



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

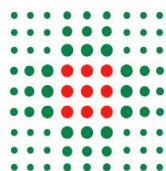
OVERALL DATA

HIP, KNEE AND SHOULDER ARTHROPLASTY

IN EMILIA-ROMAGNA REGION (ITALY)

2000-2021

VERSION 1 - AUGUST 2024



**SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA**

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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 annual 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 2021.

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. 223000 hip, 141000 knee and 11600 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 know 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 adherence 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 2021, data on 9301 primary THAs, 175 resurfacing, 2198 hemiarthroplasties and 852 partial or total revisions were registered.

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 15000 THA per year.

During 2021 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 2021, 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 60% in year 2000 and 95% in year 2021, whilst hybrid fixation was 23% 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: 87.8% of THA implanted in Emilia-Romagna region on resident patients are still in place 20 years after the operation.

A large part (75%) of 5315 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 ≥ 36 mm is lower than met-met < 36 mm. Survival of resurfacing, at 15 years, is slightly lower than THA (86.8%, statistically significant). Total revisions are not revised the second time in 79.5% (95% CI 76.9-82.2) of cases at 20 yrs. Hemiarthroplasty has an optimal survival of the implant (94.3, 95% CI 93.4-95.2, 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 2021, data on 7207 primary knee prostheses, 1136 partial prostheses and 591 revisions were registered. High percentage of knee prostheses is implanted in private structures: 76% in 2021 of primary knee prostheses (vs 43% in 2000) and 62% in 2021 of revision (vs 25% in 2000).

In 2021, 14% of implanted prostheses are unicompartmental, 53% are bicompartamental with no patella resurfacing and the remaining 34% 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 2021, 97% of implants are cemented, in the half of them cement is antibiotic loaded. Hybrid fixation is almost completely absent. Mobile insert are decreasing (8% in 2021). 50% of insert are in Standard Poly and the remaining 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 bicompartamental is 93.1% at 15 yrs, survival of tricompartmental is 93.9% and survival of unicompartmental is significantly lower (81.7%). 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 80.0% 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

During 2021, 1032 reverse prostheses, 49 anatomical and 49 hemi were carried out.

Similar to knee prostheses, high percentage of primary shoulder prostheses is implanted in private structures (52% in 2021 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 (73 vs 58).

Reverse prosthesis is implanted mainly in arthrosis (eccentric osteoarthritis in particular) and in fracture (20%).

Anatomic prosthesis is implanted in concentric arthrosis (82%), while hemiarthroplasties treat both fractures (60% of implants) and arthrosis.

Fixation is mainly cementless for reverse and anatomic prosthesis, while 31% of hemiarthroplasties are cemented.

Survival of reverse prosthesis at 10 yrs is 94.1%. Instability, glenoid loosening and septic loosening represent the most frequent causes of failure.

Bologna, 20th August 2024

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.

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Ospedale privato casa di cura "Prof. Fogliani"	Dir. San. Dr.ssa Elisa Nicoli	Dr.ssa Elisa Nicoli
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RIPO staff belongs to Medical Technology Laboratory (LTM) of Rizzoli Orthopaedic Institutes.

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

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PART ONE: HIP PROSTHESES

January 2000 – December 2021

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 **96.4%** in the year 2021. 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
2021	47.2	99.6	71.6

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 2021, according to **type of surgery**.

Type of surgery	N = 223337 ¹
Primary THA	146918 (65.8)
Hemiarthroplasties	50756 (22.7)
Total and partial revision*	19874 (8.9)
Resurfacing	3025 (1.4)
Prosthesis removal	1739 (0.8)
Other**	904 (0.4)
Hemiarthroplasty with buffer ^o	121 (0.1)

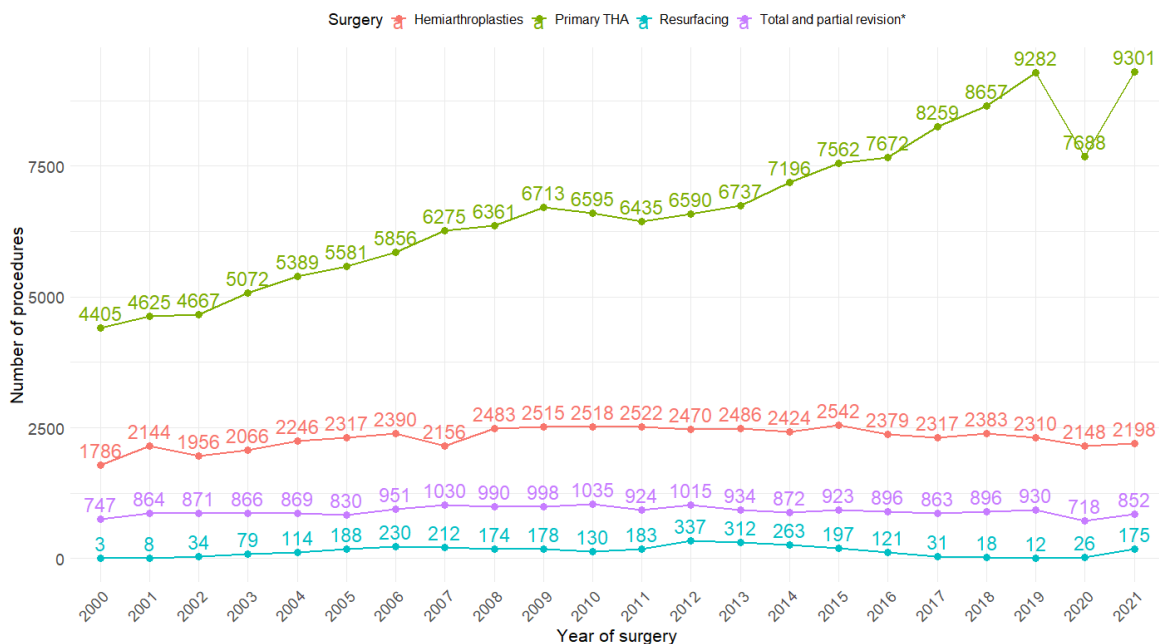
¹ n (%)

^o acetabular buffer

* 5.055 total revision, 7.682 cup revisions, 4.226 stem revisions, 2.911 revisions of other components.

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

Variation in the number of procedures over the years



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 2021, according to **type of operation** and **age group** of patients at the time of surgery

Type of surgery	<40, N = 4835 ¹	40-49, N = 11208 ¹	50-59, N = 25924 ¹	60-69, N = 49181 ¹	70-79, N = 70665 ¹	≥80, N = 61400 ¹
Primary THA	4003 (82.8)	9328 (83.2)	22114 (85.3)	41829 (85.1)	52045 (73.7)	17596 (28.7)
Hemiarthroplasties	29 (0.6)	83 (0.7)	258 (1.0)	1349 (2.7)	10032 (14.2)	39005 (63.5)
Resurfacing	343 (7.1)	764 (6.8)	1101 (4.2)	684 (1.4)	127 (0.2)	6 (0.0)
Revision	361 (7.5)	850 (7.6)	2138 (8.2)	4685 (9.5)	7558 (10.7)	4282 (7.0)
Prosthesis removal	57 (1.2)	108 (1.0)	194 (0.7)	419 (0.9)	612 (0.9)	349 (0.6)
Other	42 (0.9)	75 (0.7)	119 (0.5)	215 (0.4)	291 (0.4)	162 (0.3)

¹ n (%)

Average age of patients undergoing hip replacement with a date of hospitalisation between 1 January 2000 and 31 December 2021, by type of surgery

	Primary THA, N = 146918	Hemiarthroplasties, N = 50756	Resurfacing, N = 3025	Revision, N = 19874
Età				
Median (Range)	69.0 (11.0, 101.0)	85.0 (14.0, 109.0)	53.0 (15.0, 83.0)	72.0 (15.0, 100.0)
Mean (SD)	66.8 (11.9)	83.9 (7.3)	52.7 (10.6)	70.3 (11.7)

Average age of patients undergoing hip prostheses by type of operation, year 2000 and 2021, for hip resurfacing reference year 2003

Age	Year of surgery 2000	Year of surgery 2021	p-value ¹
Primary THA	N = 4405	N = 9301	
Median (Range)	68.0 (16.0, 99.0)	68.0 (13.0, 96.0)	
Mean (SD)	66.0 (11.2)	67.0 (11.8)	<0.001
Hemiarthroplasties	N = 1786	N = 2198	
Median (Range)	83.0 (35.0, 104.0)	86.0 (30.0, 103.0)	
Mean (SD)	82.4 (7.7)	85.4 (6.8)	<0.001
Revision	N = 747	N = 852	
Median (Range)	70.0 (22.0, 97.0)	73.0 (19.0, 98.0)	<0.001
Mean (SD)	68.6 (10.4)	71.6 (12.1)	

¹ Welch Two Sample t-test

Age	Year of surgery 2003	Year of surgery 2021	p-value ¹
Resurfacing	N = 79	N = 175	
Median (Range)	52.0 (18.0, 72.0)	53.0 (23.0, 69.0)	
Mean (SD)	49.9 (11.0)	52.6 (8.7)	0.058

¹ Welch Two Sample t-test

3.2 Gender

Number of hip replacement operations performed on patients with a hospitalisation date between 1 January 2000 and 31 December 2021, by **type of surgery** and **gender** of patients

Tipo di surgery	F, N = 137726 ¹	M, N = 85611 ¹
Primary THA	85441 (58.2)	61477 (41.8)
Hemiarthroplasties	37262 (73.4)	13494 (26.6)
Hemiarthroplasty with buffer	95 (78.5)	26 (21.5)
Resurfacing	693 (22.9)	2332 (77.1)
Revision	12778 (64.3)	7096 (35.7)
Prosthesis removal	962 (55.3)	777 (44.7)
Other	495 (54.8)	409 (45.2)
¹ n (%)		

3.3 Side of surgery

Coxarthrosis more often affects right hip (56.8%) than left hip (43.2%). 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	52.6	60.1
Left	47.4	39.9

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

3.4 Bilateral prosthesis

Between 1st January 2000 and 31st December 2021, 14130 patients underwent bilateral operations for Coxarthrosis.

10807 (76.5%) chose to undergo the second operation at the same hospital where the first one was performed;

1057 (7.5%) chose to undergo the second operation at a different hospital, to follow the surgeon;

2266 (16.0%) 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 54.1%.

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 2021, according to **diagnosis**

Diagnosis	
THA, N = 146918¹	
Primary arthritis	102297 (70.0)
Femoral neck fracture	13693 (9.4)
Sequelae of LCA and DCA	12297 (8.4)
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	8756 (6.0)
Post-traumatic arthritis	2915 (2.0)
Femoral neck fracture sequelae	1559 (1.1)
Post-traumatic necrosis	1554 (1.1)
Rheumatic arthritis	1290 (0.9)
Epiphysiolysis sequelae	363 (0.2)
Perthes disease sequelae	340 (0.2)
Tumor	280 (0.2)
Septic coxitis sequelae	190 (0.1)
Paget disease	108 (0.1)
Acetabulum fracture	74 (0.1)
TBC coxitis sequelae	67 (0.0)
Other	440 (0.3)
Unknown	695
Resurfacing, N = 3025¹	
Primary arthritis	2535 (84.1)
Sequelae of LCA and DCA	189 (6.3)
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	102 (3.4)
Post-traumatic arthritis	97 (3.2)
Rheumatic arthritis	29 (1.0)
Epiphysiolysis sequelae	14 (0.5)
Post-traumatic necrosis	13 (0.4)
Perthes disease sequelae	11 (0.4)
Femoral neck fracture sequelae	8 (0.3)

Septic coxitis sequelae	3 (0.1)
Paget disease	3 (0.1)
TBC coxitis sequelae	1 (0.0)
Femoral neck fracture	1 (0.0)
Other	10 (0.3)
Unknown	9
Hemiarthroplasties, N = 50756¹	
Femoral neck fracture	49102 (97.5)
Femoral neck fracture sequelae	516 (1.0)
Tumor	500 (1.0)
Primary arthritis	135 (0.3)
Post-traumatic necrosis	51 (0.1)
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	33 (0.1)
Post-traumatic arthritis	21 (0.0)
Sequelae of LCA and DCA	3 (0.0)
Rheumatic arthritis	2 (0.0)
Paget disease	2 (0.0)
Septic coxitis sequelae	1 (0.0)
Epiphysiolysis sequelae	1 (0.0)
Other	7 (0.0)
Unknown	382

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

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

Diagnosis	2000-2015, N = 96059 ¹	2016-2018, N = 24588 ¹	2019-2021, N = 26271 ¹
Primary arthritis	65095 (68.0)	17796 (72.7)	19406 (74.4)
Femoral neck fracture	8725 (9.1)	2323 (9.5)	2645 (10.1)
Sequelae of LCA and DCA	9586 (10.0)	1568 (6.4)	1143 (4.4)
Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	5677 (5.9)	1430 (5.8)	1649 (6.3)
Post-traumatic arthritis	2186 (2.3)	391 (1.6)	338 (1.3)
Femoral neck fracture sequelae	894 (0.9)	303 (1.2)	362 (1.4)
Post-traumatic necrosis	1167 (1.2)	216 (0.9)	171 (0.7)
Rheumatic arthritis	1044 (1.1)	148 (0.6)	98 (0.4)
Other	1289 (1.3)	287 (1.2)	286 (1.1)
Unknown	396	126	173

¹ n (%)

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

Diagnosis	Age group	<40, N = 4003 ¹	40-49, N = 9328 ¹	50-59, N = 22114 ¹	60-69, N = 41829 ¹	70-79, N = 52045 ¹	≥80, N = 17596 ¹
Primary arthritis		760 (0.7)	4304 (4.2)	13985 (13.7)	30976 (30.3)	39284 (38.4)	12985 (12.7)
Femoral neck fracture		81 (0.6)	305 (2.2)	1328 (9.7)	3531 (25.8)	6288 (45.9)	2160 (15.8)
Sequelae of LCA and DCA		1071 (8.7)	2309 (18.8)	3440 (28.0)	3181 (25.9)	1949 (15.8)	347 (2.8)

Femoral head necrosis (idiopathic, due to dialysis, due to steroids)	788 (9.0)	1076 (12.3)	1566 (17.9)	2009 (22.9)	2253 (25.7)	1064 (12.2)
Post-traumatic arthritis	338 (11.6)	510 (17.5)	620 (21.3)	683 (23.4)	579 (19.9)	185 (6.3)
Femoral neck fracture sequelae	69 (4.4)	128 (8.2)	180 (11.5)	291 (18.7)	489 (31.4)	402 (25.8)
Post-traumatic necrosis	260 (16.7)	195 (12.5)	282 (18.1)	301 (19.4)	321 (20.7)	195 (12.5)
Rheumatic arthritis	178 (13.8)	150 (11.6)	223 (17.3)	320 (24.8)	341 (26.4)	78 (6.0)
Epiphysiolysis sequelae	127 (35.0)	100 (27.5)	74 (20.4)	41 (11.3)	19 (5.2)	2 (0.6)
Perthes disease sequelae	133 (39.1)	75 (22.1)	57 (16.8)	48 (14.1)	22 (6.5)	5 (1.5)
Tumor	22 (7.9)	35 (12.5)	63 (22.5)	87 (31.1)	63 (22.5)	10 (3.6)
Septic coxitis sequelae	59 (31.1)	22 (11.6)	43 (22.6)	32 (16.8)	30 (15.8)	4 (2.1)
Paget disease	0 (0.0)	0 (0.0)	8 (7.4)	30 (27.8)	54 (50.0)	16 (14.8)
Acetabulum fracture	2 (2.7)	1 (1.4)	11 (14.9)	11 (14.9)	25 (33.8)	24 (32.4)
TBC coxitis sequelae	7 (10.4)	11 (16.4)	17 (25.4)	20 (29.9)	10 (14.9)	2 (3.0)
Other	97 (22.0)	64 (14.5)	115 (26.1)	87 (19.8)	61 (13.9)	16 (3.6)
Unknown	11	43	102	181	257	101
¹ n (%)						

3.6 Causes for revision

Number of **revision** operations carried out on patients admitted between 1st January 2000 and 31st December 2021 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.

Diagnosi di reimpianto	
Revision of resurfacing, N = 205¹	
Aseptic loosening	93 (45.4)
Bone fracture	55 (26.8)
Metallosis	36 (17.6)
Pain without loosening	14 (6.8)
Instability	4 (2.0)
Breakage of prosthesis	3 (1.5)
Revision of primary THA, N = 18077¹	
Cup aseptic loosening	5260 (29.4)
Total aseptic loosening	2989 (16.7)
Stem aseptic loosening	2403 (13.4)
Dislocation	1677 (9.4)
Periprosthetic bone fracture	1435 (8.0)
Two steps revision	977 (5.5)
Breakage of prosthesis	912 (5.1)
	<i>Breakage of neck</i> 306
	<i>Breakage of liner</i> 209
	<i>Breakage of head</i> 127
	<i>Breakage of stem</i> 121
	<i>Breakage of cup</i> 112
	<i>Breakage of liner and head</i> 16
	<i>Unknown</i> 21
Poly wear	783 (4.4)
Other	385 (2.2)
Pain without loosening	336 (1.9)
Metallosis	213 (1.2)
Septic loosening	213 (1.2)

Primary instability	125 (0.7)
Heterotopic bone	97 (0.5)
Trauma	39 (0.2)
Acetabulum fracture	27 (0.2)
Unknown	206
Revision of hemiarthroplasty, N = 1592¹	
Prosthesis dislocation	557 (35.3)
Cotiloiditis	386 (24.5)
Stem aseptic loosening	295 (18.7)
Periprosthetic bone fracture	185 (11.7)
Other	58 (3.7)
Septic loosening	40 (2.5)
Two steps revision	26 (1.6)
Breakage of prosthesis	10 (0.6)
	<i>Breakage of stem</i> 5
	<i>Breakage of cup</i> 4
	<i>Breakage of liner</i> 1
Instability	9 (0.6)
Poly wear	7 (0.4)
Heterotopic bone	5 (0.3)
Unknown	14
¹ n (%)	

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

Cups used in primary THA			
Cemented cup	2000-2015, N = 5178¹	2016-2018, N = 173¹	2019-2021, N = 128¹
MULLER Cremascoli	961 (18.6)	0 (0.0)	0 (0.0)
CONTEMPORARY	827 (16.0)	6 (3.5)	2 (1.6)
Howmedica			
ZCA Zimmer	655 (12.7)	11 (6.4)	1 (0.8)
PE (Muller Protek) Sulzer	520 (10.1)	25 (14.5)	9 (7.2)
MULLER Samo	441 (8.5)	0 (0.0)	0 (0.0)
REFLECTION ALL-POLY	310 (6.0)	15 (8.7)	3 (2.4)
Smith and Nephew			
MULLER LIMA	258 (5.0)	2 (1.2)	2 (1.6)
PE ADLER	171 (3.3)	9 (5.2)	3 (2.4)
MULLER Smith and Nephew	161 (3.1)	0 (0.0)	0 (0.0)
Nephew			
MULLER CITIEFFE	115 (2.2)	8 (4.7)	0 (0.0)
AVANTAGE CEMENTED	94 (1.8)	7 (4.1)	18 (14.4)
BIOMET			
LUNA AMPLITUDE	88 (1.7)	0 (0.0)	0 (0.0)
CCB MATHYS	58 (1.1)	0 (0.0)	0 (0.0)

CONSTRAINED CEMENTED GROUPE LEPINE	57 (1.1)	0 (0.0)	0 (0.0)
Other (models with less than 50 cases)	451 (8.7)	89 (51.7)	87 (69.6)
Unknown	11	1	3
¹ n (%)			
Uncemented cup	2000-2015, N = 90748 ¹	2016-2018, N = 24358 ¹	2019-2021, N = 26074 ¹
FIXA TI-POR ADLER	14352 (15.8)	7747 (31.8)	6525 (25.0)
FIXA ADLER	7500 (8.3)	0 (0.0)	0 (0.0)
ANCA FIT Cremascoli	6720 (7.4)	0 (0.0)	0 (0.0)
EP-FIT PLUS ENDOPLUS	5532 (6.1)	469 (1.9)	283 (1.1)
CONTINUUM ZIMMER	1604 (1.8)	1074 (4.4)	2453 (9.4)
R3 SMITH AND NEPHEW	2934 (3.2)	2,177 (8.9)	1 (0.0)
VERSAFITCUP CC TRIO	824 (0.9)	1,289 (5.3)	2344 (9.0)
MEDACTA			
DELTA TT LIMA	1315 (1.4)	971 (4.0)	1818 (7.0)
PINNACLE SECTOR II	2534 (2.8)	733 (3.0)	433 (1.7)
POROCOAT DEPUY			
R3 THREE-HOLE SMITH AND NEPHEW	1 (0.0)	635 (2.6)	2811 (10.8)
TRIDENT PLS HA CLUSTER Howmedica	2389 (2.6)	499 (2.0)	272 (1.0)
FITMORE Sulzer	2947 (3.2)	88 (0.4)	15 (0.1)
JUMP SYSTEM	574 (0.6)	1,289 (5.3)	958 (3.7)
PERMEDICA			
ABGII Howmedica	2771 (3.1)	9 (0.0)	0 (0.0)
DELTA PF LIMA	2107 (2.3)	414 (1.7)	195 (0.7)
G7 PPS BIOMET	205 (0.2)	954 (3.9)	1056 (4.1)
CLS Sulzer	2079 (2.3)	0 (0.0)	0 (0.0)
EXCEED ABT BIOMET	1687 (1.9)	233 (1.0)	157 (0.6)
REFLECTION SMITH AND NEPHEW	1989 (2.2)	79 (0.3)	0 (0.0)
EXPANSYS MATHYS	1620 (1.8)	5 (0.0)	0 (0.0)
ALLOFIT S IT ZIMMER	877 (1.0)	470 (1.9)	146 (0.6)
PINNACLE SECTOR	203 (0.2)	484 (2.0)	723 (2.8)
GRIPTION DEPUY			
DUOFIT PSF Samo	1377 (1.5)	1 (0.0)	0 (0.0)
BICON PLUS ENDOPLUS	1351 (1.5)	11 (0.0)	0 (0.0)
STANDARD CUP PROTEK Sulzer	1306 (1.4)	0 (0.0)	0 (0.0)
CLS ZIMMER	1297 (1.4)	1 (0.0)	0 (0.0)
TRILOGY Zimmer	1138 (1.3)	8 (0.0)	54 (0.2)
JUMP SYSTEM TRASER	0 (0.0)	323 (1.3)	581 (2.2)
PERMEDICA			
RECAP RESURFACING BIOMET	895 (1.0)	0 (0.0)	0 (0.0)
VERSAFITCUP CC	875 (1.0)	0 (0.0)	0 (0.0)
MEDACTA			
MPACT MEDACTA	63 (0.1)	271 (1.1)	524 (2.0)

TOP LINK	716 (0.8)	86 (0.4)	49 (0.2)
HILOCK LINE SYMBIOS	717 (0.8)	0 (0.0)	0 (0.0)
SPARKUP SAMO	613 (0.7)	30 (0.1)	0 (0.0)
ADAPTIVE WINGS SAMO	406 (0.4)	192 (0.8)	20 (0.1)
I1CUP LINK	0 (0.0)	202 (0.8)	408 (1.6)
MAXERA ZIMMER	409 (0.5)	132 (0.5)	60 (0.2)
SELEXYS TH MATHYS	583 (0.6)	0 (0.0)	0 (0.0)
TRINITY CORIN	44 (0.0)	173 (0.7)	335 (1.3)
FIN II BIOIMPIANTI	306 (0.3)	157 (0.6)	74 (0.3)
DELTAMOTION	444 (0.5)	86 (0.4)	0 (0.0)
FINSBURY			
GYROS DEPUY	51 (0.1)	294 (1.2)	161 (0.6)
BS CITIEFFE	463 (0.5)	30 (0.1)	6 (0.0)
AVANTAGE RELOAD	437 (0.5)	22 (0.1)	7 (0.0)
BIOMET			
APRIL SYMBIOS	446 (0.5)	19 (0.1)	0 (0.0)
TRABECULAR METAL	347 (0.4)	35 (0.1)	62 (0.2)
MODULAR CLUSTER-HOLED ZIMMER			
RM MATHYS	284 (0.3)	72 (0.3)	69 (0.3)
TRABECULAR METAL	417 (0.5)	0 (0.0)	0 (0.0)
MONOBLOCK ZIMMER			
FIXA DUPLEX ADLER	1 (0.0)	99 (0.4)	314 (1.2)
MALLORY BIOMET	360 (0.4)	38 (0.2)	13 (0.0)
AGILIS TI-POR ADLER	215 (0.2)	75 (0.3)	109 (0.4)
TRIDENT PSL HA SOLID	246 (0.3)	147 (0.6)	6 (0.0)
HOWMEDICA			
TRILOGY AB ZIMMER	378 (0.4)	0 (0.0)	0 (0.0)
POLARCUP TI-PLASMA	151 (0.2)	86 (0.4)	131 (0.5)
ORTHO-ID			
PINNACLE BANTAM	162 (0.2)	92 (0.4)	111 (0.4)
POROCOAT DEPUY			
DUALIS BIOIMPIANTI	12 (0.0)	174 (0.7)	154 (0.6)
BETA CUP LINK	319 (0.4)	15 (0.1)	2 (0.0)
DUROM HIP	330 (0.4)	0 (0.0)	0 (0.0)
RESURFACING ZIMMER			
EASY HIT MEDICA	313 (0.3)	0 (0.0)	0 (0.0)
TRIDENT II TRITANIUM	0 (0.0)	1 (0.0)	310 (1.2)
CLUSTER STRYKER			
ORTHOPAEDICS			
AVANTAGE BIOMET	300 (0.3)	0 (0.0)	0 (0.0)
Other (models with less than 300 cases)	10155 (11.2)	1863 (7.6)	2307 (8.9)
Unknown	57	4	17
¹ n (%)			
Unknown cup cementation	2000-2015, N = 133¹	2016-2018, N = 57¹	2019-2021, N = 69¹
Unknown	133	57	69
¹ n (%)			

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

4.2 Cups used in total revision surgery

Cups in total revision surgery			
<u>Cemented cup</u>	2000-2015, N =	2016-2018,	2019-2021,
	730¹	N = 66¹	N = 48¹
PE (Muller Protek) Sulzer	181 (25.0)	5 (7.6)	5 (10.4)
CONTEMPORARY Howmedica	138 (19.0)	2 (3.0)	3 (6.3)
MULLER LIMA	55 (7.6)	5 (7.6)	1 (2.1)
MULLER Cremascoli	58 (8.0)	0 (0.0)	0 (0.0)
MULLER Samo	53 (7.3)	0 (0.0)	0 (0.0)
ZCA Zimmer	43 (5.9)	1 (1.5)	0 (0.0)
AVANTAGE CEMENTED BIOMET	30 (4.1)	4 (6.1)	5 (10.4)
CCB MATHYS	20 (2.8)	0 (0.0)	0 (0.0)
REFLECTION ALL-POLY Smith and Nephew	11 (1.5)	5 (7.6)	3 (6.3)
INSERTO USATO COME COTILE	14 (1.9)	1 (1.5)	2 (4.2)
POLARCUP CEMENTED SMITH AND NEPHEW	6 (0.8)	6 (9.1)	4 (8.3)
MULLER PCR SAMO	13 (1.8)	0 (0.0)	1 (2.1)
PE ADLER	8 (1.1)	2 (3.0)	0 (0.0)
Other (models with less than 10 cases)	95 (13.1)	35 (53.0)	24 (50.0)
Unknown	5	0	0
¹ n (%)			
<u>Uncemented cup</u>	2000-2015, N =	2016-2018,	2019-2021,
	3275¹	N = 476¹	N = 442¹
FIXA TI-POR ADLER	228 (7.0)	96 (20.3)	88 (20.0)
ANCA FIT Cremascoli	301 (9.2)	0 (0.0)	0 (0.0)
DELTA ONE TT LIMA	139 (4.3)	66 (13.9)	94 (21.3)
DELTA TT LIMA	87 (2.7)	46 (9.7)	49 (11.1)
TRIDENT PLS HA CLUSTER Howmedica	168 (5.1)	6 (1.3)	2 (0.5)
TRABECULAR METAL MODULAR MULTI-HOLED ZIMMER	157 (4.8)	11 (2.3)	0 (0.0)
CONTINUUM ZIMMER	85 (2.6)	43 (9.1)	31 (7.0)
TRILOGY Zimmer	142 (4.3)	0 (0.0)	1 (0.2)
STANDARD CUP PROTEK Sulzer	132 (4.0)	0 (0.0)	0 (0.0)
FIXA ADLER	131 (4.0)	0 (0.0)	0 (0.0)
HERMES BS REV CITIEFFE	74 (2.3)	17 (3.6)	18 (4.1)
DELTA REVISION TT LIMA	52 (1.6)	30 (6.3)	17 (3.9)
MC MINN LINK	93 (2.8)	1 (0.2)	0 (0.0)
OMNIA TI-POR ADLER	43 (1.3)	38 (8.0)	8 (1.8)
OMNIA ADLER	52 (1.6)	0 (0.0)	0 (0.0)
EP-FIT PLUS ENDOPLUS	41 (1.3)	5 (1.1)	4 (0.9)
DUOFIT PSF Samo	48 (1.5)	0 (0.0)	0 (0.0)
LOR ALLOPRO SULZER	48 (1.5)	0 (0.0)	0 (0.0)
OSTEOLOCK Howmedica	47 (1.4)	0 (0.0)	0 (0.0)
DELTA PF LIMA	43 (1.3)	1 (0.2)	0 (0.0)
FITMORE Sulzer	44 (1.3)	0 (0.0)	0 (0.0)
REGENEREX RINGLOC+ BIOMET	41 (1.3)	0 (0.0)	0 (0.0)
PINNACLE MULTIHOLE GRIPTION DEPUY	33 (1.0)	5 (1.1)	0 (0.0)

TRIDENT ARC2F HOWMEDICA	37 (1.1)	0 (0.0)	0 (0.0)
PROCOTYL-E CREMASCOLI	36 (1.1)	0 (0.0)	0 (0.0)
TRABECULAR METAL REVISION	33 (1.0)	2 (0.4)	0 (0.0)
ZIMMER			
CLS Sulzer	34 (1.0)	0 (0.0)	0 (0.0)
PINNACLE MULTIHOLE II POROCOAT	33 (1.0)	0 (0.0)	0 (0.0)
DEPUY			
REFLECTION SMITH AND NEPHEW	30 (0.9)	0 (0.0)	0 (0.0)
TRABECULAR METAL MODULAR	26 (0.8)	1 (0.2)	1 (0.2)
CLUSTER-HOLED ZIMMER			
BICON PLUS ENDOPLUS	25 (0.8)	0 (0.0)	0 (0.0)
CONICAL SCREW CUP PROTEK	25 (0.8)	0 (0.0)	0 (0.0)
R3 SMITH AND NEPHEW	20 (0.6)	5 (1.1)	0 (0.0)
SECUR-FIT OSTEONICS	25 (0.8)	0 (0.0)	0 (0.0)
TRITANIUM HEMISPHERICAL STRYKER	21 (0.6)	3 (0.6)	1 (0.2)
ORTHOPAEDICS			
CUSTOM MADE	15 (0.5)	2 (0.4)	7 (1.6)
TRILOGY IT ZIMMER	19 (0.6)	2 (0.4)	3 (0.7)
BOFOR ENDOPLUS	22 (0.7)	0 (0.0)	0 (0.0)
REDAPT MODULAR SMITH AND	0 (0.0)	0 (0.0)	22 (5.0)
NEPHEW			
TRIDENT TRITANIUM HEMI. STRYKER	17 (0.5)	5 (1.1)	0 (0.0)
ORTHOPAEDICS			
ABGII Howmedica	21 (0.6)	0 (0.0)	0 (0.0)
PINNACLE REVISION DP GRIPTION	5 (0.2)	11 (2.3)	5 (1.1)
DEPUY			
PROCOTYL-Z-PIVOT CREMASCOLI	21 (0.6)	0 (0.0)	0 (0.0)
Other (models with less than 20 cases)	574 (17.6)	78 (16.5)	90 (20.4)
Unknown	7	2	1
¹ n (%)			
Unknown cup cementation	2000-2015, N =	2016-2018,	2019-2021, N =
	9 ¹	N = 7 ¹	= 2 ¹
Unknown	9	7	2
¹ n (%)			

4.3 Stems used in primary surgery

Stems in primary surgery

Cemented stem	2000-2015, N =	2016-2018, N =	2019-2021, N =
	12847 ¹	750 ¹	1136 ¹
EXETER V40 Howmedica	1141 (8.9)	147 (19.6)	119 (10.5)
APTA CEM ADLER	1173 (9.2)	57 (7.6)	70 (6.2)
BASIS SMITH AND NEPHEW	1029 (8.0)	17 (2.3)	0 (0.0)
SPECTRON Smith and Nephew	730 (5.7)	0 (0.0)	0 (0.0)
JVC Cremascoli	728 (5.7)	0 (0.0)	0 (0.0)
P507 Samo	657 (5.1)	0 (0.0)	0 (0.0)
VERSYS HERITAGE ZIMMER	55 (0.4)	0 (0.0)	468 (41.2)
MRL Cremascoli	469 (3.7)	0 (0.0)	0 (0.0)
LC Samo	412 (3.2)	0 (0.0)	0 (0.0)

AD Samo	388 (3.0)	0 (0.0)	0 (0.0)
DEFINITION Howmedica	347 (2.7)	0 (0.0)	0 (0.0)
VERSYS CEMENTED ZIMMER	335 (2.6)	0 (0.0)	0 (0.0)
LUBINUS SP2 Link	312 (2.4)	15 (2.0)	2 (0.2)
ANCA-FIT CLU Cremascoli	314 (2.4)	0 (0.0)	0 (0.0)
C STEM DEPUY	313 (2.4)	0 (0.0)	0 (0.0)
AHS Cremascoli	306 (2.4)	0 (0.0)	0 (0.0)
EXETER Howmedica	290 (2.3)	0 (0.0)	0 (0.0)
VERSYS ADVOCATE ZIMMER	249 (1.9)	6 (0.8)	0 (0.0)
CCA MATHYS	237 (1.8)	0 (0.0)	0 (0.0)
AB CITIEFFE	224 (1.7)	10 (1.3)	2 (0.2)
POLARSTEM CEM ENDOPLUS	83 (0.6)	103 (13.7)	44 (3.9)
C-STEM AMT DEPUY	229 (1.8)	0 (0.0)	0 (0.0)
ULTIMA Johnson e Johnson	197 (1.5)	0 (0.0)	0 (0.0)
MS 30 ZIMMER	187 (1.5)	0 (0.0)	3 (0.3)
ABG CEMENTED HOWMEDICA	151 (1.2)	0 (0.0)	0 (0.0)
PAVI CEM GROUPE LEPINE	47 (0.4)	67 (8.9)	31 (2.7)
VERSYS LD/FX ZIMMER	133 (1.0)	0 (0.0)	0 (0.0)
HYDRA CEM ADLER	69 (0.5)	25 (3.3)	38 (3.3)
TAPERLOC CEM BIOMET	82 (0.6)	24 (3.2)	17 (1.5)
KORUS CEM BIOIMPIANTI	15 (0.1)	58 (7.7)	48 (4.2)
MERCURIUS ADLER	112 (0.9)	0 (0.0)	0 (0.0)
EXACTA PLUS PERMEDICA	4 (0.0)	26 (3.5)	74 (6.5)
CORAIL CEMENTED DEPUY	38 (0.3)	41 (5.5)	22 (1.9)
SL CEMENTED LIMA	92 (0.7)	2 (0.3)	2 (0.2)
ANCA Cremascoli	89 (0.7)	0 (0.0)	0 (0.0)
MBA GROUPE LEPINE	88 (0.7)	0 (0.0)	0 (0.0)
CORAE CEM ADLER	68 (0.5)	16 (2.1)	0 (0.0)
ABG Howmedica	80 (0.6)	0 (0.0)	0 (0.0)
DUOFIT CKA SAMO	55 (0.4)	21 (2.8)	3 (0.3)
DUOFIT CFS SAMO	75 (0.6)	0 (0.0)	0 (0.0)
FULLFIX MATHYS	69 (0.5)	0 (0.0)	0 (0.0)
ARCAD SO SYMBIOS	66 (0.5)	0 (0.0)	0 (0.0)
CPCS SMITH AND NEPHEW	52 (0.4)	9 (1.2)	1 (0.1)
PERFECTA RA WRIGHT	60 (0.5)	0 (0.0)	0 (0.0)
MULLER AUTOBLOCCANTE Sulzer	57 (0.4)	0 (0.0)	0 (0.0)
VERSYS REVISION CALCAR ZIMMER	24 (0.2)	16 (2.1)	16 (1.4)
ABGII CEMENTED HOWMEDICA	55 (0.4)	0 (0.0)	0 (0.0)
SL STREAKES HITMEDICA	50 (0.4)	0 (0.0)	0 (0.0)
Other (models with less than 50 cases)	781 (6.1)	90 (12.0)	175 (15.4)
Unknown	30	0	1
¹ n (%)			
Uncemented stem	2000-2015, N =	2016-2018, N =	2019-2021, N =
	83020 ¹	23777 ¹	25055 ¹
APTA ADLER NON CEM	9128 (11.0)	1619 (6.8)	492 (2.0)
HYDRA ADLER	3073 (3.7)	1735 (7.3)	1498 (6.0)
RECTA ADLER	5254 (6.3)	551 (2.3)	500 (2.0)
CLS Sulzer	4715 (5.7)	356 (1.5)	912 (3.6)
POLARSTEM ENDOPLUS	869 (1.0)	1468 (6.2)	2406 (9.6)

