



THE NATIONAL ARTHROPLASTY REGISTRY OF SLOVENIA (RES): 6th REPORT 2025 (data from 2019 to 2024)



<https://www.res-nars.si/>

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6TH REPORT OF THE NATIONAL ARTHROPLASTY REGISTRY OF SLOVENIA (RES) FOR THE PERIOD 2019-2024

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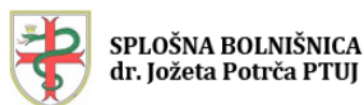
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1 Message from the Head of the National Arthroplasty Registry of Slovenia (RES)

Dr. Vesna Levašič, PhD, MD



Dear All,

Before you is the 6th report of the National Arthroplasty Registry of Slovenia (RES) 2025, which covers data from the period 2019 to 2024. I must thank all providers who regularly send forms to RES and respond to our questions when data is missing. It is precisely this responsiveness that ensures the high quality of data in RES.

RES is a living system that we update every year. We have digitalized the exports of primary surgeries, we are preparing exports for revisions, and we regularly review the Implant Library, which is an important database for recognizing barcodes from original implant labels. Together with my colleagues, we strive to keep the data up to date and accurate.

The absolute number of recorded surgeries is increasing, from the initial 7,854 in 2019 to 10,506 in 2024. In 2020, the number of surgeries was the lowest—6,565—due to the impact of the coronavirus pandemic (Figure 1).

Since the end of 2021, the Act on Health Care Data Collections has also included the collection of quality-of-life questionnaires (PROMs), specifically the Oxford Hip and Oxford Knee Scores and the EQ5D5L questionnaires. For this reason, we developed a new PROMs application as an additional RES module. Two administrators are responsible for data entry, linking the data with surgeries, and calling patients according to the worklist generated by the application, 6 and 12 months after surgery. This report presents the results of patient responses for those operated on in 2024 and their 6-month follow-up results. PROMs are a very current topic in arthroplasty registries, which has also been recognized by the Ministry of Health through the NaVTeZ program (Value-Based Healthcare).

For a quick overview of RES operations, the website <https://www.res-nars.si/> is useful, especially the Statistics tab, where data is displayed immediately once entered into the application. This tab is interactive—you can select the joint type, individual year, provider, and view preoperative diagnoses, patient age structure, surgical approach, and manufacturers of the implants used. The website also contains all annual reports, publications related to RES, descriptions of activities, and instructions for completing and submitting forms.

Dear colleagues, patients, and decision-makers, I invite you to review the latest report and encourage you to contribute your constructive suggestions and comments.

Enjoy the reading!

2 Statistical report

Prof. Dr. Eva Podovšovnik, PhD



The Valdoltra Orthopaedic Hospital (OB Valdoltra), as the holder of the National Arthroplasty Registry of Slovenia (RES), has been collecting data since 1 January 2019 on hip and knee endoprostheses implanted in hospitals within the territory of the Republic of Slovenia (RS) in patients who are citizens of the RS.

With the amendment to the Act on Data Collections in the Field of Healthcare (ZZPPZ-B), published in the Official Gazette No. 34 on 4 May 2018, RES obtained the legal basis for its operation. The holder of the data collection under the serial number NIJZ 53.1 – the Arthroplasty Registry – is OB Valdoltra, which authorizes us to collect data on hip and knee endoprostheses from all Slovenian public and private institutions performing hip and knee arthroplasty procedures, for patients insured by the Health Insurance Institute of Slovenia (ZZZS) as well as self-paying patients.

The Act entered into force on 1 January 2019, and from that date onward, providers performing hip and knee arthroplasty must, on the first day of each month, send completed forms—available on the RES website—together with the original implant labels and complete patient details to RES, headquartered at OB Valdoltra.

Since the establishment of RES in January 2019, all entities performing hip and knee arthroplasty in the territory of the Republic of Slovenia, regardless of concession status, are required to submit data on performed surgical procedures. These data must be submitted using the prescribed forms (see Appendices 1, 2, 3, and 4) and are then digitized. Data may be submitted directly in electronic form or on paper in the agreed standard format (form¹), or the administrator may obtain them directly from healthcare providers.

In RES, basic data are recorded about every patient² who has had an endoprosthesis—or a part of it—inserted, replaced, or removed in the hip or knee joint. In addition, RES also keeps data on the healthcare provider³, data on the implanted components of the endoprosthesis⁴,

¹ All the necessary forms for reporting data are available on the website <https://www.res-nars.si/>

² The basic patient data entered into RES include the ZZZS health insurance number, EMŠO (unique personal identification number), personal name, birth surname, gender, date of birth, place of birth, citizenship, CRP changes (general status, date, type and group of event), residence (permanent and temporary, and mailing address), date and place of death, education, marital status, and occupation.

³ The following information about the provider is entered in the RES: personal name, healthcare professional number, ZZZS number of the surgeon, title, provider number and ZZZS number of the healthcare provider where the procedure was performed.

⁴ Data on the installed parts of the endoprosthesis that are kept in the RES are: manufacturer, type, original name, catalog number, part of the endoprosthesis, type of material and method of fixation of the endoprosthesis.

data on the surgical procedure⁵, as well as data on any previous surgical procedure⁶ in cases where a previously inserted endoprosthesis or part of it has been removed. The data in RES are stored permanently.

On 14 July 2021, the Ministry of Health added the collection of quality-of-life questionnaires (PROMs) to Annex 1 of the ZZPPZ-B Act, specifically the Oxford Hip Score (OHS), Oxford Knee Score (OKS), and the EQ5D5L questionnaire. Preoperative forms are collected in paper form in individual hospitals. Digitalization is carried out in parallel with the digitalization of the RES register itself. Patients are contacted 6 and 12 months after surgery, when they complete the quality-of-life questionnaires either by phone or in writing. The data are stored permanently in RES.

The administrator may also obtain data relevant to the register from the Central Population Register (CRP), the Register of Spatial Units of the Republic of Slovenia, the Records of Healthcare Worker Movements and the Network of Healthcare Institutions, from the Health Insurance Institute of Slovenia (ZZZS) from the Register of Compulsorily Insured Persons, and from the Central Patient Data Register (CRPP), based on the linking identifier of the citizen's unique personal identification number (EMŠO) or the ZZZS insurance number.

Authorized access to the collected data is granted to healthcare providers who perform arthroplasty procedures for their own patients, as well as to the National Institute of Public Health (NIJZ).

The RES database is maintained for the following purposes:

- monitoring the survival⁷ of implanted hip and knee endoprostheses,
- ensuring quality control of endoprosthetic surgeries,
- enabling rapid detection of lower-quality endoprostheses,
- indirectly reducing the costs of primary and revision hip and knee endoprosthesis surgeries,
- serving as a basis for clinical and epidemiological studies and professional analyses, and
- providing data for the Central Patient Data Register (CRPP).

According to the ZZPPZ-B Act, the administrator (OB Valdoltra) is required to analyze the collected data and prepare and publish periodic reports on its website at least once a year. All reports are published on the RES website: <https://www.res-nars.si/sl>.

In this document, we present an analysis of the data for the period from 2019 to 2024. It should be emphasized that the number of units in individual analyses may vary due to missing data.

In the chapter on the research design, we describe the method of data collection. We then present general information about the hospitals and the surgical procedures. Each chapter concludes with an analysis of the performance of hip endoprostheses, followed by knee endoprostheses. Each chapter ends with the key findings and proposed measures.

⁵ The following data about the surgical procedure is kept in the RES: date, side of the procedure, reason for the operation - diagnosis or reason for revision, previous surgical procedures on the joint in question, surgical approach and, in the case of revision, its scope.

⁶ Regarding the previous surgical procedure to remove a previously inserted endoprosthesis or part thereof, data on the date of the previous surgical procedure, the healthcare provider of the previous surgical procedure, and the removed part of the endoprosthesis are entered in the RES.

⁷ Survival is defined as the time from endoprosthesis insertion to its removal.

3 Summary of key findings

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2025 year's report confirms that the number of hip and knee endoprosthetic surgeries in Slovenia continues to increase. In 2024, the total number of endoprosthetic procedures reported to the register was the highest so far — 10,506. Compliance among most providers performing these procedures is good, although one provider stands out with poorer compliance in 2024.

It is well known that the outcome of total hip and knee replacement is influenced by many factors. For this reason, this year's report also includes tables of the causes of endoprosthesis revisions, together with the probability of revisions shown in summary tables. This provides basic information about which factors have the greatest impact on the likelihood of early revisions. In this way, we can already anticipate whether a higher-than-average number of revisions may be related to the design of the prosthesis itself.

In the report for the 2024 data, we present five-year results for the first time. The cumulative five-year probability of revision of a total hip endoprosthesis in Slovenia is therefore 3.04%.

The share of cemented hip prostheses has decreased further, while the number of hybrid endoprostheses implanted this year has increased slightly. The proportion of anterior approach procedures continues to rise. The most commonly used head size remains 32 mm. The probability of revision for prostheses with standard 36 mm heads is still the highest (3.19% after five years), as in previous reports. The highest revision probability is observed in dual-mobility prostheses — 3.47% over five years. The share of ceramic heads continues to increase (76% in 2024). The bearing couple with the best five-year outcome is ceramic-on-ceramic, with a 2% revision probability. However, the proportion of these endoprostheses in the RES register is low — 4.6%.

In 2024, a total of 484 hip endoprosthesis revisions were recorded, of which approximately three-quarters were first-time revisions. The main cause of revision in 2024 was periprosthetic fracture, while in the period from 2019 to 2024, the leading cause was aseptic loosening. The lateral approach is the most commonly used technique in revision surgeries.

The cumulative five-year probability of revision of total hip endoprostheses is 3.04%. The combination Optimys–RM Pressfit Vitamys has the lowest revision probability — 0.95%. However, the register also includes two combinations with more than 200 implanted prostheses that have a revision probability higher than 5%.

The report also includes 6-month PROM results. The improvement in OHS is the same for men and women (median of 21 points), with the highest improvement observed in the group of patients aged 55 to 64 (although not statistically significant). We also did not observe any statistically significant differences by gender or age in the pre- to postoperative changes of the other PROMs.

The number of partial hip prostheses is also increasing from year to year — in 2024, a total of 813 were implanted, one-third in men and two-thirds in women. The proportion of anterior approach procedures is also rising for this type of surgery — in 2024, it reached 44.2%. Most of these prostheses are cemented (81% in 2024). The 90-day postoperative mortality rate was the lowest since 2019 — 12.5%.

In 2024, 3,781 primary total and 674 primary partial knee endoprostheses were implanted, for a total of 4,455. In this year's report, data on total and partial knee prostheses are presented separately.

The median age of patients receiving total knee endoprostheses in 2024 is 71.2 years. A total of 85.3% of knee prostheses are cemented, and only 0.2% are hybrid. The most commonly used surgical approach is the medial parapatellar approach (98.3% in 2024).

The five-year cumulative probability of revision for total knee prostheses is 3.67%, which is therefore higher than for total hip endoprostheses. It should be emphasized that one type of the total and one of the partial knee prostheses show distinctly poor results.

The report also includes 6-month PROM results for knee prostheses. A total of 2,088 questionnaires were completed (59.3%). The improvement in OKS was one point higher in men, with the greatest improvement (although not statistically significant) observed in patients aged 65 to 74. The highest improvement in EQ-5D-5L values was observed in the same age group.

The total number of knee endoprosthesis revisions in 2024 was lower (304) than the number of hip endoprosthesis revisions. Unlike total hip prostheses, the most common cause of knee revisions is infection, followed by aseptic loosening.

For the group of knee endoprostheses implanted between 2019 and 2024, the main cause of revision is infection, followed by instability or malalignment of the prosthesis. This indicates that in most cases the primary reason for revision is an early or late surgical complication rather than the design of the endoprosthesis itself. Unlike most international registries, in Slovenia, the cumulative five-year revision probability is higher for cemented total knee prostheses than for uncemented ones. It should be noted, however, that a single type of uncemented prosthesis predominates in Slovenia. The cemented total knee endoprosthesis Attune CR – Attune FB tibial baseplate has the lowest five-year revision probability.

The five-year cumulative probability of revision for partial knee endoprostheses is 4.15%, which is higher than for total endoprostheses. The probability of revision depends strongly on the type of implant used. The implant with the lowest revision probability is the Physica-ZUK–Physica ZUK endoprosthesis at 2.88%, while the highest is the uncemented Uni Score HA – Uni Score FB tibial implant at 11.87%. The main cause of revision for this prosthesis is early aseptic loosening.

4 List of abbreviations

C

- CI** – confidence interval
- CoC** – ceramic-on-ceramic bearing surface
- CoP** – ceramic-on-polyethylene bearing surface
- CoXP** – ceramic-on-crosslinked polyethylene bearing surface
- CRP** – Central Population Register
- CRPP** – Central Patient Data Register

E

- EMŠO** – Unified Citizen Identification Number
- EQ5D5L** – Standardised Questionnaire for Self-Assessment of Quality of Life

I

- IQ** – interquartile range
- IS** – information system
- IT** – information technology

K

- KS** – Clinical Sanatorium

M

- Me** – median
- MoP** – metal-on-polyethylene bearing surface
- MoXP** – metal-on-crosslinked polyethylene bearing surface
- MZ** – Ministry of Health

N

- NA** – Non-applicable
- NIJZ** – National Institute of Public Health
- NP** – Not provided

O

- OA** – Osteoarthritis
- OB** – Orthopaedic Hospital
- OECD** – Organization for Economic Co-operation and Development
- OHS** – Oxford Hip Score

OKS – Oxford Knee Score

P

PE – polyethylene

PEP – partial endoprosthesis

PK – partial knee

PROM - patient-reported outcome measure

R

RES – The National Arthroplasty Registry of Slovenia

RS – Republic of Slovenia

S

SB – General Hospital

SD – Standard Deviation

SURS – Statistical Office of the Republic of Slovenia

T

TEP – total endoprosthesis

TH – Total Hip

TK – Total Knee

U

UKC – University Medical Centre

X

XLPE – Highly cross-linked polyethylene

Z

ZZPPZ-B – Act on Databases in the Field of Healthcare

ZZZS – Health Insurance Institute of Slovenia

5 Terminology used

A

The **acetabular component** is the part of a total hip replacement that is inserted into the acetabulum. The acetabular component may consist of a single part (monobloc) or multiple parts (modular acetabular component). Typically, a modular acetabular component consists of a metal cup and an insert.

Arthrodesis is a procedure in which the bones of a natural joint are fused together.

Arthroplasty is a procedure in which a native joint is surgically replaced with an artificial prosthesis.

Aseptic loosening of a prosthesis means loosening of a part of or the whole prosthesis without evidence of inflammation.

B

A **bilateral prosthesis** is an endoprosthesis that has been inserted into the knee/hip on both sides at the same time

A **bipolar head endoprosthesis** is a composite head of the femoral part of the prosthesis used for hemiarthroplasty, where the smaller head is fixed to the stem of the prosthesis, and the larger head snaps onto the smaller head. The result is that movement can occur in two planes, one between the smaller and larger heads and one between the larger head and the acetabulum of the pelvis.

The **bearing surface** represents the two surfaces in the combination of the head and the acetabulum in a total hip endoprosthesis that articulate together. The report includes metal-on-polyethylene, metal-on-metal, ceramic-on-polyethylene, ceramic-on-ceramic, and dual-mobility heads, where the outer polyethylene part of the head articulates with the metallic acetabular component.

C

Cement is the material used to attach joint replacements to the bone – polymethyl methacrylate (PMMA).

A **cemented endoprosthesis** is a prosthesis that is designed to be attached to the bone with bone cement.

An **uncemented endoprosthesis** is fixed in such a way that the bone gradually grows in or onto the surface of the endoprosthesis. This process is called osseointegration.

The **confidence interval** is the interval that contains the true value of the parameter with a certain level of confidence (usually 95%).

Compliance is the ratio between the completed forms in the RES database for a certain period and the record of the number of registered cases of hip or knee arthroplasty by the ZZSZ (in the same period).

Cross-linked polyethylene has a modified structure. This structure is created during the cross-linking process, where additional links are formed in the material, increasing its density and resistance to deformation at high temperatures.

Cumulative revision rate: The cumulative revision rate is defined as $1 - S(t)$, where $S(t)$ represents the survival probability estimated using the Kaplan-Meier method. This measure reflects the proportion of primary replacements that have been revised by time t , accounting

for right-censored data such as patient death or the end of the observation period due to database closure.

Data coverage is a measure of how well the data covers a specific area, population, region, or category. Coverage is crucial in data analysis, as it affects the reliability of the results and the conclusions that can be drawn from them.

A **dislocation of a part of an endoprosthesis** in a hip prosthesis means that the articular head has slipped out of the centre of the cup. In a knee prosthesis, this typically means that the patella has shifted to one side, but it can also occur when the PE insert has slipped or the prosthesis has completely dislocated.

A **dual mobility** hip replacement is the type of replacement featuring two articular surfaces: an inner articulation, where the head of the prosthesis moves within the greater polyethylene head, and an outer articulation, where the polyethylene head moves within the metal acetabulum shell. This dual articulation allows for an increased range of motion and better stability, which is particularly beneficial for patients at higher risk of dislocation.

E

An **endoprosthesis** is an artificial orthopaedic implant that replaces a defective joint or part of a bone.

The **endoprosthesis insert** is part of a knee endoprosthesis and is attached to the surface of the tibial plateau to provide an articular surface with the femoral component. Acetabular inserts are part of a hip prosthesis and are inserted within the modular acetabular component.

An **endoprosthesis manufacturer** is the company that manufactures part or all of an endoprosthesis.

The **endoprosthesis neck** is the part of the proximal stem of a hip prosthesis.

Endoprosthesis type is a generic description of the prosthesis, e.g., cemented stem (hip), patellofemoral endoprosthesis (knee).

F

Femoral stem is the stem of a hip replacement that is inserted into the patient's femur (thigh bone). A modular head is attached to the neck of the stem. The stem can also have a modular structure with a modular neck of a proximal stem.

Femoral knee component is the part of a knee prosthesis used to replace the surface of the femur (thigh bone).

A **fracture** of a part of an endoprosthesis is when one part of the endoprosthesis cracks or breaks.

H

The **head of an endoprosthesis** is the spherical part of the femoral component of an artificial hip replacement, usually modular. Older models had the head firmly attached to the stem (monobloc).

A **hybrid prosthesis** is an arthroplasty in which one component is cemented and the other is uncemented.

In hip arthroplasty, "hybrid" refers to the combination of a cemented stem and an uncemented acetabular component, while "reverse hybrid" refers to the combination of an uncemented stem and a cemented acetabular component.

In the case of knee arthroplasty, "hybrid" refers to the combination of an uncemented femoral component and a cemented tibial component, and "reverse hybrid" is the reverse combination.

I

Incidence refers to the number of events in a given population over a limited period of time.

The **incidence rate** is the number of new cases per specified number of people (for example, per 1,000 or 100,000 people) per year. It is an important indicator in epidemiology, as it allows comparisons between different groups or regions.

The **interquartile range** is the range of values from the 25th (first quartile) to the 75th (third quartile) percentile of the distribution of variables.

K

The **Kaplan-Meier Survival Curve** shows the proportion of patients who are revision-free over time. It accounts for censored data—that is, patients whose outcomes are unknown due to death or database closure.

L

Lethality is the number of deaths from a specific disease (in our case, surgery), usually calculated per 100 patients. The meaning is often mistakenly equated with **mortality**.

M

A **minimally invasive surgical approach** is an operation performed through small incisions (usually less than 10 cm). This may require the use of special instruments.

Modified polyethylene is any polyethylene component that has been modified to improve its performance characteristics. Some of these processes involve chemical changes, such as increasing the cross-linking of the polymer chains or the addition of vitamin E and/or other antioxidants.

A **modular component** consists of more than one piece, e.g. modular acetabular cup with a modular insert or a femoral stem with a modular femoral head.

A **modular stem** is a femoral stem that consists of an additional modular neck and also has a modular head.

A **monobloc component** is assembled or supplied as one piece, e.g. a monobloc knee tibial component.

Mortality is the number of deaths per specified population (usually per 1,000) in one year

O

Osteoarthritis is a degenerative joint disease in which the articular cartilage wears away and the bone underneath changes.

Osteolysis is the pathological destruction or disappearance of bone tissue.

Osteosynthesis is a procedure to repair fracture with, for example, plates, screws, nails, or wires.

An **osteotomy** is a surgical procedure in which a bone is intentionally cut to change its shape, length, or alignment. This procedure is usually used to treat bone deformities, improve joint function, or reduce pain.

The **Oxford Hip Score** is a standardized questionnaire to measure function and pain after hip arthroplasty.

The **Oxford Knee Score** is a standardized questionnaire to measure function and pain after knee arthroplasty.

P

In **partial knee arthroplasty**, only one compartment of the knee, which consists of three compartments: medial (inner), lateral (outer), and patellofemoral (anterior), is resurfaced with prosthetic components.

The **patient** is the person using the health care service.

The **patellar part** of the knee endoprosthesis. It's a polyethylene button cemented into the inner surface of the patella. There are also designs in which the polyethylene button is attached to a metal plate. See also patella resurfacing.

A **patellofemoral endoprosthesis** is a knee implant that replaces the patellofemoral joint surface. It is a two-piece knee prosthesis that provides an articular surface between the patella and the trochlea.

Patellar resurfacing is the fixation of a polyethylene button to the bony part of the patella.

Periprosthetic joint inflammation is (usually) a bacterial infection of the implanted endoprosthesis.

Prevalence is the proportion of individuals who suffer from a particular disease or condition.

Primary knee arthroplasty refers to the initial (first) total or partial knee replacement surgery.

Primary partial hip arthroplasty refers to the initial partial hip replacement surgery.

Primary total hip arthroplasty refers to the initial total hip replacement surgery.

The **procedure** is a single operation. See also primary hip/knee replacement and revision hip/knee.

The **provider of healthcare services** is a public health institution or other legal person in the Republic of Slovenia that has a contract with the ZZS for the provision of certain health services or offers these services on a self-pay basis.

R

A **reverse hybrid endoprosthesis** is a total hip prosthesis with a cemented acetabulum and an uncemented stem.

Revision burden is the number of revisions in a given period x 100 / the sum of the number of primary and revision surgeries in the same period. It is the proportion of revision surgeries performed as a % of the total number of surgeries for a given joint.

Revision hip arthroplasty refers to the re-operation of a previously implanted hip/knee replacement, where one or more prosthetic components are replaced, removed, or added.

Revision knee arthroplasty refers to the re-operation of a previously implanted knee replacement, where one or more prosthetic components are replaced, removed, or added.

Rheumatoid arthritis is an autoimmune inflammatory disease of the joints.

S

The **surgical approach** - the specific pathway or technique used by the surgeon to access a joint during an operation.

T

The **tibial component** is a part of a knee prosthesis used to replace the articular surface of the tibia of the knee joint. It can be modular or monobloc (one-piece).

A **two-stage revision** is a revision procedure that consists of two consecutive events, where the second stage of a two-stage revision follows the first stage of revision. It is used in some cases of infection of joint prostheses.

U

Unicondylar arthroplasty is a surgical procedure in which only one compartment (condyle) of a joint is replaced with prosthetic components, while the unaffected compartments are preserved.

6 Research design

RES obtains data directly from providers performing hip and knee arthroplasty procedures in the Republic of Slovenia. Under the Health Care Databases Act (ZZPPZ-B), these providers are required to submit data on completed knee and hip arthroplasties at least once per month using prescribed forms. The RES administrator at Valdoltra Orthopaedic Hospital then verifies the consistency of these data with those held by the Health Insurance Institute of Slovenia (ZZZS), which finances this activity and oversees the actual number of procedures performed.

In 2022, we carried out the digitalization of RES and entered all data from the beginning of its operation, i.e., from 1 January 2019, into the application. From the second half of 2022 onward (after the application was tested), data have been entered directly into the application. These data are then imported into the IBM SPSS PASW Statistics and R software environments, where all statistical analyses are performed. For graphical presentations, the IBM SPSS Statistics 31.0, Tableau Software, Microsoft Excel, and R are used.

6.1 Received forms and compliance with the Health Insurance Institute of Slovenia (ZZZS)

In Figure 1, we present the number of all received forms between 2019 and 2024 according to the type of arthroplasty.

In total, during these years, we received data for 23,307 primary total hip and 3,909 primary partial hip arthroplasties, 17,726 primary total knee and 2,846 primary partial knee arthroplasties, as well as 2,451 revision hip and 1,434 revision knee arthroplasties.

Figure 2 shows the compliance between the forms received in the RES database and the arthroplasties recorded in the ZZZS database. For the RES database, we included forms received for the period from 1 January 2019 to 31 December 2024. The database of primary hip and knee arthroplasties was exported on 15 September 2025, the database of revision hip arthroplasties on 6 February 2026, and the database of revision knee arthroplasties on 12 March 2026.

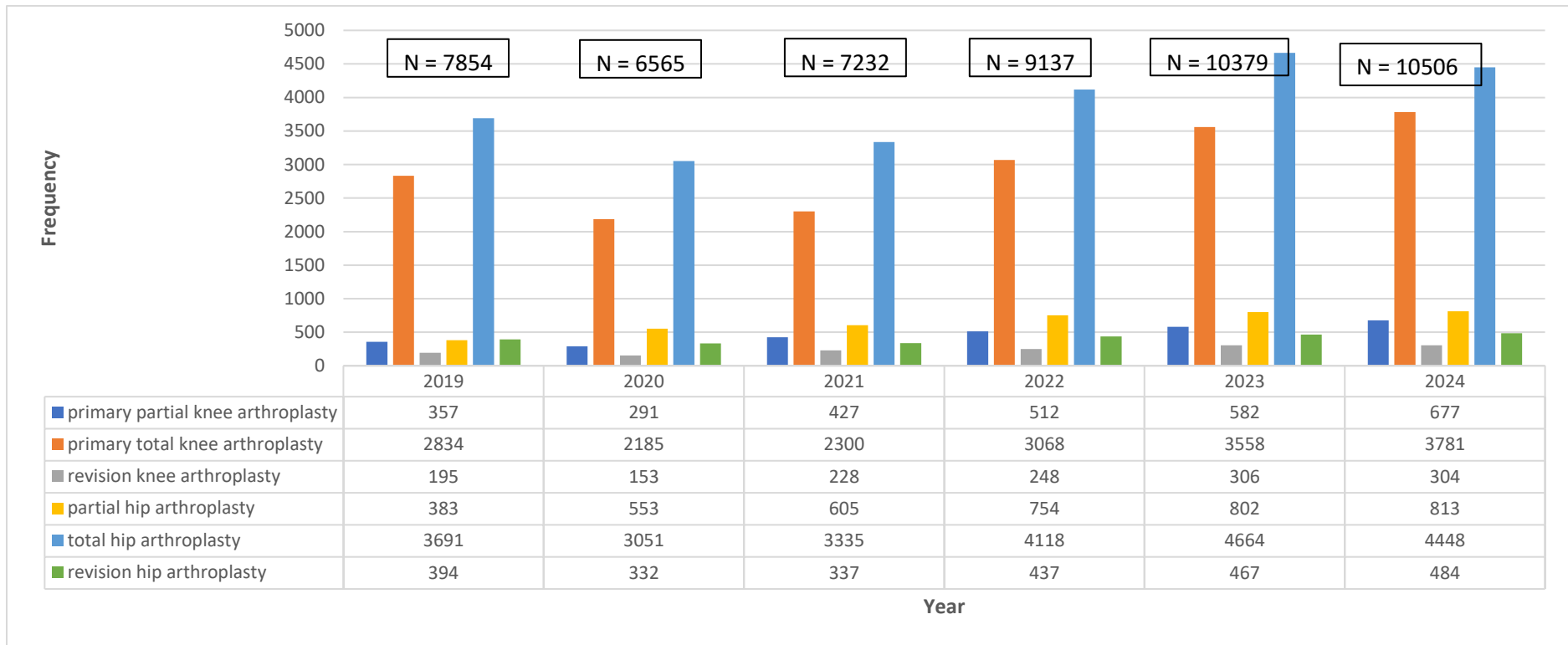


Figure 1: Number of forms received in the RES database between 2019 and 2024 by type of arthroplasty (Source: RES).

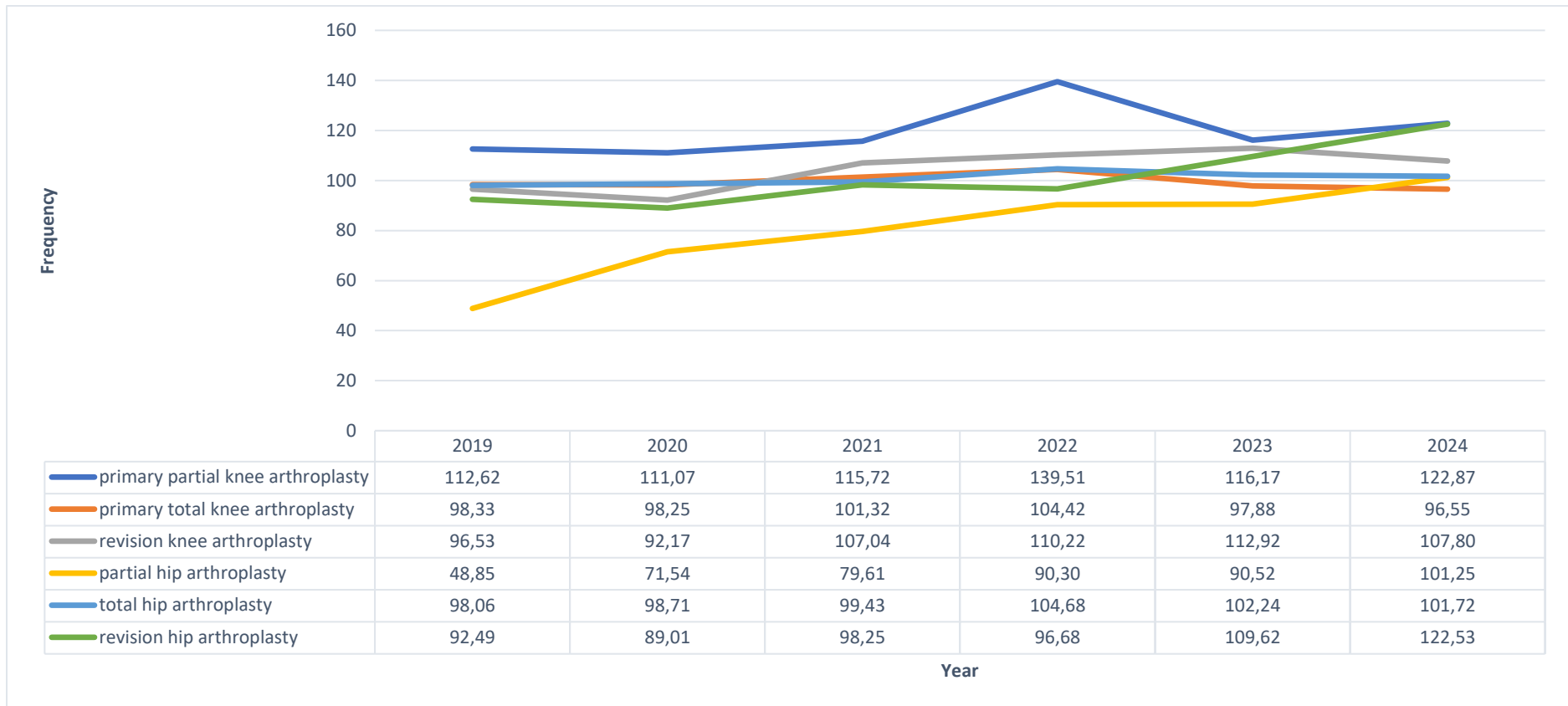


Figure 2: Proportion between forms received (RES) and hip and knee arthroplasties performed (ZZZS) in % (Source: RES and ZZZS).

Given the obligation to submit data to RES, we can see that for the period from 2019 to 2024 we achieve 99.5% compliance for all performed hip and knee arthroplasties. We can also observe that the ratio between the forms received in the RES database and the procedures recorded by ZZZS increased from 2019 until 2022 and then stabilized. Compliance was 93.8% in 2019, 95.3% in 2020, 99% in 2021, 104.4% in 2022, 101% in 2023, and 101.8% in 2024 (Figure 2).

We also examined the number of forms received in the RES database and the number of all recorded hip (Figure 3) and knee (Figure 4) arthroplasties in Slovenia in 2024 by individual providers, which serves as the basis for measuring compliance:

$$\text{compliance} = \frac{\text{number of surgeries RES}}{\text{number of surgeries ZZZS}} * 100$$

Based on the presented findings, we can conclude that the RES database shows a high level of comparability with the actual number of hip and knee arthroplasties performed, which allows us to generalize the obtained results at the national level. The higher number of entries in RES is a consequence of reporting self-pay procedures and procedures financed through ZZZS agreements with foreign insurance companies.

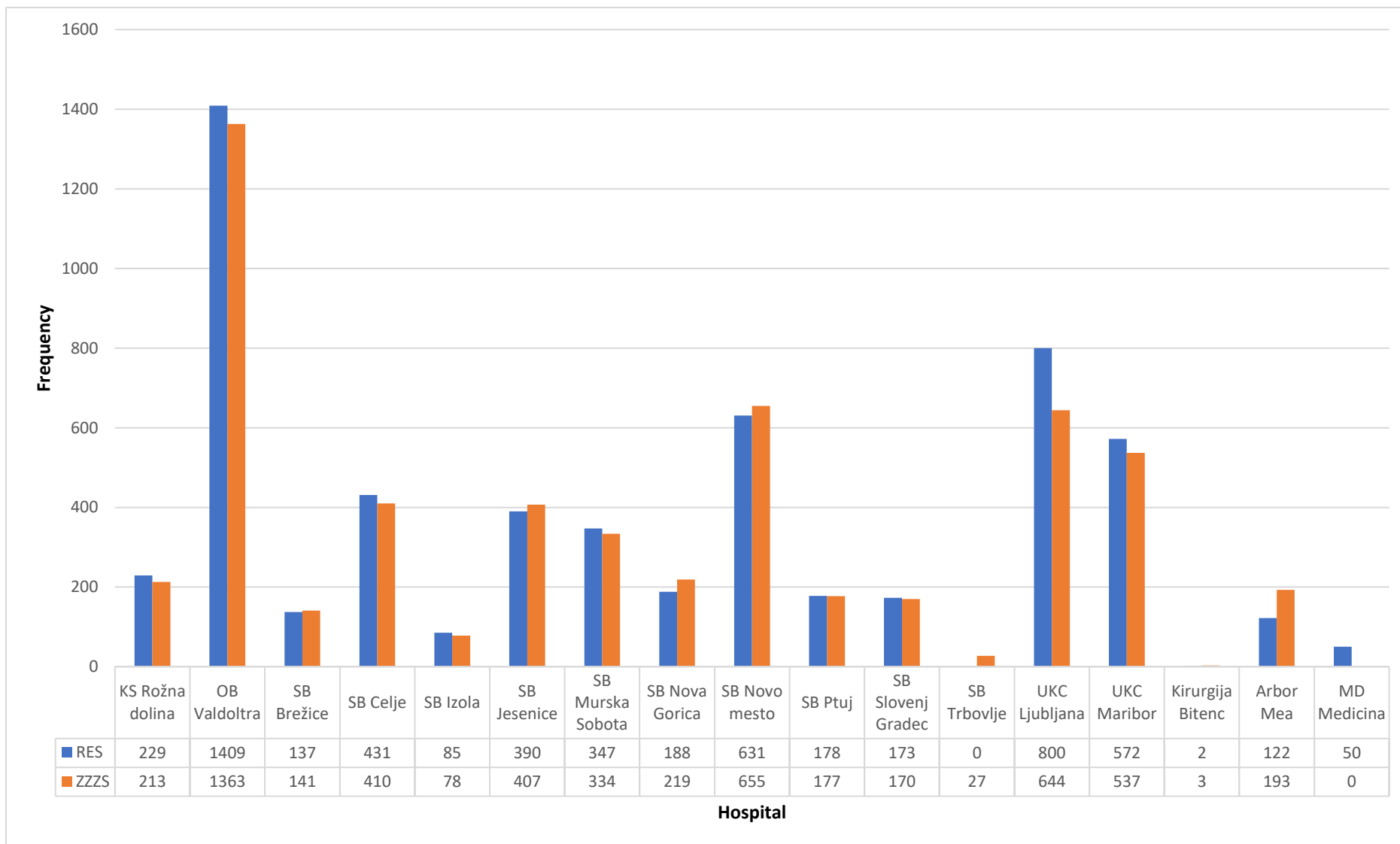


Figure 3: Number of forms received in RES and number of recorded total hip arthroplasties according to ZZZS data for 2024 (Source: RES and ZZZS).

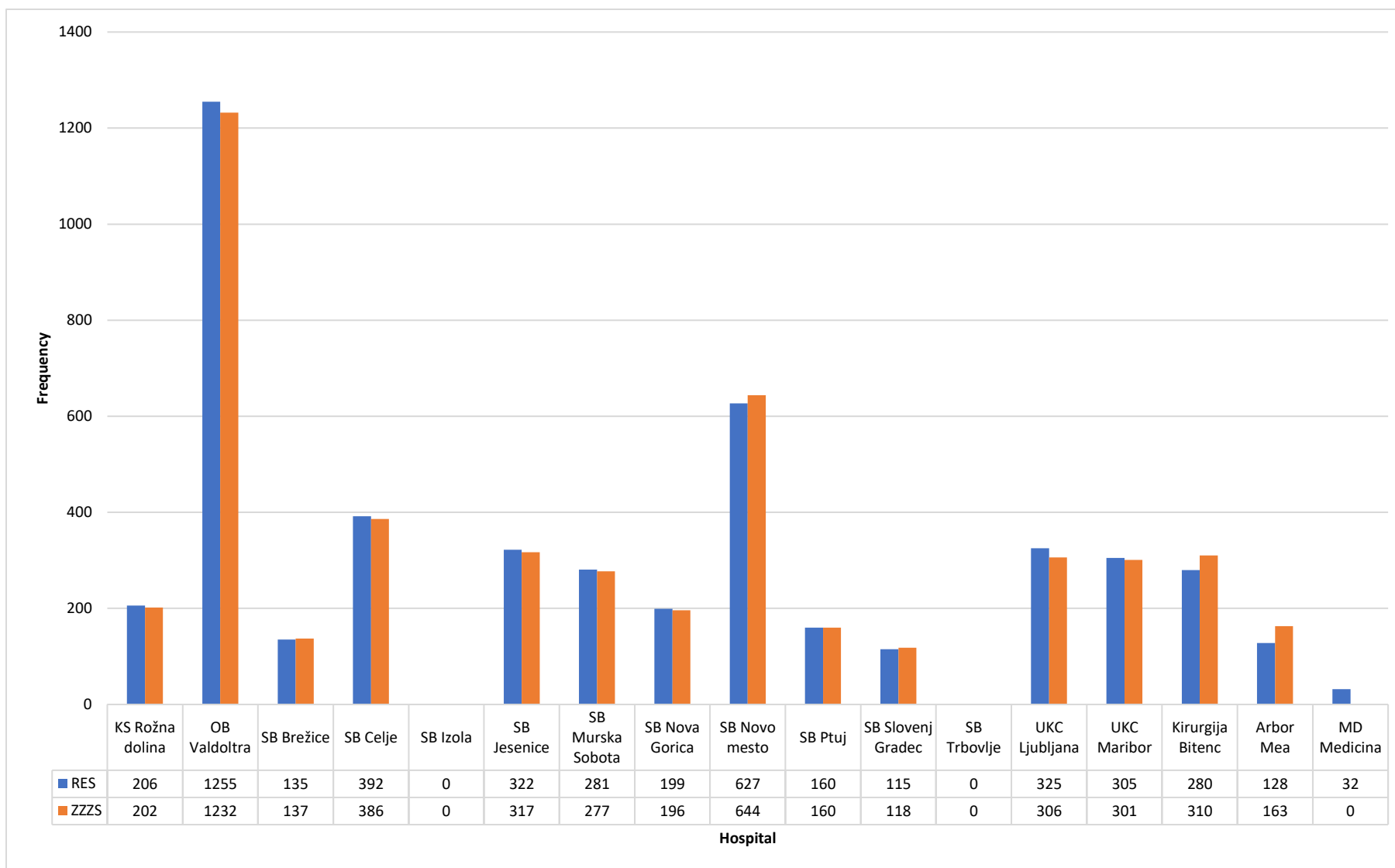


Figure 4: Number of forms received in RES and number of all knee arthroplasties recorded according to ZZZS data for 2024 (Source: RES and ZZZS).

6.2 Incidence of arthroplasties in the Republic of Slovenia

In Figure 5, the incidence rate of individual arthroplasty types in the Republic of Slovenia is presented for the period from 2019 to 2024. To calculate this, we obtained data on the number of inhabitants from the website www.stat.si, the official website of the Statistical Office of the Republic of Slovenia (SURS). We used the population count of the Republic of Slovenia for the fourth quarter (Q4) of each respective year.

The incidence rate was calculated using the following formula:

$$\textit{incidence rate}(\textit{year}) = \frac{\textit{number of surgeries RES}(\textit{year})}{100000 \textit{inhabitants RS}(\textit{year}, \textit{Q4})}$$

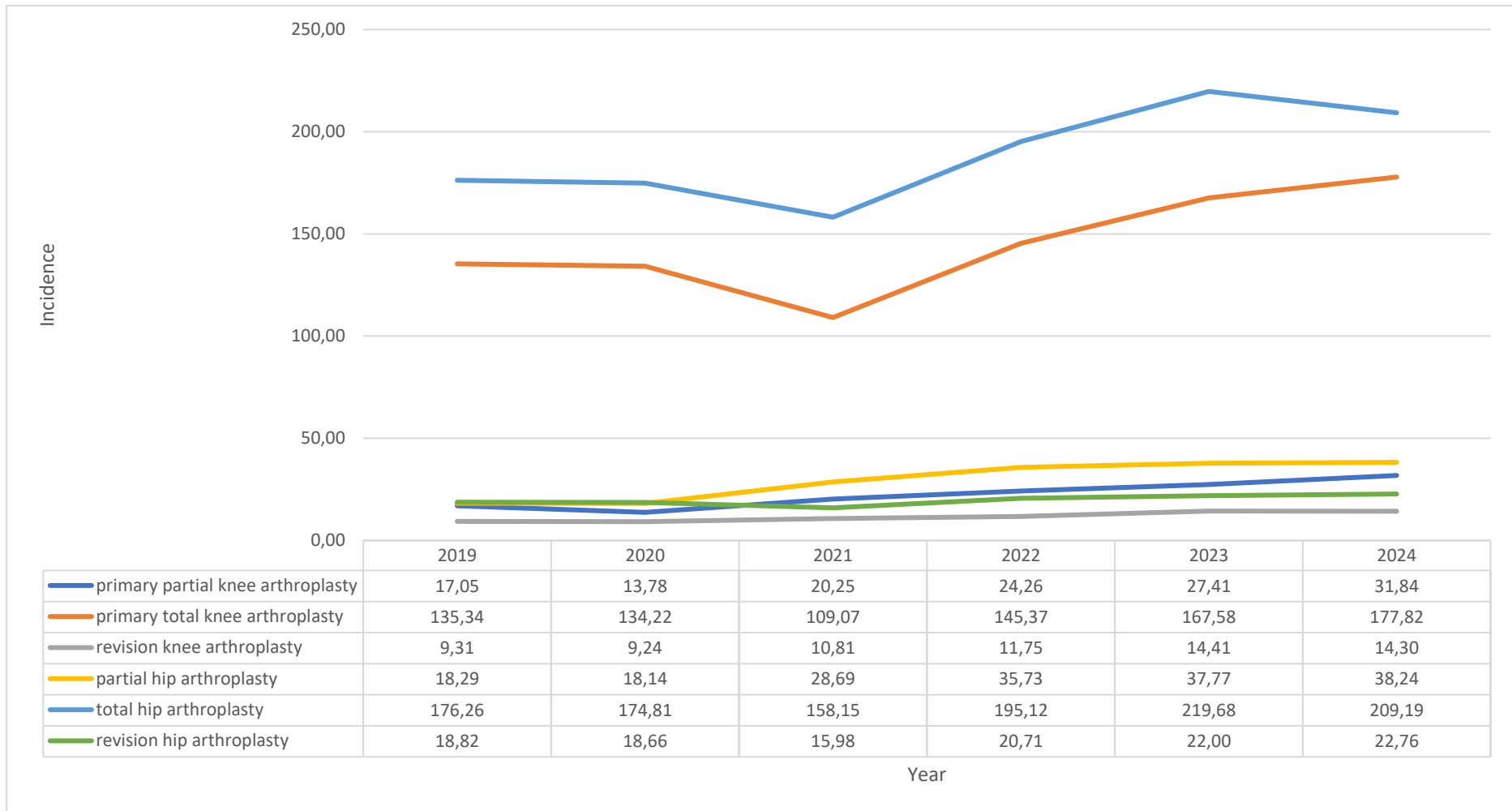


Figure 5: Incidence rate of number of operations per 100,000 population by year (Source: RES, SORS).

The highest incidence rate (Figure 5) is observed in total hip arthroplasty, ranging from a minimum of 158.2 operations per 100,000 inhabitants of the Republic of Slovenia in 2021 to 217.8 operations per 100,000 inhabitants in 2024, and in primary total knee arthroplasty, from 109 operations per 100,000 inhabitants in 2021 to 177.8 operations per 100,000 inhabitants in 2024.

The incidence rate for partial hip arthroplasties ranges from 18 (in 2019 and 2020) to 38 (in 2024) operations per 100,000 inhabitants. In the case of revision hip arthroplasty, the incidence rate ranges from 16 (in 2021) to 22 (in 2023 and 2024) operations per 100,000 inhabitants.

The incidence rate for primary partial knee arthroplasties is considerably lower, ranging from 14 in 2020 to 31 in 2024. The total incidence of knee endoprostheses in 2024 was 209 prostheses per 100,000 inhabitants. The lowest incidence rate is observed in revision knee arthroplasties, ranging from 11 (in 2019 and 2020) to 14 (in 2023 and 2024) operations per 100,000 inhabitants.

In general, it can be observed that the incidence rate of primary and revision hip and knee arthroplasties increased over the period from 2019 to 2024. It can also be noted that the incidence of primary partial hip and partial knee arthroplasties nearly doubled during this period.

6.3 Health service providers

Table 1 shows that there are 17 providers⁸ in the Republic of Slovenia performing hip and knee arthroplasty procedures. It should be noted that data on the number of operations are obtained both through the RES system and from the records of the Health Insurance Institute of Slovenia (ZZZS), which means that data on self-funded surgical procedures are sometimes missing, although these should also be reported by providers in accordance with the ZZPPZ-B legislation.

It is evident that, despite the legal obligation to submit data, some providers do not report the required data to the RES at all (e.g., SB Trbovlje). Kirurgija Bitenc began submitting arthroplasty data to the RES database in 2020, while Arbor Mea and MD Medicina started in 2022. SB Izola does not perform knee arthroplasties.

⁸ For SB Trbovlje, the data were obtained from the records of the Health Insurance Institute of Slovenia (ZZZS).

Table 1: List of hospitals that perform hip and knee arthroplasty in the Republic of Slovenia (Source: OB VALDOLTRA)

Hospital	Data 2019 to 2024	
	hip	knee
KS Rožna dolina	Yes	Yes
OB Valdoltra	Yes	Yes
SB Brežice	Yes	Yes
SB Celje	Yes	Yes
SB Izola	Yes	No
SB Jesenice	Yes	Yes
SB Murska Sobota	Yes	Yes
SB Nova Gorica	Yes	Yes
SB Novo mesto	Yes	Yes
SB Ptuj	Yes	Yes
SB Slovenj Gradec	Yes	Yes
SB Trbovlje	Yes	No
UKC Ljubljana	Yes	Yes
UKC Maribor	Yes	Yes
Kirurgija Bitenc	Yes (from 2021 on)	Yes (from 2020 on)
Arbor Mea	Yes (from 2022 on)	Yes (from 2022 on)
MD Medicina	Yes (from 2022 on)	Yes (from 2022 on)

6.4 Description of data

Within the RES system, data are collected on the patient, the surgical procedure, and the implant, as well as patient-reported outcomes based on self-assessment of health. Figure 5 presents a summary of the information obtained.

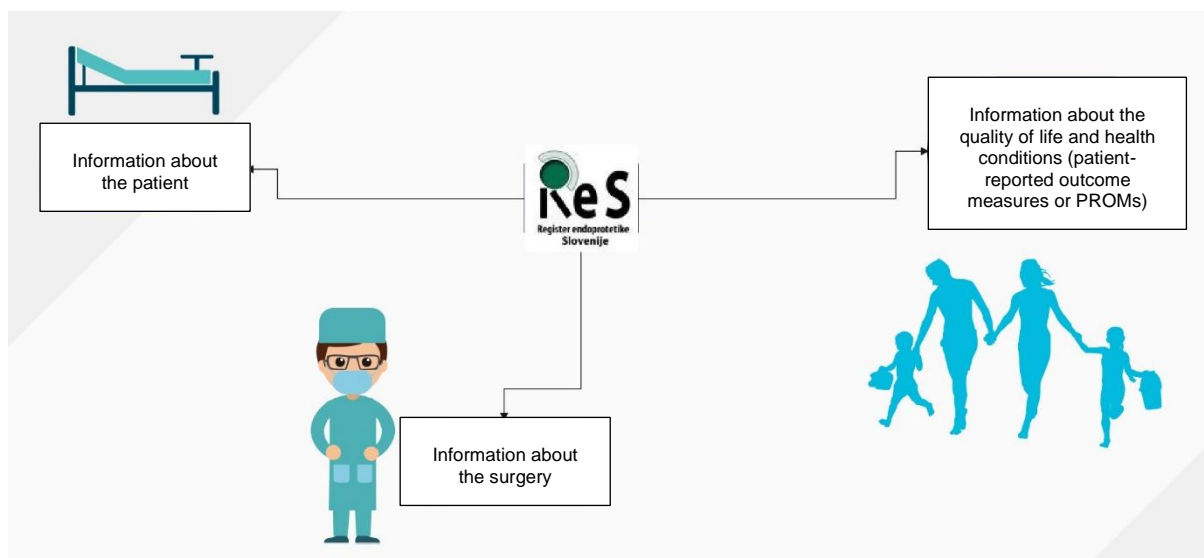


Figure 6: Display of data collected in the RES.

6.4.1 Information about the patient

The RES system collects basic patient information, including first and last name, date of birth, date of death, permanent residence address, gender, personal identification number (EMŠO), and health insurance number. For the purposes of data processing, personal identifiers are excluded from the analysis. Only gender and the patient's date of birth are considered, from which the age at the time of surgery is calculated.

Data entry personnel retrieve additional patient information through the health insurance number or EMŠO from the CRRP (Central Registry of Patient Data). Furthermore, data on a patient's (possible) death are updated daily within the RES application.

6.4.2 Information about surgery

The following data vary depending on the type of arthroplasty and whether a primary procedure or a revision surgery was performed.

In the section of the questionnaire intended for primary procedures, the side of the operated hip or knee is first recorded. This is followed by data on the diagnosis, previous surgical procedures, the current operation, prosthesis fixation, and the surgical approach used. This section is tailored to the type of endoprosthesis—hip or knee. In the final part of the questionnaire for primary endoprostheses, information on the implant is collected from the original manufacturer's labels, linked to the RES Implant Library.

For hip endoprostheses, data are collected on the acetabular component, liner, cage, femoral component, neck, and head. In addition, information is recorded on whether screws, wires, and plates were used. For knee endoprostheses, data are recorded on the femoral component, tibial component, insert, patellar button, and any stems used. As with hip endoprostheses, the use of screws, wires, and plates is also recorded under "other."

The form intended for revision of hip and knee endoprostheses includes data on the side of the procedure, as well as information on previous surgical procedures on the same hip or knee (medical history), including primary surgery, replacement, removal, and the date of the previous procedure. The response options are adapted to the type of procedure (hip or knee).

This is followed by data on the new implant, collected from the original manufacturer's labels, separately for hip and knee endoprostheses. For hip endoprostheses, there is space for labels corresponding to the acetabular component, liner, cage, femoral component, neck, and head, as well as for bone cement. Under "other," it is recorded whether screws, wires, and plates were used.

For knee endoprostheses, the labels include data on the femoral component, tibial component, insert, patellar component, tibial and/or femoral stems, and the bone cement used. Under "other," the use of screws, wires, and plates is also recorded.

Subsequently, for both hip and knee endoprostheses, the reasons for revision are listed, with one selected as the primary cause. For hip endoprostheses, additional information is recorded regarding the current surgical procedure on that hip, including the extent of revision, indication of a two-stage revision, conversion to a total prosthesis, the surgical approach used, and other specific features. For knee endoprostheses, the extent of revision and the surgical approach are recorded.

In the final part of the questionnaire, information is provided on the removed components of the prosthesis, separately for hip and knee endoprostheses.

All data on surgical procedures are recorded by providers on standardized forms published on the RES website: <https://www.res-nars.si/>.

6.4.3 Patient-reported outcome measures (PROMs)

In September 2022, we began collecting data on patients' self-assessed health and quality of life following hip or knee arthroplasty. For this purpose, we used validated questionnaires translated into Slovenian, which are also used by other endoprosthesis registries (patient-reported outcome measures – PROMs).

The methodology for data collection in this case is as follows. Printed consent forms for telephone-based data collection, along with questionnaires on well-being and quality of life, are sent to all providers of hip and knee arthroplasty in the Republic of Slovenia. These providers then distribute the consent forms and questionnaires to all patients scheduled for hip

or knee arthroplasty before surgery. The questionnaires cover well-being (OHS or OKS) and quality of life (EQ-5D-5L). It is recommended that patients complete them during their visit to the anesthesiology clinic or on the day before surgery when they are admitted to the hospital.

The providers then send the completed forms to the RES. Data entry personnel input the data into the RES application and link it to the corresponding procedure. The application automatically generates a task list, and a RES administrator contacts the patient after 6 and 12 months (if the patient has consented to the use of their phone number) or sends the questionnaires by mail with a return envelope, asking again about their well-being and quality of life. The data are then continuously entered into the RES application (Figure 7).

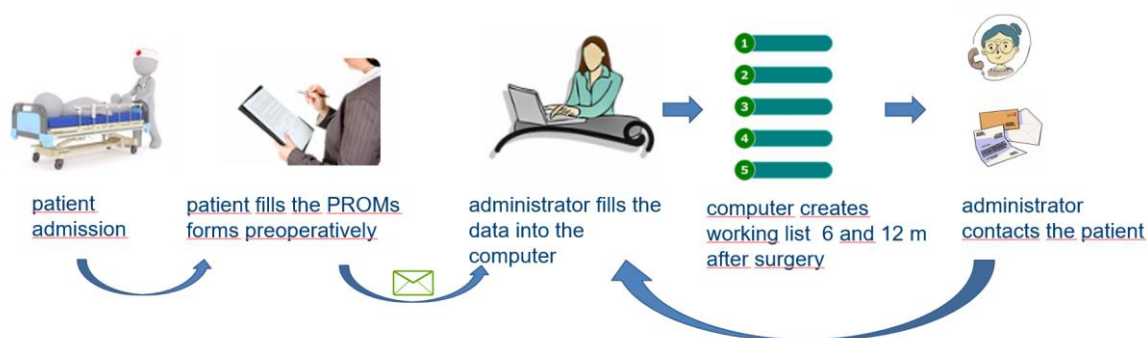


Figure 7: Display of the process of collecting and entering PROMs questionnaires.

When assessing patients' well-being before surgery, as well as 6 and 12 months after the procedure, we use the Oxford Hip Score (OHS) in the case of hip arthroplasty (Kalairajah et al., 2005) and the Oxford Knee Score (OKS) in the case of knee arthroplasty. For the calculation of values, we follow the methodology and guidelines of the Organisation for Economic Co-operation and Development (OECD) (OECD, 2019).

To assess quality of life, we use the EQ-5D-5L questionnaire, which patients complete before surgery and again at 6 and 12 months after the procedure. For value calculation, we follow the methodology and guidelines of the EuroQol Foundation (Van Reenen et al., 2021), as well as the Slovenian value set developed by Prevolnik Rupel and colleagues (Prevolnik Rupel et al., 2020; Prevolnik Rupel & Ogorevc, 2020a, 2020b).

Preoperative data are collected from providers in the RES database using standardized paper forms, which are subsequently digitized through entry into the RES application. Data for the 6- and 12-month postoperative periods are mostly collected through telephone interviews with patients. These are conducted in the RES call center, where an administrator enters responses directly into the RES application.

6.5 Statistical analysis

Descriptive variables are presented as counts or proportions (%), while numerical variables are reported as the median (Me) and interquartile range (IQR), or with a 95% confidence interval (CI) for the median.

In the survival analysis, the unit of observation is the endoprosthesis, and the outcome of interest is the time from the date of the primary surgery to the first revision (event). Prosthesis times for patients who died during the observation period or who did not experience the event (first revision) by the end of follow-up (31 December 2024) are treated as censored (Pruneski et al., 2023). The Kaplan–Meier method is used, and the cumulative percentage of revisions (with 95% confidence intervals, CI) is reported at one, two, three, and five years after the primary implantation.

7 Hip arthroplasties

Hip arthroplasty is divided into three categories: primary total hip arthroplasty, primary partial hip arthroplasty, and revision hip arthroplasty.

This chapter presents results on the completeness of collected data for primary total hip arthroplasty, primary partial hip arthroplasty, and revision hip arthroplasty for the period from 1 January 2019 to 31 December 2024. This is followed by results on patient demographics, the surgical procedure, implanted and removed materials, and findings from questionnaire-based assessments of quality of life. The final section presents the results of the survival analysis of hip implants for the same period (1 January 2019 to 31 December 2024).

7.1 Primary total hip arthroplasties – data up to 31 December 2024

In the RES database, a total of 23,307 primary total hip arthroplasties were recorded for the period from 1 January 2019 to 31 December 2024. Between 1 January 2024 and 31 December 2024, 4,448 primary total hip arthroplasties were recorded.

At the beginning of the chapter, the completeness of the collected data is presented by the surgical provider, followed by the results of analyses by patient and surgical procedure characteristics, and then by the characteristics of the implanted prosthesis. Differences by patient gender, age at the time of surgery, and surgical provider are also analyzed. The final section presents the results of the collected PROMs before and after primary total hip arthroplasty.

7.1.1 Compliance of the obtained data

Compliance is defined as the ratio between completed forms in the RES database for the period from 1 January 2019 to 31 December 2024 and the number of recorded primary total hip arthroplasties reported by the Health Insurance Institute of Slovenia (ZZZS) for the same period, according to providers of hip arthroplasty services in the Republic of Slovenia. Results are presented for follow-up periods of up to 6 years after the surgical procedure.

Discrepancies in compliance arise due to non-reporting of data to the RES database, as well as the reporting of cases that are not recorded by ZZZS (self-paying patients and procedures funded through conventions).

