Register endoprotetike Slovenije

THE NATIONAL ARTHROPLASTY REGISTRY OF SLOVENIA (RES): 2022 REPORT(data from 2019 to 2021)

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Valdoltra Orthopaedic Hospital

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Partnering hospitals:

univerzitetni klinični center ljubljana
University Medical Centre Ljubljana

UKC MARIBOR Univerzitetni klinični center Maribor

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

Dr. Vesna Levašič, MD, PhD

Dear Sir/Madam,

We are pleased to present the third report of The National Arthroplasty Registry of Slovenia (RES), this time in a print-friendly format.

This year's data covers the entire year of 2021 and the monitoring of hip and knee endoprostheses for all three years, from the beginning of RES surgery, thus covering the period from 2019 to 2021.

I would like to express my gratitude to all public hospitals, both university medical centres, as well as those private institutions that provide data to the registry. I also extend my thanks to the entire RES team, composed of: Denia Savarin - Methodologist, Assoc. Prof. Dr. Eva Podovšovnik - Statistical Advisor, Helena Opara - Health Associate responsible for managing the implant library, Marjeta Bremec - Health Associate responsible for accurate data entry into the application, Milan Turk - IT engineer serving as a link between the register and the application developer, Bojana Lango Gomezel - expert ensuring user support and proper functioning of the application, and Asst. Prof. Dr. Simon Kovač - orthopaedic consultant carefully reviewing the report publications.

I wish to express my thanks also to the working group of the Slovenian Medical Association's Orthopaedic Society for their support, comments, and advice.

RES operates as a healthcare program under the Ministry of Health, with funding provided by the Health Insurance Institute of Slovenia (ZZZS).

The RES report is intended for patients, generic public, as well as physicians, orthopaedists, traumatologists, healthcare system planners, endoprosthesis manufacturers, and, of course, for comparisons with registries in Europe and around the world.

With the aim of making the information provided by the register accessible to everyone, we invite you to read the report.

Ankaran, December 2022

2 Introduction to statistical report

Assoc. Prof. Eva Podovšovnik, PhD

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

RES, with the amendment of the Act on Data Collections in the Field of Health Care (ZZPPZ-B), published in the Official Gazette no. 34 on 4 May 2018, received a legal basis for its functioning. The collection under serial number NIJZ 53.1 The National Arthroplasty Registry of Slovenia is managed by Valdoltra Orthopaedic Hospital (OB Valdoltra), which gives it the authority to collect data on hip and knee endoprostheses from all Slovenian public and private institutes that perform hip and knee arthroplasties, for insured persons at the Institute for Health Insurance of the Republic of Slovenia (ZZZS) and self-payers. The law came into force on 1/1/2019, therefore, from this day on, the 1st of every month, hospitals performing hip and knee arthroplasty must send completed forms, which can be found on the website of OB Valdoltra, with original implant labels and complete patient generals at RES, which is based in OB Valdoltra. Ever since the establishment of RES in January 2019, all entities that perform hip and knee arthroplasty in the territory of the Republic of Slovenia, regardless of the concession, are obliged to provide information on the surgeries performed. This data is collected on prescribed forms and then digitized. The data is submitted to the collection directly in electronic form or on paper in an agreed standard format (form[1]), or the administrator obtains it from health care hospitals.

Basic data on a patient[2] who has had a endoprosthesis or a part of it inserted, replaced or removed in the hip or knee joint is kept in the RES. In addition, data on the hospital[3], data on the inserted parts of the endoprosthesis[4], data on the surgery[5] and also data on the previous

[1] All necessary data reporting forms are available on the Valdoltra International Patients website https://www.ob-valdoltra.si/sl/international.

[2] The basic patient data entered in the RES are ZZZS health insurance number, unique social security number EMŠO, 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, residence for mail delivery), date and place of death, highest level of education, marital status and occupation.

[3] The following information about the hospital is entered in the RES: personal name, number of the health worker, ZZZS number of the orthopaedist, title, number of the hospital and ZZZS number of the hospital of the health activity where the intervention was performed.

[4] Data on the embedded parts of the endoprosthesis, which 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.

[5] The following information about the surgery is kept in the RES: date, side of the surgery, reason for the surgery - diagnosis or reason for revision, previous surgeries on the joint, operative approach and, in case of revision, its extent.

surgery[6], in case of removal of a previously inserted endoprosthesis or its part, are also kept in the RES. Data is stored permanently in RES.

Based on the ZZPPZ-B, all hospitals of public health services and other legal and natural persons, regardless of the concession, which perform the medical activity of arthroplasty of hips or knees are obliged to send the data on an ongoing basis. The RES manager can also obtain relevant data for the collection from the Central Population Register (CRP), the Register of Spatial Units of the Republic of Slovenia, the Register of Movements of Health Workers and the Network of Health Institutions, from the ZZZS from the Register of Insured Persons of Compulsory Health Insurance and the Central Registry of Patient Data (CRPP) at on the basis of the connecting character of the citizen's uniform identity number (EMŠO) or ZZZS number of the insured person.

Hospitals who perform the medical activity of arthroplasty for their patients and the National Institute of Public Health (NIJZ) are entitled to the access to collected data.

The RES collection is managed for:

- monitoring the survival[7] of inserted hip and knee joint endoprostheses,

- ensuring control over the quality of endoprosthetic surgeries,

- enabling quick detection of lower-quality endoprostheses,

- indirectly also reducing the costs of primary and revision hip and knee endoprosthesis surgeries,

- as a basis for clinical and epidemiological studies and expert analyzes and

- providing data for CRPP.

According to ZZPPZ -B, the manager (OB Valdoltra) is obliged to analyze the data obtained and prepare and publish periodic reports on its website, at least once a year. Separate reports were prepared for 2019 and 2020, providing key results for hip and knee arthroplasties for each year. All reports are published on the OB Valdoltra website (https://www.ob-valdoltra.si/sl/raziskovalna-dejavnost/register-endoprotetike-slovenije).

In this document, we present the analysis of data for 2021 and a comparative analysis for the period from 2019 to 2021. We must emphasize that the number of units in individual analyzes may differ due to missing data. We present this in more detail in each analysis separately. In the chapter on the research design, we describe the method of data acquisition. We then provide general information about hospitals and surgeries. Each chapter ends with an analysis of the success of endoprostheses of the hip and then the knee. This is followed by a concluding chapter with key findings and proposed measures.

[6] Regarding the previous surgery for the removal of a previously inserted endoprosthesis or its part, information about the date of the previous surgery, the institution and hospital of the previous surgery, 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

Asst. Prof. Dr. Simon Kovač, MD, PhD, orthopedic specialist

Dear,

In the report of the National Arthroplasty Registry of Slovenia (RES) for the years 2019-2021, we present data on 19,966 surgical procedures on the hip and knee. The report can be considered as composed of several parts. Firstly, we describe the performed surgeries in 2021, specifically for hip and knee arthroplasties. Then, we provide tables with data on the success rates of all collected primary implants and their revisions in the three-year period of 2019-2021.

The entire report is divided into the following areas:
- Primary total hip arthroplasty
- Primary partial hip arthroplasty
- Hip revision arthroplasty
- Primary partial and total knee arthroplasty
- Knee revision arthroplasty

Most of the report focuses on describing the work in Slovenian orthopedics in 2021, primarily for the purpose of comprehensive registry data collection. We anticipate that such entries will no longer be present in the coming years and that our focus will shift to the period from the establishment of the registry to the publication of the next report.

The data that are truly important for the registry and will be included in all future reports are provided in Chapters 5.5 - Performance Results of Hip Implants 2019-2021 and 6.4 - Performance Results of Knee Implants 2019-2021. These data are updated annually and serve as the basis for further analyses of the longevity of individual implant combinations.

An astute reader will immediately notice the difference, for example, in the number of recorded revisions performed in Slovenia in 2021. According to RES data, there were 299 hip revisions and 229 knee revisions. The main reason for revision in hip revisions is instability (30%), while deep infection is the primary reason for knee revisions (27%). However, if we consider only the primary hip operations in the past three years, Tables 3 and 4 show that out of 11,581 inserted hip (partial and total) implants, 181 implants were revised (1.56%). Similarly, as seen in Tables 5 and 6, out of 8,385 inserted primary knee (partial and total) implants, 136 were revised (1.62%).

Our task in the coming years will primarily involve analyzing the revisions of these implants, thus achieving the registry's goal of analyzing the quality of implants used in arthroplasty.

We are aware that there is still a lot of work ahead of us. In the transition to the RES application solution, we have spent considerable time verifying the reliability of the entered and analyzed data. We will address this by automating data collection and upgrading the software, allowing us to obtain the desired results more quickly.

4 Research design

RES obtains data directly from hospitals that perform knee and hip arthroplasty in the Republic of Slovenia. According to the Act on Data Collections in the Field of Health Care, they are obliged to send data on knee and hip arthroplasty performed on the prescribed forms at least once a month. The manager of RES then checks the consistency of the data with those held by ZZZS, which is the payer of this activity and has control over the actual interventions of this type.

Figure 1 shows the ratio (proportion) between received forms in the RES database and data on the number of knee and hip arthroplasties (ZZZS data). In doing so, we took into account the forms received in the RES database until December 31, 2022.

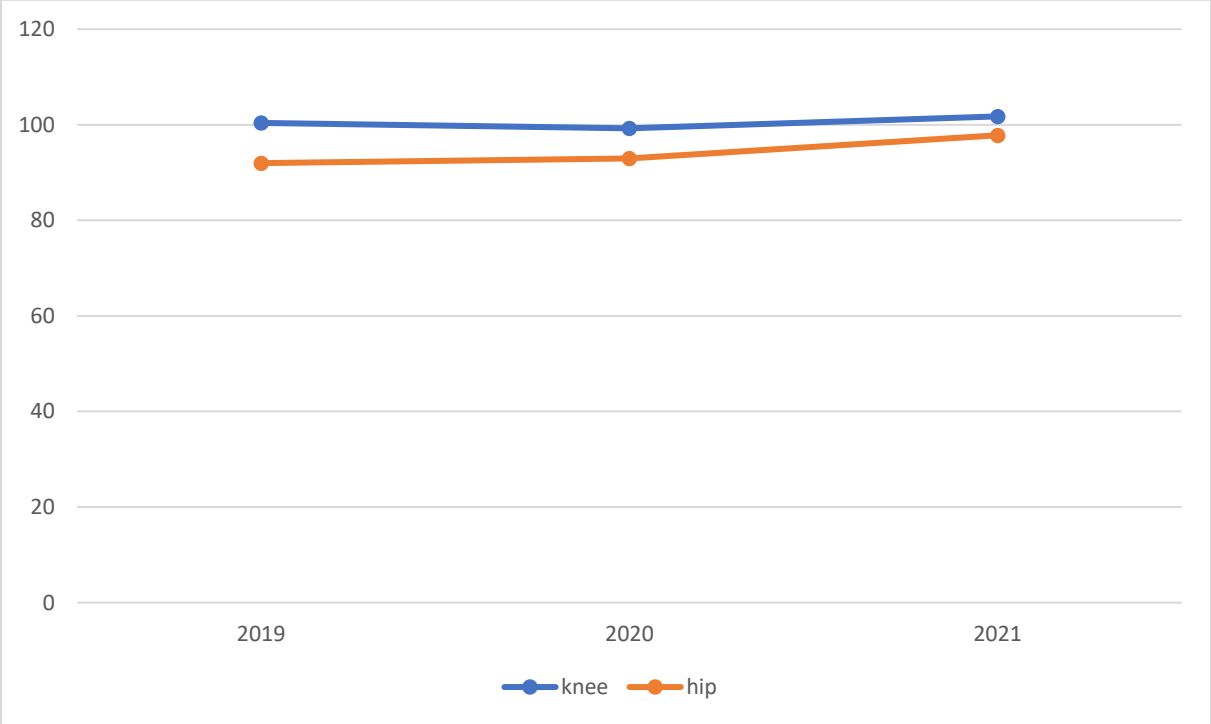


Figure 1: Ratio between forms received (RES) and hip and knee arthroplasties performed (ZZZS) (Source: RES and ZZZS).

Based on the obligation to submit data to the RES, we can assume that by 2021 we have achieved the compliance of 99.39% of all performed knee and hip arthroplasties. Here we can see that the ratio is slightly higher in the case of knee arthroplasties (101.74%[8]) than in the case of hip arthroplasties (97.79%).

We can also notice that since 2019, the ratio between the forms received in the RES database and the data from ZZZS has been constantly increasing. For knee arthroplasties, this ratio was 100.35% in 2019, 99.25% in 2020, and 101.74% in 2021. For hip arthroplasties, this ratio was 91.97% in 2019, 92.94% in 2020, and 97.79% in 2021.

On the basis of what has been written, we can conclude that the RES database has a high degree of comparability with the actual number of knee and hip arthroplasties, which allows us to generalize the obtained results at the national level.

[8] In the RES database, we have a larger number of data, since the unit of observation is each side of the hip or knee, while in the ZZZS database, the unit of observation is an individual surgery (in the case of a surgery on both hips or both knees, this is recorded as one unit of data).

4.1 Target population

Ever since the establishment of RES in January 2019, all hospitals who perform arthroplasty of knees and hips in the territory of the Republic of Slovenia, regardless of their concession, are obliged to provide information on the surgeries performed. This data is obtained on prescribed forms and then digitized. Table 1 shows a list of all entities that perform this activity in the Republic of Slovenia.

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

Table 1: List of hospitals who perform arthroplasty of knees and hips in the Republic of Slovenia (Source: OB VALDOLTRA)

Table 1 shows that there are 17 hospitals[9] in the Republic of Slovenia that perform arthroplasty of hips and knees. It should be noted here that data on the number of surgeries are obtained both through RES and from the records of ZZZS, which means that data on self-pay surgeries, which otherwise should also be obtained from hospitals under ZZPPZ-B, is missing.

It is clear that, despite the legal obligation to provide data, there are hospitals who do not provide the necessary data to RES at all (e.g. SB Trbovlje, Arbor Mea and MD Medicina).

4.2 Description of collected data

As part of RES, we collect the following data:

First, we collect basic information about the surgery, namely the date of the surgery, the hospital code and the hospital code.

We then collect basic information about the patient: his first and last name, date of birth, gender, his unique citizen registration number (EMŠO), health insurance number and hospital registration number. For data processing purposes, the individual's personal information is excluded from the analysis. In the analysis, we only take into account the gender and the individual's date of birth, from which we calculate his age at the time of surgery.

[9] We obtained information for SB Trbovlje and Arbor Mea through the records of ZZZS.

The following information varies depending on the type of arthroplasty and whether primary surgery or revision surgery was performed.

In the part of the questionnaire intended for primary surgeries, the side of the hip or knee surgery is recorded first. The following is information about the diagnosis, previous surgeries, current surgery, fixation of the prosthesis and the chirurgic approach used during surgery. This part is adapted to the type of endoprosthesis - hip or knee. In the last part of the primary endoprosthesis questionnaire, information about the implant is collected. In hip arthroplasty, information is collected about the acetabular part, stem, insert, neck and head. In addition, it is also recorded whether screws, wires and plates were used. In the case of knee endoprosthesis, data are recorded on the femoral part, tibial part, insert, patella and stem. As with hip arthroplasty, in the case of knee arthroplasty, whether screws, wires or plates were used is entered under the rest.

The form intended for the revision of knee and hip endoprostheses firstly contains information on which side was operated on. The information about previous surgeries on the same hip or knee (history) is collected: primary surgery, replacement surgery, removal surgery and date of primary surgery. Answers are adapted to the type of surgery (hip or knee). Next, data on the new implant is collected separately for hip and knee arthroplasty. In hip arthroplasty, there are issues related to the acetabular part, the insert, the femoral part, the neck and the head. Under other components, it is recorded whether screws, wires and plates were used. In the case of knee endoprosthesis, data are recorded on the femoral component, the tibial component, the insert, the patella and the stem. Among other components, it is recorded whether screws, wires and plates were used. In the following, for both knee and hip endoprostheses, the reasons for revision are listed, whereby one of the listed reasons is selected. For hip arthroplasty, information about the current surgery on that hip is then recorded: extent of revision, 2-level revision designation, conversion to total replacement, approach used, and other specifics. In the case of knee arthroplasty, the extent of revision and the chirurgical approach used are recorded. In the last part of the questionnaire, information is given about the removed part of the prosthesis, separately for hip and knee endoprosthesis. For hip arthroplasty, we collect information on the acetabular part, insert, ring, femoral part, femoral neck, and femoral head by manufacturer. In the case of knee endoprosthesis, the questionnaire contains information on the femoral component, tibial component, insert, patella and stem according to the manufacturer.

4.3 Statistical analysis

In the case of categorical variables, we will examine frequency distributions. We will give the frequency and percentage of each occurrence on the variables.

For numerical variables, we will first look at the distribution of the variables. In doing so, we will use the Kolmogorov-Smirnov test, taking into account the 5% significance level. In the case of normality of the distribution, we will calculate arithmetic means and standard deviations. In the case of a distribution that is not approximately normal, we will calculate the median and interquartile rank.

The differences between individual groups were estimated using 95% confidence intervals for the arithmetic mean or median for numerical variables (patient age). Using the bootstrap method for 1000 samples, we will determine the median and estimate the lower and upper limits of the confidence interval for the median.

In the case of examining gender differences, we will calculate the HI-squared or Fisher's test (in the case of two dichotomous variables).

In case of examination of differences according to the hospital, we will calculate the HI-square test.

In all cases, we will take into account the 5% significance level for each calculated coefficients.

4.4 Used terminology

Primary partial hip arthroplasty refers to the initial (first) partial hip replacement surgery.

Primary total hip arthroplasty refers to the initial (first) total hip replacement surgery.

Revision hip arthroplasty refers to the revision surgery of a previously inserted hip endoprothesis where one or more prosthetic components are replaced, removed, or added.

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

Revision knee arthroplasty refers to the revision surgery of a previously inserted knee endoprothesis where one or more prosthetic components are replaced, removed, or added.

Revision burden is the number of revisions in a given time period x 100 / the sum of the number of primary and revision surgeries in the same period.

4.5 Abbreviations

CoC – ceramic on ceramic bearing surface

CoP – ceramic on polyethylene bearing surface

CoXP – ceramic on cross-linked polyethylene bearing surface

CRP – Central Population Register

CRPP - Central Registry of Patient Data

EMŠO – unique citizen identification number

IS – information system

IT - information technology

KS – Surgical centre

MoP – metal on polyethylene bearing surface

MoXP – metal on cross-linked polyethylene bearing surface

MZ - Ministry of Health

NIJZ – National Institute of Public Health

OB – Orthopaedic Hospital

PEP – Partial endoprosthesis

RES – The National Arthroplasty Registry of Slovenia

RES ID – identification number in The National Arthroplasty Registry of Slovenia

RS – Republic of Slovenia

SB – General Hospital

TEP – Total endoprosthesis

UKC – University Medical Center

ZZPPZ-B – The Healthcare Databases Act

ZZZS – The Health Insurance Institute of Slovenia

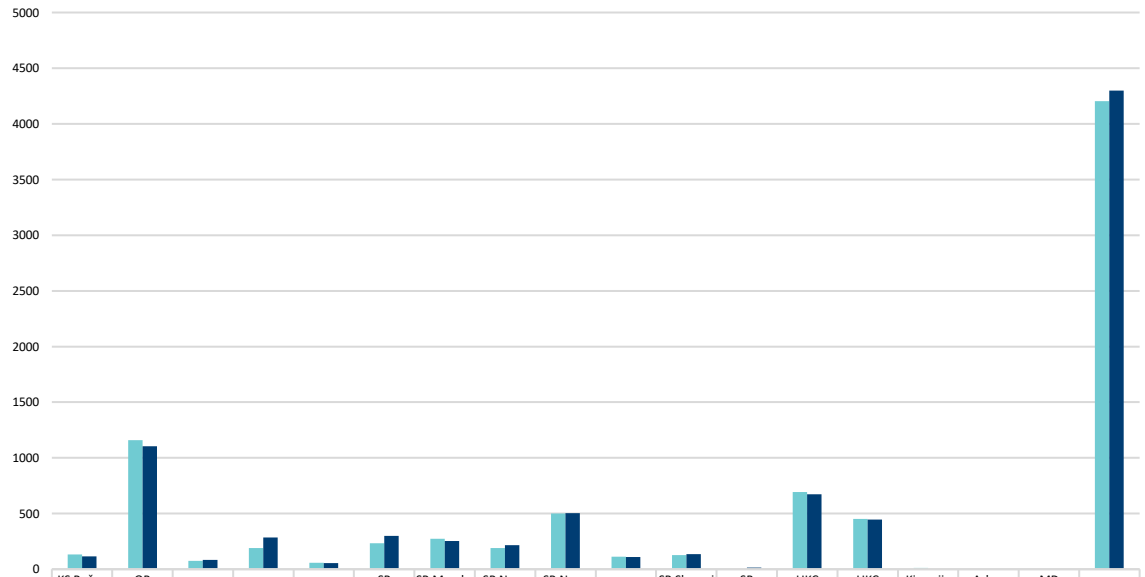
5 Hip arthroplasty

Hip arthroplasties are divided into three categories, namely primary total arthroplasty, primary partial arthroplasty and revision surgery.

In this chapter, we present the results on the compliance of the hip arthroplasty data obtained, the primary total hip arthroplasty data, the primary partial total hip arthroplasty data, and the revision hip arthroplasty data.

5.1 Compliance of obtained data for 2021

Compliance is the ratio between completed forms in the RES database for the year 2021 and the record of the number of hip arthroplasties by ZZZS, according to hospitals in the Republic of Slovenia. It should be noted that in the RES database we have data on individual surgeries according to the side of the surgery (in the case of simultaneous surgery on the left and right hip, two separate cases are recorded), while the ZZZS records data on patients or performed surgeries regardless of the side of the surgery (in the case of simultaneous surgery on the left and right hip, only one case is recorded). ZZZS also does not show primary hip arthroplasties and revision hip arthroplasties separately. The divergence therefore occurs due to the different methodology of handling the unit of study and due to non-reporting of data in the RES database.



	KS Rožna dolina	OB Valdoltra	SB Brežice	SB Celje	SB Izola	SB Jesenice	SB Murska Sobota	SB Nova Gorica	SB Novo mesto	SB Ptuj	SB Slovenj Gradec	SB Trbovlje	UKC Ljubljana	UKC Maribor	Kirurgija Bitenc	Arbor Mea	MD Medicina	Total
RES	132	1159	74	189	57	234	273	190	500	113	126	0	693	453	11	0	0	4204
ZZZS	117	1106	84	284	56	299	253	215	504	109	137	16	674	445			0	4299

Figure 2: Data on the number of primary partial, total and revision hip arthroplasties performed in 2021 - comparison of RES and ZZZS.

From Figure 2, we can see that ZZZS has 4,299 hip arthroplasties recorded for 2021, while RES has 4,204 hip arthroplasties recorded in the database, which amounts to 97.8% compliance.

In most hospitals, the number of hip arthroplasties in the RES database is always slightly higher than in the ZZZS database, which is due to the different methodology of treating the unit in question. The only exceptions are SB Brežice and SB Novo mesto, where slightly fewer units are recorded in the RES database than in the ZZZS database.

In the ZZZS database for SB Celje[10], SB Jesenice[11] and SB Nova Gorica[12], there is a slightly higher number of recorded surgeries in ZZZS than in RES. SB Trbovlje does not submit data to RES at all. The latter reasons prevent us from generalizing the obtained results to all hip arthroplasties performed on Slovenian patients in 2021.

5.2 Primary total hip arthroplasties

For the year 2021, we have recorded data in the RES database for 3,331 such surgeries performed in the Republic of Slovenia.

First, we will present the results of the analyzes based on the characteristics of the patients, the surgery, and then on the characteristics of the inserted prosthesis. In doing so, we also examined the differences according to the gender of the patients, their age at the time of the surgery, and the hospital of the surgery.

5.2.1 Primary total hip arthroplasties according to patient data

First, we examined the distribution of primary total hip arthroplasties according to patient gender and age at surgery.

5.2.1.1 Primary total hip arthroplasties according to patient gender

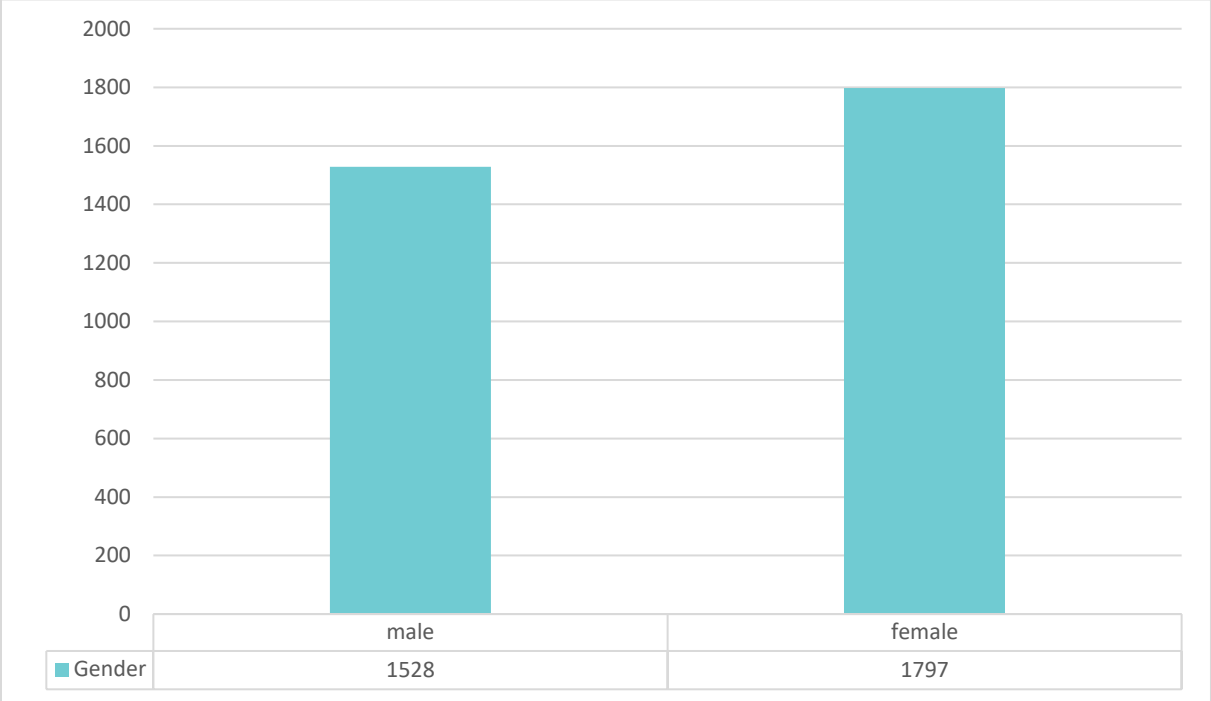


Figure 3: Primary total hip arthroplasties by gender of patients (Source: RES).

[10] In the case of SB Celje, we can see in the RES database that we have data for 162 total and only 7 partial hip arthroplasties. We can conclude that data is not sent to the RES database from the traumatology department of SB Celje.
[11] In the case of SB Jesenice, we can see in the RES database that we have data for 221 total and only 2 partial hip arthroplasties. We can conclude that data is not sent to the RES database from the trauma department of SB Jesenice.
[12] In the case of SB Nova Gorica, we can see in the RES database that we have data for 137 total and only 49 partial hip arthroplasties. We can conclude that they did not send data to the RES database about all performed surgeries of this type.

In the RES database for 2021, there is no data on the gender of 6 (0.2%) patients who underwent primary total hip arthroplasty in 2021.

From the RES database, we can see that in 2021, 1,528 (46%) men and 1,797 (54%) women underwent a primary total hip arthroplasty.

5.2.1.2 Primary total hip arthroplasties according to patient age at surgery

We calculated the age of the patients at the time of surgery. Age in years is shown in the figure below.

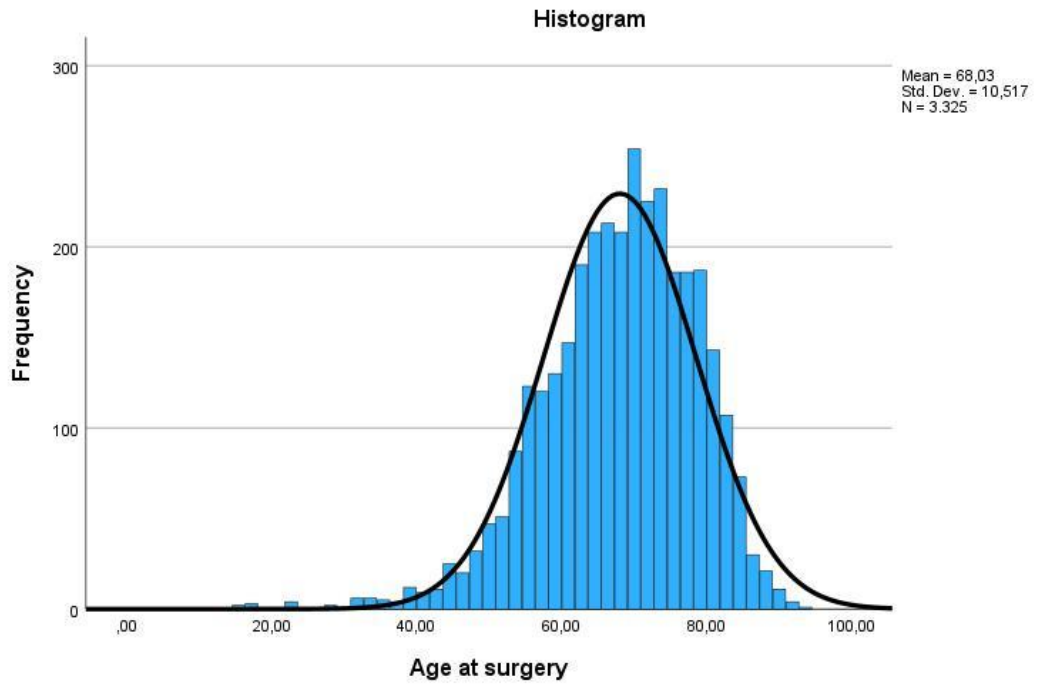


Figure 4: Primary total hip arthroplasties according to the age of the patients at the time of surgery (Source: RES).

In the RES database for the year 2021, there is no information about the date of birth or about the date of surgery for 6 surgeries. We excluded these from further analysis.

Based on the Kolmogorov-Smirnov test ($p < 0.001$), we can conclude that the age of the patients at the time of surgery is not approximately normally distributed. For this reason, we used non-parametric tests and the calculation of the median as a measure of centrality in further analyses.

The median in this case is 69 years. The youngest patient was 15.4 years old at the time of primary hip arthroplasty, and the oldest was 94 years old.

5.2.2 Primary total hip arthroplasties by hospital

We reviewed the number of primary total hip arthroplasties by hospital. Hospitals are shown on the map of Slovenia according to the number of procedures performed.

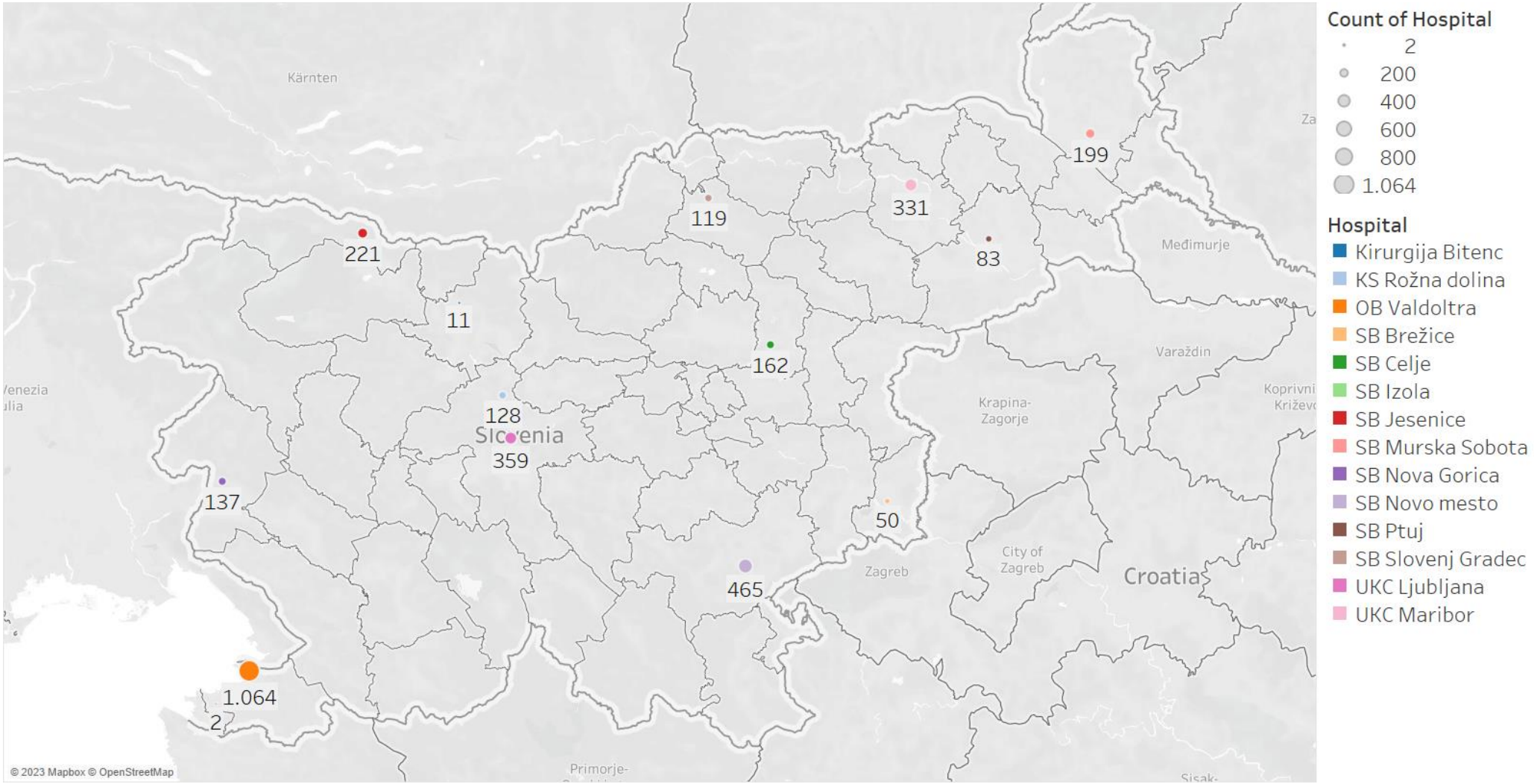


Figure 5: Primary total hip arthroplasties by hospital (Source: RES).

In the RES database for the year 2021, we received data on 1,064 (31.9%) primary total hip arthroplasties performed in OB Valdoltra, 465 (14%) in SB Novo mesto, 359 (10.8%) performed in UKC Ljubljana, 331 (9.9%) in UKC Maribor, 221 (6.6%) in SB Jesenice, 199 (6%) were carried out in SB Murska Sobota, 162 (4.9%) in SB Celje, 137 (4, 1%) in SB Nova Gorica, 128 (3.8%) in KS Rožna dolina, 119 (3.6%) in SB Slovenj Gradec, 83 (2.5%) in SB Ptuj, 50 (1.5%) in SB Brežice, 11 (0.3%) in Kirurgija Bitenc and 2 (0.1%) in SB Izola.

5.2.3 Primary total hip arthroplasties according to the characteristics of the current surgery

Primary total hip arthroplasties were also analyzed according to the characteristics of the surgery, namely the side of the surgery, the diagnosis at the time of the surgery, previous surgeries on the hip, the current surgery, fixation of the prosthesis and the approach used during the surgery.

5.2.3.1 Primary total hip arthroplasties by side of surgery

Figure 5 shows the side of the procedure in primary hip arthroplasty in 2021.

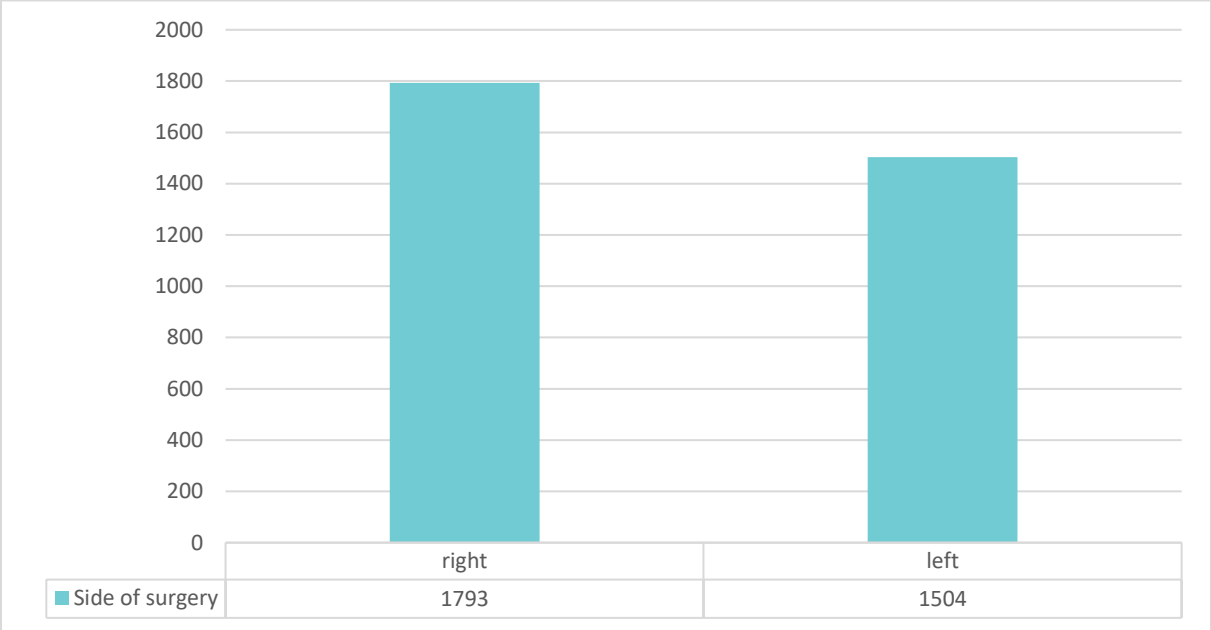


Figure 6: Side of surgery in primary total hip arthroplasty (Source: RES).

In the RES database, we have 3,331 primary total hip arthroplasties recorded for 2021. In 34 cases (1%), we do not have information on which side the surgery was performed. We excluded them from further statistical analysis.

In 1,793 recorded cases (54.4%), primary total hip arthroplasty was performed on the right side, and in 1,504 (45.6%) cases on the left side.

5.2.3.2 Primary total hip arthroplasties according to diagnosis at surgery

Figure 7 shows the distribution of diagnoses before primary total hip arthroplasty. One of the following diagnoses could be recorded: idiopathic arthrosis, dysplasia or LCC, posttraumatic, aseptic necrosis of the head, epiphysiolysis or post-Perthes, rheumatoid arthritis, ankylosing spondylitis and other diagnoses. The distribution of diagnoses for primary total hip arthroplasty is given in the figure below.

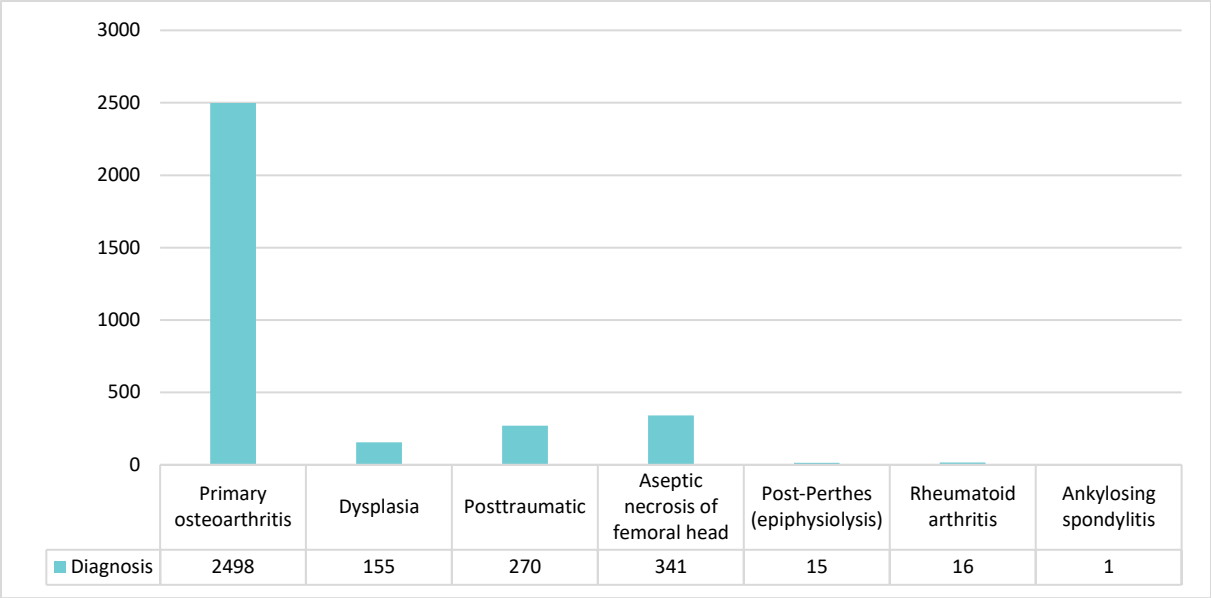


Figure 7: Diagnosis before primary total hip arthroplasty (source: RES).

In the RES database, we have 3,331 cases of primary total hip arthroplasty recorded for the year 2021. Other diagnoses were recorded in 35 (1.1%) cases[13]. We excluded them from further statistical analysis.

The majority, 2,498 or 75.8%, of recorded cases of primary total hip arthroplasty were performed due to idiopathic arthrosis. This is followed by fracture (270 or 8.2% of cases), aseptic necrosis of the head (341 or 10.3% of cases), dysplasia or LCC (155 or 4.7% of cases), rheumatoid arthritis (16 or 0.5% of cases), epiphysiolysis or post-Perthes (15 or 0.5% of cases) and ankylosing spondylitis (1 case).

5.2.3.3 Primary total hip arthroplasties in relation to endoprosthesis fixation

Figure 8 shows endoprosthesis fixation in cases recorded in the RES database for primary total hip arthroplasties. The endoprosthesis can be cemented, uncemented / cementless, hybrid or reverse hybrid. The distribution of responses is given in the figure below.

[13] No other possible diagnoses were identified.

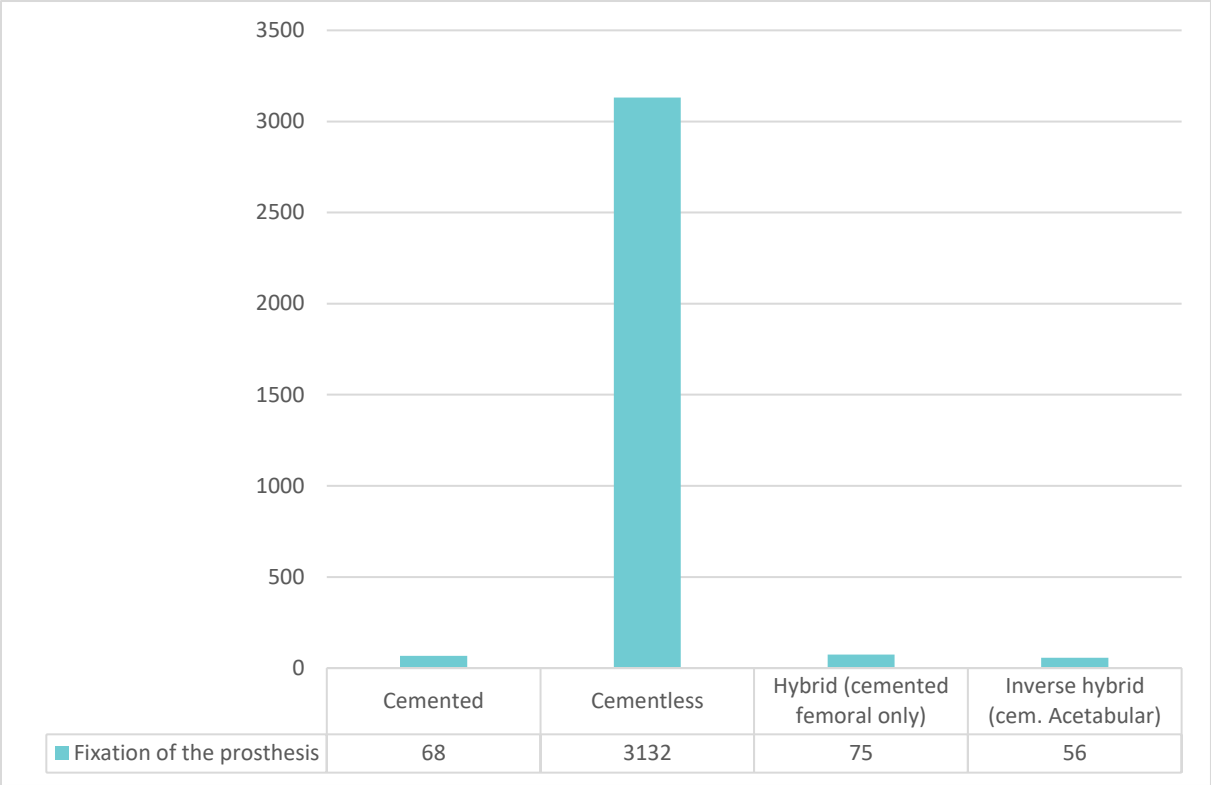


Figure 8: Fixation of the prosthesis in primary total hip arthroplasty (Source: RES).

Of the 3,331 registered cases of primary total hip arthroplasties in the RES database for 2021, the most, 3,132 or 94%, were uncemented, 75 (2.3%) hybrid, 68 (2%) cemented and 56 (1.7%) reverse hybrid prosthesis.

Figure 9 shows the association between prosthesis fixation in primary total hip arthroplasty and patient age. In 6 cases, we do not have information on the age of the patient and/or fixation of the prosthesis. We excluded them from the statistical analysis.

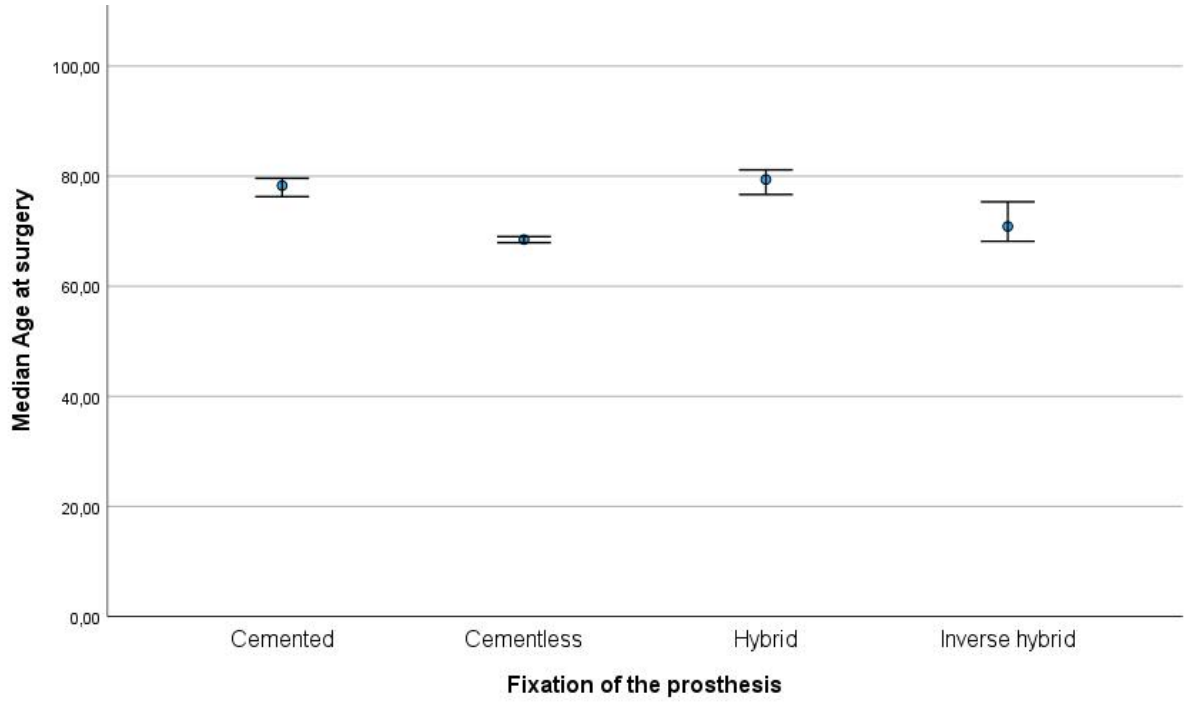


Figure 9: Fixation of the prosthesis in primary total hip arthroplasty by age of the patients at the time of surgery (Source: RES).