SL PLUS ENDOPLUS	4391 (5.3)	248 (1.0)	73 (0.3)
ANCA FIT Cremascoli	4506 (5.4)	0 (0.0)	0 (0.0)
CONUS CENTERPULSE	3284 (4.0)	361 (1.5)	243 (1.0)
CORAIL DEPUY	1976 (2.4)	843 (3.5)	604 (2.4)
TAPERLOC BIOMET	2973 (3.6)	6 (0.0)	26 (0.1)
ABGII Howmedica	2979 (3.6)	0 (0.0)	0 (0.0)
HYDRA-FIX ADLER	0 (0.0)	941 (4.0)	1843 (7.4)
SL PLUS MIA STEM SMITH AND NEPHEW	1673 (2.0)	724 (3.0)	365 (1.5)
AMISTEM-H MEDACTA	548 (0.7)	990 (4.2)	976 (3.9)
CORAE ADLER	1560 (1.9)	866 (3.6)	0 (0.0)
CBC MATHYS	2303 (2.8)	6 (0.0)	0 (0.0)
EXACTA PERMEDICA	200 (0.2)	820 (3.4)	1184 (4.7)
TRI-LOCK DEPUY	813 (1.0)	723 (3.0)	579 (2.3)
APTA-FIX ADLER	142 (0.2)	982 (4.1)	975 (3.9)
H-MAX S LIMA	472 (0.6)	595 (2.5)	939 (3.7)
CONUS Sulzer	2003 (2.4)	0 (0.0)	0 (0.0)
MINIMAX MEDACTA	723 (0.9)	521 (2.2)	625 (2.5)
PROXIPLUS ENDOPLANT GMBH	1509 (1.8)	91 (0.4)	1 (0.0)
ALATA ACUTA S ADLER	1032 (1.2)	365 (1.5)	155 (0.6)
FITMORE ZIMMER	1004 (1.2)	462 (1.9)	0 (0.0)
TAPERLOC COMPLETE BIOMET	338 (0.4)	655 (2.8)	430 (1.7)
ADR ENDOPLUS	1024 (1.2)	312 (1.3)	77 (0.3)
MODULUS LIMA	928 (1.1)	243 (1.0)	206 (0.8)
VERSYS FIBER METAL TAPER	1268 (1.5)	82 (0.3)	13 (0.1)
Zimmer			
NANOS ENDOPLANT GMBH	729 (0.9)	386 (1.6)	219 (0.9)
TAPERLOC COMPLETE	75 (0.1)	439 (1.8)	744 (3.0)
MICROPLASTY BIOMET			
ACCOLADE II OSTEONICS	121 (0.1)	452 (1.9)	641 (2.6)
HOWMEDICA			
C2 LIMA	1074 (1.3)	87 (0.4)	53 (0.2)
AMISTEM-P MEDACTA	0 (0.0)	0 (0.0)	1184 (4.7)
CFP LINK	1083 (1.3)	23 (0.1)	14 (0.1)
KORUS BIOIMPIANTI	77 (0.1)	476 (2.0)	421 (1.7)
SYNTHESIS PERMEDICA	249 (0.3)	488 (2.1)	220 (0.9)
LCU LINK	119 (0.1)	357 (1.5)	446 (1.8)
SYNERGY SMITH AND NEPHEW	840 (1.0)	61 (0.3)	0 (0.0)
SUMMIT DEPUY	480 (0.6)	174 (0.7)	175 (0.7)
MINIMA S LIMA	17 (0.0)	147 (0.6)	640 (2.6)
PULCHRA-FIX ADLER	0 (0.0)	315 (1.3)	478 (1.9)
PROFEMUR Z CREMASCOLI	715 (0.9)	0 (0.0)	29 (0.1)
FITMORE B EXT. ZIMMER	6 (0.0)	83 (0.3)	646 (2.6)
AVENIR MULLER ZIMMER	110 (0.1)	291 (1.2)	265 (1.1)
RECTA-FIX ADLER	209 (0.3)	283 (1.2)	87 (0.3)
ABGII Howmedica	549 (0.7)	10 (0.0)	0 (0.0)
DREAM ADLER	0 (0.0)	0 (0.0)	553 (2.2)
SAM-FIT LIMA	436 (0.5)	81 (0.3)	13 (0.1)
ACCOLADE OSTEONICS	525 (0.6)	4 (0.0)	0 (0.0)
HOWMEDICA			

TAPERLOC MICROPLASTY BIOMET	492 (0.6)	11 (0.0)	1 (0.0)
GTS BIOMET	352 (0.4)	77 (0.3)	39 (0.2)
QUADRA-S MEDACTA	391 (0.5)	66 (0.3)	8 (0.0)
PARVA ADLER	398 (0.5)	59 (0.2)	4 (0.0)
PLS LIMA	306 (0.4)	82 (0.3)	62 (0.2)
ALLOCLASSIC SL ZIMMER	364 (0.4)	44 (0.2)	40 (0.2)
MULTIFIT SAMO	386 (0.5)	51 (0.2)	10 (0.0)
FIT STEM LIMA	352 (0.4)	76 (0.3)	16 (0.1)
BHS Smith and Nephew	438 (0.5)	0 (0.0)	0 (0.0)
PBF PERMEDICA	433 (0.5)	4 (0.0)	0 (0.0)
TWINSYS MATHYS	293 (0.4)	76 (0.3)	63 (0.3)
EXACTA S PERMEDICA	21 (0.0)	232 (1.0)	163 (0.7)
Z1 CITIEFFE	383 (0.5)	27 (0.1)	1 (0.0)
FITMORE B ZIMMER	93 (0.1)	44 (0.2)	270 (1.1)
MISTRAL SAMO	212 (0.3)	175 (0.7)	14 (0.1)
DUOFIT RKT Samo	348 (0.4)	43 (0.2)	2 (0.0)
TAPERLOC COMPLETE REDUCED DISTAL BIOMET	27 (0.0)	152 (0.6)	214 (0.9)
QUADRA-H MEDACTA	268 (0.3)	23 (0.1)	82 (0.3)
HIPSTAR HOWMEDICA	337 (0.4)	0 (0.0)	0 (0.0)
ABG Howmedica	332 (0.4)	0 (0.0)	0 (0.0)
SPS MODULAR SYMBIOS	332 (0.4)	0 (0.0)	0 (0.0)
DUOFIT RTT SAMO	318 (0.4)	11 (0.0)	0 (0.0)
TRIFIT TS CORIN	2 (0.0)	40 (0.2)	280 (1.1)
EHS Cremascoli	312 (0.4)	0 (0.0)	0 (0.0)
PROXILOCK FT Stratec	304 (0.4)	0 (0.0)	0 (0.0)
CONELock SHORT BIOMET	301 (0.4)	0 (0.0)	0 (0.0)
Other (models with less than 300 cases)	7081 (8.5)	1758 (7.4)	1827 (7.3)
Unknown	42	4	9
¹ n (%)			

<u>Unknown stem cementation</u>	2000-2015, N =	2016-2018, N =	2019-2021, N =
	192 ¹	61 ¹	80 ¹
Unknown	192	61	80
¹ n (%)			

4.4 Stems used in total revision surgery

Stems in total revision surgery			
<u>Cemented stem</u>	2000-2015, N =	2016-2018, N =	2019-2021, N =
	530 ¹	= 53 ¹	70 ¹
EXETER V40 Howmedica	66 (12.7)	4 (7.7)	4 (5.8)
APTA CEM ADLER	35 (6.7)	2 (3.8)	7 (10.1)
VERSYS REVISION CALCAR ZIMMER	24 (4.6)	4 (7.7)	16 (23.2)
JVC Cremascoli	32 (6.1)	0 (0.0)	0 (0.0)
AD Samo	29 (5.6)	1 (1.9)	0 (0.0)
ANCA Cremascoli	25 (4.8)	0 (0.0)	0 (0.0)

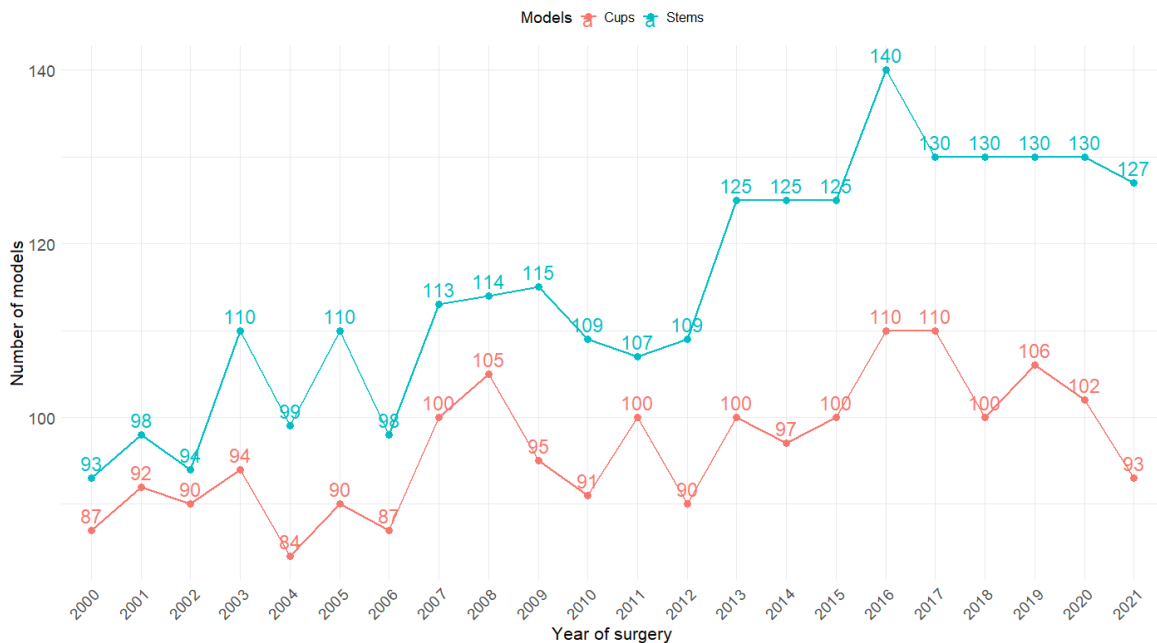
Altro (models with less than 20 cases)	310 (59.5)	41 (78.8)	42 (60.9)
Unknown	9	1	1
¹ n (%)			

<u>Uncemented stem</u>	2000-2015, N =	2016-2018, N =	2019-2021, N =
	3475 ¹	= 488 ¹	418 ¹
SL REVISION Sulzer	636 (18.5)	73 (15.0)	56 (13.4)
REVISION HIP LIMA	252 (7.3)	130 (26.7)	140 (33.5)
PROFEMUR R VERS. 4 Cremascoli	414 (12.1)	0 (0.0)	0 (0.0)
ALATA AEQUA REVISION ADLER	244 (7.1)	84 (17.2)	36 (8.6)
RESTORATION HOWMEDICA	301 (8.8)	14 (2.9)	2 (0.5)
S. ROM Johnson e Johnson	147 (4.3)	0 (0.0)	0 (0.0)
ALATA ACUTA S ADLER	100 (2.9)	24 (4.9)	19 (4.5)
CONELock REVISION BIOMET	137 (4.0)	0 (0.0)	0 (0.0)
MGS SAMO	122 (3.6)	1 (0.2)	0 (0.0)
MP RECONSTRUCTION	69 (2.0)	6 (1.2)	7 (1.7)
PROSTHESIS LINK			
RESTORATION T3 HOWMEDICA	74 (2.2)	0 (0.0)	0 (0.0)
MODULUS LIMA	58 (1.7)	9 (1.8)	5 (1.2)
C2 LIMA	65 (1.9)	1 (0.2)	1 (0.2)
ANCA FIT Cremascoli	59 (1.7)	0 (0.0)	0 (0.0)
RECLAIM DEPUY	33 (1.0)	14 (2.9)	6 (1.4)
CONUS Sulzer	52 (1.5)	0 (0.0)	0 (0.0)
REDAPT SMITH AND NEPHEW	0 (0.0)	12 (2.5)	39 (9.3)
ZMR REVISION TAPER CONE	51 (1.5)	0 (0.0)	0 (0.0)
ZIMMER			
CLS Sulzer	46 (1.3)	2 (0.4)	2 (0.5)
CONUS CENTERPULSE	39 (1.1)	6 (1.2)	4 (1.0)
SL PLUS ENDOPLUS	40 (1.2)	0 (0.0)	0 (0.0)
APTA ADLER NON CEM	30 (0.9)	6 (1.2)	2 (0.5)
SLR PLUS ENDOPLUS	31 (0.9)	0 (0.0)	1 (0.2)
ZMR REVISION TAPER ZIMMER	30 (0.9)	0 (0.0)	0 (0.0)
ADR ENDOPLUS	25 (0.7)	4 (0.8)	0 (0.0)
EMPERION SMITH AND NEPHEW	23 (0.7)	0 (0.0)	0 (0.0)
PM PROMOTION PERMEDICA	4 (0.1)	9 (1.8)	10 (2.4)
VERSYS FIBER METAL TAPER	22 (0.6)	0 (0.0)	1 (0.2)
Zimmer			
H-MAX S LIMA	3 (0.1)	2 (0.4)	16 (3.8)
CBC MATHYS	20 (0.6)	0 (0.0)	0 (0.0)
CBK REVISION MATHYS	20 (0.6)	0 (0.0)	0 (0.0)
Other (models with less than 20 cases)	288 (8.4)	90 (18.5)	71 (17.0)
Unknown	40	1	0
¹ n (%)			

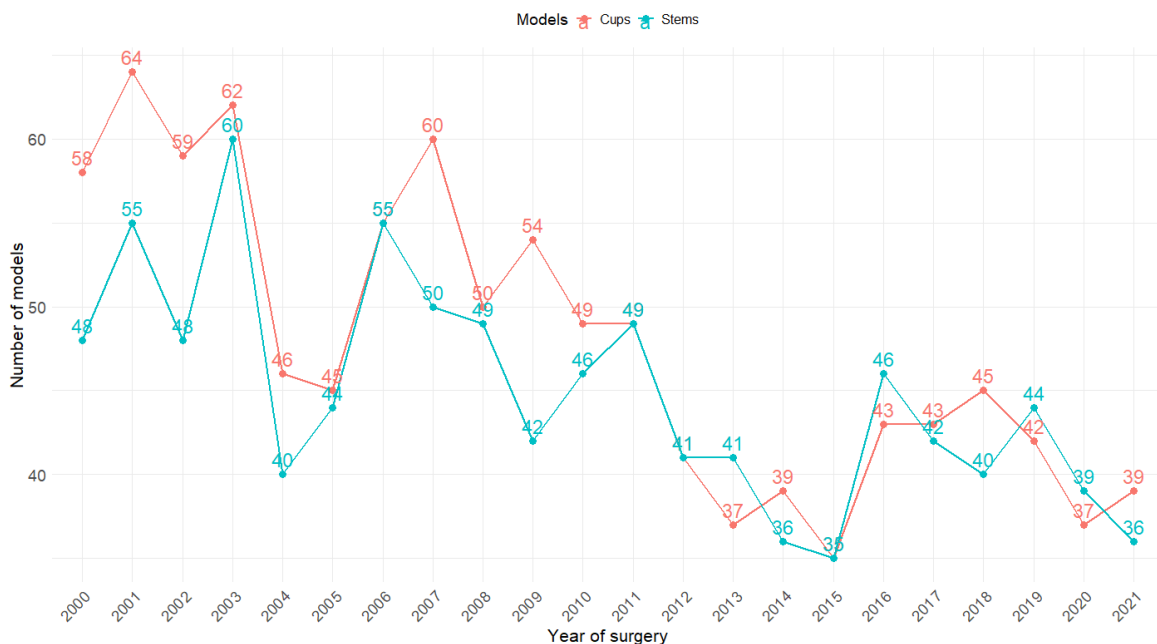
<u>Unknown stem cementation</u>	2000-2015, N =	2016-2018, N =	2019-2021, N =
	9 ¹	8 ¹	4 ¹
Unknown	9	8	4
¹ n (%)			

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**



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



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

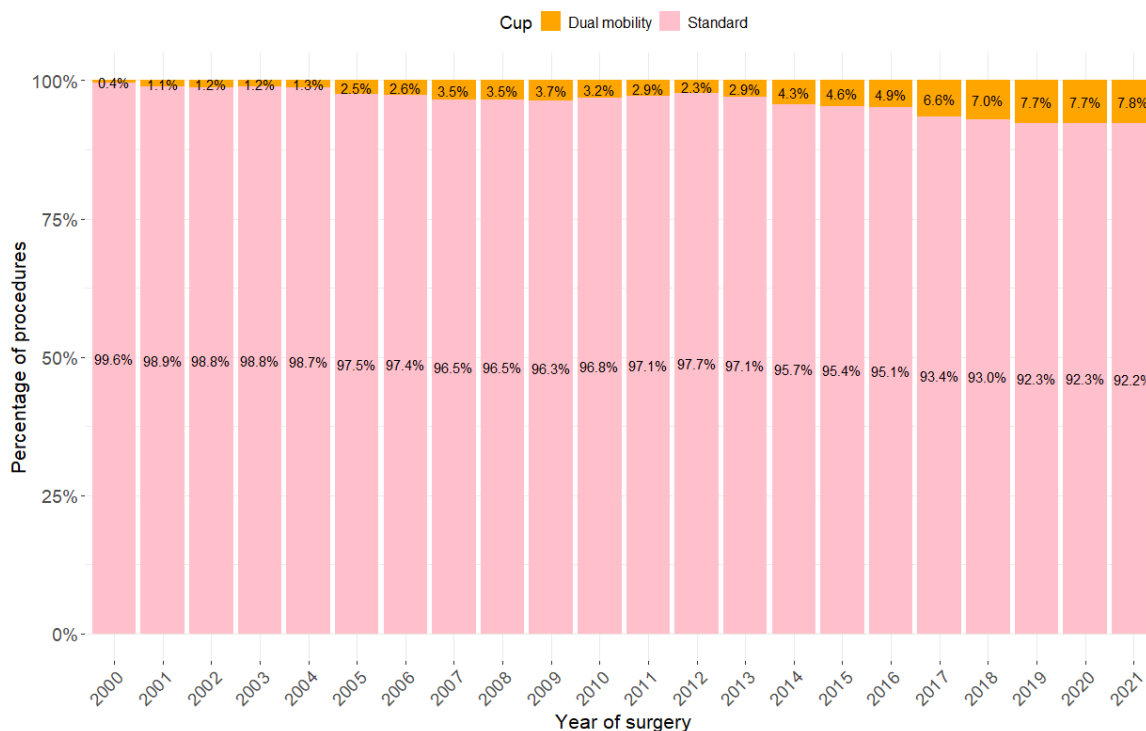


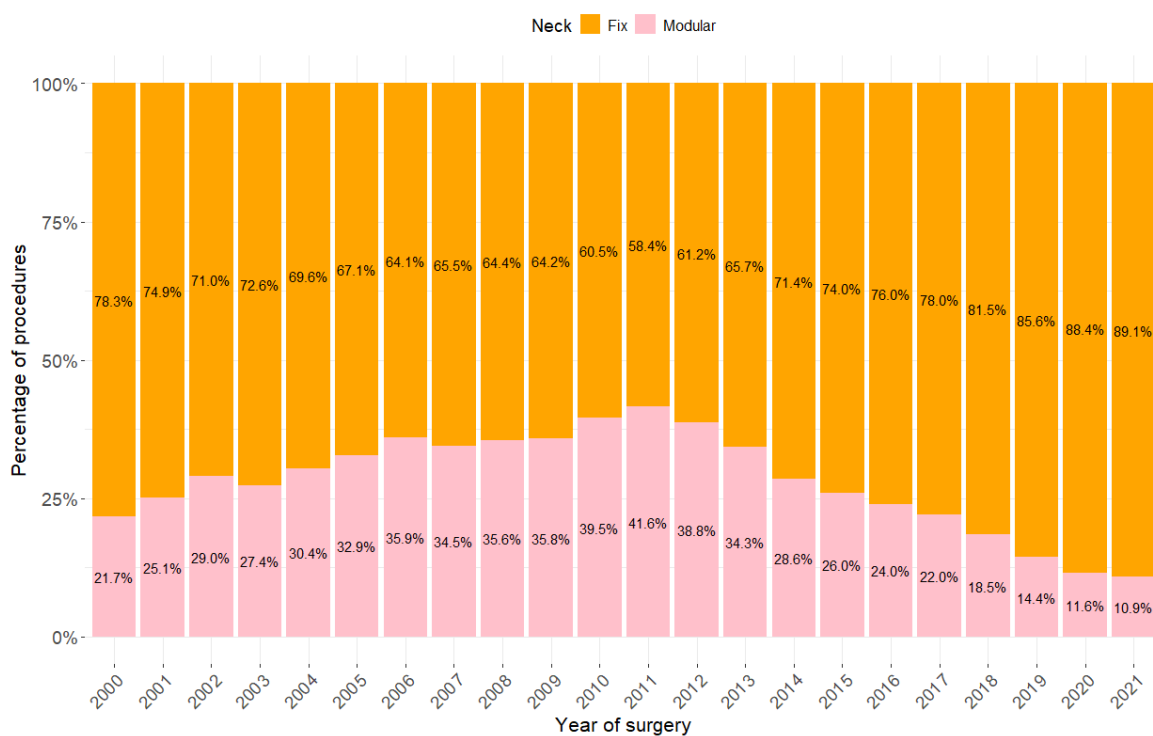
Table below shows most used types of dual mobility cups

Dual mobility cup in THA			
Types of dual mobility cups	2000-2015, N = 2627 ¹	2016-2018, N = 1523 ¹	2019-2021, N = 2031 ¹
GYROS DEPUY	51 (1.9)	294 (19.3)	161 (8.0)
AVANTAGE RELOAD BIOMET	437 (16.7)	22 (1.4)	7 (0.3)
FIXA DUPLEX ADLER	1 (0.0)	99 (6.5)	316 (15.6)
TRIDENT PLS HA CLUSTER Howmedica	101 (3.8)	146 (9.6)	129 (6.4)
POLARCUP TI-PLASMA ORTHO-ID	154 (5.9)	86 (5.7)	131 (6.5)
DUALIS BIOIMPIANTI	12 (0.5)	174 (11.4)	154 (7.6)
EASY HIT MEDICA	312 (11.9)	0 (0.0)	0 (0.0)
AVANTAGE BIOMET	300 (11.4)	0 (0.0)	0 (0.0)
QUATTRO VPS PF HAP PNP GROUPE LEPINE	0 (0.0)	141 (9.3)	148 (7.3)
ACORN PERMEDICA	5 (0.2)	78 (5.1)	149 (7.4)
FIXA TI-POR ADLER	0 (0.0)	15 (1.0)	173 (8.5)
JUMP SYSTEM TRASER PERMEDICA	0 (0.0)	53 (3.5)	113 (5.6)
VERSAFITCUP DM MEDACTA	122 (4.6)	22 (1.4)	8 (0.4)
AVANTAGE 3P BIOMET	144 (5.5)	1 (0.1)	0 (0.0)
DMX TRANSYSTEME	100 (3.8)	24 (1.6)	0 (0.0)
AVANTAGE CEMENTED BIOMET	94 (3.6)	7 (0.5)	19 (0.9)
MOBILIS I OTHESIO	114 (4.3)	0 (0.0)	0 (0.0)

G7 OSSEO TI BIOMET	0 (0.0)	4 (0.3)	93 (4.6)
DELTA TT LIMA	16 (0.6)	22 (1.4)	58 (2.9)
NOVAE E TH SERF	67 (2.6)	19 (1.3)	4 (0.2)
QUATTRO VPS PF HAP GROUPE LEPINE	62 (2.4)	27 (1.8)	0 (0.0)
C2M PF SYMBIOS	82 (3.1)	0 (0.0)	0 (0.0)
TRITANIUM HEMISPHERICAL STRYKER	29 (1.1)	45 (3.0)	6 (0.3)
ORTHOPAEDICS			
POLARCUP ORTHO-ID	73 (2.8)	1 (0.1)	0 (0.0)
TRIDENT II TRITANIUM CLUSTER	0 (0.0)	1 (0.1)	70 (3.5)
STRYKER ORTHOPAEDICS			
G7 PPS BIOMET	0 (0.0)	5 (0.3)	44 (2.2)
POLARCUP TI-PLASMA ENDOPLUS	49 (1.9)	0 (0.0)	0 (0.0)
ADES DEDIENNE SANTE	19 (0.7)	28 (1.8)	0 (0.0)
POLARCUP CEMENTED SMITH AND	30 (1.1)	10 (0.7)	3 (0.1)
NEPHEW			
TRIDENT HEMI. HA SOLID STRYKER	0 (0.0)	19 (1.3)	24 (1.2)
ORTHOPAEDICS			
DMX CEMENTED TRANSYSTEME	31 (1.2)	2 (0.1)	0 (0.0)
STAFIT ZIMMER	30 (1.1)	0 (0.0)	0 (0.0)
Other (less than 30 procedures)	189 (7.2)	175 (11.5)	215 (10.6)
Unknown	3	3	6
¹ n (%)			

4.7 Modular neck

Percentage distribution of conventional primary total denture implants with fixed or modular neck stem over the years.

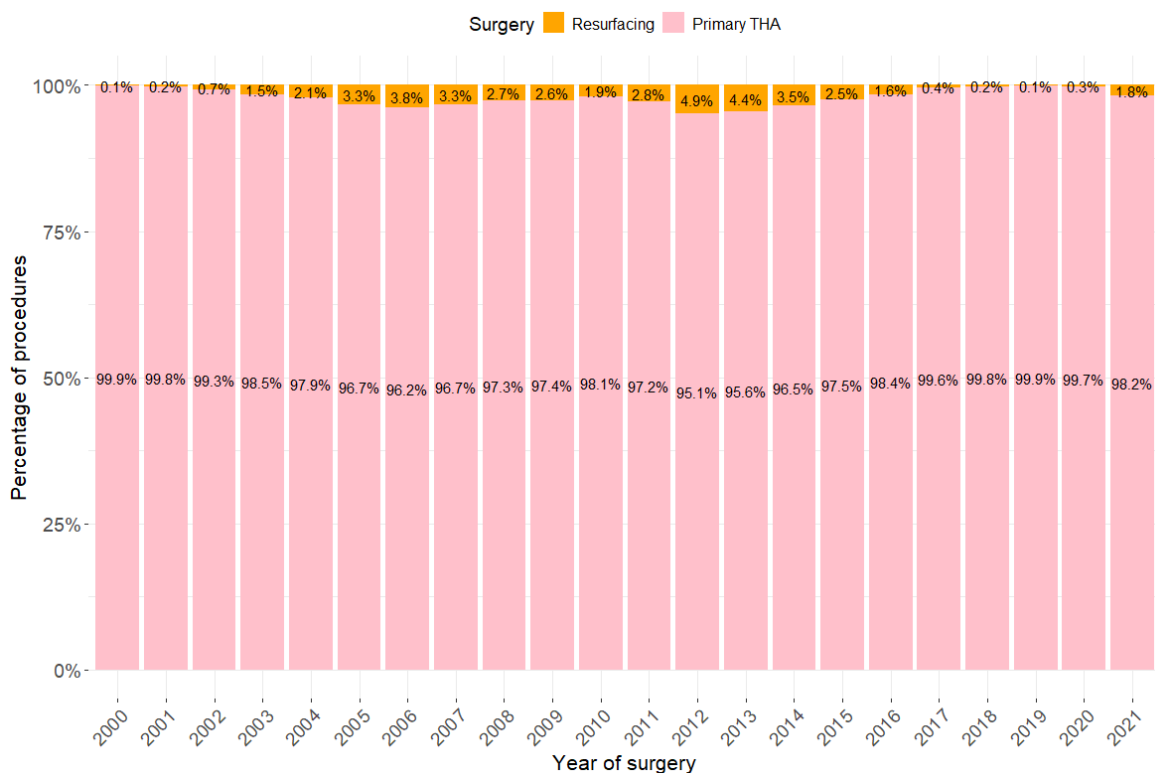


In the following table types of stems with proximal modularity more present in database.

Proximal modularity in THA			
Models	2000-2015, N = 31450¹	2016-2018, N = 5262¹	2019-2021, N = 3241¹
APTA ADLER NON CEM	9135 (29.1)	1619 (30.8)	493 (15.2)
HYDRA ADLER	3074 (9.8)	1736 (33.0)	1499 (46.3)
RECTA ADLER	5255 (16.7)	552 (10.5)	499 (15.4)
ANCA FIT Cremascoli	4507 (14.3)	0 (0.0)	0 (0.0)
ALATA ACUTA S ADLER	1034 (3.3)	365 (6.9)	156 (4.8)
MODULUS LIMA	928 (3.0)	243 (4.6)	205 (6.3)
APTA CEM ADLER	1173 (3.7)	57 (1.1)	67 (2.1)
JVC Cremascoli	728 (2.3)	0 (0.0)	0 (0.0)
PROFEMUR Z CREMASCOLI	712 (2.3)	0 (0.0)	0 (0.0)
SAM-FIT LIMA	436 (1.4)	82 (1.6)	13 (0.4)
Other (less than 50 procedures)	289 (0.9)	122 (2.3)	95 (2.9)
PARVA ADLER	399 (1.3)	59 (1.1)	4 (0.1)
MULTIFIT SAMO	386 (1.2)	51 (1.0)	10 (0.3)
SPS MODULAR SYMBIOS	332 (1.1)	0 (0.0)	0 (0.0)
ANCA-FIT CLU Cremascoli	314 (1.0)	0 (0.0)	0 (0.0)
EHS Cremascoli	311 (1.0)	0 (0.0)	0 (0.0)
CLS BREVIUS ZIMMER	253 (0.8)	35 (0.7)	0 (0.0)
H-MAX M LIMA	208 (0.7)	64 (1.2)	11 (0.3)
PULCHRA ADLER	88 (0.3)	95 (1.8)	46 (1.4)
STEM CREMASCOLI	211 (0.7)	0 (0.0)	0 (0.0)
HARMONY MODULAR SYMBIOS	192 (0.6)	2 (0.0)	0 (0.0)
S. ROM Johnson e Johnson	180 (0.6)	8 (0.2)	2 (0.1)
G3 CITIEFFE	179 (0.6)	0 (0.0)	0 (0.0)
REVISION HIP LIMA	51 (0.2)	43 (0.8)	59 (1.8)
HYDRA CEM ADLER	69 (0.2)	25 (0.5)	38 (1.2)
VITAE ADLER	131 (0.4)	0 (0.0)	0 (0.0)
MBA HAP GROUPE LEPINE	128 (0.4)	0 (0.0)	0 (0.0)
ALATA AEQUA REVISION	48 (0.2)	32 (0.6)	36 (1.1)
ADLER			
SMF SMITH AND NEPHEW	115 (0.4)	0 (0.0)	0 (0.0)
MERCURIUS ADLER	112 (0.4)	0 (0.0)	0 (0.0)
PROFEMUR L MICROPORT	99 (0.3)	1 (0.0)	0 (0.0)
MINIFIT SAMO	23 (0.1)	67 (1.3)	7 (0.2)
MBA GROUPE LEPINE	88 (0.3)	0 (0.0)	0 (0.0)
PROFEMUR C CREMASCOLI	87 (0.3)	0 (0.0)	0 (0.0)
STELO MODULARE NDS1	77 (0.2)	0 (0.0)	0 (0.0)
CITIEFFE			
ABGII MODULAR	66 (0.2)	0 (0.0)	0 (0.0)
HOWMEDICA			
Unknown	32	4	1
¹ n (%)			

4.8 Resurfacing arthroplasty

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



Resurfacing arthroplasty used between 1st January 2000 and 31st December 2021

Resurfacing models	2000-2015, N =	2016-2018, N =	2019-2021, N =
	2642 ¹	170 ¹	213 ¹
BHR – Smith & Nephew	1640 (62.1)	161 (94.7)	206 (96.7)
ADEPT – Finsbury	437 (16.5)	0 (0.0)	5 (2.3)
BMHR* – Smith & Nephew	198 (7.5)	0 (0.0)	0 (0.0)
MITCH TRH – Finsbury	89 (3.4)	0 (0.0)	0 (0.0)
ASR – DePuy	77 (2.9)	0 (0.0)	0 (0.0)
RECAP – Biomet	65 (2.5)	0 (0.0)	0 (0.0)
MRS* – Lima	45 (1.7)	0 (0.0)	0 (0.0)
ROMAX – Medacta	33 (1.2)	0 (0.0)	0 (0.0)
CONSERVE PLUS – Wright	22 (0.8)	9 (5.3)	0 (0.0)
ICON – International Orthopaedics	21 (0.8)	0 (0.0)	0 (0.0)
DUROM Hip Resurfacing – Zimmer	8 (0.3)	0 (0.0)	0 (0.0)
WAGNER METASUL - Protek	3 (0.1)	0 (0.0)	0 (0.0)
CUSTOM MADE - Adler-Ortho	0 (0.0)	0 (0.0)	2 (0.9)
ACCIS - Implantcast	1 (0.0)	0 (0.0)	0 (0.0)
CORMET – Corin	1 (0.0)	0 (0.0)	0 (0.0)
TRIBOFIT – Active Implants	1 (0.0)	0 (0.0)	0 (0.0)
Unknown	1	0	0

¹ n (%)

* Considered similar to resurfacing

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 2021, according to the **type of operation** and **articular coupling**. **Dual mobility** cups are **excluded**.

