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ITALIAN ARTHROPLASTY REGISTRY

Data 2007-2022

riap

Italian Arthroplasty Registry

Addendum to the Annual Report 2023

English version of Tables and Figures

Data 2007-2022

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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 2007-2022.

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

Technical Appendix 2A provides an analysis of national Hospital Discharge Data for 2021 and 2022. Technical Appendix 2B 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 2022.

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 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 procedure 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 Impiantabili 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 2014-2023.

RIAP today: an evolving pathway

Also this year and similarly to the registries of other countries, the 2023 RIAP Cumulative Annual Report, continuing the approach proposed for the 2022 RIAP Report, covers the whole period of the Registry's activity, from 2007 (the year data collection started) to 2022, with the aim of showing the complex development of the project over time and the analysis of all the data collected on hip, knee, shoulder and ankle arthroplasty procedures.

Key achievements

Here is a summary of the main activities and achievements over the period 2007-2022:

Enrollment of missing Regions. The number of regions and institutions involved in RIAP has varied over time. In the beginning, only the three regions that had already started their own regional registry were involved: Lombardy, Emilia-Romagna and Apulia. However, over a period of 15 years, a total of 14 regions, the two Autonomous Provinces of Trento and Bolzano, three Local Health Authorities (ASLs) and three hospitals were involved in RIAP and submitted data, also thanks to the intensive awareness-raising activities carried out by the RIAP Research group and the interested Scientific societies (Figure 1.1). Unfortunately, the contribution of some of them was limited in time and there were various reasons for leaving the project or stopping sending data (lack of human resources, reorganisation of health management at regional level with consequent changes in priorities for action, difficulties in applying privacy regulations, etc.).

At 31.12.23, seven Regions, the Autonomous Province of Trento, the Autonomous Province of Bolzano, two ASLs and three hospitals had formally joined RIAP. As for the procedures performed in 2022, six participating institutions provided data for hip and knee, four for shoulder and two for ankle.

RIAP as a reference to develop other RIPI research lines. Thanks to RIAP, the only Registry that has defined and tested the methodology to actively collect data within the framework of the National Registry of Implantable Prostheses (RIPI), a collaborative network has been developed over the years and is now becoming increasingly widespread, both nationally and internationally.

Indeed, from 2019 onwards RIAP has become one of RIPI's lines of activity and is recognised today as a "pathfinder" for the development of medical device registries that already exist

and those that will be included in the broader context of RIPI.

RIPI Regulation. With the publication of the RIPI Regulation, foreseen by DPCM 3/3/2017, the feeding of the Registry, currently mandatory only in some limited and specific regional contexts, will become mandatory at national level. In this way, it will be possible to meet the requirements of the EU MDR 2017/745 and to complete the complex regulatory process that has so far required 17 years of synergistic work between the different actors involved in the field of registries in Italy.

The text of the RIPI decree, prepared by the ISS working group, defines the data to be collected in a standardised way, who can have access to the Registry and what operations can be carried out. Currently, it is under consideration by the competent bodies of the Ministry of Health.

RIAP-MD Dictionary update and collaboration with the National Joint Registry (NJR). RIAP-MD Dictionary is a key element in the process of identifying and characterising implanted devices. Integrated into the RaDaR Platform since 2013, the Dictionary is regularly updated by Manufacturers with data needed to ensure device identification and traceability. In case an implanted device is not already registered in RIAP-MD Dictionary, the health operator is required to send through the platform a request to RIAP that upload it into the database following a specific procedure. At 31 December 2023, the RIAP-MD Dictionary contained approximately 85,000 product codes submitted by more than 40 companies representing more than 80 manufacturers.

In order to include in the Dictionary also the technical characteristics essential for comparative analyses of medical device performance, RIAP signed an agreement with the English National Joint Registry (NJR, UK) in 2021, with the aim of accessing, consulting and, if necessary, feeding the component library created by the NJR together with the German Endoprostheses Register (EPRD). This collaboration has marked the beginning of an important project to create an international dictionary of orthopaedic prostheses.

Updating of web applications and the π-RIPI Project. The data flow infrastructure and tools to support data collection have been continuously updated and improved over time (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.

In the course of 2023, in order to provide an improved data collection tool through the implementation of a prototype platform for all implantable prosthesis registries included in RIPI (joint prostheses, defibrillators and pacemakers, spinal devices, heart valves and implantable hearing devices), the RIAP Research Group launched the project 'Creation of the prototype of the data collection platform of the National Registry of Implantable Prostheses (π-RIPI)' as part of the 'Rome Technopole'(RT) project of the National Recovery and Resilience Plan (PNRR). Starting from the different components experimentally developed by the RIAP Research group and using software engineering principles, π-RIPI aims at implementing an integrated platform, composed of several modules, each referring to one of the different registries included in RIPI and developed according to RIPI architectural standards. Currently, the module for tracking the RIAP implanted devices is being implemented. It will also include an Artificial Intelligence (AI) module to retrieve from the network the characteristics and descriptive information of joint prostheses registered in RIAP.

Collaboration with the Ministry of Health. Thanks to the continuous support of the Ministry of Health and the network of stakeholders involved (Ministry of Health, Regions, Scientific Societies manufacturers, patients) RIAP has been able to develop and implement an innovative information flow over a period of 17 years. This flow, once data collection becomes mandatory at the national level, will represent an invaluable source of data to follow implanted patients over time and space, thus improving their safety and quality of life, an objective in line with EU MDR 745/2017.

In Italy, the National Registry of Breast implants, established at the Ministry of Health and mandatory since 18/01/2023, has been designed following the model already defined by RIAP and implemented and tested in a pilot phase in close collaboration with the ISS.

The Ministry of Health has also supported the RIAP team in the drafting of the RIPI Regulation.

Participation in international projects and networks and dissemination of results. Over the period 2007-2022, the results of the RIAP activities have been systematically disseminated and the Registry's participation in international projects/networks has always been actively promoted. At the international level, RIAP is currently strongly involved in:

i) the International Society of Arthroplasty Registries (ISAR), of which it has been a member since 2013. Since 2012, RIAP

has participated: in all ISAR annual congresses, where important scientific results achieved by the arthroplasty registries of the different countries are shared; in the ISAR Steering Committee meetings where RIAP scientific coordinator participates as member at large since 2022. As an ISAR member registry, RIAP has completed a form reporting a short and standardised registry description to improve the knowledge of existing registries, their activities, similarities and differences, and to facilitate the 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.

ii) the Network of Orthopaedic Registries of Europe (NORE), since 2017, a collaboration aimed at supporting the development of registries in European countries;

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 has been a partner, aiming at providing the European Commission with the best scientific evidence to support the implementation of the European Regulation 2017/745.

More recently, 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 between RIAP and NJR.

Communication. Communication has always played an important role among the 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. The constant update of the RIAP (https://riap.iss.it/riap/it/, https://riap.iss.it/riap/en/) and RIPI (https://ripi.iss.it/ripi/it/, https://ripi.iss.it/ripi/en/) websites through the publication of the RIAP reports and news on the activities carried out by the RIAP/RIPI Research Group has helped to increase the visibility of RIAP at the national and international level over time.

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: 58,997,201 on 1 January 2023

Scope of registry: National

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

Year started: 2006 (pilot), 2007 (actual)

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-defined 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): 22.8 % (2022); 23.5% (2007-2022 average) at the national level

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: 2022

Completeness of procedure registration (%), (N procedures captured in registry[i]/total N of procedures) (2022; 2007-2022 average):

Primary hip procedures (%):	14.8; 22.6	Revision hip procedures (%):	9.5; 17.2
Primary knee procedures (%):	14.2; 21.1	Revision knee procedures (%):	9.1;13.1
Shoulder procedures (%):	17.0;12.3	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 yet calculated. We plan to perform this analysis in the future for the regions that provide the pseudonymised ID code (Autonomous Province of Bolzano, Autonomous Province of Trento, Marche Campania, Apulia, Sicily)

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 one or all of the elements of the prosthesis are removed and replaced with a new one

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 yet applicable

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/ (the last Report refers to data collected from 2007 to 2022)

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

Other (if any):

[i] that have passed quality audit on interventions

Key findings from the 2023 Annual Report

Analysis of the RIAP data from 2007 to 2022

The 2023 RIAP Report presents the cumulative results of the analysis of the data collected between 1.1.2007 and 31.12.2022.

Similarly to the 2022 version, the 2023 RIAP Report presents the results of the analyses carried out on joint replacements data (hip, knee, shoulder and ankle) collected and managed by the Regions, Autonomous Provinces, Local Health Units or single hospitals that participated in RIAP during the period between 1.1.2007 and 31.12.2022.

Data collection started with the hip in 2007 and was progressively extended to the knee in 2010, the shoulder in 2017 and the ankle in 2019. However, the RIAP database also contains data from procedures performed in regions where the regional registry was already active before the official year of the RIAP data collection.

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 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 2.2a) and then a quality audit on devices (Fig 2.2b) 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 2007-2022. 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 2B of the REPORT RIAP 2023).

In 2022, a total of 719,294 procedures were collected and admitted to the quality audit, of which 439,589 were for hip (Table 2.2a), 271,516 for knee (Table 2.2b), 8,181 for shoulder (Table 2.2c) and 8 for ankle. For ankle, due to the small number of procedures collected

(8), it was decided, as in previous years, not to include the corresponding tables in Chapter 2 of the RIAP Report.

The total number of procedures that passed the quality audit on interventions was 618,400, of which 371,182 were for hip, 239,412 for knee and 7,806 for shoulder.

The result of the quality audit on devices showed that at the end of the process 393,024 procedures passed both quality audits (procedure and device). Of these, 227,495 were for hip, 160,855 for knee and 4,674 for shoulder.

Compared to the total data collected, 86.0% of the procedures passed the quality audit on interventions and 54.6% passed the quality audit on devices.

Main results for each single joint

Hip. A total of 439,589 hip interventions were collected. Of these, 371,182 (84.4%) passed the quality audit on interventions and 227,495 (51.8%) passed that on devices. There has been a 34.4% increase in the total number of procedures performed in centres that collected data in both 2021 and 2022 (Tables 2.3-2.13).

Knee. The number of procedures collected for the knee was 271,516, almost half the number of procedures collected for the hip.

A total of 239,412 procedures passed the quality audit on interventions (88.2%) and 160,855 (59.2%) that on device. Again, the comparison between the participating institutions in 2021 and 2022 shows an increase in the total number of procedures performed (51.2%), which was higher than for the hip (Tables 2.14-2.22).

Shoulder. As the collection of shoulder procedures in RIAP is more recent, the numbers are significantly lower (8,181) with respect to the other two joints.

In this case, 7,806 (95.4%) interventions passed the quality audit on interventions and 4,674 (57.1%) that on devices. As with the hip and knee, the shoulder also shows an increase in the total number of procedures performed (37.7%) when comparing the participating institutions in 2021 and 2022 (Tables 2.23-2.31).

RIAP *coverage* and *completeness*

A detailed analysis of the RIAP coverage, completeness and accuracy on interventions and devices is presented in the Appendix 2D of the 2023 RIAP Report at both national and local level. Coverage and completeness were calcu-

lated 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.

Regarding the trend of the indicators for the institutions that participated in RIAP compared to the areas covered by them, an increasing trend in the values of the coverage and completeness can be observed since 2013, reaching levels above 80% in 2022, thanks to the participation of the RIAP institutions for which registration of procedures has been made mandatory by local measures.

Regarding accuracy indicators, they are also significantly influenced by the participation of institutions. In particular, the drastic decrease measured in 2013 for the knee, in 2014 for the accuracy on interventions and in 2022 for the accuracy on devices are due to the non-inclusion of the data from Lombardy, either because they were not sent (2014) or they were received when the analyses had already been completed (2022).

Similarly to Lombardy, the data collected in 2022 by the Casa di Cura S. Maria Maddalena di Occhiobello (data received late) and the Autonomous Province of Bolzano were not admitted to the quality audit. In the first case, data were received too late, while in the case of the Autonomous Province of Bolzano the feeding of RIAP will resume as soon as the national regulation required by DL 179/2012 is approved.

As the contribution of Lombardy represents more than 60% of the data collected by RIAP, the exclusion of these data from the analyses resulted in the completeness scores being more than halved, even though the absolute number of interventions increased compared to those presented in the 2022 RIAP Annual Report. However, if the comparison between 2022 and 2021 is made only for those institutions that sent data to RIAP in both years, an upward trend is observed (+41%) due to the greater number of interventions from regions where contribution to the registry was made mandatory by local measures (Sicily, Apulia, Campania).

There is an increase for each of the joints: 34.4% for the hip, 51.2% for the knee and 37.7% for the shoulder; the ankle, on the other hand, has too few operations to allow for any epidemiological considerations. This is an encouraging sign that confirms the relevance of the awareness-raising activities on the importance of participation in the registry carried out

by the scientific societies and the RIAP Research Group.

In particular, in Sicily, with the application of the Legislative Decree no. 174 of 1/3/2021, there has been a steady increase in coverage and completeness in 2022, reaching 80% and 85% respectively. Moreover, in March 2023, the Autonomous Province of Trento formally adopted its own regional regulation, a measure that obliges health care institutions to feed the joint replacement registry.

However, a comparison with previous years must take into account the effect of the elective surgical procedures postponement in 2020 caused by the Covid-19 pandemic. With the resumption of regular surgery, an increase in the number of procedures has actually been observed in 2021 and 2022.

Analysis of the data from the national Hospital Discharge Record Database

In addition to the registry data, the Annual Report dedicates, as usual, a specific Appendix to the analysis of the Hospital Discharge Records (HDR) database, which provides useful information on the volumes of activity at the national level for the various types of surgical procedures, their temporal trends and the characteristics of patients, thus representing an important reference tool for clinical practice, citizens and health policies.

More specifically, the Appendix 2A provides an overview of all procedures performed at the national level from 2001 to 2022 for all the ICD9-CM codes of principal and secondary procedures of interest for RIAP (hip, knee, shoulder and ankle) (Appendix 2A Table 1). It also presents the results of detailed descriptive analyses performed on the HDR national database for the last two available years (2021 and 2022) (Appendix 2A 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 interregional mobility;

- hospitalisation and incidence rates by region;
- evolution of incidence and hospitalisation rates at the national level from 2001 to 2022.

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 strong increase in the number of operations for all joints seen in 2022 compared to 2021 could be related to the normal growth of the arthroplasty phenomenon, but also to the attempt to recover pre-pandemic levels confirming what has already been observed between 2020 and 2021, where the resumption of elective activity was accompanied by an attempt to make up for missed surgeries.

Conclusions

The 2023 RIAP Cumulative Report summarises the development of RIAP over 17 long years and therefore represents an important milestone in the scientific production of the Italian Arthroplasty Registry (RIAP). Therefore, despite all its limitations, the RIAP Report continues to provide a unique epidemiological overview of joint replacement surgery throughout Italy.

Over the years, the representativeness of the RIAP at the national level has stabilised at around 35% until 2021 for both coverage and completeness, then settled at values close to 20% in 2022. This reduction is due to the non-inclusion of data from Lombardy, the region with the highest volume of joint replacements at the national level.

The changes observed over time in all the indicators calculated at both local and national level confirm that, pending the adoption of the RIPI National Regulation, the role that decision-makers at the local level can play in improving participation levels remains crucial.

Thanks to the continuous support of the General Directorate of Medical Devices of the Ministry of Health and the network of actors involved (Ministry of Health, regions, scientific societies, manufacturers, patients), RIAP has been able to develop and implement an innovative information flow. This flow, once it becomes mandatory in the whole country with

the publication of the RIPI Regulation required by DL 179/2012 and DPCM 3/3/2017, will represent a valuable source of data to follow-up the implanted patients over time, thus improving their safety and quality of life, an objective in line with what is required by the EU MDR 745/2017.

Actually, at both national and international levels, an increasing attention is being paid to registries as tools that can improve patient safety and quality of life by providing reliable data and monitoring surgical outcomes to avoid adverse events related to the implanted prosthesis.

RIAP is recognised at both national and international level as a valuable database at the service of healthcare institutions and the community. It is therefore necessary to continue to raise awareness of the importance of the registries in order to not lose what has been achieved so far thanks to the passion of all those who have believed in this project over the years and have worked hard to make it possible.

How to calculate indicators used in RIAP 2023 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).

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 all the areas covered by them (Figure 2); for each region and participating institutions in relation to its own area (Figures 3-23).

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

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

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

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

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

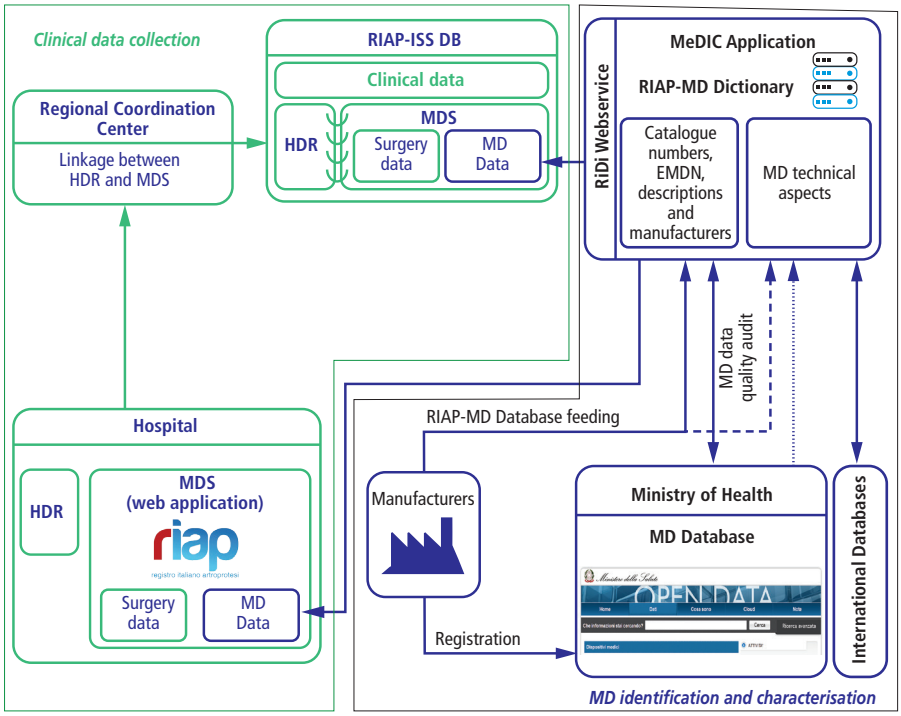
$$\textit{Completeness} = \frac{\text{Number of procedures collected by RIAP}}{\text{Total number of procedures of interest performed in a specific geographical area}}$$

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

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

Figure 1.1. Participation in RIAP (as of 31/12/2023)

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. From 2007 to 2022

Participating institution	2007	2008	2009	2010	2011	2012	2013
Region	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Aosta Valley					1		
Lombardy	109	112	112	113	112	111	
AP Bolzano				8	8	8	8
AP Trento				5	6	6	6
Veneto				2			
Emilia-Romagna	67	65					
Tuscany				5	4		
Marche							3
Lazio				3	2	2	2
Abruzzi							
Campania							
Apulia	11	12	6	44	2	1	44
Basilicata		1	2	2	4	3	3
Calabria							
Sicily							7
Single hospital/foundation							
Clinica Città di Alessandria							
Casa di cura Santa Maria Maddalena, Occhiobello (RO)							
PO Universitario Santa Maria della Misericordia, Udine							
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		2	1	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**	**74**
All joint replacements	**189**	**194**	**122**	**184**	**140**	**133**	**74**

(^) Data not analysed because received too late

(*) AP Bolzano actively participates in RIAP. Data after 2020 will be sent to RIAP as soon as the RIPI Regulation required by DPCM 3/3/2021 is published

2014	2015	2016	2017	2018	2019	2020	2021	2022
N	N	N	N	N	N	N	N	N
111	112	108	105	105	104	106	102	102 (^)
8	8	8	11	12	12	12	12 (*)	13 (*)
8	7	8	8	8	8	8	9	9
	1	1	1	1	3	3	3	
20	17	13	13	11	10	18	10	11
	2	2			3	2		
			68	65	56	54	49	57
41	44	42	45	46	42	42	39	41
	2	2	1	1	4	1		
7	6	5	11	16				
13	8	12	8	4	7	9	48	57
				1	1	1	1	1
								1 (^)
		1	1	1	1	1		
3		1	1					
					1	1		
						1		
					1			
211	**207**	**203**	**273**	**271**	**253**	**259**	**261**	**176**
243	**208**	**207**	**279**	**273**	**255**	**259**	**263**	**178**

Table 2.1b. Knee. Number of centres collecting data for RIAP by participating institution. From 2007 to 2022

Participating institution	2007	2008	2009	2010	2011	2012	2013
Region	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Aosta Valley							
Lombardy	108	109	108	112	111	110	
AP Bolzano					8	8	8
AP Trento							
Veneto							
Emilia-Romagna							
Tuscany							
Marche							2
Lazio							
Abruzzi							
Campania							
Apulia							42
Basilicata							3
Calabria							
Sicily							7
Single hospital/foundation							
Clinica Città di Alessandria							
Casa di cura Santa Maria Maddalena, Occhiobello (RO)							
PO Universitario Santa Maria della Misericordia, Udine							
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		2	1	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**	**63**
All joint replacements	**189**	**194**	**122**	**184**	**140**	**133**	**74**

(^) Data not analysed because received too late

(*) AP Bolzano actively participates in RIAP. Data after 2020 will be sent to RIAP as soon as the RIPI Regulation required by DPCM 3/3/2021 is published

2014	2015	2016	2017	2018	2019	2020	2021	2022
N	N	N	N	N	N	N	N	N
	112	110	108	107	105	104	101	101 (^)
8	8	8	11	12	12	12	12 (*)	13 (*)
	5	9	8	8	8	8	9	9
	1	1	1	1	3	3	3	
20	14	9	13	10	10	14	10	11
	2	2			3	2		
			64	62	53	49	45	52
41	44	42	42	42	40	40	38	40
	2	2	1	1	3	1		
5	5	5	8	14				
13	8	12	7	4	7	8	47	55
				1	1	1	1	1
								1 (^)
		1	1	1	1	1		
3		1	1					
					1	1		
						1		
					1			
90	**201**	**202**	**265**	**263**	**248**	**245**	**254**	**168**
243	**208**	**207**	**279**	**273**	**255**	**259**	**263**	**178**

Table 2.1c. Shoulder. Number of hospitals collecting data for RIAP by participating institution. From 2017 to 2022

Participating institution	2017	2018	2019	2020	2021	2022
Region	**N**	**N**	**N**	**N**	**N**	**N**
Aosta Valley						
Lombardy						
AP Bolzano			6	5	11 (*)	8 (*)
AP Trento						
Veneto						
Emilia-Romagna						
Tuscany						
Marche		6	8	12	10	9
Lazio						
Abruzzi			2	1		
Campania	34	34	34	34	38	41
Apulia	33	34	33	34	34	37
Basilicata			2			
Calabria						
Sicily		1	3	4	35	38
Single hospital/foundation						
Clinica Città di Alessandria						
Casa di cura Santa Maria Maddalena, Occhiobello (RO)						1 (^)
PO Universitario Santa Maria della Misericordia, Udine		1	1	1		
Fondazione Livio Sciutto / Fondazione Spotorno (SV)						
Casa di cura San Feliciano, Rome			1	1		
Casa di cura Villa Aurora, Rome						
Ospedale San Pietro Fatebenefratelli, Rome						
Total number of hospitals collecting data for RIAP						
Shoulder replacements	**67**	**76**	**90**	**92**	**117**	**125**
All joint replacements	**279**	**273**	**255**	**259**	**263**	**178**

(^) Data not analysed because received too late

(*) AP Bolzano actively participates in RIAP. Data after 2020 will be sent to RIAP as soon as the RIPI Regulation required by DPCM 3/3/2021 is published

Table 2.1d. Ankle. Number of hospitals collecting data for RIAP by participating institution. From 2019 to 2022

Participating institution	2019	2020	2021	2022
Region	**N**	**N**	**N**	**N**
Aosta Valley				
Lombardy				
AP Bolzano				
AP Trento				
Veneto				
Emilia-Romagna				
Tuscany				
Marche				1
Lazio				
Abruzzi				
Campania	1			
Apulia				
Basilicata				
Calabria				
Sicily				2
Single hospital/foundation				
Clinica Città di Alessandria				
Casa di cura Santa Maria Maddalena, Occhiobello (RO)				1 (^)
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 number of hospitals collecting data for RIAP				
Ankle eplacements	**1**	**0**	**0**	**3**
All joint replacements	**255**	**259**	**263**	**178**

(^) Data not analysed because received too late

Table 2.2a. Hip. Number of procedures collected by RIAP and admitted to quality audit by participating institution. From 2007 to 2022

Participating institution	2007	2008	2009	2010	2011	2012	2013
Region	**N**	**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	1,365
AP Trento				200	664	763	719
Veneto				90			
Emilia-Romagna	8,784	8,989					
Tuscany				333	88		
Marche							25
Lazio				106	157	160	9
Abruzzi							
Campania							
Apulia	499	473	491	1,605	11	9	4,439
Basilicata		7	48	69	344	320	155
Calabria							
Sicily							212
Single hospital/foundation							
Clinica Città di Alessandria							
Casa di cura Santa Maria Maddalena, Occhiobello (RO)							
PO Universitario Santa Maria della Misericordia, Udine							
Fondazione Livio Sciutto/Fondazione Spotorno (SV)		819	701	719	643	592	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**	**7,516**

(^) Data not analysed because received too late

(*) AP Bolzano actively participates in RIAP. Data after 2020 will be sent to RIAP as soon as the RIPI Regulation required by DPCM 3/3/2021 is published

2014	2015	2016	2017	2018	2019	2020	2021	2022	Total admitted to quality audit
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	25,888 (^)	273,442
1,428	1,499	1,404	1,410	1,341	1,422	1,042	1,539 (*)	1,670 (*)	14,547
1,033	833	1,110	1,187	1,343	1,433	1,149	1,641	1,863	13,938
									90
									17,773
	382	357	98	476	541	733	341		3,349
847	1,014	802	702	767	1,261	1,084	986	1,214	8,702
									432
	45	54			110	127			336
			5,519	4,897	4,777	3,922	4,470	6,468	30,053
4,354	4,621	3,534	4,790	4,781	4,949	4,642	5,073	5,723	49,994
	348	225	110	126	183	81			2,016
606	664	722	747	883					3,622
529	634	795	700	195	496	632	3,111	5,267	12,571
				319	306	193	258	350	1,426
								242 (^)	0
		123	158	161	160	94			696
1,374		555	226						6,221
					124	61			185
						94			94
					79				79
26,474	**30,399**	**31,899**	**38,457**	**38,634**	**40,571**	**31,383**	**39,001**	**20,885**	**439,589**

Table 2.2b. Knee. Number of procedures collected by RIAP and admitted to quality audit by participating institution. From 2007 to 2022

Participating institution	2007	2008	2009	2010	2011	2012	2013
Region	**N**	**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	735
AP Trento							
Veneto							
Emilia-Romagna							
Tuscany							
Marche							8
Lazio							
Abruzzi							
Campania							
Apulia							3,152
Basilicata							84
Calabria							
Sicily							150
Single hospital/foundation							
Clinica Città di Alessandria							
Casa di cura Santa Maria Maddalena, Occhiobello (RO)							
PO Universitario Santa Maria della Misericordia, Udine							
Fondazione Livio Sciutto / Fondazione Spotorno (SV)		411	470	467	431	351	336
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**	**4,465**

(^) Data not analysed because received too late

(*) AP Bolzano actively participates in RIAP. Data after 2020 will be sent to RIAP as soon as the RIPI Regulation required by DPCM 3/3/2021 is published

2014	2015	2016	2017	2018	2019	2020	2021	2022	Total admitted to quality audit
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	21,219 (^)	173,473
846	920	932	979	902	931	603	1,065 (*)	1,225 (*)	7,925
	40	659	687	772	773	572	824	1,071	5,398
									0
									0
	156	175	98	257	310	325	330		1,651
660	852	874	845	895	1,108	522	593	960	7,317
									0
	16	14			97	76			203
			3,444	3,199	3,433	2,445	3,025	4,710	20,256
2,817	3,279	2,673	3,553	3,669	3,534	3,038	3,143	4,009	32,867
	299	223	104	74	169	7			960
460	646	811	965	467					3,349
485	760	914	896	567	823	762	2,688	4,803	12,848
				261	304	190	182	254	1,191
								317 (^)	0
		128	126	139	129	55			577
436		264	125						3,291
					113	41			154
						32			32
					24				24
5,704	**21,435**	**23,434**	**28,039**	**28,524**	**30,986**	**20,066**	**27,156**	**15,807**	**271,516**

Table 2.2c. Shoulder. Number of procedures collected by RIAP and admitted to quality audit by participating institution. From 2017 to 2022

Participating institution	2017	2018	2019	2020	2021	2022	Total admitted to quality audit
Region	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Aosta Valley							0
Lombardy							0
AP Bolzano			28	48	73 (*)	74 (*)	76
AP Trento							0
Veneto							0
Emilia-Romagna							0
Tuscany							0
Marche		23	61	68	50	72	274
Lazio							0
Abruzzi			4	2			6
Campania	416	515	566	518	705	986	3,706
Apulia	440	471	539	474	540	638	3,102
Basilicata			11				11
Calabria							0
Sicily		6	23	29	338	552	948
Single hospital/foundation							
Clinica Città di Alessandria							0
Casa di cura Santa Maria Maddalena, Occhiobello (RO)						15 (^)	0
PO Universitario Santa Maria della Misericordia, Udine		12	13	4			29
Fondazione Livio Sciutto / Fondazione Spotorno (SV)							0
Casa di cura San Feliciano, Rome			21	8			29
Casa di cura Villa Aurora, Rome							0
Ospedale San Pietro Fatebenefratelli, Rome							0
Total							
Shoulder replacements	**856**	**1,027**	**1,266**	**1,151**	**1,633**	**2,248**	**8,181**

(^) Data not analysed because received too late

(*) AP Bolzano actively participates in RIAP. Data after 2020 will be sent to RIAP as soon as the RIPI Regulation required by DPCM 3/3/2021 is published

Table 2.2d. Ankle. Number of procedures collected by RIAP by participating institution. From 2019 to 2022

Participating institution	2019	2020	2021	2022	Total admitted to quality audit
Region	**N**	**N**	**N**	**N**	**N**
Aosta Valley					0
Lombardy					0
AP Bolzano					0
AP Trento					0
Veneto					0
Emilia-Romagna					0
Tuscany					0
Marche				1	1
Lazio					0
Abruzzi					0
Campania	3				3
Apulia					0
Basilicata					0
Calabria					0
Sicily				4	4
Single hospital/foundation					
Clinica Città di Alessandria					0
Casa di cura Santa Maria Maddalena, Occhiobello (RO)				1 (^)	0
PO Universitario Santa Maria della Misericordia, Udine					0
Fondazione Livio Sciutto / Fondazione Spotorno (SV)					0
Casa di cura San Feliciano, Rome					0
Casa di cura Villa Aurora, Rome					0
Ospedale San Pietro Fatebenefratelli, Rome					0
Total					
Ankle replacements	**3**	**0**	**0**	**5**	**8**

(^) Data not analysed because received too late

Table 2.3. Hip. Number of procedures included in procedure analysis and *completeness* by procedure type. 2007-2022 and 2022

	N	%	*Completeness (*)*	
			2007-2022	*2022*
			(1)	*(2)*
Procedure type	**371,182**		***22.2***	***14.4***
Primary	**348,775**	***94.0***	***22.6***	***14.8***
Total replacement	266,041	*76.3*	*23.4*	*14.9*
- elective	235,907	*88.7*		
- emergency	30,134	*11.3*		
Partial replacement	**82,734**	***23.7***	*20.6*	***14.3***
Revision	**22,407**	***6.0***	***17.2***	***9.5***
Partial revision (**)	13,461	*60.1*		
Total revision	6,125	*27.3*		
Removal (***)	2,821	*12.6*		

(*) *Completeness* (expressed in %): 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. 2007-2022

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Hospital type	**235,907**		**30,134**		**82,734**		**22,407**		**371,182**	
Public hospitals	84,008	*35.6*	21,313	*70.8*	65,641	*79.3*	9,396	*41.9*	180,358	*48.6*
Private hospitals, accredited	150,935	*64.0*	8,797	*29.2*	17,055	*20.6*	12,903	*57.5*	189,690	*51.1*
Private hospitals, non-accredited	964	*0.4*	24	*0.1*	38	*0*	108	*0.5*	1,134	*0.3*

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

Table 2.5. Hip. Number of procedures by gender and age group and by procedure type. 2007-2022

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Gender	**235,907**		**30,134**		**82,734**		**22,407**		**371,182**	
Male	108,726	*46.1*	8,425	*28.0*	21,450	*25.9*	8,827	*39.4*	147,428	*39.7*
Female	127,181	*53.9*	21,709	*72.0*	61,284	*74.1*	13,580	*60.6*	223,754	*60.3*
Age group by gender										
Male	**108,726**		**8,425**		**21,450**		**8,827**		**147,428**	
Mean age	64		71		82		69		68	
Standard deviation	12		13		9		12		13	
<45	6,242	*5.7*	243	*2.9*	129	*0.6*	344	*3.9*	6,958	*4.7*
45 - 54	2,274	*2.1*	1,161	*13.8*	233	*1.1*	832	*9.4*	4,500	*3.1*
55 - 64	14,884	*13.7*	722	*8.6*	574	*2.7*	1,599	*18.1*	17,779	*12.1*
65 - 74	26,579	*24.4*	1,339	*15.9*	2,082	*9.7*	2,667	*30.2*	32,667	*22.2*
75 - 84	36,057	*33.2*	2,463	*29.2*	8,524	*39.7*	2,743	*31.1*	49,787	*33.8*
≥ 85	22,690	*20.9*	2,497	*29.6*	9,908	*46.2*	642	*7.3*	35,737	*24.2*
Female	**127,181**		**21,709**		**61,284**		**13,580**		**223,754**	
Mean age	69		74		83		72		73	
Standard deviation	11		10		7		11		12	
<45	3,295	*2.6*	119	*0.5*	92	*0.2*	233	*1.7*	3,739	*1.7*
45 - 54	5,565	*4.4*	3,188	*14.7*	212	*0.3*	699	*5.1*	9,664	*4.3*
55 - 64	9,550	*7.5*	675	*3.1*	693	*1.1*	1,824	*13.4*	12,742	*5.7*
65 - 74	23,877	*18.8*	2,807	*12.9*	4,363	*7.1*	4,010	*29.5*	35,057	*15.7*
75 - 84	44,970	*35.4*	7,289	*33.6*	25,484	*41.6*	5,253	*38.7*	82,996	*37.1*
≥ 85	39,924	*31.4*	7,631	*35.2*	30,440	*49.7*	1,561	*11.5*	79,556	*35.6*

(*) 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. 2007-2022

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Side	**235,907**		**30,134**		**82,734**		**22,407**		**371,182**	
Right	127,128	*53.9*	15,178	*50.4*	41,436	*50.1*	11,688	*52.2*	195,430	*52.7*
Left	103,764	*44.0*	14,874	*49.4*	41,101	*49.7*	10,617	*47.4*	170,356	*45.9*
Bilateral	5,015	*2.1*	82	*0.3*	197	*0.2*	102	*0.5*	5,396	*1.5*
Surgical approach	**235,907**		**30,134**		**82,734**		**22,407**		**371,182**	
Anterior	34,455	*14.6*	1,515	*5.0*	3,587	*4.3*	1,109	*4.9*	40,666	*11.0*
Anterolateral	22,182	*9.4*	5,184	*17.2*	15,799	*19.1*	2,142	*9.6*	45,307	*12.2*
Lateral	49,165	*20.8*	8,704	*28.9*	30,077	*36.4*	6,031	*26.9*	93,977	*25.3*
Posterolateral	125,719	*53.3*	14,433	*47.9*	32,234	*39.0*	12,733	*56.8*	185,119	*49.9*
Other	4,386	*1.9*	298	*1.0*	1,037	*1.3*	392	*1.7*	6,113	*1.6*

(*) 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. 2007-2022

	Total replacement				Partial replacement		TOTAL	
	elective		emergency					
	N	%	N	%	N	%	N	%
Indication for surgery	**235,907**		**30,134**		**82,734**		**348,775**	
Primary osteoarthritis	206,984	*87.7*	0	*0.0*	1,852	*2.2*	208,836	*59.9*
Post-traumatic osteoarthritis	4,228	*1.8*	0	*0.0*	494	*0.6*	4,722	*1.4*
Rheumatoid arthritis	988	*0.4*	0	*0.0*	5	*0.0*	993	*0.3*
Neoplasia	399	*0.2*	0	*0.0*	427	*0.5*	826	*0.2*
Aseptic necroisis of femoral head	10,452	*4.4*	0	*0.0*	186	*0.2*	10,638	*3.1*
Congenital hip dislocation or dysplasia outcomes	7,389	*3.1*	0	*0.0*	57	*0.1*	7,446	*2.1*
Perthes disease or epiphysiolysis	555	*0.2*	0	*0.0*	68	*0.1*	623	*0.2*
Fracture of neck and/or of femur	0	*0.0*	30,134	*100.0*	78,733	*95.2*	108,867	*31.2*
Septic coxitis outcomes	62	*0.0*	0	*0.0*	2	*0.0*	64	*0.0*
Pseudoarthrosis caused by neck fracture	274	*0.1*	0	*0.0*	93	*0.1*	367	*0.1*
Other	4,576	*1.9*	0	*0.0*	817	*1.0*	5,393	*1.5*
Previous surgery	**235,907**		**30,134**		**82,734**		**348,775**	
None	219,959	*93.2*	28,403	*94.3*	77,434	*93.6*	325,796	*93.4*
Osteosynthesis	3,338	*1.4*	534	*1.8*	611	*0.7*	4,483	*1.3*
Osteotomy	1,227	*0.5*	8	*0.0*	18	*0.0*	1,253	*0.4*
Arthrodesis	61	*0.0*	3	*0.0*	15	*0.0*	79	*0.0*
Other	11,322	*4.8*	1,186	*3.9*	4,656	*5.6*	17,164	*4.9*

Table 2.8. Hip. Number of revisions by indication for surgery and type of previous surgery. 2007-2022

	Revision (*)	
	N	%
Indication for surgery	**22.407**	
Pain	1,271	*5.7*
Lysis	630	*2.8*
Wear	1,740	*7.8*
Implant breaking	613	*2.7*
Prosthesis dislocation	3,063	*13.7*
Periprosthetic fracture	2,510	*11.2*
Infection	1,728	*7.7*
Previous prosthesis removal outcomes	403	*1.8*
Aseptic loosening, cup	4,759	*21.2*
Aseptic loosening, stem	2,439	*10.9*
Aseptic loosening, total	1,906	*8.5*
Disease progression	18	*0.1*
High concentration of metal ions	6	*0.0*
Spacer breaking	6	*0.0*
Other	1,315	*5.9*
Previous surgery	**22.407**	
Total hip replacement	17,729	*79.1*
Revision of hip replacement	1,313	*5.9*
Spacer implant or prosthesis removal (**)	1,449	*6.5*
Partial hip replacement	1,434	*6.4*
Other	482	*2.2*

(*) 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. 2007-2022

	N	%
Procedure type	**227,495**	
Primary	**214,486**	***94.3***
Total replacement	167,025	*77.9*
- elective	145,946	*87.4*
- emergency	21,079	*12.6*
Partial replacement	47,461	*22.1*
Revision	**13,009**	***5.7***
Partial revision (*)	9,299	*71.5*
Total revision	1,779	*13.7*
Removal of prosthesis (**)	1,931	*14.8*

(*) 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. 2007-2022

	Total replacement				Partial replacement		Revision (*)		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Fixation	**145,946**		**21,079**		**47,461**		**13,009**		**227,495**	
Cemented (stem + cup)	6,207	*4.3*	1,141	*5.4*	0	*0.0*	478	*3.7*	7,826	*3.4*
Reverse hybrid (uncemented stem and cemented cup)	1,255	*0.9*	821	*3.9*	0	*0.0*	692	*5.3*	2,768	*1.2*
Only cemented cup	0	*0.0*	0	*0.0*	0	*0.0*	444	*3.4*	444	*0.2*
Hybrid (cemented stem and uncementled cup)	4,887	*3.3*	1,275	*6.0*	0	*0.0*	349	*2.7*	6,511	*2.9*
Uncemented (stem + cup)	133,597	*91.5*	17,842	*84.6*	0	*0.0*	7,333	*56.4*	158,772	*69.8*
Only uncemented cup	0	*0.0*	0	*0.0*	0	*0.0*	1,306	*10.0*	1,306	*0.6*
Only cemented stem	0	*0.0*	0	*0.0*	19,542	*41.2*	292	*2.2*	19,834	*8.7*
Only uncemented stem	0	*0.0*	0	*0.0*	27,919	*58.8*	1,226	*9.4*	29,145	*12.8*
Fixation declared "not applicable" for cup and stem	0	*0.0*	0	*0.0*	0	*0.0*	889	*6.8*	889	*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. 2007-2022

