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Annual Report

ITALIAN ARTHROPLASTY REGISTRY

riap

Italian Arthroplasty Registry

Addendum to the
Annual Report 2019

English version of Tables and Figures

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This summary provides a brief overview of the main findings described in the 2019 RIAP Annual Report, as by the end of 2019.

It contains all the tables and figures, while the entire Report is available only in Italian (you can find it here). The technical Appendix includes an analysis of the most recent national Hospital Discharge Data available (years 2016 and 2017).

RIAP: the most important things to know

What is RIAP?

The Italian Arthroplasty Registry, RIAP, was started in 2006 within the framework of a collaboration between the Italian Ministry of Health, DG for Medical Devices and Pharmaceutical Services (DGDMF) and the Italian National Institute of Health (Istituto Superiore di Sanità, ISS), to set up a data flow to monitor the joint prostheses performance.

What are the goals?

Main aims of the RIAP are to monitor the long-term effectiveness of hip, knee, shoulder and ankle prostheses (measured as implant survival), and support Regions and hospitals when recall of patients is needed because of problems reported on specific implants.

What information is collected?

The information collected includes Hospital Discharge Data (HDD) integrated with an additional Minimum Data Set (MDS) - specific for each joint - about the procedure, the operated body side and the data needed to identify the implanted device. In 2018, 70,584 procedures were collected (+4.7% more than a year before), representing about 33,3% of the national volume.

Personal data are treated by RIAP in compliance with the current European legislation on privacy (EU Regulation 2016/679). Clinical, health and demographic data are treated applying criteria ensuring the highest confidentiality, in compliance with the security regulations for digital and paper-based archives.

How is RIAP organised?

RIAP is a federation of regional registries coordinated by the ISS. Through a web interface, the surgeons collect the MDS, which is successively linked to the HDD by the regional coordinating center. The latter is responsible for the transmission of the linked data to the ISS. Currently, participation of Regions and structures is on a voluntary basis.

A distinctive feature of the RIAP model is its transferability into areas beyond arthroplasty, especially where the replacement interventions are mainly carried out in structures that can provide the Hospital Discharge Data (Schede di dimissione ospedaliera, SDO).

Why a registry, and why a national registry?

Joint prosthesis is a recognised solution for the treatment of disabling joint diseases. In Italy, like in many countries, arthroplasties are constantly growing. A national registry allows as-

sessing the outcomes of primary and revision procedures, based on patient's specificity, and intervention and implanted device characteristics. If needed, there must be the possibility to recall all the implanted patients, including the patients that were operated in a different region from the one they live in. This is the reason why the Registry must have national coverage.

How is the implanted device identified and characterised?

The RIAP-DM Dictionary, a database containing data supplied by manufacturers useful to identify each implanted device, is available for the operators.

To identify each implanted device, RIAP made the RIAP-DM Dictionary available to operators.

It is a database containing data supplied by manufacturers, including single-device specific data. The information contained in the RIAP-DM Dictionary is checked and matched against the information from the National Database of medical devices of the Ministry of Health.

RIAP is now developing a collaboration with the National Joint Registry for England, Wales, Northern Ireland and the Isle of Man, to utilise its component database and classification, recently upgraded in cooperation with the Endoprothesen Register Deutschland (EPRD) to include in the RIAP-DM Dictionary the specs of the implanted device.

[Here](#) you can consult the Report summaries (Addendum) of years 2014-2018.

RIAP in 2018-2019: progress and key achievements

Highlights

- Starting from February 2019, the RIAP is part of the Italian Implantable Prostheses Registry (RIPI) and represents the model for the other registries considered by the RIPI.
- Capitalising the experience gained with the RIAP, we have been supporting the Italian Ministry of Health in the development of a pilot platform for the National Registry of Breast Implants. We also worked on drafting the regulation prescribed by the law that will render mandatory for the Italian Regions to feed the registries.
- We implemented a new module in our IT platform RaDaR to allow the collection of additional data regarding ankle arthroplasty. We also kept updating the RIAP-DM Dictionary, our database of implantable devices, increasing the number of product codes (+1000) and contributors. The Quality Control procedures have been further improved.
- In 2019 we exchanged knowledge

with the English National Joint Registry (NJR). This collaboration has allowed us to support the Ministry of Health in updating the national Classification of Medical Devices (CND) and in its transition to the European Medical Device Nomenclature.

- Three new topics resulting from the RIAP analytical work in 2019 are reproduced in the Report: first survival analysis in AP of Bolzano, start of retrospective data gathering in AP Trento, and analysis on national HDD 2016-2017.

2019 has been a year of ongoing activities, but also of new achievements and improved procedures that allowed us to provide surgeons and patients with better information to support decision-making on prostheses. Our team kept growing and was enforced by PhD students and researchers.

Hereby is a summary of the main activities and achievements of 2019:

- The drafting of the regulation required by the decree (DPCM - Decreto del Presidente del Consiglio) has begun, the last piece of the regulatory framework for the registries which, with the law

n.145/2018, made it mandatory for the Regions to feed them.

- A special commitment has been dedicated to the drafting of the launch of the Italian Implantable Prosthesis Registry (Registro Italiano delle Protesi Implantabili, RIPI) in order to make it operational in accordance with the law. The RIPI has been launched in February 2019 (see ripi.iss.it). It is a coordinating structure of registries of implantable devices divided by subject: Italian Spinal Implants Registry (RIDIS), Italian Implantable Cardioverter-defibrillator and Pacemaker Registry (RIDEP), Italian Heart Valves Registry (RIVAC) and the RIAP which is its most developed component and a model (Figure 1.1).
- Thanks to the feedback provided by the participants, the quality of data gathered in the regions has been growing: 96.1% of cases passed QC on interventions this year, vs 91% a year before.
- The process of the IT infrastructure re-engineering started in order to include and automatise the quality control processes and provide faster feedback to the participants

In February 2019, we made the new module for Ankle arthroplasty data collection avail-

able to registered operators on the IT platform RaDaR.

The RIAP-DM Dictionary has been updated, adding 1000 product codes by the end of the year (over 66,000) relating to 101 manufacturers, sent by 39 companies.

- We took part in the works of the International Society of Arthroplasty registries (ISAR). We have developed communications with the Network of Orthopedic Registries of Europe (NORE) and with the English National Joint Registry. It is our intention to sign a collaboration agreement with the NJR by 2020. The aim is to access, consult and possibly feed the Component Library NJR-EPRD (the database of devices shared between the English NJR register and the German EPRD registry).
- We further optimised the RIAP communication assets - the annual report and the website, and launched the website of the RIPI, in Italian and English.
- Through the application of the new function of patients pseudonymisation the Autonomous Province of Bolzano provided the RIAP with its complete 10 years historical data. At the same time, the Autonomous Province of Trento has

launched a retrospective recovery process of missing information (mainly on hip procedures) from 2010 to 2018 using our web application RaDaR2. This result is a first step to produce implant survival analysis, made possible thanks to the proactive approach of the regional RIAP participants.

To provide the reader with figures about the national number of arthroplasties performed in Italy, this edition of the annual Report contains detailed analysis of the 2016 and 2017 HDD data, the last available to the Institute (see Appendix 2A). HDD data represent an important reference to perform statistical and epidemiological analysis in public health and to calculate the actual RIAP completeness at both national and regional levels.

To do this, HDD was browsed using the ICD9-CM procedure codes of interest for RIAP (Hip, Knee, Shoulder and Ankle primary and revision arthroplasties) listed in Table 1. All the procedures performed during a hospitalisation were included. Hip and shoulder arthroplasties were further classified on the basis of the associated diagnosis; emergency procedures are those performed to treat a fracture (ICD9-CM codes 820.XX and 812.XX). Inter-regional mobility for every joint was measured using the

attraction and escape indices computed considering only the ICD9-CM code registered in the so-called "principal procedure". Appendix 2A shows the temporal trend of the number of procedures over 17 years of observation (2001-2017) and, for each joint and for the years 2016 and 2017, the volumes of activity broken down by region, the characteristics of the operated patients (sex, age), the modality of discharge and the interregional mobility (the latter not for ankle).

RELATED ACTIVITIES AND COLLABORATIONS

In 2019, the RIAP team actively collaborated with the Italian Ministry of Health. Capitalising on the Registry's experience, we provided support to the Ministry in the development of the pilot platform of the National Registry of Breast Implants.

Moreover, the RIAP team collaborated with the ministerial Healthcare Technical Committee for updating the Italian CND classification, taken as the basic nomenclature of reference in the pan-european medical devices database EU-DAMED.

In June 2019, we presented a first study on harmonisation of CND and NJR classifications, to create a shared international database of the orthopaedic prostheses. Both CND and

NJR taxonomies were matched and compared for hip joint components. A combination of attributes in the NJR taxonomy was found for each CND terminal level. This is the first step towards the organisation of an international component database since their comparability enables the integration of devices from different databases.

Key findings from the annual report 2019

In 2019, RIAP collected and admitted to quality control the data on **70,584** procedures performed in 2018 in eight regions (Lombardy, Tuscany, Marche, Apulia, Basilicata, Calabria, Sicily, and Campania), two Autonomous Provinces (Bolzano, Trento) and two hospital structures ("Policlinico Città di Alessandria" of Alessandria and "Santa Maria della Misericordia" of Udine) (Table 2.1, Figure 1.2).

After the quality control, 96.1% and 92.6% of the received records, respectively, were admitted to the interventions analysis and to the devices analysis. Both percentage figures are higher than in 2018. (Figure 2.1, Figure 2.2).

The overall 2018 data completeness of RIAP was 64.7% (Table 2.1). Compared to 2017, a slight reduction in completeness was recorded for hip (- 0.1%) and knee (- 0.8%) and a bigger drop for shoulder (- 40.7%) resulting in

general reduction in completeness of - 0.9%. As in previous years, in the regions where no provision has been adopted that effectively makes data recording mandatory, we observe low values of data completeness and coverage. For the shoulder, another possible cause of downtrend is the start of data collection in Marche and Sicily where only some structures have given their contribution, and therefore, the number of procedures recorded was significantly lower than that of the interventions carried out globally in the region.

Overall, in 2018 the estimated number of replacements performed in Italy was around 212,205 of which RIAP data represented 33.3% (estimate) vs 33.2% of 2017 (Table 2.2).

Hip: Of 38,734 interventions collected, 37,709 passed the QC for interventions analysis. Total hip replacements represent 72.5% of analysed cases, partial hip replacements - 21.9%, and revisions - 5.6%. 36,353 passed the QC for devices analysis (fixation type, materials of bearing surfaces, type of stem). (Tables 2.3 - 2.13, Figures 2.3, 2.4).

Knee: Of 29,918 interventions collected, 29,198 passed the QC for interventions analysis. 83.6% of primary interventions recorded were total, while 16.4% were unicondylar

knee replacements. 28,497 (94% of interventions received) passed the QC for devices analysis (fixation type, tibial tray type). (Tables 2.14 - 2.22).

Shoulder: Of 1038 interventions collected, 939 passed the QC for interventions analysis. 56.7% of the interventions were total replacements, 3.5% were partial replacements and 2% were revisions. 39.8% of primary interventions were not specified (those are 366 interventions from the Register of Orthopaedic Prosthetic Implantology of the Apulia Region). 481 interventions (45.8% of interventions received) passed the QC for devices analysis. (See Tables 2.23 - 2.30).

Challenges

The first goal for the upcoming years is to make RIAP a nationwide and 100% complete registry. This means to achieve the enrollment of all the 21 Italian Regions and full collection of required data. A challenging task, especially considering that in the Italian National Health Service, the Regions are autonomous in regards to health services planning and organisation. Achieving this goal highly depends on the strategies adopted at local level. In the RIAP network, the data completeness and quality varies across Regions even if the law (L145/2018) made it mandatory to feed the

national Registry. Highest levels of completeness are registered where regional data collection was made compulsory. Therefore, it is of high importance that rules rendering data collection indispensable are introduced at regional level, i.e. by linking the reimbursement of interventions costs to the registration of the performed procedure. In the near future, the Regulation required by law will be finalised, defining the detailed procedures of feeding the RIAP and other national Registries.

As for the quality improvement of regional data, it remains crucial that the regional coordination centres will continue to communicate the results of the QC to each structure, in order to monitor compilation errors and improve the quality of collected data. The RIAP team will continue to work on the automatised QC to provide the regional data operators with immediate feedback.

Future development and plans for 2020-2022

The activities of the RIAP will now continue within **the operational framework of the RIPI**, of which the RIAP development constitutes an important research line. In 2019, we have taken the first concrete steps to structure RIPI, organising a first working group for the Italian Spinal Implants Registry (RIDIS) and

collaborating with the Italian Association of Arrhythmology and Cardiac Stimulation (AIAC) to design the Italian Implantable Cardioverter-defibrillator and Pacemaker Registry (RIDEP).

In 2020-2021, the consolidated experience of the RIAP will be extended to design the registries of spinal devices, pacemakers and defibrillators, and heart valves. Support will be further provided to the Ministry of Health to launch the National Registry of Breast Implants. The goal is to use the RIAP as a benchmark for a national system of registries that, soon, might be integrated into the current flows of the National Health Service. Re-engineering the IT infrastructure and designing the RIPI platform could become the first step of this process.

With the entry into force of the new European regulation EU 2017/745, the classification and traceability of medical devices become critically important. The implantable devices should be included in the European database on medical devices (EUDAMED) by 26 May, 2021. In this situation, it is our aim to further collaborate

with the Italian Ministry of Health to **contribute to updating the national classification CND for joint prostheses**. With the same aim, in order to keep the RIAP-DM Dictionary constantly updated and to start the design of the dictionaries of the other registries, we will intensify the collaboration with the industry through Confindustria-DM.

We will keep strengthening the international collaborations, contributing to the work of the International Society of Arthroplasty Registry (ISAR), the Network of Orthopaedic Registries in Europe (NORE) and participating in international technical meetings and calls of European projects (Horizon). In 2020 we should formalise the collaboration with the NJR for access to the NJR / EPRD database.

