
Recurrent dislocation	-	-	1	0.7	-	-

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

Deformity	-	-	-	-	1	0.9
Unknown	-	-	1	0.7	1	0.9
Total	**45**	**100.0**	**145**	**100.0**	**109**	**100.0**

Number of shoulder **revisions** carried out on patients with admission date between 1st July 2008 and 31st December 2020, according to **diagnosis** and type of **revision**

Diagnosis	**N.**	**%**
Glenoid erosion	112	16.5
Two steps revision	92	13.6
Glenoid loosening	74	10.9
Anterior instability	66	9.7
Humeral loosening	61	9.0
Superior instability	41	6.0
Pain	40	5.9
Dislocation	35	5.2
Other instability	23	3.4
Periprosthetic bone fracture	18	2.7
Septic loosening	12	1.8
Other	70	10.3
Unknown	34	5.0
Total	**678**	**100.0**

Type of revision	**N.**	**%**
From hemi to reverse	170	25.1
From reverse to reverse	170	25.1
Implant after removal	101	14.9
From reverse to hemi	63	9.3
From anatomic to reverse	50	7.4
From hemi to hemi	30	4.4
From resurfacing to reverse	20	2.9
From anatomic to anatomic	7	1.0
From resurfacing to anatomic	4	0.6
From hemi to anatomic	4	0.6
Other	24	3.5
Unknown	35	5.2
Total	**587**	**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 2020 according to **surgical approach**

Type of surgery	**Deltoid-pectoral**	**Trans-deltoid**	**Superior lateral**	**Other**
Reverse prosthesis	6120	867	49	239
Hemiarthroplasty	1018	27	1	7
Anatomical prosthesis	612	5	-	-
Revisions	592	44	1	6

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

Hemi stemless	134	7	1	-
Prosthesis removal	147	5	-	2
Standard resurfacing	120	2	-	1
Reverse stemless	34	72	-	2
Anatomical stemless	44	-	-	-
Anatomical resurfacing	12	-	-	-
Partial resurfacing	1	-	-	-
Total*	**8834**	**1029**	**52**	**257**

*184 missing data (1,8%)

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2020, according to **anaesthesia**

Anaesthesia	N.	%
General	4447	46.8
Mixed	4447	46.8
Loco-regional	605	6.4
Total*	**9499**	**100.0**

*857 missing data (8.3%)

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2019 according to stem fixation and type of operation

Antithromboembolic prophylaxis

In 2020, heparin is used in 86% of primary surgery, and no prophylaxis in 14,0%.

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 2020 according to **stem fixation** and type of **surgery**

Stem fixation	Anatomical prosthesis	%	Reverse prosthesis	%	Hemiarthroplasty	%
Cemented	36	5.8	1055	14.3	346	32.5
Cementless	589	94.2	6326	85.7	717	67.5
Total	**625**	**100.0**	**7381**	**100.0**	**1063**	**100.0**

19.2 Material, form and fixation of glenoid in Anatomical prosthesis

Glenoid material	Anatomical prosthesis	%
Metal backed	282	45.1
Polyethylene	331	53.0
Crosslinked polyethylene	7	1.1
Other	5	0.8
Total	**625**	**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

Glenoid form	Anatomical prosthesis	%
Pegs	429	68.6
Screws	179	28.6
Keel	17	2.7
Total	**625**	**100.0**

Glenoid fixation	Anatomical prosthesis	%
Cemented	343	54.9
Cementless	282	45.1
Total	**625**	**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 2020 according to the **type of stem**