	Total replacement				TOTAL	
	elective		emergency			
	N	%	N	%	N	%
Bearing type (head/insert)	**145,946**		**21,079**		**167,025**	
Ceramics-Ceramics	24,311	*16.7*	1,541	*7.3*	25,852	*15.5*
Ceramics-Metal	1,164	*0.8*	279	*1.3*	1,443	*0.9*
Ceramics-Polyethylene	83,941	*57.5*	10,764	*51.1*	94,705	*56.7*
Metal-Ceramics	240	*0.2*	28	*0.1*	268	*0.2*
Metal-Metal	892	*0.6*	303	*1.4*	1,195	*0.7*
Metal-Polyethylene	11,056	*7.6*	3,661	*17.4*	14,717	*8.8*
Procedures not rinclude the registration of both head and insert implantation	24,342	*16.7*	4,503	*21.4*	28,845	*17.3*

Table 2.12. Hip. Number of revision by bearing type. 2007-2022

	Revision (*)	
	N	%
Bearing type (head/insert)	**13,009**	
Ceramics-Ceramics	468	*3.6*
Ceramics-Metal	195	*1.5*
Ceramics-Polyethylene	4,174	*32.1*
Metal-Ceramics	15	*0.1*
Metal-Metal	193	*1.5*
Metal-Polyethylene	2,055	*15.8*
Procedures not rinclude the registration of both head and insert implantation	5,909	*45.4*

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

Table 2.13. Hip. Number of total replacements by stem type and by procedure type. 2007-2022

	Total replacement				TOTAL	
	elective		emergency			
	N	%	N	%	N	%
Stem type	**145,946**		**21,079**		**167,025**	
Uncemented	**122,419**	***83.9***	**17,083**	***81.0***	**139,502**	***83.5***
Modular	**6,189**	***5.1***	**2,053**	***12.0***	**8,242**	***5.9***
Non-modular	**96,079**	***78.5***	**13,492**	***79.0***	**109,571**	***78.5***
Straight	87,658	*91.2*	12,870	*95.4*	100,528	*91.7*
Anatomical	8,421	*8.8*	622	*4.6*	9,043	*8.3*
Conservative	**18,449**	***15.1***	**546**	***3.2***	**18,995**	***13.6***
Revision	**1,702**	***1.4***	**992**	***5.8***	**2,694**	***1.9***
Cemented	**7,428**	***5.1***	**2,451**	***11.6***	**9,879**	***5.9***
Modular	**326**	***4.4***	**121**	***4.9***	**447**	***4.5***
Non-modular	**6,850**	***92.2***	**2,287**	***93.3***	**9,137**	***92.5***
Straight	6,408	*93.5*	2,146	*93.8*	8,554	*93.6*
Anatomical	442	*6.5*	141	*6.2*	583	*6.4*
Conservative	**188**	***2.5***	**20**	***0.8***	**208**	***2.1***
Revision	**64**	***0.9***	**23**	***0.9***	**87**	***0.9***
Other stem type / Stem type not reported	**16,099**	***11.0***	**1,545**	***7.3***	**17,644**	***10.6***

Table 2.14. Knee. Number of procedures included in procedure analysis and *completeness* by procedure type. 2007-2022 and 2022

	N	%	*Completeness (*)*	
			2007-2022	*2022*
			(1)	*(2)*
Procedure type	**239,412**		***20.5***	***13.9***
Primary	**229,000**	***95.7***	***21.1***	***14.2***
- total	178,143	*77.8*		
- unicompartmental	50,857	*22.2*		
Revision	**10,412**	***4.3***	***13.1***	***9.1***
Partial revision	2,404	*23.1*		
Total revision	7,466	*71.7*		
Prosthesis removal, spacer replacement (**)	404	*3.9*		
Primary patella implant on existing prosthesis	138	*1.3*		

(*) *Completeness* (expressed in %): 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. 2007-2022

	Primary				Revision (*)		TOTAL	
	total		monocompartimental					
	N	%	N	%	N	%	N	%
Hospital type	**178,143**		**50,857**		**10,412**		**239,412**	
Public hospitals	52,388	*29.4*	11,572	*22.8*	2,689	*25.8*	66,649	*27.9*
Private hospitals, accredited	125,346	*70.3*	39,176	*77.0*	7,703	*74.0*	172,225	*72.0*
Private hospitals, non-accredited	409	*0.2*	109	*0.2*	20	*0.2*	538	*0.2*

(*) Total or partial revision, primary implantation of the patella only on an already implanted 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. 2007-2022

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Gender	**178.143**		**50.857**		**10.412**		**239.412**	
Male	56,479	*31.7*	17,106	*33.6*	3,278	*31.5*	76,863	*32.1*
Female	121,664	*68.3*	33,751	*66.4*	7,134	*68.5*	162,549	*67.9*
Age group by gender								
Male	**56,479**		**17,106**		**3,278**		**76,863**	
Mean age	69		67		69		69	
Standard deviation	9		9		10		9	
<45	538	*1.0*	235	*1.4*	47	*1.4*	820	*1.1*
45 - 54	2,820	*5.0*	1,280	*7.5*	264	*8.1*	4,364	*5.7*
55 - 64	11,024	*19.5*	4,020	*23.5*	660	*20.1*	15,704	*20.4*
65 - 74	24,221	*42.9*	7,194	*42.1*	1,204	*36.7*	32,619	*42.4*
75 - 84	16,902	*29.9*	4,119	*24.1*	1,005	*30.7*	22,026	*28.7*
≥85	974	*1.7*	258	*1.5*	98	*3.0*	1,330	*1.7*
Female	**121,664**		**33,751**		**7,134**		**162,549**	
Mean age	71		69		71		70	
Standard deviation	8		9		9		8	
<45	429	*0.4*	217	*0.6*	36	*0.5*	682	*0.4*
45 - 54	3,515	*2.9*	1,787	*5.3*	295	*4.1*	5,597	*3.4*
55 - 64	19,450	*16.0*	6,625	*19.6*	1,179	*16.5*	27,254	*16.8*
65 - 74	54,332	*44.7*	14,505	*43.0*	2,907	*40.7*	71,744	*44.1*
75 - 84	41,455	*34.1*	10,067	*29.8*	2,463	*34.5*	53,985	*33.2*
≥85	2,483	*2.0*	550	*1.6*	254	*3.6*	3,287	*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. 2007-2022

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Side	**178,143**		**50,857**		**10,412**		**239,412**	
Right	94,489	*53.0*	26,449	*52.0*	5,548	*53.3*	126,486	*52.8*
Left	81,570	*45.8*	22,993	*45.2*	4,823	*46.3*	109,386	*45.7*
Bilateral	2,084	*1.2*	1,415	*2.8*	41	*0.4*	3,540	*1.5*
Surgical approach	**178,143**		**50,857**		**10,412**		**239,412**	
Medial parapatellar	154,033	*86.5*	39,189	*77.1*	8,920	*85.7*	202,142	*84.4*
Lateral parapatellar	3,949	*2.2*	2,144	*4.2*	226	*2.2*	6,319	*2.6*
Mid-vastus	9,827	*5.5*	3,466	*6.8*	642	*6.2*	13,935	*5.8*
Minimally invasive mid-vastus	4,349	*2.4*	3,822	*7.5*	235	*2.3*	8,406	*3.5*
Quad-sparing	372	*0.2*	623	*1.2*	8	*0.1*	1,003	*0.4*
Sub-vastus	1,858	*1.0*	395	*0.8*	56	*0.5*	2,309	*1.0*
Minimally invasive sub-vastus	534	*0.3*	325	*0.6*	42	*0.4*	901	*0.4*
V Quadriceps	26	*0.0*	13	*0.0*	24	*0.2*	63	*0.0*
Tibial tuberosity osteotomy	185	*0.1*	27	*0.1*	45	*0.4*	257	*0.1*
Other	3,010	*1.7*	853	*1.7*	214	*2.1*	4,077	*1.7*

(*) 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. 2007-2022

	Primary				TOTAL	
	total		unicompartmental			
	N	%	N	%	N	%
Indication for surgery	**178,143**		**50,857**		**229,000**	
Primary osteoarthritis	169,176	*95.0*	47,157	*92.7*	216,333	*94.5*
Post-traumatic osteoarthritis	2,806	*1.6*	665	*1.3*	3,471	*1.5*
Rheumatoid arthritis	1,215	*0.7*	183	*0.4*	1,398	*0.6*
Neoplasia	110	*0.1*	33	*0.1*	143	*0.1*
Osteonecrosis	998	*0.6*	1,099	*2.2*	2,097	*0.9*
Other	3,838	*2.2*	1,720	*3.4*	5,558	*2.4*
Previous surgery	**178,143**		**50,857**		**229,000**	
None	162,495	*91.2*	45,016	*88.5*	207,511	*90.6*
Arthrodesis	107	*0.1*	10	*0.0*	117	*0.1*
Osteotomy	1,522	*0.9*	257	*0.5*	1,779	*0.8*
Arthroscopy	2,919	*1.6*	1,485	*2.9*	4,404	*1.9*
Osteosynthesis	666	*0.4*	224	*0.4*	890	*0.4*
Other	10,434	*5.9*	3,865	*7.6*	14,299	*6.2*

Table 2.19. Knee. Number of revision by indication for surgery and type of previous surgery. 2007-2022

	Revision (*)	
	N	%
Indication for surgery	**10.412**	
Aseptic loosening of several components	2,502	*24.0*
Aseptic loosening of femur	418	*4.0*
Aseptic loosening of tibia	1,019	*9.8*
Aseptic loosening of patella	31	*0.3*
Implant removal outcomes	37	*0.4*
Wear	267	*2.6*
Dislocation	194	*1.9*
Instability	480	*4.6*
Periprosthetic fracture	168	*1.6*
Implant breaking	122	*1.2*
Spacer breaking	13	*0.1*
Infection	1,968	*18.9*
Stiffness	198	*1.9*
Disease progression	174	*1.7*
Pain	1,847	*17.7*
Other	974	*9.4*
Previous surgery	**10.412**	
Primary total	6,061	*58.2*
Primary unicompartmental	1,572	*15.1*
Primary unspecified	386	*3.7*
Revision of knee replacement	712	*6.8*
Spacer	1,119	*10.7*
Other	562	*5.4*

(*) 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. 2007-2022

	N	%
Procedure type	**160,855**	
Primary	**152,283**	***94.7***
- total	123,925	*81.4*
- unicompartmental	28,358	*18.6*
Revision	**8,572**	***5.3***
Partial revision	2,019	*23.6*
Total revision	6,143	*71.7*
Removal, spacer replacement (*)	292	*3.4*
Primary patella implant on existing prosthesis	118	*1.4*

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

Table 2.21. Knee. Number of procedures by fixation and by procedure type. 2007-2022

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Fixation	**123,925**		**28,358**		**8,572**		**160,855**	
Patella not implanted	**111,143**	***89.7***	**26,549**	***93.6***	**3,399**	***39.7***	**141,091**	***87.7***
Cemented (femoral and tibial components)	83,525	*75.2*	19,206	*72.3*	2,454	*72.2*	105,185	*74.6*
Cemented femoral component and uncemented tibial component	1,966	*1.8*	777	*2.9*	107	*3.1*	2,850	*2.0*
Only cemented femoral component	0	*0.0*	0	*0.0*	101	*3.0*	101	*0.1*
Uncemented femoral component and cemented tibial component	3,538	*3.2*	1,040	*3.9*	111	*3.3*	4,689	*3.3*
Uncemented	22,114	*19.9*	5,524	*20.8*	70	*2.1*	27,708	*19.6*
Only uncemented femoral component	0	*0.0*	0	*0.0*	6	*0.2*	6	*0.0*
Only cemented tibial component	0	*0.0*	2	*0.0*	168	*4.9*	170	*0.1*
Only uncemented tibial component	0	*0.0*	0	*0.0*	60	*1.8*	60	*0.0*
Fixaction declared "not applicable" for both femoral and tibial components	0	*0.0*	0	*0.0*	322	*9.5*	322	*0.2*
Patella implanted (cemented)	**10,030**	***8.1***	**762**	***2.7***	**3,469**	***40.5***	**14,261**	***8.9***
Cemented (femoral and tibial components)	9,636	*96.1*	700	*91.9*	1,541	*44.4*	11,877	*83.3*
Cemented femoral component and uncemented tibial component	73	*0.7*	49	*6.4*	126	*3.6*	248	*1.7*
Only cemented femoral component	0	*0.0*	1	*0.1*	0	*0.0*	1	*0.0*
Uncemented femoral component and cemented tibial component	183	*1.8*	3	*0.4*	254	*7.3*	440	*3.1*
Uncemented	138	*1.4*	9	*1.2*	1,540	*44.4*	1,687	*11.8*
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	*0.0*

(continued)

Table 2.21. (continued)

	Primary				Revision (*)		TOTAL	
	total		unicompartmental					
	N	%	N	%	N	%	N	%
Patella implanted (uncemented)	**2,752**	***2.2***	**1,047**	***3.7***	**1,704**	***19.9***	**5,503**	***3.4***
Cemented (femoral and tibial components)	1,419	*51.6*	763	*72.9*	1,127	*66.1*	3,309	*60.1*
Cemented femoral component and uncemented tibial component	36	*1.3*	19	*1.8*	19	*1.1*	74	*1.3*
Only cemented femoral component	0	*0.0*	0	*0.0*	3	*0.2*	3	*0.1*
Uncemented femoral component and cemented tibial component	136	*4.9*	26	*2.5*	59	*3.5*	221	*4.0*
Uncemented	1,161	*42.2*	239	*22.8*	237	*13.9*	1,637	*29.7*
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*	21	*1.2*	21	*0.4*
Only uncemented tibial component	0	*0.0*	0	*0.0*	2	*0.1*	2	*0.0*
Only patella	0	*0.0*	0	*0.0*	236	*13.8*	236	*4.3*

(*) 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. 2007-2022

	N	%
Type of tibial tray	**152,283**	
Mobile bearing	**32,460**	***21.3***
Cemented	23,052	*71.0*
Uncemented	7,156	*22.0*
Cementable	2,252	*6.9*
Fixed	**73,057**	***48.0***
Cemented	69,510	*95.1*
Uncemented	2,881	*3.9*
Cementable	666	*0.9*
Missing	**46,766**	***30.7***

Table 2.23. Shoulder. Number of procedures included in procedure analysis and *completeness* by procedure type. 2017-2022 and 2022

	N	%	*Completeness (*)*	
			2017-2022	*2022*
			(1)	*(2)*
Procedure type	**7,806**		***12.3***	***17.0***
Primary	**7,656**	***98.1***	***na (***)***	***na (***)***
Total replacement	6,350	*82.9*		
- elective	4,236	*66.7*		
- emergency	2,114	*33.3*		
Partial replacement	434	*5.7*		
Not specified	872	*11.4*		
Revision (**)	**150**	***1.9***	***na (***)***	***na (***)***

(*) *Completeness* (expressed in %): 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. 2017-2022

	N	%
Type of prosthesis implanted in the total replacement	**6,350**	
Elective	**4,236**	***66.7***
- anatomical	246	*5.8*
- resurfacing	38	*0.9*
- reverse	3,686	*87.0*
- interposition	266	*6.3*
Emergency	**2,114**	***33.3***
- anatomical	72	*3.4*
- resurfacing	0	*0.0*
- reverse	2,042	*96.6*
- interposition	0	*0.0*

Tabella 2.25. Shoulder. Number of procedures by hospital type and by procedure type. 2017-2022

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Hospital type	**4,236**		**2,114**		**434**		**872**		**150**		**7,806**	
Public hospitals	526	*12.4*	1,336	*63.1*	133	*30.7*	395	*45.3*	46	*30.7*	2,436	*31.2*
Private hospitals, accredited	3,707	*87.5*	778	*36.8*	301	*69.4*	477	*54.7*	104	*69.3*	5,367	*68.7*
Private hospitals, non-accredited	3	*0.1*	0	*0*	0	*0*	0	*0*	0	*0*	3	*0*

(*) 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. 2017-2022

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Gender	**4,236**		**2,114**		**434**		**872**		**150**		**7,806**	
Male	1,283	*30.3*	348	*16.5*	204	*47.0*	197	*22.6*	54	*36.0*	2,086	*26.7*
Female	2,953	*69.7*	1,766	*83.5*	230	*53.0*	675	*77.4*	96	*64.0*	5,720	*73.3*
Age group by gender												
Male	**1,283**		**348**		**204**		**197**		**54**		**2,086**	
Mean age	67		69		59		70		62		67	
Standard deviation	9		11		12		9		13		10	
<45	17	*1.3*	5	*1.4*	20	*9.8*	1	*0.5*	4	*7.4*	47	*2.3*
45 - 54	96	*7.5*	25	*7.2*	35	*17.2*	9	*4.6*	12	*22.2*	177	*8.5*
55 - 64	295	*23.0*	62	*17.8*	81	*39.7*	36	*18.3*	12	*22.2*	486	*23.3*
65 - 74	577	*45.0*	122	*35.1*	54	*26.5*	92	*46.7*	15	*27.8*	860	*41.2*
75 - 84	288	*22.4*	118	*33.9*	9	*4.4*	52	*26.4*	10	*18.5*	477	*22.9*
≥85	10	*0.8*	16	*4.6*	5	*2.5*	7	*3.6*	1	*1.9*	39	*1.9*
Female	**2,953**		**1,766**		**230**		**675**		**96**		**5,720**	
Mean age	71		73		68		73		71		72	
Standard deviation	7		8		10		7		8		8	
<45	5	*0.2*	0	*0.0*	3	*1.3*	2	*0.3*	0	*0.0*	10	*0.2*
45 - 54	44	*1.5*	18	*1.0*	12	*5.2*	4	*0.6*	1	*1.0*	79	*1.4*
55 - 64	388	*13.1*	184	*10.4*	61	*26.5*	50	*7.4*	20	*20.8*	703	*12.3*
65 - 74	1,399	*47.4*	692	*39.2*	89	*38.7*	278	*41.2*	33	*34.4*	2,491	*43.5*
75 - 84	1,061	*35.9*	737	*41.7*	53	*23.0*	309	*45.8*	39	*40.6*	2,199	*38.4*
≥85	56	*1.9*	135	*7.6*	12	*5.2*	32	*4.7*	3	*3.1*	238	*4.2*

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

Table 2.27. Shoulder. Number of procedures by side and surgical approach and by procedure type. 2017-2022

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Side	**4,236**		**2,114**		**434**		**872**		**150**		**7,806**	
Right	2,790	*65.9*	1,178	*55.7*	269	*62.0*	561	*64.3*	96	*64.0*	4,894	*62.7*
Left	1,446	*34.1*	935	*44.2*	165	*38.0*	311	*35.7*	54	*36.0*	2,911	*37.3*
Bilateral	0	*0.0*	1	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	1	*0.0*
Surgical approach	**4,236**		**2,114**		**434**		**872**		**150**		**7,806**	
Deltopectoral	3,256	*76.9*	1,858	*87.9*	224	*51.6*	726	*83.3*	134	*89.3*	6,198	*79.4*
Trans-deltoid	409	*9.7*	42	*2.0*	108	*24.9*	34	*3.9*	2	*1.3*	595	*7.6*
Missing	470	*11.1*	207	*9.8*	4	*0.9*	89	*10.2*	9	*6.0*	779	*10.0*
Other	101	*2.4*	7	*0.3*	98	*22.6*	23	*2.6*	5	*3.3*	234	*3.0*

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

Table 2.28. Shoulder. Number of primary procedures by indication for surgery and type of previous surgery and by procedure type. 2017-2022

	Total replacement				Partial replacement		Not specified		TOTAL	
	elective		emergency							
	N	%	N	%	N	%	N	%	N	%
Indication for surgery	**4,236**		**2,114**		**434**		**872**		**7,656**	
Eccentric osteoarthritis (*)	2,597	*61.3*	0	*0.0*	29	*6.7*	357	*40.9*	2,983	*39.0*
Concentric osteoarthritis	651	*15.4*	0	*0.0*	69	*15.9*	44	*5.0*	764	*10.0*
Rheumatoid arthritis	27	*0.6*	0	*0.0*	1	*0.2*	10	*1.1*	38	*0.5*
Neoplasia	2	*0.0*	0	*0.0*	1	*0.2*	0	*0.0*	3	*0.0*
Osteonecrosis	52	*1.2*	0	*0.0*	7	*1.6*	18	*2.1*	77	*1.0*
Fracture	0	*0.0*	2,114	*100.0*	118	*27.2*	334	*38.3*	2,566	*33.5*
Massive cuff tear in absence of osteoarthritis	175	*4.1*	0	*0.0*	163	*37.6*	0	*0.0*	338	*4.4*
Previous fracture outcomes	146	*3.4*	0	*0.0*	10	*2.3*	0	*0.0*	156	*2.0*
Dislocation	17	*0.4*	0	*0.0*	8	*1.8*	0	*0.0*	25	*0.3*
Other	569	*13.4*	0	*0.0*	28	*6.5*	109	*12.5*	706	*9.2*
Previous surgery	**4,236**		**2,114**		**434**		**872**		**7,656**	
None	4,026	*95.0*	2,091	*98.9*	423	*97.5*	872	*100.0*	7,412	*96.8*
Osteosynthesis	59	*1.4*	5	*0.2*	4	*0.9*	0	*0.0*	68	*0.9*
Arthrotomy	17	*0.4*	0	*0.0*	1	*0.2*	0	*0.0*	18	*0.2*
Arthrodesis	2	*0.0*	0	*0.0*	2	*0.5*	0	*0.0*	4	*0.1*
Arthroscopy	98	*2.3*	5	*0.2*	0	*0.0*	0	*0.0*	103	*1.3*
Other	34	*0.8*	13	*0.6*	4	*0.9*	0	*0.0*	51	*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. 2017-2022

	Revision (*)	
	N	%
Indication for surgery	**150**	
Instability	23	*15.3*
Glenoid erosion	7	*4.7*
Periprosthetic fracture	11	*7.3*
Infection	29	*19.3*
Implant removal outcomes	3	*2.0*
Aseptic mobilisation	46	*30.7*
Periprothesic fracture	6	*4.0*
Pain	6	*4.0*
Implant breaking	1	*0.7*
Other	18	*12.0*
Previous surgery	**150**	
Primary (**)	112	*74.7*
Shoulder replacement revision (***)	30	*20.0*
Other	8	*5.3*

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

(**) Partial primary intervention: anatomic, resurfacing, implanted prothesis 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. 2017-2022

	N	%
Procedure type	**4,729**	
Primary	**4,609**	***97.5***
Total replacement	3,682	*79.9*
- elective	2,538	*68.9*
- emergency	1,144	*31.1*
Partial replacement	55	*1.2*
Non specificato	872	*18.9*
Revision (*)	**120**	***2.5***

(*) 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. 2017-2022

	Total replacement				Partial replacement		Not specified		Revision (*)		TOTAL	
	elective		emergency									
	N	%	N	%	N	%	N	%	N	%	N	%
Fixation	**2,538**		**1,089**		**55**		**872**		**120**		**4,674**	
Cemented (glenoid + stem)	53	*2.1*	64	*5.9*	0	*0.0*	0	*0.0*	3	*2.5*	120	*2.6*
Reverse hybrid (cemented glenoid and uncemented stem)	149	*5.9*	253	*23.2*	0	*0.0*	0	*0.0*	7	*5.8*	409	*8.8*
Hybrid (uncemented glenoid and cemented stem)	33	*1.3*	8	*0.7*	0	*0.0*	0	*0.0*	0	*0.0*	41	*0.9*
Uncemented (glenoid + stem)	2,303	*90.7*	764	*70.2*	0	*0.0*	0	*0.0*	40	*33.3*	3,107	*66.5*
Only cemented glenoid	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	4	*3.3*	4	*0.1*
Only uncemented glenoid	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	14	*11.7*	14	*0.3*
Only cemented stem	0	*0.0*	0	*0.0*	28	*50.9*	0	*0.0*	1	*0.8*	29	*0.6*
Only stem uncemented	0	*0.0*	0	*0.0*	27	*49.1*	0	*0.0*	10	*8.3*	37	*0.8*
Not applicable	0	*0.0*	0	*0.0*	0	*0.0*	872	*100.0*	41	*34.2*	913	*19.5*

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

Figura 2.1. Flowchart of the operational procedure for the collection and submission of data on joint replacements by a RIAP participating institution

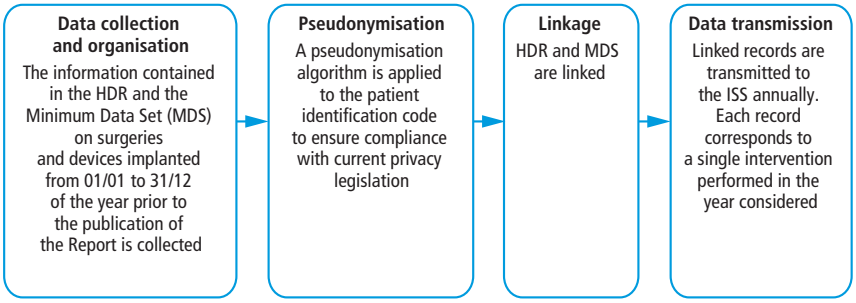


Figure 2.2a.Flowchart of the RIAP data quality audit. Procedure analysis. 2007-2022

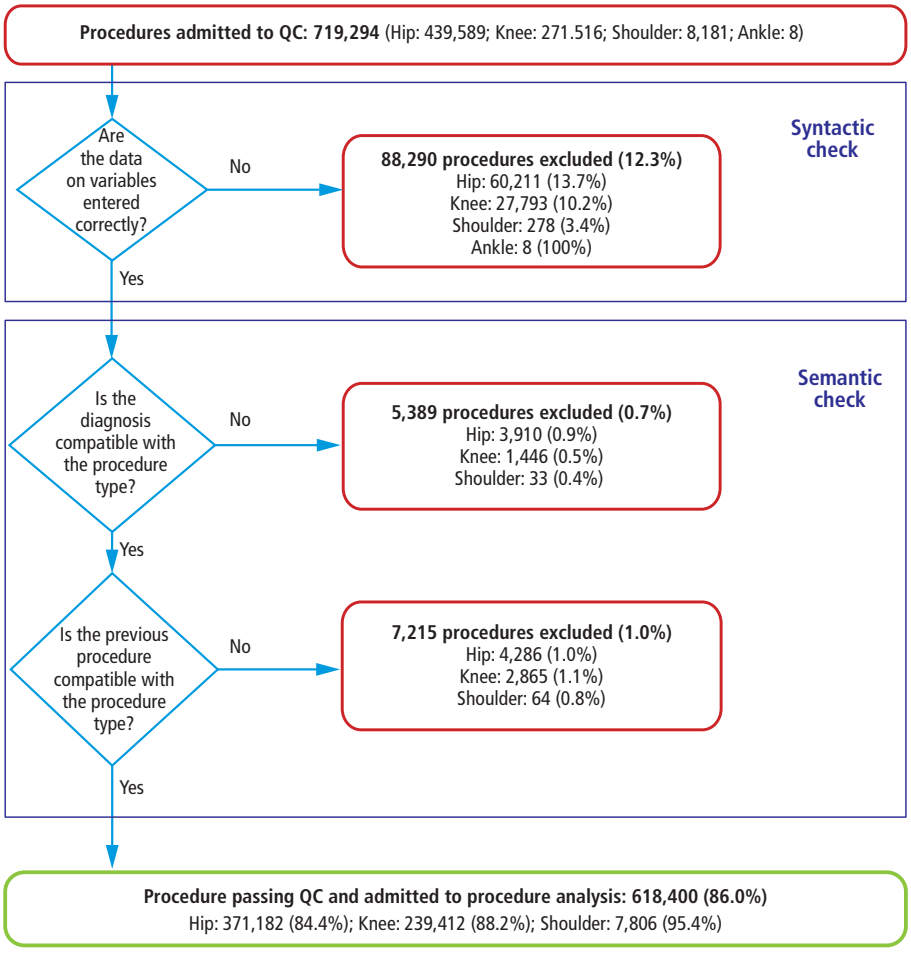


Figure 2.2b. Flowchart of the RIAP data quality audit. Device analysis. 2007-2022

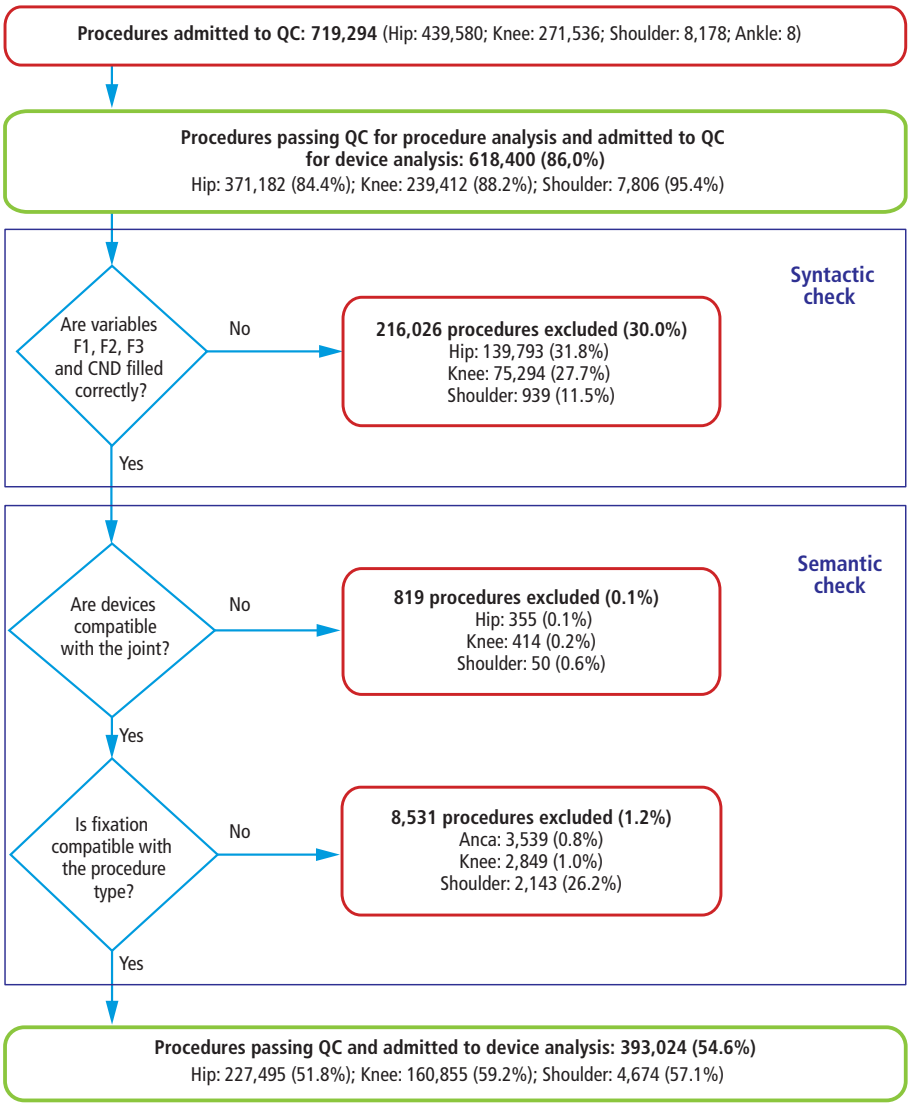


Figure 2.3. Hip. Types of bearing. Total replacement (elective procedures). 2007-2022

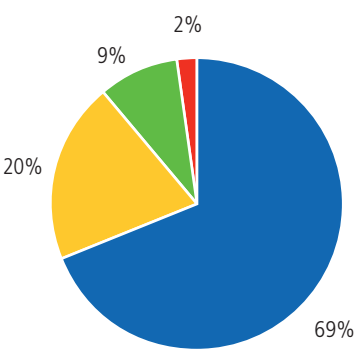
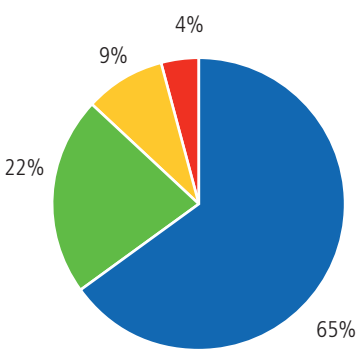


Chart Legend:
CoP = Ceramics/Polyethylene, CoC = Ceramic/Ceramic,
MoP = Metal/Polyethylene, MoM = Metal/Metal,
CoM = Ceramic/Metal, MoC = Metal/Ceramic

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). 2007-2022



CoP
MoP
CoC
Other (CoM, MoM, MoC)

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

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 in Italy. From 2001 to 2022

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
	Total hip replacement (elective)	*40.060*	*44.505*	*47.908*	*50.684*	*51.769*	*52.186*	*53.157*
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 femural 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
	Total shoulder replacement (elective)	*417*	*644*	*1.085*	*1.629*	*2.092*	*2.382*	*2.815*
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

All procedures registered in HDR either in the "principal" or in the "secondary" fields

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	% (°)
98,585	**100,844**	**102,652**	**105,803**	**108,906**	**112,375**	**113,511**	**117,910**	**98,507**	**117,304**	**127,384**	***2.6***
64,503	66,257	68,190	71,178	74,660	77,787	79,288	83,157	66,939	84,142	93,092	*3.3*
54.852	*56.598*	*58.491*	*60.656*	*64.102*	*66.917*	*68.525*	*71.625*	*55.869*	*72.081*	*80.451*	*3.4*
25,346	25,979	26,141	26,222	25,879	26,101	25,646	25,876	24,292	24,786	25,465	*0.8*
96	99	45	107	147	65	251	229	256	319	284	*-0.2*
8,640	8,509	8,276	8,296	8,220	8,422	8,326	8,648	7,020	8,057	8,543	*1.6*
66,007	**67,634**	**70,313**	**73,191**	**78,779**	**81,271**	**84,582**	**89,210**	**67,826**	**81,992**	**99,222**	***6.1***
61,541	62,910	65,614	68,091	73,394	75,668	78,423	82,815	62,606	76,018	92,526	*6.0*
4,466	4,724	4,699	5,100	5,385	5,603	6,159	6,395	5,220	5,974	6,696	*8.1*
5,143	**5,795**	**6,511**	**7,145**	**8,053**	**9,101**	**10,125**	**10,989**	**9,195**	**11,366**	**12,774**	***10.5***
3,830	4,441	5,309	5,970	6,892	7,862	8,840	9,767	8,184	10,068	11,541	*14.2*
3.042	*3.479*	*4.085*	*4.474*	*5.225*	*5.921*	*6.712*	*7.347*	*5.758*	*7.154*	*8.480*	*15.4*
1,313	1,354	1,202	1,175	1,161	1,239	1,285	1,222	1,011	1,298	1,233	*1.8*
313	**330**	**387**	**482**	**546**	**600**	**653**	**767**	**593**	**820**	**995**	***11.8***
313	330	387	482	546	600	653	767	593	820	995	*11.8*
1,291	**1,300**	**1,358**	**1,479**	**1,444**	**1,489**	**1,573**	**1,568**	**1,283**	**1,500**	**1,670**	***4.0***
443	440	453	530	481	468	493	415	234	306	341	*0.4*
83	96	103	102	74	77	79	63	42	49	66	*-5.4*
74	65	49	51	52	37	59	43	27	40	32	*-1.1*
447	473	491	523	549	608	616	682	662	682	788	*10.9*
244	226	262	273	288	299	326	365	318	423	443	*8.8*
171,339	**175,903**	**181,221**	**188,100**	**197,728**	**204,836**	**210,444**	**220,444**	**177,404**	**212,982**	**242,045**	***4.0***

Table 2. Hip. Number of procedures by region of admission and by procedure type. 2021 and 2022

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2021		2022		2021		2022	
	N	%	N	%	N	%	N	%
Piedmont	7,196	9.9	7,856	9.7	1,193	9.9	1,128	8.9
Aosta Valley	185	0.3	206	0.3	25	0.2	24	0.2
Lombardy	15,716	21.7	18,370	22.8	1,503	12.4	1,702	13.5
AP Bolzano	1,114	1.5	1,134	1.4	82	0.7	112	0.9
AP Trento	1,167	1.6	1,384	1.7	84	0.7	99	0.8
Veneto	6,901	9.5	7,321	9.1	867	7.2	928	7.3
Friuli Venezia Giulia	1,670	2.3	1,799	2.2	256	2.1	262	2.1
Liguria	738	1.0	715	0.9	612	5.1	627	5.0
Emilia-Romagna	8,884	12.3	10,357	12.8	879	7.3	1,022	8.1
Tuscany	5,765	8.0	6,102	7.6	935	7.7	935	7.4
Umbria	771	1.1	843	1.0	140	1.2	127	1.0
Marche	1,430	2.0	1,741	2.2	504	4.2	544	4.3
Lazio	6,191	8.6	6,760	8.4	1,171	9.7	1,156	9.1
Abruzzi	1,540	2.1	1,749	2.2	341	2.8	385	3.0
Molise	199	0.3	207	0.3	25	0.2	37	0.3
Campania	4,164	5.8	4,365	5.4	1,286	10.6	1,281	10.1
Apulia	2,804	3.9	3,199	4.0	566	4.7	601	4.7
Basilicata	180	0.2	195	0.2	68	0.6	76	0.6
Calabria	1,092	1.5	1,256	1.6	236	2.0	250	2.0
Sicily	3,547	4.9	4,040	5.0	1,015	8.4	1,082	8.6
Sardinia	1,129	1.6	1,123	1.4	290	2.4	276	2.2
Italy	**72,383**	***100.0***	**80,722**	***100.0***	**12,078**	***100.0***	**12,654**	***100.0***
% of national volume	*61.7*		*63.4*		*10.3*		*9.9*	

All procedures registered in HDR either in the "principal" or in the "secondary" fields

Partial replacement				Revision				Total			
2021		2022		2021		2022		2021		2022	
N	%	N	%	N	%	N	%	N	%	N	%
1,699	6.9	1,868	7.3	786	9.8	802	9.4	10,874	9.3	11,654	9.1
71	0.3	83	0.3	5	0.1	10	0.1	286	0.2	323	0.3
4,705	19.0	4,777	18.8	1,765	21.9	1,971	23.1	23,689	20.2	26,820	21.1
261	1.1	273	1.1	130	1.6	103	1.2	1,587	1.4	1,622	1.3
318	1.3	314	1.2	111	1.4	110	1.3	1,680	1.4	1,907	1.5
2,271	9.2	2,374	9.3	691	8.6	712	8.3	10,730	9.1	11,335	8.9
823	3.3	749	2.9	192	2.4	168	2.0	2,941	2.5	2,978	2.3
626	2.5	616	2.4	162	2.0	168	2.0	2,138	1.8	2,126	1.7
2,326	9.4	2,401	9.4	962	11.9	1,064	12.5	13,051	11.1	14,844	11.7
1,925	7.8	1,917	7.5	702	8.7	733	8.6	9,327	8.0	9,687	7.6
510	2.1	514	2.0	96	1.2	83	1.0	1,517	1.3	1,567	1.2
424	1.7	403	1.6	195	2.4	163	1.9	2,553	2.2	2,851	2.2
2,154	8.7	2,311	9.1	609	7.6	749	8.8	10,125	8.6	10,976	8.6
558	2.3	548	2.2	130	1.6	150	1.8	2,569	2.2	2,832	2.2
117	0.5	124	0.5	14	0.2	9	0.1	355	0.3	377	0.3
1,492	6.0	1,554	6.1	587	7.3	548	6.4	7,529	6.4	7,748	6.1
1,504	6.1	1,581	6.2	269	3.3	287	3.4	5,143	4.4	5,668	4.4
250	1.0	223	0.9	24	0.3	29	0.3	522	0.4	523	0.4
644	2.6	659	2.6	96	1.2	113	1.3	2,068	1.8	2,278	1.8
1,500	6.1	1,534	6.0	442	5.5	482	5.6	6,504	5.5	7,138	5.6
608	2.5	642	2.5	89	1.1	89	1.0	2,116	1.8	2,130	1.7
24,786	***100.0***	**25,465**	***100.0***	**8,057**	***100.0***	**8,543**	***100.0***	**117,304**	***100.0***	**127,384**	***100.0***
21.1		*20.0*		*6.9*		*6.7*		*100.0*		*100.0*	