We will continue **raising stakeholder awareness** about the importance of recording the replacement surgeries. Moreover, we plan to increase our focus on the needs of our target audiences in 2020-2021, by developing a scientific research regarding the communication strategy of the RIPI.

Figure 1.1. RIPI organisation

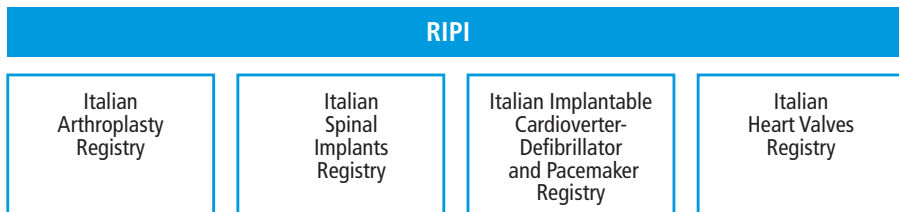


Figure 1.2. Participation in the RIAP

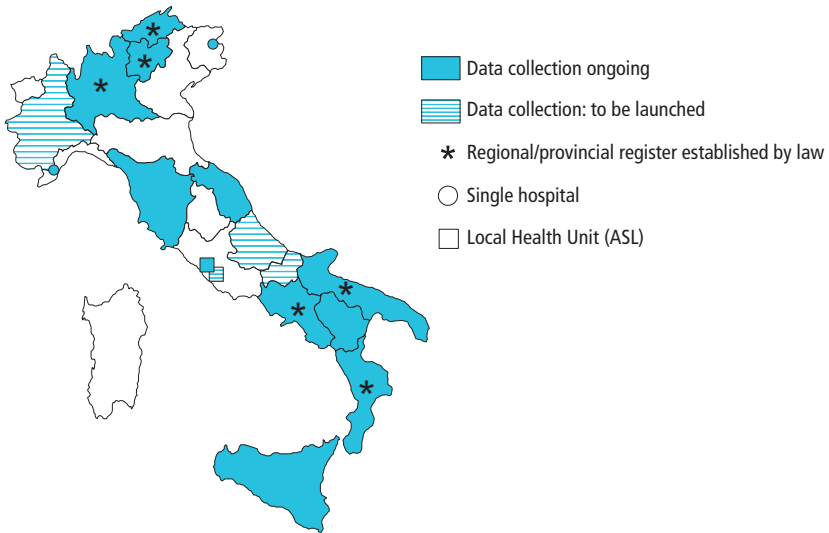


Figure 1.3. Flow diagram of the RIAP data collection model

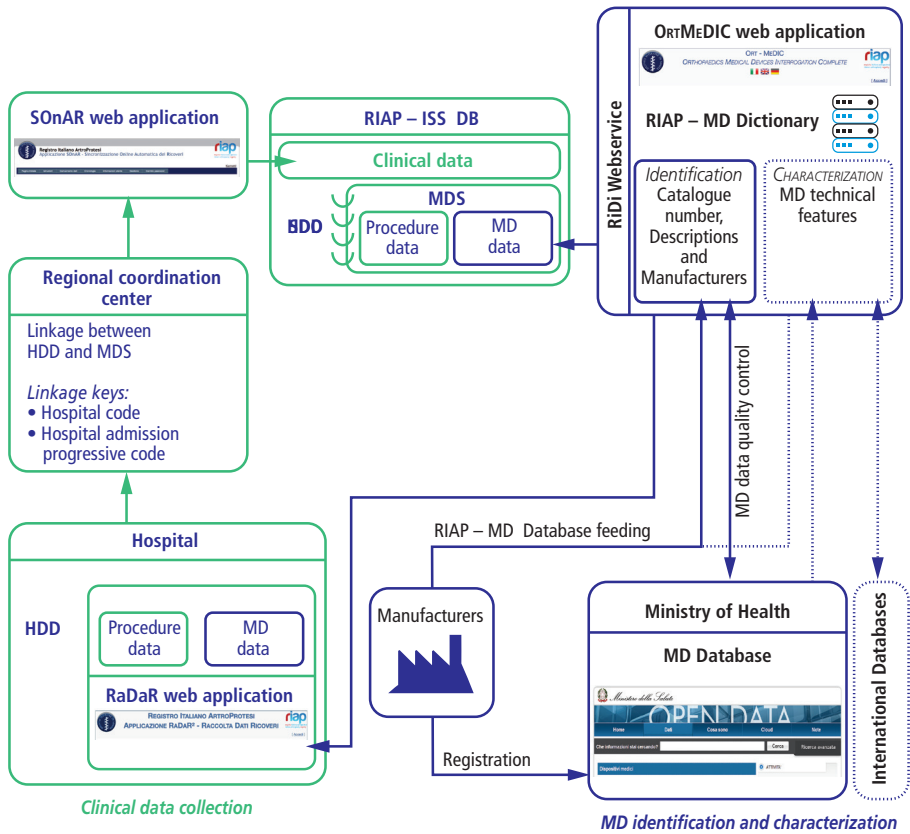


Table 2.1. Number of participating hospitals and coverage and number of collected procedures and completeness, by participating institution and by joint (year 2018)

Participating authority	Joint	Participating authority	Coverage (*)	Collected procedures	Completeness (**)
Regions		N	%	N	%
Lombardy	Hip	105	100.0	23,903	97.7
	Knee	107	100.0	19,115	97.5
AP Bolzano	Hip	12	100.0	1,341	96.0
	Knee	12	100.0	902	95.0
	Shoulder	4	44.4	23	31.1
AP Trento	Hip	8	100.0	1,358	97.6
	Knee	8	100.0	772	97.0
Tuscany	Hip	1	2.3	476	5.0
	Knee	1	2.2	257	3.0
Marche	Hip	11	61.1	767	31.1
	Knee	10	55.6	895	45.0
	Shoulder	6	33.3	23	8.9
Campania	Hip	65	84.4	4,901	75.7
	Knee	62	87.3	3,199	78.4
	Shoulder	34	75.6	515	79.8
Apulia	Hip	45	100.0	4,782	99.8
	Knee	42	100.0	3,669	99.9
	Shoulder	34	100.0	471	99.8
Basilicata	Hip	1	16.7	126	21.1
	Knee	1	16.7	74	26.6
Calabria	Hip	16	76.2	885	46.1
	Knee	14	70.0	468	27.7
Sicily	Hip	4	5.5	195	3.3
	Knee	4	5.8	567	10.4
	Shoulder	1	1.9	6	1.1
Subtotal (regions)	Hip	268	65.5	38,734	65.6
	Knee	261	65.6	29,918	63.6
	Shoulder	79	49.7	1,038	51.7

(continued)

Table 2.1. (continued)

Participating authority	Joint	Participating authority	Coverage (*)	Collected procedures	Completeness (**)
		N	%	N	%
Single hospitals					
Città di Alessandria Hospital (Alessandria)	Hip	1	-	321	77.9
	Knee	1	-	261	62.9
Santa Maria della Misericordia Hospital (Udine)	Hip	1	-	161	100.0
	Knee	1	-	139	100.0
	Shoulder	1	-	12	100.0
Subtotal (single hospitals)	Hip	2	-	482	84.1
	Knee	2	-	400	72.2
	Shoulder	1	-	12	100.0
Total number of procedures admitted to quality control		N	%	N	%
	Hip	270	-	39,216	65.8
	Knee	263	-	30,318	63.7
	Shoulder	80	-	1,050	52.0
	ALL	273		70,584	64.7

(*) Coverage: ratio between hospitals participating in RIAP and hospitals performing arthroplasties, based on data from HDD

(**) Completeness: ratio between procedures collected by RIAP and procedures performed by all hospitals in the Region, based on data from HDD

Table 2.2. RIAP completeness (years 2017 and 2018). Comparison with HDD data 2017 and estimate 2018, by joint

	2017			2018		
	HDD	RIAP	Completeness	HDD (estimate)	RIAP	Completeness (estimate)
	N	N	%	N	N	%
Joint	202,747	67,366	33.2	212,205	70,584	33.3
Hip	112,375	38,460	34.2	115,308	39,216	34.0
Knee	81,271	28,023	34.5	86,735	30,318	35.0
Shoulder	9,101	883	9.7	10,162	1,050	10.3

Table 2.3. Hip. Number of procedures analysed, by procedure type

	N	%
Procedure type	37,709	
Total replacement	27,329	72.5
- elective	24,049	88.0
- emergency	3,280	12.0
Partial replacement	8,269	21.9
Revision	2,111	5.6
Partial revision (*)	1,459	69.1
Total revision	230	10.9
Removal of prosthesis (**)	422	20.0

(*) Includes: conversion from partial to total prosthesis

(**) Includes: removal of prosthesis, removal with spacer implant, spacer revision

Table 2.4. Hip. Number of procedures by type of hospital, by procedure type

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Type of hospital	24,049		3,280		8,269		2,111		37,709	
Public hospitals	10,064	41.8	2,779	84.7	6,884	83.3	1,091	51.7	20,818	55.2
Private hospitals, accredited	12,744	53.0	477	14.5	1,274	15.4	946	44.8	15,441	40.9
Private hospitals, not accredited	1,241	5.2	24	0.7	111	1.3	74	3.5	1,450	3.8

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.5. Hip. Number of procedures by patient gender and age group, by procedure type

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Gender	24,049		3,280		8,269		2,111		37,709	
Male	11,198	46.6	915	27.9	2,162	26.1	836	39.6	15,111	40.1
Female	12,851	53.4	2,365	72.1	6,107	73.9	1,275	60.4	22,598	59.9
Age group by gender										
Male	11,198		915		2,162		836		15,111	
Mean age	65		71		83		69		68	
Standard deviation	12		12		8		13		13	
<45	634	5.7	16	1.7	5	0.2	35	4.2	690	4.6
45 - 54	1,693	15.1	103	11.3	12	0.6	92	11.0	1,900	12.6
55 - 64	2,770	24.7	128	14.0	50	2.3	155	18.5	3,103	20.5
65 - 74	3,541	31.6	252	27.5	175	8.1	252	30.1	4,220	27.9
75 - 84	2,285	20.4	289	31.6	858	39.7	232	27.8	3,664	24.2
≥ 85	275	2.5	127	13.9	1,062	49.1	70	8.4	1,534	10.2
Female	12,851		2,365		6,107		1,275		22,598	
Mean age	70		74		84		74		74	
Standard deviation	11		10		7		11		12	
<45	309	2.4	14	0.6	4	0.1	14	1.1	341	1.5
45 - 54	935	7.3	81	3.4	16	0.3	59	4.6	1,091	4.8
55 - 64	2,382	18.5	286	12.1	56	0.9	163	12.8	2,887	12.8
65 - 74	4,403	34.3	810	34.2	390	6.4	361	28.3	5,964	26.4
75 - 84	4,161	32.4	834	35.3	2,445	40.0	481	37.7	7,921	35.1
≥ 85	661	5.1	340	14.4	3,196	52.3	197	15.5	4,394	19.4

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.6. Hip. Number of procedures by operated side, surgical approach and fixation, by procedure type

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Operated side	24,049		3,280		8,269		2,111		37,709	
Right	12,864	53.5	1,671	50.9	4,179	50.5	1,060	50.2	19,774	52.4
Left	10,440	43.4	1,599	48.8	4,061	49.1	1,038	49.2	17,138	45.4
Bilateral	745	3.1	10	0.3	29	0.4	13	0.6	797	2.1
Surgical approach	24,049		3,280		8,269		2,111		37,709	
Anterior	4,661	19.4	210	6.4	448	5.4	122	5.8	5,441	14.4
Anterolateral	2,413	10.0	622	19.0	1,736	21.0	259	12.3	5,030	13.3
Lateral	4,037	16.8	898	27.4	2,757	33.3	513	24.3	8,205	21.8
Posterolateral	12,479	51.9	1,531	46.7	3,302	39.9	1,198	56.8	18,510	49.1
Other	459	1.9	19	0.6	26	0.3	19	0.9	523	1.4

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.7. Hip. Number of primary procedures by indication for surgery and previous procedure, by procedure type

	Total replacement				Partial replacement		TOTAL	
	elective		emergency		N	%	N	%
	N	%	N	%				
Indication for surgery	24,049		3,280		8,269		35,598	
Primary osteoarthritis	21,615	89.9	0	0.0	134	1.6	21,749	61.1
Post-traumatic osteoarthritis	343	1.4	0	0.0	33	0.4	376	1.1
Rheumatoid arthritis	58	0.2	0	0.0	0	0.0	58	0.2
Neoplasia	36	0.1	0	0.0	30	0.4	66	0.2
Aseptic necrosis of femoral head	952	4.0	0	0.0	15	0.2	967	2.7
Congenital dislocation/hip dysplasia	590	2.5	0	0.0	4	0.0	594	1.7
Perthes disease or epiphysiolysis	62	0.3	0	0.0	9	0.1	71	0.2
Fractured neck of femur	0	0.0	3,280	100.0	7,968	96.4	11,248	31.6
Septic coxitis	5	0.0	0	0.0	0	0.0	5	0.0
Pseudoarthrosis neck fracture related	28	0.1	0	0.0	12	0.1	40	0.1
Other	360	1.5	0	0.0	64	0.8	424	1.2
Previous procedure	24,049		3,280		8,269		35,598	
None	21,990	91.4	3,098	94.5	7,613	92.1	32,701	91.9
Osteosynthesis	303	1.3	60	1.8	57	0.7	420	1.2
Osteotomy	91	0.4	0	0.0	4	0.0	95	0.3
Arthrodesis	4	0.0	0	0.0	2	0.0	6	0.0
Other	1,661	6.9	122	3.7	593	7.2	2,376	6.7

Table 2.8. Hip. Number of revision procedures by indication for surgery and previous procedure

