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Data 2007-2021



Italian Arthroplasty Registry

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Data 2007-2021

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This summary provides a brief overview of the RIAP Cumulative Report 2022 and contains the main tables and figures summarising the data collected over the period 2007-2021.

The full Report is available in Italian only ([click here](#)).

Technical Appendix 2A provides an analysis of national Hospital Discharge Data for 2020 and 2021. Technical Appendix 2D shows changes over time in RIAP *coverage* and *completeness* at national level and in *coverage*, *completeness*, *accuracy* on interventions and devices for all institutions participating in RIAP from 2007 to 2021.

RIAP: the most important things to know

Why a Registry, and why a National Registry?

Joint replacement is an accepted solution for treating joint disease and restoring function.

In Italy, as in many other countries, the number of patients undergoing joint replacement surgery is steadily increasing.

Arthroplasty registries are an important tool for assessing the true outcomes of both primary and revision procedures, monitoring the safety and performance of implants and quickly recalling patients in the event of implant failure or risk. In Italy, patients are often operated on in a different region to the one in which they live. Therefore, complete linkage of all primary and revision procedures and monitoring of the associated implanted devices can only be achieved through a national registry. To ensure that all patients are monitored, the *completeness* and *coverage* of the registry should be close to 100%, which can only be achieved if data collection is mandatory. The experience of some regions participating in RIAP (Apulia, Campania and Sicily) has shown that, following the adoption of regional legislation linking the reimbursement of the proce-

dures to its inclusion in the registry, the regional *completeness* increased dramatically to levels above 90%.

What is RIAP?

The Italian Arthroplasty Registry (Registro Italiano ArtroProtesi, RIAP) was established in 2006 within the framework of a collaboration between the Italian Ministry of Health, Directorate General 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 creating a national data collection system to help monitor the safety and survival of implanted joint prostheses and, therefore, the health of patients. Since 2006, the DGDMF has supported a series of studies aimed at progressively implementing the collection of hip, knee, shoulder and ankle procedures in the registry.

RIAP currently collects data on primary, removal and revision hip, knee, shoulder and ankle procedures. Although the participation of the institutions involved is voluntary, today RIAP represents the largest database of its kind in Italy and is one of the registries included in the National Registry of Implantable Prostheses (Registro Nazionale delle Protesi Impiantabili,

RIPI), established at the Italian National Institute of Health (Istituto Superiore di Sanità, ISS) by the Italian Prime Minister Decree (DPCM) 3/3/2017. RIPI accomplishes what required by the EU Medical Device Regulation 2017/745 (MDR), which highlights the role of registries as tools to protect patient health and safety. Once the RIPI regulation foreseen by the DPCM 3/3/2017 enters into force, data collection will become mandatory at national level, thus ensuring a complete data collection.

Over the last four years, RIAP has been the model for the development of the methodological framework of other registries included in RIPI: the Italian Spinal Implant Registry (Registro Italiano Dispositivi Implantabili per chirurgia Spinale, RIDIS), the Italian Implantable Cardioverter-defibrillator and Pacemaker Registry (Registro Italiano Defibrillatori e Pacemaker, RIDEP), the Italian Implantable Hearing Device Registry (RIDIU) and the Italian Craniofacial Implant Registry (RICRAF). RIAP has also been used as the basis for the development of the National Registry of Breast Implants (Registro Nazionale degli Impianti Protesici Mammari, RNPM), managed and coordinated by the Ministry of Health, with mandatory data collection since January 2023.

What are the goals?

RIAP has two main objectives: to assess the long-term effectiveness and safety of hip, knee, shoulder and ankle joint prostheses by measuring the implant survival rate, and to help regions and hospitals recall patients in case of a prosthesis-related adverse event. To this end, patients undergoing surgery at centres participating in RIAP are registered and followed over time to detect any failure of the implanted device. Currently, the data collected by RIAP allows to implement survival analysis in some participating regions. In the event of a device recall, RIAP can provide the participating regions with a list of pseudonyms identifying patients who have been implanted with the recalled device in that region.

What information is collected?

The Information collected includes the Hospital Discharge Record (HDR, in Italian: Scheda di Dimissione Ospedaliera - SDO) and an additional Minimum Data Set (MDS) including technical aspects of the surgery, the operated side and information to identify and describe the implanted device for each of the joints.

All personal patient data are processed and handled by RIAP in line with the General Data Protection Regulation (EU-GDPR 2016/679). Currently, pending the entry into force of RIPI

regulation, informed consent of the patient is required. Clinical, health and demographic data are processed in a manner that ensures the highest level of confidentiality, in compliance with the security requirements for digital and paper-based archiving systems.

How is RIAP organised?

RIAP is a federation of regional registries that participate in data collection on a voluntary basis. They are centrally coordinated by the ISS to ensure standard procedures for data collection, submission and processing. For the collection and transmission of MDS data, the ISS has developed and made available to the participating institutions the RaDaR platform (Raccolta Dati Ricoveri, in English: Hospitalizations Data Collection) and the SOnAR application (Sincronizzazione Online Automatica dei Ricoveri, in English: Automatic Online Synchronisation of Hospitalisations). All technical documents related to the organisation and transmission of RIAP data and the updated procedures are available on the RIAP website.

Currently, participation in the Registry is voluntary, which hinders the achievement of high *completeness* rates and the registration of all prostheses implanted at national level.

The RIAP organisational model can be extended to other fields beyond arthroplasty, especially where implant procedures are mainly performed in centres of the National Health System that are required to provide the HDR.

How is the implanted device identified and characterised?

A key element of the RIAP flow is the RIAP-DM Dictionary, which assists healthcare operators in the registration of implanted devices. The RIAP-DM Dictionary is a database containing information provided by implant manufacturers that allows the identification and characterisation of each implanted device. The data contained in the RIAP-DM Dictionary, which is accessible to all healthcare operators, is regularly updated and validated with the National Database of Medical Devices of the Ministry of Health.

[Here](#) you can find the Report summaries (Addendum) of years 2014-2021.

RIAP today: an evolving pathway

For the first time and in line with other international registries, the RIAP Cumulative Report 2022 covers the whole period of the Registry's activity, from 2007 (the year data collection started) to 2021, and presents both its complex path of evolution and the analysis of all the data collected.

Key achievements

Here is a summary of the main activities and achievements over the period 2007-2021:

Enrollment of missing Regions. The number of regions and institutions participating in RIAP has varied over time and the enrollment of missing regions has been continuously encouraged. Initially, only those regions that had already started their own regional registries (Lombardy, Emilia-Romagna and Apulia) were involved. However, over a period of 15 years, a total of 16 regions, three Local Health Units (Azienda Sanitaria Locale – ASL) and three hospitals have been contributing in some way to RIAP by sending collected data. Unfortunately, some of them have left the project or have been forced to stop sending data for several reasons (lack of human resources, reorganisation of health management at regional level,

difficulties emerging in the application of privacy legislation, etc.). Despite this fragmentary picture, the establishment of six new regional registries within a decade (Apulia in 2010, Autonomous Province of Bolzano in 2011, Calabria in 2013, Campania in 2016, Autonomous Province of Trento in 2018, Sicily in 2021) undoubtedly represents a success, also thanks to the intensive awareness-raising activities carried out by the RIAP Research group and the interested Scientific societies (Figure 1.1).

RIAP as a reference to develop other RIPI research lines. RIAP is recognised as the 'pathfinder' for the development of other medical device registries that have already been or will be included in the broader context of the National Registry of Implantable Prostheses (RIPI). Over the last four years, the Technical Panels of RIDIS, RIDEP and, more recently, RIDIU have met regularly to define i) the model for data collection following the RIAP dataflow (Figure 1.2); ii) the information to be collected in addition to that included in the HDR; iii) the structure of the specific DM Dictionary. In addition, the Technical Panel of RICRAF, set up in January 2023, has defined the first steps to be taken to implement the registry.

RIAP Dictionary update and collaboration with the National Joint Registry (NJR). The RIAP-

DM Dictionary is regularly updated with data necessary for device traceability, thanks to the contribution of implant manufacturers. On 31/12/2022, the RIAP-DM Dictionary contained over 90,000 product codes submitted by more than 40 companies representing over 90 manufacturers. In 2021, RIAP signed an agreement with the English National Joint Registry (NJR, UK), completing a long collaboration that began in 2016. Thanks to this agreement, the RIAP-DM Dictionary will be completed with the technical characteristics of medical devices necessary to carry out comparative analysis of performance. To this end, RIAP will be able to access and, if necessary, feed the NJR Component Library, already created in collaboration with the German Arthroplasty Registry (Endoprothesen Register Deutschland, EPRD).

Updating of web applications, design of a new IT platform. The data flow infrastructure and tools to support data collection have been continuously updated and improved (Figure 1.2). The web applications developed to support MDS collection and data transfer from the RIAP participating institutions to the ISS have also been regularly updated, based on suggestions from the RIAP Scientific Committee. In addition, the project plan for a new IT platform has been finalised (Bacocco DL, Carrani E, Cicciani B, Di Sanzo P, Leotta F, Torre M. Design

and implementation of the new Italian health-care digital interoperable registry for implantable medical devices. *Softw Pract Exper.* 2022; 52(11): 2368–2392. doi:10.1002/spe.3130). The RaDaR and SOnAR IT platforms, already used for the collection and transfer of RIAP data, will be integrated into a single platform capable of integrating all data flows from the different registries included in the RIPI framework.

Collaboration with the Ministry of Health. RIAP activities have been continuously supported by the Italian Ministry of Health and the RIAP team has contributed with its experience to the implementation of the data collection platform of the National Registry of Breast Implants (Registro Nazionale delle Protesi Mammarie, RNPM). More recently, the Ministry of Health has supported the RIAP team in the drafting of the RIPI Regulation.

Participation in international projects and networks and dissemination of results. The results of the RIAP activities have been systematically disseminated over the period 2007-2021 and the Registry's participation in international projects/networks has always been actively promoted. At the international level, RIAP is currently strongly involved in the activities of:

- i) the International Society of Arthroplasty Registries (ISAR), of which it has been a member since 2013, through participation in the Annual congresses, during which important scientific results achieved by the arthroplasty registries of the various countries are shared, and at the Steering Committee meetings by the RIAP scientific responsible as member at large;
- ii) the Network of Orthopaedic Registries of Europe (NORE), since 2017, a collaboration aimed at supporting the development of registries in European countries through regular participation in meetings;
- iii) the Orthopaedic Data Evaluation Panel (ODEP), since 2016, whose aim is to collaborate with surgeons, manufacturers and hospitals and to promote evidence-based implant selection so that patients can receive the best and safest implants;
- iv) the project 'Coordinating Research and Evidence for Medical Devices (CORE-MD)' (Horizon 2020, grant agreement no. 965246, 1 April 2021-31 March 2024), of which RIAP is a member, aiming at supporting the European Commission in the implementation of the European Regulation 2017/745.

The RIDIS project group explored also the possibility of a collaboration with EUROSPINE team to develop an international database of spinal surgery implantable devices following the example of the collaboration with the NJR.

As an ISAR member registry, RIAP has recently been invited to complete a form reporting a short and standardised registry description developed to improve the knowledge of existing registries, their activities, similarities and differences, and to facilitate understanding and use of harmonised registry data worldwide. This form has also been translated into Italian by the RIAP Research Group to facilitate its use by national stakeholders.

Communication. Has always played an important role among RIAP activities, with the aim of increasing the visibility of the registry among different audiences (patients, surgeons, decision-makers, scientific community, industry and others), raising awareness of importance of monitoring implantable devices, making the dialogue with patients more direct and highlighting the benefits of participating in the registry. Within the framework of a dedicated research project, a communication strategy for the RIAP has recently been developed, which is also applicable to other registries. Key elements of this strategy are: i) identify the communication pri-

orities of the registry and its stakeholders; ii) set up objectives to meet these needs; iii) continuously evaluate and measure the effectiveness of communication activities constantly.

RIPI Regulation. In 2021, the ISS President established an ISS working group to draft the

Regulation foreseen by the DPCM 3/3/2017 and required by the DL 179/2012. The Regulation, once published, will definitively solve the problem of poor adherence to the Registry by making data collection mandatory at the national level and RIAP a complete health data information flow.



ISAR template short registry description

This short registry description - to be published at the beginning of the annual report or on the registry website - gives an overview of the registry in English. It is intended to inform users of registry data (in particular regulatory agencies, notified bodies, health technology assessment agencies, clinicians, industry and others) about the type and structure of the registry, the quality of the registration and the outputs provided.

Registry name: Italian Arthroplasty Registry (RIAP)

Country/Region: Italy

Total population of area covered by the registry: 59 641 488 on 1 January 2020

Scope of registry: National

Website: <https://riap.iss.it/riap/en/>

Year started: 2006

Which joints does the registry cover: Hip;Knee;Shoulder;Ankle

Data owners: Public authority

Preferred contact: marina.torre@iss.it

Registry input

General

Funding: Public institution;Government

Patient consent: Opt-in

Data collection

Patient identifier: pseudonymised personal ID (from all the participating regions but Lombardy)

Possibility for linkage to other data sources: Yes routinely

Possibility to share data for research with external parties:

Individual data: No

Aggregate data: Yes

Source of implant details: Pre-specified list of implants;

Unique Device Identifier (UDI) recorded: No

Coverage

Definition: Coverage is a measure of the population that the registry system serves.

Coverage of hospital registration (%), (N participating/total N of hospitals): 32.5% at the national level

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Completeness

Definition: Completeness is a measure of how well the event(s) of interest in the population are captured. Content completeness is a measure of how well the individual data fields are captured.

Reference: United Nations. A review of key concepts: Coverage & completeness. 2016

Year or period latest coverage and completeness applies to: 2020

Completeness of procedure registration (%), (N procedures captured in registry/total N of procedures):

Primary hip procedures (%):	31.9	Revision hip procedures (%):	22.5
Primary knee procedures (%):	29.3	Revision knee procedures (%):	20.2
Shoulder procedures (%):	9.8	Revision shoulder procedures (%):	not available
Completeness other joints:	0		

Data source(s) for assessment of coverage and completeness: National database of Hospital Discharge Records

Proportion successful linkage revision-primary (%): Not calculated yet. We plan to perform this analysis for the next report for the regions providing the pseudonymised ID code (PA Bolzano, PA Trento, Campania, Puglia, Sicilia)

Response rates PROs hip elective procedures (%): Before surgery: 0; 1 year after surgery: 0; Both: 0

Response rates PROs knee elective procedures (%): Before surgery: 0; 1 year after surgery: 0; Both: 0

Response rates PROs shoulder elective procedures (%): Before surgery: 0; 1 year after surgery: 0; Both: 0

Registry output

Outcomes reported

Definition of revision that the registry applies: Surgery in which an element or all the elements of the prosthesis are removed and replaced

All-cause revision: No **Specific causes of revision assessed:** Yes

Reporting of cumulative incidence of revision (95%CI) by implant/implant combination: No

Minimum N of procedures per specific implant to be reported in annual report (for cumulated risk of revision): not applicable yet

Definition of reoperation that the registry applies: Reoperations are not captured

Reoperation: No **Specific causes of reoperation assessed:** No

Patient-reported outcomes: Generic: No, Joint-specific: No, Satisfaction: No

Implant outlier identification: No If Yes:

Reports/Publications

Annual report website: <https://riap.iss.it/riap/en/activities/reports/> (last report refers to data collected in 2020)

Link to website with registries' publications: <https://riap.iss.it/riap/en/activities/publications/>

Other (if any):

Key findings from the 2022 Annual Report

ANALYSIS OF THE RIAP DATA FROM 2007 TO 2021

The 2022 RIAP Report presents the cumulative results of the analysis of the data collected between 1.1.2007 and 31.12.2021.

The data presented in the 2022 RIAP Report refer to joint replacements (hip, knee and shoulder) from the following regions: Aosta Valley, Lombardy, AP Bolzano, AP Trento, Veneto, Emilia-Romagna, Tuscany, Marche, Lazio, Abruzzi, Campania, Apulia, Basilicata, Calabria, Sicily, and the following centres: Clinica Città di Alessandria, PO Universitario Santa Maria della Misericordia (Udine), Livio Sciuotto Foundation/ Spotorno Foundation (SV), San Feliciano Nursing Home (Rome), Villa Aurora Nursing Home (Rome), San Pietro Fatebenefratelli Hospital (Rome). Data collection started in 2007, mainly for hip and involving the three regions that already had regional registries established by that time (Apulia, Lombardy and Emilia-Romagna), to be gradually extended over the years to other joints and other institutions. Data collection for knee started in 2010 (some institutions also added data collected earlier to ensure a longer observation period). Data collection for shoulder started in 2017.

The number of institutions sending data increased from 189 in 2007 to 263 in 2021.

More specifically, the number of institutions collecting data on hip increased from 187 to 261 for hip (Table 2.1a), those collecting data on knee from 108 to 254 (Table 2.1b), and those collecting data on shoulder from 67 in 2017 to 117 in 2021 (Table 2.1c). Similarly, the number of surgeries recorded increased from 35,128 in 2007 to 67,790 in 2021: from 25,766 to 39,001 for hip, from 9,632 to 27,156 for knee, from 856 to 1,633 for shoulder. In 2019, a module for the ankle module was introduced in the RaDaR application. Only three interventions performed in 2019 by a centre in Campania (with a 100% centre *completeness*) were collected for this joint but were not included in the analysis.

As described in Figure 1.2, data are sent from the Regional Reference Centre (or the single institution from a Region not participating in RIAP) to the ISS for research and analysis using a web-based data entry interface. Each record submitted relates to a single joint replacement and is the result of the linkage between the HDR associated with the procedure performed and the MDS specific to each joint included in the RIAP (hip, knee, shoulder and ankle). To comply with personal data protection rules, each record is pseudonymised beforehand.

The data are then checked to eliminate any duplicates before undergoing a first quality audit on interventions (Figure 2.1) and then a quality audit on devices (Fig 2.2) only for those records that pass the quality audit on interventions.

Values for *coverage*, *completeness*, and *accuracy* on interventions and devices (see Glossary for their definition) were calculated for all participating regions and centres for all records that had passed the quality audit process for the period 2007-2021. Analyses of the time trend of the values for *coverage*, *completeness* and *accuracy* on interventions and devices are presented for the whole RIAP and for each participating institution (Appendix 2D of the REPORT RIAP 2022).

A total of 680,346 procedures were collected and admitted to the quality audit: 418,704 were hip procedures (Table 2.2a), 255,709 were knee procedures (Table 2.2b) and 5,933 were shoulder procedures (Table 2.2c). A total of 584,116 procedures, representing 85.9% of the records received, successfully passed the quality audit on interventions. A total of 366,980 procedures passed the quality audit on devices, representing 53.9% of the records received.

MAIN RESULTS FOR EACH SINGLE JOINT

Hip. Out of the 418,704 procedures collected, 352,843 were eligible for analysis. Primary procedures accounted for 93.9%, of which 76.1% were total replacements, 23.9% were partial replacements, and 6.1% were revisions. The most frequently operated side was the right one (52.6%), the most common surgical approach in total replacements was the posterolateral (53.3% in elective procedures, 47% in acute trauma). Hip fracture was diagnosed in 10.9% of total hip arthroplasties (acute trauma). The most common cause of primary total elective replacements was primary arthritis (87.6%), followed by necrosis of femoral head (4.4%) and congenital hip dislocation or dysplasia outcomes (3.2%). In partial replacements the diagnosis was femoral neck and/or head fracture (95.1%). In revisions, the diagnosis was aseptic loosening in 41% of cases, mostly of the cup (21.5%), followed by dislocation (13.5%), periprosthetic fracture (11%) and infection (7.6%). In total elective replacements the most common bearing combination was ceramic-polyethylene (55.5%). Regarding the type of device, the most commonly used were uncemented stems (80.6%); non-modular stems were the most commonly used (94.2% of uncemented stems and 95.6% of cemented stems) (Tables 2.3-2.13).

Knee. Out of the 255,709 procedures collected, 225,636 were eligible for analysis. Out of the primary procedures recorded, 77% were total knee replacements and 23% were unicompartmental. The most frequently operated side was the right one (52.8%), the most common surgical approach was the medial parapatellar (85.9% in total knee replacements, 77.4% in unicompartmental, 85.6% in revisions). In almost all primary procedures, primary arthrosis was reported as the main reason for surgery (94.4%). The cause of knee revision was aseptic loosening in 38% of the cases, infection in 18.5%, and pain in 18.2%. Regarding the type of device, a fixed tibial tray was implanted in 43.7% of primary replacements, cemented in 95.1% of cases (Tables 2.14-2.22).

Shoulder. Out of the 5,933 procedures collected, 5,637 were eligible for analysis. Primary procedures accounted for 97.9% of cases, and revisions for 2.1%. Out of primary interventions, 79.2% were total replacements, 5% were partial replacements. Reverse prostheses were most commonly used in total replacements: 84.7% in elective procedures, 96.6% in acute trauma procedures. The most frequently operated side was the right one (63.1%) and the deltopectoral surgical approach was used in 79.2% of cases (75.1% in total elective replacements; 87% in total replacements for

acute trauma; 65.5% in partial replacements; 87.6% in revisions). The main cause of primary shoulder replacements was eccentric osteoarthritis (39.4%), followed by fracture (34.1%); as for revisions, instability, aseptic loosening, infection and dislocation account for 74.4% of cases (Tables 2.23-2.31).

RIAP COVERAGE AND COMPLETENESS

A detailed analysis of RIAP *coverage*, *completeness* and *accuracy* on interventions and devices is presented in the Appendix 2D of the RIAP Report 2022 at both national and local level. *Coverage* and *completeness* were calculated taking into account all data received and admitted to the quality audit (raw data without duplicates), while *accuracy* on interventions and devices was calculated on data that passed the quality audit.

For both indicators of *coverage* and *completeness*, there has been an increase in the representativeness of RIAP at the national level over the years, reaching values of around 35% in recent years (Appendix 2D, Figure 1). The RIAP *completeness* for the whole period (2007-2021) was 25.0%: 27.1% for hip, 23.9% for knee and 5.7% for shoulder. The value for shoulder rises to 11.7% if only the actual data collection period starting in 2017 is considered. These values differ from those reported

in Chapter 2 (Tables 2.3, 2.14, 2.23), which were calculated only on the basis of data that passed the quality audit.

Looking at the data related only to institutions participating in RIAP compared to the total number of joint replacements performed in their areas of competence such as region, health local unit, hospital etc. (Appendix 2D, Figure 2), the RIAP *completeness* for the whole period (2007-2021) is 63.1% (61.5% for hip, 66.1% for knee and 55.0% for shoulder), the *accuracy* on interventions is 85.9% (84.3% for hip, 88.2% for knee and 95.0% for the shoulder) and the *accuracy* on devices is 53.9% (50.7% for hip, 59.1% for knee and 61.2% for shoulder).

Looking at the trend over time, the decreasing values are due to the inclusion of additional regions with a high surgery volume but initially low participation (varying over time as shown in Tables 2.1 and 2.2).

Figures 3-23 of Appendix 2D show the time trends in *coverage*, *completeness* and *accuracy* on interventions and devices for RIAP participating institutions.

The changes observed over time in all the indicators calculated at both local and national

level confirm that, pending the adoption of the national Regulation, the role that decision-makers at the local level can play in improving participation levels remains crucial.

Analysis of the data from the national Hospital Discharge Record Database

It is widely recognised that the HDR represents a rich source of information for performing statistical and epidemiological analyses in public health. In the context of RIAP, HDR provide a complete overview of joint replacements (hip, knee, shoulder, ankle) performed at the national level and allow to calculate registry *completeness* at both national and regional level.

Appendix 2A provides an overview of all procedures performed at the national level from 2001 to 2021 for all the ICD9-CM codes of principal and secondary procedures of interest for RIAP (hip, knee, shoulder and ankle) (Table 1). It also presents the results of detailed descriptive analysis performed on the HDR national database for the last two available years (2020 and 2021) (Tables 2-20; Figures 1-21).

For each joint, the tables show:

- the number of procedures performed by region;

- the number of hospitals by volume class and by region;
- the demographic characteristics of operated patients (gender, age);
- the percentage distribution of discharges by discharge type.

For each joint, the graphs show:

- attraction and escape indices by region (except for the ankle) to measure inter-regional mobility;
- hospitalisation and incidence rates by region;
- evolution of incidence and hospitalisation rates at the national level from 2001 to 2021.

Attraction and escape indices for each joint (Appendix 2A Figure 1 hip, Figure 8 knee, Figure 12 shoulder) were calculated considering only elective primary procedures registered as principal in the HDR. Data on the resident population used to calculate incidence and hospitalisation rates are available from the [ISTAT database](#).

The dramatic drop in the data shown for 2020 is due to the suspension of elective surgical activity since March 2020 in response to the Covid-19 pandemic. In 2021, there is an at-

tempt to return to pre-pandemic levels: the number of interventions compared to previous years is slightly lower for hip and knee, while an upward trend similar to pre-pandemic levels is observed for shoulder and ankle. It is difficult to determine whether all surgeries that had been postponed during the period of suspension of elective activity have now been performed. This information can only be obtained over time through studies specifically designed to assess this outcome.

The trends observed in previous years in terms of interregional mobility are confirmed in 2020 and 2021, with the northern regions having a higher attraction index for all joints.

Conclusions

The RIAP Annual Report 2022 is a cumulative document that represents an important milestone in the scientific production of RIAP, as it shows the evolution of RIAP over 16 years as a result of the synergistic work of the stakeholders involved, with the continuous support of the DGDMF. Thanks to the application of the Ontology-Based Data Management (OBDM) approach, it has been possible to gather all available data collected from 2007 to 2021 from different information sources in a single

central repository, thus providing a complete overview of the data collection. Therefore, despite the national average RIAP *completeness* of 25%, this report provides a first (and unique) epidemiological overview of joint replacement in Italy over 16 years.

RIAP has proven to be a consistent flow of information that, when fully operational, will allow the safety of implanted devices to be continuously monitored and patients to be traced in the event of adverse outcomes. RIAP is also recognised as a “pathfinder” for the development of the network of MD registries that have already been or will be included in the broader context of the National Italian Implantable Prostheses Registry (RIPI) (<http://ripi.iss.it>), established at the ISS by Prime Ministerial Decree 3/3/2017. With the publication of the RIPI regulation required by the Prime Ministerial Decree of 3/3/2017, data submission will become mandatory, allowing for the achievement of a complete and representative nationwide data collection. In fact, the cumulative data from 2007 to 2021 confirm that a relevant participation is registered only in those regions where the registration of procedures has been made mandatory by specific local laws.

One of the core functions of an arthroplasty registry is to perform ‘survival analysis’ on im-

planted devices to detect possible early failures and improve implant safety. Due to the low level of data *completeness* and to the lack of the adoption of the standardised patient pseudonymisation algorithm defined by RIAP in all regions, it is currently not possible to perform survival analysis at a national level. Only when these two issues are resolved, RIAP will be able to link all revisions to their primary intervention and thus function properly.

Currently, the analysis of medical devices includes the type of fixation (cemented, uncemented, hybrid) and the distribution of the type of hip stem and tibial tray, the latter based on the European Medical Device Nomenclature (EMDN) codes assigned to the device. Once the linkage with NJR data is fully operational, more detailed analysis on devices will be carried out.

With the publication of the RIPI Regulation as a Decree of the Minister of Health required by the DPCM 3/3/2017, the complex regulatory process leading to the establishment of the RIPI (and thus also the RIAP) will be completed, the requirements of the European Regulation on Medical Devices 2017/745 will be met, and the RIAP will become a mandatory information flow within the Italian National Health Service.

How to calculate indicators used in RIAP 2022 Report

In this paragraph the way to calculate the indicators applied to HDR (Appendix 2A) and RIAP (Appendix 2B) is shown.

For HDR, the results of the application of the following indicators are reported in Appendix 2A: Attraction Index and Escape Index for years 2021 and 2022 (Figures 1, 8, 12); Incidence rate and Hospitalisation rate for years 2021 and 2022 (Figures 2-5, 9-10 and 13-16); temporal trend of the ratio between incidence and hospital rates for years 2001-2022 (Figures 6, 7, 11, 17, 18).

$$\text{Attraction index} = \frac{\text{Number of discharges of patients not resident in the region}}{\text{Total number of discharges in the region}}$$

$$\text{Escape index} = \frac{\text{Number of discharges of resident patients that are made out of the region}}{\text{Total number of discharges of resident patients that are made in the country}}$$

$$\text{Incidence rate} = \frac{\text{Number of procedures performed in the region on resident and non-resident patients}}{\text{Resident population in the region}}$$

$$\text{Hospitalisation rate} = \frac{\text{Number of procedures performed in the country on patients residing in the region}}{\text{Resident population in the region}}$$

For RIAP the temporal trends of the following indicators are reported in Appendix 2B for years 2007-2022: coverage (a), completeness (b), accuracy on interventions (c), accuracy on devices (d).

In particular, Figure 1 shows coverage and completeness for RIAP in relation to the national territory. All indicators are shown for: institutions participating in RIAP in relation to the areas covered by them (Figure 2); for each region and participating institutions (Figures 3-23).

$$\text{Coverage} = \frac{\text{Number of hospitals participating in data collection}}{\text{Total number of hospitals performing procedures of interest in a specific geographical area}}$$

$$\text{Completeness} = \frac{\text{Number of procedures collected by RIAP}}{\text{Total number of procedures of interest performed in a specific geographical area}}$$

$$\text{Accuracy on interventions} = \frac{\text{Number of procedures passing quality audit on interventions}}{\text{Number of procedures admitted to quality audit}}$$

$$\text{Accuracy on devices} = \frac{\text{Number of procedures passing quality audit on devices}}{\text{Number of procedures admitted to quality audit}}$$

Figure 1.1. Participation in RIAP (as of 31/12/2022)

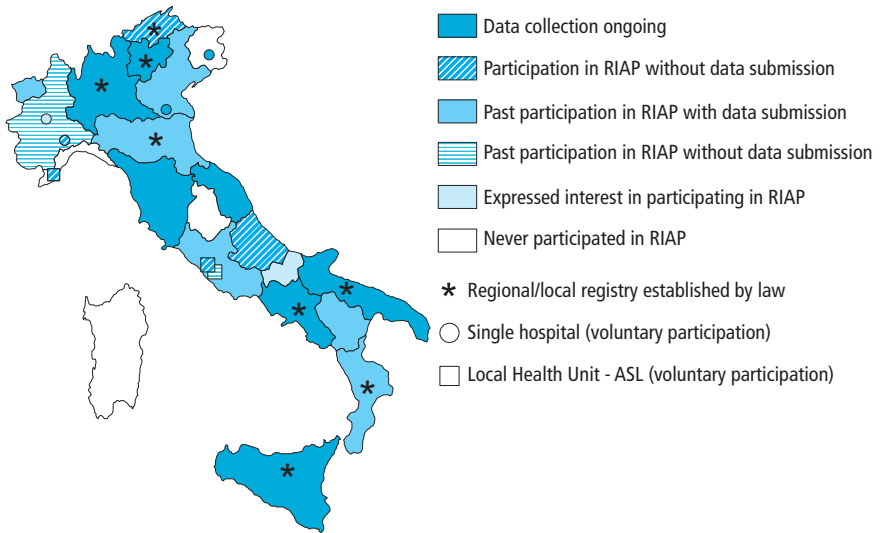
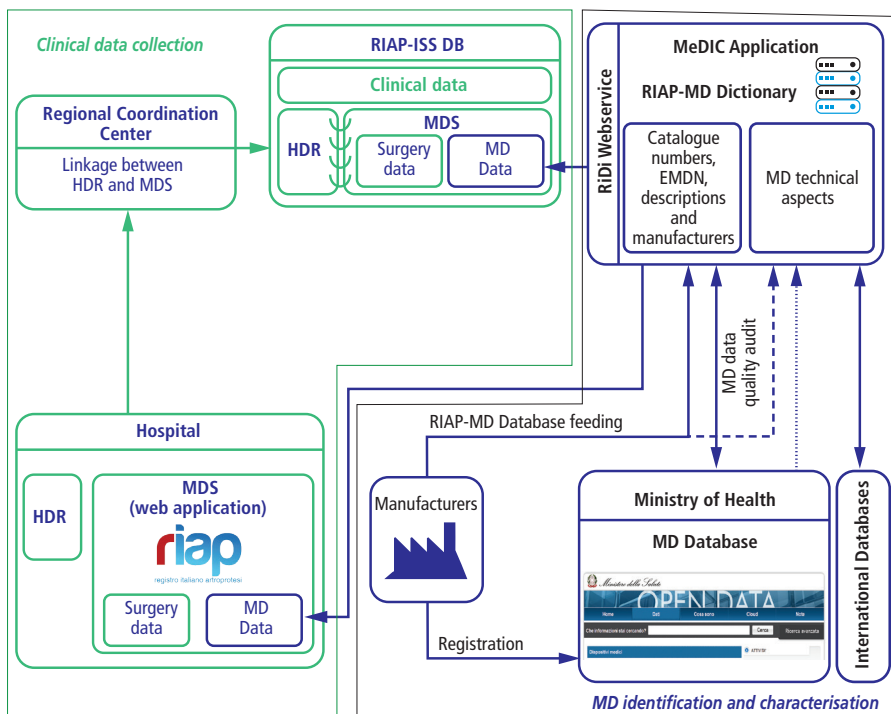


Figure 1.2. Flow diagram of the RIAP data collection model



Note: already implemented and active flow (continuous line); hypothesis of flow not yet implemented and potentially subject to change (dashed or dotted line)

Table 2.1a. Hip. Number of hospitals collecting data for RIAP by participating institution (years 2007-2021)

Participating institution	2007	2008	2009	2010	2011	2012
Region	N	N	N	N	N	N
Aosta Valley					1	
Lombardy	109	112	112	113	112	111
AP Bolzano				8	8	8
AP Trento				5	6	6
Veneto				2		
Emilia-Romagna	67	65				
Tuscany				5	4	
Marche						
Lazio				3	2	2
Abruzzi						
Campania						
Apulia	11	12	6	44	2	1
Basilicata		1	2	2	4	3
Calabria						
Sicily						
Single hospital/foundation						
Clinica Città di Alessandria						
PO Universitario Santa Maria della Misericordia, Udine						
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		2	1	1	1	1
Casa di cura San Feliciano, Rome						
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total number of hospitals collecting data for RIAP						
Hip replacements	187	192	121	183	140	132
All joint replacements	189	194	122	184	140	133

2013	2014	2015	2016	2017	2018	2019	2020	2021
N	N	N	N	N	N	N	N	N
	111	112	108	105	105	104	106	102
8	8	8	8	11	12	12	12	
6	8	7	8	8	8	8	8	9
		1	1	1	1	3	3	3
3	20	17	13	13	11	10	18	10
2								
		2	2			3	2	
				68	65	56	54	49
44	41	44	42	45	46	42	42	39
3		2	2	1	1	4	1	
	7	6	5	11	16			
7	13	8	12	8	4	7	9	48
					1	1	1	1
			1	1	1	1	1	
1	3		1	1				
						1	1	
							1	
						1		
74	211	207	203	273	271	253	259	261
74	243	208	207	279	273	255	259	263

Table 2.1b. Knee. Number of centres collecting data for RIAP by participating institution (years 2007-2021)

Participating institution	2007	2008	2009	2010	2011	2012
Region	N	N	N	N	N	N
Aosta Valley						
Lombardy	108	109	108	112	111	110
AP Bolzano					8	8
AP Trento						
Veneto						
Emilia-Romagna						
Tuscany						
Marche						
Lazio						
Abruzzi						
Campania						
Apulia						
Basilicata						
Calabria						
Sicily						
Single hospital/foundation						
Clinica Città di Alessandria						
PO Universitario Santa Maria della Misericordia, Udine						
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		2	1	1	1	1
Casa di cura San Feliciano, Rome						
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total number of hospitals collecting data for RIAP						
Knee replacements	108	111	109	113	120	119
All joint replacements	189	194	122	184	140	133

2013	2014	2015	2016	2017	2018	2019	2020	2021
N	N	N	N	N	N	N	N	N
		112	110	108	107	105	104	101
8	8	8	8	11	12	12	12	
		5	9	8	8	8	8	9
		1	1	1	1	3	3	3
2	20	14	9	13	10	10	14	10
		2	2			3	2	
				64	62	53	49	45
42	41	44	42	42	42	40	40	38
3		2	2	1	1	3	1	
	5	5	5	8	14			
7	13	8	12	7	4	7	8	47
					1	1	1	1
			1	1	1	1	1	
1	3		1	1				
						1	1	
							1	
						1		
63	90	201	202	265	263	248	245	254
74	243	208	207	279	273	255	259	263

Table 2.1c. Shoulder. Number of hospitals collecting data for RIAP by participating institution (years 2007-2021)

Participating institution	2007	2008	2009	2010	2011	2012
Region	N	N	N	N	N	N
Aosta Valley						
Lombardy						
AP Bolzano						
AP Trento						
Veneto						
Emilia-Romagna						
Tuscany						
Marche						
Lazio						
Abruzzi						
Campania						
Apulia						
Basilicata						
Calabria						
Sicily						
Single hospital/foundation						
Clinica Città di Alessandria						
PO Universitario Santa Maria della Misericordia, Udine						
Fondazione Livio Sciuotto / Fondazione Spotorno (SV)						
Casa di cura San Feliciano, Rome						
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total number of hospitals collecting data for RIAP						
Shoulder replacements	0	0	0	0	0	0
All joint replacements	189	194	122	184	140	133

2013	2014	2015	2016	2017	2018	2019	2020	2021
N	N	N	N	N	N	N	N	N
						6	5	
					6	8	12	10
						2	1	
				34	34	34	34	38
				33	34	33	34	34
						2		
					1	3	4	35
					1	1	1	
						1	1	
0	0	0	0	67	76	90	92	117
74	243	208	207	279	273	255	259	263

Table 2.2a. Hip. Number of procedures collected by RIAP and admitted to quality audit by participating institution (years 2007-2021)

Participating institution	2007	2008	2009	2010	2011	2012
Region	N	N	N	N	N	N
Aosta Valley					23	
Lombardy	16,483	16,595	16,709	17,181	17,878	18,181
AP Bolzano				1,180	1,212	1,244
AP Trento				200	664	763
Veneto				90		
Emilia-Romagna	8,784	8,989				
Tuscany				333	88	
Marche						
Lazio				106	157	160
Abruzzi						
Campania						
Apulia	499	473	491	1,605	11	9
Basilicata		7	48	69	344	320
Calabria						
Sicily						
Single hospital/foundation						
Clinica Città di Alessandria						
PO Universitario Santa Maria della Misericordia, Udine						
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		819	701	719	643	592
Casa di cura San Feliciano, Rome						
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total						
Hip replacements	25,766	26,883	17,949	21,483	21,020	21,269
All joint replacements	35,128	37,185	28,484	32,530	33,083	33,860

2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
N	N	N	N	N	N	N	N	N	N
									23
	16,303	20,359	22,218	22,810	23,345	24,730	17,529	23,121	273,442
1,365	1,428	1,499	1,404	1,410	1,341	1,422	1,042		14,547
719	1,033	833	1,110	1,187	1,343	1,433	1,149	1,641	12,075
									90
									17,773
		382	357	98	476	541	733	341	3,349
25	847	1,014	802	702	767	1,261	1,084	986	7,488
9									432
		45	54			110	127		336
				5,519	4,897	4,777	3,922	4,470	23,585
4,439	4,354	4,621	3,534	4,790	4,781	4,949	4,642	5,073	44,271
155		348	225	110	126	183	81		2,016
	606	664	722	747	883				3,622
212	529	634	795	700	195	496	632	3,111	7,304
					319	306	193	258	1,076
			123	158	161	160	94		696
592	1,374		555	226					6,221
						124	61		185
							94		94
						79			79
7,516	26,474	30,399	31,899	38,457	38,634	40,571	31,383	39,001	418,704
11,981	32,178	51,834	55,333	67,352	68,185	72,823	52,600	67,790	680,346

Table 2.2b. Knee. Number of procedures collected by RIAP and admitted to quality audit by participating institution (years 2007-2021)

Participating institution	2007	2008	2009	2010	2011	2012
Region	N	N	N	N	N	N
Aosta Valley						
Lombardy	9,362	9,891	10,065	10,580	11,252	11,543
AP Bolzano					380	697
AP Trento						
Veneto						
Emilia-Romagna						
Tuscany						
Marche						
Lazio						
Abruzzi						
Campania						
Apulia						
Basilicata						
Calabria						
Sicily						
Single hospital/foundation						
Clinica Città di Alessandria						
PO Universitario Santa Maria della Misericordia, Udine						
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		411	470	467	431	351
Casa di cura San Feliciano, Rome						
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total						
Knee replacements	9,362	10,302	10,535	11,047	12,063	12,591
All joint replacements	35,128	37,185	28,484	32,530	33,083	33,860

2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
N	N	N	N	N	N	N	N	N	N
									0
		14,467	15,767	16,217	17,322	19,238	11,398	16,371	173,473
735	846	920	932	979	902	931	603		7,925
		40	659	687	772	773	572	824	4,327
									0
									0
		156	175	98	257	310	325	330	1,651
8	660	852	874	845	895	1,108	522	593	6,357
									0
		16	14			97	76		203
				3,444	3,199	3,433	2,445	3,025	15,546
3,152	2,817	3,279	2,673	3,553	3,669	3,534	3,038	3,143	28,858
84		299	223	104	74	169	7		960
	460	646	811	965	467				3,349
150	485	760	914	896	567	823	762	2,688	8,045
					261	304	190	182	937
			128	126	139	129	55		577
336	436		264	125					3,291
						113	41		154
							32		32
						24			24
4,465	5,704	21,435	23,434	28,039	28,524	30,986	20,066	27,156	255,709
11,981	32,178	51,834	55,333	67,352	68,185	72,823	52,600	67,790	680,346

Table 2.2c. Shoulder. Number of procedures collected by RIAP and admitted to quality audit by participating institution (years 2007-2021)

Participating institution	2007	2008	2009	2010	2011	2012
Region	N	N	N	N	N	N
Aosta Valley						
Lombardy						
AP Bolzano						
AP Trento						
Veneto						
Emilia-Romagna						
Tuscany						
Marche						
Lazio						
Abruzzi						
Campania						
Apulia						
Basilicata						
Calabria						
Sicily						
Single hospital/foundation						
Clinica Città di Alessandria						
PO Universitario Santa Maria della Misericordia, Udine						
Fondazione Livio Sciutto / Fondazione Spotorno (SV)						
Casa di cura San Feliciano, Rome						
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total						
Shoulder replacements	0	0	0	0	0	0
All joint replacements	35,128	37,185	28,484	32,530	33,083	33,860

2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
N	N	N	N	N	N	N	N	N	N
									0
									0
						28	48		76
									0
									0
									0
									0
					23	61	68	50	202
									0
						4	2		6
				416	515	566	518	705	2,720
				440	471	539	474	540	2,464
						11			11
									0
					6	23	29	338	396
									0
					12	13	4		29
									0
						21	8		29
									0
									0
0	0	0	0	856	1,027	1,266	1,151	1,633	5,933
11,981	32,178	51,834	55,333	67,352	68,185	72,823	52,600	67,790	680,346

Table 2.3. Hip. Number of procedures included in procedure analysis and *completeness* by procedure type (years 2007-2021)

	N	%	Completeness (*)			
			2007-2021		2021	
			(1)	(2)	(3)	(4)
Procedure type	352,843		51.1	22.8	62.7	31.3
Primary	331,244	93.9	52.3	23.3	64.2	31.9
Total replacement	252,158	76.1	54.5	24.1	66.5	32.9
- elective	224,678	89.1				
- emergency	27,480	10.9				
Partial replacement	79,086	23.9	46.7	21.0	57.9	28.9
Revision	21,599	6.1	38.5	22.8	43.4	22.8
Partial revision (**)	12,971	60.1				
Total revision	5,846	27.1				
Removal (***)	2,782	12.9				

(*) *Completeness*: expressed in %. Columns 1 and 3: ratio between the number of procedures registered in RIAP, linked to the HDR and having passed the quality audit on procedures, and the number of procedures registered in the HDR by participating institutions.