Table 3. Hip. Primary total replacement. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2021	2022	2021	2022	2021	2022
	N	N	N	N	N	N
Piedmont	14	12	12	8	12	15
Aosta Valley	0	0	1	1	1	1
Lombardy	28	21	35	37	20	23
AP Bolzano	1	3	5	4	5	6
AP Trento	1	1	3	1	3	4
Veneto	7	9	15	11	11	14
Friuli Venezia Giulia	1	0	7	7	4	5
Liguria	6	8	3	2	6	6
Emilia-Romagna	13	8	12	16	24	19
Tuscany	12	11	10	11	11	13
Umbria	5	5	6	5	2	3
Marche	3	2	6	5	5	8
Lazio	39	44	16	15	16	18
Abruzzi	8	3	7	8	1	4
Molise	4	3	0	1	1	1
Campania	40	38	16	15	10	12
Apulia	14	16	11	10	10	10
Basilicata	5	5	0	0	1	1
Calabria	13	13	6	4	2	2
Sicily	40	38	20	22	9	8
Sardinia	13	16	5	4	2	2
Italy	**267**	**256**	**196**	**187**	**156**	**175**
% of national volume	*36.7*	*34.6*	*27.0*	*25.3*	*21.5*	*23.7*

All procedures registered in HDR either in the "principal" or in the "secondary" fields

201-300		>300		Total			
2021	2022	2021	2022	2021		2022	
N	N	N	N	N	%	N	%
6	6	7	9	51	*7.0*	50	*6.8*
0	0	0	0	2	*0.3*	2	*0.3*
8	7	13	17	104	*14.3*	105	*14.2*
1	0	0	0	12	*1.7*	13	*1.8*
2	2	0	1	9	*1.2*	9	*1.2*
3	4	9	9	45	*6.2*	47	*6.4*
0	0	2	2	14	*1.9*	14	*1.9*
0	1	1	0	16	*2.2*	17	*2.3*
8	7	5	10	62	*8.5*	60	*8.1*
4	4	7	7	44	*6.1*	46	*6.2*
0	0	0	0	13	*1.8*	13	*1.8*
3	2	0	1	17	*2.3*	18	*2.4*
4	3	4	5	79	*10.9*	85	*11.5*
1	1	2	2	19	*2.6*	18	*2.4*
0	0	0	0	5	*0.7*	5	*0.7*
5	6	3	2	74	*10.2*	73	*9.9*
2	4	1	1	38	*5.2*	41	*5.5*
0	0	0	0	6	*0.8*	6	*0.8*
1	1	0	1	22	*3.0*	21	*2.8*
3	1	1	3	73	*10.0*	72	*9.7*
2	2	0	0	22	*3.0*	24	*3.2*
53	**51**	**55**	**70**	**727**	***100.0***	**739**	***100.0***
7.3	*6.9*	*7.6*	*9.5*	*100.0*		*100.0*	

Table 4. Hip. Revision. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume			
	1-10		11-25	
	2021	2022	2021	2022
	N	N	N	N
Piedmont	17	21	25	16
Aosta Valley	2	2	0	0
Lombardy	63	53	24	33
AP Bolzano	6	4	4	6
AP Trento	5	5	3	2
Veneto	23	22	13	15
Friuli Venezia Giulia	4	5	7	7
Liguria	9	8	4	4
Emilia-Romagna	28	32	17	20
Tuscany	16	21	15	10
Umbria	8	10	4	2
Marche	8	13	7	5
Lazio	55	42	8	13
Abruzzi	13	11	5	7
Molise	4	4	0	0
Campania	44	43	10	10
Apulia	26	31	9	7
Basilicata	5	5	0	1
Calabria	16	17	3	0
Sicily	49	54	6	7
Sardinia	20	19	1	2
Italy	**421**	**422**	**165**	**167**
% of national volume	*65.3*	*64.7*	*25.6*	*25.6*

All procedures registered in HDR either in the "principal" or in the "secondary" fields

26-50		>50		Total			
2021	2022	2021	2022	2021		2022	
N	N	N	N	N	%	N	%
5	8	1	1	48	*7.4*	46	*7.1*
0	0	0	0	2	*0.3*	2	*0.3*
9	7	4	7	100	*15.5*	100	*15.3*
1	0	0	0	11	*1.7*	10	*1.5*
0	1	0	0	8	*1.2*	8	*1.2*
5	7	1	0	42	*6.5*	44	*6.7*
1	1	0	0	12	*1.9*	13	*2.0*
1	1	0	0	14	*2.2*	13	*2.0*
7	4	1	2	53	*8.2*	58	*8.9*
5	6	3	3	39	*6.0*	40	*6.1*
0	0	0	0	12	*1.9*	12	*1.8*
1	0	0	0	16	*2.5*	18	*2.8*
3	5	2	3	68	*10.5*	63	*9.7*
0	0	0	0	18	*2.8*	18	*2.8*
0	0	0	0	4	*0.6*	4	*0.6*
3	2	1	2	58	*9.0*	57	*8.7*
1	0	0	0	36	*5.6*	38	*5.8*
0	0	0	0	5	*0.8*	6	*0.9*
0	1	0	0	19	*2.9*	18	*2.8*
4	2	0	0	59	*9.1*	63	*9.7*
0	0	0	0	21	*3.3*	21	*3.2*
46	**45**	**13**	**18**	**645**	***100.0***	**652**	***100.0***
7.1	*6.9*	*2.0*	*2.8*	*100.0*		*100.0*	

Table 5. Hip. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2021 and 2022

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
	%	%	%	%	%	%	%	%	%	%
Gender										
Male	47.8	48.0	29.3	28.8	28.7	28.2	38.8	40.5	41.2	41.6
Female	52.2	52.0	70.7	71.2	71.3	71.8	61.2	59.5	58.8	58.4
Age (male)										
Mean age	65.3	65.6	71.1	71.3	84.2	84.2	69.6	69.8	68.8	68.8
Standard deviation	11.7	11.5	11.9	11.9	7.9	8.3	12.9	12.8	13.1	12.9
Age group										
0-44	4.2	3.8	1.8	2.1	0.2	0.4	3.8	3.3	3.4	3.2
45-54	14.3	13.7	8.1	7.3	0.6	0.5	9.8	9.7	11.5	11.2
55-64	26.3	26.3	17.5	16.7	1.5	1.7	17.4	19.4	21.5	21.8
65-74	31.7	32.0	28.6	30.0	6.9	6.7	29.7	27.2	27.6	28.1
75-84	20.8	21.5	32.7	31.7	36.8	36.8	29.3	29.3	24.5	24.8
85+	2.7	2.7	11.4	12.2	54.0	54.0	10.0	11.2	11.4	10.9
Age (female)										
Mean age	69.9	70.0	74.0	73.9	85.0	84.9	74.8	74.5	74.7	74.5
Standard deviation	10.7	10.5	9.4	9.4	7.1	7.0	11.1	11.1	11.6	11.5
Age group										
0-44	1.9	1.6	0.3	0.3	0.1	0.1	1.1	1.3	1.2	1.1
45-54	6.7	6.5	2.6	2.7	0.3	0.3	4.4	4.1	4.4	4.4
55-64	19.2	19.1	12.6	12.6	1.0	0.9	11.5	11.7	13.2	13.3
65-74	35.2	35.6	33.7	34.2	5.1	5.0	24.5	26.5	26.5	27.3
75-84	31.6	32.0	39.1	38.7	37.0	38.3	40.7	39.4	34.5	34.8
85+	5.3	5.1	11.7	11.5	56.5	55.4	17.9	17.0	20.2	19.2

Table 6. Hip. Percent distribution of hospital discharges by discharge type and by procedure type. 2021 and 2022

Discharge type	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Revision		Total	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
	%	%	%	%	%	%	%	%	%	%
Deceased	0.1	0.1	1.2	1.0	3.5	3.5	1.4	1.6	1.0	1.0
Ordinary discharge	59.6	58.0	54.4	53.2	46.8	45.7	56.3	55.4	56.2	54.8
Discharge to a Residential Care Facility	1.0	1.3	6.2	6.8	10.4	11.6	4.3	4.7	3.8	4.1
Discharge with home health services	0.1	0.0	0.4	0.2	0.6	0.4	0.3	0.3	0.2	0.1
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	1.0	1.2	2.1	2.2	2.8	2.6	1.9	2.2	1.5	1.7
Transfer in the same hospital	21.7	22.4	8.3	8.5	7.2	6.8	16.8	16.5	16.9	17.5
Transfer to an inpatient rehabilitation facility	15.6	16.1	23.3	24.0	23.8	24.1	16.6	17.0	18.2	18.6
Discharge with integrated home care	0.7	0.7	3.7	3.7	4.5	4.9	1.9	1.9	1.9	1.9

Figure 1. Hip. Elective total replacement. Inter-regional mobility (attraction and escape indices) in 2021 (a) and in 2022 (b)

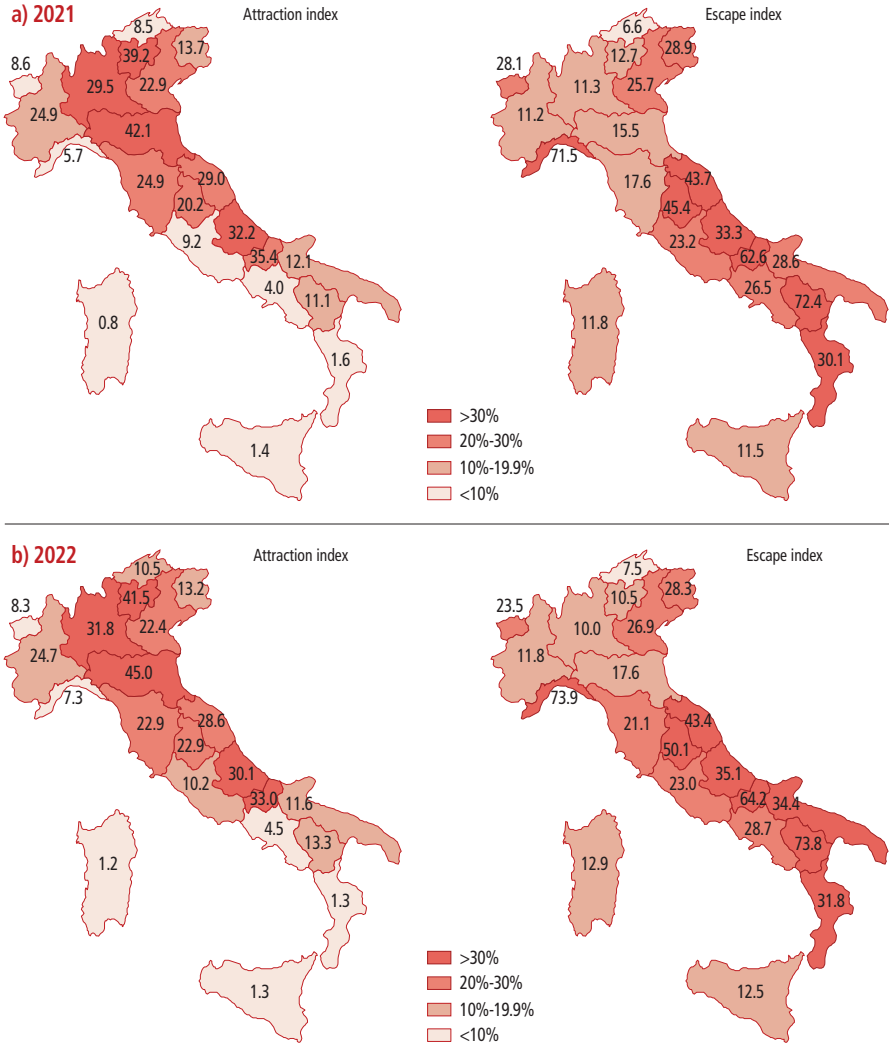
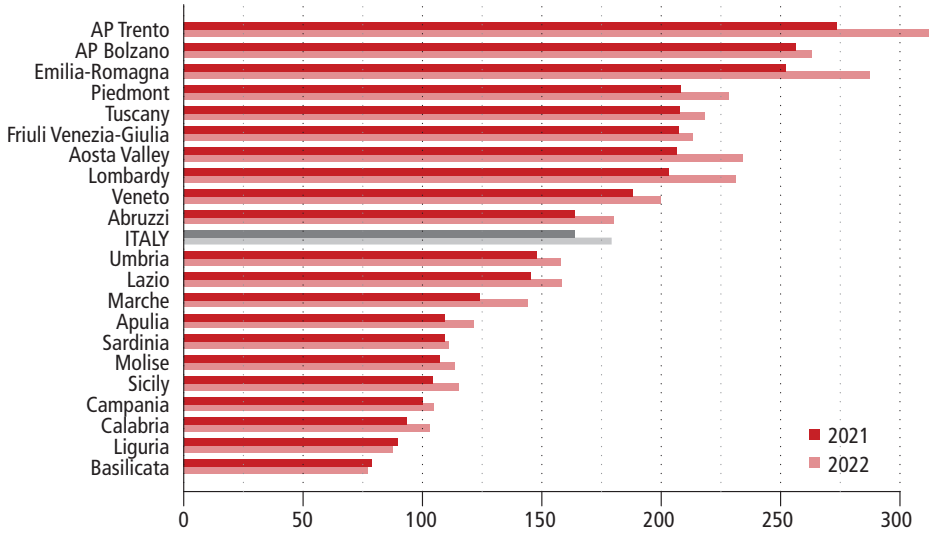
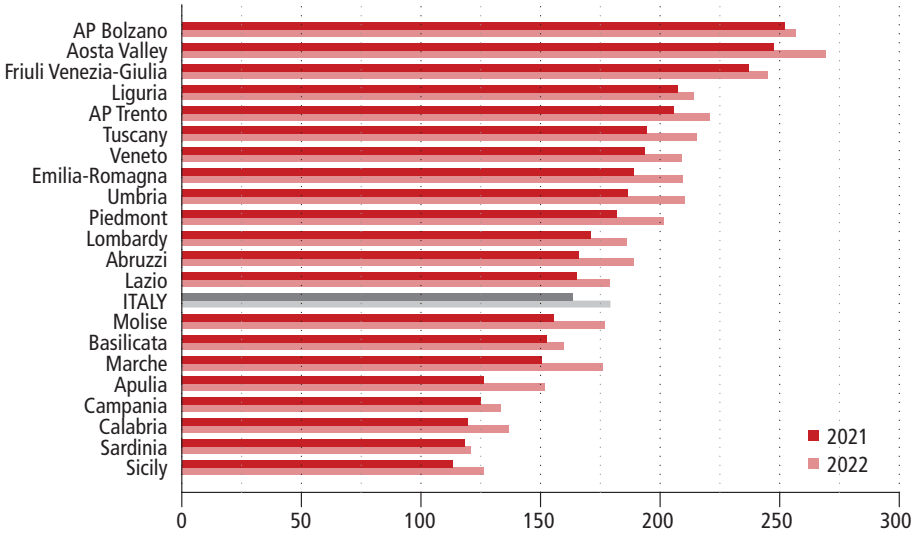


Figure 2. Hip. Elective total and partial replacement. Incidence rate by region (per 100,000 residents). 2021 and 2022



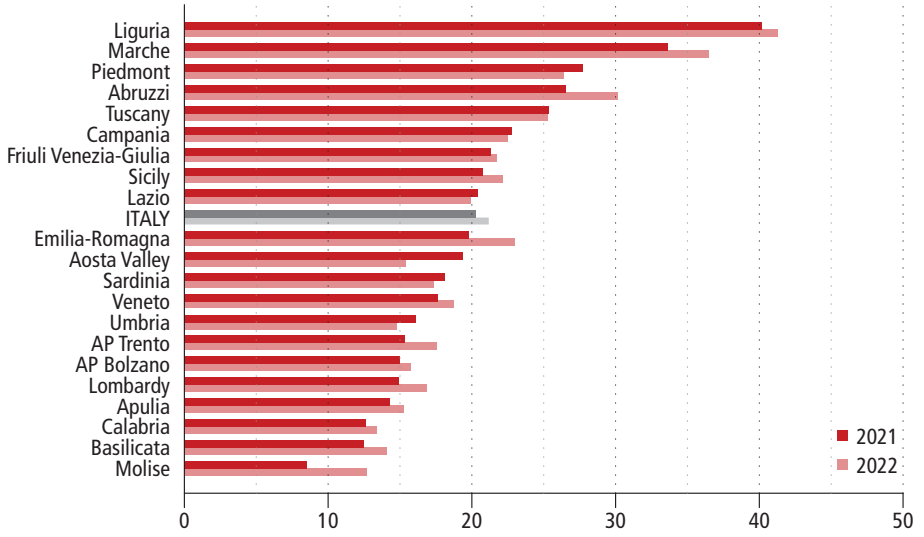
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 3. Hip. Elective total and partial replacement. Hospitalisation rate by region (per 100,000 residents). 2021 and 2022



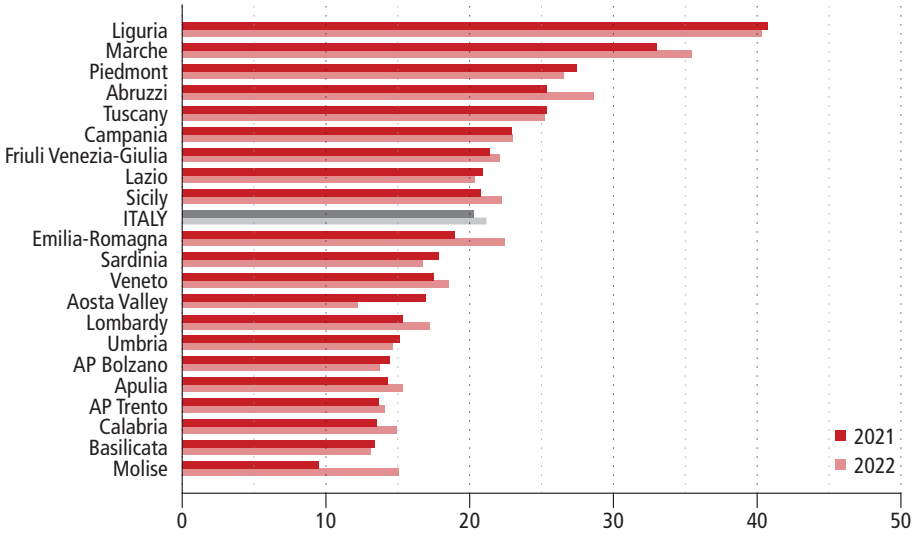
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 4. Hip. Emergency total and partial replacement. Incidence rate by region (per 100,000 residents). 2021 and 2022



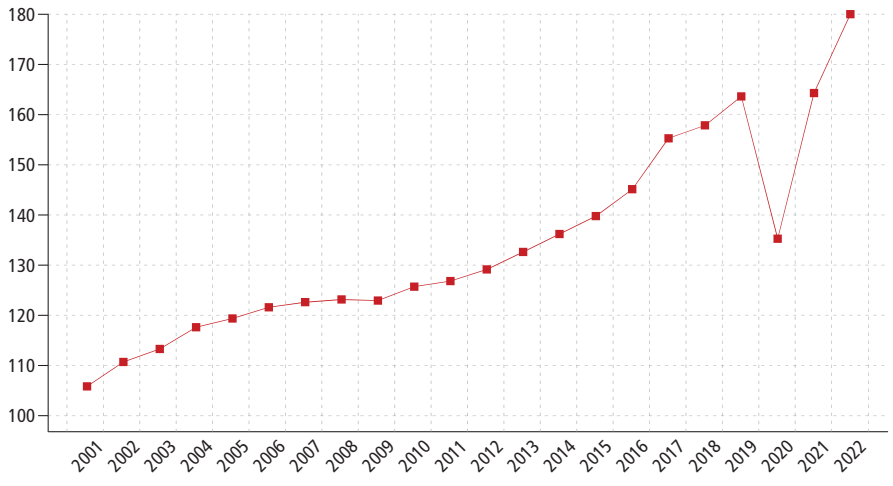
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 5. Hip. Emergency total and partial replacement. Hospitalisation rate by region (per 100,000 residents). 2021 and 2022



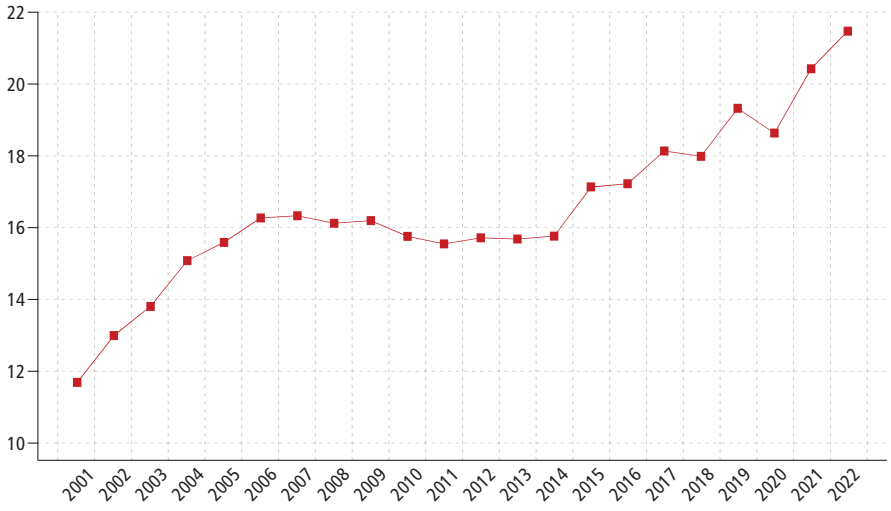
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 6. Hip. Elective total and partial replacement. National incidence/hospitalisation rate (per 100,000 residents). From 2001 to 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 7. Hip. Emergency total and partial replacement. National incidence/hospitalisation rate (per 100,000 residents). From 2001 to 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Table 7. Knee. Number of procedures by region of admission and by procedure type. 2021 and 2022

Region of admission	Total replacement			
	2021		2022	
	N	%	N	%
Piedmont	6,593	*8.7*	8,346	*9.0*
Aosta Valley	203	*0.3*	203	*0.2*
Lombardy	15,524	*20.4*	20,485	*22.1*
AP Bolzano	1,042	*1.4*	1,148	*1.2*
AP Trento	813	*1.1*	1,056	*1.1*
Veneto	7,894	*10.4*	8,991	*9.7*
Friuli Venezia Giulia	1,723	*2.3*	2,149	*2.3*
Liguria	719	*0.9*	909	*1.0*
Emilia-Romagna	8,798	*11.6*	10,857	*11.7*
Tuscany	6,564	*8.6*	7,475	*8.1*
Umbria	1,133	*1.5*	1,318	*1.4*
Marche	1,599	*2.1*	1,980	*2.1*
Lazio	6,461	*8.5*	7,526	*8.1*
Abruzzi	1,828	*2.4*	2,135	*2.3*
Molise	196	*0.3*	232	*0.3*
Campania	4,192	*5.5*	4,859	*5.3*
Apulia	2,956	*3.9*	3,734	*4.0*
Basilicata	152	*0.2*	199	*0.2*
Calabria	1,401	*1.8*	1,759	*1.9*
Sicily	4,427	*5.8*	5,354	*5.8*
Sardinia	1,800	*2.4*	1,811	*2.0*
Italy	**76,018**	***100.0***	**92,526**	***100.0***
% of national volume	*92.7*		*93.3*	

Revision				Total			
2021		2022		2021		2022	
N	%	N	%	N	%	N	%
576	*9,6*	563	*8,4*	7.169	*8,7*	8.909	*9,0*
18	*0,3*	13	*0,2*	221	*0,3*	216	*0,2*
1.344	*22,5*	1.587	*23,7*	16.868	*20,6*	22.072	*22,2*
67	*1,1*	66	*1,0*	1.109	*1,4*	1.214	*1,2*
22	*0,4*	51	*0,8*	835	*1,0*	1.107	*1,1*
522	*8,7*	647	*9,7*	8.416	*10,3*	9.638	*9,7*
111	*1,9*	122	*1,8*	1.834	*2,2*	2.271	*2,3*
61	*1,0*	83	*1,2*	780	*1,0*	992	*1,0*
756	*12,7*	945	*14,1*	9.554	*11,7*	11.802	*11,9*
647	*10,8*	664	*9,9*	7.211	*8,8*	8.139	*8,2*
111	*1,9*	96	*1,4*	1.244	*1,5*	1.414	*1,4*
89	*1,5*	94	*1,4*	1.688	*2,1*	2.074	*2,1*
483	*8,1*	541	*8,1*	6.944	*8,5*	8.067	*8,1*
102	*1,7*	80	*1,2*	1.930	*2,4*	2.215	*2,2*
5	*0,1*	3	*0,0*	201	*0,2*	235	*0,2*
333	*5,6*	379	*5,7*	4.525	*5,5*	5.238	*5,3*
197	*3,3*	201	*3,0*	3.153	*3,8*	3.935	*4,0*
8	*0,1*	6	*0,1*	160	*0,2*	205	*0,2*
80	*1,3*	96	*1,4*	1.481	*1,8*	1.855	*1,9*
363	*6,1*	393	*5,9*	4.790	*5,8*	5.747	*5,8*
79	*1,3*	66	*1,0*	1.879	*2,3*	1.877	*1,9*
5.974	***100,0***	**6.696**	***100,0***	**81.992**	***100,0***	**99.222**	***100,0***
7,3		*6,7*		*100,0*		*100,0*	

Table 8. Knee. Primary total replacement. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume					
	1-50		51-100		101-200	
	2021	2022	2021	2022	2021	2022
	N	N	N	N	N	N
Piedmont	25	20	9	10	3	6
Aosta Valley	1	1	0	0	1	1
Lombardy	58	46	11	23	11	10
AP Bolzano	5	6	2	2	5	4
AP Trento	2	1	1	3	6	5
Veneto	22	18	9	14	4	6
Friuli Venezia Giulia	7	4	3	6	1	1
Liguria	10	10	2	1	3	3
Emilia-Romagna	27	23	5	10	14	5
Tuscany	19	19	10	10	5	5
Umbria	5	6	4	3	3	3
Marche	9	7	4	8	2	1
Lazio	46	49	8	9	12	14
Abruzzi	12	9	2	4	1	1
Molise	4	4	0	0	1	1
Campania	38	35	13	9	9	12
Apulia	22	23	6	3	5	8
Basilicata	5	5	1	0	0	1
Calabria	10	11	4	3	1	3
Sicily	39	37	14	13	10	13
Sardinia	12	13	2	2	2	2
Italy	**378**	**347**	**110**	**133**	**99**	**105**
% of national volume	*54.1*	*48.3*	*15.7*	*18.5*	*14.2*	*14.6*

All procedures registered in HDR either in the "principal" or in the "secondary" fields

201-300		>300		Total			
2021	2022	2021	2022	2021		2022	
N	N	N	N	N	%	N	%
5	5	7	8	49	*7.0*	49	*6.8*
0	0	0	0	2	*0.3*	2	*0.3*
9	6	16	22	105	*15.0*	107	*14.9*
0	1	0	0	12	*1.7*	13	*1.8*
0	0	0	0	9	*1.3*	9	*1.3*
1	2	10	10	46	*6.6*	50	*7.0*
1	0	2	3	14	*2.0*	14	*1.9*
0	1	0	0	15	*2.1*	15	*2.1*
3	7	10	14	59	*8.4*	59	*8.2*
2	3	9	9	45	*6.4*	46	*6.4*
1	0	0	1	13	*1.9*	13	*1.8*
0	1	2	2	17	*2.4*	19	*2.6*
4	3	4	6	74	*10.6*	81	*11.3*
1	1	3	3	19	*2.7*	18	*2.5*
0	0	0	0	5	*0.7*	5	*0.7*
5	6	0	1	65	*9.3*	63	*8.8*
4	4	1	2	38	*5.4*	40	*5.6*
0	0	0	0	6	*0.9*	6	*0.8*
2	1	1	2	18	*2.6*	20	*2.8*
3	3	2	3	68	*9.7*	69	*9.6*
3	2	1	2	20	*2.9*	21	*2.9*
44	**46**	**68**	**88**	**699**	***100.0***	**719**	***100.0***
6.3	*6.4*	*9.7*	*12.2*	*100.0*		*100.0*	

Table 9. Knee. Revision. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume											
	1-10		11-25		26-50		>50		Total			
	2021	2022	2021	2022	2021	2022	2021	2022	2021		2022	
	N	N	N	N	N	N	N	N	N	%	N	%
Piedmont	22	26	9	8	6	8	1	1	38	*7.1*	43	*7.8*
Aosta Valley	0	1	1	0	0	0	0	0	1	*0.2*	1	*0.2*
Lombardy	63	55	13	18	9	7	4	7	89	*16.6*	87	*15.8*
AP Bolzano	8	7	2	3	0	0	0	0	10	*1.9*	10	*1.8*
AP Trento	7	8	0	1	0	0	0	0	7	*1.3*	9	*1.6*
Veneto	26	28	7	9	3	3	1	1	37	*6.9*	41	*7.4*
Friuli Venezia Giulia	10	11	1	1	2	2	0	0	13	*2.4*	14	*2.5*
Liguria	11	8	2	2	0	0	0	0	13	*2.4*	10	*1.8*
Emilia-Romagna	31	33	16	11	5	10	1	1	53	*9.9*	55	*10.0*
Tuscany	23	23	5	7	6	6	2	2	36	*6.7*	38	*6.9*
Umbria	9	10	2	1	1	1	0	0	12	*2.2*	12	*2.2*
Marche	8	15	3	1	0	1	0	0	11	*2.0*	17	*3.1*
Lazio	41	33	5	14	5	5	1	1	52	*9.7*	53	*9.6*
Abruzzi	10	10	4	3	0	0	0	0	14	*2.6*	13	*2.4*
Molise	2	1	0	0	0	0	0	0	2	*0.4*	1	*0.2*
Campania	33	41	9	7	1	0	1	1	44	*8.2*	49	*8.9*
Apulia	23	18	6	5	1	1	0	0	30	*5.6*	24	*4.3*
Basilicata	3	3	0	0	0	0	0	0	3	*0.6*	3	*0.5*
Calabria	11	10	1	1	1	1	0	0	13	*2.4*	12	*2.2*
Sicily	37	36	7	12	2	1	0	0	46	*8.6*	49	*8.9*
Sardinia	10	10	3	1	0	0	0	0	13	*2.4*	11	*2.0*
Italy	**388**	**387**	**96**	**105**	**42**	**46**	**11**	**14**	**537**	***100.0***	**552**	***100.0***
% of national volume	*72.3*	*70.1*	*17.9*	*19.0*	*7.8*	*8.3*	*2.0*	*2.5*	*100.0*		*100.0*	

All procedures registered in HDR either in the "principal" or in the "secondary" fields

Table 10. Knee. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2021 and 2022

	Total replacement		Revision		Total	
	2021	2022	2021	2022	2021	2022
	%	%	%	%	%	%
Gender						
Male	35.8	36.0	35.5	35.7	35.8	36.0
Female	64.2	64.0	64.5	64.3	64.2	64.0
Age (male)						
Mean age	68.7	69.3	68.3	68.7	68.7	69.2
Standard deviation	9.5	9.3	11.1	10.9	9.6	9.4
Age group						
0-44	1.1	0.9	2.7	2.2	1.2	1.0
45-54	6.3	5.5	7.5	6.7	6.3	5.6
55-64	23.3	22.0	23.3	21.9	23.3	22.0
65-74	39.6	40.1	34.8	35.4	39.2	39.8
75-84	27.7	29.3	28.8	30.4	27.7	29.4
85+	2.1	2.1	2.9	3.4	2.1	2.2
Age (female)						
Mean age	70.6	71.0	71.0	71.0	70.6	70.9
Standard deviation	8.6	9.4	9.4	9.4	8.7	8.5
Age group						
0-44	0.4	0.3	0.8	0.8	0.4	0.4
45-54	4.0	3.7	4.5	4.0	4.1	3.7
55-64	18.0	17.1	16.4	17.9	17.9	17.2
65-74	42.2	41.8	39.7	38.0	42.0	41.5
75-84	32.8	34.6	34.5	35.0	33.0	34.6
85+	2.5	2.5	4.0	4.2	2.6	2.6

Table 11. Knee. Percent distribution of hospital discharges by discharge type and by procedure type. 2021 and 2022

Discharge type	Total replacement (elective)		Revision		Total	
	2021	2022	2021	2022	2021	2022
	%	%	%	%	%	%
Deceased	0.0	0.0	0.1	0.2	0.0	0.0
Ordinary discharge	56.6	54.0	56.9	57.1	56.6	54.1
Discharge to a Residential Care Facility	0.9	1.0	1.0	1.1	0.9	1.1
Discharge with home health services	0.0	0.0	0.2	0.1	0.0	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	0.8	1.1	1.1	1.2	0.8	1.1
Transfer in the same hospital	25.5	26.5	23.7	23.9	25.5	26.4
Transfer to an inpatient rehabilitation facility	15.7	16.9	16.1	15.7	15.7	16.8
Discharge with integrated home care	0.4	0.4	0.7	0.5	0.4	0.4

Figure 8. Knee. Total replacement. Inter-regional mobility (attraction and escape indices) in 2021 (a) and in 2022 (b)

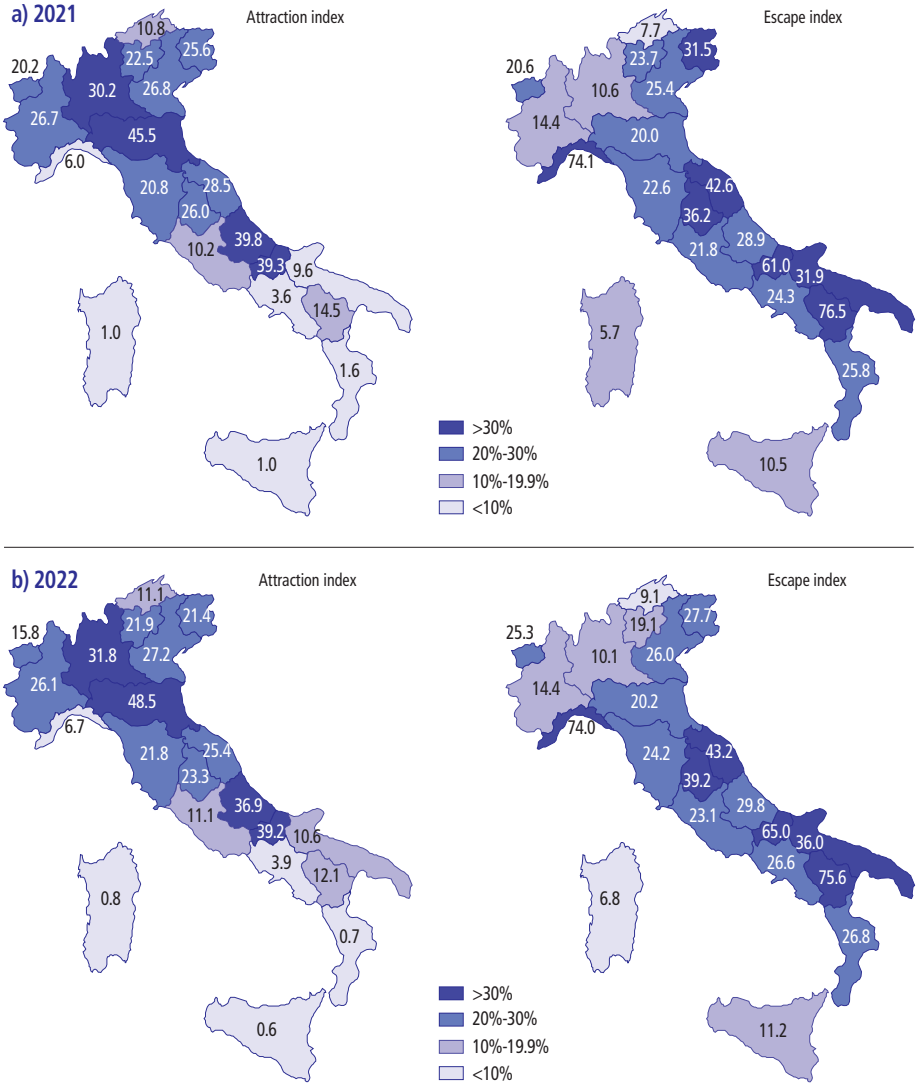
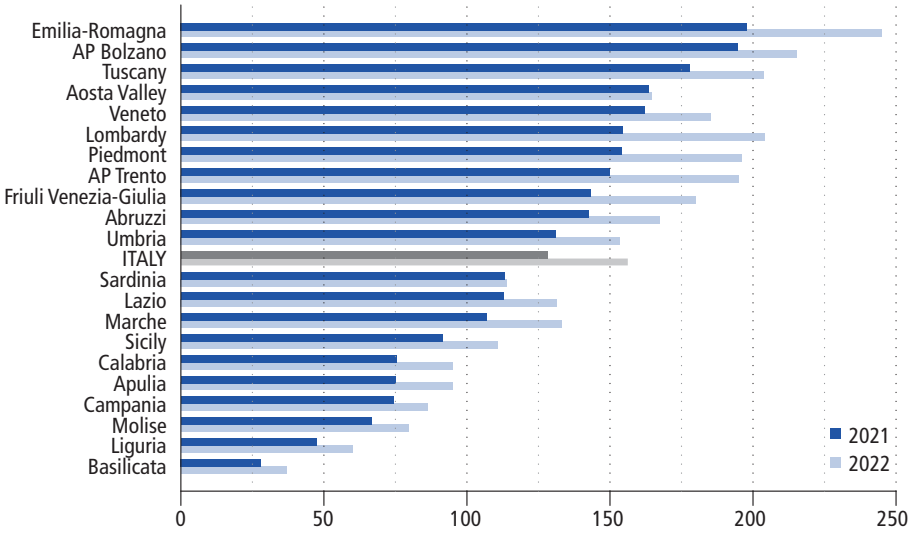
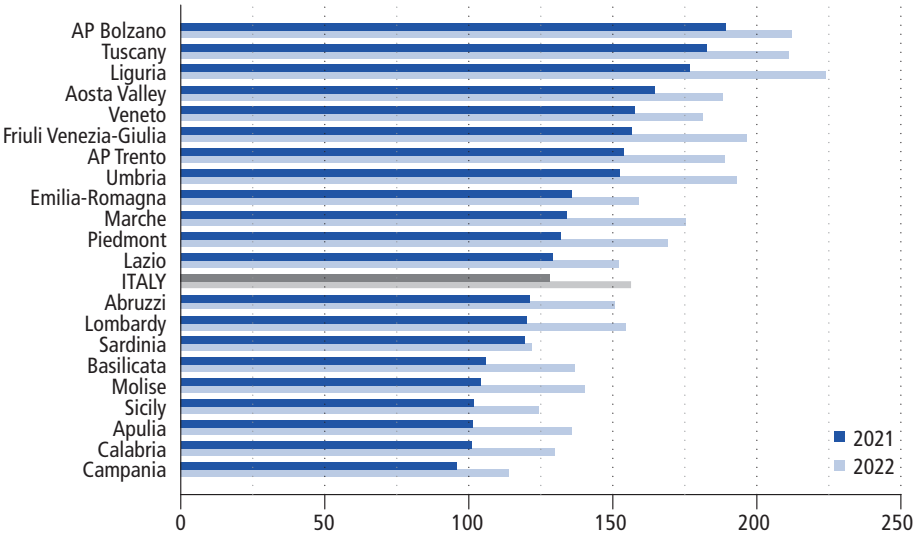


Figure 9. Knee. Total replacement. Incidence rate by region (per 100,000 residents) 2021 and 2022



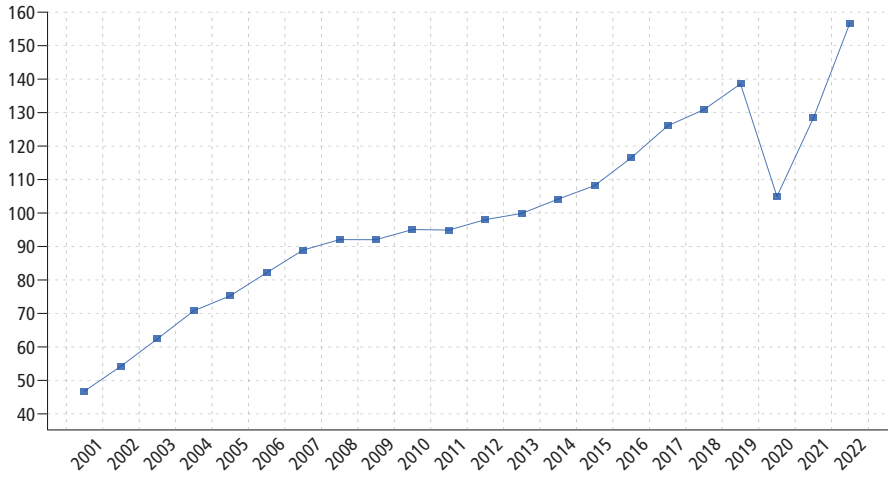
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 10. Knee. Total replacement. Hospitalisation rate by region (per 100,000 residents). 2021 and 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 11. Knee. Total replacement. National incidence/hospitalisation rate (per 100,000 residents). From 2001 to 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Table 12. Shoulder. Number of procedures by region of admission and by procedure type. 2021 and 2022