Model of Stem	Anatomical prosthesis		Reverse prosthesis		Hemiarthroplasty	
	N	%	N	%	N	%
SMR ALETTATO	196	31.4	2680	36.3	499	46.9
DELTA XTEND	1	0.2	1389	18.8	37	3.5
AEQUALIS ASCEND FLEX S PTC	229	36.6	599	8.1	50	4.7
DELTA XTEND CEMENTED	-	-	454	6.2	21	2.0
TRABECULAR METAL REVERSE	-	-	367	5.0	12	1.1
EQUINOXE PRIMARY	-	-	309	4.2	1	0.1
AEQUALIS REVERSED	-	-	301	4.1	1	0.1
SMR CEMENTED	4	0.6	135	1.8	95	8.9
COMPREHENSIVE MINI	-	-	177	2.4	6	0.6
BIGLIANI/FLATOW	113	18.1	-	-	25	2.4
DUOCENTRIC	-	-	127	1.7	-	-
EQUINOXE PLATFORM FRACTURE	-	-	94	1.3	2	0.2
AEQUALIS REVERSED CEMENTED	-	-	92	1.2	-	-
ARROW	1	0.2	67	0.9	6	0.6
UNIVERS REVERS	-	-	70	0.9	1	0.1
SMR REVISION	-	-	43	0.6	17	1.6
AFFINIS FRACTURE	-	-	44	0.6	16	1.5
ANATOMICAL SHOULDER	12	1.9	20	0.3	18	1.7
AFFINIS INVERSE	-	-	48	0.7	-	-
ANATOMICAL SHOULDER CEMENTED	8	1.3	25	0.3	8	0.8
ANATOMICAL SHOULDER FRACTURE	1	0.2	6	0.1	31	2.9
TITAN	-	-	38	0.5	-	-
SHOULDER SYSTEM SHORT	2	0.3	34	0.5	-	-

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

LTO CEMENTED	2	0.3	-	-	31	2.9
GLOBAL FX	-	-	-	-	33	3.1
HUMELOCK REVERSED	-	-	31	0.4	-	-
SHOULDER SYSTEM	1	0.2	27	0.4	-	-
BIGLIANI/FLATOW TRABECULAR METAL	2	0.3	-	-	25	2.4
AEQUALIS ASCEND	21	3.4	-	-	3	0.3
GLOBAL ADVANTAGE	2	0.3	-	-	21	2.0
PROMOS	-	-	17	0.2	6	0.6
GLOBAL UNITE	3	0.5	4	0.1	16	1.5
DUOCENTRIC CEMENTED	-	-	22	0.3	-	-
Other (models < 20 cases)	22	3.5	145	2.0	79	7.4
Unknown	5	0.8	16	0.2	3	0.3
Total	**625**	**100.0**	**7381**	**100.0**	**1063**	**100.0**

Number of shoulder **Anatomical prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2020 according to the **type of glenoid**

Model of Glenoid	**Anatomical prosthesis**	
	N	**%**
AEQUALIS PERFORM	253	40.5
SMR RIVESTITA	170	27.2
BIGLIANI/FLATOW TRABECULAR METAL	73	11.7
BIGLIANI/FLATOW	46	7.4
SMR;SMR PEG TT	30	4.8
ANATOMICAL SHOULDER	16	2.6
Other (models < 10 cases)	33	5.3
Unknown	4	0.6
Total	**625**	**100.0**

Number of shoulder **Reverse prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2020 according to the **type of metaglena**

Model of metaglena	**Reverse prosthesis**	
	N	**%**
SMR RIVESTITA	2635	35.7
DELTA Xtend	1848	25.0
AEQUALIS REVERSED	795	10.8
EQUINOXE REVERSE	404	5.5
TRABECULAR METAL REVERSE	350	4.7
SMR;SMR PEG TT	231	3.1
AEQUALIS REVERSED II	161	2.2
COMPREHENSIVE REVERSE MINI	150	2.0
DUOCENTRIC	149	2.0
AFFINIS INVERSE	91	1.2
UNIVERS REVERS	70	0.9
COMPREHENSIVE REVERSE	67	0.9
ARROW	67	0.9
SHOULDER SYSTEM	61	0.8
TITAN REVERSE	39	0.5
HUMELOCK REVERSED	35	0.5

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

ANATOMICAL SHOULDER INVERSE/REVERSE	34	0.5
AEQUALIS PERFORM+ REVERSED;AEQUALIS PERFORM REVERSED POST	29	0.4
AEQUALIS PERFORM+ REVERSED	22	0.3
DELTA CTA	21	0.3
PROMOS REVERSE	17	0.2
MIRAI	15	0.2
AGILON	14	0.2
VERSO	11	0.1
T.E.S.S.	10	0.1
Other (models < 10 cases)	46	0.6
Unknown	9	0.1
Total	**7381**	**100.0**

Number of shoulder **Hemiarthroplasty** carried out on patients with admission date between 1st July 2008 and 31st December 2020 according to the **type of humeral head**