Table 2: Data on compliance of primary total hip arthroplasties in the period from 2019 to 2024, by hospital - comparison of RES and ZZZS (Source: RES and ZZZS)⁹.

Compliance	2019	2020	2021	2022	2023	2024
KS Rožna dolina	104.65	108.06	110.43	132.80	104.15	105.66
OB Valdoltra	101.93	102.40	102.60	105.05	104.79	102.22
SB Brežice	103.33	100.00	79.37	97.03	95.24	97.27
SB Celje	97.79	86.87	86.24	96.47	100.96	102.86
SB Izola	100.00	80.00	100.00	60.00	175.00	120.00
SB Jesenice	97.51	97.11	95.30	104.12	101.61	100.31
SB Murska Sobota	101.28	101.61	102.07	106.78	100.76	101.61
SB Nova Gorica	97.39	98.18	93.79	96.39	98.17	97.78
SB Novo mesto	97.65	98.65	100.85	107.10	101.27	99.46
SB Ptuj	97.45	93.94	96.43	101.90	98.62	100.68
SB Slovenj Gradec	97.35	89.57	100.85	98.67	101.53	101.59
SB Trbovlje	NP	NP	NP	NP	NP	NP
UKC Ljubljana	87.33	97.06	98.89	102.37	102.54	106.23
UKC Maribor	100.22	99.08	96.52	98.60	102.38	106.00
Kirurgija Bitenc	NP	NP	NP	NP	96.77	66.67
Arbor Mea	NP	NP	NP	NP	66.95	63.02
MD Medicina	NP	NP	NP	NP	NP	NP
KS Rožna dolina	104.65	108.06	110.43	132.80	104.15	105.66
Total	98.06	98.71	99.43	104.68	102.24	101.72

The Health Insurance Institute of Slovenia (ZZZS) recorded 23,078 primary total hip arthroplasties for the period from 2019 to 2024, while the RES database contains 23,307 such procedures, corresponding to a compliance rate of 101.7% (Table 2).

In most institutions, the number of hip arthroplasties recorded in the RES database is slightly higher than in the ZZZS database. In 2024, exceptions include SB Brežice (compliance 97.3%), SB Nova Gorica (97.8%), SB Novo mesto (99.5%), Kirurgija Bitenc (66.7%), and Arbor Mea (63%), where the RES database contains slightly fewer cases than the ZZZS database. In 2024, MD Medicina submitted data to RES on 50 performed primary total hip arthroplasties; however, these procedures are not recorded in the ZZZS database, because they involve self-paying patients or foreign nationals. SB Trbovlje does not report data to RES at all.

Based on the above, it can be concluded that the obtained results can be generalized to all primary total hip arthroplasties performed in the Republic of Slovenia between 2019 and 2024.

7.1.2 Gender and age of patients undergoing primary total hip arthroplasty

We analyzed patients' demographic characteristics, including their gender (Figure 8) and age at the time of surgery (Figure 9). Table 3 then presents the median age of patients by gender for each individual year.

⁹ For MD Medicine, Arbor Mea and Bitenc Surgery, the ZZZS does not keep records of operations performed throughout the years, as they were performed on a self-pay basis. For this reason, compliance could not be calculated. In this case, the table shows the code NP (no data).

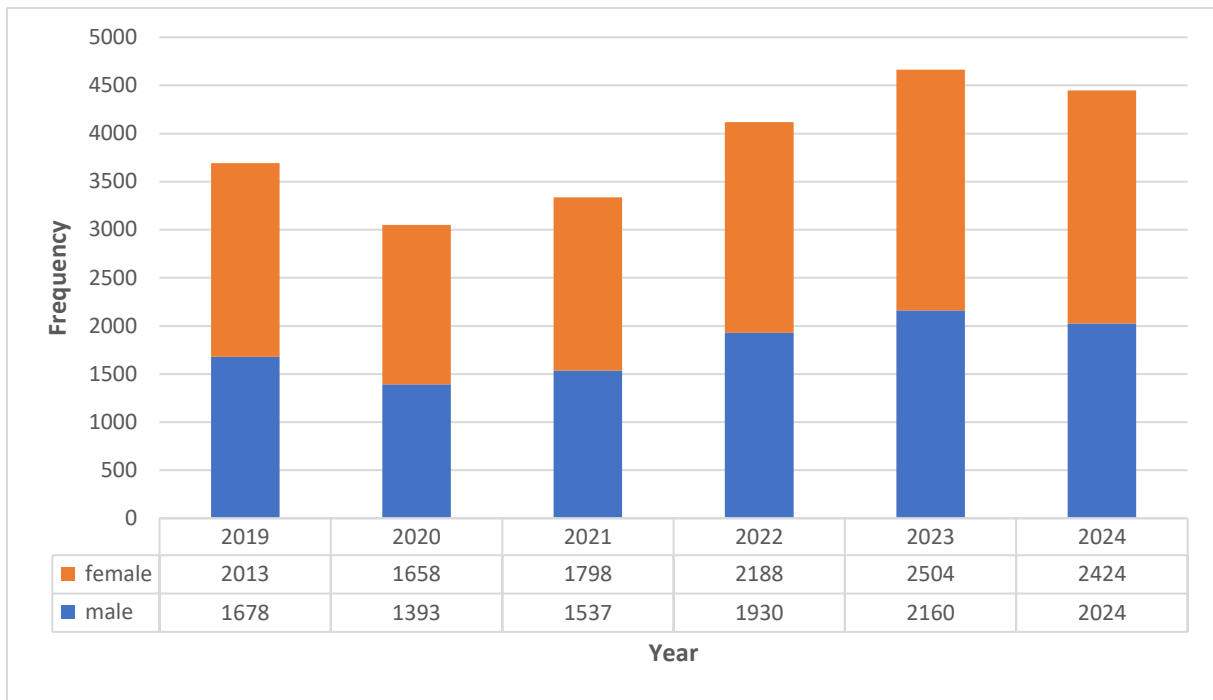


Figure 8: Primary total hip arthroplasty between 2019 and 2024, by patient gender (Source: RES).

Figure 8 shows that in 2024, slightly more primary total hip arthroplasties were performed in women (54.5%) than in men (45.5%). Over the entire period from 2019 to 2024, the proportion of women undergoing primary total hip arthroplasty was consistently higher—by 6 to 9%—than that of men.

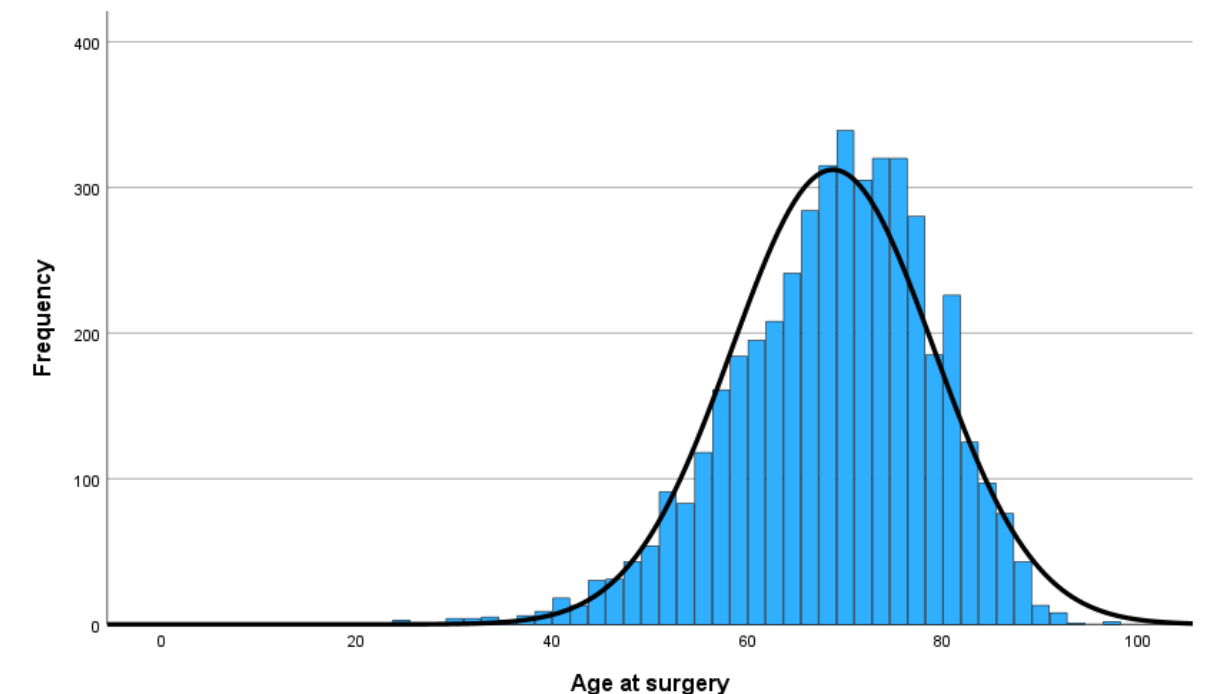


Figure 9: Primary total hip arthroplasty in 2024, by patient age (Source: RES).

Figure 9 shows the age distribution of patients undergoing primary total hip arthroplasty in 2024. The median age was 69.7 years. The youngest patient was 15.9 years old, while the oldest was 96.7 years old.

Table 3: Age of patients undergoing primary total hip arthroplasty between 2019 and 2024, by gender (Source: RES).

Age at surgery			Year of surgery					
			2019	2020	2021	2022	2023	2024
gender	Male	Median	67.3	66.9	67.1	67.0	67.6	67.8
	Female	Median	70.0	70.5	70.5	70.7	70.8	71.2
Total		Median	68.8	69.0	69.1	69.2	69.4	69.7

On average, women were 2.5 years older than men at the time of surgery (Table 3).

Between 2019 and 2024, the median age increased. Among men, the median age rose by 0.5 years, while among women it increased by 1.1 years.

7.1.3 Region of residence of patients with primary total hip endoprostheses

For each provider, Figure 10 shows the proportion of primary total hip arthroplasties performed in 2024 in patients whose permanent residence is outside the region where the provider is registered.

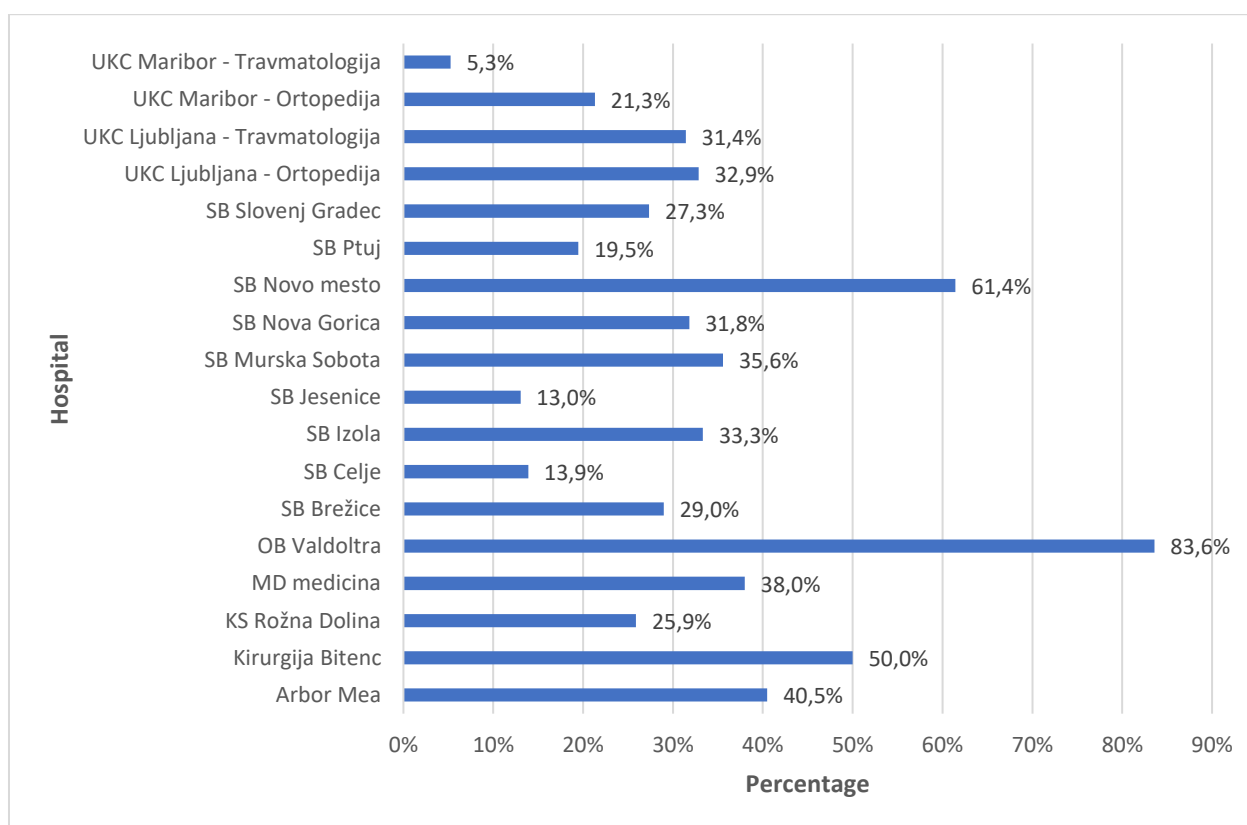


Figure 10: Share of patients in 2024 whose region of permanent residence differs from the region of the surgery provider (Source: RES).

Most hospitals in Slovenia operate primarily on patients from the region in which the hospital is located (Figure 10). The exceptions are SB Novo Mesto, where 61.4% of patients come from other regions, and OB Valdoltra, where as many as 83.6% of patients are from other regions.

7.1.4 Characteristics of surgical procedures in primary total hip arthroplasty

This section presents the following: the surgical provider (Figure 11), the side of the procedure (Figure 12 and Table 4), the preoperative diagnosis (Figure 13 and Table 5), the surgical approach (Figure 14 and Table 6), and previous operations on the operated hip (Figures 15 and 16).

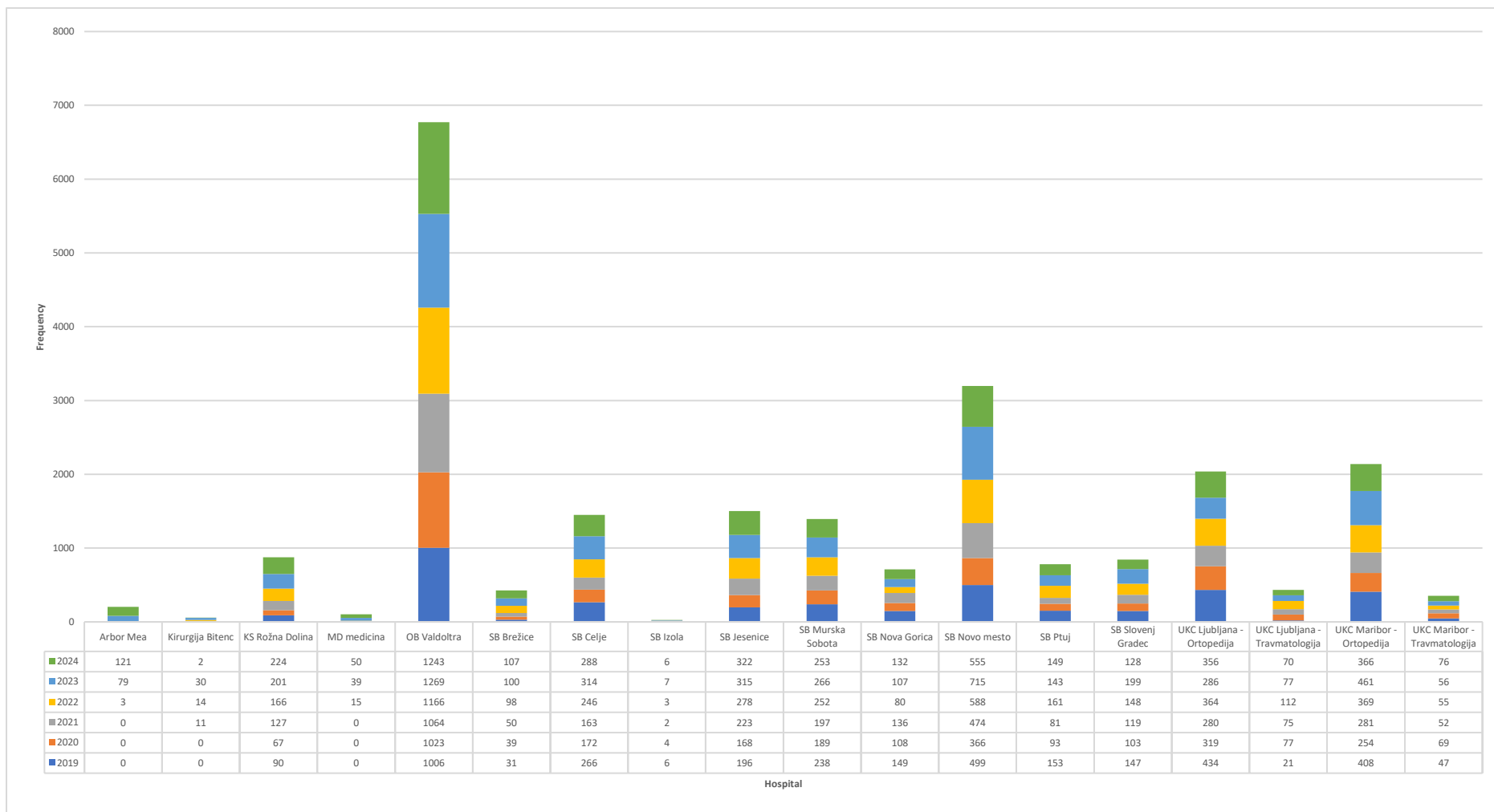


Figure 11: Primary total hip arthroplasty between 2019 and 2024, by hospitals (Source: RES).

In 2024, the highest number of procedures was performed at OB Valdoltra (1,243 – 28%). This was followed by SB Novo mesto (555 – 12.5%), UKC Maribor – Orthopaedics (366 – 8.2%), UKC Ljubljana – Orthopaedics (356 – 8%), SB Jesenice (322 – 7.2%), SB Celje (288 – 6.5%), SB Murska Sobota (253 – 5.7%), and KS Rožna dolina (224 – 5%). All other providers performed fewer than 200 such procedures each (Figure 11).

Figure 12 and Table 4 show the side of the surgical procedure.

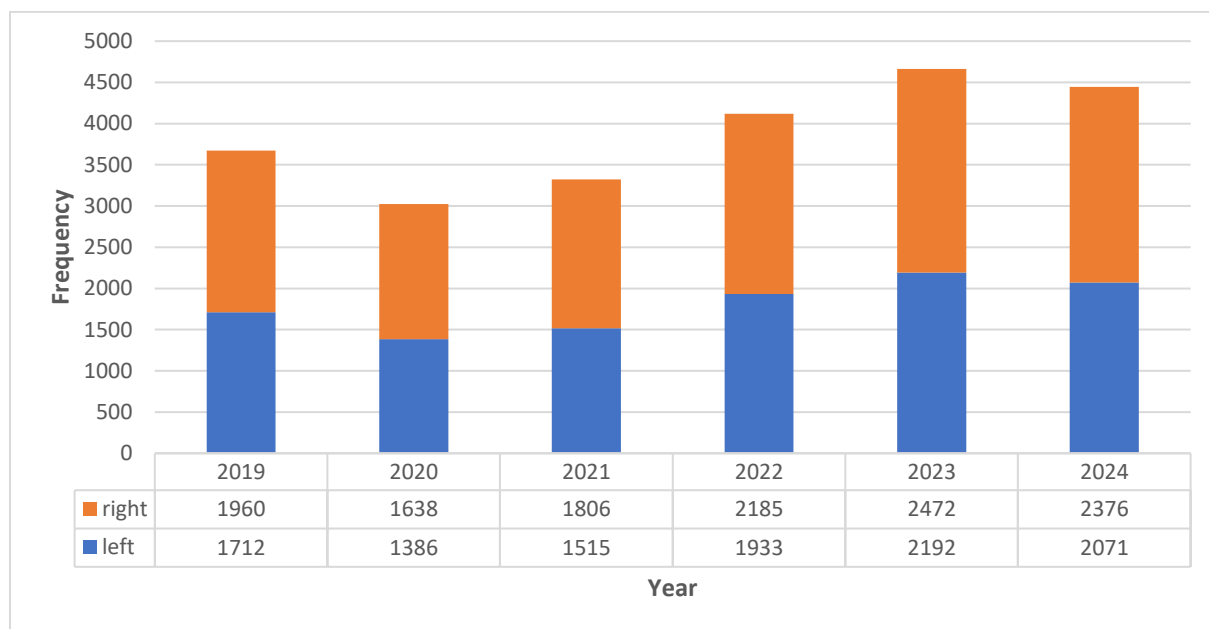


Figure 12: Primary total hip arthroplasties between 2019 and 2024, by surgical side¹⁰ (Source: RES).

Table 4: Primary total hip arthroplasties between 2019 and 2024, by surgical side (Source: RES).

Side	2019 do 2023		2024	
	N	f%	N	f%
right	10061	53.3	2376	53.4
left	8738	46.3	2071	46.6
No data available	60	0.3	1	<0.01

In 2024, slightly more procedures were performed on the right hip (2,376 – 53.4%) than on the left hip (2,070 – 46.6%) (Figure 12 and Table 4).

¹⁰ The RES database does not contain information on the surgical side for 19 primary total hip arthroplasties performed in 2019, 27 performed in 2020, 14 performed in 2021, and 1 performed in 2024.

Figure 13 presents data on preoperative diagnoses for the period from 2019 to 2024.

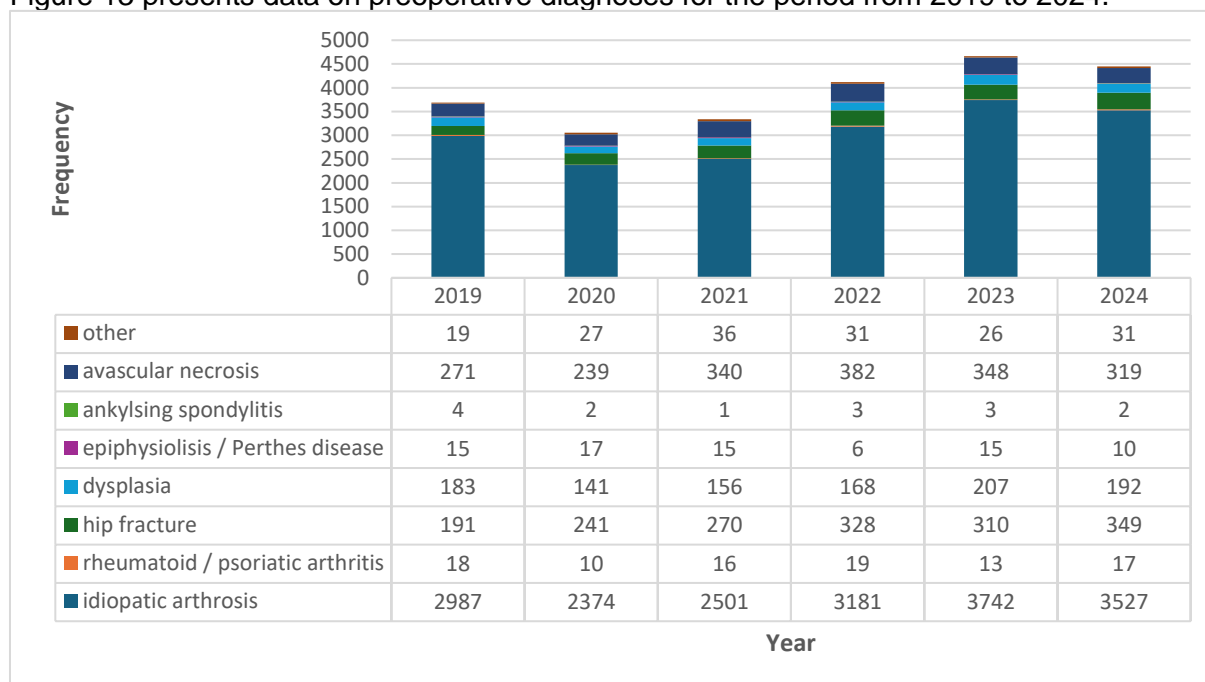


Figure 13: Primary total hip arthroplasty between 2019 and 2024, by diagnosis¹¹ (Source: RES).

In 2024, primary total hip arthroplasty was most frequently performed due to idiopathic osteoarthritis (3,527 – 79.3%) (Figure 13). Less common indications included hip fractures (349 – 7.8%), avascular necrosis (319 – 7.2%), sequelae of dysplasia (192 – 4.3%), rheumatoid/gouty/psoriatic arthritis (17 – 0.4%), sequelae of epiphysiolysis/Perthes disease (10 – 0.2%), and ankylosing spondylitis (2 – less than 0.1%). In 31 cases, other diagnoses were reported.

In the analysis, we retained only those diagnoses that occurred in at least 30 cases in 2024. All other diagnoses were grouped into the category “other.” Table 5 presents the number and proportion of individual diagnoses, the median age by diagnosis, and the proportion of men and women for each diagnosis. For the “other” category, the median age and the proportion of men and women are not reported.

¹¹ The RES database is missing information on diagnosis for 3 primary total hip arthroplasty procedures performed in 2019 and 1 in 2024.

Table 5: Primary total hip arthroplasty between 2019 and 2024, by preoperative diagnosis (by gender and age) (Source: RES)

Diagnosis	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
avascular necrosis	1580	8.4	68.8	49.4	50.6	319	7.2	68.6	53.0	47.0
idiopathic osteoarthritis	14785	78.4	69.5	47.1	52.9	3527	79.3	70.4	45.5	54.5
dysplasia	855	4.5	58.4	29.0	71.0	192	4.3	59.7	32.3	67.7
hip fracture	1340	7.1	69.6	42.8	57.2	349	7.8	69.4	45.6	54.4
other	296	1.7				60	1.4			

Patients operated on due to sequelae of dysplasia were consistently noticeably younger than those with other diagnoses throughout all years of follow-up (Table 5). In 2024, more women (67.7%) than men (32.3%) underwent surgery due to sequelae of dysplasia. In contrast, avascular necrosis was more common in men (53%) than in women (47%).

Figure 14 shows the number and type of surgical approaches between 2019 and 2024.

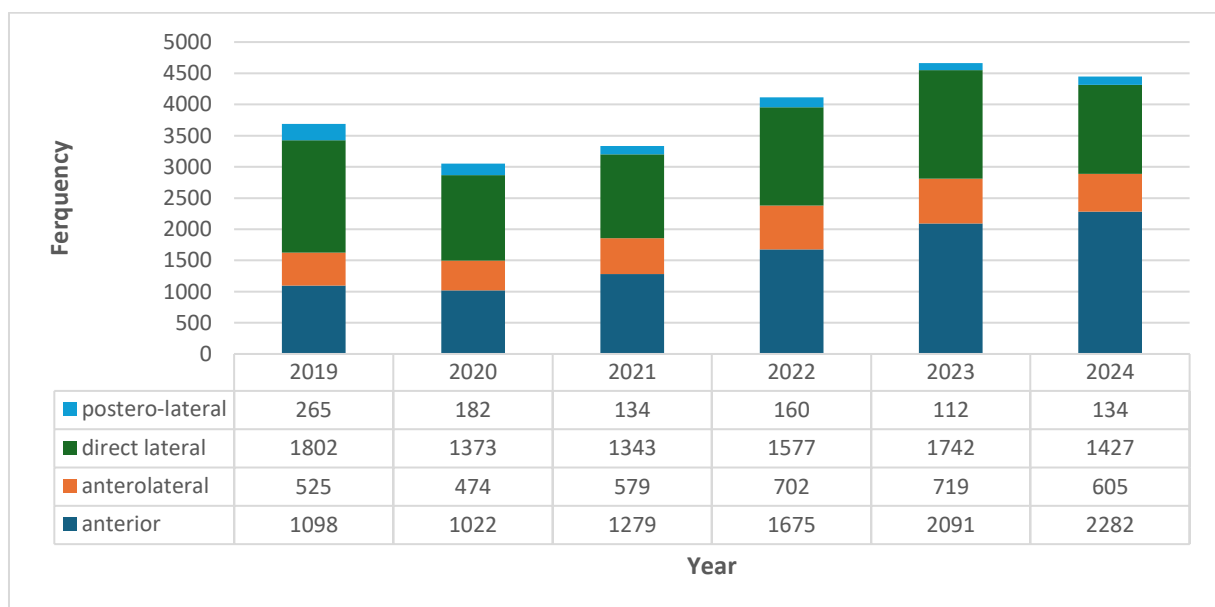


Figure 14: Primary total hip arthroplasty between 2019 and 2024, by surgical approach¹² used (Source: RES).

Figure 12 shows that in 2024, the anterior approach was the most commonly used in primary total hip arthroplasties (51.3% of all cases). This was followed by the direct lateral approach (32.1%). Less commonly used surgical approaches were the anterolateral (13.6%) and postero-lateral (3%) approaches.

¹² Data on the surgical approach are not available in RES database in 1 primary total hip arthroplasty performed in 2021 and for 4 cases in 2022.

Table 6: Primary total hip arthroplasty between 2019 and 2024, by surgical approach used (by gender and age) (Source: RES).

Surgical approach	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Anterior	7165	38.0	67.9	47.5	52.5	2282	51.3	68.9	45.7	54.3
Anterolateral	2999	15.9	70.2	44.9	55.1	605	13.6	70.4	43.3	56.7
Direct lateral	7837	41.6	69.4	45.5	54.5	1427	32.1	70.8	46.7	53.3
Postero-lateral	853	4.5	70.2	45.1	54.9	134	3.0	69.9	39.6	60.4

The median age of patients ranges between 68 and 71 years (Table 6). Between the period 2019–2023 and 2024, the median age increased across all approaches, except for the posterolateral approach. The proportion of men and women does not differ substantially between individual surgical approaches.

In 2024, the share of the anterior surgical approach increased to 51.3%, while the proportion of the direct lateral approach decreased (from 41.6% in the period 2019–2023 to 32.1% in 2024).

The following section presents the number of primary total hip arthroplasties according to previous operations (Figure 15).

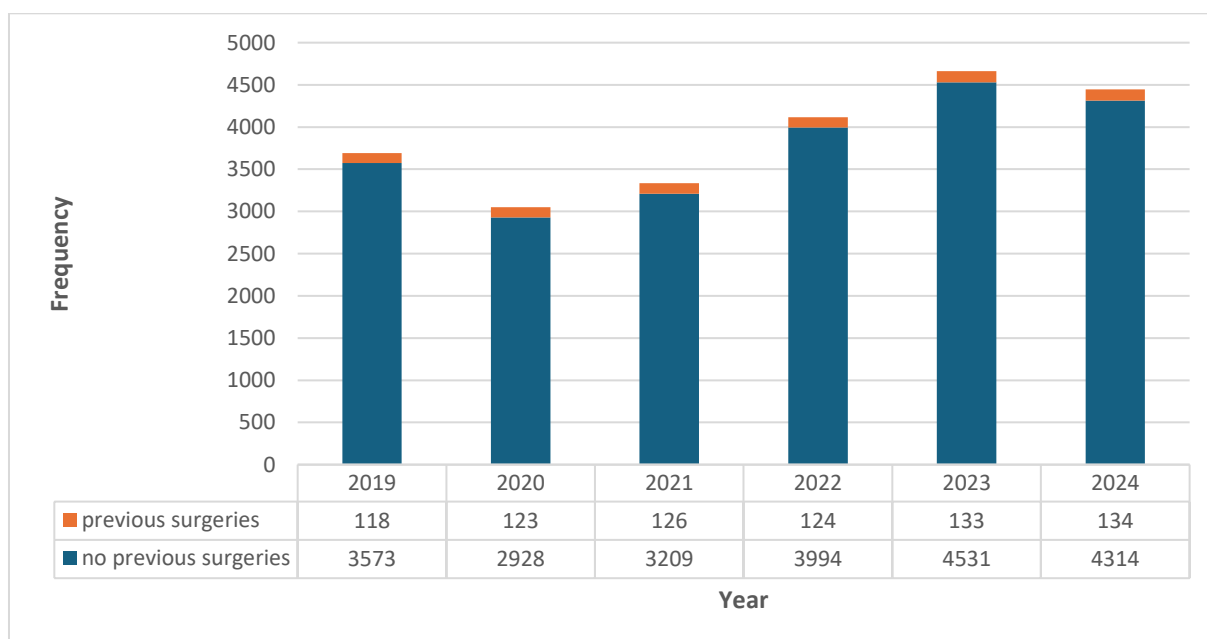


Figure 15: Number of patients with or without previous hip surgeries between 2019 and 2024 (Source: RES).

Between 2019 and 2024, the number of patients who had undergone previous hip surgeries increased from 118 (3.2% of all primary total hip arthroplasties) to 134 (3%).

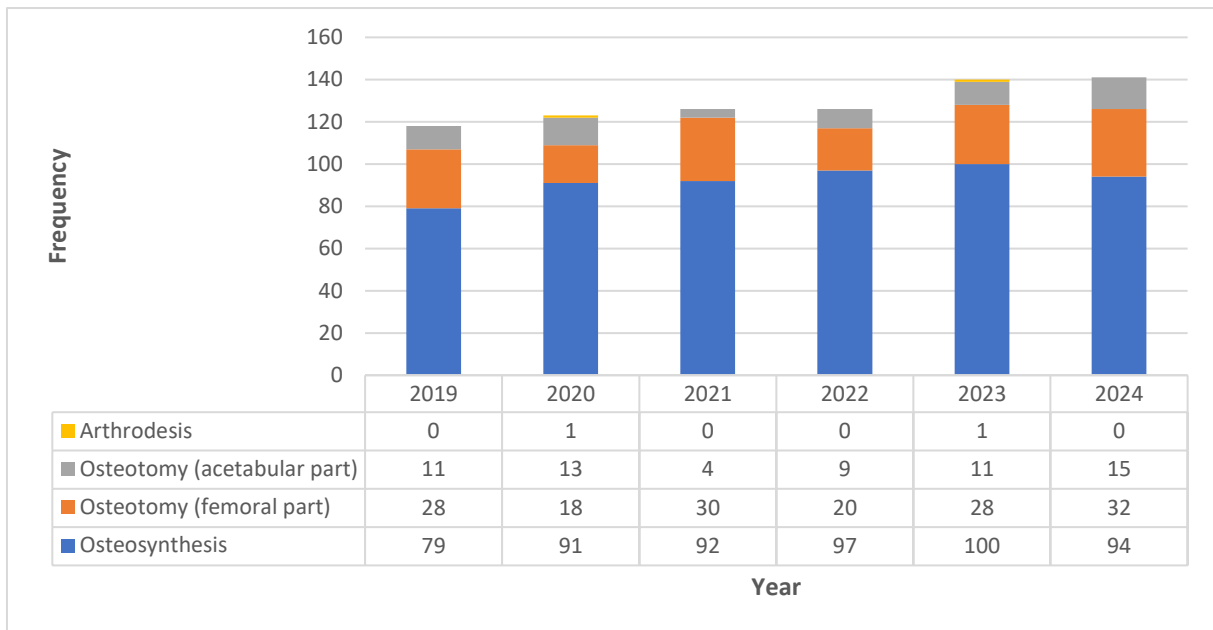


Figure 16 shows the number of different types of previous operations on the operated hip.

Figure 16: Previous surgeries on the operated hip in primary total hip arthroplasty between 2019 and 2024 (Source: RES).

The most common previous surgical procedure throughout the entire period was osteosynthesis following a fracture (Figure 16).

7.1.5 Characteristics of primary total hip endoprostheses

The following section presents the type of fixation of the prosthesis, as well as the characteristics of the femoral stem, acetabular component, and head in primary total hip arthroplasty.

Figure 17 and Table 7 show the type of prosthesis fixation. Hybrid fixation refers to a prosthesis with a cemented stem and an uncemented cup, while reverse hybrid fixation refers to a prosthesis with an uncemented stem and a cemented cup.

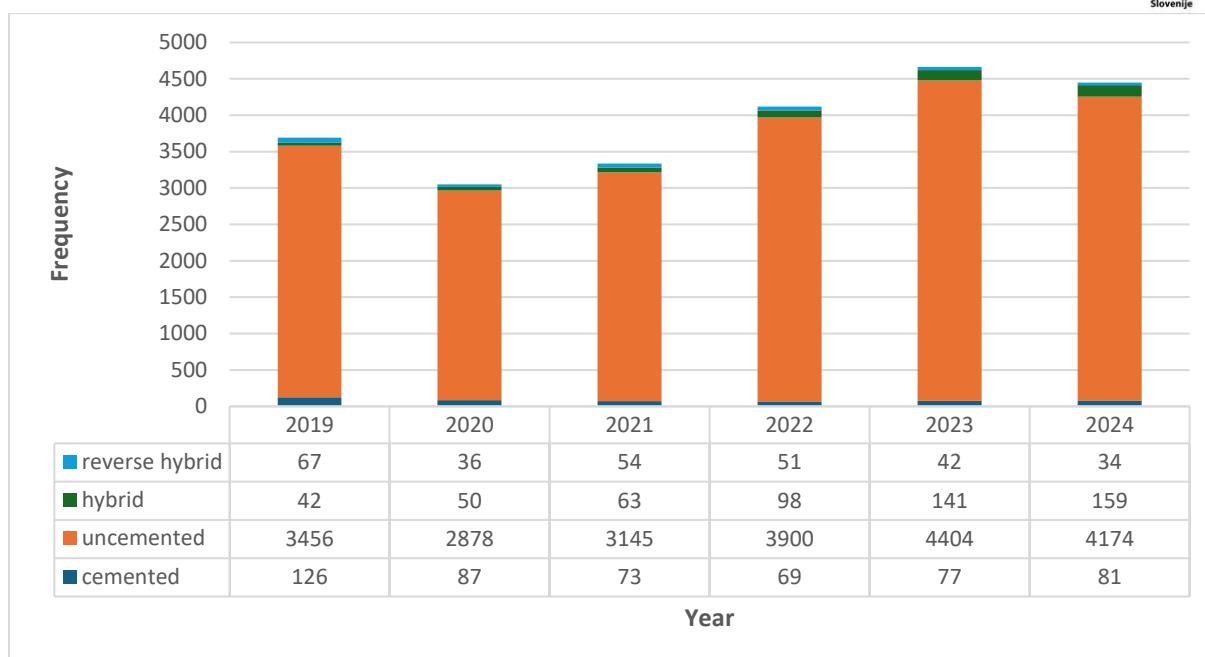


Figure 17: Primary total hip arthroplasty between 2019 and 2024, by prosthesis fixation (Source: RES).

In 2024, 4,174 (93.8%) endoprostheses were uncemented (Figure 17). There were 159 (3.6%) hybrid prostheses, 81 (1.8%) cemented prostheses, and 34 (0.8%) reverse hybrid prostheses.

Table 7: Primary total hip arthroplasty between 2019 and 2024, by prosthesis fixation (by gender and age) (Source: RES).

Prosthesis fixation	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
cemented	432	2.3	79.8	26.9	73.1	81	1.8	81.2	23.5	76.5
hybrid	394	2.1	79.3	20.3	79.7	159	3.6	77.2	28.3	71.7
uncemented	17783	94.3	68.6	47.4	52.6	4174	93.8	69.2	46.7	53.3
reverse hybrid	250	1.3	71.9	29.6	70.4	34	0.8	75.8	29.4	70.6

In 2024, the median age of patients with uncemented prostheses in primary total hip arthroplasty was 69.2 years; for reverse hybrid prostheses, it was 75.8 years, for hybrid prostheses, 77.2 years, and for cemented prostheses, 81.2 years (Table 7).

Uncemented prostheses were more frequently implanted in women (53.3%), as were cemented prostheses (76.5%).

Figure 18 shows the characteristics of the implanted acetabular components of hip endoprostheses.



Figure 18: Primary total hip arthroplasties between 2019 and 2024 by type of acetabular component¹³ of the endoprosthesis (Source: RES).

For 2024, the RES database (see Figure 15) includes data on 4,009 (90.1%) standard acetabular components, 428 (9.6%) dual mobility components, 8 (0.2%) revision components, and 3 resurfacing acetabular components used in primary total hip arthroplasties.

In the following analysis, we focused only on standard heads and dual mobility heads of endoprostheses (Figure 19 and Table 8). Resurfacing prostheses were excluded from the analysis.

¹³ For 2019, data on the type of acetabular component are missing in one case.

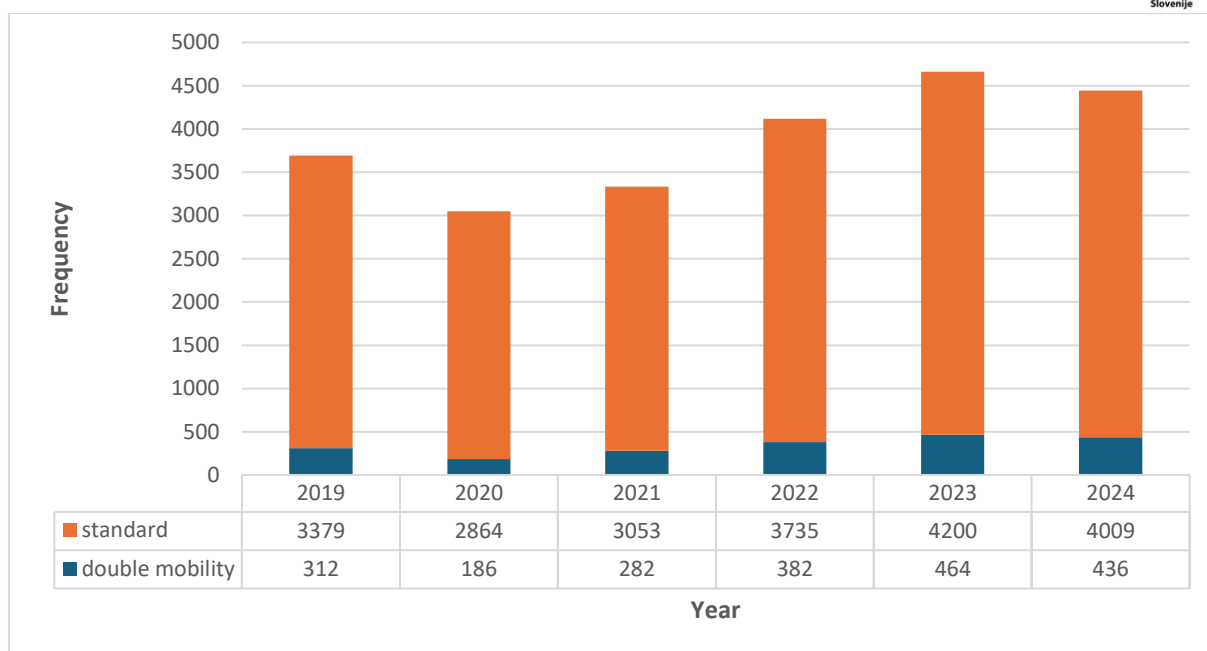


Figure 19: Type of femoral head in primary total hip arthroplasties between 2019 and 2024 (Source: RES).

The RES database (Figure 19) recorded 4,017 (90.4%) standard prosthetic heads and 428 (9.6%) heads in dual mobility bearing in primary total hip arthroplasties in 2024.

Table 8: Primary total hip arthroplasties between 2019 and 2024 by type of femoral head (by gender and age) (Source: RES).

Type of femoral head	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Standard	17242	91.4	68.6	47.3	52.7	4017	90.4	69.2	47.1	52.9
Dual mobility	1616	8.6	73.6	33.5	66.5	428	9.6	73.2	30.1	69.9

In 2024, among patients receiving a standard prosthetic head in primary total hip arthroplasty, 47.1% were men and 52.9% were women (Table 8). Heads in dual mobility bearing were received by 30.1% men and 69.9% women.

The median age of patients with standard heads in 2024 was 69.2 years, while for those with dual mobility heads it was 73.2 years.

Figure 20 shows the manufacturers of femoral stems of endoprostheses by individual provider in 2024.

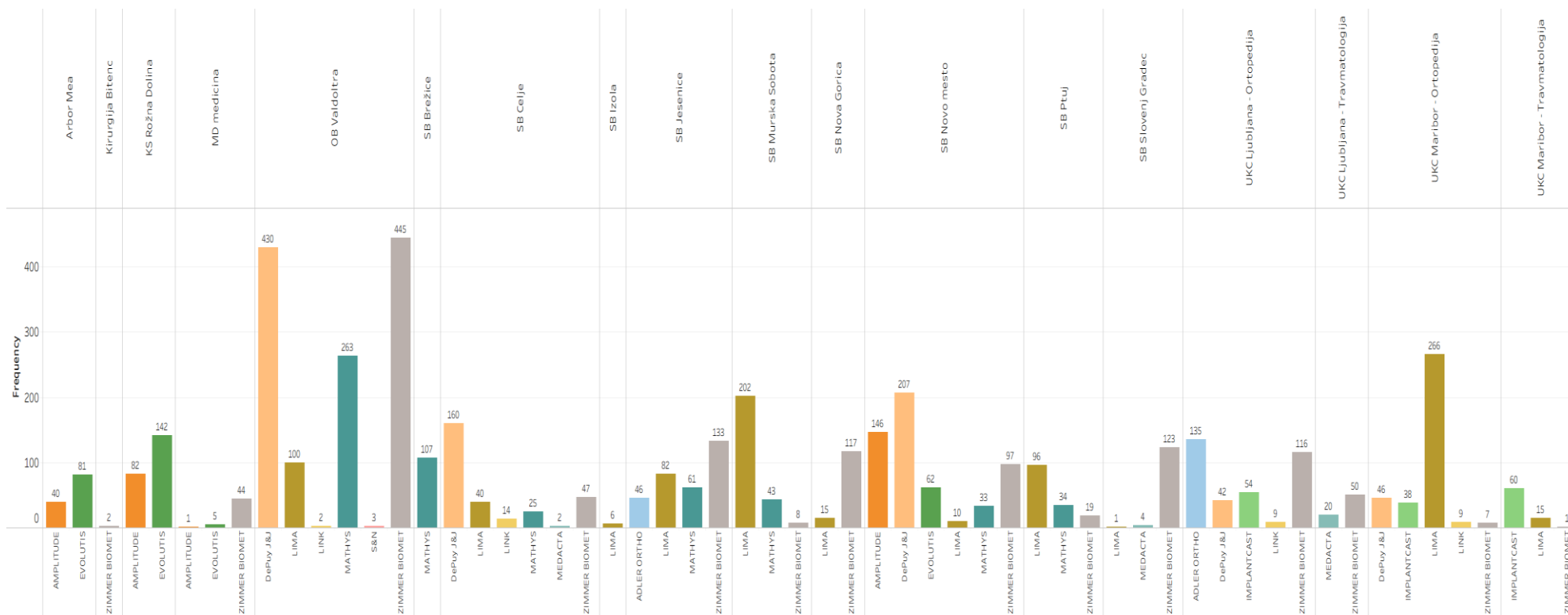


Figure 20: Primary total hip arthroplasty according to the manufacturer of the femoral part of the endoprosthesis and the hospital performing the surgery (Source: RES).

In 2024, femoral stems from 11 different manufacturers were used in Slovenia.

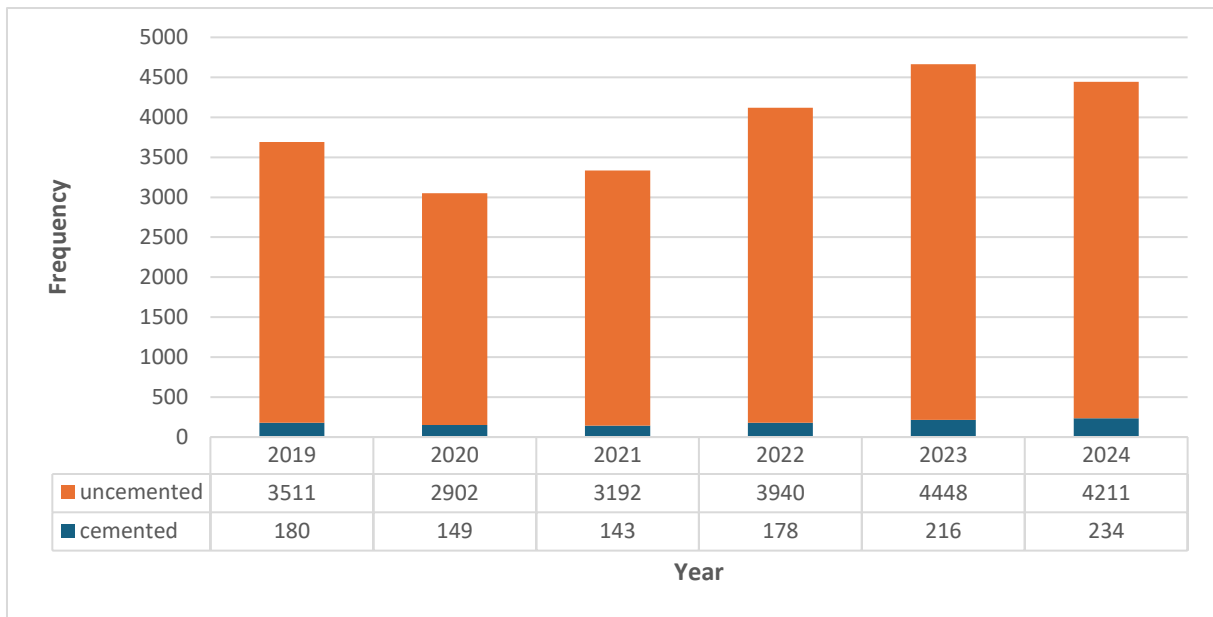


Figure 21: Primary total hip arthroplasty between 2019 and 2024, by fixation of the endoprosthesis stem (Source: RES).

The proportion of cemented stems was low throughout all years of follow-up. In 2024, it was 5.3% (Figure 19).

Table 9: Primary total hip arthroplasty between 2019 and 2024, by fixation of the endoprosthesis stem (by gender and age) (Source: RES).

Stem fixation	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Cemented	866	4.6	79.7	23.3	76.7	234	5.3	78.6	24.8	75.2
Uncemented	17992	95.4	68.6	47.2	52.8	4211	94.7	69.3	46.6	53.4

Among patients with an uncemented femoral stem in 2024, 46.6% were men and 53.4% were women.

The median age of patients with an uncemented stem in 2024 was 69.3 years, compared with 78.6 years for those with a cemented stem (Table 9).

Figure 22 shows the fixation of the acetabular component of hip endoprostheses between 2019 and 2024.

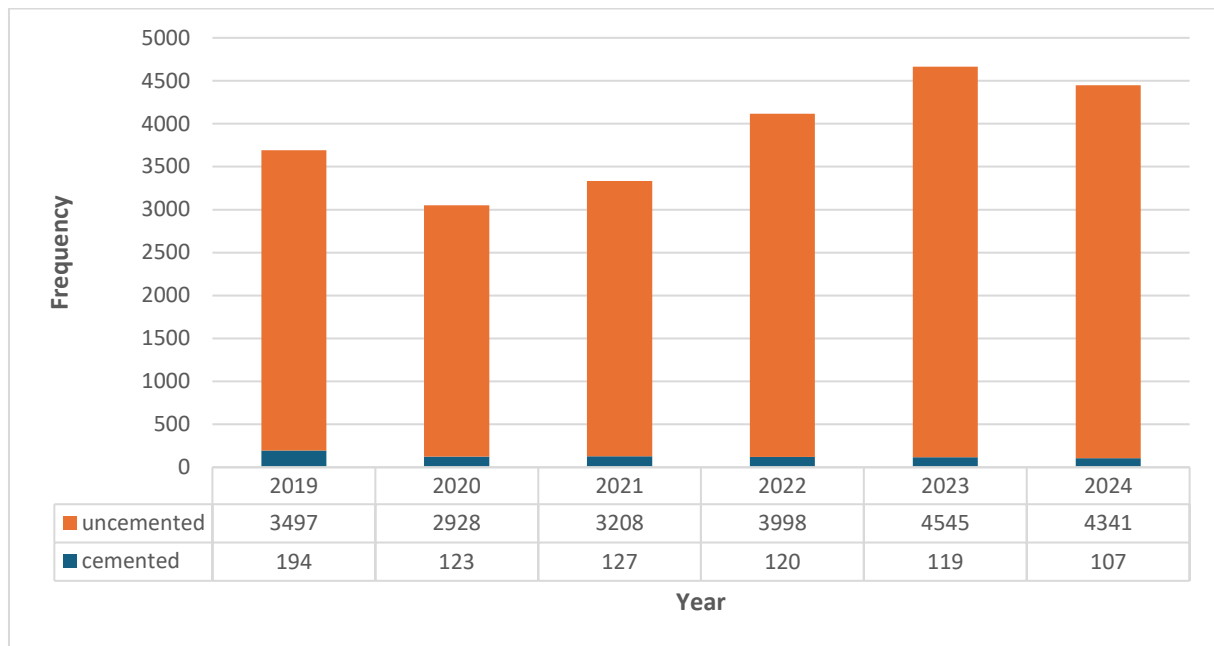


Figure 22: Primary total hip arthroplasty between 2019 and 2024, by acetabular fixation¹⁴ of the endoprosthesis (Source: RES).

From 2019 to 2024, the vast majority of acetabular components were uncemented. In 2024, 4,341 (97.6%) uncemented and 107 (2.4%) cemented acetabular components were implanted in primary total hip arthroplasties (Table 10).

Table 10: Primary total hip arthroplasty between 2019 and 2024, by fixation of the acetabular part of the endoprosthesis (by gender and age) (Source: RES).

Fixation of the acetabular part	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
cemented	683	3.6	77.8	27.8	72.2	107	2.4	80.4	25.2	74.8
uncemented	18175	96.4	68.8	46.8	53.2	4341	97.6	69.5	46.0	54.0

In 2024, 4,341 (97.6%) primary total hip arthroplasties involved an uncemented acetabular component, while 107 (2.4%) involved a cemented component (Figure 22). Slightly fewer men (46%) than women (54%) received an uncemented acetabular component.

The median age of patients with an uncemented acetabular component was 69.5 years, while for those with a cemented component it was 80.4 years (Table 10). It can be observed that since 2019, the median age of patients with a cemented acetabular component has increased from 77.8 to 80.4 years.

¹⁴ In the RES database, data on the fixation of the acetabular component is missing in one case from 2019.

In the analysis of implanted heads in total hip endoprostheses, we divided them into heads used in standard bearing combinations (femoral heads and acetabular components), while heads of dual mobility endoprostheses are presented separately.

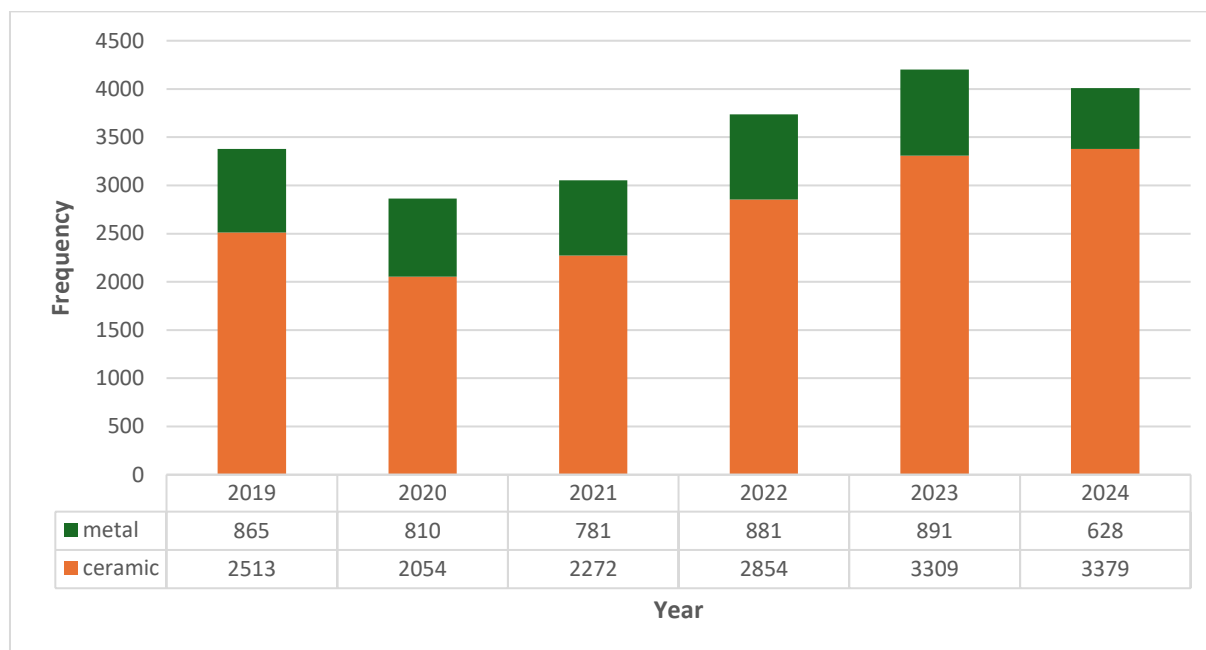


Figure 23: Primary total hip arthroplasties between 2019 and 2024 by material of the standard femoral head¹⁵ (Source: RES).

Figure 23 shows primary total hip arthroplasties according to the material of the implanted standard femoral head. In 2024, a ceramic head was used in 3,382 cases (84.2%), while a metal head was used in 633 cases (15.8%).

Table 11: Primary total hip arthroplasties between 2019 and 2024 by head material and type of femoral head (by gender and age) (Source: RES).

	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Ceramic	13009	69.0	66.0	49.9	50.1	3382	76.1	67.9	48.9	51.1
Metal	4233	22.4	75.5	39.2	60.8	633	14.3	76.9	37.8	62.2
Dual mobility	1616	8.6	73.6	33.5	66.5	428	9.6	73.2	30.1	69.9

In 2024, 3,382 (76.1%) standard ceramic heads, 633 (14.3%) standard metal heads, and 428 (9.6%) heads used in dual mobility bearing were implanted in primary total hip arthroplasties (Table 11). Metal standard heads were more commonly used in older patients (median age 76.9 years), while standard ceramic heads were more frequently used in younger patients (median age 67.9 years).

Table 11 also shows that the proportion of patients with implanted standard ceramic heads increased from 69% in 2019 to 76.1% in 2024. The share of patients with dual mobility heads rose from 8.6% in 2019 to 9.6% in 2024. In contrast, there was a notable decrease in the

¹⁵ The RES database does not contain information on the material of the femoral head of the endoprosthesis in one case in 2019 and in two cases in 2024.

proportion of patients with standard metal heads—from 22.4% in the period 2019–2023 to 14.3% in 2024.