Region of admission	Total replacement (elective)				Total replacement (emergency)			
	2021		2022		2021		2022	
	N	%	N	%	N	%	N	%
Piedmont	830	*11.6*	1,039	*12.3*	200	*6.9*	215	*7.0*
Aosta Valley	3	*0.0*	5	*0.1*	3	*0.1*	2	*0.1*
Lombardy	943	*13.2*	1,291	*15.2*	509	*17.5*	580	*18.9*
AP Bolzano	44	*0.6*	45	*0.5*	25	*0.9*	25	*0.8*
AP Trento	32	*0.4*	53	*0.6*	29	*1.0*	34	*1.1*
Veneto	599	*8.4*	671	*7.9*	288	*9.9*	256	*8.4*
Friuli Venezia Giulia	64	*0.9*	101	*1.2*	63	*2.2*	63	*2.1*
Liguria	19	*0.3*	20	*0.2*	17	*0.6*	23	*0.8*
Emilia-Romagna	986	*13.8*	1,237	*14.6*	231	*7.9*	211	*6.9*
Tuscany	758	*10.6*	812	*9.6*	126	*4.3*	147	*4.8*
Umbria	100	*1.4*	96	*1.1*	47	*1.6*	61	*2.0*
Marche	159	*2.2*	178	*2.1*	82	*2.8*	91	*3.0*
Lazio	889	*12.4*	1,072	*12.6*	351	*12.0*	389	*12.7*
Abruzzi	200	*2.8*	196	*2.3*	80	*2.7*	85	*2.8*
Molise	12	*0.2*	10	*0.1*	6	*0.2*	6	*0.2*
Campania	591	*8.3*	649	*7.7*	249	*8.5*	274	*9.0*
Apulia	308	*4.3*	367	*4.3*	211	*7.2*	225	*7.4*
Basilicata	7	*0.1*	5	*0.1*	18	*0.6*	12	*0.4*
Calabria	127	*1.8*	123	*1.5*	67	*2.3*	57	*1.9*
Sicily	397	*5.5*	440	*5.2*	293	*10.1*	269	*8.8*
Sardinia	86	*1.2*	70	*0.8*	19	*0.7*	36	*1.2*
Italy	**7,154**	***100.0***	**8,480**	***100.0***	**2,914**	***100.0***	**3,061**	***100.0***
% of national volume	*62.9*		*66.4*		*25.6*		*24.0*	

All procedures registered in HDR either in the "principal" or in the "secondary" fields

Partial replacement				Total			
2021		2022		2021		2022	
N	%	N	%	N	%	N	%
39	3.0	40	3.2	1,069	9.4	1,294	10.1
0	0.0	0	0.0	6	0.1	7	0.1
80	6.2	89	7.2	1,532	13.5	1,960	15.3
5	0.4	0	0.0	74	0.7	70	0.5
5	0.4	4	0.3	66	0.6	91	0.7
424	32.7	400	32.4	1,311	11.5	1,327	10.4
21	1.6	19	1.5	148	1.3	183	1.4
4	0.3	5	0.4	40	0.4	48	0.4
87	6.7	93	7.5	1,304	11.5	1,541	12.1
47	3.6	49	4.0	931	8.2	1,008	7.9
87	6.7	105	8.5	234	2.1	262	2.1
28	2.2	34	2.8	269	2.4	303	2.4
88	6.8	90	7.3	1,328	11.7	1,551	12.1
27	2.1	28	2.3	307	2.7	309	2.4
1	0.1	1	0.1	19	0.2	17	0.1
232	17.9	180	14.6	1,072	9.4	1,103	8.6
26	2.0	22	1.8	545	4.8	614	4.8
1	0.1	3	0.2	26	0.2	20	0.2
7	0.5	6	0.5	201	1.8	186	1.5
70	5.4	51	4.1	760	6.7	760	5.9
19	1.5	14	1.1	124	1.1	120	0.9
1,298	***100.0***	**1,233**	***100.0***	**11,366**	***100.0***	**12,774**	***100.0***
11.4		*9.7*		*100.0*		*100.0*	

Table 13. Shoulder. Total replacement. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2021	2022	2021	2022	2021	2022
	N	N	N	N	N	N
Piedmont	11	7	7	8	8	8
Aosta Valley	1	1	1	1	0	0
Lombardy	20	17	30	21	11	21
AP Bolzano	6	3	1	2	0	2
AP Trento	3	2	2	2	1	2
Veneto	4	5	7	7	10	9
Friuli Venezia Giulia	4	1	1	3	5	3
Liguria	9	7	3	2	0	1
Emilia-Romagna	15	13	10	11	6	6
Tuscany	8	7	10	7	3	3
Umbria	5	4	3	2	1	1
Marche	5	7	2	2	4	5
Lazio	19	25	18	15	6	7
Abruzzi	2	2	6	7	4	2
Molise	1	1	1	2	1	0
Campania	24	17	8	13	7	5
Apulia	8	7	8	6	7	9
Basilicata	1	2	3	2	0	0
Calabria	9	3	0	7	3	3
Sicily	24	20	14	14	9	7
Sardinia	8	6	2	3	0	3
Italy	**187**	**157**	**137**	**137**	**86**	**97**
% of national volume	*30.7*	*25.4*	*22.5*	*22.2*	*14.1*	*15.7*

All procedures registered in HDR either in the "principal" or in the "secondary" fields

15-24		>24		Total			
2021	2022	2021	2022	2021		2022	
N	N	N	N	N	%	N	%
6	8	12	13	44	*7.2*	44	*7.1*
0	0	0	0	2	*0.3*	2	*0.3*
19	17	14	22	94	*15.4*	98	*15.9*
3	0	0	1	10	*1.6*	8	*1.3*
1	1	0	1	7	*1.1*	8	*1.3*
7	15	13	9	41	*6.7*	45	*7.3*
3	5	0	0	13	*2.1*	12	*1.9*
0	0	0	0	12	*2.0*	10	*1.6*
10	9	15	18	56	*9.2*	57	*9.2*
6	4	9	12	36	*5.9*	33	*5.3*
0	3	3	2	12	*2.0*	12	*1.9*
4	3	2	2	17	*2.8*	19	*3.1*
7	13	14	14	64	*10.5*	74	*12.0*
1	3	4	3	17	*2.8*	17	*2.8*
0	0	0	0	3	*0.5*	3	*0.5*
5	6	9	11	53	*8.7*	52	*8.4*
6	9	5	5	34	*5.6*	36	*5.8*
0	0	0	0	4	*0.7*	4	*0.6*
4	3	2	1	18	*3.0*	17	*2.8*
2	5	9	8	58	*9.5*	54	*8.7*
4	0	0	1	14	*2.3*	13	*2.1*
88	**104**	**111**	**123**	**609**	***100.0***	**618**	***100.0***
14.4	*16.8*	*18.2*	*19.9*	*100.0*		*100.0*	

Table 14. Shoulder. Partial replacement. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume					
	1-4		5-9		10-14	
	2021	2022	2021	2022	2021	2022
	N	N	N	N	N	N
Piedmont	13	15	0	1	2	1
Aosta Valley	0	0	0	0	0	0
Lombardy	29	38	3	1	0	0
AP Bolzano	3	0	0	0	0	0
AP Trento	2	2	0	0	0	0
Veneto	17	16	8	11	4	2
Friuli Venezia Giulia	9	7	0	1	0	0
Liguria	2	2	0	0	0	0
Emilia-Romagna	25	23	1	1	3	1
Tuscany	12	12	0	1	0	0
Umbria	3	2	2	1	0	0
Marche	5	6	0	0	0	0
Lazio	22	19	5	4	0	1
Abruzzi	8	5	0	0	1	0
Molise	1	1	0	0	0	0
Campania	16	14	1	2	0	0
Apulia	12	13	1	0	0	0
Basilicata	1	2	0	0	0	0
Calabria	5	1	0	1	0	0
Sicily	19	12	2	2	0	0
Sardinia	8	8	1	0	0	0
Italy	**212**	**198**	**24**	**26**	**10**	**5**
% of national volume	*80.6*	*79.2*	*9.1*	*10.4*	*3.8*	*2.0*

All procedures registered in HDR either in the "principal" or in the "secondary" fields

15-24		>24		Total			
2020	2021	2020	2021	2020		2021	
N	N	N	N	N	%	N	%
0	0	0	0	15	*5.7*	17	*6.8*
0	0	0	0	0	*0.0*	0	*0.0*
1	1	0	0	33	*12.5*	40	*16.0*
0	0	0	0	3	*1.1*	0	*0.0*
0	0	0	0	2	*0.8*	2	*0.8*
2	2	4	4	35	*13.3*	35	*14.0*
0	0	0	0	9	*3.4*	8	*3.2*
0	0	0	0	2	*0.8*	2	*0.8*
0	2	0	0	29	*11.0*	27	*10.8*
0	1	1	0	13	*4.9*	14	*5.6*
0	0	2	3	7	*2.7*	6	*2.4*
1	1	0	0	6	*2.3*	7	*2.8*
1	1	0	0	28	*10.6*	25	*10.0*
0	1	0	0	9	*3.4*	6	*2.4*
0	0	0	0	1	*0.4*	1	*0.4*
0	1	4	3	21	*8.0*	20	*8.0*
0	0	0	0	13	*4.9*	13	*5.2*
0	0	0	0	1	*0.4*	2	*0.8*
0	0	0	0	5	*1.9*	2	*0.8*
0	1	1	0	22	*8.4*	15	*6.0*
0	0	0	0	9	*3.4*	8	*3.2*
5	**11**	**12**	**10**	**263**	***100.0***	**250**	***100.0***
1.9	*4.4*	*4.6*	*4.0*	*100.0*		*100.0*	

Table 15. Shoulder. Percent distribution of hospital discharges by patient gender and age group and by procedure type. 2021 and 2022

	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2021	2022	2021	2022	2021	2022	2021	2022
	%	%	%	%	%	%	%	%
Gender								
Male	32.7	33.7	17.1	17.0	48.4	49.8	30.5	31.3
Female	67.3	66.3	82.9	83.0	51.6	50.2	69.5	68.7
Age (male)								
Mean age	68,3	68,8	71,3	71,2	61,5	61,5	67,5	68,0
Standard deviation	9,6	9,6	10,2	9,8	11,6	12,2	10,5	10,4
Age group								
0-44	1.7	1.6	1.2	0.6	7.2	7.0	2.6	2.3
45-54	6.7	6.6	5.6	6.5	16.9	16.7	8.4	8.1
55-64	23.2	20.6	15.3	15.4	35.1	37.1	24.2	22.5
65-74	41.8	41.6	38.1	37.1	29.5	26.3	39.0	38.7
75-84	25.1	28.0	32.7	33.7	9.3	11.4	23.3	26.2
85+	1.5	1.5	7.1	6.7	2.1	1.5	2.4	2.2
Age (female)								
Mean age	72.8	73.1	74.7	74.6	67.3	67.5	72.9	73.2
Standard deviation	7.9	7.7	7.5	7.6	10.6	11.6	8.3	8.2
Age group								
0-44	0.4	0.3	0.4	0.0	1.6	2.1	0.4	0.4
45-54	1.8	1.9	1.8	0.9	8.1	9.6	2.1	2.1
55-64	11.2	9.8	11.2	9.6	29.3	26.4	12.0	10.9
65-74	41.7	40.7	41.7	35.8	33.3	33.2	39.3	38.8
75-84	41.4	44.0	41.4	45.7	24.2	23.3	41.5	43.0
85+	3.5	3.3	3.5	8.0	3.4	5.3	4.7	4.8

Table 16. Shoulder. Percent distribution of hospital discharges by discharge type and by procedure type. 2021 and 2022

Discharge type	Total replacement (elective)		Total replacement (emergency)		Partial replacement		Total	
	2021	2022	2021	2022	2021	2022	2021	2022
	%	%	%	%	%	%	%	%
Deceased	0.1	0.0	0.2	0.2	0.2	0.1	0.1	0.1
Ordinary discharge	96.4	96.4	92.8	92.4	97.3	97.9	95.6	95.5
Discharge to a Residential Care Facility	0.1	0.2	1.8	2.2	0.6	0.2	0.6	0.7
Discharge with home health services	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1
Discharge against medical advice	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2
Transfer to an acute admission unit of a different hospital	0.2	0.2	0.6	0.5	0.1	0.4	0.3	0.3
Transfer in the same hospital	1.6	1.9	0.7	1.0	0.8	0.3	1.3	1.5
Transfer to an inpatient rehabilitation facility	1.2	1.0	2.5	2.2	0.5	0.5	1.5	1.2
Discharge with integrated home care	0.1	0.1	1.2	1.2	0.2	0.3	0.4	0.4

Figure 12. Shoulder. Elective total replacement. Inter-regional mobility (attraction and escape indices) in 2021 (a) and in 2022 (b)

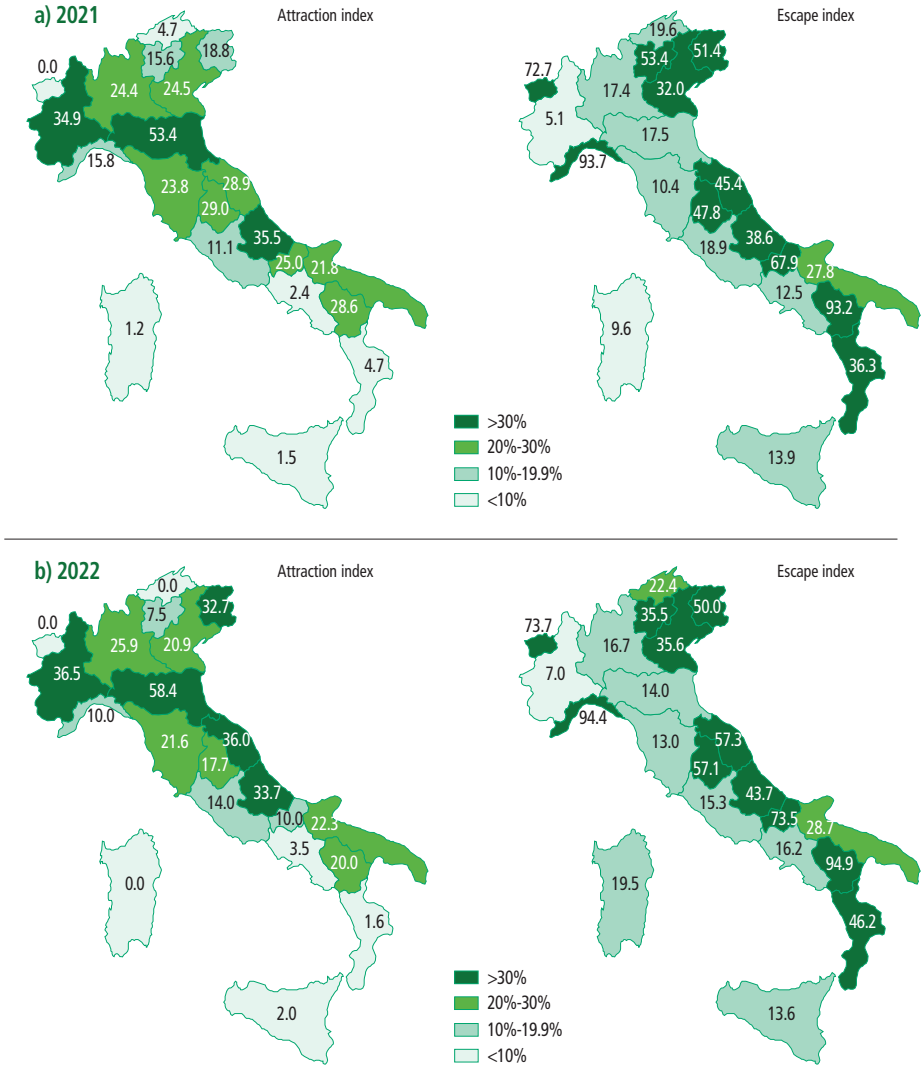
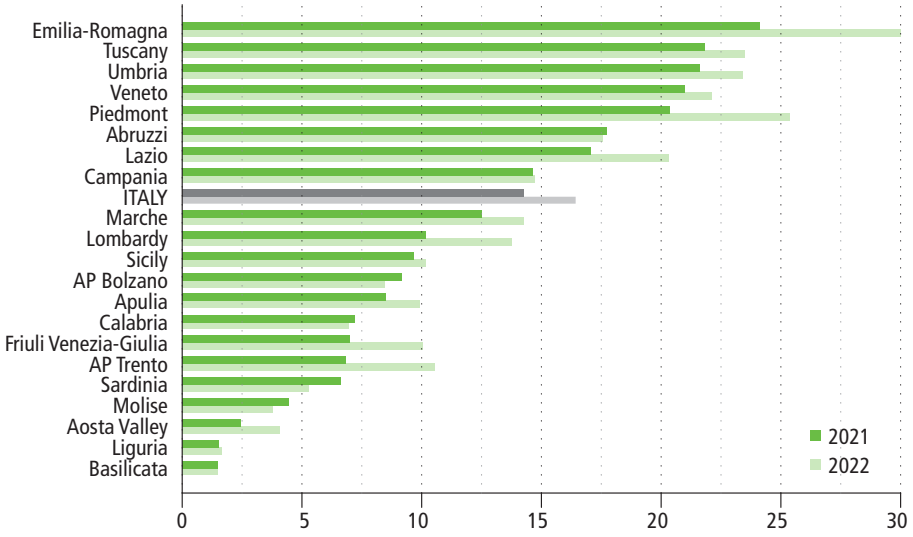
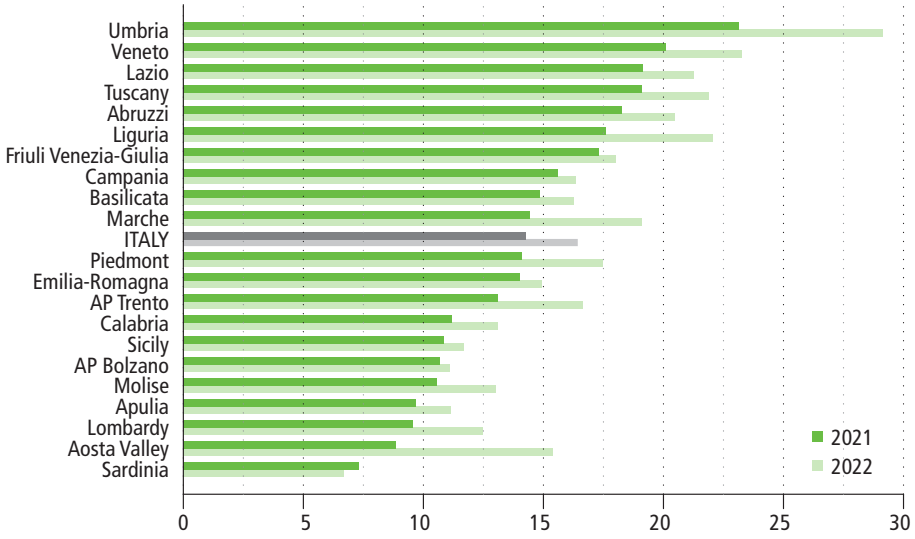


Figure 13. Shoulder. Elective total and partial replacement. Incidence rate by region (per 100,000 residents). 2021 and 2022



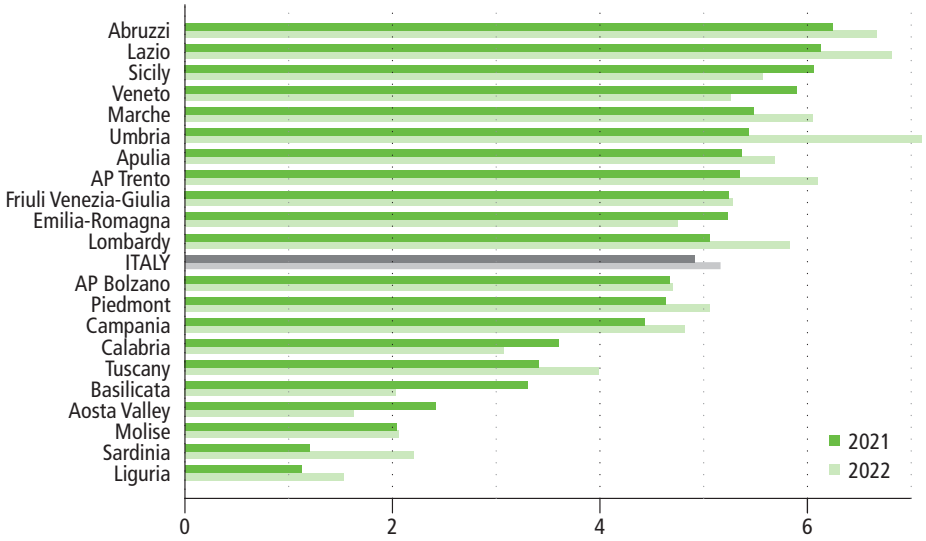
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 14. Shoulder. Elective total and partial replacement. Hospitalisation rate by region (per 100,000 residents). 2021 and 2022



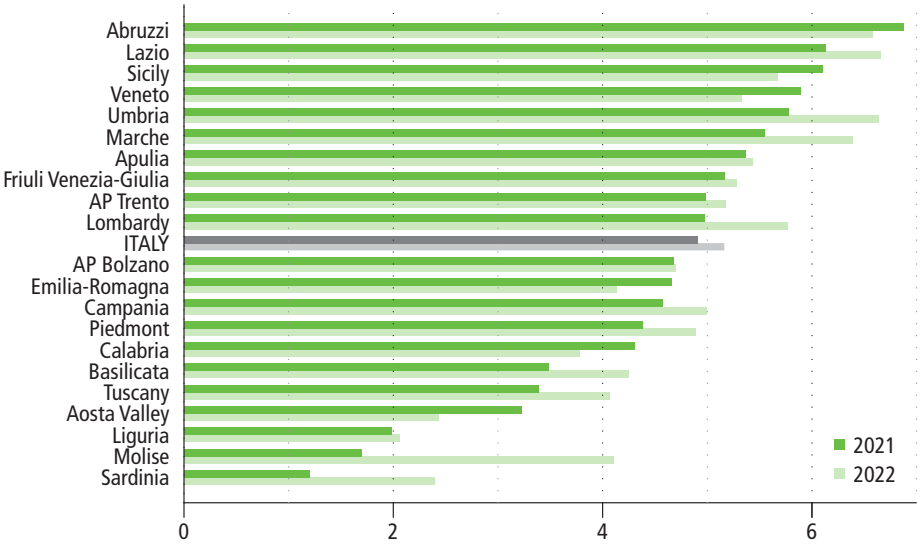
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 15. Shoulder. Emergency total and partial replacement. Incidence rate by region (per 100,000 residents). 2021 and 2022



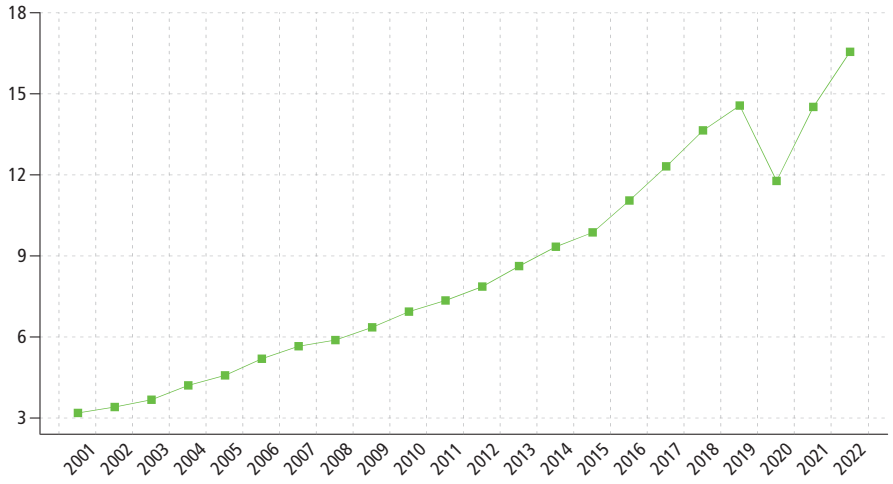
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 16. Shoulder. Emergency total and partial replacement. Hospitalisation rate by region (per 100,000 residents). 2021 and 2022



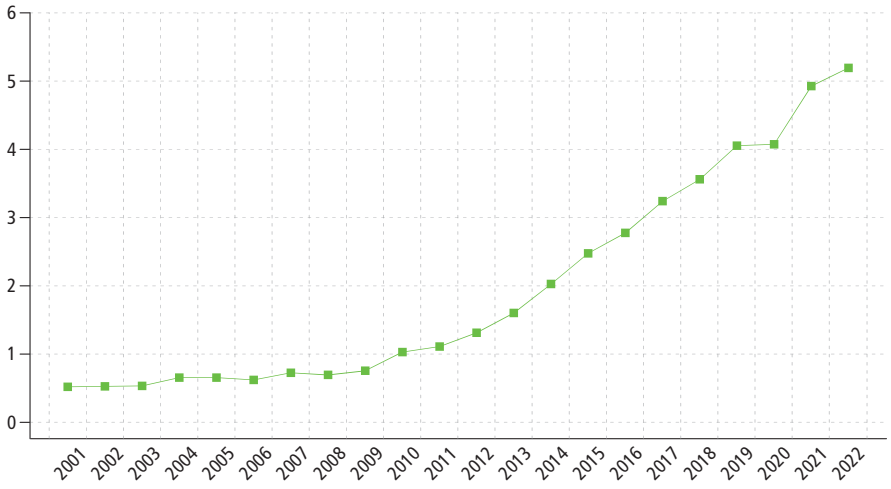
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 17. Shoulder. Elective total and partial replacement. National incidence/hospitalisation rate (per 100,000 residents). From 2001 to 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 18. Shoulder. Emergency total and partial replacement. National incidence/hospitalisation rate (per 100,000 residents). From 2001 to 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Table 17. Ankle. Total replacement. Number of procedures by region of admission and by procedure type. 2021 and 2022

Region of admission	Total replacement			
	2021		2022	
	N	%	N	%
Piedmont	47	*5.7*	46	*4.6*
Aosta Valley	2	*0.2*	12	*1.2*
Lombardy	341	*41.6*	394	*39.6*
AP Bolzano	0	*0.0*	0	*0.0*
AP Trento	15	*1.8*	11	*1.1*
Veneto	69	*8.4*	99	*9.9*
Friuli Venezia Giulia	2	*0.2*	0	*0.0*
Liguria	1	*0.1*	1	*0.1*
Emilia-Romagna	201	*24.5*	288	*28.9*
Tuscany	17	*2.1*	18	*1.8*
Umbria	2	*0.2*	0	*0.0*
Marche	8	*1.0*	3	*0.3*
Lazio	73	*8.9*	57	*5.7*
Abruzzi	2	*0.2*	2	*0.2*
Molise	0	*0.0*	0	*0.0*
Campania	12	*1.5*	15	*1.5*
Apulia	8	*1.0*	11	*1.1*
Basilicata	0	*0.0*	0	*0.0*
Calabria	3	*0.4*	8	*0.8*
Sicily	14	*1.7*	21	*2.1*
Sardinia	3	*0.4*	9	*0.9*
Italy	**820**	***100.0***	**995**	***100.0***
% of national volume				

All procedures registered in HDR either in the "principal" or in the "secondary" fields

Table 18. Ankle. Total replacement. Number of hospitals performing procedures by region of admission and by class of volume. 2021 and 2022

Region of admission	Class of volume									
	1-2		3-4		>4		Total			
	2021	2022	2021	2022	2021	2022	2021		2022	
	N	N	N	N	N	N	N	%	N	%
Piedmont	3	6	0	2	5	3	8	*6.2*	11	*8.5*
Aosta Valley	1	0	0	0	0	1	1	*0.8*	1	*0.8*
Lombardy	18	16	3	3	7	9	28	*21.7*	28	*21.5*
AP Bolzano	0	0	0	0	0	0	0	*0.0*	0	*0.0*
AP Trento	2	0	0	0	1	1	3	*2.3*	1	*0.8*
Veneto	7	6	2	1	6	6	15	*11.6*	13	*10.0*
Friuli Venezia Giulia	2	0	0	0	0	0	2	*1.6*	0	*0.0*
Liguria	1	1	0	0	0	0	1	*0.8*	1	*0.8*
Emilia-Romagna	4	11	6	6	6	5	16	*12.4*	22	*16.9*
Tuscany	4	5	2	4	1	0	7	*5.4*	9	*6.9*
Umbria	2	0	0	0	0	0	2	*1.6*	0	*0.0*
Marche	1	2	2	0	0	0	3	*2.3*	2	*1.5*
Lazio	13	11	5	2	3	3	21	*16.3*	16	*12.3*
Abruzzi	1	2	0	0	0	0	1	*0.8*	2	*1.5*
Molise	0	0	0	0	0	0	0	*0.0*	0	*0.0*
Campania	4	7	2	0	0	1	6	*4.7*	8	*6.2*
Apulia	2	3	2	0	0	1	4	*3.1*	4	*3.1*
Basilicata	0	0	0	0	0	0	0	*0.0*	0	*0.0*
Calabria	3	4	0	1	0	0	3	*2.3*	5	*3.8*
Sicily	4	3	1	2	1	1	6	*4.7*	6	*4.6*
Sardinia	2	0	0	0	0	1	2	*1.6*	1	*0.8*
Italy	**74**	**77**	**25**	**21**	**30**	**32**	**129**	***100.0***	**130**	***100.0***
% of national volume	*57.4*	*59.2*	*19.4*	*16.2*	*23.3*	*24.6*	*100.0*		*100.0*	

All procedures registered in HDR either in the "principal" or in the "secondary" fields

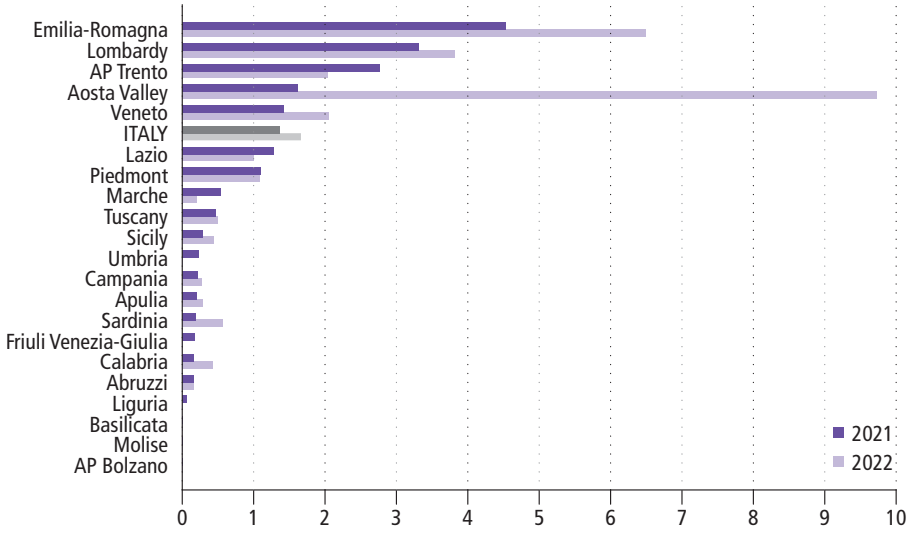
Table 19. Ankle. Total replacement. Percent distribution of hospital discharges by patient gender and age group. 2021 and 2022

	Total replacement	
	2021	2022
	%	%
Gender		
Male	56.4	58.9
Female	43.6	41.1
Age (male)		
Mean age	55.6	57.7
Standard deviation	14.2	13.1
Age group		
0-19	0.9	0.7
20-39	12.8	8.4
40-49	18.0	16.9
50-59	28.1	25.6
60-69	22.9	27.9
70-79	15.8	18.5
80+	1.5	2.1
Age (female)		
Mean age	56.3	58.4
Standard deviation	15.3	12.9
Age group		
0-19	1.7	0.7
20-39	12.3	6.6
40-49	12.6	13.7
50-59	28.0	29.7
60-69	25.2	29.7
70-79	16.5	16.2
80+	3.6	3.4

Table 20. Ankle. Total replacement. Percent distribution of hospital discharges by discharge type. 2021 and 2022

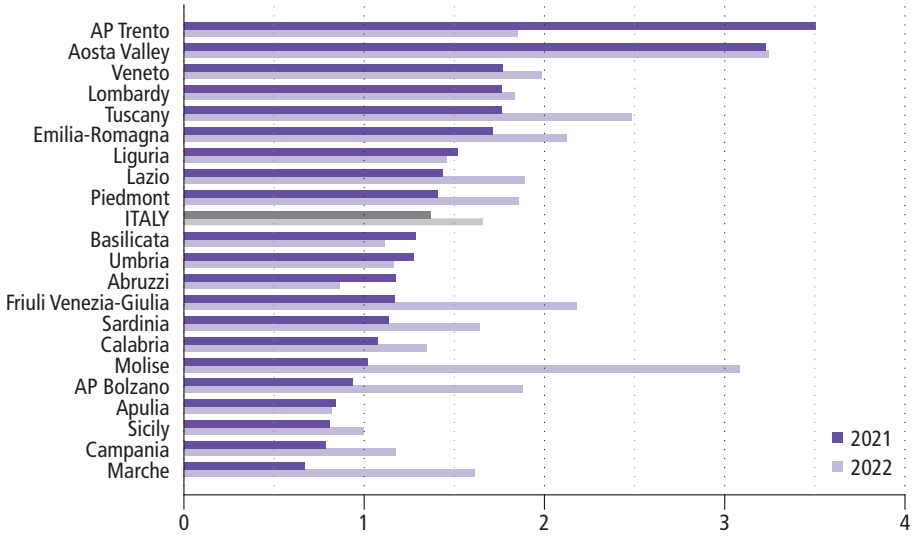
Discharge type	Total replacement	
	2021	2022
	%	%
Deceased	0.0	0.0
Ordinary discharge	98.3	98.8
Discharge to a Residential Care Facility	0.0	0.1
Discharge with home health services	0.0	0.0
Discharge against medical advice	0.2	0.0
Transfer to an acute admission unit of a different hospital	0.0	0.2
Transfer in the same hospital	0.7	0.4
Transfer to an inpatient rehabilitation facility	0.7	0.5
Discharge with integrated home care	0.0	0.0

Figure 19. Ankle. Total replacement. Incidence rate by region (per 100,000 residents). 2021 and 2022



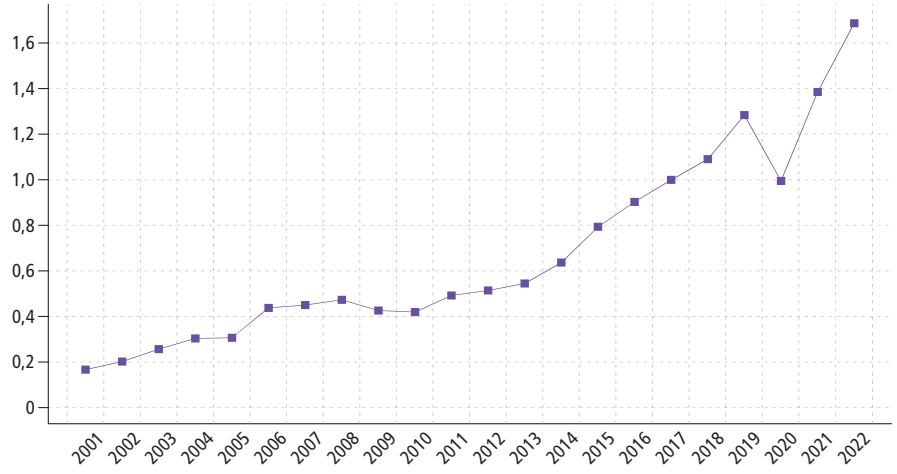
All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 20. Ankle. Total replacement. Hospitalisation rate by region (per 100,000 residents). 2021 and 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 21. Ankle. Total replacement. National incidence/hospitalisation rate by region (per 100,000 residents). From 2001 to 2022



All procedures registered in HDR either in the "principal" or in the "secondary" fields

Figure 1. RIAP *coverage* (a) and *completeness* (b) in relation to the total national territory. From 2007 to 2022