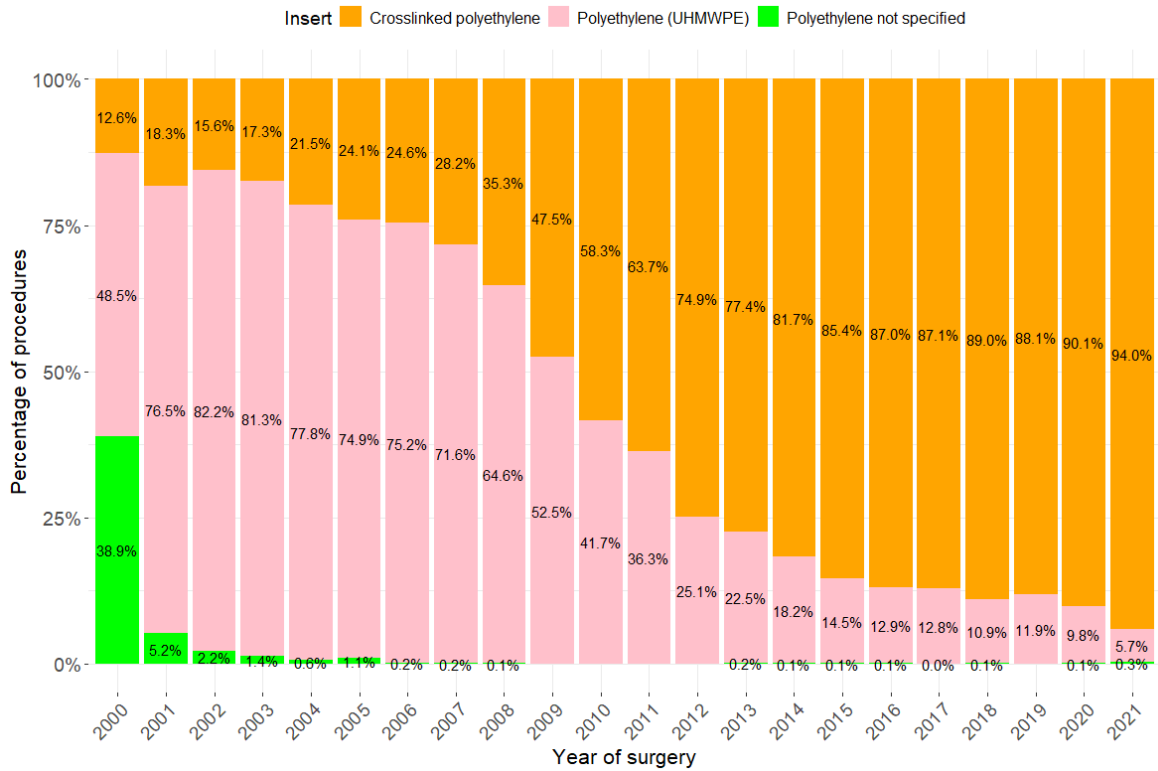
Polyethylene has been called cross-linked (XLPE) from Manufacturer Company directions.

Articular coupling (head-liner)	Primary THA, N = 140737¹	Tota, N = 4709¹
Composite Ceramic-Composite Ceramic	50351 (35.9)	860 (18.4)
Composite Ceramic-XLPE	18967 (13.5)	652 (13.9)
Metal-UHMWPE	13769 (9.8)	785 (16.8)
Alumina-Alumina	11035 (7.9)	327 (7.0)
Alumina-UHMWPE	9251 (6.6)	610 (13.0)
Metal-XLPE	7952 (5.7)	573 (12.2)
Composite Ceramic-XLPE+Vit.E	7209 (5.1)	97 (2.1)
Metal-Metal	5409 (3.9)	93 (2.0)
Ceramicised Metal-XLPE	3713 (2.6)	54 (1.2)
Alumina-XLPE	1861 (1.3)	128 (2.7)
Composite Ceramic-UHMWPE	1842 (1.3)	88 (1.9)
Alumina-Composite Ceramic	1818 (1.3)	58 (1.2)
Composite Ceramic-Alumina	1350 (1.0)	12 (0.3)
Alumina-undefined Poly*	909 (0.6)	87 (1.9)
Metal-Uhmwpe+Metal	886 (0.6)	6 (0.1)
Alumina-Uhmwpe+Alumina	773 (0.6)	13 (0.3)
Other (less than 100 procedures)	471 (0.3)	76 (1.6)
Revision Composite Ceramic-Composite Ceramic	511 (0.4)	16 (0.3)
Ceramicised Metal-UHMWPE	429 (0.3)	21 (0.4)
Metal- undefined Poly*	329 (0.2)	49 (1.0)
Alumina-Metal+Alumina	300 (0.2)	59 (1.3)
Zirconia Ceramic-XLPE+Vit. E	326 (0.2)	0 (0.0)
Composite Ceramic-Metal+ XLPE+Vit.E	309 (0.2)	0 (0.0)
Zirconia Ceramic -UHMWPE	206 (0.1)	18 (0.4)
Composite Ceramic-Metal	222 (0.2)	0 (0.0)
Unknown	539	27

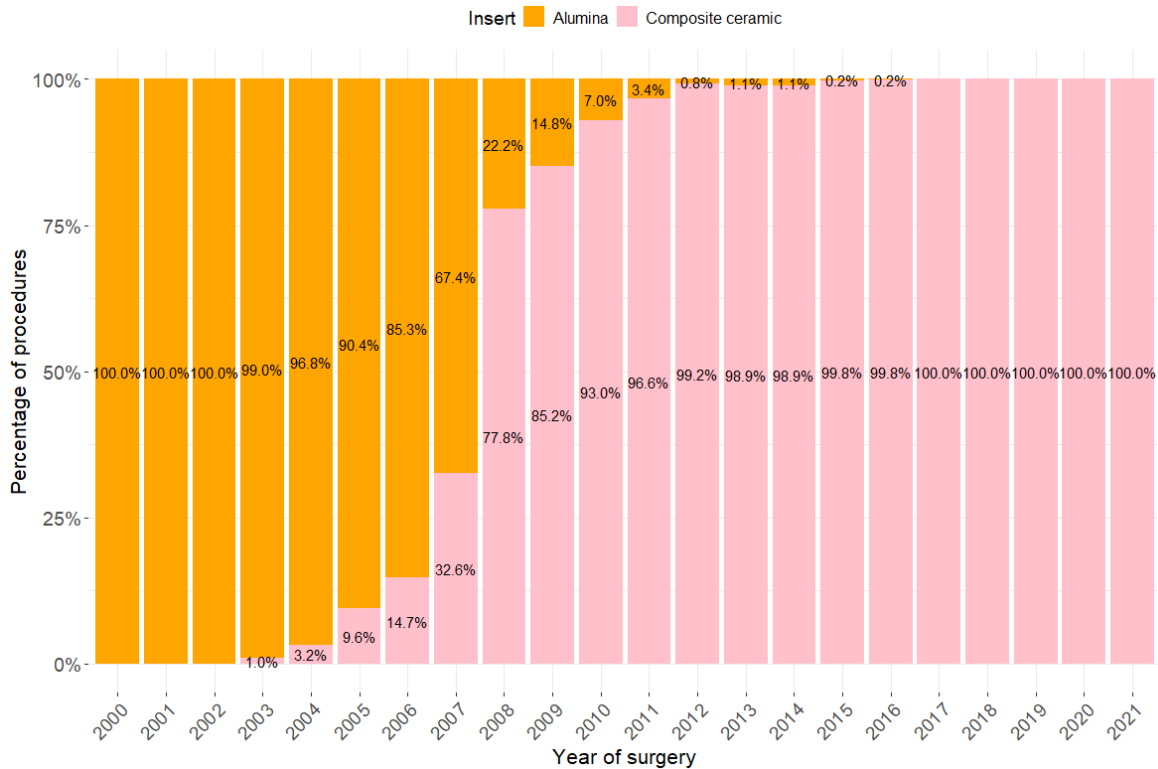
¹ n (%)

*missing label did not allow classification of poly

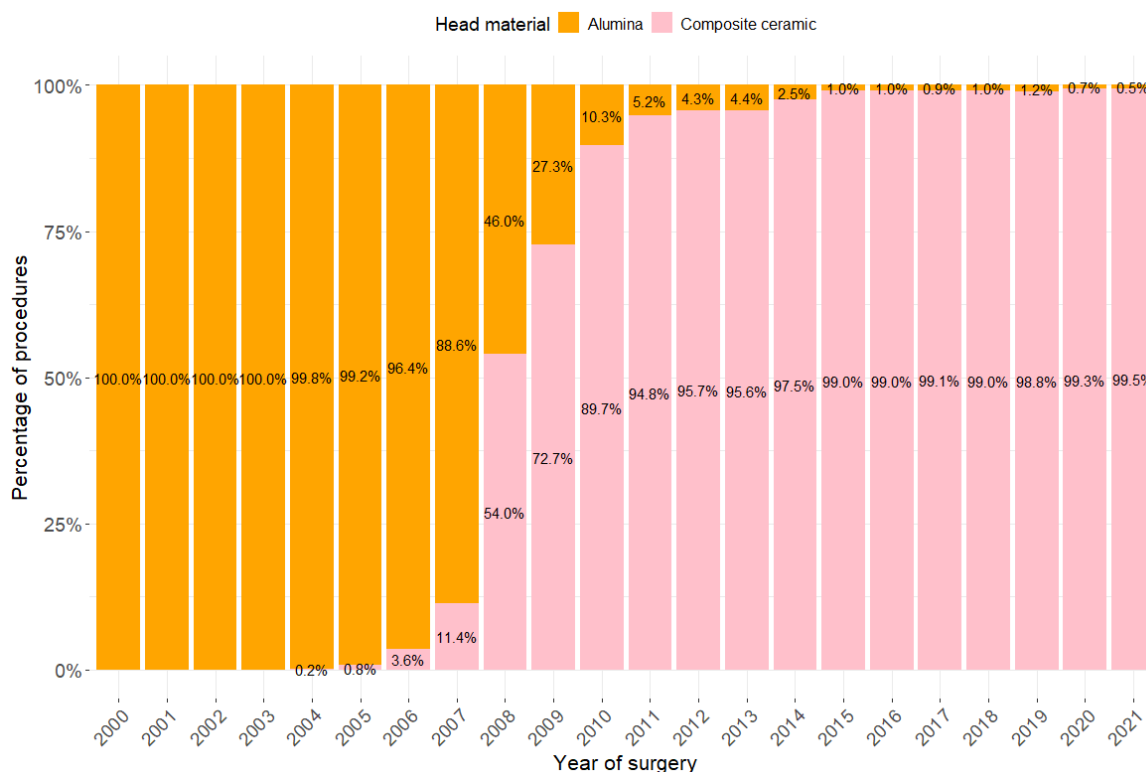
Percentage of total hip arthroplasty interventions between 2001 and 2020, according to the **type of polyethylene** used. All types of poly (with or without **anti-luxation lip**, constrained) are considered.



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



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



Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2021, according to **material** and **diameter of the head**

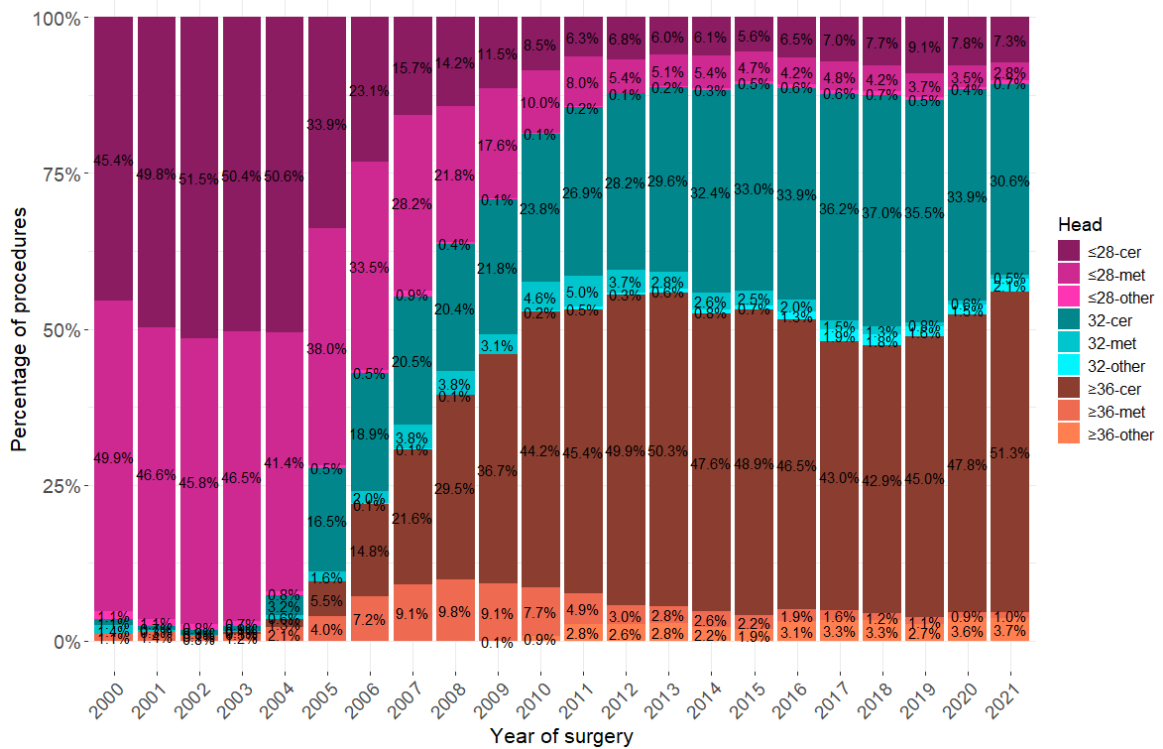
Diameter of head	22, N = 1200 [†]	26, N = 30 [†]	28, N = 47922 [†]	32, N = 39943 [†]	36, N = 48488 [†]	≥38, N = 9038 [†]	Unknown, N = 297 [†]
Alumina	1 (0.1)	0 (0.0)	17666 (36.9)	5360 (13.4)	3512 (7.2)	1 (0.0)	30 (55.6)
Composite ceramic	0 (0.0)	0 (0.0)	6333 (13.2)	30344 (76.0)	39757 (82.1)	5896 (65.3)	1 (1.9)
Revision ceramic	0 (0.0)	0 (0.0)	15 (0.0)	26 (0.1)	15 (0.0)	531 (5.9)	0 (0.0)
Cr-Co	1013 (84.8)	24 (80.0)	19218 (40.2)	2785 (7.0)	2445 (5.0)	2496 (27.6)	23 (42.6)
Inox	167 (14.0)	5 (16.7)	3537 (7.4)	203 (0.5)	32 (0.1)	0 (0.0)	0 (0.0)
Ceramicised Metal	13 (1.1)	0 (0.0)	556 (1.2)	1093 (2.7)	2469 (5.1)	31 (0.3)	0 (0.0)
Surface-treated metal	0 (0.0)	0 (0.0)	180 (0.4)	0 (0.0)	0 (0.0)	78 (0.9)	0 (0.0)
Zirconia	1 (0.1)	1 (3.3)	321 (0.7)	106 (0.3)	215 (0.4)	0 (0.0)	0 (0.0)
Unknown	5	0	96	26	43	5	243

¹ n (%)

Year of surgery	Mat. testina	Diameter of the head (mm) in THA								
		≤28, N = 49051			32, N = 39917			≥36, N = 57478		
		cer, N = 24338	met, N = 23964 ¹	altro, N = 749	cer, N = 35836	met, N = 2988	altro, N = 1093	cer, N = 49927	met, N = 4973	altro, N = 2578
2000	1986 (45.4)	2181 (49.9)	50 (1.1)	47 (1.1)	60 (1.4)	0 (0.0)	0 (0.0)	49 (1.1)	0 (0.0)	
2001	2294 (49.8)	2148 (46.6)	50 (1.1)	31 (0.7)	16 (0.3)	0 (0.0)	0 (0.0)	66 (1.4)	0 (0.0)	
2002	2392 (51.5)	2128 (45.8)	39 (0.8)	40 (0.9)	5 (0.1)	0 (0.0)	0 (0.0)	38 (0.8)	0 (0.0)	
2003	2543 (50.4)	2345 (46.5)	36 (0.7)	44 (0.9)	4 (0.1)	0 (0.0)	16 (0.3)	60 (1.2)	0 (0.0)	
2004	2711 (50.6)	2218 (41.4)	41 (0.8)	170 (3.2)	34 (0.6)	0 (0.0)	70 (1.3)	115 (2.1)	0 (0.0)	
2005	1877 (33.9)	2104 (38.0)	26 (0.5)	916 (16.5)	88 (1.6)	0 (0.0)	305 (5.5)	220 (4.0)	0 (0.0)	
2006	1347 (23.1)	1953 (33.5)	29 (0.5)	1099 (18.9)	115 (2.0)	7 (0.1)	861 (14.8)	419 (7.2)	0 (0.0)	
2007	982 (15.7)	1767 (28.2)	59 (0.9)	1283 (20.5)	240 (3.8)	9 (0.1)	1356 (21.6)	569 (9.1)	0 (0.0)	
2008	905 (14.2)	1383 (21.8)	25 (0.4)	1295 (20.4)	239 (3.8)	7 (0.1)	1877 (29.5)	625 (9.8)	0 (0.0)	
2009	770 (11.5)	1178 (17.6)	7 (0.1)	1458 (21.8)	211 (3.1)	0 (0.0)	2462 (36.7)	612 (9.1)	5 (0.1)	
2010	563 (8.5)	660 (10.0)	6 (0.1)	1568 (23.8)	304 (4.6)	10 (0.2)	2914 (44.2)	505 (7.7)	57 (0.9)	
2011	405 (6.3)	513 (8.0)	13 (0.2)	1731 (26.9)	322 (5.0)	30 (0.5)	2919 (45.4)	315 (4.9)	177 (2.8)	
2012	444 (6.8)	354 (5.4)	4 (0.1)	1856 (28.2)	243 (3.7)	19 (0.3)	3278 (49.9)	199 (3.0)	174 (2.6)	
2013	403 (6.0)	340 (5.1)	13 (0.2)	1989 (29.6)	186 (2.8)	38 (0.6)	3381 (50.3)	185 (2.8)	191 (2.8)	
2014	437 (6.1)	386 (5.4)	22 (0.3)	2326 (32.4)	186 (2.6)	56 (0.8)	3417 (47.6)	187 (2.6)	155 (2.2)	
2015	420 (5.6)	356 (4.7)	34 (0.5)	2492 (33.0)	187 (2.5)	50 (0.7)	3687 (48.9)	168 (2.2)	147 (1.9)	
2016	498 (6.5)	324 (4.2)	46 (0.6)	2589 (33.9)	150 (2.0)	96 (1.3)	3551 (46.5)	147 (1.9)	240 (3.1)	

		Diameter of the head (mm) in THA								
		≤28, N = 49051			32, N = 39917			≥36, N = 57478		
Year of surgery	Mat. testina	cer, N =	met, N =	altro, N =	cer, N =	met, N =	altro, N =	cer, N =	met, N =	altro, N =
		24338	23964	749	35836	2988	2988	1093	49927	4973
2017		581 (7.0)	392 (4.8)	52 (0.6)	2982 (36.2)	122 (1.5)	157 (1.9)	3548 (43.0)	133 (1.6)	275 (3.3)
2018		668 (7.7)	360 (4.2)	57 (0.7)	3198 (37.0)	114 (1.3)	153 (1.8)	3702 (42.9)	102 (1.2)	283 (3.3)
2019		842 (9.1)	347 (3.7)	50 (0.5)	3291 (35.5)	70 (0.8)	147 (1.6)	4167 (45.0)	99 (1.1)	250 (2.7)
2020		596 (7.8)	265 (3.5)	28 (0.4)	2598 (33.9)	43 (0.6)	117 (1.5)	3662 (47.8)	71 (0.9)	279 (3.6)
2021		674 (7.3)	262 (2.8)	62 (0.7)	2833 (30.6)	49 (0.5)	197 (2.1)	4754 (51.3)	89 (1.0)	345 (3.7)

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



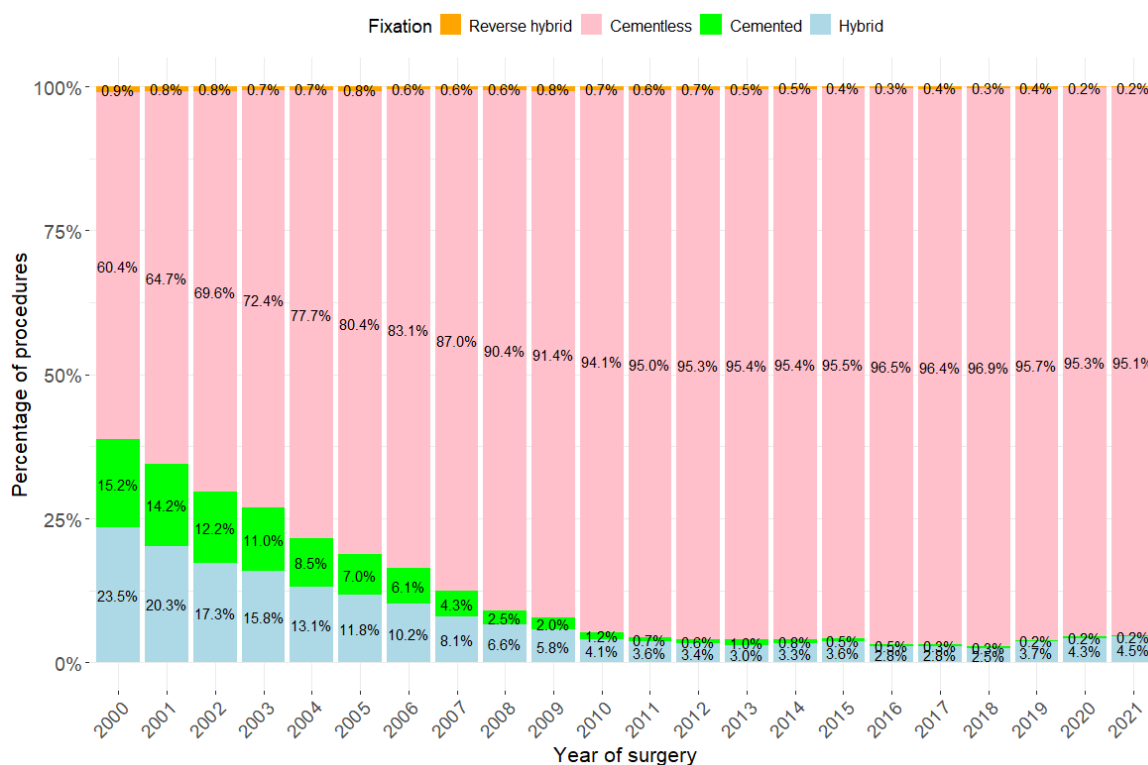
4.10 Prosthesis fixation

Number of hip arthroplasty operations on patients admitted between 1st January 2000 and 31st December 2021, according to **type of operation** and **fixation**

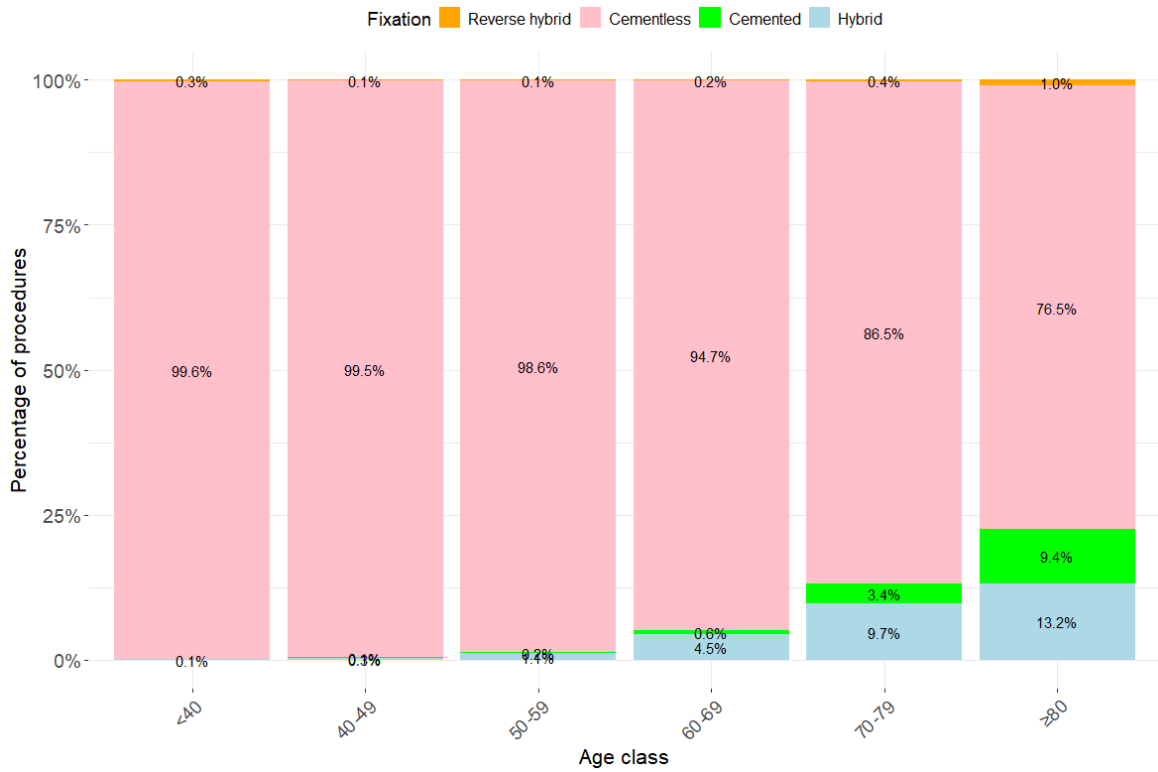
Fixation	Primary THA, N = 146918 ¹	Total revision, N = 5055 ¹
Cementless	131016 (89.4)	3776 (75.1)
Hybrid (cemented stem and cementless cup)	10026 (6.8)	408 (8.1)
Cemented	4695 (3.2)	243 (4.8)
Reverse hybrid (cementless stem and cemented cup)	777 (0.5)	600 (11.9)
Unknown	404	28

¹ n (%)

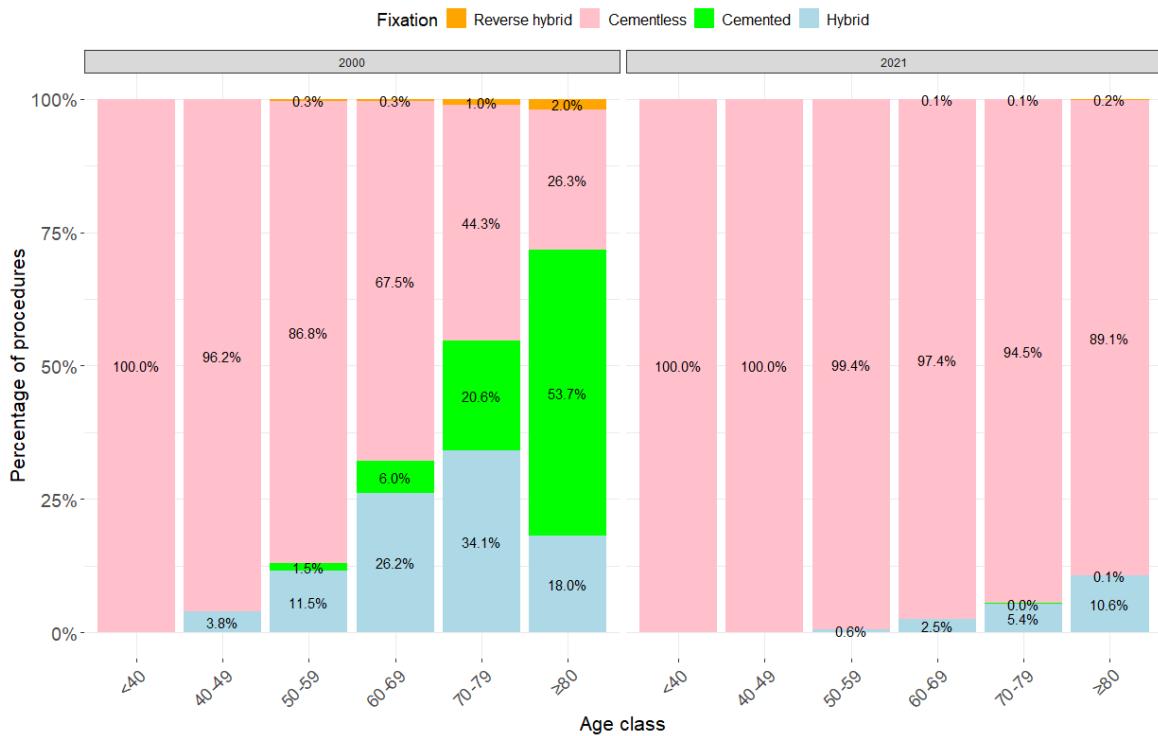
Percentage of **total hip arthroplasties** according to **fixation during the years 2000–2021**



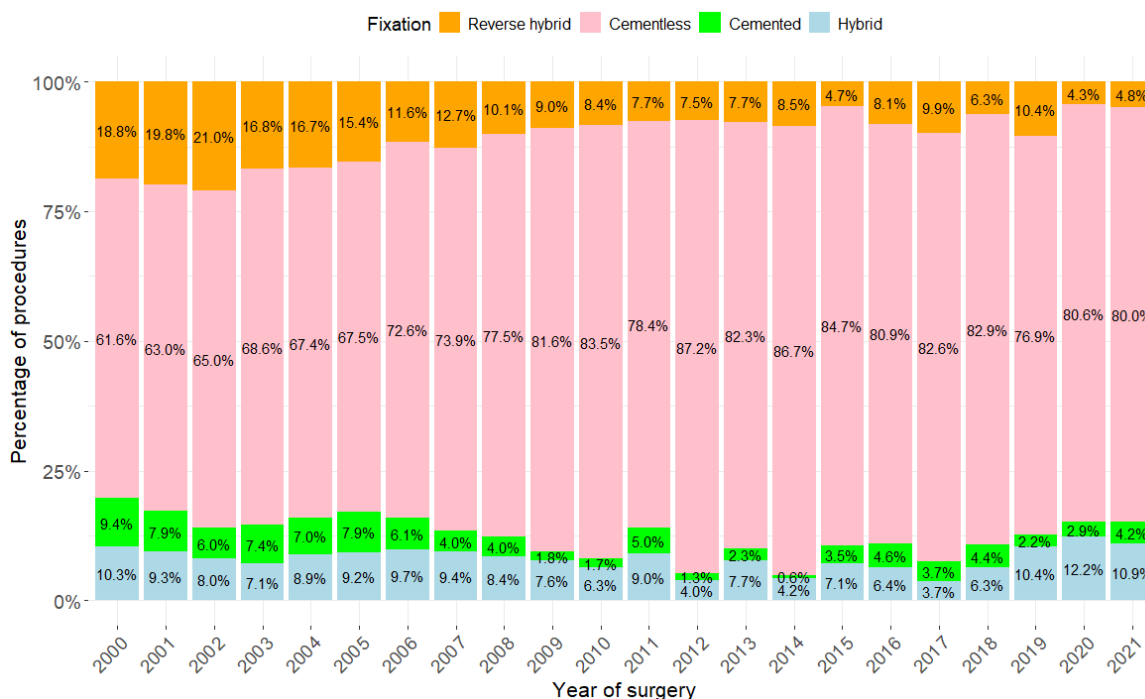
Percentage of total hip arthroplasties for **coxarthrosis** according to **fixation**, by **age of patient**



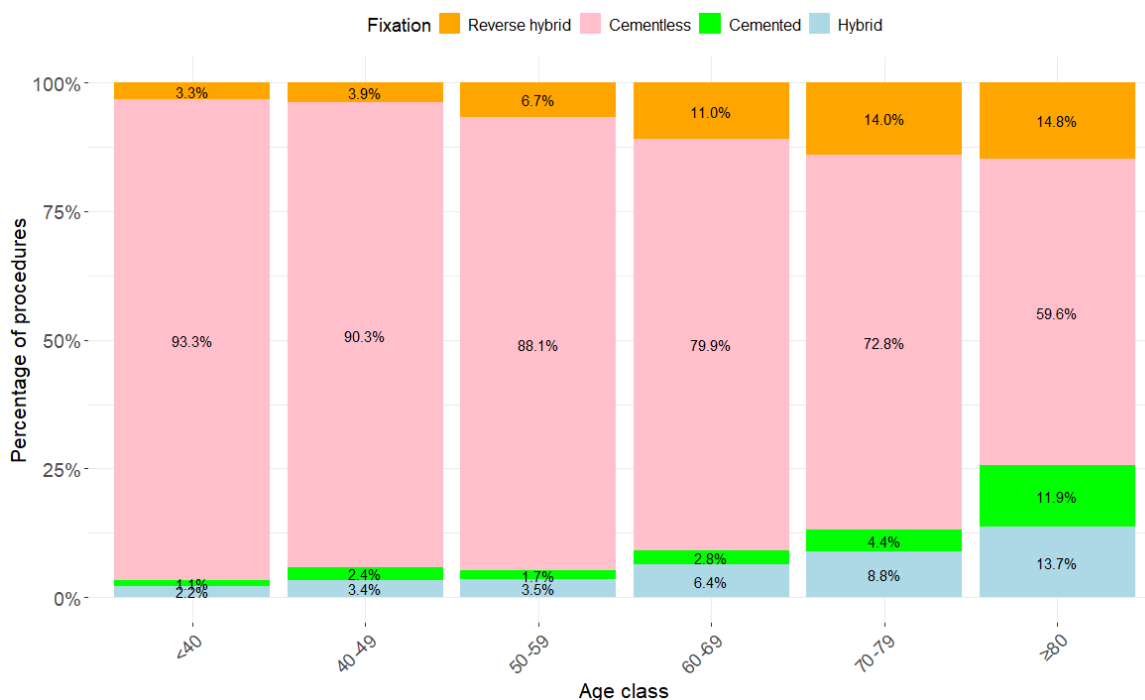
Percentage of total hip arthroplasties for **coxarthrosis** according to **fixation** and **class of age** – Comparison **2000-2021**



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



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



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 Hemiarthro plasties	% in Resurf.
Surgical Simplex P - Howmedica	33.6	35.0	32.1
Cemex System - Tecres	9.9	20.5	1.0
Smartset Hv - Depuy	6.4	8.3	2.2
Antibiotic Simplex - Howmedica	6.0	2.6	57.3
Cmw 3 - Depuy	4.8	0.7	0.0
Palacos R - Biomet	4.7	0.9	0.9
Amplicem 3 - Amplimedical	2.9	2.4	0.0
Smartset Mv - Depuy	2.2	6.2	0.0
Cemex Rx - Tecres	1.8	3.7	0.1
Palacos R - Heraeus Medical	1.8	3.3	0.1
Cemex + Cemex System - Tecres	1.6	0.0	0.0
Cemex - Tecres	1.5	1.1	0.1
Cemfix 1 - Teknimed	1.4	3.1	0.0
Exolent High - Elmdown	1.3	0.4	0.0
Cemex Rx + Cemex System - Tecres	1.2	0.0	0.0
Amplicem 1 + Amplicem 3 - Amplimedical	1.1	0.0	0.0
Cemex Sys. -Tecres+Surgical Simplex P-How	1.1	0.0	0.0
Amplicem1-Amplim.+Smartset Hv-Depuy	1.0	0.0	0.0
Vacu Mix Plus Cmw 3 - Depuy	1.0	3.1	0.0
<i>Versabond - Smith and Nephew</i>	1.0	0.0	1.9
Sulcem 3 - Centerpulse	0.9	0.7	0.0
Cemex Genta + Cemex Genta Sys.- Tecres	0.8	0.0	0.0
Palacos R+G - Heraeus Medical	0.7	0.9	0.0
Cemfix 3 - Teknimed	0.7	0.2	0.0
Aminofix 1 - Groupe Lepine	0.7	0.0	0.0
Refobacin Bone Cement R - Biomet	0.6	0.0	0.0
Bone Cement R - Biomet	0.6	0.1	0.7
Hi-Fatigue - Zimmer	0.6	0.0	0.5
Smartset GMV - Depuy	0.6	0.0	0.0
Cemex Genta - Tecres	0.5	0.3	0.0
Palacos R 40 - Sp Europe	0.5	0.1	0.0
Cemex Genta System - Tecres	0.4	1.6	0.9
Palacos LV + G - Heraeus Medical	0.3	0.7	0.0
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	0.3	0.0	0.1
Amplicem 3G - Amplimedical	0.2	0.0	0.0
Cemex XL - Tecres	0.2	0.4	0.0
Palamed G - Heraeus Medical	0.2	0.1	0.0
Osteobond - Zimmer	0.2	0.0	0.8
Smartset GHV - Depuy	0.2	0.0	0.0
Palamed - Heraeus Medical	0.1	0.8	0.1
Other without antibiotic	1.6	2.0	0.4
Other with antibiotic	1.5	0.6	0.3
Total	100.0	100.0	100.0

Antibiotic-loaded cement was chosen in 13.7% of THA, in 6.9% of hemi and in 59.0% of resurfacing. Surgical Simplex P – Howmedica in 2020-2021 was chosen in 17.5% of THA and in 30.7% of hemi with at least one cemented component.