	Revision (*)	
	N	%
Indication for surgery	2,111	
Pain	118	5.6
Lysis	57	2.7
Wear	174	8.2
Implant fracture	73	3.5
Prosthesis dislocation	293	13.9
Periprosthetic fracture	260	12.3
Infection	185	8.8
Previous prosthesis removal	34	1.6
Aseptic loosening, cup	382	18.1
Aseptic loosening, stem	228	10.8
Aseptic loosening, total	148	7.0
Disease progression	2	0.1
Other	157	7.4
Previous procedure	2,111	
Total hip replacement	1,607	76.1
Revision of hip replacement	80	3.8
Spacer implantation or prosthesis removal (**)	182	8.6
Partial hip replacement	172	8.1
Other	70	3.3

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

(**) Includes: removal of prosthesis, removal with spacer implant, spacer revision

Table 2.9. Hip. Number of procedures analysed, by device

	N	%
Procedure type	36,353	
Total replacement	26,905	74.0
- elective	23,726	88.2
- emergency	3,179	11.8
Partial replacement	7,366	20.3
Revision	2,082	5.7
Partial revision (*)	1,456	69.9
Total revision	205	9.8
Removal of prosthesis (**)	421	20.2

(*) Includes: conversion from partial to total prosthesis

(**) Includes: removal of prosthesis, removal with spacer implant, spacer revision

Table 2.10. Hip. Number of procedures by type of fixation, by procedure type

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Fixation	23,726		3,179		7,366		2,082		36,353	
Cemented (stem + cup)	1,120	4.7	196	6.2	0	0.0	92	4.4	1,408	3.9
Reverse hybrid (uncemented stem and cemented cup)	301	1.3	141	4.4	0	0.0	123	5.9	565	1.6
Only cemented cup	0	0.0	0	0.0	0	0.0	71	3.4	71	0.2
Hybrid (cemented stem and uncemented cup)	1,113	4.7	202	6.4	0	0.0	68	3.3	1,383	3.8
Uncemented (stem + cup)	21,192	89.3	2,640	83.0	0	0.0	1,254	60.2	25,086	69.0
Only uncemented cup	0	0.0	0	0.0	0	0.0	169	8.1	169	0.5
Only cemented stem	0	0.0	0	0.0	3,091	42.0	38	1.8	3,129	8.6
Only uncemented stem	0	0.0	0	0.0	4,275	58.0	182	8.7	4,457	12.3
Fixation declared "not applicable" for cup and stem even if the component is present	0	0.0	0	0.0	0	0.0	85	4.1	85	0.2

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.11. Hip. Number of total replacement procedures by type of bearing, by procedure type

	Total replacement				TOTAL	
	elective		emergency		N	%
	N	%	N	%		
Bearing type (head/insert)	23,726		3,179		26,905	
Ceramics-Ceramics	3,467	14.6	204	6.4	3,671	13.6
Ceramics-Metal	118	0.5	29	0.9	147	0.5
Ceramics-Polyethylene	14,616	61.6	1,623	51.1	16,239	60.4
Metal-Ceramics	39	0.2	7	0.2	46	0.2
Metal-Metal	108	0.5	22	0.7	130	0.5
Metal-Polyethylene	2,176	9.2	588	18.5	2,764	10.3
Procedures that do not report the implantation of a head and an insert	3,202	13.5	706	22.2	3,908	14.5

Table 2.12. Hip. Number of revision procedures by type of bearing

Type of bearing (head/insert)	Revision (*)	
	N	%
Type of bearing (head/insert)	2,082	
Ceramics-Ceramics	42	2.0
Ceramics-Metal	31	1.5
Ceramics-Polyethylene	625	30.0
Metal-Ceramics	1	0.0
Metal-Metal	45	2.2
Metal-Polyethylene	327	15.7
Procedures that do not report the implantation of a head and an insert	1,011	48.6

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.13. Hip. Number of total replacement procedures by stem type, by procedure type

	Total replacement				TOTAL	
	elective		emergency		N	%
	N	%	N	%		
Stem type	23,726		3,179		26,905	
Uncemented	19,232	81.1	2,370	74.6	21,602	80.3
Modular	1,122	5.8	307	13.0	1,429	6.6
Non-modular	18,110	94.2	2,063	87.0	20,173	93.4
Straight	13,563	74.9	1,851	89.7	15,414	76.4
Anatomical	2,076	11.5	125	6.1	2,201	10.9
Conservative	2,470	13.6	87	4.2	2,557	12.7
Cemented	1,375	5.8	412	13.0	1,787	6.6
Modular	52	3.8	12	2.9	64	3.6
Non-modular	1,323	96.2	400	97.1	1,723	96.4
Straight	1,205	91.1	376	94.0	1,581	91.8
Anatomical	101	7.6	23	5.8	124	7.2
Conservative	17	1.3	1	0.3	18	1.0
Other stem type / Stem type not reported	3,119	13.1	397	12.5	3,516	13.1

Table 2.14. Knee. Number of procedures analysed, by procedure type

	N	%
Procedure type	29,198	
Primary	27,588	94.5
- total	23,064	83.6
- unicompartmental	4,524	16.4
Revision	1,610	5.5
Partial revision	358	22.2
Total revision	1,184	73.5
Removal of prosthesis	47	2.9
Primary patella implant on existing prosthesis	21	1.3

Table 2.15. Knee. Number of procedures by type of hospital, by procedure type

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Type of hospital	23,064		4,524		1,610		29,198	
Public hospitals	9,081	39.4	922	20.4	553	34.3	10,556	36.2
Private hospitals, accredited	12,257	53.1	3,277	72.4	987	61.3	16,521	56.6
Private hospitals, not accredited	1,726	7.5	325	7.2	70	4.3	2,121	7.3

(*) Total or partial revision, removal of prosthesis, primary patella implant on existing prosthesis, spacer revision

Table 2.16. Knee. Number of procedures by patient gender and age group, by procedure type

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Gender	23,064		4,524		1,610		29,198	
Male	7,380	32.0	1,692	37.4	516	32.0	9,588	32.8
Female	15,684	68.0	2,832	62.6	1,094	68.0	19,610	67.2
Age group by gender								
Male	7,380		1,692		516		9,588	
Mean age	70		67		67		69	
Standard deviation	9		10		10		9	
<45	67	0.9	23	1.4	7	1.4	97	1.0
45 - 54	376	5.1	148	8.7	27	5.2	551	5.7
55 - 64	1,381	18.7	424	25.1	93	18.0	1,898	19.8
65 - 74	3,132	42.4	730	43.1	203	39.3	4,065	42.4
75 - 84	2,319	31.4	339	20.0	174	33.7	2,832	29.5
≥85	105	1.4	28	1.7	12	2.3	145	1.5
Female	15,684		2,832		1,094		19,610	
Mean age	71		68		68		71	
Standard deviation	8		9		9		8	
<45	42	0.3	23	0.8	1	0.1	66	0.3
45 - 54	510	3.3	195	6.9	42	3.8	747	3.8
55 - 64	2,481	15.8	632	22.3	166	15.2	3,279	16.7
65 - 74	6,940	44.2	1,219	43.0	477	43.6	8,636	44.0
75 - 84	5,398	34.4	714	25.2	368	33.6	6,480	33.0
≥85	313	2.0	49	1.7	40	3.7	402	2.0

(*) Total or partial revision, removal of prosthesis, primary patella implant on existing prosthesis, spacer revision

Table 2.17. Knee. Number of procedures by operated side and surgical approach, by procedure type

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Operated side	23,064		4,524		1,610		29,198	
Right	12,178	52.8	2,203	48.7	830	51.6	15,211	52.1
Left	10,565	45.8	1,977	43.7	768	47.7	13,310	45.6
Bilateral	321	1.4	344	7.6	12	0.7	677	2.3
Surgical approach	23,064		4,524		1,610		29,198	
Medial parapatellar	20,274	87.9	3,123	69.0	1,388	86.2	24,785	84.9
Lateral parapatellar	477	2.1	249	5.5	25	1.6	751	2.6
Mid-vastus	1,244	5.4	356	7.9	102	6.3	1,702	5.8
Minimally invasive mid-vastus	365	1.6	537	11.9	37	2.3	939	3.2
Quad-sparing	59	0.3	124	2.7	3	0.2	186	0.6
Sub-vastus	258	1.1	42	0.9	10	0.6	310	1.1
Minimally invasive sub-vastus	86	0.4	54	1.2	5	0.3	145	0.5
V Quadriceps	1	0.0	0	0.0	4	0.2	5	0.0
Tibial tuberosity osteotomy	8	0.0	2	0.0	5	0.3	15	0.1
Other	292	1.3	37	0.8	31	1.9	360	1.2

(*) Total or partial revision, removal of prosthesis, primary patella implant on existing prosthesis, spacer revision

Table 2.18. Knee. Number of primary procedures, by indication for surgery and previous procedure

	Primary				TOTAL	
	total		unicompartmental		N	%
	N	%	N	%		
Indication for surgery	23,064		4,524		27,588	
Primary osteoarthritis	21,764	94.4	4,184	92.5	25,948	94.1
Post-traumatic osteoarthritis	368	1.6	50	1.1	418	1.5
Rheumatoid arthritis	122	0.5	3	0.1	125	0.5
Neoplasia	15	0.1	2	0.0	17	0.1
Osteonecrosis	107	0.5	170	3.8	277	1.0
Other	688	3.0	115	2.5	803	2.9
Previous procedure	23,064		4,524		27,588	
None	20,549	89.1	4,191	92.6	24,740	89.7
Arthrodesis	8	0.0	1	0.0	9	0.0
Osteotomy	152	0.7	12	0.3	164	0.6
Arthroscopy	503	2.2	176	3.9	679	2.5
Osteosynthesis	142	0.6	11	0.2	153	0.6
Other	1,710	7.4	133	2.9	1,843	6.7

Table 2.19. Knee. Number of revision procedures, by indication for surgery and previous procedure

	Revision (*)	
	N	%
Indication for surgery	1,610	
Aseptic loosening of several components	418	26.0
Aseptic loosening of femur	88	5.5
Aseptic loosening of tibia	160	9.9
Aseptic loosening of patella	4	0.2
Wear	38	2.4
Dislocation	39	2.4
Instability	56	3.5
Periprosthetic fracture	19	1.2
Implant fracture	23	1.4
Fractured spacer	2	0.1
Infection	249	15.5
Stiffness	25	1.6
Disease progression	37	2.3
Pain	269	16.7
Other	183	11.4
Previous procedure	1,610	
Primary total	992	61.6
Primary unicompartmental	267	16.6
Revision of knee replacement	116	7.2
Spacer	143	8.9
Other	92	5.7

(*) Total or partial revision, removal of prosthesis, primary patella implant on existing prosthesis, spacer revision

Table 2.20. Knee. Number of procedures analysed for the implanted device, by procedure type

	N	%
Procedure type	28,497	
Primary	26,917	94.5
- total	22,695	84.3
- unicompartmental	4,222	15.7
Revision	1,580	5.5

Table 2.21. Knee. Number of procedures by type of fixation, by procedure type

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Fixation	22,695		4,222		1,580		28,497	
Patella not implanted	19,930	87.8	4,145	98.2	601	38.0	24,676	86.6
Cemented (femoral and tibial components)	13,342	66.9	2,724	65.7	380	63.2	16,446	66.6
Cemented femoral component and uncemented tibial component	678	3.4	284	6.9	49	8.2	1,011	4.1
Only cemented femoral component	0	0.0	0	0.0	17	2.8	17	0.1
Uncemented femoral component and cemented tibial component	1,043	5.2	373	9.0	54	9.0	1,470	6.0
Uncemented	4,867	24.4	764	18.4	12	2.0	5,643	22.9
Only uncemented femoral component	0	0.0	0	0.0	0	0.0	0	0.0
Only cemented tibial component	0	0.0	0	0.0	29	4.8	29	0.1
Only uncemented tibial component	0	0.0	0	0.0	9	1.5	9	0.0
Fixation declared "not applicable" for both femoral and tibial components	0	0.0	0	0.0	51	8.5	51	0.2
Patella implanted (cemented)	2,187	9.6	63	1.5	296	18.7	2,546	8.9
Cemented (femoral and tibial components)	2,073	94.8	36	57.1	186	62.8	2,295	90.1
Cemented femoral component and uncemented tibial component	8	0.4	22	34.9	5	1.7	35	1.4
Only cemented femoral component	0	0.0	0	0.0	1	0.3	1	0.0
Uncemented femoral component and cemented tibial component	67	3.1	1	1.6	13	4.4	81	3.2
Uncemented	39	1.8	4	6.3	63	21.3	106	4.2
Only uncemented femoral component	0	0.0	0	0.0	0	0.0	0	0.0
Only cemented tibial component	0	0.0	0	0.0	0	0.0	0	0.0
Only uncemented tibial component	0	0.0	0	0.0	0	0.0	0	0.0
Only patella	0	0.0	0	0.0	28	9.5	28	1.1

(continued)

Table 2.21. (continued)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Patella implanted (uncemented)	578	2.5	14	0.3	683	43.2	1,275	4.5
Cemented (femoral and tibial components)	156	27.0	11	78.6	275	40.3	442	34.7
Cemented femoral component and uncemented tibial component	43	7.4	1	7.1	38	5.6	82	6.4
Only cemented femoral component	0	0.0	0	0.0	0	0.0	0	0.0
Uncemented femoral component and cemented tibial component	48	8.3	0	0.0	70	10.2	118	9.3
Uncemented	331	57.3	2	14.3	300	43.9	633	49.6
Only uncemented femoral component	0	0.0	0	0.0	0	0.0	0	0.0
Only cemented tibial component	0	0.0	0	0.0	0	0.0	0	0.0
Only uncemented tibial component	0	0.0	0	0.0	0	0.0	0	0.0
Only patella	0	0.0	0	0.0	0	0.0	0	0.0
Procedures not admitted to the analysis of the fixation mode	0	0.0	0	0.0	0	0.0	0	0.0

(*) Total or partial revision, removal of prosthesis, primary patella implant on existing prosthesis, spacer revision

