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## Original article

# Progression and projection for shoulder surgery in France, 2012–2070: Epidemiologic study with trend and projection analysis

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## Abstract

**Introduction:** Shoulder surgery has been rapidly expanding over the past 20 years and now makes up a large share of orthopedic surgery practice. Data on how this activity has changed is not available in France due to a lack of registries. The study objectives were to 1) quantify the number of shoulder surgeries in France, 2) predict how this activity will change over the next 50 years based on extreme scenarios.

**Methods:** This study involved an analysis of shoulder surgery data taken from the French hospital discharge database (PMSI). Two mathematical scenarios were applied to define the change over time: the first only considered the evolution in the population and changes in the age brackets over time; the second extrapolated the trends observed over the past few years (2012 to 2018).

**Results:** In 2018, there were 234,612 procedures coded as primary shoulder surgery procedures in France. This activity increased 24.5% between 2012 and 2018 and is projected to increase 18% to 161% from now to 2050, depending on the scenario ( $p < 0.0001$ ). Rotator cuff surgery procedures were done 173,799 times – of which 61,055 were tendon repair – representing 74% of all shoulder procedures. The scenarios point to an increase of 13.6% to more than 300% ( $p < 0.0001$ ). Primary shoulder arthroplasty corresponded to 17,043 procedures in 2018 (7.3% of all procedures), with a 47% increase between 2012 and 2018. Between 2018 and 2050, the number of total shoulder arthroplasty procedures is expected to increase 31% to 322% ( $p < 0.0001$ ). The total number of revision arthroplasty procedures was 1508, increasing by 39% from 2012 to 2018. There were 14,229 procedures done for anterior or posterior instability in 2018 (6% of total). Bone block procedures made up 53% of these cases. This increased 17% between 2012 and 2018, with a projected increase of 5% to 82% up to 2050 ( $p < 0.01$ ).

**Discussion:** Shoulder surgery is the third largest activity in the orthopedic realm after hip and knee surgery, although it has seen the largest increases in recent years. This growth in shoulder procedures should continue over the next decades.

Level of evidence: IV, descriptive epidemiology study

Keywords: epidemiology; shoulder; cuff tear; prosthesis; instability, evolution; prediction; national data

## 1. Introduction

The number of orthopedic surgery procedures has increased since the 1950s throughout the world [1,2]. This can be attributed to several factors:

- patients asking for surgery and it being done more often [3]
- better surgical outcomes because of the improved techniques/implants and peri-operative care
- better training of surgeons inspired by internationally renowned opinion leaders [4–6].

This is especially true for the shoulder joint, which is the third leading cause of musculoskeletal disorders in general medicine and rheumatology [7]. Furthermore, demographic data show that the French population is increasing in size and in age [8].

Shoulder surgery is done in different age groups in three main areas: glenohumeral stabilization for chronic dislocations, rotator cuff repair, joint replacement (arthroplasty) for glenohumeral osteoarthritis or fractures. Thus, it would be useful to know how many of these surgeries are being done and how well the supply matches the demand. Nordic countries are at the forefront to this type of research given that, for the past 20 years, all procedures have been recorded in registers [9,10]. In France, this analysis is done by looking at procedure coding.

To our knowledge, data on how this activity has changed is not available in France. This led us to carry out a study with the aims of 1) quantifying the number of shoulder surgeries in France, 2) predicting how this activity will change over the next 50 years based on extreme scenarios. We hypothesized that the number of shoulder surgeries will increase over the next 50 years.

## 2. Materials and Methods

### Materials

The method used is similar to the one used in a previous publication on the change in number of hip surgeries in France [11].

This was an epidemiological study of French data on shoulder surgery procedures. The population statistics were obtained from the French National Institute of Statistics and Economic Studies (INSEE) for demographics and projected changes in the coming years. This type of study involves low, middle and high estimates based on different criteria such as life expectancy, fertility rate and migration. In our study, we took the middle scenario, which uses the mean of these various parameters. We integrated the variations that INSEE expects in each age bracket of the population.

Data on the number of each type of shoulder surgery were requested based on procedure codes in the CCAM [General medical acts classification] (as primary procedure) based on the Diamant file of the French hospital discharge database (PMSI) for all hospitalizations in the medicine-surgery-obstetrics-odontology (MSOO) wards. These data were obtained by pairing the standardized discharge summaries (RSS) – which contains administrative, demographic, medical and treatment information – with the CCAM procedure. We also obtained the FINESS number (National Directory of Health and Social Establishments) of the legal entity using the DRESS (Directorate for Research, Studies, Assessment and Statistics of Ministry of Health) as a source. With the PMSI, we collected the patient's sex and age bracket: 0–14 years, 15–29 years, 30–44 years, 45–59 years, 60–74 years, 75–89 years and 90+ years. Lastly, using the MSOO anonymous discharge summary (RSA) file, we collected the year that the surgical procedure of interest was done. The FINESS and legal entity were used to classify the healthcare facilities into public, non-profit and for-profit hospitals.

The coding information was consulted in May 2019 to capture data from 2018 in its entirety.

## Methods

The primary aim of this study was to generate data on the current shoulder surgery activity in France. The secondary aim was to evaluate how this activity has changed in recent years and will change over the next 50 years.

The data were classified into different categories for a more refined analysis: surgery for rotator cuff lesions (tendon repair, tenotomy/tenodesis of long head of biceps, procedure in subacromial space), surgery to stabilize the glenohumeral joint anteriorly or posteriorly (bone block, ligament or capsule-labrum re-attachment), joint replacement surgery no matter the indication (total shoulder arthroplasty, humeral hemiarthroplasty), revision arthroplasty (change, conversion, removal), and other procedures (joint lavage, synovectomy, tumor surgery, reduction of shoulder dislocation). Fracture fixation was excluded from the analysis. All the procedure codes included in each category are listed in [Table 1](#).

For each category, we defined two scenarios based on the methods used by the DRESS [12]:

- Scenario 1: This scenario has fixed characteristics. The scenario exactly reproduces the parameters measured during the last year of PMSI data available (2018) and assumes they are identical over time. It only considers how the population evolves and how the age distribution changes over time. In some ways, it acts as a reference. In this scenario, the model was adjusted for each procedure, with weighing based on the expected change in each age bracket according to INSEE data. For example, procedures done in younger patients increase less than procedures done in older patients because the population is projected to become older in the coming years. Thus, for each procedure and for each decade going forward we came up with a multiplication factor based on the age pyramid for each procedure and the INSEE data. A few examples are shown in [Table 2](#).
- Scenario 2: This is the change scenario. It reuses the trends observed in the 2012–2018 period while integrating the population changes from scenario 1. In this scenario, for each procedure, the changes in the number of procedures done was estimated using a linear regression over the prior available years and the equation used for future projections.

The geographic descriptions were done using raw data by taking an average of the number of procedures over the 2012–2018 period with calculation for each region of the share by hospital type. The total number of procedures and number per resident were calculated.

## Statistical methods

Statistical calculations were done using Excel™ software (Microsoft, Redmond, USA) and XLSTAT™ software (Addinsoft, New York, USA). The overall projections for each procedure are the sum of the individual projections for each age bracket weighted by the INSEE data. Thus, independent models were created for each procedure as a function of its target population and the age brackets affected by one or another procedure. The results are presented as raw counts or mean  $\pm$  standard deviation with minimum and maximum values for the quantitative variables. The 95% confidence intervals were calculated. There was no missing data and all the data were included in the analysis. The changes in number of procedures are given as raw numbers; statistical analysis is not possible because these are real numbers, not estimates; the differences observed are inevitably true.

### 3. Results

#### Overall activity (Table 3)

In 2018, the last year available in France, there were 234,612 procedures coded as primary shoulder surgery procedures. This activity has increased constantly over 7 years (+24.5%) from 188,496 in 2012 to 234,612 in 2018. During this period, 50,428 procedures (23.5%) were done at public hospitals, 12,331 were done at private nonprofit hospitals (5.7%) and 151,996 were done at private for-profit hospitals (70.8%). This share of activity between public and private was stable from 2012 to 2018. The procedures were performed in men in 51.7% of cases (111,038 procedures). Between 2018 and 2050, scenario 1 projects a 18% increase and scenario 2 a 161% increase ( $p < 0.0001$ ) (Fig. 1).

