# Online LROI annual report 2020 - **PDF**


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# Introduction

This online annual report 2020 of the Dutch Arthroplasty Register (LROI) contains information on hip, knee, ankle, shoulder, elbow, wrist and finger arthroplasties in the Netherlands in 2019. In this annual report, the focus is on trends in arthroplasty procedures and on their outcomes. Furthermore, second revision rates of hip and knee arthroplasties in the Netherlands are shown for the first time.

You will find data on:

- Prosthesis characteristics
- Surgical techniques
- Patient characteristics of patients who underwent an arthroplasty procedure
- Patients' experiences in the form of PROMs (Patient Reported Outcome Measures)
- Survival of prostheses, like overall and major first revision and second revision rates
- Data quality, like for example completeness and validity of the register

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# Hip arthroplasty

## Numbers

### Registered procedures 2007-2019

**TABLE Number of registered hip arthroplasties per year of surgery (2007-2019) in the LROI in May 2020**

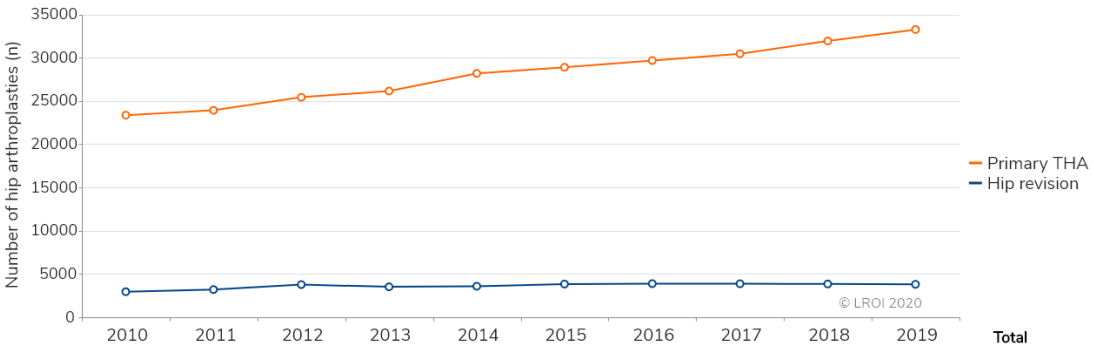
| Year of surgery | Type of hip arthroplasty: Total arthroplasty (n) | Hemi-arthroplasty (n) | Resurfacing arthroplasty (n) | Other (n) | Unknown/ missing (n) | Revision arthroplasty (n) | Total (n) |
|---|---|---|---|---|---|---|---|
| 2007 | 8,667 | 938 | 452 | 378 | 909 | 1,268 | 12,612 |
| 2008 | 15,180 | 1,365 | 734 | 411 | 417 | 1,858 | 19,965 |
| 2009 | 21,558 | 2,049 | 863 | 631 | 314 | 2,680 | 28,095 |
| 2010 | 23,350 | 2,348 | 609 | 643 | 289 | 2,952 | 30,191 |
| 2011 | 23,914 | 2,394 | 227 | 664 | 254 | 3,198 | 30,651 |
| 2012 | 25,420 | 2,792 | 10 | 606 | 231 | 3,770 | 32,829 |
| 2013 | 26,144 | 3,017 | 1 | 166 | 268 | 3,517 | 33,113 |
| 2014 | 28,180 | 3,737 | 0 | 29 | 162 | 3,583 | 35,691 |
| 2015 | 28,890 | 4,921 | 15 | 21 | 76 | 3,834 | 37,757 |
| 2016 | 29,671 | 5,323 | 16 | 28 | 104 | 3,882 | 39,024 |
| 2017 | 30,453 | 5,727 | 5 | 28 | 51 | 3,870 | 40,134 |
| 2018 | 31,931 | 6,062 | 1 | 24 | 24 | 3,845 | 41,887 |
| 2019 | 33,248 | 5,810 | 0 | 24 | 39 | 3,804 | 42,925 |
| Total | 326,606 | 46,483 | 2,933 | 3,653 | 3,138 | 42,061 | 424,874 |



**The LROI is nearly complete as of 2010. Therefore, a dotted line was inserted between 2009 and 2010.**

### Type of procedures 2010-2019

**FIGURE Number of primary total hip arthroplasties and hip revision arthroplasties registered in the LROI in the Netherlands in 2010-2019**



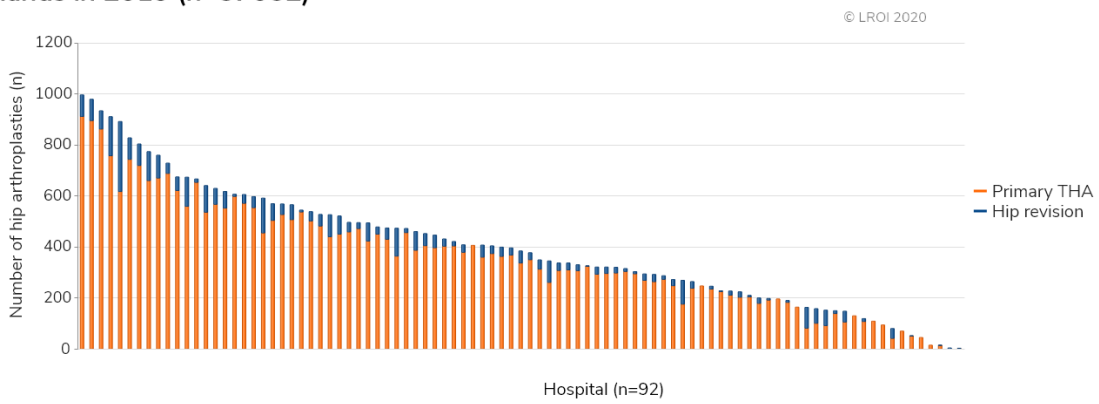

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of procedure (n) | | | | | | | | | | | |
| Primary THA | 23,350 | 23,914 | 25,420 | 26,144 | 28,180 | 28,890 | 29,671 | 30,453 | 31,931 | 33,248 | **281,201** |
| Hip revision | 2,952 | 3,198 | 3,770 | 3,517 | 3,583 | 3,834 | 3,882 | 3,870 | 3,845 | 3,804 | **36,255** |
| Total: | **26,302** | **27,112** | **29,190** | **29,661** | **31,763** | **32,724** | **33,553** | **34,323** | **35,776** | **37,052** | **317,456** |

THA: total hip arthroplasty.

**Out of 33,248 primary total hip arthroplasties that were performed in 2019, 3.0% (n=1,011) was performed bilaterally.**

## Type of procedure per hospital

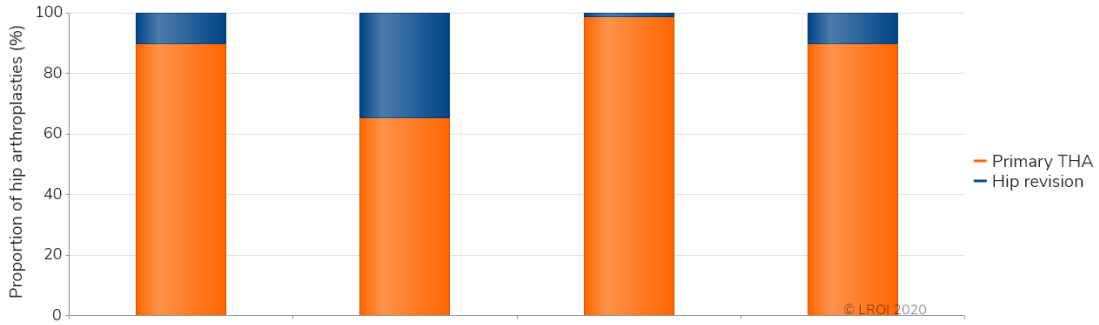
**FIGURE Number of primary total hip arthroplasties and hip revision arthroplasties per hospital in the Netherlands in 2019 (n=37052)**




THA: total hip arthroplasty.

## Type of procedure by type of hospital

**FIGURE Primary total hip arthroplasties and hip revision arthroplasties (proportion [%] per category) by type of hospital in the Netherlands in 2019**




| Type of hospital | General | UMC | Private | Total |
|---|---|---|---|---|
| **Type of procedure (%)** | | | | |
| Primary THA | 89.70 | 65.21 | 98.66 | **89.73** |
| Hip revision | 10.30 | 34.79 | 1.34 | **10.27** |
| Total (n): | **32,023** | **1,308** | **3,721** | **37,052** |

Please note: In 2019, 70 general hospitals, 7 UMCs and 16 private hospitals performed hip arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.
THA: total hip arthroplasty.

# Total hip arthroplasty

## Demographics

### *Patient characteristics by diagnosis*

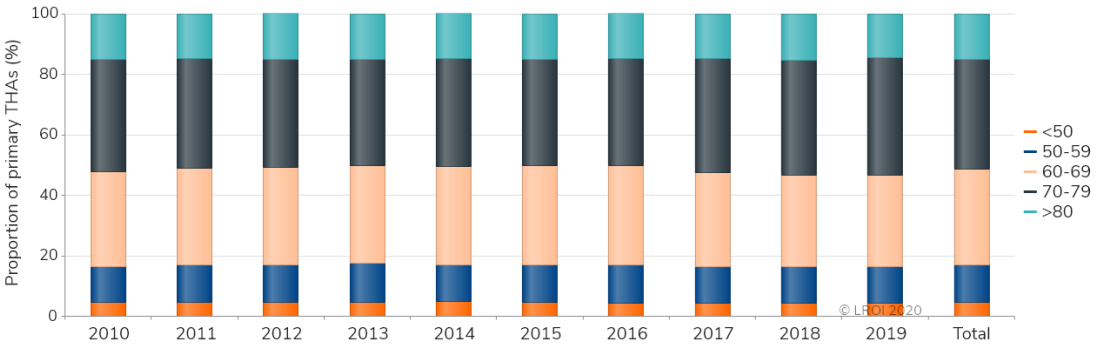
**TABLE Patient characteristics of all patients with a registered primary total hip arthroplasty by diagnosis in the Netherlands in 2019**

| N | Osteoarthritis 28,747 (86.5%) | Fracture 1,774 (5.3%) | Osteonecrosis 889 (2.7%) | Late post-traumatic 775 (2.3%) | Dysplasia 532 (1.6%) | Reumatoid arthritis 150 (0.5%) | Post-Perthes' disease 86 (0.3%) | Tumour 66 (0.2%) | Total 33,248 |
|---|---|---|---|---|---|---|---|---|---|
| **Mean age (years) (SD)** | 69.7 (9.7) | 69.5 (8.8) | 62.8 (14.8) | 67.9 (11.9) | 52.0 (13.5) | 65.3 (12.7) | 51.1 (14.0) | 67.3 (12.5) | 69.1 (10.4) |
| **Age (years) (%)** | | | | | | | | | |
| <50 | 3 | 2 | 18 | 8 | 42 | 8 | 49 | 9 | 4 |
| 50-59 | 12 | 10 | 20 | 14 | 30 | 22 | 22 | 15 | 12 |
| 60-69 | 30 | 35 | 27 | 29 | 19 | 25 | 21 | 30 | 30 |
| 70-79 | 40 | 43 | 22 | 34 | 8 | 37 | 8 | 29 | 39 |
| ≥80 | 15 | 10 | 13 | 15 | 1 | 8 | 0 | 17 | 15 |
| **Gender (%)** | | | | | | | | | |
| Men | 35 | 32 | 47 | 41 | 28 | 22 | 66 | 45 | 36 |
| Women | 65 | 68 | 53 | 59 | 72 | 78 | 34 | 55 | 64 |
| **ASA score (%)** | | | | | | | | | |
| I | 15 | 12 | 12 | 11 | 34 | 2 | 30 | 1 | 15 |
| II | 62 | 56 | 52 | 58 | 54 | 62 | 62 | 23 | 61 |
| III-IV | 23 | 32 | 36 | 31 | 12 | 36 | 8 | 76 | 24 |
| **Type of hospital (%)** | | | | | | | | | |
| General | 86 | 95 | 84 | 91 | 72 | 85 | 78 | 71 | 86 |
| UMC | 2 | 5 | 10 | 5 | 13 | 11 | 8 | 29 | 3 |
| Private | 12 | 0 | 6 | 4 | 15 | 4 | 14 | 0 | 11 |
| **Charnley-score (%)** | | | | | | | | | |
| A One hip joint affected | 41 | 65 | 57 | 81 | 51 | 27 | 70 | 60 | 43 |
| B1 Both hip joints affected | 32 | 12 | 21 | 9 | 27 | 28 | 15 | 16 | 31 |
| B2 Contralateral hip joint with a total hip prosthesis | 24 | 18 | 18 | 7 | 19 | 18 | 12 | 16 | 23 |
| C Multiple joints affected or chronic disease that affects quality of life | 3 | 5 | 4 | 3 | 3 | 27 | 3 | 8 | 3 |
| **Mean Body Mass Index (kg/m²) (SD)** | 27.5 (5.7) | 25.1 (4.0) | 26.5 (4.8) | 25.8 (4.3) | 26.8 (4.9) | 26.7 (4.8) | 27.9 (5.2) | 27.4 (6.8) | 27.3 (5.6) |
| **Body Mass Index (kg/m²) (%)** | | | | | | | | | |
| Underweight (≤18,5) | 1 | 4 | 3 | 2 | 2 | 1 | 1 | 2 | 1 |
| Normal weight (>18,5-25) | 32 | 51 | 41 | 46 | 39 | 42 | 30 | 48 | 34 |
| Overweight (>25-30) | 42 | 34 | 35 | 35 | 37 | 36 | 44 | 30 | 41 |
| Obesity (>30-40) | 24 | 11 | 20 | 17 | 20 | 20 | 21 | 14 | 23 |
| Morbid obesity (>40) | 1 | 0 | 1 | 0 | 2 | 1 | 4 | 6 | 1 |
| **Smoking (%)** | | | | | | | | | |
| No | 91 | 89 | 79 | 82 | 87 | 87 | 83 | 89 | 90 |
| Yes | 9 | 11 | 21 | 18 | 13 | 13 | 17 | 11 | 10 |

Please note: In 2019, 199 (0.6%) patients received a primary THA after a diagnosis that is not listed in the table. Of 30 (0.1%) primary THAs the diagnosis was not registered.
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation; THA: total hip arthroplasty.

*Age category 2010-2019*

**FIGURE Trend (proportion [%] per year) in age category in primary total hip arthroplasties in the Netherlands in 2010-2019**




| Age category (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| <50 | 4.49 | 4.48 | 4.63 | 4.69 | 4.76 | 4.73 | 4.46 | 4.43 | 4.32 | 4.18 | **4.51** |
| 50-59 | 12.00 | 12.48 | 12.30 | 12.76 | 12.34 | 12.39 | 12.59 | 11.99 | 12.18 | 12.31 | **12.33** |
| 60-69 | 31.16 | 31.90 | 32.15 | 32.29 | 32.36 | 32.76 | 32.81 | 31.18 | 30.21 | 30.13 | **31.65** |
| 70-79 | 37.17 | 36.22 | 35.71 | 35.10 | 35.63 | 35.05 | 35.41 | 37.51 | 38.01 | 38.87 | **36.54** |
| >80 | 15.18 | 14.92 | 15.22 | 15.16 | 14.92 | 15.06 | 14.74 | 14.89 | 15.28 | 14.51 | **14.97** |
| Total (n): | **23,315** | **23,865** | **25,362** | **26,097** | **28,150** | **28,873** | **29,651** | **30,449** | **31,927** | **33,248** | **280,937** |

THA: total hip arthroplasty.

*Previous surgery 2014-2019*

**TABLE Trend (proportion [%] per year) in Previous surgeries to the same joint in patients who underwent a primary total hip arthroplasty in the Netherlands in 2014-2019**

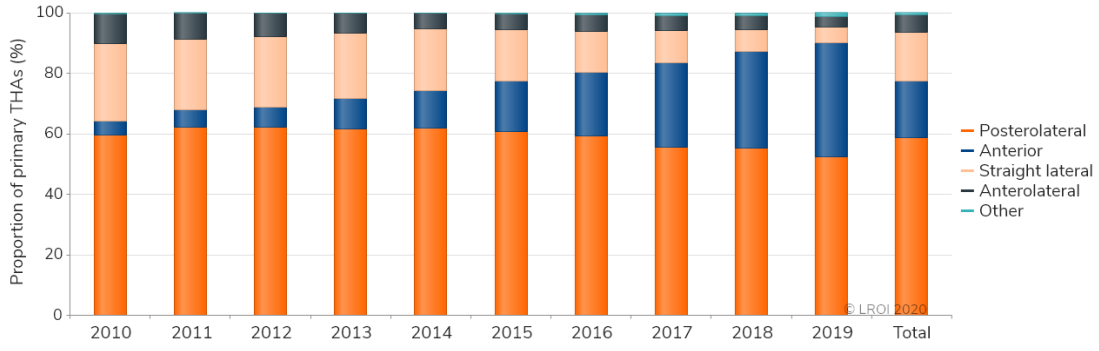
| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Primary THA (n)** | 27,118 | 27,998 | 29,577 | 30,106 | 31,484 | 32,682 | 178,965 |
| **Previous surgery to the relevant hip (total) Proportion[1] (%)** | 5.0 | 5.0 | 4.9 | 4.8 | 4.5 | 4.7 | 4.8 |
| Osteosynthesis | 3.5 | 3.6 | 3.6 | 3.5 | 3.3 | 3.5 | 3.5 |
| Osteotomy | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.8 | 0.9 |
| Arthroscopy | 0.3 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 |
| Girdlestone situation | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Arthrodesis | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 |
| Other | 1.0 | 1.0 | 1.0 | 0.9 | 0.8 | 0.9 | 0.9 |

[1] A patient may have undergone multiple Previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patients with one or more Previous surgeries to the same joint.
THA: total hip arthroplasty.

## Surgical techniques

### *Surgical approach 2010-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary total hip arthroplasty in the Netherlands in 2010-2019**

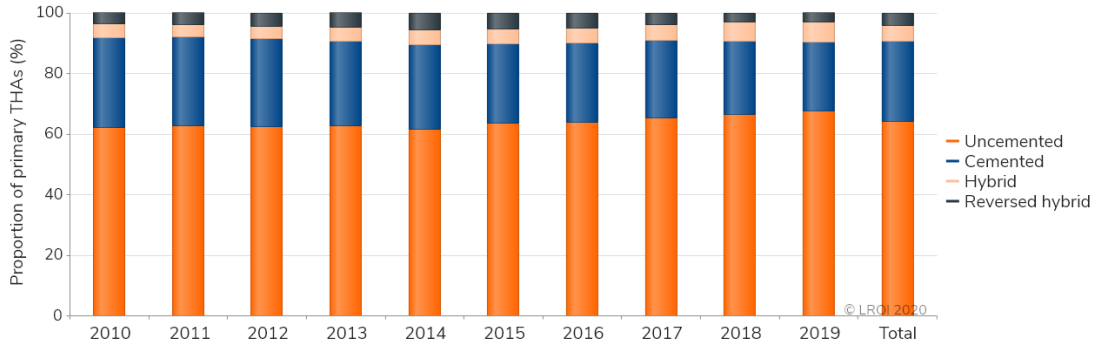



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surgical approach (%)** | | | | | | | | | | | |
| Posterolateral | 59.58 | 62.24 | 62.10 | 61.65 | 62.00 | 60.66 | 59.28 | 55.64 | 55.29 | 52.40 | **58.78** |
| Anterior | 4.69 | 5.63 | 6.81 | 9.93 | 12.35 | 16.76 | 20.87 | 27.73 | 31.80 | 37.68 | **18.67** |
| Straight lateral | 25.65 | 23.31 | 23.06 | 21.76 | 20.20 | 17.03 | 13.54 | 10.65 | 7.40 | 5.24 | **16.01** |
| Anterolateral | 9.64 | 8.62 | 7.87 | 6.56 | 5.35 | 5.12 | 5.50 | 4.96 | 4.43 | 3.46 | **5.94** |
| Other | 0.44 | 0.20 | 0.16 | 0.09 | 0.10 | 0.43 | 0.81 | 1.02 | 1.08 | 1.23 | **0.60** |
| Total (n): | **23,154** | **23,693** | **25,200** | **25,973** | **28,016** | **28,811** | **29,655** | **30,430** | **31,909** | **33,221** | 280,062 |

THA: total hip arthroplasty.

### *Fixation 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in primary total hip arthroplasties in the Netherlands in 2010-2019**



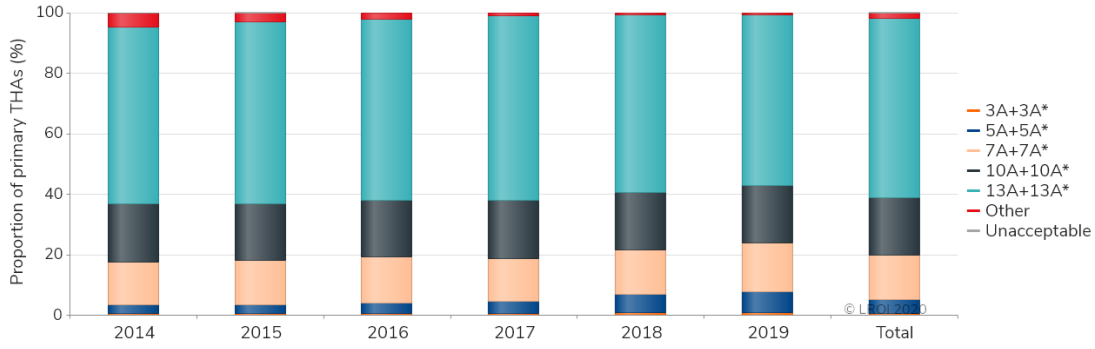

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixation (%)** | | | | | | | | | | | |
| Uncemented | 62.27 | 62.87 | 62.47 | 62.65 | 61.52 | 63.56 | 63.89 | 65.39 | 66.46 | 67.64 | **64.05** |
| Cemented | 29.39 | 29.20 | 28.96 | 27.98 | 27.96 | 26.13 | 26.16 | 25.44 | 24.14 | 22.70 | **26.57** |
| Hybrid | 4.79 | 4.04 | 4.08 | 4.62 | 4.77 | 4.91 | 4.89 | 5.27 | 6.27 | 6.72 | **5.12** |
| Reversed hybrid | 3.55 | 3.90 | 4.49 | 4.75 | 5.74 | 5.40 | 5.06 | 3.90 | 3.12 | 2.95 | **4.26** |
| Total (n): | **23,157** | **23,722** | **25,210** | **25,976** | **28,009** | **28,751** | **29,509** | **29,993** | **31,707** | **32,940** | 278,974 |

THA: total hip arthroplasty.

## Prosthesis characteristics

### *ODEP acetabular component*

**FIGURE** Trend (proportion [%] per year) in odep rating acetabulum component in primary total hip arthroplasties in the Netherlands in 2014-2019

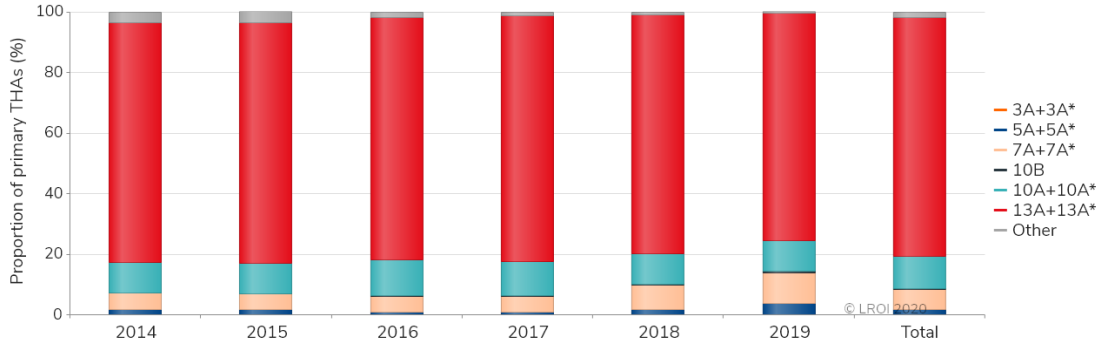



| ODEP rating (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| 3A+3A* | 0.63 | 0.55 | 0.55 | 0.57 | 0.86 | 0.84 | **0.67** |
| 5A+5A* | 2.91 | 2.89 | 3.53 | 3.92 | 5.92 | 7.02 | **4.44** |
| 7A+7A* | 14.06 | 14.81 | 15.12 | 14.17 | 14.85 | 16.06 | **14.86** |
| 10A+10A* | 19.30 | 18.59 | 18.78 | 19.26 | 18.90 | 18.86 | **18.95** |
| 13A+13A* | 58.39 | 60.12 | 59.75 | 61.21 | 58.85 | 56.60 | **59.12** |
| Other | 4.52 | 3.02 | 2.27 | 0.86 | 0.62 | 0.62 | **1.93** |
| Unacceptable | 0.19 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | **0.04** |
| Total (n): | **27,795** | **28,440** | **28,460** | **29,599** | **30,937** | **31,508** | **176,739** |

Please note: More information on ODEP rating can be found on www.odep.org.uk.
Other: All total hip acetabular cups of which no ODEP rating is available.
THA: total hip arthroplasty.

### *ODEP femoral component*

**FIGURE** Trend (proportion [%] per year) in odep rating femur component in primary total hip arthroplasties in the Netherlands in 2014-2019

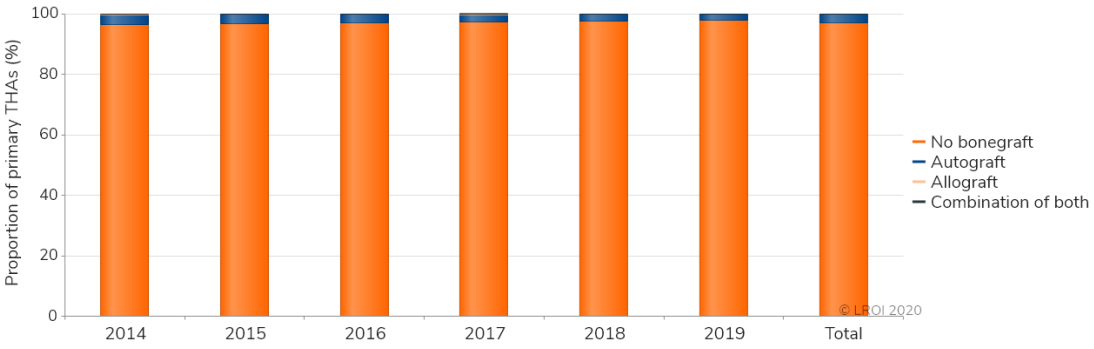



| ODEP rating (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| 3A+3A* | 0.11 | 0.02 | 0.01 | 0.03 | 0.03 | 0.06 | **0.04** |
| 5A+5A* | 1.58 | 1.71 | 0.87 | 0.92 | 1.61 | 3.56 | **1.73** |
| 7A+7A* | 5.43 | 5.12 | 5.07 | 5.12 | 8.04 | 10.29 | **6.59** |
| 10B | 0.02 | 0.06 | 0.39 | 0.37 | 0.43 | 0.43 | **0.29** |
| 10A+10A* | 10.15 | 10.18 | 11.77 | 11.17 | 10.06 | 10.11 | **10.57** |
| 13A+13A* | 79.06 | 79.31 | 80.08 | 81.09 | 78.88 | 75.20 | **78.89** |
| Other | 3.65 | 3.61 | 1.81 | 1.30 | 0.93 | 0.37 | **1.89** |
| Total (n): | **27,720** | **28,373** | **28,736** | **29,643** | **31,091** | **31,478** | **177,041** |

Please note: More information on ODEP rating can be found on www.odep.org.uk.
Other: All total hip femoral stems of which no ODEP rating is available.
THA: total hip arthroplasty.

*Type of bonegraft 2014-2019*

**FIGURE Trend (proportion [%] per year) in type of bonegraft in primary total hip arthroplasties in the Netherlands in 2014-2019**

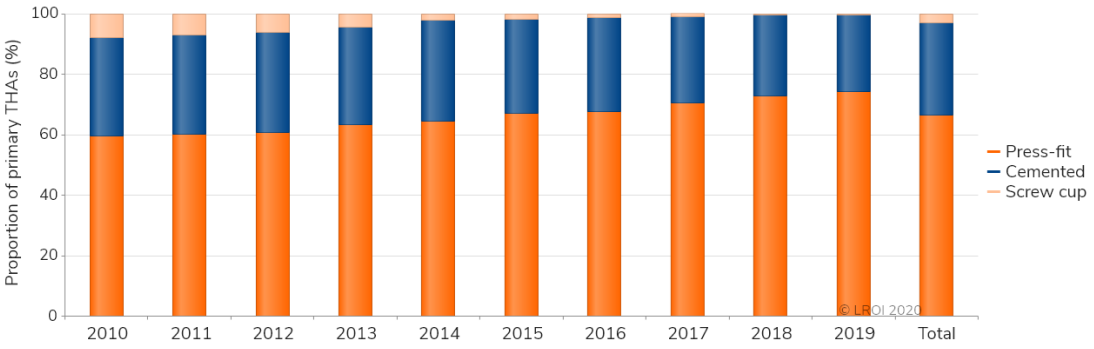



| Type of bonegraft (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| No bonegraft | 96.35 | 96.61 | 96.91 | 97.14 | 97.65 | 97.87 | **97.12** |
| Autograft | 3.36 | 3.15 | 2.85 | 2.57 | 2.16 | 1.92 | **2.64** |
| Allograft | 0.17 | 0.14 | 0.14 | 0.16 | 0.12 | 0.12 | **0.14** |
| Combination of both | 0.11 | 0.10 | 0.10 | 0.14 | 0.07 | 0.08 | **0.10** |
| Total (n): | **27,267** | **28,537** | **29,574** | **30,334** | **31,792** | **32,975** | 180,479 |

THA: total hip arthroplasty.

*Type of acetabular component 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of acetabular component in primary total hip arthroplasties in the Netherlands in 2010-2019**

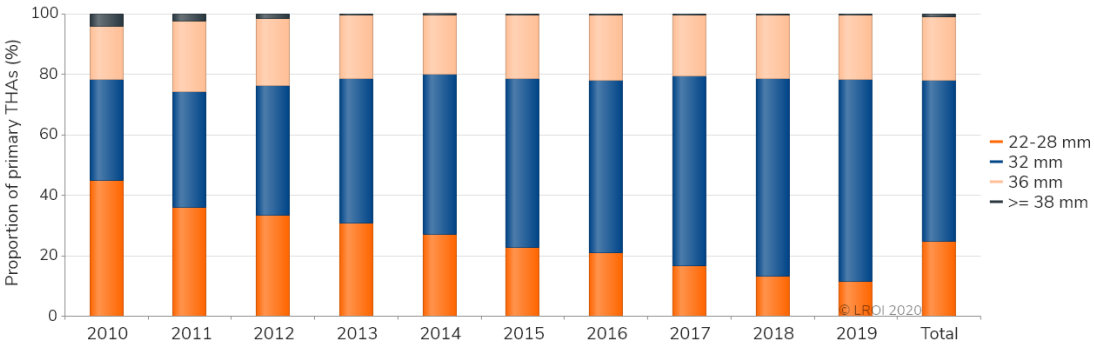



| Type of acetabular component (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Press-fit | 59.46 | 60.14 | 60.63 | 63.20 | 64.36 | 67.14 | 67.63 | 70.58 | 72.86 | 74.27 | **66.55** |
| Cemented | 32.62 | 32.83 | 33.21 | 32.34 | 33.41 | 31.02 | 31.02 | 28.50 | 26.64 | 25.26 | **30.44** |
| Screw cup | 7.92 | 7.03 | 6.16 | 4.46 | 2.22 | 1.84 | 1.35 | 0.93 | 0.50 | 0.47 | **3.01** |
| Total (n): | **22,759** | **23,316** | **24,855** | **25,756** | **27,796** | **28,440** | **28,461** | **29,601** | **30,941** | **31,523** | 273,448 |

THA: total hip arthroplasty.

*Femoral head diameter 2010-2019*

**FIGURE Trend (proportion [%] per year) in femoral head component diameter in primary total hip arthroplasties in the Netherlands in 2010-2019**



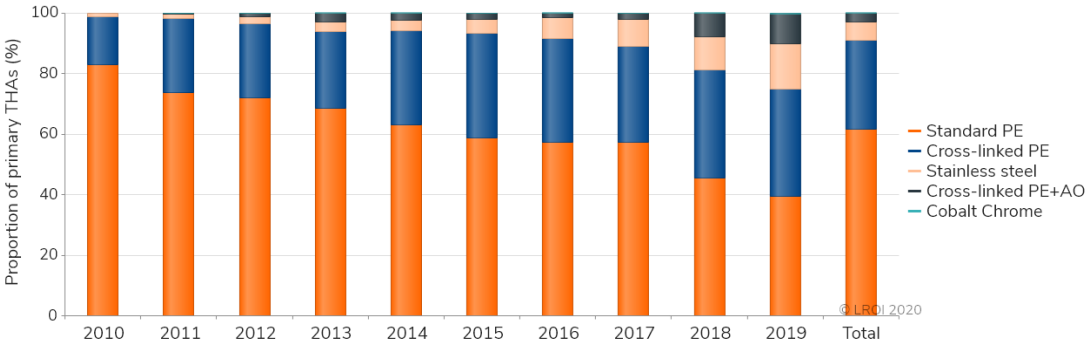

| Femoral head size (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 22-28 mm | 44.90 | 36.02 | 33.28 | 30.68 | 27.10 | 22.85 | 21.06 | 16.58 | 13.10 | 11.61 | **24.68** |
| 32 mm | 33.50 | 38.09 | 42.97 | 47.79 | 52.80 | 55.81 | 57.01 | 62.90 | 65.47 | 66.67 | **53.43** |
| 36 mm | 17.53 | 23.31 | 22.27 | 21.04 | 19.58 | 20.90 | 21.48 | 20.12 | 20.88 | 21.22 | **20.84** |
| >= 38 mm | 4.07 | 2.58 | 1.48 | 0.49 | 0.53 | 0.44 | 0.45 | 0.40 | 0.55 | 0.49 | **1.05** |
| Total (n): | **22,806** | **23,436** | **25,007** | **25,765** | **27,778** | **28,423** | **28,743** | **29,613** | **31,023** | **31,308** | **273,902** |

THA: total hip arthroplasty.

## Materials

*Cemented acetabular component 2010-2019*

**FIGURE Trend (proportion [%] per year) in cemented acetabulum material in primary total hip arthroplasties in the Netherlands in 2010-2019**

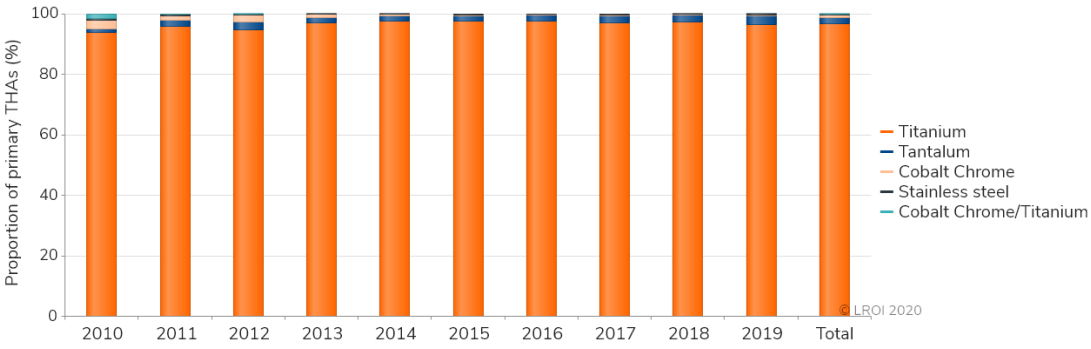



| Cemented acetabulum material (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard PE | 82.79 | 73.77 | 71.97 | 68.50 | 63.13 | 58.66 | 57.25 | 57.31 | 45.40 | 39.53 | **61.58** |
| Cross-linked PE | 15.88 | 24.45 | 24.39 | 25.23 | 30.96 | 34.58 | 34.27 | 31.57 | 35.72 | 35.33 | **29.48** |
| Stainless steel | 1.33 | 1.35 | 2.23 | 3.21 | 3.59 | 4.70 | 7.01 | 9.09 | 11.06 | 14.82 | **5.86** |
| Cross-linked PE+AO | 0.00 | 0.42 | 1.38 | 3.00 | 2.12 | 1.89 | 1.25 | 1.80 | 7.61 | 9.99 | **2.94** |
| Cobalt Chrome | 0.00 | 0.01 | 0.02 | 0.07 | 0.20 | 0.17 | 0.23 | 0.23 | 0.22 | 0.33 | **0.15** |
| Total (n): | **7,424** | **7,653** | **8,253** | **8,329** | **9,287** | **8,821** | **8,828** | **8,436** | **8,243** | **7,961** | **83,235** |

Please note: Titanium was used in 8 (0.01%) primary THAs in 2010-2019.
THA: total hip arthroplasty; PE: polyethylene; AO: antioxidant.

*Uncemented acetabular component 2010-2019*

**FIGURE Trend (proportion [%] per year) in uncemented acetabulum material in primary total hip arthroplasties in the Netherlands in 2010-2019**



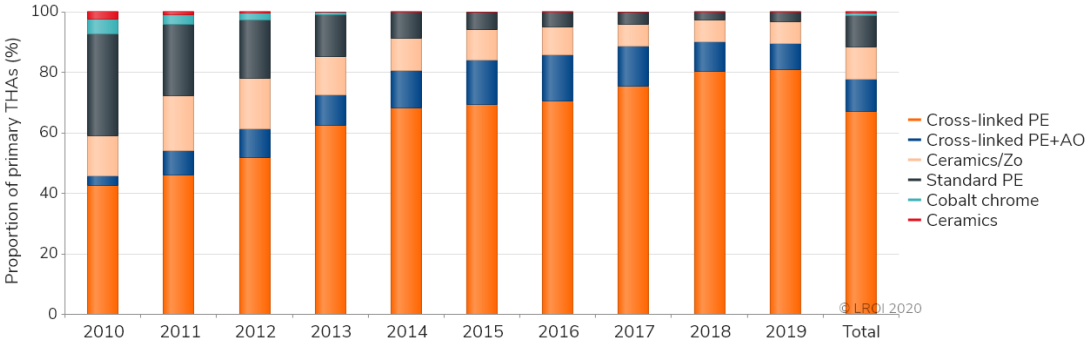

**Uncemented acetabulum material (%)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Titanium | 93.75 | 95.87 | 94.74 | 96.94 | 97.54 | 97.58 | 97.47 | 97.04 | 97.29 | 96.46 | **96.58** |
| Tantalum | 1.34 | 1.97 | 2.59 | 1.85 | 1.87 | 1.75 | 2.02 | 2.23 | 2.23 | 2.95 | **2.12** |
| Cobalt Chrome | 2.82 | 1.56 | 2.12 | 0.96 | 0.34 | 0.37 | 0.24 | 0.35 | 0.22 | 0.19 | **0.81** |
| Stainless steel | 0.53 | 0.47 | 0.52 | 0.26 | 0.25 | 0.29 | 0.27 | 0.37 | 0.26 | 0.41 | **0.36** |
| Cobalt Chrome/Titanium | 1.55 | 0.13 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.14** |
| Total (n): | **15,334** | **15,661** | **16,601** | **17,426** | **18,508** | **19,618** | **19,633** | **21,165** | **22,698** | **23,561** | **190,205** |

THA: total hip arthroplasty.

*Inlay 2010-2019*

**FIGURE Trend (proportion [%] per year) in inlay material in primary total hip arthroplasties in the Netherlands in 2010-2019**



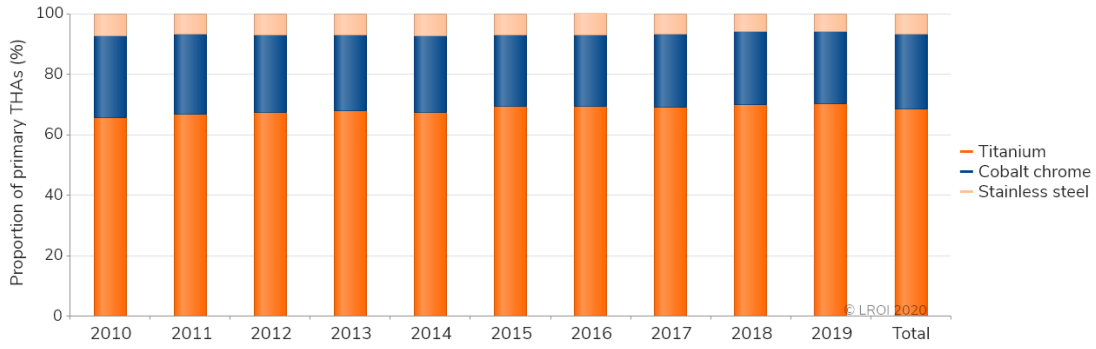

**Inlay material (%)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cross-linked PE | 42.47 | 46.13 | 51.75 | 62.47 | 68.15 | 69.39 | 70.52 | 75.35 | 80.28 | 80.88 | **66.93** |
| Cross-linked PE+AO | 3.29 | 8.10 | 9.46 | 10.17 | 12.34 | 14.68 | 15.11 | 13.20 | 9.86 | 8.57 | **10.73** |
| Ceramics/Zo | 13.27 | 18.12 | 16.83 | 12.68 | 10.65 | 10.04 | 9.22 | 7.33 | 7.16 | 7.19 | **10.69** |
| Standard PE | 33.57 | 23.54 | 19.34 | 13.54 | 8.64 | 5.63 | 5.09 | 4.02 | 2.61 | 3.13 | **10.35** |
| Cobalt chrome | 5.04 | 3.17 | 2.33 | 0.95 | 0.17 | 0.13 | 0.04 | 0.08 | 0.09 | 0.22 | **0.99** |
| Ceramics | 2.37 | 0.94 | 0.30 | 0.19 | 0.07 | 0.12 | 0.03 | 0.01 | 0.01 | 0.02 | **0.32** |
| Total (n): | **12,956** | **14,412** | **15,429** | **15,975** | **16,842** | **17,974** | **18,939** | **20,473** | **22,104** | **23,032** | **178,136** |

THA: total hip arthroplasty; PE: polyethylene; AO: antioxidant; Zo: Oxidized Zirconium.

*Femur component 2010-2019*

**FIGURE Trend (proportion [%] per year) in femur component material in primary total hip arthroplasties in the Netherlands in 2010-2019**

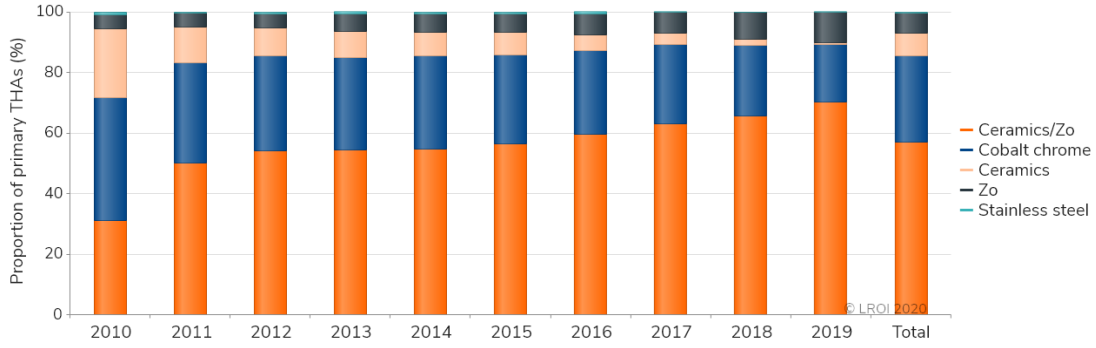



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Femur material (%)** | | | | | | | | | | | |
| Titanium | 65.69 | 66.89 | 67.27 | 67.82 | 67.38 | 69.35 | 69.22 | 69.11 | 70.01 | 70.19 | **68.43** |
| Cobalt chrome | 26.91 | 26.32 | 25.74 | 25.25 | 25.25 | 23.58 | 23.63 | 24.03 | 24.03 | 23.84 | **24.75** |
| Stainless steel | 7.40 | 6.79 | 6.99 | 6.93 | 7.37 | 7.07 | 7.16 | 6.86 | 5.96 | 5.97 | **6.82** |
| Total (n): | **22,776** | **23,484** | **25,059** | **25,862** | **27,720** | **28,371** | **28,736** | **29,643** | **31,091** | **31,481** | 274,223 |

Please note: A composite femur component was used in 10 (0.04%) primary THAs in 2010.
THA: total hip arthroplasty.

*Femoral head component 2010-2019*

**FIGURE Trend (proportion [%] per year) in femoral head material in primary total hip arthroplasties in the Netherlands in 2010-2019**

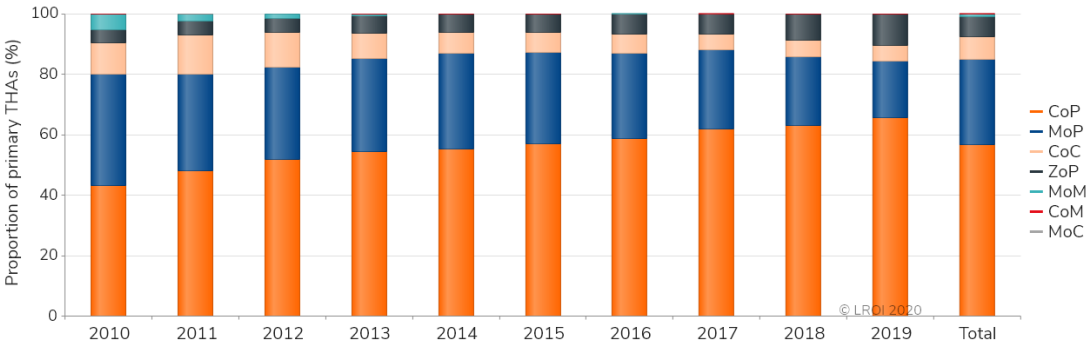



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Femoral head material (%)** | | | | | | | | | | | |
| Ceramics/Zo | 31.02 | 50.11 | 54.23 | 54.34 | 54.77 | 56.38 | 59.57 | 62.99 | 65.57 | 70.26 | **56.85** |
| Cobalt chrome | 40.76 | 33.16 | 31.14 | 30.41 | 30.56 | 29.24 | 27.57 | 26.17 | 23.34 | 18.85 | **28.59** |
| Ceramics | 22.52 | 11.64 | 9.34 | 8.83 | 7.97 | 7.60 | 5.37 | 3.71 | 2.05 | 0.72 | **7.43** |
| Zo | 4.62 | 4.56 | 4.62 | 5.72 | 6.02 | 6.05 | 6.79 | 6.86 | 8.94 | 10.06 | **6.59** |
| Stainless steel | 1.08 | 0.53 | 0.67 | 0.71 | 0.68 | 0.72 | 0.70 | 0.28 | 0.10 | 0.12 | **0.54** |
| Total (n): | **22,820** | **23,437** | **25,007** | **25,766** | **27,775** | **28,423** | **28,743** | **29,611** | **31,018** | **31,303** | 273,903 |

Please note: A cross-linked PE femoral head was used in 8 (<0.01%) primary THAs in 2010-2019. A titanium femoral head was used in 7 (<0.01%) primary THAs in 2010-2019. A standard PE femoral head was used in 5 (<0.01%) primary THAs in 2010-2019.
THA: total hip arthroplasty; PE: polyethylene; Zo: Oxidized Zirconium.

*Articulation 2010-2019*

**FIGURE Trend (proportion [%] per year) in articulation in primary total hip arthroplasties in the Netherlands in 2010-2019**

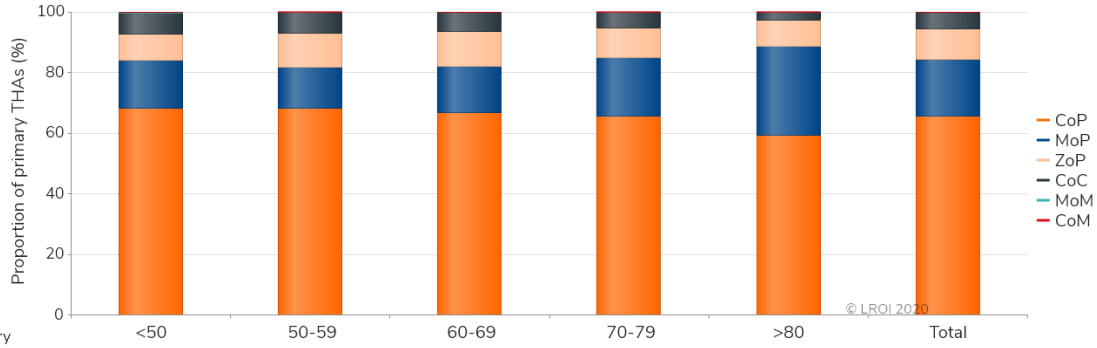



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Articulation (%)** | | | | | | | | | | | |
| CoP | 43.25 | 48.09 | 51.83 | 54.42 | 55.27 | 56.89 | 58.71 | 61.74 | 63.14 | 65.48 | **56.58** |
| MoP | 36.84 | 31.80 | 30.42 | 30.79 | 31.75 | 30.23 | 28.21 | 26.22 | 22.73 | 18.72 | **28.31** |
| CoC | 10.13 | 13.17 | 11.54 | 8.37 | 6.75 | 6.62 | 6.20 | 5.15 | 5.21 | 5.41 | **7.59** |
| ZoP | 4.55 | 4.63 | 4.70 | 5.81 | 6.18 | 6.20 | 6.87 | 6.82 | 8.81 | 10.19 | **6.65** |
| MoM | 5.20 | 2.28 | 1.51 | 0.59 | 0.03 | 0.05 | 0.02 | 0.06 | 0.03 | 0.12 | **0.85** |
| CoM | 0.02 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.02 | 0.07 | 0.08 | **0.03** |
| MoC | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.00** |
| Total (n): | **21,818** | **22,681** | **24,220** | **25,063** | **26,730** | **27,465** | **28,111** | **28,993** | **30,183** | **30,383** | **265,647** |

THA: total hip arthroplasty; CoP: Ceramics-on-polyethylene; MoP: Metal-on-polyethylene; CoC: Ceramics-on-ceramics; ZoP: Oxidized Zirconium-on-polyethylene; MoM: Metal-on-Metal; CoM: Ceramics-on-Metal; MoC: Metal-on-ceramics.

*Articulation by age category*

**FIGURE Articulation (proportion [%] per category) in primary total hip arthroplasties by age category in the Netherlands in 2019**



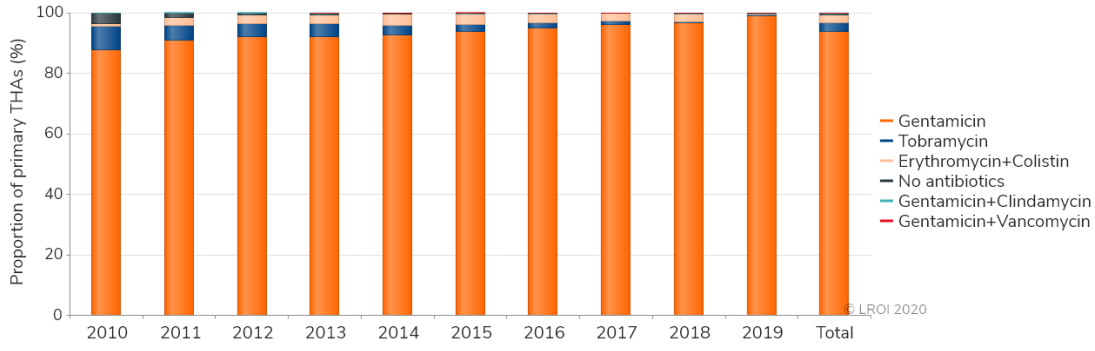

| Age category | <50 | 50-59 | 60-69 | 70-79 | >80 | Total |
|---|---|---|---|---|---|---|
| **Articulation (%)** | | | | | | |
| CoP | 68.06 | 68.29 | 66.89 | 65.58 | 59.33 | **65.48** |
| MoP | 16.05 | 13.43 | 15.15 | 19.45 | 29.20 | **18.72** |
| ZoP | 8.51 | 11.11 | 11.43 | 9.64 | 8.81 | **10.19** |
| CoC | 6.98 | 6.99 | 6.32 | 5.16 | 2.49 | **5.41** |
| MoM | 0.16 | 0.11 | 0.15 | 0.11 | 0.07 | **0.12** |
| CoM | 0.24 | 0.08 | 0.05 | 0.07 | 0.11 | **0.08** |
| Total (n): | **1,246** | **3,664** | **9,149** | **11,861** | **4,463** | **30,383** |

THA: total hip arthroplasty; CoP: Ceramics-on-polyethylene; MoP: Metal-on-polyethylene; ZoP: Oxidized Zirconium-on-polyethylene; CoC: Ceramics-on-ceramics; MoM: Metal-on-Metal; CoM: Ceramics-on-Metal.

## Bone cement

### *Antibiotics 2010-2019*

**FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in primary total hip arthroplasties in the Netherlands in 2010-2019**



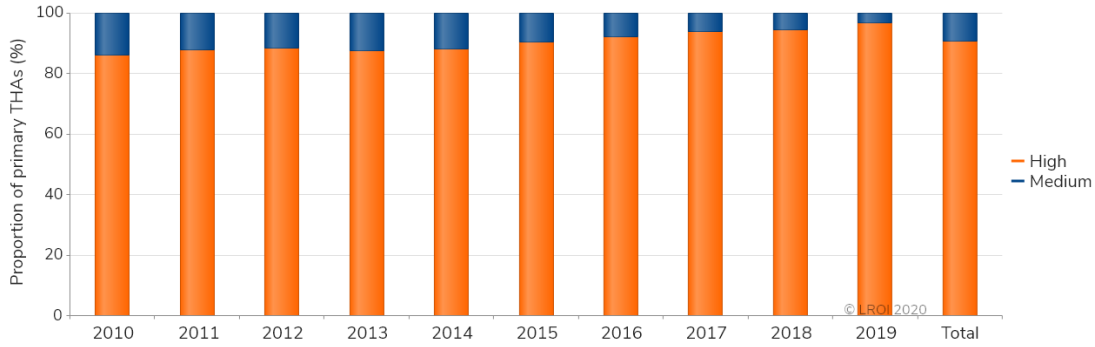

**Bone cement antibiotics (%)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Gentamicin | 87.75 | 90.88 | 91.99 | 92.20 | 92.77 | 93.95 | 95.05 | 96.19 | 96.61 | 98.97 | **93.79** |
| Tobramycin | 7.70 | 4.95 | 4.52 | 4.07 | 2.97 | 2.29 | 1.77 | 0.95 | 0.33 | 0.20 | **2.85** |
| Erythromycin+Colistin | 0.92 | 2.60 | 2.88 | 3.06 | 3.75 | 3.32 | 2.84 | 2.61 | 2.74 | 0.49 | **2.55** |
| No antibiotics | 3.36 | 1.42 | 0.40 | 0.32 | 0.23 | 0.07 | 0.01 | 0.02 | 0.01 | 0.01 | **0.52** |
| Gentamicin+Clindamycin | 0.26 | 0.17 | 0.22 | 0.31 | 0.27 | 0.37 | 0.30 | 0.21 | 0.26 | 0.25 | **0.26** |
| Gentamicin+Vancomycin | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.01 | 0.03 | 0.02 | 0.05 | 0.08 | **0.02** |
| Total (n): | **7,945** | **8,472** | **9,110** | **9,351** | **10,006** | **9,582** | **9,817** | **9,909** | **9,705** | **9,473** | **93,370** |

THA: total hip arthroplasty.

### *Viscosity 2010-2019*

**FIGURE Trend (proportion [%] per year) in bone cement viscosity in primary total hip arthroplasties in the Netherlands in 2010-2019**



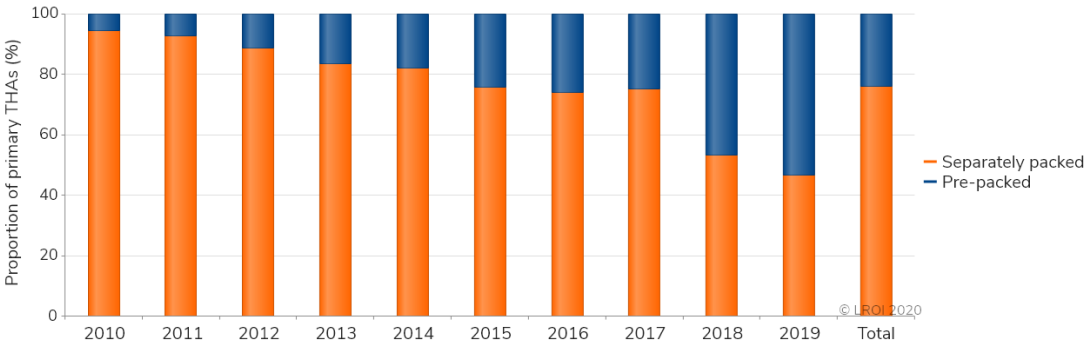

**Bone cement viscosity (%)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High | 85.90 | 87.72 | 88.48 | 87.48 | 88.10 | 90.44 | 92.16 | 93.88 | 94.43 | 96.55 | **90.65** |
| Medium | 14.10 | 12.28 | 11.52 | 12.52 | 11.90 | 9.56 | 7.84 | 6.12 | 5.57 | 3.45 | **9.35** |
| Total (n): | **7,943** | **8,471** | **9,109** | **9,350** | **10,005** | **9,582** | **9,817** | **9,908** | **9,705** | **9,473** | **93,363** |

Please note: Low viscosity in bone cement was used in 7 (<0.01%) primary THAs in 2010-2019.
THA: total hip arthroplasty.

*Vacuum mixing system 2010-2019*

**FIGURE** Trend (proportion [%] per year) in use of bone cement pre-packed in a vacuum mixing system in primary total hip arthroplasties in the Netherlands in 2010-2019




| Vacuum mixing system (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Separately packed | 94.41 | 92.58 | 88.61 | 83.51 | 82.08 | 75.65 | 74.10 | 75.24 | 53.12 | 46.76 | **76.04** |
| Pre-packed | 5.59 | 7.42 | 11.39 | 16.49 | 17.92 | 24.35 | 25.90 | 24.76 | 46.88 | 53.24 | **23.96** |
| Total (n): | **7,945** | **8,472** | **9,110** | **9,351** | **10,006** | **9,582** | **9,817** | **9,909** | **9,705** | **9,473** | **93,370** |

THA: total hip arthroplasty; Separately packed: separately packed bone cement components; Pre-packed: bone cement pre-packed in a vacuum mixing system.

## Most frequently registered

*Components*

**TABLE** The most frequently registered acetabulum (both cemented and uncemented) and femur (both cemented and uncemented) components in primary total hip arthroplasties in the Netherlands in 2019

**Acetabulum**

| Cemented (n=8,070) | | Uncemented (n=23,222) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Muller low profile Durasul | 15.8 | Allofit | 35.5 |
| IP Cup | 14.5 | Pinnacle | 20.1 |
| Avantage Cemented | 12.8 | R3 | 12.9 |
| FAL Cup | 11.0 | Trident | 7.0 |
| Exceed ABT Cemented | 9.7 | Exceed ABT | 5.7 |
| Exeter Rimfit X3 | 8.4 | Trident Tritanium | 3.6 |
| Muller low profile | 7.7 | RM Pressfit Vitamys cup | 3.2 |
| Reflection All Poly XLPE | 5.3 | Continuum | 2.9 |
| Marathon | 3.8 | RM Pressfit cup | 2.5 |
| IP Cup X-Linked | 3.0 | Delta-TT | 1.8 |

**Femur**

| Cemented (n=9,104) | | Uncemented (n=21,894) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Lubinus SPII | 36.9 | Taperloc Complete | 32.2 |
| Original ME Muller | 26.8 | Corail | 20.2 |
| Exeter | 12.0 | Polarstem | 13.1 |
| Stanmore | 8.6 | Accolade | 8.0 |
| Spectron EF | 4.0 | Twinsys stem Cementless | 4.7 |
| C-Stem AMT | 2.5 | Accolade II | 4.0 |
| Twinsys stem Cemented | 1.9 | CLS Spotorno | 3.4 |
| Taperloc Hip Cemented CoCr | 1.5 | Alloclassic Zweymuller SL | 3.3 |
| CPT | 1.2 | M/L Taper | 2.6 |
| CPCS | 1.1 | Corail AMT | 1.7 |

*Types of bone cement*

**TABLE The most frequently registered types of bone cement by type of mixing system used during primary total hip arthroplasties in the Netherlands in 2019**

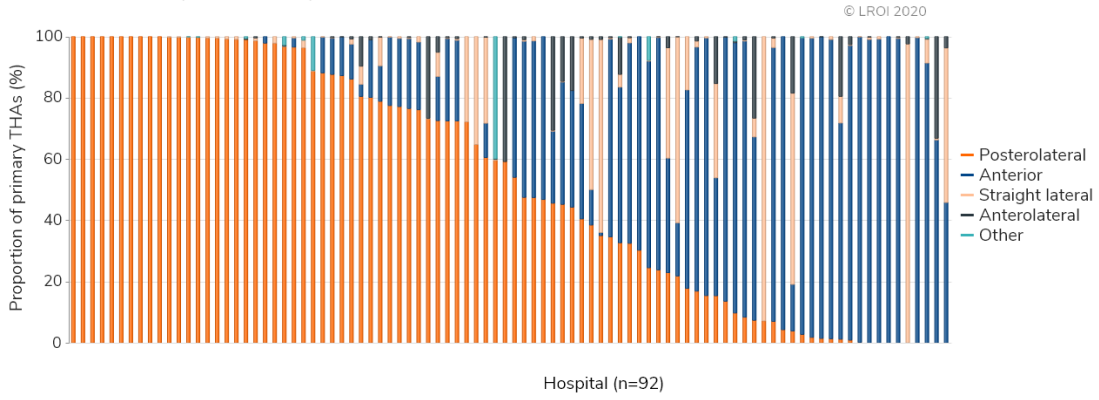
| Separately packed bone cement components (n=4,430) | | Bone cement pre-packed in a vacuum mixing system (n=5,042) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 88.3 | Palacos R+G | 48.4 |
| Palacos MV+G | 5.3 | Refobacin Bone Cement R | 45.5 |
| Refobacin Bone Cement R | 3.3 | Refobacin Plus Bone Cement | 6.1 |
| Simplex ABC EC | 1.0 | | |
| Subiton G | 0.6 | | |



## Practice variation

*Surgical approach*

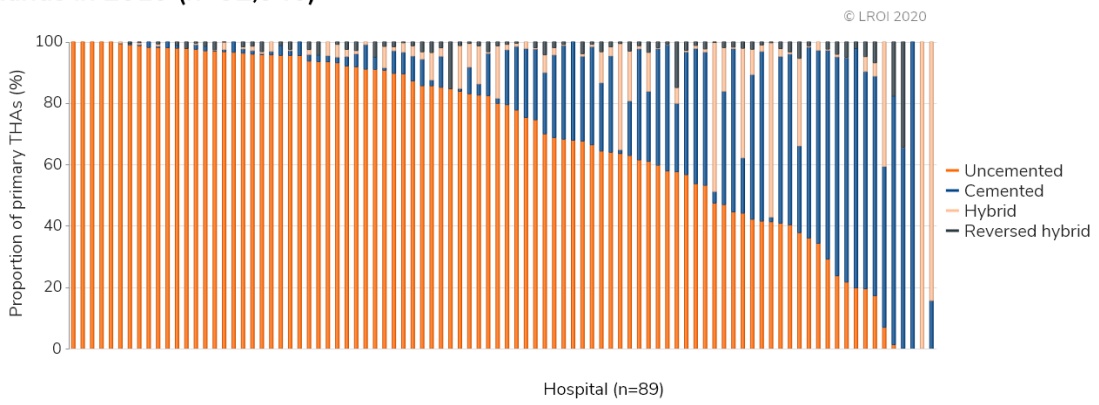
**FIGURE Distribution of surgical approach used during primary total hip arthroplasties per hospital in the Netherlands in 2019 (n=33,221)**




THA: total hip arthroplasty.

*Fixation*

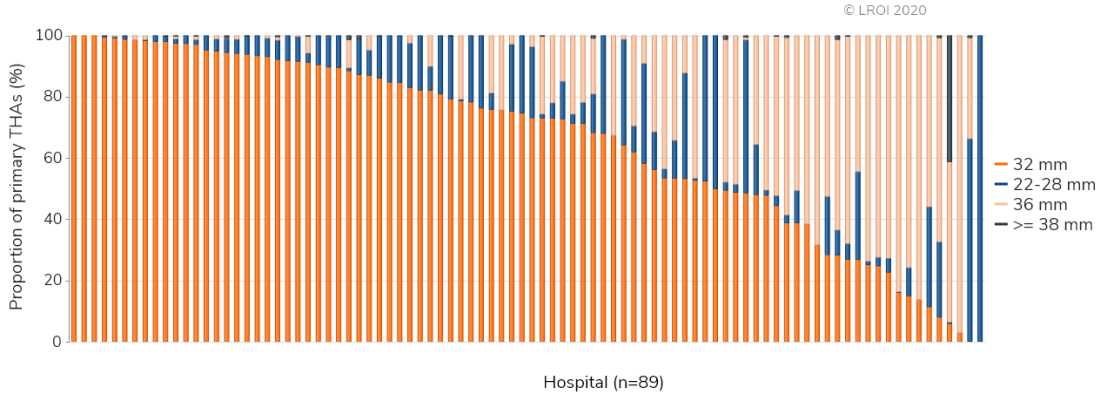
**FIGURE Distribution of type of fixation used during primary total hip arthroplasties per hospital in the Netherlands in 2019 (n=32,940)**




THA: total hip arthroplasty.

*Femoral head diameter*

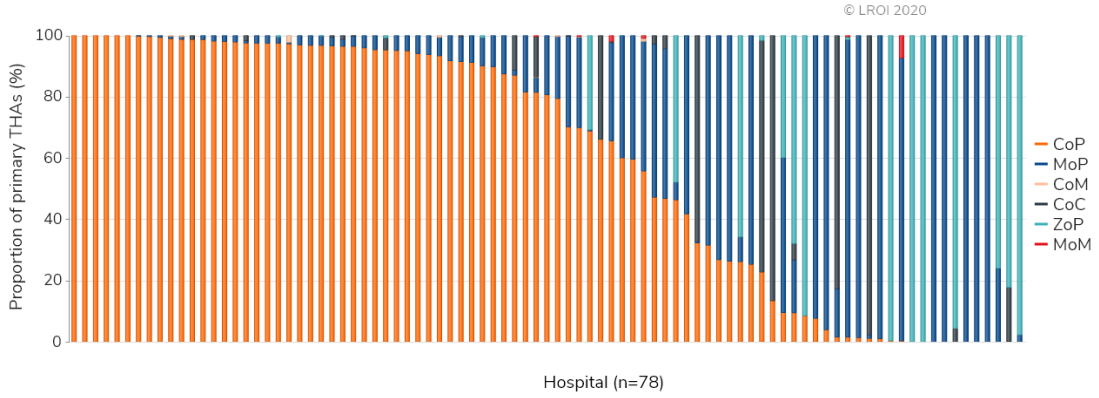
FIGURE Distribution of diameter femoral head used during primary total hip arthroplasties per hospital in the Netherlands in 2019 (n=31,308)




THA: total hip arthroplasty.

*Articulation*

FIGURE Distribution of articulation used during primary total hip arthroplasties per hospital in the Netherlands in 2019 (n=30,383)




THA: total hip arthroplasty; CoP: Ceramics-on-polyethylene; MoP: Metal-on-polyethylene; ZoP: Oxidized Zirconium-on-polyethylene; CoC: Ceramics-on-ceramics; MoM: Metal-on-Metal; CoM: Ceramics-on-Metal.

# Hip hemiarthroplasty

## Demographics

**TABLE Patient characteristics of all patients with a primary hip hemiarthroplasty by specialism in the Netherlands in 2019**

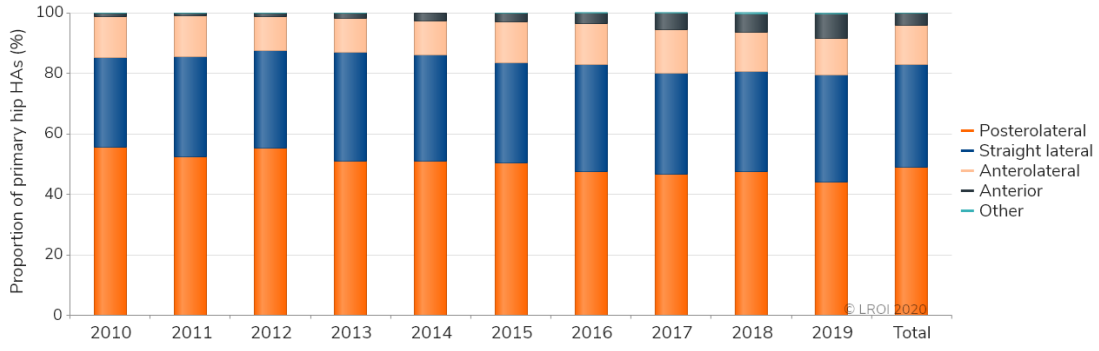
| | Orthopaedic surgeon | Trauma surgeon | Total |
|---|---|---|---|
| **N** | **4,009 (69.2%)** | **1,788 (30.8%)** | **5,810** |
| **Mean age (years) (SD)** | 82.6 (8.0) | 82.2 (8.3) | 82.5 (8.1) |
| **Age (years) (%)** | | | |
| <50 | 0 | 0 | 0 |
| 50-59 | 1 | 1 | 1 |
| 60-69 | 5 | 5 | 5 |
| 70-79 | 24 | 25 | 25 |
| ≥80 | 70 | 69 | 69 |
| **Gender (%)** | | | |
| Men | 32 | 33 | 33 |
| Women | 68 | 67 | 67 |
| **ASA score (%)** | | | |
| I | 1 | 1 | 1 |
| II | 27 | 26 | 27 |
| III-IV | 72 | 73 | 72 |
| **Type of hospital (%)** | | | |
| General | 97 | 96 | 97 |
| UMC | 3 | 4 | 3 |
| **Diagnosis (%)** | | | |
| Fracture (acute) | 96 | 99 | 97 |
| Osteoarthritis | 2 | 0 | 1 |
| Late post-traumatic | 1 | 1 | 1 |
| Tumour | 1 | 0 | 1 |
| Osteonecrosis | 0 | 0 | 0 |
| Dysplasia | 0 | 0 | 0 |
| Rheumatoid arthritis | 0 | 0 | 0 |
| Post-Perthes' disease | 0 | 0 | 0 |
| Inflammatory arthritis | 0 | 0 | 0 |
| **Charnley-score (%)** | | | |
| A One hip joint affected | 61 | 34 | 58 |
| B1 Both hip joints affected | 13 | 37 | 16 |
| B2 Contralateral hip joint with a total hip prosthesis | 18 | 9 | 17 |
| C Multiple joints affected or chronic disease that affects quality of life | 8 | 20 | 9 |
| **Mean Body Mass Index (kg/m²) (SD)** | 24.7 (4.3) | 24.4 (4.2) | 24.6 (4.3) |
| **Body Mass Index (kg/m²) (%)** | | | |
| Underweight (≤18,5) | 5 | 7 | 6 |
| Normal weight (>18,5-25) | 55 | 53 | 54 |
| Overweight (>25-30) | 31 | 31 | 31 |
| Obesity (>30-40) | 9 | 8 | 9 |
| Morbid obesity (>40) | 0 | 1 | 0 |
| **Smoking (%)** | | | |
| No | 94 | 94 | 94 |
| Yes | 6 | 6 | 6 |

Please note: In 2019, 73 general hospitals and 8 UMCs performed primary hip hemiarthroplasties.
General: general hospital; UMC: university medical centre; SD: standard deviation.