Columns 2 and 4: ratio between the number of procedures registered in RIAP, linked to the HDR and having passed the quality audit on procedures, and the number of procedures registered in the HDR at national level.

(**) Includes conversion from partial to total replacement

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

Table 2.4. Hip. Number of procedures by hospital type and by procedure type (years 2007-2021)

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Hospital type	224,678		27,480		79,086		21,599		352,843	
Public hospitals	81,444	36.2	19,656	71.5	62,691	79.3	9,088	42.1	172,879	49.0
Private hospitals, accredited	142,270	63.3	7,800	28.4	16,357	20.7	12,403	57.4	178,830	50.7
Private hospitals, not accredited	964	0.4	24	0.1	38	0.0	108	0.5	1,134	0.3

(*) Total or partial revision, conversion from partial to total arthroplasty, removal, removal with spacer implantation, spacer replacement

Table 2.5. Hip. Number of procedures by gender and age group and by procedure type (years 2007-2021)

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Gender	224,678		27,480		79,086		21,599		352,843	
Male	103,276	46.0	7,691	28.0	20,392	25.8	8,528	39.5	139,887	39.6
Female	121,402	54.0	19,789	72.0	58,694	74.2	13,071	60.5	212,956	60.4
Age group by gender										
Male	103,276		7,691		20,392		8,528		139,887	
Mean age	64		70		82		69		68	
Standard deviation	12		13		9		12		13	
<45	5,993	5.8	230	3.0	129	0.6	336	3.9	6,688	4.8
45 - 54	14,092	13.6	660	8.6	233	1.1	794	9.3	15,779	11.3
55 - 64	25,035	24.2	1,229	16.0	552	2.7	1,532	18.0	28,348	20.3
65 - 74	34,284	33.2	2,257	29.3	2,001	9.8	2,592	30.4	41,134	29.4
75 - 84	21,711	21.0	2,287	29.7	8,104	39.7	2,665	31.3	34,767	24.9
≥ 85	2,161	2.1	1,028	13.4	9,373	46.0	609	7.1	13,171	9.4
Female	121,402		19,789		58,694		13,071		212,956	
Mean age	69		73		83		72		73	
Standard deviation	11		10		7		11		12	
<45	3,210	2.6	117	0.6	91	0.2	220	1.7	3,638	1.7
45 - 54	9,116	7.5	624	3.2	207	0.4	674	5.2	10,621	5.0
55 - 64	22,579	18.6	2,557	12.9	663	1.1	1,757	13.4	27,556	12.9
65 - 74	42,790	35.2	6,674	33.7	4,178	7.1	3,869	29.6	57,511	27.0
75 - 84	38,338	31.6	6,963	35.2	24,348	41.5	5,062	38.7	74,711	35.1
≥ 85	5,369	4.4	2,854	14.4	29,207	49.8	1,489	11.4	38,919	18.3

(*) Total or partial revision, conversion from partial to total replacement, removal, removal with spacer implantation, spacer replacement

Table 2.6. Hip. Number of procedures by side and surgical approach and by procedure type (years 2007-2021)

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Side	224,678		27,480		79,086		21,599		352,843	
Right	120,872	53.8	13,812	50.3	39,600	50.1	11,231	52.0	185,515	52.6
Left	98,956	44.0	13,588	49.4	39,294	49.7	10,266	47.5	162,104	45.9
Bilateral	4,850	2.2	80	0.3	192	0.2	102	0.5	5,224	1.5
Surgical approach	224,678		27,480		79,086		21,599		352,843	
Anterior	32,772	14.6	1,446	5.3	3,521	4.5	1,071	5.0	38,810	11.0
Anterolateral	20,276	9.0	4,612	16.8	14,417	18.2	2,000	9.3	41,305	11.7
Lateral	47,466	21.1	8,200	29.8	29,336	37.1	5,861	27.1	90,863	25.8
Posterolateral	119,799	53.3	12,924	47.0	30,777	38.9	12,286	56.9	175,786	49.8
Other	3,497	1.6	229	0.8	771	1.0	225	1.0	4,722	1.3
Not reported	868	0.4	69	0.3	264	0.3	156	0.7	1,357	0.4

(*) Total or partial revision, conversion from partial to total replacement, 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 (years 2007-2021)

	Total replacement				Partial replacement		TOTAL	
	elective		emergency		N	%	N	%
	N	%	N	%				
Indication for surgery	224,678		27,480		79,086		331,244	
Primary osteoarthritis	196,741	87.6	0	0.0	1,822	2.3	198,563	59.9
Post-traumatic osteoarthritis	4,124	1.8	0	0.0	456	0.6	4,580	1.4
Rheumatoid arthritis	965	0.4	0	0.0	5	0.0	970	0.3
Neoplasia	386	0.2	0	0.0	420	0.5	806	0.2
Aseptic necrosis of femoral head	9,987	4.4	0	0.0	178	0.2	10,165	3.1
Congenital hip dislocation or dysplasia outcomes	7,242	3.2	0	0.0	56	0.1	7,298	2.2
Perthes disease or epiphysiolysis	532	0.2	0	0.0	65	0.1	597	0.2
Fracture of neck and/or of femur	0	0.0	27,480	100.0	75,228	95.1	102,708	31.0
Septic coxitis outcomes	55	0.0	0	0.0	1	0.0	56	0.0
Pseudoarthrosis caused by neck fracture	229	0.1	0	0.0	80	0.1	309	0.1
Other	4,417	2.0	0	0.0	775	1.0	5,192	1.6
Previous surgery	224,678		27,480		79,086		331,244	
None	209,005	93.0	25,779	93.8	73,820	93.3	308,604	93.2
Osteosynthesis	3,211	1.4	518	1.9	595	0.8	4,324	1.3
Osteotomy	1,216	0.5	8	0.0	18	0.0	1,242	0.4
Arthrodesis	52	0.0	3	0.0	14	0.0	69	0.0
Other	11,194	5.0	1,172	4.3	4,639	5.9	17,005	5.1

Table 2.8. Hip. Number of revisions by indication for surgery and type of previous surgery (years 2007-2021)

	Revision (*)	
	N	%
Indication for surgery	21,599	
Pain	1,250	5.8
Lysis	628	2.9
Wear	1,719	8.0
Implant breaking	584	2.7
Prosthesis dislocation	2,911	13.5
Periprosthetic fracture	2,375	11.0
Infection	1,639	7.6
Previous prosthesis removal outcomes	381	1.8
Aseptic loosening, cup	4,633	21.5
Aseptic loosening, stem	2,380	11.0
Aseptic loosening, total	1,829	8.5
Disease progression	13	0.1
High concentration of metal ions	4	0.0
Spacer breaking	6	0.0
Other	1,247	5.8
Previous surgery	21,599	
Total hip replacement	17,096	79.2
Revision of hip replacement	1,267	5.9
Spacer implant or prosthesis removal (**)	1,420	6.6
Partial hip replacement	1,366	6.3
Other	450	2.1

(*) Total or partial revision, conversion from partial to total replacement, 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 (years 2007-2021)

	N	%
Procedure type	212,321	
Primary	199,979	94.2
Total replacement	154,383	77.2
- elective	135,562	87.8
- emergency	18,821	12.2
Partial replacement	45,596	22.8
Revision	12,342	5.8
Partial revision (*)	8,906	72.2
Total revision	1,543	12.5
Removal of prosthesis (**)	1,893	15.3

(*) Includes conversion from partial to total replacement

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

Table 2.10. Hip. Number of procedures by fixation and by procedure type (years 2007-2021)

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Fixation	135,562		18,821		45,596		12,342		212,321	
Cemented (stem + cup)	5,685	4.2	1,105	5.9	0	0.0	459	3.7	7,249	3.4
Reverse hybrid (uncemented stem and cemented cup)	1,203	0.9	748	4.0	0	0.0	680	5.5	2,631	1.2
Only cemented cup	0	0.0	0	0.0	0	0.0	417	3.4	417	0.2
Hybrid (cemented stem and uncemented cup)	4,613	3.4	1,195	6.3	0	0.0	342	2.8	6,150	2.9
Uncemented (stem + cup)	124,061	91.5	15,773	83.8	0	0.0	7,037	57.0	146,871	69.2
Only uncemented cup	0	0.0	0	0.0	0	0.0	1,171	9.5	1,171	0.6
Only cemented stem	0	0.0	0	0.0	18,500	40.6	278	2.3	18,778	8.8
Only uncemented stem	0	0.0	0	0.0	27,096	59.4	1,130	9.2	28,226	13.3
Fixation declared "not applicable" for cup and stem	0	0.0	0	0.0	0	0.0	828	6.7	828	0.4

(*) Total or partial revision, conversion from partial to total replacement, removal, removal with spacer implantation, spacer replacement

Table 2.11. Hip. Number of total replacement procedures by bearing type and by procedure type (years 2007-2021)

	Total replacement				TOTAL	
	elective		emergency		N	%
	N	%	N	%		
Bearing type (head/insert)	135,562		18,821		154,383	
Ceramics-Ceramics	22,510	16.6	1,384	7.4	23,894	15.5
Ceramics-Metal	876	0.6	145	0.8	1,021	0.7
Ceramics-Polyethylene	76,255	56.3	9,472	50.3	85,727	55.5
Metal-Ceramics	208	0.2	26	0.1	234	0.2
Metal-Metal	443	0.3	111	0.6	554	0.4
Metal-Polyethylene	9,791	7.2	3,080	16.4	12,871	8.3
Procedures not include the registration of both head and insert implantation	25,479	18.8	4,603	24.5	30,082	19.5

Table 2.12. Hip. Number of revision by bearing type (years 2007-2021)

Bearing type (head/insert)	Revision (*)	
	N	%
Bearing type (head/insert)	12,342	
Ceramics-Ceramics	422	3.4
Ceramics-Metal	120	1.0
Ceramics-Polyethylene	3,593	29.1
Metal-Ceramics	14	0.1
Metal-Metal	113	0.9
Metal-Polyethylene	1,724	14.0
Procedures not include the registration of both head and insert implantation	6,356	51.5

(*) Total or partial revision, conversion from partial to total replacement, removal, removal with spacer implantation, spacer replacement

Table 2.13. Hip. Number of total replacements by stem type and by procedure type (years 2007-2021)

	Total replacement				TOTAL	
	elective		emergency		N	%
	N	%	N	%		
Stem type	135,562		18,821		154,383	
Uncemented	110,316	81.4	14,060	74.7	124,376	80.6
Modular	5,488	5.0	1,722	12.2	7,210	5.8
Non-modular	104,828	95.0	12,338	87.8	117,166	94.2
Straight	80,437	76.7	11,345	92.0	91,782	78.3
Anatomical	7,805	7.4	558	4.5	8,363	7.1
Conservative	16,586	15.8	435	3.5	17,021	14.5
Cemented	6,522	4.8	2,279	12.1	8,801	5.7
Modular	279	4.3	104	4.6	383	4.4
Non-modular	6,243	95.7	2,175	95.4	8,418	95.6
Straight	5,754	92.2	2,022	93.0	7,776	92.4
Anatomical	391	6.3	136	6.3	527	6.3
Conservative	98	1.6	17	0.8	115	1.4
Other stem type / Stem type not reported	18,724	13.8	2,482	13.2	21,206	13.7

Table 2.14. Knee. Number of procedures included in procedure analysis and *completeness* by procedure type (years 2007-2021)

	N	%	<i>Completeness</i> (*)			
			2007-2021		2021	
			(1)	(2)	(3)	(4)
Procedure type	225,636		46.1	21.1	63.6	31.3
Primary	215,836	95.7	47.5	21.7	65.4	32.1
- total	166,209	77.0				
- unicompartmental	49,627	23.0				
Revision	9,800	4.3	27.7	13.4	41.3	21.2
Partial revision	2,302	23.5				
Total revision	7,067	72.1				
Prosthesis removal, spacer replacement (**)	305	3.1				
Primary patella implant on existing prosthesis	126	1.3				

(*) *Completeness* (expressed in %). Columns 1 and 3: ratio between the number of procedures registered in RIAP, linked to the HDR and having passed the quality audit on procedures, and the number of procedures registered in the HDR by participating institutions.

Columns 2 and 4: ratio between the number of procedures registered in RIAP, linked to the HDR and having passed the quality audit on procedures, and the number of procedures registered in the HDR at national level.

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

Table 2.15. Knee. Number of procedures by hospital type and by procedure type (years 2007-2021)

	Primary				Revision (*)		TOTAL	
	total		monocompartmental		N	%	N	%
	N	%	N	%				
Hospital type	166,209		49,627		9,800		225,636	
Public hospitals	50,264	30.3	11,242	22.6	2,558	26.1	64,064	28.4
Private hospitals, accredited	115,536	69.5	38,276	77.2	7,222	73.7	161,034	71.4
Private hospitals, not accredited	409	0.2	109	0.2	20	0.2	538	0.2

(*) Total or partial revision, primary patella implantation 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 (years 2007-2021)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Gender	166,209		49,627		9,800		225,636	
Male	52,771	31.7	16,625	33.5	3,094	31.6	72,490	32.1
Female	113,438	68.3	33,002	66.5	6,706	68.4	153,146	67.9
Age group by gender								
Male	52,771		16,625		3,094		72,490	
Mean age	69		67		69		69	
Standard deviation	9		9		10		9	
<45	511	1.0	230	1.4	45	1.5	786	1.1
45 - 54	2,660	5.0	1,240	7.5	257	8.3	4,157	5.7
55 - 64	10,254	19.4	3,881	23.3	615	19.9	14,750	20.3
65 - 74	22,604	42.8	7,005	42.1	1,140	36.8	30,749	42.4
75 - 84	15,846	30.0	4,020	24.2	942	30.4	20,808	28.7
≥85	896	1.7	249	1.5	95	3.1	1,240	1.7
Female	113,438		33,002		6,706		153,146	
Mean age	71		69		71		70	
Standard deviation	8		9		9		8	
<45	408	0.4	212	0.6	35	0.5	655	0.4
45 - 54	3,275	2.9	1,729	5.2	278	4.1	5,282	3.4
55 - 64	18,040	15.9	6,454	19.6	1,101	16.4	25,595	16.7
65 - 74	50,433	44.5	14,188	43.0	2,729	40.7	67,350	44.0
75 - 84	38,932	34.3	9,882	29.9	2,321	34.6	51,135	33.4
≥85	2,350	2.1	537	1.6	242	3.6	3,129	2.0

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

Table 2.17. Knee. Number of procedures by side and surgical approach and by procedure type (years 2007-2021)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Side	166,209		49,627		9,800		225,636	
Right	88,152	53.0	25,799	52.0	5,245	53.5	119,196	52.8
Left	76,024	45.7	22,434	45.2	4,517	46.1	102,975	45.6
Bilateral	2,033	1.2	1,394	2.8	38	0.4	3,465	1.5
Surgical approach	166,209		49,627		9,800		225,636	
Medial parapatellar	142,825	85.9	38,435	77.4	8,384	85.6	189,644	84.0
Lateral parapatellar	3,805	2.3	2,104	4.2	222	2.3	6,131	2.7
Mid-vastus	9,667	5.8	3,404	6.9	632	6.4	13,703	6.1
Minimally invasive mid-vastus	4,389	2.6	3,684	7.4	235	2.4	8,308	3.7
Quad-sparing	313	0.2	637	1.3	8	0.1	958	0.4
Sub-vastus	1,736	1.0	343	0.7	50	0.5	2,129	0.9
Minimally invasive sub-vastus	413	0.2	290	0.6	26	0.3	729	0.3
V Quadriceps	26	0.0	13	0.0	24	0.2	63	0.0
Tibial tuberosity osteotomy	186	0.1	27	0.1	45	0.5	258	0.1
Missing	533	0.3	9	0.0	14	0.1	556	0.2
Other	2,316	1.4	681	1.4	160	1.6	3,157	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 (years 2007-2021)

	Primary				TOTAL	
	total		unicompartmental		N	%
	N	%	N	%		
Indication for surgery	166,209		49,627		215,836	
Primary osteoarthritis	157,673	94.9	46,095	92.9	203,768	94.4
Post-traumatic osteoarthritis	2,692	1.6	657	1.3	3,349	1.6
Rheumatoid arthritis	1,149	0.7	179	0.4	1,328	0.6
Neoplasia	96	0.1	33	0.1	129	0.1
Osteonecrosis	938	0.6	1,063	2.1	2,001	0.9
Other	3,661	2.2	1,600	3.2	5,261	2.4
Previous surgery	166,209		49,627		215,836	
None	151,008	90.9	43,826	88.3	194,834	90.3
Arthrodesis	103	0.1	11	0.0	114	0.1
Osteotomy	1,475	0.9	255	0.5	1,730	0.8
Arthroscopy	2,763	1.7	1,457	2.9	4,220	2.0
Osteosynthesis	610	0.4	220	0.4	830	0.4
Other	10,250	6.2	3,858	7.8	14,108	6.5

Table 2.19. Knee. Number of revision by indication for surgery and type of previous surgery (years 2007-2021)

	Revision (*)	
	N	%
Indication for surgery	9,800	
Aseptic loosening of several components	2,311	23.6
Aseptic loosening of femur	407	4.2
Aseptic loosening of tibia	972	9.9
Aseptic loosening of patella	28	0.3
Implant removal outcomes	17	0.2
Wear	262	2.7
Dislocation	184	1.9
Instability	455	4.6
Periprosthetic fracture	151	1.5
Implant breaking	118	1.2
Spacer breaking	10	0.1
Infection	1,813	18.5
Stiffness	190	1.9
Disease progression	170	1.7
Pain	1,784	18.2
Other	928	9.5
Previous surgery	9,800	
Primary total	5,622	57.4
Primary unicompartmental	1,513	15.4
Primary unspecified	386	3.9
Revision of knee replacement	709	7.2
Spacer	1,058	10.8
Other	512	5.2

(*) 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 (years 2007-2021)

	N	%
Procedure type	151,028	
Primary	142,896	94.6
- total	115,603	80.9
- unicompartmental	27,293	19.1
Revision	8,132	5.4
Partial revision	1,939	23.8
Total revision	5,842	71.8
Removal, spacer replacement (*)	237	2.9
Primary patella implant on existing prosthesis	114	1.4

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

Table 2.21. Knee. Number of procedures by fixation and by procedure type (years 2007-2021)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Fixation	115,603		27,293		8,132		151,028	
Patella not implanted	102,618	88.8	25,825	94.6	3,047	37.5	131,490	87.1
Cemented (femoral and tibial components)	75,603	73.7	18,534	71.8	2,166	71.1	96,303	73.2
Cemented femoral component and uncemented tibial component	1,849	1.8	773	3.0	104	3.4	2,726	2.1
Only cemented femoral component	0	0.0	0	0.0	96	3.2	96	0.1
Uncemented femoral component and cemented tibial component	3,499	3.4	1,037	4.0	107	3.5	4,643	3.5
Uncemented	21,667	21.1	5,481	21.2	66	2.2	27,214	20.7
Only uncemented femoral component	0	0.0	0	0.0	6	0.2	6	0.0
Only cemented tibial component	0	0.0	0	0.0	150	4.9	150	0.1
Only uncemented tibial component	0	0.0	0	0.0	56	1.8	56	0.0
Fixation declared "not applicable" for both femoral and tibial components	0	0.0	0	0.0	296	9.7	296	0.2
Patella implanted (cemented)	10,229	8.8	427	1.6	1,617	19.9	12,273	8.1
Cemented (femoral and tibial components)	9,831	96.1	365	85.5	1,062	65.7	11,258	91.7
Cemented femoral component and uncemented tibial component	73	0.7	49	11.5	19	1.2	141	1.1
Only cemented femoral component	0	0.0	0	0.0	3	0.2	3	0.0
Uncemented femoral component and cemented tibial component	184	1.8	3	0.7	58	3.6	245	2.0
Uncemented	141	1.4	10	2.3	237	14.7	388	3.2
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	17	1.1	17	0.1
Only uncemented tibial component	0	0.0	0	0.0	2	0.1	2	0.0
Only patella	0	0.0	0	0.0	219	13.5	219	1.8

(continued)

Table 2.21. (continued)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental		N	%	N	%
	N	%	N	%				
Patella implanted (uncemented)	2,756	2.4	1,041	3.8	3,468	42.6	7,265	4.8
Cemented (femoral and tibial components)	1,419	51.5	760	73.0	1,540	44.4	3,719	51.2
Cemented femoral component and uncemented tibial component	36	1.3	19	1.8	126	3.6	181	2.5
Only cemented femoral component	0	0.0	0	0.0	0	0.0	0	0.0
Uncemented femoral component and cemented tibial component	136	4.9	26	2.5	254	7.3	416	5.7
Uncemented	1,165	42.3	236	22.7	1,540	44.4	2,941	40.5
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	2	0.1	2	0.0
Only uncemented tibial component	0	0.0	0	0.0	1	0.0	1	0.0
Only patella	0	0.0	0	0.0	5	0.1	5	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 (years 2007-2021)

	N	%
Type of tibial tray	142,896	
Mobile bearing	26,955	18.9
Cemented	19,252	71.4
Uncemented	5,658	21.0
Cementable	2,045	7.6
Fixed	62,427	43.7
Cemented	59,339	95.1
Uncemented	2,582	4.1
Cementable	506	0.8
Missing	53,514	37.4

Table 2.23. Shoulder. Number of procedures included in procedure analysis and *completeness* by procedure type (years 2007-2021)

	N	%	<i>Completeness</i> (*)			
			2007-2021		2021	
			(1)	(2)	(3)	(4)
Procedure type	5,637		11.9	5.5	27.7	12.9
Primary	5,516	97.9	<i>na (***)</i>	<i>na (***)</i>	<i>na (***)</i>	<i>na (***)</i>
Total replacement	4,366	79.2				
- elective	2,930	67.1				
- emergency	1,436	32.9				
Partial replacement	278	5.0				
Non specificato	872	15.8				
Revision (**)	121	2.1	<i>na (***)</i>	<i>na (***)</i>	<i>na (***)</i>	<i>na (***)</i>

(*) *Completeness* (expressed in %). Columns 1 and 3: ratio between the number of procedures registered in RIAP, linked to the HDR and having passed the quality audit on procedures, and the number of procedures registered in the HDR by participating institutions.

Columns 2 and 4: ratio between the number of procedures registered in RIAP, linked to the HDR and having passed the quality audit on procedures, and the number of procedures registered in the HDR at national level.

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

(***) There is no ICD-9 CM code to classify shoulder revision procedure in HDR

Table 2.24. Shoulder. Number of total replacements by type of implanted prosthesis (years 2007-2021)

	N	%
Type of prosthesis implanted in the total replacement	4,366	
Elective	2,930	67.1
- anatomical	158	5.4
- resurfacing	24	0.8
- reverse	2,482	84.7
- interposition	266	9.1
Emergency	1,436	32.9
- anatomical	49	3.4
- resurfacing	0	0.0
- reverse	1,387	96.6
- interposition	0	0.0

Table 2.25. Shoulder. Number of procedures by hospital type and by procedure type (years 2007-2021)

Hospital type	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%	N	%
	N	%	N	%								
Hospital type	2,930		1,436		278		872		121		5,637	
Public hospitals	371	12.6	926	64.4	121	43.5	395	45.3	40	33.1	1,853	32.8
Private hospitals, accredited	2,556	87.2	510	35.5	157	56.5	477	54.7	81	66.9	3,781	67.1
Private hospitals, non-accredited	3	0.1	0	0.0	0	0.0	0	0.0	0	0.0	3	0.1

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

Table 2.26. Shoulder. Number of procedures by gender and age group and by procedure type (years 2007-2021)

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%	N	%
	N	%	N	%								
Gender	2,930		1,436		278		872		121		5,637	
Male	881	30.1	245	17.1	117	42.1	197	22.6	43	35.5	1,483	26.3
Female	2,049	69.9	1,191	82.9	161	57.9	675	77.4	78	64.5	4,154	73.7
Age group by gender												
Male	881		245		117		197		43		1,483	
Mean age	67		69		61		70		61		67	
Standard deviation	9		11		12		9		13		10	
<45	12	1.4	4	1.6	13	11.1	1	0.5	4	9.3	34	2.3
45 - 54	66	7.5	19	7.8	17	14.5	9	4.6	10	23.3	121	8.2
55 - 64	222	25.2	46	18.8	40	34.2	36	18.3	11	25.6	355	23.9
65 - 74	387	43.9	78	31.8	36	30.8	92	46.7	12	27.9	605	40.8
75 - 84	186	21.1	89	36.3	6	5.1	52	26.4	6	14.0	339	22.9
≥85	8	0.9	9	3.7	5	4.3	7	3.6	0	0.0	29	2.0
Female	2,049		1,191		161		675		78		4,154	
Mean age	71		74		69		73		71		72	
Standard deviation	7		8		10		7		8		8	
<45	5	0.2	0	0.0	2	1.2	2	0.3	0	0.0	9	0.2
45 - 54	36	1.8	12	1.0	6	3.7	4	0.6	0	0.0	58	1.4
55 - 64	281	13.7	111	9.3	39	24.2	50	7.4	20	25.6	501	12.1
65 - 74	973	47.5	474	39.8	62	38.5	278	41.2	27	34.6	1,814	43.7
75 - 84	717	35.0	496	41.6	42	26.1	309	45.8	28	35.9	1,592	38.3
≥85	37	1.8	98	8.2	10	6.2	32	4.7	3	3.8	180	4.3

(*) 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 (years 2007-2021)

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%	N	%
	N	%	N	%								
Side	2,930		1,436		278		872		121		5,637	
Right	1,953	66.7	800	55.7	167	60.1	561	64.3	76	62.8	3,557	63.1
Left	977	33.3	635	44.2	111	39.9	311	35.7	45	37.2	2,079	36.9
Bilateral	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	1	0.0
Surgical approach	2,930		1,436		278		872		121		5,637	
Deltopectoral	2,201	75.1	1,250	87.0	182	65.5	726	83.3	106	87.6	4,465	79.2
Trans-deltoid	341	11.6	29	2.0	57	20.5	34	3.9	2	1.7	463	8.2
Missing	298	10.2	150	10.4	4	1.4	89	10.2	8	6.6	549	9.7
Other	90	3.1	7	0.5	35	12.6	23	2.6	5	4.1	160	2.8

(*) 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 (years 2007-2021)

	Total replacement				Partial replacement		Not specified		TOTAL	
	elective		emergency		N	%	N	%	N	%
	N	%	N	%						
Indication for surgery	2,930		1,436		278		872		5,516	
Eccentric osteoarthritis (*)	1,792	61.2	0	0.0	23	8.3	357	40.9	2,172	39.4
Concentric osteoarthritis	378	12.9	0	0.0	59	21.2	44	5.0	481	8.7
Rheumatoid arthritis	19	0.6	0	0.0	1	0.4	10	1.1	30	0.5
Neoplasia	2	0.1	0	0.0	1	0.4	0	0.0	3	0.1
Osteonecrosis	41	1.4	0	0.0	5	1.8	18	2.1	64	1.2
Fracture	0	0.0	1,436	100.0	109	39.2	334	38.3	1,879	34.1
Massive cuff tear in absence of osteoarthritis	78	2.7	0	0.0	67	24.1	0	0.0	145	2.6
Previous fracture outcomes	101	3.4	0	0.0	7	2.5	0	0.0	108	2.0
Dislocation	7	0.2	0	0.0	0	0.0	0	0.0	7	0.1
Other	512	17.5	0	0.0	6	2.2	109	12.5	627	11.4
Previous surgery	2,930		1,436		278		872		5,516	
None	2,765	94.4	1,420	98.9	272	97.8	872	100.0	5,329	96.6
Osteosynthesis	41	1.4	4	0.3	2	0.7	0	0.0	47	0.9
Arthrotomy	13	0.4	0	0.0	0	0.0	0	0.0	13	0.2
Arthrodesis	2	0.1	0	0.0	0	0.0	0	0.0	2	0.0
Arthroscopy	82	2.8	5	0.3	1	0.4	0	0.0	88	1.6
Other	27	0.9	7	0.5	3	1.1	0	0.0	37	0.7

(*) Includes also data collected under the broader definition of "osteoarthritis"

Table 2.29. Shoulder. Number of revision by indication for surgery and type of previous surgery (years 2007-2021)

	Revision (*)	
	N	%
Indication for surgery	121	
Instability	22	18.2
Glenoid erosion	5	4.1
Periprosthetic fracture	11	9.1
Infection	22	18.2
Implant removal outcomes	1	0.8
Aseptic mobilisation	35	28.9
Periprosthetic fracture	4	3.3
Pain	5	4.1
Implant breaking	1	0.8
Other	15	12.4
Previous surgery	121	
Primary (**)	89	73.6
Shoulder replacement revision (***)	26	21.5
Other	6	5.0

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

(**) Partial primary intervention: anatomic, resurfacing, implanted prosthesis not specified; total primary intervention: anatomic, reverse

(***) Revision, removal, removal with spacer implantation

Table 2.30. Shoulder. Number of procedures included in device analysis by procedure type (years 2007-2021)

	N	%
Procedure type	3,631	
Primary	3,527	97.1
Total replacement	2,611	74.0
- elective	1,861	71.3
- emergency	750	28.7
Partial replacement	44	1.2
Non specificato	872	24.7
Revision (*)	104	2.9

(*) 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 (years 2007-2021)

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency		N	%	N	%	N	%	N	%
	N	%	N	%								
Fixation	1,861		750		44		872		104		3,631	
Cemented (glenoid + stem)	44	2.4	59	7.9	0	0.0	0	0.0	3	2.9	106	2.9
Reverse hybrid (cemented glenoid and uncemented stem)	123	6.6	192	25.6	0	0.0	0	0.0	6	5.8	321	8.8
Hybrid (uncemented glenoid and cemented stem)	26	1.4	5	0.7	0	0.0	0	0.0	0	0.0	31	0.9
Uncemented (glenoid + stem)	1,668	89.6	494	65.9	0	0.0	0	0.0	36	34.6	2,198	60.5
Only cemented glenoid	0	0.0	0	0.0	0	0.0	0	0.0	3	2.9	3	0.1
Only uncemented glenoid	0	0.0	0	0.0	0	0.0	0	0.0	11	10.6	11	0.3
Only cemented stem	0	0.0	0	0.0	28	63.6	0	0.0	0	0.0	28	0.8
Only stem uncemented	0	0.0	0	0.0	16	36.4	0	0.0	9	8.7	25	0.7
Not applicable	0	0.0	0	0.0	0	0.0	872	100.0	36	34.6	908	25.0

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

Figure 2.1. Flowchart of the RIAP data quality audit: procedures. 2007-2021

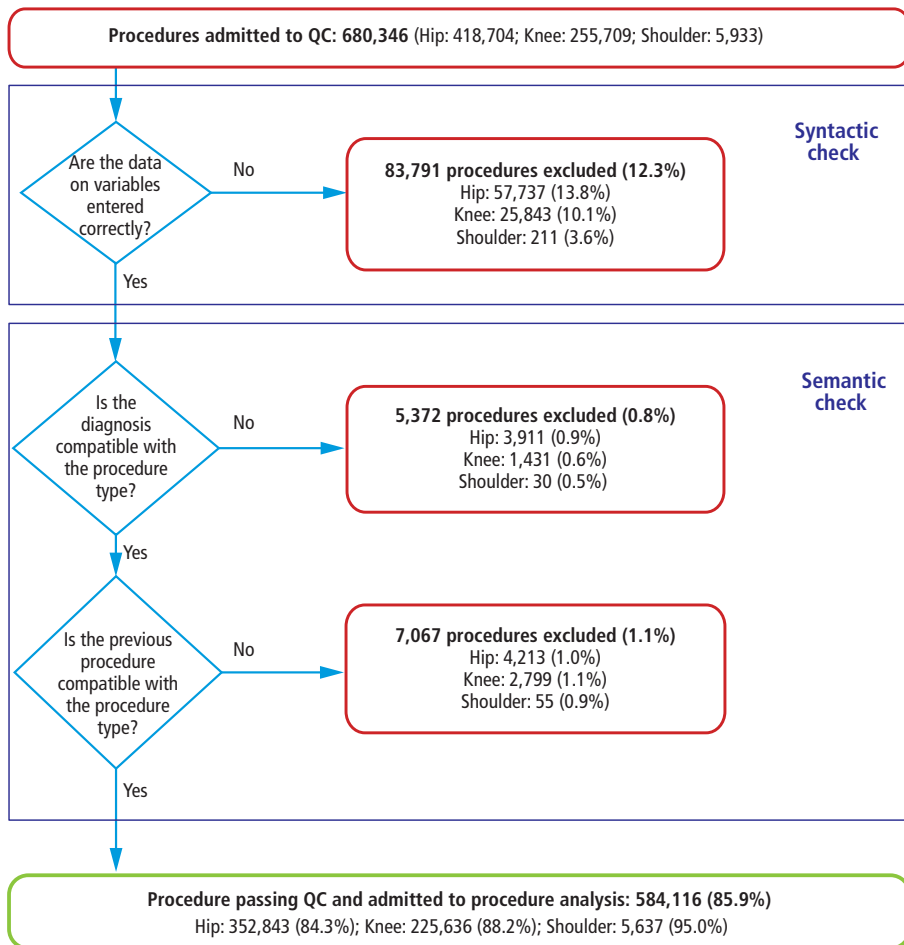


Figure 2.2. Flowchart of the RIAP data quality audit for device analysis. 2007-2021

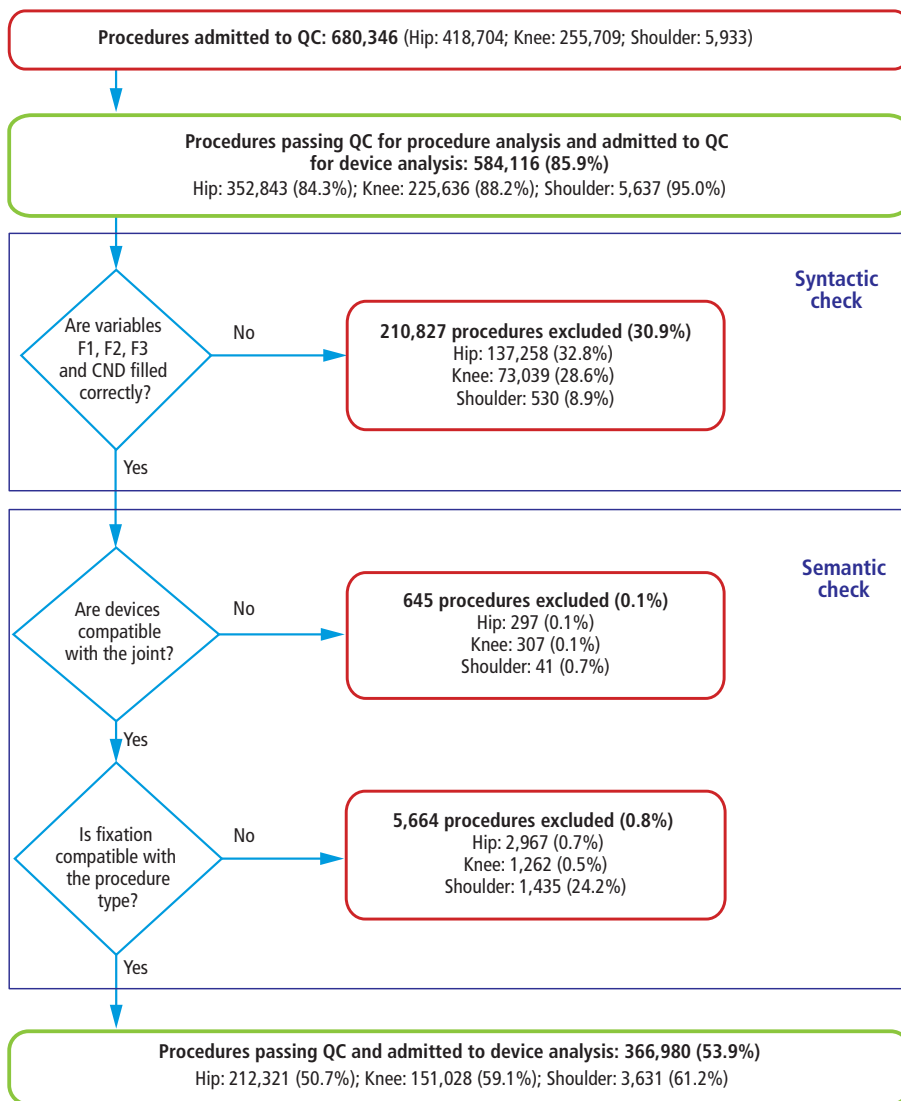
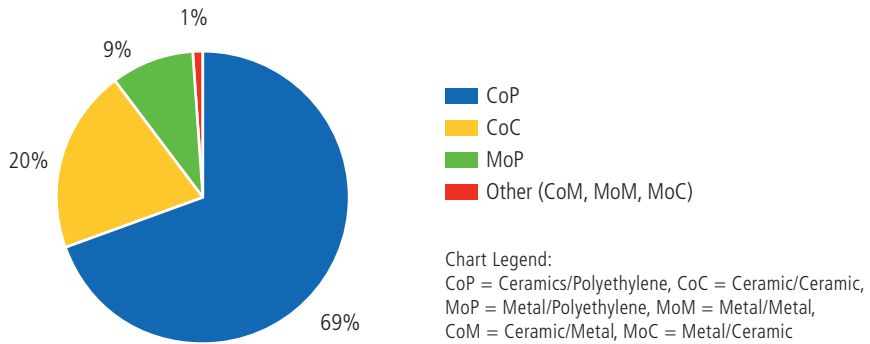
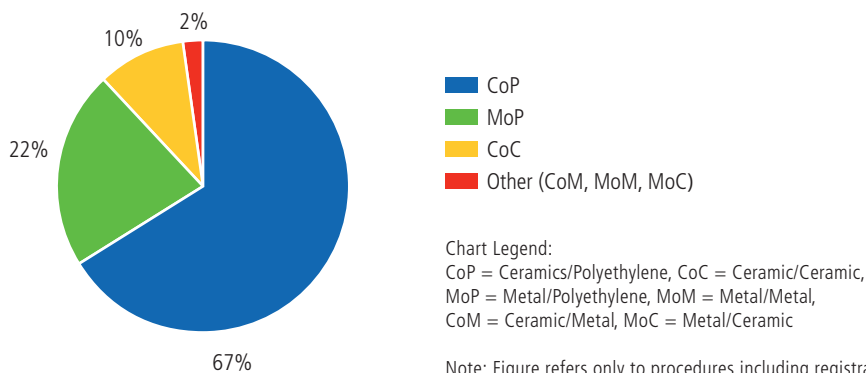


Figure 2.3. Hip. Types of bearing. Total replacement (elective procedures). 2007-2021



Note: Figure refers only to procedures including registration of both head and insert implantation. 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). 2007-2021



Note: Figure refers only to procedures including registration of both head and insert implantation. The first component indicates the material of the head, the second the material of the insert.

