Online LROI annual report 2021 - **PDF**

www.lroi-report.nl | www.lroi-rapportage.nl

Introduction

This online annual report 2021 of the Dutch Arthroplasty Register (LROI) contains information on hip, knee, ankle, shoulder, elbow, wrist and finger arthroplasties in the Netherlands between 2007 and 2020. 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.

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, for example completeness and validity of the register

Contact

Dutch Arthroplasty Register (LROI)
Bruistensingel 230 | 5232 AD 's-Hertogenbosch | The Netherlands
+31(0) 73 700 3420 | lroi@orthopeden.org
www.lroi.nl

Colophon

Citation: LROI, 2021. *Annual report 2021.* Retrieved from https://www.lroi-report.nl/ (accessed [access-date]).

Layout
SDB groep BV, Almere, the Netherlands
Photography
Puur Pulles Fotografie, Hilversum, the Netherlands
Werry Crone, Utrecht, the Netherlands
Site by
GoPublic, Amsterdam, the Netherlands

Contents

Hip arthroplasty

Numbers

Registered procedures

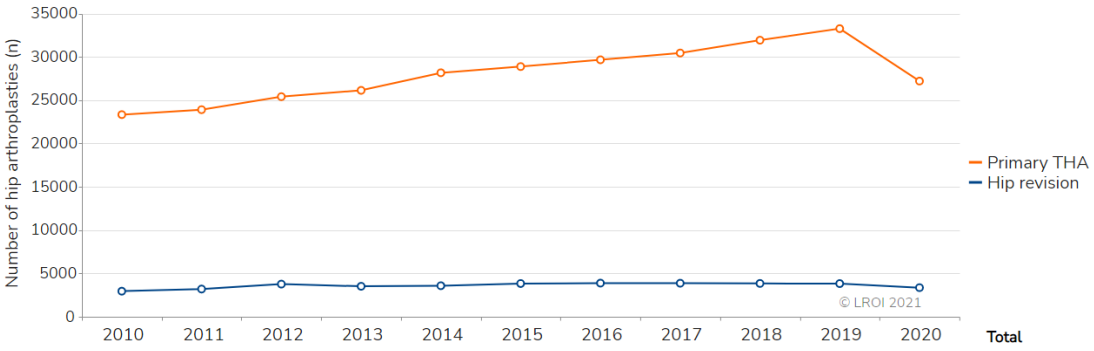
TABLE Number of registered hip arthroplasties per year of surgery (2007-2020) in the LROI in April 2021

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	8,665	976	452	342	909	1,268	12,612
2008	15,174	1,398	733	385	417	1,858	19,965
2009	21,547	2,101	860	599	308	2,680	28,095
2010	23,331	2,399	610	621	281	2,952	30,194
2011	23,900	2,438	227	639	248	3,198	30,650
2012	25,423	2,833	10	593	219	3,767	32,825
2013	26,131	3,041	1	155	266	3,517	33,111
2014	28,161	3,757	0	29	160	3,583	35,690
2015	28,877	4,936	15	20	74	3,834	37,756
2016	29,658	5,338	16	27	103	3,882	39,024
2017	30,443	5,742	5	27	51	3,870	40,138
2018	31,920	6,079	1	23	24	3,845	41,892
2019	33,253	6,112	0	19	39	3,828	43,251
2020	27,205	6,191	0	28	32	3,361	36,817
Total	353,668	53,341	2,930	3,507	3,131	45,443	462,020

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

Type of procedures

FIGURE Number of primary total hip arthroplasties and hip revision arthroplasties registered in the LROI in the Netherlands in 2010-2020



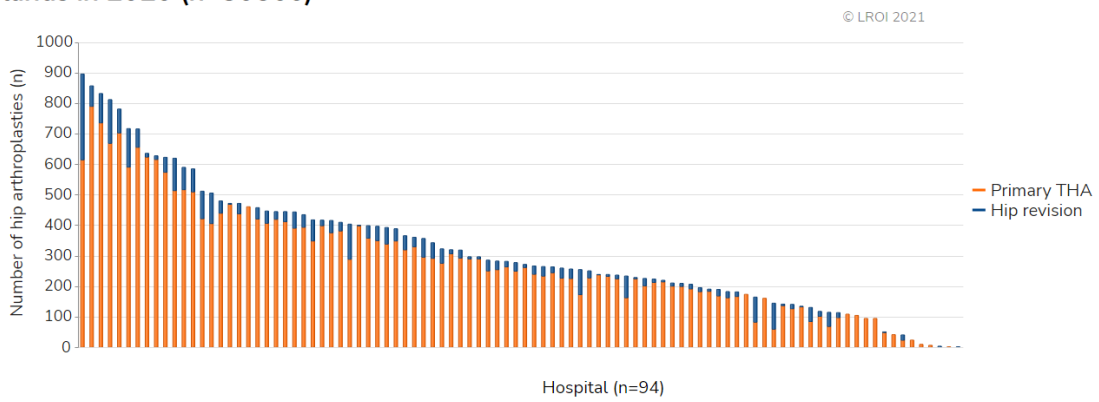
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Type of procedure (n)												
Primary THA	23,331	23,900	25,403	26,131	28,161	28,877	29,658	30,443	31,920	33,253	27,205	**308,282**
Hip revision	2,952	3,198	3,767	3,517	3,583	3,834	3,882	3,870	3,845	3,828	3,361	**39,637**
Total:	**26,283**	**27,098**	**29,170**	**29,648**	**31,744**	**32,711**	**33,540**	**34,313**	**35,765**	**37,081**	**30,566**	**347,919**

THA: total hip arthroplasty.

Out of 27,205 primary total hip arthroplasties that were performed in 2020, 3.0% (n=699) was performed bilaterally.

Type of procedure per hospital

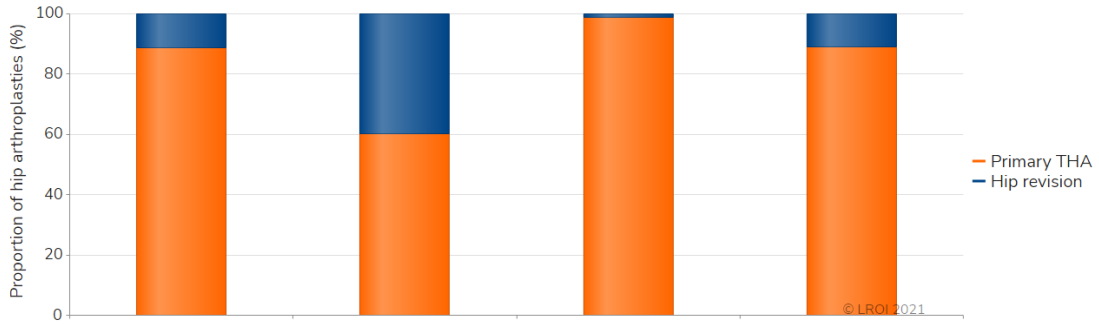
FIGURE Number of primary total hip arthroplasties and hip revision arthroplasties per hospital in the Netherlands in 2020 (n=30566)



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 2020



Type of hospital	General	UMC	Private	Total
Type of procedure (%)				
Primary THA	88.63	60.24	98.69	**89.00**
Hip revision	11.37	39.76	1.31	**11.00**
Total (n):	**25,293**	**1,079**	**4,194**	**30,566**

Please note: In 2020, 72 general hospitals, 7 UMCs and 17 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

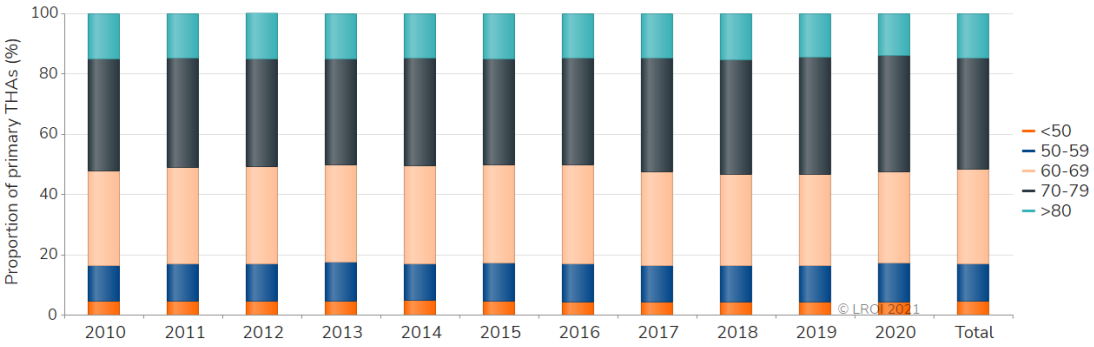
TABLE Patient characteristics of all patients with a registered primary total hip arthroplasty by diagnosis in the Netherlands in 2020

	Osteoarthritis	Fracture	Osteonecrosis	Late post-traumatic	Dysplasia	Rheumatoid arthritis	Post-Perthes disease	Tumour	Total
N	**23,128 (85.0%)**	**1,648 (6.1%)**	**794 (2.9%)**	**677 (2.5%)**	**457 (1.7%)**	**115 (0.4%)**	**75 (0.3%)**	**97 (0.4%)**	**27,205**
Mean age (years) (SD)	69.5 (9.7)	69.7 (8.3)	63.1 (16.3)	68.0 (12.5)	51.9 (13.9)	62.7 (15.0)	46.7 (16.8)	62.4 (13.4)	68.8 (10.6)
Age (years) (%)									
<50	3	1	19	7	41	8	52	13	4
50-59	12	9	16	16	31	22	28	21	13
60-69	30	36	26	27	16	25	11	33	30
70-79	40	44	24	32	10	37	7	26	39
≥80	15	10	15	18	2	8	2	7	14
Gender (%)									
Men	35	34	47	47	24	25	67	43	36
Women	65	66	53	53	76	75	33	57	64
ASA score (%)									
I	16	13	11	14	34	3	43	4	16
II	63	56	48	50	56	62	47	30	61
III-IV	21	31	41	36	10	35	10	66	23
Type of hospital (%)									
General	82	96	82	87	68	81	76	70	83
UMC	1	4	11	7	12	10	8	30	2
Private	17	0	7	6	20	9	16	0	15
Charnley-score (%)									
A One hip joint affected	41	64	52	75	47	28	73	79	43
B1 Both hip joints affected	31	14	21	12	28	26	16	4	30
B2 Contralateral hip joint with a total hip prosthesis	25	16	21	10	22	25	11	10	24
C Multiple joints affected or chronic disease that affects quality of life	3	6	6	3	3	21	0	7	3
Mean Body Mass Index (kg/m²) (SD)	27.3 (4.5)	25.0 (4.0)	26.8 (5.4)	25.7 (4.6)	26.9 (4.8)	27.0 (5.0)	26.7 (4.8)	27.5 (7.0)	27.1 (4.6)
Body Mass Index (kg/m²) (%)									
Underweight (≤18,5)	1	2	2	2	1	3	1	2	1
Normal weight (>18,5-25)	33	55	42	49	37	33	46	46	35
Overweight (>25-30)	42	33	33	36	37	37	27	29	41
Obesity (>30-40)	23	10	21	12	24	26	26	16	22
Morbid obesity (>40)	1	0	2	1	1	1	0	7	1
Smoking (%)									
No	91	91	81	85	88	92	89	94	91
Yes	9	9	19	15	12	8	11	6	9

Please note: In 2020, 181 (0.7%) patients received a primary THA after a diagnosis that is not listed in the table. Of 33 (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

FIGURE Trend (proportion [%] per year) in age category in primary total hip arthroplasties in the Netherlands in 2010-2020



Age category (%)												
<50	4.50	4.49	4.63	4.70	4.76	4.73	4.46	4.43	4.32	4.18	4.32	**4.49**
50-59	12.02	12.49	12.31	12.76	12.35	12.40	12.59	11.99	12.18	12.31	12.88	**12.38**
60-69	31.18	31.91	32.17	32.30	32.37	32.77	32.82	31.18	30.22	30.14	30.26	**31.54**
70-79	37.18	36.23	35.71	35.11	35.64	35.06	35.41	37.51	38.02	38.89	38.45	**36.72**
>80	15.12	14.88	15.19	15.13	14.88	15.04	14.72	14.88	15.26	14.48	14.08	**14.87**
Total (n):	**23,295**	**23,852**	**25,347**	**26,086**	**28,131**	**28,860**	**29,639**	**30,439**	**31,916**	**33,253**	**27,205**	308,023

THA: total hip arthroplasty.

Previous surgery

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 2014-2020

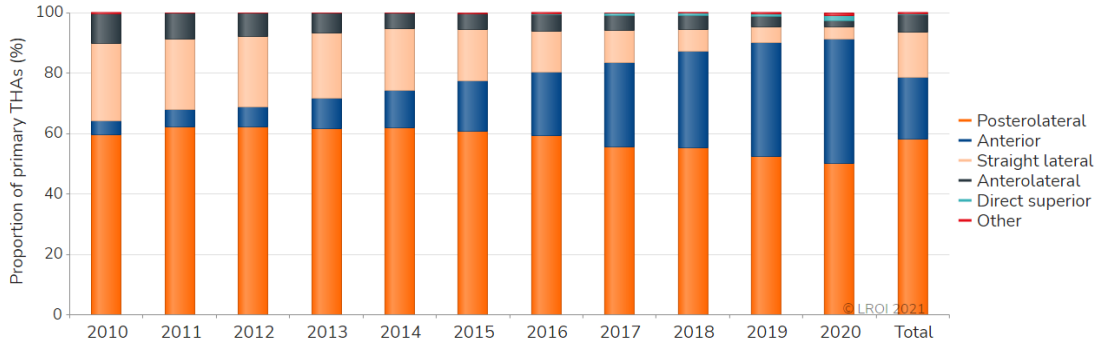
Year	2014	2015	2016	2017	2018	2019	2020	Total
Primary THA (n)	27,101	27,986	29,564	30,096	31,473	32,687	27,007	205,914
Previous surgery to the relevant hip (total) Proportion[1] (%)	5.0	5.0	4.9	4.8	4.5	4.7	4.8	4.8
Osteosynthesis	3.5	3.6	3.6	3.5	3.3	3.5	3.6	3.5
Osteotomy	0.8	0.8	0.9	0.9	0.9	0.8	0.8	0.9
Arthroscopy	0.3	0.2	0.3	0.2	0.2	0.2	0.3	0.2
Girdlestone situation	0.1	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	0.0	0.1
Other	1.0	1.0	1.0	0.9	0.8	0.9	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

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary total hip arthroplasty in the Netherlands in 2010-2020

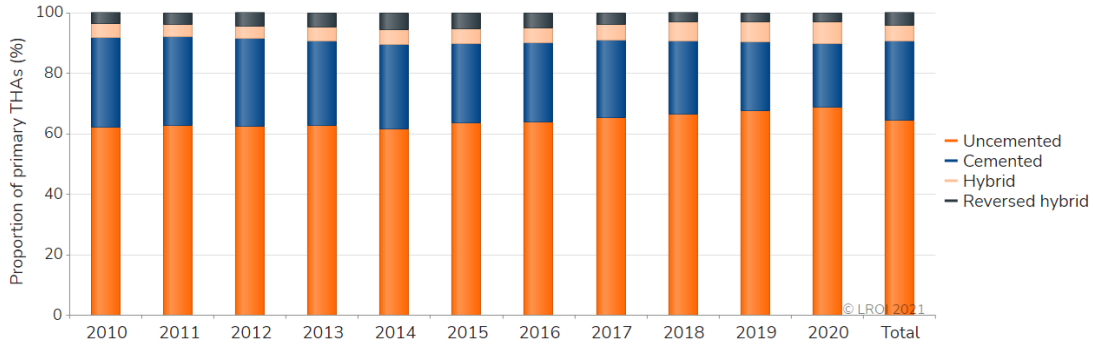


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Surgical approach (%)												
Posterolateral	59.55	62.25	62.11	61.65	61.99	60.65	59.28	55.65	55.29	52.41	49.99	**58.00**
Anterior	4.70	5.64	6.81	9.93	12.36	16.77	20.88	27.73	31.80	37.69	41.16	**20.67**
Straight lateral	25.67	23.28	23.05	21.76	20.19	17.03	13.53	10.64	7.40	5.22	4.10	**14.95**
Anterolateral	9.65	8.62	7.87	6.56	5.35	5.11	5.50	4.96	4.43	3.46	2.02	**5.59**
Direct superior	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.81	0.81	0.82	1.76	**0.44**
Other	0.44	0.20	0.15	0.09	0.10	0.43	0.52	0.21	0.28	0.41	0.97	**0.35**
Total (n):	**23,136**	**23,677**	**25,183**	**25,961**	**27,999**	**28,798**	**29,642**	**30,420**	**31,898**	**33,226**	**27,171**	**307,111**

THA: total hip arthroplasty.

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary total hip arthroplasties in the Netherlands in 2010-2020



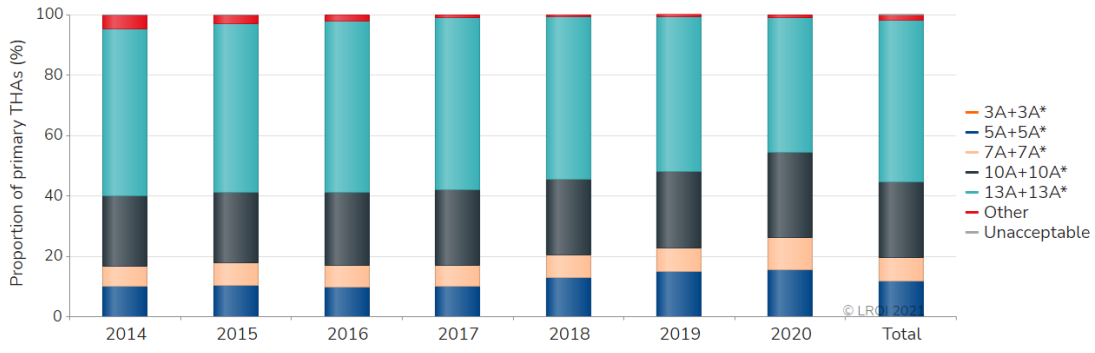
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Uncemented	62.25	62.86	62.45	62.63	61.51	63.55	63.89	65.35	66.39	67.52	68.70	**64.43**
Cemented	29.41	29.21	28.99	28.00	27.97	26.14	26.16	25.48	24.23	22.84	21.18	**26.13**
Hybrid	4.80	4.03	4.08	4.62	4.78	4.90	4.89	5.27	6.26	6.70	7.13	**5.29**
Reversed hybrid	3.55	3.90	4.49	4.75	5.74	5.41	5.06	3.90	3.12	2.94	2.99	**4.15**
Total (n):	**23,145**	**23,719**	**25,205**	**25,980**	**27,996**	**28,749**	**29,506**	**30,005**	**31,733**	**33,014**	**26,996**	**306,048**

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 2014-2020

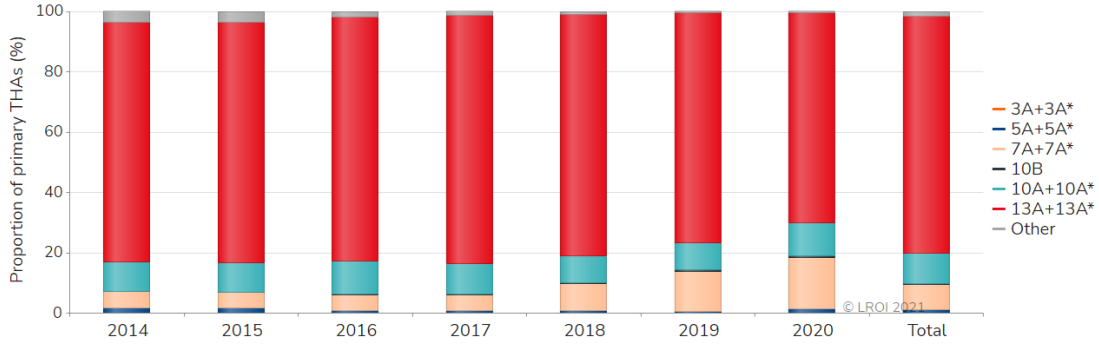


Year	2014	2015	2016	2017	2018	2019	2020	Total
ODEP rating (%)								
3A+3A*	0.08	0.08	0.02	0.00	0.00	0.00	0.01	**0.03**
5A+5A*	9.87	10.21	9.70	10.20	12.87	14.87	15.52	**11.88**
7A+7A*	6.75	7.62	7.30	6.86	7.45	7.95	10.68	**7.75**
10A+10A*	23.44	23.27	24.27	24.99	25.01	25.20	28.21	**24.87**
13A+13A*	55.14	55.77	56.48	57.03	54.02	51.38	44.46	**53.62**
Other	4.53	3.01	2.23	0.91	0.65	0.61	1.12	**1.83**
Unacceptable	0.19	0.03	0.00	0.00	0.00	0.00	0.00	**0.03**
Total (n):	**27,824**	**28,461**	**28,822**	**29,625**	**30,966**	**31,608**	**24,926**	**202,232**

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 2014-2020

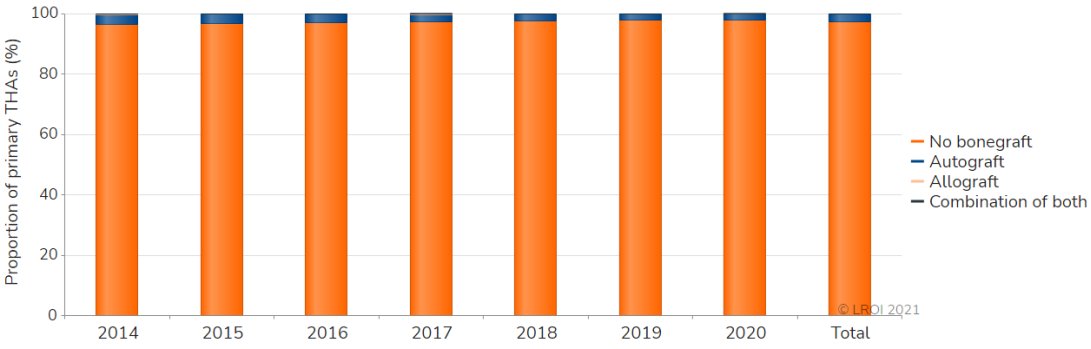


Year	2014	2015	2016	2017	2018	2019	2020	Total
ODEP rating (%)								
3A+3A*	0.11	0.02	0.00	0.00	0.00	0.00	0.00	**0.02**
5A+5A*	1.48	1.68	0.78	0.84	0.82	0.67	1.44	**1.08**
7A+7A*	5.47	5.12	5.16	5.23	8.83	13.15	16.99	**8.47**
10B	0.02	0.06	0.39	0.37	0.43	0.43	0.48	**0.31**
10A+10A*	9.84	9.73	10.95	9.91	8.80	8.93	11.16	**9.85**
13A+13A*	79.46	79.80	80.91	82.35	80.18	76.42	69.59	**78.57**
Other	3.63	3.59	1.81	1.31	0.93	0.41	0.35	**1.70**
Total (n):	**27,727**	**28,378**	**28,760**	**29,684**	**31,142**	**31,614**	**24,690**	**201,995**

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

FIGURE Trend (proportion [%] per year) in type of bonegraft in primary total hip arthroplasties in the Netherlands in 2014-2020

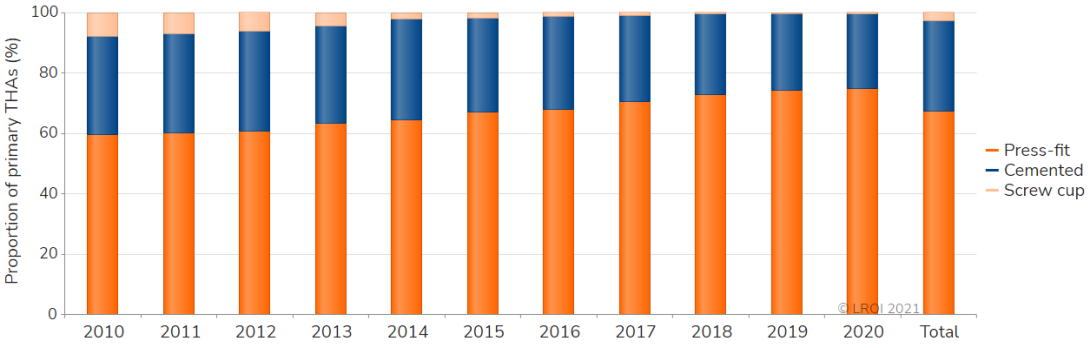


Type of bonegraft (%)	2014	2015	2016	2017	2018	2019	2020	Total
No bonegraft	96.35	96.61	96.91	97.14	97.65	97.87	97.98	**97.23**
Autograft	3.36	3.14	2.85	2.57	2.16	1.92	1.78	**2.53**
Allograft	0.17	0.14	0.14	0.16	0.12	0.12	0.15	**0.14**
Combination of both	0.11	0.10	0.10	0.14	0.07	0.08	0.09	**0.10**
Total (n):	**27,252**	**28,525**	**29,561**	**30,324**	**31,781**	**32,980**	**26,818**	**207,241**

THA: total hip arthroplasty.

Type of acetabular component

FIGURE Trend (proportion [%] per year) in type of acetabular component in primary total hip arthroplasties in the Netherlands in 2010-2020

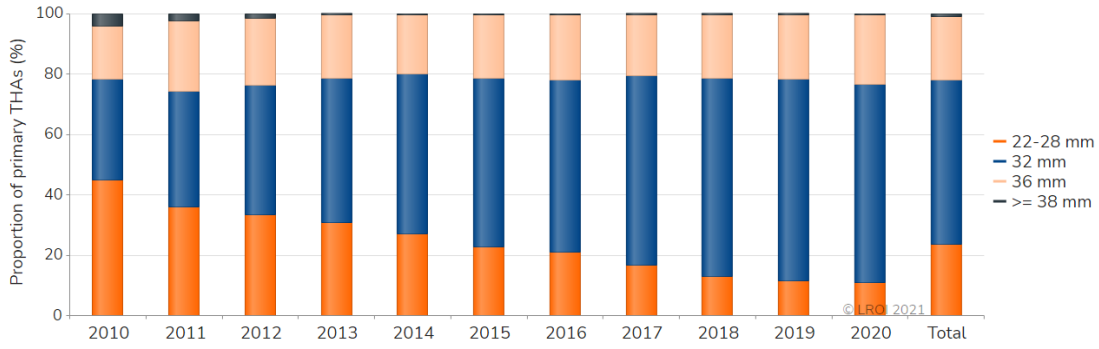


Type of acetabular component (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Press-fit	59.44	60.12	60.63	63.19	64.37	67.14	68.02	70.58	72.88	74.28	74.88	**67.29**
Cemented	32.63	32.85	33.22	32.36	33.41	31.01	30.65	28.50	26.63	25.25	24.83	**29.94**
Screw cup	7.93	7.03	6.16	4.45	2.22	1.84	1.34	0.93	0.50	0.47	0.30	**2.78**
Total (n):	**22,774**	**23,337**	**24,877**	**25,773**	**27,825**	**28,461**	**28,823**	**29,626**	**30,967**	**31,620**	**24,930**	**299,013**

THA: total hip arthroplasty.

Femoral head diameter

FIGURE Trend (proportion [%] per year) in femoral head component diameter in primary total hip arthroplasties in the Netherlands in 2010-2020



Femoral head size (%)

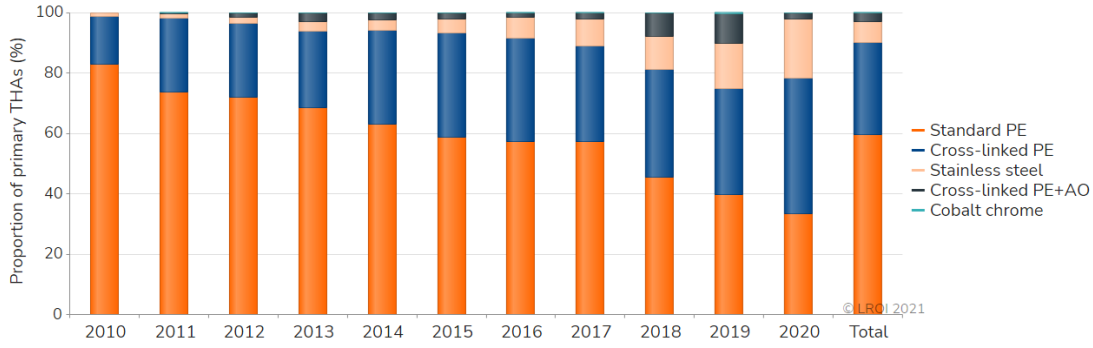
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
22-28 mm	44.84	36.01	33.27	30.69	27.10	22.86	21.05	16.59	13.09	11.59	10.82	**23.51**
32 mm	33.55	38.10	43.00	47.80	52.83	55.81	57.02	62.89	65.45	66.72	65.66	**54.47**
36 mm	17.55	23.32	22.27	21.05	19.59	20.90	21.50	20.12	20.94	21.24	23.02	**21.03**
>= 38 mm	4.06	2.57	1.46	0.47	0.48	0.43	0.43	0.41	0.53	0.46	0.49	**0.98**
Total (n):	**22,796**	**23,442**	**25,008**	**25,778**	**27,795**	**28,440**	**28,764**	**29,658**	**31,066**	**31,395**	**24,770**	**298,912**

THA: total hip arthroplasty.

Materials

Cemented acetabular component

FIGURE Trend (proportion [%] per year) in cemented acetabulum material in primary total hip arthroplasties in the Netherlands in 2010-2020



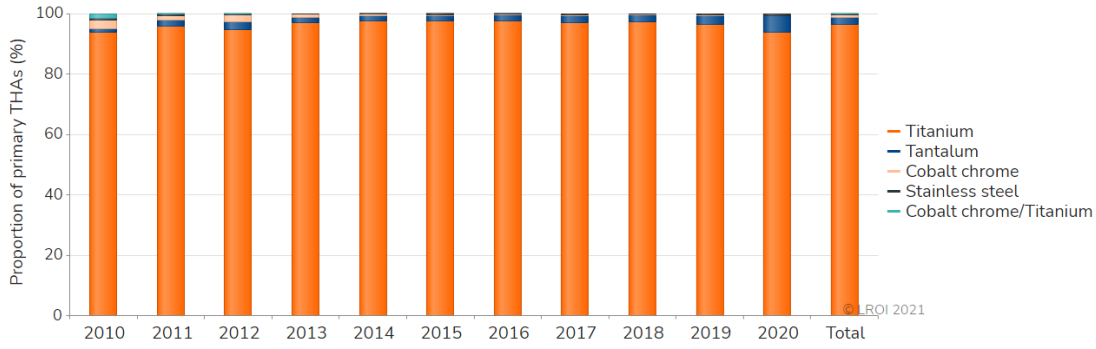
Cemented acetabulum material (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Standard PE	82.79	73.80	71.94	68.48	63.13	58.68	57.26	57.29	45.40	39.60	33.48	**59.64**
Cross-linked PE	15.88	24.43	24.38	25.25	30.94	34.56	34.26	31.60	35.71	35.30	44.77	**30.53**
Stainless steel	1.33	1.34	2.23	3.20	3.58	4.70	7.01	9.09	11.07	14.82	19.45	**6.80**
Cross-linked PE+AO	0.00	0.42	1.43	3.00	2.12	1.89	1.25	1.80	7.60	9.96	2.10	**2.88**
Cobalt chrome	0.00	0.01	0.02	0.07	0.23	0.17	0.23	0.23	0.22	0.33	0.19	**0.16**
Total (n):	**7,430**	**7,664**	**8,262**	**8,338**	**9,295**	**8,826**	**8,833**	**8,442**	**8,245**	**7,983**	**6,189**	**89,507**

Please note: Titanium was used in 8 (0.01%) primary THAs in 2010-2020.
Please note: Stainless steel was used in cemented dual mobility cups.
THA: total hip arthroplasty; PE: polyethylene; AO: antioxidant.

Uncemented acetabular component

FIGURE Trend (proportion [%] per year) in uncemented acetabulum material in primary total hip arthroplasties in the Netherlands in 2010-2020



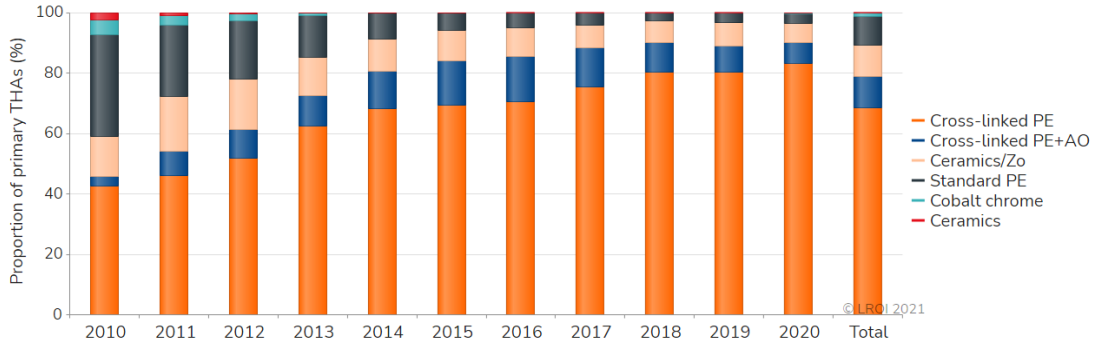
Uncemented acetabulum material (%)

Titanium	93.75	95.88	94.74	96.94	97.54	97.59	97.54	97.07	97.32	96.47	93.78	**96.34**
Tantalum	1.34	1.97	2.59	1.85	1.87	1.75	1.98	2.23	2.23	2.95	5.38	**2.41**
Cobalt chrome	2.82	1.56	2.12	0.95	0.34	0.37	0.22	0.33	0.18	0.17	0.10	**0.74**
Stainless steel	0.53	0.47	0.52	0.26	0.25	0.29	0.27	0.37	0.26	0.41	0.73	**0.39**
Cobalt chrome/Titanium	1.55	0.13	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.13**
Total (n):	**15,341**	**15,671**	**16,614**	**17,434**	**18,529**	**19,634**	**19,990**	**21,184**	**22,722**	**23,636**	**18,741**	**209,496**

Please note: Standard PE was used in 2 (0.01%) primary THAs in 2010.
THA: total hip arthroplasty.

Inlay

FIGURE Trend (proportion [%] per year) in inlay material in primary total hip arthroplasties in the Netherlands in 2010-2020



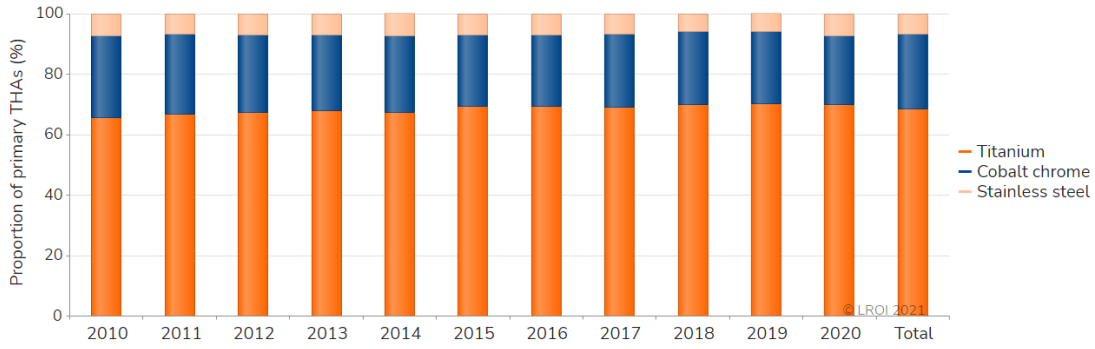
Inlay material (%)

Cross-linked PE	42.46	46.10	51.77	62.47	68.13	69.35	70.50	75.29	80.27	80.35	83.23	**68.39**
Cross-linked PE+AO	3.32	8.11	9.47	10.17	12.34	14.69	15.11	13.19	9.87	8.50	6.97	**10.37**
Ceramics/Zo	13.27	18.10	16.81	12.67	10.64	10.05	9.22	7.34	7.15	7.80	6.15	**10.33**
Standard PE	33.55	23.58	19.32	13.55	8.64	5.64	5.09	4.04	2.61	3.12	3.31	**9.69**
Cobalt chrome	5.03	3.17	2.33	0.95	0.18	0.15	0.06	0.12	0.09	0.22	0.32	**0.94**
Ceramics	2.37	0.94	0.30	0.19	0.07	0.12	0.03	0.02	0.01	0.02	0.02	**0.29**
Total (n):	**12,970**	**14,427**	**15,450**	**15,989**	**16,867**	**17,998**	**18,970**	**20,514**	**22,144**	**23,282**	**18,348**	**196,959**

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

Femur component

FIGURE Trend (proportion [%] per year) in femur component material in primary total hip arthroplasties in the Netherlands in 2010-2020

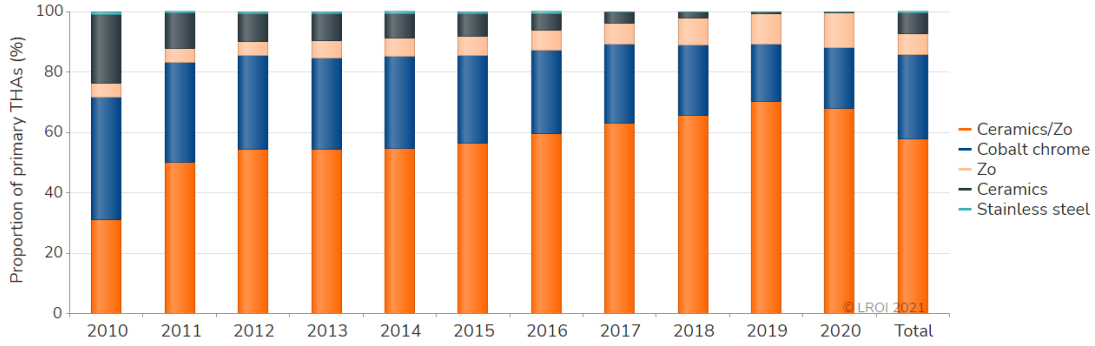


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Femur material (%)												
Titanium	65.69	66.88	67.27	67.85	67.37	69.36	69.23	69.13	70.00	70.11	70.01	**68.56**
Cobalt chrome	26.91	26.32	25.72	25.22	25.26	23.56	23.61	24.00	24.02	23.95	22.72	**24.58**
Stainless steel	7.40	6.80	7.01	6.93	7.37	7.08	7.16	6.87	5.98	5.95	7.26	**6.86**
Total (n):	**22,760**	**23,488**	**25,062**	**25,872**	**27,727**	**28,376**	**28,760**	**29,684**	**31,142**	**31,622**	**24,692**	**299,185**

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

Femoral head component

FIGURE Trend (proportion [%] per year) in femoral head material in primary total hip arthroplasties in the Netherlands in 2010-2020

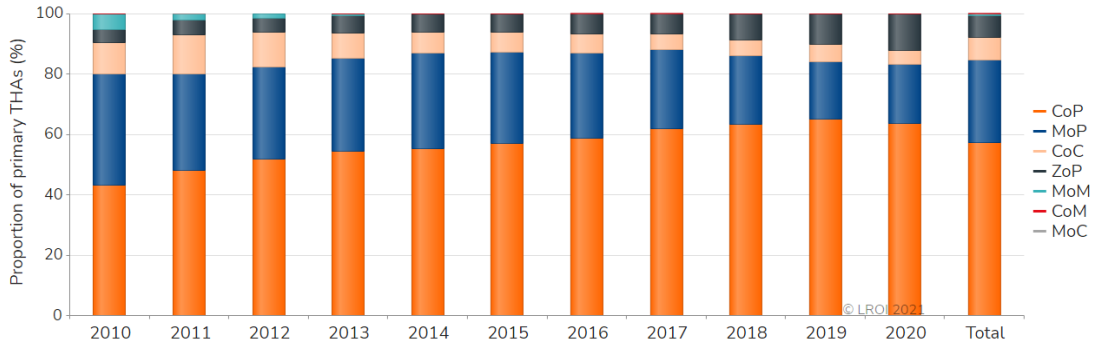


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Femoral head material (%)												
Ceramics/Zo	31.07	50.17	54.27	54.35	54.81	56.39	59.59	63.00	65.58	70.24	68.05	**57.81**
Cobalt chrome	40.69	33.09	31.09	30.36	30.51	29.22	27.54	26.15	23.32	18.89	19.94	**27.84**
Zo	4.62	4.56	4.62	5.72	6.02	6.05	6.79	6.85	8.94	10.03	11.67	**7.01**
Ceramics	22.53	11.65	9.35	8.86	7.99	7.61	5.38	3.72	2.06	0.72	0.24	**6.84**
Stainless steel	1.09	0.54	0.67	0.71	0.68	0.72	0.71	0.28	0.10	0.12	0.09	**0.50**
Total (n):	**22,810**	**23,443**	**25,008**	**25,779**	**27,792**	**28,440**	**28,764**	**29,655**	**31,065**	**31,391**	**24,770**	**298,917**

Please note: A titanium femoral head was used in 7 (<0.01%) primary THAs in 2010-2020. A cross-linked PE femoral head was used in 5 (<0.01%) primary THAs in 2010-2020. A standard PE femoral head was used in 5 (<0.01%) primary THAs in 2010-2020.
THA: total hip arthroplasty; PE: polyethylene; Zo: Oxidized Zirconium.

Articulation

FIGURE Trend (proportion [%] per year) in articulation in primary total hip arthroplasties in the Netherlands in 2010-2020

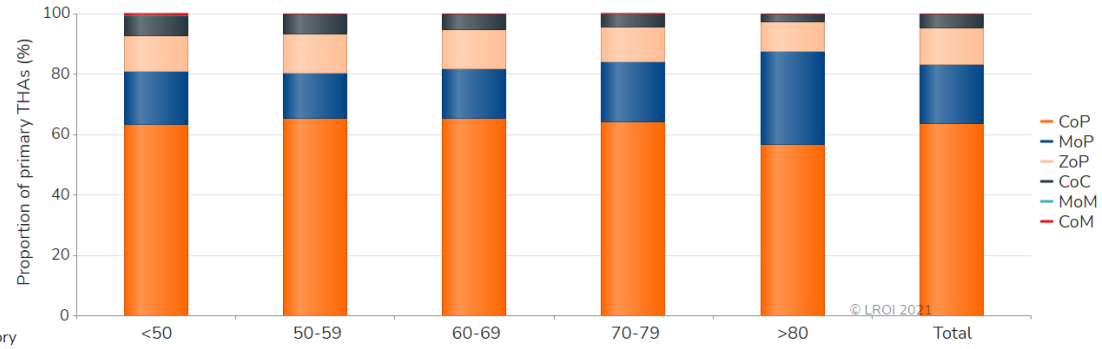


Articulation (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
CoP	43.26	48.18	51.86	54.44	55.26	56.89	58.70	61.75	63.19	65.17	63.56	**57.15**
MoP	36.83	31.75	30.41	30.78	31.76	30.24	28.20	26.21	22.71	18.72	19.67	**27.58**
CoC	10.13	13.15	11.52	8.36	6.76	6.62	6.21	5.16	5.22	5.87	4.62	**7.39**
ZoP	4.55	4.63	4.70	5.81	6.18	6.19	6.87	6.82	8.83	10.10	11.91	**7.07**
MoM	5.20	2.28	1.51	0.60	0.03	0.04	0.02	0.05	0.03	0.11	0.16	**0.79**
CoM	0.02	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.08	**0.02**
MoC	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Total (n):	**21,847**	**22,721**	**24,259**	**25,105**	**26,794**	**27,521**	**28,171**	**29,077**	**30,261**	**30,686**	**23,995**	**290,437**

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 2020



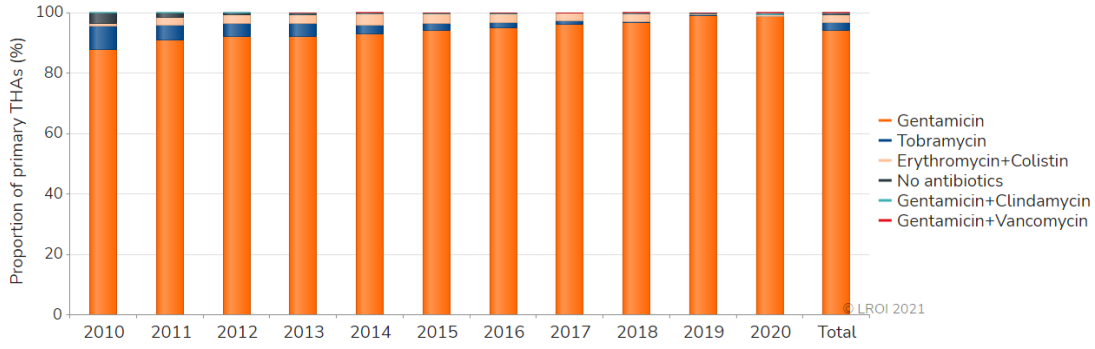
Articulation (%)	<50	50-59	60-69	70-79	>80	Total
CoP	63.27	65.43	65.38	64.15	56.74	**63.56**
MoP	17.73	14.85	16.36	19.80	30.85	**19.67**
ZoP	11.66	13.08	13.08	11.49	9.69	**11.91**
CoC	6.76	6.37	5.01	4.32	2.49	**4.62**
MoM	0.29	0.10	0.10	0.20	0.17	**0.16**
CoM	0.29	0.17	0.07	0.04	0.06	**0.08**
Total (n):	**1,021**	**2,997**	**7,184**	**9,305**	**3,488**	**23,995**

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

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in primary total hip arthroplasties in the Netherlands in 2010-2020



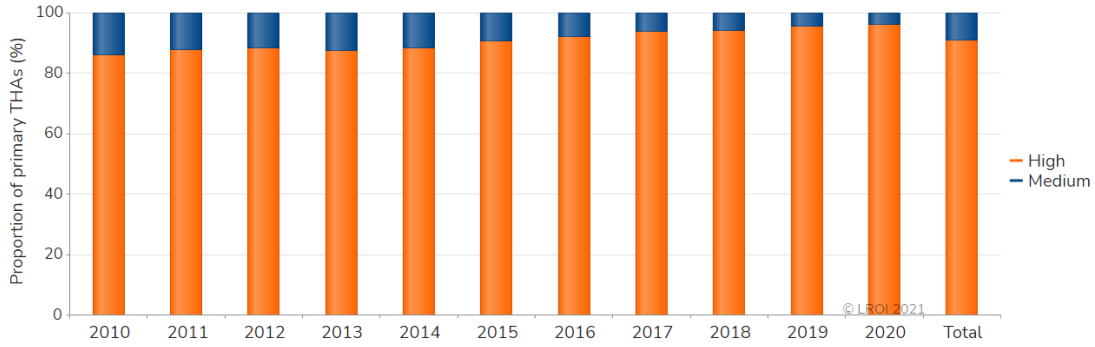
Bone cement antibiotics (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Gentamicin	87.76	90.87	91.98	92.20	92.88	94.02	95.05	96.20	96.64	99.03	98.63	**94.21**
Tobramycin	7.70	4.95	4.53	4.08	2.91	2.25	1.77	0.94	0.33	0.16	0.15	**2.62**
Erythromycin+Colistin	0.92	2.60	2.88	3.06	3.68	3.28	2.84	2.60	2.72	0.46	0.43	**2.37**
No antibiotics	3.36	1.42	0.40	0.32	0.23	0.07	0.01	0.02	0.01	0.01	0.01	**0.48**
Gentamicin+Clindamycin	0.26	0.17	0.22	0.31	0.29	0.37	0.30	0.21	0.26	0.25	0.51	**0.28**
Gentamicin+Vancomycin	0.00	0.00	0.00	0.03	0.01	0.01	0.03	0.02	0.05	0.08	0.27	**0.04**
Total (n):	**7,938**	**8,463**	**9,100**	**9,341**	**10,128**	**9,691**	**9,803**	**9,951**	**9,781**	**9,723**	**7,892**	**101,811**

THA: total hip arthroplasty.

Viscosity

FIGURE Trend (proportion [%] per year) in bone cement viscosity in primary total hip arthroplasties in the Netherlands in 2010-2020



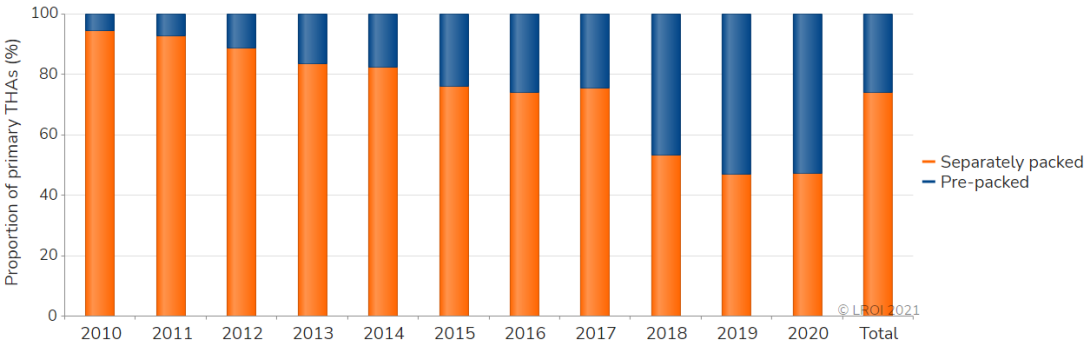
Bone cement viscosity (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
High	85.90	87.71	88.47	87.49	88.28	90.56	92.16	93.91	94.08	95.63	95.98	**90.99**
Medium	14.10	12.29	11.53	12.51	11.72	9.44	7.84	6.09	5.92	4.37	4.02	**9.01**
Total (n):	**7,936**	**8,462**	**9,099**	**9,340**	**10,127**	**9,691**	**9,803**	**9,950**	**9,781**	**9,723**	**7,892**	**101,804**

Please note: Low viscosity in bone cement was used in 7 (<0.01%) primary THAs in 2010-2017.
THA: total hip arthroplasty.

