2020

Annual Report

ITALIAN ARTHROPLASTY REGISTRY

riap

Italian Arthroplasty Registry

Addendum to the Annual Report 2020

English version of Tables and Figures

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Via San Giovanni Valdarno 8, 00138 Roma
Telefono (+39) 06 86281 – Fax (+39) 06 86282250
pensiero@pensiero.it
www.pensiero.it – www.vapensiero.info
www.facebook.com/PensieroScientifico
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Editorial coordination: Martina Teodoli

Authors

Paola Ciccarelli
Iuliia Urakcheeva
and Marina Torre

Italian National Institute of Health
Scientific secretariat of the President's Office
RIPI working group
Rome

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Appendix 2A. Joint replacements in Italy. Hospital Discharge Data analysis 2018-2019

This summary provides a brief overview of the main findings described in the 2020 RIAP Annual Report and contains the most relevant tables and figures summarizing collected data.

The whole 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 (2018 and 2019).

RIAP: the most important things to know

What is RIAP?

The Italian Arthroplasty Registry (Registro Italiano ArtroProtesi, RIAP) was set up in 2006 within the framework of a collaboration between the Italian Ministry of Health, Directorate for Medical Devices and Pharmaceutical Services (Direzione Generale dei Dispositivi Medici e del servizio Farmaceutico, DGDMF), and the Italian National Institute of Health (Istituto Superiore di Sanità, ISS) with the aim of establishing a national data collection system to help monitor the safety and survivorship of joint prostheses.

RIAP is currently the largest database of its kind in Italy. It is one of the four registries currently included in the Italian Implantable Prostheses Registry (Registro nazionale delle protesi impiantabili, RIPI), whose aim is to systematically collect data of all procedures related to the implant of joint prostheses, spinal devices, implantable cardioverter defibrillators, pacemakers and artificial heart valves (Figure 1.1). RIPI was established by Decree DPCM 3/3/2017 at the ISS. As soon as the Regulation foreseen by the DPCM comes into force, data collection will become mandatory at the national level.

What are the goals?

RIAP has been primarily built to reach the following two important objectives: to assess long-term effectiveness and safety of hip, knee, shoulder and ankle joint prostheses, by measuring the implant survival rate, and to support Regions and hospitals in recalling patients in case of a prosthesis-related adverse event. Therefore, patients undergoing surgery in centres participating in RIAP are registered and followed-up over time to detect the eventual failure of the implanted device. Currently, data collected by RIAP allows to perform survival analyses in some participating Regions. In case of recall from the market of a specific device, RIAP can provide the participating Regions with the list of pseudonyms identifying patients operated in the Region and interested by the recall. With its activity, RIPI permits to meet the requirements of the EU Medical Device Regulation (MDR 2017/745, in force since 26 May 2021).

What information is collected?

The information collected includes Hospital Discharge Data (HDD, in Italian: Schede di Dimissione Ospedaliera - SDO) supplemented with an additional Minimum Dataset (MDS) including technical aspects of surgery, operated side and information allowing identification

and description of the implanted device for each of the joints.

All patient personal data are processed and handled by the RIAP in line with General Data Protection Regulation (EU-GDPR 2016/679). Currently, pending the entry into force of the Regulation, the informed consent by the patient is needed. Clinical, health and demographic data are processed in a manner that ensures the highest levels of confidentiality, in compliance with security requirements for digital and paper-based archiving systems.

How is RIAP organised?

RIAP is a federation of regional registries that voluntarily participate in data collection. They are coordinated by the ISS, thus ensuring standard procedures for data collection, submission and processing. Using a web-based data entry interface, the surgeons collect and submit the minimum dataset to the Regional Coordinating Centre, which is responsible for linking MDS to the HDD for each procedure. Once the datasets have been linked, they are submitted to the ISS for research and analysis purposes. Currently, contribution to the Registry is on a voluntary basis, which hampers the achievement of high *completeness* rates and the record of all prostheses implanted at national level.

The RIAP model can be extended to other fields beyond arthroplasty, especially where device implants are mainly carried out in centres of the National Health System that are required to provide HDD.

Why a Registry, and why a National Registry?

Joint replacement is a recognised solution for the treatment of disabling joint diseases. In Italy, like in many other countries, the number of patients undergoing arthroplasty is constantly growing. A national registry allows to assess the outcomes of both primary and revision procedures in order to monitor safety and performance of implants and to collect useful information on type of procedure and features of implanted device. It also allows to recall patients, including those undergoing surgery in a different Region from the one they live in, in case of implant failure or risks. These are some of the reasons why contribution to Registry should be mandatory, thus ensuring a complete national *coverage*.

How is the implanted device identified and characterised?

The RIAP-DM Dictionary is a database containing information provided by implant manufacturers allowing identification and characterization of each implanted device. Data contained

in the RIAP-DM Dictionary, accessible by all health operators, are regularly updated and validated using the National Database of Medical Devices of the Ministry of Health.

In 2020, the drafting of a collaboration agreement with the National Joint Registry (NJR) was started. Thanks to this collaboration, the RIAP will be enabled to use the NJR component database and classification system, a large database of joint prostheses that the NJR has already shared with the German Arthroplasty Registry (Endoprothesen Register Deutschland, EPRD). This will improve data comparability across the majority of the registries globally.

Here you can find the Report summaries (Addendum) of years 2014-2019.

RIAP in 2020

Highlights

- As an effect of the COVID-19 pandemic, in March 2020, during the first lockdown, all elective procedures were interrupted. To evaluate the impact of COVID-19 pandemic on the volume of joint replacement procedures, the RIAP team launched a dedicated study in collaboration with 7 Italian Regions. The findings of the study are illustrated in detail in the ISS Covid Report "*Impact of COVID-19 pandemic emergency on joint arthroplasties in seven Italian Regions. Version of March 17, 2021*." (in Italian).
- Recommendations for patients waiting for surgery were published on the website.
- RIAP, being the major research line of the RIPI, has extended its methodology to other two registries dealing with spinal implants and cardioverter-defibrillators and pacemakers.
- The database of implantable devices, the RIAP-DM Dictionary, was regularly updated thanks to the contribution of implant manufacturers. At the same time, the process to formalise the collaboration with the English NJR was started in order to have access to the technical features of the implanted medical devices, which represent key variables to be used in survival analysis.
- The procedures supporting the automation of the quality control of data were designed (Figure 1.1), technical documents were updated and a working group to perform the first survival analyses on the data of the Autonomous Provinces of Bolzano and Trento was set up.
- The RIAP team supported the Italian Ministry of Health in its activities to update the online data collection platform of the National Registry of Breast Implants (Registro Nazionale delle Protesi Mammarie, RNPM) and the National Medical Device Nomenclature (Classificazione Nazionale dei Dispositivi Medici, CND) with regard to categories of orthopaedic implants.
- RIAP activity results were disseminated and participation in international projects/networks was promoted. Enrollment of missing Regions was continuously encouraged.

Key achievements

The most relevant event in 2020 was the outbreak of the COVID-19 pandemic, which dramatically impacted people's lives on every level and represented a watershed moment for the

national healthcare systems that were not adequately prepared to deal with coronavirus pandemic.

The COVID-19 pandemic heavily impacted the RIAP annual work plan. Nevertheless, the team did its utmost to carry on activities with the continued aim of improving safety and clinical outcomes for the benefit of patients and the orthopaedic healthcare sector.

Here is a summary of the main activities and achievements of 2020:

ISS Covid Report *"Impact of COVID-19 pandemic emergency on joint arthroplasties in seven Italian Regions. Version of March 17, 2021"* and **Recommendations for patients**. The heavy effect of the COVID-19 pandemic has prompted an unprecedented re-organisation of healthcare services worldwide. Care capacity was prioritised for COVID-19 patients during the peaks of the pandemic. Many non-urgent procedures, including joint replacements, were canceled or postponed, leading to the growing uncertainty for patients waiting their turn. As a consequence, RIAP activities were also reorganised. In March 2020, during the first wave of pandemic, surgical volume significantly dropped. Elective surgeries were interrupted, showing a decrease in April 2020 by 96.1% compared to years 2018 and 2019. The impact of COVID-19 pandemic on the volume of joint replacement procedures is illustrated in detail in the study resulted from a collaboration between the RIAP team and 7 Italian Regions (Piedmont, Lombardy, Autonomous Province of Bolzano, Autonomous Province of Trento, Tuscany, Apulia and Sicily) and published as ISS Covid Report. In addition, in collaboration with the Italian Society of Orthopaedics and Traumatology (Società Italiana Ortopedia e Traumatologia, SIOT), recommendations were developed for the patients whose operation had been postponed (see the section "Artroprotesi and Covid-19" of the RIAP website, in Italian).

RIAP as a reference to develop other RIPI research lines. In the last two years, the RIAP model has been applied to develop the methodological framework of two other registries included in RIPI: the Italian Spinal Implants Registry (Registro Italiano Dispositivi Impiantabili per chirurgia Spinale, RIDIS) and the Italian Implantable Cardioverter-defibrillator and Pacemaker Registry (Registro Italiano Defibrillatori e Pacemaker, RIDEP). For these registries, the technical committees were set up in order to define i) the model for data collection; ii) the information to be collected in addition to those included in the HDD; iii) the structure

of the specific DM Dictionary. Both minimum datasets were defined and approved by the expert panels and are now ready to be implemented in the future informatic platform.

RIAP Dictionary update and NJR collaboration. The collaboration with industry in activities related to medical devices was further developed, in particular to regularly update, enhance and improve the RIAP-DM Dictionary, which at the end of 2020 included 80.545 product codes provided by 39 manufacturers, of which 44% were bar-coded to improve and facilitate data entry.

The collaboration with the English NJR allowed a comparison between the Italian CND and the English NJR nomenclatures for some joints of interest for RIAP (hip, knee and shoulder) with the aim of developing a harmonised nomenclature. The methodology adopted in the comparison and the results obtained from it were presented to the 2020 National Congress of Bioengineering (Gruppo Nazionale di Bioingegneria, GNB) and to the European Federation of national associations of ORthopaedics and Traumatology (EFORT) Congress 2020 and will provide support to the future development of the RIAP-NJR-EPRD Dictionary. In addition, this comparison represented a first example of a standardised and international nomenclature to be proposed as integration within the European Medical Device Nomenclature (EMDN). The RIAP team, thanks to its long experience in the field of hip, knee, shoulder and ankle arthroplasty, strongly supported the Ministry of Health in its objective to integrate the CND within the EMDN.

Automation of the quality control procedures, updating of technical documents and first survival analyses. Procedures aimed at automating the process of data extraction and quality control were designed. The main aim is to provide quick feedback on data quality to registry participants in order to help them reduce errors and improve quality of data they submit. In addition, some procedures related to data collection, process and submission were further developed and made available on the RIAP website. Although some drawbacks highlighted in previous RIAP reports still remain, in 2020 a slight improvement in data quality was observed.

Thanks to the collaboration of the orthopaedic surgeons from the RIAP Steering Committee, record layouts were simplified and came into effect on 01/01/2021, after getting approval from the whole Steering Committee.

In collaboration with the Autonomous Provinces of Bolzano and Trento, a working group was set up to perform first implant survival analyses on data collected by their registries over a period of 10 years.

Collaboration with the Ministry of Health. In 2020, the RIAP team continued to collaborate with the Italian Ministry of Health. In particular, the RIAP team contributed to updating the online data collection platform of the National Registry of Breast Implants (Registro Nazionale degli Impianti Protesici Mammari, RNPM), available to users since March 2020, exactly one year after the launch of the pilot platform. This new platform officially marked the beginning of systematic data collection on breast implants (https://www.rnpm.it).

In addition, the RIAP team supported the Ministry of Health in updating the National Medical Device Nomenclature (Classificazione Nazionale dei Dispositivi Medici, CND) with regard to categories of orthopaedic implants, definitively approved on December 2020. On March 2019, the CND was selected as the basis for the future European Medical Device Nomenclature (EMDN), which will support the functioning of the European Medical Device Database (EUDAMED) in accordance with Regulation (EU) 2017/745 – MDR and Regulation (EU) 2017/746.

Dissemination of the results, participation in the international projects/networks and enrollment of missing Regions. The visibility at the international level was increased thanks to the participation in the ISAR 2020 Annual Congress, held online for the first time, and by strengthening the collaboration with the Network of Orthopaedic Registries of Europe (NORE), aimed at supporting the development of registries in European countries.

In 2020, RIAP became partner of the project "Coordinating Research and Evidence for Medical Devices" (CORE-MD) financed within the HORIZON 2020 Framework Programme with the main aim to review and develop methodologies to improve clinical assessments and evaluate high risk medical device performance in order to support the development of guidelines and regulations at European level.

The RIAP team continued dissemination activities both at national and international levels through traditional means such as RIAP and RIPI project websites; scientific publications, including the RIAP Annual Report; RIAP Steering Committee meetings; participation in scientific conferences and meetings. Since the

outbreak of COVID-19 pandemic, all events were organised and attended in videoconference. The emergency situation hampered the organization of dissemination events, such as a scheduled workshop to present the RIPI, which had to be postponed. Last but not least, the RIAP team focused on online communication skills and tools aimed at different stakeholders, with a particular attention to patient information needs.

The survey launched in 2017 to enquire organizational aspects of regional registries included in the RIAP was concluded, highlighting both strengths to be emphasized and areas for action, in order to make the RIAP a fully functioning national registry, also by adopting a specific Regulation. On the basis of the achieved results, the RIAP team continued to promote enrollment of missing Regions through targeted information and communication activities.

Key findings from the 2020 Annual Report

Analysis of the RIAP data

In 2019, RIAP collected data on 75,682 joint replacement procedures (41,432 hip procedures; 2,984 knee procedures; 1,263 shoulder procedures; 3 ankle procedures) performed in eight Regions (Lombardy, Tuscany, Marche, Abruzzo, Campania, Apulia, Basilicata, Sicily), two Autonomous Provinces (Bolzano, Trento) and four centres from non-participating Regions ("Policlinico Città di Alessandria" of Alessandria; "PO Universitario Santa Maria della Misericordia" of Udine; "Ospedale San Pietro Fatebenefratelli" e "Casa di Cura San Feliciano" of Rome, ASL 1) (Table 2.1, Figure 1.2).

Overall, compared to 2018, an increase in number of collected data was observed (+7.2%): +5.7% for hip, +8.8% for knee, +20.3% for shoulder. Data on ankle procedures were collected for the first time in one clinic in Campania Region. Basilicata and Abruzzo Regions started data collection for shoulder procedures. In participating Regions, *coverage* was 62.3% for hip, 65.5% for knee, 48.4% for shoulder. *Completeness* was 65.2% (65.9% for hip, 65.5% for knee and 45.1% for shoulder) with an overall increasing trend in all participating Regions, except in Campania due probably to the lack of full application of the local legislation making data recording mandatory. An increase in *completeness* values was observed in the Marche Region, thanks to the introduction of local legislation making participation in the registry mandatory.

Similarly to previous years, both indicators, although showing a slight increase, remained low in the Regions where contribution to the registry is voluntary.

Overall, in 2019 RIAP data accounted for 34.2% of the national volume (35.1% for hip, 37% for knee, 11.5% for shoulder) (Table 2.2).

After quality control (QC), 96.3% of collected data were eligible for procedure analysis and 93% for device analysis. A slight increase can be observed in both values compared to 2018. (Figure 2.1, Figure 2.2). Analyses on devices were performed using CND classification codes describing the implanted device.

Hip: A total of 41,432 procedures were collected, of which 39,779 were eligible for analysis. Total hip replacements represented 73.6% of the recorded cases, partial hip replacements 20.8% and revisions 5.6%. A total of 38,626 (93.2% of interventions recorded) were admitted to device analysis after quality control (fixation type, bearing surface combinations, stem type). (Tables 2.3-2.13, Figures 2.3, 2.4).