APPENDICES

Table 1. Joint replacements (principal and secondary procedures) in Italy. 2001-2021

ICD-9-CM Code	Procedure	2001	2003	2005	2007	2009	2010	2011
	Hip	74,408	80,999	87,499	91,077	93,241	95,347	96,125
81.51	Total hip replacement	46,850	52,541	57,112	60,425	61,601	61,774	62,664
	<i>Total hip replacement (elective)</i>	<i>40,060</i>	<i>44,505</i>	<i>47,908</i>	<i>50,684</i>	<i>51,769</i>	<i>52,186</i>	<i>53,157</i>
81.52	Partial hip replacement	21,394	21,753	23,227	23,119	23,393	24,847	25,091
00.85(*)	Resurfacing hip, total, acetabulum and femoral head	0	0	0	0	293	445	162
(**)	Revision of hip replacement	6,164	6,705	7,160	7,533	7,954	8,281	8,208
	Knee	28,693	38,655	47,643	57,054	61,079	63,254	63,749
81.54	Total knee replacement	27,401	36,714	45,116	53,930	57,004	59,080	59,472
(***)	Revision of knee replacement	1,292	1,941	2,527	3,124	4,075	4,174	4,277
	Shoulder	1,559	1,866	2,517	3,255	3,783	4,326	4,684
81.80	Total shoulder replacement	709	948	1,462	2,048	2,537	2,990	3,478
	<i>Total shoulder replacement (elective)</i>	<i>417</i>	<i>644</i>	<i>1,085</i>	<i>1,629</i>	<i>2,092</i>	<i>2,382</i>	<i>2,815</i>
81.81	Partial shoulder replacement	850	918	1,055	1,207	1,246	1,336	1,206
	Ankle	95	147	179	268	256	255	298
81.56	Total ankle replacement	95	147	179	268	256	255	298
	Other joints	736	870	1,668	1,570	1,332	1,302	1,349
81.57	Replacement of joint of foot and toe	316	414	604	692	521	557	543
81.59	Revision of joint replacement of lower extremity, not elsewhere classified	214	173	672	365	187	128	107
81.73	Total wrist replacement	40	44	60	66	59	50	68
81.84	Total elbow replacement	90	162	251	314	402	402	434
81.97	Revision of joint replacement of upper extremity	76	77	81	133	163	165	197
	Total	105,491	122,537	139,506	153,224	159,691	164,484	166,205

(*) 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

Note: The years 2002, 2004 and 2008 are not shown due to space limitations. The number of procedures carried out in these years is available in previous RIAP reports

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	% (°)
98,585	100,844	102,652	105,803	108,906	112,375	113,511	117,910	98,507	117,304	2.3
64,503	66,257	68,190	71,178	74,660	77,787	79,288	83,157	66,939	84,142	3.0
54,852	56,598	58,491	60,656	64,102	66,917	68,525	71,625	55,869	72,081	3.0
25,346	25,979	26,141	26,222	25,879	26,101	25,646	25,876	24,292	24,786	0.7
96	99	45	107	147	65	251	229	256	319	0.7
8,640	8,509	8,276	8,296	8,220	8,422	8,326	8,648	7,020	8,057	1.3
66,007	67,634	70,313	73,191	78,779	81,271	84,582	89,210	67,826	81,992	5.4
61,541	62,910	65,614	68,091	73,394	75,668	78,423	82,815	62,606	76,018	5.2
4,466	4,724	4,699	5,100	5,385	5,603	6,159	6,395	5,220	5,974	8.0
5,143	5,795	6,511	7,145	8,053	9,101	10,125	10,989	9,195	11,366	10.4
3,830	4,441	5,309	5,970	6,892	7,862	8,840	9,767	8,184	10,068	14.2
3,042	3,479	4,085	4,474	5,225	5,921	6,712	7,347	5,758	7,154	15.3
1,313	1,354	1,202	1,175	1,161	1,239	1,285	1,222	1,011	1,298	2.1
313	330	387	482	546	600	653	767	593	820	11.4
313	330	387	482	546	600	653	767	593	820	11.4
1,291	1,300	1,358	1,479	1,444	1,489	1,573	1,568	1,283	1,500	3.6
443	440	453	530	481	468	493	415	234	306	-0.2
83	96	103	102	74	77	79	63	42	49	-7.1
74	65	49	51	52	37	59	43	27	40	0.0
447	473	491	523	549	608	616	682	662	682	10.7
244	226	262	273	288	299	326	365	318	423	9.0
171,339	175,903	181,221	188,100	197,728	204,836	210,444	220,444	177,404	212,982	3.6

Table 2. Hip. Number of principal and secondary procedures by region of admission and by procedure type. 2020-2021

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2020		2021		2020		2021	
	N	%	N	%	N	%	N	%
Piedmont	5,190	9.3	7,196	9.9	1,067	9.6	1,193	9.9
Aosta Valley	111	0.2	185	0.3	17	0.2	25	0.2
Lombardy	10,618	18.9	15,716	21.7	1,346	12.1	1,503	12.4
AP Bolzano	698	1.2	1,114	1.5	75	0.7	82	0.7
AP Trento	763	1.4	1,167	1.6	83	0.7	84	0.7
Veneto	6,207	11.1	6,901	9.5	869	7.8	867	7.2
Friuli Venezia Giulia	1,390	2.5	1,670	2.3	234	2.1	256	2.1
Liguria	484	0.9	738	1.0	632	5.7	612	5.1
Emilia-Romagna	7,029	12.5	8,884	12.3	894	8.1	879	7.3
Tuscany	5,116	9.1	5,765	8.0	856	7.7	935	7.7
Umbria	744	1.3	771	1.1	127	1.1	140	1.2
Marche	1,275	2.3	1,430	2.0	414	3.7	504	4.2
Lazio	4,831	8.6	6,191	8.6	1,082	9.8	1,171	9.7
Abruzzi	1,262	2.2	1,540	2.1	281	2.5	341	2.8
Molise	129	0.2	199	0.3	16	0.1	25	0.2
Campania	3,032	5.4	4,164	5.8	1,238	11.2	1,286	10.6
Apulia	2,506	4.5	2,804	3.9	473	4.3	566	4.7
Basilicata	120	0.2	180	0.2	71	0.6	68	0.6
Calabria	879	1.6	1,092	1.5	236	2.1	236	2.0
Sicily	2,911	5.2	3,547	4.9	884	8.0	1,015	8.4
Sardinia	808	1.4	1,129	1.6	197	1.8	290	2.4
Italy	56,103	100.0	72,383	100.0	11,092	100.0	12,078	100.0
<i>% of national volume</i>	<i>57.0</i>		<i>61.7</i>		<i>11.3</i>		<i>10.3</i>	

Partial replacement				Revision				Total			
2020		2021		2020		2021		2020		2021	
N	%	N	%	N	%	N	%	N	%	N	%
1,710	7.0	1,699	6.9	699	10.0	786	9.8	8,666	8.8	10,874	9.3
64	0.3	71	0.3	8	0.1	5	0.1	200	0.2	286	0.2
4730	19.5	4,705	19.0	1,310	18.7	1,765	21.9	18,004	18.3	23,689	20.2
231	1.0	261	1.1	102	1.5	130	1.6	1,106	1.1	1,587	1.4
268	1.1	318	1.3	94	1.3	111	1.4	1,208	1.2	1,680	1.4
2,257	9.3	2,271	9.2	579	8.2	691	8.6	9,912	10.1	10,730	9.1
812	3.3	823	3.3	158	2.3	192	2.4	2,594	2.6	2,941	2.5
638	2.6	626	2.5	145	2.1	162	2.0	1,899	1.9	2,138	1.8
2,317	9.5	2,326	9.4	800	11.4	962	11.9	11,040	11.2	13,051	11.1
1,844	7.6	1,925	7.8	678	9.7	702	8.7	8,494	8.6	9,327	8.0
501	2.1	510	2.1	99	1.4	96	1.2	1,471	1.5	1,517	1.3
529	2.2	424	1.7	164	2.3	195	2.4	2,382	2.4	2,553	2.2
2,074	8.5	2,154	8.7	644	9.2	609	7.6	8,631	8.8	10,125	8.6
560	2.3	558	2.3	142	2.0	130	1.6	2,245	2.3	2,569	2.2
138	0.6	117	0.5	7	0.1	14	0.2	290	0.3	355	0.3
1,319	5.4	1,492	6.0	480	6.8	587	7.3	6,069	6.2	7,529	6.4
1,446	6.0	1,504	6.1	297	4.2	269	3.3	4,722	4.8	5,143	4.4
227	0.9	250	1.0	28	0.4	24	0.3	446	0.5	522	0.4
534	2.2	644	2.6	108	1.5	96	1.2	1,757	1.8	2,068	1.8
1,513	6.2	1,500	6.1	414	5.9	442	5.5	5,722	5.8	6,504	5.5
580	2.4	608	2.5	64	0.9	89	1.1	1,649	1.7	2,116	1.8
24,292	100.0	24,786	100.0	7,020	100.0	8,057	100.0	98,507	100.0	117,304	100.0
24.7		21.1		7.1		6.9		100.0		100.0	

Table 3. Hip. Primary total replacement. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2020	2021	2020	2021	2020	2021
	N	N	N	N	N	N
Piedmont	18	14	13	12	11	12
Aosta Valley	1	0	1	1	0	1
Lombardy	48	28	28	35	17	20
AP Bolzano	6	1	3	5	3	5
AP Trento	2	1	3	3	2	3
Veneto	12	7	16	15	7	11
Friuli Venezia Giulia	2	1	6	7	4	4
Liguria	9	6	2	3	4	6
Emilia-Romagna	18	13	19	12	19	24
Tuscany	16	12	13	10	8	11
Umbria	6	5	4	6	3	2
Marche	7	3	6	6	5	5
Lazio	47	39	17	16	15	16
Abruzzi	9	8	6	7	2	1
Molise	4	4	1	0	0	1
Campania	49	40	13	16	8	10
Apulia	17	14	16	11	5	10
Basilicata	5	5	1	0	0	1
Calabria	15	13	3	6	2	2
Sicily	46	40	16	20	7	9
Sardinia	15	13	5	5	2	2
Italy	352	267	192	196	124	156
<i>% of national volume</i>	<i>47.1</i>	<i>36.7</i>	<i>25.7</i>	<i>27.0</i>	<i>16.6</i>	<i>21.5</i>

201-300		>300		Total			
2020	2021	2020	2021	2020		2021	
N	N	N	N	N	%	N	%
4	6	6	7	52	7.0	51	7.0
0	0	0	0	2	0.3	2	0.3
7	8	8	13	108	14.4	104	14.3
0	1	0	0	12	1.6	12	1.7
1	2	0	0	8	1.1	9	1.2
6	3	7	9	48	6.4	45	6.2
1	0	1	2	14	1.9	14	1.9
1	0	0	1	16	2.1	16	2.2
6	8	3	5	65	8.7	62	8.5
8	4	3	7	48	6.4	44	6.1
0	0	0	0	13	1.7	13	1.8
1	3	0	0	19	2.5	17	2.3
1	4	3	4	83	11.1	79	10.9
2	1	0	2	19	2.5	19	2.6
0	0	0	0	5	0.7	5	0.7
4	5	1	3	75	10.0	74	10.2
3	2	0	1	41	5.5	38	5.2
0	0	0	0	6	0.8	6	0.8
1	1	0	0	21	2.8	22	3.0
2	3	0	1	71	9.5	73	10.0
0	2	0	0	22	2.9	22	3.0
48	53	32	55	748	100.0	727	100.0
6.4	7.3	4.3	7.6	100.0		100.0	

Table 4. Hip. Revision. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume			
	1-10		11-25	
	2020	2021	2020	2021
	N	N	N	N
Piedmont	25	17	22	25
Aosta Valley	1	2	0	0
Lombardy	65	63	23	24
AP Bolzano	5	6	3	4
AP Trento	6	5	0	3
Veneto	28	23	12	13
Friuli Venezia Giulia	7	4	5	7
Liguria	12	9	3	4
Emilia-Romagna	34	28	18	17
Tuscany	18	16	15	15
Umbria	8	8	3	4
Marche	13	8	4	7
Lazio	53	55	9	8
Abruzzi	13	13	5	5
Molise	2	4	0	0
Campania	51	44	6	10
Apulia	24	26	11	9
Basilicata	6	5	0	0
Calabria	15	16	0	3
Sicily	52	49	5	6
Sardinia	21	20	0	1
Italy	459	421	144	165
<i>% of national volume</i>	<i>70.9</i>	<i>65.3</i>	<i>22.3</i>	<i>25.6</i>

26-50		>50		Total			
2020	2021	2020	2021	2020		2021	
N	N	N	N	N	%	N	%
1	5	1	1	49	7.6	48	7.4
0	0	0	0	1	0.2	2	0.3
5	9	3	4	96	14.8	100	15.5
1	1	0	0	9	1.4	11	1.7
1	0	0	0	7	1.1	8	1.2
5	5	0	1	45	7.0	42	6.5
1	1	0	0	13	2.0	12	1.9
1	1	0	0	16	2.5	14	2.2
3	7	1	1	56	8.7	53	8.2
5	5	2	3	40	6.2	39	6.0
0	0	0	0	11	1.7	12	1.9
1	1	0	0	18	2.8	16	2.5
3	3	2	2	67	10.4	68	10.5
0	0	0	0	18	2.8	18	2.8
0	0	0	0	2	0.3	4	0.6
4	3	0	1	61	9.4	58	9.0
0	1	0	0	35	5.4	36	5.6
0	0	0	0	6	0.9	5	0.8
1	0	0	0	16	2.5	19	2.9
3	4	0	0	60	9.3	59	9.1
0	0	0	0	21	3.2	21	3.3
35	46	9	13	647	100.0	645	100.0
5.4	7.1	1.4	2.0	100.0		100.0	

Table 5. Hip. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2020-2021

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
	%	%	%	%	%	%	%	%	%	%
Gender										
Male	47.4	47.8	28.4	29.3	27.9	28.7	39.1	38.8	39.9	41.2
Female	52.6	52.2	71.6	70.7	72.1	71.3	60.9	61.2	60.1	58.8
Age (male)										
Mean age	65.1	65.3	71.8	71.1	84.2	84.2	69.6	69.6	69.3	68.8
Standard deviation	11.8	11.7	20.2	11.9	8.1	7.9	12.8	12.9	14.2	13.1
Age group										
0-44	4.8	4.2	1.8	1.8	0.3	0.2	4.5	3.8	3.7	3.4
45-54	14.4	14.3	7.5	8.1	0.5	0.6	9.1	9.8	11.1	11.5
55-64	25.8	26.3	16.7	17.5	1.4	1.5	17.3	17.4	20.2	21.5
65-74	32.2	31.7	30.3	28.6	7.1	6.9	28.3	29.7	27.4	27.6
75-84	20.4	20.8	32.5	32.7	35.9	36.8	30.6	29.3	24.8	24.5
85+	2.4	2.7	11.2	11.4	54.7	54.0	10.3	10.0	12.8	11.4
Age (female)										
Mean age	69.7	69.9	73.9	74.0	84.8	85.0	74.9	74.8	75.1	74.7
Standard deviation	10.6	10.7	9.4	9.4	7.1	7.1	11.1	11.1	11.6	11.6
Age group										
0-44	1.8	1.9	0.3	0.3	0.1	0.1	1.1	1.1	1.0	1.2
45-54	7.2	6.7	2.7	2.6	0.4	0.3	3.8	4.4	4.3	4.4
55-64	19.0	19.2	12.4	12.6	0.9	1.0	12.0	11.5	12.2	13.2
65-74	36.0	35.2	34.6	33.7	5.7	5.1	26.4	24.5	26.1	26.5
75-84	31.2	31.6	37.9	39.1	37.3	37.0	37.7	40.7	34.3	34.5
85+	4.8	5.3	12.2	11.7	55.7	56.5	19.0	17.9	21.9	20.2

Table 6. Hip. Percent distribution of hospital discharges by discharge type and by procedure type. 2020-2021

Discharge type	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
	%	%	%	%	%	%	%	%	%	%
Deceased	0.1	0.1	1.0	1.2	3.7	3.5	1.5	1.4	1.2	1.0
Ordinary discharge	58.4	59.6	56.8	54.4	46.8	46.8	56.1	56.3	55.2	56.2
Discharge to a Residential Care Facility	1.3	1.0	5.5	6.2	9.6	10.4	4.4	4.3	4.1	3.8
Discharge with home health services	0.2	0.1	0.6	0.4	0.6	0.6	0.5	0.3	0.3	0.2
Discharge against medical advice	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3
Transfer to an acute admission unit of a different hospital	1.1	1.0	2.1	2.1	3.2	2.8	2.2	1.9	1.8	1.5
Transfer in the same hospital	23.2	21.7	9.4	8.3	8.9	7.2	17.3	16.8	17.7	16.9
Transfer to an inpatient rehabilitation facility	14.9	15.6	21.1	23.3	22.4	23.8	15.6	16.6	17.5	18.2
Discharge with integrated home care	0.6	0.7	3.1	3.7	4.4	4.5	2.0	1.9	1.9	1.9

Figure 1. Hip. Elective total replacement (principal procedures). Inter-regional mobility (attraction and escape indices) in 2020 (a) and in 2021 (b)

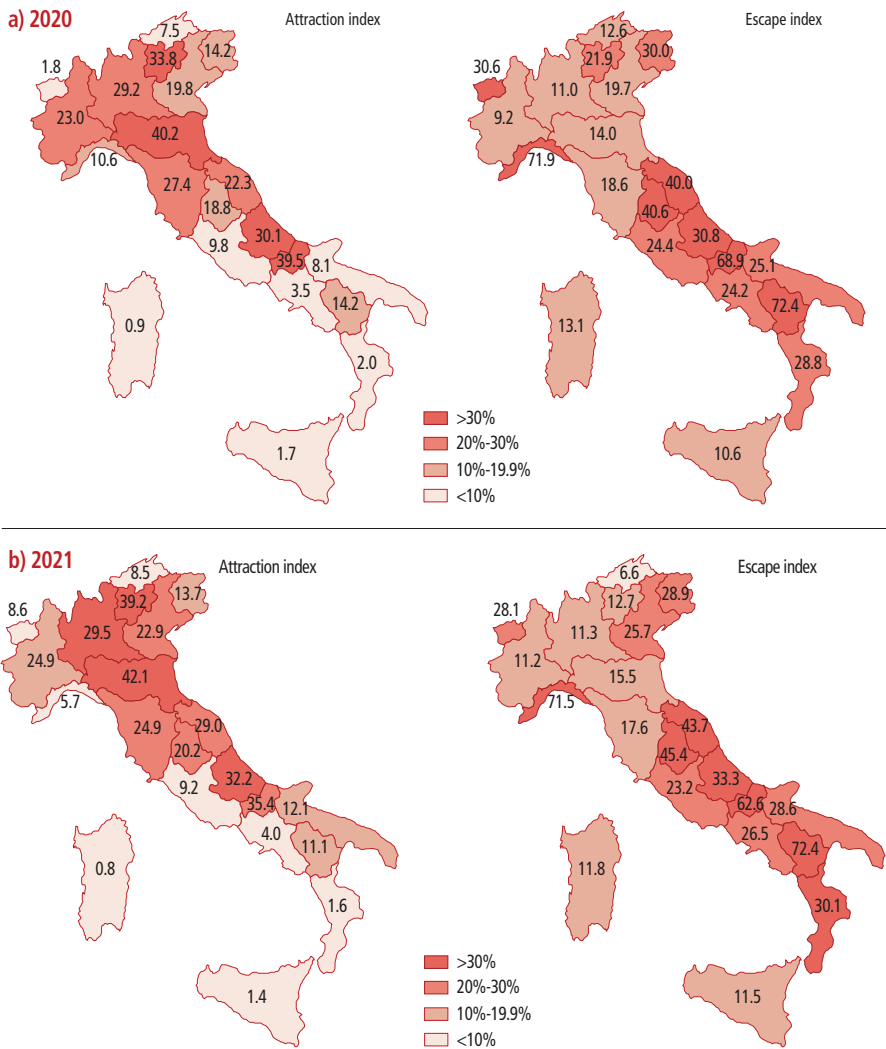


Figure 2. Hip. Elective total and partial replacement (principal and secondary procedures). Incidence rate by region (per 100,000 residents). 2020-2021

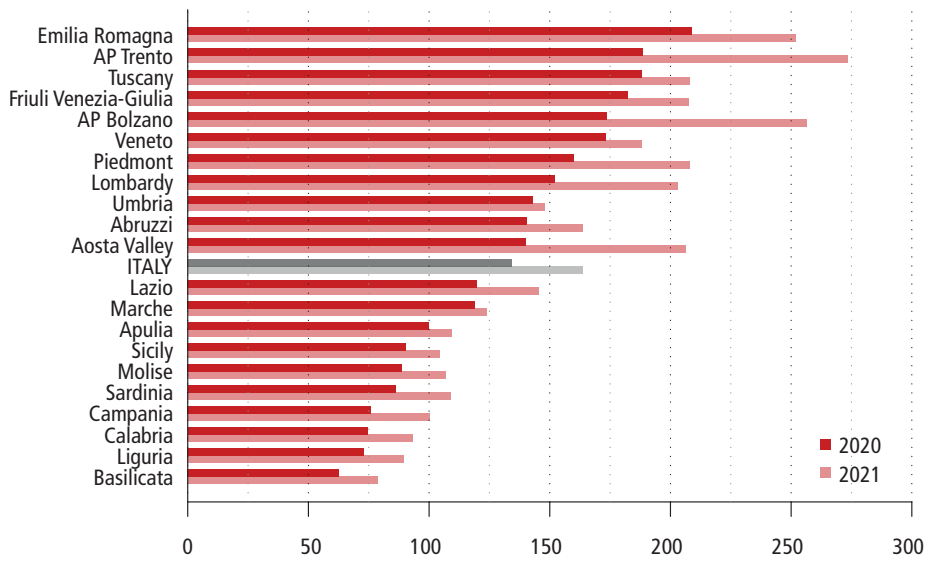


Figure 3. Hip. Elective total and partial replacement (principal and secondary procedures). Hospitalisation rate by region (per 100,000 residents). 2020-2021

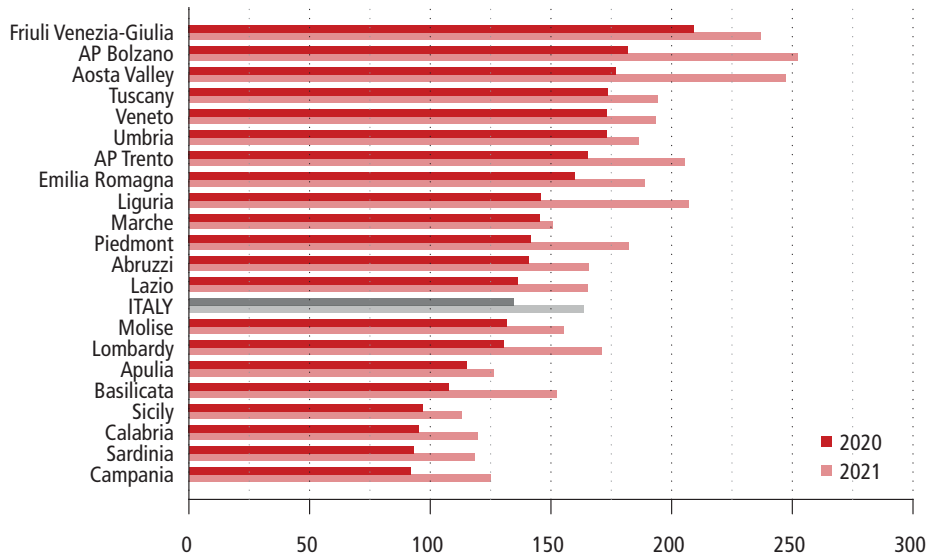


Figure 4. Hip. Emergency total and partial replacement (principal and secondary procedures). Incidence rate by region (per 100,000 residents). 2020-2021

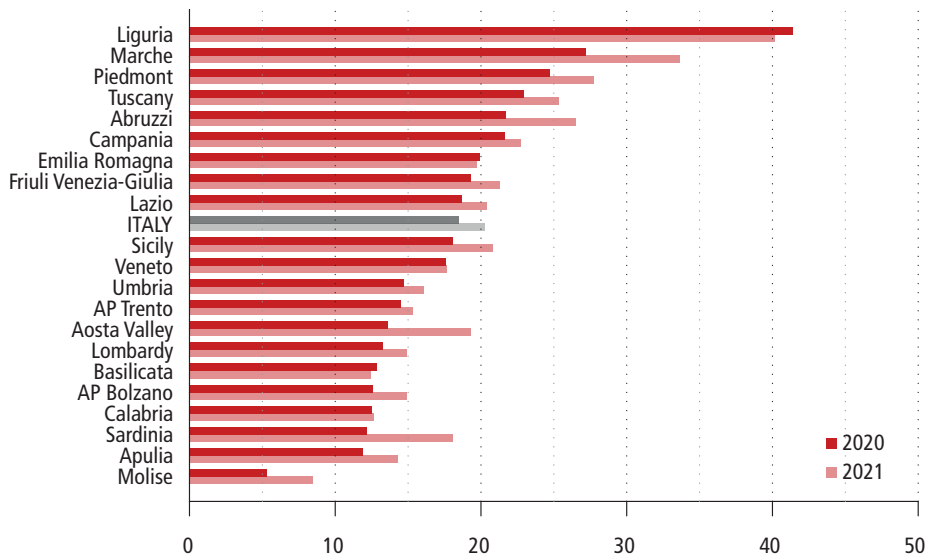


Figure 5. Hip. Emergency total and partial replacement (principal and secondary procedures). Hospitalisation rate by region (per 100,000 residents). 2020-2021

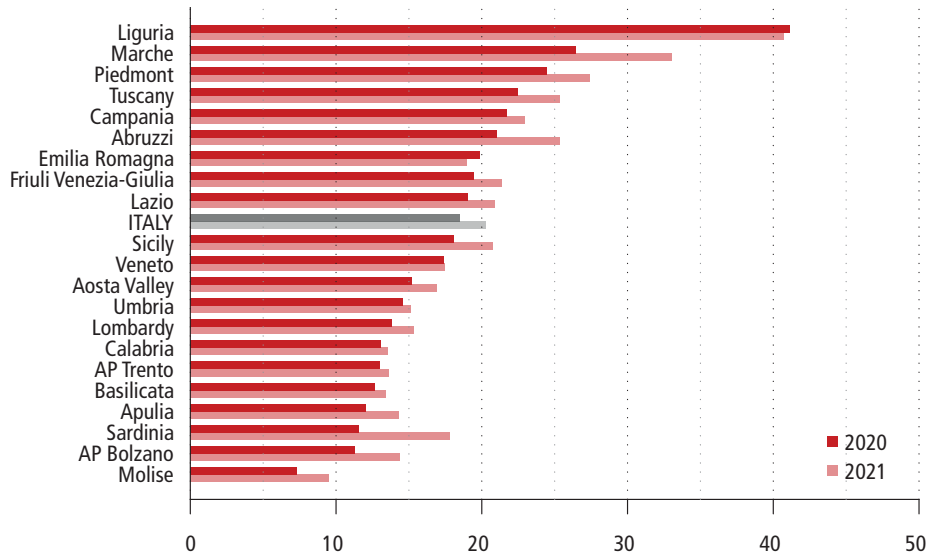


Figure 6. Hip. Elective total and partial replacement (principal and secondary procedures). National incidence/hospitalisation rate (per 100,000 residents). 2001-2021

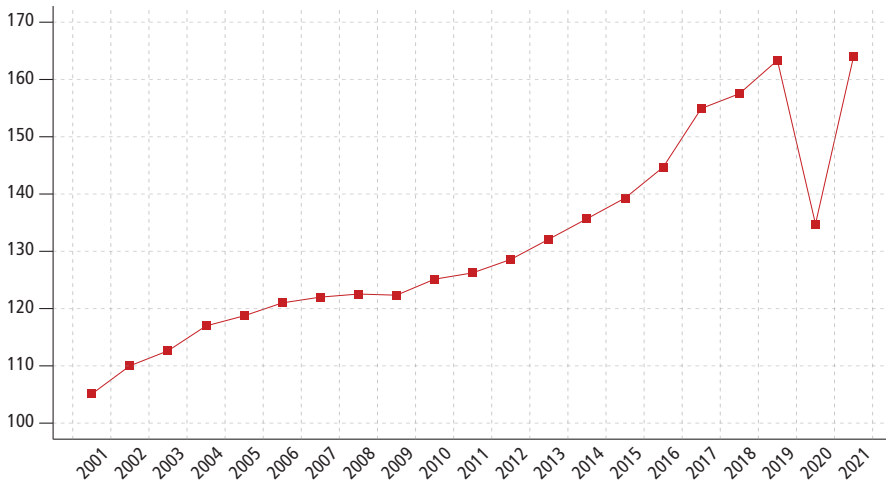


Figure 7. Hip. Emergency total and partial replacement (principal and secondary procedures). National incidence/hospitalisation rate (per 100,000 residents). 2001-2021

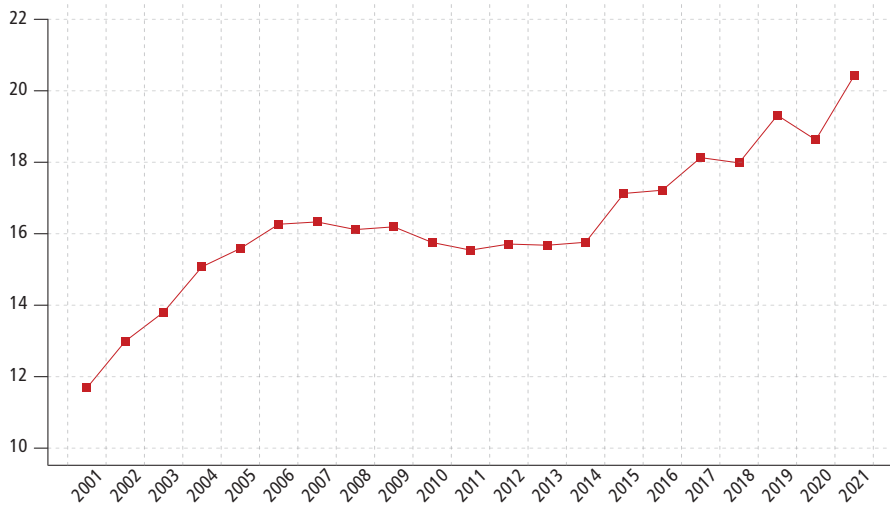


Table 7. Knee. Number of procedures (principal and secondary) by region of admission and by procedure type. 2020-2021

Region of admission	Total replacement			
	2020		2021	
	N	%	N	%
Piedmont	5,055	8.1	6,593	8.7
Aosta Valley	114	0.2	203	0.3
Lombardy	10,796	17.2	15,524	20.4
AP Bolzano	570	0.9	1,042	1.4
AP Trento	564	0.9	813	1.1
Veneto	7,552	12.1	7,894	10.4
Friuli Venezia Giulia	1,531	2.4	1,723	2.3
Liguria	533	0.9	719	0.9
Emilia-Romagna	6,936	11.1	8,798	11.6
Tuscany	6,098	9.7	6,564	8.6
Umbria	1,133	1.8	1,133	1.5
Marche	1,636	2.6	1,599	2.1
Lazio	5,654	9.0	6,461	8.5
Abruzzi	1,672	2.7	1,828	2.4
Molise	170	0.3	196	0.3
Campania	3,122	5.0	4,192	5.5
Apulia	2,895	4.6	2,956	3.9
Basilicata	96	0.2	152	0.2
Calabria	1,206	1.9	1,401	1.8
Sicily	3,917	6.3	4,427	5.8
Sardinia	1,356	2.2	1,800	2.4
Italy	62,606	100.0	76,018	100.0
% of national volume	92.3		92.7	

Revision				Total			
2020		2021		2020		2021	
N	%	N	%	N	%	N	%
425	8.1	576	9.6	5,480	8.1	7,169	8.7
5	0.1	18	0.3	119	0.2	221	0.3
990	19.0	1,344	22.5	11,786	17.4	16,868	20.6
48	0.9	67	1.1	618	0.9	1,109	1.4
33	0.6	22	0.4	597	0.9	835	1.0
488	9.3	522	8.7	8,040	11.9	8,416	10.3
102	2.0	111	1.9	1,633	2.4	1,834	2.2
96	1.8	61	1.0	629	0.9	780	1.0
719	13.8	756	12.7	7,655	11.3	9,554	11.7
690	13.2	647	10.8	6,788	10.0	7,211	8.8
85	1.6	111	1.9	1,218	1.8	1,244	1.5
85	1.6	89	1.5	1,721	2.5	1,688	2.1
453	8.7	483	8.1	6,107	9.0	6,944	8.5
88	1.7	102	1.7	1,760	2.6	1,930	2.4
7	0.1	5	0.1	177	0.3	201	0.2
248	4.8	333	5.6	3,370	5.0	4,525	5.5
160	3.1	197	3.3	3,055	4.5	3,153	3.8
2	0.0	8	0.1	98	0.1	160	0.2
68	1.3	80	1.3	1,274	1.9	1,481	1.8
365	7.0	363	6.1	4,282	6.3	4,790	5.8
63	1.2	79	1.3	1,419	2.1	1,879	2.3
5,220	100.0	5,974	100.0	67,826	100.0	81,992	100.0
7.7		7.3		100.0		100.0	

Table 8. Knee. Primary total replacement. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2020	2021	2020	2021	2020	2021
	N	N	N	N	N	N
Piedmont	30	25	7	9	2	3
Aosta Valley	1	1	1	0	0	1
Lombardy	65	58	12	11	15	11
AP Bolzano	8	5	1	2	3	5
AP Trento	3	2	3	1	2	6
Veneto	19	22	11	9	7	4
Friuli Venezia Giulia	9	7	1	3	1	1
Liguria	14	10	3	2	0	3
Emilia-Romagna	30	27	10	5	10	14
Tuscany	24	19	10	10	5	5
Umbria	4	5	6	4	3	3
Marche	8	9	5	4	1	2
Lazio	51	46	13	8	9	12
Abruzzi	13	12	1	2	1	1
Molise	4	4	0	0	1	1
Campania	45	38	12	13	9	9
Apulia	25	22	5	6	5	5
Basilicata	5	5	1	1	0	0
Calabria	8	10	4	4	2	1
Sicily	45	39	11	14	9	10
Sardinia	11	12	1	2	6	2
Italy	422	378	118	110	91	99
<i>% of national volume</i>	<i>58.8</i>	<i>54.1</i>	<i>16.4</i>	<i>15.7</i>	<i>12.7</i>	<i>14.2</i>

201-300		>300		Total			
2020	2021	2020	2021	2020		2021	
N	N	N	N	N	%	N	%
6	5	5	7	50	7.0	49	7.0
0	0	0	0	2	0.3	2	0.3
8	9	8	16	108	15.0	105	15.0
0	0	0	0	12	1.7	12	1.7
0	0	0	0	8	1.1	9	1.3
1	1	9	10	47	6.5	46	6.6
2	1	1	2	14	1.9	14	2.0
0	0	0	0	17	2.4	15	2.1
8	3	4	10	62	8.6	59	8.4
1	2	8	9	48	6.7	45	6.4
1	1	0	0	14	1.9	13	1.9
2	0	1	2	17	2.4	17	2.4
1	4	4	4	78	10.9	74	10.6
1	1	3	3	19	2.6	19	2.7
0	0	0	0	5	0.7	5	0.7
1	5	0	0	67	9.3	65	9.3
3	4	2	1	40	5.6	38	5.4
0	0	0	0	6	0.8	6	0.9
2	2	0	1	16	2.2	18	2.6
2	3	2	2	69	9.6	68	9.7
1	3	0	1	19	2.6	20	2.9
40	44	47	68	718	100.0	699	100.0
5.6	6.3	6.5	9.7	100.0		100.0	