Figure 9 shows that there are statistically significant differences at the 0.05 significance level in the fixation of the prosthesis in primary total hip arthroplasty according to the age of the patients at surgery. Thus, we can see that the youngest patients with uncemented prosthesis fixation are in primary total hip arthroplasty ($67.9 < Me < 69.1$). Patients with inserted reverse hybrid prosthesis fixation are younger ($68.5 < Me < 74.5$) than those who were inserted with cemented ($76.3 < Me < 79.6$) or hybrid fixed prosthesis ($76.7 < Me < 81.2$).

In the figure below, we examined whether there is an association between fixation of the prosthesis in primary total hip arthroplasty and the hospital of the surgery.

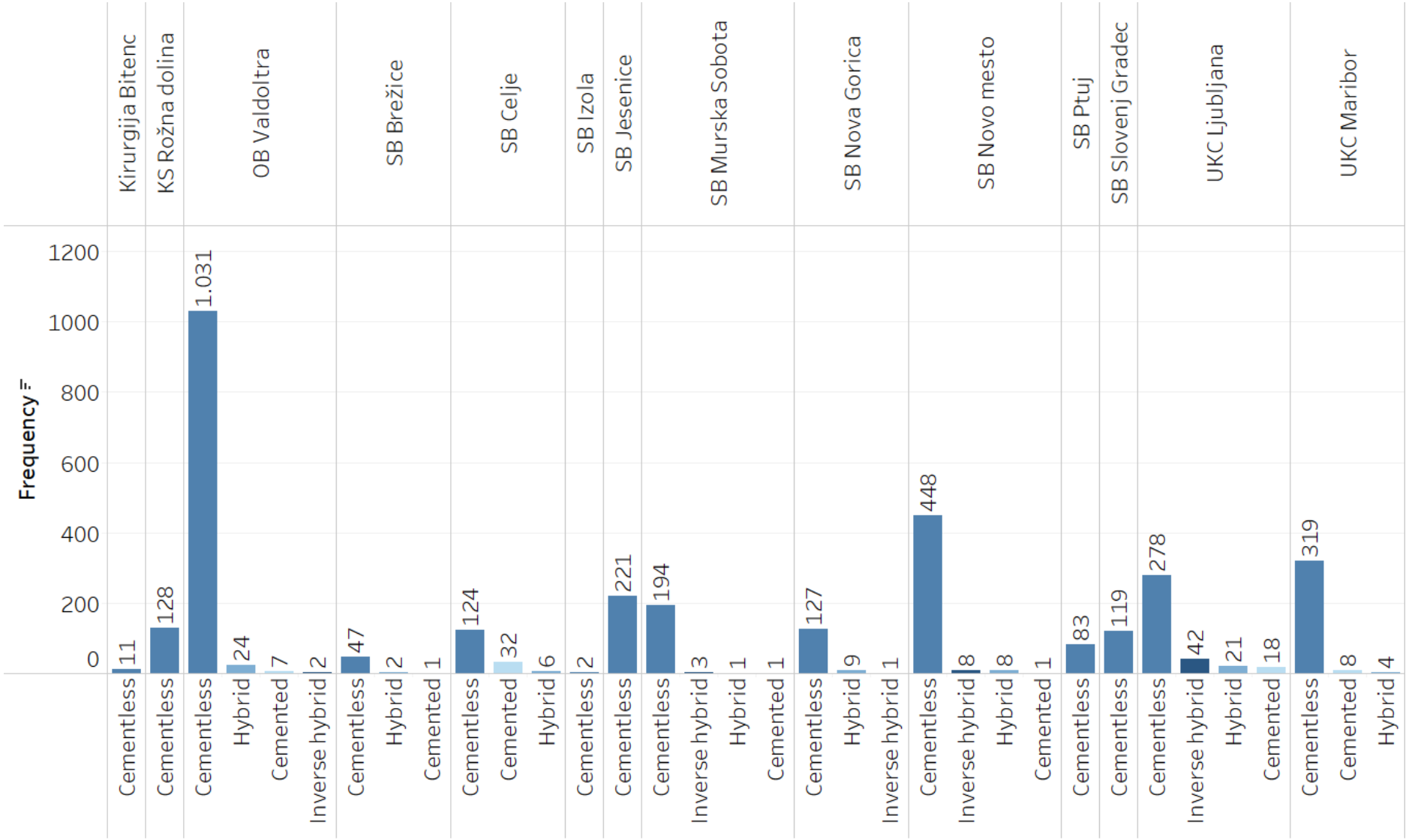


Figure 10: Fixation of the prosthesis in primary total hip arthroplasty by hospital (Source: RES).

The results of the Chi-square test ($X^2 = 618.1$, $p < 0.001$) suggest that there is an association between endoprosthesis fixation in primary total hip arthroplasty and the hospital, but the results due to a large number of cells with less than 5 units (55.4%) cannot be generalized.

5.2.3.4 *Primary total hip arthroplasties according to the chirurgical approach used*

In the following we describe (see figure below) the chirurgical approach used during primary total hip arthroplasty, namely this approach could be anterior, antero-lateral, direct lateral, postero-lateral or minimally invasive.

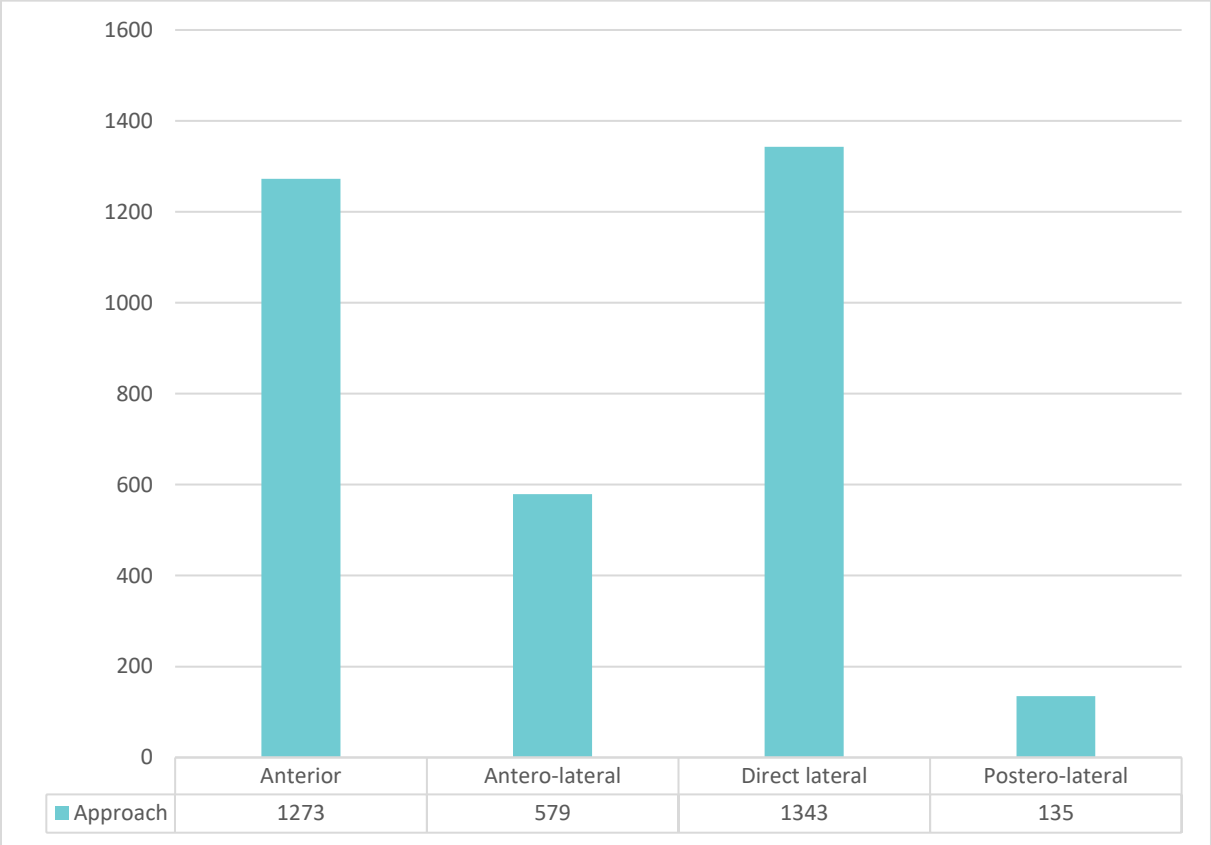


Figure 11: The chirurgicaol approach used in primary total hip arthroplasty (Source: RES).

In one case, we do not have information recorded in the RES database about which chirurgical approach was used during the primary total hip arthroplasty. We excluded it from further statistical analysis.

In 2021, among the registered cases in the RES database, a direct lateral approach was used for primary total hip arthroplasty (1,343, respectively 40.3%). They are followed by anterior approach (1,273 or 38.2%), antero-lateral approach (579 or 17.4%) and postero-lateral approach (135 or 4.1%).

Next, we looked at whether there was an association between the recorded approach used during primary total hip arthroplasty and the hospital of the surgery. In 1 case, we have no information about the hospital of the surgery and/or the chirurgical approach used. We excluded it from the statistical analysis. The results are given in the figure below.

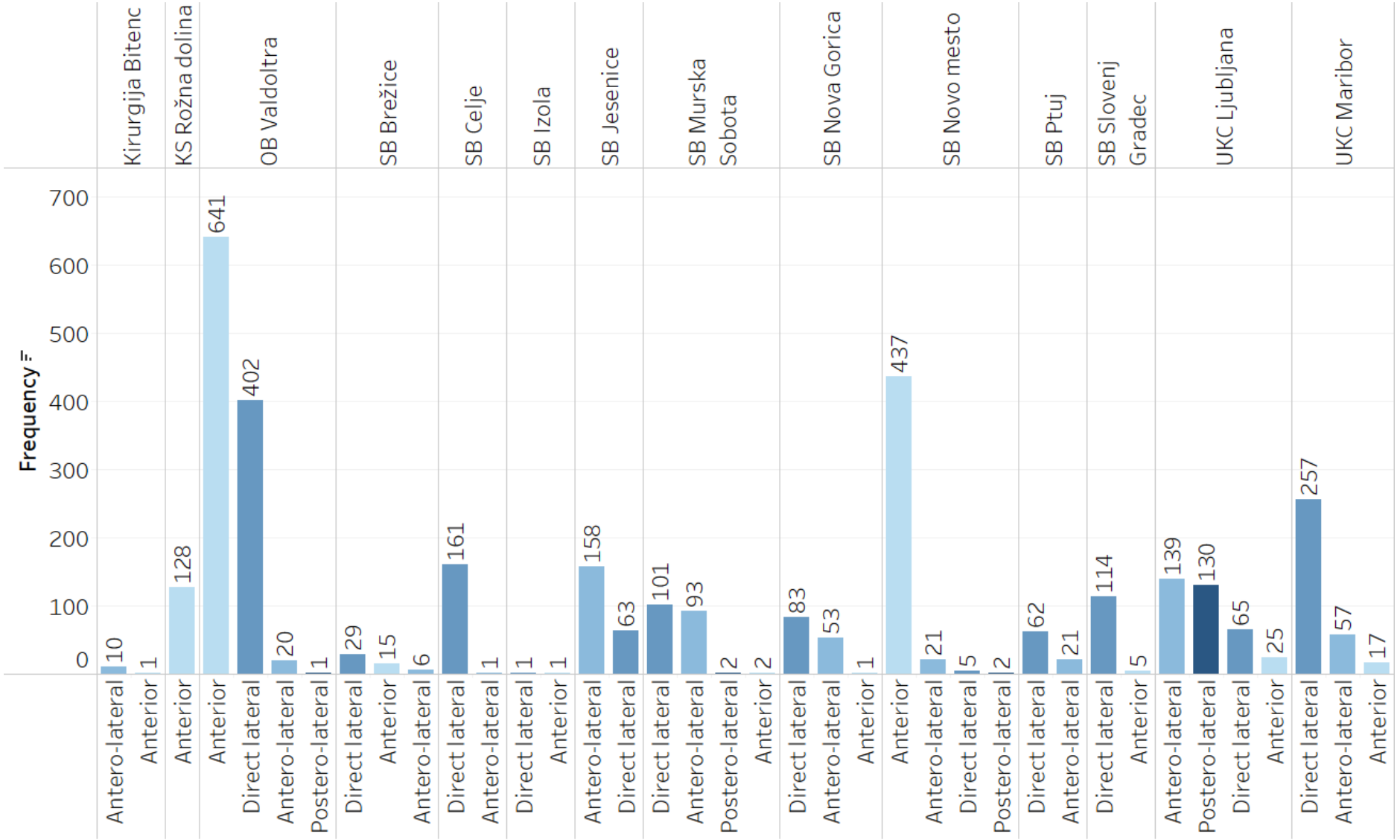


Figure 12: The approach used in primary total hip arthroplasty by hospital (Source: RES).

To verify the association, we used the HI-square test ($X^2 = 3774.4$, $p < 0.001$) and showed that there is a statistically significant association between the chirurgical approach used in primary total hip arthroplasty and the hospital of the surgery.

5.2.4 Primary total hip arthroplasties according to previous surgeries

In the following, we looked at whether the patients in question had previous surgeries on the hip on which primary total hip arthroplasty was performed in 2021. The results are presented in Figure 13.

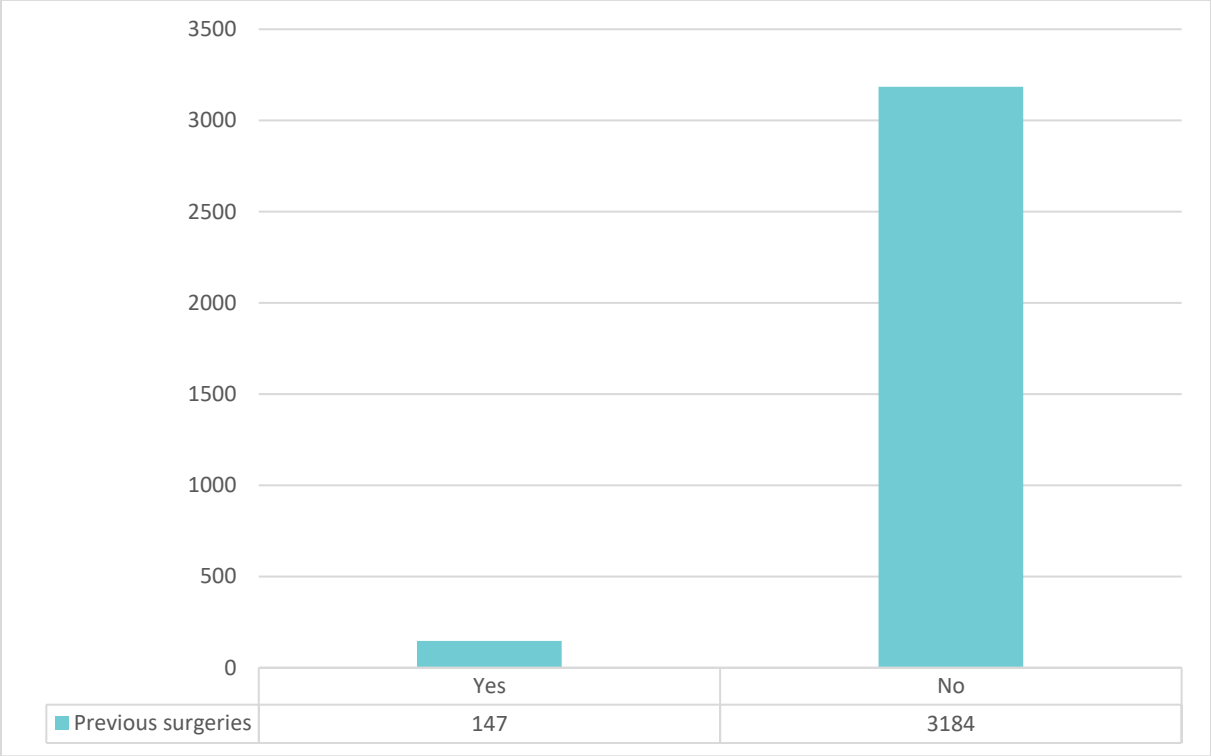


Figure 13: Previous surgeries on the hip that underwent primary total hip arthroplasty (Source: RES).

In the RES database, we have 3,331 primary total hip arthroplasties recorded for 2021.

In 95.6% (3,184) of primary total hip arthroplasties recorded in 2021, patients had no prior surgery on the affected hip, while in 147 (4.4%) cases patients had prior surgery on that hip.

In the following, in cases where it was stated that the patients had already had a previous surgery on the hip on which primary total hip arthroplasty was performed in 2021, we examined which surgeries they had. There were 147 such cases. The distribution can be found in the figure below.

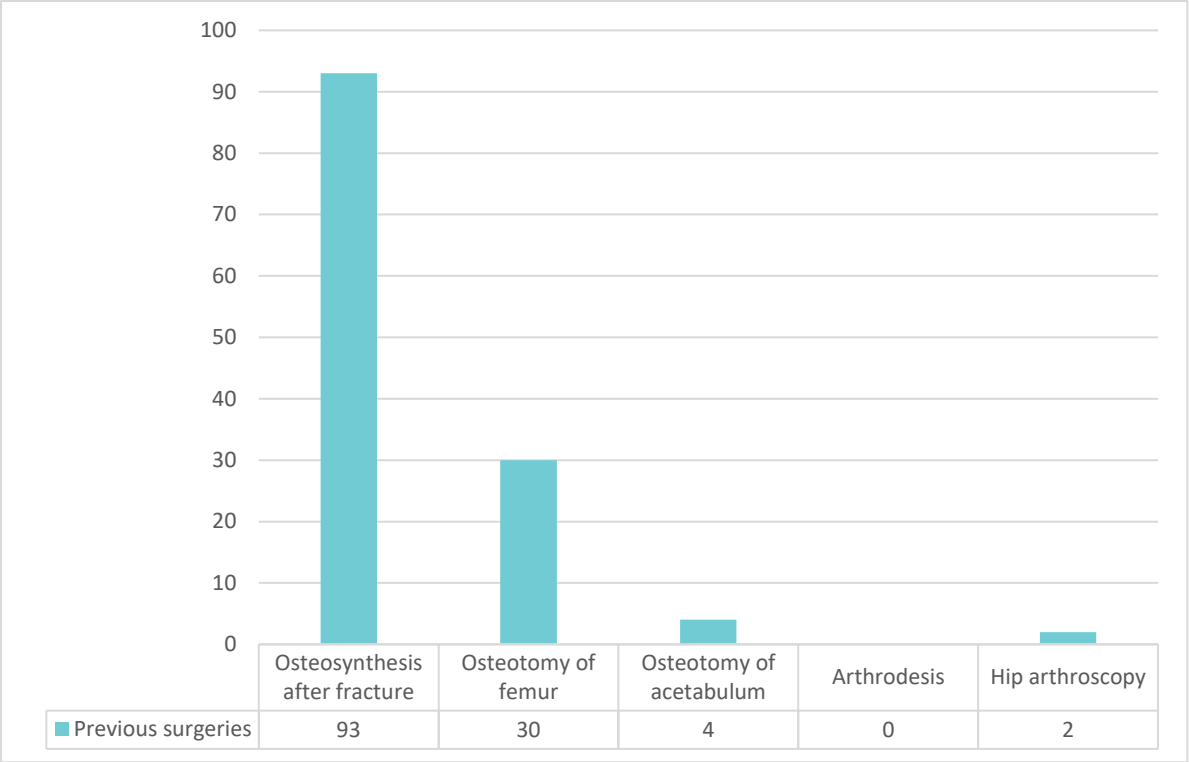


Figure 14: Type of previous surgery in primary total hip arthroplasty (Source: RES).

In 147 recorded cases in the RES database for 2021, it is recorded that in this current primary total hip arthroplasty, the patients had already had previous surgeries on this hip. Other surgeries were listed in 18 cases. In the other cases, no surgery was indicated. Other surgeries and non-responses were excluded from the analysis.

93 (63.3%) had post-fracture osteosynthesis, 30 (20.4%) had femoral osteotomy, 4 (2.7%) had acetabular osteotomy and 2 (1.4%) had arthroscopy the hip.

5.2.5 Primary total hip arthroplasties by implant manufacturer

In the next chapter, we will review primary total hip replacements in 2021 by implant manufacturer.

5.2.5.1 Primary total hip arthroplasties by femoral stem manufacturer

The distribution of manufacturers of the inserted stem in primary total hip endoprostheses recorded in the RES database for 2021 is given in the figure below.

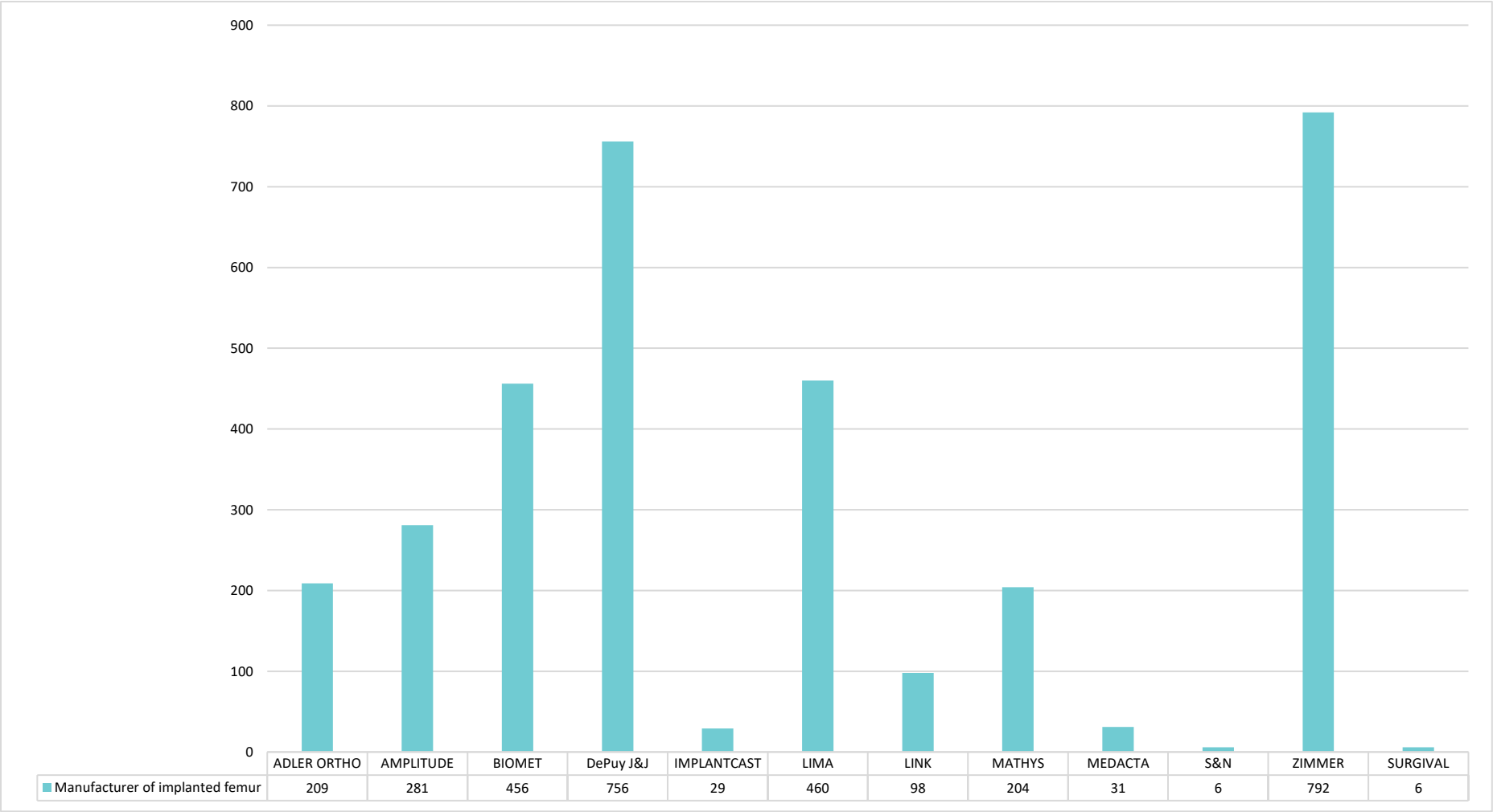


Figure 15: Femoral stem manufacturers in primary total hip arthroplasties (Source: RES).

In 3 (0.1%) cases in the RES database for 2021, we do not have information on the manufacturer of the femoral stem in primary total hip arthroplasties. We excluded them from further statistical analysis.

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

Next, we looked at whether there was an association between the manufacturers of the stem that was inserted into the patient during primary total hip arthroplasty and the hospital of the surgery. In 3 cases, we did not get information about the manufacturer of the stem implant and/or the hospital of the surgery. We excluded them from the statistical analysis. The results are presented in the figure below.

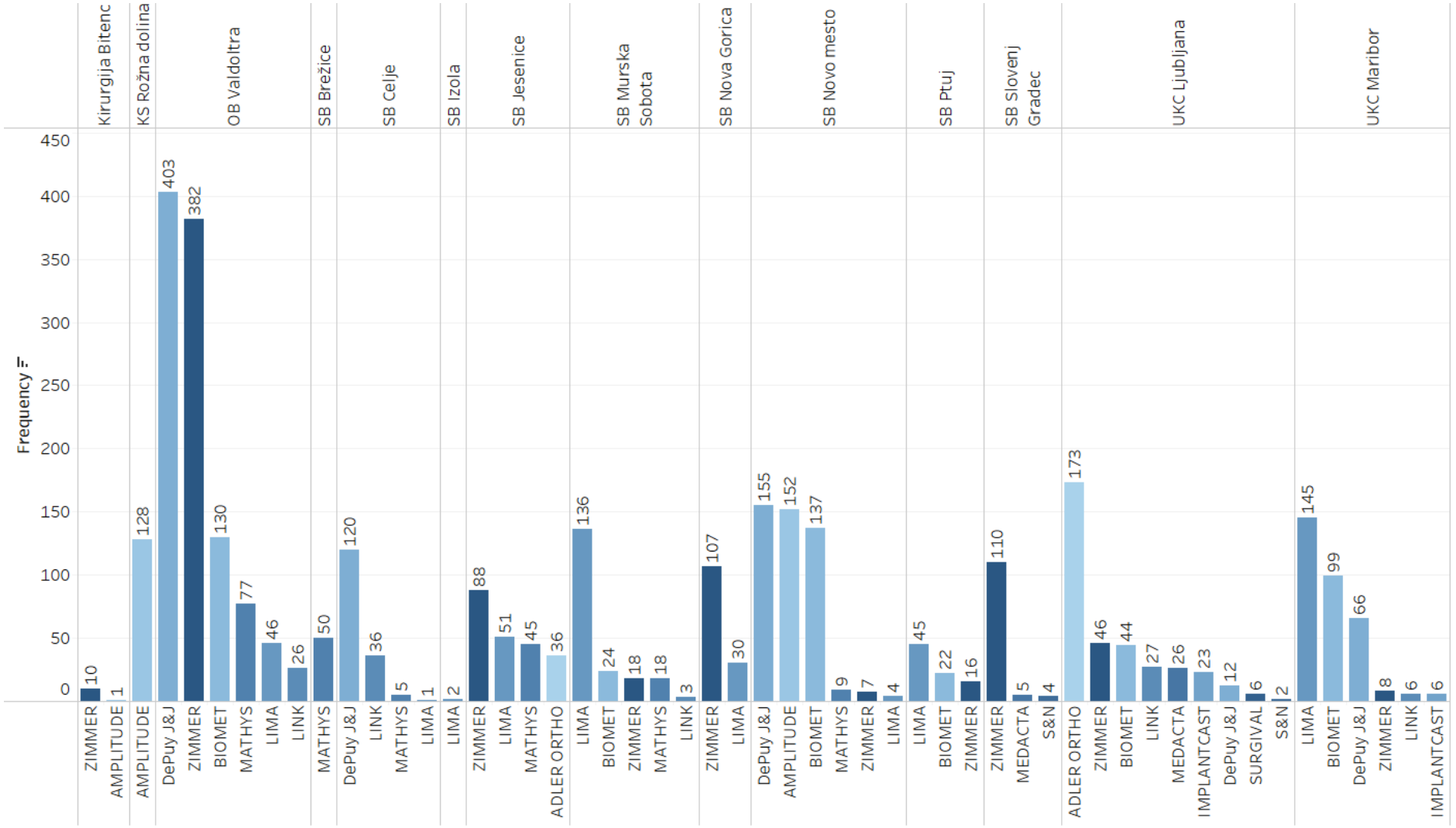


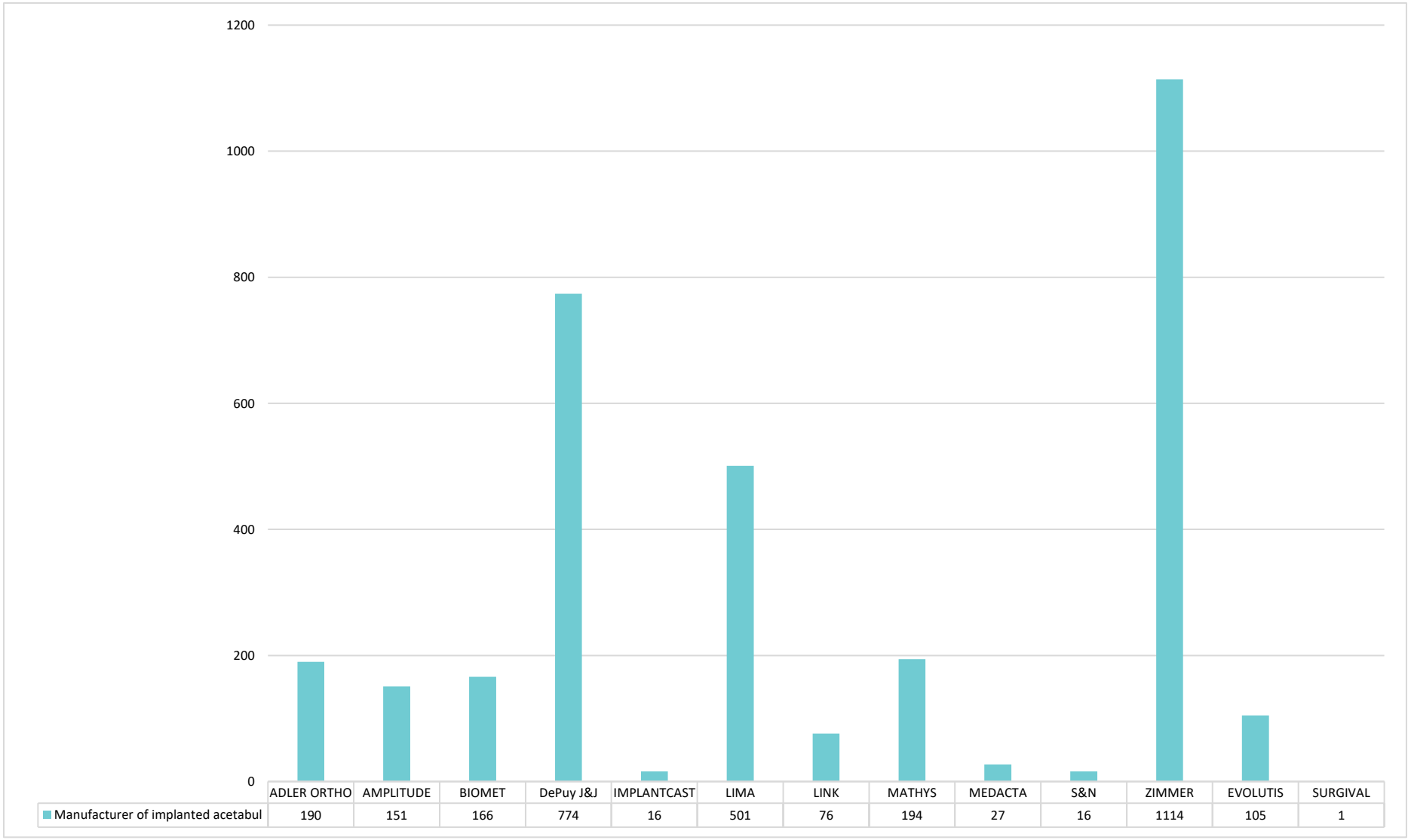
Figure 16: Manufacturers of implanted stems in primary total hip arthroplasties by hospital (Source: RES).

We should not generalize the results of the HI-squared test, as we have an excessive number of cells with less than 5 units (47%).

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

5.2.5.2 Primary total hip arthroplasties according to manufacturer of inserted acetabulum

The distribution of manufacturers of the inserted acetabulum in primary total hip endoprostheses recorded in the RES database for 2021 is given in the figure below.



	ADLER ORTHO	AMPLITUDE	BIOMET	DePuy J&J	IMPLANTCAST	LIMA	LINK	MATHYS	MEDACTA	S&N	ZIMMER	EVOLUTIS	SURGIVAL
Manufacturer of implanted acetabul	190	151	166	774	16	501	76	194	27	16	1114	105	1

Figure 17: Implanted acetabulum manufacturers in primary total hip arthroplasties (Source: RES).

In 4 cases in the RES database for the year 2021, we did not have information about the manufacturer of the primary total hip arthroplasty acetabulum. We excluded this unit from further analysis.

Most often, 1,114 times or 33.4%, the manufacturer of the acetabular implant in primary total hip arthroplasty was ZIMMER. It is followed by the following manufacturers: DePuy J&J (774 or 23.2%), LIMA (501 or 15%), MATHYS (194 or 5.8%), ADLER ORTHO (190 or 5.7%), BIOMET (166 or 5 %), AMPLITUDE (151 and 4.5% respectively), LINK (76 and 2.3% respectively), MEDACTA (27 and 0.8% respectively), IMPLANTCAST (16 and 0.5% respectively), S&N (16 and 0.5% respectively %), EVOLUTIS (105 and 3.2% respectively) and SURGIVAL (1 and 0.03% respectively).

In the last part of the review of results in primary total hip arthroplasties, we checked whether there is an association between the manufacturers of the implanted acetabulum and the hospital of the surgery. The results are shown in the figure below.

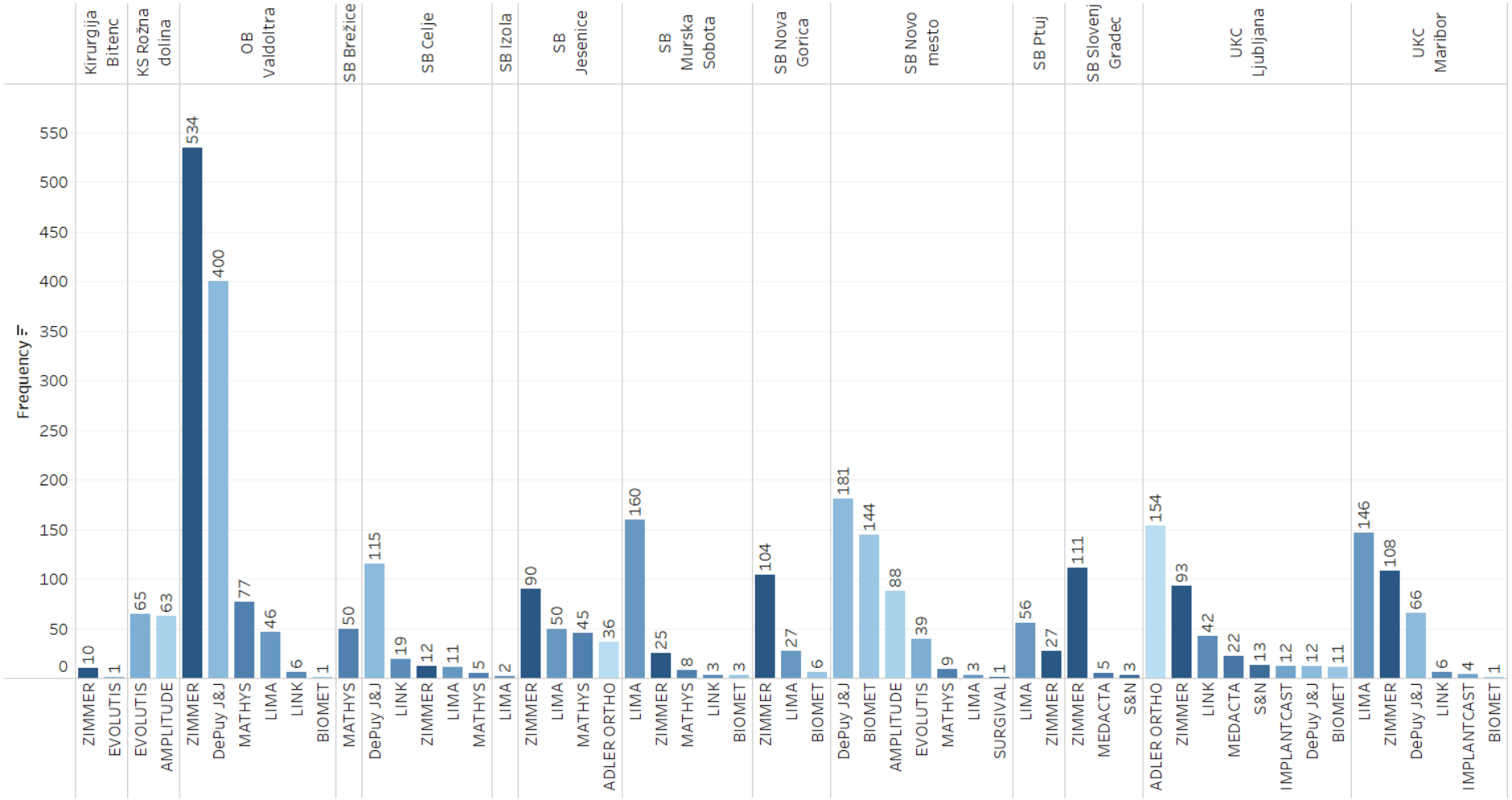


Figure 18: Implant acetabulum manufacturers in primary total hip arthroplasties by hospital (Source: RES).

We should not generalize the results of the HI-squared test, as we have an excessive number of cells with less than 5 units (50%).

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

5.2.5.3 *Primary total hip arthroplasties by implant head size*

We were also interested in the size of the inserted head in primary total hip arthroplasties (see figure below).

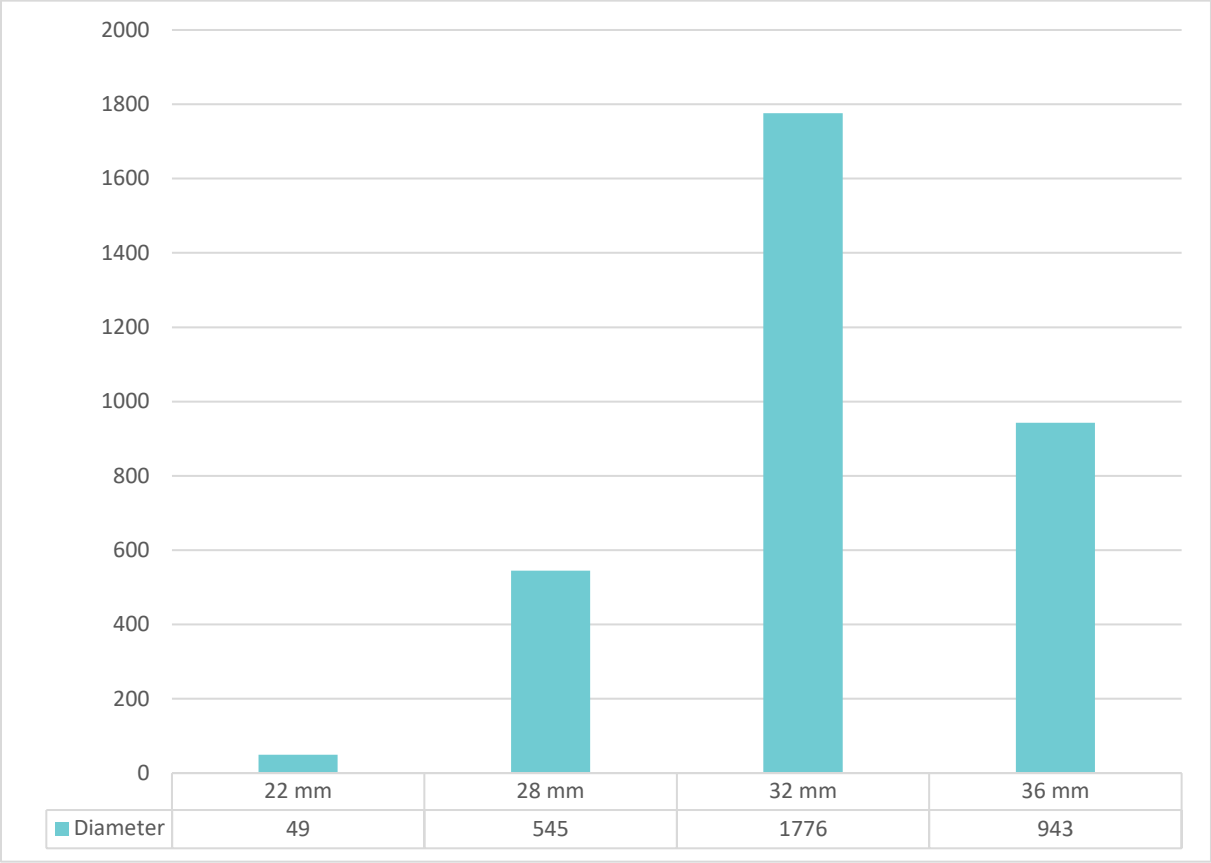


Figure 19: Head sizes used in primary total hip arthroplasty (Source: RES).

A head size of 32 mm is mostly used in total hip arthroplasty.

5.2.5.4 *Primary total hip arthroplasties according to the type of head-acetabulum bearing surface*

We checked the type of loading surface between the head and acetabulum of the total hip arthroplasty used in 2021.

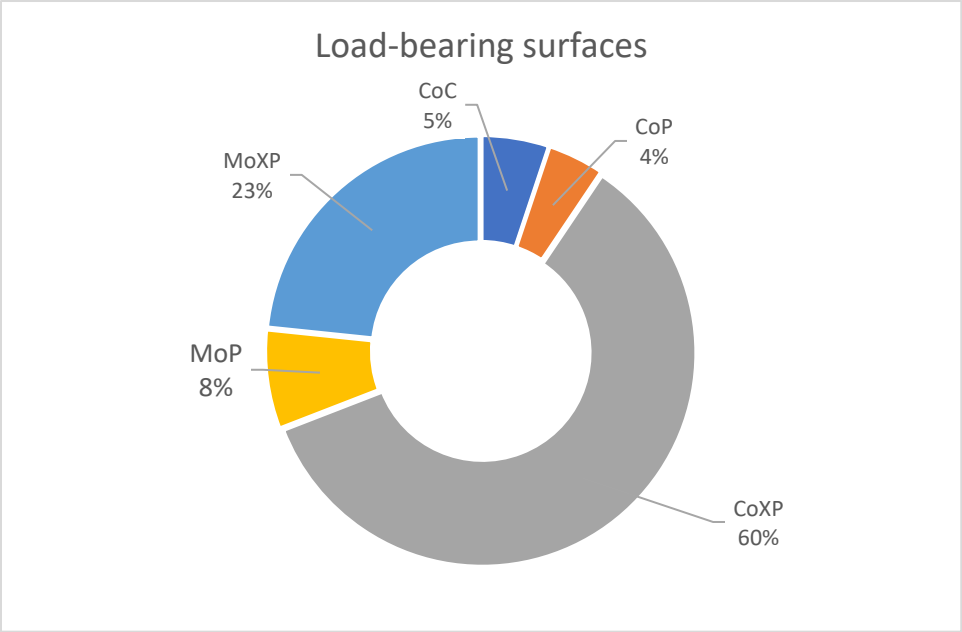


Figure 20: Load-bearing surfaces in primary total hip arthroplasty (Source: RES).

Ceramic on crosslinked polyethylene (CoXP) loading surface was used in 60%, followed by metal on crosslinked polyethylene (MoXP) in 23%, then metal on polyethylene (MoP) in 8%, ceramic on ceramic (CoC) in 5% and in 4% ceramic on polyethylene (CoP).

5.3 Primary partial hip arthroplasties

We present the characteristics of primary partial hip arthroplasties individually, as they are performed in trauma departments of hospitals. For the year 2021, we have recorded data in the RES database for 574 such surgeries performed in the Republic of Slovenia.

We examined differences based on patient, hospital, and characteristics of the surgery.

5.3.1 Primary partial hip arthroplasties according to patient data

First, we examined the distribution of primary partial hip arthroplasties according to patient gender and age.

5.3.1.1 Primary partial hip arthroplasties according to patient gender

We reviewed the distribution of primary partial hip arthroplasties by patient gender (see figure below).

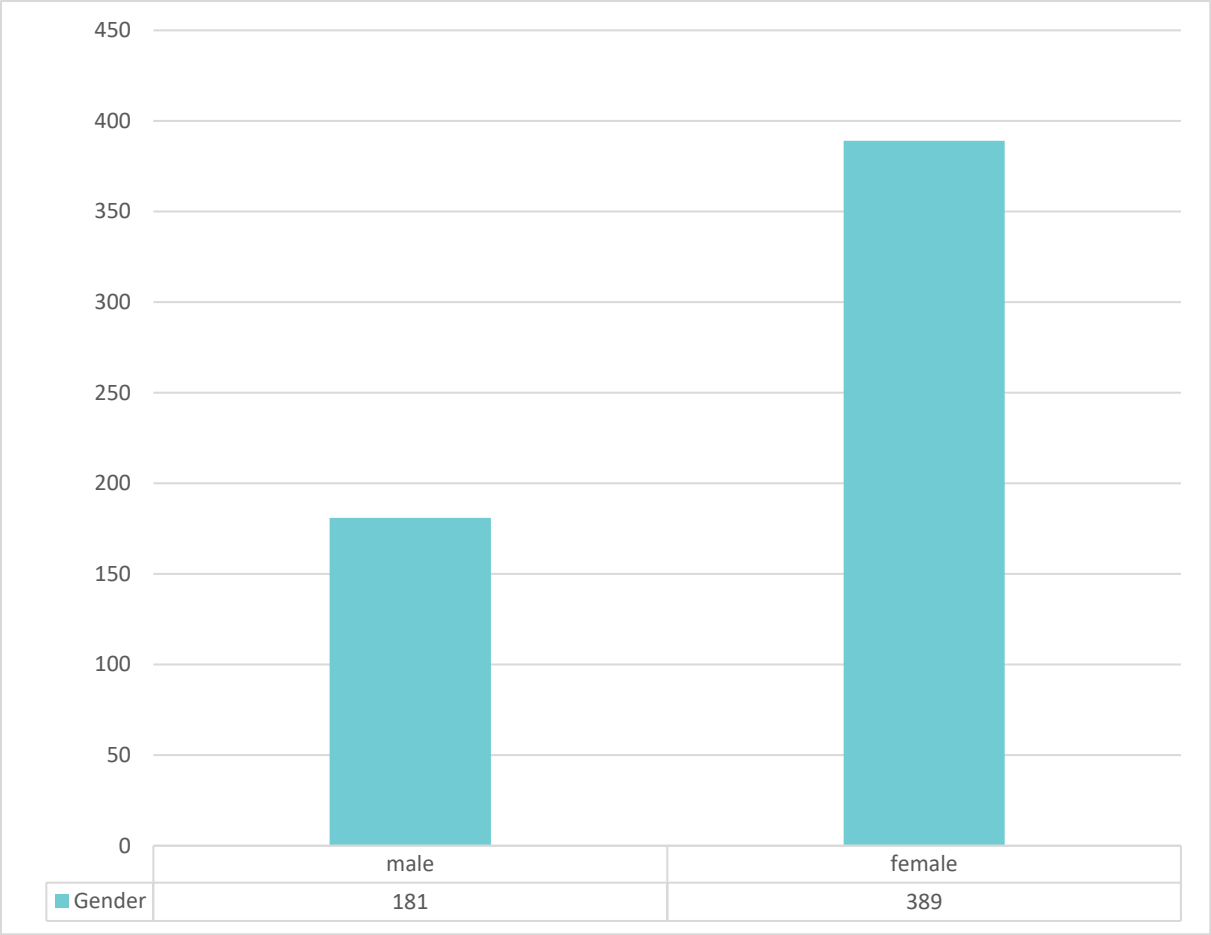


Figure 21: Primary partial hip arthroplasties by gender (Source: RES).