#### Rotator cuff surgery

There were 173,799 rotator cuff procedures of which 61,055 were tendon repairs (35.1%, 6.8/10 000 inhabitants), 40,796 were procedures on the long head of biceps (23.5%) and 71,948 were procedures in the subacromial space (41.4%), making up 74% of all procedures done. This increased 21.2% over the 7 years analyzed (from 135,203 in 2012 to 173,799 in 2018), with a statistically significant difference between these three types of surgery: +28.2% for tendon repair, +96.8% for long head of biceps and +7.6% for subacromial space ( $p = 0.01$ ). These procedures were done by arthroscopy in 87.4% of cases (151,887 procedures) with no difference between the tendon repair procedures and the other procedures. These procedures were done in men in 50% of cases (78,808 procedures). Between 2018 and 2050, scenario 1 projects a 13.6% increase while scenario 2 projects a 152.9% increase in tendon repairs, and a 300%+ increase in long head of biceps and subacromial procedures ( $p < 0.0001$ ) (Fig. 2).

#### Joint replacement surgery

There were 17,043 primary joint replacement surgeries in 2018 (7.3% of all procedure, 1.7/10,000 inhabitants), with an increase of +47.6% between 2012 and 2018 (11,544 and 17,043 procedures, respectively). Total shoulder arthroplasty made up 94% of these procedures (16,003). The procedures were performed in women in 69% of cases (10,399 procedures). Between 2018 and 2050, scenario 1 projects a 31% increase while scenario 2 projects a 322% increase in total shoulder arthroplasty, and a 481% decrease in humeral hemiarthroplasty procedures ( $p < 0.0001$ ) (Fig. 3).

A total of 1508 revision arthroplasty procedures were done (+39% between 2012 and 2018). Figure 4 shows the average number of procedures of the 7-year period for each type of revision surgery. The distribution did not change significantly ( $p = 0.45$ ) during this period. The procedures were performed in women in 57% of cases (726 procedures). Between 2018 and 2050, scenario 1 projects a 36% increase and scenario 2 a 273% increase ( $p < 0.0001$ ) (Fig. 5).

### Anterior or posterior instability surgery

There were 14,229 procedures done for anterior or posterior instability in 2018 (6% of all procedures, 1.5/10,000 inhabitants). The increase between 2012 and 2018 was 16.7% (12,196 and 14,229 procedures, respectively). Bone block procedures made up 53% of these cases and were stable during this period. The procedures were performed in men in 81% of cases (10,693 procedures). Between 2018 and 2050, scenario 1 projects a 5% increase while scenario 2 projects an 82% increase in ligament and capsule-labrum re-attachment, and a 59% increase in bone block procedures ( $p < 0.01$ ) (Fig. 6).

### Other surgery

The number of joint lavage, synovectomy, tumor excision, labral repair and shoulder reduction procedures in 2018 is listed in Table 3. The trend for these procedures was stable during the analyzed period (-10% to +10%). Between 2018 and 2050:

- for joint lavage, scenario 1 projects a 20% increase and scenario 2 an 82% decrease ( $p < 0.01$ )
- for synovectomy, scenario 1 projects a 20% increase and scenario 2 a 96% increase ( $p < 0.01$ )
- for tumor excision, scenario 1 projects a 13% increase and scenario 2 a 40% increase ( $p < 0.02$ )
- for labral repair, scenario 1 projects a 3% increase and scenario 2 a 61% decrease ( $p < 0.01$ )
- for shoulder reduction, scenario 1 projects a 21% increase and scenario 2 a 5% increase ( $p = 0.03$ ).

### Shoulder surgery activity throughout France

The geographical distribution of rotator cuff repair, arthroplasty and instability surgery activity with their average values between 2012 and 2018 is shown in Figures 7, 8 and 9, respectively. In metropolitan France, there were significant regional differences in these three broad types of surgeries ( $p < 0.0001$ ). The frequency (per 10,000 inhabitants) for rotator cuff surgery ranged from 14.0 to 37.7, for arthroplasty surgery it ranged from 2.0 to 3.5 and for instability surgery it ranged from 1.0 to 3.0. In France's overseas departments and territories, the overall and specific volume of shoulder surgery activity were significantly lower than in metropolitan France ( $p < 0.001$ ).

The share of procedures between public, private non-profit, private for-profit hospitals in the three main shoulder surgery categories significantly varied between regions ( $p < 0.001$ ). Depending on the region, 54% to 89% of rotator cuff repair procedures, 29% to 43% of arthroplasty procedures and 67% to 87% of instability procedures were done at private hospitals.

## 4. Discussion

This study provides hard data on the current shoulder surgery activity in France and its potential change over the coming decades (fracture fixation excluded). Our main hypothesis was confirmed with a projected increase of 18% to 161% between now and 2050, depending on which scenario is used.

The current level of surgical activity in France is comparable to that of other countries for rotator cuff repair [13,14], joint replacement [15,16], and glenohumeral stabilization [17,18].

The two scenarios that we used for future projection gave highly different results. These data are estimates based on mathematical models, hence the true growth in each type of procedure falls somewhere between scenario 1 and 2 in most cases.

Recent data on hip and knee surgery in France [11] show an approximately 8% growth in the number of procedures from 2012 to 2018 and projected growth of 15% to 98% from now until 2050. Comparatively, shoulder surgery has experienced stronger growth over the past years (+24%), likely because it is a “newer” surgery for which many innovations being introduced since the early 2000s. The projected 18% to 161% increase in the number of procedures until 2050 appears justified.

The largest increase in volume will be in rotator cuff repair and arthroplasty procedures, according to our analysis. Other than demographic changes, this can be explained by the fact that these types of procedures have been associated with the most technological innovations (e.g. development of suture anchors and arthroscopy instruments, invention of the reverse shoulder arthroplasty by the French surgeon Paul Grammont, shift to using reverse arthroplasty for fracture treatment and revision cases). Another explanation is that the training of young surgeons has been optimized through theoretical and practical work on simulators or cadavers sponsored by learned societies such as the SOFCOT and SFA[19–21].

Comparing this French data with data from other countries is difficult because the various publications often do not cover the same periods. Nevertheless, some data is useful for putting the surgical activity and its recent change into perspective.

For rotator cuff surgery, the frequency of tendon repair (68/100,000 inhabitants in France) was 16.3, 62.1 and 83.1 /100.000 inhabitants on average in Great Britain in 2009-2010 [22], in Italy between 2001 and 2014 [14] and in New York state in the USA in 2009 [13]. These numbers were greatly increasing in these countries although the number of subacromial procedures increased more than the number of repairs (ratio of 1 suture repair to 5 acromioplasties in NYC and Great Britain). This was not the case in France as tendon repairs increased 28% and subacromial procedures by 7%.

As for arthroplasty surgery, the data and registers of 10 different countries [15,23] show an average of about 20 procedures per 100,000 inhabitants in 2012 (6, 13, 21.3, 34 per 100,000 for Great Britain, Sweden, USA and Germany, respectively). The French data is comparable with 17 per 100,000 inhabitants and a 47% increase between 2012 and 2018. The procedure coding in France is not specific enough to differentiate between the types of total joint replacement: anatomical or reverse. Nevertheless, the trend in most countries is a strong increase in the number of reverse implants at



the expense of anatomical implants and humeral hemiarthroplasty [24]. This can be explained by better knowledge of the outcomes with these implants, especially in an older population that often has cuff tear arthropathy or complex fractures of the proximal humerus where reverse implants have been shown to be superior to hemiarthroplasty [25–27].

Published data on glenohumeral stabilization procedures is rarer. The incidence in 2006 in the USA was 6.89/100,000 inhabitants [28]. More recently, Riff [18] analyzed a private registry of 22.7 million patients and found that 5985 stabilization procedures had been done between 2007 and 2015 (thus 2.93/100,000 inhabitants per year). Ligament and capsule/labrum surgery made up 96% of this volume, although bone block surgery was increasingly more frequent in recent years [18] especially with young surgeons [29]. Thus, France has a higher number of shoulder stabilization procedures and a more even distribution between capsulolabral and bone block procedures, which can be explained by the fact that the coracoid bone graft procedure was developed in France by Latarjet and Patte. The volume of shoulder stabilization procedures has increased slightly over the past 6 years (+17%), while the number of shoulder reduction procedures was stable (-4% over the same period), which leaves us to believe that these surgical procedures are effective at reducing the number of recurrences in the long term.