Model of Humeral Head	**Hemiarthroplasty**	
	N	**%**
SMR	539	50.7
SMR CTA	74	7.0
BIGLIANI/FLATOW	62	5.8
DELTA XTEND CTA	58	5.5
GLOBAL ADVANTAGE	49	4.6
AEQUALIS ASCEND FLEX PYC	42	4.0
RANDELLI - LTO	33	3.1
ANATOMICAL SHOULDER FRACTURE	31	2.9
ANATOMICAL SHOULDER	26	2.4
AEQUALIS	18	1.7
AFFINIS FRACTURE	16	1.5
M.R.S.	16	1.5
GLOBAL UNITE	16	1.5
AEQUALIS ASCEND FLEX	10	0.9
Other (models < 10 cases)	71	6.7
Unknown	2	0.2
Total	**1063**	**100.0**

Number of **shoulder resurfacing** carried out on patients with admission date between 1st July 2008 and 31st December 2020 according to the **type of prosthesis**

Model of prosthesis	**Standard resurfacing**		**Anatomical resurfacing**		**Partial resurfacing**	
	N	**%**	**N**	**%**	**N**	**%**
SMR - Lima	54	43.2	1	8.3	-	-
EPOCA RH - Synthes	10	8.0	11	91.7	-	-
COPELAND - Biomet	18	14.4	-	-	-	-
GLOBAL CAP – DePuy	15	12.0	-	-	-	-
PYROTITAN - Ascension Orthopedics	8	6.4	-	-	-	-

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

AEQUALIS RESURFACING - Tornier	6	4.8	-	-	-	-
EQUINOXE - Exactech	5	4.0				
DUROM SHOULDER - Zimmer	4	3.2	-	-	-	-
COPELAND THIN - Biomet	3	2.4	-	-	-	-
CAPICA - Implantcast	1	0.8	-	-	-	-
HEMICAP - Arthrosurface	-	-	-	-	1	100.0
OVO - Arthrosurface	1	0.8	-	-	-	-
Total	**125**	**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 2020 according to the **type of prosthesis**

Model of prosthesis	**Anatomical stemless**		**Hemi stemless**		**Reverse stemless**	
	N.	**%**	**N.**	**%**	**N.**	**%**
VERSO - Biomet	-	-	-	-	89	81.7
T.E.S.S. - Biomet	8	17.8	68	46.9	-	-
ECLIPSE - Arthrex	8	17.8	26	17.9	-	-
SIDUS - Zimmer	3	6.7	22	15.2	-	-
COMPREHENSIVE VERSA -DIAL- Biomet	-	-	16	11.0	-	-
AFFINIS SHORT - Mathys	5	11.1	9	6.2	-	-
MIRAI - Permedica	4	8.9	-	-	10	9.2
SMR - Lima	8	17.8	1	0.7	-	-
T.E.S.S. INVERSA - Biomet	-	-	-	-	5	4.6
SMR INVERSA HP - Lima	-	-	-	-	5	4.6
BIGLIANI/FLATOW - Zimmer	4	8.9	-	-	-	-
HUMELOCK - Fx Solution	2	4.4	1	0.7	-	-
AFFINIS FRACTURE - Mathys	3	6.7	-	-	-	-
SIMPLICITI - Tornier	-	-	1	0.7	-	-
GLOBAL ICON - DePuy	-	-	1	0.7	-	-
Total	**45**	**100.0**	**145**	**100.0**	**109**	**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 2020

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	33	*0.4*	Dislocation	13	*0.2*
Tendon lesion	4	*0.05*			
Vascular lesion	1	*0.01*			

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

Fracture	44	*0.6*	Early Infection	1	*0.01*
Other	15	*0.2*			
Total	**98**	***1.2***	**Total**	**14**	***0.2***

Complications rate in **hemiarthroplasties** carried out on patients hospitalized between July 1st 2008 and December 31st 2020

Complications occurred during hospitalization					
Intra-operative			**Post-operative local**		
	N.	**%**		**N.**	**%**
Muscular lesion	8	*0.8*	Early Infection	4	*0.4*
Tendon lesion	2	*0.2*			
Vascular lesion	1	*0.1*			
Fracture	13	*1.2*	Dislocation	-	-
Other	4	*0.4*			
Total	**28**	***2.6***	**Total**	**4**	***0.4***

They were observed also 3 deaths in hemiarthroplasty, 4 deaths in reverse prosthesis, 1 death in prosthesis removal and 1 death in revision.