Knee: A total of 32,984 procedures were collected, of which 31,833 were eligible for analysis. Of all primary procedures recorded, 83.7% were total knee replacements, while 16.4% were unicondylar knee replacements. A total of 31,168 (94.5% of interventions recorded) were admitted to device analysis after quality control (fixation type, tibial tray type). (Tables 2.14-2.22).

Shoulder: A total of 1,263 procedures were collected, of which 1,246 were eligible for analysis. Primary procedures represents 97.7% of total cases, revisions 2.3%. Of all primary procedures recorded, 91.9% were total knee replacements and 5.2% were partial replacements; for 2.9% of interventions procedure type was not recorded. A total of 606 interventions (48.0% of interventions recorded) were admitted to device analysis after quality control (Tables 2.23-2.30).

Analysis of the data from the national hospital discharge database

It is widely recognized that HDD represents a rich source of information to perform statistical and epidemiological analyses in public health and assess the current RIAP *completeness* at both national and regional level.

To provide the reader with an overview of the volume of arthroplasties performed in Italy, this Annual Report contains a specific section (Appendix 2A) showing data related to hip, knee, shoulder and ankle replacements extracted from most recent HDD available to ISS (2018 and 2019) and broken down, for each of the joints, by Region, operated patient data (sex, age), type of discharge and interregional mobility (the latter is not available for ankle replacements). The Appendix 2A also shows the

temporal trend of the volume of replacements over 19 years of observation (2001-2019).

HDD were browsed using the ICD9-CM procedure codes of interest for RIAP (hip, knee, shoulder and ankle primary and revision procedures) listed in Table 1. All surgery procedures performed during hospitalisation were included. Hip and shoulder replacements were further classified on the basis of the associated diagnosis; emergency surgeries were defined as interventions performed when a fracture is diagnosed (ICD9-CM codes 820.XX and 812.XX). Interregional mobility for each of the joint, except for ankle, was measured using the attraction and escape indices computed considering only the ICD9-CM code registered in the so-called "primary procedure".

Challenges

The RIAP represents a landmark for all parties interested in arthroplasty. Although an increase was observed in the volume of the recorded procedures and in the *completeness* (+0.5%) compared to 2018, participation in the Registry on a voluntary basis still hampers the full functioning of the RIAP.

The first goal for the upcoming years is to achieve the enrollment of missing Regions in order to have full collection of data and make RIAP a nationwide and a 100% complete registry. This is of course a challenging task, especially considering that in Italy the Regions and the Autonomous Provinces exercise their autonomy in planning and delivering public health services. The first crucial step to make the RIAP a fully national registry is to develop the Regulation required by the DPCM 3/3/2017 following the example of the RNPM Regulation, in order to define the detailed procedures of feeding the RIAP and other national registries.

Although the Law n.145 of 2018 made it mandatory to participate in the national registries established by the DPCM 3/3/2017, *completeness* and quality of data vary considerably across Regions participating in the RIAP. The highest levels of *completeness* are registered where regional regulations made data collection mandatory. Therefore, more efforts should be made at the regional level in order to increase participation in the RIAP.

To be able to recall implanted patients while respecting privacy rules requirements, the RIAP team set a procedure to pseudonymise patient data using their tax code. This procedure has been gradually introduced in all participating Regions, except in Lombardy using a different pseudonymisation system. It is hoped that in

the near future the same procedure to pseudonymise data can be followed in order to allow comparative analysis of data from all Regions.

The simplification and improvement of data entry procedures for both manufacturers and health operators will hopefully result in an overall increase in data *completeness*.

Completeness and pseudonymisation are key elements to perform survival analysis and therefore fulfill the requirements of EU Medical Device Regulation (MDR) 2017/745 to improve health and safety of patients.

Future developments and plans

The activities of the RIAP will continue within the RIPI framework and the extensive experience of the RIAP team will be used to support the ongoing activities of the new registries of spinal devices, pacemakers and defibrillators, and heart valves.

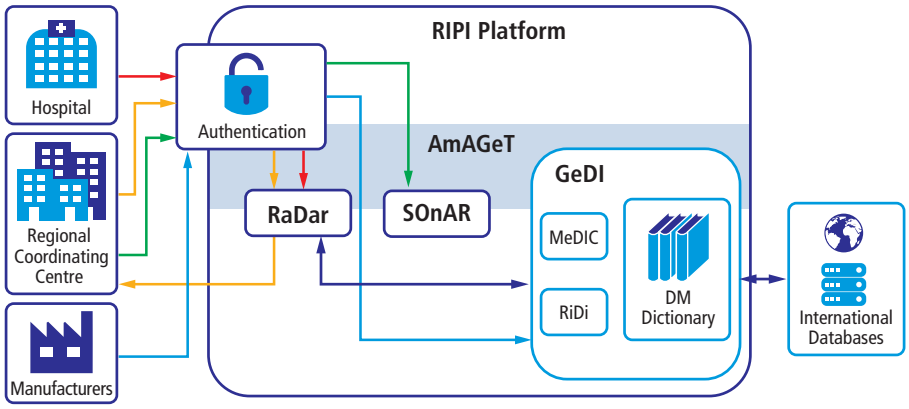
The RIAP team will keep strengthening the collaboration with the Ministry of Health regarding the ongoing common activities within the RNPM and the CND and with the English NJR and implant manufacturers to further improve the RIAP-DM Dictionary through the introduction of more information and missing bar codes.

It is planned for the upcoming years to enhance data collection on ankle replacements, in order to include them in future procedure and device analyses, and to increase the volume of all recorded surgical procedures thanks to the simplification of record layouts. In particular, the possibility for Lombardy region to collect data on shoulder and ankle replacements will be explored given the consistent number of surgical procedures performed in this Region. This will strongly increase the *completeness* of the RIAP data.

The RIAP team will focus on increasing the visibility of activities performed at both national and international level by regularly updating and improving its websites and participating in national and international scientific events.

The RIAP team will continue to raise stakeholder and policy makers awareness about the importance of medical device registries as a powerful tool to identify safety issues associated with the implantable devices. To ensure full application of Medical Device Regulation, all involved parties are required to work together to reach the desired objectives and the highest level of patient safety.

Figure 1.1. Flow diagram of the RIPI data collection model.



The RIPI data collection model is based on the following components: Authentication; AmAGeT (Administration, Authorization and Territorial Management - "Amministrazione, Autorizzazione e Gestione Territoriale"), for managing authorization of operations based on a Role Based Access Control (RBAC) mechanism reflecting the current federated structure of the Italian National Health Service; RaDaR (Hospitalization Data Collection - "Raccolta Dati Ricoveri"), for collecting data of surgeries from participating institutions; SOnAR (Automatic Online Synchronization of Hospitalization - "Sincronizzazione Online Automatica Ricoveri"), for allowing clinical data transfer from the Regional Coordination Centers. GeDI (Management of Implantable Devices - "Gestione dei Dispositivi Impiantabili"), for managing the Medical Device Dictionary (DM-Dictionary) using MeDIC (Medical Device Complete Query - "Medical Device Interrogazione Completa") and RiDi (Device Search - "Ricerca Dispositivi") web applications.

Figure 1.2. Participation in the RIAP (as of 31/12/2020)

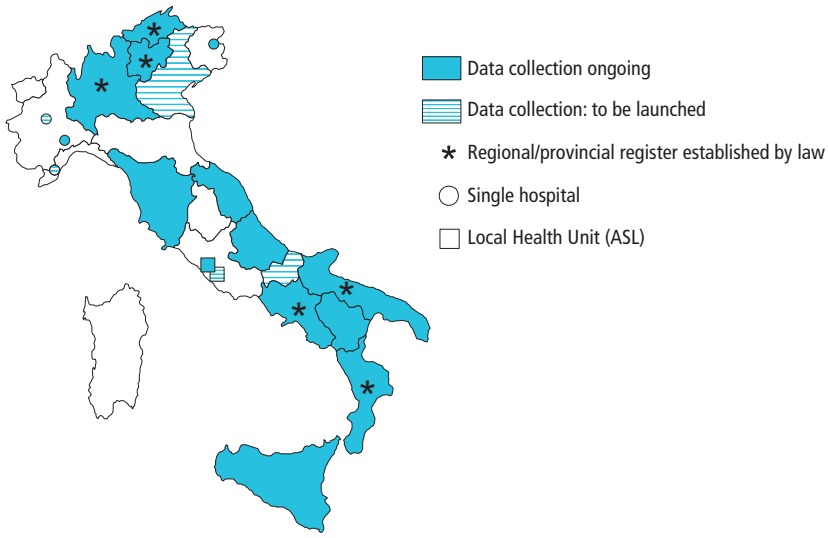


Table 2.1. Number of participating hospitals and *coverage* and number of RIAP procedures admitted to quality control and *completeness* by participating institution and by joint (year 2019)

Participating institution	Joint	Participating hospitals	*Coverage (*)*	RIAP procedures	*Completeness (**)*
Region		**N**	*%*	**N**	*%*
Lombardy	Hip	104	*97.2*	25,508	*99.1*
	Knee	105	*97.2*	21,254	*98.5*
AP Bolzano	Hip	12	*100.0*	1,422	*98.8*
	Knee	12	*100.0*	931	*95.6*
	Shoulder	6	*75.0*	28	*42.4*
AP Trento	Hip	8	*100.0*	1,429	*98.6*
	Knee	8	*100.0*	771	*98.3*
Tuscany	Hip	3	*6.3*	541	*5.6*
	Knee	3	*6.1*	310	*3.7*
Marche	Hip	16	*88.9*	1,263	*49.3*
	Knee	14	*73.7*	1,108	*57.9*
	Shoulder	9	*52.9*	61	*23.6*
Abruzzo	Hip	3	*15.0*	110	*4.3*
	Knee	3	*15.0*	97	*4.5*
	Shoulder	2	*11.1*	4	*1.4*
Campania	Hip	56	*71.8*	4,777	*68.9*
	Knee	53	*73.6*	3,433	*73.7*
	Shoulder	34	*66.7*	566	*66.7*
	Ankle	1	*20.0*	3	*37.5*
Apulia	Hip	42	*100.0*	4,950	*99.1*
	Knee	40	*100.0*	3,535	*100.0*
	Shoulder	33	*100.0*	539	*99.8*
Basilicata	Hip	2	*100.0*	178	*33.1*
	Knee	2	*100.0*	160	*64.0*
	Shoulder	2	*100.0*	11	*37.9*
Sicily	Hip	7	*9.9*	597	*9.7*
	Knee	7	*10.4*	820	*15.2*
	Shoulder	3	*5.5*	21	*3.0*
Subtotal (Regions)	**Hip**	**253**	***62.3***	**40,775**	***66.0***
	Knee	**247**	***65.5***	**32,419**	***65.9***
	Shoulder	**89**	***48.4***	**1,230**	***44.8***
	Ankle	**1**	**n.a.**	**3**	***n.a.***

(continued)

Table 2.1. (continued)

Participating institution	Joint	Participating hospitals	*Coverage (*)*	RIAP procedures	*Completeness (**)*
Single hospital		**N**	**%**	**N**	**%**
Clinica Città di Alessandria	Hip	1	-	306	*63.8*
	Knee	1	-	304	*51.8*
Presidio Ospedaliero Universitario Santa Maria della Misericordia, Udine	Hip	1	-	160	*100.0*
	Knee	1	-	129	*100.0*
	Shoulder	1	-	13	*100.0*
Ospedale S. Pietro Fatebenefratelli, Rome	Hip	1	-	81	*30.0*
	Knee	1	-	21	*17.2*
Casa di cura S. Feliciano, Rome	Hip	1	-	110	*47.8*
	Knee	1	-	111	*35.0*
	Shoulder	1	-	20	*50.0*
Subtotal (Hospitals)	**Hip**	**4**	**-**	**657**	***57.6***
	Knee	**4**	**-**	**565**	***48.9***
	Shoulder	**2**	**-**	**33**	***62.3***
Total number of procedures admitted to quality control		**N**	**%**	**N**	**%**
	Hip	**257**	**-**	**41,432**	***65.9***
	Knee	**251**	**-**	**32,984**	***65.5***
	Shoulder	**91**	**-**	**1,263**	***45.1***
	Ankle	**1**	**-**	**3**	***n.a.***
	ALL JOINTS	**260**		**75,682**	***65.2***

(*) *Coverage*: ratio between number of hospitals participating in RIAP and number of hospitals performing athroplasties according to HDD
(**) *Completeness*: ratio between number of procedures collected by RIAP and number of procedures recorded in HDD from participating institutions

Table 2.2. RIAP *completeness* (years 2018 and 2019). Comparison with 2018 and 2019 Hospital Discharge Data (HDD) by joint

	2018			2019		
	HDD	RIAP	*Completeness (*)*	HDD	RIAP	*Completeness (*)*
Joint	**N**	**N**	***%***	**N**	**N**	***%***
All	**211,080**	**70,584**	***33.4***	**221,047**	**75,682**	***34.2***
Hip	114,260	39,216	*34.3*	118,673	41,432	*34.9*
Knee	85,777	30,318	*35.3*	90,366	32,984	*36.5*
Shoulder	10,296	1,050	*10.2*	11,161	1,263	*11.3*
Ankle	747	0	*0.0*	847	3	*0.4*

(*) *Completeness*: ratio between number of procedures collected by RIAP and number of procedures recorded in HDD at national level

Table 2.3. Hip. Number of procedures included in procedure analysis and *completeness* by procedure type

	N	%	*Completeness (*) %*
Procedure type	**39,779**		***65.6***
Primary	**37,559**	***94.4***	***67.0***
Total replacement	**29,269**	***73.6***	
- elective	25,715	*87.9*	
- emergency	3,554	*12.1*	
Partial replacement	**8,290**	***20.8***	
Revision	**2,220**	***5.6***	***48.7***
Partial revision (**)	1,529	*68.9*	
Total revision	246	*11.1*	
Removal (***)	445	*20.0*	

(*) *Completeness:* ratio between number of procedures collected by RIAP and number of procedures recorded in HDD by participating centres