Our analysis of the distribution of surgical activity between public and private healthcare facilities shows a large variation throughout France, with a large majority of the activity occurring at private hospitals, which is expected to increase in the coming years. The shift to outpatient procedures with the goal of improving profitability driven by the French T2A (activity-based payment/funding system) has without a doubt pushed surgeons to train in arthroscopy / minimally invasive techniques, which are especially well suited to practicing in private healthcare facilities. In parallel, the public facilities that are also university-based are guided by a government decision model toward practices that are structurally extensive and costly, leaving little room for other types of surgeries. This disparity also raises the problem of current and future training of surgeons, which must be provided both by public university facilities and private facilities that are renowned for their expertise.

This epidemiological study has some limitations:

- the projections take into account only the current number of procedures, their recent change and the change in the population. They do not account for important “non-foreseeable” factors such as a country’s health policies (e.g. elimination of reimbursement for a procedure or reduction of the budget allocated to health would inevitably reduce the activity); change in the medical demographics (e.g. number of surgeons per inhabitants, feminization of the profession); and the advent of major innovations (e.g. new treatment for osteoarthritis).

- the estimates are based on the primary surgical procedure only. There may be a classification bias. Poor estimates of certain procedures is possible either because of oversight or incorrect coding (lack of exhaustivity, which is not very likely given that payment is directly tied to the T2A), or because they are coded as procedures associated with a primary procedure (2nd or 3rd procedures). Nevertheless, using a mean of the procedures from 2012 to 2018 and their trends helps to minimize the impact of this bias.

- the evolution of the population is not homogeneous and may be false. This is re-evaluated every year by INSEE. We chose to use this institute's middle scenario in both of our scenarios to simplify our statistical analysis (see Methods).

- while a linear regression was used in scenario 2, another type of growth pattern (exponential or logarithmic) could have been used instead. This is especially true for certain procedures such as MEKA009 and MEKA010 (unipolar implant) that have been on the decrease in recent years and in which the projections result in negative volume in the coming decades, which is not possible.

## 5. Conclusion

Shoulder surgery is a “newer” surgery than hip and knee surgery and has benefited from recent significant innovations. The large increase in volume seen in the recent years is expected to continue in France, especially for procedures that are done in patients above 50 years of age.

Conflict of interest: RE and SD have no conflict of interest to declare. SB is a consultant with Zimmer (outside this study). GV is a consultant with FH Ortho (outside this study). NB is a consultant with Smith & Nephew, Wright Medical, Stryker, Conmed (outside this study). JB is a consultant with Arthrex, SBM and Move Up and has received royalties from Move up (outside this study).

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Author contributions: GV contributed to the design of this study, data collection, writing the article and corrections; RE contributed to the design of the study and statistical analysis; JB and NB provided critical revisions to this article; SD and SB supervised the project.

### **Legends of Figures**

Figure 1: Change in the annual number of all shoulder surgery procedures between 2012 and 2018 with trends out to 2070

Figure 2: Change in the number of rotator cuff surgery procedures annually between 2012 and 2018 with trends out to 2070

Figure 3: Change in the number of primary shoulder arthroplasty surgery procedures annually between 2012 and 2018 with trends out to 2070

Figure 4: Mean distribution of type of revision arthroplasty procedures from 2012 to 2018

Figure 5: Change in the number of revision shoulder arthroplasty surgery procedures annually between 2012 and 2018 with trends out to 2070

Figure 6: Change in the number of shoulder stabilization surgery procedures annually between 2012 and 2018 with trends out to 2070

Figure 7: Distribution in France of rotator cuff repair procedures, 2012–2018 average

Figure 8: Distribution in France of shoulder arthroplasty procedures, 2012–2018 average (TSA: total shoulder arthroplasty)

Figure 9: Distribution in France of anterior or posterior shoulder stabilization procedures, 2012–2018 average

Table 1: Classification of procedure codes studied

class	sub-class	PMSI - CCAM Procedure code
Rotator cuff surgery	Tendon repair	MJEC001 - SUTURE 1TENDON ROTATOR CUFF, SHOULDER, ARTHROSCOPY MJEC002 - SUTURE MULTIPLE TENDONS ROTATOR CUFF, SHOULDER, ARTHROSCOPY MJEA010 - SUTURE 1TENDON ROTATOR CUFF, SHOULDER, OPEN MJEA006 - SUTURE MULTIPLE TENDONS ROTATOR CUFF, SHOULDER, OPEN
	Long head of biceps	MJDC001 - TENODESIS +/- RESEC. ARTIC. PORTION BICEPS ARTHROSCOPY MJDA001 - TENODESIS +/- RESEC. ARTIC. PORTION BICEPS, OPEN
	Subacromial space procedure	MEMA006 - ACROMIOPLASTY WITHOUT IMPLANT, OPEN MEMA011 - ARTHROPLASTY ACR.CLAV RESEC. LATERAL END CLAV. ARTHROTOMY MEMA017 - ACROMIOPLASTY WITHOUT IMPLANT + ARTHROPLASTY ACR.CLAV RESEC. LATERAL END CLAV MEMC001 - ARTHROPLASTY ACR.CLAV RESEC. LATERAL END CLAV. ARTHROSCOPY MEMC003 - ACROMIOPLASTY WITHOUT IMPLANT ARTHROSCOPY MEMC005 - ACROMIOPLASTY + ARTHROPLASTY ACR.CLAV RESEC. LATERAL END CLAV. ARTHROSCOPY
Anterior or posterior GH stabilization procedure	Bone block	MEMA005 - 1 GLENOID BONE BLOCK HARVEST. CORACOID, OPEN MEMA018 - 1 GLENOID BONE BLOCK, BONE/MUSC, OPEN
	Capsulolabral and ligament reattachment	MEMA012 - CAPSULOPLASTY ANT/POST JOINT SCAP.HUM, OPEN MEMC002 - CAPSULOPLASTY ANT/POST JOINT SCAP.HUM ARTHROSCOPY
Implant surgery	Total joint replacement	MEKA006 - JOINT REPLACEMENT SCAP.HUM IMPLANT TOT. MEKA007 - JOINT REPLACEMENT SCAP.HUM IMPLANT TOT. + PROX. OSTEOTOMY HUMERUS MEKA008 - IMPLANT TOTAL SHOULDER + SUTURE REINSERTION +/- ROTATOR CUFF REPAIR
	Humeral hemiarthroplasty	MEKA005 - IMPLANT SHOULDER UNIPOLAR/MOBILE CUP + REINSERTION +/- ROTATOR CUFF REPAIR MEKA009 - IMPLANT SHOULDER UNIPOLAR/MOBILE CUP + PROX. OSTEOTOMY HUMERUS MEKA010 - IMPLANT SHOULDER UNIPOLAR/MOBILE CUP
	Implant revision	MEKA001 - CHANGE 1 COMPONENT TOT. SCAP.HUM MEKA002 - CHANGE 1 COMPONENT HUMERAL +/- GLENOID IMPLANT TOT + RECONSTR. BONE MEKA003 - CHANGE 1 COMPONENT HUMERAL PR 1 COMPONENT TOT. SCAP.HUM MEKA004 - CHANGE 1 COMPONENT HUMERAL/GLENOID IMPLANT TOT. SHOULDER MEGA001 - REMOVAL 1 COMPONENT JOINT SCAP.HUM + SCAP.HUM FUSION MEGA002 - REMOVAL 1 COMPONENT JOINT SCAP.HUM
Other procedures	Joint lavage	MEJC001 - JOINT LAVAGE SCAP.HUM ARTHROSCOPY MEJA001 - JOINT LAVAGE SCAP.HUM ARTHROTOMY
	Synovectomy	MEFC002 - SYNOVECTOMY TOT. JOINT SCAP.HUM ARTHROSCOPY MEFA003 - SYNOVECTOMY TOT. JOINT SCAP.HUM ARTHROTOMY
	Tumor excision	MEMA003 - RECONSTR. BONE SHOULDER + FUSION AFTER RESEC. SEGT MEMA009 - ARTHROPLASTY SHOULDER MASSIVE CUSTOM IMPLANT AFTER RESEC. SEGT MEMA015 - ARTHROPLASTY SCAP.HUM WITHOUT IMPLANT, OPEN MEFA004 - HUMEROSCAPULECTOMY

Labral repair

MEMC004 - REPAIR GLENOID LABRUM SCAP.HUM ARTHROSCOPY  
MEFC001 - RESEC. GLENOID LABRUM SCAP.HUM ARTHROSCOPY  
MEFA001 - RESEC. GLENOID LABRUM SCAP.HUM ARTHROTOMY

Glenohumeral  
reduction

MEEP002 - REDUC. 1 DISLOCATION SCAP.HUM  
MEEP003 - REDUC. 1 DISLOCATION SCAP.HUM + FRAC. PROX. HUMERUS HOMOLAT.  
MEEA001 - REDUC. 1 DISLOCATION SCAP.HUM + BONE FRAC. PROX. HUMERUS HOMOLAT.  
MEEA002 - REDUC. SURGERY DISCL. SCAP.HUM + BONE FRAC. GLENOID/NECK SCAPULA +/-  
TUBERC. HUMERAL  
MEEA003 - REDUC. 1 DISLOCATION SCAP.HUM ARTHROTOMY

Table 2: Examples of the multipliers per procedure based on the distribution of the population changes for each age group impacted by this procedure.