Vacuum mixing system

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 2010-2020



Vacuum mixing system (%)												
Separately packed	94.41	92.60	88.64	83.52	82.30	75.98	74.06	75.35	53.32	46.95	47.26	**73.83**
Pre-packed	5.59	7.40	11.36	16.48	17.70	24.02	25.94	24.65	46.68	53.05	52.74	**26.17**
Total (n):	**7,938**	**8,463**	**9,100**	**9,341**	**10,128**	**9,691**	**9,803**	**9,951**	**9,781**	**9,723**	**7,892**	**101,811**

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 2020

Acetabulum

Cemented (n=6,325)		Uncemented (n=18,404)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Avantage Cemented	16.1	Allofit	29.7
Muller low profile Durasul	15.3	Pinnacle	20.0
IP Cup	13.5	R3	15.0
Marathon	10.9	Trident	8.1
Exeter Rimfit X3	9.2	Continuum	5.2
FAL Cup	7.1	RM Pressfit Vitamys cup	4.4
CCB cup Low Profile	5.0	Trident Tritanium	3.7
Muller low profile	5.0	Exceed ABT	2.5
Reflection All Poly XLPE	3.4	Pinnacle Gription	2.5
IP Cup X-Linked	2.5	RM Pressfit cup	1.9

Femur

Cemented (n=7,346)		Uncemented (n=17,147)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Lubinus SPII	34.2	Taperloc Complete	26.9
Original ME Muller	28.0	Corail	20.2
Exeter	12.1	Polarstem	14.9
C-Stem AMT	6.5	Accolade II	8.0
CCA stem	4.0	Accolade	4.6
Spectron EF	2.8	Twinsys stem Cementless	4.2
Taperloc Hip Cemented CoCr	2.8	CLS Spotorno	3.3
Stanmore	2.1	M/L Taper	3.1
CPCS	1.8	Alloclassic Zweymuller SL	2.8
Twinsys stem Cemented	1.7	Corail AMT	2.4

Types of bone cement

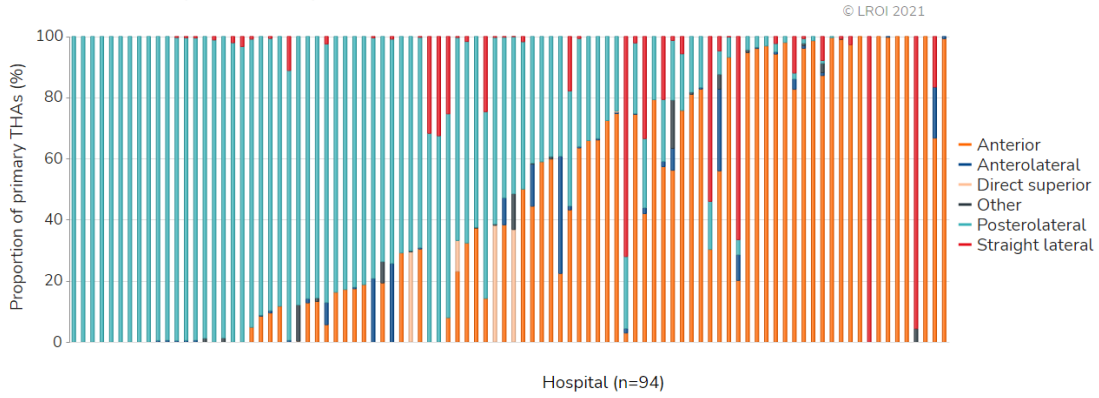
TABLE The most frequently registered types of bone cement by type of mixing system used during primary total hip arthroplasties in the Netherlands in 2020

Separately packed bone cement components (n=3,730)		Bone cement pre-packed in a vacuum mixing system (n=4,158)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	82.5	Palacos R+G	50.5
Refobacin Bone Cement R	7.3	Refobacin Bone Cement R	41.8
Palacos MV+G	4.1	Refobacin Plus Bone Cement	7.7
Subiton G	3.1		
Simplex ABC EC	0.9		

Practice variation

Surgical approach

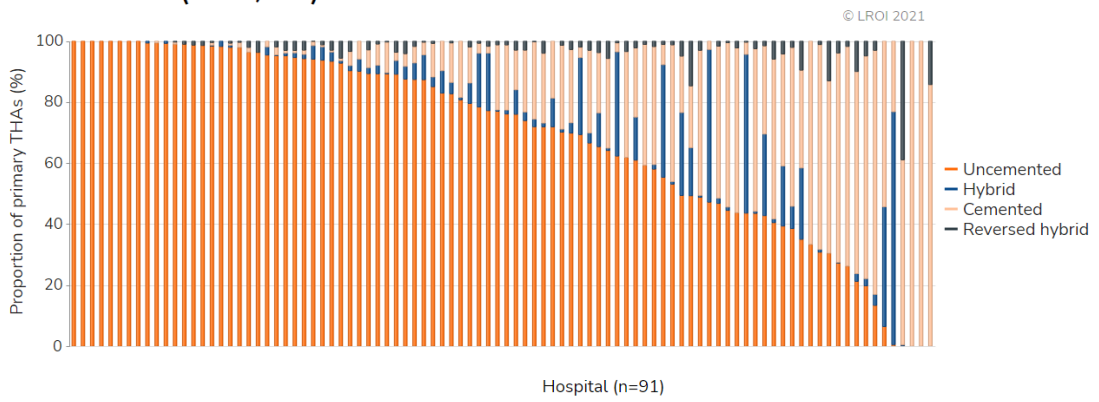
FIGURE Distribution of surgical approach used during primary total hip arthroplasties per hospital in the Netherlands in 2020 (n=27,171)



THA: total hip arthroplasty.

Fixation

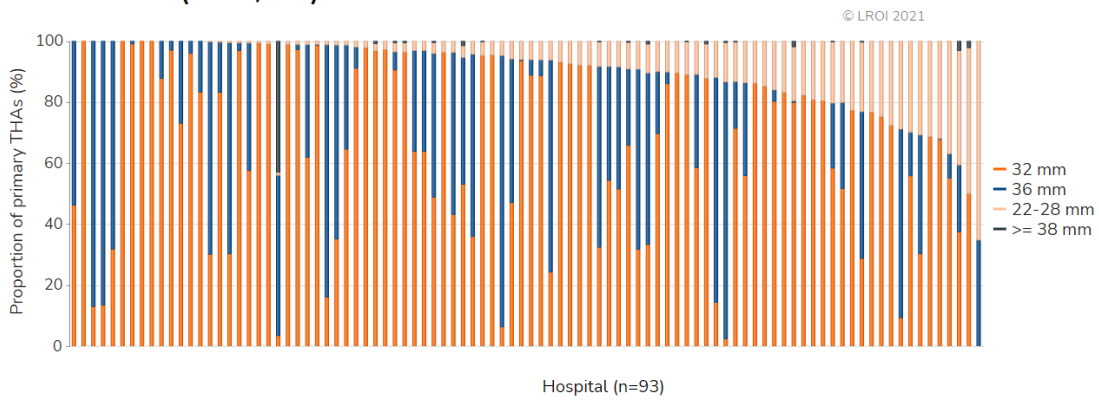
FIGURE Distribution of type of fixation used during primary total hip arthroplasties per hospital in the Netherlands in 2020 (n=26,996)



THA: total hip arthroplasty.

Femoral head diameter

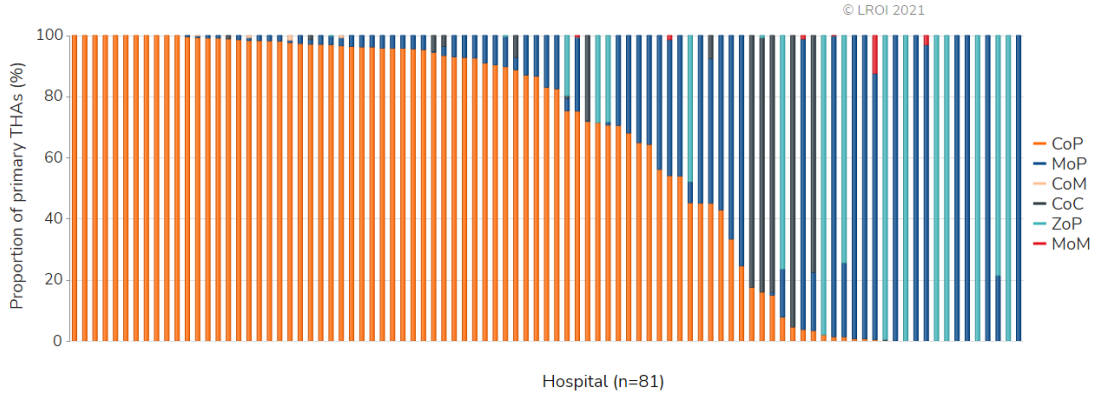
FIGURE Distribution of diameter femoral head used during primary total hip arthroplasties per hospital in the Netherlands in 2020 (n=24,770)



THA: total hip arthroplasty.

Articulation

FIGURE Distribution of articulation used during primary total hip arthroplasties per hospital in the Netherlands in 2020 (n=23,995)



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 2020

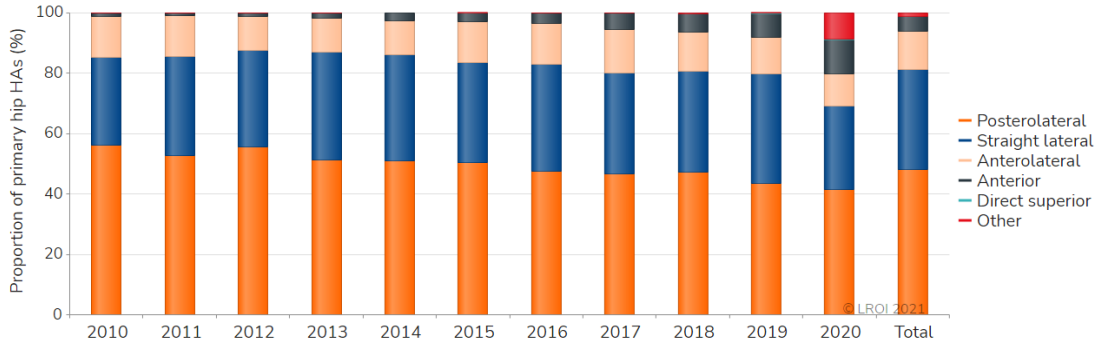
	Orthopaedic surgeon	Trauma surgeon	Total
N	**4,174 (67.4%)**	**2,017 (32.6%)**	**6,191**
Mean age (years) (SD)	82.1 (8.2)	82.6 (7.9)	82.2 (8.1)
Age (years) (%)			
<50	0	0	0
50-59	1	1	1
60-69	5	5	5
70-79	26	24	25
≥80	68	70	69
Gender (%)			
Men	36	34	36
Women	64	66	64
ASA score (%)			
I	1	1	1
II	27	27	27
III-IV	72	72	72
Type of hospital (%)			
General	97	97	97
UMC	3	3	3
Diagnosis (%)			
Fracture (acute)	96	99	97
Osteoarthritis	1	0	1
Late post-traumatic	1	1	1
Tumour	2	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	55	39	52
B1 Both hip joints affected	14	34	18
B2 Contralateral hip joint with a total hip prosthesis	21	12	19
C Multiple joints affected or chronic disease that affects quality of life	10	15	11
Mean Body Mass Index (kg/m²) (SD)	24.6 (4.1)	24.4 (4.0)	24.5 (4.1)
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	5	5	5
Normal weight (>18,5-25)	54	57	55
Overweight (>25-30)	32	31	32
Obesity (>30-40)	9	7	8
Morbid obesity (>40)	0	0	0
Smoking (%)			
No	94	95	94
Yes	6	5	6

Please note: In 2020, 73 general hospitals, 7 UMCs and 1 private hospital performed primary hip hemiarthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

Surgical techniques

Surgical approach

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary hip hemiarthroplasty in the Netherlands in 2010-2020

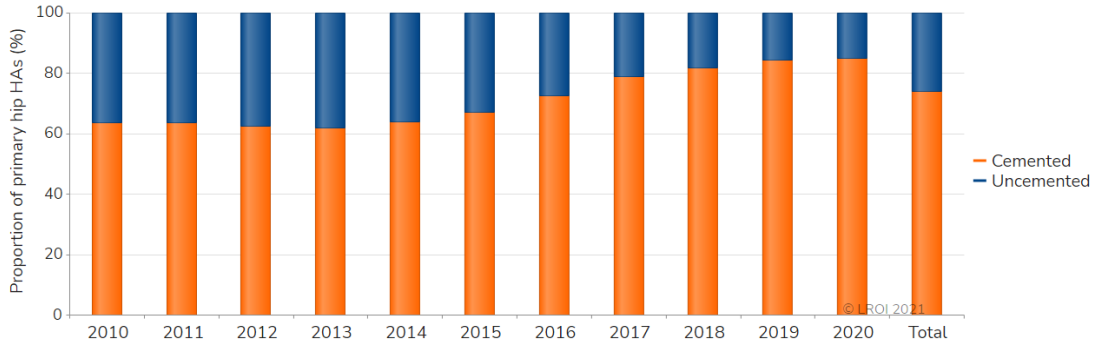


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Surgical approach (%)												
Posterolateral	56.16	52.52	55.51	51.15	51.03	50.34	47.37	46.54	47.32	43.52	41.55	**48.00**
Straight lateral	29.13	33.04	32.02	35.86	35.05	33.17	35.48	33.51	33.16	36.29	27.57	**33.18**
Anterolateral	13.45	13.35	11.28	11.06	11.07	13.45	13.47	14.25	13.13	11.93	10.70	**12.50**
Anterior	1.18	0.88	1.08	1.80	2.85	2.98	3.56	5.59	6.05	7.92	11.20	**5.02**
Direct superior	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.16	0.28	**0.06**
Other	0.08	0.21	0.11	0.13	0.00	0.06	0.11	0.09	0.30	0.18	8.70	**1.23**
Total (n):	**2,379**	**2,397**	**2,776**	**3,003**	**3,723**	**4,730**	**5,330**	**5,705**	**5,932**	**6,087**	**6,159**	**48,221**

HA: hemiarthroplasty.

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary hip hemiarthroplasties in the Netherlands in 2010-2020



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Cemented	63.54	63.57	62.40	61.79	63.98	66.95	72.59	78.78	81.64	84.38	84.77	**74.09**
Uncemented	36.46	36.43	37.60	38.21	36.02	33.05	27.41	21.22	18.36	15.62	15.23	**25.91**
Total (n):	**2,315**	**2,366**	**2,766**	**2,965**	**3,690**	**4,675**	**5,261**	**5,637**	**5,833**	**6,024**	**6,022**	**47,554**

HA: hemiarthroplasty.

Most frequently registered

Components

TABLE The most frequently registered femur and femoral head components in primary hip hemiarthroplasties in the Netherlands in 2020

Femur component (n=5,531)		Femoral head component (n=5,531)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Original ME Muller	29.2	Unipolar Head	33.1
Lubinus SPII	17.9	Link CoCr head	20.2
CCA stem	9.8	Stainless Steel head	10.8
Spectron EF	8.1	Modular Cathcard Unipolar head	10.4
Exeter	5.1	UHR Unitrax	7.6
C-Stem AMT	5.0	Uni-polar	6.3
Stanmore	3.7	Hemi Heads	4.5
Lubinus Classic Plus	2.9	Smith & Nephew CoCr head	3.5
Corail	2.7	Versys Endo	1.0
Accolade II	2.6	Bioloxa Delta	0.8

Types of bone cement

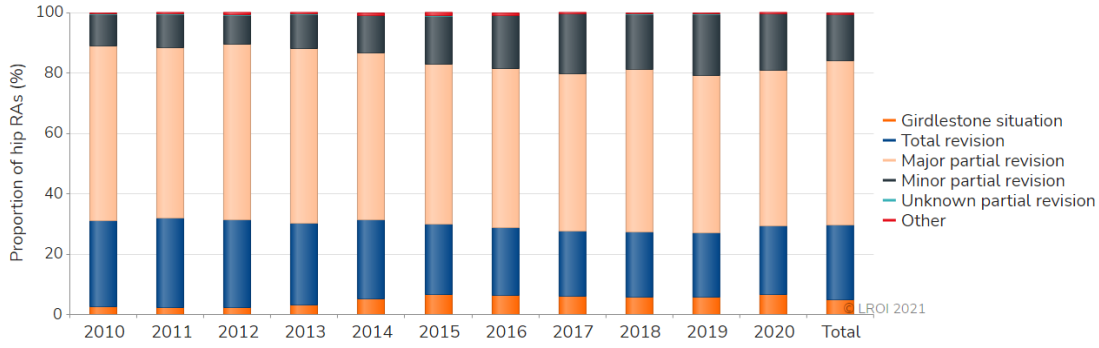
TABLE The most frequently registered types of bone cement by type of mixing system used during primary hip hemiarthroplasties in the Netherlands in 2020

Separately packed bone cement components (n=1,647)		Bone cement pre-packed in a vacuum mixing system (n=2,430)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	64.0	Palacos R+G	47.9
Refobacin Bone Cement R	16.6	Refobacin Bone Cement R	41.9
Copal G+C	7.3	Refobacin Plus Bone Cement	10.2
Subiton G	4.9		
Palacos MV+G	4.5		

Hip revision arthroplasty

Type of revision

FIGURE Trend (proportion [%] per year) in type of revision in hip revision arthroplasties in the Netherlands in 2010-2020



Type of revision (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Girdlestone situation	2.59	2.39	2.25	3.26	5.21	6.66	6.35	6.12	5.84	5.82	6.55	**4.92**
Total revision	28.47	29.65	29.13	26.87	26.13	23.22	22.30	21.53	21.47	21.12	22.72	**24.59**
Major partial revision	57.77	56.33	58.02	58.02	55.19	52.99	52.71	52.14	53.93	52.23	51.63	**54.51**
Minor partial revision	10.47	10.87	9.58	11.27	12.40	15.90	17.55	19.75	18.13	20.09	18.54	**15.17**
Unknown partial revision	0.14	0.26	0.19	0.15	0.03	0.08	0.08	0.08	0.21	0.24	0.03	**0.13**
Other	0.55	0.51	0.84	0.44	1.04	1.15	1.01	0.39	0.42	0.50	0.54	**0.68**
Total (n):	**2,894**	**3,137**	**3,697**	**3,435**	**3,548**	**3,812**	**3,857**	**3,859**	**3,838**	**3,812**	**3,345**	**39,234**

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 1,045 (60.5%) major partial hip revision arthroplasties the acetabulum component was revised and in 682 (39.5%) major partial revision arthroplasties the femur component was revised in 2020.

Reasons for revision

TABLE Trend (proportion [%] per year) in reasons for revision in patients who underwent a hip revision arthroplasty in the Netherlands in 2014-2020

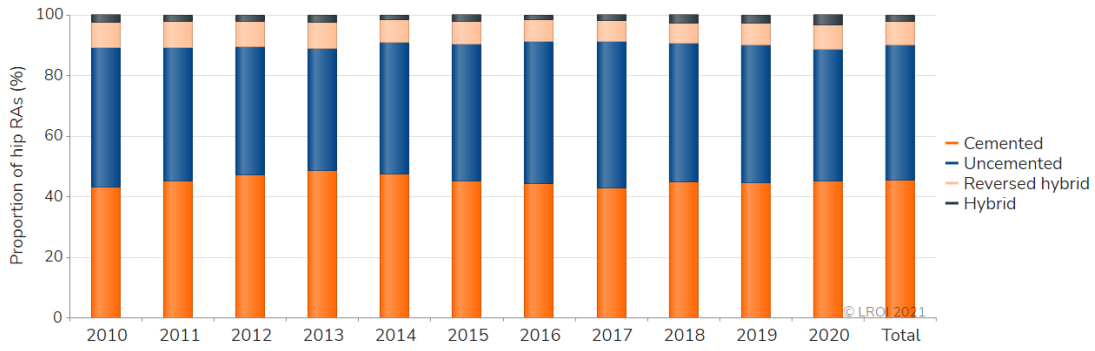
Year	2014	2015	2016	2017	2018	2019	2020	Total
Hip revision arthroplasty (n)	3,583	3,834	3,882	3,870	3,845	3,828	3,361	26,203
Reasons for revision; Proportion[1] (%)								
Loosening of acetabulum component	26.4	24.8	22.3	21.8	21.1	20.5	18.9	22.3
Infection	12.3	17.9	19.4	21.2	20.7	22.7	24.3	19.8
Dislocation	19.1	19.9	19.4	17.8	18.9	18.4	17.9	18.8
Loosening of femur component	20.9	19.5	18.8	18.2	19.2	17.1	17.2	18.7
Inlay wear	20.1	19.6	18.3	18.2	15.9	15.9	13.7	17.4
Peri-prosthetic fracture	11.7	11.4	12.5	14.7	14.4	14.5	17.2	13.7
Girdlestone situation	6.4	5.7	6.1	5.3	4.8	4.5	4.4	5.3
Symptomatic MoM bearing	5.8	4.6	3.9	2.7	2.7	2.8	2.7	3.6
Peri-articular ossification	2.6	2.0	2.3	1.5	1.3	1.1	1.2	1.7
Other	11.6	11.3	10.6	10.1	11.3	12.8	10.8	11.2

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

Surgical techniques

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in hip revision arthroplasties in the Netherlands in 2010-2020

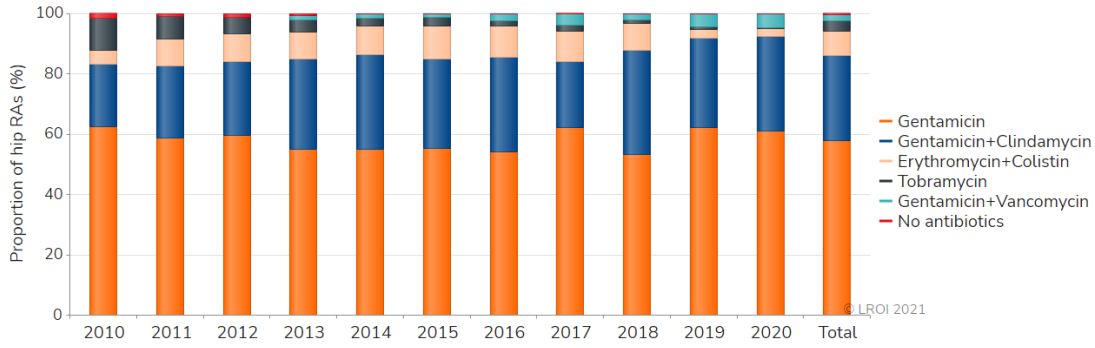


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Cemented	43.26	45.21	47.18	48.61	47.59	45.29	44.28	42.85	44.90	44.67	45.27	**45.38**
Uncemented	45.95	43.95	42.27	40.21	43.30	45.00	46.84	48.46	45.82	45.41	43.36	**44.65**
Reversed hybrid	8.33	8.75	8.48	8.68	7.55	7.51	7.33	6.72	6.63	7.32	7.98	**7.71**
Hybrid	2.47	2.09	2.06	2.50	1.55	2.20	1.55	1.98	2.66	2.60	3.40	**2.26**
Total (n):	**2,677**	**2,915**	**3,442**	**3,238**	**3,284**	**3,462**	**3,548**	**3,543**	**3,575**	**3,499**	**3,033**	**36,216**

RA: revision arthroplasty.

Bone cement antibiotics

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in hip revision arthroplasties in the Netherlands in 2010-2020



Bone cement antibiotics (%)												
Gentamicin	62.46	58.79	59.54	54.92	54.95	55.15	54.22	62.20	53.10	62.02	61.04	**57.78**
Gentamicin+Clindamycin	20.68	23.90	24.60	30.00	31.37	29.63	31.16	21.87	34.55	29.69	31.24	**28.30**
Erythromycin+Colistin	4.56	8.83	9.23	8.78	9.39	11.04	10.48	10.07	9.07	3.01	2.57	**8.11**
Tobramycin	10.59	7.33	5.20	4.03	2.58	2.92	1.63	2.00	1.19	0.92	0.50	**3.40**
Gentamicin+Vancomycin	0.08	0.00	0.21	1.44	1.60	1.14	2.39	3.80	1.91	4.23	4.57	**1.92**
No antibiotics	1.63	1.15	1.22	0.83	0.11	0.11	0.12	0.07	0.18	0.12	0.07	**0.49**
Total (n):	**1,228**	**1,473**	**1,886**	**1,810**	**1,747**	**1,748**	**1,717**	**1,500**	**1,676**	**1,630**	**1,399**	**17,814**

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 2020

Acetabulum

Cemented (n=1,187)		Uncemented (n=410)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Avantage Cemented	56.4	Continuum	22.7
Polarcup	14.9	Delta-One TT	12.0
Trabecular Metal	5.7	Avantage Reload	10.2
Exeter Rimfit X3	2.8	Trident	8.1
DS Evolution	2.3	Allofit	6.6
Muller low profile Durasul	2.1	Trident Tritanium	6.1
Saturne Dual Mobility Cemented	2.0	Polarcup	3.9
Reflection All Poly XLPE	1.9	Trabecular Metal	3.7
Marathon	1.7	Pinnacle	3.2
IP Cup	1.3	Saturne Dual Mobility	3.2

Femur

Cemented (n=586)		Uncemented (n=672)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Exeter	24.2	Restoration Modular	16.96
Lubinus SPII	21.8	MP Reconstruction Prosthesis	13.39
Original ME Muller	11.1	Arcos	12.5
Spectron EF	7.3	Revitan	10.57
CPT	5.8	Redapt	10.42
C-Stem AMT	4.4	Wagner SL	3.57
MP Reconstruction Prosthesis	3.1	MRS stem	3.27
C-Stem AMT Long	2.6	Alloclassic SLL	2.68
CCA stem	2.4	Taperloc Complete	2.68
Twinsys stem Cemented	2.4	Alloclassic Zweymuller SL	2.53

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 2020

Separately packed bone cement components (n=939)		Bone cement pre-packed in a vacuum mixing system (n=457)	
Name	Proportion (%)	Name	Proportion (%)
Copal G+C	31.4	Palacos R+G	50.8
Palacos R+G	30.9	Refobacin Bone Cement R	41.8
Refobacin Revision	14.4	Refobacin Plus Bone Cement	5.9
Copal G+V	5.8	Refobacin Revision	1.5
Refobacin Bone Cement R	5.5		

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 2015-2019 (n=153,643)

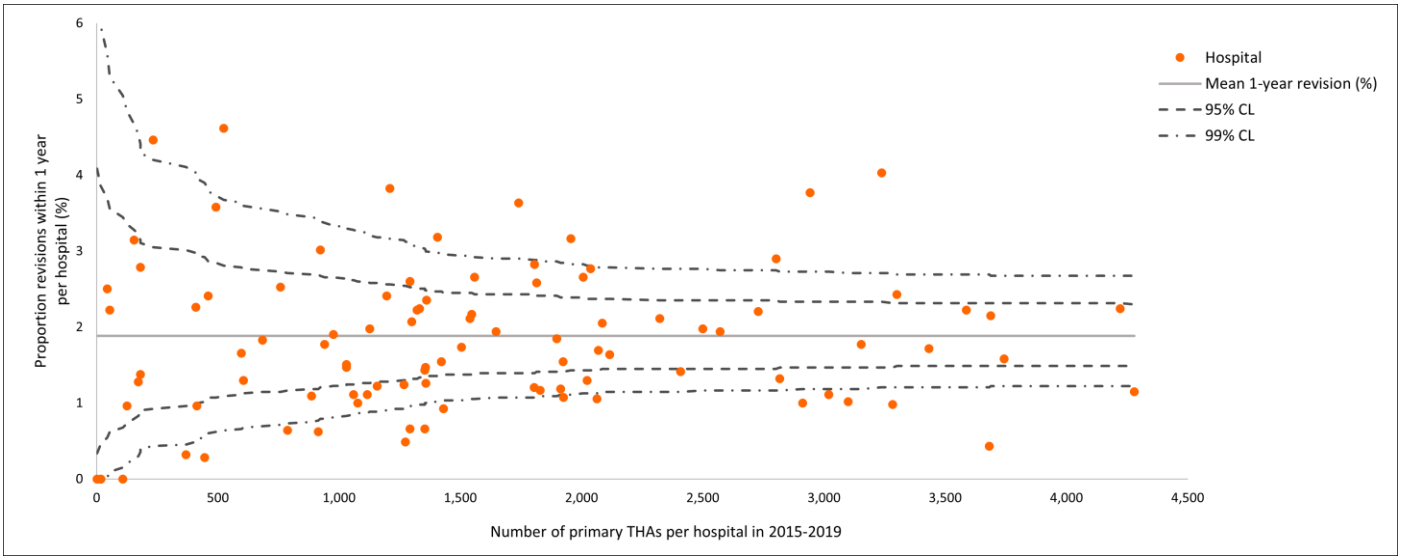
	Cumulative 1-year revision percentage	
	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Any type of revision[1]	1.9 (1.8-1.9)	1.8 (1.7-1.9)
Major revision[2]	1.1 (1.0-1.1)	1.1 (1.0-1.1)
Minor revision[3]	0.8 (0.7-0.8)	0.7 (0.7-0.7)

[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 2015-2019, 1,901 (1.2%) 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 2015-2019 (n=153,576)

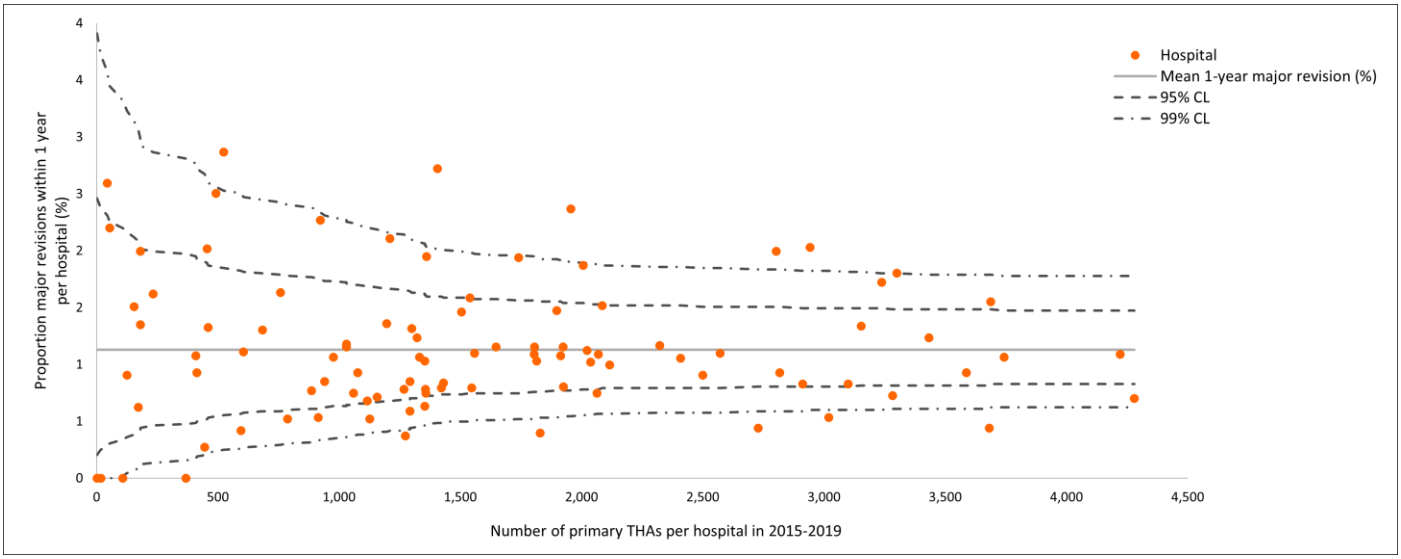


Please note: The proportions of revisions within 1 year per hospital were adjusted for casemix factors age, gender, ASA score, BMI, smoking, charnley score and diagnosis (osteoarthritis versus other).
THA: total hip arthroplasty; CL: control limits; CI: confidence interval.

The mean 1-year revision percentage is 1.9 (95% CI: 1.7-1.9) in the Netherlands in 2015-2019.
Control limits 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 2015-2019 (n=153,574)



Please note: Major revision is defined as revision of at least acetabulum or femur compenent.
Please note: The proportions of revisions within 1 year per hospital were adjusted for casemix factors age, gender, ASA score, BMI, smoking, charnley score and diagnosis (osteoarthritis versus other).
THA: total hip arthroplasty; CL: control limits; CI: confidence interval.

The mean 1-year major revision percentage is 1.1 (95% CI: 1.0-1.1) in the Netherlands in 2015-2019. Control limits 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 2015-2019

Reasons for revision	Major revision[1] (n=526) Proportion[4] (%)	Minor revision[2] (n=438) Proportion[4] (%)	Any type of revision[3] (n=977) Proportion[4] (%)
Infection	15.6	71.9	41.2
Dislocation	34.2	12.6	24.2
Peri-prosthetic fracture	32.7	1.8	18.5
Loosening of femur component	15.2	0.7	8.5
Loosening of acetabulum component	8.2	0.0	4.4
Girdlestone situation	2.7	0.0	1.5
Inlay wear	0.8	0.5	0.6
Peri-articular ossification	0.4	0.0	0.2
Symptomatic MoM bearing	0.0	0.0	0.0
Other	12.9	13.2	13.1

[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. As such, the total proportion is over 100%.

Type of revision per year

TABLE Type of revision within one year after a primary total hip arthroplasty in the Netherlands in 2015-2019 (n=153,643)

Type of revision	Proportion (%)
Major revisions	**1.1**
Only acetabulum component	0.4
Only femur component	0.5
Acetabulum and femur component	0.2
Minor revisions	**0.8**
DAIR	0.5
No DAIR	0.2

Major revision: revision of at least the acetabulum or femur component.
Minor revision: only inlay and/or femoral head exchange.
DAIR: minor revision with infection as reason for revision.
THA: total hip arthroplasty; DAIR: debridement, antibiotics and implant retention.

Time after primary THA

TABLE Time after primary total hip arthroplasty until short-term revision in the Netherlands in 2013-2017 (n=142,876)

Time after primary THA	Percentage revisions (%)
Day 0-29	0.8
Day 30-182	0.6
Day 183-364	0.3
Day 365-730 (second year)	0.6
Day 731-1095 (third year)	0.4

THA: total hip arthroplasty;

Short- and long-term revision

Overall

FIGURE Cumulative revision percentage of total hip arthroplasties by type of revision in the Netherlands in 2007-2020 (n=352,299)

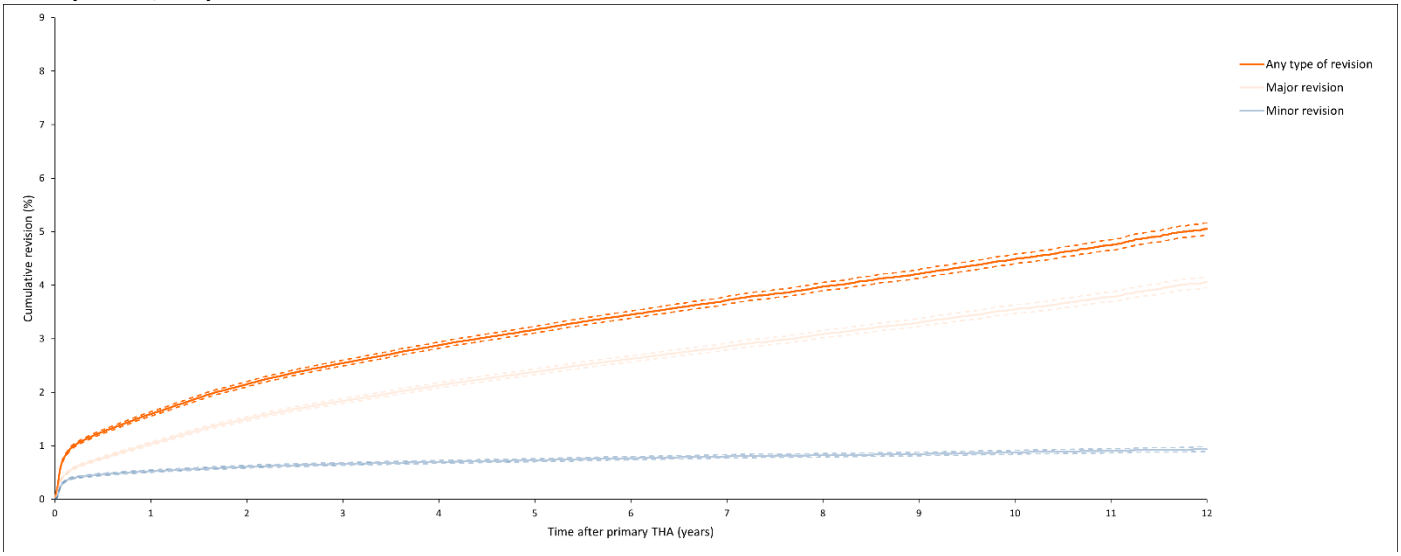


TABLE Cumulative revision percentages

	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Any type of revision			
1-year revision (%)	318,189	1.6 (1.6-1.6)	1.6 (1.5-1.6)
3-year revision (%)	244,691	2.5 (2.5-2.6)	2.6 (2.5-2.6)
5-year revision (%)	179,585	3.2 (3.1-3.2)	3.3 (3.2-3.3)
10-year revision (%)	52,939	4.5 (4.4-4.6)	4.8 (4.7-4.9)
12-year revision (%)	18,200	5.1 (4.9-5.2)	5.6 (5.4-5.7)
Major revision[2]			
1-year revision (%)	319,970	1.0 (1.0-1.1)	1.0 (1.0-1.1)
3-year revision (%)	246,398	1.8 (1.8-1.9)	1.9 (1.8-1.9)
5-year revision (%)	180,868	2.4 (2.3-2.4)	2.4 (2.4-2.5)
10-year revision (%)	53,499	3.6 (3.5-3.6)	3.8 (3.7-3.9)
12-year revision (%)	18,405	4.1 (3.9-4.2)	4.5 (4.4-4.6)
Minor revision[3]			
1-year revision (%)	321,642	0.5 (0.5-0.6)	0.5 (0.5-0.5)
3-year revision (%)	249,755	0.7 (0.6-0.7)	0.7 (0.6-0.7)
5-year revision (%)	184,734	0.7 (0.7-0.8)	0.7 (0.7-0.8)
10-year revision (%)	55,795	0.9 (0.8-0.9)	0.9 (0.9-0.9)
12-year revision (%)	19,381	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 2007-2020, 41,487 (11.8%) primary THAs were implanted in patients who died within twelve years after the primary diagnosis

By gender

FIGURE Cumulative revision percentage of total hip arthroplasties by gender in the Netherlands in 2007-2020 (n=351,763)

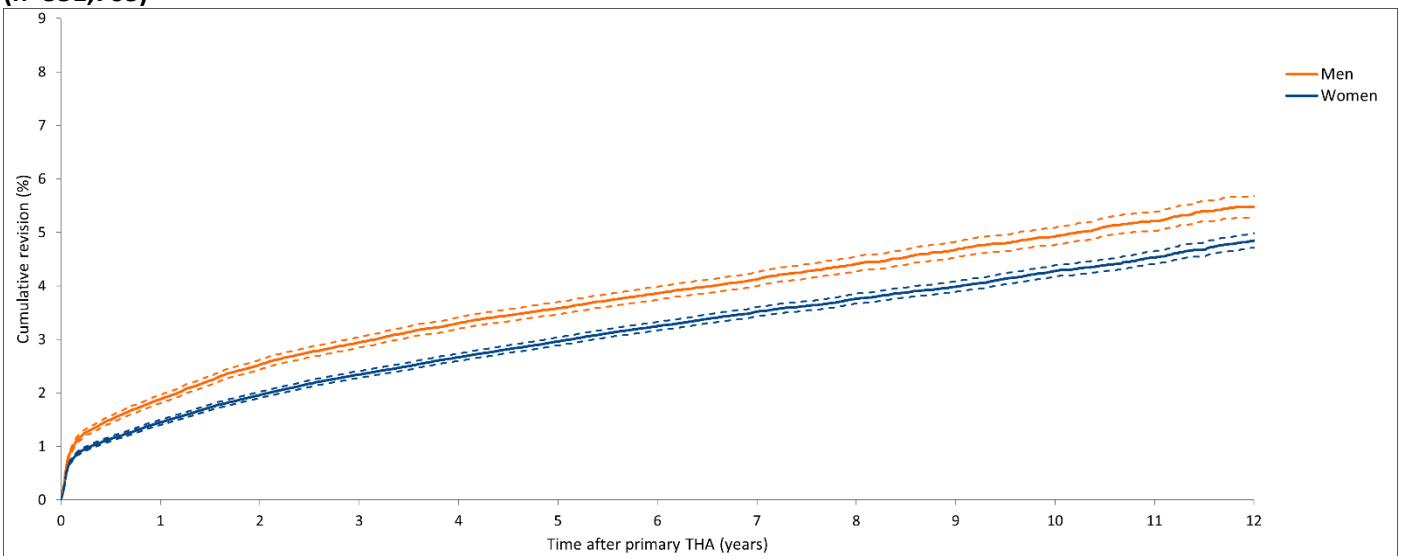


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Gender			
Men	119,245	5.5 (5.3-5.7)	6.1 (5.8-6.3)
Women	232,518	4.8 (4.7-5.0)	5.3 (5.1-5.4)

[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 2007-2020 (n=351,937)

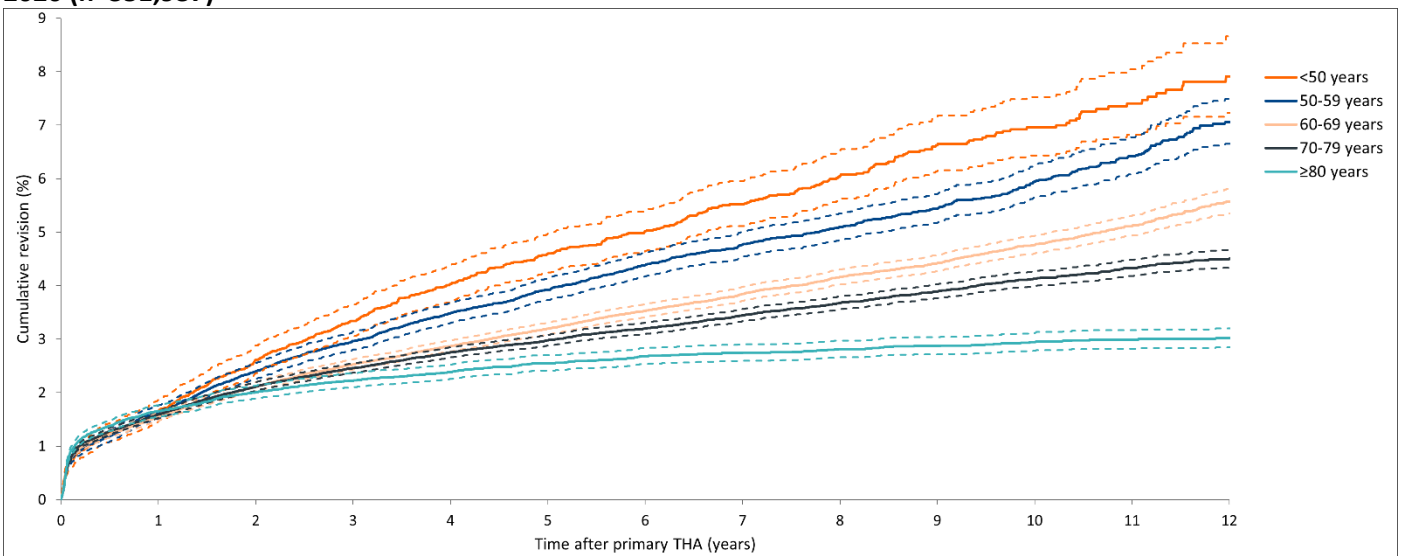


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Age (years)			
<50	15,503	7.9 (7.2-8.7)	8.0 (7.4-8.9)
50-59	43,364	7.1 (6.6-7.5)	7.3 (6.8-7.7)
60-69	110,688	5.6 (5.4-5.8)	5.9 (5.6-6.1)
70-79	129,814	4.5 (4.3-4.7)	5.0 (4.8-5.2)
≥80	52,503	3.0 (2.8-3.2)	3.5 (3.3-3.6)

[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 2007-2020 (n=341,669)

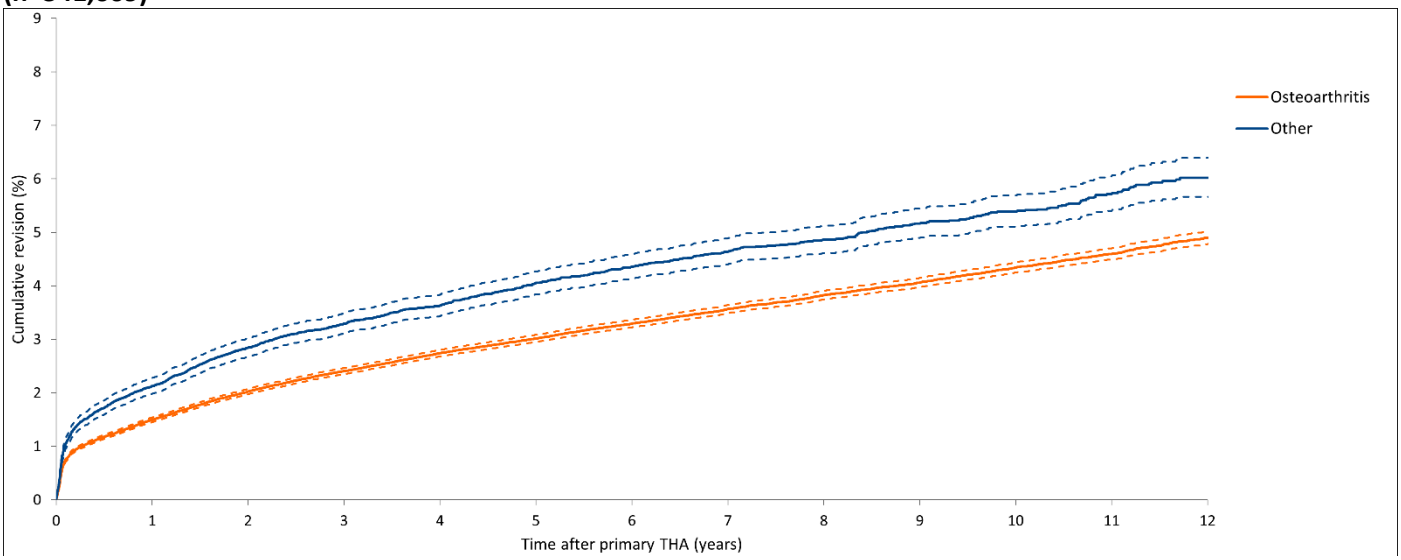


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Diagnosis			
Osteoarthritis	303,914	4.9 (4.8-5.0)	5.4 (5.2-5.5)
Other	37,755	6.0 (5.7-6.4)	6.8 (6.4-7.3)

[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 2007-2020 (n=342,347)

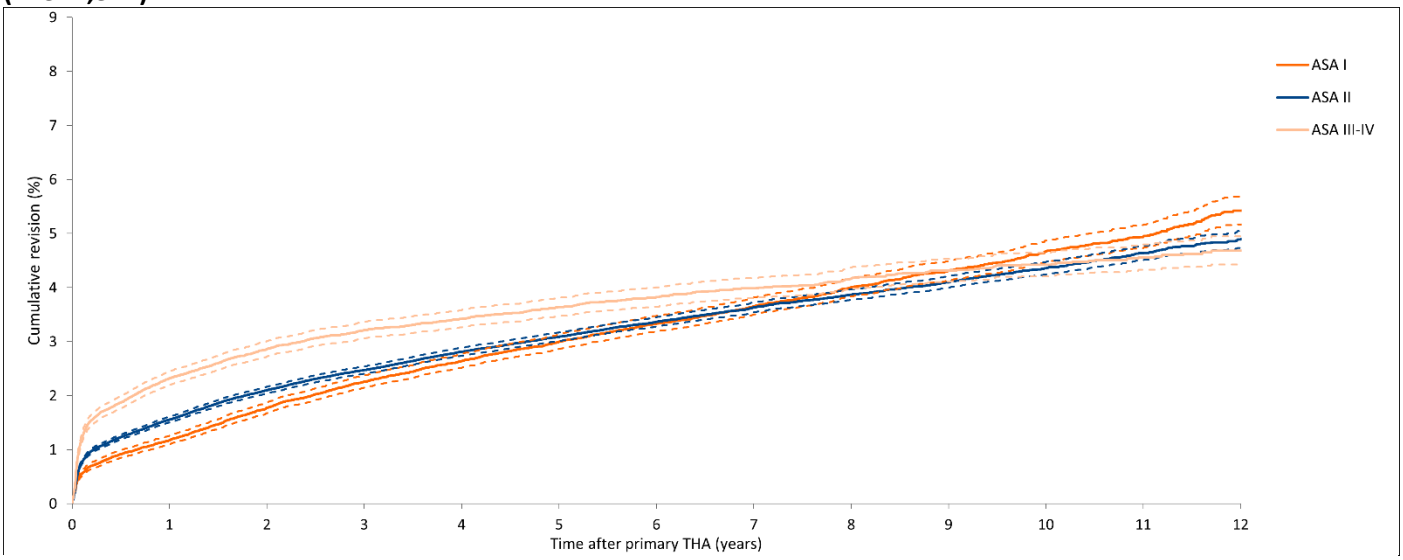


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
ASA score			
I	70,555	5.4 (5.2-5.7)	5.7 (5.4-6.0)
II	214,923	4.9 (4.7-5.0)	5.3 (5.1-5.5)
III-IV	56,869	4.7 (4.4-4.9)	5.5 (5.1-5.9)

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

By BMI category

Figure Cumulative revision percentage of total hip arthroplasties by BMI category in the Netherlands in 2014-2020 (n=204,907)

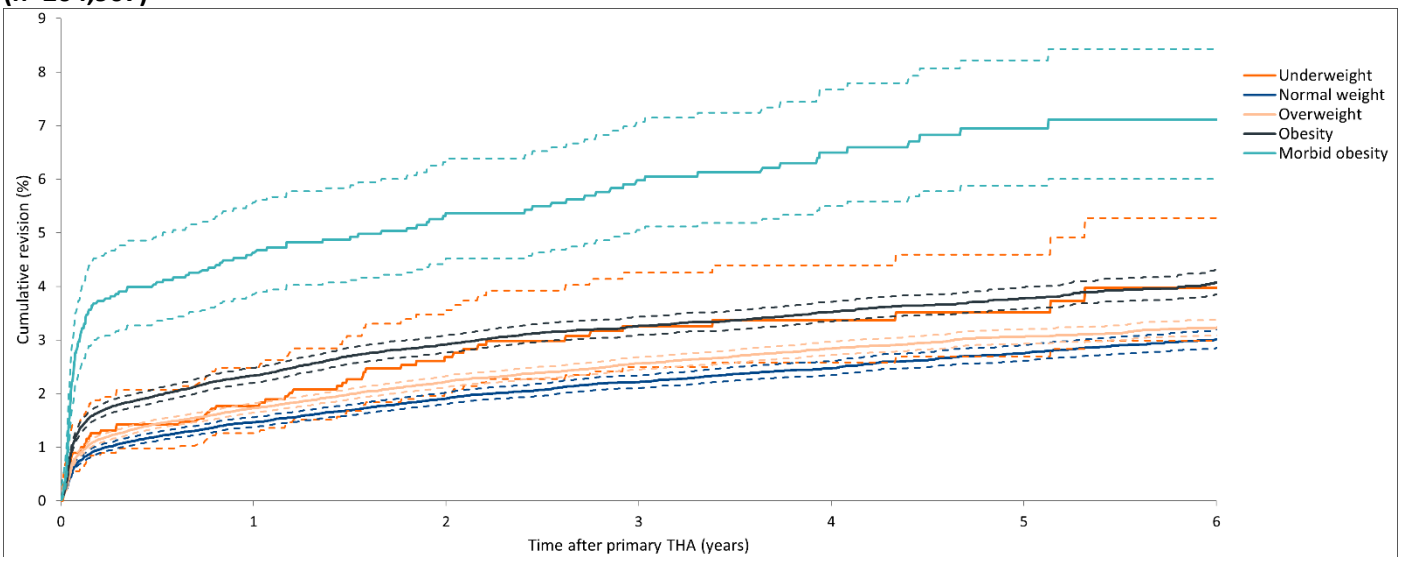


TABLE Cumulative 6-year revision percentage

		Cumulative 6-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Body Mass Index (kg/m²)			
Underweight (≤18,5)	1,915	4.0 (3.0-5.3)	4.3 (3.0-5.6)
Normal weight (>18,5-25)	68,916	3.0 (2.8-3.2)	3.1 (2.9-3.3)
Overweight (>25-30)	85,574	3.2 (3.1-3.4)	3.3 (3.2-3.5)
Obesity (>30-40)	46,100	4.1 (3.8-4.3)	4.1 (3.9-4.4)
Morbid obesity (>40)	2,402	7.1 (6.0-8.4)	7.3 (6.0-8.9)

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
THA: total hip arthroplasty; CI: confidence interval.