Table 2.22. Knee. Number of primary procedures by type of tibial tray

	N	%
Type of tibial tray	22,695	
Mobile bearing	5,452	24.0
Cemented	3,664	67.2
Uncemented	1,557	28.6
Cementable	231	4.2
Fixed	11,597	51.1
Cemented	11,107	95.8
Uncemented	458	3.9
Cementable	32	0.3
Tibial tray not reported	5,646	24.9

Table 2.23. Shoulder. Number of procedures analysed, by procedure type

	N	%
Procedure type	939	
Primary	920	98.0
Total	522	56.7
- elective	410	78.5
- emergency	112	21.5
Partial replacement	32	3.5
Not specified	366	39.8
Revision	19	2.0

Table 2.24. Shoulder. Number of procedures by prosthesis type implanted in the total replacement

	N	%
Type of prosthesis implanted in the total replacement	522	
Elective	410	78.5
- anatomical	14	3.4
- coating	0	0.0
- reverse	314	76.6
- interposition	82	20.0
Emergency	112	21.5
- anatomical	7	6.3
- coating	0	0.0
- reverse	105	93.8
- interposition	0	0.0

Table 2.25. Shoulder. Number of procedures by type of hospital, by procedure type

	Primary								Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified		N	%	N	%
	elective		emergency		N	%	N	%				
	N	%	N	%					N	%	N	%
Type of hospital	410		112		32		366		19		939	
Public hospitals	388	94.6	112	100	32	100	142	38.8	19	100	693	73.8
Private hospitals, accredited	15	3.7	0	0.0	0	0.0	129	35.2	0	0.0	144	15.3
Private hospitals, not accredited	7	1.7	0	0.0	0	0.0	95	26.0	0	0.0	102	10.9

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.26. Shoulder. Number of procedures by patient gender and age group, by procedure type

	Primary								Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified					
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Gender	410		112		32		366		19		939	
Male	126	30.7	21	18.8	15	46.9	91	24.9	7	36.8	260	27.7
Female	284	69.3	91	81.3	17	53.1	275	75.1	12	63.2	679	72.3
Age group by gender												
Male	126		21		15		91		7		260	
Mean age	67		72		53		70		63		66	
Standard deviation	10		8		10		9		12		10	
<45	2	1.6	0	0.0	4	26.7	1	1.1	1	14.3	8	3.1
45 - 54	19	15.1	0	0.0	4	26.7	6	6.6	1	14.3	30	11.5
55 - 64	33	26.2	3	14.3	5	33.3	18	19.8	2	28.6	61	23.5
65 - 74	47	37.3	10	47.6	1	6.7	42	46.2	3	42.9	103	39.6
75 - 84	25	19.8	6	28.6	1	6.7	22	24.2	0	0.0	54	20.8
≥85	0	0.0	2	9.5	0	0.0	2	2.2	0	0.0	4	1.5
Female	284		91		17		275		12		679	
Mean age	71		74		67		74		68		72	
Standard deviation	7		8		9		7		6		7	
<45	2	0.7	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3
45 - 54	6	2.1	1	1.1	1	5.9	1	0.4	0	0.0	9	1.3
55 - 64	47	16.5	8	8.8	6	35.3	17	6.2	4	33.3	82	12.1
65 - 74	148	52.1	40	44.0	7	41.2	120	43.6	6	50.0	321	47.3
75 - 84	80	28.2	33	36.3	2	11.8	124	45.1	2	16.7	241	35.5
≥85	1	0.4	9	9.9	1	5.9	13	4.7	0	0.0	24	3.5

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.27. Shoulder. Number of procedures by operated side and surgical approach, by procedure type

	Primary								Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified		N	%	N	%
	elective		emergency		N	%	N	%				
	N	%	N	%					N	%	N	%
Operated side	410		112		32		366		19		939	
Right	263	64.1	55	49.1	18	56.3	238	65.0	13	68.4	587	62.5
Left	147	35.9	57	50.9	14	43.8	128	35.0	6	31.6	352	37.5
Bilateral	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Surgical approach	410		112		32		366		19		939	
Deltopectoral	322	78.5	112	100.0	26	81.3	344	94.0	16	84.2	820	87.3
Transdeltoida	54	13.2	0	0.0	5	15.6	14	3.8	0	0.0	73	7.8
Other	34	8.3	0	0.0	1	3.1	8	2.2	3	15.8	46	4.9

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.28. Shoulder. Number of primary procedures by indication for surgery and previous procedure

	Primary								TOTAL	
	Total replacement				Partial replacement		Not specified		N	%
	elective		emergency		N	%	N	%		
	N	%	N	%						
Cause	410		112		32		366		920	
Eccentric osteoarthritis	228	55.6	0	0.0	1	3.1	132	36.1	361	39.2
Concentric osteoarthritis	57	13.9	0	0.0	13	40.6	22	6.0	92	10.0
Rheumatoid arthritis	4	1.0	0	0.0	1	3.1	4	1.1	9	1.0
Neoplasia	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Osteonecrosis	2	0.5	0	0.0	1	3.1	7	1.9	10	1.1
Fracture	0	0.0	112	100.0	15	46.9	157	42.9	284	30.9
Previous fracture	17	4.1	0	0.0	1	3.1	0	0.0	18	2.0
Other	102	24.9	0	0.0	0	0.0	44	12.0	146	15.9
Previous	410		112		32		366		920	
None	375	91.5	111	99.1	31	96.9	365	99.7	882	95.9
Osteosynthesis	7	1.7	0	0.0	1	3.1	1	0.3	9	1.0
Arthrotomy	3	0.7	0	0.0	0	0.0	0	0.0	3	0.3
Arthrodesis	1	0.2	0	0.0	0	0.0	0	0.0	1	0.1
Arthroscopy	18	4.4	1	0.9	0	0.0	0	0.0	19	2.1
Other	6	1.5	0	0.0	0	0.0	0	0.0	6	0.7

Table 2.29. Shoulder. Number of revision procedures by indication for surgery and previous procedure

	Revision (*)	
	N	%
Indication for surgery	19	
Instability	3	15.8
Lysis	0	0.0
Glenoid erosion	1	5.3
Prosthesis breakage	0	0.0
Dislocation	3	15.8
Periprosthetic fracture	0	0.0
Infection	3	15.8
Prosthesis removal outcomes	0	0.0
Aseptic mobilisation	5	26.3
Disease progression	0	0.0
Pain	1	5.3
Other	3	15.8
Previous procedure	19	
Primary	17	89.5
Removal	1	5.3
Shoulder replacement revision	1	5.3
Other	0	0.0

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Table 2.30. Shoulder. Number of procedures by type of fixation, by procedure type

									Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified					
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Fixation	325		110		24		3		19		481	
Cemented (glenoid + stem)	5	1.5	16	14.5	0	0.0	0	0.0	1	5.3	22	4.6
Reverse hybrid (cemented glenoid and uncemented stem)	3	0.9	2	1.8	0	0.0	0	0.0	0	0.0	5	1.0
Only cemented glenoid	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Hybrid (uncemented glenoid and cemented stem)	20	6.2	28	25.5	0	0.0	0	0.0	3	15.8	51	10.6
Uncemented (glenoid + stem)	297	91.4	64	58.2	0	0.0	3	100.0	9	47.4	373	77.5
Only uncemented glenoid	0	0.0	0	0.0	0	0.0	0	0.0	3	15.8	3	0.6
Only cemented stem	0	0.0	0	0.0	7	29.2	0	0.0	1	5.3	8	1.7
Only stem uncemented	0	0.0	0	0.0	17	70.8	0	0.0	2	10.5	19	4.0
Fixation declared "not applicable" for glenoid and stem	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

(*) Total or partial revision, removal of prosthesis, conversion from partial to total prosthesis, spacer revision

Figure 2.1. Flowchart of the RIAP data quality control process: procedures

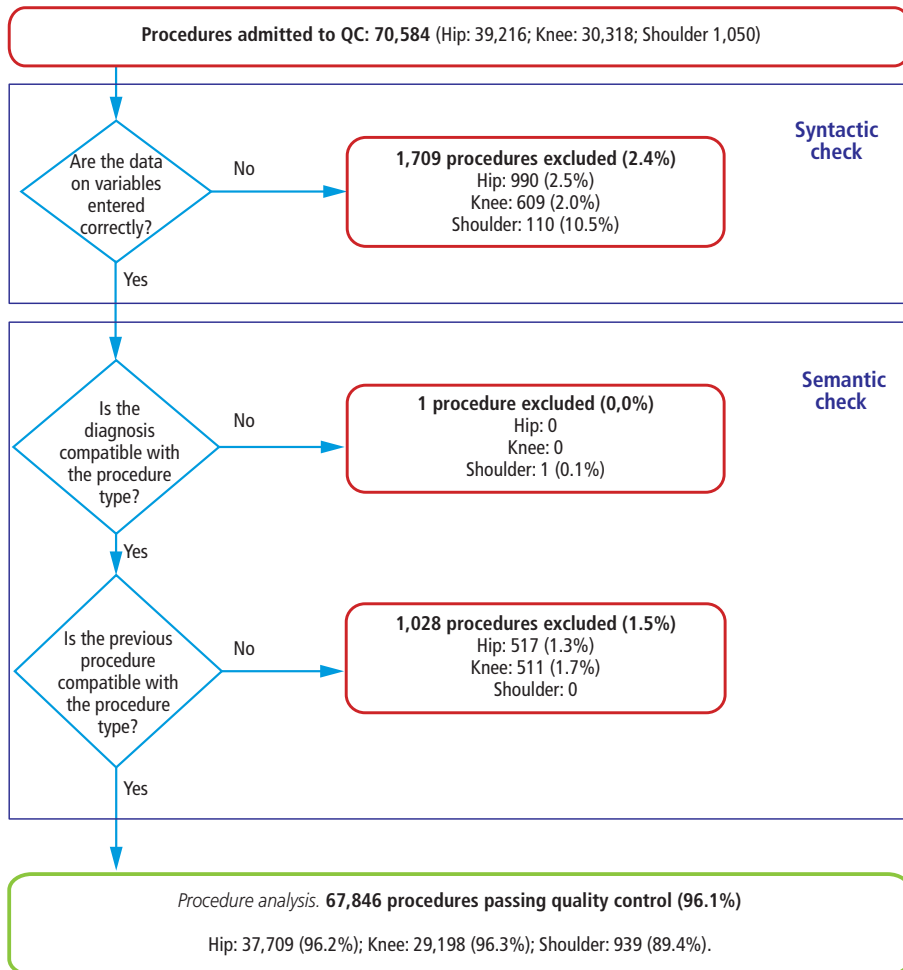


Figure 2.2. Flowchart of the RIAP data quality control process: implanted medical devices

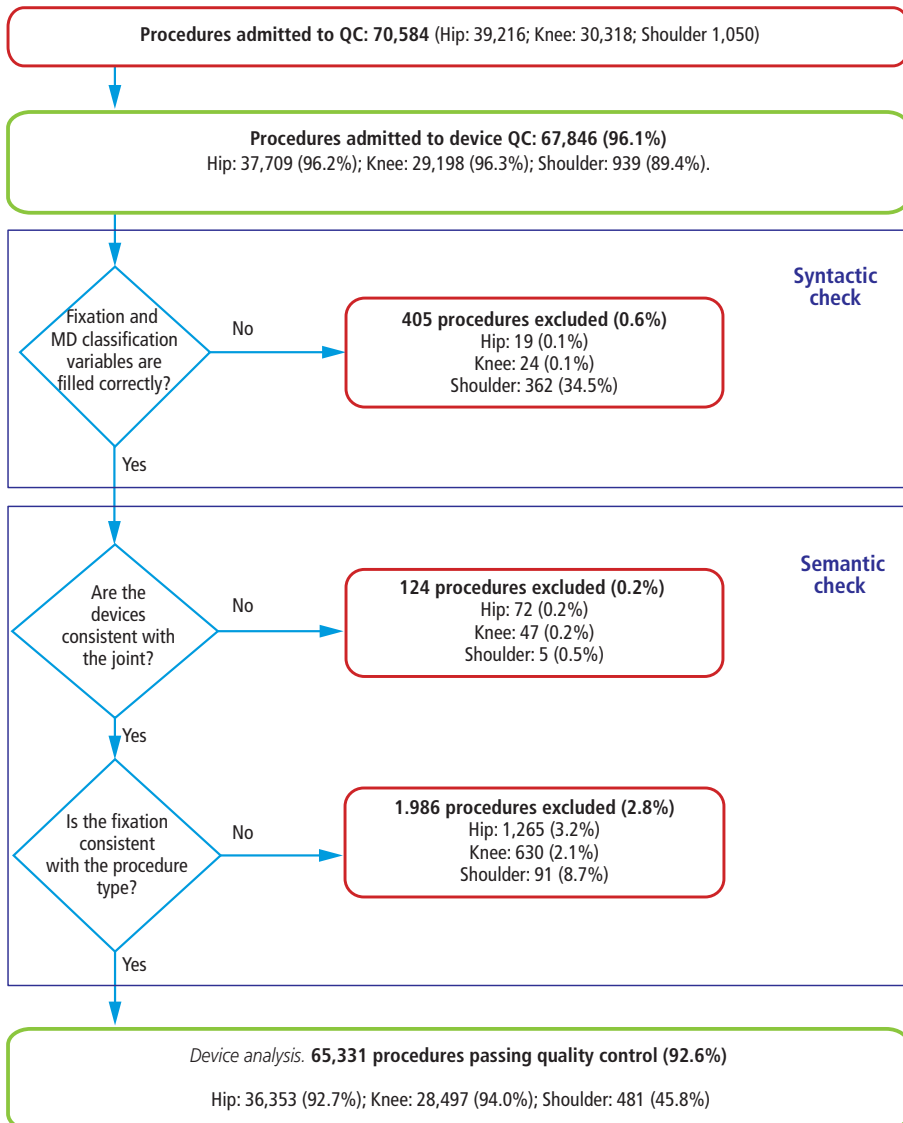


Figure 2.3. Hip. Types of bearing. Total replacement (elective procedures)