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

		Year 2020	
Type of surgery	**N.**	**Mean pre-op. (range)**	**Mean post-op. (range)**
Reverse prosthesis	778	1.4 (0-19)	4.1 (1-28)
Hemiarthroplasty	48	2.0 (0-14)	5.1 (2-24)
Revisions	77	1.0 (0-14)	4.7 (1-21)
Anatomical prosthesis	37	0.5 (0-1)	3.1 (2-6)
Prosthesis removal	18	2.0 (0-21)	9.7 (2-38)

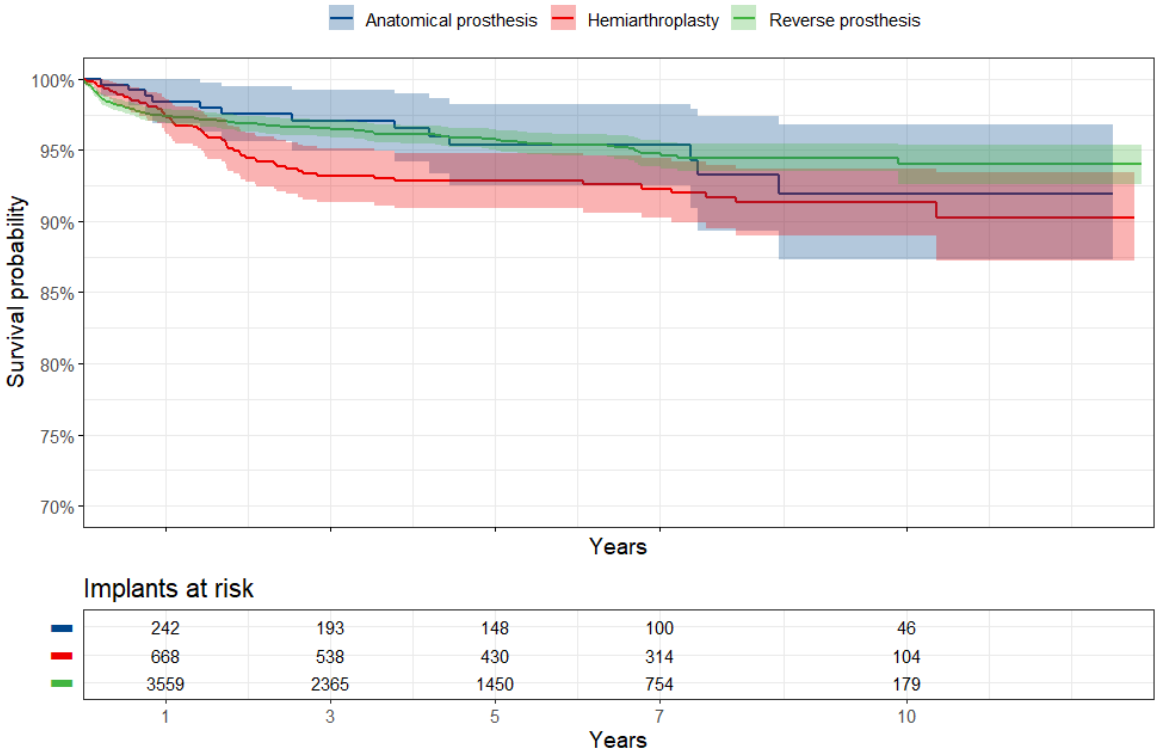
22. Analysis of survival of primary surgery

Survival curve is used to estimate the probability of each patient to remain at 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 2020 only on patients living in the Region were analysed.

Type of surgery	**Number of surgeries**	**Number of revisions**	**Mean Follow-up**
Anatomical prosthesis	262	13	5.8
Reverse prosthesis	4169	161	4.1
Hemiarthroplasty	749	54	5.9
Standard resurfacing	41	4	8.8
Anatomical resurfacing	2	1	7.4
Partial resurfacing	1	-	11.9
Anatomical stemless	18	5	5.3
Hemi stemless	61	8	7.1
Reverse stemless	47	2	2.3