By Charnley score

Figure Cumulative revision percentage of total hip arthroplasties by charnley score in the Netherlands in 2014-2020 (n=196,990)

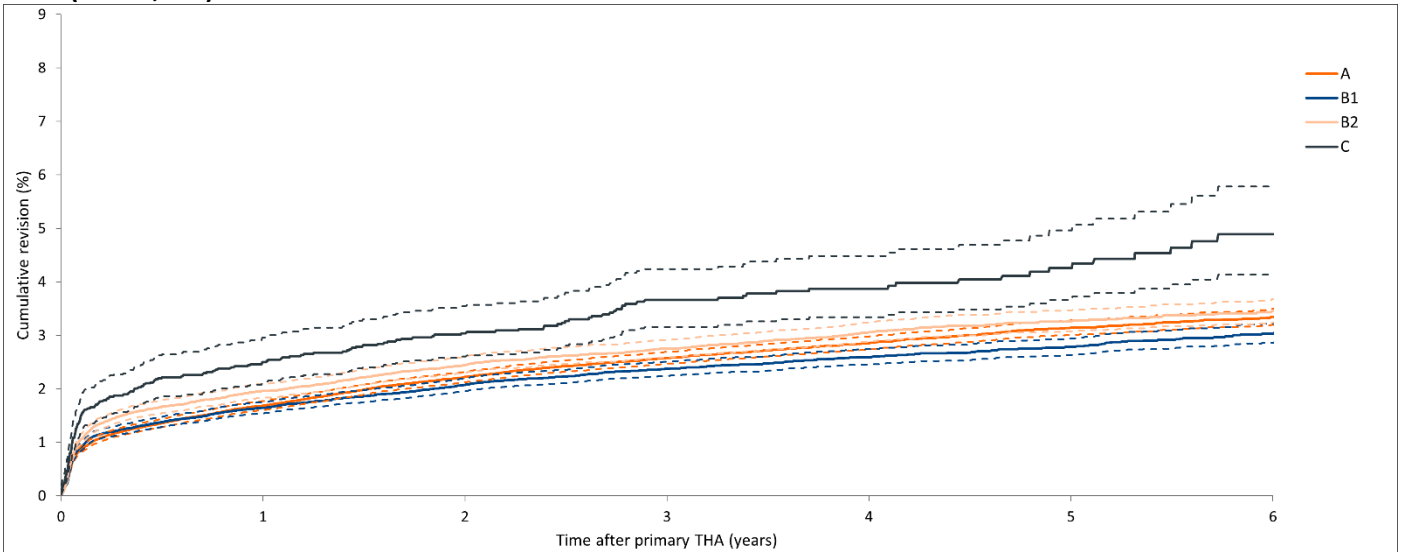


TABLE Cumulative 6-year revision percentage

		Cumulative 6-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Charnley-score			
A One hip joint affected	89,377	3.3 (3.2-3.5)	3.4 (3.3-3.6)
B1 Both hip joints affected	58,484	3.0 (2.9-3.2)	3.1 (2.9-3.3)
B2 Contralateral hip joint with a total hip prosthesis	43,596	3.4 (3.2-3.7)	3.5 (3.3-3.7)
C Multiple joints affected or chronic disease that affects quality of life	5,533	4.9 (4.1-5.8)	5.1 (4.2-6.0)

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
THA: total hip arthroplasty; CI: confidence interval.

By Smoking

Figure Cumulative revision percentage of total hip arthroplasties by smoking in the Netherlands in 2014-2020 (n=200,467)

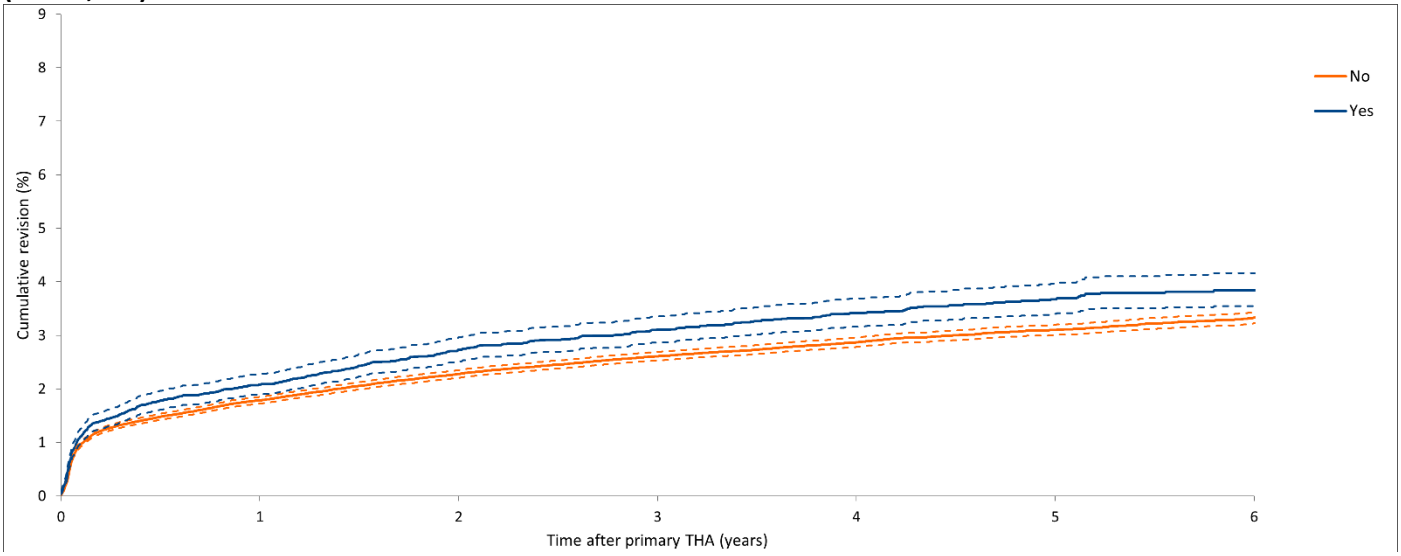


TABLE Cumulative 6-year revision percentage

		Cumulative 6-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Smoking			
No	178,359	3.3 (3.2-3.4)	3.4 (3.3-3.5)
Yes	22,108	3.8 (3.5-4.2)	4.0 (3.7-4.3)

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
THA: total hip arthroplasty; CI: confidence interval.

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 2007-2020 (n=78,492)

					Type of revision (n)					Cumulative revision percentage Kaplan Meier (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	12yr
All cemented THAs for osteoarthritis		**78,492**	**76 (71-80)**	**2,138**	**428**	**228**	**870**	**570**	**42**	**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)**	**4.3 (4.1-4.6)**
Lubinus SPII	IP Cup	13,184	76 (71-81)	322	44	44	142	87	5	1.1 (0.9-1.3)	1.9 (1.7-2.2)	2.5 (2.2-2.8)	2.7 (2.4-3.1)	3.1 (2.7-3.5)	3.6 (3.1-4.2)
Original ME Muller	Muller low profile Durasul	7,568	74 (70-79)	191	26	5	34	123	3	1.7 (1.4-2.0)	2.2 (1.8-2.5)	2.7 (2.3-3.1)	3.0 (2.5-3.4)	3.5 (2.9-4.1)	4.0 (2.9-5.0)
Original ME Muller	Muller low profile	6,148	77 (73-81)	163	22	2	96	37	6	1.4 (1.1-1.7)	2.3 (1.9-2.7)	2.6 (2.2-3.0)	3.0 (2.5-3.5)	3.0 (2.5-3.5)	3.3 (2.7-3.9)
Lubinus SPII	FAL Cup	5,344	75 (70-80)	172	40	8	66	53	5	1.9 (1.5-2.3)	2.6 (2.2-3.1)	3.3 (2.7-3.8)	4.1 (3.4-4.8)	4.6 (3.8-5.4)	4.5 (3.9-7.1)
Spectron EF	Reflection All Poly XLPE	4,744	77 (73-81)	105	35	11	37	22	0	0.7 (0.4-0.9)	1.5 (1.1-1.8)	1.8 (1.4-2.2)	2.6 (2.1-3.1)	2.8 (2.2-3.4)	3.0 (2.4-3.7)
Exeter	Exeter Rimfit X3	4,311	75 (69-80)	89	20	20	20	29	0	1.3 (1.0-1.7)	1.9 (1.5-2.3)	2.4 (1.9-2.9)	2.4 (1.9-2.9)	n.a.	n.a.
Stanmore	Stanmore	3,355	75 (70-80)	70	26	2	36	4	2	0.7 (0.4-1.0)	1.4 (1.0-1.8)	1.9 (1.4-2.4)	2.1 (1.6-2.6)	2.7 (2.0-3.3)	2.7 (2.0-3.3)
Exeter	Exeter Contemporary Hooded	2,811*	77 (72-81)	88	19	19	33	14	3	1.2 (0.8-1.6)	1.7 (1.2-2.2)	2.3 (1.7-2.9)	2.9 (2.2-3.5)	4.3 (3.3-5.3)	4.7 (3.6-5.8)
Lubinus SPII	SHP	2,492*	75 (71-80)	44	9	3	31	1	0	0.2 (0.0-0.4)	0.7 (0.3-1.0)	1.0 (0.6-1.3)	1.7 (1.2-2.2)	2.0 (1.4-2.6)	2.0 (1.4-2.6)
Exeter	Exeter	2,434*	73 (68-79)	138	23	14	67	30	4	2.8 (2.1-3.5)	3.6 (2.8-4.3)	4.2 (3.4-4.9)	5.0 (4.1-5.9)	6.4 (5.3-7.5)	7.1 (5.8-8.4)
Exeter	Exeter Contemporary Flanged	2,396	75 (67-80)	66	15	8	34	7	2	0.7 (0.4-1.1)	1.4 (0.9-1.8)	1.8 (1.3-2.4)	2.2 (1.6-2.8)	3.3 (2.4-4.2)	4.3 (3.0-5.5)
Stanmore	SHP	2,090	75 (71-79)	109	36	5	58	9	1	1.6 (1.1-2.1)	3.1 (2.3-3.8)	4.1 (3.2-5.0)	4.9 (3.9-5.9)	6.0 (4.8-7.2)	6.9 (5.5-8.3)
CCA stem	CCB cup Low Profile	1,592	77 (73-80)	46	7	2	11	25	1	2.0 (1.3-2.7)	2.3 (1.6-3.0)	2.7 (1.8-3.5)	2.9 (2.0-3.8)	4.2 (2.3-5.8)	5.0 (2.8-7.1)
Stanmore	Exceed ABT Cemented	1,235	76 (71-81)	19	3	1	6	9	0	1.1 (0.5-1.6)	1.3 (0.7-2.0)	1.7 (0.7-2.6)	2.8 (0.9-4.7)	n.a.	n.a.
Stanmore	All Poly Arcom Cup	1,052*	74 (69-79)	19	2	4	12	0	1	0.3 (0.0-0.6)	1.3 (0.6-2.0)	1.7 (0.9-2.5)	1.8 (1.0-2.7)	n.a.	n.a.
Lubinus SPII	IP Cup X-Linked	920	77 (72-81)	21	5	2	5	9	0	1.6 (0.7-2.4)	2.5 (1.4-3.5)	2.7 (1.5-3.9)	2.7 (1.5-3.9)	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 (0.5-2.0)	1.3 (0.5-2.0)	1.8 (0.5-3.0)	n.a.
Spectron EF	Mueller cup	825*	77 (72-81)	11	3	2	4	2	0	0.4 (0.0-0.8)	0.8 (0.1-1.3)	1.0 (0.3-1.6)	1.1 (0.4-1.8)	1.3 (0.5-2.0)	1.6 (0.6-2.7)
C-Stem AMT	Marathon	799	80 (76-84)	11	0	2	0	9	0	1.3 (0.5-2.1)	1.5 (0.6-2.5)	n.a.	n.a.	n.a.	n.a.
Twinsys stem Cemented	CCB cup Low Profile	780	80 (76-83)	8	1	2	4	0	1	0.5 (0.0-1.1)	1.1 (0.3-1.9)	1.3 (0.4-2.2)	1.3 (0.4-2.2)	n.a.	n.a.
Original ME Muller	Avantage Cemented	773	77 (71-82)	30	2	1	1	26	0	3.4 (2.1-4.7)	3.9 (2.4-5.4)	5.3 (2.9-7.6)	n.a.	n.a.	n.a.
Spectron EF	Reflection All Poly	615*	77 (74-82)	42	10	0	28	4	0	0.8 (0.1-1.5)	1.8 (0.8-2.9)	2.7 (1.4-4.0)	3.3 (1.8-4.7)	6.7 (4.5-8.8)	8.5 (6.0-11.1)
Lubinus SPII	Avantage Cemented	569	78 (71-82)	18	4	0	1	13	0	2.3 (1.1-3.6)	2.6 (1.2-3.9)	4.1 (1.9-6.2)	5.4 (2.1-8.6)	n.a.	n.a.
Spectron EF	Muller low profile Durasul	503	78 (74-83)	10	4	0	1	5	0	0.8 (0.0-1.6)	1.7 (0.5-2.9)	2.0 (0.7-3.4)	n.a.	n.a.	n.a.
MS30	Muller low profile	496*	78 (74-83)	16	0	8	7	1	0	0.8 (0.0-1.6)	1.7 (0.5-2.8)	2.4 (1.0-3.8)	3.1 (1.4-4.8)	5.0 (2.2-7.7)	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	367	79 (74-84)	10	0	1	0	9	0	2.2 (0.7-3.7)	2.8 (1.1-4.5)	2.8 (1.1-4.5)	n.a.	n.a.	n.a.
GHE-huftstiel	Huftpfanne	271*	75 (71-80)	21	4	3	14	0	0	0.4 (0.0-1.1)	1.5 (0.0-3.0)	2.7 (0.7-4.7)	4.4 (1.9-6.7)	7.4 (4.0-10.8)	11.9 (6.4-17.3)
Exeter	Avantage Cemented	263	73 (63-82)	6	2	2	0	2	0	1.2 (0.0-2.6)	2.3 (0.3-4.4)	3.0 (0.6-5.5)	3.0 (0.6-5.5)	n.a.	n.a.
Charnley Modular	Marathon	255*	71 (76-79)	9	3	4	2	0	0	0.4 (0.0-1.2)	1.2 (0.0-2.6)	1.6 (0.0-3.2)	4.0 (1.4-6.4)	n.a.	n.a.

* Denotes prosthesis combinations with no reported use in primary THAs in 2020.
Please note: n.a. if <50 cases were at risk; THA: total hip 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.

TABLE Cumulative revision percentages of uncemented primary total hip arthroplasties by prosthesis component combination of patients who underwent a THA for osteoarthritis in the Netherlands in 2007-2020 (n=196,494)

					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	12yr
All uncemented THAs for osteoarthritis		**196,494**	**68 (62-74)**	**6,634**	1,069	2,347	**1,725**	**1,371**	**122**	**1.5 (1.5-1.6)**	**2.5 (2.5-2.6)**	**3.2 (3.1-3.3)**	**3.9 (3.8-4.0)**	**4.9 (4.7-5.0)**	**5.7 (5.5-5.8)**
Corail	Pinnacle	33,246	69 (62-75)	760	134	238	157	222	9	1.2 (1.1-1.3)	1.9 (1.8-2.1)	2.4 (2.2-2.6)	2.8 (2.5-3.0)	3.6 (3.2-4.0)	4.0 (3.5-4.4)
Taperloc Complete	Allofit	14,629	67 (61-73)	257	40	96	45	73	3	1.5 (1.3-1.6)	2.1 (1.8-2.3)	2.1 (1.8-2.4)	n.a.	n.a.	n.a.
Alloclassic Zweymuller SL	Allofit	14,104	70 (64-76)	457	73	174	108	97	5	1.1 (1.0-1.3)	2.0 (1.0-1.3)	2.6 (2.3-2.9)	3.1 (2.8-3.4)	4.3 (3.8-4.7)	4.6 (4.1-5.0)
CLS Spotorno	Allofit	10,492	64 (59-69)	444	50	171	118	87	18	2.5 (2.2-2.8)	3.5 (3.2-3.9)	4.1 (3.7-4.5)	4.7 (4.2-5.1)	5.2 (4.6-5.8)	5.8 (4.9-6.7)
Taperloc Complete	Exceed ABT	8,332	69 (63-75)	180	31	69	32	44	4	1.5 (1.2-1.7)	2.0 (1.7-2.3)	2.4 (2.0-2.7)	2.7 (2.2-3.2)	2.9 (2.3-3.4)	n.a.
Accolade	Trident	7,532	69 (62-76)	292	39	154	41	56	2	1.4 (1.1-1.7)	2.9 (2.5-3.3)	3.8 (3.4-4.3)	4.6 (4.0-5.2)	5.7 (4.9-6.6)	8.2 (5.9-10.6)
Polarstem	R3	7,390	69 (62-75)	153	11	51	16	74	1	1.9 (1.6-2.2)	2.5 (2.1-3.0)	2.5 (2.1-3.0)	n.a.	n.a.	n.a.
Mallory Head Stems	Mallory Head	5,978	65 (60-69)	203	27	23	80	67	6	1.4 (1.1-1.7)	2.3 (1.9-2.7)	2.8 (2.3-3.2)	3.3 (2.8-3.7)	3.8 (3.2-4.3)	4.2 (3.6-4.9)
Accolade	Trident Titanium	4,533	68 (62-74)	103	6	39	20	37	1	1.0 (0.7-1.3)	2.0 (1.6-2.4)	2.6 (2.1-3.2)	3.0 (2.4-3.6)	n.a.	n.a.
Taperloc Hip system	Exceed ABT	3,829	68 (62-74)	118	19	31	35	25	8	1.2 (0.8-1.5)	2.3 (1.8-2.8)	2.7 (2.2-3.2)	2.9 (2.4-3.5)	3.4 (2.8-4.1)	n.a.
Twinsys stem Cementless	RM Pressfit Vitamys cup	3,755	66 (60-71)	88	13	41	21	11	2	1.3 (0.9-1.7)	2.0 (1.5-2.4)	2.5 (1.9-3.1)	2.7 (2.0-3.3)	5.1 (3.4-6.7)	n.a.
SL Plus	Bicon Plus	3,744	70 (64-76)	230	35	118	59	16	2	1.6 (1.2-2.0)	3.9 (3.2-4.5)	5.2 (4.5-5.9)	6.1 (5.3-6.9)	7.3 (6.4-8.3)	7.3 (6.4-8.3)
Taperloc Hip system	Mallory Head	3,652	67 (61-71)	129	24	37	46	21	1	1.4 (1.0-1.8)	2.6 (2.0-3.1)	2.9 (2.4-3.5)	3.5 (2.9-4.1)	3.9 (3.2-4.6)	4.9 (3.8-5.9)
Twinsys stem Cementless	RM Pressfit cup	3,133	73 (67-78)	107	15	48	21	22	1	2.4 (1.9-3.0)	3.1 (2.5-3.7)	3.5 (2.8-4.1)	3.9 (3.1-4.7)	4.5 (3.3-5.8)	n.a.
Taperloc Complete	Mallory Head	3,077	67 (61-72)	110	18	24	29	38	1	2.1 (1.6-2.6)	3.1 (2.5-3.7)	3.4 (2.7-4.0)	4.0 (3.2-4.8)	6.1 (3.1-9.1)	n.a.
Synergy	Reflection	2,912*	66 (60-72)	128	11	64	23	29	1	2.1 (1.6-2.7)	2.7 (2.1-3.3)	3.1 (2.5-3.8)	3.6 (2.9-4.3)	4.4 (3.6-5.2)	6.1 (4.8-7.4)
Alloclassic Zweymuller SL	Alloclassic Zweymuller CSF	2,891*	69 (63-75)	121	15	48	21	35	2	1.1 (0.7-1.5)	2.7 (2.1-3.2)	3.3 (2.6-4.0)	3.6 (2.9-4.3)	4.4 (3.6-5.2)	4.8 (3.9-5.6)
Alloclassic offset	Allofit	2,605	71 (64-77)	75	15	28	15	14	3	1.3 (0.9-1.8)	2.0 (1.5-2.6)	2.7 (2.0-3.4)	3.0 (2.3-3.7)	3.8 (2.8-4.7)	4.2 (3.1-5.3)
Symax	Trident	2,066*	69 (63-75)	68	6	16	20	26	0	0.6 (0.3-0.9)	1.7 (1.1-2.2)	2.2 (1.5-2.8)	2.8 (2.0-3.5)	3.3 (2.5-4.1)	3.8 (2.8-4.7)
Synergy	R3	2,063	66 (60-72)	57	7	33	8	7	2	1.8 (1.2-2.4)	2.2 (1.6-2.9)	2.7 (2.0-3.4)	3.0 (2.2-3.8)	3.1 (2.3-4.0)	n.a.
M/L Taper	Allofit IT	1,938	71 (65-76)	64	9	27	18	9	1	2.2 (1.5-2.8)	3.0 (2.2-3.8)	3.6 (2.7-4.5)	4.0 (3.0-5.0)	4.4 (3.1-5.7)	n.a.
Accolade II	Trident	1,880	69 (63-76)	29	2	14	3	9	1	1.6 (1.0-2.2)	3.2 (0.3-6.2)	3.2 (0.3-6.2)	n.a.	n.a.	n.a.
Anthology	R3	1,751	65 (60-69)	57	8	20	14	15	0	2.2 (1.5-2.8)	2.7 (2.0-3.5)	3.6 (2.7-4.6)	3.8 (2.8-4.8)	3.8 (2.8-4.8)	n.a.
Symax	Trident Titanium	1,739*	67 (61-73)	80	9	35	23	12	1	2.3 (1.6-3.0)	3.6 (2.7-4.5)	4.0 (3.0-4.9)	4.7 (3.7-5.7)	4.9 (3.9-6.0)	n.a.
Mallory Head Stems	Exceed ABT	1,630*	65 (59-71)	36	3	15	16	2	0	0.7 (0.3-1.1)	1.6 (1.0-2.2)	1.7 (1.1-2.3)	2.0 (1.3-2.7)	2.6 (1.7-3.4)	n.a.
Omnifit HA	Trident	1,494*	63 (57-67)	140	16	67	24	29	4	3.1 (2.2-4.0)	4.5 (3.4-5.6)	6.3 (5.1-7.5)	7.8 (6.4-9.2)	9.6 (8.1-11.2)	10.1 (8.5-11.8)
Alloclassic Zweymuller SL	Continuum	1,170	70 (64-77)	25	4	11	3	6	1	1.4 (0.5-1.6)	1.7 (0.9-2.5)	2.1 (1.3-3.0)	2.3 (1.4-3.2)	n.a.	n.a.
CLS Spotorno	RM Classic cup	1,169*	63 (58-68)	70	14	20	28	7	1	1.9 (1.1-1.7)	2.7 (1.7-3.6)	3.4 (2.3-4.4)	3.9 (2.8-5.0)	5.1 (3.8-6.4)	6.7 (5.1-8.3)
CLS Spotorno	Pinnacle	1,157*	67 (62-72)	48	7	16	10	15	0	1.3 (0.6-2.0)	2.3 (1.4-3.1)	2.9 (1.9-3.9)	3.7 (2.5-4.9)	5.5 (3.8-7.2)	6.5 (4.3-8.6)
SL Plus Mia	R3	1,106*	71 (65-77)	32	3	16	5	8	0	1.9 (1.1-2.7)	2.7 (1.8-3.7)	3.1 (2.0-4.1)	3.1 (2.0-4.1)	n.a.	n.a.
M/L Taper	Continuum	1,085	69 (63-73)	16	1	13	1	1	0	1.3 (0.6-1.9)	1.7 (0.9-2.5)	1.7 (0.9-2.5)	n.a.	n.a.	n.a.
Corail AMT	Pinnacle	1,045	68 (61-74)	12	1	4	4	3	0	0.9 (0.3-1.5)	1.4 (0.6-2.2)	n.a.	n.a.	n.a.	n.a.
SL Plus	Reflection	1,019*	67 (61-73)	38	4	12	13	9	0	1.8 (1.0-2.6)	3.3 (2.2-4.4)	3.6 (2.4-4.7)	4.0 (2.7-5.3)	n.a.	n.a.
SL Plus	Hofer-Imhoff Lubrimet	971*	70 (64-76)	54	14	26	7	5	2	1.1 (0.5-1.8)	2.2 (1.3-3.1)	3.5 (2.3-4.6)	4.4 (3.1-5.7)	5.4 (4.0-6.9)	5.9 (4.3-7.5)
Polarstem	Reflection	924*	70 (64-76)	17	4	4	2	7	0	1.1 (0.4-1.7)	1.7 (0.8-2.5)	2.4 (1.1-3.7)	2.4 (1.1-3.7)	n.a.	n.a.
Alloclassic Zweymuller SL	Trilogy	821*	70 (64-76)	31	7	10	7	7	0	1.2 (0.5-2.0)	2.2 (1.2-3.2)	2.7 (1.6-3.8)	3.1 (1.9-4.3)	3.8 (2.5-5.2)	4.0 (2.6-5.4)
SL Plus	EP-Fit Plus	781*	68 (63-75)	43	10	22	10	1	0	1.3 (0.5-2.1)	3.0 (1.8-4.2)	3.7 (2.3-5.0)	4.8 (3.3-6.4)	5.8 (4.1-7.6)	6.5 (4.5-8.5)
Alloclassic Zweymuller SL	Alloclassic Variall	767*	71 (64-77)	22	4	10	2	5	1	1.1 (0.3-1.8)	2.0 (1.0-3.0)	2.4 (1.3-3.5)	2.7 (1.5-3.8)	3.1 (1.8-4.5)	3.1 (1.8-4.5)
CLS Spotorno	Fitmore	754*	66 (61-71)	35	3	16	5	10	1	1.7 (0.8-2.7)	2.3 (1.2-3.3)	2.5 (1.4-3.6)	3.2 (1.9-4.5)	4.4 (2.9-5.9)	5.5 (3.6-7.4)
DB10	Spidercup	750*	71 (64-77)	36	2	18	8	7	1	1.5 (0.6-2.3)	2.3 (1.2-3.4)	2.9 (1.7-4.1)	3.8 (2.4-5.2)	5.2 (3.3-7.2)	7.7 (4.6-10.7)
CLS Spotorno	Morscher	711*	73 (68-78)	37	6	19	12	0	0	1.3 (0.4-2.1)	2.6 (1.4-3.8)	3.2 (1.9-4.5)	4.3 (2.7-5.9)	6.4 (4.2-8.5)	7.4 (4.5-10.3)
Summit Tapered	Pinnacle Gription	672	68 (62-73)	15	1	4	2	7	1	2.1 (0.9-3.2)	2.5 (1.2-3.7)	n.a.	n.a.	n.a.	n.a.
CLS Spotorno	RM Pressfit cup	623*	66 (60-71)	48	5	18	17	5	3	3.1 (1.7-4.4)	4.4 (2.8-6.0)	5.7 (3.8-7.5)	6.3 (4.3-8.2)	7.6 (5.4-9.7)	9.7 (6.8-12.5)
CBH stem	RM Pressfit Vitamys cup	591*	65 (60-70)	23	8	6	7	2	0	1.0 (0.2-1.8)	2.4 (1.2-3.6)	3.3 (1.8-4.7)	4.1 (2.4-5.8)	n.a.	n.a.
Avenir Muller	Allofit	585	68 (62-73)	10	0	6	2	2	0	1.3 (0.3-2.2)	1.3 (0.3-2.2)	1.5 (0.5-2.5)	2.0 (0.8-3.3)	2.0 (0.8-3.3)	n.a.
Taperloc Complete	Continuum	583	67 (57-73)	10	2	4	0	4	0	1.8 (0.7-3.0)	n.a.	n.a.	n.a.	n.a.	n.a.
Alloclassic Zweymuller SL	Trabecular Metal	547*	68 (62-75)	23	2	7	7	6	1	0.6 (0.0-1.2)	1.9 (0.7-3.0)	2.6 (1.3-4.0)	3.2 (1.7-4.7)	3.4 (1.8-4.9)	5.1 (2.8-7.3)
CBH stem	RM Pressfit cup	546*	75 (69-79)	21	4	6	9	2	0	2.0 (0.8-3.2)	3.3 (1.8-4.9)	3.6 (2.0-5.2)	4.1 (2.3-5.8)	n.a.	n.a.

* Denotes prosthesis combinations with no reported use in primary THAs in 2020.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.

Only combinations with over 500 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

TABLE Cumulative revision percentages of the most frequently types of bone cement by type of mixing system in primary total hip arthroplasties in the Netherlands in 2007-2020

		Cumulative revision percentage Kaplan Meier (95% CI)					
Bone cement	**n**	**1yr**	**3yr**	**5yr**	**7yr**	**10yr**	**12yr**
Separately packed bone cement components (n=86,541)							
Palacos R+G	66,000	1.5 (1.4-1.6)	2.4 (2.3-2.5)	3.0 (2.9-3.1)	3.5 (3.3-3.6)	4.2 (4.0-4.4)	4.8 (4.5-5.1)
Refobacin Bone Cement R	6,077	0.9 (0.7-1.2)	1.8 (1.5-2.1)	2.2 (1.8-2.6)	2.7 (2.3-3.2)	3.6 (3.0-4.1)	3.7 (3.1-4.3)
Palacos MV+G	3,614	0.9 (0.6-1.2)	1.5 (1.1-1.9)	2.2 (1.6-2.7)	3.3 (2.6-4.0)	3.7 (2.8-4.5)	n.a.
Simplex ABC EC	2,664	2.2 (1.6-2.8)	3.6 (2.9-4.3)	4.4 (3.6-5.2)	5.1 (4.2-6.0)	7.0 (5.6-8.4)	8.9 (6.5-11.2)
Simplex ABC Tobra	2,308	2.0 (1.4-2.5)	3.1 (2.4-3.8)	3.8 (3.0-4.5)	4.4 (3.6-5.3)	6.2 (5.1-7.3)	7.4 (6.0-8.7)
Simplex P	1,379	0.7 (0.3-1.2)	1.8 (1.1-2.5)	1.8 (1.1-2.5)	2.0 (1.2-2.8)	2.7 (1.6-3.9)	2.7 (1.6-3.9)
Simplex HV	586*	0.7 (0.0-1.4)	0.9 (0.1-1.6)	2.5 (1.0-4.0)	n.a.	n.a.	n.a.
Refobacin Plus Bone Cement	560*	1.6 (0.6-2.7)	2.6 (1.2-3.9)	3.4 (1.9-5.0)	3.7 (2.1-5.4)	4.5 (2.5-6.4)	5.1 (2.8-7.5)
Palamed G	493*	0.4 (0.0-1.0)	0.8 (0.0-1.6)	1.3 (0.3-2.3)	2.0 (0.7-3.2)	3.0 (1.4-4.6)	3.3 (1.6-5.0)
Biomet Plus Bone Cement	458*	0.4 (0.0-1.0)	1.3 (0.3-2.4)	2.5 (1.0-4.0)	3.3 (1.6-4.9)	4.3 (2.3-6.3)	5.4 (3.1-7.6)
CMW 1 Gentamicin Bone Cement	326*	1.9 (0.4-3.3)	2.8 (1.0-4.6)	3.1 (1.2-5.0)	3.1 (1.2-5.0)	4.0 (1.7-6.2)	4.5 (2.1-6.8)
Palacos R	314	1.6 (0.2-3.0)	2.7 (0.8-4.5)	4.2 (1.8-6.5)	5.0 (2.4-7.6)	6.4 (3.2-9.6)	n.a.
Subiton G	284	1.3 (0.0-2.8)	n.a.	n.a.	n.a.	n.a.	n.a.
Palamed	277*	1.1 (0.0-2.3)	2.5 (0.7-4.4)	3.7 (1.4-5.9)	3.7 (1.4-5.9)	6.1 (3.2-9.0)	7.0 (3.9-10.1)
Bone cement pre-packed in a vacuum mixing system (n=26,953)							
Refobacin Bone Cement R	13,609	2.0 (1.7-2.2)	2.8 (2.5-3.1)	3.4 (3.0-3.7)	4.1 (3.6-4.5)	6.1 (4.2-8.0)	n.a.
Palacos R+G	8,745	2.1 (1.8-2.4)	2.8 (2.4-3.2)	3.7 (3.0-4.3)	n.a.	n.a.	n.a.
Refobacin Plus Bone Cement	4,044	1.2 (0.9-1.5)	2.1 (1.6-2.5)	2.5 (2.0-3.1)	3.0 (2.4-3.7)	3.2 (2.6-3.9)	4.5 (2.6-6.3)
Cemex Genta	433*	1.2 (0.1-2.2)	1.9 (0.6-3.2)	2.2 (0.8-3.5)	2.2 (0.8-3.5)	n.a.	n.a.

* Denotes types of bone cement with no reported use in primary THAs in 2020.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.

Only types of bone cement 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.

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)

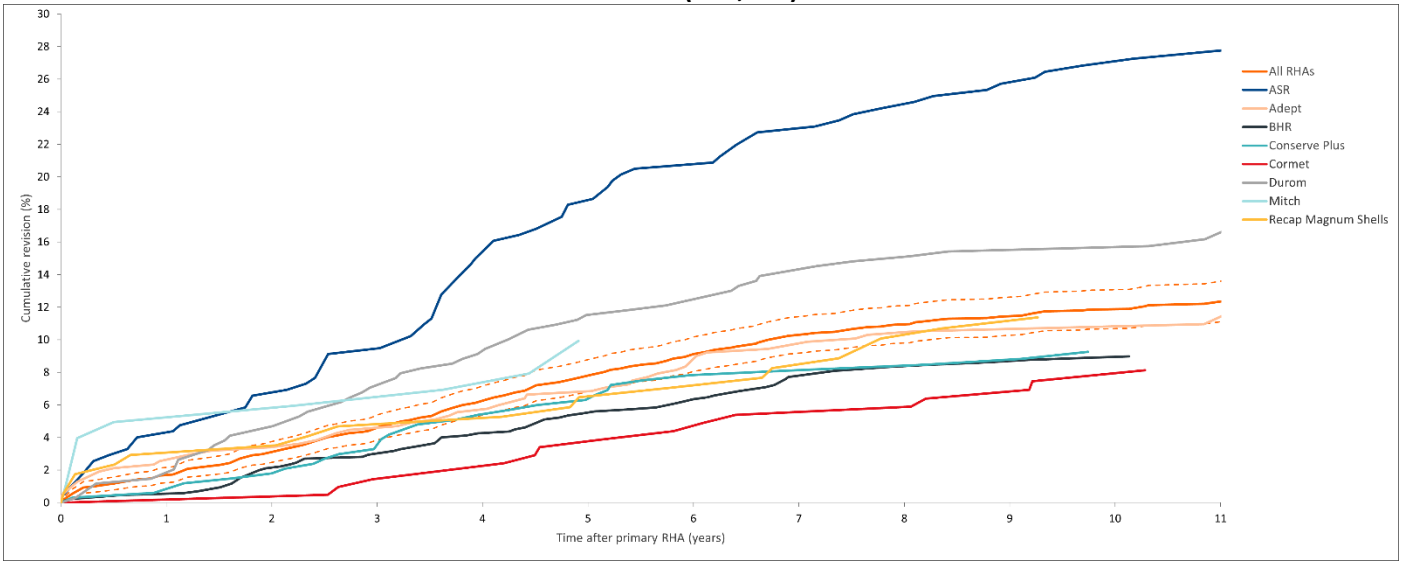


TABLE Cumulative revision percentages of primary resurfacing hip arthroplasties by type of prosthesis

				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 2007-2020 (n=78,492)

					Cumulative revision percentage Kaplan Meier (95% CI)					
Femur component	Acetabulum component	Total primary THAs (n)	Median (IQR) age (yr)	Major revision[1] arthroplasties (n)	1yr	3yr	5yr	7yr	10yr	12yr
All cemented THAs for osteoarthritis		**78,492**	**76 (71-80)**	**1,526**	**0.6 (0.6-0.7)**	**1.3 (1.2-1.3)**	**1.7 (1.6-1.8)**	**2.4 (2.2-2.5)**	**2.9 (2.7-3.0)**	**3.4 (3.2-3.7)**
Lubinus SPII	IP Cup	13,184	76 (71-81)	230	0.5 (0.4-0.6)	1.3 (1.1-1.4)	1.8 (1.5-2.0)	2.0 (1.7-2.3)	2.4 (2.1-2.8)	2.9 (2.4-3.4)
Original ME Muller	Muller low profile Durasul	7,568	74 (70-79)	65	0.2 (0.2-0.5)	0.6 (0.4-0.8)	1.0 (0.7-1.3)	1.2 (0.8-1.5)	1.5 (1.0-1.9)	1.5 (1.0-1.9)
Original ME Muller	Muller low profile	6,148	77 (73-81)	120	0.8 (0.6-1.1)	1.6 (1.3-2.0)	1.9 (1.6-2.3)	2.3 (1.8-2.7)	2.3 (1.8-2.7)	2.6 (2.0-3.1)
Lubinus SPII	FAL Cup	5,344	75 (70-80)	114	0.8 (0.6-1.1)	1.5 (1.1-1.9)	2.2 (1.7-2.6)	3.0 (2.4-3.6)	3.5 (2.7-4.3)	4.4 (2.8-6.0)
Spectron EF	Reflection All Poly XLPE	4,744	77 (73-81)	83	0.3 (0.2-0.5)	1.0 (0.7-1.3)	1.4 (1.1-1.8)	2.1 (1.6-2.5)	2.3 (1.8-2.8)	2.5 (1.9-3.1)
Exeter	Exeter Rimfit X3	4,311	75 (69-80)	60	0.7 (0.5-1.0)	1.3 (0.9-1.6)	1.7 (1.3-2.1)	1.7 (1.3-2.1)	n.a.	n.a.
Stanmore	Stanmore	3,355	75 (70-80)	64	0.6 (0.3-0.8)	1.3 (0.9-1.7)	1.7 (1.3-2.2)	1.9 (1.4-2.4)	2.4 (1.8-3.1)	2.4 (1.8-3.1)
Exeter	Exeter Contemporary Hooded	2,811*	77 (72-81)	71	0.7 (0.4-1.0)	1.2 (0.8-1.6)	1.7 (1.2-2.2)	2.2 (1.6-2.8)	3.7 (2.7-4.6)	4.0 (3.0-5.1)
Lubinus SPII	SHP	2,492*	75 (71-80)	43	0.2 (0.0-0.4)	0.6 (0.3-0.9)	0.9 (0.5-1.3)	1.7 (1.1-2.2)	2.0 (1.4-2.6)	2.0 (1.4-2.6)
Exeter	Exeter	2,434*	73 (68-79)	104	1.7 (1.1-2.2)	2.3 (1.7-2.9)	2.9 (2.2-3.6)	3.7 (2.9-4.4)	4.9 (4.0-5.9)	5.5 (4.4-6.7)

[1] Revision of at least the acetabulum or femur component.
* Denotes prosthesis combinations with no reported use in primary THAs in 2020.
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 2007-2020 (n=196,494)

					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		**196,494**	**68 (62-74)**	**5,141**	**1.1 (1.0-1.1)**	**1.9 (1.8-1.9)**	**2.5 (2.4-2.6)**	**3.0 (2.9-3.1)**	**3.9 (3.8-4.0)**	**4.6 (4.4-4.8)**
Corail	Pinnacle	33,246	69 (62-75)	529	0.7 (0.6-0.8)	1.3 (1.2-1.4)	1.7 (1.5-1.8)	2.0 (1.8-2.2)	2.6 (2.3-2.9)	3.0 (2.5-3.4)
Taperloc Complete	Allofit	14,629	67 (61-73)	181	1.0 (0.8-1.1)	1.5 (1.3-1.7)	1.5 (1.3-1.8)	n.a.	n.a.	n.a.
Alloclassic Zweymuller SL	Allofit	14,104	70 (64-76)	355	0.8 (0.7-1.0)	1.5 (1.3-1.7)	2.0 (1.8-2.3)	2.4 (2.1-2.6)	3.3 (2.9-3.7)	3.6 (3.2-4.0)
CLS Spotorno	Allofit	10,492	64 (59-69)	339	1.8 (1.5-2.0)	2.6 (2.3-2.9)	3.1 (2.7-3.4)	3.6 (3.2-4.0)	4.1 (3.6-4.7)	4.7 (3.9-5.6)
Taperloc Complete	Exceed ABT	8,332	69 (63-75)	132	1.1 (0.9-1.3)	1.5 (1.2-1.7)	1.7 (1.4-2.0)	2.0 (1.6-2.5)	2.2 (1.7-2.7)	n.a.
Accolade	Trident	7,532	69 (62-76)	234	1.0 (0.8-1.3)	2.3 (1.9-2.6)	3.1 (2.7-3.5)	3.6 (3.1-4.1)	4.7 (3.9-5.5)	7.1 (4.8-9.3)
Polarstem	R3	7,390	69 (62-75)	78	0.9 (0.7-1.1)	1.4 (1.0-1.8)	1.4 (1.0-1.8)	n.a.	n.a.	n.a.
Mallory Head Stems	Mallory Head	5,978	65 (60-69)	130	0.9 (0.7-1.1)	1.4 (1.1-1.7)	1.8 (1.5-2.2)	2.2 (1.8-2.5)	2.4 (2.0-2.9)	2.7 (2.2-3.2)
Accolade	Trident Tritanium	4,533	68 (62-74)	65	0.5 (0.3-0.7)	1.2 (0.9-1.6)	1.7 (1.2-2.1)	2.0 (1.5-2.5)	n.a.	n.a.
Taperloc Hip system	Exceed ABT	3,829	68 (62-74)	85	0.9 (0.6-1.2)	1.7 (1.3-2.1)	1.9 (1.5-2.4)	2.1 (1.7-2.6)	2.5 (1.9-3.1)	2.5 (1.9-3.1)

[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 2007-2020 (n=10,886)

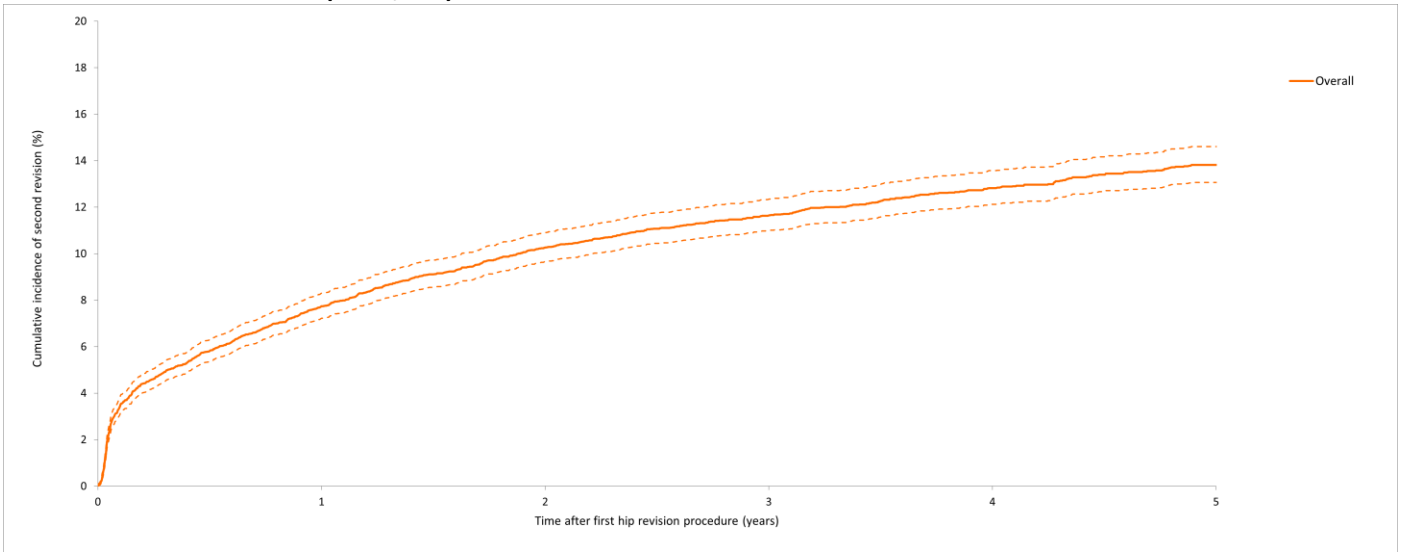


TABLE Cumulative second revision percentages

	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
1-year second revision (%)	8,916	7.9 (7.4-8.4)	7.9 (7.4-8.4)
3-year second revision (%)	6,022	11.7 (11.1-12.4)	12.0 (11.3-12.6)
5-year second revision (%)	3,818	13.6 (13.0-14.4)	14.1 (13.4-14.8)
7-year second revision (%)	2,223	15.3 (14.5-16.1)	16.1 (15.2-16.9)

[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 2007-2020 (n=10,886)