PROCEDURE - No. of procedures, primary one only	2020	2025	2030	2035	2040	2050	2060	2070
MJEC001 - SUTURE 1 TENDON ROTATOR CUFF, SHOULDER, ARTHROSCOPY	1,008	1,026	1,042	1,058	1,073	1,088	1,094	1,107
MEMA005 - 1 BONE BLOCK, GLENOID HARVEST CORACOID, OPEN	1,003	1,003	0,999	1,002	1,013	1,021	1,019	1,027
MEKA006 - JOINT REPLACEMENT SCAP.HUM IMPLANT TOT.	1,030	1,117	1,212	1,280	1,312	1,366	1,422	1,462
MEJC001 - JOINT LAVAGE SCAP.HUM ARTHROSCOPY	1,007	1,022	1,035	1,048	1,062	1,081	1,092	1,107
MEEP002 - REDUC. 1 DISLOCATION SCAP.HUM	1,020	1,074	1,133	1,176	1,200	1,255	1,313	1,353

Table 3: Number of shoulder surgery procedures in 2018, GH: glenohumeral

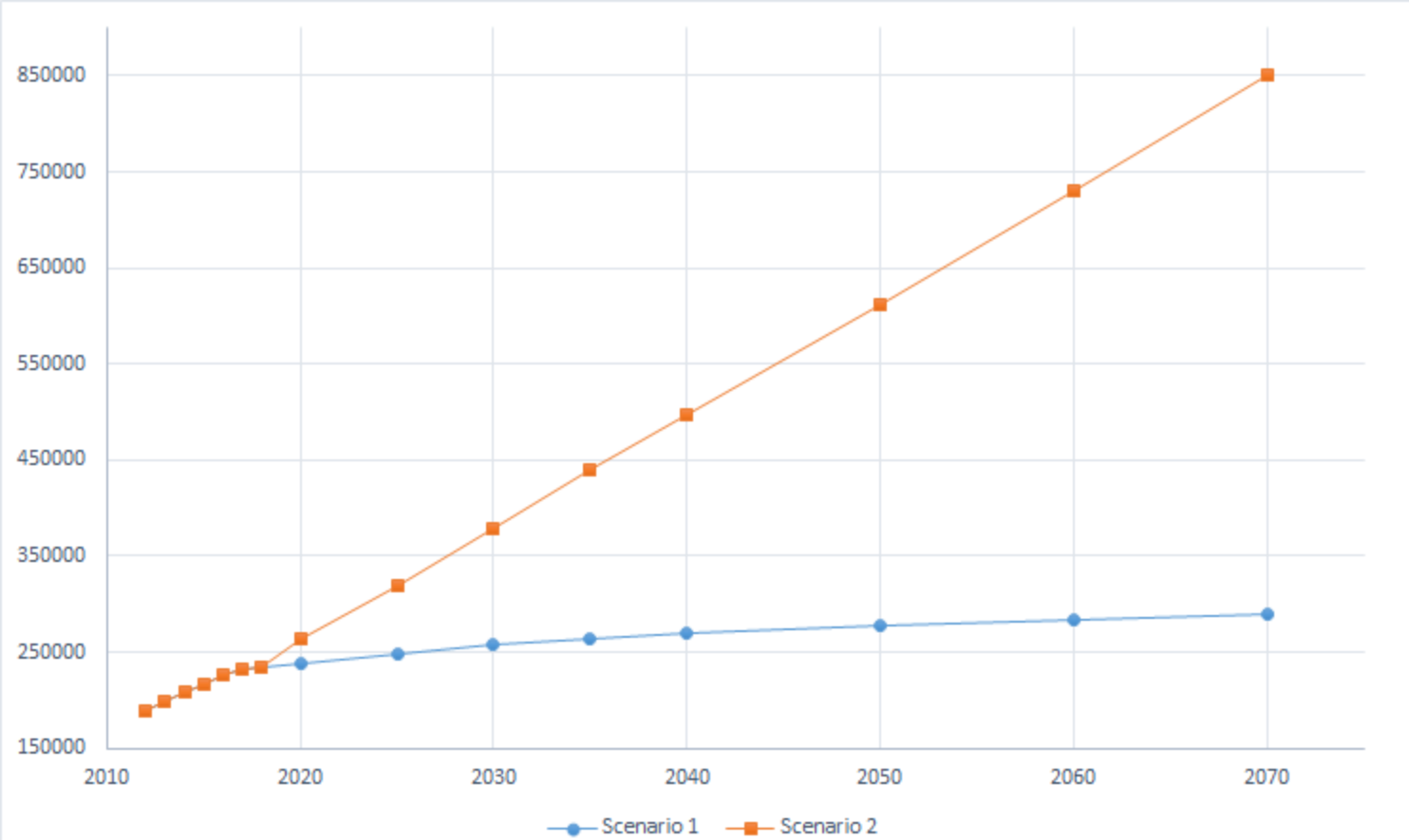
class	sub-class	Number of procedures in 2018
Rotator cuff surgery	Tendon repair procedure	61055
	Long head of biceps procedure	40796
	Subacromial space procedure	71948
GH stabilization procedure	Bone block	7307
	Capsuloplasty	6922
Implant surgery	Total shoulder replacement	16003
	Humeral hemiarthroplasty	1040
	Implant revision	1508
Other	Joint lavage	3055
	Synovectomy	3415
	Tumor excision	155
	Labral repair	4250
	Reduction of GH dislocation	9859
TOTAL of all shoulder procedures (except fracture fixation)		234612