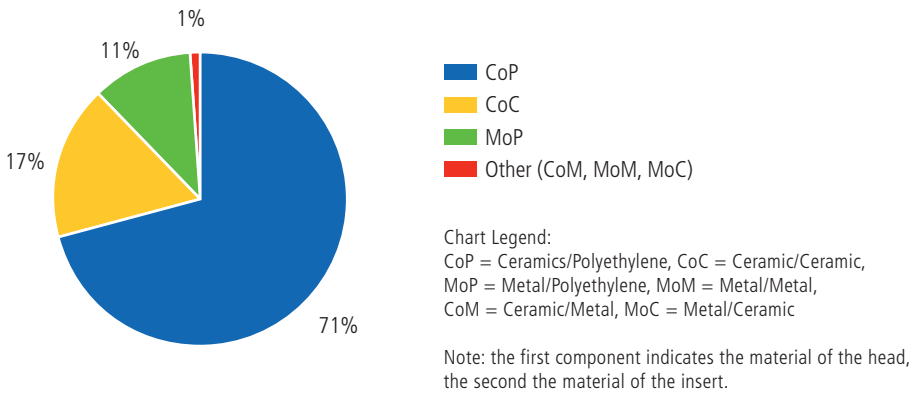
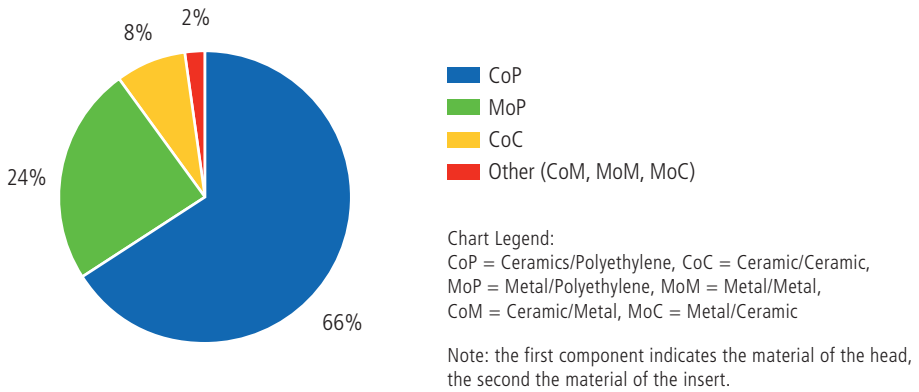


Figure 2.4. Hip. Types of bearing. Total replacement (emergency)



APPENDIX

Table 1. Joint replacements in Italy, per year of discharge. 2001-2017 and estimate 2018

ICD-9-CM Code	Procedure	2001	2002	2003	2004	2005	2006	2007	2008
	Hip	74,408	78,497	80,999	85,307	87,499	90,062	91,077	92,217
81.51	Total hip replacement	46,850	49,820	52,541	55,875	57,112	59,315	60,425	60,840
	<i>Total hip replacement (elective)</i>	<i>40,067</i>	<i>42,284</i>	<i>44,505</i>	<i>47,047</i>	<i>47,908</i>	<i>49,657</i>	<i>50,684</i>	<i>51,110</i>
81.52	Partial hip replacement	21,394	22,015	21,753	22,474	23,227	23,286	23,119	23,896
00.85(*)	Hip resurfacing	0	0	0	0	0	0	0	0
(**)	Revision of hip replacement	6,164	6,662	6,705	6,958	7,160	7,461	7,533	7,481
	Knee	28,693	33,417	38,655	44,324	47,643	52,322	57,054	59,956
81.54	Total knee replacement	27,401	31,740	36,714	42,081	45,116	49,560	53,930	56,525
(***)	Total knee replacement	1,292	1,677	1,941	2,243	2,527	2,762	3,124	3,431
	Shoulder	1,559	1,700	1,866	2,296	2,517	2,888	3,255	3,412
81.80	Total shoulder replacement	709	820	948	1,263	1,462	1,695	2,048	2,190
	<i>Total shoulder replacement (elective)</i>	<i>419</i>	<i>525</i>	<i>644</i>	<i>889</i>	<i>1,085</i>	<i>1,336</i>	<i>1,629</i>	<i>1,788</i>
81.81	Partial shoulder replacement	850	880	918	1,033	1,055	1,193	1,207	1,222
	Ankle	95	115	147	175	179	257	268	284
81.56	Total ankle replacement	95	115	147	175	179	257	268	284
	Other joints	736	836	870	1,154	1,668	1,713	1,570	1,315
81.57	Replacement of joint of foot and toe	316	391	414	467	604	629	692	656
81.59	Revision of joint replacement of lower extremity, not elsewhere classified	214	181	173	338	672	588	365	140
81.73	Total wrist replacement	40	42	44	49	60	81	66	69
81.84	Total elbow replacement	90	145	162	203	251	317	314	311
81.97	Revision of joint replacement of upper extremity	76	77	77	97	81	98	133	139
	Total	105,491	114,565	122,537	133,256	139,506	147,242	153,224	157,184

(°) Average annual increase

(*) New code introduced on 1st January 2009

(**) Codes: 00.70, 00.71, 00.72, 00.73 (introduced on 1st January 2009) and 81.53 (Hip replacement revision not specified)

(***) Code: 00.80, 00.81, 00.82, 00.83, 00.84 (introduced on 1st January 2009) and 81.55 (Knee replacement revision not otherwise specified)

2009	2010	2011	2012	2013	2014	2015	2016	2017	% (*)	Estimate 2018
93,241	95,348	96,125	98,585	100,844	102,652	105,803	108,906	112,375	2.6	115,308
61,601	61,775	62,664	64,503	66,257	68,190	71,178	74,660	77,787	3.2	
51,769	52,187	53,157	54,852	56,598	58,491	60,661	64,102	66,917	3.3	
23,393	24,847	25,091	25,346	25,979	26,141	26,222	25,879	26,101	1.3	
293	445	162	96	99	45	107	147	65	-17.2	
7,954	8,281	8,208	8,640	8,509	8,276	8,296	8,220	8,422	2.0	
61,079	63,255	63,749	66,007	67,634	70,313	73,191	78,779	81,271	6.7	86,735
57,004	59,081	59,472	61,541	62,910	65,614	68,091	73,394	75,668	6.6	
4,075	4,174	4,277	4,466	4,724	4,699	5,100	5,385	5,603	9.6	
3,783	4,326	4,684	5,143	5,795	6,511	7,145	8,053	9,101	11.7	10,162
2,537	2,990	3,478	3,830	4,441	5,309	5,970	6,892	7,862	16.2	
2,093	2,382	2,816	3,042	3,480	4,085	4,474	5,226	5,922	18.0	
1,246	1,336	1,206	1,313	1,354	1,202	1,175	1,161	1,239	2.4	
256	255	298	313	330	387	482	546	600	12.2	673
256	255	298	313	330	387	482	546	600	12.2	
1,332	1,302	1,349	1,291	1,300	1,358	1,479	1,444	1,489	4.5	1,556
521	557	543	443	440	453	530	481	468	2.5	
187	128	107	83	96	103	102	74	77	-6.2	
59	50	68	74	65	49	51	52	37	-0.5	
402	402	434	447	473	491	523	549	608	12.7	
163	165	197	244	226	262	273	288	299	8.9	
159,691	164,486	166,205	171,339	175,903	181,221	188,100	197,728	204,836	4.2	214,434

Table 2. Hip. Number of procedures by region of admission and procedure type. 2016-2017

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2016		2017		2016		2017	
	N	%	N	%	N	%	N	%
Piedmont	5,538	8.6	6,240	9.3	870	8.2	1,032	9.5
Aosta Valley	146	0.2	158	0.2	16	0.2	15	0.1
Lombardy	14,914	23.2	15,950	23.8	1,308	12.4	1,340	12.3
AP Bolzano	1,009	1.6	999	1.5	114	1.1	87	0.8
AP Trento	770	1.2	794	1.2	80	0.8	86	0.8
Veneto	6,850	10.7	6,801	10.2	844	8.0	781	7.2
Friuli Venezia Giulia	1,815	2.8	1,827	2.7	167	1.6	183	1.7
Liguria	1,405	2.2	1,232	1.8	728	6.9	648	6.0
Emilia-Romagna	7,244	11.3	7,611	11.4	753	7.1	839	7.7
Tuscany	5,302	8.3	5,740	8.6	899	8.5	842	7.7
Umbria	827	1.3	838	1.3	133	1.3	157	1.4
Marche	1,273	2.0	1,265	1.9	373	3.5	448	4.1
Lazio	5,113	8.0	5,369	8.0	1,113	10.5	1,199	11.0
Abruzzi	1,424	2.2	1,429	2.1	291	2.8	296	2.7
Molise	169	0.3	179	0.3	19	0.2	26	0.2
Campania	3,151	4.9	3,167	4.7	891	8.4	908	8.3
Apulia	2,490	3.9	2,428	3.6	593	5.6	531	4.9
Basilicata	280	0.4	250	0.4	80	0.8	88	0.8
Calabria	879	1.4	933	1.4	271	2.6	268	2.5
Sicily	2,728	4.2	2,872	4.3	869	8.2	914	8.4
Sardinia	915	1.4	894	1.3	153	1.4	188	1.7
Italy	64,242	100	66,976	100	10,565	100	10,876	100
<i>% of national volume</i>	59.0		59.6		9.7		9.7	

Partial replacement				Revision				Total			
2016		2017		2016		2017		2016		2017	
N	%	N	%	N	%	N	%	N	%	N	%
1,925	7.4	1,805	6.9	751	9.1	766	9.1	9,084	8.3	9,843	8.8
88	0.3	73	0.3	28	0.3	22	0.3	278	0.3	268	0.2
4,978	19.2	5,131	19.7	1,916	23.3	2,059	24.4	23,116	21.2	24,480	21.8
174	0.7	216	0.8	143	1.7	129	1.5	1,440	1.3	1,431	1.3
272	1.1	326	1.2	83	1.0	96	1.1	1,205	1.1	1,302	1.2
2,195	8.5	2,291	8.8	648	7.9	723	8.6	10,537	9.7	10,596	9.4
839	3.2	827	3.2	233	2.8	181	2.1	3,054	2.8	3,018	2.7
638	2.5	688	2.6	269	3.3	235	2.8	3,040	2.8	2,803	2.5
2,544	9.8	2,351	9.0	1,026	12.5	946	11.2	11,567	10.6	11,747	10.5
2,095	8.1	2,081	8.0	806	9.8	744	8.8	9,102	8.4	9,407	8.4
550	2.1	610	2.3	129	1.6	105	1.2	1,639	1.5	1,710	1.5
582	2.2	605	2.3	137	1.7	177	2.1	2,365	2.2	2,495	2.2
2,145	8.3	2,033	7.8	560	6.8	622	7.4	8,931	8.2	9,223	8.2
642	2.5	607	2.3	140	1.7	163	1.9	2,497	2.3	2,495	2.2
155	0.6	207	0.8	24	0.3	15	0.2	367	0.3	427	0.4
1,569	6.1	1,660	6.4	437	5.3	481	5.7	6,048	5.6	6,216	5.5
1,447	5.6	1,549	5.9	299	3.6	318	3.8	4,829	4.4	4,826	4.3
253	1.0	268	1.0	39	0.5	28	0.3	652	0.6	634	0.6
686	2.7	581	2.2	98	1.2	126	1.5	1,934	1.8	1,908	1.7
1,591	6.1	1,600	6.1	369	4.5	397	4.7	5,557	5.1	5,783	5.1
511	2.0	592	2.3	85	1.0	89	1.1	1,664	1.5	1,763	1.6
25,879	100	26,101	100	8,220	100	8,422	100	108,906	100	112,375	100
23.8		23.2		7.5		7.5		100.0		100.0	

Table 3. Hip. Primary total replacement. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2016	2017	2016	2017	2016	2017
	N	N	N	N	N	N
Piedmont	17	15	13	10	12	13
Aosta Valley	0	0	2	2	0	0
Lombardy	37	33	31	31	24	25
AP Bolzano	2	3	4	4	3	3
AP Trento	2	3	2	1	3	3
Veneto	10	9	14	9	14	20
Friuli Venezia Giulia	6	2	8	4	5	6
Liguria	3	5	3	2	6	7
Emilia-Romagna	17	12	23	22	21	21
Tuscany	18	16	16	17	6	6
Umbria	5	4	6	5	3	4
Marche	7	8	4	2	5	6
Lazio	48	44	15	20	13	13
Abruzzi	9	7	6	8	3	3
Molise	3	3	2	2	0	0
Campania	47	45	13	13	8	10
Apulia	20	21	11	11	9	9
Basilicata	4	4	2	1	1	1
Calabria	15	14	1	3	3	2
Sicily	45	46	21	16	5	7
Sardinia	15	14	5	6	2	2
Italy	330	308	202	189	146	161
<i>% of national volume</i>	43.0	41.1	26.3	25.2	19.0	21.5

201-300		>300		Total			
2016	2017	2016	2017	2016		2017	
N	N	N	N	N	%	N	%
7	5	4	8	53	6.9	51	6.8
0	0	0	0	2	0.3	2	0.3
6	7	14	13	112	14.6	109	14.6
1	1	0	0	10	1.3	11	1.5
1	1	0	0	8	1.0	8	1.1
6	4	6	6	50	6.5	48	6.4
2	2	0	1	21	2.7	15	2.0
2	1	1	1	15	2.0	16	2.1
5	7	3	2	69	9.0	64	8.5
6	5	5	7	51	6.6	51	6.8
0	0	0	0	14	1.8	13	1.7
2	2	0	0	18	2.3	18	2.4
4	4	3	3	83	10.8	84	11.2
2	1	0	1	20	2.6	20	2.7
0	0	0	0	5	0.7	5	0.7
4	3	0	0	72	9.4	71	9.5
2	2	0	0	42	5.5	43	5.7
0	0	0	0	7	0.9	6	0.8
1	2	0	0	20	2.6	21	2.8
2	2	0	0	73	9.5	71	9.5
0	0	0	0	22	2.9	22	2.9
53	49	36	42	767	100	749	100
6.9	6.5	4.7	5.6	100		100	