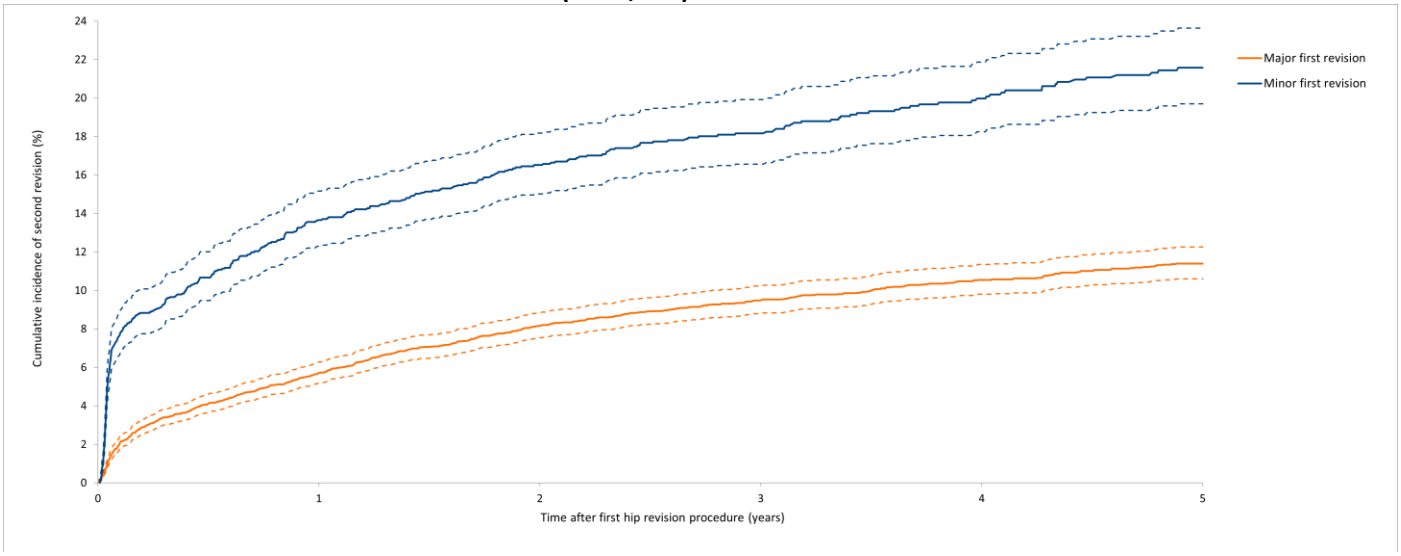


TABLE Cumulative second revision percentages

	Number of first revisions (n)	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Major first revision	8,280			
1-year second revision (%)		6,817	5.7 (5.3-6.3)	5.8 (5.3-6.3)
3-year second revision (%)		4,638	9.5 (8.9-10.2)	9.8 (9.1-10.5)
5-year second revision (%)		3,051	11.3 (10.6-12.1)	11.7 (10.9-12.5)
Minor first revision	2,606			
1-year second revision (%)		1,950	14.0 (12.8-15.5)	14.1 (12.8-15.5)
3-year second revision (%)		1,256	18.3 (16.8-20.0)	18.6 (17.1-20.2)
5-year second revision (%)		672	20.9 (19.3-22.7)	21.5 (19.7-23.3)

[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 2007-2020 (n=9,094)

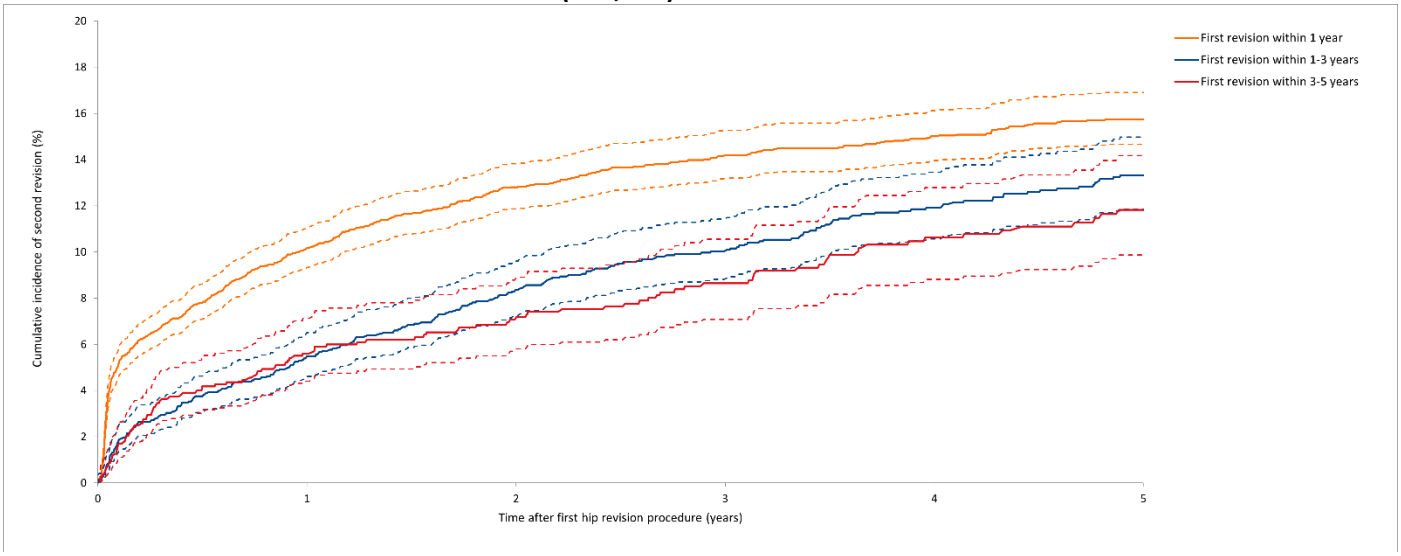


TABLE Cumulative second revision percentages

	Number of first revisions (n)	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
First revision within 1 year	5,293			
1-year second revision (%)		4,236	10.4 (9.6-11.3)	10.5 (9.6-11.3)
3-year second revision (%)		2,932	14.5 (13.5-15.5)	14.7 (13.7-15.7)
5-year second revision (%)		1,940	15.8 (14.8-16.9)	16.2 (15.1-17.3)
First revision within 1-3 years	2,491			
1-year second revision (%)		2,137	5.5 (4.7-6.5)	5.5 (4.6-6.4)
3-year second revision (%)		1,592	9.8 (8.7-11.2)	10.0 (8.8-11.2)
5-year second revision (%)		1,088	12.9 (11.5-14.4)	13.3 (11.8-14.8)
First revision within 3-5 years	1,310			
1-year second revision (%)		1,093	5.6 (4.5-7.0)	5.7 (4.4-6.9)
3-year second revision (%)		774	8.3 (6.9-10.1)	8.5 (6.9-10.1)
5-year second revision (%)		519	11.3 (9.5-13.4)	11.7 (9.7-13.7)

[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 2007-2020

	Major first revision[1] (n=794)	Minor first revision[2] (n=479)	Any type of first revision[3] (n=1,307)
Reasons for second revision	**Proportion[4] (%)**	**Proportion[4] (%)**	**Proportion[4] (%)**
Infection	29.0	57.2	40.2
Dislocation	28.2	29.0	27.9
Loosening of acetabulum component	20.5	4.6	14.2
Loosening of femur component	18.4	4.8	12.9
Peri-prosthetic fracture	9.8	1.9	6.8
Inlay wear	3.3	3.1	3.1
Symptomatic MoM bearing	1.3	0.4	1.0
Peri-articular ossification	1.3	0.2	0.8
Other	14.4	7.5	12.0

[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

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=91) in the Netherlands in 2014-2020

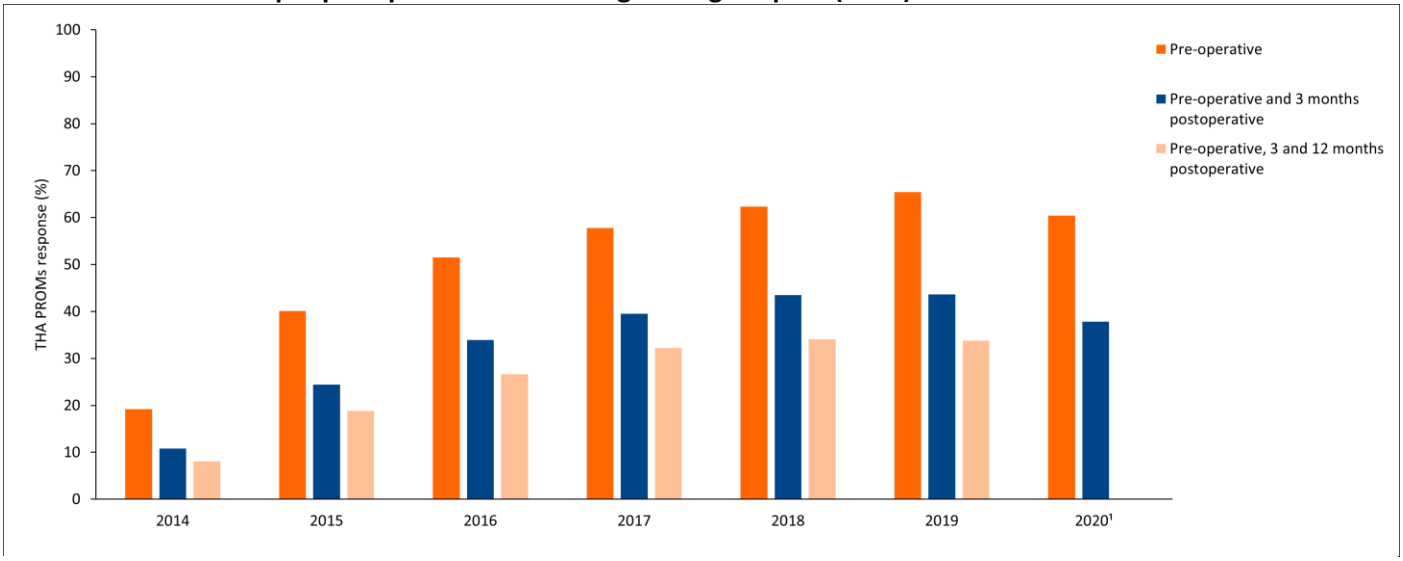


TABLE PROMs response percentages

Year	2014	2015	2016	2017	2018	2019	2020¹
THA for osteoarthritis (n)	23,406	24,057	24,670	25,565	26,909	27,647	22,036
THA PROMs response (%)							
Pre-operative	19.2	40.1	51.5	57.8	62.3	65.4	60.4
Pre-operative and 3 months postoperative	10.8	24.4	33.9	39.5	43.5	43.6	37.8
Pre-operative, 3 and 12 months postoperative	8.1	18.8	26.6	32.2	34.1	33.8	n.a.

¹ The 12 months postoperative PROMs response percentage is not (yet) available for 2020. The 3 months postoperative response percentage is not (yet) available after October 1st 2020. In total, 16,598 patients underwent a THA for osteoarthritis between January 1st and October 1st 2020.
THA: total hip arthroplasty; PROM: patient reported outcome measure.

Mean scores

NRS (rest)

FIGURE Mean pre-operative, 3 months and 12 months postoperative NRS (activity) scores of patients who underwent a THA for osteoarthritis by ASA score in the Netherlands in 2014-2020

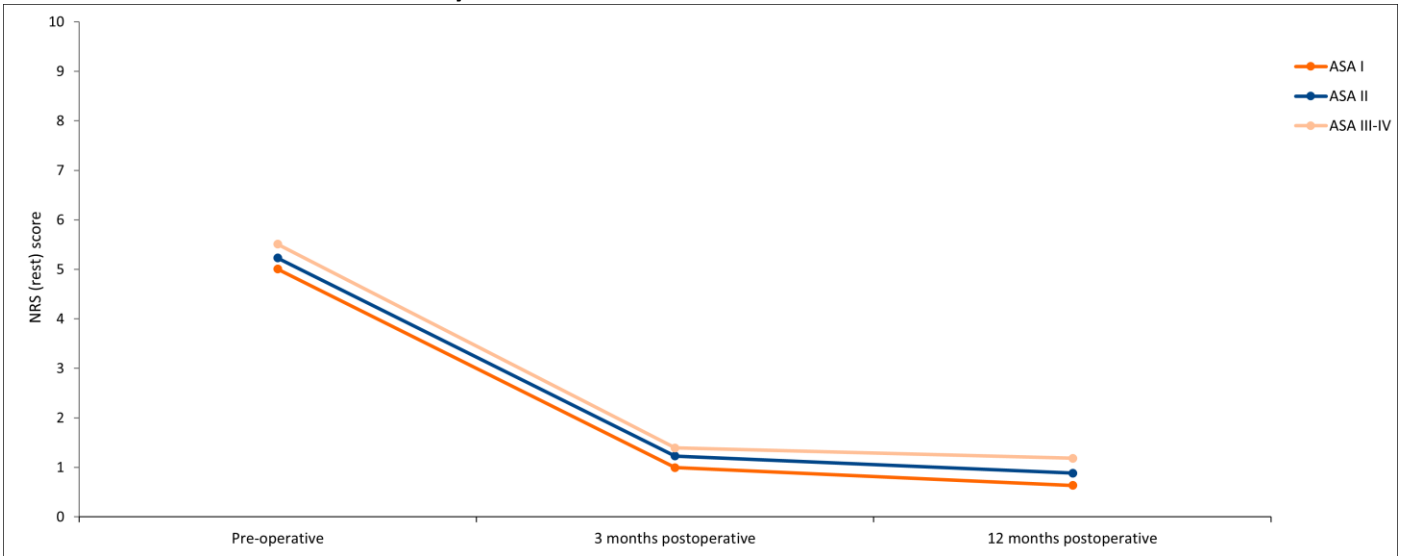


TABLE Mean NRS (rest) scores

NRS (rest) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	14,961	5.0 (5.0-5.0)	11,943	1.0 (1.0-1.0)	2,470	0.6 (0.6-0.7)
ASA II	55,922	5.2 (5.2-5.3)	41,282	1.2 (1.2-1.2)	8,847	0.9 (0.8-0.9)
ASA III-IV	16,359	5.5 (5.5-5.5)	11,255	1.4 (1.4-1.4)	2,889	1.1 (1.1-1.3)
Total	87,272	5.2 (5.2-5.3)	64,501	1.2 (1.2-1.2)	14,206	0.9 (0.9-0.9)

[1] The 12 months NRS (rest) score is not (yet) available for 2020.
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 EQ-5D index scores of patients who underwent a THA for osteoarthritis by ASA score in the Netherlands in 2014-2020

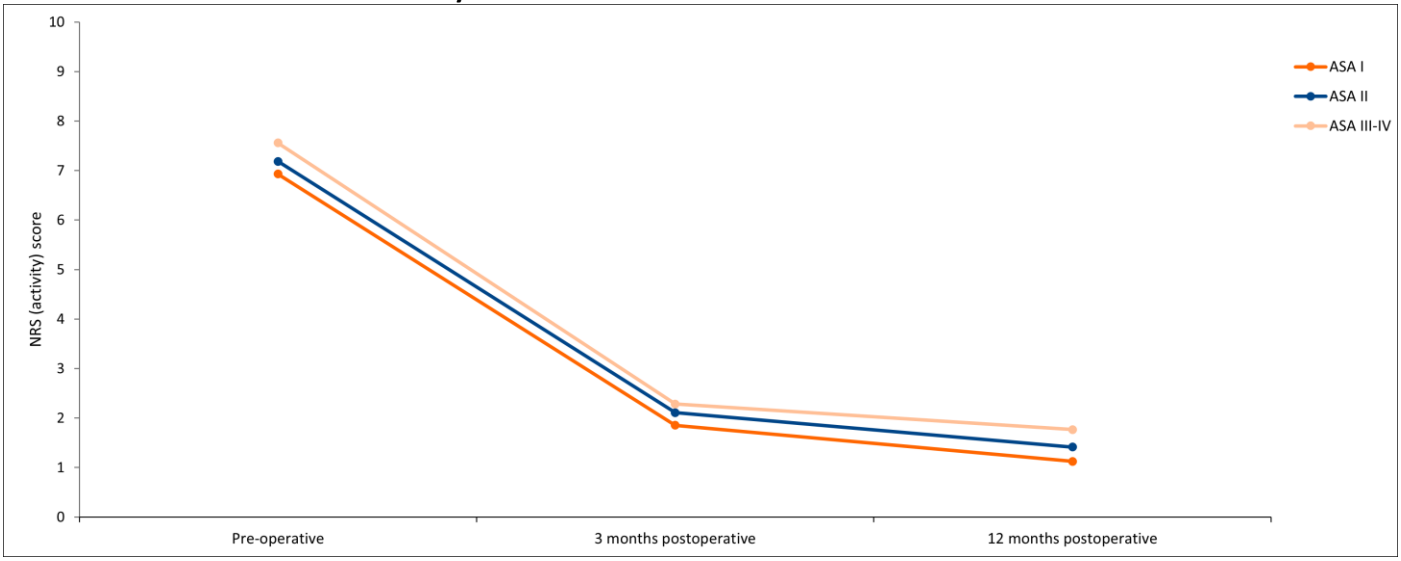


TABLE Mean NRS (activity) scores

NRS (activity) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	15,029	6.9 (6.9-7.0)	11,954	1.9 (1.8-1.9)	2,471	1.1 (1.1-1.2)
ASA II	56,048	7.2 (7.2-7.2)	41,327	2.1 (2.1-2.1)	8,849	1.4 (1.4-1.5)
ASA III-IV	16,380	7.6 (7.5-7.6)	11,251	2.3 (2.2-2.3)	2,884	1.8 (1.7-1.9)
Total	87,487	7.2 (7.2-7.2)	64,553	2.1 (2.1-2.1)	14,204	1.4 (1.4-1.5)

[1] The 12 months NRS (activity) score is not (yet) available for 2020.
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 thermometer scores of patients who underwent a THA for osteoarthritis by ASA score in the Netherlands in 2014-2020

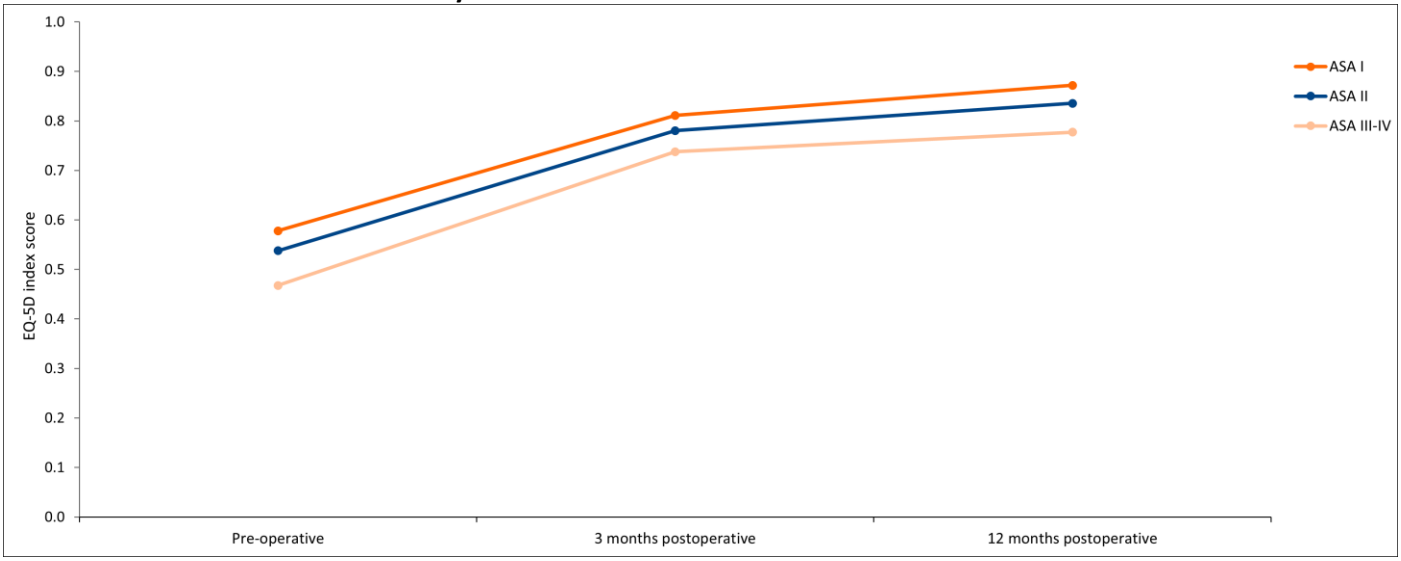


TABLE Mean EQ-5D index scores

EQ-5D Index score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	15,168	0.58 (0.58-0.58)	11,935	0.81 (0.81-0.81)	2,423	0.87 (0.87-0.88)
ASA II	56,324	0.54 (0.54-0.54)	40,876	0.78 (0.78-0.78)	8,688	0.84 (0.83-0.84)
ASA III-IV	16,317	0.47 (0.46-0.47)	11,069	0.74 (0.73-0.74)	2,792	0.78 (0.77-0.78)
Total	87,845	0.53 (0.53-0.53)	63,903	0.78 (0.78-0.78)	13,903	0.83 (0.83-0.83)

[1] The 12 months EQ-5D index score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

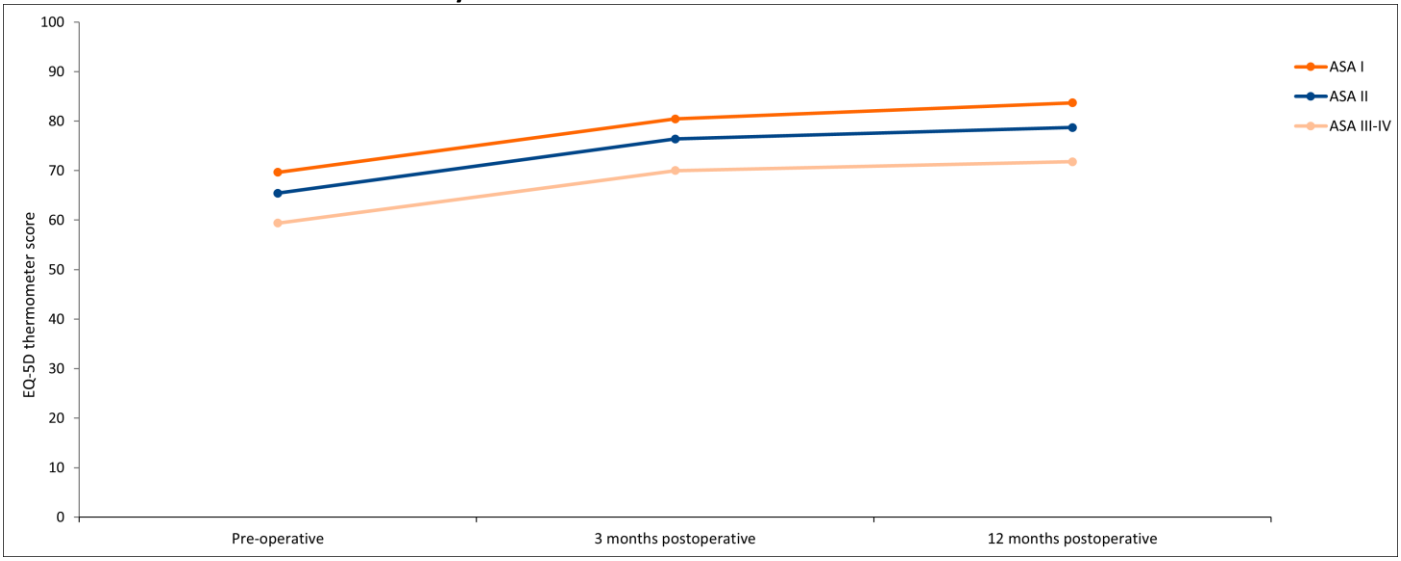


TABLE Mean EQ-5D thermometer scores

EQ-5D thermometer score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	15,205	69.7 (69.4-70.0)	12,047	80.4 (80.1-80.7)	2,430	83.7 (83.1-84.3)
ASA II	56,462	65.4 (65.3-65.5)	41,330	76.4 (76.2-76.6)	8,673	78.7 (78.3-79.1)
ASA III-IV	16,348	59.4 (59.1-59.7)	11,225	70.0 (69.6-70.4)	2,798	71.8 (71.0-72.5)
Total	88,052	65.1 (64.9-65.2)	64,625	76.0 (75.9-76.2)	13,902	78.2 (77.9-78.5)

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

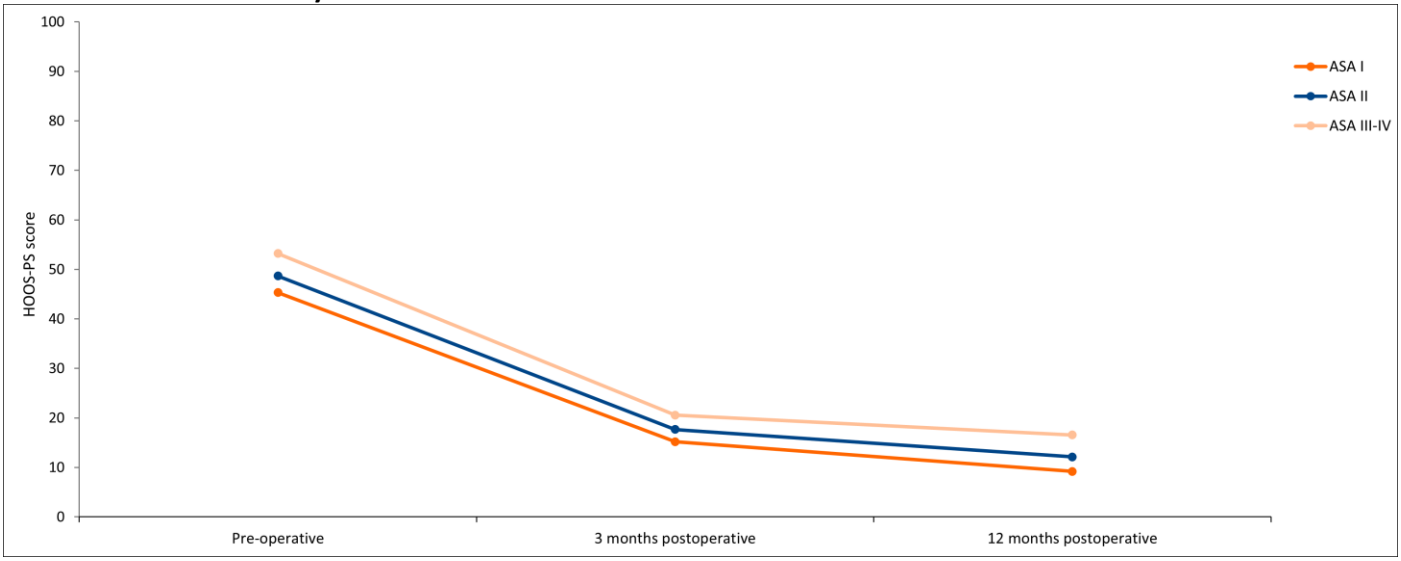


TABLE Mean HOOS-PS scores

HOOS-PS score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	14,619	45.3 (45.1-45.6)	11,343	15.2 (14.9-15.4)	2,412	9.2 (8.7-9.6)
ASA II	53,492	48.7 (48.5-48.8)	37,968	17.7 (17.5-17.8)	8,281	12.1 (11.8-12.4)
ASA III-IV	15,198	53.2 (52.9-53.5)	9,791	20.5 (20.2-20.9)	2,850	16.5 (15.9-17.2)
Total	83,337	48.9 (48.8-49.0)	59,123	17.7 (17.5-17.8)	13,273	12.4 (12.2-12.7)

[1] The 12 months HOOS-PS score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

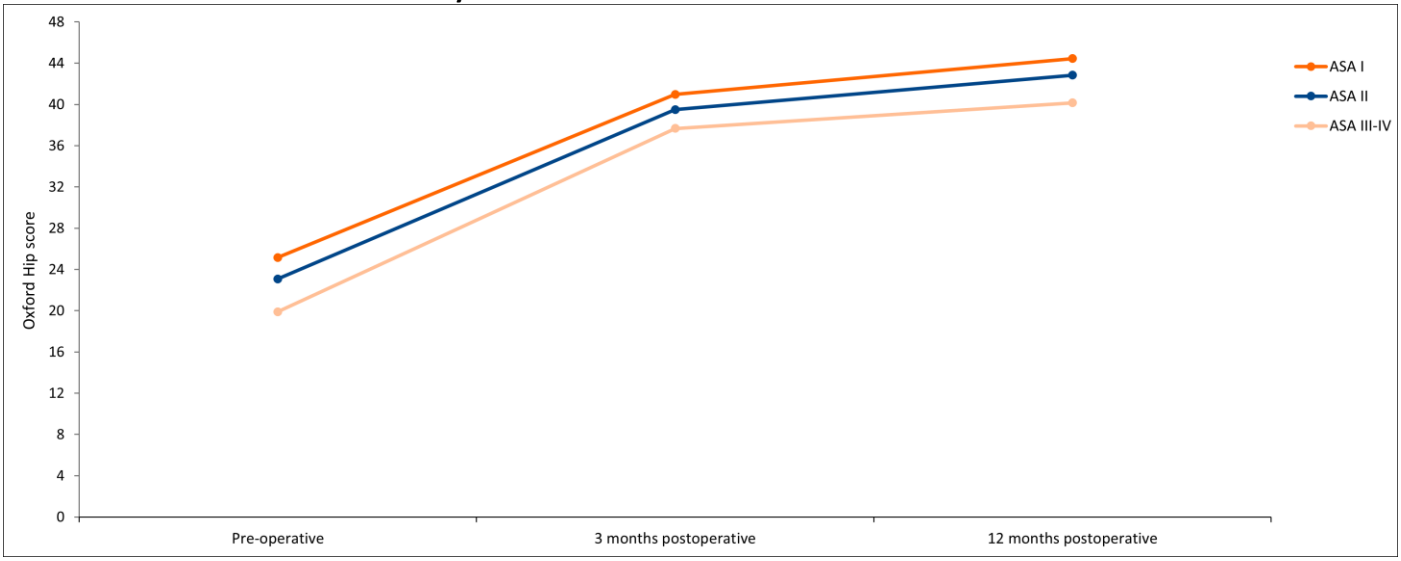


TABLE Mean Oxford Hip scores

Oxford Hip score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	13,917	25.2 (25.0-25.3)	10,945	41.0 (40.8-41.1)	2,389	44.4 (44.2-44.7)
ASA II	50,921	23.1 (23.0-23.1)	37,065	39.5 (39.4-39.6)	8,302	42.8 (42.7-43.0)
ASA III-IV	14,685	19.9 (19.8-20.0)	9,968	37.7 (37.5-37.8)	2,637	40.2 (39.8-40.5)
Total	79,554	22.9 (22.8-22.9)	57,997	39.5 (39.4-39.5)	13,328	42.6 (42.5-42.7)

[1] The 12 months Oxford Hip score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

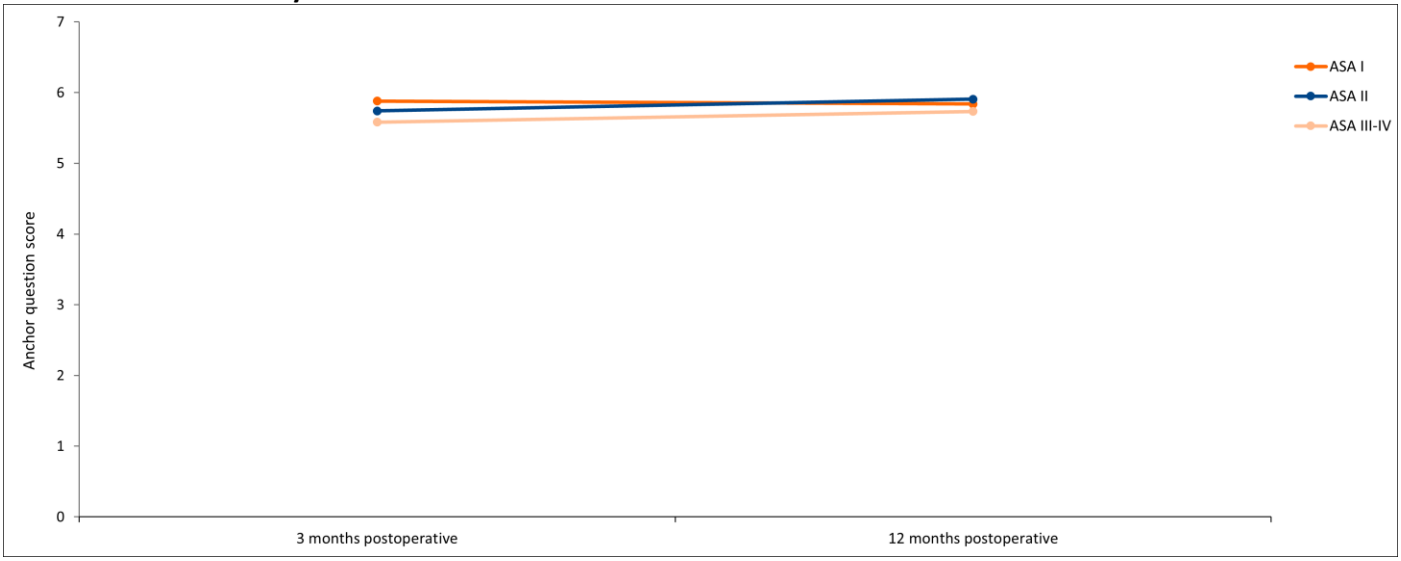


TABLE Mean anchor question: Daily functioning

Anchor question score	3 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	11,331	5.9 (5.9-5.9)	2,485	5.8 (5.8-5.9)
ASA II	39,146	5.7 (5.7-5.8)	8,826	5.9 (5.9-5.9)
ASA III-IV	10,803	5.6 (5.6-5.6)	2,859	5.7 (5.7-5.8)
Total	61,298	5.7 (5.7-5.7)	14,170	5.9 (5.8-5.9)

[1] The 12 months anchor question score is not (yet) available for 2020.
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

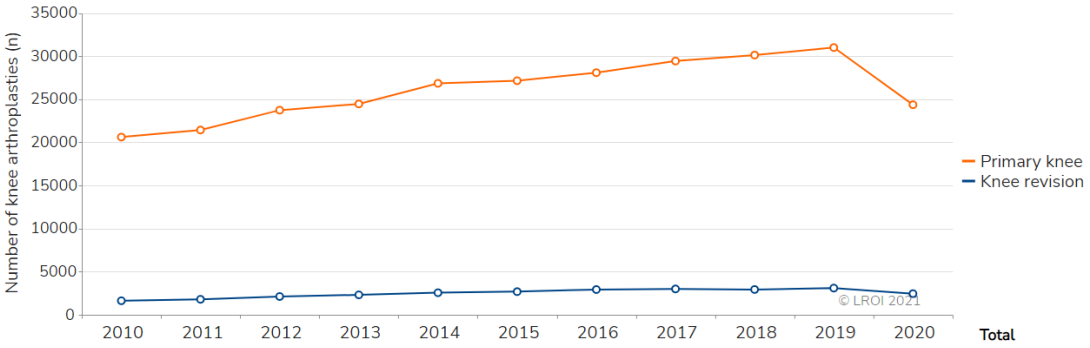
TABLE Number of registered knee arthroplasties per year of surgery (2007-2020) in the LROI in April 2021

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	7,035	774	47	43	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	18,508	1,716	143	79	162	1,624	22,232
2011	19,521	1,586	116	81	126	1,794	23,224
2012	21,719	1,578	172	91	171	2,116	25,847
2013	22,306	1,804	135	30	178	2,309	26,762
2014	24,244	2,364	116	26	92	2,557	29,399
2015	24,246	2,692	157	10	39	2,685	29,829
2016	24,885	2,947	144	6	94	2,926	31,002
2017	25,554	3,662	168	19	24	2,997	32,424
2018	25,838	4,073	183	17	12	2,931	33,054
2019	25,881	4,892	175	25	21	3,096	34,090
2020	19,501	4,677	158	15	8	2,452	26,811
Total	287,777	35,525	1,945	565	2,233	30,290	358,335

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

Type of procedures

FIGURE Number of primary knee arthroplasties and knee revision arthroplasties registered in the LROI in the Netherlands in 2010-2020

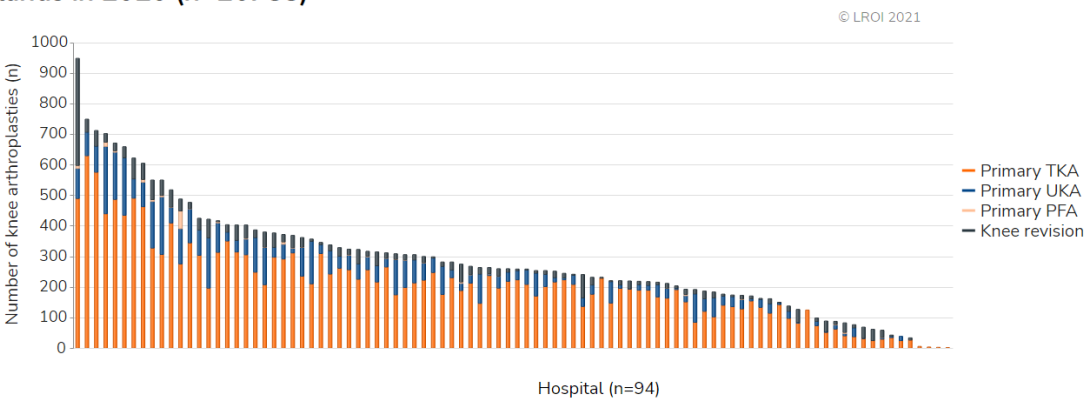


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Type of procedure (n)												
Primary knee	20,608	21,430	23,731	24,453	26,842	27,144	28,076	29,427	30,123	30,994	24,359	**287,187**
Knee revision	1,624	1,794	2,116	2,309	2,557	2,685	2,926	2,997	2,931	3,096	2,452	**27,487**
Total:	**22,232**	**23,224**	**25,847**	**26,762**	**29,399**	**29,829**	**31,002**	**32,424**	**33,054**	**34,090**	**26,811**	**314,674**

Out of 24,359 primary knee arthroplasties that were performed in 2020, 3% (n=688) was performed bilaterally.

Type of procedure per hospital

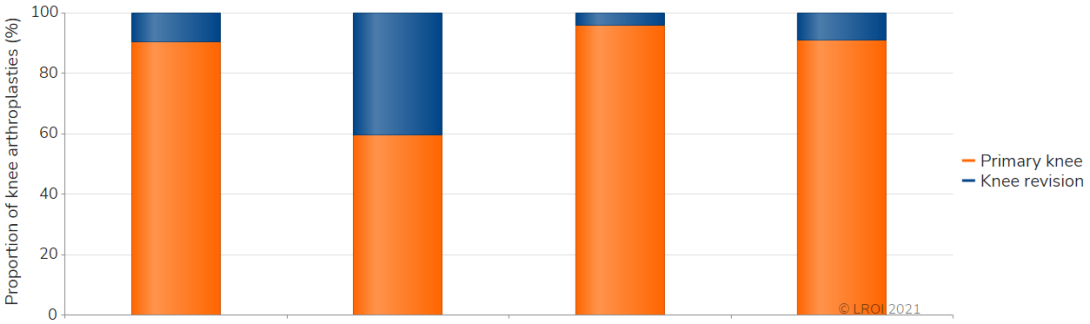
FIGURE Number of primary knee arthroplasties and knee revision arthroplasties per hospital in the Netherlands in 2020 (n=26788)



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 2020

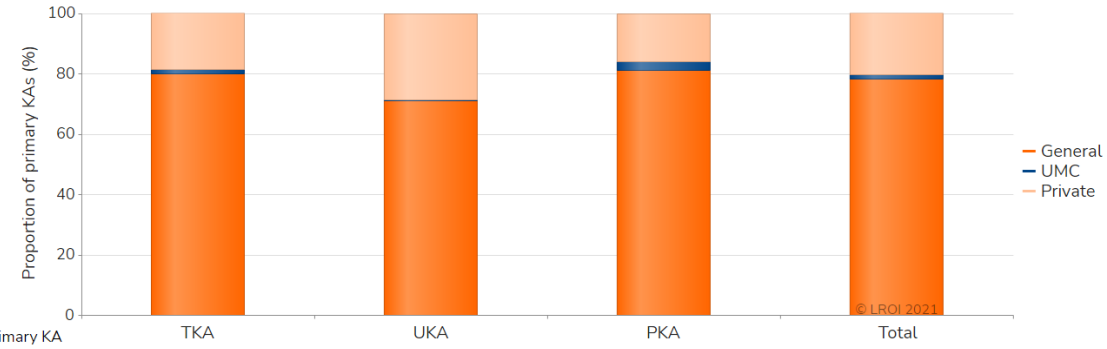


Type of hospital	General	UMC	Private	Total
Type of procedure (%)				
Primary knee	90.37	59.46	95.97	**90.85**
Knee revision	9.63	40.54	4.03	**9.15**
Total (n):	**21,110**	**518**	**5,183**	**26,811**

Please note: In 2020, 68 general hospitals, 7 UMCs and 19 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 2020

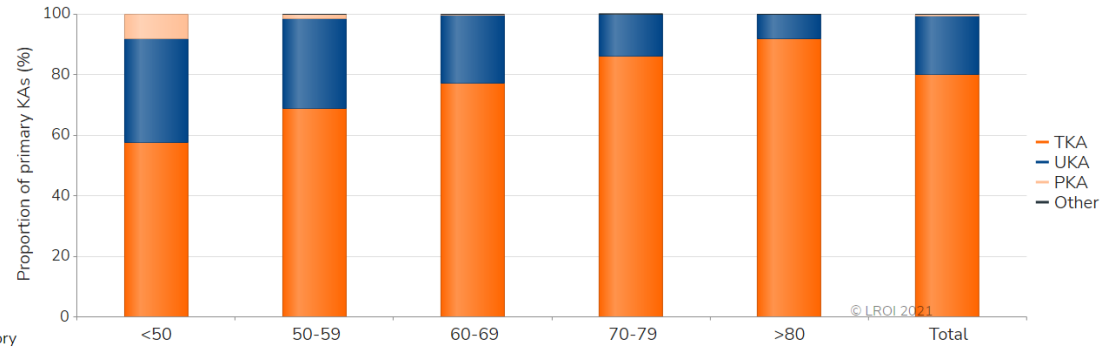


Type of primary KA	TKA	UKA	PKA	Total
Type of hospital (%)				
General	80.06	70.96	81.01	**78.32**
UMC	1.45	0.41	3.16	**1.26**
Private	18.50	28.63	15.82	**20.43**
Total (n):	**19,501**	**4,677**	**158**	**24,336**

Please note: In 2020, 15 (0.06%) primary knee arthroplasties were registered in the LROI as other type of primary knee arthroplasty. Of 8 (0.03%) 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 2020



Age category	<50	50-59	60-69	70-79	>80	Total
Type of primary knee arthroplasty (%)						
TKA	57.48	68.67	77.26	86.01	91.85	**80.08**
UKA	34.19	29.64	22.25	13.77	7.93	**19.21**
PKA	8.33	1.64	0.45	0.17	0.00	**0.65**
Other	0.00	0.05	0.03	0.06	0.22	**0.06**
Total (n):	**468**	**3,968**	**8,642**	**8,977**	**2,295**	**24,350**

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 2020

N	TKA (n=19,501)	UKA (n=4,677)	PFA (n=158)	Total[1] (n=24,359)
Mean age (years) (SD)	68.9 (8.8)	64.7 (8.7)	55.8 (9.9)	68.0 (9.0)
Age (years) (%)				
<50	1	3	25	2
50-59	14	25	41	16
60-69	34	41	25	36
70-79	40	27	9	37
≥80	11	4	0	9
Gender (%)				
Men	38	47	25	39
Women	62	53	75	61
ASA score (%)				
I	12	19	32	13
II	64	67	58	65
III-IV	24	14	9	22
Type of hospital (%)				
General	80	71	81	78
UMC	1	0	3	1
Private	19	29	16	21
Diagnosis (%)				
Osteoarthritis	97	98	97	97
Post-traumatic	2	0	2	1
Rheumatoid arthritis	1	0	0	1
Osteonecrosis	0	1	0	1
Other	0	0	1	0
Charnley-score (%)				
A One knee joint affected	37	49	45	39
B1 Both knee joints affected	35	32	34	35
B2 Contralateral knee joint with a total knee prosthesis	24	17	18	23
C Multiple joints affected or chronic disease that affects quality of life	4	2	3	3
Mean Body Mass Index (kg/m²) (SD)	29.5 (5.0)	28.9 (4.3)	27.7 (3.9)	29.4 (4.9)
Body Mass Index (kg/m²) (%)				
Underweight (≤18,5)	0	0	0	0
Normal weight (>18,5-25)	18	19	24	18
Overweight (>25-30)	41	45	50	42
Obesity (>30-40)	38	35	25	37
Morbid obesity (>40)	3	1	1	3
Smoking (%)				
No	93	91	91	93
Yes	7	9	9	7

[1] Also contains 15 (0.06%) primary knee arthroplasties that were registered as other and 8 (0.03%) 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

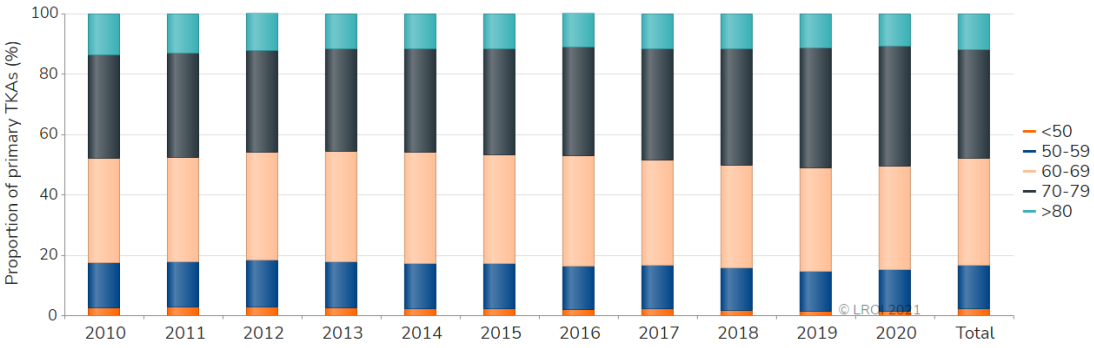
TABLE Patient characteristics of all patients with a registered primary knee arthroplasty by type of diagnosis in the Netherlands in 2020

N	Osteoarthritis (n=23,450)	Post-traumatic (n=337)	Rheumatoid arthritis (n=234)	Osteonecrosis (n=142)	Total (n=24,359)
Mean age (years) (SD)	68.1 (8.9)	62.2 (10.6)	65.0 (9.2)	69.6 (10.6)	68.0 (9.0)
Age (years) (%)					
<50	2	11	4	2	2
50-59	16	29	22	10	16
60-69	36	34	41	35	36
70-79	37	22	28	35	37
≥80	10	4	5	18	9
Gender (%)					
Men	40	39	24	39	39
Women	60	61	76	61	61
ASA score (%)					
I	13	19	1	9	13
II	65	64	65	69	65
III-IV	22	17	34	22	22
Type of hospital (%)					
General	78	71	91	79	78
UMC	1	9	4	4	1
Private	21	20	5	17	21
Charnley-score (%)					
A One knee joint affected	39	76	24	76	39
B1 Both knee joints affected	35	14	35	11	35
B2 Contralateral knee joint with a total knee prosthesis	23	6	17	7	23
C Multiple joints affected or chronic disease that affects quality of life	3	4	24	6	3
Mean Body Mass Index (kg/m²) (SD)	29.4 (4.8)	28.6 (5.1)	29.1 (5.7)	28.9 (4.5)	29.4 (4.9)
Body Mass Index (kg/m²) (%)					
Underweight (≤18,5)	0	2	1	0	0
Normal weight (>18,5-25)	18	23	24	19	18
Overweight (>25-30)	42	40	37	44	42
Obesity (>30-40)	37	32	34	35	37
Morbid obesity (>40)	3	3	4	2	3
Smoking (%)					
No	93	86	88	90	93
Yes	7	14	12	10	7

Please note: In 2020, 115 (0.5%) patients had a primary knee arthroplasty after a diagnosis that is not listed in the table. Of 81 (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

FIGURE Trend (proportion [%] per year) in age category in primary total knee arthroplasties in the Netherlands in 2010-2020



Year

Age category (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
<50	2.62	2.89	2.79	2.64	2.38	2.41	2.01	2.19	1.76	1.50	1.38	**2.21**
50-59	14.92	14.82	15.58	15.06	14.75	14.88	14.39	14.37	13.99	13.15	13.97	**14.50**
60-69	34.50	34.60	35.86	36.68	37.10	36.06	36.52	35.07	34.15	34.20	34.24	**35.39**
70-79	34.33	34.53	33.65	33.99	34.13	35.07	35.86	36.72	38.33	39.69	39.59	**36.07**
>80	13.63	13.15	12.13	11.63	11.64	11.58	11.23	11.65	11.77	11.46	10.81	**11.83**
Total (n):	**18,483**	**19,483**	**21,675**	**22,266**	**24,216**	**24,237**	**24,864**	**25,551**	**25,837**	**25,877**	**19,500**	**251,989**

TKA: total knee arthroplasty.

Previous surgery

TABLE Trend (proportion [%] per year) in previous surgeries to the same joint in patients who underwent a primary knee arthoplasty in the Netherlands in 2014-2020

Year	2014	2015	2016	2017	2018	2019	2020	Total
Primary knee arthroplasty (n)	26,035	26,479	27,805	29,297	28,216	28,007	24,205	190,089
Previous surgery to the relevant knee (total) Proportion[1] (%)	35.7	34.5	33.4	28.0	25.2	24.6	23.1	29.2
Meniscectomy	28.4	27.3	26.6	22.1	20.6	19.9	18.4	23.3
Arthroscopy	17.7	18.9	19.3	17.1	15.6	15.3	14.3	16.9
Osteotomy	3.0	3.0	2.8	2.9	2.8	2.4	2.3	2.7
Osteosynthesis	1.7	1.7	1.4	1.5	1.5	1.6	1.4	1.5
ACL reconstruction	1.3	1.5	1.5	1.5	1.4	1.5	1.8	1.5
Synovectomy	1.2	1.2	1.0	0.8	0.6	0.6	0.7	0.9
Patella realignment	0.7	0.6	0.5	0.6	0.6	0.5	0.5	0.6
Other	2.6	2.3	2.6	2.4	2.4	2.8	2.6	2.5

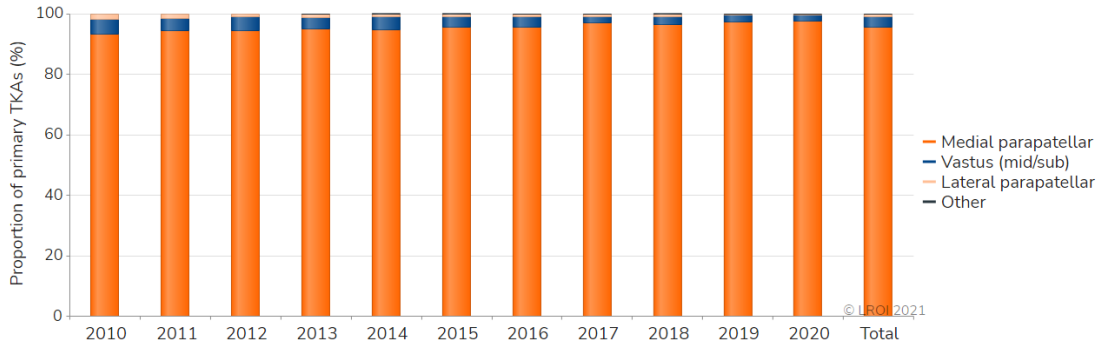
[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patiens with one or more previous surgeries to the same joint.