In the RES database for 2021, there is no data on the gender of 4 (0.7%) patients who underwent primary partial hip arthroplasty in 2021.

From the RES database for 2021, we can see that in 2021, 181 (31.8%) men and 389 (68.2%) women underwent a partial hip arthroplasty.

5.3.1.2 Primary partial hip arthroplasties according to the age of the patients at the time of surgery

We then calculated the patients' age at the time of surgery by subtracting the patient's date of birth from the date of surgery. Age in years is shown in the figure below.

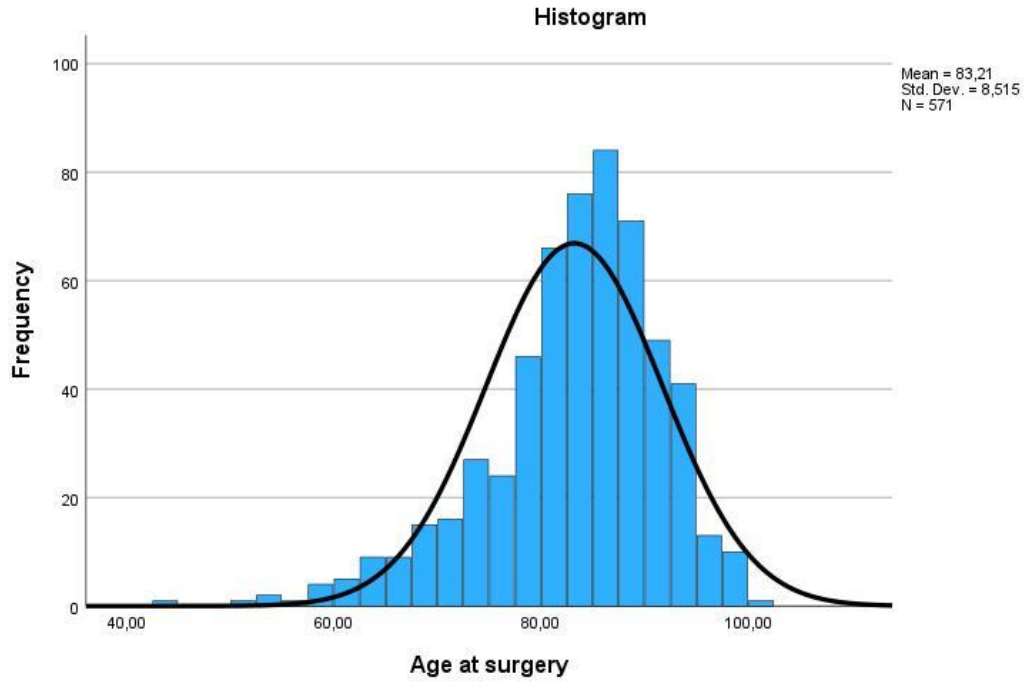


Figure 22: Primary partial hip arthroplasties by age of patients at the time of surgery (Source: RES).

In the RES database for the year 2021, there is no information about the date of birth or about the date of surgery for 3 surgeries. We excluded these from further analysis.

Based on the Kolmogorov-Smirnov test ($p < 0.01$), we can conclude that the age of the patients at the time of surgery is not approximately normally distributed. For this reason, in the analyzes we used non-parametric tests and the calculation of the median as a measure of centrality.

The median in this case is 83.2 years. Half of the primary partial hip arthroplasties recorded in the 2021 RES database were performed on patients who were 83.2 years of age and older, and half were performed on patients who were 83.2 years of age and younger. The youngest patient was 44.6 years old, and the oldest was 100.8 years old.

5.3.2 Primary partial hip arthroplasties by hospital

In the following, we examined the number of primary partial hip arthroplasties according to the hospital of the surgery (see figure below).

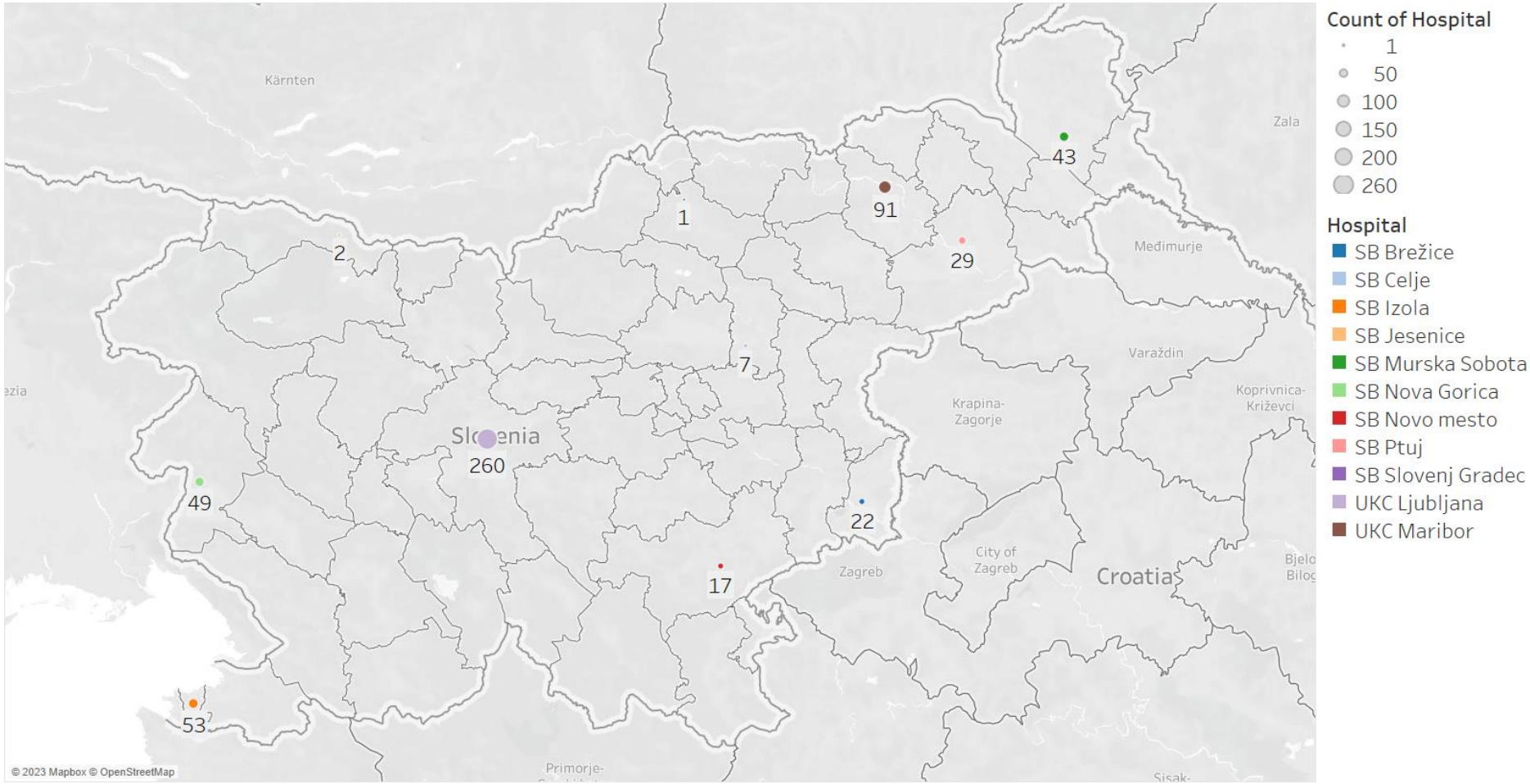


Figure 23: Primary partial hip arthroplasties by hospital (Source: RES).

In the RES database for the year 2021, we received data on 260 (45.3%) primary partial hip arthroplasties performed at UKC Ljubljana, 91 (15.9%) at UKC Maribor, 53 (9.2%) at SB Izola, 49 (8.5%) were carried out in SB Nova Gorica, 43 (7.5%) in SB Murska Sobota, 29 (5.1%) in SB Ptuj, 22 (3.8%) in SB Brežice, 17 (3 %) in SB Novo mesto, 7 (1.2%) in SB Celje, 2 (0.3%) in SB Jesenice and 1 (0.2%) in SB Slovenj Gradec.

5.3.3 Primary partial hip arthroplasties according to the characteristics of the current surgery

We analyzed primary partial hip arthroplasties according to the side of the surgery, the diagnosis at the time of surgery, previous surgeries on the hip, the extent of the current surgery, the characteristics of the fixation of the prosthesis, and the chirurgical approach used during the surgery.

5.3.3.1 Primary partial hip arthroplasties by side of surgery

The distribution of surgeries by surgery side in 2021 is given in the figure below.

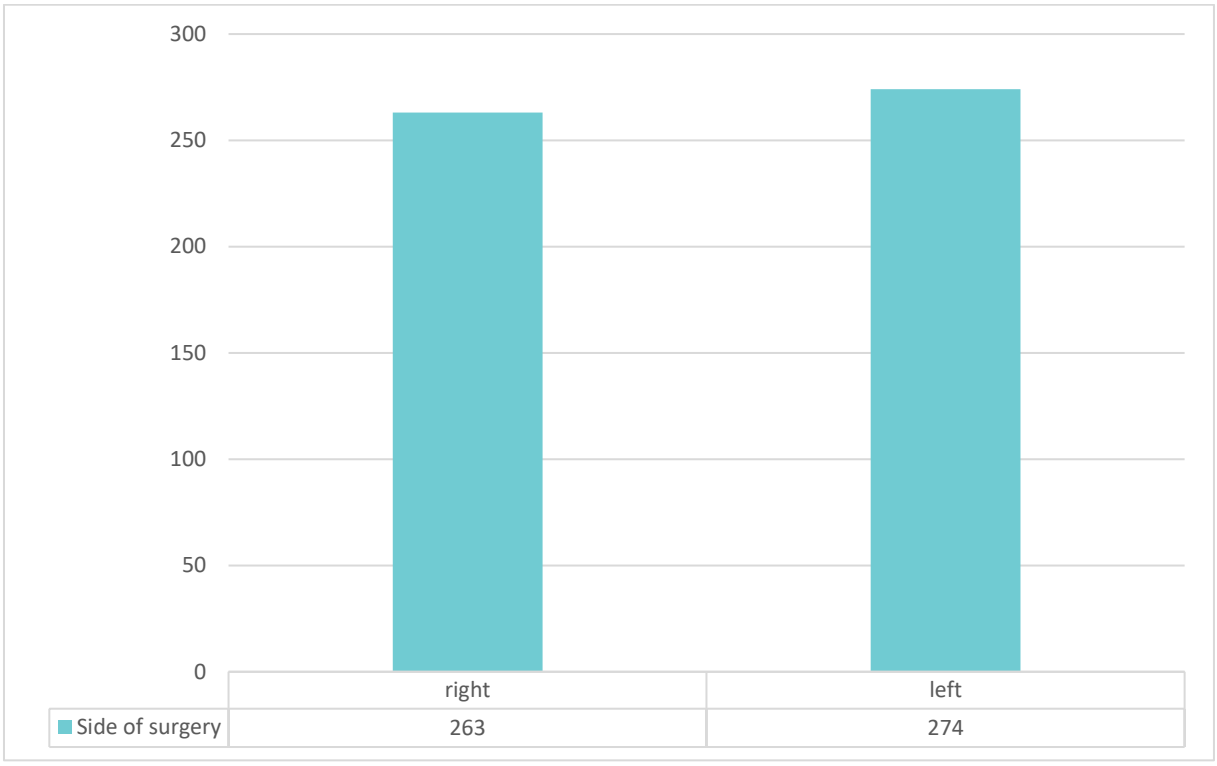


Figure 24: Side of surgery in primary partial hip arthroplasty (Source: RES).

In the RES database, we have 574 primary partial hip arthroplasties recorded for 2021. In 37 cases (6.4%), we do not have information on which side the surgery was performed. We excluded them from further statistical analysis.

In 274 recorded cases (51%), the primary partial hip arthroplasty was performed on the left side, and in 263 (49%) cases on the right side.

5.3.3.2 Primary partial hip arthroplasties according to diagnosis at surgery

In the following, we examined the diagnosis made during the primary partial hip arthroplasty. One of the following diagnoses could be recorded: idiopathic arthrosis, dysplasia or LCC, posttraumatic, aseptic necrosis of the head, epiphysiolysis or post-Perthes, rheumatoid arthritis, ankylosing spondylitis and other diagnoses. The distribution of diagnoses for primary partial hip arthroplasty is given in the figure below.

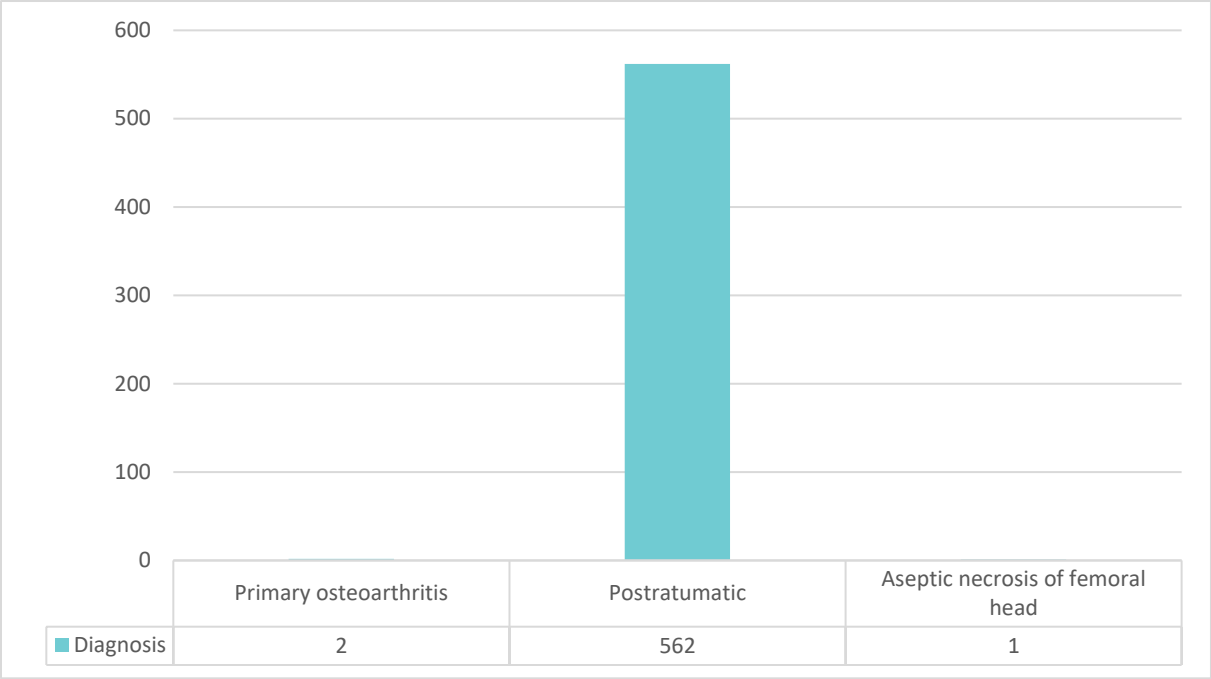


Figure 25: Diagnosis before primary paricular hip arthroplasty (source: RES).

In the RES database, we have 574 cases of primary partial hip arthroplasty recorded for the year 2021. Other diagnoses were recorded in 9 (1.6%) cases. We excluded them from further statistical analysis.

As expected, in almost all cases (99.5%), the diagnosis at surgery in the case of primary partial hip arthroplasty was due to a fracture. In only one case, the diagnosis at the time of this surgery was aseptic necrosis of the head, and in 2 cases it was idiopathic arthrosis.

5.3.3.3 Primary partial hip arthroplasties according to the method of fixation of the prosthesis

In the following, we checked the method of fixation of the stem of the prosthesis in cases recorded in the RES database for primary partial hip arthroplasties. Fixation of the stem in partial hip arthroplasty can be cemented or uncemented. The distribution of responses is given in the figure below.

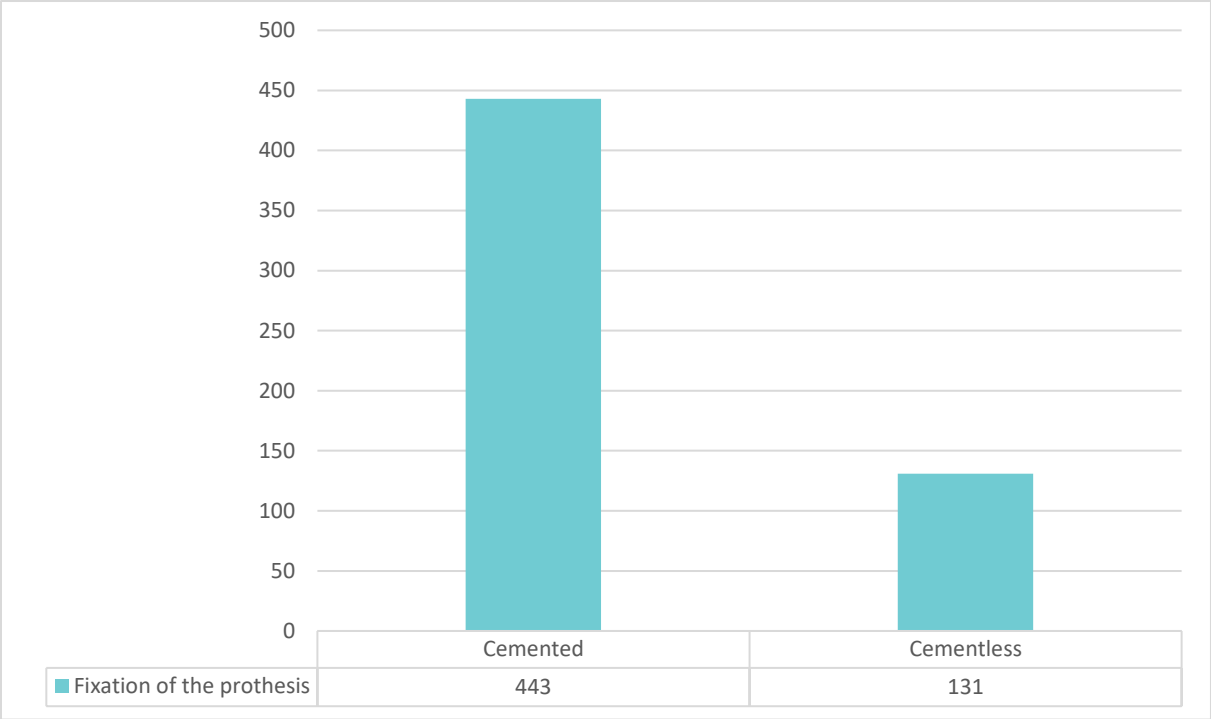


Figure 26: Fixation of the prosthesis stem in primary partial hip arthroplasty (Source: RES).

Of the 574 recorded cases of primary hip arthroplasties in the RES database for 2021, the most, 443 or 77.2% were cemented, while 131 or 22.8% were uncemented.

We also examined whether there is an association between endoprosthesis fixation in primary partial hip arthroplasty and the hospital of the surgery (see figure below).

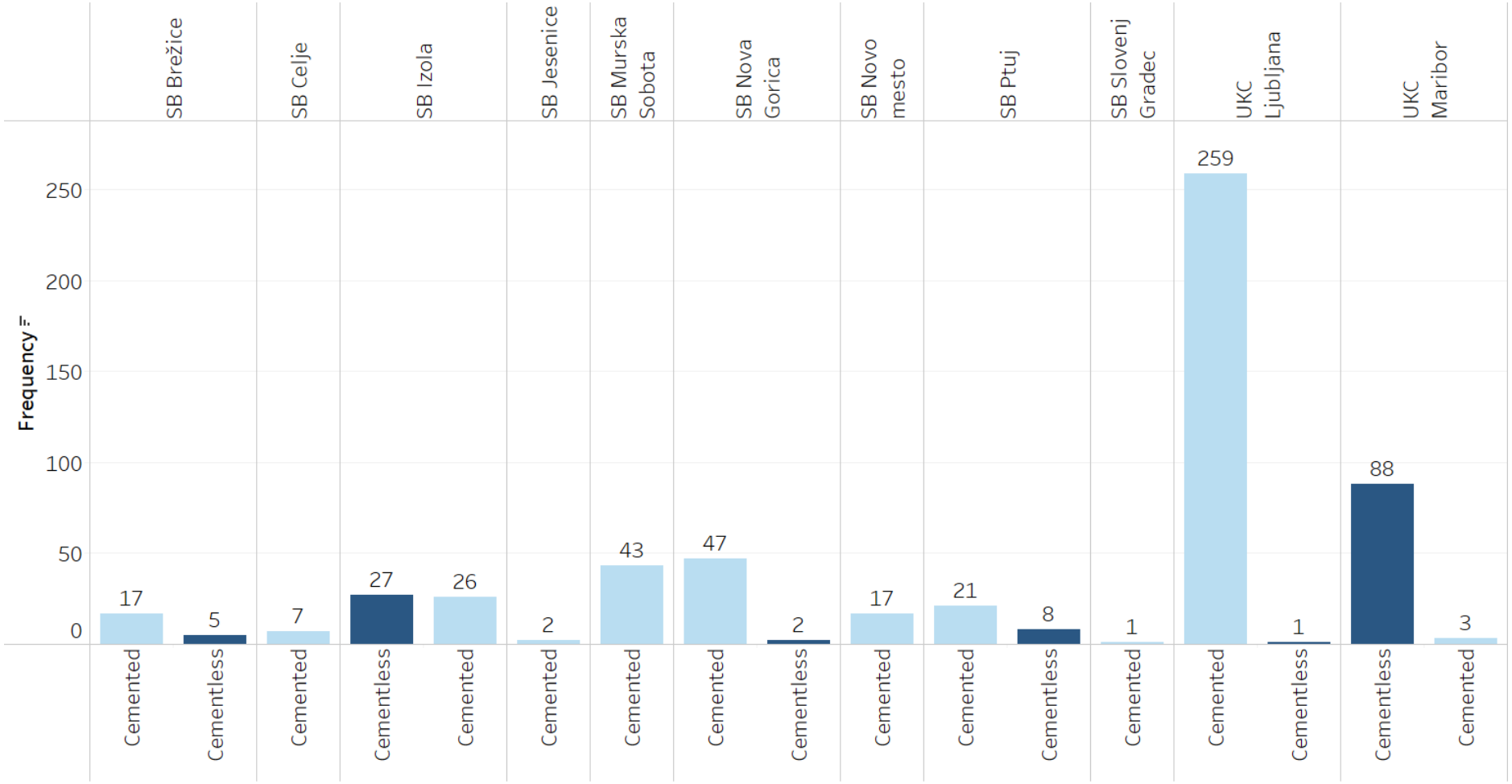


Figure 27: Endoprosthesis fixation in primary partial hip arthroplasty by hospital (Source: RES).

The results of the Chi-square test ($X^2 = 411$, $p < 0.001$) suggest that there is an association between fixation of primary partial hip arthroplasty and the hospital of the surgery, but the results cannot be generalized due to the large number of cells with less than 5 units (27.3%). All associated percentages are given in relation to the proportion of fixation of primary partial hip arthroplasty at each hospital (based on all surgeries performed at the hospital).

In the RES database for the year 2021, we see that there were more cemented partial endoprostheses in SB Celje (100%), in SB Murska Sobota (100%), in SB Jesenice (100%), in SB Slovenj Gradec (100%), in SB Novo mesto (100%), in UKC Ljubljana (99.6%), in SB Nova Gorica (95.9%), in SB Brežice (77.3%) as in SB Ptuj (72.4%), in SB Izola (49.1%) and in UKC Maribor (3.3%).

In the RES database for 2021, we see that there were more cementless partial endoprostheses in UKC Maribor (96.7%), in SB Izola (50.9%) and in SB Ptuj (27.6%) than in SB Brežice (22 .7%), in SB Nova Gorica (4.1%) and in UKC Ljubljana (0.4%). According to data from the RES database, other hospitals did not perform primary partial hip arthroplasties with cementless fixation of the prosthesis in 2021.

5.3.3.4 Primary partial hip arthroplasties according to the chirurgical approach used

The figure below shows the approach used during primary parietal hip arthroplasty, namely this approach could be anterior, antero-lateral, direct lateral, postero-lateral or minimally invasive.

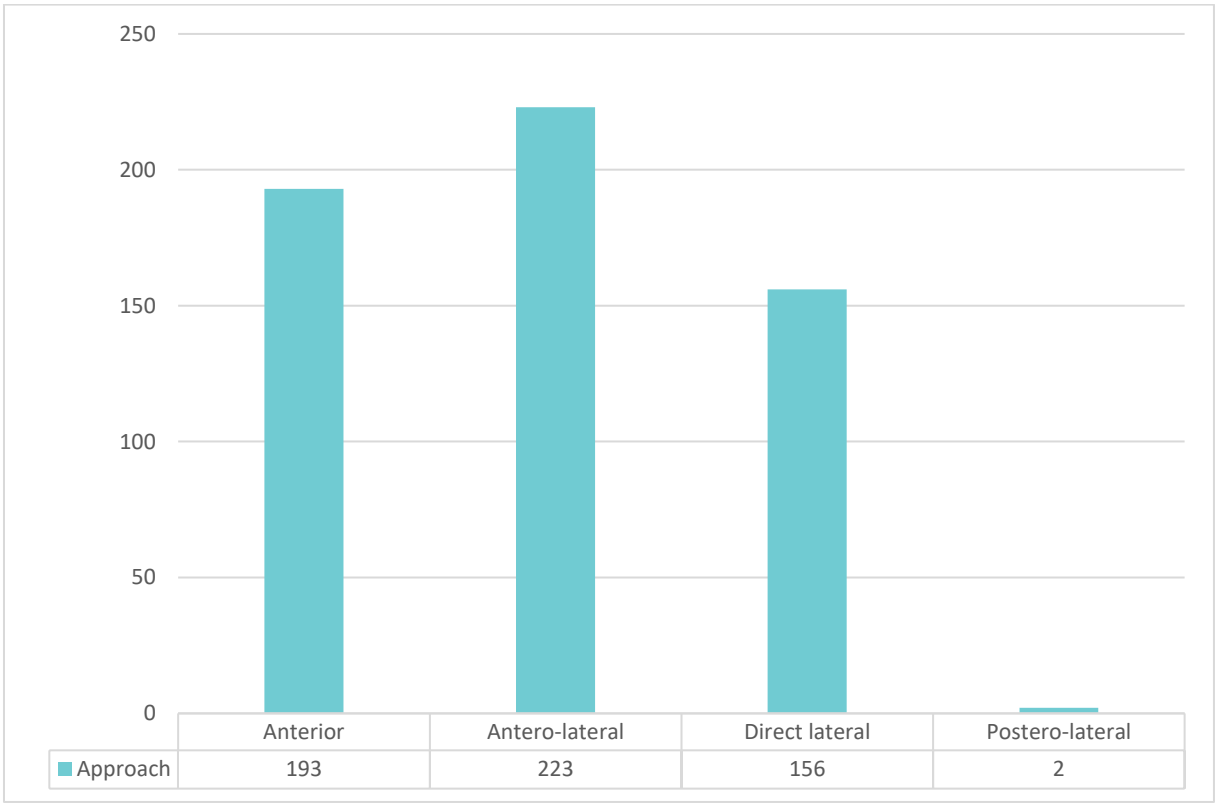


Figure 28: The approach used in primary partial hip arthroplasty (Source: RES).

In 2021, among the recorded cases in the RES database, the antero-lateral approach was most often used for primary partial hip arthroplasty (223 or 38.9%, respectively). They are followed by the anterior approach (193 or 33.6%), and the direct-lateral approach (156 or 27.2%). The postero-lateral approach was used in only two cases (0.3%).

Next, we looked at whether there was an association between the recorded chirurgical approach used during primary partial hip arthroplasty and the hospital of the surgery. The results are given in the figure below.

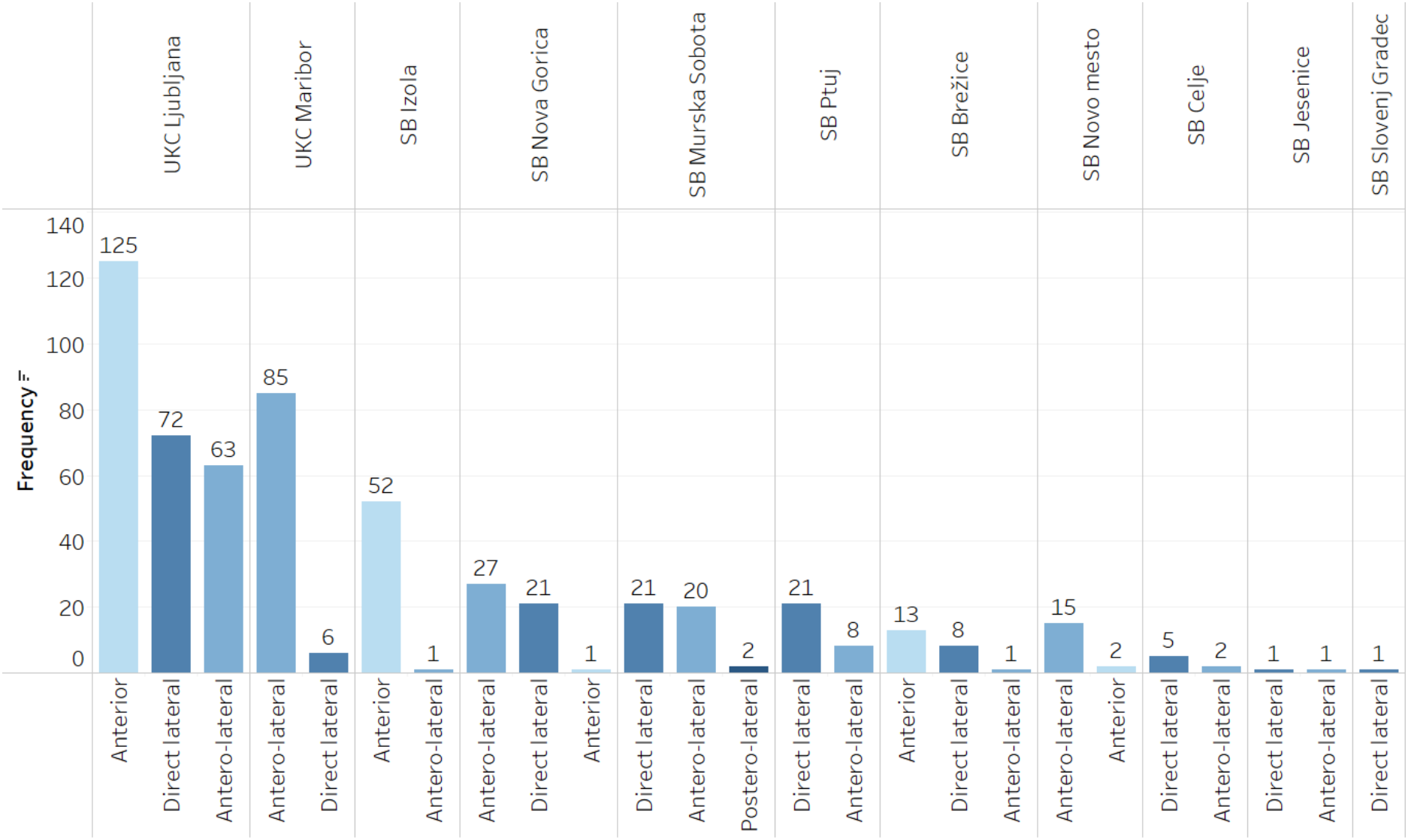


Figure 29: The approach used in primary partial hip arthroplasty by hospital (Source: RES).

The HI-squared test was used to test for association (X^2 = 386.3, p < 0.001), but due to the large number of cells with less than 5 units (47.7%), the results cannot be generalized.

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

5.3.4 Primary partial hip arthroplasties according to previous surgeries

We checked whether the patients in question had previous surgeries on the hip on which primary partial hip arthroplasty was performed in 2021. The results are presented in Figure 30.

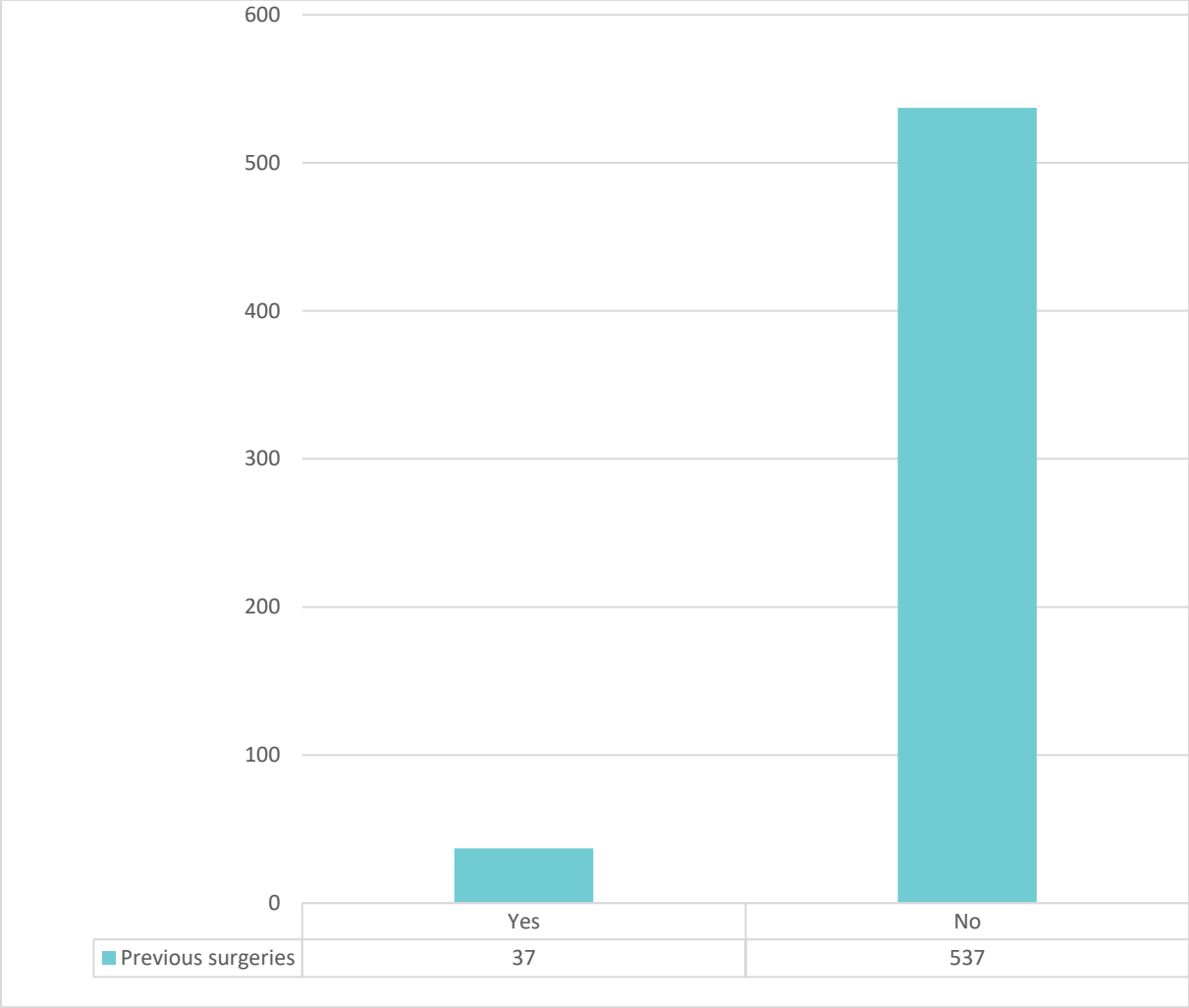


Figure 30: Previous surgeries on the hip that underwent primary partial hip arthroplasty (Source: RES).

In the RES database, we have 574 primary partial hip arthroplasties recorded for 2021.

In 93.6% (537) of recorded cases of primary partial hip arthroplasties in 2021, patients had no previous surgery on the affected hip, while 37 (6.4%) cases indicated that patients had already had previous surgery on that hip hip: 12 had osteosynthesis after fracture. In 25 cases, other surgeries were specified, without the specified surgery.

The results are expected, since the preoperative diagnosis for partial hip endoprosthesis is most often a hip fracture where there was no previous surgery.

5.3.5 Primary partial hip arthroplasties by implant manufacturer

In the next chapter, we will look at the manufacturers of the implant that was inserted in patients for primary partial hip arthroplasty in 2021. Here we are interested in the manufacturers of the stem and head.

5.3.5.1 Primary partial hip arthroplasties by manufacturer of femoral stem

First, we reviewed the characteristics of the inserted femporal stem in primary partial hip arthroplasty in 2021. In the figure below, we show the manufacturers of the used implanted stems.

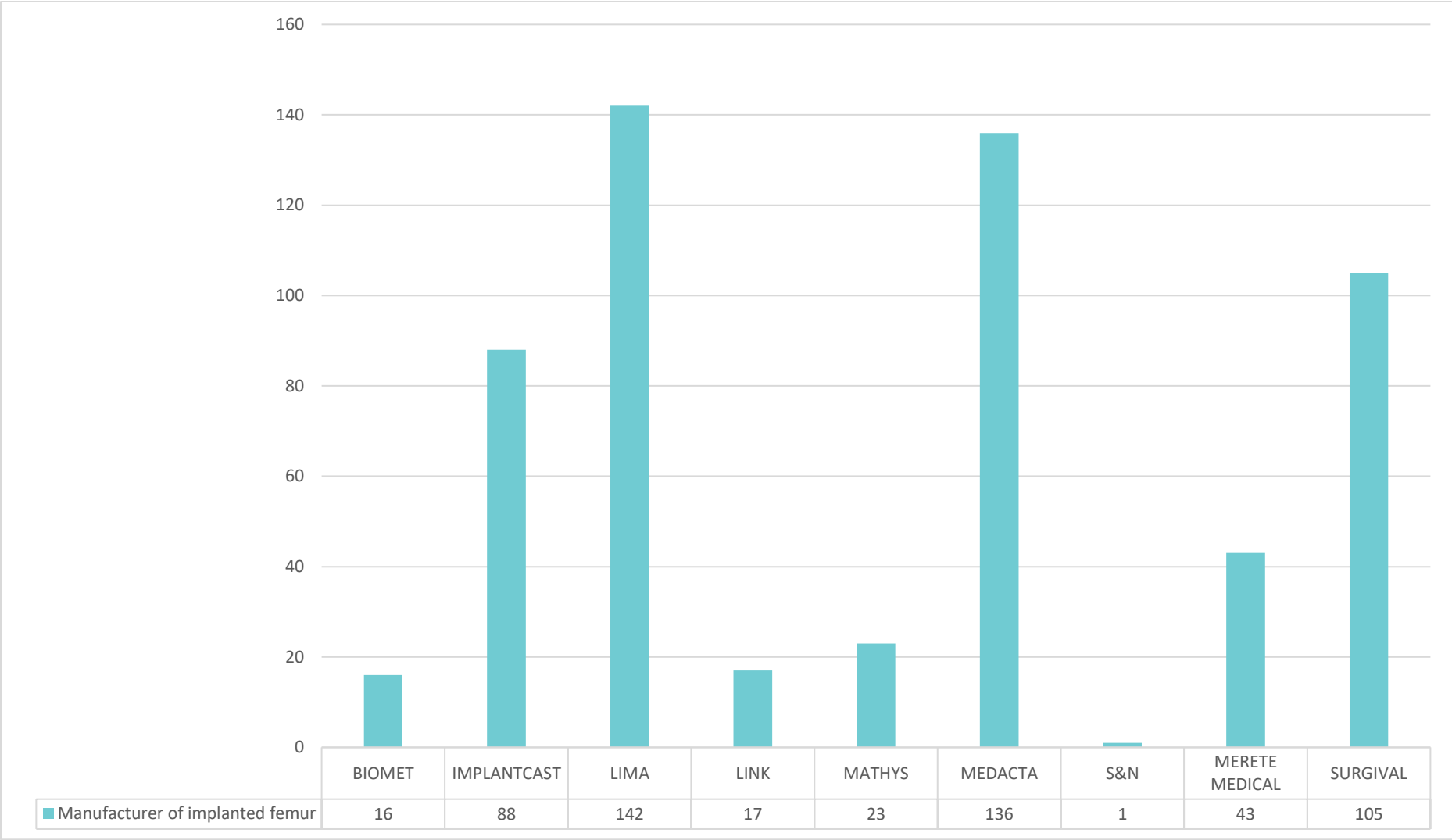


Figure 31: Primary partial hip arthroplasty stem implant manufacturer (Source: RES).

In 3 cases (0.5%) it was recorded in the RES database for the year 2021 that the manufacturer was not listed in the list of manufacturers for the stem part of the primary partial hip arthroplasty implant. We excluded these cases from further analysis.

In most (136 or 23.8%) cases, the manufacturer of the MEDACTA femoral stem was recorded. They are followed by LIMA (142 respectively 24.9%), SURGIVAL (105 respectively 18.4%), IMPLANTCAST (88 respectively 15.4%), MERETE MEDICAL (43 respectively 7.5%), MATHYS (23 respectively 4%), LINK (17 or 3%), BIOMET (16 or 2.8%) and S&N (1 or 0.2%).

In the last part of this chapter, we used the HI-square to check whether there is an association between the manufacturers of the femoral stem in primary partial hip arthroplasty and the hospital of the activity. In 3 cases, we have no information about the manufacturer of the stem implant and/or the hospital of the surgery. We excluded these from the analysis. The results are presented in the figure below.

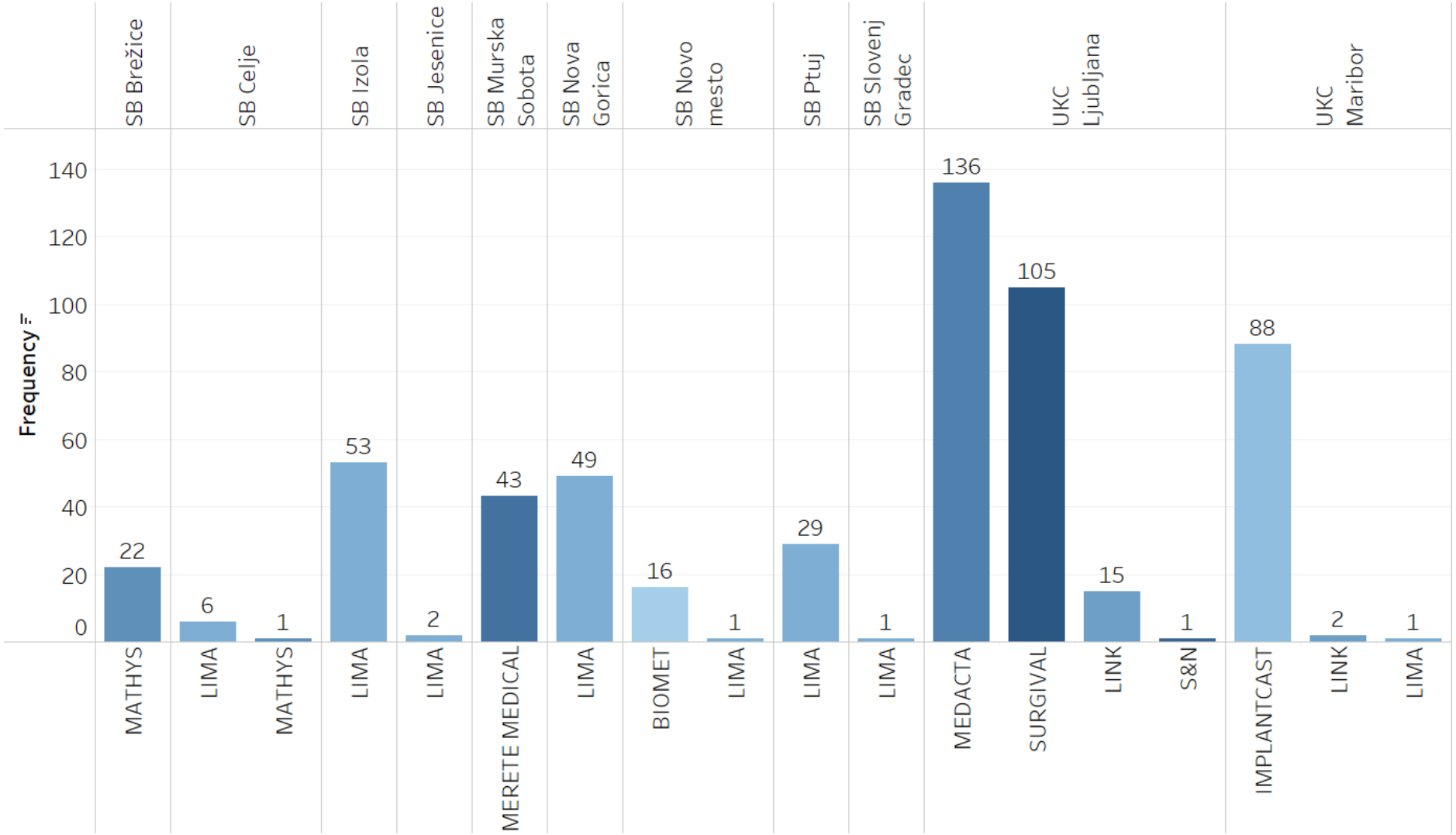


Figure 32: Manufacturer of the implanted stem in primary partial hip arthroplasty by hospital (Source: RES).

Due to the excessive number of cells with less than 5 units (69.7%), the obtained results cannot be generalized.

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

5.3.5.2 Primary partial hip arthroplasties according to the inserted implant head

In the following, we present the manufacturers of the implanted head in primary partial hip arthroplasties recorded in the RES database for the year 2021. Figure 33 shows the distribution of the manufacturers of these implant parts.