## Surgical techniques

### *Surgical approach 2010-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary hip hemiarthroplasty in the Netherlands in 2010-2019**

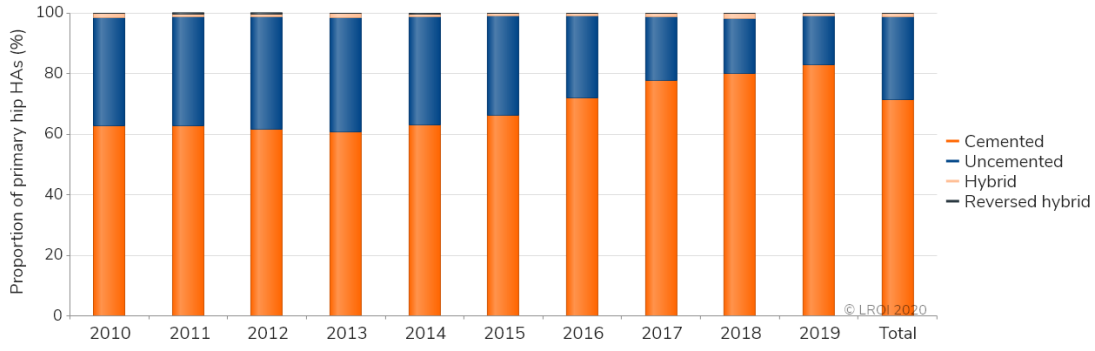



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surgical approach (%)** | | | | | | | | | | | |
| Posterolateral | 55.51 | 52.27 | 55.35 | 51.01 | 50.92 | 50.29 | 47.38 | 46.61 | 47.35 | 43.93 | **48.95** |
| Straight lateral | 29.60 | 33.22 | 32.09 | 36.01 | 35.12 | 33.23 | 35.52 | 33.48 | 33.14 | 35.54 | **33.96** |
| Anterolateral | 13.64 | 13.49 | 11.39 | 11.11 | 11.10 | 13.47 | 13.45 | 14.29 | 13.14 | 12.01 | **12.82** |
| Anterior | 1.20 | 0.89 | 1.10 | 1.74 | 2.86 | 2.95 | 3.54 | 5.52 | 6.04 | 8.16 | **4.11** |
| Other | 0.04 | 0.13 | 0.07 | 0.13 | 0.00 | 0.06 | 0.11 | 0.11 | 0.34 | 0.36 | **0.16** |
| Total (n): | **2,331** | **2,357** | **2,739** | **2,980** | **3,704** | **4,715** | **5,315** | **5,690** | **5,915** | **5,796** | **41,542** |

HA: hemiarthroplasty.

### *Fixation 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in primary hip hemiarthroplasties in the Netherlands in 2010-2019**




| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixation (%)** | | | | | | | | | | | |
| Cemented | 62.87 | 62.63 | 61.67 | 60.60 | 63.16 | 66.26 | 71.83 | 77.69 | 80.07 | 82.91 | **71.43** |
| Uncemented | 35.58 | 36.07 | 37.14 | 37.70 | 35.52 | 32.72 | 27.17 | 20.90 | 18.03 | 16.03 | **27.24** |
| Hybrid | 1.29 | 1.01 | 0.87 | 1.47 | 1.02 | 0.91 | 0.94 | 1.39 | 1.86 | 1.02 | **1.20** |
| Reversed hybrid | 0.26 | 0.29 | 0.33 | 0.23 | 0.30 | 0.11 | 0.06 | 0.02 | 0.03 | 0.03 | **0.13** |
| Total (n): | **2,319** | **2,376** | **2,768** | **3,000** | **3,716** | **4,707** | **5,297** | **5,698** | **5,922** | **5,776** | **41,579** |

HA: hemiarthroplasty.

## Most frequently registered

### *Components*

**TABLE The most frequently registered femur and femoral head components in primary hip hemiarthroplasties in the Netherlands in 2019**

| Femur component (n=5,216) | | Femoral head component (n=5,216) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Original ME Muller | 29.2 | Unipolar Head | 33.9 |
| Lubinus SPII | 19.6 | Link CoCr head | 20.2 |
| Spectron EF | 8.0 | Modular Cathcard Unipolar head | 10.1 |
| CCA stem | 5.9 | UHR Unitrax | 8.2 |
| Exeter | 5.1 | Stainless Steel head | 7.3 |
| Stanmore | 4.4 | Uni-polar | 6.5 |
| C-Stem AMT | 4.4 | Hemi Heads | 5.2 |
| Alloclassic Zweymuller SL | 3.7 | Smith&Nephew CoCr head | 4.2 |
| Corail | 2.8 | Versys Endo | 1.1 |
| Accolade | 2.3 | VarioCup | 0.8 |



### *Types of bone cement*

**TABLE The most frequently registered types of bone cement by type of mixing system used during primary hip hemiarthroplasties in the Netherlands in 2019**

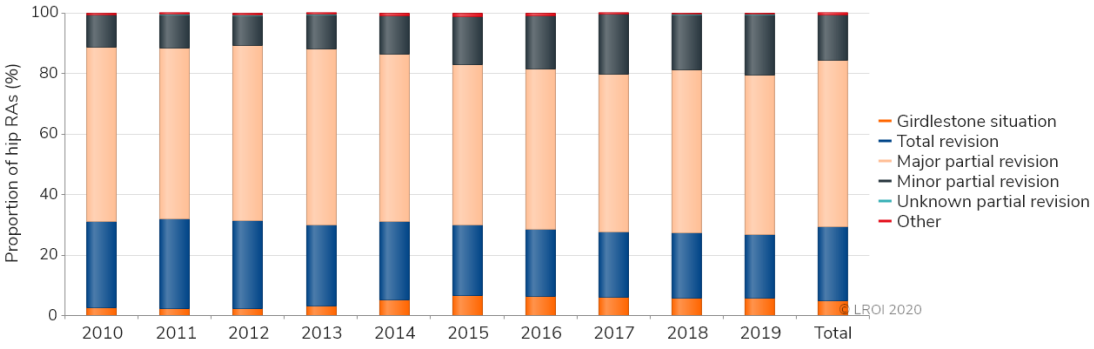
| Separately packed bone cement components (n=1,547) | | Bone cement pre-packed in a vacuum mixing system (n=1,996) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 79.0 | Refobacin Bone Cement R | 46.2 |
| Copal G+C | 6.3 | Palacos R+G | 42.1 |
| Palacos MV+G | 5.0 | Refobacin Plus Bone Cement | 11.7 |
| Refobacin Bone Cement R | 3.6 | | |
| Simplex P | 2.2 | | |



## Hip revision arthroplasty

### Type of revision 2010-2019

**FIGURE Trend (proportion [%] per year) in type of revision in hip revision arthroplasties in the Netherlands in 2010-2019**




| Type of revision (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Girdlestone situation | 2.59 | 2.39 | 2.25 | 3.26 | 5.21 | 6.66 | 6.35 | 6.12 | 5.84 | 5.81 | **4.77** |
| Total revision | 28.44 | 29.67 | 29.10 | 26.81 | 26.01 | 23.14 | 22.27 | 21.53 | 21.44 | 21.09 | **24.72** |
| Major partial revision | 57.60 | 56.24 | 57.99 | 58.05 | 55.16 | 53.02 | 52.71 | 52.09 | 53.93 | 52.46 | **54.78** |
| Minor partial revision | 10.61 | 10.91 | 9.63 | 11.30 | 12.54 | 15.92 | 17.58 | 19.80 | 18.16 | 19.93 | **14.89** |
| Unknown partial revision | 0.17 | 0.29 | 0.19 | 0.15 | 0.03 | 0.10 | 0.08 | 0.08 | 0.21 | 0.21 | **0.15** |
| Other | 0.59 | 0.51 | 0.84 | 0.44 | 1.04 | 1.15 | 1.01 | 0.39 | 0.42 | 0.50 | **0.69** |
| Total (n): | **2,894** | **3,135** | **3,697** | **3,435** | **3,548** | **3,812** | **3,857** | **3,859** | **3,838** | **3,788** | **35,863** |

RA: revision arthroplasty.
Major partial revision: revision of at least acetabulum or femur component.
Minor partial revision: only inlay and/or femoral head exchange (including DAIR procedures).
Unknown partial revision: partial revision of which the revised components were unknown.

**In 1,299 (65.4%) major partial hip revision arthroplasties the acetabulum component was revised and in 688 (34.6%) major partial revision arthroplasties the femur component was revised in 2019.**

## Reasons for revision 2014-2019

**TABLE Trend (proportion [%] per year) in reasons for revision or re-surgery in patients who underwent a hip revision arthroplasty in the Netherlands in 2014-2019**

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Hip revision arthroplasty (n)** | 3,583 | 3,834 | 3,882 | 3,870 | 3,845 | 3,804 | 22,818 |
| **Reasons for revision; Proportion[1] (%)** | | | | | | | |
| Loosening of acetabulum component | 26.4 | 24.8 | 22.3 | 21.8 | 21.1 | 20.6 | 22.8 |
| Infection | 12.3 | 17.9 | 19.4 | 21.2 | 20.7 | 22.5 | 19.1 |
| Dislocation | 19.1 | 19.9 | 19.4 | 17.8 | 18.9 | 18.6 | 19.0 |
| Loosening of femur component | 20.9 | 19.5 | 18.8 | 18.2 | 19.2 | 17.2 | 18.9 |
| Inlay wear | 20.1 | 19.6 | 18.3 | 18.2 | 15.9 | 15.9 | 18.0 |
| Peri-prosthetic fracture | 11.7 | 11.4 | 12.5 | 14.7 | 14.4 | 14.5 | 13.2 |
| Girdlestone situation | 6.4 | 5.7 | 6.1 | 5.3 | 4.8 | 4.6 | 5.5 |
| Symptomatic MoM bearing | 5.8 | 4.6 | 3.9 | 2.7 | 2.7 | 2.8 | 3.7 |
| Peri-articular ossification | 2.6 | 2.0 | 2.3 | 1.5 | 1.3 | 1.1 | 1.8 |
| Other | 11.6 | 11.3 | 10.6 | 10.1 | 11.3 | 12.8 | 11.3 |

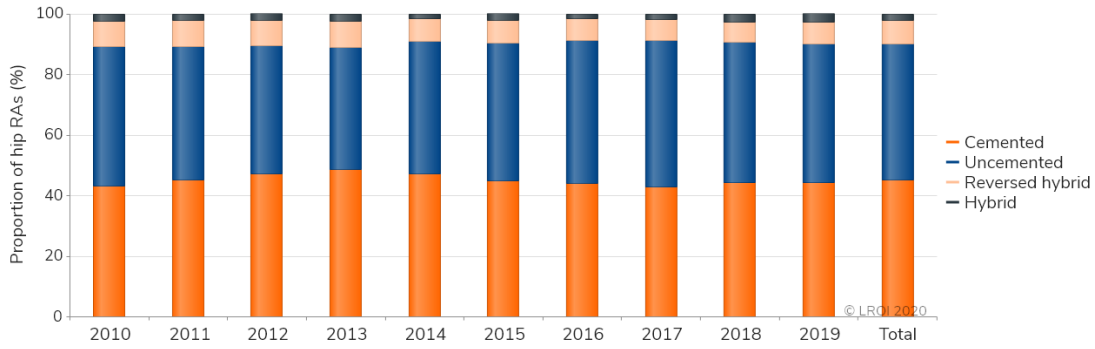
[1] One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.



## Surgical techniques

### *Fixation 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in hip revision arthroplasties in the Netherlands in 2010-2019**

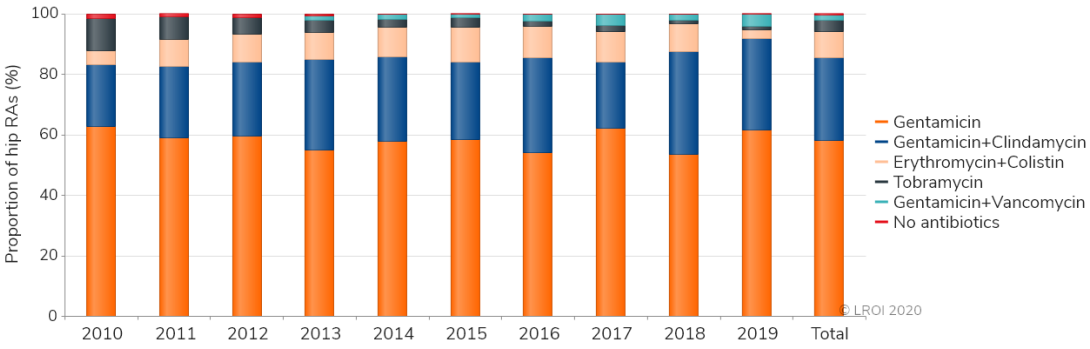



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixation (%)** | | | | | | | | | | | |
| Cemented | 43.19 | 45.18 | 47.09 | 48.55 | 47.30 | 44.93 | 44.14 | 42.75 | 44.38 | 44.41 | **45.19** |
| Uncemented | 46.00 | 43.98 | 42.35 | 40.26 | 43.58 | 45.36 | 46.96 | 48.54 | 46.25 | 45.54 | **44.93** |
| Reversed hybrid | 8.34 | 8.75 | 8.50 | 8.69 | 7.56 | 7.51 | 7.35 | 6.73 | 6.69 | 7.42 | **7.71** |
| Hybrid | 2.47 | 2.09 | 2.07 | 2.50 | 1.55 | 2.20 | 1.55 | 1.98 | 2.68 | 2.64 | **2.17** |
| Total (n): | **2,674** | **2,913** | **3,436** | **3,234** | **3,281** | **3,461** | **3,539** | **3,537** | **3,542** | **3,452** | **33,069** |

RA: revision arthroplasty.

*Bone cement antibiotics 2010-2019*

**FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in hip revision arthroplasties in the Netherlands in 2010-2019**




| Bone cement antibiotics (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gentamicin | 62.66 | 58.99 | 59.58 | 54.92 | 57.73 | 58.32 | 54.22 | 62.28 | 53.49 | 61.70 | **58.19** |
| Gentamicin+Clindamycin | 20.42 | 23.64 | 24.56 | 30.00 | 27.90 | 25.59 | 31.16 | 21.76 | 33.94 | 30.01 | **27.16** |
| Erythromycin+Colistin | 4.58 | 8.86 | 9.23 | 8.78 | 9.86 | 11.68 | 10.48 | 10.08 | 9.23 | 3.06 | **8.71** |
| Tobramycin | 10.62 | 7.36 | 5.20 | 4.03 | 2.71 | 3.09 | 1.63 | 2.00 | 1.21 | 0.94 | **3.70** |
| Gentamicin+Vancomycin | 0.08 | 0.00 | 0.21 | 1.44 | 1.68 | 1.21 | 2.39 | 3.81 | 1.94 | 4.18 | **1.71** |
| No antibiotics | 1.63 | 1.16 | 1.22 | 0.83 | 0.12 | 0.12 | 0.12 | 0.07 | 0.18 | 0.12 | **0.54** |
| Total (n): | **1,224** | **1,468** | **1,885** | **1,810** | **1,663** | **1,653** | **1,717** | **1,498** | **1,647** | **1,603** | **16,168** |

RA: revision arthroplasty.

## Most frequently registered

### *Components*

**TABLE The most frequently registered acetabulum (both cemented and uncemented) and femur (both cemented and uncemented) components in hip revision arthroplasties in the Netherlands in 2019**

**Acetabulum**

| Cemented (n=1,384) | | Uncemented (n=486) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Avantage Cemented | 54.6 | Continuum | 17.9 |
| Polarcup | 14.7 | Delta-one TT | 11.1 |
| Exeter Rimfit X3 | 4.1 | Trident | 10.5 |
| Saturne Dual Mobility Cemented | 3.8 | Allofit | 9.3 |
| Reflection All Poly XLPE | 3.5 | R3 | 9.1 |
| Trabecular Metal | 3.1 | Polarcup | 6.2 |
| FAL Cup | 2.3 | Avantage Reload | 4.9 |
| DS Evolution | 1.8 | Saturne Dual Mobility | 4.1 |
| Marathon | 1.6 | Delta-TT | 3.7 |
| Muller low profile Durasul | 1.6 | Trident Tritanium | 3.7 |

**Femur**

| Cemented (n=623) | | Uncemented (n=717) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Lubinus SPII | 26.5 | Restoration Modular | 22.3 |
| Exeter | 20.6 | MP Reconstruction Prosthesis | 13.4 |
| Original ME Muller | 10.6 | Arcos | 10.0 |
| Spectron EF | 7.7 | Revitan | 8.0 |
| Stanmore | 6.7 | Redapt | 7.8 |
| CPT | 5.8 | Alloclassic SLL | 4.5 |
| Twinsys stem Cemented | 3.5 | Wagner SL | 4.1 |
| MP Reconstruction Prosthesis | 2.9 | Corail Revision | 3.4 |
| C-Stem AMT Long | 2.1 | Polarstem | 2.8 |
| CCA stem | 2.1 | Echelon | 2.1 |

*Types of bone cement*

**TABLE The most frequently registered types of bone cement by type of mixing system used during hip revision arthroplasties in the Netherlands in 2019**

| Separately packed bone cement components (n=1,133) | | Bone cement pre-packed in a vacuum mixing system (n=465) | |
|---|---|---|---|
| Name | Proportion (%) | Name | Proportion (%) |
| Palacos R+G | 39.1 | Refobacin Bone Cement R | 53.5 |
| Copal G+C | 29.4 | Palacos R+G | 36.3 |
| Refobacin Revision | 12.7 | Refobacin Plus Bone Cement | 9.0 |
| Copal G+V | 5.5 | Refobacin Revision | 1.1 |
| Simplex ABC EC | 4.3 | | |



# Survival

## Revision within 1 year

*By type of revision*

**TABLE Cumulative 1-year revision percentage of primary total hip arthroplasties by type of revision in the Netherlands in 2014-2018 (n=148,646)**

| | Cumulative 1-year revision percentage | |
|---|---|---|
| | Competing Risk (95% CI) | Kaplan Meier (95% CI) |
| Any type of revision[1] | 1.8 (1.7-1.9) | 1.8 (1.7-1.9) |
| Major revision[2] | 1.1 (1.0-1.1) | 1.1 (1.0-1.1) |
| Minor revision[3] | 0.7 (0.7-0.7) | 0.7 (0.7-0.7) |

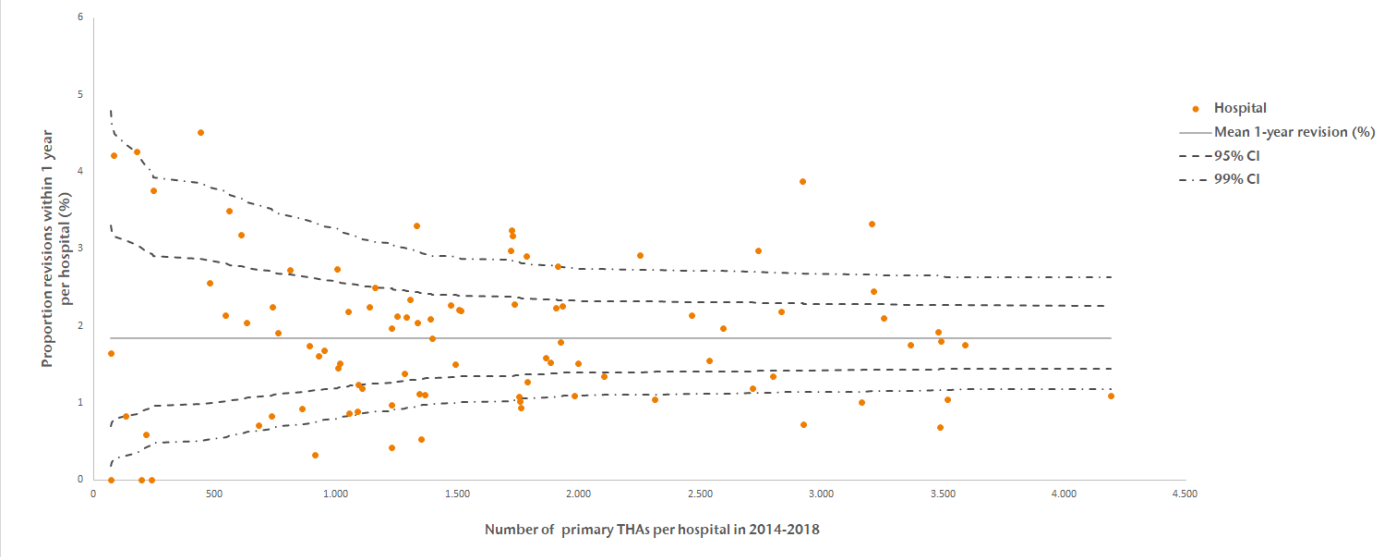
[1] Any type of revision includes minor and major revisions as well as revision procedures that could not be classified as minor or major revision.
[2] Revision of at least the acetabulum or femur component.
[3] Only inlay and/or femoral head exchange (including DAIR procedures).
THA: total hip arthroplasty; CI: confidence interval.



**In 2014-2018, 1,879 (1.3%) primary THAs were implanted in patients who died within one year after the primary procedure.**

*Overall revision per hospital*

**FIGURE Funnel plot of proportion of hip revision arthroplasties within one year after a total hip arthroplasty per hospital in the Netherlands in 2014-2018 (n=148,522)**

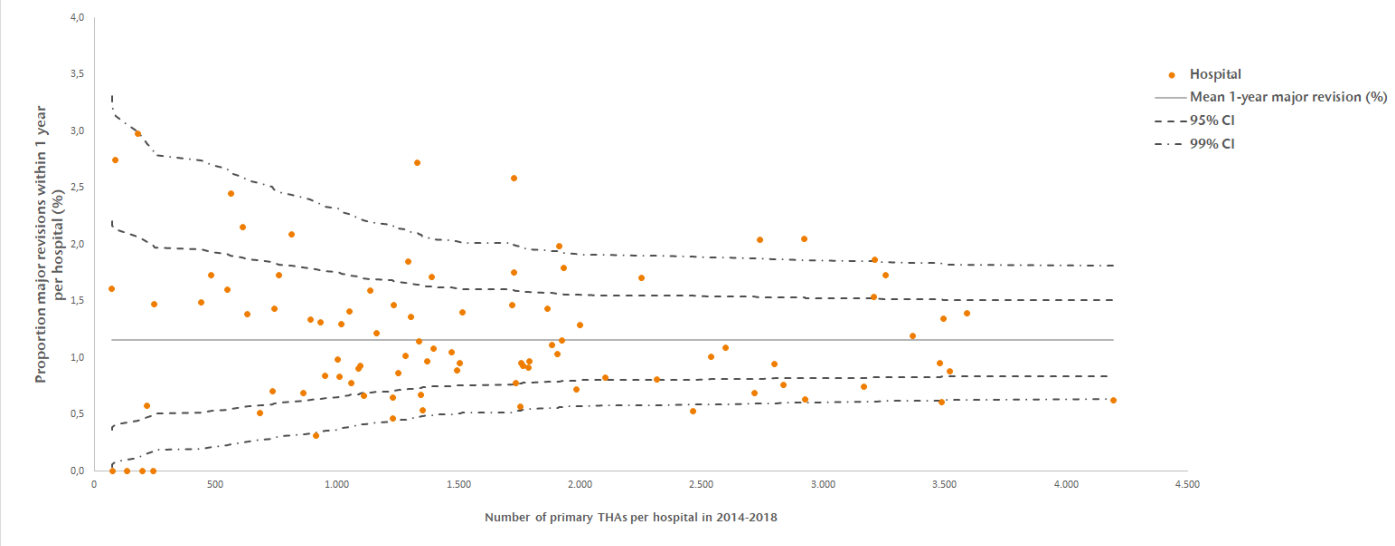



Please note: The proportions of revisions within 1 year per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).
THA: total hip arthroplasty; CI: confidence interval.

**The mean 1-year revision percentage is 1.8 (95% CI: 1.7-1.9 ) in the Netherlands in 2014-2018. Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.**

*Major revision per hospital*

**FIGURE Funnel plot of proportion of hip major revision arthroplasties within one year after a total hip arthroplasty per hospital in the Netherlands in 2014-2018 (n=148,522)**




Please note: Major revision is defined as revision of at least acetabulum or femur component
Please note: The proportions of revisions within 1 year per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).

THA: total hip arthroplasty; CI: confidence interval.

**The mean 1-year revision percentage is 1.2 (95% CI: 1.2-1.2 ) in the Netherlands in 2014-2018. Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.**

*Reasons for revision by type of revision*

**TABLE Reasons for revision within one year in patients that underwent a hip revision arthroplasty by type of revision in the Netherlands in 2014-2018**

| Reasons for revision | Major revision[1] (n=1,635) Proportion[4] (%) | Minor revision[2] (n=1,053) Proportion[4] (%) | Any type of revision[3] (n=2,732) Proportion[4] (%) |
|---|---|---|---|
| Infection | 12.9 | 67.1 | 34.1 |
| Dislocation | 34.4 | 18.1 | 27.6 |
| Peri-prosthetic fracture | 30.3 | 1.8 | 19.0 |
| Loosening of femur component | 20.6 | 0.5 | 12.6 |
| Loosening of acetabulum component | 10.0 | 0.4 | 6.1 |
| Girdlestone situation | 2.6 | 0.1 | 1.6 |
| Inlay wear | 1.3 | 1.1 | 1.2 |
| Peri-articular ossification | 0.7 | 0.5 | 0.6 |
| Symptomatic MoM bearing | 0.1 | 0.0 | 0.1 |
| Other | 10.2 | 14.3 | 11.7 |

[1] Revision of at least the acetabulum or femur component.
[2] Only inlay and/or femoral head exchange (including DAIR procedures).
[3] Any type of revision includes minor and major revisions as well as revision procedures that could not be classified as minor or major revision.
4 One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.

## Revision within 11 years

*Overall*

**FIGURE Cumulative revision percentage of total hip arthroplasties by type of revision in the Netherlands in 2007-2019 (n=325,334)**

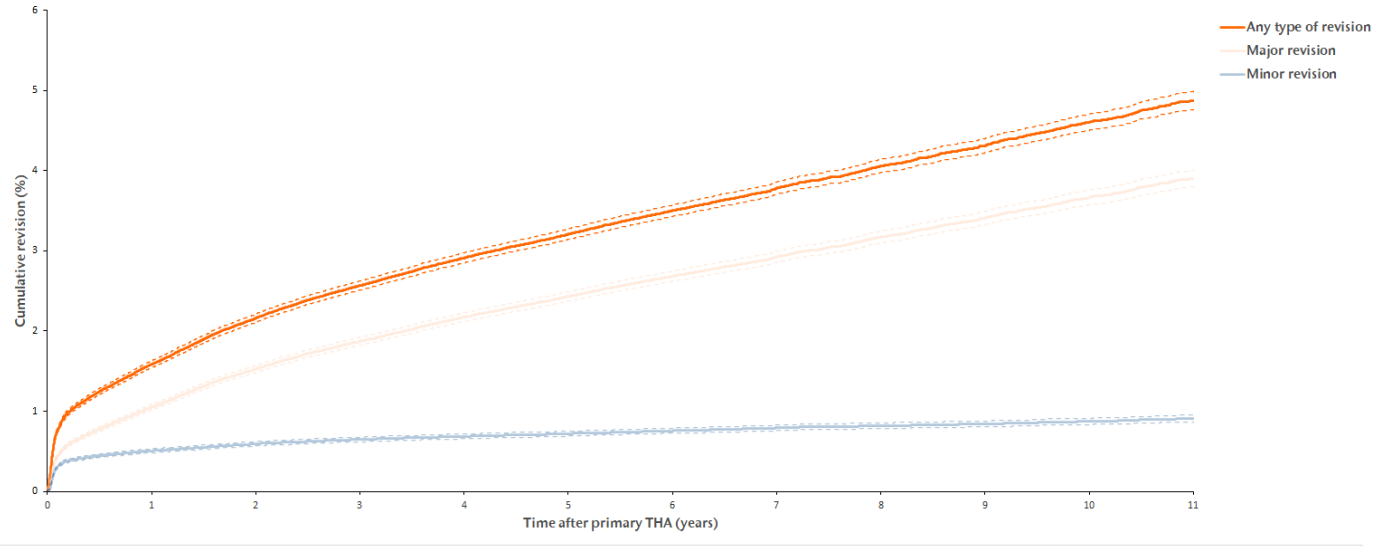



**TABLE Cumulative 11-year revision percentage of total hip arthroplasties by type of revision in the Netherlands in 2007-2019 (n=325,334)**

| | Cumulative 11-year revision percentage | |
|---|---|---|
| | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Any type of revision | 4.9 (4.8-5.0) | 5.3 (5.2-5.4) |
| Major revision[2] | 3.9 (3.8-4.0) | 4.3 (4.1-4.4) |
| Minor revision[3] | 0.9 (0.9-1.0) | 1.0 (0.9-1.0) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
2 Revision of at least the acetabulum or femur component.
3 Only inlay and/or femoral head exchange (including DAIR procedures).
CI: confidence interval.



**In 2007-2019, 33,297 (10.8%) primary THAs were implanted in patients who died within eleven years after the primary diagnosis**

*By gender*

**FIGURE Cumulative revision percentage of total hip arthroplasties by gender in the Netherlands in 2007-2019 (n=324,806)**

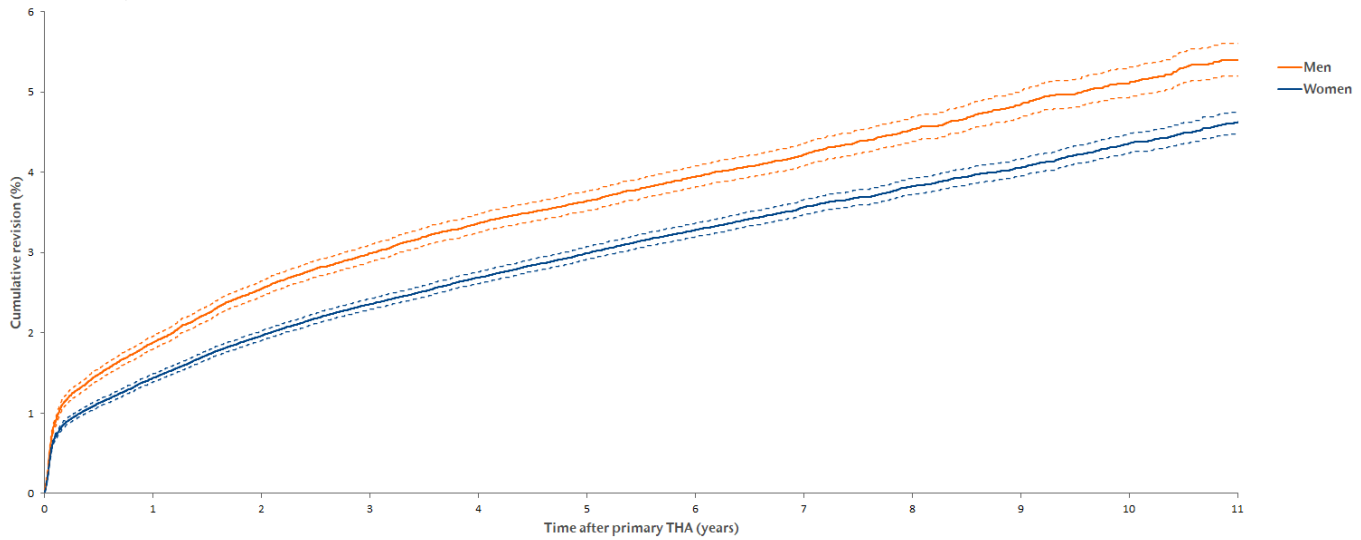



**TABLE Cumulative 11-year revision percentage of total hip arthroplasties by gender in the Netherlands in 2007-2019 (n=324,806)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Gender | | | |
| Men | 109,609 | 5.4 (5.2-5.6) | 5.9 (5.7-6.1) |
| Women | 215,197 | 4.6 (4.5-4.8) | 5.0 (4.8-5.2) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*By age category*

**FIGURE Cumulative revision percentage of total hip arthroplasties by age category in the Netherlands in 2007-2019 (n=314,245)**

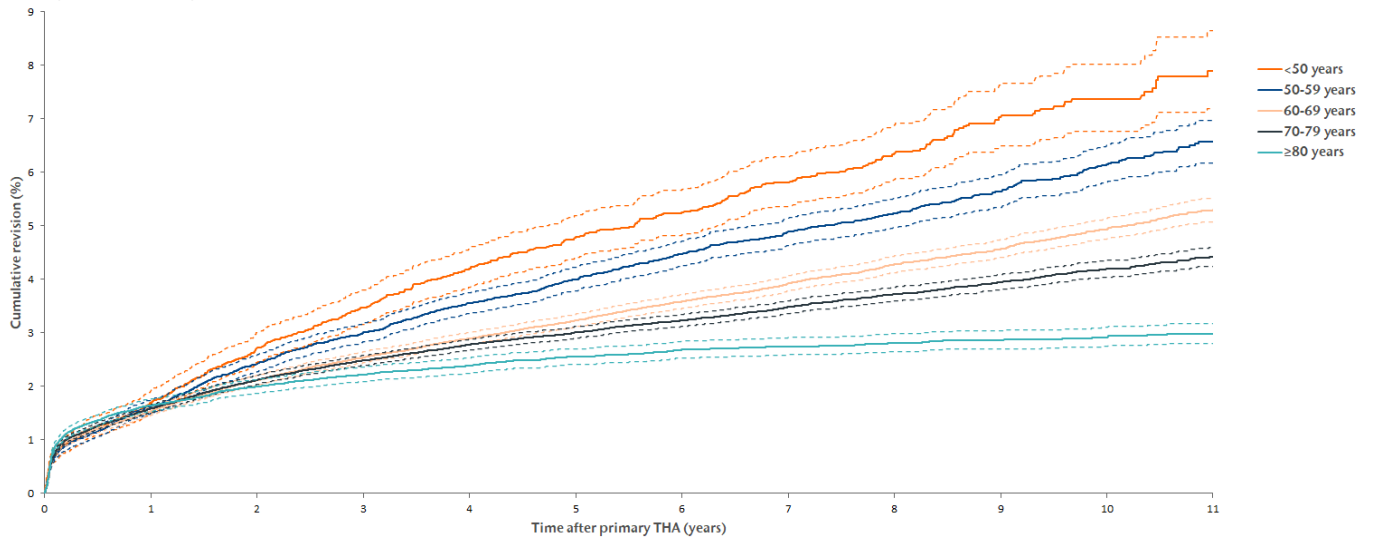



**TABLE Cumulative 11-year revision percentage of total hip arthroplasties by age category in the Netherlands in 2007-2019 (n=314,245)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Age (years) | | | |
| <50 | 14,398 | 7.9 (7.2-8.7) | 8.1 (7.3-8.8) |
| 50-59 | 39,868 | 6.6 (6.2-7.0) | 6.7 (6.3-7.2) |
| 60-69 | 102,481 | 5.3 (5.1-5.5) | 5.6 (5.3-5.8) |
| 70-79 | 119,422 | 4.4 (4.2-4.6) | 4.8 (4.6-5.0) |
| ≥80 | 48,798 | 3.0 (2.8-3.2) | 3.4 (3.2-3.6) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*By diagnosis*

**FIGURE Cumulative revision percentage of total hip arthroplasties by diagnosis in the Netherlands in 2007-2019 (n=322,718)**

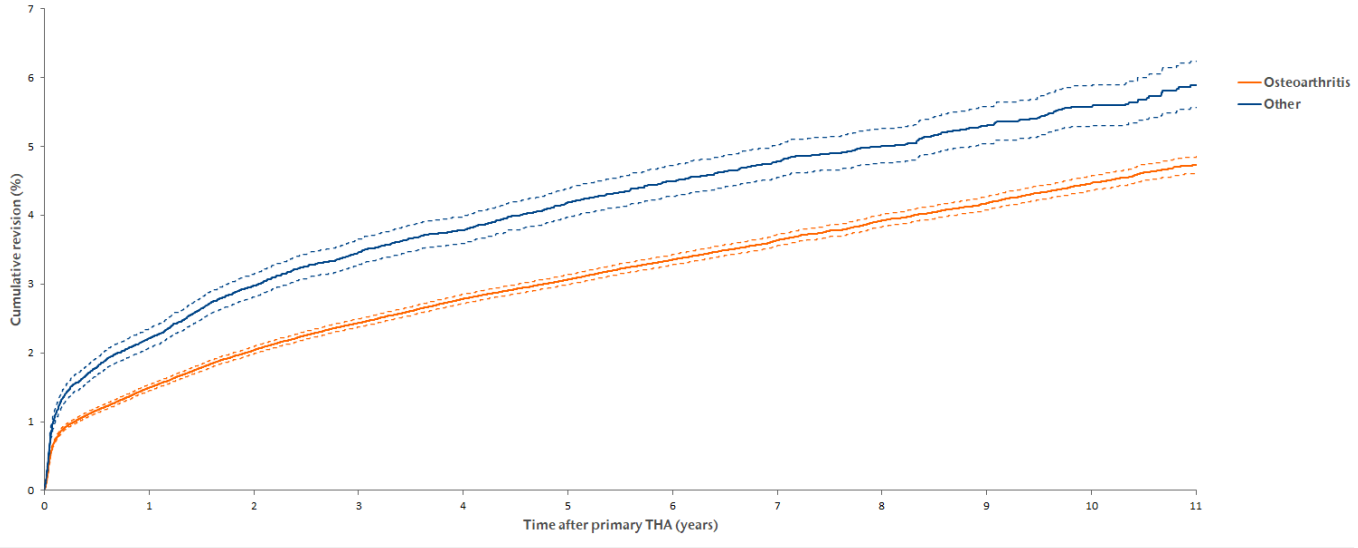



**TABLE Cumulative 11-year revision percentage of total hip arthroplasties by diagnosis in the Netherlands in 2007-2019 (n=322,718)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Diagnosis | | | |
| Osteoarthritis | 280,856 | 4.7 (4.6-4.8) | 5.1 (5.0-5.3) |
| Other | 41,862 | 5.9 (5.6-6.2) | 6.6 (6.2-7.0) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*By ASA score*

**FIGURE Cumulative revision percentage of total hip arthroplasties by ASA score in the Netherlands in 2007-2019 (n=305,156)**

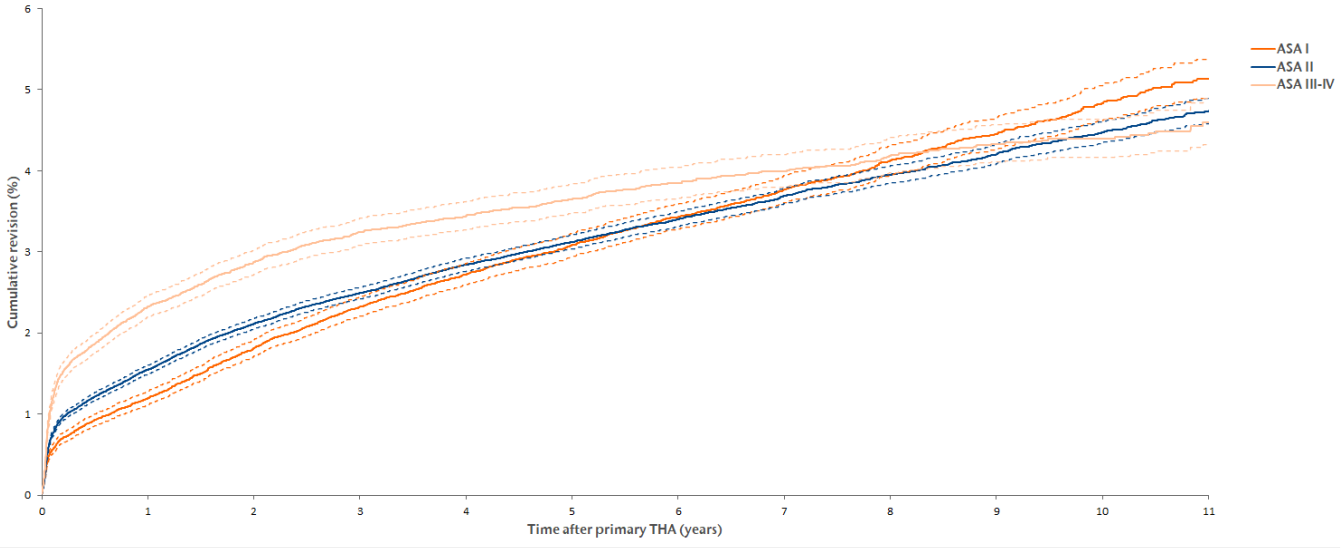



**TABLE Cumulative 11-year revision percentage of total hip arthroplasties by ASA score in the Netherlands in 2007-2019 (n=305,156)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| ASA score | | | |
| I | 66,292 | 5.1 (4.9-5.4) | 5.3 (5.1-5.6) |
| II | 198,41 | 4.7 (4.6-4.9) | 5.1 (4.9-5.3) |
| III-IV | 50,686 | 4.6 (4.3-4.9) | 5.3 (4.9-5.7) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

## Revision per component

### *Cemented primary THA*

**TABLE Cumulative revision percentages of cemented primary total hip arthroplasties by prosthesis component combination of patients who underwent a THA for osteoarthritis in the Netherlands in 2007-2019 (n=74,095)**

| | | | | | Type of revision (n) | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Femur component | Acetabulum component | Total primary THAs (n) | Median (IQR) age (yr) | Total revision arthroplasties (n) | Total hip (complete revision) | Only femur component | Only acetabulum component | Only femoral head/inlay | Missing/ unknown | 1yr | 3yr | 5yr | 7yr | 10yr | 11yr |
| **All cemented THAs for osteoarthritis** | | **74,095** | **76 (71-80)** | **1,896** | **375** | **208** | **779** | **495** | **39** | **1.3 (1.2-1.3)** | **2.0 (1.9-2.1)** | **2.5 (2.4-2.6)** | **3.0 (2.8-3.1)** | **3.7 (3.5-3.9)** | **4.0 (3.8-4.3)** |
| Lubinus SPII | IP Cup | 12,470 | 76 (71-80) | 292 | 41 | 43 | 132 | 73 | 3 | 1.1 (0.9-1.3) | 1.9 (1.7-2.2) | 2.5 (2.2-2.8) | 2.7 (2.4-3.1) | 3.4 (2.9-3.8) | 3.8 (3.1-4.5) |
| Original ME Muller | Muller low profile Durasul | 6,832 | 74 (69-79) | 164 | 21 | 4 | 28 | 109 | 2 | 1.6 (1.3-1.9) | 2.2 (1.8-2.5) | 2.7 (2.3-3.2) | 3.0 (2.5-3.4) | 3.5 (2.8-4.2) | 3.5 (2.8-4.2) |
| Original ME Muller | Muller low profile | 5,953 | 77 (73-81) | 141 | 18 | 1 | 81 | 35 | 6 | 1.4 (1.1-1.7) | 2.3 (1.9-2.7) | 2.5 (2.0-2.9) | 2.7 (2.2-3.1) | 2.7 (2.2-3.1) | 3.2 (2.5-3.8) |
| Lubinus SPII | FAL Cup | 4,991 | 75 (70-80) | 142 | 32 | 8 | 51 | 47 | 4 | 1.8 (1.4-2.1) | 2.5 (2.0-3.0) | 3.2 (2.6-3.8) | 3.9 (3.2-4.7) | 4.5 (3.6-5.4) | 4.5 (3.6-5.4) |
| Spectron EF | Reflection All Poly XLPE | 4,634 | 77 (73-81) | 97 | 31 | 11 | 35 | 20 | 0 | 0.8 (0.5-1.0) | 1.5 (1.1-1.9) | 1.9 (1.4-2.3) | 2.5 (2.0-3.1) | 2.8 (2.2-3.4) | 3.0 (2.3-3.7) |
| Exeter | Exeter Rimfit X3 | 3,917 | 75 (69-80) | 81 | 17 | 20 | 17 | 27 | 0 | 1.5 (1.1-1.9) | 2.1 (1.6-2.5) | 2.5 (2.0-3.1) | 2.5 (2.0-3.1) | n.a. | n.a. |
| Stanmore | Stanmore | 3,344 | 75 (70-80) | 68 | 25 | 2 | 35 | 4 | 2 | 0.7 (0.4-1.0) | 1.5 (1.1-1.9) | 1.9 (1.4-2.4) | 2.1 (1.6-2.6) | 2.7 (2.0-3.4) | 2.7 (2.0-3.4) |
| Exeter | Exeter Contemporary Hooded | 2,807 | 77 (72-81) | 81 | 17 | 17 | 30 | 14 | 3 | 1.2 (0.8-1.6) | 1.7 (1.2-2.2) | 2.2 (1.6-2.8) | 2.8 (2.1-3.5) | 4.3 (3.3-5.4) | 4.5 (3.4-5.6) |
| Lubinus SPII | SHP | 2,491* | 75 (71-80) | 42 | 9 | 3 | 29 | 1 | 0 | 0.4 (0.1-0.6) | 0.7 (0.4-1.0) | 1.0 (0.6-1.4) | 1.7 (1.1-2.2) | 2.0 (1.4-2.7) | 2.0 (1.4-2.7) |
| Exeter | Exeter | 2,432* | 73 (68-79) | 122 | 19 | 12 | 59 | 28 | 4 | 2.8 (2.1-3.5) | 3.6 (2.8-4.3) | 4.2 (3.4-4.9) | 4.9 (4.0-5.7) | 5.9 (4.8-7.0) | 6.0 (4.9-7.2) |
| Exeter | Exeter Contemporary Flanged | 2,381 | 75 (67-80) | 59 | 14 | 6 | 30 | 7 | 2 | 0.8 (0.4-1.1) | 1.4 (0.9-1.9) | 1.9 (1.3-2.4) | 2.2 (1.5-2.8) | 3.2 (2.3-4.2) | 3.7 (2.5-4.8) |
| Stanmore | SHP | 2,081 | 75 (71-79) | 102 | 33 | 5 | 54 | 9 | 1 | 1.6 (1.1-2.1) | 3.1 (2.3-3.9) | 4.2 (3.3-5.1) | 5.0 (4.0-6.0) | 5.9 (4.7-7.1) | 6.4 (5.0-7.8) |
| CCA stem | CCB cup Low Profile | 1,429* | 77 (73-80) | 41 | 6 | 2 | 11 | 21 | 1 | 2.0 (1.3-2.8) | 2.4 (1.6-3.1) | 2.8 (1.9-3.7) | 3.0 (2.0-3.9) | 3.9 (2.3-5.5) | 5.0 (2.3-7.6) |
| Stanmore | Exceed ABT Cemented | 1,188 | 76 (71-81) | 18 | 3 | 0 | 6 | 9 | 0 | 1.2 (0.6-2.0) | 1.5 (0.7-2.9) | 1.9 (0.8-2.9) | 4.5 (0.2-8.9) | n.a. | n.a. |
| Stanmore | All Poly Arcom Cup | 1,049* | 74 (69-79) | 18 | 2 | 3 | 12 | 0 | 1 | 0.3 (0.0-0.6) | 1.3 (0.6-2.0) | 1.8 (1.0-2.7) | 2.0 (1.1-3.0) | n.a. | n.a. |
| Stanmore | Muller | 875 | 76 (71-81) | 12 | 3 | 2 | 6 | 1 | 0 | 0.7 (0.1-1.2) | 1.3 (0.5-2.0) | 1.3 (0.6-2.1) | 1.3 (0.6-2.1) | 2.0 (0.4-3.6) | n.a. |
| Spectron EF | Mueller cup | 825* | 77 (72-81) | 11 | 3 | 2 | 4 | 2 | 0 | 0.4 (0.0-0.8) | 0.7 (0.1-1.3) | 1.1 (0.4-1.8) | 1.1 (0.4-1.8) | 1.3 (0.5-2.1) | 1.9 (0.5-3.4) |
| Lubinus SPII | IP Cup X-Linked | 811 | 77 (73-81) | 14 | 3 | 1 | 4 | 6 | 0 | 1.5 (0.6-2.3) | 2.0 (0.9-3.1) | 2.0 (0.9-3.1) | n.a. | n.a. | n.a. |
| Twinsys stem Cemented | CCB cup Low Profile | 703 | 80 (76-84) | 7 | 1 | 2 | 3 | 0 | 1 | 0.6 (0.0-1.2) | 1.1 (0.2-2.0) | 1.4 (0.3-2.5) | 1.4 (0.3-2.5) | n.a. | n.a. |
| Spectron EF | Reflection All Poly | 615* | 77 (74-82) | 37 | 8 | 0 | 26 | 3 | 0 | 0.8 (0.1-1.5) | 1.8 (0.8-2.9) | 2.7 (1.4-4.0) | 3.5 (2.0-5.0) | 6.6 (4.4-8.8) | 7.3 (4.9-9.6) |
| Original ME Muller | Avantage Cemented | 551 | 78 (72-83) | 19 | 2 | 1 | 1 | 15 | 0 | 3.2 (1.6-4.7) | 3.7 (1.8-5.5) | 4.8 (2.0-7.5) | n.a. | n.a. | n.a. |
| Spectron EF | Muller low profile Durasul | 499 | 78 (74-83) | 9 | 3 | 0 | 1 | 5 | 0 | 0.8 (0.0-1.6) | 1.9 (0.6-3.3) | n.a. | n.a. | n.a. | n.a. |
| MS30 | Muller low profile | 496* | 78 (74-83) | 15 | 0 | 8 | 6 | 1 | 0 | 0.8 (0.0-1.6) | 1.7 (0.5-2.8) | 2.6 (1.0-4.1) | 3.0 (1.3-4.7) | 5.5 (2.1-8.9) | n.a. |
| C-Stem AMT | Marathon | 467 | 81 (78-84) | 6 | 0 | 0 | 0 | 6 | 0 | 1.3 (0.3-2.4) | n.a. | n.a. | n.a. | n.a. | n.a. |
| Lubinus SPII | Avantage Cemented | 457 | 78 (71-83) | 13 | 4 | 0 | 1 | 8 | 0 | 2.1 (0.7-3.4) | 2.1 (0.7-3.4) | 4.0 (1.5-6.5) | 5.9 (1.4-10.4) | n.a. | n.a. |
| Stanmore | Apollo | 372* | 75 (70-80) | 6 | 3 | 1 | 1 | 0 | 1 | 0.3 (0.0-0.8) | 0.8 (0.0-1.8) | 1.4 (0.2-2.7) | 1.4 (0.2-2.7) | n.a. | n.a. |
| Stanmore | Avantage Cemented | 347 | 79 (74-84) | 10 | 0 | 1 | 0 | 9 | 0 | 2.7 (0.9-4.5) | 3.1 (1.2-5.0) | n.a. | n.a. | n.a. | n.a. |
| GHE-huftstiel | Huftpfanne | 271* | 75 (71-80) | 19 | 3 | 3 | 13 | 0 | 0 | 0.4 (0.0-1.1) | 1.9 (0.2-3.6) | 2.7 (0.7-4.7) | 4.9 (2.2-7.6) | 7.7 (4.1-11.4) | n.a. |
| Charnley Modular | Marathon | 255* | 71 (65-79) | 7 | 3 | 2 | 2 | 0 | 0 | 0.4 (0.0-1.2) | 1.2 (0.0-2.6) | 1.6 (0.0-3.2) | 3.0 (0.8-5.2) | n.a. | n.a. |

[1] Revision of at least the acetabulum or femur component.

* Denotes prosthesis combinations with no reported use in primary THAs in 2019.

Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.

**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*Uncemented primary THA*

**TABLE Cumulative major revision percentages of the most frequently used uncemented primary total hip arthroplasties by prosthesis component combination of patients who underwent a tha for osteoarthritis in the Netherlands in 2007-2019 (n=179,994)**

| | | | | | Type of revision (n) | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Femur component** | **Acetabulum component** | **Total primary THAs (n)** | **Median (IQR) age (yr)** | **Total RAs (n)** | **Total hip (complete revision)** | **Only femur component** | **Only acetabulum component** | **Only femoral head/inlay** | **Missing/ unknown** | **1yr** | **3yr** | **5yr** | **7yr** | **10yr** | **11yr** |
| **All uncemented THAs for osteoarthritis** | | **179,994** | **68 (61-74)** | **5,987** | **956** | **2,110** | **1,561** | **1,245** | **115** | **1.6 (1.6-1.7)** | **2.6 (2.6-2.7)** | **3.4 (3.3-3.5)** | **4.1 (3.9-4.2)** | **5.1 (4.9-5.3)** | **5.5 (5.3-5.7)** |
| Corail | Pinnacle | 30,397 | 69 (62-75) | 694 | 122 | 217 | 138 | 209 | 8 | 1.3 (1.2-1.4) | 2.0 (1.9-2.2) | 2.5 (2.3-2.7) | 3.0 (2.8-3.3) | 4.0 (3.6-4.5) | 4.5 (3.9-5.2) |
| Alloclassic Zweymuller SL | Allofit | 13,802 | 70 (64-76) | 418 | 68 | 158 | 99 | 88 | 5 | 1.2 (1.0-1.4) | 2.0 (1.8-2.2) | 2.6 (2.3-2.9) | 3.3 (2.9-3.6) | 42 (3.7-4.6) | 4.4 (3.9-4.8) |
| Taperloc Complete | Allofit | 11,781 | 68 (61-73) | 195 | 24 | 76 | 31 | 61 | 3 | 1.6 (1.3-1.8) | 2.3 (1.8-2.7) | 2.3 (1.8-2.7) | n.a. | n.a. | n.a. |
| CLS Spotorno | Allofit | 9,826 | 65 (59-69) | 387 | 43 | 156 | 96 | 75 | 17 | 2.5 (2.2-2.9) | 3.5 (3.1-3.9) | 4.0 (3.6-4.4) | 4.5 (4.0-4.9) | 5.1 (4.4-5.8) | 5.6 (4.6-6.7) |
| Taperloc Complete | Exceed ABT | 7,912 | 69 (63-75) | 159 | 26 | 63 | 28 | 38 | 4 | 1.5 (1.2-1.8) | 2.0 (1.7-2.4) | 2.3 (1.9-2.7) | 2.6 (2.1-3.2) | n.a. | n.a. |
| Accolade | Trident | 7,359 | 69 (62-76) | 258 | 34 | 138 | 36 | 48 | 2 | 1.5 (1.2-1.7) | 3.0 (2.6-3.4) | 4.0 (3.5-4.6) | 4.7 (4.1-5.3) | 6.0 (4.9-7.0) | 7.0 (5.1-9.0) |
| Mallory Head Stems | Mallory Head | 5,958 | 65 (60-69) | 192 | 25 | 24 | 73 | 64 | 6 | 1.4 (1.1-1.7) | 2.3 (1.9-2.7) | 2.8 (2.3-3.2) | 3.3 (2.8-3.8) | 3.9 (3.3-4.5) | 4.3 (3.6-5.0) |
| Polarstem | R3 | 5,102 | 69 (62-74) | 107 | 5 | 39 | 14 | 49 | 0 | 2.2 (1.7-2.6) | 2.7 (2.0-3.3) | 2.7 (2.0-3.3) | n.a. | n.a. | n.a. |
| Accolade | Trident Tritanium | 4,133 | 68 (62-74) | 85 | 5 | 34 | 15 | 31 | 0 | 1.0 (0.7-1.3) | 1.9 (1.4-2.3) | 2.6 (2.0-3.2) | 3.0 (2.3-3.7) | n.a. | n.a. |
| Taperloc Hip system | Exceed ABT | 3,825 | 68 (62-74) | 110 | 17 | 31 | 30 | 24 | 8 | 1.2 (0.9-1.6) | 2.3 (1.8-2.8) | 2.7 (2.2-3.3) | 2.9 (2.4-3.5) | 3.3 (2.6-4.0) | n.a. |
| SL Plus | Bicon Plus | 3,687 | 70 (64-76) | 208 | 32 | 103 | 55 | 16 | 2 | 1.7 (1.3-2.1) | 3.9 (3.3-4.6) | 5.1 (4.4-5.8) | 6.0 (5.1-6.8) | 7.1 (6.1-8.1) | 7.1 (6.1-8.1) |
| Taperloc Hip system | Mallory Head | 3,651* | 67 (61-71) | 122 | 22 | 37 | 43 | 19 | 1 | 1.5 (1.1-1.9) | 2.5 (2.0-3.0) | 2.9 (2.3-3.4) | 3.6 (2.9-4.3) | 4.0 (3.2-4.8) | 4.4 (3.4-5.3) |
| Twinsys stem Cementless | RM Pressfit Vitamys cup | 3,277 | 66 (60-71) | 78 | 10 | 36 | 18 | 12 | 2 | 1.4 (1.0-1.8) | 2.2 (1.7-2.7) | 2.9 (2.1-3.4) | 2.9 (2.2-3.6) | 5.0 (3.1-6.9) | n.a. |
| Taperloc Complete | Mallory Head | 3,061 | 67 (61-73) | 104 | 15 | 23 | 29 | 36 | 1 | 2.1 (1.6-2.6) | 3.2 (2.5-3.8) | 3.4 (2.7-4.0) | 4.5 (3.3-5.7) | n.a. | n.a. |
| Twinsys stem Cementless | RM Pressfit cup | 2,982 | 73 (96-79) | 95 | 13 | 43 | 20 | 18 | 1 | 2.4 (1.9-3.0) | 3.0 (2.4-3.6) | 3.3 (2.6-4.0) | 4.2 (3.2-5.2) | n.a. | n.a. |
| Synergy | Reflection | 2,912* | 66 (60-72) | 119 | 10 | 59 | 22 | 27 | 1 | 2.2 (1.6-2.7) | 2.7 (2.1-3.3) | 3.1 (2.5-3.8) | 3.6 (2.9-4.3) | 4.5 (3.6-5.3) | 5.0 (3.9-6.0) |
| Alloclassic Zweymuller SL | Alloclassic Zweymuller CSF | 2,890* | 69 (63-75) | 116 | 15 | 45 | 19 | 35 | 2 | 1.3 (0.9-1.7) | 2.7 (2.1-3.3) | 3.4 (2.7-4.0) | 3.7 (3.0-4.4) | 4.4 (3.6-5.2) | 4.5 (3.6-5.3) |
| Alloclassic offset | Allofit | 2,485 | 71 (64-77) | 70 | 15 | 24 | 14 | 14 | 3 | 1.4 (0.9-1.9) | 2.1 (1.5-2.7) | 2.8 (2.1-3.5) | 3.3 (2.5-4.1) | 3.8 (2.8-4.7) | 4.1 (2.9-5.2) |
| Symax | Trident | 2,066* | 69 (63-75) | 65 | 5 | 15 | 17 | 28 | 0 | 0.6 (0.3-1.0) | 1.7 (1.1-2.2) | 2.2 (1.6-2.9) | 2.8 (2.1-3.5) | 3.3 (2.5-4.1) | 3.6 (2.7-4.6) |
| Synergy | R3 | 2,053* | 66 (59-72) | 55 | 7 | 31 | 8 | 7 | 2 | 1.8 (1.2-2.4) | 2.3 (1.6-2.9) | 2.6 (1.9-3.3) | 3.1 (2.2-3.9) | n.a. | n.a. |
| Symax | Trident Tritanium | 1,738* | 67 (61-73) | 76 | 8 | 35 | 21 | 11 | 1 | 2.3 (1.6-3.0) | 3.6 (2.7-4.5) | 4.1 (3.1-5.0) | 4.5 (3.5-5.5) | n.a. | n.a. |
| M/L Taper | Allofit IT | 1,731 | 71 (65-76) | 58 | 7 | 26 | 16 | 8 | 1 | 2.2 (1.5-2.9) | 3.1 (2.2-3.9) | 3.7 (2.7-4.7) | 4.2 (3.0-5.4) | n.a. | n.a. |
| Anthology | R3 | 1,635 | 65 (60-69) | 51 | 8 | 19 | 10 | 14 | 0 | 2.3 (1.5-3.0) | 3.0 (2.1-3.8) | 3.7 (2.6-4.7) | 3.7 (2.6-4.7) | 3.7 (2.6-4.7) | n.a. |
| Mallory Head Stems | Exceed ABT | 1,630* | 65 (59-71) | 33 | 3 | 13 | 15 | 2 | 0 | 0.7 (0.3-1.2) | 1.5 (0.9-2.1) | 1.6 (1.0-2.2) | 2.0 (1.3-2.7) | 2.3 (1.5-3.1) | n.a. |
| Omnifit HA | Trident | 1,494* | 63 (57-67) | 134 | 15 | 64 | 22 | 29 | 4 | 3.2 (2.3-4.1) | 4.6 (3.6-5.7) | 6.3 (5.1-7.6) | 7.8 (6.4-9.2) | 9.6 (8.0-11.2) | 9.6 (8.0-11.2) |
| CLS Spotorno | RM Classic cup | 1,169* | 63 (58-68) | 66 | 14 | 17 | 27 | 7 | 1 | 1.9 (1.1-2.7) | 2.7 (1.7-3.6) | 3.4 (2.3-4.4) | 4.1 (2.9-5.2) | 5.5 (4.1-6.9) | 6.3 (4.7-7.8) |
| CLS Spotorno | Pinnacle | 1,148 | 67 (62-72) | 43 | 7 | 15 | 7 | 14 | 0 | 1.3 (0.7-2.0) | 2.3 (1.4-3.1) | 2.9 (1.8-3.9) | 3.9 (2.6-5.3) | 5.8 (3.8-7.8) | 6.7 (4.0-9.3) |
| Alloclassic Zweymuller SL | Continuum | 1,124 | 70 (64-77) | 22 | 4 | 10 | 3 | 4 | 1 | 0.9 (0.3-1.5) | 1.6 (0.8-2.4) | 2.0 (1.1-2.8) | 2.1 (1.2-3.0) | n.a. | n.a. |
| SL Plus Mia | R3 | 1,106 | 71 (65-77) | 31 | 3 | 15 | 5 | 8 | 0 | 2.0 (1.2-2.8) | 2.7 (1.7-3.7) | 3.1 (2.0-4.2) | 3.1 (2.0-4.2) | n.a. | n.a. |
| SL Plus | Reflection | 1,020* | 67 (61-73) | 36 | 4 | 10 | 13 | 9 | 1 | 1.9 (1.0-2.7) | 3.3 (2.2-4.4) | 3.5 (2.4-4.7) | 3.9 (2.5-5.2) | n.a. | n.a. |
| SL Plus | Hofer-Imhoff Lubrimet | 968* | 70 (64-76) | 50 | 13 | 24 | 6 | 5 | 2 | 1.4 (0.6-2.1) | 2.3 (1.4-3.2) | 3.5 (2.3-4.7) | 4.5 (3.2-5.8) | 5.4 (3.9-6.8) | 5.6 (4.1-7.2) |
| Polarstem | Reflection | 921 | 70 (64-76) | 16 | 4 | 4 | 2 | 6 | 0 | 1.1 (0.4-1.8) | 1.9 (0.9-2.9) | 2.4 (1.0-3.8) | n.a. | n.a. | n.a. |
| M/L Taper | Continuum | 872 | 68 (63-75) | 10 | 0 | 9 | 0 | 1 | 0 | 1.1 (0.4-1.8) | 1.4 (0.5-2.2) | n.a. | n.a. | n.a. | n.a. |
| Accolade II | Trident | 842 | 69 (62-75) | 17 | 0 | 9 | 1 | 7 | 0 | 2.4 (1.2-3.6) | 4.0 (0.7-7.3) | 4.0 (0.7-7.3) | n.a. | n.a. | n.a. |
| Alloclassic Zweymuller SL | Trilogy | 822* | 70 (64-76) | 31 | 7 | 10 | 7 | 7 | 0 | 1.3 (0.6-2.1) | 2.2 (1.2-3.2) | 2.7 (1.6-3.8) | 3.1 (1.9-4.3) | 4.2 (2.7-5.7) | 4.2 (2.7-5.7) |
| SL Plus | EP-Fit Plus | 781* | 68 (63-75) | 41 | 10 | 20 | 10 | 1 | 0 | 1.4 (0.6-2.3) | 3.1 (1.9-4.4) | 3.7 (2.3-5.0) | 48 (3.3-6.4) | 5.9 (4.0-7.7) | 6.5 (4.3-8.8) |
| Alloclassic Zweymuller SL | Alloclassic Variall | 766* | 71 (64-77) | 21 | 4 | 9 | 2 | 5 | 1 | 1.2 (0.4-1.9) | 2.0 (1.0-3.0) | 2.4 (1.3-3.5) | 2.7 (1.5-3.9) | 3.0 (1.7 (4.2) | 3.0 (1.7-4.2) |
| CLS Spotorno | Fitmore | 754* | 66 (61-71) | 33 | 3 | 14 | 5 | 10 | 1 | 1.7 (0.8-2.7) | 2.3 (1.2-3.3) | 2.7 (1.5-3.8) | 3.2 (2.0-4.5) | 4.6 (3.0-6.3) | 4.9 (3.2-6.6) |
| DB10 | Spidercup | 748* | 71 (64-77) | 32 | 2 | 14 | 8 | 7 | 1 | 1.8 (0.8-2.7) | 2.3 (1.2-3.4) | 3.0 (1.8-4.3) | 3.9 (2.4-5.2) | 4.6 (2.8-6.4) | 6.2 (3.3-9.0) |
| CLS Spotorno | Morscher | 711 | 73 (68-78) | 35 | 5 | 18 | 12 | 0 | 0 | 1.4 (0.5-2.3) | 2.6 (1.4-3.8) | 3.3 (1.9-4.6) | 4.5 (2.8-6.1) | 6.7 (4.3-9.1) | 6.7 (4.3-9.1) |
| Corail AMT | Pinnacle | 686 | 68 (61-74) | 9 | 0 | 3 | 3 | 3 | 0 | 1.2 (0.4-2.1) | 1.5 (0.5-2.6) | n.a. | n.a. | n.a. | n.a. |
| CLS Spotorno | RM Pressfit cup | 623 | 66 (60-71) | 45 | 5 | 17 | 15 | 5 | 3 | 3.1 (1.7-4.4) | 4.8 (3.1-6.5) | 5.8 (3.9-7.6) | 6.4 (4.4-8.3) | 7.9 (5.5-10.2) | 8.3 (5.8-10.7) |
| CBH stem | RM Pressfit Vitamys cup | 590 | 65 (60-70) | 20 | 8 | 4 | 6 | 2 | 0 | 1.2 (0.3-2.1) | 2.4 (1.2-3.6) | 3.5 (2.1-5.1) | 3.5 (2.1-5.1) | n.a. | n.a. |
| Alloclassic Zweymuller SL | Trabecular Metal | 548* | 68 (62-75) | 20 | 1 | 6 | 6 | 6 | 1 | 0.7 (0.0-1.4) | 1.8 (0.7-3.0) | 2.6 (1.3-3.9) | 3.4 (1.8-4.9) | 3.4 (1.8-4.9) | 3.4 (1.8-4.9) |
| CBH stem | RM Pressfit cup | 546 | 75 (69-79) | 21 | 4 | 6 | 9 | 2 | 0 | 2.4 (1.1-3.7) | 3.4 (1.8-4.9) | 3.6 (2.0-5.2) | 4.3 (2.4-6.1) | n.a. | n.a. |

[1] Revision of at least the acetabulum or femur component.

Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.