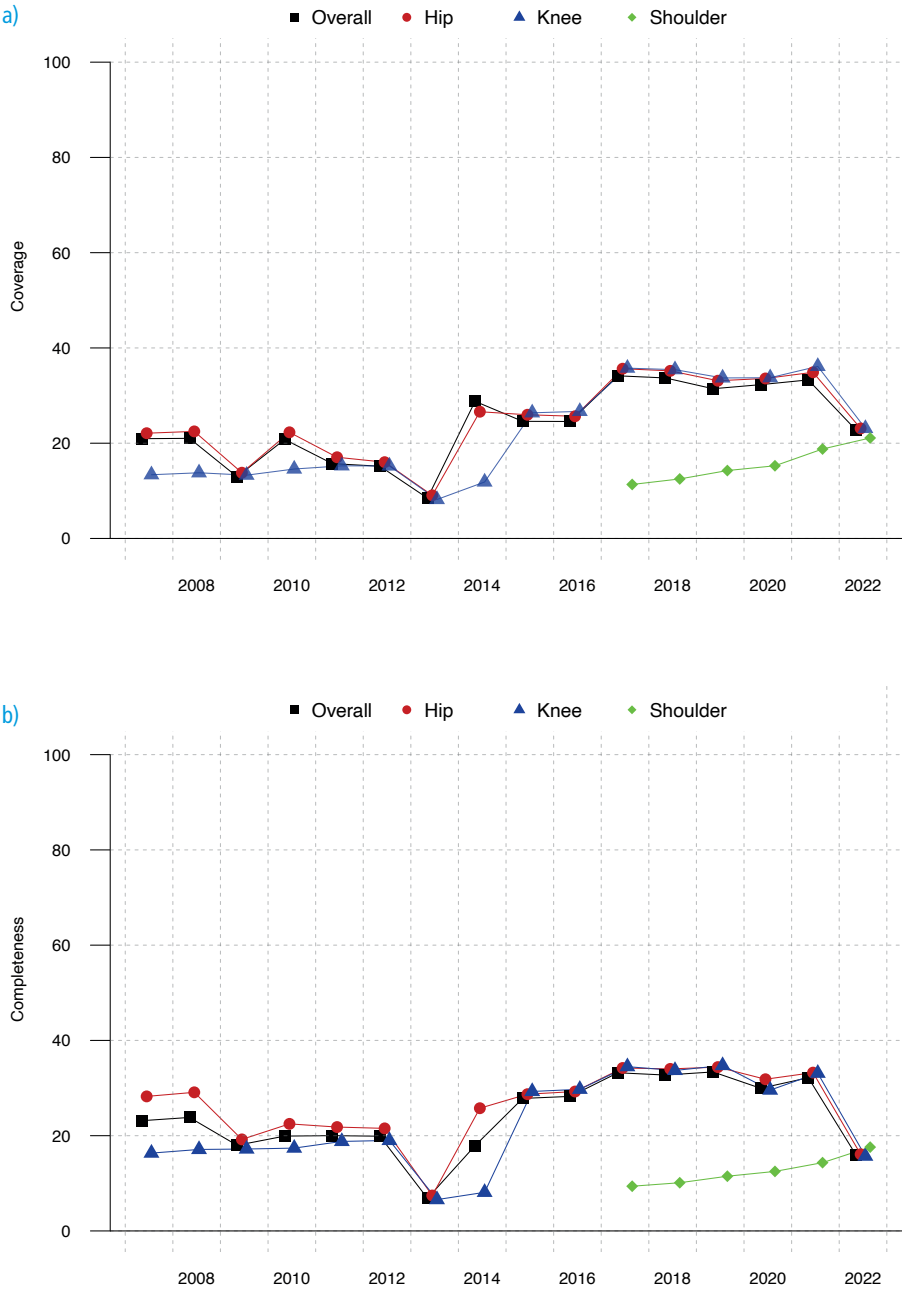
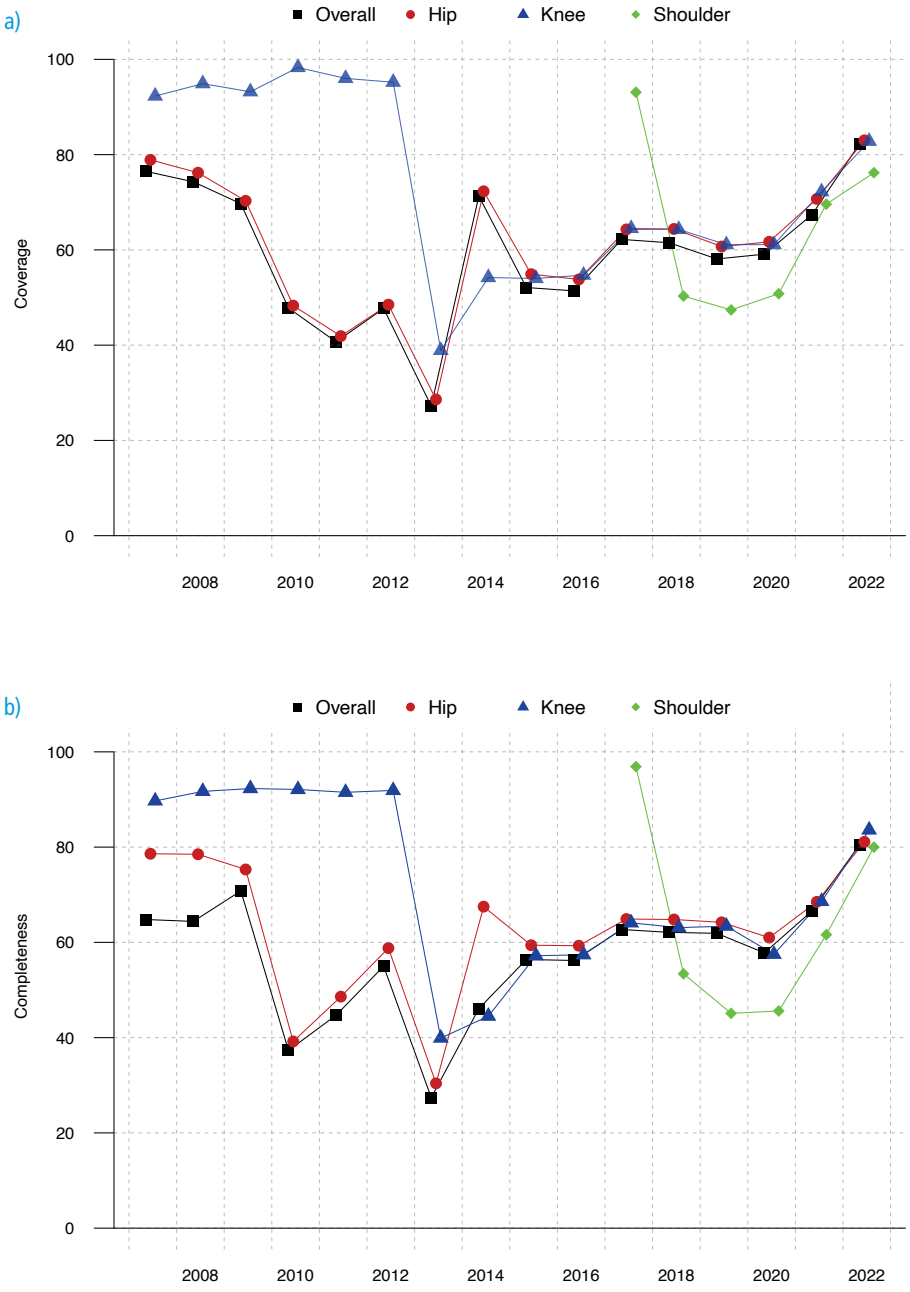
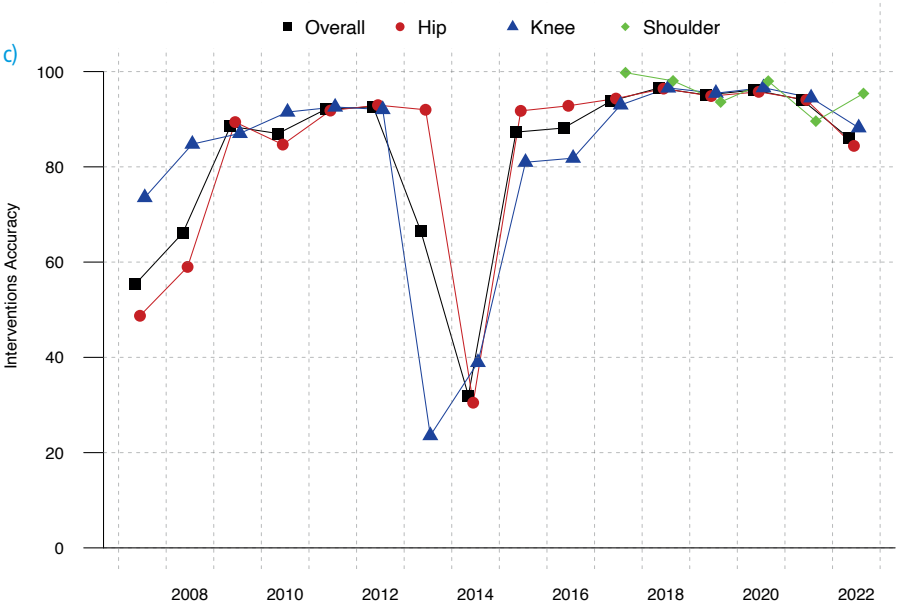


Figure 2. *Coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d) of the institutions participating in RIAP in relation to the areas covered. From 2007 to 2022



c)


Overall
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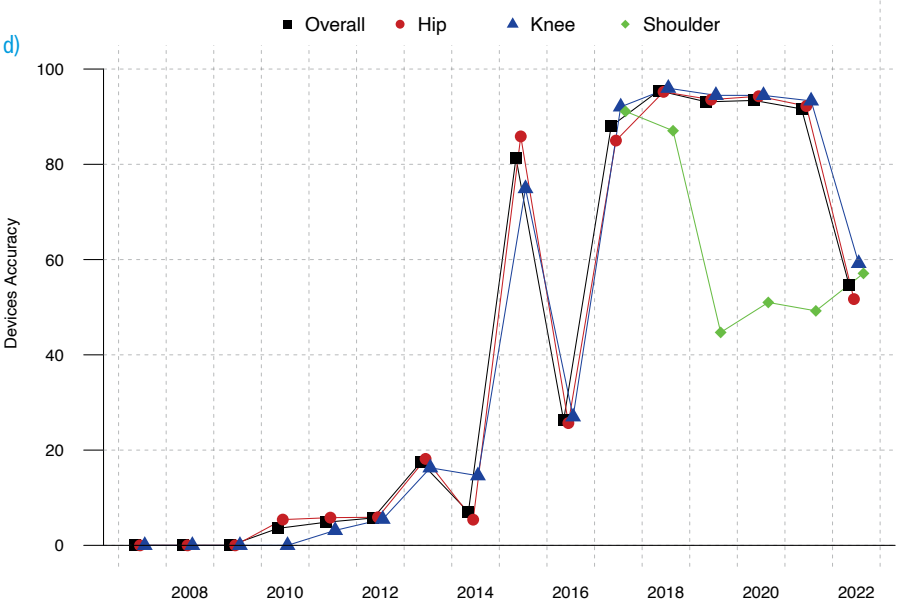
d)


Overall
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Devices Accuracy
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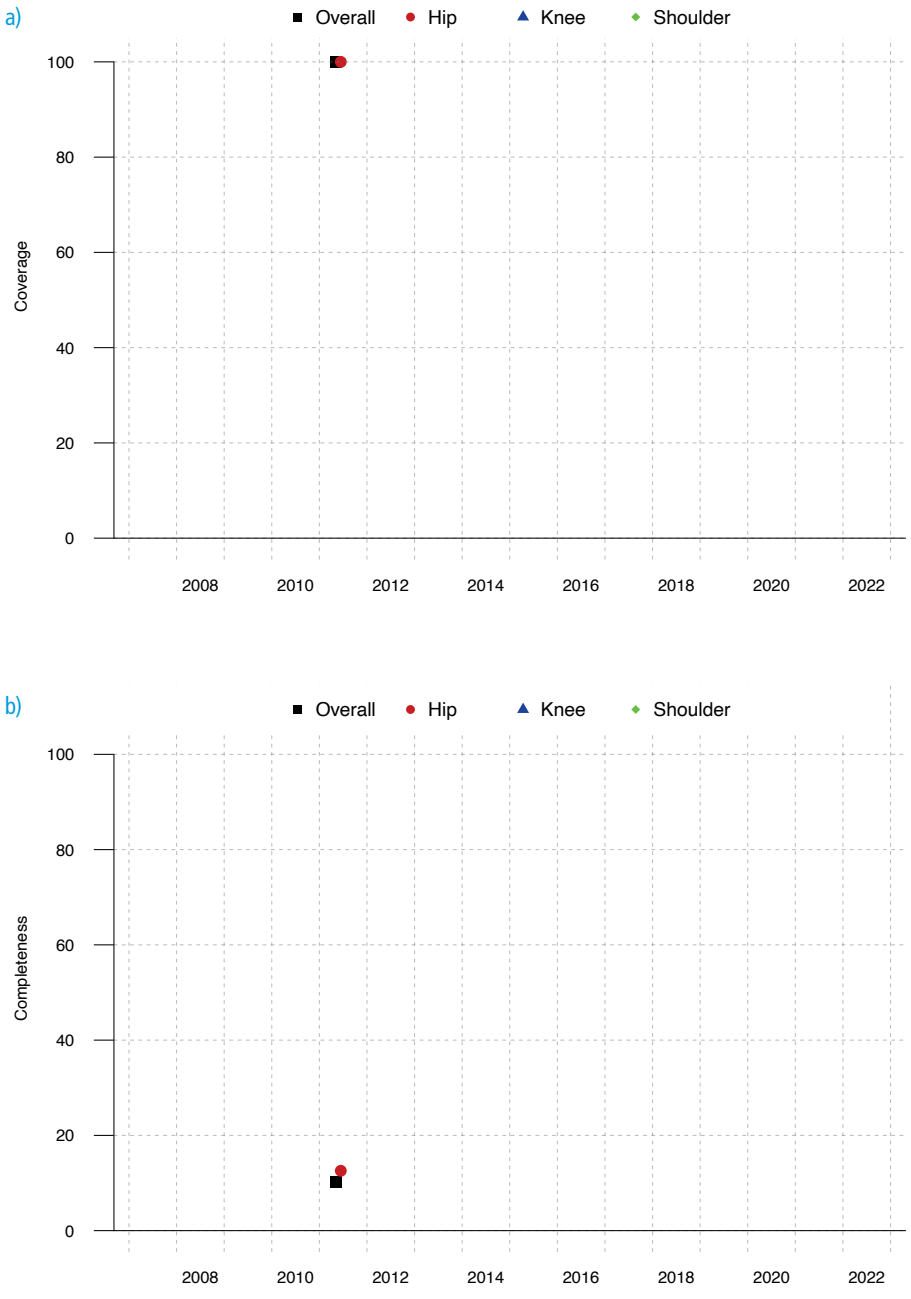
Figure 3. Aosta Valley. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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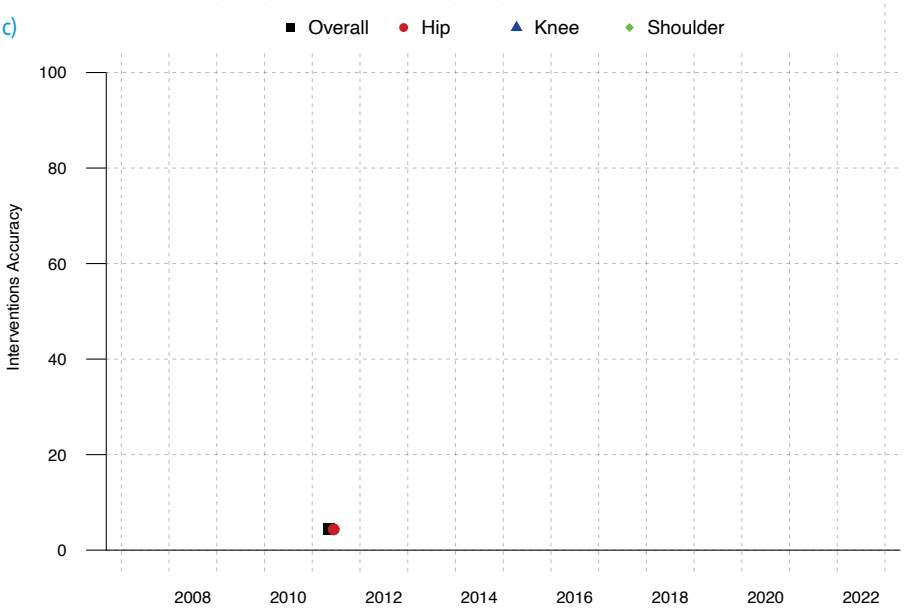
Overall
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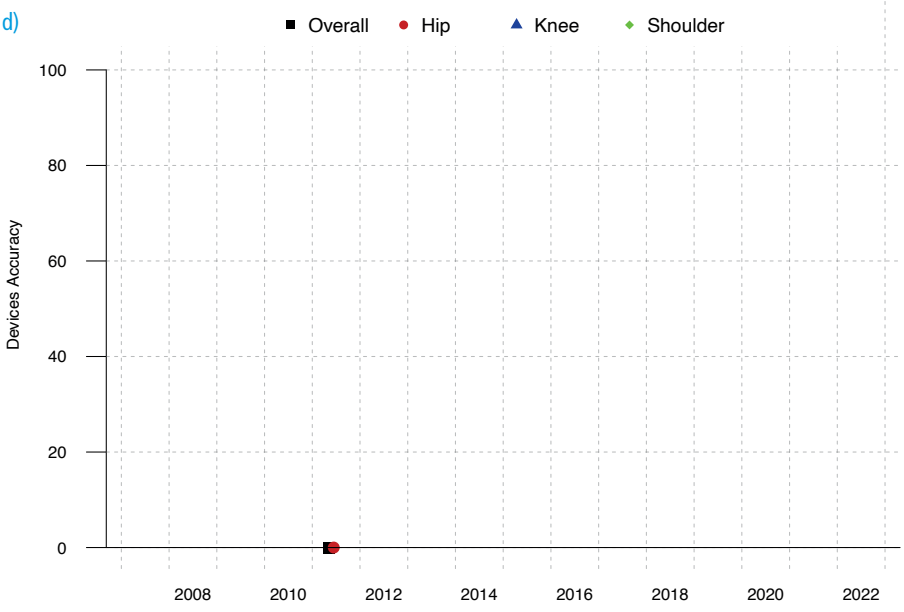
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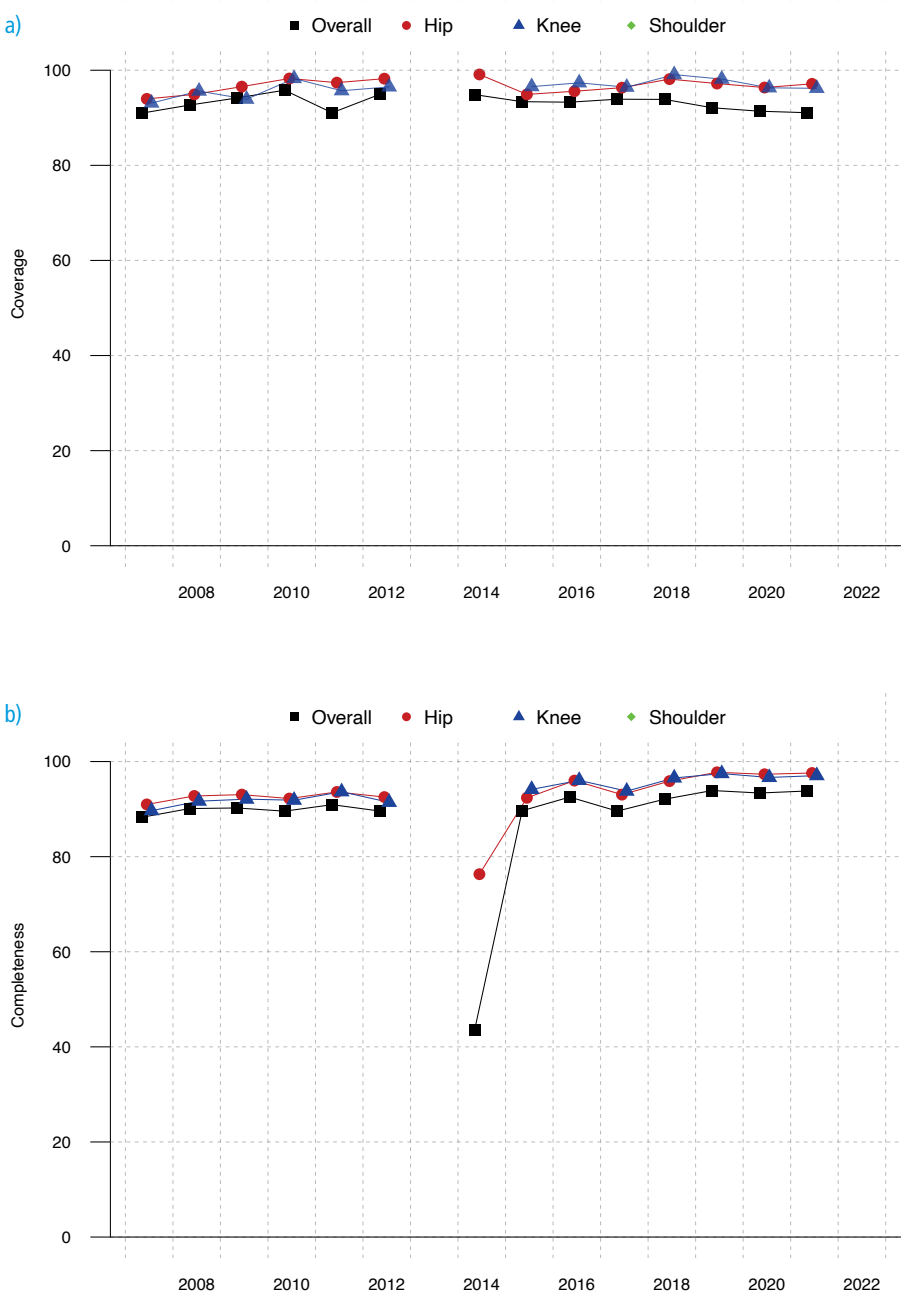
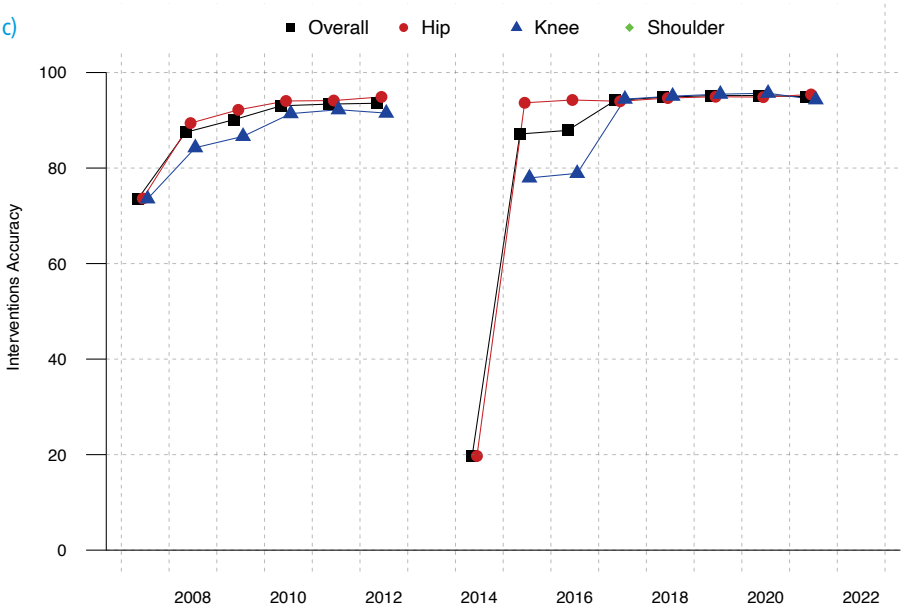
Figure 4. Lombardy. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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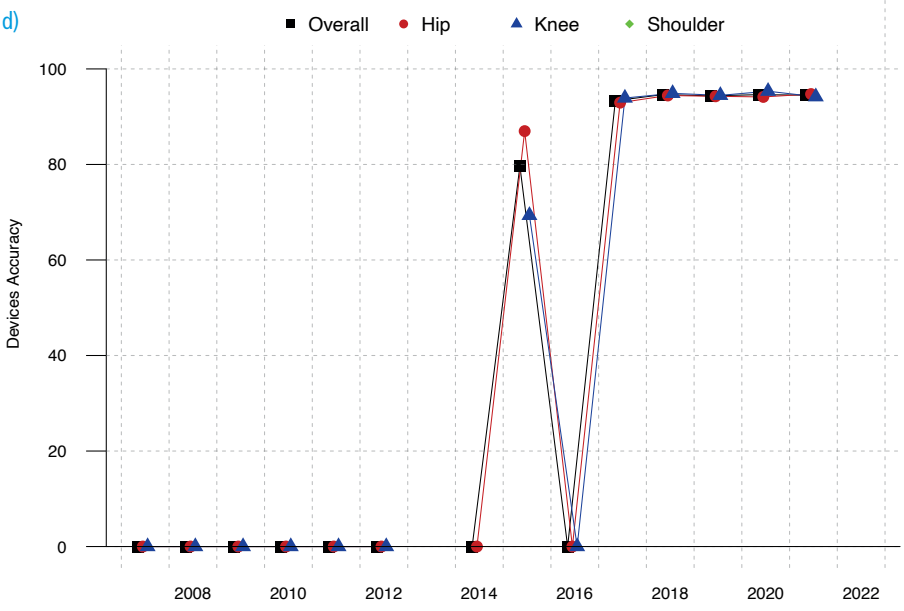
Overall
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Devices Accuracy
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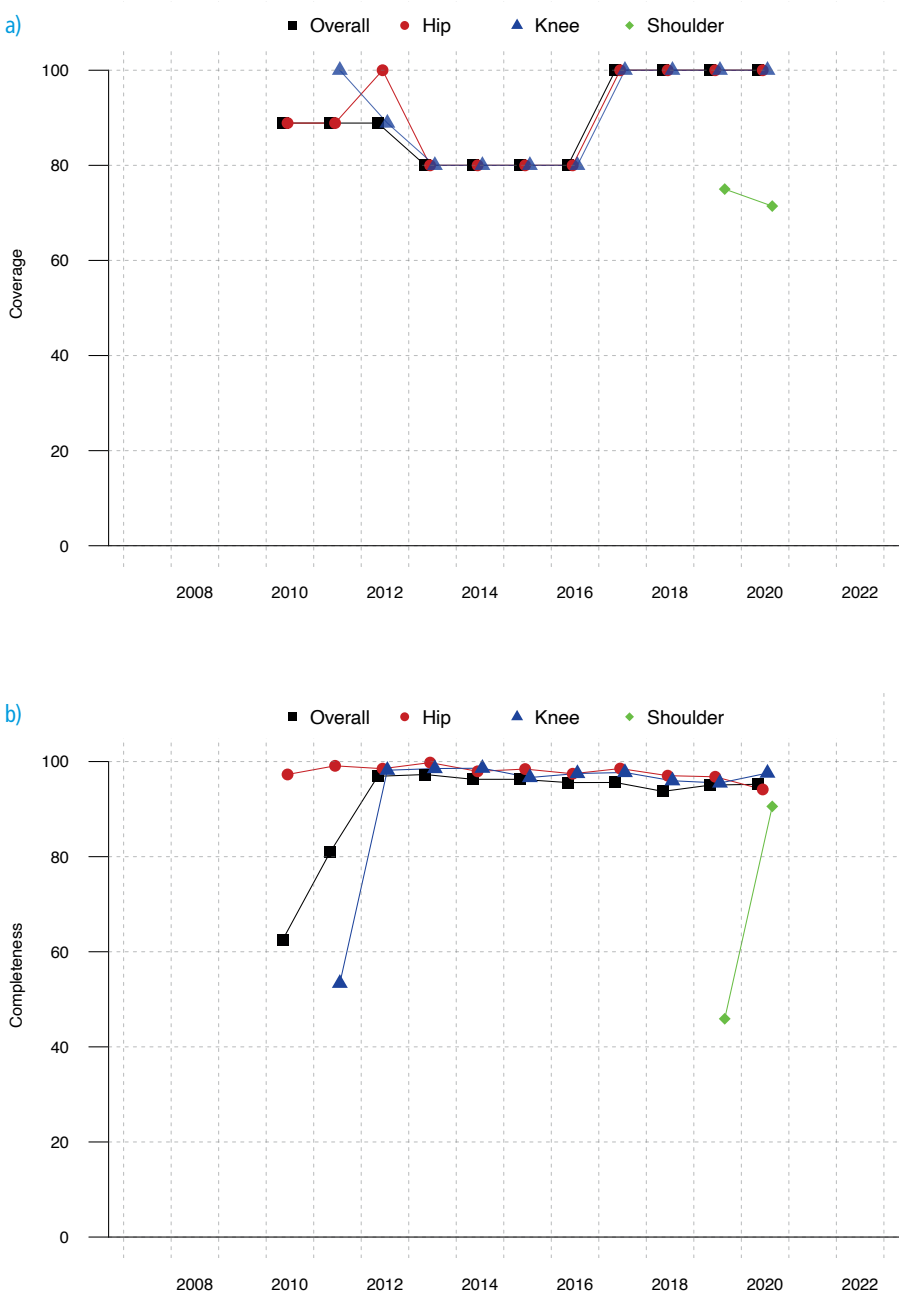
Figure 5. Autonomous Province of Bolzano. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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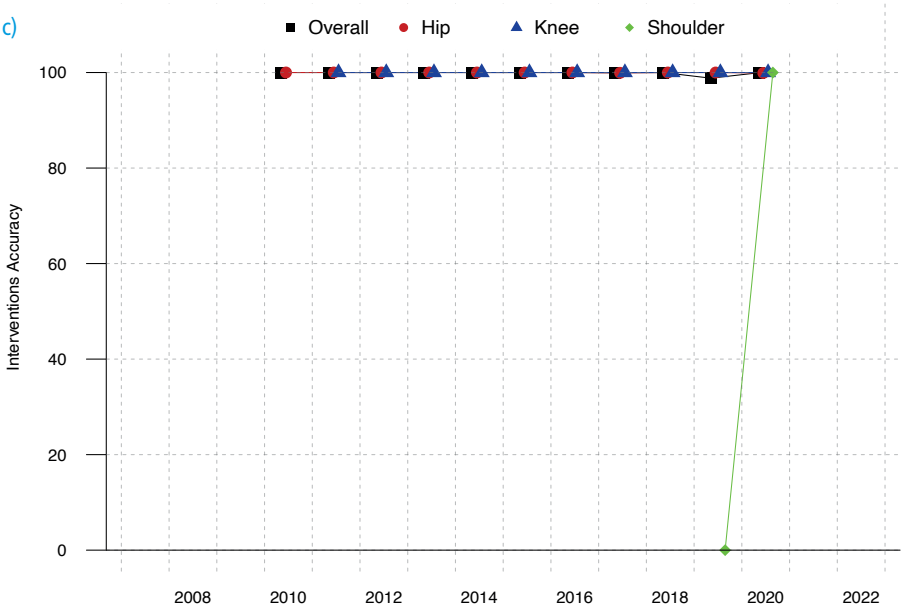
Overall
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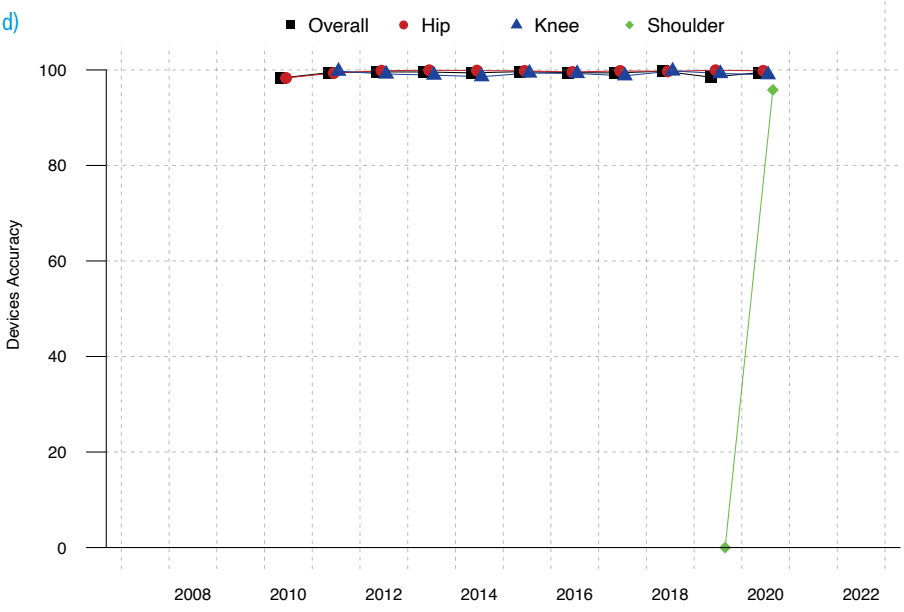
Overall
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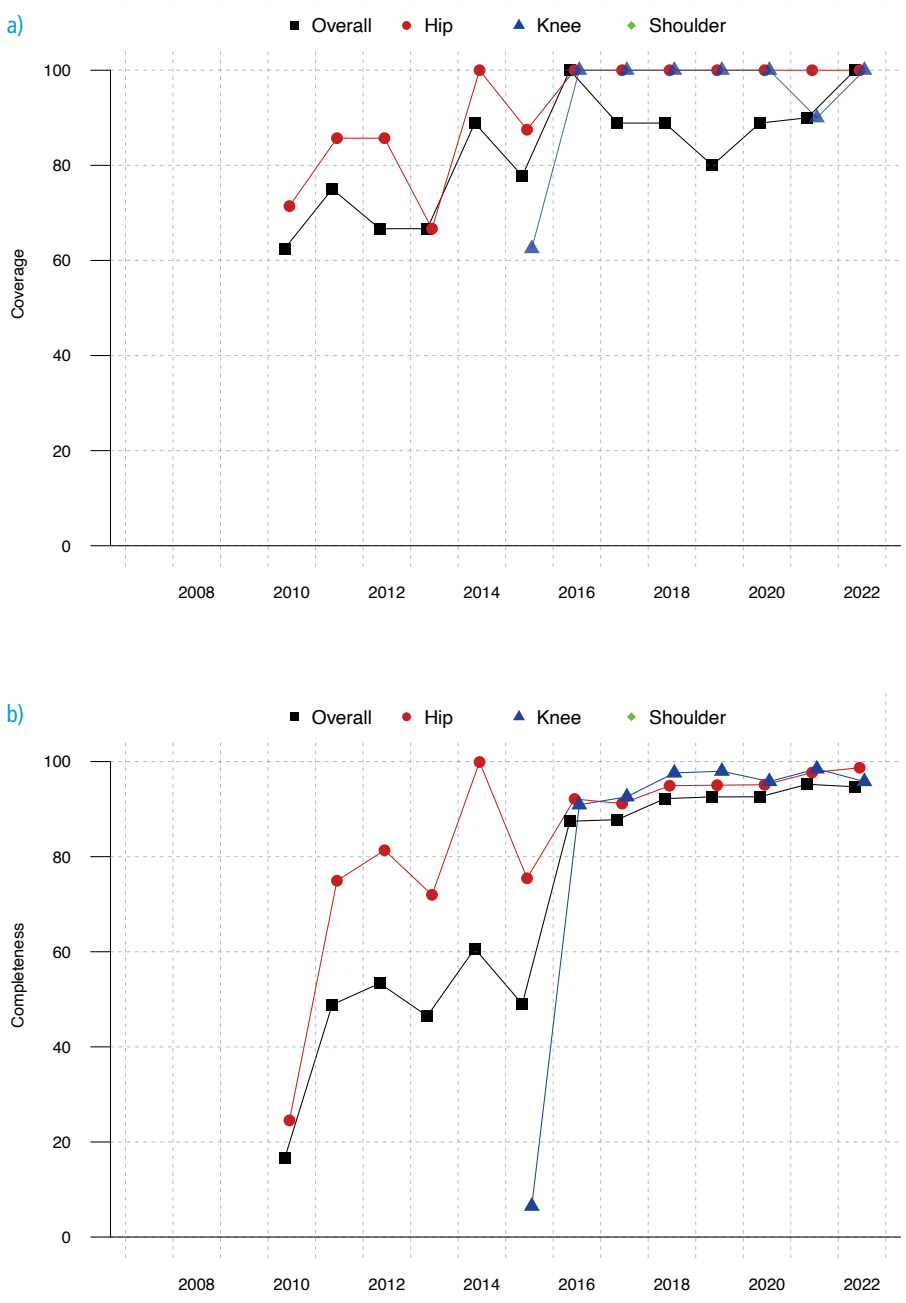
Figure 6. Autonomous Province of Trento. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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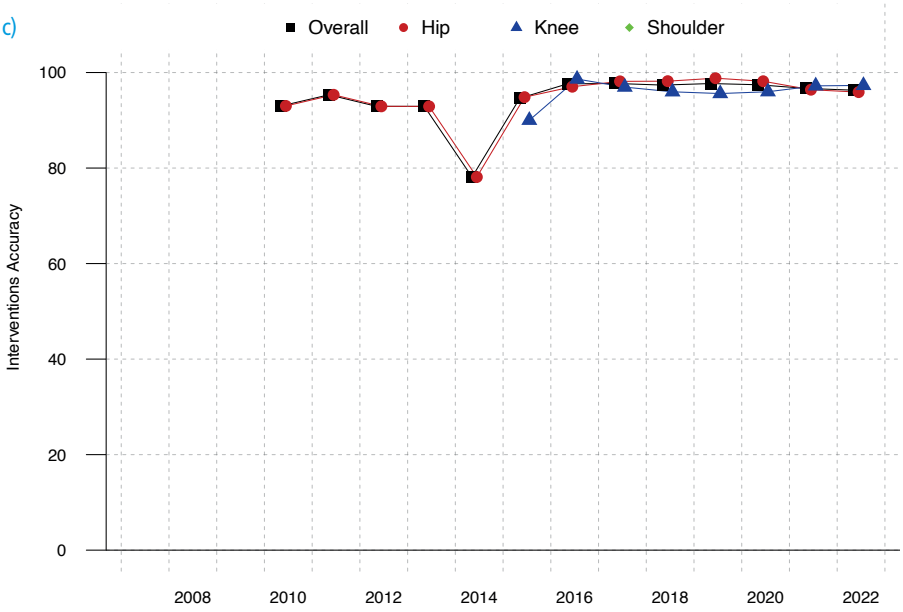
Overall
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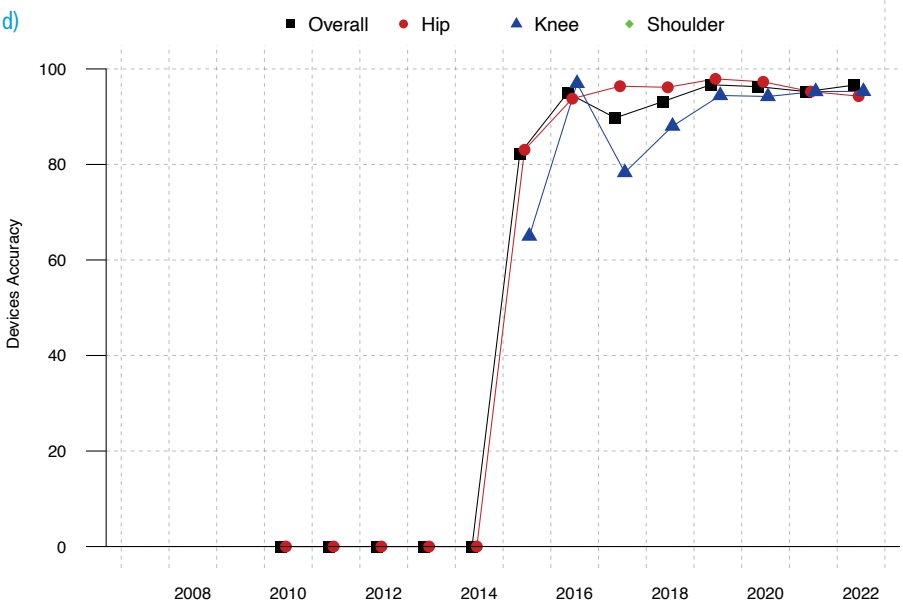
Overall
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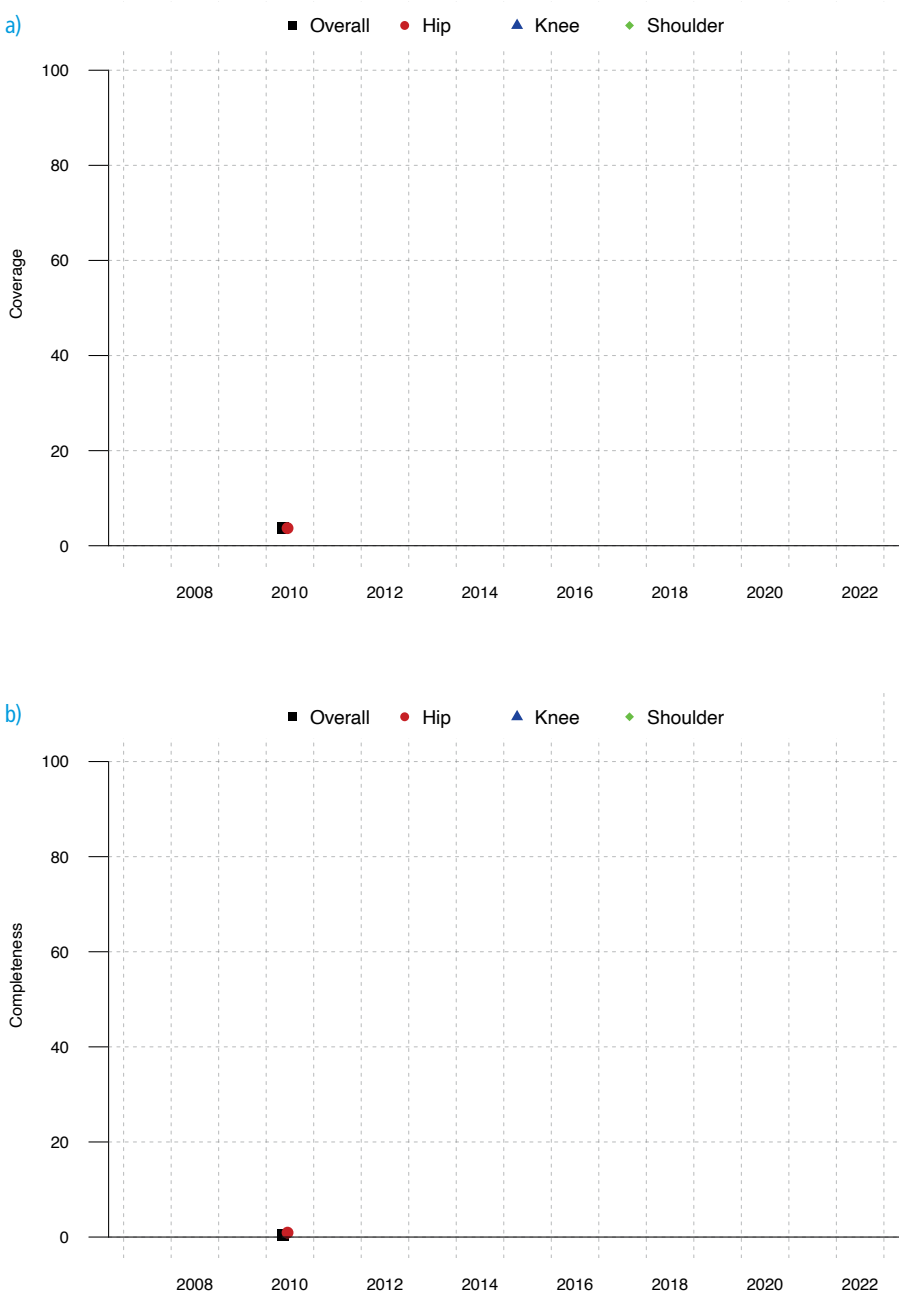
Figure 7. Veneto. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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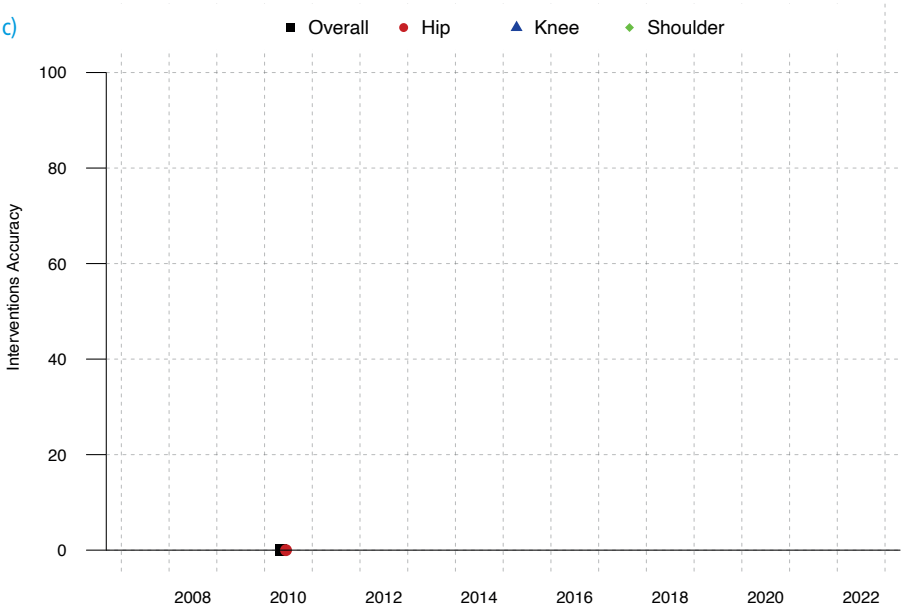
Overall
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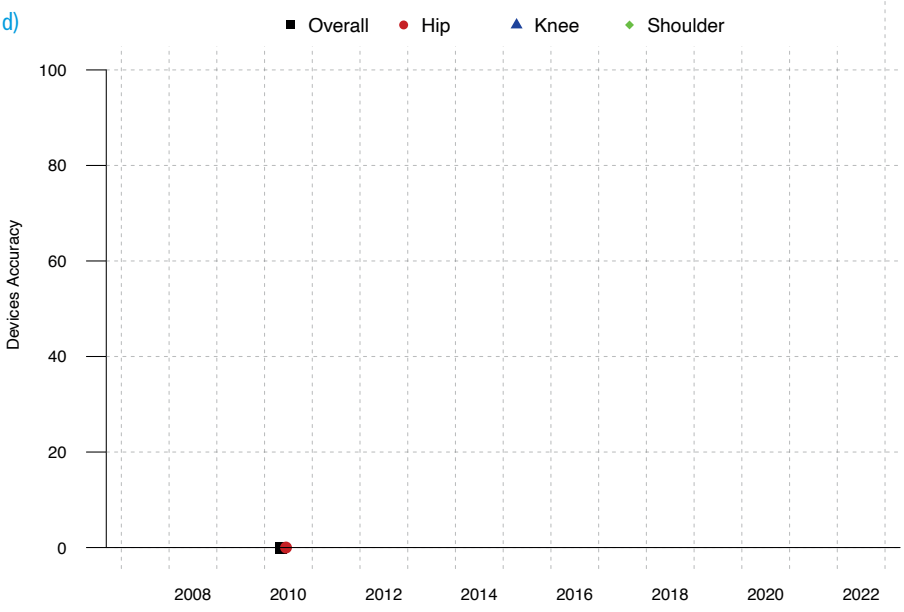
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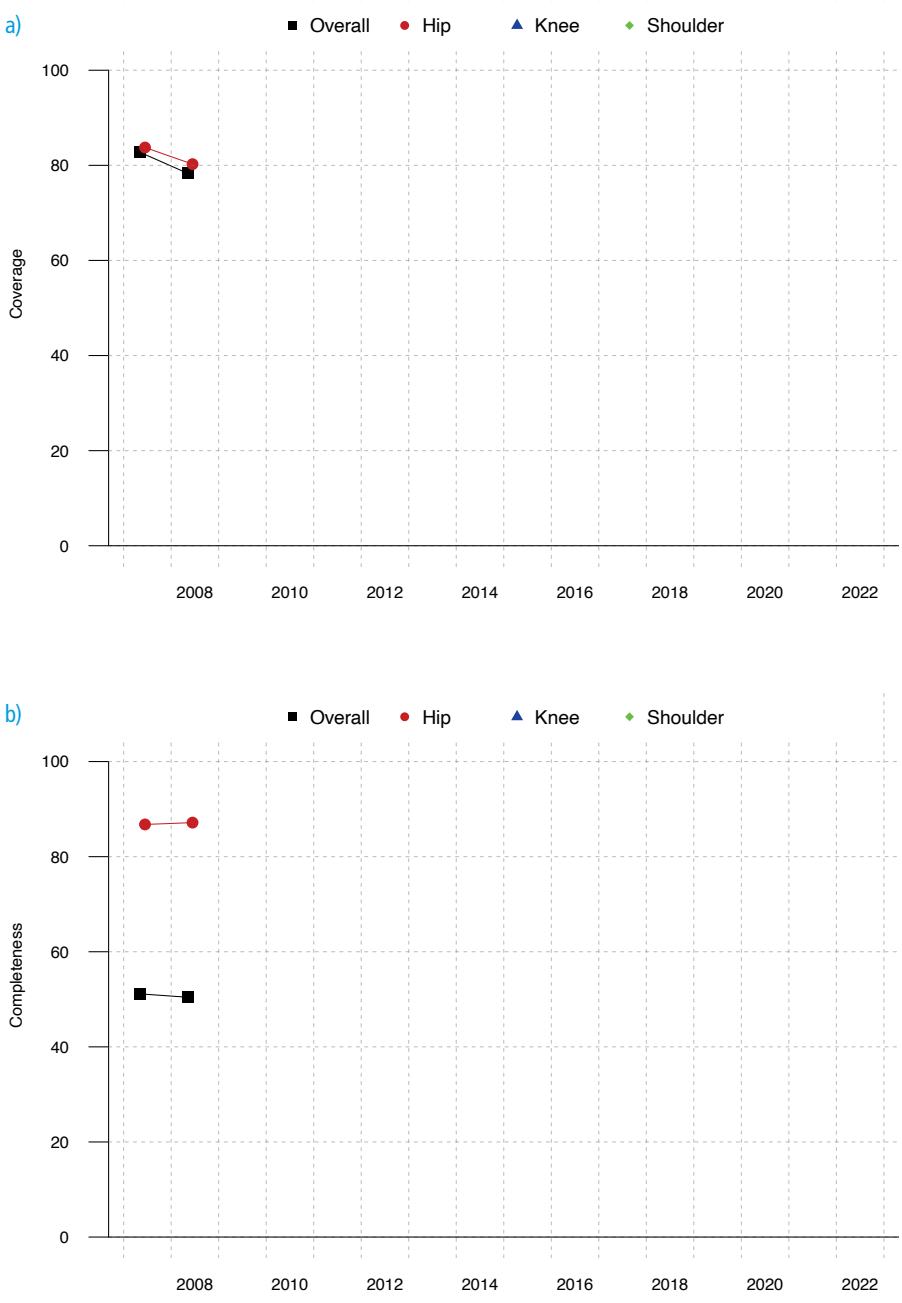
Figure 8. Emilia-Romagna. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d) From 2007 to 2022