Table 9. Knee. Revision. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume											
	1-10		11-25		26-50		>50		Total			
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021		
	N	N	N	N	N	N	N	N	N	%	N	%
Piedmont	27	22	9	9	4	6	0	1	40	7.2	38	7.1
Aosta Valley	1	0	0	1	0	0	0	0	1	0.2	1	0.2
Lombardy	64	63	12	13	9	9	1	4	86	15.4	89	16.6
AP Bolzano	7	8	2	2	0	0	0	0	9	1.6	10	1.9
AP Trento	7	7	0	0	0	0	0	0	7	1.3	7	1.3
Veneto	33	26	10	7	1	3	1	1	45	8.1	37	6.9
Friuli Venezia Giulia	11	10	1	1	1	2	0	0	13	2.3	13	2.4
Liguria	10	11	1	2	1	0	0	0	12	2.2	13	2.4
Emilia-Romagna	35	31	14	16	5	5	1	1	55	9.9	53	9.9
Tuscany	28	23	1	5	5	6	4	2	38	6.8	36	6.7
Umbria	10	9	1	2	1	1	0	0	12	2.2	12	2.2
Marche	11	8	1	3	1	0	0	0	13	2.3	11	2.0
Lazio	47	41	6	5	4	5	1	1	58	10.4	52	9.7
Abruzzi	12	10	3	4	0	0	0	0	15	2.7	14	2.6
Molise	3	2	0	0	0	0	0	0	3	0.5	2	0.4
Campania	39	33	7	9	0	1	1	1	47	8.4	44	8.2
Apulia	26	23	3	6	1	1	0	0	30	5.4	30	5.6
Basilicata	2	3	0	0	0	0	0	0	2	0.4	3	0.6
Calabria	10	11	2	1	0	1	0	0	12	2.2	13	2.4
Sicily	38	37	9	7	1	2	0	0	48	8.6	46	8.6
Sardinia	11	10	1	3	0	0	0	0	12	2.2	13	2.4
Italy	432	388	83	96	34	42	9	11	558	100.0	537	100.0
<i>% of national volume</i>	<i>77.4</i>	<i>72.3</i>	<i>14.9</i>	<i>17.9</i>	<i>6.1</i>	<i>7.8</i>	<i>1.6</i>	<i>2.0</i>	<i>100.0</i>		<i>100.0</i>	

Table 10. Knee. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2020-2021

	Total replacement		Revision		Total	
	2020	2021	2020	2021	2020	2021
	%	%	%	%	%	%
Gender						
Male	35.0	35.8	33.8	35.5	34.9	35.8
Female	65.0	64.2	66.2	64.5	65.1	64.2
Age (male)						
Mean age	68,8	68,7	68,3	68,3	68,8	68,7
Standard deviation	9,4	9,5	11,1	11,1	9,6	9,6
Age group						
0-44	1.2	1.1	2.7	2.7	1.3	1.2
45-54	5.8	6.3	7.8	7.5	5.9	6.3
55-64	22.4	23.3	20.4	23.3	22.2	23.3
65-74	41.6	39.6	37.8	34.8	41.3	39.2
75-84	27.2	27.7	29.7	28.8	27.4	27.7
85+	1.8	2.1	1.6	2.9	1.8	2.1
Age (female)						
Mean age	70,6	71,0	70,8	71,0	70,6	70,6
Standard deviation	8,4	9,4	9,4	9,4	8,5	8,7
Age group						
0-44	0.4	0.4	0.7	0.8	0.4	0.4
45-54	3.7	4.0	4.2	4.5	3.7	4.1
55-64	17.7	18.0	17.2	16.4	17.7	17.9
65-74	43.6	42.2	41.1	39.7	43.4	42.0
75-84	32.4	32.8	33.0	34.5	32.5	33.0
85+	2.1	2.5	3.8	4.0	2.3	2.6

Table 11. Knee. Percent distribution of hospital discharges by discharge type and by procedure type. 2020-2021

Discharge type	Total replacement (elective)		Revision		Total	
	2020	2021	2020	2021	2020	2021
	%	%	%	%	%	%
Deceased	0.0	0.0	0.2	0.1	0.0	0.0
Ordinary discharge	55.1	56.6	57.4	56.9	55.4	56.6
Discharge to a Residential Care Facility	1.1	0.9	1.2	1.0	1.1	0.9
Discharge with home health services	0.1	0.0	0.2	0.2	0.1	0.0
Discharge against medical advice	0.1	0.1	0.2	0.2	0.1	0.1
Transfer to an acute admission unit of a different hospital	0.9	0.8	1.2	1.1	0.9	0.8
Transfer in the same hospital	26.9	25.5	23.7	23.7	26.7	25.5
Transfer to an inpatient rehabilitation facility	15.4	15.7	15.3	16.1	15.3	15.7
Discharge with integrated home care	0.4	0.4	0.6	0.7	0.4	0.4

Figure 8. Knee. Total replacement (principal procedures). Inter-regional mobility (attraction and escape indices) in 2020 (a) and in 2021 (b)

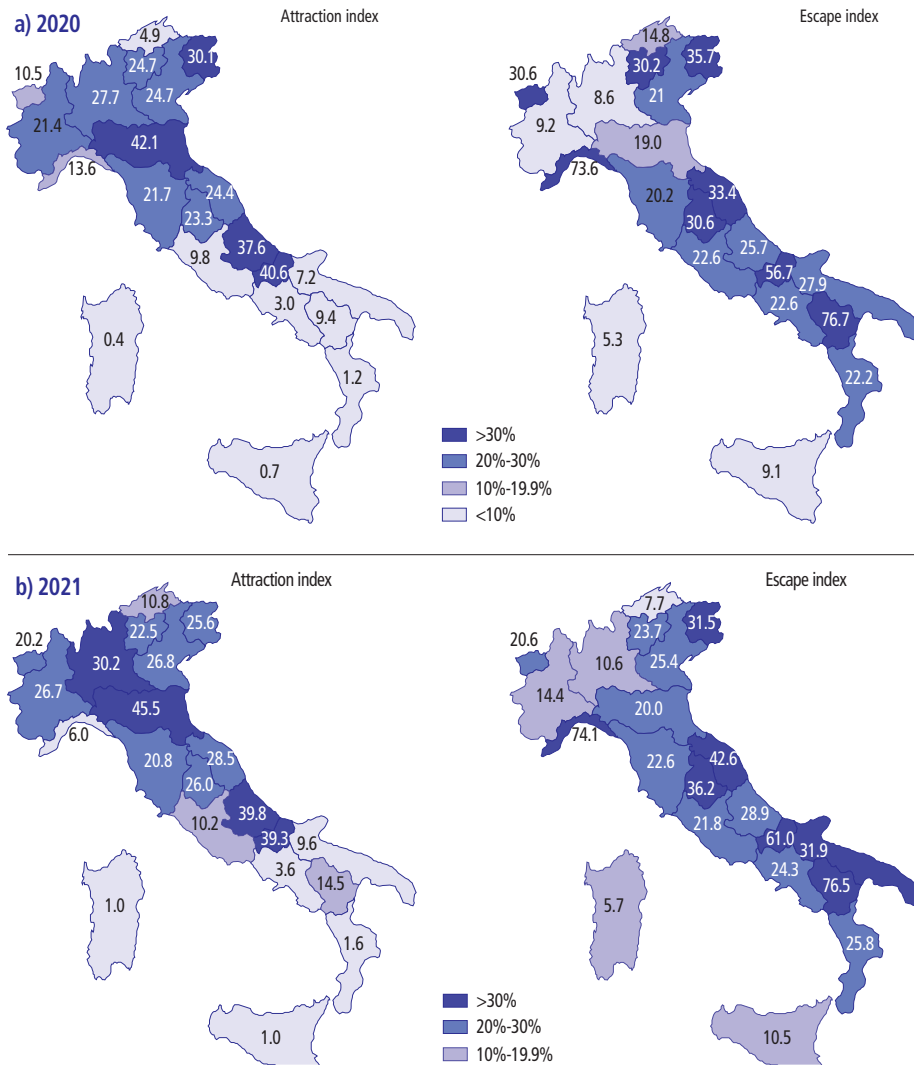


Figure 9. Knee. Total replacement (principal and secondary procedures). Incidence rate by region (per 100,000 residents). 2020-2021

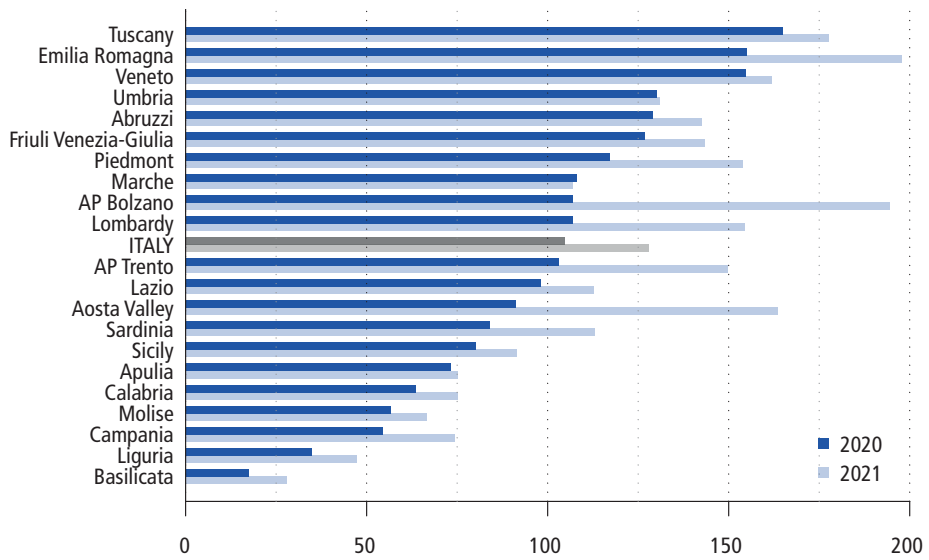


Figure 10. Knee. Total replacement (principal and secondary procedures). Hospitalisation rate by region (per 100,000 residents). 2020-2021

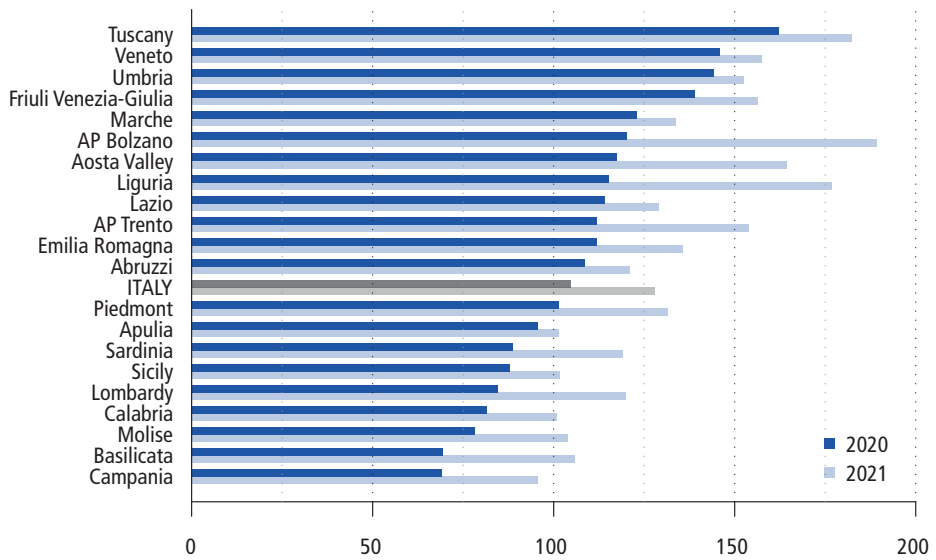


Figure 11. Knee. Total replacement (principal and secondary procedures). National incidence/hospitalisation rate (per 100,000 residents). 2001-2021

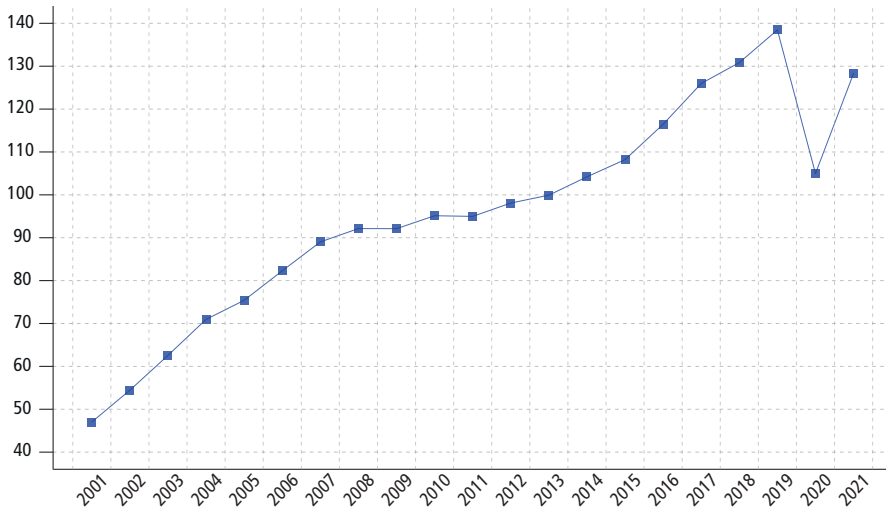


Table 12. Shoulder. Number of procedures (principal and secondary) by region of admission and by procedure type. 2020-2021

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2020		2021		2020		2021	
	N	%	N	%	N	%	N	%
Piedmont	604	10.5	830	11.6	196	8.1	200	6.9
Aosta Valley	8	0.1	3	0.0	2	0.1	3	0.1
Lombardy	702	12.2	943	13.2	391	16.1	509	17.5
AP Bolzano	36	0.6	44	0.6	13	0.5	25	0.9
AP Trento	26	0.5	32	0.4	24	1.0	29	1.0
Veneto	542	9.4	599	8.4	245	10.1	288	9.9
Friuli Venezia Giulia	92	1.6	64	0.9	64	2.6	63	2.2
Liguria	29	0.5	19	0.3	26	1.1	17	0.6
Emilia-Romagna	734	12.7	986	13.8	191	7.9	231	7.9
Tuscany	658	11.4	758	10.6	99	4.1	126	4.3
Umbria	90	1.6	100	1.4	39	1.6	47	1.6
Marche	165	2.9	159	2.2	80	3.3	82	2.8
Lazio	720	12.5	889	12.4	253	10.4	351	12.0
Abruzzi	171	3.0	200	2.8	60	2.5	80	2.7
Molise	3	0.1	12	0.2	7	0.3	6	0.2
Campania	443	7.7	591	8.3	190	7.8	249	8.5
Apulia	221	3.8	308	4.3	223	9.2	211	7.2
Basilicata	4	0.1	7	0.1	12	0.5	18	0.6
Calabria	71	1.2	127	1.8	44	1.8	67	2.3
Sicily	393	6.8	397	5.5	240	9.9	293	10.1
Sardinia	46	0.8	86	1.2	27	1.1	19	0.7
Italy	5,758	100.0	7,154	100.0	2,426	100.0	2,914	100.0
% of national volume	62.6		62.9		26.4		25.6	

Partial replacement				Total			
2020		2021		2020		2021	
N	%	N	%	N	%	N	%
36	3.6	39	3.0	836	9.1	1,069	9.4
0	0.0	0	0.0	10	0.1	6	0.1
81	8.0	80	6.2	1,174	12.8	1,532	13.5
4	0.4	5	0.4	53	0.6	74	0.7
4	0.4	5	0.4	54	0.6	66	0.6
284	28.1	424	32.7	1,071	11.6	1,311	11.5
25	2.5	21	1.6	181	2.0	148	1.3
5	0.5	4	0.3	60	0.7	40	0.4
74	7.3	87	6.7	999	10.9	1,304	11.5
59	5.8	47	3.6	816	8.9	931	8.2
80	7.9	87	6.7	209	2.3	234	2.1
26	2.6	28	2.2	271	2.9	269	2.4
88	8.7	88	6.8	1,061	11.5	1,328	11.7
24	2.4	27	2.1	255	2.8	307	2.7
5	0.5	1	0.1	15	0.2	19	0.2
114	11.3	232	17.9	747	8.1	1,072	9.4
30	3.0	26	2.0	474	5.2	545	4.8
5	0.5	1	0.1	21	0.2	26	0.2
3	0.3	7	0.5	118	1.3	201	1.8
53	5.2	70	5.4	686	7.5	760	6.7
11	1.1	19	1.5	84	0.9	124	1.1
1,011	100.0	1,298	100.0	9,195	100.0	11,366	100.0
11.0		11.4		100.0		100.0	

Table 13. Shoulder. Total replacement. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2020	2021	2020	2021	2020	2021
	N	N	N	N	N	N
Piedmont	11	11	11	7	4	8
Aosta Valley	1	1	1	1	0	0
Lombardy	23	20	23	30	20	11
AP Bolzano	2	6	3	1	1	0
AP Trento	1	3	3	2	1	1
Veneto	9	4	5	7	9	10
Friuli Venezia Giulia	3	4	2	1	3	5
Liguria	10	9	5	3	0	0
Emilia-Romagna	11	15	15	10	8	6
Tuscany	15	8	4	10	4	3
Umbria	5	5	4	3	1	1
Marche	4	5	4	2	5	4
Lazio	29	19	13	18	6	6
Abruzzi	8	2	2	6	3	4
Molise	2	1	1	1	0	1
Campania	23	24	6	8	4	7
Apulia	9	8	8	8	8	7
Basilicata	1	1	2	3	0	0
Calabria	5	9	5	0	3	3
Sicily	22	24	14	14	3	9
Sardinia	6	8	2	2	2	0
Italy	200	187	133	137	85	86
<i>% of national volume</i>	<i>34.4</i>	<i>30.7</i>	<i>22.9</i>	<i>22.5</i>	<i>14.6</i>	<i>14.1</i>

15-24		>24		Total			
2020	2021	2020	2021	2020		2021	
N	N	N	N	N	%	N	%
10	6	6	12	42	7.2	44	7.2
0	0	0	0	2	0.3	2	0.3
12	19	10	14	88	15.1	94	15.4
1	3	0	0	7	1.2	10	1.6
1	1	0	0	6	1.0	7	1.1
7	7	12	13	42	7.2	41	6.7
3	3	1	0	12	2.1	13	2.1
0	0	0	0	15	2.6	12	2.0
11	10	9	15	54	9.3	56	9.2
6	6	8	9	37	6.4	36	5.9
1	0	2	3	13	2.2	12	2.0
2	4	2	2	17	2.9	17	2.8
8	7	10	14	66	11.3	64	10.5
1	1	3	4	17	2.9	17	2.8
0	0	0	0	3	0.5	3	0.5
8	5	6	9	47	8.1	53	8.7
5	6	4	5	34	5.8	34	5.6
0	0	0	0	3	0.5	4	0.7
2	4	0	2	15	2.6	18	3.0
5	2	7	9	51	8.8	58	9.5
1	4	0	0	11	1.9	14	2.3
84	88	80	111	582	100.0	609	100.0
14.4	14.4	13.7	18.2	100.0		100.0	

Table 14. Shoulder. Partial replacement. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2020	2021	2020	2021	2020	2021
	N	N	N	N	N	N
Piedmont	12	13	1	0	1	2
Aosta Valley	0	0	0	0	0	0
Lombardy	43	29	2	3	0	0
AP Bolzano	2	3	0	0	0	0
AP Trento	2	2	0	0	0	0
Veneto	17	17	10	8	1	4
Friuli Venezia Giulia	6	9	2	0	0	0
Liguria	2	2	0	0	0	0
Emilia-Romagna	23	25	3	1	0	3
Tuscany	11	12	2	0	0	0
Umbria	2	3	2	2	1	0
Marche	4	5	0	0	0	0
Lazio	25	22	2	5	0	0
Abruzzi	6	8	1	0	1	1
Molise	0	1	1	0	0	0
Campania	15	16	3	1	1	0
Apulia	11	12	2	1	0	0
Basilicata	0	1	1	0	0	0
Calabria	3	5	0	0	0	0
Sicily	16	19	2	2	1	0
Sardinia	6	8	0	1	0	0
Italy	206	212	34	24	6	10
<i>% of national volume</i>	<i>79.2</i>	<i>80.6</i>	<i>13.1</i>	<i>9.1</i>	<i>2.3</i>	<i>3.8</i>

15-24		>24		Total			
2020	2021	2020	2021	2020		2021	
N	N	N	N	N	%	N	%
0	0	0	0	14	5.4	15	5.7
0	0	0	0	0	0.0	0	0.0
0	1	0	0	45	17.3	33	12.5
0	0	0	0	2	0.8	3	1.1
0	0	0	0	2	0.8	2	0.8
4	2	2	4	34	13.1	35	13.3
0	0	0	0	8	3.1	9	3.4
0	0	0	0	2	0.8	2	0.8
1	0	0	0	27	10.4	29	11.0
0	0	1	1	14	5.4	13	4.9
1	0	1	2	7	2.7	7	2.7
1	1	0	0	5	1.9	6	2.3
2	1	0	0	29	11.2	28	10.6
0	0	0	0	8	3.1	9	3.4
0	0	0	0	1	0.4	1	0.4
0	0	1	4	20	7.7	21	8.0
0	0	0	0	13	5.0	13	4.9
0	0	0	0	1	0.4	1	0.4
0	0	0	0	3	1.2	5	1.9
0	0	0	1	19	7.3	22	8.4
0	0	0	0	6	2.3	9	3.4
9	5	5	12	260	100.0	263	100.0
3.5	1.9	1.9	4.6	100.0		100.0	

Table 15. Shoulder. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2020-2021

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2020	2021	2020	2021	2020	2021	2020	2021
	%	%	%	%	%	%	%	%
Gender								
Male	31.5	32.7	16.5	17.1	44.6	48.4	29.0	30.5
Female	68.5	67.3	83.5	82.9	55.4	51.6	71.0	69.5
Age (male)								
Mean age	68.5	68.3	70.7	71.3	62.9	61.5	67.9	67.5
Standard deviation	9.7	9.6	10.6	10.2	12.3	11.6	10.6	10.5
Age group								
0-44	2.2	1.7	1.8	1.2	5.3	7.2	2.7	2.6
45-54	6.1	6.7	7.0	5.6	18.0	16.9	8.2	8.4
55-64	20.6	23.2	18.0	15.3	30.4	35.1	21.9	24.2
65-74	42.6	41.8	31.8	38.1	29.8	29.5	38.8	39.0
75-84	27.2	25.1	35.8	32.7	13.8	9.3	26.2	23.3
85+	1.4	1.5	5.5	7.1	2.7	2.1	2.2	2.4
Age (female)								
Mean age	72.9	72.8	74.9	74.7	68.9	67.3	73.2	72.9
Standard deviation	7.6	7.9	7.3	7.5	10.3	10.6	8.0	8.3
Age group								
0-44	0.4	0.4	0.4	0.1	1.1	1.6	0.4	0.4
45-54	1.4	1.8	1.4	0.9	6.1	8.1	1.6	2.1
55-64	10.3	11.2	10.3	8.9	27.0	29.3	10.9	12.0
65-74	43.0	41.7	43.0	36.2	33.5	33.3	40.2	39.3
75-84	41.5	41.4	41.5	46.5	27.0	24.2	42.0	41.5
85+	3.3	3.5	3.3	7.5	5.4	3.4	5.0	4.7

Table 16. Shoulder. Percent distribution of hospital discharges by discharge type and by procedure type. 2020-2021

Discharge type	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2020	2021	2020	2021	2020	2021	2020	2021
	%	%	%	%	%	%	%	%
Deceased	0.1	0.1	0.3	0.2	0.1	0.2	0.1	0.1
Ordinary discharge	95.4	96.4	92.0	92.8	96.0	97.3	94.8	95.6
Discharge to a Residential Care Facility	0.2	0.1	1.2	1.8	1.0	0.6	0.5	0.6
Discharge with home health services	0.3	0.0	0.4	0.0	0.3	0.1	0.3	0.0
Discharge against medical advice	0.3	0.3	0.4	0.2	0.2	0.2	0.3	0.2
Transfer to an acute admission unit of a different hospital	0.2	0.2	0.5	0.6	0.3	0.1	0.3	0.3
Transfer in the same hospital	1.8	1.6	1.2	0.7	0.7	0.8	1.5	1.3
Transfer to an inpatient rehabilitation facility	1.6	1.2	2.6	2.5	1.1	0.5	1.8	1.5
Discharge with integrated home care	0.1	0.1	1.4	1.2	0.3	0.2	0.4	0.4

Figure 12. Shoulder. Elective total replacement (principal procedures). Inter-regional mobility (attraction and escape indices) in 2020 (a) and in 2021 (b)

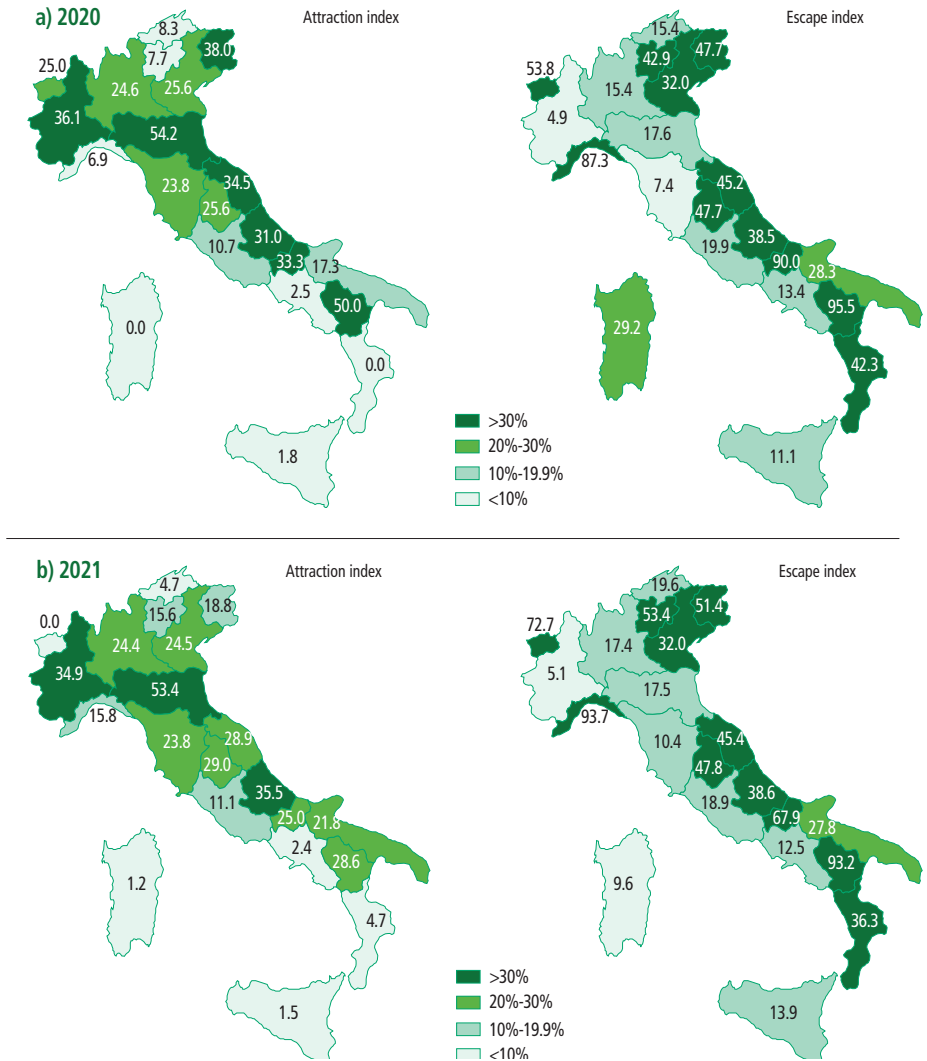


Figure 13. Shoulder. Elective total and partial replacement (principal and secondary procedures). Incidence rate by region (per 100,000 residents). 2020-2021

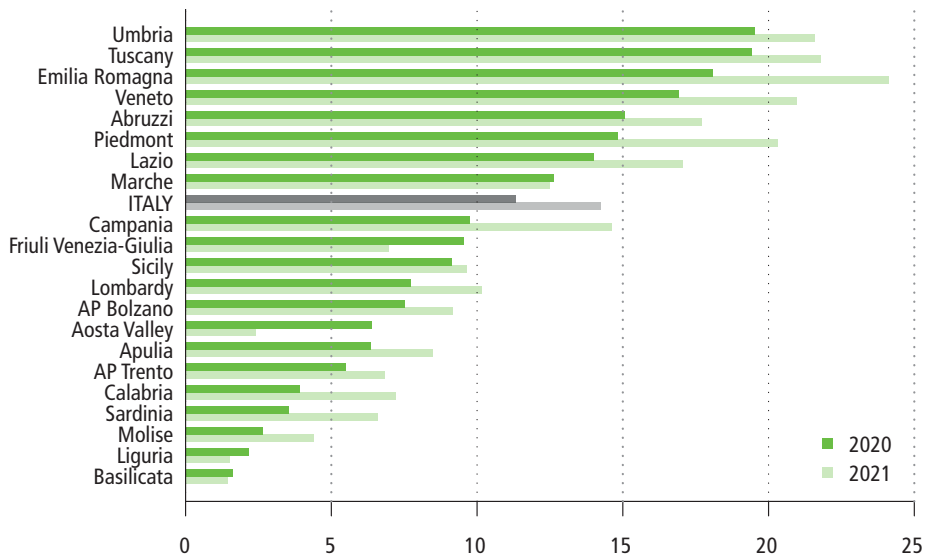


Figure 14. Shoulder. Elective total and partial replacement (principal and secondary procedures). Hospitalisation rate by region (per 100,000 residents). 2020-2021

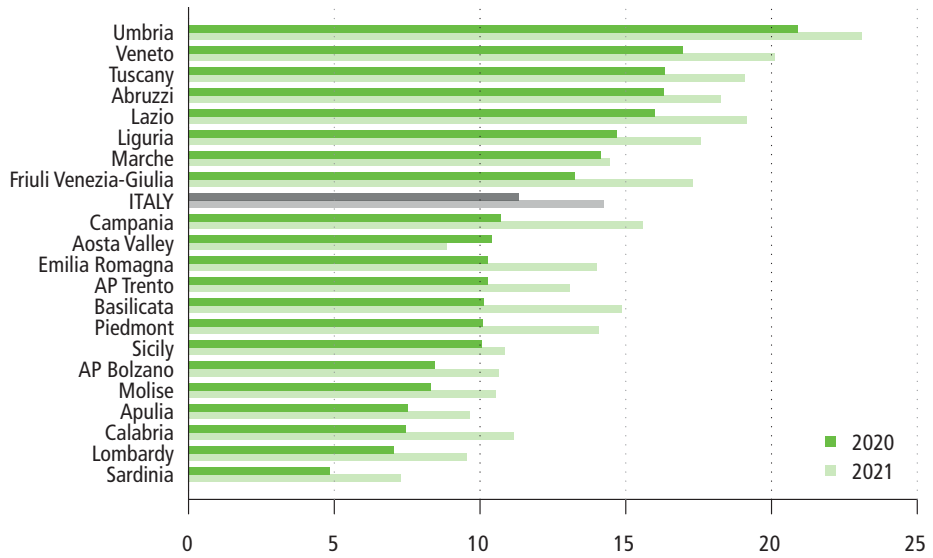


Figure 15. Shoulder. Emergency total and partial replacement (principal and secondary procedures). Incidence rate by region (per 100,000 residents). 2020-2021

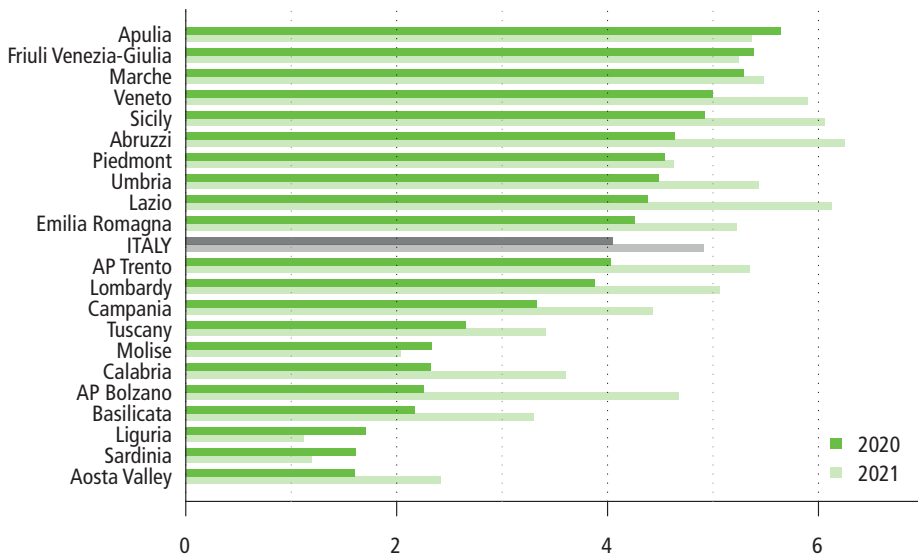


Figure 16. Shoulder. Emergency total and partial replacement (principal and secondary procedures). Hospitalisation rate by region (per 100,000 residents). 2020-2021

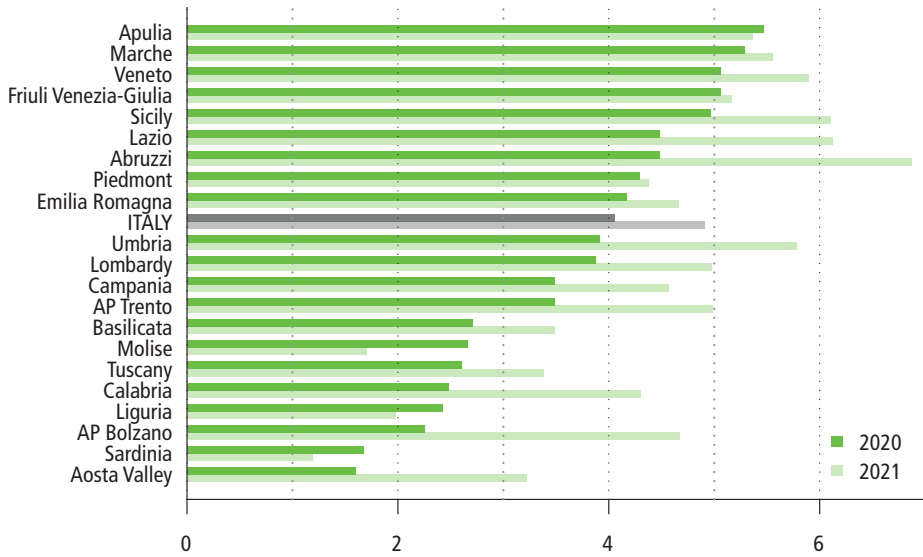


Figure 17. Shoulder. Elective total and partial replacement (principal and secondary procedures). National incidence/hospitalisation rate (per 100,000 residents). 2001-2021

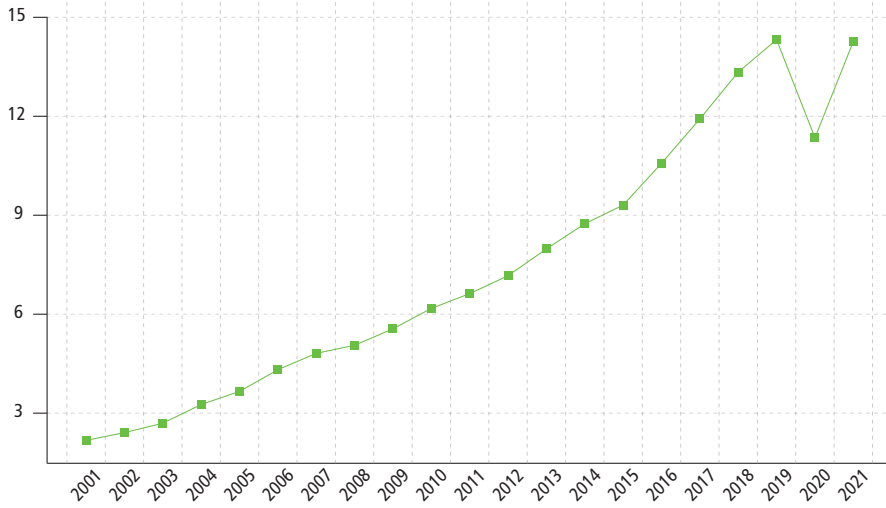


Figure 18. Shoulder. Emergency total and partial replacement (principal and secondary procedures). National incidence/hospitalisation rate (per 100,000 residents). 2001-2021

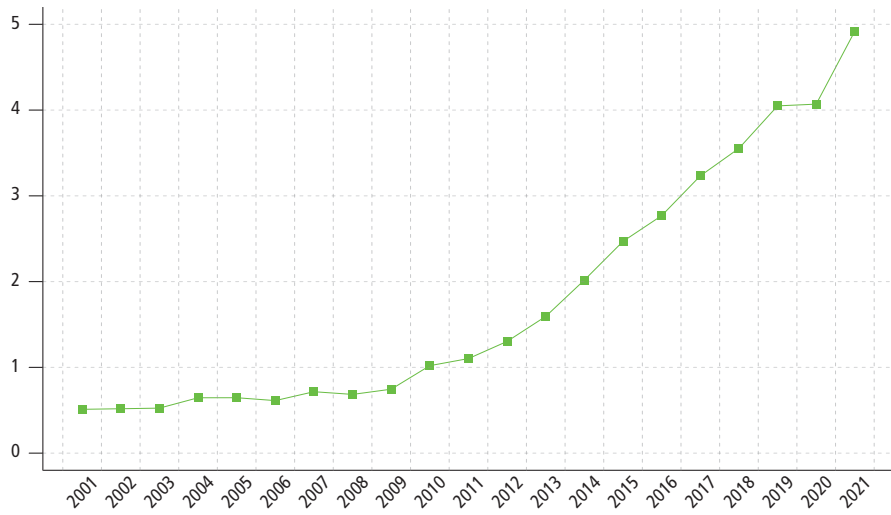


Table 17. Ankle. Total replacement. Number of procedures (principal and secondary) by region of admission and by procedure type. 2020-2021

Region of admission	Total replacement			
	2020		2021	
	N	%	N	%
Piedmont	27	4.6	47	5.7
Aosta Valley	0	0.0	2	0.2
Lombardy	267	45.0	341	41.6
AP Bolzano	0	0.0	0	0.0
AP Trento	13	2.2	15	1.8
Veneto	58	9.8	69	8.4
Friuli Venezia Giulia	2	0.3	2	0.2
Liguria	1	0.2	1	0.1
Emilia-Romagna	133	22.4	201	24.5
Tuscany	6	1.0	17	2.1
Umbria	1	0.2	2	0.2
Marche	3	0.5	8	1.0
Lazio	50	8.4	73	8.9
Abruzzi	2	0.3	2	0.2
Molise	0	0.0	0	0.0
Campania	7	1.2	12	1.5
Apulia	4	0.7	8	1.0
Basilicata	0	0.0	0	0.0
Calabria	6	1.0	3	0.4
Sicily	12	2.0	14	1.7
Sardinia	1	0.2	3	0.4
Italy	593	100.0	820	100.0
<i>% of national volume</i>				

Table 18. Ankle. Total replacement. Number of hospitals performing procedures (principal and secondary) by region of admission and by class of volume. 2020-2021