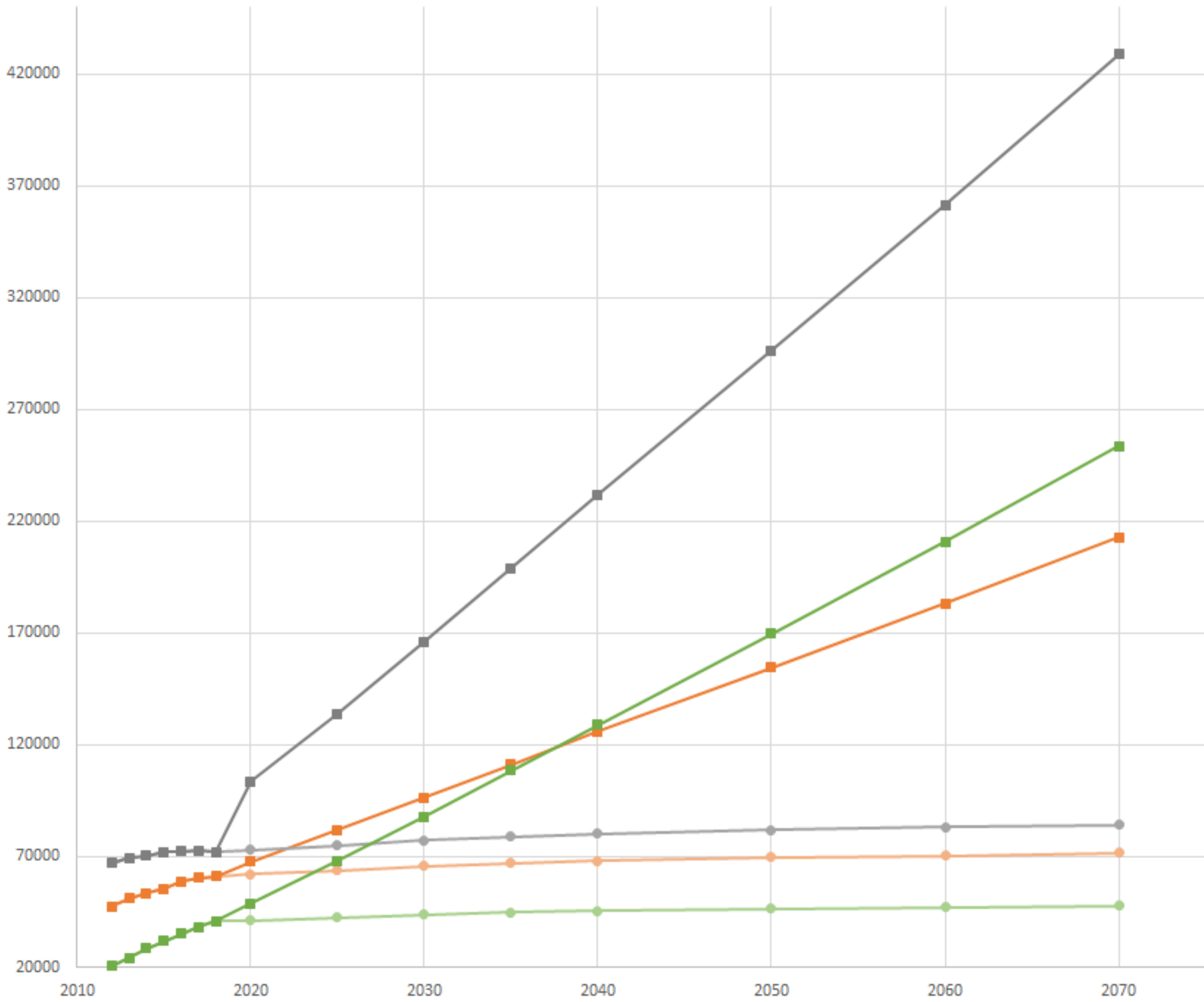
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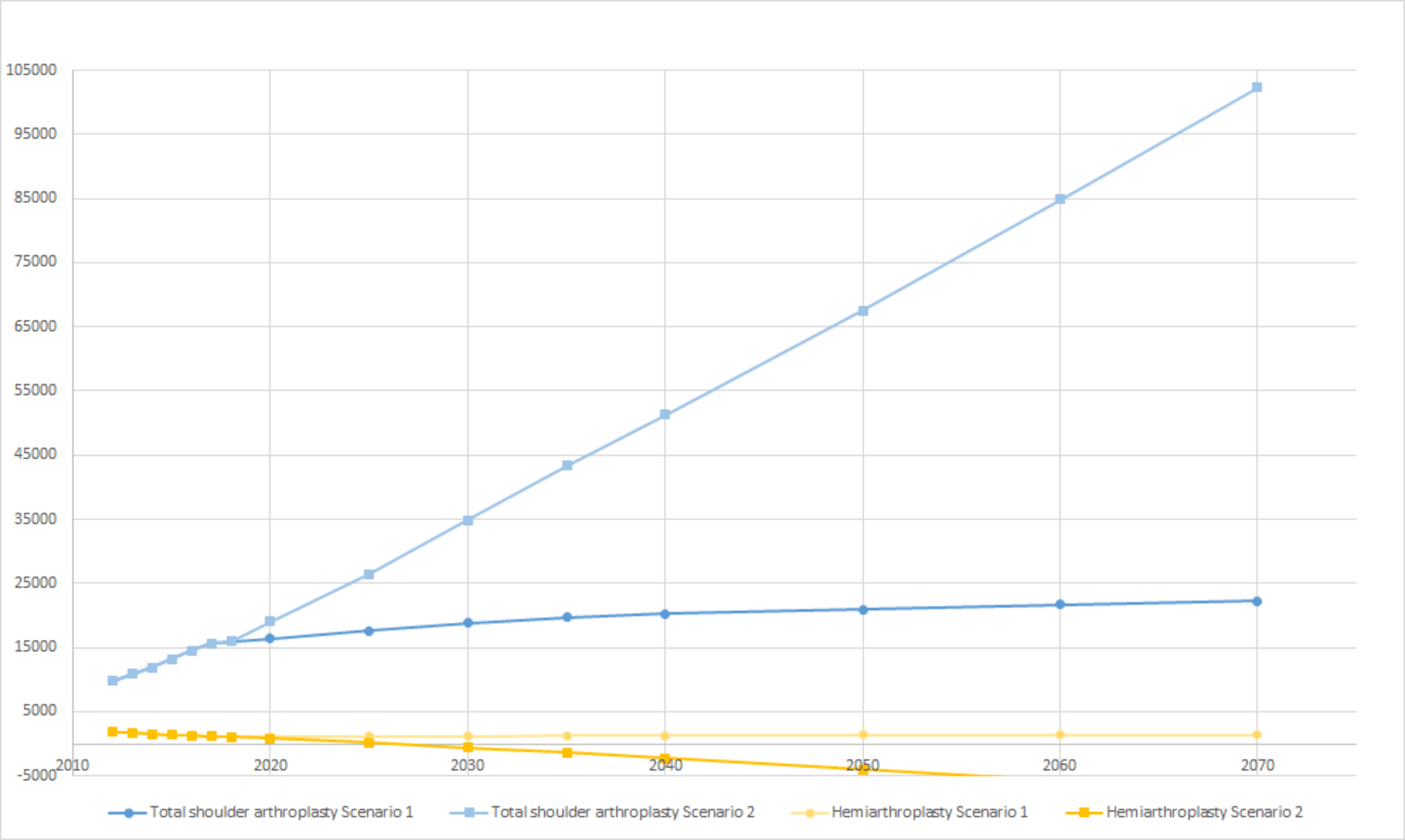


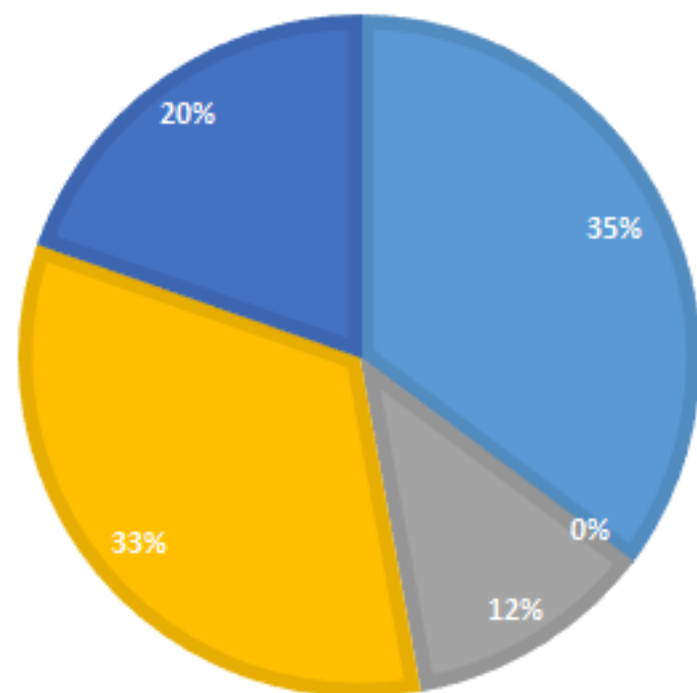
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- Tendon repair Scenario 1
  - Subacromial procedure Scenario 1
  - Long head of biceps procedure Scenario 1
- Tendon repair Scenario 2
  - Subacromial procedure Scenario 2
  - Long head of biceps procedure Scenario 2