**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*Bone cement*

## TABLE Cumulative revision percentages of the most frequently types of bone cement by type of mixing system in 2019, in primary total hip arthroplasties in the Netherlands in 2007-2019

| | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|
| **Bone cement** | **n** | **1yr** | **3yr** | **5yr** | **7yr** | **10yr** | **11yr** |
| Separately packed bone cement components (n=81,999) | | | | | | | |
| Palacos R+G | 62,615 | 1.5 (1.4-1.6) | 2.4 (2.3-2.5) | 3.0 (2.8-3.1) | 3.4 (3.3-3.6) | 4.2 (4.0-4.5) | 4.5 (4.2-4.8) |
| Palacos MV+G | 3,463 | 0.9 (0.6-1.2) | 1.5 (1.0-1.9) | 2.1 (1.6-2.7) | 3.4 (2.6-4.3) | n.a. | n.a. |
| Refobacin Bone Cement R | 5,827 | 0.9 (0.6-1.1) | 1.7 (1.3-2.0) | 2.0 (1.7-2.4) | 2.6 (2.1-3.0) | 3.2 (2.6-3.8) | 3.3 (2.7-4.0) |
| Simplex ABC EC | 2,635 | 2.4 (1.8-2.9) | 3.5 (2.8-4.3) | 4.4 (3.6-5.3) | 5.2 (4.2-6.2) | 7.5 (5.6-9.3) | 7.9 (5.9-10.0) |
| Subiton G | 27 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Bone cement pre-packed in a vacuum mixing system (n=22,650) | | | | | | | |
| Palacos R+G | 6,651 | 2.1 (1.8-2.5) | 2.8 (2.3-3.3) | 3.6 (2.4-4.8) | n.a. | n.a. | n.a. |
| Refobacin Bone Cement R | 11,757 | 2.0 (1.7-2.3) | 2.8 (2.5-3.1) | 3.4 (3.0-3.8) | 4.0 (3.5-4.5) | n.a. | n.a. |
| Refobacin Plus Bone Cement | 3,731 | 1.0 (0.7-1.4) | 1.9 (1.4-2.3) | 2.3 (1.7-2.8) | 2.8 (2.1-3.4) | 2.9 (2.2-3.6) | 2.9 (2.2-3.6) |

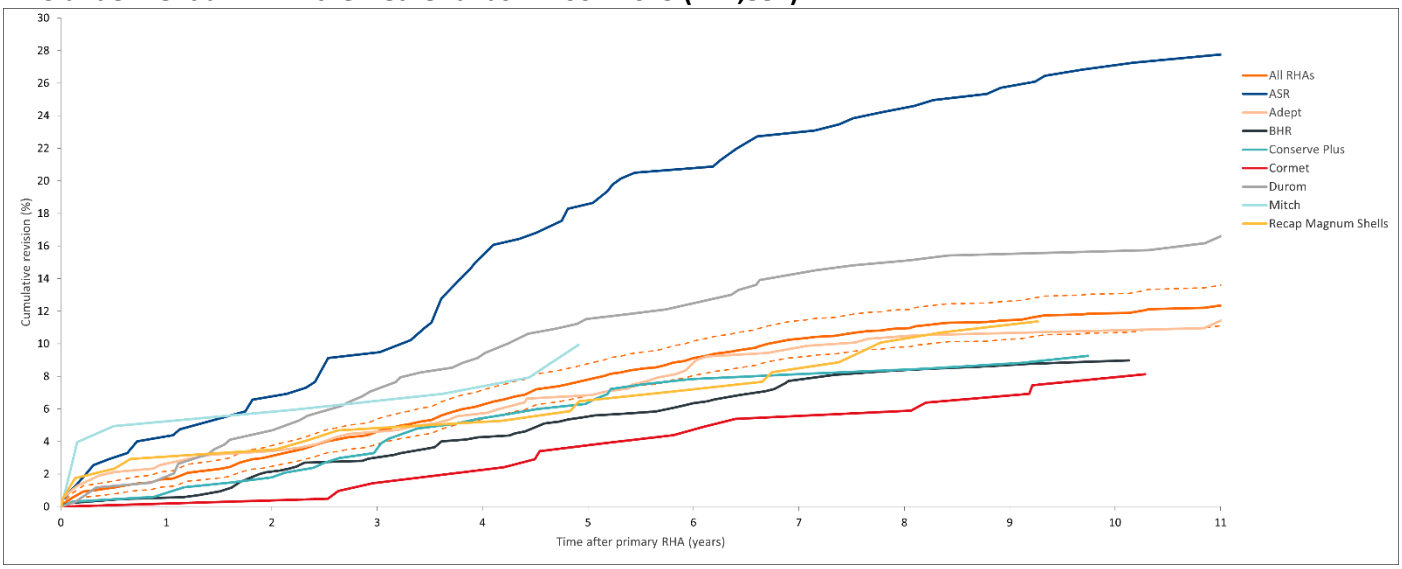
Please note: Revision is defined as any change (insertion, replacement and/or removal) of one or more components of the prosthesis.
n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*Resurfacing hip arthroplasty*

## FIGURE Cumulative revision percentages of primary resurfacing hip arthroplasties by type of prosthesis of patients who underwent a RHA in the Netherlands in 2007-2019 (n=2,887)




## TABLE Cumulative revision percentages of primary resurfacing hip arthroplasties by type of prosthesis

| | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Type of prosthesis** | **Total primary RHAs (n)** | **Median (IQR) age (yr)** | **Total RAs (n)** | **1yr** | **3yr** | **5yr** | **7yr** | **10yr** | **11yr** |
| **All resurfacing hip arthroplasties** | **2,887** | **54 (49-59)** | **346** | **1.7 (1.2-2.1)** | **4.4 (3.7-5.2)** | **7.7 (6.7-8.6)** | **10.2 (9.1-11.4)** | **11.8 (10.6-13.0)** | **12.2 (11.0-13.4)** |
| Adept | 471 | 54 (48-59) | 53 | 2.6 (1.1-4.0) | 4.5 (2.6-6.3) | 6.6 (4.4-8.9) | 9.4 (6.8-12.1) | 10.5 (7.7-13.3) | 11.0 (8.1-13.9) |
| ASR | 274 | 53 (47-56) | 75 | 4.0 (1.7-6.3) | 9.1 (5.7-12.5) | 18.3 (13.7-22.9) | 22.7 (17.7-27.7) | 26.8 (21.6-32.1) | 27.3 (22.0-32.5) |
| BHR | 853 | 54 (48-58) | 75 | 0.5 (0.0-0.9) | 2.9 (1.8-4.1) | 5.5 (3.9-7.0) | 7.7 (5.6-9.5) | 8.8 (6.8-10.7) | 9.0 (7.0-11.0) |
| Conserve Plus | 338 | 55 (50-60) | 30 | 0.6 (0.0-1.4) | 3.3 (1.4-5.2) | 6.3 (3.7-8.9) | 7.8 (4.9-10.7) | 9.3 (6.1-12.4) | 9.3 (6.1-12.4) |
| Cormet | 212 | 58 (51-61) | 16 | 0.0 (0.0-0.0) | 1.4 (0.0-3.1) | 3.4 (0.9-5.9) | 5.4 (2.3-8.5) | 7.5 (3.8-11.1) | 8.1 (4.3-12.0) |
| Durom | 341 | 54 (50-59) | 55 | 1.5 (0.2-2.7) | 7.1 (4.3-9.8) | 11.5 (8.1-14.9) | 13.9 (10.2-17.6) | 15.4 (11.6-19.3) | 16.2 (12.2-20.1) |
| Mitch | 101 | 57 (51-61) | 10 | 5.0 (0.7-9.2) | 5.9 (1.3-10.5) | 9.9 (4.1-15.8) | 9.9 (4.1-15.8) | 9.9 (4.1-15.8) | n.a. |
| Recap Magnum Shells | 171 | 55 (49-59) | 19 | 2.9 (0.4-5.4) | 4.7 (1.5-7.8) | 6.5 (2.8-10.1) | 8.3 (4.1-12.4) | 11.4 (6.6-16.2) | 11.4 (6.6-16.2) |

Please note: n.a. if <50 cases were at risk; RHA: resurfacing hip arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

## Major revision per component

### *Cemented primary THA*

**TABLE Cumulative major revision percentages of the most frequently used cemented primary total hip arthroplasties by prosthesis component combination of patients who underwent a tha for osteoarthritis in the Netherlands in 2007-2019 (n=74,095)**

| | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Femur component | Acetabulum component | Total primary THAs (n) | Median (IQR) age (yr) | Major revision[1] arthroplasties (n) | 1yr | 3yr | 5yr | 7yr | 10yr | 11yr |
| **All cemented THAs for osteoarthritis** | | **74,095** | **76 (71-80)** | **1,362** | **0.7 (0.6-0.7)** | **1.3 (1.2-1.4)** | **1.8 (1.7-1.9)** | **2.2 (2.1-2.3)** | **2.9 (2.7-3.1)** | **3.2 (3.0-3.4)** |
| Lubinus SPII | IP Cup | 12,470 | 76 (71-80) | 216 | 0.5 (0.4-0.7) | 1.3 (1.1-1.5) | 1.8 (1.6-2.1) | 2.1 (1.8-2.4) | 2.7 (2.2-3.2) | 3.2 (2.5-3.8) |
| Original ME Muller | Muller low profile Durasul | 6,832 | 74 (69-79) | 53 | 0.3 (0.2-0.5) | 0.6 (0.4-0.8) | 1.0 (0.7-1.3) | 1.1 (0.8-1.5) | 1.5 (1.0-2.0) | 1.5 (1.0-2.0) |
| Original ME Muller | Muller low profile | 5,953 | 77 (73-81) | 100 | 0.9 (0.6-1.1) | 1.6 (1.2-1.9) | 1.8 (1.4-2.1) | 1.9 (1.5-2.3) | 1.9 (1.5-2.3) | 2.4 (1.7-3.1) |
| Lubinus SPII | FAL Cup | 4,991 | 75 (70-80) | 91 | 0.7 (0.5-1.0) | 1.5 (1.1-1.8) | 2.2 (1.7-2.7) | 2.9 (2.2-3.6) | 3.5 (2.6-4.3) | 3.5 (2.6-4.3) |
| Spectron EF | Reflection All Poly XLPE | 4,634 | 77 (73-81) | 77 | 0.4 (0.2-0.6) | 1.1 (0.8-1.4) | 1.4 (1.1-1.8) | 2.1 (1.6-2.6) | 2.3 (1.8-2.9) | 2.5 (1.9-3.2) |
| Exeter | Exeter Rimfit X3 | 3,917 | 75 (69-80) | 54 | 0.9 (0.6-1.2) | 1.3 (0.9-1.7) | 1.8 (1.3-2.3) | 1.8 (1.3-2.3) | n.a. | n.a. |
| Stanmore | Stanmore | 3,344 | 75 (70-80) | 62 | 0.6 (0.3-0.9) | 1.3 (0.9-1.7) | 1.7 (1.3-2.2) | 2.0 (1.4-2.5) | 2.5 (1.8-3.2) | 2.5 (1.8-3.2) |
| Exeter | Exeter Contemporary Hooded | 2,807 | 77 (72-81) | 64 | 0.8 (0.4-1.1) | 1.2 (0.8-1.6) | 1.7 (1.1-2.2) | 2.2 (1.5-2.8) | 3.7 (2.7-4.6) | 3.8 (2.8-4.9) |
| Lubinus SPII | SHP | 2,491* | 75 (71-80) | 41 | 0.3 (0.1-0.5) | 0.7 (0.3-1.0) | 1.0 (0.6-1.4) | 1.6 (1.1-2.1) | 2.0 (1.4-2.6) | 2.0 (1.4-2.6) |
| Exeter | Exeter | 2,432* | 73 (68-79) | 90 | 1.7 (1.1-2.2) | 2.3 (1.7-2.9) | 2.9 (2.2-3.5) | 3.5 (2.7-4.3) | 4.5 (3.5-5.5) | 4.7 (3.7-5.8) |

[1] Revision of at least the acetabulum or femur component.
* Denotes prosthesis combinations with no reported use in primary THAs in 2019.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

### *Uncemented primary THA*

**TABLE Cumulative major revision percentages of the most frequently used uncemented primary total hip arthroplasties by prosthesis component combination of patients who underwent a tha for osteoarthritis in the Netherlands in 2007-2019 (n=179,994)**

| | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Femur component | Acetabulum component | Total primary THAs (n) | Median (IQR) age (yr) | Major revision[1] arthroplasties (n) | 1yr | 3yr | 5yr | 7yr | 10yr | 11 yr |
| **All uncemented THAs for osteoarthritis** | | **179,994** | **68 (61-74)** | **4,627** | **1.2 (1.1-1.2)** | **2.0 (1.9-2.0)** | **2.6 (2.5-2.7)** | **3.2 (3.1-3.3)** | **4.1 (3.9-4.2)** | **4.4 (4.2-4.5)** |
| Corail | Pinnacle | 30,397 | 69 (62-75) | 477 | 0.8 (0.7-0.9) | 1.4 (1.2-1.5) | 1.7 (1.6-1.9) | 2.2 (1.9-2.4) | 2.9 (2.5-3.3) | 3.4 (2.8-4.1) |
| Alloclassic Zweymuller SL | Allofit | 13,802 | 70 (64-76) | 325 | 0.9 (0.7-1.0) | 1.5 (1.3-1.8) | 2.1 (1.8-2.3) | 2.5 (2.2-2.8) | 3.2 (2.8-3.6) | 3.4 (3.0-3.8) |
| Taperloc Complete | Allofit | 11,781 | 68 (61-73) | 131 | 1.0 (0.8-1.2) | 1.6 (1.2-2.0) | 1.6 (1.2-2.0) | n.a. | n.a. | n.a. |
| CLS Spotorno | Allofit | 9,826 | 65 (59-69) | 295 | 1.9 (1.6-2.1) | 2.6 (2.3-2.9) | 3.0 (2.6-3.4) | 3.5 (3.0-3.9) | 4.1 (3.4-4.8) | 4.6 (3.6-5.7) |
| Taperloc Complete | Exceed ABT | 7,912 | 69 (63-75) | 117 | 1.2 (0.9-1.4) | 1.5 (1.2-1.8) | 1.7 (1.3-2.0) | 2.0 (1.5-2.5) | n.a. | n.a. |
| Accolade | Trident | 7,359 | 69 (62-76) | 208 | 1.1 (0.9-1.4) | 2.4 (2.0-2.8) | 3.3 (2.8-3.8) | 3.8 (3.2-4.3) | 5.0 (4.0-6.1) | 5.8 (4.0-7.6) |
| Mallory Head Stems | Mallory Head | 5,958 | 65 (60-69) | 122 | 0.9 (0.6-1.1) | 1.4 (1.1-1.7) | 1.8 (1.5-2.2) | 2.2 (1.8-2.5) | 2.5 (2.0-3.0) | 2.6 (2.1-3.1) |
| Polarstem | R3 | 5,102 | 69 (62-74) | 58 | 1.1 (0.8-1.4) | 1.6 (1.1-2.1) | 1.6 (1.1-2.1) | n.a. | n.a. | n.a. |
| Accolade | Trident Tritanium | 4,133 | 68 (62-74) | 54 | 0.5 (0.3-0.8) | 1.2 (0.8-1.5) | 1.7 (1.2-2.2) | 2.0 (1.4-2.6) | n.a. | n.a. |
| Taperloc Hip system | Exceed ABT | 3,825 | 68 (62-74) | 78 | 0.9 (0.6-1.2) | 1.7 (1.3-2.1) | 2.0 (1.5-2.4) | 2.1 (1.6-2.5) | 2.4 (1.7-3.0) | n.a. |

[1] Revision of at least the acetabulum or femur component.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

## Rerevision

### *Overall second revision*

**FIGURE Cumulative second revision percentage of total hip arthroplasty after a one-stage first revision in the Netherlands in 2007-2019 (n=9,895)**

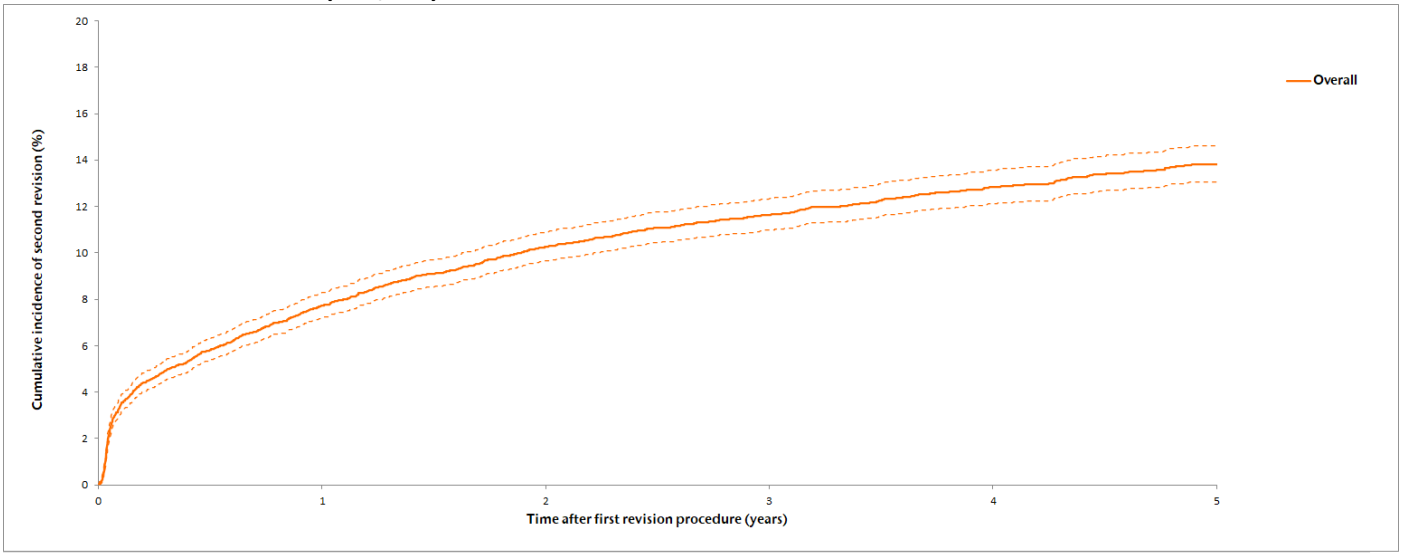



**TABLE Cumulative second revision percentage of total hip arthroplasty after a one-stage first revision in the Netherlands in 2007-2019 (n=9,895)**

| | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
|---|---|---|
| 1-year second revision (%) | 7.7 (7.2-8.3) | 7.8 (7.2-8.3) |
| 3-year second revision (%) | 11.6 (11.0-12.3) | 11.9 (11.2-12.6) |
| 5-year second revision (%) | 13.8 (13.1-14.6) | 14.3 (13.5-15.1) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis.
CI: confidence interval.

*By type of first revision*

**FIGURE Cumulative second revision percentage of total hip arthroplasty after a one-stage first revision by type of first revision in the Netherlands in 2007-2019 (n=9,895)**

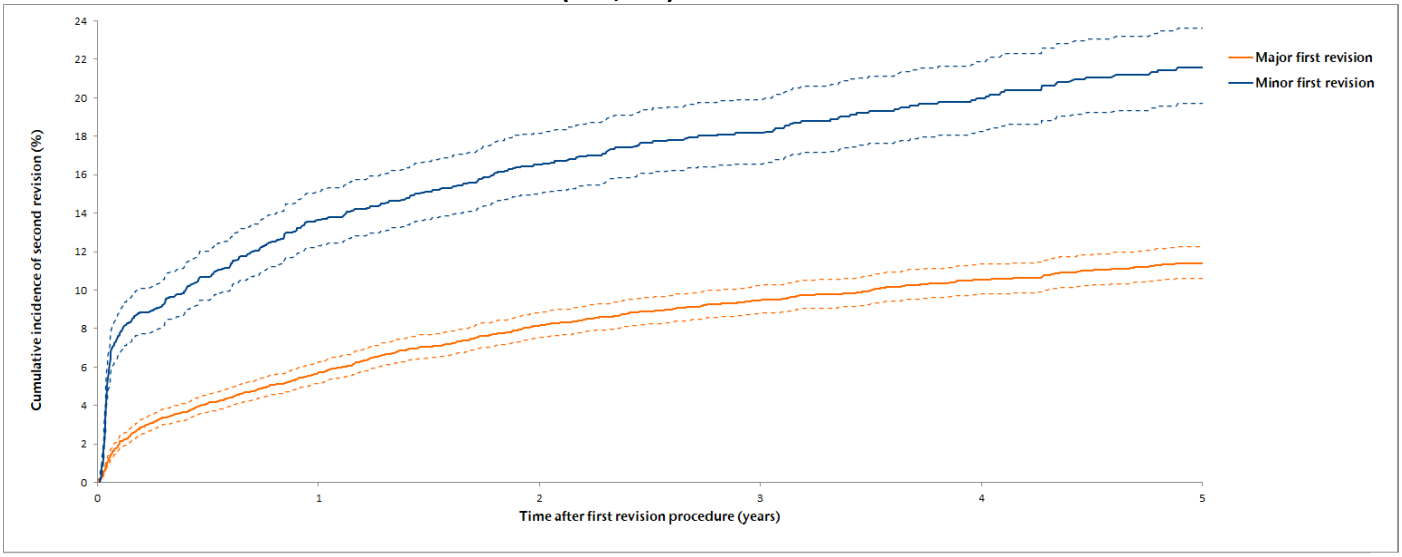



**TABLE Cumulative second revision percentage of total hip arthroplasty after a one-stage first revision by type of first revision in the Netherlands in 2007-2019 (n=9,895)**

| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
|---|---|---|---|
| **Major first revision** | 7,403 | | |
| 1-year second revision (%) | | 5.7 (5.2-6.3) | 5.8 (5.2-6.3) |
| 3-year second revision (%) | | 9.5 (8.8-10.2) | 9.7 (9.0-10.5) |
| 5-year second revision (%) | | 11.4 (10.6-12.2) | 11.9 (11.0-12.7) |
| **Minor first revision** | 2,312 | | |
| 1-year second revision (%) | | 13.7 (12.3-15.2) | 13.7 (12.3-15.2) |
| 3-year second revision (%) | | 18.2 (16.6-19.9) | 18.5 (16.8-20.2) |
| 5-year second revision (%) | | 21.6 (19.7-23.6) | 22.2 (20.2-24.3) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis.
Major revision: revision of at least the acetabulum or femur component.
Minor revision: only inlay and/or femoral head exchange (including DAIR procedures).
CI: confidence interval.

*By time to first revision*

**FIGURE Cumulative second revision percentage of total hip arthroplasty after a one-stage first revision by time to first revision in the Netherlands in 2007-2019 (n=8,301)**

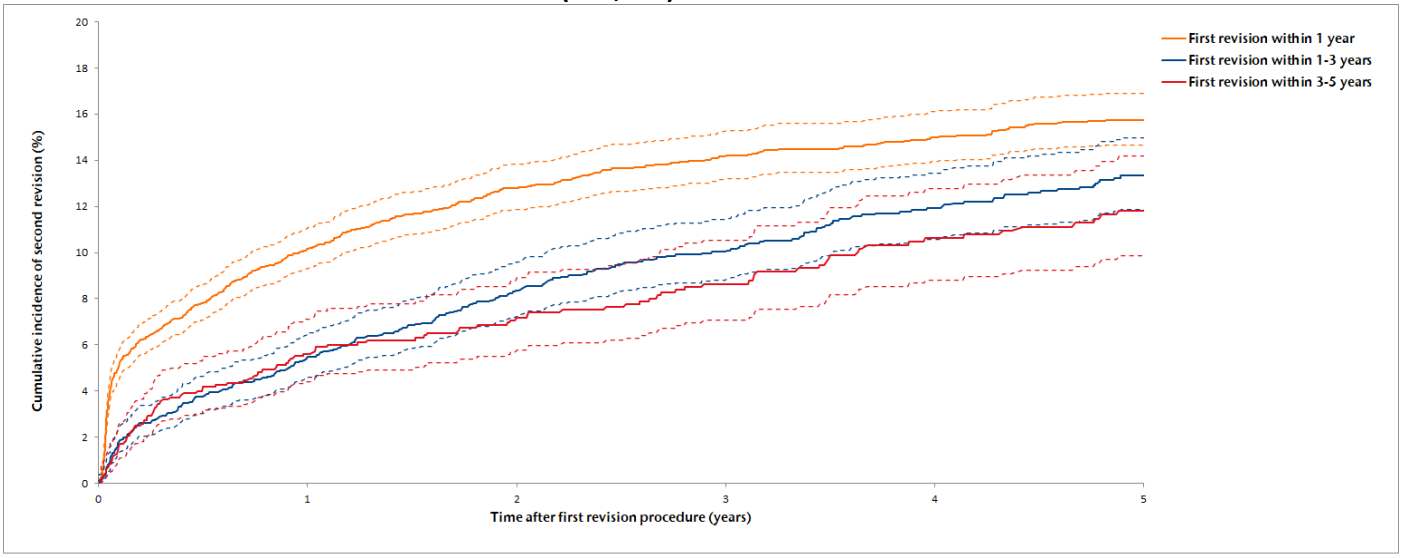



**TABLE Cumulative second revision percentage of total hip arthroplasty after a one-stage first revision by time to first revision in the Netherlands in 2007-2019 (n=8,301)**

| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
|---|---|---|---|
| **First revision within 1 year** | 4,837 | | |
| 1-year second revision (%) | | 10.2 (9.3-11.1) | 10.2 (9.3-11.1) |
| 3-year second revision (%) | | 14.2 (13.2-15.2) | 14.5 (13.4-15.5) |
| 5-year second revision (%) | | 15.7 (14.7-16.9) | 16.2 (15.0-17.4) |
| **First revision within 1-3 years** | 2,292 | | |
| 1-year second revision (%) | | 5.5 (4.6-6.5) | 5.4 (4.5-6.4) |
| 3-year second revision (%) | | 10.0 (8.8-11.4) | 10.2 (8.9-11.5) |
| 5-year second revision (%) | | 13.3 (11.9-15.0) | 13.7 (12.1-15.4) |
| **First revision within 3-5 years** | 1,172 | | |
| 1-year second revision (%) | | 5.6 (4.4-7.1) | 5.6 (4.3-7.0) |
| 3-year second revision (%) | | 8.6 (7.1-10.6) | 8.8 (7.0-10.5) |
| 5-year second revision (%) | | 11.8 (9.9-14.2) | 12.2 (10.0-14.4) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis.
CI: confidence interval.



*Reasons for seconds revision by type of first revision*

**TABLE Reasons for second revision within five years in patients who underwent a second revision after a one-stage first revision of a total hip arthroplasty by type of first revision in the Netherlands in 2007-2019**

| | Major first revision[1] (n=696) | Minor first revision[2] (n=417) | Any type of first revision[3] (n=1,144) |
|---|---|---|---|
| **Reasons for second revision** | **Proportion[4] (%)** | **Proportion[4] (%)** | **Proportion[4] (%)** |
| Infection | 28.4 | 54.4 | 38.8 |
| Dislocation | 28.7 | 30.7 | 28.8 |
| Loosening of acetabulum component | 20.7 | 4.8 | 14.3 |
| Loosening of femur component | 18.8 | 4.6 | 13.1 |
| Peri-prosthetic fracture | 9.3 | 1.7 | 6.5 |
| Inlay wear | 3.2 | 3.4 | 3.1 |
| Symptomatic MoM bearing | 1.4 | 0.5 | 1.1 |
| Peri-articular ossification | 1.3 | 0.2 | 0.9 |
| Other | 14.8 | 7.7 | 12.4 |

[1] Revision of at least the acetabulum or femur component.
[2] Only inlay and/or femoral head exchange (including DAIR procedures).
[3] Any type of revision includes minor and major revisions as well as revision procedures that could not be classified as minor or major revision.
4 One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis.

# PROMs

## Response 2014-2019

**FIGURE Pre-operative, 3 months and 12 months postoperative response percentage of patients who underwent a THA for osteoarthritis per pre-operative PROMs registering hospital (n=89) in the Netherlands in 2014-2019**

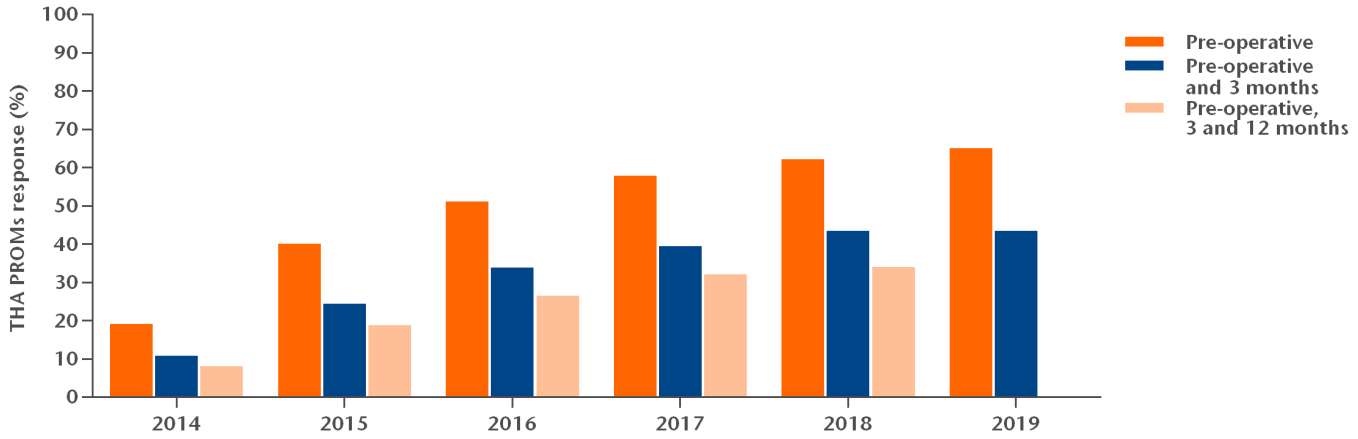



**TABLE Pre-operative, 3 months and 12 months postoperative response percentage of patients who underwent a THA for osteoarthritis per pre-operative PROMs registering hospital (n=89) in the Netherlands in 2014-2019**

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019[1] |
|---|---|---|---|---|---|---|
| **THA for osteoarthritis (n)** | 23,404 | 24,055 | 24,671 | 25,566 | 26,907 | 27,580 |
| **THA PROMs response (%)** | | | | | | |
| Pre-operative | 19.2 | 40.1 | 51.1 | 57.8 | 62.2 | 65.1 |
| Pre-operative and 3 months postoperative | 10.8 | 24.4 | 33.9 | 39.5 | 43.5 | 43.5 |
| Pre-operative, 3 and 12 months postoperative | 8.1 | 18.8 | 26.6 | 32.2 | 34.0 | n.a. |

[1] The 12 months postoperative PROMs response percentage is not (yet) available for 2019. The 3 months postoperative response percentage is not (yet) available after October 1st 2019. In total, 20,697 patients underwent a THA for osteoarthritis between January 1st and October 1st 2019.
THA: total hip arthroplasty; PROM: patient reported outcome measure.

## Mean scores (preoperative, 3 months and 12 months)

*NRS (rest)*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative NRS (rest) scores of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**

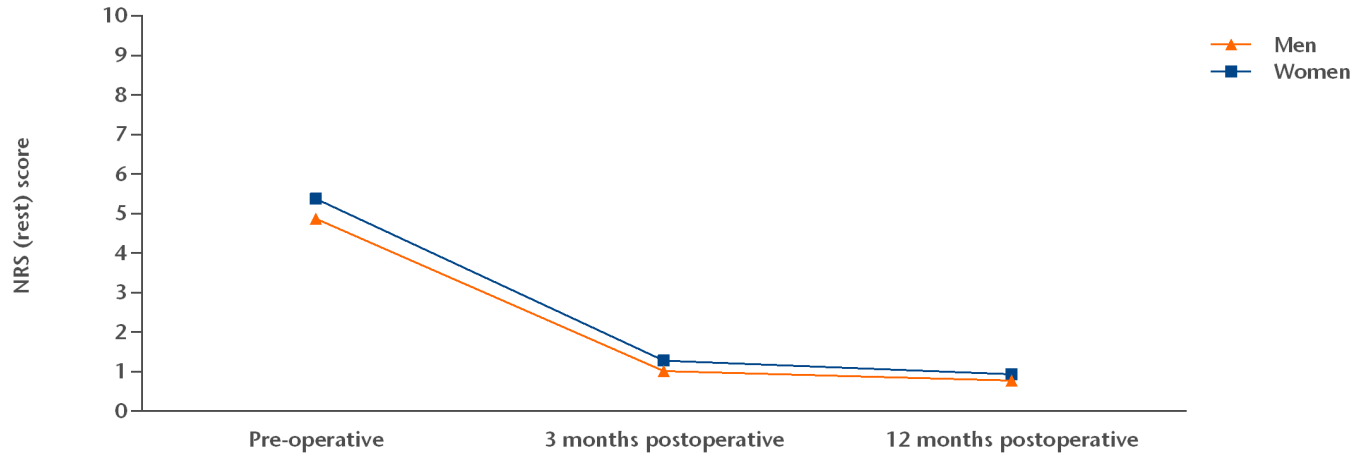



**TABLE Mean NRS (rest) scores**

| NRS (rest) score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 26,057 | 4.9 (4.8-4.9) | 19,866 | 1.0 (1.0-1.1) | 15,122 | 0.8 (0.8-0.8) |
| Women | 48,125 | 5.4 (5.4-5.4) | 35,111 | 1.3 (1.3-1.3) | 26,758 | 0.9 (0.9-1.0) |
| Total[2] | 74,210 | 5.2 (5.2-5.2) | 54,996 | 1.2 (1.2-1.2) | 41,896 | 0.9 (0.9-0.9) |

[1] The 12 months NRS (rest) score is not (yet) available for 2019.
[2] Also contains NRS (rest) scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The NRS (rest) score measures pain during rest. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain.**

*NRS (activity)*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative NRS (activity) scores of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**

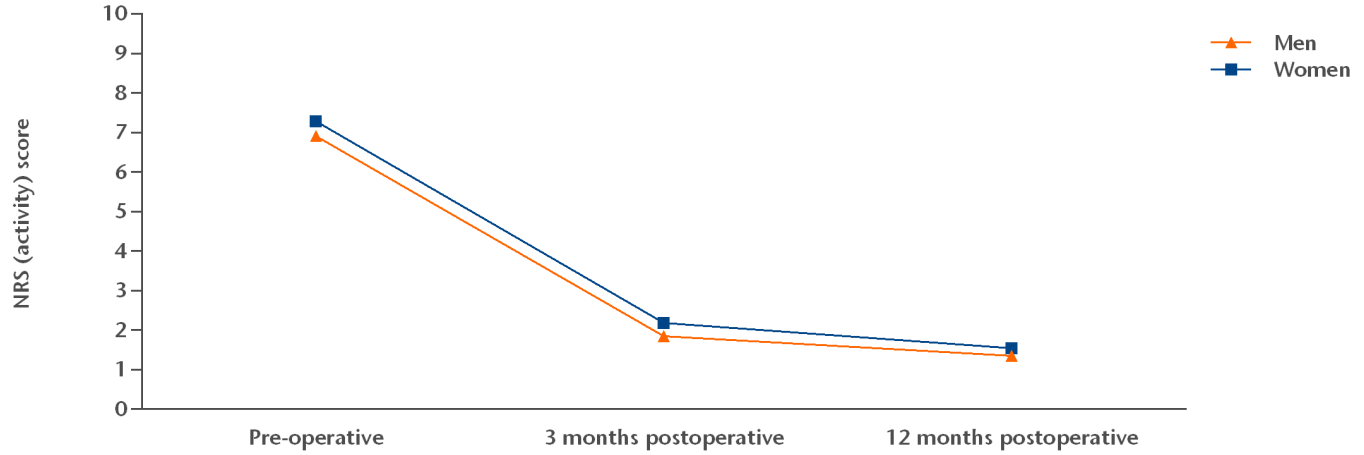



**TABLE Mean NRS (activity) scores**

| NRS (activity) score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 26,138 | 6.9 (6.9-7.0) | 19,887 | 1.9 (1.8-1.9) | 15,180 | 1.3 (1.3-1.4) |
| Women | 48,256 | 7.3 (7.3-7.3) | 35,141 | 2.2 (2.2-2.2) | 26,830 | 1.5 (1.5-1.6) |
| Total[2] | 74,422 | 7.2 (7.2-7.2) | 55,047 | 2.1 (2.1-2.1) | 42,026 | 1.5 (1.4-1.5) |

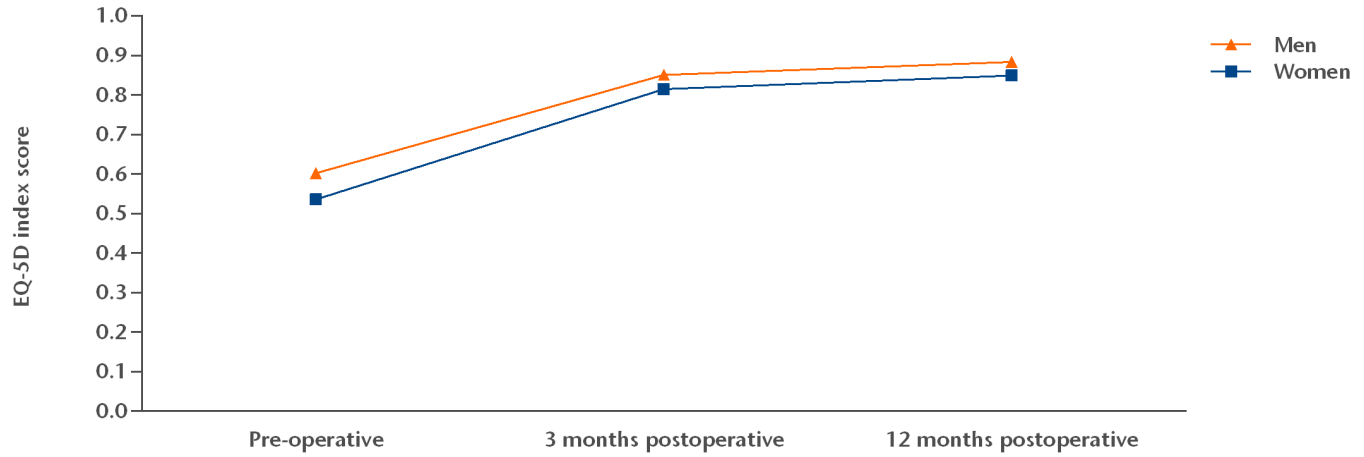
[1] The 12 months NRS (activity) score is not (yet) available for 2019.
[2] Also contains NRS (activity) scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The NRS (activity) score measures pain during activity. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain.**

*EQ5D index score*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative EQ-5D Index scores of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**




## TABLE Mean EQ5D index scores

| EQ-5D Index score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 26,265 | 0.60 (0.60-0.61) | 19,753 | 0.85 (0.85-0.85) | 15,198 | 0.88 (0.88-0.89) |
| Women | 48,431 | 0.54 (0.53-0.54) | 34,776 | 0.82 (0.82-0.82) | 26,778 | 0.85 (0.85-0.85) |
| Total[2] | 74,725 | 0.56 (0.56-0.56) | 55,548 | 0.83 (0.83-0.83) | 41,992 | 0.86 (0.86-0.86) |

[1] The 12 months EQ-5D index score is not (yet) available for 2019.
[2] Also contains EQ-5D index scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The EQ-5D index score measures quality of life. The score has a range of -0.329 to 1.0, with 1.0 representing the best possible quality of life.**

*EQ5D thermometer*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative EQ-5D thermometer scores of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**

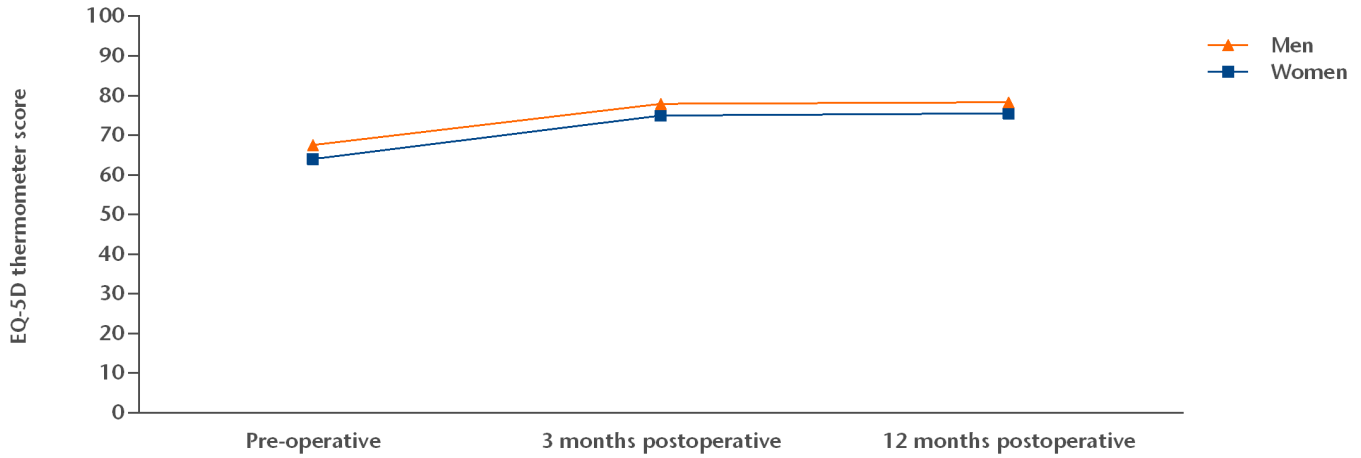



**TABLE Mean EQ5D thermometer scores**

| EQ-5D thermometer score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 26,379 | 67.3 (67.0-67.5) | 19,995 | 77.4 (77.2-77.7) | 15,513 | 77.9 (77.6-78.2) |
| Women | 48,553 | 63.8 (63.6-63.9) | 35,243 | 74.8 (74.6-75.0) | 27,238 | 75.1 (75.3-21.3) |
| Total[2] | 74,960 | 65.0 (64.9-65.1) | 55,257 | 75.7 (75.6-75.9) | 42,857 | 76.1 (75.9-76.3) |

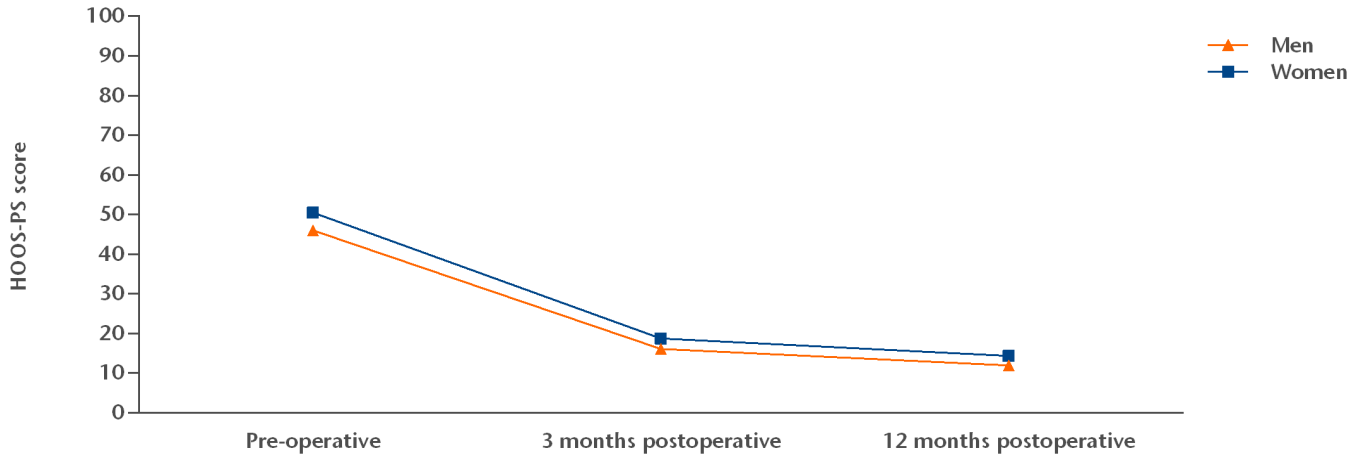
[1] The 12 months EQ-5D thermometer score is not (yet) available for 2019.
[2] Also contains EQ-5D thermometer scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The EQ-5D thermometer score measures the health situation. The score has a range of 0.0 to 100.0, with 0.0 representing the worst possible health situation and 100.0 the best possible health situation.**

*HOOS-PS score*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative HOOS-PS scores of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**




## TABLE Mean HOOS-PS scores

| HOOS-PS score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 25,327 | 46.0 (45.8-46.2) | 18,617 | 16.1 (15.9-16.3) | 14,553 | 11.9 (11.7-12.1) |
| Women | 45,541 | 50.4 (50.2-50.6) | 31,584 | 18.6 (18.5-18.8) | 24,587 | 14.3 (14.1-14.5) |
| Total[2] | 70,897 | 48.8 (48.7-49.0) | 50,220 | 17.7 (17.6-17.8) | 39,156 | 13.4 (13.3-13.5) |

[1] The 12 months HOOS-PS score is not (yet) available for 2019.
[2] Also contains HOOS-PS scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The HOOS-PS score measures the physical functioning of patients with osteoarthritis to the hip. The score has a range of 0.0 to 100.0, with 0.0 representing no effort and 100.0 the most possible effort.**

*Oxford Hip score*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative Oxford Hip scores of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**

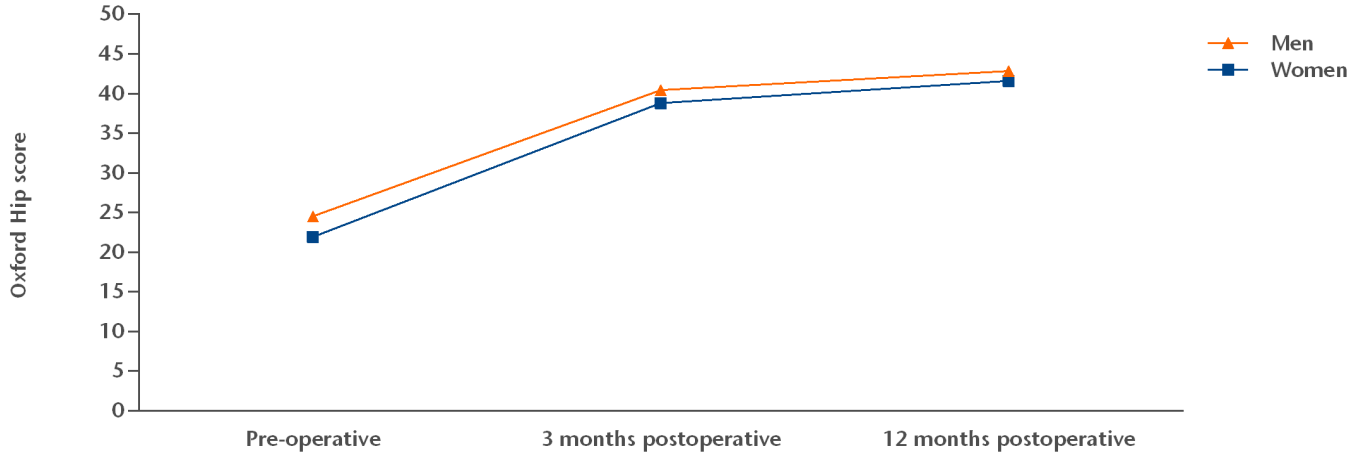



**TABLE Mean OHS scores**

| Oxford Hip score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 23,768 | 24.5 (24.4-24.6) | 17,917 | 40.4 (40.3-40.5) | 13,657 | 42.8 (42.7-42.9) |
| Women | 43,726 | 22.0 (21.9-22.1) | 31,205 | 38.8 (38.7-38.8) | 23,909 | 41.5 (41.4-41.6) |
| Total[2] | 67,520 | 22.9 (22.8-22.9) | 49,141 | 39.3 (39.3-39.4) | 37,580 | 42.0 (41.9-42.1) |

[1] The 12 months Oxford Hip score is not (yet) available for 2019.
[2] Also contains Oxford Hip scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The Oxford Hip score measures the physical functioning and pain of patients with osteoarthritis to the hip. The score has a range of 0.0 to 48.0, with 0.0 representing no functional ability and 48.0 the most functional ability.**

*Anchor question: Daily functioning*

**FIGURE Mean 3 months and 12 months postoperative Change in daily functioning of patients who underwent a THA for osteoarthritis by gender in the Netherlands in 2014-2019**

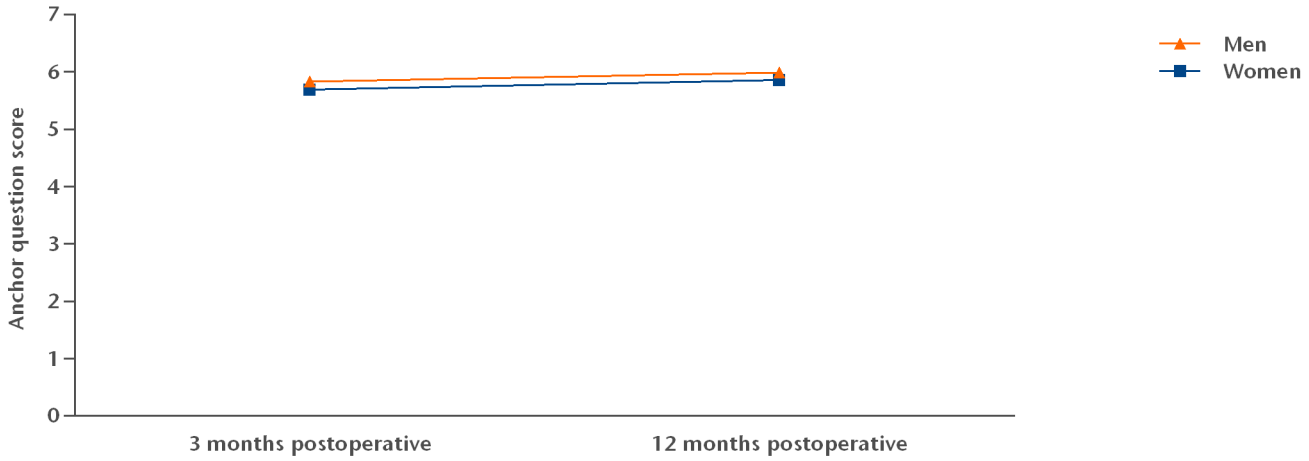



**TABLE Mean anchor question: Daily functioning**

| Anchor question score | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 18,702 | 5.8 (5.8-5.9) | 14,720 | 6.0 (6.0-6.0) |
| Women | 32,938 | 5.7 (5.7-5.7) | 26,028 | 5.9 (5.9-5.9) |
| Total[2] | 51,659 | 5.7 (5.7-5.8) | 40,764 | 5.9 (5.9-5.9) |

[1] The 12 months anchor question score is not (yet) available for 2019.
[2] Also contains anchor question scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.



**The anchor question measures change in daily functioning after joint replacement. The score has a range of 1.0 to 7.0, with 1.0 representing very deteriorated and 7.0 representing very improved.**

# Knee arthroplasty

## Numbers

### Registered procedures 2007-2019

**TABLE Number of registered knee arthroplasties per year of surgery (2007-2019) in the LROI in May 2019**

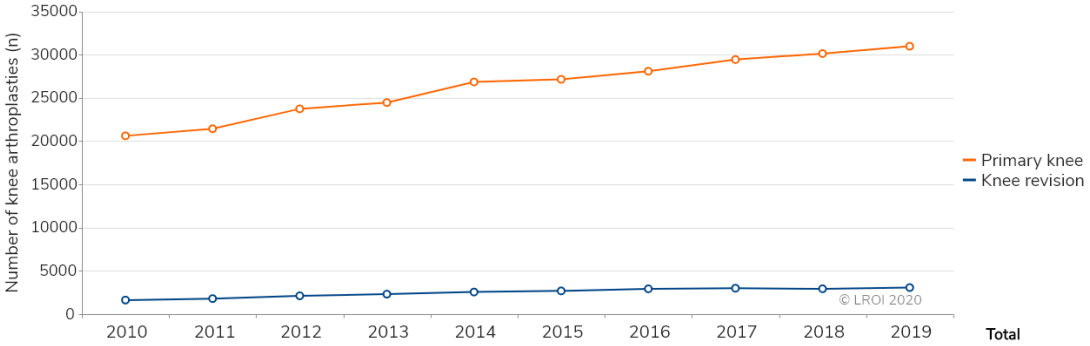
| Year of surgery | Type of knee arthroplasty: Total arthroplasty (n) | Unicondylar arthroplasty (n) | Patellofemoral arthroplasty (n) | Other (n) | Unknown/ missing (n) | Revision arthroplasty (n) | Total (n) |
|---|---|---|---|---|---|---|---|
| 2007 | 7,037 | 773 | 47 | 42 | 840 | 595 | 9,334 |
| 2008 | 11,749 | 1,212 | 92 | 61 | 353 | 908 | 14,375 |
| 2009 | 16,790 | 1,548 | 139 | 62 | 113 | 1,300 | 19,952 |
| 2010 | 18,509 | 1,717 | 143 | 78 | 163 | 1,624 | 22,234 |
| 2011 | 19,521 | 1,586 | 116 | 80 | 127 | 1,794 | 23,224 |
| 2012 | 21,718 | 1,578 | 172 | 91 | 172 | 2,116 | 25,847 |
| 2013 | 22,309 | 1,804 | 135 | 28 | 178 | 2,310 | 26,764 |
| 2014 | 24,243 | 2,364 | 116 | 26 | 92 | 2,557 | 29,398 |
| 2015 | 24,245 | 2,692 | 157 | 10 | 39 | 2,685 | 29,828 |
| 2016 | 24,887 | 2,947 | 144 | 5 | 94 | 2,926 | 31,003 |
| 2017 | 25,556 | 3,662 | 168 | 17 | 24 | 2,997 | 32,424 |
| 2018 | 25,843 | 4,073 | 183 | 10 | 14 | 2,931 | 33,054 |
| 2019 | 25,859 | 4,888 | 175 | 26 | 20 | 3,069 | 34,037 |
| Total | 268,266 | 30,844 | 1,787 | 536 | 2,229 | 27,812 | 331,474 |



**The LROI is nearly complete as of 2010. Therefore, a dotted line was inserted between 2009 and 2010.**

### Type of procedures 2010-2019

**FIGURE Number of primary knee arthroplasties and knee revision arthroplasties registered in the LROI in the Netherlands in 2010-2019**

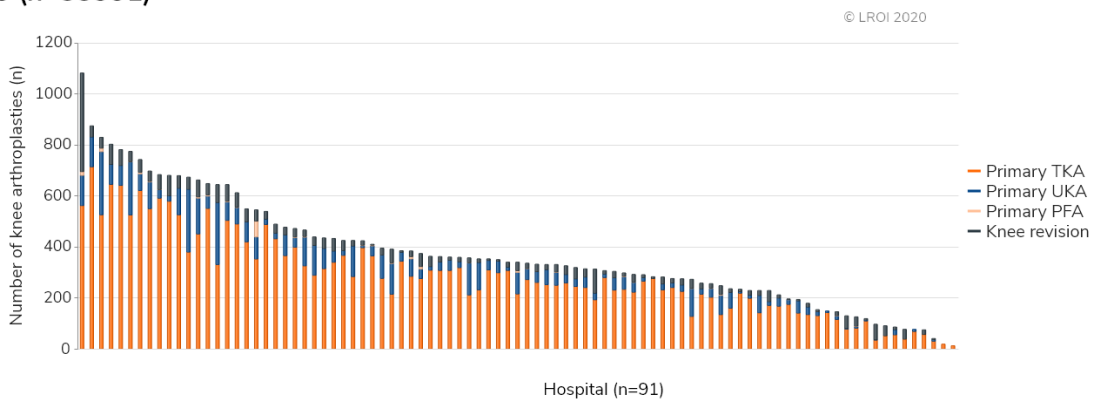



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type of procedure (n)** | | | | | | | | | | | |
| Primary knee | 20,610 | 21,430 | 23,731 | 24,454 | 26,841 | 27,143 | 28,077 | 29,427 | 30,123 | 30,968 | **262,804** |
| Knee revision | 1,624 | 1,794 | 2,116 | 2,310 | 2,557 | 2,685 | 2,926 | 2,997 | 2,931 | 3,069 | **25,009** |
| Total: | **22,234** | **23,224** | **25,847** | **26,764** | **29,398** | **29,828** | **31,003** | **32,424** | **33,054** | **34,037** | **287,813** |

**Out of 30,968 primary knee arthroplasties that were performed in 2019, 3% (n=981) was performed bilaterally.**

## Type of procedure per hospital

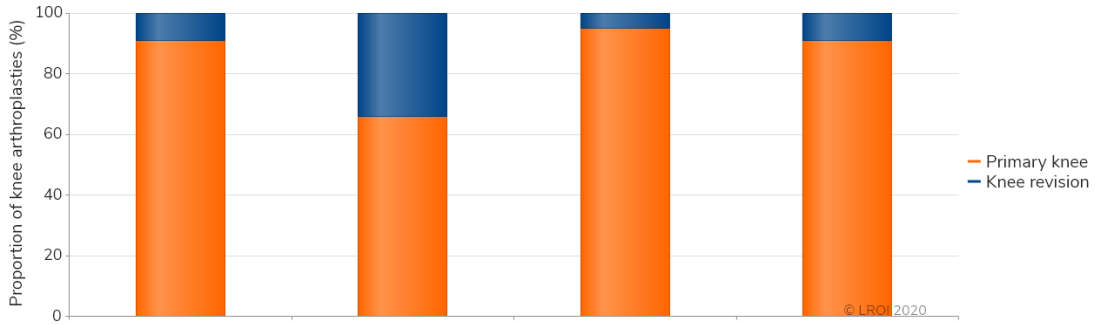
**FIGURE Number of primary knee arthroplasties and knee revision arthroplasties per hospital in the Netherlands in 2019 (n=33991)**




TKA: total knee arthroplasty; UKA: unicondylar knee arthroplasty; PKA: patellofemoral knee arthroplasty.

## Type of procedure by type of hospital

**FIGURE Primary knee arthroplasties and knee revision arthroplasties (proportion [%] per category) by type of hospital in the Netherlands in 2019**

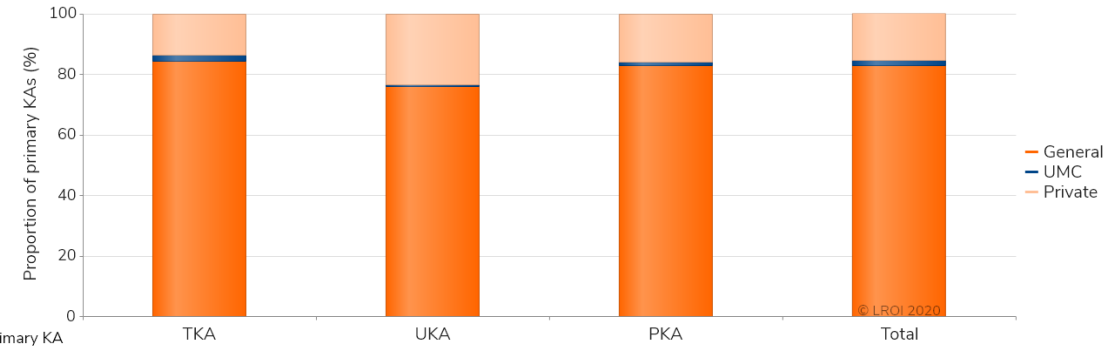



| Type of hospital | General | UMC | Private | Total |
|---|---|---|---|---|
| **Type of procedure (%)** | | | | |
| Primary knee | 91.03 | 65.94 | 94.88 | **90.98** |
| Knee revision | 8.97 | 34.06 | 5.12 | **9.02** |
| Total (n): | **28,208** | **831** | **4,998** | **34,037** |

Please note: In 2019, 67 general hospitals, 7 UMCs and 17 private hospitals performed knee arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.

## Type of primary knee prosthesis by type of hospital

### FIGURE Type of hospital (proportion [%] per catergory) by type of primary knee arthroplasty in the Netherlands in 2019

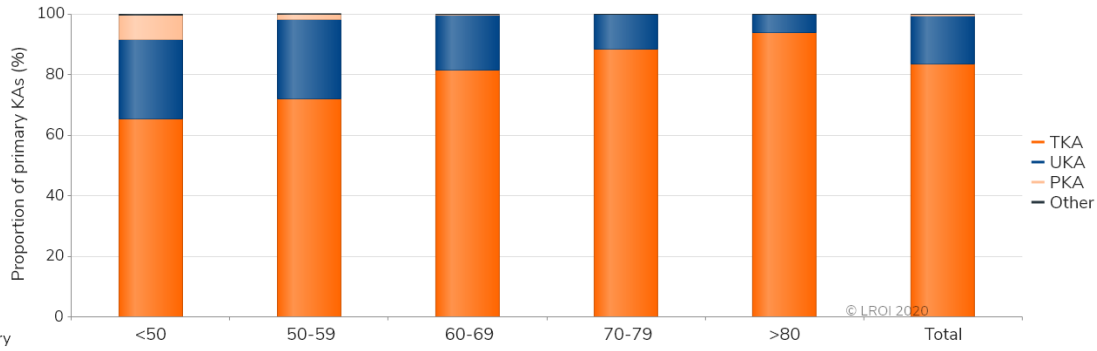



| Type of primary KA | TKA | UKA | PKA | Total |
|---|---|---|---|---|
| **Type of hospital (%)** | | | | |
| General | 84.30 | 76.00 | 82.86 | **82.98** |
| UMC | 1.96 | 0.53 | 1.14 | **1.73** |
| Private | 13.74 | 23.47 | 16.00 | **15.29** |
| Total (n): | **25,859** | **4,888** | **175** | 30,922 |

Please note: In 2019, 26 (0.08%) primary knee arthroplasties were registered in the LROI as other type of primary knee arthroplasty. Of 20 (0.06%) primary knee arthroplasties, the type of prosthesis was not registered.
KA: knee arthroplasty; TKA: total knee arthroplasty; UKA: unicondylar knee arthroplasty; PKA: patellofemoral knee arthroplasty.
General: general hospital; UMC: university medical centre; Private: private hospital.

## Type of primary knee prosthesis by age category

### FIGURE Type of primary knee arthroplasty (proportion [%] per category) of patients who underwent a primary knee arthroplasty by age category in the Netherlands in 2019




| Age category | <50 | 50-59 | 60-69 | 70-79 | >80 | Total |
|---|---|---|---|---|---|---|
| **Type of primary knee arthroplasty (%)** | | | | | | |
| TKA | 65.32 | 71.90 | 81.47 | 88.42 | 93.71 | **83.55** |
| UKA | 26.09 | 26.26 | 18.19 | 11.39 | 6.17 | **15.80** |
| PKA | 8.08 | 1.65 | 0.29 | 0.13 | 0.06 | **0.57** |
| Other | 0.51 | 0.19 | 0.05 | 0.06 | 0.06 | **0.08** |
| Total (n): | **594** | **4,730** | **10,850** | **11,607** | **3,163** | 30,944 |

KA: knee arthroplasty; TKA: total knee arthroplasty; UKA: unicondylar knee arthroplasty; PKA: patellofemoral knee arthroplasty.

# Patient characteristics

## By type of knee prosthesis

**TABLE Patient characteristics of all patients with a registered primary knee arthroplasty by type of knee arthroplasty in the Netherlands in 2019**

| N | TKA (n=25,859) | UKA (n=4,888) | PFA (n=175) | Total[1] (n=30,968) |
|---|---|---|---|---|
| **Mean age (years) (SD)** | 69.1 (8.8) | 64.8 (8.5) | 55.0 (10.2) | 68.3 (9.0) |
| **Age (years) (%)** | | | | |
| <50 | 2 | 3 | 27 | 2 |
| 50-59 | 13 | 26 | 45 | 15 |
| 60-69 | 34 | 40 | 18 | 35 |
| 70-79 | 40 | 27 | 9 | 38 |
| ≥80 | 11 | 4 | 1 | 10 |
| **Gender (%)** | | | | |
| Men | 37 | 45 | 26 | 38 |
| Women | 63 | 55 | 74 | 62 |
| **ASA score (%)** | | | | |
| I | 11 | 18 | 29 | 12 |
| II | 64 | 67 | 63 | 65 |
| III-IV | 25 | 15 | 8 | 23 |
| **Type of hospital (%)** | | | | |
| General | 84 | 76 | 83 | 83 |
| UMC | 2 | 1 | 1 | 2 |
| Private | 14 | 23 | 16 | 15 |
| **Diagnosis (%)** | | | | |
| Osteoarthritis | 97 | 98 | 96 | 97 |
| Post-traumatic | 2 | 0 | 4 | 1 |
| Rheumatoid arthritis | 1 | 0 | 0 | 1 |
| Osteonecrosis | 0 | 1 | 0 | 1 |
| Other | 0 | 0 | 0 | 0 |
| **Charnley-score (%)** | | | | |
| A One knee joint affected | 38 | 51 | 59 | 40 |
| B1 Both knee joints affected | 35 | 31 | 28 | 34 |
| B2 Contralateral knee joint with a total knee prosthesis | 23 | 17 | 12 | 22 |
| C Multiple joints affected or chronic disease that affects quality of life | 4 | 1 | 1 | 4 |
| **Mean Body Mass Index (kg/m²) (SD)** | 29.7 (5.4) | 29.1 (5.8) | 28.4 (5.0) | 29.6 (5.5) |
| **Body Mass Index (kg/m²) (%)** | | | | |
| Underweight (≤18,5) | 0 | 0 | 0 | 0 |
| Normal weight (>18,5-25) | 17 | 18 | 23 | 17 |
| Overweight (>25-30) | 41 | 45 | 45 | 42 |
| Obesity (>30-40) | 39 | 35 | 30 | 38 |
| Morbid obesity (>40) | 3 | 2 | 2 | 3 |
| **Smoking (%)** | | | | |
| No | 92 | 90 | 89 | 92 |
| Yes | 8 | 10 | 11 | 8 |

[1] Also contains 26 (0.08%) primary knee arthroplasties that were registered as other and 20 (0.06%) primary knee arthroplasties of which the type of prosthesis had not been registered.
TKA: total knee arthroplasty; UKA: unicondylar knee arthropalsty; PFA: patellofemoral knee arthroplasty; General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

By diagnosis

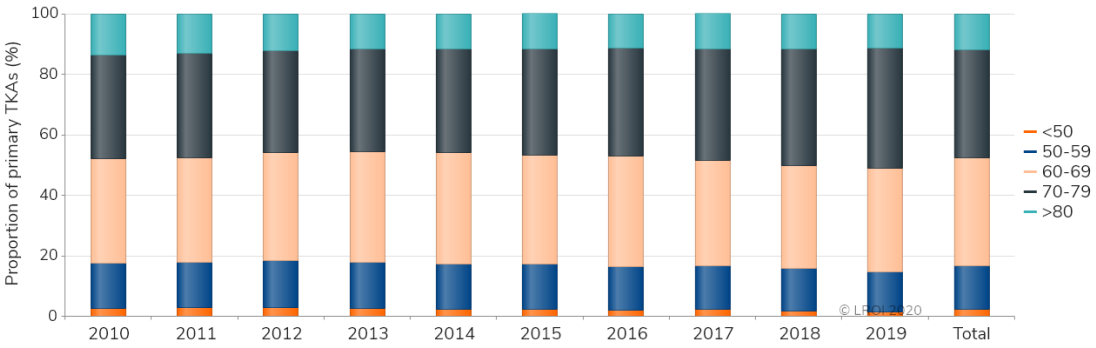
## TABLE Patient characteristics of all patients with a registered primary knee arthroplasty by type of diagnosis in the Netherlands in 2019

| N | Osteoarthritis (n=29,862) | Post-traumatic (n=413) | Rheumatoid arthritis (n=314) | Osteonecrosis (n=161) | Total (n=30,968) |
|---|---|---|---|---|---|
| **Mean age (years) (SD)** | 68.5 (8.8) | 63.0 (10.2) | 65.6 (11.0) | 68.5 (10.7) | 68.3 (9.0) |
| **Age (years) (%)** | | | | | |
| <50 | 2 | 9 | 6 | 3 | 2 |
| 50-59 | 15 | 27 | 21 | 17 | 15 |
| 60-69 | 35 | 37 | 33 | 29 | 35 |
| 70-79 | 38 | 22 | 31 | 38 | 38 |
| ≥80 | 10 | 5 | 9 | 13 | 10 |
| **Gender (%)** | | | | | |
| Men | 38 | 41 | 24 | 33 | 38 |
| Women | 62 | 59 | 76 | 67 | 62 |
| **ASA score (%)** | | | | | |
| I | 12 | 18 | 2 | 12 | 12 |
| II | 65 | 65 | 60 | 65 | 65 |
| III-IV | 23 | 17 | 38 | 23 | 23 |
| **Type of hospital (%)** | | | | | |
| General | 83 | 78 | 88 | 86 | 83 |
| UMC | 2 | 9 | 6 | 2 | 2 |
| Private | 15 | 13 | 6 | 12 | 15 |
| **Charnley-score (%)** | | | | | |
| A One knee joint affected | 40 | 76 | 23 | 71 | 40 |
| B1 Both knee joints affected | 35 | 12 | 36 | 16 | 34 |
| B2 Contralateral knee joint with a total knee prosthesis | 22 | 8 | 20 | 8 | 22 |
| C Multiple joints affected or chronic disease that affects quality of life | 3 | 4 | 21 | 5 | 4 |
| **Mean Body Mass Index (kg/m²) (SD)** | 29.6 (5.5) | 28.4 (5.0) | 28.7 (5.3) | 28.7 (4.3) | 29.6 (5.5) |
| **Body Mass Index (kg/m²) (%)** | | | | | |
| Underweight (≤18,5) | 0 | 0 | 1 | 0 | 0 |
| Normal weight (>18,5-25) | 17 | 27 | 25 | 20 | 17 |
| Overweight (>25-30) | 42 | 40 | 36 | 46 | 42 |
| Obesity (>30-40) | 38 | 29 | 35 | 33 | 38 |
| Morbid obesity (>40) | 3 | 4 | 3 | 1 | 3 |
| **Smoking (%)** | | | | | |
| No | 92 | 83 | 91 | 87 | 92 |
| Yes | 8 | 17 | 9 | 13 | 8 |

Please note: In 2019, 126 (0.4%) patients had a primary knee arthroplasty after a diagnosis that is not listed in the table. Of 92 (0.3%) primary knee arthroplasties the diagnosis was not registered.
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

## Age category 2010-2019

**FIGURE Trend (proportion [%] per year) in age category in primary total knee arthroplasties in the Netherlands in 2010-2019**




| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age category (%)** | | | | | | | | | | | |
| <50 | 2.63 | 2.89 | 2.79 | 2.64 | 2.38 | 2.41 | 2.01 | 2.20 | 1.77 | 1.50 | **2.28** |
| 50-59 | 14.92 | 14.82 | 15.57 | 15.06 | 14.75 | 14.89 | 14.39 | 14.37 | 13.98 | 13.15 | **14.55** |
| 60-69 | 34.49 | 34.61 | 35.86 | 36.68 | 37.10 | 36.07 | 36.51 | 35.07 | 34.14 | 34.19 | **35.48** |
| 70-79 | 34.33 | 34.53 | 33.65 | 33.99 | 34.14 | 35.06 | 35.86 | 36.72 | 38.33 | 39.69 | **35.77** |
| >80 | 13.63 | 13.15 | 12.13 | 11.63 | 11.63 | 11.58 | 11.23 | 11.65 | 11.78 | 11.46 | **11.91** |
| Total (n): | **18,484** | **19,483** | **21,673** | **22,269** | **24,214** | **24,236** | **24,865** | **25,553** | **25,842** | **25,855** | **232,474** |

TKA: total knee arthroplasty.

## Previous surgery 2014-2019

**TABLE Trend (proportion [%] per year) in Previous surgeries to the same joint in patients who underwent a primary knee arthoplasty in the Netherlands in 2014-2019**

| **Year** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **Total** |
|---|---|---|---|---|---|---|---|
| **Primary knee arthroplasty (n)** | 26,033 | 26,477 | 27,806 | 29,297 | 28,258 | 27,982 | 165,853 |
| **Previous surgery to the relevant knee (total) Proportion[1] (%)** | 35.7 | 34.5 | 33.4 | 28.0 | 25.2 | 24.5 | 30.1 |
| Meniscectomy | 28.4 | 27.3 | 26.6 | 22.3 | 20.6 | 19.9 | 24.1 |
| Arthroscopy | 17.7 | 18.9 | 19.3 | 17.1 | 15.6 | 15.3 | 17.3 |
| Osteotomy | 3.0 | 3.0 | 2.8 | 2.9 | 2.8 | 2.5 | 2.8 |
| Osteosynthesis | 1.7 | 1.7 | 1.4 | 1.5 | 1.5 | 1.6 | 1.6 |
| ACL reconstruction | 1.3 | 1.5 | 1.5 | 1.5 | 1.4 | 1.5 | 1.5 |
| Synovectomy | 1.2 | 1.2 | 1.0 | 0.8 | 0.6 | 0.6 | 0.9 |
| Other | 3.3 | 2.9 | 3.1 | 3.0 | 3.0 | 3.4 | 3.1 |

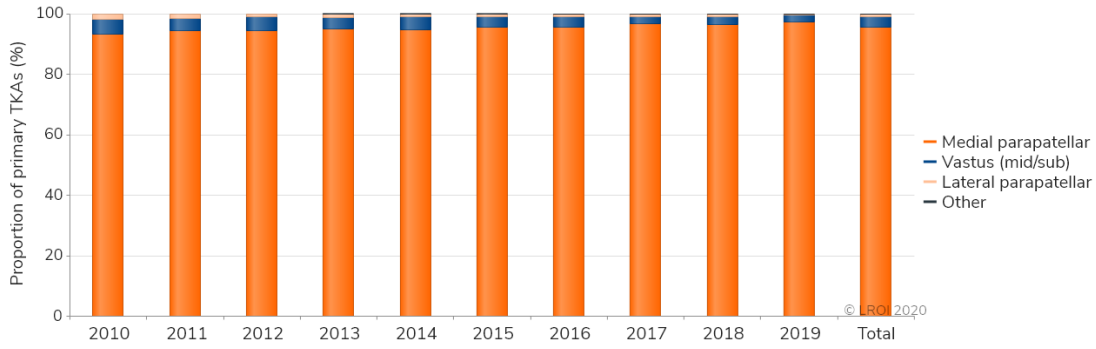
[1] A patient may have undergone multiple Previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patiens with one or more Previous surgeries to the same joint.