Region of admission	Class of volume									
	1-2		3-4		>4		Total			
	2020	2021	2020	2021	2020	2021	2020	%	2021	%
	N	N	N	N	N	N	N		N	%
Piedmont	4	3	3	0	2	5	9	9.0	8	6.2
Aosta Valley	0	1	0	0	0	0	0	0.0	1	0.8
Lombardy	17	18	3	3	3	7	23	23.0	28	21.7
AP Bolzano	0	0	0	0	0	0	0	0.0	0	0.0
AP Trento	1	2	0	0	1	1	2	2.0	3	2.3
Veneto	4	7	0	2	6	6	10	10.0	15	11.6
Friuli Venezia Giulia	2	2	0	0	0	0	2	2.0	2	1.6
Liguria	1	1	0	0	0	0	1	1.0	1	0.8
Emilia-Romagna	9	4	2	6	4	6	15	15.0	16	12.4
Tuscany	5	4	0	2	0	1	5	5.0	7	5.4
Umbria	1	2	0	0	0	0	1	1.0	2	1.6
Marche	2	1	0	2	0	0	2	2.0	3	2.3
Lazio	6	13	5	5	2	3	13	13.0	21	16.3
Abruzzi	1	1	0	0	0	0	1	1.0	1	0.8
Molise	0	0	0	0	0	0	0	0.0	0	0.0
Campania	5	4	0	2	0	0	5	5.0	6	4.7
Apulia	3	2	0	2	0	0	3	3.0	4	3.1
Basilicata	0	0	0	0	0	0	0	0.0	0	0.0
Calabria	0	3	2	0	0	0	2	2.0	3	2.3
Sicily	2	4	3	1	0	1	5	5.0	6	4.7
Sardinia	1	2	0	0	0	0	1	1.0	2	1.6
Italy	64	74	18	25	18	30	100	100.0	129	100.0
% of national volume	64.0	57.4	18.0	19.4	18.0	23.3	100.0		100.0	

Table 19. Ankle. Total replacement. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2020-2021

	Total replacement	
	2020	2021
	%	%
Gender		
Male	60.4	56.4
Female	39.6	43.6
Age (male)		
Mean age	56.4	55.6
Standard deviation	14.0	14.2
Age group		
0-19	0.6	0.9
20-39	12.6	12.8
40-49	15.4	18.0
50-59	25.4	28.1
60-69	29.1	22.9
70-79	14.5	15.8
80+	2.5	1.5
Age (female)		
Mean age	56.7	56.3
Standard deviation	14.7	15.3
Age group		
0-19	1.7	1.7
20-39	9.4	12.3
40-49	17.9	12.6
50-59	27.7	28.0
60-69	19.1	25.2
70-79	21.3	16.5
80+	3.0	3.6

Table 20. Ankle. Total replacement. Percent distribution of hospital discharges by discharge type. 2020-2021

Discharge type	Total replacement	
	2020	2021
	%	%
Deceased	0.0	0.0
Ordinary discharge	98.1	98.3
Discharge to a Residential Care Facility	0.2	0.0
Discharge with home health services	0.2	0.0
Discharge against medical advice	0.2	0.2
Transfer to an acute admission unit of a different hospital	0.0	0.0
Transfer in the same hospital	0.8	0.7
Transfer to an inpatient rehabilitation facility	0.5	0.7
Discharge with integrated home care	0.0	0.0

Figure 19. Ankle. Total replacement (principal and secondary procedures). Incidence rate by region (per 100,000 residents). 2020-2021

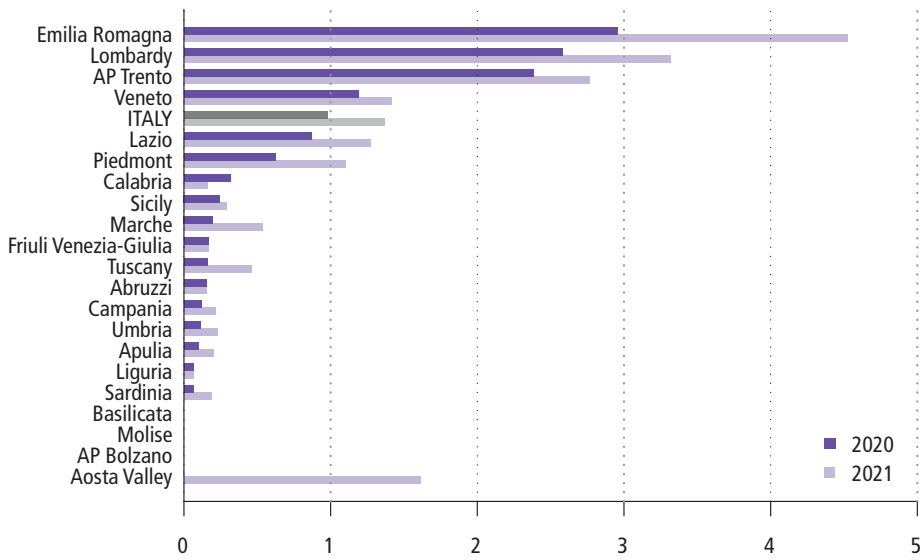


Figure 20. Ankle. Total replacement (principal and secondary procedures). Hospitalisation rate by region (per 100,000 residents). 2020-2021

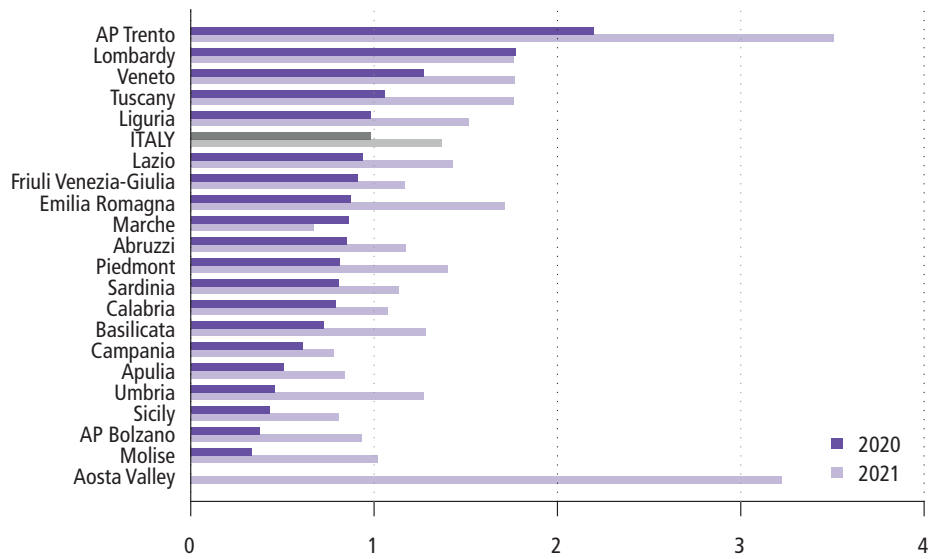


Figure 21. Ankle. Total replacement (principal and secondary procedures). National incidence/hospitalisation rate by region (per 100,000 residents). 2001-2021

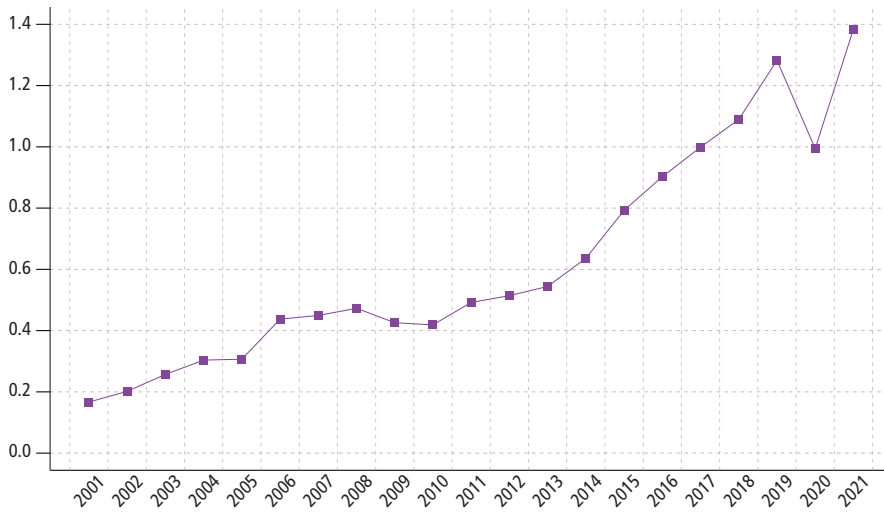


Figure 1. Temporal trends in RIAP coverage (a) and completeness (b) in relation to the total national territory. 2007-2021

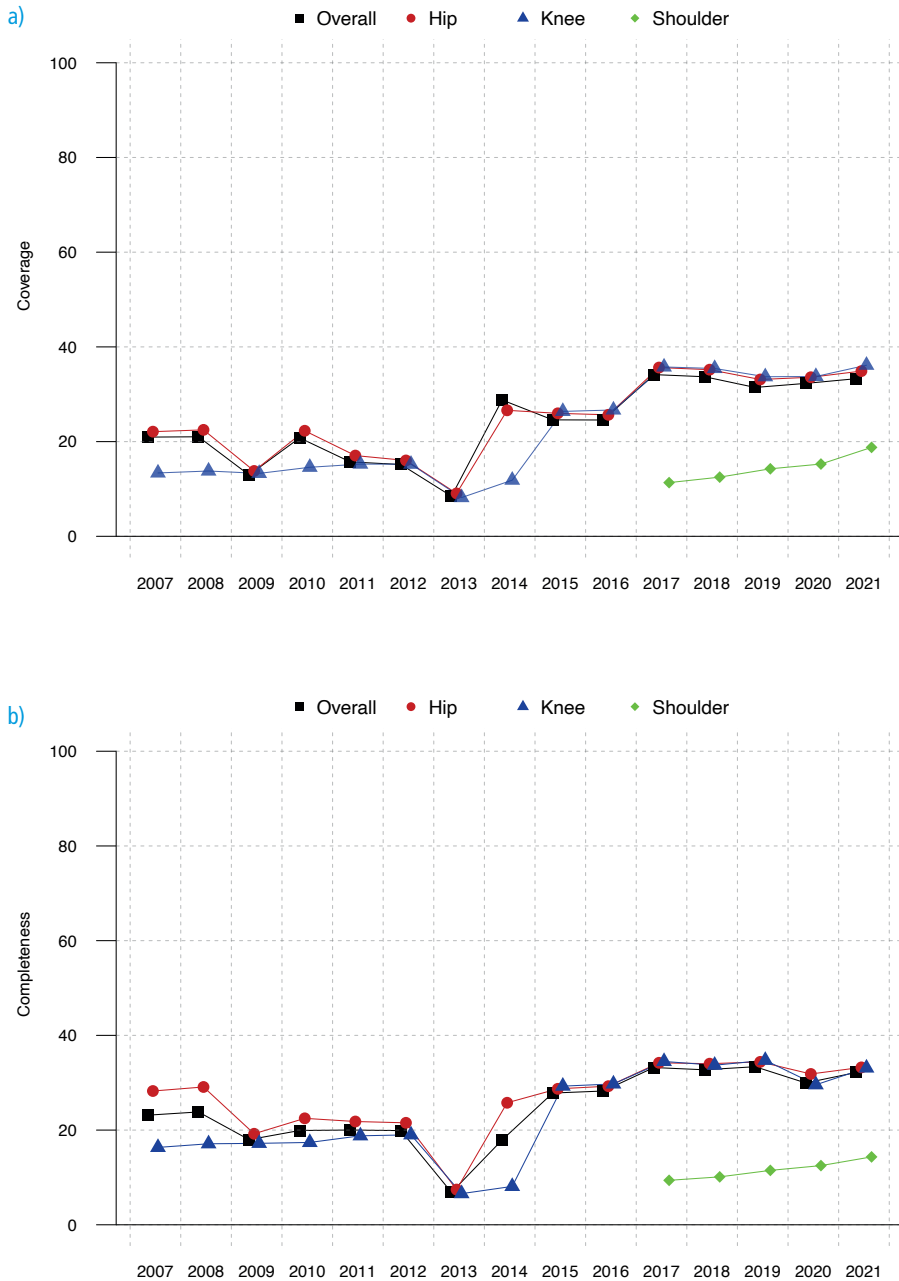
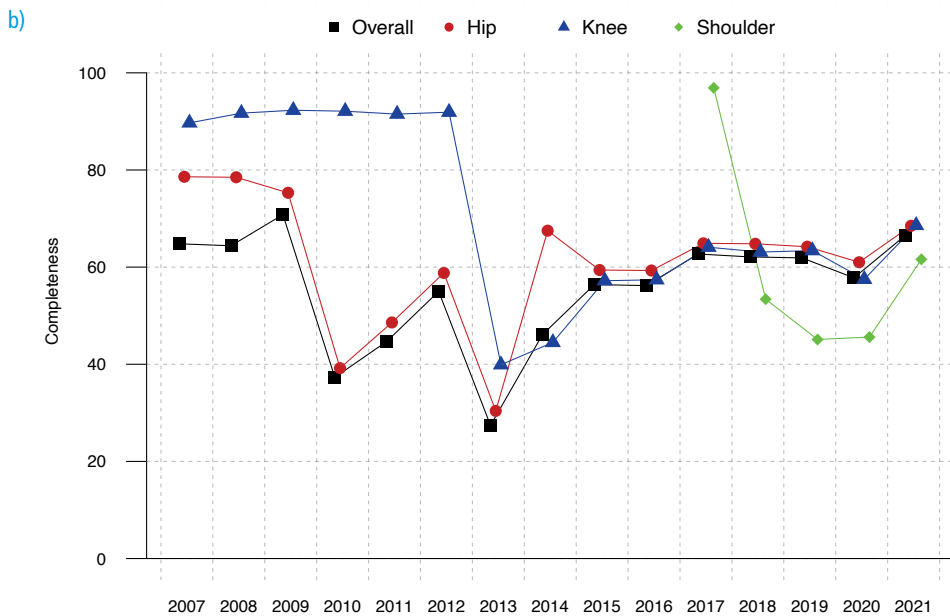
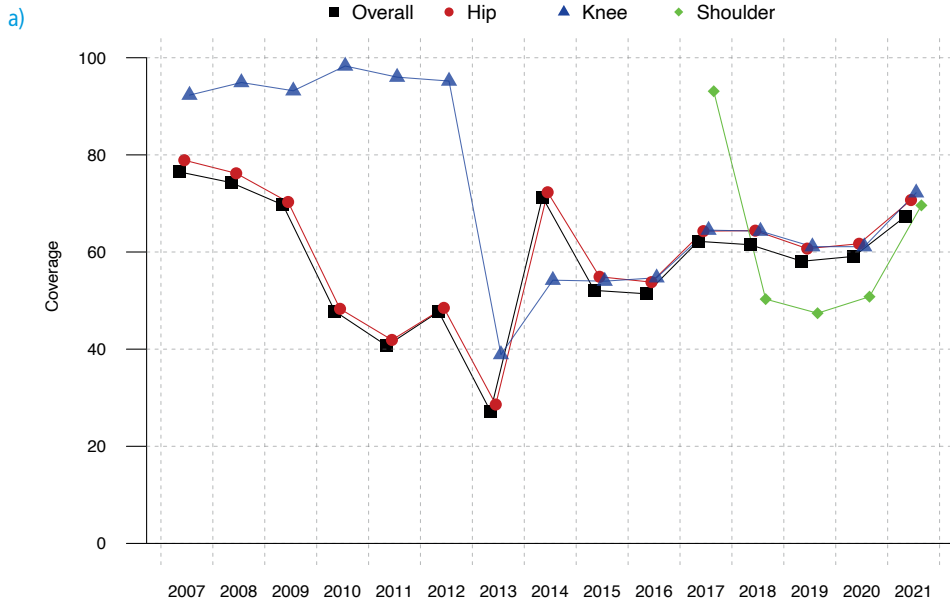


Figure 2. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d) of the institutions participating in RIAP in relation to the areas covered by them. 2007-2021



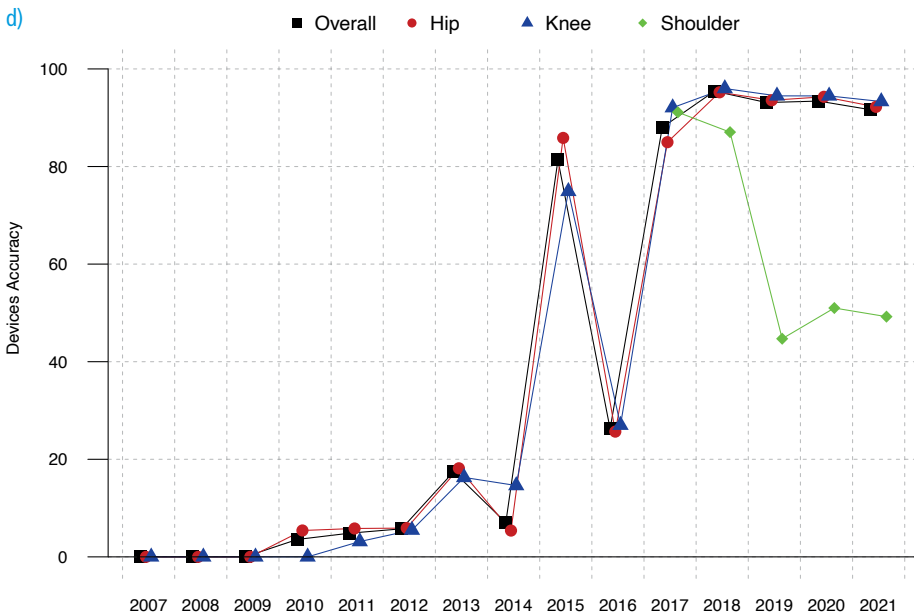
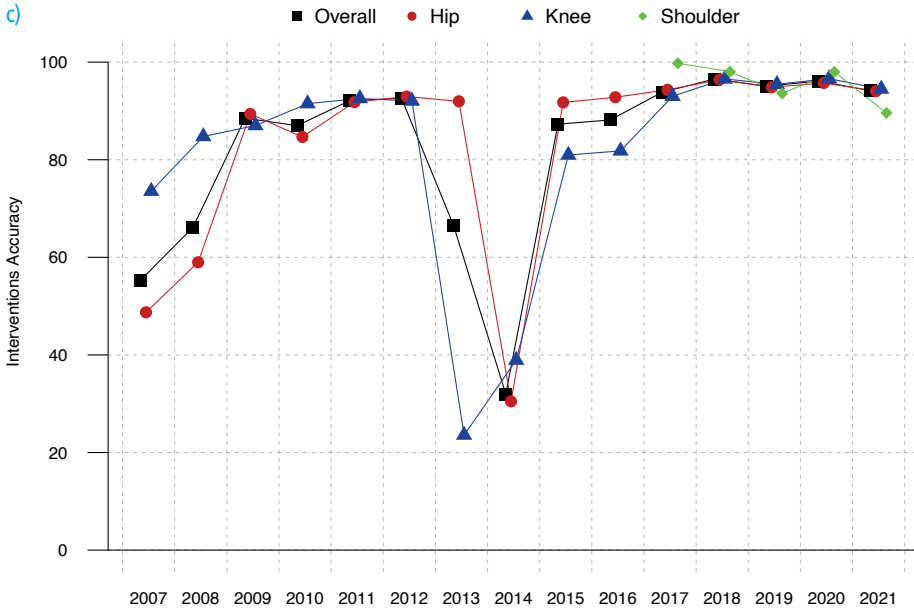
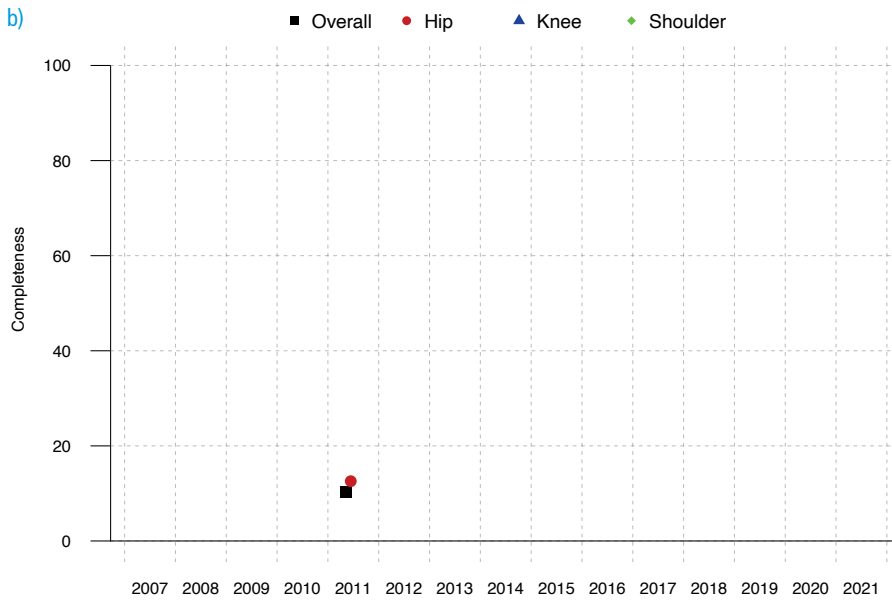
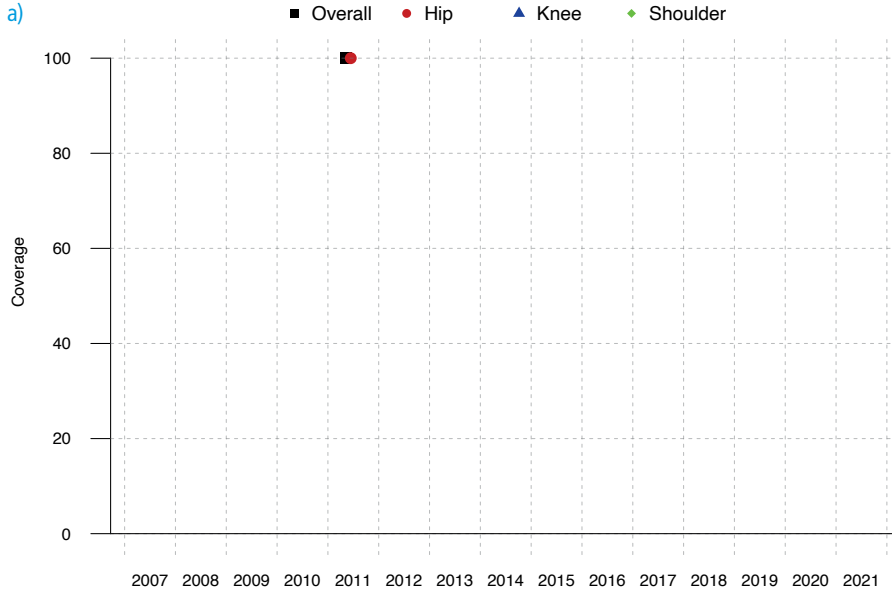


Figure 3. Aosta Valley. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



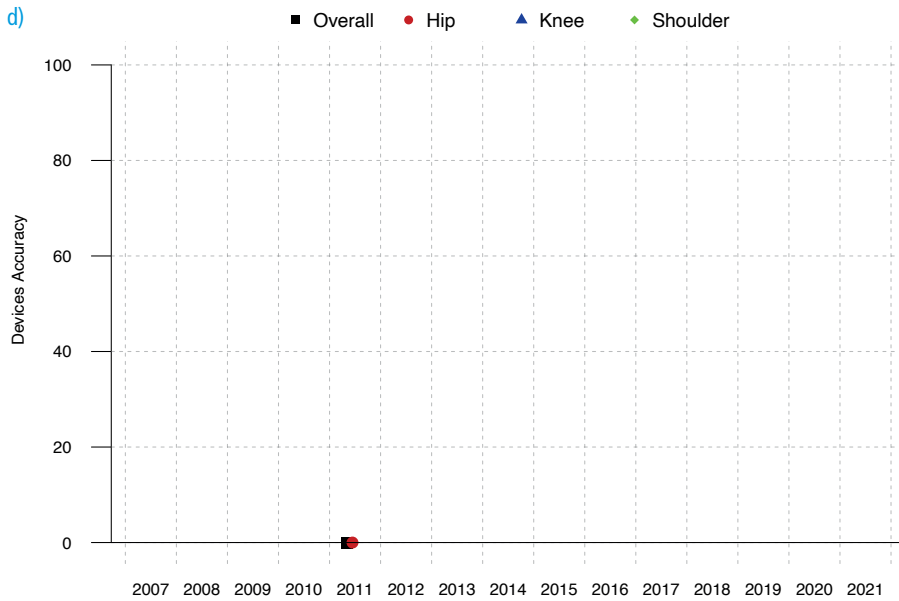
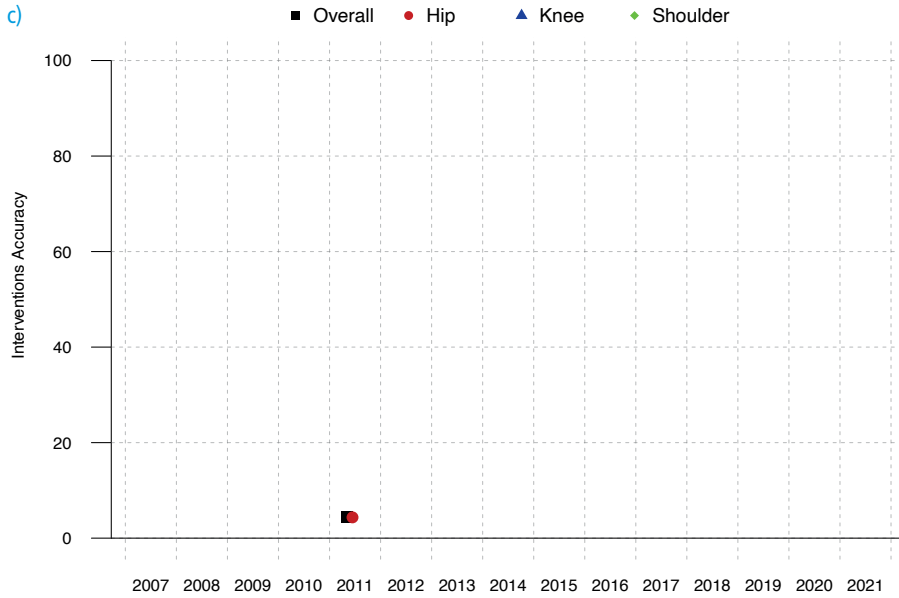
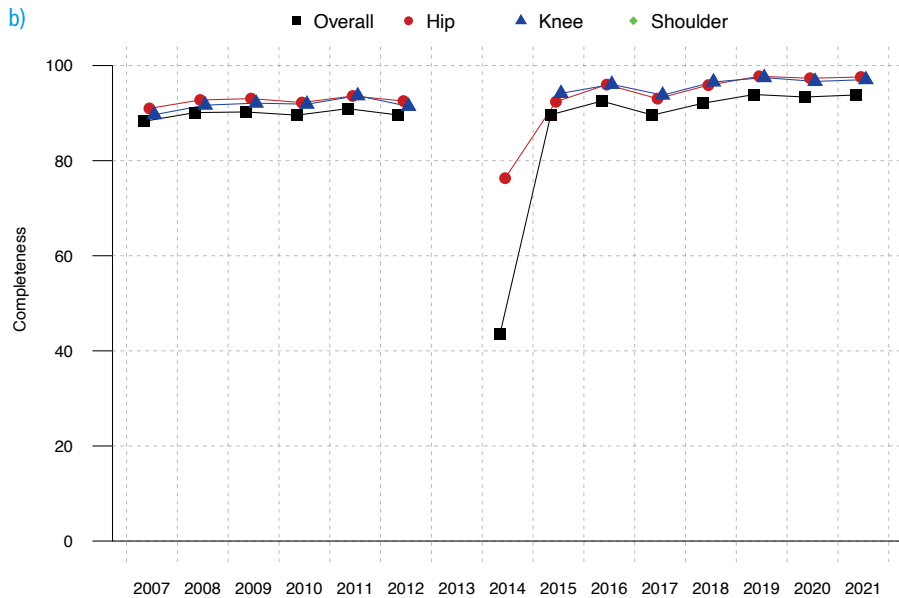
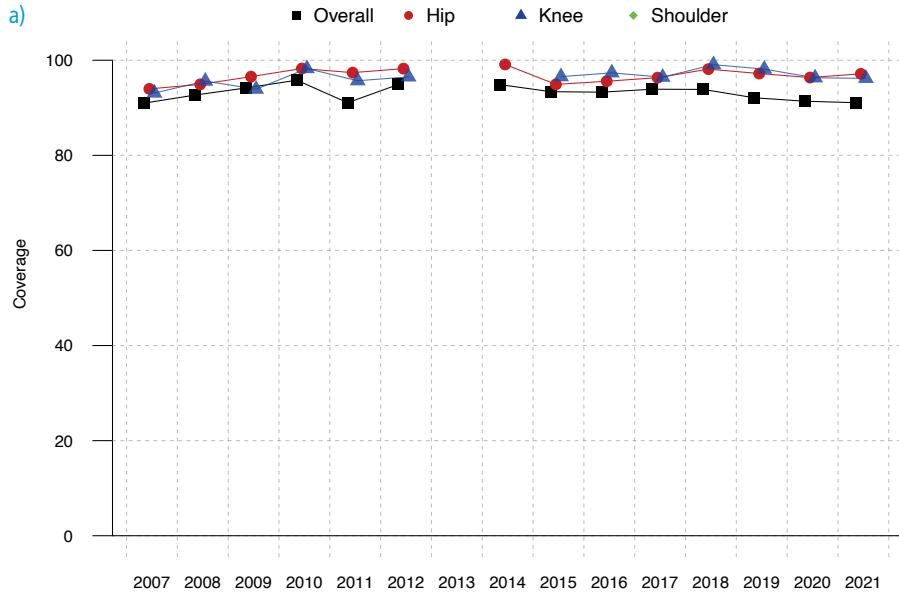


Figure 4. Lombardy. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



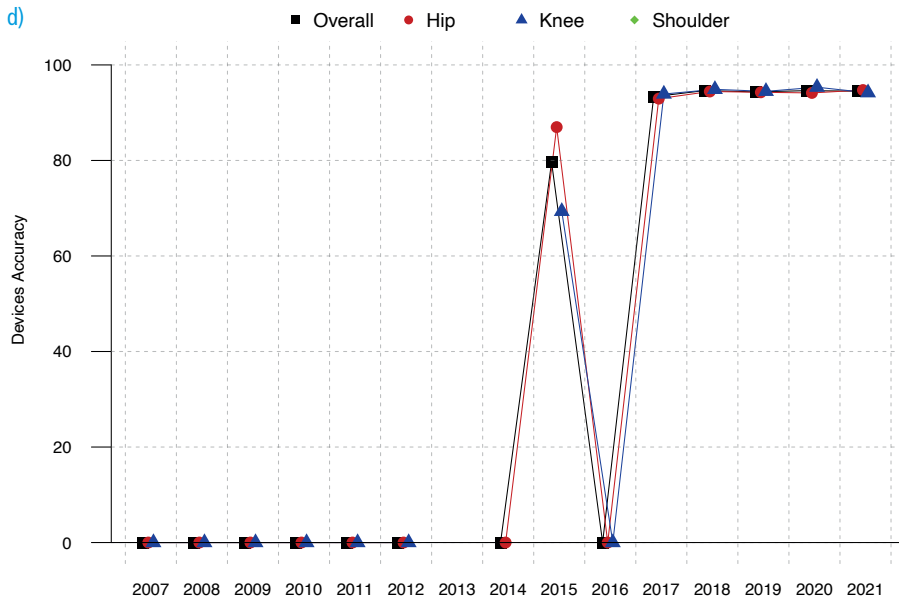
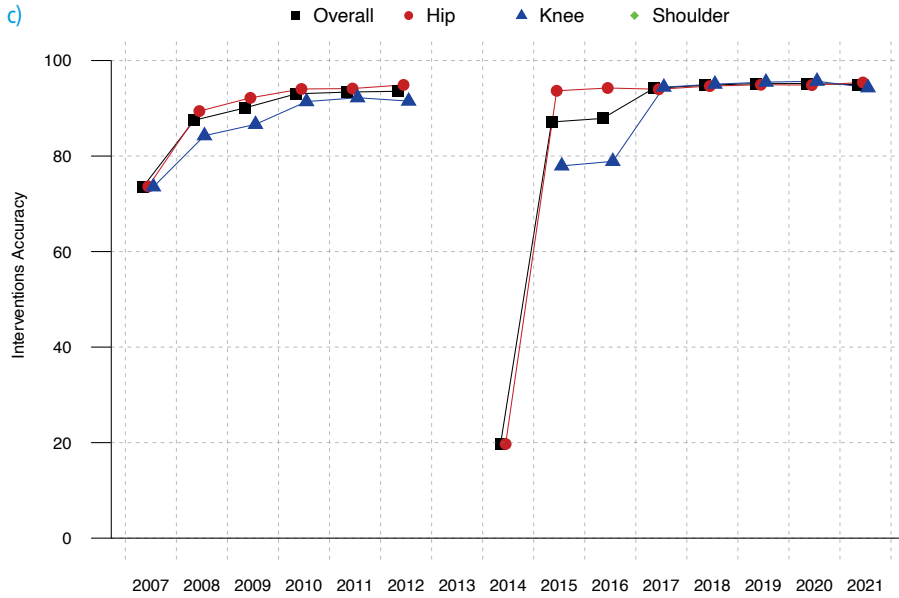
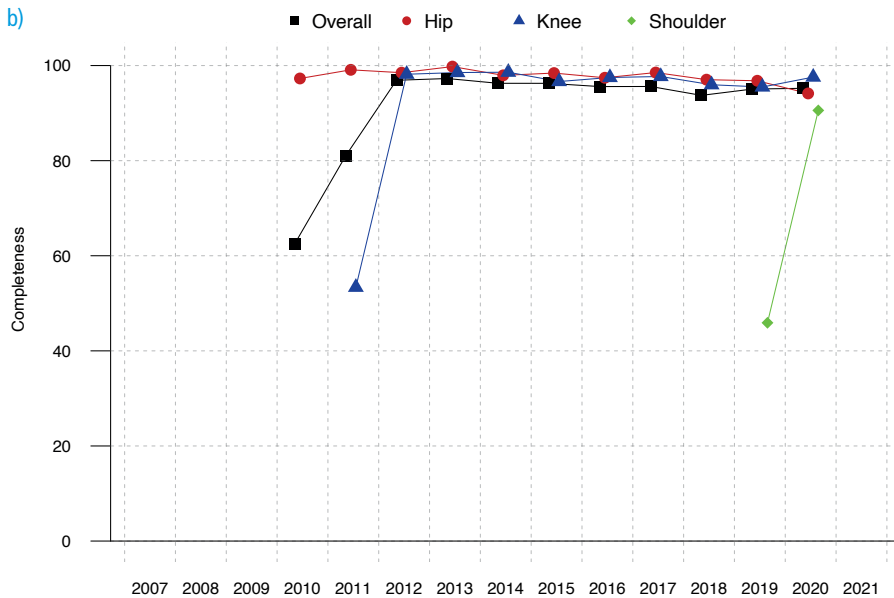
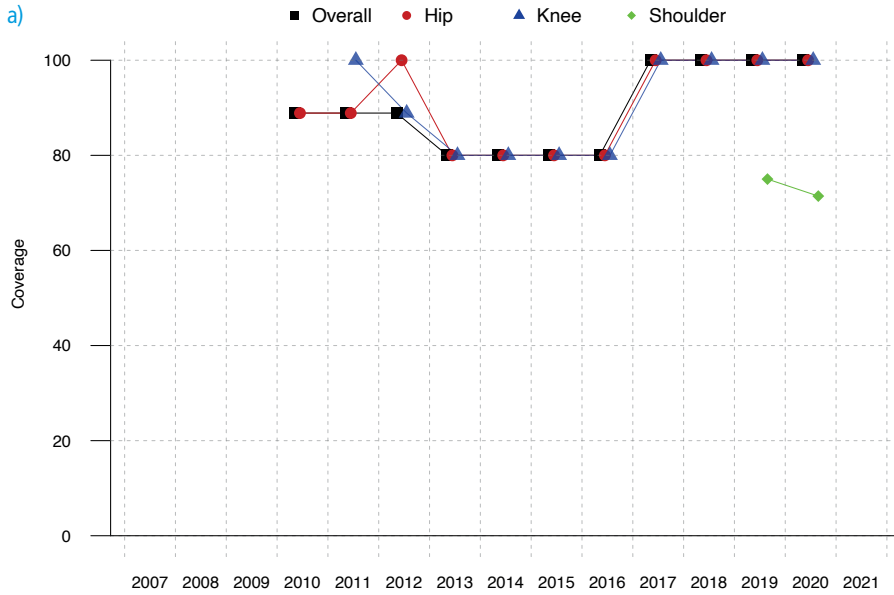


Figure 5. Autonomous Province of Bolzano. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



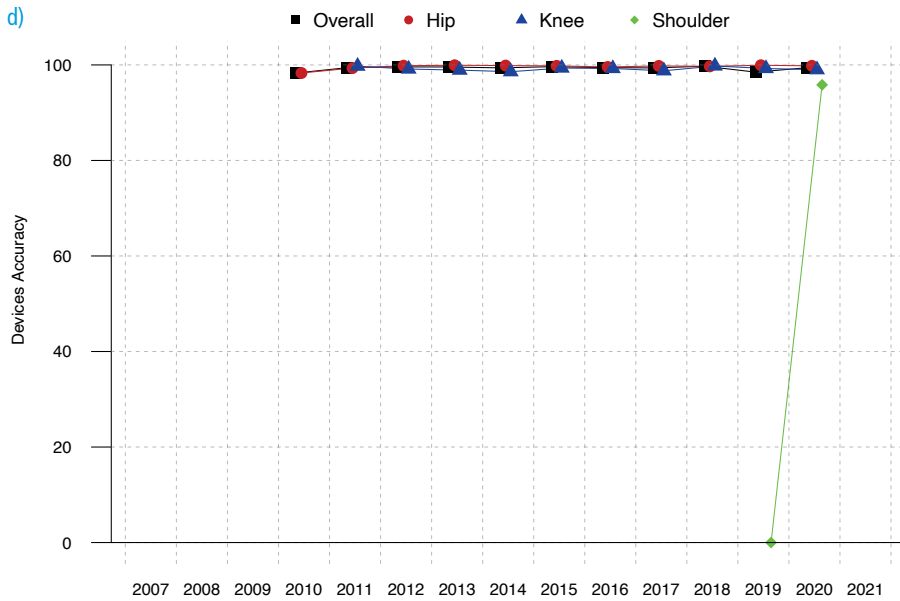
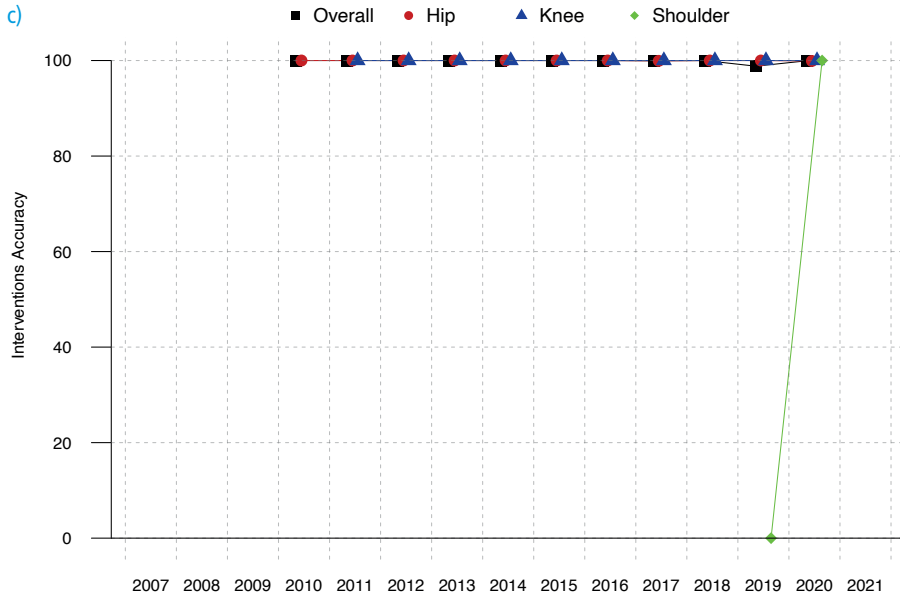
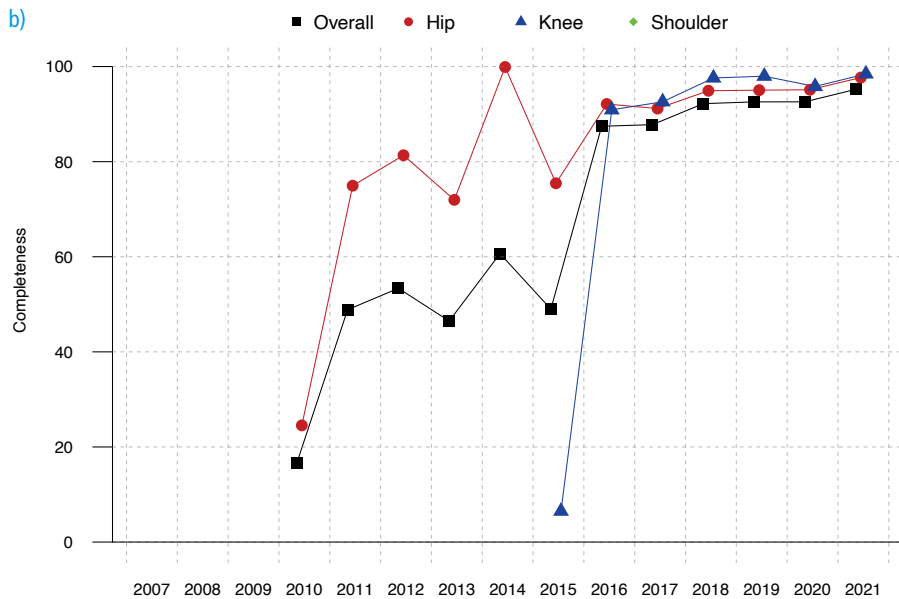
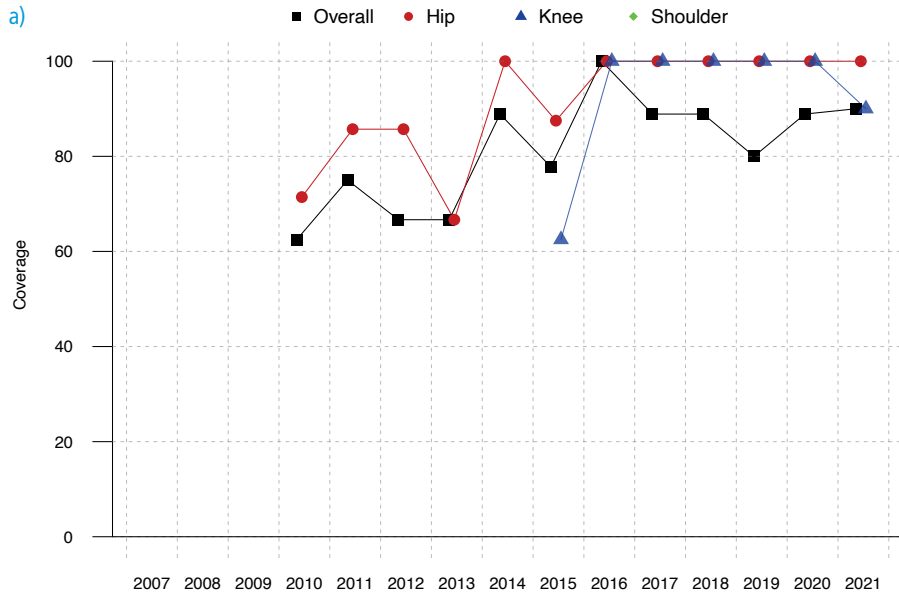