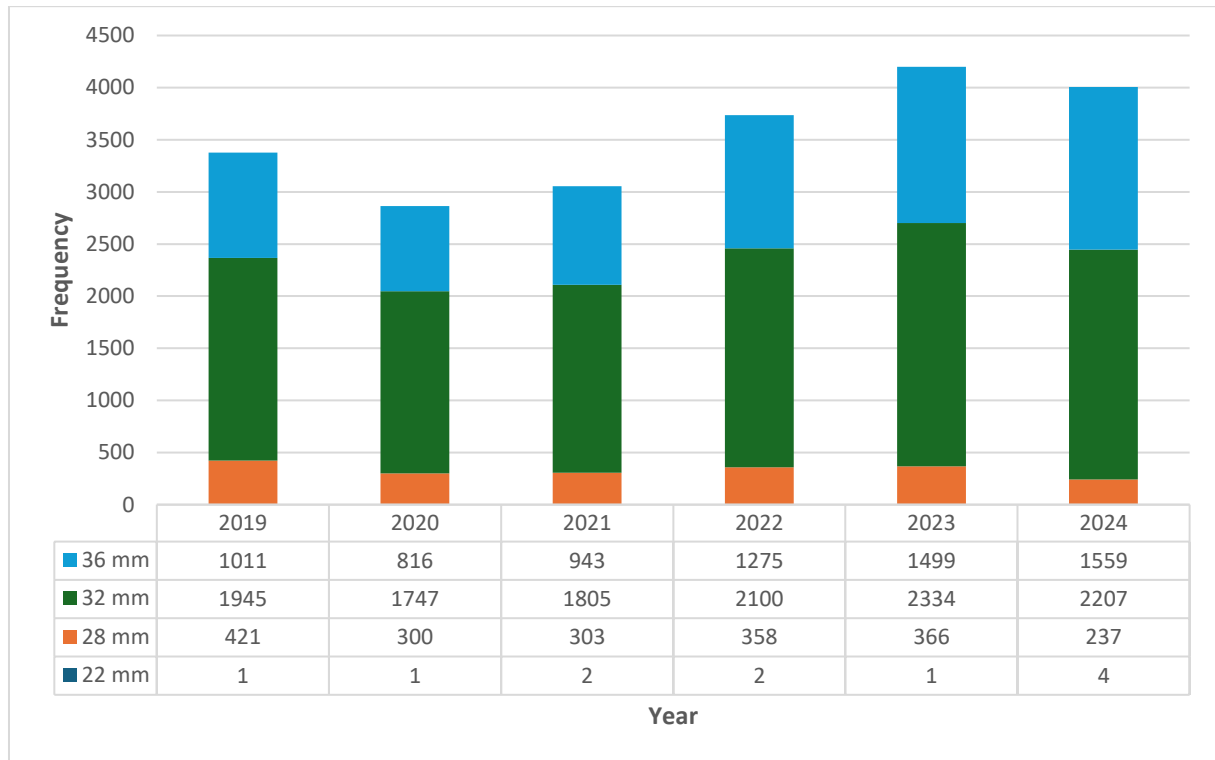


Figure 24: Primary total hip arthroplasty with a standard head between 2019 and 2024, by endoprosthesis head size¹⁶ (Source: RES).

In 2024, the most commonly implanted standard heads were 32 mm in size (55%), followed by 36 mm heads (38.9%), 28 mm heads (6%), and 22 mm heads (0.1%) (Figure 24).

The table below presents an analysis of endoprosthesis head sizes. Data on the proportion by gender and median age are not shown for groups with fewer than 30 patients.

Table 12: Primary total hip arthroplasties between 2019 and 2024 by head size and type of femoral head (by gender and age) (Source: RES).

Head size	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Standard 22 mm	7	<0.01				4	0.1			
Standard 28 mm	1754	9.3	69.2	7.9	92.1	242	5.5	71.7	7.4	92.6
Standard 32 mm	9935	52.7	69.3	42.1	57.9	2209	49.7	69.3	35.4	64.6
Standard 36 mm	5546	29.4	67.0	69.2	30.8	1560	35.1	68.8	70.0	30.0
Double mobility	1616	8.6	73.6	33.5	66.5	428	9.6	73.2	30.1	69.9

Table 12 shows that in 2024, the most frequently implanted component in primary total hip arthroplasty was a standard prosthetic head of size 32 mm (49.7% of cases). This was followed

¹⁶ In the RES database, we do not have data for 21 endoprosthesis head sizes that were inserted in 2022 for total hip arthroplasty.

by standard heads of size 36 mm (35.1%), dual mobility heads (9.6%), and standard heads of size 28 mm (5.5%). Only four patients received a standard head of size 22 mm.

A higher proportion of men (70%) than women (30%) received larger standard heads (36 mm), whereas women more often received smaller standard heads and dual mobility heads compared to men.

The following section presents data on bearing surfaces in standard primary hip endoprostheses between 2019 and 2024.

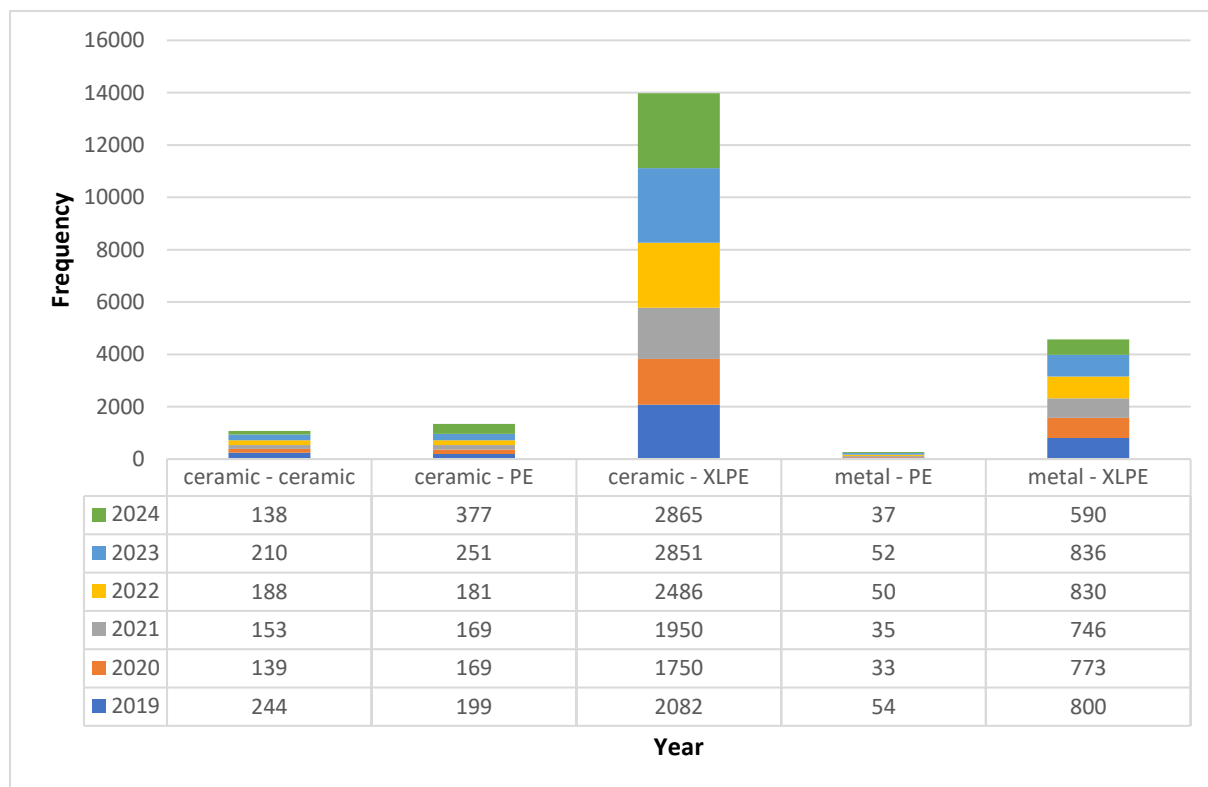


Figure 25: The bearing surface os standard primary total hip arthroplasty between 2019 and 2024¹⁷ (Source: RES).

In 2024 (see Figure 25), the most frequently used bearing surface combination was ceramic and cross-linked polyethylene (71.4%). This was followed by metal and cross-linked polyethylene (14.6%), ceramic and polyethylene (9.4%), ceramic and ceramic (3.4%), metal and polyethylene (1%), and metal and ceramic (0.2%).

Table 13: Bearing surface of the primary total hip arthroplasty (by gender and age) (Source: RES).

Bearing surface	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Ceramic ceramic	934	5.4	59.5	58.9	41.1	138	3.4	65.5	52.2	47.8
Ceramic PE	969	5.6	69.1	47.5	52.5	377	9.4	68.3	48.3	51.7
Ceramic XLPE	11119	64.5	66.3	49.4	50.6	2865	71.5	68.0	48.8	51.2
Metal - PE	224	1.3	79.6	29.0	71.0	37	0.9	80.8	29.7	70.3
etal - XLPE	3985	23.1	75.3	39.7	60.3	590	14.7	76.6	38.3	61.7

¹⁷ In the RES database, data on two bearing surfaces are missing for the year 2024.

From Table 13, it can be observed that the proportion of ceramic–ceramic bearing surfaces decreased from 5.4% in 2019 to 3.4% in 2024. The share of ceramic–polyethylene (ceramic–PE) bearing surfaces nearly doubled over this period (from 5.6% to 9.4%). There was also a notable decline in metal–cross-linked polyethylene (metal–XLPE) bearing surfaces (from 23.1% to 14.7%).

In primary total hip arthroplasty, men more frequently received endoprostheses with ceramic–ceramic bearing surfaces, whereas women more often received ceramic–PE, ceramic–XLPE, metal–PE, and metal–XLPE combinations. The youngest patients were more likely to receive ceramic–ceramic bearing surfaces (median age 65.5 years in 2024), while the oldest patients most commonly received metal–PE bearing surfaces (median age 80.8 years in 2024).

7.1.6 90-day mortality after primary total hip arthroplasty

For each patient, the database includes the date of surgery and the date of death. Only cases in which the patient’s death occurred within 90 days or less after the surgical procedure were considered.

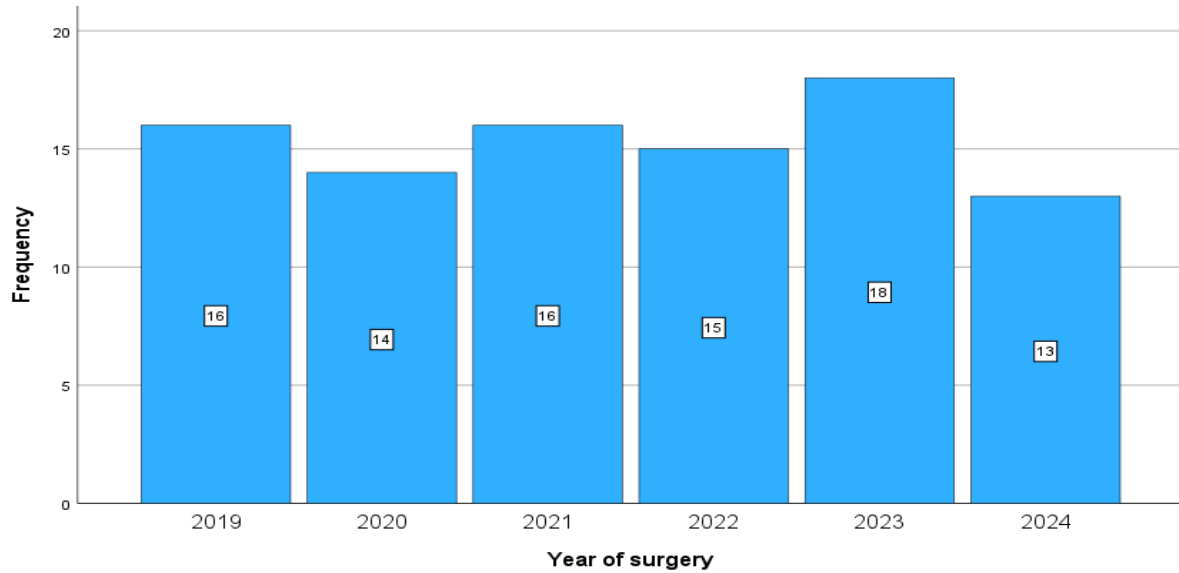


Figure 26: Number of deaths within 90 days after primary total hip arthroplasty between 2019 and 2024 (source: RES).

Mortality was calculated for patients who died within the first 90 days after the surgical procedure.

mortality 90 days after primary total hip arthroplasty

$$= \frac{\text{number of deaths 90 days after primary total hip arthroplasty}}{\text{number of primary total hip arthroplasties}} * 100$$

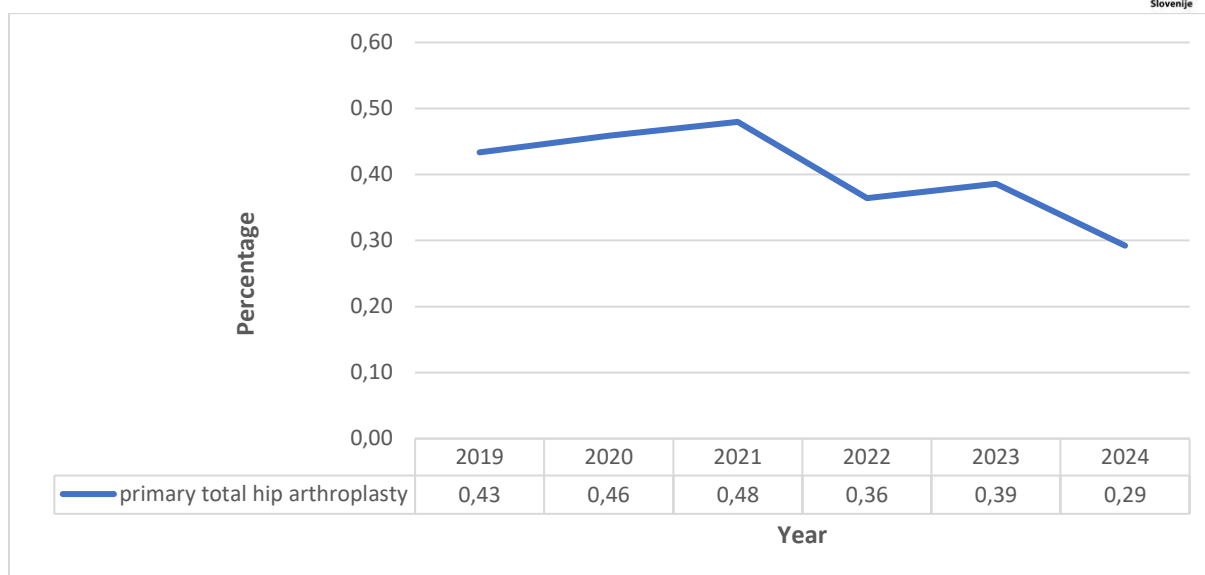


Figure 27: Mortality 90 days after primary total hip arthroplasty (Source: RES).

Since 2019, the lowest 90-day postoperative mortality rate was observed in 2024 (0.29%).

7.1.7 Self-reported health and quality of life in 2024 – PROMS questionnaires before and after primary total hip arthroplasty for the diagnosis of idiopathic osteoarthritis

Patients completed the questionnaires before primary total hip arthroplasty in 2024 and again 6 months after the procedure. Only fully completed questionnaires were included in the analysis. Not enough time had yet elapsed for the 12-month follow-up reliable analysis.

The analysis included only patients with a primary diagnosis of idiopathic osteoarthritis. The dataset was extracted from the application on 15 September 2025. Of the 4,448 primary total hip arthroplasties performed between 1 January 2024 and 31 December 2024, 3,527 (79.3%) were for the diagnosis of idiopathic osteoarthritis (see Figure 25).

Respondents were divided into four age groups: under 55 years, 55–64 years, 65–74 years, and over 74 years¹⁸.

OHS QUESTIONNAIRE

The Oxford Hip Score (OHS) questionnaire¹⁹ is used to assess functional impairment in patients with hip disorders. It consists of 12 questions, each rated on a 5-point scale, where 0 indicates no problems, and 4 indicates severe functional impairment of the hip.

The OHS result is calculated as the sum of a patient's responses to all 12 questions. The total score ranges from 0 (complete dysfunction of the operated hip and severe pain) to 48 (full function of the operated hip and no pain).

We calculated the difference between the OHS score obtained 6 months after surgery and the preoperative OHS score.

Figure 28 presents the number of completed OHS questionnaires before surgery and 6 months after surgery by individual providers. It also shows the number of primary total hip arthroplasties performed in 2024 with a diagnosis of osteoarthritis (OA).

¹⁸ We chose this age group classification based on a review of reports from other international arthroplasty registries.

¹⁹ The Slovenian version of the OHS questionnaire is available on the RES website.

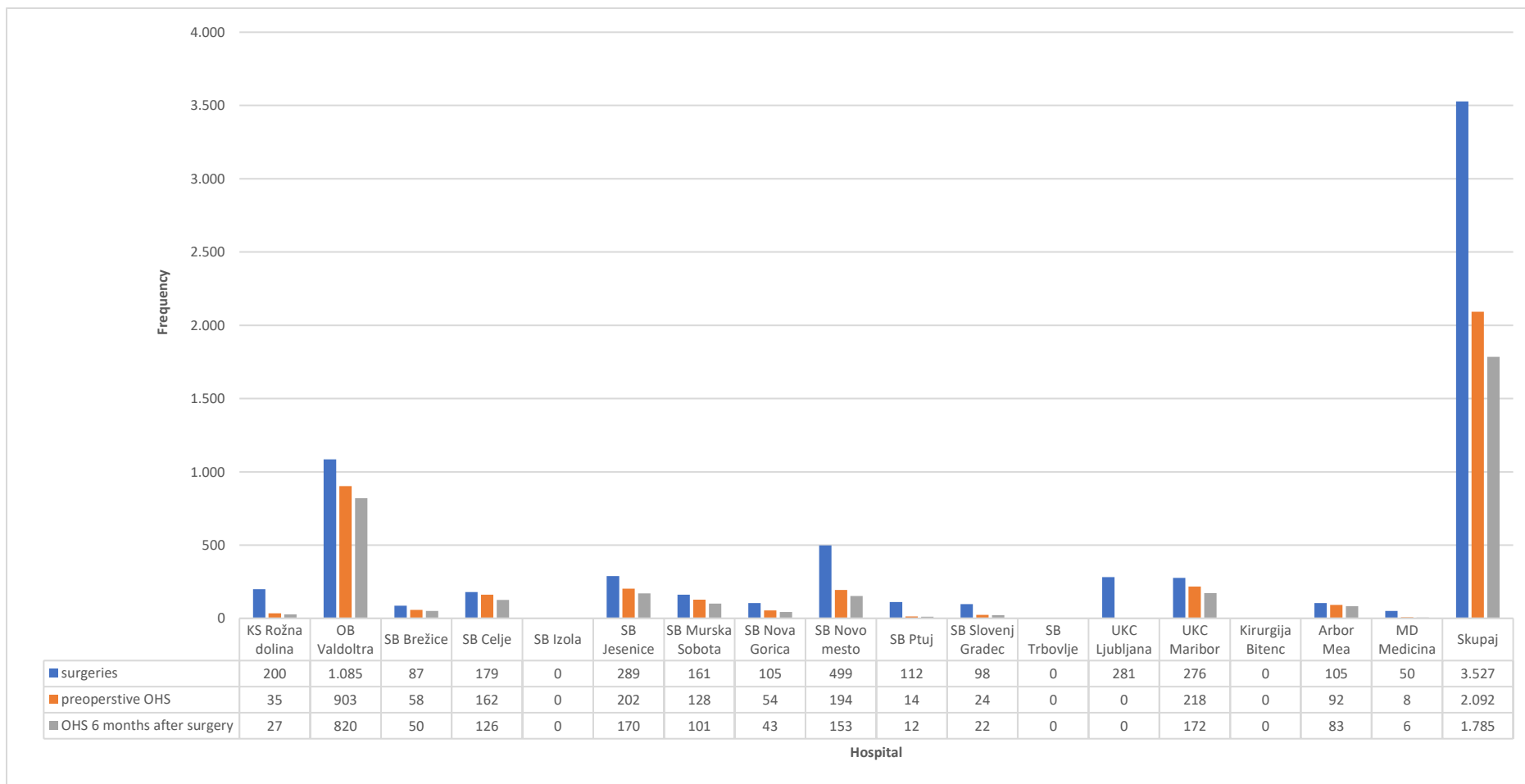


Figure 28: Number of PROMs (OHS) forms obtained in primary total hip arthroplasties, by hospitals, patients operated on in 2024 (Source: RES).

In the preoperative period (see Figure 28), 2,282 questionnaires (64.7%) were completed for primary total hip arthroplasties performed between 1 January 2024 and 31 December 2024. Six months after surgery, 2,176 completed OHS questionnaires (61.7%) were collected from all procedures with a diagnosis of osteoarthritis (OA).

When calculating the difference between the OHS score 6 months after surgery and the preoperative OHS score, only fully completed questionnaires from both time points were included.

The OHS difference could be calculated for 1,816 cases. The median improvement in OHS score was 21 points.

Figure 29 shows the differences between preoperative and 6-month postoperative OHS scores by gender, while Figure 30 presents these differences by age.

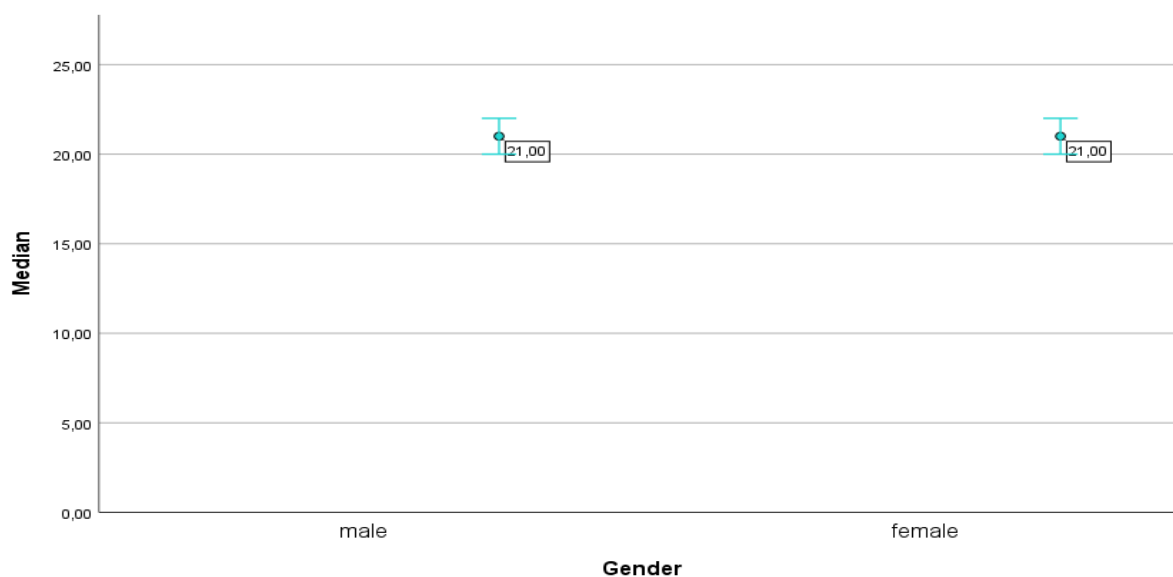


Figure 29: Median with 95% confidence interval of the difference between the preoperative OHS score and 6 months after surgery by the gender of the patients (Source: RES).

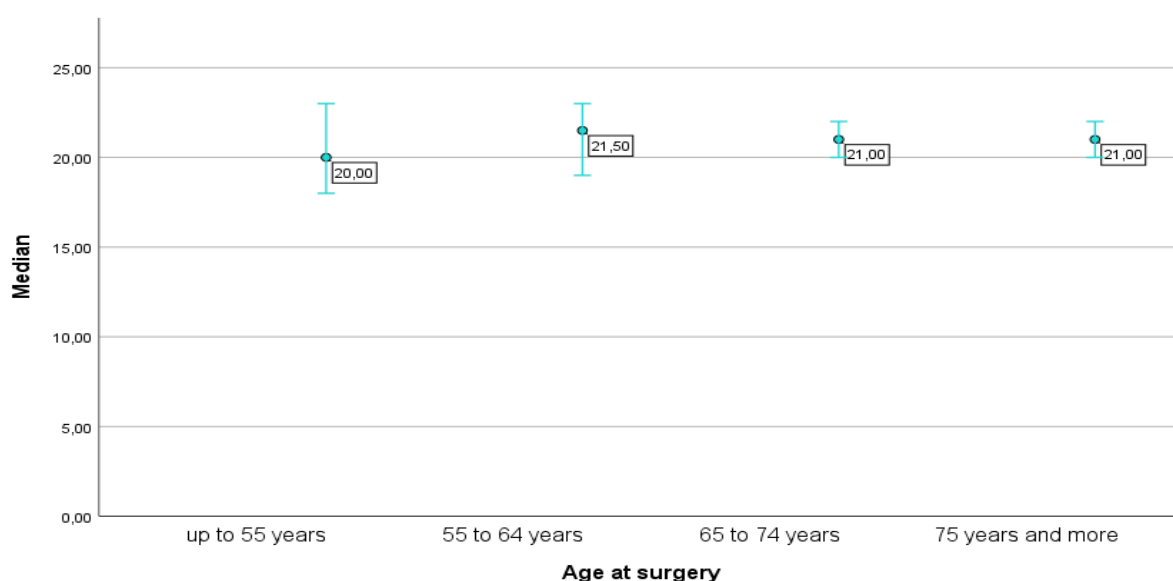


Figure 30: Median with 95% confidence interval for the difference between the preoperative OHS score and 6 months after surgery by the age of the patients (Source: RES).

The median differences in OHS scores across age groups range between 20 points (for patients younger than 55 years) and 21.5 points (for those aged 55 to 64 years). No statistically significant differences were observed between age groups (Figure 30).

EQ-5D-5L QUESTIONNAIRE

The EQ-5D-5L questionnaire²⁰ measures patients' overall health status. Patients rate their mobility, self-care, ability to perform usual activities, pain, and anxiety/depression on a scale from 1 (no problems) to 5 (extreme problems) on the day of completing the questionnaire.

For weighting the responses, we used value sets developed for the Slovenian population by the Institute for Economic Research (Prevolnik Rupel & Ogorevc, 2020). Lower values indicate poorer health status, while higher values indicate better health status. The highest possible score is 1, representing perfect quality of life, and the lowest possible score is -1, indicating the worst possible quality of life.

We calculated the difference between the EQ-5D-5L score obtained 6 months after surgery and the preoperative score.

The EQ-5D-5L difference was calculated for 1,674 cases of primary total hip arthroplasties performed in 2024. The median difference was 0.21 points.

We analyzed 95% confidence intervals for the median differences in EQ-5D-5L scores by gender (Figure 31) and by age (Figure 32) of the surveyed patients.

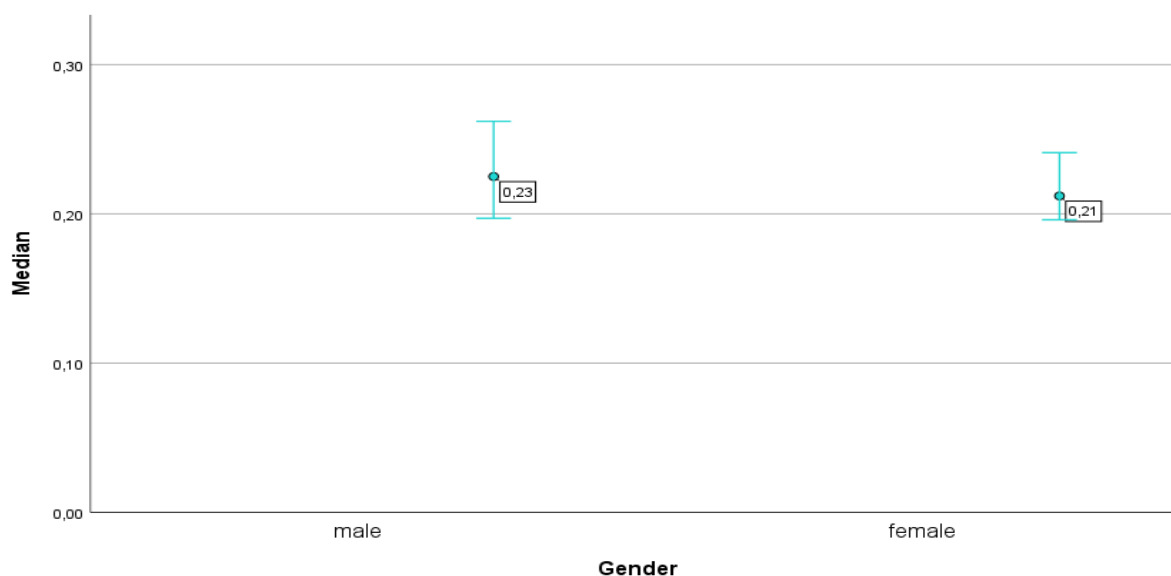


Figure 31: Median with 95% confidence interval for the difference between the preoperative EQ-5D-5L score and 6 months after surgery, by patient gender (Source: RES).

No differences were observed in the median EQ-5D-5L index changes by gender (Figure 31). The median improvement was 0.23 points in men and 0.21 points in women.

²⁰ The Slovenian version of the EQ-5D-5L questionnaire is available on the RES website.

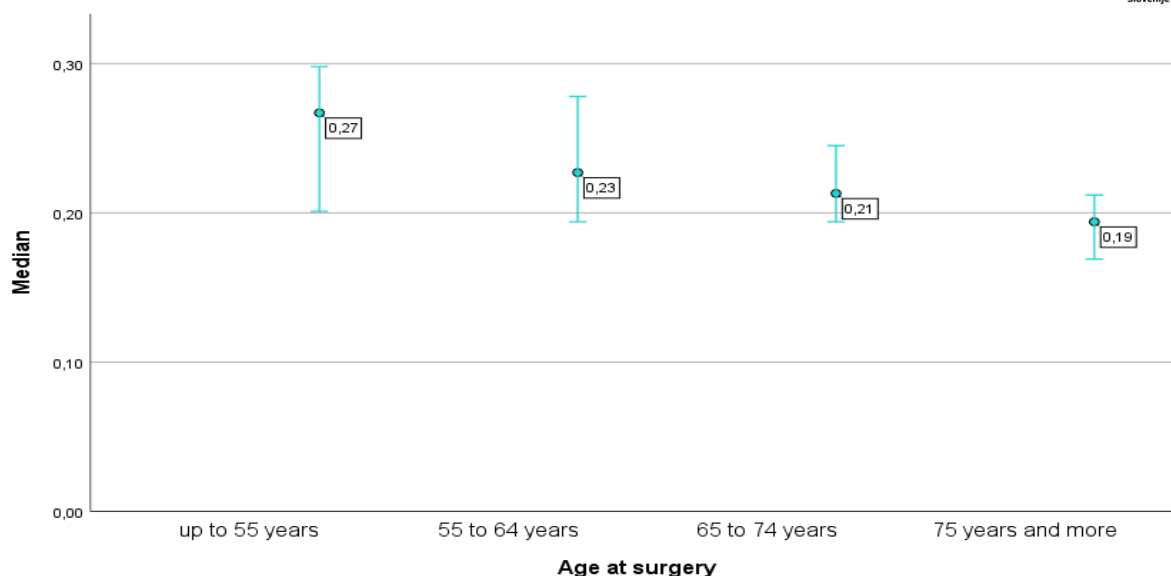


Figure 32: Median with 95% confidence interval for the difference between the EQ-5D-5L score 6 months after surgery and before surgery, according to the age of the patients (Source: RES).

No differences were observed in the median changes of the EQ-5D-5L index by age when comparing values 6 months after surgery with preoperative values (see Figure 32). In patients older than 75 years, the median improvement was slightly lower (0.19 points) compared to other age groups, where the median differences ranged between 0.21 and 0.27 points.

VISUAL ANALOGUE SCALE (VAS)

The VAS scale²¹ measures overall self-rated health on the day the questionnaire is completed. The score is given on a scale from 0 (worst imaginable health) to 100 (best imaginable health).

We calculated the difference between the VAS score at 6 months after surgery and the preoperative value.

The change in overall health status could be calculated for 1,605 cases. The median improvement was 10 points.

Figure 33 shows the 95% confidence intervals for the median differences in overall health by gender, while Figure 34 presents these differences by age.

²¹ The VAS questionnaire is part of the EQ-5D-5L questionnaire, which is available on the RES website.

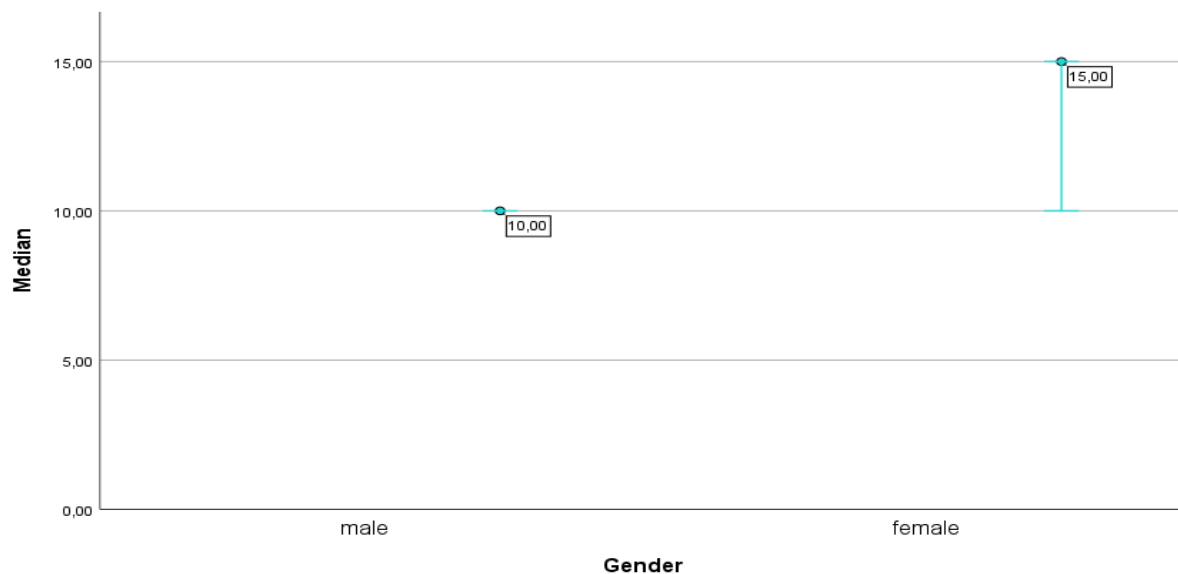


Figure 33: Median with 95% confidence interval for the difference between the VAS score before and 6 months after surgery by the gender of the patients (Source: RES).

There is no statistically significant difference in the median change in VAS scores between 6 months after surgery and the preoperative period by gender (see Figure 33).

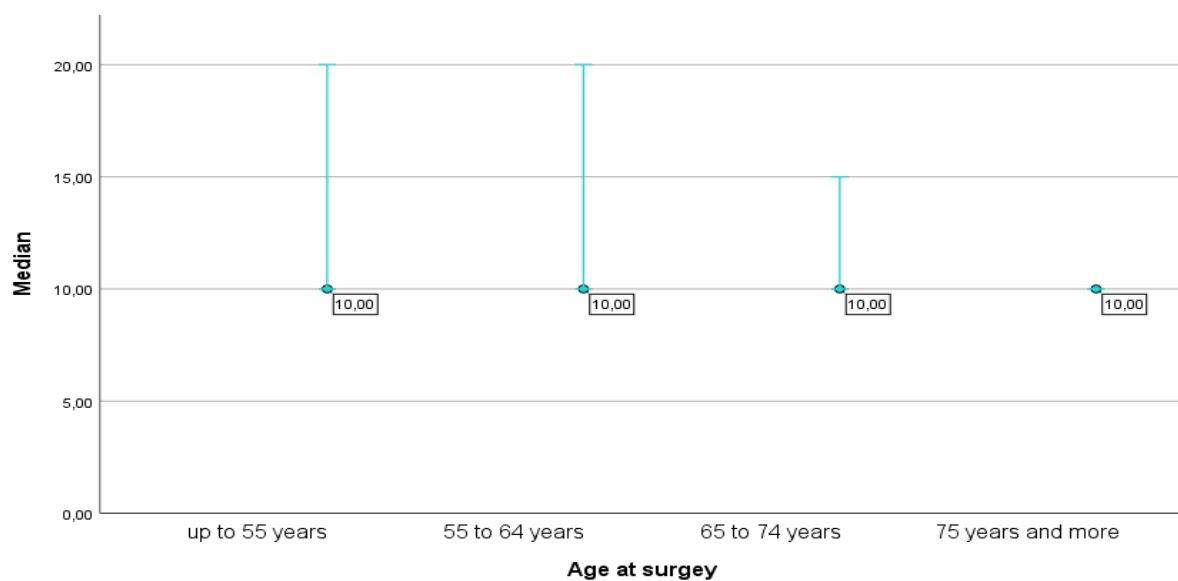


Figure 34: Median with 95% confidence interval for the difference between the VAS score 6 months after surgery and before surgery, according to the age of the patients (Source: RES).

Figure 34 presents the differences in median VAS values across age groups. No statistically significant differences were observed between the age groups.

7.2 Primary partial hip arthroplasties – data up to 31 December 2024

We present the analysis of primary partial hip arthroplasties separately, as they are mostly performed due to hip fractures in trauma departments of hospitals. The RES database recorded data for 813 procedures performed in the Republic of Slovenia in 2024.

We analyzed differences based on patient data, the provider, and characteristics related to the surgical procedure. This included differences by patient gender, their age at the time of surgery, and the provider performing the procedure. In the final section, we present data on function and pain, as well as overall health status, before and after primary partial hip arthroplasty.

7.2.1 Compliance of the obtained data

Table 14 presents the compliance between collected forms of primary partial hip arthroplasties and the surgical procedures recorded by the ZZS for the period from 1 January 2019 to 31 December 2024, by providers.

In the RES database, 3,910 primary partial hip arthroplasties were recorded for the period from 1 January 2019 to 31 December 2024. For the year 2024, data on 813 such procedures were recorded.

KS Rožna dolina and OB Valdoltra do not perform primary partial hip arthroplasties (see Table 14). SB Celje began submitting data on these procedures only in 2021, while SB Trbovlje did not submit any data on these procedures throughout the entire period.

Table 14: Data on compliance of primary partial hip arthroplasties in the period from 2019 to 2024, by provider - comparison of RES and ZZS (Source: RES and ZZS)²².

Compliance	2019	2020	2021	2022	2023	2024
KS Rožna dolina	NP	NP	NP	NP	NP	NP
OB Valdoltra	NP	NP	NP	NP	NP	NP
SB Brežice	121.43	95.45	95.65	93.55	96.43	100.00
SB Celje	0.00	0.00	8.24	98.90	96.05	100.96
SB Izola	91.80	103.13	100.00	101.27	80.65	107.14
SB Jesenice	11.29	70.42	70.59	89.83	87.95	73.85
SB Murska Sobota	100.00	91.67	89.13	102.38	111.54	105.17
SB Nova Gorica	98.55	79.37	76.56	80.77	82.09	62.50
SB Novo mesto	73.68	51.16	65.52	77.14	65.91	66.67
SB Ptuj	85.29	70.00	120.83	83.87	93.75	121.74
SB Slovenj Gradec	10.00	0.00	5.56	23.33	67.86	100.00
SB Trbovlje	0.00	0.00	0.00	0.00	0.00	0.00
UKC Ljubljana	20.90	96.19	98.47	98.49	97.73	142.16
UKC Maribor	102.33	92.77	101.12	97.40	108.25	103.19
Kirurgija Bitenc	NP	NP	NP	NP	NP	NP
Arbor Mea	NP	NP	NP	NP	NP	NP
MD Medicina	NP	NP	NP	NP	NP	NP
Total	48.85	71.54	79.61	90.30	90.52	101.25

7.2.2 Patient gender and age in primary partial hip arthroplasties

We reviewed the demographic data of patients: their gender (Figure 35) and age at the time of surgery (Figure 36). In Table 15, we then present the median patient age by gender for each individual year.

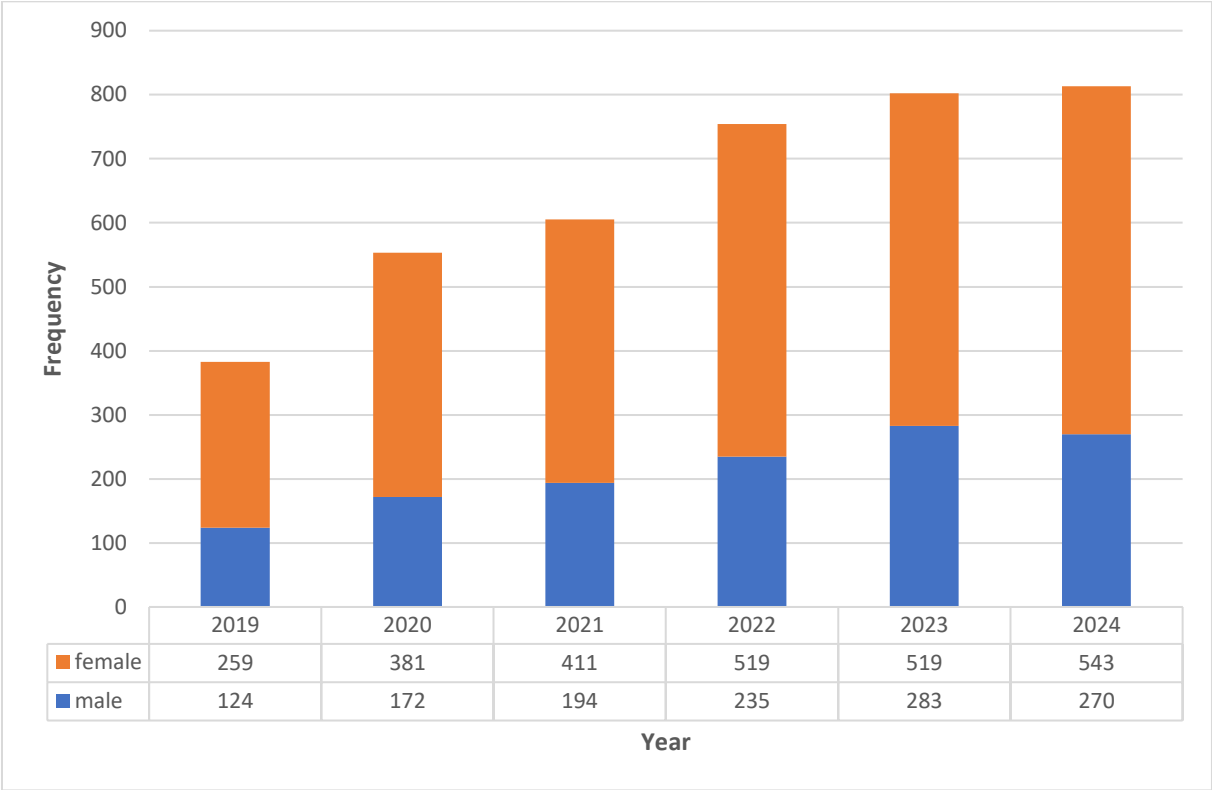


Figure 35: Primary partial hip arthroplasty between 2019 and 2024, by patient gender (Source: RES).

Figure 35 shows that in 2024, more primary partial hip arthroplasties were performed in women (66.8%) than in men (33.2%).

Throughout the entire period from 2019 to 2024, the proportion of women was consistently higher (approximately two-thirds of all primary partial hip arthroplasties) than that of men.

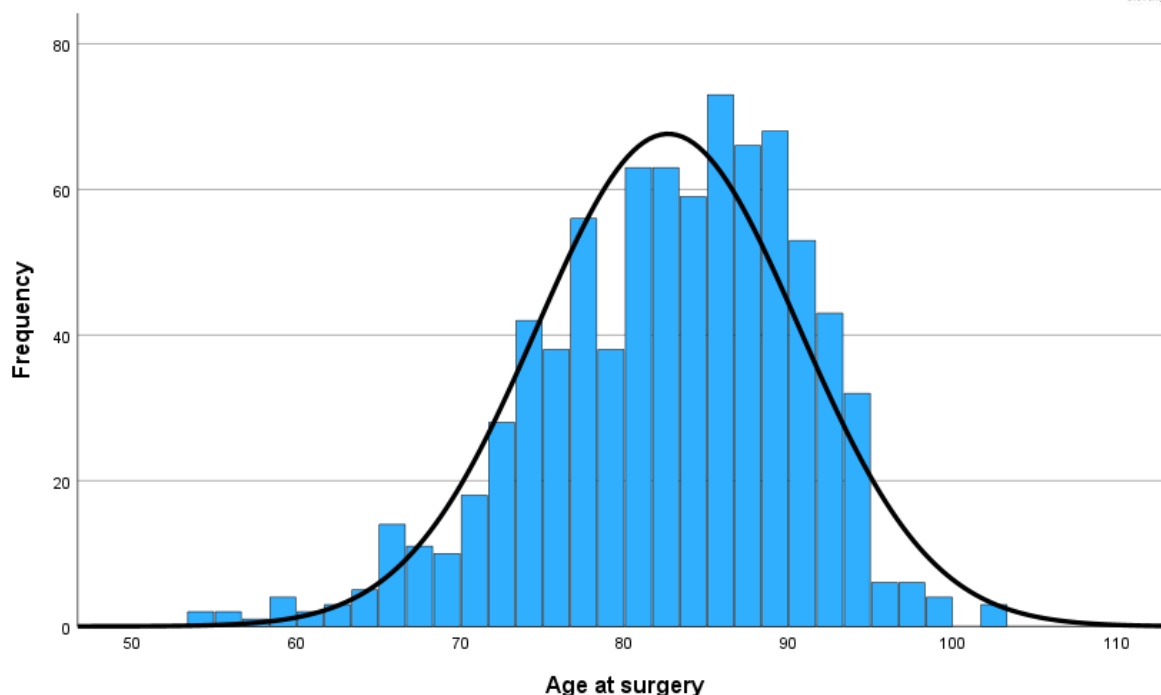


Figure 36: Primary partial hip arthroplasty in 2024, by patient age (Source: RES).

Figure 36 shows the distribution of patient age at the time of primary partial hip arthroplasty in 2024. The median age is 82.6 years. The youngest patient was 53.9 years old, and the oldest was 103.1 years old.

Table 15: Age of patients undergoing partial hip arthroplasty by gender; median with 95% confidence interval (Source: RES).

Ag at surgery			Year of surgery					
			2019	2020	2021	2022	2023	2024
gender	male	Median	81.2	81.7	83.4	83.4	82.3	82,3
	female	Median	85.2	84.9	85.0	84.5	84.2	83,9
Total		Median	84,3	84.3	84.4	84.1	83.7	83.5

Table 15 shows that in 2024, women were older at the time of surgery (Me = 83.9 years) than men (Me = 82.3 years).

The median age of patients undergoing primary partial hip arthroplasty decreased between 2019 and 2024. In 2024, the median age was almost one year lower than in 2019. Among men, the median age increased by one year, while among women it decreased by 1.3 years.

7.2.3 Region of permanent residence of patients with primary partial hip endoprostheses

We examined the region of permanent residence of patients undergoing primary partial hip arthroplasties and compared it with the location of the surgical procedure. Figure 37 shows the proportion of primary partial hip arthroplasties in 2024 performed on patients whose permanent residence was not in the region where the surgery was carried out.

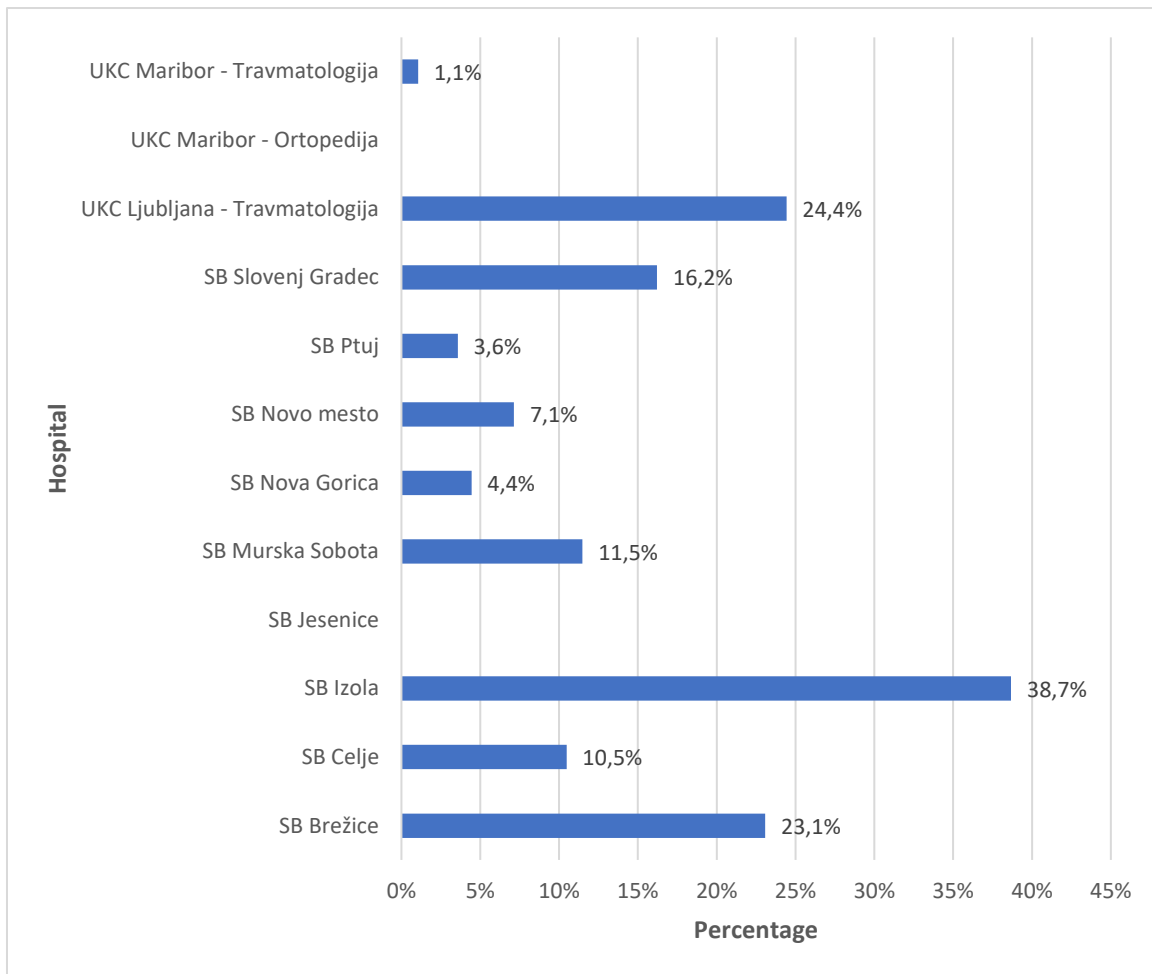


Figure 37: Patients undergoing primary partial hip arthroplasty in 2024 whose region of permanent residence differs from the region of the surgical provider (Source: RES).

Most patients were operated on in their region of permanent residence (Figure 37). The hospital with the highest proportion of cases in which patients do not come from the hospital's region is SB Izola (38.7%).

7.2.4 Characteristics of primary partial hip arthroplasty procedures

This section presents the provider of the surgical procedure (Figure 38), the side of the operation (Figure 39), the diagnosis at the time of surgery (Figure 40), the surgical approach (Figure 41), and the fixation of the prosthesis (Figure 42).

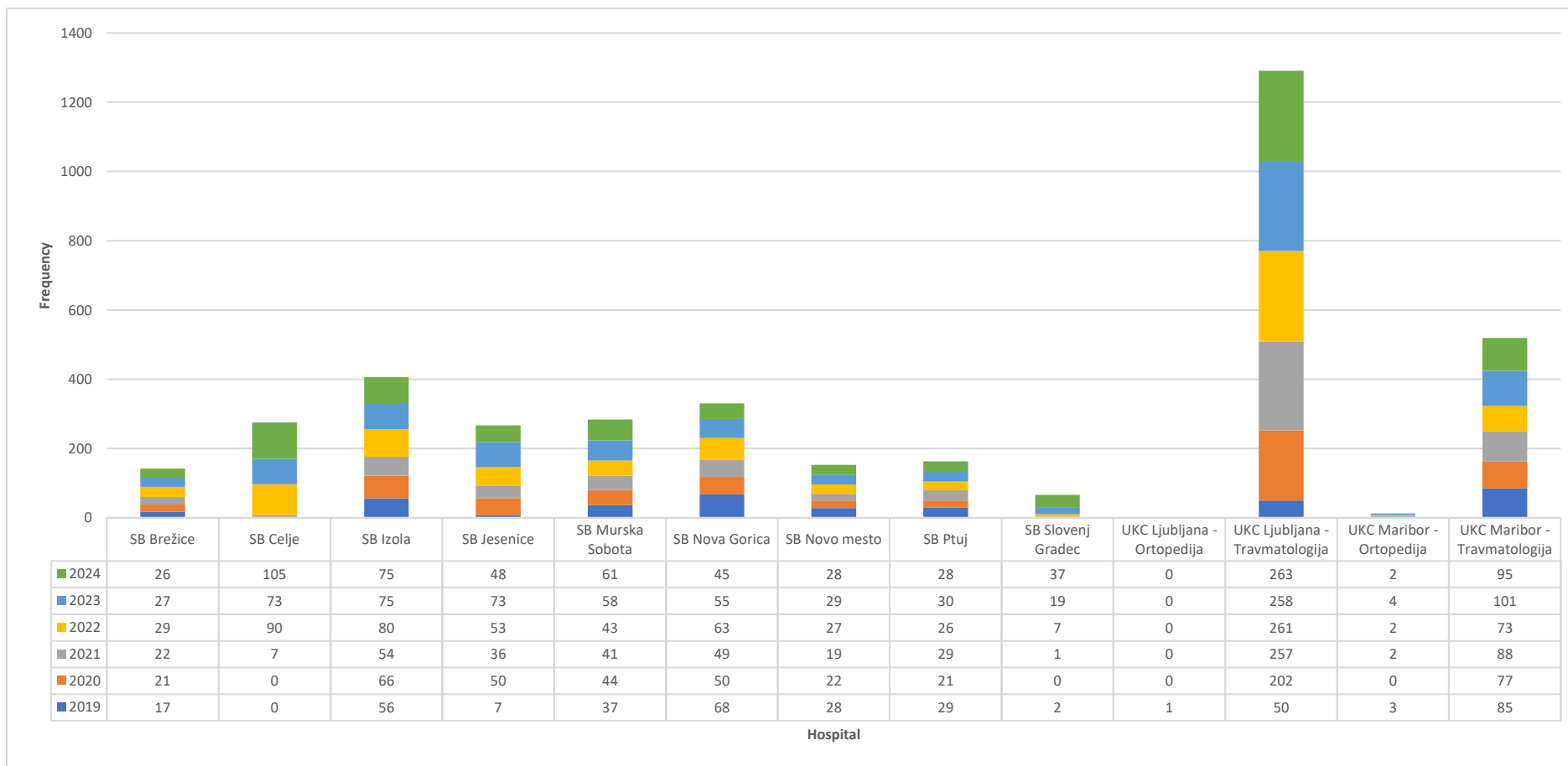


Figure 38: Primary partial hip arthroplasty between 2019 and 2024, by hospital (Source: RES).

In 2024 (Figure 38), the highest number of primary partial hip arthroplasties was performed at the trauma department of the University Medical Centre Ljubljana (263 – 32.3% of all). This was followed by General Hospital Celje (105 – 12.9%), the trauma department of the University Medical Centre Maribor (95 – 11.7%), General Hospital Izola (75 – 9.2%), General Hospital Murska Sobota (61 – 7.5%), General Hospital Jesenice (48 – 5.9%), and General Hospital Nova Gorica (45 – 5.5%). Other providers performed fewer than 40 primary partial hip arthroplasties each in 2024.

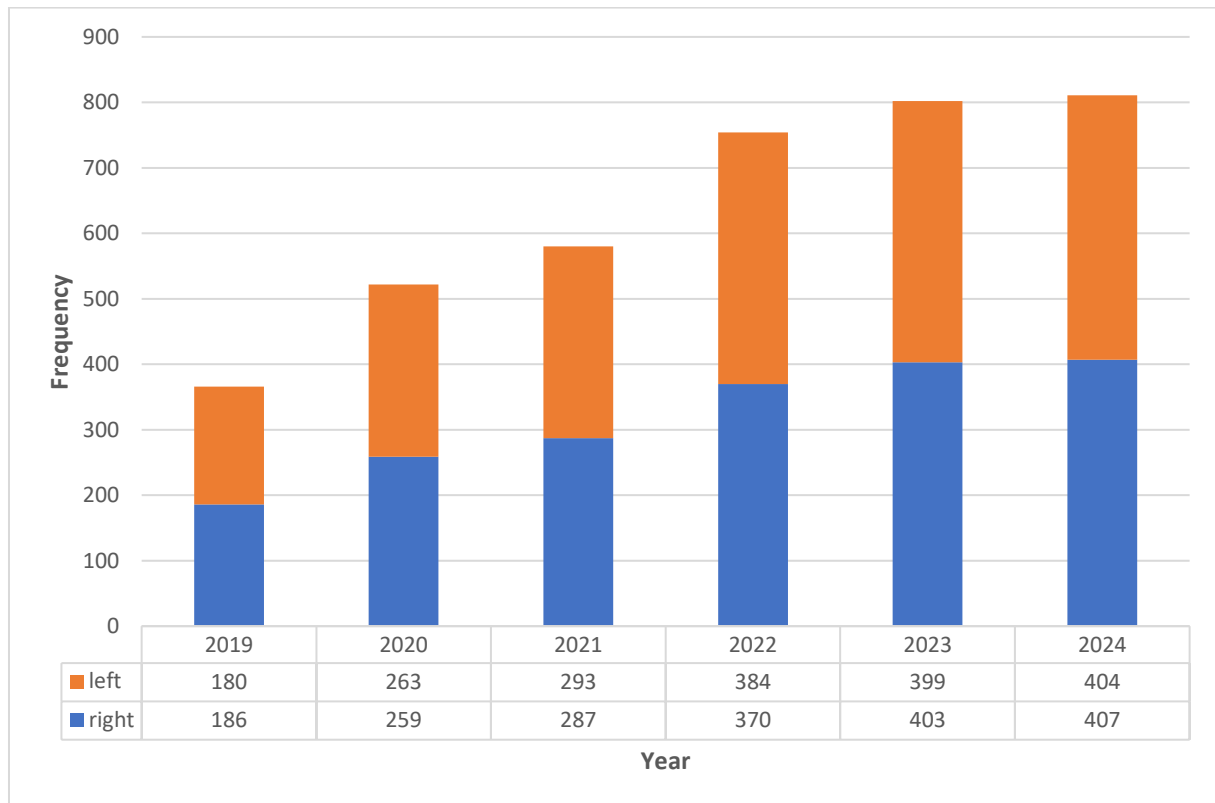


Figure 39: Primary partial hip arthroplasty between 2019 and 2024, by surgical side²³ (Source: RES).