# Total knee arthroplasty

## Surgical techniques

### *Surgical approach 2010-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary total knee arthroplasty in the Netherlands in 2010-2019**

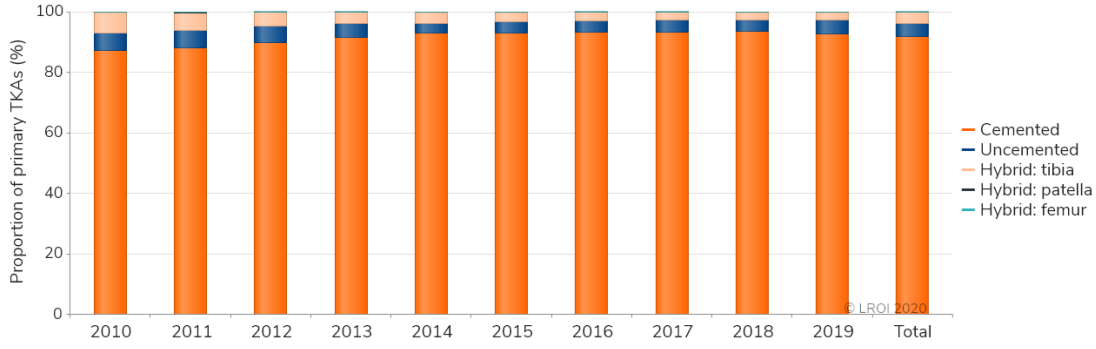



| Surgical approach (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Medial parapatellar | 93.32 | 94.35 | 94.26 | 95.08 | 94.68 | 95.62 | 95.54 | 96.83 | 96.30 | 97.31 | **95.45** |
| Vastus (mid/sub) | 4.82 | 4.09 | 4.66 | 3.72 | 4.17 | 3.38 | 3.52 | 2.17 | 2.76 | 2.16 | **3.46** |
| Lateral parapatellar | 1.85 | 1.56 | 1.08 | 1.05 | 0.96 | 0.96 | 0.86 | 0.87 | 0.84 | 0.47 | **1.01** |
| Other | 0.00 | 0.00 | 0.00 | 0.16 | 0.20 | 0.05 | 0.08 | 0.13 | 0.10 | 0.06 | **0.08** |
| Total (n): | **18,117** | **19,119** | **21,288** | **22,002** | **24,100** | **24,158** | **24,867** | **25,551** | **25,837** | **25,808** | **230,847** |

TKA: total knee arthroplasty.

### *Fixation 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in primary total knee arthroplasties in the Netherlands in 2010-2019**



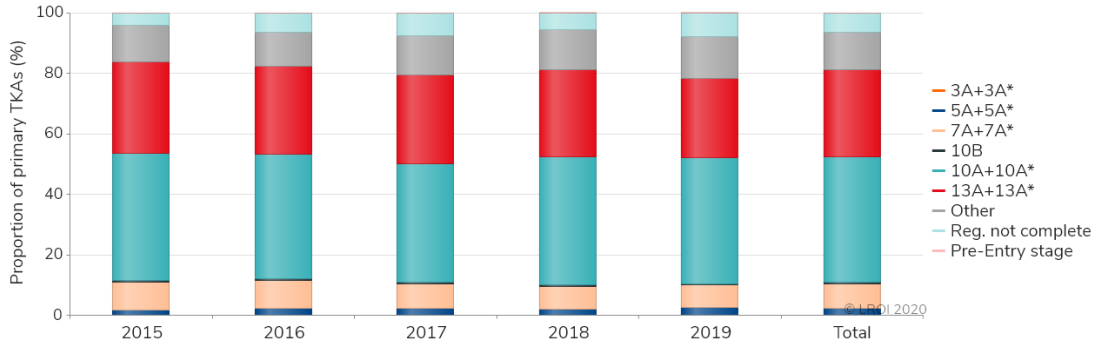

| Fixation (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cemented | 87.06 | 87.92 | 89.89 | 91.54 | 92.85 | 93.02 | 93.29 | 93.37 | 93.55 | 92.80 | **91.78** |
| Uncemented | 6.02 | 5.96 | 5.44 | 4.47 | 3.38 | 3.61 | 3.64 | 3.94 | 3.71 | 4.50 | **4.37** |
| Hybrid: tibia | 6.71 | 5.81 | 4.56 | 3.93 | 3.72 | 3.34 | 3.03 | 2.64 | 2.67 | 2.64 | **3.76** |
| Hybrid: patella | 0.16 | 0.23 | 0.07 | 0.02 | 0.00 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | **0.05** |
| Hybrid: femur | 0.04 | 0.08 | 0.05 | 0.04 | 0.04 | 0.02 | 0.03 | 0.04 | 0.04 | 0.04 | **0.04** |
| Total (n): | **18,043** | **19,097** | **21,314** | **22,037** | **24,013** | **24,074** | **24,775** | **25,442** | **25,716** | **25,668** | **230,179** |

TKA: total knee arthroplasty.

## Prosthesis characteristics

### *ODEP rating*

**FIGURE Trend (proportion [%] per year) in odep rating in primary total knee arthroplasties in the Netherlands in 2015-2019**

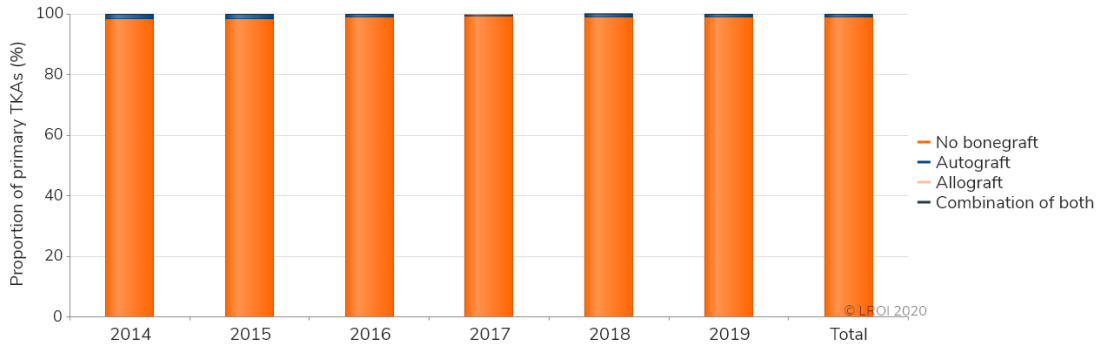



| ODEP rating (%) | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|
| 3A+3A* | 0.08 | 0.06 | 0.08 | 0.09 | 0.08 | **0.08** |
| 5A+5A* | 1.65 | 2.31 | 2.17 | 1.81 | 2.51 | **2.09** |
| 7A+7A* | 9.26 | 9.04 | 8.01 | 7.74 | 7.57 | **8.31** |
| 10B | 0.47 | 0.58 | 0.60 | 0.35 | 0.07 | **0.41** |
| 10A+10A* | 42.11 | 41.23 | 39.18 | 42.52 | 41.75 | **41.36** |
| 13A+13A* | 30.25 | 29.00 | 29.51 | 28.72 | 26.43 | **28.76** |
| Other | 11.88 | 11.44 | 12.79 | 13.28 | 13.69 | **12.63** |
| Reg. not complete | 4.18 | 6.18 | 7.46 | 5.38 | 7.76 | **6.21** |
| Pre-Entry stage | 0.11 | 0.16 | 0.19 | 0.12 | 0.14 | **0.14** |
| Total (n): | **24,245** | **24,887** | **25,556** | **25,843** | **25,859** | **126,390** |

Please note: More information on ODEP rating can be found on www.odep.org.uk.
Other: All TKAs of which no ODEP rating is available.
Reg. not complete: All TKAs of which at least one component (femur, tibia and/or insert) has not been registered.
TKA: total knee arthroplasty.

### *Type of bonegraft 2014-2019*

**FIGURE Trend (proportion [%] per year) in type of bonegraft in primary total knee arthroplasty in the Netherlands in 2014-2019**

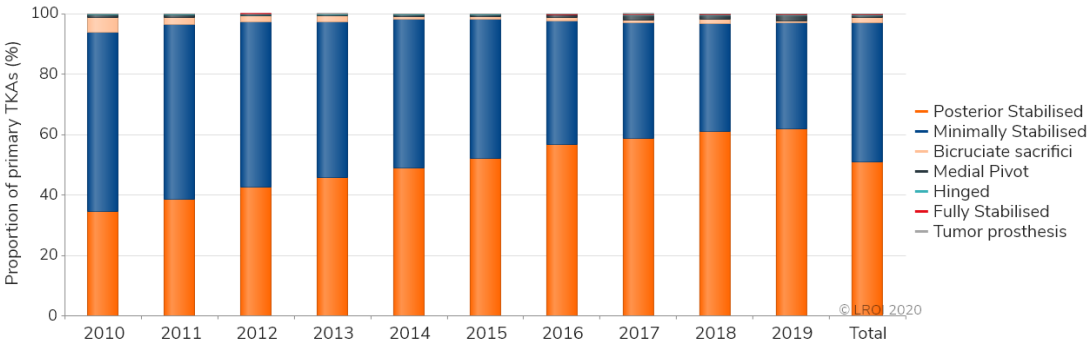



| Type of bonegraft (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| No bonegraft | 98.55 | 98.39 | 98.94 | 99.22 | 99.02 | 99.10 | **98.88** |
| Autograft | 1.39 | 1.55 | 1.01 | 0.75 | 0.93 | 0.88 | **1.08** |
| Allograft | 0.03 | 0.02 | 0.03 | 0.02 | 0.03 | 0.01 | **0.02** |
| Combination of both | 0.03 | 0.03 | 0.02 | 0.00 | 0.03 | 0.01 | **0.02** |
| Total (n): | **23,759** | **24,084** | **24,852** | **25,522** | **25,817** | **25,454** | **149,488** |

TKA: total knee arthroplasty.

*Type of femur component 2010-2019*

FIGURE Trend (proportion [%] per year) in type of femur component in primary total knee arthroplasties in the Netherlands in 2010-2019



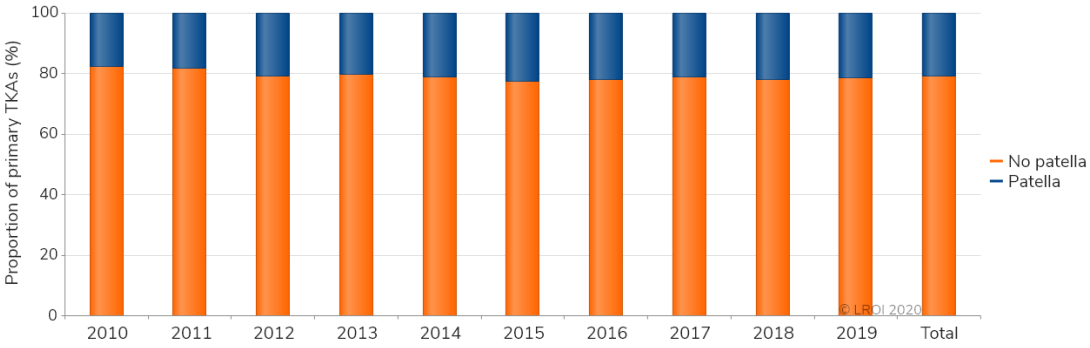

**Type of femur component (%)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Posterior Stabilised | 34.46 | 38.42 | 42.47 | 45.76 | 48.83 | 52.05 | 56.57 | 58.68 | 61.12 | 61.76 | **50.81** |
| Minimally Stabilised | 59.30 | 58.00 | 54.81 | 51.53 | 49.22 | 45.98 | 40.99 | 38.19 | 35.57 | 35.13 | **46.15** |
| Bicruciate sacrifici | 4.83 | 2.37 | 1.98 | 1.87 | 1.04 | 0.88 | 1.05 | 0.97 | 1.33 | 0.78 | **1.61** |
| Medial Pivot | 0.92 | 0.69 | 0.37 | 0.32 | 0.42 | 0.59 | 0.82 | 1.54 | 1.24 | 1.47 | **0.85** |
| Hinged | 0.23 | 0.24 | 0.20 | 0.30 | 0.28 | 0.24 | 0.27 | 0.31 | 0.41 | 0.39 | **0.29** |
| Fully Stabilised | 0.25 | 0.26 | 0.17 | 0.20 | 0.19 | 0.23 | 0.26 | 0.29 | 0.31 | 0.44 | **0.26** |
| Tumor prosthesis | 0.01 | 0.02 | 0.00 | 0.03 | 0.02 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | **0.02** |
| Total (n): | **18,332** | **19,336** | **21,514** | **22,134** | **24,021** | **23,773** | **23,732** | **23,984** | **24,929** | **24,266** | **226,021** |

TKA: total knee arthroplasty.

*Implantation of patella 2010-2019*

FIGURE Trend (proportion [%] per year) in implantation of patella in primary total knee arthroplasties in the Netherlands in 2010-2019




**Implantation of patella (%)**

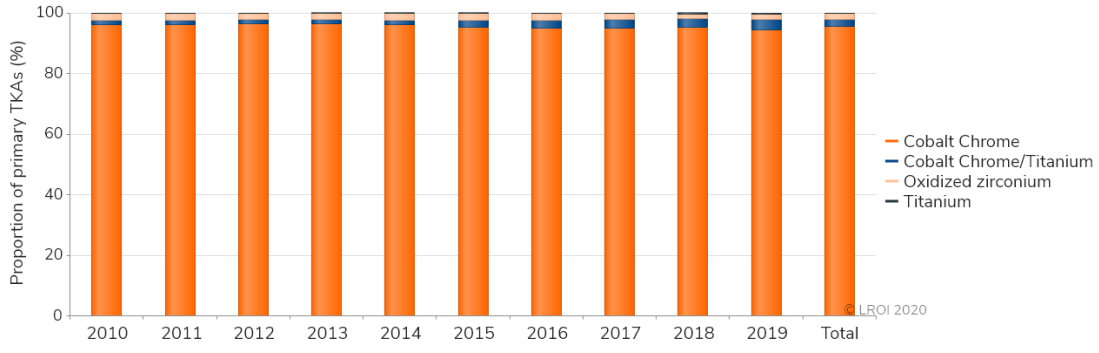
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No patella | 82.21 | 81.59 | 79.01 | 79.65 | 78.75 | 77.48 | 77.97 | 78.73 | 78.06 | 78.68 | **79.07** |
| Patella | 17.79 | 18.41 | 20.99 | 20.35 | 21.25 | 22.52 | 22.03 | 21.27 | 21.94 | 21.32 | **20.93** |
| Total (n): | **18,509** | **19,521** | **21,718** | **22,309** | **24,243** | **24,245** | **24,887** | **25,556** | **25,843** | **25,859** | **232,690** |

TKA: total knee arthroplasty.

## Materials

### *Femur component 2010-2019*

**FIGURE Trend (proportion [%] per year) in femur material in primary total knee arthroplasties in the Netherlands in 2010-2019**

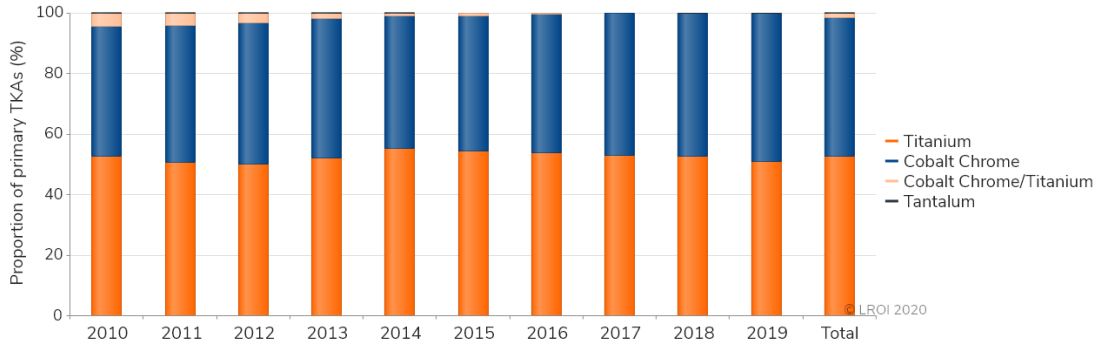



| Femur material (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cobalt Chrome | 96.24 | 96.00 | 96.32 | 96.53 | 96.17 | 95.38 | 95.01 | 95.07 | 95.24 | 94.49 | **95.60** |
| Cobalt Chrome/Titanium | 1.21 | 1.58 | 1.42 | 1.45 | 1.43 | 2.23 | 2.60 | 2.72 | 2.97 | 3.35 | **2.14** |
| Oxidized zirconium | 2.52 | 2.34 | 2.18 | 1.94 | 2.31 | 2.23 | 2.17 | 1.98 | 1.50 | 1.84 | **2.08** |
| Titanium | 0.03 | 0.08 | 0.08 | 0.09 | 0.09 | 0.17 | 0.21 | 0.23 | 0.30 | 0.32 | **0.17** |
| Total (n): | **18,332** | **19,336** | **21,514** | **22,134** | **24,021** | **23,773** | **23,732** | **23,984** | **24,929** | **24,267** | **226,022** |

TKA: total knee arthroplasty.

### *Tibia component 2010-2019*

**FIGURE Trend (proportion [%] per year) in tibia material in primary total knee arthroplasties in the Netherlands in 2010-2019**

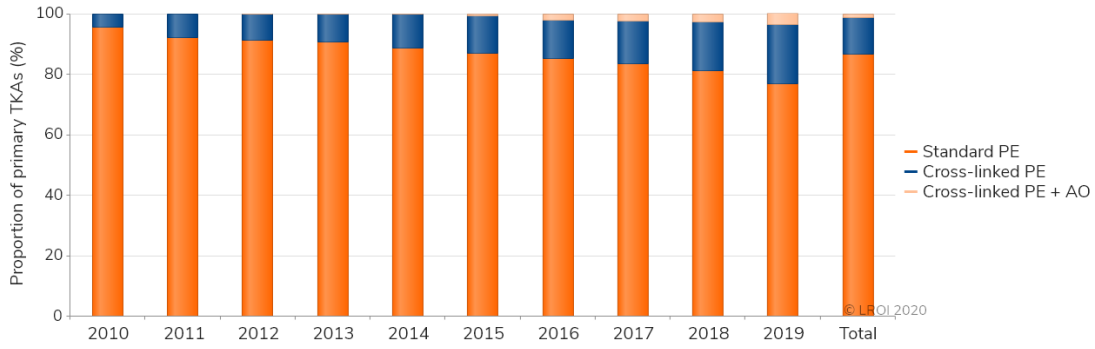



| Tibia material (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Titanium | 52.57 | 50.76 | 50.15 | 52.14 | 55.15 | 54.45 | 53.95 | 53.02 | 52.72 | 50.91 | **52.65** |
| Cobalt Chrome | 42.86 | 45.08 | 46.67 | 46.13 | 43.70 | 44.51 | 45.71 | 46.98 | 47.26 | 49.07 | **45.89** |
| Cobalt Chrome/Titanium | 4.56 | 4.16 | 3.17 | 1.72 | 1.15 | 1.04 | 0.34 | 0.00 | 0.00 | 0.00 | **1.46** |
| Tantalum | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | **0.01** |
| Total (n): | **18,280** | **19,277** | **21,443** | **22,088** | **24,011** | **23,800** | **24,017** | **24,108** | **24,926** | **24,324** | **226,274** |

Please note: A standard PE tibia component was implanted in 3 (<0.01%) primary TKAs in 2010-2016.
TKA: total knee arthroplasty; PE:polyethylene.

*Insert 2010-2019*

**FIGURE Trend (proportion [%] per year) in insert material in primary total knee arthroplasties in the Netherlands in 2010-2019**

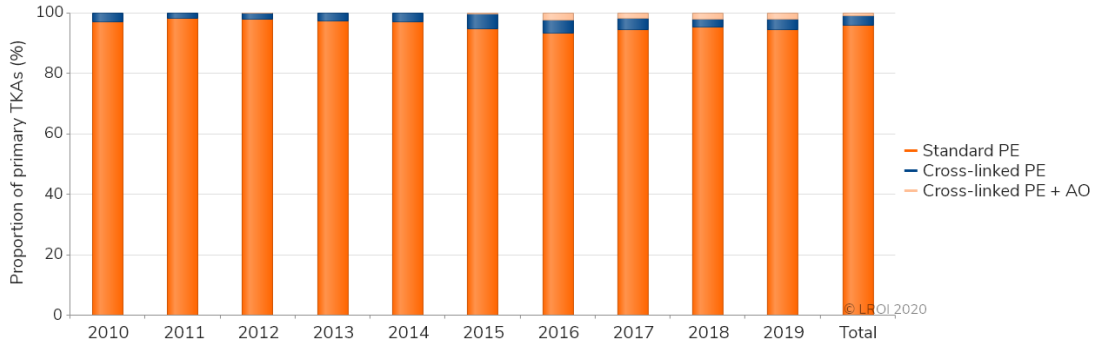



| Insert material (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard PE | 95.62 | 92.23 | 91.18 | 90.78 | 88.65 | 87.01 | 85.17 | 83.55 | 81.23 | 76.82 | **86.71** |
| Cross-linked PE | 4.38 | 7.77 | 8.78 | 9.21 | 11.29 | 12.13 | 12.75 | 13.94 | 16.00 | 19.49 | **11.98** |
| Cross-linked PE + AO | 0.00 | 0.00 | 0.03 | 0.01 | 0.06 | 0.86 | 2.08 | 2.51 | 2.77 | 3.70 | **1.31** |
| Total (n): | **17,472** | **18,475** | **20,724** | **21,519** | **23,577** | **23,438** | **23,908** | **24,411** | **25,144** | **24,212** | **222,880** |

TKA: total knee arthroplasty; PE: polyethylene; AO: antioxidant.

*Patella component 2010-2019*

**FIGURE Trend (proportion [%] per year) in patella material in primary total knee arthroplasties in the Netherlands in 2010-2019**



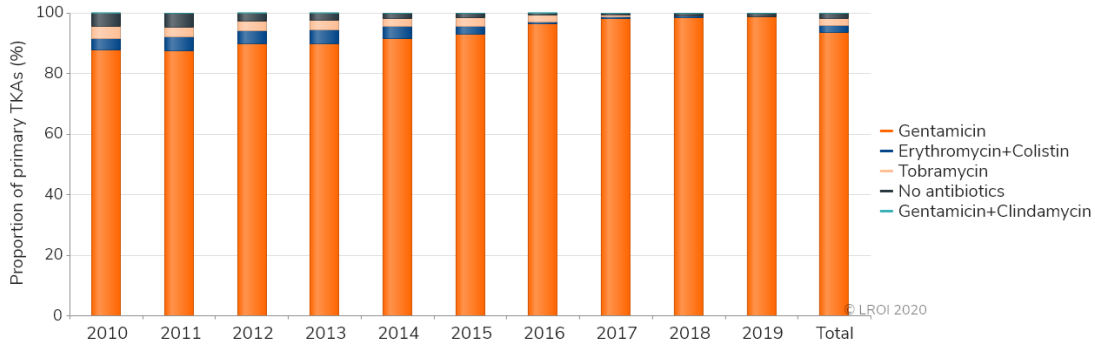

| Patella material (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard PE | 96.94 | 98.05 | 97.86 | 97.22 | 97.03 | 94.66 | 93.33 | 94.33 | 95.29 | 94.52 | **95.74** |
| Cross-linked PE | 3.06 | 1.95 | 2.12 | 2.78 | 2.97 | 5.03 | 4.22 | 3.66 | 2.63 | 3.21 | **3.23** |
| Cross-linked PE + AO | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.31 | 2.45 | 2.01 | 2.08 | 2.27 | **1.02** |
| Total (n): | **3,204** | **3,532** | **4,489** | **4,463** | **5,057** | **5,229** | **5,266** | **5,221** | **5,478** | **5,200** | **47,139** |

TKA: total knee arthroplasty; PE: polyethylene; AO: antioxidant.

## Bone cement

### *Antibiotics 2010-2019*

**FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in primary total knee arthroplasties in the Netherlands in 2010-2019**



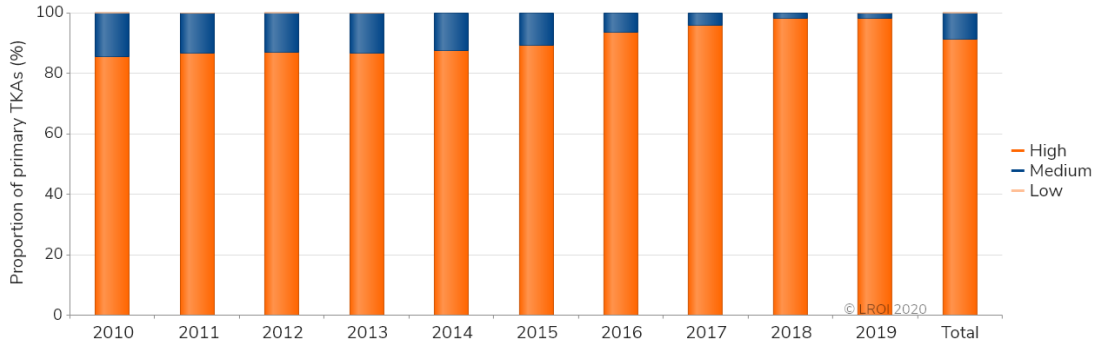

**Bone cement antibiotics (%)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gentamicin | 87.67 | 87.56 | 89.73 | 89.80 | 91.46 | 93.02 | 96.29 | 98.13 | 98.54 | 98.67 | **93.50** |
| Erythromycin+Colistin | 3.90 | 4.47 | 4.25 | 4.48 | 4.01 | 2.58 | 0.69 | 0.47 | 0.32 | 0.00 | **2.37** |
| Tobramycin | 4.09 | 3.22 | 3.27 | 3.41 | 2.71 | 2.90 | 2.20 | 0.62 | 0.00 | 0.00 | **2.13** |
| No antibiotics | 4.25 | 4.64 | 2.56 | 2.17 | 1.71 | 1.39 | 0.67 | 0.69 | 0.99 | 1.23 | **1.88** |
| Gentamicin+Clindamycin | 0.09 | 0.11 | 0.20 | 0.15 | 0.11 | 0.11 | 0.15 | 0.09 | 0.15 | 0.10 | **0.12** |
| Total (n): | **15,112** | **16,846** | **19,032** | **19,988** | **21,602** | **21,789** | **22,603** | **22,230** | **22,131** | **21,261** | **202,594** |

Please note: Bone cement with gentamicin and vancomycin was used in 12 (<0.01%) primary TKAs in 2015-2019.
TKA: total knee arthroplasty.

### *Viscosity 2010-2019*

**FIGURE Trend (proportion [%] per year) in bone cement viscosity in primary total knee arthroplasties in the Netherlands in 2010-2019**



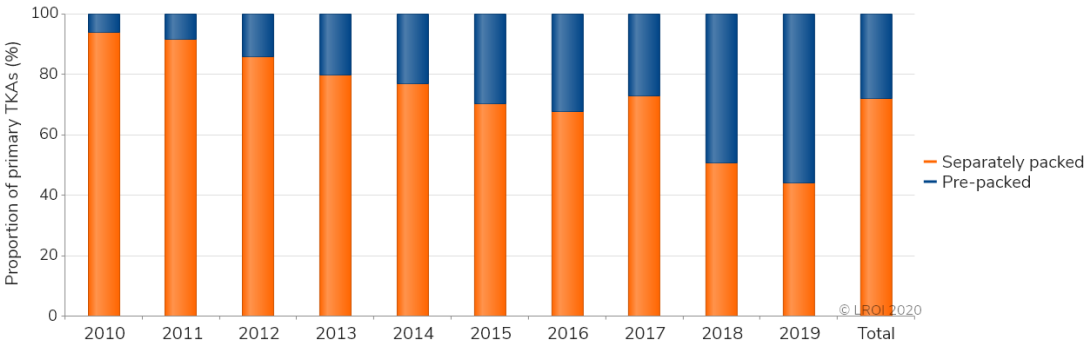

**Bone cement viscosity (%)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High | 85.54 | 86.69 | 86.99 | 86.60 | 87.58 | 89.34 | 93.53 | 95.79 | 98.17 | 98.22 | **91.23** |
| Medium | 14.40 | 13.30 | 12.99 | 13.39 | 12.42 | 10.66 | 6.47 | 4.21 | 1.83 | 1.75 | **8.76** |
| Low | 0.06 | 0.01 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | **0.01** |
| Total (n): | **15,112** | **16,846** | **19,032** | **19,988** | **21,602** | **21,791** | **22,604** | **22,230** | **22,137** | **21,264** | **202,606** |

TKA: total knee arthroplasty.

*Vacuum mixing system 2010-2019*

**FIGURE** Trend (proportion [%] per year) in use of bone cement pre-packed in a vacuum mixing system in primary total knee arthroplasties in the Netherlands in 2010-2019




| Vacuum mixing system (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Separately packed | 93.75 | 91.37 | 85.62 | 79.58 | 76.81 | 70.12 | 67.67 | 72.67 | 50.57 | 44.10 | **71.89** |
| Pre-packed | 6.25 | 8.63 | 14.38 | 20.42 | 23.19 | 29.88 | 32.33 | 27.33 | 49.43 | 55.90 | **28.11** |
| Total (n): | **15,112** | **16,846** | **19,032** | **19,988** | **21,602** | **21,791** | **22,604** | **22,230** | **22,137** | **21,264** | **202,606** |

TKA: total knee arthroplasty; Separately packed: separately packed bone cement components; Pre-packed: Bone cement pre-packed in a vacuum mixing system.

## Most frequently registered

*Total knee prostheses*

**TABLE The most frequently registered primary total knee arthroplasties in the Netherlands in 2019 (n=24,267)**

| Name | Proportion (%) |
|---|---|
| Genesis II | 23.9 |
| NexGen | 21.7 |
| Vanguard Complete Knee | 21.2 |
| LCS | 9.5 |
| PFC / SIGMA | 9.3 |



*Types of bone cement*

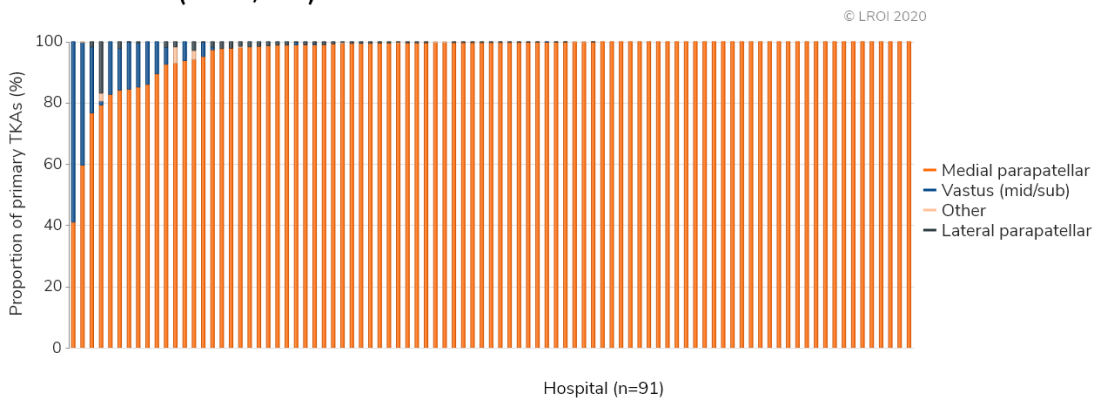
**TABLE The most frequently registered types of bone cement by type of mixing system used during primary total knee arthroplasties in the Netherlands in 2019**

| Separately packed bone cement components (n=11,045) | | Bone cement pre-packed in a vacuum mixing system (n=10,804) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 85.5 | Palacos R+G | 50.0 |
| Refobacin Bone Cement R | 6.1 | Refobacin Bone Cement R | 43.1 |
| Palacos MV+G | 3.0 | Refobacin Plus Bone Cement | 6.9 |
| Biomet Plus Bone Cement | 1.7 | | |
| Simplex HV | 1.2 | | |

## Practice variation

### *Surgical approach*

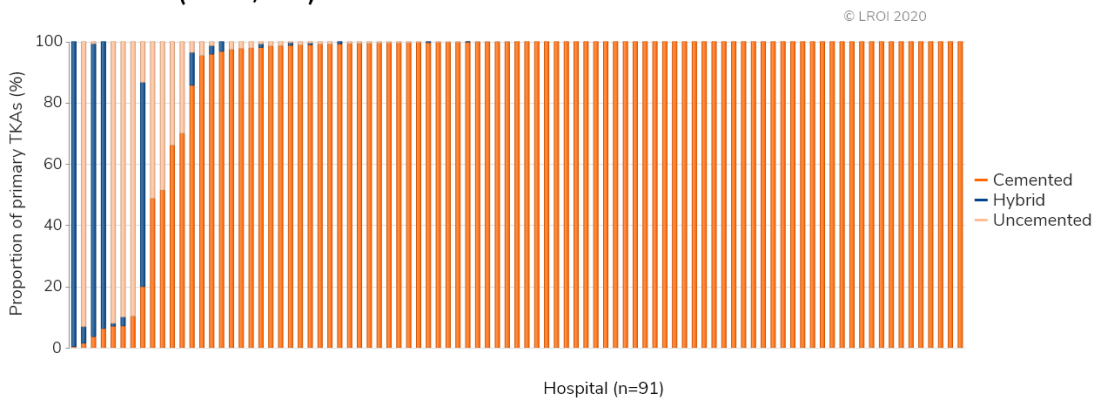
**FIGURE** Distribution of surgical approach used during primary total knee arthroplasties per hospital in the Netherlands in 2019 (n=25,808)




TKA: total knee arthroplasty.

### *Fixation*

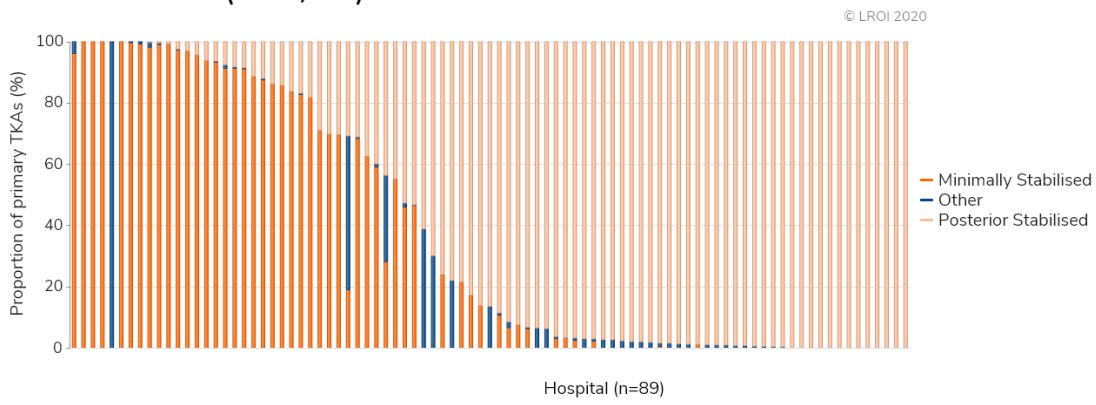
**FIGURE** Distribution of type of fixation used during primary total knee arthroplasties per hospital in the Netherlands in 2019 (n=25,668)




TKA: total knee arthroplasty.

### *Type of femur component*

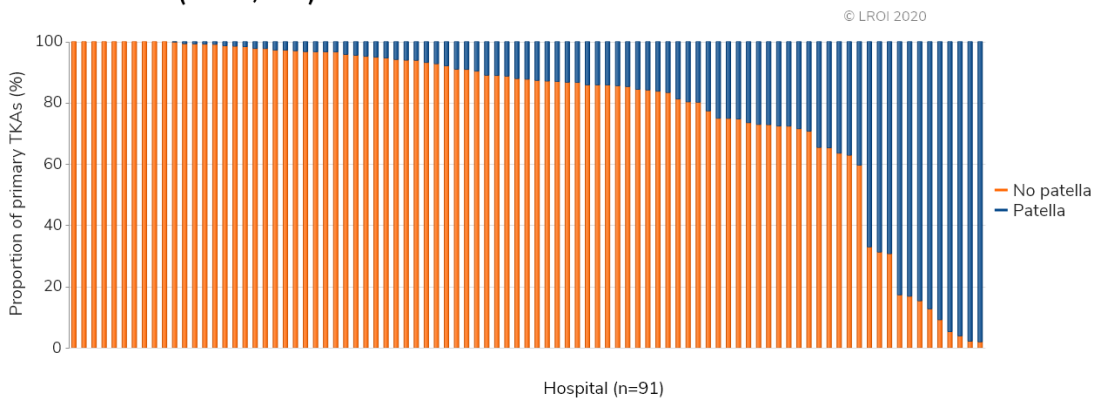
**FIGURE** Distribution of type of femur component used during primary total knee arthroplasties per hospital in the Netherlands in 2019 (n=24,266)




TKA: total knee arthroplasty.

*Implantation of patella*

**FIGURE Distribution of implantation of patella during primary total knee arthroplasties per hospital in the Netherlands in 2019 (n=25,859)**



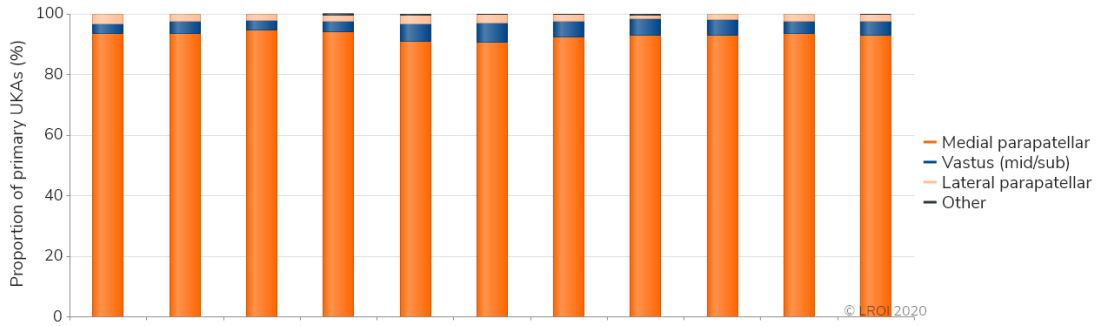

TKA: total knee arthroplasty.

## Unicondylar knee arthroplasty

### Surgical techniques

*Surgical approach 2010-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary unicondylar knee arthroplasty in the Netherlands in 2010-2019**

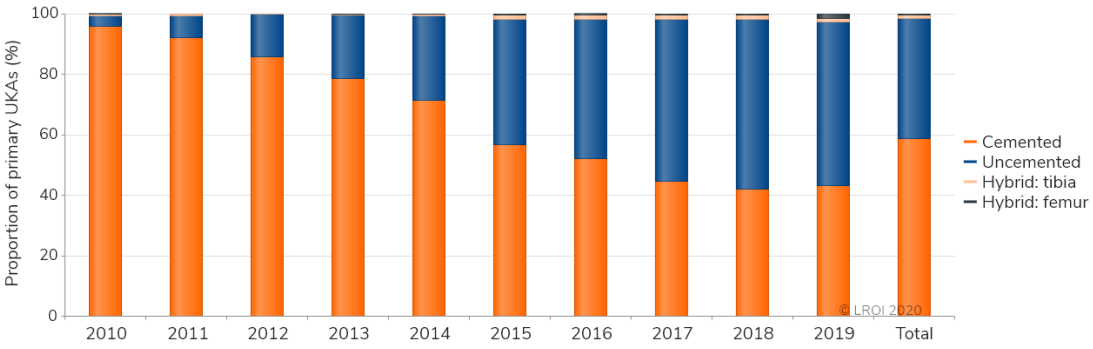



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surgical approach (%)** | | | | | | | | | | | |
| Medial parapatellar | 93.46 | 93.49 | 94.60 | 94.01 | 91.03 | 90.70 | 92.28 | 92.98 | 92.87 | 93.60 | **92.83** |
| Vastus (mid/sub) | 3.18 | 3.95 | 3.19 | 3.65 | 5.55 | 6.30 | 5.37 | 5.41 | 5.33 | 4.06 | **4.79** |
| Lateral parapatellar | 3.36 | 2.55 | 2.21 | 1.94 | 3.12 | 2.89 | 2.11 | 1.23 | 1.79 | 2.34 | **2.24** |
| Other | 0.00 | 0.00 | 0.00 | 0.40 | 0.30 | 0.11 | 0.24 | 0.38 | 0.00 | 0.00 | **0.14** |
| Total (n): | **1,667** | **1,568** | **1,537** | **1,754** | **2,342** | **2,668** | **2,940** | **3,662** | **4,069** | **4,878** | 27,085 |

UKA: unicondylar knee arthroplasty.

*Fixation 2010-2019*

**FIGURE** Trend (proportion [%] per year) in type of fixation in primary unicondylar knee arthroplasties in the Netherlands in 2010-2019




| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixation (%)** | | | | | | | | | | | |
| Cemented | 95.95 | 92.18 | 85.88 | 78.47 | 71.28 | 56.61 | 52.01 | 44.60 | 41.93 | 43.04 | **58.74** |
| Uncemented | 3.22 | 7.17 | 13.86 | 20.97 | 27.87 | 41.44 | 46.09 | 53.65 | 56.20 | 54.20 | **39.64** |
| Hybrid: tibia | 0.78 | 0.64 | 0.26 | 0.39 | 0.64 | 1.64 | 1.50 | 1.39 | 1.38 | 1.28 | **1.13** |
| Hybrid: femur | 0.06 | 0.00 | 0.00 | 0.17 | 0.21 | 0.30 | 0.41 | 0.36 | 0.49 | 1.48 | **0.49** |
| Total (n): | **1,677** | **1,561** | **1,558** | **1,793** | **2,347** | **2,676** | **2,942** | **3,657** | **4,066** | **4,858** | **27,135** |

UKA: unicondylar knee arthroplasty.

## Most frequently registered

*Unicondylar knee prostheses*

**TABLE The most frequently registered primary unicondylar knee arthroplasties in the Netherlands in 2019 (n=4,309)**

| Name | Proportion (%) |
|---|---|
| Oxford PKR cementless | 54.0 |
| Oxford PKR cemented | 28.0 |
| Physica Zimmer Unicompartmental High Flex Knee | 13.3 |
| Journey Uni | 1.7 |
| Triathlon | 1.1 |



*Types of bone cement*

**TABLE The most frequently registered types of bone cement by type of mixing system used during primary unicondylar knee arthroplasties in the Netherlands in 2019**

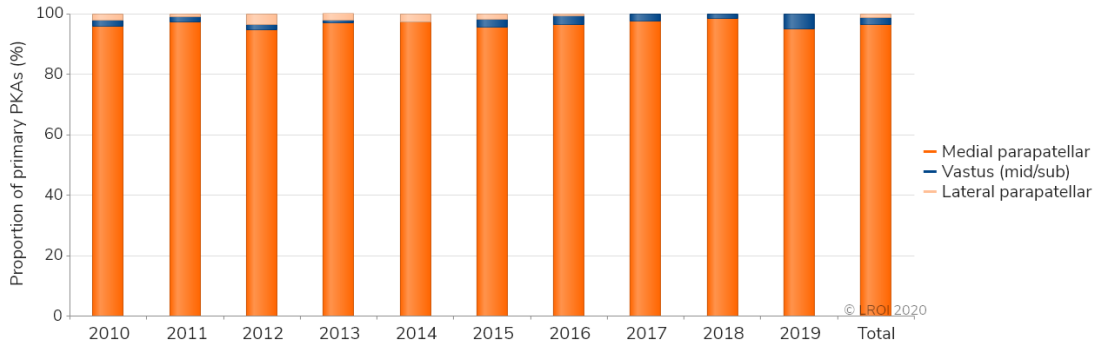
| Separately packed bone cement components (n=1,126) | | Bone cement pre-packed in a vacuum mixing system (n=885) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 80.3 | Refobacin Bone Cement R | 62.9 |
| Palacos MV+G | 9.9 | Palacos R+G | 32.8 |
| Biomet Plus Bone Cement | 5.4 | Refobacin Plus Bone Cement | 4.3 |
| Refobacin Bone Cement R | 3.6 | | |
| Simplex HV | 0.4 | | |
| Subition G | 0.4 | | |

# Patellofemoral knee arthroplasty

## Surgical techniques

### *Surgical approach 2010-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary patellofemoral knee arthroplasty in the Netherlands in 2010-2019**

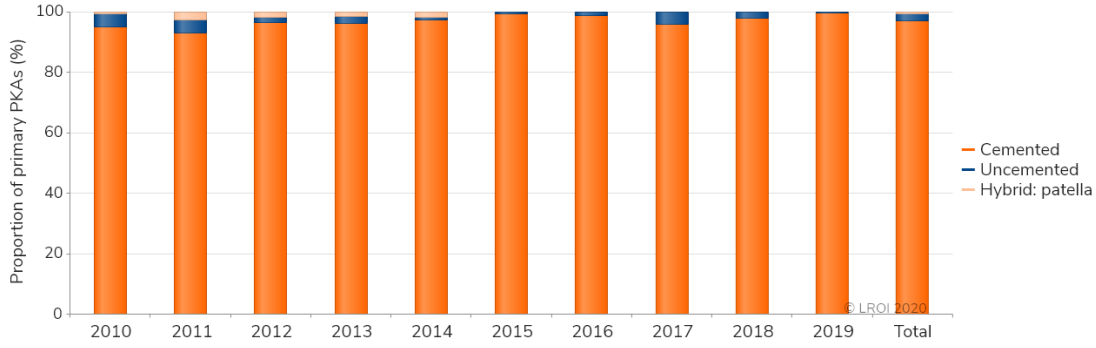



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surgical approach (%)** | | | | | | | | | | | |
| Medial parapatellar | 95.80 | 97.39 | 94.64 | 96.95 | 97.37 | 95.51 | 96.50 | 97.60 | 98.34 | 94.86 | **96.45** |
| Vastus (mid/sub) | 2.10 | 1.74 | 1.79 | 0.76 | 0.00 | 2.56 | 2.80 | 2.40 | 1.66 | 5.14 | **2.21** |
| Lateral parapatellar | 2.10 | 0.87 | 3.57 | 2.29 | 2.63 | 1.92 | 0.70 | 0.00 | 0.00 | 0.00 | **1.34** |
| Total (n): | **143** | **115** | **168** | **131** | **114** | **156** | **143** | **167** | **181** | **175** | 1,493 |

Please note: In 2018, the surgical approach of 1 (<0.01%) primary PKA was registered as other.
PKA: patellofemoral knee arthroplasty.

### *Fixation 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in primary patellofemoral knee arthroplasties in the Netherlands in 2010-2019**




| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixation (%)** | | | | | | | | | | | |
| Cemented | 95.07 | 92.98 | 96.49 | 96.24 | 97.39 | 99.36 | 98.61 | 95.83 | 97.80 | 99.43 | **97.07** |
| Uncemented | 4.23 | 4.39 | 1.75 | 2.26 | 0.87 | 0.64 | 1.39 | 4.17 | 2.20 | 0.57 | **2.20** |
| Hybrid: patella | 0.70 | 2.63 | 1.75 | 1.50 | 1.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.73** |
| Total (n): | **142** | **114** | **171** | **133** | **115** | **156** | **144** | **168** | **182** | **175** | 1,500 |

PKA: patellofemoral knee arthroplasty.

## Most frequently registered

### *Patellofemoral knee prostheses*

**TABLE The most frequently registered primary patellofemoral knee arthroplasties in the Netherlands in 2019 (n=152)**

| Name | Proportion (%) |
|---|---|
| Gender Solutions® Patello-Femoral Joint | 55.3 |
| Journey PFJ | 27.0 |
| Avon | 11.2 |
| PFR implant | 4.0 |
| IBalance PFJ | 2.6 |

*Types of bone cement*

**TABLE The most frequently registered types of bone cement used during primary patellofemoral knee arthroplasties in the Netherlands in 2019 (n=97)**

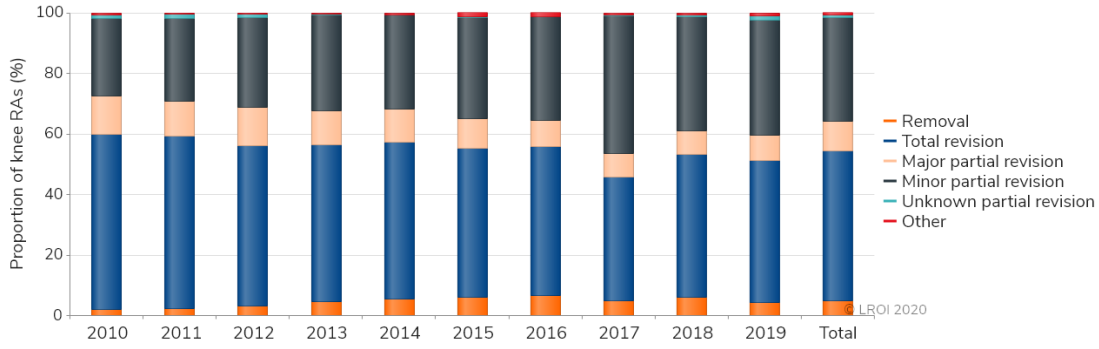
| Name | Proportion (%) |
|---|---|
| Palacos R+G | 76.3 |
| Refobacin Bone Cement R | 11.3 |
| Refobacin Plus Bone Cement | 9.3 |
| Refobacin Revision | 2.1 |
| Subiton G | 1.0 |



## Knee revision arthroplasty

### Type of revision 2010-2019

**FIGURE Trend (proportion [%] per year) in type of revision in knee revision arthroplasties in the Netherlands in 2010-2019**




| Type of revision (%) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Removal | 2.15 | 2.27 | 3.18 | 4.52 | 5.37 | 6.16 | 6.68 | 4.76 | 6.13 | 4.38 | **4.82** |
| Total revision | 57.60 | 56.91 | 52.99 | 51.95 | 51.82 | 49.16 | 49.04 | 40.86 | 47.24 | 46.86 | **49.59** |
| Major partial revision | 12.68 | 11.71 | 12.68 | 11.20 | 10.90 | 9.79 | 8.88 | 7.89 | 7.70 | 8.24 | **9.83** |
| Minor partial revision | 25.62 | 27.35 | 29.60 | 31.49 | 31.08 | 33.21 | 34.00 | 45.39 | 37.59 | 38.13 | **34.30** |
| Unknown partial revision | 1.32 | 1.19 | 1.01 | 0.31 | 0.24 | 0.26 | 0.21 | 0.27 | 0.65 | 1.37 | **0.64** |
| Other | 0.63 | 0.57 | 0.53 | 0.53 | 0.59 | 1.42 | 1.20 | 0.82 | 0.68 | 1.01 | **0.83** |
| Total (n): | **1,585** | **1,759** | **2,074** | **2,258** | **2,532** | **2,677** | **2,906** | **2,939** | **2,921** | **3,058** | **24,709** |

RA: revision arthroplasty.
Major partial revision: revision of at least femur or tibia component.
Minor partial revision: Only insert and/or patella exchange (including patella addition).
Unknown partial revision: partial revision of which the revised components were unknown.

**In 2019, the femur component was revised in 96 (38.1%) major partial knee revision arthroplasties and the tibia component was revised in 156 (61.9%) major partial knee revision arthroplasties.**

### Reasons for revision 2014-2019

**TABLE Trend (proportion [%] per year) in reasons for revision or re-surgery in patients who underwent a knee revision arthropalsty in the Netherlands in 2014-2019**

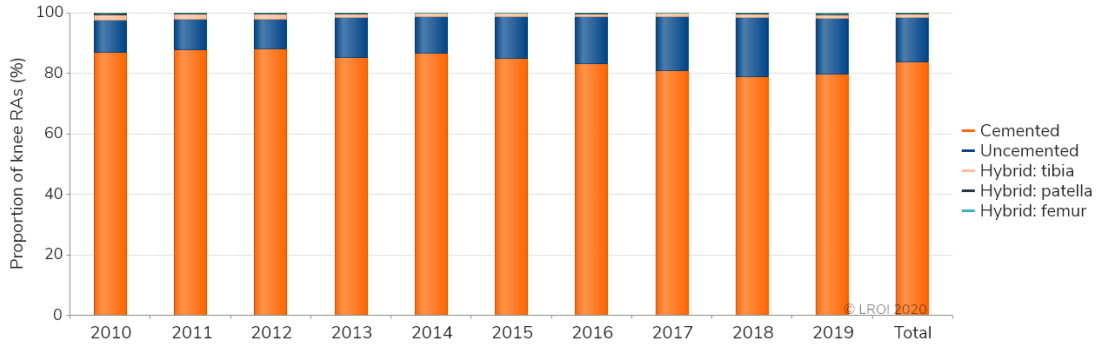
| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Knee revision arthroplasty (n)** | 2,557 | 2,685 | 2,926 | 2,997 | 2,931 | 3,069 | 17,165 |
| **Reasons for revision; Proportion[1] (%)** | | | | | | | |
| Instability | 25.3 | 26.4 | 25.1 | 27.7 | 25.8 | 27.4 | 26.3 |
| Patellar pain | 22.9 | 23.0 | 21.5 | 19.7 | 18.9 | 20.2 | 21.0 |
| Loosening of tibia component | 22.3 | 20.6 | 21.9 | 20.9 | 19.5 | 20.9 | 21.0 |
| Infection | 14.7 | 16.5 | 19.6 | 20.3 | 20.8 | 19.9 | 18.8 |
| Malalignment | 15.7 | 14.7 | 13.9 | 11.3 | 10.7 | 10.2 | 12.6 |
| Loosening of femur component | 10.0 | 9.5 | 9.0 | 8.9 | 8.4 | 8.7 | 9.0 |
| Progression of osteoarthritis | 9.1 | 8.3 | 9.3 | 8.2 | 8.7 | 8.0 | 8.6 |
| Insert wear | 8.4 | 7.8 | 7.6 | 6.8 | 6.6 | 7.1 | 7.3 |
| Revision after knee removal | 6.9 | 5.7 | 6.3 | 5.6 | 4.9 | 4.2 | 5.6 |
| Arthrofibrosis | 4.7 | 5.1 | 4.3 | 4.9 | 4.6 | 5.3 | 4.8 |
| Patellar dislocation | 2.5 | 2.8 | 2.1 | 2.4 | 2.2 | 2.4 | 2.4 |
| Periprosthetic fracture | 2.2 | 2.3 | 1.7 | 1.8 | 1.5 | 1.9 | 1.9 |
| Loosening of patella component | 2.0 | 1.5 | 1.9 | 1.8 | 1.4 | 1.8 | 1.7 |
| Other | 8.1 | 8.6 | 8.3 | 7.4 | 7.8 | 7.9 | 8.0 |

[1] One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.

## Surgical techniques

### *Fixation 2010-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in knee revision arthroplasties in the Netherlands in 2010-2019**

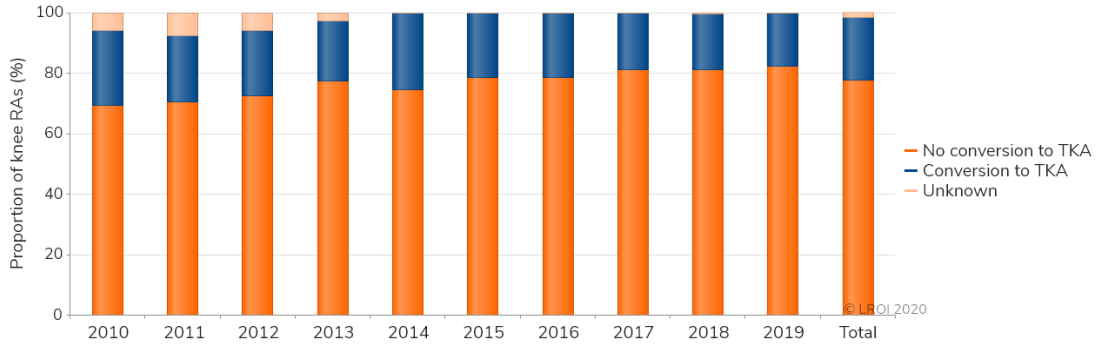



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixation (%)** | | | | | | | | | | | |
| Cemented | 86.99 | 87.82 | 88.16 | 85.32 | 86.57 | 84.80 | 83.11 | 80.81 | 78.79 | 79.58 | **83.63** |
| Uncemented | 10.52 | 9.91 | 9.67 | 13.07 | 12.27 | 13.96 | 15.57 | 17.95 | 19.57 | 18.65 | **14.75** |
| Hybrid: tibia | 1.89 | 1.84 | 1.74 | 1.22 | 0.95 | 0.99 | 1.01 | 1.05 | 1.31 | 1.17 | **1.26** |
| Hybrid: patella | 0.40 | 0.24 | 0.26 | 0.15 | 0.17 | 0.21 | 0.23 | 0.11 | 0.22 | 0.28 | **0.22** |
| Hybrid: femur | 0.20 | 0.18 | 0.16 | 0.24 | 0.04 | 0.04 | 0.08 | 0.07 | 0.11 | 0.32 | **0.14** |
| Total (n): | **1,483** | **1,634** | **1,892** | **2,043** | **2,315** | **2,428** | **2,665** | **2,752** | **2,673** | **2,831** | **22,716** |

RA: revision arthroplasty.

### *Conversion to TKA 2010-2019*

**FIGURE Trend (proportion [%] per year) in conversion of a unicondylar or patellofemoral knee arthroplasty to a total knee arthroplasty in the Netherlands in 2010-2019**

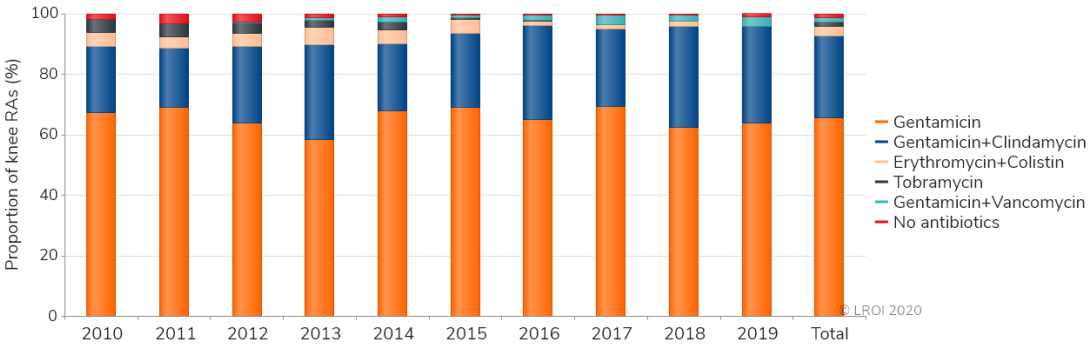



| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Conversion to TKA (%)** | | | | | | | | | | | |
| No conversion to TKA | 69.21 | 70.52 | 72.59 | 77.29 | 74.55 | 78.58 | 78.56 | 81.15 | 81.22 | 82.28 | **77.68** |
| Conversion to TKA | 24.84 | 21.93 | 21.53 | 19.91 | 25.40 | 21.37 | 21.36 | 18.71 | 18.44 | 17.65 | **20.70** |
| Unknown | 5.95 | 7.55 | 5.88 | 2.80 | 0.05 | 0.04 | 0.08 | 0.14 | 0.34 | 0.07 | **1.62** |
| Total (n): | **1,260** | **1,391** | **1,616** | **1,713** | **2,063** | **2,246** | **2,640** | **2,774** | **2,647** | **2,754** | **21,104** |

RA: revision arthroplasty; TKA: total knee arthroplasty.

*Bone cement antibiotics 2010-2019*

**FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in knee revision arthroplasties in the Netherlands in 2010-2019**




| Bone cement antibiotics (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gentamicin | 67.38 | 68.95 | 63.87 | 58.55 | 67.82 | 69.20 | 65.08 | 69.38 | 62.57 | 63.81 | **65.55** |
| Gentamicin+Clindamycin | 21.89 | 19.58 | 25.40 | 31.22 | 22.38 | 24.20 | 31.15 | 25.47 | 33.19 | 32.09 | **27.16** |
| Erythromycin+Colistin | 4.46 | 3.87 | 4.25 | 5.68 | 4.62 | 4.60 | 1.32 | 1.54 | 1.74 | 0.00 | **3.04** |
| Tobramycin | 4.29 | 4.39 | 3.49 | 2.33 | 2.37 | 0.74 | 0.34 | 0.05 | 0.05 | 0.00 | **1.57** |
| Gentamicin+Vancomycin | 0.00 | 0.00 | 0.13 | 1.02 | 1.82 | 0.91 | 1.67 | 3.03 | 1.90 | 3.16 | **1.49** |
| No antibiotics | 1.97 | 3.20 | 2.86 | 1.20 | 0.97 | 0.34 | 0.44 | 0.53 | 0.54 | 0.95 | **1.19** |
| Total (n): | **1,165** | **1,343** | **1,575** | **1,672** | **1,644** | **1,760** | **2,042** | **1,881** | **1,838** | **1,901** | **16,821** |

RA: revision arthroplasty.

## Most frequently registered

*Components*

**TABLE The most frequently registered femur, tibia, insert and patella components in knee revision arthroplasties in the Netherlands in 2019**

| Femur (n=1,338) | | Tibia (n=1,380) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Legion | 25.0 | Legion | 26.2 |
| NexGen | 19.4 | NexGen | 18.5 |
| Genesis II | 7.7 | S-ROM | 9.4 |
| LCS | 6.7 | Triathlon | 6.2 |
| Triathlon | 6.5 | Vanguard 360 | 6.2 |
| Vanguard Complete Knee | 6.1 | Vanguard Complete Knee | 5.9 |
| Legion Hinged | 5.2 | Genesis II | 5.1 |
| Vanguard 360 | 5.0 | Legion Hinged | 4.6 |
| PFC / SIGMA | 4.8 | PFC / SIGMA | 4.1 |
| RT Plus | 3.0 | RT Plus | 2.9 |

| Insert (n=2,187) | | Patella (n=1,148) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Genesis II | 26.9 | Genesis II | 46.9 |
| NexGen | 17.3 | Vanguard | 15.2 |
| Vanguard Complete Knee | 10.0 | NexGen | 14.4 |
| LCS | 6.3 | PFC / SIGMA | 7.4 |
| Triathlon | 6.1 | Triathlon | 4.6 |
| PFC / SIGMA | 5.7 | LCS | 2.9 |
| Legion | 4.2 | Attune | 2.1 |
| Oxford PKR | 4.0 | AGC | 1.7 |
| Vanguard SSK | 3.5 | balanSys | 1.3 |
| Legion Hinged | 3.5 | ACS | 0.8 |

*Types of bone cement*

**TABLE The most frequently registered types of bone cement by type of mixing system used during knee revision arthroplasties in the Netherlands in 2019**

| Separately packed bone cement components (n=1,212) | | Bone cement pre-packed in a vacuum mixing system (n=679) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 38.3 | Refobacin Bone Cement R | 51.7 |
| Copal G+C | 38.2 | Palacos R+G | 40.4 |
| Refobacin Revision | 11.5 | Refobacin Plus Bone Cement | 7.5 |
| Copal G+V | 4.8 | Refobacin Revision | 0.4 |
| Refobacin Bone Cement R | 3.1 | | |



# Survival

## Revision within 1 and 3 years

*By type of revision*

**TABLE Cumulative 1-year and 3-years revision percentage of primary total knee arthroplasties by type of revision in the Netherlands in 2012-2016 (n=117,040)**

| | Cumulative 1-year revision percentage | | Cumulative 3-years revision percentage | |
|---|---|---|---|---|
| | **Competing Risk (95% CI)** | **Kaplan Meier (95% CI)** | **Competing Risk (95% CI)** | **Kaplan Meier (95% CI)** |
| Any type of revision[1] | 1.1 (1.0-1.1) | 1.0 (0.9-1.0) | 3.5 (3.4-3.6) | 3.5 (3.4-3.6) |
| Major revision[2] | 0.4 (0.4-0.5) | 0.4 (0.4-0.4) | 1.6 (1.5-1.7) | 1.6 (1.5-1.7) |
| Minor revision[3] | 0.6 (0.6-0.7) | 0.5 (0.5-0.6) | 1.8 (1.8-1.9) | 1.8 (1.8-1.9) |

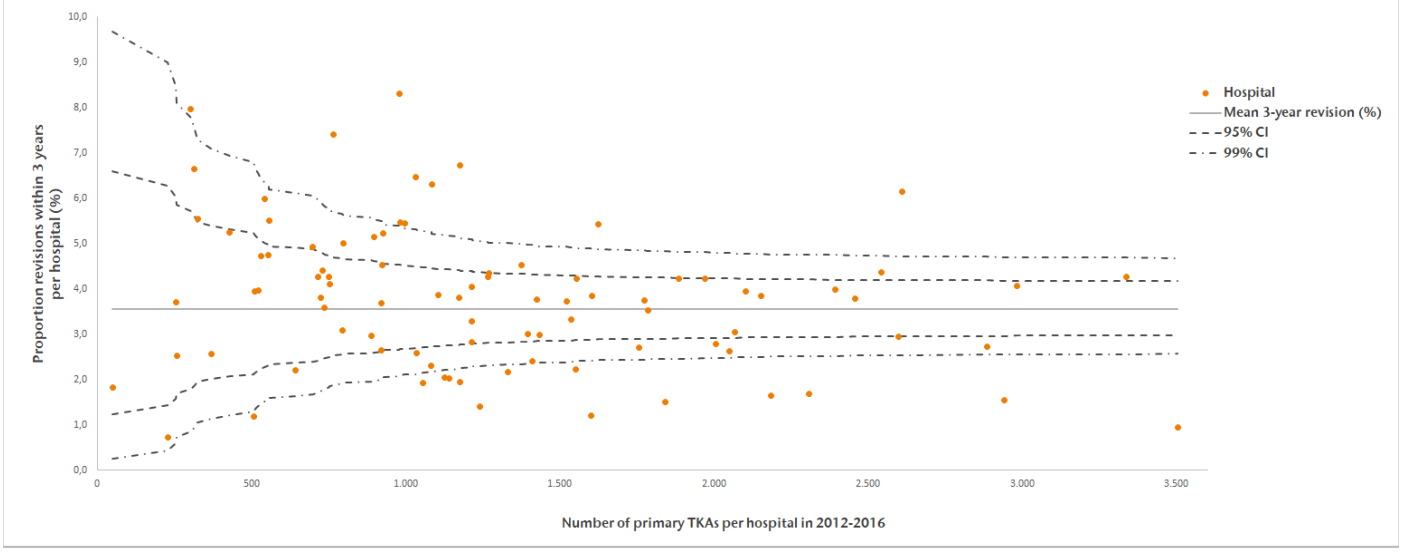
[1] Any type of revision includes minor and major revisions as well as revision procedures that could not be classified as minor or major revision.
[2] Revision of at least the femur or tibia component.
[3] Only insert and/or patella exchange (including patella addition).
CI: confidence interval.



**In 2012-2016, 3,459 (3.0%) primary TKAs were implanted in patients who died within three year after the primary procedure.**

*Overall revision per hospital*

**FIGURE Funnel plot of proportion of knee revision arthroplasties within three years after a total knee arthroplasty per hospital in the Netherlands in 2012-2016 (n=115,987)**

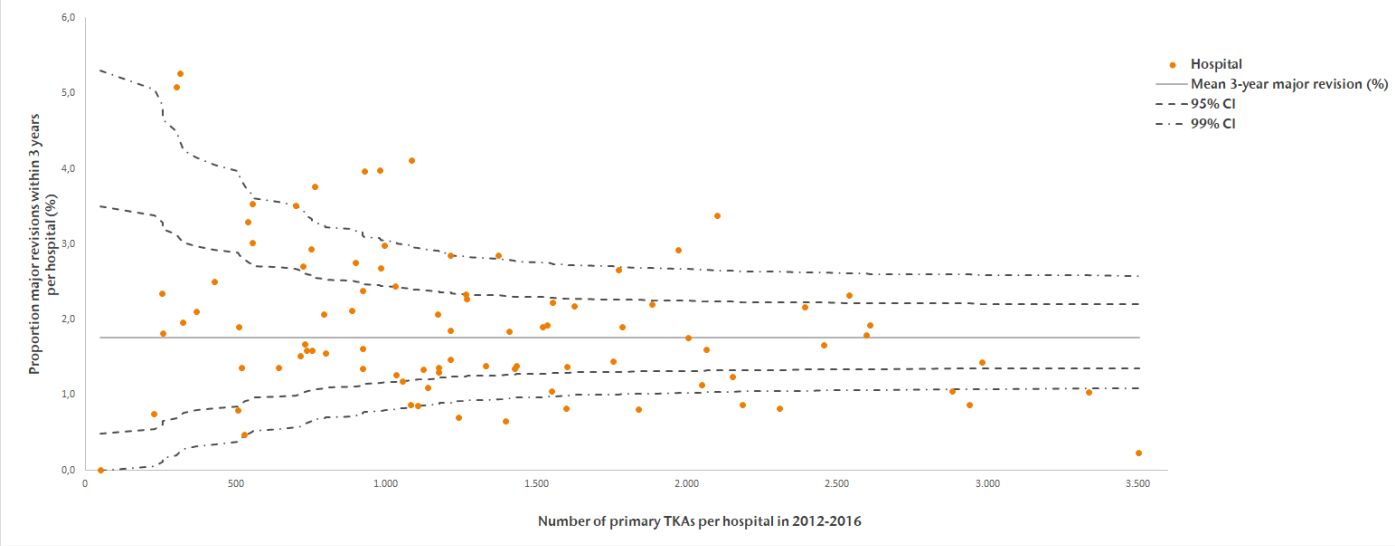



Please note: The proportion of revisions within 3 years per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).
TKA: total knee arthroplasty; CI: confidence interval.

**The mean 3-years revision percentage is 3.55 in the Netherlands in 2012-2016.**
**Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.**

*Major revision per hospital*

**FIGURE Funnel plot of proportion of knee major revision arthroplasties within three years after a total knee arthroplasty per hospital in the Netherlands in 2012-2016 (n=115,987)**




Please note: Major revision is defined as revision of at least femur or tibia component.
Please note: The proportion of revisions within 3 years per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).
TKA: total knee arthroplasty; CI: confidence interval.

**The mean 3-years major revision percentage is 1.76 in the Netherlands in 2012-2016.**
**Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.**

*Reasons for revision by type of revision*

**TABLE Reasons for revision within three years in patients that underwent a knee revision arthroplasty by type of revision in the Netherlands in 2012-2016**

| | Major revision[1] (n=1,887) | Minor revision[2] (n=2,158) | Any type of revision[3] (n=4,156) |
|---|---|---|---|
| **Reasons for revision** | **Proportion[4] (%)** | **Proportion[4] (%)** | **Proportion[4] (%)** |
| Patellar dislocation | 2.2 | 3.8 | 31.6 |
| Patellar pain | 10.2 | 50.6 | 31.6 |
| Instability | 31.4 | 23.9 | 26.7 |
| Infection | 17.9 | 17.3 | 17.6 |
| Loosening of tibia component | 35.0 | 0.7 | 16.4 |
| Malalignment | 28.7 | 1.8 | 14.0 |
| Arthrofibrosis | 7.0 | 6.4 | 6.8 |
| Loosening of femur component | 9.2 | 0.2 | 4.3 |
| Periprosthetic fracture | 4.1 | 0.3 | 2.1 |
| Revision after knee removal | 3.9 | 0.1 | 1.9 |
| Insert wear | 1.1 | 2.3 | 1.7 |
| Loosening of patella component | 0.3 | 1.2 | 0.7 |
| Progression of osteoarthritis | 0.4 | 0.6 | 0.5 |
| Other | 7.6 | 8.6 | 8.3 |

[1] Revision of at least the femur or tibia component.
[2] Only insert and/or patella exchange (including patella addition).
[3] Any type of revision includes minor and major revisions as well as revision procedures that could not be classified as minor or major revision.
4 One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.