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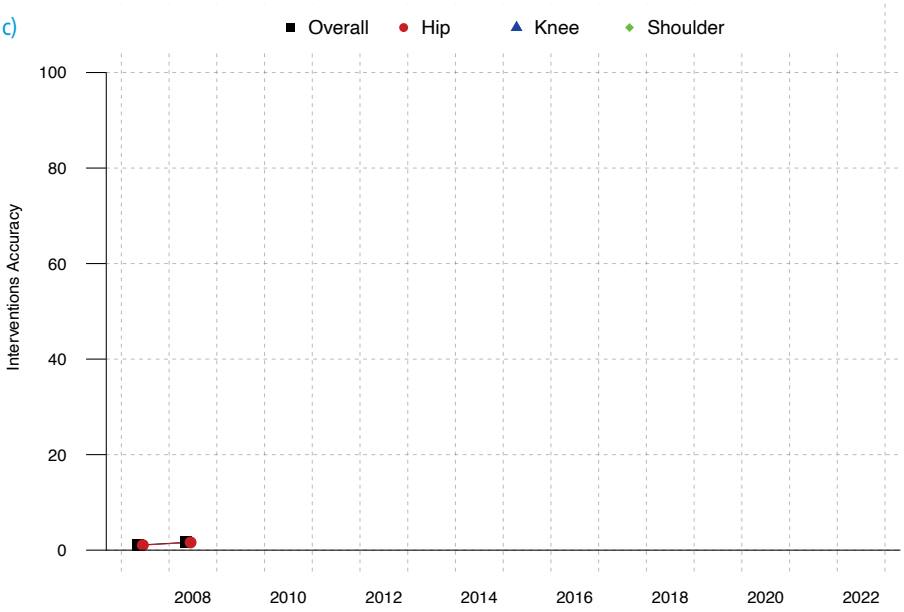
Overall
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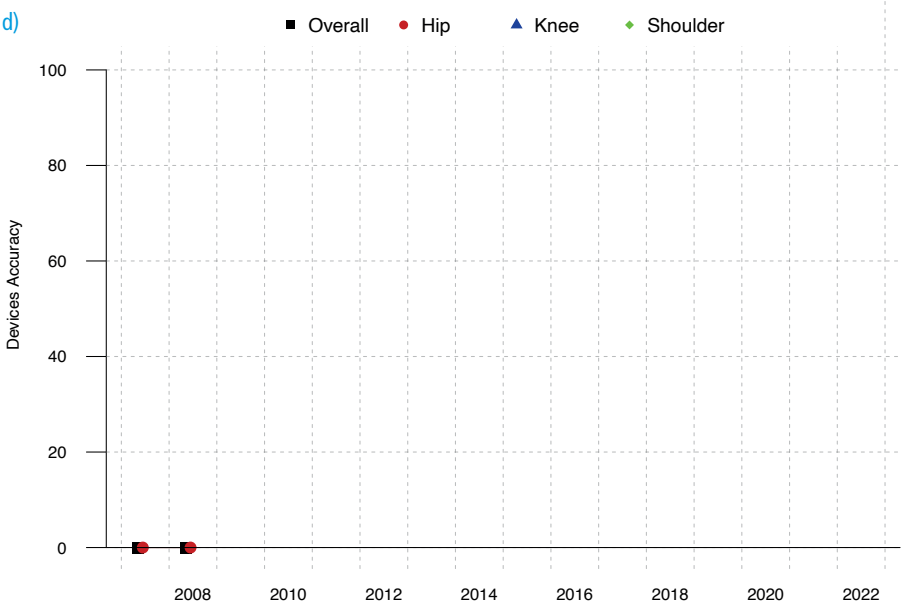
Overall
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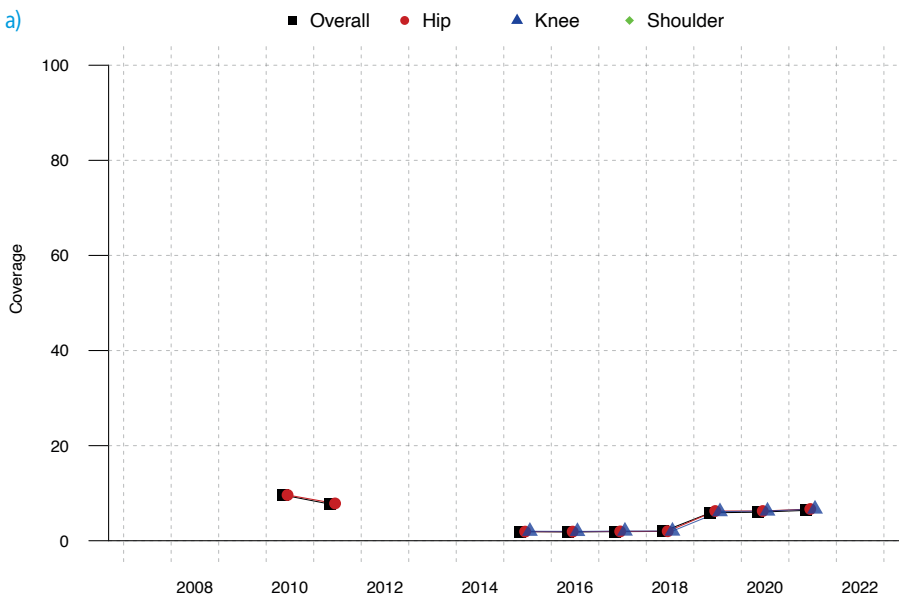
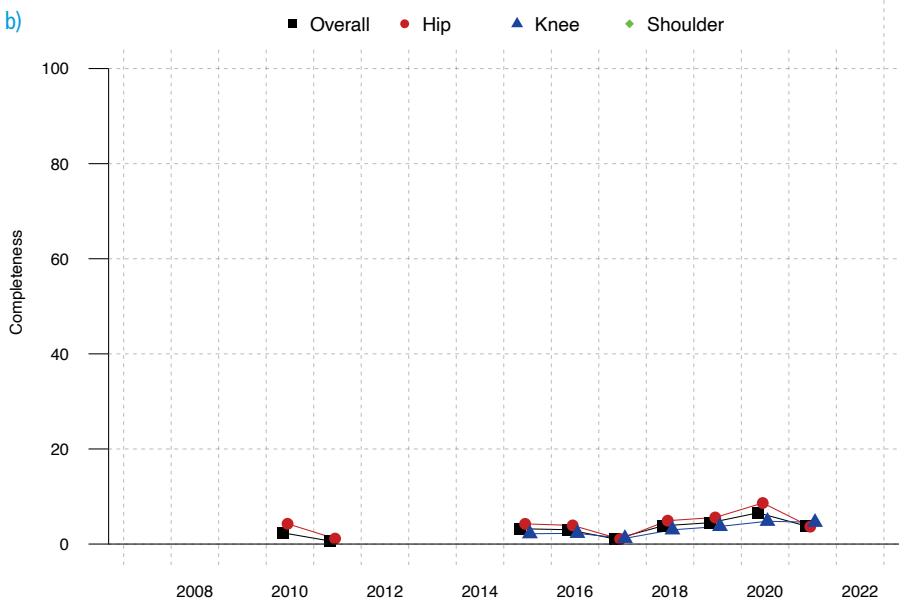
Figure 9. Tuscany. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022





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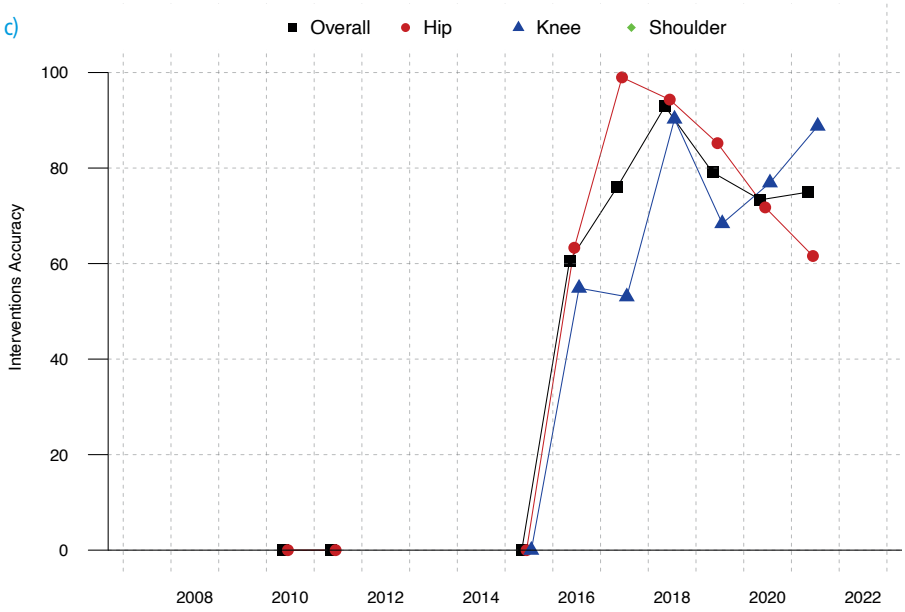
Overall
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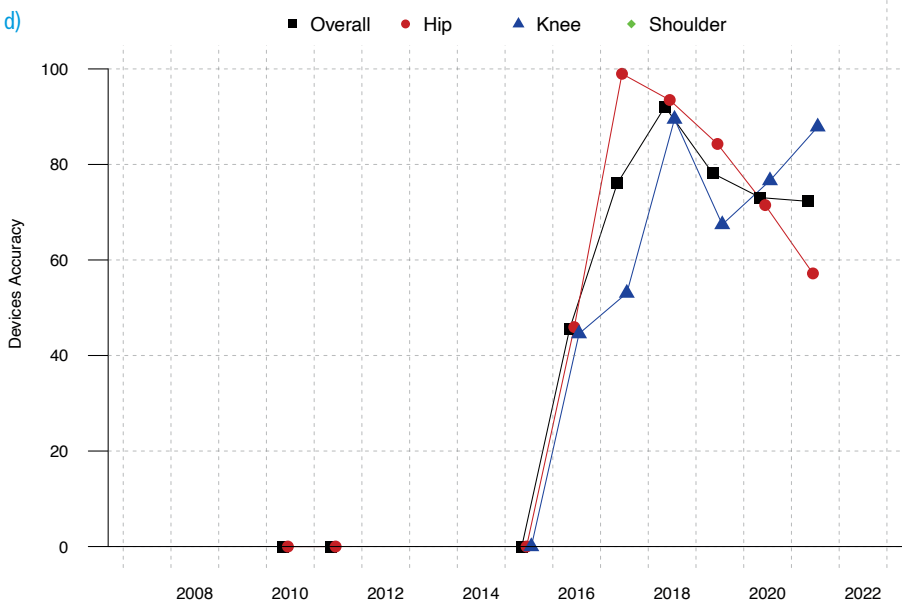
Overall
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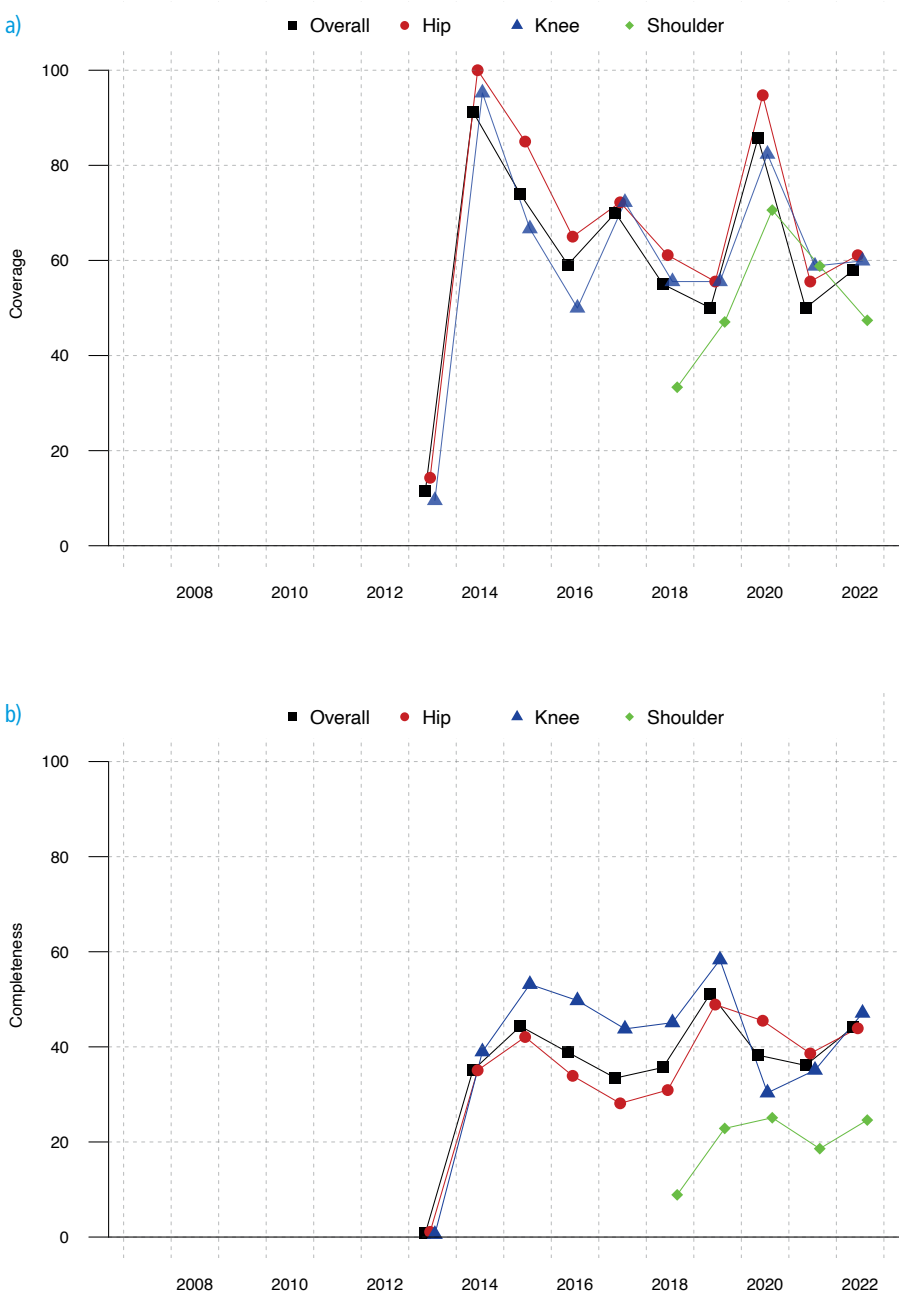
Figure 10. Marche. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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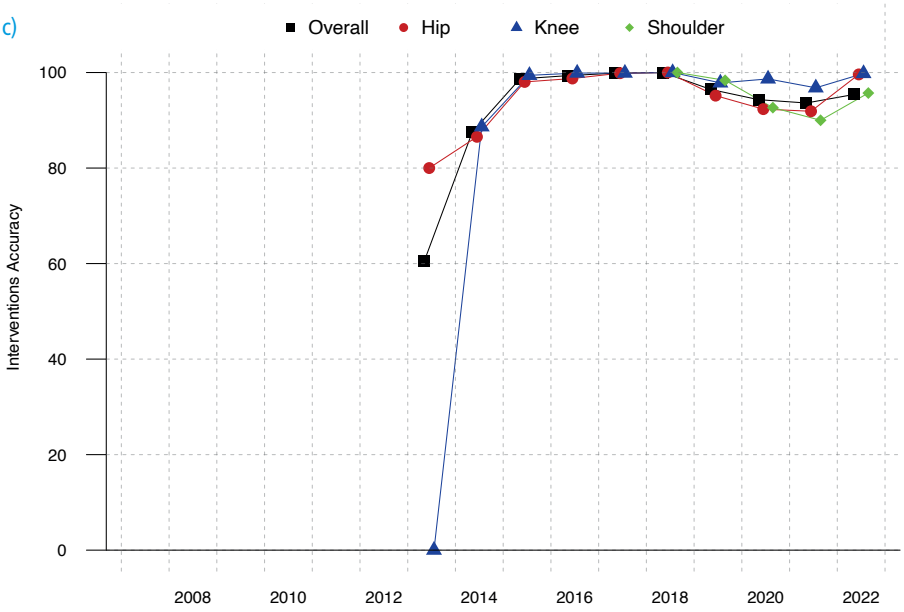
Overall
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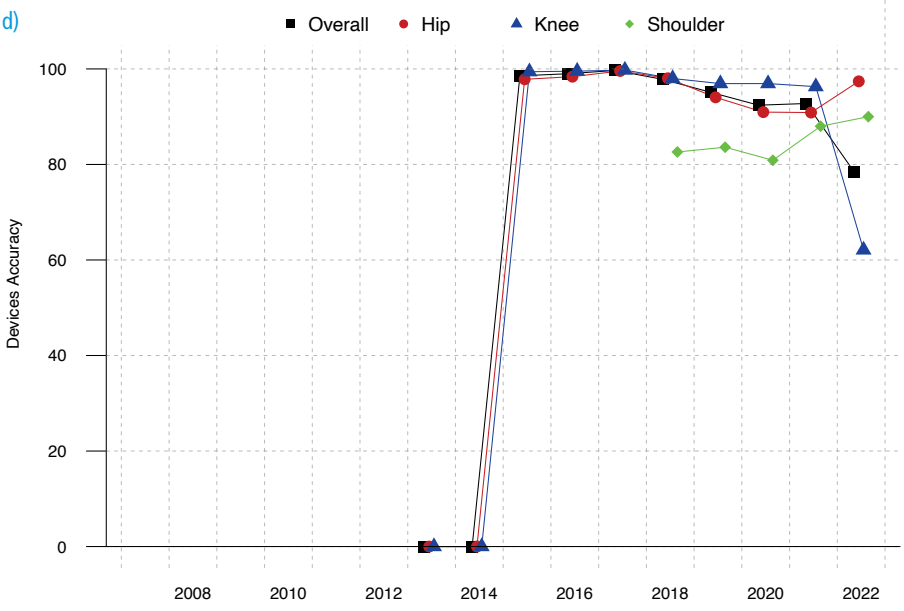
Overall
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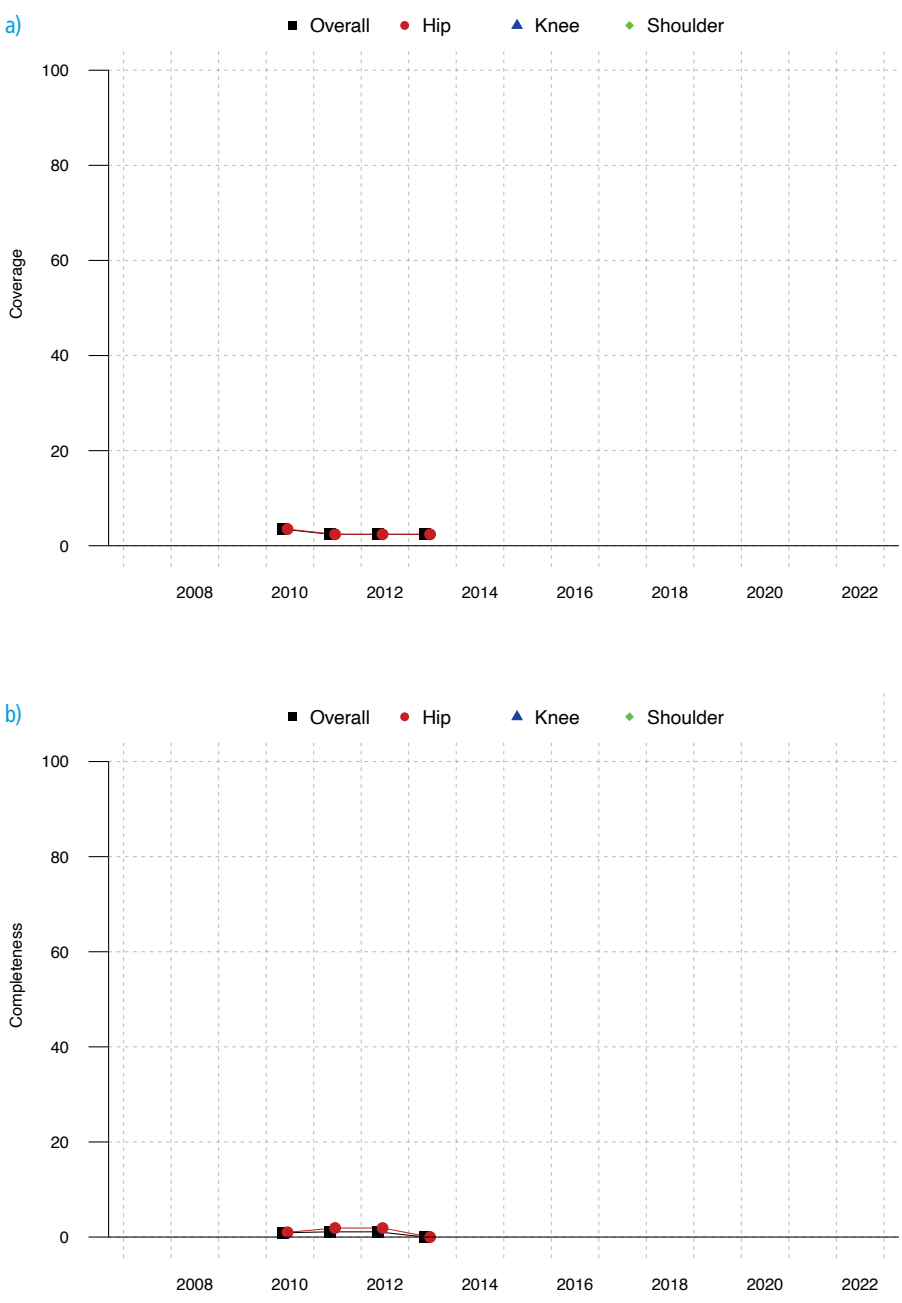
Figure 11. Lazio. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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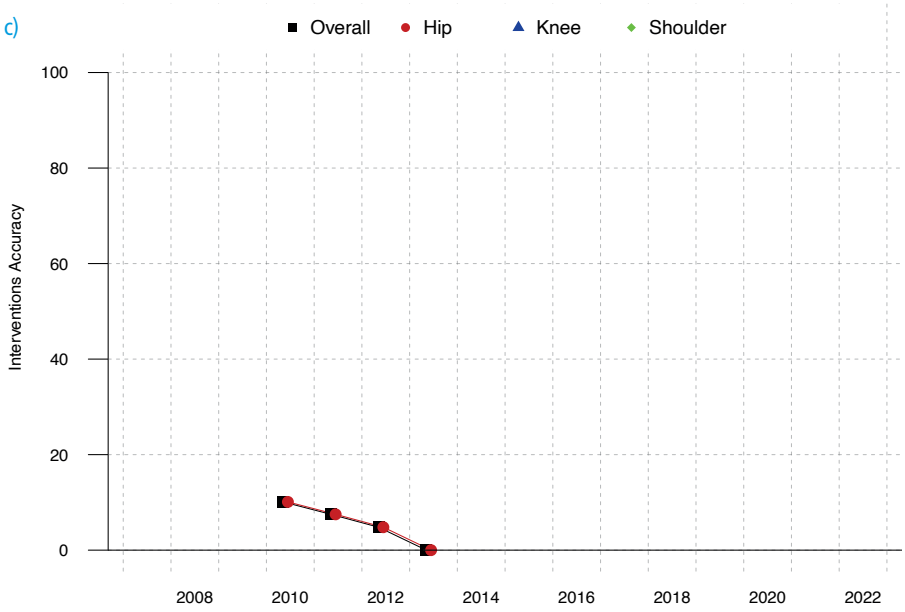
Overall
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Interventions Accuracy
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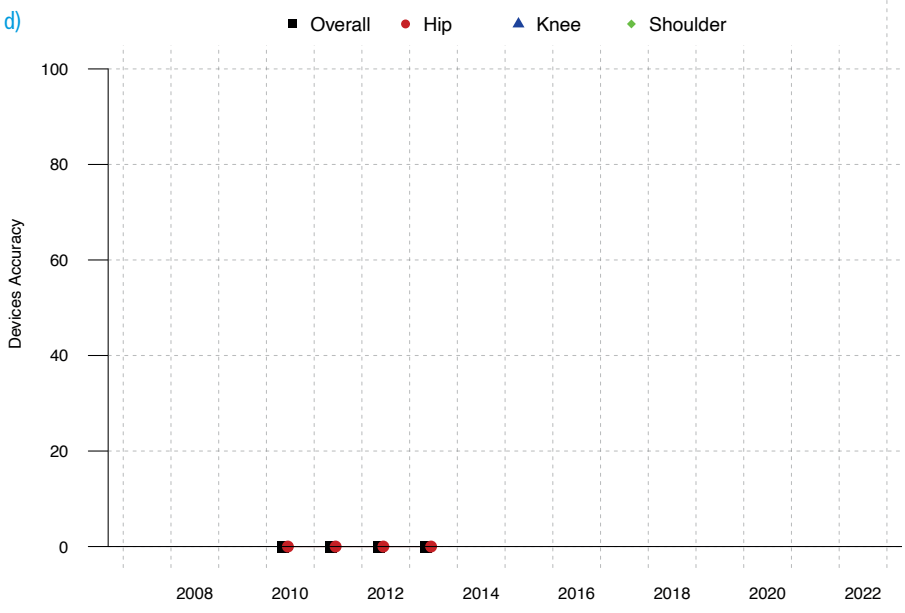
Overall
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Devices Accuracy
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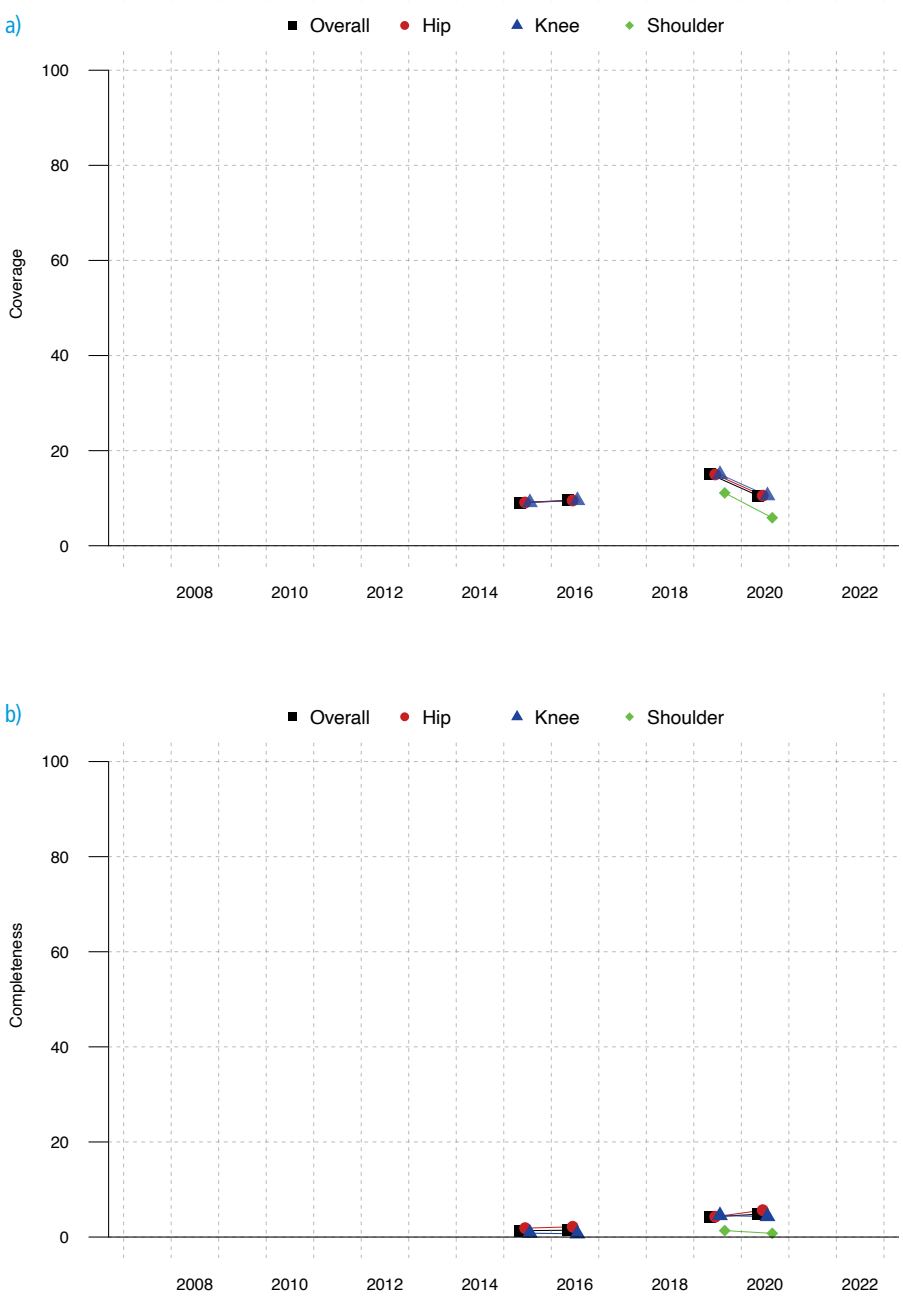
Figure 12. Abruzzi. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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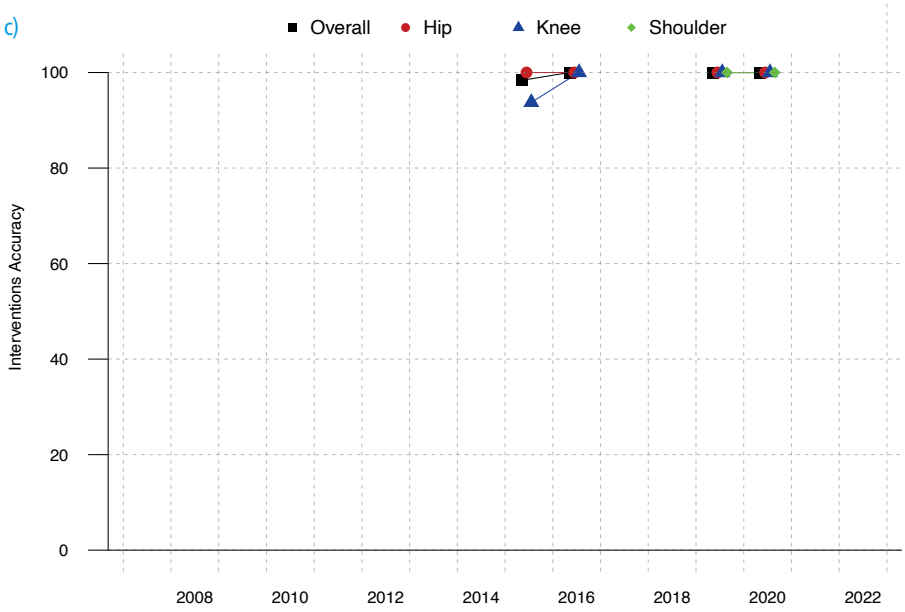
Overall
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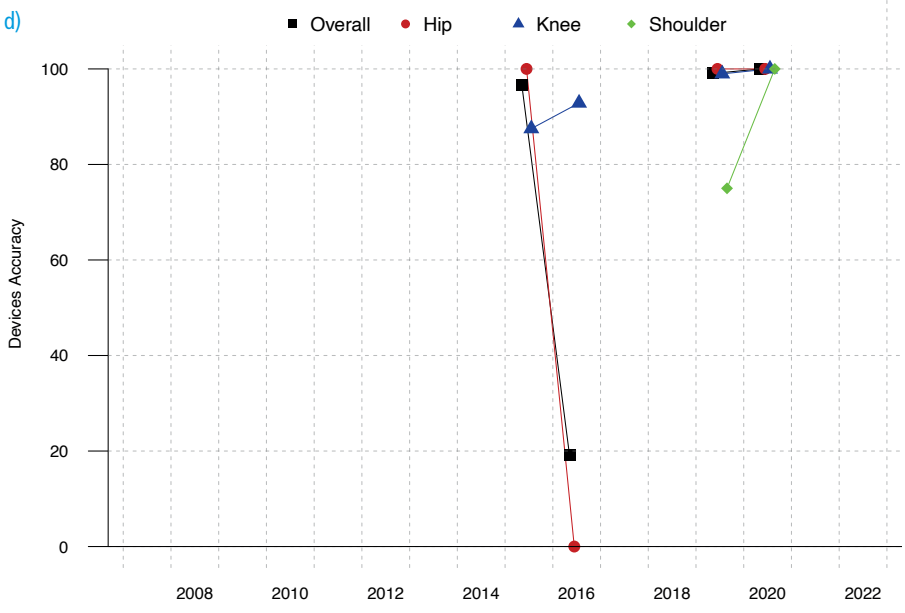
Overall
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Knee
Shoulder
Devices Accuracy
100
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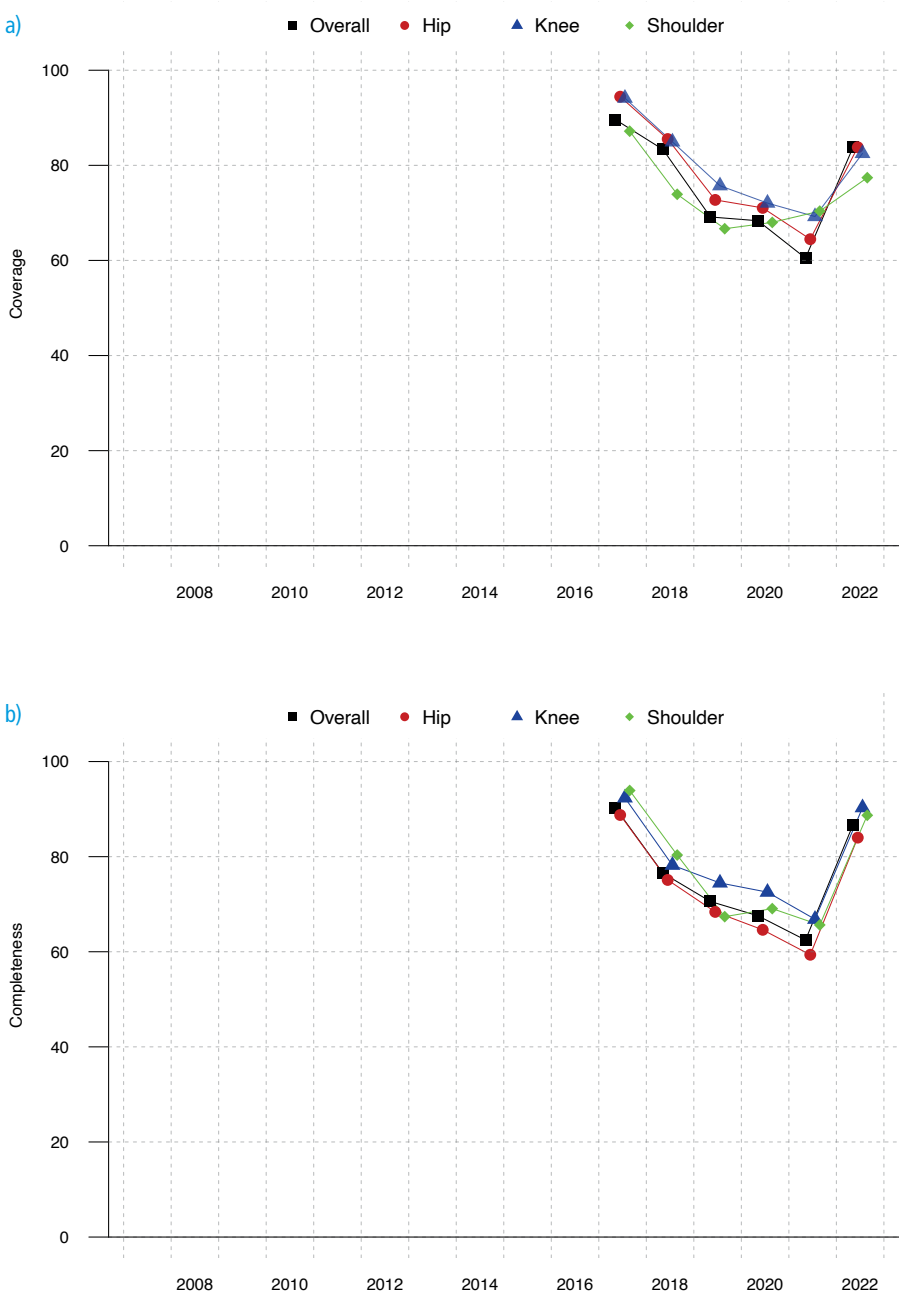
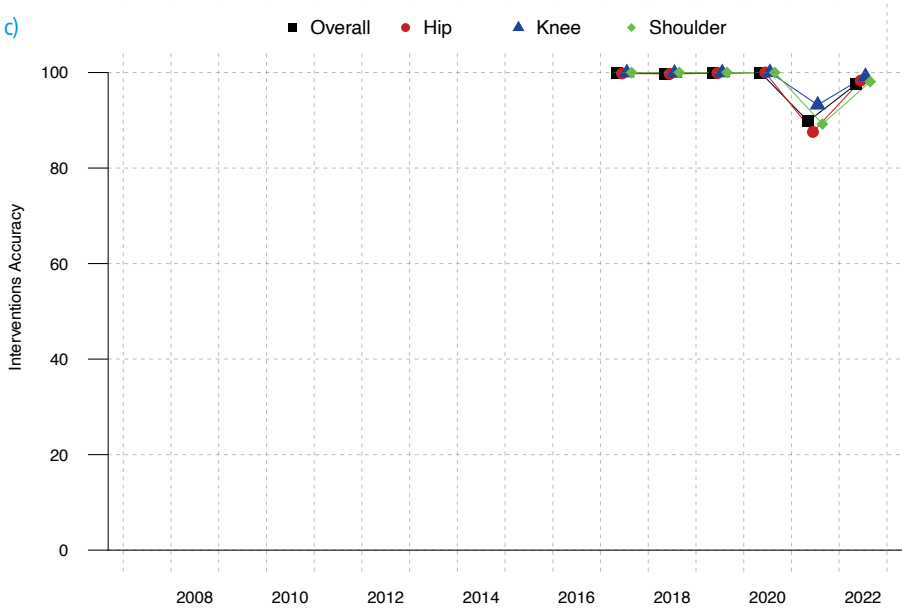
Figure 13. Campania. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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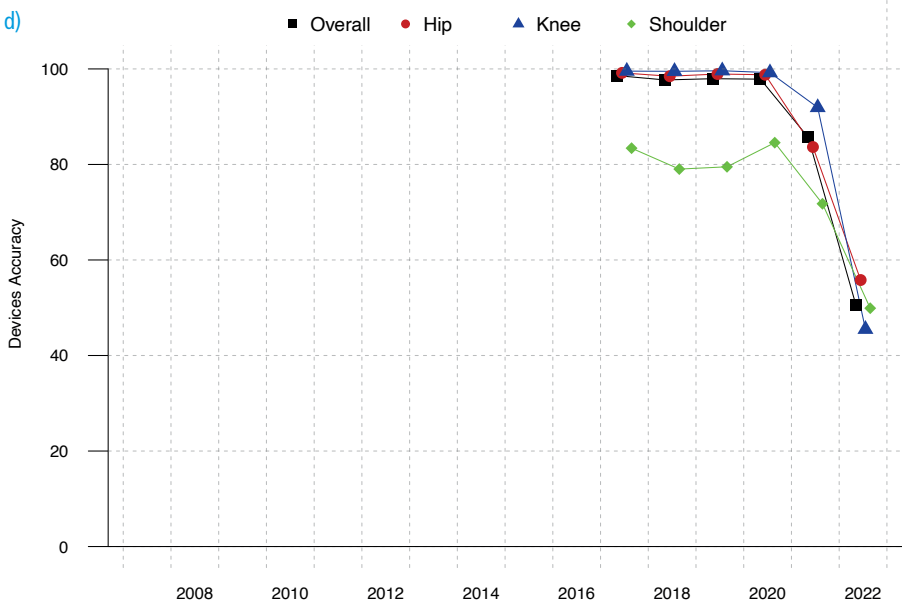
d)