Total knee arthroplasty

Surgical techniques

Surgical approach

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary total knee arthroplasty in the Netherlands in 2010-2020

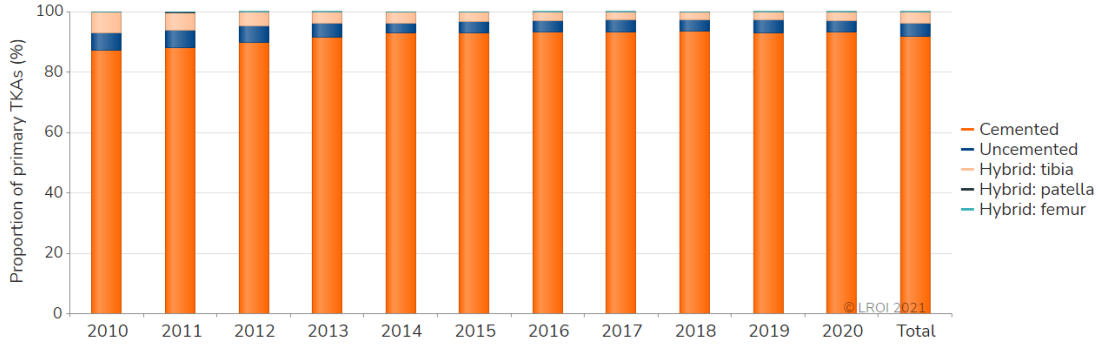


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Surgical approach (%)												
Medial parapatellar	93.33	94.35	94.26	95.08	94.68	95.62	95.54	96.85	96.31	97.31	97.48	**95.61**
Vastus (mid/sub)	4.82	4.09	4.65	3.71	4.17	3.38	3.52	2.17	2.76	2.16	1.96	**3.34**
Lateral parapatellar	1.85	1.56	1.08	1.05	0.96	0.96	0.86	0.86	0.84	0.46	0.50	**0.97**
Other	0.00	0.00	0.00	0.16	0.20	0.05	0.08	0.12	0.10	0.06	0.05	**0.08**
Total (n):	**18,116**	**19,120**	**21,289**	**22,000**	**24,101**	**24,159**	**24,865**	**25,549**	**25,832**	**25,830**	**19,446**	250,307

TKA: total knee arthroplasty.

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary total knee arthroplasties in the Netherlands in 2010-2020



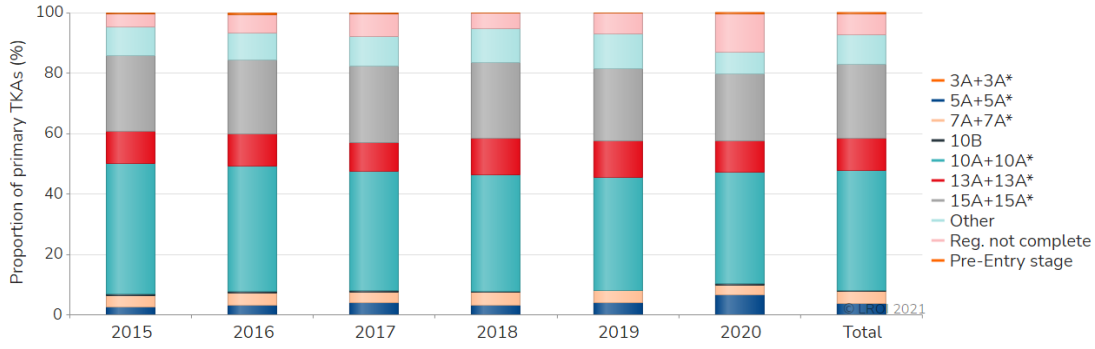
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Cemented	87.07	87.92	89.89	91.55	92.85	93.02	93.30	93.37	93.57	92.81	93.34	**91.91**
Uncemented	6.02	5.96	5.44	4.47	3.38	3.61	3.64	3.94	3.71	4.50	3.60	**4.31**
Hybrid: tibia	6.71	5.81	4.56	3.93	3.73	3.34	3.02	2.64	2.67	2.64	3.03	**3.70**
Hybrid: patella	0.16	0.23	0.07	0.02	0.00	0.00	0.02	0.01	0.02	0.02	0.01	**0.04**
Hybrid: femur	0.04	0.08	0.05	0.04	0.04	0.02	0.03	0.04	0.03	0.04	0.03	**0.04**
Total (n):	**18,042**	**19,096**	**21,315**	**22,035**	**24,014**	**24,075**	**24,773**	**25,442**	**25,712**	**25,690**	**19,434**	249,628

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 2015-2020

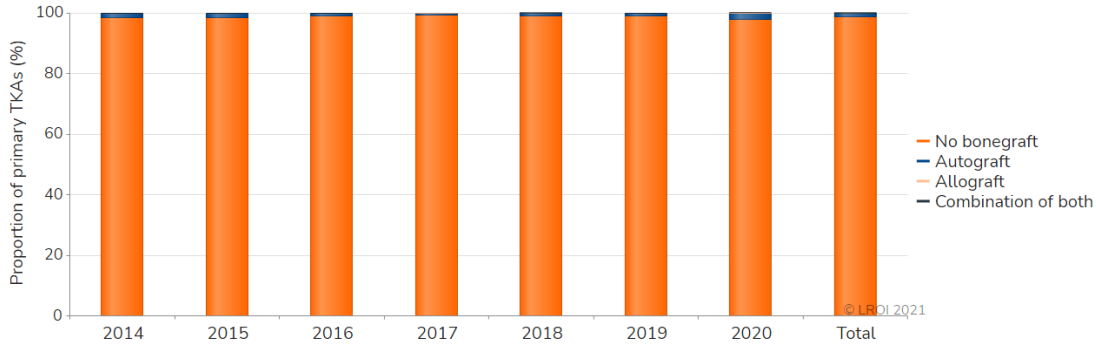


ODEP rating (%)	2015	2016	2017	2018	2019	2020	Total
3A+3A*	0.06	0.05	0.04	0.09	0.04	0.05	**0.06**
5A+5A*	2.59	3.24	3.85	3.08	3.94	6.71	**3.80**
7A+7A*	3.66	3.97	3.64	4.23	4.09	3.16	**3.82**
10B	0.47	0.58	0.60	0.35	0.07	0.35	**0.41**
10A+10A*	43.24	41.48	39.27	38.58	37.38	36.92	**39.54**
13A+13A*	10.72	10.62	9.52	11.96	12.12	10.45	**10.92**
15A+15A*	24.89	24.45	25.30	25.24	23.91	21.93	**24.38**
Other	9.59	8.82	10.01	11.10	11.30	7.46	**9.82**
Reg. not complete	4.21	6.12	7.43	5.18	6.89	12.67	**6.88**
Pre-Entry stage	0.56	0.66	0.33	0.18	0.24	0.32	**0.38**
Total (n):	**24,246**	**24,885**	**25,554**	**25,838**	**25,881**	**19,501**	**145,905**

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

FIGURE Trend (proportion [%] per year) in type of bonegraft in primary total knee arthroplasty in the Netherlands in 2014-2020

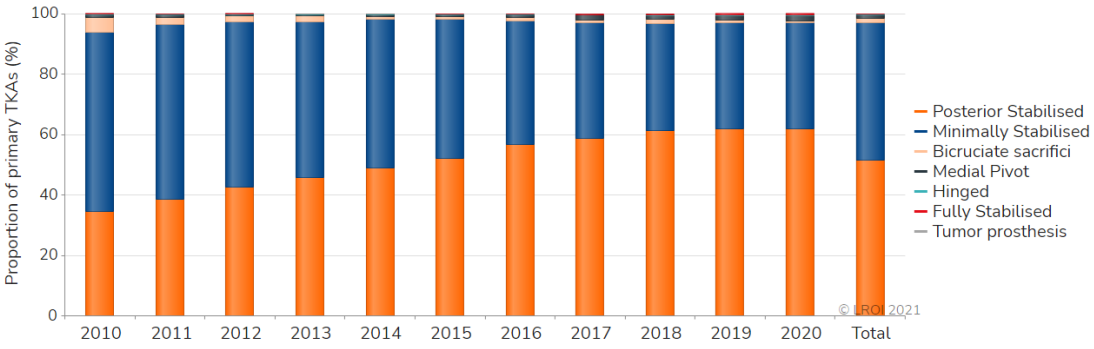


Type of bonegraft (%)	2014	2015	2016	2017	2018	2019	2020	Total
No bonegraft	98.55	98.39	98.94	99.22	99.02	99.10	97.90	**98.77**
Autograft	1.39	1.55	1.01	0.75	0.93	0.88	2.06	**1.19**
Allograft	0.03	0.02	0.03	0.02	0.03	0.01	0.04	**0.03**
Combination of both	0.03	0.03	0.02	0.00	0.03	0.01	0.01	**0.02**
Total (n):	**23,760**	**24,085**	**24,850**	**25,520**	**25,812**	**25,476**	**19,303**	**168,806**

TKA: total knee arthroplasty.

Type of femur component

FIGURE Trend (proportion [%] per year) in type of femur component in primary total knee arthroplasties in the Netherlands in 2010-2020



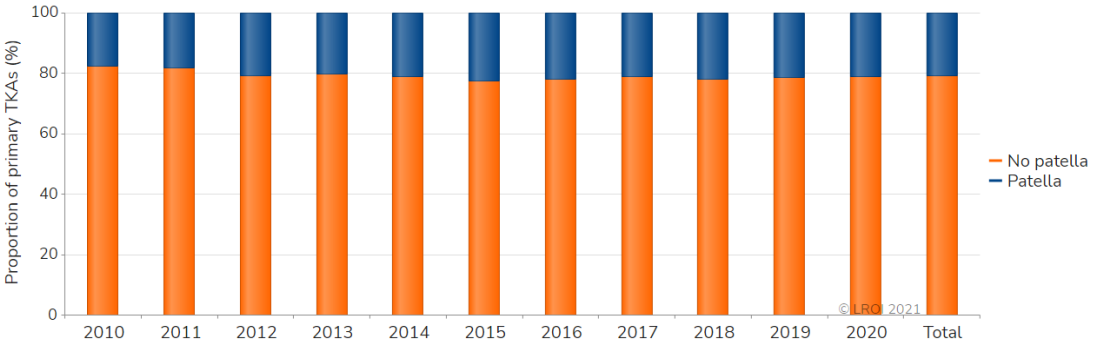
Type of femur component (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Posterior Stabilised	34.48	38.43	42.47	45.78	48.86	52.07	56.62	58.74	61.17	61.96	61.82	**51.65**
Minimally Stabilised	59.30	58.02	54.82	51.54	49.21	45.98	41.00	38.21	35.63	35.00	35.28	**45.36**
Bicruciate sacrifici	4.83	2.37	1.98	1.87	1.04	0.88	1.05	0.97	1.33	0.78	0.51	**1.53**
Medial Pivot	0.92	0.69	0.37	0.32	0.42	0.59	0.83	1.54	1.24	1.46	1.70	**0.91**
Hinged	0.23	0.22	0.19	0.28	0.27	0.24	0.24	0.24	0.30	0.36	0.40	**0.27**
Fully Stabilised	0.25	0.26	0.17	0.20	0.19	0.23	0.26	0.30	0.33	0.45	0.29	**0.27**
Tumor prosthesis	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Total (n):	**18,335**	**19,334**	**21,519**	**22,131**	**24,030**	**23,773**	**23,732**	**23,976**	**24,948**	**24,425**	**17,545**	**243,748**

TKA: total knee arthroplasty.

Implantation of patella

FIGURE Trend (proportion [%] per year) in implantation of patella in primary total knee arthroplasties in the Netherlands in 2010-2020



Implantation of patella (%)

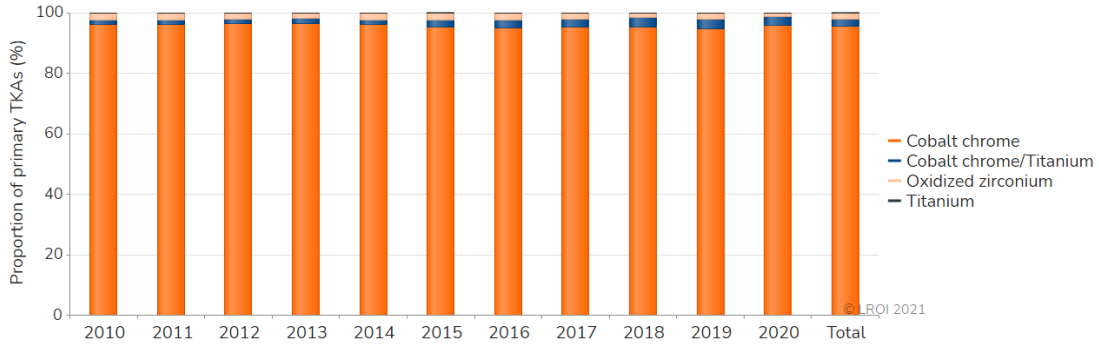
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
No patella	82.21	81.59	79.00	79.66	78.75	77.48	77.97	78.72	78.04	78.66	78.71	**79.04**
Patella	17.79	18.41	21.00	20.34	21.25	22.52	22.03	21.28	21.96	21.34	21.29	**20.96**
Total (n):	**18,508**	**19,521**	**21,719**	**22,306**	**24,244**	**24,246**	**24,885**	**25,554**	**25,838**	**25,881**	**19,501**	**252,203**

TKA: total knee arthroplasty.

Materials

Femur component

FIGURE Trend (proportion [%] per year) in femur material in primary total knee arthroplasties in the Netherlands in 2010-2020



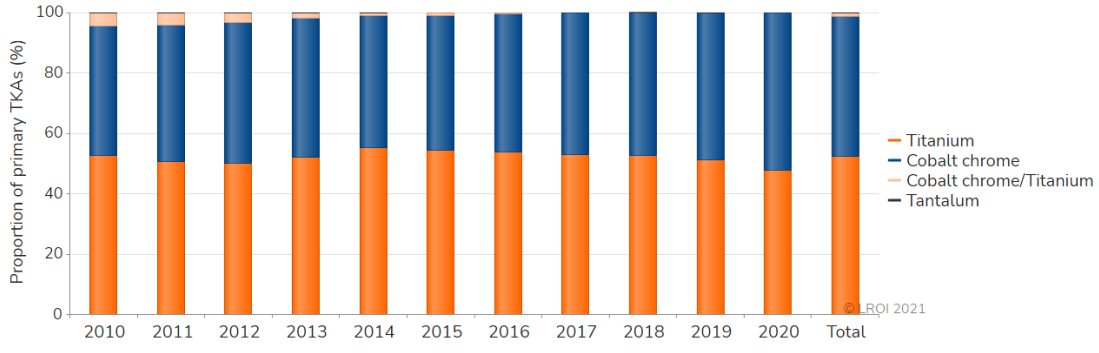
Femur material (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Cobalt chrome	96.25	96.03	96.33	96.54	96.18	95.39	95.06	95.14	95.35	94.62	95.87	**95.67**
Cobalt chrome/Titanium	1.21	1.58	1.42	1.45	1.44	2.23	2.60	2.72	2.97	3.32	2.74	**2.19**
Oxidized zirconium	2.52	2.34	2.18	1.94	2.31	2.23	2.17	1.98	1.50	1.83	1.30	**2.03**
Titanium	0.02	0.05	0.07	0.07	0.07	0.15	0.16	0.15	0.18	0.23	0.09	**0.12**
Total (n):	**18,335**	**19,334**	**21,519**	**22,131**	**24,030**	**23,773**	**23,732**	**23,976**	**24,948**	**24,425**	**17,538**	**243,741**

TKA: total knee arthroplasty.

Tibia component

FIGURE Trend (proportion [%] per year) in tibia material in primary total knee arthroplasties in the Netherlands in 2010-2020



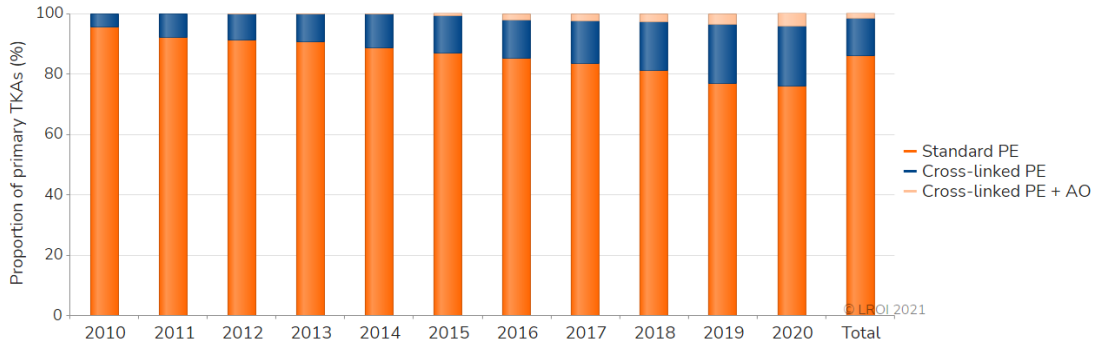
Tibia material (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Titanium	52.53	50.72	50.08	52.05	55.14	54.43	53.93	52.97	52.64	51.13	47.64	**52.27**
Cobalt chrome	42.88	45.12	46.74	46.22	43.71	44.53	45.73	47.03	47.35	48.85	52.36	**46.37**
Cobalt chrome/Titanium	4.57	4.15	3.16	1.71	1.14	1.04	0.34	0.00	0.00	0.00	0.00	**1.35**
Tantalum	0.02	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.02	0.02	0.00	**0.01**
Total (n):	**18,287**	**19,289**	**21,478**	**22,105**	**24,035**	**23,805**	**24,042**	**24,124**	**24,963**	**24,547**	**17,587**	**244,262**

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

FIGURE Trend (proportion [%] per year) in insert material in primary total knee arthroplasties in the Netherlands in 2010-2020

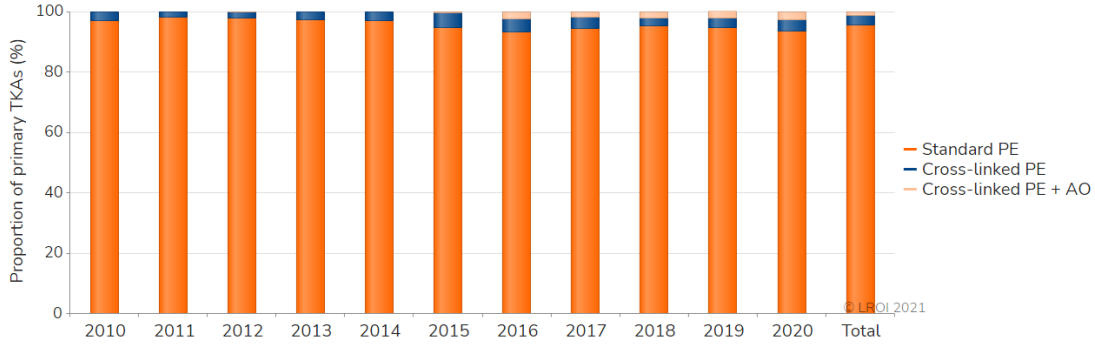


Insert material (%)												
Standard PE	95.61	92.21	91.18	90.78	88.64	87.02	85.18	83.54	81.21	76.96	75.84	**85.93**
Cross-linked PE	4.39	7.79	8.78	9.21	11.29	12.13	12.74	13.95	16.01	19.37	19.89	**12.55**
Cross-linked PE + AO	0.00	0.00	0.03	0.01	0.07	0.86	2.08	2.50	2.78	3.66	4.28	**1.53**
Total (n):	**17,482**	**18,501**	**20,767**	**21,560**	**23,600**	**23,455**	**23,938**	**24,441**	**25,167**	**24,430**	**17,364**	**240,705**

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

Patella component

FIGURE Trend (proportion [%] per year) in patella material in primary total knee arthroplasties in the Netherlands in 2010-2020



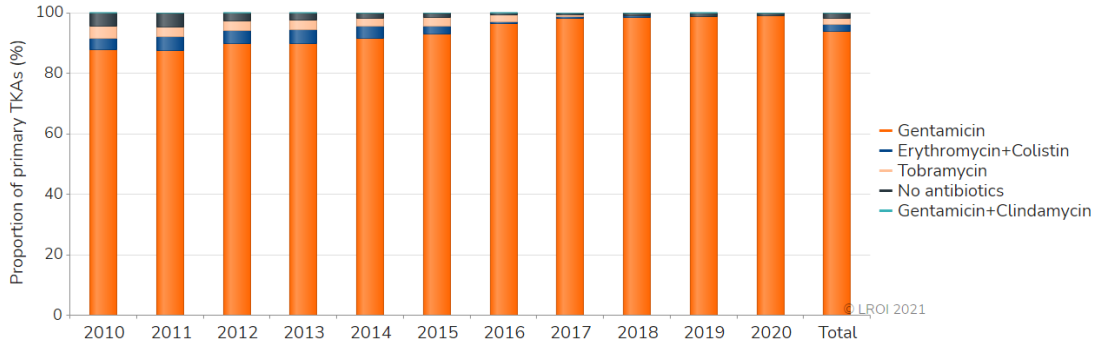
Patella material (%)												
Standard PE	96.94	98.05	97.86	97.22	97.03	94.66	93.34	94.33	95.29	94.55	93.64	**95.59**
Cross-linked PE	3.06	1.95	2.11	2.78	2.97	5.03	4.21	3.66	2.63	3.20	3.52	**3.25**
Cross-linked PE + AO	0.00	0.00	0.02	0.00	0.00	0.31	2.45	2.01	2.08	2.26	2.84	**1.16**
Total (n):	**3,203**	**3,534**	**4,494**	**4,462**	**5,059**	**5,228**	**5,272**	**5,222**	**5,481**	**5,225**	**3,803**	**50,983**

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

Bone cement

Antibiotics

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in primary total knee arthroplasties in the Netherlands in 2010-2020



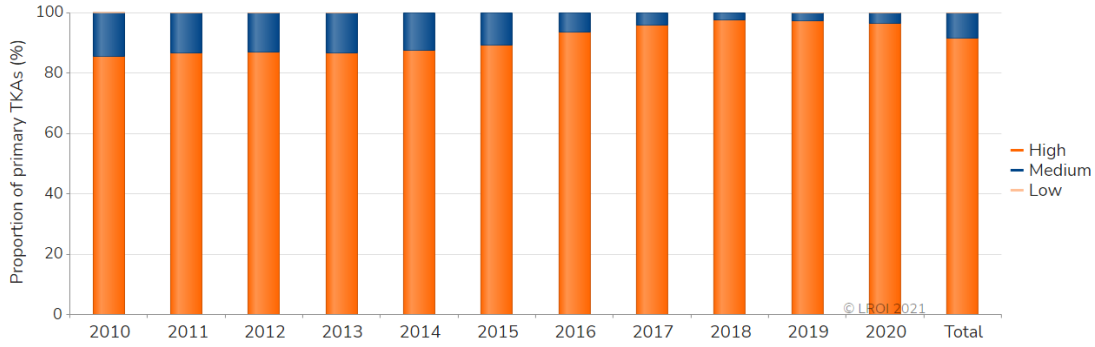
Bone cement antibiotics (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Gentamicin	87.67	87.56	89.73	89.80	91.46	93.02	96.29	98.13	98.55	98.71	98.87	**93.91**
Erythromycin+Colistin	3.90	4.47	4.25	4.48	4.01	2.58	0.69	0.47	0.31	0.00	0.00	**2.19**
Tobramycin	4.09	3.22	3.27	3.41	2.71	2.90	2.20	0.62	0.00	0.00	0.00	**1.97**
No antibiotics	4.25	4.64	2.56	2.17	1.71	1.39	0.67	0.69	0.98	1.20	1.08	**1.81**
Gentamicin+Clindamycin	0.09	0.11	0.20	0.15	0.11	0.11	0.15	0.09	0.15	0.10	0.05	**0.12**
Total (n):	**15,112**	**16,845**	**19,031**	**19,987**	**21,604**	**21,790**	**22,597**	**22,228**	**22,340**	**21,816**	**15,865**	**219,215**

Please note: Bone cement with gentamicin and vancomycin was used in 13 (<0.01%) primary TKAs in 2015-2020.
TKA: total knee arthroplasty.

Viscosity

FIGURE Trend (proportion [%] per year) in bone cement viscosity in primary total knee arthroplasties in the Netherlands in 2010-2020



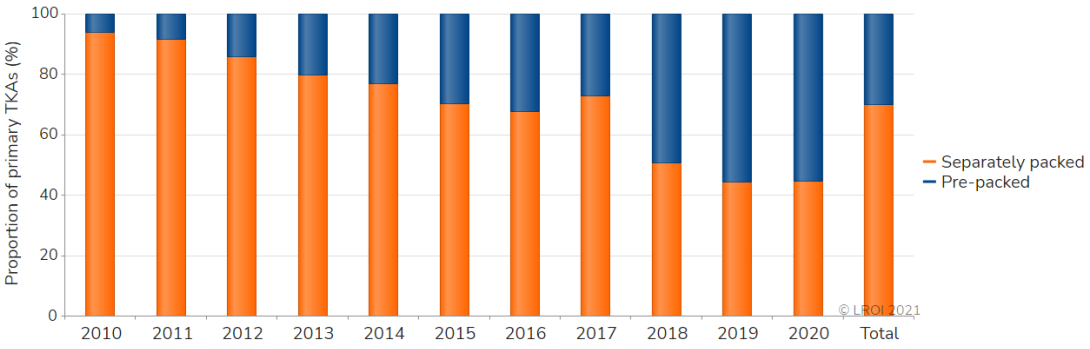
Bone cement viscosity (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
High	85.54	86.69	86.98	86.60	87.59	89.34	93.53	95.79	97.66	97.17	96.34	**91.47**
Medium	14.40	13.30	12.99	13.39	12.41	10.66	6.47	4.21	2.34	2.80	3.64	**8.52**
Low	0.06	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.02	**0.01**
Total (n):	**15,112**	**16,845**	**19,031**	**19,987**	**21,604**	**21,792**	**22,598**	**22,228**	**22,346**	**21,819**	**15,866**	**219,228**

TKA: total knee arthroplasty.

Vacuum mixing system

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 2010-2020



Vacuum mixing system (%)												
Separately packed	93.75	91.37	85.62	79.58	76.81	70.12	67.66	72.67	50.65	44.27	44.49	**69.84**
Pre-packed	6.25	8.63	14.38	20.42	23.19	29.88	32.34	27.33	49.35	55.73	55.51	**30.16**
Total (n):	**15,112**	**16,845**	**19,031**	**19,987**	**21,604**	**21,792**	**22,598**	**22,228**	**22,346**	**21,819**	**15,866**	**219,228**

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 2020 (n=17,512)

Name	Proportion (%)
Genesis II	23.0
Vanguard Complete Knee	20.9
NexGen	19.1
PFC / SIGMA	8.9
Triathlon	8.7

Types of bone cement

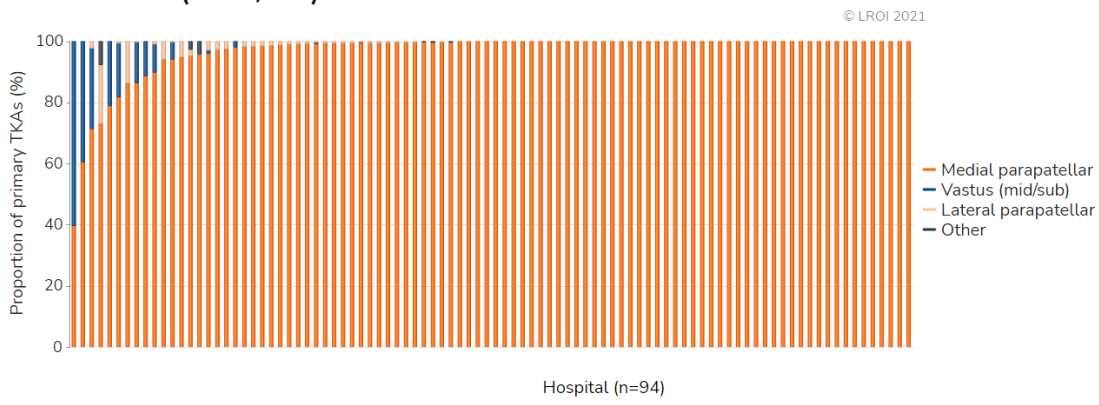
TABLE The most frequently registered types of bone cement by type of mixing system used during primary total knee arthroplasties in the Netherlands in 2020

Separately packed bone cement components (n=7,054)		Bone cement pre-packed in a vacuum mixing system (n=8,804)	
Name	Proportion (%)	Name	Proportion (%)
Palacos R+G	69.9	Palacos R+G	51.4
Refobacin Bone Cement R	16.8	Refobacin Bone Cement R	40.2
Subiton G	5.0	Refobacin Plus Bone Cement	8.4
Palacos MV+G	3.2		
Simplex HV	2.5		

Practice variation

Surgical approach

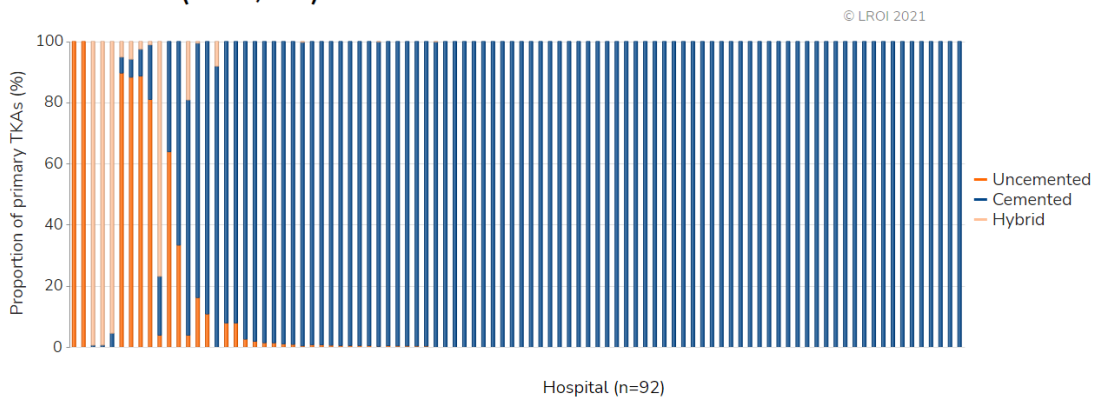
FIGURE Distribution of surgical approach used during primary total knee arthroplasties per hospital in the Netherlands in 2020 (n=19,446)



TKA: total knee arthroplasty.

Fixation

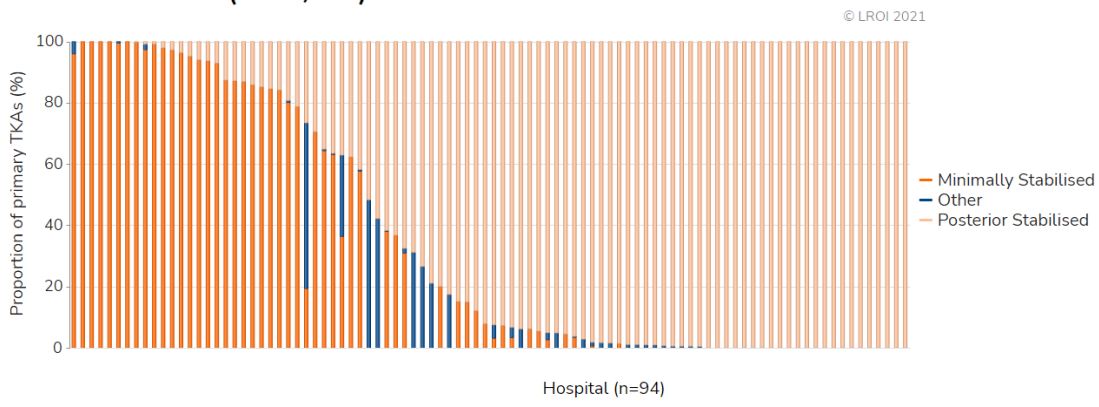
FIGURE Distribution of type of fixation used during primary total knee arthroplasties per hospital in the Netherlands in 2020 (n=19,434)



TKA: total knee arthroplasty.

Type of femur component

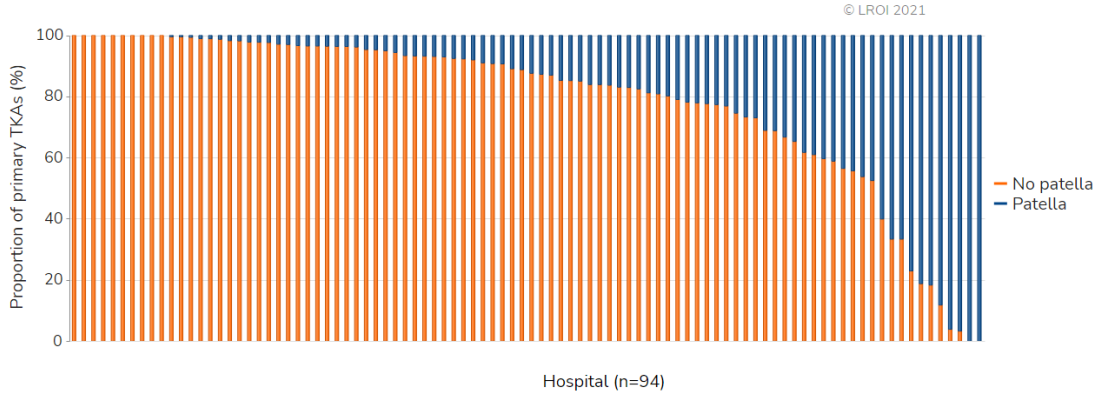
FIGURE Distribution of type of femur component used during primary total knee arthroplasties per hospital in the Netherlands in 2020 (n=17,545)



TKA: total knee arthroplasty.

Implantation of patella

FIGURE Distribution of implantation of patella during primary total knee arthroplasties per hospital in the Netherlands in 2020 (n=19,501)



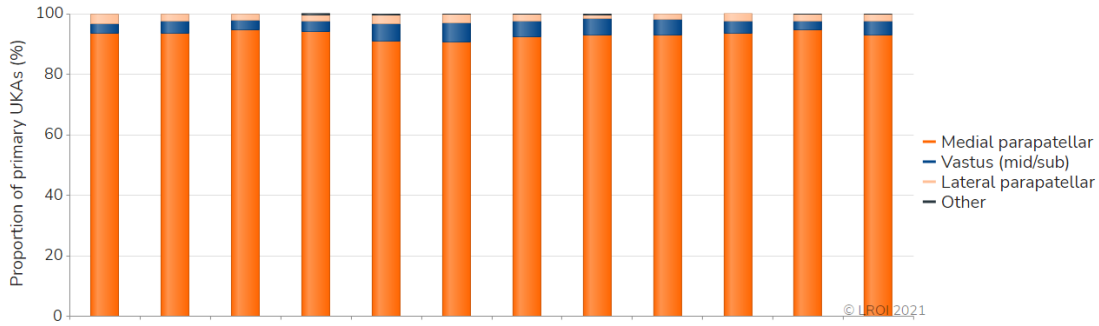
TKA: total knee arthroplasty.

Unicondylar knee arthroplasty

Surgical techniques

Surgical approach

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary unicondylar knee arthroplasty in the Netherlands in 2010-2020

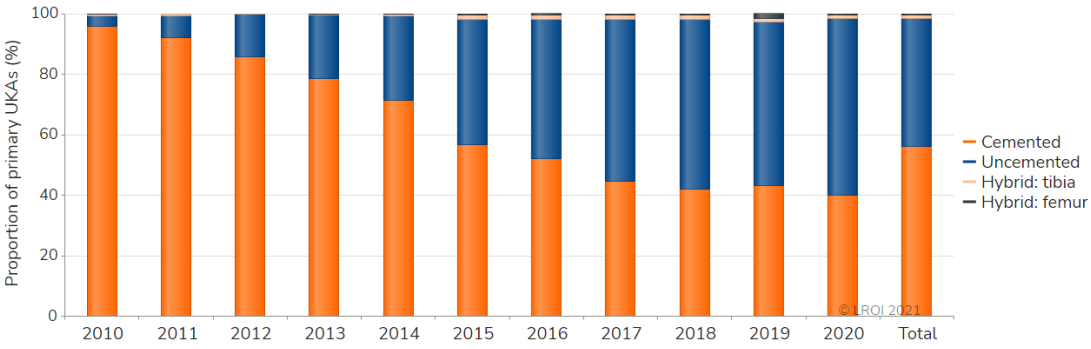


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Surgical approach (%)												
Medial parapatellar	93.46	93.49	94.60	94.01	91.03	90.70	92.28	92.98	92.87	93.61	94.56	**93.08**
Vastus (mid/sub)	3.18	3.95	3.19	3.65	5.55	6.30	5.37	5.41	5.33	4.06	3.13	**4.54**
Lateral parapatellar	3.36	2.55	2.21	1.94	3.12	2.89	2.11	1.23	1.79	2.34	2.18	**2.24**
Other	0.00	0.00	0.00	0.40	0.30	0.11	0.24	0.38	0.00	0.00	0.13	**0.14**
Total (n):	**1,667**	**1,568**	**1,537**	**1,754**	**2,342**	**2,668**	**2,940**	**3,662**	**4,070**	**4,881**	**4,670**	31,759

UKA: unicondylar knee arthroplasty.

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary unicondylar knee arthroplasties in the Netherlands in 2010-2020



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Cemented	95.94	92.18	85.88	78.47	71.28	56.61	52.01	44.60	41.92	43.03	40.01	**55.98**
Uncemented	3.22	7.17	13.86	20.97	27.87	41.44	46.09	53.65	56.21	54.24	58.40	**42.41**
Hybrid: tibia	0.78	0.64	0.26	0.39	0.64	1.64	1.50	1.39	1.38	1.28	1.03	**1.11**
Hybrid: femur	0.06	0.00	0.00	0.17	0.21	0.30	0.41	0.36	0.49	1.46	0.56	**0.50**
Total (n):	**1,676**	**1,561**	**1,558**	**1,793**	**2,347**	**2,676**	**2,942**	**3,657**	**4,067**	**4,862**	**4,666**	**31,805**

UKA: unicondylar knee arthroplasty.

Most frequently registered

Unicondylar knee prostheses

TABLE The most frequently registered primary unicondylar knee arthroplasties in the Netherlands in 2020 (n=3,943)

Name	Proportion (%)
Oxford PKR cementless	58.1
Oxford PKR cemented	20.3
Physica Zimmer Unicompartmental High Flex Knee	17.8
Journey Uni	1.7
BalanSys Uni	1.5

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 2020

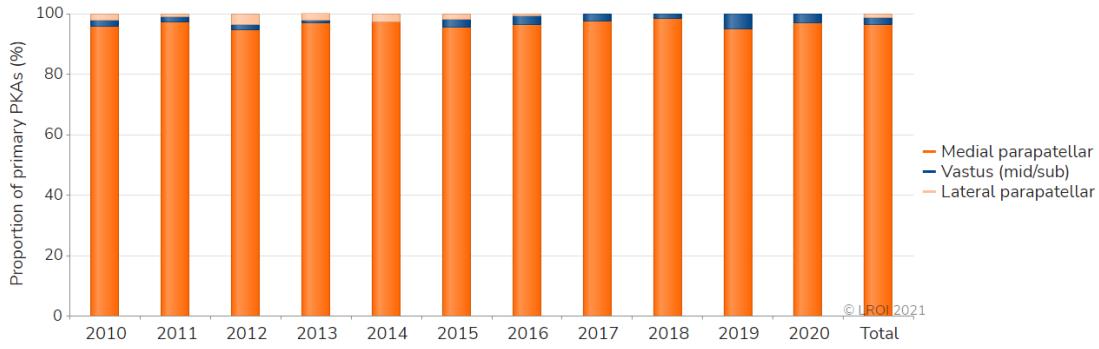
Separately packed bone cement components (n=1,060)		Bone cement pre-packed in a vacuum mixing system (n=669)	
Name	Proportion (%)	Name	Proportion (%)
Palacos R+G	69.8	Palacos R+G	48.1
Refobacin Bone Cement R	11.0	Refobacin Bone Cement R	46.6
Palacos MV+G	8.7	Refobacin Plus Bone Cement	5.2
Biomet Plus Bone Cement	5.5		
Subiton G	2.9		

Patellofemoral knee arthroplasty

Surgical techniques

Surgical approach

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary patellofemoral knee arthroplasty in the Netherlands in 2010-2020

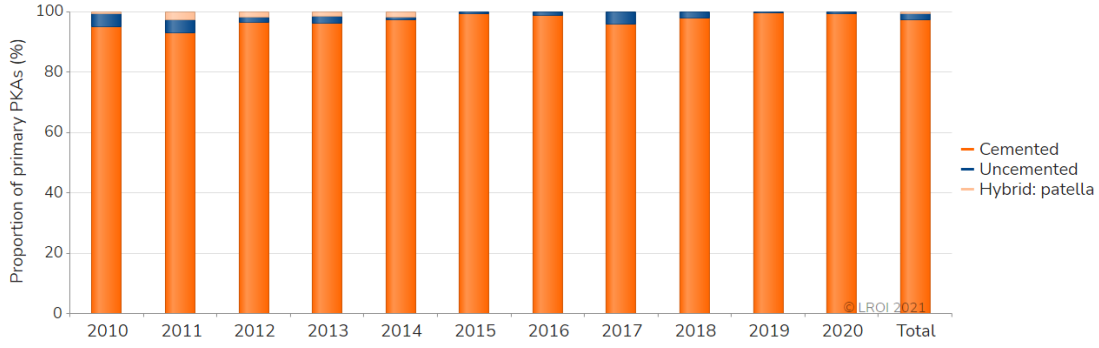


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Surgical approach (%)												
Medial parapatellar	95.80	97.39	94.64	96.95	97.37	95.51	96.50	97.60	98.34	94.86	96.84	**96.49**
Vastus (mid/sub)	2.10	1.74	1.79	0.76	0.00	2.56	2.80	2.40	1.66	5.14	3.16	**2.30**
Lateral parapatellar	2.10	0.87	3.57	2.29	2.63	1.92	0.70	0.00	0.00	0.00	0.00	**1.21**
Total (n):	**143**	**115**	**168**	**131**	**114**	**156**	**143**	**167**	**181**	**175**	**158**	**1,651**

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

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary patellofemoral knee arthroplasties in the Netherlands in 2010-2020



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Cemented	95.07	92.98	96.49	96.24	97.39	99.36	98.61	95.83	97.80	99.43	99.37	**97.29**
Uncemented	4.23	4.39	1.75	2.26	0.87	0.64	1.39	4.17	2.20	0.57	0.63	**2.05**
Hybrid: patella	0.70	2.63	1.75	1.50	1.74	0.00	0.00	0.00	0.00	0.00	0.00	**0.66**
Total (n):	**142**	**114**	**171**	**133**	**115**	**156**	**144**	**168**	**182**	**175**	**158**	**1,658**

PKA: patellofemoral knee arthroplasty.

Most frequently registered

Patellofemoral knee prostheses

TABLE The most frequently registered primary patellofemoral knee arthroplasties in the Netherlands in 2020 (n=142)

Name	Proportion (%)
Gender Solutions® Patello-Femoral Joint	57.8
Journey PFJ	23.9
Avon	13.4
IBalance PFJ	4.2
PFR implant	0.7

Types of bone cement

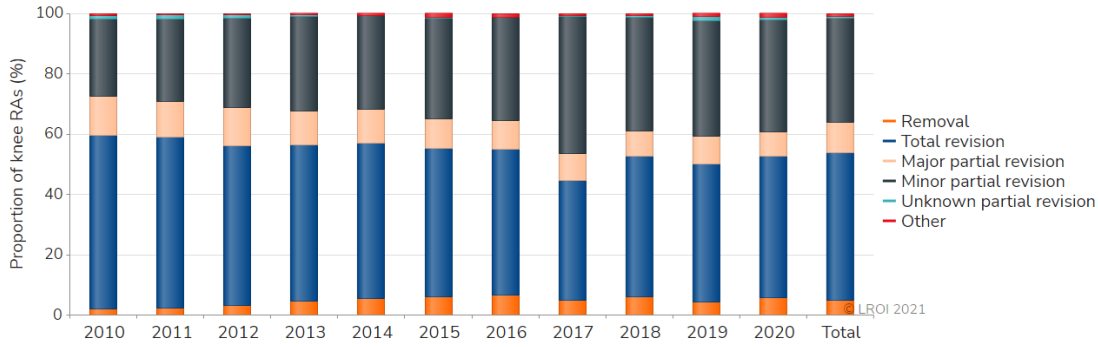
TABLE The most frequently registered types of bone cement used during primary patellofemoral knee arthroplasties in the Netherlands in 2020 (n=129)

Name	Proportion (%)
Palacos R+G	83.0
Refobacin Bone Cement R	11.6
Refobacin Plus Bone Cement	4.7
Subiton G	0.8

Knee revision arthroplasty

Type of revision

FIGURE Trend (proportion [%] per year) in type of revision in knee revision arthroplasties in the Netherlands in 2010-2020



Type of revision (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Removal	2.15	2.27	3.18	4.52	5.37	6.16	6.67	4.76	6.13	4.38	5.88	**4.91**
Total revision	57.41	56.68	52.84	51.95	51.60	49.05	48.43	39.91	46.42	45.61	46.84	**48.87**
Major partial revision	12.87	11.94	12.78	11.16	11.09	9.94	9.46	8.88	8.49	9.30	8.00	**10.10**
Minor partial revision	25.62	27.35	29.65	31.49	31.15	33.21	34.02	45.39	37.62	38.38	37.16	**34.60**
Unknown partial revision	1.32	1.19	1.01	0.31	0.20	0.26	0.21	0.24	0.65	1.36	0.86	**0.65**
Other	0.63	0.57	0.53	0.58	0.59	1.38	1.20	0.82	0.68	0.97	1.27	**0.87**
Total (n):	**1,585**	**1,759**	**2,074**	**2,258**	**2,533**	**2,677**	**2,907**	**2,939**	**2,921**	**3,085**	**2,449**	**27,187**

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 2020, the femur component was revised in 67 (34.2%) major partial knee revision arthroplasties and the tibia component was revised in 129 (65.8%) major partial knee revision arthroplasties.