## Revision within 11 years

*TKA overall*

**FIGURE Cumulative revision percentage of total knee arthroplasties by type of revision in the Netherlands in 2007-2019 (n=267,340)**

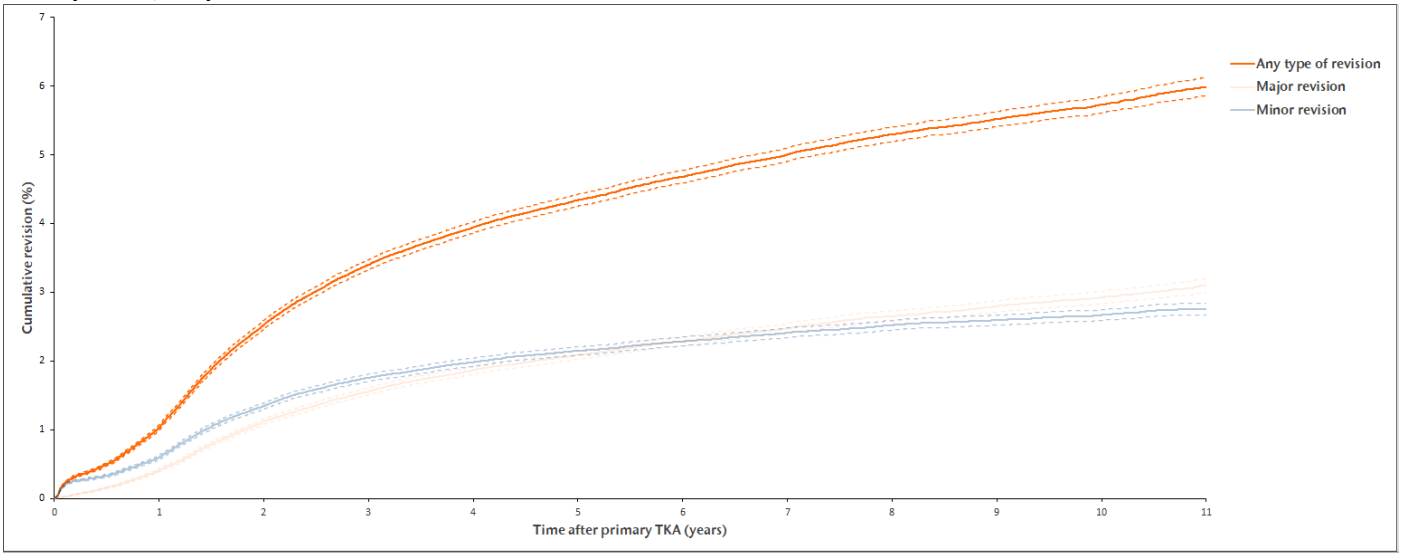



**TABLE Cumulative 11-year revision percentage of total knee arthroplasties by type of revision in the Netherlands in 2007-2019 (n=267,340)**

| | Cumulative 11-year revision percentage | |
|---|---|---|
| | Competing Risk[4] (95% CI) | Kaplan Meier (95% CI) |
| Any type of revision[1] | 6.0 (5.9-6.1) | 6.3 (6.2-6.5) |
| Major revision[2] | 3.1 (3.0-3.2) | 3.3 (3.2-3.4) |
| Minor revision[3] | 2.8 (2.7-2.8) | 2.9 (2.8-3.0) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
[2] Revision of at least the femur or tibia component.
[3]Only insert and/or patella exchange (including patella addition).
TKA: total knee arthroplasty; CI: confidence interval.



**In 2007-2019, 22,816 (8.5%) primary TKAs were implanted in patients who died within eleven years after the primary diagnosis**

*TKA by gender*

**FIGURE Cumulative revision percentage of total knee arthroplasties by gender in the Netherlands in 2007-2019 (n=266,847)**

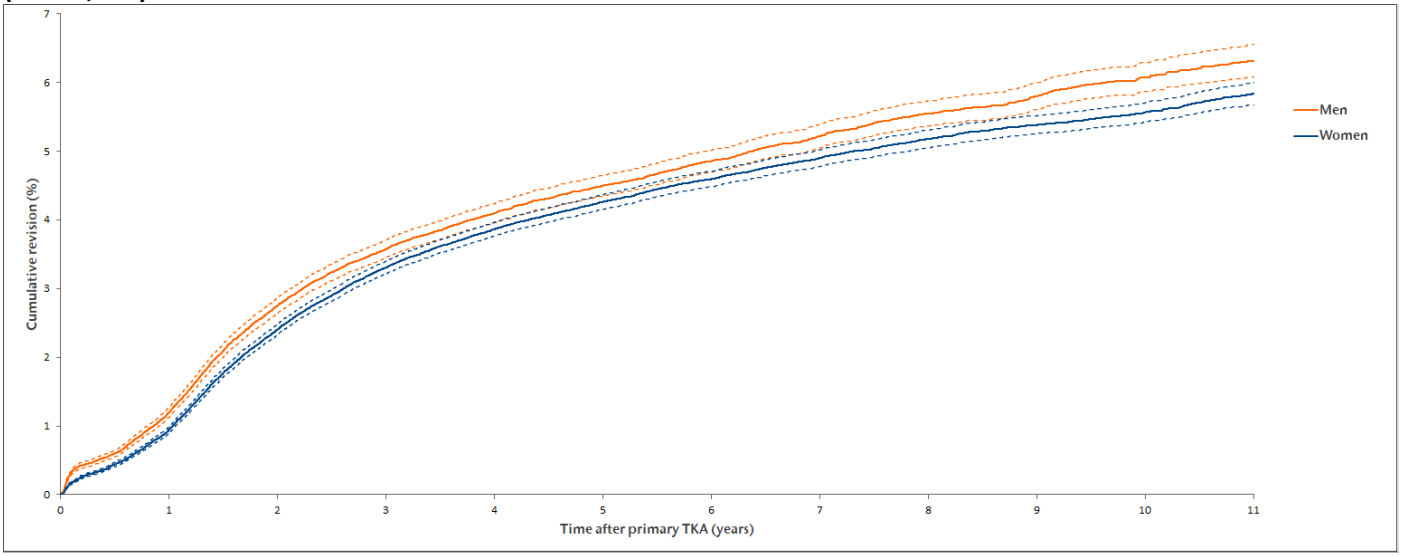



**TABLE Cumulative 11-year revision percentage of total knee arthroplasties by gender in the Netherlands in 2007-2019 (n=266,847)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Gender | | | |
| Men | 92,828 | 6.3 (6.1-6.5) | 6.8 (6.5-7.0) |
| Women | 174,019 | 5.8 (5.7-6.0) | 6.1 (6.0-6.3) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*TKA by age category*

**FIGURE Cumulative revision percentage of total knee arthroplasties by age category in the Netherlands in 2007-2019 (n=267,061)**

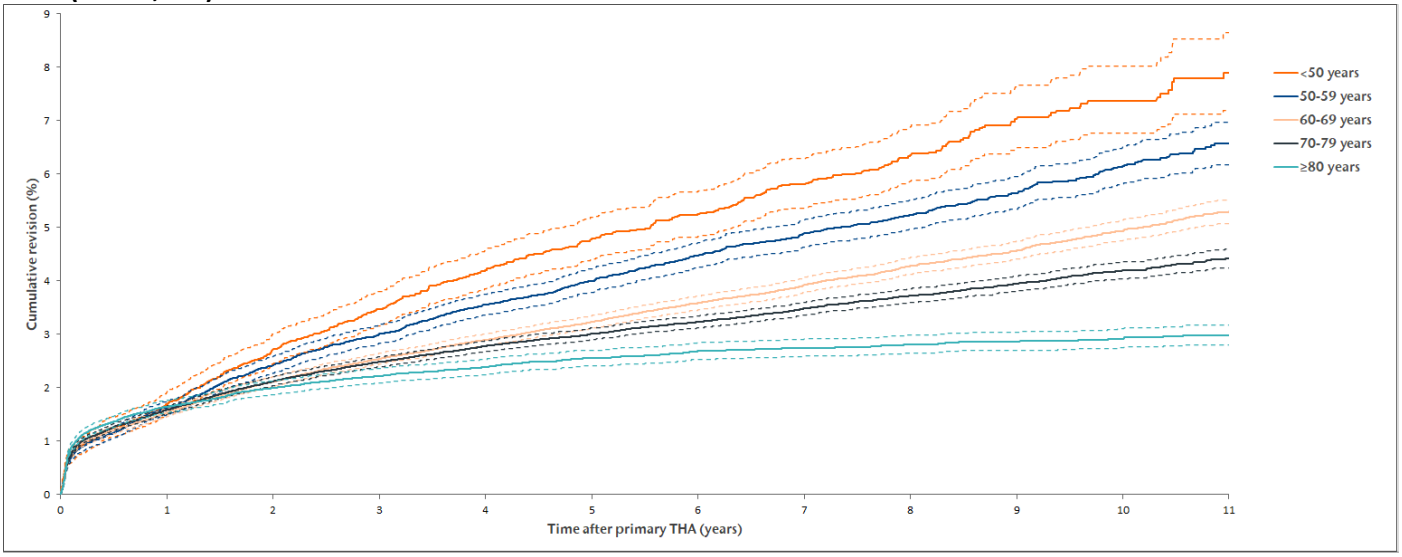



**TABLE Cumulative 11-year revision percentage of total knee arthroplasties by age category in the Netherlands in 2007-2019 (n=267,061)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Age (years) | | | |
| <50 | 6,261 | 14.9 (13.7-16.2) | 15.0 (13.7-16.2) |
| 50-59 | 38,853 | 10.2 (9.8-10.7) | 10.4 (9.9-10.8) |
| 60-69 | 93,840 | 6.6 (6.3-6.8) | 6.8 (6.5-7.0) |
| 70-79 | 95,364 | 4.3 (4.1-4.5) | 4.6 (4.4-4.8) |
| ≥80 | 32,743 | 2.4 (2.2-2.6) | 2.6 (2.3-2.8) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*TKA by diagnosis*

**FIGURE Cumulative revision percentage of total knee arthroplasties by diagnosis in the Netherlands in 2007-2019 (n=264,856)**

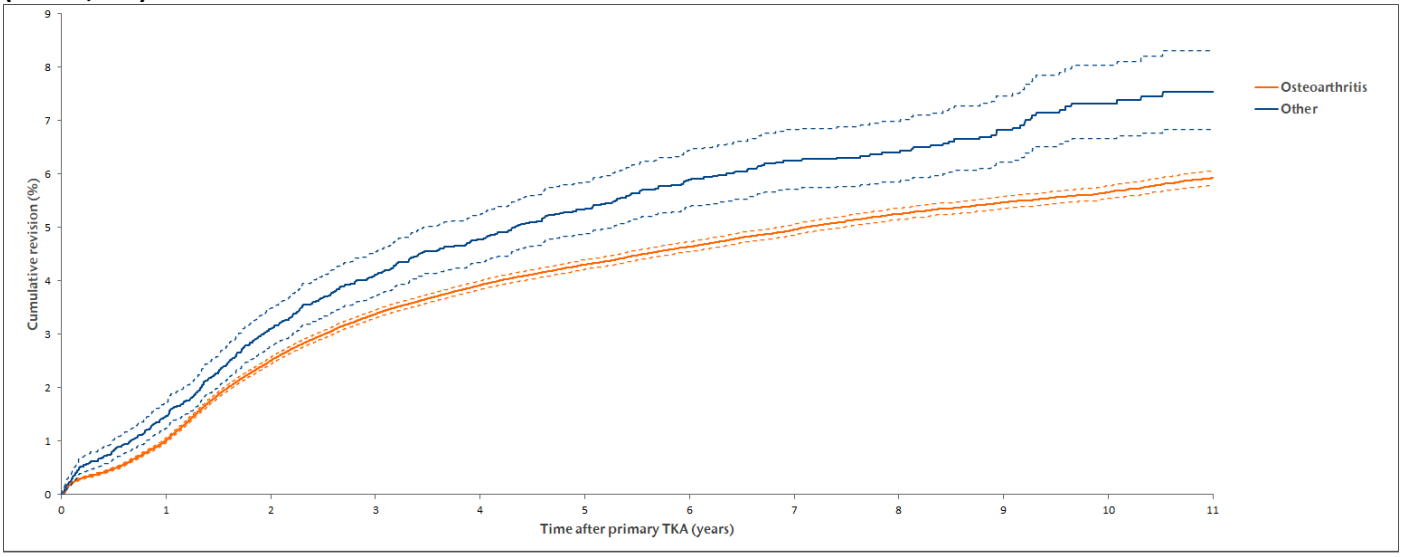



**TABLE Cumulative 11-year revision percentage of total knee arthroplasties by diagnosis in the Netherlands in 2007-2019 (n=264,856)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Diagnosis | | | |
| Osteoarthritis | 254,808 | 5.9 (5.8-6.1) | 6.3 (6.1-6.4) |
| Other | 10,048 | 7.5 (6.8-8.3) | 8.1 (7.3-9.0) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*TKA by ASA score*

**FIGURE Cumulative revision percentage of total knee arthroplasties by ASA score in the Netherlands in 2007-2019 (n=258,027)**

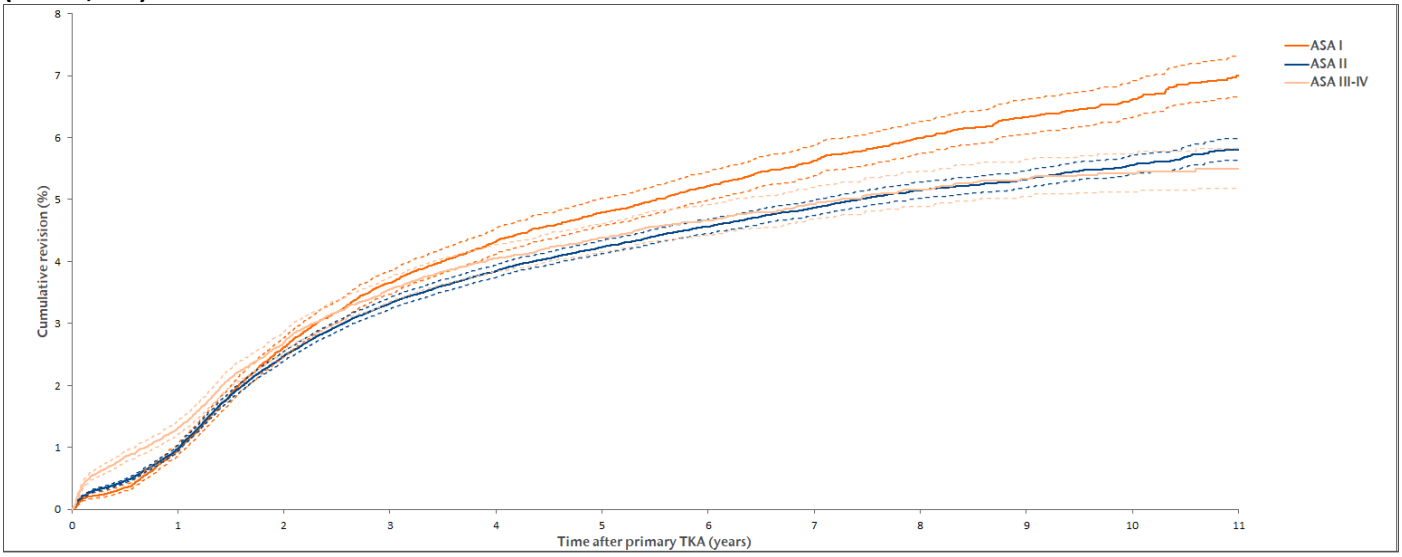



**TABLE Cumulative 11-year revision percentage of total knee arthroplasties by ASA score in the Netherlands in 2007-2019 (n=258,027)**

| | | Cumulative 11-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| ASA score | | | |
| I | 43,325 | 7.0 (6.7-7.3) | 7.2 (6.9-7.5) |
| II | 172,220 | 5.8 (5.6-6.0) | 6.1 (5.9-6.3) |
| III-IV | 42,482 | 5.5 (5.2-5.8) | 6.0 (5.6-6.4) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
CI: confidence interval.

*UKA overall*

**FIGURE Cumulative revision percentage of unicondylar knee arthroplasties of patients who underwent a UKA for osteoarthritis in the Netherlands in 2007-2019 (n=30,041)**

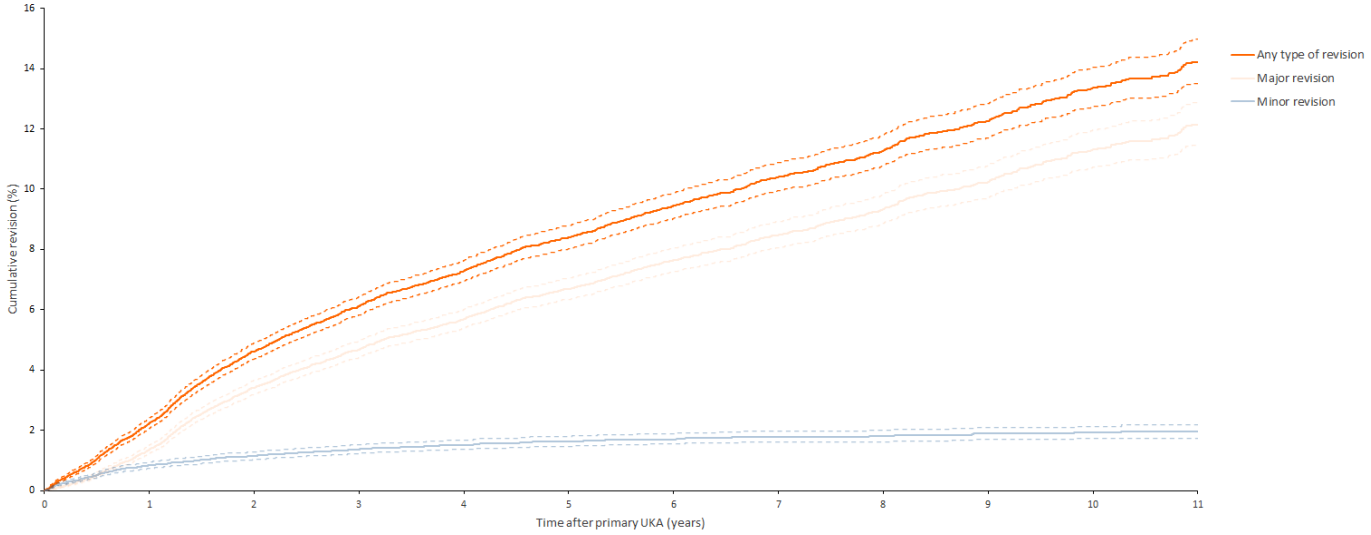



**TABLE Cumulative 11-year revision percentage of unicondylar knee arthroplasties**

| | Cumulative 11-year revision percentage | |
|---|---|---|
| | Competing Risk[4] (95% CI) | Kaplan Meier (95% CI) |
| Any type of revision[1] | 14.2 (13.5-15.0) | 14.8 (14.0-15.5) |
| Major revision[2] | 12.1 (11.5-12.9) | 12.6 (11.9-13.4) |
| Minor revision[3] | 1.9 (1.7-2.2) | 2.0 (1.8-2.2) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
[2] Revision of at least the femur or tibia component.
[3]Only insert and/or patella exchange (including patella addition).
UKA: unicondylarl knee arthroplasty; CI: confidence interval.



**In 2007-2019, 945 (3.1%) primary UKAs were implanted in patients who died within eleven years after the primary diagnosis.**

*Cemented primary TKA*

# TABLE Cumulative revision percentages of cemented primary total knee arthroplasties by prosthesis component combination of patients who underwent a TKA for osteoarthritis in the Netherlands in 2007-2019 (n=227,972)

| | | | | | Type of revision (n) | | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Femur component | Tibia component | Total primary TKAs (n) | Median (IQR) age (yr) | Total RAs (n) | Total knee (complete revision) | Patella addition | Only femur component | Only tibia component | Only insert/ patella | Missing/ unknown | 1yr | 3yr | 5yr | 7yr | 10yr | 11yr |
| **All cemented TKAs for osteoarthritis** | | **227,972** | **69 (63-75)** | **9,051** | **3,128** | **1,814** | **405** | **818** | **2,634** | **252** | **1.0 (1.0-1.1)** | **3.4 (3.3-3.5)** | **4.4 (4.3-4.5)** | **5.1 (5.0-5.3)** | **6.0 (5.8-6.1)** | **6.5 (6.2-6.5)** |
| Genesis II | Genesis II | 50,725 | 69 (62-75) | 2,249 | 564 | 511 | 198 | 138 | 772 | 66 | 1.2 (1.1-1.3) | 4.2 (4.0-4.3) | 5.2 (5.0-5.4) | 5.6 (5.2-5.8) | 6.5 (6.2-6.9) | 6.8 (6.5-7.2) |
| NexGen | NexGen | 48,827 | 69 (63-75) | 1,857 | 750 | 200 | 57 | 223 | 567 | 60 | 1.0 (0.9-1.1) | 3.0 (2.8-3.1) | 4.1 (3.9-4.3) | 5.1 (4.9-5.4) | 6.1 (5.8-6.5) | 6.5 (6.2-7.0) |
| Vanguard Complete Knee | Vanguard Complete Knee | 37,873 | 69 (62-75) | 1,296 | 428 | 261 | 35 | 117 | 419 | 36 | 1.0 (0.9-1.1) | 3.1 (2.9-3.3) | 4.0 (3.8-4.2) | 4.7 (4.4-4.9) | 5.3 (4.9-5.6) | 5.4 (5.0-5.7) |
| PFC / Sigma | PFC / Sigma | 27,266 | 70 (63-76) | 974 | 280 | 247 | 24 | 73 | 326 | 24 | 1.0 (0.9-1.1) | 3.2 (3.0-3.4) | 3.9 (3.6-4.2) | 4.3 (4.0-4.6) | 4.8 (4.4-5.1) | 5.0 (4.6-5.3) |
| LCS | LCS | 16,001 | 70 (63-76) | 618 | 317 | 58 | 28 | 124 | 82 | 9 | 0.7 (0.6-0.9) | 3.4 (3.0-3.7) | 4.4 (4.1-4.8) | 5.1 (4.6-5.5) | 5.8 (5.2-6.3) | 6.1 (5.4-6.7) |
| Triathlon | Triathlon | 6,012 | 70 (64-76) | 187 | 55 | 33 | 12 | 11 | 73 | 3 | 1.3 (1.0-1.6) | 3.7 (3.1-4.3) | 4.4 (3.7-5.0) | 5.4 (4.4-6.1) | n.a. | n.a. |
| AGC V2 | AGC V2 | 4,418* | 71 (65-77) | 149 | 85 | 47 | 1 | 2 | 10 | 4 | 0.4 (0.2-0.6) | 2.1 (1.7-2.5) | 2.6 (2.1-3.1) | 3.2 (2.7-3.8) | 3.6 (3.0-4.2) | 4.2 (3.4-5.0) |
| TC Plus | TC Plus | 3,083 | 70 (63-76) | 86 | 47 | 16 | 2 | 5 | 12 | 4 | 0.7 (0.4-0.9) | 2.2 (1.7-2.8) | 3.0 (2.3-3.6) | 3.4 (2.7-4.2) | 4.0 (3.0-5.0) | 4.4 (3.2-5.6) |
| Optetrak | Optetrak | 3,065* | 70 (62-76) | 296 | 146 | 89 | 3 | 33 | 20 | 5 | 1.3 (0.9-1.7) | 5.4 (4.6-6.2) | 7.2 (6.3-8.2) | 9.2 (8.1-10.3) | 11.9 (10.5-13.4) | 13.3 (11.4-15.2) |
| balanSys | balanSys | 2,941 | 69 (62-76) | 122 | 49 | 45 | 1 | 5 | 19 | 3 | 0.6 (0.4-0.9) | 3.5 (2.8-4.3) | 4.9 (3.7-5.7) | 5.9 (4.7-7.0) | 7.2 (5.5-8.8) | 8.5 (6.4-10.6) |
| ACS | ACS | 2,662 | 67 (60-73) | 128 | 29 | 18 | 8 | 12 | 53 | 8 | 0.8 (0.4-1.1) | 3.9 (3.1-4.6) | 4.7 (3.9-5.6) | 5.0 (4.1-5.9) | 5.7 (4.6-6.7) | n.a. |
| Scorpio NRG | Scorpio | 2,629* | 70 (63-76) | 125 | 41 | 43 | 9 | 3 | 28 | 1 | 0.9 (0.6-1.3) | 3.4 (2.7-4.1) | 4.5 (3.7-5.4) | 5.2 (4.3-6.1) | 5.8 (4.7-6.8) | 5.8 (4.7-6.8) |
| Scorpio | Scorpio | 2,240* | 71 (63-76) | 105 | 54 | 22 | 3 | 6 | 17 | 3 | 0.4 (0.1-0.7) | 2.4 (1.8-3.0) | 3.2 (2.5-3.9) | 3.8 (2.9-4.6) | 4.8 (3.9-5.7) | 5.3 (4.3-6.3) |
| Attune | Attune | 1,348 | 66 (60-73) | 27 | 5 | 7 | 1 | 7 | 6 | 1 | 0.5 (0.1-0.9) | 2.7 (1.6-3.9) | n.a. | n.a. | n.a. | n.a. |
| Journey BCS | Journey BCS | 1,271 | 68 (61-74) | 105 | 13 | 53 | 1 | 3 | 33 | 2 | 1.2 (0.6-1.9) | 6.2 (4.7-7.7) | 9.8 (7.9-11.8) | 9.9 (7.9-11.9) | 12.4 (10.0-15.2) | 13.9 (10.7-17.1) |
| PFC / SIGMA | LCS | 1,209 | 66 (58-75) | 52 | 26 | 11 | 3 | 1 | 9 | 2 | 0.3 (0.0-0.7) | 2.2 (1.3-3.0) | 3.2 (2.1-4.2) | 4.1 (2.9-5.3) | 5.2 (3.7-6.7) | 6.8 (4.4-9.1) |
| NexGen GSF | NexGen | 1,119 | 68 (61-74) | 28 | 14 | 5 | 0 | 1 | 7 | 1 | 0.6 (0.2-1.0) | 1.6 (0.8-2.3) | 2.6 (1.6-3.7) | 3.1 (1.8-4.3) | n.a. | n.a. |
| Journey II BCS | Journey BCS | 986 | 66 (60-73) | 48 | 8 | 23 | 0 | 0 | 15 | 2 | 0.3 (0.0-0.7) | 4.8 (3.3-6.3) | 6.3 (4.5-8.2) | n.a. | n.a. | n.a. |
| MRK | MRK | 920 | 69 (62-75) | 14 | 6 | 6 | 0 | 0 | 2 | 0 | 0.3 (0.0-0.6) | 1.8 (0.7-2.9) | 2.5 (1.0-4.0) | 3.1 (1.2-5.1) | n.a. | n.a. |
| Innex | Innex | 908* | 70 (62-78) | 37 | 13 | 10 | 0 | 4 | 10 | 0 | 1.2 (0.5-1.9) | 2.6 (1.5-3.6) | 3.5 (2.3-4.7) | 4.2 (2.9-5.7) | 4.4 (3.0-5.9) | 5.0 (3.2-6.9) |
| Profix | Profix | 772* | 68 (61-76) | 57 | 40 | 7 | 1 | 2 | 6 | 1 | 0.7 (0.1-1.2) | 3.7 (2.3-5.0) | 5.7 (4.1-7.4) | 6.7 (4.9-8.5) | 8.1 (6.0-10.1) | 8.1 (6.0-10.1) |
| Genesis II | Profix/Genesis MB baseplate | 622* | 67 (60-75) | 65 | 27 | 29 | 0 | 1 | 7 | 1 | 2.0 (0.9-3.0) | 7.1 (5.1-9.1) | 9.2 (6.8-11.5) | 10.3 (7.8-12.7) | 11.2 (8.6-13.8) | 11.2 (8.6-13.8) |
| Evolution MP | Evolution MP | 583 | 69 (63-74) | 10 | 1 | 4 | 0 | 0 | 5 | 0 | 0.6 (0.0-1.2) | 3.2 (1.0-5.4) | n.a. | n.a. | n.a. | n.a. |
| Personaâ® | Personaâ® | 460 | 68 (62-73) | 17 | 8 | 1 | 0 | 1 | 7 | 0 | 0.9 (0.0-1.9) | 5.3 (2.5-8.0) | 7.5 (3.7-11.2) | n.a. | n.a. | n.a. |
| Rotaglide | Rotaglide | 427* | 72 (65-78) | 33 | 24 | 2 | 2 | 0 | 5 | 0 | 1.2 (0.1-2.2) | 4.7 (2.7-6.8) | 6.2 (3.9-8.5) | 7.3 (4.8-9.9) | 8.9 (5.8-12.1) | 8.9 (5.8-12.1) |
| Advance MP | Advance | 312* | 71 (65-78) | 30 | 5 | 9 | 1 | 5 | 10 | 0 | 1.9 (0.4-3.5) | 7.7 (4.8-10.7) | 9.0 (5.8-12.2) | 9.4 (6.1-12.6) | 9.7 (6.4-13.0) | 9.7 (6.4-13.0) |
| Maxim | Vanguard Complete Knee | 272* | 70 (63-77) | 14 | 3 | 3 | 1 | 2 | 5 | 0 | 1.5 (0.0-2.9) | 2.9 (0.9-4.9) | 3.3 (1.2-5.4) | 4.1 (1.7-6.4) | 4.8 (2.3-7.4) | 5.2 (5.6-7.8) |

* Denotes prosthesis combinations with no reported use in primary TKAs in 2019.
Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; RA: revision arthroplasty; CI: confidence interval; IQR: interquartile range.



**Only combinations with over 250 procedures have been listed.**

**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*Uncemented primary TKA*

# TABLE Cumulative revision percentages of uncemented primary total knee arthroplasties by prosthesis component combination of patients who underwent a TKA for osteoarthritis in the Netherlands in 2007-2019 (n=12,008)

| | | | | | Type of revision (n) | | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Femur component | Tibia component | Total primary TKAs (n) | Median (IQR) age (yr) | Total RAs (n) | Total knee (complete revision) | Patella addition | Only femur component | Only tibia component | Only insert/ patella | Missing/ unknown | 1yr | 3yr | 5yr | 7yr | 10yr | 11yr |
| **All uncemented TKAs for osteoarthritis** | | **12,008** | **69 (62-76)** | **546** | **188** | **83** | **11** | **107** | **149** | **8** | **1.2 (1.0-1.4)** | **3.8 (3.5-4.2)** | **4.8 (4.3-5.2)** | **5.3 (4.8-5.7)** | **6.1 (5.6-6.7)** | **6.5 (5.8-7.1)** |
| LCS | LCS | 7,840 | 69 (63-76) | 329 | 89 | 42 | 8 | 85 | 101 | 4 | 1.1 (0.8-1.3) | 3.6 (3.2-4.1) | 4.3 (3.8-4.7) | 4.7 (4.1-5.2) | 5.4 (4.8-6.0) | 5.7 (5.0-6.4) |
| Triathlon | Triathlon | 1,057 | 70 (63-76) | 26 | 9 | 5 | 0 | 2 | 10 | 0 | 0.7 (0.2-1.2) | 1.9 (1.0-2.8) | 3.0 (1.7-4.2) | 3.5 (2.0-4.9) | n.a. | n.a. |
| ACS | ACS | 430 | 69 (61-76) | 21 | 9 | 4 | 1 | 3 | 4 | 0 | 2.8 (1.3-4.4) | 4.6 (2.6-6.6) | 5.2 (3.0-7.4) | 5.2 (3.0-7.4) | n.a. | n.a. |
| Duracon | Duracon | 282* | 69 (61-77) | 9 | 4 | 1 | 0 | 0 | 4 | 0 | 0.4 (0.0-1.1) | 0.7 (0.0-1.7) | 1.4 (0.0-2.8) | 1.4 (0.0-2.8) | 3.1 (1.0-5.1) | 3.8 (1.3-6.4) |
| Rotaglide | Rotaglide | 265* | 69 (61-76) | 54 | 35 | 10 | 1 | 1 | 6 | 1 | 2.3 (0.5-4.1) | 10.3 (6.6-14.0) | 16.3 (11.8-20.8) | 19.8 (14.8-24.7) | 21.9 (16.5-27.3) | n.a. |
| ACS LD | ACS LD | 224 | 70 (61-76) | 11 | 5 | 2 | 0 | 1 | 3 | 0 | 1.4 (0.0-2.9) | 5.9 (2.4-9.4) | n.a. | n.a. | n.a. | n.a. |
| NexGen | NexGen | 218 | 69 (62-77) | 14 | 7 | 1 | 0 | 2 | 4 | 0 | 1.9 (0.1-3.8) | 5.3 (1.9-8.7) | 7.1 (2.9-11.3) | 8.3 (3.6-12.1) | n.a. | n.a. |
| Genesis II | Genesis II | 191 | 68 (62-76) | 9 | 4 | 2 | 0 | 1 | 1 | 1 | 1.1 (0.0-2.6) | 5.3 (1.9-8.8) | 5.3 (1.9-8.8) | 5.3 (1.9-8.8) | n.a. | n.a. |
| Vanguard Complete Knee | Vanguard Complete Knee | 154 | 67 (61-74) | 11 | 5 | 1 | 0 | 4 | 1 | 0 | 3.3 (0.4-6.1) | 6.4 (2.3-10.4) | 6.4 (2.3-10.4) | 6.4 (2.3-10.4) | n.a. | n.a. |

* Denotes prosthesis combinations with no reported use in primary TKAs in 2019.
Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; RA: revision arthroplasty; CI: confidence interval; IQR: interquartile range.



**Only combinations with over 100 procedures have been listed.**
**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*Bone cement TKA*

## TABLE Cumulative revision percentages of The most frequently registered types of bone cement by type of mixing system in 2019, in primary total knee arthroplasties in the Netherlands in 2007-2019

| | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|
| **Bone cement** | **n** | **1yr** | **3yr** | **5yr** | **7yr** | **10yr** | **11yr** |
| Separately packed bone cement components (n=163,277) | | | | | | | |
| Palacos R+G | 122,717 | 1.0 (1.0-1.1) | 3.5 (3.4-3.6) | 4.5 (4.3-4.6) | 5.2 (5.1-5.4) | 6.1 (5.9-6.3) | 6.5 (6.2-6.7) |
| Refobacin Bone Cement R | 11,171 | 0.9 (0.7-1.1) | 3.2 (2.8-3.5) | 4.2 (3.8-4.7) | 5.5 (5.0-6.0) | 6.3 (5.7-6.9) | 7.2 (6.5-7.9) |
| Palacos MV+G | 7,804 | 0.9 (0.6-1.1) | 3.2 (2.8-3.6) | 4.1 (3.6-4.6) | 5.0 (4.4-5.5) | n.a. | n.a. |
| Biomet Plus Bone Cement | 1,411 | 1.2 (0.6-1.8) | 3.9 (2.8-5.0) | 4.9 (3.6-6.2) | 4.9 (3.6-6.2) | n.a. | n.a. |
| Simplex HV | 205 | 2.6 (0.0-5.3) | 3.8 (0.3-7.2) | n.a. | n.a. | n.a. | n.a. |
| Bone cement pre-packed in a vacuum mixing system (n=57,693) | | | | | | | |
| Palacos R+G | 16,270 | 1.3 (1.1-1.4) | 3.9 (3.5-4.3) | 4.4 (3.8-4.9) | n.a. | n.a. | n.a. |
| Refobacin Bone Cement R | 26,226 | 1.2 (1.1-1.4) | 3.6 (3.3-3.9) | 4.7 (4.4-5.0) | 5.5 (5.0-5.9) | 6.2 (5.5-7.0) | n.a. |
| Refobacin Plus Bone Cement | 13,616 | 0.9 (0.7-1.0) | 3.4 (3.1-3.7) | 4.3 (3.9-4.6) | 4.9 (4.5-5.4) | 5.3 (4.8-5.9) | 5.7 (4.8-6.5) |

Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*UKA*

# TABLE Cumulative revision percentages of primary unicondylar knee arthroplasties by prosthesis component combination of patients who underwent a UKA for osteoarthritis in the Netherlands in 2007-2019 (n=30,041)

| | | | | | Type of revision (n) | | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Femur component | Tibia component | Total primary UKAs (n) | Median (IQR) age (yr) | Total RAs (n) | Total revision | Patella addition | Only femur | Only tibia | Only insert/ patella | Missing/ unknown | 1yr | 3yr | 5yr | 7yr | 10yr | 11yr |
| **All UKAs for osteoarthritis** | | **30,041** | **63 (57-69)** | **2,216** | **1,694** | **8** | **15** | **58** | **411** | **30** | **2.3 (2.1-2.4)** | **6.2 (5.9-6.5)** | **8.5 (8.1-8.9)** | **10.6 (10.1-11.1)** | **13.8 (13.1-14.5)** | **14.8 (14.0-15.5)** |
| Oxford PKR cemented | Oxford PKR cemented | 13,027 | 63 (57-69) | 1,245 | 991 | 5 | 9 | 30 | 191 | 19 | 2.2 (1.9-2.4) | 6.5 (6.0-6.9) | 8.9 (8.4-9.5) | 11.0 (10.4-11.7) | 14.2 (13.4-15.1) | 15.2 (14.3-16.2) |
| Oxford PKR cementless | Oxford PKR cementless | 9,412 | 64 (58-70) | 363 | 190 | 1 | 2 | 12 | 153 | 5 | 2.1 (1.8-2.4) | 4.8 (4.2-5.3) | 5.9 (5.2-6.6) | 7.3 (6.1-8.4) | n.a. | n.a. |
| Physica Zimmer Unicompartmental High Flex Knee | Physica Zimmer Unicompartmental High Flex Knee | 2,111 | 62 (57-67) | 82 | 73 | 0 | 0 | 1 | 8 | 0 | 1.0 (0.5-1.4) | 3.7 (2.7-4.7) | 5.1 (3.8-6.4) | 7.1 (5.3-8.9) | 10.0 (7.3-12.7) | 11.5 (8.1-14.8) |
| Genesis Uni | Genesis Uni | 1,274 | 62 (56-69) | 193 | 182 | 1 | 0 | 2 | 5 | 3 | 2.9 (2.0-3.8) | 9.0 (7.4-10.5) | 12.7 (10.8-14.6) | 15.2 (13.1-17.3) | 18.0 (15.5-20.4) | 18.3 (15.8-20.9) |
| balanSys UNI | balanSys UNI | 393 | 61 (55-68) | 49 | 40 | 1 | 0 | 3 | 5 | 0 | 3.6 (1.7-5.5) | 10.1 (6.9-13.3) | 11.2 (7.8-14.5) | 12.5 (8.8-16.1) | n.a. | n.a. |
| Journey Uni | Journey Uni | 340 | 62 (56-69) | 19 | 15 | 0 | 2 | 1 | 0 | 1 | 2.7 (0.8-4.5) | 6.9 (3.5-10.3) | n.a. | n.a. | n.a. | n.a. |
| Oxford PKR cementless | Oxford PKR cemented | 319 | 66 (56-69) | 16 | 8 | 0 | 0 | 0 | 8 | 0 | 3.8 (1.6-6.1) | 5.5 (2.6-8.4) | n.a. | n.a. | n.a. | n.a. |
| TRIATHLON | TRIATHLON | 180 | 60 (54-64) | 12 | 11 | 0 | 0 | 0 | 1 | 0 | 1.2 (0.0-2.9) | 6.8 (2.2-11.4) | 9.1 (3.6-14.6) | 11.9 (5.3-18.4) | n.a. | n.a. |
| HLS uni | HLS Uni | 170 | 58 (52-65) | 34 | 33 | 0 | 0 | 0 | 1 | 0 | 2.4 (0.1-4.6) | 8.9 (4.6-13.1) | 16.6 (10.9-22.2) | 19.6 (13.6-25.6) | 20.4 (14.2-26.5) | n.a. |
| Oxford PKR cemented | Oxford PKR cementless | 156 | 66 (59-73) | 8 | 3 | 0 | 1 | 0 | 4 | 0 | 3.1 (0.1-6.0) | n.a. | n.a. | n.a. | n.a. | n.a. |
| Allegretto | Allegretto | 108 | 57 (51-65) | 16 | 13 | 0 | 0 | 3 | 0 | 0 | 7.5 (2.5-12.5) | 13.9 (7.1-20.7) | 16.8 (9.1-24.4) | n.a. | n.a. | n.a. |

Please note: n.a. if <50 cases were at risk; UKA: unicondylar knee arthroplasty; CI: confidence interval; IQR: interquartile range.



**Only combinations with over 100 procedures have been listed.**
**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

Major revision per component

*Cemented primary TKA*

## TABLE Cumulative major revision percentages of cemented primary total knee arthroplasties by prosthesis component combination of patients who underwent a TKA for osteoarthritis in the Netherlands in 2007-2019 (n=227,972)

| | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Femur component** | **Tibia component** | **Total primary TKAs (n)** | **Median (IQR) age (yr)** | **Major revision[1] arthroplasties (n)** | **1yr** | **3yr** | **5yr** | **7yr** | **10yr** | **11yr** |
| **All cemented TKAs for osteoarthritis** | | **227,972** | **69 (63-75)** | **4,351** | **0.4 (0.4-0.4)** | **1.5 (1.5-1.6)** | **2.1 (2.0-2.2)** | **2.5 (2.4-2.6)** | **3.1 (2.9-3.2)** | **3.3 (3.2-3.5)** |
| Genesis II | Genesis II | 50,725 | 69 (62-75) | 900 | 0.4 (0.4-0.5) | 1.6 (1.5-1.8) | 2.1 (2.0-2.3) | 2.4 (2.2-2.5) | 2.5 (2.3-2.7) | 2.9 (2.6-3.1) |
| NexGen | NexGen | 48,827 | 69 (63-75) | 1,030 | 0.4 (0.3-0.4) | 1.5 (1.3-1.6) | 2.2 (2.0-2.3) | 3.0 (2.8-3.2) | 3.8 (3.5-4.1) | 4.1 (3.8-4.5) |
| Vanguard Complete Knee | Vanguard Complete Knee | 37,873 | 69 (62-75) | 580 | 0.4 (0.3-0.4) | 1.4 (1.3-1.5) | 1.8 (1.7-2.0) | 2.1 (1.9-2.3) | 2.5 (2.2-2.7) | 2.5 (2.2-2.8) |
| PFC / Sigma | PFC / Sigma | 27,266 | 70 (63-76) | 377 | 0.4 (0.3-0.4) | 1.2 (1.0-1.3) | 1.5 (1.3-1.7) | 1.7 (1.5-1.9) | 1.9 (1.7-2.1) | 2.0 (1.7-2.2) |
| LCS | LCS | 16,001 | 70 (63-76) | 469 | 0.5 (0.3-0.6) | 2.5 (2.2-2.7) | 3.3 (3.0-3.7) | 3.9 (3.5-4.2) | 4.5 (4.0-5.0) | 4.8 (4.2-5.4) |
| Triathlon | Triathlon | 6,012 | 70 (64-76) | 78 | 0.5 (0.3-0.7) | 1.6 (1.2-2.0) | 1.9 (1.4-2.3) | 2.2 (1.7-2.8) | n.a. | n.a. |
| AGC V2 | AGC V2 | 4,418* | 71 (65-77) | 88 | 0.2 (0.1-0.3) | 1.1 (0.8-1.4) | 1.4 (1.1-1.8) | 1.8 (1.4-2.2) | 2.2 (1.7-2.7) | 2.7 (2.0-3.4) |
| TC Plus | TC Plus | 3,083 | 70 (63-76) | 54 | 0.4 (0.2-0.7) | 1.3 (0.9-1.8) | 1.9 (1.4-3.5) | 2.2 (1.6-2.8) | 2.4 (1.7-3.1) | 2.4 (1.7-3.1) |
| Optetrak | Optetrak | 3,065* | 70 (62-76) | 182 | 0.7 (0.4-1.0) | 3.0 (2.4-3.6) | 4.2 (3.5-4.9) | 5.4 (4.5-6.2) | 7.6 (6.4-8.8) | 9.0 (7.2-10.7) |
| balanSys | balanSys | 2,941 | 69 (62-76) | 55 | 0.2 (0.0-0.4) | 1.5 (1.0-2.0) | 2.4 (1.7-3.0) | 2.8 (1.9-3.6) | 3.2 (2.2-4.2) | 3.9 (2.5-5.2) |

[1] Revision of at least the femur or tibia component.
* Denotes prosthesis combinations with no reported use in primary TKAs in 2019.
Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

*Uncemented primary TKA*

## TABLE Cumulative major revision percentages of uncemented primary total knee arthroplasties by prosthesis component combination of patients who underwent a TKA for osteoarthritis in the Netherlands in 2007-2019 (n=12,008)

| | | | | | Cumulative revision percentage (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Femur component** | **Tibia component** | **Total primary TKAs (n)** | **Median (IQR) age (yr)** | **Major revision[1] arthroplasties (n)** | **1yr** | **3yr** | **5yr** | **7yr** | **10yr** | **11yr** |
| **All uncemented TKAs for osteoarthritis** | | **12,008** | **69 (62-76)** | **306** | **0.7 (0.6-0.9)** | **2.2 (1.9-2.5)** | **2.7 (2.4-3.0)** | **3.0 (2.6-3.3)** | **3.4 (3.0-3.7)** | **3.6 (3.1-4.0)** |
| LCS | LCS | 7,84 | 69 (63-76) | 182 | 0.6 (0.4-0.8) | 2.1 (1.7-2.4) | 2.5 (2.1-2.9) | 2.6 (2.2-3.0) | 2.9 (2.4-3.3) | 2.9 (2.4-3.3) |
| Triathlon | Triathlon | 1,057 | 70 (63-76) | 11 | 0.4 (0.0-0.8) | 0.8 (0.2-1.3) | 1.1 (0.4-1.8) | 1.3 (0.5-2.2) | n.a. | n.a. |
| ACS | ACS | 430 | 69 (61-76) | 13 | 2.1 (0.8-3.5) | 3.1 (1.4-4.8) | 3.1 (1.4-4.8) | 3.1 (1.4-4.8) | n.a. | n.a. |
| Duracon | Duracon | 282* | 69 (61-77) | 4 | 0.0 (0.0-0.0) | 0.0 (0.0-0.0) | 0.4 (0.0-1.1) | 0.4 (0.0-1.1) | 1.6 (0.0-3.1) | 1.6 (0.0-3.1) |
| Rotaglide | Rotaglide | 265* | 69 (61-76) | 37 | 1.1 (0.0-2.4) | 6.5 (3.5-9.5) | 10.5 (6.7-14.2) | 13.1 (8.9-17.2) | 15.2 (10.4-20.0) | n.a. |
| ACS LD | ACS LD | 224 | 70 (61-76) | 6 | 0.9 (0.0-2.2) | 3.4 (0.6-6.3) | n.a. | n.a. | n.a. | n.a. |
| NexGen | NexGen | 218 | 69 (62-77) | 9 | 1.0 (0.0-2.3) | 3.7 (0.8-6.7) | 4.6 (1.2-7.9) | 5.8 (1.7-9.9) | n.a. | n.a. |
| Genesis II | Genesis II | 191 | 68 (62-76) | 5 | 0.5 (0.0-1.6) | 3.0 (0.4-5.6) | 3.0 (0.4-5.6) | 3.0 (0.4-5.6) | n.a. | n.a. |
| Vanguard Complete Knee | Vanguard Complete Knee | 154 | 67 (61-74) | 9 | 2.6 (0.1-5.1) | 5.0 (1.4-8.6) | 5.0 (1.4-8.6) | 5.0 (1.4-8.6) | n.a. | n.a. |

[1] Revision of at least the femur or tibia component.
* Denotes prosthesis combinations with no reported use in primary TKAs in 2019.
Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; CI: confidence interval; IQR: interquartile range.



**Results must be interpreted with caution. Patient characteristics like age and diagnosis, as well as procedure characteristics like the experience of the surgeon performing the procedure, femoral head size and articulation of the prosthesis may have influenced the cumulative revision percentages.**

## Rerevision

### *Overall second revision*

**FIGURE Cumulative second revision percentage of total knee arthroplasty after a one-stage first revision in the Netherlands in 2007-2019 (n=7,523)**

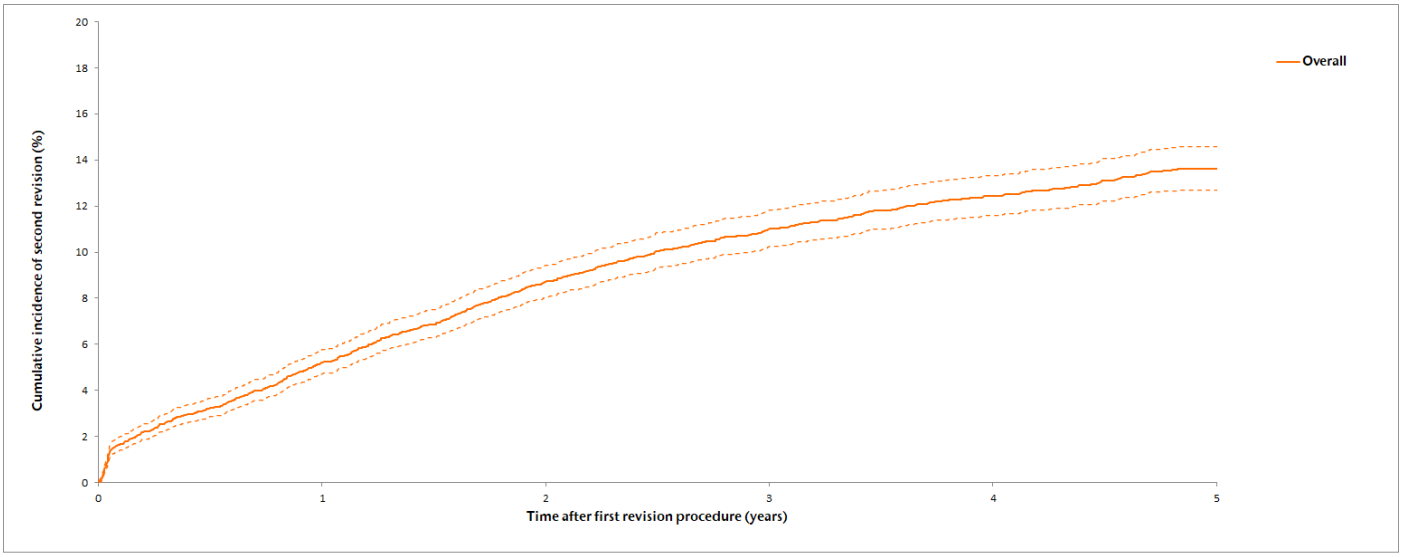


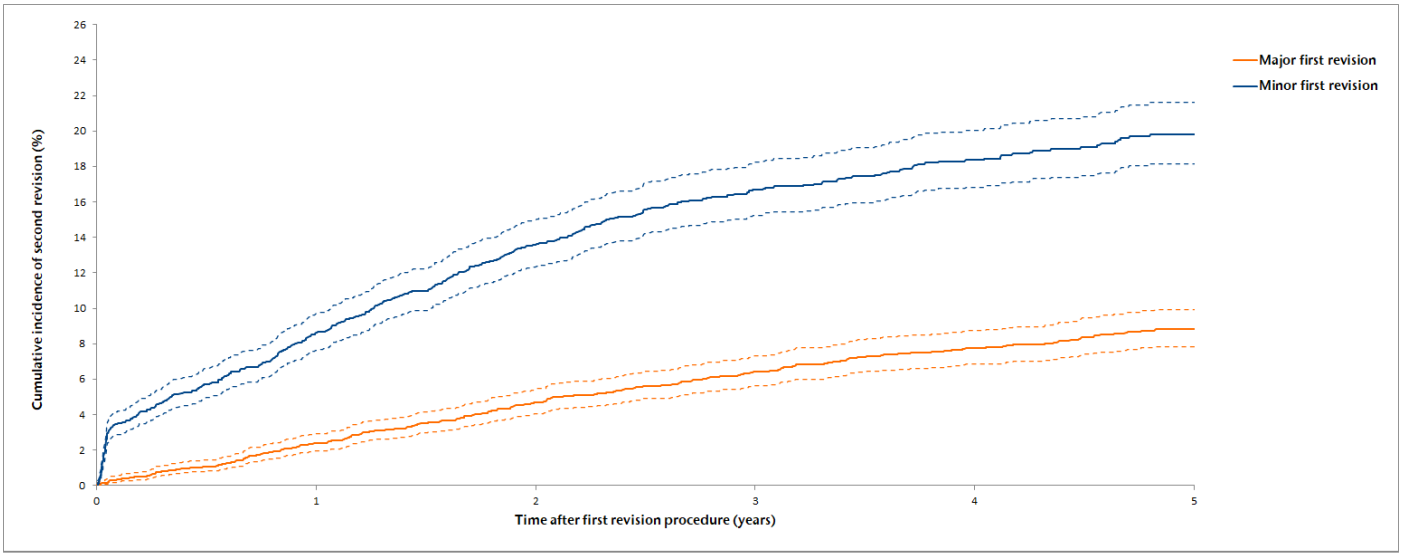

**TABLE Cumulative second revision percentages**

| | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
|---|---|---|
| 1-year second revision (%) | 5.2 (4.7-5.8) | 5.2 (4.7-5.7) |
| 3-year second revision (%) | 11.0 (10.2-11.8) | 11.1 (10.3-11.9) |
| 5-year second revision (%) | 13.6 (12.7-14.6) | 13.9 (12.9-14.8) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis (excluding patella addition).
CI: confidence interval.

*By type of first revision*

**FIGURE Cumulative second revision percentage of total knee arthroplasty after a one-stage first revision by type of first revision in the Netherlands in 2007-2019 (n=7,252)**



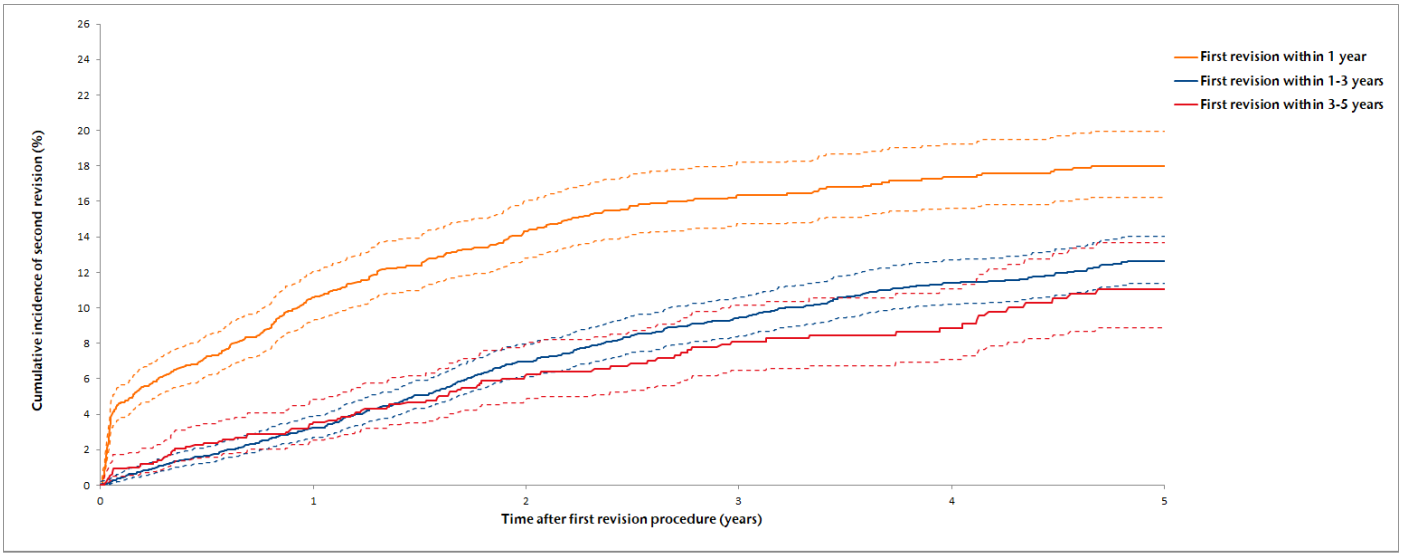

## TABLE Cumulative second revision percentages

| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
|---|---|---|---|
| **Major first revision** | 4,178 | | |
| 1-year second revision (%) | | 2.4 (2.0-3.0) | 2.4 (1.9-2.9) |
| 3-year second revision (%) | | 6.4 (5.6-7.3) | 6.5 (5.6-7.3) |
| 5-year second revision (%) | | 8.8 (7.8-9.9) | 9.0 (7.9-10.0) |
| **Minor first revision** | 3,074 | | |
| 1-year second revision (%) | | 8.6 (7.7-9.7) | 8.6 (7.6-9.6) |
| 3-year second revision (%) | | 16.7 (15.3-18.2) | 17.0 (15.5-18.5) |
| 5-year second revision (%) | | 19.8 (18.1-21.6) | 20.3 (18.5-22.1) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis (excluding patella addition).
Major revision: revision of at least the femur or tibia component.
Minor revision: only insert and/or patella exchange (excluding patella addition).
CI: confidence interval.

*By time to first revision*

**FIGURE Cumulative second revision percentage of total knee arthroplasty after a one-stage first revision by time to first revision in the Netherlands in 2007-2019 (n=6,500)**




## TABLE Cumulative second revision percentages

| | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
|---|---|---|---|
| **First revision within 1 year** | 2,031 | | |
| 1-year second revision (%) | | 10.6 (9.3-12.1) | 10.5 (9.2-11.9) |
| 3-year second revision (%) | | 16.4 (14.7-18.2) | 16.5 (14.8-18.3) |
| 5-year second revision (%) | | 18.0 (16.2-20.0) | 18.3 (16.4-20.2) |
| **First revision within 1-3 years** | 3,380 | | |
| 1-year second revision (%) | | 3.3 (2.7-3.9) | 3.2 (2.6-3.8) |
| 3-year second revision (%) | | 9.4 (8.4-10.6) | 9.5 (8.4-10.6) |
| 5-year second revision (%) | | 12.6 (11.4-14.1) | 12.9 (11.5-14.2) |
| **First revision within 3-5 years** | 1,089 | | |
| 1-year second revision (%) | | 3.5 (2.6-4.9) | 3.4 (2.3-4.6) |
| 3-year second revision (%) | | 8.1 (6.5-10.2) | 8.2 (6.4-10.1) |
| 5-year second revision (%) | | 11.0 (8.9-13.7) | 11.3 (8.9-13.8) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis (excluding patella addition).
CI: confidence interval.

*Reasons for seconds revision by type of first revision*

**TABLE Reasons for second revision within five years in patients who underwent a second revision after a one-stage first revision of a total knee arthroplasty by type of first revision in the Netherlands in 2007-2019**

| Reasons for second revision | Major first revision[1] (n=264) Proportion[4] (%) | Minor first revision[2] (n=461) Proportion[4] (%) | Any type of first revision[3] (n=773) Proportion[4] (%) |
|---|---|---|---|
| Infection | 26.1 | 44.5 | 38.1 |
| Instability | 28.0 | 27.8 | 27.4 |
| Loosening of tibia component | 20.8 | 13.9 | 16.6 |
| Patellar pain | 14.4 | 9.8 | 11.8 |
| Malalignment | 7.6 | 10.4 | 9.7 |
| Loosening of femur component | 12.5 | 3.9 | 7.5 |
| Arthrofibrosis | 6.8 | 5.4 | 6.1 |
| Patellar dislocation | 4.2 | 4.3 | 4.0 |
| Loosening of patella component | 1.1 | 1.5 | 1.6 |
| Insert wear | 0.4 | 1.5 | 1.2 |
| Periprosthetic fracture | 0.8 | 0.7 | 0.6 |
| Progression of osteoarthritis | 0.0 | 0.2 | 0.1 |
| Other | 9.8 | 6.1 | 7.4 |

[1] Revision of at least the femur or tibia component.
[2] Only insert and/or patella exchange.
[3] Any type of revision includes minor and major revisions as well as revision procedures that could not be classified as minor or major revision.
4 One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.
One-stage revision: A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis (excluding patella addition).



# PROMs

## Response 2014-2019

**FIGURE Pre-operative, 6 months and 12 months postoperative response percentage of patients who underwent a TKA for osteoarthritis per pre-operative PROMs registering hospital (n=87) in the Netherlands in 2014-2019**

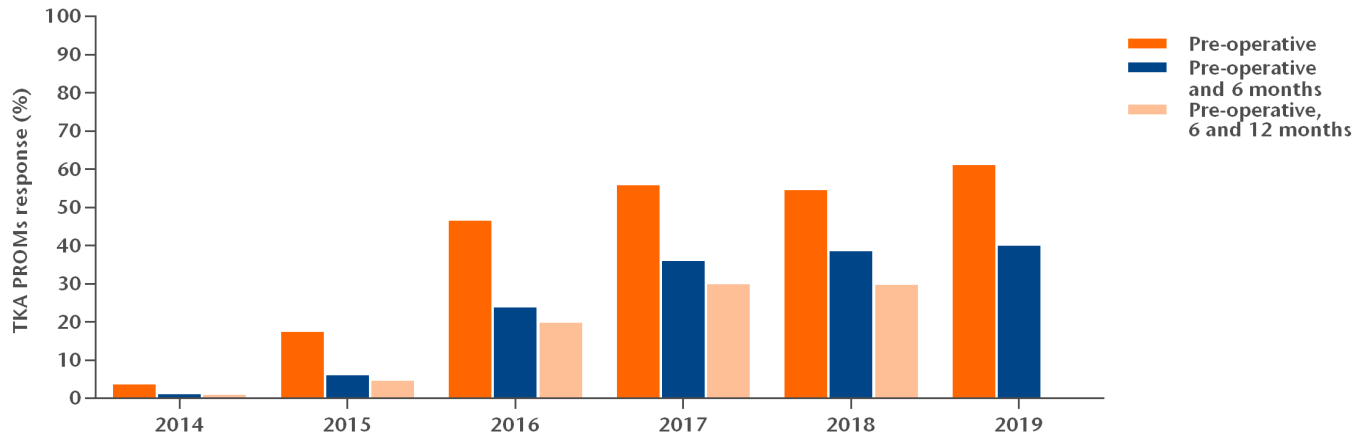



**TABLE PROMs response percentages**

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019[1] |
|---|---|---|---|---|---|---|
| TKA for osteoarthritis (n) | 22,137 | 22,289 | 22,919 | 23,603 | 23,994 | 23,789 |
| TKA PROMs response (%) | | | | | | |
| Pre-operative | 3.7 | 17.5 | 46.6 | 55.8 | 54.5 | 61.1 |
| Pre-operative and 6 months postoperative | 1.1 | 6.0 | 23.8 | 35.9 | 38.5 | 40.0 |
| Pre-operative, 6 and 12 months postoperative | 0.9 | 4.7 | 19.8 | 29.9 | 29.7 | n.a. |

[1] The 12 months postoperative PROMs response percentage is not (yet) available for 2019. The 6 months postoperative response percentage is not (yet) available after July 1st 2019. In total, 212,499 patients underwent a TKA for osteoarthritis between January 1st and July 1st 2019.
TKA: total knee arthroplasty; PROM: patient reported outcome measure.