Table 4. Hip. Revision. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume											
	1-10		11-25		26-50		>50		Total			
	2016	2017	2016	2017	2016	2017	2016	2017	2016		2017	
	N	N	N	N	N	N	N	N	N	%	N	%
Piedmont	19	20	23	21	4	6	1	1	47	6.9	48	7.3
Aosta Valley	1	1	1	1	0	0	0	0	2	0.3	2	0.3
Lombardy	54	49	36	32	8	12	7	8	105	15.5	101	15.3
AP Bolzano	3	4	3	3	2	2	0	0	8	1.2	9	1.4
AP Trento	4	5	0	1	2	1	0	0	6	0.9	7	1.1
Veneto	25	24	17	16	7	7	0	0	49	7.2	47	7.1
Friuli Venezia Giulia	12	10	8	3	1	0	0	1	21	3.1	14	2.1
Liguria	7	8	3	5	1	2	2	1	13	1.9	16	2.4
Emilia-Romagna	37	30	16	21	8	4	2	2	63	9.3	57	8.6
Tuscany	24	23	11	9	8	10	3	3	46	6.8	45	6.8
Umbria	8	8	3	2	1	1	0	0	12	1.8	11	1.7
Marche	11	9	6	6	0	1	0	0	17	2.5	16	2.4
Lazio	47	50	12	13	4	5	1	1	64	9.4	69	10.5
Abruzzi	13	12	3	6	1	0	0	0	17	2.5	18	2.7
Molise	3	3	1	0	0	0	0	0	4	0.6	3	0.5
Campania	51	47	6	6	1	2	1	2	59	8.7	57	8.6
Apulia	30	25	9	8	1	2	0	0	40	5.9	35	5.3
Basilicata	3	5	2	1	0	0	0	0	5	0.7	6	0.9
Calabria	14	14	1	2	1	1	0	0	16	2.4	17	2.6
Sicily	57	54	9	7	1	2	0	0	67	9.9	63	9.6
Sardinia	15	17	2	1	0	0	0	0	17	2.5	18	2.7
Italy	438	418	172	164	51	58	17	19	678	100	659	100
<i>% of national volume</i>	64.6	63.4	25.4	24.9	7.5	8.8	2.5	2.9	100		100	

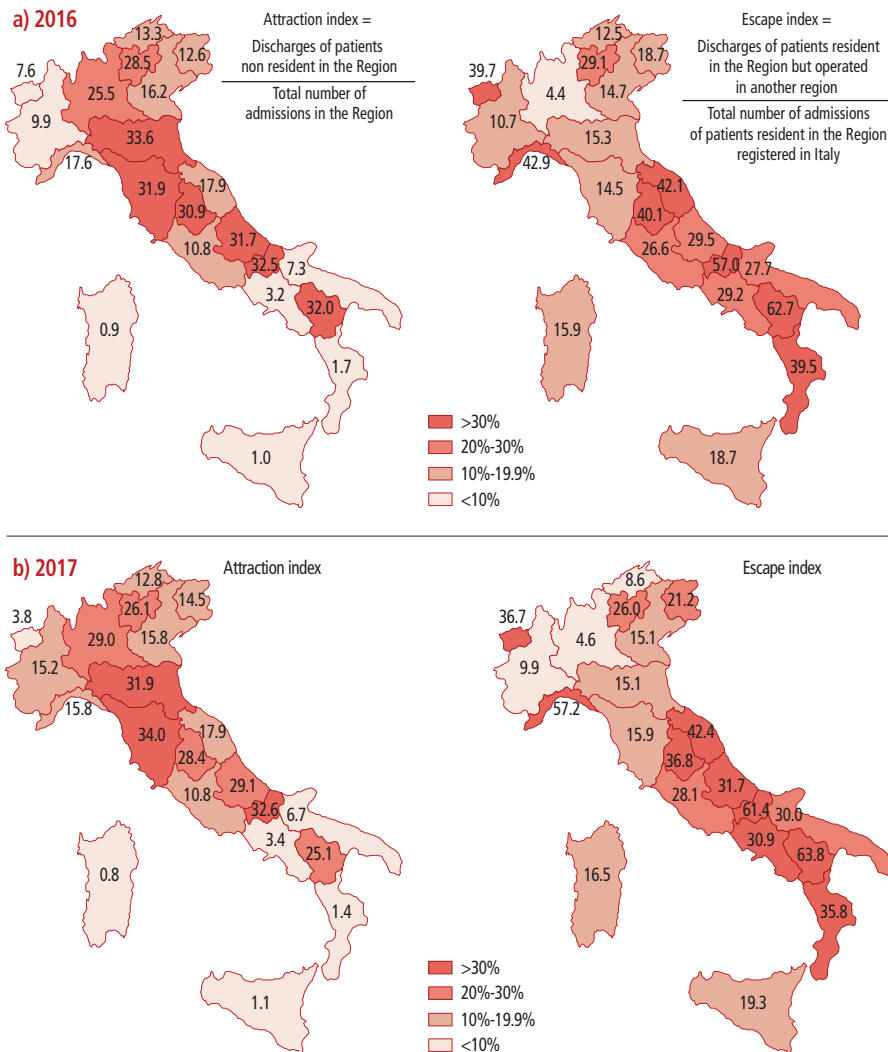
Table 5. Hip. Percent distribution of hospital discharges by patient gender and age group, and by procedure type. 2016 and 2017

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	%	%	%	%	%	%	%	%	%	%
Gender										
Male	46.0	46.3	26.1	27.2	27.0	27.8	39.5	40.2	39.1	39.7
Female	54.0	53.7	73.9	72.8	73.0	72.2	60.5	59.8	60.9	60.3
Age (male)										
Mean age	65.4	65.4	71.9	71.9	83.5	83.2	69.1	69.5	69.1	69.1
Standard deviation	11.9	11.8	12.1	12.3	8.4	9.4	12.6	12.5	13.2	13.3
Age group										
0-44	5.3	5.1	2.1	2.3	0.5	0.9	4.3	4.2	4.2	4.2
45-54	13.4	13.3	7.6	7.7	0.5	0.9	10.0	8.9	10.6	10.6
55-64	23.2	23.8	14.8	15.7	1.7	2.0	16.7	17.4	18.6	19.2
65-74	33.3	33.2	29.1	27.4	7.3	7.8	29.9	28.9	28.5	28.3
75-84	22.8	22.3	32.1	32.3	38.7	37.6	31.3	31.9	26.7	26.2
85+	2.0	2.2	14.3	14.6	51.3	50.9	7.9	8.8	11.4	11.5
Age (female)										
Mean age	69.6	69.6	74.3	74.0	84.3	84.4	73.4	73.7	74.6	74.5
Standard deviation	10.8	10.8	9.7	9.7	7.1	7.4	11.3	11.1	11.7	11.7
Age group										
0-44	2.3	2.4	0.3	0.4	0.1	0.2	2.1	1.6	1.4	1.5
45-54	7.3	7.2	2.8	2.6	0.3	0.4	4.7	4.9	4.6	4.6
55-64	17.6	18.0	11.9	12.6	1.1	1.0	11.3	11.5	11.7	12.1
65-74	35.4	35.0	33.5	33.6	6.0	5.8	27.4	26.8	26.2	26.1
75-84	33.1	33.0	37.2	37.3	39.4	39.2	41.1	40.8	35.9	35.8
85+	4.3	4.4	14.3	13.5	53.1	53.4	13.3	14.4	20.1	19.9

Table 6. Hip. Percent distribution of hospital discharges by mode of discharge and by procedure type. 2016 and 2017

Mode of discharge	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
	%	%	%	%	%	%	%	%	%	%
Deceased	0.2	0.1	1.2	1.2	3.0	2.8	1.2	1.0	1.0	0.9
Ordinary discharge	54.0	50.3	53.9	51.2	50.1	47.4	54.6	50.7	53.1	49.7
Discharge to a residential health care	1.0	1.5	6.0	6.7	9.6	9.4	3.3	3.9	3.7	4.0
Discharge to hospital at home	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.1
Discharge against medical advice	0.1	0.1	0.4	0.3	0.4	0.4	0.2	0.3	0.2	0.2
Transfer to an acute admission unit of a different hospital	2.2	2.1	4.4	4.9	4.5	4.3	3.1	2.8	3.0	2.9
Transfer in the same hospital	23.1	27.5	9.3	10.4	7.3	10.5	18.4	21.8	17.7	21.4
Transfer to an inpatient rehabilitation hospital	15.0	17.6	18.5	22.9	18.5	22.3	14.8	18.2	16.1	19.3
Discharge to a nursing home	4.4	0.7	6.1	2.2	6.1	2.6	4.3	1.2	5.0	1.3

Figure 1. Hip. Elective total replacement. Inter-regional mobility (attraction and escape indices) in 2016 (a) and in 2017 (b)



NOTE: For regions with low number of procedures (i.e. Umbria, Molise and Basilicata) inter-regional mobility indices might be biased

Table 7. Knee. Number of procedures by region of admission and procedure type. 2016-2017

Region of admission	Total replacement			
	2016		2017	
	N	%	N	%
Piedmont	5,030	6.9	5,969	7.9
Aosta Valley	167	0.2	136	0.2
Lombardy	15,111	20.6	15,880	21.0
AP Bolzano	881	1.2	903	1.2
AP Trento	682	0.9	709	0.9
Veneto	7,830	10.7	7,531	10.0
Friuli Venezia Giulia	1,707	2.3	1,761	2.3
Liguria	1,315	1.8	1,198	1.6
Emilia-Romagna	7,752	10.6	7,695	10.2
Tuscany	7,149	9.7	7,541	10.0
Umbria	1,300	1.8	1,415	1.9
Marche	1,681	2.3	1,815	2.4
Lazio	5,651	7.7	6,185	8.2
Abruzzi	1,988	2.7	1,915	2.5
Molise	227	0.3	200	0.3
Campania	3,281	4.5	3,537	4.7
Apulia	3,426	4.7	3,370	4.5
Basilicata	387	0.5	264	0.3
Calabria	1,350	1.8	1,439	1.9
Sicily	4,959	6.8	4,795	6.3
Sardinia	1,520	2.1	1,410	1.9
Italy	73,394	100	75,668	100
<i>% of national volume</i>	93.2		93.1	

Revision				Total			
2016		2017		2016		2017	
N	%	N	%	N	%	N	%
397	7.4	433	7.7	5,427	6.9	6,402	7.9
7	0.1	9	0.2	174	0.2	145	0.2
1,299	24.1	1,407	25.1	16,410	20.8	17,287	21.3
75	1.4	98	1.7	956	1.2	1,001	1.2
43	0.8	33	0.6	725	0.9	742	0.9
507	9.4	447	8.0	8,337	10.6	7,978	9.8
112	2.1	110	2.0	1,819	2.3	1,871	2.3
147	2.7	134	2.4	1,462	1.9	1,332	1.6
729	13.5	702	12.5	8,481	10.8	8,397	10.3
625	11.6	648	11.6	7,774	9.9	8,189	10.1
81	1.5	86	1.5	1,381	1.8	1,501	1.8
75	1.4	115	2.1	1,756	2.2	1,930	2.4
376	7.0	393	7.0	6,027	7.7	6,578	8.1
69	1.3	89	1.6	2,057	2.6	2,004	2.5
10	0.2	5	0.1	237	0.3	205	0.3
175	3.2	192	3.4	3,456	4.4	3,729	4.6
158	2.9	185	3.3	3,584	4.5	3,555	4.4
35	0.6	18	0.3	422	0.5	282	0.3
56	1.0	73	1.3	1,406	1.8	1,512	1.9
353	6.6	380	6.8	5,312	6.7	5,175	6.4
56	1.0	46	0.8	1,576	2.0	1,456	1.8
5,385	100	5,603	100	78,779	100	81,271	100
6.8		6.9		100		100	

Table 8. Knee. Primary total replacement. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2016	2017	2016	2017	2016	2017
	N	N	N	N	N	N
Piedmont	22	20	11	10	9	8
Aosta Valley	1	1	0	1	1	0
Lombardy	47	41	25	34	23	13
AP Bolzano	4	5	2	2	4	4
AP Trento	1	2	5	4	2	2
Veneto	19	19	11	16	10	6
Friuli Venezia Giulia	9	4	5	3	6	7
Liguria	7	9	3	3	3	5
Emilia-Romagna	25	21	16	16	16	15
Tuscany	18	19	12	9	9	9
Umbria	2	2	7	7	4	4
Marche	8	9	6	5	1	1
Lazio	51	47	12	14	12	12
Abruzzi	13	10	3	5	2	2
Molise	3	4	0	0	1	1
Campania	50	39	12	18	5	6
Apulia	23	22	9	9	6	6
Basilicata	4	4	1	1	2	1
Calabria	14	14	1	3	1	1
Sicily	39	40	16	16	5	5
Sardinia	13	15	2	1	3	3
Italy	373	347	159	177	125	111
<i>% of national volume</i>	<i>49.6</i>	<i>47.1</i>	<i>21.1</i>	<i>24.0</i>	<i>16.6</i>	<i>15.1</i>

201-300		>300		Total			
2016	2017	2016	2017	2016		2017	
N	N	N	N	N	%	N	%
4	3	4	7	50	6.6	48	6.5
0	0	0	0	2	0.3	2	0.3
6	10	12	14	113	15.0	112	15.2
0	0	0	0	10	1.3	11	1.5
0	0	0	0	8	1.1	8	1.1
3	1	7	8	50	6.6	50	6.8
0	0	1	1	21	2.8	15	2.0
1	0	1	0	15	2.0	17	2.3
6	6	4	5	67	8.9	63	8.5
4	4	7	8	50	6.6	49	6.6
1	1	0	0	14	1.9	14	1.9
2	2	1	1	18	2.4	18	2.4
0	0	5	5	80	10.6	78	10.6
1	1	2	2	21	2.8	20	2.7
0	0	0	0	4	0.5	5	0.7
4	4	0	0	71	9.4	67	9.1
4	4	1	1	43	5.7	42	5.7
0	0	0	0	7	0.9	6	0.8
1	1	2	2	19	2.5	21	2.8
8	8	1	1	69	9.2	70	9.5
1	1	1	1	20	2.7	21	2.8
46	46	49	56	752	100	737	100
6.1	6.2	6.5	7.6	100		100	