(**) Includes conversion from endoprosthesis to arthroprosthesis

(***) Includes removal, removal with spacer implantation, spacer replacement

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

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Hospital type	**25,715**		**3,554**		**8,290**		**2,220**		**39,779**	
Public hospitals	8,322	*32.4*	2,803	*78.9*	6,951	*83.8*	965	*43.5*	19,041	*47.9*
Private hospitals, accredited	17,294	*67.3*	750	*21.1*	1,336	*16.1*	1,246	*56.1*	20,626	*51.9*
Private hospitals, not accredited	99	*0.4*	1	*0.0*	3	*0.0*	9	*0.4*	112	*0.3*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Gender	**25,715**		**3,554**		**8,290**		**2,220**		**39,779**	
Male	12,037	*46.8*	1,004	*28.2*	2,248	*27.1*	918	*41.4*	16,207	*40.7*
Female	13,678	*53.2*	2,550	*71.8*	6,042	*72.9*	1,302	*58.6*	23,572	*59.3*
Age group by gender										
Male	**12,037**		**1,004**		**2,248**		**918**		**16,207**	
Mean age	64		71		83		69		68	
Standard deviation	12		13		9		13		13	
<45	664	*5.5*	29	*2.9*	11	*0.5*	38	*4.1*	742	*4.6*
45 - 54	1,741	*14.5*	82	*8.2*	12	*0.5*	83	*9.0*	1,918	*11.8*
55 - 64	2,982	*24.8*	173	*17.2*	51	*2.3*	165	*18.0*	3,371	*20.8*
65 - 74	3,851	*32.0*	273	*27.2*	184	*8.2*	265	*28.9*	4,573	*28.2*
75 - 84	2,500	*20.8*	310	*30.9*	839	*37.3*	298	*32.5*	3,947	*24.4*
≥ 85	299	*2.5*	137	*13.6*	1,151	*51.2*	69	*7.5*	1,656	*10.2*
Female	**13,678**		**2,550**		**6,042**		**1,302**		**23,572**	
Mean age	69		73		84		73		73	
Standard deviation	11		10		7		11		12	
<45	320	*2.3*	18	*0.7*	6	*0.1*	24	*1.8*	368	*1.6*
45 - 54	1,030	*7.5*	96	*3.8*	19	*0.3*	64	*4.9*	1,209	*5.1*
55 - 64	2,677	*19.6*	317	*12.4*	57	*0.9*	159	*12.2*	3,210	*13.6*
65 - 74	4,671	*34.1*	864	*33.9*	349	*5.8*	368	*28.3*	6,252	*26.5*
75 - 84	4,298	*31.4*	873	*34.2*	2,409	*39.9*	517	*39.7*	8,097	*34.4*
≥ 85	682	*5.0*	382	*15.0*	3,202	*53.0*	170	*13.1*	4,436	*18.8*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Side	**25,715**		**3,554**		**8,290**		**2,220**		**39,779**	
Right	13,480	*52.4*	1,789	*50.3*	4,158	*50.2*	1,162	*52.3*	20,589	*51.8*
Left	11,281	*43.9*	1,758	*49.5*	4,108	*49.6*	1,051	*47.3*	18,198	*45.7*
Bilateral	954	*3.7*	7	*0.2*	24	*0.3*	7	*0.3*	992	*2.5*
Surgical approach	**25,715**		**3,554**		**8,290**		**2,220**		**39,779**	
Anterior	5,297	*20.6*	283	*8.0*	603	*7.3*	153	*6.9*	6,336	*15.9*
Anterolateral	2,486	*9.7*	655	*18.4*	1,759	*21.2*	250	*11.3*	5,150	*12.9*
Lateral	4,292	*16.7*	960	*27.0*	2,646	*31.9*	510	*23.0*	8,408	*21.1*
Posterolateral	13,079	*50.9*	1,614	*45.4*	3,235	*39.0*	1,291	*58.2*	19,219	*48.3*
Other	561	*2.2*	42	*1.2*	47	*0.6*	16	*0.7*	666	*1.7*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	Total replacement				Partial replacement		TOTAL	
	elective		emergency					
	N	%	N	%	N	%	N	%
Indication for surgery	**25,715**		**3,554**		**8,290**		**37,559**	
Primary osteoarthritis	23,037	*89.6*	0	*0.0*	133	*1.6*	23,170	*61.7*
Post-traumatic osteoarthritis	426	*1.7*	0	*0.0*	28	*0.3*	454	*1.2*
Rheumatoid arthritis	83	*0.3*	0	*0.0*	2	*0.0*	85	*0.2*
Neoplasia	33	*0.1*	0	*0.0*	35	*0.4*	68	*0.2*
Aseptic necroisis of femoral head	1,072	*4.2*	0	*0.0*	12	*0.1*	1,084	*2.9*
Congenital hip dislocation or dysplasia outcomes	563	*2.2*	0	*0.0*	5	*0.1*	568	*1.5*
Perthes disease or epiphysiolysis	60	*0.2*	0	*0.0*	8	*0.1*	68	*0.2*
Fractured of neck and/or of femur	0	*0.0*	3,554	*100.0*	7,981	*96.3*	11,535	*30.7*
Septic coxitis outcomes	8	*0.0*	0	*0.0*	0	*0.0*	8	*0.0*
Pseudoarthrosis caused by neck fracture	43	*0.2*	0	*0.0*	12	*0.1*	55	*0.1*
Other	390	*1.5*	0	*0.0*	74	*0.9*	464	*1.2*
Previous surgery	**25,715**		**3,554**		**8,290**		**37,559**	
None	23,619	*91.8*	3,311	*93.2*	7,608	*91.8*	34,538	*92.0*
Osteosynthesis	306	*1.2*	53	*1.5*	63	*0.8*	422	*1.1*
Osteotomy	101	*0.4*	1	*0.0*	2	*0.0*	104	*0.3*
Arthrodesis	4	*0.0*	0	*0.0*	1	*0.0*	5	*0.0*
Other	1,685	*6.6*	189	*5.3*	616	*7.4*	2,490	*6.6*

Table 2.8. Hip. Number of revisions by indication for surgery and type of previous surgery

	Revision (*)	
	N	%
Indication for surgery	**2.220**	
Pain	102	*4.6*
Lysis	66	*3.0*
Wear	192	*8.6*
Implant fracture	80	*3.6*
Prosthesis dislocation	326	*14.7*
Periprosthetic fracture	294	*13.2*
Infection	250	*11.3*
Previous prosthesis removal outcomes	30	*1.4*
Aseptic loosening, cup	380	*17.1*
Aseptic loosening, stem	220	*9.9*
Aseptic loosening, total	153	*6.9*
Disease progression	2	*0.1*
High concentration of metal ions	1	*0.0*
Other	124	*5.6*
Previous surgery	**2.220**	
Total hip replacement	1,716	*77.3*
Revision of hip replacement	88	*4.0*
Spacer implant or prosthesis removal (**)	212	*9.5*
Partial hip replacement	162	*7.3*
Other	42	*1.9*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement
(**) Includes removal, removal with spacer implant, spacer replacement

Table 2.9. Hip. Number of procedures included in device analysis by procedure type

	N	%
Procedure type	**38,626**	
Total replacement	**28,543**	***73.9***
- elective	25,050	*87.8*
- emergency	3,493	*12.2*
Partial replacement	**7,880**	***20.4***
Revision	**2,203**	***5.7***
Partial revision (*)	1,527	*69.3*
Total revision	240	*10.9*
Removal of prosthesis (**)	436	*19.8*

(*) Includes conversion from endoprosthesis to arthroprosthesis
(**) Includes removal, removal with spacer implantation spacer replacement

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

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Fixation	**25,050**		**3,493**		**7,880**		**2,203**		**38,626**	
Cemented (stem + cup)	1,105	*4.4*	175	*5.0*	0	*0.0*	65	*3.0*	1,345	*3.5*
Reverse hybrid (uncemented stem and cemented cup)	313	*1.2*	136	*3.9*	0	*0.0*	106	*4.8*	555	*1.4*
Only cemented cup	0	*0.0*	0	*0.0*	0	*0.0*	74	*3.4*	74	*0.2*
Hybrid (cemented stem and uncementled cup)	864	*3.4*	179	*5.1*	0	*0.0*	51	*2.3*	1,094	*2.8*
Uncemented (stem + cup)	22,768	*90.9*	3,003	*86.0*	0	*0.0*	1,404	*63.7*	27,175	*70.4*
Only uncemented cup	0	*0.0*	0	*0.0*	0	*0.0*	196	*8.9*	196	*0.5*
Only cemented stem	0	*0.0*	0	*0.0*	3,123	*39.6*	31	*1.4*	3,154	*8.2*
Only uncemented stem	0	*0.0*	0	*0.0*	4,757	*60.4*	181	*8.2*	4,938	*12.8*
Fixation declared "not applicable" for cup and stem	0	*0.0*	0	*0.0*	0	*0.0*	95	*4.3*	95	*0.2*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	Total replacement				TOTAL	
	elective		emergency			
	N	%	N	%	N	%
Bearing type (head/insert)	**25,050**		**3,493**		**28,543**	
Ceramics-Ceramics	3,677	*14.7*	239	*6.8*	3,916	*13.7*
Ceramics-Metal	196	*0.8*	36	*1.0*	232	*0.8*
Ceramics-Polyethylene	17,116	*68.3*	2,163	*61.9*	19,279	*67.5*
Metal-Ceramics	6	*0.0*	3	*0.1*	9	*0.0*
Metal-Metal	139	*0.6*	38	*1.1*	177	*0.6*
Metal-Polyethylene	1,990	*7.9*	624	*17.9*	2,614	*9.2*
Procedures not reporting the implantation of a head and an insert	1,926	*7.7*	390	*11.2*	2,316	*8.1*

Table 2.12. Hip. Number of revision by bearing type

	Revision (*)	
	N	%
Bearing type (head/insert)	**2,203**	
Ceramics-Ceramics	52	*2.4*
Ceramics-Metal	24	*1.1*
Ceramics-Polyethylene	756	*34.3*
Metal-Ceramics	6	*0.3*
Metal-Metal	48	*2.2*
Metal-Polyethylene	386	*17.5*
Procedures not reporting the implantation of a head and an insert	931	*42.3*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

Table 2.13. Hip. Number of total replacements by stem type and by procedure type

	Total replacement				TOTAL	
	elective		emergency			
	N	%	N	%	N	%
Stem type	**25,050**		**3,493**		**28,543**	
Uncemented	**22,660**	***90.5***	**2,958**	***84.7***	**25,618**	***89.8***
Modular	**1,058**	***4.7***	**389**	***13.2***	**1,447**	***5.6***
Non-modular	**21,602**	***95.3***	**2,569**	***86.8***	**24,171**	***94.4***
Straight	16,967	*78.5*	2,416	*94.0*	19,383	*80.2*
Anatomical	683	*3.2*	67	*2.6*	750	*3.1*
Conservative	3,952	*18.3*	86	*3.3*	4,038	*16.7*
Cemented	**1,010**	***4.0***	**347**	***9.9***	**1,357**	***4.8***
Modular	**30**	***3.0***	**13**	***3.7***	**43**	***3.2***
Non-modular	**980**	***97.0***	**334**	***96.3***	**1,314**	***96.8***
Straight	924	*94.3*	317	*94.9*	1,241	*94.4*
Anatomical	43	*4.4*	15	*4.5*	58	*4.4*
Conservative	13	*1.3*	2	*0.6*	15	*1.1*
Other stem type / Stem type not reported	**1,380**	***5.5***	**188**	***5.4***	**1,568**	***5.5***

Table 2.14. Knee. Number of procedures included in procedure analysis and *completeness* by procedure type

	N	%	*Completeness (*) (%)*
Procedure type	**31,833**		**68,0**
Primary	**30,016**	**94,3**	***69.2***
total	25,119	83,7	
unicompartmental	4,897	16,3	
Revision	**1,817**	**5,7**	***53.1***
Partial revision	405	22,3	
Total revision	1,343	73,9	
Prosthesis removal, spacer replacement	44	2,4	
Primary patella implant on existing prosthesis	25	1,4	

(*) *Completeness*: ratio between number of procedures collected by RIAP and number of procedures recorded in HDD by participating institutions

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

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Hospital type	**25,119**		**4,897**		**1,817**		**31,833**	
Public hospitals	7,638	*30.4*	683	*14*	424	*23.4*	8,745	*27.4*
Private hospitals, accredited	17,429	*69.4*	4,208	*86*	1390	*76.5*	23,027	*72.4*
Private hospitals, not accredited	52	*0.2*	6	*0.1*	3	*0.2*	61	*0.2*

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

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

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Gender	**25,119**		**4,897**		**1,817**		**31,833**	
Male	8,151	*32.4*	1,794	*36.6*	564	*31.0*	10,509	*33.0*
Female	16,968	*67.6*	3,103	*63.4*	1,253	*69.0*	21,324	*67.0*
Age group by gender								
Male	**8,151**		**1,794**		**564**		**10,509**	
Mean age	69		67		69		69	
Standard deviation	9		9		10		9	
<45	77	*0.9*	22	*1.2*	7	*1.2*	106	*1.0*
45 - 54	454	*5.6*	174	*9.7*	48	*8.5*	676	*6.4*
55 - 64	1,607	*19.7*	475	*26.5*	115	*20.4*	2,197	*20.9*
65 - 74	3,374	*41.4*	723	*40.3*	207	*36.7*	4,304	*41.0*
75 - 84	2,492	*30.6*	377	*21.0*	171	*30.3*	3,040	*28.9*
≥85	147	*1.8*	23	*1.3*	16	*2.8*	186	*1.8*
Female	**16,968**		**3,103**		**1,253**		**21,324**	
Mean age	71		68		70		70	
Standard deviation	8		9		9		9	
<45	71	*0.4*	23	*0.7*	14	*1.1*	108	*0.5*
45 - 54	535	*3.2*	204	*6.6*	58	*4.6*	797	*3.7*
55 - 64	2,657	*15.7*	734	*23.7*	217	*17.3*	3,608	*16.9*
65 - 74	7,416	*43.7*	1,265	*40.8*	503	*40.1*	9,184	*43.1*
75 - 84	5,880	*34.7*	802	*25.8*	410	*32.7*	7,092	*33.3*
≥85	409	*2.4*	75	*2.4*	51	*4.1*	535	*2.5*

(*) Total or partial revision, removal, removal with spacer implantation, spacer replacement

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

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Side	**25,119**		**4,897**		**1,817**		**31,833**	
Right	13,184	*52.5*	2,353	*48.0*	964	*53.1*	16,501	*51.8*
Left	11,479	*45.7*	2,153	*44.0*	848	*46.7*	14,480	*45.5*
Bilateral	456	*1.8*	391	*8.0*	5	*0.3*	852	*2.7*
Surgical approach	**25,119**		**4,897**		**1,817**		**31,833**	
Medial parapatellar	21,639	*86.1*	3,148	*64.3*	1,507	*82.9*	26,294	*82.6*
Lateral parapatellar	518	*2.1*	355	*7.2*	39	*2.1*	912	*2.9*
Mid-vastus	1,632	*6.5*	589	*12.0*	172	*9.5*	2,393	*7.5*
Minimally invasive mid-vastus	476	*1.9*	548	*11.2*	47	*2.6*	1,071	*3.4*
Quad-sparing	89	*0.4*	106	*2.2*	1	*0.1*	196	*0.6*
Sub-vastus	302	*1.2*	26	*0.5*	13	*0.7*	341	*1.1*
Minimally invasive sub-vastus	98	*0.4*	65	*1.3*	7	*0.4*	170	*0.5*
V Quadriceps	0	*0.0*	5	*0.1*	2	*0.1*	7	*0.0*
Tibial tuberosity osteotomy	5	*0.0*	1	*0.0*	3	*0.2*	9	*0.0*
Other	360	*1.4*	54	*1.1*	26	*1.4*	440	*1.4*

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

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

	Primary				TOTAL	
	total		unicompartmental			
	N	%	N	%	N	%
Indication for surgery	**25,119**		**4,897**		**30,016**	
Primary osteoarthritis	23,826	*94.9*	4,544	*92.8*	28,370	*94.5*
Post-traumatic osteoarthritis	409	*1.6*	49	*1.0*	458	*1.5*
Rheumatoid arthritis	127	*0.5*	2	*0.0*	129	*0.4*
Neoplasia	19	*0.1*	0	*0.0*	19	*0.1*
Osteonecrosis	116	*0.5*	123	*2.5*	239	*0.8*
Other	622	*2.5*	179	*3.7*	801	*2.7*
Previous surgery	**25,119**		**4,897**		**30,016**	
None	22,370	*89.1*	4,479	*91.5*	26,849	*89.4*
Arthrodesis	18	*0.1*	1	*0.0*	19	*0.1*
Osteotomy	161	*0.6*	6	*0.1*	167	*0.6*
Arthroscopy	595	*2.4*	196	*4.0*	791	*2.6*
Osteosynthesis	125	*0.5*	19	*0.4*	144	*0.5*
Other	1,850	*7.4*	196	*4.0*	2,046	*6.8*

Table 2.19. Knee. Number of revision by indication for surgery and type of previous surgery