Figure 6. Autonomous Province of Trento. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



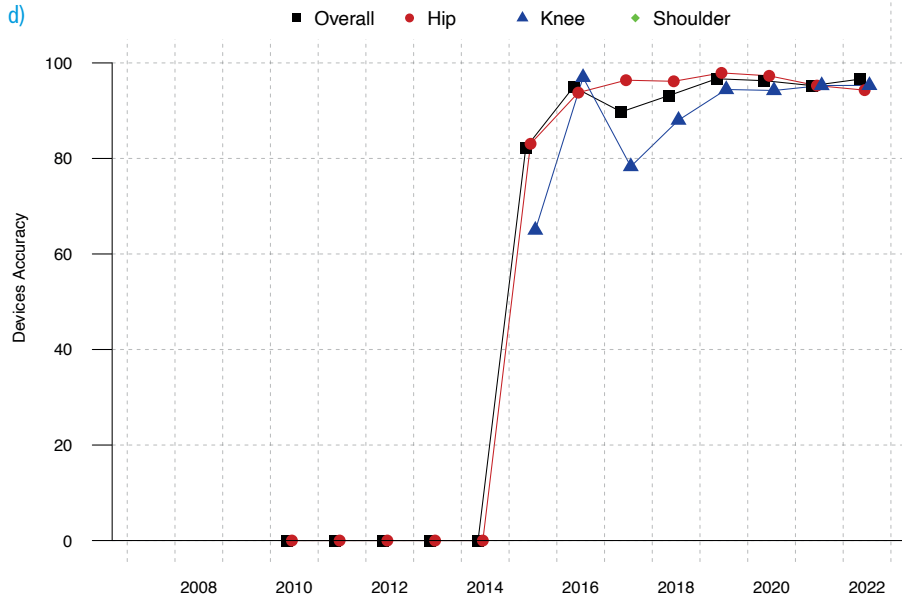
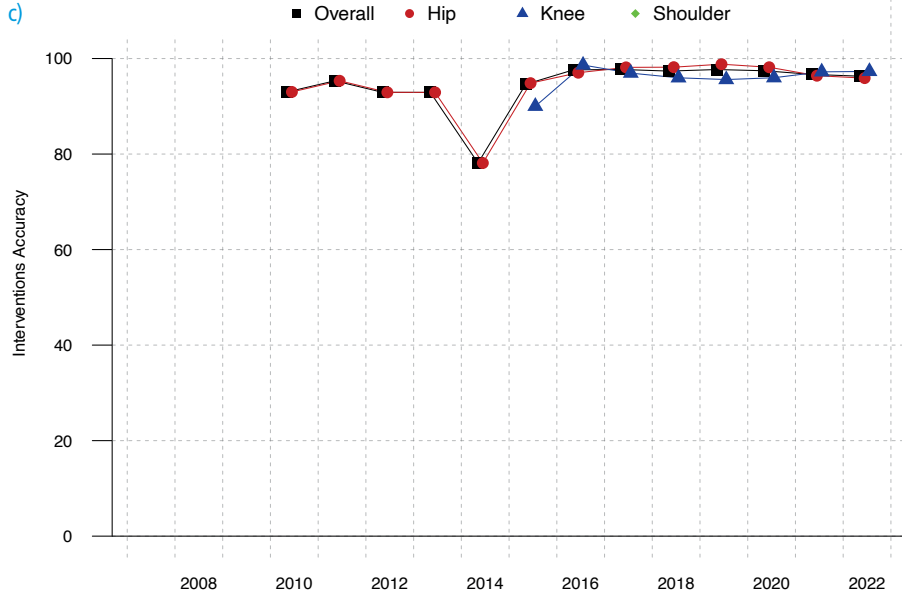
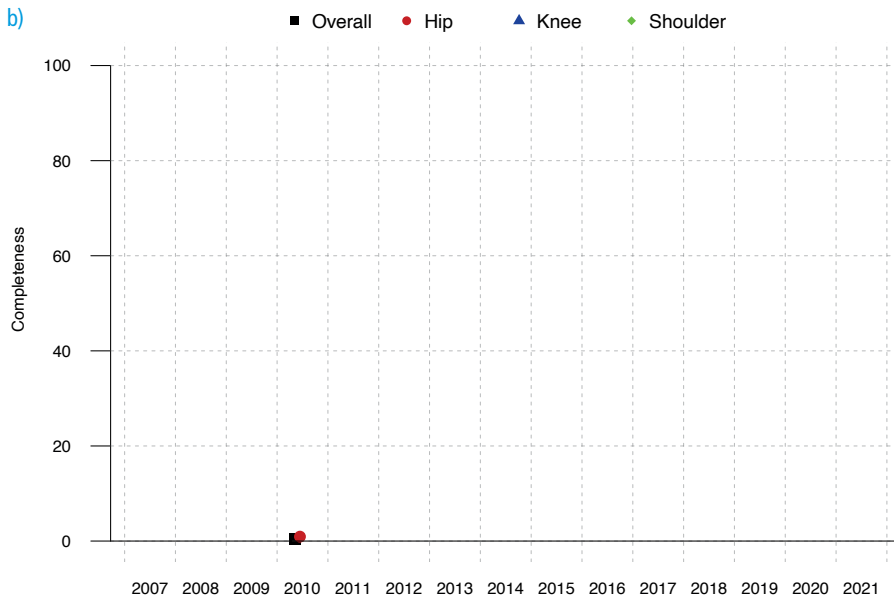
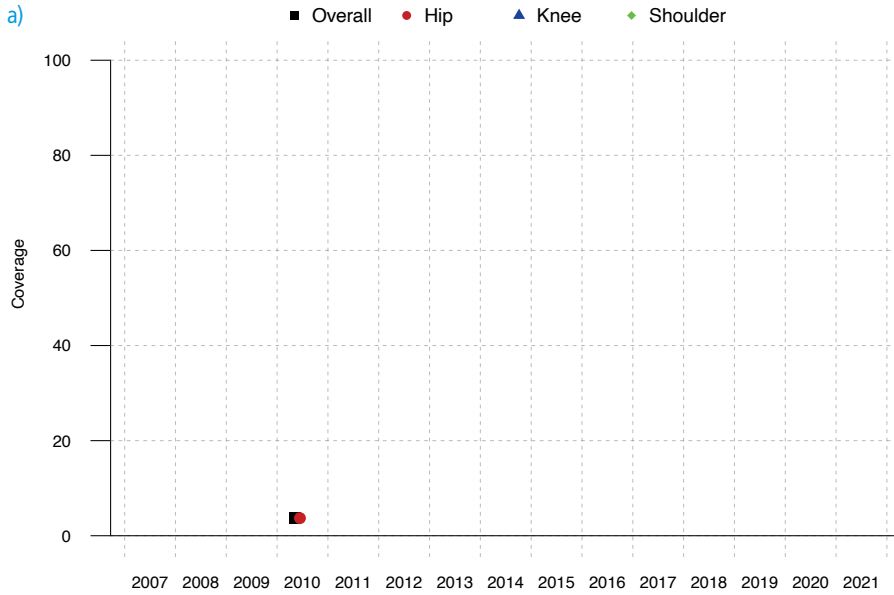


Figure 7. Veneto. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



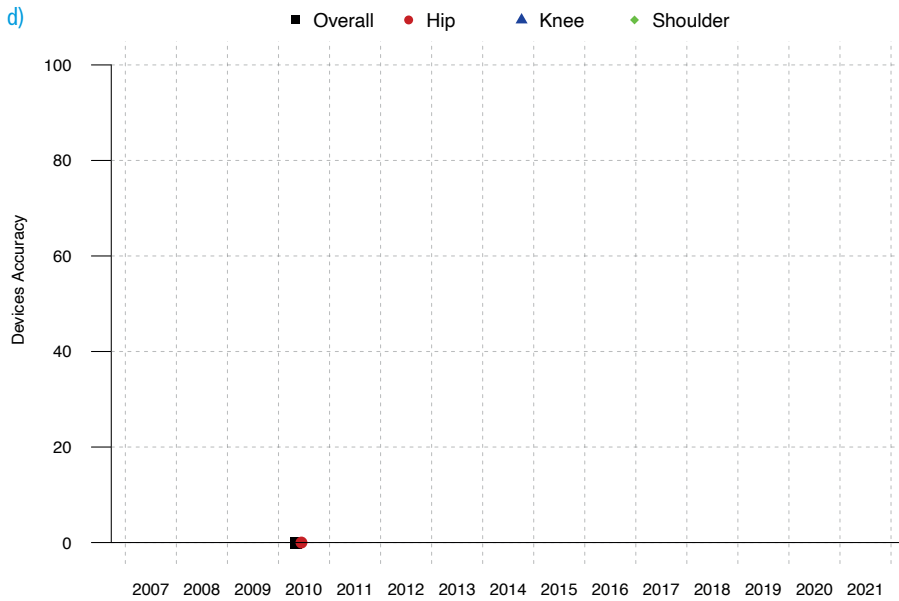
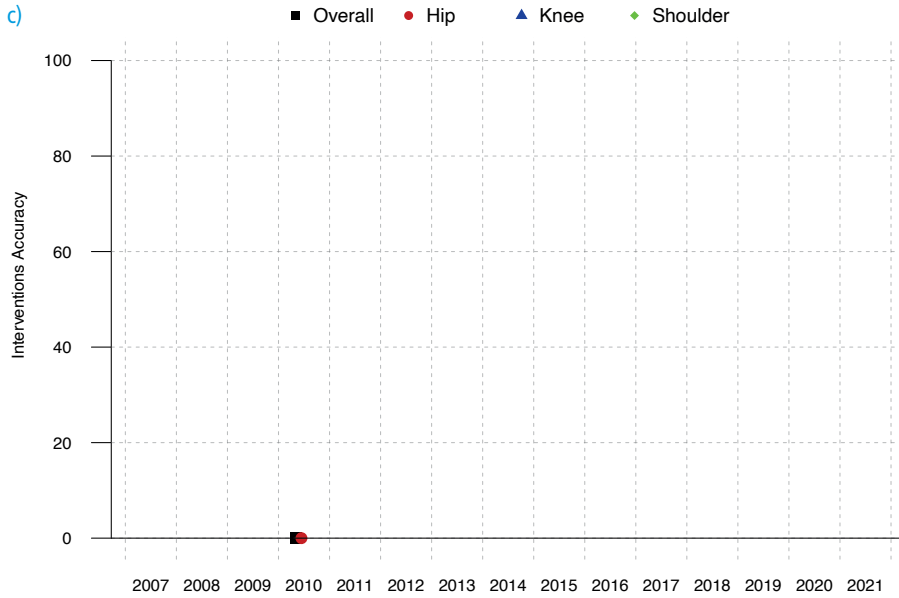
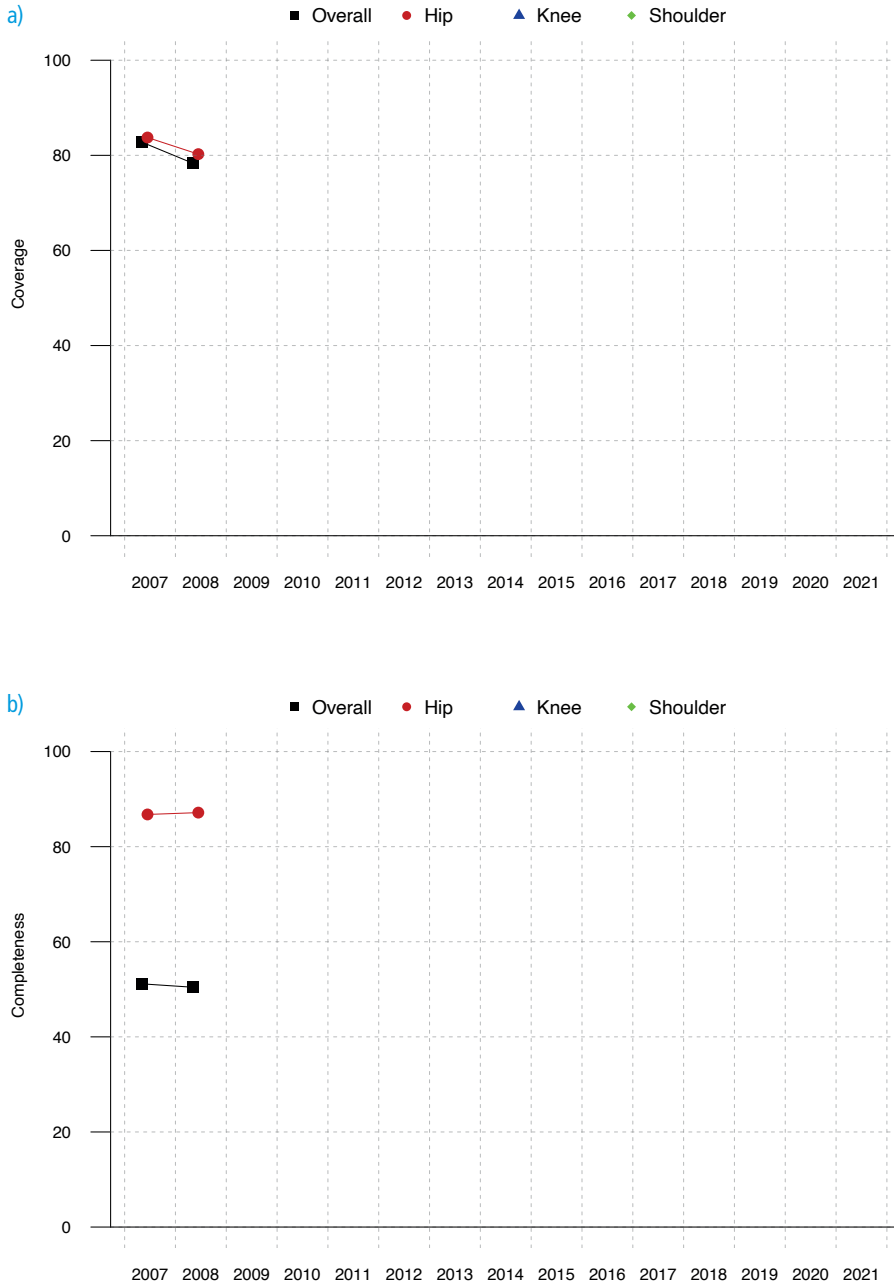


Figure 8. Emilia-Romagna. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



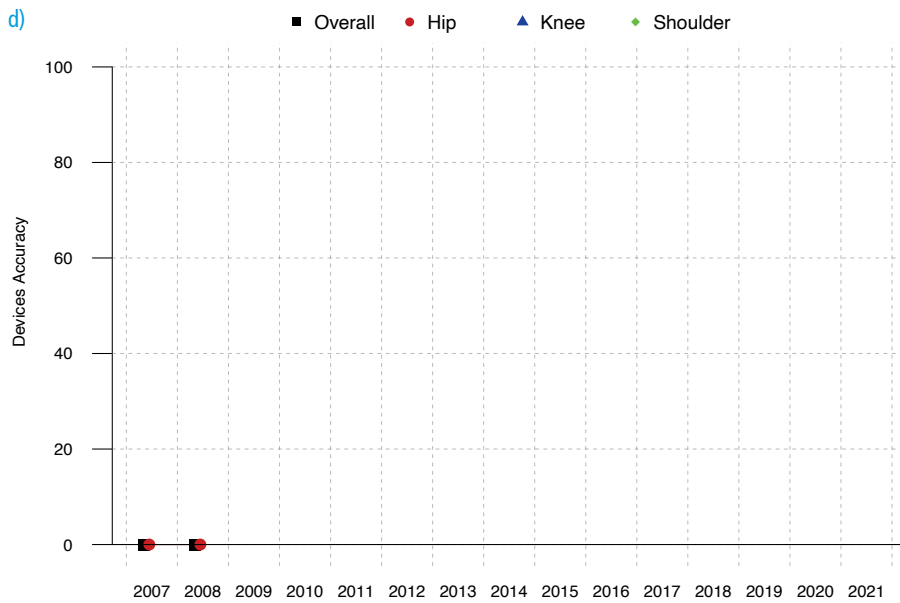
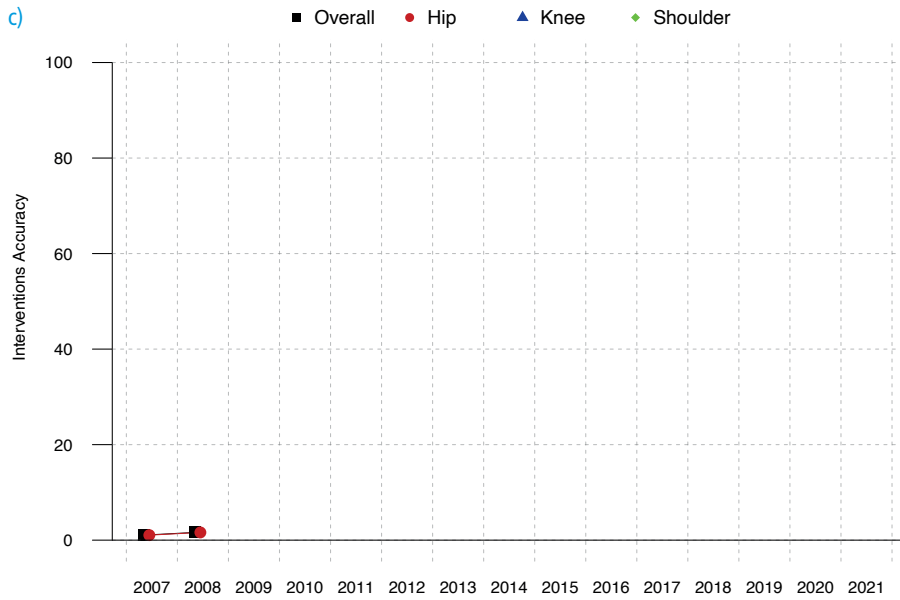
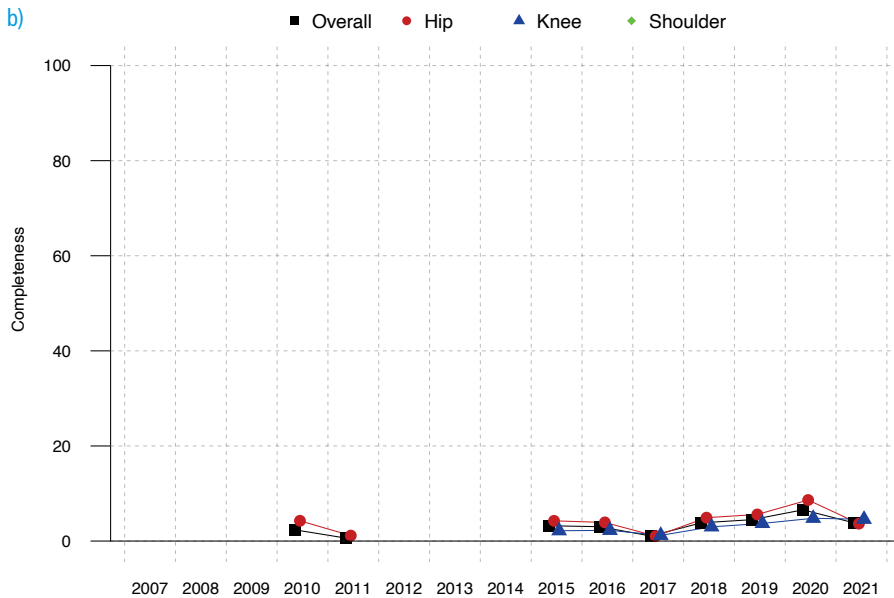
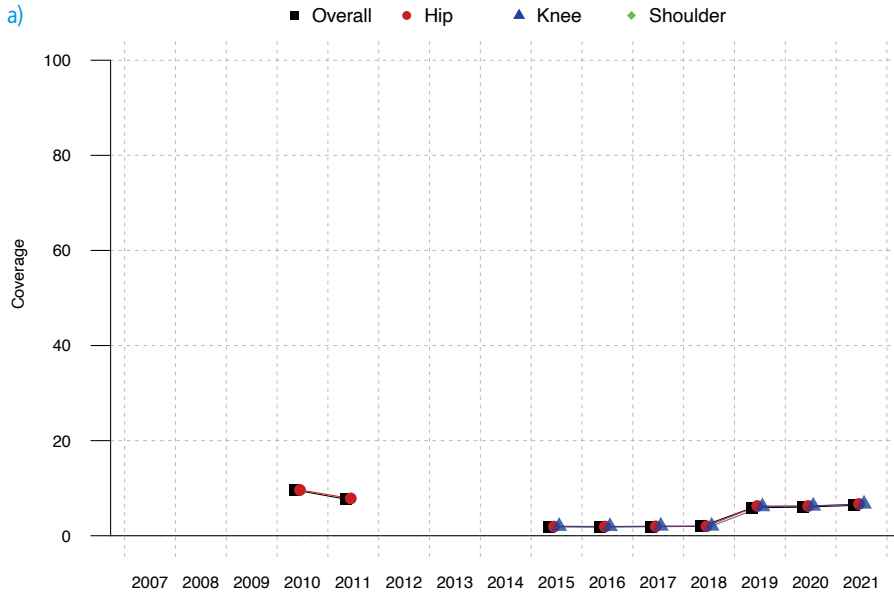


Figure 9. Tuscany. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



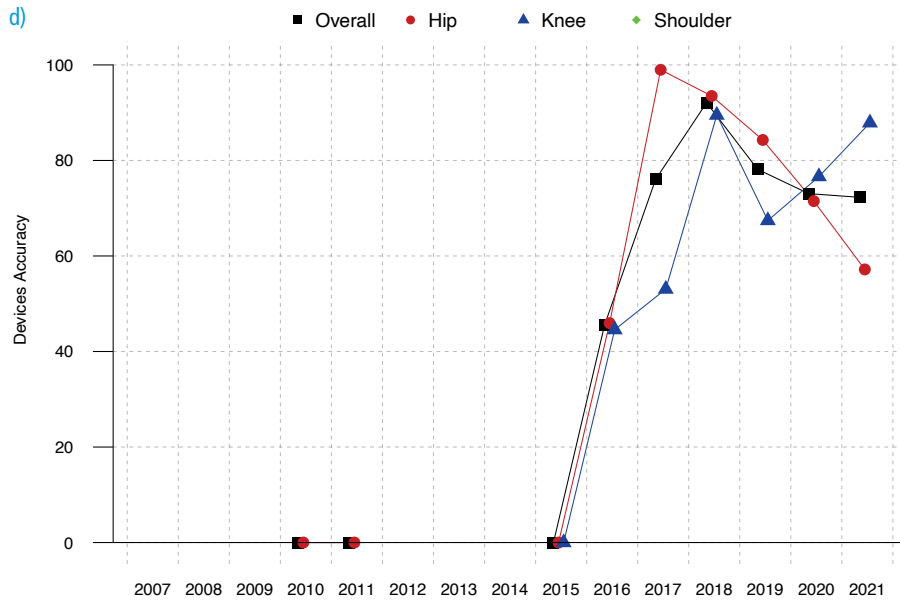
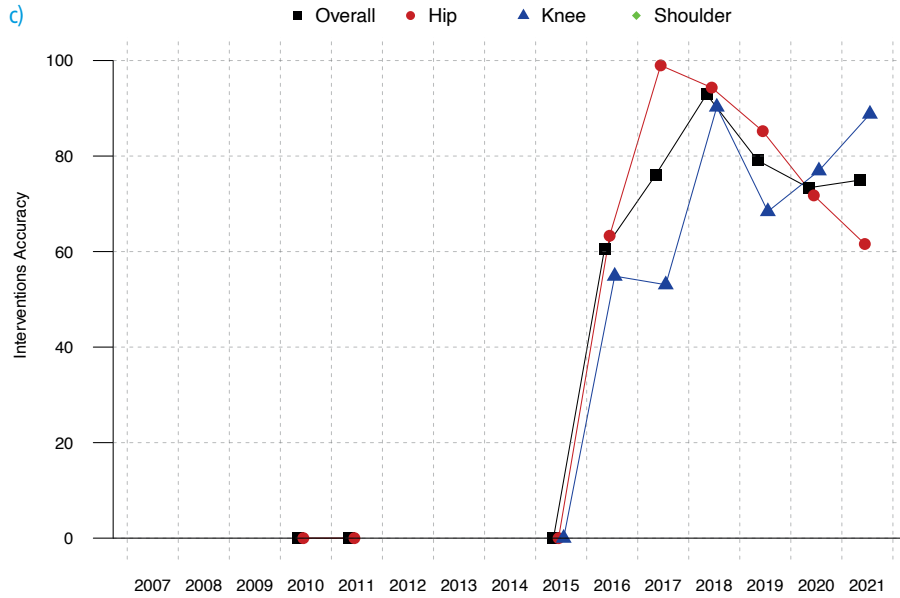
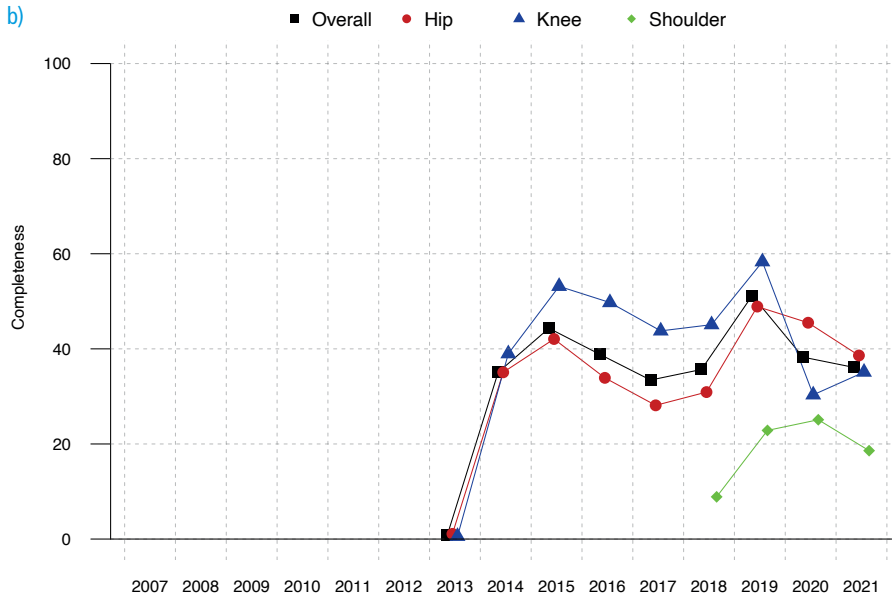
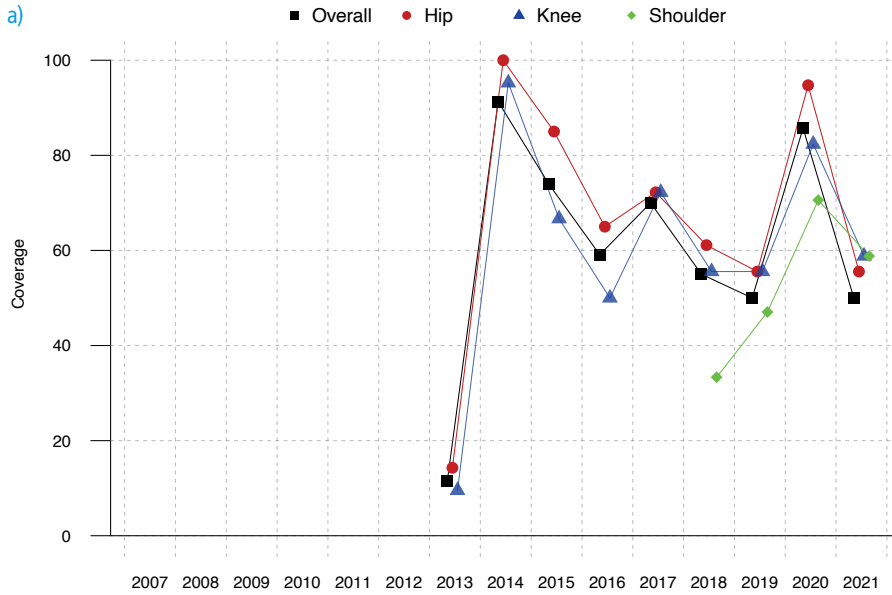


Figure 10. Marche. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



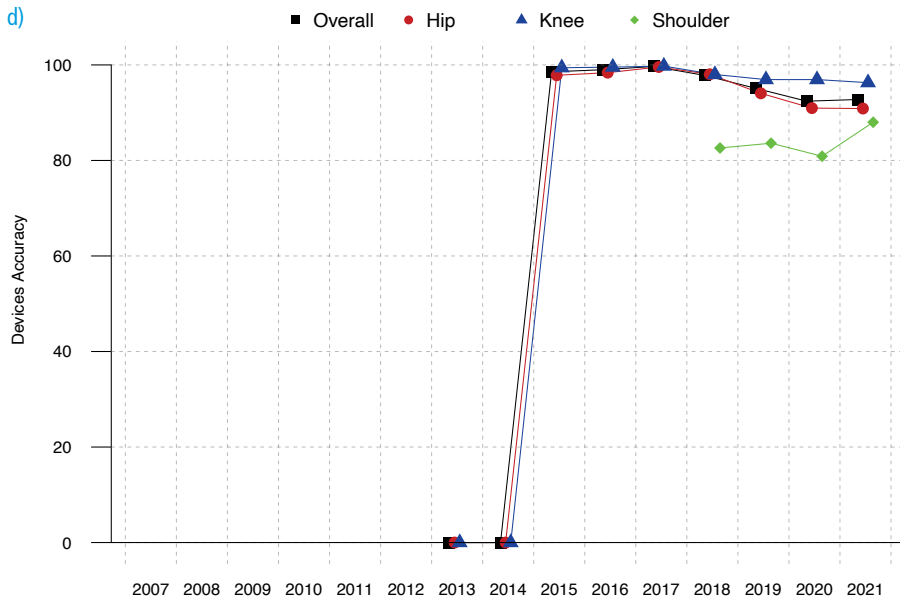
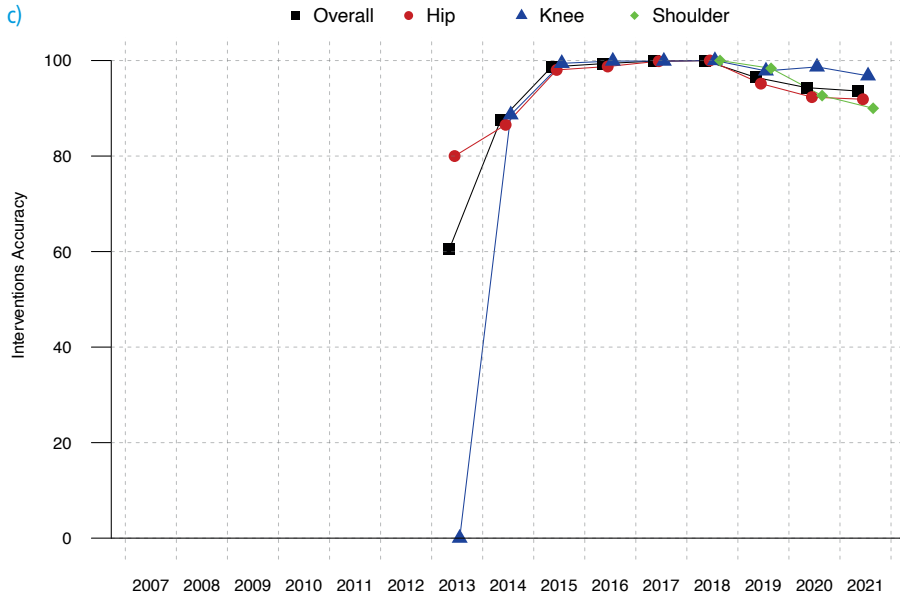
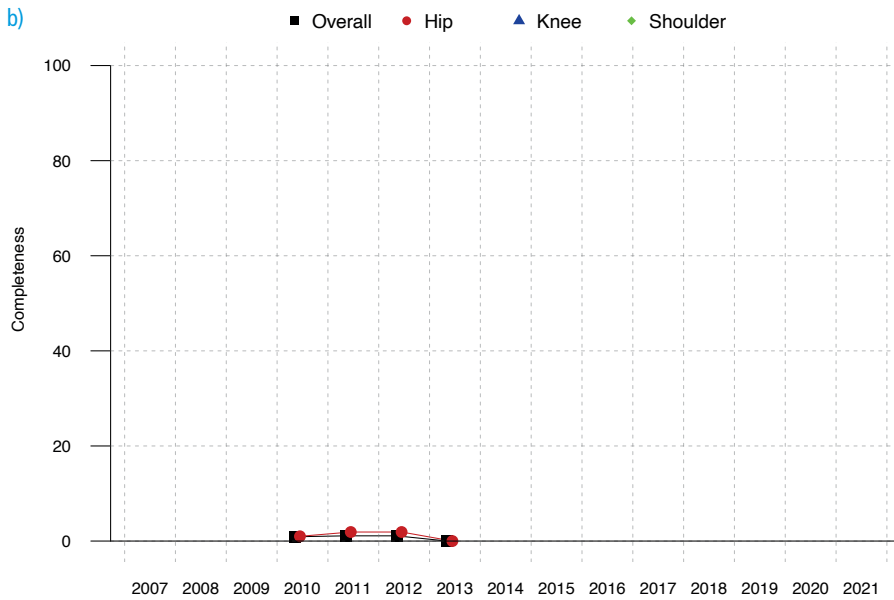
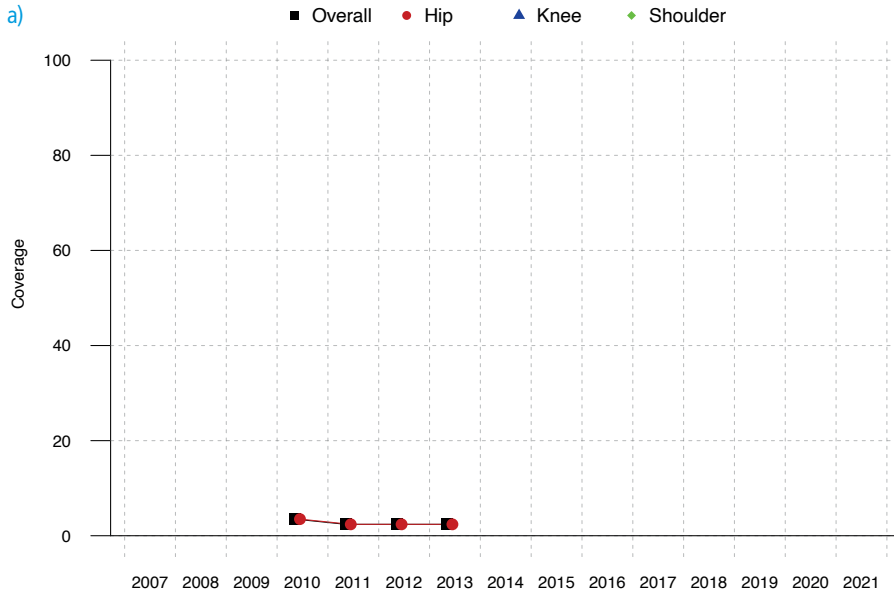