Table 9. Knee. Revision. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume											
	1-10		11-25		26-50		>50		Total			
	2016	2017	2016	2017	2016	2017	2016	2017	2016		2017	
	N	N	N	N	N	N	N	N	N	%	N	%
Piedmont	30	30	8	7	2	5	1	0	41	7.2	42	7.3
Aosta Valley	2	1	0	0	0	0	0	0	2	0.4	1	0.2
Lombardy	63	66	18	12	9	10	4	5	94	16.6	93	16.1
AP Bolzano	5	2	4	5	0	0	0	0	9	1.6	7	1.2
AP Trento	6	8	1	0	0	0	0	0	7	1.2	8	1.4
Veneto	24	28	13	8	0	3	3	1	40	7.1	40	6.9
Friuli Venezia Giulia	16	10	3	3	0	1	0	0	19	3.4	14	2.4
Liguria	5	7	5	5	0	1	1	0	11	1.9	13	2.3
Emilia-Romagna	40	39	12	12	2	3	3	3	57	10.1	57	9.9
Tuscany	29	29	9	6	4	6	3	2	45	7.9	43	7.5
Umbria	9	7	2	4	0	0	0	0	11	1.9	11	1.9
Marche	14	12	1	1	0	2	0	0	15	2.6	15	2.6
Lazio	40	46	8	4	4	4	0	0	52	9.2	54	9.4
Abruzzi	8	13	3	3	0	0	0	0	11	1.9	16	2.8
Molise	2	3	0	0	0	0	0	0	2	0.4	3	0.5
Campania	41	38	2	5	1	0	0	0	44	7.8	43	7.5
Apulia	27	30	3	6	0	0	0	0	30	5.3	36	6.2
Basilicata	3	4	1	0	0	0	0	0	4	0.7	4	0.7
Calabria	9	10	3	2	0	0	0	0	12	2.1	12	2.1
Sicily	36	41	9	10	2	2	0	0	47	8.3	53	9.2
Sardinia	14	11	0	1	0	0	0	0	14	2.5	12	2.1
Italy	423	435	105	94	24	37	15	11	567	100	577	100
<i>% of national volume</i>	74.6	75.4	18.5	16.3	4.2	6.4	2.6	1.9	100		100	

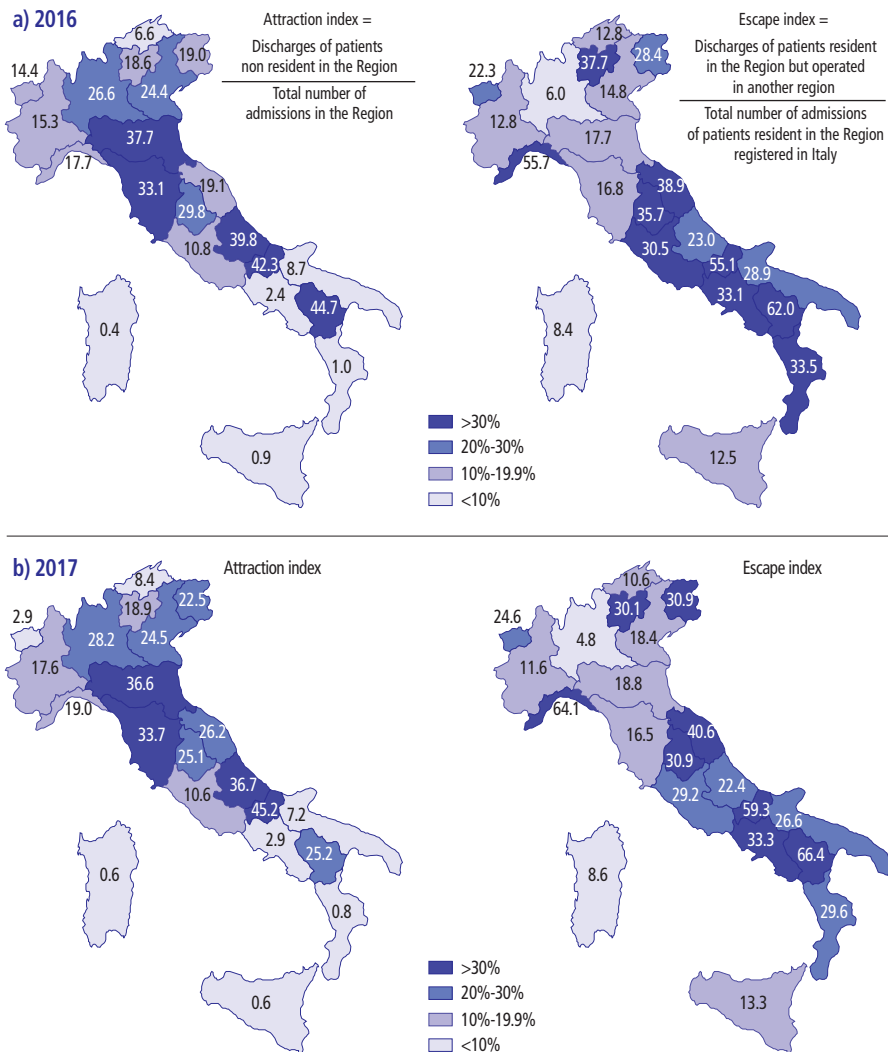
Table 10. Knee. Percent distribution of hospital discharges by patient gender and age group, and by procedure type. 2016 and 2017

	Total replacement		Revision		Total	
	2016	2017	2016	2017	2016	2017
	%	%	%	%	%	%
Gender						
Male	32.4	32.9	32.1	33.1	32.4	32.9
Female	67.6	67.1	67.9	66.9	67.6	67.1
Age (male)						
Mean age	69.5	69.4	67.7	68.6	69.4	69.4
Standard deviation	9.4	9.3	12.3	11.4	9.6	9.4
Age group						
0-44	1.6	1.2	4.5	3.3	1.8	1.3
45-54	5.1	5.3	8.8	6.9	5.3	5.4
55-64	18.1	19.0	16.9	19.1	18.0	19.0
65-74	42.1	42.4	37.8	37.1	41.8	42.0
75-84	31.3	30.3	28.9	30.1	31.1	30.3
85+	1.8	1.8	3.2	3.5	1.9	1.9
Age (female)						
Mean age	70.8	70.8	70.7	70.6	70.8	70.8
Standard deviation	8.2	8.2	9.2	9.3	8.3	8.2
Age group						
0-44	0.5	0.4	1.2	1.3	0.6	0.5
45-54	3.2	3.2	3.5	3.9	3.2	3.3
55-64	15.9	16.2	16.6	17.3	15.9	16.3
65-74	43.9	44.6	40.5	39.8	43.7	44.3
75-84	34.6	33.6	35.3	34.3	34.7	33.7
85+	1.8	1.9	2.9	3.3	1.9	2.0

Table 11. Knee. Percent distribution of hospital discharges by mode of discharge and by procedure type. 2016 and 2017

Mode of discharge	Total replacement (elective)		Revision		Total	
	2016	2017	2016	2017	2016	2017
	%	%	%	%	%	%
Deceased	0.1	0.0	0.1	0.2	0.1	0.0
Ordinary discharge	53.3	48.5	56.5	51.8	53.5	48.7
Discharge to a residential health care	0.7	1.0	1.1	1.1	0.7	1.0
Discharge to hospital at home	0.0	0.0	0.0	0.1	0.0	0.0
Discharge against medical advice	0.1	0.1	0.1	0.2	0.1	0.1
Transfer to an acute admission unit of a different hospital	1.9	2.0	2.1	1.9	1.9	2.0
Transfer in the same hospital	24.7	31.1	24.7	30.2	24.7	31.1
Transfer to an inpatient rehabilitation hospital	15.9	16.7	12.6	14.1	15.7	16.5
Discharge to a nursing home	3.3	0.4	2.7	0.5	3.2	0.4

Figure 2. Knee. Total replacement. Inter-regional mobility (attraction and escape indices) in 2016 (a) and in 2017 (b)



NOTE: For regions with low number of procedures (i.e Umbria, Molise and Basilicata) inter-regional mobility indices might be biased

Table 12. Shoulder. Number of procedures by region of admission and procedure type. 2016-2017

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2016		2017		2016		2017	
	N	%	N	%	N	%	N	%
Piedmont	492	9.4	489	8.3	125	7.5	149	7.7
Aosta Valley	4	0.1	11	0.2	2	0.1	5	0.3
Lombardy	915	17.5	1,174	19.8	335	20.1	398	20.5
AP Bolzano	32	0.6	48	0.8	2	0.1	9	0.5
AP Trento	43	0.8	41	0.7	25	1.5	30	1.5
Veneto	494	9.5	514	8.7	199	11.9	208	10.7
Friuli Venezia Giulia	145	2.8	108	1.8	29	1.7	26	1.3
Liguria	75	1.4	39	0.7	27	1.6	21	1.1
Emilia-Romagna	732	14.0	828	14.0	140	8.4	161	8.3
Tuscany	549	10.5	635	10.7	94	5.6	85	4.4
Umbria	83	1.6	106	1.8	27	1.6	62	3.2
Marche	98	1.9	113	1.9	75	4.5	76	3.9
Lazio	566	10.8	622	10.5	166	10.0	212	10.9
Abruzzi	128	2.4	160	2.7	44	2.6	61	3.1
Molise	3	0.1	5	0.1	5	0.3	6	0.3
Campania	222	4.2	306	5.2	45	2.7	85	4.4
Apulia	230	4.4	243	4.1	132	7.9	117	6.0
Basilicata	44	0.8	14	0.2	5	0.3	6	0.3
Calabria	54	1.0	68	1.1	20	1.2	29	1.5
Sicily	289	5.5	362	6.1	151	9.1	174	9.0
Sardinia	27	0.5	35	0.6	19	1.1	21	1.1
Italy	5,225	100	5,921	100	1,667	100	1,941	100
<i>% of national volume</i>	64.9		65.1		20.7		21.3	

Partial replacement				Total			
2016		2017		2016		2017	
N	%	N	%	N	%	N	%
34	2.9	40	3.2	651	8.1	678	7.4
0	0.0	0	0.0	6	0.1	16	0.2
234	20.2	186	15.0	1,484	18.4	1,758	19.3
13	1.1	9	0.7	47	0.6	66	0.7
25	2.2	17	1.4	93	1.2	88	1.0
268	23.1	343	27.7	961	11.9	1,065	11.7
30	2.6	36	2.9	204	2.5	170	1.9
18	1.6	10	0.8	120	1.5	70	0.8
72	6.2	82	6.6	944	11.7	1,071	11.8
81	7.0	74	6.0	724	9.0	794	8.7
52	4.5	76	6.1	162	2.0	244	2.7
18	1.6	10	0.8	191	2.4	199	2.2
104	9.0	123	9.9	836	10.4	957	10.5
15	1.3	23	1.9	187	2.3	244	2.7
5	0.4	1	0.1	13	0.2	12	0.1
54	4.7	52	4.2	321	4.0	443	4.9
60	5.2	77	6.2	422	5.2	437	4.8
9	0.8	1	0.1	58	0.7	21	0.2
7	0.6	10	0.8	81	1.0	107	1.2
34	2.9	48	3.9	474	5.9	584	6.4
28	2.4	21	1.7	74	0.9	77	0.8
1,161	100	1,239	100	8,053	100	9,101	100
14.4		13.6		100		100	

Table 13. Shoulder. Total replacement. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2016	2017	2016	2017	2016	2017
	N	N	N	N	N	N
Piedmont	15	12	7	5	10	8
Aosta Valley	2	0	0	2	0	0
Lombardy	34	23	29	32	11	11
AP Bolzano	7	5	2	1	0	2
AP Trento	3	2	3	0	0	2
Veneto	5	6	10	8	8	11
Friuli Venezia Giulia	5	2	3	4	5	5
Liguria	9	9	3	5	1	1
Emilia-Romagna	17	17	14	11	3	9
Tuscany	14	14	4	8	4	1
Umbria	1	2	4	2	3	3
Marche	7	6	4	4	2	3
Lazio	26	28	7	7	4	2
Abruzzi	9	8	6	3	1	0
Molise	1	2	1	1	0	0
Campania	21	18	6	8	2	5
Apulia	14	15	4	7	5	5
Basilicata	0	0	2	0	0	2
Calabria	4	7	4	3	3	1
Sicily	23	27	12	11	5	6
Sardinia	10	7	0	1	0	1
Italy	227	210	125	123	67	78
<i>% of national volume</i>	<i>40.7</i>	<i>37.0</i>	<i>22.4</i>	<i>21.7</i>	<i>12.0</i>	<i>13.8</i>

15-24		>24		Total			
2016	2017	2016	2017	2016		2017	
N	N	N	N	N	%	N	%
7	8	7	8	46	8.2	41	7.2
0	0	0	0	2	0.4	2	0.4
8	15	15	15	97	17.4	96	16.9
0	1	0	0	9	1.6	9	1.6
2	2	0	0	8	1.4	6	1.1
12	9	8	10	43	7.7	44	7.8
2	0	1	1	16	2.9	12	2.1
0	0	1	0	14	2.5	15	2.6
5	2	13	15	52	9.3	54	9.5
4	2	8	10	34	6.1	35	6.2
2	2	0	2	10	1.8	11	1.9
0	3	3	1	16	2.9	17	3.0
7	9	10	10	54	9.7	56	9.9
1	4	2	2	19	3.4	17	3.0
0	0	0	0	2	0.4	3	0.5
1	2	4	5	34	6.1	38	6.7
3	3	4	3	30	5.4	33	5.8
0	0	1	0	3	0.5	2	0.4
0	1	0	1	11	2.0	13	2.3
3	3	4	6	47	8.4	53	9.3
0	1	1	0	11	2.0	10	1.8
57	67	82	89	558	100	567	100
10.2	11.8	14.7	15.7	100		100	