Reasons for revision

TABLE Trend (proportion [%] per year) in reasons for revision in patients who underwent a knee revision arthropalsty in the Netherlands in 2014-2020

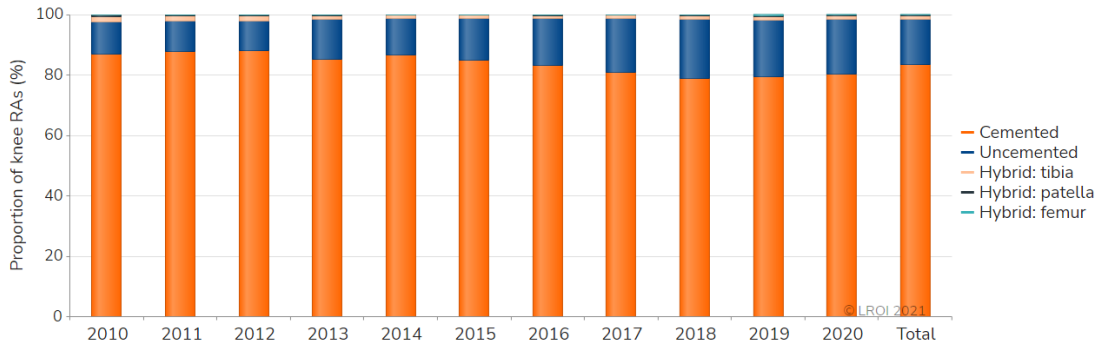
Year	2014	2015	2016	2017	2018	2019	2020	Total
Knee revision arthroplasty (n)	2,557	2,685	2,926	2,997	2,931	3,069	2,452	19,644
Reasons for revision; Proportion[1] (%)								
Instability	25.3	26.4	25.1	27.7	25.8	27.3	26.3	26.3
Loosening of tibia component	22.3	20.6	21.9	20.9	19.5	20.8	19.6	20.8
Patellar pain	22.9	23.0	21.5	19.7	18.9	20.1	18.8	20.7
Infection	14.7	16.5	19.6	20.3	20.8	20.2	23.3	19.4
Malalignment	15.7	14.7	13.9	11.3	10.7	10.2	10.6	12.4
Loosening of femur component	10.0	9.5	9.0	8.9	8.4	8.6	8.1	8.9
Progression of osteoarthritis	9.1	8.3	9.3	8.2	8.7	8.0	7.7	8.5
Insert wear	8.4	7.8	7.6	6.8	6.6	7.1	6.9	7.3
Revision after knee removal	6.9	5.7	6.3	5.6	4.9	4.2	5.0	5.5
Arthrofibrosis	4.7	5.1	4.3	4.9	4.6	5.2	4.0	4.7
Patellar dislocation	2.5	2.8	2.1	2.4	2.2	2.5	2.7	2.4
Periprosthetic fracture	2.2	2.3	1.7	1.8	1.5	1.9	2.6	2.0
Loosening of patella component	2.0	1.5	1.9	1.8	1.4	1.7	1.8	1.7
Other	8.1	8.6	8.3	7.4	7.8	7.8	7.5	7.9

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

Surgical techniques

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in knee revision arthroplasties in the Netherlands in 2010-2020

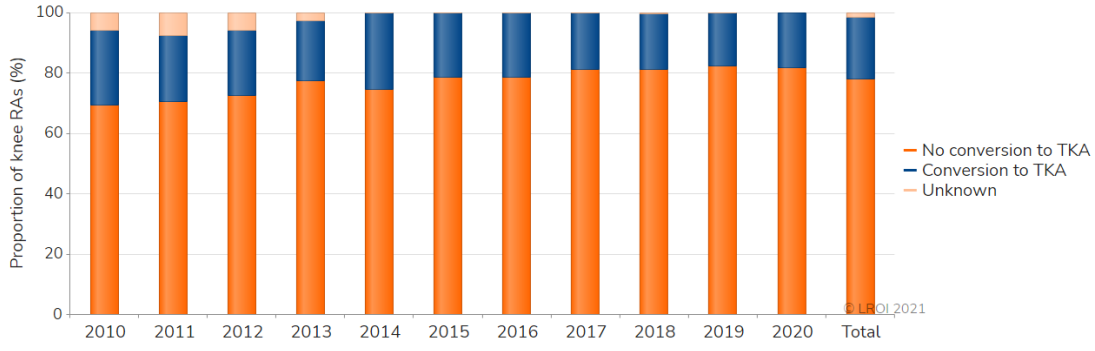


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fixation (%)												
Cemented	86.99	87.82	88.16	85.32	86.61	84.84	83.11	80.81	78.79	79.39	80.22	**83.31**
Uncemented	10.52	9.91	9.67	13.07	12.22	13.92	15.57	17.95	19.57	18.86	18.30	**15.09**
Hybrid: tibia	1.89	1.84	1.74	1.22	0.95	0.99	1.01	1.05	1.31	1.16	1.13	**1.25**
Hybrid: patella	0.40	0.24	0.26	0.15	0.17	0.21	0.23	0.11	0.22	0.28	0.18	**0.22**
Hybrid: femur	0.20	0.18	0.16	0.24	0.04	0.04	0.08	0.07	0.11	0.32	0.18	**0.14**
Total (n):	**1,483**	**1,634**	**1,892**	**2,043**	**2,315**	**2,428**	**2,665**	**2,752**	**2,673**	**2,853**	**2,219**	**24,957**

RA: revision arthroplasty.

Conversion to TKA

FIGURE Trend (proportion [%] per year) in conversion of a unicondylar or patellofemoral knee arthroplasty to a total knee arthroplasty in the Netherlands in 2010-2020

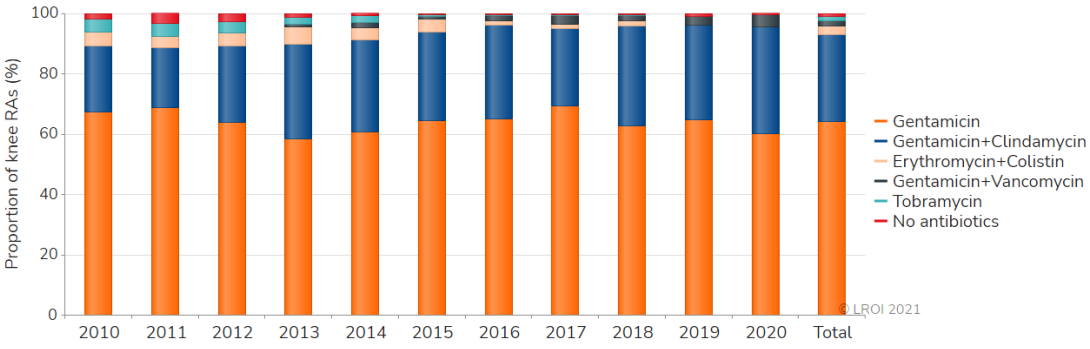


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Conversion to TKA (%)												
No conversion to TKA	69.21	70.52	72.59	77.29	74.55	78.58	78.56	81.15	81.22	82.36	81.73	**78.08**
Conversion to TKA	24.84	21.93	21.53	19.91	25.40	21.37	21.36	18.71	18.44	17.57	18.27	**20.45**
Unknown	5.95	7.55	5.88	2.80	0.05	0.04	0.08	0.14	0.34	0.07	0.00	**1.46**
Total (n):	**1,260**	**1,391**	**1,616**	**1,713**	**2,063**	**2,246**	**2,640**	**2,774**	**2,647**	**2,778**	**2,244**	**23,372**

RA: revision arthroplasty; TKA: total knee arthroplasty.

Bone cement antibiotics

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in knee revision arthroplasties in the Netherlands in 2010-2020



Bone cement antibiotics (%)

Gentamicin	67.38	68.90	63.87	58.48	60.83	64.58	65.08	69.38	62.71	64.77	60.03	**64.10**
Gentamicin+Clindamycin	21.89	19.64	25.40	31.30	30.39	29.27	31.15	25.47	33.06	31.28	35.49	**28.99**
Erythromycin+Colistin	4.46	3.87	4.25	5.68	4.15	4.29	1.32	1.54	1.73	0.00	0.00	**2.73**
Gentamicin+Vancomycin	0.00	0.00	0.13	1.02	1.64	0.85	1.67	3.03	1.90	3.03	4.01	**1.66**
Tobramycin	4.29	4.39	3.49	2.33	2.13	0.69	0.34	0.05	0.05	0.00	0.00	**1.41**
No antibiotics	1.97	3.20	2.86	1.19	0.87	0.32	0.44	0.53	0.54	0.92	0.47	**1.11**
Total (n):	**1,165**	**1,344**	**1,575**	**1,674**	**1,833**	**1,886**	**2,042**	**1,881**	**1,845**	**1,950**	**1,496**	**18,691**

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 2020

Femur (n=932)		**Tibia (n=1,081)**	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Legion	25.0	Legion	24.8
NexGen	17.6	NexGen	15.8
Genesis II	9.7	S-ROM	9.5
Triathlon	7.6	Triathlon	8.4
Vanguard 360	6.6	Vanguard 360	7.0
PFC / SIGMA	6.2	Genesis II	5.2
Vanguard Complete Knee	5.9	RT Plus	4.5
LCS	4.0	Vanguard Complete Knee	4.2
Legion Hinged	3.7	Endo Rotation Knee	3.3
Attune	2.7	Legion Hinged	3.2

Insert (n=1,675)		**Patella (n=920)**	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Genesis II	27.3	Genesis II	52.0
NexGen	16.2	Vanguard	13.0
Vanguard Complete Knee	7.8	NexGen	12.4
Triathlon	6.8	PFC / SIGMA	5.3
PFC / SIGMA	6.0	Triathlon	5.1
Oxford PKR	5.2	LCS	2.7
LCS	4.7	Attune	2.2
Legion	4.5	balanSys	2.1
Vanguard SSK	4.2	Persona	1.3
RT Plus	3.0	TC Plus	1.1

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 2020

Separately packed bone cement components (n=1,023)		Bone cement pre-packed in a vacuum mixing system (n=465)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Copal G+C	39.2	Palacos R+G	49.2
Palacos R+G	30.0	Refobacin Bone Cement R	40.9
Refobacin Revision	12.5	Refobacin Plus Bone Cement	6.5
Refobacin Bone Cement R	6.0	Refobacin Revision	3.4
Copal G+V	4.4		

Survival

Revision within 1 and 3 years

By type of revision

TABLE Cumulative 1-year and 3-year revision percentage of primary total knee arthroplasties by type of revision in the Netherlands in 2013-2017 (n=120,845)

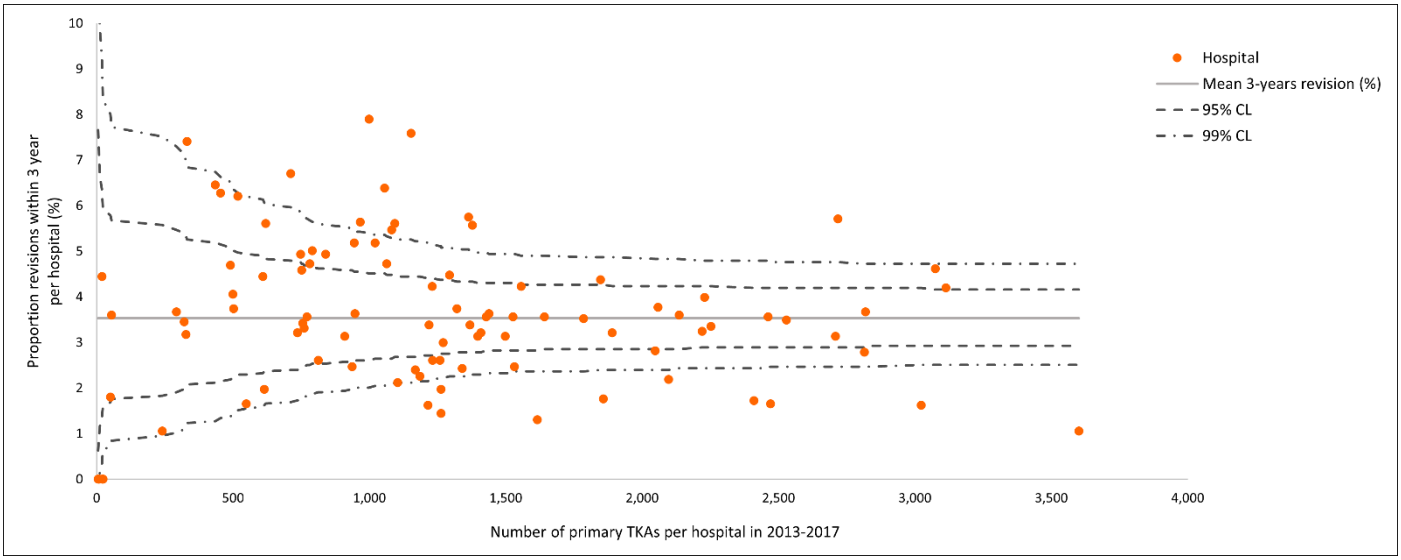
	Cumulative 1-year revision percentage		Cumulative 3-year revision percentage	
	Competing Risk (95% CI)	**Kaplan Meier (95% CI)**	**Competing Risk (95% CI)**	**Kaplan Meier (95% CI)**
Any type of revision[1]	1.1 (1.0-1.2)	1.0 (0.9-1.1)	3.5 (3.4-3.6)	3.5 (3.4-3.6)
Major revision[2]	0.4 (0.4-0.5)	0.4 (0.3-0.4)	1.5 (1.5-1.6)	1.5 (1.5-1.6)
Minor revision[3]	0.7 (0.6-0.7)	0.6 (0.6-0.7)	1.9 (1.8-2.0)	1.9 (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 2013-2017, 3,687 (3.1%) primary TKAs were implanted in patients who died within three years 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 2013-2017 (n=120,301)

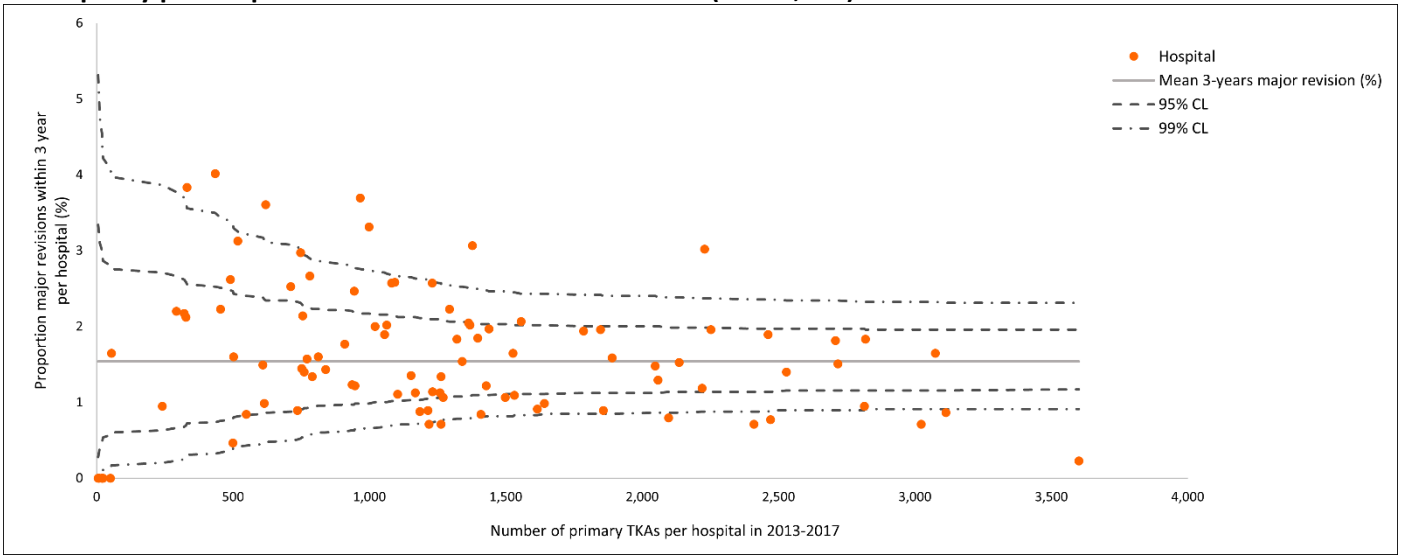


Please note: The proportion of revisions within 3 years per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).
TKA: total knee arthroplasty; CI: confidence interval.

The mean 3-years revision percentage is 3.5 (95% CI: 3.4-3.6) in the Netherlands in 2013-2017.
Control limits 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 2013-2017 (n=120,301)



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 1.5 (95% CI: 1.5-1.6) in the Netherlands in 2013-2017. Control limits 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 2013-2017

Reasons for revision	Major revision[1] (n=1,871) Proportion[4] (%)	Minor revision[2] (n=2,294) Proportion[4] (%)	Any type of revision[3] (n=4,272) Proportion[4] (%)
Patellar pain	9.5	46.8	30.0
Instability	32.7	23.9	27.2
Infection	17.3	21.0	19.4
Loosening of tibia component	35.3	0.7	16.0
Malalignment	28.9	1.6	13.6
Arthrofibrosis	7.7	6.7	7.2
Loosening of femur component	9.2	0.2	4.1
Patellar dislocation	2.4	3.7	3.1
Periprosthetic fracture	4.4	0.3	2.2
Revision after knee removal	3.6	0.2	1.7
Insert wear	0.9	2.2	1.6
Loosening of patella component	0.4	0.9	0.7
Progression of osteoarthritis	0.3	0.6	0.5
Other	7.4	8.6	8.1

[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%.

Type of revision per year

TABLE Type of revision within one year after a primary total knee arthroplasty in the Netherlands in 2013-2017 (n=120,845)

Type of revision	Within 1 year Proportion (%)	Within 3 years Proportion (%)
Major revisions	**0.4**	**1.5**
Only femur component	0.1	0.2
Only tibia component	0.1	0.3
Femur and tibia component	0.3	1.1
Minor revisions	**0.7**	**1.9**
DAIR	0.3	0.4
No DAIR	0.2	0.8
Patella addition	0.1	0.7

Major revision: revision of at least the femur or tibia component.
Minor revision: only inlay and/or patella exchange.
DAIR: minor revision with infection as reason for revision.
TKA: total knee arthroplasty; DAIR: debridement, antibiotics and implant retention.

Time after primary TKA

TABLE Time after primary total knee arthroplasty until short-term revision in the Netherlands in 2013-2017 (n=120,845)

Time after primary TKA	Percentage revisions (%)
Day 0-29	0.3
Day 30-182	0.3
Day 183-364	0.6
Day 365-730 (second year)	1.5
Day 731-1095 (third year)	0.9

TKA: total knee arthroplasty;

Short- and long-term revision

TKA overall

FIGURE Cumulative revision percentage of total knee arthroplasties by type of revision in the Netherlands in 2007-2020 (n=286,795)

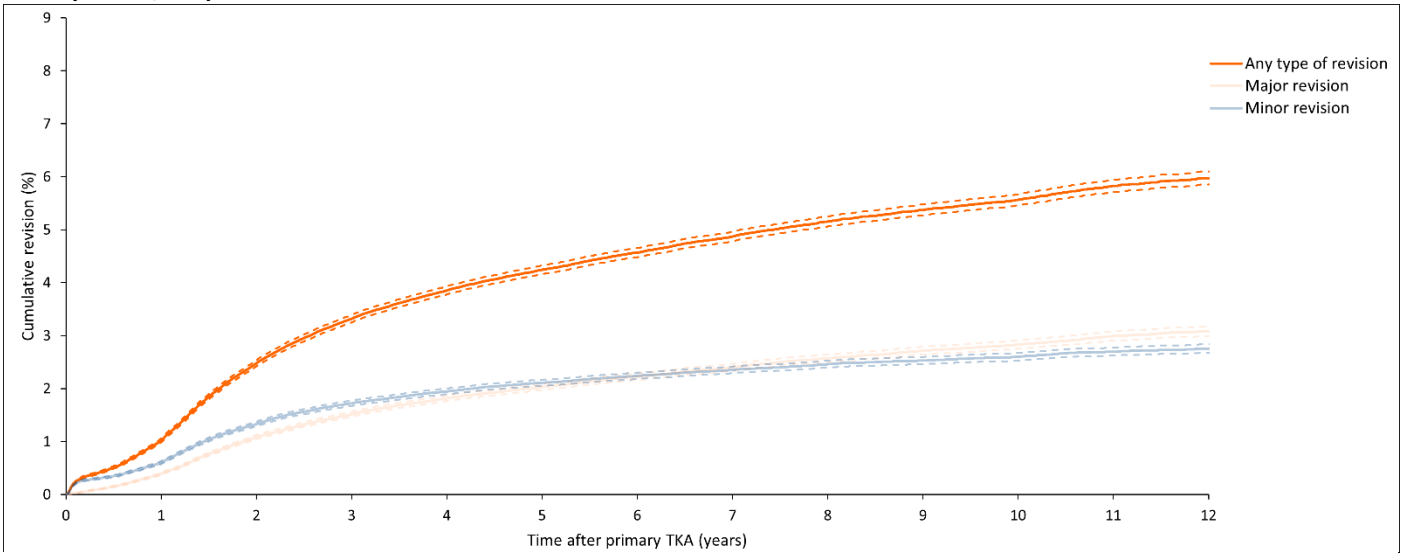


TABLE Cumulative revision percentages

	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Any type of revision			
1-year revision (%)	264,698	1.0 (1.0-1.1)	0.9 (0.9-1.0)
3-year revision (%)	204,071	3.3 (3.2-3.4)	3.3 (3.2-3.4)
5-year revision (%)	149,711	4.2 (4.2-4.3)	4.3 (4.2-4.4)
10-year revision (%)	42,303	5.6 (5.5-5.7)	5.8 (5.7-5.9)
12-year revision (%)	14,335	6.0 (5.9-6.1)	6.4 (6.2-6.5)
Major revision[2]			
1-year revision (%)	266,226	0.4 (0.4-0.4)	0.3 (0.3-0.4)
3-year revision (%)	207,880	1.5 (1.5-1.6)	1.5 (1.5-1.5)
5-year revision (%)	153,215	2.0 (2.0-2.1)	2.1 (2.0-2.1)
10-year revision (%)	43,577	2.8 (2.8-2.9)	3.0 (2.9-3.1)
12-year revision (%)	14,789	3.1 (3.0-3.2)	3.3 (3.2-3.4)
Minor revision[3]			
1-year revision (%)	265,717	0.6 (0.6-0.6)	0.5 (0.5-0.6)
3-year revision (%)	207,629	1.7 (1.7-1.8)	1.7 (1.7-1.8)
5-year revision (%)	153,448	2.1 (2.1-2.2)	2.1 (2.1-2.2)
10-year revision (%)	44,004	2.6 (2.5-2.7)	2.7 (2.6-2.8)
12-year revision (%)	14,928	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 2007-2020, 29,068 (10.6%) primary TKAs were implanted in patients who died within twelve years after the primary diagnosis

TKA by gender

FIGURE Cumulative revision percentage of total knee arthroplasties by gender in the Netherlands in 2007-2020 (n=286,795)

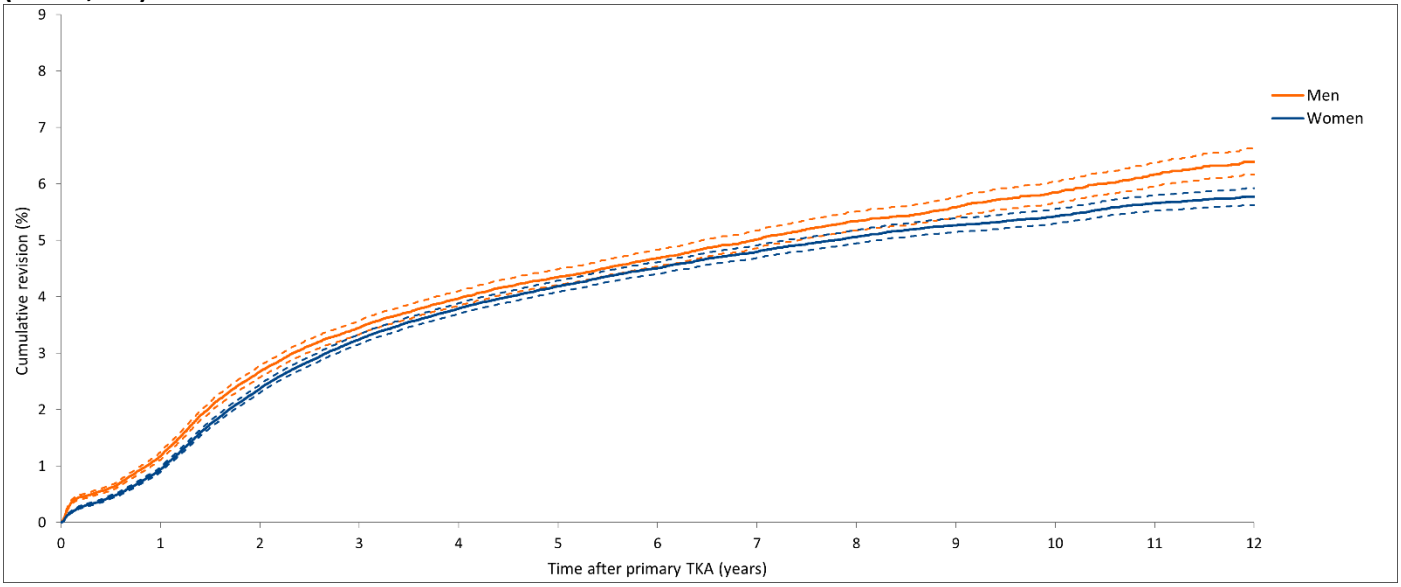


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Gender			
Men	100,176	6.4 (6.2-6.6)	6.9 (6.7-7.2)
Women	186,129	5.8 (5.6-5.9)	6.1 (5.9-6.3)

[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 2007-2020 (n=286,521)

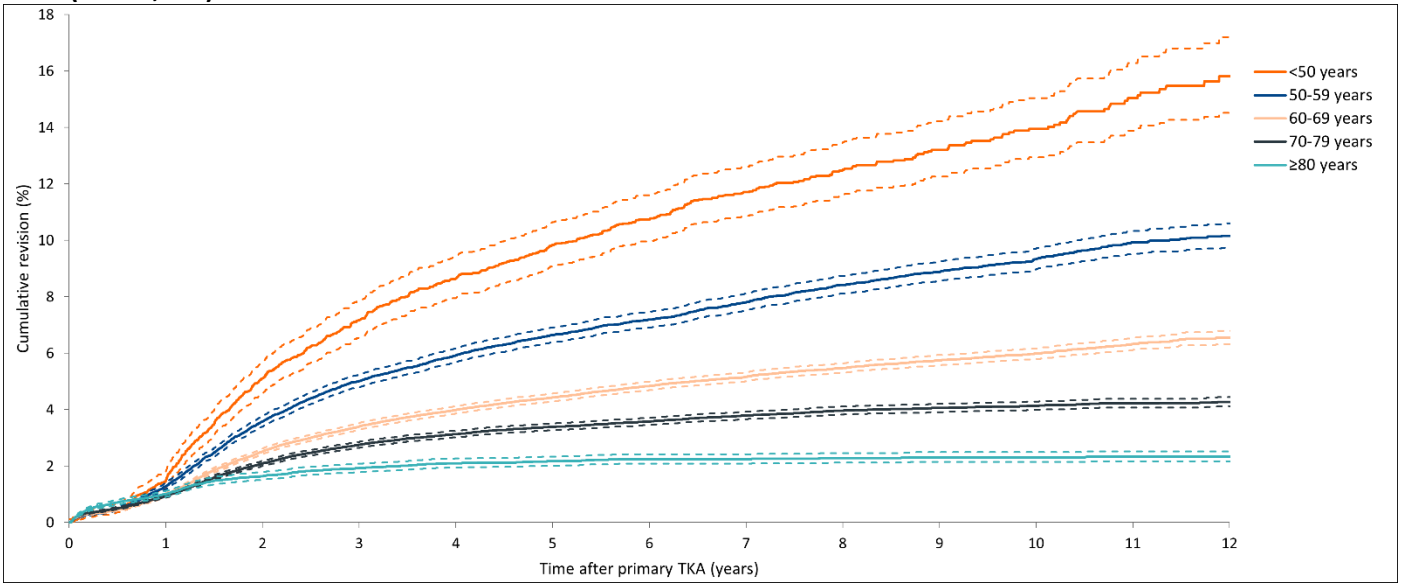


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Age (years)			
<50	6,522	15.8 (14.5-17.2)	16.1 (14.7-17.5)
50-59	41,573	10.2 (9.7-10.6)	10.3 (9.9-10.8)
60-69	100,502	6.6 (6.3-6.8)	6.8 (6.6-7.0)
70-79	103,075	4.3 (4.1-4.4)	4.6 (4.4-4.7)
≥80	34,849	2.3 (2.2-2.5)	2.5 (2.3-2.7)

[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 2007-2020 (n=284,252)

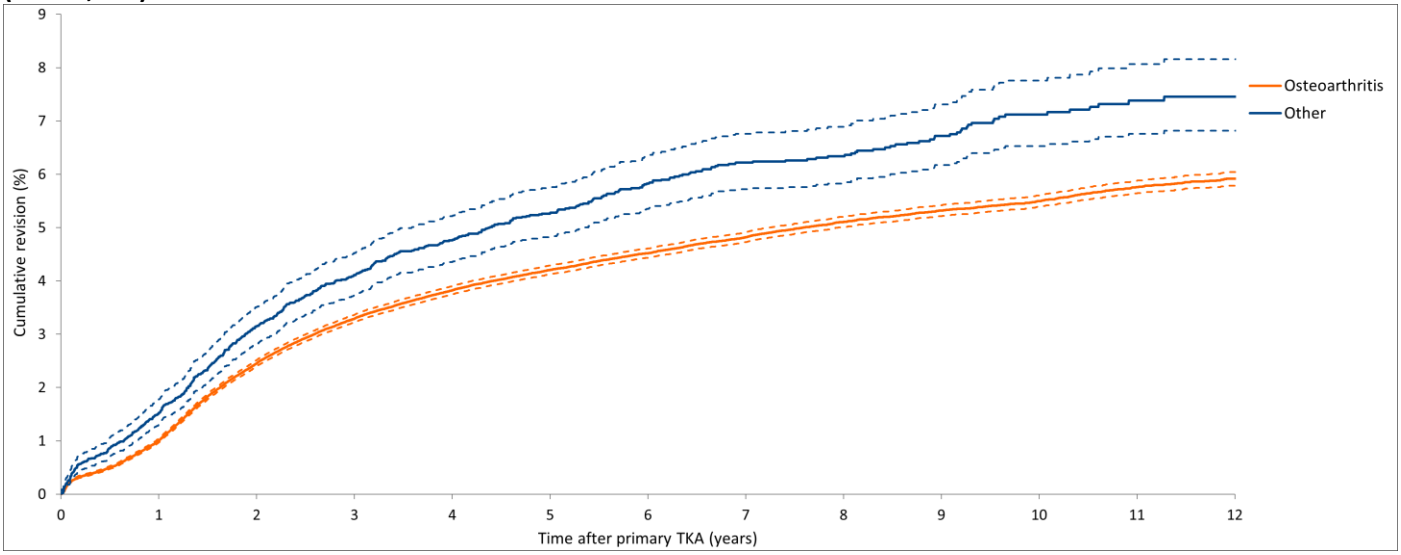


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Diagnosis			
Osteoarthritis	273,477	5.9 (5.8-6.0)	6.3 (6.2-6.5)
Other	10,775	7.5 (6.8-8.2)	8.0 (7.3-8.8)

[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 2007-2020 (n=277,459)

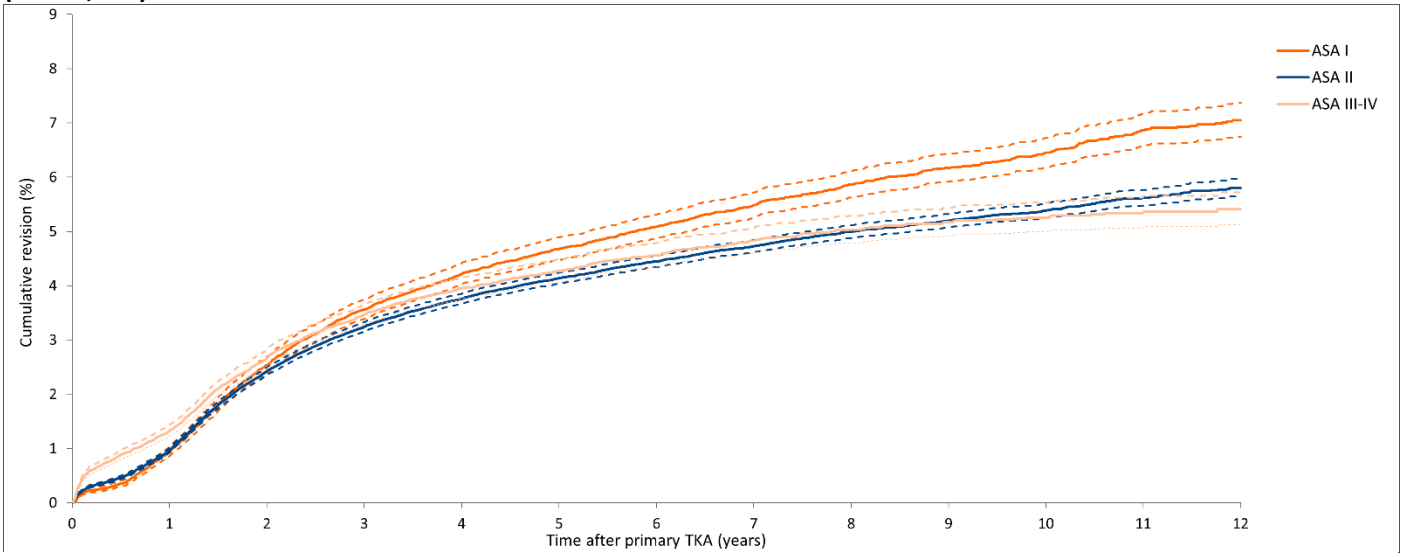


TABLE Cumulative 12-year revision percentage

		Cumulative 12-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
ASA score			
I	45,552	7.1 (6.7-7.4)	7.3 (7.0-7.7)
II	184,678	5.8 (5.6-6.0)	6.2 (6.0-6.4)
III-IV	47,229	5.4 (5.1-5.7)	6.0 (5.6-6.4)

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

TKA by BMI category

FIGURE Cumulative revision percentage of total knee arthroplasties by BMI category in the Netherlands in 2014-2020 (n=166,538)

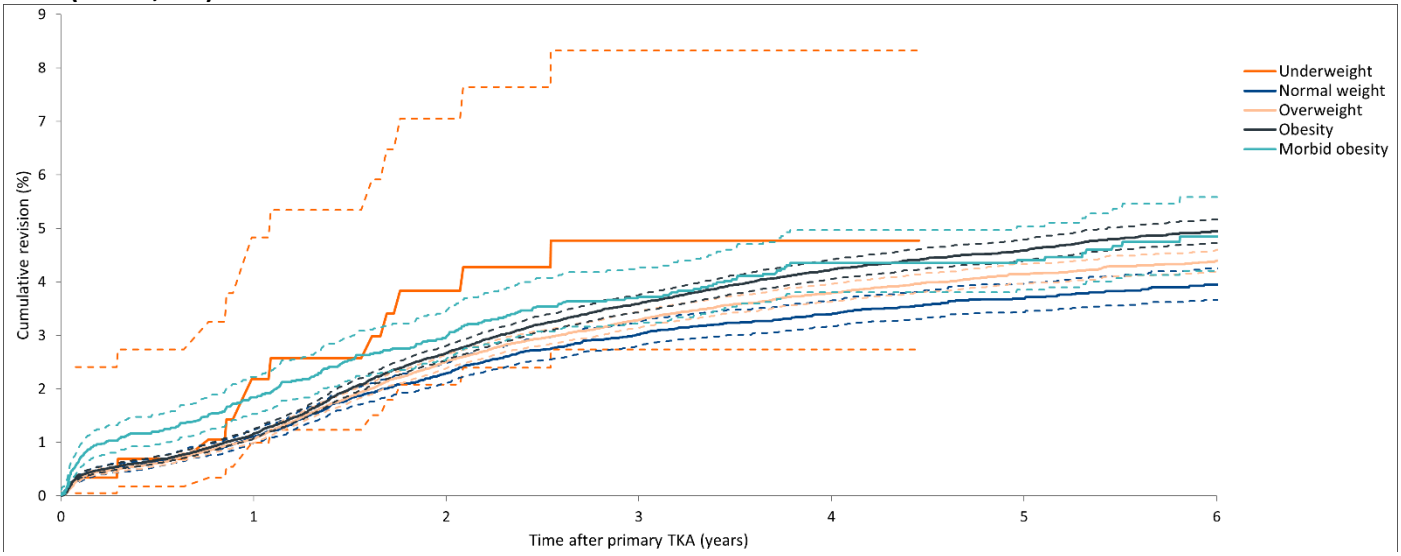


TABLE Cumulative 6-year revision percentage

		Cumulative 6-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Body Mass Index (kg/m²)			
Underweight (≤18,5)	294	n.a.	n.a.
Normal weight (>18,5-25)	28,367	3.9 (3.7-4.3)	4.1 (3.7-4.4)
Overweight (>25-30)	68,262	4.4 (4.2-4.6)	4.5 (4.3-4.7)
Obesity (>30-40)	63,563	4.9 (4.7-5.2)	5.0 (4.8-5.3)
Morbid obesity (>40)	6,052	4.8 (4.2-5.6)	5.0 (4.3-5.7)

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

TKA by Charnley score

FIGURE Cumulative revision percentage of total knee arthroplasties by charnley score in the Netherlands in 2014-2020 (n=166,076)

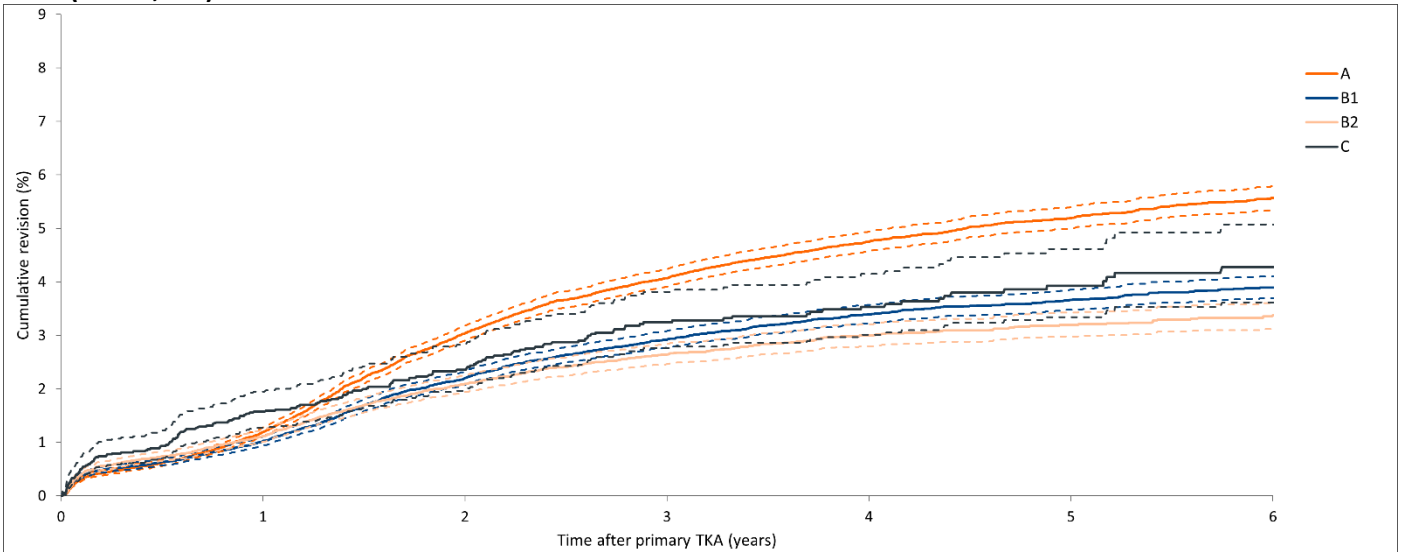


TABLE Cumulative 6-year revision percentage

		Cumulative 6-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Charnley-score			
A One hip joint affected	68,124	5.6 (5.3-5.8)	5.7 (5.4-5.9)
B1 Both hip joints affected	57,160	3.9 (3.7-4.1)	4.0 (3.8-4.2)
B2 Contralateral hip joint with a total hip prosthesis	35,329	3.4 (3.1-3.6)	3.4 (3.2-3.7)
C Multiple joints affected or chronic disease that affects quality of life	5,463	4.3 (3.6-5.1)	4.4 (3.7-5.2)

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

TKA by smoking

FIGURE Cumulative revision percentage of total knee arthroplasties by smoking in the Netherlands in 2014-2020 (n=162,207)

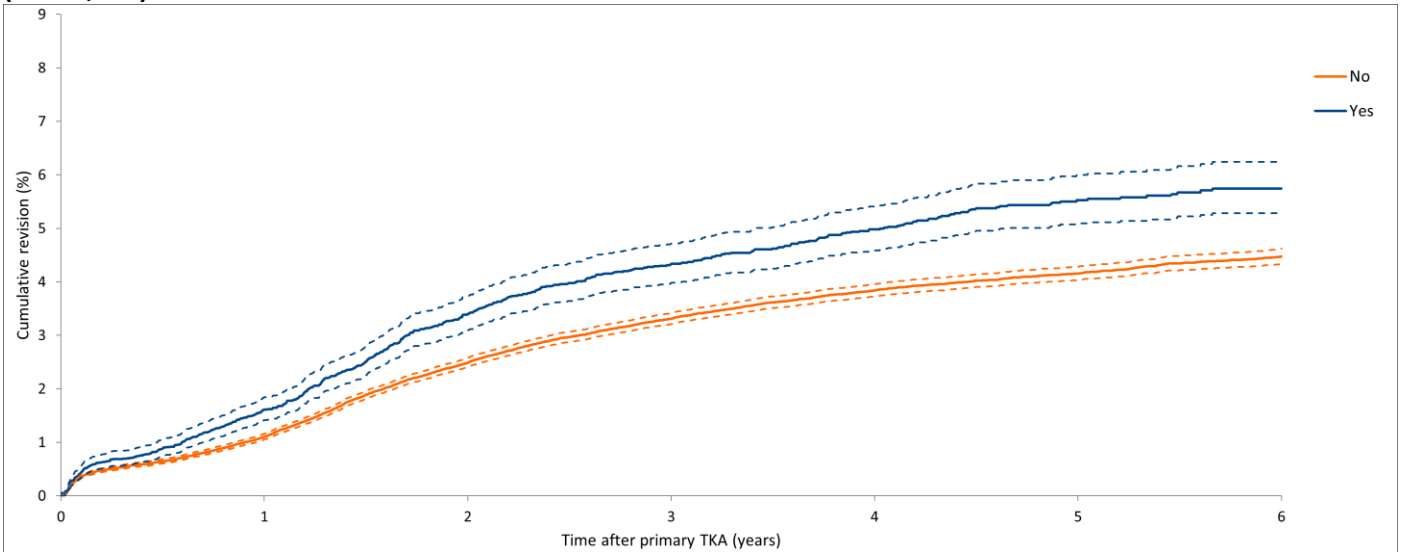


TABLE Cumulative 6-year revision percentage

		Cumulative 6-year revision percentage	
	Number (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Smoking			
No	148,246	4.5 (4.3-4.6)	4.6 (4.4-4.7)
Yes	13,961	5.7 (5.3-6.2)	5.9 (5.4-6.4)

[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 2007-2020 (n=34,632)

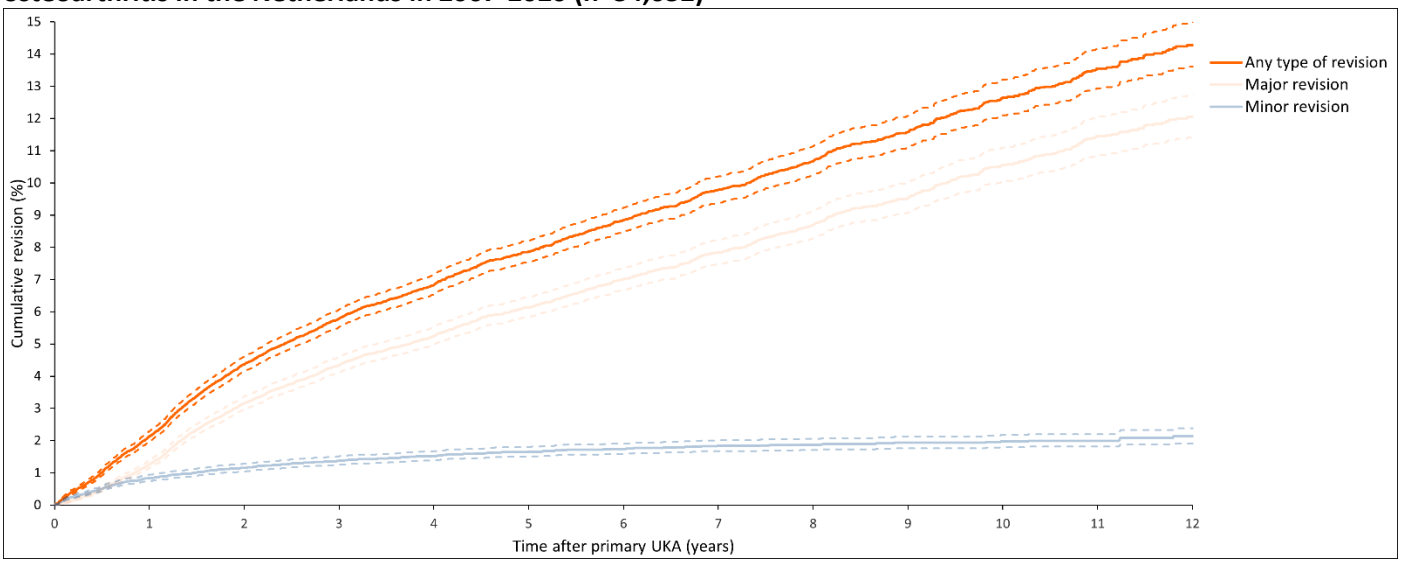


TABLE Cumulative 12-year revision percentage of unicondylar knee arthroplasties

	Cumulative 12-year revision percentage	
	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Any type of revision	14.3 (13.6-15.0)	14.9 (14.1-15.6)
Major revision[2]	12.1 (11.4-12.7)	12.6 (11.8-13.3)
Minor revision[3]	2.1 (1.9-2.4)	2.2 (1.9-2.4)

[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 2007-2020, 1,287 (3.7%) primary UKAs were implanted in patients who died within twelve 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 2007-2020 (n=245,342)

					Type of revision (n)						Cumulative revision percentage Kaplan Meier (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	12yr
All cemented TKAs for osteoarthritis		**245,342**	**69 (62-75)**	**10,075**	**3,467**	**1,970**	**441**	**953**	**2,971**	**273**	**0.9 (0.9-0.9)**	**3.3 (3.2-3.3)**	**4.3 (4.2-4.4)**	**5.0 (4.9-5.1)**	**5.8 (5.7-5.9)**	**6.4 (6.2-6.6)**
Genesis II	Genesis II	54,470	69 (62-75)	2,525	609	574	211	178	881	72	1.1 (1.0-1.2)	4.0 (3.8-4.2	5.1 (4.9-5.3)	5.6 (5.4-5.9)	6.3 (6.0-6.6)	6.8 (6.5-7.2)
NexGen	NexGen	52,138	69 (63-75)	2,111	845	224	61	268	652	61	0.9 (0.8-1.0)	2.9 (2.7-3.0)	4.0 (3.8-4.2)	5.0 (4.8-5.2)	6.0 (5.7-6.3)	6.8 (6.4-7.2)
Vanguard Complete Knee	Vanguard Complete Knee	41,005	69 (62-75)	1,427	472	279	38	125	473	40	0.9 (0.8-1.0)	3.0 (2.8-3.1)	3.8 (3.5-4.0)	4.3 (4.1-4.6)	5.0 (4.7-5.3)	5.4 (5.0-5.8)
PFC / Sigma	PFC / Sigma	28,773	70 (63-76)	1,052	310	253	28	81	354	26	0.9 (0.8-1.0)	3.0 (2.8-3.2)	3.8 (3.6-4.0)	4.2 (3.9-4.4)	4.6 (4.3-4.9)	4.8 (4.5-5.2)
LCS	LCS	16,881	70 (63-76)	679	346	63	34	135	91	10	0.6 (0.5-0.8)	3.2 (2.9-3.5)	4.3 (3.9-4.6)	4.8 (4.5-5.2)	5.5 (5.0-5.9)	6.0 (5.4-6.6)
Triathlon	Triathlon	7,404	70 (64-76)	234	68	38	13	25	86	4	1.1 (0.8-1.3)	3.5 (3.0-3.9)	4.3 (3.7-4.9)	5.0 (4.3-5.7)	n.a.	n.a.
AGC V2	AGC V2	4,420*	71 (65-77)	161	91	52	1	2	10	5	0.3 (0.1-0.5)	2.0 (1.6-2.4)	2.6 (2.1-3.1)	3.2 (2.6-3.7)	3.7 (3.1-4.3)	4.6 (3.8-5.4)
balanSys	balanSys	3,283	69 (62-76)	143	52	55	3	7	23	3	0.5 (0.3-0.8)	3.5 (2.8-4.2)	5.0 (4.1-5.8)	5.7 (4.7-6.7)	6.9 (5.5-8.2)	8.2 (6.3-10.0)
TC Plus	TC Plus	3,278	70 (63-76)	99	52	24	2	5	12	4	0.5 (0.3-0.8)	2.2 (1.7-2.8)	2.9 (2.3-3.5)	3.3 (2.6-4.0)	4.3 (3.3-5.2)	4.8 (3.6-5.9)
Optetrak	Optetrak	3,071*	70 (62-76)	327	177	89	3	33	20	5	1.1 (0.7-1.4)	5.3 (4.5-6.1)	7.1 (6.2-8.1)	9.1 (8.1-10.2)	12.0 (10.7-13.3)	14.4 (12.6-16.2)
ACS	ACS	2,666	67 (60-73)	134	31	20	9	12	55	7	0.7 (0.4-1.0)	3.8 (3.1-4.5)	4.7 (3.9-5.5)	5.0 (4.2-5.9)	5.5 (4.6-6.5)	n.a.
Scorpio NRG	Scorpio	2,630*	70 (63-76)	133	45	43	10	4	29	2	0.8 (0.5-1.1)	3.1 (2.4-3.8)	4.5 (3.6-5.3)	5.2 (4.3-6.0)	5.8 (4.8-6.8)	n.a.
Scorpio	Scorpio	2,240*	71 (63-76)	108	55	22	3	6	18	4	0.3 (0.1-0.5)	2.4 (1.7-3.0)	3.2 (2.5-3.9)	3.7 (2.9-4.5)	4.7 (3.8-5.7)	5.5 (4.5-6.5)
Attune	Attune	1,939	67 (60-74)	34	5	10	1	9	8	1	0.4 (0.1-0.7)	2.5 (1.6-3.4)	3.3 (2.2-4.5)	n.a.	n.a.	n.a.
Journey BCS	Journey BCS	1,317	69 (61-74)	115	15	55	1	3	39	2	1.0 (0.5-1.5)	5.7 (4.4-7.1)	7.2 (5.7-8.8)	9.1 (7.3-10.9)	11.3 (9.2-13.5)	13.6 (10.8-16.3)
PFC / Sigma	LCS	1,211*	66 (58-75)	53	27	11	3	1	9	2	0.3 (0.0-0.7)	1.9 (1.2-2.7)	3.0 (2.0-3.9)	4.0 (2.8-5.2)	4.9 (3.5-6.3)	5.8 (4.1-7.5)
NexGen GSF	NexGen	1,155	68 (61-74)	32	18	5	0	1	7	1	0.5 (0.1-0.9)	1.7 (0.9-2.4)	2.8 (1.8-3.8)	3.1 (2.0-4.2)	3.7 (2.3-5.2)	n.a.
MRK	MRK	1,117	69 (62-75)	18	8	7	0	0	2	1	0.2 (0.0-0.5)	1.5 (0.6-2.4)	2.4 (1.2-3.5)	3.2 (1.5-4.8)	n.a.	n.a.
Journey II BCS	Journey BCS	1,021	66 (60-72)	55	10	24	0	0	19	2	0.2 (0.0-0.5)	4.4 (3.0-5.7)	6.0 (4.4-7.6)	7.6 (5.1-10.0)	n.a.	n.a.
Innex	Innex	909*	70 (62-78)	37	13	10	0	4	10	0	1.2 (0.5-1.9)	2.6 (1.5-3.6)	3.4 (2.2-4.6)	4.0 (2.7-5.3)	4.3 (2.9-5.7)	4.6 (3.1-6.1)
Profix	Profix	772*	68 (61-76)	57	40	7	1	2	6	1	0.5 (0.0-1.0)	3.7 (2.3-5.0)	5.6 (3.9-7.2)	6.6 (4.8-8.3)	7.8 (5.8-9.7)	7.8 (5.8-9.7)
Persona	Persona	754	69 (62-74)	23	9	3	0	2	9	0	0.8 (0.1-1.5)	5.4 (2.9-7.9)	7.2 (4.2-10.1)	n.a.	n.a.	n.a.
Evolution MP	Evolution MP	709	69 (63-74)	12	2	5	0	0	5	0	0.4 (0.0-1.0)	2.5 (1.0-3.9)	n.a.	n.a.	n.a.	n.a.
Genesis II	Profix / Genesis MB baseplate	622*	67 (60-75)	66	27	30	0	1	7	1	1.0 (0.2-1.8)	6.9 (4.9-8.9)	9.0 (6.7-11.3)	10.3 (7.8-12.7)	11.4 (8.8-14.0)	11.4 (8.8-14.0)
Rotaglide	Rotaglide	428*	72 (65-78)	37	26	2	2	0	7	0	0.9 (0.0-1.9)	4.5 (2.5-6.5)	5.9 (3.7-8.2)	7.2 (4.7-9.6)	9.9 (6.8-13.1)	n.a.
Advance MP	Advance	312*	71 (65-78)	31	6	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)	n.a.
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 (2.6-7.8)

* Denotes prosthesis combinations with no reported use in primary TKAs in 2020.
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 2007-2020 (n=12,680)

					Type of revision (n)						Cumulative revision percentage Kaplan Meier (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	12yr
All uncemented TKAs for osteoarthritis		**12,680**	**69 (62-76)**	**583**	**204**	**84**	**12**	**111**	**164**	**8**	**1.0 (0.8-1.2)**	**3.7 (3.3-4.0)**	**4.6 (4.2-5.0)**	**5.1 (4.7-5.6)**	**5.8 (5.3-6.3)**	**6.3 (5.7-6.8)**
LCS	LCS	8,160	69 (63-76)	350	98	42	9	87	110	4	0.9 (0.7-1.1)	3.5 (3.1-3.9)	4.2 (3.8-4.7)	4.6 (4.1-5.1)	5.1 (4.6-5.7)	5.5 (4.9-6.1)
Triathlon	Triathlon	1,115	70 (63-76)	27	10	5	0	2	10	0	0.5 (0.1-0.9)	1.7 (0.9-2.5)	2.6 (1.5-3.7)	3.3 (2.0-4.6)	3.8 (2.1-5.5)	n.a.
ACS	ACS	494	69 (61-75)	23	10	4	1	3	5	0	2.6 (1.1-4.0)	4.5 (2.5-6.4)	5.0 (3.0-7.0)	5.4 (3.2-7.6)	n.a.	n.a.
Duracon	Duracon	282*	69 (61-77)	9	4	1	0	0	4	0	0.4 (0.0-1.0)	0.7 (0.0-1.7)	1.4 (0.0-2.8)	1.4 (0.0-2.8)	3.1 (1.0-5.1)	3.5 (1.2-5.7)
Rotaglide	Rotaglide	265*	69 (61-76)	55	35	10	1	1	7	1	1.5 (0.0-3.0)	10.3 (6.6-14.0)	16.3 (11.8-20.8)	19.8 (148-24.7)	21.4 (16.2-26.6)	n.a.
NexGen	NexGen	225	70 (62-77)	15	6	1	0	3	5	0	1.8 (0.1-3.5)	4.8 (1.9-7.8)	6.5 (2.8-10.2)	7.6 (3.4-11.8)	n.a.	n.a.
ACS LD	ACS LD	224*	70 (61-76)	12	6	2	0	1	3	0	1.4 (0.0-2.9)	5.7 (2.6-8.8)	n.a.	n.a.	n.a.	n.a.
Genesis II	Genesis II	201	69 (62-75)	9	4	2	0	1	1	1	1.1 (0.0-2.5)	5.0 (1.8-8.2)	5.0 (1.8-8.2)	5.0 (1.8-8.2)	n.a.	n.a.
Vanguard Complete Knee	Vanguard Complete Knee	156	67 (61-74)	11	5	1	0	4	1	0	2.6 (0.1-5.1)	6.0 (2.2-9.9)	6.0 (2.2-9.9)	6.0 (2.2-9.9)	n.a.	n.a.
Attune	Attune	145	69 (64-73)	7	2	1	0	0	4	0	3.1 (0.1-6.0)	n.a.	n.a.	n.a.	n.a.	n.a.