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



Type of operation	1 Year	3 Years	5 Years	7 Years	10 Years	p-value[1]
						0.014
Anatomical prosthesis	98.4 [96.9,100.0]	97.1 [95.0,99.2]	95.4 [92.5,98.3]	95.4 [92.5,98.3]	91.9 [87.3,96.8]	
Hemiarthroplasty	97.3 [96.2,98.5]	93.2 [91.3,95.1]	92.8 [90.9,94.8]	92.3 [90.2,94.4]	91.3 [89.0,93.7]	
Reverse prosthesis	97.4 [96.9,97.9]	96.5 [96.0,97.1]	95.8 [95.1,96.5]	94.7 [93.8,95.7]	94.0 [92.6,95.4]	

[1] Log-rank test

Anatomical prosthesis			
Cause of revision	**Rate**	**%**	**% distribut. of failure causes**
Instability	5/262	1.9	38.5
Pain	2/262	0.8	15.4
Septic loosening	2/262	0.8	15.4
Total aseptic loosening	1/262	0.4	7.7
Glenoid erosion	1/262	0.4	7.7
Poly wear	1/262	0.4	7.7
Breakage of insert	1/262	0.4	7.7
Total	13/262	5.0	100.0

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

Reverse prosthesis

Cause of revision	Rate	%	% distribut. of failure causes
Septic loosening	40/4169	1.0	24.8
Instability	34/4169	0.8	21.1
Glenoid loosening	23/4169	0.6	14.3
Dislocation	11/4169	0.3	6.8
Humeral loosening	9/4169	0.2	5.6
Periprosthetic bone fracture	6/4169	0.1	3.7
Glenoid erosion	4/4169	0.1	2.5
Pain	3/4169	0.1	1.9
Other	10/4169	0.2	6.2
Unknown (4 *performed outside region*)	21/4169	0.5	13.0
Total	161/4169	3.9	100.0

Hemiarthroplasty

Cause of revision	Rate	%	% distribut. of failure causes
Glenoid erosion	13/749	1.7	24.5
Instability	8/749	1.1	15.1
Septic loosening	6/749	0.8	11.3
Periprosthetic bone fracture	5/749	0.7	7.5
Humeral loosening	4/749	0.5	7.5
Pain	3/749	0.4	5.7
Cuff breakage	2/749	0.3	3.8
Dislocation	2/749	0.3	3.8
Total aseptic loosening	1/749	0.1	1.9
Other	2/749	0.3	3.8
Unknown *(5 performed outside region)*	8/749	1.1	13.2
Total	54/749	7.2	100.0

Standard resurfacing

Cause of revision	Rate	%	% distribut. of failure causes
Glenoid erosion	3/41	7.3	75.0
Pain	1/41	2.4	25.0
Total	3/41	9.8	100.0

Anatomical stemless

Cause of revision	Rate	%	% distribut. of failure causes
Pain	1/18	5.6	20.0
Septic loosening	1/18	5.6	20.0
Instability	1/18	5.6	20.0
Dislocation	1/18	5.6	20.0
Poly wear	1/18	5.6	20.0
Total	5/18	27.8	100.0

Hemi stemless

Cause of revision	Rate	%	% distribut. of failure causes
Pain	2/61	3.3	25.0
Glenoid erosion	2/61	3.3	25.0
Septic loosening	1/61	1.6	12.5
Humeral loosening	1/61	1.6	12.5

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

Unknown *(2 performed outside region)*	2/61	3.3	25.0
Total	8/61	13.1	100.0

Reverse stemless

Cause of revision	Rate	%	% distribut. of failure causes
Septic loosening	1/47	2.1	50.0
Instability	1/47	2.1	50.0
Total	2/47	4.3	100.0

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

Model of prosthesis	From years	N.	N. failures	% survival at 5 yrs (C.I. 95%)	N. at risk at 5 yrs	Mean Follow-up
SMR INVERSA HP - Lima	2008	948	32	95.4 (93.4-96.8)	227	3.3
SMR - Lima	2008	919	43	94.8 (92.9-96.2)	334	4.3
DELTA XTEND - Depuy	2008	819	23	97.9 (96.6-98.7)	465	5.5
AEQUALIS REVERSED II - Tornier	2011	361	17	93.2 (88.9-96.0)	70	3.3
EQUINOXE REVERSE - Exactech	2013	291	7	97.9 (95.1-99.2)	40	2.9
TRABECULAR METAL REVERSE - Zimmer	2008	223	8	95.1 (89.8-97.7)	86	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