In 2024, approximately the same number of primary partial hip arthroplasties were performed on the right hip (407) and the left hip (404), as shown in Figure 39.

²³ The RES database does not contain information on the surgical side for 17 cases in 2019, 31 cases in 2020, 25 cases in 2021, and 2 cases in 2024.

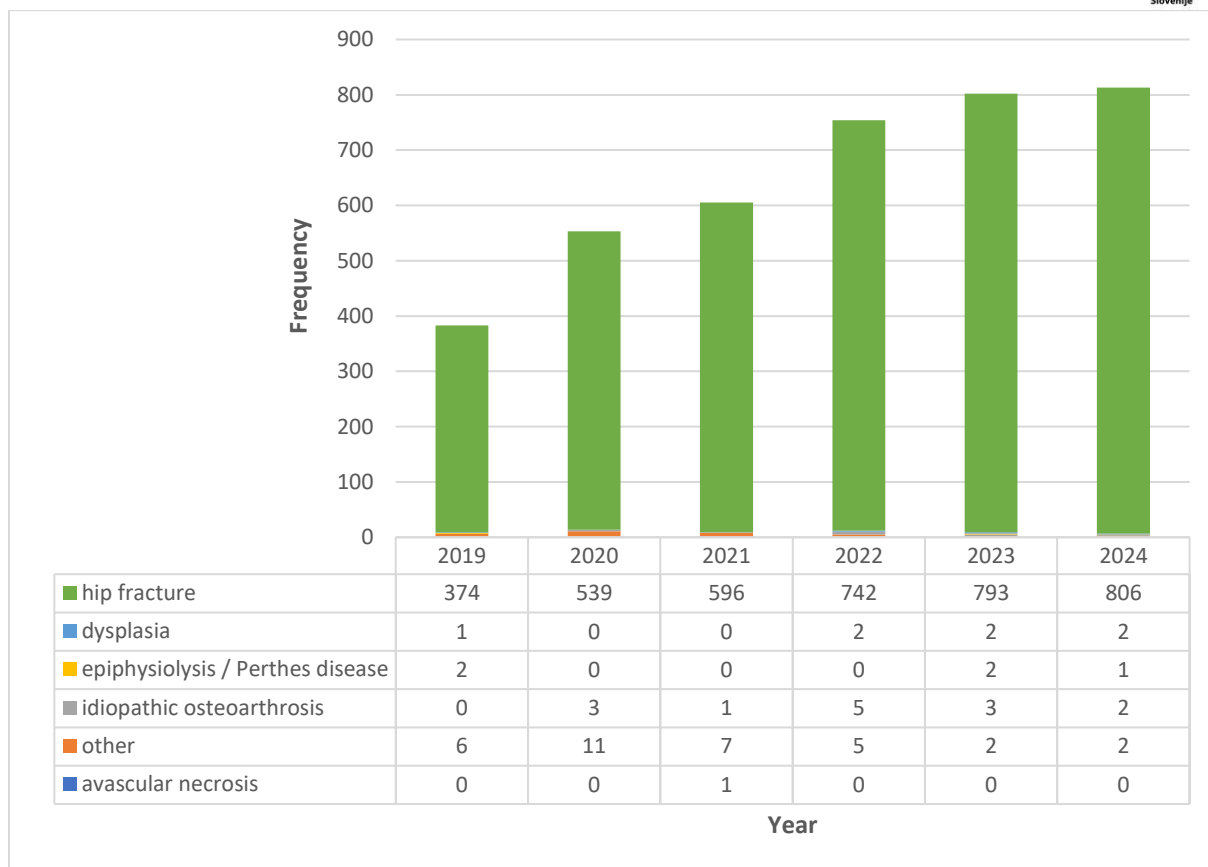


Figure 40: Primary partial hip arthroplasty between 2019 and 2024, by diagnosis at the time of surgery (Source: RES).

The most common diagnosis for primary partial hip arthroplasties in 2024 (Figure 40) was, as expected, hip fracture (in 806 cases – 99.1% of all cases). Other diagnoses occurred very rarely or not at all.

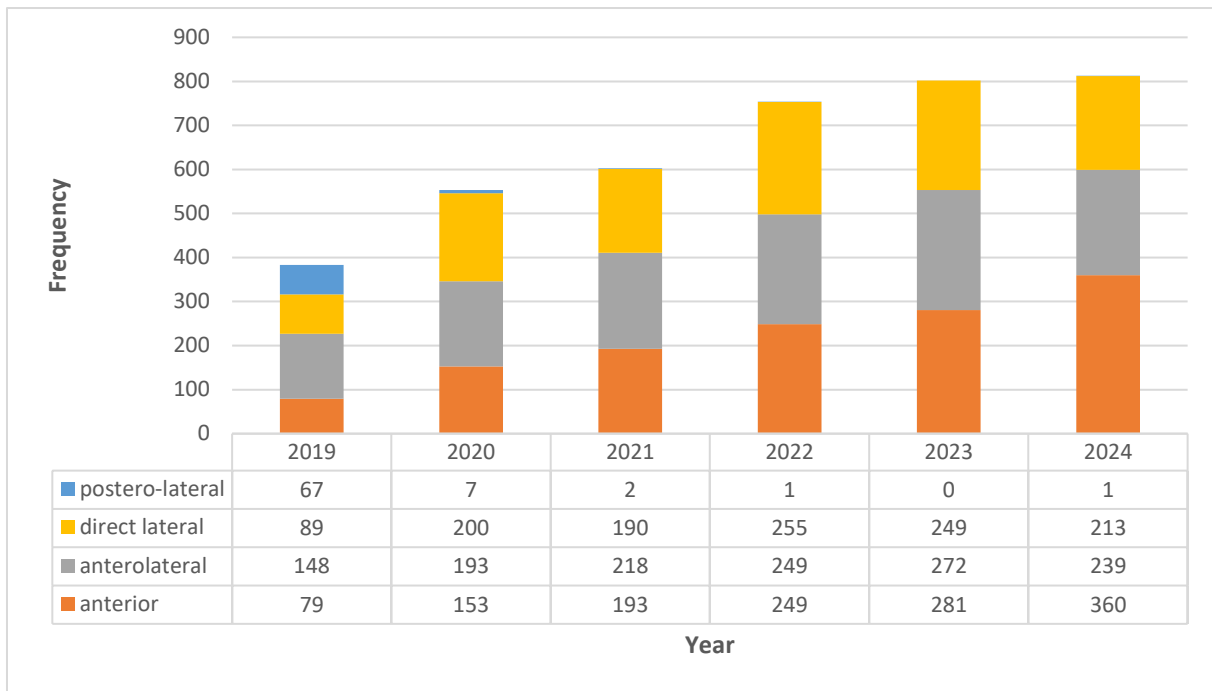


Figure 41: Primary partial hip arthroplasty between 2019 and 2024, by surgical approach²⁴ (Source: RES).

In 2024, the anterior (44.3% of cases), anterolateral (29.4% of cases), and direct lateral (26.2% of cases) approaches were used in primary partial hip arthroplasties (Figure 41). The posterolateral approach was used once. The frequency of the anterior approach has been increasing in recent years.

Table 16 shows the number and proportion of surgical approaches used. In cases where there are fewer than 30 units in a group, calculations are not provided.

Table 16: Surgical approach used in primary partial hip arthroplasty between 2019 and 2024, by patient gender and age (Source: RES).

Surgical approach	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
anterior	955	30.8	84.6	33.3	66.7	359	44.2	84.0	33.6	66.4
anterolateral	1080	34.9	84.4	30.8	69.2	239	29.4	83.5	31.8	68.2
direct lateral	983	31.7	83.0	33.2	66.8	213	26.2	82.8	34.3	65.7
postero-lateral	77	2.5	84.7	40.3	59.7	1	0.2			

In 2024, the proportion of women within each surgical approach was consistently around two-thirds, while men accounted for approximately one-third for each approach used. The median age was lowest for the direct lateral approach (82.8 years) and highest for the anterior approach (84 years) (Table 16).

²⁴ In 2021, there is no information on the surgical approach used in 2 cases.

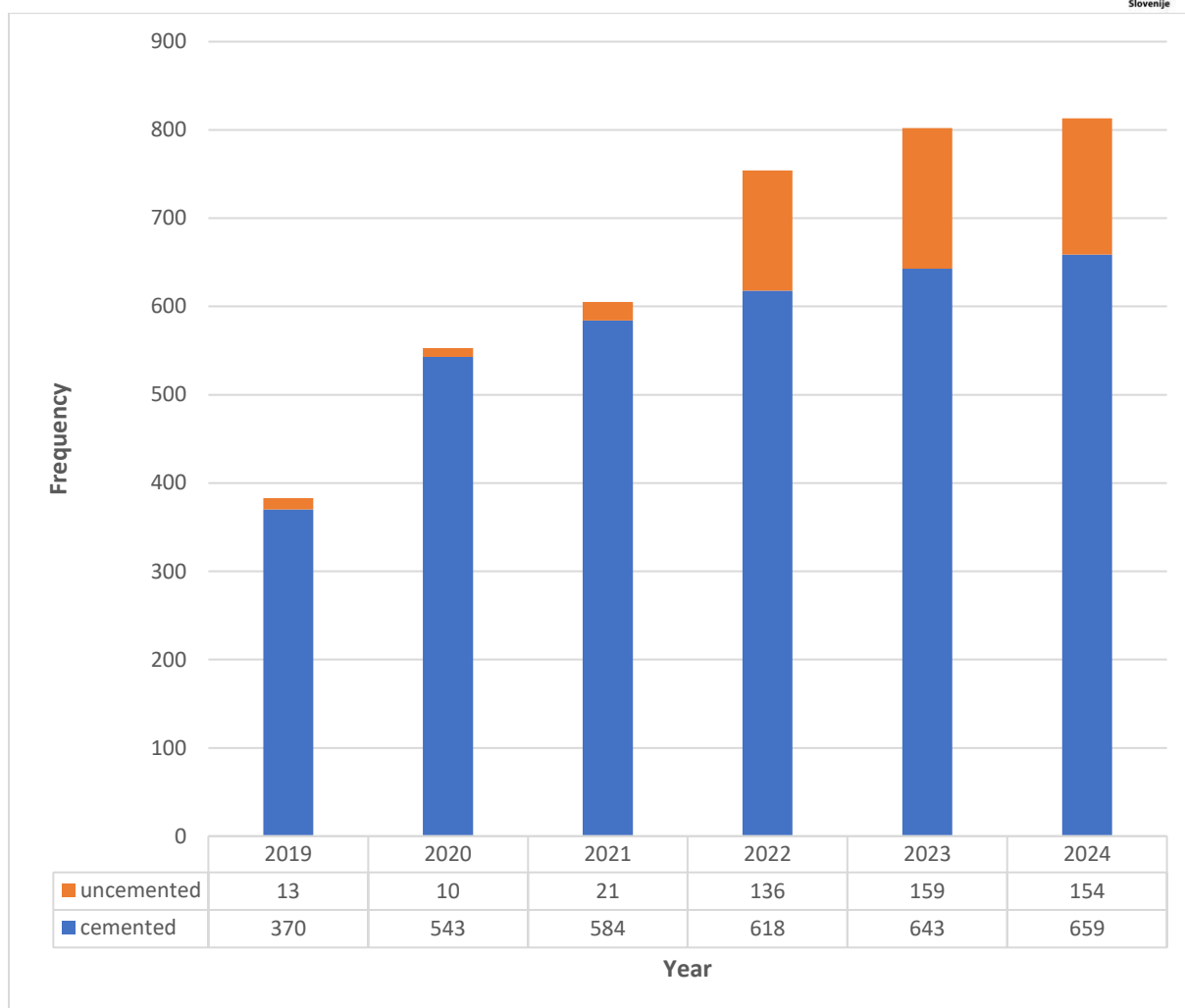


Figure 42: Primary partial hip arthroplasties between 2019 and 2024 by type of endoprosthesis fixation (Source: RES).

In 2024, cemented endoprostheses predominated in primary partial hip arthroplasties (81.1%). Uncemented prostheses were used in 18.9% of cases (Figure 42).

7.2.5 Characteristics of implanted primary partial hip endoprostheses

The following section presents the characteristics of the femoral stem and the bipolar head of the endoprosthesis.

Figure 43 shows the manufacturers of partial femoral endoprostheses by provider in 2024.

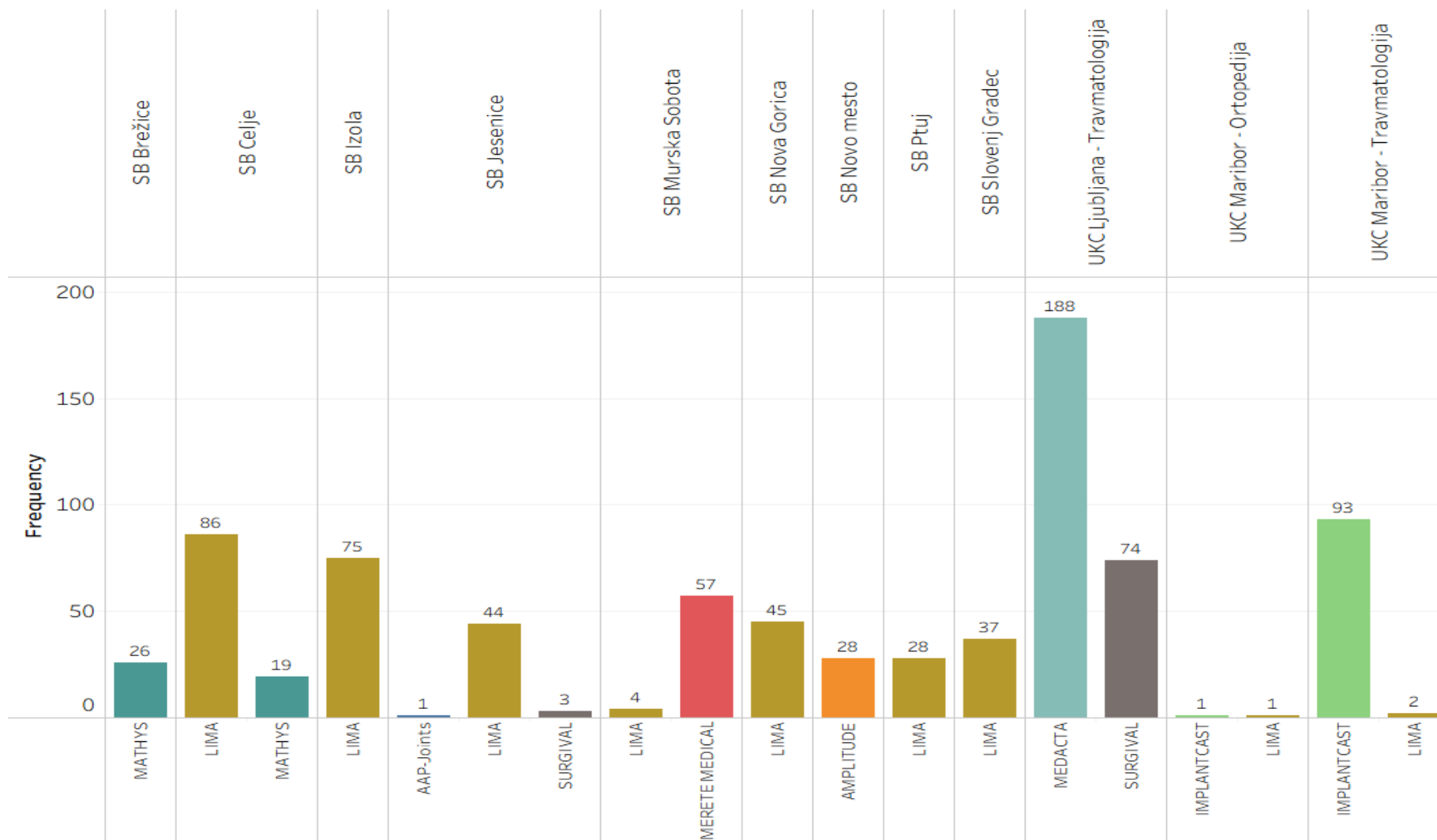


Figure 43: Primary partial hip arthroplasty between 2019 and 2024, by femoral stem manufacturer and hospital (Source: RES).

Table 17: Femoral stem fixation in primary partial hip arthroplasty between 2019 and 2024, according to patient gender and age (Source: RES).

Stem fixation	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
cemented	2496	80.6	84.5	32.0	68.0	653	80.5	83.9	32.2	67.8
uncemented	601	19.4	82.4	37.2	62.8	155	19.5	82.3	37.7	62.3

In 2024, the femoral stem was cemented in 653 cases (80.5%) and uncemented in 158 cases (19.5%). The median age of patients with cemented stems was 83.9 years, while for uncemented stems it was 82.3 years (Table 17). Cemented femoral stems were used in 67.8% of women and 32.2% of men.

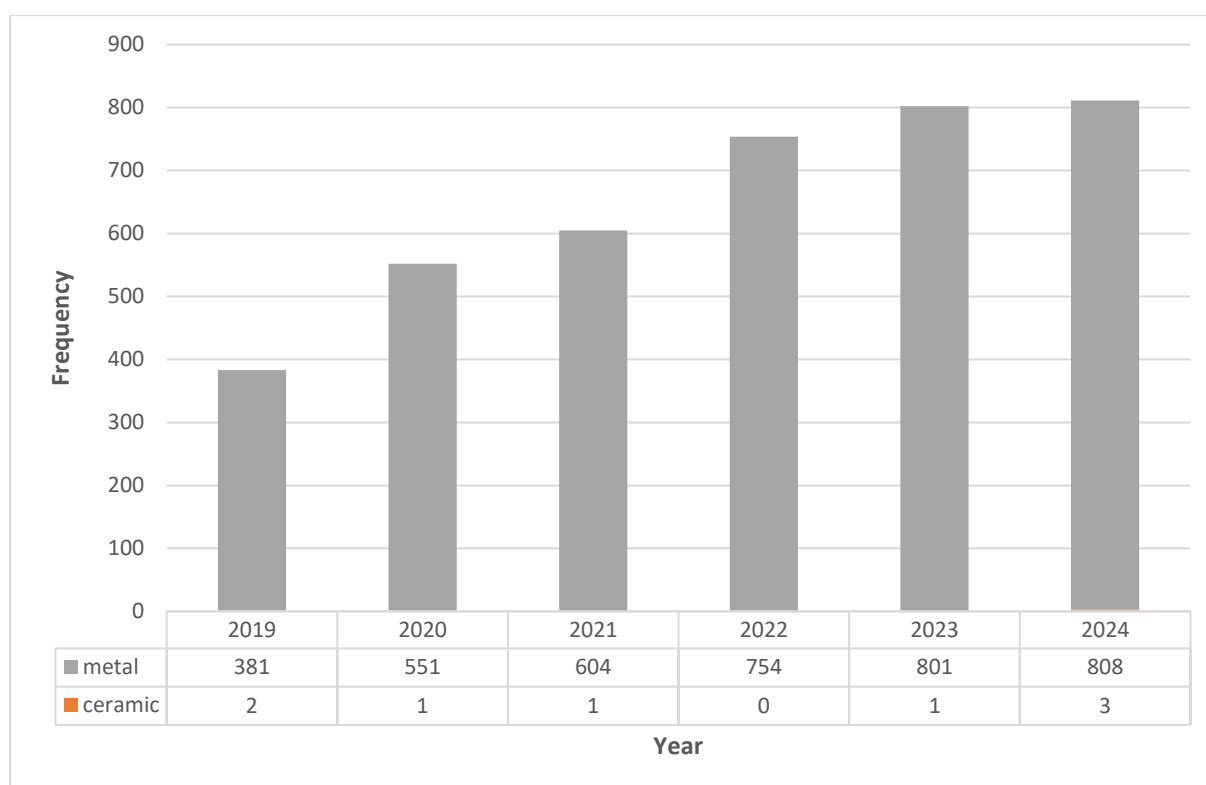


Figure 44: Primary partial hip arthroplasties between 2019 and 2024 by material of the femoral head²⁵ (Source: RES).

In 2024, in the vast majority of cases (808 cases, or 99.4%), a metal endoprosthetic head was used in partial hip arthroplasty. Only in 3 cases was a ceramic endoprosthetic head implanted (Figure 44).

²⁵ The RES database does not contain information on the material of the bipolar endoprosthetic head for 1 case in 2020 and 2 cases in 2024.

7.2.6 90-day mortality after primary partial hip arthroplasty

For each patient, the database records the date of surgery and the date of death. We included only those cases where the patient's death occurred within 90 days or less after the surgical procedure.

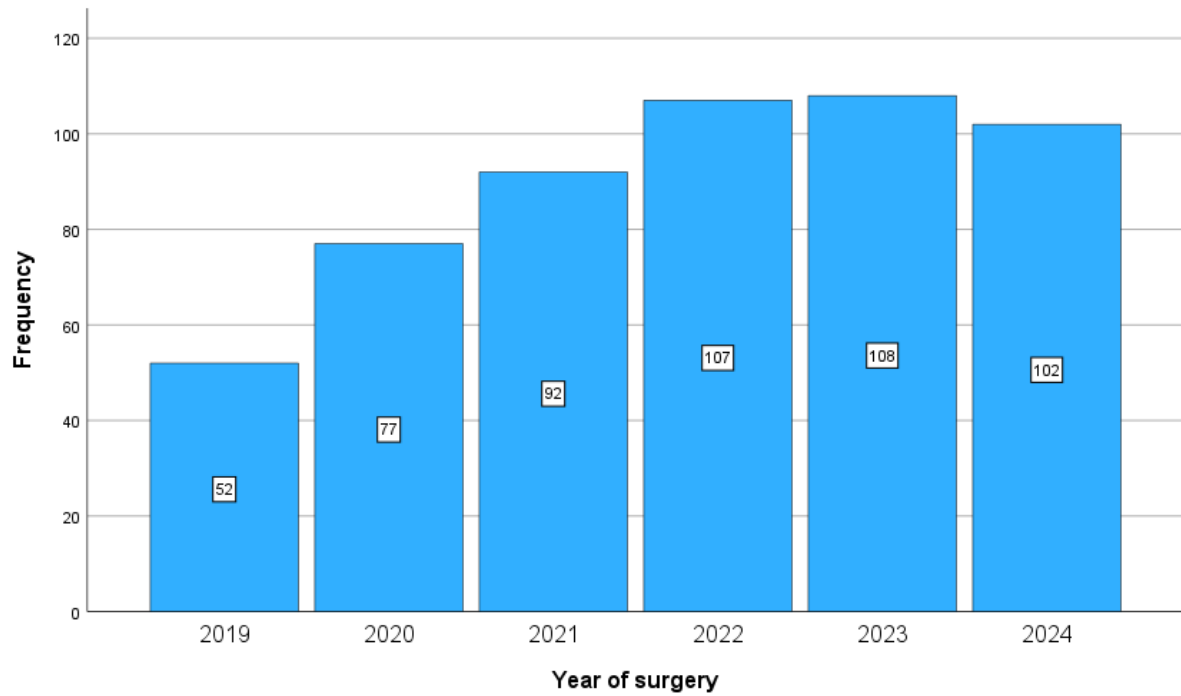


Figure 45: Number of deaths after primary partial hip arthroplasty between 2019 and 2024 (source: RES)

Figure 45 shows that after primary partial hip arthroplasty performed in 2019, there were 52 patient deaths within 90 days of the surgical procedure. In 2020, there were 77 such cases; in 2021, 92; in 2022, 107; in 2023, 108; and in 2024, 102.

We calculated mortality for patients who died within the first 90 days after the surgical procedure:

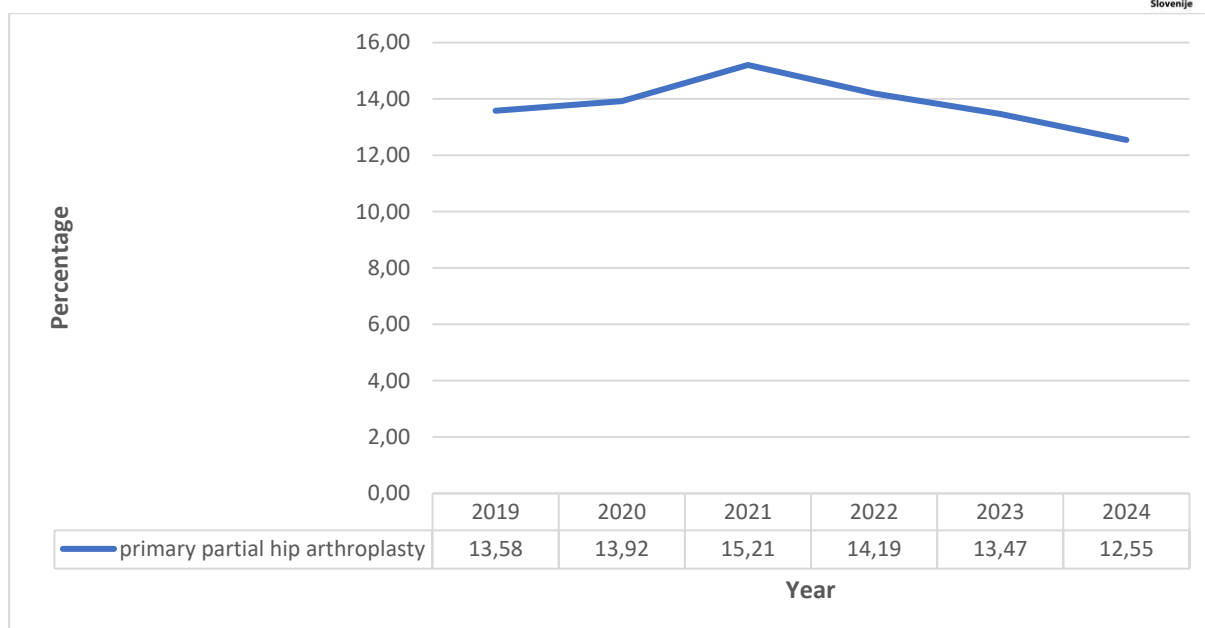


Figure 46: Mortality 90 days after primary partial hip arthroplasty (Source: RES).

Figure 46 shows that, since 2019, the 90-day mortality rate after the surgical procedure was lowest in 2024 (12.55%). Compared to mortality after total hip arthroplasties, this rate is 30 to 35 times higher.

7.3 Revisions of total hip endoprostheses – data up to 31 December 2024

This section of the report presents revisions of total hip endoprostheses in the Republic of Slovenia from 2019 to 2024. A total of 2,451 hip endoprosthesis revisions were recorded in the RES database during this period. In 2024, 484 revision hip endoprosthesis procedures were recorded. Data collection was completed on 6 February 2026.

This chapter presents data on revision surgical procedures, including patient characteristics (gender and age at the time of surgery), the provider and the surgeon, characteristics of the revision procedure (side of surgery, previous procedures on the same hip, reason for revision, extent of revision, and surgical approach used), as well as data on the new implant (manufacturer) and the proportion of revisions by individual implant combinations.

7.3.1 Compliance of the obtained data

In the case of hip endoprosthesis revisions, discrepancies in compliance between data submitted to the RES and data recorded by the ZZZS are observed. This is because the ZZZS does not record the removal of a component (e.g. according to the Girdlestone procedure) as an independent revision surgical procedure, whereas in the RES each component removal is recorded as a separate revision of the hip endoprosthesis. Another possible reason for discrepancies is that the provider performing the revision may not report the procedure to the RES.

Table 18: Data on compliance of revision hip arthroplasties in the period from 2019 to 2024, by provider - comparison of RES and ZZZS (Source: RES and ZZZS)²⁶.

Compliance	2019	2020	2021	2022	2023	2024
KS Rožna dolina	NP	100.00	200.00	166.67	250.00	500.00
OB Valdoltra	103.50	100.69	103.67	104.73	109.59	112.93
SB Brežice	50.00	200.00	66.67	75.00	71.43	80.00
SB Celje	87.88	79.31	74.07	89.29	130.00	146.15
SB Izola	200.00	0.00	200.00	150.00	100.00	133.33
SB Jesenice	73.91	80.00	68.75	84.38	93.55	95.24
SB Murska Sobota	116.00	80.77	130.00	100.00	115.63	122.22
SB Nova Gorica	50.00	80.00	60.00	85.71	100.00	91.67
SB Novo mesto	95.00	76.67	73.08	89.74	97.06	87.27
SB Ptuj	200.00	66.67	100.00	33.33	400.00	16.67
SB Slovenj Gradec	80.00	50.00	160.00	85.71	90.91	114.29
SB Trbovlje	NP	NP	NP	NP	NP	NP
UKC Ljubljana	78.30	84.06	95.12	99.12	112.35	193.10
UKC Maribor	102.38	96.43	109.68	80.00	107.69	126.92
Total	92.49	89.01	98.25	96.68	109.62	122.53

Compliance of revision hip endoprosthesis procedures in the Republic of Slovenia increased between 2019 and 2024: it was 92.5% in 2019, 89% in 2020, 98.3% in 2021, 96.7% in 2022, 109.6% in 2023, and 122.5% in 2024 (Table 18). General Hospital Trbovlje did not submit a single form with data on revision hip arthroplasties to the RES database during this period.

7.3.2 Patient gender and age in revision hip arthroplasty procedures

Out of a total of 2,451 revision hip procedures entered into the RES database, 484 were recorded between 1 January 2024 and 31 December 2024.

²⁶ For MD Medicine, Arbor Meo and Bitenc Surgery, the ZZZS did not have records of operations performed until 2022. For this reason, we cannot calculate compliance.

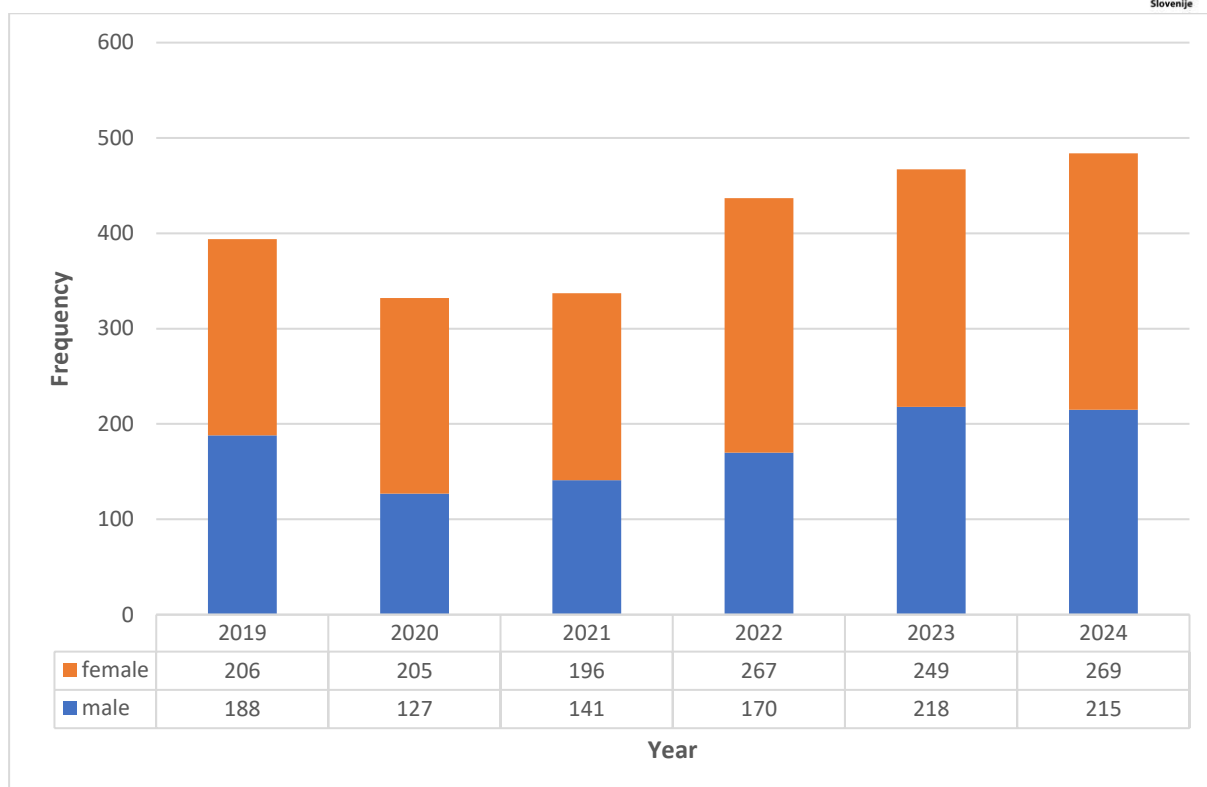


Figure 47: Revision hip arthroplasties between 2019 and 2024 by patient gender (Source: RES).

In 2024, a total of 269 (55.6%) revision hip procedures were performed in women and 215 (44.4%) in men (Figure 47).

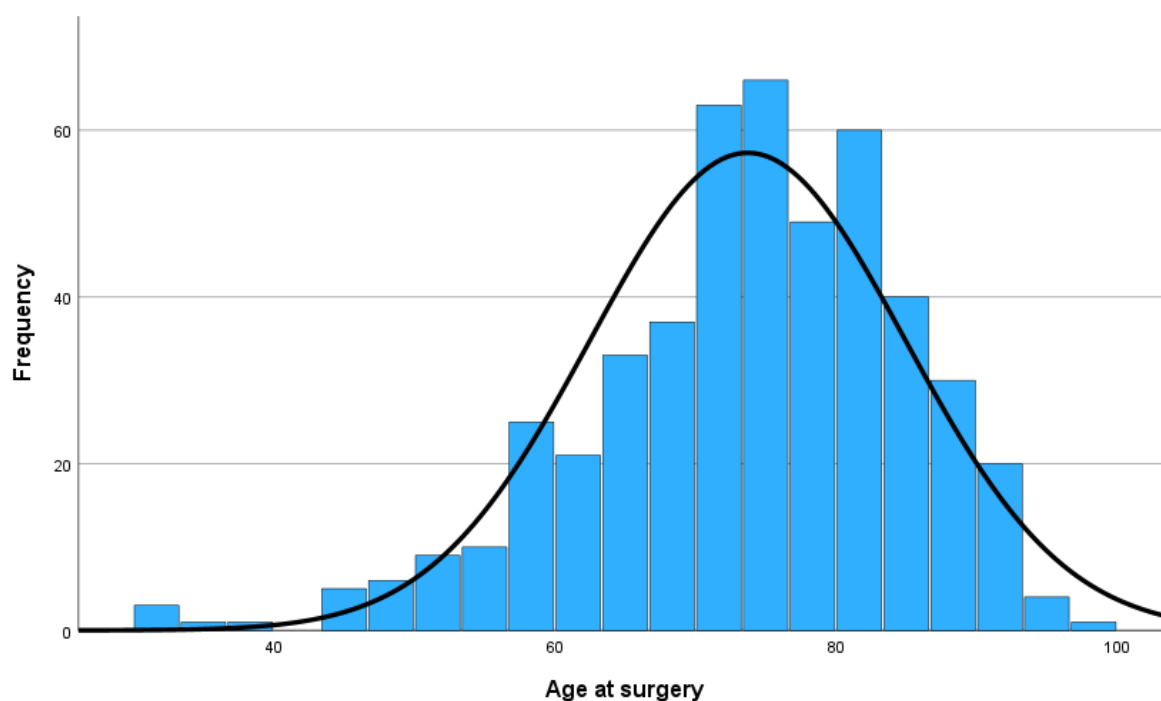


Figure 48: Revision hip arthroplasties in 2024 according to patient age at surgery (Source: RES).

In 2024, the median age for revision hip endoprosthesis procedures was 75.3 years. The youngest patient was 31.7 years old at the time of surgery, and the oldest was 96.8 years (Figure 48).

7.3.3 Characteristics of surgical procedures in hip endoprosthesis revisions

This part of the report presents the characteristics of revision procedures: providers performing the procedures (Figure 49), revision burden (Figure 50), time from primary hip arthroplasty to first revision (Figure 51), side of the procedure (Figure 52), reason for revision (Figure 53), number of previous procedures (Figure 54), type of previous procedure (Figure 55), extent of revision (Figure 56), and the surgical approach used (Figure 57).

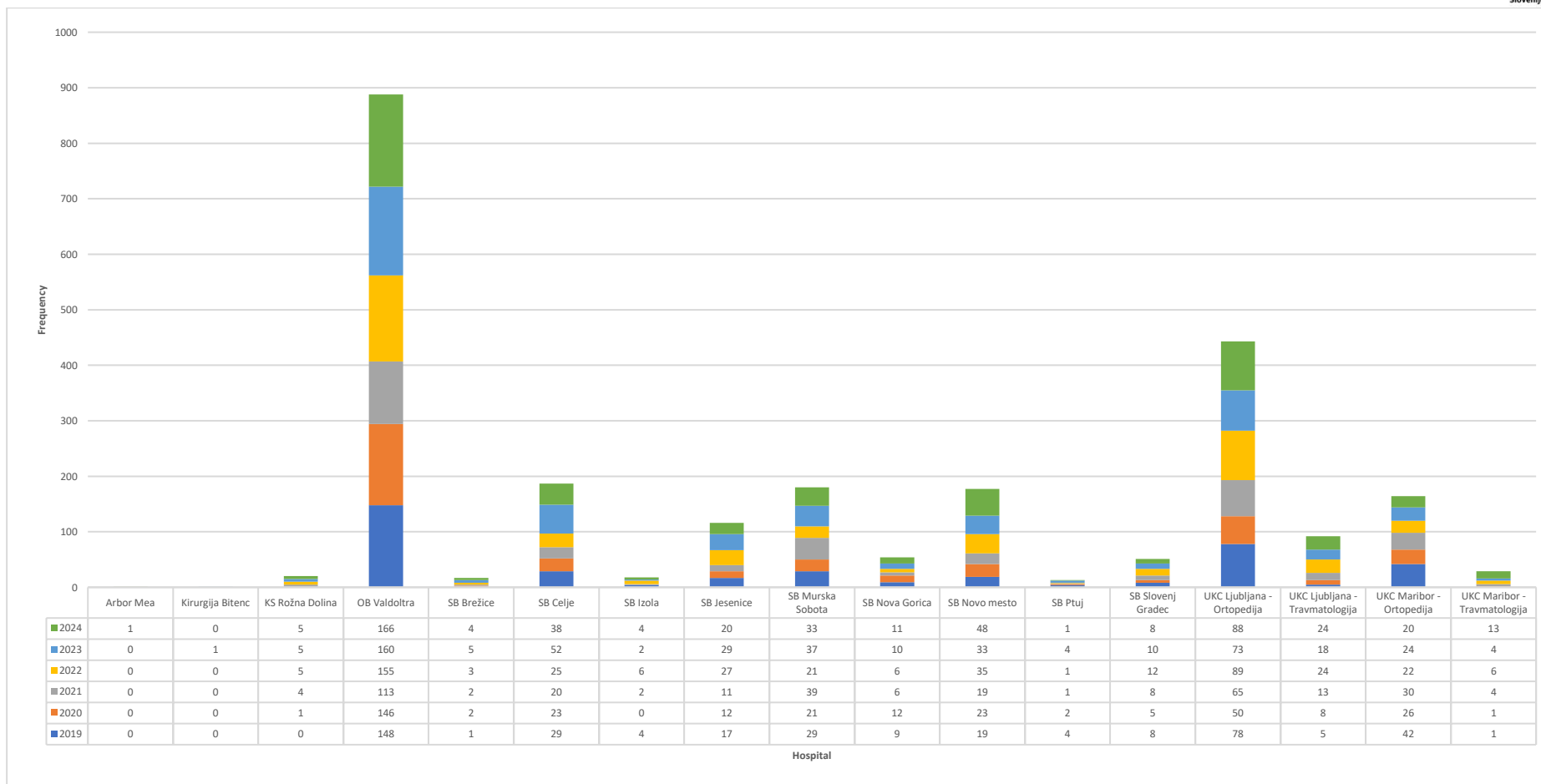


Figure 49: Revision hip arthroplasties between 2019 and 2024 by hospital (Source: RES).

Figure 49 shows the providers of revision procedures between 2019 and 2024. At Valdoltra Orthopaedic Hospital, more than 30% of all hip endoprosthesis revisions in Slovenia are performed annually.

The figure below presents the revision burden. Revision burden is defined as the number of revision procedures at a given institution multiplied by 100 and divided by all procedures on that type of joint (both primary and revision combined) performed at the institution.

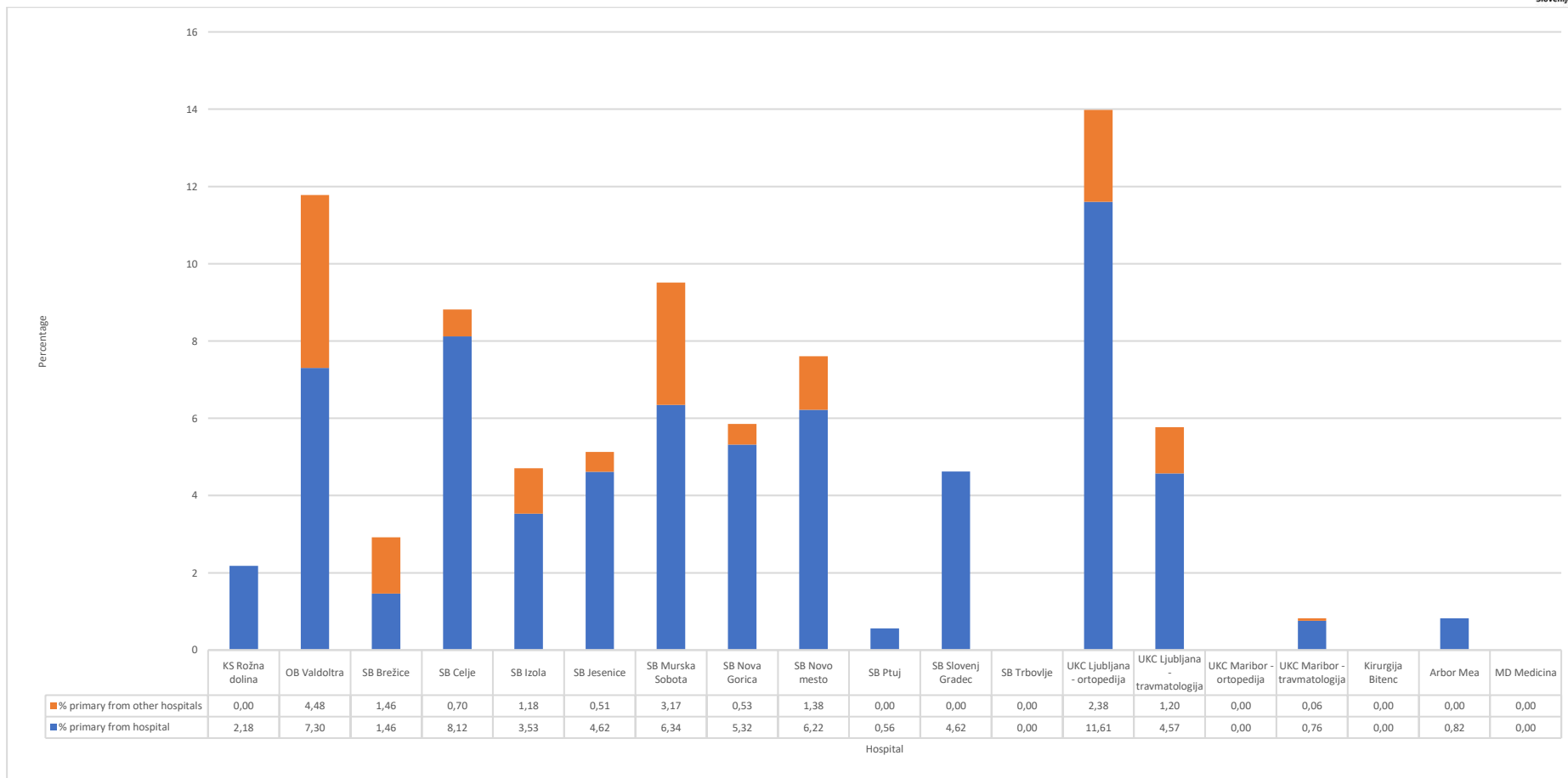


Figure 50: Revision burden of hip arthroplasties by hospital in 2024 (Source: RES).

The highest revision burden is borne by the University Medical Centre Ljubljana – Orthopaedics (14%) and Valdoltra Orthopaedic Hospital (11.8%). Other providers have a share of revision hip procedures below 10%. At Valdoltra Orthopaedic Hospital, 4.5% of the revision burden comes from procedures referred from other hospitals (Figure 50).

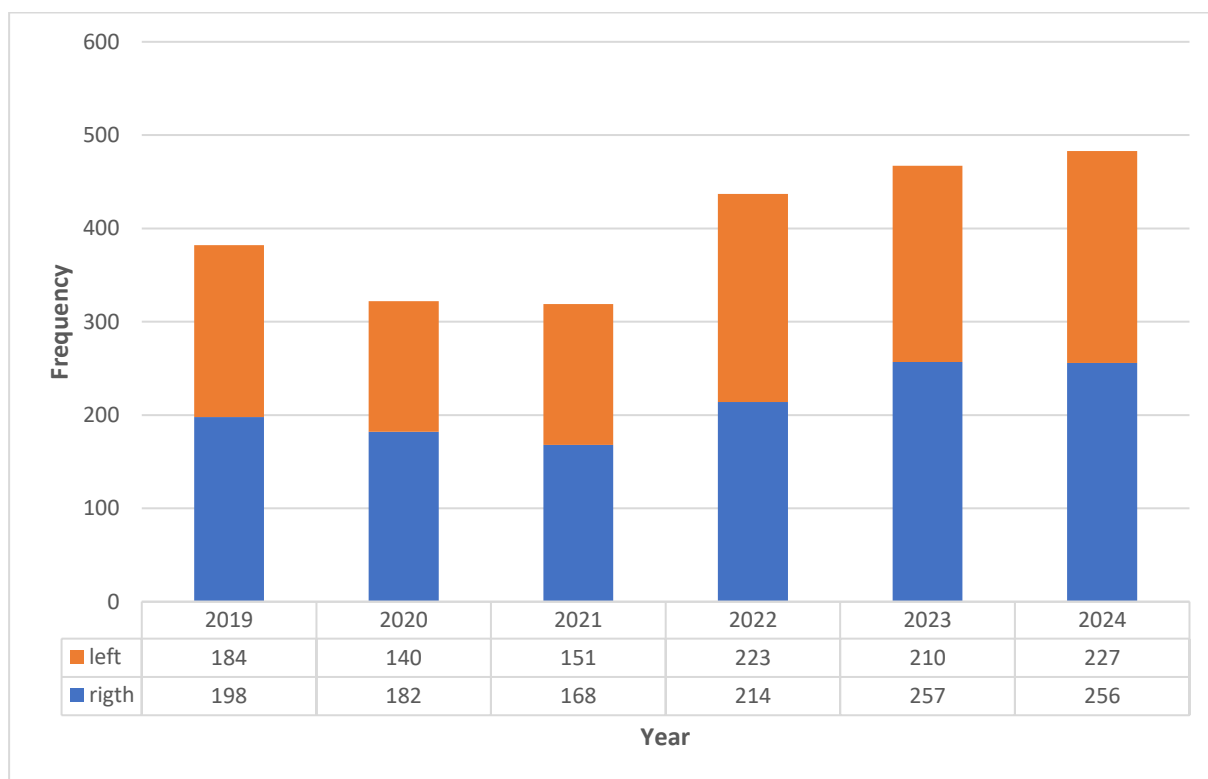


Figure 51: Revision hip arthroplasty between 2019 and 2024 by surgical side²⁷ (Source: RES).

In 2024, a total of 227 (47%) revision hip arthroplasties were performed on the left hip and 256 (53%) on the right hip (Figure 51).

²⁷ The RES database does not contain information on the surgical side for 12 revision hip surgeries performed in 2019, 10 performed in 2020, 18 performed in 2021, and 1 performed in 2024.

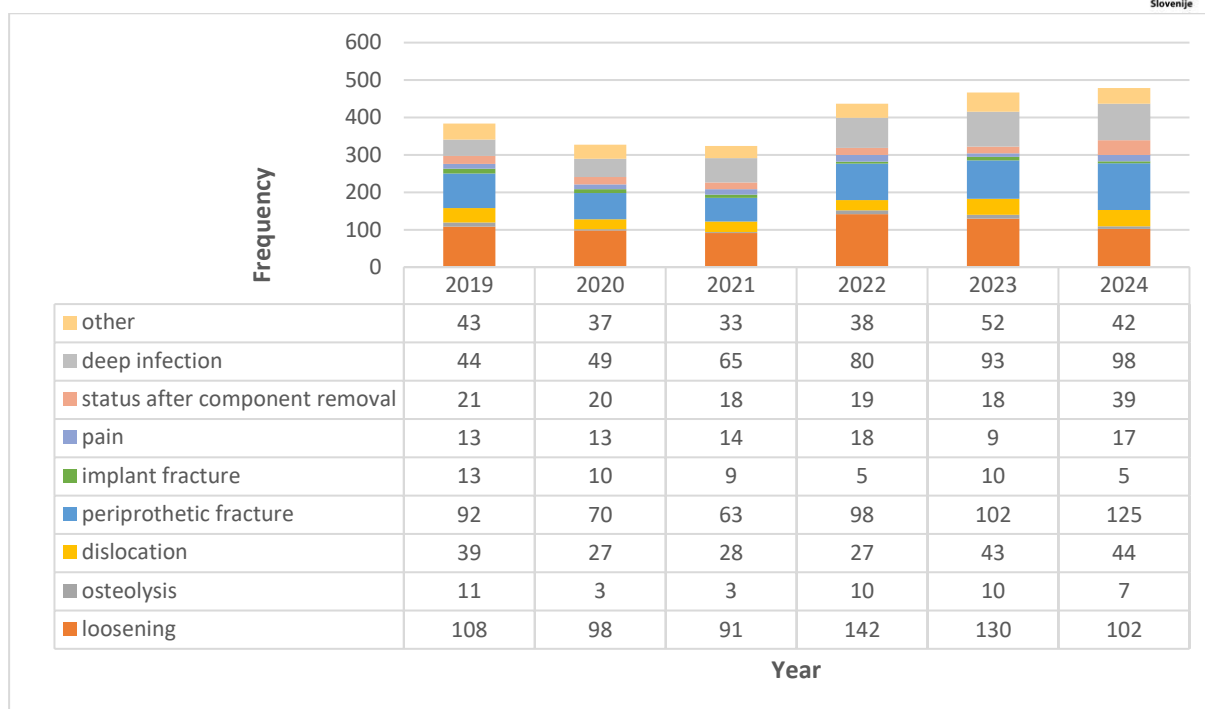


Figure 52: Hip arthroplasty revisions between 2019 and 2024 by reason of revision (Source: RES).

In 2024 (Figure 52), the most common reason for revision was periprosthetic fracture (125 cases – 26.1%). This was followed by loosening (102 – 21.3%), deep infection (98 – 20.5%), dislocation (44 – 9.2%), status after component removal (39 – 8.1%), pain (17 – 3.5%), osteolysis (7 – 1.5%), and implant fracture (5 – 1%). In 42 cases (8.8%), other reasons for revision were reported.

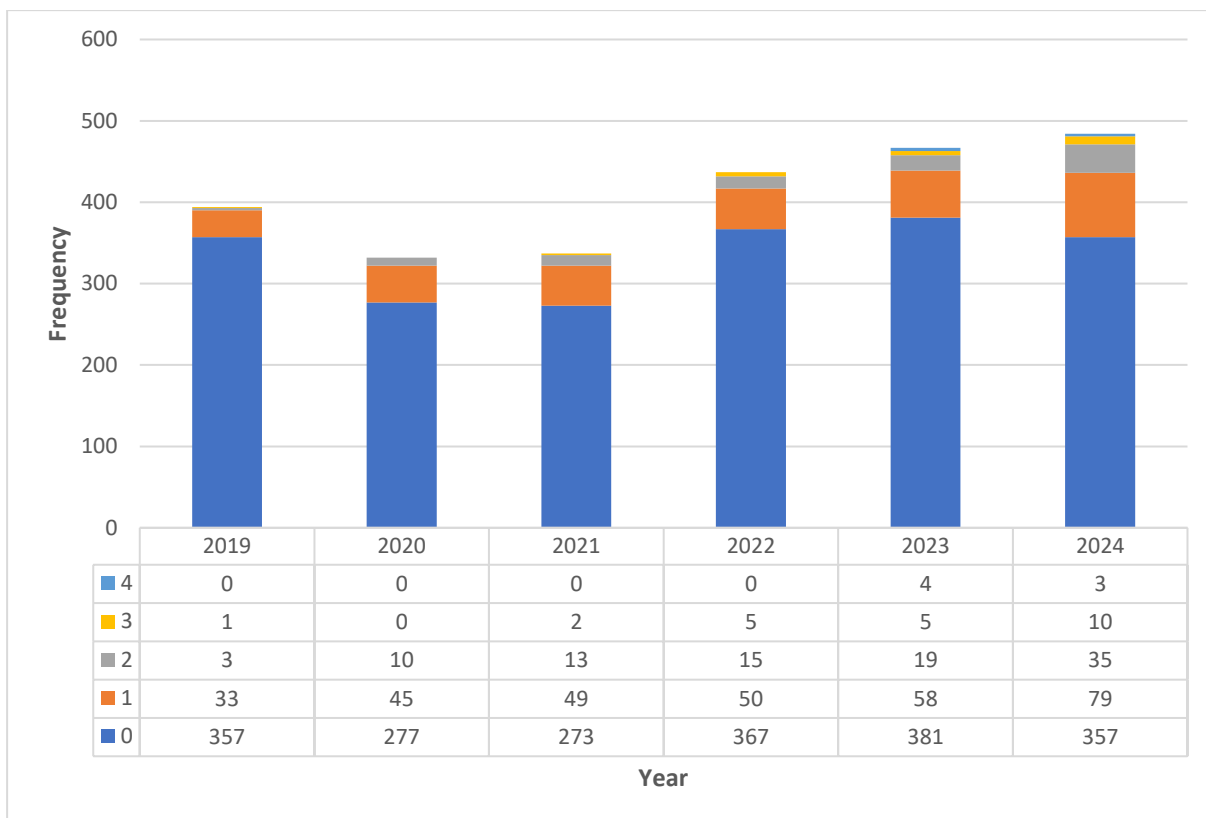


Figure 53: Revision hip arthroplasties between 2019 and 2024 by number of previous revision surgeries (Source: RES).

In 2024, the RES database recorded 357 (73.8%) revision procedures in patients who had no prior revisions. In 79 cases (16.3%), this was the second revision; in 35 cases (7.2%), the third revision; in 10 cases (2.1%), the fourth revision; and in 3 cases (0.6%), the fifth revision (Figure 53).

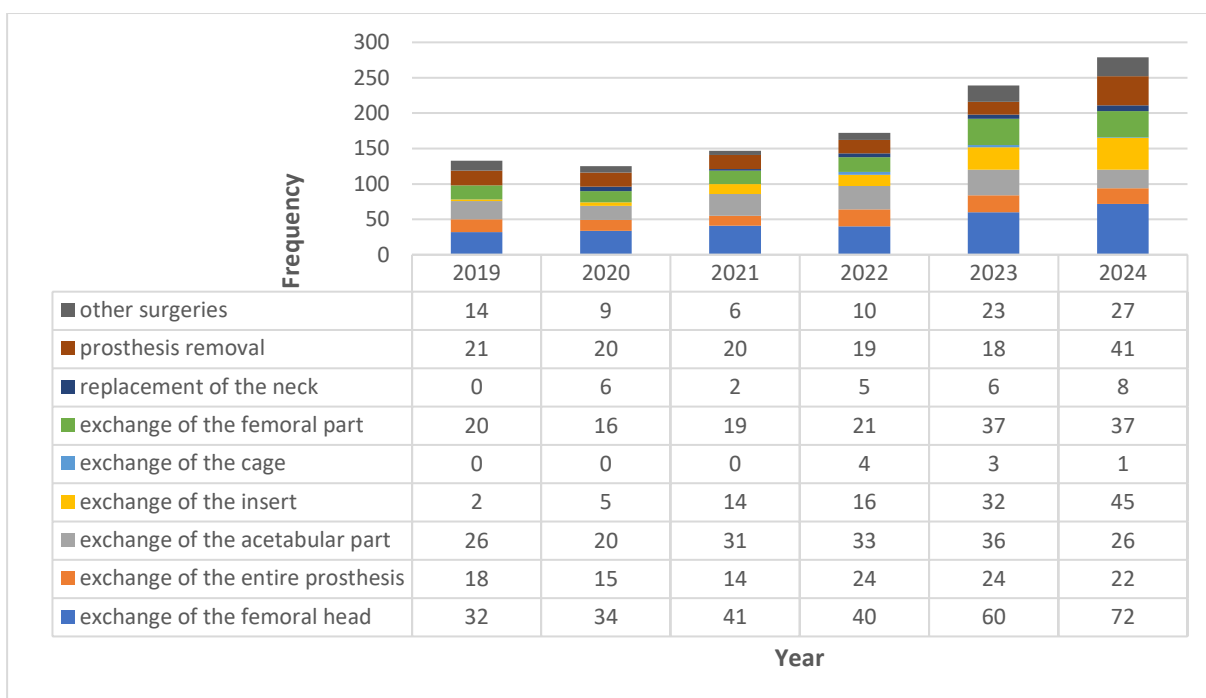


Figure 54: Type of previous surgery in revision hip arthroplasties between 2019 and 2024 (Source: RES).

In 2024, the most common prior procedure before revision hip arthroplasty was exchange of the prosthetic head (72 cases). This was followed by liner exchange (45 cases), removal of the endoprosthesis (41 cases), exchange of the femoral component (37 cases), exchange of the acetabular component (26 cases), and total endoprosthesis exchange (22 cases). Neck (8 cases) and cage replacement (1 case) were less common prior procedures. In 27 cases, other procedures were reported (Figure 54).

Figure 55 presents the extent of revision, where multiple options could be selected simultaneously.