5. Types of hemiarthroplasty

5.1 Hemiarthroplasty cup and stem

Monoblock	2000-2015, N = 112¹
THOMPSON CORIN	76 (67.9)
AUSTIN MOORE AMPLIMEDICAL	16 (14.3)
THOMPSON AMPLIMEDICAL	14 (12.5)
THOMPSON HOWMEDICA	4 (3.6)
THOMPSON BIOIMPIANTI	1 (0.9)
THOMPSON SURGIVAL	1 (0.9)
¹ n (%)	

Monoarticular	2000-2015, N = 425¹
TESTA ELLITTICA - Samo	422 (99.3)
Other	3 (0.7)
¹ n (%)	

Biarticular	2000-2015, N = 36484¹	2016-2018, N = 7079¹	2019-2021, N = 6656¹
JANUS BIOIMPIANTI	3825 (10.5)	2701 (38.5)	2678 (40.5)
C1 - Citieffe	6965 (19.2)	454 (6.5)	271 (4.1)
SPHERI-LOCK - Hit Medica	6081 (16.8)	77 (1.1)	0 (0.0)
TESTA BIARTICOLARE LOCK LIMA	2361 (6.5)	945 (13.5)	1002 (15.1)
UHR STRYKER ORTHOPAEDICS	3420 (9.4)	296 (4.2)	154 (2.3)
CUPOLA MOBILE MODULARE MICROPORT	1557 (4.3)	413 (5.9)	467 (7.1)
BI-POLAR DEPUY	2025 (5.6)	31 (0.4)	257 (3.9)
CUPOLA MOBILE BIARTICOLARE - Permedica	724 (2.0)	163 (2.3)	1195 (18.1)
TESTA BIPOLARE SAMO	178 (0.5)	1,402 (20.0)	256 (3.9)
ULTIMA MONK - Johnson+Johnson	1004 (2.8)	0 (0.0)	0 (0.0)
CUPOLA NEMAUSUS TRANSYSTEME	912 (2.5)	34 (0.5)	0 (0.0)
CUPOLA MOBILE ZIMMER	882 (2.4)	0 (0.0)	0 (0.0)
CUPOLA SEM - D.M.O.	731 (2.0)	0 (0.0)	0 (0.0)
CUPOLA BIPOLARE MATHYS	716 (2.0)	1 (0.0)	0 (0.0)
TESTA BIARTICOLARE - Lima	630 (1.7)	1 (0.0)	1 (0.0)
MODULAR BIPOLAR - Protek	612 (1.7)	0 (0.0)	0 (0.0)
BI-POLAR BIOMET	515 (1.4)	76 (1.1)	0 (0.0)
CENTRAX - Howmedica	543 (1.5)	0 (0.0)	0 (0.0)
CUPOLA BIPOLARE ZIMMER	460 (1.3)	14 (0.2)	21 (0.3)
CUPOLA MOBILE MEDACTA	194 (0.5)	47 (0.7)	154 (2.3)
SPHERIC AMPLITUDE	352 (1.0)	0 (0.0)	0 (0.0)
RETENTIVE MOBILE CUP - Cedior	292 (0.8)	0 (0.0)	1 (0.0)
TESTA BIPOLARE SMITH AND NEPHEW	170 (0.5)	94 (1.3)	16 (0.2)
BICENTRIC - Howmedica	236 (0.7)	0 (0.0)	0 (0.0)
SPHERI-LOCK LSM-MED	5 (0.0)	207 (2.9)	0 (0.0)
TESTA BIPOLARE -Amplimedical	193 (0.5)	0 (0.0)	0 (0.0)

CORON TANTUM	190 (0.5)	0 (0.0)	0 (0.0)
TANDEM INTL BIPOLAR SMITH AND NEPHEW	79 (0.2)	12 (0.2)	51 (0.8)
CUPOLA MOBILE BIBOP SYMBIOS	78 (0.2)	32 (0.5)	0 (0.0)
Other (less than 100 cases)	337 (0.9)	19 (0.3)	94 (1.4)
Unknown	217	60	38

¹ n (%)

Stem in hemiarthroplasties

Cemented stem	2000-2015, N =	2016-2018, N =	2019-2021, N =
	29804 ¹	4572 ¹	3847 ¹
AB CITIEFFE	6327 (21.3)	410 (9.0)	145 (3.8)
KORUS CEM BIOIMPIANTI	694 (2.3)	1278 (28.1)	1109 (28.9)
SL Cemented - Lima	1636 (5.5)	460 (10.1)	430 (11.2)
SPERI-SYSTEM II - Hit medica	2480 (8.4)	2 (0.0)	0 (0.0)
SL STREAKES - Hit Medica	1941 (6.5)	1 (0.0)	0 (0.0)
SL - Permedica	679 (2.3)	126 (2.8)	988 (25.7)
DUOFIT CKA SAMO	222 (0.7)	1234 (27.1)	221 (5.8)
G2 DEPUY	1507 (5.1)	0 (0.0)	0 (0.0)
EXETER V40 Howmedica	999 (3.4)	279 (6.1)	149 (3.9)
PROFEMUR GLADIATOR CEMENTED	350 (1.2)	381 (8.4)	437 (11.4)
MICROPORT			
APTA CEM ADLER	1034 (3.5)	2 (0.0)	0 (0.0)
ORTHO-FIT ZIMMER	830 (2.8)	0 (0.0)	0 (0.0)
STANDARD STRAIGHT ZIMMER	778 (2.6)	0 (0.0)	0 (0.0)
SL -Hit Medica	737 (2.5)	0 (0.0)	0 (0.0)
CORAIL CEMENTED DEPUY	577 (1.9)	3 (0.1)	76 (2.0)
CCA MATHYS	647 (2.2)	0 (0.0)	0 (0.0)
SEM II DMO	638 (2.2)	0 (0.0)	0 (0.0)
RELIANCE - Howmedica	623 (2.1)	0 (0.0)	0 (0.0)
LOGICA MIRROR LIMA	540 (1.8)	7 (0.2)	6 (0.2)
VERSYS LD/FX- Zimmer	546 (1.8)	0 (0.0)	0 (0.0)
FIN BIOIMPIANTI	526 (1.8)	0 (0.0)	0 (0.0)
JVC Cremascoli	481 (1.6)	0 (0.0)	0 (0.0)
S-TAPER MIRROR BIOIMPIANTI	430 (1.4)	0 (0.0)	0 (0.0)
LC - Samo	423 (1.4)	0 (0.0)	0 (0.0)
ULTIMA LX JOHNSON AND JOHNSON	317 (1.1)	0 (0.0)	0 (0.0)
AHS - Cremascoli	312 (1.1)	0 (0.0)	0 (0.0)
MRL - Cremascoli	270 (0.9)	0 (0.0)	0 (0.0)
LOGICA LIMA	249 (0.8)	0 (0.0)	0 (0.0)
DEFINITION Howmedica	240 (0.8)	0 (0.0)	0 (0.0)
VERSYS ADVOCATE ZIMMER	135 (0.5)	59 (1.3)	43 (1.1)
H-MAX C LIMA	1 (0.0)	98 (2.2)	114 (3.0)
EXETER Howmedica	181 (0.6)	0 (0.0)	0 (0.0)
QUADRA-C MEDACTA	177 (0.6)	0 (0.0)	1 (0.0)
C-STEM AMT DEPUY	171 (0.6)	0 (0.0)	0 (0.0)
SL - Amplimedical	158 (0.5)	0 (0.0)	0 (0.0)
ULTIMA STRAIGHT JOHNSON ANDJOHNSON	156 (0.5)	0 (0.0)	0 (0.0)
ALBI PTC - Cremascoli	149 (0.5)	0 (0.0)	0 (0.0)
VERSYS HERITAGE ZIMMER	140 (0.5)	0 (0.0)	0 (0.0)
SL STREAKES LSM-MED	2 (0.0)	107 (2.3)	0 (0.0)
Other (less than 100 cases)	1364 (4.6)	109 (2.4)	123 (3.2)
Unknown	137	16	5

Cementless stem	2000-2015, N =	2016-2018, N =	2019-2021, N =
	7154 ¹	2486 ¹	2787 ¹
KORUS BIOIMPIANTI	825 (11.5)	1281 (51.5)	1474 (52.9)
ACCOLADE OSTEONICS HOWMEDICA	1806 (25.2)	0 (0.0)	0 (0.0)
S-TAPER BIOIMPIANTI	1171 (16.4)	66 (2.7)	0 (0.0)
SL LIMA	336 (4.7)	317 (12.8)	334 (12.0)
LOGICA CS LIMA	399 (5.6)	194 (7.8)	59 (2.1)
Z1 CITIEFFE	129 (1.8)	67 (2.7)	105 (3.8)
HIP FRACTURE - Howmedica	283 (4.0)	0 (0.0)	0 (0.0)
CORAIL DEPUY	59 (0.8)	28 (1.1)	181 (6.5)
PPF BIOMET	266 (3.7)	0 (0.0)	0 (0.0)
POLARSTEM ENDOPLUS	117 (1.6)	85 (3.4)	61 (2.2)
ENDON TANTUM	188 (2.6)	0 (0.0)	0 (0.0)
APTA ADLER NON CEM	133 (1.9)	33 (1.3)	21 (0.8)
AMISTEM-H MEDACTA	0 (0.0)	40 (1.6)	111 (4.0)
HYDRA ADLER	86 (1.2)	29 (1.2)	35 (1.3)
RECTA ADLER	138 (1.9)	2 (0.1)	1 (0.0)
SL X-PORE PERMEDICA	0 (0.0)	25 (1.0)	115 (4.1)
TAPERLOC COMPLETE BIOMET	45 (0.6)	74 (3.0)	2 (0.1)
Other (less than 100 cases)	1173 (16.4)	245 (9.9)	288 (10.3)

Unknown stem cementation	2000-2015, N = 63¹	2016-2018, N =	2019-2021, N =
		21 ¹	22 ¹
Unknown	63	21	22

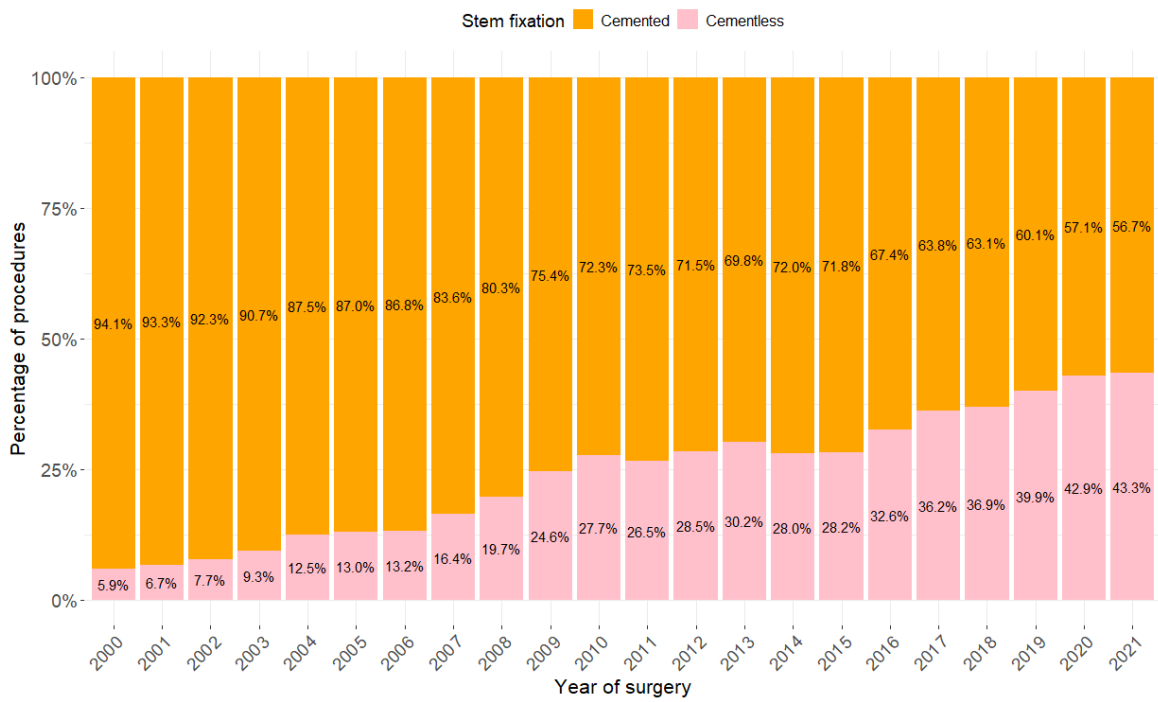
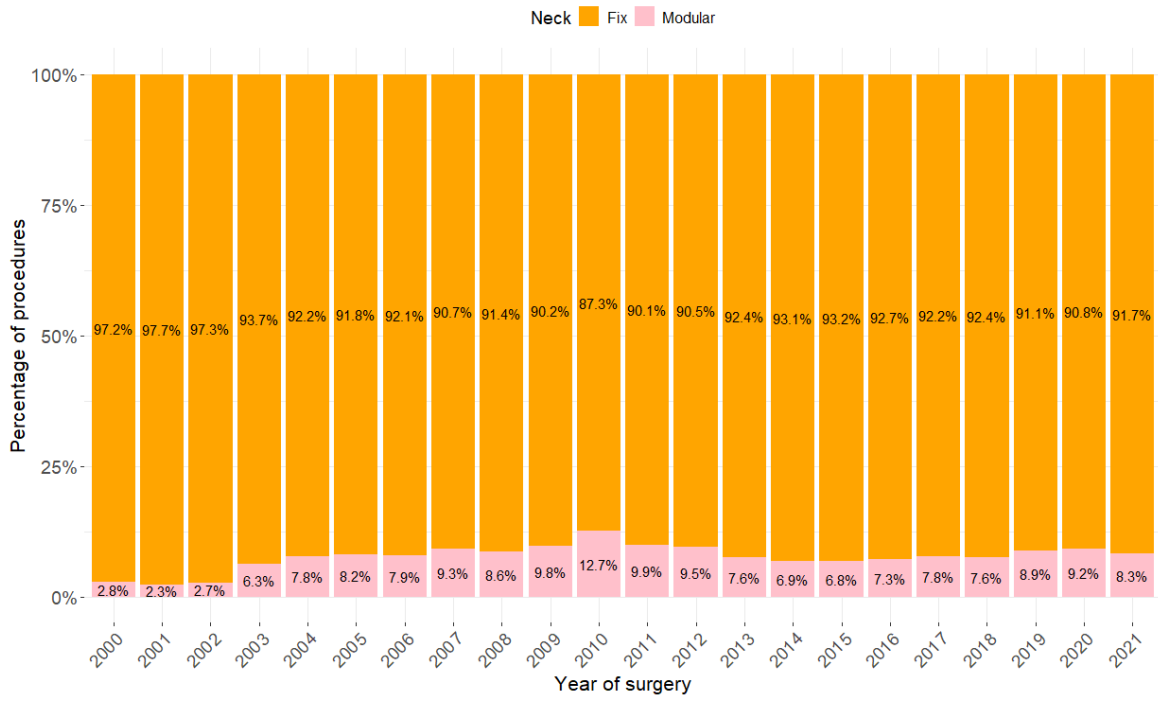
¹ n (%)

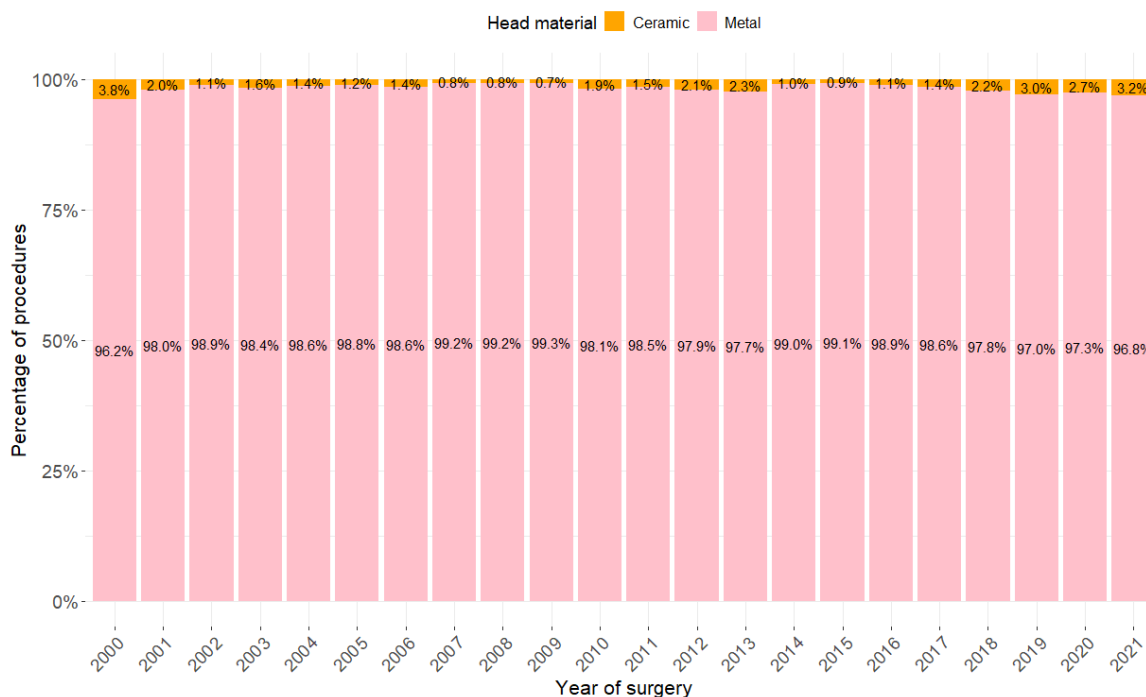
5.2 Other characteristics of hemiarthroplasties

Number of surgeries according to **hemihead type**

Hemihead type	N = 50756¹
Bipolar head – to be assembled in the operating theatre	49109 (96.8)
Bipolar head – preassembled	1103 (2.2)
Monoarticular	425 (0.8)
Monoblock prosthesis	112 (0.2)
Type of Bipolar cup not specified	7 (0.0)

¹ n (%)





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 2021

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	%		N.	%
Calcar fracture	589	0.4			
Diaphysis fracture	440	0.3	T V P	117	0.1
Greater troch. fracture	298	0.2			
Acetabulum fracture	198	0.1			
Anaesthesiolog. complications	164	0.1			
Hemorrhagia	65	0.04	Early Infection	107	0.1
Instability	27	0.02			
Other	170	0.1			
Total	1951	1.3	Total	224	0.2

The rate of complications in **revision surgery** carried out on patients hospitalized between 1st January 2000 and 31st December 2021

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	%		N.	%
Diaphysis fracture	272	1.4			
Calcar fracture	86	0.4	Early Infection	68	0.3
Greater troch. fracture	72	0.4			
Anaesthesiolog. complications	61	0.3			
Acetabulum fracture	29	0.1	T V P	28	0.1
Hemorrhagia	34	0.2			
Other	55	0.3			
Total	609	3.1	Total	96	0.5

The rate of complications in **hemiarthroplasty** carried out on patients hospitalized between 1st January 2000 and 31st December 2021

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	%		N.	%
Calcar fracture	259	0.5			
Anaesthesiolog. complications	170	0.3	T V P	77	0.2
Greater troch. fracture	156	0.3			
Diaphysis fracture	88	0.2			
Hemorrhagia	24	0.05	Early Infection	73	0.1
Acetabulum fracture	7	0.01			
Other	75	0.1			
Total	779	1.5	Total	150	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 2021. Only deaths occurred during hospitalization are recorded.

Year 2000-2021			
Type of surgery	Deaths	Number of surgeries	%
Primary THA	307	146918	0.2
Hemiarthroplasties	2165	50756	4.3
Partial and total revision	138	19874	0.7
Resurfacing	-	3025	-
Prosthesis removal	39	1739	2.2

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
2021	12.6	24.0

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 2021			
Type of surgery	N.	Mean pre-op.	Range
Primary THA	9304	1.0	0-47
Hemiarthroplasties	2202	2.4	0-48
Revision	893	3.1	0-61
Prosthesis removal	99	4.7	0-32

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 2021 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	103645	0.99 (0.99, 0.99)	<0.001
Sex F	62242	Reference	
M	41403	1.20 (1.13, 1.27)	<0.001
Diagnosis Coxarthrosis	72290	Reference	
Femoral fractures and sequelae	16205	1.39 (1.30, 1.50)	<0.001
Sequelae of congenital and infantile disease	7694	0.90 (0.81, 1.00)	0.047
Femoral head necrosis	5654	1.20 (1.07, 1.35)	0.002
Rheumatic arthritis	731	1.05 (0.77, 1.43)	0.750
Other	1071	1.68 (1.33, 2.11)	<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 2021 **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 procedures	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	104237	3116	1920	279	8.0
Hemiarthroplasty*	49057	895	230	26	3.7
Resurfacing^	912	61	25	10	10.9
Total revision	3315	281	136	20	8.1

* hemiarthroplasties with acetabular buffer are not considered

^ Resurfacing prosthesis has been significantly used only since

41.4% of Revisions after primary THA was performed in a different hospital, **22.8%** after Hemiarthroplasty and **36.0%** 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	3971	1065	279	5315/104237
Hemiarthroplasty*	965	160	26	1151/49057
Resurfacing	85	1	10	96/912
Total revision	329	77	19	425/3315

* 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.

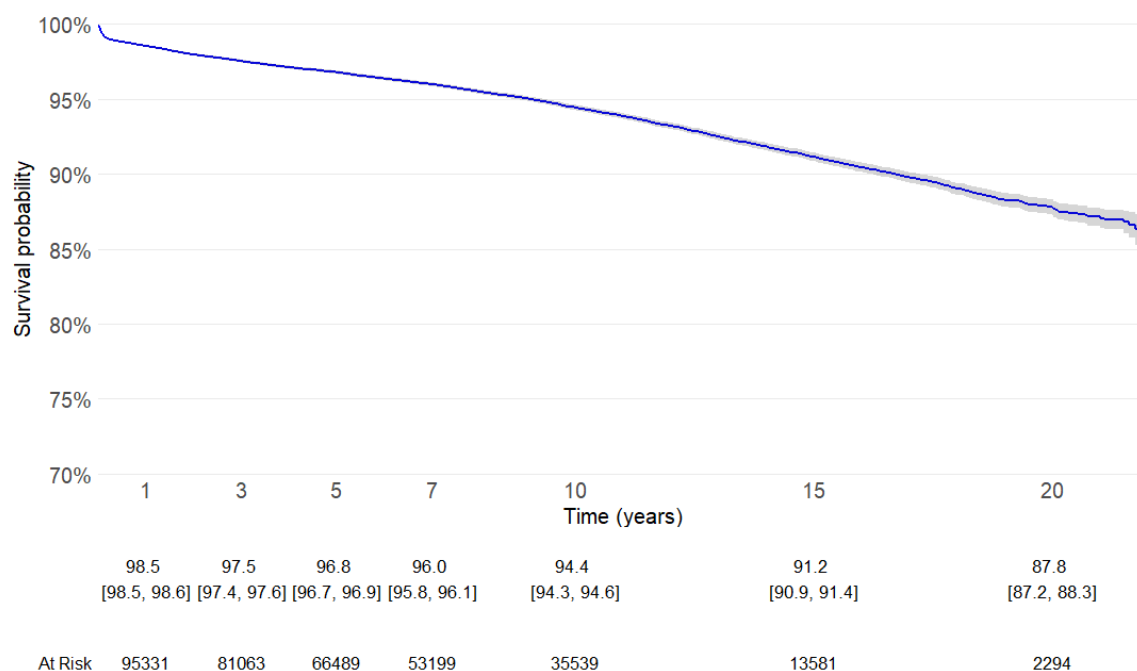
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

The following 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

104237 primary arthroplasties are under observation. On these, 5315 revisions were carried out.

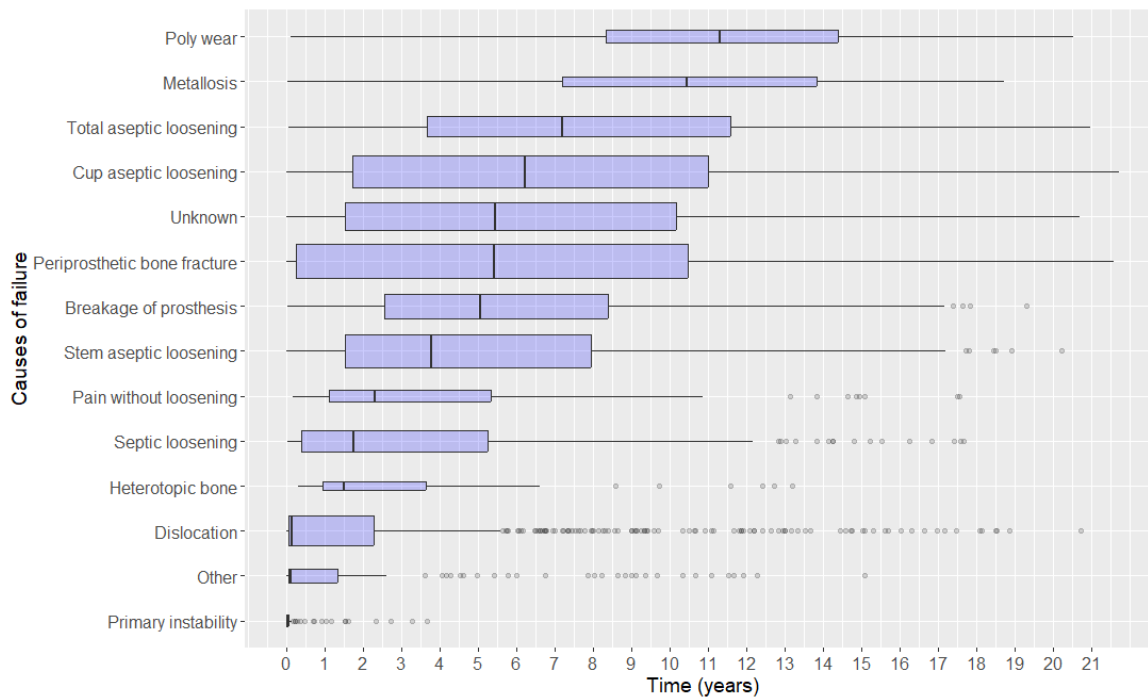


The following table shows the **rate of revision** in total joint arthroplasty according to **cause of revision**: the **% distribution of the causes of failure** is shown

Cause of revision	n/N	IR (%)	% Distribution failure causes
Periprosthetic bone fracture	834/104237	0.8	15.7
Stem aseptic loosening	833/104237	0.8	15.7
Cup aseptic loosening	754/104237	0.7	14.2
Dislocation	673/104237	0.6	12.7
Breakage of prosthesis	450/104237	0.4	8.5
Septic loosening	340/104237	0.3	6.4
Total aseptic loosening	288/104237	0.3	5.4
Unknown – outside region	279/104237	0.3	5.2
Unknown	255/104237	0.2	4.8
Other	157/104237	0.2	3.0
Poly wear	131/104237	0.1	2.5
Pain without loosening	111/104237	0.1	2.1
Primary instability	98/104237	0.1	1.8
Metallosis	67/104237	0.1	1.3
Heterotopic bone	45/104237	0.0	0.8
Total	5315/104237	5.1	100.0

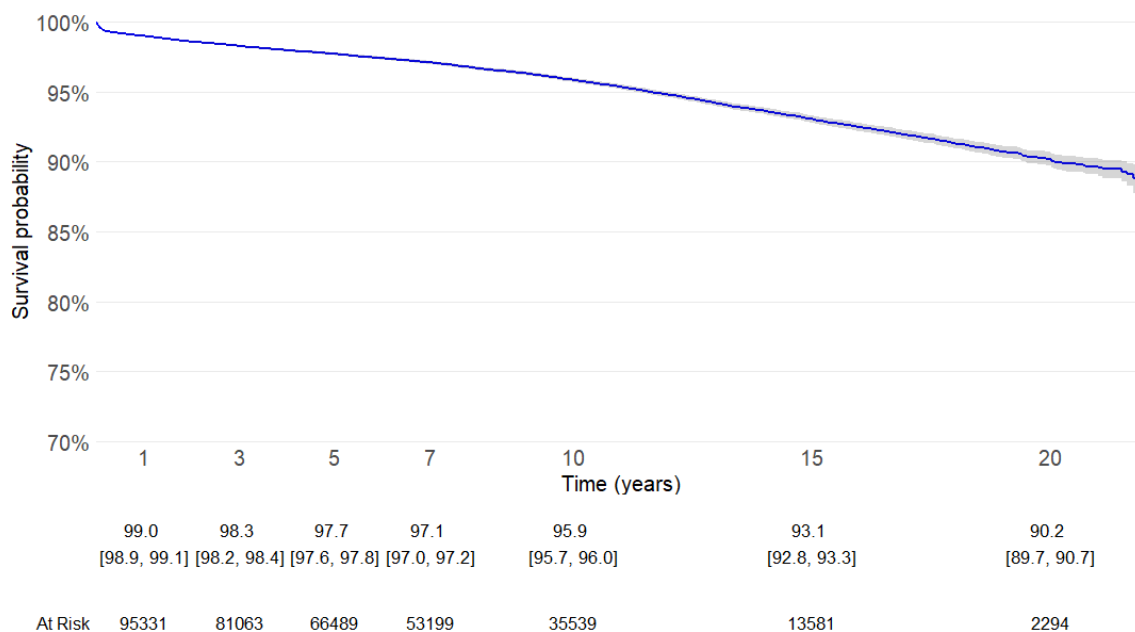
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Percentage of causes of revision according to follow-up



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

104237 primary arthroplasties are under observation. Of these, 3971 revisions were carried out to remove cup and/or stem.



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° failures	% 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	5371	125	98.3 [98.0,98.7]	4013	97.2 [96.7,97.8]	1550
Fixa TI-por (Hydra) Adler-Ortho	2007	4757	129	97.3 [96.8,97.8]	2412	96.0 [95.2,96.8]	532
AnCA Fit (AnCA Fit) Wright Cremascoli	2000	2875	302	95.9 [95.2,96.6]	2594	93.2 [92.3,94.2]	2260
FIXA (RECTA) Adler- Ortho	2004	2727	191	96.4 [95.7,97.1]	2447	93.6 [92.7,94.6]	1861
R3 (POLARSTEM) Smith & Nephew	2012	2407	31	98.5 [97.9,99.1]	357	— [—,—]	0
Fixa Ti-por (HYDRA- FIX) Adler-Ortho	2016	2241	42	97.6 [96.7,98.4]	32	— [—,—]	0
R3 (SL PLUS MIA) Smith & Nephew	2010	1998	39	98.3 [97.7,98.9]	1216	97.7 [96.8,98.5]	190
EP-FIT PLUS (SL PLUS) Endoplus	2003	1996	104	96.7 [95.9,97.5]	1703	95.0 [93.9,96.0]	1173
ABGII (ABGII) Stryker Howmedica	2000	1965	143	97.7 [97.0,98.4]	1755	95.2 [94.2,96.2]	1394
Fixa TI-por (RECTA) Adler-Ortho	2007	1959	73	96.9 [96.1,97.7]	1283	95.8 [94.7,96.8]	382
Fixa TI-por (CORAE) Adler-Ortho	2010	1916	41	97.9 [97.2,98.5]	1405	97.7 [97.0,98.4]	15
Fixa (APTA) Adler- Ortho	2004	1712	111	96.8 [95.9,97.6]	1576	94.3 [93.1,95.4]	1338
CLS (CLS) Sulzer Centerpulse Zimmer	2000	1516	124	97.5 [96.7,98.3]	1342	94.5 [93.3,95.7]	1084
JUMP SYSTEM (EXACTA) Permedica	2010	1340	16	98.7 [98.0,99.3]	235	98.7 [98.0,99.3]	1
FITMORE (CONUS) SulzerCenterpulse Zimmer	2000	1257	70	97.3 [96.4,98.2]	1082	96.0 [94.9,97.2]	781
Exceed ABT (TAPERLOC) Biomet	2006	1203	22	98.4 [97.7,99.1]	938	97.7 [96.7,98.8]	289
EXPANSION (CBC) Mathys	2003	1200	106	94.7 [93.4,96.0]	1007	90.9 [89.2,92.7]	630
DELTA TT (H-MAX S) Lima	2009	1138	23	97.7 [96.7,98.7]	321	97.3 [96.2,98.5]	3
FIXA TI-por (APTA-FIX) Adler-Ortho	2015	1129	25	97.3 [96.1,98.5]	194	— [—,—]	0
EP-FIT PLUS (PROXYPLUS) Smith & Nephew	2005	1099	40	98.2 [97.4,99.0]	982	96.3 [95.1,97.5]	584
Versafitcup CC (Amistem H) Medacta	2011	1097	33	97.0 [95.8,98.1]	375	93.7 [89.8,97.8]	9
BICON PLUS (SL PLUS) Smith & Nephew	2000	936	98	95.7 [94.4,97.0]	811	92.8 [91.1,94.6]	633
G7 PPS (TAPERLOC COMPLETE MICROPLASTY) Biomet	2015	923	14	98.4 [97.5,99.3]	145	— [—,—]	0
Ep-fit (Polarstem) Endoplus	2008	784	14	98.5 [97.7,99.4]	493	97.8 [96.7,99.0]	39