Figure 11. Lazio. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



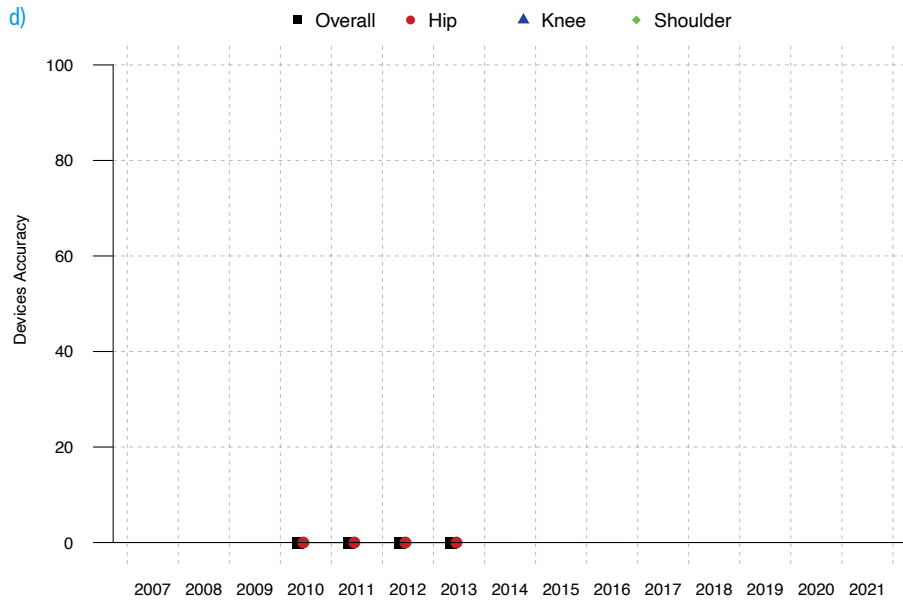
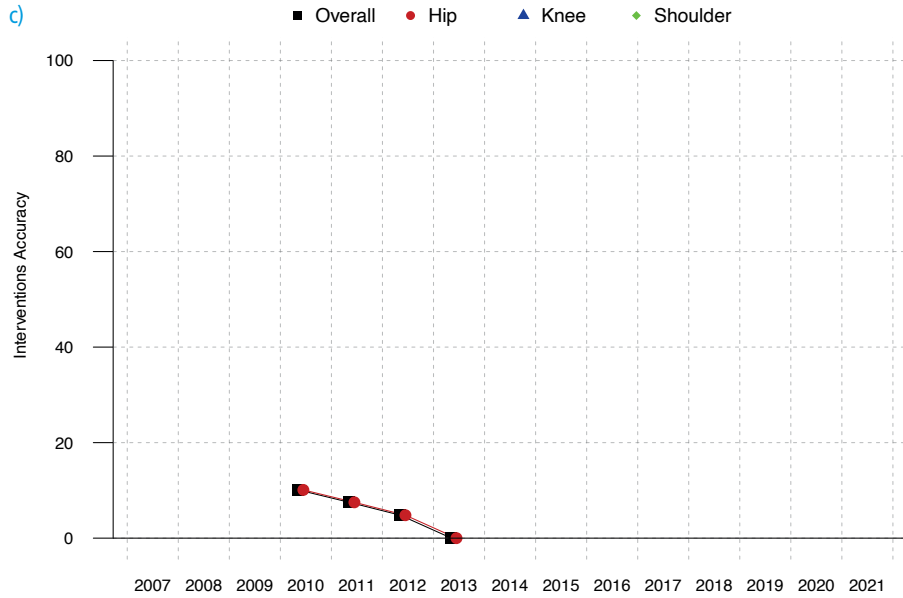
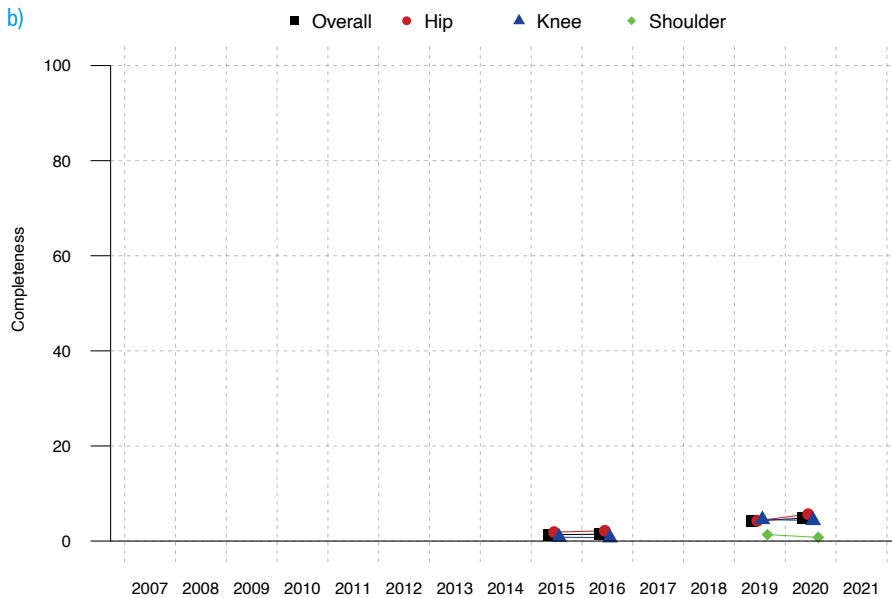
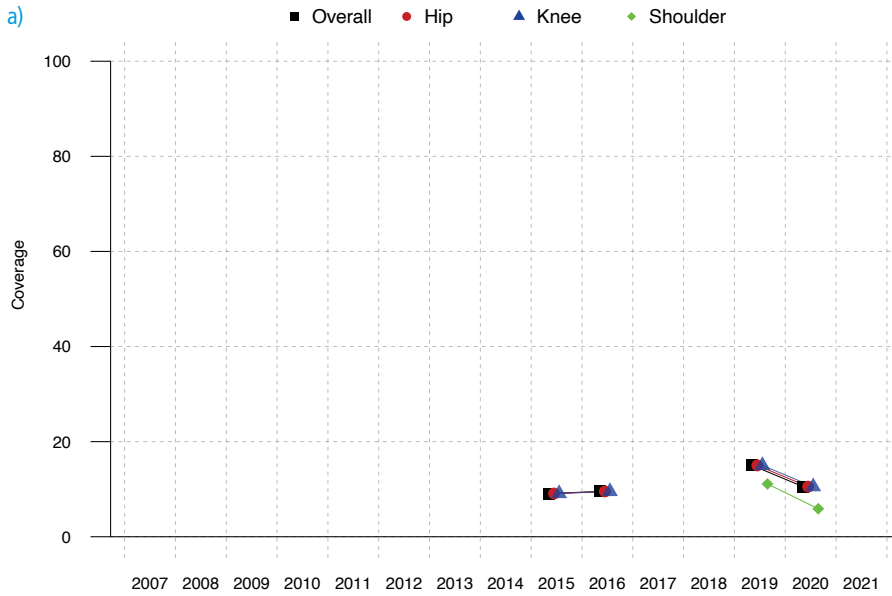


Figure 12. Abruzzi. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



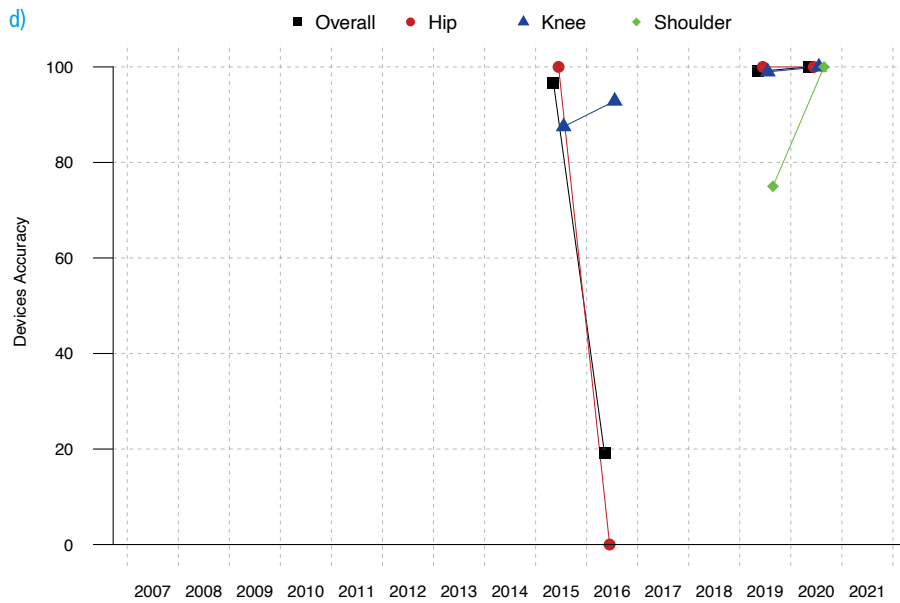
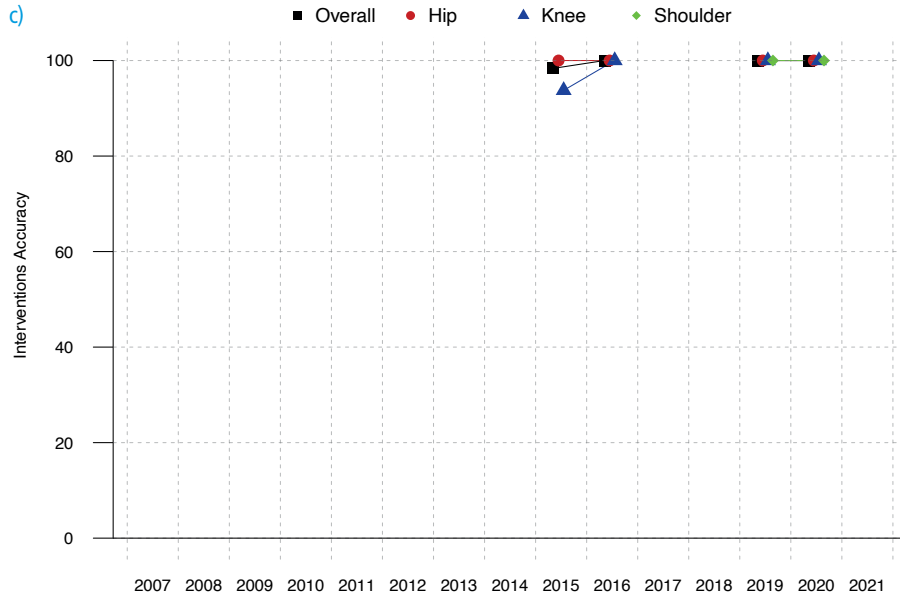
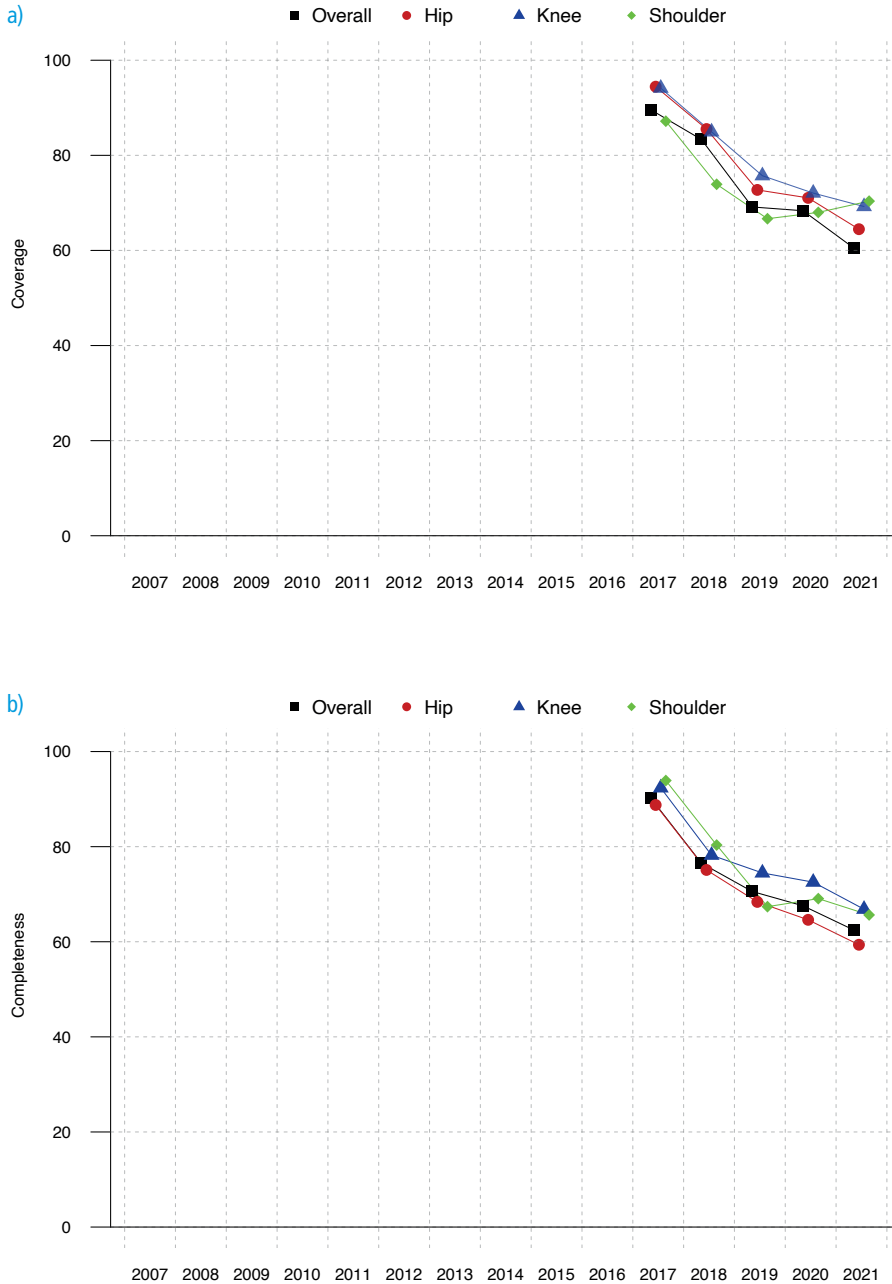


Figure 13. Campania. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



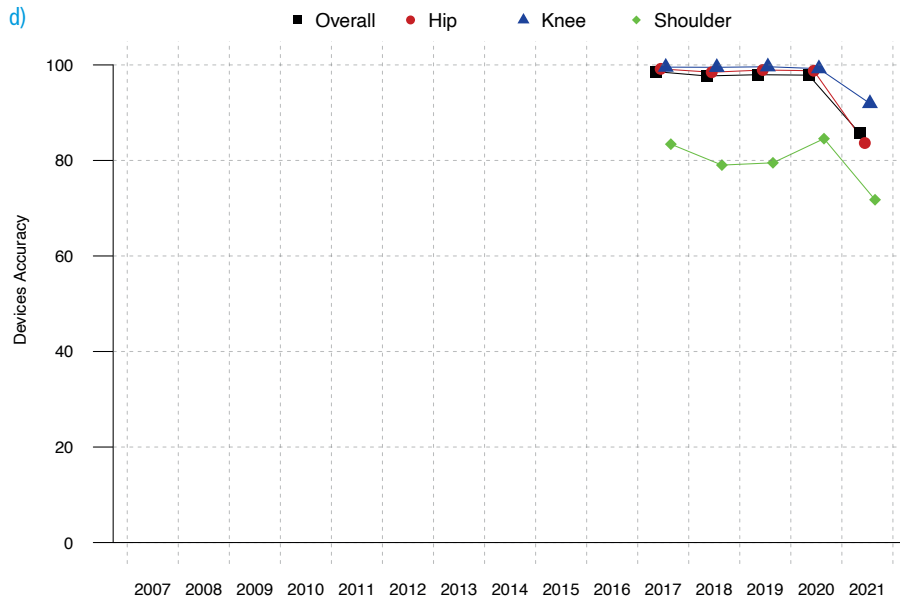
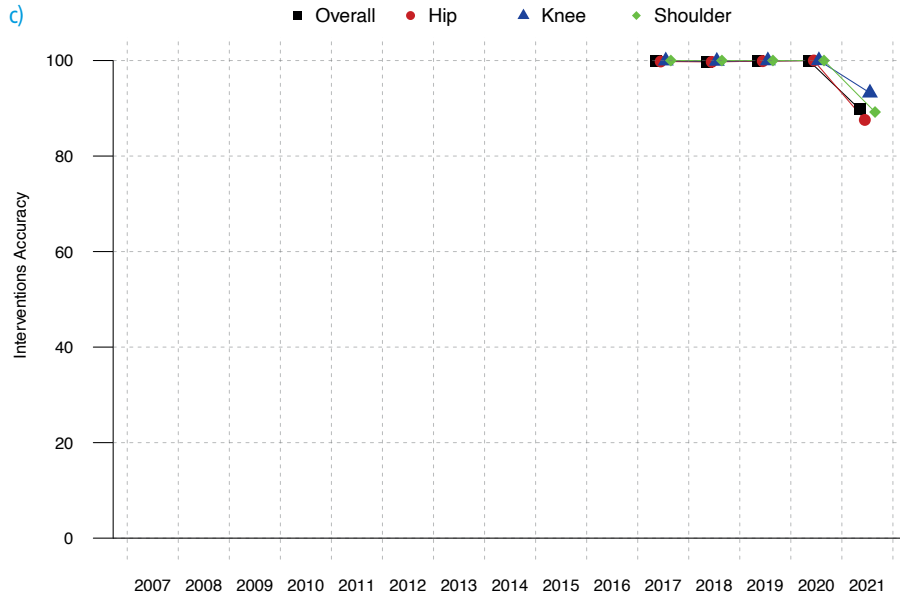
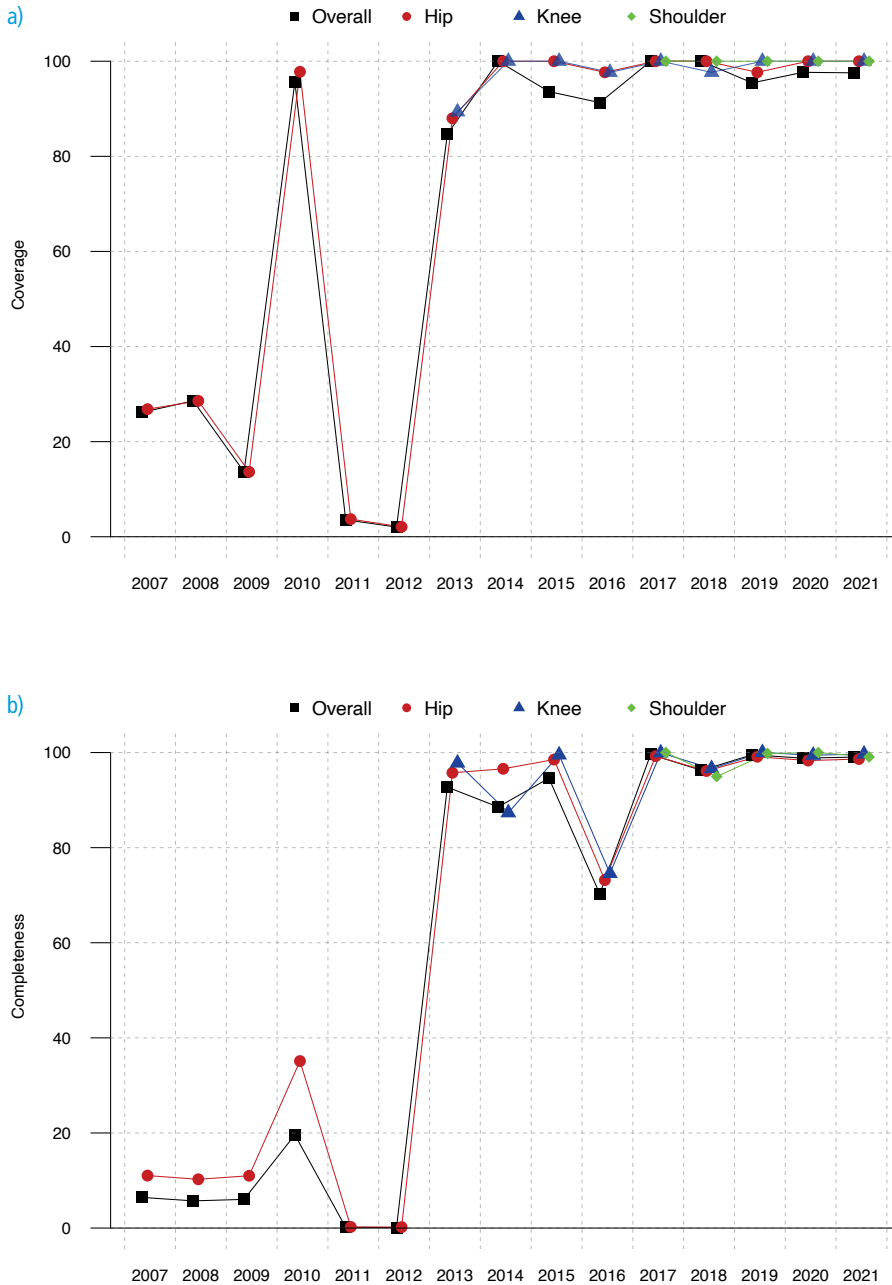


Figure 14. Apulia. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



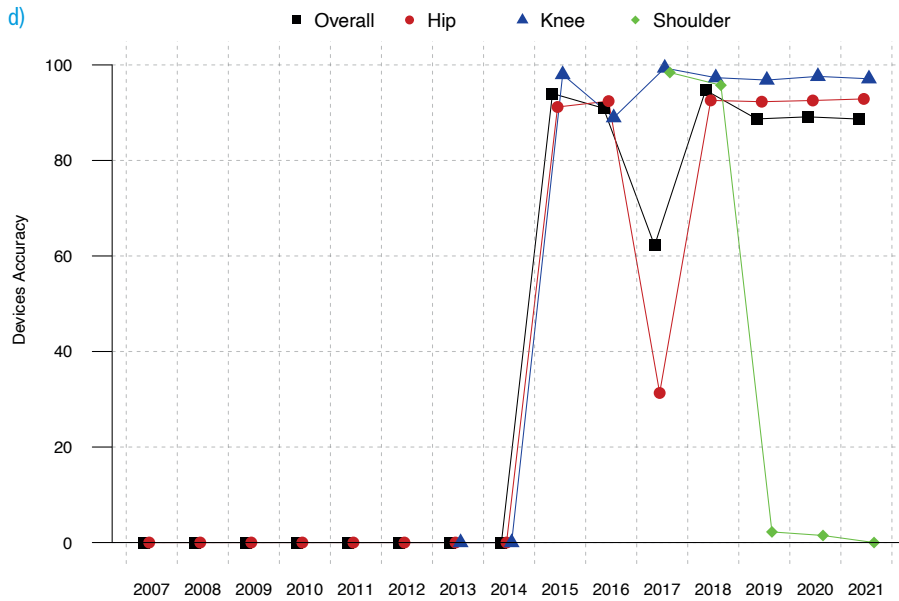
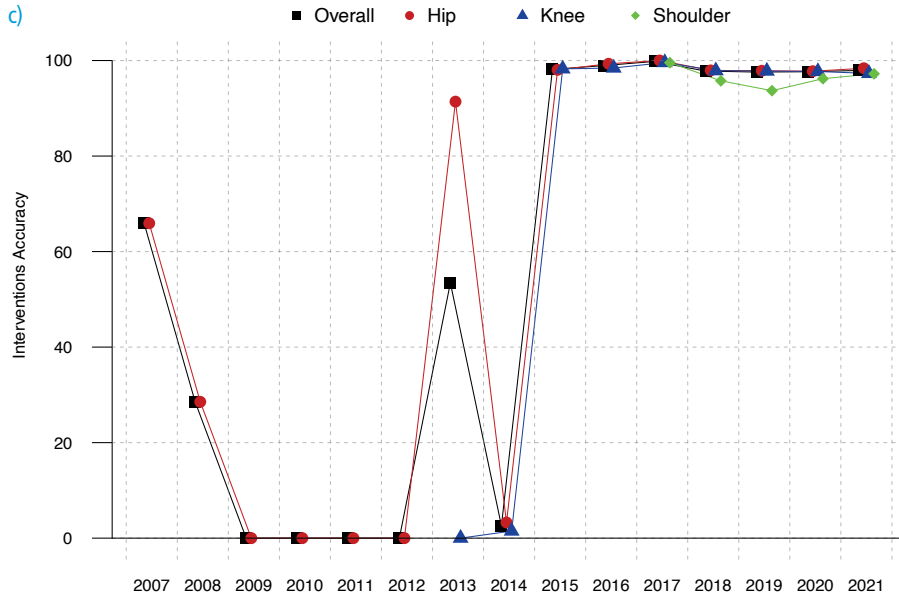
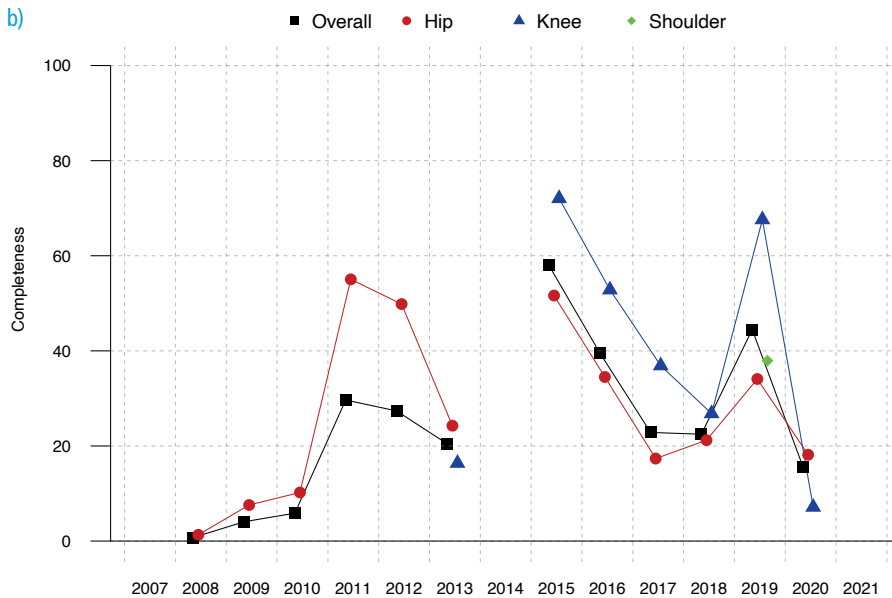
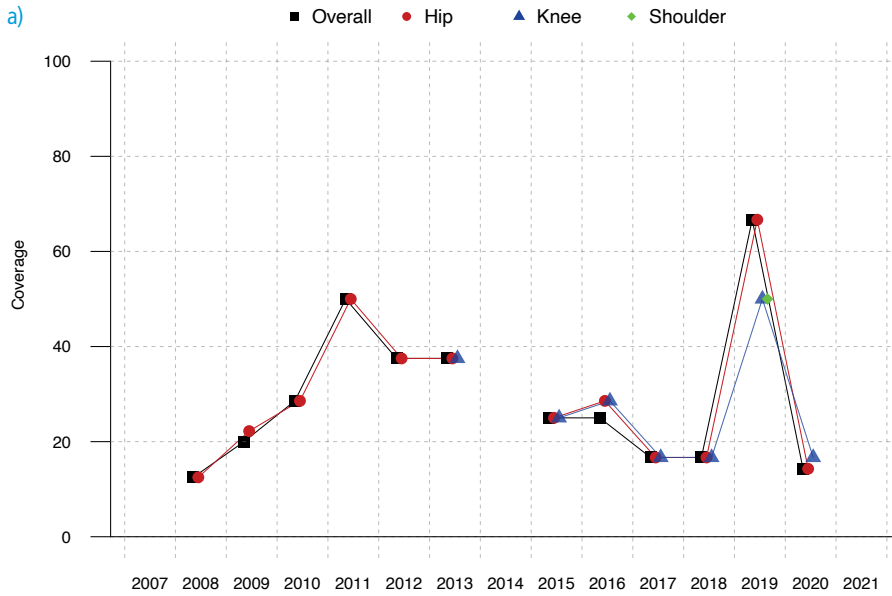


Figure 15. Basilicata. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



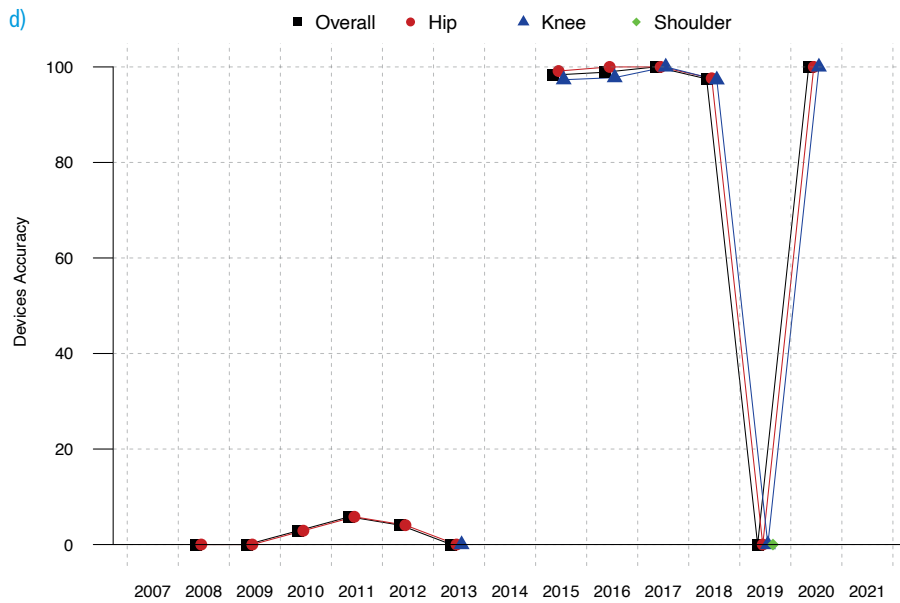
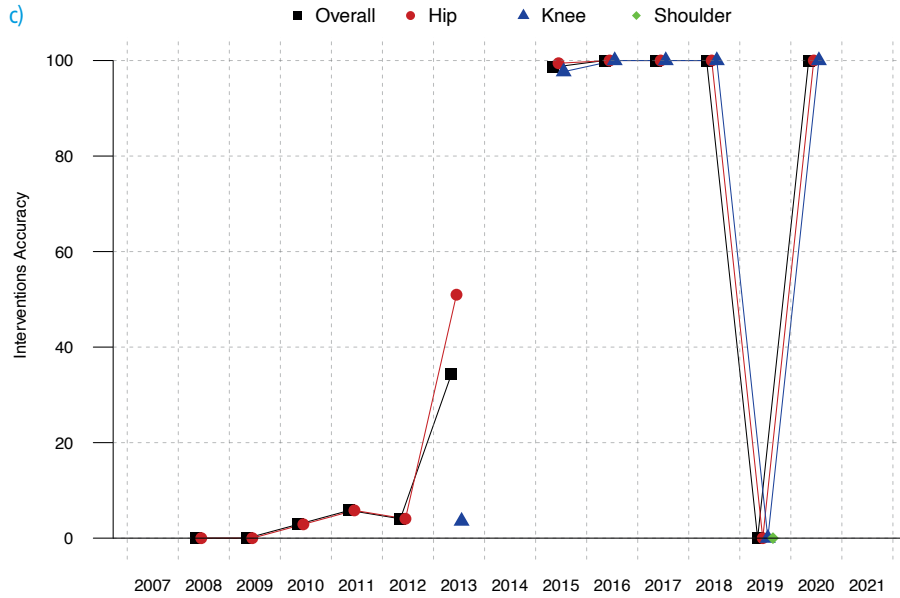
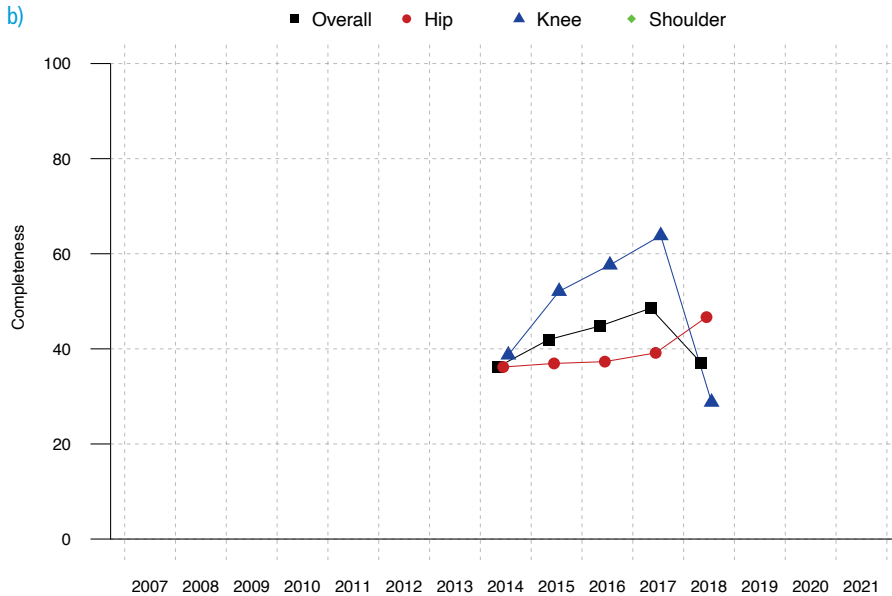
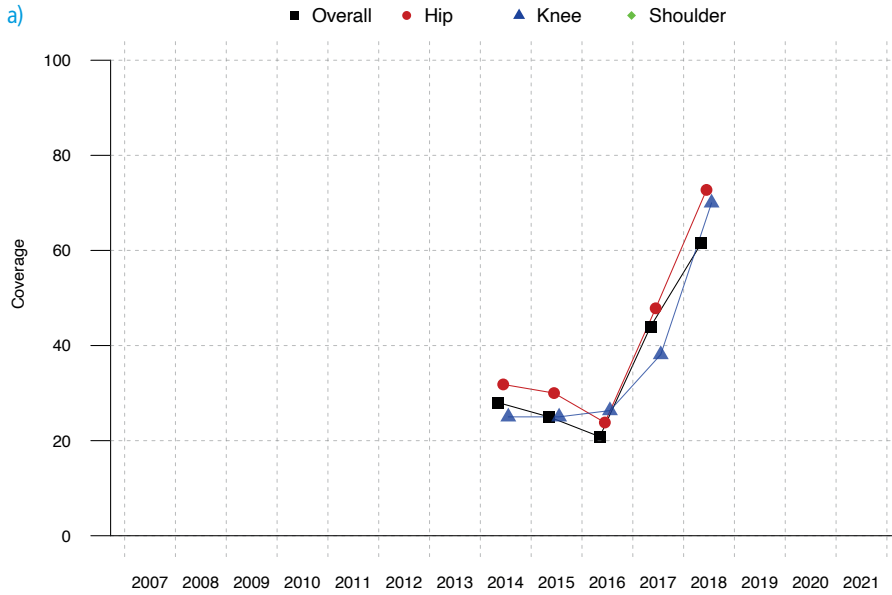


Figure 16. Calabria. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



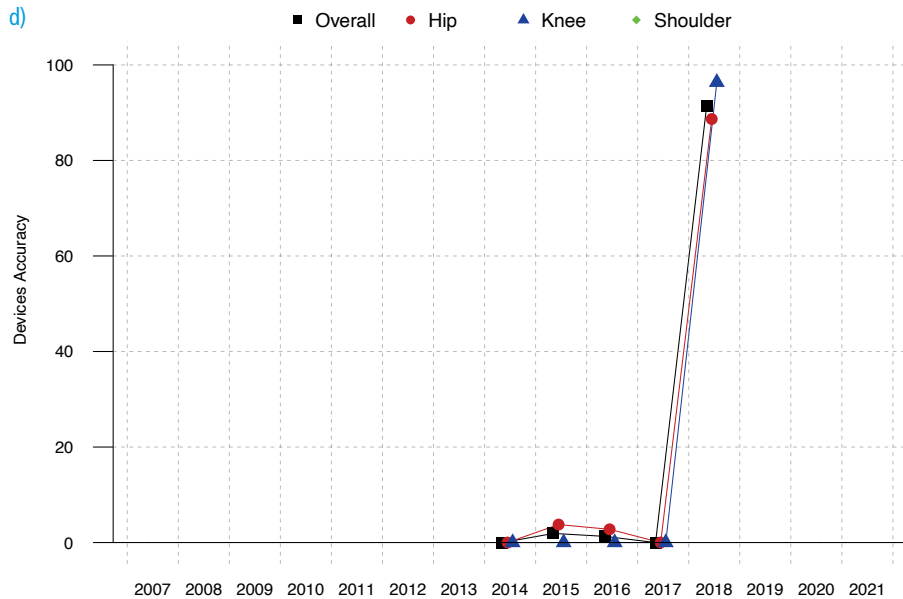
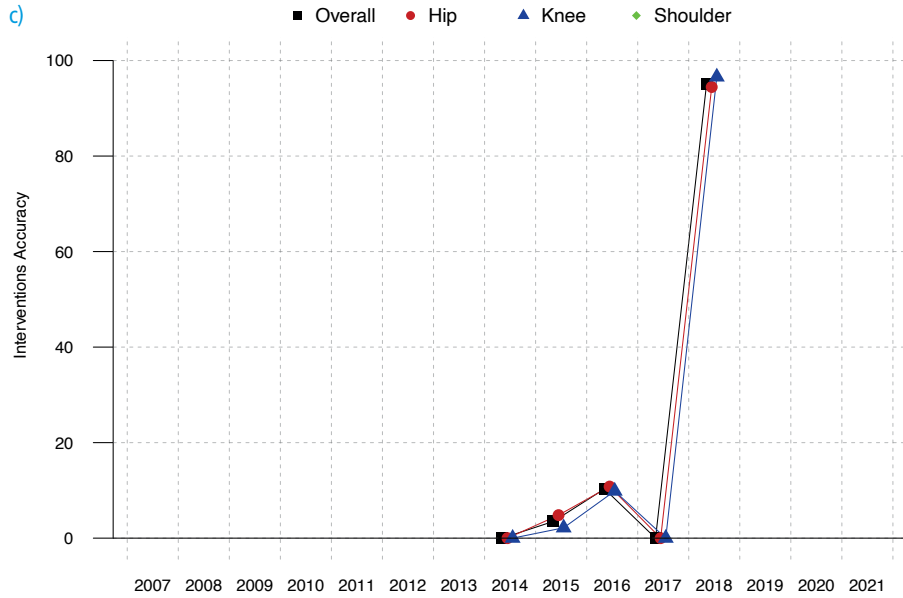
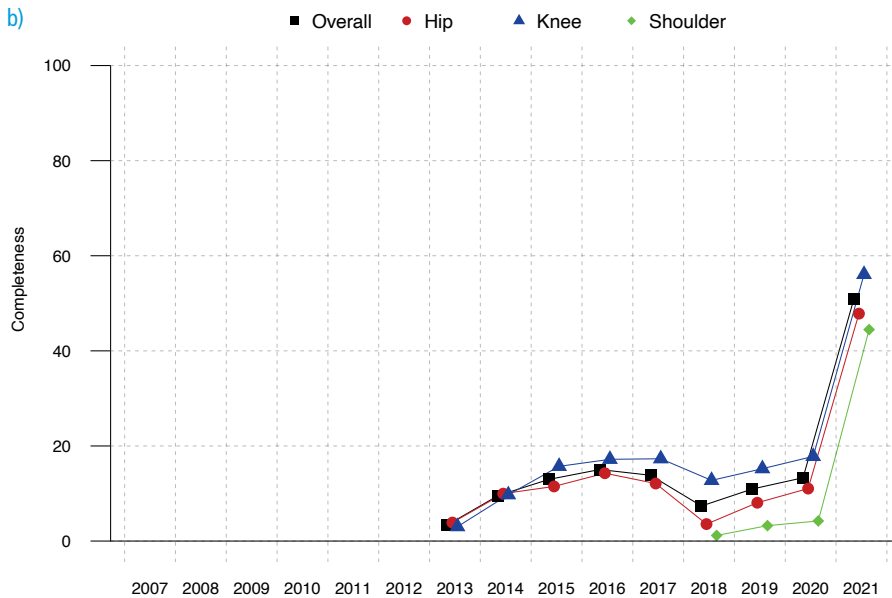
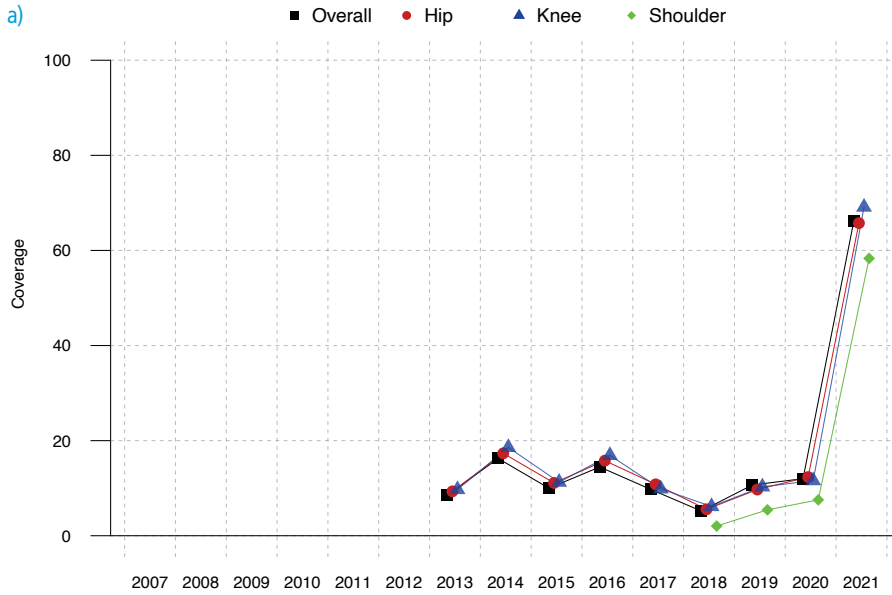