## Mean scores (pre-operative, 6 months and 12 months)

*NRS (rest)*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative NRS (rest) scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

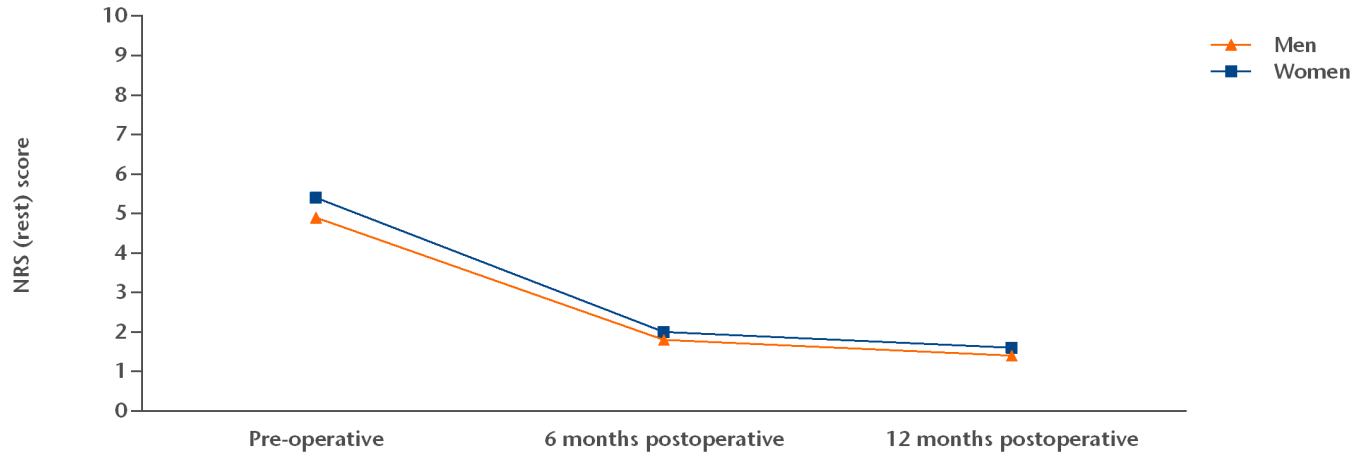



**TABLE Mean pre-operative, 6 months and 12 months postoperative NRS (rest) scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

| NRS (rest) score | Pre-operative | | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 19,801 | 4.9 (4.8-4.9) | 13,441 | 1.8 (1.7-1.8) | 11,494 | 1.4 (1.3-1.4) |
| Women | 33,642 | 5.4 (5.4-5.4) | 21,469 | 2.0 (1.9-2.0) | 57,659 | 1.6 (1.6-1.7) |
| Total[2] | 53,466 | 5.2 (5.2-5.2) | 34,923 | 1.9 (1.9-2.3) | 30,013 | 1.5 (1.5-1.6) |

[1] The 12 months NRS (rest) score is not (yet) available for 2019.
[2] Also contains NRS (rest) scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The NRS (rest) score measures pain during rest. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain.**

*NRS (activity)*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative NRS (activity) scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

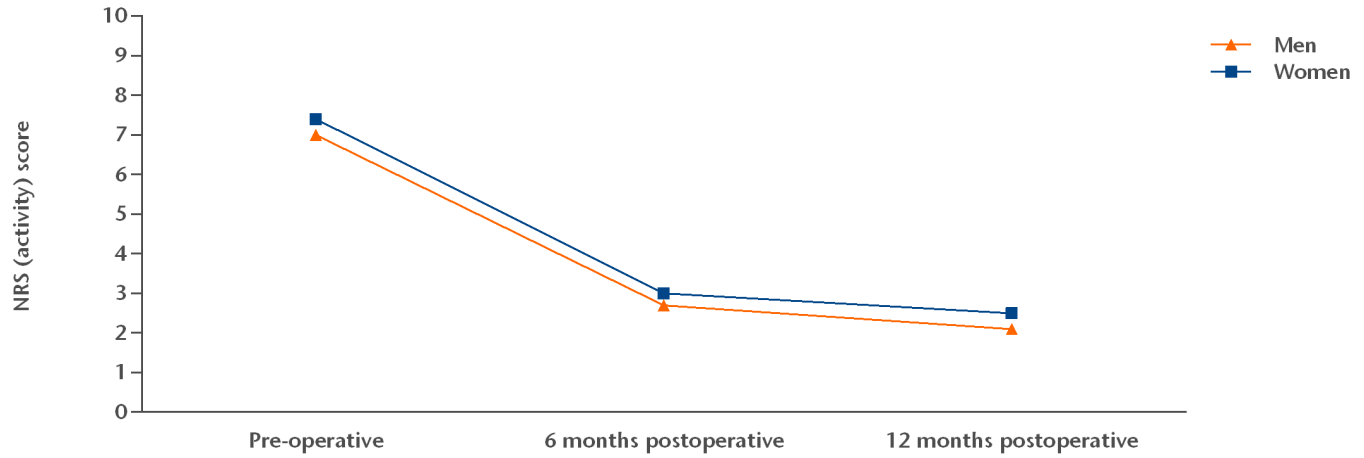



**TABLE Mean pre-operative, 6 months and 12 months postoperative NRS (activity) scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

| NRS (activity) score | Pre-operative | | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 19,793 | 7.0 (7.0-7.1) | 13,443 | 2.7 (2.6-2.7) | 11,502 | 2.1 (2.1-2.2) |
| Women | 33,623 | 7.4 (7.4-7.4) | 21,486 | 3.0 (2.9-3.0) | 18,532 | 2.5 (2.4-2.5) |
| Total[2] | 53,439 | 7.3 (7.3-7.3) | 34,942 | 2.9 (2.8-2.9) | 30,046 | 2.3 (2.3-2.4) |

[1] The 12 months NRS (activity) score is not (yet) available for 2019.
[2] Also contains NRS (activity) scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The NRS (activity) score measures pain during activity. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain.**

*EQ5D index score*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative EQ-5D index scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

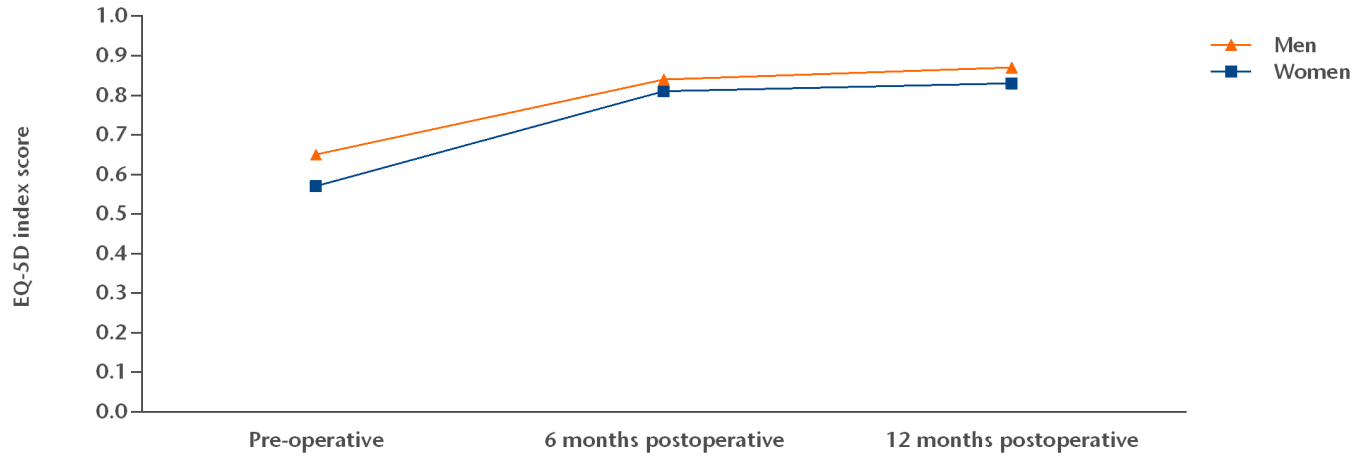



**TABLE Mean pre-operative, 6 months and 12 months postoperative EQ-5D index scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

| EQ-5D Index score | Pre-operative | | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 20,711 | 0.65 (0.64-0.65) | 14,057 | 0.84 (0.84-0.85) | 12,226 | 0.87 (0.87-0.87) |
| Women | 35,100 | 0.57 (0.57-0.58) | 22,337 | 0.81 (0.81-0.82) | 76,166 | 0.83 (0.82-0.83) |
| Total[2] | 55,836 | 0.60 (0.60-0.60) | 36,408 | 0.83 (0.82-0.83) | 31,882 | 0.84 (0.84-0.84) |

[1] The 12 months EQ-5D index score is not (yet) available for 2019.
[2] Also contains EQ-5D index scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The EQ-5D index score measures quality of life. The score has a range of -0.329 to 1.0, with 1.0 representing the best possible quality of life.**

*EQ5D thermometer*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative EQ-5D thermometer scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

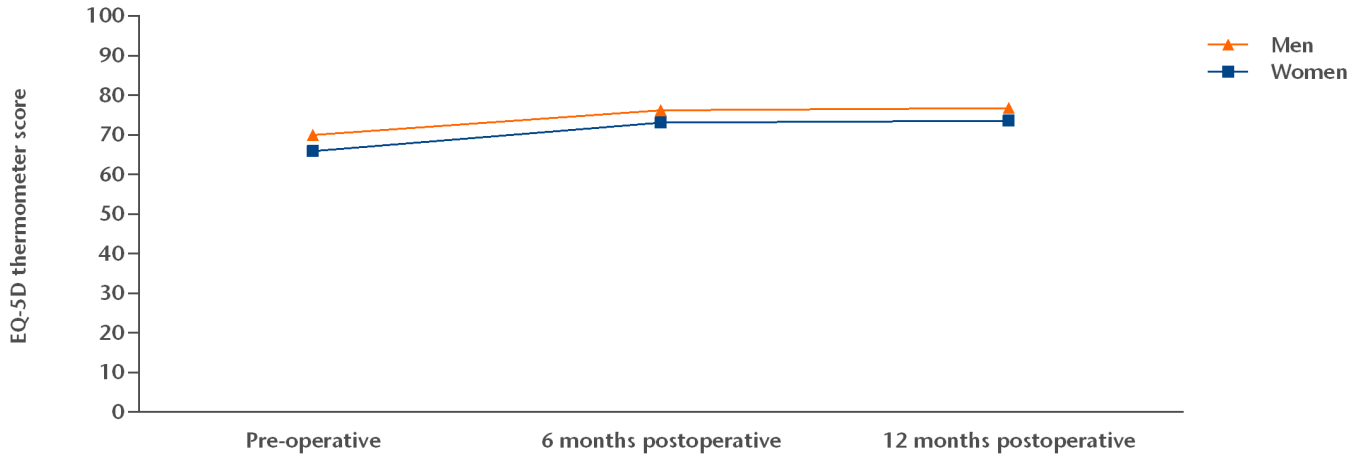



**TABLE Mean pre-operative, 6 months and 12 months postoperative EQ-5D thermometer scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

| EQ-5D thermometer score | Pre-operative | | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 20,790 | 70.0 (69.8-70.3) | 14,179 | 76.2 (75.9-76.5) | 12,382 | 76.8 (76.5-77.2) |
| Women | 35,191 | 65.9 (65.7-66.2) | 22,603 | 73.1 (72.8-73.4) | 19,919 | 73.6 (73.3-73.8) |
| Total[2] | 56,007 | 67.5 (67.3-67.6) | 36,795 | 74.3 (74.1-74.5) | 32,315 | 74.8 (74.6-75.0) |

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2019.
[2] Also contains EQ-5D thermometer scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The EQ-5D thermometer score measures the health situation. The score has a range of 0.0 to 100.0, with 0.0 representing the worst possible health situation and 100.0 the best possible health situation.**

*KOOS-PS score*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative KOOS-PS scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

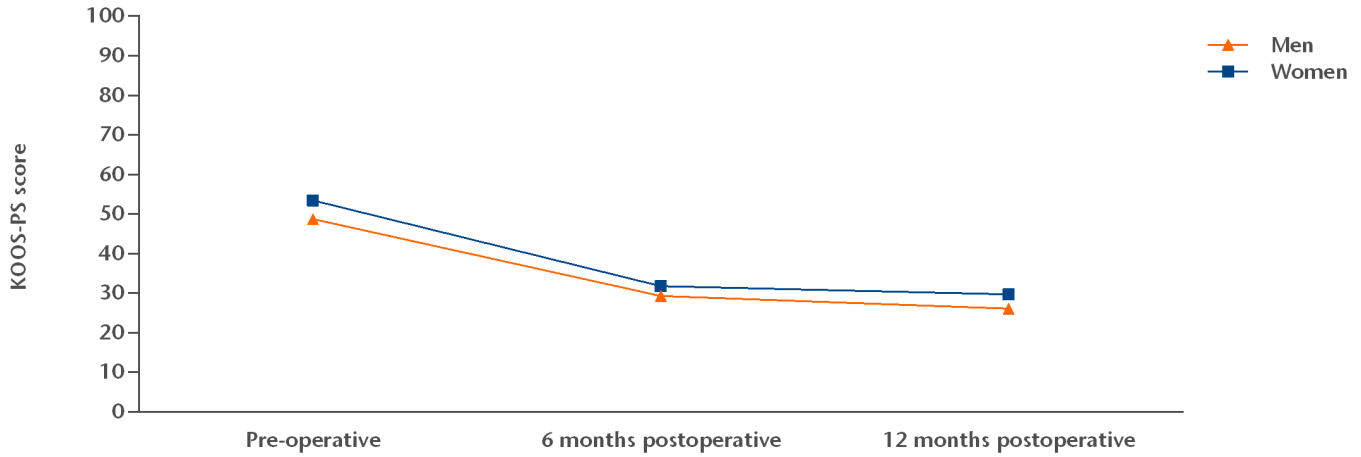



**TABLE Mean pre-operative, 6 months and 12 months postoperative KOOS-PS scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

| KOOS-PS score | Pre-operative | | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 20,658 | 48.7 (48.5-48.9) | 13,909 | 29.3 (29.0-29.5) | 12,094 | 26.1 (25.8-26.3) |
| Women | 34,653 | 53.4 (53.4-53.6) | 21,624 | 31.8 ( 31.6-32.0) | 18,892 | 29.7 (29.5-29.9) |
| Total[2] | 55,334 | 51.6 (51.5-51.8) | 35,547 | 30.8 (30.6-30.9) | 31,000 | 28.3 (28.1-28.5) |

[1] The 12 months KOOS-PS score is not (yet) available for 2019.
[2] Also contains KOOS-PS scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The KOOS-PS score measures the physical functioning of patients with osteoarthritis to the knee. The score has a range of 0.0 to 100.0, with 0.0 representing no effort and 100.0 the most possible effort.**

*Oxford Knee score*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative Oxford Knee scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

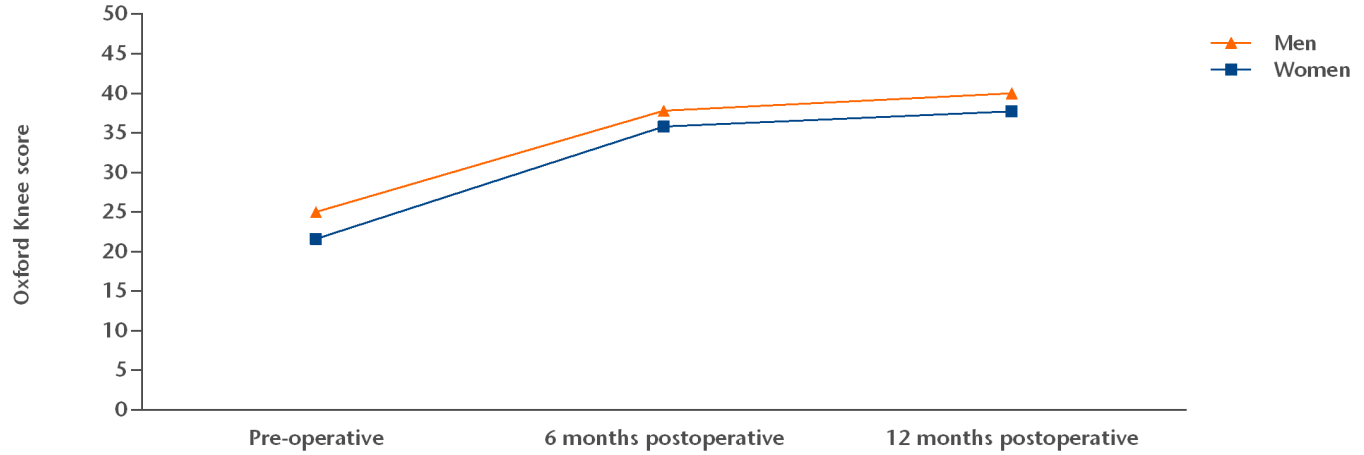



**TABLE Mean pre-operative, 6 months and 12 months postoperative Oxford Knee scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

| Oxford Knee score | Pre-operative | | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 18,187 | 25.0 (24.9-25.1) | 12,797 | 37.8 (37.6-38.0) | 10,840 | 40.0 (39.8-40.1) |
| Women | 30,662 | 21.6 (21.6-21.7) | 20,195 | 35.8 (35.7-36.0) | 17,273 | 37.7 (37.6-37.8) |
| Total[2] | 48,866 | 22.9 (22.8-23.0) | 33,002 | 36.6 (36.5-36.7) | 28,123 | 38.6 (38.5-38.7) |

[1] The 12 months Oxford Knee score is not (yet) available for 2019.
[2] Also contains Oxford Knee scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The Oxford Knee score measures the physical functioning and pain of patients with osteoarthritis to the knee. The score has a range of 0.0 to 48.0, with 0.0 representing no functional ability and 48.0 the most functional ability.**

*NRS (satisfaction)*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative NRS (satisfaction) scores of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

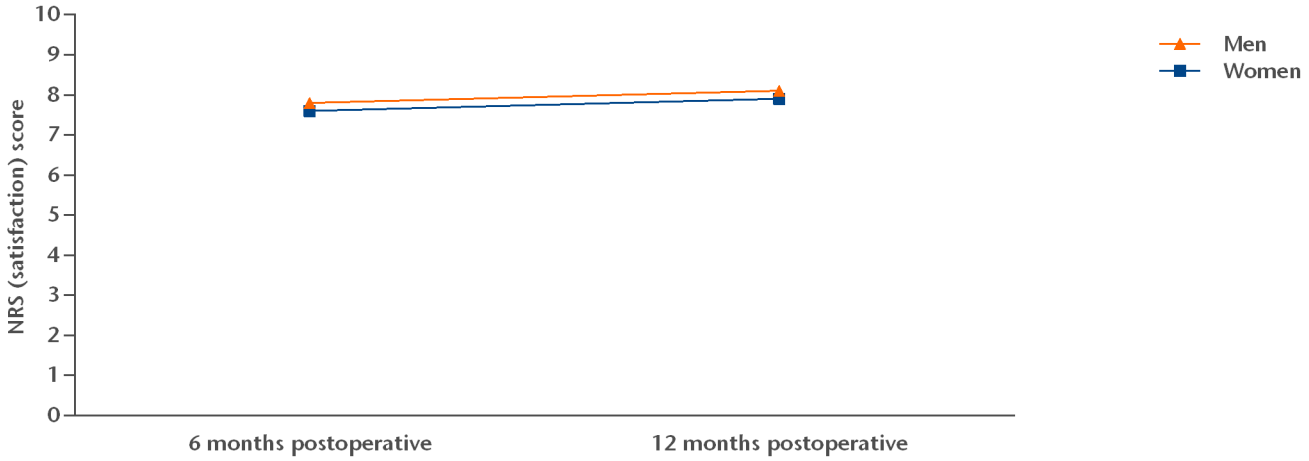



**TABLE Mean NRS (satisfaction) scores**

| NRS (satisfaction) | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 12,087 | 7.8 (7.7-7.8) | 10,380 | 8.1 (8.0-8.1) |
| Women | 19,086 | 7.6 (7.6-7.7) | 16,623 | 7.9 (7.8-7.9) |
| Total[2] | 31,186 | 7.7 (7.7-7.7) | 27,013 | 7.9 (7.9-8.0) |

[1] The 12 months NRS (satisfaction) score is not (yet) available for 2019.
[2] Also contains NRS (satisfaction) scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The NRS (satisfaction) score measures patients' satisfaction with the outcome of after joint replacement. The score has a range of 1.0 to 10.0, with 1.0 representing very unsatisfied and 10.0 representing very satisfied.**

*Anchor question: Daily functioning*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative change in daily functioning of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

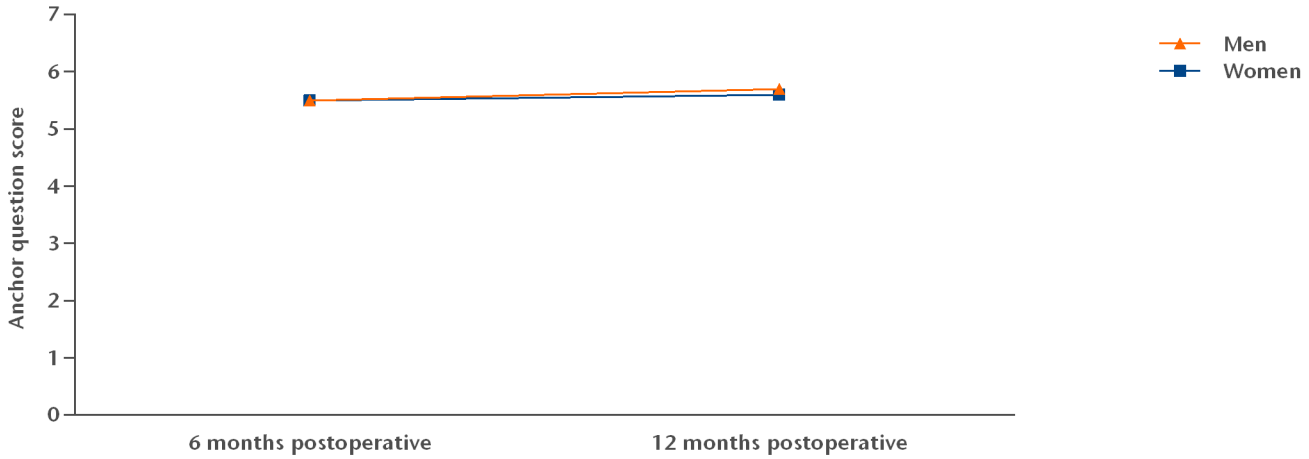



**TABLE Mean anchor question: Daily functioning**

| Anchor question score | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 12,853 | 5.5 (5.5-5.5) | 11,356 | 5.7 (5.7-5.7) |
| Women | 20,611 | 5.5 (5.4-5.5) | 18,370 | 5.6 (5.6-5.6) |
| Total[2] | 33,478 | 5.5 (5.5-5.5) | 29,739 | 5.7 (5.6-5.7) |

[1] The 12 months anchor question score is not (yet) available for 2019.
[2] Also contains anchor question scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The anchor question measures change in daily functioning after joint replacement.**
**The score has a range of 1.0 to 7.0, with 1.0 representing very deteriorated and 7.0 representing very improved.**

*Anchor question: Pain*

**FIGURE Mean pre-operative, 6 months and 12 months postoperative change in pain of patients who underwent a TKA for osteoarthritis by gender in the Netherlands in 2014-2019**

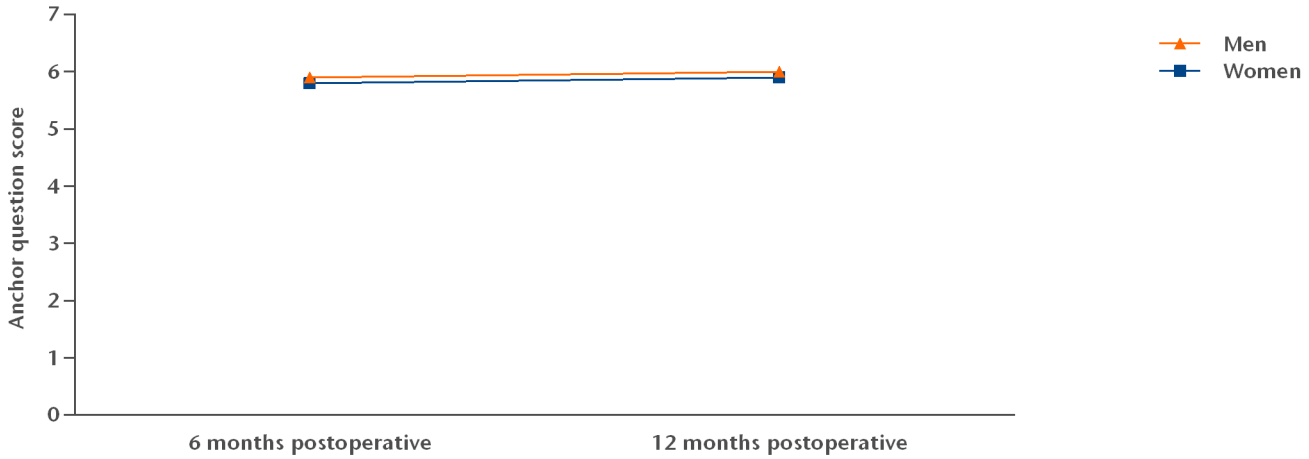



**TABLE Mean anchor question: Pain**

| Anchor question score | 6 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 11,663 | 5.9 (5.9-5.9) | 10,056 | 6.0 (6.0-6.1) |
| Women | 18,698 | 5.8 (5.8-5.8) | 16,266 | 5.9 (5.9-6.0) |
| Total[2] | 30,374 | 5.8 (5.8-5.9) | 26,334 | 6.0 (6.0-6.0) |

[1] The 12 months anchor question score is not (yet) available for 2019.
[2] Also contains anchor question scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.



**The anchor question measures change in pain degree after joint replacement.**
**The score has a range of 1.0 to 7.0, with 1.0 representing very deteriorated and 7.0 representing very improved.**

# Ankle arthroplasty

## Numbers

### Registered procedures 2014-2019

**TABLE Number of registered ankle arthroplasties per year of surgery (2014-2019) in the LROI in May 2019**

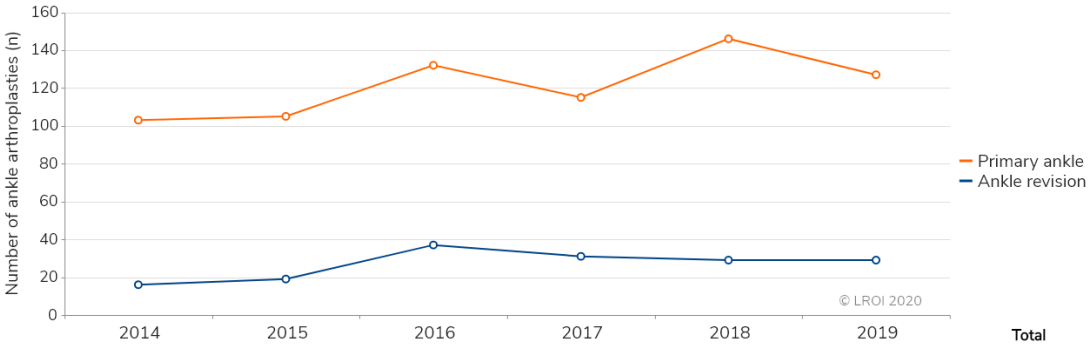
| Year of surgery | Type of ankle arthroplasty: Total arthroplasty (n) | Other (n) | Revision arthroplasty (n) | Total[1] (n) |
|---|---|---|---|---|
| 2014 | 102 | 0 | 16 | 119 |
| 2015 | 105 | 0 | 19 | 124 |
| 2016 | 125 | 6 | 37 | 169 |
| 2017 | 111 | 3 | 31 | 146 |
| 2018 | 143 | 1 | 29 | 175 |
| 2019 | 124 | 2 | 29 | 156 |
| Total | 710 | 12 | 161 | 889 |

[1] In 0.7% (n=6) primary ankle arthroplasties the type of primary ankle prosthesis has not been registered.



### Type of procedures 2014-2019

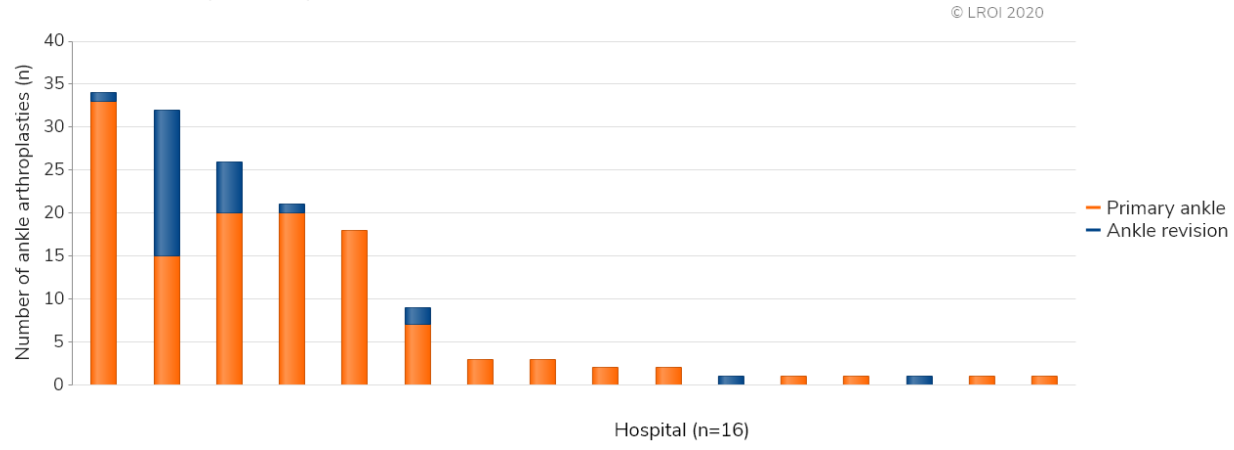
**FIGURE Number of primary ankle arthroplasties and ankle revision arthroplasties registered in the LROI in the Netherlands in 2014-2019**




| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Type of procedure (n)** | | | | | | | |
| Primary ankle | 103 | 105 | 132 | 115 | 146 | 127 | **728** |
| Ankle revision | 16 | 19 | 37 | 31 | 29 | 29 | **161** |
| Total: | **119** | **124** | **169** | **146** | **175** | **156** | **889** |

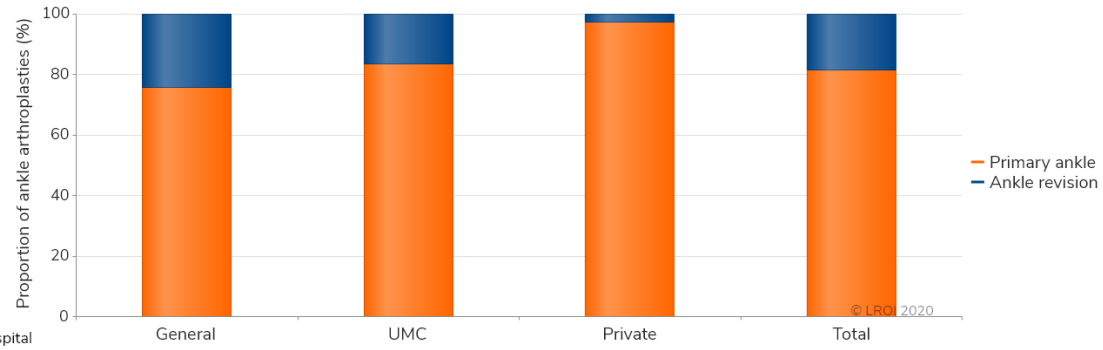
### Type of procedure per hospital

**FIGURE Number of primary ankle arthroplasties and ankle revision arthroplasties per hospital in the Netherlands in 2019 (n=156)**



## Type of procedure by type of hospital

**FIGURE Primary ankle arthroplasties and ankle revision arthroplasties (proportion [%] per category) by type of hospital in the Netherlands in 2019**




| Type of hospital | General | UMC | Private | Total |
|---|---|---|---|---|
| **Type of procedure (%)** | | | | |
| Primary ankle | 75.70 | 83.33 | 97.30 | **81.41** |
| Ankle revision | 24.30 | 16.67 | 2.70 | **18.59** |
| Total (n): | **107** | **12** | **37** | **156** |

Please note: In 2019, 11 general hospitals, 3 UMCs and 2 private hospitals performed ankle arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.

# Primary ankle arthroplasty

## Demographics

### *Patient characteristics by diagnosis*

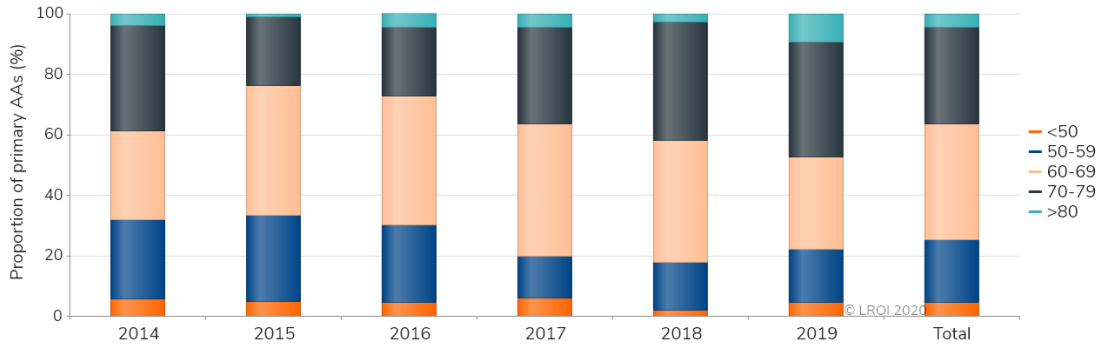
**TABLE Patient characteristics of all patients with a registered primary ankle arthroplasty by diagnosis in the Netherlands in 2019**

| | Osteoarthritis (n=106) | No osteoarthritis[1] (n=21) | Total (n=127) |
|---|---|---|---|
| **Mean age (years) (SD)** | 68.1 (8.4) | 62.6 (13.3) | 67.2 (9.5) |
| **Age (years) (%)** | | | |
| <50 | 2 | 19 | 5 |
| 50-59 | 16 | 24 | 17 |
| 60-69 | 35 | 10 | 30 |
| 70-79 | 38 | 38 | 38 |
| ≥80 | 9 | 9 | 10 |
| **Gender (%)** | | | |
| Men | 62 | 43 | 59 |
| Women | 38 | 57 | 41 |
| **ASA score (%)** | | | |
| I | 15 | 24 | 17 |
| II | 70 | 71 | 70 |
| III-IV | 15 | 5 | 13 |
| **Type of hospital (%)** | | | |
| General | 62 | 71 | 64 |
| UMC | 8 | 10 | 8 |
| Private | 30 | 19 | 28 |
| **Charnley-score (%)** | | | |
| A One ankle joint affected | 70 | 69 | 70 |
| B1 Both ankle joints affected | 13 | 5 | 12 |
| B2 Contralateral ankle joint with a total ankle prosthesis | 9 | 0 | 7 |
| C Multiple joints affected or chronic disease that affects quality of life | 8 | 26 | 11 |
| **Mean Body Mass Index (kg/m²) (SD)** | 27.7 (4.2) | 26.3 (4.3) | 27.4 (4.2) |
| **Body Mass Index (kg/m²) (%)** | | | |
| Underweight (≤18,5) | 0 | 0 | 0 |
| Normal weight (>18,5-25) | 29 | 33 | 30 |
| Overweight (>25-30) | 46 | 43 | 45 |
| Obesity (>30-40) | 23 | 24 | 23 |
| Morbid obesity (>40) | 2 | 0 | 2 |
| **Smoking (%)** | | | |
| No | 92 | 89 | 92 |
| Yes | 8 | 11 | 8 |

[1] Another diagnosis than osteoarthritis registered as primary diagnosis, specifically post-traumatic (9%), rheumatoid arthritis (4%), inflammatory arthritis (2%), tumour (1%) or other primary diagnosis (2%).
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

*Age category 2014-2019*

**FIGURE Trend (proportion [%] per year) in age category in primary ankle arthroplasties in the Netherlands in 2014-2019**




| Age category (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| <50 | 5.83 | 4.76 | 4.55 | 6.09 | 2.05 | 4.72 | **4.53** |
| 50-59 | 26.21 | 28.57 | 25.76 | 13.91 | 15.75 | 17.32 | **20.88** |
| 60-69 | 29.13 | 42.86 | 42.42 | 43.48 | 40.41 | 30.71 | **38.32** |
| 70-79 | 34.95 | 22.86 | 22.73 | 32.17 | 39.04 | 37.80 | **31.87** |
| >80 | 3.88 | 0.95 | 4.55 | 4.35 | 2.74 | 9.45 | **4.40** |
| Total (n): | **103** | **105** | **132** | **115** | **146** | **127** | **728** |

AA: ankle arthroplasty.

*Previous surgery 2016-2019*

**TABLE Trend (proportion [%] per year) in Previous surgeries to the same joint in patients who underwent a primary ankle arthoplasty in the Netherlands in 2016-2019**

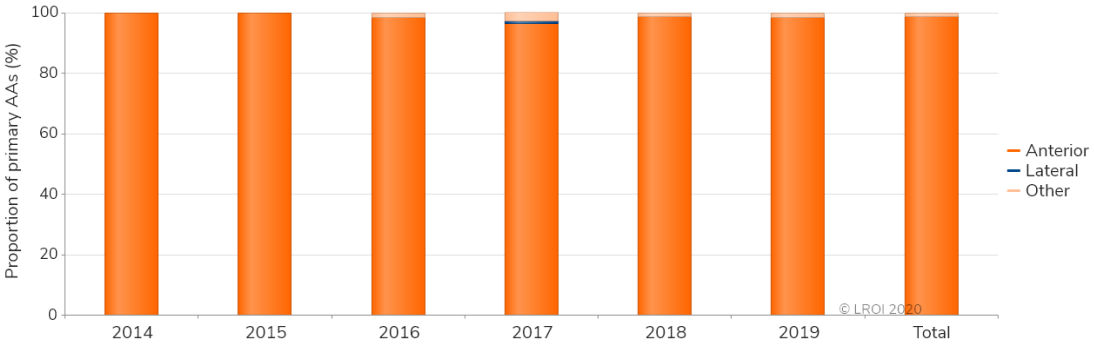
| Year | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|
| **Primary ankle arthroplasty (n)** | 125 | 113 | 144 | 126 | 508 |
| **Previous surgery to the relevant ankle (total); Proportion[1] (%)** | 31.2 | 28.3 | 29.9 | 33.3 | 30.7 |
| Osteosynthesis | 13.6 | 16.8 | 9.7 | 11.9 | 12.8 |
| Hindfoot surgery | 6.4 | 3.5 | 12.5 | 7.9 | 7.9 |
| Arthroscopy | 7.2 | 11.5 | 5.6 | 4.8 | 7.1 |
| Arthrodesis | 4.0 | 1.8 | 5.6 | 4.0 | 3.9 |
| Osteotomy | 2.4 | 1.8 | 1.4 | 7.9 | 3.4 |
| Ligament reconstruction | 1.6 | 1.8 | 0.7 | 3.2 | 1.8 |
| Synovectomy | 1.6 | 2.7 | 0.7 | 2.4 | 1.8 |
| Treatment of osteochondral bone defect | 1.6 | 2.7 | 1.4 | 0.0 | 1.4 |
| Forefoot surgery | 2.4 | 0.0 | 1.4 | 0.0 | 1.0 |
| Other | 4.8 | 2.7 | 3.5 | 7.1 | 4.5 |

[1] A patient may have undergone multiple Previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patients with one or more Previous surgeries to the same joint.

## Surgery and prosthesis

### *Surgical approach 2014-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary ankle arthroplasty in the Netherlands in 2014-2019**

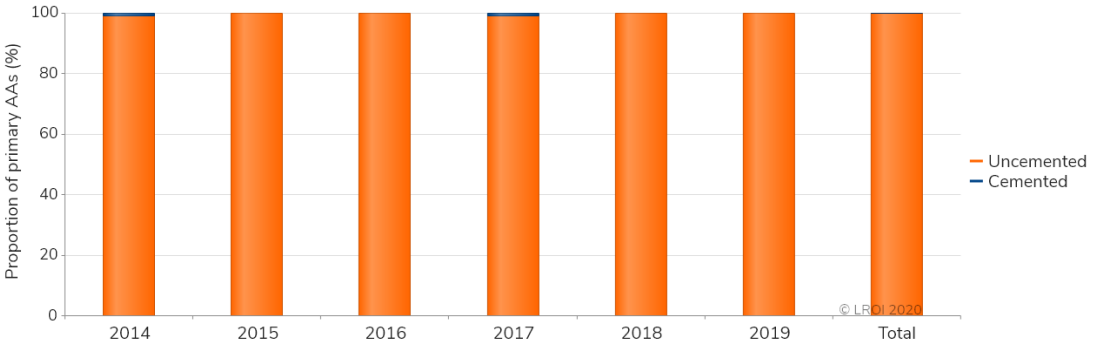



| Surgical approach (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Anterior | 100.00 | 100.00 | 98.46 | 96.43 | 98.60 | 98.39 | **98.59** |
| Lateral | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | **0.14** |
| Other | 0.00 | 0.00 | 1.54 | 2.68 | 1.40 | 1.61 | **1.27** |
| Total (n): | **101** | **101** | **130** | **112** | **143** | **124** | **711** |

AA: ankle arthroplasty.

### *Fixation 2014-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in primary ankle arthroplasties in the Netherlands in 2014-2019**

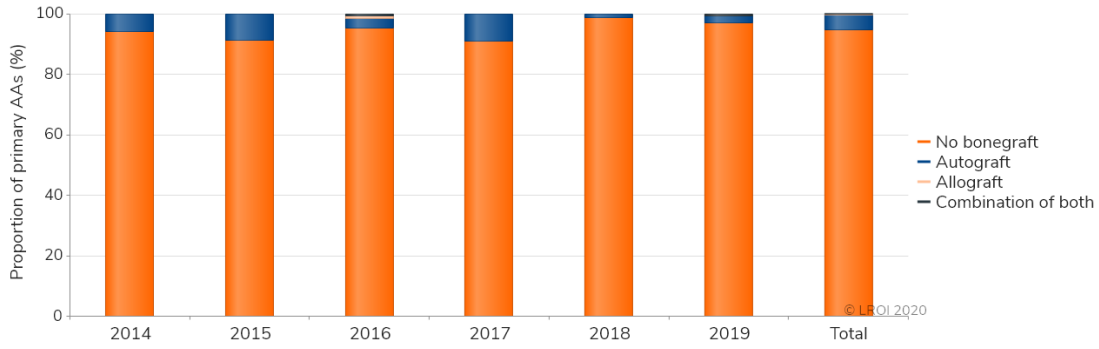



| Fixation (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Uncemented | 99.02 | 100.00 | 100.00 | 99.13 | 100.00 | 100.00 | **99.72** |
| Cemented | 0.98 | 0.00 | 0.00 | 0.87 | 0.00 | 0.00 | **0.28** |
| Total (n): | **102** | **104** | **130** | **115** | **144** | **127** | **722** |

AA: ankle arthroplasty.

*Type of bonegraft 2014-2019*

FIGURE Trend (proportion [%] per year) in type of bonegraft in primary ankle arthroplasties in the Netherlands in 2014-2019

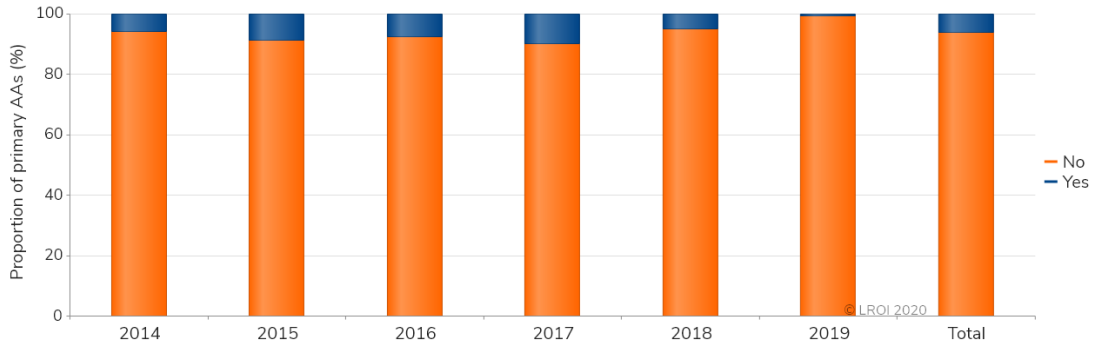



| Type of bonegraft (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| No bonegraft | 94.00 | 91.18 | 95.38 | 90.99 | 98.57 | 96.85 | **94.79** |
| Autograft | 6.00 | 8.82 | 3.08 | 9.01 | 1.43 | 2.36 | **4.79** |
| Allograft | 0.00 | 0.00 | 0.77 | 0.00 | 0.00 | 0.00 | **0.14** |
| Combination of both | 0.00 | 0.00 | 0.77 | 0.00 | 0.00 | 0.79 | **0.28** |
| Total (n): | **100** | **102** | **130** | **111** | **140** | **127** | **710** |

AA: ankle arthroplasty.

*Medial malleolus osteotomy 2014-2019*

FIGURE Trend (proportion [%] per year) in medial malleolus osteotomy in primary ankle arthroplasties in the Netherlands in 2014-2019

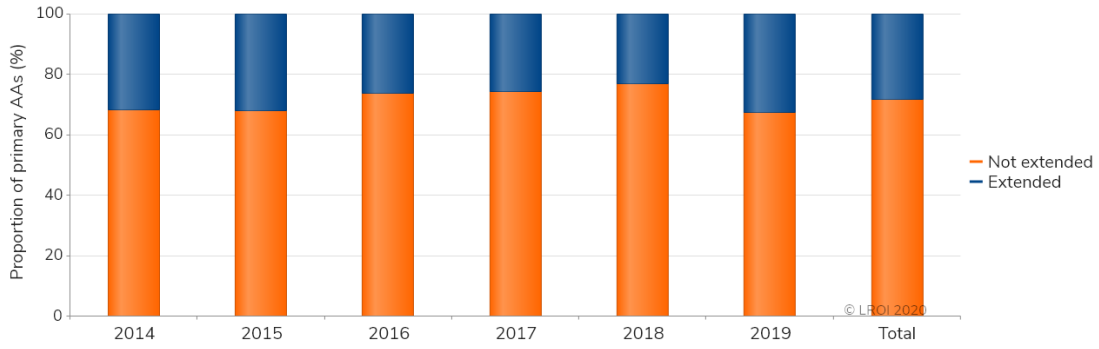



| Medial malleolus osteotomy (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| No | 94.12 | 91.26 | 92.31 | 90.18 | 95.07 | 99.21 | **93.85** |
| Yes | 5.88 | 8.74 | 7.69 | 9.82 | 4.93 | 0.79 | **6.15** |
| Total (n): | **102** | **103** | **130** | **112** | **142** | **126** | **715** |

AA: ankle arthroplasty.

*Extension heel cord 2014-2019*

**FIGURE Trend (proportion [%] per year) in heel cord extension in primary ankle arthroplasties in the Netherlands in 2014-2019**




| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Extension heel cord (%)** | | | | | | | |
| Not extended | 68.32 | 67.96 | 73.64 | 74.11 | 76.76 | 67.46 | **71.67** |
| Extended | 31.68 | 32.04 | 26.36 | 25.89 | 23.24 | 32.54 | **28.33** |
| Total (n): | **101** | **103** | **129** | **112** | **142** | **126** | **713** |

AA: ankle arthroplasty.

*Most frequently registered ankle prostheses*

**TABLE The most frequently registered primary ankle arthroplasties in the Netherlands in 2019 (n=127)**

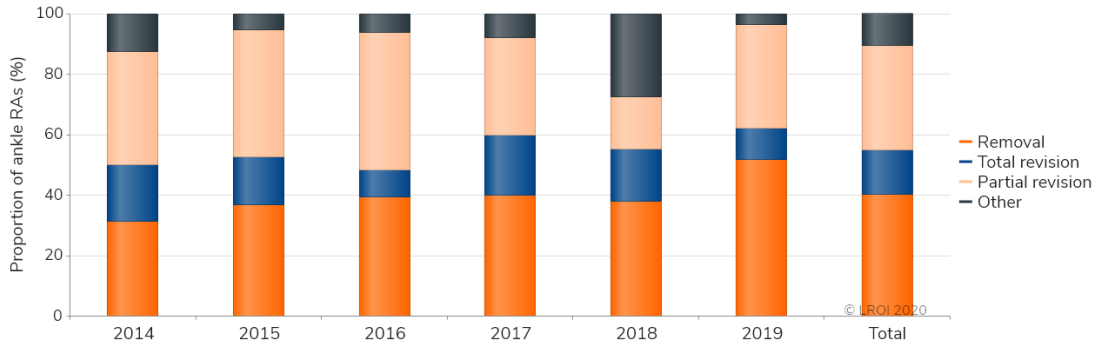
| Name | Proportion (%) |
|---|---|
| Salto | 48.2 |
| Infinity | 35.1 |
| Cadence | 7.0 |
| Box | 6.1 |
| Inbone | 3.5 |



## Ankle revision arthroplasty

### Type of revision 2014-2019

**FIGURE Trend (proportion [%] per year) in type of revision arthroplasty of ankle revision arthroplasties in the Netherlands in 2014-2019**




| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Type of revision (%)** | | | | | | | |
| Removal | 31.25 | 36.84 | 39.39 | 40.00 | 37.93 | 51.72 | **40.40** |
| Total revision | 18.75 | 15.79 | 9.09 | 20.00 | 17.24 | 10.34 | **14.57** |
| Partial revision | 37.50 | 42.11 | 45.45 | 32.00 | 17.24 | 34.48 | **34.44** |
| Other | 12.50 | 5.26 | 6.06 | 8.00 | 27.59 | 3.45 | **10.60** |
| Total (n): | **16** | **19** | **33** | **25** | **29** | **29** | **151** |

Please note: In 10 (6.6%) ankle revision arthroplasties, the type of revision was not registered.
RA: revision arthroplasty.

## Reasons for revision 2016-2019

**TABLE Trend (proportion [%] per year) reasons for revision or re-surgery in patients who underwent an ankle revision arthropalsty in the Netherlands in 2016-2019**

| Year | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|
| **Ankle revision arthroplasty (n)** | 37 | 31 | 29 | 29 | 126 |
| **Reasons for revision; Proportion[1] (%)** | | | | | |
| Cyst formation | 21.6 | 41.9 | 41.4 | 55.2 | 38.9 |
| Inlay wear | 35.1 | 45.2 | 31.0 | 41.4 | 38.1 |
| Loosening of talus component | 29.7 | 38.7 | 37.9 | 41.4 | 36.5 |
| Loosening of tibia component | 18.9 | 22.6 | 34.5 | 27.6 | 25.4 |
| Malalignment | 8.1 | 29.0 | 24.1 | 27.6 | 21.4 |
| Instability | 8.1 | 25.8 | 20.7 | 24.1 | 19.1 |
| Infection | 13.5 | 3.2 | 24.1 | 10.3 | 12.7 |
| Dislocation | 5.4 | 9.7 | 6.9 | 10.3 | 7.9 |
| Arthrofibrosis | 5.4 | 9.7 | 3.5 | 6.9 | 6.4 |
| Peri-prosthetic fracture | 0.0 | 3.2 | 3.5 | 3.5 | 2.4 |
| Other | 5.4 | 0.0 | 10.3 | 10.3 | 6.4 |

[1] One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.

# Shoulder arthroplasty

## Numbers

### Registered procedures 2014-2019

**TABLE NUMBER OF REGISTERED SHOULDER ARTHROPLASTIES PER YEAR OF SURGERY (2014-2018) IN THE LROI IN APRIL 2019.**

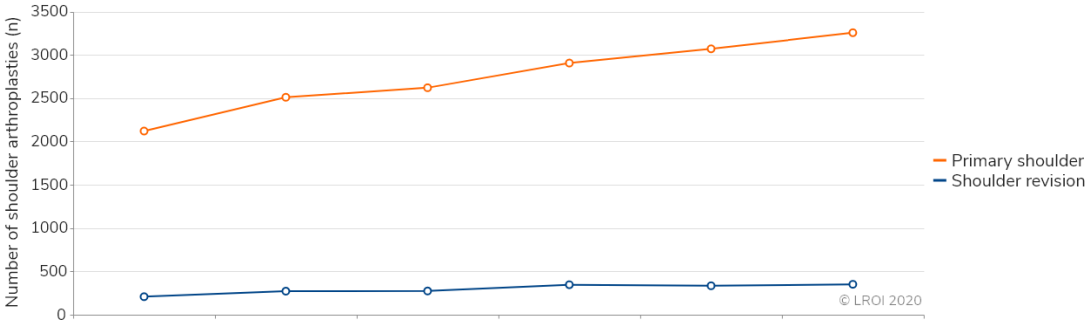
| Year of surgery | Type of shoulder arthroplasty: Reversed arthroplasty (n) | Total anatomical arthroplasty (n) | Hemi-arthroplasty (n) | Revision arthroplasty (n) | Total[1] (n) |
|---|---|---|---|---|---|
| 2014 | 1,166 | 465 | 459 | 208 | 2,328 |
| 2015 | 1,491 | 581 | 425 | 272 | 2,782 |
| 2016 | 1,688 | 601 | 316 | 274 | 2,896 |
| 2017 | 1,956 | 628 | 323 | 351 | 3,275 |
| 2018 | 2,087 | 672 | 257 | 329 | 3,351 |
| Total | 8,388 | 2,947 | 1,780 | 1,434 | 14,632 |

[1] In 0.6% (n=83) primary shoulder arthroplasties the type of primary shoulder prosthesis has not been registered.



### Procedures 2014-2019

**FIGURE Number of primary shoulder arthroplasties and shoulder revision arthroplasties registered in the LROI in the Netherlands 2014-2019**

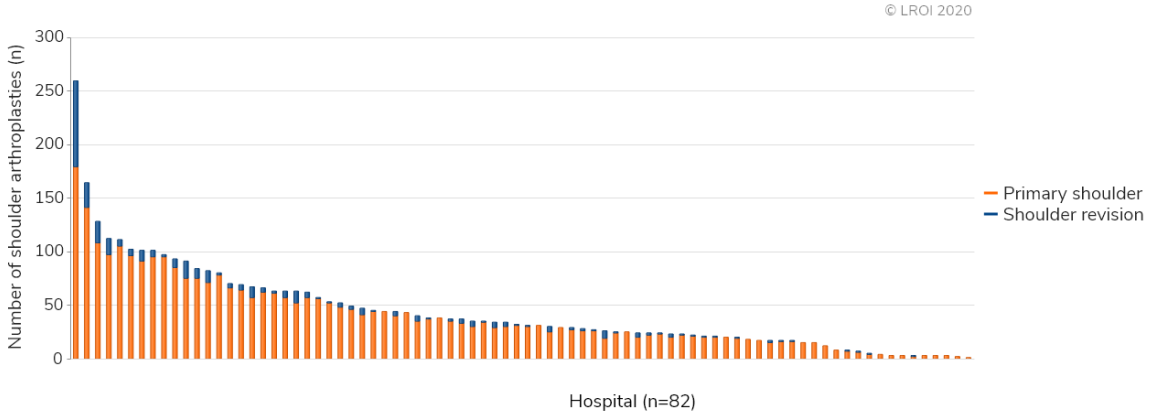



| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Type of procedure (n)** | | | | | | | |
| Shoulder revision | 208 | 272 | 274 | 346 | 334 | 351 | **1,785** |
| Primary shoulder | 2,120 | 2,510 | 2,620 | 2,905 | 3,069 | 3,255 | **16,479** |
| Total: | **2,328** | **2,782** | **2,894** | **3,251** | **3,403** | **3,606** | **18,264** |

**Out of 3,255 primary shoulder arthroplasties that were performed in 2019, 2% (n=53) was performed bilaterally.**

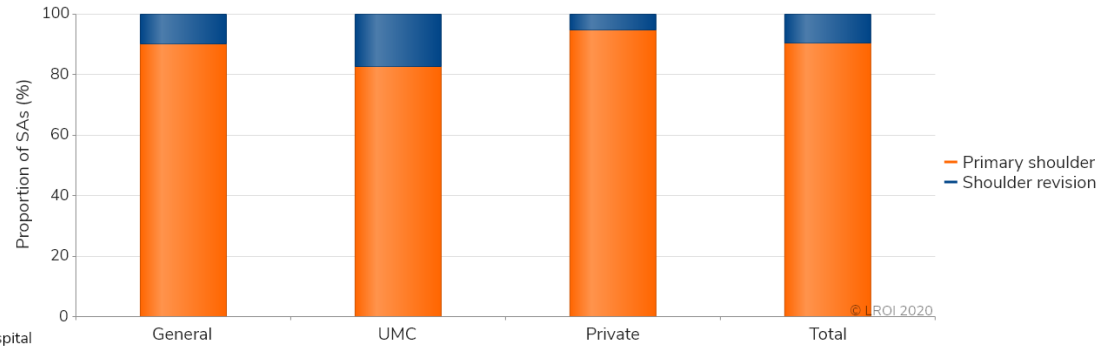
### Type of procedure per hospital

**FIGURE Number of primary shoulder arthroplasties and shoulder revision arthroplasties per hospital in the Netherlands 2019 (n=3606)**



## Type of procedure by type of hospital

### FIGURE Primary shoulder arthroplasties and shoulder revision arthroplasties (proportion [%] per category) by type of hospital in the Netherlands in 2019

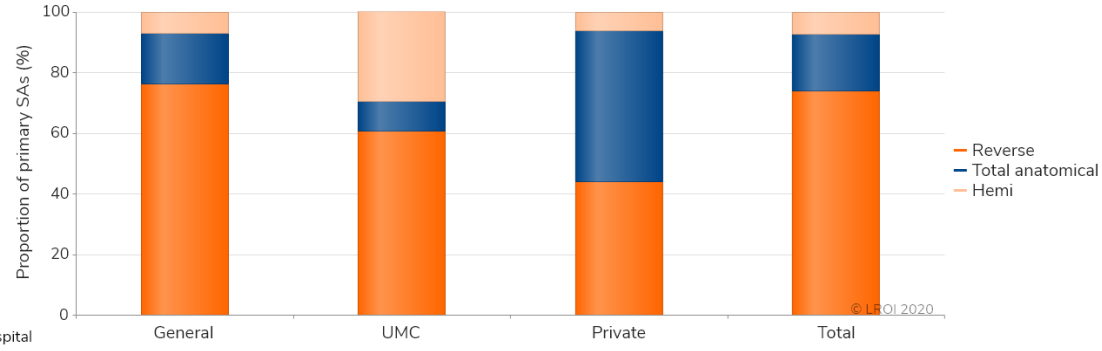



| Type of procedure (%) | General | UMC | Private | Total |
|---|---|---|---|---|
| Primary shoulder | 90.17 | 82.67 | 94.58 | **90.27** |
| Shoulder revision | 9.83 | 17.33 | 5.42 | **9.73** |
| Total (n): | **3,328** | **75** | **203** | **3,606** |

Please note: In 2019, 65 general hospitals, 6 UMCs and 11 private hospitals performed shoulder arthroplasties.
SA: shoulder arthroplasty; General: general hospital; UMC: university medical centre; Private: private hospital.

## Type of primary shoulder prosthesis by type of hospital

### FIGURE Type of primary shoulder arthroplasty (proportion [%] per category) by type of hospital in the Netherlands in 2019

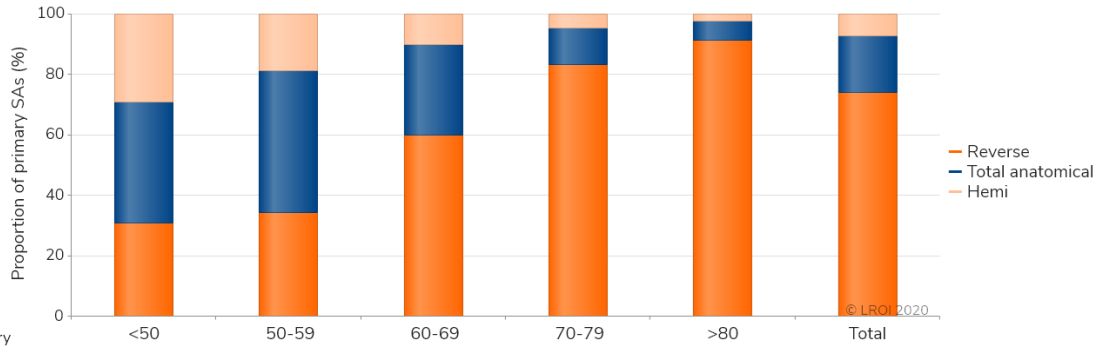



| Type of primary shoulder arthroplasty (%) | General | UMC | Private | Total |
|---|---|---|---|---|
| Reverse | 76.21 | 60.66 | 43.98 | **74.02** |
| Total anatomical | 16.84 | 9.84 | 49.74 | **18.64** |
| Hemi | 6.95 | 29.51 | 6.28 | **7.33** |
| Total (n): | **2,993** | **61** | **191** | **3,245** |

Please note: In 10 (0.3%) primary shoulder arthroplasties, the type of primary shoulder arthroplasty was not registered in 2019.
SA: shoulder arthroplasty; Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.
General: general hospital; UMC: university medical centre; Private: private hospital.

## Type of primary shoulder prosthesis by age category

**FIGURE** Type of primary shoulder arthroplasty (proportion [%] per category) by age category in patients with a primary shoulder arthroplasty in the Netherlands in 2019




| Type of primary shoulder arthroplasty (%) | | | | | | |
|---|---|---|---|---|---|---|
| Reverse | 30.77 | 34.17 | 59.93 | 83.06 | 91.14 | **74.02** |
| Total anatomical | 40.00 | 47.08 | 29.72 | 12.10 | 6.28 | **18.64** |
| Hemi | 29.23 | 18.75 | 10.35 | 4.84 | 2.58 | **7.33** |
| Total (n): | **65** | **240** | **831** | **1,488** | **621** | **3,245** |

SA: shoulder arthroplasty; Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

# Primary shoulder arthroplasty

## Demographics

### Patient characteristics by type of shoulder prosthesis

**TABLE Patient characteristics of all patients with a registered primary shoulder arthroplasty by type of primary shoulder arthroplasty in the Netherlands in 2019**

| N | Reverse (n=2,402) | Total anatomical (n=605) | Hemi (n=238) | Total[1] (n=3,255) |
|---|---|---|---|---|
| **Mean age (years) (SD)** | 73.8 (7.9) | 65.9 (9.2) | 64.8 (10.8) | 71.7 (9.1) |
| **Age (years) (%)** | | | | |
| <50 | 1 | 4 | 8 | 2 |
| 50-59 | 3 | 19 | 19 | 7 |
| 60-69 | 21 | 41 | 36 | 26 |
| 70-79 | 51 | 30 | 30 | 46 |
| ≥80 | 24 | 6 | 7 | 19 |
| **Gender (%)** | | | | |
| Men | 25 | 31 | 35 | 27 |
| Women | 75 | 69 | 65 | 73 |
| **ASA score (%)** | | | | |
| I | 5 | 14 | 15 | 8 |
| II | 55 | 65 | 56 | 57 |
| III-IV | 40 | 21 | 29 | 35 |
| **Type of hospital (%)** | | | | |
| General | 95 | 83 | 87 | 92 |
| UMC | 2 | 1 | 8 | 2 |
| Private | 3 | 16 | 5 | 6 |
| **Diagnosis (%)** | | | | |
| Osteoarthritis | 33 | 88 | 57 | 45 |
| Cuff arthropathy | 23 | 0 | 1 | 17 |
| Fracture | 17 | 1 | 16 | 14 |
| Post-traumatic | 10 | 4 | 12 | 9 |
| Cuff rupture | 10 | 0 | 1 | 8 |
| Rheumatoid arthritis | 2 | 2 | 1 | 2 |
| Osteonecrosis | 2 | 4 | 8 | 2 |
| Other | 3 | 1 | 4 | 3 |
| **Walch score (%)** | | | | |
| A1 Humeral head centered, minor erosion glenoid | 51 | 39 | 66 | 50 |
| A2 Humeral head centered, major erosion glenoid | 28 | 30 | 21 | 28 |
| B1 Humeral head subluxed posteriorly, posterior joint space narrow, subchondrial sclerosis and osteophytes | 9 | 19 | 6 | 11 |
| B2 Humeral head subluxed posteriorly retroverted, glenoid with posterior rim erosion | 7 | 9 | 4 | 8 |
| B3 Humeral head subluxed posteriorly more than 70 percent and glenoid retroversion more than 10 degrees | 3 | 2 | 1 | 2 |
| C Glenoid retroversion more than 25 degrees regardless of erosion | 2 | 1 | 2 | 1 |
| **Mean Body Mass Index (kg/m²) (SD)** | 28.3 (5.3) | 28.4 (5.0) | 28.9 (5.3) | 28.3 (5.2) |
| **Body Mass Index (kg/m²) (%)** | | | | |
| Underweight (≤18,5) | 1 | 0 | 0 | 1 |
| Normal weight (>18,5-25) | 27 | 27 | 23 | 27 |
| Overweight (>25-30) | 41 | 40 | 44 | 41 |
| Obesity (>30-40) | 28 | 31 | 30 | 28 |
| Morbid obesity (>40) | 3 | 2 | 3 | 3 |
| **Smoking (%)** | | | | |
| No | 92 | 90 | 89 | 91 |
| Yes | 8 | 10 | 11 | 9 |

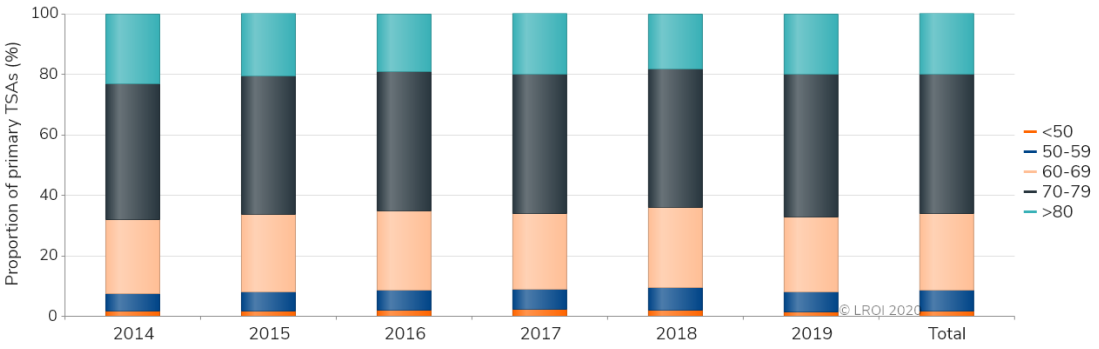
[1] Also contains 10 (0.3%) primary shoulder arthroplasties of which the the type of prosthesis had not been registered.
Reverse: reverse total shoulder arthroplasty; Total anatomical: anatomic total shoulder arthroplasty; Hemi: shoulder hemiarthroplasty; General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.



**The Number of registered shoulder hemiarthroplaties in the LROI is not complete, since these procedures are also performed by trauma surgeons. For 2019, only shoulder hemiarthroplasties that were carried out by orthopaedic surgeons were registered in the LROI.**

*Age category 2014-2019*

**FIGURE** Trend (proportion [%] per year) in age category in primary total (anatomical or reverse) shoulder arthroplasties in the Netherlands in 2014-2019




| Age category (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| <50 | 1.69 | 1.60 | 2.00 | 2.18 | 1.94 | 1.53 | **1.83** |
| 50-59 | 5.83 | 6.32 | 6.52 | 6.81 | 7.61 | 6.48 | **6.67** |
| 60-69 | 24.47 | 25.66 | 26.22 | 25.01 | 26.54 | 24.78 | **25.48** |
| 70-79 | 44.92 | 45.92 | 46.01 | 46.10 | 45.63 | 47.09 | **46.05** |
| >80 | 23.09 | 20.51 | 19.25 | 19.91 | 18.28 | 20.12 | **19.98** |
| Total (n): | **1,594** | **2,058** | **2,254** | **2,527** | **2,735** | **3,007** | **14,175** |

TSA: total shoulder arthroplasty.

*Previous surgery by type of shoulder prosthesis*

**TABLE** Previous surgeries to the same joint in patients who underwent a primary shoulder arthroplasty by type of primary shoulder arthroplasty in the Netherlands in 2019

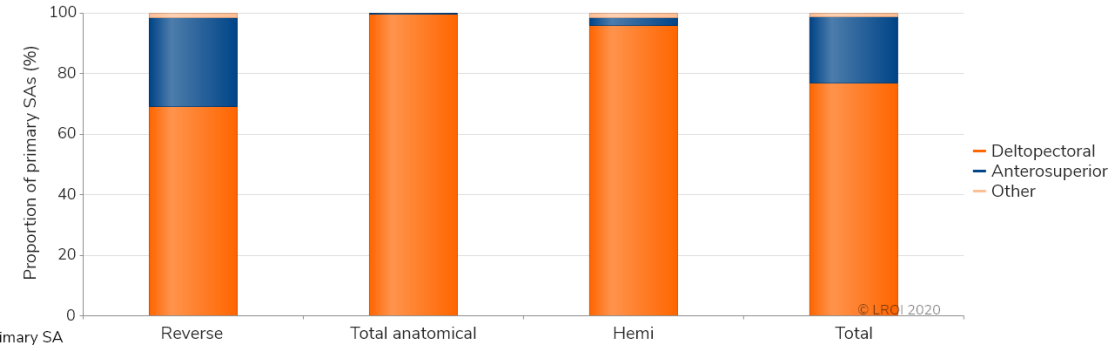
| | Reverse (n=2,374) Proportion[1] (%) | Total anatomical (n=589) Proportion[1] (%) | Hemi (n=237) Proportion[1] (%) |
|---|---|---|---|
| Previous surgery to the relevant shoulder (total) | 17.6 | 15.1 | 16.0 |
| Osteosynthesis | 5.7 | 5.6 | 9.0 |
| Acromioplasty | 7.2 | 3.1 | 4.6 |
| Rotator cuff repair | 9.9 | 1.2 | 3.1 |
| Distal clavicle resection | 2.9 | 2.1 | 2.0 |
| Stabilisation procedure | 1.0 | 3.9 | 2.0 |
| Other | 0.0 | 0.0 | 0.0 |

[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patiens with one or more previous surgeries to the same joint.
Reverse: reverse total shoulder arthroplasty; Total anatomical: anatomic total shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

## Surgical techniques

### *Surgical approach by type of shoulder prosthesis*

**FIGURE** Surgical approach (proportion [%] per category) by type of primary shoulder arthroplasty in patients with a primary shoulder arthroplasty in the Netherlands in 2019 (n=6872)

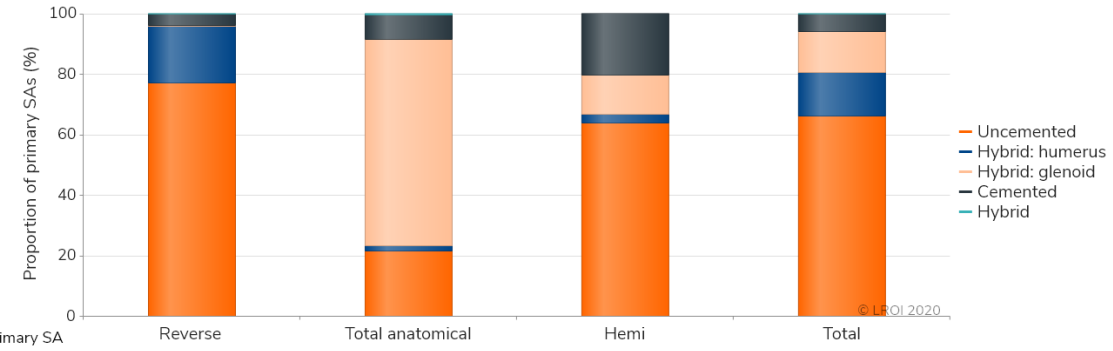



| Type of primary SA | Reverse | Total anatomical | Hemi | Total |
|---|---|---|---|---|
| **Surgical approach (%)** | | | | |
| Deltopectoral | 69.10 | 99.50 | 95.80 | **76.70** |
| Anterosuperior | 29.32 | 0.50 | 2.52 | **22.00** |
| Other | 1.58 | 0.00 | 1.68 | **1.30** |
| Total (n): | **2,398** | **600** | **238** | **3,236** |

SA: shoulder arthroplasty. Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

### *Fixation by type of shoulder prosthesis*

**FIGURE** Type of fixation (proportion [%] per category) by type of primary shoulder arthroplasty in patients with a primary shoulder arthroplasty in the Netherlands in 2019 (n=6718)



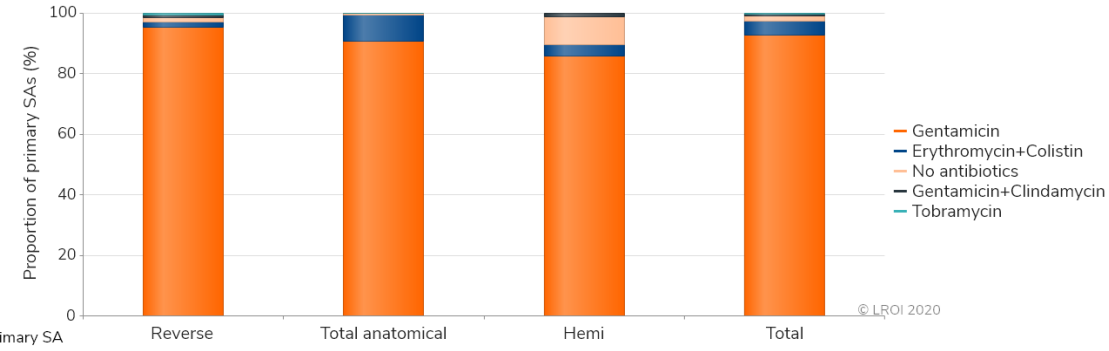

| Type of primary SA | Reverse | Total anatomical | Hemi | Total |
|---|---|---|---|---|
| **Fixation (%)** | | | | |
| Uncemented | 77.11 | 21.72 | 63.87 | **66.10** |
| Hybrid: humerus | 18.77 | 1.58 | 2.94 | **14.47** |
| Hybrid: glenoid | 0.26 | 68.30 | 13.03 | **13.52** |
| Cemented | 3.83 | 7.88 | 20.17 | **5.79** |
| Hybrid | 0.04 | 0.53 | 0.00 | **0.13** |
| Total (n): | **2,350** | **571** | **238** | **3,159** |

SA: shoulder arthroplasty. Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

## Bone cement

### *Antibiotics by type of shoulder prosthesis*

**FIGURE** Use of antibiotics in bone cement (proportion [%] per category) by type of primary shoulder arthroplasty in patients with a primary shoulder arthroplasty in the Netherlands in 2019 (n=2452)

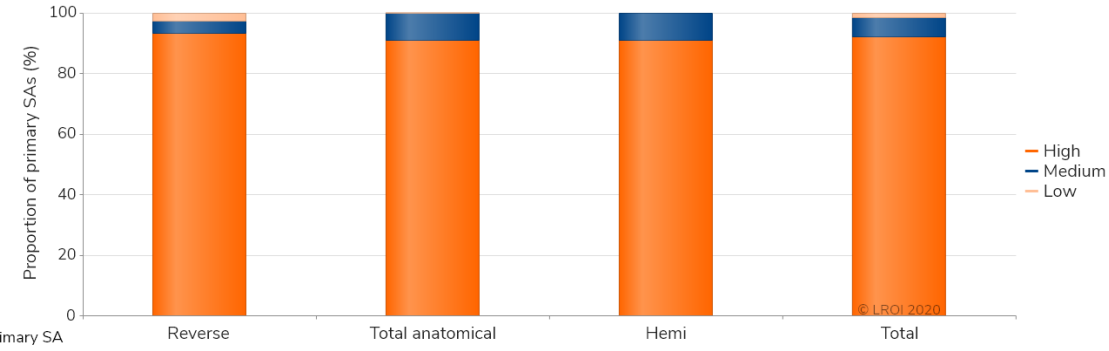



| Bone cement antibiotics (%) | | | | |
|---|---|---|---|---|
| Gentamicin | 95.25 | 90.78 | 85.71 | **92.69** |
| Erythromycin+Colistin | 1.71 | 8.51 | 3.90 | **4.68** |
| No antibiotics | 1.33 | 0.47 | 9.09 | **1.56** |
| Gentamicin+Clindamycin | 0.95 | 0.00 | 1.30 | **0.58** |
| Tobramycin | 0.76 | 0.24 | 0.00 | **0.49** |
| Total (n): | **526** | **423** | **77** | **1,026** |

SA: shoulder arthroplasty. Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

### *Viscosity by type of shoulder prosthesis*

**FIGURE** Bone cement viscosity (proportion [%] per category) by type of primary shoulder arthroplasty in patients with a primary shoulder arthroplasty in the Netherlands in 2019 (n=2452)

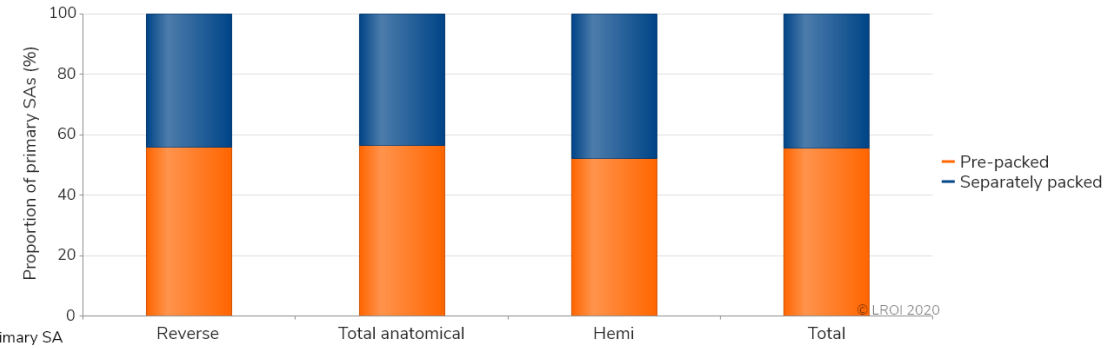



| Bone cement viscosity (%) | | | | |
|---|---|---|---|---|
| High | 93.35 | 91.02 | 90.91 | **92.20** |
| Medium | 3.99 | 8.75 | 9.09 | **6.34** |
| Low | 2.66 | 0.24 | 0.00 | **1.46** |
| Total (n): | **526** | **423** | **77** | **1,026** |

SA: shoulder arthroplasty. Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

*Vacuum mixing system by type of shoulder prosthesis*

**FIGURE** Bone cement pre-packed in a vacuum mixing system (proportion [%] per category) by type of primary shoulder arthroplasty in patients with a primary shoulder arthroplasty in the Netherlands in 2019 (n=2452)




| Type of primary SA | Reverse | Total anatomical | Hemi | Total |
|---|---|---|---|---|
| **Vacuum mixing system (%)** | | | | |
| Pre-packed | 55.70 | 56.26 | 51.95 | **55.65** |
| Separately packed | 44.30 | 43.74 | 48.05 | **44.35** |
| Total (n): | **526** | **423** | **77** | **1,026** |

Separately packed: separately packed bone cement components; Pre-packed: Bone cement pre-packed in a vacuum mixing system.
SA: shoulder arthroplasty. Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

## Most frequently registered components

*Reverse total shoulder arthroplasty*

**TABLE The most frequently registered humeral stems, humeral liners, glenospheres, metaphyses and glenoid baseplates in primary reverse total shoulder arthroplasties in the Netherlands in 2019**

| **Humeral stem (n=2,216)** | | **Humeral liner (n=2,013)** | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Delta X-tend | 34.1 | Delta X-tend | 36.9 |
| Aequalis Ascend Flex | 14.9 | Aequalis Ascend Flex | 15.1 |
| Comprehensive | 11.3 | Comprehensive | 12.0 |
| Aequalis Reversed | 9.8 | Aequalis Reversed | 10.1 |
| Equinoxe | 5.6 | Equinoxe | 5.9 |

| **Glenosphere (n=2,141)** | | **Metaphysis (n=1,789)** | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Delta X-tend | 37.8 | Delta X-tend | 38.1 |
| Aequalis Reversed | 24.8 | Aequalis Ascend Flex | 17.2 |
| Comprehensive | 11.8 | Comprehensive | 13.1 |
| TM Reverse Glenoid Heads | 6.6 | Aequalis Reversed | 11.6 |
| Aequalis Perform Reversed | 6.1 | Equinoxe | 7.4 |

| **Glenoid baseplate (n=1,829)** | |
|---|---|
| **Name** | **Proportion (%)** |
| Delta X-tend | 40.0 |
| Aequalis Reversed | 25.7 |
| Comprehensive | 11.9 |
| Trabecular Metal Baseplate | 6.4 |
| Aequalis Perform Reversed | 6.1 |

*Total anatomical shoulder arthroplasty*

**TABLE The most frequently registered humeral stems, humeral heads and glenoid components in primary total anatomical shoulder arthroplasties in the Netherlands in 2019**

| Humeral stem (n=503) | | Humeral head (n=519) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Aequalis Acsend Flex | 27.0 | Aequalis Acsend Flex | 26.4 |
| Global Unite | 12.9 | Global Unite/ Global AP | 17.5 |
| Affinis Short | 10.9 | Affinis Short | 10.6 |
| Comprehensive | 10.1 | Comprehensive | 9.8 |
| Global AP | 7.8 | SMR head | 9.8 |

| Glenoid (n=502) | |
|---|---|
| **Name** | **Proportion (%)** |
| Aequalis Perform glenoid | 30.1 |
| Global APG+ | 29.5 |
| Comprehensive | 10.6 |
| Aequalis Sferisch Glenoid | 6.6 |
| Affinis | 6.2 |



*Shoulder hemiarthroplasty*

**TABLE The most frequently registered humeral stems and humeral heads in primary shoulder hemiarthroplasties in the Netherlands in 2019**

| Humeral stem (n=185) | | Humeral head (n=179) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Comprehensive | 24.9 | Comprehensive | 23.5 |
| Aequalis Acsend Flex | 20.0 | Aequalis Pyrocarbon | 14.0 |
| Affinis Short | 9.7 | Aequalis humeral head | 10.1 |
| Aequalis Fracture hemi | 8.6 | Affinis Short | 10.1 |
| Copeland | 5.4 | SMR head | 6.1 |



## Most frequently registered types of bone cement

*Reverse total shoulder arthroplasty*

**TABLE The most frequently registered types of bone cement by type of mixing system used during primary reverse total shoulder arthroplasties in the Netherlands in 2019**

| Separately packed bone cement (n=233) | | Bone cement pre-packed in a vacuum mixing system (n=292) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 68.2 | Palacos R+G | 47.3 |
| Refobacin Bone Cement R | 10.3 | Refobacin Bone Cement R | 44.2 |
| Palacos LV+G | 6.0 | Refobacin Plus Bone Cement | 8.6 |
| Simplex ABC EC | 3.9 | | |
| Palacos MV+G | 3.0 | | |

*Total anatomical shoulder arthroplasty*

**TABLE The most frequently registered types of bone cement by type of mixing system used during primary total anatomical shoulder arthroplasties in the Netherlands in 2019**

| Separately packed bone cement (n=185) | | Bone cement pre-packed in a vacuum mixing system (n=238) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 71.9 | Palacos R+G | 50.4 |
| Simplex ABC EC | 19.5 | Refobacin Bone Cement R | 45.0 |
| Refobacin Bone Cement R | 5.9 | Refobacin Plus Bone Cement | 4.6 |
| Biomet Plus Bone Cement | 1.1 | | |
| Refobacin Plus Bone Cement | 0.5 | | |



*Shoulder hemiarthroplasty*

**TABLE The most frequently registered types of bone cement by type of mixing system used during primary shoulder hemiarthroplasties in the Netherlands in 2019**

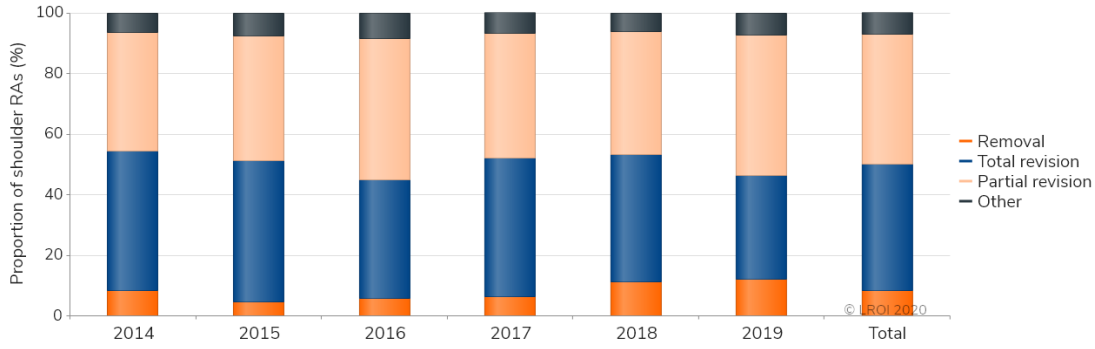
| Separately packed bone cement (n=37) | | Bone cement pre-packed in a vacuum mixing system (n=40) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Palacos R+G | 51.4 | Refobacin Bone Cement R | 65.0 |
| Biomet Plus Bone Cement | 18.9 | Palacos R+G | 20.0 |
| Palacos MV+G | 8.1 | Refobacin Plus Bone Cement | 15.0 |
| Simplex ABC EC | 8.1 | | |
| Refobacin Plus Bone Cement | 5.4 | | |



## Shoulder revision arthroplasty

### Type of revision 2014-2019

**FIGURE Trend (proportion [%] per year) in type of revision in shoulder revision arthroplasties in the Netherlands in 2014-2019**




| Type of shoulder revision (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Removal | 8.33 | 4.62 | 5.70 | 6.33 | 11.21 | 12.14 | **8.29** |
| Total revision | 46.08 | 46.54 | 39.16 | 45.78 | 42.06 | 34.10 | **41.89** |
| Partial revision | 39.22 | 41.15 | 46.77 | 41.27 | 40.50 | 46.53 | **42.76** |
| Other | 6.37 | 7.69 | 8.37 | 6.63 | 6.23 | 7.23 | **7.07** |
| Total (n): | **204** | **260** | **263** | **332** | **321** | **346** | 1,726 |

RA: revision arthroplasty.