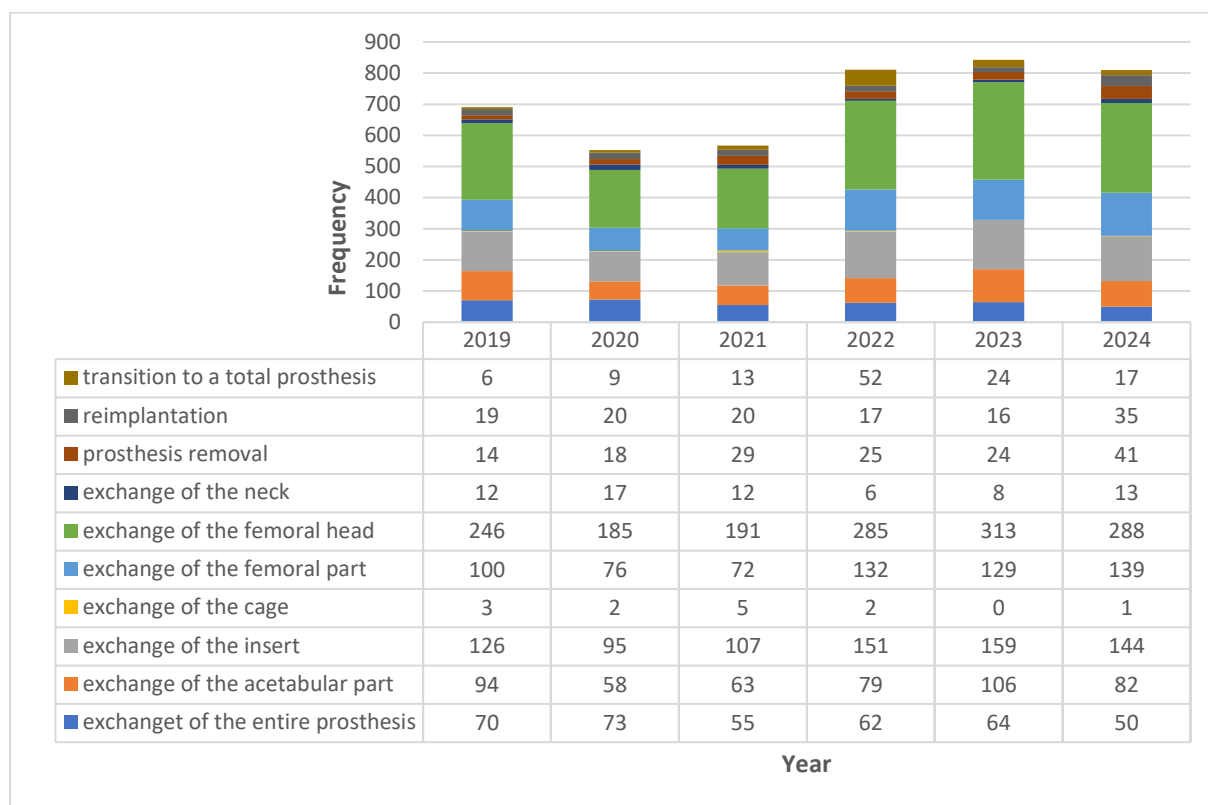


Figure 55: Revision hip arthroplasty between 2019 and 2024, by revision volume (Source: RES).

In 2024, a total of 484 revision hip arthroplasties were performed. Of these, there were 288 prosthetic head replacements, 144 liner exchanges, 139 femoral component replacements, 82 acetabular component replacements, 50 total endoprosthesis replacements, 41 two-stage revisions (removal of the endoprosthesis), 35 reimplantations, 17 conversions to total endoprosthesis (Figure 56), 13 neck replacements, and 1 ring replacement. In 17 cases, another type of revision hip arthroplasty was reported.

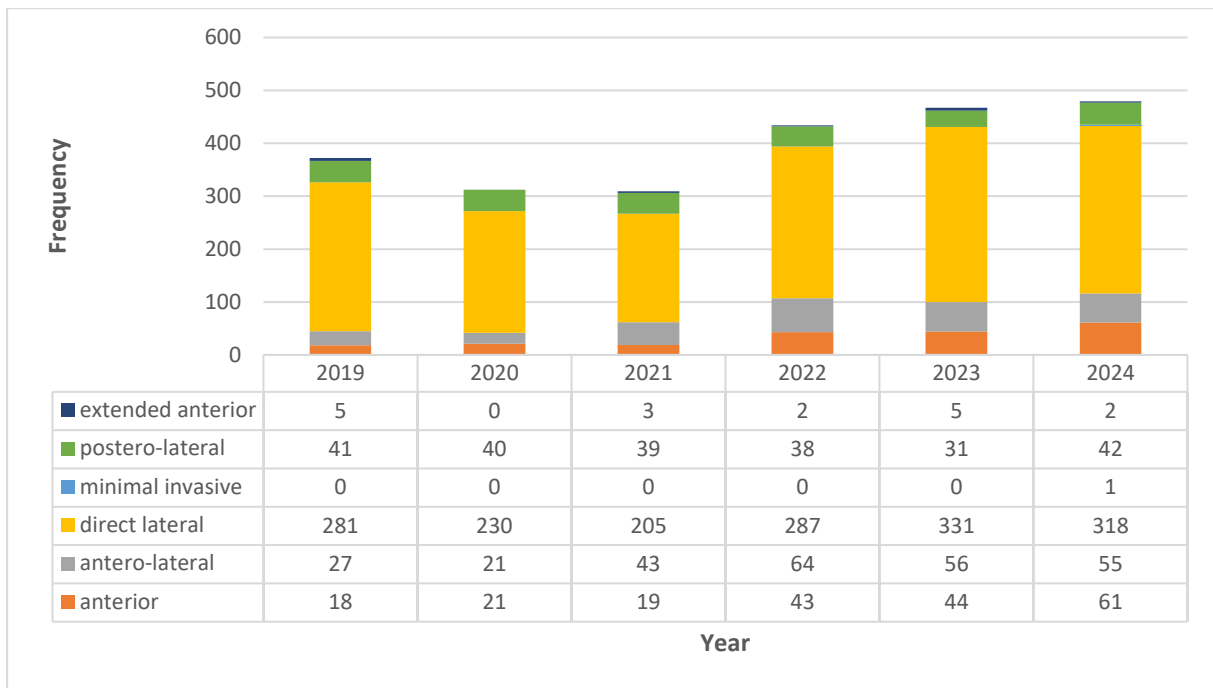


Figure 56: Revision hip arthroplasty between 2019 and 2024, by surgical approach²⁸ (Source: RES).

In 2024, the direct lateral surgical approach was used in 66.4% of revision hip arthroplasties. This was followed by the anterior approach (12.7% of cases), the anterolateral approach (11.5%), and the posterolateral approach (8.8%), while the extended anterior approach was used twice and the minimally invasive in one case (Figure 56).

7.3.4 First revision hip arthroplasties

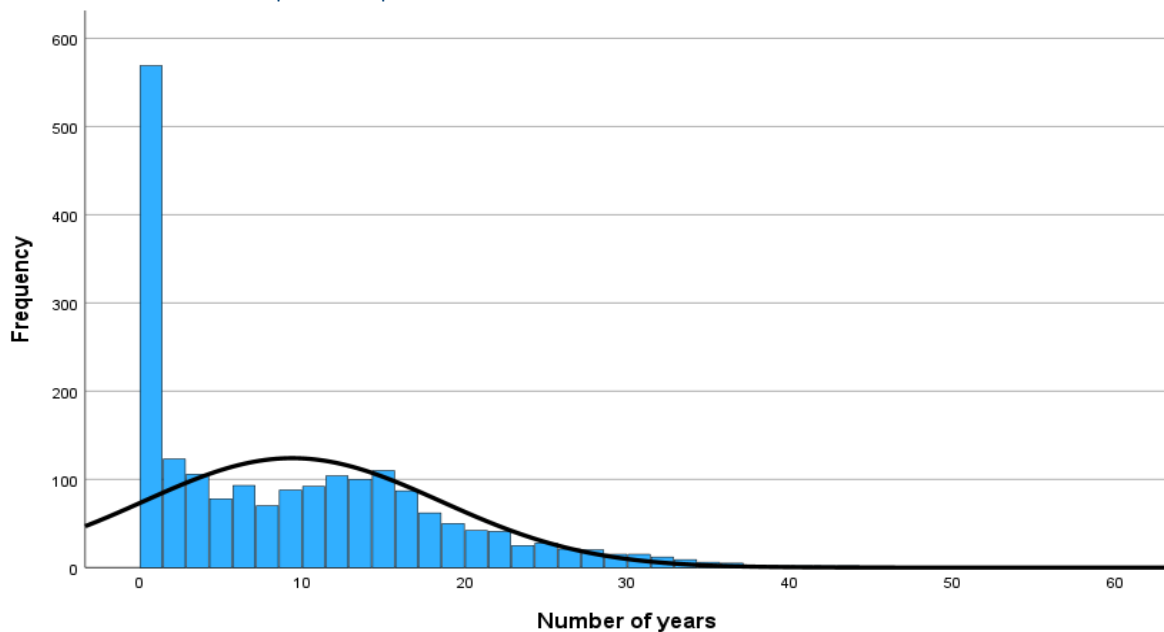


Figure 57: Time from primary hip arthroplasty to first revision between 2019 and 2024 (Source: RES).

²⁸ There is no information on the surgical approach used for 22 cases in 2019, 20 cases in 2020, 28 cases in 2021, 3 cases in 2022, and 5 cases in 2024.

In 2024, the average time between primary hip arthroplasty and the first revision was 9.4 years.

7.4 Survival analysis of total hip endoprostheses – data up to 31 December 2024

In this chapter, we present the survival of primary total hip endoprostheses. The analysis includes implants inserted between 1 January 2019 and 31 December 2024. The observation period runs from the primary surgery to the first revision, where the first revision is defined as any reoperation for any reason, regardless of its extent (replacement of the entire prosthesis or only part of it). For patients who died during follow-up or did not experience an event (first revision) by the end of the observation period, the data are treated as censored.

To estimate survival at time t^* (the function $S(t)$), we use the Kaplan–Meier method. The results are presented as the cumulative proportion of revisions, that is, $1 - S(t)$. The proportions at one, three, and five years after primary implantation are shown.

The results are presented in four sections. First, we show the results by individual combinations, including only those stem–cup combinations with at least 200 cases. This is followed by an analysis based on the bearing surface (head–cup), with the following categories: dual mobility, ceramic-on-ceramic, ceramic-on-PE, ceramic-on-XLPE, and metal-on-PE and metal-on-XLPE. Next, we analyse prostheses according to fixation type (cemented, uncemented, hybrid, and reverse hybrid), and finally according to head size (dual mobility, ≤ 28 mm, 32 mm, and 36 mm).

Each section contains a table with annual data and a table of cumulative revision percentages. The section on implant combinations also includes a table showing the causes of revisions.

7.4.1 Combinations of implants (stem–cup)

Table 19: Number and % of primary hip implant combinations (stem-cup) by year (Source: RES).

Year	2019-2024		2019		2020		2021		2022		2023		2024	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
All total hip endoprostheses	23307		3691		3051		3335		4118		4664		4448	
Corail - Pinnacle (DePuy)	4590	19.7	597	16.2	615	20.2	742	22.2	887	21.5	947	23	802	19.5
H-MAX S fem stem - Delta PF cup (Lima)	3199	13.7	576	15.6	407	13.3	350	10.5	572	13.9	699	17	595	14.4
Zweymuller Alloclassic - Allofit (Zimmer Biomet)	3169	13.6	710	19.2	627	20.6	568	17	458	11.1	491	11.9	315	7.6
Apta-Fix Uncemented Stem - Fixa Larus (Adler Ortho)	1170	5	241	6.5	184	6	165	4.9	232	5.6	169	4.1	179	4.3
Taperloc Complete Microplasty - Allofit (Zimmer Biomet)	1165	5	150	4.1	164	5.4	155	4.6	194	4.7	204	5	298	7.2
Evok fem stem - Saturne II Dual Mobility (Amplitude)	1098	4.7	138	3.7	102	3.3	152	4.6	213	5.2	249	6	244	5.9
TwinSys fem stem - RM Pressfit Vitamys (Mathys)	712	3.1	37	1	53	1.7	94	2.8	174	4.2	172	4.2	182	4.4
Avenir Uncemented - Allofit (Zimmer Biomet)	581	2.5	0	0	4	0.1	135	4	139	3.4	149	3.6	154	3.7
Evok fem stem - Freeline cup (Amplitude / Evolutis)	575	2.5	70	1.9	65	2.1	105	3.1	145	3.5	122	3	68	1.7
Optimys - RM Pressfit Vitamys (Mathys)	510	2.2	0	0	7	0.2	12	0.4	29	0.7	178	4.3	284	6.9
Taperloc Complete Uncemented Stem - Allofit (Zimmer Biomet)	407	1.7	75	2	70	2.3	59	1.8	67	1.6	51	1.2	85	2.1
Exception Uncemented - Avantage DM Uncemented Cup (Zimmer Biomet)	391	1.7	67	1.8	38	1.2	73	2.2	80	1.9	95	2.3	38	0.9
EcoFit stem - EcoFit Cup Epore (Implantcast)	341	1.5	92	2.5	85	2.8	12	0.4	24	0.6	43	1	85	2.1
Evok fem stem - Stellar cup (Amplitude / Evolutis)	305	1.3	0	0	0	0	0	0	0	0	112	2.7	193	4.7
CBH - RM Pressfit Vitamys (Mathys)	298	1.3	27	0.7	44	1.4	78	2.3	109	2.6	40	1	0	0
Minima S std - Delta PF cup (Lima)	270	1.2	0	0	23	0.8	29	0.9	62	1.5	90	2.2	66	1.6
Zweymuller Alloclassic - Allofit-S IT (Zimmer Biomet)	270	1.2	75	2	37	1.2	46	1.4	31	0.8	54	1.3	27	0.7
SP II Cemented Stem - Allofit (Link / Zimmer Biomet)	217	0.9	21	0.6	32	1	32	1	37	0.9	44	1.1	51	1.2
Total*	19268	82.8	2876	77.8	2557	83.6	2807	84.1	3453	83.7	3909	94.9	3666	88.9

* Number of implanted total hip endoprostheses with more than 200 cases

Throughout the entire period, the most frequently implanted combination was Corail – Pinnacle (DePuy), with 4,590 cases (19.7%). This was followed by H-MAX S femoral stem – Delta PF cup (Lima) (13.7%) and Zweymüller Alloclassic – Allofit (Zimmer Biomet) (13.6%). All other combinations were used in fewer than 10% of cases (Table 19).

Table 20: One-, three-, and five-year cumulative revision rate of primary hip implant combinations (stem-cup) with 95% confidence interval (CI) (Source: RES).

Stem - cup (manufacturer)	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All total hip endoprotheses	23307	554	69 (62-76)	54	1.91 (1.74 - 2.1)	2.52 (2.31 - 2.75)	3.04 (2.77 - 3.34)
Corail - Pinnacle (DePuy)	4590	86	67 (59-73)	52	1.64 (1.3 - 2.05)	1.94 (1.56 - 2.43)	2.28 (1.82 - 2.87)
H-MAX S fem stem - Delta PF cup (Lima)	3199	49	70 (64-76)	53	1.37 (1.01 - 1.85)	1.59 (1.19 - 2.13)	1.93 (1.41 - 2.64)
Zweymuller Alloclassic - Allofit (Zimmer Biomet)	3169	95	70 (63-77)	55	2.13 (1.68 - 2.7)	3.09 (2.51 - 3.8)	3.4 (2.76 - 4.19)
Apta-Fix Uncemented Stem - Fixa Larus (Adler Ortho)	1170	54	69 (62-75)	52	3.41 (2.51 - 4.64)	4.61 (3.49 - 6.07)	5.54 (4.18 - 7.33)
Taperloc Complete Microplasty - Allofit (Zimmer Biomet)	1165	13	66 (58-73)	53	1.07 (0.61 - 1.88)	1.07 (0.61 - 1.88)	1.31 (0.73 - 2.33)
Evok fem stem - Saturne II Dual Mobility (Amplitude)	1098	22	74 (70-80)	62	1.75 (1.11 - 2.77)	2.2 (1.39 - 3.49)	3.17 (1.87 - 5.35)
TwinSys fem stem - RM Pressfit Vitamys (Mathys)	712	10	72 (66-78)	58	1.29 (0.68 - 2.47)	1.56 (0.83 - 2.93)	1.56 (0.83 - 2.93)
Avenir Uncemented - Allofit (Zimmer Biomet)	581	15	69 (61-75)	56	2.1 (1.2 - 3.67)	2.72 (1.59 - 4.63)	3.53 (1.92 - 6.44)
Evok fem stem - Freeline cup (Amplitude / Evolutis)	575	13	64 (57-70)	50	1.28 (0.61 - 2.66)	2.73 (1.51 - 4.9)	3.9 (1.9 - 7.9)
Optimys - RM Pressfit Vitamys (Mathys)	510	4	67 (60-73)	51	0.95 (0.35 - 2.57)	0.95 (0.35 - 2.57)	0.95 (0.35 - 2.57)
Taperloc Complete Uncemented Stem - Allofit (Zimmer Biomet)	407	8	69 (61-74)	52	1.88 (0.9 - 3.91)	2.38 (1.17 - 4.82)	2.38 (1.17 - 4.82)
Exception Uncemented - Avantage DM Uncemented Cup (Zimmer Biomet)	391	13	71 (64-76)	58	2.64 (1.43 - 4.85)	3.58 (2 - 6.35)	4.41 (2.43 - 7.96)
EcoFit stem - EcoFit Cup Epore (Implantcast)	341	15	57 (51-62)	48	3.29 (1.83 - 5.86)	5.19 (3.11 - 8.57)	5.19 (3.11 - 8.57)
Evok fem stem - Stellar cup (Amplitude / Evolutis)	305	7	67 (60-74)	53	3.06 (1.38 - 6.69)	3.06 (1.38 - 6.69)	
CBH - RM Pressfit Vitamys (Mathys)	298	8	69 (61-76)	53	1.01 (0.33 - 3.09)	2.83 (1.42 - 5.6)	2.83 (1.42 - 5.6)
Minima S std - Delta PF cup (Lima)	270	4	64 (57-71)	32	1.5 (0.57 - 3.96)	1.5 (0.57 - 3.96)	1.5 (0.57 - 3.96)
Zweymuller Alloclassic - Allofit-S IT (Zimmer Biomet)	270	6	57 (51-62)	50	1.87 (0.78 - 4.43)	1.87 (0.78 - 4.43)	2.92 (1.19 - 7.08)
SP II Cemented Stem - Allofit (Link / Zimmer Biomet)	217	5	81 (75-85)	71	2.14 (0.8 - 5.62)	2.14 (0.8 - 5.62)	3.54 (1.34 - 9.16)

Over the entire period, 554 of 23,307 primary hip prostheses underwent first revision (2.3%). The median age of patients at the time of primary implantation was 69 years, and 54% of the prostheses were implanted in women. The estimated cumulative revision percentage was 1.91% at one year, 2.52% at three years, and 3.04% at five years. The cumulative revision percentages for individual combinations are presented in more detail in Table 20.

Table 21 presents the prostheses by individual causes of revision. Of the 19,268 prostheses implanted in more than 200 cases, 427 (2.2%) underwent a first revision. The most common cause of revision was infection (34.7%), followed by periprosthetic fracture (24.8%), loosening (14.1%), other causes (12.4%), dislocation (9.4%), pain (3.5%), and implant fracture (0.2%).

Table 21: Number of primary hip implant combinations by reason for revision in the period 2019-2024 (Source: RES).

Stem-cup (manufacturer)	Number of first revisions	Number of primaries	% of revisions	Infection	Periprosthetic fracture	Loosening	Dislocation	Pain	Implant fracture	Other	NP
Total	427	19268	2.22	148	106	60	40	15	1	53	4
Corail - Pinnacle (DePuy)	86	4590	1.87	33	18	9	5	2	0	18	1
H-MAX S fem stem - Delta PF cup (Lima)	49	3199	1.53	16	19	3	4	1	1	5	0
Zweymuller Alloclassic - Allofit (Zimmer Biomet)	95	3169	3.00	35	22	22	9	2	0	5	0
Apta-Fix Uncemented Stem - Fixa Larus (Adler Ortho)	54	1170	4.62	12	14	5	10	4	0	9	0
Taperloc Complete Microplasty - Allofit (Zimmer Biomet)	13	1165	1.12	8	1	1	1	0	0	2	0
Evok fem stem - Saturne II Dual Mobility (Amplitude)	22	1098	2.00	11	7	2	1	0	0	0	1
TwinSys fem stem - RM Pressfit Vitamys (Mathys)	10	712	1.40	5	1	0	2	1	0	0	1
Avenir Uncemented - Allofit (Zimmer Biomet)	15	581	2.58	5	8	1	1	0	0	0	0
Evok fem stem - Freeline cup (Amplitude / Evolutis)	13	575	2.26	2	4	5	0	0	0	2	0
Optimys - RM Pressfit Vitamys (Mathys)	4	510	0.78	0	3	0	0	0	0	1	0
Taperloc Complete Uncemented Stem - Allofit (Zimmer Biomet)	8	407	1.97	1	0	3	0	0	0	4	0
Exception Uncemented - Avantage DM Uncemented Cup (Zimmer Biomet)	13	391	3.32	5	3	2	0	2	0	1	0
EcoFit stem - EcoFit Cup Epore (Implantcast)	15	341	4.40	3	3	2	6	0	0	1	0
Evok fem stem - Stellar cup (Amplitude / Evolutis)	7	305	2.30	4	2	0	0	1	0	0	0
CBH - RM Pressfit Vitamys (Mathys)	8	298	2.68	0	0	4	0	1	0	3	0
Minima S std - Delta PF cup (Lima)	4	270	1.48	2	1	0	1	0	0	0	0
Zweymuller Alloclassic - Allofit-S IT (Zimmer Biomet)	6	270	2.22	3	0	0	0	1	0	1	1
SP II Cemented Stem - Allofit (Link / Zimmer Biomet)	5	217	2.30	3	0	1	0	0	0	1	0

7.4.2 Bearing surface (head–cup)

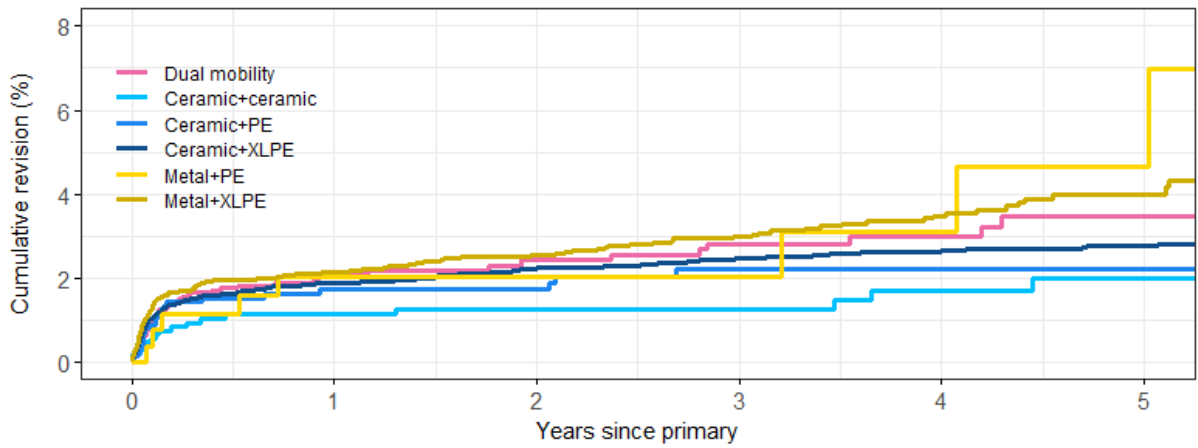
Table 22: Number and % of primary hip prostheses by bearing surface by year (Source: RES).

Year	2019-2024		2019		2020		2021		2022		2023		2024	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
All TH endoprotheses	23307		3691		3051		3335		4118		4664		4448	
Dual mobility	2044	8.8	312	8.5	185	6.1	282	8.5	378	9.2	459	9.8	428	9.2
Ceramic+ceramic	1072	4.8	244	6.6	139	4.6	153	4.6	188	4.6	210	4.5	138	3
Ceramic+PE	1349	5.8	199	5.4	169	5.5	169	5.1	181	4.4	251	5.4	380	8.1
Ceramic+XLPE	13992	60	2082	56.4	1750	57.4	1950	58.5	2488	60.4	2856	61.2	2866	61.4
Metal+PE	263	1.1	54	1.5	33	1.1	35	1	50	1.2	52	1.1	39	0.8
Metal+XLPE	4582	19.7	800	21.7	775	25.4	746	22.4	833	20.2	836	17.9	592	12.7
Metal+metal	3	0	0	0	0	0	0	0	0	0	0	0	3	0.1
NP	2	0	0	0	0	0	0	0	0	0	0	0	2	0

During the entire period, the most frequently implanted prostheses had a ceramic-on-XLPE bearing surface, with 13,992 such cases (60%). These were followed by metal-on-XLPE (19.7%) and dual mobility (8.8%) (Table 22).

Table 23: One-, three-, and five-year cumulative revision rates of hip prostheses by bearing surface, with 95% confidence intervals (CI) (Source: RES).

Bearing surface	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All TH endoprotheses	23307	554	69 (62-76)	54	1.91 (1.74 - 2.1)	2.52 (2.31 - 2.75)	3.04 (2.77 - 3.34)
Dual mobility	2044	51	74 (68-79)	61	2.13 (1.57 - 2.88)	2.81 (2.1 - 3.77)	3.47 (2.52 - 4.77)
Ceramic+ceramic	1072	16	60 (51-67)	48	1.14 (0.65 - 1.99)	1.25 (0.73 - 2.15)	2 (1.16 - 3.43)
Ceramic+PE	1349	25	69 (61-76)	52	1.73 (1.14 - 2.62)	2.22 (1.47 - 3.33)	2.22 (1.47 - 3.33)
Ceramic+XLPE	13992	315	66 (60-73)	52	1.88 (1.67 - 2.13)	2.47 (2.2 - 2.77)	2.77 (2.45 - 3.12)
Metal+PE	263	8	80 (74-85)	65	2.04 (0.85 - 4.83)	2.04 (0.85 - 4.83)	4.65 (1.94 - 10.94)
Metal+XLPE	4582	139	76 (71-80)	57	2.14 (1.76 - 2.61)	2.98 (2.49 - 3.56)	4 (3.32 - 4.82)



Number at risk

■	2044	1560	1085	714	437	264
■	1072	919	709	524	371	233
■	1349	921	659	473	316	166
■	13992	10827	7936	5467	3560	1893
■	263	209	154	101	62	41
■	4582	3821	2942	2098	1369	686

Figure 58: Cumulative revision rate of primary hip prostheses by bearing surface (Source: RES).

Figure 58 shows that the ceramic-on-ceramic and ceramic-on-PE bearing surfaces have the lowest five-year probability of revision. The highest probability of revision is observed for the metal-on-PE surface. More detailed data are presented in Table 24.

7.4.3 Fixation of the endoprosthesis

Table 24: Number and % of primary endoprostheses by fixation by years (Source: RES).

Year	2019-2024		2019		2020		2021		2022		2023		2024	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
All prostheses	23307		3691		3051		3335		4118		4664		4448	
Cemented	513	2.2	126	3.4	87	2.9	73	2.2	69	1.7	77	1.7	81	1.8
Hybrid (cem. stem / uncem. cup)	553	2.4	42	1.1	50	1.6	63	1.9	98	2.4	141	3	159	3.6
Uncemented	21957	94.2	3456	93.6	2878	94.3	3145	94.3	3900	94.7	4404	94.4	4174	93.8
Reverse hybrid	284	1.2	67	1.8	36	1.2	54	1.6	51	1.2	42	0.9	34	0.8

Over the entire period, uncemented prostheses were implanted most frequently (94.2%). All other fixation types are presented in more detail in Table 24.

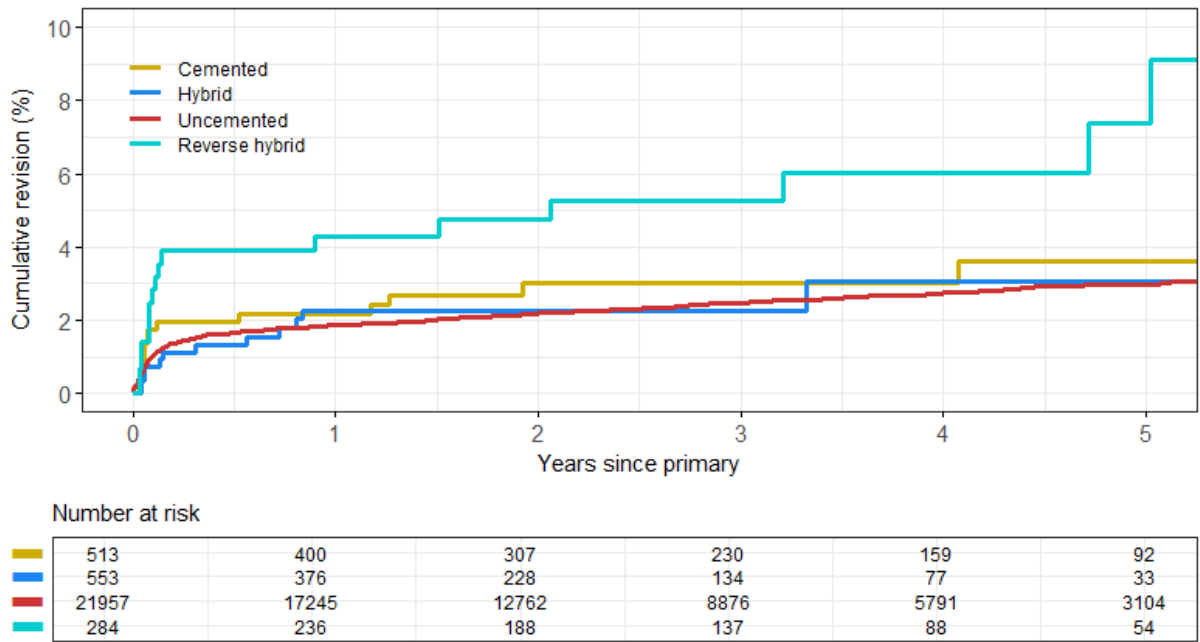


Figure 59: Cumulative revision rate of primary hip prostheses by fixation (Source: RES).

Figure 59 shows that reverse hybrid prostheses stand out, as they have the highest probability of revision, while among the remaining three fixation types, uncemented prostheses perform the best. The cumulative revision percentages for all fixation types are presented in more detail in Table 25.

Table 25: One-, three- and five-year cumulative revision rate of primary endoprostheses by fixation, with 95% confidence interval (CI) (Source: RES).

Fixation of the prosthesis	Number of primaries	Number of first revisions	Age Mediana (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All prostheses	23307	554	69 (62-76)	54	1.91 (1.74 - 2.1)	2.52 (2.31 - 2.75)	3.04 (2.77 - 3.34)
Cemented	513	15	80 (76-84)	73	2.19 (1.22 - 3.91)	3 (1.78 - 5.04)	3.61 (2.09 - 6.19)
Hybrid (cem. stem / uncem. cup)	553	12	79 (73-84)	80	2.27 (1.26 - 4.08)	2.27 (1.26 - 4.08)	3.08 (1.57 - 5.98)
Uncemented	21957	510	69 (61-75)	53	1.87 (1.69 - 2.06)	2.48 (2.26 - 2.72)	2.96 (2.69 - 3.26)
Reverse hybrid	284	17	72 (67-78)	70	4.31 (2.47 - 7.46)	5.26 (3.14 - 8.77)	7.4 (4.27 - 12.69)

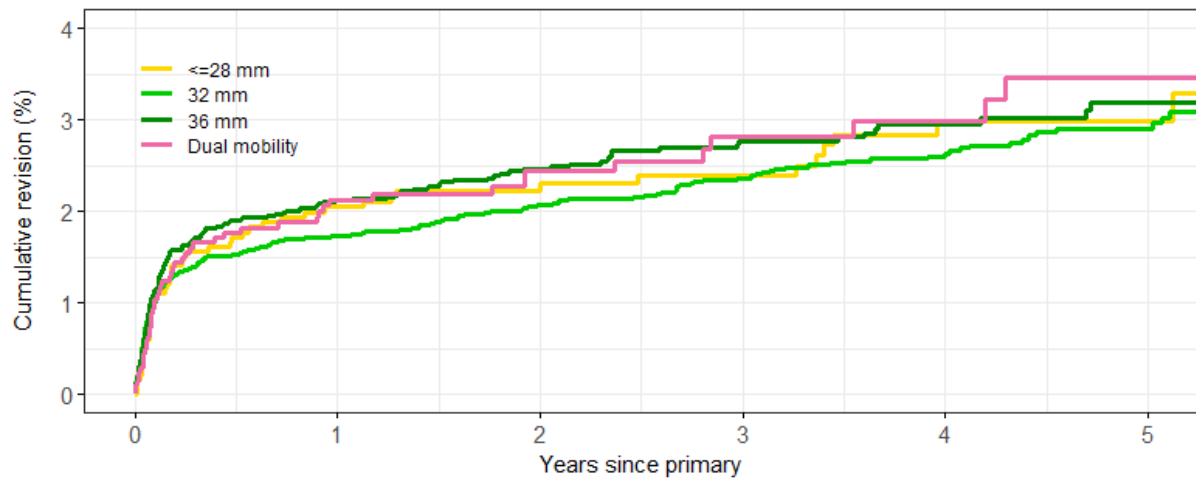
7.4.4 Head size of the endoprosthesis

Table 26: Number and % of primary endoprostheses by head size by year (Source: RES).

Year	2019-2024		2019		2020		2021		2022		2023		2024	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Vse proteze	23307		3691		3051		3335		4118		4664		4448	
≤ 28 mm	2008	8.6	422	11.4	302	9.9	305	9.1	364	8.8	368	7.9	247	5.3
32 mm	12143	52.1	1945	52.7	1748	57.3	1805	54.1	2101	51	2336	50.1	2208	47.3
36 mm	7107	30.5	1012	27.4	816	26.7	943	28.3	1275	31	1501	32.2	1560	33.4
Dual mobility	2044	8.8	312	8.5	185	6.1	282	8.5	378	9.2	459	9.8	428	9.2
≥ 50 mm	3	0	0	0	0	0	0	0	0	0	0	0	3	0.1
NP	2	0	0	0	0	0	0	0	0	0	0	0	2	0

Note: Heads sized ≥ 50 mm are resurfacing prostheses.

Over the entire period, the most frequently implanted head size was 32 mm (52.1%). The head sizes are presented in more detail in Table 26.



Number at risk

≤ 28 mm	2008	1707	1329	963	657	386
32 mm	12143	9624	7233	5121	3357	1730
36 mm	7107	5366	3838	2579	1664	903
Dual mobility	2044	1560	1085	714	437	264

Figure 60: Cumulative revision rate of primary hip prostheses by head size (Source: RES).

Figure 60 shows the probability of revision according to head size. The cumulative revision percentages are presented in Table 27.

Table 27: One-, three- and five-year cumulative revision rates of primary prosthesis revisions by head size with 95% confidence interval (CI) (Source: RES).

Head size	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All prostheses	23307	554	69 (62-76)	54	1.91 (1.74 - 2.1)	2.52 (2.31 - 2.75)	3.04 (2.77 - 3.34)
≤ 28 cm	2008	51	70 (62-76)	90	2.05 (1.51 - 2.78)	2.39 (1.78 - 3.19)	2.99 (2.23 - 3.99)
32 cm	12143	274	69 (62-76)	58	1.73 (1.51 - 1.99)	2.37 (2.09 - 2.68)	2.91 (2.55 - 3.32)
36 cm	7107	178	67 (60-74)	31	2.12 (1.8 - 2.49)	2.77 (2.37 - 3.22)	3.19 (2.7 - 3.77)
Dual mobility	2044	51	74 (69-79)	66	2.13 (1.57 - 2.88)	2.81 (2.1 - 3.77)	3.47 (2.52 - 4.77)

7.5 Summary of the RES registry analysis for hip arthroplasties

In 2024, the consistency between the data of the Health Insurance Institute of Slovenia (ZZZS) and the National Arthroplasty Registry of Slovenia (RES) remains at a very high level, confirming the reliability and quality of both data sources. The exceptions are Arbor Mea, from which we did not receive data for approximately 60 cases, and the Trbovlje General Hospital, which does not submit any data to the RES.

Osteoarthritis (OA) continues to be the leading indication for surgery, accounting for 79.3% of cases in 2024, representing a slight increase compared to the average between 2019 and 2023 (78.4%). The proportion of other diagnoses is gradually decreasing. Surgical approaches are also changing—the share of the anterior approach continues to rise and, for the first time in 2024, exceeded half of all cases, reaching 51.3% (compared with 38% in the 2019–2023 period). The use of other approaches is declining.

The types of prostheses used have remained largely unchanged—uncemented prostheses account for 93.8% of all cases. The use of hybrid prostheses is increasing, while the share of fully cemented prostheses continues to decline. The proportion of dual-mobility prostheses slightly increased in 2024 compared with the 2019–2023 period. These prostheses represent 9.6% of all implanted endoprostheses. Ceramic heads combined with XLPE were used in 71.5% of cases (compared with 64.5% in 2019–2023). The most frequently used femoral head size is 32 mm, representing 49.7% of all cases.

Ninety-day postoperative mortality remains almost unchanged. As expected, mortality after hemiarthroplasty is significantly higher, approximately 30 times higher compared with total hip arthroplasty.

PROM (Patient-Reported Outcome Measures) results show that the median difference between the preoperative and 6-month postoperative Oxford Hip Score (OHS) is around 20 points, with no differences observed between genders or age groups. According to the EQ-5D-5L data, the median improvement in quality of life from before surgery to 6 months postoperatively is 0.21 points, and this improvement does not differ significantly by gender or age group.

The five-year cumulative probability of revision for total hip endoprostheses in Slovenia is 3.04%. Uncemented prostheses have the lowest revision probability at 2.96%, while reverse hybrid prostheses have the highest at 7.4%. Prostheses combined with a 36 mm head or with

dual mobility also show a higher revision probability than the overall rate. The analysis of implant revision probabilities showed that two implant combinations have approximately twice the five-year revision rate compared with the overall rate: Apta-Fix Cementless Stem – Fixa Larus (Adler Ortho) with a five-year revision rate of 5.54% (95% CI: 4.18–7.33), and EcoFit Stem – EcoFit Cup Epore (Implantcast) with a five-year revision rate of 5.19% (95% CI: 3.11–8.57). The lowest five-year revision probability was observed for the combination Optimys – RM Pressfit Vitamys (Mathys), at 0.95% (95% CI: 0.35–2.57%).

8 Knee arthroplasties

In this chapter, we focus on knee arthroplasties performed in the Republic of Slovenia during the period from January 1, 2019 to December 31, 2024. The RES database contains data on 17,726 total and partial knee endoprostheses implanted during this period. In our analyses, we included data received up to September 15, 2025.

First, we present the compliance of the collected data. We then show results on patient demographic characteristics, findings related to the surgical procedures, data on implanted and removed materials, and results from questionnaires assessing functionality, pain, and general health before and after knee arthroplasty. This is followed by a survival analysis of knee implants for the period from January 1, 2019, to December 31, 2024. Finally, we provide concluding findings regarding knee arthroplasties in the period from 2019 to 2024.

8.1 Primary total knee arthroplasties – data up to December 31, 2024

In the period from January 1, 2019, to December 31, 2024, we received a total of 17,726 forms on primary total knee arthroplasties. For the year 2024, the RES database contains data on 3,781 primary total knee arthroplasties.

We examined differences with respect to patient data, the provider, and characteristics related to the surgical procedure. In doing so, we also analyzed differences by patient gender, their age at the time of surgery, and the provider performing the procedure. In the final section, we present data on function and pain, as well as general health, before and after primary total knee arthroplasty.

8.1.1 Compliance of the collected data

Table 28 shows the compliance (the ratio between completed forms in the RES database and the recorded number of knee arthroplasties reported by the Health Insurance Institute of Slovenia) for each year, according to providers performing knee arthroplasty procedures in the Republic of Slovenia. Discrepancies arise due to the reporting of cases not recorded by the Health Insurance Institute (self-paying patients, foreign patients, and cases covered through conventions).

Table 28: Reporting compliance data for primary total knee arthroplasties between 2019 and 2024 in the Republic of Slovenia, by hospital (Source: RES and ZZZS).

Compliance	2019	2020	2021	2022	2023	2024
KS Rožna dolina	100.00	101.25	102.46	135.53	102.34	99.49
OB Valdoltra	97.21	97.32	97.77	102.06	99.13	97.49
SB Brežice	104.88	90.16	104.11	99.09	94.23	97.58
SB Celje	100.42	100.00	97.32	100.00	100.00	100.27
SB Izola	NP	NP	NP	NP	NP	NP
SB Jesenice	92.45	94.48	103.26	99.23	97.15	100.35
SB Murska Sobota	102.33	102.72	103.51	105.86	104.64	102.73
SB Nova Gorica	103.17	98.77	90.91	92.47	100.78	100.56
SB Novo mesto	96.61	99.41	93.31	105.59	94.46	93.67
SB Ptuj	103.15	103.80	93.51	102.82	101.30	100.70
SB Slovenj Gradec	100.00	100.00	102.56	101.11	99.39	100.00
SB Trbovlje	NP	NP	NP	NP	NP	NP
UKC Ljubljana	95.85	96.36	93.01	90.73	95.36	96.30
UKC Maribor	97.58	98.61	100.00	98.10	99.38	100.37
Kirurgija Bitenc	NP	100.00	NP	NP	93.22	88.89
Arbor Mea	NP	NP	NP	NP	61.95	58.39
MD Medicina	NP	NP	NP	NP	NP	NP
Total	98.33	98.33	101.68	104.75	98.12	96.60

In 2024, the Health Insurance Institute of Slovenia recorded 3,914 primary total knee arthroplasties, while 3,781 such procedures were recorded in the RES database (96.6%). Primary total knee arthroplasties are not performed at SB Izola and SB Trbovlje.

The number of primary total knee arthroplasties recorded in the RES database for 2024 is lower than in the Health Insurance Institute database. This is due to poor compliance among some providers. At Kirurgija Bitenc, compliance is only 88.9%, while at Arbor Mea, it is just slightly above half (58.3%).

The total number of records in the two databases differs only minimally, which allows us to conclude that the RES database has effectively reached a census of data on primary knee arthroplasties performed in 2024. This enables the formulation of conclusions for all such procedures performed on Slovenian patients in 2024. However, with lower compliance, it is not possible to conduct a reliable analysis of data by the provider.

8.1.2 Gender and age of patients undergoing primary total knee arthroplasty

This section presents the demographic characteristics of patients: their gender (Figure 61) and age at the time of surgery (Figure 62). Table 30 shows the median age of patients by gender and by individual year.

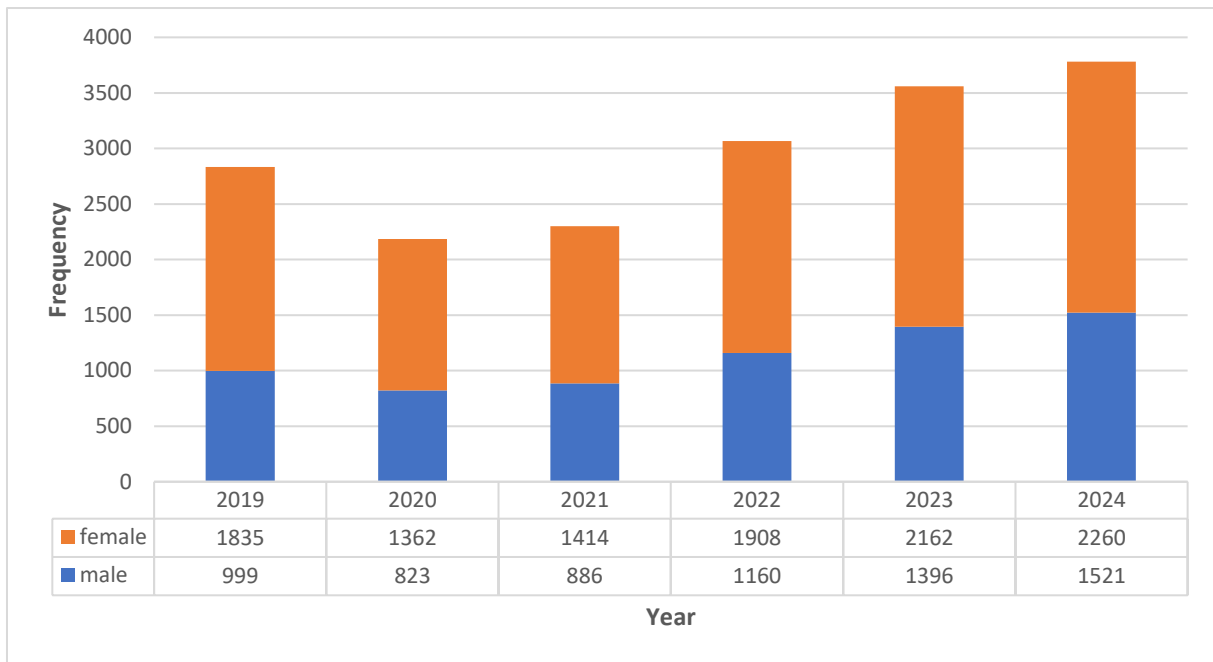


Figure 61: Primary total knee arthroplasty between 2019 and 2024, by patient gender (Source: RES).

In 2024, a total of 2,260 (59.8%) primary total knee arthroplasties were performed in women and 1,521 (40.2%) in men (Figure 61).

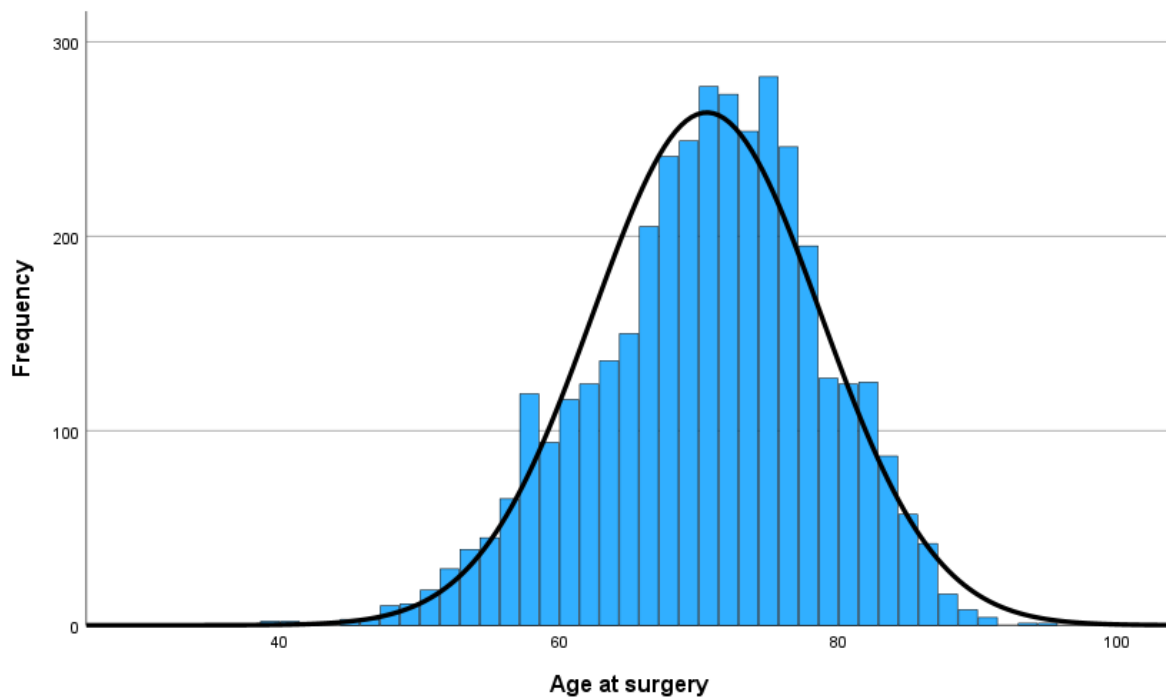


Figure 62: Primary total knee arthroplasty in 2024, by patient age at surgery (Source: RES).

Figure 62 shows the age distribution of patients undergoing primary total knee arthroplasty in 2024. The median age was 71.2 years. The youngest patient was 38.9 years old, and the oldest was 94.3 years old.

Table 29: Age of patients at primary total knee arthroplasty between 2019 and 2024, by gender (Source: RES).

Age at surgery			Year					
			2019	2020	2021	2022	2023	2024
Gender	male	Median	68.2	68.9	69.3	69.3	70.1	70,3
	female	Median	71.3	71.1	71.7	71.5	71.6	71,8
Total		Median	70,2	70.3	70.8	70.8	71.0	71.2

Women were on average 1.5 years older than men at the time of surgery (Table 29). The median age increased between 2019 and 2024. Among men, the median age rose by 2.1 years, while among women it increased by 1 year.

8.1.3 Region of residence of patients with implanted primary total knee endoprotheses

For each provider, Figure 63 shows the proportion of primary total knee arthroplasties in 2024 performed on patients who do not have permanent residence in the region where the provider is registered.

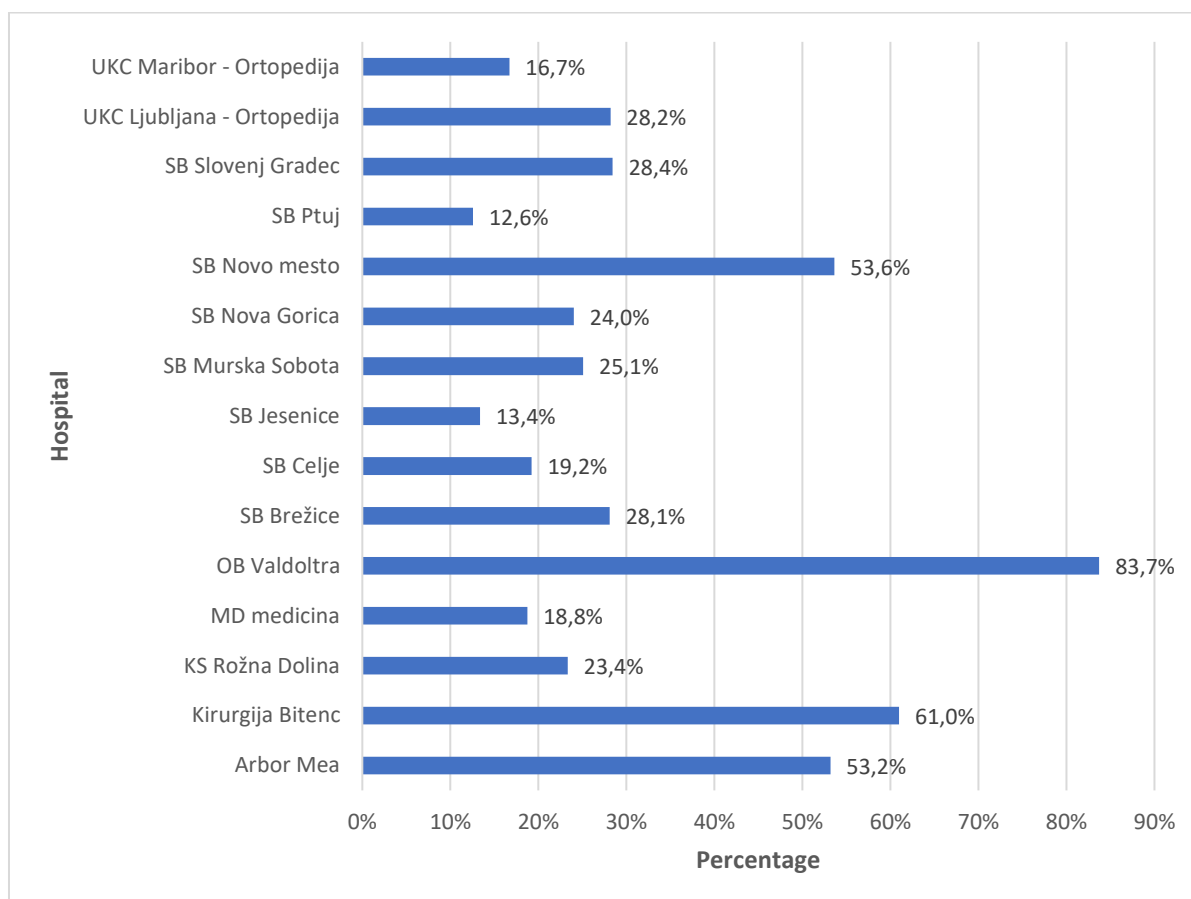


Figure 63: Primary total knee arthroplasties by provider and proportion of regional mismatch in 2024 (Source: RES).

Most hospitals in Slovenia operate on patients from the region in which the hospital is located (Figure 63). Exceptions include Arbor Mea (53.2%), SB Novo Mesto (53.6%), Kirurgija Bitenc (61%), and OB Valdoltra, with as many as 83.7% of patients coming from other regions.

8.1.4 Characteristics of the surgical procedure in primary total knee arthroplasty

This section presents the provider performing the procedure (Figure 64), the side of the operation (Figure 65), the preoperative diagnosis (Figure 66), prosthesis fixation (Figure 67 and Table 34), and the surgical approach (Figure 68 and Table 35).

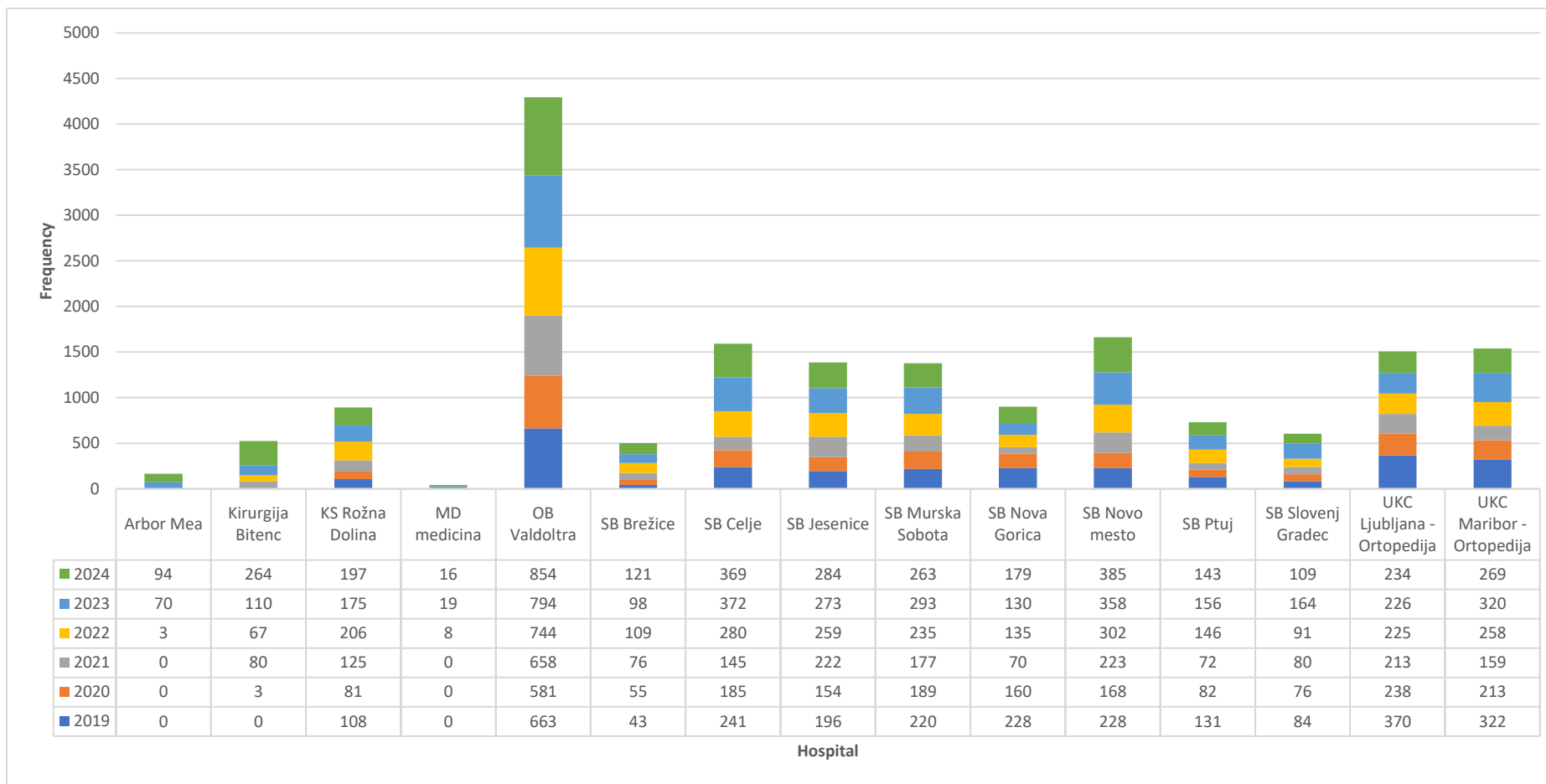


Figure 64: Primary total knee arthroplasty between 2019 and 2024, by provider (Source: RES).

In 2024, the highest proportion of procedures (Figure 64) was performed at OB Valdoltra (22.6%). This was followed by SB Novo Mesto (9.4%), SB Celje (9.0%), SB Jesenice (7.5%), the Orthopaedic Department of UKC Maribor (7.1%), Kirurgija Bitenc (7.0%), SB Murska Sobota (7.0%), the Orthopaedic Clinic of UKC Ljubljana (6.2%), and KS Rožna Dolina (5.2%). Other providers each performed less than 5% of primary total knee arthroplasties in 2024.

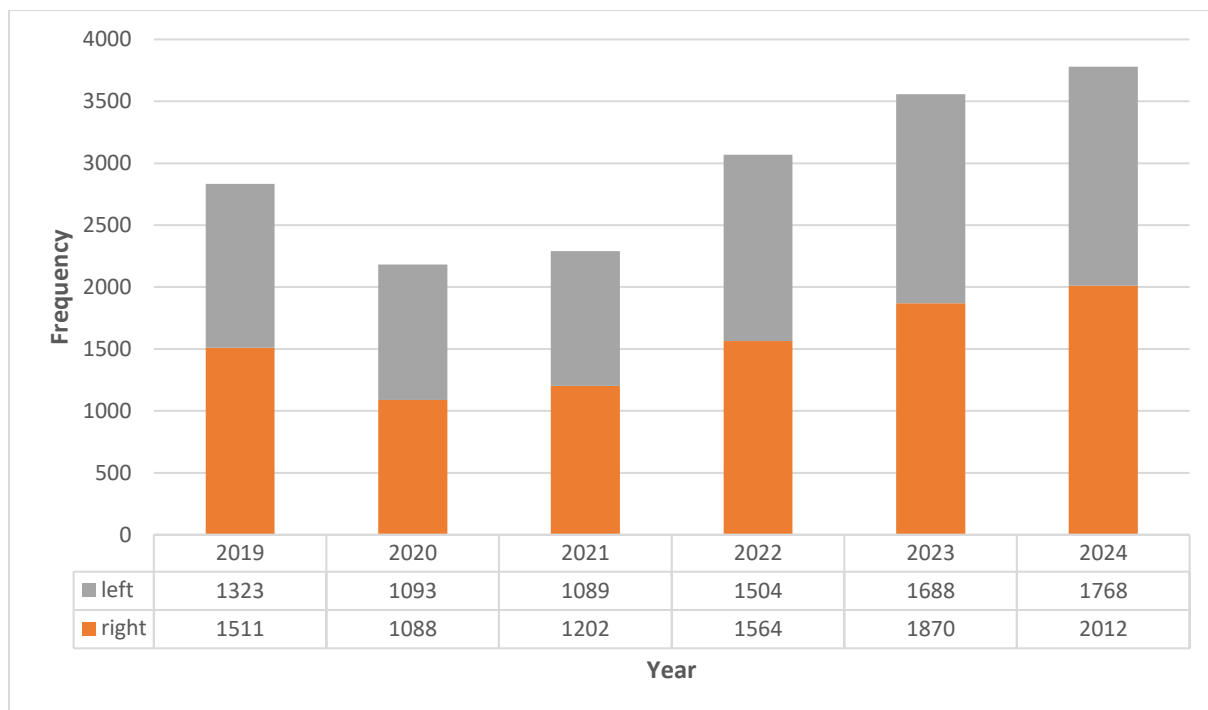


Figure 65: Primary total knee arthroplasty between 2019 and 2024, by surgical side²⁹ (Source: RES).