* Denotes prosthesis combinations with no reported use in primary TKAs in 2020.
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 primary total knee arthroplasties in the Netherlands in 2007-2020

		Cumulative revision percentage Kaplan Meier (95% CI)					
Bone cement	**n**	**1yr**	**3yr**	**5yr**	**7yr**	**10yr**	**12yr**
Separately packed bone cement components (n=171,828)							
Palacos R+G	127,684	0.9 (0.9-1.0)	3.4 (3.2-3.5)	4.4 (4.3-4.5)	5.1 (4.9-5.2)	5.9 (5.7-6.0)	6.5 (6.3-6.7)
Refobacin Bone Cement R	12,343	0.8 (0.6-0.9)	3.1 (2.8-3.4)	4.1 (3.7-4.5)	5.3 (4.8-5.7)	6.6 (6.0-7.2)	7.4 (6.7-8.1)
Palacos MV+G	8,029	0.8 (0.6-1.0)	3.1 (2.7-3.5)	4.1 (3.6-4.6)	4.9 (4.4-5.4)	5.4 (4.8-6.1)	n.a.
Simplex ABC EC	5,367*	1.0 (0.7-1.3)	3.8 (3.3-4.4)	5.2 (4.6-5.8)	6.3 (5.6-6.9)	7.4 (6.6-8.3)	7.6 (6.7-8.5)
Simplex ABC Tobra	5,119*	0.8 (0.5-1.0)	2.2 (1.8-2.6)	3.0 (2.5-3.5)	3.7 (3.1-4.2)	4.6 (3.9-5.3)	5.3 (4.4-6.2)
Refobacin Plus Bone Cement	3,163	1.1 (0.7-1.4)	4.4 (3.7-5.1)	5.5 (4.7-6.3)	5.9 (5.1-6.8)	6.5 (5.6-7.4)	7.2 (6.0-8.3)
Palacos R	1,748*	0.6 (0.2-0.9)	2.6 (1.9-3.4)	3.3 (2.4-4.1)	3.9 (3.0-4.9)	4.8 (3.7-5.9)	5.3 (4.0-6.6)
Biomet Plus Bone Cement	1,471	1.0 (0.5-1.5)	3.7 (2.7-4.7)	4.6 (3.4-5.8)	4.8 (3.5-6.0)	5.4 (3.9-6.8)	n.a.
Palamed G	1,430*	0.2 (0.0-0.4)	2.3 (1.5-3.0)	3.1 (2.2-4.1)	3.5 (2.6-4.5)	4.0 (3.0-5.0)	4.3 (3.2-5.4)
Subiton G	797	0.4 (0.0-1.0)	n.a.	n.a.	n.a.	n.a.	n.a.
Versabond	647*	0.6 (0.0-1.2)	5.3 (3.6-7.0)	6.3 (4.4-8.1)	6.8 (4.8-8.7)	7.4 (5.3-9.5)	n.a.
cemSys 1G	634*	1.4 (0.5-2.3)	3.8 (2.3-5.3)	7.3 (5.0-9.6)	7.7 (5.3-10.2)	n.a.	n.a.
Simplex P	404*	0.0 (0.0-0.0)	2.8 (1.2-4.4)	3.9 (1.9-5.8)	4.4 (2.4-6.5)	5.4 (3.1-7.6)	5.7 (3.3-8.1)
Simplex HV	381	0.8 (0.0-1.7)	3.1 (0.2-5.9)	n.a.	n.a.	n.a.	n.a.
Biomet Bone Cement R	379	0.6 (0.0-1.5)	3.9 (1.3-6.5)	5.7 (2.1-9.3)	6.7 (2.7-10.6)	6.7 (2.7-10.6)	n.a.
Synicem1G	340*	0.6 (0.0-1.4)	3.7 (1.6-5.7)	n.a.	n.a.	n.a.	n.a.
Palamed	250*	0.8 (0.0-1.9)	2.8 (0.8-4.8)	4.0 (1.6-6.4)	4.9 (2.2-7.5)	5.3 (2.5-8.1)	5.3 (2.5-8.1)
Bone cement pre-packed in a vacuum mixing system (n=66,934)							
Refobacin Bone Cement R	30,094	1.1 (1.0-1.2)	3.4 (3.1-3.6)	4.4 (4.1-4.6)	5.1 (4.7-5.4)	6.0 (5.3-6.6)	n.a.
Palacos R+G	20,790	1.1 (0.9-1.2)	3.5 (3.1-3.8)	4.1 (3.7-4.5)	4.6 (3.8-5.4)	n.a.	n.a.
Refobacin Plus Bone Cement	14,366	0.7 (0.6-0.9)	3.2 (2.9-3.5)	4.0 (3.7-4.4)	4.5 (4.1-4.9)	5.1 (4.6-5.6)	6.5 (5.0-8.1)
Cemex Genta	1,439*	1.0 (0.5-1.6)	4.9 (3.8-6.0)	5.6 (4.4-6.8)	6.1 (4.8-7.4)	6.6 (5.2-8.1)	n.a.

* Denotes types of bone cement with no reported use in primary TKAs in 2020.
Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; CI: confidence interval; IQR: interquartile range.

Only types of bone cement 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.

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 2007-2020 (n=34,632)

					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	12yr
All UKAs for osteoarthritis		**34,632**	**63 (57-69)**	**2,522**	**1,902**	**7**	**15**	**64**	**503**	**31**	**1.9 (1.8-2.1)**	**5.7 (5.4-6.0)**	**7.9 (7.5-8.2)**	**9.9 (9.5-10.3)**	**13.0 (12.4-13.6)**	**14.9 (14.2-15.7)**
Oxford PKR Cemented	Oxford PKR Cemented	13,716	63 (57-69)	1,380	1,099	5	10	30	217	20	1.9 (1.7-2.1)	6.2 (5.8-6.6)	8.7 (8.2-9.2)	10.7 (10.1-11.3)	13.8 (13.0-14.5)	15.7 (14.7-16.6)
Oxford PKR Uncemented	Oxford PKR Uncemented	11,562	64 (58-70)	448	231	0	2	15	196	5	2.0 (1.7-2.2)	4.3 (3.9-4.7)	5.2 (4.7-5.7)	6.8 (5.9-7.7)	n.a.	n.a.
Physica Zimmer Unicompartmental High Flex Knee	Physica Zimmer Unicompartmental High Flex Knee	2,811	62 (57-68)	104	92	0	0	1	12	0	0.7 (0.4-1.1)	3.3-(2.5-4.1)	5.0 (3.8-6.1)	7.1 (5.4-8.7)	10.5 (8.0-13.0)	11.5 (8.7-14.3)
Genesis Uni	Genesis Uni	1,276	62 (56-69)	204	192	1	0	2	6	3	2.7 (1.8-3.6)	8.8 (7.2-10.3)	12.4 (10.6-14.2)	14.8 (12.8-16.8)	17.6 (15.3-20.0)	19.1 (16.5-21.8)
balanSys UNI	balanSys UNI	450	61 (55-68)	52	43	1	0	3	5	0	2.4 (0.9-3.9)	9.7 (6.7-12.7)	11.3 (8.0-14.5)	12.4 (8.9-15.8)	17.0 (12.2-21.8)	n.a.
Journey Uni	Journey Uni	407	62 (56-69)	23	19	0	2	1	0	1	1.6 (0.3-2.9)	5.9 (3.2-8.6)	8.8 (4.9-12.7)	n.a.	n.a.	n.a.
Oxford PKR Uncemented	Oxford PKR Cemented	362	65 (56-72)	18	9	0	0	0	9	0	2.9 (1.1-4.7)	5.3 (2.7-7.8)	6.9 (3.5-10.2)	n.a.	n.a.	n.a.
Triathlon	Triathlon	197	70 (63-76)	17	16	0	0	0	1	0	1.6 (0.0-3.3)	6.6 (2.5-10.7)	8.7 (3.8-13.5)	11.1 (5.3-16.9)	n.a.	n.a.
Oxford PKR Cemented	Oxford PKR Uncemented	181	66 (59-73)	12	6	0	1	0	5	0	2.8 (0.4-5.3)	7.8 (2.9-12.7)	n.a.	n.a.	n.a.	n.a.
HLS uni	HLS Uni	171*	58 (52-65)	35	34	0	0	0	1	0	2.3 (0.1-4.6)	8.8 (4.5-13.0)	16.5 (10.9-22.0)	19.4 (13.5-25.4)	20.8 (14.7-27.0)	n.a.
Allegretto	Allegretto	108*	57 (51-65)	18	15	0	0	3	0	0	6.5 (1.8-11.1)	12.2 (6.0-18.4)	17.0 (9.5-24.5)	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 2007-2020 (n=245,342)

					Cumulative revision percentage Kaplan Meier (95% CI)					
Femur component	Tibia component	Total primary TKAs (n)	Median (IQR) age (yr)	Major revision[1] arthroplasties (n)	1yr	3yr	5yr	7yr	10yr	12yr
All cemented TKAs for osteoarthritis		**245,342**	**69 (63-75)**	**4,861**	**0.3 (0.3-0.3)**	**1.5 (1.4-1.5)**	**2.0 (2.0-2.1)**	**2.4 (2.3-2.5)**	**2.9 (2.8-3.0)**	**3.3 (3.2-3.5)**
Genesis II	Genesis II	54,470	69 (62-75)	998	0.4 (0.3-0.4)	1.6 (1.4-1.7)	2.0 (1.9-2.2)	2.3 (2.1-2.4)	2.6 (2.4-2.7)	2.8 (2.5-3.0)
NexGen	NexGen	52,138	69 (63-75)	1,174	0.3 (0.2-0.3)	1.4 (1.3-1.5)	2.1 (1.9-2.2)	2.8 (2.7-3.0)	3.7 (3.4-3.9)	4.3 (4.0-4.7)
Vanguard Complete Knee	Vanguard Complete Knee	41,005	69 (62-75)	635	0.3 (0.3-0.4)	1.3 (1.2-1.4)	1.7 (1.5-1.8)	2.0 (1.8-2.1)	2.3 (2.1-2.5)	2.5 (2.2-2.8)
PFC / Sigma	PFC / Sigma	28,773	70 (63-76)	419	0.3 (0.2-0.3)	1.1 (1.0-1.2)	1.5 (1.3-1.7)	1.7 (1.5-1.8)	1.9 (1.7-2.1)	2.0 (1.8-2.2)
LCS	LCS	16,881	70 (63-76)	515	0.4 (0.3-0.4)	2.3 (2.1-2.6)	3.2 (2.9-3.5)	3.7 (3.4-4.0)	4.3 (3.9-4.6)	4.7 (4.2-5.3)
Triathlon	Triathlon	7,404	70 (64-76)	106	0.4 (0.3-0.6)	1.5 (1.2-1.8)	2.0 (1.6-2.4)	2.4 (1.9-3.0)	n.a.	n.a.
AGC V2	AGC V2	4,420*	71 (65-77)	94	0.1 (0.0-0.2)	1.0 (0.7-1.3)	1.4 (1.1-1.8)	1.8 (1.4-2.2)	2.2 (1.8-2.7)	2.7 (2.1-3.3)
balanSys	balanSys	3,283	69 (62-76)	62	0.2 (0.0-0.3)	1.4 (0.9-1.8)	2.3 (1.7-2.9)	2.6 (1.9-3.3)	2.9 (2.1-3.8)	3.6 (2.4-4.8)
TC Plus	TC Plus	3,278	70 (63-76)	59	0.3 (0.1-0.6)	1.3 (0.9-1.7)	1.9 (1.3-2.4)	2.2 (1.6-2.7)	2.3 (1.7-3.0)	2.6 (1.8-3.4)
Optetrak	Optetrak	3,071*	70 (62-76)	213	0.6 (0.3-0.8)	3.0 (2.3-3.6)	4.2 (3.4-4.9)	5.5 (4.6-6.3)	7.9 (6.8-9.0)	10.3 (8.6-11.9)

[1] Revision of at least the femur or tibia component.
* Denotes prosthesis combinations with no reported use in primary TKAs in 2020.
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 2007-2020 (n=12,680)

					Cumulative revision percentage Kaplan Meier (95% CI)					
Femur component	Tibia component	Total primary TKAs (n)	Median (IQR) age (yr)	Major revision[1] arthroplasties (n)	1yr	3yr	5yr	7yr	10yr	12yr
All uncemented TKAs for osteoarthritis		**12,680**	**69 (62-76)**	**327**	**0.6 (0.5-0.7)**	**2.1 (1.8-2.3)**	**2.6 (2.3-2.9)**	**2.9 (2.6-3.2)**	**3.3 (2.9-3.6)**	**3.4 (3.0-3.8)**
LCS	LCS	8,160	69 (63-76)	194	0.5 (0.4-0.7)	2.0 (1.7-2.3)	2.5 (2.1-2.8)	2.6 (2.2-3.0)	2.8 (2.4-3.2)	2.9 (2.4-3.3)
Triathlon	Triathlon	1,115	70 (63-76)	12	0.4 (0.0-0.7)	0.7 (0.2-1.2)	1.0 (0.3-1.6)	1.4 (0.5-2.3)	2.0 (0.6-3.4)	n.a.
ACS	ACS	494	69 (61-75)	14	1.7 (0.5-2.9)	2.9 (1.3-4.5)	2.9 (1.3-4.5)	3.4 (1.6-5.1)	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	0.4 (0.0-1.1)	6.5 (3.5-9.5)	10.5 (6.7-14.2)	13.1 (8.9-17.2)	14.7 (10.2-19.2)	n.a.
NexGen	NexGen	225	70 (62-77)	9	0.9 (0.0-2.1)	3.0 (0.6-5.4)	3.8 (1.0-6.6)	4.9 (1.4-8.4)	n.a.	n.a.
ACS LD	ACS LD	224*	70 (61-76)	7	0.9 (0.0-2.2)	3.4 (0.9-5.9)	n.a.	n.a.	n.a.	n.a.
Genesis II	Genesis II	201	69 (62-75)	5	0.5 (0.0-1.5)	2.8 (0.4-5.2)	2.8 (0.4-5.2)	2.8 (0.4-5.2)	n.a.	n.a.
Vanguard Complete Knee	Vanguard Complete Knee	156	67 (61-74)	9	1.9 (0.0-4.1)	4.7 (1.3-8.2)	4.7 (1.3-8.2)	4.7 (1.3-8.2)	n.a.	n.a.
Attune	Attune	145	69 (64-73)	2	0.7 (0.0-2.1)	n.a.	n.a.	n.a.	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 2020.
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 2007-2020 (n=8,240)

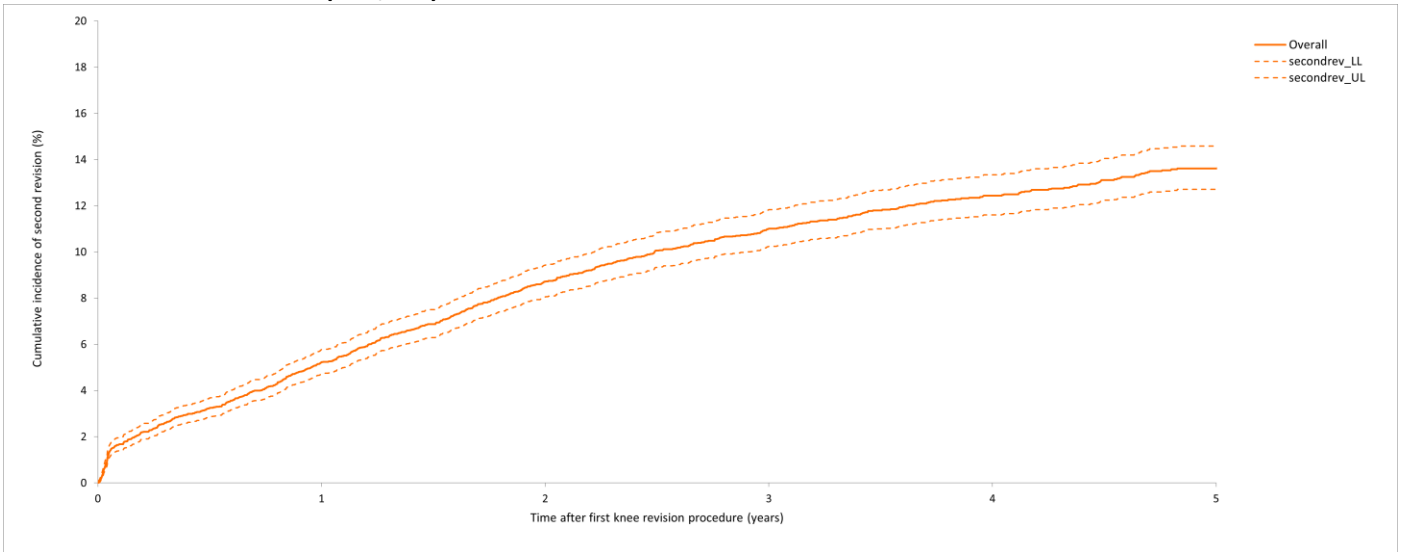


TABLE Cumulative second revision percentages

	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
1-year second revision (%)	7,150	5.6 (5.1-6.1)	5.6 (5.1-6.1)
3-year second revision (%)	4,620	11.7 (11.0-12.5)	11.8 (11.1-12.6)
5-year second revision (%)	2,732	15.1 (14.2-16.0)	15.4 (14.5-16.3)
7-year second revision (%)	1,490	17.4 (16.4-18.5)	17.9 (16.9-19.0)

[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 2007-2020 (n=8,240)

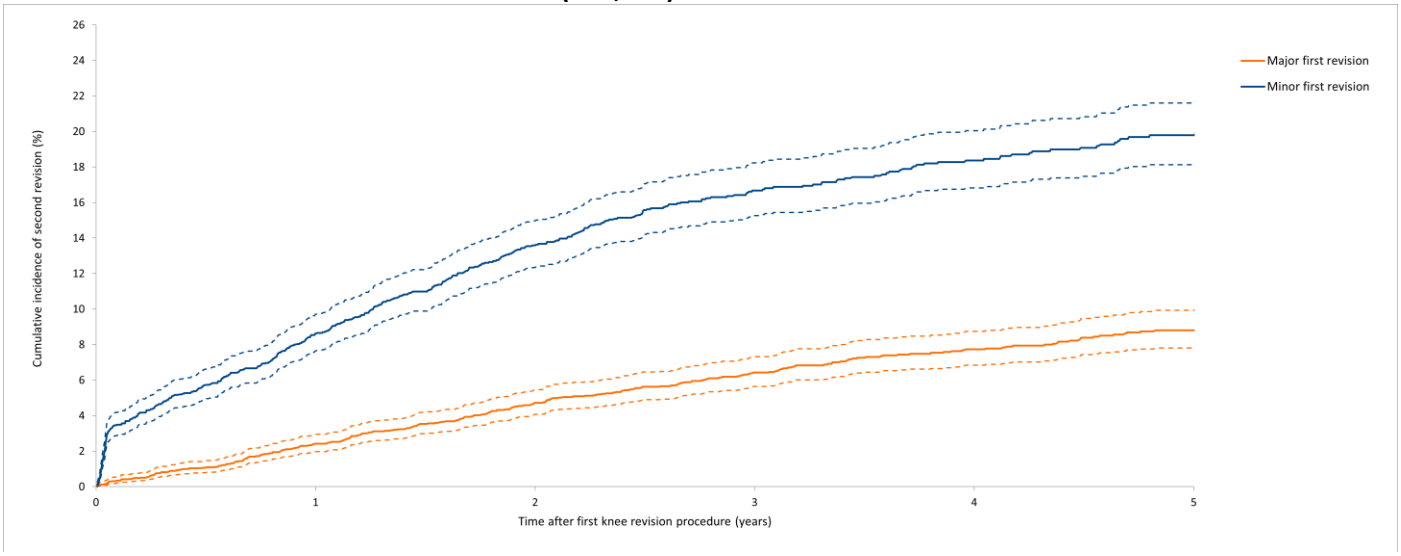


TABLE Cumulative second revision percentages

	Number of first revisions (n)	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Major first revision	4,784			
1-year second revision (%)		4,132	3.1 (2.6-3.7)	3.1 (2.6-3.6)
3-year second revision (%)		2,791	8.1 (7.3-9.0)	8.2 (7.3-9.0)
5-year second revision (%)		1,760	11.7 (10.6-12.8)	11.8 (10.7-12.9)
Minor first revision	3,456			
1-year second revision (%)		2,777	8.6 (7.7-9.6)	8.6 (7.7-9.6)
3-year second revision (%)		1,665	16.0 (14.8-17.4)	16.3 (15.0-17.7)
5-year second revision (%)		863	19.3 (17.8-20.9)	19.8 (18.2-21.4)

[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 (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 2007-2020 (n=7,235)

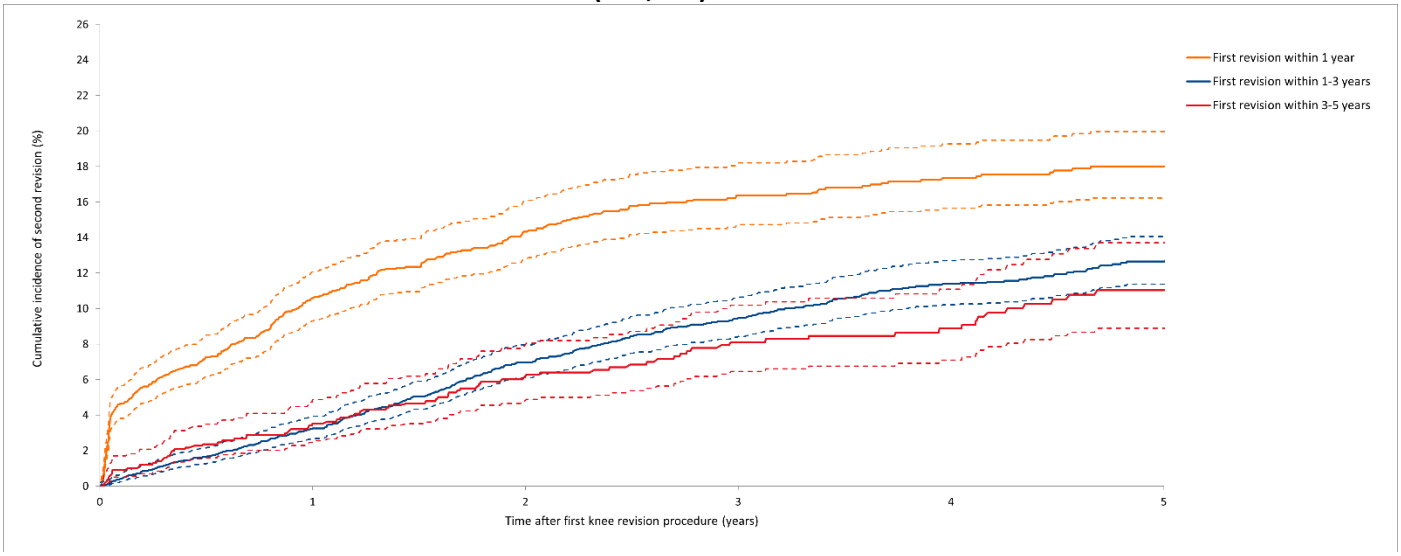


TABLE Cumulative second revision percentages

	Number of first revisions (n)	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
First revision within 1 year	2,237			
1-year second revision (%)		1,807	11.3 (10.1-12.8)	11.3 (10.0-12.7)
3-year second revision (%)		1,206	17.3 (15.8-19.1)	17.5 (15.9-19.2)
5-year second revision (%)		767	19.9 (18.1-21.8)	20.3 (18.4-22.2)
First revision within 1-3 years	3,740			
1-year second revision (%)		3,298	3.5 (2.9-4.1)	3.4 (2.8-4.0)
3-year second revision (%)		2,278	10.2 (9.2-11.4)	10.4 (9.3-11.4)
5-year second revision (%)		1,429	13.8 (12.6-15.1)	14.0 (12.7-15.3)
First revision within 3-5 years	1,258			
1-year second revision (%)		1,054	4.1 (3.1-5.4)	4.0 (2.9-5.1)
3-year second revision (%)		695	9.0 (7.4-10.9)	9.1 (7.3-10.9)
5-year second revision (%)		392	13.2 (11.1-15.8)	13.5 (11.2-15.9)

[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 2007-2020

Reasons for second revision	Major first revision[1] (n=420) Proportion[4] (%)	Minor first revision[2] (n=538) Proportion[4] (%)	Any type of first revision[3] (n=1,015) Proportion[4] (%)
Infection	42.1	46.3	44.6
Instability	21.9	28.8	25.5
Loosening of tibia component	19.8	13.4	16.2
Patellar pain	11.0	8.6	10.0
Malalignment	6.0	10.4	8.7
Loosening of femur component	13.1	4.1	8.4
Arthrofibrosis	6.0	4.6	5.3
Patellar dislocation	3.3	4.3	3.7
Loosening of patella component	1.0	1.7	1.5
Insert wear	0.2	1.9	1.3
Periprosthetic fracture	0.5	0.6	0.5
Progression of osteoarthritis	0.0	0.2	0.1
Other	6.9	5.8	6.2

[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

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=92) in the Netherlands in 2014-2020

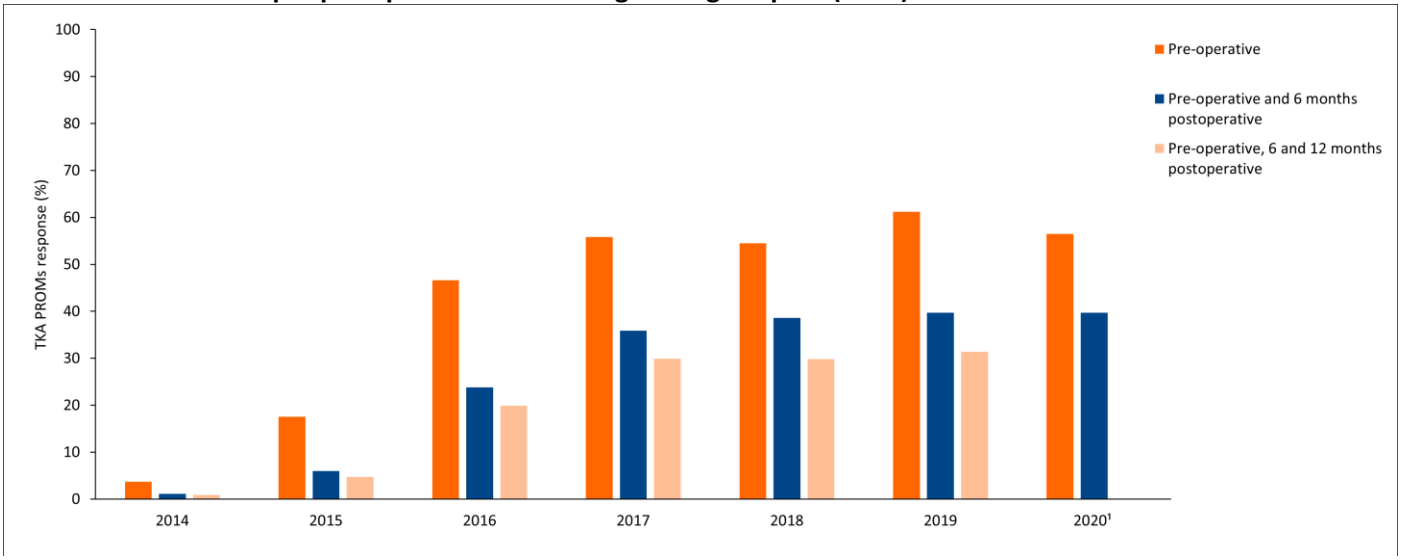


TABLE PROMs response percentages

Year	2014	2015	2016	2017	2018	2019	2020¹
TKA for osteoarthritis (n)	22,139	22,291	22,918	23,603	24,003	23,892	17,772
TKA PROMs response (%)							
Pre-operative	3.7	17.5	46.6	55.8	54.5	61.2	56.5
Pre-operative and 6 months postoperative	1.1	6.0	23.8	35.9	38.6	39.7	39.7
Pre-operative, 6 and 12 months postoperative	0.9	4.7	19.9	29.9	29.8	31.4	n.a.

¹ The 12 months postoperative PROMs response percentage is not (yet) available for 2020. The 6 months postoperative response percentage is not (yet) available after July 1st 2020. In total, 7,997 patients underwent a TKA for osteoarthritis between January 1st and July 1st 2020.
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 ASA score in the Netherlands in 2014-2020

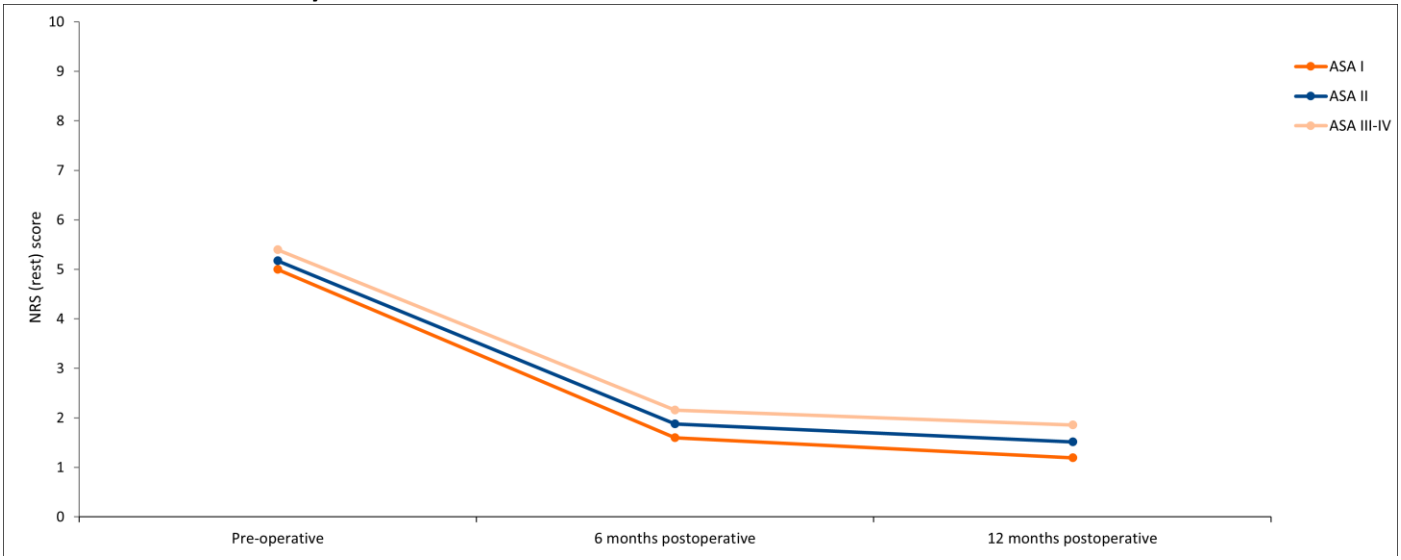


TABLE Mean NRS (rest) scores

NRS (rest) score	Pre-operative		6 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	7,554	5.0 (4.9-5.1)	5,529	1.6 (1.5-1.7)	5,226	1.2 (1.1-1.2)
ASA II	41,931	5.2 (5.1-5.2)	28,232	1.9 (1.9-1.9)	26,764	1.5 (1.4-1.5)
ASA III-IV	13,759	5.4 (5.4-5.4)	8,884	2.2 (2.1-2.2)	7,813	1.9 (1.8-1.9)
Total	63,254	5.2 (5.2-5.2)	42,649	1.9 (1.9-1.9)	39,806	1.5 (1.5-1.6)

[1] The 12 months NRS (rest) score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

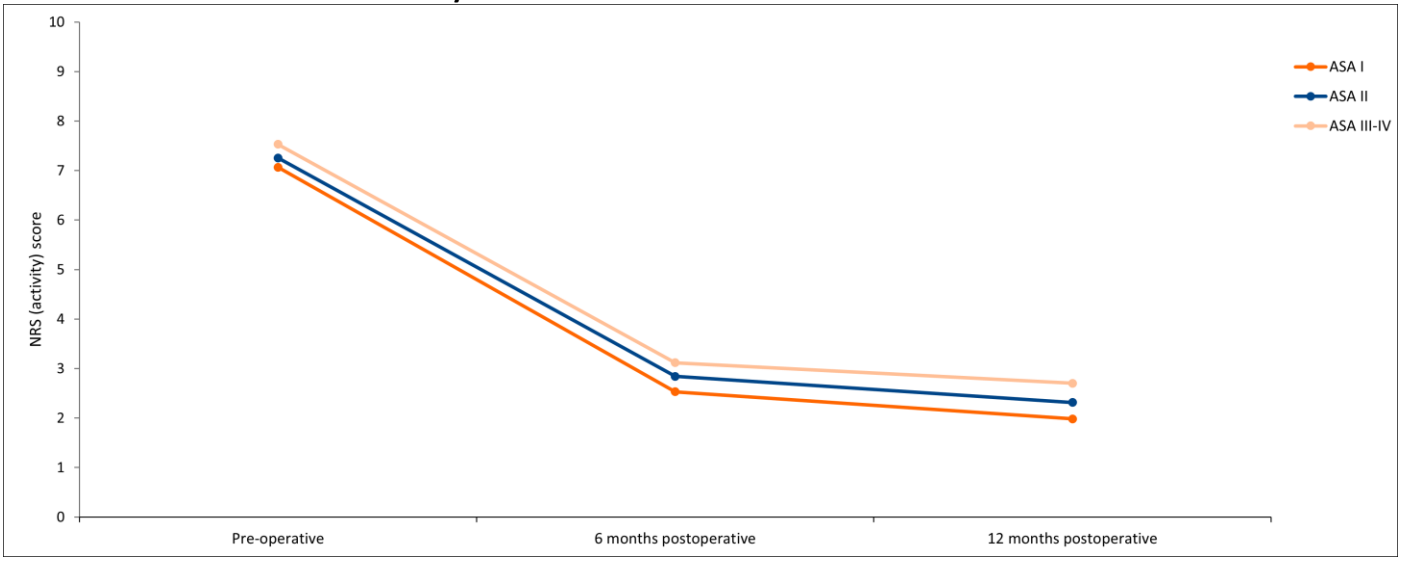


TABLE Mean NRS (activity) scores

NRS (activity) score	Pre-operative		6 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	7,545	7.1 (7.0-7.1)	5,533	2.5 (2.5-2.6)	5,234	2.0 (1.9-2.0)
ASA II	41,922	7.3 (7.2-7.3)	28,249	2.8 (2.8-2.9)	26,772	2.3 (2.3-2.3)
ASA III-IV	13,747	7.5 (7.5-7.6)	8,880	3.1 (3.1-3.2)	7,826	2.7 (2.6-2.8)
Total	63,224	7.3 (7.3-7.3)	42,666	2.9 (2.8-2.9)	39,835	2.3 (2.3-2.4)

[1] The 12 months NRS (activity) score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

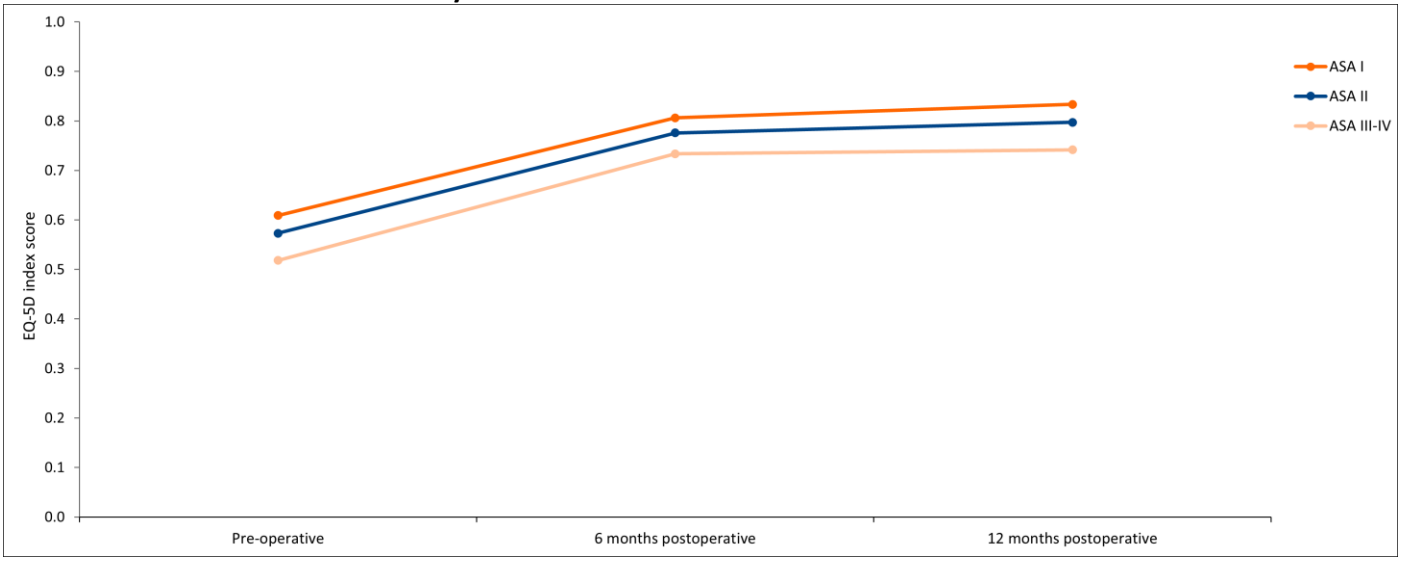


TABLE Mean EQ-5D index scores

EQ-5D Index score	Pre-operative		6 months postoperative		12 months postoperative[1]	
ASA Score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	7,973	0.61 (0.61-0.61)	5,872	0.81 (0.80-0.81)	5,589	0.83 (0.83-0.84)
ASA II	43,635	0.57 (0.57-0.57)	29,360	0.78 (0.77-0.78)	28,222	0.80 (0.80-0.80)
ASA III-IV	14,119	0.52 (0.51-0.52)	8,885	0.73 (0.73-0.74)	7,932	0.74 (0.74-0.75)
Total	65,742	0.57 (0.56-0.57)	44,124	0.77 (0.76-0.77)	41,748	0.79 (0.79-0.79)

[1] The 12 months EQ-5D index score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

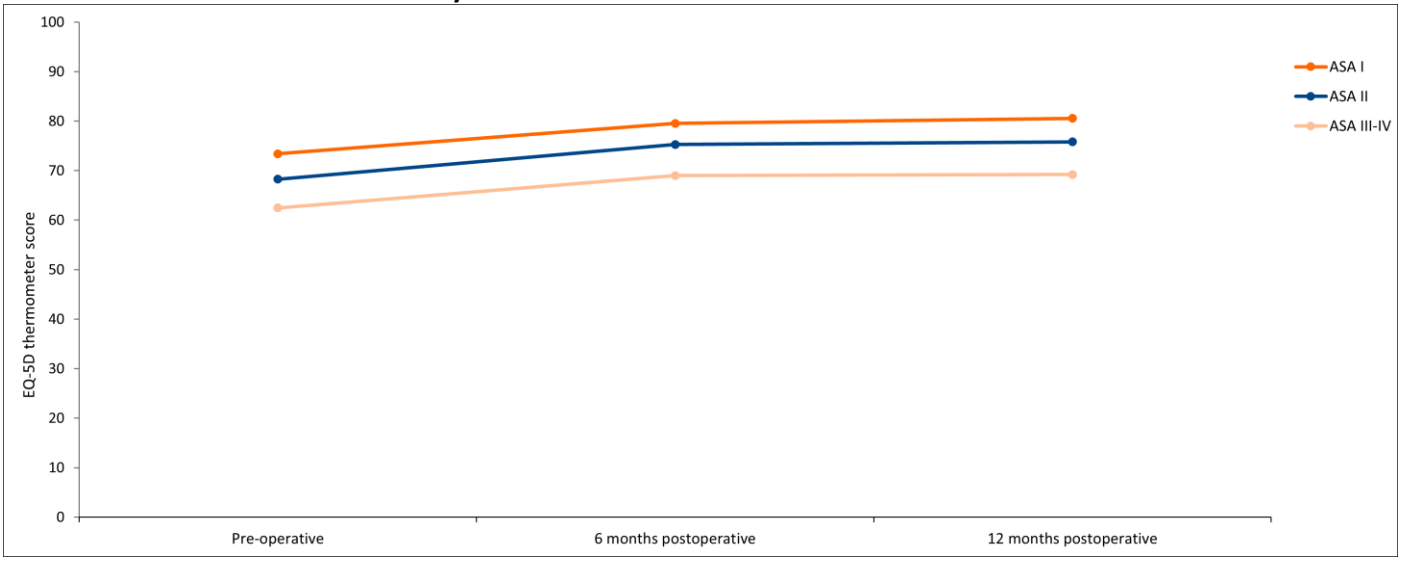


TABLE Mean EQ-5D thermometer scores

EQ-5D thermometer score	Pre-operative		6 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	8,012	73.4 (73.0-73.8)	5,886	79.5 (79.1-80.0)	5,636	80.5 (80.1-81.0)
ASA II	43,734	68.3 (68.1-68.4)	29,616	75.3 (75.1-75.5)	28,480	75.8 (75.6-76.0)
ASA III-IV	14,101	62.5 (62.1-62.8)	9,001	69.0 (68.6-69.4)	8,038	69.2 (68.8-69.7)
Total	65,861	67.7 (67.5-67.8)	44,510	74.6 (74.4-74.8)	42,159	75.2 (75.0-75.4)

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

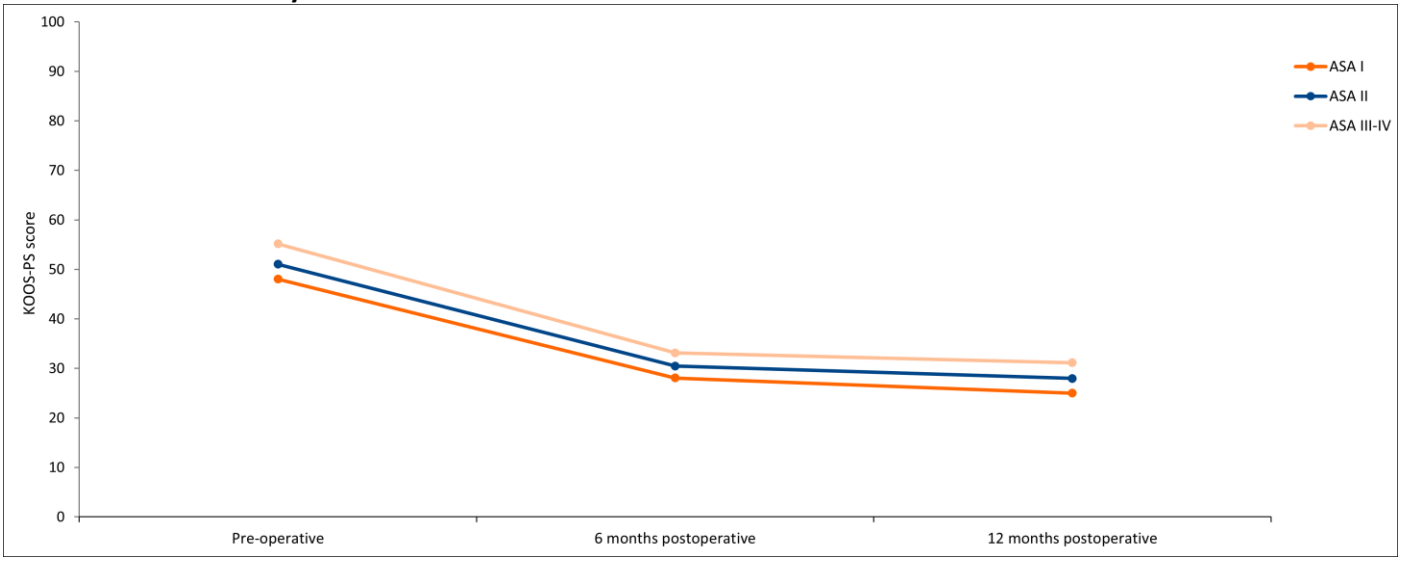


TABLE Mean KOOS-PS scores

KOOS-PS score	Pre-operative		6 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	7,899	48.0 (47.7-48.4)	5,814	28.1 (27.7-28.4)	5,544	25.0 (24.6-25.4)
ASA II	43,129	51.1 (50.9-51.2)	28,764	30.5 (30.3-30.6)	27,557	28.0 (27.8-28.1)
ASA III-IV	13,887	55.2 (54.9-55.4)	8,608	33.1 (32.8-33.4)	7,673	31.2 (30.8-31.5)
Total	64,929	51.6 (51.4-51.7)	43,192	30.7 (30.5-30.8)	40,779	28.2 (28.0-28.3)