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

FITMORE (CLS) SulzerCenterpulse Zimmer	2000	768	42	97.1 [95.9,98.3]	684	95.4 [93.8,96.9]	560
VERSAFITCUP CC TRIO (MINIMAX) Medacta	2012	740	23	96.2 [94.7,97.8]	193	— [—,—]	0
G7 PPS (TAPERLOC COMPLETE) Biomet	2014	728	14	97.9 [96.8,99.0]	207	— [—,—]	0
PINNACLE SECTOR II (CORAIL) DePuy	2002	727	48	96.0 [94.5,97.4]	580	92.5 [90.3,94.7]	320
JUMP SYSTEM (SYNTHESIS) Permedica	2013	647	23	96.6 [95.0,98.1]	270	— [—,—]	0
REFLECTION (BASIS) Smith & Nephew	2001	626	59	96.7 [95.2,98.1]	538	92.3 [90.0,94.7]	348
TRIDENT PSL HA CLUSTER (EXETER V40) Howmedica	2002	613	9	99.1 [98.2,99.9]	367	98.3 [96.9,99.7]	199
CLS (CONUS) SulzerCenterpulse Zimmer	2000	595	63	97.1 [95.7,98.4]	534	94.0 [92.0,96.0]	455
Fixa (APTA) Adler- Ortho	2005	573	23	97.1 [95.8,98.5]	479	96.4 [94.9,98.0]	339
PINNACLE SECTOR II (SUMMIT) DePuy	2003	570	13	97.6 [96.2,99.0]	351	97.6 [96.2,99.0]	139
DELTA TT (MODULUS HIP SYSTEM) Lima	2007	554	19	97.0 [95.5,98.5]	345	96.0 [94.1,97.8]	120
Fixa TI-por (Alata Acuta) Adler-Ortho	2007	541	15	97.1 [95.6,98.5]	328	97.1 [95.6,98.5]	120
REFLECTION (SYNERGY) Smith & Nephew	2000	537	35	98.3 [97.2,99.4]	491	94.8 [92.6,97.1]	245
TRILOGY (VERSYS FIBER) Zimmer	2000	505	30	96.4 [94.7,98.0]	448	94.9 [93.0,96.9]	358
TRIDENT PSL HA CLUSTER (ABGII) Stryker Howmedica	2002	502	44	95.7 [93.9,97.5]	448	93.0 [90.7,95.4]	282
CONTEMPORARY (EXETER V40) Stryker Howmedica	2000	497	28	95.8 [93.9,97.7]	373	94.1 [91.7,96.5]	219
DUOFIT PSF (P507) Samo	2000	492	36	98.1 [96.8,99.3]	434	96.3 [94.5,98.1]	342
RECAP RESURFACING (TAPERLOC) Biomet	2005	486	37	96.0 [94.3,97.8]	439	93.9 [91.7,96.1]	375
CONTINUUM (CLS) Zimmer	2010	478	10	98.1 [96.7,99.4]	303	97.1 [95.2,99.0]	36
R3 (SL PLUS) Smith & Nephew	2009	459	25	95.9 [94.1,97.8]	292	92.4 [89.1,95.9]	79
R3 THREE-HOLE Smith and Nephew (NANOS) Endoplant	2010	443	10	97.9 [96.5,99.4]	162	94.9 [90.0,100.0]	17
DELTA PF (MODULUS HIP SYSTEM) Lima	2003	442	16	97.5 [96.0,99.0]	362	96.8 [95.1,98.6]	253
CONTINUUM (AVENIR) Zimmer	2014	435	10	97.2 [95.4,99.0]	125	— [—,—]	0
SELEXYS TH (CBC) Mathys	2006	435	59	92.0 [89.4,94.7]	352	86.6 [83.2,90.1]	264
Fixa TI-por (Pulchra- fix) Adler-Ortho	2016	428	19	94.7 [92.3,97.2]	1	— [—,—]	0
DELTA TT (MINIMA S) Lima	2013	423	8	97.6 [95.8,99.3]	17	— [—,—]	0
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	419	19	96.3 [94.5,98.2]	257	94.9 [92.6,97.4]	61

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

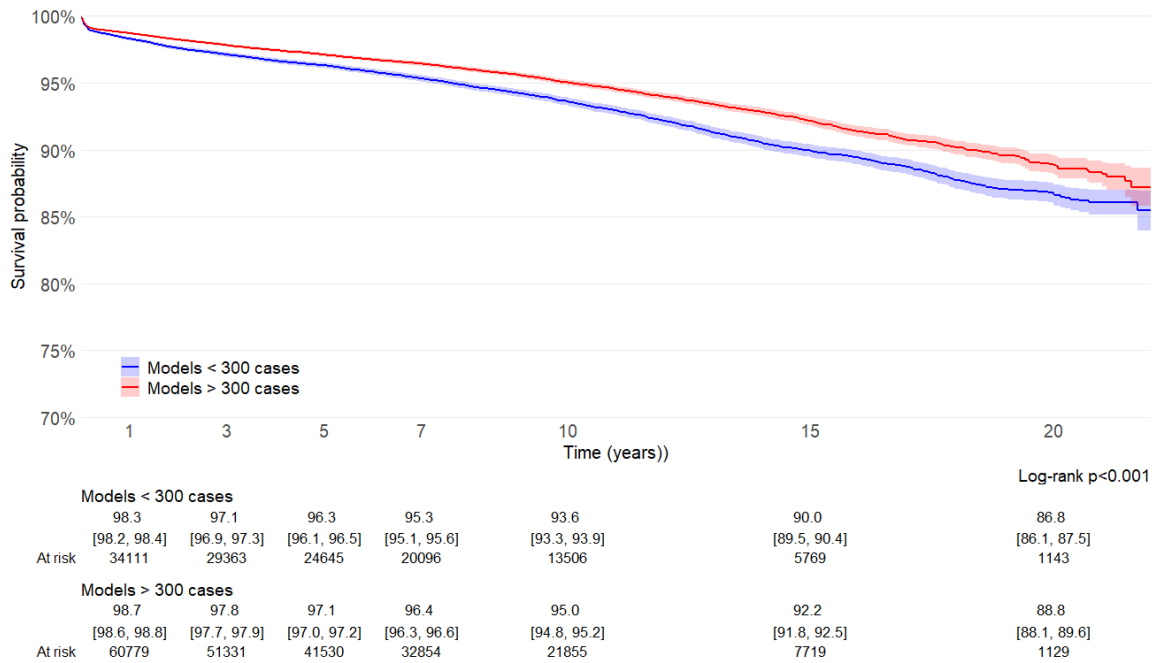
PINNACLE SECTOR GRIPTION (CORAIL) DePuy	2012	411	15	94.8 [91.9,97.8]	105	— [—,—]	0
TOP (CFP) Link	2000	403	17	97.7 [96.2,99.2]	368	95.9 [93.9,98.0]	293
TRIDENT PSL HA CLUSTER (ACCOLADE II) Howmedica	2012	403	11	97.3 [95.7,99.0]	89	— [—,—]	0
I1CUP (LCU)-Link	2016	384	4	98.9 [97.8,100.0]	19	— [—,—]	0
CONTINUUM (CONUS) Zimmer	2010	373	13	96.9 [95.1,98.7]	239	95.4 [92.7,98.2]	79
VERSAFITCUP CC TRIO (AMISTEM-P) Medacta	2019	370	9	— [—,—]	0	— [—,—]	0
Versafitcup CC (Minimax) Medacta	2007	363	22	96.6 [94.8,98.5]	317	93.0 [90.2,96.0]	147
CUPULE RELOAD AVANTAGE (TAPERLOC) Biomet	2008	357	15	96.9 [95.1,98.7]	310	96.1 [94.0,98.2]	136
PINNACLE SECTOR GRIPTION (TRI-LOCK) DePuy	2012	355	9	95.9 [92.2,99.7]	39	— [—,—]	0
EP-FIT PLUS (SL PLUS MIA) Smith & Nephew	2009	349	15	96.8 [94.9,98.8]	218	93.8 [90.6,97.2]	53
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]	242
CLS Zimmer (SL PLUS) Smith & Nephew	2001	311	20	96.6 [94.5,98.7]	269	95.0 [92.4,97.6]	213
CONTINUUM (FITMORE B EXT.) Zimmer	2017	309	13	— [—,—]	0	— [—,—]	0
EP-FIT PLUS Endoplus (NANOS) Endoplast	2005	309	10	97.7 [96.0,99.4]	266	96.9 [94.8,98.9]	155
MULLER (MRL) Wright Cremascoli	2000	308	19	96.5 [94.4,98.7]	246	94.8 [92.2,97.5]	173
Other (models < 300 cases)	2000	37431	2274	96.3 [96.1,96.5]	24645	93.6 [93.3,93.9]	13506

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 2000-2021.

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

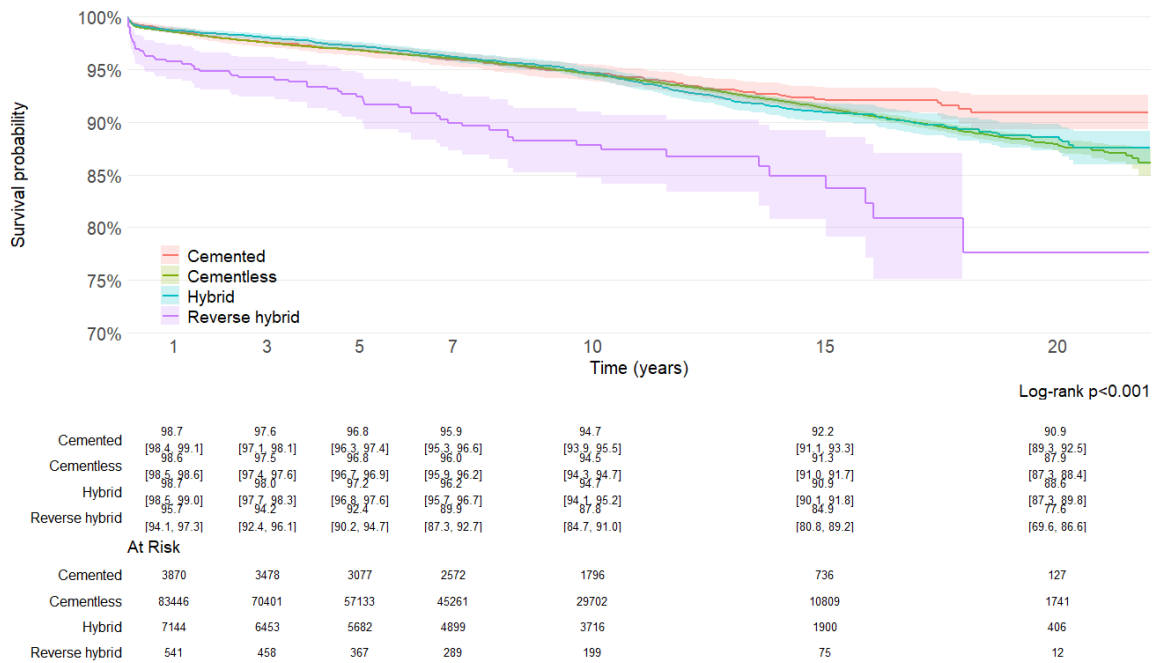
Type of Prosthesis	Mean follow-up (years)	N.	N. failures
Models <300 cases	8.3	37431	2274
Models >300 cases	7.8	66283	2928

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 considered separately.



Cause of failure	n/N	IR (%)	% Distribution failure causes
Cementless			
Periprosthetic bone fracture	745/91393	0.8	16.7
Stem aseptic loosening	659/91393	0.7	14.8
Cup aseptic loosening	606/91393	0.7	13.6

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

Dislocation	539/91393	0.6	12.1
Breakage of prosthesis	437/91393	0.5	9.8
Septic loosening	279/91393	0.3	6.2
Total aseptic loosening	179/91393	0.2	4.0
Pain without loosening	110/91393	0.1	2.5
Poly wear	107/91393	0.1	2.4
Primary instability	91/91393	0.1	2.0
Metallosis	64/91393	0.1	1.4
Heterotopic bone	40/91393	0.0	0.9
Other	145/91393	0.2	3.2
Unknown	216/91393	0.2	4.8
Unknown – outside region	249/91393	0.3	5.6
Total	4466/91393	4.8	100.0
Cemented			
Cup aseptic loosening	66/4181	1.6	30.7
Total aseptic loosening	39/4181	0.9	18.1
Dislocation	28/4181	0.7	13.0
Stem aseptic loosening	20/4181	0.5	9.3
Septic loosening	20/4181	0.5	9.3
Periprosthetic bone fracture	18/4181	0.4	8.4
Primary instability	4/4181	0.1	1.9
Breakage of prosthesis	2/4181	0.0	0.9
Other	1/4181	0.0	0.5
Unknown	10/4181	0.2	4.7
Unknown – outside region	7/4181	0.2	3.3
Total	215/4181	5.1	100.0
Hybrid (Stem cem. and cup cementless)			
Stem aseptic loosening	133/7642	1.7	28.4
Dislocation	81/7642	1.1	17.3
Periprosthetic bone fracture	57/7642	0.7	12.2
Total aseptic loosening	56/7642	0.7	11.9
Cup aseptic loosening	38/7642	0.5	8.1
Septic loosening	35/7642	0.5	7.5
Poly wear	17/7642	0.2	3.6
Breakage of prosthesis	7/7642	0.1	1.5
Heterotopic bone	3/7642	0.0	0.6
Primary instability	2/7642	0.0	0.4
Pain without loosening	1/7642	0.0	0.2
Other	9/7642	0.1	1.9
Unknown	18/7642	0.2	3.8
Unknown – outside region	12/7642	0.2	2.6
Total	469/7642	6.1	100.0
Reverse hybrid (Stem cementless e cup cemented)			
Cup aseptic loosening	23/622	3.7	35.4
Dislocation	9/622	1.4	13.8
Periprosthetic bone fracture	8/622	1.3	12.3
Stem aseptic loosening	7/622	1.1	10.8
Total aseptic loosening	5/622	0.8	7.7
Septic loosening	3/622	0.5	4.6
Breakage of prosthesis	2/622	0.3	3.1
Metallosis	1/622	0.2	1.5
Unknown	1/622	0.2	1.5
Unknown – outside region	6/622	1.0	9.2
Total	65/622	10.4	100.0

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

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

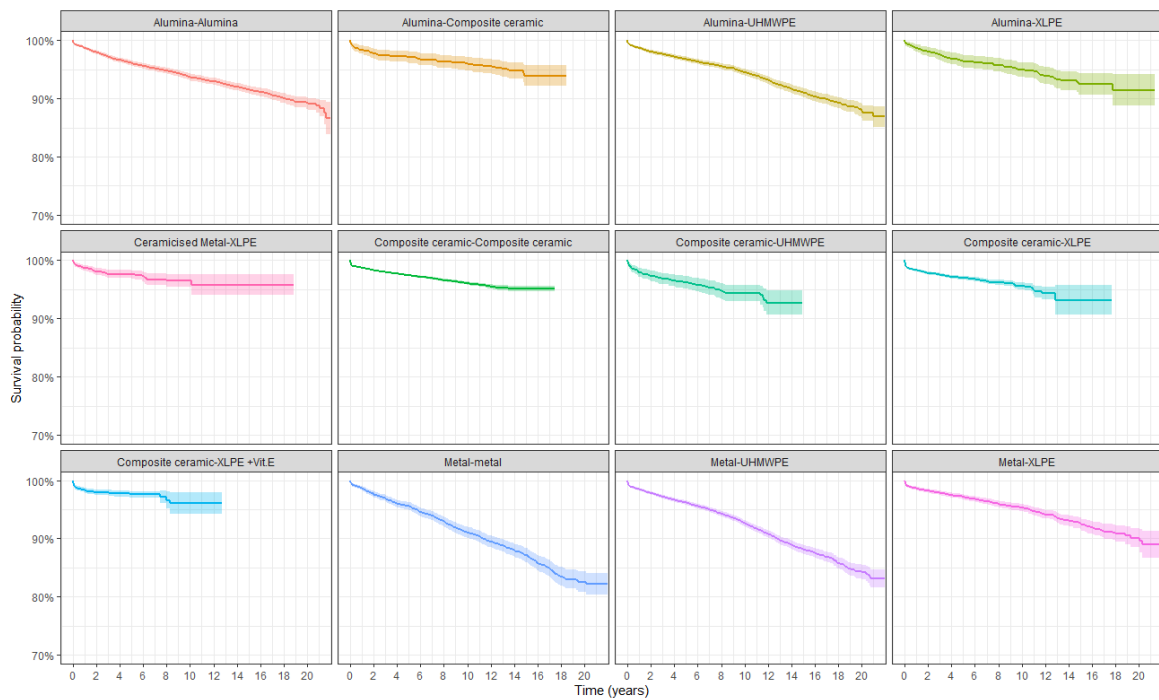
The following table shows survival details of prosthesis according to articular coupling. Only couplings with more than 1000 cases are presented. Dual mobility cups are excluded.

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
Alumina-Alumina	13.6	7555	619	96.1 [95.6,96.5]	6869	93.7 [93.1,94.3]	5890	
Alumina-Composite Ceramic	12.1	1171	57	97.1 [96.1,98.0]	1076	96.0 [94.9,97.2]	924	
Alumina-UHMWPE	12.2	7305	558	96.8 [96.4,97.2]	6335	94.5 [94.0,95.1]	4796	
Alumina-XLPE	11.3	1242	73	96.4 [95.3,97.4]	1058	94.9 [93.7,96.2]	833	
Composite Ceramic-Composite Ceramic	6.1	34338	985	97.4 [97.3,97.6]	19593	96.1 [95.8,96.4]	6267	
Composite Ceramic-UHMWPE	7.5	1310	65	96.2 [95.2,97.3]	898	94.3 [92.9,95.8]	449	
Composite Ceramic-XLPE	4.6	13606	396	96.9 [96.6,97.2]	5454	95.5 [95.0,96.1]	968	
Composite Ceramic-XLPE + Vit.E	3.2	3913	82	97.6 [97.0,98.2]	807	96.0 [94.2,97.9]	94	
Metal-Metal	4.5	3841	472	95.6 [94.9,96.2]	3480	91.1 [90.1,92.0]	2954	
Metal-UHMWPE	13.0	11467	1017	96.2 [95.8,96.5]	9327	92.6 [92.1,93.2]	6425	
Metal-XLPE	10.8	6064	290	97.1 [96.7,97.6]	4408	95.3 [94.7,95.9]	2307	
Ceramicised Metal-XLPE	8.9	2268	54	97.7 [97.0,98.3]	805	96.5 [95.4,97.6]	153	

¹ Log-rank test



Cause of revision	n/N	IR (%)	% Distribution failure causes
Alumina-Alumina			
Breakage of prosthesis	171/7555	2.3	27.6
Periprosthetic bone fracture	129/7555	1.7	20.8
Stem aseptic loosening	83/7555	1.1	13.4
Dislocation	59/7555	0.8	9.5
Cup aseptic loosening	48/7555	0.6	7.8
Septic loosening	16/7555	0.2	2.6
Total aseptic loosening	15/7555	0.2	2.4
Pain without loosening	11/7555	0.1	1.8
Primary instability	5/7555	0.1	0.8
Heterotopic bone	5/7555	0.1	0.8
Poly wear	2/7555	0.0	0.3
Other	10/7555	0.1	1.6
Unknown	23/7555	0.3	3.7
Unknown – outside region	42/7555	0.6	6.8
Total	619/7555	8.2	100.0
Metal-Metal			
Cup aseptic loosening	113/3841	2.9	23.9
Metallosis	53/3841	1.4	11.2
Stem aseptic loosening	48/3841	1.2	10.2
Total aseptic loosening	36/3841	0.9	7.6
Septic loosening	32/3841	0.8	6.8
Breakage of prosthesis	32/3841	0.8	6.8
Dislocation	31/3841	0.8	6.6
Periprosthetic bone fracture	30/3841	0.8	6.4
Pain without loosening	17/3841	0.4	3.6
Primary instability	5/3841	0.1	1.1
Heterotopic bone	2/3841	0.1	0.4
Other	8/3841	0.2	1.7
Unknown	17/3841	0.4	3.6
Unknown – outside region	48/3841	1.2	10.2
Total	472/3841	12.2	100.0
Metal-Polietilene Standard			
Cup aseptic loosening	227/11467	2.0	22.3
Stem aseptic loosening	176/11467	1.5	17.3
Dislocation	151/11467	1.3	14.8

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

Total aseptic loosening	113/11467	1.0	11.1
Periprosthetic bone fracture	89/11467	0.8	8.8
Poly wear	74/11467	0.6	7.3
Septic loosening	44/11467	0.4	4.3
Breakage of prosthesis	17/11467	0.1	1.7
Pain without loosening	16/11467	0.1	1.6
Primary instability	9/11467	0.1	0.9
Heterotopic bone	2/11467	0.0	0.2
Metallosis	1/11467	0.0	0.1
Other	5/11467	0.0	0.5
Unknown	46/11467	0.4	4.5
Unknown – outside region	47/11467	0.4	4.6
Total	1017/11467	8.9	100.0
Composite Ceramic-Composite Ceramic			
Periprosthetic bone fracture	180/34338	0.5	18.3
Stem aseptic loosening	169/34338	0.5	17.2
Breakage of prosthesis	138/34338	0.4	14
Dislocation	108/34338	0.3	11
Septic loosening	86/34338	0.3	8.7
Cup aseptic loosening	65/34338	0.2	6.6
Primary instability	38/34338	0.1	3.9
Pain without loosening	28/34338	0.1	2.8
Heterotopic bone	15/34338	0.0	1.5
Total aseptic loosening	11/34338	0.0	1.1
Metallosis	3/34338	0.0	0.3
Poly wear	1/34338	0.0	0.1
Other	64/34338	0.2	6.5
Unknown	36/34338	0.1	3.7
Unknown – outside region	43/34338	0.1	4.4
Total	985/34338	2.9	100.0
Composite Ceramic-XLPE			
Dislocation	82/13606	0.6	20.7
Periprosthetic bone fracture	75/13606	0.6	18.9
Stem aseptic loosening	57/13606	0.4	14.4
Cup aseptic loosening	43/13606	0.3	10.9
Septic loosening	30/13606	0.2	7.6
Primary instability	11/13606	0.1	2.8
Breakage of prosthesis	8/13606	0.1	2
Pain without loosening	6/13606	0.0	1.5
Heterotopic bone	6/13606	0.0	1.5
Total aseptic loosening	5/13606	0.0	1.3
Poly wear	4/13606	0.0	1
Other	19/13606	0.1	4.8
Unknown	36/13606	0.3	9.1
Unknown – outside region	14/13606	0.1	3.5
Total	396/13606	2.9	100.0
Alumina- Composite Ceramic			
Breakage of prosthesis	15/1171	1.3	26.3
Dislocation	13/1171	1.1	22.8
Stem aseptic loosening	9/1171	0.8	15.8
Periprosthetic bone fracture	6/1171	0.5	10.5
Cup aseptic loosening	3/1171	0.3	5.3
Septic loosening	2/1171	0.2	3.5
Heterotopic bone	1/1171	0.1	1.8
Other	2/1171	0.2	3.5
Unknown	1/1171	0.1	1.8
Unknown – outside region	5/1171	0.4	8.8
Total	57/1171	4.8	100.0
Alumina-UHMWPE			
Stem aseptic loosening	112/7305	1.5	20.1
Periprosthetic bone fracture	84/7305	1.1	15.1
Dislocation	81/7305	1.1	14.5
Cup aseptic loosening	80/7305	1.1	14.3

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

Total aseptic loosening	42/7305	0.6	7.5
Septic loosening	28/7305	0.4	5
Poly wear	26/7305	0.4	4.7
Breakage of prosthesis	24/7305	0.3	4.3
Pain without loosening	9/7305	0.1	1.6
Primary instability	6/7305	0.1	1.1
Heterotopic bone	6/7305	0.1	1.1
Metallosis	2/7305	0.0	0.4
Other	4/7305	0.1	0.7
Unknown	30/7305	0.4	5.4
Unknown – outside region	24/7305	0.3	4.3
Total	558/7305	7.6	100.0
Composite Ceramic-UHMWPE			
Dislocation	16/1310	1.2	24.6
Stem aseptic loosening	10/1310	0.8	15.4
Cup aseptic loosening	6/1310	0.5	9.2
Periprosthetic bone fracture	5/1310	0.4	7.7
Breakage of prosthesis	5/1310	0.4	7.7
Pain without loosening	3/1310	0.2	4.6
Septic loosening	3/1310	0.2	4.6
Poly wear	3/1310	0.2	4.6
Total aseptic loosening	2/1310	0.2	3.1
Primary instability	1/1310	0.1	1.5
Metallosis	1/1310	0.1	1.5
Other	3/1310	0.2	4.6
Unknown	5/1310	0.4	7.7
Unknown – outside region	2/1310	0.2	3.1
Total	65/1310	4.9	100.0
Composite Ceramic-XLPE + Vitamina E			
Periprosthetic bone fracture	15/3913	0.4	18.3
Septic loosening	15/3913	0.4	18.3
Dislocation	14/3913	0.4	17.1
Stem aseptic loosening	9/3913	0.2	11
Cup aseptic loosening	8/3913	0.2	9.8
Primary instability	4/3913	0.1	4.9
Total aseptic loosening	3/3913	0.1	3.7
Pain without loosening	2/3913	0.1	2.4
Heterotopic bone	1/3913	0.0	1.2
Breakage of prosthesis	1/3913	0.0	1.2
Other	5/3913	0.1	6.1
Unknown	4/3913	0.1	4.9
Unknown – outside region	1/3913	0.0	1.2
Total	82/3913	2.1	100.0
Alumina-XLPE			
Stem aseptic loosening	19/1242	1.5	26
Periprosthetic bone fracture	13/1242	1.0	17.8
Cup aseptic loosening	9/1242	0.7	12.3
Dislocation	5/1242	0.4	6.8
Septic loosening	5/1242	0.4	6.8
Total aseptic loosening	3/1242	0.2	4.1
Primary instability	2/1242	0.2	2.7
Breakage of prosthesis	2/1242	0.2	2.7
Pain without loosening	1/1242	0.1	1.4
Poly wear	1/1242	0.1	1.4
Other	2/1242	0.2	2.7
Unknown	6/1242	0.5	8.2
Unknown – outside region	5/1242	0.4	6.8
Total	73/1242	5.8	100.0
Metal-XLPE			
Periprosthetic bone fracture	98/6064	1.6	33.8
Dislocation	43/6064	0.7	14.8
Stem aseptic loosening	33/6064	0.5	11.4
Cup aseptic loosening	24/6064	0.4	8.3

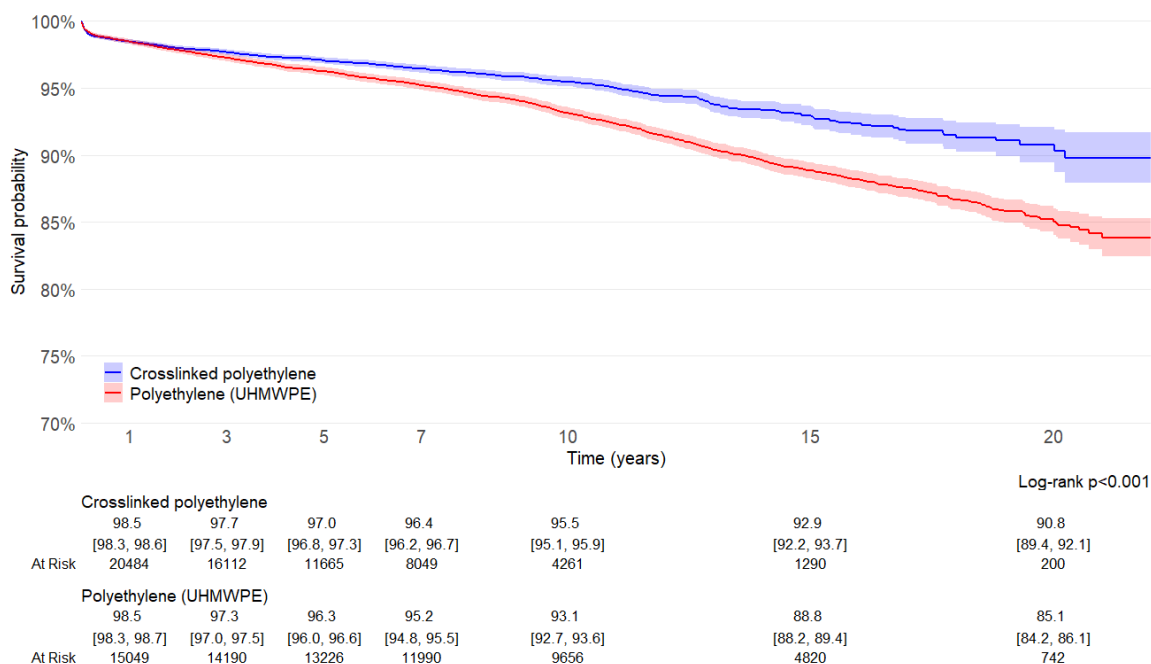
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

Septic loosening	23/6064	0.4	7.9
Total aseptic loosening	14/6064	0.2	4.8
Pain without loosening	7/6064	0.1	2.4
Primary instability	7/6064	0.1	2.4
Poly wear	6/6064	0.1	2.1
Breakage of prosthesis	2/6064	0.0	0.7
Heterotopic bone	1/6064	0.0	0.3
Other	12/6064	0.2	4.1
Unknown	11/6064	0.2	3.8
Unknown – outside region	9/6064	0.1	3.1
Total	290/6064	4.8	100.0
<i>Ceramicised Metal-XLPE</i>			
Stem aseptic loosening	13/2268	0.6	24.1
Periprosthetic bone fracture	8/2268	0.4	14.8
Septic loosening	8/2268	0.4	14.8
Dislocation	5/2268	0.2	9.3
Cup aseptic loosening	4/2268	0.2	7.4
Pain without loosening	3/2268	0.1	5.6
Heterotopic bone	2/2268	0.1	3.7
Total aseptic loosening	1/2268	0.0	1.9
Other	3/2268	0.1	5.6
Unknown	4/2268	0.2	7.4
Unknown – outside region	3/2268	0.1	5.6
Total	54/2268	2.4	100.0

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

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.

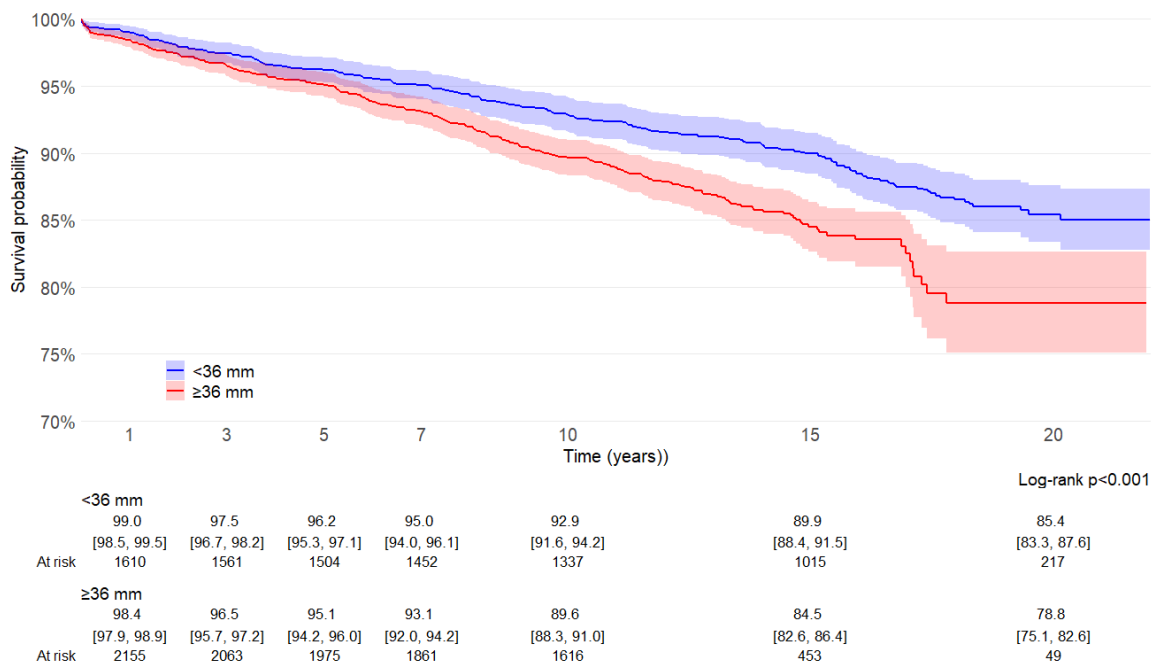


The Cox multivariate analysis identifies any variables (independent of each other) that can influence the event, in our case the removal of at least one prosthesis component. Analysis was performed on four independent variables: sex, age at surgery, head diameter and types of poly.

	N	Hazard ratio	p
Age	38654	0.98 (0.97, 0.98)	<0.001
Sex			
F	24203	Reference	
M	14451	1.13 (1.04, 1.24)	0.005
Head diameter			
<36 mm	29189	Reference	
≥36 mm	9465	1.07 (0.92, 1.24)	0.398
Insert			
Crosslinked polyethylene	23048	Reference	
Polyethylene (UHMWPE)	15606	1.47 (1.33, 1.63)	<0.001

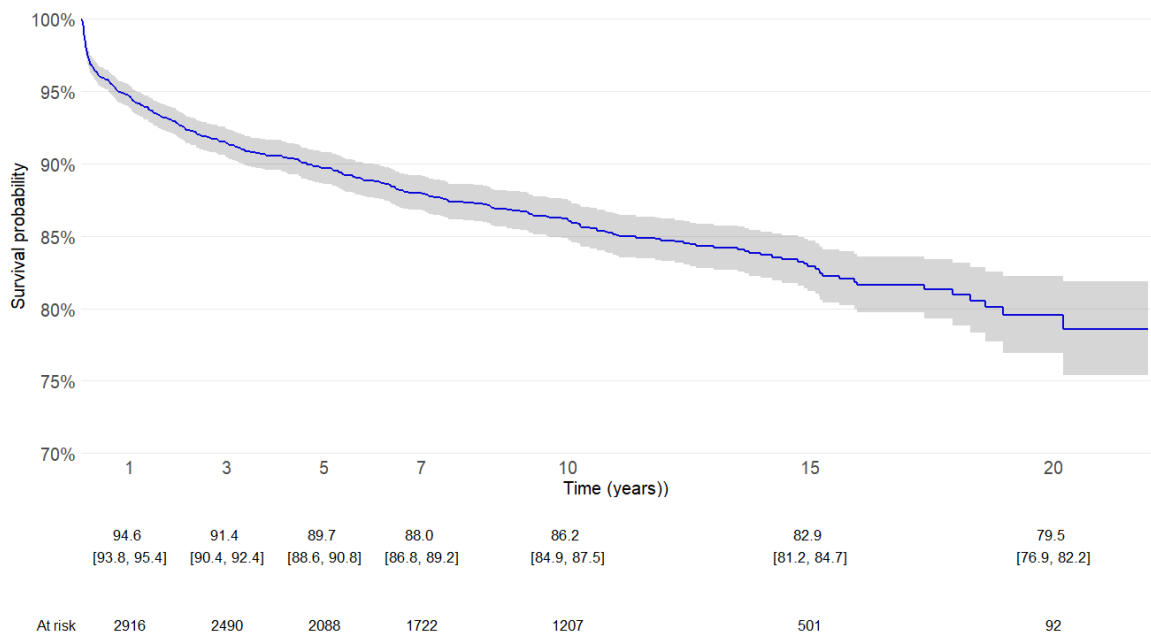
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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



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).



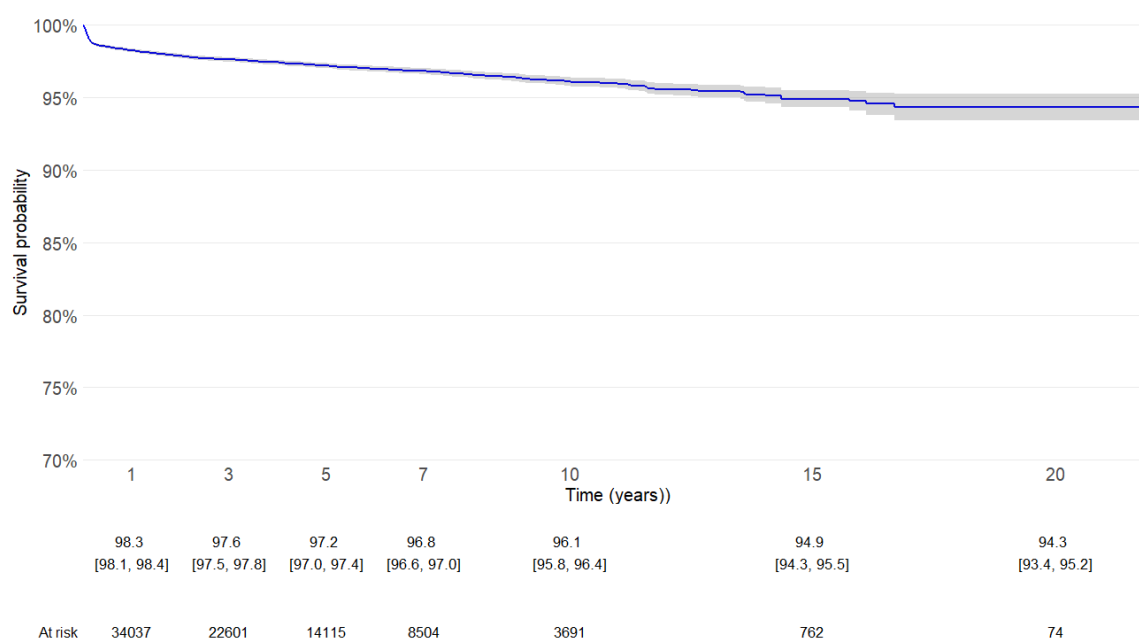
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the ‘loss’ of non-resident patients

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

Cause of failure	n/N	IR (%)	% Distribution failure causes
Cup aseptic loosening	84/3315	2.5	19.8
Dislocation	74/3315	2.2	17.4
Septic loosening	66/3315	2.0	15.5
Stem aseptic loosening	61/3315	1.8	14.4
Total aseptic loosening	31/3315	0.9	7.3
Periprosthetic bone fracture	23/3315	0.7	5.4
Breakage of prosthesis	7/3315	0.2	1.6
Pain without loosening	6/3315	0.2	1.4
Primary instability	4/3315	0.1	0.9
Metallosis	3/3315	0.1	0.7
Poly wear	3/3315	0.1	0.7
Other	15/3315	0.5	3.5
Unknown	29/3315	0.9	6.8
Unknown – outside region	19/3315	0.6	4.5
Total	425/3315	12.8	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.