Figure 17. Sicily. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



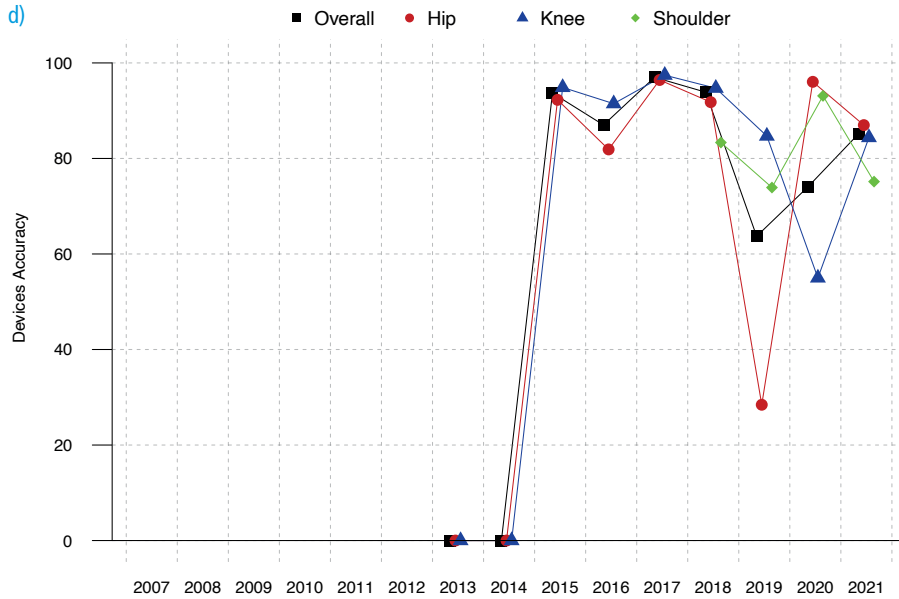
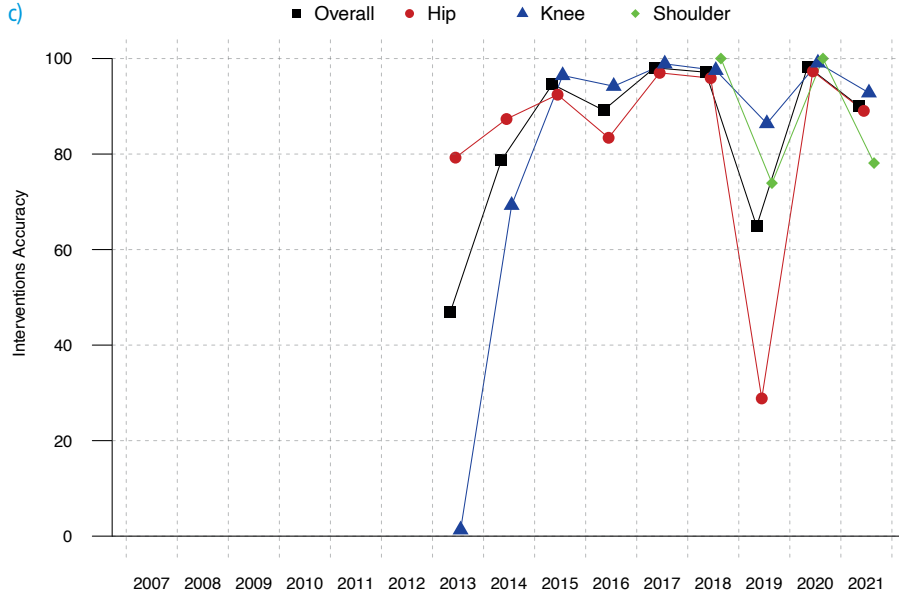
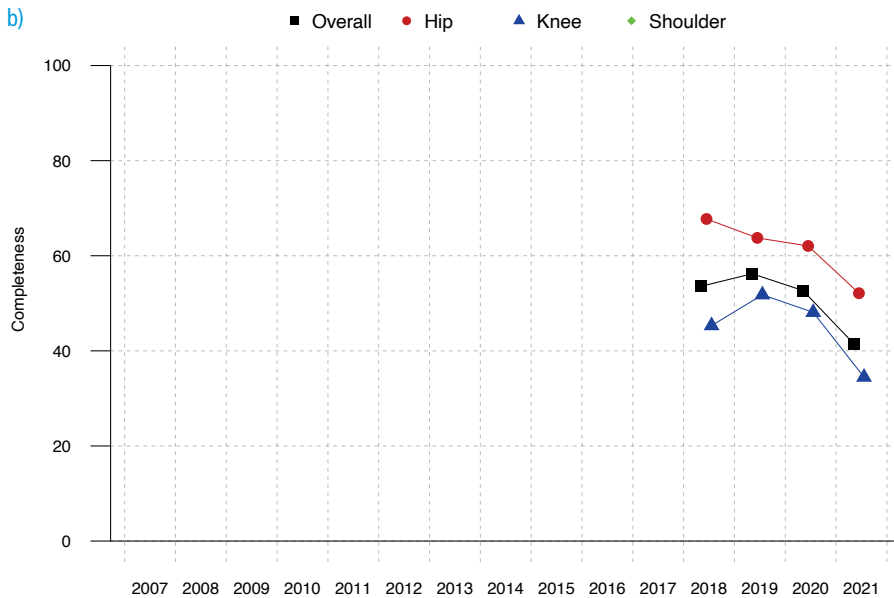
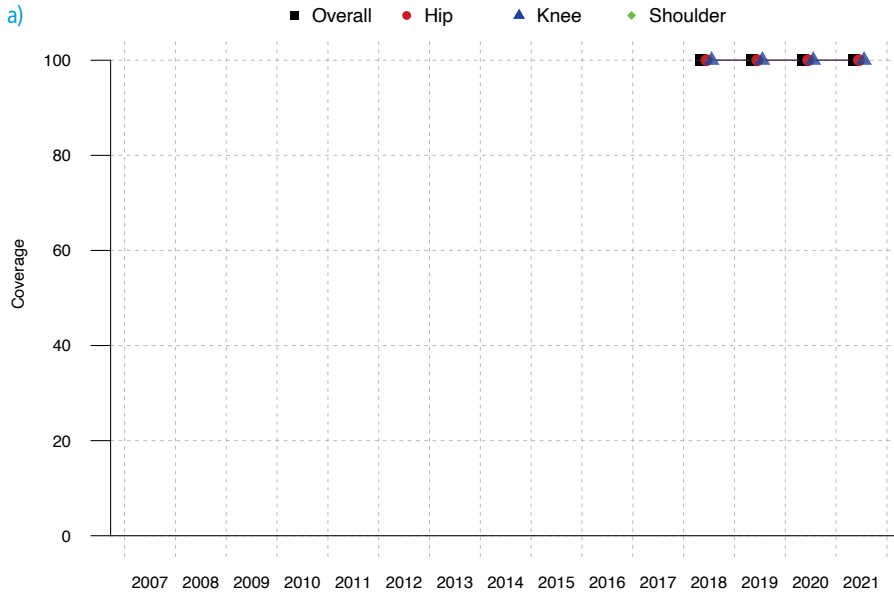


Figure 18. Clinica Città di Alessandria. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



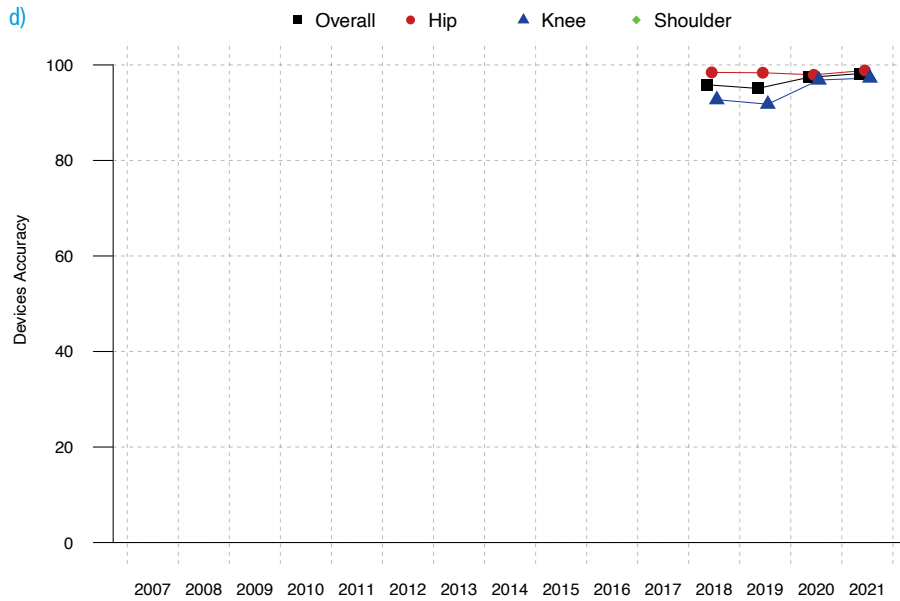
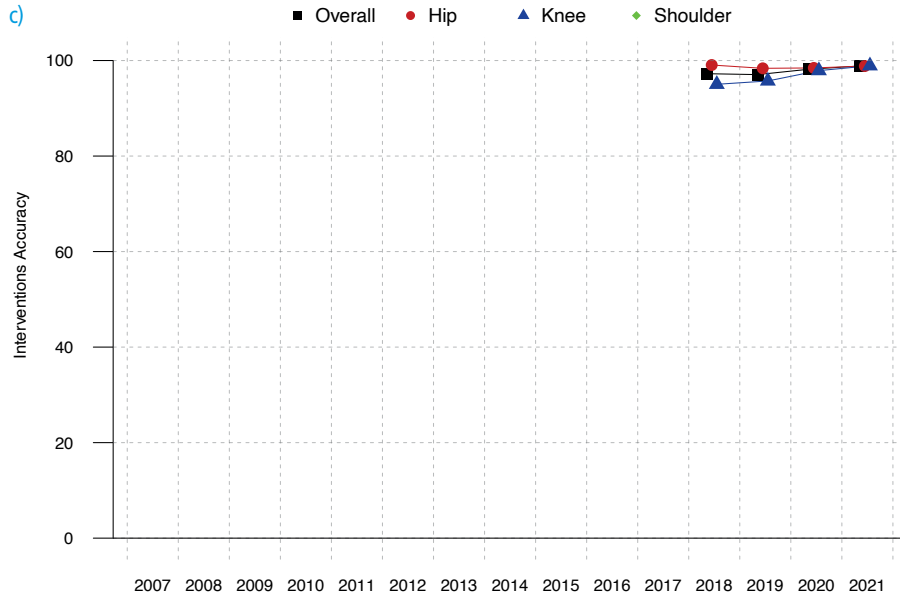
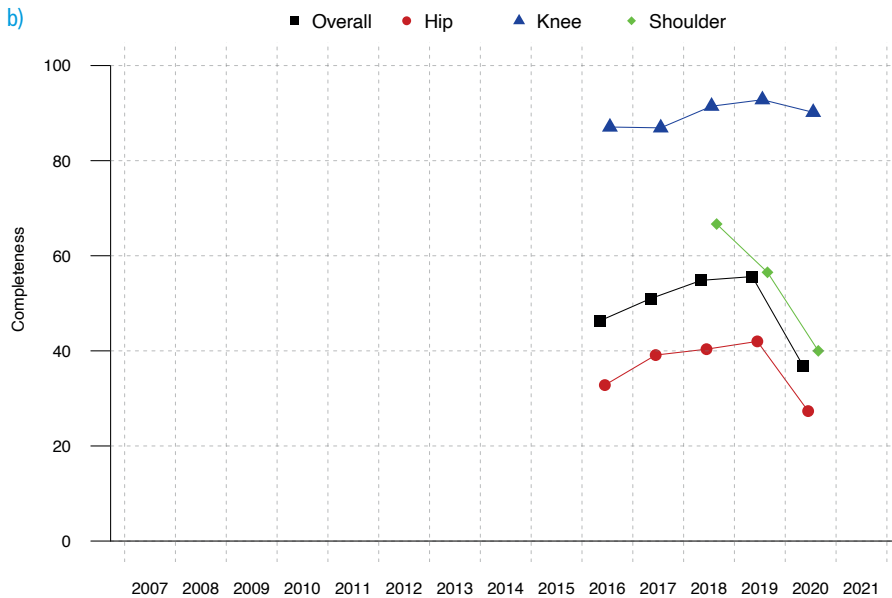
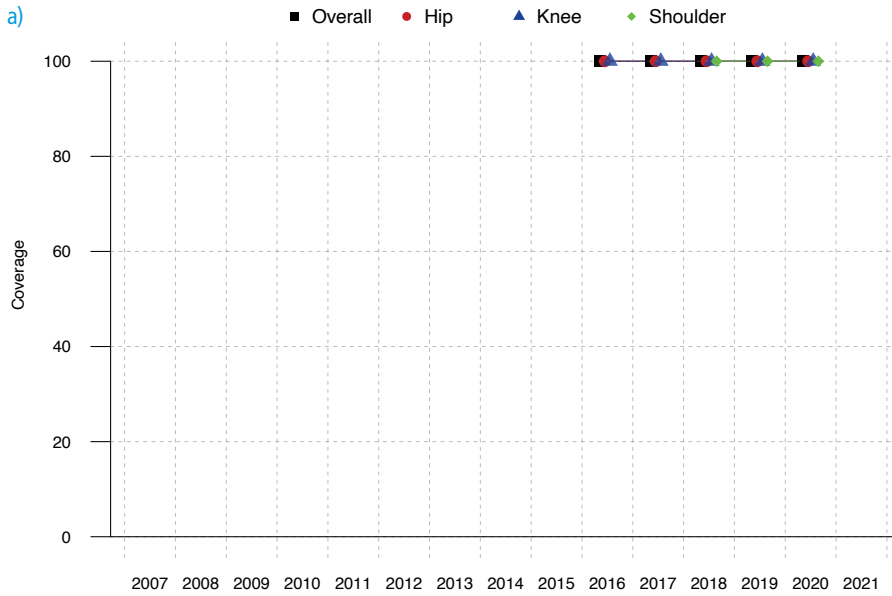


Figure 19. "PO Universitario Santa Maria della Misericordia" of Udine. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



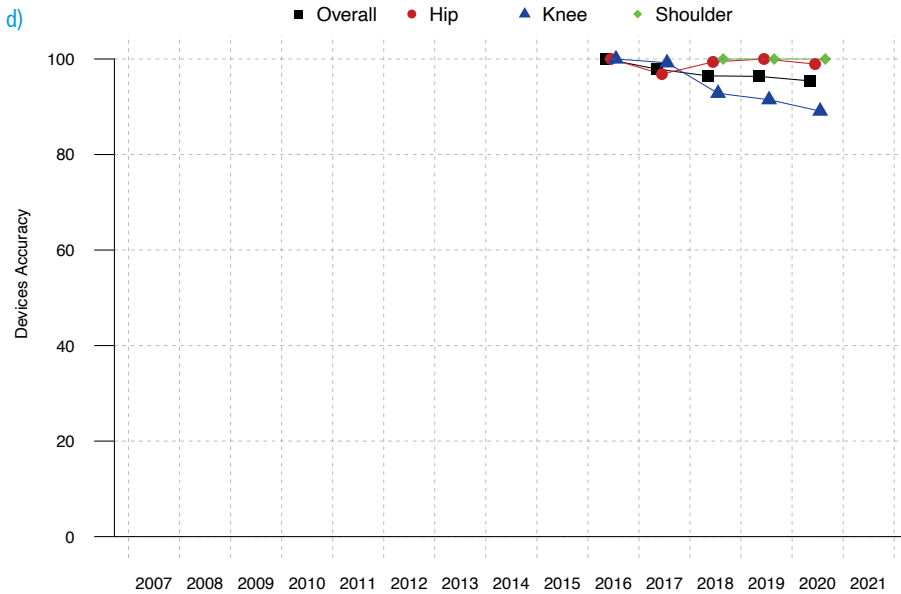
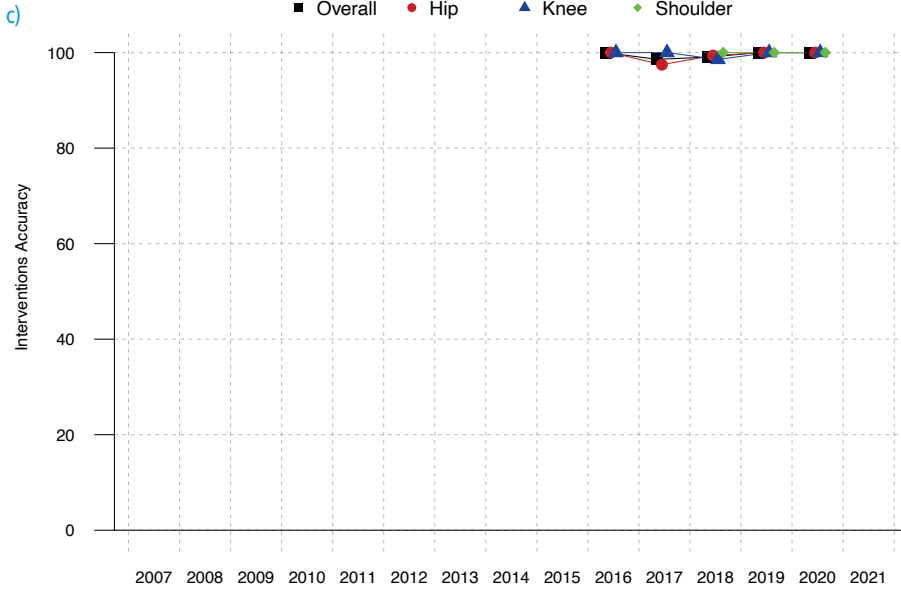
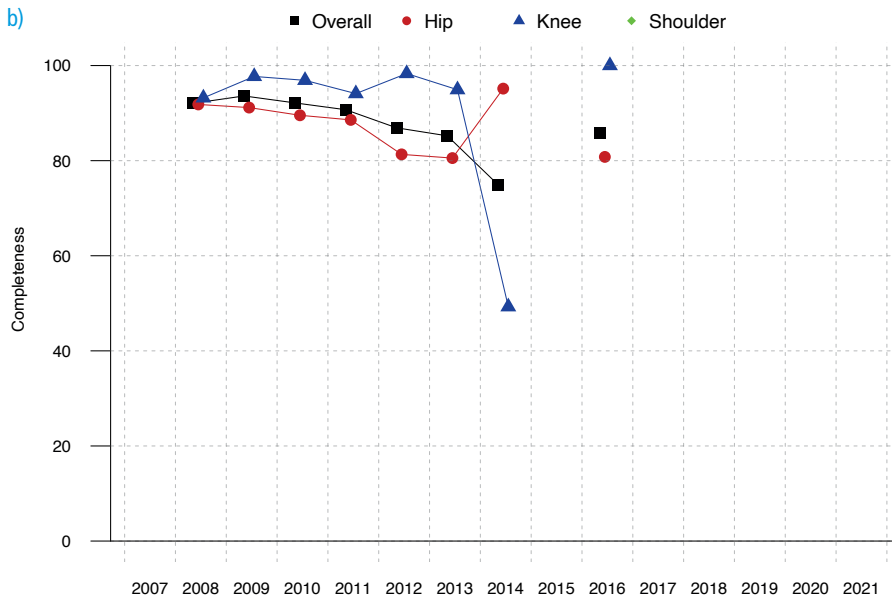
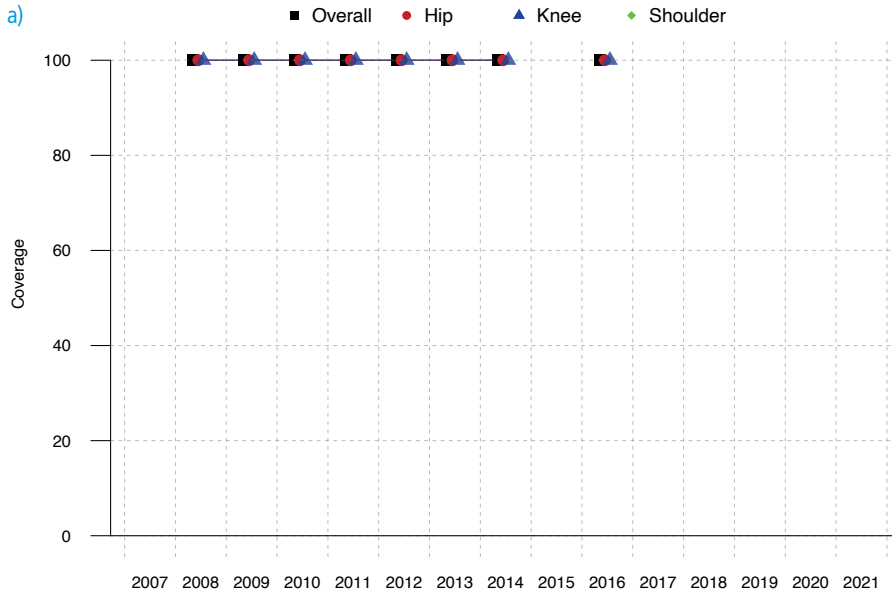


Figure 20. "Fondazione Livio Sciuotto/Fondazione Spotorno" of Savona. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



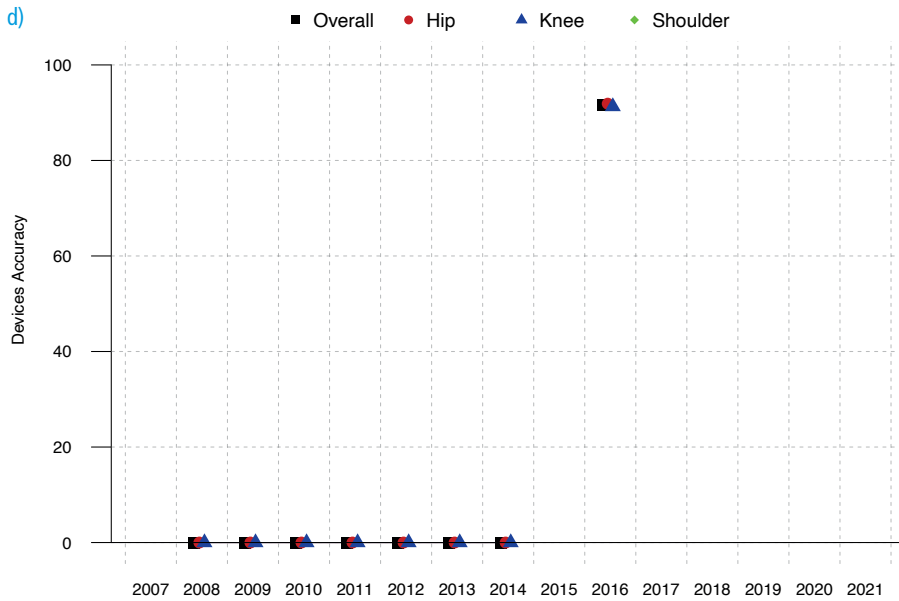
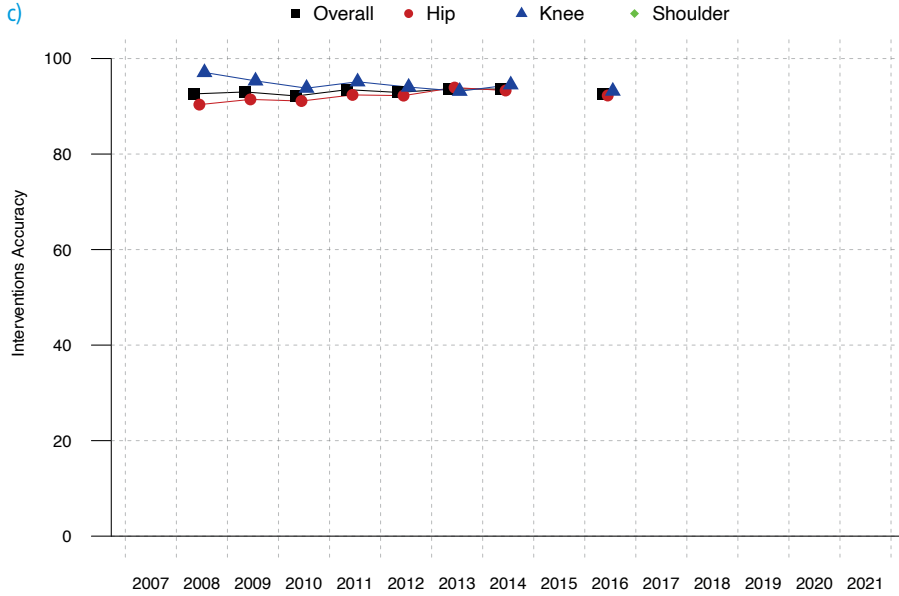
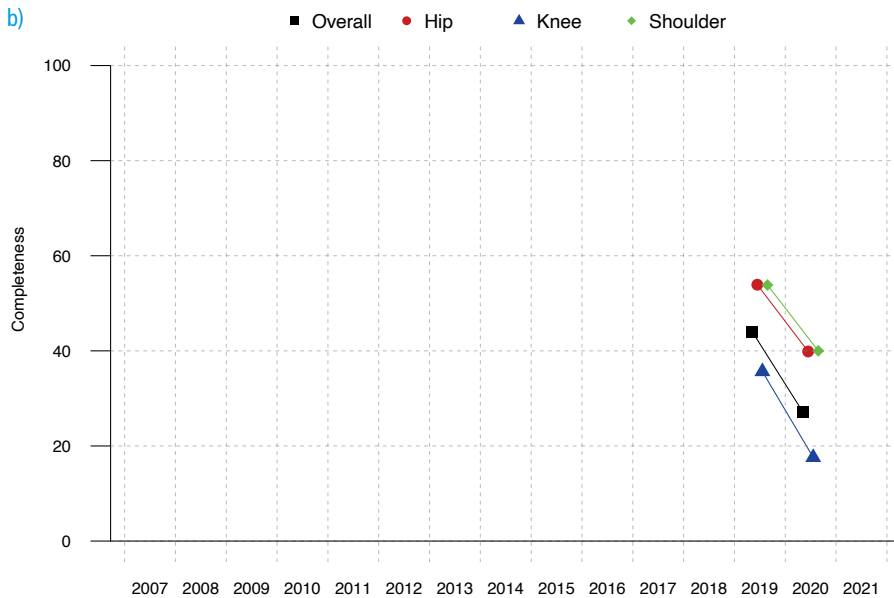
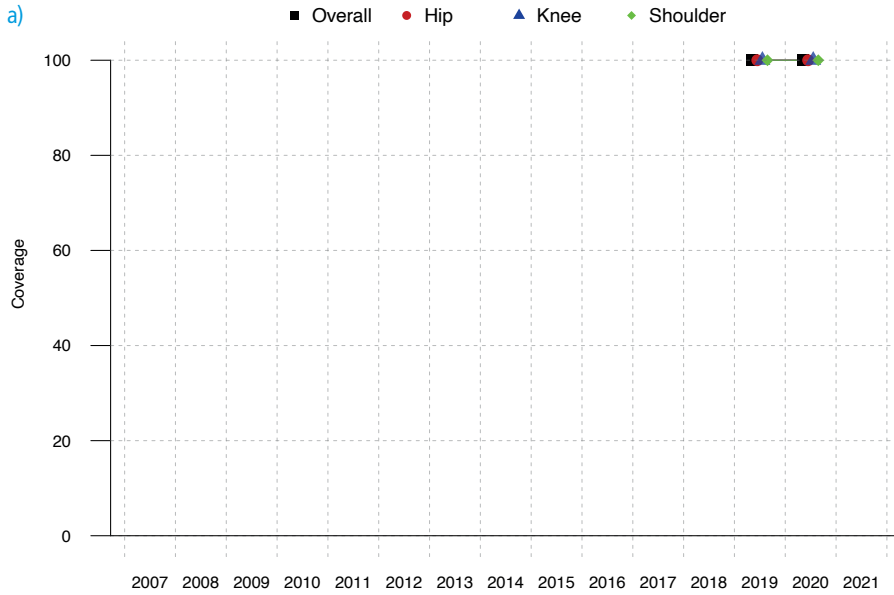


Figure 21. "Casa di cura San Feliciano" of Rome. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



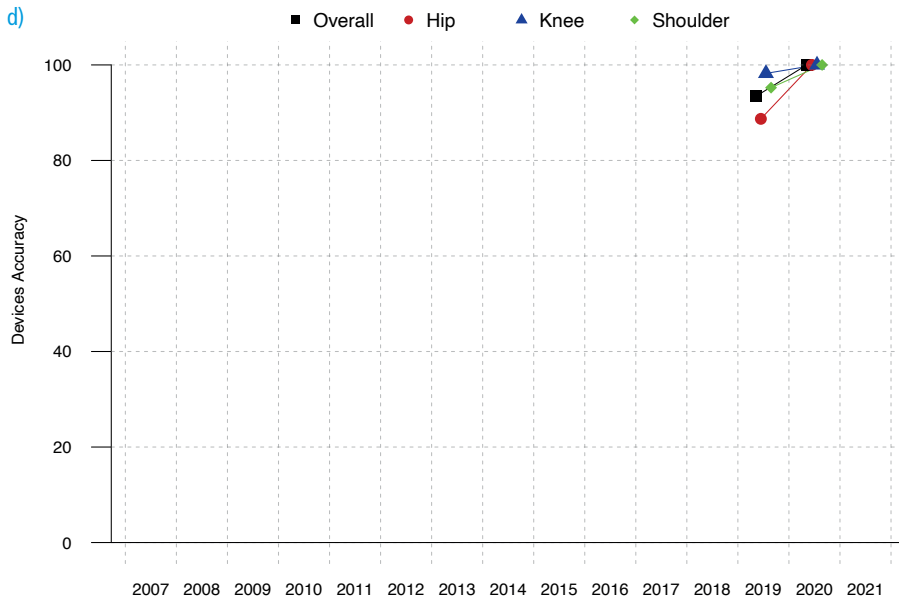
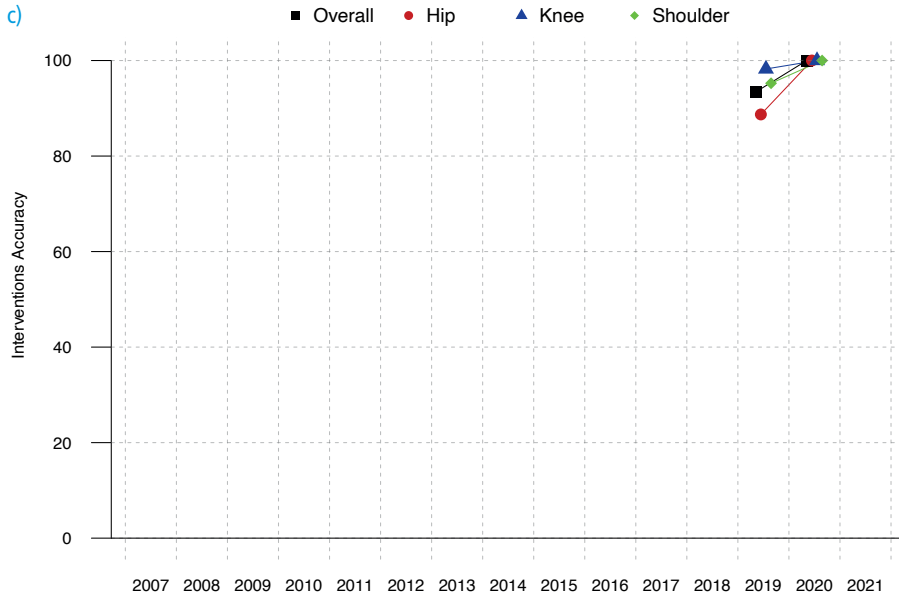
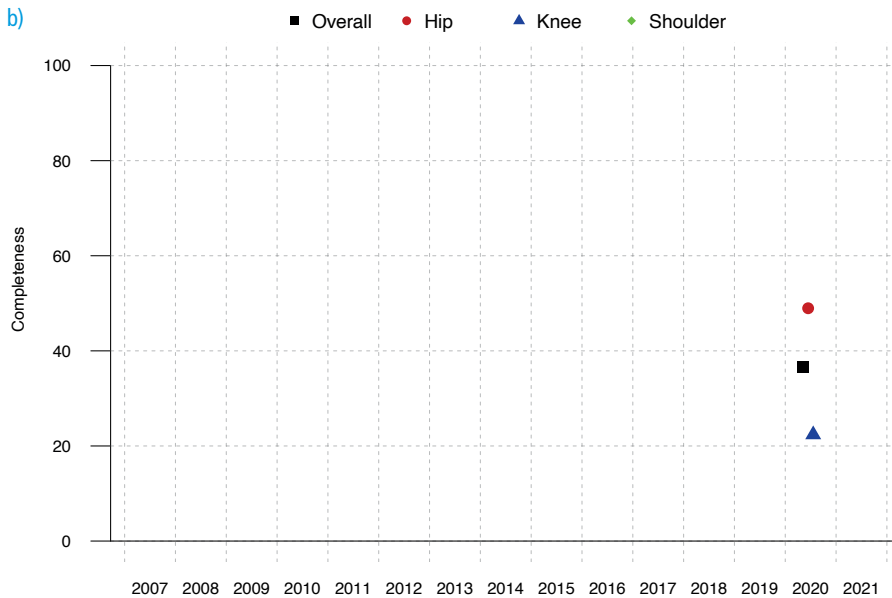
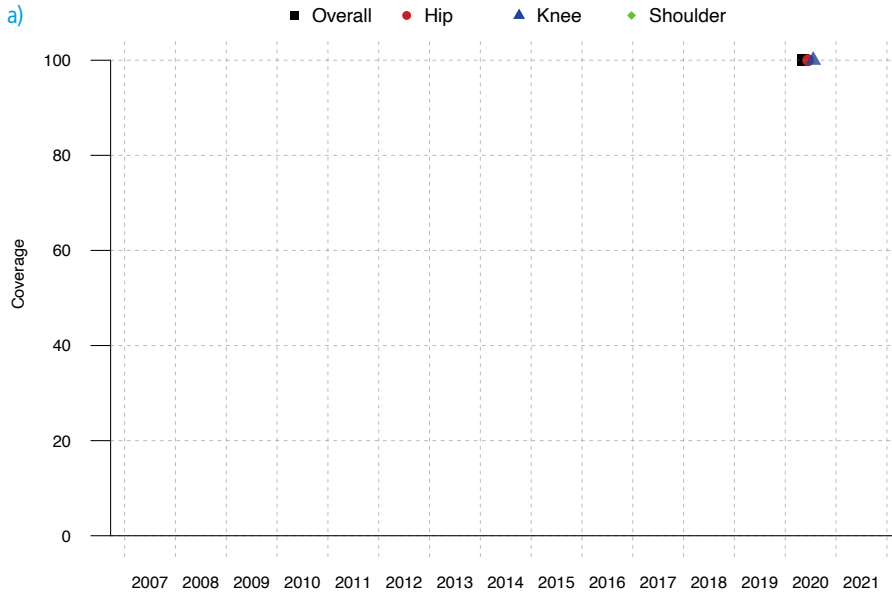


Figure 22. "Casa di cura Villa Aurora" of Rome. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021



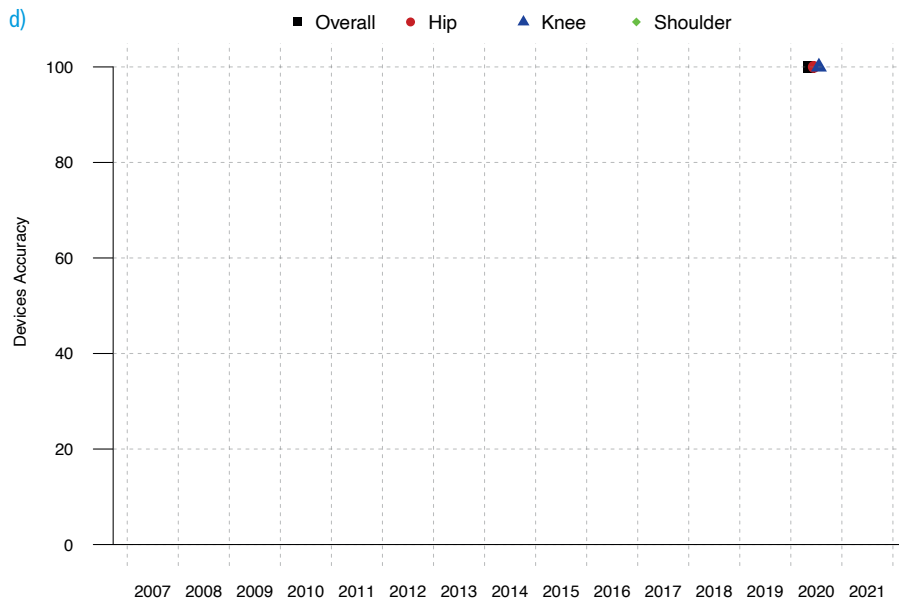
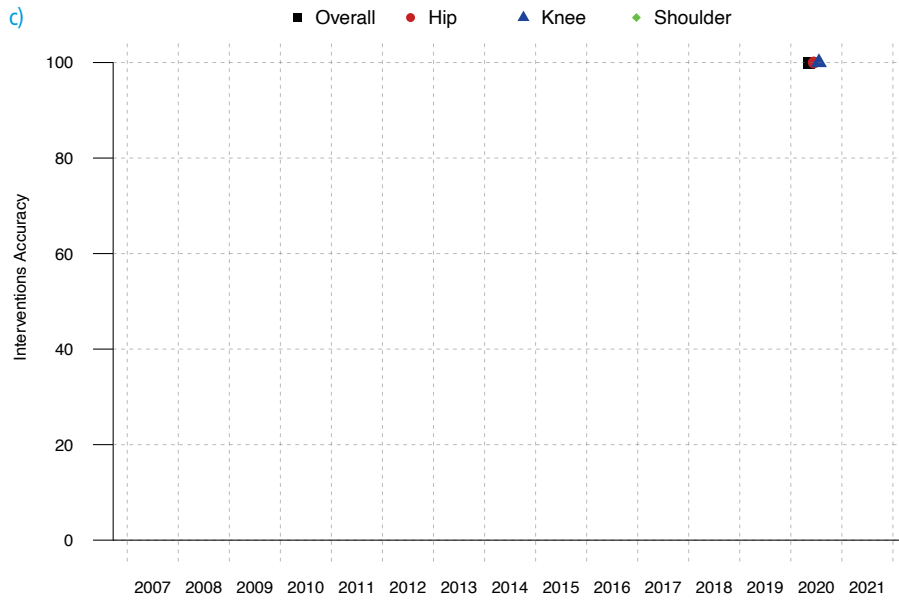


Figure 23. "Ospedale San Pietro Fatebenefratelli" of Rome. Temporal trends in coverage (a), completeness (b), accuracy on interventions (c) and accuracy on devices (d). 2007-2021