Slightly more procedures were performed on the right knee (53.2%) than on the left knee (46.8%) in 2024 (Figure 65).

²⁹ In 2020, the RES database lacks information on the surgical side for 4 procedures, in 2021 for 9 procedures, and in 2024 for 1 procedure.

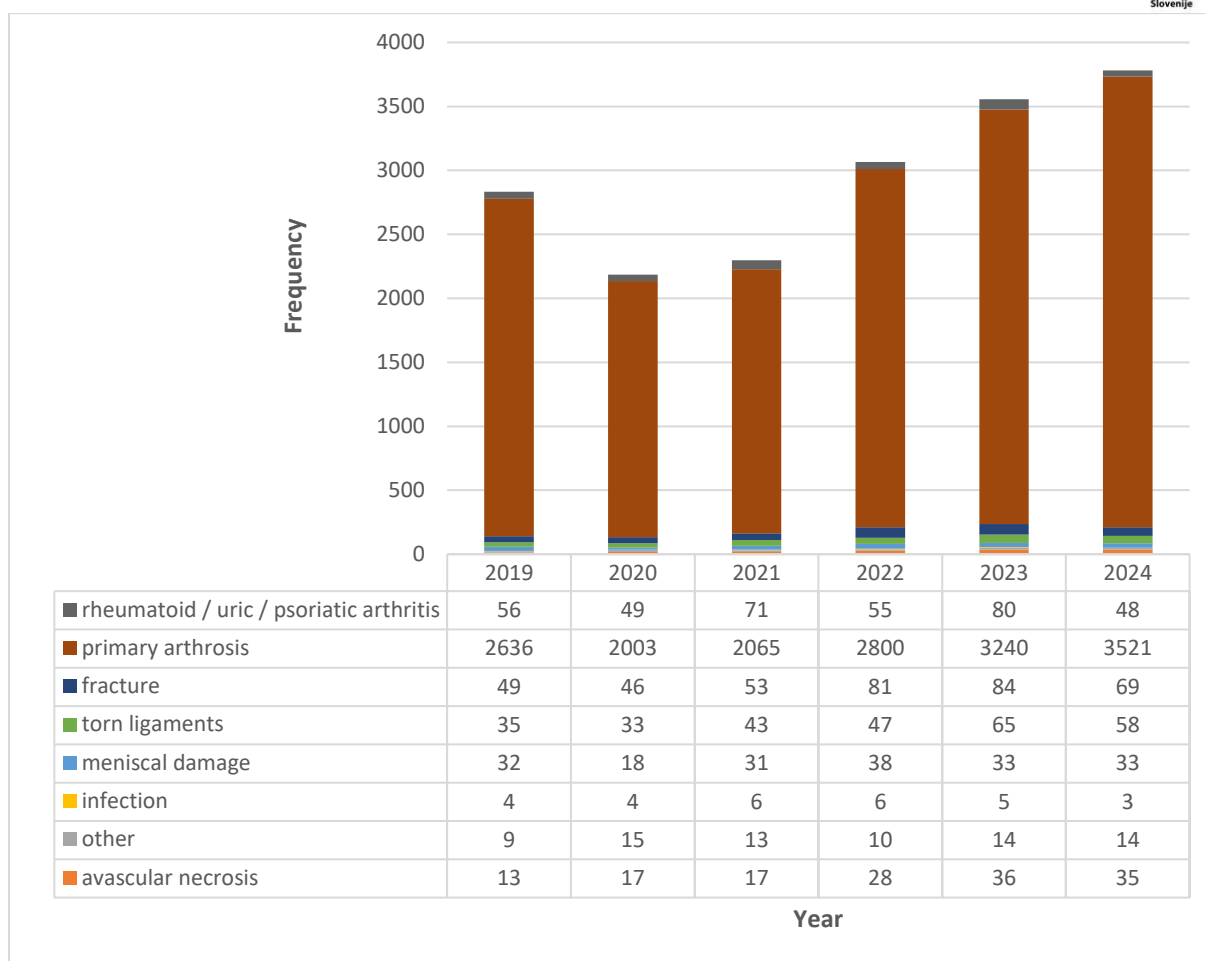


Figure 66: Primary total knee arthroplasties between 2019 and 2024 by diagnosis³⁰ at the time of surgery (Source: RES).

The majority—93.1%—of all primary total knee arthroplasties in 2024 were performed due to primary osteoarthritis (Figure 66). Other diagnoses each accounted for less than 2% of cases. Additional diagnoses reported in individual cases included tibial cyst, epiphyseal dysplasia, hemophilic arthropathy, multipartite patella, status after total meniscectomy, post-traumatic osteoarthritis, spondyloarthritis, status after osteochondral defect, tumor, and valgus deformity following a traffic accident.

The table below presents analyses by diagnosis. Results are not shown for groups with fewer than 30 cases.

³⁰ The RES database does not contain diagnosis data for 1 primary total knee arthroplasty performed in 2021, 3 in 2022, and 1 in 2023.

Table 30: Primary total knee arthroplasties between 2019 and 2024, by surgical diagnosis, by gender, and age of patients (Source: RES).

Diagnosis	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
Avascular necrosis	111	0.8	73.2	25.2	74.8	35	0.9	74.8	26.6	71.4
Primary osteoarthritis	12744	91.4	70.9	36.6	63.4	3521	93.1	71.4	39.3	60.7
Sequelae after infection	25	0.2				3	0.1			
Sequelae of meniscal damage	152	1.1	65.5	67.1	32.9	33	0.9	63.7	75.8	24.2
Sequelae of torn ligaments	223	1.6	60.1	67.3	32.7	58	1.5	59.3	72.4	27.6
Posttraumatic osteoarthritis	313	2.2	68.1	52.7	47.3	69	1.8	70.4	46.4	53.6
Rheumatoid / uric / psoriatic arthritis	311	2.2	66.9	34.7	65.3	48	1.3	69.3	37.5	62.5
Other	61	0.4				14	0.4			

Patients operated on due to ligament ruptures (Me = 59.3 years) were younger in 2024 than patients operated on due to avascular necrosis (Me = 74.8 years), idiopathic osteoarthritis (Me = 71.4 years), and fracture-related conditions (Me = 70.4 years) (Table 30).

More women than men underwent primary knee arthroplasty due to primary (idiopathic) osteoarthritis, avascular necrosis, and inflammatory arthritis, whereas diagnoses related to meniscal injuries and ligament ruptures were more common in men.

Procedures due to fractures were performed in approximately similar proportions among women (53.6%) and men (46.4%).

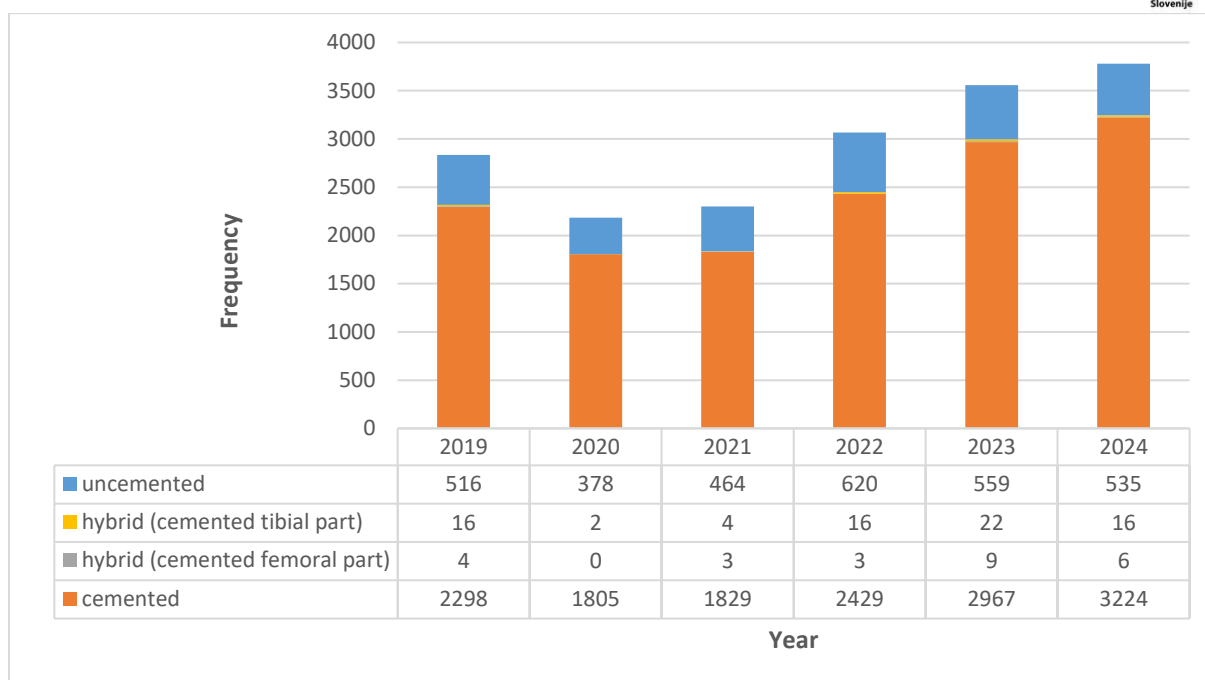


Figure 67: Primary total knee arthroplasty between 2019 and 2024, by prosthesis fixation³¹ (Source: RES).

In 2024, the RES database recorded 85.3% cemented endoprostheses, 14.1% uncemented, 0.4% hybrid with a cemented tibial component, and 0.2% reverse hybrid with a cemented femoral component (Figure 67).

The table below presents the number and proportion of individual fixation types, also by gender, as well as the median age of patients. Data on gender distribution and median age are not shown for groups with fewer than 30 patients.

Table 31: Primary total knee arthroplasty between 2019 and 2024, by prosthesis fixation, and gender and age of patients (Source: RES).

Fixation of the prosthesis	2019 - 2023					2024				
	N	f%	Age (Me)	f _M %	f _Z %	N	f%	Age (Me)	f _M %	f _Z %
cemented	11328	81.2	70.8	36.6	63.4	3224	85.3	71.2	39.7	60.3
hybrid (cemented femoral part)	19	0.1				6	0.2			
Hybrid (cemented tibial part)	60	0.4	70.4	53.3	46.7	16	0.4			
uncemented	2537	18.2	69.5	42.5	57.5	535	14.1	71.0	42.1	57.9

A smaller proportion of men (39.7%) than women (60.3%) received a cemented endoprosthesis in 2024 (Table 36). The median age of patients was very similar for cemented (Me = 71.2 years) and uncemented (Me = 71 years) endoprostheses (Table 31).

³¹ The RES database does not contain information on prosthesis fixation in 1 case in 2023.

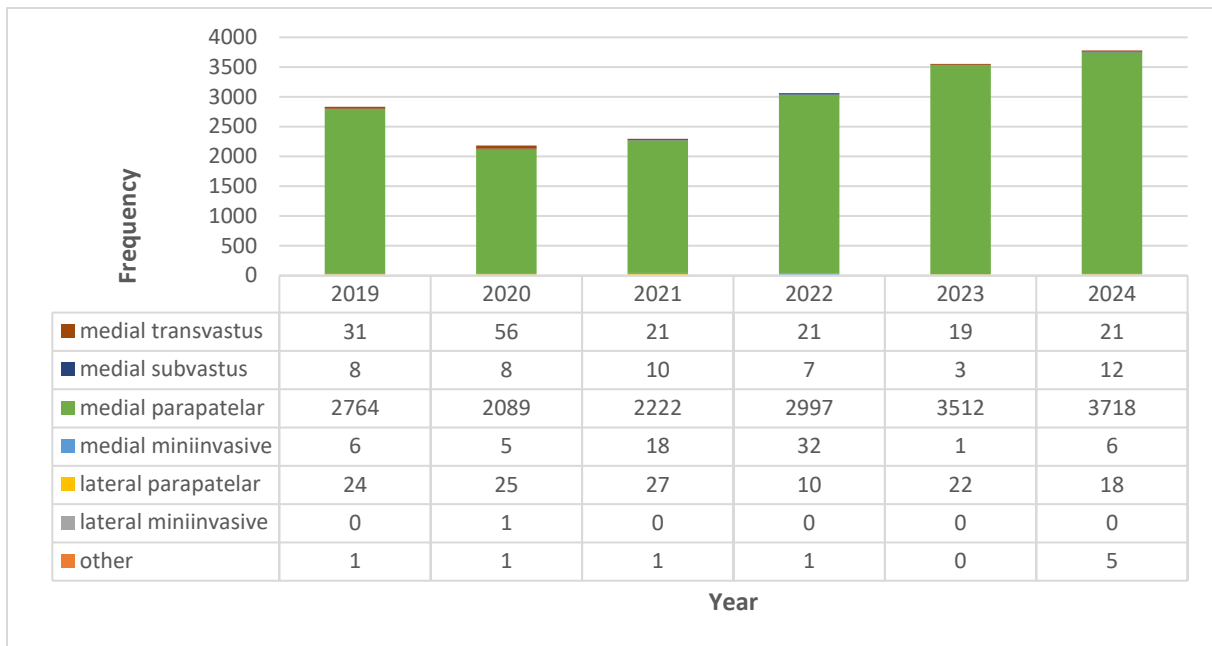


Figure 68: Primary total knee arthroplasties between 2019 and 2023, by surgical approach³² (Source: RES).

In 2024, 98.3% of primary total knee arthroplasties were performed using the medial parapatellar approach. Other surgical approaches were each used in less than 1% of cases (Figure 68).

Table 32: Primary total knee arthroplasty between 2019 and 2024, according to previous surgeries³³ on the operated knee, by gender and age of patients (Source: RES).

	2019 - 2023	2024
Previous surgeries	<i>N</i>	<i>N</i>
Osteosynthesis	236	50
Osteotomy	62	10
Arthrodesis	3	0
Sinovectomy	38	7
Meniscectomy	414	97
Arthroscopy	565	191
Anterior cruciate ligament reconstruction	160	56

In 2024, 191 patients had undergone arthroscopy before primary total knee arthroplasty, 97 had a meniscectomy, 56 had anterior cruciate ligament reconstruction, and 50 had osteosynthesis, while other previous procedures were less frequent (Table 32).

8.1.5 Manufacturers of primary knee endoprostheses

Figure 69 shows the manufacturers of total knee endoprostheses, distributed by providers performing arthroplasty procedures.

³² In the RES database, we do not have data on the surgical approach used in one case in 2021, one case in 2023 and one in 2024.

³³ Individuals may have had multiple prior surgeries.

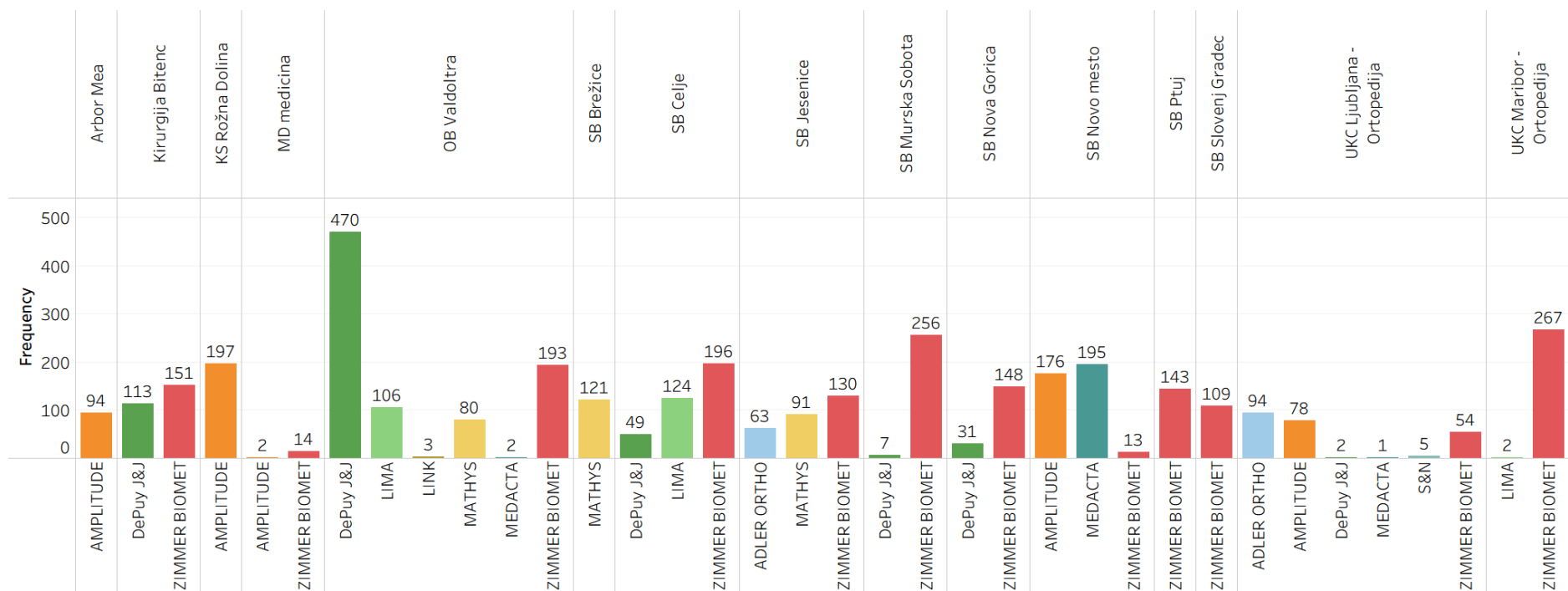


Figure 69: Primary total knee arthroplasty according to the manufacturer of the femoral part of the endoprosthesis, by hospital (Source: RES).

8.1.6 Mortality within 90 days after primary total knee arthroplasty

In addition to the date of the surgical procedure, the RES database also records the date of a patient's death, if applicable. One of the quality indicators is mortality within 90 days after the procedure.

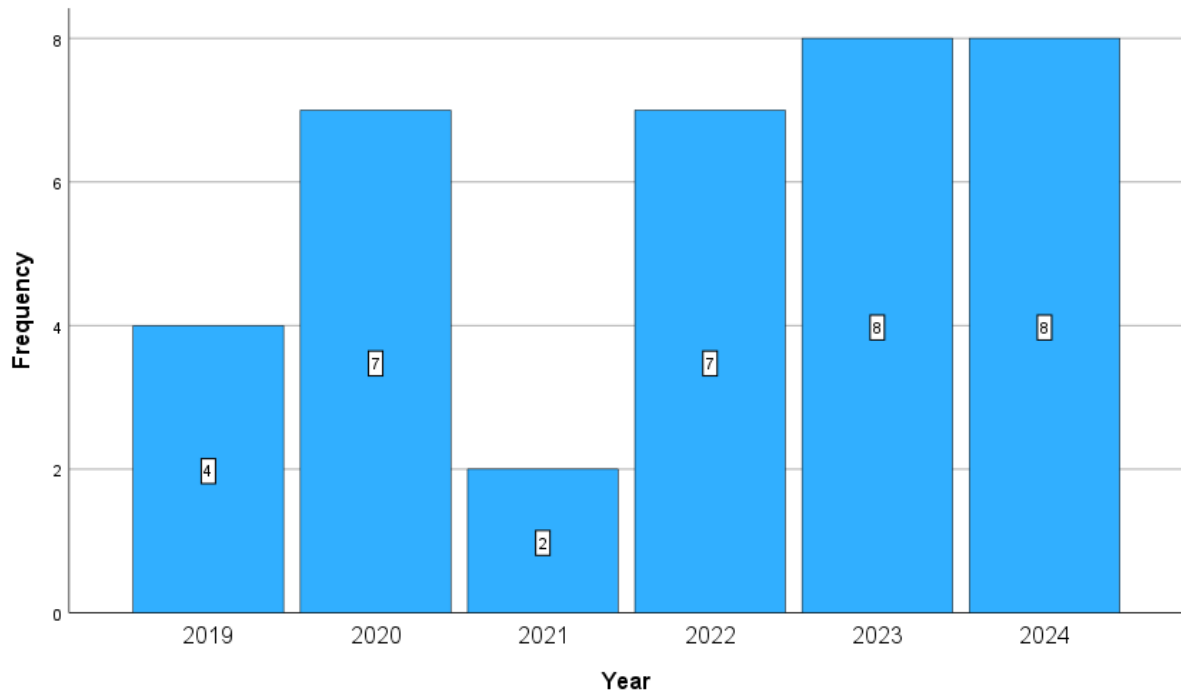


Figure 70: Number of deaths after primary total knee arthroplasty between 2019 and 2024 (source: RES).

From Figure 70, we can see that after primary total knee arthroplasty performed in 2019, there were 4 patient deaths within 90 days of the procedure. In 2020, there were 7 such cases, in 2021 there were 2, in 2022 there were 7, in 2023 there were 8, and in 2024 there were 8.

Mortality was calculated for patients who died within the first 90 days after the surgical procedure:

$$\begin{aligned} & \text{mortality 90 days after primary total hip arthroplasty} \\ &= \frac{\text{number of deaths 90 days after primary total hip arthroplasty}}{\text{number of deaths 90 days after primary total hip arthroplasty}} * 100 \end{aligned}$$

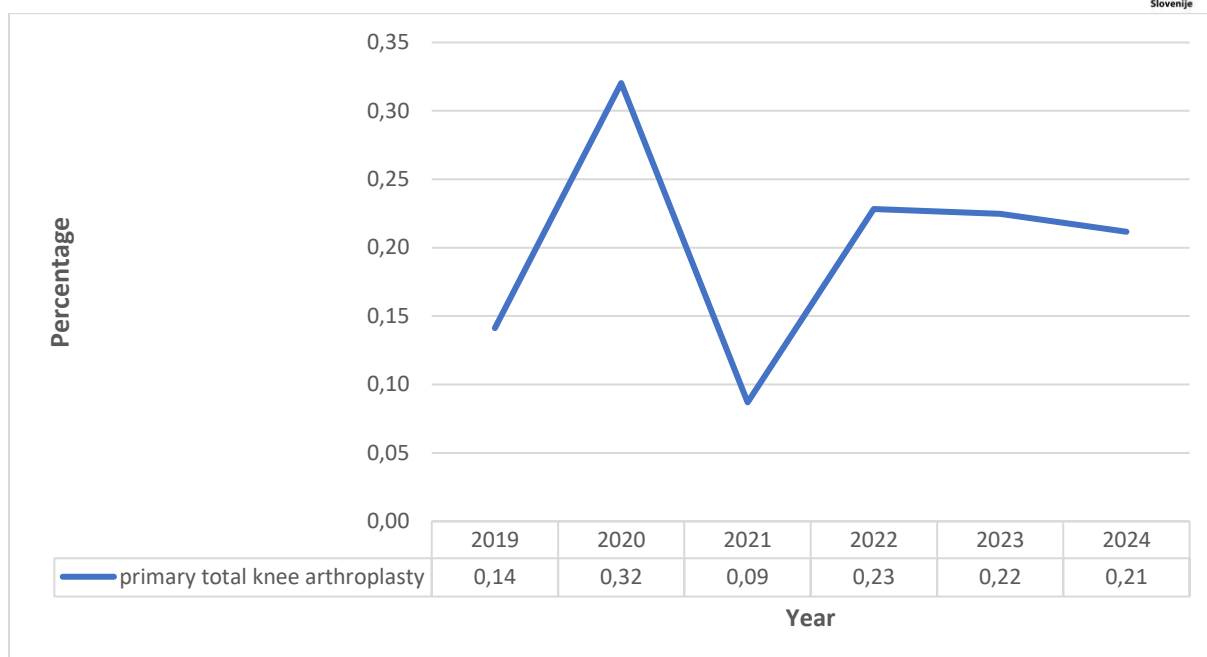


Figure 71: Mortality 90 days after primary total knee arthroplasty (Source: RES).

Mortality within 90 days after primary total knee arthroplasty did not change substantially between 2022 and 2024 (Figure 71). It increased between 2019 (0.14%) and 2020 (0.32%), then decreased to 0.09% in 2021, and subsequently rose again to above 0.20% in the years 2022 to 2024.

8.1.7 Patient-reported health status and quality of life – PROMs questionnaires before and after primary total knee arthroplasty for idiopathic osteoarthritis

Patients completed questionnaires before primary total knee arthroplasty in 2024 and again 6 months after the procedure. Only fully completed questionnaires were included in the analysis. For the 12-month follow-up, insufficient time has elapsed for all patients.

The analysis included only patients diagnosed with idiopathic osteoarthritis. We analyzed the database with data available up to September 15, 2025. Of the 3,781 primary total knee arthroplasties performed between January 1, 2024 and December 31, 2024, 3,520 (93.1%) were procedures for primary osteoarthritis.

OKS QUESTIONNAIRE

The OKS (Oxford Knee Score) questionnaire³⁴ is used to assess functional impairment in patients with knee disorders. It consists of 12 questions measured on a 5-point scale, where 0 indicates no problems and 4 indicates severe problems. In accordance with the OECD methodology (OECD, 2019), the OKS value is calculated as the sum of responses to the 12 questions for each patient. The score ranges from 0 (complete dysfunction of the operated knee and unbearable pain) to 48 (full function of the operated knee and no pain).

³⁴ The Slovenian version of the OKS questionnaire is available on the RES website.

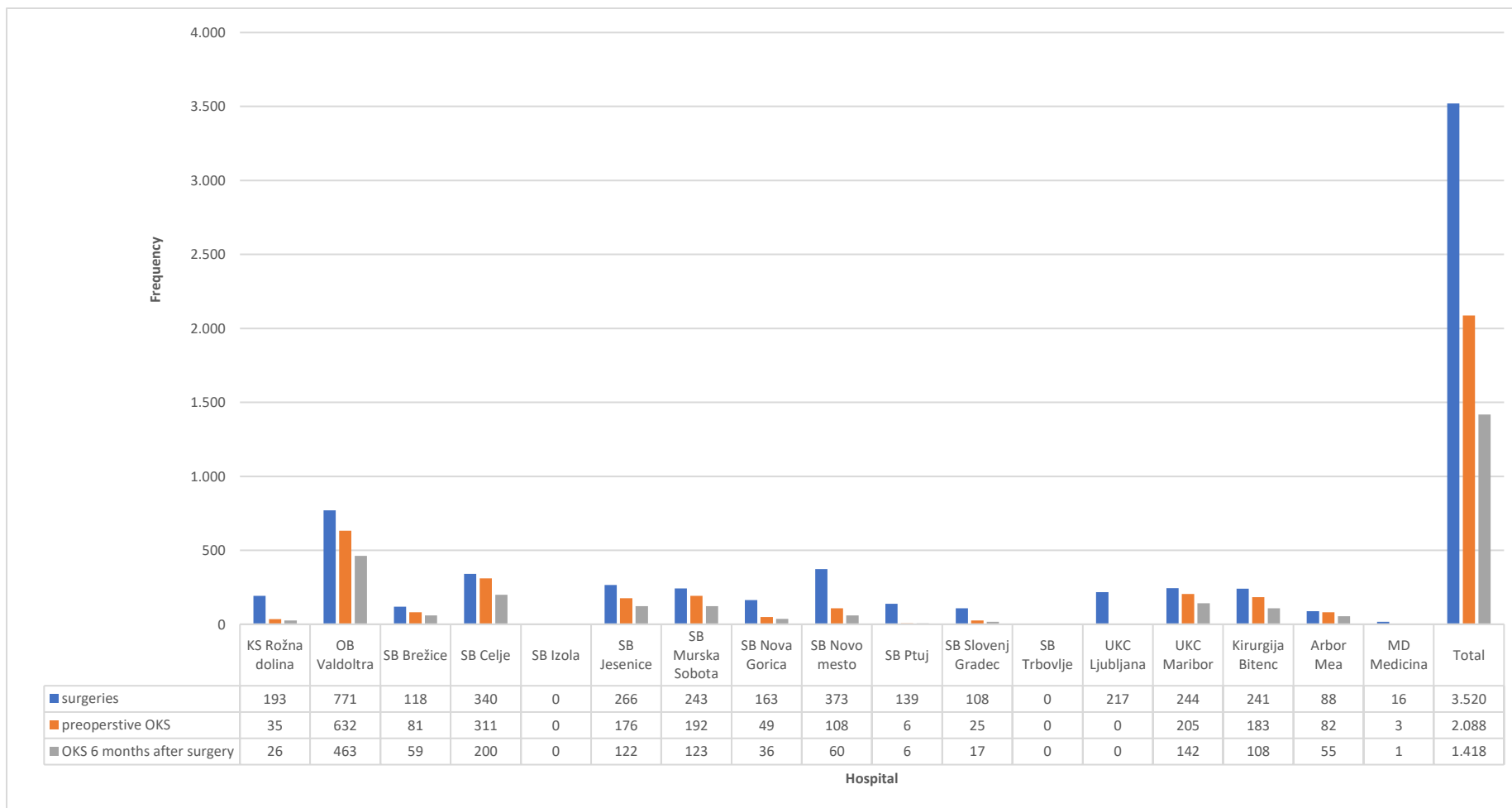


Figure 72: Number of PROMs (OKS) obtained in primary total knee arthroplasties with diagnosis OA, by healthcare provider, for 2024 (Source: RES).

In the preoperative period (see Figure 72), 2,088 questionnaires (59.3%) were completed, while 6 months after the procedure, 1,418 questionnaires (40.3%) were completed among all patients operated on for osteoarthritis.

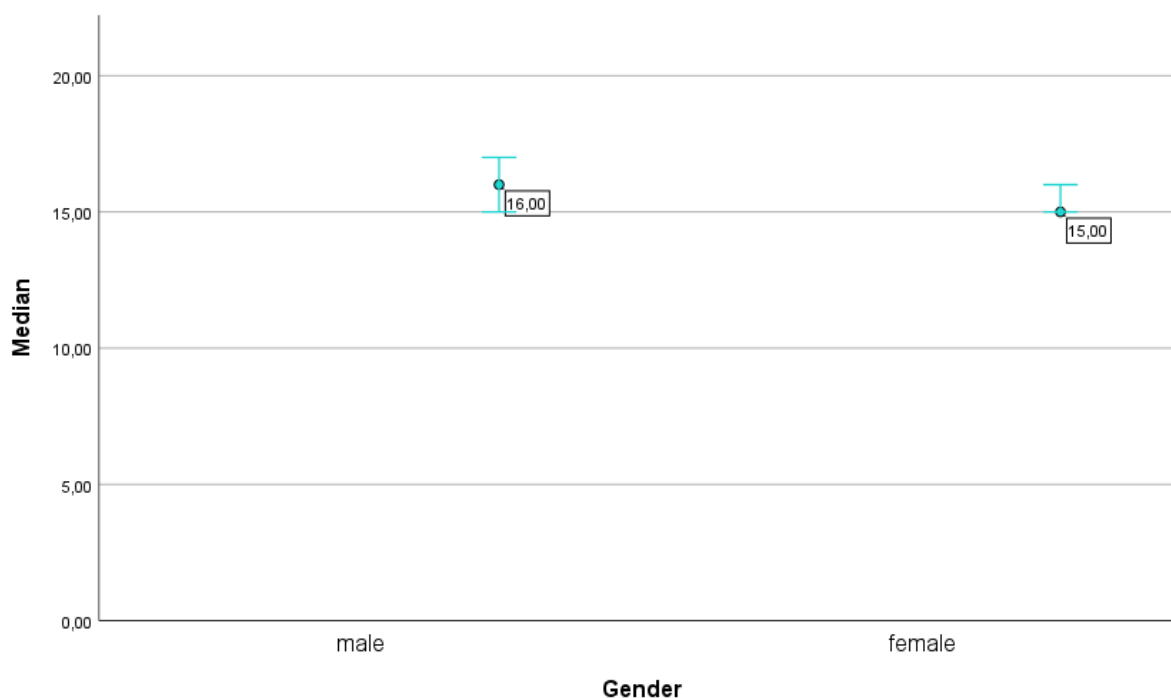


Figure 73: Median with 95% confidence interval for the difference between the OKS score 6 months after surgery and before surgery, according to patient gender (Source: RES).

For both men (16 points) and women (15 points), the median difference in OKS before and 6 months after surgery is very similar (Figure 73).

Respondents were divided into four age groups: under 55 years, 55–64 years, 65–74 years, and over 74 years. The difference between the preoperative and the 6-month postoperative OKS results is presented.

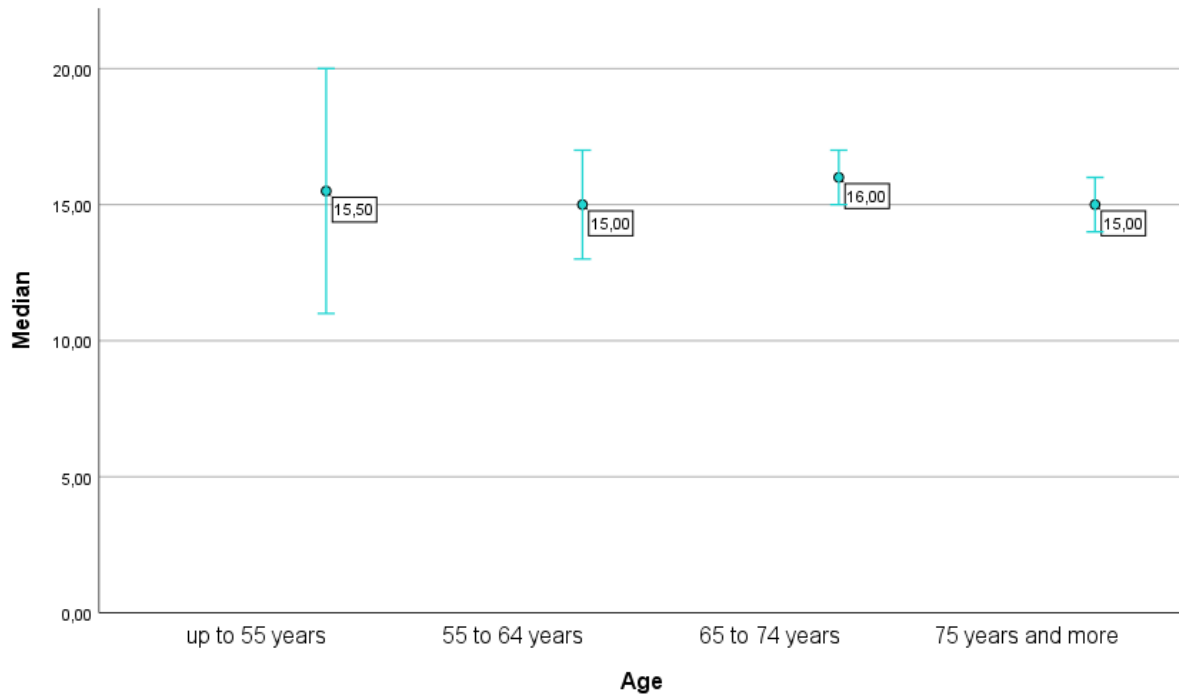


Figure 74: Median with 95% confidence interval for the difference between the OKS score before and 6 months after surgery, by the age of the patients (Source: RES).

The median differences in OKS before and 6 months after surgery, stratified by age groups, do not show statistically significant differences and range between 15 and 16 points (Figure 74).

EQ-5D-5L QUESTIONNAIRE

We also analyzed the results of the EQ-5D-5L³⁵, which is used to assess patients' general health status. For weighting the responses, we applied weights developed for the Slovenian population by the Institute of Economic Research (Prevolnik Rupel & Ogorevc, 2020). A lower value indicates a poorer health status, while a higher value indicates a better assessment of general health. The median differences between the results 6 months after surgery and the preoperative results are presented.

³⁵ The Slovenian version of the EQ-5D-5L questionnaire is available on the RES website.

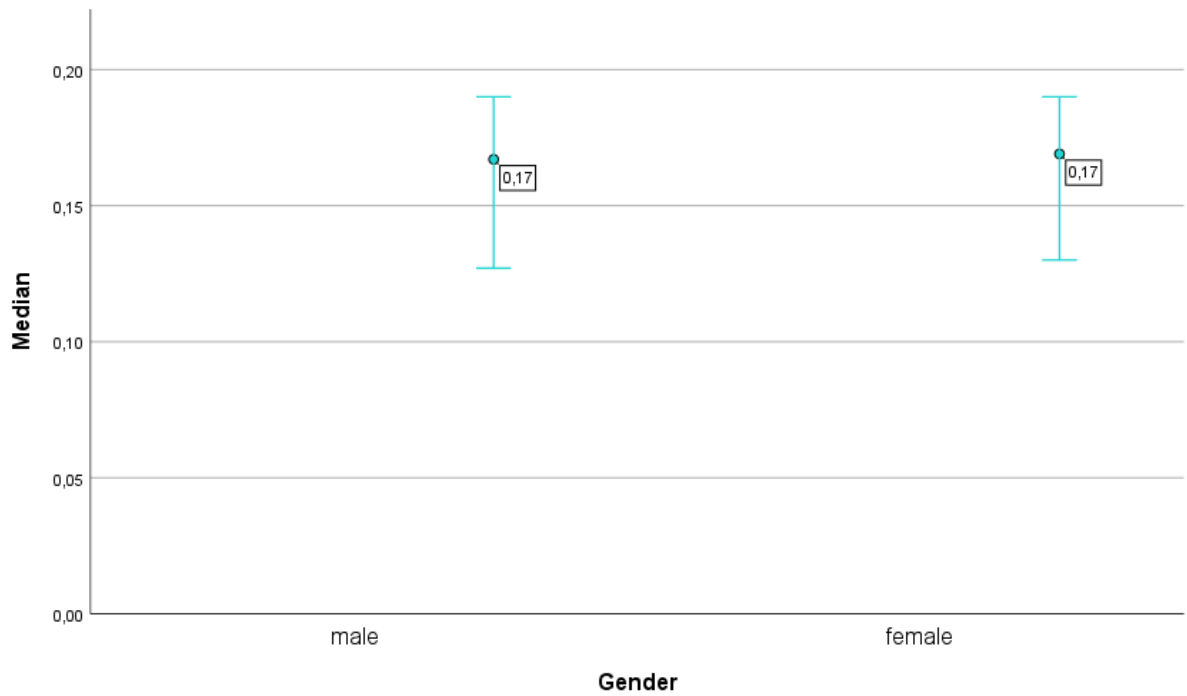


Figure 75: EQ-5D-5L score with 95% confidence interval in median of the difference by gender (Source: RES).

There were no statistically significant differences in the median change between genders for the EQ-5D-5L questionnaire (Figure 75). The median change was 0.17 points for both women and men.

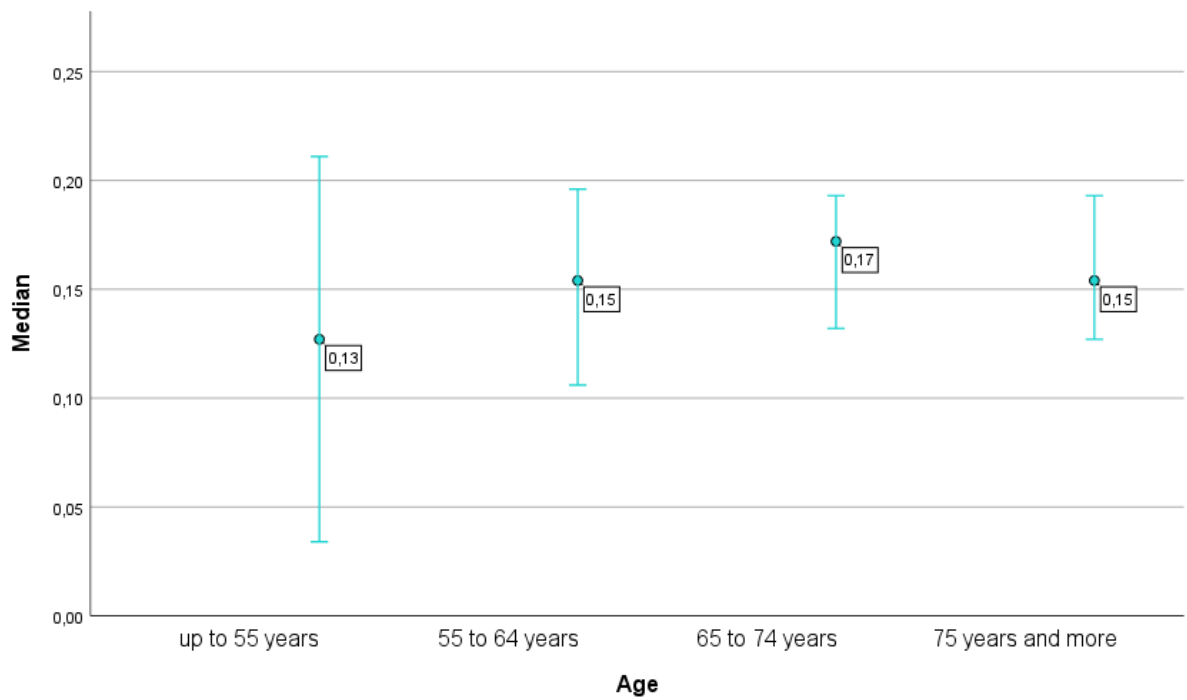


Figure 76: EQ-5D-5L score with 95% confidence interval in median of the difference by age at surgery (Source: RES).

Similarly, there were no statistically significant differences in the median changes between preoperative and 6-month postoperative EQ-5D-5L results across age groups (Figure 76).

VISUAL ANALOGUE SCALE (VAS)

The VAS questionnaire³⁶ is part of the EQ-5D-5L and assesses health status on the day of the survey. A score of 0 represents the worst possible health state, while 100 represents the best possible health state. We calculated the difference between the preoperative result and the result 6 months after surgery.

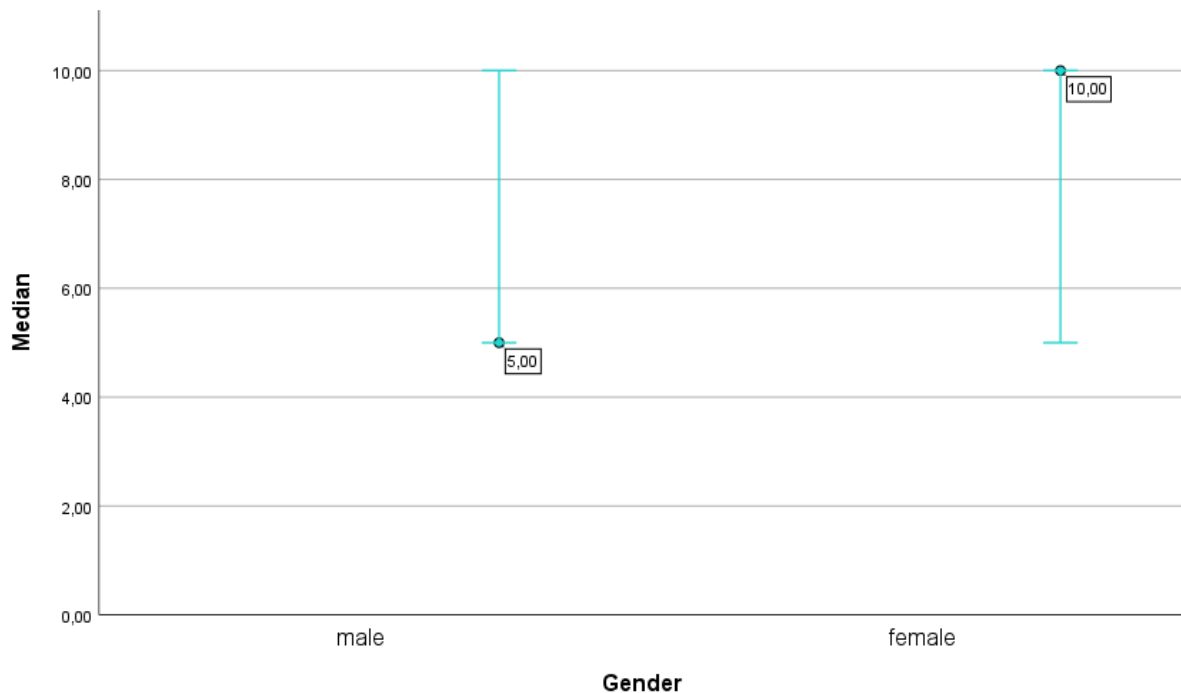


Figure 77: The improvement of health assessment on the day of completing the survey, 6 months after the surgery, with a 95% confidence interval for the median by gender (Source: RES).

We examined differences by gender using 95% confidence intervals for the median. The median change in VAS was 5 points in men and 10 points in women (Figure 77).

³⁶ The VAS questionnaire is part of the EQ-5D-5L questionnaire, which is available on the RES website.

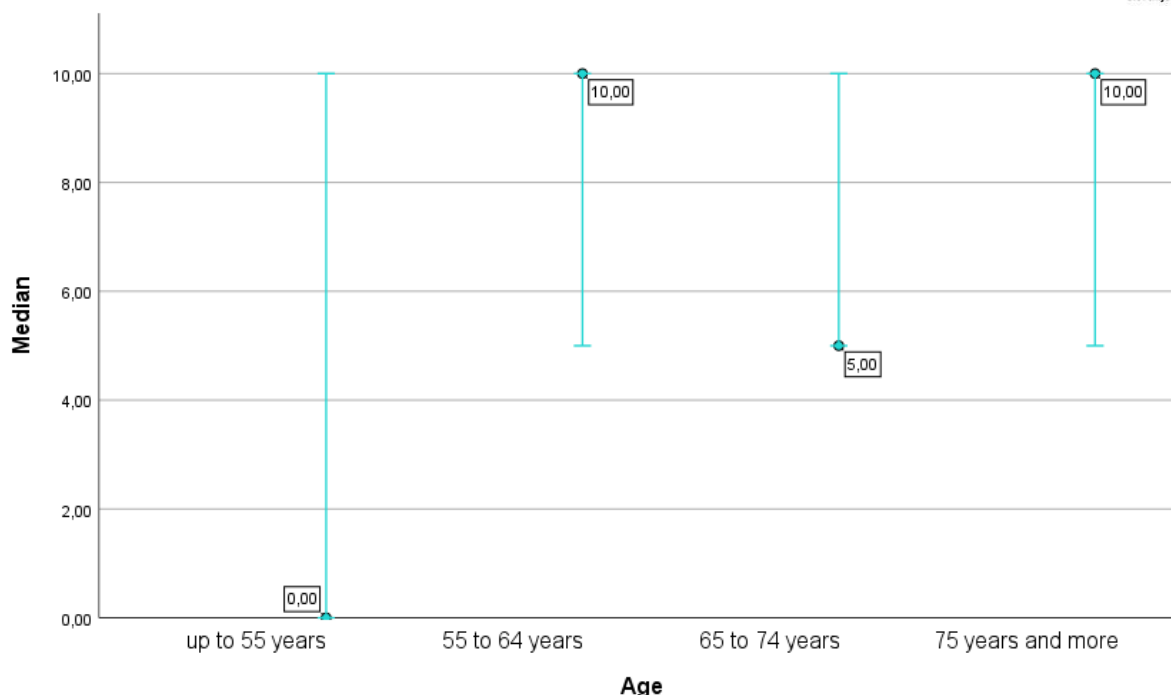


Figure 78: The improvement of the median, 95% confidence interval, of health assessment, 6 months after the surgery, by age at surgery (Source: RES).

There were no statistically significant differences between age groups in the median change of VAS scores 6 months after surgery compared to preoperative values (Figure 78).

8.2 Primary partial knee arthroplasties – data up to December 31, 2024

In the period from January 1, 2019 to December 31, 2024, we received a total of 2,846 forms on primary partial knee arthroplasties. For 2024, the RES database recorded data on 677 primary partial knee arthroplasties.

We analyzed differences with respect to patient characteristics, providers, and features of the surgical procedure. Differences were also examined by patient gender, age at the time of surgery, and the provider performing the procedure. In the final section, we present data on function and pain, as well as general health, before and after primary partial knee arthroplasty.

8.2.1 Compliance of the collected data

Table 34 shows the compliance (the ratio between completed forms in the RES database and the recorded number of primary partial knee arthroplasties reported by the Health Insurance Institute of Slovenia) for each year, according to providers performing knee arthroplasty procedures in the Republic of Slovenia. Discrepancies arise due to the reporting of cases not recorded by the Health Insurance Institute (self-paying patients, foreign patients, and cases covered through conventions).

Table 33: Reporting compliance data for primary partial knee arthroplasties between 2019 and 2024 in the Republic of Slovenia, by surgical provider (Source: RES and ZZZS).

Compliance	2019	2020	2021	2022	2023	2024
KS Rožna dolina	NP	NP	NP	NP	50.00	100.00
OB Valdoltra	118.24	116.78	119.69	138.27	109.57	111.41
SB Brežice	NP	NP	NP	NP	120.00	120.00
SB Celje	NP	NP	100.00	125.00	100.00	100.00
SB Izola	NP	NP	NP	NP	NP	NP
SB Jesenice	NP	NP	NP	NP	126.67	122.22
SB Murska Sobota	100.00	NP	NP	100.00	100.00	100.00
SB Nova Gorica	100.00	100.00	NP	150.00	100.00	133.33
SB Novo mesto	97.32	95.38	100.00	117.22	111.38	111.17
SB Ptuj	100.00	200.00	150.00	88.89	92.86	106.25
SB Slovenj Gradec	NP	NP	NP	100.00	NP	NP
SB Trbovlje	NP	NP	NP	NP	NP	NP
UKC Ljubljana	103.13	97.30	127.27	174.19	123.08	152.94
UKC Maribor	88.89	81.82	66.67	107.14	108.33	100.00
Kirurgija Bitenc	NP	NP	NP	NP	NP	NP
Arbor Mea	NP	NP	NP	NP	NP	NP
MD Medicina	NP	NP	NP	NP	NP	NP
Total	112.62	110.23	113.26	136.17	114.12	122.42

In 2024, the Health Insurance Institute of Slovenia recorded 553 primary partial knee arthroplasties, while 677 such procedures were recorded in the RES database (122.4%). Primary partial knee arthroplasties are not performed at SB Izola and SB Trbovlje. Arbor Mea does not report partial and total knee arthroplasties separately to the Health Insurance Institute, which is why it is not included in the table above.

The number of primary partial knee arthroplasties recorded in the RES database for 2024 is slightly higher than in the Health Insurance Institute database, due to the reporting of self-paying procedures and procedures covered through conventions.

The total number of records in the two databases differs only minimally, allowing us to conclude that the RES database has effectively reached a census of data on primary partial knee arthroplasties performed in 2024. This enables the formulation of conclusions for all such procedures performed on Slovenian patients in 2024.

8.2.2 Gender and age of patients undergoing primary partial knee arthroplasty

This section presents the demographic characteristics of patients: their gender (Figure 79) and age at the time of surgery (Figure 80). Table 35 shows the median age of patients by gender and by individual year.

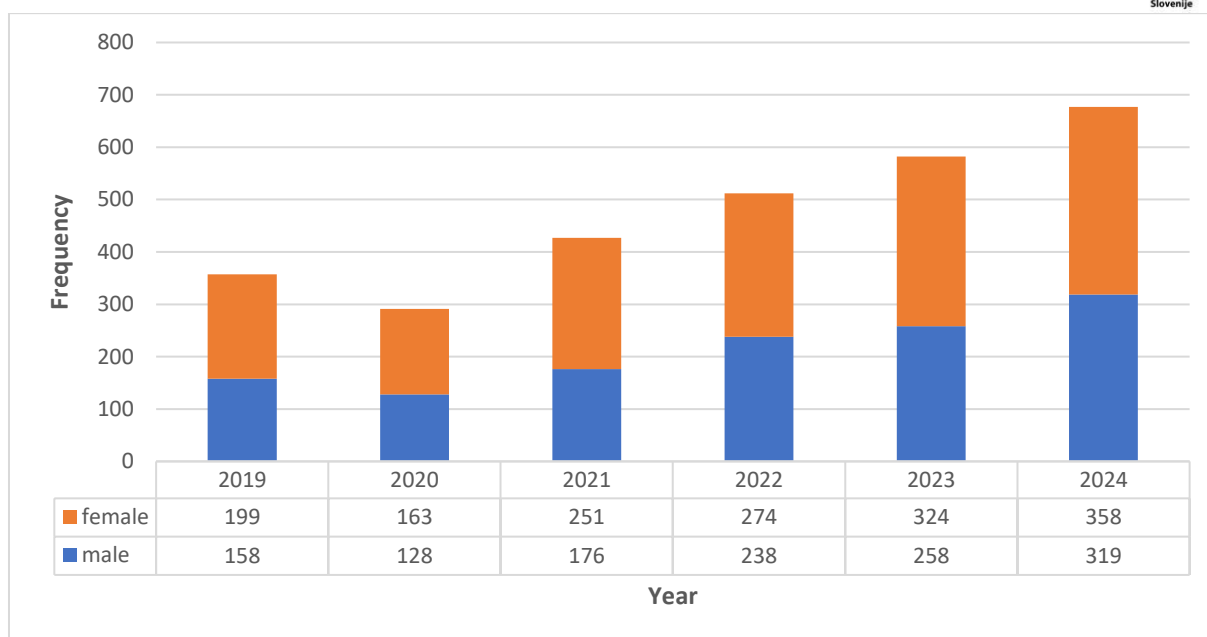


Figure 79: Primary partial knee arthroplasty between 2019 and 2024, by patient gender (Source: RES).

In 2024, a total of 358 (52.9%) primary partial knee arthroplasties were performed in women and 319 (47.1%) in men (Figure 79).

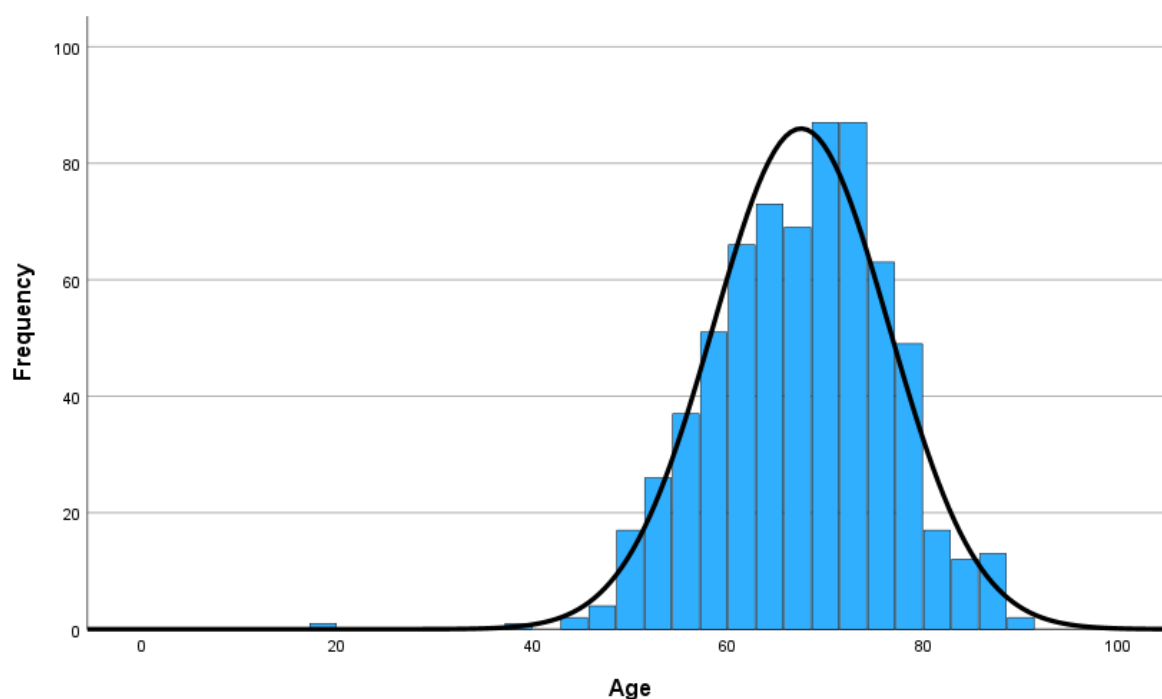


Figure 80: Primary partial knee arthroplasty in 2024, by patient age at surgery (Source: RES).

In 2024, the median age of patients undergoing primary partial knee arthroplasty was 68.4 years. The youngest patient was 19.1 years old, and the oldest was 89.3 years old (Figure 80).

Table 34: Age of patients at primary partial knee arthroplasty between 2019 and 2024, by gender (Source: RES).

Age at surgery			Year					
			2019	2020	2021	2022	2023	2024
Gender	male	Median	66.6	65.3	67.9	66.4	67.3	67,9
	female	Median	67.6	69.0	68.9	68.6	69.0	69,2
Total		Median	67,1	67.5	68.4	67.6	68.5	68.4

In 2024, the median age for primary partial knee arthroplasty was slightly higher in women (69.2 years) than in men (67.9 years) (Table 34).

8.2.3 Region of residence of patients with implanted primary partial knee endoprostheses

For each provider, Figure 81 shows the proportion of primary partial knee arthroplasties in 2024 performed on patients who do not have permanent residence in the region where the provider is registered.