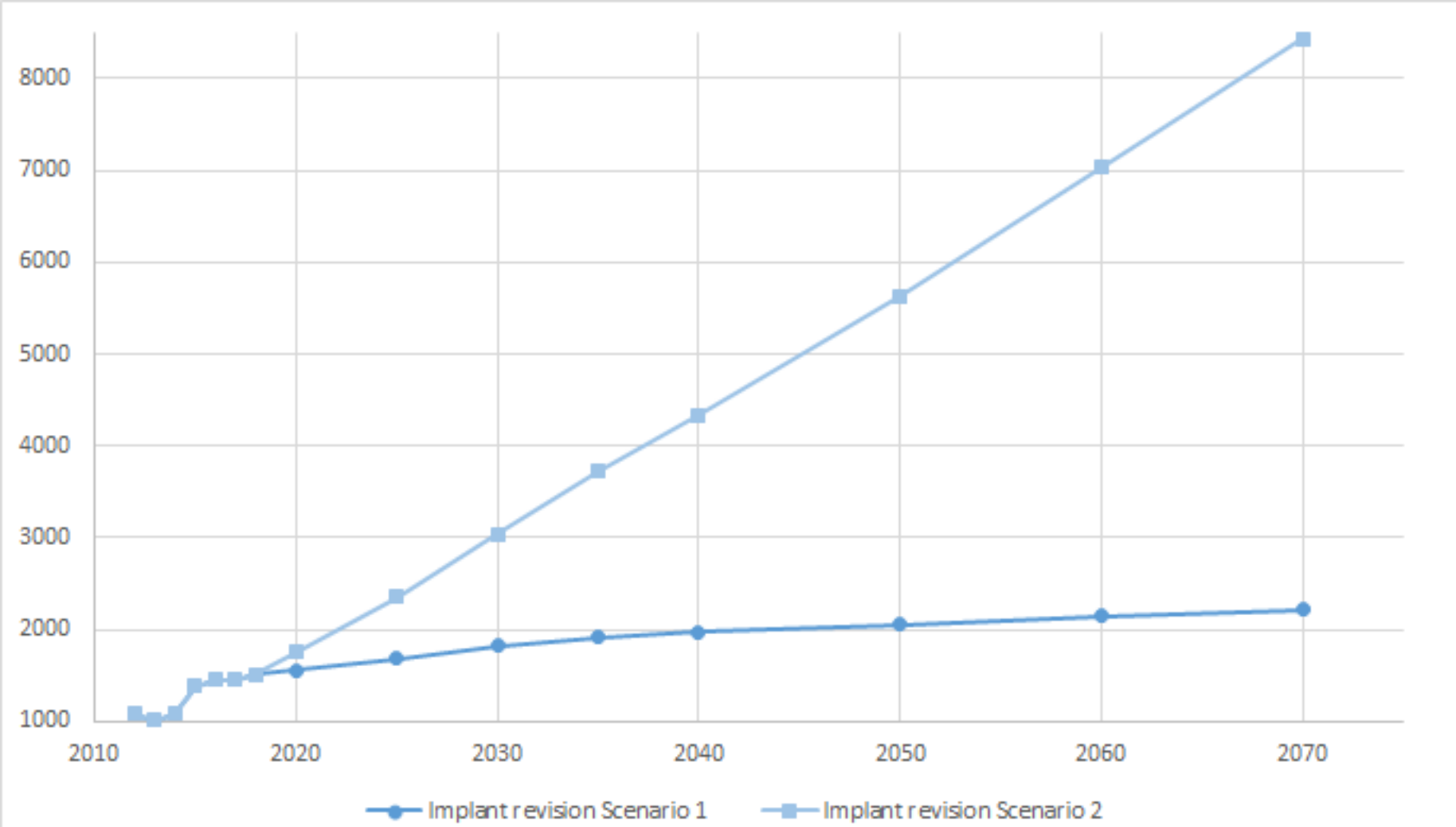
■ MEKA001 - CHANGE 1 COMPONENT TOT. SCAP.HUM

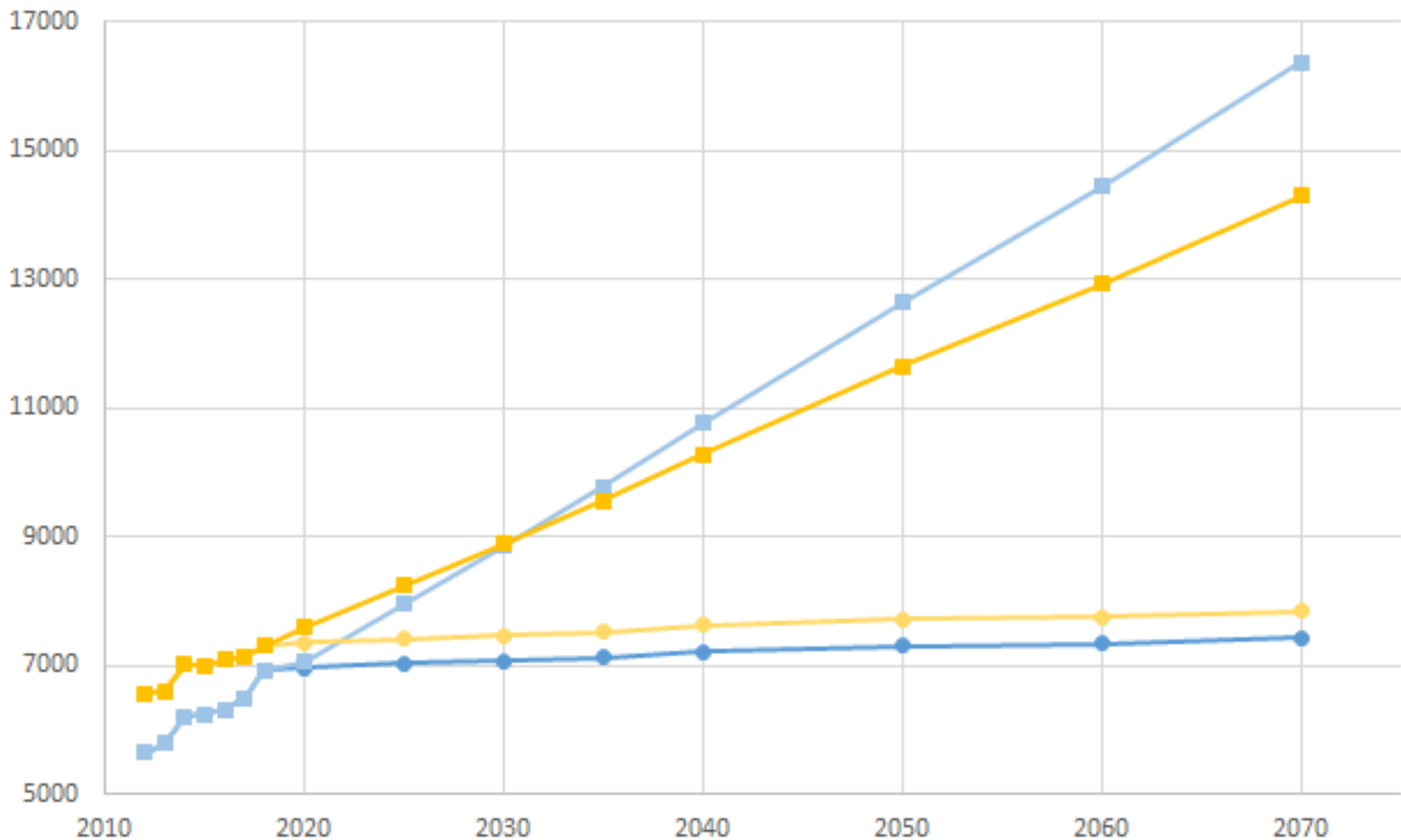
■ MEKA002 - CHANGE 1 COMPONENT HUMERAL +/- GLENOID IMPLANT TOT + RECONSTR. BONE

■ MEKA003 - CHANGE 1 COMPONENT HUMERAL PR 1 COMPONENT TOT. SCAP.HUM

■ MEKA004 - CHANGE 1 COMPONENT HUMERAL/GLENOID IMPLANT TOT. SHOULDER

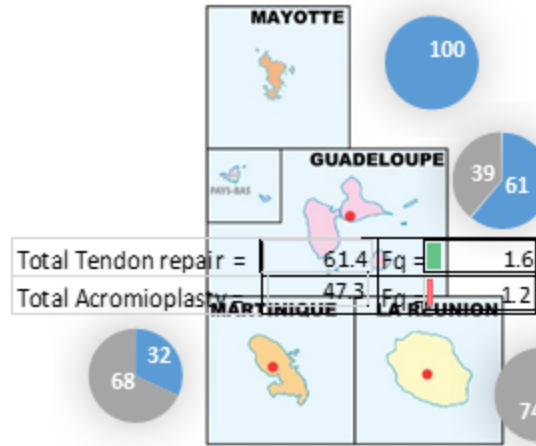
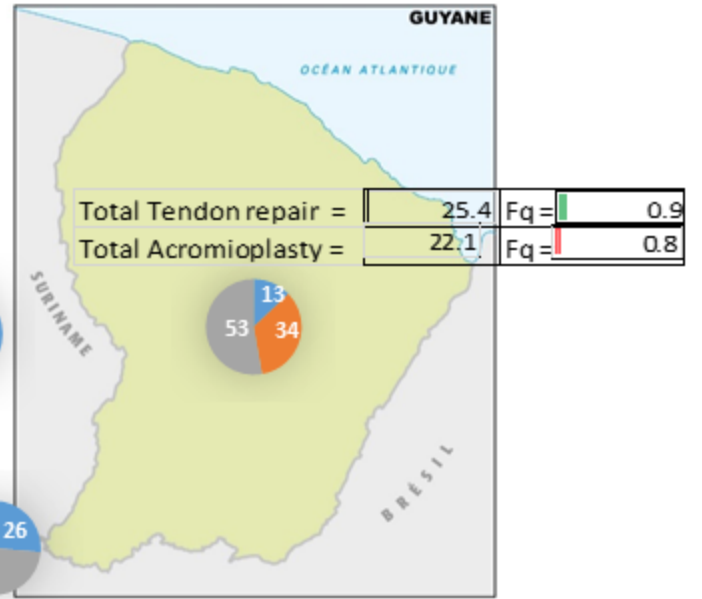
■ MEGA001 + MEGA002 - REMOVE 1 COMPONENT JOINT SCAP.HUM +/- SCAP.HUM FUSION