Overall
Hip
Knee
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Devices Accuracy
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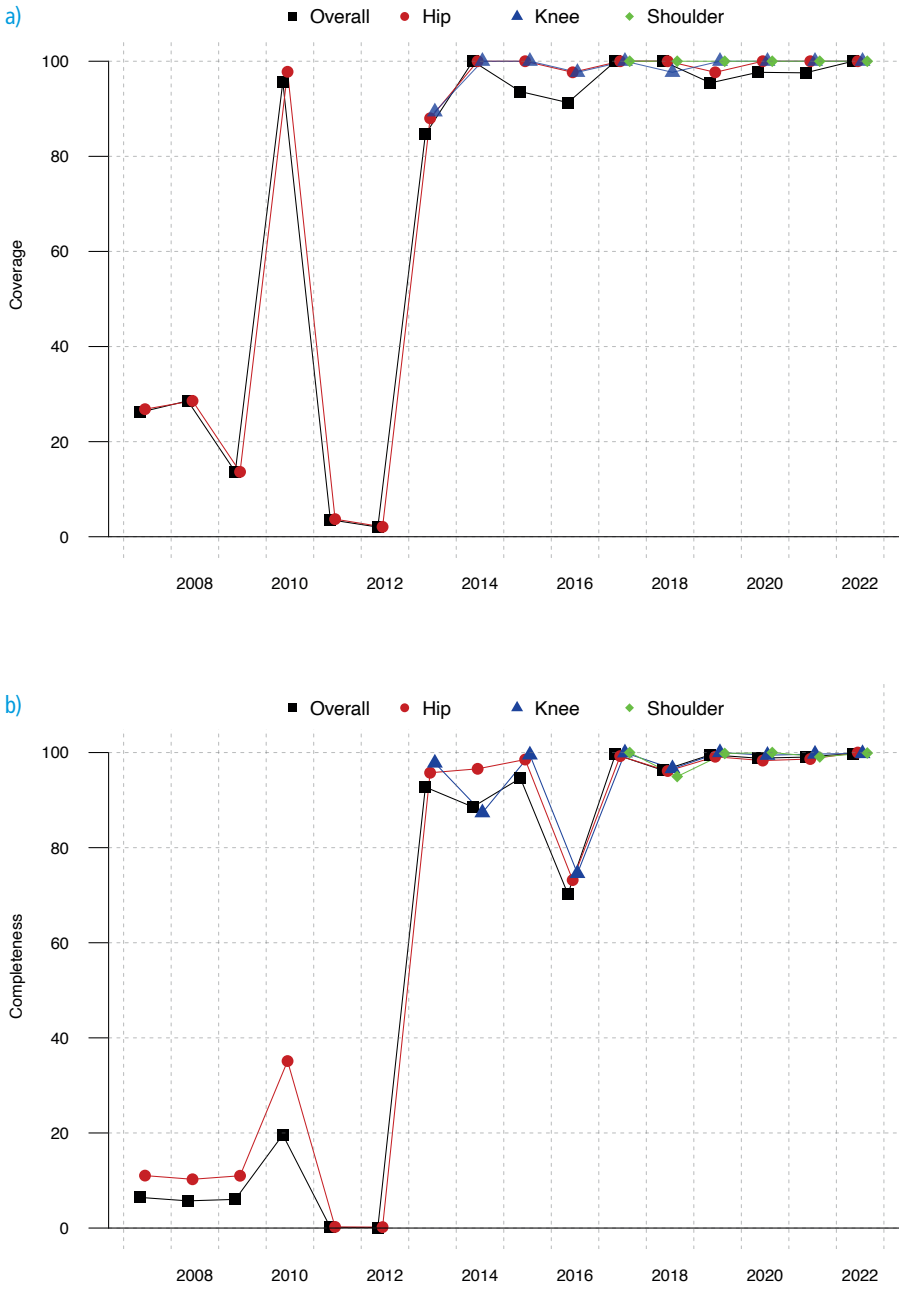
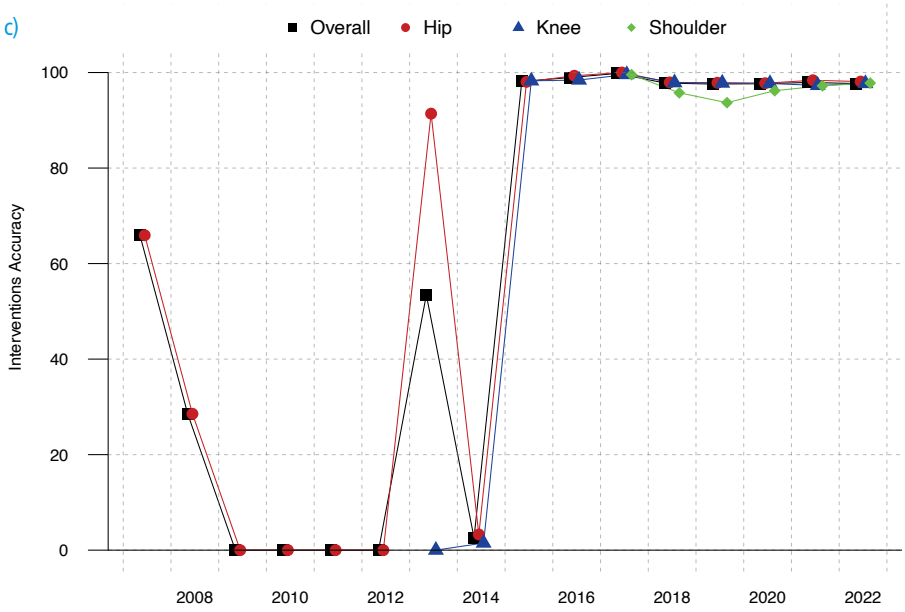
Figure 14. Apulia. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Knee
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Interventions Accuracy
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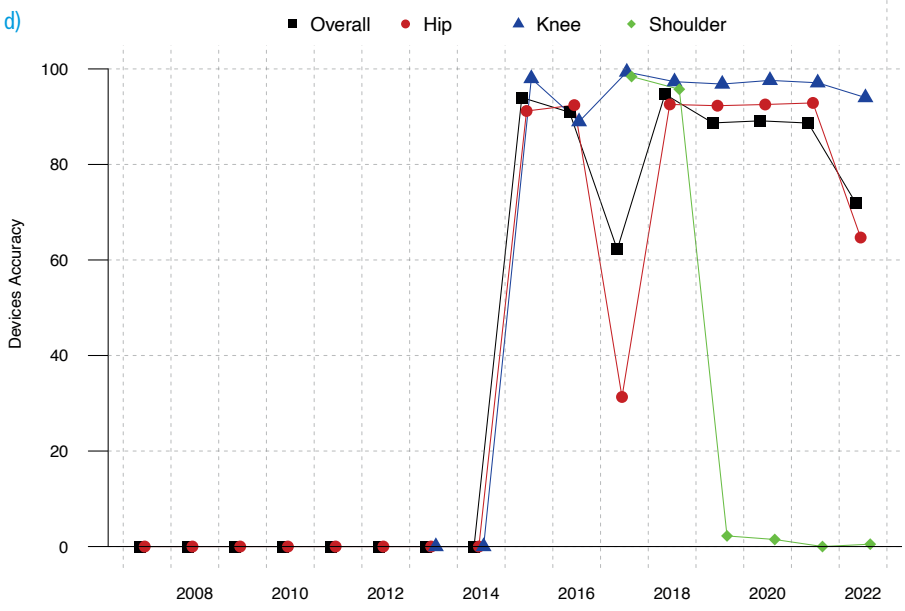
d)


Overall
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Knee
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Devices Accuracy
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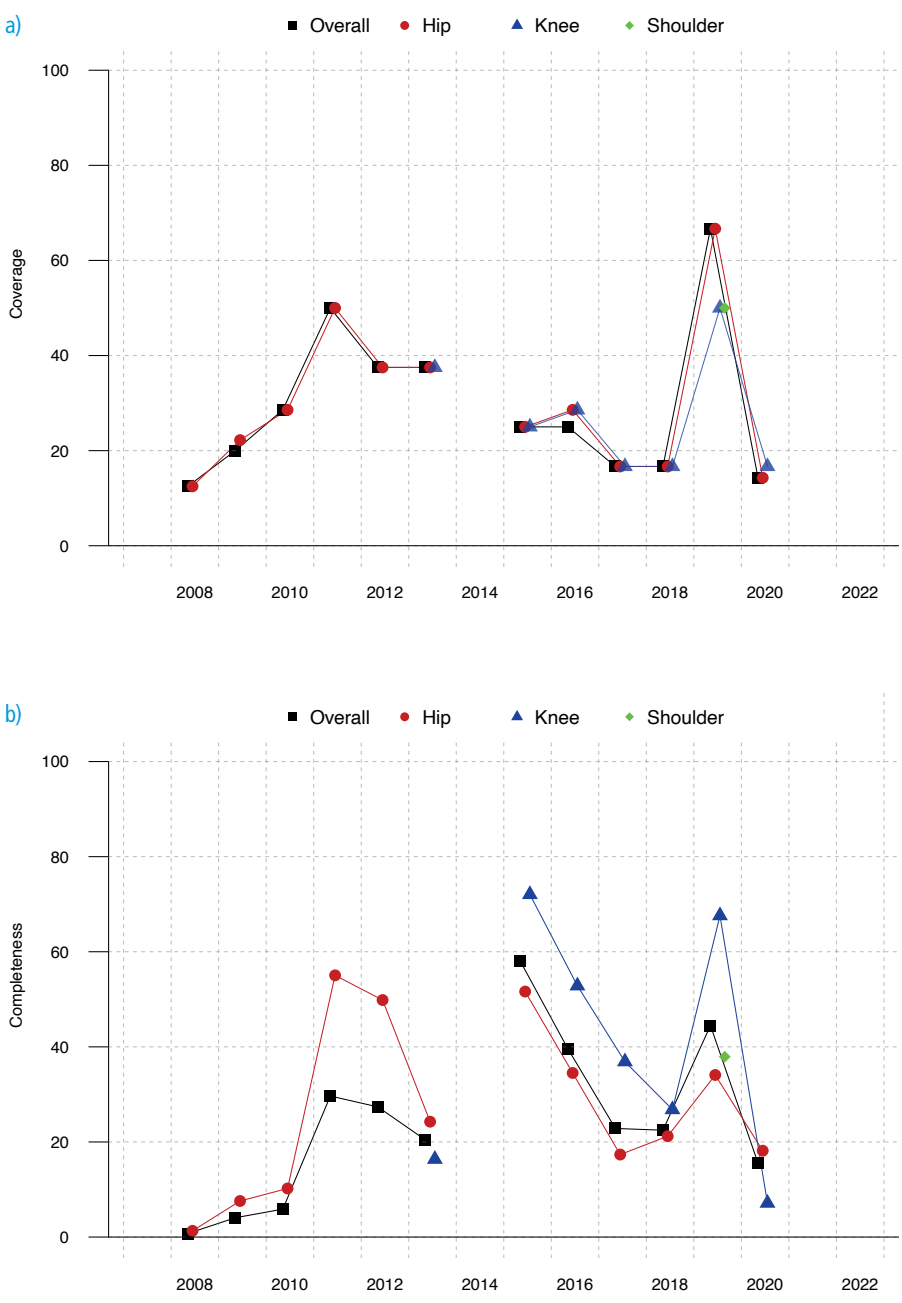
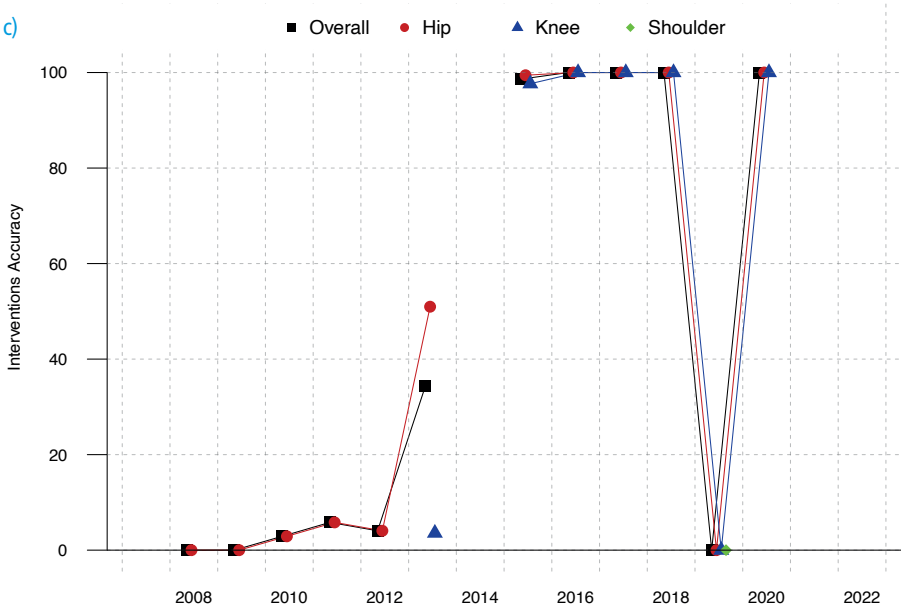
Figure 15. Basilicata. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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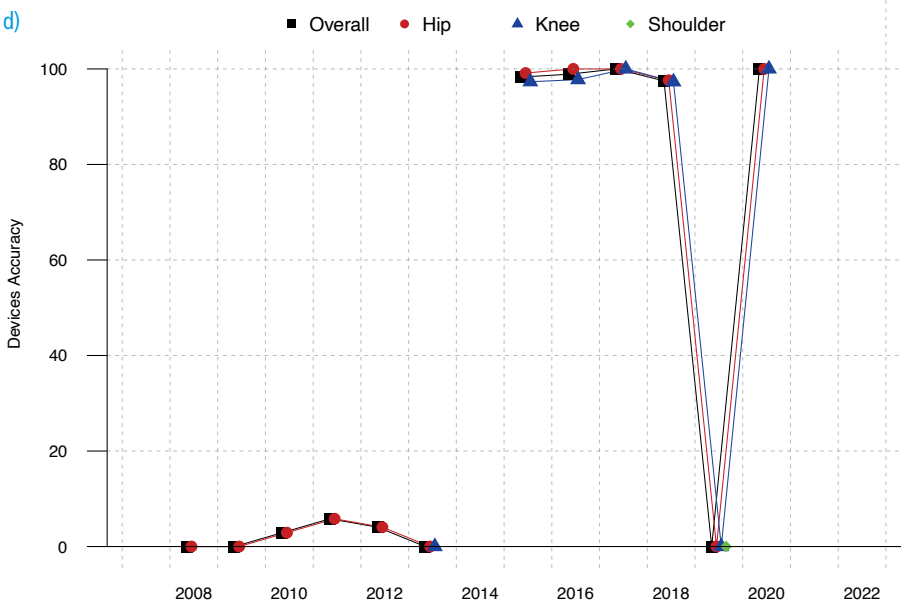
d)


Overall
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Devices Accuracy
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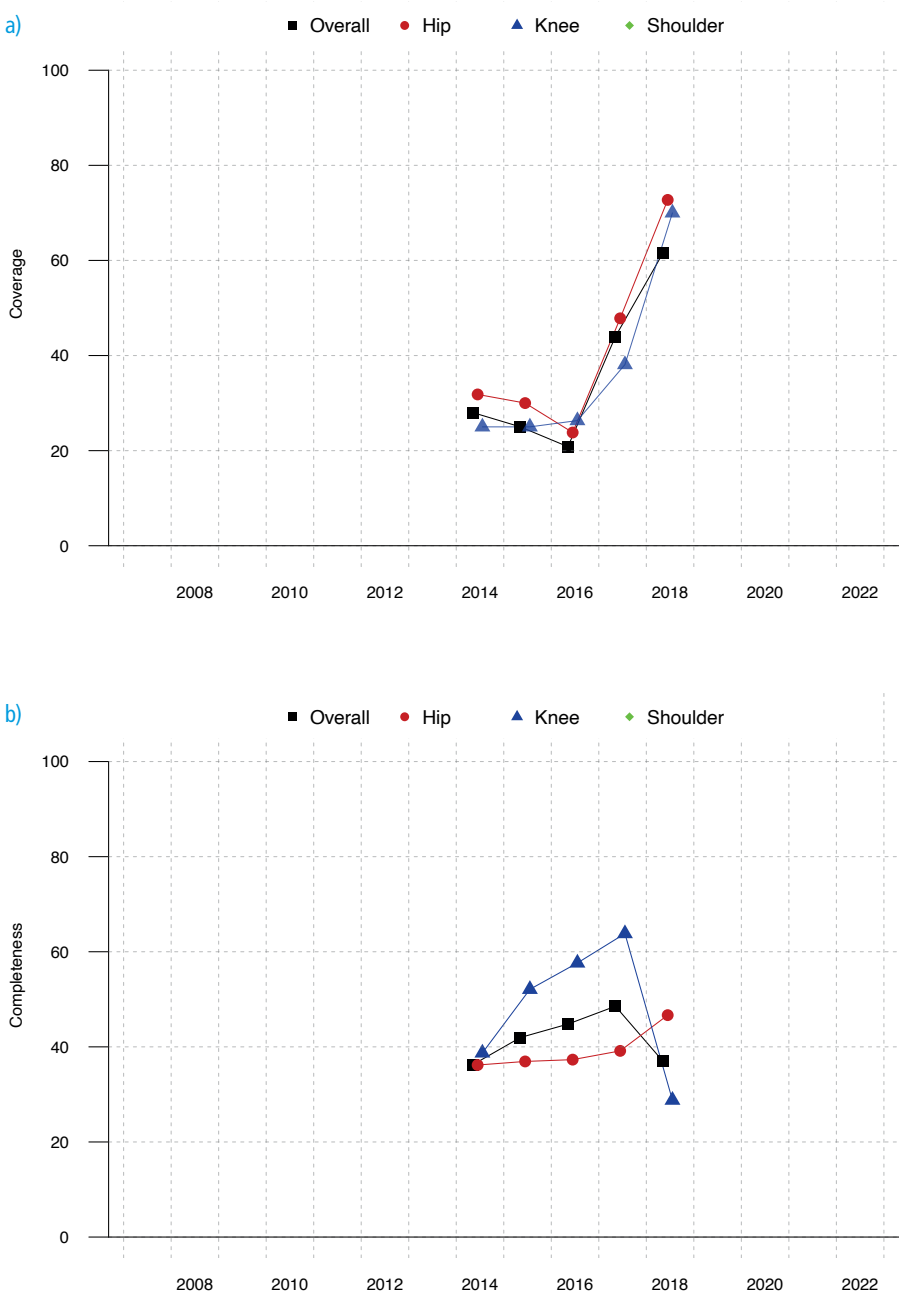
Figure 16. Calabria. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