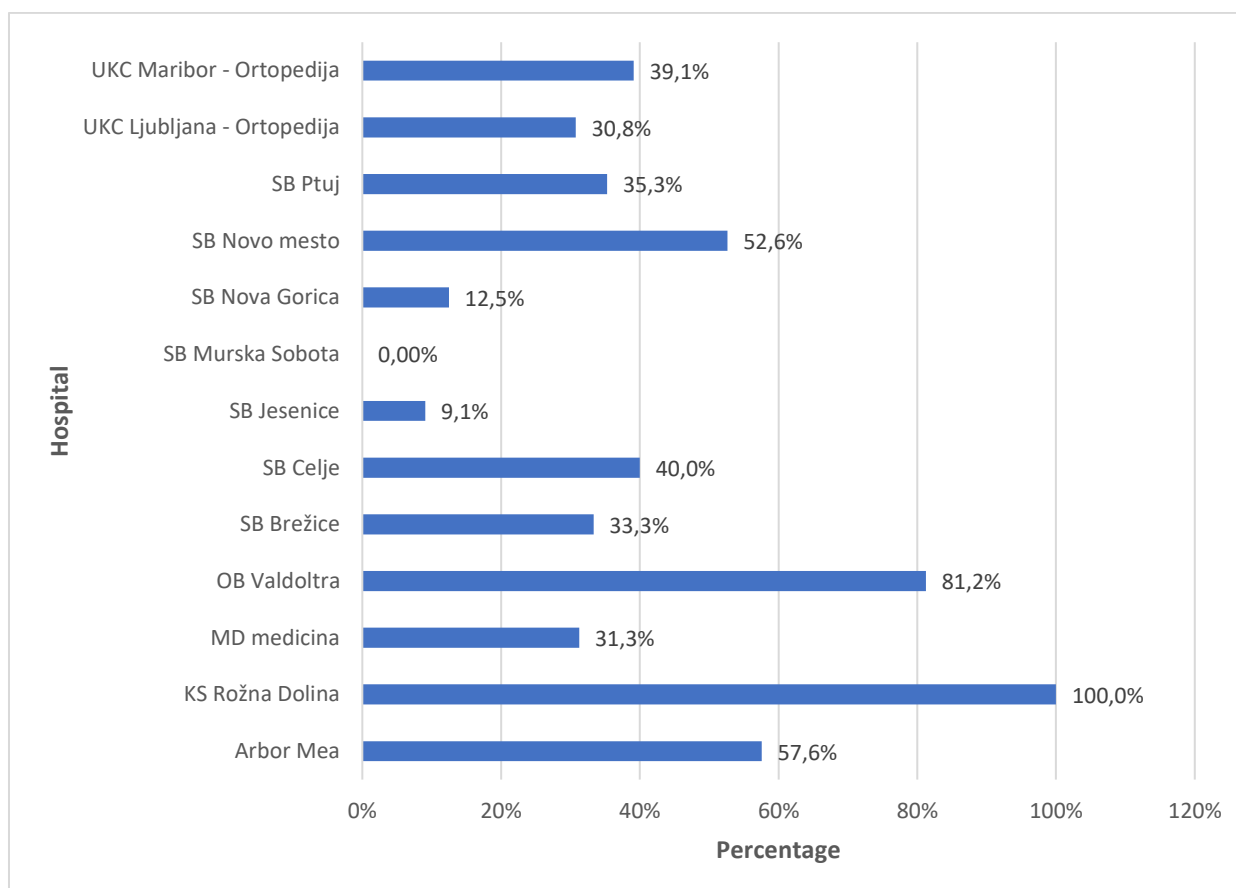


Figure 81: Age of patients at primary partial knee arthroplasty between 2019 and 2024, by gender (Source: RES).

In 2024, KS Rožna Dolina (100%) and OB Valdoltra (81.2%) were the providers performing the highest proportion of procedures on patients from regions other than where the provider is based. According to RES data, more than half of such procedures on patients from outside the provider's region were also performed at Arbor Mea (57.6%) and SB Novo Mesto (52.6%).

8.2.4 Characteristics of the surgical procedure in primary partial knee arthroplasty

The following section presents the provider performing the procedure (Figure 82), the side of the operation (Figure 83), the preoperative diagnosis (Figure 84), prosthesis fixation (Figure 85), and the surgical approach used (Figure 86).

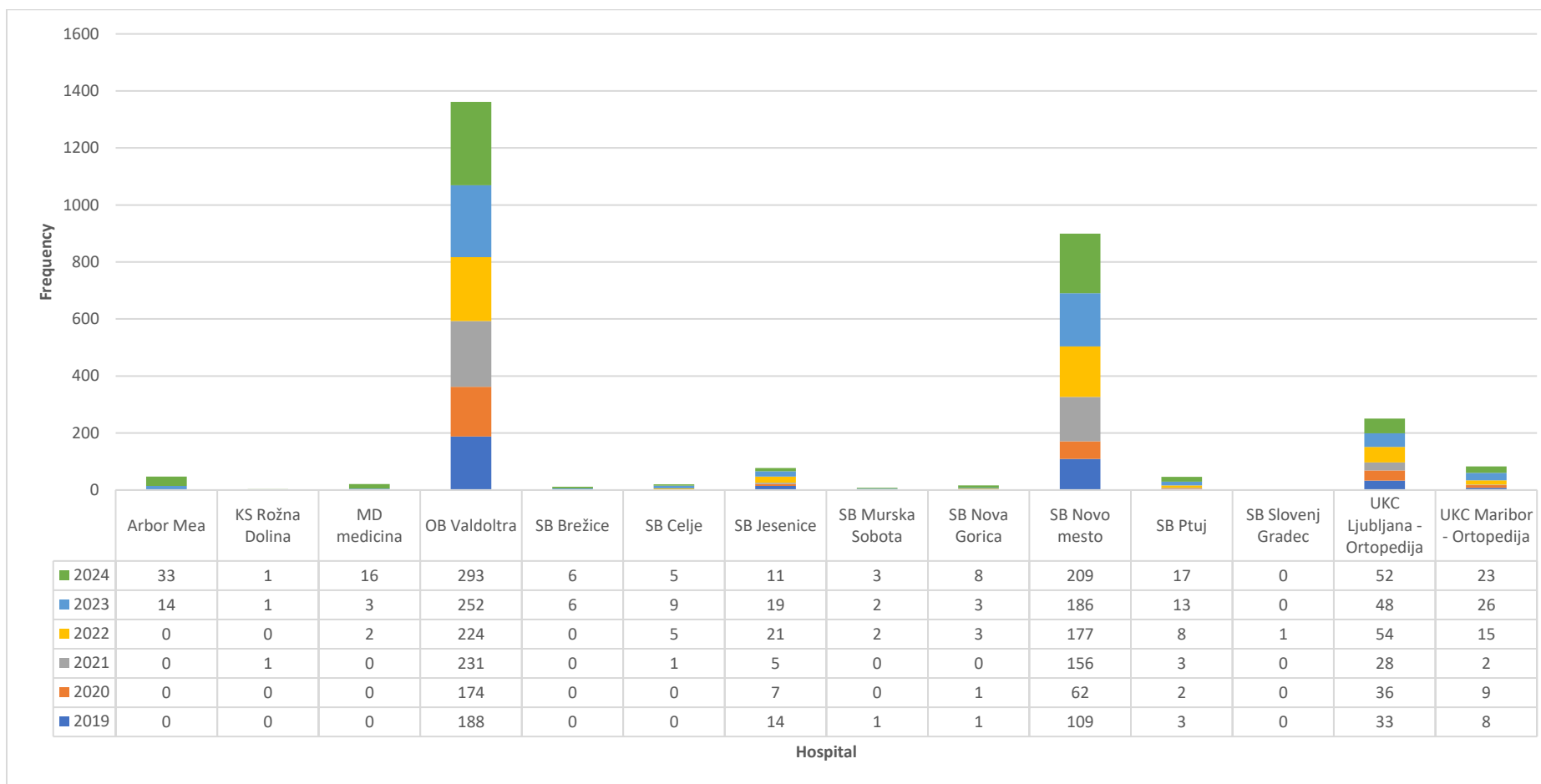


Figure 82: Primary partial knee arthroplasty between 2019 and 2024, by provider (Source: RES).

In 2024, the highest number of primary partial knee arthroplasties in the Republic of Slovenia (Figure 82) was performed at OB Valdoltra (43.3%). This was followed by SB Novo Mesto (30.9%) and the Orthopaedic Clinic of UKC Ljubljana (7.7%). Other providers each performed fewer than 50 primary partial knee arthroplasties in 2024.

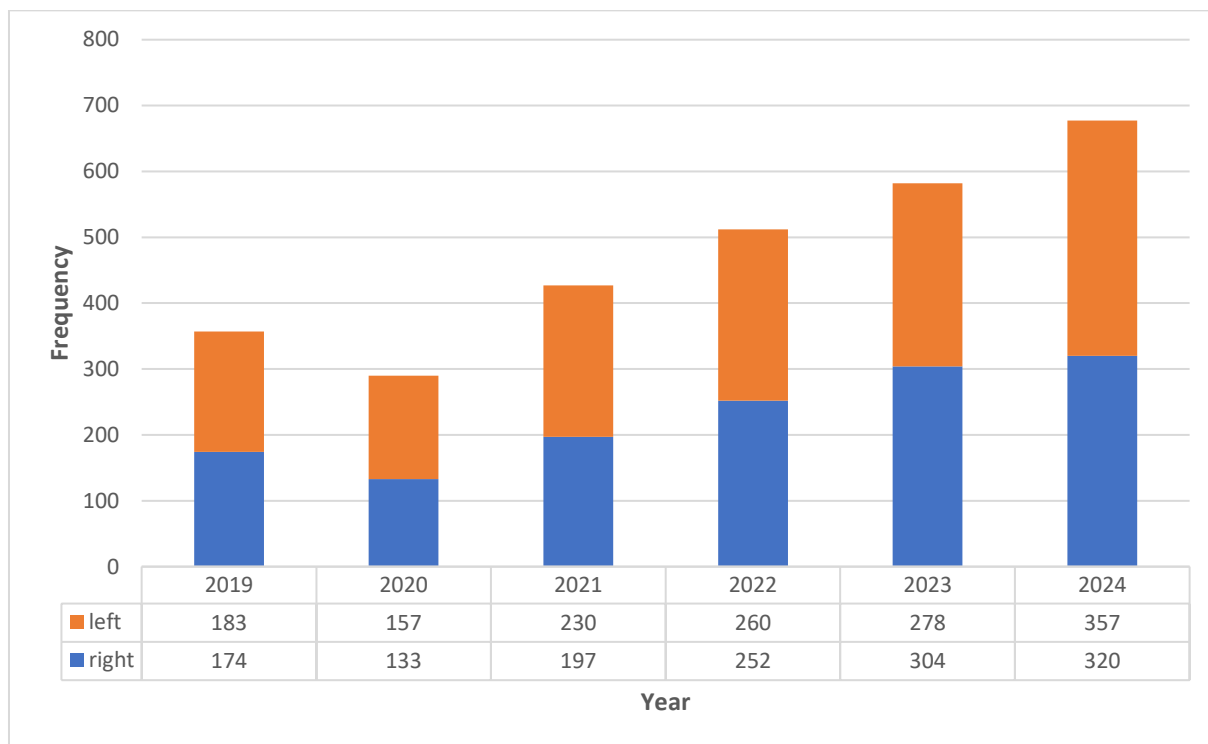


Figure 83: Primary partial knee arthroplasty between 2019 and 2024, by surgical side³⁷ (Source: RES).

In 2024 (Figure 83), 320 procedures (47.3%) were performed on the right knee and 357 (52.7%) on the left knee.

³⁷ In 2020, the RES database does not contain information on the surgical side for 1 procedure.

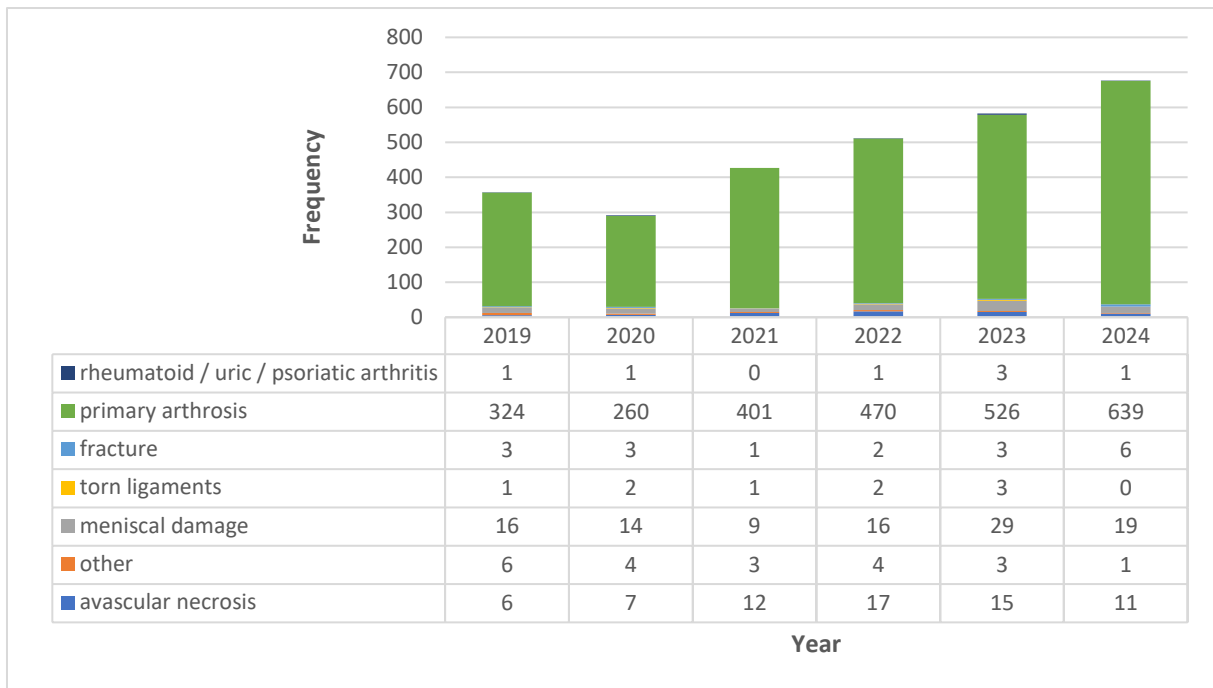


Figure 84: Primary partial knee arthroplasties between 2019 and 2024 by diagnosis at the time of surgery (Source: RES).

The majority—94.9%—of all primary partial knee arthroplasties in 2024 were performed due to primary osteoarthritis. Other diagnoses each accounted for less than 3% of cases. In one case, another diagnosis was reported—failed chondrocyte transplantation (Figure 84).

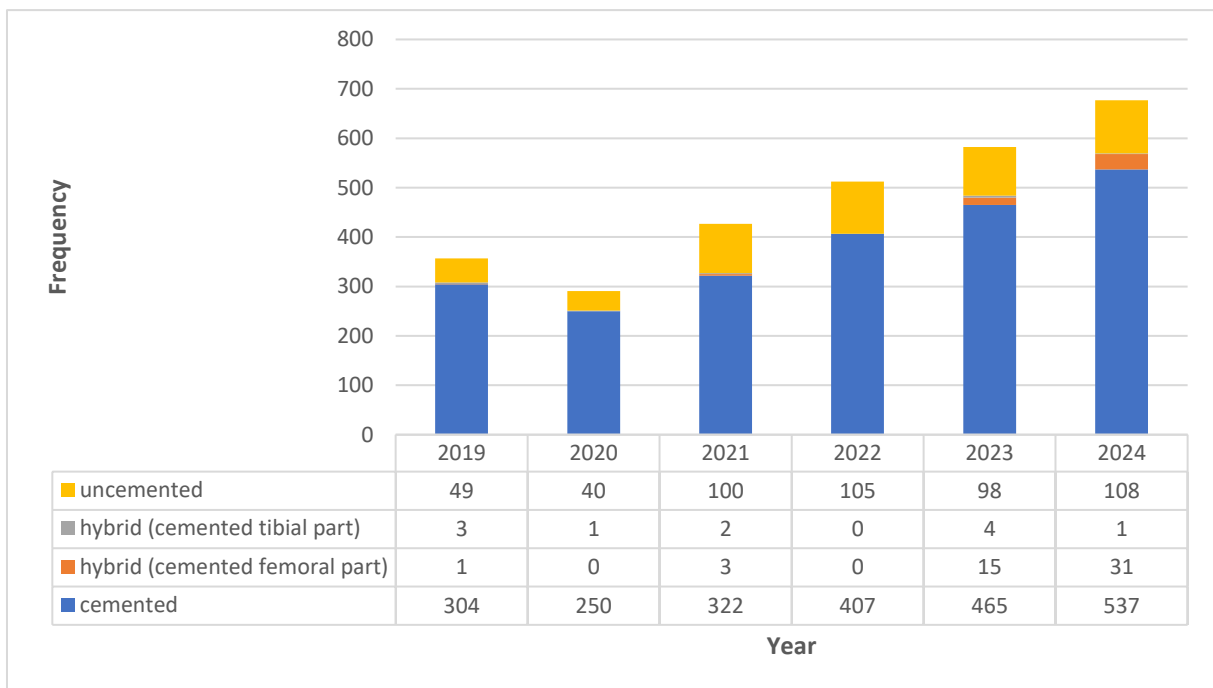


Figure 85: Primary total knee arthroplasty between 2019 and 2024, by prosthesis fixation (Source: RES).

In 2024, 80.6% of endoprotheses were cemented, 18.1% were uncemented, 0.9% were hybrid with a cemented femoral component, and 0.5% were hybrid with a cemented tibial component (Figure 85).

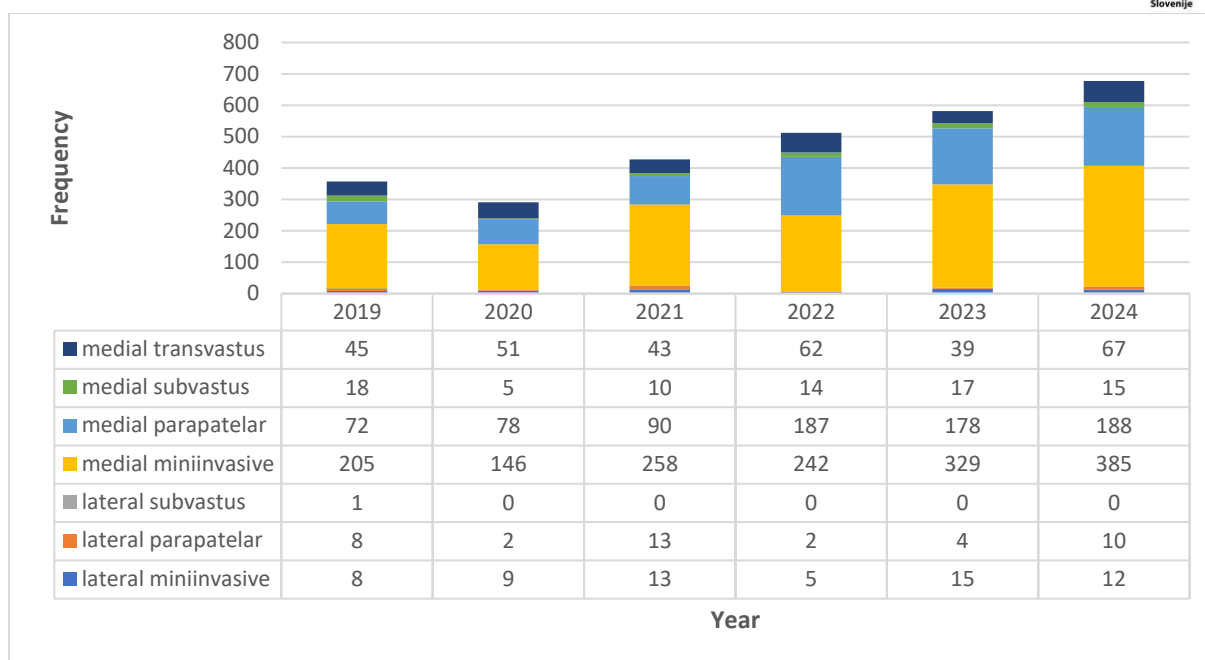


Figure 86: Primary partial knee arthroplasties between 2019 and 2023, by surgical approach (Source: RES).

In 2024, 56.9% of primary partial knee arthroplasties were performed using a medial minimally invasive approach, 27.8% using a medial parapatellar approach, and 9.9% using a medial transvastus approach. Other surgical approaches were each used in less than 2.5% of cases (Figure 86).

8.2.5 Manufacturers of primary partial knee endoprostheses

Figure 87 shows the manufacturers of primary partial knee endoprostheses by provider.

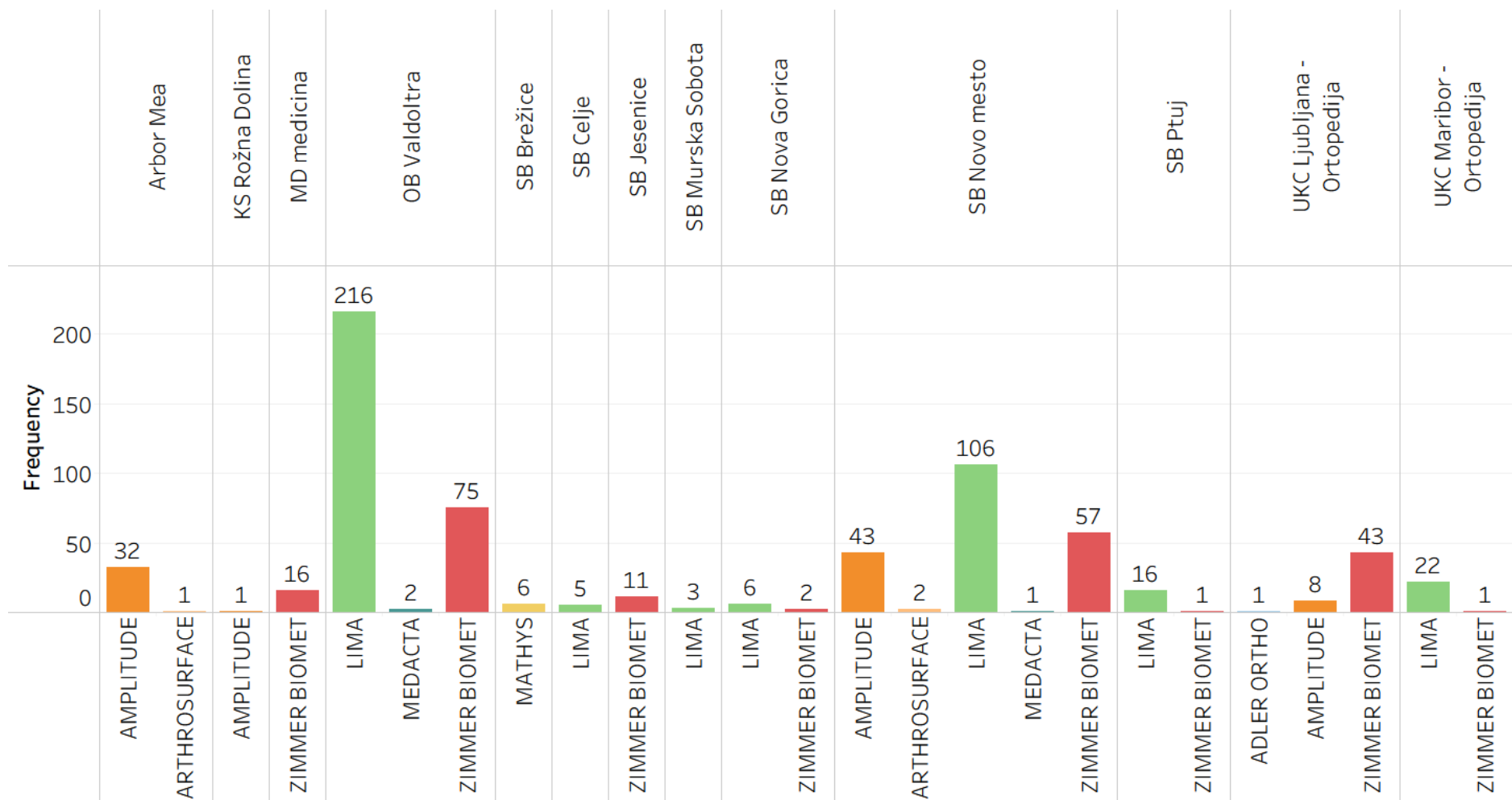


Figure 87: Primary partial knee arthroplasty according to the manufacturer of the femoral part of the endoprosthesis, by healthcare provider (Source: RES).

8.2.6 Patient-reported health status and quality of life – PROMs questionnaires before and after primary partial knee arthroplasty for idiopathic osteoarthritis

Patients completed questionnaires before the primary procedure, and again 6 months and 12 months after it.

The analysis included only patients diagnosed with idiopathic osteoarthritis. We analyzed the database with data available up to September 15, 2025. Of the 677 primary partial knee arthroplasties performed between January 1, 2024, and December 31, 2024, 519 (76.7%) were procedures for primary osteoarthritis.

OKS QUESTIONNAIRE

The OKS questionnaire items and methodology have already been described in the section on total knee endoprostheses.

In the preoperative period (see Figure 88), 255 questionnaires (49.1%) were completed, and in the period 6 months after surgery, 196 questionnaires were completed (37.8% of all patients operated on for primary osteoarthritis).

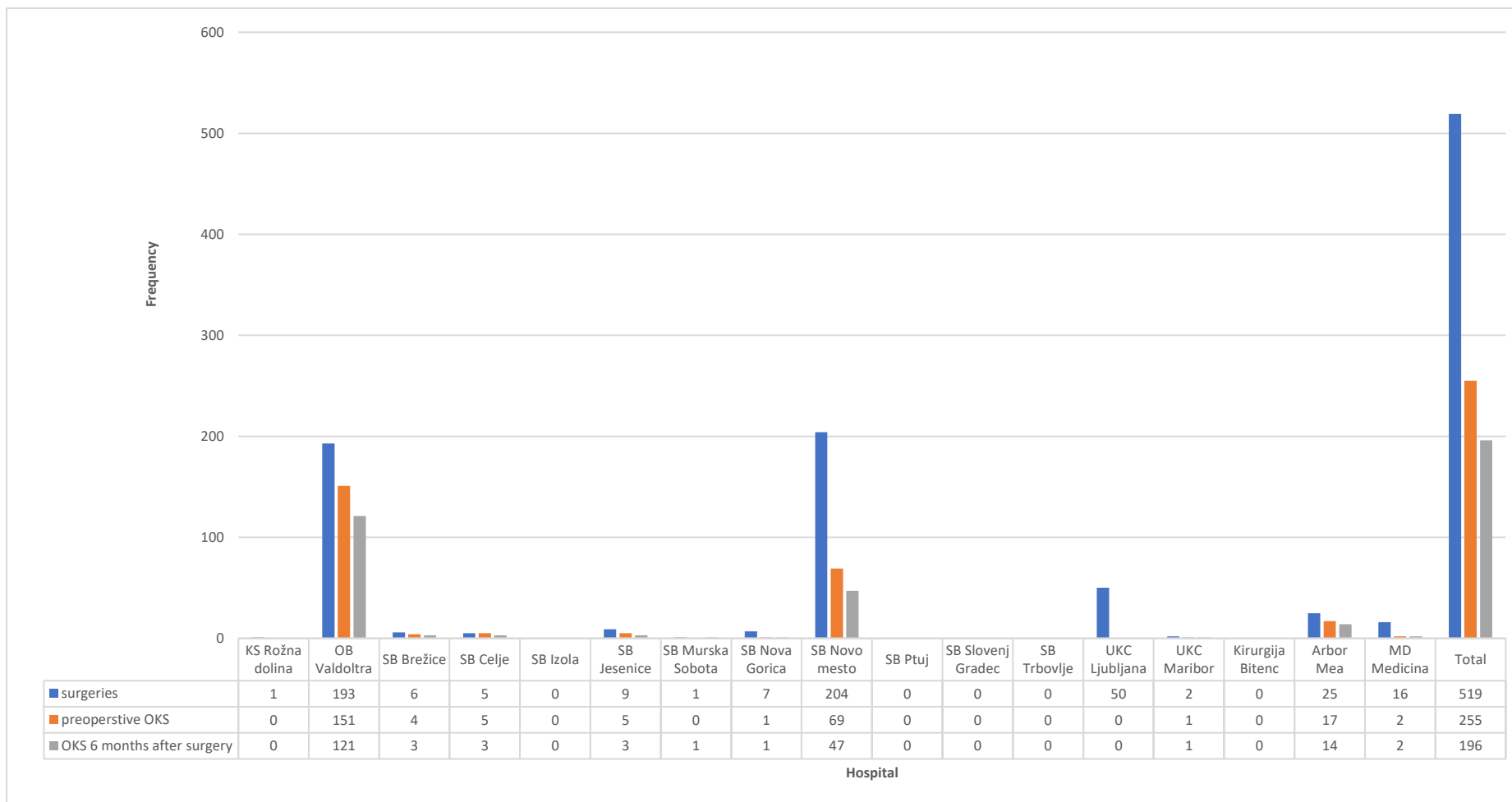


Figure 88: Number of PROMs (OKS) obtained in primary partial knee arthroplasties with diagnosis OA, by healthcare provider, for 2024 (Source: RES).

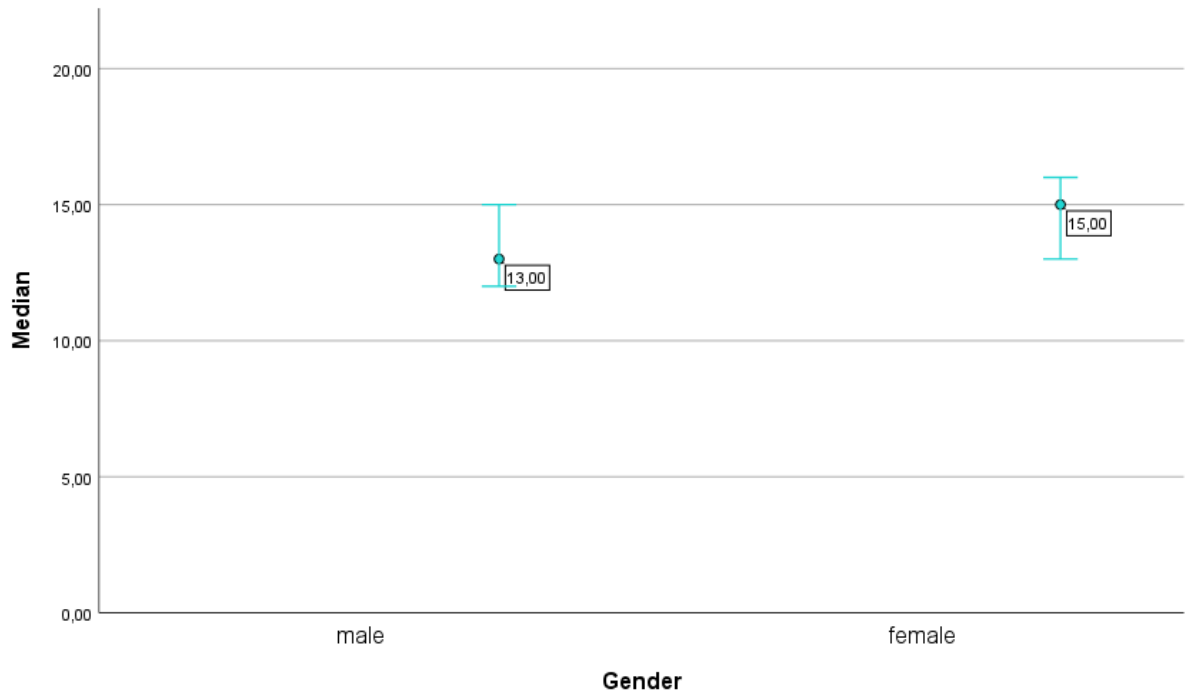


Figure 89: Median with 95% confidence interval for the difference between the OKS score 6 months after surgery and before partial knee arthroplasty, according to patient gender (Source: RES).

For men (13 points) and women (15 points), the median difference in OKS between the preoperative score and the score 6 months after surgery is very similar (Figure 89).

Respondents were divided into four age groups: under 55 years, 55–64 years, 65–74 years, and over 74 years. The difference between the OKS score 6 months after the procedure and the preoperative result is presented.

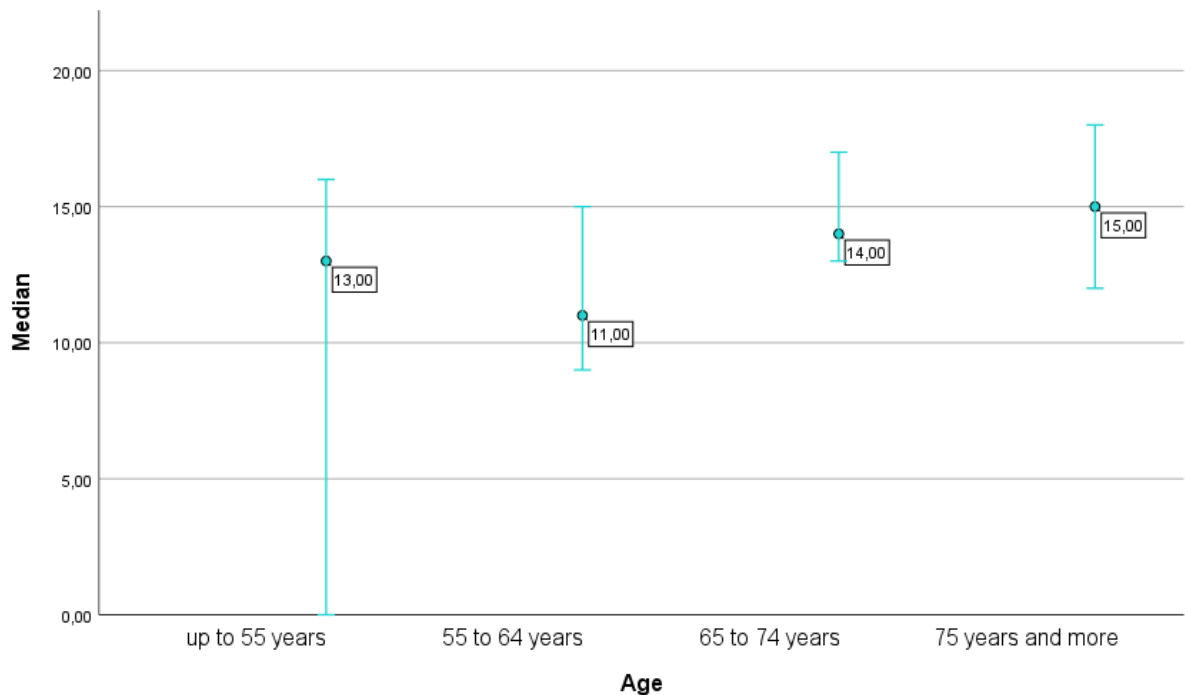


Figure 90: Median with 95% confidence interval for the difference between the OKS score before and 6 months after partial knee arthroplasty, by the age of the patients (Source: RES).

No statistically significant differences in the median were observed between age groups (Figure 90).

EQ-5D-5L QUESTIONNAIRE³⁸

The EQ-5D-5L questionnaire items and methodology have already been described in the section on total knee endoprostheses.

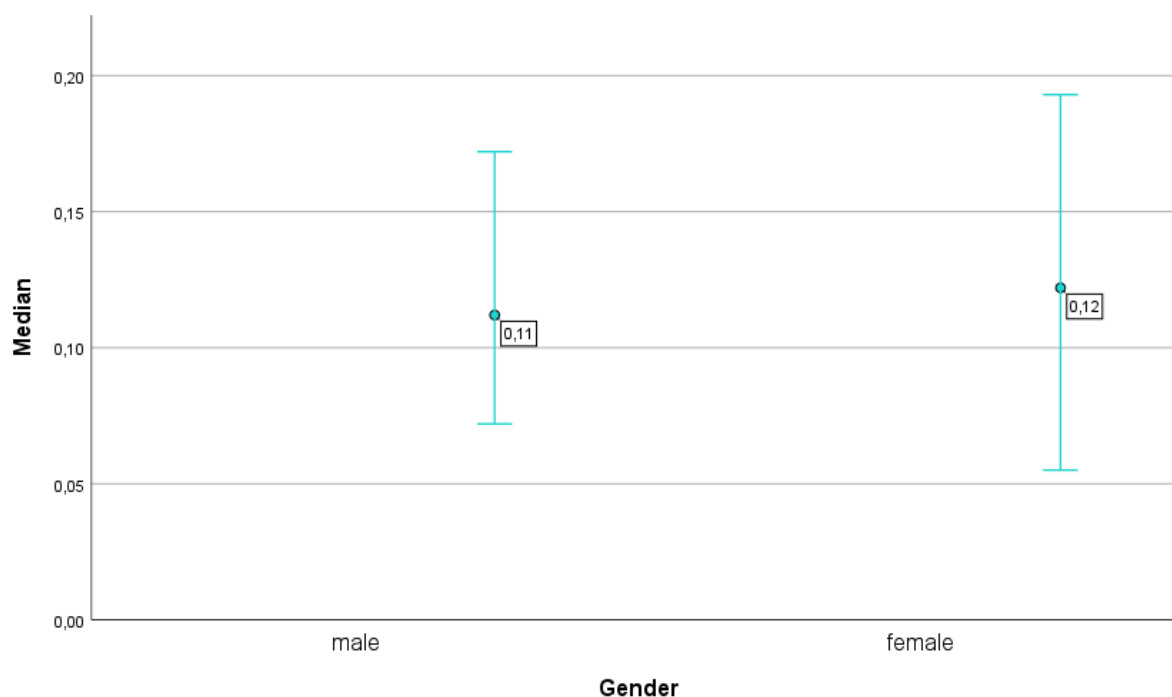


Figure 91: Median with 95% confidence interval for the difference between the EQ-5D-5L before and 6 months after partial knee arthroplasty, by gender (Source: RES).

There were no statistically significant differences in the median change between genders for the EQ-5D-5L questionnaire. The median change was 0.12 points for women and 0.13 points for men (Figure 91).

³⁸ The Slovenian version of the EQ-5D-5L questionnaire is available on the RES website.

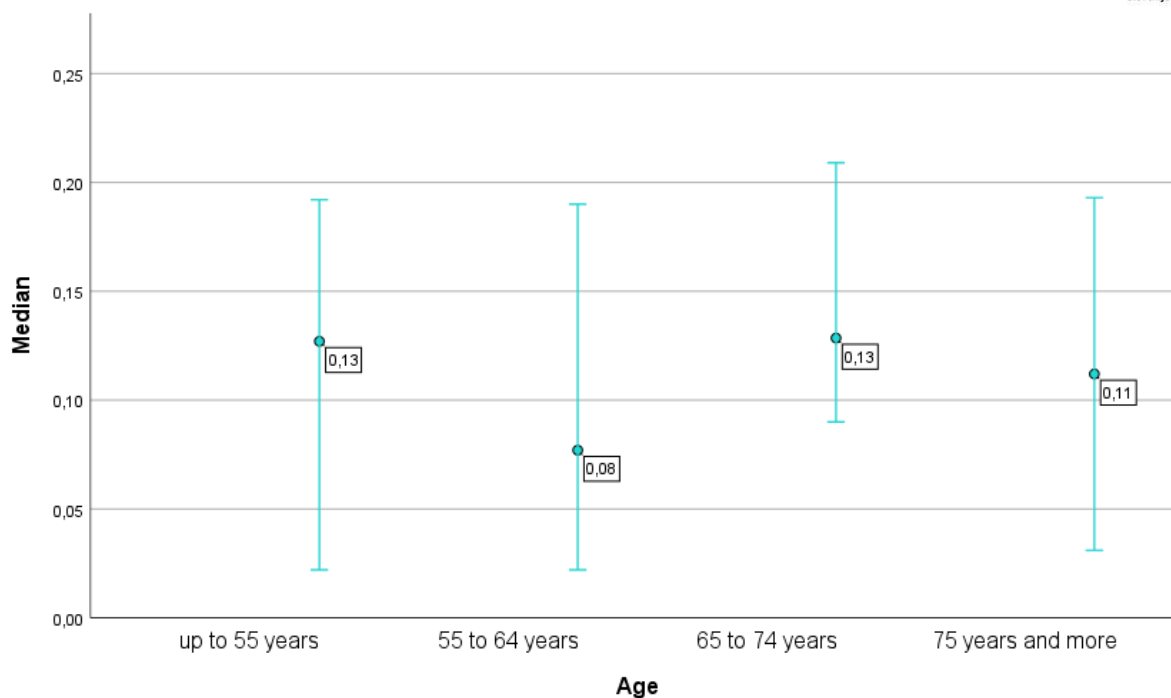


Figure 92: Median with 95% confidence interval for the difference between the EQ-5D-5L before and 6 months after partial knee arthroplasty, by age at surgery (Source: RES).

Similarly, there were no statistically significant differences in the median changes between preoperative and 6-month postoperative EQ-5D-5L results across age groups, ranging from 0.07 points in patients aged 55–64 to 0.15 points in those aged 65–74 (Figure 92).

VISUAL ANALOGUE SCALE (VAS)³⁹

The VAS questionnaire is part of the EQ-5D-5L and assesses health status on the day of the survey. A score of 0 represents the worst possible health state, while 100 represents the best possible health state. We calculated the difference between the result 6 months after surgery and the preoperative result.

³⁹ The VAS questionnaire is part of the EQ-5D-5L questionnaire, which is available on the RES website.

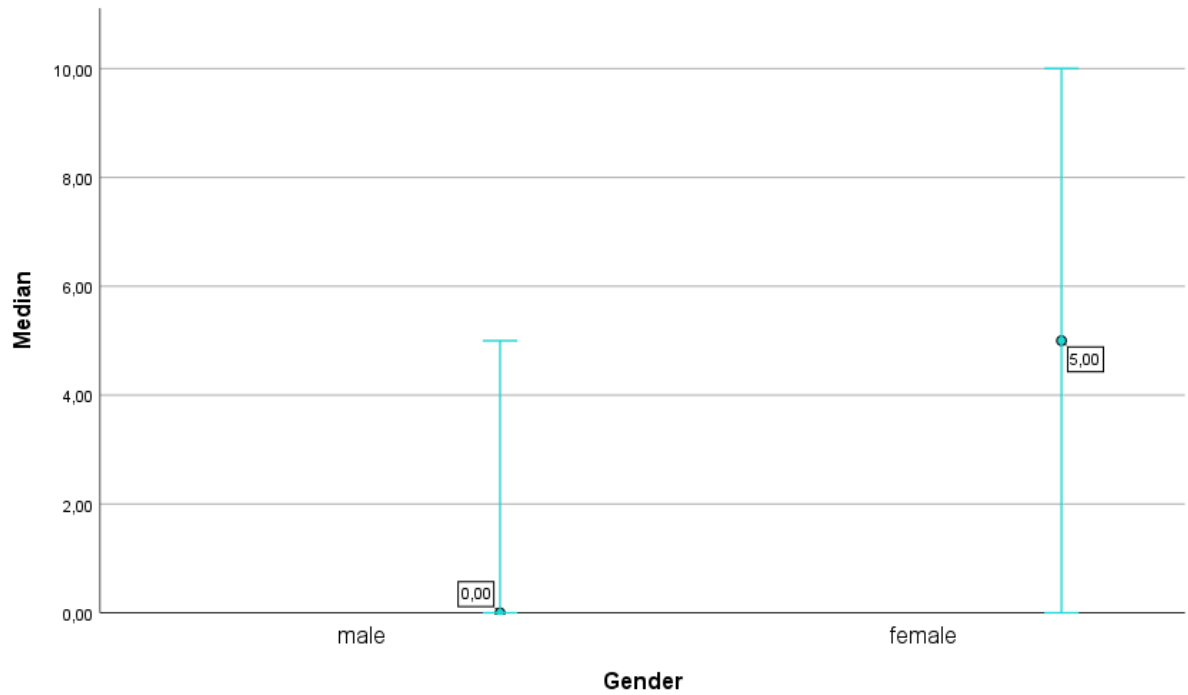


Figure 93: The improvement of health assessment on the day of completing the survey, 6 months after the partial knee arthroplasty, with a 95% confidence interval for the median, by gender (Source: RES).

The median difference by gender using 95% confidence intervals was 0 for men and 5 for women (see Figure 93).

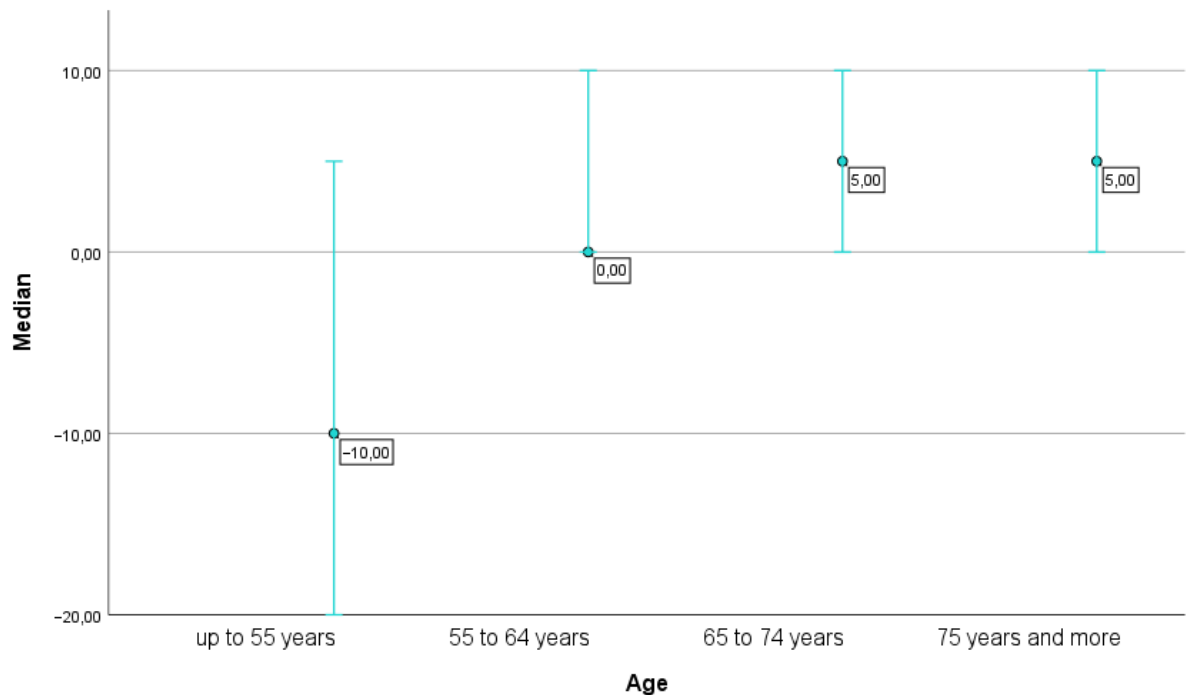


Figure 94: The improvement of the median, 95% confidence interval, of health assessment, 6 months after the partial knee arthroplasty, by age at surgery (Source: RES).

There were no statistically significant differences between age groups in the median change of VAS scores before and 6 months after surgery. Patients younger than 55 years had a negative median change (Figure 94).

8.3 Revision knee arthroplasty procedures – data up to December 31, 2024

This section of the report presents revision knee arthroplasties in the Republic of Slovenia from 2019 to 2024. The RES database contains records of 1,434 revision knee arthroplasties during this period, including 304 procedures performed between January 1, 2024, and December 31, 2024. The analysis is based on data entered into the RES database up to March 12, 2026.

The report provides information on the current surgical procedure in relation to patient characteristics (gender, age at the time of surgery), provider, surgeon, characteristics of the revision procedure (side of surgery, previous operations on the same knee, reason for revision, extent of revision, and surgical approach), data on the new implant (manufacturer), and the distribution of revisions by implant combinations.

8.3.1 Compliance of the collected data

The table below shows the compliance for revision knee arthroplasties.

Table 35: Revisions by number of performed revision knee arthroplasties between 2019 and 2024 in the Republic of Slovenia, according to the surgical provider - comparison of RES and ZZZS.

Compliance	2019	2020	2021	2022	2023	2024
KS Rožna dolina	100.00	100.00	0.00	NP	125.00	266.67
OB Valdoltra	93.83	87.84	91.40	98.95	109.62	116.13
SB Brežice	NP	NP	100.00	200.00	66.67	100.00
SB Celje	100.00	63.64	100.00	137.50	85.00	138.46
SB Izola	NP	NP	NP	NP	NP	NP
SB Jesenice	52.94	45.45	86.67	92.31	93.75	108.00
SB Murska Sobota	76.92	116.67	200.00	128.57	130.00	83.33
SB Nova Gorica	84.62	83.33	111.11	100.00	100.00	100.00
SB Novo mesto	83.33	75.00	85.00	84.62	102.78	73.33
SB Ptuj	200.00	NP	NP	NP	NP	0.00
SB Slovenj Gradec	107.69	166.67	114.29	100.00	180.00	66.67
SB Trbovlje	NP	NP	NP	NP	NP	NP
UKC Ljubljana	123.08	155.56	160.87	135.48	140.00	134.48
UKC Maribor	155.56	91.67	121.43	78.57	136.36	130.00
Kirurgija Bitenc	NP	NP	NP	NP	111.11	123.08
Arbor Mea	NP	NP	NP	NP	NP	50.00
MD Medicina	NP	NP	NP	NP	NP	NP
Total	96.53	92.17	107.04	107.83	112.92	107.80

In 2019, data compliance between the RES database and the Health Insurance Institute of Slovenia was 109.9%. It decreased to 99.4% in 2020, then increased to 113.6% in 2021, 115.1% in 2022, 112.6% in 2023, and 107.8% in 2024 (Table 35). In 2024, lower compliance was observed at SB Murska Sobota, SB Novo Mesto, and SB Slovenj Gradec, although their compliance had been exemplary in previous years. For Arbor Mea, compliance could be compared for the first time in 2024 and was only 50%.

8.3.2 Gender and age of patients undergoing revision knee arthroplasty

The gender and age of patients undergoing revision knee arthroplasty performed between 2019 and 2024 in the Republic of Slovenia are presented in Figures 95 and 96.

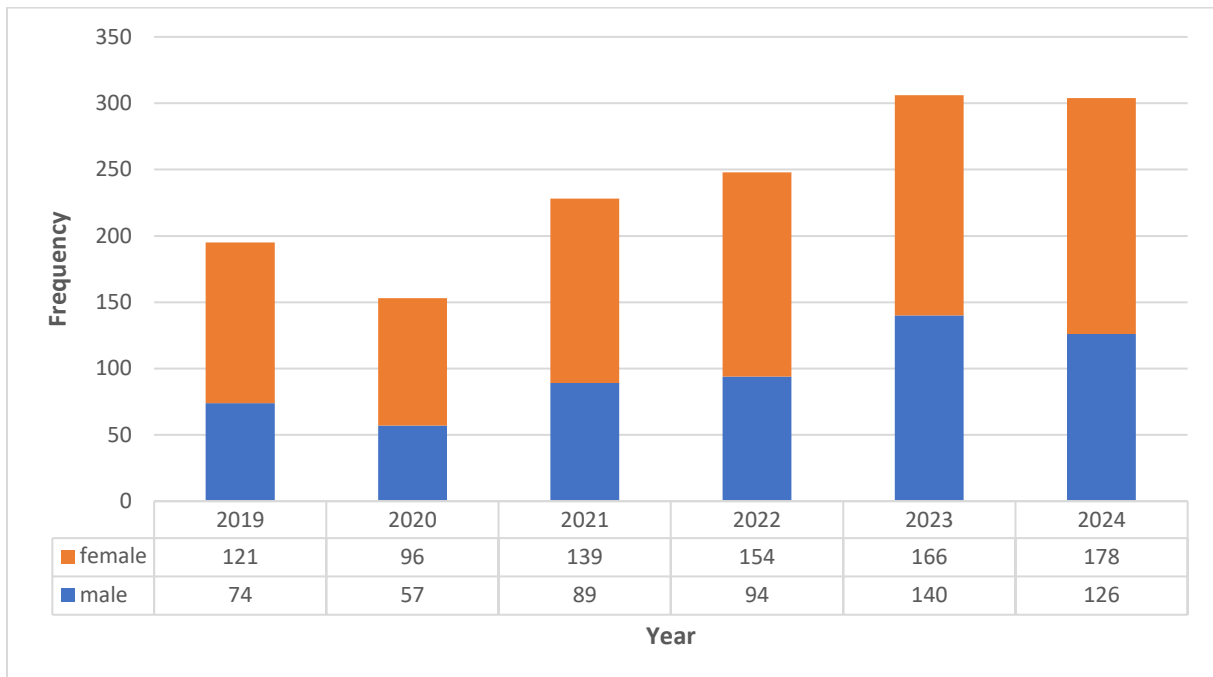


Figure 95: Number of revision knee arthroplasties between 2019 and 2024 by patient gender (Source: RES).

In 2024, 178 (58.6%) revision knee arthroplasties were performed in women and 126 (41.4%) in men (Figure 95).

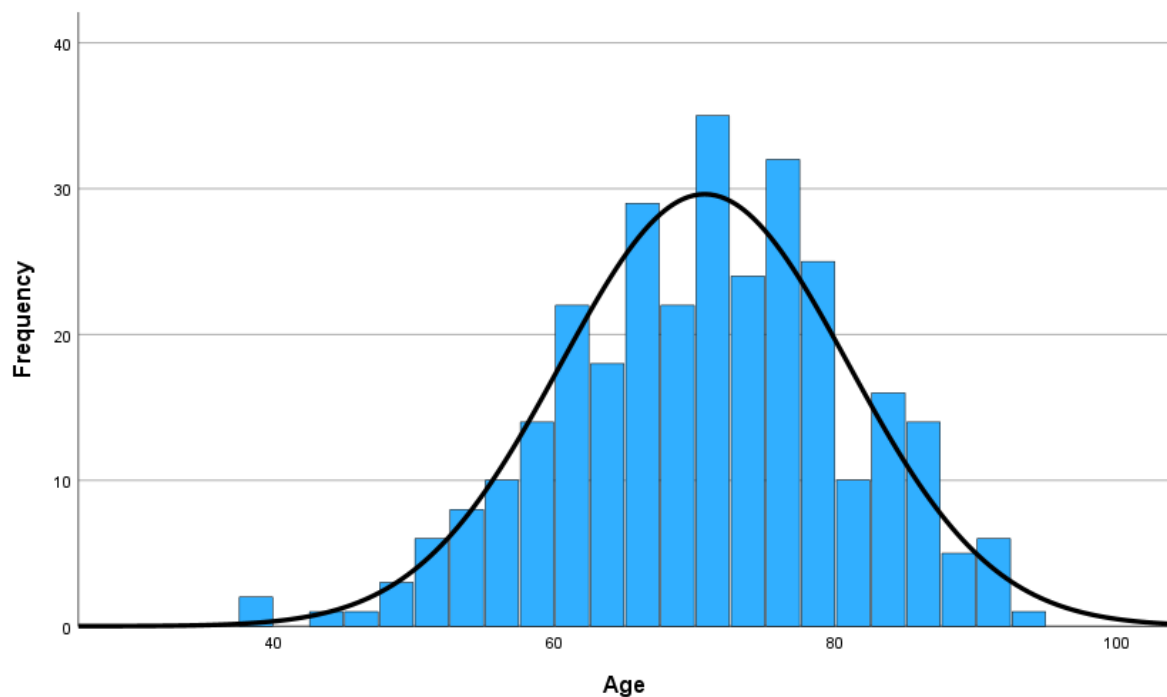


Figure 96: Revision knee arthroplasty in 2024 by patient age at surgery (Source: RES).

In 2024, the median age of patients undergoing revision knee arthroplasty was 70.7 years. The youngest patient was 39.5 years old, and the oldest was 92.6 years old (Figure 96).

8.3.3 Characteristics of the surgical procedure in revision knee arthroplasty

This section presents data on the provider performing the procedure (Figure 97), the burden of knee revisions (Figure 98), the side of the operation (Figure 99), the reason for revision (Figure 100), the extent of revision (Figure 101), the surgical approach used (Figure 102), and previous revisions (Figure 103).

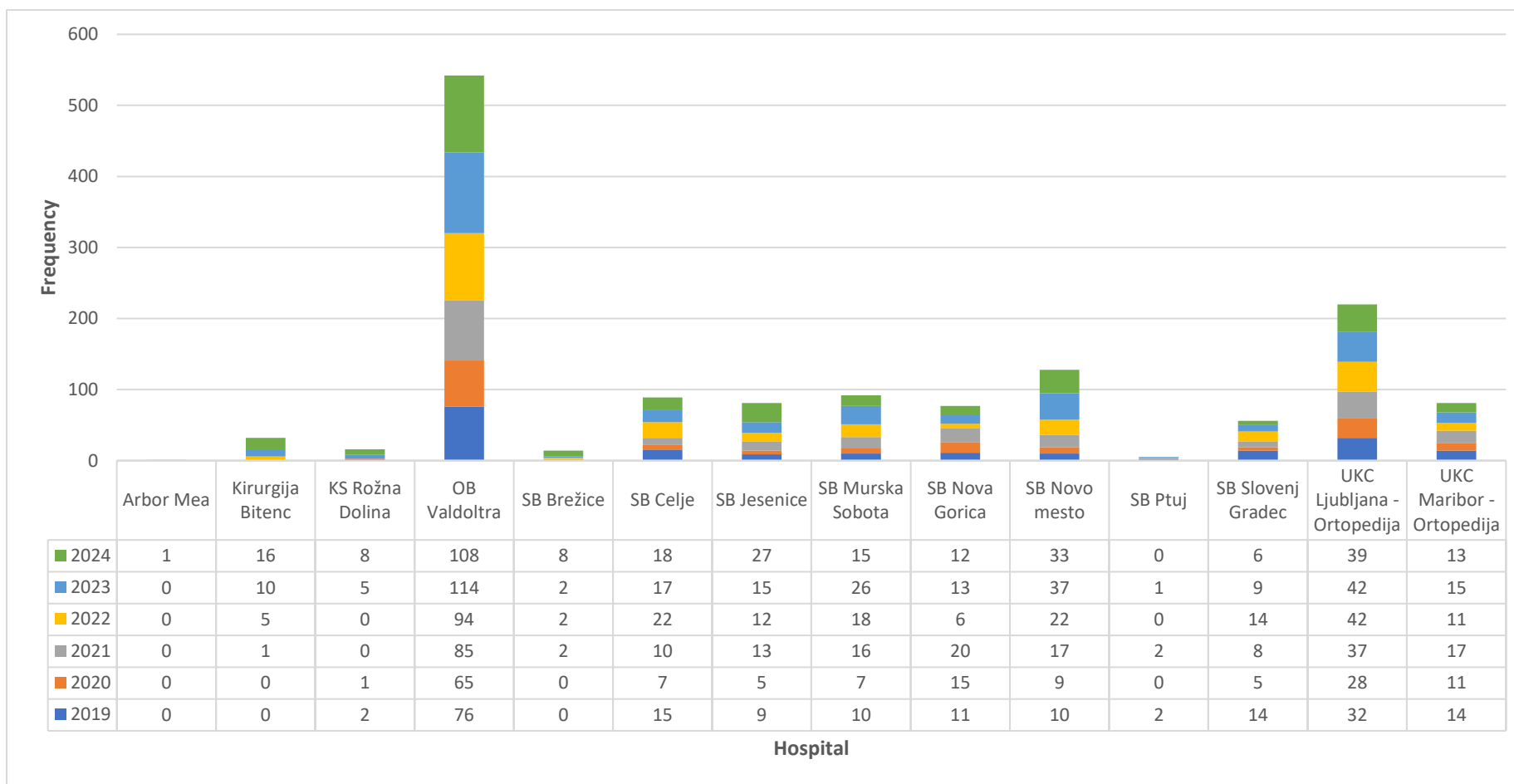


Figure 97: Healthcare providers (hospitals) of revision knee arthroplasties between 2019 and 2024 (Source: RES).