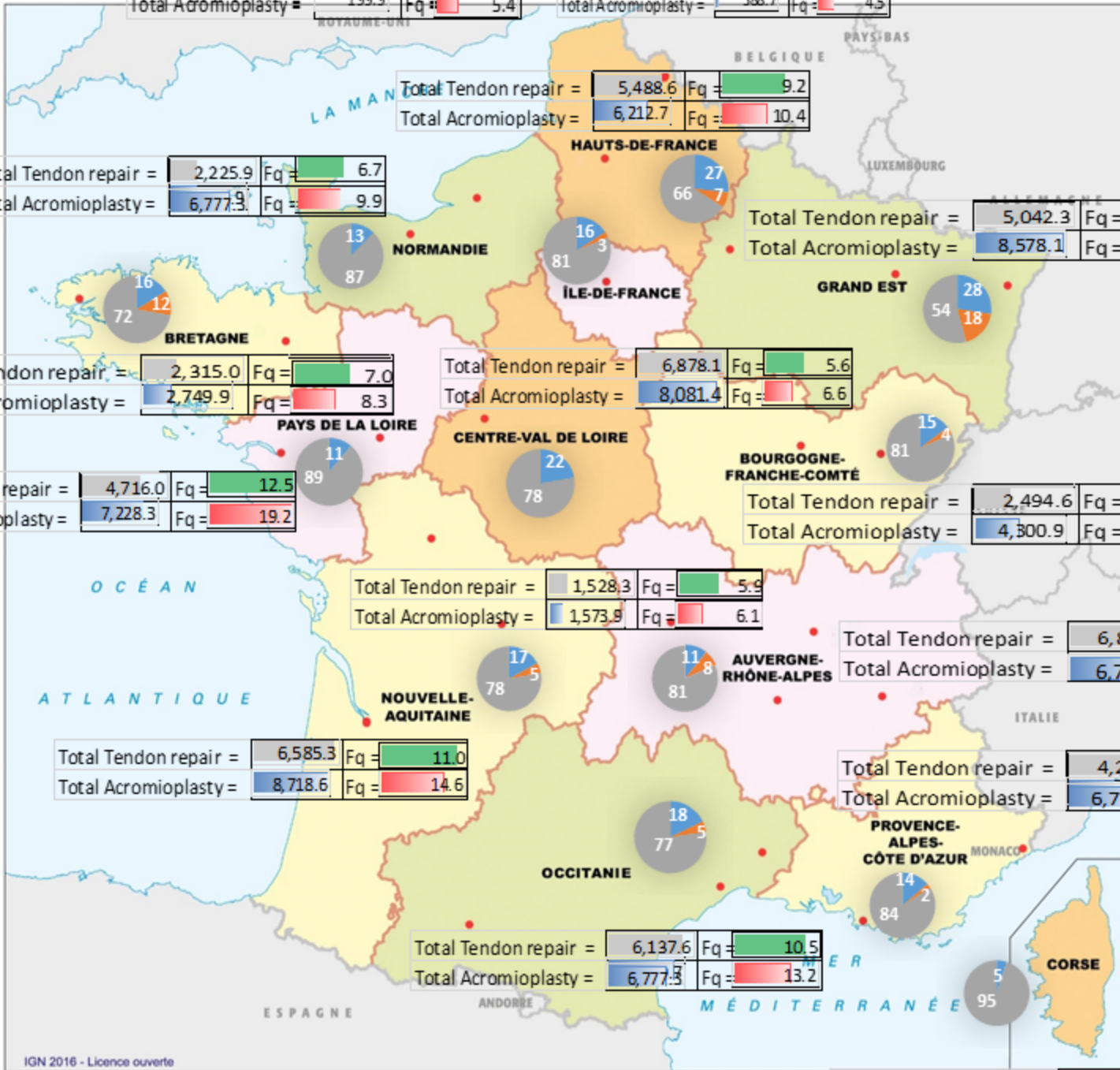
- Capsulolabral and ligament reattachment Scenario 1
- Capsulolabral and ligament reattachment Scenario 2
- Bone block Scenario 1
- Bone block Scenario 2

Total Tendon repair =	0.4	Fq =	0.0
Total Acromioplasty =	3.6	Fq =	0.1

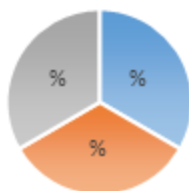


Total Tendon repair =	202.3	Fq =	5.5
Total Acromioplasty =	199.9	Fq =	5.4

Total Tendon repair =	404.1	Fq =	4.7
Total Acromioplasty =	388.7	Fq =	4.5



### Share by hospital type



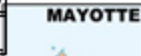
- public
- non-profit
- for-profit

Mean number annually from 2012 to 2018 per 10,000 inhabitants	Mean number between 2012 and 2018
Fq =	total =
ranking of regions	