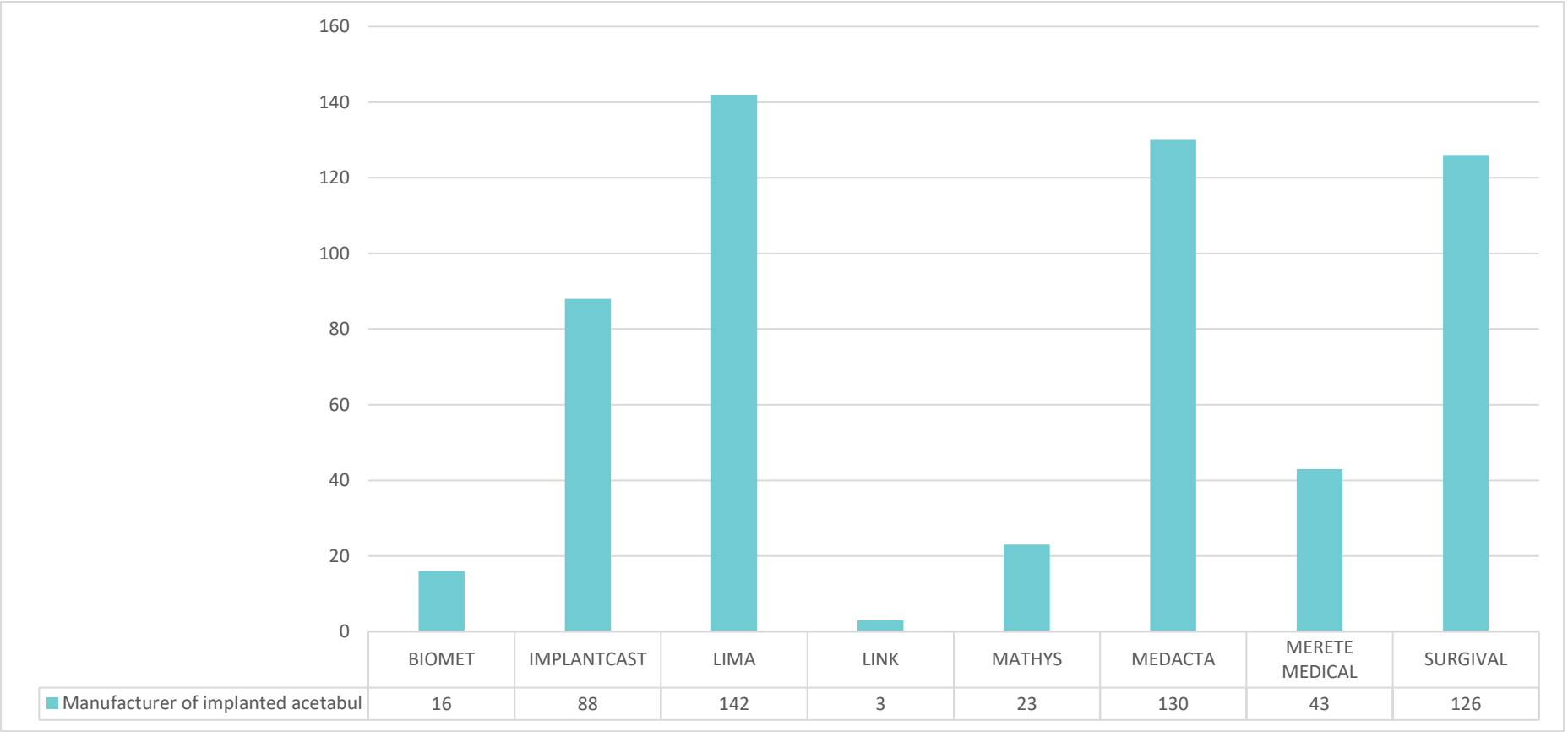


Figure 33: Implanted head manufacturers in primary partial hip arthroplasties (Source: RES).

In 3 cases in the RES database for the year 2021, we did not have information about the manufacturer of the implant head in primary partial hip arthroplasty. We excluded these units from further analysis.

Most often, 142 times or 24.9%, the manufacturer of the implant head in primary partial hip arthroplasty was LIMA. It is followed by the following manufacturers: MEDACTA (130 respectively 22.8 %), SURGIVAL (126 respectively 22.1 %), IMPLANTCAST (88 respectively 15.4 %), MERETE MEDICAL (43 respectively 7.5 %), MATHYS (23 respectively 4%), BIOMET (16 or 2.8%) and LINK (3 or 0.5%).

In the last part of the review of results in primary partial hip arthroplasties, we checked whether there is an association between the manufacturers of the implant head and the hospital of the surgery. In 3 cases, we have no information about the manufacturer of the implant head and/or the hospital of the surgery. We excluded these from the analysis. The results are shown in the figure below.

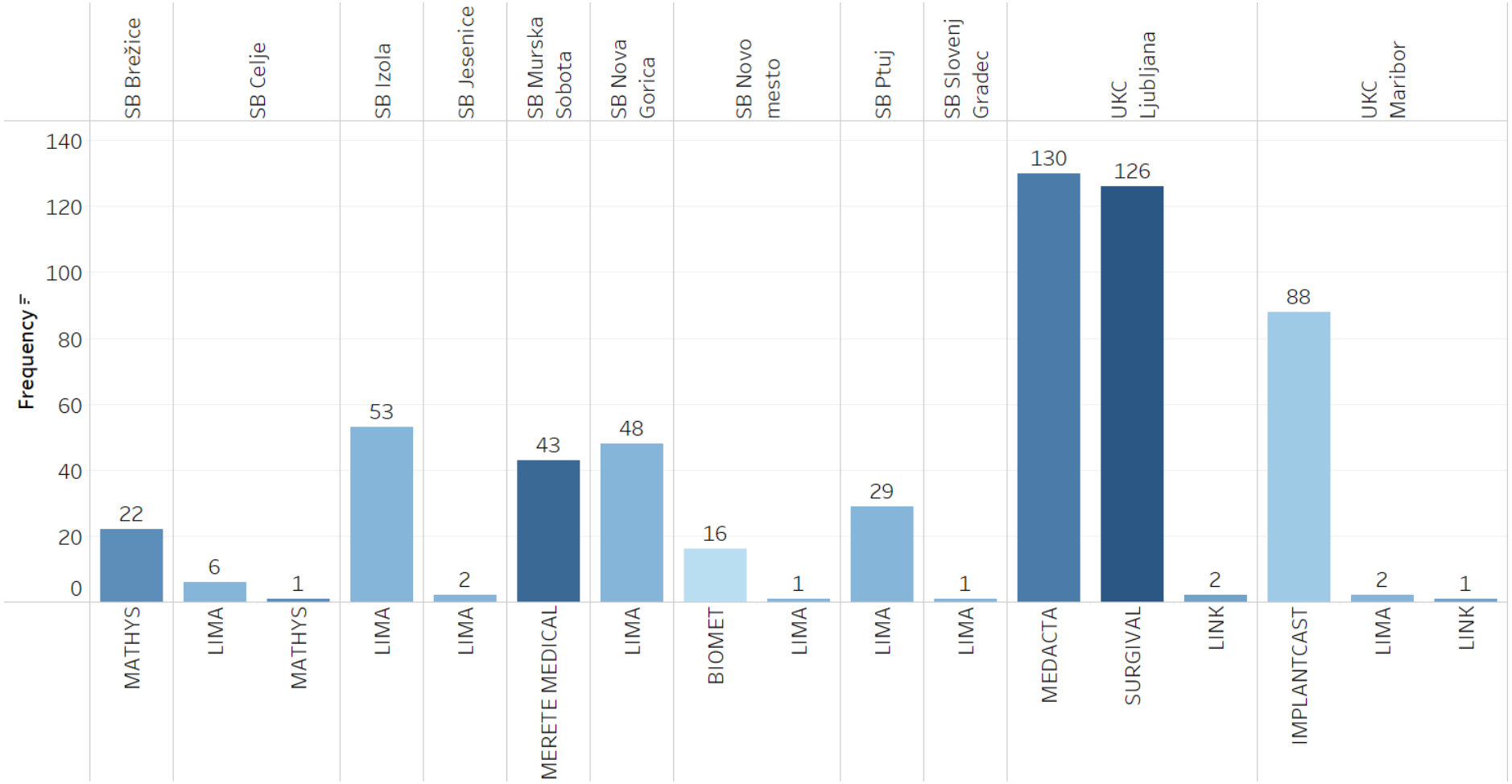


Figure 34: Manufacturers of implanted head in primary partial hip arthroplasties by hospital (Source: RES).

We should not generalize the results of the HI-squared test, as we have an excessive number of cells with less than 5 units (67%).

Here, too, the cost of endoprostheses per hospital depends on the selected providers in public tenders.

5.4 Revision hip arthroplasty

In this part of the report, we present revisions of hip arthroplasties in the Republic of Slovenia in 2021. We have recorded 299 revisions of hip arthroplasties in RES in 2021.

We will provide information about the current surgery according to patient characteristics (gender, age at surgery), according to hospital, characteristics of revision surgery (side of surgery, previous surgeries, reason for revision, extent of revision and the approach used during surgery), data about the new implant (manufacturer) and data on the percentage of revisions of individual implant combinations.

5.4.1 Revision hip arthroplasty according to patient characteristics

First, we were interested in the characteristics of patients who had revision hip arthroplasty surgery in 2021. We examined their gender and age at the time of surgery.

5.4.1.1 Revision hip arthroplasty by patient gender

First, we examined the gender of patients who had revision hip arthroplasty in 2021. The distribution is given in the figure below.

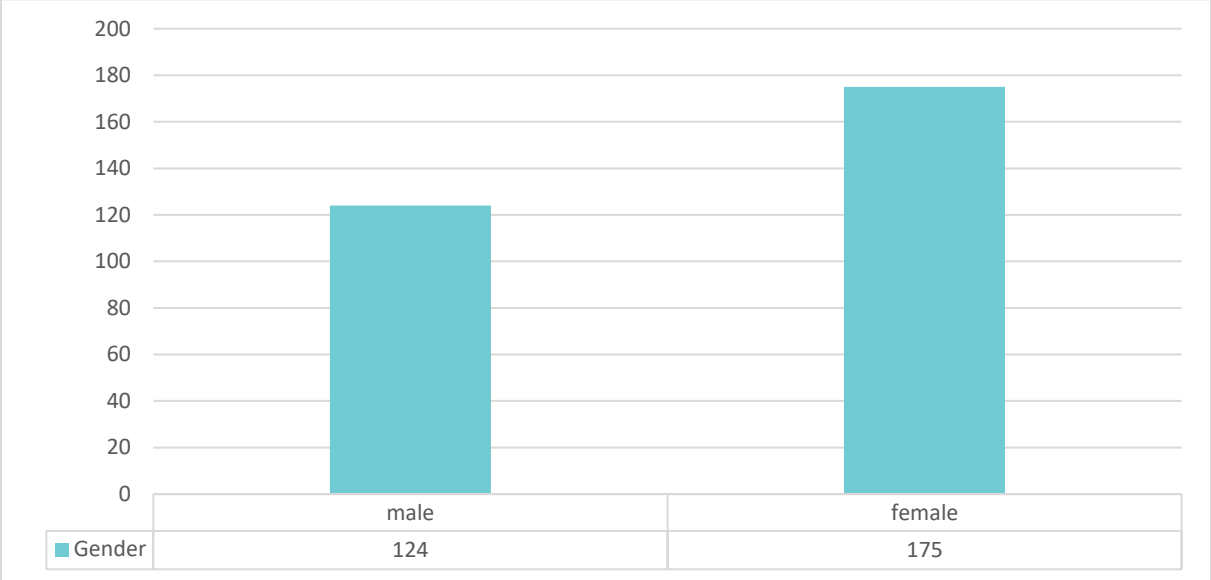


Figure 35: Revision hip arthroplasties by patient gender (Source: RES).

In the RES database for 2021, we have data on revision hip arthroplasties performed, namely, in 175 (58.5%) cases, women, and in 124 cases (41.5%) men.

5.4.1.2 Revisions hip arthroplasty by patient age at surgery

In the following, we calculated the age of the patients as the difference between the date of surgery and the date of birth of the patient. Age in years is given in the picture below.

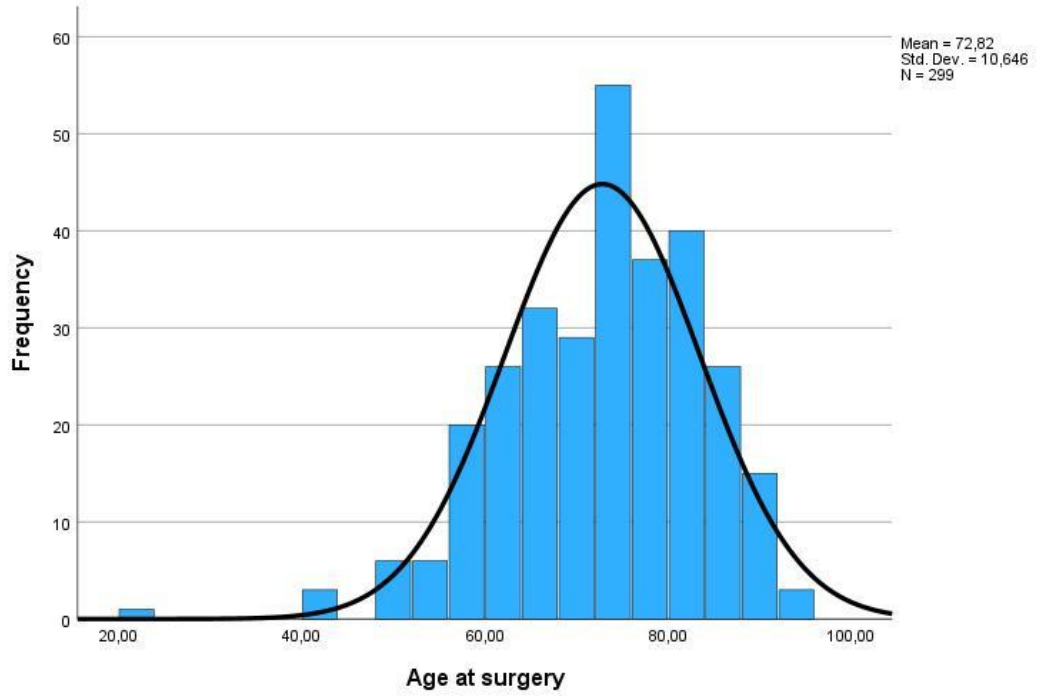


Figure 36: Revision hip arthroplasties by patient age at surgery (Source: RES).

From the RES database for 2021, it can be seen that the age distribution in years (Kolmogorov-Smirnov test $p < 0.01$) is not approximately normal. Non-parametric tests and the median were used for analyses.

The median in this case is 73. Half of the patients from the RES database for the year 2021 were 73 years of age or older at the time of revision hip arthroplasty, and half of them were 73 years of age or younger. The youngest patient was 23 years old, and the oldest was 93.

5.4.2 Hip arthroplasty revisions by hospital

5.4.2.1 Revision burden of hip arthroplasty

We reviewed the revision burden on every hospital. The definition of the revision burden is: number of revisions in one year x 100 / number of primary and revision surgeries in this year. Table 2 shows which hospitals performed revision surgeries and in what number for the year 2021.

Hospital 2021	Primary parcial hip artroplastics	Primary total hip artroplastics	Revisions	Burden of revisions (%)*
Kirurgija Bitenc	0	11	0	0,0
KS Rožna dolina	0	128	4	3,0
OB Valdoltra	0	1064	95	8,2
SB Brežice	22	50	2	2,7
SB Celje	7	162	20	10,6
SB Izola	53	2	2	3,5
SB Jesenice	2	221	11	4,7
SB Murska Sobota	43	199	31	11,4
SB Nova Gorica	49	137	4	2,1
SB Novo mesto	17	465	18	3,6

SB Ptuj	29	83	1	0,9
SB Slovenj Gradec	1	119	6	4,8
UKC Ljubljana	260	359	74	10,7
UKC Maribor	91	331	31	6,8
SLOVENIJA	**574**	**3331**	**299**	**7,1**

* number of revisions in one year x 100 / number of primary and revision surgeries in that year

Table 2: Revision burden of hip arthroplasty by hospitals (Source: RES).

From the RES database for the year 2021, we collected in Table 2 data on primary partial and total hip endoprostheses and on all revisions that were made in each hospital, regardless of whether the previous surgery was done in another institution. Based on this data, we also calculated the revision burden.

5.4.2.2 Number of hip arthroplasty revisions

In the following, we examined the number of revision hip arthroplasty surgeries according to the hospital. The distribution is shown in the figure below.

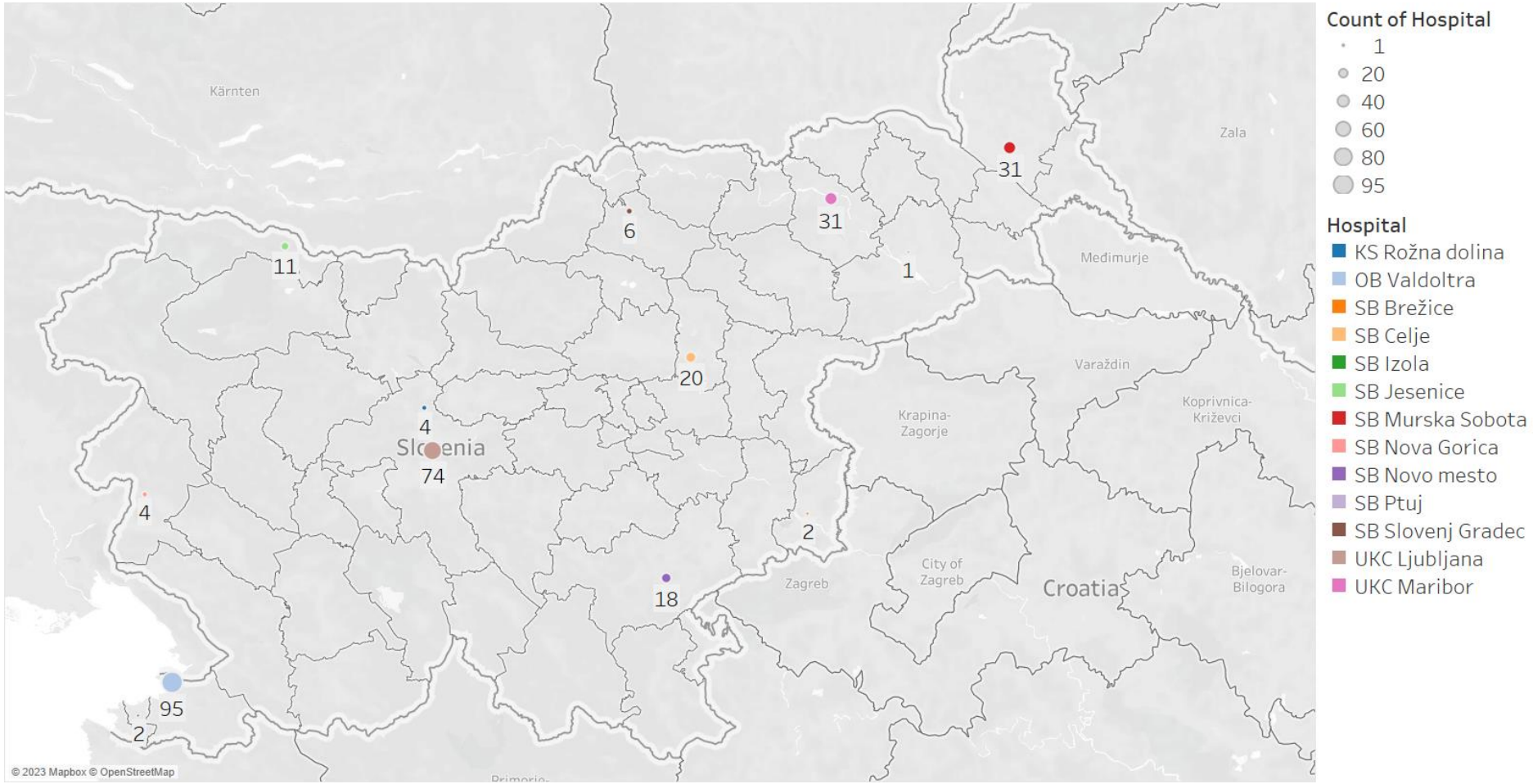


Figure 37: Revision hip arthroplasties by hospital (Source: RES).

In the RES database for the year 2021, we have data for 95 (31.8%) revisions of hip arthroplasties, which were carried out in OB Valdoltra, for 74 (24.7%) which were carried out in UKC Ljubljana, 31 (10, 4%) were performed in SB Murska Sobota and UKC Maribor, 20 (6.7%) in SB Celje, 18 (6%) in SB Novo mesto, 11 (3.7%) in SB Jesenice, 6 (2%)) in SB Slovenj Gradec, 4 (1.3%) in KS Rožna dolina and SB Nova Gorica, 2 (0.7%) in SB Brežice and SB Izola and 1 (0.3%) in SB Ptuj.

5.4.3 Revision hip arthroplasty according to the characteristics of revision surgery

In the next section, we present the characteristics of the revision surgery: the side of the surgery, the reason for the revision, the scope of the revision, the chirurgical approach.

5.4.3.1 Revisions hip arthroplasty by side of surgery

In the RES database for the year 2021, we have recorded 299 revisions of hip endoprostheses. First, we wanted to check the number of surgeries for each side (left or right hip). The results are given in the figure below.

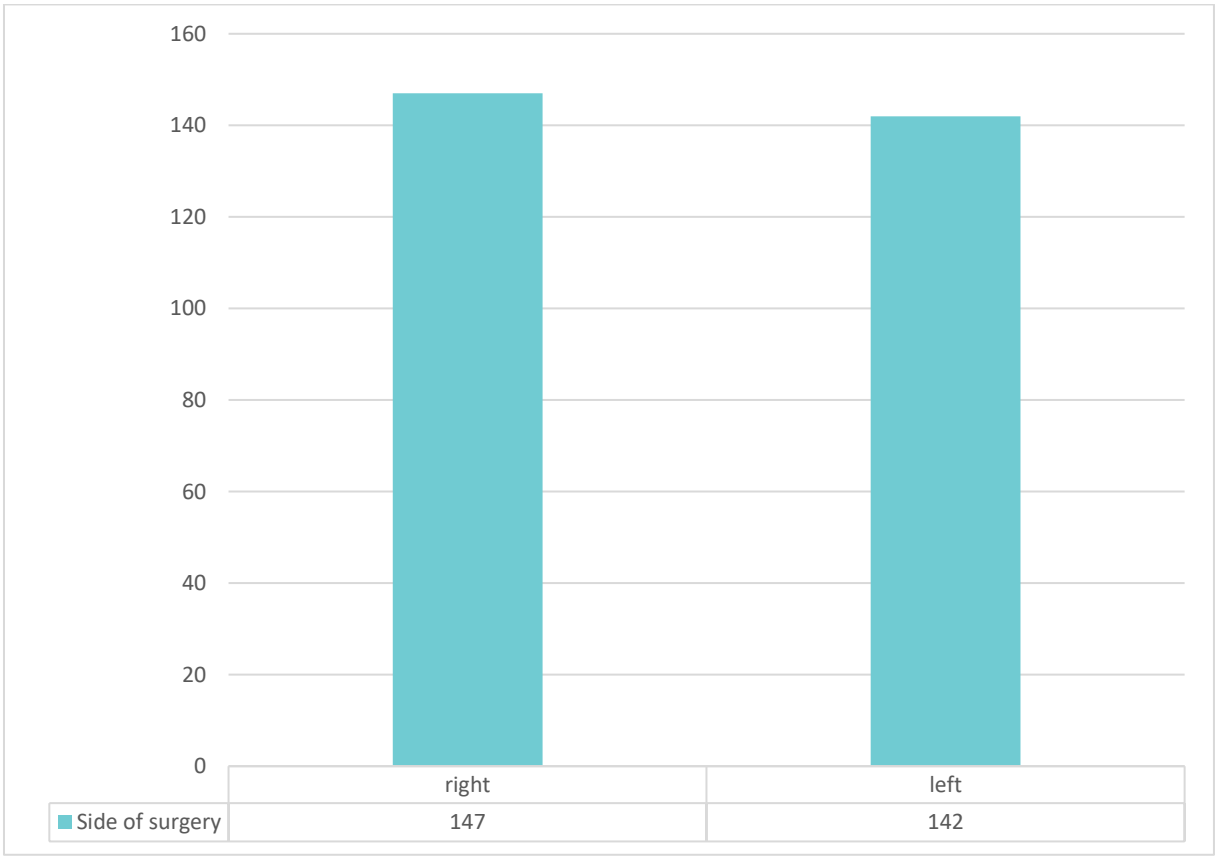


Figure 38: Number of hip revisions by side of surgery (Source: RES).

In 10 cases (3.3%), we did not get information on which hip the surgery was performed on. We excluded them from further statistical analysis.

Figure 38 shows that the RES database for 2021 contains 147 (50.9%) data for right hip revisions and 142 (49.1%) data for left hip revisions.

5.4.3.2 Revisions of hip arthroplasty according to the reason for the revision

The following reasons are given for revision of hip arthroplasty: loosening of the acetabular part, loosening of the femoral part, loosening of both parts, luxation, early infection (less than three months after surgery), late infection (more than three months after surgery), periprosthetic fracture of acetabulum, periprosthetic fracture of femur, pain, fracture of the

prosthesis, osteolysis of the acetabulum (without rocking), osteolysis of the femur, paraarticular ossification, inlay wear, condition after removal of components, and others. The distribution of responses is given in the figure below.

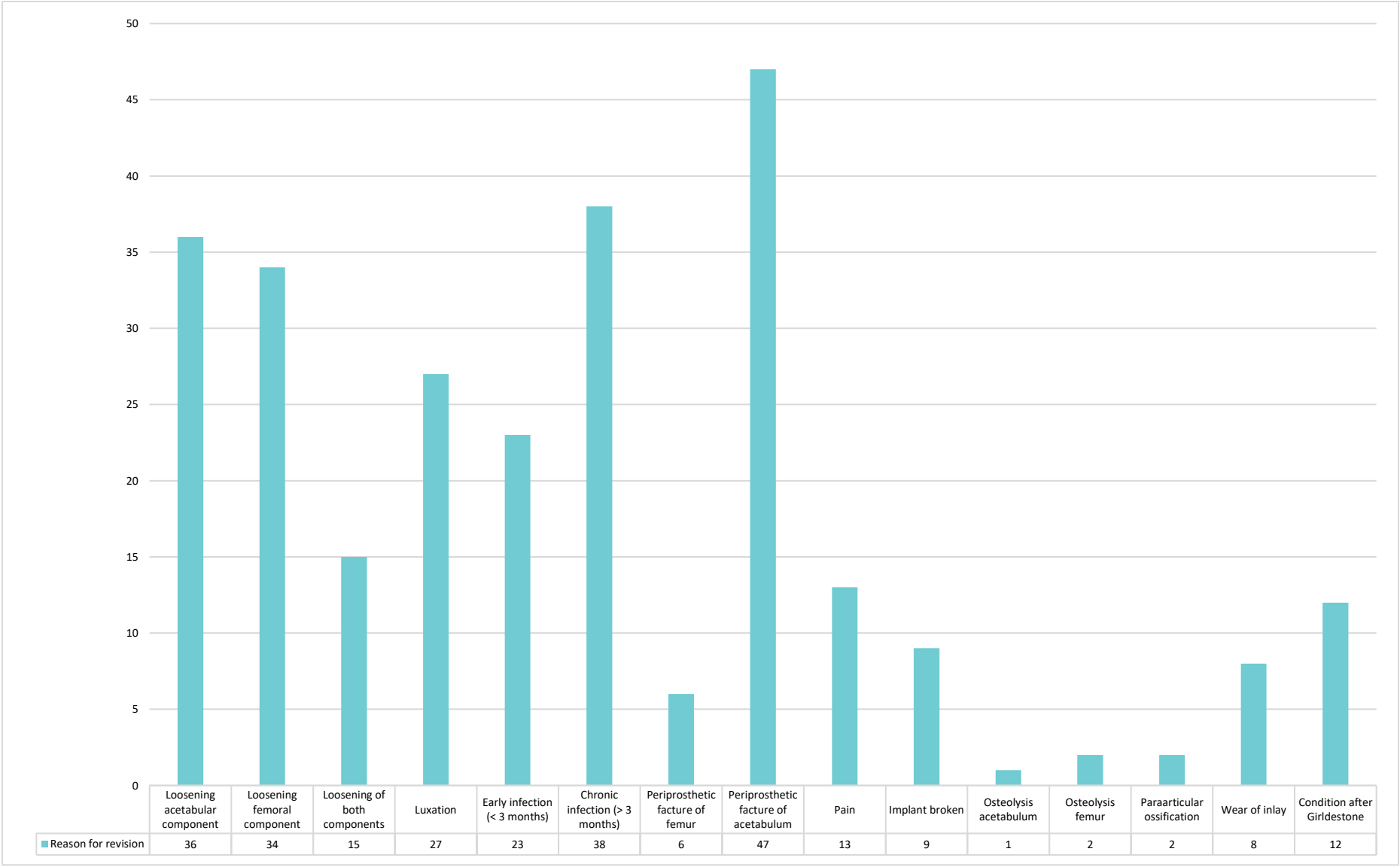


Figure 39: Reasion for revision hip arthroplasty (Source: RES).

In the RES database for 2021, there is no information on the cause of revision arthroplasty for 14 (4.7%) cases. In 12 cases (4%), other causes were mentioned[14]. All 26 cases were excluded from further analysis.

From the RES database for 2021, we can see that the most common (47 or 17.2% of cases) cause of hip revision was a periprosthetic fracture of the femur. This is followed by late infection (38 or 13.9%), loosening of the acetabular part (36 ro 13.2%), loosening of the femoral part (34 or 12.5%), dislocation of the prosthesis (27 or 9.9%), early infection (23 or 8.4%), loosening of both parts (15 or 5.5%), pain (13 or 4.8%), condition after removal of components (12 or 4.4%), prosthesis fracture (9 or 3%), insert wear (8 or 2.9%y), periprosthetic acetabular fracture (6 or 2.2%), femoral osteolysis and articular ossification (2 or 0.7%) and acetabular osteolysis (1 or 0,4%).

When we grouped the reasons for hip endoprosthesis revisions, we found that the most common reason for hip endoprosthesis revisions is loosening (Figure 40).

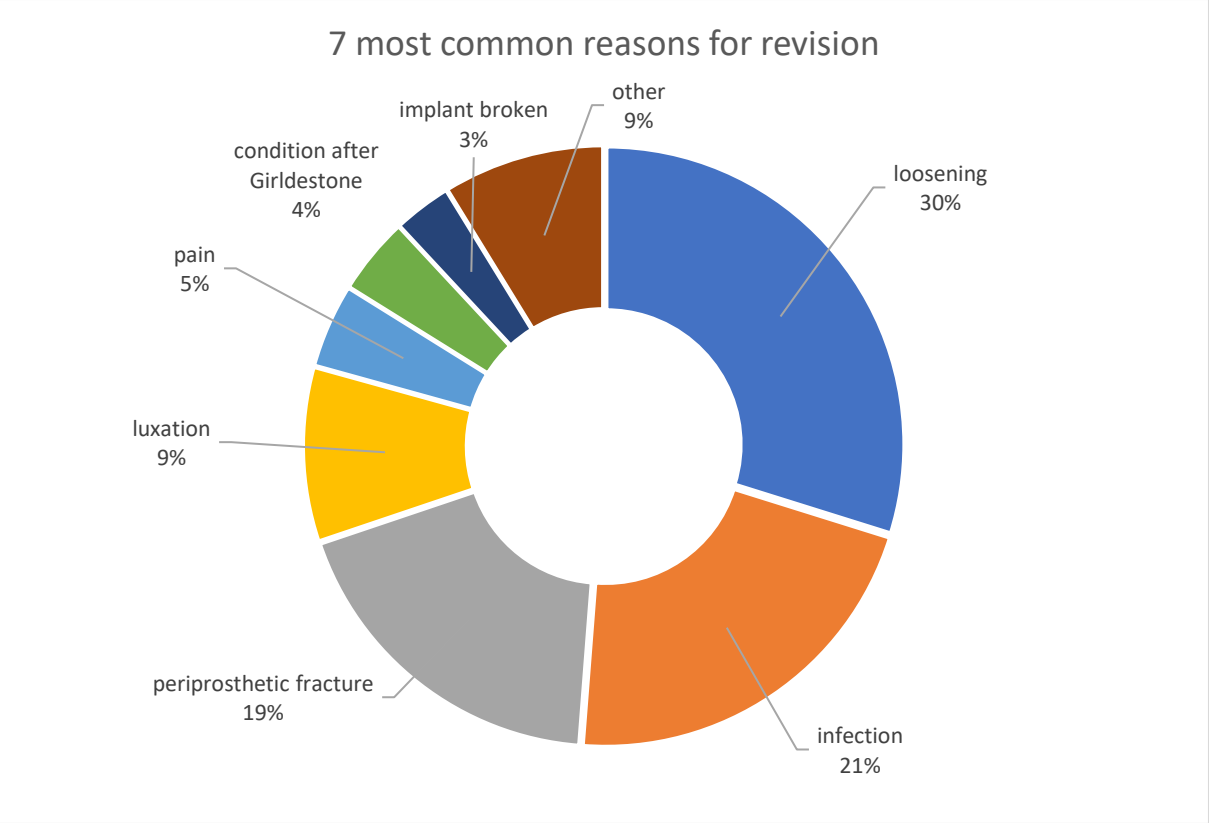


Figure 40: Proportion of hip arthroplasty revisions 2021: 7 main causes (Source: RES).

5.4.3.3 Revisions of hip arthroplasty according to the extent of revision of the current surgery

In the following, we examined revision hip arthroplasties according to the scope of the revision. We were interested in whether a replacement, removal of components (according to Girldestone), re-implantation of components (according to Girldestone) or transition to a total prosthesis was performed. The results are presented in the figure below.

[14] In only one case we receivea the reason for revision, which was a hematoma. In other cases, we did not get a specification of what the other reasons for the hip revision were.

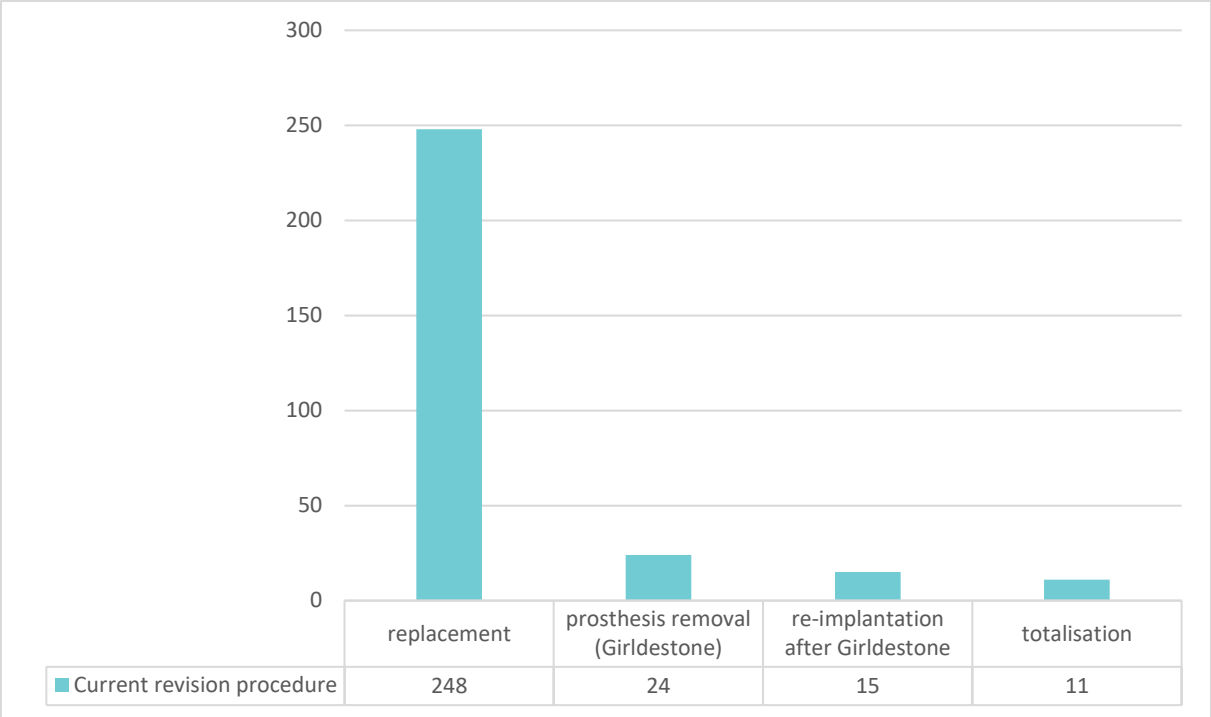


Figure 41: Revision hip arthroplasties by extent of revision (Source: RES).

In one case (0.3%), we did not receive information about the extent of hip revision. We excluded this case from further analysis.

In the RES database for 2021, 248 (83.2%) cases of prosthesis replacement, 24 (8.1%) cases of component removal, 15 (5%) cases of re-implantation of components and 11 (3.7%) cases of transitions are recorded into a total prosthesis.

We then checked whether there was an association between the extent of hip revision and the hospital of the surgery (see figure below). In 1 case, we do not have information about the hospital of the surgery and/or the scope of the current audit. We excluded it from the analysis.

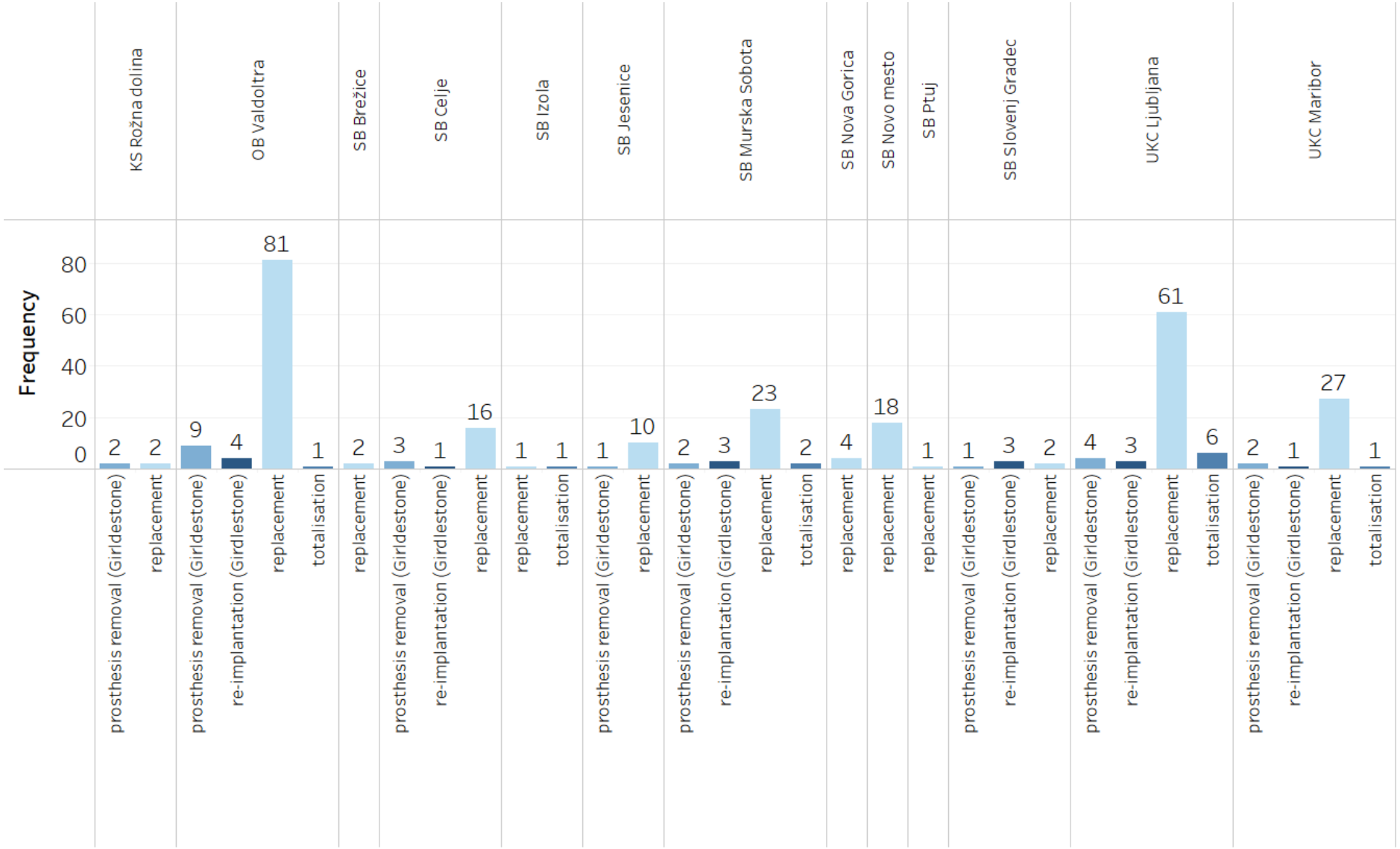


Figure 42: Revision hip arthroplasties by extent of the revision and hospital (Source: RES).

When calculating the HI-squared test, we encountered an excessive number (82.7%) of cells with less than 5 units. For this reason, the results should not be generalized.

5.4.3.4 Revision hip arthroplasty according to revision chirurgical approach

In the following, we reviewed which chirurgical approach was used in the hip revision. Here, the possible answers were anterior, antero-lateral, direct lateral, postero-lateral, extended anterior and others. We excluded the later from further analysis. We added the extended anterior answer to the anterior approach. The distribution of chirurgical approaches used in hip revision in 2021 is shown in the figure below.

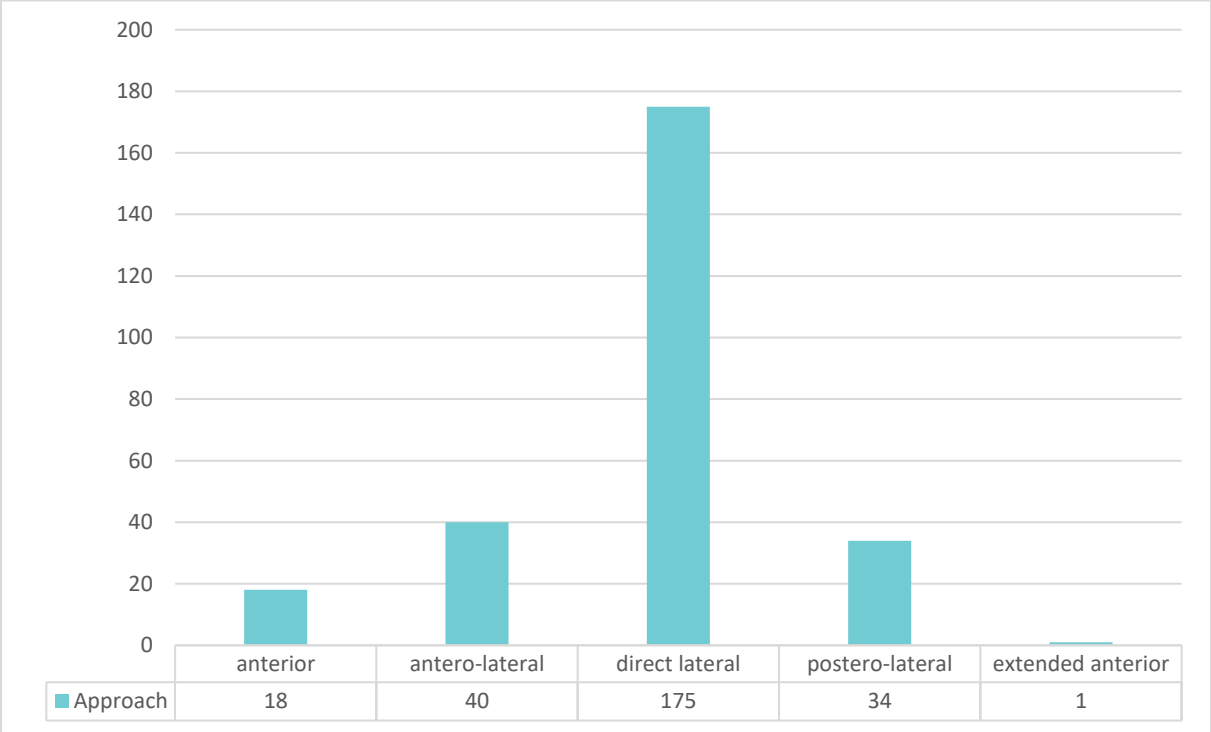


Figure 43: The chirurgical approach used in hip revision (Source: RES).

In the RES database for 2021, in 30 cases (10%), there was no information on the chirurgical approach used in hip revision. In one case (0.3%), other chirurgical approach was indicated but not explicitly mentioned. All 31 cases were excluded from further analysis.

In the RES database for 2021, we have data for 175 (65.3%) hip revisions using a direct lateral chirurgical approach, 40 (14.9%) hip revisions using an antero-lateral chirurgical approach, 34 (12.7%) of hip revisions using a postero-lateral chirurgical approach and 19 (7.1%) hip revisions using an anterior chirurgical approach.

In the following, we examined whether there is a connection between the chirurgical approach used during hip revision and the hospital of the surgery (see figure below). In 31 cases, we did not get information about the hospital of the surgery and/or the chirurgical approach used. We excluded these from further analysis.

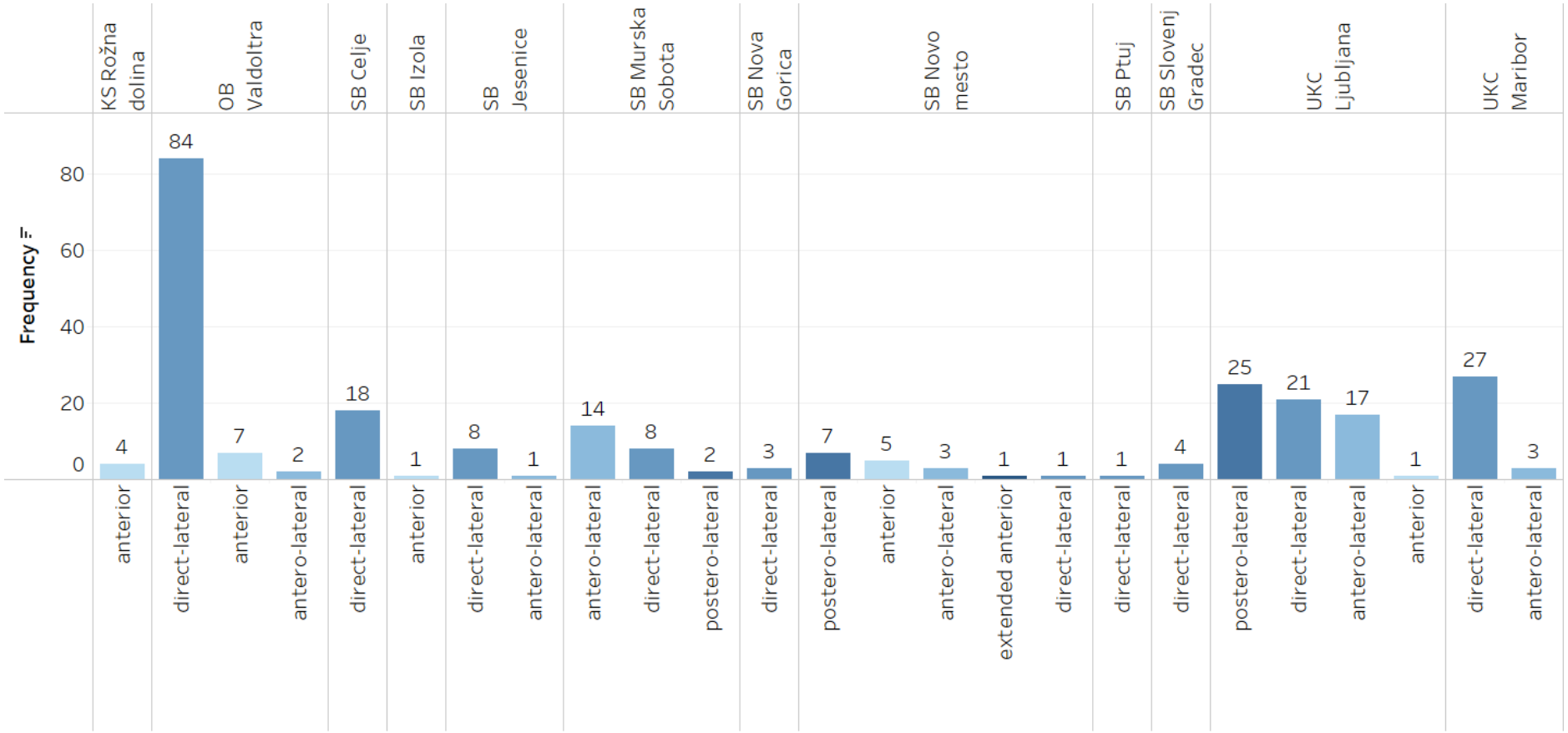


Figure 44: The chirurgical approach used in hip endoprosthesis revision by hospital (Source: RES).