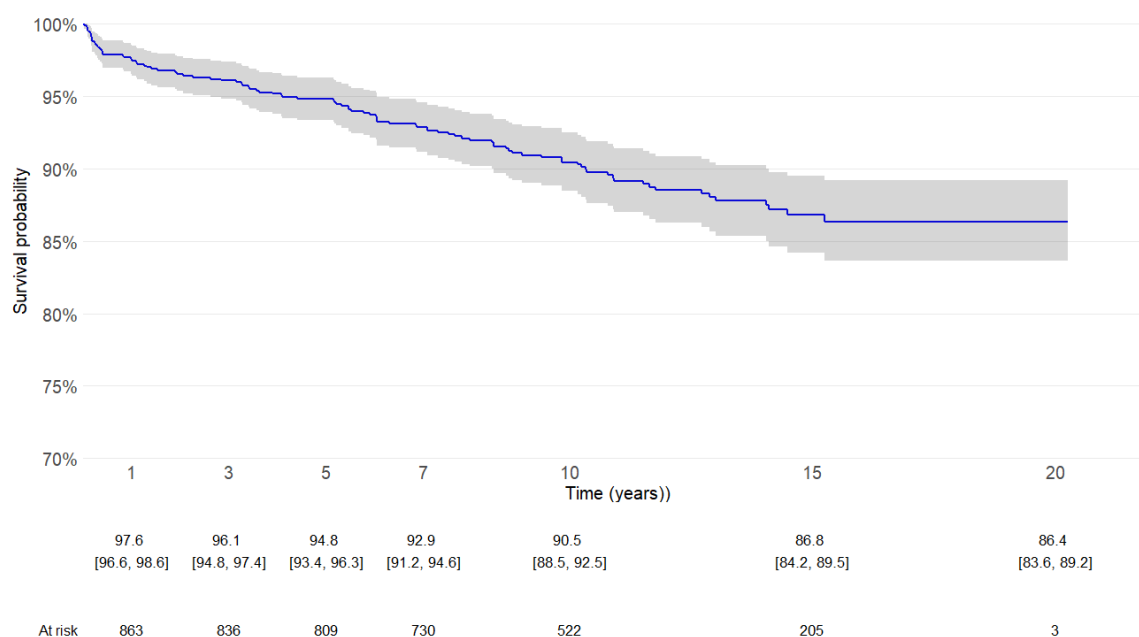
Survival analyses are performed only on patients living in the Emilia-Romagna region, in order to avoid the bias resulting from the 'loss' of non-resident patients

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 failure	n/N	IR (%)	% Distribution failure causes
Dislocation	487/49057	1.0	42.3
Periprosthetic bone fracture	152/49057	0.3	13.2
Cotiloiditis	139/49057	0.3	12.1
Stem aseptic loosening	134/49057	0.3	11.6
Septic loosening	88/49057	0.2	7.6
Early Infection	34/49057	0.1	3.0
Primary instability	18/49057	0.0	1.5
Other	11/49057	0.0	1.0
Unknown	66/49057	0.1	5.7
Unknown – outside region	22/49057	0.0	1.9
Total	1151/49057	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.



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

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

Cause of failure	n/N	IR (%)	% Distribution failure causes
Aseptic loosening	29/912	3.2	30.2
Periprosthetic bone fracture	21/912	2.3	21.9
Metal sensitization	16/912	1.8	16.7
Pain without loosening	10/912	1.1	10.4
Septic loosening	4/912	0.4	4.2
Breakage of prosthesis	2/912	0.2	2.1
Dislocation	1/912	0.1	1.0
Unknown	4/912	0.4	4.2
Unknown – outside region	9/912	1.0	9.4
Total	96/912	10.5	100.0

Model of prosthesis	From year	N.	N. failures	% 5 year survival [95% CI]	At risk at 5 years	% 10 year survival [95% CI]	At risk at 10 years
BHR - Smith And Nephew	2001	538	37	97.5 [96.1,98.8]	472	94.2 [92.1,96.5]	274
ADEPT - Finsbury	2005	122	4	97.5 [94.8,100.0]	118	97.5 [94.8,100.0]	80
BMHR SMITH AND NEPHEW	2007	75	4	98.7 [96.1,100.0]	72	94.4 [89.2,99.9]	42
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 (less than 40 cases)	2000	68	13	88.2 [80.9,96.2]	59	80.4 [71.4,90.6]	51

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 2021

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 **96.0%** 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

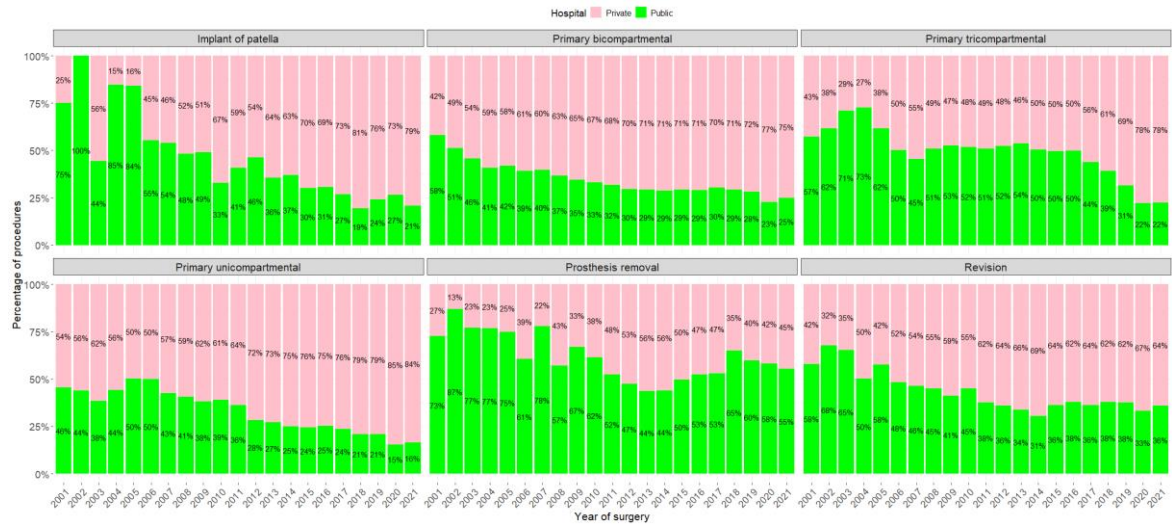
% of operations performed in public hospitals (AUSL, AOSP, IRCCS)		
Year of surgery	Primary	Revision
2000	57.0	75.0
2001	59.0	71.0
2002	53.0	70.0
2003	49.0	68.0
2004	47.1	58.3
2005	45.3	60.2
2006	42.9	54.3
2007	42.3	49.9
2008	40.6	55.0
2009	37.7	49.8
2010	37.3	50.9
2011	35.9	45.5
2012	33.8	43.9
2013	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
2021	24.0	37.6

Fonte: banca dati 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 2021 percentage of primary THA and revisions performed in public hospitals is respectively 47.2% and 71.6%.

Comparison of the distribution by type of surgery between total and partial knee replacement surgeries performed in public and private hospitals between 2001 and 2021



From: database RIPO

10. Type of operation

Bicompartamental implant has only femoral and tibial component, whilst tricompartmental one has patella too.

Implant of patella occurs when a bicompartamental knee prosthesis is transformed into tricompartmental with a second surgery. This is considered as a failure of primary bi-compartmental.

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2021, according to **type**

Type of surgery	N = 141161 [†]
Primary bicompartamental	84572 (60.2)
Primary tricompartmental	26937 (19.2)
Primary unicompartmental	15270 (10.9)
Revision [^]	9063 (6.4)
Prosthesis removal	1974 (1.4)
Implant of patella	1079 (0.8)
Other prostheses [*]	634 (0.5)
Other operations [°]	1029 (0.7)

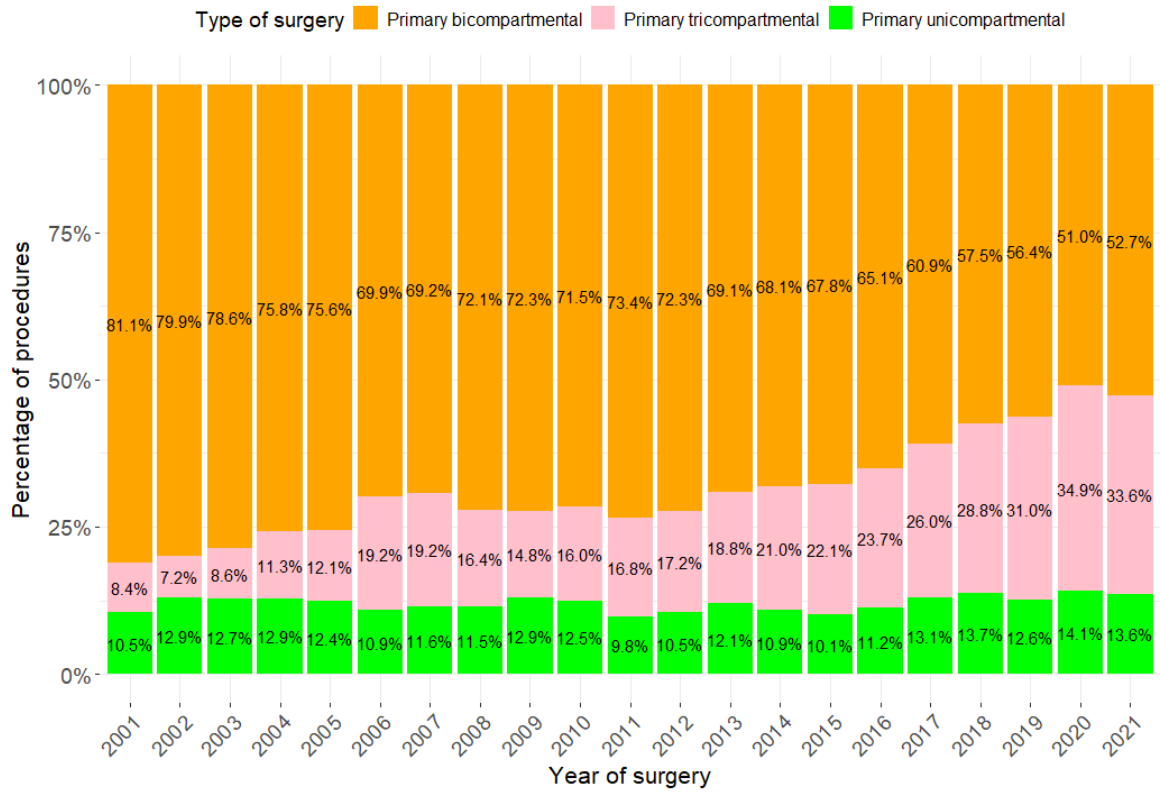
[†] n (%)

^{*}55 Hemicap–Arthrosurface, 34 Hemicap patello_femoral–Arthrosurface, 67 Avon-Patello-Femoral Joint Stryker, 109 Gender-Patello-Femoral Joint System Zimmer, 115 Journey-PFJ-Patellofemoral Smith&Nephew, 55 other patella-femoral, 53 Unicompartmental Plus+patella

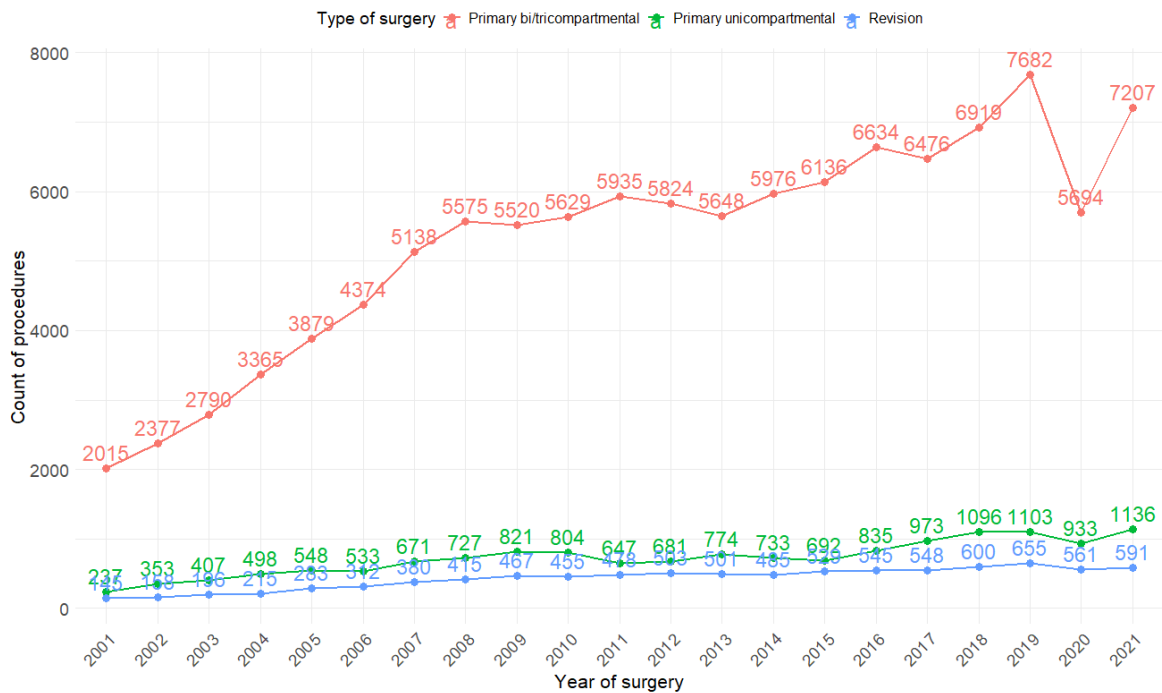
[°]of which 540 spacer exchange, 73 stiff knee loosening, 78 debridement’s, 7 dislocation reductions

[^]1138 liner revisions, 15 femoral component revisions, 5 tibial component revisions, 164 femoral component and liner revisions, 490 tibial component and liner revisions, 7192 total revisions, 59 patella revisions

Trend of primary intervention types over the years



Annual trend in the number of primary and replant interventions



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 2021, according to **type of surgery** and **age group** of patients at the time of surgery

Type of surgery	<40, N = 510 ¹	40-49, N = 2538 ¹	50-59, N = 13976 ¹	60-69, N = 44134 ¹	70-79, N = 64114 ¹	≥80, N = 15881 ¹
Bi-tricomp	314 (71.7)	1521 (64.3)	9271 (68.3)	33810 (77.8)	53399 (84.3)	13194 (83.9)
Unicomp	44 (10.0)	515 (21.8)	2984 (22.0)	6008 (13.8)	4691 (7.4)	1028 (6.5)
Revision	46 (10.5)	246 (10.4)	974 (7.2)	2739 (6.3)	3904 (6.2)	1154 (7.3)
Prosthesis removal	23 (5.3)	59 (2.5)	237 (1.7)	610 (1.4)	814 (1.3)	231 (1.5)
Patella only	11 (2.5)	24 (1.0)	100 (0.7)	305 (0.7)	522 (0.8)	117 (0.7)

¹ n (%)

Mean age at surgery, according to type of operation - years 2001-2021

	Primary bi/tricompartmental, N = 111509	Primary unicompartmental, N = 15270	Revision, N = 9063
Age			
Median (Range)	71.0 (13.0, 96.0)	67.0 (23.0, 93.0)	71.0 (18.0, 95.0)
Mean (SD)	70.5 (8.3)	66.2 (9.1)	69.6 (9.4)

Mean age at surgery, according to type of operation - years 2001 and 2021

Age	Year of surgery 2001	Year of surgery 2021	p-value ¹
Primary bi/tricompartmental	N = 2015	N = 7207	
Median (Range)	72.0 (23.0, 92.0)	71.0 (19.0, 92.0)	
Mean (SD)	71.2 (7.4)	70.3 (8.8)	<0.001
Primary unicompartmental	N = 237	N = 1136	
Median (Range)	69.0 (45.0, 87.0)	67.0 (39.0, 89.0)	
Mean (SD)	69.0 (7.7)	66.6 (9.3)	<0.001
Revision	N = 145	N = 591	
Median (Range)	73.0 (26.0, 87.0)	71.0 (26.0, 94.0)	0.018
Mean (SD)	71.8 (8.4)	69.9 (9.4)	

¹ Welch Two Sample t-test

Mean age at surgery, according to type of operation - years 2001-2021 - according to private or public hospital

Age	Private hospitals	Public hospitals	p-value ¹
Primary bi/tricompartmental	N = 71353	N = 39440	
Median (Range)	71.0 (19.0, 96.0)	72.0 (13.0, 94.0)	
Mean (SD)	70.3 (8.3)	70.9 (8.2)	<0.001
Primary unicompartmental	N = 10594	N = 4608	
Median (Range)	66.0 (28.0, 93.0)	68.0 (23.0, 89.0)	
Mean (SD)	65.7 (9.2)	67.2 (8.8)	<0.001
Revision	N = 5375	N = 3647	
Median (Range)	70.0 (26.0, 95.0)	71.0 (18.0, 94.0)	
Mean (SD)	69.4 (9.2)	69.8 (9.6)	0.103

¹ Welch Two Sample t-test

11.2 Gender

Number of knee operations carried out on patients with admission date between 1st July 2000 and 31st December 2021, according to **type of operation** and **gender** of patients

Type of operation	F, N = 97249 ¹	M, N = 43912 ¹
Bi/tricompar-timental	77783 (81.1)	33,726 (78.4)
Unicompartmental	9707 (10.1)	5,563 (12.9)
Revision	6404 (6.7)	2,659 (6.2)
Prosthesis removal	1178 (1.2)	796 (1.8)
Patella only	791 (0.8)	288 (0.7)

¹ n (%)

11.3 Side of surgery

There is a prevalence of operations performed on the right side (54.5%) in comparison with the left side (45.5%). 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 (22 years), 21391 patients underwent bilateral operations. 17295 (80.9%) chose to undergo the second operation at the same hospital where the first one was performed; 1438 (6.7%) chose to undergo the second operation at a different hospital to follow the surgeon; 2658 (12.4%) 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 53.8% 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 2021, according to **diagnosis**

Diagnosis in unicompartmental knee prosthesis	N = 15270¹
Primary arthritis	12636 (83.1)
Deformity	1330 (8.7)
Necrosis of the condyle	768 (5.1)
Post-traumatic arthritis	129 (0.8)
Post-traumatic necrosis	98 (0.6)
Sequelae of fracture	95 (0.6)
Idiopathic necrosis	35 (0.2)
Post meniscectomy	26 (0.2)
Rheumatic arthritis	18 (0.1)
Sequelae of osteotomy	17 (0.1)
Other	49 (0.3)
Unknown	69
¹ n (%)	

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 July 2000 and 31st December 2020, according to **diagnosis**

Diagnosis in bi/tricompartmental knee prosthesis	N = 111509¹
Primary arthritis	93566 (84.3)
Deformity	10839 (9.8)
Post-traumatic arthritis	1577 (1.4)
Sequelae of fracture	1446 (1.3)
Rheumatic arthritis	1239 (1.1)
Necrosis of the condyle	826 (0.7)
Sequelae of osteotomy	520 (0.5)
Post-traumatic necrosis	125 (0.1)
Post meniscectomy	113 (0.1)
Sequelae of septic arthritis	106 (0.1)
Sequelae of poliomyelitis	74 (0.1)
Idiopathic necrosis	41 (0.0)
Tumor	39 (0.0)
Chondrocalcinosis	30 (0.0)
TBC coxitis sequelae	17 (0.0)
Paget disease	15 (0.0)
Other	440 (0.4)
Unknown	496
¹ n (%)	

11.7 Reasons for revisions and removal

Number of **revision operations** carried out on patients admitted between 1st July 2000 and 31st December 2021, 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 = 9063¹
Total aseptic loosening	3250 (36.3)
Two steps revision	1651 (18.5)
Pain without loosening	939 (10.5)
Aseptic loosening of tibial component	901 (10.1)
Insert wear	303 (3.4)
Aseptic loosening of femoral component	226 (2.5)
Septic loosening	211 (2.4)
Prosthesis dislocation	208 (2.3)
Instability	189 (2.1)
Periprosthetic bone fracture	166 (1.9)
Stiffness	100 (1.1)
Progression of disease	86 (1.0)
Breakage of prosthesis	40 (0.4)
Trauma	36 (0.4)
Other	642 (7.2)
Unknown	115
¹ n (%)	

Number of **prosthesis removal** carried out on patients admitted between 1st July 2000 and 31st December 2021, 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 = 1974¹
Septic loosening	1628 (83.4)
Early Infection	120 (6.2)
Total aseptic loosening	108 (5.5)
Pain without loosening	24 (1.2)
Aseptic loosening of tibial component	20 (1.0)
Periprosthetic bone fracture	10 (0.5)
Prosthesis dislocation	6 (0.3)
Other	35 (1.8)
Unknown	23
¹ n (%)	

12. Types of knee prosthesis

12.1 Unicompartmental prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2021, primary unicompartmental surgery. All poly tibial components in **bold**.

Type of Prosthesis	2000-2015, N = 9194 ¹	2016-2018, N = 2904 ¹	2019-2021, N = 3172 ¹
PHYSICA ZUK - Lima	1023 (11.2)	558 (19.2)	674 (21.2)
JOURNEY UNI - Smith & Nephew	402 (4.4)	842 (29.0)	432 (13.6)
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	1392 (15.2)	17 (0.6)	0 (0.0)
GENESIS UNI - Smith & Nephew	1166 (12.7)	33 (1.1)	0 (0.0)
UNI SIGMA HP - De Puy Johnson & Johnson	704 (7.7)	196 (6.8)	175 (5.5)
MITUS - ENDO-MODEL UNI - ALL POLY - Link	443 (4.8)	204 (7.0)	113 (3.6)
RESTORIS MCK UNI - Mako	43 (0.5)	169 (5.8)	413 (13.0)
JOURNEY II - UNI XLPE - Smith & Nephew	0 (0.0)	86 (3.0)	412 (13.0)
EFDIOS - Citieffe	477 (5.2)	0 (0.0)	0 (0.0)
ALLEGRETTO UNI - Protek-Sulzer	343 (3.7)	56 (1.9)	34 (1.1)
JOURNEY UNI - ALL POLY - Smith & Nephew	295 (3.2)	75 (2.6)	59 (1.9)
GKS - ONE - ALL POLY - Permedica	349 (3.8)	33 (1.1)	0 (0.0)
PRESERVATION UNI - ALL POLY - Depuy	379 (4.1)	0 (0.0)	0 (0.0)
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	12 (0.1)	175 (6.0)	129 (4.1)
GENESIS UNI - ALL POLY - Smith & Nephew	307 (3.3)	0 (0.0)	0 (0.0)
PERSONA UNI - Biomet	0 (0.0)	54 (1.9)	211 (6.7)
UC-PLUS SOLUTION - Endoplus	243 (2.6)	0 (0.0)	0 (0.0)
UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	132 (1.4)	55 (1.9)	42 (1.3)
BALANSYS - UNI - Mathys	156 (1.7)	30 (1.0)	42 (1.3)
UNIVATION F - B.Braun	11 (0.1)	83 (2.9)	89 (2.8)
MILLER GALANTE UNI - Zimmer	179 (2.0)	0 (0.0)	0 (0.0)
OPTETRAK - UNI - ALL POLY - Exactech	176 (1.9)	2 (0.1)	0 (0.0)
GENUS UNI - Adler-Ortho	51 (0.6)	54 (1.9)	69 (2.2)
HLS - UNI EVOLUTION - ALL POLY - Tornier	156 (1.7)	0 (0.0)	0 (0.0)
GKS - ONE - Permedica	36 (0.4)	52 (1.8)	67 (2.1)
MAIOR - Finceramica	154 (1.7)	0 (0.0)	0 (0.0)
UC-PLUS SOLUTION - ALL POLY - Endoplus	144 (1.6)	0 (0.0)	0 (0.0)
TRIATHLON - PKR - Howmedica Osteonics	44 (0.5)	5 (0.2)	26 (0.8)
MITUS - ENDO-MODEL UNI - METAL-BACKED - LINK	8 (0.1)	12 (0.4)	53 (1.7)
HERMES UNI - Ceraver	8 (0.1)	64 (2.2)	0 (0.0)
EIUS UNI - ALL POLY - Stryker Howmedica	59 (0.6)	0 (0.0)	0 (0.0)
PFC - UNI - De Puy Johnson & Johnson	56 (0.6)	0 (0.0)	0 (0.0)
GMK - UNI - FIXED - MEDACTA	5 (0.1)	11 (0.4)	30 (0.9)
IBALANCE UNI - Arthrex	29 (0.3)	7 (0.2)	2 (0.1)

K-MONO - Gruppo Biompianti	0 (0.0)	0 (0.0)	38 (1.2)
UNIGLIDE MOBILE - CORIN MEDICAL	5 (0.1)	13 (0.4)	20 (0.6)
MOTO - PARTIAL KNEE - Medacta	0 (0.0)	0 (0.0)	35 (1.1)
PRESERVATION UNI - Depuy	27 (0.3)	0 (0.0)	0 (0.0)
UNICIA - VECTEUR ORTHOPEDIC – Stratec	27 (0.3)	0 (0.0)	0 (0.0)
Other (<25 cases)	132 (1.4)	15 (0.5)	7 (0.2)
Unknown	21	3	0
¹ n (%)			

12.2 Bi-tricompartamental knee prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2021, primary bi/tricompartamental surgery

Type of Prosthesis	2000-2015, N = 70897 ¹	2016-2018, N = 20029 ¹	2019-2021, N = 20583 ¹
NEXGEN – Zimmer	14438 (20.4)	1691 (8.4)	739 (3.6)
LEGION - Smith & Nephew	1275 (1.8)	3532 (17.6)	4117 (20.0)
VANGUARD – Biomet Merck France	5803 (8.2)	1368 (6.8)	1132 (5.5)
ATTUNE – DePuy	1515 (2.1)	3014 (15.1)	3336 (16.2)
P.F.C – DePuy	6530 (9.2)	439 (2.2)	255 (1.2)
GENESIS - Smith & Nephew	5722 (8.1)	953 (4.8)	312 (1.5)
PROFIX – Smith & Nephew	5160 (7.3)	0 (0.0)	0 (0.0)
GEMINI - Link	2744 (3.9)	581 (2.9)	600 (2.9)
TRIATHLON – Stryker Howmedica Osteonics	1977 (2.8)	857 (4.3)	921 (4.5)
PERSONA - Zimmer	729 (1.0)	978 (4.9)	1782 (8.7)
TC-PLUS - SOLUTION - Smith & Nephew	2919 (4.1)	256 (1.3)	32 (0.2)
OPTETRACK – Exactech	1534 (2.2)	827 (4.1)	674 (3.3)
SCORPIO – Stryker Howmedica	2739 (3.9)	55 (0.3)	0 (0.0)
GENUS – Adler-Ortho	1621 (2.3)	599 (3.0)	532 (2.6)
G.K.S. – Permedica	1052 (1.5)	740 (3.7)	786 (3.8)
PHYSICA - Lima	52 (0.1)	932 (4.7)	1454 (7.1)
BALANSYS - Mathys	918 (1.3)	350 (1.7)	338 (1.6)
GSP - TREKKING - Samo	1169 (1.7)	378 (1.9)	46 (0.2)
GMK - Medacta	153 (0.2)	293 (1.5)	959 (4.7)
ADVANCE - Wright	1017 (1.4)	128 (0.6)	45 (0.2)
JOURNEY – Smith & Nephew	393 (0.6)	298 (1.5)	459 (2.2)
LCS – DePuy	945 (1.3)	80 (0.4)	75 (0.4)
FIRST - Symbios Orthopedie SA	990 (1.4)	5 (0.0)	0 (0.0)
ROTAGLIDE – Corin Medical	869 (1.2)	6 (0.0)	0 (0.0)
APEX - Omniflife Science	305 (0.4)	269 (1.3)	286 (1.4)
INNEX - Protek Sulzer	515 (0.7)	230 (1.1)	45 (0.2)
COLUMBUS - B.Braun	447 (0.6)	196 (1.0)	131 (0.6)
UNITY KNEE - Corin Medical	17 (0.0)	232 (1.2)	514 (2.5)
INTERAX - Stryker Howmedica	737 (1.0)	0 (0.0)	0 (0.0)
GENIUS TRICCC - Dedienne Sante	677 (1.0)	8 (0.0)	0 (0.0)
T.A.C.K. – Link	636 (0.9)	0 (0.0)	0 (0.0)
ACS - Implantcast	395 (0.6)	184 (0.9)	44 (0.2)
AGC - Biomet Merck France	593 (0.8)	0 (0.0)	0 (0.0)
SCORE – Amplitude	584 (0.8)	1 (0.0)	0 (0.0)
ENDO-MODEL - Link	403 (0.6)	59 (0.3)	58 (0.3)
K-MOD - Gruppo Biompianti	12 (0.0)	233 (1.2)	268 (1.3)
MULTIGEN - Lima	448 (0.6)	3 (0.0)	5 (0.0)

HLS – Tornier	388 (0.5)	0 (0.0)	0 (0.0)
913 – Wright Cremascoli	358 (0.5)	0 (0.0)	0 (0.0)
RT-PLUS - Smith & Nephew	234 (0.3)	54 (0.3)	66 (0.3)
PERFORMANCE – Kirschner Biomet Merck	281 (0.4)	0 (0.0)	0 (0.0)
DURACON – Stryker Howmedica	267 (0.4)	0 (0.0)	0 (0.0)
U2 - United Orthopedic Corporation	63 (0.1)	1 (0.0)	183 (0.9)
SIGMA RP - TC3 - DePuy	124 (0.2)	45 (0.2)	29 (0.1)
EVOLUTION - Wright	2 (0.0)	27 (0.1)	160 (0.8)
SKS - DEEP DISH - Aston Medical	57 (0.1)	71 (0.4)	61 (0.3)
E.MOTION - B.Braun	181 (0.3)	0 (0.0)	0 (0.0)
CONTINUUM KNEE SYSTEM – Stratec Medical	166 (0.2)	0 (0.0)	0 (0.0)
RO.C.C. – Biomet Merck France	163 (0.2)	0 (0.0)	0 (0.0)
CINETIQUE - Medacta	100 (0.1)	0 (0.0)	0 (0.0)
Other (<100 cases)	410 (0.6)	49 (0.2)	136 (0.7)
Unknown	70	7	3
¹ n (%)			

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

12.3 Revision prosthesis

Prostheses used in patients admitted between 1st July 2000 and 31st December 2021 in total revision surgery.