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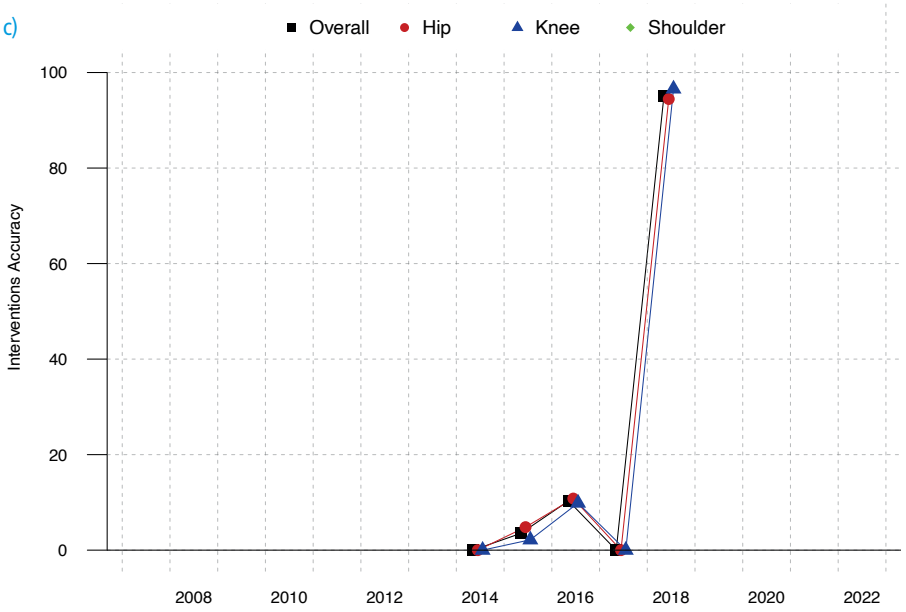
Overall
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Interventions Accuracy
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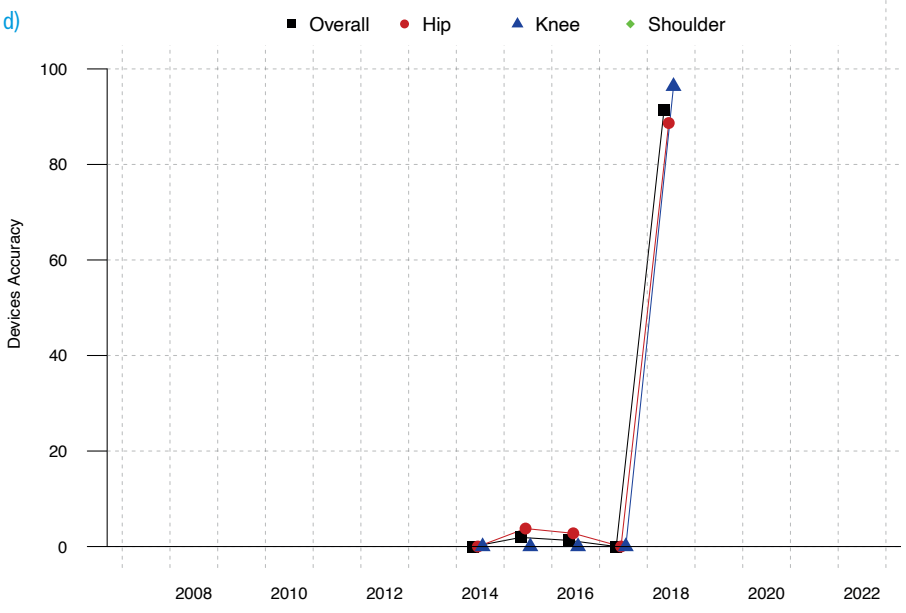
Overall
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Devices Accuracy
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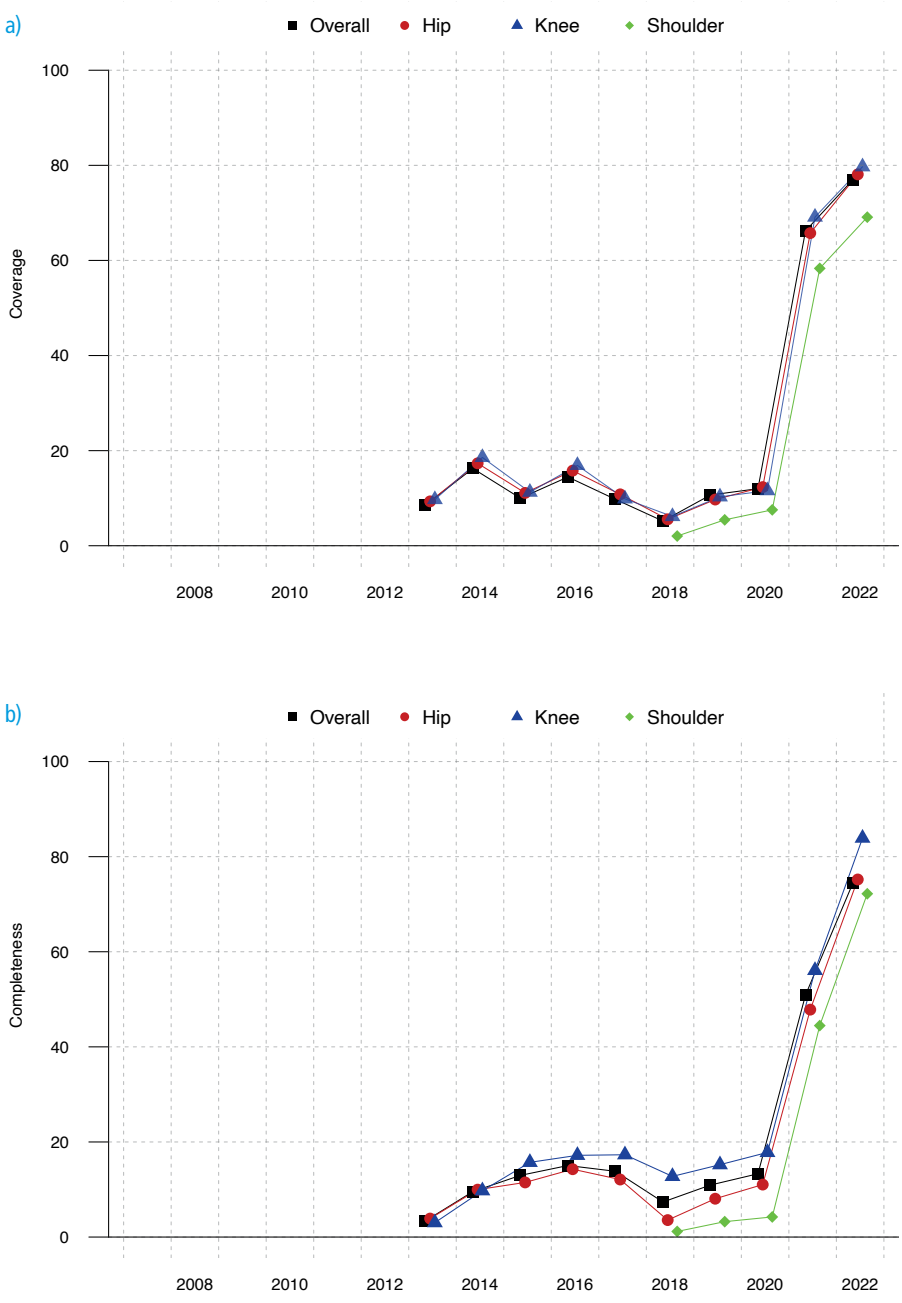
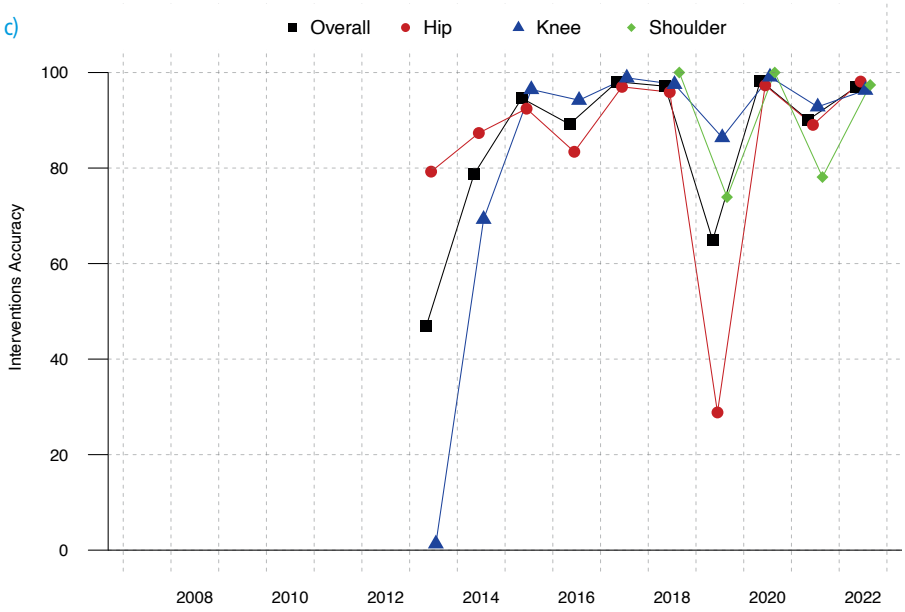
Figure 17. Sicily. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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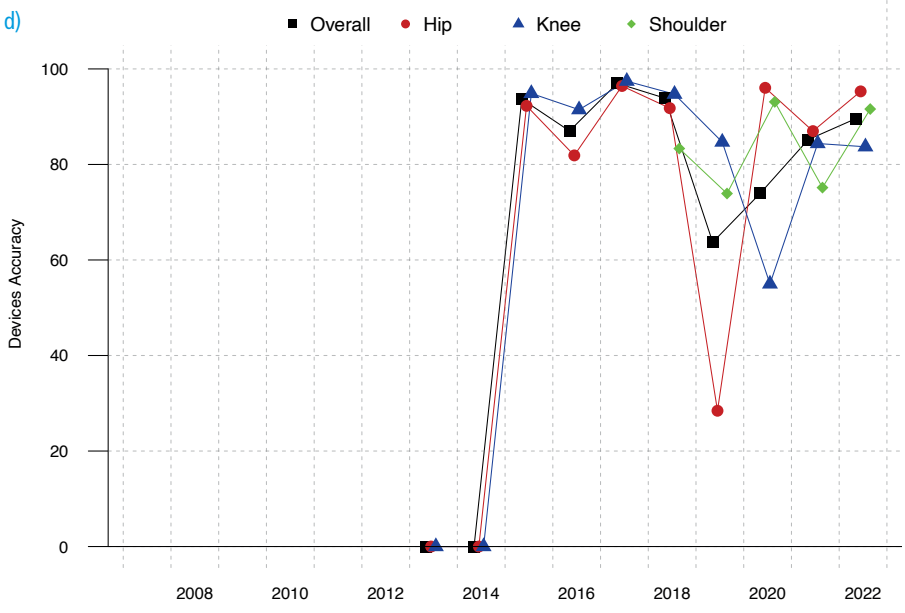
Overall
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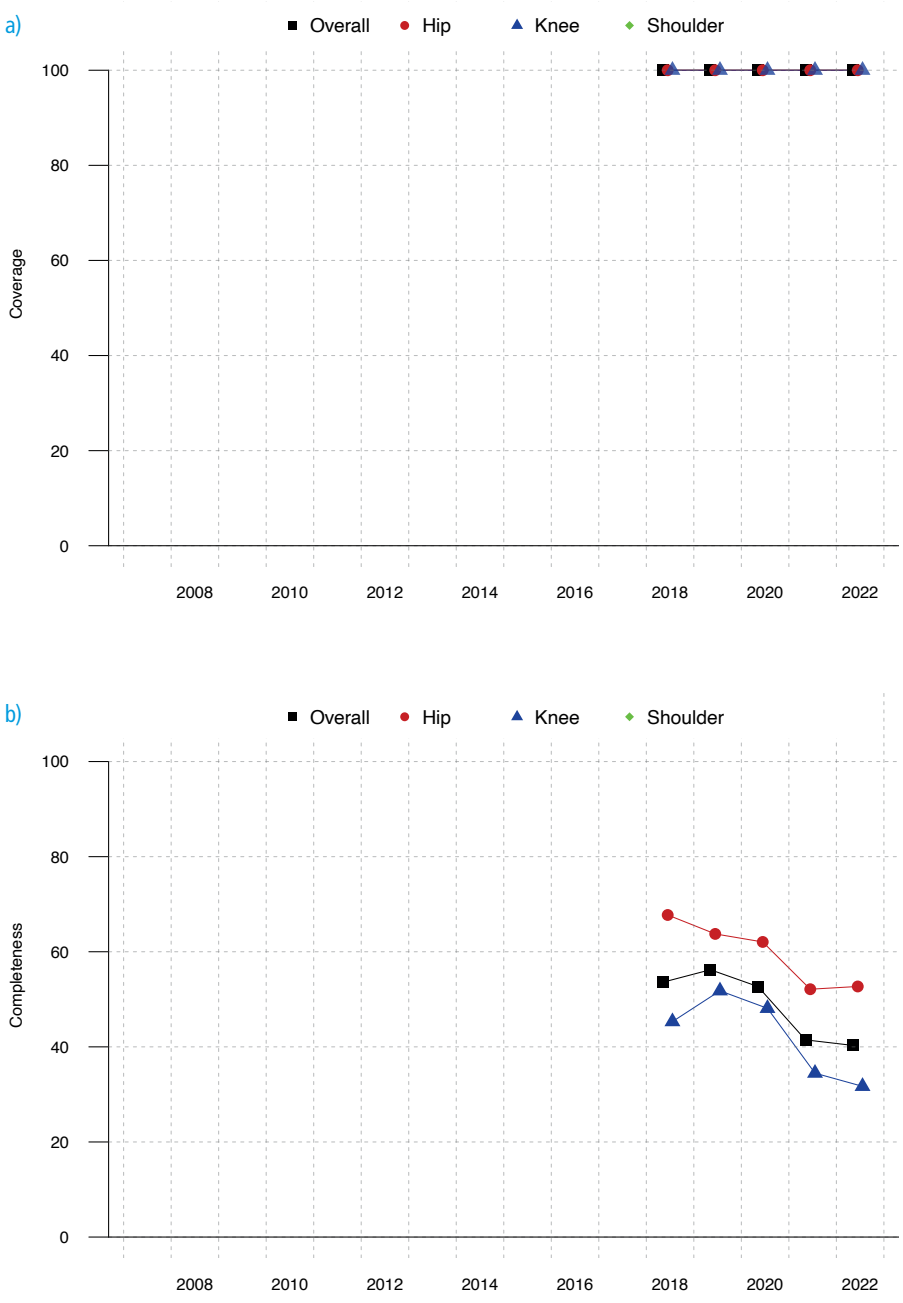
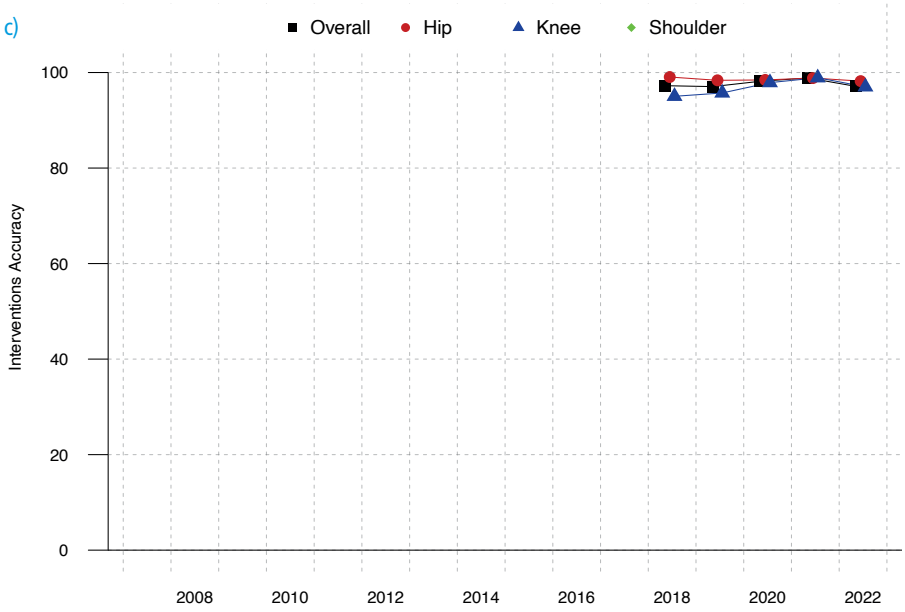
Figure 18. Clinica Città di Alessandria. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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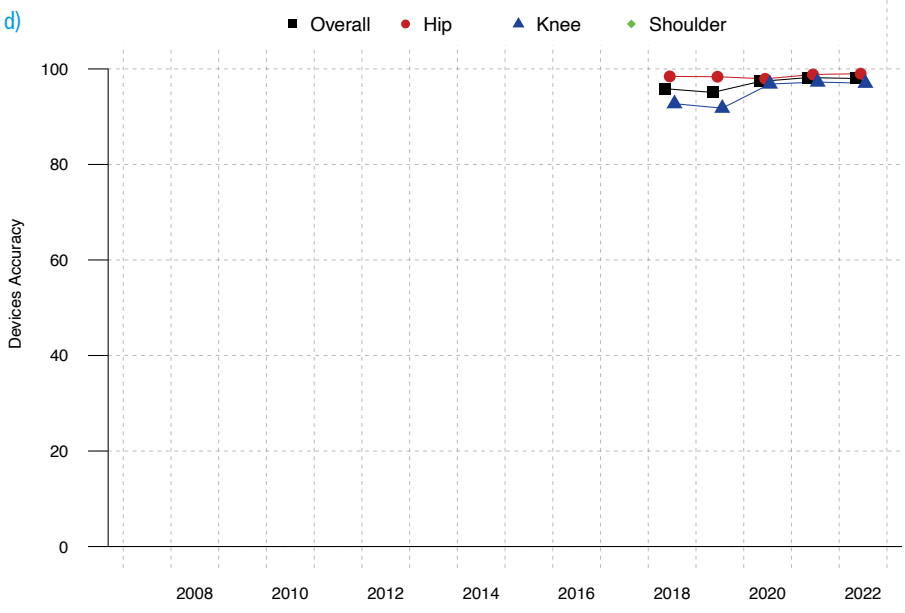
Overall
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Devices Accuracy
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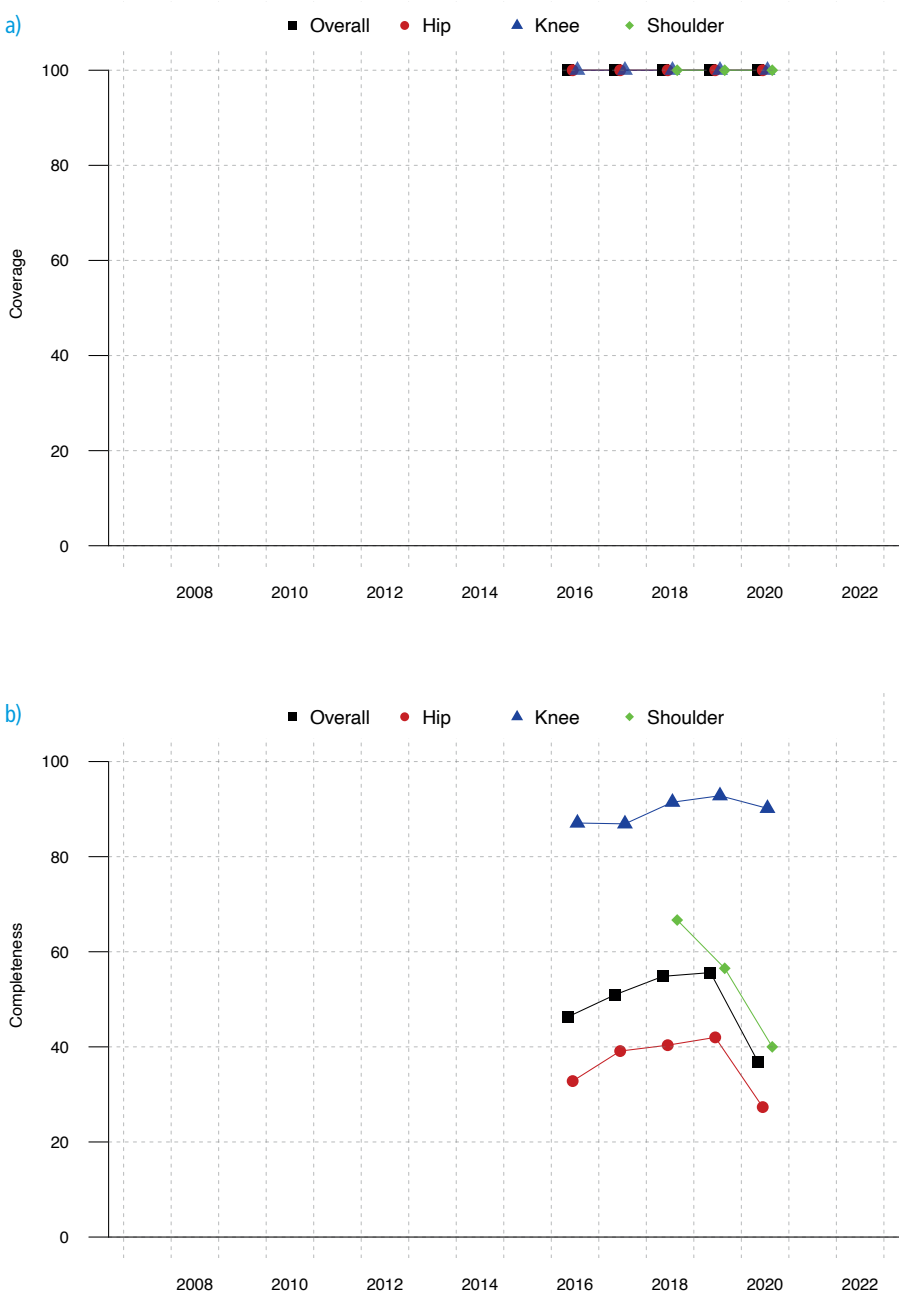
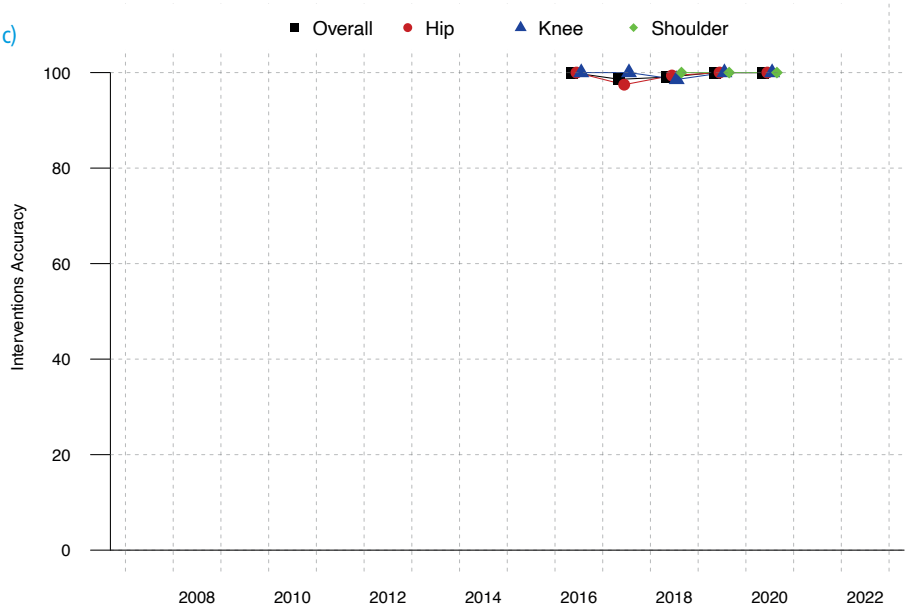
Figure 19. "PO Universitario Santa Maria della Misericordia" of Udine. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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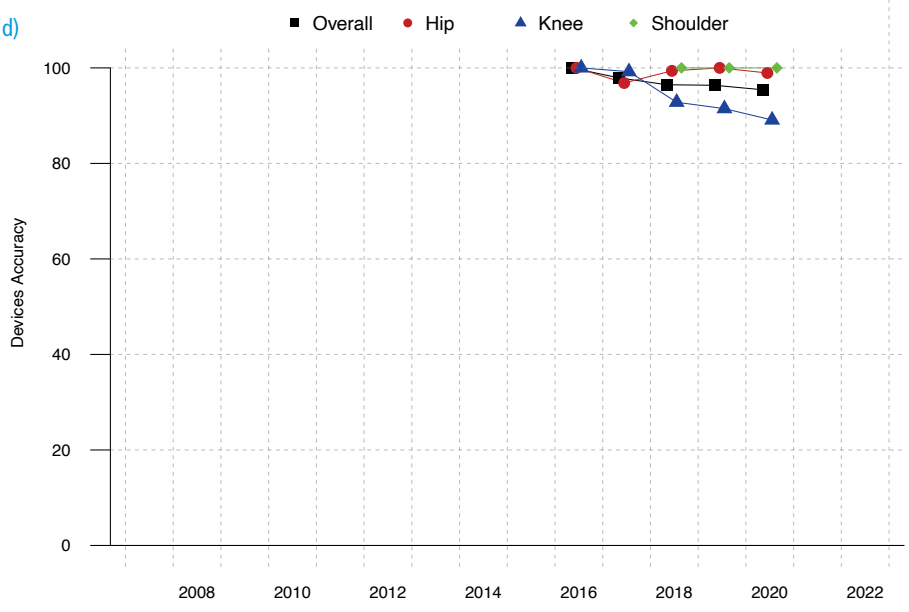
Overall
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Devices Accuracy
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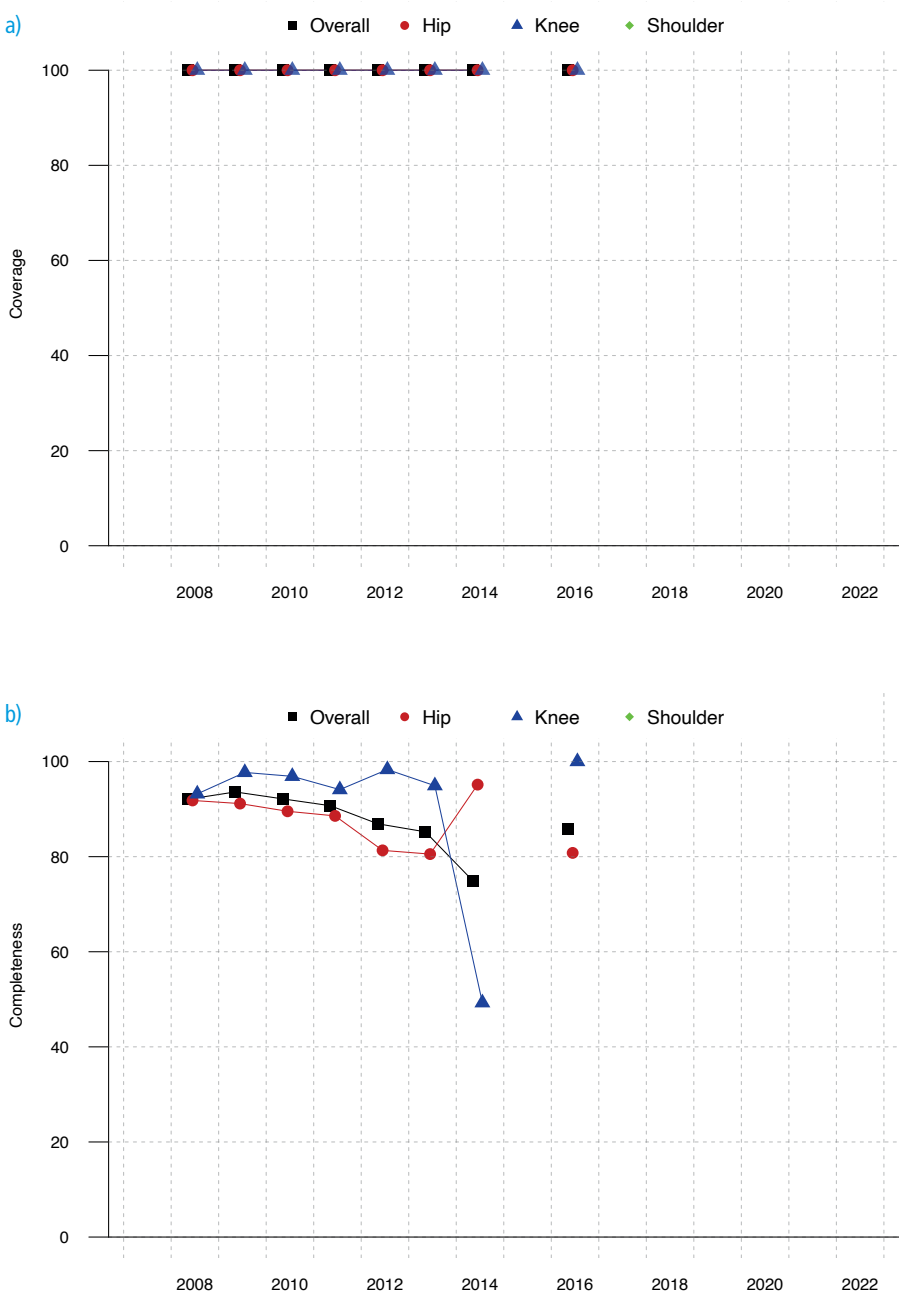
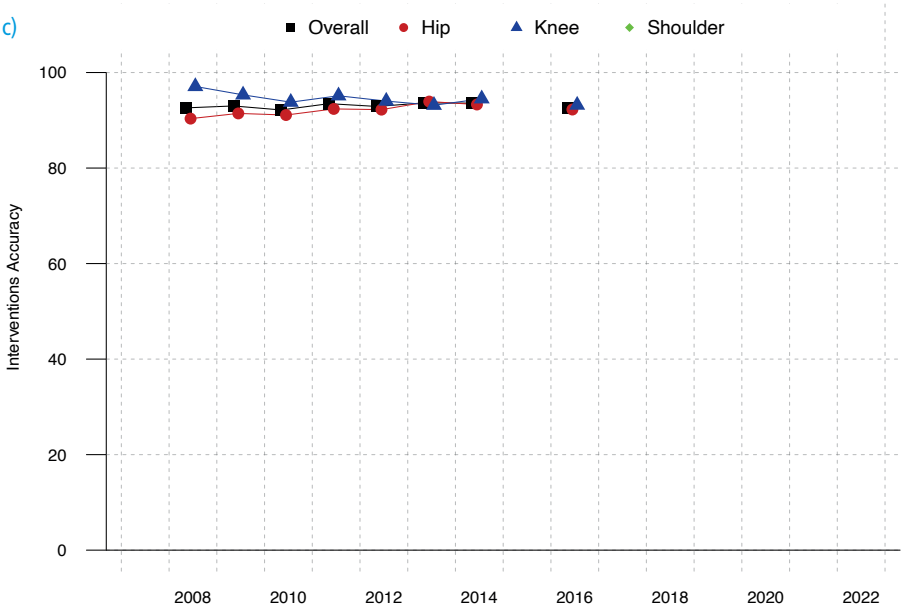
Figure 20. "Fondazione Livio Sciutto/Fondazione Spotorno" of Savona. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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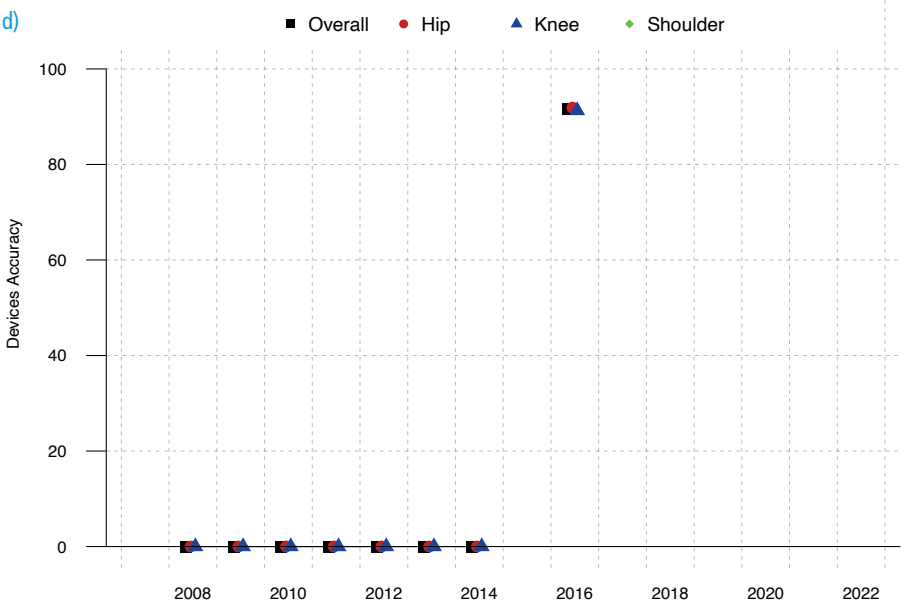
Overall
Hip
Knee
Shoulder
Devices Accuracy
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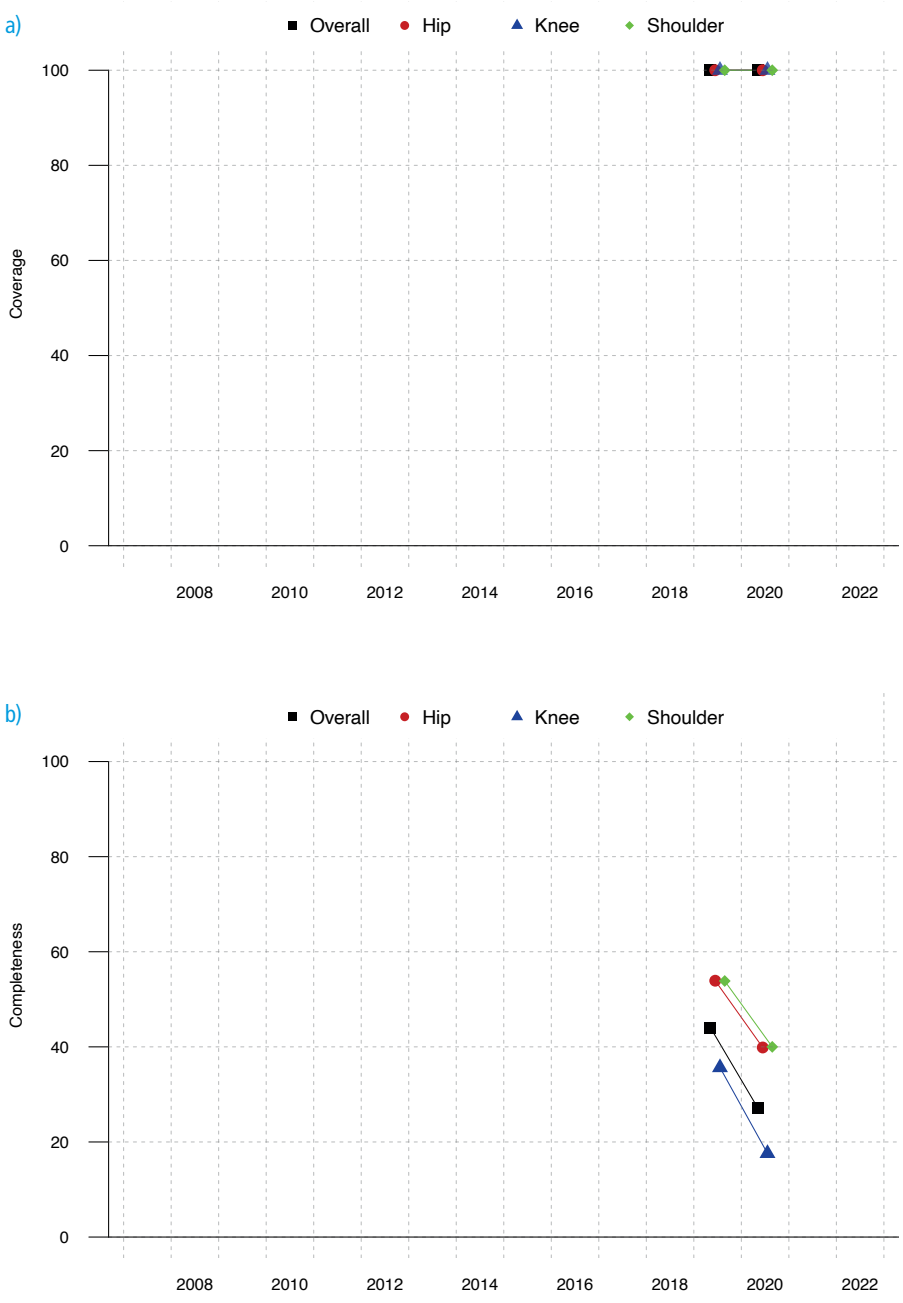
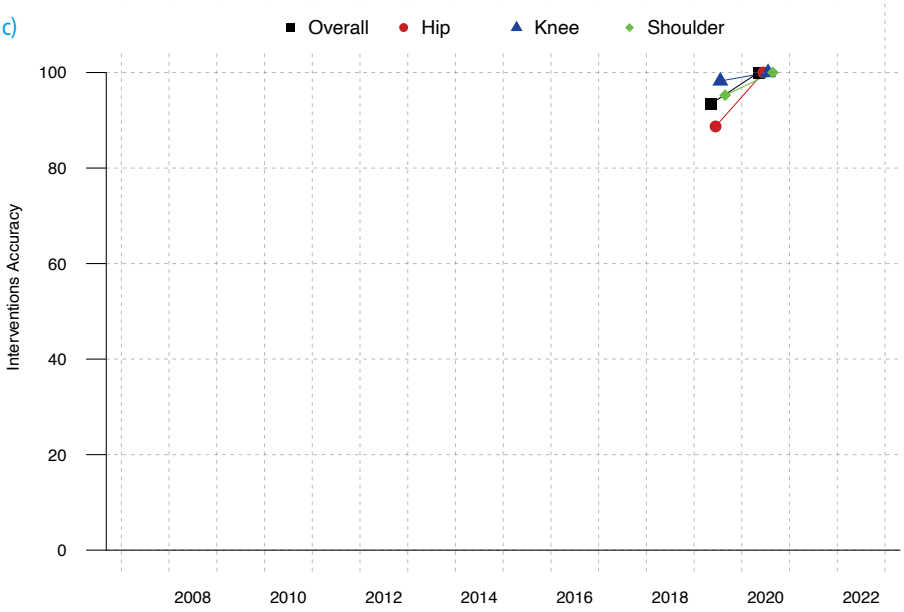
Figure 21. "Casa di cura San Feliciano" of Rome. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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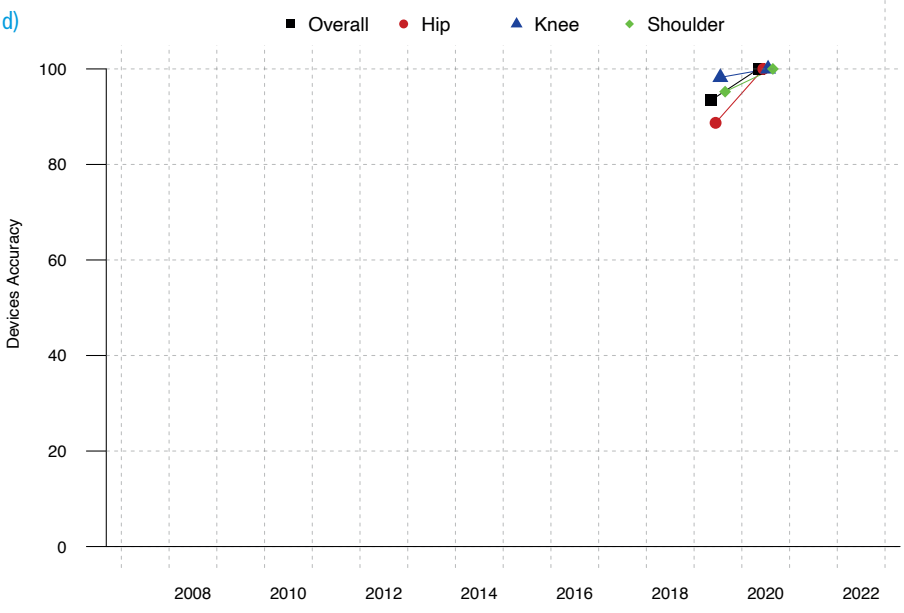
Overall
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Devices Accuracy
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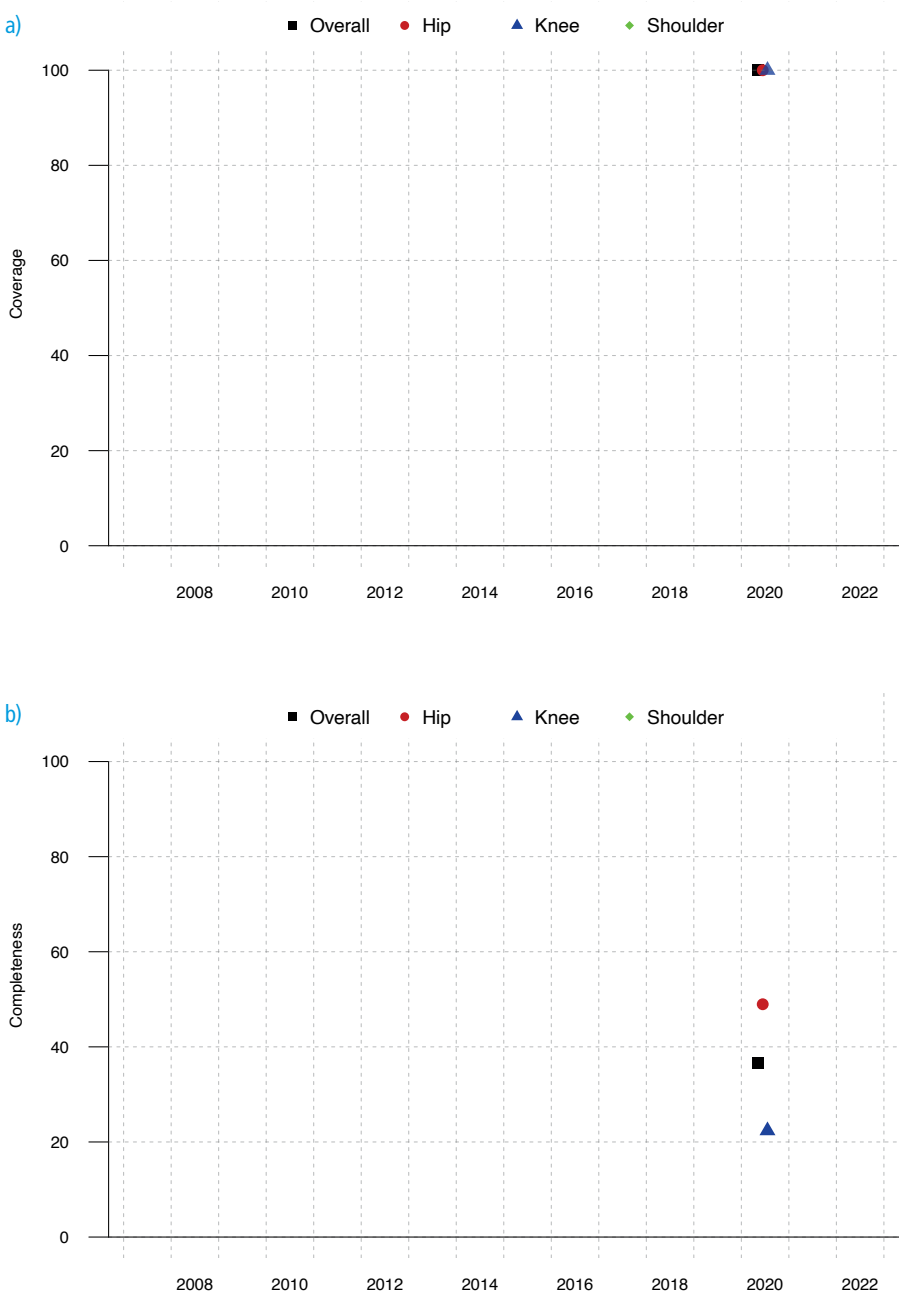
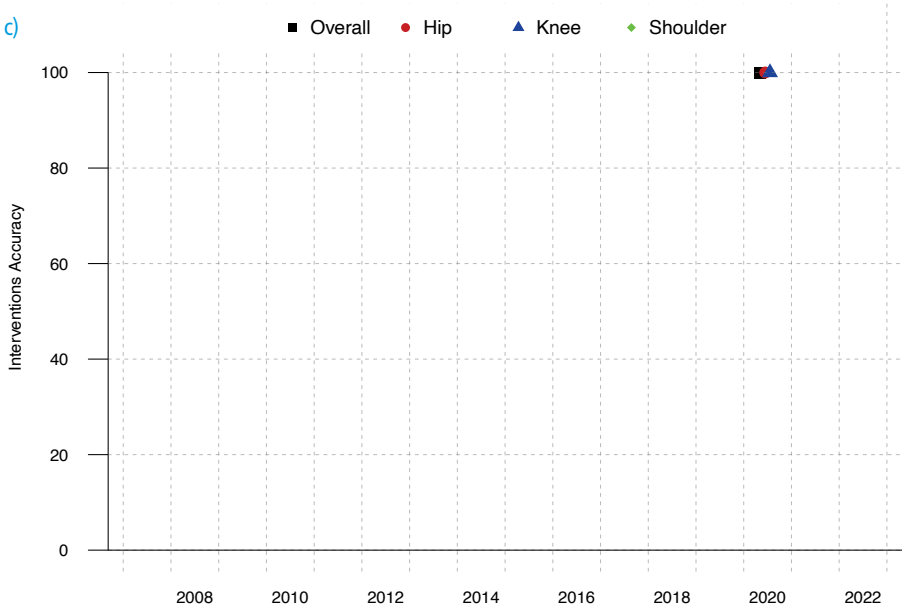
Figure 22. "Casa di cura Villa Aurora" of Rome. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022



c)


Overall
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Interventions Accuracy
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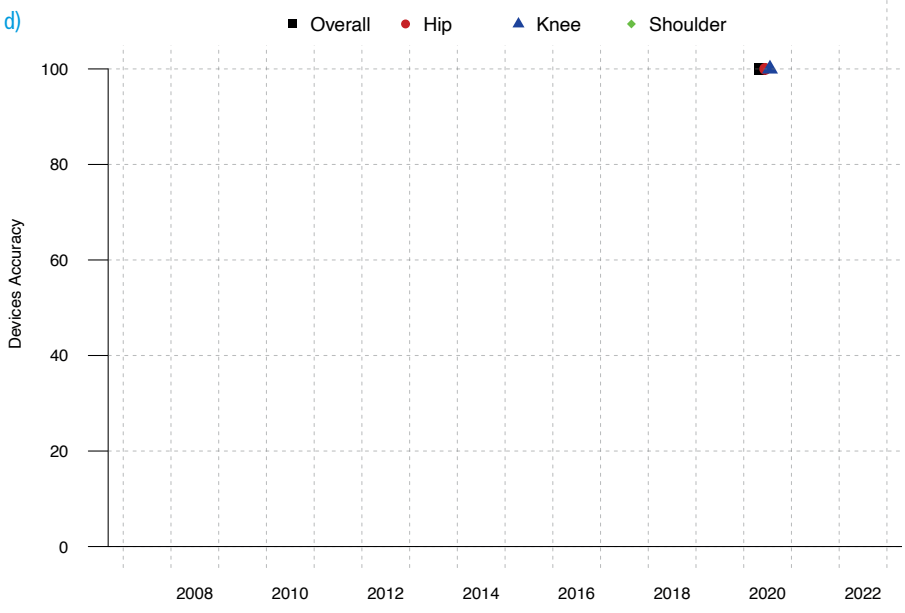
Overall
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Devices Accuracy
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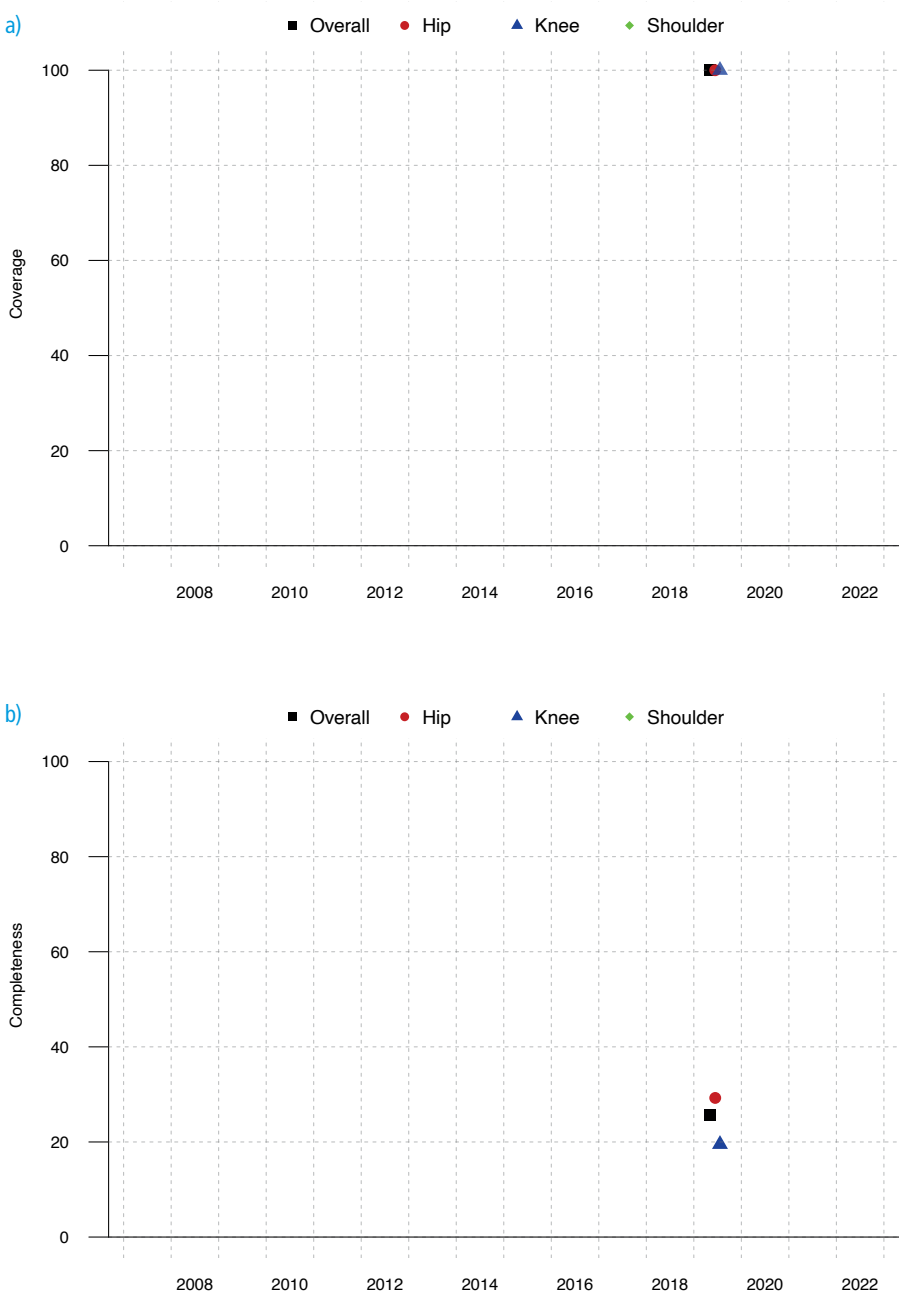
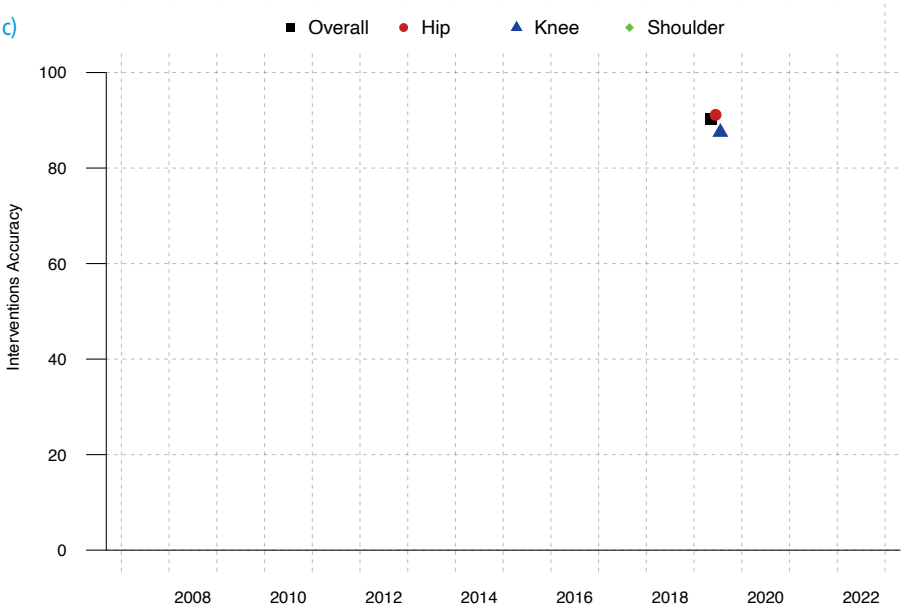
Figure 23. "Ospedale San Pietro Fatebenefratelli" of Rome. Temporal trends in *coverage* (a), *completeness* (b), *accuracy* on interventions (c) and *accuracy* on devices (d). From 2007 to 2022




c)
Overall
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Interventions Accuracy
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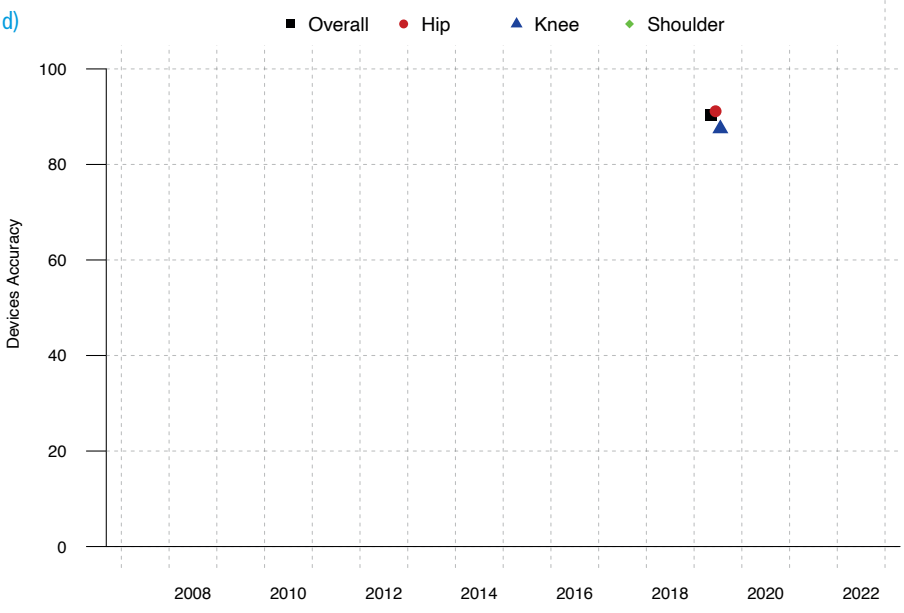
d)
Overall
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Devices Accuracy
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