Based on the results of the HI-squared test, we cannot generalize the obtained results, as we have an excessive number (80%) of cells with less than 5 units.

5.4.4 Prior surgeries on the revised hip

The picture below shows the previous surgeries on the revised hip in 2021.

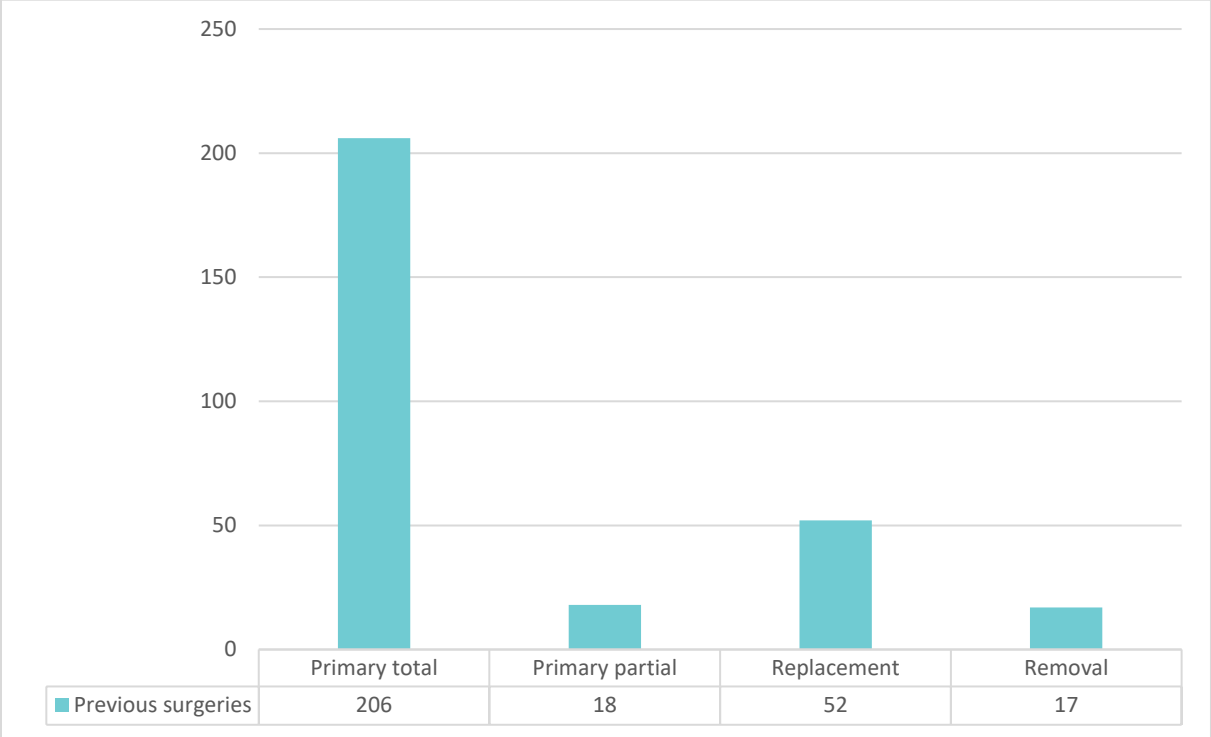


Figure 45: Previous surgeries on the revised hip (Source: RES).

In the case of hip revisions in 2021, there were 206 (69.4%) patients with a previous primary total arthroplasty, 18 (6.1%) with a previous primary partial, then 52 (17.5%) with a previous replacement on the revised hip and 17 (5.4%) where the patients had already had the prosthesis removed on the revised hip. In four cases, other surgeries were indicated. We did not have data for two surgeries.

5.4.5 First hip arthroplasty revisions in 2021

In this work, we show the characteristics of the first revisions of primary hip arthroplasty performed in 2021: type of primary arthroplasty, hospital of primary arthroplasty, number of days from primary arthroplasty to first revision.

In the RES database for 2021, we have data for 208 hip revisions in which primary total arthroplasty of this hip was performed, and 19 hip revisions in which primary partial arthroplasty of this hip was performed. We have a total of 227 of them.

5.4.5.1 Hospital of primary hip arthroplasty, revised for the first time in 2021

In the next part of the research, we examined the hospitals of primary hip arthroplasty, which was revised for the first time in 2021. The results are presented in the figure below.

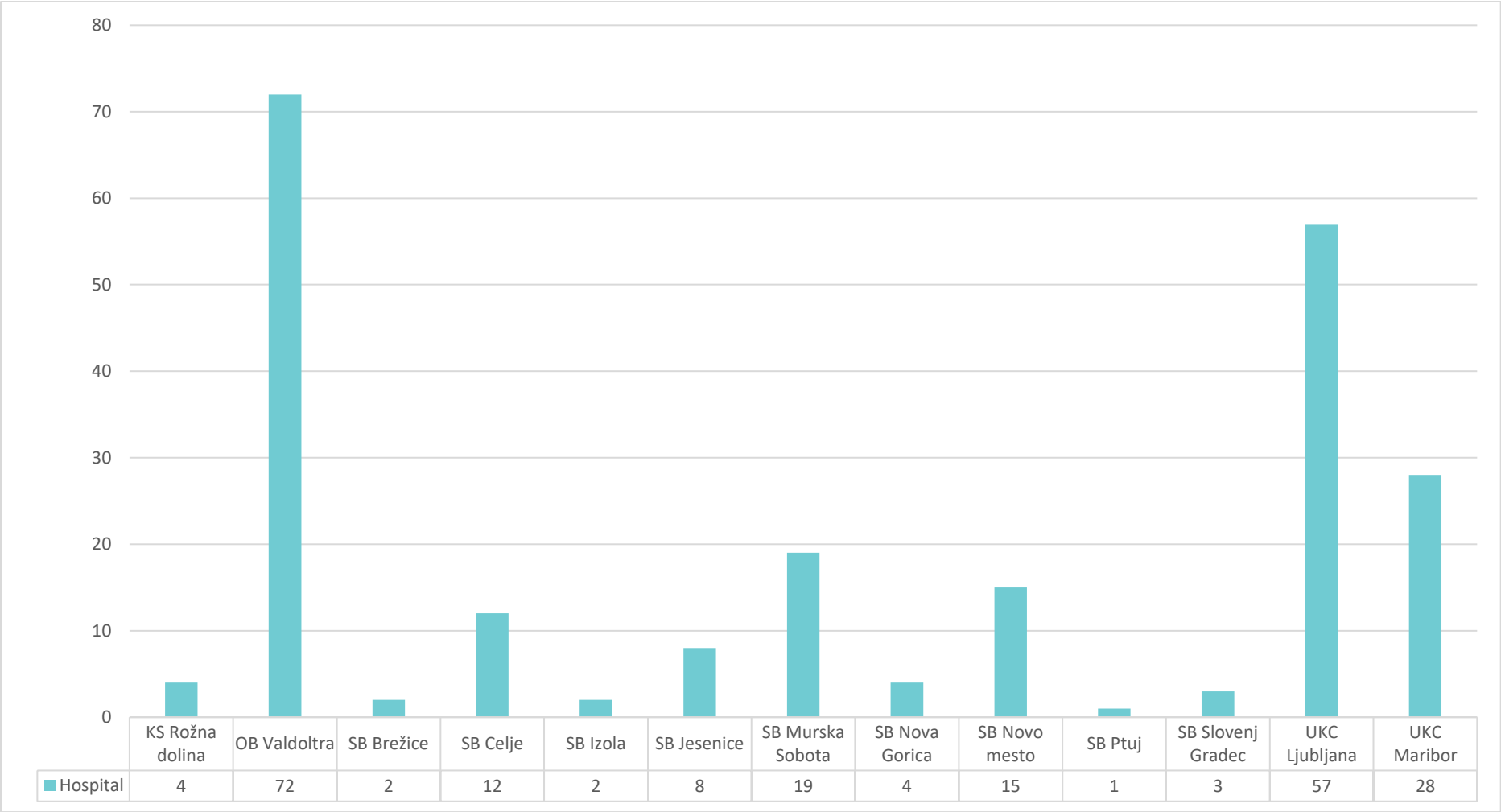


Figure 46: Hospital of primary hip arthroplasty revised for the first time in 2021 (Source: RES).

In the RES database for 2021, we do not have information on 8 (3.6%) hospitals of primary arthroplasty of the revised hip in 2021. In two cases (0.9%), the hospitals of primary arthroplasty were foreign medical institutions. All 10 cases were excluded from further statistical analysis.

In the RES database for the year 2021, we have data for 72 surgeries primarily performed in OB Valdoltra (31.7%), 57 surgeries primarily performed in UKC Ljubljana (25.1%), 28 (12.3%) cases of primary surgery in UKC Maribor, 19 (8.4%) in SB Murska Sobota, 15 (6.6%) in SB Novo mesto, 12 (5.3%) in SB Celje, 8 (3.5%) in SB Jesenice, 4 (1.8%) in KS Rožna dolina and SB Nova Gorica (5.2%), 3 (1.3%) in SB Slovenj Gradac, 2 (0.9%) in SB Brežice and SB Izola and 1 (0.4 %) in SB Ptuj.

5.4.5.2 Time from primary hip arthroplasty to first revision performed in 2021

We were also interested in how much time passed from the primary hip arthroplasty to the first revision of the hip endoprosthesis in 2021. Figure 48 shows the number of days since the primary hip arthroplasty.

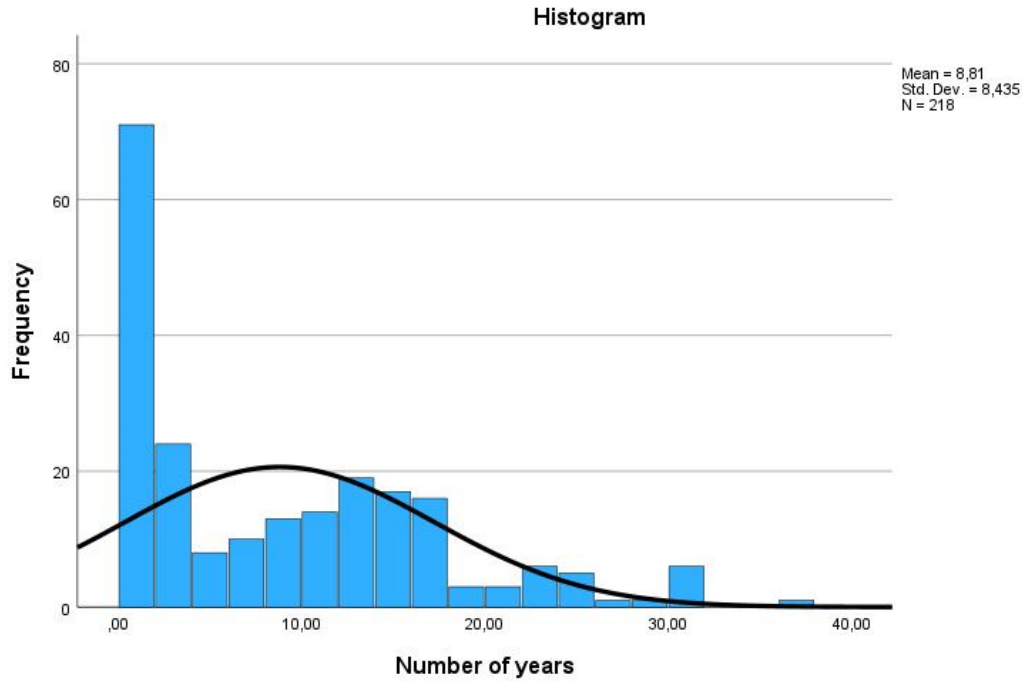


Figure 47: Number of years from primary hip arthroplasty to first hip revision (Source: RES).

In 9 cases, we did not get information on how many years passed from the primary hip arthroplasty to its revision in 2021. We excluded these cases from further analysis.

From the 2021 RES database, we can conclude that the average time between primary hip arthroplasty and revision in 2021 was 8.8 years with a standard deviation of 8.4 years. The shortest period between primary arthroplasty and hip revision in 2021 is 0 years, and the longest period is 37 years. Half of the revisions in 2021 were performed 7.5 years or more after the primary surgery for that hip, and half were performed 7.5 years or less after the primary hip surgery.

5.4.6 Inserted materials in revision hip arthroplasty

In this chapter, we reviewed the materials inserted in the first hip revision. In doing so, we checked the manufacturer of the inserted stem and the manufacturer of the inserted acetabulum.

5.4.6.1 Inserted stem in revision hip arthroplasty

In the figure below, we show the manufacturers of inserted stems in revision hip arthroplasty in 2021.

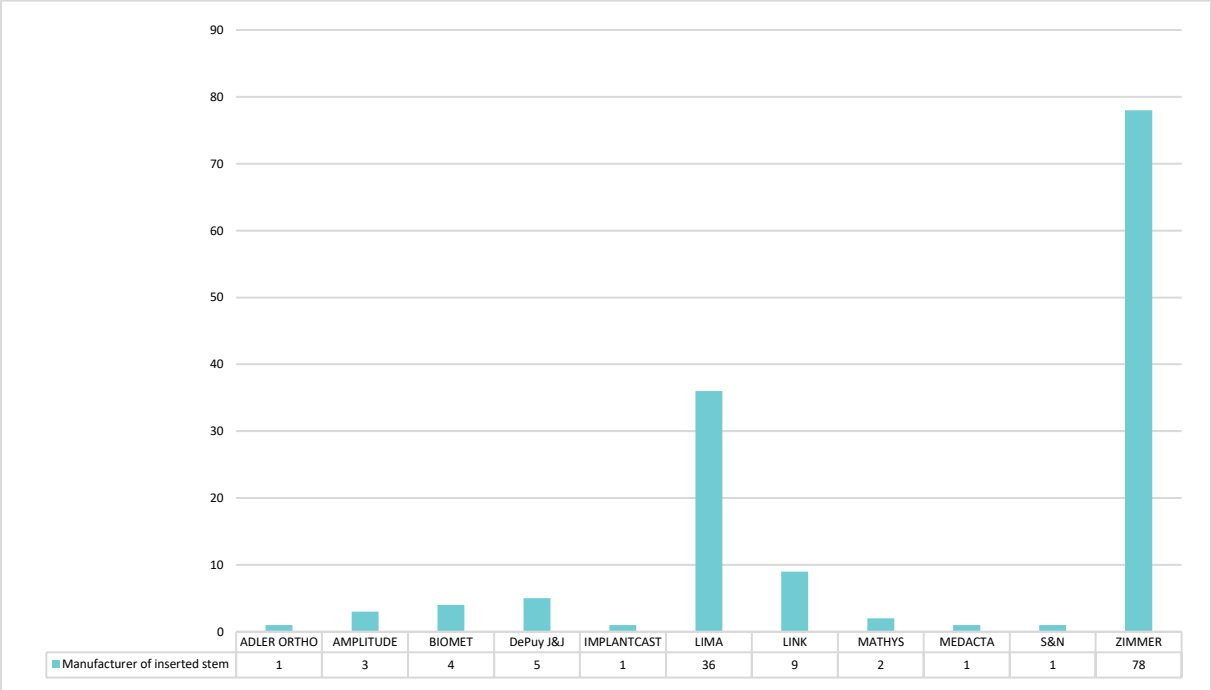


Figure 48: Manufacturer of the inserted stem in revision hip arthroplasty (Source: RES).

In 158 (52.8%) cases, we do not have information about the manufacturer of the inserted stem in revision hip arthroplasty. We excluded them from further statistical analysis.

In 2021, in revision hip arthroplasties, 78 (55.3%) ZIMMER stems were inserted, 36 (25.5%) LIMA stems, 9 (6.4%) LINK stems, 5 (3.5%) LINK stems manufactured by DePuy J&J, 4 (2.8%) stems manufactured by BIOMET, 3 (2.1%) stems manufactured by AMPLITUDE, 2 (1.4%) manufactured by MATHYS and 1 (0.7%) stem manufactured by ADLER ORTHO, IMPLANTCAST, MEDACTA and S&N.

In the figure below, we show the manufacturers of the inserted stem in revision hip arthroplasty according to the hospital.

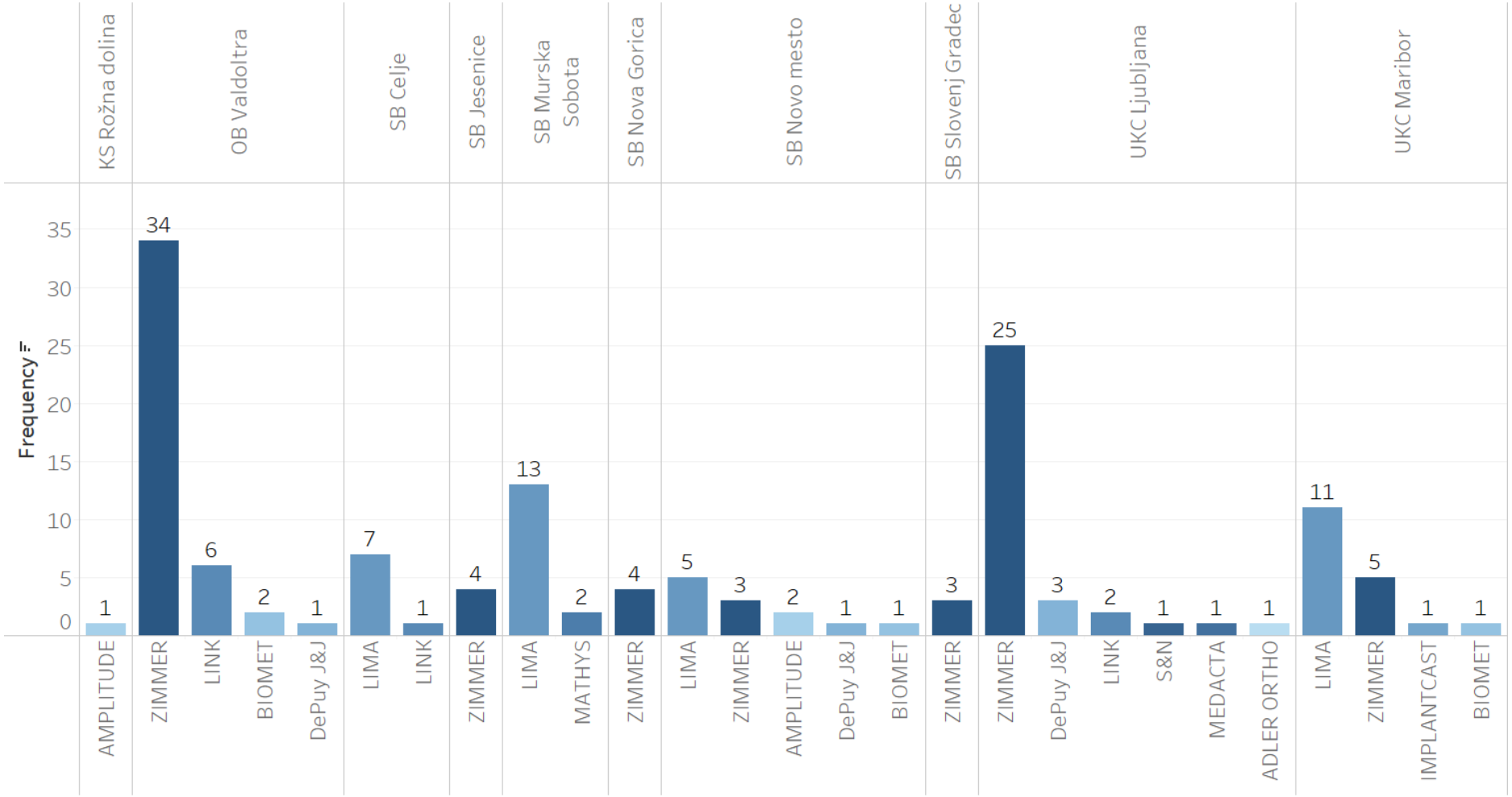


Figure 49: Manufacturer of the inserted stem by hospital (Source: RES).

Based on the results of the HI-squared test, due to the excessive number of cells with less than 5 units (93.6%), the obtained results should not be generalized.

5.4.6.2 Inserted acetabulums at first hip revision

In the picture below, we show the manufacturer of the inserted acetabulum during hip revision.

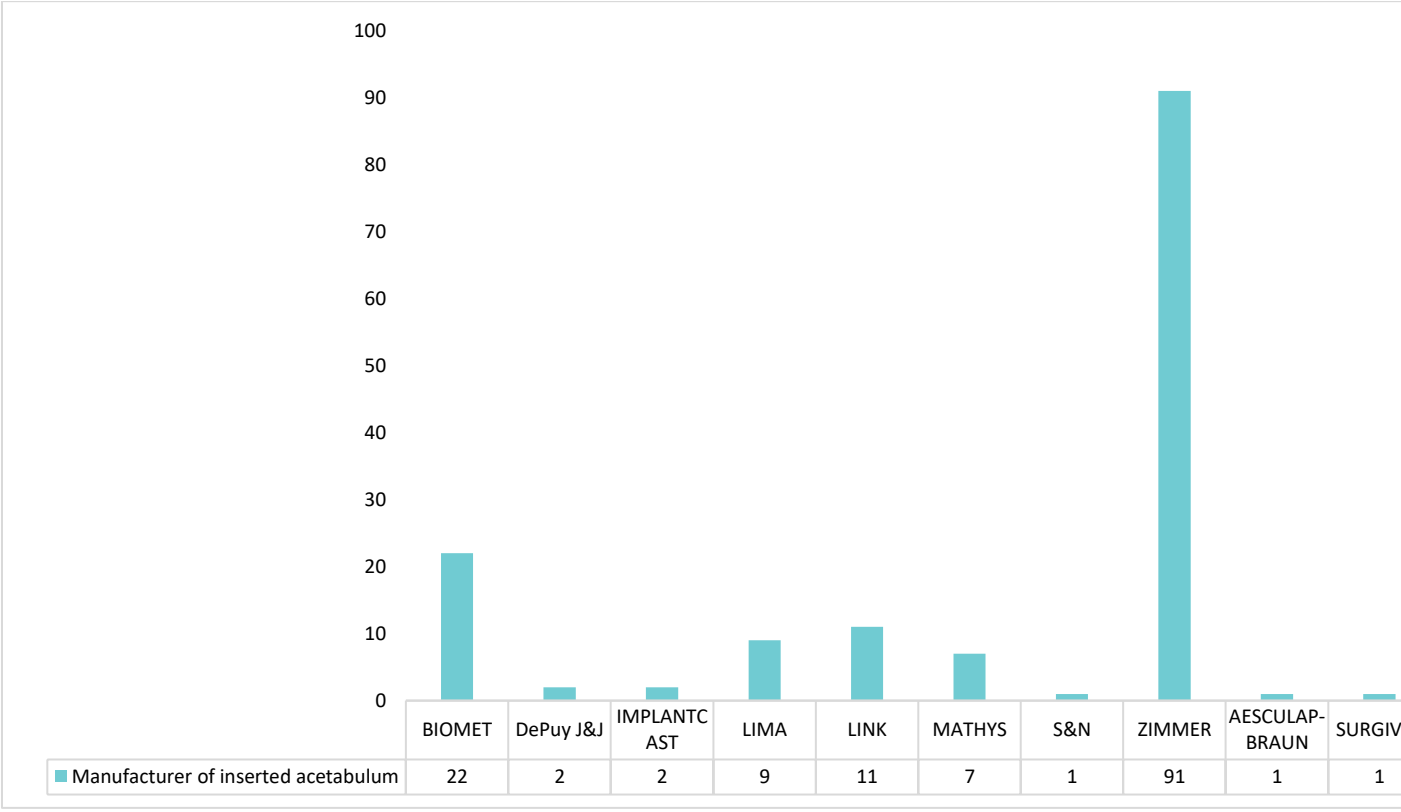


Figure 50: Inserted acetabulum manufacturer (Source: RES).

In 28 cases, we did not receive information about the manufacturer of the inserted acetabulum. We excluded these from further analysis.

In most cases, 32 or 25.4% of all, the manufacturer of the inserted acetabulum was ZIMMER. The following manufacturers follow: S&N (ENDOPLUS) (21 or 16.7% of cases), LIMA (17 or 13.5%), LINK (11 or 8.7%), DePuy J&J and MATHYS (6 or 4.8 %), IMPLANTCAST (5 or 4%), WRIGHT (CREMASCOLI) (4 or 3.2%), AMPLITUDE, SURGIVAL, WRIGHT and CREMASCOLI (3 or 2.4%), S&N, HELIPRO, MERETE MEDICAL and ZIMMER (BIOMET) (2 or 1.6%) and BIOMET, MEDACTA, STRYKER and PROTEK (1 or 0.8%).

In the figure below, we give the manufacturers of the inserted acetabulum according to the hospital.

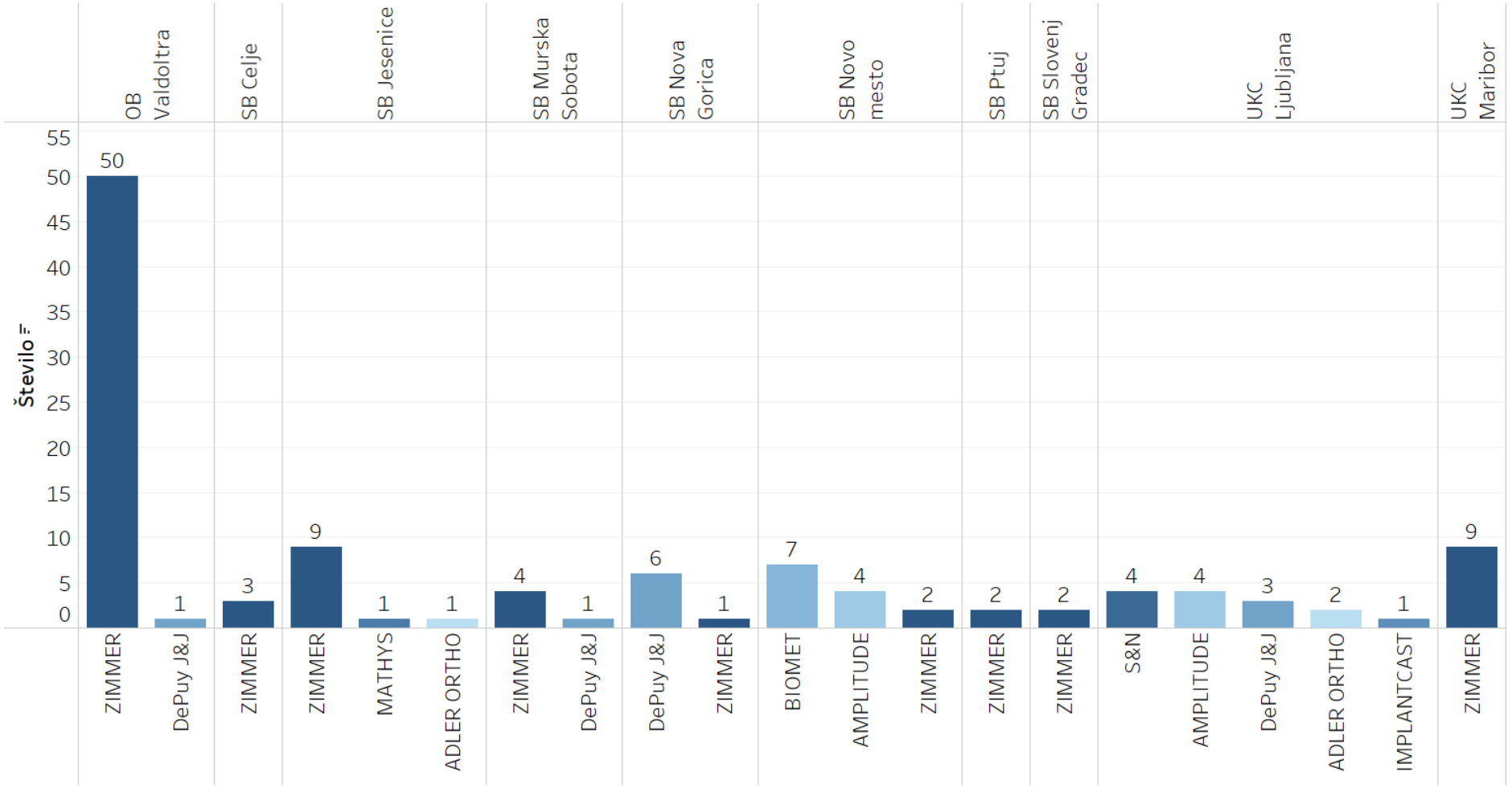


Figure 51: Insertion acetabulum manufacturer by hospital (Source: RES).

Due to the excessive number of cells with less than 5 units (94.5%), the obtained results should not be generalized.

Note: However, we are aware that the cost of endoprostheses per hospital depends on the selected providers in public tenders.

5.5 Performance results of hip implants

In this chapter, we show the success of hip implants, especially primary total and primary partial, according to the percentage (proportion) of revision.

5.5.1 Performance results of primary total hip arthroplasties

Table 3 gives the percentage of revisions for primary total hip arthroplasty over a 3-year period between 2019 and 2021.

Table 3: Percentage of revisions of primary total hip endoprosthesis from 2019 to 2021 (Source: RES).

Total Hip Endoprothesis (fem-acet)	N°of primaries	Revisions 19-21	% of revisions 19-21
ADLER ORTHO	**590**	**18**	**3,1**
uncemented	**590**	**18**	**3,1**
Apta Fix-Fixa Larus	590	18	3,1
CoXP	556	15	2,7
MoXP	34	3	8,8
AMPLITUDE	**439**	**6**	**1,4**
uncemented	**439**	**6**	**1,4**
Acor Monoblock-Saturne II Dual Mobility	46	0	0,0
MoP	37	0	0,0
CoP	9	0	0,0
Evok-Saturne II Dual Mobility	393	6	1,5
MoP	314	6	1,9
CoP	79	0	0,0
DePuy J&J	**2053**	**20**	**1,0**
uncemented	**2053**	**20**	**1,0**
Corail-Bi-Mentum	4	0	0,0
MoP	2	0	0,0
CoP	2	0	0,0
Corail-Pinnacle	1451	12	0,8
CoC	68	0	0,0
CoXP	1015	11	1,1
MoXP	368	1	0,3
Corail-Pinnacle Gription	492	7	1,4
CoC	21	0	0,0
CoXP	419	5	1,2
MoXP	52	2	3,8
Tri-Lock-Pinnacle	97	1	1,0
CoC	5	0	0,0
CoXP	62	1	1,6
MoXP	30	0	0,0
Tri-Lock-Pinnacle Gription	9	0	0,0

CoC	2	0	0,0
CoXP	7	0	0,0
IMPLANTCAST	**205**	**9**	**4,4**
uncemented	**205**	**9**	**4,4**
Actinia stem-EcoFit Epore	6	0	0,0
CoXP	6	0	0,0
EcoFit-EcoFit Epore	198	9	4,5
CoXP	185	9	4,9
MoXP	13	0	0,0
Mutars fem-Mutars Lumic	1	0	0,0
MoXP	1	0	0,0
LIMA	**1564**	**14**	**0,9**
uncemented	**1522**	**13**	**0,9**
C2-Delta Fins	1	0	0,0
CoXP	1	0	0,0
C2-Delta PF	79	1	1,3
CoC	1	0	0,0
CoXP	68	1	1,5
MoXP	10	0	0,0
Fit-Delta PF	5	0	0,0
CoC	1	0	0,0
CoXP	4	0	0,0
H-MAX S-Delta Fins	3	0	0,0
CoXP	1	0	0,0
MoXP	2	0	0,0
H-MAX S-Delta PF	1336	11	0,8
CoC	152	2	1,3
CoXP	861	7	0,8
MoXP	323	2	0,6
H-MAX S-Delta TT	31	0	0,0
CoXP	27	0	0,0
MoXP	4	0	0,0
Minima S-Delta PF	57	1	1,8
CoXP	57	1	1,8
Minima S-Delta TT	4	0	0,0
CoXP	4	0	0,0
Modulus-Delta One TT	1	0	0,0
MoXP	1	0	0,0
Modulus-Delta PF	1	0	0,0
CoC	1	0	0,0
Modulus-Delta TT	2	0	0,0
CoXP	1	0	0,0
CoP	1	0	0,0
Revision Modular-Delta PF	2	0	0,0
CoXP	1	0	0,0
MoXP	1	0	0,0
hybrid	**21**	**0**	**0,0**

H-MAX C-Delta PF	16	0	0,0
CoXP	1	0	0,0
MoXP	15	0	0,0
H-MAX C-Delta TT	5	0	0,0
CoXP	5	0	0,0
cemented	**12**	**0**	**0,0**
H-MAX C-Muller cem acet	7	0	0,0
CoP	7	0	0,0
H-MAX C-Muller Lima	2	0	0,0
MoP	1	0	0,0
CoP	1	0	0,0
H-MAX C-Protruded cem	3	0	0,0
MoP	2	0	0,0
CoP	1	0	0,0
obratno hybrid	**9**	**1**	**11,1**
H-MAX S-Muller cem acet	2	1	50,0
MoP	1	0	0,0
CoP	1	1	100,0
H-MAX S-Protruded cem	7	0	0,0
MoP	7	0	0,0
LINK	**181**	**3**	**1,7**
uncemented	**16**	**0**	**0,0**
SP-CL-CombiCup PF	16	0	0,0
CoC	10	0	0,0
CoXP	6	0	0,0
cemented	**164**	**3**	**1,8**
Lubinus SPII-IP	110	2	1,8
MoP	38	0	0,0
CoP	72	2	2,8
Lubinus SPII-IP XLPE	39	1	2,6
MoXP	39	1	2,6
Lubinus SPII-Lubinus PE	14	0	0,0
MoP	14	0	0,0
Lubinus SPII-Lubinus XLPE	1	0	0,0
MoXP	1	0	0,0
obratno hybrid	**1**	**0**	**0,0**
Lubinus SPII-IP	1	0	0,0
CoP	1	0	0,0
MATHYS	**374**	**2**	**0,5**
uncemented	**364**	**2**	**0,5**
CBH-RM Vitamys	149	0	0,0
CoXP	97	0	0,0
MoXP	52	0	0,0
CBH-Selexys PC	7	0	0,0
CoC	4	0	0,0
CoXP	3	0	0,0
Optimys-Anexys Cluster shell	4	0	0,0
CoC	4	0	0,0

Optimys-RM Vitamys	19	0	0,0
CoXP	19	0	0,0
TwinSys-RM Vitamys	184	2	1,1
CoXP	182	2	1,1
MoXP	2	0	0,0
TwinSys-Selexys PC	1	0	0,0
CoC	1	0	0,0
hybrid	**9**	**0**	**0,0**
CCA cem-RM Vitamys	5	0	0,0
CoXP	4	0	0,0
MoXP	1	0	0,0
TwinSys-RM Vitamys	4	0	0,0
CoXP	4	0	0,0
cemented	**1**	**0**	**0,0**
CCA cem-CCB Mathys	1	0	0,0
MoP	1	0	0,0
MEDACTA	**70**	**3**	**4,3**
uncemented	**63**	**3**	**4,8**
Quadra-H-Versafit CC Trio	63	3	4,8
CoXP	16	0	0,0
MoXP	47	3	6,4
hybrid	**7**	**0**	**0,0**
Quadra-C-Versafit CC Trio	7	0	0,0
MoXP	7	0	0,0
MIXED FEM-ACET	**855**	**24**	**2,8**
uncemented	**506**	**11**	**2,2**
Acor Monoblock-ConeTact	1	0	0,0
MoP	1	0	0,0
Acor Monoblock-G7	1	0	0,0
CoP	1	0	0,0
Alloclassic-Delta PF	2	0	0,0
MoXP	2	0	0,0
Alloclassic-Fixa Larus	1	0	0,0
CoXP	1	0	0,0
Apta Fix-Allofit	7	0	0,0
CoXP	7	0	0,0
Apta Fix-Allofit IT	4	0	0,0
CoC	3	0	0,0
CoXP	1	0	0,0
Apta Fix-Continuum	17	0	0,0
CoC	1	0	0,0
CoXP	15	0	0,0
MoXP	1	0	0,0
Apta Fix-R3	3	0	0,0
CoXP	3	0	0,0
Avenir-Pinnacle	1	0	0,0
MoXP	1	0	0,0
Avenir-Pinnacle Gription	1	0	0,0

CoXP	1	0	0,0
C2-RM Vitamys	1	0	0,0
CoXP	1	0	0,0
Corail-Allofit	26	1	3,8
CoXP	22	1	4,5
MoXP	4	0	0,0
Corail-Avantage cless	1	0	0,0
CoP	1	0	0,0
Corail-Continuum	1	0	0,0
CoXP	1	0	0,0
Corail-Delta PF	1	0	0,0
CoXP	1	0	0,0
Corail-Freeliner	3	0	0,0
CoXP	3	0	0,0
Corail-G7	10	0	0,0
MoP	1	0	0,0
CoP	9	0	0,0
Corail-Pinnacle	8	0	0,0
CoC	1	0	0,0
CoXP	7	0	0,0
Corail-Pinnacle Gription	1	0	0,0
CoXP	1	0	0,0
Corail-Saturne II Dual Mobility	4	0	0,0
MoP	4	0	0,0
EcoFit-Allofit	3	0	0,0
CoXP	3	0	0,0
EcoFit-Bicon Plus	1	0	0,0
CoXP	1	0	0,0
EcoFit-Continuum	3	0	0,0
CoXP	3	0	0,0
Evok-Allofit	5	0	0,0
CoXP	1	0	0,0
MoXP	4	0	0,0
Evok-ConeTact	1	0	0,0
MoP	1	0	0,0
Evok-G7	11	0	0,0
MoP	1	0	0,0
CoP	10	0	0,0
Evok-Pinnacle	95	2	2,1
CoXP	71	1	1,4
MoXP	24	1	4,2
Evok-Pinnacle Gription	13	0	0,0
CoC	2	0	0,0
CoXP	7	0	0,0
MoXP	4	0	0,0
H-MAX C-Avantage cless	1	0	0,0
MoP	1	0	0,0
H-MAX S-Allofit	11	0	0,0

CoXP	7	0	0,0
MoXP	4	0	0,0
H-MAX S-Allofit IT	3	0	0,0
CoC	2	0	0,0
CoXP	1	0	0,0
H-MAX S-Anexys Cluster shell	1	1	100,0
MoXP	1	1	100,0
H-MAX S-Avantage cless	3	0	0,0
MoP	3	0	0,0
H-MAX S-CombiCup PF	1	0	0,0
CoC	1	0	0,0
H-MAX S-Continuum	17	1	5,9
CoXP	15	0	0,0
MoXP	2	1	50,0
H-MAX S-TMARS revision	1	0	0,0
MoP	1	0	0,0
Minima S-Allofit IT	1	0	0,0
CoXP	1	0	0,0
Modular Revision-Avantage cless	2	0	0,0
MoP	2	0	0,0
Modular Revision-Continuum	1	1	100,0
CoXP	1	1	100,0
Modular Revision-Delta PF	5	1	20,0
CoC	2	1	50,0
CoXP	2	0	0,0
MoXP	1	0	0,0
Modular Revision-G7	1	0	0,0
MoP	1	0	0,0
Modular Revision-Pinnacle	1	1	100,0
MoXP	1	1	100,0
Modulus-Allofit	1	0	0,0
CoXP	1	0	0,0
Modulus-Allofit IT	1	0	0,0
CoC	1	0	0,0
Modulus-Avantage cless	1	0	0,0
CoP	1	0	0,0
Modulus-G7	1	0	0,0
CoP	1	0	0,0
Modulus-Pinnacle	1	0	0,0
CoXP	1	0	0,0
Modulus-Pinnacle Gription	2	0	0,0
CoC	1	0	0,0
CoXP	1	0	0,0
MP Reconstruction-Pinnacle Gription	1	0	0,0
CoXP	1	0	0,0
Optimys-Avantage cless	1	0	0,0
CoP	1	0	0,0
Optimys-Delta PF	9	0	0,0

CoXP	9	0	0,0
Pannon-CL MOD-Pinnacle Gription	1	1	100,0
MoXP	1	1	100,0
Revision LR-Avantage cless	1	0	0,0
MoP	1	0	0,0
Revision Modular-Allofit	3	2	66,7
CoXP	3	2	66,7
Revision Modular-Avantage cless	2	0	0,0
MoP	1	0	0,0
CoP	1	0	0,0
SL-PLUS-Allofit	2	0	0,0
CoXP	2	0	0,0
SL-PLUS-Continuum	8	0	0,0
CoXP	8	0	0,0
SL-PLUS-EcoFit Epore	5	0	0,0
CoXP	5	0	0,0
SL-PLUS-Fixa Larus	10	0	0,0
CoXP	10	0	0,0
SLR-PLUS REV-Continuum	1	0	0,0
CoXP	1	0	0,0
SP-CL-Allofit	1	0	0,0
CoXP	1	0	0,0
SP-CL-Allofit IT	1	0	0,0
CoC	1	0	0,0
SP-CL-Delta PF	1	0	0,0
CoXP	1	0	0,0
Taperloc Complete Microplasty-Allofit	7	0	0,0
CoXP	7	0	0,0
Taperloc Complete Microplasty-Allofit IT	1	0	0,0
CoC	1	0	0,0
Taperloc Complete Microplasty-Delta PF	99	0	0,0
CoC	23	0	0,0
CoXP	64	0	0,0
MoXP	12	0	0,0
Taperloc Complete Microplasty-Fixa Larus	22	0	0,0
CoXP	13	0	0,0
MoXP	9	0	0,0
Taperloc Complete Microplasty-Freeliner	2	0	0,0
CoXP	2	0	0,0
Taperloc Complete Microplasty-Pinnacle	20	0	0,0
CoXP	19	0	0,0
MoXP	1	0	0,0
Taperloc Complete Microplasty-Pinnacle Gription	1	0	0,0
CoXP	1	0	0,0
Tri-Lock-Freeliner	1	0	0,0
CoXP	1	0	0,0
Tri-Lock-G7	1	0	0,0
CoP	1	0	0,0

Exception-Pinnacle Gription	1	0	0,0
CoC	1	0	0,0
Exception-Pinnacle	22	0	0,0
CoXP	18	0	0,0
MoXP	4	0	0,0
hybrid	**125**	**1**	**0,8**
H-MAX C-Allofit	5	0	0,0
MoXP	5	0	0,0
H-MAX C-Avantage cless	1	0	0,0
MoP	1	0	0,0
H-MAX C-Continuum	2	0	0,0
CoXP	1	0	0,0
MoXP	1	0	0,0
H-MAX C-Pinnacle Gription	1	0	0,0
CoXP	1	0	0,0
Lubinus SPII-Allofit	85	1	1,2
CoXP	5	1	20,0
MoXP	80	0	0,0
Lubinus SPII-Avantage cless	3	0	0,0
MoP	3	0	0,0
Lubinus SPII-EcoFit Epore	6	0	0,0
MoXP	6	0	0,0
Lubinus SPII-Fixa Larus	8	0	0,0
MoXP	8	0	0,0
Lubinus SPII-Pinnacle	3	0	0,0
CoXP	3	0	0,0
Quadra-C-Allofit	2	0	0,0
MoXP	2	0	0,0
Self Locking cem-Allofit	9	0	0,0
MoXP	9	0	0,0
cemented	**96**	**3**	**3,1**
H-MAX C-Avantage cem	1	0	0,0
MoP	1	0	0,0
Lubinus SPII-Avantage cem	5	0	0,0
MoP	5	0	0,0
Lubinus SPII-Müller	1	1	100,0
CoP	1	1	100,0
Lubinus SPII-Muller cem acet	7	0	0,0
CoP	7	0	0,0
Lubinus SPII-Muller Durasul	7	0	0,0
CoXP	5	0	0,0
MoXP	2	0	0,0
Lubinus SPII-Muller Lima	3	1	33,3
CoP	3	1	33,3
Lubinus SPII-Müller Merete Medical	24	0	0,0
MoP	2	0	0,0
CoP	22	0	0,0
Lubinus SPII-Polarcup cem	40	1	2,5

MoP	40	1	2,5
MUTARS FILIA-Polarcup cem	1	0	0,0
MoP	1	0	0,0
Quadra-C-Lubinus PE	1	0	0,0
MoP	1	0	0,0
Self Locking cem-Lubinus PE	4	0	0,0
MoP	4	0	0,0
SL-IP XLPE	1	0	0,0
MoXP	1	0	0,0
Lubinus SPII-Protruded cem	1	0	0,0
CoP	1	0	0,0
obratno hybrid	**128**	**9**	**7,0**
Alloclassic-IP	1	0	0,0
CoP	1	0	0,0
Alloclassic-IP XLPE	1	0	0,0
CoXP	1	0	0,0
Apta Fix-IP	13	1	7,7
MoP	1	0	0,0
CoP	12	1	8,3
Apta Fix-IP XLPE	59	6	10,2
CoXP	55	6	10,9
MoXP	4	0	0,0
Corail-IP	1	0	0,0
MoP	1	0	0,0
Corail-Muller Durasul	2	0	0,0
MoXP	2	0	0,0
EcoFit-Avantage cem	1	0	0,0
MoP	1	0	0,0
EcoFit-IP	1	0	0,0
CoP	1	0	0,0
EcoFit-IP XLPE	6	1	16,7
CoXP	5	1	20,0
MoXP	1	0	0,0
EcoFit-Polarcup cem	30	1	3,3
MoP	30	1	3,3
Evok-Avantage cem	1	0	0,0
MoP	1	0	0,0
H-MAX S-Avantage cem	1	0	0,0
MoP	1	0	0,0
H-MAX S-Muller Durasul	3	0	0,0
MoXP	3	0	0,0
Quadra-H-Lubinus PE	2	0	0,0
MoP	2	0	0,0
SL-PLUS-IP XLPE	4	0	0,0
CoXP	4	0	0,0
Taperloc Complete Microplasty-IP XLPE	2	0	0,0
MoXP	2	0	0,0
S&N	**38**	**2**	**5,3**

uncemented	**33**	**2**	**6,1**
SL-PLUS-Bicon Plus	1	0	0,0
CoXP	1	0	0,0
SL-PLUS-R3	32	2	6,3
CoC	4	0	0,0
CoXP	28	2	7,1
obratno hybrid	**5**	**0**	**0,0**
SL-PLUS-Polarcup cem	4	0	0,0
MoP	4	0	0,0
SLR-PLUS REV-Polarcup cem	1	0	0,0
MoP	1	0	0,0
SANATMETAL	**12**	**0**	**0,0**
uncemented	**12**	**0**	**0,0**
Pannon-CL MOD-ConeTact	3	0	0,0
MoP	3	0	0,0
Pannon-CL MOD-ConeTact	3	0	0,0
MoP	2	0	0,0
CoP	1	0	0,0
Pannon-HA-ConeTact	3	0	0,0
MoP	3	0	0,0
Pannon-HA-ConeTact	3	0	0,0
CoP	3	0	0,0
STRYKER	**2**	**0**	**0,0**
uncemented	**2**	**0**	**0,0**
ABG II-Trident PSL HA shell	2	0	0,0
CoP	2	0	0,0
ZIMMER BIOMET	**3447**	**57**	**1,7**
uncemented	**3392**	**56**	**1,7**
Alloclassic-Allofit	1928	34	1,8
CoXP	931	19	2,0
MoXP	983	15	1,5
MoP	13	0	0,0
CoP	1	0	0,0
Alloclassic-Allofit IT	159	2	1,3
CoC	152	2	1,3
CoXP	7	0	0,0
Alloclassic-Avantage cless	11	1	9,1
MoP	11	1	9,1
Alloclassic-Continuum	6	0	0,0
CoXP	4	0	0,0
MoXP	2	0	0,0
Alloclassic-TMARS revision	2	0	0,0
MoXP	2	0	0,0
Aloclassic Revision-Allofit	6	0	0,0
CoXP	3	0	0,0
MoXP	3	0	0,0
Avenir-Allofit	139	3	2,2
CoXP	81	1	1,2

MoXP	58	2	3,4
Avenir-Allofit IT	3	0	0,0
CoC	2	0	0,0
CoXP	1	0	0,0
Avenir-Avantage cless	5	0	0,0
MoP	4	0	0,0
CoP	1	0	0,0
Avenir-G7	4	0	0,0
MoP	1	0	0,0
CoP	3	0	0,0
Corail-G7	1	0	0,0
CoP	1	0	0,0
Taperloc Complete Microplasty-Allofit	668	7	1,0
CoXP	597	3	0,5
MoXP	71	4	5,6
Taperloc Complete Microplasty-Allofit IT	89	1	1,1
CoC	21	0	0,0
CoXP	68	1	1,5
Taperloc Complete Microplasty-Avantage cless	5	0	0,0
MoP	5	0	0,0
Taperloc Complete Microplasty-Continuum	15	0	0,0
CoC	2	0	0,0
CoXP	13	0	0,0
Taperloc Complete Microplasty-G7	121	2	1,7
CoC	19	0	0,0
MoP	3	0	0,0
CoP	99	2	2,0
Wagner SL REV-Allofit	6	0	0,0
MoXP	6	0	0,0
Exception-Avantage cless	170	3	1,8
MoXP	1	0	0,0
MoP	140	3	2,1
CoP	29	0	0,0
Exception-G7	46	2	4,3
CoC	1	0	0,0
MoP	1	0	0,0
CoP	44	2	4,5
Exception-Allofit	8	1	12,5
CoXP	5	1	20,0
MoXP	3	0	0,0
hybrid	**30**	**1**	**3,3**
Avenir cem-Allofit	12	1	8,3
MoXP	12	1	8,3
Exception-Avantage cless	18	0	0,0
MoP	18	0	0,0
cemented	**8**	**0**	**0,0**
Avenir cem-Muller Durasul	1	0	0,0
MoXP	1	0	0,0

Exception-Avantage cem	7	0	0,0
MoP	5	0	0,0
CoP	2	0	0,0
obratno hybrid	**17**	**0**	**0,0**
Alloclassic-Muller Durasul	3	0	0,0
MoXP	3	0	0,0
Taperloc Complete Microplasty-Avantage cem	1	0	0,0
MoP	1	0	0,0
Exception-Avantage cem	13	0	0,0
MoP	13	0	0,0
AMPLITUDE-EVOLUTIS	**249**	**4**	**1,6**
uncemented	**249**	**4**	**1,6**
Acor Monoblock-Freeliner	8	0	0,0
CoC	1	0	0,0
CoXP	6	0	0,0
MoXP	1	0	0,0
Evok-Freeliner	241	4	1,7
CoC	4	0	0,0
CoXP	234	4	1,7
MoXP	3	0	0,0
Sum	**10079**	**162**	**1,6**

The success of total endoprostheses was measured by the proportion of revisions, which was 1.6% in three years (from 2019 to 2021). Shown in red are stem-cup combinations that were more than 2x larger than the average, with more than 20 primary surgeries.