In 2024 (Figure 97), the largest share—37.8% (108)—of all revision knee arthroplasties was performed at OB Valdoltra. A further 12.8% (39) were carried out at the Orthopaedic Clinic of UKC Ljubljana, 10.9% (33) at SB Novo Mesto, 8.9% (27) at SB Jesenice, 5.9% (18) at SB Celje, 5.3% (16) at Kirurgija Bitenc, 4.9% (15) at SB Murska Sobota, 4.3% (13) at the Orthopaedic Department of UKC Maribor, 3.9% (12) at SB Nova Gorica, 2.6% (8) at KS Rožna Dolina, 2.6% (8) at SB Brežice, 2.0% (6) at SB Slovenj Gradec, and 1 case (0.3%) at Arbor Mea.

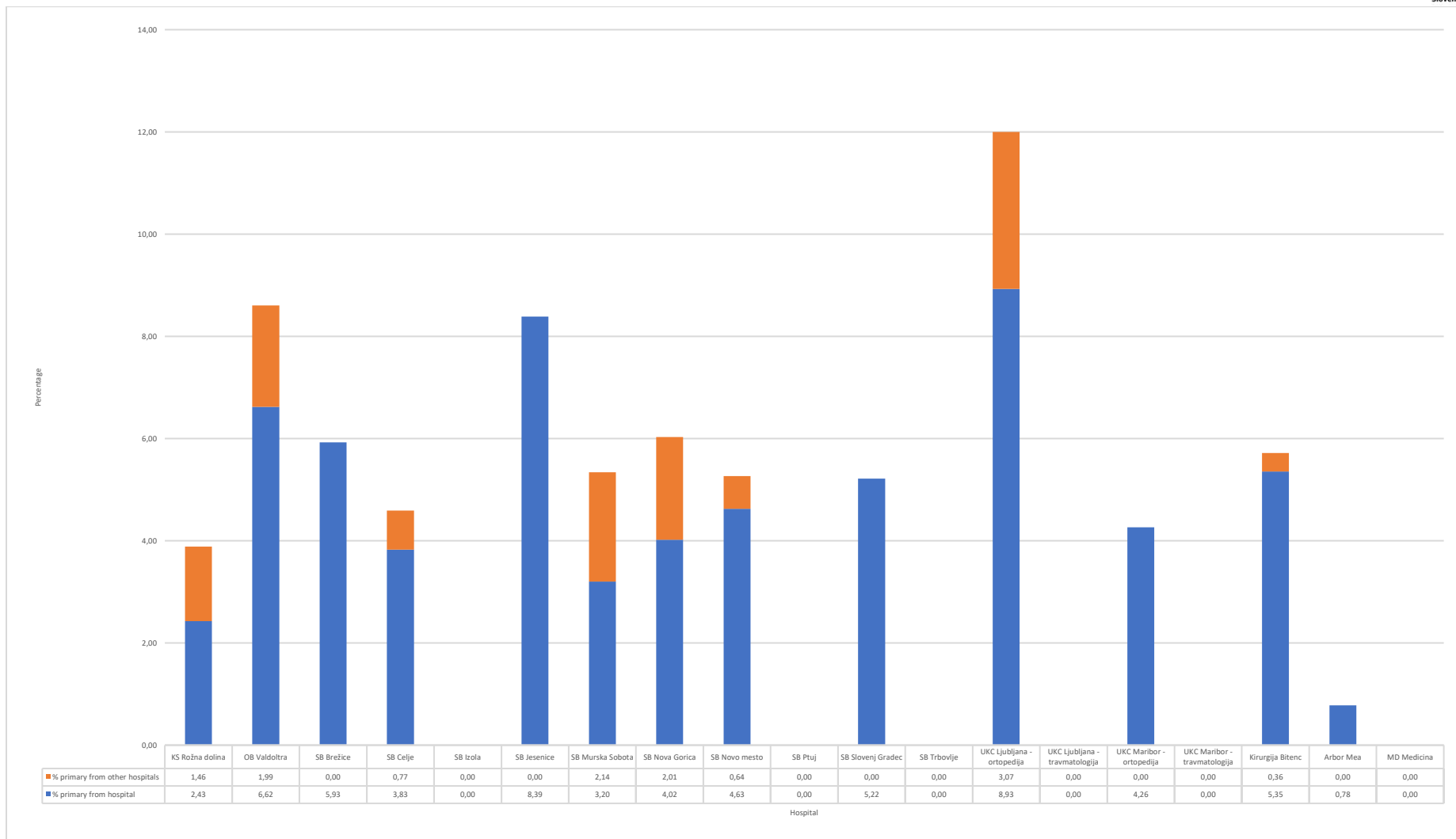


Figure 98: Revision burden of knee arthroplasties by hospitals in 2024 (Source: RES).

Breme revizij je število revizijskih operacij v posamezni ustanovi*100, deljeno z vsemi operacijami na tem sklepu (primarnimi in revizijskimi skupaj) v ustanovi. Največje breme kolenskih revizij nosi Ortopedska klinika UKC Ljubljana (12 %). Sledijo OB Valdoltra (8,6 %), SB Jesenice (8,4 %), SB Nova Gorica (6 %), SB Brežice (5,9 %), Kirurgija Bitenc (5,7 %), SB Murska Sobota (5,3 %), SB Novo mesto (5,3 %) in SB Slovenj Gradec (5,2 %). Ostali izvajalci imajo breme kolenskih revizij nižje od 5 % (slika 99).

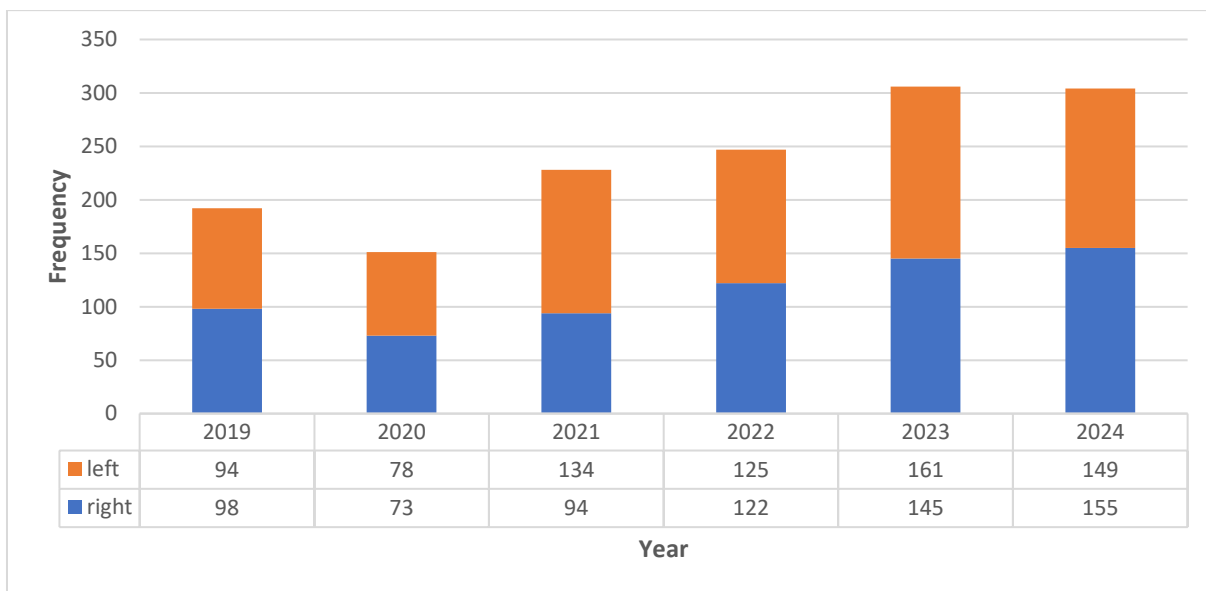


Figure 99: Number of revision arthroplasty surgery between 2019 and 2024, by surgery side (Source: RES).

In 2024, according to RES data (Figure 67), 49% (149) of revision arthroplasties were performed on the left knee and 51% (155) on the right knee (Figure 99).

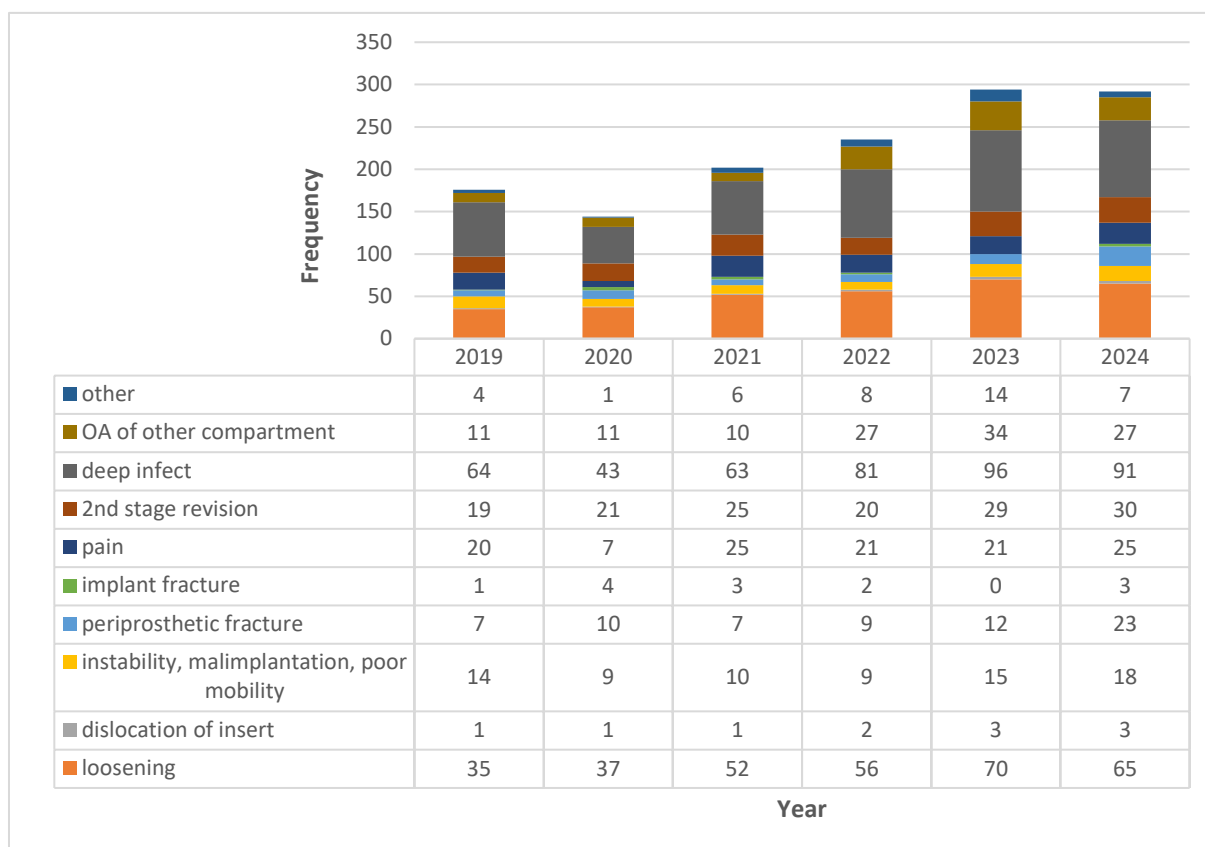


Figure 100: Reasons for revisions from 2019 to 2024 (Source: RES).

The most common reason for revision in 2024 (Figure 100) was deep infection (91 cases; 29.9%). This was followed by loosening (65 cases; 21.4%), status after component removal (30 cases; 9.9%), pain (25 cases; 8.2%), osteoarthritis of another compartment (27 cases; 8.9%), periprosthetic fracture (23 cases; 7.6%), instability, malalignment, and reduced mobility (18 cases; 5.9%), and dislocation of the polyethylene insert (3 cases; 1.0%). In 7 cases (2.3%), other causes were reported.

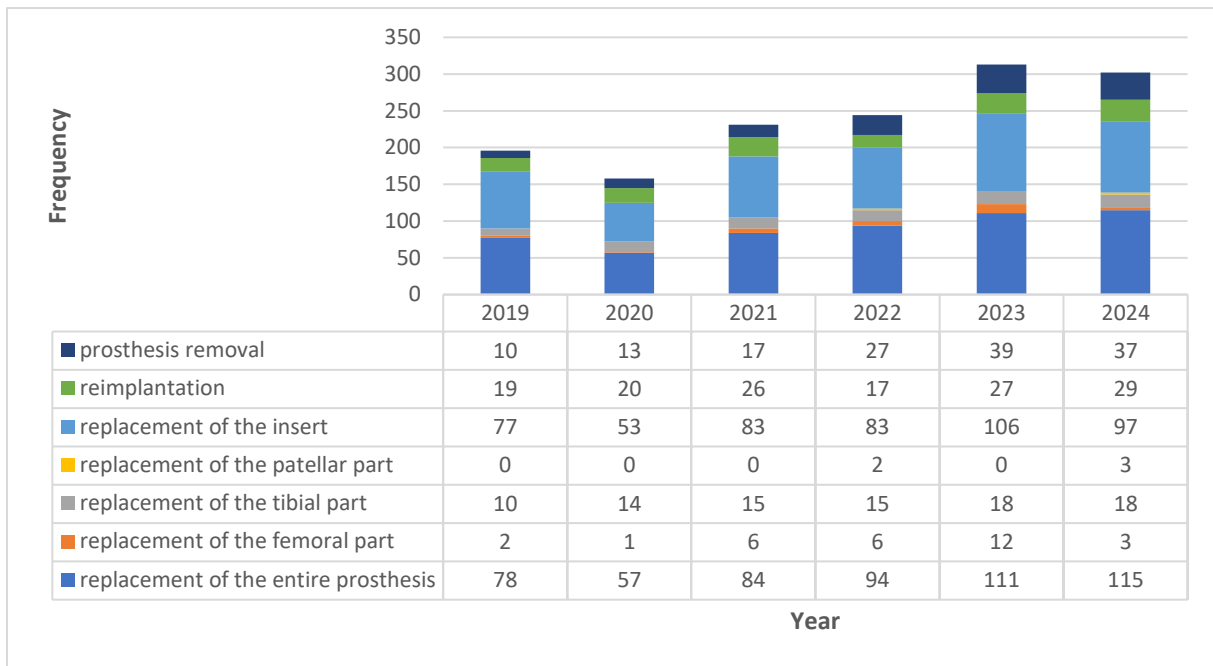


Figure 101: Revisions of knee arthroplasties between 2019 and 2024 by revision volume (Source: RES).

In 2024, there were 115 revision knee arthroplasties in which the entire endoprosthesis was replaced (Figure 101). The insert was replaced in 97 cases, in 18 cases the tibial component and in 3 cases the patellar or femoral component. In 37 cases, the prosthesis was removed, and in 29 cases, reimplantation was performed following prosthesis removal.



Figure 102: Surgical approach used in revision knee arthroplasties between 2019 and 2024 (Source: RES).

Figure 102 presents the surgical approaches used in revision knee arthroplasties in the Republic of Slovenia. In 2024, the medial parapatellar approach was used most frequently (290 cases; 95.4%). Other approaches were used very rarely.

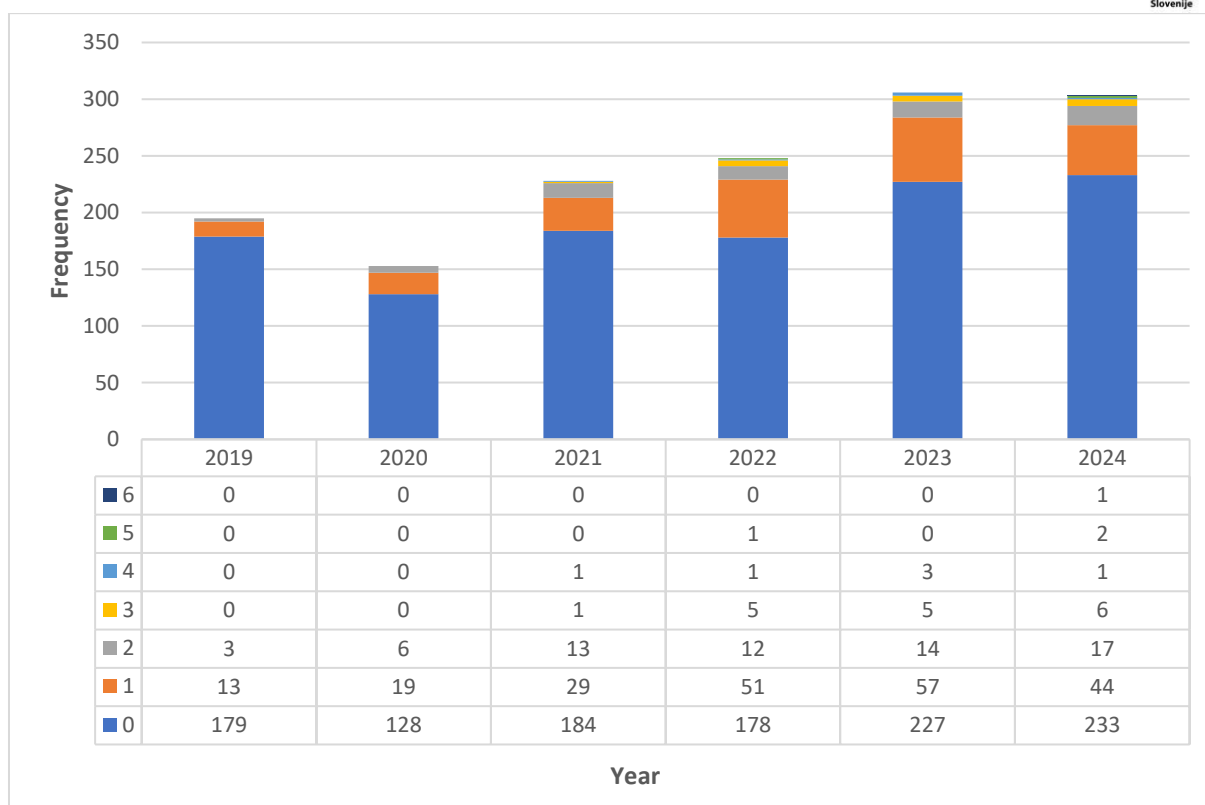


Figure 103: Knee arthroplasty revisions between 2019 and 2024 by number of previous revision surgeries (Source: RES).

In 2024, 76.6% of revision knee arthroplasties were first-time revisions (Figure 103).

8.3.4 First revision knee arthroplasties

In this section, we present only first revision knee arthroplasties, specifically the time from the primary knee arthroplasty to the first revision (Figure 104).

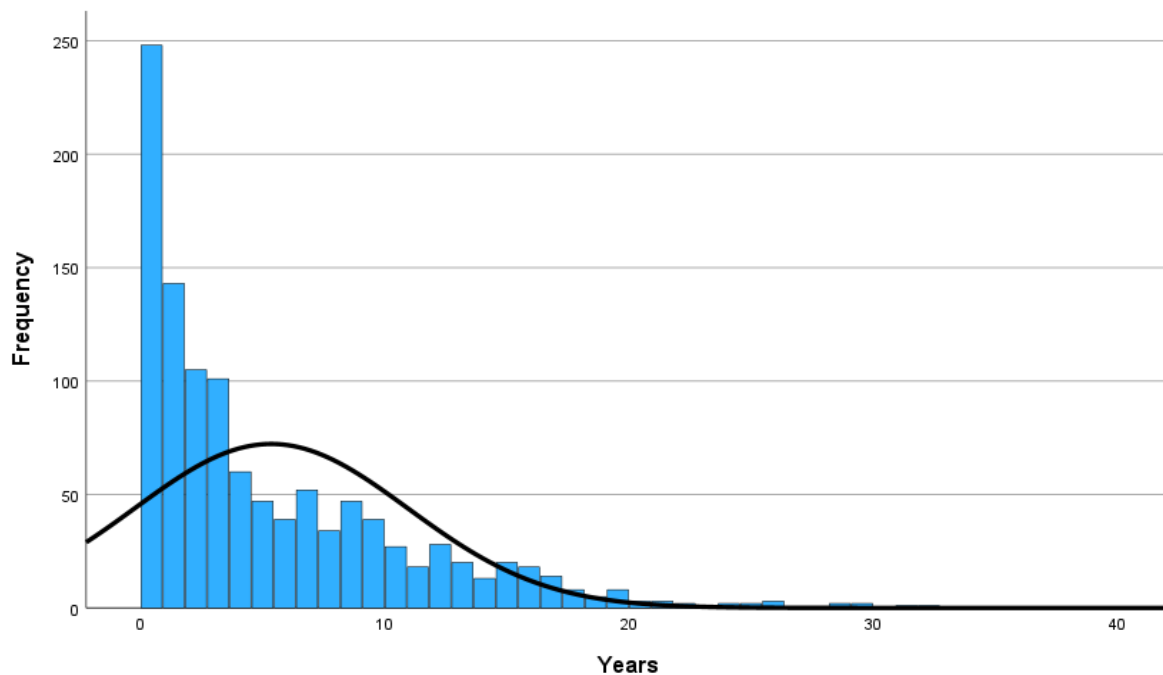


Figure 104: Time from primary knee arthroplasty to first knee revision from 2019 to 2024 (Source: RES).

Between 2019 and 2024, the median time from primary knee arthroplasty to the first revision knee arthroplasty was 3.2 years. The shortest time to revision was on the same day as the primary knee arthroplasty, while the longest interval to first revision was 32.7 years.

8.4 Survival analysis of knee endoprostheses – data up to 31 December 2024

This chapter presents the survival of primary total and partial knee endoprostheses. The analysis includes implants inserted between 1 January 2019 and 31 December 2024. The observation period spans from the primary surgery to the first revision, where the first revision is defined as any reoperation for any reason, regardless of its extent (replacement of the entire endoprosthesis or only a part of it). For patients who died during follow-up or did not experience an event (first revision) by the end of the observation period, the data are treated as censored.

To estimate survival at time t (the function $S(t)$), we use the Kaplan–Meier method. The results are presented as the cumulative proportion of revisions, that is, $1 - S(t)$. The proportions are shown at one, three, and five years after the primary implantation. In the analysis that also considers the effects of gender and age, we use the Cox model, and the results are presented as hazard ratios (HR).

The results are presented in three sections. First, we show the outcomes for total knee prostheses by individual implant combinations, including only those combinations of femoral and tibial components with at least 200 cases. This is followed by an analysis based on the type of fixation (cemented and uncemented prostheses). The next section presents the results for partial knee prostheses in the same manner. Finally, we provide a comparison of both types of prostheses, followed by a comparison limited to cemented total and partial prostheses.

Each section includes a table with annual data, a table of cumulative revision percentages, and a table showing the reasons for revision.

8.4.1 Total knee endoprotheses

Table 36: Number and % of primary total knee implant combinations (femur-tibia) by year (Source: RES).

Year	2019-2024		2019		2020		2021		2022		2023		2024	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
All total knee endoprotheses	17729		2834		2185		2300		3068		3558		3784	
Nexgen LPS Flex - Nexgen tib (Zimmer Biomet)	5434	30.7	959	33.8	695	31.8	588	25.6	965	31.5	1116	31.4	1111	29.4
Sigma CR fem - Sigma tib (DePuy)	1934	10.9	409	14.4	344	15.7	363	15.8	258	8.4	263	7.4	297	7.8
balanSys PS - balanSys tib (Mathys)	1390	7.8	179	6.3	175	8.0	218	9.5	257	8.4	272	7.6	289	7.6
Score PS cless - Score MB tib (Amplitude)	1154	6.5	290	10.2	222	10.2	125	5.4	204	6.6	173	4.9	140	3.7
Score II cless - Score MB tib (Amplitude)	1009	5.7	0	0.0	0	0.0	191	8.3	244	8.0	254	7.1	320	8.5
Genus CR - Genus FB tib (Adler Ortho)	797	4.5	217	7.7	112	5.1	129	5.6	132	4.3	114	3.2	93	2.5
Persona CR - Persona tibial (Zimmer Biomet)	651	3.7	0	0.0	3	0.1	86	3.7	103	3.4	185	5.2	274	7.2
Sigma PS fem - Sigma tib (DePuy)	482	2.7	113	4.0	110	5.0	91	4.0	89	2.9	36	1.0	43	1.1
Nexgen CR Flex - Nexgen tib (Zimmer Biomet)	445	2.5	62	2.2	76	3.5	58	2.5	71	2.3	83	2.3	95	2.5
Attune CR - Attune FB tib (DePuy)	440	2.5	73	2.6	41	1.9	52	2.3	76	2.5	88	2.5	110	2.9
GMK Sphere fem - GMK Sphere tib (Medacta)	408	2.3	0	0.0	2	0.1	20	0.9	39	1.3	154	4.3	193	5.1
Sigma CR fem - Sigma PFC tib* (DePuy)	402	2.3	40	1.4	43	2.0	17	0.7	94	3.1	59	1.7	149	3.9
Physica KR fem - Physica FB tib (Lima)	380	2.1	3	0.1	0	0.0	17	0.7	53	1.7	165	4.6	142	3.8
Genus PS - Genus FB tib (Adler Ortho)	293	1.7	5	0.2	13	0.6	69	3.0	75	2.4	68	1.9	63	1.7
Persona PS - Persona tibial (Zimmer Biomet)	268	1.5	3	0.1	0	0.0	22	1.0	47	1.5	93	2.6	103	2.7
Nexgen CR cless - TM Monoblock tib (Zimmer Biomet)	239	1.3	94	3.3	80	3.7	65	2.8	0	0.0	0	0.0	0	0.0
Nexgen CR cless - Nexgen TM FB tib (Zimmer Biomet)	236	1.3	10	0.4	17	0.8	28	1.2	84	2.7	68	1.9	29	0.8
Nexgen LPS Flex cless - Nexgen TM FB tib (Zimmer Biomet)	212	1.2	0	0.0	8	0.4	49	2.1	55	1.8	61	1.7	39	1.0
Physica PS fem - Physica FB tib (Lima)	201	1.1	1	0.0	0	0.0	0	0.0	6	0.2	104	2.9	90	2.4
Total*	16375	92.4	2458	86.7	1941	88.8	2188	95.1	2852	93.0	3356	94.3	3580	94.6

* Number of implanted total hip endoprotheses with more than 200 cases

Table 37: One-, three-, and five-year cumulative revision rates of primary total knee implant combinations (femur-tibia) with 95% confidence interval (CI) (Source: RES).

Femur-tibia (manufacturer)	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All total knee endoprostheses	17729	419	71 (64-76)	62	1.28 (1.11 - 1.46)	2.84 (2.56 - 3.15)	3.67 (3.3 - 4.08)
Nexgen LPS Flex - Nexgen tib (Zimmer Biomet)	5434	122	71 (65-76)	61	1.11 (0.85 - 1.45)	2.63 (2.15 - 3.21)	3.76 (3.09 - 4.58)
Sigma CR fem - Sigma tib (DePuy)	1934	43	71 (65-76)	62	1.08 (0.7 - 1.67)	2.16 (1.55 - 3.02)	2.9 (2.13 - 3.96)
balanSys PS - balanSys tib (Mathys)	1390	35	72 (66-78)	70	0.97 (0.55 - 1.7)	3.3 (2.32 - 4.68)	3.75 (2.65 - 5.32)
Score PS cless - Score MB tib (Amplitude)	1154	16	71 (65-77)	65	0.72 (0.36 - 1.44)	1.31 (0.75 - 2.26)	1.68 (0.99 - 2.84)
Score II cless - Score MB tib (Amplitude)	1009	11	71 (65-76)	62	0.82 (0.39 - 1.72)	1.42 (0.74 - 2.68)	
Genus CR - Genus FB tib (Adler Ortho)	797	33	73 (67-79)	65	2.39 (1.51 - 3.77)	4.83 (3.42 - 6.81)	5.09 (3.62 - 7.14)
Persona CR - Persona tibial (Zimmer Biomet)	651	32	69 (63-75)	55	3.87 (2.52 - 5.9)	10.06 (6.44 - 15.56)	
Sigma PS fem - Sigma tib (DePuy)	482	12	70 (64-75)	67	0.87 (0.33 - 2.3)	2.23 (1.16 - 4.27)	3.91 (2.11 - 7.2)
Nexgen CR Flex - Nexgen tib (Zimmer Biomet)	445	6	72 (66-77)	69	1.24 (0.52 - 2.96)	1.57 (0.7 - 3.47)	1.57 (0.7 - 3.47)
Attune CR - Attune FB tib (DePuy)	440	3	69 (63-75)	58	0.5 (0.12 - 1.98)	0.5 (0.12 - 1.98)	0.5 (0.12 - 1.98)
GMK Sphere fem - GMK Sphere tib (Medacta)	408	4	71 (65-76)	60	0.55 (0.14 - 2.22)	1.09 (0.33 - 3.58)	
Sigma CR fem - Sigma PFC tib (DePuy)	402	9	73 (68-77)	58	1.82 (0.82 - 4.05)	2.91 (1.4 - 5.98)	3.99 (1.89 - 8.32)
Physica KR fem - Physica FB tib (Lima)	380	2	70 (64-76)	66	0.54 (0.13 - 2.14)	0.54 (0.13 - 2.14)	0.54 (0.13 - 2.14)
Genus PS - Genus FB tib (Adler Ortho)	293	15	72 (68-78)	58	2.19 (0.99 - 4.82)	7.95 (4.71 - 13.24)	7.95 (4.71 - 13.24)
Persona PS - Persona tibial (Zimmer Biomet)	268	4	66 (60-72)	64	1.29 (0.42 - 3.96)	1.93 (0.71 - 5.15)	1.93 (0.71 - 5.15)
Nexgen CR cless - TM Monoblock tib (Zimmer Biomet)*	239	8	65 (58-69)	53	1.26 (0.41 - 3.84)	2.95 (1.41 - 6.08)	2.95 (1.41 - 6.08)
Nexgen CR cless - Nexgen TM FB tib (Zimmer Biomet)	236	4	66 (60-71)	38	1.79 (0.68 - 4.7)	1.79 (0.68 - 4.7)	1.79 (0.68 - 4.7)
Nexgen LPS Flex cless - Nexgen TM FB tib (Zimmer Biomet)	212	6	67 (60-72)	29	1.48 (0.48 - 4.52)	3.41 (1.53 - 7.5)	
Physica PS fem - Physica FB tib (Lima)	201	3	73 (67-76)	67	1.06 (0.26 - 4.17)	2.79 (0.75 - 10.16)	2.79 (0.75 - 10.16)

*The endoprosthesis has not been implanted since 2021

Table 38: Number of primary total knee implant combinations by reason for revision in the period 2019-2024 (Source: RES).

Femur-tibia (manufacturer)	Number of first revisions	Number of primaries	% revisions	Infection	Periprosthetic fracture	Implant fracture	Loosening	Instability, malalignment, poor ROM	Pain	Other	NP
Total	368	16375	2.2	160	13	0	45	65	44	10	31
Nexgen LPS Flex - Nexgen tib (Zimmer Biomet)	122	5434	2.2	65	1	0	13	23	5	4	11
Sigma CR fem - Sigma tib (DePuy)	43	1934	2.2	22	0	0	8	4	6	0	3
balanSys PS - balanSys tib (Mathys)	35	1390	2.5	14	2	0	6	7	5	1	0
Score PS cless - Score MB tib (Amplitude)	16	1154	1.4	7	3	0	1	0	3	0	2
Score II cless - Score MB tib (Amplitude)	11	1009	1.1	5	1	0	1	2	0	1	1
Genus CR - Genus FB tib (Adler Ortho)	33	797	4.1	10	1	0	1	5	10	0	6
Persona CR - Persona tibial (Zimmer Biomet)	32	651	4.9	9	1	0	8	6	1	3	4
Sigma PS fem - Sigma tib (DePuy)	12	482	2.5	4	0	0	0	3	3	1	1
Nexgen CR Flex - Nexgen tib (Zimmer Biomet)	6	445	1.3	5	0	0	1	0	0	0	0
Attune CR - Attune FB tib (DePuy)	3	440	0.7	2	0	0	1	0	0	0	0
GMK Sphere fem - GMK Sphere tib (Medacta)	4	408	1.0	0	0	0	0	4	0	0	0
Sigma CR fem - Sigma PFC tib (DePuy)	9	402	2.2	6	0	0	1	1	0	0	1
Physica KR fem - Physica FB tib (Lima)	2	380	0.5	0	1	0	0	0	0	0	1
Genus PS - Genus FB tib (Adler Ortho)	15	293	5.1	5	0	0	1	6	3	0	0
Persona PS - Persona tibial (Zimmer Biomet)	4	268	1.5	2	0	0	0	1	1	0	0
Nexgen CR cless - TM Monoblock tib (Zimmer Biomet)	8	239	3.3	0	0	0	0	2	6	0	0
Nexgen CR cless - Nexgen TM FB tib (Zimmer Biomet)	4	236	1.7	3	0	0	1	0	0	0	0
Nexgen LPS Flex cless - Nexgen TM FB tib (Zimmer Biomet)	6	212	2.8	1	3	0	0	1	1	0	0
Physica PS fem - Physica FB tib (Lima)	3	201	1.5	0	0	0	2	0	0	0	1

8.4.1.1 Total knee endoprosthesis fixation

Table 39: One-, three-, and five-year cumulative revision rates of primary total knee prostheses by fixation, with 95% confidence intervals (CI) (Source: RES).

Fixation	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All total knee endoprosthesis	17729	419	71 (64-76)	62	1.28 (1.11 - 1.46)	2.84 (2.56 - 3.15)	3.67 (3.3 - 4.08)
Cemented	14559	363	71 (65-76)	63	1.33 (1.15 - 1.53)	2.94 (2.62 - 3.29)	3.8 (3.38 - 4.26)
Uncemented	3067	54	70 (64-75)	57	0.87 (0.65 - 1.15)	1.92 (1.46 - 2.51)	2.48 (1.89 - 3.25)

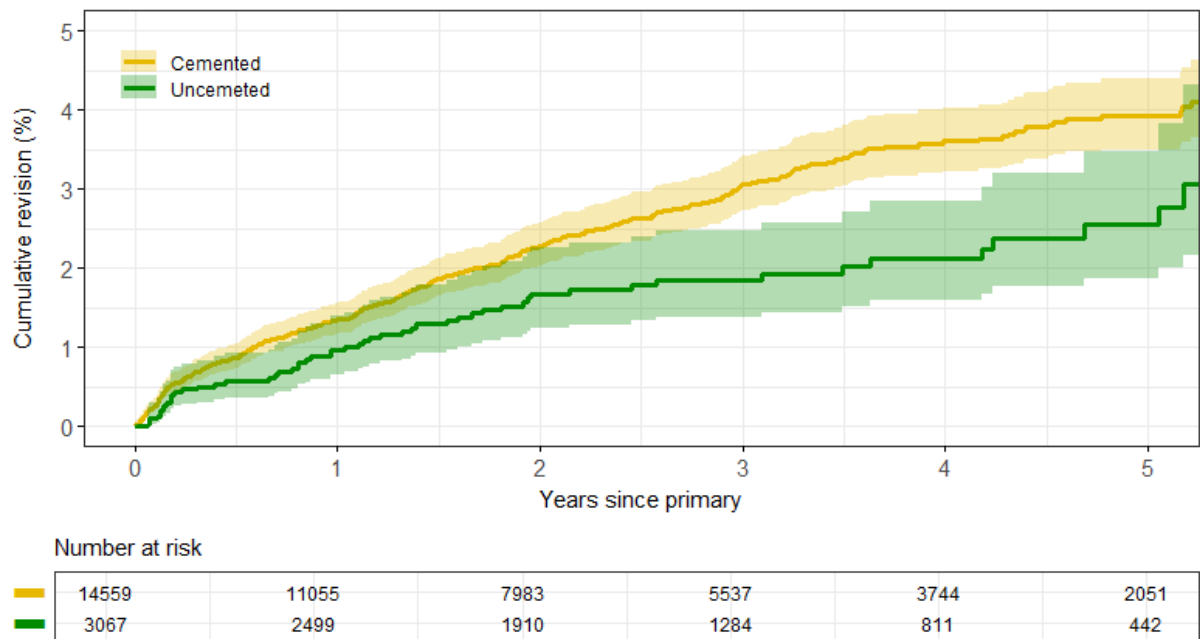


Figure 105: Cumulative revision rate of total knee prostheses by fixation (Source: RES).

HR – adjusted for gender and age: cemented vs. uncemented, HR = 1.56 (95% CI 1.17–2.07), p = 0.002

From the five-year revision data, it is evident that uncemented total knee endoprosthesis in Slovenia have a lower probability of revision compared with cemented ones (Table 39 and Figure 105).

8.4.2 Partial knee endoprosthesis

This chapter presents the results on the revision probability of partial knee endoprosthesis and the reasons for revision (Tables 40 to 42).

Table 40: Number and % of primary partial knee implant combinations (femur-tibia) by year (Source: RES).

Year	2019-2024		2019		2020		2021		2022		2023		2024	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Femur-tibia (manufacturer)														
All partial knee endoprosthesis	2842		356		291		427		512		582		674	
Physica ZUK - Physica ZUK tib (Lima)	1778	62.6	238	66.9	200	68.7	281	65.8	328	64.1	346	59.5	346	51.3
Persona Partial Knee - Persona Partial tib (Zimmer Biomet)	343	12.1	6	1.7	20	6.9	29	6.8	66	12.9	83	14.3	83	12.3
Oxford class fem - Oxford Uncemented Partial Knee tib (Zimmer Biomet)	262	9.2	45	12.6	20	6.9	45	10.5	41	8.0	48	8.2	48	7.1
Uni Score HA - Uni Score FB tib (Amplitude)	220	7.7	2	0.6	18	6.2	49	11.5	59	11.5	42	7.2	50	7.4
Total*	*2603*	91.6	291	81.7	258	88.7	404	94.6	494	96.5	519	89.2	527	78.2

*Number of partial knee endoprosthesis with more than 200 cases

Table 41: One-, three-, and five-year cumulative revision rates of primary partial knee implant combinations (femur-tibia) with 95% confidence intervals (CI) (Source: RES).

Femur-tibia (manufacturer)	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All partial knee endoprosthesis	2842	74	68 (61-74)	55	1.28 (0.91 - 1.8)	3.26 (2.54 - 4.19)	4.15 (3.22 - 5.34)
Physica ZUK - Physica ZUK Tibial (Lima)	1778	28	68 (62-74)	54	0.56 (0.29 - 1.07)	1.87 (1.21 - 2.87)	2.88 (1.89 - 4.37)
Persona Partial Knee - Persona Partial tib (Zimmer Biomet)	343	6	68 (60-74)	53	1.44 (0.54 - 3.83)	1.95 (0.8 - 4.7)	4.28 (1.37 - 12.93)
Oxford class fem - Oxford Uncemented Partial Knee Tibial (Zimmer Biomet)	262	11	67 (61-73)	55	3.66 (1.92 - 6.92)	4.25 (2.29 - 7.8)	5.13 (2.79 - 9.34)
Uni Score HA - Uni Score FB tib (Amplitude)	220	19	69 (61-74)	56	4.57 (2.39 - 8.62)	11.87 (7.64 - 18.21)	11.87 (7.64 - 18.21)

The best five-year outcomes are observed for the cemented partial knee endoprosthesis with a fixed-bearing polyethylene insert. The Physica ZUK partial endoprosthesis is also the most frequently used implant in Slovenia. The most common reason for revision is aseptic loosening, followed by periprosthetic fracture (Tables 42 and 43).

Table 42: Number of primary partial knee implant combinations by reason for revision in the period 2019-2024 (Source: RES).

Femur-tibia (manufacturer)	Number of first revisions	Število primarnih operacij	% of revisions	Infection	Periprosthetic fracture	Implant fracture	Loosening	OA of the other compartment	Pain	Other	NP
Total	64	2603	2.5	8	11	1	24	8	6	0	6
Physica ZUK - Physica ZUK Tibial (Lima)	28	1778	1.6	5	3	0	8	4	4	0	4
Persona Partial Knee - Persona Partial tib (Zimmer Biomet)	6	343	1.7	0	2	0	0	2	1	0	1
Oxford cless fem - Oxford Cementless Partial Knee Tibial (Zimmer Biomet)	11	262	4.2	1	6	0	1	2	0	0	1
Uni Score HA - Uni Score FB tib (Amplitude)	19	220	8.6	2	0	1	15	0	1	0	0

In contrast to total knee endoprosthesis, where infection is the main reason for revision, the leading cause of revision in partial knee endoprosthesis is loosening (Table 42).

8.4.2.1 Partial knee endoprosthesis fixation

Table 43: One-, three-, and five-year cumulative revision rates of primary partial knee prostheses by fixation, with 95% confidence intervals (CI) (Source: RES).

Fixation	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All PK endoprosthesis	2842	74	68 (61-74)	55	1.28 (0.91 - 1.8)	3.26 (2.54 - 4.19)	4.15 (3.22 - 5.34)
Cemented	2296	42	68 (61-74)	55	0.73 (0.44 - 1.21)	2.21 (1.56 - 3.13)	3.15 (2.23 - 4.44)
Uncemented	484	30	68 (61-73)	55	4.05 (2.56 - 6.35)	7.61 (5.3 - 10.87)	

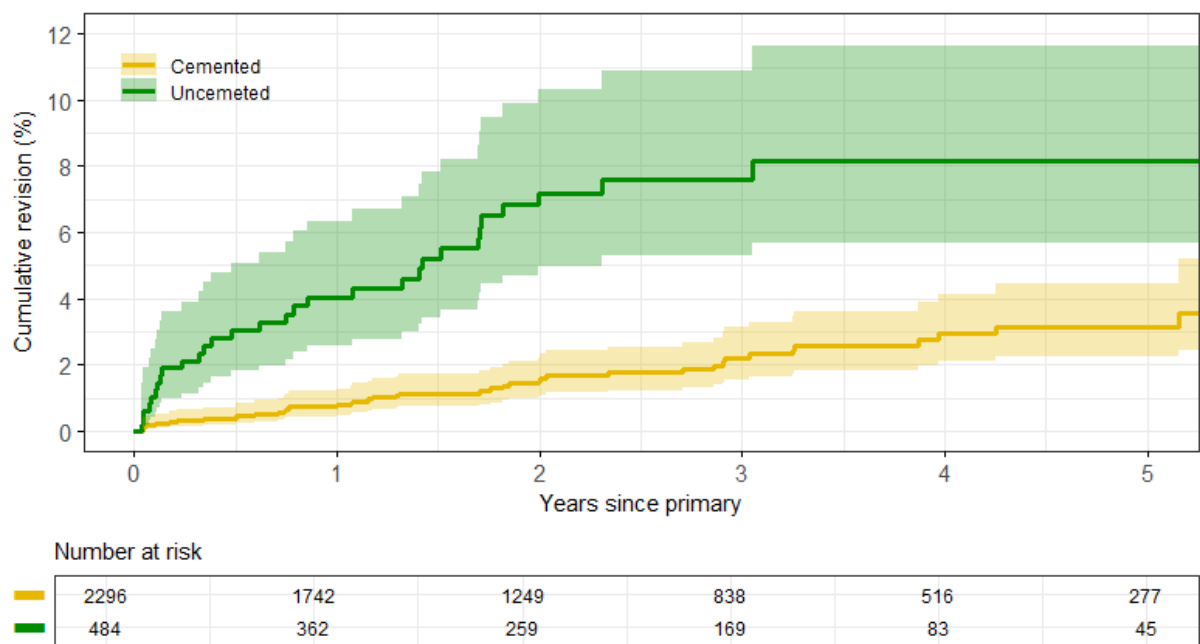


Figure 106: Cumulative revision rate of partial knee prostheses by fixation (Source: RES).

HR – adjusted for gender and age: cemented vs. uncemented, HR = 0.28 (95% CI 0.18–0.45), p < 0.001

Figure 106 shows that uncemented partial knee prostheses have a higher probability of revision than cemented ones. Although uncemented prostheses account for only 16.9% of cases, the uncemented Uni Score endoprosthesis demonstrates notably poor outcomes (Table 41).

8.5 Comparison of total and partial knee prostheses

Table 44: One-, three-, and five-year cumulative revision rates of knee prostheses by prosthesis type, with 95% confidence intervals (CI) (Source: RES).

Prosthesis type	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All knee endoprotheses	20571	493	70 (64-76)	61	1.28 (1.13 - 1.45)	2.89 (2.63 - 3.19)	3.73 (3.38 - 4.11)
Total	17729	419	71 (64-76)	62	1.28 (1.11 - 1.46)	2.84 (2.56 - 3.15)	3.67 (3.3 - 4.08)
Partial	2842	74	68 (61-74)	55	1.28 (0.91 - 1.8)	3.26 (2.54 - 4.19)	4.15 (3.22 - 5.34)

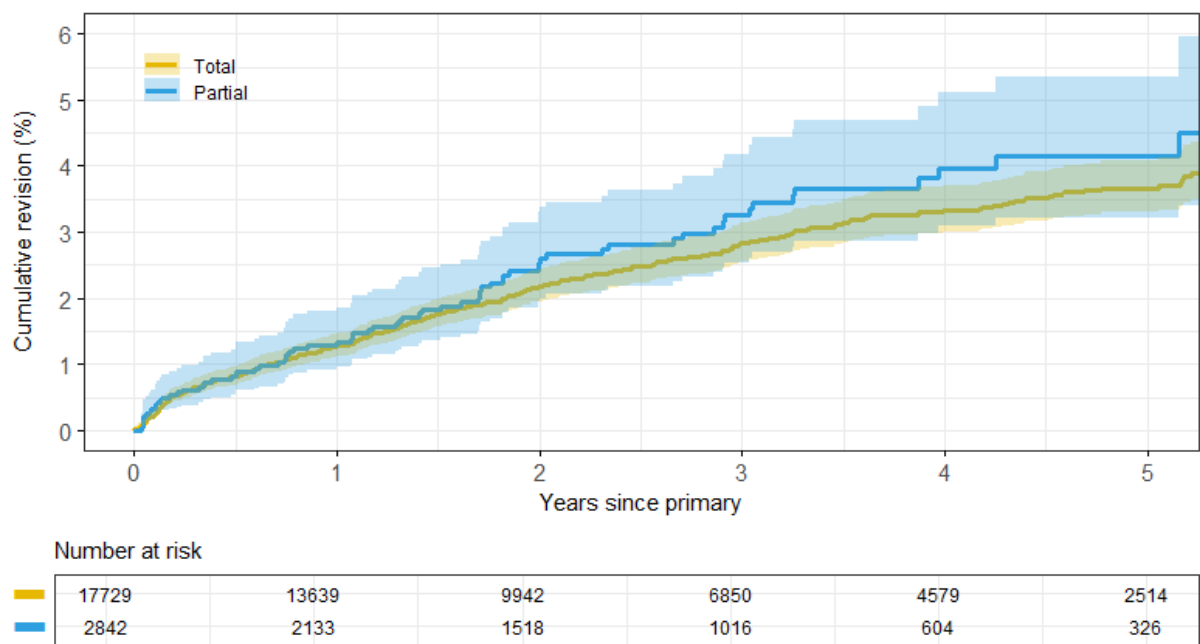


Figure 107: Cumulative revision rate of knee prostheses by prosthesis type (Source: RES).

HR – adjusted for gender and age: total vs. partial, HR = 0.92 (95% CI 0.72–1.18), p = 0.513

From Figure 107, it is evident that there is no difference in the probability of revision between total and partial knee prostheses.

8.5.1 Cemented knee prostheses

Table 45: One-, three-, and five-year cumulative revision rates of cemented knee prostheses by prosthesis type, with 95% confidence intervals (CI) (Source: RES).

Prosthesis type	Number of primaries	Number of first revisions	Age Median (IQR)	% of prostheses in women	Cumulative % of revisions (95% CI)		
					1 Year	3 Years	5 Years
All cemented knee prostheses	16885	405	71 (64-76)	62	1.27 (1.1 - 1.46)	2.95 (2.65 - 3.28)	3.82 (3.43 - 4.25)
Cemented total	14559	363	71 (65-76)	63	1.35 (1.17 - 1.56)	3.06 (2.74 - 3.42)	3.92 (3.5 - 4.39)
Cemented partial	2296	42	68 (61-74)	55	0.73 (0.44 - 1.21)	2.21 (1.56 - 3.13)	3.15 (2.23 - 4.44)

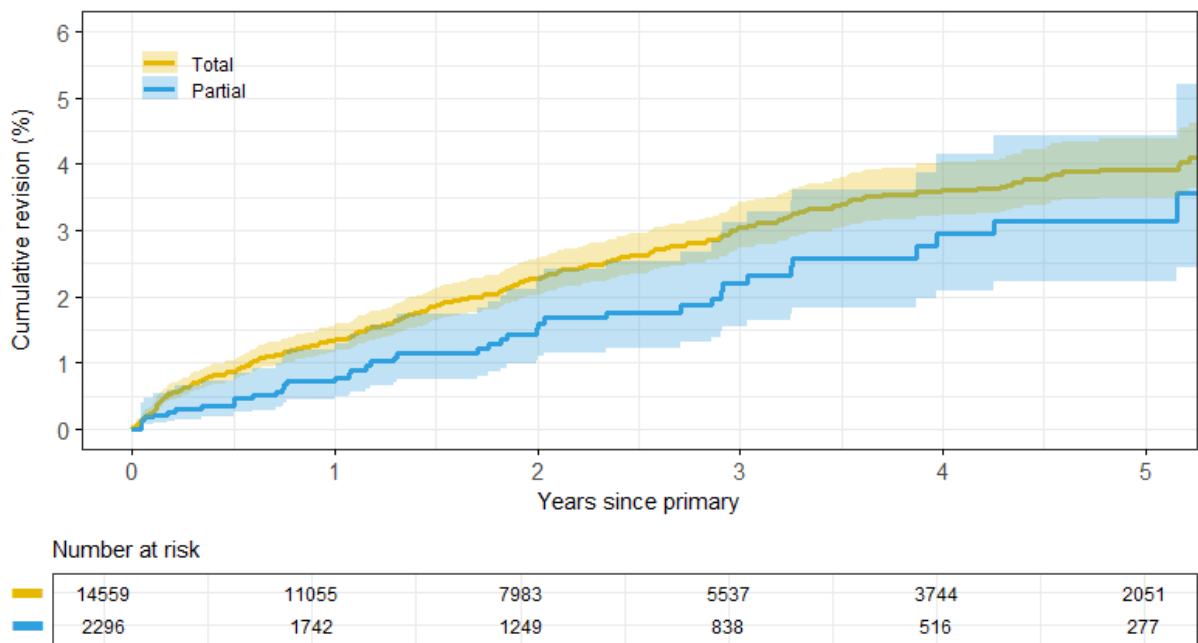


Figure 108: Cumulative revision rate of cemented knee prostheses by prosthesis type (Source: RES).

HR – adjusted for gender and age: total vs. partial, HR = 1.44 (95% CI 1.04–1.99), p = 0.026

From Table 45 and Figure 108, it is evident that cemented total knee prostheses show slightly worse outcomes than partial ones, even after adjustment for patient age and gender (p=0.026).

8.6 Summary of the RES registry analysis for knee arthroplasties

In 2024, the concordance (compliance) between the data of the Health Insurance Institute of Slovenia (ZZZS) and the National Arthroplasty Registry of Slovenia (RES) remains very high, with the exception of four institutions whose compliance is below 85%.

In the implant structure, we observe that slightly fewer uncemented knee prostheses were implanted in 2024 (14.1%) compared with the period 2019–2023 (18.2%). The medial parapatellar approach remains by far the most common surgical approach, used in 98.3% of cases. Partial knee prostheses (PKA) accounted for 15.1% of all implantations, representing a slight increase compared with previous years. The average age at surgery is 2.8 years higher in patients receiving a total knee prosthesis than in those receiving a partial knee endoprosthesis.

Postoperative mortality after knee surgery remains exceptionally low—0.21%, which is lower than the mortality observed after total hip arthroplasty.

The postoperative improvement in the Oxford Knee Score (OKS) six months after surgery was two points higher in total knee endoprostheses compared with partial prostheses. No statistically significant differences in PROM changes were observed between genders or across age groups.

Infection has been the most common cause of knee endoprosthesis revision throughout all years of follow-up. In 2024, it accounted for 29.9% of all revision indications.

For total knee prostheses implanted between 2019 and 2024, infection is an even more prominent factor—accounting for 43.5% of all revisions. In partial prostheses during the same period, the leading cause of revision is loosening, present in 37.5% of cases.

The five-year cumulative revision rate for primary total knee prostheses is 3.67%, while it is slightly higher for partial knee ones, at 4.15%. In particular, uncemented partial prostheses showed a markedly higher probability of five-year revision. This was mainly due to the poor performance of the uncemented Uni Score HA – Uni Score FB prosthesis, with a five-year revision rate of 11.87% (95% CI: 7.64–18.21).

The revision probability of uncemented total knee prostheses is lower than that of cemented ones. However, the cemented total endoprosthesis Attune CR – Attune FB tib (DePuy) has the lowest five-year revision probability at 0.5%.

A combination with more than double the five-year revision probability is the Genus PS – Genus FB tib (Adler Ortho): 7.95% (95% CI: 4.71–13.24). This combination is no longer in use. Particularly poor is the three-year revision probability of the Persona CR – Persona tibial (Zimmer Biomet) combination: 10.06% (95% CI: 6.44–15.56). A more detailed analysis of these combinations conducted a year ago showed that both were used predominantly in individual institutions, which may have influenced the results.

9 Publications in 2025

9.1 Original scientific article

- ROŠKAR, Samo, LEVAŠIČ, Vesna, BLAS, Mateja, KOVAČ, Simon. A single perioperative dose of dexamethasone is not associated with an increased risk of infection with hip or knee osteoarthritis considered for elective primary total hip or knee arthroplasty. *Arthroplasty today*. 2025, vol. 34, iss. [article no.] 101761, str. 1-5. ISSN 2352-3441. <https://pmc.ncbi.nlm.nih.gov/articles/PMC12269854/pdf/main.pdf>, DOI: 10.1016/j.artd.2025.101761. [COBISS.SI-ID 241063171], [SNIP, WoS, Scopus]
- GODICELJ, Žiga, KASTELIC, Jure, LEVAŠIČ, Vesna, KRAJNC, Zmago, MOLIČNIK, Andrej, NOVAK, Igor, NARANĐA, Jakob, ZAJC, Jan, FOKTER, Samo K. Comparison of mid-term survival of uncemented total knee arthroplasties with modular tibial components made of porous tantalum vs. cemented total knee arthroplasties. Expert review of medical devices. 2025, vol. 22, no. 12, str. 1415-1423, ilustr. ISSN 1745-2422. <https://www.tandfonline.com/doi/full/10.1080/17434440.2025.2569571>, <https://doi.org/10.1080/17434440.2025.2569571>, DOI: 10.1080/17434440.2025.2569571. [COBISS.SI-ID 252605443], [JCR, SNIP, WoS, Scopus]

9.2 Published scientific conference contribution

- LEVAŠIČ, Vesna, BLAS, Mateja, PODOVŠOVNIK, Eva, KOVAČ, Simon. 5 let Registra endoprotetike Slovenije (RES), spoznanja do sedaj. V: ŠUSTER, Katja (ur.), ROŠKAR, Samo (ur.), LEVAŠIČ, Vesna (ur.). *12. raziskovalni dan Ortopedske bolnišnice Valdoltra : zbornik*. Ankaran: Ortopedska bolnišnica Valdoltra, 2025.
- PODOVŠOVNIK, Eva, LEVAŠIČ, Vesna. Mnenja pacientov štejejo : Analiza izida zdravljenja pred in po primarni artroplastiki kolka ali kolena v OB Valdoltra. V: ŠUSTER, Katja (ur.), ROŠKAR, Samo (ur.), LEVAŠIČ, Vesna (ur.). *12. raziskovalni dan Ortopedske bolnišnice Valdoltra : zbornik*. Ankaran: Ortopedska bolnišnica Valdoltra, 2025.

9.3 Published scientific conference contribution abstract

- PODOVŠOVNIK, Eva, LEVAŠIČ, Vesna. Gender, age, and Oxford Knee Score as determinants of visual analogue scale : The case of the National Arthroplasty Registry of Slovenia. V: *14th International Congress of Arthroplasty Registries*. [S. n.]: The Piano, 2025.
- PODOVŠOVNIK, Eva, LEVAŠIČ, Vesna. Gender, age, type of arthroplasty, and EQ-5D-SL as determinants for visual analogue scale : The case of National Arthroplasty Registry of Slovenia. V: *14th International Congress of Arthroplasty Registries*. [S. n.]: The Piano, 2025.
- PODOVŠOVNIK, Eva, LEVAŠIČ, Vesna. Gender, age, and Oxford Hip score as determinants of visual analogue scale : The case of the National Arthroplasty Registry of Slovenia. V: *14th International Congress of Arthroplasty Registries*. [S. n.]: The Piano, 2025.
- PODOVŠOVNIK, Eva, LEVAŠIČ, Vesna, BLAS, Mateja. Gender and age determinants of patient-reported outcome measures: the case of The National Arthroplasty Registry of Slovenia. V: *Book of abstracts*.
- BLAS, Mateja, LEVAŠIČ, Vesna, PODOVŠOVNIK, Eva, KOVAČ, Simon. Survival analysis of standard and dual mobility primary total hip arthroplasty: first results from the National Arthroplasty Registry of Slovenia (RES). V: *Book of abstracts*.

10 Used literature

10.1 Annual reports of the registers

The National Arthroplasty Registry of Slovenia (RES) <https://www.res-nars.si/en>

Valdoltra Arthroplasty Registry <https://www.ob-valdoltra.si/sl/international>

The National Joint Registry (NJR) <https://reports.njrcentre.org.uk/>

Das Endoprothesenregister Deutschland (EPRD) <https://www.eprd.de/de/>

AOA National Joint Replacement Registry <https://aoanjrr.sahmri.com/home>

NZOA Joint Registry <https://www.nzoa.org.nz/nzoa-joint-registry>

The Swedish Arthroplasty Register <https://sar.registercentrum.se/>

10.2 References

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Prevolnik Rupel, V., & Ogorevc, M. (2020b). EQ5D5L Slovenian population norms. *Health and Quality of Life Outcomes*, 18(1). <https://doi.org/10.1186/s12955-020-01584-w>

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Van Reenen, M., Janssen, B., Stolk, E., Boye, K. S., Herdman, M., Kennedy-Martin, M., Kennedy-Martin, T., & Slaap, B. (2021). CHANGES INCLUDED in this update of the EQ5D5L User Guide Table of contents. www.euroqol.co