	Revision (*)	
	N	%
Indication for surgery	**1.817**	
Aseptic loosening of several components	454	*25.0*
Aseptic loosening of femur	85	*4.7*
Aseptic loosening of tibia	171	*9.4*
Aseptic loosening of patella	7	*0.4*
Wear	34	*1.9*
Dislocation	31	*1.7*
Instability	98	*5.4*
Periprosthetic fracture	31	*1.7*
Implant fracture	17	*0.9*
Fractured spacer	1	*0.1*
Infection	303	*16.7*
Stiffness	40	*2.2*
Disease progression	35	*1.9*
Pain	334	*18.4*
Other	176	*9.7*
Previous surgery	**1.817**	
Primary total	1,121	*61.7*
Primary unicompartmental	353	*19.4*
Revision of knee replacement	120	*6.6*
Spacer	151	*8.3*
Other	72	*4.0*

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

Table 2.20. Knee. Number of procedures included in device analysis by procedure type

	N	%
Procedure type	**31,168**	
Primary	**29,407**	***94.3***
- total	24,843	*84.5*
- unicompartmental	4,564	*15.5*
Revision	**1,761**	***5.7***

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

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Fixation	**24,843**		**4,564**		**1,761**		**31,168**	
Patella not implanted	**22,404**	***90.2***	**3,319**	***72.7***	**569**	***32.3***	**26,292**	***84.4***
Cemented (femoral and tibial components)	15,221	*67.9*	2,165	*65.2*	366	*64.3*	17,752	*67.5*
Cemented femoral component and uncemented tibial component	760	*3.4*	201	*6.1*	52	*9.1*	1,013	*3.9*
Only cemented femoral component	0	*0.0*	0	*0.0*	14	*2.5*	14	*0.1*
Uncemented femoral component and cemented tibial component	1,163	*5.2*	233	*7.0*	54	*9.5*	1,450	*5.5*
Uncemented	5,260	*23.5*	720	*21.7*	16	*2.8*	5,996	*22.8*
Only uncemented femoral component	0	*0.0*	0	*0.0*	2	*0.4*	2	*0.0*
Only cemented tibial component	0	*0.0*	0	*0.0*	24	*4.2*	24	*0.1*
Only uncemented tibial component	0	*0.0*	0	*0.0*	10	*1.8*	10	*0.0*
Fixaction declared "not applicable" for both femoral and tibial components	0	*0.0*	0	*0.0*	31	*5.4*	31	*0.1*
Patella implanted (cemented)	**2,054**	***8.3***	**210**	***4.6***	**405**	***23.0***	**2,669**	***8.6***
Cemented (femoral and tibial components)	1,952	*95.0*	209	*99.5*	260	*64.2*	2,421	*90.7*
Cemented femoral component and uncemented tibial component	23	*1.1*	0	*0.0*	4	*1.0*	27	*1.0*
Only cemented femoral component	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*
Uncemented femoral component and cemented tibial component	48	*2.3*	1	*0.5*	17	*4.2*	66	*2.5*
Uncemented	31	*1.5*	0	*0.0*	86	*21.2*	117	*4.4*
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*	6	*1.5*	6	*0.2*
Only uncemented tibial component	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*
Only patella	0	*0.0*	0	*0.0*	32	*7.9*	32	*1.2*

(continued)

Table 2.21. (continued)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Patella implanted (uncemented)	**385**	***1.5***	**1,035**	***22.7***	**787**	***44.7***	**2,207**	***7.1***
Cemented (femoral and tibial components)	170	*44.2*	720	*69.6*	316	*40.2*	1,206	*54.6*
Cemented femoral component and uncemented tibial component	11	*2.9*	22	*2.1*	38	*4.8*	71	*3.2*
Only cemented femoral component	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*
Uncemented femoral component and cemented tibial component	11	*2.9*	52	*5.0*	66	*8.4*	129	*5.8*
Uncemented	193	*50.1*	241	*23.3*	364	*46.3*	798	*36.2*
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*	1	*0.1*	1	*0.0*
Only patella	0	*0.0*	0	*0.0*	2	*0.3*	2	*0.1*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	N	%
Type of tibial tray	**24,843**	
Mobile bearing	**4,950**	***19.9***
Cemented	3,831	*77.4*
Uncemented	764	*15.4*
Cementable	355	*7.2*
Fixed	**12,500**	***50.3***
Cemented	11,837	*94.7*
Uncemented	556	*4.4*
Cementable	107	*0.9*
Missing	**7,393**	***29.8***

Table 2.23. Shoulder. Number of procedures included in procedure analysis and *completeness* by procedure type

	N	%	*Completeness (*) (%)*
Procedure type	**1,246**		**22,8**
Primary	**1,217**	***97.7***	***23.0***
Total replacement	1,119	*91.9*	
- elective	761	*68.0*	
- emergency	358	*32.0*	
Partial replacement	63	*5.2*	
Not specified	35	*2.9*	
Revision (**)	**29**	***2.3***	***17.2***

(*) *Completeness*: ratio between number of procedures collected by RIAP and number of procedures recorded in HDD by participating institutions

(**) Includes total or partial revision, removal, removal with spacer implantation, spacer replacement

Table 2.24. Shoulder. Number of total replacements by type of implanted prosthesis

	N	%
Type of prosthesis implanted in the total replacement	**1,119**	
Elective	**761**	***68.0***
- anatomical	31	*4.1*
- resurfacing	1	*0.1*
- reverse	637	*83.7*
- interposition	92	*12.1*
Emergency	**358**	***32.0***
- anatomical	3	*0.8*
- resurfacing	0	*0.0*
- reverse	355	*99.2*
- interposition	0	*0.0*

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

	Primary								Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified					
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Hospital type	**761**		**358**		**63**		**35**		**29**		**1,246**	
Public hospitals	230	*30.3*	298	*83.2*	42	*66.6*	16	*45.7*	15	*51.7*	601	*48.2*
Private hospitals, accredited	531	*69.7*	60	*16.7*	21	*33.3*	16	*45.7*	14	*48.3*	642	*51.5*
Private hospitals, non-accredited	0	*0.0*	0	*0.0*	0	*0*	3	*8.6*			3	*0.2*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	Primary								Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified					
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Gender	**761**		**358**		**63**		**35**		**29**		**1,246**	
Male	236	*31.0*	60	*16.8*	17	*27.0*	*16*	*45.7*	13	*44.8*	342	*27.4*
Female	525	*69.0*	298	*83.2*	46	*73.0*	*19*	*54.3*	16	*55.2*	904	*72.6*
Age group by gender												
Male	**236**		**60**		**17**		**16**		**13**		**342**	
Mean age	67		71		60		*64*		60		67	
Standard deviation	9		10		7		*9*		17		10	
<45	2	*0.8*	0	*0.0*	1	*5.9*	*0*	*0.0*	2	*15.4*	5	*1.5*
45 - 54	20	*8.5*	3	*5.0*	2	*11.8*	*1*	*0.0*	3	*23.1*	29	*8.5*
55 - 64	55	*23.3*	11	*18.3*	8	*47.1*	*8*	*0.0*	3	*23.1*	85	*24.9*
65 - 74	107	*45.3*	21	*35.0*	4	*23.5*	*5*	*0.0*	1	*7.7*	138	*40.4*
75 - 84	50	*21.2*	20	*33.3*	2	*11.8*	*2*	*0.0*	4	*30.8*	78	*22.8*
≥85	2	*0.8*	5	*8.3*	0	*0.0*	*0*	*0.0*	0	*0.0*	7	*2.0*
Female	**525**		**298**		**46**		**19**		**16**		**904**	
Mean age	72		74		71		*71*		68		73	
Standard deviation	7		8		10		*8*		9		8	
<45	1	*0.2*	0	*0.0*	1	*2.2*	*0*	*0.0*	0	*0.0*	2	*0.2*
45 - 54	5	*1.0*	1	*0.3*	1	*2.2*	*0*	*0.0*	0	*0.0*	7	*0.8*
55 - 64	65	*12.4*	32	*10.7*	6	*13.0*	*4*	*21.1*	7	*43.8*	114	*12.6*
65 - 74	254	*48.4*	107	*35.9*	23	*50.0*	*8*	*42.1*	4	*25.0*	396	*43.8*
75 - 84	180	*34.3*	131	*44.0*	12	*26.1*	*6*	*31.6*	5	*31.3*	334	*36.9*
≥85	20	*3.8*	27	*9.1*	3	*6.5*	*1*	*5.3*	0	*0.0*	51	*5.6*

(*) Total or partial revision, conversion to endoprosthesis to arthroprosthesis, removal, removal with spacer implantation, spacer replacement

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

	Primary								Revision (*)		TOTAL	
	Total replacement				Partial replacement		Not specified					
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Side	**761**		**358**		**63**		**35**		**29**		**1,246**	
Right	497	*65.3*	219	*61.2*	37	*58.7*	17	*48.6*	18	*62.1*	788	*63.2*
Left	264	*34.7*	138	*38.5*	26	*41.3*	18	*51.4*	11	*37.9*	457	*36.7*
Bilateral	0	*0.0*	1	*0.3*	0	*0.0*	0	*0.0*	0	*0.0*	1	*0.1*
Surgical approach	**761**		**358**		**63**		**35**		**29**		**1,246**	
Deltopectoral	562	*73.9*	307	*85.8*	62	*98.4*	33	*94.3*	27	*93.1*	991	*79.5*
Trans-deltoid	85	*11.2*	9	*2.5*	0	*0.0*	0	*0.0*	0	*0.0*	94	*7.5*
Other	17	*2.2*	3	*0.8*	1	*1.6*	2	*5.7*	1	*3.4*	24	*1.9*
Missing	97	*12.7*	39	*10.9*	0	*0.0*	0	*0.0*	1	*3.4*	137	*11.0*

(*) Includes total or partial revision, removal, removal with spacer implantation, spacer replacement

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

	Primary								TOTAL	
	Total replacement				Partial replacement		Not specified			
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Indication for surgery	**761**		**358**		**63**		**35**		**1,217**	
Eccentric osteoarthritis	454	*59.7*	0	*0.0*	9	*14.3*	21	*60.0*	484	*39.8*
Concentric osteoarthritis	95	*12.5*	0	*0.0*	14	*22.2*	3	*8.6*	112	*9.2*
Rheumatoid arthritis	3	*0.4*	0	*0.0*	0	*0.0*	1	*2.9*	4	*0.3*
Neoplasia	0	*0.0*	0	*0.0*	1	*1.6*	0	*0.0*	1	*0.1*
Osteonecrosis	9	*1.2*	0	*0.0*	2	*3.2*	2	*5.7*	13	*1.1*
Fracture	0	*0.0*	358	*100.0*	36	*57.1*	8	*22.9*	402	*33.0*
Previous fracture	29	*3.8*	0	*0.0*	0	*0.0*	0	*0.0*	29	*2.4*
Other	171	*22.5*	0	*0.0*	1	*1.6*	0	*0.0*	172	*14.1*
Previous surgery	**761**		**358**		**63**		**35**		**1,217**	
None	731	*96.1*	357	*99.7*	62	*98.4*	33	*94.3*	1,183	*97.2*
Osteosynthesis	11	*1.4*	0	*0.0*	0	*0.0*	2	*5.7*	13	*1.1*
Arthrotomy	1	*0.1*	0	*0.0*	0	*0.0*	0	*0.0*	1	*0.1*
Arthroscopy	13	*1.7*	0	*0.0*	0	*0.0*	0	*0.0*	13	*1.1*
Other	5	*0.7*	1	*0.3*	1	*1.6*	0	*0.0*	7	*0.6*

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

	Revision (*)	
	N	%
Indication for surgery	**29**	
Instability	10	*34.5*
Glenoid erosion	1	*3.4*
Dislocation	3	*10.3*
Infection	4	*13.8*
Prosthesis removal outcomes	1	*3.4*
Aseptic mobilisation	7	*24.1*
Other	3	*10.3*
Previous surgery	**29**	
Primary	23	*79.3*
Removal	4	*13.8*
Shoulder replacement revision	2	*6.9*
Other	0	*0.0*

(*) Includes total or partial revision, removal, removal with spacer implantation, spacer replacement

Table 2.30. Shoulder. Number of procedures included in device analysis by procedure type

	N	%
Procedure type	**606**	
Primary	**577**	***95.2***
Total replacement	543	*94.1*
- elective	400	*73.7*
- emergency	143	*26.3*
Partial replacement	29	*5.0*
Not specified	5	*0.9*
Revision (*)	**29**	***4.8***

(*) Includes total or partial revision, removal, removal with spacer implantation, spacer replacement

Table 2.31. Shoulder. Number of procedures by fixation and by procedure type

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	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*
Not applicable	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

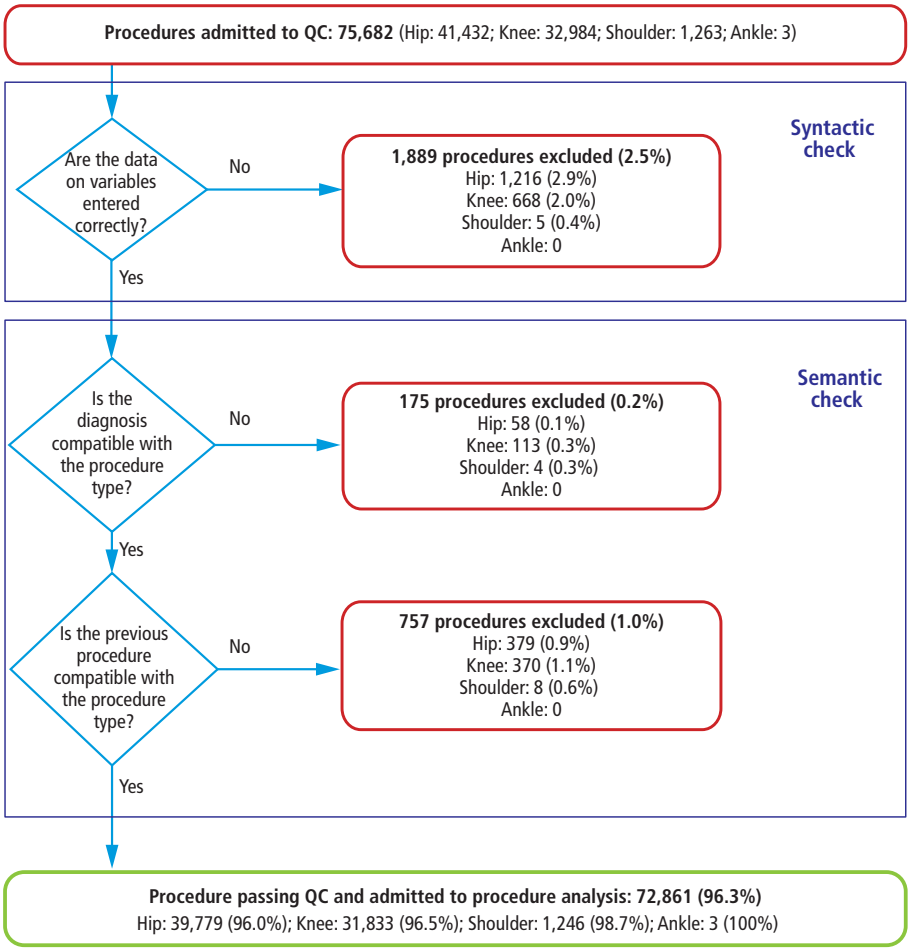


Figure 2.2. Flowchart of the RIAP data quality control process for device analysis