5.5.2 Performance results of primary partial hip arthroplasties

The table shows the percentage of revisions of primary partial hip arthroplasty with data over a 3-year period between 2019 and 2021.

Table 4: Percentage of revisions of primary partial hip endoprosthesis from 2019 to 2021 (Source: RES).

Parcial bipolar hip endoprosthesis (fem-head)	N°primaries	Revisions 19-21	% of revisions 19-21
AESCULAP-BRAUN	**3**		**0,0**
cemented	**3**		**0,0**
Aesculap Bicontact S stem-Aesculap Bipolar	3		0,0
AMPLITUDE	**1**		**0,0**
uncemented	**1**		**0,0**
Evok-Lock Bipolar head Lima	1		0,0
DePuy J&J	**4**		**0,0**
uncemented	**4**		**0,0**
Corail-Lock Bipolar head Lima	4		0,0
IMPLANTCAST	**249**	**3**	**1,2**
cemented	**2**		**0,0**
EcoFit-Ic-bipolar head	2		0,0
uncemented	**247**	**3**	**1,2**

EcoFit-Ic-bipolar head	247	3	1,2
LIMA	**474**	**6**	**1,3**
cemented	**348**	**5**	**1,4**
CL Revision cem-Bipolar Twinset	1		0,0
CL Revision cem-Lock Bipolar head Lima	1		0,0
H-MAX C-Ic-bipolar head	2		0,0
H-MAX C-Lock Bipolar head Lima	132	2	1,5
SL-Lock Bipolar head Lima	212	3	1,4
uncemented	**126**	**1**	**0,8**
C2-Lock Bipolar head Lima	11		0,0
H-MAX S-Lock Bipolar head Lima	115	1	0,9
LIMA	**5**		**0,0**
cemented	**5**		**0,0**
H-MAX C-Lock Bipolar head Lima	5		0,0
LINK	**42**	**2**	**4,8**
cemented	**42**	**2**	**4,8**
Lubinus SPII-Ic-bipolar head	2		0,0
Lubinus SPII-Surgival biarticular	40	2	5,0
MATHYS	**61**	**3**	**4,9**
cemented	**43**	**2**	**4,7**
CCA cem-Bipolar head Mathys	41	2	4,9
TwinSys-Bipolar head Mathys	2		0,0
uncemented	**18**	**1**	**5,6**
CBH-Bipolar head Mathys	8		0,0
TwinSys-Bipolar head Mathys	10	1	10,0
MEDACTA	**248**	**1**	**0,4**
cemented	**247**	**1**	**0,4**
Quadra-C-Bipolar Head Medacta	234	1	0,4
Quadra-C-Surgival biarticular	13		0,0
uncemented	**1**		**0,0**
Quadra-H-Bipolar Head Medacta	1		0,0
MERETE MEDICAL	**122**	**1**	**0,8**
cemented	**122**	**1**	**0,8**
Müller-Bipolar Twinset	122	1	0,8
SURGIVAL	**228**	**3**	**1,3**
cemented	**228**	**3**	**1,3**
Self Locking cem-Surgival biarticular	218	3	1,4
Self Locking cem-Bipolar Head Medacta	2		0,0
Self Locking SS cem-Surgival biarticular	8		0,0
ZIMMER BIOMET	**65**		**0,0**
cemented	**59**		**0,0**
Exeption-Lock Bipolar head Lima	58		0,0
Exeption-Bipolar head Lima	1		0,0
uncemented	**6**		**0,0**
Alloclassic-Ic-bipolar head	2		0,0
Exeption-Lock Bipolar head Lima	4		0,0
Sum	**1502**	**19**	**1,3**

The success of partial prostheses was measured by the proportion of revisions, which was 1.26% in three years (from 2019 to 2021). It should be emphasized here that these are patients after a hip fracture, who are older and, according to data from previous years, also have a higher mortality rate, so the probability of revision is lower for them than for patients with elective hip surgery.

5.6 Conclusions regarding hip arthroplasty

5.6.1 Total hip arthroplasty

In the years from 2019 to 2021, we performed 10,079 primary total hip arthroplasty (THA) procedures in Slovenia. Out of these, 162 (1.6%) required revision surgery. Among the primary endoprostheses, only 280 cemented implants were used, accounting for 2.77% of all primary THA procedures. The revision rate in the cemented prosthesis group was 2.14%. Hybrid THA implants were used in even fewer cases, with 162 (1.6%) instances, and the least number of procedures involved reverse hybrid endoprostheses, which were used in 137 cases (1.4% of all THA procedures).

Table 3 reveals that a relatively high proportion of the implanted THA prostheses consisted of different manufacturers' acetabular cups and femoral stems. The revision rate in this group was 2.81%, which is higher than the average. Particularly high revision rates were observed in the mixed reverse hybrid endoprostheses group, with 9 out of 128 implanted THA prostheses (7.0%) requiring revision. The main reasons for revision in this group were deep infection and periprosthetic fracture. Among the reverse hybrids, the combination of AptaFix femoral stem and IP XLPE acetabular cup stood out with 6 revisions out of 59 implanted THA prostheses (10.2%). The primary reason for revision in this group was early infection.

The lowest revision rate was observed in the uncemented THA group. Out of 9,446 implanted prostheses, 144 (1.5%) required revision. However, two combinations within the uncemented prosthesis group had higher revision rates:

- The AptaFix-FixaLarus combination had a revision rate of 3.1%, with the main reason for revision being prosthesis dislocation.
- The combination of EcoFit-EcoFit Epore, in ceramic/ceramic articulation, had a revision rate of 4.9% (9 out of 185 primary prostheses). The primary reason for revision in this group was also prosthesis dislocation.
- The combination of Quadra H-Versafit CC Trio from Medacta also had a revision rate of 4.8% (3 out of 63). The main reason for revision in this group was loosening of the femoral component.

5.6.2 Partial hip arthroplasty

During the period between 2019 and 2021, a total of 1,502 femoral fracture fixation devices (PEP hip implants) were implanted. Out of these, 19 (1.8%) required revision surgery during that period.

Among the 474 implants used, the most commonly utilized endoprosthesis was manufactured by Lima (cumulative loosening rate during this period was 1.27%). However, the individually most frequently used cemented stem was the Quadra model from Medacta, which also had a low revision rate during this period (1 out of 247, or 0.4%).

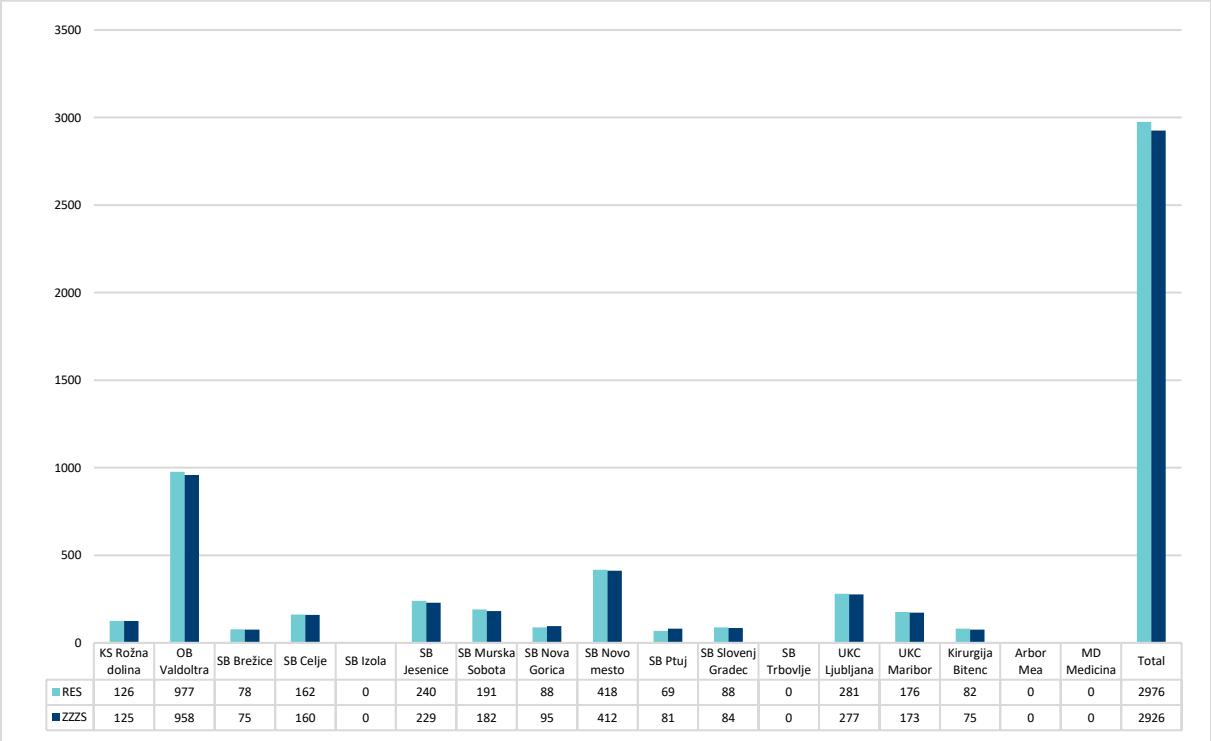
6 Knee arthroplasties

In this chapter, we focus on knee arthroplasties performed in the Republic of Slovenia in the period from 1/1/2021 to 12/31/2021. In the analysis, we took into account the data we received until 10/1/2022. We received a total of 2,749 data on primary knee arthroplasties.

First, we will present the compliance of the obtained data. This is followed by an analysis of primary knee arthroplasties and then an analysis of the first revision of knee arthroplasties. At the end of the chapter, we will give final conclusions regarding knee arthroplasties in 2021.

6.1 Compliance of the obtained data

First of all, we provide the compliance (ratio between completed forms in the RES database for the year 2021 and the record of the number of knee arthroplasties by the ZZZS) for the year 2021 (see the picture below), according to the hospitals of knee arthroplasty in the Republic of Slovenia. It should be noted that in the RES database we have data on individual surgeries according to the side of the surgery (in the case of simultaneous surgery on the left and right knee, two separate cases are recorded), while the ZZZS records data on the performed surgeries regardless of the side of the surgery (in in the case of simultaneous surgery on the left and right knee, only one case is recorded). As a result, discreapance may occur in the number of recorded surgeries. ZZZS does not treat primary knee arthroplasties and revision knee arthroplasties separately. For this reason, we treated all knee arthroplasties together.



	KS Rožna dolina	OB Valdoltra	SB Brežice	SB Celje	SB Izola	SB Jesenice	SB Murska Sobota	SB Nova Gorica	SB Novo mesto	SB Ptuj	SB Slovenj Gradec	SB Trbovlje	UKC Ljubljana	UKC Maribor	Kirurgija Bitenc	Arbor Mea	MD Medicina	Total
RES	126	977	78	162	0	240	191	88	418	69	88	0	281	176	82	0	0	2976
ZZZS	125	958	75	160	0	229	182	95	412	81	84	0	277	173	75	0	0	2926

Figure 52: Data on the number of performed primary and revision knee arthroplasties in 2021 - comparison of RES and ZZZS.

From Figure 52, we can see that ZZZS has 2,926 knee arthroplasties recorded for 2021, while in RES database we have 2,976 knee arthroplasties recorded in the RES database. SB Izola and SB Trbovlje do not perform knee arthroplasties, but we do not have information about ArborMea. The number of knee arthroplasties in the RES database is always slightly higher than in the ZZZS database, which is due to the different methodology of the unit in question. The only exceptions are SB Nova Gorica and SB Ptuj, where slightly fewer units are registered

in the RES database than in the ZZZS database. The number of data in both databases differs minimally, as a result of which we can conclude that in the RES database we have reached the census of data on knee arthroplasties performed in 2021, which enables the preparation of conclusions for all surgeries of this type performed on Slovenian patients in 2021.

6.2 Primary knee arthroplasties

In this part of the report, we present primary knee arthroplasties in the Republic of Slovenia in 2021. In RES, we obtained data for 2,748 primary knee arthroplasties. In this part of the report, we first focus on primary knee arthroplasty data. The following is information on the implanted parts of the endoprosthesis.

6.2.1 Primary knee arthroplasties according to patient data

First, we looked at the data obtained on patients who underwent primary knee arthroplasty in 2021. We were interested in their gender and age.

6.2.1.1 Primary knee arthroplasties according to patient gender

In the figure below, we present the distribution of patients from the RES database who underwent primary knee arthroplasty in 2021, according to their gender.

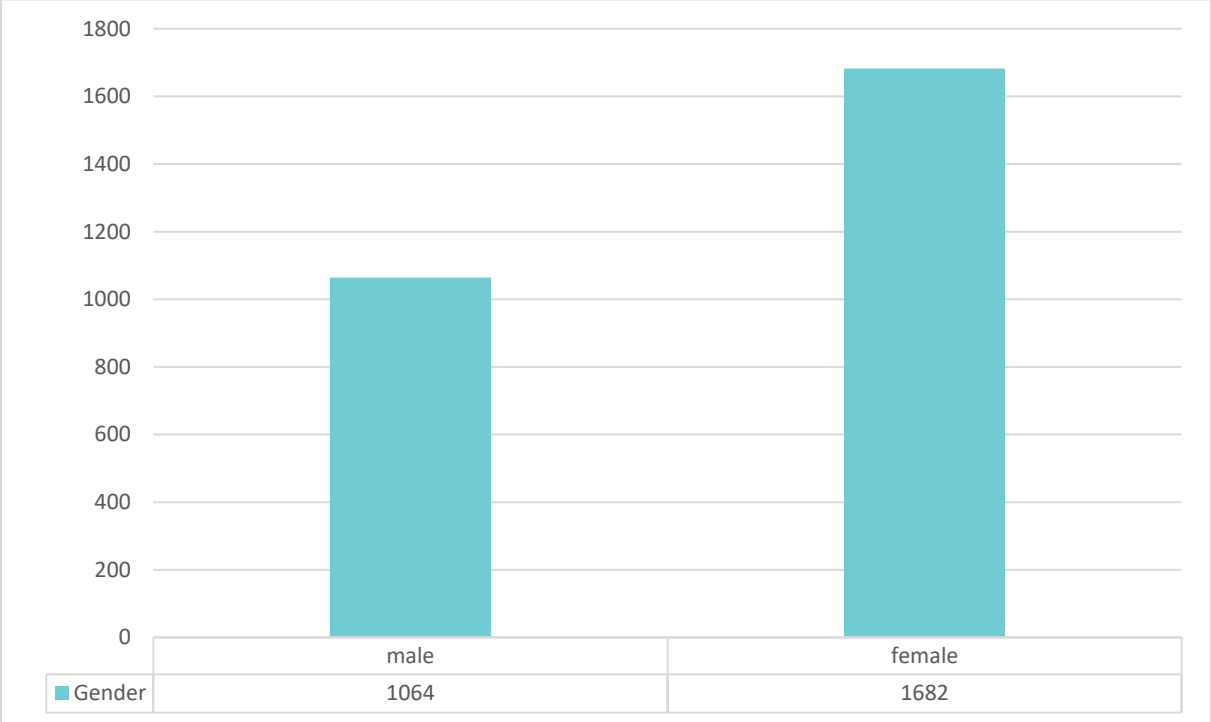


Figure 53: Primary knee arthroplasties by gender (Source: RES).

In two cases (0.1%), we did not receive information on the gender of the patient. We excluded these two cases from further analysis.

In the RES database for the year 2021, we have information on 1,064 (38.7%) primary knee arthroplasties performed on male patients and 1,682 (61.3%) on female patients.

6.2.1.2 Primary knee arthroplasties according to the age of the patients at the time of surgery

Then we checked the age of the patients at the time of surgery. The distribution is presented in the figure below.

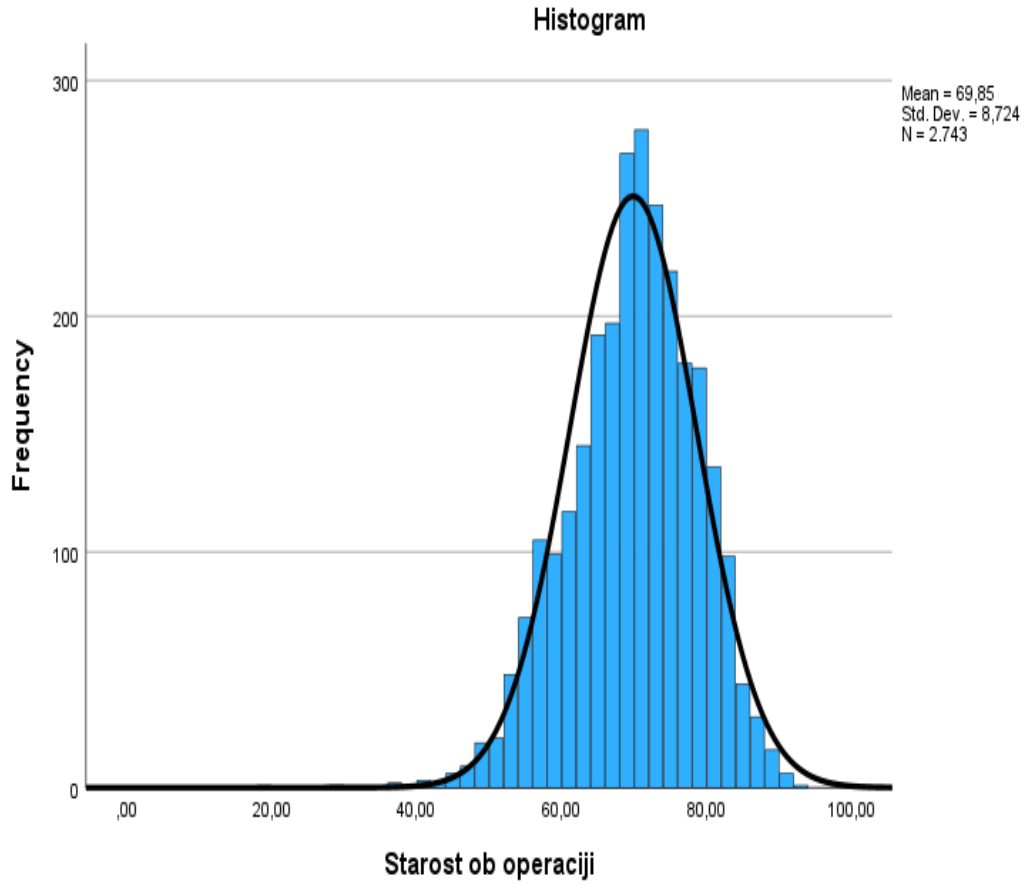


Figure 54: Primary knee arthroplasties by age of patients at surgery (Source: RES).

In 5 cases, we did not receive the date of birth of the patients, which made it impossible to calculate their age at the time of surgery. These patients were excluded from further statistical analysis.

In the RES database for the year 2021, we have data on the age of 2,743 patients at the time of primary knee arthroplasty. With the help of the Kolmogorov-Smirnov test ($p < 0.001$), we proved that the age distribution is not approximately normal. For this reason, we used non-parametric tests and the calculation of the median.

The median is 70.5 years, which means that half of the patients at the time of primary knee arthroplasty were 70 years of age or older, and half were 70 years of age or younger. The youngest patient was 19.23 years old, and the oldest was 93.3 years old.

6.2.2 Primary knee arthroplasties according to information about the hospital of the surgery

In the next part of the report, we reviewed primary knee arthroplasties according to the hospital of the surgery. The results are presented in the figure below.

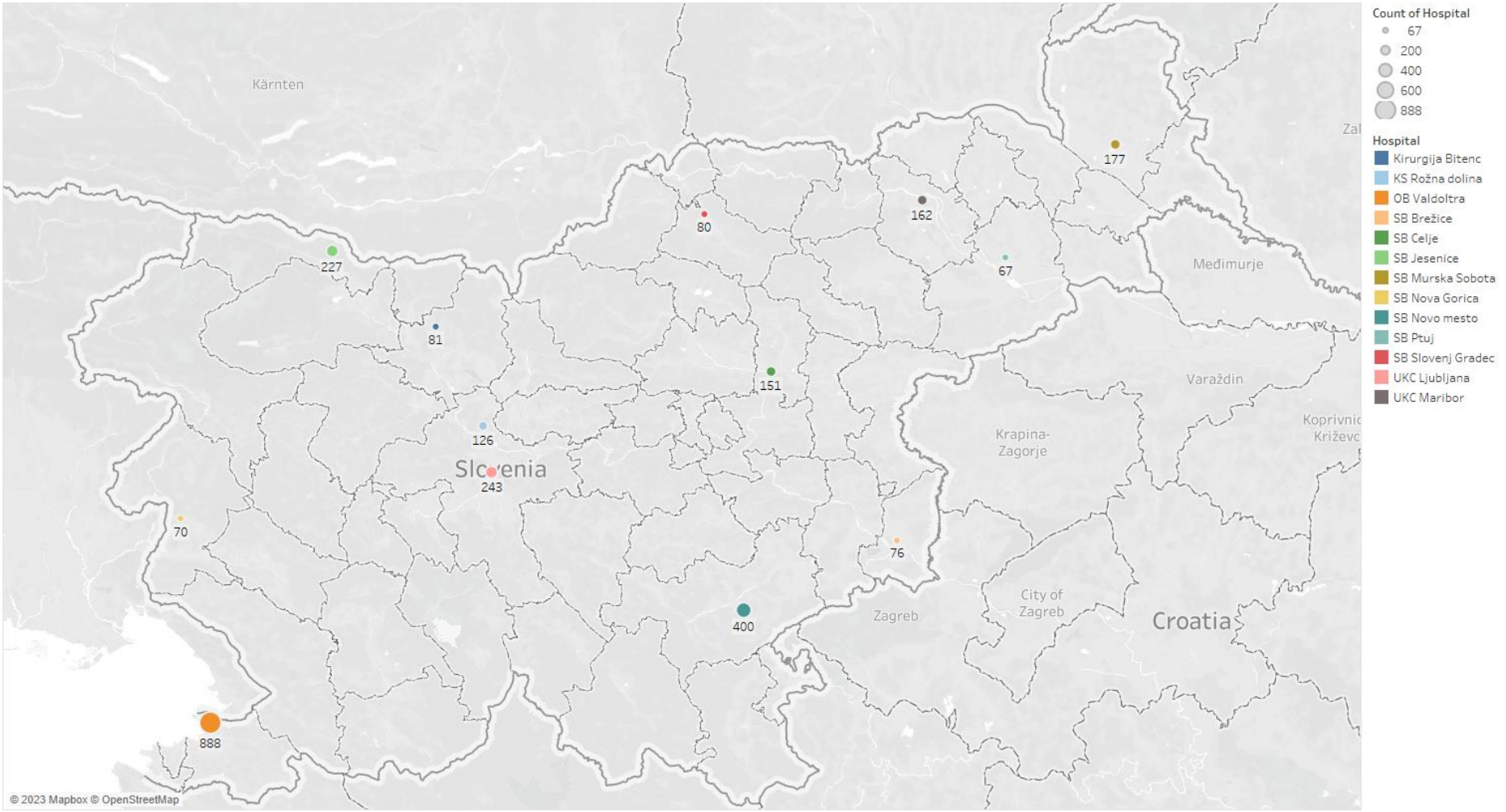


Figure 55: Primary knee arthroplasties by hospital (Source: RES).

In the RES database for the year 2021, we have data on 888 (32.3%) primary knee arthroplasties performed in OB Valdoltra, 400 (14.6%) in SB Novo mesto, 243 (8.8%) in UKC Ljubljana , 227 (8.3%) in SB Jesenice, 177 (6.4%) in SB Murska Sobota, 162 (5.9%) in UKC Maribor, 151 (5.5%) in SB Celje, 126 (4, 6%) in KS Rožna dolina, 81 (2.9%) in Kirurgiji Bitenc, 80 (2.9%) in SB Slovenj Gradec, 76 (2.8%) in SB Brežice, 70 (2.5%) in SB Nova Gorica and 67 (2.4%) in SB Ptuj.

6.2.3 Primary knee arthroplasties according to the characteristics of the current surgery

In the following, we would like to present data on primary knee arthroplasty: side of surgery, diagnosis, previous surgeries, fixation of the prosthesis and the chirurgical approach used. Here, we present the differences according to the gender and age of the patient at the time of surgery and the hospital of the primary knee arthroplasty.

6.2.3.1 Side of surgery in primary knee arthroplasty

First, we checked the surgery side. Here, we examined the differences between the left and right sides of the knee primary arthroplasty (Figure 56).

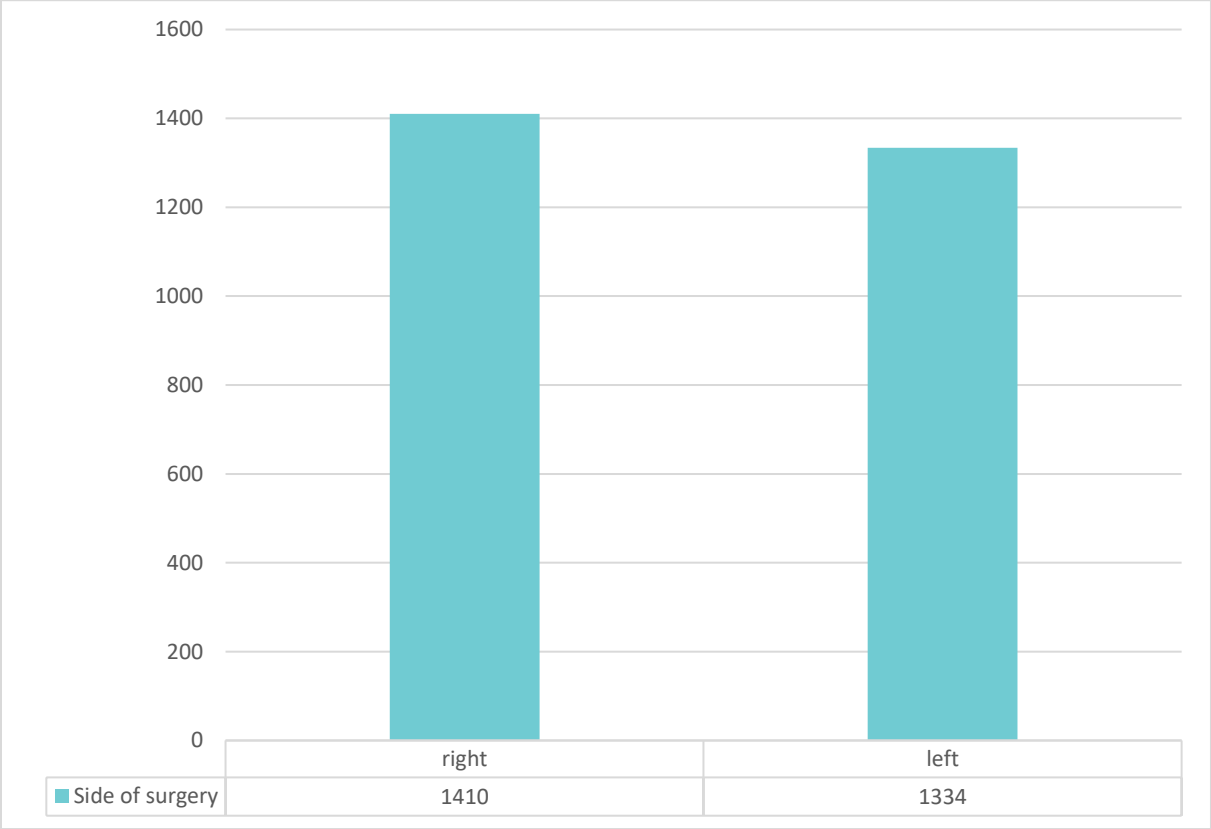


Figure 56: Primary knee arthroplasty procedure side (Source: RES).

For 4 (0.1% of all) knee arthroplasties, we do not have information on the side of the surgery. We excluded them from further statistical analysis.

For the Republic of Slovenia, RES has data for 2021 for 1,410 (51.4%) right knee arthroplasties and 1,334 (48.6%) left knee arthroplasties.

6.2.3.2 Diagnosis in primary knee arthroplasty

In the following, we reviewed the differences between the diagnosis and the data on patients in the RES database for the year 2021. The following possible diagnoses for primary knee arthroplasty were listed: primary osteoarthrosis, rheumatoid / uric / psoriatic arthritis,

posttraumatic, as a result of torn ligaments, as a result of meniscal damage, due to infection, aseptic bone necrosis, primary unicondylar osteoarthrosis and others[15].

For the year 2021, we have data for 2,748 primary knee arthroplasties in the RES database. Figure 57 shows the distribution of knee arthroplasties by individual diagnoses.

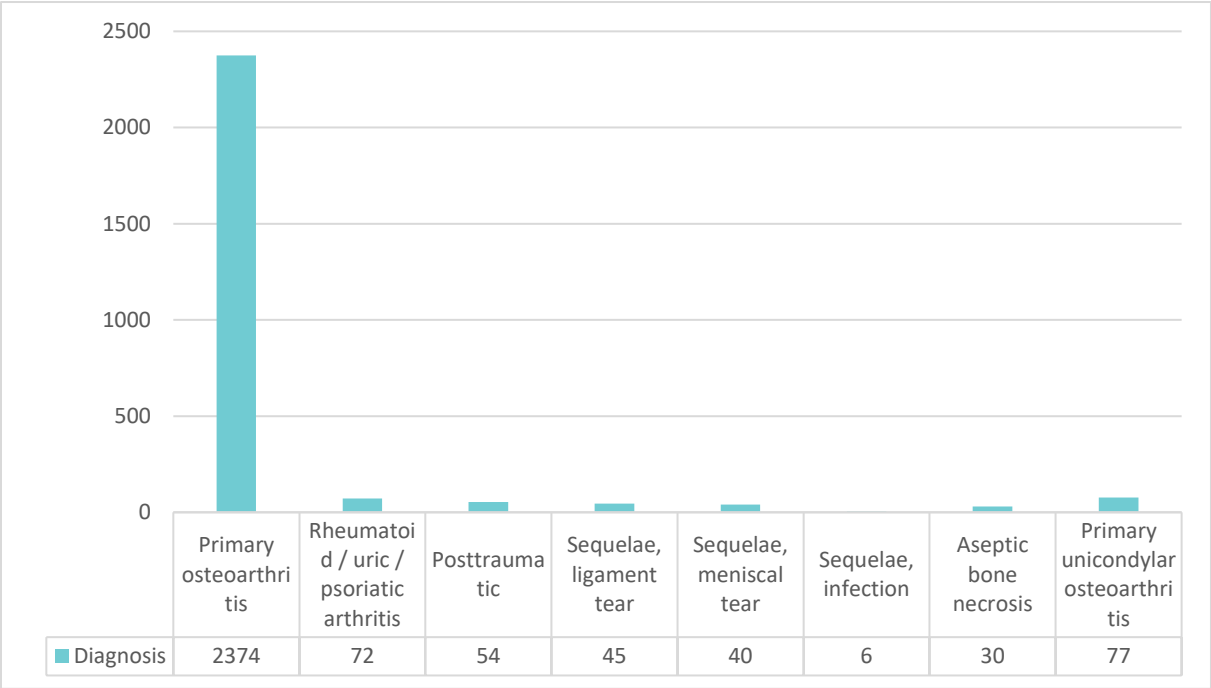


Figure 57: Diagnosis during primary knee arthroplasty (Source: RES).

For 36 cases (1.3%) of recorded knee arthroplasties performed in 2021, we do not have information on the diagnosis. We excluded them from further statistical analysis. We also excluded other diagnoses from the analysis.

In the RES database, we have 2,374 (88%) primary knee arthroplasties recorded for the year 2021, which were performed due to the diagnosis of primary osteoarthrosis. To a lesser extent, knee arthroplasties were performed due to primary unicondylar osteoarthrosis (77 or 2.9% of all primary knee arthroplasties), rheumatic / uric / psoriatic arthritis (72 or 2.7% of all primary knee arthroplasties), because of fracture (54 or 2 % of all primary knee arthroplasties), consequences of torn ligaments (45 or 1.7% of all primary knee arthroplasties), consequences of meniscal damage (40 or 1.5% of all primary knee arthroplasties), aseptic bone necrosis (30 or 1.1% of all primary knee arthroplasties) and the consequences of infection (6 or 0.2% of all primary knee arthroplasties).

In the following, we show (see Figure 58) an overview of diagnoses in the RES database for the year 2021 for primary knee arthroplasty, according to the hospital of the surgery. In 36 cases, we do not have information about the hospital of the surgery and/or the diagnosis at the time of the surgery. We excluded them from the analysis.

[15] Other diagnoses were excluded from the analysis. Hemophilia was reported in 2 cases, osteosarcoma of the femur in 1, and a condition after femoral osteotomy in 1. In the other 10 cases, we did not receive a recorded diagnosis at the time of this knee arthroplasty.

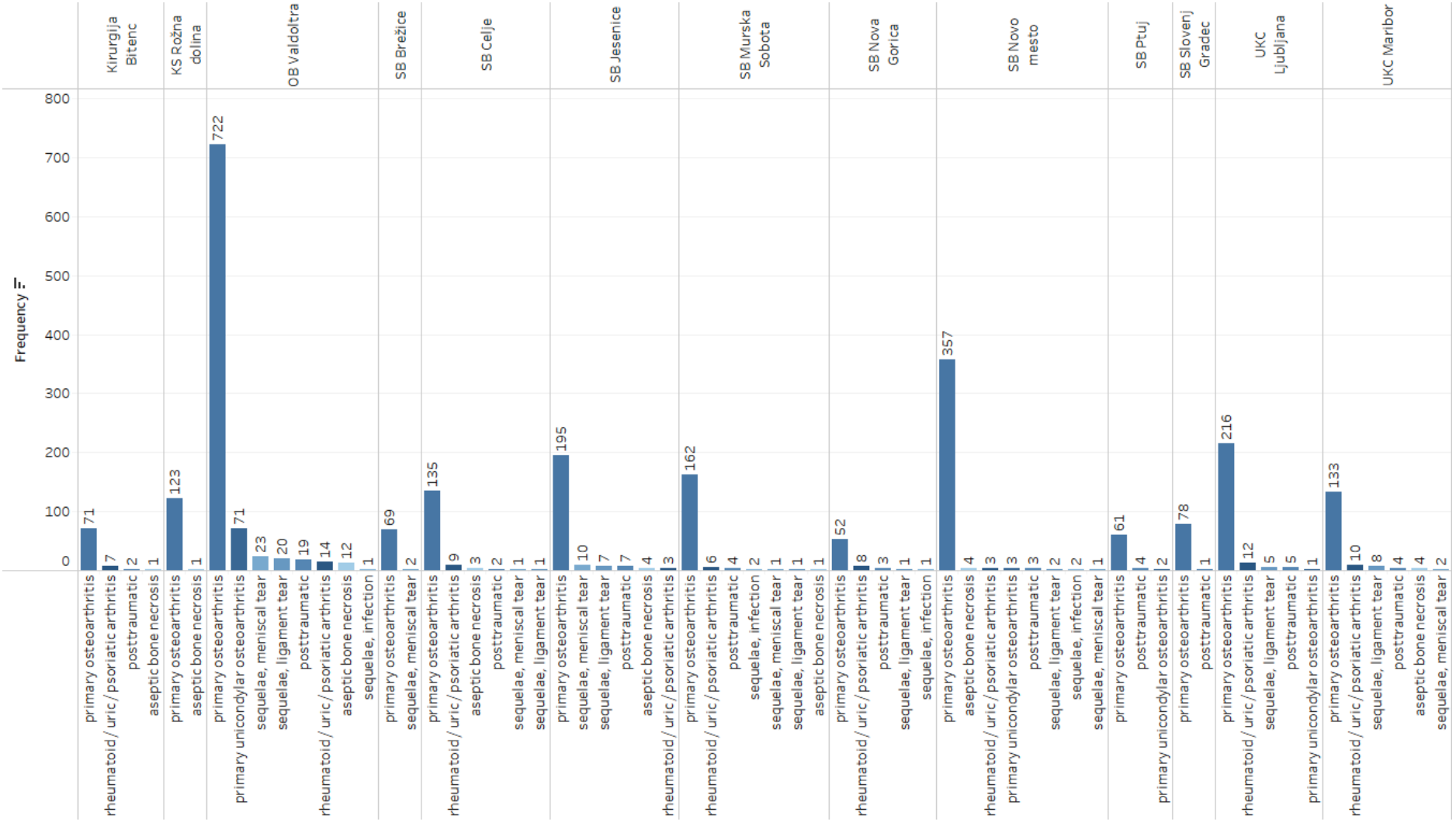


Figure 58: Diagnosis during primary knee arthroplasty by hospital (Source: RES).

When reviewing the results of the HI-squared test, from the RES database for 2021, to determine the association between the hospital and the diagnosis for knee arthroplasty, we can conclude that the results are not the most reliable, as the proportion of cells with less than 5 units is 72.1%.

6.2.3.3 Type of primary knee arthroplasty

We described the type of current surgery: partial medial, partial lateral, total with patella, total without patella, or patellofemoral surgery. The distribution can be found in Figure 59.

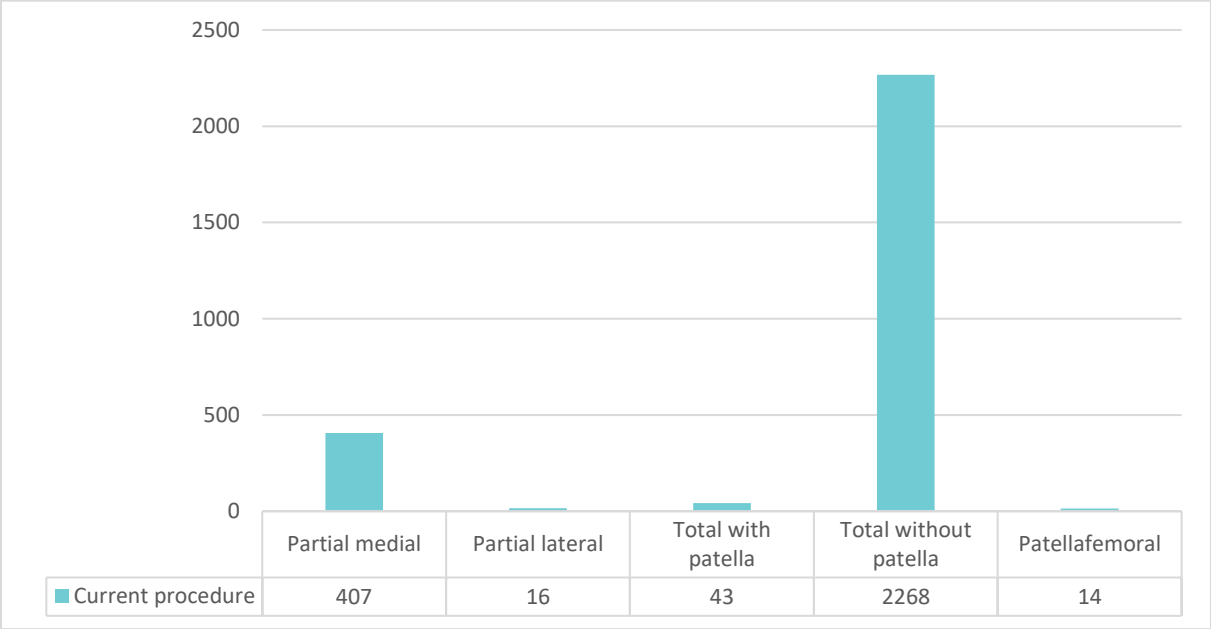


Figure 59: Type of knee arthroplasty (Source: RES).

In the RES database for the year 2021, we have data for 2,268 (82.5%) total knee arthroplasties without patella, 407 (14.8%) partial medial knee arthroplasties, 43 (1.6%) total knee arthroplasties with patella, 16 (0 .6%) partial lateral knee arthroplasties and 14 (0.5%) patellofemoral knee arthroplasties.

Figure 60 shows the type of current primary knee arthroplasty by hospital.

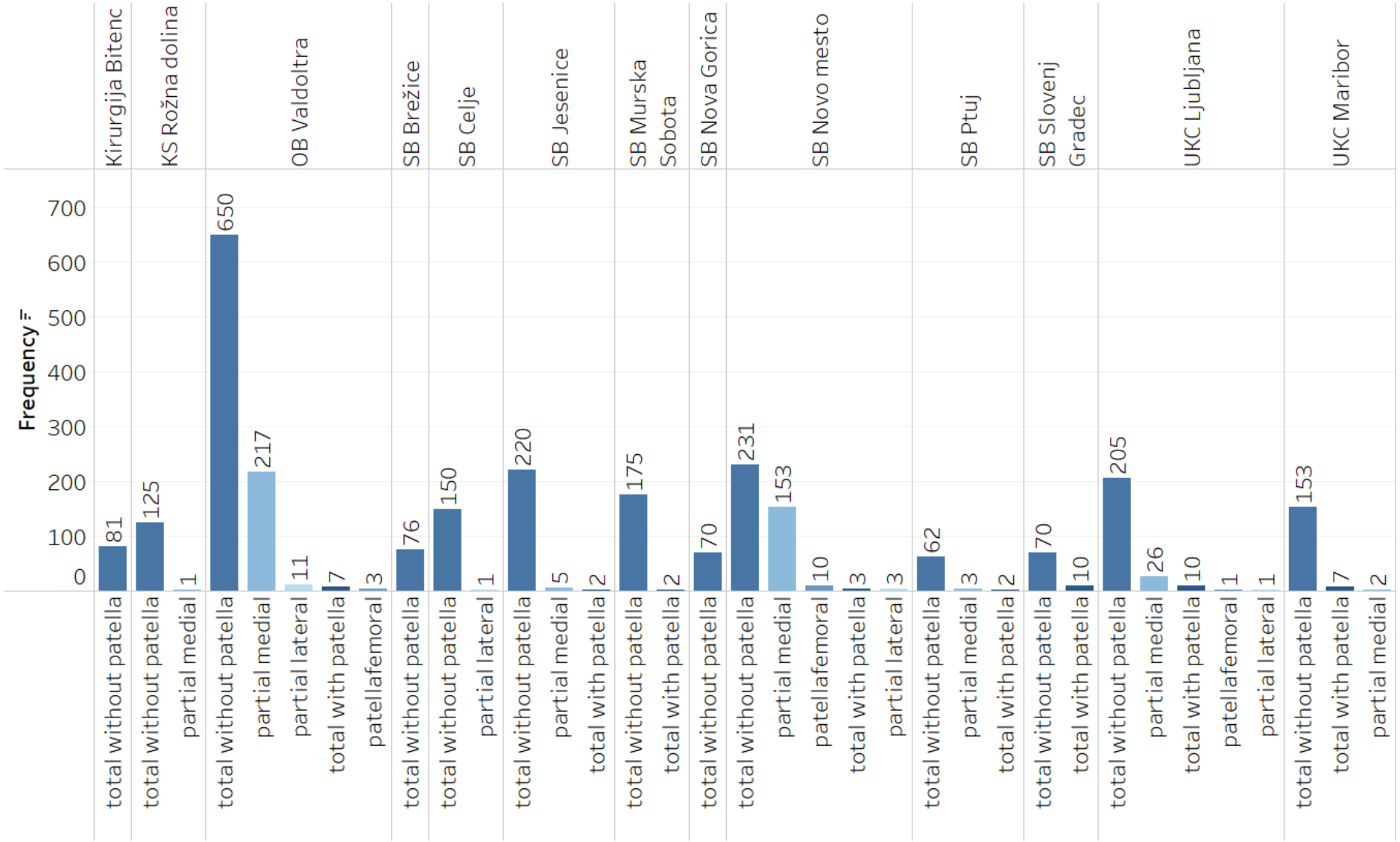


Figure 60: Type of current primary knee arthroplasty, by hospital (Source: RES).

In the case of the review of the type of current knee arthroplasty according to the hospital of the surgery in the RES database for 2021, the reliability of the results is lower, since we have an excessive proportion (55.4%) of cells with a frequency lower than 5.

The largest number of partial knee arthroplasties in relation to all performed primary knee arthroplasties is performed in SB Novo Mesto (41.5%), followed by OB Valdoltra with 26% and UKC Ljubljana with 11.5%.

6.2.3.4 Fixation of the prosthesis in primary knee arthroplasty

In the following, we present the prosthesis and its fixation. We were interested in whether it is cemented, cementless, hybrid with a cemented femoral part, hybrid with a cemented tibial part, or hybrid with a cemented patellar part. An illustration of prostheses fixation in knee arthroplasties is given in Figure 61.