## Reasons for revision 2014-2019

**TABLE Trend (proportion [%] per year) in reasons for revision or re-surgery in patients who underwent a shoulder revision arthroplasty by type of shoulder arthroplasty in the Netherlands in 2014-2019**

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| **Shoulder revision (n)** | 195 | 264 | 267 | 334 | 318 | 341 | 1,719 |
| Reasons for revision; Proportion[1] (%) | | | | | | | |
| Infection | 20.5 | 17.1 | 22.9 | 22.2 | 26.1 | 28.5 | 23.3 |
| Instability | 13.1 | 15.9 | 24.0 | 27.3 | 23.7 | 23.5 | 21.9 |
| Progression of osteoarthritis | 25.6 | 25.4 | 17.2 | 17.4 | 15.7 | 12.6 | 18.3 |
| Cuff rupture | 14.9 | 15.5 | 11.2 | 15.0 | 12.6 | 11.7 | 13.4 |
| Loosening of glenoid component | 13.2 | 13.6 | 10.9 | 13.5 | 11.6 | 11.7 | 12.4 |
| Cuff arthropathy | 13.2 | 13.6 | 13.9 | 12.3 | 10.1 | 12.0 | 12.4 |
| Malalignment | 12.8 | 13.3 | 8.6 | 8.9 | 6.3 | 6.5 | 9.0 |
| Loosening of humeral component | 8.2 | 7.6 | 11.2 | 4.8 | 7.6 | 5.6 | 5.6 |
| Peri-prosthetic fracture | 3.1 | 6.1 | 5.2 | 4.8 | 6.9 | 6.5 | 5.6 |
| Other | 11.3 | 12.1 | 12.4 | 9.6 | 13.2 | 12.3 | 11.8 |

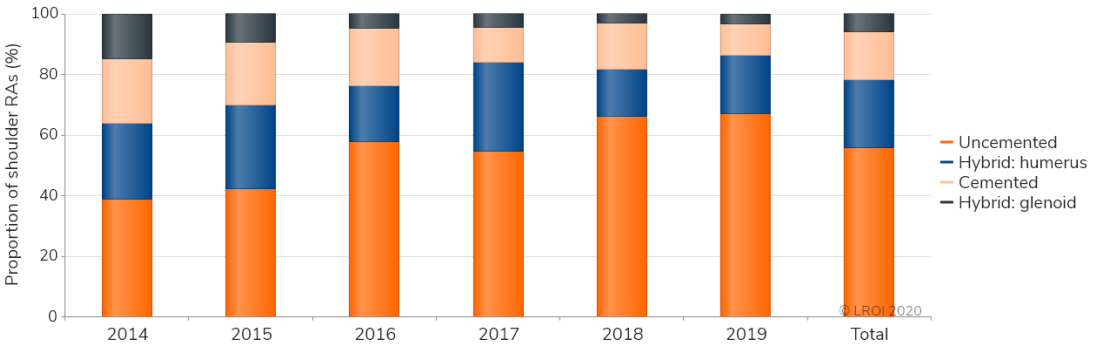
[1] One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.



## Surgical techniques

### *Fixation 2014-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in shoulder revision arthroplasties in the Netherlands in 2014-2019**

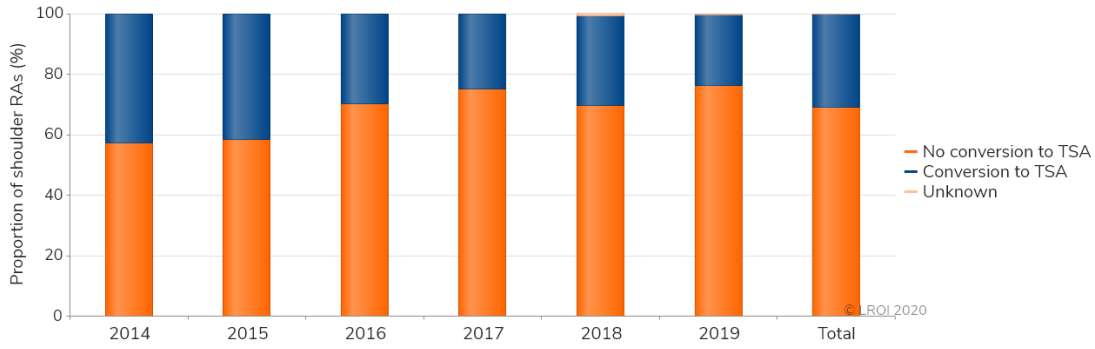



| Fixation (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Uncemented | 38.98 | 42.28 | 57.96 | 54.55 | 66.28 | 67.11 | **55.79** |
| Hybrid: humerus | 24.86 | 27.64 | 18.37 | 29.55 | 15.33 | 19.27 | **22.50** |
| Cemented | 21.47 | 20.73 | 18.78 | 11.36 | 15.33 | 10.30 | **15.67** |
| Hybrid: glenoid | 14.69 | 9.35 | 4.90 | 4.55 | 3.07 | 3.32 | **6.05** |
| Total (n): | **177** | **246** | **245** | **308** | **261** | **301** | 1,538 |

RA: revision arthroplasty.

*Conversion to TSA 2014-2019*

**FIGURE** Trend (proportion [%] per year) in conversion of a shoulder hemiprosthesis to a total (anatomical or reverse) shoulder arthroplasty in the Netherlands in 2014-2019

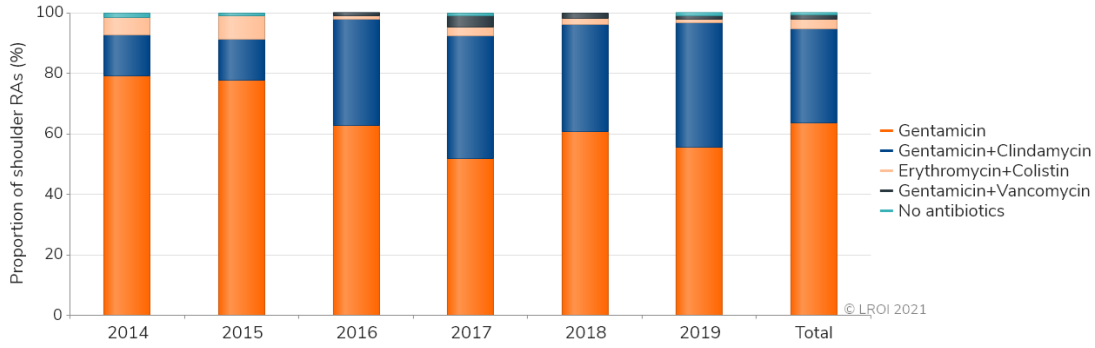



| Conversion to TSA (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| No conversion to TSA | 57.14 | 58.51 | 70.24 | 75.23 | 69.67 | 76.36 | **69.16** |
| Conversion to TSA | 42.86 | 41.49 | 29.76 | 24.77 | 29.67 | 23.33 | **30.65** |
| Unknown | 0.00 | 0.00 | 0.00 | 0.00 | 0.67 | 0.30 | **0.18** |
| Total (n): | **182** | **241** | **252** | **323** | **300** | **330** | **1,628** |

RA: revision arthroplasty; TSA: total shoulder arthroplasty.

*Bone cement antibiotics 2014-2019*

**FIGURE** Trend (proportion [%] per year) in use of antibiotics in bone cement in shoulder revision arthroplasties in the Netherlands in 2014-2019




| Bone cement antibiotics (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gentamicin | 79.10 | 77.78 | 62.63 | 51.92 | 60.58 | 55.68 | **63.59** |
| Gentamicin+Clindamycin | 13.43 | 13.33 | 35.35 | 40.38 | 35.58 | 40.91 | **30.98** |
| Erythromycin+Colistin | 5.97 | 7.78 | 1.01 | 2.88 | 1.92 | 1.14 | **3.26** |
| Gentamicin+Vancomycin | 0.00 | 0.00 | 1.01 | 3.85 | 1.92 | 1.14 | **1.45** |
| No antibiotics | 1.49 | 1.11 | 0.00 | 0.96 | 0.00 | 1.14 | **0.72** |
| Total (n): | **67** | **90** | **99** | **104** | **104** | **88** | **552** |

RA: revision arthroplasty.

## Most frequently registered

### *Components*

**TABLE The most frequently registered humeral stems, humeral heads, humeral liners, glenoid baseplates, glenospheres, glenoid components and metaphyses in shoulder revision arthroplasties in the Netherlands in 2019**

| Humeral stem (n=149) | | Humeral head (n=30) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Delta X-tend | 55.4 | Aequalis Ascend Flex | 20.0 |
| Aequalis Ascend Flex | 9.2 | Global AP | 16.7 |
| Aequalis Reversed | 9.2 | Global Unite/ Global AP | 13.3 |
| Global Unite | 7.7 | Aequalis humerus kop | 10.0 |
| Aequalis Reversed Fractuur | 4.6 | Comprehensive | 6.7 |

| Humeral liner (n=210) | | Glenoid baseplate (n=124) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Delta X-tend | 39.5 | Delta X-tend | 48.4 |
| Aequalis Ascend Flex | 14.3 | Aequalis Reversed | 21.8 |
| Comprehensive | 9.0 | Comprehensive | 9.7 |
| Aequalis Reversed | 8.6 | Trabecular Metal Baseplate | 6.5 |
| Anatomical Inverse Humeral Poly Inlays | 6.2 | Aequalis Perform Reversed | 4.8 |

| Glenosphere (n=118) | | Glenoid component (n=2) | |
|---|---|---|---|
| **Name** | **Proportion (%)** | **Name** | **Proportion (%)** |
| Delta X-tend | 43.2 | SMR PE liner | 50.0 |
| Aequalis Reversed | 21.8 | Anatomical Shoulder Bipolar Inserts | 50.0 |
| Aequalis Perform Reversed | 9.3 | | |
| Affinis Inverse | 5.1 | | |
| SMR reversed head | 5.1 | | |

| Metaphysis (n=121 | |
|---|---|
| **Name** | **Proportion (%)** |
| Delta X-tend | 23.1 |
| Aequalis Ascend Flex | 21.5 |
| Comprehensive | 17.4 |
| Aequalis Reversed | 11.6 |
| Anatomical inverse Humeral Cups | 10.7 |



### *Types of bone cement*

**TABLE The most frequently registered types of bone cement used during shoulder revision arthroplasties in the Netherlands in 2019 (n=83)**

| Name | Proportion (%) |
|---|---|
| Copal G+C | 34.9 |
| Palacos R+G | 34.9 |
| Refobacin Bone Cement R | 14.5 |
| Refobacin Revision | 4.8 |
| Refobacin Plus Bone Cement | 3.6 |



## Survival

### Revision within 1 year

### *By type of shoulder arthroplasty*

**TABLE Cumulative revision percentage of primary shoulder arthroplasties by type of shoulder arthroplasty in the Netherlands in 2014-2019 (n=16,309)**

| | | Cumulative 5-year revision percentage | |
|---|---|---|---|
| **Type of primary shoulder arthroplasty** | **Number (n)** | **Competing Risk[1] (95% CI)** | **Kaplan Meier (95% CI)** |
| Reverse | 10,782 | 4.4 (3.9-4.9) | 4.7 (4.1-5.2) |
| Total anatomical | 3,587 | 5.8 (4.8-7.0) | 5.9 (4.8-7.1) |
| Hemi | 1,940 | 11.3 (9.6-13.1) | 11.9 (10.0-13.7) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty. CI: confidence interval

*Reasons for revision*

**TABLE Reasons for revision within one year in patients that underwent a shoulder revision arthroplasty by type of shoulder arthroplasty in the Netherlands in 2014-2018**

| | Type of primary shoulder arthroplasty | | |
|---|---|---|---|
| | Reverse (n=209) | Total anatomical (n=49) | Hemi (n=54) |
| Reason for revision | Proportion[1] (%) | Proportion[1] (%) | Proportion[1] (%) |
| Instability | 42.1 | 34.7 | 24.1 |
| Infection | 30.6 | 6.1 | 9.3 |
| Cuff rupture | n.a. | 34.7 | 29.6 |
| Malalignment | 7.2 | 14.3 | 13.0 |
| Cuff arthroplasty | n.a. | 14.3 | 25.9 |
| Loosening of glenoid component | 8.1 | 14.3 | 1.9 |
| Loosening of humeral component | 2.9 | 4.1 | 11.1 |
| Peri-prosthetic fracture | 6.2 | 2.0 | 1.9 |
| Progression of osteoarthritis | 1.4 | 4.1 | 18.5 |
| Other | 9.1 | 10.2 | 16.7 |

Please note: After a reverse total shoulder arthroplasty, the rotater cuff is no longer present.
Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.
[1]One patient may have more than one reason of revision.



## Revision within 5 years

*By type of shoulder arthroplasty*

**FIGURE Cumulative revision percentage of primary shoulder arthroplasties by type of shoulder arthroplasty in the Netherlands in 2014-2019 (n=16,309)**

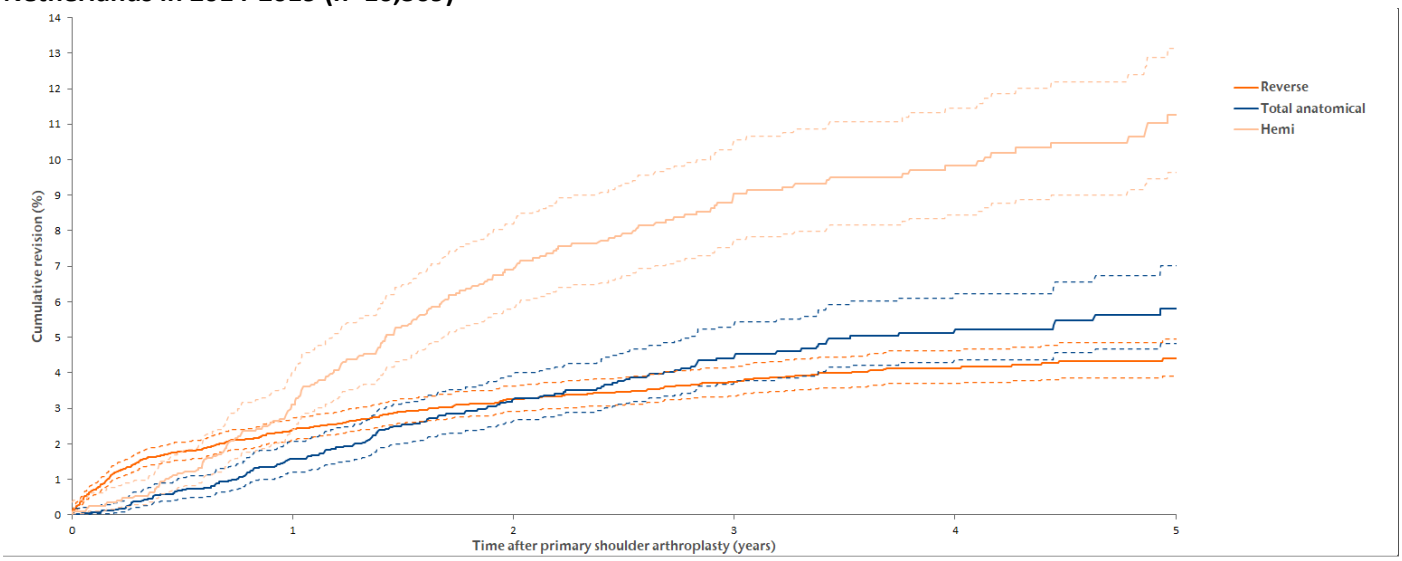



**TABLE Cumulative revision percentage of primary shoulder arthroplasties by type of shoulder arthroplasty in the Netherlands in 2014-2019 (n=16,309)**

| | | Cumulative 5-year revision percentage | |
|---|---|---|---|
| Type of primary shoulder arthroplasty | Number (n) | Competing Risk[1] (95% CI) | Kaplan Meier (95% CI) |
| Reverse | 10,782 | 4.4 (3.9-4.9) | 4.7 (4.1-5.2) |
| Total anatomical | 3,587 | 5.8 (4.8-7.0) | 5.9 (4.8-7.1) |
| Hemi | 1,940 | 11.3 (9.6-13.1) | 11.9 (10.0-13.7) |

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty. CI: confidence interval

*Reverse total shoulder arthroplasty by demographics*

## TABLE Cumulative 5-year revision percentage of primary reverse total shoulder arthroplasties by demographics in the Netherlands in 2014-2019

| | | Cumulative 5-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk (95% CI) | Kaplan Meier (95% CI) |
| **Total** | 10,782 | 4.4 (3.9-4.9) | 4.7 (4.1-5.2) |
| **Gender** | | | |
| Men | 2,478 | 8.9 (7.5-10.4) | 9.4 (7.8-10.9) |
| Women | 8,293 | 3.1 (2.6-3.7) | 3.3 (2.8-3.9) |
| **Age (years)** | | | |
| <50 | 83 | n.a. | n.a. |
| 50-59 | 365 | n.a. | n.a. |
| 60-69 | 2,300 | 7.0 (5.7-8.6) | 7.3 (5.8-8.7) |
| 70-79 | 5,454 | 4.0 (4.4-4.8) | 4.3 (3.5-5.0) |
| ≥80 | 2,568 | 2.2 (1.7-2.9) | 2.4 (1.7-3.0) |
| **Diagnosis** | | | |
| Osteoarthritis | 3,276 | 3.9 (3.1-4.9) | 4.2 (3.2-5.1) |
| Other | 7,477 | 4.8 (4.1-5.6) | 4.9 (4.2-5.6) |
| **ASA score** | | | |
| I | 583 | 8.5 (5.4-13.4) | 8.8 (4.9-12.6) |
| II | 6,334 | 3.7 (3.2-4.4) | 3.9 (3.3-4.5) |
| III-IV | 3,707 | 4.8 (3.9-5.8) | 5.2 (4.2-6.2) |
| **Walch score** | | | |
| A1 | 4,970 | 4.5 (3.8-5.3) | 4.7 (3.9-5.5) |
| A2 | 2,289 | 4.5 (3.5-5.9) | 4.8 (3.5-6.0) |
| B1 | 993 | 3.4 (2.3-5.0) | 3.4 (2.1-4.7) |
| B2 | 555 | n.a. | n.a. |
| B3 | 183 | n.a. | n.a. |
| C | | | |
| **Body Mass Index (kg/m²)** | | | |
| Underweight (≤18,5) | 109 | n.a. | n.a. |
| Normal weight (>18,5-25) | 3,017 | 4.0 (3.1-5.2) | 4.3 (3.2-5.5) |
| Overweight (>25-30) | 4,192 | 4.2 (3.5-5.1) | 4.5 (3.7-5.3) |
| Obesity (>30-40) | 3,008 | 4.8 (3.9-5.8) | 4.9 (3.9-5.9) |
| Morbid obesity (>40) | 292 | n.a. | n.a. |
| **Smoking** | | | |
| No | 9,467 | 4.3 (3.8-4.9) | 4.5 (3.9-5.1) |
| Yes | 404 | 5.6 (4.2-7.4) | 5.8 (4.2-7.3) |

Please note: n.a. if <50 cases were at risk; CI: confidence interval.

*Total anatomical shoulder arthroplasty by demographics*

## TABLE Cumulative 5-year revision percentage of primary total anatomical shoulder arthroplasties by demographics in the Netherlands in 2014-2019

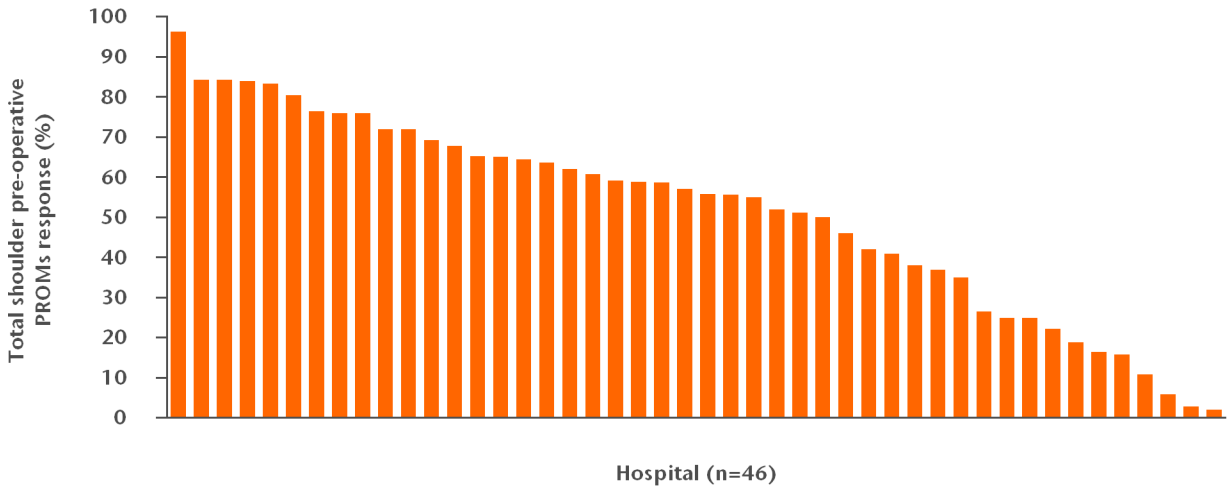
| | | Cumulative 5-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk (95% CI) | Kaplan Meier (95% CI) |
| **Total** | 3,587 | 5.8 (4.8-7.0) | 5.9 (4.8-7.1) |
| **Gender** | | | |
| Men | 1,065 | 5.9 (4.3-8.0) | 5.9 (4.1-7.8) |
| Women | 2,518 | 5.8 (4.6-7.3) | 5.9 (4.5-7.3) |
| **Age (years)** | | | |
| <50 | 204 | n.a. | n.a. |
| 50-59 | 622 | 9.5 (6.5-13.9) | 9.7 (6.0-13.3) |
| 60-69 | 1,383 | 5.7 (4.4-7.5) | 5.8 (4.2-7.4) |
| 70-79 | 1,093 | 4.1 (2.6-6.6) | 4.2 (2.2-6.3) |
| ≥80 | 282 | n.a. | n.a. |
| **Diagnosis** | | | |
| Osteoarthritis | 2,971 | 5.2 (4.2-6.6) | 5.3 (4.1-6.6) |
| Other | 602 | 9.8 (7.0-13.8) | 8.9 (6.0-11.7) |
| **ASA score** | | | |
| I | 512 | 8.1 (5.2-12.8) | 7.9 (4.4-11.4) |
| II | 2,365 | 5.9 (4.7-7.4) | 6.0 (4.6-7.4) |
| III-IV | 667 | 4.0 (2.5-6.4) | 3.9 (2.0-5.8) |
| **Walch score** | | | |
| A1 | 1,453 | 6.6 (5.0-8.5) | 6.7 (4.9-8.4) |
| A2 | 1,006 | 5.9 (4.2-8.3) | 6.0 (3.9-8.0) |
| B1 | 575 | 3.5 (2.0-5.9) | 3.5 (1.6-5.4) |
| B2 | 241 | n.a. | n.a. |
| B3 | 45 | n.a. | n.a. |
| C | 14 | n.a. | n.a. |
| **Body Mass Index (kg/m²)** | | | |
| Underweight (≤18,5) | 16 | n.a. | n.a. |
| Normal weight (>18,5-25) | 873 | 5.8 (4.0-8.6) | 6.0 (3.6-8.3) |
| Overweight (>25-30) | 1,393 | 4.5 (3.4-6.1) | 4.6 (3.2-6.0) |
| Obesity (>30-40) | 1,128 | 7.8 (5.7-10.8) | 8.0 (5.4-10.6) |
| Morbid obesity (>40) | 108 | n.a. | n.a. |
| **Smoking** | | | |
| No | 3,099 | 5.3 (4.3-6.6) | 5.4 (4.2-6.5) |
| Yes | 429 | 7.9 (5.1-12.2) | 8.2 (4.6-11.9) |

Please note: n.a. if <50 cases were at risk; CI: confidence interval.

# PROMs

## Response 2019

**FIGURE Pre-operative PROMs response percentage of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty per PROMs registering hospital in the Netherlands in 2019 (n=2,012)**




**The mean pre-operative response rate in a PROMs registering hospital in 2019 was 51.4%.**
**Of the 1,415 patients who underwent a primary total shoulder arthroplasty between January and October 1st, the mean three months postoperative response rate was 37.2%.**
**In 2018, the mean twelve months postoperative response rate was 45.8% of the 1,541 patients who underwent a primary total shoulder arthroplasty in a pre-operative PROMs registering hospital.**

## Mean scores (pre-operative, 3 months and 12 months)

*NRS (rest)*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative NRS (rest) scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

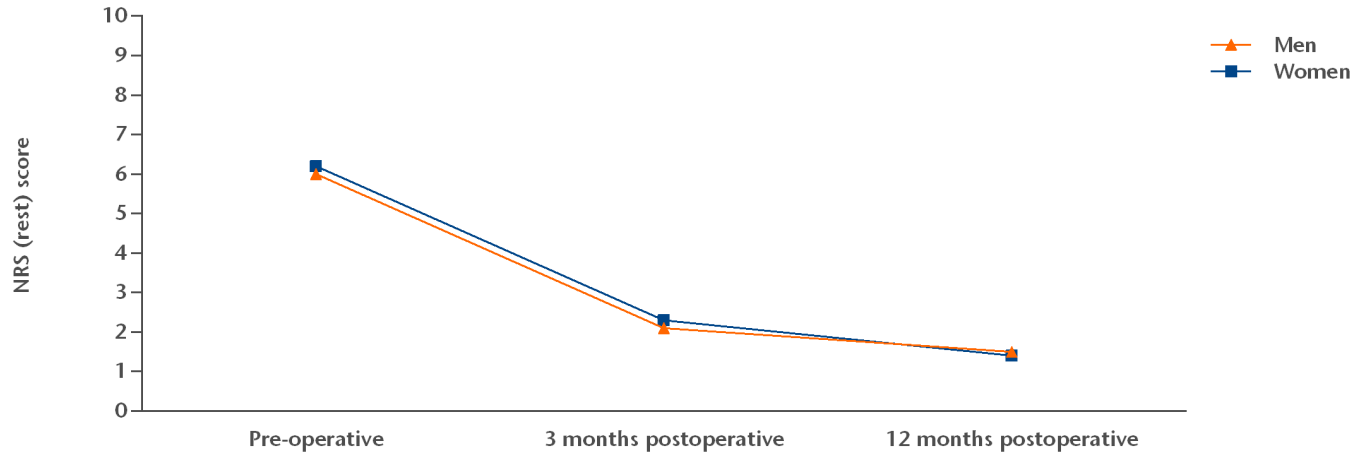



**TABLE Mean pre-operative, 3 months and 12 months postoperative NRS (rest) scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

| NRS (rest) score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 593 | 6.0 (5.9-6.2) | 414 | 2.1 (1.9-2.3) | 292 | 1.5 (1.3-1.8) |
| Women | 1,604 | 6.2 (6.1-6.4) | 1,036 | 2.3 (2.2-2.5) | 803 | 1.4 (1.3-1.6) |
| Total | 2,197 | 6.2 (6.1-6.3) | 1,450 | 2.3 (2.1-2.4) | 1,095 | 1.5 (1.3-1.6) |

[1] The 12 months NRS (rest) score is not (yet) available for 2019.
CI: confidence interval.



**The NRS (rest) score measures pain during rest. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain.**

*NRS (activity)*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative NRS (activity) scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

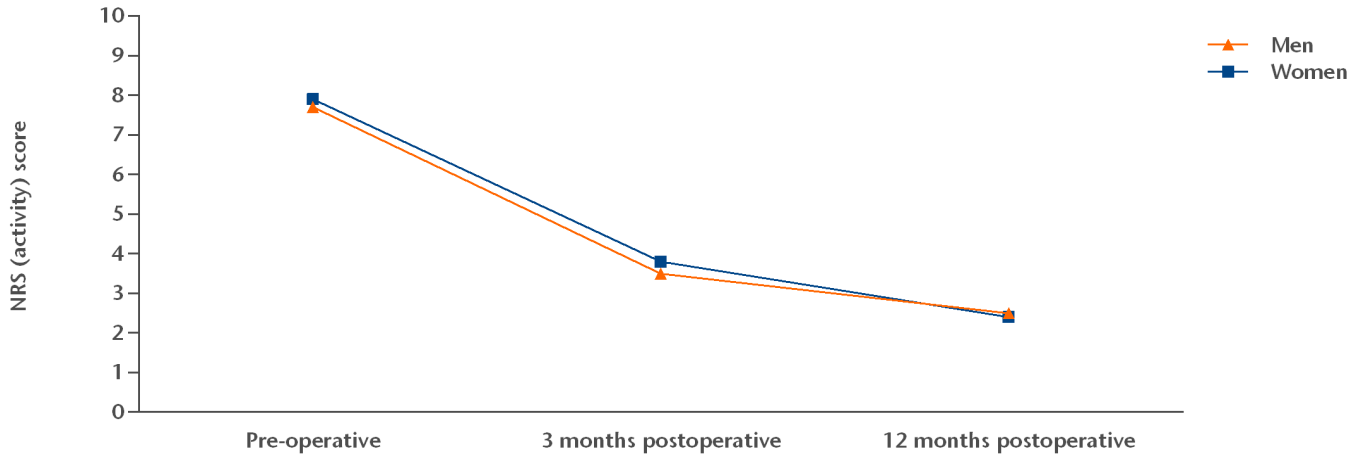



**TABLE Mean pre-operative, 3 months and 12 months postoperative NRS (activity) scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

| NRS (activity) score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 592 | 7.7 (7.5-7.9) | 414 | 3.5 (3.3-3.8) | 292 | 2.5 (2.2-2.8) |
| Women | 1,605 | 7.9 (7.8-8.0) | 1,033 | 3.8 (3.7-4.0) | 798 | 2.4 (2.2-2.5) |
| Total | 2,197 | 7.9 (7.8-7.9) | 1,447 | 3.7 (3.7-3.9) | 1,090 | 2.4 (2.2-2.5) |

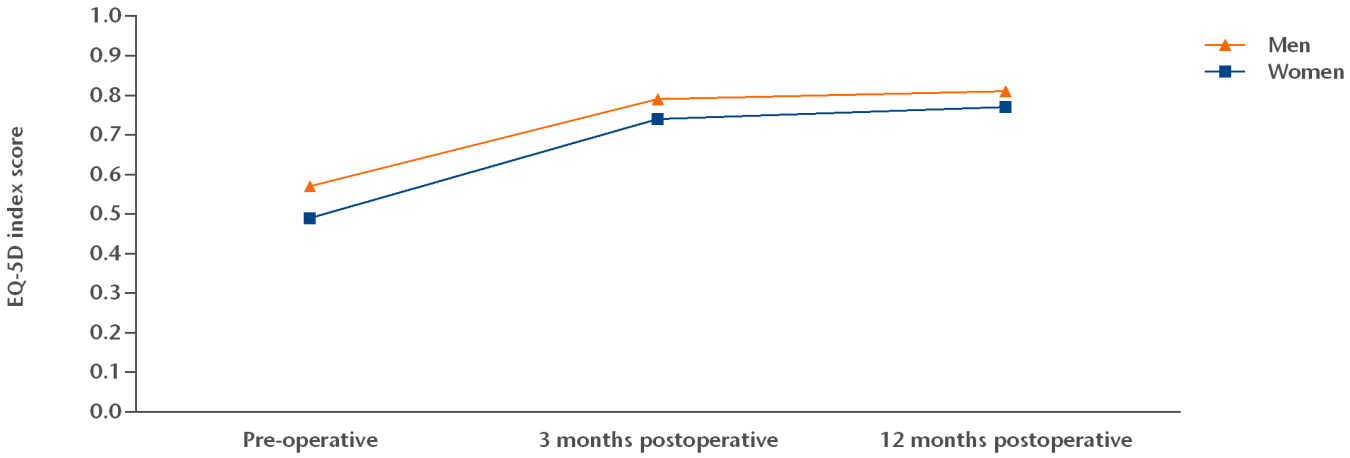
[1] The 12 months NRS (activity) score is not (yet) available for 2019.
CI: confidence interval.



**The NRS (activity) score measures pain during activity. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain.**

*EQ5D index score*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative EQ-5D index scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**




## TABLE Mean EQ-5D Index scores

| EQ-5D index score | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 583 | 0.57 (0.55-0.59) | 413 | 0.79 (0.77-0.81) | 287 | 0.81 (0.79-0.84) |
| Women | 1,586 | 0.49 (0.47-0.50) | 1,034 | 0.74 (0.72-0.75) | 789 | 0.77 (0.76-0.79) |
| Total | 2,169 | 0.51 (0.50-0.52) | 1,447 | 0.75 (0.74-0.76) | 1,076 | 0.78 (0.77-0.80) |

[1] The 12 months EQ-5D index score is not (yet) available for 2019.
CI: confidence interval.



**The EQ-5D index score measures quality of life.**
**The score has a range of -0.329 to 1.0, with 1.0 representing the best possible quality of life.**

*EQ5D thermometer*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative EQ-5D thermometer scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

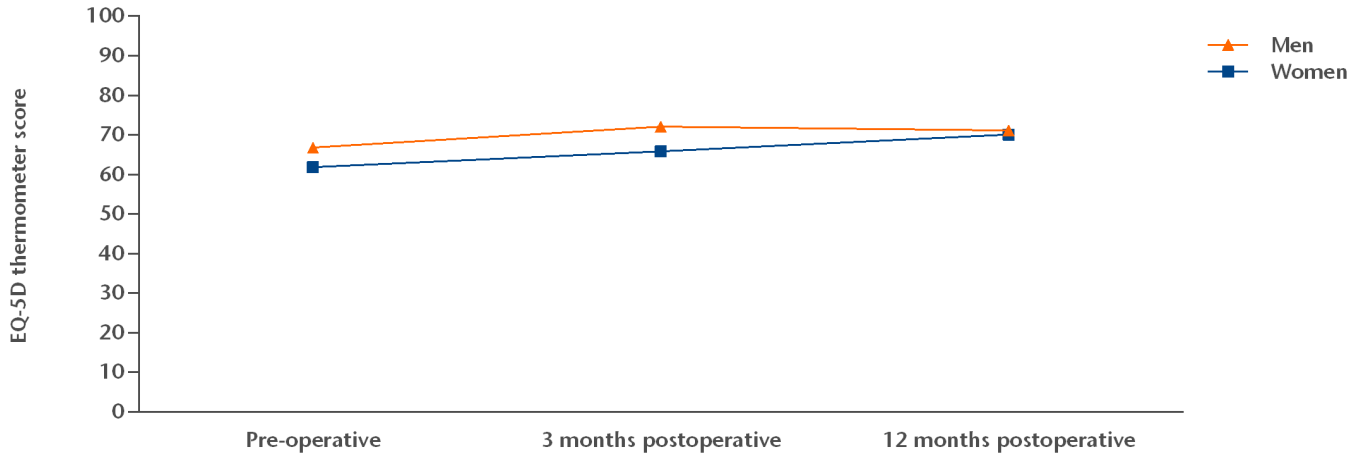



**TABLE Mean EQ-5D thermometer scores**

| EQ-5D thermometer | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 606 | 66.8 (65.0-68.6) | 437 | 72.1 (69.9-74.3) | 299 | 71.1 (68.4-73.8) |
| Women | 1,653 | 61.8 (60.7-62.9) | 1,095 | 65.8 (64.3-67.3) | 819 | 70.1 (68.6-71.5) |
| Total | 2,259 | 63.2 (62.3-64.1) | 1,532 | 67.6 (66.5-68.8) | 1,118 | 70.3 (69.0-71.6) |

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2019.
CI: confidence interval.



**The EQ-5D thermometer score measures the health situation.**
**The score has a range of 0.0 to 100.0, with 0.0 representing the worst possible health situation and 100.0 the best possible health situation.**

*Oxford Shoulder score*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative Oxford Shoulder scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

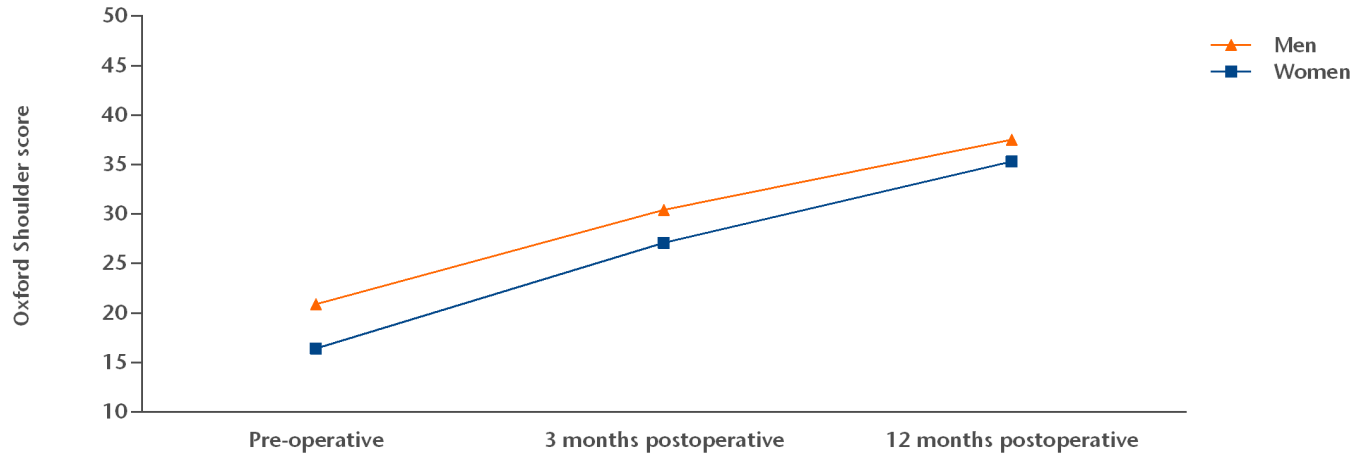



**TABLE Mean OSS scores**

| Oxford Shoulder | Pre-operative | | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 574 | 20.9 (20.2-21.6) | 409 | 30.4 (29.3-31.5) | 273 | 37.5 (36.3-38.7) |
| Women | 1,535 | 16.4 (16.0-16.8) | 1,001 | 27.1 (26.5-27.8) | 731 | 35.3 (34.5-36.0) |
| Total | 2,109 | 17.6 (17.2-18.0) | 1,410 | 28.1 (27.5-28.6) | 1,004 | 35.9 (35.2-36.5) |

[1] The 12 months Oxford Shoulder score is not (yet) available for 2019.
CI: confidence interval.



**The Oxford Shoulder score measures the physical functioning and pain of patients with osteoarthritis to the shoulder. The score has a range of 0.0 to 48.0, with 0.0 representing no functional ability and 48.0 the most functional ability.**

*Recommendation*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative recommendation scores of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

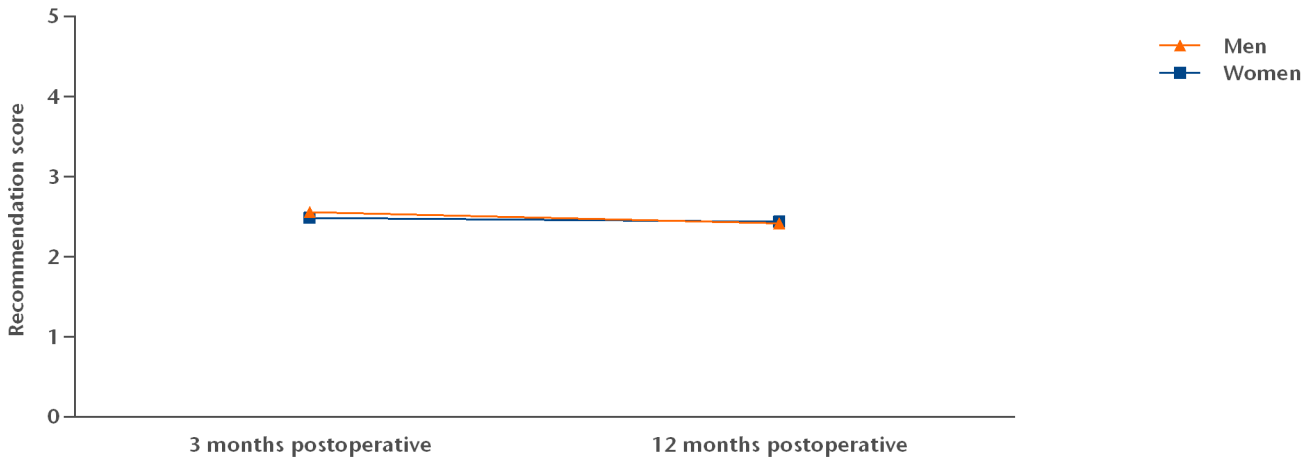



**TABLE Mean recommendation**

| Recommendation score | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 371 | 2.56 (2.39-2.72) | 267 | 2.42 (2.23-2.62) |
| Women | 939 | 2.49 (2.40-2.59) | 732 | 2.44 (2.32-2.55) |
| Total | 1,310 | 2.51 (2.43-2.60) | 999 | 2.43 (2.33-2.53) |

[1] The 12 months recommendation score is not (yet) available for 2019.
CI: confidence interval.



**The recommendation score measures to what extend the patient would recommend joint replacement to a friend or relative. The score has a range of 1.0 to 5.0, with 1.0 representing totally disagreement and 5.0 representing totally agreement.**

*Anchor question: Daily functioning*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative change in daily functioning of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

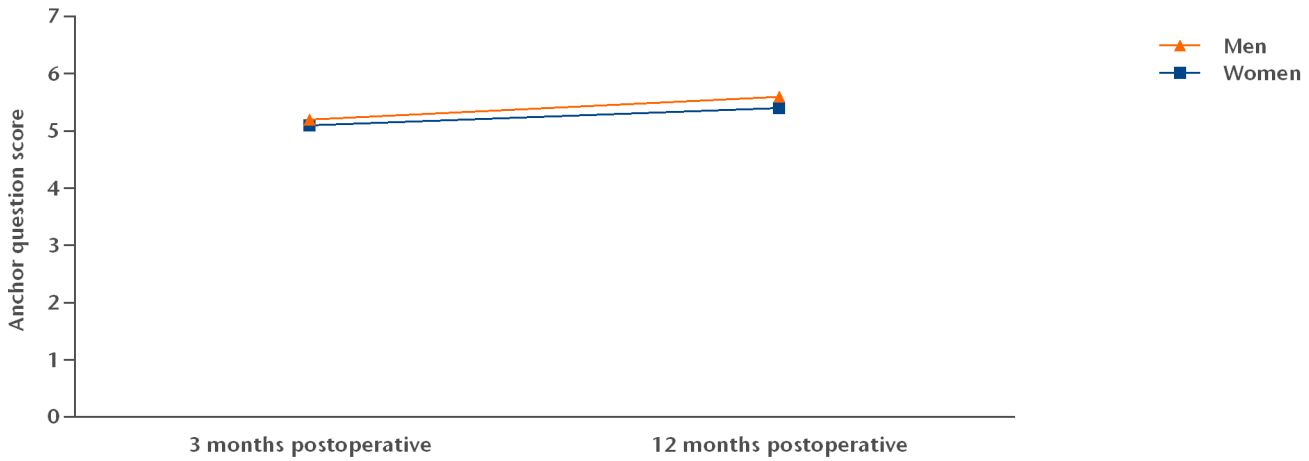



**TABLE Mean anchor question: Daily functioning**

| Anchor question score | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 399 | 5.2 (5.0-5.3) | 272 | 5.6 (5.4-5.7) |
| Women | 1,011 | 5.1 (5.0-5.2) | 776 | 5.4 (5.3-5.5) |
| Total | 1,410 | 5.1 (5.0-5.2) | 1,048 | 5.4 (5.3-5.5) |

[1] The 12 months anchor question score is not (yet) available for 2019.
CI: confidence interval.



**The anchor question measures change in daily functioning after joint replacement.**
**The score has a range of 1.0 to 7.0, with 1.0 representing very deteriorated and 7.0 representing very improved.**

*Anchor question: Pain*

**FIGURE Mean pre-operative, 3 months and 12 months postoperative change in pain of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by gender in the Netherlands in 2016-2019**

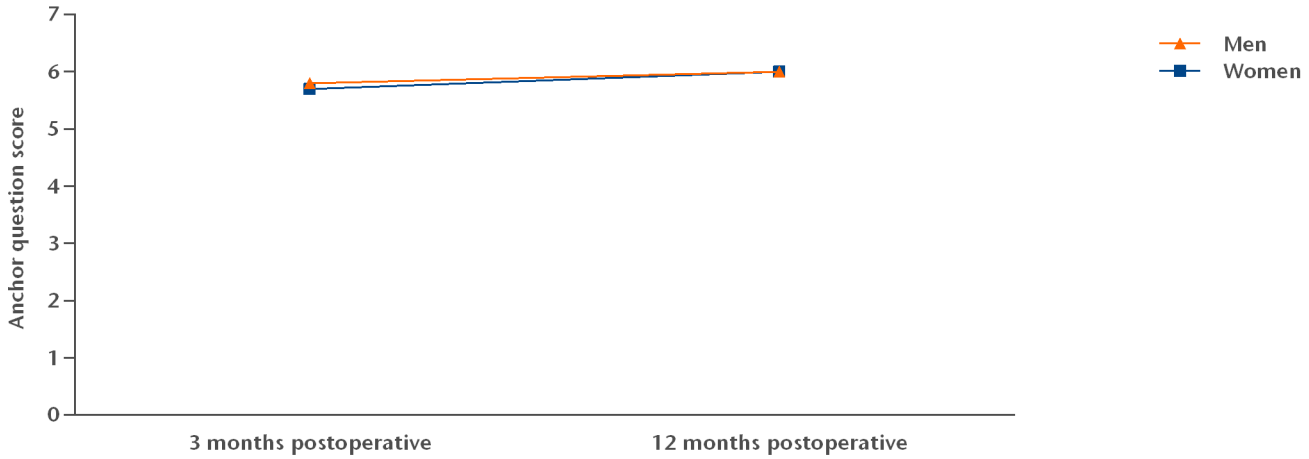



**TABLE Mean anchor question: Pain**

| Anchor question score | 3 months postoperative | | 12 months postoperative[1] | |
|---|---|---|---|---|
| Gender | n | Mean (95% CI) | n | Mean (95% CI) |
| Men | 392 | 5.8 (5.6-5.9) | 264 | 6.0 (5.9-6.2) |
| Women | 983 | 5.7 (5.6-5.8) | 743 | 6.0 (6.0-6.1) |
| Total | 1,375 | 5.7 (5.7-5.8) | 1,007 | 6.0 (6.0-6.1) |

[1] The 12 months anchor question score is not (yet) available for 2019.
CI: confidence interval.



**The anchor question measures change in pain degree after joint replacement.**
**The score has a range of 1.0 to 7.0, with 1.0 representing very deteriorated and 7.0 representing very improved.**

# Elbow arthroplasty

## Numbers

### Registered procedures 2014-2019

**TABLE Number of registered elbow arthroplasties per year of surgery (2014-2019) in the LROI in May 2019**

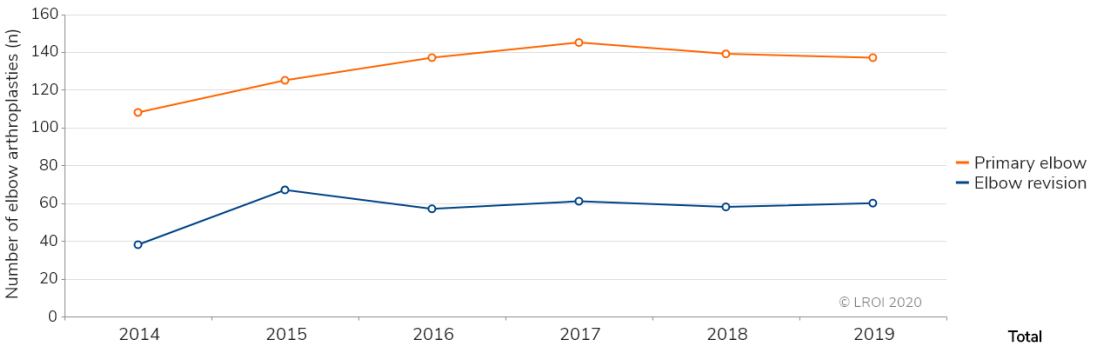
| | Type of elbow arthroplasty | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year of surgery | Total arthroplasty (n) | Distal hemihumeral arthroplasty (n) | Radial head arthroplasty (n) | Radiocapitellar arthroplasty (n) | Lateral resurfacing arthroplasty (n) | Other (n) | Revision arthroplasty (n) | Total[1] (n) |
| 2014 | 72 | 5 | 23 | 0 | 0 | 0 | 38 | 146 |
| 2015 | 78 | 4 | 41 | 1 | 0 | 0 | 67 | 192 |
| 2016 | 67 | 2 | 45 | 13 | 0 | 2 | 57 | 194 |
| 2017 | 67 | 1 | 41 | 13 | 0 | 0 | 61 | 206 |
| 2018 | 73 | 5 | 54 | 2 | 0 | 2 | 58 | 197 |
| 2019 | 79 | 2 | 56 | 0 | 0 | 0 | 60 | 197 |
| Total | 436 | 19 | 260 | 29 | 0 | 4 | 341 | 1,132 |

[1] In 3.8% (n=43) primary elbow arthroplasties the type of primary elbow prosthesis has not been registered.



### Procedures 2014-2019

**FIGURE Number of primary elbow arthroplasties and elbow revision arthroplasties registered in the LROI in the Netherlands in 2014-2019**

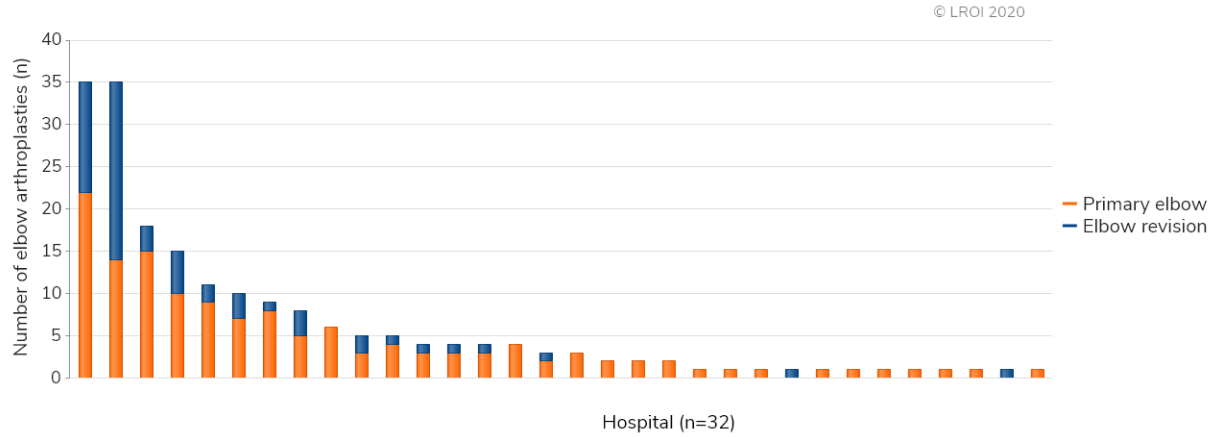



| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Type of procedure (n) | | | | | | | |
| Primary elbow | 108 | 125 | 137 | 145 | 139 | 137 | **791** |
| Elbow revision | 38 | 67 | 57 | 61 | 58 | 60 | **341** |
| Total: | **146** | **192** | **194** | **206** | **197** | **197** | 1,132 |

**Out of 137 primary elbow arthroplasties that were performed in 2019, 1% (n=1) was performed bilaterally.**

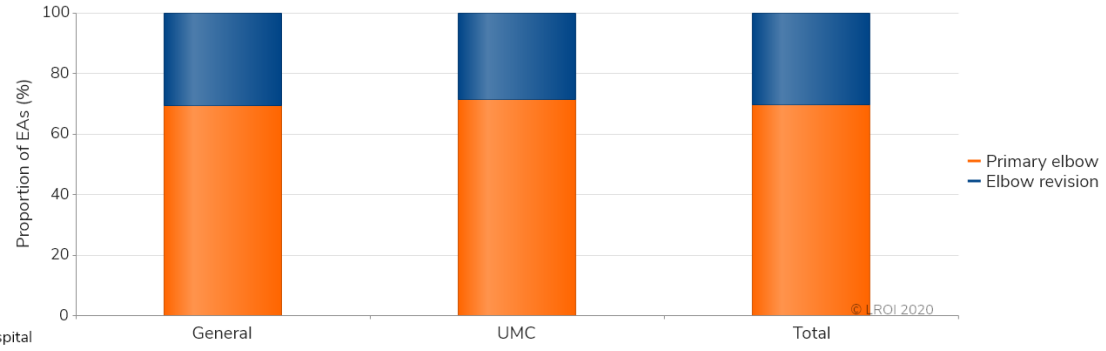
### Type of procedure per hospital

**FIGURE Number of primary elbow arthroplasties and elbow revision arthroplasties per hospital in the Netherlands in 2019 (n=197)**



## Type of procedure by type of hospital

**FIGURE Primary elbow arthroplasties and elbow revision arthroplasties (proportion [%] per category) by type of hospital in the Netherlands in 2019**




| Type of hospital | General | UMC | Total |
|---|---|---|---|
| **Type of procedure (%)** | | | |
| Primary elbow | 69.32 | 71.43 | **69.54** |
| Elbow revision | 30.68 | 28.57 | **30.46** |
| Total (n): | **176** | **21** | **197** |

Please note: In 2019, 28 general hospitals and 4 UMCs performed elbow arthroplasties.
EA: elbow arthroplasty; General: general hospital; UMC: university medical centre.

# Primary elbow arthroplasty

## Demographics

*Patient characteristics by type of elbow prosthesis*

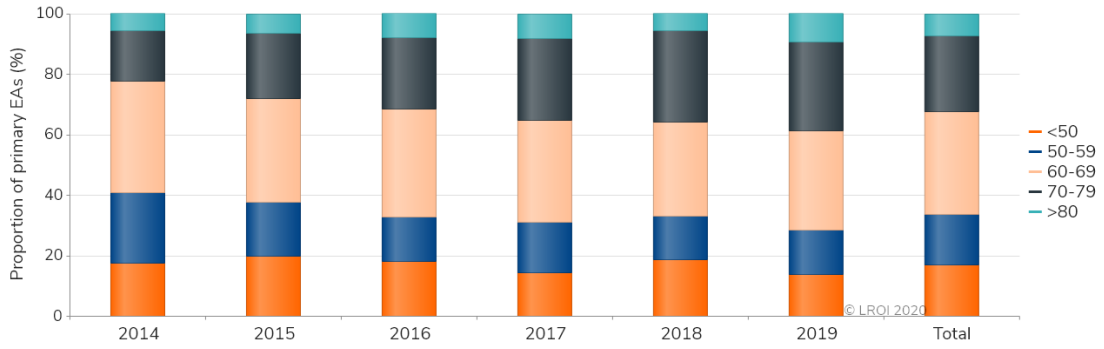
**TABLE Patient characteristics of all patients with a registered primary elbow arthroplasty by type of elbow arthroplasty in the Netherlands in 2019**

| | Total arthroplasty[1] (n=81) | Radial head arthroplasty (n=56) | Total (n=137) |
|---|---|---|---|
| **Mean age (years) (SD)** | 69.5 (10.6) | 57.8 (13.4) | 64.7 (13.1) |
| **Age (years) (%)** | | | |
| <50 | 4 | 29 | 14 |
| 50-59 | 12 | 18 | 15 |
| 60-69 | 33 | 32 | 33 |
| 70-79 | 35 | 21 | 29 |
| ≥80 | 16 | 0 | 9 |
| **Gender (%)** | | | |
| Men | 25 | 29 | 26 |
| Women | 75 | 71 | 74 |
| **ASA score (%)** | | | |
| I | 9 | 34 | 19 |
| II | 47 | 54 | 50 |
| III-IV | 44 | 12 | 31 |
| **Type of hospital (%)** | | | |
| General | 89 | 89 | 89 |
| UMC | 11 | 11 | 11 |
| **Diagnosis (%)** | | | |
| Acute fracture | 16 | 71 | 39 |
| Rheumatoid arthritis | 27 | 0 | 16 |
| Late post-traumatic | 36 | 22 | 30 |
| Osteoarthritis | 12 | 0 | 7 |
| Osteonecrosis | 0 | 2 | 1 |
| Hemophilic arthropathy | 3 | 0 | 1 |
| Tumour | 1 | 0 | 1 |
| Other | 5 | 5 | 5 |
| **Mean Body Mass Index (kg/m²) (SD)** | 27.1 (5.4) | 27.2 (5.1) | 27.1 (5.2) |
| **Body Mass Index (kg/m²) (%)** | | | |
| Underweight (≤18,5) | 0 | 2 | 1 |
| Normal weight (>18,5-25) | 40 | 33 | 37 |
| Overweight (>25-30) | 33 | 43 | 37 |
| Obesity (>30-40) | 25 | 20 | 23 |
| Morbid obesity (>40) | 2 | 2 | 2 |
| **Smoking (%)** | | | |
| No | 92 | 95 | 93 |
| Yes | 8 | 5 | 7 |

[1] Including distal hemihumeral prostheses (n=2).
General: general hospital; UMC: university medical centre; SD: standard deviation.

*Age category 2014-2019*

**FIGURE Trend (proportion [%] per year) in age category in primary elbow arthroplasties in the Netherlands in 2014-2019**




| Age category (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| <50 | 17.59 | 20.00 | 18.25 | 14.48 | 18.71 | 13.87 | **17.07** |
| 50-59 | 23.15 | 17.60 | 14.60 | 16.55 | 14.39 | 14.60 | **16.56** |
| 60-69 | 37.04 | 34.40 | 35.77 | 33.79 | 30.94 | 32.85 | **34.01** |
| 70-79 | 16.67 | 21.60 | 23.36 | 26.90 | 30.22 | 29.20 | **25.03** |
| >80 | 5.56 | 6.40 | 8.03 | 8.28 | 5.76 | 9.49 | **7.33** |
| Total (n): | **108** | **125** | **137** | **145** | **139** | **137** | **791** |

EA: elbow arthroplasty.

*Previous surgery 2016-2019*

**TABLE Trend (proportion [%] per year) in previous surgeries to the same joint in patients who underwent a primary elbow arthoplasty in the Netherlands in 2016-2019**

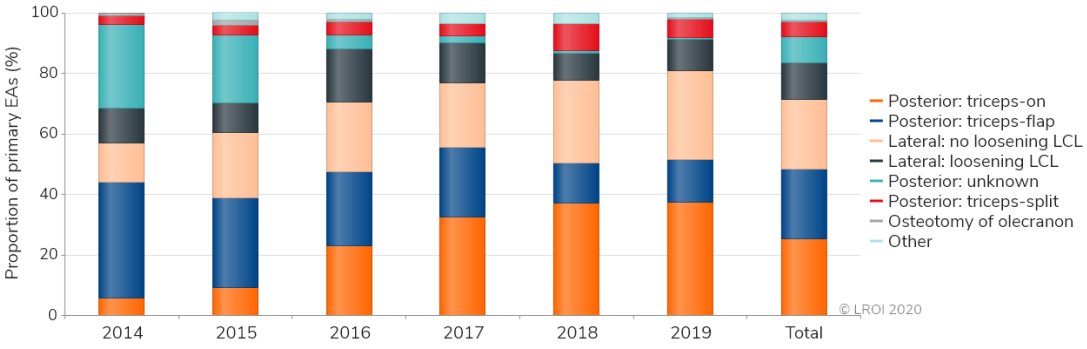
| Year | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|
| **Primary elbow arthroplasty (n)** | 134 | 143 | 134 | 137 | 548 |
| **Previous surgery to the relevant elbow (total); Proportion[1] (%)** | 39.6 | 32.9 | 29.1 | 32.9 | 33.6 |
| Osteosynthesis | 17.2 | 18.9 | 14.9 | 21.9 | 18.3 |
| Lateral arthrotomy | 22.4 | 19.6 | 8.2 | 16.8 | 16.8 |
| Plate or screw removal | 9.0 | 7.0 | 6.7 | 12.4 | 8.8 |
| Posterior arthrotomy | 7.5 | 8.4 | 8.2 | 7.3 | 7.9 |
| Decompression ulnar nerve | 3.7 | 4.9 | 3.7 | 2.9 | 3.8 |
| Medial arthrotomy | 4.5 | 3.5 | 3.0 | 3.7 | 3.7 |
| Arthroscopy | 6.0 | 1.4 | 2.2 | 2.2 | 2.9 |
| Transposition ulnar nerve | 0.0 | 1.4 | 1.5 | 2.2 | 1.3 |
| Arthrodesis | 0.0 | 0.0 | 1.5 | 0.0 | 0.4 |
| Other | 10.5 | 4.9 | 5.2 | 8.0 | 7.1 |

[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patiens with one or more previous surgeries to the same joint.

## Surgical techniques

### *Surgical approach 2014-2019*

**FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary elbow arthroplasty in the Netherlands in 2014-2019**

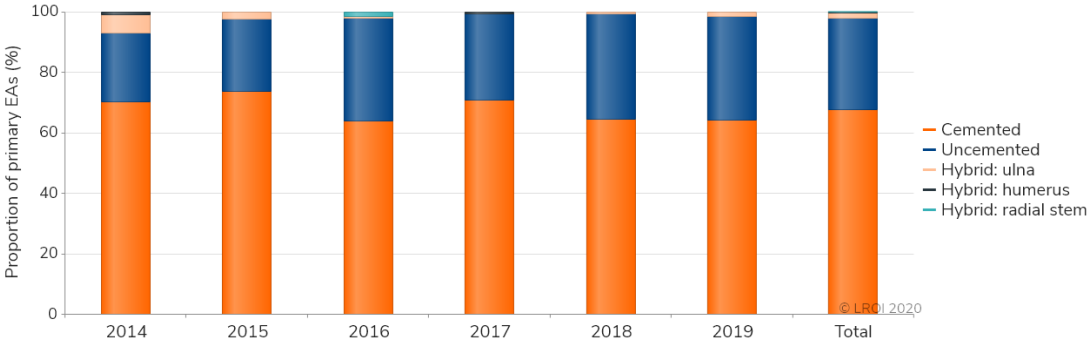



| Surgical approach (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Posterior: triceps-on | 5.88 | 9.09 | 22.96 | 32.39 | 37.04 | 37.50 | **25.29** |
| Posterior: triceps-flap | 38.24 | 29.75 | 24.44 | 23.24 | 13.33 | 13.97 | **23.09** |
| Lateral: no loosening LCL | 12.75 | 21.49 | 22.96 | 21.13 | 27.41 | 29.41 | **22.96** |
| Lateral: loosening LCL | 11.76 | 9.92 | 17.78 | 13.38 | 8.89 | 10.29 | **12.06** |
| Posterior: unknown | 27.45 | 22.31 | 4.44 | 2.11 | 0.74 | 0.74 | **8.56** |
| Posterior: triceps-split | 2.94 | 3.31 | 4.44 | 4.23 | 8.89 | 5.88 | **5.06** |
| Osteotomy of olecranon | 0.98 | 1.65 | 0.74 | 0.00 | 0.00 | 0.74 | **0.65** |
| Other | 0.00 | 2.48 | 2.22 | 3.52 | 3.70 | 1.47 | **2.33** |
| Total (n): | **102** | **121** | **135** | **142** | **135** | **136** | **771** |

EA: elbow arthroplasty.

### *Fixation 2014-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in primary elbow arthroplasties in the Netherlands in 2014-2019**



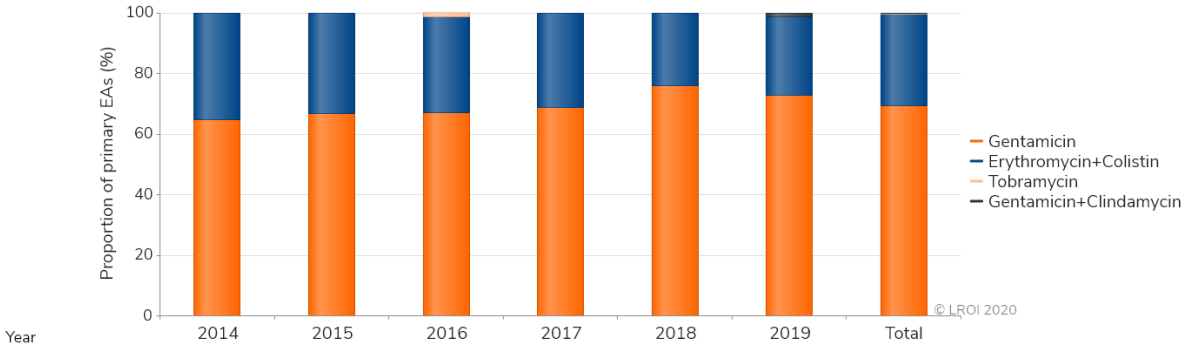

| Fixation (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cemented | 70.30 | 73.77 | 63.91 | 70.92 | 64.44 | 64.23 | **67.75** |
| Uncemented | 22.77 | 23.77 | 33.83 | 28.37 | 34.81 | 34.31 | **30.04** |
| Hybrid: ulna | 5.94 | 2.46 | 0.75 | 0.00 | 0.74 | 1.46 | **1.69** |
| Hybrid: humerus | 0.99 | 0.00 | 0.00 | 0.71 | 0.00 | 0.00 | **0.26** |
| Hybrid: radial stem | 0.00 | 0.00 | 1.50 | 0.00 | 0.00 | 0.00 | **0.26** |
| Total (n): | **101** | **122** | **133** | **141** | **135** | **137** | **769** |

EA: elbow arthroplasty.