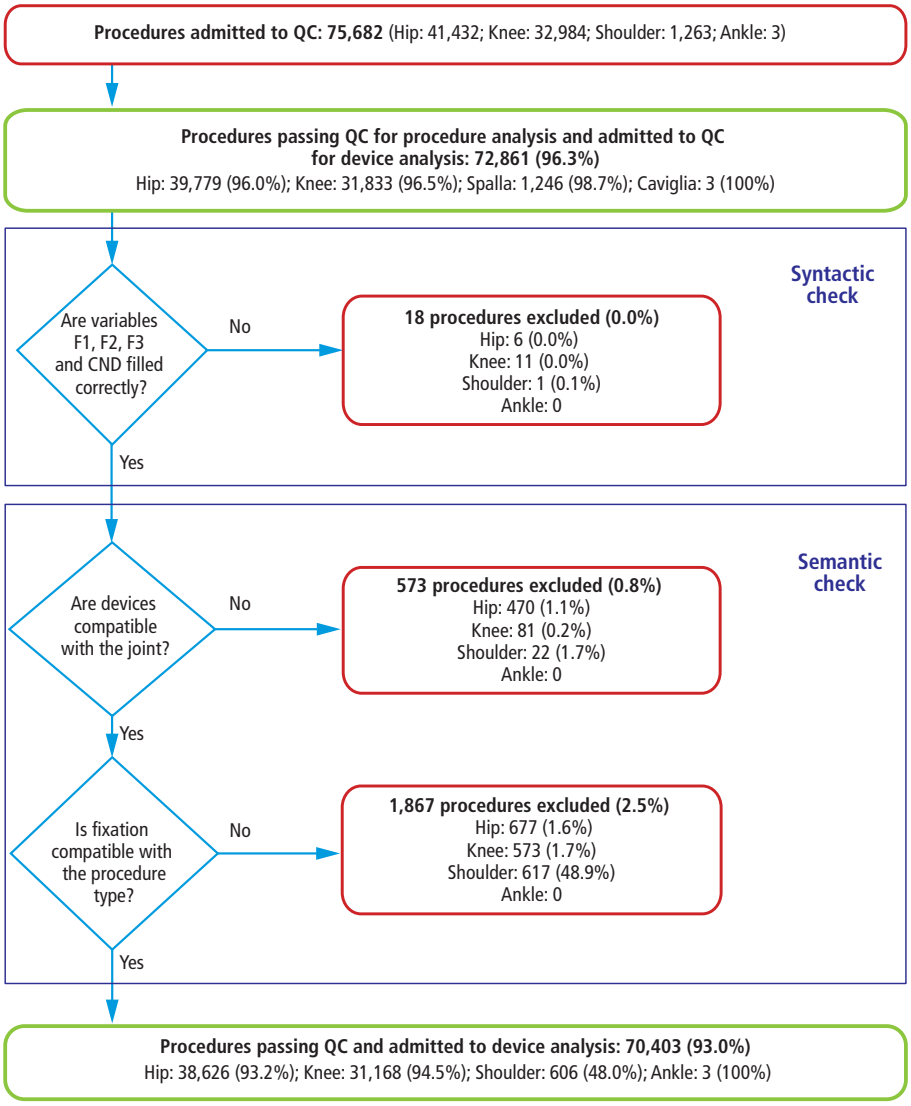


Figure 2.3. Hip. Types of bearing. Total replacement (elective procedures)

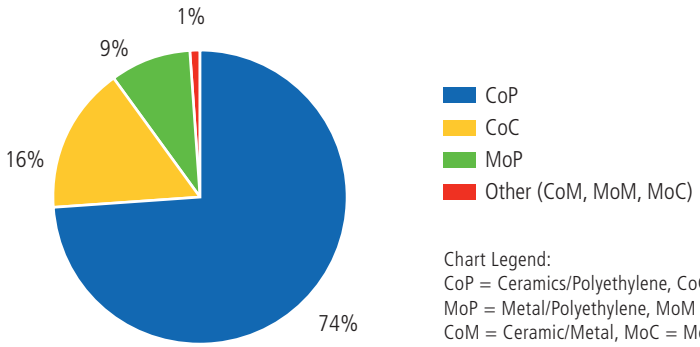


Chart Legend:
CoP = Ceramics/Polyethylene, CoC = Ceramic/Ceramic,
MoP = Metal/Polyethylene, MoM = Metal/Metal,
CoM = Ceramic/Metal, MoC = Metal/Ceramic

Note: the first component indicates the material of the head, the second the material of the insert.

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

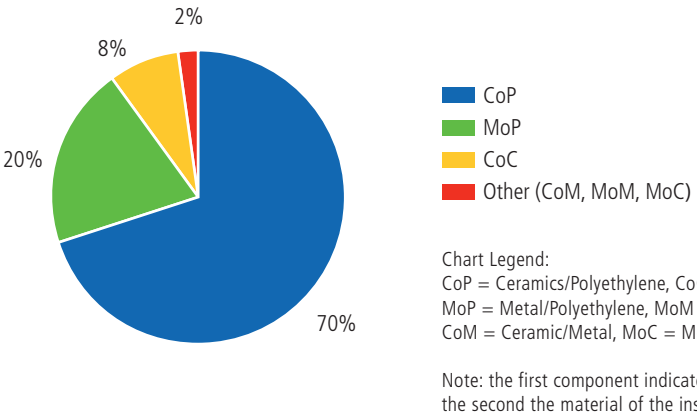


Chart Legend:
CoP = Ceramics/Polyethylene, CoC = Ceramic/Ceramic,
MoP = Metal/Polyethylene, MoM = Metal/Metal,
CoM = Ceramic/Metal, MoC = Metal/Ceramic

Note: the first component indicates the material of the head, the second the material of the insert.

APPENDIX

Table 1. Joint replacements (primary and revision procedures) in Italy. 2001-2019

ICD-9-CM Code	Procedure	2001	2003	2005	2006	2007	2008	2009
	Hip	**74,408**	**80,999**	**87,499**	**90,062**	**91,077**	**92,217**	**93,241**
81,51	Total hip replacement	46,850	52,541	57,112	59,315	60,425	60,840	61,601
	Total hip replacement (elective)	*40.060*	*44.505*	*47.908*	*49.657*	*50.684*	*51.110*	*51.769*
81,52	Partial hip replacement	21,394	21,753	23,227	23,286	23,119	23,896	23,393
00,85(*)	Hip resurfacing	0	0	0	0	0	0	293
(**)	Revision of hip replacement	6,164	6,705	7,160	7,461	7,533	7,481	7,954
	Knee	**28,693**	**38,655**	**47,643**	**52,322**	**57,054**	**59,956**	**61,079**
81,54	Total knee replacement	27,401	36,714	45,116	49,560	53,930	56,525	57,004
(***)	Revision of knee replacement	1,292	1,941	2,527	2,762	3,124	3,431	4,075
	Shoulder	**1,559**	**1,866**	**2,517**	**2,888**	**3,255**	**3,412**	**3,783**
81,80	Total shoulder replacement	709	948	1,462	1,695	2,048	2,190	2,537
	Total shoulder replacement (elective)	*417*	*644*	*1.085*	*1.336*	*1.629*	*1.788*	*2.092*
81,81	Partial shoulder replacement	850	918	1,055	1,193	1,207	1,222	1,246
	Ankle	**95**	**147**	**179**	**257**	**268**	**284**	**256**
81,56	Total ankle replacement	95	147	179	257	268	284	256
	Other joints	**736**	**870**	**1,668**	**1,713**	**1,570**	**1,315**	**1,332**
81,57	Foot and toe joint replacement	316	414	604	629	692	656	521
81,59	Revision of lower extremity joint replacement	214	173	672	588	365	140	187
81,73	Total wrist replacement	40	44	60	81	66	69	59
81,84	Total elbow replacement	90	162	251	317	314	311	402
81,97	Revision of upper extremity joint replacement	76	77	81	98	133	139	163
	Total	**105,491**	**122,537**	**139,506**	**147,242**	**153,224**	**157,184**	**159,691**

(°) Average annual increase

(*) New code introduced on 1st January 2009

(**) 81,53 code and new codes introduced since 1st january 2019: 00,70, 00,71, 00,72, 00,73

(***) 81,55 code and new codes introduced since 1st january 2019: 00,80, 00,81, 00,82, 00,83, 00,84

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	% (°)
95,348	**96,125**	**98,585**	**100,844**	**102,652**	**105,803**	**108,906**	**112,375**	**113,511**	**117,911**	***2.6***
61,775	62,664	64,503	66,257	68,190	71,178	74,660	77,787	79,288	83,158	*3.2*
52.187	*53.157*	*54.852*	*56.598*	*58.491*	*60.661*	*64.102*	*66.917*	*68.525*	*71.626*	*3.3*
24,847	25,091	25,346	25,979	26,141	26,222	25,879	26,101	25,646	25,876	*1.1*
445	162	96	99	45	107	147	65	251	229	*-2.4*
8,281	8,208	8,640	8,509	8,276	8,296	8,220	8,422	8,326	8,648	*1.9*
63,255	**63,749**	**66,007**	**67,634**	**70,313**	**73,191**	**78,779**	**81,271**	**84,582**	**89,210**	***6.5***
59,081	59,472	61,541	62,910	65,614	68,091	73,394	75,668	78,423	82,815	*6.3*
4,174	4,277	4,466	4,724	4,699	5,100	5,385	5,603	6,159	6,395	*9.3*
4,326	**4,684**	**5,143**	**5,795**	**6,511**	**7,145**	**8,053**	**9,101**	**10,125**	**10,989**	***11.5***
2,990	3,478	3,830	4,441	5,309	5,970	6,892	7,862	8,840	9,767	*15.7*
2.382	*2.815*	*3.042*	*3.479*	*4.085*	*4.474*	*5.225*	*5.921*	*6.712*	*7.347*	*17.3*
1,336	1,206	1,313	1,354	1,202	1,175	1,161	1,239	1,285	1,222	*2.0*
255	**298**	**313**	**330**	**387**	**482**	**546**	**600**	**653**	**767**	***12.3***
255	298	313	330	387	482	546	600	653	767	*12.3*
1,302	**1,349**	**1,291**	**1,300**	**1,358**	**1,479**	**1,444**	**1,489**	**1,573**	**1,568**	***4.3***
557	543	443	440	453	530	481	468	493	415	*1.5*
128	107	83	96	103	102	74	77	79	63	*-6.6*
50	68	74	65	49	51	52	37	59	43	*0.4*
402	434	447	473	491	523	549	608	616	682	*11.9*
165	197	244	226	262	273	288	299	326	365	*9.1*
164,486	**166,205**	**171,339**	**175,903**	**181,221**	**188,100**	**197,728**	**204,836**	**210,444**	**220,445**	***4.2***

Table 2. Hip. Number of primary and revision procedures by region of admission and by procedure type. 2018-2019

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2018		2019		2018		2019	
	N	%	N	%	N	%	N	%
Piedmont	6,597	*9.6*	6,956	*9.7*	1,060	*9.8*	1,028	*8.9*
Aosta Valley	178	*0.3*	156	*0.2*	18	*0.2*	22	*0.2*
Lombardy	15,963	*23.2*	16,680	*23.2*	1,396	*13.0*	1,630	*14.1*
AP Bolzano	1,000	*1.5*	1,013	*1.4*	120	*1.1*	105	*0.9*
AP Trento	904	*1.3*	970	*1.3*	89	*0.8*	94	*0.8*
Veneto	6,695	*9.7*	7,276	*10.1*	788	*7.3*	802	*7.0*
Friuli Venezia Giulia	1,768	*2.6*	1,620	*2.3*	167	*1.6*	220	*1.9*
Liguria	1,199	*1.7*	1,188	*1.7*	565	*5.2*	674	*5.8*
Emilia-Romagna	8,118	*11.8*	8,530	*11.9*	708	*6.6*	846	*7.3*
Tuscany	6,130	*8.9*	6,066	*8.4*	863	*8.0*	909	*7.9*
Umbria	862	*1.3*	905	*1.3*	134	*1.2*	159	*1.4*
Marche	1,304	*1.9*	1,418	*2.0*	433	*4.0*	401	*3.5*
Lazio	5,509	*8.0*	5,637	*7.8*	1,204	*11.2*	1,146	*9.9*
Abruzzi	1,532	*2.2*	1,577	*2.2*	261	*2.4*	274	*2.4*
Molise	167	*0.2*	200	*0.3*	24	*0.2*	21	*0.2*
Campania	3,466	*5.0*	3,750	*5.2*	984	*9.1*	1,180	*10.2*
Apulia	2,535	*3.7*	2,555	*3.6*	550	*5.1*	545	*4.7*
Basilicata	229	*0.3*	195	*0.3*	61	*0.6*	58	*0.5*
Calabria	924	*1.3*	1,050	*1.5*	279	*2.6*	262	*2.3*
Sicily	2,726	*4.0*	3,191	*4.4*	888	*8.2*	926	*8.0*
Sardinia	963	*1.4*	920	*1.3*	179	*1.7*	237	*2.1*
Italy	**68,769**	***100***	**71,853**	***100***	**10,771**	***100***	**11,539**	***100***
% of national volume	*60.6*		*60.9*		*9.5*		*9.8*	

Partial replacement				Revision				Total			
2018		2019		2018		2019		2018		2019	
N	%	N	%	N	%	N	%	N	%	N	%
1,894	*7.4*	1,875	*7.2*	800	*9.6*	799	*9.2*	10,351	*9.1*	10,658	*9.0*
84	*0.3*	72	*0.3*	13	*0.2*	13	*0.2*	293	*0.3*	263	*0.2*
5,036	*19.6*	4,968	*19.2*	1,916	*23.0*	2,017	*23.3*	24,311	*21.4*	25,295	*21.5*
163	*0.6*	243	*0.9*	99	*1.2*	107	*1.2*	1,382	*1.2*	1,468	*1.2*
310	*1.2*	307	*1.2*	112	*1.3*	137	*1.6*	1,415	*1.2*	1,508	*1.3*
2,232	*8.7*	2,405	*9.3*	647	*7.8*	757	*8.8*	10,362	*9.1*	11,240	*9.5*
821	*3.2*	809	*3.1*	195	*2.3*	204	*2.4*	2,951	*2.6*	2,853	*2.4*
730	*2.8*	685	*2.6*	248	*3.0*	227	*2.6*	2,742	*2.4*	2,774	*2.4*
2,460	*9.6*	2,457	*9.5*	1,014	*12.2*	1,016	*11.7*	12,300	*10.8*	12,849	*10.9*
1,953	*7.6*	1,972	*7.6*	734	*8.8*	729	*8.4*	9,680	*8.5*	9,676	*8.2*
555	*2.2*	516	*2.0*	108	*1.3*	137	*1.6*	1,659	*1.5*	1,717	*1.5*
572	*2.2*	560	*2.2*	172	*2.1*	200	*2.3*	2,481	*2.2*	2,579	*2.2*
2,068	*8.1*	2,100	*8.1*	624	*7.5*	696	*8.0*	9,405	*8.3*	9,579	*8.1*
585	*2.3*	570	*2.2*	162	*1.9*	154	*1.8*	2,540	*2.2*	2,575	*2.2*
158	*0.6*	142	*0.5*	12	*0.1*	10	*0.1*	361	*0.3*	373	*0.3*
1,614	*6.3*	1,559	*6.0*	457	*5.5*	497	*5.7*	6,521	*5.7*	6,986	*5.9*
1,540	*6.0*	1,592	*6.2*	349	*4.2*	301	*3.5*	4,974	*4.4*	4,993	*4.2*
273	*1.1*	246	*1.0*	31	*0.4*	38	*0.4*	594	*0.5*	537	*0.5*
563	*2.2*	593	*2.3*	126	*1.5*	117	*1.4*	1,892	*1.7*	2,022	*1.7*
1,450	*5.7*	1,608	*6.2*	400	*4.8*	425	*4.9*	5,464	*4.8*	6,150	*5.2*
586	*2.3*	598	*2.3*	108	*1.3*	69	*0.8*	1,836	*1.6*	1,824	*1.5*
25,647	***100***	**25,877**	***100***	**8,327**	***100***	**8,650**	***100***	**113,514**	***100***	**117,919**	***100***
22.6		*21.9*		*7.3*		*7.3*		*100.0*		*100.0*	