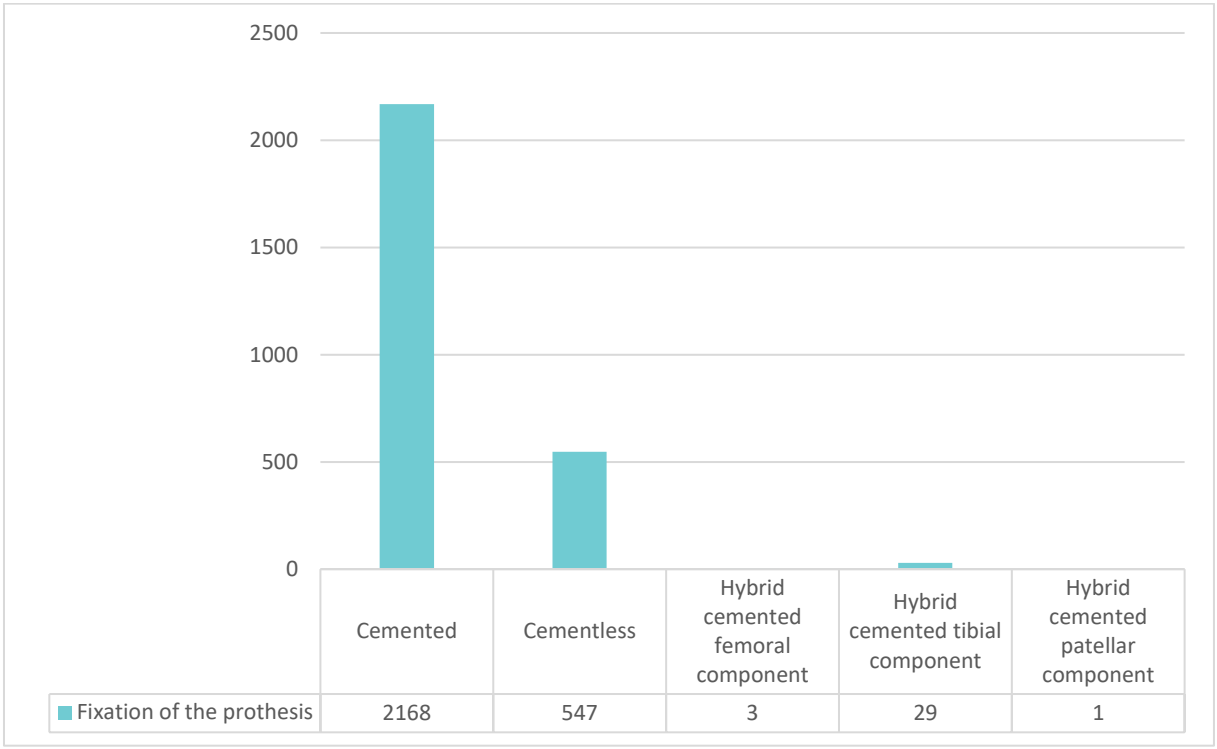


Figure 61: Prosthesis fixations in primary knee arthroplasty (Source: RES).

As we can see from Figure 61, we have the largest number of knee arthroplasties recorded in the RES database for 2021 (2,168 or 78.9%), where the prosthesis was cemented. 547 or 19.9% of prostheses were cementless, while the proportion of prostheses with hybrid cemented patellar part (1 or 0.1%), hybrid cemented tibial part (29 or 1.1%) and hybrid cemented femoral part (3 or 0.1%) is extremely low.

In the following, we show the fixation of the prosthesis according to the hospital.

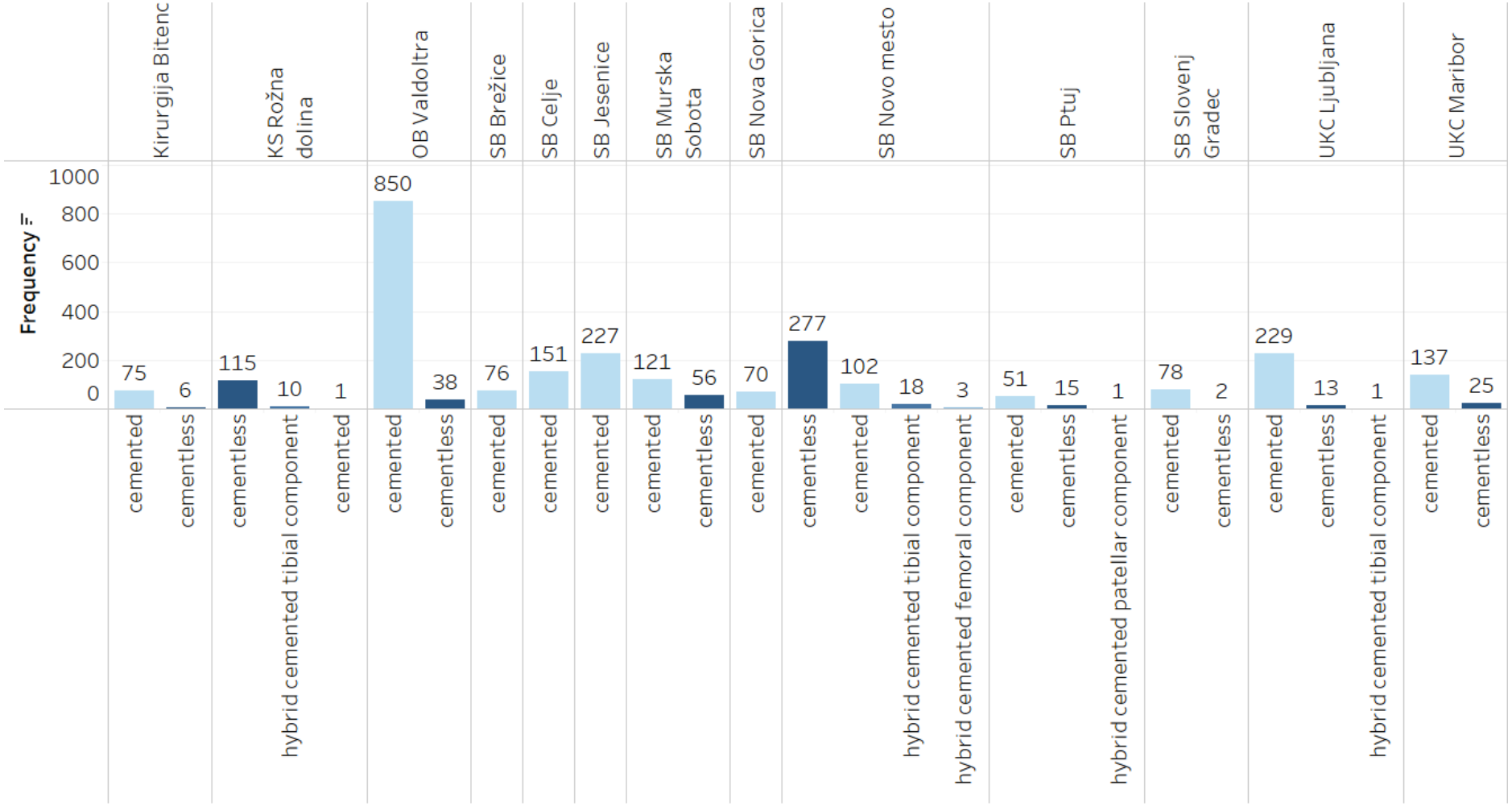


Figure 62: Fixation of the prosthesis, by hospital (Source: RES).

When fixing the prosthesis according to the hospital in 2021, we have an excessive number of cells in the RES database (58.5%) with less than 5 units, which makes it impossible to generalize the results.

6.2.3.5 *Applied chirurgical approach in primary knee arthroplasty*

In the following part, we checked the chirurgical approach used in primary knee arthroplasty: medial parapatellar, medial subvastus, medial minimal invasive, medial transvastus, lateral parapatellar, lateral subvastus and lateral minimal invasive. Figure 63 shows the distribution of approaches used in primary knee arthroplasty in 2021 in the RES database.

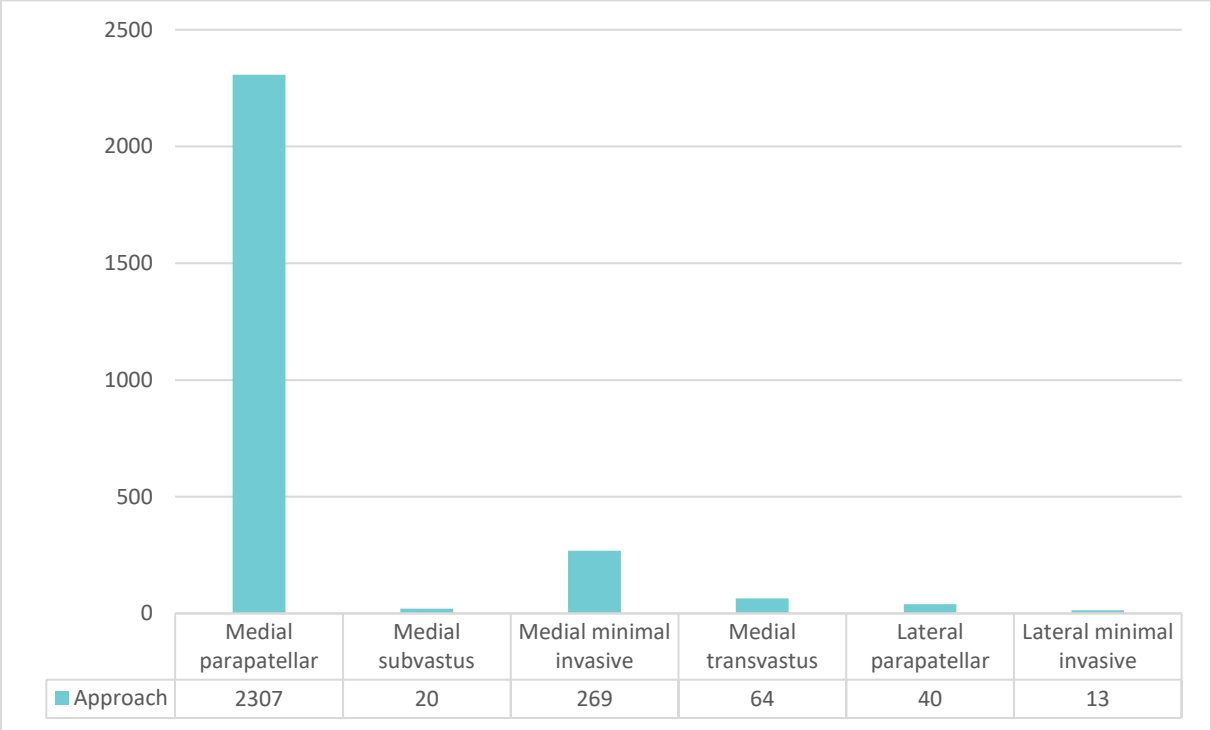


Figure 63: The chirurgical approach used in primary knee arthroplasty (Source: RES).

For 35 (1.3%) cases, we do not have a stated chirurgical approach used in primary knee arthroplasty in the RES database for 2021. We excluded these units from further statistical analysis.

In 2021, the medial parapatellar approach was most frequently used in primary knee arthroplasties (85%). This is followed by the medial minimal invasive approach (9.9%), medial transvastus (2.4%), lateral parapatellar (1.5%), medial subvastus (0.7%) and lateral minimal invasive approach (0.5%). Lateral subvastus was not used in any recorded case in 2021 knee arthroplasties.

Figure 64 shows the distribution of chirurgical approaches used in primary knee arthroplasty in 2021, by hospital. In 35 cases, we did not get information about the hospital of the surgery and/or the chirurgical approach used. We excluded these from further analysis.

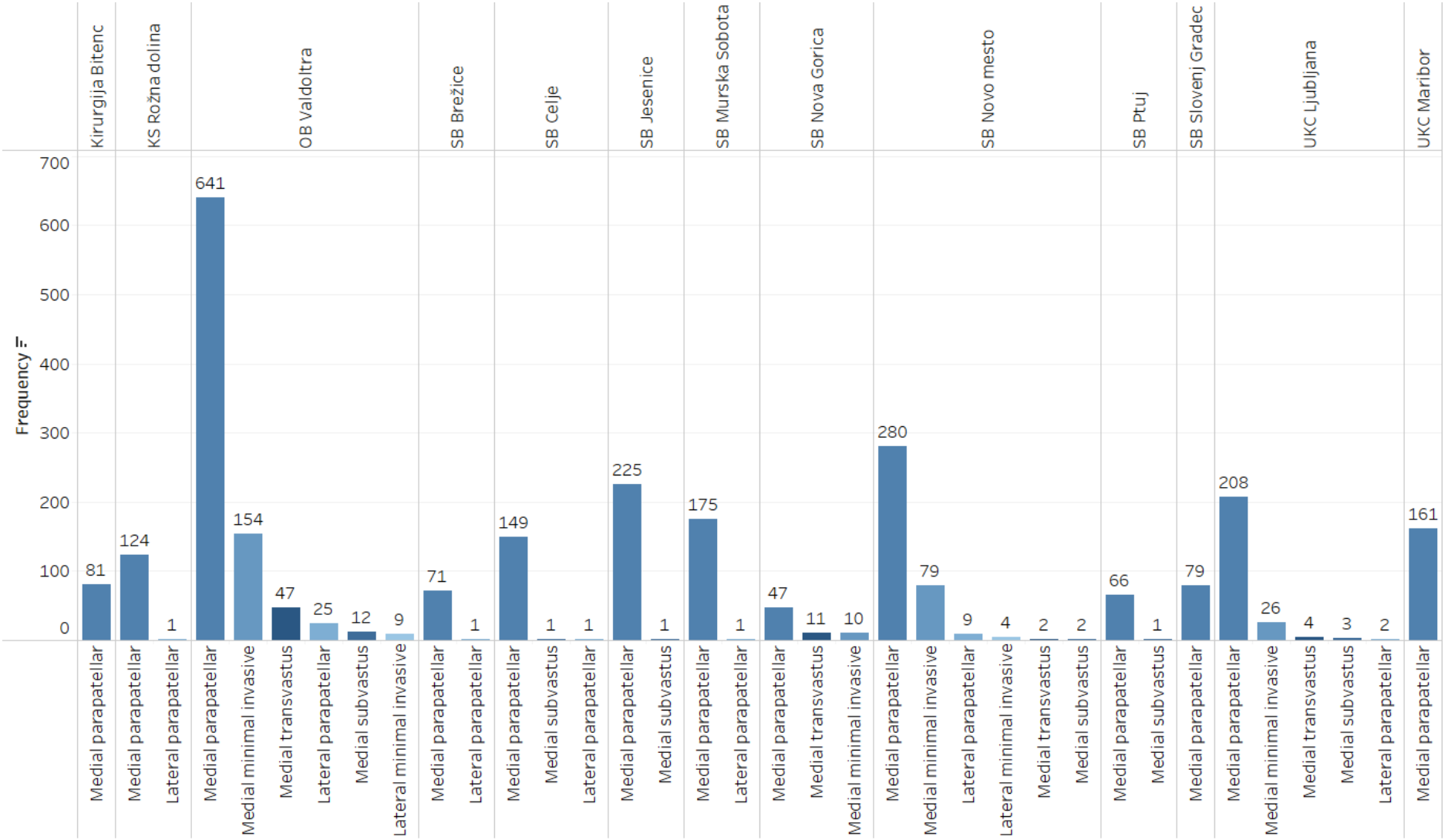


Figure 64: The chirurgical approach used by hospital (Source: RES).

In the chirurgical approach used in primary knee arthroplasty, by hospital of the surgery in 2021, we have an excessive number of cells in the RES database (57.7%) with less than 5 units, which makes it impossible to generalize the results.

6.2.4 Previous knee surgeries in primary knee arthroplasty

First, we give the number of primary knee arthroplasties based on the presence of previous surgeries on the knee (see Figure 65). In doing so, we checked whether the patients had undergone any previous surgery on the knee or not.

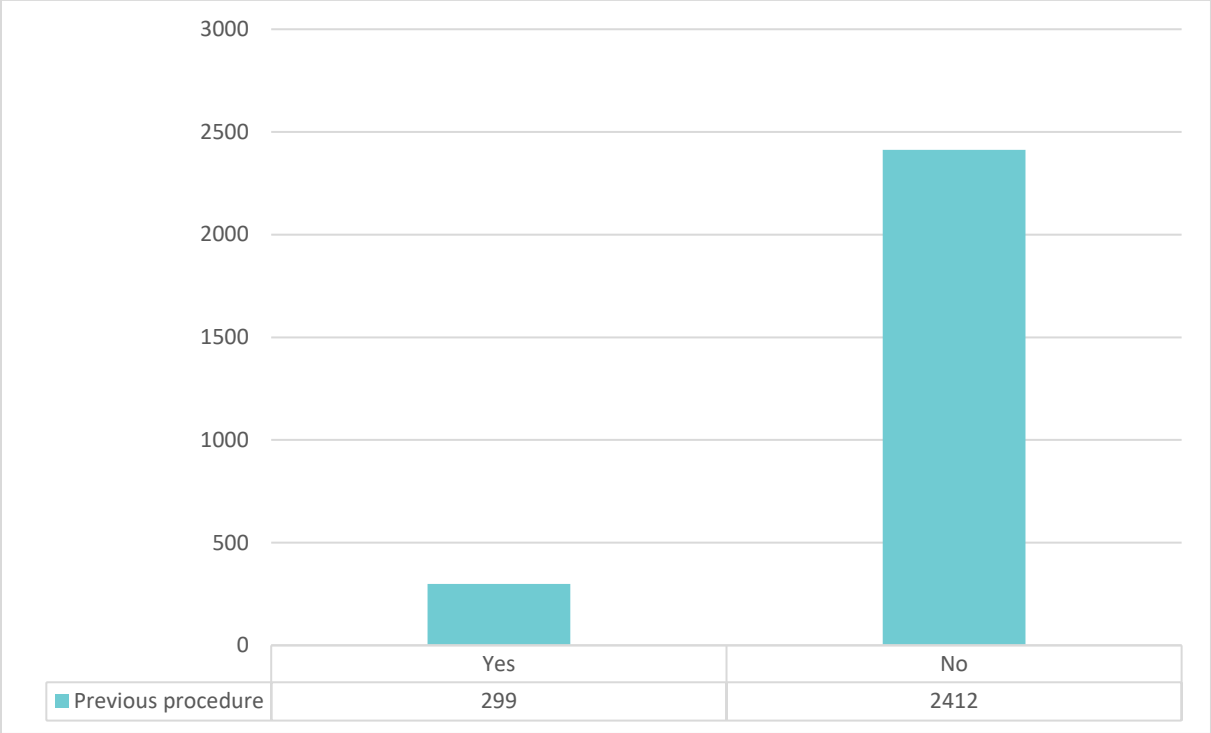


Figure 65: The presence of previous knee surgeries (Source: RES).

In 37 cases (1.3%), we did not get information on whether the patients in question had already had previous surgeries on the knee or not. We excluded them from further statistical analysis.

From Figure 65, we can see that in the RES database for the year 2021, we have as many as 2,412 or 89% of patients who did not have previous surgeries on the knee, while 299 or 11% of patients already had previous surgeries on the knee.

Below we describe previous knee surgeries: osteosynthesis, osteotomy, arthrodesis, synovectomy, meniscectomy, arthroscopy, anterior cruciate ligament reconstruction and others. In doing so, all previous surgeries are marked on the form. For each patient, all possible previous surgeries are recorded, which means that an individual patient can be treated as a statistical unit in analyses. In the 2021 RES database, 2,413 (89%) of all patients had no other prior surgery prior to primary knee arthroplasty. We excluded them from further statistical analysis. The database thus left 299 cases of surgeries in which patients had already had a previous surgery on this knee. The figure below shows the number of patients according to the type of previous surgery.

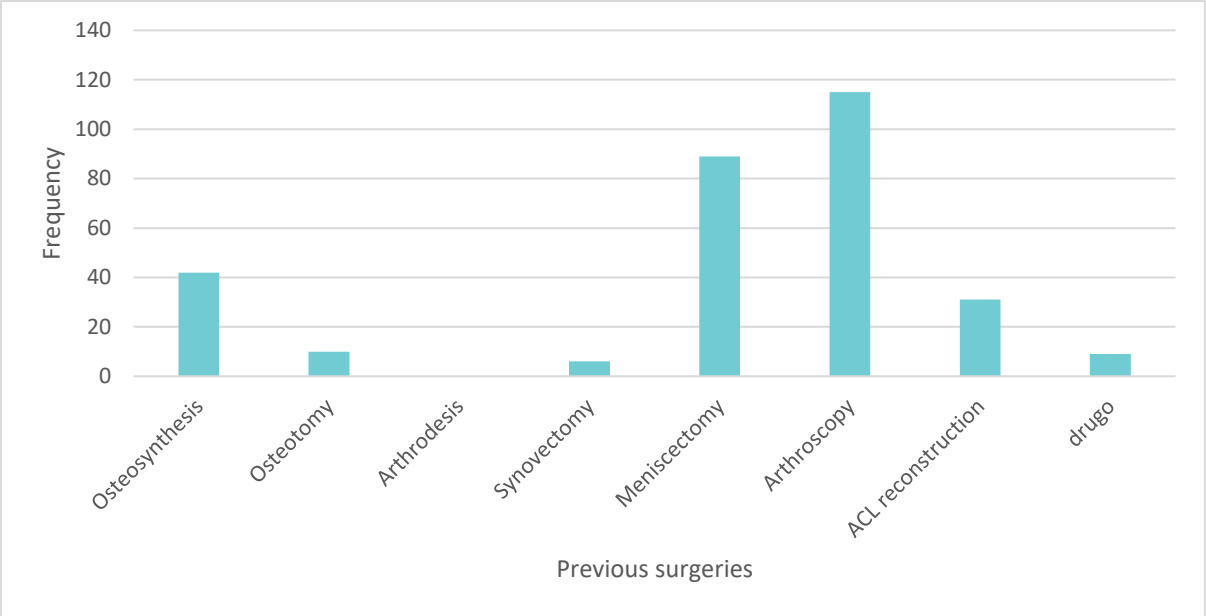


Figure 66: Previous knee surgeries before primary knee arthroplasty (Source: RES).

In the RES database for 2021, there are a 115 (38.5%) of all patients with previous surgery who underwent arthroscopy before primary knee arthroplasty. They are followed by those who had meniscectomy (89 or 29.8%), osteosynthesis (42 or 14%), anterior cruciate ligament reconstruction (31 or 10.4%), osteotomy (10 or 3.3%), synovectomy (6 or 2 %), while arthrodesis was not performed in any case. 9 or 3% of all patients with prior surgeries reported other prior surgeries, with no type of prior surgery on that knee listed. We omitted these from further statistical analysis.

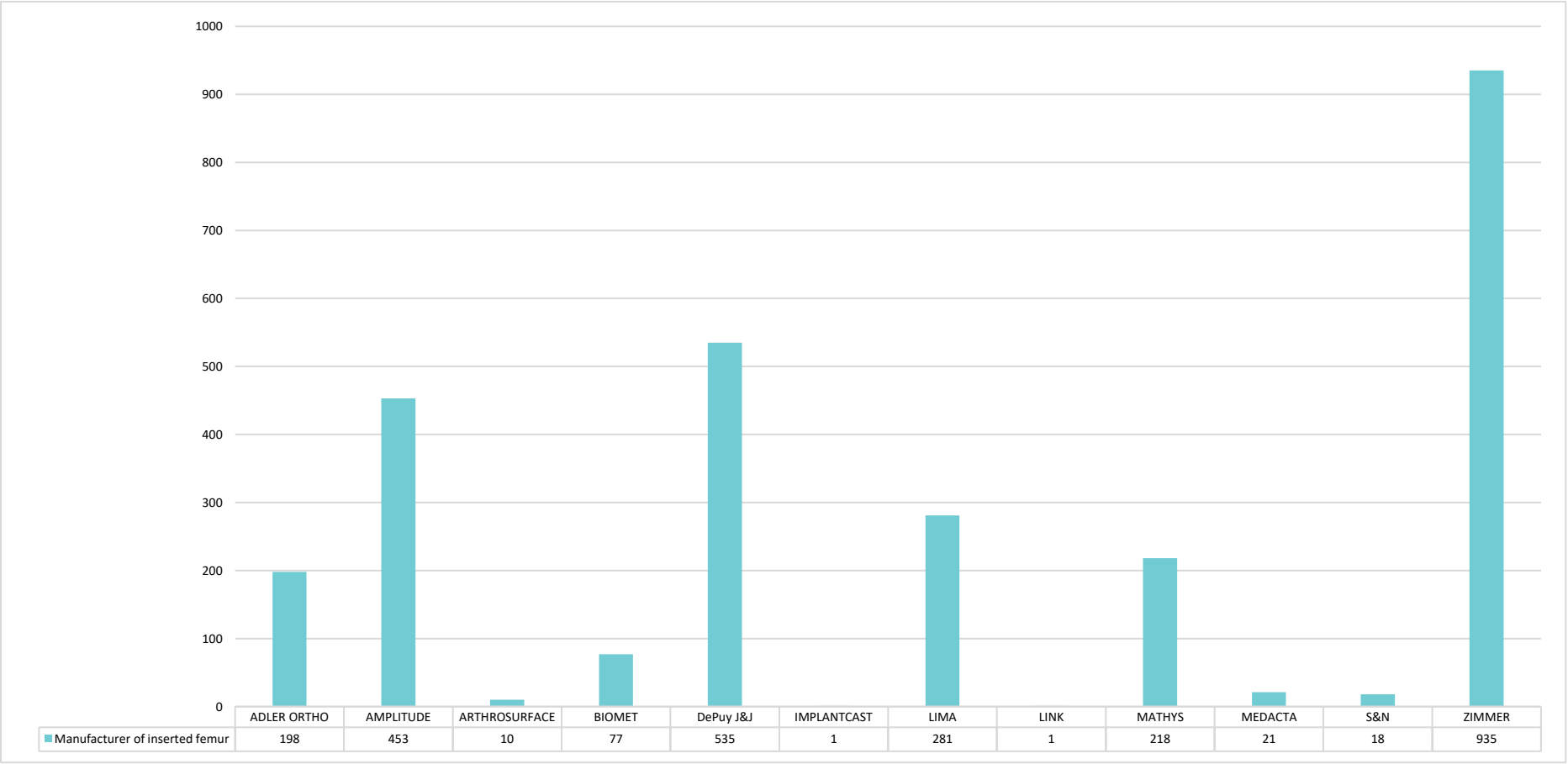
6.2.5 Primary knee arthroplasties according to data on implanted endoprosthesis parts

For implants in primary knee arthroplasty, we are interested in identifying the manufacturer of the implant. We looked at the manufacturers of the femoral part[16] of the implant. In doing so, we first analyzed the manufacturer and then the differences between manufacturers in relation to the hospital of the surgery.

6.2.5.1 Primary knee arthroplasties by manufacturer

We will examine the manufacturer of implants in primary knee arthroplasty, and then the differences by the hospital of the surgery.

[16] In the case of knee implants, the manufacturer of the femoral and tibial part of the implant and the insert is the same. Therefore, we analyzed the data only according to the femoral part.



	ADLER ORTHO	AMPLITUDE	ARTHROSURFACE	BIOMET	DePuy J&J	IMPLANTCAST	LIMA	LINK	MATHYS	MEDACTA	S&N	ZIMMER
Manufacturer of inserted femur	198	453	10	77	535	1	281	1	218	21	18	935

Figure 67: Primary knee arthroplasty implanted femur manufacturer (Source: RES).

In most case, 34%, the implanted femoral parts in primary knee arthroplasties performed in 2021 were owned by ZIMMER. The following manufacturers are DePuy J&J (19.5%), AMPLITUDE (16.5%), LIMA (10.2%), MATHYS (7.9%), ADLER ORTHO (7.2%), BIOMET (2.8%), MEDACTA (0.8%), S&N (0.7%), ARTHROSURFACE (0.4%), while IMPLANTCAST and LINK femoral implanted parts were selected each time in only 1 misled case.

Figure 68 shows the distribution of implant manufacturers in primary knee arthroplasty according to the hospital of the surgery.

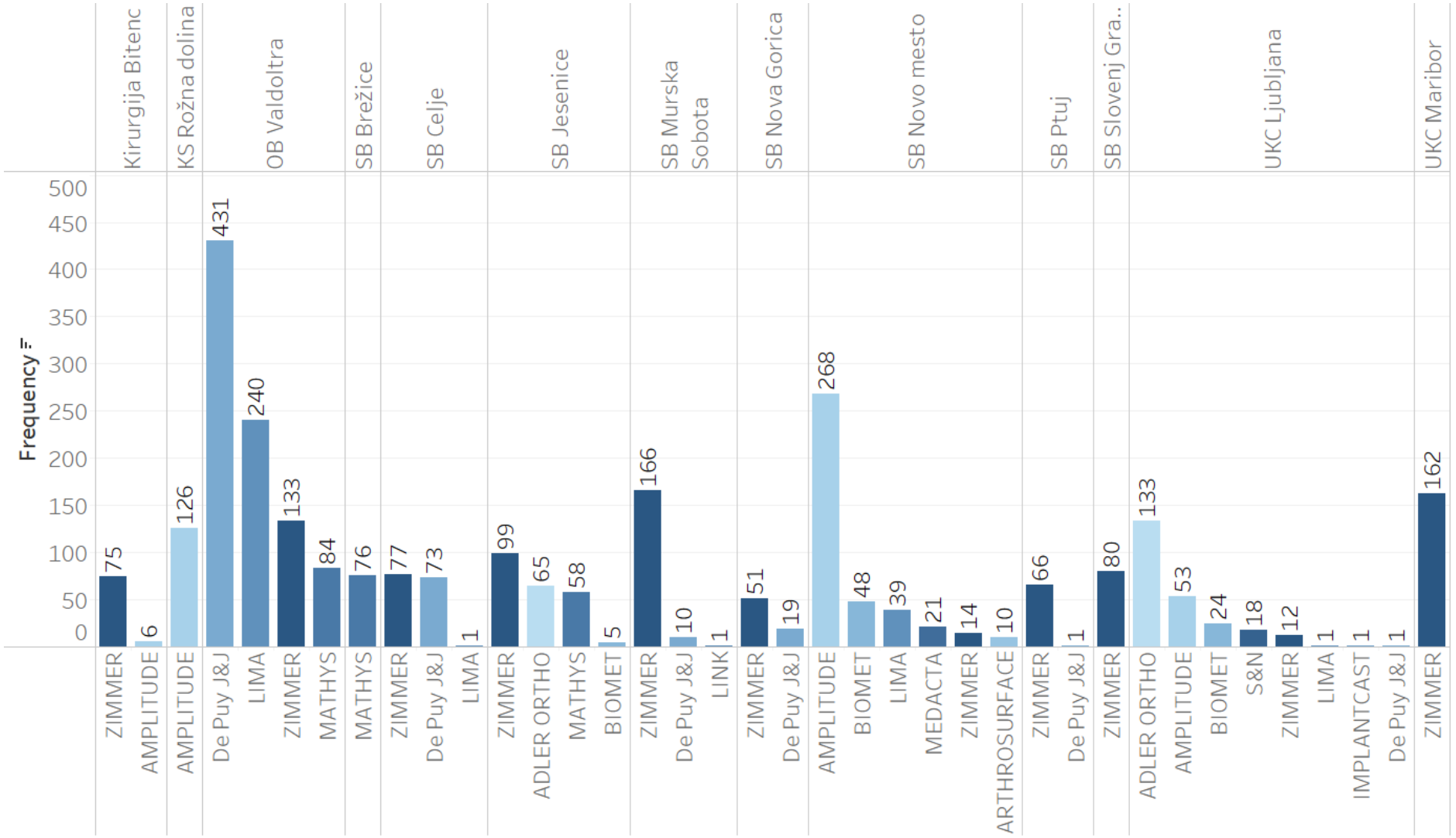


Figure 68: Primary knee arthroplasty manufacturer by hospital (Source: RES).

When examining the association between the manufacturers of the femoral part of the implant in primary knee arthroplasty and the hospital of the surgery, we cannot generalize the results, as we have too many (46.8%) cells with less than 5 units.

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

6.3 Revisions of knee arthroplasty

In this part of the report, we present revisions of knee arthroplasties in the Republic of Slovenia in 2021. RES has recorded 228 revisions of knee arthroplasties in 2021.

We will provide information about the current surgery according to the characteristics of the patient (gender, age at the time of surgery), according to the hospital, characteristics of the revision surgery (site of surgery, previous surgeries on this knee, reason for revision, extent of revision and the chirurgical approach used during surgery), information about new implant (manufacturer) and data on the percentage (share) of revisions of individual implant combinations.

6.3.1 Revisions of knee arthroplasty based on patient information

First, we reviewed the data on the patients, namely their gender and age at the time of surgery.

6.3.1.1 Revisions of knee arthroplasty by gender of the patient

The figure below shows the distribution of knee arthroplasty revisions in 2021 according to the gender of the patient.

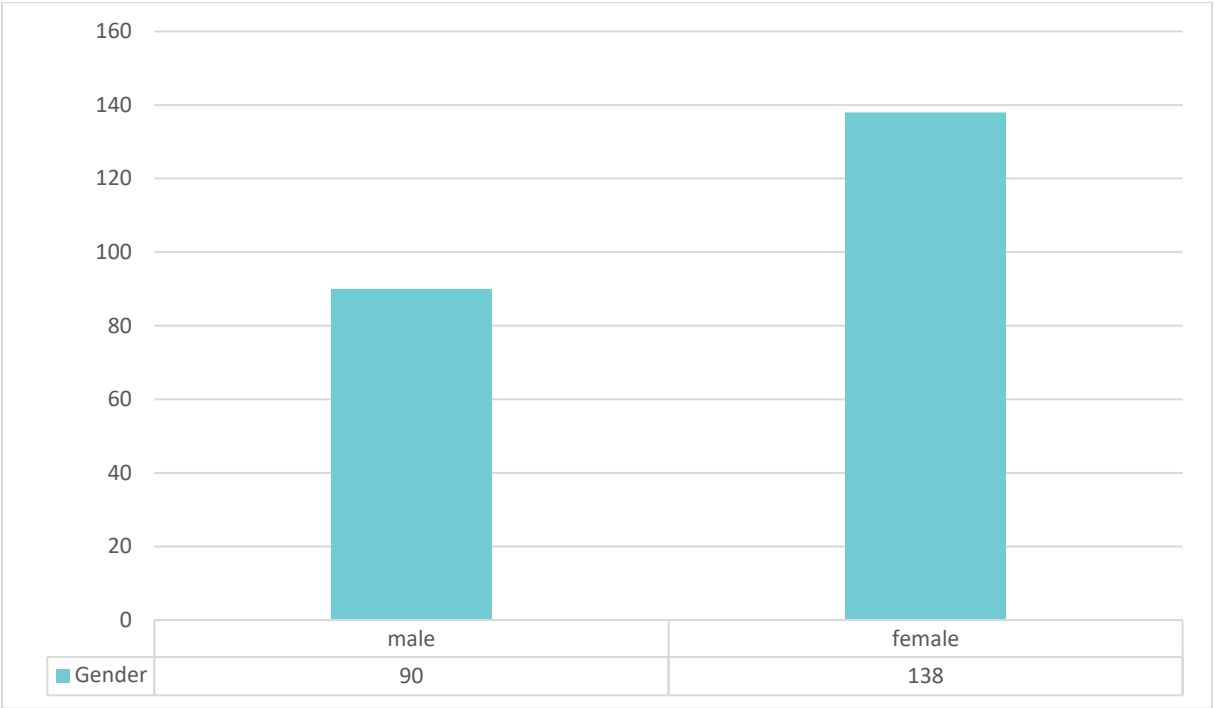


Figure 69: Revisions of knee arthroplasty by the gender of the patient (Source: RES).

In the RES database for 2021, we have data for 138 (60.5%) revisions of knee arthroplasties performed on female patients, and 90 (39.5%) such surgeries performed on male patients.

We then calculated the patient's age at the time of surgery from the patient's date of birth and the date of surgery. The results are presented in the figure below.

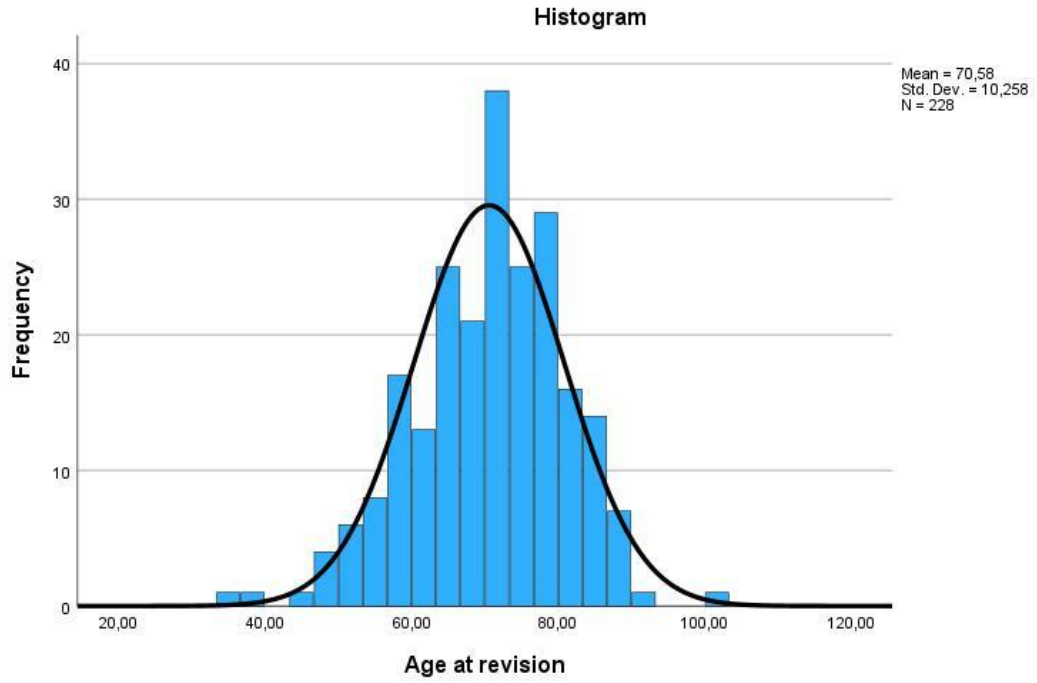


Figure 70: First revisions of knee arthroplasty by patient age at surgery (Source: RES).

Based on the Kolmogorov-Smirnov test (p = 0.01), we can determine from the RES database for 2021 that the data on the age of the patients at the time of surgery is not approximately normally distributed. For this reason, we calculated non-parametric tests.

The median age of patients undergoing revision knee arthroplasty in 2021 is 71.2 years. This means that half of the patients at the time of surgery were 71.2 years old or older, and half of them were 71.2 years old or younger. The youngest patient was 33.8 years old, and the oldest was 101.3 years old.

6.3.2 Revisions of knee arthroplasties by hospital

6.3.2.1 The revision burden of knee arthroplasties

In Table 5 we show the revision burden of knee arthroplasties by hospital.

Table 5: Revision burden of knee arthroplasties by hospital (Source: RES).

Hospital 2021	Primary Knee Arthroplasties	Revisions	Revision burden (%)*
Kirurgija Bitenc	81	1	1,22
KS Rožna dolina	126	0	0,00
OB Valdoltra	888	89	9,11
SB Brežice	76	2	2,56
SB Celje	151	11	6,79
SB Jesenice	227	13	5,42
SB Murska Sobota	177	14	7,33
SB Nova Gorica	70	18	20,45
SB Novo mesto	400	18	4,31
SB Ptuj	67	2	2,90
SB Slovenj Gradec	80	8	9,09

UKC Ljubljana	243	38	13,52
UKC Maribor	162	14	7,95
SLOVENIJA	**2748**	**228**	**7,66**

* N°of revisions in one year x 100 / N°of primaries and revision operations in the same year

From the RES database for the year 2021, we collected data in a table on the total number of primary partial and total knee arthroplasties and on all revisions that were made in an individual institution, regardless of whether the previous surgery was done in another institution. Based on this data, we also calculated the audit burden.

6.3.2.2 Number of revision knee arthroplasties

The figure below shows the distribution of revisions of knee arthroplasties by the hospital of the surgery.

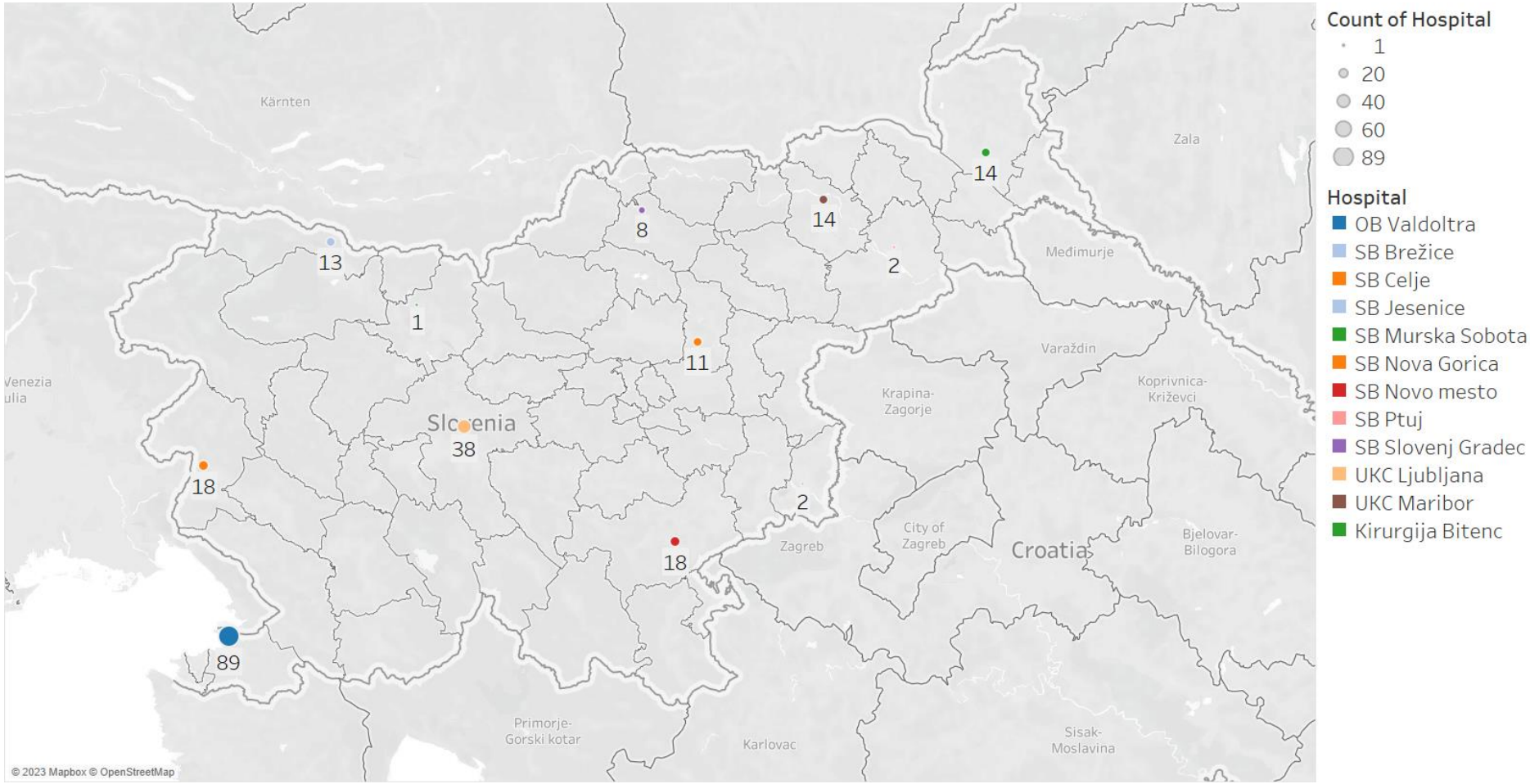


Figure 71: Revisions of knee arthroplasties by hospital (Source: RES).

In the RES database for the year 2021, we have data for 89 (39%) revision knee arthroplasties, which were performed in OB Valdoltra, for 38 (16.7%) which were performed in UKC Ljubljana, for 18 (7.9 %), which were carried out in SB Nova Gorica and SB Novo mesto, for 14 (6.1%) each, which were carried out in SB Murska Sobota and UKC Maribor, for 13 (5.7%), which were carried out in SB Jesenice, for 11 (4.8%), which were carried out in SB Celje, for 8 (3.5%), which were carried out in SB Slovenj Gradec, for 2 each (0.9%) , which were performed in SB Brežice and SB Ptuj and 1 (0.4%), which was performed in Kirurgija Bitenc.

6.3.3 Revisions of knee arthroplasties based on current surgery data

First, we present the characteristics of revision knee arthroplasty based on current surgery data. In doing so, we will provide information on the side of the surgery, previous surgeries, the reason for the revision, the scope of the revision and the chirurgical approach used in the surgery.

6.3.3.1 Revision knee arthroplasties according to the side of surgery

In the following, we looked at the side of the surgery (left or right[17]) in revision knee arthroplasty. The results are shown in Figure 72.

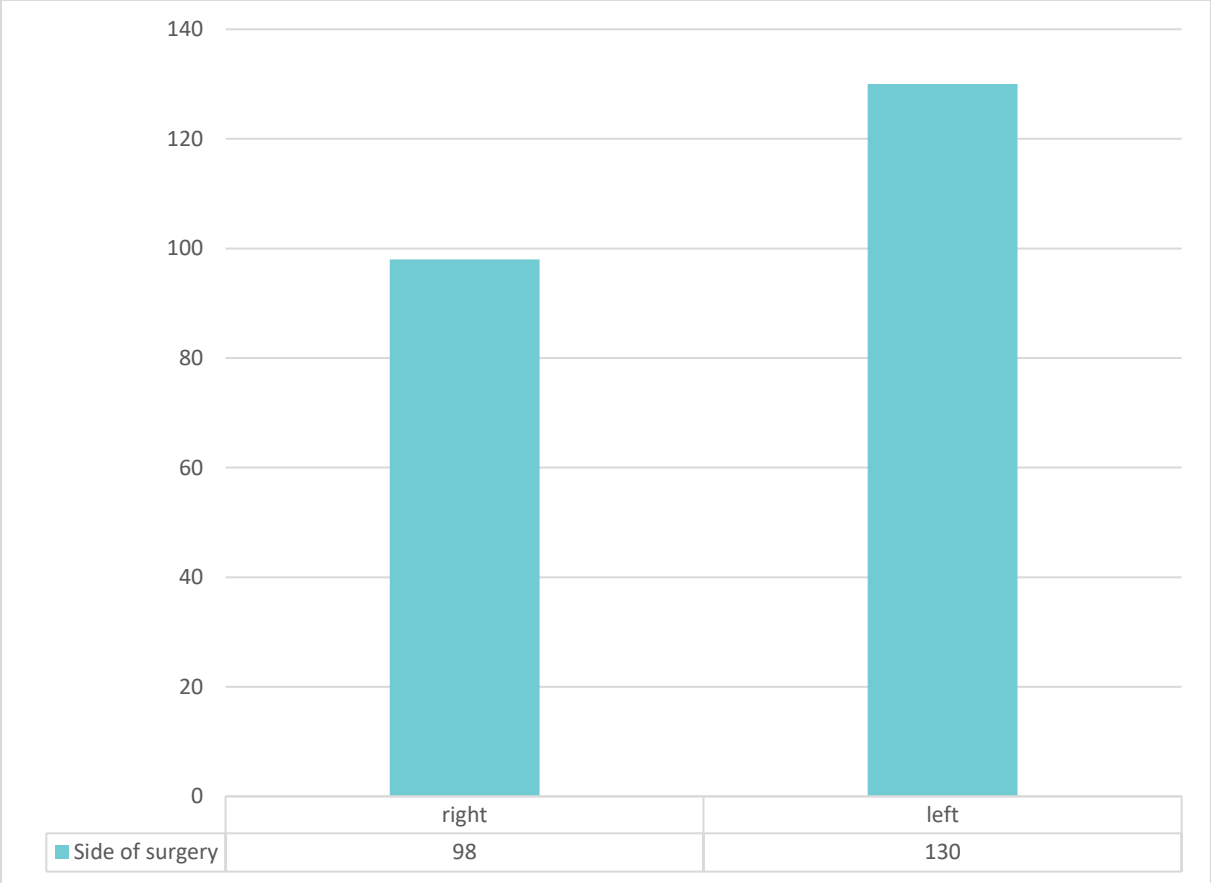


Figure 72: Revisions of knee arthroplasties according to the side of surgery (Source: RES).

130 (57%) revisions of left knee arthroplasties and 98 (43%) revisions of right knee arthroplasties are recorded in RES for 2021.

[17] If the patient was operated on the right and left side, two records are given in the register, for each side separately.