Type of Prosthesis	2000-2015, N = 4507 ¹	2016-2018, N = 1322 ¹	2019-2021 , N = 1363 ¹
NEXGEN – Zimmer	1164 (25.9)	224 (17.0)	134 (9.9)
LEGION - Smith & Nephew	438 (9.8)	436 (33.0)	537 (39.6)
ENDO-MODEL - Link	401 (8.9)	128 (9.7)	118 (8.7)
SIGMA RP - TC3 - DePuy	277 (6.2)	64 (4.8)	50 (3.7)
P.F.C – DePuy	332 (7.4)	51 (3.9)	4 (0.3)
RT-PLUS - Smith & Nephew	266 (5.9)	39 (3.0)	56 (4.1)
GENESIS - Smith & Nephew	178 (4.0)	17 (1.3)	5 (0.4)
ATTUNE – DePuy	16 (0.4)	46 (3.5)	126 (9.3)
G.K.S. – Permedica	132 (2.9)	34 (2.6)	19 (1.4)
VANGUARD – Biomet Merck France	108 (2.4)	36 (2.7)	35 (2.6)
OPTETRACK – Exactech	95 (2.1)	29 (2.2)	41 (3.0)
DURATION MRH - Osteonics	127 (2.8)	12 (0.9)	11 (0.8)
AGC - Biomet Merck France	127 (2.8)	0 (0.0)	0 (0.0)
PROFIX – Smith & Nephew	122 (2.7)	0 (0.0)	0 (0.0)
TRIATHLON – Stryker Howmedica Osteonics	70 (1.6)	31 (2.3)	21 (1.5)
SCORPIO – Stryker Howmedica	94 (2.1)	0 (0.0)	0 (0.0)
ACS - Implantcast	41 (0.9)	17 (1.3)	14 (1.0)
LPS - HINGE - DePuy	25 (0.6)	12 (0.9)	25 (1.8)
COLUMBUS - B.Braun	9 (0.2)	21 (1.6)	30 (2.2)
GEMINI - Link	35 (0.8)	9 (0.7)	11 (0.8)
BALANSYS - Mathys	27 (0.6)	12 (0.9)	15 (1.1)
GSP - TREKKING - Samo	34 (0.8)	15 (1.1)	1 (0.1)
S-ROM NRH - Johnson & Johnson	47 (1.0)	0 (0.0)	0 (0.0)
TC-PLUS - SOLUTION - Smith & Nephew	37 (0.8)	1 (0.1)	0 (0.0)
INTERAX - Stryker Howmedica	35 (0.8)	0 (0.0)	0 (0.0)

PERSONA - Zimmer	6 (0.1)	8 (0.6)	21 (1.5)
APEX - Omniflife Science	9 (0.2)	11 (0.8)	7 (0.5)
MUTARS - IMPLANTCAST	15 (0.3)	8 (0.6)	4 (0.3)
Other (<25 cases)	223 (5.0)	59 (4.5)	72 (5.3)
Unknown	17	2	6

¹ n (%)

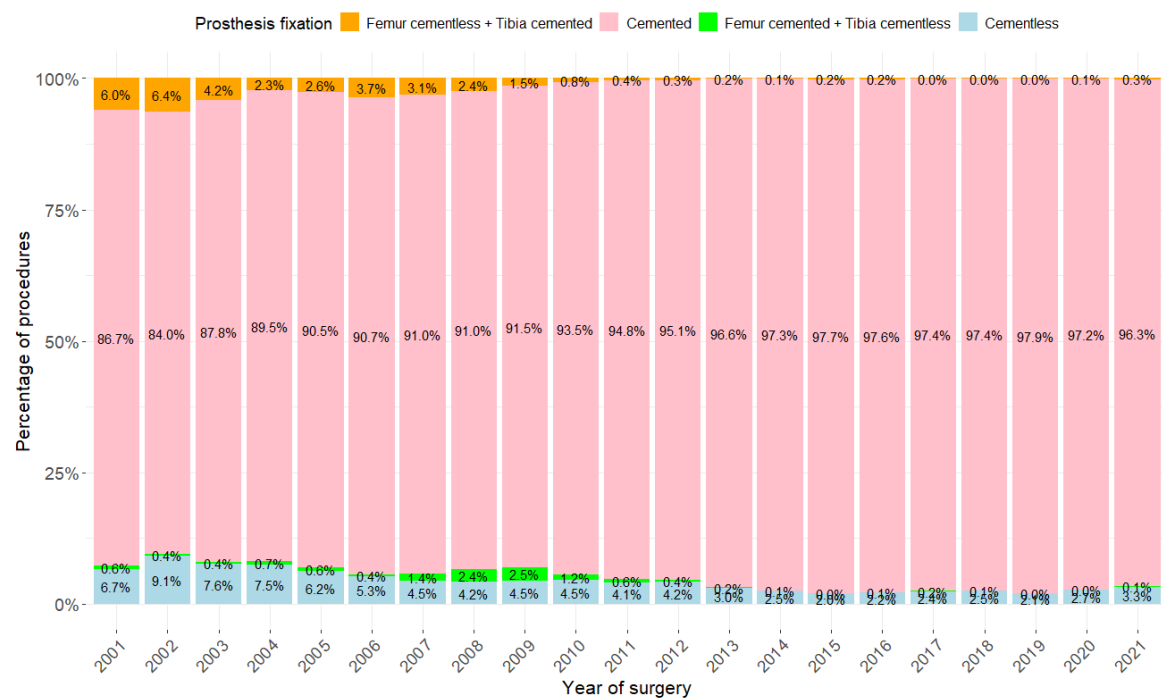
12.4 Prosthesis fixation

Number of knee prosthesis arthroplasty performed on patients admitted to hospital between 1st July 2000 and 31st December 2021 according to **prosthesis fixation**

Fixation	Primary unicompartmental, N = 15270 ¹	Primary bi/tricompartmental, N = 111509 ¹	Total revision, N = 7192 ¹	Total, N = 133971 ¹
Cemented	14420 (94.5)	105252 (94.4)	7098 (98.9)	126770 (94.7)
Cementless	648 (4.2)	4250 (3.8)	48 (0.7)	4946 (3.7)
Femur cementless + Tibia cemented	161 (1.1)	1338 (1.2)	17 (0.2)	1516 (1.1)
Femur cemented + Tibia cementless	30 (0.2)	630 (0.6)	13 (0.2)	673 (0.5)
Unknown	11	39	16	66

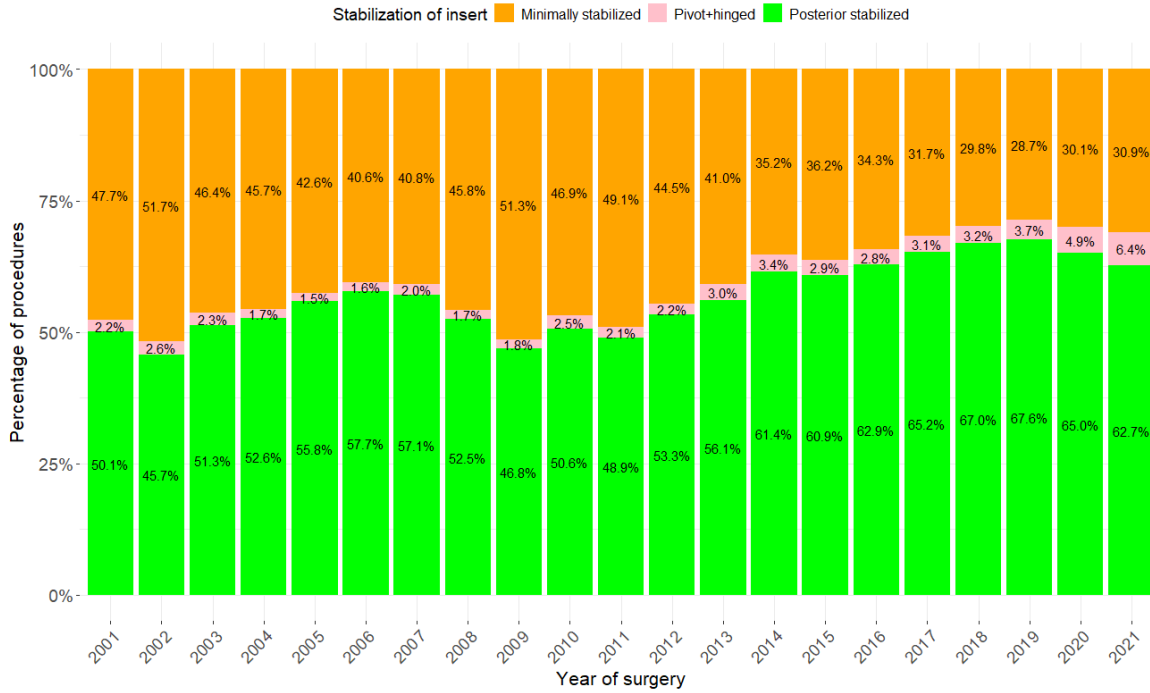
¹ n (%)

Trends over the years of implants, by fixation of bi-tricompartmental prostheses

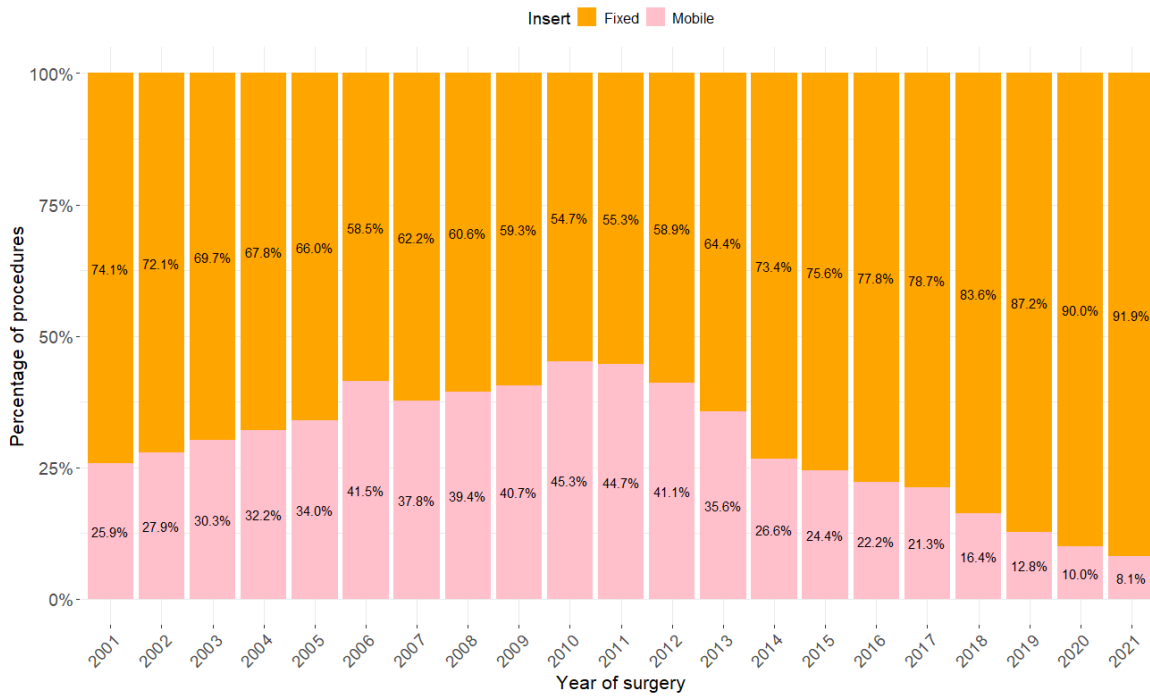


12.5 Type of insert

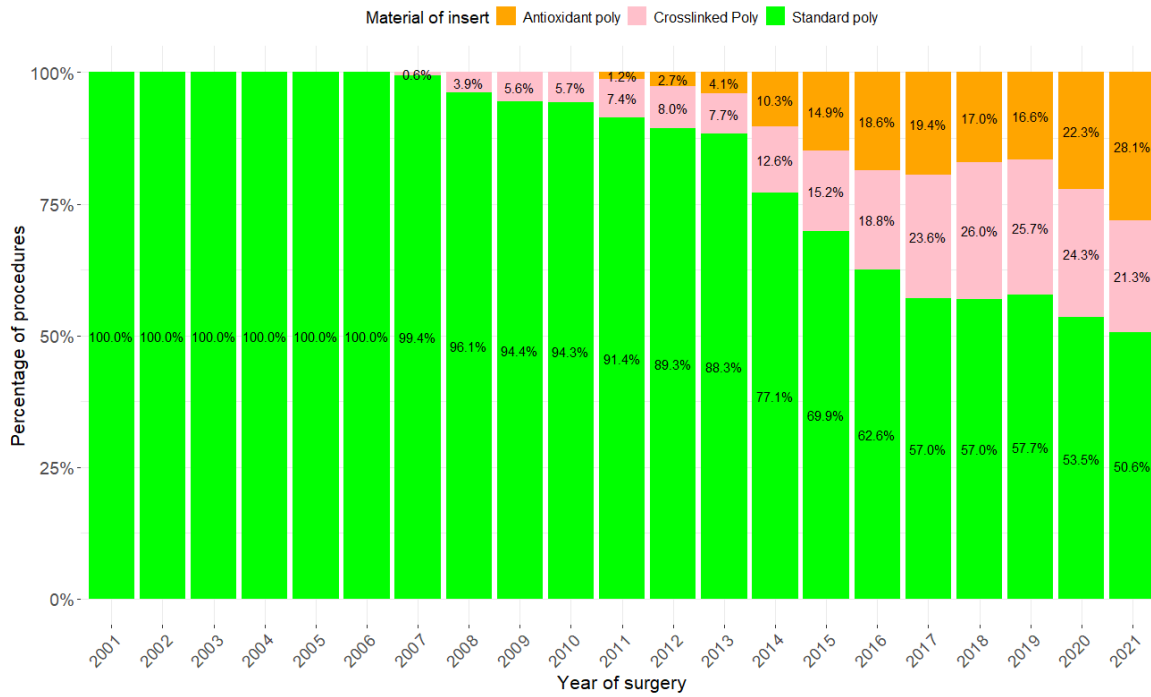
Stabilization of insert in bi-tricompartamental knee prostheses according to year of intervention.



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

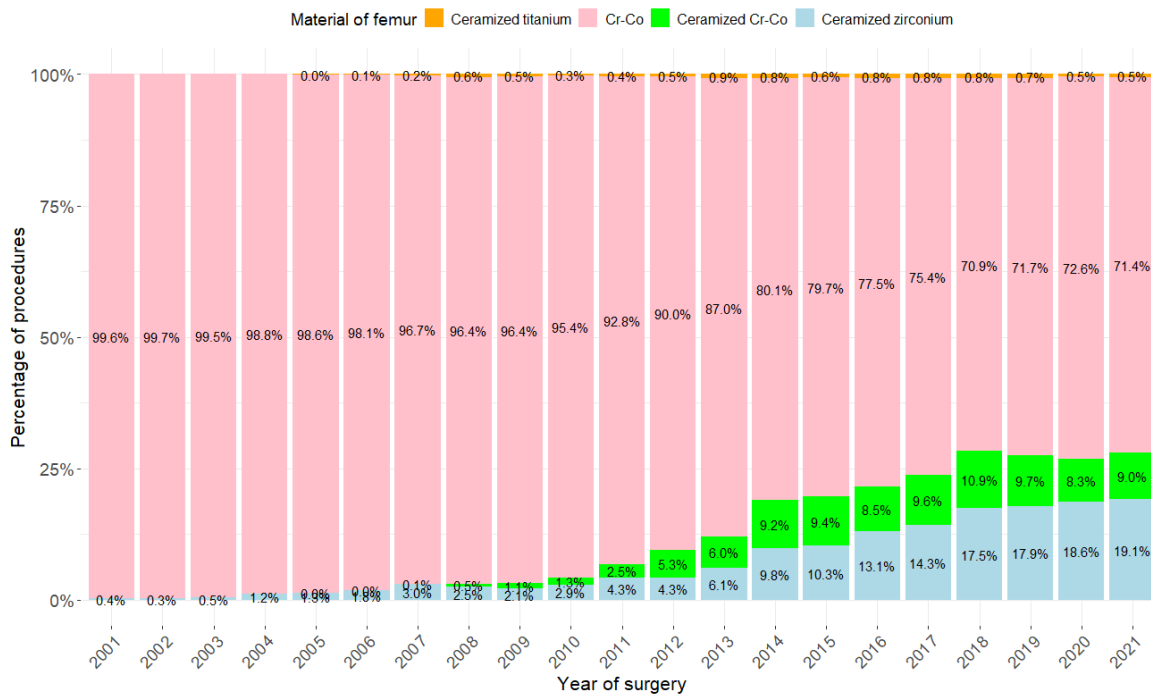


Materials of insert of bi-tricompartmental knee prosthesis according to year of implant



12.6 Type of femur

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



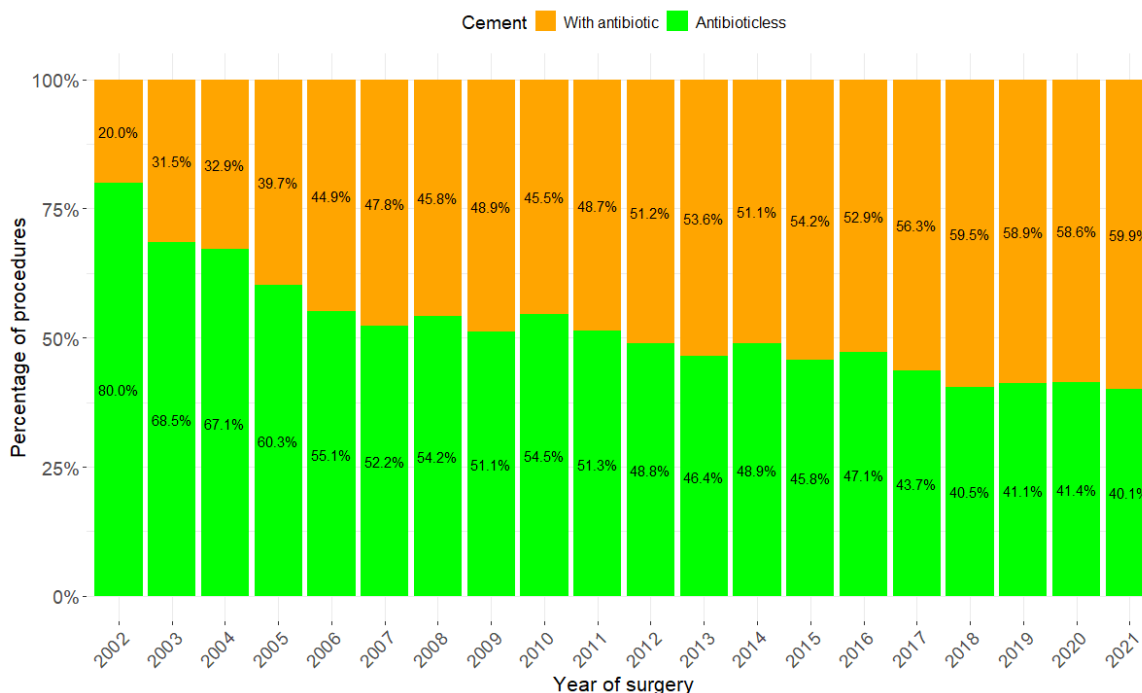
Between 1st July 2000 and 31st December 2021, 22 cases of composite ceramic are observed.

12.7 Bone Cement

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

Cement	%
Surgical Simplex P - Howmedica	16.5
Antibiotic Simplex - Howmedica	11.4
Palacos R+G - Heraeus Medical	9.5
Palacos R - Heraeus Medical	8.9
Hi-Fatigue G - Zimmer	6.7
Hi-Fatigue - Zimmer	4.2
Refobacin Bone Cement R - Biomet	3.5
Versabond - Smith&Nephew	2.3
Smartset GMV - Depuy	2.1
Osteobond - Zimmer	2.0
Smartset MV - Depuy	2.0
Smartset GHV - Depuy	1.9
Palamed G - Heraeus Medical	1.9
Aminofix 1 - Groupe Lepine	1.8
Versabond AB - Smith&Nephew	1.8
Cemfix 1 - Teknimed	1.7
Bone Cement R - Biomet	1.6
Palamed - Heraeus Medical	1.4
Cemex System - Tecres	1.4
Cemex Genta System - Tecres	1.3
CMW 2 - Depuy	1.2
Refobacin Revision - Biomet	1.2
Altro Cemento con antibiotico	7.6
Altro Cemento senza antibiotico	6.0
Totale	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 2021.

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	%		N.	%
Tibial fracture	13	0.1			
Femoral fracture	10	0.1			
Anaesthesiologic	3	0.02	Early Infection	4	0.03
Tibial tuberosity fracture	2	0.01			
Ligament lesion	1	0.01	Deep venous thrombosis	6	0.04
Other	7	0.05			
Total	36	0.3	Total	10	0.1

The rate of complications in **primary bi-tricompartmental surgery** carried out on patients hospitalized between 1st July 2000 and 31st December 2021

Complications occurred during hospitalization					
Intra-operative			Intra-operative		
	N.	%		N.	%
Femoral fracture	86	0.1			
Tibial fracture	46	0.04			
Patellar tendon rupture	39	0.03	Deep venous thrombosis	185	0.2
Ligament lesion	37	0.03			
Anaesthesiologic	32	0.03			
Hemorrhagia	25	0.03			
Vascular lesion	18	0.02			
Tibial tuberosity fracture	9	0.01	Early Infection	41	0.04
Other	51	0.05			
Total	343	0.3	Total	226	0.2

The rate of complications in **revision surgery** carried out on patients hospitalized between 1st July 2000 and 31st December 2021

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	%		N.	%
Femoral fracture	31	0.3			
Tibial fracture	28	0.3			
Patellar tendon rupture	25	0.3	Early Infection	18	0.2
Anaesthesiologic	10	0.1			
Tibial tuberosity fracture	10	0.1			
Vascular lesion	6	0.1			
Hemorrhagia	4	0.04	Deep venous thrombosis	16	0.2
Ligament lesion	1	0.01			
Other	15	0.2			
Total	130	1.4	Total	34	0.4

13.1 Deaths occurred during hospitalization

Rate of deaths in knee prosthetic surgery carried out on patients hospitalized between 1st July 2000 and 31st December 2020. Only deaths occurred during hospitalization are recorded.

Year 2000-2021			
Type of surgery	Deaths	Number of surgeries	%
Primary bi/tricompartmental	77	111509	0.07
Primary unicompartmental	1	15270	0.01
Revision	14	9063	0.15
Prosthesis removal	6	1974	0.30

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 prosthetic 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 2021 only on patients living in the Region, were analysed.

		N		Hazard ratio	p
Age	>60	63544	■	Reference	
	≤60	6429		2.05 (1.87, 2.26)	<0.001
Sex	F	49361	■	Reference	
	M	20612		1.12 (1.03, 1.20)	0.005
Diagnosis	Arthrosis	58766	■	Reference	
	Other	11207		1.08 (0.99, 1.19)	0.097
Type of insert	Fix	49496	■	Reference	
	Mobile	20477		1.28 (1.19, 1.38)	<0.001

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 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 '≤ 60 years' had a greater risk (2.05) of failure than patients of the group '> 60 years'.

Patients of the group 'mobile insert' had a greater risk (1.28) of failure than patients of the group 'fix insert'.

Concerning gender, males have a higher risk of 1.12 compared to women.

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

Unicompartmental

All primary unicompartmental knee arthroplasties performed in the Region between July 2000 and December 2021 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 ' ≤ 60 years' had a greater risk of failure than patients of the group ' > 60 years'. Concerning gender, females have a higher risk of 1.23 compared to women.

		N	Hazard ratio		p
Age	>60	5744	■	Reference	
	≤ 60	1607	■	1.78 (1.53, 2.07)	<0.001
Sex	M	2473	■	Reference	
	F	4878	■	1.23 (1.04, 1.44)	0.01
Tibial component	All poly	1851	■	Reference	
	Metal backed	5500	■	1.05 (0.90, 1.23)	0.53

Type of tibial component does not influence the risk ($p=0.53$).

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.

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

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	53469	1361	1073	153	7.9	2587/53469
Primary tricompartmental	16591	389	169	47	6.3	605/16591
Primary unicompartamental	8864	405	348	71	7.6	824/8864
Total revision	3918	320	208	37	6.5	565/3918

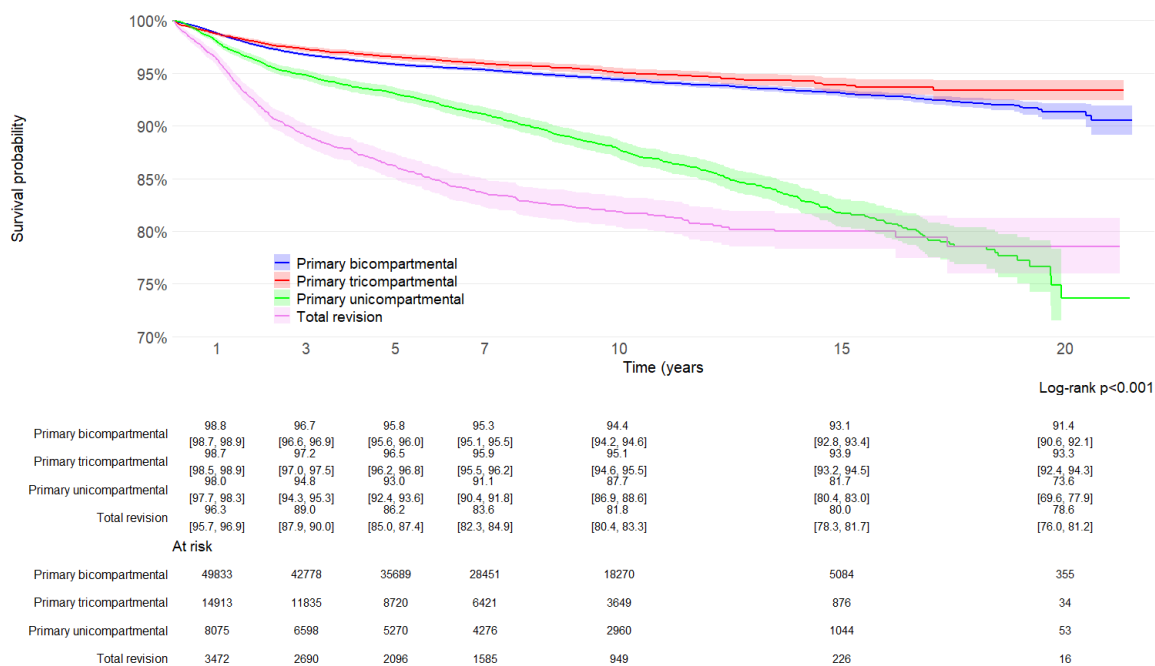
In Primary knee arthroplasties, **46.3%** of Revisions was performed in a different hospital.

14.3 Survival analysis of uni and bicompartmental

Analysis has been separately performed for uni, bi, tricompartmental prosthesis and total revisions. The revision of a single component (even insert) is considered as a failure. Prosthetization of patella, in a second surgery, is 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	53469	1626	808	153	2587/53469
Primary tricompartmental	16591	426	132	47	605/16591
Primary unicompartamental	8864	730	28	71	824/8864
Total revision	3918			37	565/3918

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.



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

Primary Unicompartmental			
Cause of revision	Incidence	IR (%)	% Distribution failure causes
Total aseptic loosening	359/8864	4.1	38.4
Pain without loosening	149/8864	1.7	15.9
Aseptic loosening of tibial component	110/8864	1.2	11.8
Septic loosening	63/8864	0.7	6.7
Progression of disease	38/8864	0.4	4.1
Aseptic loosening of femoral component	30/8864	0.3	3.2
Insert wear	26/8864	0.3	2.8
Breakage of prosthesis	21/8864	0.2	2.2
Prosthesis dislocation	17/8864	0.2	1.8
Periprosthetic bone fracture	14/8864	0.2	1.5
Instability	6/8864	0.1	0.6
Trauma	2/8864	0.0	0.2
Other	10/8864	0.1	1.1
Unknown	90/8864	1.0	9.6
Unknown (outside region)	1/8864	0.0	0.1
Total	936/8864	10.6	100.0

Primary Bi-tricompartmental			
Cause of revision	Incidence	IR (%)	% Distribution failure causes
Total aseptic loosening	698/70060	1.0	21.9
Septic loosening	671/70060	1.0	21.0
Pain without loosening	421/70060	0.6	13.2
Aseptic loosening of tibial component	259/70060	0.4	8.1
Patellar pain	129/70060	0.2	4.0
Progression of disease	121/70060	0.2	3.8
Prosthesis dislocation	95/70060	0.1	3.0

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

Insert wear	73/70060	0.1	2.3
Periprosthetic bone fracture	71/70060	0.1	2.2
Instability	66/70060	0.1	2.1
Aseptic loosening of femoral component	55/70060	0.1	1.7
Stiffness	52/70060	0.1	1.6
Breakage of prosthesis	26/70060	0.0	0.8
Trauma	8/70060	0.0	0.3
Patellar chondropathy	8/70060	0.0	0.3
Other	94/70060	0.1	2.9
Unknown	166/70060	0.2	5.2
Unknown – outside region	179/70060	0.3	5.6
Total	3192/70060	4.6	100.0

Total revision

Cause of re-revision	Incidence	IR (%)	% Distribution failure causes
Septic loosening	152/3918	3.9	26.9
Total aseptic loosening	103/3918	2.6	18.2
Pain without loosening	58/3918	1.5	10.3
Aseptic loosening of tibial component	47/3918	1.2	8.3
Early Infection	20/3918	0.5	3.5
Patellar pain	15/3918	0.4	2.7
Aseptic loosening of femoral component	14/3918	0.4	2.5
Instability	14/3918	0.4	2.5
Prosthesis dislocation	13/3918	0.3	2.3
Progression of disease	9/3918	0.2	1.6
Periprosthetic bone fracture	9/3918	0.2	1.6
Insert wear	8/3918	0.2	1.4
Breakage of prosthesis	5/3918	0.1	0.9
Stiffness	5/3918	0.1	0.9
Other	29/3918	0.7	5.1
Unknown	64/3918	1.6	11.3
Totale	565/3918	14.4	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 100 cases.

In bold Monoblock Prosthesis

Model	Year of first implant	N.	N. failures	5 year survival probability [95% CI]	At risk at 5 years	10 year survival probability [95% CI]	At risk at 10 years
PHYSICA ZUK - Lima	2005	1512	59	96.6 [95.5,97.6]	611	92.7 [90.5,94.9]	213
OXFORD UNICOMPARTMENTAL PHASE 3 - Biomet Merck	2000	865	172	90.8 [88.8,92.7]	749	85.4 [83.1,87.9]	589
JOURNEY UNI - Smith & Nephew	2011	723	48	92.5 [90.2,94.7]	242	88.3 [83.4,93.6]	1
GENESIS UNI - Smith & Nephew	2000	676	108	92.4 [90.4,94.4]	598	87.1 [84.6,89.8]	445
UNI SIGMA HP - De Puy Johnson & Johnson	2009	559	32	94.7 [92.8,96.7]	440	92.1 [89.1,95.2]	69
MITUS - ENDO-MODEL UNI - ALL POLY - Link	2003	484	56	92.4 [90.0,95.0]	294	87.4 [83.8,91.0]	176

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

RESTORIS MCK UNI - Mako	2014	353	4	98.9 [97.7,100.0]	70	— [—,—]	0
JOURNEY UNI - ALL POLY - Smith & Nephew	2010	330	29	94.0 [91.2,96.9]	200	87.8 [83.4,92.4]	60
JOURNEY II - UNI XLPE - Smith & Nephew	2017	321	8	— [—,—]	0	— [—,—]	0
EFDIOS - Citieffe	2000	314	64	92.7 [89.9,95.7]	272	83.9 [79.8,88.3]	212
ALLEGRETTO UNI - Protek-Sulzer	2000	306	38	93.0 [90.1,96.0]	238	89.3 [85.6,93.2]	161
OXFORD ANATOMIC PARTIAL KNEE - Biomet Merck	2014	244	14	91.8 [87.4,96.4]	38	— [—,—]	0
GKS - ONE - ALL POLY - Permedica	2006	214	24	93.9 [90.7,97.2]	190	87.5 [82.7,92.6]	88
PRESERVATION UNI - ALL POLY - Depuy	2002	187	28	92.3 [88.5,96.3]	163	87.0 [82.2,92.1]	137
UC-PLUS SOLUTION - Smith & Nephew	2000	177	18	97.1 [94.7,99.6]	164	94.7 [91.3,98.1]	145
HLS - UNI EVOLUTION - ALL POLY - Tornier	2001	144	16	95.7 [92.3,99.1]	128	89.4 [84.3,94.8]	97
UC-PLUS SOLUTION - ALL POLY - Smith & Nephew	2003	140	26	88.3 [83.1,93.9]	117	81.7 [75.4,88.7]	85
OPTETRAK - UNI - ALL POLY - Exactech	2005	131	7	98.5 [96.4,100.0]	120	95.9 [92.4,99.5]	104
UNI SIGMA HP - ALL POLY - De Puy Johnson & Johnson	2010	121	12	90.5 [85.1,96.4]	69	83.8 [73.5,95.6]	10
MILLER GALANTE UNI - Zimmer	2001	118	14	95.7 [92.1,99.5]	108	91.9 [86.9,97.1]	90
BALANSYS - UNI - Mathys	2005	108	19	85.1 [78.6,92.1]	91	82.6 [75.6,90.3]	56
GENUS UNI - Adler-Ortho	2013	103	10	89.3 [82.9,96.3]	25	— [—,—]	0
Other (<100 cases)	2000	702	117	86.7 [83.9,89.6]	317	78.2 [74.2,82.4]	204
Unknown	2000	32	13	87.5 [76.8,99.7]	26	72.2 [57.3,90.9]	18

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 100 cases.

Model	Year of first implant	N.	N. failures	5 year survival probability [95% CI]	At risk at 5 years	10 year survival probability [95% CI]	At risk at 10 years
NEXGEN - LPS - FLEX FISSO - ZIMMER	2002	6209	211	97.3 [96.8,97.7]	4860	96.4 [95.9,96.9]	2626
LEGION - PS XLPE HIGH FLEXION - SMITH & NEPHEW	2011	4381	157	95.3 [94.5,96.0]	929	90.5 [84.3,97.3]	14
VANGUARD - PS - BIOMET ORTHOPEDICS	2005	3661	106	97.2 [96.7,97.8]	2338	96.4 [95.6,97.1]	897
GENESIS II - PS HIGH FLEXION - SMITH & NEPHEW	2004	2974	104	97.0 [96.3,97.6]	2565	96.2 [95.5,97.0]	733
GEMINI MK II - LINK	2002	2766	124	96.1 [95.4,96.9]	1936	94.6 [93.6,95.6]	898

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

TC-PLUS - SB SOLUTION - ENDOPLUS	2002	2170	77	97.5 [96.8,98.2]	1873	96.3 [95.4,97.2]	892
ATTUNE - PS FIXED – De Puy Johnson & Johnson	2012	2093	80	95.2 [94.1,96.3]	772	— [—,—]	—
PROFIX-CONFORMING Smith&Nephew	2000	2040	105	96.2 [95.4,97.1]	1833	94.9 [93.9,95.9]	1390
NEXGEN-LPS Zimmer	2000	2012	100	97.1 [96.3,97.8]	1798	95.5 [94.5,96.4]	1423
PHYSICA - PS FIXED - LIMA	2014	1747	24	98.3 [97.6,99.0]	215	— [—,—]	—
PFC - RP - PS - De Puy Johnson & Johnson	2000	1737	101	95.8 [94.8,96.7]	1535	94.2 [93.1,95.3]	838
PERSONA - PS - ZIMMER	2013	1616	41	96.3 [95.1,97.5]	443	— [—,—]	—
NEXGEN - CR FLEX FISSO - ZIMMER	2004	1584	56	97.0 [96.1,97.9]	1202	95.7 [94.5,96.9]	422
TRIATHLON - CR - HOWMEDICA OSTEONICS	2005	1574	34	97.8 [97.1,98.6]	1035	97.2 [96.2,98.2]	322
GENESIS II - C R - Smith & Nephew	2001	1397	73	95.2 [94.0,96.4]	967	94.3 [92.9,95.6]	540
ATTUNE - PS MOBILE – De Puy Johnson & Johnson	2014	1309	65	94.0 [92.6,95.5]	364	— [—,—]	—
OPTETRAK - LOGIC PS - EXACTECH	2011	1119	39	95.4 [93.8,97.0]	284	94.5 [92.4,96.5]	1
VANGUARD - CR-LIPPED - BIOMET ORTHOPEDICS	2006	1092	47	95.7 [94.5,97.0]	711	95.0 [93.6,96.5]	377
GENUS PE - Adler-Ortho	2008	948	48	96.7 [95.5,97.8]	842	94.5 [93.0,96.1]	421
LEGION - CR XLPE HIGH FLEXION - Smith & Nephew	2012	942	27	95.9 [94.3,97.5]	165	— [—,—]	—
NEXGEN - LPS - FLEX MOBILE - ZIMMER	2002	846	42	96.7 [95.5,97.9]	743	95.4 [93.9,96.9]	438
TRIATHLON - PS - HOWMEDICA OSTEONICS	2007	727	16	97.8 [96.6,99.0]	318	96.6 [94.3,98.8]	66
LEGION - CONSTRAINED - SMITH & NEPHEW	2008	697	26	95.6 [93.9,97.3]	218	95.1 [93.1,97.1]	16
PFC-RP-CVD De Puy Johnson&Johnson	2001	669	39	95.4 [93.7,97.0]	521	94.1 [92.3,96.1]	278
ROTAGLIDE Corin Medical	2000	655	91	90.6 [88.4,92.9]	545	87.5 [84.9,90.2]	365
GMK - PRIMARY - SPHERE FIXED - MEDACTA	2014	652	7	98.3 [96.9,99.6]	22	— [—,—]	—
FIRST - SYMBIOS ORTHOPEDIE SA	2006	649	40	94.8 [93.1,96.5]	569	93.7 [91.8,95.7]	356
PFC-PS De Puy Johnson&Johnson	2000	638	40	94.6 [92.9,96.4]	517	93.1 [91.0,95.3]	213
ADVANCE Medial Pivot - Wright	2000	634	32	95.5 [93.8,97.1]	518	95.3 [93.6,97.0]	339
JOURNEY II - BCS XLPE - SMITH & NEPHEW	2012	629	29	94.1 [91.9,96.4]	156	— [—,—]	—
GENIUS TRICCC Dedienne Sante	2000	598	71	91.9 [89.7,94.2]	500	88.8 [86.2,91.5]	341
PROFIX-PS Smith&Nephew	2002	588	31	96.0 [94.4,97.6]	518	94.6 [92.7,96.5]	423
INNEX - MOBILE BEARING - UCOR - PROTEK SULZER	2002	584	21	96.7 [95.2,98.2]	412	95.7 [93.7,97.7]	78
SCORPIO - NRG - PS – Howmedica Osteonics	2004	550	48	93.7 [91.6,95.7]	484	91.4 [89.0,93.9]	341

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

SCORPIO - NRG - CR – Howmedica Osteonics	2007	533	25	95.9 [94.2,97.6]	468	95.5 [93.7,97.3]	234
T.A.C.K. - Link	2000	530	64	93.6 [91.5,95.7]	457	90.7 [88.2,93.3]	366
LCS - UNIVERSAL - RP - De Puy Johnson & Johnson	2000	488	21	96.2 [94.6,98.0]	431	96.0 [94.3,97.8]	351
APEX - PS - OMNILIFE SCIENCE	2011	460	16	95.6 [93.5,97.8]	102	95.6 [93.5,97.8]	7
PFC - SIGMA RPF - DE PUY JOHNSON & JOHNSON	2005	449	28	95.7 [93.9,97.6]	405	93.2 [90.8,95.7]	243
SCORE - AMPLITUDE	2004	437	16	97.2 [95.7,98.8]	390	96.1 [94.2,98.0]	303
OPTETRAK - RBK - HI- FLEX - EXACTECH	2006	399	18	95.9 [94.0,97.9]	362	95.3 [93.2,97.5]	270
GSP - TREKKING - MBH PS - SAMO	2007	396	24	95.0 [92.9,97.2]	256	92.3 [89.1,95.5]	54
GENESIS II - MOBILE BEARING - Smith & Nephew	2001	360	22	95.7 [93.6,97.9]	311	94.1 [91.6,96.6]	228
BALANSYS - MOBILE BEARING - MATHYS	2005	353	13	96.5 [94.5,98.5]	285	96.5 [94.5,98.5]	127
GKS - PRIME - FLEX UC - PERMEDICA	2016	345	9	95.7 [92.8,98.7]	40	— [—,—]	—
PFC - CVD - De Puy J.&J.	2000	339	9	98.1 [96.7,99.6]	284	98.1 [96.7,99.6]	195
GENESIS II - DISHED - SMITH & NEPHEW	2001	326	17	95.4 [93.0,97.8]	256	93.9 [91.1,96.8]	154
LCS - COMPLETE - RP - DEPUY JOHNSON & JOHNSON	2004	312	18	95.7 [93.4,98.0]	262	94.1 [91.5,96.9]	193
Other (<300 cases)	2000	11603	688	95.0 [94.6,95.4]	7211	92.9 [92.3,93.5]	4018
Unknown	2000	243	52	88.7 [84.7,92.9]	181	81.0 [75.7,86.6]	128

Le analisi di sopravvivenza sono eseguite solo sui pazienti residenti in Regione Emilia-Romagna, per evitare il bias risultante dalla perdita al follow-up dei pazienti non residenti.