Table 3. Hip. Primary total replacement. Number of hospitals performing primary and revision procedures by region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2018	2019	2018	2019	2018	2019
	N	N	N	N	N	N
Piedmont	12	9	7	9	15	17
Aosta Valley	0	0	1	1	1	1
Lombardy	26	25	30	35	29	23
AP Bolzano	5	4	3	4	3	2
AP Trento	1	1	2	2	4	4
Veneto	11	11	15	16	15	10
Friuli Venezia Giulia	2	1	5	6	7	6
Liguria	5	4	4	2	6	7
Emilia-Romagna	11	14	23	17	20	22
Tuscany	15	15	11	12	10	6
Umbria	3	4	7	3	3	6
Marche	8	8	2	2	7	5
Lazio	41	41	18	23	17	13
Abruzzi	6	7	9	7	3	3
Molise	3	3	2	1	0	1
Campania	51	46	10	14	10	9
Apulia	18	18	14	13	10	9
Basilicata	4	4	1	1	1	1
Calabria	12	11	5	5	3	2
Sicily	43	42	24	24	3	4
Sardinia	13	12	6	7	2	2
Italy	**290**	**280**	**199**	**204**	**169**	**153**
% of national volume	*38.7*	*37.3*	*26.5*	*27.2*	*22.5*	*20.4*

201-300		>300		Total			
2018	2019	2018	2019	2018		2019	
N	N	N	N	N	%	N	%
7	6	7	8	48	*6.4*	49	*6.5*
0	0	0	0	2	*0.3*	2	*0.3*
8	8	13	15	106	*14.1*	106	*14.1*
1	2	0	0	12	*1.6*	12	*1.6*
1	1	0	0	8	*1.1*	8	*1.1*
7	8	5	7	53	*7.1*	52	*6.9*
0	2	1	0	15	*2.0*	15	*2.0*
1	1	1	1	17	*2.3*	15	*2.0*
8	8	2	5	64	*8.5*	66	*8.8*
7	8	6	7	49	*6.5*	48	*6.4*
0	0	0	0	13	*1.7*	13	*1.7*
1	3	0	0	18	*2.4*	18	*2.4*
2	4	3	3	81	*10.8*	84	*11.2*
2	3	0	0	20	*2.7*	20	*2.7*
0	0	0	0	5	*0.7*	5	*0.7*
5	6	0	1	76	*10.1*	76	*10.1*
0	1	1	1	43	*5.7*	42	*5.6*
0	0	0	0	6	*0.8*	6	*0.8*
1	1	0	1	21	*2.8*	20	*2.7*
0	0	2	2	72	*9.6*	72	*9.6*
0	0	0	0	21	*2.8*	21	*2.8*
51	**62**	**41**	**51**	**750**	***100***	**750**	***100***
6.8	*8.3*	*5.5*	*6.8*	*100.0*		*100.0*	

Table 4. Hip. Revision. Number of hospitals performing primary and revision procedures by region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume											
	1-10		11-25		26-50		>50		Total			
	2018	2019	2018	2019	2018	2019	2018	2019	2018		2019	
	N	N	N	N	N	N	N	N	N	%	N	%
Piedmont	21	20	19	16	6	10	1	1	47	*7.2*	47	*7.1*
Aosta Valley	2	1	0	1	0	0	0	0	2	*0.3*	2	*0.3*
Lombardy	43	51	38	33	11	13	7	6	99	*15.1*	103	*15.5*
AP Bolzano	7	4	2	4	1	1	0	0	10	*1.5*	9	*1.4*
AP Trento	5	5	1	2	0	0	1	1	7	*1.1*	8	*1.2*
Veneto	22	24	16	16	8	7	1	2	47	*7.2*	49	*7.4*
Friuli Venezia Giulia	6	7	5	5	1	2	1	0	13	*2.0*	14	*2.1*
Liguria	6	11	8	4	0	1	1	1	15	*2.3*	17	*2.6*
Emilia-Romagna	33	30	18	18	9	8	2	1	62	*9.5*	57	*8.6*
Tuscany	19	19	14	11	6	9	3	2	42	*6.4*	41	*6.2*
Umbria	7	7	4	4	0	1	0	0	11	*1.7*	12	*1.8*
Marche	11	10	5	6	1	1	0	0	17	*2.6*	17	*2.6*
Lazio	49	52	10	13	7	3	1	3	67	*10.2*	71	*10.7*
Abruzzi	11	11	6	6	0	0	0	0	17	*2.6*	17	*2.6*
Molise	3	2	0	0	0	0	0	0	3	*0.5*	2	*0.3*
Campania	41	47	10	13	2	2	1	1	54	*8.2*	63	*9.5*
Apulia	30	25	7	9	4	1	0	0	41	*6.3*	35	*5.3*
Basilicata	4	4	1	2	0	0	0	0	5	*0.8*	6	*0.9*
Calabria	15	15	2	1	1	1	0	0	18	*2.7*	17	*2.6*
Sicily	50	53	7	7	1	1	1	1	59	*9.0*	62	*9.3*
Sardinia	17	16	2	0	0	0	0	0	19	*2.9*	16	*2.4*
Italy	**402**	**414**	**175**	**171**	**58**	**61**	**20**	**19**	**655**	***100***	**665**	***100***
% of national volume	*61.4*	*62.3*	*26.7*	*25.7*	*8.9*	*9.2*	*3.1*	*2.9*	*100.0*		*100.0*	

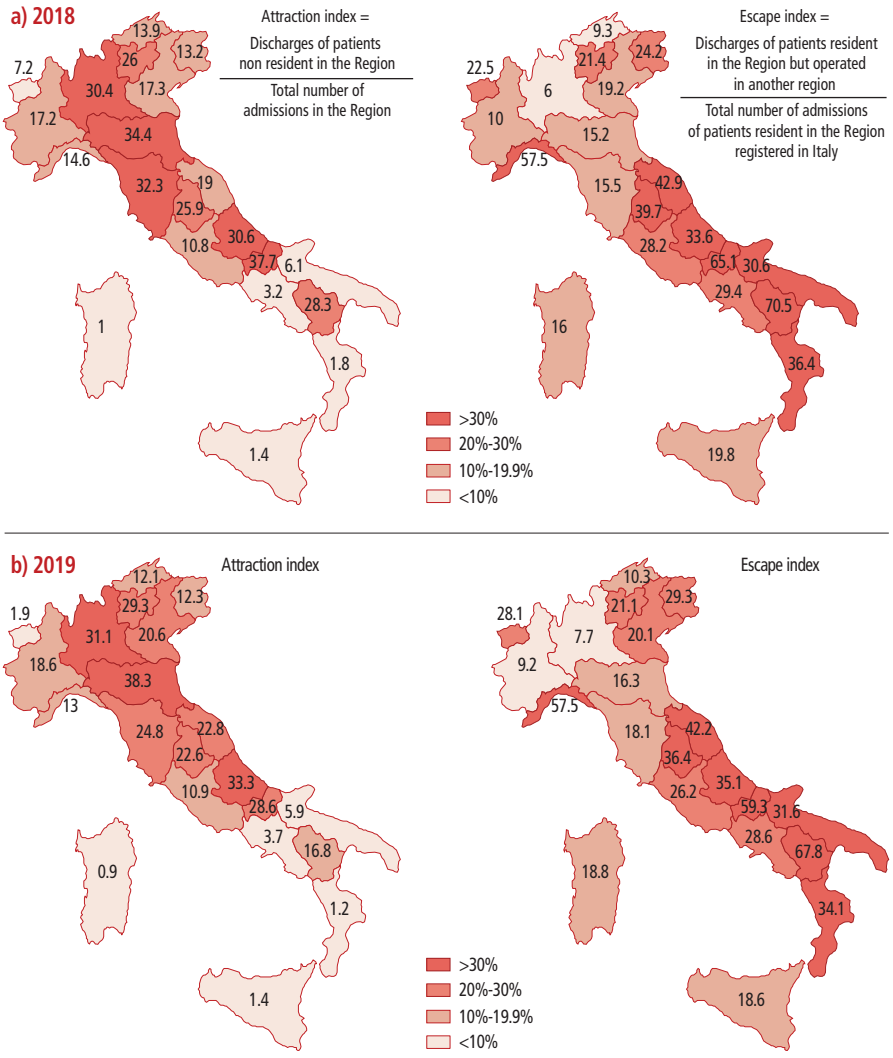
Table 5. Hip. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2018 and 2019

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
	%	%	%	%	%	%	%	%	%	%
Gender										
Male	46.7	46.8	27.1	28.1	27.4	28.0	40.3	39.6	40.0	40.3
Female	53.3	53.2	72.9	71.9	72.6	72.0	59.7	60.4	60.0	59.7
Age (male)										
Mean age	65.4	65.5	71.6	71.9	83.5	84.1	69.7	69.9	68.9	69.1
Standard deviation	11.8	11.8	12.1	11.9	8.9	8.0	12.4	12.6	13.2	13.2
Age group										
0-44	4.9	4.7	1.9	2.2	0.6	0.2	3.7	3.6	3.9	3.8
45-54	13.7	13.8	8.6	6.6	0.8	0.6	8.9	9.2	11.1	11.0
55-64	24.6	24.6	15.7	16.0	2.1	1.7	17.6	16.9	20.0	20.0
65-74	32.5	32.5	27.7	28.9	7.1	6.7	29.4	28.5	28.0	28.0
75-84	22.0	21.8	32.7	32.8	37.4	37.5	31.5	32.5	25.8	25.7
85+	2.3	2.6	13.4	13.6	52.0	53.4	8.8	9.2	11.3	11.6
Age (female)										
Mean age	69.8	69.8	73.8	73.6	84.5	84.8	74.4	74.2	74.6	74.6
Standard deviation	10.7	10.7	9.5	9.4	7.1	7.0	10.7	11.0	11.6	11.6
Age group										
0-44	2.1	2.1	0.4	0.4	0.1	0.1	1.1	1.4	1.3	1.3
45-54	7.0	7.0	2.7	3.0	0.3	0.2	4.0	4.8	4.4	4.6
55-64	18.2	18.4	12.4	12.8	0.9	0.8	11.4	11.0	12.3	12.5
65-74	35.3	35.1	34.3	34.6	5.5	5.4	27.2	26.3	26.4	26.5
75-84	32.4	32.8	38.2	37.7	38.9	38.3	40.7	41.4	35.5	35.4
85+	4.9	4.7	12.1	11.5	54.2	55.2	15.6	15.1	20.1	19.8

Table 6. Hip. Percent distribution of hospital discharges by discharge type and by procedure type. 2018 and 2019

Discharge type	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
	%	%	%	%	%	%	%	%	%	%
Deceased	0.1	0.1	1.1	0.9	3.0	3.1	1.0	1.1	0.9	0.9
Ordinary discharge	50.1	51.6	51.4	49.9	44.9	42.8	50.2	49.0	49.1	49.3
Discharge to a Residential Care Facility	1.7	1.6	6.1	6.4	10.3	10.9	4.1	4.8	4.3	4.3
Discharge with home health services	0.1	0.2	0.2	0.5	0.3	0.7	0.2	0.6	0.1	0.3
Discharge against medical advice	0.1	0.2	0.4	0.3	0.4	0.3	0.3	0.3	0.2	0.2
Transfer to an acute admission unit of a different hospital	2.2	1.8	5.0	3.5	4.4	3.9	3.1	2.7	3.0	2.5
Transfer in the same hospital	27.4	26.5	11.0	11.5	10.8	10.7	22.2	21.4	21.7	21.2
Transfer to an inpatient rehabilitation facility	17.6	17.2	23.0	24.5	22.6	23.9	17.6	18.0	19.2	19.5
Discharge with integrated home care	0.7	0.8	1.9	2.4	3.3	3.6	1.4	2.0	1.5	1.7

Figure 1. Hip. Elective total replacement. Inter-regional mobility (attraction and escape indices) in 2018 (a) and in 2019 (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 by procedure type. 2018-2019

Region of admission	Total replacement			
	2018		2019	
	N	%	N	%
Piedmont	6,199	*7.9*	6,665	*8.0*
Aosta Valley	138	*0.2*	170	*0.2*
Lombardy	16,462	*21.0*	18,135	*21.9*
AP Bolzano	852	*1.1*	886	*1.1*
AP Trento	749	*1.0*	749	*0.9*
Veneto	8,010	*10.2*	8,126	*9.8*
Friuli Venezia Giulia	1,847	*2.4*	1,899	*2.3*
Liguria	1,453	*1.9*	1,400	*1.7*
Emilia-Romagna	8,270	*10.5*	9,025	*10.9*
Tuscany	7,846	*10.0*	7,639	*9.2*
Umbria	1,471	*1.9*	1,471	*1.8*
Marche	1,909	*2.4*	1,789	*2.2*
Lazio	6,236	*7.9*	6,585	*8.0*
Abruzzi	2,011	*2.6*	2,031	*2.5*
Molise	241	*0.3*	256	*0.3*
Campania	3,849	*4.9*	4,310	*5.2*
Apulia	3,586	*4.6*	3,370	*4.1*
Basilicata	259	*0.3*	243	*0.3*
Calabria	1,551	*2.0*	1,612	*1.9*
Sicily	4,120	*5.3*	5,079	*6.1*
Sardinia	1,401	*1.8*	1,388	*1.7*
Italy	**78,460**	***100***	**82,828**	***100***
% of national volume	*92.7*		*92.8*	

Revision				Total			
2018		2019		2018		2019	
N	%	N	%	N	%	N	%
565	9.2	538	8.4	6,764	8.0	7,203	8.1
16	0.3	9	0.1	154	0.2	179	0.2
1,476	24.0	1,598	25.0	17,938	21.2	19,733	22.1
87	1.4	89	1.4	939	1.1	975	1.1
42	0.7	40	0.6	791	0.9	789	0.9
511	8.3	523	8.2	8,521	10.1	8,649	9.7
121	2.0	108	1.7	1,968	2.3	2,007	2.2
179	2.9	183	2.9	1,632	1.9	1,583	1.8
774	12.6	867	13.6	9,044	10.7	9,892	11.1
748	12.1	713	11.1	8,594	10.2	8,352	9.4
91	1.5	106	1.7	1,562	1.8	1,577	1.8
76	1.2	111	1.7	1,985	2.3	1,900	2.1
452	7.3	415	6.5	6,688	7.9	7,000	7.8
82	1.3	111	1.7	2,093	2.5	2,142	2.4
6	0.1	8	0.1	247	0.3	264	0.3
242	3.9	300	4.7	4,091	4.8	4,610	5.2
211	3.4	162	2.5	3,797	4.5	3,532	4.0
17	0.3	7	0.1	276	0.3	250	0.3
71	1.2	109	1.7	1,622	1.9	1,721	1.9
324	5.3	327	5.1	4,444	5.3	5,406	6.1
70	1.1	73	1.1	1,471	1.7	1,461	1.6
6,161	***100***	**6,397**	***100***	**84,621**	***100***	**89,225**	***100***
7.3		7.2		100.0		100.0	