## Bone cement

### *Antibiotics 2014-2019*

**FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in primary elbow arthroplasties in the Netherlands in 2014-2019**

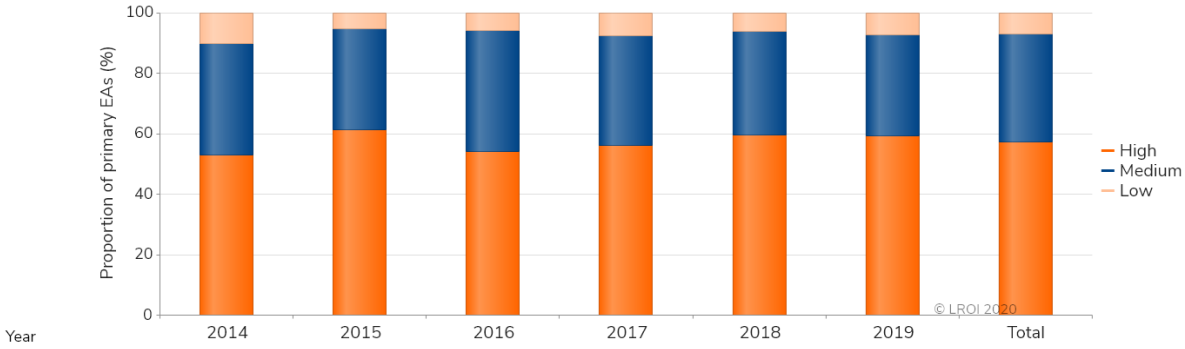



| Bone cement antibiotics (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Gentamicin | 64.71 | 66.67 | 67.06 | 68.75 | 75.95 | 72.84 | **69.44** |
| Erythromycin+Colistin | 35.29 | 33.33 | 31.76 | 31.25 | 24.05 | 25.93 | **30.13** |
| Tobramycin | 0.00 | 0.00 | 1.18 | 0.00 | 0.00 | 0.00 | **0.21** |
| Gentamicin+Clindamycin | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.23 | **0.21** |
| Total (n): | **68** | **75** | **85** | **80** | **79** | **81** | 468 |

EA: elbow arthroplasty.

### *Viscosity 2014-2019*

**FIGURE Trend (proportion [%] per year) in bone cement viscosity in primary elbow arthroplasties in the Netherlands in 2014-2019**

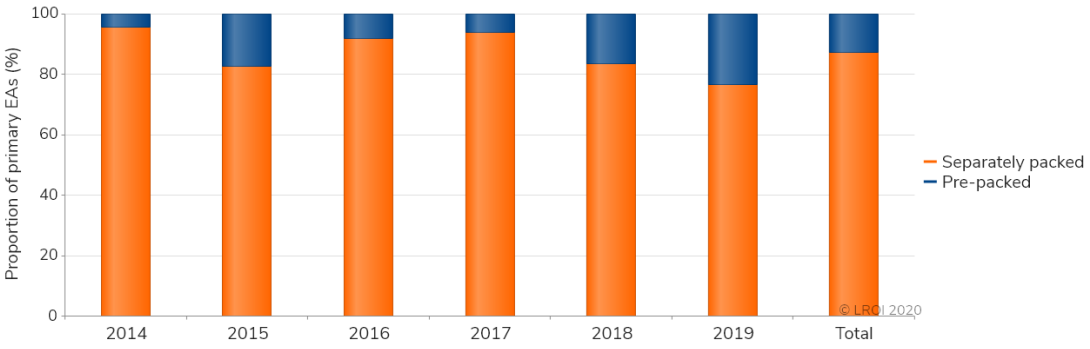



| Bone cement viscosity (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| High | 52.94 | 61.33 | 54.12 | 56.25 | 59.49 | 59.26 | **57.26** |
| Medium | 36.76 | 33.33 | 40.00 | 36.25 | 34.18 | 33.33 | **35.68** |
| Low | 10.29 | 5.33 | 5.88 | 7.50 | 6.33 | 7.41 | **7.05** |
| Total (n): | **68** | **75** | **85** | **80** | **79** | **81** | 468 |

EA: elbow arthroplasty.

*Vacuum mixing system 2014-2019*

**FIGURE** Trend (proportion [%] per year) in use of bone cement pre-packed in a vacuum mixing system in primary elbow arthroplasties in the Netherlands in 2014-2019




| Vacuum mixing system (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Separately packed | 95.59 | 82.67 | 91.76 | 93.75 | 83.54 | 76.54 | **87.18** |
| Pre-packed | 4.41 | 17.33 | 8.24 | 6.25 | 16.46 | 23.46 | **12.82** |
| Total (n): | **68** | **75** | **85** | **80** | **79** | **81** | 468 |

EA: elbow arthroplasty; Separately packed: separately packed bone cement components; Pre-packed: Bone cement pre-packed in a vacuum mixing system.

## Most frequently registered

*Elbow prostheses*

**TABLE** The most frequently registered total elbow arthroplasties and radial head arthroplasties in primary elbow arthroplasties in the Netherlands in 2019

| Total elbow arthroplasties[1] (n=64) | | | Radial head arthroplasties (n=43) | | |
|---|---|---|---|---|---|
| **Name** | **Number (n)** | **Proportion (%)** | **Name** | **Number (n)** | **Proportion (%)** |
| Latitude EV | 27 | 42.2 | RHS | 25 | 58.1 |
| Coonrad/Morrey | 25 | 39.1 | Explor | 14 | 32.6 |
| Discovery | 5 | 7.8 | Anatomic Radial Head | 3 | 7.0 |
| Latitude | 6 | 9.4 | CRF | 1 | 2.3 |
| NES | 1 | 1.6 | | | |

[1] Including distal hemihumeral prostheses (n=2).



*Types of bone cement*

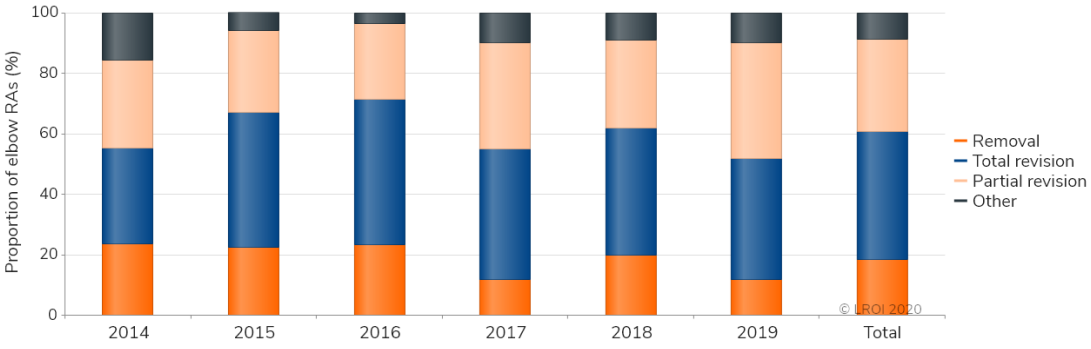
**TABLE** The registered types of bone cement used during primary elbow arthroplasties in the Netherlands in 2019 (n=81)

| Name | Number (n) | Proportion (%) |
|---|---|---|
| Palacos R+G | 29 | 35.8 |
| Simplex ABC EC | 21 | 25.9 |
| Refobacin Plus Bone Cement | 9 | 11.1 |
| Refobacin Bone Cement R | 9 | 11.1 |
| Palacos LV+G | 6 | 7.4 |
| Palacos MV+G | 6 | 7.4 |
| Refobacin Revision | 1 | 1.2 |

# Elbow revision arthroplasty

## Type of revision 2014-2019

**FIGURE Trend (proportion [%] per year) in type of revision in elbow revision arthroplasties in the Netherlands in 2014-2019**




| Type of elbow revision (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Removal | 23.68 | 22.39 | 23.21 | 11.67 | 20.00 | 11.67 | **18.45** |
| Total revision | 31.58 | 44.78 | 48.21 | 43.33 | 41.82 | 40.00 | **42.26** |
| Partial revision | 28.95 | 26.87 | 25.00 | 35.00 | 29.09 | 38.33 | **30.65** |
| Other | 15.79 | 5.97 | 3.57 | 10.00 | 9.09 | 10.00 | **8.63** |
| Total (n): | **38** | **67** | **56** | **60** | **55** | **60** | 336 |

RA: revision arthroplasty.

## Reasons for revision 2016-2019

**TABLE Trend (proportion [%] per year) in reasons for revision or re-surgery in patients who underwent an elbow revision arthroplasty in the Netherlands in 2016-2019**

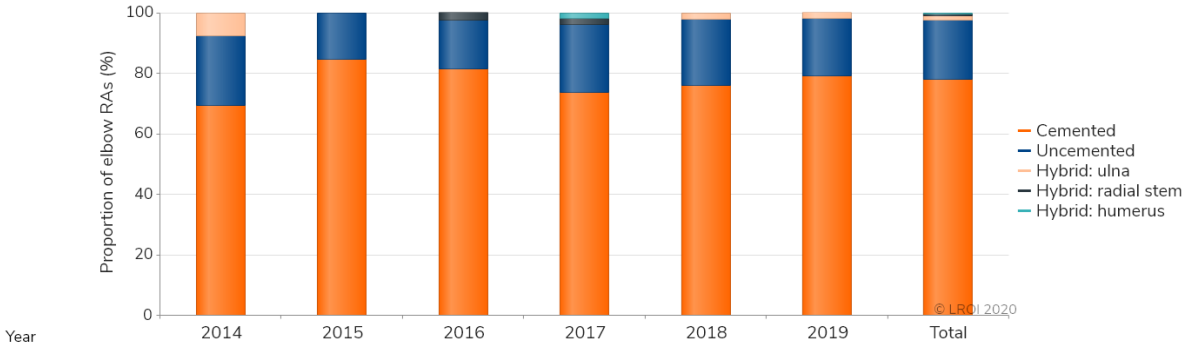
| Year | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|
| **Elbow revision arthroplasty (n)** | 53 | 51 | 51 | 52 | 207 |
| **Reasons for revision; Proportion[1] (%)** | | | | | |
| Polyethylene wear | 30.2 | 33.3 | 31.4 | 26.9 | 30.4 |
| Instability | 22.6 | 49.0 | 17.7 | 19.2 | 27.1 |
| Metallosis | 24.5 | 27.5 | 25.5 | 28.9 | 26.6 |
| Loosening of radial head component | 22.6 | 21.6 | 23.5 | 19.2 | 21.7 |
| Loosening of ulnar component | 17.0 | 21.6 | 19.6 | 21.2 | 19.8 |
| Peri-prosthetic fracture | 3.8 | 21.6 | 21.6 | 23.1 | 17.4 |
| Loosening of humeral component | 17.0 | 17.7 | 17.7 | 15.4 | 16.9 |
| Infection | 15.1 | 3.9 | 17.7 | 19.2 | 14.0 |
| Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

[1] One patient may have more than one reason for revision or re-surgery. As such, the total proportion is over 100%.

## Surgery and prosthesis

### *Fixation 2014-2019*

**FIGURE Trend (proportion [%] per year) in type of fixation in elbow revision arthroplasties in the Netherlands in 2014-2019**

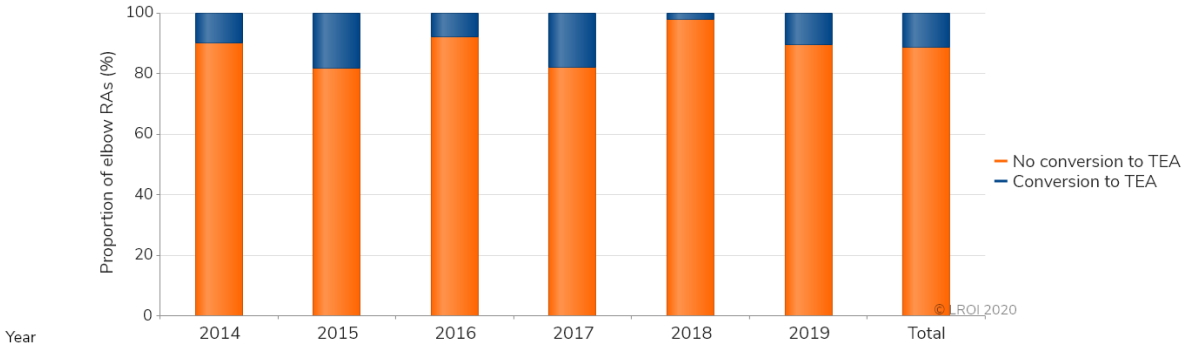



| Fixation (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| Cemented | 69.23 | 84.62 | 81.40 | 73.58 | 76.09 | 79.25 | **78.02** |
| Uncemented | 23.08 | 15.38 | 16.28 | 22.64 | 21.74 | 18.87 | **19.41** |
| Hybrid: ulna | 7.69 | 0.00 | 0.00 | 0.00 | 2.17 | 1.89 | **1.47** |
| Hybrid: radial stem | 0.00 | 0.00 | 2.33 | 1.89 | 0.00 | 0.00 | **0.73** |
| Hybrid: humerus | 0.00 | 0.00 | 0.00 | 1.89 | 0.00 | 0.00 | **0.37** |
| Total (n): | **26** | **52** | **43** | **53** | **46** | **53** | **273** |

RA: revision arthroplasty.

### *Conversion to TEA 2014-2019*

**FIGURE Trend (proportion [%] per year) in conversion of a radial head arthroplasty to a total elbow arthroplasy in the Netherlands in 2014-2019**

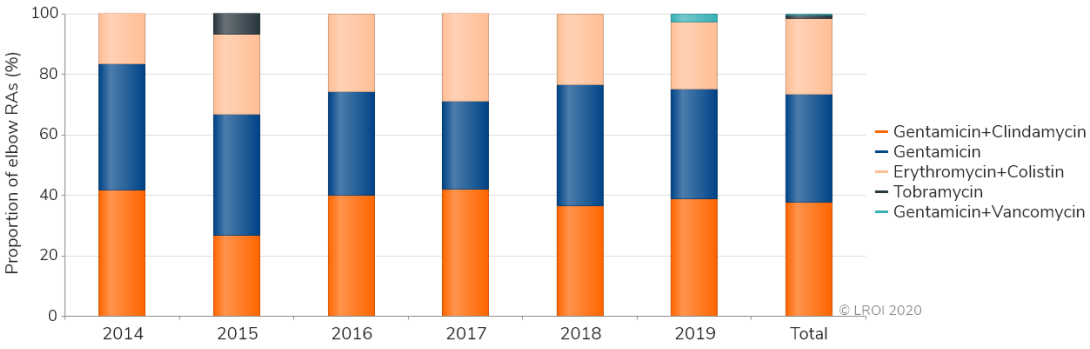



| Conversion to TEA (%) | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|---|---|
| No conversion to TEA | 90.00 | 81.82 | 92.00 | 82.14 | 97.96 | 89.47 | **88.55** |
| Conversion to TEA | 10.00 | 18.18 | 8.00 | 17.86 | 2.04 | 10.53 | **11.45** |
| Total (n): | **30** | **55** | **50** | **56** | **49** | **57** | **297** |

RA: revision arthroplasty; TEA: total elbow arthroplasty.

*Bone cement antibiotics 2014-2019*

**FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in elbow revision arthroplasties in the Netherlands in 2014-2019**




| Bone cement antibiotics (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gentamicin+Clindamycin | 41.67 | 26.67 | 40.00 | 42.11 | 36.67 | 38.89 | **37.57** |
| Gentamicin | 41.67 | 40.00 | 34.29 | 28.95 | 40.00 | 36.11 | **35.91** |
| Erythromycin+Colistin | 16.67 | 26.67 | 25.71 | 28.95 | 23.33 | 22.22 | **24.86** |
| Tobramycin | 0.00 | 6.67 | 0.00 | 0.00 | 0.00 | 0.00 | **1.10** |
| Gentamicin+Vancomycin | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.78 | **0.55** |
| Total (n): | **12** | **30** | **35** | **38** | **30** | **36** | 181 |

RA: revision arthroplasty.

*Most frequently registered components*

**TABLE The most frequently registered humerus, ulna, radial head and radial stem components in elbow revision arthroplasties in the Netherlands in 2019**

| Humerus (n=25) | Number (n) | Proportion (%) |
|---|---|---|
| Latitude EV | 14 | 56.0 |
| Coonrad/Morrey | 6 | 24.0 |
| Latitude | 2 | 8.0 |
| Discovery | 1 | 8.0 |
| NES | 2 | 4.0 |

| Ulna (n=34) | Number (n) | Proportion (%) |
|---|---|---|
| Latitude | 16 | 47.1 |
| Latitude EV | 8 | 23.5 |
| Coonrad/Morrey | 7 | 20.6 |
| Discovery | 2 | 5.9 |
| NES | 1 | 2.9 |

| Radial head (n=5) | Number (n) | Proportion (%) |
|---|---|---|
| RHS | 3 | 60.0 |
| Anatomic Radial Head | 2 | 40.0 |

| Radial stem (n=5) | Number (n) | Proportion (%) |
|---|---|---|
| RHS | 3 | 60.0 |
| Anatomic Radial Head | 2 | 40.0 |

*Most frequently registered types of bone cement*

**TABLE The most frequently registered types of bone cement used during elbow revision arthroplasties in the Netherlands in 2019 (n=36)**

| Year | 2016 | 2017 | 2018 | 2019 | Total |
|---|---|---|---|---|---|
| **Elbow revision arthroplasty (n)** | 53 | 51 | 51 | 52 | 207 |
| **Reasons for revision; Proportion[1] (%)** | | | | | |
| Polyethylene wear | 30.2 | 33.3 | 31.4 | 26.9 | 30.4 |
| Instability | 22.6 | 49.0 | 17.7 | 19.2 | 27.1 |
| Metallosis | 24.5 | 27.5 | 25.5 | 28.9 | 26.6 |
| Loosening of radial head component | 22.6 | 21.6 | 23.5 | 19.2 | 21.7 |
| Loosening of ulnar component | 17.0 | 21.6 | 19.6 | 21.2 | 19.8 |
| Peri-prosthetic fracture | 3.8 | 21.6 | 21.6 | 23.1 | 17.4 |
| Loosening of humeral component | 17.0 | 17.7 | 17.7 | 15.4 | 16.9 |
| Infection | 15.1 | 3.9 | 17.7 | 19.2 | 14.0 |
| Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

# Wrist arthroplasty

## Numbers

### Registered procedures 2017-2019

**TABLE Number of registered wrist arthroplasties per year of surgery (2017-2019) in the LROI in May 2019**

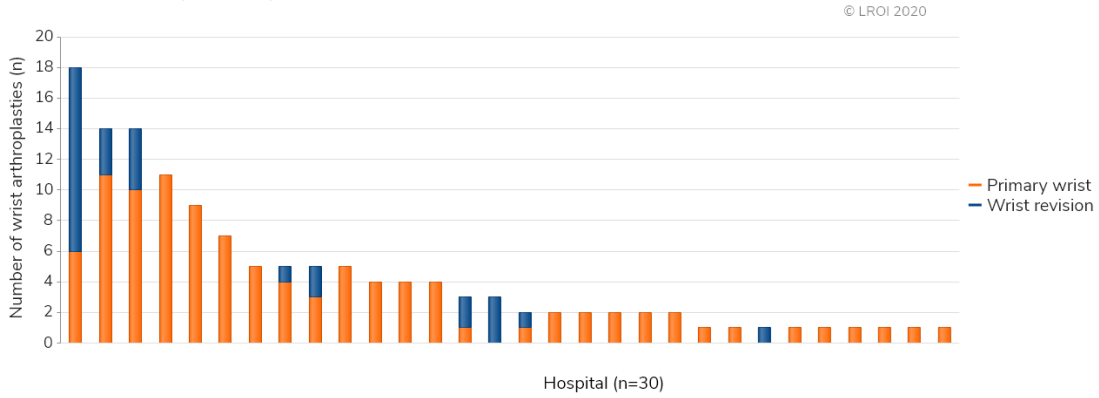
| Year of surgery | Type of wrist arthroplasty | | | | Total[1] (n) |
|---|---|---|---|---|---|
| | Total arthroplasty (n) | Ulnar head/ DRU arthroplasty (n) | Other (n) | Revision arthroplasty (n) | |
| 2017 | 33 | 15 | 13 | 15 | 82 |
| 2018 | 36 | 22 | 7 | 18 | 87 |
| 2019 | 40 | 35 | 21 | 29 | 132 |
| Total | 109 | 72 | 41 | 62 | 301 |

[1] In 7.1% (n=17) primary wrist arthroplasties the type of primary wrist prosthesis has not been registered.



### Type of procedure per hospital

**FIGURE Number of primary wrist arthroplasties and wrist revision arthroplasties per hospital in the Netherlands in 2019 (n=132)**




Please note: In 2019, 25 general hospitals, 4 UMCs and 1 private hospitals performed wrist arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.

# Primary wrist arthroplasty

## Demographics

### *Patient characteristics*

**TABLE Patient characteristics of all patients with a registered primary wrist arthroplasty in the Netherlands in 2019**

| | Plastic surgeon (n=70) | Orthopaedic surgeon (n=33) | Total (n=103) |
|---|---|---|---|
| **Mean age (years) (SD)** | 61.9 (11.1) | 64.0 (10.4) | 62.6 (10.9) |
| **Age (years) (%)** | | | |
| <50 | 11 | 15 | 11 |
| 50-59 | 30 | 49 | 25 |
| 60-69 | 33 | 24 | 38 |
| 70-79 | 22 | 9 | 22 |
| ≥80 | 4 | 3 | 4 |
| **Gender (%)** | | | |
| Men | 37 | 27 | 34 |
| Women | 44 | 73 | 66 |
| **ASA score (%)** | | | |
| I | 24 | 6 | 18 |
| II | 55 | 55 | 55 |
| III-IV | 21 | 39 | 27 |
| **Type of hospital (%)** | | | |
| General | 88 | 91 | 89 |
| UMC | 9 | 9 | 9 |
| Private | 3 | 0 | 2 |
| **Diagnosis (%)** | | | |
| Osteoarthritis | 73 | 46 | 64 |
| Post-traumatic | 14 | 21 | 17 |
| Rheumatoid arthritis | 3 | 21 | 9 |
| Osteonecrosis | 2 | 3 | 0 |
| Other | 8 | 9 | 8 |
| **Mean Body Mass Index (kg/m²) (SD)** | 27.9 (5.7) | 29.8 (6.6) | 28.6 (6.1) |
| **Body Mass Index (kg/m²) (%)** | | | |
| Underweight (≤18,5) | 2 | 0 | 1 |
| Normal weight (>18,5-25) | 34 | 24 | 31 |
| Overweight (>25-30) | 31 | 40 | 34 |
| Obesity (>30-40) | 30 | 30 | 30 |
| Morbid obesity (>40) | 3 | 6 | 4 |
| **Smoking (%)** | | | |
| No | 92 | 82 | 89 |
| Yes | 8 | 18 | 11 |

General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.



### *Previous surgery*

**TABLE Previous surgeries to the same joint in patients who underwent a primary wrist arthroplasty in the Netherlands in 2019 (n=94)**

| | Number[1] n (%) |
|---|---|
| Previous surgery to the relevant wrist (total) | 27 (29) |
| ORIF of a distal radius fracture | 4 (4) |
| Proximal row carpectomy | 4 (4) |
| Corrective osteotomy radius | 2 (2) |
| Intercarpal stabilisation/ligament reconstruction | 2 (2) |
| Corrective osteotomy ulna | 1 (1) |
| Partial arthrodesis | 1 (1) |
| ORIF of a carpal fracture | 1 (1) |
| Total arthrodesis | 1 (1) |
| Sauvé-Kapandji procedure | 0 (0) |
| Partial radial styloidectomy | 0 (0) |
| Stabilisation of perilunate dislocation | 0 (0) |
| Other | 17 (18) |

ORIF: open reduction and internal fixation.
[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total number is more than the total number of patiens with one or more previous surgeries to the same joint.

## Surgery and prosthesis

### *Most frequently registered components*

**TABLE The most frequently registered carpal, radial stem and ulnar head components in primary wrist arthroplasties in the Netherlands in 2019**

**Carpal (n=35)**

| Name | Number (n) |
|---|---|
| Freedom | 30 |
| Motec | 2 |
| APSI | 1 |
| Distal radioulnar joint | 1 |
| RCPI | 1 |

**Radial stem (n=36)**

| Name | Number (n) |
|---|---|
| Freedom | 29 |
| Distal radioulnar joint | 7 |

**Ulnar head (n=5)**

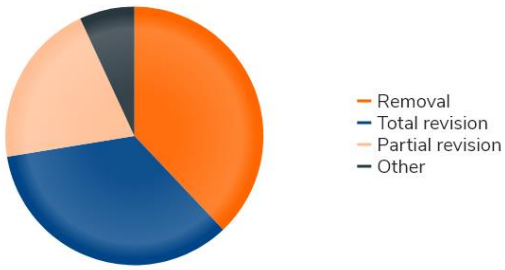
| Name | Number (n) |
|---|---|
| DRUJ System | 3 |
| Motec | 2 |



## Wrist revision arthroplasty

### Type of revision

**FIGURE Type of revision arthroplasty of wrist revision arthroplasties in the Netherlands in 2019 (n=29)**




| Type of revision | Number (n) |
|---|---|
| Removal | 11 |
| Total revision | 10 |
| Partial revision | 6 |
| Other | 2 |



### Reasons for revision

**TABLE Reasons for revision in patients who underwent a wrist revision arthroplasty in the Netherlands in 2019 (n=29)**

| Reasons for revision | Number[1] (n) |
|---|---|
| Loosening of carpal component | 8 |
| Lysis of components | 6 |
| Instability | 6 |
| Loosening of radial component | 5 |
| Infection | 4 |
| Dislocation | 3 |
| Implant fracture | 1 |
| Loosening of ulnar component | 0 |
| Peri-prosthetic fracture | 0 |
| Other | 8 |

[1] One patient may have more than one reason for revision or re-surgery.

# Finger arthroplasty

## Numbers

### Registered procedures 2017-2019

**TABLE Number of registered finger arthroplasties per year of surgery (2017-2019) in the LROI in May 2019**

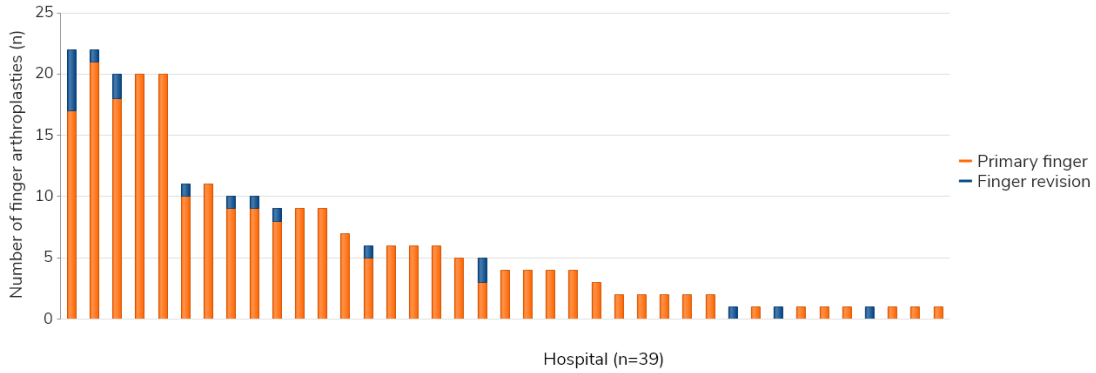
| Year of surgery | Type of finger arthroplasty | | |
|---|---|---|---|
| | Total arthroplasty (n) | Revision arthroplasty (n) | Total (n) |
| 2017 | 177 | 14 | 191 |
| 2018 | 190 | 23 | 213 |
| 2019 | 235 | 18 | 253 |
| Total | 602 | 55 | 647 |



### Type of procedure per hospital

**FIGURE Number of primary finger arthroplasties and finger revision arthroplasties per hospital in the Netherlands in 2019 (n=253)**






Please note: In 2019, 29 general hospitals, 6 UMCs and 4 private hospitals performed finger arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.

### Type of primary finger prosthesis

**TABLE Type of primary finger prosthesis in primary finger arthroplasties in the Netherlands in 2019 (n=190)**

| Finger joint | Type of finger | | | | |
|---|---|---|---|---|---|
| | Thumb (n) | Index (n) | Middle (n) | Ring (n) | Small (n) |
| CMC | 9 | n.a. | n.a. | n.a. | n.a. |
| MCP | 1 | 21 | 20 | 6 | 8 |
| PIP | n.a. | 13 | 43 | 50 | 14 |
| DIP | 0 | 3 | 0 | 1 | 1 |
| Total (n) | 10 | 37 | 63 | 57 | 23 |

Please note: In 45 (19.1%) primary finger arthroplasties the type of finger prosthesis was not registered.

# Primary finger arthroplasty

## Demographics

### *Patient characteristics by specialism*

**TABLE Patient characteristics of all patients with a registered primary shoulder arthroplasty by type of primary shoulder arthroplasty in the Netherlands in 2019**

| N | Reverse (n=2,402) | Total anatomical (n=605) | Hemi (n=238) | Total[1] (n=3,255) |
|---|---|---|---|---|
| **Mean age (years) (SD)** | 73.8 (7.9) | 65.9 (9.2) | 64.8 (10.8) | 71.7 (9.1) |
| **Age (years) (%)** | | | | |
| <50 | 1 | 4 | 8 | 2 |
| 50-59 | 3 | 19 | 19 | 7 |
| 60-69 | 21 | 41 | 36 | 26 |
| 70-79 | 51 | 30 | 30 | 46 |
| ≥80 | 24 | 6 | 7 | 19 |
| **Gender (%)** | | | | |
| Men | 25 | 31 | 35 | 27 |
| Women | 75 | 69 | 65 | 73 |
| **ASA score (%)** | | | | |
| I | 5 | 14 | 15 | 8 |
| II | 55 | 65 | 56 | 57 |
| III-IV | 40 | 21 | 29 | 35 |
| **Type of hospital (%)** | | | | |
| General | 95 | 83 | 87 | 92 |
| UMC | 2 | 1 | 8 | 2 |
| Private | 3 | 16 | 5 | 6 |
| **Diagnosis (%)** | | | | |
| Osteoarthritis | 33 | 88 | 57 | 45 |
| Cuff arthropathy | 23 | 0 | 1 | 17 |
| Fracture | 17 | 1 | 16 | 14 |
| Post-traumatic | 10 | 4 | 12 | 9 |
| Cuff rupture | 10 | 0 | 1 | 8 |
| Rheumatoid arthritis | 2 | 2 | 1 | 2 |
| Osteonecrosis | 2 | 4 | 8 | 2 |
| Other | 3 | 1 | 4 | 3 |
| **Walch score (%)** | | | | |
| A1 Humeral head centered, minor erosion glenoid | 51 | 39 | 66 | 50 |
| A2 Humeral head centered, major erosion glenoid | 28 | 30 | 21 | 28 |
| B1 Humeral head subluxed posteriorly, posterior joint space narrow, subchondrial sclerosis and osteophytes | 9 | 19 | 6 | 11 |
| B2 Humeral head subluxed posteriorly retroverted, glenoid with posterior rim erosion | 7 | 9 | 4 | 8 |
| B3 Humeral head subluxed posteriorly more than 70 percent and glenoid retroversion more than 10 degrees | 3 | 2 | 1 | 2 |
| C Glenoid retroversion more than 25 degrees regardless of erosion | 2 | 1 | 2 | 1 |
| **Mean Body Mass Index (kg/m²) (SD)** | 28.3 (5.3) | 28.4 (5.0) | 28.9 (5.3) | 28.3 (5.2) |
| **Body Mass Index (kg/m²) (%)** | | | | |
| Underweight (≤18,5) | 1 | 0 | 0 | 1 |
| Normal weight (>18,5-25) | 27 | 27 | 23 | 27 |
| Overweight (>25-30) | 41 | 40 | 44 | 41 |
| Obesity (>30-40) | 28 | 31 | 30 | 28 |
| Morbid obesity (>40) | 3 | 2 | 3 | 3 |
| **Smoking (%)** | | | | |
| No | 92 | 90 | 89 | 91 |
| Yes | 8 | 10 | 11 | 9 |

[1] Also contains 10 (0.3%) primary shoulder arthroplasties of which the the type of prosthesis had not been registered.
Reverse: reverse total shoulder arthroplasty; Total anatomical: anatomic total shoulder arthroplasty; Hemi: shoulder hemiarthroplasty; General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.



**The Number of registered shoulder hemiarthroplaties in the LROI is not complete, since these procedures are also performed by trauma surgeons. For 2019, only shoulder hemiarthroplasties that were carried out by orthopaedic surgeons were registered in the LROI.**

*Previous surgery*

**TABLE Previous surgeries to the same joint in patients who underwent a primary finger arthroplasty in the Netherlands in 2019 (n=225)**

| | Number[1] (n) |
|---|---|
| Previous surgery to the relevant finger (total) | 17 |
| Arthrodesis | 3 |
| Interposition arthroplasty | 3 |
| Interposition spacer | 3 |
| Ligament reconstruction | 2 |
| Correction osteotomy | 1 |
| Other | 9 |

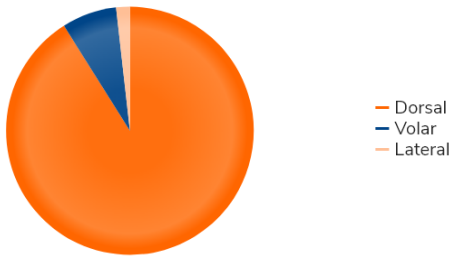
[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total number is more than the total number of patiens with one or more previous surgeries to the same joint.



## Surgery and prosthesis

*Surgical approach*

**FIGURE Surgical approach for performing a primary finger arthroplasty in the Netherlands in 2019 (n=224)**

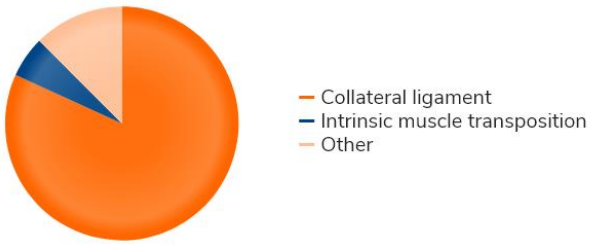



| Surgical approach | Number (n) | Proportion (%) |
|---|---|---|
| Dorsal | 204 | 91.07% |
| Volar | 16 | 7.14% |
| Lateral | 4 | 1.79% |



*Soft tissue stabilisation*

**FIGURE Type of stabilisation in primary finger arthroplasty in the Netherlands in 2019 (n=176)**

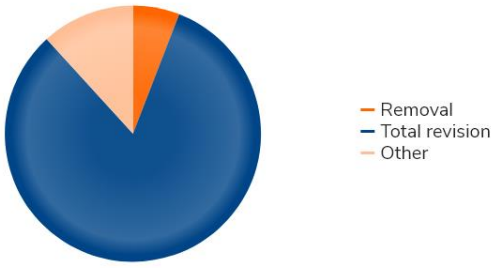



| Stabilisation | Number (n) | Proportion (%) |
|---|---|---|
| Collateral ligament | 144 | 81.82% |
| Intrinsic muscle transposition | 10 | 5.68% |
| Other | 22 | 12.50% |

# Finger revision arthroplasty

## Type of revision

**FIGURE** Type of revision arthroplasty of finger revision arthroplasties in the Netherlands in 2019 (n=17)




| Type of revision | Number (n) |
|---|---|
| Removal | 1 |
| Total revision | 14 |
| Other | 2 |



## Reasons for revision

**TABLE Reasons for revision in patients who underwent a finger revision arthroplasty in the Netherlands in 2019 (n=15)**

| Reasons for revision | Number[1] (n) |
|---|---|
| Implant fracture | 8 |
| Instability | 6 |
| Bone resorption of distal component | 5 |
| Bone resorption of proximal component | 5 |
| Loosening of distal component | 5 |
| Loosening of proximal component | 5 |
| Infection | 0 |
| Peri-prosthetic fracture | 0 |
| Other | 5 |

[1] One patient may have more than one reason for revision or re-surgery.

# Data quality

## Completeness

### Coverage and completeness

**TABLE Completeness of registering hospitals and completeness of registered arthroplasties in the LROI based on the hospital information system in 2019**

| | Number of hospitals in LROI[1] (n) | Completeness of registering hospitals[2] (%) | Median [range] number of registrations | Completeness of registrations[3] (%) |
|---|---|---|---|---|
| **Hip arthroplasties** | | 100 | | |
| Primary total hip arthroplasties | 91 | | 350 [1-910] | 99 |
| Primary hip hemiarthroplasties (orthopaedic surgeon) | 74 | | 40 [1-258] | 94 |
| Primary hip hemiarthroplasties (trauma surgeon) | 40 | | 33 [1-174] | 63 |
| Hip revision arthroplasties | 82 | | 36 [1-274] | 97 |
| **Knee arthroplasties** | | 100 | | |
| Primary knee arthroplasties | 90 | | 318 [12-833] | 99 |
| Knee revision arthroplasties | 86 | | 30 [3-386] | 97 |
| **Ankle arthroplasties** | | | | |
| Primary ankle arthroplasties | 14 | Unknown | 3 [1-33] | 98 |
| Ankle revision arthroplasties | 6 | | 2 [1-17] | 55 |
| **Shoulder arthroplasties** | | 100 | | |
| Primary shoulder arthroplasties | 81 | | 30 [2-179] | 96 |
| Shoulder revision arthroplasties | 61 | | 3 [1-80] | 91 |
| **Elbow arthroplasties** | | Unknown | | |
| Primary elbow arthroplasties | 29 | | 3 [1-22] | 85 |
| Elbow revision arthroplasties | 16 | | 2 [1-21] | 83 |
| **Wrist arthroplasties** | | | | |
| Primary wrist arthroplasties (orthopaedic surgeon) | 10 | Unknown | 3 [1-11] | 55 |
| Primary wrist arthroplasties (plastic surgeon) | 15 | | 2 [1-10] | 50 |
| Wrist revision arthroplasties (orthopaedic surgeon) | 6 | | 2 [1-10] | 77 |
| Wrist revision arthroplasties (plastic surgeon) | 6 | | 3 [1-12] | 50 |
| **Finger arthroplasties** | | | | |
| Primary finger arthroplasties (orthopaedic surgeon) | 16 | Unknown | 2 [1-20] | 66 |
| Primary finger arthroplasties (plastic surgeon) | 25 | | 6 [1-21] | 60 |
| Finger revision arthroplasties (orthopaedic surgeon) | 4 | | 3 [1-5] | 90 |
| Finger revision arthroplasties (plastic surgeon) | 9 | | 1 [1-2] | 57 |

[1] Number of hospitals that performed arthroplasties in accordance with their hospital information system in 2019.
[2] Proportion of total number of hospitals that performed arthroplasties in 2019 (based on Vektis data).
[3] Completeness of Number of registered arthroplasties in the LROI in October 2019, compared to the total number of arthroplasties performed (based on the hospital information system) in 2019. This pertains only to hospitals that submitted data for comparison..



**Vektis is a care information centre. Vektis collects and analyses data on the costs and quality of health care in the Netherlands. Vektis data mainly originates from reimbursement files of health care insurers. Therefore, Vektis has national data on medication use and use of aiding devices, data on primary health care and data on Diagnosis Treatment Combinations (DBCs/DOT) in hospitals and any other types of insured care in the Netherlands. In addition, Vektis collects demographic data, based on surveys among insurers and results of quality studies[1].**
**[1]www.vektis.nl.**

## Overall completeness per arthroplasty

**FIGURE Completeness (proportion [%] per joint) of the registration of procedures in the LROI in 2019**

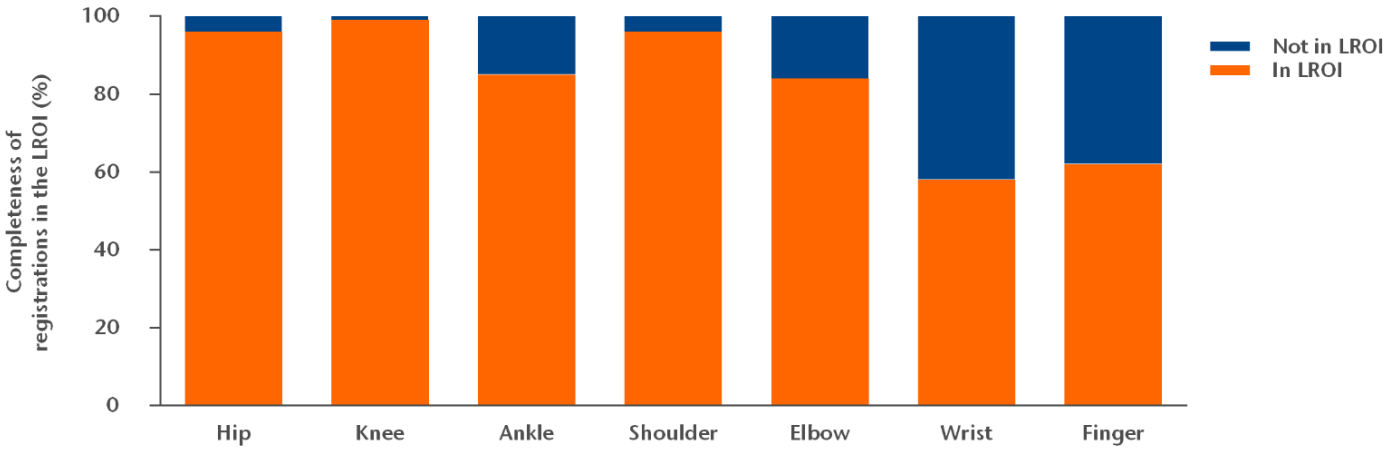



**TABLE Completeness (proportion [%] per joint) of the registration of procedures in the LROI in 2019**

| | Hip[1] | Knee | Ankle | Shoulder | Elbow | Wrist | Finger |
|---|---|---|---|---|---|---|---|
| Number of procedures in HIS (n) | 44,340 | 34,300 | 162 | 3,698 | 215 | 181 | 372 |
| Completeness of registrations in the LROI[2] (%) | 95.8 | 98.7 | 84.6 | 95.7 | 84.2 | 58.0 | 61.8 |

[1] Includes primary total hip arthroplasties, primary hip hemiarthroplasties and hip revision arthroplasties.
[2] Completeness of number of registered arthroplasties (orthopaedic, trauma and plastic surgery) in the LROI in October 2020, compared to the total number of arthroplasties performed (based on the hospital information system) in 2019. This pertains only to hospital that submitted data for comparison.



# Validity

## Overall validity

**FIGURE Validity (proportion [%] per joint) of the registration of procedures in the LROI in 2019**

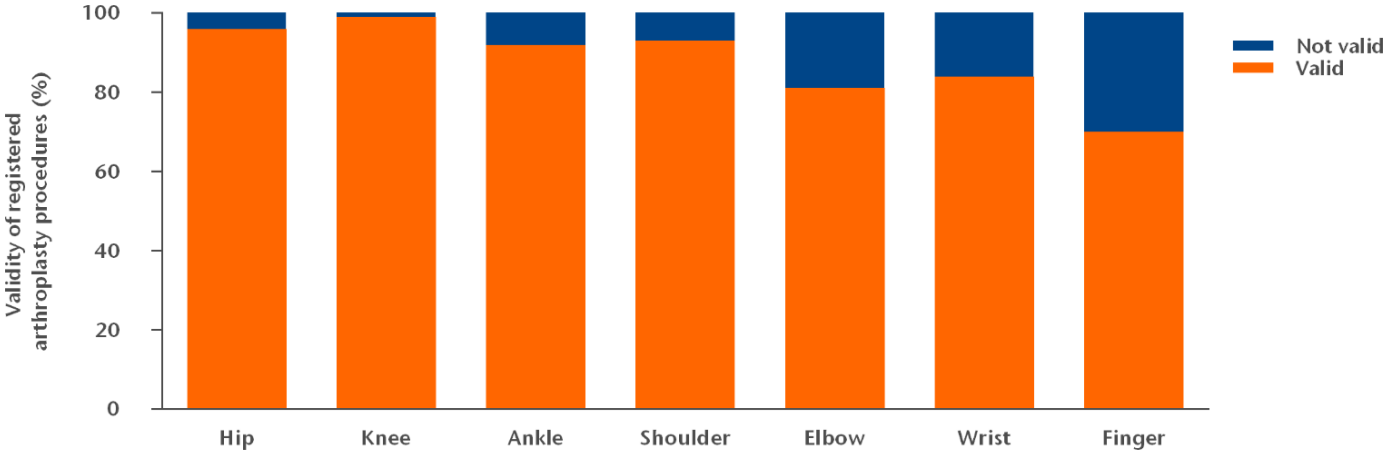



**TABLE Validity (proportion [%] per joint) of the registration of procedures in the LROI in 2019**

| | Hip | Knee | Ankle | Shoulder | Elbow | Wrist | Finger |
|---|---|---|---|---|---|---|---|
| Number of procedures (n) | 42,925 | 34,037 | 156 | 3,610 | 197 | 132 | 253 |
| Valid registered procedures (%) | 96.0 | 98.5 | 91.7 | 92.5 | 80.7 | 84.1 | 69.6 |

## Validity per variable

**TABLE Overview of validity by variable for each joint of hip, knee, ankle, shoulder, wrist and finger arthroplasties registered in the LROI in the Netherlands in 2019**

| | Hip | Knee | Ankle | Shoulder | Elbow | Wrist | Finger |
|---|---|---|---|---|---|---|---|
| **Number of arthroplasties (n)** | **42,925** | **34,037** | **156** | **3,610** | **197** | **132** | **253** |
| Number of primary arthroplasties (n) | 39,121 | 30,968 | 127 | 3,259 | 137 | 103 | 235 |
| Number of revision arthroplasties (n) | 3,804 | 3,069 | 29 | 351 | 60 | 29 | 18 |
| **General characteristics** | % | % | % | % | % | % | % |
| Gender | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Encrypted citizen service number | 99.7 | 99.9 | 100.0 | 99.7 | 100.0 | 100.0 | 100.0 |
| HIS patient number | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Date of birth | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Type of procedure | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Operating side | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Postal code | 99.9 | 99.9 | 100.0 | 100.0 | 100.0 | 95.5 | 93.7 |
| BMI | 97.6 | 99.6 | 99.4 | 98.8 | 98.0 | 93.2 | 90.9 |
| Smoking | 99.4 | 99.8 | 96.8 | 98.6 | 98.5 | 94.7 | 92.5 |
| ASA score | 99.7 | 99.6 | 100.0 | 97.8 | 98.9 | 93.9 | 96.1 |
| Fixation | 99.8 | 99.7 | 98.7 | 99.8 | 100.0 | 90.2 | 93.3 |
| **Primary arthroplasty characteristics** | % | % | % | % | % | % | % |
| Diagnosis | 99.1 | 99.7 | 100.0 | 99.6 | 100.0 | 93.2 | 97.5 |
| Charnley/Walch score | 98.7 | 99.6 | 98.4 | 94.2 | n.a. | n.a. | n.a. |
| Prosthesis | 99.9 | 99.9 | 99.2 | 99.9 | 100.0 | 93.2 | 81.4 |
| Surgical approach | 99.8 | 99.7 | 97.6 | 99.6 | 99.3 | 93.2 | 96.2 |
| **Revision arthroplasty characteristics** | % | % | % | % | % | % | % |
| Type of revision | 99.5 | 99.5 | 100.0 | 98.6 | 100.0 | 100.0 | 94.4 |
| Charnley score | 97.9 | 97.2 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Reason for revision | 98.6 | 98.4 | 100.0 | 97.2 | 86.7 | 100.0 | 88.9 |

Please note: Validity by variable as determined in May 2020.
HIS: hospital information system; BMI: body mass index.

# General

## Methodology of survival analyses

The life span of a joint prosthesis is the time between implantation of a primary prosthesis and the time of the first revision. However, patients may die before the prosthesis needs to be revised (Figure).

**Link between primary and revision arthroplasties**

In order to assess a prosthesis' life span, follow-up time of all primary prostheses was examined. This was done by linking revision arthroplasties to the primary arthroplasties in the LROI by means of the encrypted Citizen Service Number (BSN). In this way, the correct revision arthroplasty can be linked anonymously to a primary arthroplasty. In about 11% of the arthroplasties, the encrypted BSN was not entered into the system, mainly in the first years of registration. Links between these primary and revision arthroplasties were established based on the LROI hospital number and the LROI patient number. As such, revision arthroplasties have been linked to primary arthroplasties of a patient when the patient underwent primary and revision arthroplasty on the same joint in the same hospital.

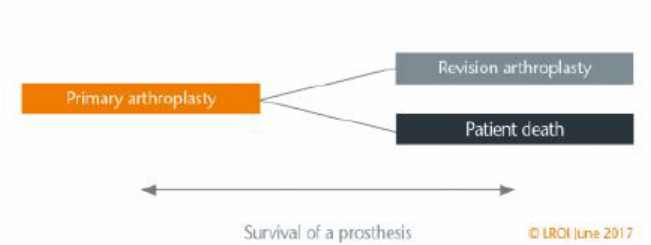
**Kaplan Meier survival analysis**

Survival of a prosthesis may be determined in various ways. Traditionally, the Kaplan Meier method is used. This method was developed for situations with one possible end point (such as death of the patient). However, in order to calculate survival of a prosthesis at least two end points are important: revision of the prosthesis and death of the patient. The Kaplan Meier method estimates the proportion of failed prostheses if patients would live on forever. However, a number of patients dies before the prosthesis requires revision. Consequently, fewer revisions are carried out than could be expected based on the model. That is why this method overrates the chance of revision.

**Competing risk survival analysis**

The competing risk method allows monitoring for several end points. When an end point occurs (such as death), other end points will no longer be available (such as prosthesis revision). The cumulative incidence (summed occurrence of an end point) will be calculated. Death of a patient is a final end point, the prosthesis will no longer be revised and this finalizes the period that a prosthesis lasts. The time at risk will be the period from primary implantation to death.

**FIGURE SURVIVAL OF A PROSTHESIS.**




**Method comparison**

In order to get a clearer picture of the difference in results between the Kaplan Meier method and competing risk method we have calculated the revision percentage within 10 years using both methods. The revision percentage was calculated for patients who underwent a total hip arthroplasty according to age group over the period 2007-2018.

This comparison shows that the revision percentage calculated by means of the Kaplan Meier method results in a higher chance of revision within 10 years. The difference is more pronounced in groups of patients with a higher chance of the competing event (death of the patient), as we can see in the groups of elderly patients (Table). This difference is still relatively minor, but will increase as follow-up extends. Consequently, this Annual Report estimates the chance of revision of a prosthesis by means of the competing risk method. However, for comparability with other arthroplasty registries Kaplan Meier revision rates are also shown.

**TABLE CUMULATIVE 10-YEAR REVISION PERCENTAGE OF PRIMARY TOTAL HIP ARTHROPLASTIES BY AGE IN THE NETHERLANDS IN 2007-2018.**

| | | Cumulative 10-year revision percentage | |
|---|---|---|---|
| | Number (n) | Competing Risk (95% CI) | Kaplan Meier (95% CI) |
| **Age (years)** | | | |
| <50 | 13,021 | 7.4 (6.8-8.2) | 7.6 (6.9-8.3) |
| 50-59 | 35,737 | 6.4 (6.0-6.9) | 6.6 (6.2-7.1) |
| 60-69 | 92,371 | 5.1 (4.8-5.3) | 5.3 (5.1-5.5) |
| 70-79 | 106,347 | 4.1 (4.0-4.3) | 4.5 (4.3-4.6) |
| ≥80 | 43,909 | 2.8 (2.6-3.0) | 3.1 (2.9-3.4) |

Please note: The primary outcome in a Kaplan Meier analysis is prosthesis survival, while this is the revision percentage of prostheses in the competing risk method.
In order to compare methods, survival as determined by means of the Kaplan Meier analysis is converted into the revision percentage (100% - survival% = revision%).
CI: confidence interval.

## Participating hospitals

### General hospitals

Admiraal de Ruyter ziekenhuis H(O) K S
Albert Schweitzer Ziekenhuis H(O+T) K S W(P) F(P)
Alrijne Ziekenhuis H(O+T) K S
Amphia Ziekenhuis H(O) K S E W(O) F(O)
Antonius Ziekenhuis H(O) K A S
Bernhoven H(O) K S E F(P)
BovenIJ Ziekenhuis H(O+T) K
Bravis Ziekenhuis H(O+T) K A S E
Canisius-Wilhelmina Ziekenhuis H(O+T) K S
Catharina Ziekenhuis H(O) K S E
Centraal Militair Hospitaal H(O)
Deventer Ziekenhuizen H(O+T) K S F(P)
Diakonessenhuis H(O) K S
Dijklander Ziekenhuis H(O) K S
Elisabeth-TweeSteden Ziekenhuis H(O) K S E
Elkerliek Ziekenhuis H(O+T) K S F(P)
Flevoziekenhuis H(O+T) K S
Franciscus Gasthuis & Vlietland H(O+T) K S W(O+P) F(O+P)
GelreZiekenhuizen, location Apeldoorn H(O+T) K S W(O) F(O)
GelreZiekenhuizen, location Zutphen H(O) K S E
Groene Hart Ziekenhuis H(O) K S W(O) F(O)
Haaglanden Medisch Centrum H(O+T) K S W(P)
HagaZiekenhuis H(O+T) K A S E F(P)
Het Van Weel-Bethesda Ziekenhuis H(O+T) K S
IJsselland Ziekenhuis H(O) K S
Ikazia Ziekenhuis H(O) K S
Isala Klinieken H(O+T) K S E
Jeroen Bosch Ziekenhuis H(O+T) K S W(O+P) F(P)
LangeLand Ziekenhuis H(O+T) K S F(P)
Laurentius Ziekenhuis H(O) K S E F(O)
Maasstad Ziekenhuis H(O+T) K S E F(O)
Martini Ziekenhuis H(O) K A S E W(P) F(P)
Máxima Medisch Centrum H(O+T) K S E W(O)
Meander Medisch Centrum H(O+T) K S W(P) F(P)
Medisch Centrum Leeuwarden H(O+T) K S W(P) F(O+P)
Medisch Spectrum Twente H(O) K S
Noordwest Ziekenhuisgroep H(O+T) K A S E W(O) F(O)
OCON H(O) K S E W(O) F(O)
OLVG H(O+T) K A S E
Ommelander Ziekenhuisgroep Groningen H(O+T) K S
Reinier de Graaf Groep H(O+T) K S E
Rijnstate H(O+T) K S E W(P) F(P)
Rivas Zorggroep H(O) K S
Rode Kruis Ziekenhuis H(O+T) K A S
Röpcke Zweers Ziekenhuis H(O) K S
Sint Maartenskliniek, location Boxmeer H(O) K
Sint Maartenskliniek, location Nijmegen H(O) K A S E W(O) F(O)
Slingeland Ziekenhuis H(O+T) K S
Spaarne Gasthuis H(O) K A S
Spijkenisse Medisch Centrum H(O) K S
St. Anna Ziekenhuis H(O+T) K A S
St. Antonius Ziekenhuis H(O+T) K S

St. Jans Gasthuis H(O+T) K S E
Streekziekenhuis Koningin Beatrix H(O+T) K S
Tergooi H(O+T) K S E
Treant Zorggroep H(O+T) K S
VieCuri MC H(O+T) K S E F(P)
Wilhelmina Ziekenhuis H(O) K S E
Zaans Medisch Centrum H(O) K S E F(O)
ZGT (T)
Ziekenhuis Amstelland H(O) K S E
Ziekenhuis Gelderse Vallei H(O+T) K S
Ziekenhuis Nij Smellinghe H(O) K S
Ziekenhuis Rivierenland H(O+T) K S
Ziekenhuis St. Jansdal H(O) K S
Ziekenhuis Tjongerschans H(O) K S
ZorgSaam Ziekenhuis H(O) K S
Zuyderland H(O) K S E W(O) F(O)

H: hip; K: knee; A: ankle; S: shoulder; E: elbow; W: wrist; F: finger.
O: orthopaedic surgery; T: trauma surgery; P: plastic surgery.

## University medical centres

Amsterdam UMC H(O+T) K A S
Erasmus MC H(O+T) K S E
Leids Universitair Medisch Centrum H(O+T) K S E
Maastricht UMC+ H(O+T) K A S E W(O+P) F(O+P)
Radboudumc H(O+T) K S E W(P)
Universitair Medisch Centrum Groningen H(O+T) K A S E W(O+P)
Universitair Medisch Centrum Utrecht H(O) K

H: hip; K: knee; A: ankle; S: shoulder; E: elbow; W: wrist.
O: orthopaedic surgery; T: trauma surgery; P: plastic surgery.

## Private hospitals

Acibadem International Medical Center H(O) K A S
Annadal Kliniek H(O) K
Annatommie MC H(O) K S
AVE Orthopedische Klinieken H(O) K S
Berne Kliniek W(P) F(P)
Bergman Clinics H(O) K A S F(P)
CortoClinics H(O) K
Eisenhower Kliniek H(O) K S
Kliniek ViaSana H(O) K S
KneeClinic K
Orthoparc Kliniek H(O) K
Park Medisch Centrum H(O) K
The Hand Clinic W(P) F(P)
Xpert Clinics H(O) K

H: hip; K: knee; A: ankle; S: shoulder; F: finger.
O: orthopaedic surgery; T: trauma surgery; P: plastic surgery.

# Definitions and abbreviations

## Definitions

**Acetabulum component**
The part of a hip prosthesis that is implanted into the acetabulum – the socket part of a ball and socket joint

**Allograft**
Transplant of bone tissue from a different body

**Anchor question**
The anchor question (daily functioning) measures change in daily functioning after joint replacement. The anchor question (pain) measures change in pain degree after joint replacement. The score has a range of 1.0 to 7.0, with 1.0 representing very deteriorated and 7.0 representing very improved.

**Arthrodesis**
A procedure in which a natural joint is fused together

**Arthrofibrosis**
Rigidity of the joint as a consequence of connective tissue adhesion

**Arthroscopy**
Keyhole surgery to examine and treat joint disorders

**Arthrotomy**
Opening a joint during surgery

**Articulation**
The two surfaces that move together (articulate) in a total joint replacement

**ASA score**
The American Society of Anaesthesiologists (ASA) score is a scoring system for grading the overall physical condition of the patient, as follows: I – fit and healthy; II – mild disease, not incapacitating; III – incapacitating systemic disease; IV – life threatening disease

**Autograft**
Transplant of bone tissue originating from the patient's own body

**Bilaterality**
Replacing the same joint on both sides of the body by means of a prosthesis within a specific period

**Body Mass Index**
Index for weight compared to body length (kg/m2); ≤18.5: underweight; >18.5-25: normal weight; >25-30: overweight; >30-40: obesity; >40: morbid obesity

**Bonegraft**
Bone transplant

**Bone resorption**
Process by which osteoclasts break down bone tissue

**Carpal component**
Part of a wrist prosthesis that is implanted in the patient's carpal bones

**Case mix**
Term used to describe variation in the population, relating to factors such as diagnosis, patient age, gender and health condition

**Cement**
Material (polymethyl methacrylate) used to fixate joint replacements to bone

**Charnley score**
Clinical classification system; A: one joint affected; B1: both joints affected; B2: contralateral joint with a prosthesis; C: several joints affected or a chronic disease that affects quality of life

**Competing risk survival analyse**
Method to calculate survival taking into account various outcomes, in this case revision and death

**Completeness**
The completeness of the number of registered procedures in the LROI, based on a comparison with the hospital information system of every hospital that performs hip and/or knee arthroplasty in the Netherlands

**Cuff arthropathy**
Osteoarthritis of the shoulder joint as a consequence of the tendons around the shoulder joint being affected

**Cuff rupture**
Rupture of a tendon of the muscles that are around the shoulder joint

**Cumulative incidence**
The added up incidence over a specific period of an event (such as revision of a prosthesis or death of a patient)

**Cumulative revision percentage**
Added up revision percentage over a specific time period

**Difference score**
Difference in calculating score between pre-operative and 3, 6 or 12 months postoperative scores

**Distal component**
Part of a finger prosthesis that replaces the distal phalanx

**Distal hemihumeral prosthesis**
Elbow prosthesis in which the distal part of the humerus (upper arm bone) is replaced

**Dual mobility cup**
Acetabular component that consists of a dual cup and, therefore, has two independent articulation points

**EQ-5D index score**
The EQ-5D index score measures quality of life. The score has a range of -0.329 to 1.0, with 1.0 representing the best possible quality of life.

**EQ-5D thermometer score**
The EQ-5D thermometer score measures the health situation. The score has a range of 0.0 to 100.0, with 0.0 representing the worst possible health situation and 100.0 the best possible health situation.

**Femur component**
Part of a hip or knee prosthesis that is implanted into the femur (thigh bone)

**Femoral head component**
Part of a hip prosthesis that is implanted on top of the femoral component of a hip prosthesis and moves inside the acetabular component or the cup of the hip joint

**Flail elbow**
Situation after removal of an elbow prosthesis in which no joint is present any more between the upper and lower arm

**Girdlestone situation**
Revision procedure to a hip in which the hip joint or hip prosthesis is removed and no new prosthesis is implanted (often because of a bacterial infection)

**Glenoid baseplate**
Part of a reversed shoulder prosthesis: a metal plate that is screwed into the glenoid (shoulder cup) of the shoulder blade, on which the glenosphere is fixed

**Glenoid component**
The part of a shoulder prosthesis that is placed in the glenoid; the cup-shaped notch of the shoulder blade

**Glenoid liner**
Intermediate component (inside layer) of a total anatomical shoulder prosthesis that will be placed in a glenoid component (most often a metal one)

**Glenosphere**
The part of a reversed shoulder prosthesis that is placed on the glenoid baseplate which is screwed into the glenoid and is spherical in shape

**HOOS-PS score**
The HOOS-PS score measures the physical functioning of patients with osteoarthritis to the hip. The score has a range of 0.0 to 100.0, with 0.0 representing no effort and 100.0 the most possible effort.

**Hybrid fixation**
Fixation of a prosthesis in which (most often) one of both parts of a prosthesis is cemented and the other one uncemented

**Humerus component**
The part of a shoulder or elbow prosthesis that replaces the humerus (upper arm bone). The humeral component of a shoulder prosthesis may consist of two parts: the humeral head and the humeral stem component

**Humeral liner**
Intermediate component (inner layer) of a reversed shoulder prosthesis that will be placed in a metaphysical component

**Inlay**
Intermediate component (inner layer), made of polyethylene

**Insert**
Intermediate component (inner layer), made of polyethylene that is placed in the tibial component of a knee prosthesis

**Kaplan Meier survival analysis**
Method to calculate survival, in which only one end point is possible, in this case revision

**KOOS-PS score**
The KOOS-PS score measures the physical functioning of patients with osteoarthritis to the knee. The score has a range of 0.0 to 100.0, with 0.0 representing no effort and 100.0 the most possible effort.

**Lateral collateral ligament**
Lateral (outer) knee ligament or elbow ligament

**Lateral resurfacing arthroplasty**
Elbow prosthesis in which only the lateral side of the joint is replaced

**Major revision**
Revision of at least the acetabular or femoral component (hip) or femoral or tibial component (knee)

**Malalignment**
Strain on a part of the body due to an abnormal position of a joint component with respect to other components

**Medial malleolus osteotomy**
Surgical approach of the ankle in which the medial malleolus (protruding part of the tibia on the inside of the ankle) is incised and later re-fixed to be able to have better access to the inside of the joint

**Meniscectomy**
Meniscus removal

**Metallosis**
Deposition of metal debris in soft tissues of the body

**Metaphysis component**
The part of a shoulder prosthesis that replaces the metaphysis (upper part) of the humerus (upper arm bone)

**Minor revision**
Revision of only inlay and/or femoral head component (hip) or only insert and/or patella exchange (knee)

**NRS score**
Numeric Rating Scale score. The NRS (rest) score measures pain during rest. The NRS (activity) score measures pain during activity. The score has a range of 0.0 to 10.0, with 0.0 representing no pain and 10.0 representing the most possible pain. The NRS (satisfaction) score measures patients' satisfaction with the outcome of joint replacement. The score has a range of 0.0 to 10.0, with 0.0 representing very unsatisfied and 10.0 representing very satisfied.

**ODEP rating**
Orthopaedic Data Evaluation Panel. ODEP provides ratings for hip femoral stems, hip acetabular cups and total knee replacement implants. An ODEP rating consists of a number and a letter (A or B), and a star (optional). The number represents the number of years for which the product's performance had been evidenced. The letter represents the strength of evidence presented by the manufacturer (A represents strong evidence and B represents acceptable evidence). A Star (*) represents very strong evidence above A and B. Detailed information can be found at www.odep.org.uk

**Olecranon**
The most proximal part of the ulna

**One-stage revision**
A single revision procedure to change (insertion, replacement and/or removal) one or more components of the prosthesis (excluding patella addition)

**Open Reduction and Internal Fixation surgery**
Type of surgery to treat a bone fracture where the broken bone is reduced or put back into place, followed by internal fixation using devices (screws, plates, rods, or pins) to hold the broken bone together

**Osteoarthritis**
Disorder in which the cartilage of a joint is affected

**Osteochondral bone defect**
Defect of the joint surface in which both cartilage and underlying bone are affected

**Osteonecrosis**
Cellular death of bone tissue

**Osteosynthesis**
Securing broken bone parts together with plates, pins and/or screws

**Osteotomy**
Incise the bone in order to correct the position, to shorten or lengthen the bone

**Oxford Hip score**
The Oxford Hip score measures the physical functioning and pain of patients with osteoarthritis to the hip. The score has a range of 0.0 to 48.0, with 0.0 representing no functional ability and 48.0 representing the most functional ability.

**Oxford Knee score**
The Oxford Knee score measures the physical functioning and pain of patients with osteoarthritis to the knee. The score has a range of 0.0 to 48.0, with 0.0 representing no functional ability and 48.0 representing the most functional ability.

**Patella addition**
Knee revision procedure in which only a patella component was added to the primary knee prosthesis

**Patella component**
Part of a knee prosthesis that is implanted on the inner side of the knee cap

**Patellofemoral prosthesis**
Two-piece knee prosthesis that provides a prosthetic (knee) articulation surface between the patella and trochlea (furrow) of the thigh bone (femur)

**Primary prosthesis**
The first time (primary) a prosthesis is implanted to replace the original joint

**PROMs**
Patient Reported Outcome Measures

**Proximal component**
Part of a finger prosthesis that replaces the proximal phalanx

**Radial head component**
Part of an elbow prosthesis that replaces the head of the radius (spoke-bone)

**Radial head prosthesis**
Elbow prosthesis in which only the head of the radius (spoke-bone) is replaced

**Radial stem component**
Part of an elbow or wrist prosthesis that is implanted in the shaft of the patient's radius (spoke-bone)

**Recommendation score**
The recommendation score measures to what extend the patient would recommend joint replacement to a friend or relative. The score has a range of 1.0 to 5.0, with 1.0 representing totally disagree and 5.0 representing totally agree.

**Resurfacing hip arthroplasty**
Hip prosthesis in which the cup (acetabulum) is replaced and a metal cap is implanted on top of the femoral head

**Resurfacing shoulder arthroplasty**
Shoulder prosthesis in which a metal cap is implanted on top of the humeral head

**Reversed hybrid fixation hip prosthesis**
Fixation of a hip prosthesis in which the acetabular component is cemented and the femoral component is uncemented

**Reversed shoulder prosthesis**
Adjusted type of total shoulder arthroplasty in which the parts are implanted in a reversed manner. A sphere (glenosphere) is implanted onto the glenoid and a stem with cup in the shaft of the shoulder head

**Revision arthroplasty**
Any change (insertion, replacement and/or removal) of one or more components of the prosthesis

**Sauvé Kapandji procedure**
Arthrodesis of a natural wrist joint and construction of a new wrist joint by splitting the ulna

**Shoulder hemiarthroplasty**
Shoulder hemiarthroplasty with humeral stem, stemless hemi shoulder prosthesis (without humeral stem) or resurfacing shoulder hemiarthroplasty

**Synovectomy**
Removal of inflamed mucosa in a joint

**Talus component**
Part of an ankle prosthesis that is inserted in the talus (ankle bone)

**Tibia component**
Part of a knee or ankle prosthesis that is inserted in the tibia (shin bone)

**Total arthroplasty**
Arthroplasty in which the entire joint of a patient is replaced

**Ulnar component**
Part of an elbow or wrist prosthesis that is inserted in the ulna

**Ulnar nerve**
One of the three nerves that runs along the elbow. This nerve largely runs along the ulna

**Unicondylar knee arthroplasty**
Replacement of half the knee (either inner or outer side) by a prosthesis

**Validity**
Level of accuracy and completeness of registered data

**Walch score**
Clinical classification system for level and type of wear of a shoulder joint; A1: humeral head centred, minimal erosion of shoulder cup; A2: humeral head centred, substantial erosion of shoulder cup; B1: Posterior subluxation of humeral head, posterior joint cavity narrow, subchondral sclerosis and osteophytes; B2: posterior subluxation of humerus head, retroversion of shoulder cup with posterior erosion; C: retroversion of shoulder cup over 25 degrees, irrespective of erosion

## Abbreviations

| | |
|---|---|
| **ASA** | American Society of Anaesthesiologists |
| **AA** | Ankle arthroplasty |
| **AO** | Antioxidant |
| **BMI** | Body Mass Index |
| **BSN** | Citizen Service Number |
| **CI** | Confidence Interval |
| **CMC** | Carpometacarpal [finger joint] |
| **D(IP)** | Distal interphalangeal [finger joint] |
| **DRU** | Distal Radioulnar [prosthesis] |
| **EA** | Elbow arthroplasty |
| **HIS** | Hospital Information System |
| **HA** | Hip arthroplasty |
| **IQR** | Interquartile range |
| **KA** | Knee arthroplasty |
| **LROI** | Dutch Arthroplasty Register |
| **MCP** | Metacarpophalangeal [finger joint] |
| **NOV** | Netherlands Orthopaedic Association |
| **NRS** | Numeric Rating Scale |
| **ODEP** | Orthopaedic Data Evaluation Panel |
| **ORIF** | Open Reduction Internal Fixation |
| **PE** | Polyethylene |
| **PIP** | Proximal interphalangeal [finger joint] |
| **PKA** | Patellofemoral Knee Arthroplasty |
| **PROM** | Patient Reported Outcome Measure |
| **RA** | Revision arthroplasty |
| **RHA** | Resurfacing hip arthroplasty |
| **SA** | Shoulder arthroplasty |
| **SD** | Standard Deviation |
| **TEA** | Total Elbow Arthroplasty |
| **THA** | Total Hip Arthroplasty |
| **TKA** | Total Knee Arthroplasty |
| **TSA** | Total Shoulder Arthroplasty |
| **UKA** | Unicondylar Knee Arthroplasty |
| **UMC** | University Medical Centre |
| **Zo** | Oxidized Zirconium |