6.3.3.2 Revisions of knee arthroplasties by reason of revision

In the following, we present the distribution of revision knee arthroplasties according to the reason for the revision (Figure 73). In this case, one of the following reasons could be selected as the reason for replacing the endoprosthesis: loosening of the entire endoprosthesis, loosening of the femoral component, loosening of the tibial component, loosening of the patellar component, early infection (up to 3 months after the primary surgery), late infection (more than 3 months after primary surgery), patellar necrosis, patellar dislocation, pain, periprosthetic fracture, instability of lateral ligaments, prosthesis dislocation, insert wear, implant fracture, poor mobility, inappropriate implantation or rotation, osteoarthritis of the second compartment, condition after component removal or other causes.

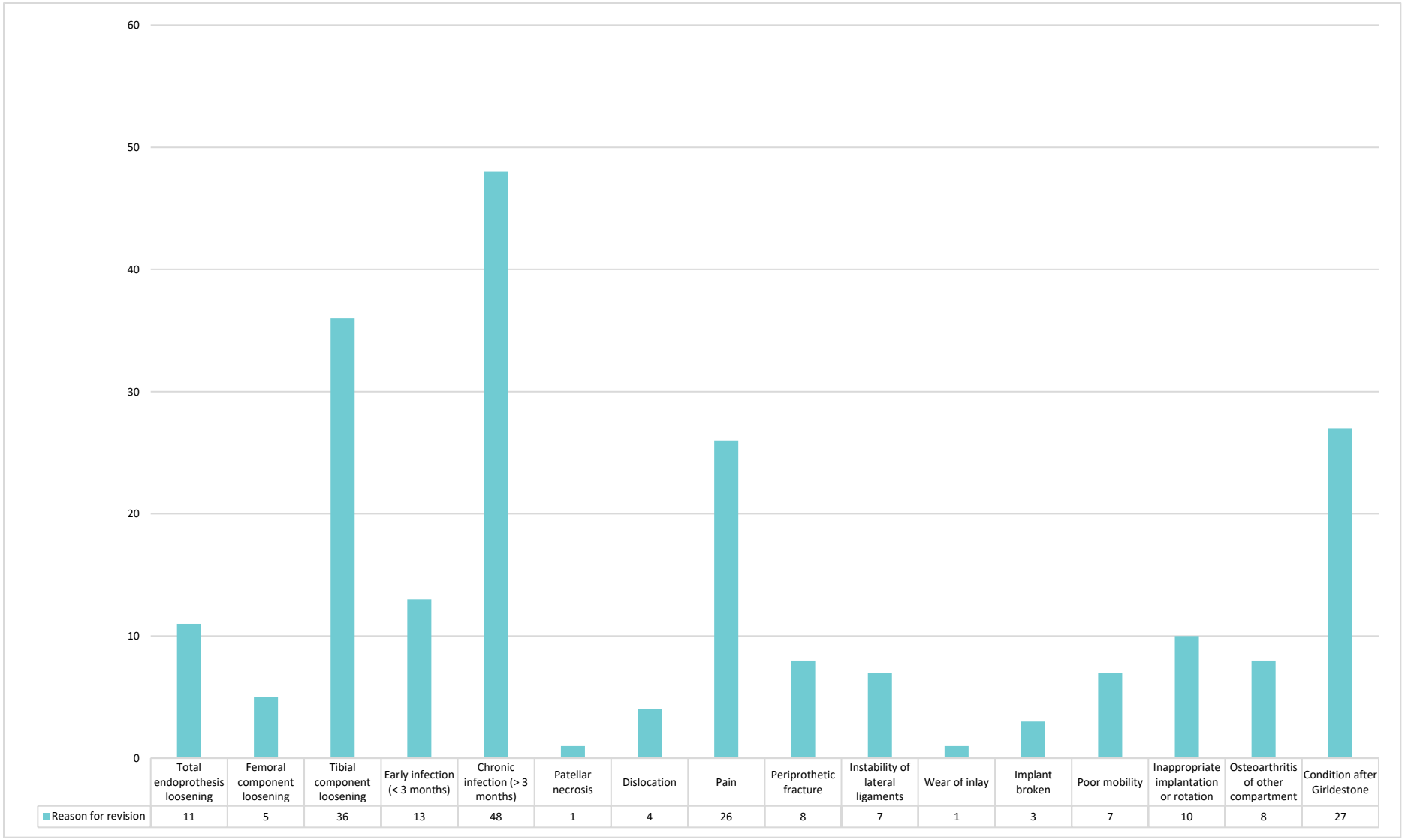


Figure 73: Revisions of knee arthroplasty by reason of revision (Source: RES).

For the year 2021, we have 228 revisions of knee arthroplasties recorded in RES database. In 5 cases (2.2%) we did not receive a written reason for the revision. In 8 cases (3.5%), other causes were given without specifying them. We excluded them from further statistical analysis.

Late infection (more than 3 months after primary surgery) was the recorded cause of 48 (22.3%) revision knee arthroplasties. The other reasons for revision are as follows: in 36 recorded cases (16.7%) it was loosening of the tibial component, in 27 cases (12.6%) it was the condition after component removal, in 26 (12.1%) cases it was pain, in 13 (6%) cases it was an early infection (up to 3 months after primary surgery), in 11 (5.1%) cases it was loosening of the entire endoprosthesis, in 10 (4.7%) cases was it inappropriate implantation or rotation, in 8 cases (3.7%) revisions due to periprosthetic fracture or osteoarthritis of the second compartment were recorded, in 7 cases (3.3%) instability of lateral ligaments and poor mobility were recorded, in 5 cases (2.3%) it was loosening of the femoral component, in 4 (1.9%) cases it was dislocation of the patella, in 3 (1.4%) cases it was fracture of the implant and 1 case each (0.5%)) is noted as patellar necrosis and inlay wear.

When we grouped the reasons for revisions, the most common reason for knee revisions in 2021 is deep infection.

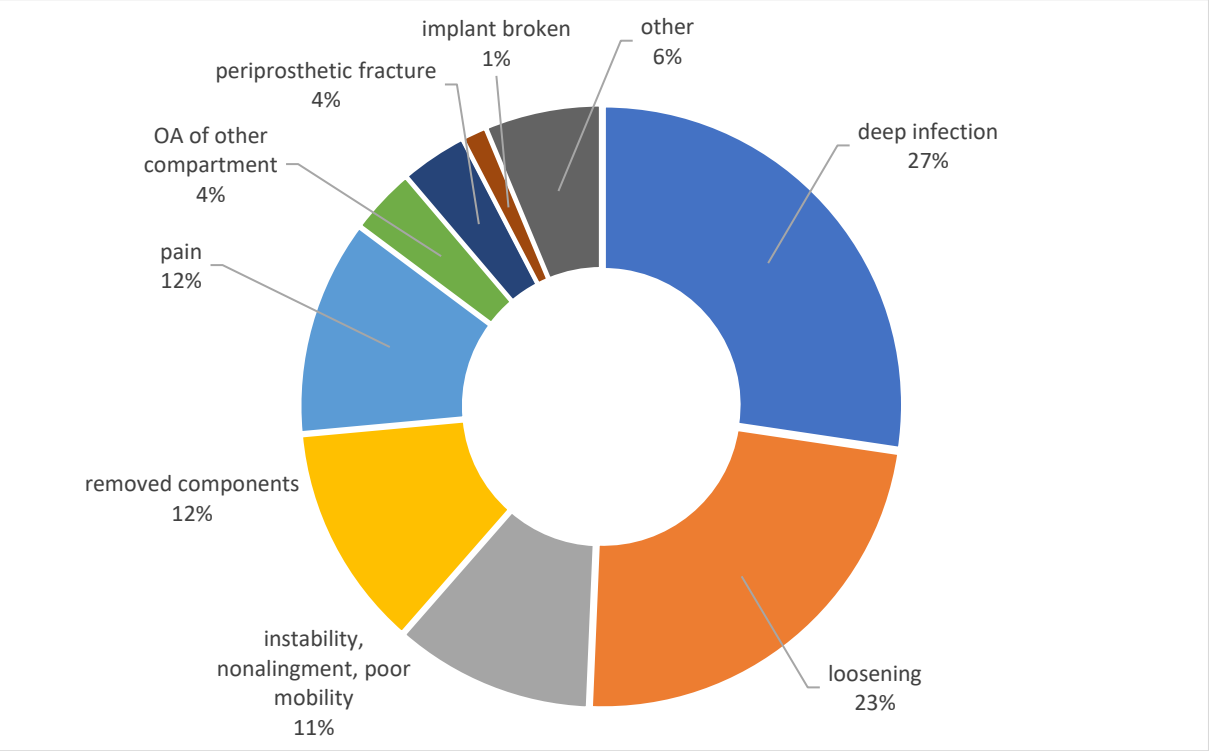


Figure 74: Proportion of knee arthroplasty revisions 2021: 8 main causes (Source: RES).

6.3.3.3 Revisions of knee arthroplasty according to the extent of revision of the current surgery

In the next chapter of the report, we show data on the extent of the knee arthroplasty revision (see Figure 75). It was possible to choose several answers, from the following offered: replacement, insertion of patellar component, reimplantation after removal, removal of the prosthesis and others[18].

[18] In 14 cases, other procedure was performed. We excluded these from further analysis.

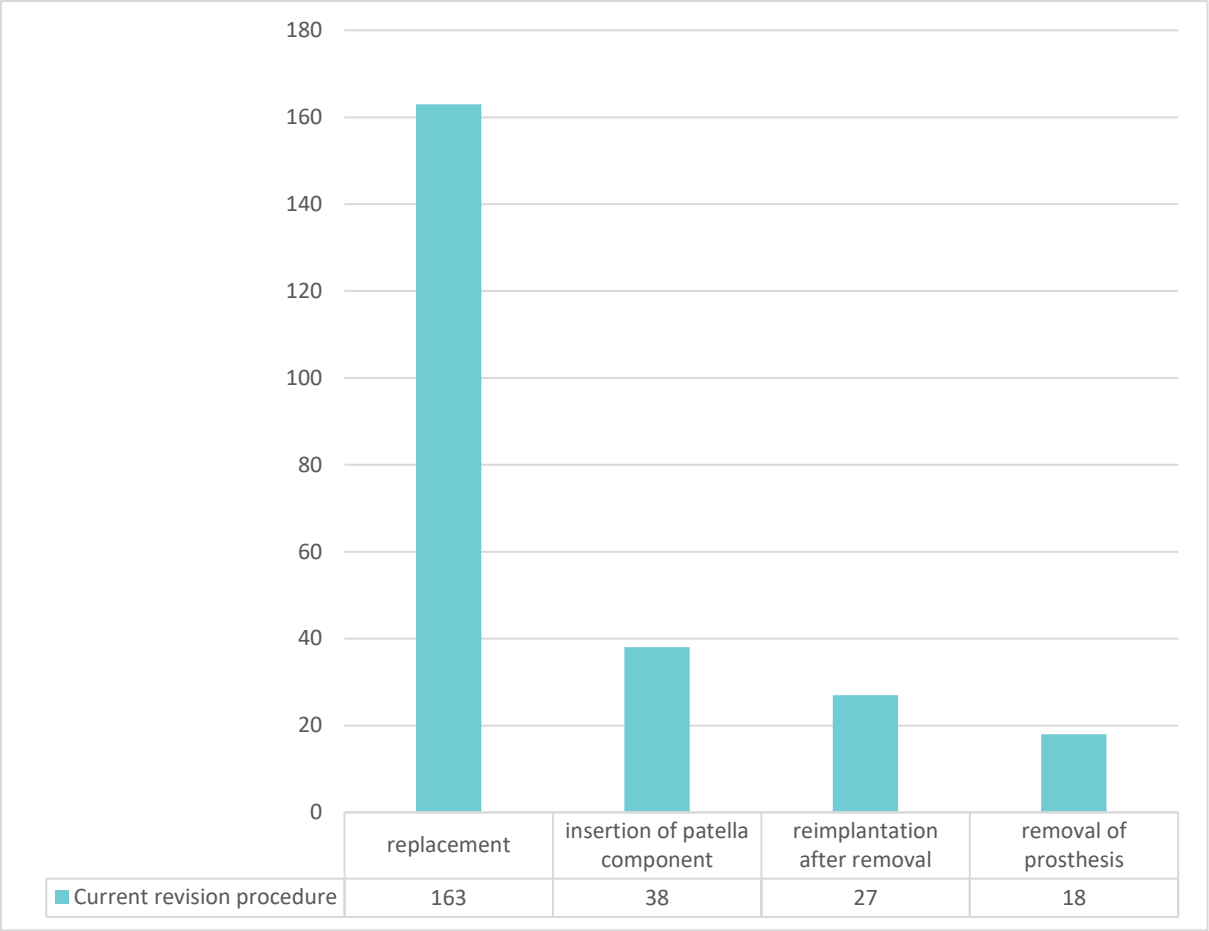


Figure 75: Extent of revision knee arthroplasty (Source: RES).

For the year 2021, RES has recorded data for 228 revisions of knee arthroplasties. Of these, in 163 (71.5% of all) cases, an exchange was performed, in 38 (16.7%) cases, a patellar component was inserted, in 27 (11.8%) cases, reimplantation was performed after removal, in 18 (7.9 %) of cases the prosthesis was removed.

6.3.3.4 Revisions of knee arthroplasty according to the chirurgical approach

In the following, we checked which chirurgical approach was used in the revision of the knee endoprosthesis. The following approaches were listed: medial parapatellar, medial subvastus, medial minimal invasive, medial transvastus, lateral parapatellar, lateral subvastus, lateral minimal invasive, and others. The distribution of answers is given in Figure 76.

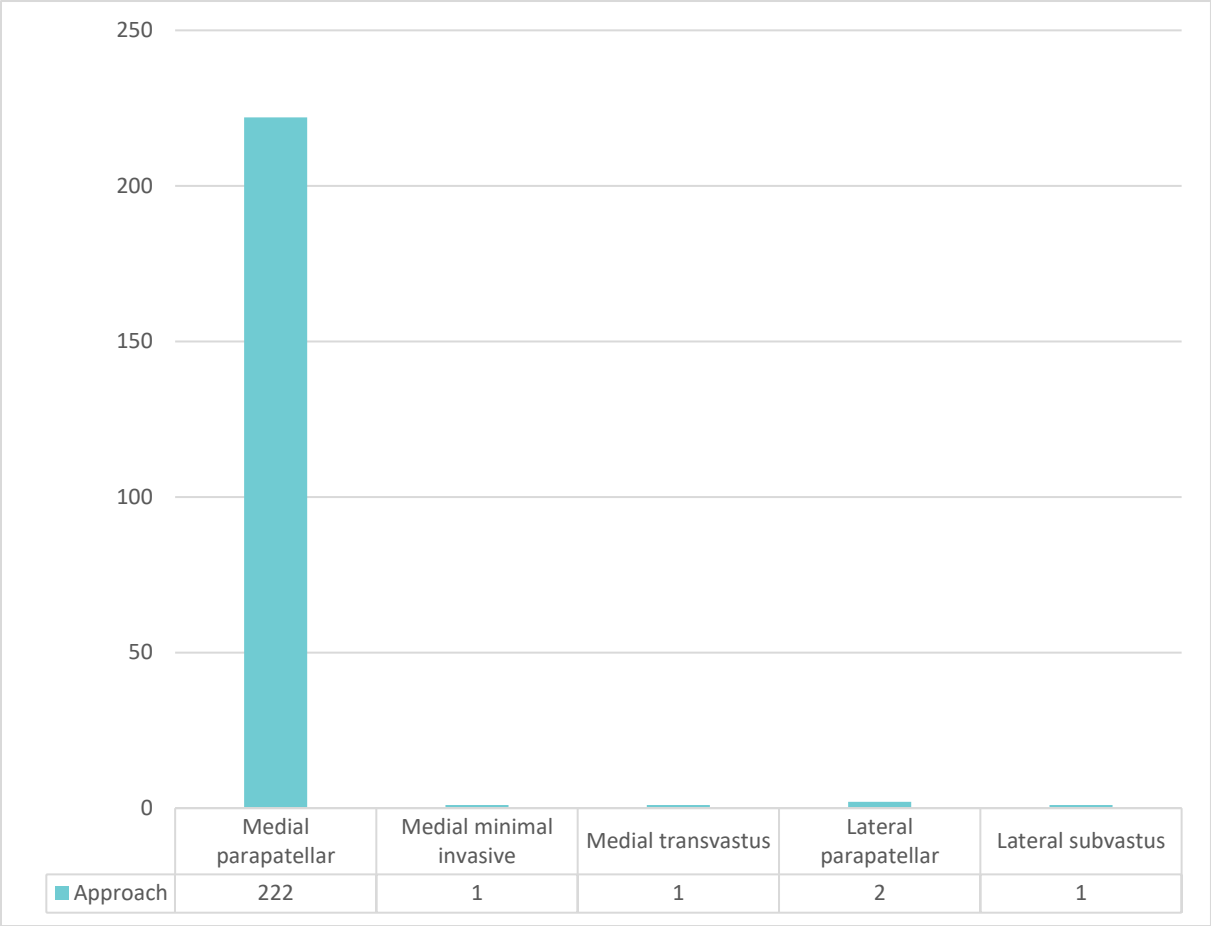


Figure 76: The approach used in revision knee arthroplasty (Source: RES).

Based on Figure 76, we can see that in 2021, from the data available from the RES database, a medial parapatellar approach was used in 222 (97.4%) cases of knee arthroplasty revision. Lateral parapatellar was used in two cases, medial minimal invasive, medial transvastus, lateral subvastus and other approaches were used once.

6.3.4 Prior surgeries on the revised knee

In the picture below, we present the previous surgeries on the revised knee in 2021.

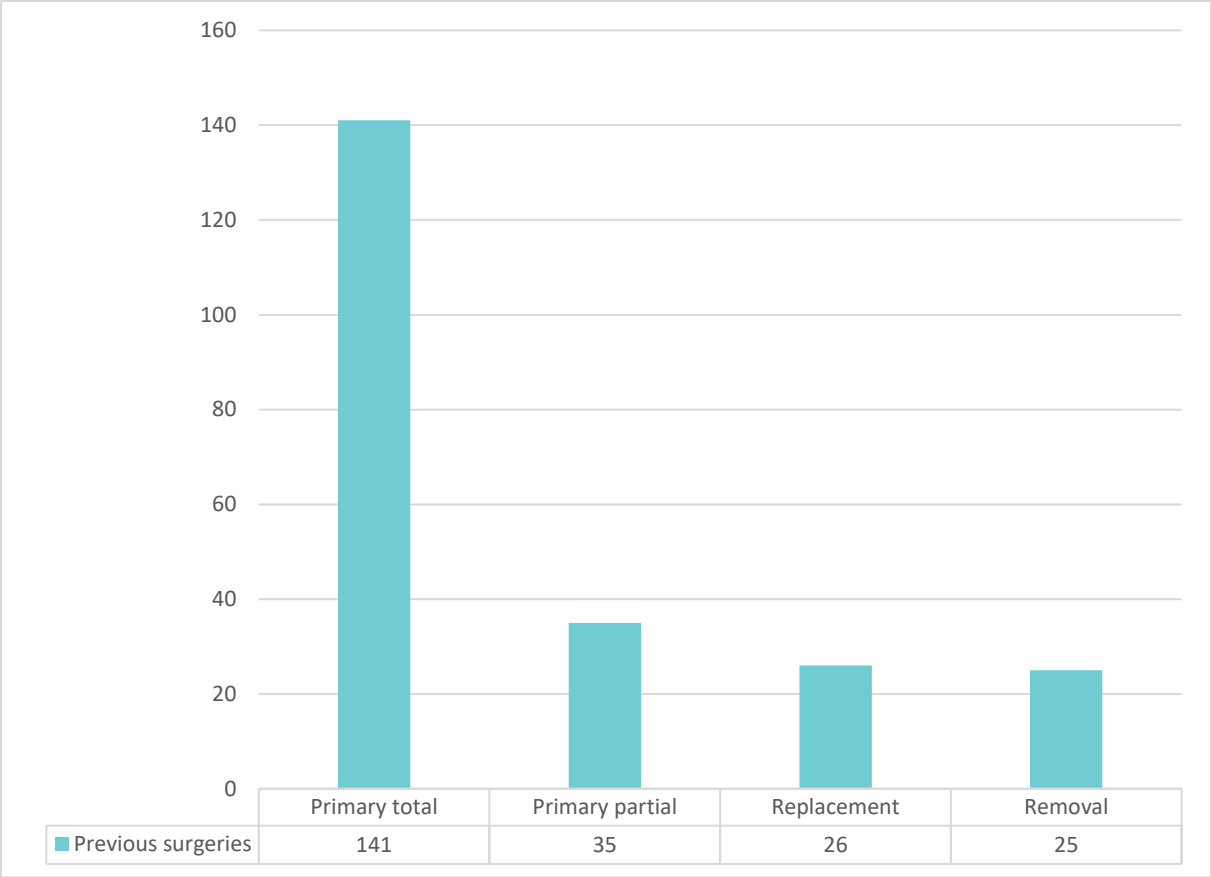


Figure 77: Previous surgeries on the revised knee (Source: RES).

In the RES database for the year 2021, we have data for 141 knee revisions, where patients previously had a primary total knee arthroplasty, in 35 primary partial knee arthroplasty, in 26 cases replacement of a prosthesis or parts of a prosthesis, and in 25 cases removal of a knee endoprosthesis.

6.3.5 First knee arthroplasty revisions in 2021

In the following, we reviewed previous surgeries on the knee on which the patients had their first revision knee arthroplasty in 2021. There were 177 of them. In this context, we were interested in the type of primary arthroplasty on this knee, the hospital of the primary arthroplasty of this knee, and the number of days from the primary to revision surgery of this knee.

For 2021, RES has recorded 177 first revisions of knee arthroplasties. During this period, there were 141 primary total knee arthroplasties revised for the first time and 35 cases of revised partial knee arthroplasties. In one case (0.6% of all), we did not receive information about the patient's previous surgeries on this knee. We excluded this from further statistical analysis.

6.3.5.1 Hospital of primary knee arthroplasty, revised for the first time in 2021

In the following, we were interested in finding out in which hospital the primary knee arthroplasty of the knee revised for the first time in 2021 was performed. The distribution of the answers obtained is shown in Figure 78.

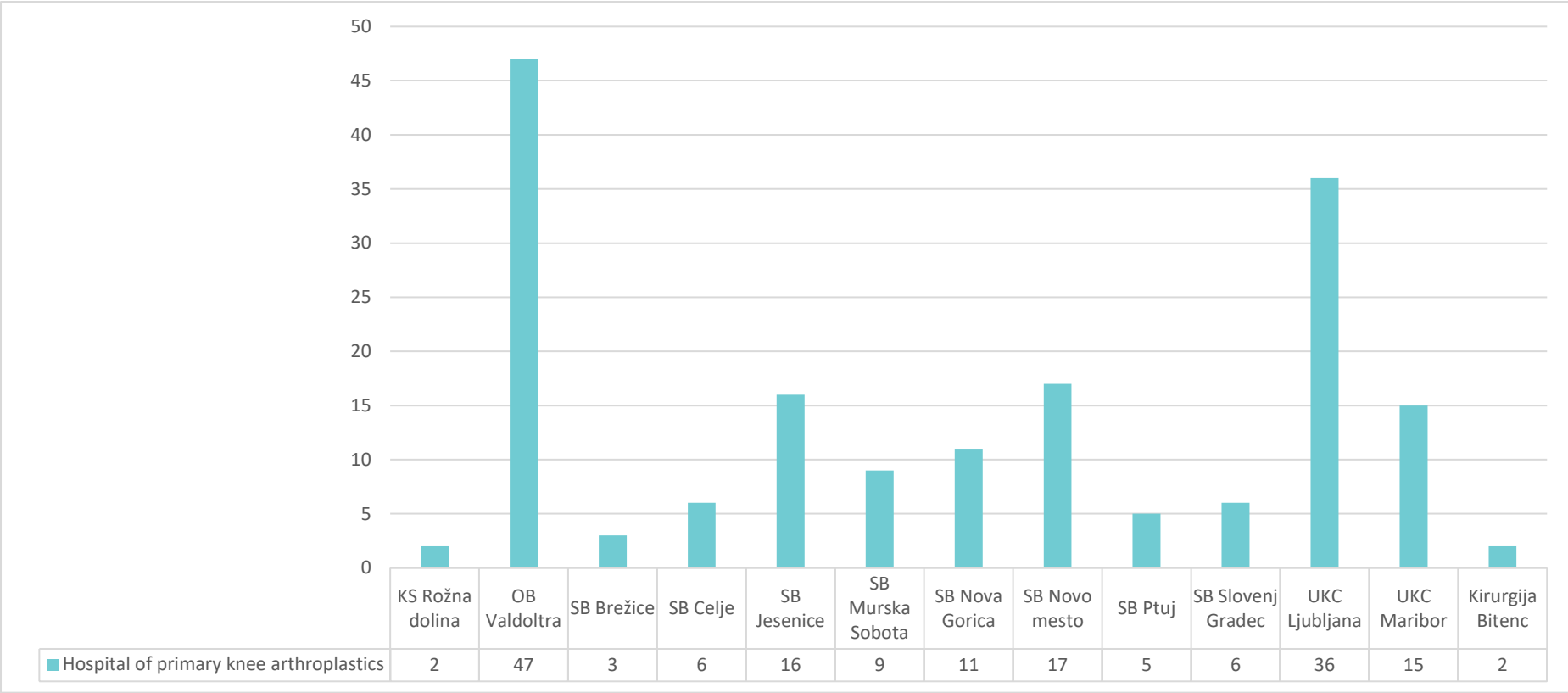


Figure 78: Hospital of primary hip arthroplasty revised for the first time in 2021 (Source: RES).

In one case (0.6%) in the RES database for 2021, there is no information about the hospital of the primary arthroplasty. In one case (0.6%), the primary knee arthroplasty was performed abroad. Both cases were excluded from further statistical analysis.

Most, 47 or 26.9%, revisions of knee endoprostheses were performed on knee arthroplasties, which were primarily performed in OB Valdoltra. They are followed by cases of revisions where the primary knee arthroplasty was performed in UKC Ljubljana (36 or 20.6%), in SB Novo mesto (17 or 9.7%), in SB Jesenice (16 or 9.1%), in UKC Maribor (15 or 8.6%), in SB Nova Gorica (11 or 6.3%), in SB Murska Sobota (9 or 5.1%), in SB Slovenj Gradec and in SB Celje (6 or 3.4%), in SB Ptuj (5 or 2.9%), in SB Brežice (3 or 1.7%), in KS Rožna dolina and Kirurgija Bitenc (in each 2 or 1.1%).

6.3.5.2 Time from primary knee arthroplasty to first knee revision performed in 2021

In the following, we checked how long (in years) after the primary knee arthrtoplasty was perfomred the revision was required. The distribution is presented in Figure 79.

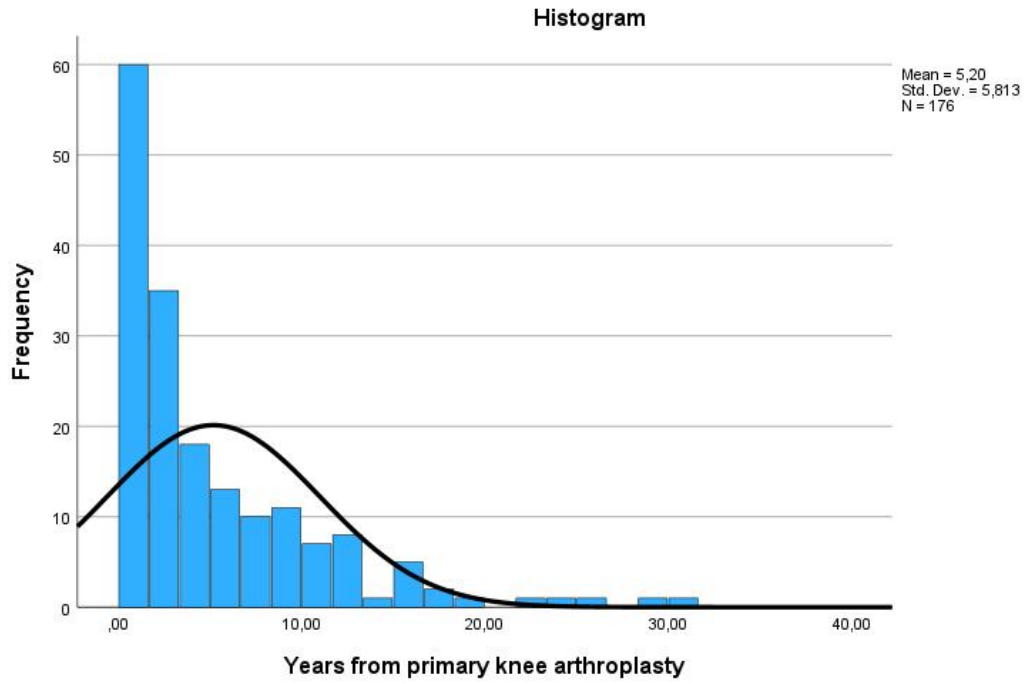


Figure 79: Number of years after primary knee arthroplasty (Source: RES).

We analyzed the number of years after primary knee arthroplasty. In one case, we have no information on when the primary knee arthroplasty was performed. We excluded this case from further statistical analysis.

From Figure 79, we can see that most of the first knee revisions were performed within a period of up to 1.5 years or up to 3 years after primary knee arthroplasties. On average, revision was performed 5.2 years (SD = 5.8 years) after the primary knee arthroplasty was performed. In one case, the first revision was performed on the same day as the primary knee arthroplasty. The longest period from primary knee arthroplasty to its revision was 30.9 years. In half of the cases, the revision knee arthroplasty was performed within 2.9 years or less, and in half of the cases within 2.9 years or more after the primary knee arthroplasty.

6.3.6 Revisions of knee arthroplasty based on implants

In the next part, we examined the characteristics of the new implant, namely we were interested in information about the replacement of the entire endoprosthesis, the femoral

component of the new implant, the tibial component of the new implant, the insert of the new implant and the patella of the new implant.

6.3.6.1 Revision knee arthroplasties according to data of the new implant

In the RES database for the year 2021, we do not have any knee endoprosthesis revisions with replacement of only the femoral component, but we have data for 117 cases where the femoral component was replaced as part of a total or partial revision. Figure 82 shows the manufacturers of inserted femoral components of knee prostheses.

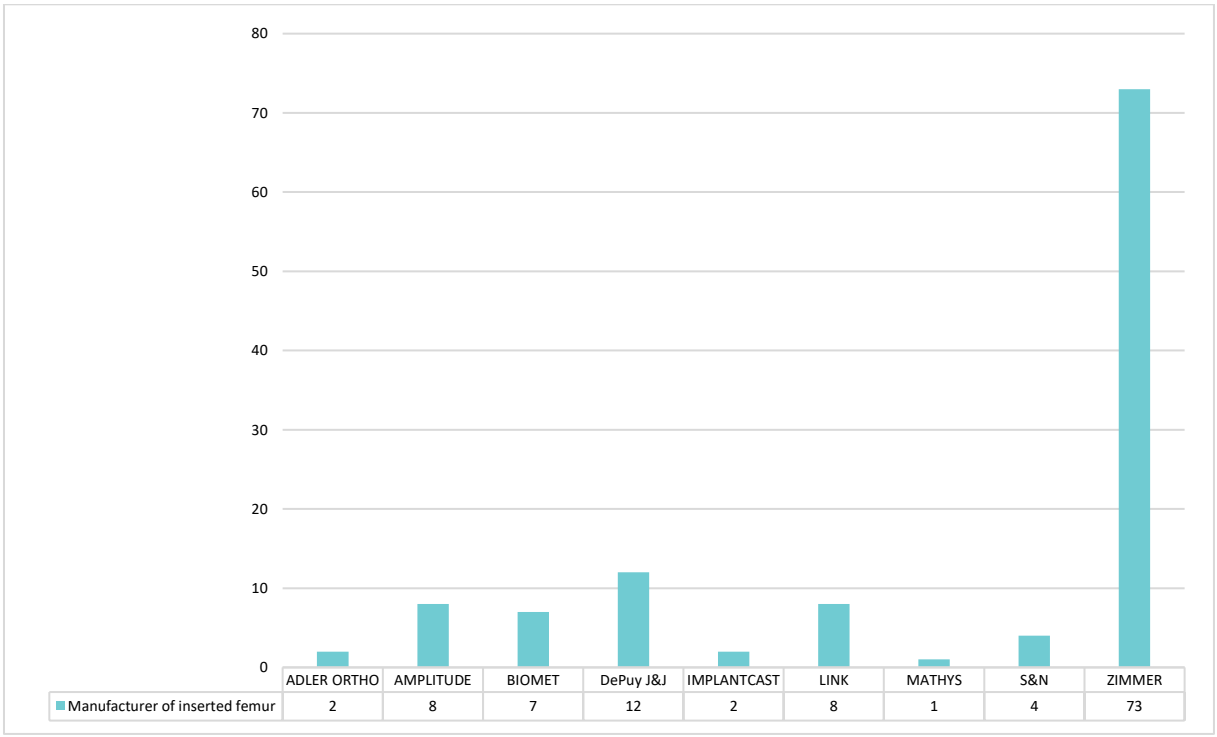


Figure 80: Manufacturers of inserted knee endoprostheses (Source: RES).

In as many as 73 (62.4%) recorded cases, a femoral part manufactured by ZIMMER was inserted during the revision of knee arthroplasty. The following manufacturers of inserted femoral components in knee endoprosthesis revisions follow: DePuy J&J (12 or 10.3%), AMPLITUDE and LINK (8 or 6.8%), BIOMET (7 or 6%), S&N (4 or 3.4 %), ADLER ORTHO and IMPLANTCAST (2 or 1.7%) and MATHYS (1 or 0.9%).

In the figure below, we present the manufacturers of the inserted femoral component in knee revision, according to the hospital of the surgery.

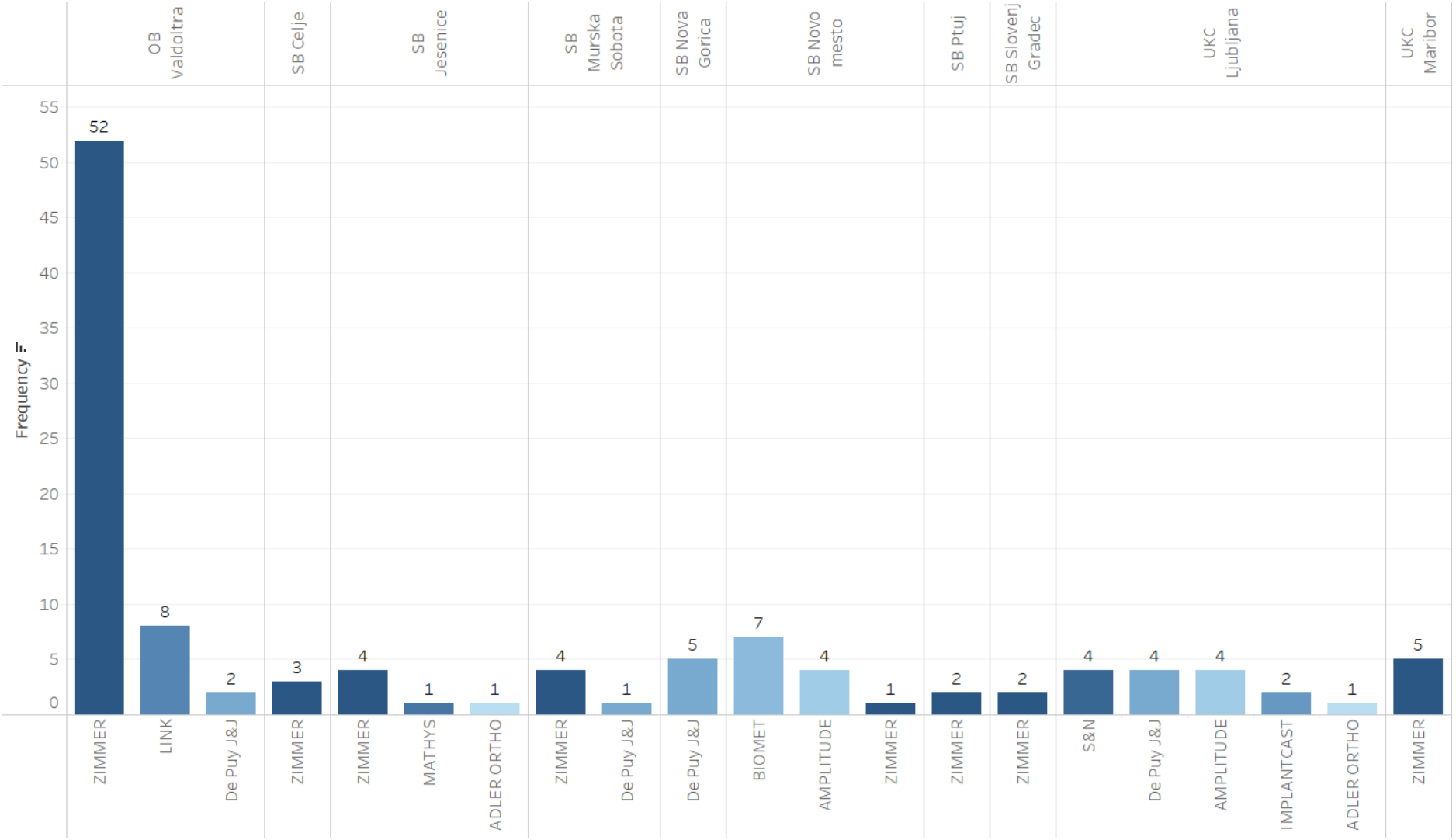


Figure 81: Manufacturers of inserted femoral components of knee revisions by hospital (Source: RES).

The results of the HI-square test ($X^2 = 241.8$, $p < 0.001$) cannot be generalized due to the large number of cells with less than 5 units (95.6%).

However, we are aware that the cost of endoprostheses per hospital is dependent on the selected providers in public tenders.

6.4 Performance results of knee implants

In this chapter, we show the success of knee implants, namely in primary partial and primary total knee arthroplasties.

6.4.1 Performance results of knee implants in primary partial knee arthroplasties

The table below shows the percentage of primary partial knee arthroplasty revisions with data over a 3-year period between 2019 and 2021.

Table 6: Percentage of revisions of primary partial knee endoprostheses from 2019 to 2021 (Source: RES).

Partial knee endoprosthesis	N°primaries	Revisions 19-21	% of refisions
AMPLITUDE	**107**	**3**	**2,80**
cemented	**26**	**2**	**7,69**
Uni Score-Uni Score cem	26	2	7,69
hybrid cemented femoral part	**3**	**0**	**0,00**
Uni Score-Uni Score	3	0	0,00
hybrid cemented tibial part	**7**	**0**	**0,00**
Uni Score HA-Uni Score cem	7	0	0,00
uncemented	**71**	**1**	**1,41**
Uni Score HA-Uni Score	71	1	1,41
ATRHROSURFACE	**15**	**0**	**0,00**
cemented patelofemoralna	**14**	**0**	**0,00**
HemiCAP PF	14	0	0,00
uncemented patelofemoralna	**1**	**0**	**0,00**
HemiCAP PF uncem	1	0	0,00
LIMA	**724**	**5**	**0,69**
cemented	**724**	**5**	**0,69**
Physica ZUK-Physica ZUK	724	5	0,69
S&N	**55**	**3**	**5,45**
cemented parcialna	**55**	**3**	**5,45**
Journey Uni Oxinium-Journey Uni	51	3	5,88
cemented patelofemoralna	4	0	0,00
Journey PFJ	4	0	0,00
ZIMMER BIOMET	**183**	**4**	**2,19**
cemented	**71**	**3**	**4,23**
Oxford-Oxford	1	1	100,00
Persona Partial-Persona Partial	55	2	3,64
cemented patelofemoralna	15	0	0,00
Patellofemoral	15	0	0,00
hybrid cemented tibial part	**2**	**0**	**0,00**

Oxford-Oxford cless	2	0	0,00
uncemented	**110**	**1**	**0,91**
Oxford cless-Oxford cless	110	1	0,91
Sum	**1084**	**15**	**1,38**

6.4.2 Performance results of knee implants in primary total knee arthroplasties

The table below shows the percentage of revisions of primary total knee arthroplasty with data over a 3-year period between 2019 and 2021.

Table 7: Percentage of revisions of primary total knee endoprotheses from 2019 to 2021 (Source: RES).

Total knee endoprosthesis	N°primaries	Revisions 19-21	% of refisions
ADLER ORTHO	**544**	**17**	**3,13**
cemented	**544**	**17**	**3,13**
Genus CR-Genus FB	458	14	3,06
Genus PS-Genus FB	86	3	3,49
AMPLITUDE	**929**	**8**	**0,86**
cemented	**63**	**1**	**1,59**
Anatomic PS-Anatomic FB	41		0,00
Score cem-Score MB cem	13	1	7,69
SCORE II cem-Score MB cem	9		0,00
hybrid cemented femoral part	**5**		**0,00**
Score cem-Score MB cless	4		0,00
SCORE II cem-Score MB cless	1		0,00
hybrid cemented tibial part	**57**	**1**	**1,75**
Score cless-Score MB cem	40	1	2,50
SCORE II -Score MB cem	16		0,00
Score Revision-Score MB cem	1		0,00
uncemented	**804**	**6**	**0,75**
Anatomic PS cless-Anatomic FB cless	17		0,00
Score cless-Score MB cless	605	6	0,99
SCORE II -Score MB cless	180		0,00
Score Revision-Score MB cless	2		0,00
DePuy J&J	**1812**	**29**	**1,60**
cemented	**1812**	**29**	**1,60**
Attune CR-Attune FB	166		0,00
Attune CR-Attune MB	2	1	50,00
Attune PS-Attune FB	60	1	1,67
Attune PS-Attune MB	3		0,00
Sigma CR-Sigma	1217	20	1,64
Sigma CR-Sigma MBT	44	2	4,55
Sigma PS-Sigma	317	5	1,58
Sigma S ROM REV-Sigma MBT	1		0,00
Sigma TC3-Sigma	2		0,00
IMPLANTCAST	**4**	**2**	**50,00**
hybrid cemented tibial part	**3**	**2**	**66,67**

Mutars Total MK-Mutars MK cem	3	2	66,67
uncemented	**1**		**0,00**
Mutars Total MK-Mutars MK	1		0,00
LIMA	**32**		**0,00**
cemented	**32**		**0,00**
Physica CR -Physica FB	11		0,00
Physica KR -Physica FB	20		0,00
Physica PS -Physica FB	1		0,00
LINK	**2**		**0,00**
cemented	**2**		**0,00**
Endo Model Rotational	2		0,00
MATHYS	**576**	**4**	**0,69**
cemented	**576**	**4**	**0,69**
BalanSys CR-BalanSys	3		0,00
BalanSys PS-BalanSys	572	4	0,70
BalanSys TiNbN-BalanSys	1		0,00
MEDACTA	**23**		**0,00**
cemented	**23**		**0,00**
GMK Sphere -GMK Sphere	23		0,00
S&N	**270**	**10**	**3,70**
cemented	**270**	**10**	**3,70**
Genesis II CR Oxinium-Genesis II	21	1	4,76
Genesis II CR-Genesis II	124	2	1,61
Genesis II CR-Legion	1		0,00
Genesis II PS-Genesis II	101	6	5,94
RT-Plus -RT-Plus	23	1	4,35
United Orthopedic	**1**		**0,00**
cemented	**1**		**0,00**
U2 PS -U2	1		0,00
ZIMMER BIOMET	**3108**	**51**	**1,64**
cemented	**2600**	**39**	**1,50**
Nexgen CR flex-Nexgen	6		0,00
Nexgen CR-Nexgen	190	3	1,58
Nexgen LCCK-Nexgen	20		0,00
Nexgen LPS Flex-Nexgen	2240	32	1,43
Nexgen RHK -Nexgen RHK	4	1	25,00
Persona CR-Persona	113	3	2,65
Vanguard 360-Vanguard 360	2		0,00
Vanguard CR-Vanguard	11		0,00
Vanguard PS-Vanguard	14		0,00
hybrid cemented femoral part	**1**		**0,00**
Nexgen CR-Nexgen TM Monoblock	1		0,00
hybrid cemented tibial part	**11**	**1**	**9,09**
Nexgen LPS-Nexgen	5		0,00
Vanguard CR cless-Vanguard	4		0,00
Vanguard PS cless-Vanguard	2	1	50,00
uncemented	**496**	**11**	**2,22**
Nexgen CR porous-Nexgen TM FB	55	2	3,64

Nexgen CR porous-Nexgen TM Monoblock	234	5	2,14
Nexgen LPS Flex-Nexgen TM FB	57	1	1,75
Nexgen LPS-Nexgen TM FB	150	3	2,00
Sum	**7301**	**121**	**1,66**

6.4.3 Conclusions regarding knee arthroplasty

6.4.3.1 Total knee endoprosthesis (TKE)

In Slovenia, between 2019 and 2021, a total of 7,301 total knee endoprostheses (TKE) were implanted. Out of these, 121 (1.7%) underwent revision surgeries during that period, with deep infection being the main reason for revision.

Among the implants, there were 1,301 uncemented total endoprostheses (17.8% of all). Out of these, 17 (1.31%) required revision during this period. Among the 6,001 cemented and hybrid endoprostheses, 101 (1.68%) underwent revision.

The most commonly used implants from Amplitude were:

The combination of Score MB cementless was used in 605 cases, with a revision rate of 1.0%.
The Score II - Score cementless prosthesis was used 180 times during this period and did not require any revisions.
Among the 496 uncemented Zimmer TKE implants, 11 (2.22%) underwent revision. The probability of revision for the Monoblock tibial component combination was 2.14%, while for the modular tibial trays combination, it was 3.64%. The reasons for revision in the Monoblock combination were pain, and in the modular combination, it was loosening and deep infection.
The most frequently used cemented prostheses were Zimmer NexGen LPS Flex - NexGen (2,240 prostheses; 32 revisions; 1.43% revision rate) and DePuy Sigma CR - Sigma (1,217 prostheses; 20 revisions; 1.64% revision rate). The main cause of revisions in these two groups was deep infection. One modular TM component was revised in combination with Nexgen LPS Flex-Nexgen TM FB (57 prostheses) due to periprosthetic fracture, and in combination with Nexgen LPS-Nexgen TM FB (150 prostheses; 3 revisions; 2.0%), two were due to loosening and one due to implant fracture.

The combinations of TKE implants that had a revision rate at least twice as high as the average were:
Adler Ortho's Genus CR - Genus (458 prostheses; 17 revisions; 3.06%)
Adler Ortho's Genus PS - Genus (86 prostheses; 3 revisions; 3.49%)
DePuy J&J's Sigma CR - Sigma MBT (44 prostheses; 2 revisions; 4.55%)
Smith&Nephew's Genesis II PS - Genesis II (101 prostheses; 6 revisions; 5.94%)
Zimmer's NexGen CR Porous - NexGen TM FB (55 prostheses; 2 revisions; 3.64%).

6.4.3.2 Partial knee endoprostheses (PKE)

In the period from 2019 to 2021, a total of 1084 PKE (partial knee endoprostheses) were implanted, representing 19.9% of all knee implants. There is a significant variation in the proportion of PKEs among different hospitals. The highest percentage of PKEs was observed at SB Novo mesto (41.5%).

Out of the 1084 implanted PKEs, 15 (1.38%) underwent revision surgeries. The main reasons for revision were implant loosening and deep infection. It is important to note that this report includes patellofemoral prostheses within the category of PKEs, and a total of 34 such prostheses were implanted without any recorded revisions.

Among the unicondylar prostheses, 181 (17.2%) were uncemented. Out of these, two (1.1%) underwent revision. Out of the 896 cemented unicondylar prostheses, 13 (1.5%) were revised.

Among the unicondylar prostheses, there are three combinations where the revision rate was twice as high as the overall revision rate. These combinations are Zimmer Persona Partial Knee (55 prostheses; 2 revisions; 3.64%), Smith&Nephew Journey Uni Oxinium - Journey Uni (51 prostheses; 3 revisions; 5.88%), and cemented Uni Score - Uni Score (26 prostheses; 2 revisions; 7.69%).

The number of primary unicondylar prostheses is still relatively low, so more relevant data on the performance of individual prostheses will be available in future reports.

7 References

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