Table 8. Knee. Primary total replacement. Number of hospitals by region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2018	2019	2018	2019	2018	2019
	N	N	N	N	N	N
Piedmont	22	17	12	11	5	6
Aosta Valley	1	0	1	1	0	1
Lombardy	41	38	25	27	19	16
AP Bolzano	6	6	2	2	3	3
AP Trento	0	1	5	4	3	3
Veneto	20	21	15	11	7	9
Friuli Venezia Giulia	6	5	1	3	6	5
Liguria	10	7	1	0	6	6
Emilia-Romagna	21	22	17	13	11	11
Tuscany	17	15	12	14	8	7
Umbria	1	1	8	7	4	5
Marche	10	8	4	6	1	1
Lazio	48	53	13	14	13	11
Abruzzi	9	9	5	6	3	1
Molise	4	4	0	0	1	1
Campania	49	43	9	15	10	7
Apulia	25	21	6	6	7	10
Basilicata	4	5	1	0	1	1
Calabria	12	10	3	2	2	3
Sicily	41	40	9	10	8	10
Sardinia	14	13	2	2	1	1
Italy	**361**	**339**	**151**	**154**	**119**	**118**
% of national volume	*48.8*	*46.4*	*20.4*	*21.1*	*16.1*	*16.2*

201-300		>300		Total			
2018	2019	2018	2019	2018		2019	
N	N	N	N	N	%	N	%
6	4	6	8	51	*6.9*	46	*6.3*
0	0	0	0	2	*0.3*	2	*0.3*
8	10	15	16	108	*14.6*	107	*14.7*
1	1	0	0	12	*1.6*	12	*1.6*
0	0	0	0	8	*1.1*	8	*1.1*
1	1	9	9	52	*7.0*	51	*7.0*
1	1	1	1	15	*2.0*	15	*2.1*
1	2	0	0	18	*2.4*	15	*2.1*
9	8	5	8	63	*8.5*	62	*8.5*
2	3	10	10	49	*6.6*	49	*6.7*
1	1	0	0	14	*1.9*	14	*1.9*
2	2	1	1	18	*2.4*	18	*2.5*
0	2	5	5	79	*10.7*	85	*11.6*
1	1	2	3	20	*2.7*	20	*2.7*
0	0	0	0	5	*0.7*	5	*0.7*
3	5	1	0	72	*9.7*	70	*9.6*
4	2	1	1	43	*5.8*	40	*5.5*
0	0	0	0	6	*0.8*	6	*0.8*
2	1	1	2	20	*2.7*	18	*2.5*
6	6	1	2	65	*8.8*	68	*9.3*
2	2	1	1	20	*2.7*	19	*2.6*
50	**52**	**59**	**67**	**740**	***100***	**730**	***100***
6.8	*7.1*	*8.0*	*9.2*	*100.0*		*100.0*	

Table 9. Knee. Revision. Number of hospitals by Region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume											
	1-10		11-25		26-50		>50		Total			
	2018	2019	2018	2019	2018	2019	2018	2019	2018		2019	
	N	N	N	N	N	N	N	N	N	%	N	%
Piedmont	26	24	7	10	9	9	0	0	42	*7.3*	43	*7.5*
Aosta Valley	1	1	1	0	0	0	0	0	2	*0.3*	1	*0.2*
Lombardy	61	67	17	12	7	7	7	8	92	*16.1*	94	*16.3*
AP Bolzano	6	5	4	4	0	0	0	0	10	*1.7*	9	*1.6*
AP Trento	7	7	0	1	0	0	0	0	7	*1.2*	8	*1.4*
Veneto	32	31	6	10	3	3	2	1	43	*7.5*	45	*7.8*
Friuli Venezia Giulia	10	7	1	4	2	0	0	0	13	*2.3*	11	*1.9*
Liguria	9	10	4	3	1	1	1	1	15	*2.6*	15	*2.6*
Emilia-Romagna	36	33	15	16	4	4	2	4	57	*10.0*	57	*9.9*
Tuscany	23	22	8	7	4	6	5	3	40	*7.0*	38	*6.6*
Umbria	10	11	1	1	1	1	0	0	12	*2.1*	13	*2.3*
Marche	14	9	1	3	0	1	0	0	15	*2.6*	13	*2.3*
Lazio	45	43	6	6	4	3	1	1	56	*9.8*	53	*9.2*
Abruzzi	11	10	3	4	0	0	0	0	14	*2.4*	14	*2.4*
Molise	3	3	0	0	0	0	0	0	3	*0.5*	3	*0.5*
Campania	39	39	6	7	0	1	0	0	45	*7.9*	47	*8.1*
Apulia	24	29	6	4	0	0	0	0	30	*5.2*	33	*5.7*
Basilicata	4	2	0	0	0	0	0	0	4	*0.7*	2	*0.3*
Calabria	13	10	1	5	0	0	0	0	14	*2.4*	15	*2.6*
Sicily	35	40	6	9	2	1	0	0	43	*7.5*	50	*8.7*
Sardinia	14	11	1	2	0	0	0	0	15	*2.6*	13	*2.3*
Italy	**423**	**414**	**94**	**108**	**37**	**37**	**18**	**18**	**572**	***100***	**577**	***100***
% of national volume	*74.0*	*71.8*	*16.4*	*18.7*	*6.5*	*6.4*	*3.1*	*3.1*	*100.0*		*100.0*	

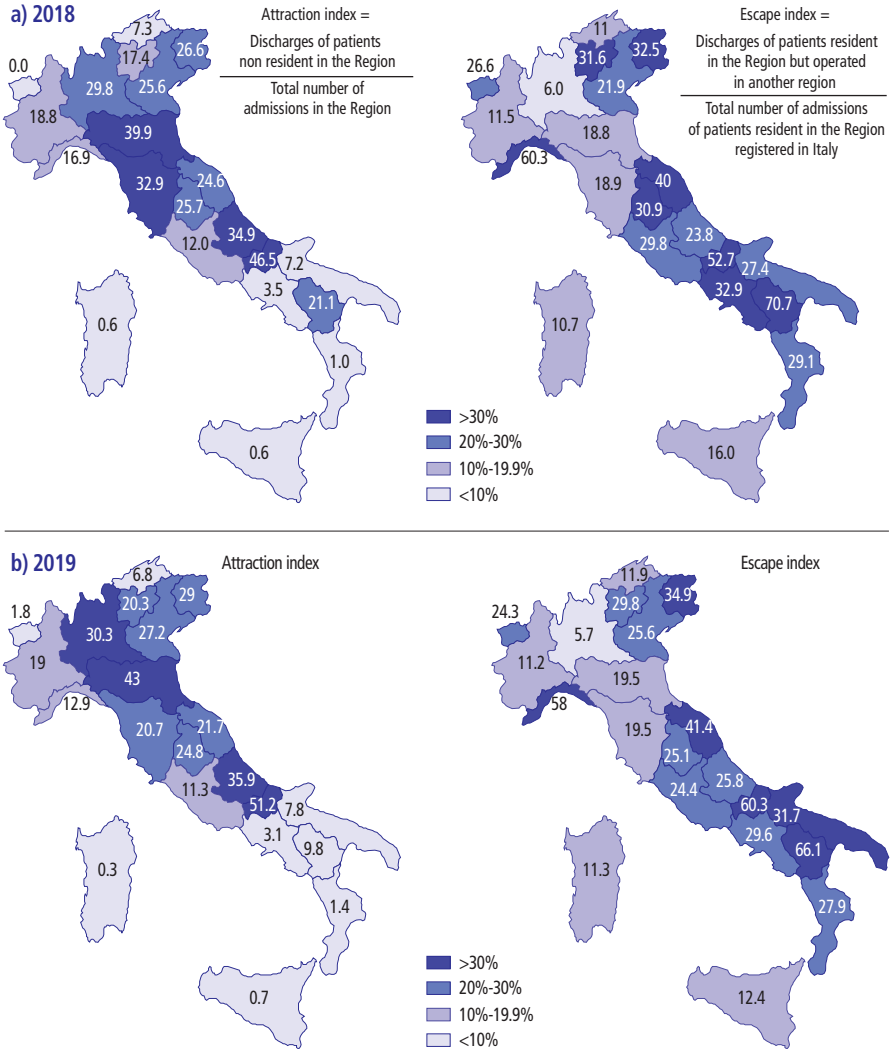
Table 10. Knee. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2018 and 2019

	Total replacement		Revision		Total	
	2018	2019	2018	2019	2018	2019
	%	%	%	%	%	%
Gender						
Male	33.3	33.7	32.6	33.4	33.2	33.7
Female	66.7	66.3	67.4	66.6	66.8	66.3
Age (male)						
Mean age	69.4	69.5	69.2	68.9	69.4	69.5
Standard deviation	9.1	10.8	10.8	11.2	9.3	10.9
Age group						
0-44	1.1	1.0	2.8	2.9	1.2	1.1
45-54	5.2	5.6	7.2	6.8	5.3	5.6
55-64	19.9	20.1	16.1	18.7	19.7	20.0
65-74	42.2	41.1	38.7	37.9	41.9	40.9
75-84	30.0	30.3	32.6	30.8	30.2	30.3
85+	1.7	1.9	2.5	3.0	1.7	2.0
Age (female)						
Mean age	70.8	70.8	70.8	70.8	70.8	70.8
Standard deviation	8.2	8.2	9.0	9.3	8.3	8.3
Age group						
0-44	0.4	0.4	0.8	1.0	0.4	0.4
45-54	3.4	3.4	4.0	4.1	3.4	3.4
55-64	16.5	16.7	16.1	16.8	16.5	16.7
65-74	44.1	43.7	42.3	41.1	43.9	43.6
75-84	33.6	33.6	33.3	33.0	33.6	33.6
85+	2.0	2.2	3.6	3.9	2.1	2.3

Table 11. Knee. Percent distribution of hospital discharges by discharge type and by procedure type. 2018 and 2019

Discharge type	Total replacement (elective)		Revision		Total	
	2018	2019	2018	2019	2018	2019
	%	%	%	%	%	%
Deceased	0.0	0.0	0.2	0.2	0.0	0.0
Ordinary discharge	48.5	49.0	50.0	50.2	48.6	49.1
Discharge to a Residential Care Facility	1.2	1.3	1.4	1.1	1.2	1.3
Discharge with home health services	0.0	0.1	0.1	0.2	0.0	0.1
Discharge against medical advice	0.1	0.1	0.1	0.1	0.1	0.1
Transfer to an acute admission unit of a different hospital	2.0	1.6	2.2	1.7	2.0	1.6
Transfer in the same hospital	30.6	30.8	29.9	30.2	30.5	30.8
Transfer to an inpatient rehabilitation facility	17.0	16.4	15.5	15.6	16.9	16.3
Discharge with integrated home care	0.6	0.6	0.6	0.8	0.6	0.6

Figure 2. Knee. Total replacement. Inter-regional mobility (attraction and escape indices) in 2018 (a) and in 2019 (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 by procedure type. 2018-2019

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2018		2019		2018		2019	
	N	%	N	%	N	%	N	%
Piedmont	669	*10.0*	744	*10.1*	162	*7.6*	176	*7.3*
Aosta Valley	6	*0.1*	6	*0.1*	0	*0.0*	1	*0.0*
Lombardy	1,291	*19.2*	1,208	*16.4*	436	*20.5*	465	*19.2*
AP Bolzano	45	*0.7*	37	*0.5*	13	*0.6*	11	*0.5*
AP Trento	37	*0.6*	46	*0.6*	34	*1.6*	28	*1.2*
Veneto	509	*7.6*	666	*9.1*	190	*8.9*	219	*9.0*
Friuli Venezia Giulia	135	*2.0*	130	*1.8*	35	*1.6*	51	*2.1*
Liguria	64	*1.0*	92	*1.3*	20	*0.9*	29	*1.2*
Emilia-Romagna	965	*14.4*	1,031	*14.0*	186	*8.7*	224	*9.3*
Tuscany	708	*10.5*	723	*9.8*	97	*4.6*	103	*4.3*
Umbria	98	*1.5*	106	*1.4*	36	*1.7*	40	*1.7*
Marche	146	*2.2*	151	*2.1*	67	*3.1*	95	*3.9*
Lazio	750	*11.2*	803	*10.9*	242	*11.4*	246	*10.2*
Abruzzi	176	*2.6*	215	*2.9*	57	*2.7*	55	*2.3*
Molise	6	*0.1*	10	*0.1*	9	*0.4*	6	*0.2*
Campania	396	*5.9*	511	*7.0*	124	*5.8*	178	*7.4*
Apulia	245	*3.6*	293	*4.0*	178	*8.4*	191	*7.9*
Basilicata	15	*0.2*	11	*0.1*	4	*0.2*	17	*0.7*
Calabria	89	*1.3*	71	*1.0*	44	*2.1*	32	*1.3*
Sicily	322	*4.8*	452	*6.2*	161	*7.6*	222	*9.2*
Sardinia	43	*0.6*	43	*0.6*	33	*1.6*	31	*1.3*
Italy	**6,715**	***100***	**7,349**	***100***	**2,128**	***100***	**2,420**	***100***
% of national volume	*66.2*		*66.7*		*21.0*		*22.0*	

Partial replacement				Total			
2018		2019		2018		2019	
N	%	N	%	N	%	N	%
42	*3.2*	41	*3.3*	873	*8.6*	961	*8.7*
0	*0.0*	0	*0.0*	6	*0.1*	7	*0.1*
146	*11.2*	107	*8.6*	1,873	*18.5*	1,780	*16.2*
13	*1.0*	13	*1.0*	71	*0.7*	61	*0.6*
17	*1.3*	12	*1.0*	88	*0.9*	86	*0.8*
396	*30.5*	394	*31.6*	1,095	*10.8*	1,279	*11.6*
27	*2.1*	49	*3.9*	197	*1.9*	230	*2.1*
6	*0.5*	1	*0.1*	90	*0.9*	122	*1.1*
100	*7.7*	82	*6.6*	1,251	*12.3*	1,337	*12.1*
62	*4.8*	67	*5.4*	867	*8.5*	893	*8.1*
83	*6.4*	79	*6.3*	217	*2.1*	225	*2.0*
46	*3.5*	21	*1.7*	259	*2.6*	267	*2.4*
96	*7.4*	91	*7.3*	1,088	*10.7*	1,140	*10.4*
20	*1.5*	24	*1.9*	253	*2.5*	294	*2.7*
4	*0.3*	6	*0.5*	19	*0.2*	22	*0.2*
121	*9.3*	151	*12.1*	641	*6.3*	840	*7.6*
73	*5.6*	56	*4.5*	496	*4.9*	540	*4.9*
1	*0.1*	1	*0.1*	20	*0.2*	29	*0.3*
5	*0.4*	4	*0.3*	138	*1.4*	107	*1.0*
25	*1.9*	36	*2.9*	508	*5.0*	710	*6.4*
17	*1.3*	10	*0.8*	93	*0.9*	84	*0.8*
1,300	***100***	**1,245**	***100***	**10,143**	***100***	**11,014**	***100***
12.8		*11.3*		*100.0*		*100.0*	

Table 13. Shoulder. Total replacement. Number of hospitals by Region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2018	2019	2018	2019	2018	2019
	N	N	N	N	N	N
Piedmont	10	7	7	10	7	8
Aosta Valley	2	2	0	0	0	0
Lombardy	21	25	30	29	14	10
AP Bolzano	4	3	1	4	1	0
AP Trento	3	3	2	2	0	1
Veneto	9	6	6	9	12	10
Friuli Venezia Giulia	1	4	5	2	2	3
Liguria	5	7	6	5	0	1
Emilia-Romagna	12	15	16	13	6	8
Tuscany	16	12	5	10	3	2
Umbria	3	3	3	4	2	1
Marche	5	4	6	7	1	1
Lazio	26	35	14	16	6	7
Abruzzi	5	5	6	3	3	5
Molise	1	0	2	1	0	1
Campania	17	21	10	12	5	1
Apulia	14	7	7	9	5	1
Basilicata	2	0	1	3	1	1
Calabria	4	5	6	6	4	1
Sicily	25	22	13	14	3	9
Sardinia	8	4	1	4	1	0
Italy	**193**	**190**	**147**	**163**	**76**	**71**
% of national volume	*32.8*	*30.9*	*25.0*	*26.5*	*12.9*	*11.6*