PART THREE: SHOULDER PROSTHESIS

July 2008 - December 2021

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 **96.1%** 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

Percentage 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
2021	47.8	69.1

From: database RIPO

16. Type of surgery

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to **type of surgery**

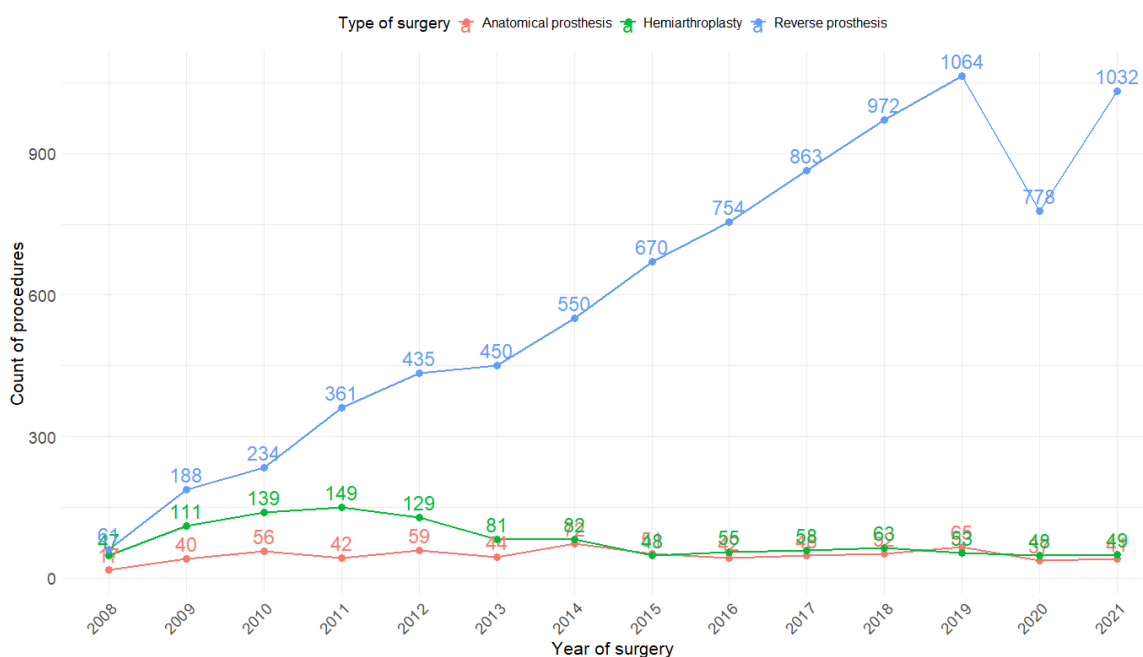
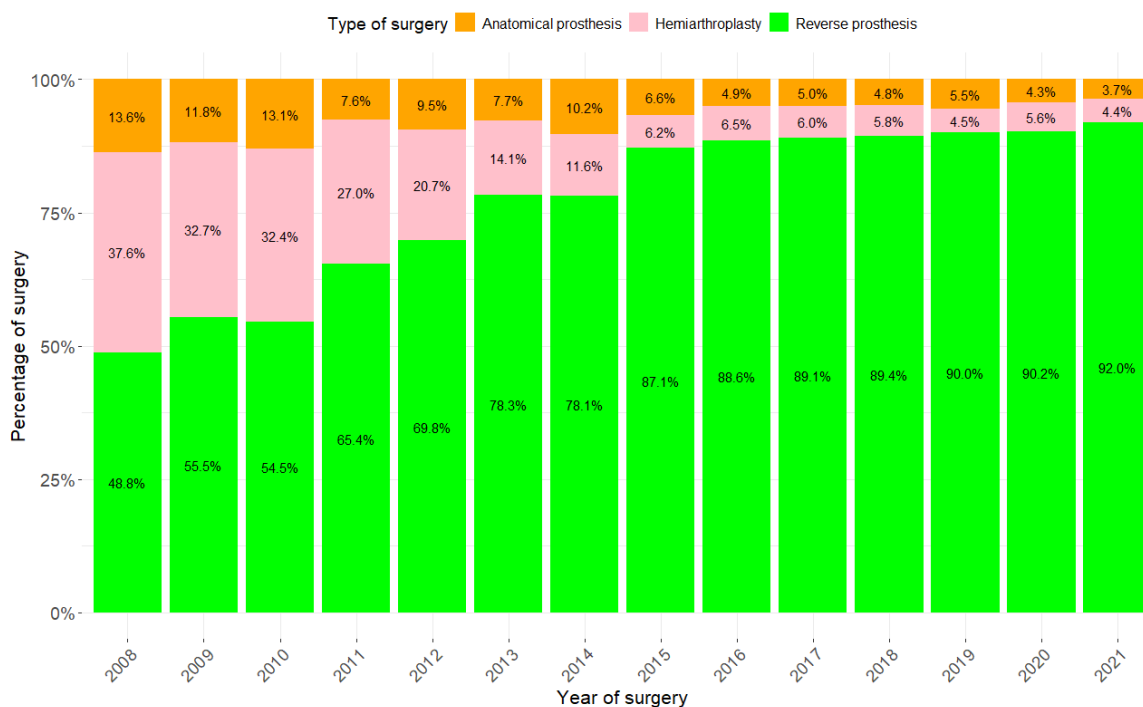
Type of surgery	N = 11662 ¹
Reverse prosthesis	8412 (72.1)
Hemiarthroplasty	1112 (9.5)
Revisions	747 (6.4)
Anatomical prosthesis	666 (5.7)
Prosthesis removal	181 (1.6)
Hemi stemless	149 (1.3)
Reverse stemless	139 (1.2)
Standard resurfacing	127 (1.1)
Other*	67 (0.6)
Anatomical stemless	49 (0.4)
Anatomical resurfacing	12 (0.1)
Partial resurfacing	1 (0.0)

¹ n (%)

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

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

Percentage per **year of implant** of Reverse prosthesis and Anatomical prosthesis



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 2021 according to **type of surgery** and **gender** of patients

Type of surgery	F, N = 8149 ¹	M, N = 3446 ¹
Reverse prosthesis	6271 (77.0)	2141 (62.1)
Hemiarthroplasty	739 (9.1)	373 (10.8)

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

Revisions	441 (5.4)	306 (8.9)
Anatomical prosthesis	356 (4.4)	310 (9.0)
Prosthesis removal	100 (1.2)	81 (2.4)
Hemi stemless	78 (1.0)	71 (2.1)
Reverse stemless	83 (1.0)	56 (1.6)
Standard resurfacing	48 (0.6)	79 (2.3)
Anatomical stemless	25 (0.3)	24 (0.7)
Anatomical resurfacing	8 (0.1)	4 (0.1)
Partial resurfacing	0 (0.0)	1 (0.0)
¹ n (%)		

17.2 Age

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

Età	Females	Males
Reverse prosthesis	N = 6271	N = 2141
Median (Range)	74.0 (30.0, 100.0)	71.0 (33.0, 92.0)
Mean (SD)	73.5 (6.8)	70.6 (8.1)
Unknown	1	0
Hemiarthroplasty	N = 739	N = 373
Median (Range)	73.0 (18.0, 97.0)	58.0 (15.0, 94.0)
Mean (SD)	71.2 (11.4)	57.9 (15.9)
Revisions	N = 441	N = 306
Median (Range)	71.0 (32.0, 90.0)	67.0 (23.0, 88.0)
Mean (SD)	69.0 (9.7)	64.4 (11.6)
Unknown	1	0
Prosthesis removal	N = 100	N = 81
Median (Range)	72.5 (47.0, 86.0)	67.0 (25.0, 88.0)
Mean (SD)	71.2 (7.8)	63.8 (12.2)
Anatomical prosthesis	N = 356	N = 310
Median (Range)	66.0 (30.0, 100.0)	60.0 (27.0, 83.0)
Mean (SD)	64.8 (9.2)	60.1 (8.6)
Reverse stemless	N = 83	N = 56
Median (Range)	71.0 (52.0, 85.0)	69.5 (54.0, 84.0)
Mean (SD)	71.5 (7.5)	69.4 (8.0)
Hemi stemless	N = 78	N = 71
Median (Range)	64.0 (32.0, 86.0)	56.0 (26.0, 78.0)
Mean (SD)	63.2 (11.0)	54.7 (12.0)
Standard resurfacing	N = 48	N = 79
Median (Range)	58.0 (21.0, 78.0)	49.0 (23.0, 80.0)
Mean (SD)	55.1 (14.7)	50.5 (13.3)
Anatomical stemless	N = 25	N = 24
Median (Range)	67.0 (53.0, 80.0)	57.0 (36.0, 75.0)
Mean (SD)	66.6 (7.3)	57.7 (11.9)
Anatomical resurfacing	N = 8	N = 4
Median (Range)	66.5 (51.0, 79.0)	72.5 (64.0, 76.0)
Mean (SD)	65.8 (9.0)	71.3 (5.5)
Other	N = 37	N = 30
Median (Range)	65.0 (23.0, 84.0)	53.5 (16.0, 78.0)
Mean (SD)	62.9 (15.2)	53.2 (13.7)
Partial resurfacing	-	N = 1
Age	-	17

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

17.3 Pathologies

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to **type of surgery** and **diagnosis** of patients

Reverse prosthesis	N = 8412¹
Eccentric osteoarthritis	4665 (56.0)
Fracture	1709 (20.5)
Concentric osteoarthritis	1235 (14.8)
Necrosis	203 (2.4)
Sequelae of fracture	176 (2.1)
Non specified osteoarthritis	88 (1.1)
Rheumatic arthritis	58 (0.7)
Inveterate dislocation	58 (0.7)
Post-traumatic necrosis	37 (0.4)
Post-traumatic arthritis	29 (0.3)
Recurrent dislocation	27 (0.3)
Other	50 (0.6)
Unknown	77
¹ n (%)	

Anatomical prosthesis	N = 666¹
Concentric osteoarthritis	541 (81.8)
Eccentric osteoarthritis	50 (7.6)
Necrosis	32 (4.8)
Rheumatic arthritis	11 (1.7)
Sequelae of fracture	8 (1.2)
Fracture	7 (1.1)
Non specified osteoarthritis	7 (1.1)
Other	5 (0.8)
Unknown	5
¹ n (%)	

Hemiarthroplasty	N = 1112¹
Fracture	666 (60.2)
Concentric osteoarthritis	105 (9.5)
Osteoarthritis	97 (8.8)
Eccentric osteoarthritis	96 (8.7)
Sequelae of fracture	48 (4.3)
Inveterate dislocation	16 (1.4)
Tumor	13 (1.2)
Rheumatic arthritis	12 (1.1)
Post-traumatic necrosis	11 (1.0)
Other	42 (3.8)
Unknown	6
¹ n (%)	

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

	Standard resurfacing, N = 127¹	Anatomical resurfacing, N = 12¹	Partial resurfacing, N = 1¹
Concentric osteoarthritis	61 (48.0)	11 (91.7)	0 (0.0)
Necrosis	32 (25.2)	1 (8.3)	1 (100.0)
Eccentric osteoarthritis	13 (10.2)	0 (0.0)	0 (0.0)
Rheumatic arthritis	3 (2.4)	0 (0.0)	0 (0.0)
Sequelae of capsuloplasty	3 (2.4)	0 (0.0)	0 (0.0)
Sequelae of fracture	3 (2.4)	0 (0.0)	0 (0.0)
Fracture	3 (2.4)	0 (0.0)	0 (0.0)
Non specified osteoarthritis	3 (2.4)	0 (0.0)	0 (0.0)
Inveterate dislocation	2 (1.6)	0 (0.0)	0 (0.0)
Tumor	2 (1.6)	0 (0.0)	0 (0.0)
Pain	1 (0.8)	0 (0.0)	0 (0.0)
Idiopathic humer head necrosis	1 (0.8)	0 (0.0)	0 (0.0)

¹ n (%)

	Anatomical stemless, N = 49¹	Hemi stemless, N = 149¹	Reverse stemless, N = 139¹
Concentric osteoarthritis	37 (75.5)	78 (52.7)	36 (26.1)
Eccentric osteoarthritis	6 (12.2)	34 (23.0)	94 (68.1)
Necrosis	2 (4.1)	20 (13.5)	2 (1.4)
Non specified osteoarthritis	2 (4.1)	3 (2.0)	2 (1.4)
Sequelae of fracture	0 (0.0)	4 (2.7)	1 (0.7)
Fracture	0 (0.0)	2 (1.4)	0 (0.0)
Inveterate dislocation	0 (0.0)	0 (0.0)	2 (1.4)
Steroid-induced necrosis	0 (0.0)	2 (1.4)	0 (0.0)
Post-traumatic necrosis	0 (0.0)	2 (1.4)	0 (0.0)
Post-traumatic arthritis	1 (2.0)	0 (0.0)	0 (0.0)
Sequelae of septic arthritis	0 (0.0)	1 (0.7)	0 (0.0)
Recurrent dislocation	0 (0.0)	1 (0.7)	0 (0.0)
Other	1 (2.0)	1 (0.7)	1 (0.7)
Unknown	-	1	1

¹ n (%)

Number of shoulder **revisions** carried out on patients with admission date between 1st July 2008 and 31st December 2021, according to **diagnosis** and type of **revision**

Diagnosis	Revisions, N = 747¹
Glenoid erosion	116 (16.0)
Two steps revision	97 (13.4)
Glenoid loosening	83 (11.1)
Anterior instability	71 (9.8)
Humeral loosening	68 (9.4)
Pain	51 (7.0)
Dislocation	49 (6.8)
Superior instability	46 (6.3)

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

Other instability	27 (3.7)
Periprosthetic bone fracture	24 (3.3)
Septic loosening	15 (2.1)
Septic loosening	15 (2.1)
Back instability	6 (0.8)
Fracture	4 (0.6)
Lower instability	2 (0.3)
Other	51 (7.0)
Unknown	22
¹ n (%)	

Type of revision	Revisions, N = 747 ¹
From reverse to reverse	210 (29.1)
From hemi to reverse	179 (24.8)
Implant after removal	106 (14.7)
From reverse to hemi	78 (10.8)
From anatomic to reverse	56 (7.8)
From hemi to hemi	33 (4.6)
From resurfacing to reverse	20 (2.8)
From anatomic to anatomic	7 (1.0)
From resurfacing to anatomic	4 (0.6)
From hemi to anatomic	4 (0.6)
Other	24 (3.3)
Unknown	26
¹ n (%)	

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 2021 according to **surgical approach**

	Deltoid- pectoral, N = 9915 ¹	Trans- deltoid, N = 1178 ¹	Anterior lateral, N = 209 ¹	Superior lateral, N = 52 ¹	Other, N = 52 ¹	Unkno wn, N = 189
Type of surgery						
Reverse prosthesis	7013 (70.7)	982 (83.4)	197 (94.3)	49 (94.2)	43 (82.7)	12 8
Hemiarthroplasty	1061 (10.7)	32 (2.7)	3 (1.4)	1 (1.9)	4 (7.7)	11
Revisions	667 (6.7)	51 (4.3)	7 (3.3)	1 (1.9)	0 (0.0)	21
Anatomical prosthesis	653 (6.6)	5 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	8
Prosthesis removal	159 (1.6)	5 (0.4)	2 (1.0)	0 (0.0)	1 (1.9)	14
Hemi stemless	138 (1.4)	7 (0.6)	0 (0.0)	1 (1.9)	0 (0.0)	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

Reverse stemless	41 (0.4)	94 (8.0)	0 (0.0)	0 (0.0)	3 (5.8)	1
Standard resurfacing	122 (1.2)	2 (0.2)	0 (0.0)	0 (0.0)	1 (1.9)	2
Anatomical stemless	48 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1
Standard resurfacing	12 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	-
Partial resurfacing	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	-
¹ n (%)						

Number of shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2021, according to **anaesthesia**

Anaesthesia	N = 11662¹
Mixed	5132 (47.8)
General	4901 (45.7)
Loco-regional	698 (6.5)
Unknown	931
¹ n (%)	

Antithromboembolic prophylaxis

In 2021, heparin is used in 92% of primary surgery, and no prophylaxis in 6%.

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 2021 according to **stem fixation** and type of **surgery**

	Anatomical prosthesis, N = 666¹	Reverse prosthesis, N = 8412¹	Hemiarthroplasty, N = 1112¹
Stem fixation			
Cementless	630 (94.6)	7298 (86.8)	764 (68.7)
Cemented	36 (5.4)	1114 (13.2)	348 (31.3)
¹ n (%)			

19.2 Material, form and fixation of glenoid in Anatomical prosthesis

Anatomical prosthesis, N = 6661	
Glenoid material	
Polyethylene	356 (53.5)
Metal backed	295 (44.3)
Crosslinked polyethylene	8 (1.2)
Other	7 (1.1)

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

Glenoid form	
Pegs	455 (68.4)
Screws	192 (28.9)
Keel	18 (2.7)
Unknown	1
Glenoid fixation	
Cemented	371 (55.7)
Non Cementless	295 (44.3)

¹ n (%)

19.3 Type of prosthesis

Number of primary shoulder operations carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to the **type of stem**

Model of Stem	Anatomical prosthesis, N = 666¹	Reverse prosthesis, N = 8412¹	Hemiarthroplasty, N = 1112¹
SMR ALETTATO	209 (31.6)	3142 (37.5)	530 (47.8)
DELTA XTEND	1 (0.2)	1449 (17.3)	37 (3.3)
AEQUALIS ASCEND FLEX S PTC	253 (38.3)	757 (9.0)	61 (5.5)
DELTA XTEND CEMENTED	0 (0.0)	472 (5.6)	21 (1.9)
TRABECULAR METAL REVERSE	0 (0.0)	401 (4.8)	12 (1.1)
EQUINOXE PRIMARY	0 (0.0)	390 (4.6)	1 (0.1)
AEQUALIS REVERSED	0 (0.0)	301 (3.6)	1 (0.1)
SMR CEMENTATO	4 (0.6)	140 (1.7)	96 (8.7)
COMPREHENSIVE MINI	0 (0.0)	216 (2.6)	8 (0.7)
BIGLIANI/FLATOW	113 (17.1)	0 (0.0)	25 (2.3)
DUOCENTRIC	0 (0.0)	133 (1.6)	0 (0.0)
EQUINOXE PLATFORM FRACTURE	0 (0.0)	107 (1.3)	2 (0.2)
AEQUALIS REVERSED CEMENTED	0 (0.0)	92 (1.1)	0 (0.0)
ARROW	1 (0.2)	71 (0.8)	7 (0.6)
SHOULDER SYSTEM SHORT	3 (0.5)	72 (0.9)	0 (0.0)
UNIVERS REVERS	0 (0.0)	74 (0.9)	1 (0.1)
AFFINIS FRACTURE	0 (0.0)	44 (0.5)	16 (1.4)
SMR REVISIONE	0 (0.0)	43 (0.5)	17 (1.5)
ANATOMICAL SHOULDER	12 (1.8)	20 (0.2)	18 (1.6)
SHOULDER	1 (0.2)	47 (0.6)	0 (0.0)

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

SYSTEM			
AFFINIS INVERSE	0 (0.0)	47 (0.6)	0 (0.0)
ANATOMICAL SHOULDER CEMENTED	8 (1.2)	25 (0.3)	8 (0.7)
TITAN	0 (0.0)	41 (0.5)	0 (0.0)
ANATOMICAL SHOULDER FRACTURE	1 (0.2)	6 (0.1)	31 (2.8)
HUMELOCK REVERSED	0 (0.0)	36 (0.4)	0 (0.0)
GLOBAL FX	0 (0.0)	0 (0.0)	33 (3.0)
LTO CEMENTATO	2 (0.3)	0 (0.0)	31 (2.8)
BIGLIANI/FLATOW TRABECULAR METAL	2 (0.3)	0 (0.0)	25 (2.3)
GLOBAL UNITE	3 (0.5)	7 (0.1)	16 (1.4)
MIRAI	3 (0.5)	22 (0.3)	0 (0.0)
AEQUALIS ASCEND	21 (3.2)	0 (0.0)	3 (0.3)
DUOCENTRIC CEMENTED	0 (0.0)	24 (0.3)	0 (0.0)
GLOBAL ADVANTAGE	2 (0.3)	0 (0.0)	21 (1.9)
PROMOS	0 (0.0)	17 (0.2)	6 (0.5)
Other (<20 cases)	22 (3.3)	193 (2.3)	82 (7.4)
Unknown	5	23	3

¹ n (%)

Number of shoulder **Anatomical prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to the **type of glenoid**

Model of Glenoid	Anatomical prosthesis, N = 666 ¹
AEQUALIS PERFORM	275 (41.6)
SMR RIVESTITA	183 (27.7)
BIGLIANI/FLATOW TRABECULAR METAL	73 (11.0)
BIGLIANI/FLATOW	46 (7.0)
SMR; SMR PEG TT	30 (4.5)
ANATOMICAL SHOULDER	16 (2.4)
Other (<10 cases)	38 (5.7)
Unknown	5

¹ n (%)

Number of shoulder **Reverse prosthesis** carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to the **model of metaglena**

Model of metaglena	Reverse prosthesis, N = 8412 ¹
SMR RIVESTITA	3105 (37.0)
DELTA XTEND	1929 (23.0)
AEQUALIS REVERSED	850 (10.1)
EQUINOXE REVERSE	498 (5.9)

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

TRABECULAR METAL REVERSE	373 (4.4)
SMR; SMR PEG TT	248 (3.0)
AEQUALIS REVERSED II	219 (2.6)
COMPREHENSIVE REVERSE MINI	195 (2.3)
DUOCENTRIC	157 (1.9)
SHOULDER SYSTEM	119 (1.4)
AFFINIS INVERSE	90 (1.1)
ARROW	71 (0.8)
UNIVERSAL GLENOID	70 (0.8)
COMPREHENSIVE REVERSE	68 (0.8)
AEQUALIS PERFORM+ REVERSED;AEQUALIS PERFORM REVERSED POST	55 (0.7)
HUMELOCK REVERSED	47 (0.6)
TITAN REVERSE	42 (0.5)
AEQUALIS PERFORM+ REVERSED	37 (0.4)
ANATOMICAL SHOULDER INVERSE/REVERSE	34 (0.4)
AEQUALIS PERFORM REVERSED	27 (0.3)
DELTA CTA	21 (0.3)
MIRAI	21 (0.3)
AGILON	18 (0.2)
EMBRACE	17 (0.2)
PROMOS REVERSE	17 (0.2)
COMPREHENSIVE REVERSE AUGMENTED	12 (0.1)
VERSO	12 (0.1)
T.E.S.S.	10 (0.1)
Other (<10 cases)	34 (0.4)
Unknown	16
¹ n (%)	

Number of shoulder **Hemiarthroplasty** carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to the **type of humeral head**

Model of Humeral Head	Hemiarthroplasty, N = 1112¹
SMR	566 (51.0)
SMR CTA	80 (7.2)
BIGLIANI/FLATOW	62 (5.6)
DELTA XTEND CTA	58 (5.2)
GLOBAL ADVANTAGE	49 (4.4)
AEQUALIS ASCEND FLEX PYC	47 (4.2)
RANDELLI - LTO	33 (3.0)
ANATOMICAL SHOULDER FRACTURE	31 (2.8)
ANATOMICAL SHOULDER	26 (2.3)
AEQUALIS	18 (1.6)
AEQUALIS ASCEND FLEX	16 (1.4)
AFFINIS FRACTURE	16 (1.4)
GLOBAL UNITE	16 (1.4)
M.R.S.	16 (1.4)
Other (<10 cases)	76 (6.8)
Unknown	2
¹ n (%)	

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

Number of **shoulder resurfacing** carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to the **type of prosthesis**

Model of prosthesis	Anatomical resurfacing, N = 12¹	Partial resurfacing, N = 1¹	Standard resurfacing, N = 127¹
SMR RESURFACING	1 (8.3)	0 (0.0)	54 (42.5)
EPOCA RH	11 (91.7)	0 (0.0)	10 (7.9)
COPELAND	0 (0.0)	0 (0.0)	18 (14.2)
GLOBAL C.A.P.	0 (0.0)	0 (0.0)	16 (12.6)
PYROTITAN	0 (0.0)	0 (0.0)	8 (6.3)
AEQUALIS RESURFACING	0 (0.0)	0 (0.0)	6 (4.7)
EQUINOXE RESURFACING	0 (0.0)	0 (0.0)	6 (4.7)
DUROM	0 (0.0)	0 (0.0)	4 (3.1)
COPELAND THIN	0 (0.0)	0 (0.0)	3 (2.4)
CAPICA	0 (0.0)	0 (0.0)	1 (0.8)
HEMICAP	0 (0.0)	1 (100.0)	0 (0.0)
OVO	0 (0.0)	0 (0.0)	1 (0.8)

¹ n (%)

Number of shoulder **stemless** carried out on patients with admission date between 1st July 2008 and 31st December 2021 according to the **type of prosthesis**

Model of prosthesis	Anatomical stemless, N = 49¹	Hemi stemless, N = 149¹	Reverse stemless, N = 139¹
VERSO - BIOMET	0 (0.0)	0 (0.0)	116 (83.5)
T.E.S.S. - BIOMET	8 (16.3)	68 (45.6)	0 (0.0)
ECLIPSE - ARTHREX	8 (16.3)	26 (17.4)	0 (0.0)
SIDUS - ZIMMER	3 (6.1)	22 (14.8)	0 (0.0)
COMPREHENSIVE VERSA -DIAL- BIOMET	0 (0.0)	18 (12.1)	0 (0.0)
AFFINIS SHORT - MATHYS	6 (12.2)	9 (6.0)	0 (0.0)
MIRAI - PERMEDICA	5 (10.2)	0 (0.0)	10 (7.2)
SMR - LIMA	10 (20.4)	3 (2.0)	0 (0.0)
SMR INVERSA HP - LIMA	0 (0.0)	0 (0.0)	8 (5.8)
T.E.S.S. INVERSA - BIOMET	0 (0.0)	0 (0.0)	5 (3.6)
BIGLIANI/FLATOW - ZIMMER	4 (8.2)	0 (0.0)	0 (0.0)
AFFINIS FRACTURE - MATHYS	3 (6.1)	0 (0.0)	0 (0.0)
HUMELock - FX SOLUTION	2 (4.1)	1 (0.7)	0 (0.0)
GLOBAL ICON - DEPUY	0 (0.0)	1 (0.7)	0 (0.0)
SIMPLICITI - TORNIER	0 (0.0)	1 (0.7)	0 (0.0)

¹ n (%)

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.

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

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 2021

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	Incidence rate (%)		N.	Incidence rate (%)
Muscular lesion	33	0.4			
Tendon lesion	6	0.1	Dislocation	13	0.1
Vascular lesion	1	0.0			
Fracture	55	0.6	Early Infection	1	0.0
Other	18	0.2			
Total	113/9078	1.2	Totale	14/9078	0.2

Complications rate in **hemiarthroplasties** carried out on patients hospitalized between July 1st 2008 and December 31st 2021

Complications occurred during hospitalization					
Intra-operative			Post-operative local		
	N.	Incidence rate (%)		N.	Incidence rate (%)
Muscular lesion	8	0.7	Early Infection	3	0.3
Tendon lesion	2	0.2			
Vascular lesion	1	0.1			
Fracture	13	1.2	Dislocation	-	-
Other	5	0.4			
Total	29/1112	2.6	Totale	3/1112	0.3

They were observed also 3 deaths in hemiarthroplasty, 6 deaths in reverse prosthesis, 1 death in prosthesis removal and 1 death in revision.

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

Year 2021			
Type of surgery	N.	Mean pre-op. (range)	Mean post-op. (range)
Reverse prosthesis	1032	1.3 (0-47)	3.9 (1-21)
Hemiarthroplasty	49	3.3 (0-44)	3.4 (0-10)
Revisions	85	1.2 (0-13)	4.3 (1-22)
Anatomical prosthesis	41	0.6 (0-2)	2.9 (1-6)
Prosthesis removal	17	3.2 (0-33)	10.7 (3-26)

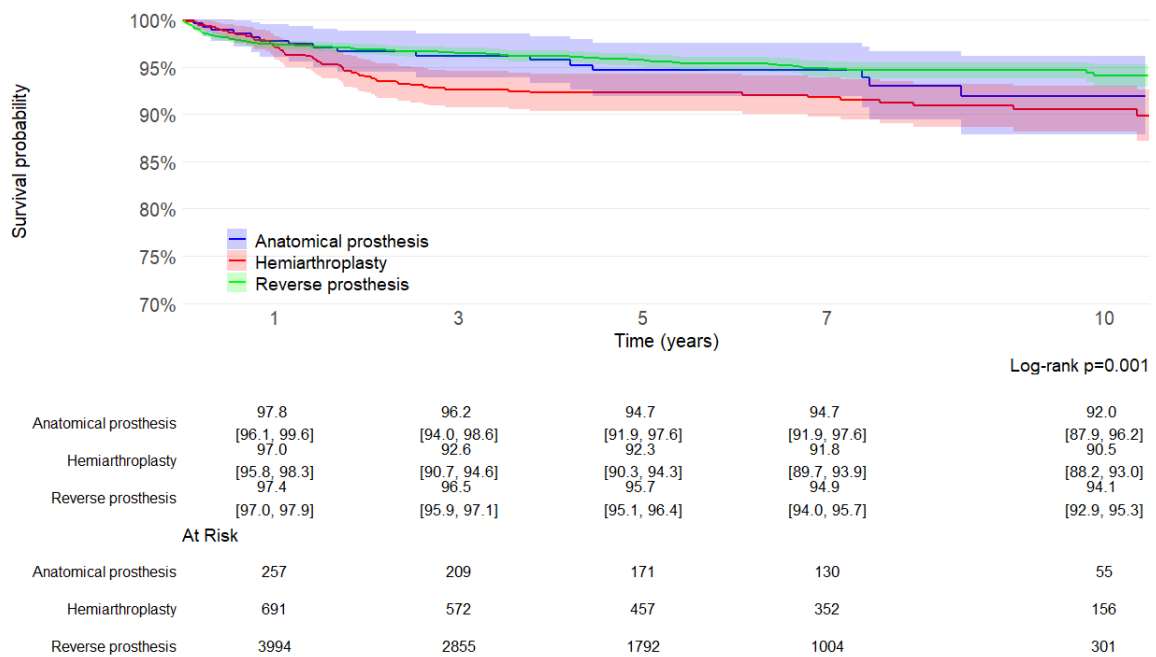
22. Survival analysis of primary surgery

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.

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

All primary shoulder arthroplasties performed in the Region between July 2008 and December 2021 only on patients living in the Region were analysed.

Type of surgery	Number of surgeries	Number of revisions	Mean Follow-up
Anatomical prosthesis	279	16	6.4
Reverse prosthesis	4728	185	4.4
Hemiarthroplasty	782	61	6.2
Standard resurfacing	41	4	9.6
Anatomical resurfacing	2	1	7,9
Partial resurfacing	1		12,9
Anatomical stemless	19	5	5,7
Hemi stemless	62	8	7,8
Reverse stemless	63	4	2,5



Anatomical prosthesis			
Cause of revision	Incidence	IR %	% distribut. of failure causes
Pain	2/279	0.7	12.5
Glenoid erosion	1/279	0.4	6.3
Instability	7/279	2.5	43.8
Humeral loosening	1/279	0.4	6.3

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	2/279	0.7	12.5
Total aseptic loosening	1/279	0.4	6.3
Breakage of insert	1/279	0.4	6.3
Poly wear	1/279	0.4	6.3
Total	16/279	5.7	100.0

Reverse prosthesis

Cause of revision	Incidence	IR %	% distribut. of failure causes
Other	11/4728	0.2	5.9
Pain	5/4728	0.1	2.7
Erosione glenoidea	5/4728	0.1	2.7
Frattura periprotetica	7/4728	0.1	3.8
Instability	38/4728	0.8	20.5
Dislocation	16/4728	0.3	8.6
Glenoid loosening	28/4728	0.6	15.1
Humeral loosening	10/4728	0.2	5.4
Septic loosening	40/4728	0.8	21.6
Total aseptic loosening	1/4728	0.0	0.5
Unknown	15/4728	0.3	8.1
Unknown performed outside region	9/4728	0.2	4.9
Total	185/4728	3.9	100.0

Hemi stemless

Cause of revision	Incidence	IR %	% distribut. of failure causes
Altro	4/782	0.5	6.6
Pain	5/782	0.6	8.2
Glenoid erosion	16/782	2.0	26.2
Periprosthetic bone fracture	5/782	0.6	8.2
Instability	9/782	1.2	14.8
Dislocation	2/782	0.3	3.3
Humeral loosening	4/782	0.5	6.6
Septic loosening	6/782	0.8	9.8
Total aseptic loosening	1/782	0.1	1.6
Unknown	2/782	0.3	3.3
Unknown performed outside region	7/782	0.9	11.5
Total	61/782	7.8	100.0

Standard resurfacing

Cause of revision	Incidence	IR %	% 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	Incidence	IR %	% distribut. of failure causes
Pain	1/19	5.3	20.0
Septic loosening	1/19	5.3	20.0
Instability	1/19	5.3	20.0
Dislocation	1/19	5.3	20.0
Poly wear	1/19	5.3	20.0
Total	5/19	26.3	100.0

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

Hemi stemless			
Cause of revision	Incidence	IR %	% distribut. of failure causes
Pain	2/62	3.2	25.0
Glenoid erosion	2/62	3.2	25.0
Septic loosening	1/62	1.6	12.5
Humeral loosening	1/62	1.6	12.5
Unknown performed outside region	2/62	3.2	25.0
Total	8/62	12.9	100.0

Reverse stemless			
Cause of revision	Incidence	IR %	% distribut. of failure causes
Other	1/63	1.6	25.0
Periprosthetic bone fracture	1/63	1.6	25.0
Instability	1/63	1.6	25.0
Septic loosening	1/63	1.6	25.0
Total	4/63	6.3	100.0

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

Model of prosthesis	From year	N.	N. failures	% survival at 5 yrs (C.I. 95%)	N. at risk at 5 yrs	Mean Follow-up
SMR INVERSA HP - Lima	2008	1148	39	95.6 (94.2-97.1)	307	3.5
SMR - Lima	2008	1012	48	94.8 (93.3-96.3)	401	4.7
DELTA XTEND - Depuy	2008	862	29	97.5 (96.4-98.5)	534	6.0
AEQUALIS REVERSED II - Tornier	2011	392	18	93.8 (9.8-96.8)	111	3.9
EQUINOXE REVERSE - Exactech	2013	356	12	96.5 (94.3-98.7)	78	3.1
TRABECULAR METAL REVERSE - Zimmer	2008	245	8	96.6 (94.1-99.2)	107	4.6

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