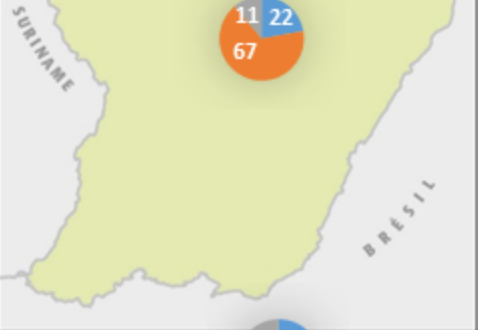
• Teaching hospital



Total TSA =	0,0	Fq =	0,0
Total Revision =	0,3	Fq =	0,0



Total TSA =	1,3	Fq =	0,0
Total Revision =	0,1	Fq =	0,0



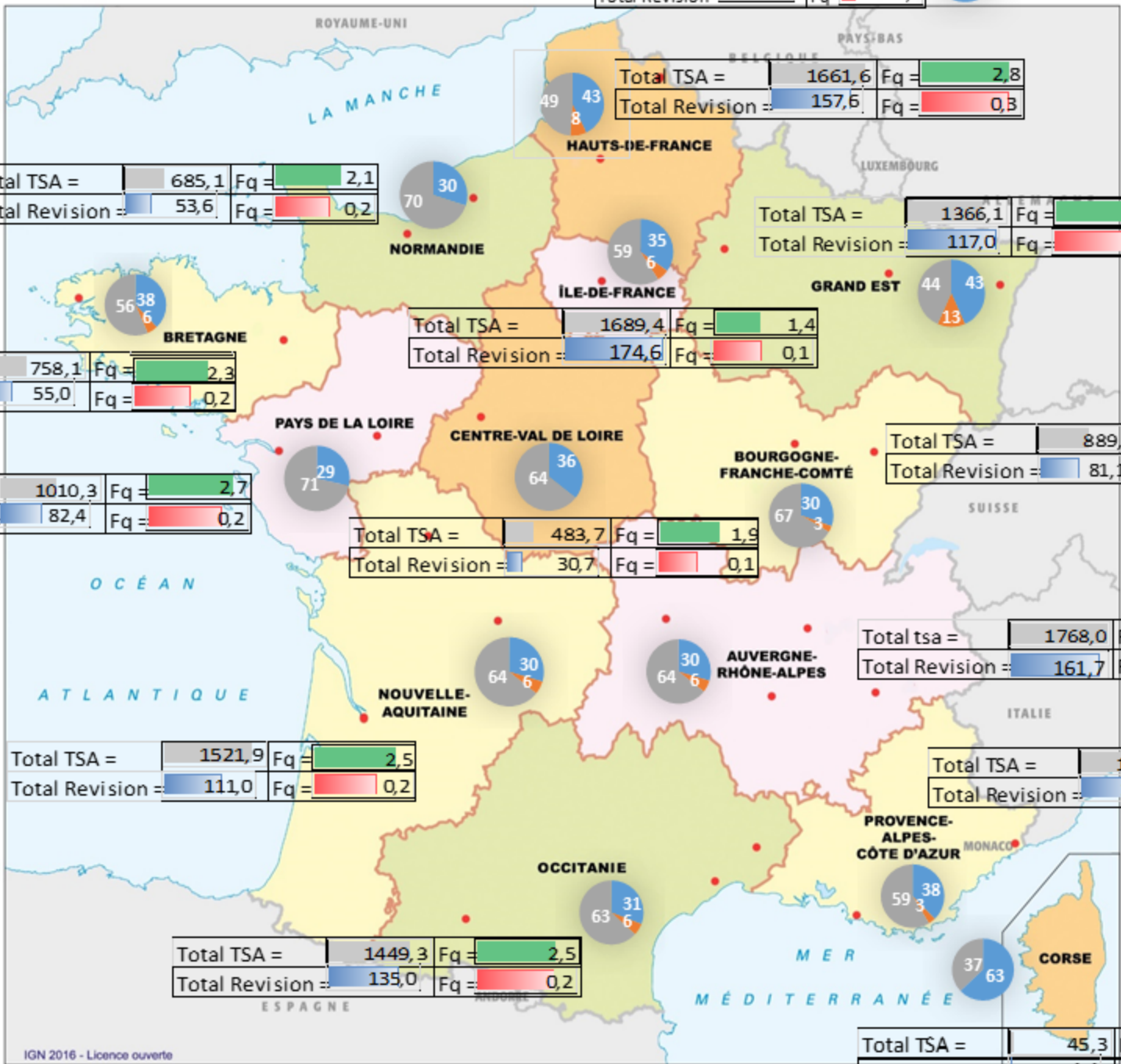
Total TSA =	18,4	Fq =	0,5
Total Revision =	1,0	Fq =	0,0



Total TSA =	17,1	Fq =	0,5
Total Revision =	1,0	Fq =	0,0



Total TSA =	41,3	Fq =	0,5
Total Revision =	4,9	Fq =	0,1



Share by hospital type

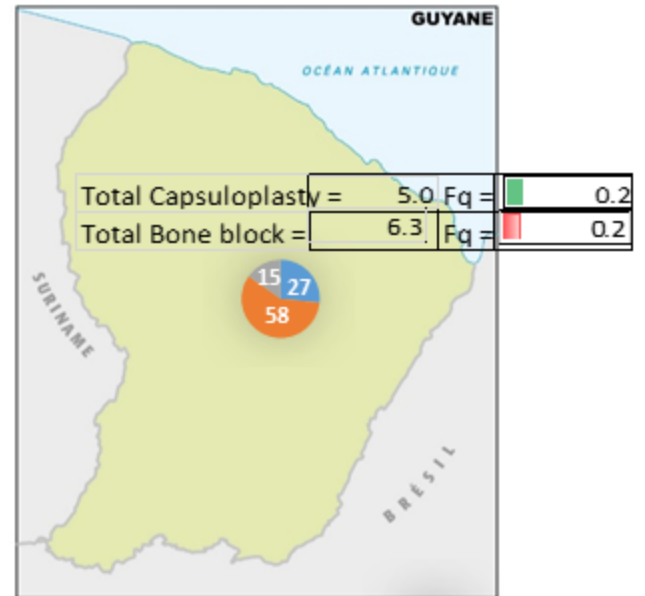


- public
- non-profit
- for profit

	mean number annually from 2012 to 2018 per 10,000 inhabitants
Fq =	mean number between 2012 and 2018
total =	ranking of regions

• Teaching hospital

Total Capsuloplasty =	0.1	Fq =	0.0
Total Bone block =	0.1	Fq =	0.0



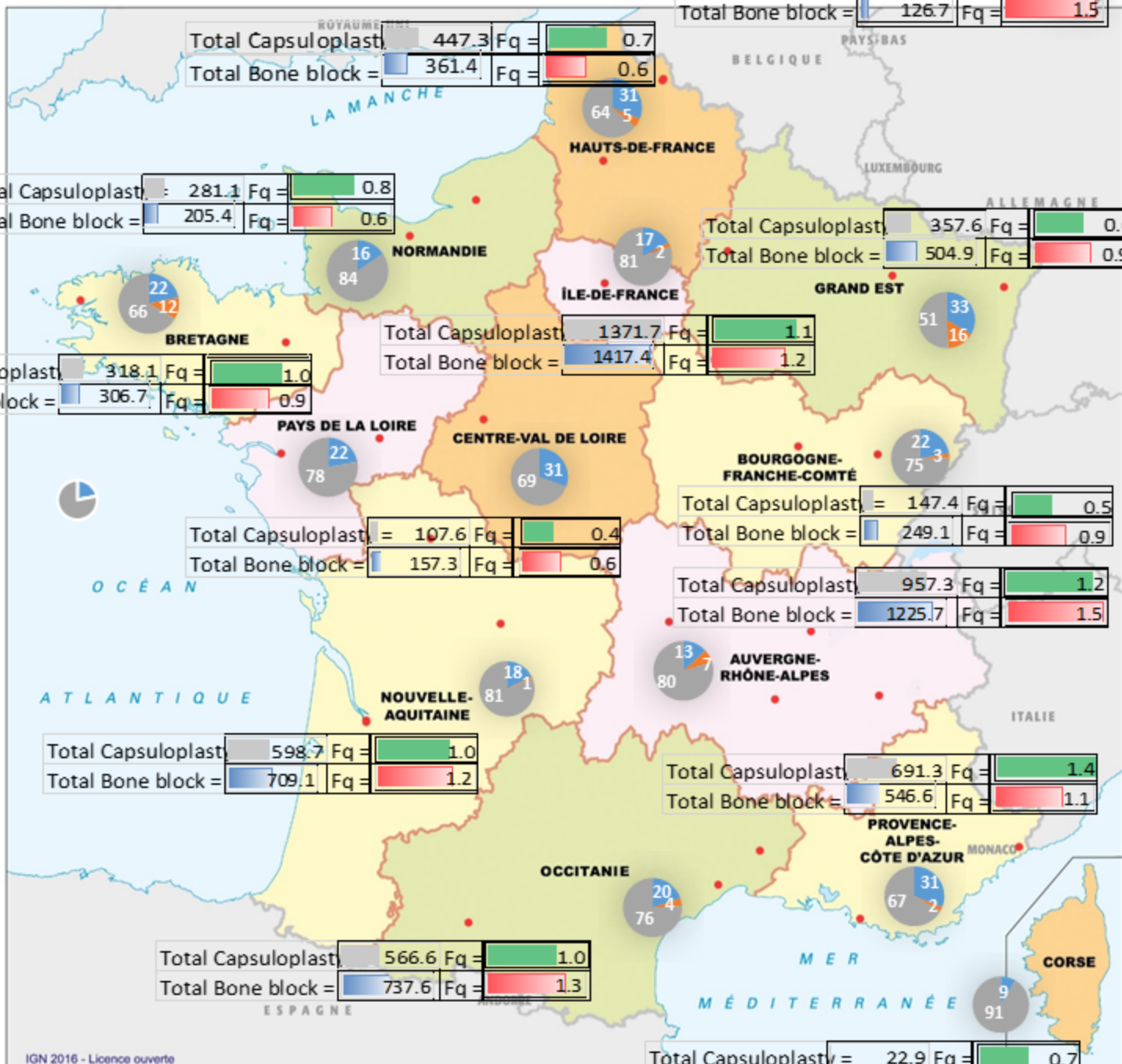
Total Capsuloplasty =	4.4	Fq =	0.1
Total Bone block =	13.1	Fq =	0.3



Total Capsuloplasty =	29.6	Fq =	0.8
Total Bone block =	4.9	Fq =	0.1



Total Capsuloplasty =	47.1	Fq =	0.5
Total Bone block =	126.7	Fq =	1.5



### Share by hospital type



- public
- non-profit
- for profit

	mean number annually from 2012 to 2018 per 10,000 inhabitants
Fq =	mean number between 2012 and 2018
total =	ranking of regions

● Teaching hospital