15-24		>24		Total			
2018	2019	2018	2019	2018		2019	
N	N	N	N	N	%	N	%
10	9	8	8	42	*7.1*	42	*6.8*
0	0	0	0	2	*0.3*	2	*0.3*
13	16	18	19	96	*16.3*	99	*16.1*
2	1	0	0	8	*1.4*	8	*1.3*
3	1	0	1	8	*1.4*	8	*1.3*
13	10	7	13	47	*8.0*	48	*7.8*
2	4	2	1	12	*2.0*	14	*2.3*
2	1	0	1	13	*2.2*	15	*2.4*
7	6	16	15	57	*9.7*	57	*9.3*
3	3	10	11	37	*6.3*	38	*6.2*
3	2	1	2	12	*2.0*	12	*2.0*
4	3	1	2	17	*2.9*	17	*2.8*
6	5	9	11	61	*10.4*	74	*12.1*
0	1	4	4	18	*3.1*	18	*2.9*
0	0	0	0	3	*0.5*	2	*0.3*
5	3	6	11	43	*7.3*	48	*7.8*
2	10	6	3	34	*5.8*	30	*4.9*
0	0	0	0	4	*0.7*	4	*0.7*
1	2	1	0	16	*2.7*	14	*2.3*
2	2	4	8	47	*8.0*	55	*9.0*
0	0	1	1	11	*1.9*	9	*1.5*
78	**79**	**94**	**111**	**588**	***100***	**614**	***100***
13.3	*12.9*	*16.0*	*18.1*	*100.0*		*100.0*	

Table 14. Shoulder. Partial replacement. Number of hospitals by Region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2018	2019	2018	2019	2018	2019
	N	N	N	N	N	N
Piedmont	13	14	3	1	0	1
Aosta Valley	0	0	0	0	0	0
Lombardy	31	34	5	3	1	2
AP Bolzano	6	5	0	0	0	0
AP Trento	3	5	1	0	0	0
Veneto	15	15	7	11	2	6
Friuli Venezia Giulia	5	6	3	5	0	0
Liguria	0	1	1	0	0	0
Emilia-Romagna	15	24	3	3	1	2
Tuscany	15	9	2	3	0	0
Umbria	4	4	1	1	1	0
Marche	5	4	2	0	2	1
Lazio	23	21	5	3	0	1
Abruzzi	9	7	1	1	0	0
Molise	3	2	0	0	0	0
Campania	16	17	6	1	0	1
Apulia	13	13	3	0	1	1
Basilicata	1	1	0	0	0	0
Calabria	4	2	0	0	0	0
Sicily	15	18	0	1	0	0
Sardinia	6	7	1	0	0	0
Italy	**202**	**209**	**44**	**33**	**8**	**15**
% of national volume	*74.0*	*77.1*	*16.1*	*12.2*	*2.9*	*5.5*

15-24		>24		Total			
2018	2019	2018	2019	2018		2019	
N	N	N	N	N	%	N	%
0	0	0	0	16	*5.9*	16	*5.9*
0	0	0	0	0	*0.0*	0	*0.0*
0	0	1	0	38	*13.9*	39	*14.4*
0	0	0	0	6	*2.2*	5	*1.8*
0	0	0	0	4	*1.5*	5	*1.8*
3	2	6	3	33	*12.1*	37	*13.7*
0	0	0	0	8	*2.9*	11	*4.1*
0	0	0	0	1	*0.4*	1	*0.4*
1	0	1	0	21	*7.7*	29	*10.7*
0	0	1	1	18	*6.6*	13	*4.8*
1	2	1	1	8	*2.9*	8	*3.0*
0	0	0	0	9	*3.3*	5	*1.8*
1	1	0	0	29	*10.6*	26	*9.6*
0	0	0	0	10	*3.7*	8	*3.0*
0	0	0	0	3	*1.1*	2	*0.7*
1	2	1	1	24	*8.8*	22	*8.1*
1	1	0	0	18	*6.6*	15	*5.5*
0	0	0	0	1	*0.4*	1	*0.4*
0	0	0	0	4	*1.5*	2	*0.7*
0	0	0	0	15	*5.5*	19	*7.0*
0	0	0	0	7	*2.6*	7	*2.6*
8	**8**	**11**	**6**	**273**	***100***	**271**	***100***
2.9	*3.0*	*4.0*	*2.2*	*100.0*		*100.0*	

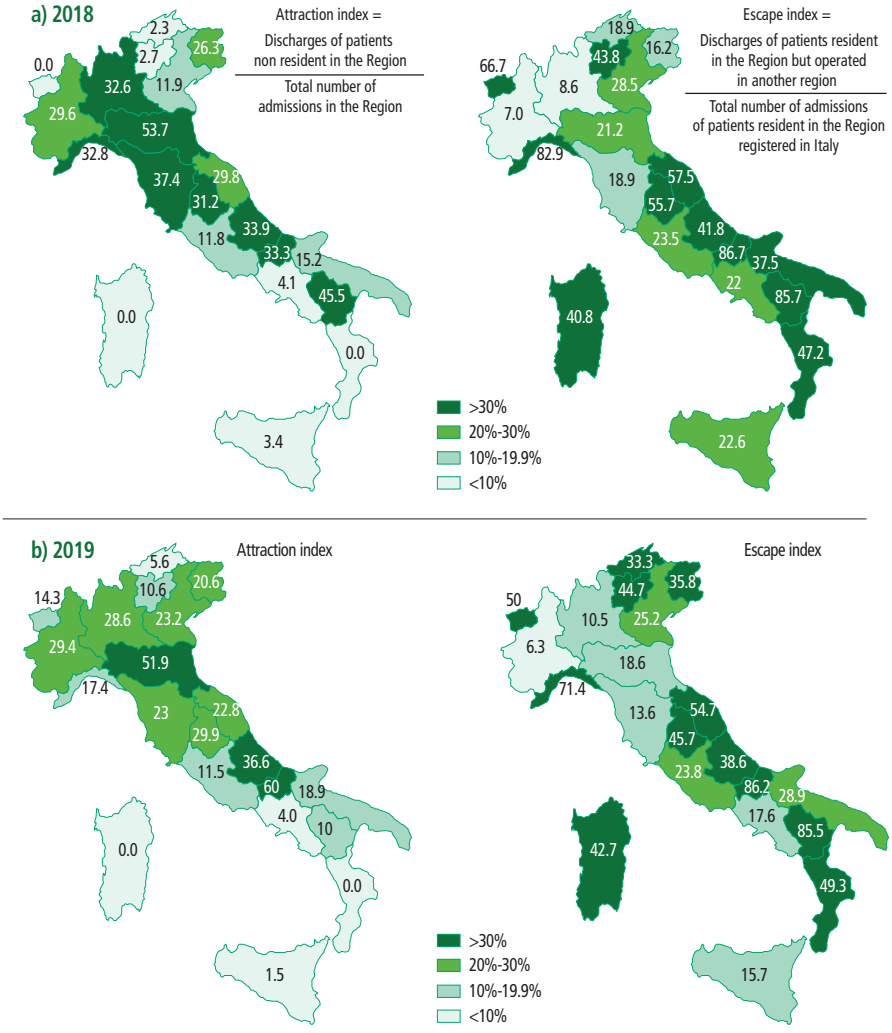
Table 15. Shoulder. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2018 and 2019

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2018	2019	2018	2019	2018	2019	2018	2019
	%	%	%	%	%	%	%	%
Gender								
Male	30.7	31.2	17.7	16.4	47.1	45.9	30.1	29.6
Female	69.3	68.8	82.3	83.6	52.9	54.1	69.9	70.4
Age (male)								
Mean age	69.1	68.8	72.2	72.6	63.4	63.0	68.3	68.3
Standard deviation	9.8	9.5	9.9	9.2	12.3	11.9	10.7	10.3
Age group								
0-44	1.9	2.1	1.1	0.3	6.0	6.5	2.6	2.6
45-54	6.0	6.1	4.3	3.0	16.2	13.7	7.8	7.0
55-64	17.1	20.0	13.6	15.9	31.9	30.8	19.7	21.4
65-74	44.3	41.8	37.3	32.8	32.5	32.7	41.1	39.1
75-84	29.6	28.8	37.6	41.2	12.6	14.9	27.2	27.9
85+	1.1	1.3	6.1	6.8	0.8	1.4	1.6	2.0
Age (female)								
Mean age	72.8	73.1	75.0	75.1	70.5	68.9	73.1	73.3
Standard deviation	7.5	7.2	7.3	7.1	10.7	10.8	8.0	7.7
Age group								
0-44	0.3	0.3	0.1	0.0	1.6	1.5	0.4	0.3
45-54	1.6	1.4	0.5	0.4	7.3	7.9	1.8	1.7
55-64	8.9	9.4	6.9	7.8	25.0	22.9	9.9	10.2
65-74	44.6	43.6	39.1	35.2	31.4	35.1	42.0	40.7
75-84	42.3	42.7	45.5	48.8	31.5	27.4	42.1	42.9
85+	2.4	2.6	8.0	7.8	3.2	5.2	3.8	4.2

Table 16. Shoulder. Percent distribution of hospital discharges by discharge type and by procedure type. 2018 and 2019

Discharge type	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2018	2019	2018	2019	2018	2019	2018	2019
	%	%	%	%	%	%	%	%
Deceased	0.0	0.0	0.4	0.2	0.0	0.1	0.1	0.1
Ordinary discharge	94.6	95.5	91.2	89.9	95.8	94.4	94.0	94.2
Discharge to a Residential Care Facility	0.3	0.3	1.6	2.1	0.7	0.8	0.6	0.7
Discharge with home health services	0.0	0.4	0.1	1.8	0.0	0.6	0.0	0.8
Discharge against medical advice	0.2	0.2	0.3	0.2	0.5	0.3	0.3	0.2
Transfer to an acute admission unit of a different hospital	0.3	0.2	0.9	0.8	0.6	0.7	0.4	0.4
Transfer in the same hospital	3.3	1.7	1.9	1.7	0.9	1.4	2.7	1.7
Transfer to an inpatient rehabilitation facility	1.3	1.3	2.8	2.3	0.9	1.4	1.5	1.6
Discharge with integrated home care	0.0	0.1	0.7	1.1	0.5	0.2	0.2	0.4

Figure 3. Shoulder. Elective total replacement. Inter-regional mobility (attraction and escape indices) in 2018 (a) and in 2019 (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 by procedure type. 2018-2019

Region of admission	Total replacement			
	2018		2019	
	N	%	N	%
Piedmont	33	*5.0*	34	*4.4*
Aosta Valley	0	*0.0*	0	*0.0*
Lombardy	254	*38.8*	310	*40.4*
AP Bolzano	2	*0.3*	2	*0.3*
AP Trento	13	*2.0*	16	*2.1*
Veneto	49	*7.5*	67	*8.7*
Friuli Venezia Giulia	2	*0.3*	2	*0.3*
Liguria	5	*0.8*	5	*0.7*
Emilia-Romagna	159	*24.3*	195	*25.4*
Tuscany	72	*11.0*	17	*2.2*
Umbria	0	*0.0*	1	*0.1*
Marche	3	*0.5*	6	*0.8*
Lazio	38	*5.8*	70	*9.1*
Abruzzi	1	*0.2*	3	*0.4*
Molise	0	*0.0*	1	*0.1*
Campania	12	*1.8*	8	*1.0*
Apulia	3	*0.5*	11	*1.4*
Basilicata	0	*0.0*	0	*0.0*
Calabria	2	*0.3*	3	*0.4*
Sicily	7	*1.1*	16	*2.1*
Sardinia	0	*0.0*	0	*0.0*
Italy	**655**	***100***	**767**	***100***
% of national volume	*100*		*100*	

Table 18. Ankle. Total replacement. Number of hospitals by Region of admission and by class of volume. 2018 and 2019

Region of admission	Class of volume			
	1-2		3-4	
	2018	2019	2018	2019
	N	N	N	N
Piedmont	5	6	3	0
Aosta Valley	0	0	0	0
Lombardy	17	13	5	5
AP Bolzano	1	2	0	0
AP Trento	2	1	0	0
Veneto	4	3	2	2
Friuli Venezia Giulia	1	2	0	0
Liguria	0	1	0	1
Emilia-Romagna	9	12	1	3
Tuscany	5	6	1	3
Umbria	0	1	0	0
Marche	3	1	0	0
Lazio	13	14	3	4
Abruzzi	1	2	0	0
Molise	0	1	0	0
Campania	6	4	1	1
Apulia	0	4	1	0
Basilicata	0	0	0	0
Calabria	2	0	0	1
Sicily	2	2	1	2
Sardinia	0	0	0	0
Italy	**71**	**75**	**18**	**22**
% of national volume	*65.7*	*62.0*	*16.7*	*18.2*

>4		Total			
2018	2019	2018		2019	
N	N	N	%	N	%
1	2	9	*8.3*	8	*6.6*
0	0	0	*0.0*	0	*0.0*
4	7	26	*24.1*	25	*20.7*
0	0	1	*0.9*	2	*1.7*
1	1	3	*2.8*	2	*1.7*
4	5	10	*9.3*	10	*8.3*
0	0	1	*0.9*	2	*1.7*
1	0	1	*0.9*	2	*1.7*
5	4	15	*13.9*	19	*15.7*
2	0	8	*7.4*	9	*7.4*
0	0	0	*0.0*	1	*0.8*
0	1	3	*2.8*	2	*1.7*
1	2	17	*15.7*	20	*16.5*
0	0	1	*0.9*	2	*1.7*
0	0	0	*0.0*	1	*0.8*
0	0	7	*6.5*	5	*4.1*
0	1	1	*0.9*	5	*4.1*
0	0	0	*0.0*	0	*0.0*
0	0	2	*1.9*	1	*0.8*
0	1	3	*2.8*	5	*4.1*
0	0	0	*0.0*	0	*0.0*
19	**24**	**108**	***100***	**121**	***100***
17.6	*19.8*	*100*		*100*	

Table 19. Ankle. Total replacement. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2018 and 2019

	Total replacement (elective)	
	2018	2019
	%	%
Gender		
Male	56.9	57.2
Female	43.1	42.8
Age (male)		
Mean age	53.5	56.2
Standard deviation	15.0	14.1
Age group		
0-19	1.6	0.9
20-39	15.6	10.3
40-49	21.0	21.2
50-59	26.3	21.9
60-69	19.1	26.4
70-79	14.0	17.1
80+	2.4	2.3
Age (female)		
Mean age	56.6	57.6
Standard deviation	14.8	14.4
Age group		
0-19	2.8	2.7
20-39	8.5	9.5
40-49	17.0	11.0
50-59	29.1	27.1
60-69	23.0	30.8
70-79	16.7	16.8
80+	2.8	2.1

Table 20. Ankle. Total replacement. Percent distribution of hospital discharges by discharge type and by procedure type. 2018 and 2019

Discharge type	Total replacement (elective)	
	2018	2019
	%	%
Deceased	0.0	0.0
Ordinary discharge	98.5	96.3
Discharge to a Residential Care Facility	0.0	0.4
Discharge with home health services	0.0	0.1
Discharge against medical advice	0.0	0.5
Transfer to an acute admission unit of a different hospital	0.2	0.1
Transfer in the same hospital	0.8	1.3
Transfer to an inpatient rehabilitation facility	0.6	1.2
Discharge with integrated home care	0.0	0.0