Table 14. Shoulder. Partial replacement. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2016	2017	2016	2017	2016	2017
	N	N	N	N	N	N
Piedmont	18	17	1	2	0	0
Aosta Valley	0	0	0	0	0	0
Lombardy	34	48	7	3	5	2
AP Bolzano	3	1	1	1	0	0
AP Trento	3	4	1	1	1	0
Veneto	19	22	7	6	4	4
Friuli Venezia Giulia	10	5	0	1	1	1
Liguria	4	1	2	1	0	0
Emilia-Romagna	19	21	1	1	0	0
Tuscany	19	20	3	1	0	0
Umbria	6	4	1	2	0	0
Marche	5	3	2	1	0	0
Lazio	28	27	4	5	2	1
Abruzzi	8	8	1	2	0	0
Molise	3	1	0	0	0	0
Campania	15	11	2	3	0	1
Apulia	13	13	4	3	1	2
Basilicata	4	1	0	0	0	0
Calabria	3	2	0	1	0	0
Sicily	12	22	2	2	0	0
Sardinia	5	6	1	1	0	0
Italy	231	237	40	37	14	11
<i>% of national volume</i>	<i>77.0</i>	<i>79.0</i>	<i>13.3</i>	<i>12.3</i>	<i>4.7</i>	<i>3.7</i>

15-24		>24		Total			
2016	2017	2016	2017	2016		2017	
N	N	N	N	N	%	N	%
0	0	0	0	19	6.3	19	6.3
0	0	0	0	0	0.0	0	0.0
2	1	1	1	49	16.3	55	18.3
0	0	0	0	4	1.3	2	0.7
0	0	0	0	5	1.7	5	1.7
5	2	1	4	36	12.0	38	12.7
0	0	0	0	11	3.7	7	2.3
0	0	0	0	6	2.0	2	0.7
2	2	0	0	22	7.3	24	8.0
0	0	1	1	23	7.7	22	7.3
1	1	0	1	8	2.7	8	2.7
0	0	0	0	7	2.3	4	1.3
0	0	0	1	34	11.3	34	11.3
0	0	0	0	9	3.0	10	3.3
0	0	0	0	3	1.0	1	0.3
1	0	0	0	18	6.0	15	5.0
0	1	0	0	18	6.0	19	6.3
0	0	0	0	4	1.3	1	0.3
0	0	0	0	3	1.0	3	1.0
0	0	0	0	14	4.7	24	8.0
1	0	0	0	7	2.3	7	2.3
12	7	3	8	300	100	300	100
4.0	2.3	1.0	2.7	100		100	

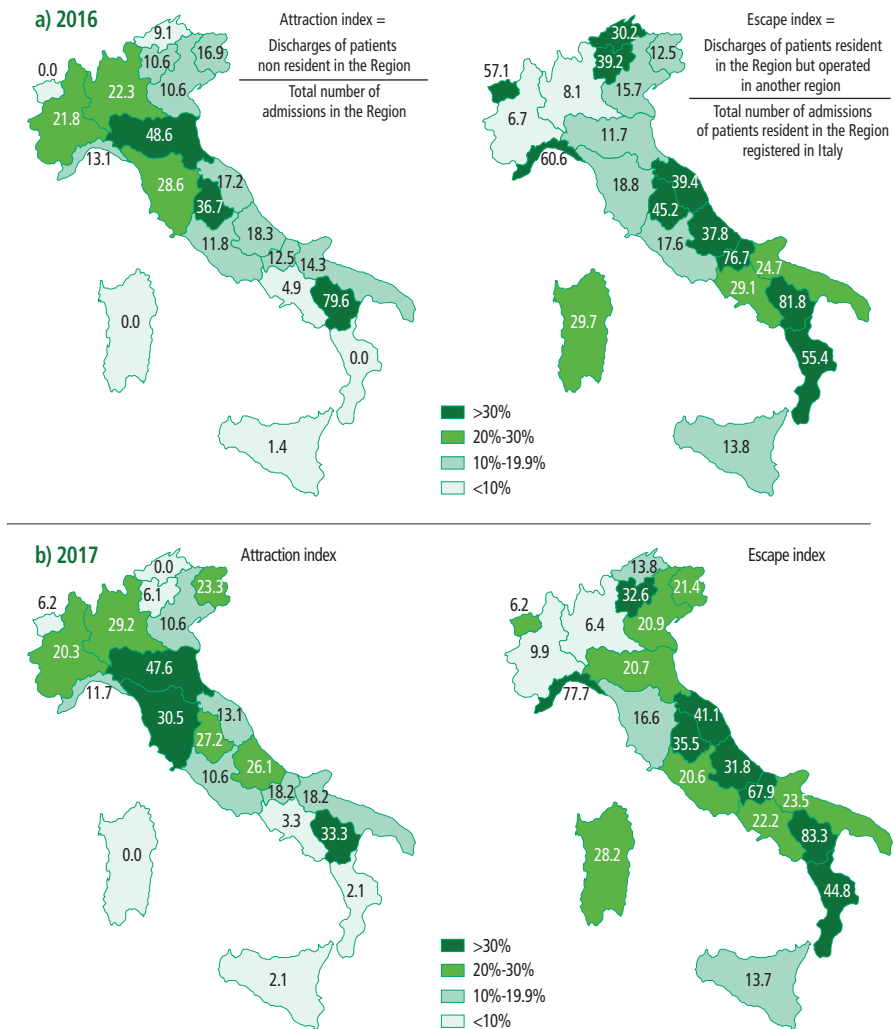
Table 15. Shoulder. Percent distribution of hospital discharges by patient gender and age group, and by procedure type. 2016 and 2017

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2016	2017	2016	2017	2016	2017	2016	2017
	%	%	%	%	%	%	%	%
Gender								
Male	30.2	31.1	15.2	16.9	40.1	43.4	28.5	29.8
Female	69.8	68.9	84.8	83.1	59.9	56.6	71.5	70.2
Age (male)								
Mean age	69.1	69.0	72.2	71.1	63.4	63.6	68.3	68.2
Standard deviation	9.8	9.7	9.9	10.2	12.3	12.5	10.7	10.6
Age group								
0-44	2.0	2.0	0.8	1.5	6.9	6.2	2.9	2.7
45-54	5.8	6.4	5.1	5.5	15.5	14.2	7.7	7.8
55-64	16.6	17.3	11.5	16.2	23.9	29.7	17.5	19.6
65-74	44.2	43.4	39.1	33.9	36.8	31.7	42.1	39.9
75-84	29.9	29.8	35.6	37.3	15.1	15.7	27.5	27.9
85+	1.5	1.1	7.9	5.5	1.9	2.6	2.3	1.9
Age (female)								
Mean age	72.8	73.0	75.0	74.7	70.5	70.1	73.1	73.1
Standard deviation	7.5	7.3	7.3	7.3	10.7	11.0	8.0	7.9
Age group								
0-44	0.6	0.4	0.1	0.2	1.7	1.7	0.6	0.5
45-54	1.6	1.5	0.8	0.7	5.0	6.9	1.8	1.9
55-64	8.4	9.0	6.7	7.2	19.4	18.1	9.3	9.5
65-74	44.2	42.1	35.4	36.9	33.7	34.8	40.8	40.0
75-84	42.1	44.6	49.5	48.4	34.0	31.9	43.0	44.2
85+	3.0	2.4	7.7	6.6	6.2	6.6	4.5	3.9

Table 16. Shoulder. Percent distribution of hospital discharges by mode of discharge and by procedure type. 2016 and 2017

Mode of discharge	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2016	2017	2016	2017	2016	2017	2016	2017
	%	%			%	%	%	%
Deceased	0.1	0.0	0.2	0.2	0.0	0.2	0.1	0.1
Ordinary discharge	93.5	92.8	90.6	90.6	95.2	94.2	93.2	92.5
Discharge to a residential health care	0.2	0.2	2.0	1.5	0.3	1.0	0.6	0.6
Discharge to hospital at home	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0
Discharge against medical advice	0.1	0.2	0.3	0.2	0.2	0.3	0.2	0.2
Transfer to an acute admission unit of a different hospital	0.4	0.6	1.2	1.5	1.2	1.1	0.7	0.9
Transfer in the same hospital	3.8	4.4	2.0	2.3	1.1	1.7	3.1	3.6
Transfer to an inpatient rehabilitation hospital	1.0	1.7	2.8	3.0	1.1	1.2	1.4	1.9
Discharge to a nursing home	0.8	0.1	0.6	0.5	0.8	0.2	0.8	0.2

Figure 3. Shoulder. Elective total replacement. Inter-regional mobility (attraction and escape indices) in 2016 (a) and in 2017 (b)



NOTE: For regions with low number of procedures (i.e Umbria, Molise and Basilicata) inter-regional mobility indices might be biased

Table 17. Ankle. Total replacement. Number of procedures by region of admission and procedure type. 2016-2017

Region of admission	Total replacement			
	2016		2017	
	N	%	N	%
Piedmont	33	6.0	26	4.3
Aosta Valley	0	0.0	0	0.0
Lombardy	248	45.4	279	46.5
AP Bolzano	0	0.0	0	0.0
AP Trento	13	2.4	9	1.5
Veneto	42	7.7	53	8.8
Friuli Venezia Giulia	2	0.4	1	0.2
Liguria	1	0.2	0	0.0
Emilia-Romagna	131	24.0	125	20.8
Tuscany	7	1.3	22	3.7
Umbria	2	0.4	2	0.3
Marche	3	0.5	5	0.8
Lazio	30	5.5	39	6.5
Abruzzi	7	1.3	0	0.0
Molise	0	0.0	0	0.0
Campania	7	1.3	11	1.8
Apulia	5	0.9	8	1.3
Basilicata	1	0.2	0	0.0
Calabria	1	0.2	4	0.7
Sicily	13	2.4	16	2.7
Sardinia	0	0.0	0	0.0
Italy	546	100	600	100
% of national volume	100		100	

Table 18. Ankle. Total replacement. Number of hospitals by region of admission and class of volume. 2016 and 2017

Region of admission	Class of volume			
	1-2		3-4	
	2016	2017	2016	2017
	N	N	N	N
Piedmont	5	7	0	1
Aosta Valley	0	0	0	0
Lombardy	12	16	3	1
AP Bolzano	0	0	0	0
AP Trento	1	1	0	0
Veneto	10	5	1	1
Friuli Venezia Giulia	2	1	0	0
Liguria	1	0	0	0
Emilia-Romagna	7	8	2	1
Tuscany	7	3	0	1
Umbria	2	1	0	0
Marche	3	1	0	1
Lazio	12	16	0	0
Abruzzi	6	0	0	0
Molise	0	0	0	0
Campania	5	5	0	1
Apulia	1	3	1	0
Basilicata	1	0	0	0
Calabria	1	0	0	1
Sicily	3	7	1	2
Sardinia	0	0	0	0
Italy	79	74	8	10
<i>% of national volume</i>	<i>74.5</i>	<i>68.5</i>	<i>7.5</i>	<i>9.3</i>

>4		Total				
2016	2017	2016		2017		
N	N	N	%	N	%	
3	2	8	7.5	10	9.3	
0	0	0	0.0	0	0.0	
3	8	18	17.0	25	23.1	
0	0	0	0.0	0	0.0	
1	1	2	1.9	2	1.9	
4	5	15	14.2	11	10.2	
0	0	2	1.9	1	0.9	
0	0	1	0.9	0	0.0	
6	5	15	14.2	14	13.0	
0	1	7	6.6	5	4.6	
0	0	2	1.9	1	0.9	
0	0	3	2.8	2	1.9	
1	1	13	12.3	17	15.7	
0	0	6	5.7	0	0.0	
0	0	0	0.0	0	0.0	
0	0	5	4.7	6	5.6	
0	1	2	1.9	4	3.7	
0	0	1	0.9	0	0.0	
0	0	1	0.9	1	0.9	
1	0	5	4.7	9	8.3	
0	0	0	0.0	0	0.0	
19	24	106	100	108	100	
17.9	22.2	100		100		

Table 19. Ankle. Total replacement. Percent distribution of hospital discharges by patient gender and age group, and by procedure type. 2016 and 2017

	Total replacement (elective)	
	2016	2017
	%	%
Gender		
Male	57.1	56.6
Female	42.9	43.4
Age (male)		
Mean age	53.7	53.2
Standard deviation	14.9	15.2
Age group		
0-19	1.3	1.2
20-39	15.7	19.5
40-49	22.4	18.6
50-59	22.8	21.9
60-69	21.5	23.1
70-79	14.4	14.8
80+	1.9	0.9
Age (female)		
Mean age	55.3	55.2
Standard deviation	14.5	15.7
Age group		
0-19	1.7	3.9
20-39	11.1	10.8
40-49	19.7	15.8
50-59	27.8	28.6
60-69	20.1	20.5
70-79	18.4	17.0
80+	1.3	3.5

Table 20. Ankle. Total replacement. Percent distribution of hospital discharges by mode of discharge, by procedure type. 2016 and 2017

Mode of discharge	Total replacement (elective)	
	2016	2017
	%	%
Deceased	0.0	0.0
Ordinary discharge	98.0	97.7
Discharge to a residential health care	0.4	0.0
Discharge to hospital at home	0.0	0.0
Discharge against medical advice	0.2	0.0
Transfer to an acute admission unit of a different hospital	0.0	0.0
Transfer in the same hospital	1.4	1.5
Transfer to an inpatient rehabilitation hospital	0.0	0.8
Discharge to a nursing home	0.0	0.0