[1] The 12 months KOOS-PS score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

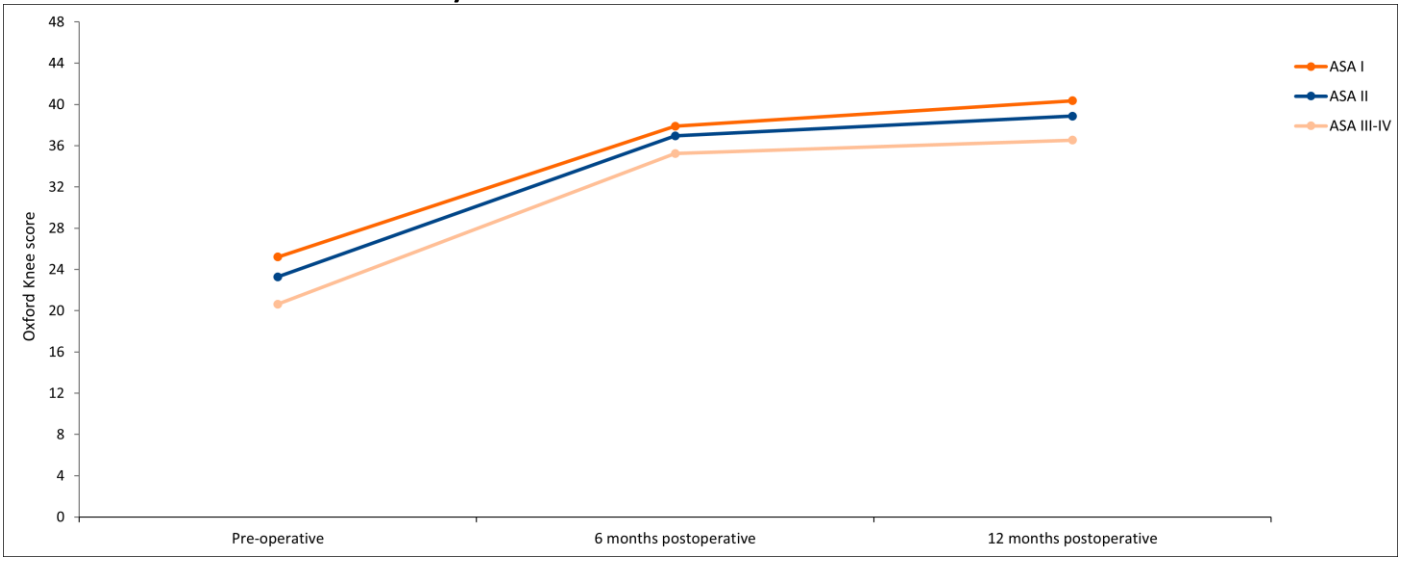


TABLE Mean Oxford Knee scores

Oxford Knee score	Pre-operative		6 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	7,150	25.2 (25.0-25.4)	5,339	37.9 (37.6-38.1)	5,069	40.4 (40.1-40.6)
ASA II	38,256	23.3 (23.2-23.4)	26,814	37.0 (36.8-37.1)	25,177	38.9 (38.8-39.0)
ASA III-IV	12,458	20.6 (20.5-20.8)	8,158	35.2 (35.0-35.4)	7,139	36.5 (36.3-36.7)
Total	57,877	22.9 (22.9-23.0)	40,316	36.7 (36.6-36.8)	37,388	38.6 (38.5-38.7)

[1] The 12 months Oxford Knee score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

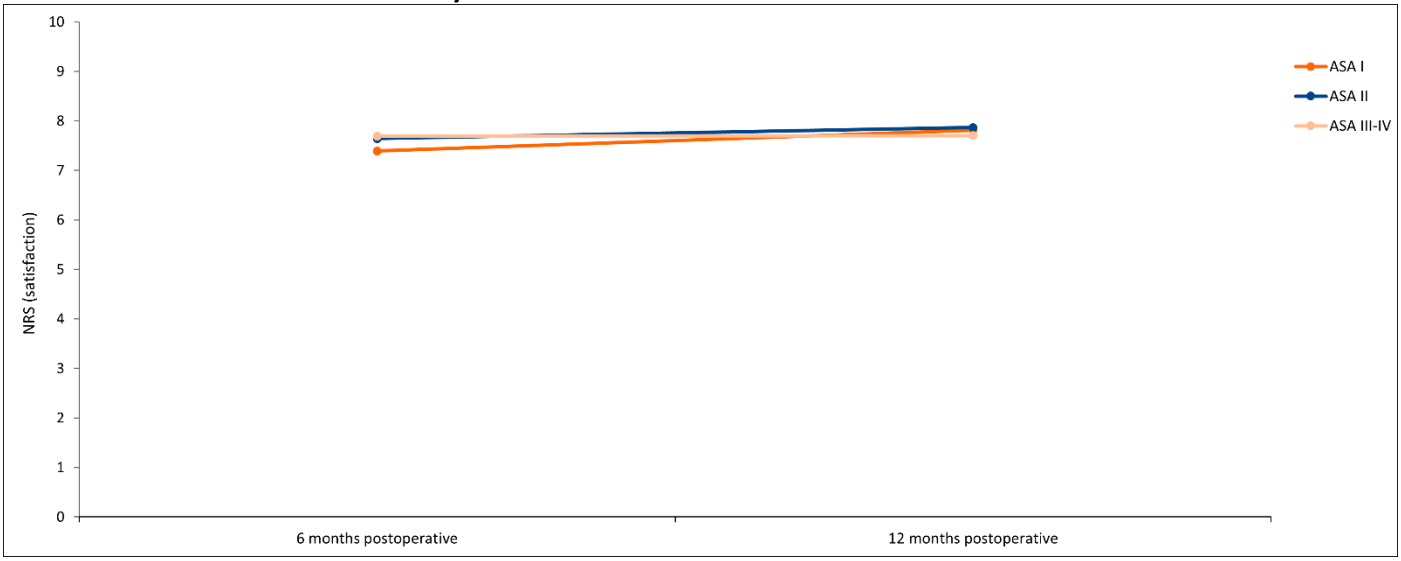


TABLE Mean NRS (satisfaction) scores

NRS (satisfaction)	6 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	4,936	7.6 (7.5-7.6)	4,738	8.0 (7.9-8.0)
ASA II	25,428	7.7 (7.6-7.7)	24,279	7.9 (7.9-7.9)
ASA III-IV	8,067	7.7 (7.6-7.7)	7,237	7.7 (7.7-7.8)
Total	38,433	7.7 (7.6-7.7)	36,256	7.9 (7.8-7.9)

[1] The 12 months NRS (satisfaction) score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

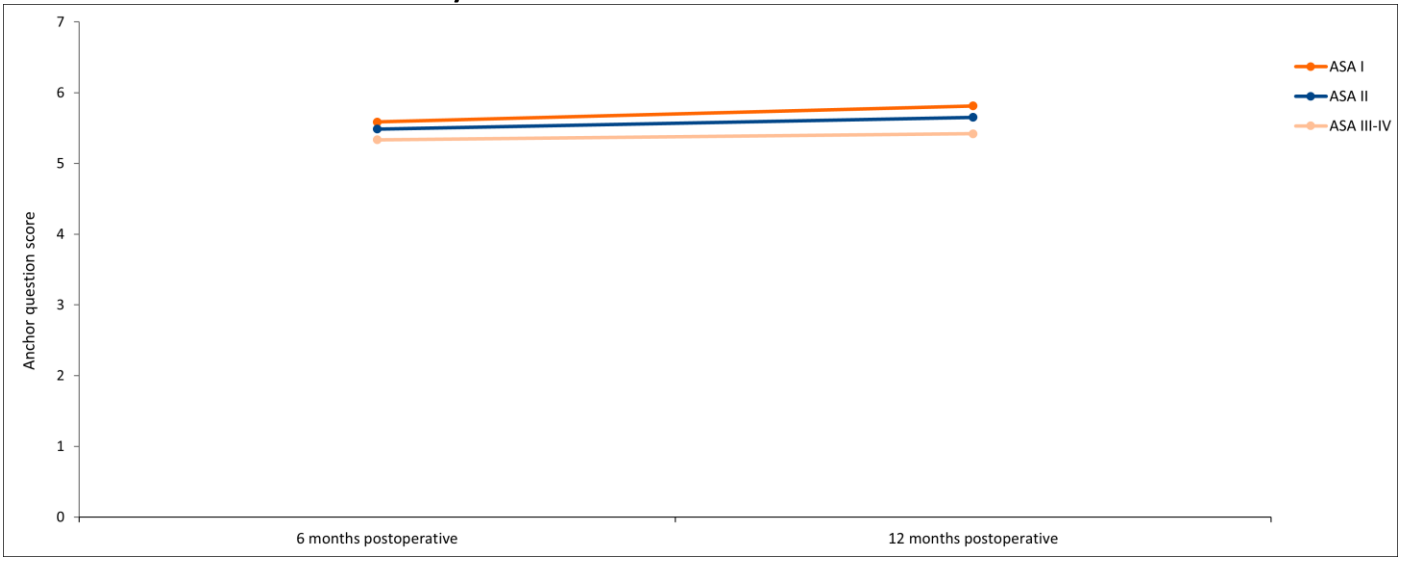


TABLE Mean anchor question: Daily functioning

Anchor question score	6 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	5,397	5.6 (5.6-5.6)	5,231	5.8 (5.8-5.8)
ASA II	27,433	5.5 (5.5-5.5)	26,775	5.7 (5.6-5.7)
ASA III-IV	8,562	5.3 (5.3-5.3)	7,767	5.4 (5.4-5.5)
Total	41,399	5.5 (5.5-5.5)	39,778	5.6 (5.6-5.6)

[1] The 12 months anchor question score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2014-2020

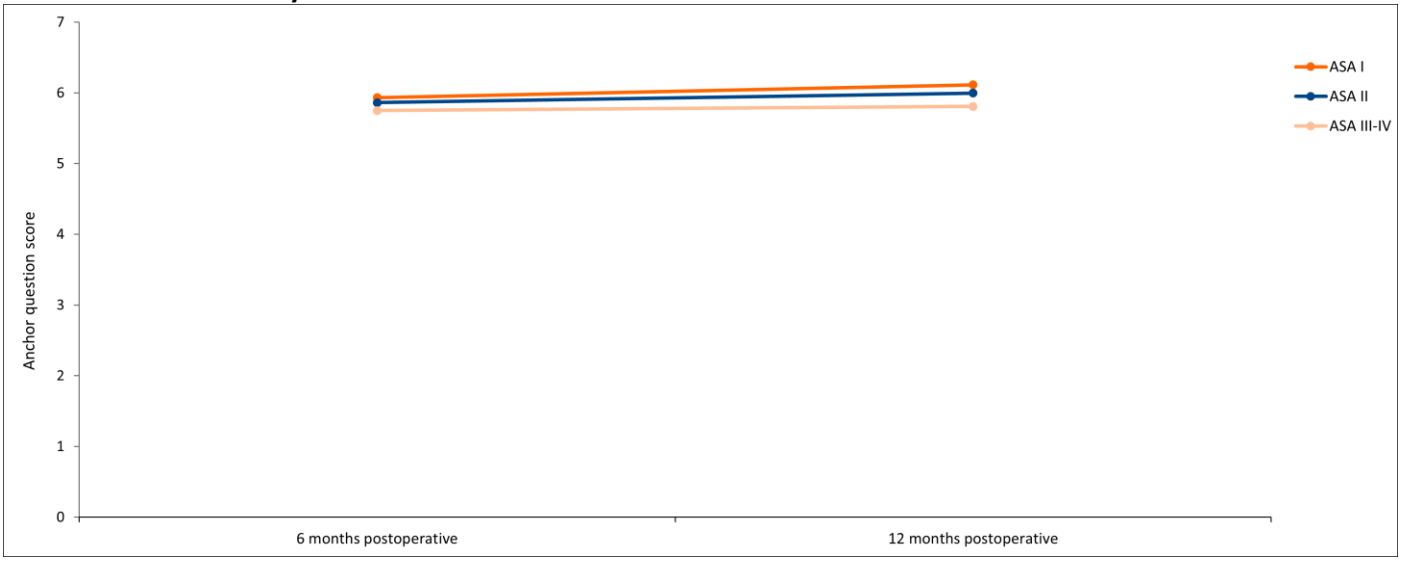


TABLE Mean anchor question: Pain

Anchor question score	6 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	4,780	5.9 (5.9-6.0)	4,664	6.1 (6.1-6.1)
ASA II	25,062	5.9 (5.8-5.9)	24,110	6.0 (6.0-6.0)
ASA III-IV	8,078	5.7 (5.7-5.8)	7,178	5.8 (5.8-5.8)
Total	37,921	5.8 (5.8-5.9)	35,953	6.0 (6.0-6.0)

[1] The 12 months anchor question score is not (yet) available for 2020.
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

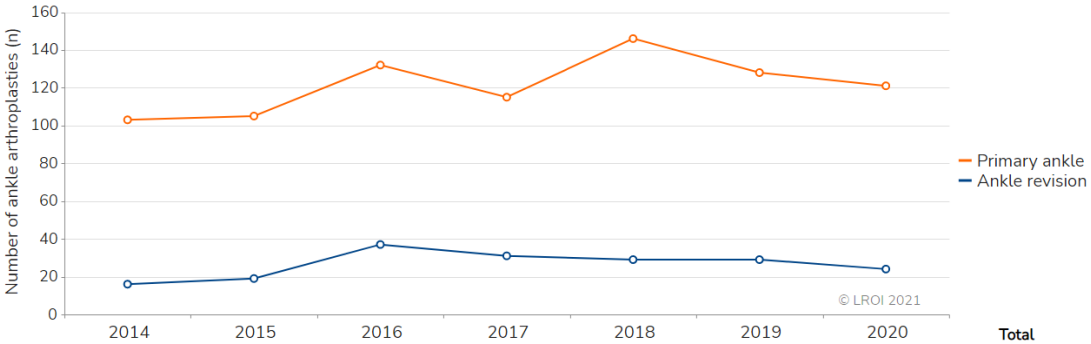
TABLE Number of registered ankle arthroplasties per year of surgery (2014-2020) in the LROI in April 2021

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	125	2	29	157
2020	120	0	24	145
Total	831	12	185	889

[1] In 0.7% (n=7) primary ankle arthroplasties the type of primary ankle prosthesis has not been registered.

Type of procedures

FIGURE Number of primary ankle arthroplasties and ankle revision arthroplasties registered in the LROI in the Netherlands in 2014-2020

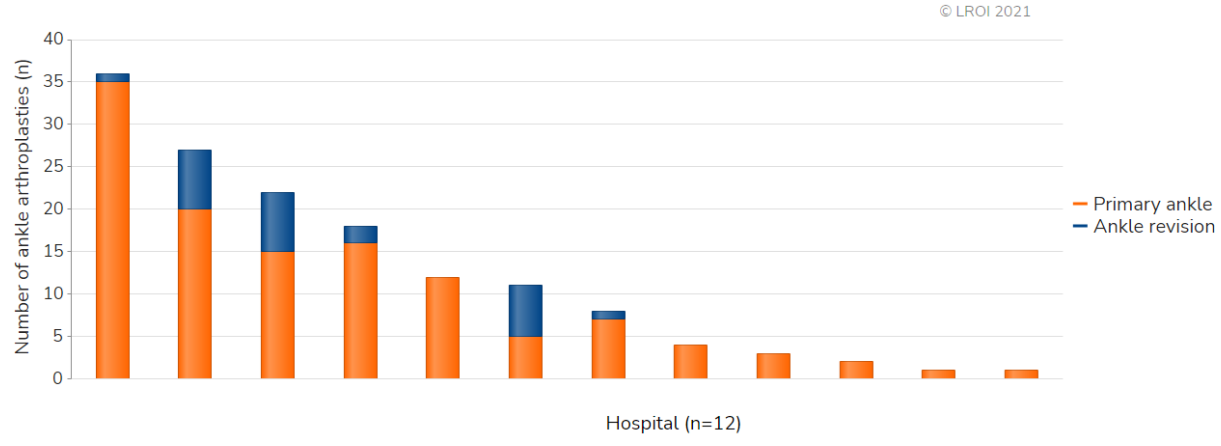


Year	2014	2015	2016	2017	2018	2019	2020	Total
Type of procedure (n)								
Primary ankle	103	105	132	115	146	128	121	**850**
Ankle revision	16	19	37	31	29	29	24	**185**
Total:	**119**	**124**	**169**	**146**	**175**	**157**	**145**	1,035

Out of 121 primary ankle arthroplasties that were performed in 2020, 1% (n=1) was performed bilaterally.

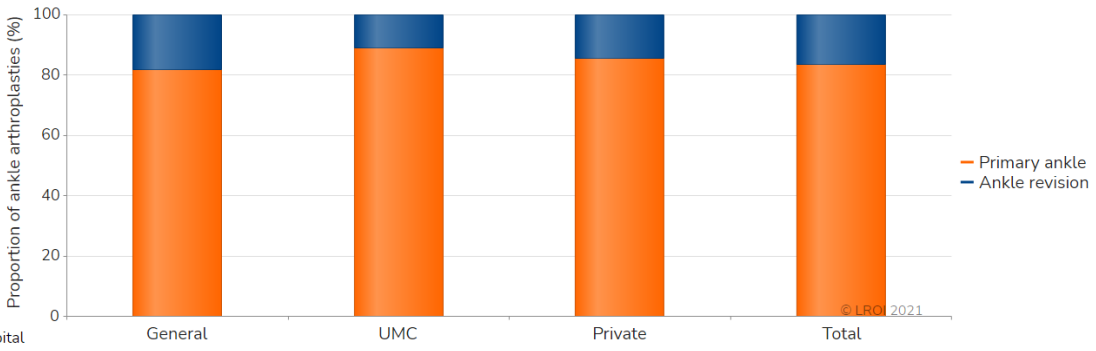
Type of procedure per hospital

FIGURE Number of primary ankle arthroplasties and ankle revision arthroplasties per hospital in the Netherlands in 2020 (n=145)



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 2020



Type of hospital	General	UMC	Private	Total
Type of procedure (%)				
Primary ankle	81.82	88.89	85.42	**83.45**
Ankle revision	18.18	11.11	14.58	**16.55**
Total (n):	**88**	**9**	**48**	**145**

Please note: In 2020, 7 general hospitals, 2 UMCs and 3 private hospitals performed ankle arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.

Primary ankle arthroplasty

Demographics

Patient characteristics by diagnosis

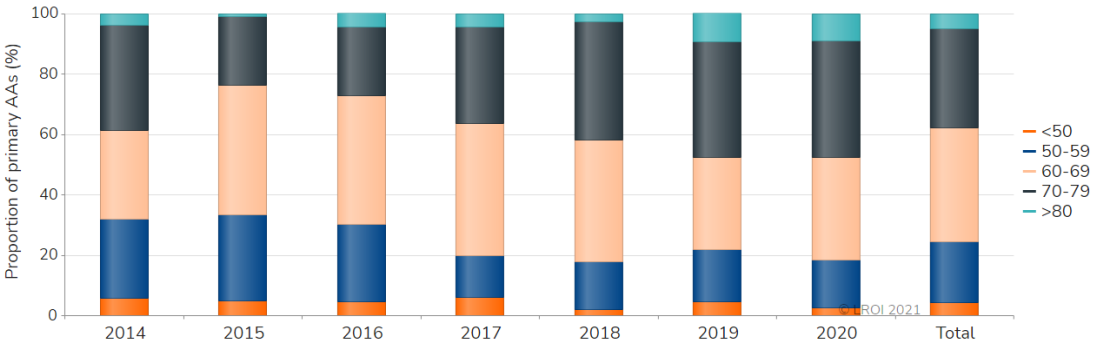
TABLE Patient characteristics of all patients with a registered primary ankle arthroplasty by diagnosis in the Netherlands in 2020

	Osteoarthritis (n=104)	No osteoarthritis[1] (n=16)	Total[2] (n=120)
Mean age (years) (SD)	68.6 (8.1)	60.0 (14.8)	67.4 (9.6)
Age (years) (%)			
<50	0	19	3
50-59	14	25	16
60-69	35	31	34
70-79	40	25	38
≥80	11	0	9
Gender (%)			
Men	63	44	60
Women	37	56	40
ASA score (%)			
I	20	0	17
II	65	81	67
III-IV	15	19	16
Type of hospital (%)			
General	57	81	60
UMC	6	6	7
Private	37	13	34
Charnley-score (%)			
A One ankle joint affected	68	75	70
B1 Both ankle joints affected	9	6	8
B2 Contralateral ankle joint with a total ankle prosthesis	8	13	8
C Multiple joints affected or chronic disease that affects quality of life	15	6	14
Mean Body Mass Index (kg/m²) (SD)	28.0 (4.5)	28.2 (3.7)	28.3 (5.1)
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	0	0	0
Normal weight (>18,5-25)	28	19	26
Overweight (>25-30)	47	50	47
Obesity (>30-40)	24	31	25
Morbid obesity (>40)	1	0	2
Smoking (%)			
No	94	93	94
Yes	6	7	6

[1] Another diagnosis than osteoarthritis registered as primary diagnosis, specifically post-traumatic (6%), rheumatoid arthritis (5%), inflammatory arthritis (1%) or other primary diagnosis (2%).
[2] Of 1 (1%) primary ankle arthroplasty, the diagnosis was not registered.
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

Age category

FIGURE Trend (proportion [%] per year) in age category in primary ankle arthroplasties in the Netherlands in 2014-2020



Age category (%)	2014	2015	2016	2017	2018	2019	2020	Total
<50	5.83	4.76	4.55	6.09	2.05	4.69	2.50	**4.24**
50-59	26.21	28.57	25.76	13.91	15.75	17.19	15.83	**20.14**
60-69	29.13	42.86	42.42	43.48	40.41	30.47	34.17	**37.69**
70-79	34.95	22.86	22.73	32.17	39.04	38.28	38.33	**32.86**
>80	3.88	0.95	4.55	4.35	2.74	9.38	9.17	**5.06**
Total (n):	**103**	**105**	**132**	**115**	**146**	**128**	**120**	**849**

AA: ankle arthroplasty.

Previous surgery

TABLE Trend (proportion [%] per year) in previous surgeries to the same joint in patients who underwent a primary ankle arthoplasty in the Netherlands in 2016-2020

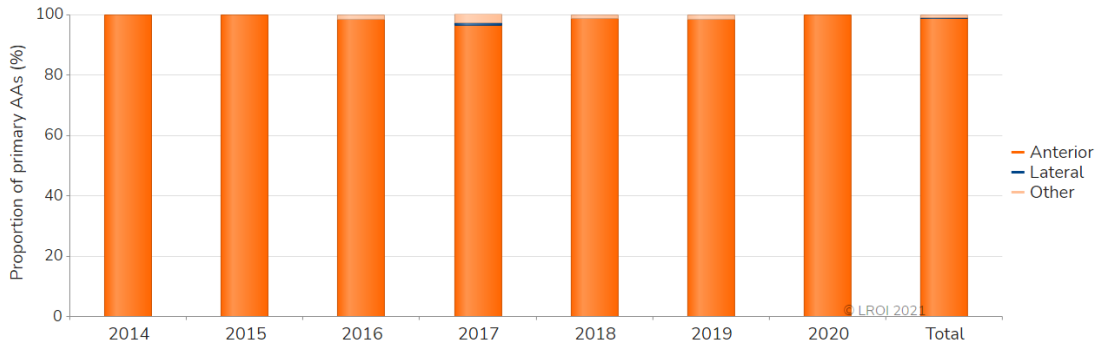
Year	2016	2017	2018	2019	2020	Total
Primary ankle arthroplasty (n)	125	113	144	127	120	629
Previous surgery to the relevant ankle (total); Proportion[1] (%)	31.2	28.3	29.9	33.1	34.2	31.3
Osteosynthesis	13.6	16.8	9.7	11.8	19.2	14.0
Arthroscopy	7.2	11.5	5.6	4.7	11.7	8.0
Hindfoot surgery	6.4	3.5	12.5	7.9	7.5	7.8
Osteotomy	2.4	1.8	1.4	7.9	8.3	4.3
Arthrodesis	4.0	1.8	5.6	3.9	4.2	4.0
Ligament reconstruction	1.6	1.8	0.7	3.2	3.3	2.1
Synovectomy	1.6	2.7	0.7	2.4	1.7	1.8
Treatment of osteochondral bone defect	1.6	2.7	1.4	0.0	1.7	1.4
Forefoot surgery	2.4	0.0	1.4	0.0	1.7	1.1
Other	4.8	2.7	3.5	7.1	5.8	4.8

[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

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary ankle arthroplasty in the Netherlands in 2014-2020

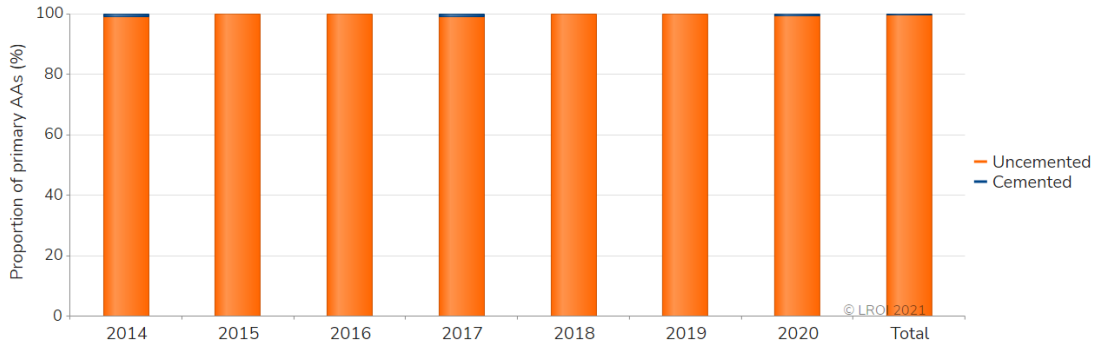


Surgical approach (%)	2014	2015	2016	2017	2018	2019	2020	Total
Anterior	100.00	100.00	98.46	96.43	98.60	98.40	100.00	**98.80**
Lateral	0.00	0.00	0.00	0.89	0.00	0.00	0.00	**0.12**
Other	0.00	0.00	1.54	2.68	1.40	1.60	0.00	**1.08**
Total (n):	**101**	**101**	**130**	**112**	**143**	**125**	**118**	**830**

AA: ankle arthroplasty.

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary ankle arthroplasties in the Netherlands in 2014-2020

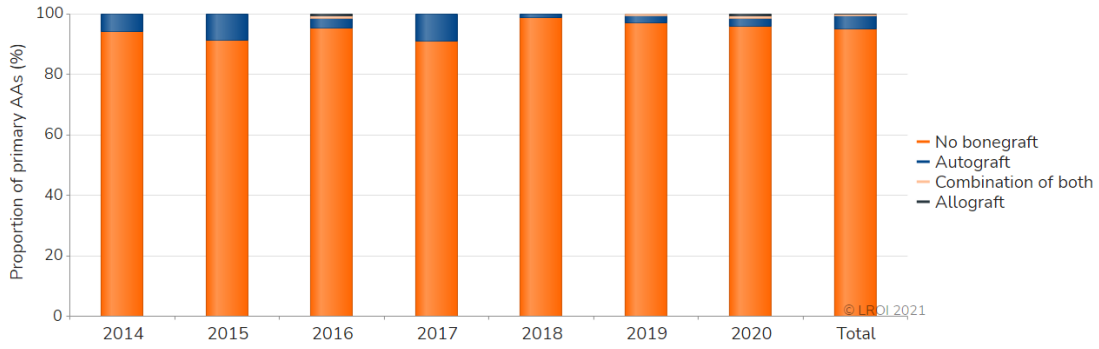


Fixation (%)	2014	2015	2016	2017	2018	2019	2020	Total
Uncemented	99.02	100.00	100.00	99.13	100.00	100.00	99.17	**99.64**
Cemented	0.98	0.00	0.00	0.87	0.00	0.00	0.83	**0.36**
Total (n):	**102**	**104**	**130**	**115**	**144**	**128**	**120**	**843**

AA: ankle arthroplasty.

Type of bonegraft

FIGURE Trend (proportion [%] per year) in type of bonegraft in primary ankle arthroplasties in the Netherlands in 2014-2020

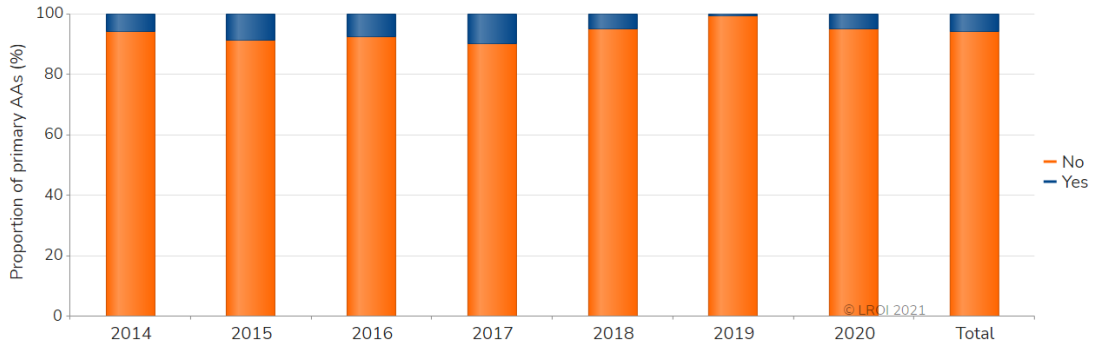


Type of bonegraft (%)	2014	2015	2016	2017	2018	2019	2020	Total
No bonegraft	94.00	91.18	95.38	90.99	98.57	96.88	95.76	**94.93**
Autograft	6.00	8.82	3.08	9.01	1.43	2.34	2.54	**4.46**
Combination of both	0.00	0.00	0.77	0.00	0.00	0.78	0.85	**0.36**
Allograft	0.00	0.00	0.77	0.00	0.00	0.00	0.85	**0.24**
Total (n):	**100**	**102**	**130**	**111**	**140**	**128**	**118**	**829**

AA: ankle arthroplasty.

Medial malleolus osteotomy

FIGURE Trend (proportion [%] per year) in medial malleolus osteotomy in primary ankle arthroplasties in the Netherlands in 2014-2020

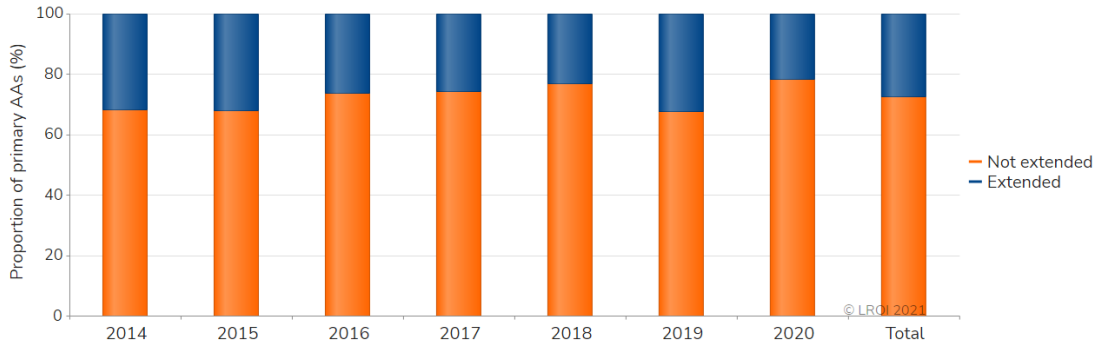


Medial malleolus osteotomy (%)	2014	2015	2016	2017	2018	2019	2020	Total
No	94.12	91.26	92.31	90.18	95.07	99.21	94.96	**94.01**
Yes	5.88	8.74	7.69	9.82	4.93	0.79	5.04	**5.99**
Total (n):	**102**	**103**	**130**	**112**	**142**	**127**	**119**	**835**

AA: ankle arthroplasty.

Extension heel cord

FIGURE Trend (proportion [%] per year) in heel cord extension in primary ankle arthroplasties in the Netherlands in 2014-2020



Extension heel cord (%)								
Not extended	68.32	67.96	73.64	74.11	76.76	67.72	78.15	**72.63**
Extended	31.68	32.04	26.36	25.89	23.24	32.28	21.85	**27.37**
Total (n):	**101**	**103**	**129**	**112**	**142**	**127**	**119**	**833**

AA: ankle arthroplasty.

Most frequently registered ankle prostheses

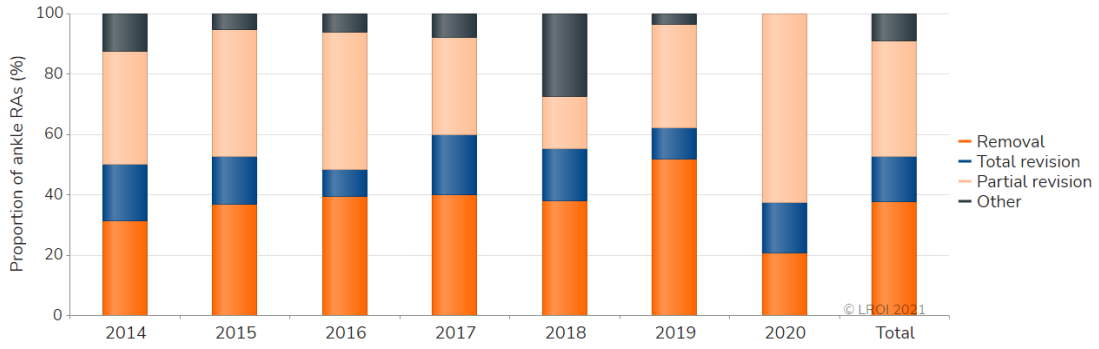
TABLE The most frequently registered primary ankle arthroplasties in the Netherlands in 2020 (n=110)

Name	Proportion (%)
Salto	52.7
Infinity	37.3
AAA OSG	4.6
Cadence	2.7
Box	1.8

Ankle revision arthroplasty

Type of revision

FIGURE Trend (proportion [%] per year) in type of revision arthroplasty of ankle revision arthroplasties in the Netherlands in 2014-2020



Type of revision (%)								
Removal	31.25	36.84	39.39	40.00	37.93	51.72	20.83	**37.71**
Total revision	18.75	15.79	9.09	20.00	17.24	10.34	16.67	**14.86**
Partial revision	37.50	42.11	45.45	32.00	17.24	34.48	62.50	**38.29**
Other	12.50	5.26	6.06	8.00	27.59	3.45	0.00	**9.14**
Total (n):	**16**	**19**	**33**	**25**	**29**	**29**	**24**	**175**

Please note: In 10 (5.4%) ankle revision arthroplasties, the type of revision was not registered.
RA: revision arthroplasty.

Reasons for revision

TABLE Trend (proportion [%] per year) reasons for revision in patients who underwent an ankle revision arthropalsty in the Netherlands in 2016-2020

Year	2016	2017	2018	2019	2020	Total
Ankle revision arthroplasty (n)	37	31	29	29	24	150
Reasons for revision; Proportion[1] (%)						
Inlay wear	35.1	45.2	31.0	41.4	33.3	37.3
Cyst formation	21.6	41.9	41.4	55.2	25.0	36.7
Loosening of talus component	29.7	38.7	37.9	41.4	12.5	32.7
Loosening of tibia component	18.9	22.6	34.5	27.6	16.7	24.0
Malalignment	8.1	29.0	24.1	27.6	12.5	20.0
Instability	8.1	25.8	20.7	24.1	20.8	19.3
Infection	13.5	3.2	24.1	10.3	8.3	12.0
Arthrofibrosis	5.4	9.7	3.5	6.9	20.8	8.7
Dislocation	5.4	9.7	6.9	10.3	8.3	8.0
Peri-prosthetic fracture	0.0	3.2	3.5	3.5	8.3	3.3
Other	5.4	0.0	10.3	10.3	16.7	8.0

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

Shoulder arthroplasty

Numbers

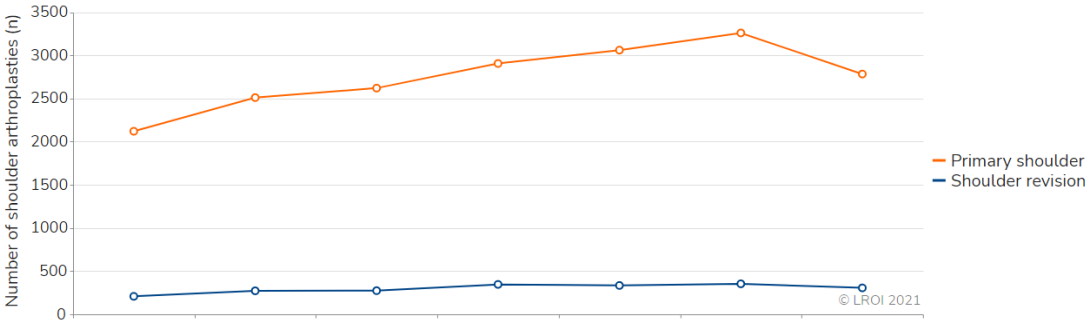
Registered procedures

TABLE Number of registered shoulder arthroplasties per year of surgery (2014-2020) in the LROI in April 2021

	Type of shoulder arthroplasty					
Year of surgery	Reversed arthroplasty (n)	Total anatomical arthroplasty (n)	Hemi-arthroplasty (n)	Unknown/ missing (n)	Revision arthroplasty (n)	Total (n)
2014	1,167	465	459	29	208	2,328
2015	1,491	581	426	12	272	2,782
2016	1,689	598	316	17	274	2,894
2017	1,954	619	315	17	346	3,251
2018	2,110	678	259	13	334	3,394
2019	2,413	660	180	6	353	3,612
2020	2,116	509	147	11	306	3,089
Total	12,940	4,110	2,102	105	2,093	21,350

Procedures

FIGURE Number of primary shoulder arthroplasties and shoulder revision arthroplasties registered in the LROI in the Netherlands 2014-2020

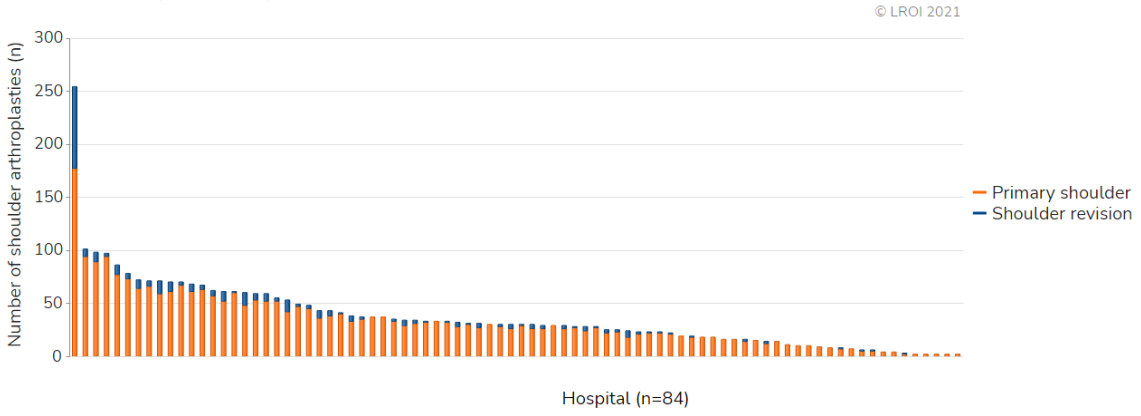


Year	2014	2015	2016	2017	2018	2019	2020	Total
Type of procedure (n)								
Primary shoulder	2,120	2,510	2,620	2,905	3,060	3,259	2,783	**19,257**
Shoulder revision	208	272	274	346	334	353	306	**2,093**
Total:	**2,328**	**2,782**	**2,894**	**3,251**	**3,394**	**3,612**	**3,089**	21,350

Out of 2,783 primary shoulder arthroplasties that were performed in 2020, 1% (n=29) was performed bilaterally.

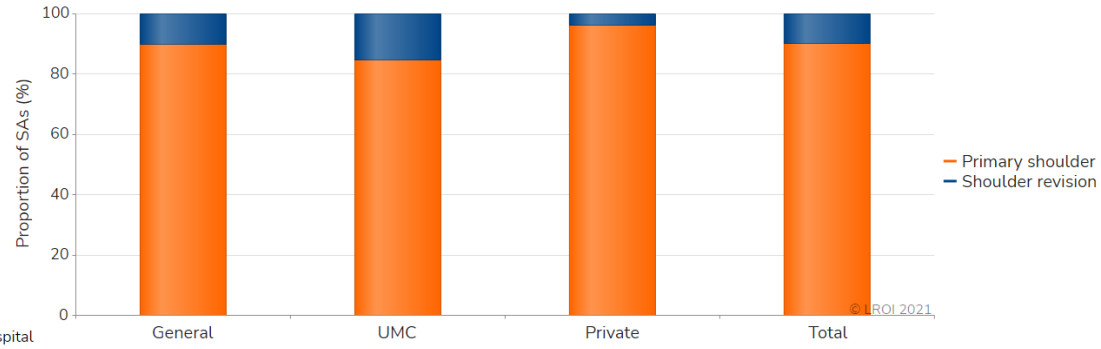
Type of procedure per hospital

FIGURE Number of primary shoulder arthroplasties and shoulder revision arthroplasties per hospital in the Netherlands 2020 (n=3089)



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 2020

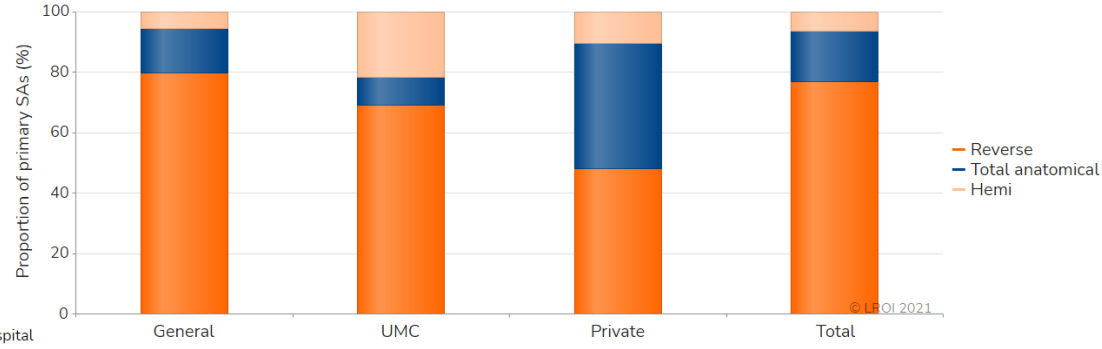


Type of procedure (%)	General	UMC	Private	Total
Primary shoulder	89.73	84.62	96.09	**90.09**
Shoulder revision	10.27	15.38	3.91	**9.91**
Total (n):	**2,794**	**65**	**230**	**3,089**

Please note: In 2020, 66 general hospitals, 5 UMCs and 13 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 2020

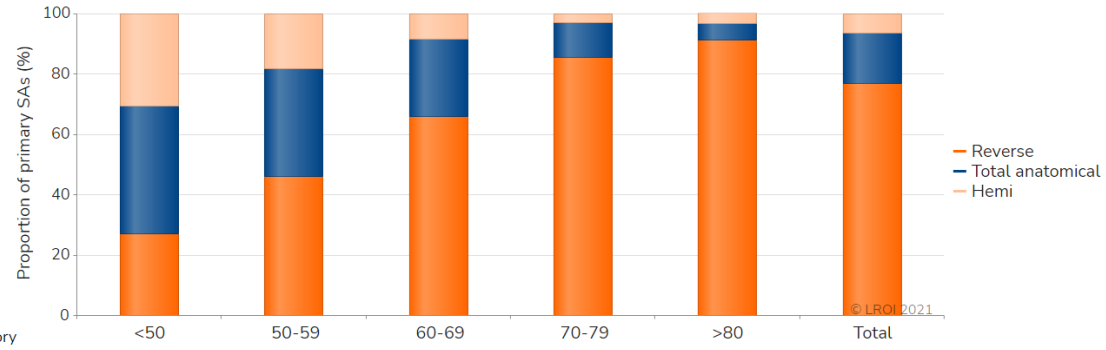


Type of primary shoulder arthroplasty (%)	General	UMC	Private	Total
Reverse	79.65	69.09	47.96	**76.91**
Total anatomical	14.69	9.09	41.63	**16.73**
Hemi	5.66	21.82	10.41	**6.36**
Total (n):	**2,491**	**55**	**221**	**2,767**

Please note: In 16 (0.6%) primary shoulder arthroplasties, the type of primary shoulder arthroplasty was not registered in 2020.
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 2020



Type of primary shoulder arthroplasty (%)						
Reverse	26.92	46.02	65.77	85.55	91.08	**76.90**
Total anatomical	42.31	35.84	25.74	11.33	5.48	**16.74**
Hemi	30.77	18.14	8.49	3.11	3.45	**6.36**
Total (n):	**52**	**226**	**742**	**1,253**	**493**	**2,766**

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 2020

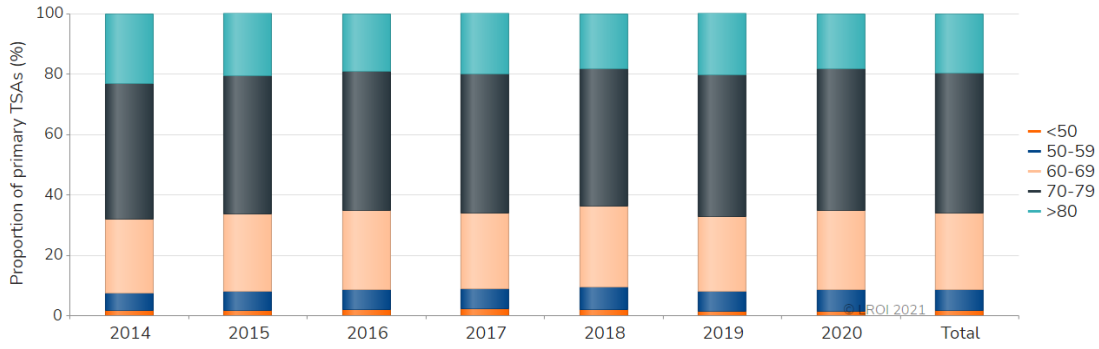
N	Reverse (n=2,128)	Total anatomical (n=463)	Hemi (n=176)	Total[1] (n=2,783)
Mean age (years) (SD)	73.1 (7.9)	65.9 (8.9)	64.3 (11.0)	71.3 (8.9)
Age (years) (%)				
<50	1	5	9	2
50-59	5	17	23	8
60-69	23	41	36	27
70-79	50	31	22	45
≥80	21	6	10	18
Gender (%)				
Men	24	28	33	25
Women	76	72	67	75
ASA score (%)				
I	5	14	7	7
II	57	66	60	59
III-IV	38	20	33	34
Type of hospital (%)				
General	93	79	80	90
UMC	2	1	7	2
Private	5	20	13	8
Specialism (%)				
Orthopaedic surgeon	99	100	97	99
Trauma surgeon	1	0	3	1
Diagnosis (%)				
Osteoarthritis	32	91	50	43
Fracture	20	0	24	17
Cuff arthropathy	20	0	1	16
Post-traumatic	12	4	8	11
Cuff rupture	7	0	0	5
Rheumatoid arthritis	2	1	3	2
Osteonecrosis	2	2	8	2
Other	5	1	6	4
Walch score (%)				
A1 Humeral head centered, minor erosion glenoid	51	38	62	49
A2 Humeral head centered, major erosion glenoid	29	33	21	29
B1 Humeral head subluxed posteriorly, posterior joint space narrow, subchondrial sclerosis and osteophytes	8	18	6	10
B2 Humeral head subluxed posteriorly retroverted, glenoid with posterior rim erosion	7	8	6	7
B3 Humeral head subluxed posteriorly more than 70 percent and glenoid retroversion more than 10 degrees	3	2	1	3
C Glenoid retroversion more than 25 degrees regardless of erosion	2	1	4	2
Mean Body Mass Index (kg/m²) (SD)	28.3 (5.4)	28.2 (5.3)	28.8 (5.7)	28.4 (5.4)
Body Mass Index (kg/m²) (%)				
Underweight (≤18,5)	1	1	2	1
Normal weight (>18,5-25)	29	25	23	28
Overweight (>25-30)	39	38	39	39
Obesity (>30-40)	28	33	34	29
Morbid obesity (>40)	3	3	2	3
Smoking (%)				
No	92	92	86	91
Yes	8	8	14	9

[1] Also contains 16 (0.6%) 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.

Age category

FIGURE Trend (proportion [%] per year) in age category in primary total (anatomical or reverse) shoulder arthroplasties in the Netherlands in 2014-2020



Age category (%)								
<50	1.69	1.60	2.00	2.18	1.93	1.56	1.39	**1.76**
50-59	5.83	6.32	6.52	6.81	7.64	6.46	7.14	**6.74**
60-69	24.47	25.66	26.22	25.01	26.57	24.70	26.22	**25.59**
70-79	44.92	45.92	46.01	46.10	45.50	47.12	46.87	**46.16**
>80	23.09	20.51	19.25	19.91	18.35	20.17	18.38	**19.75**
Total (n):	**1,594**	**2,058**	**2,254**	**2,527**	**2,747**	**3,020**	**2,590**	**16,790**

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 2020

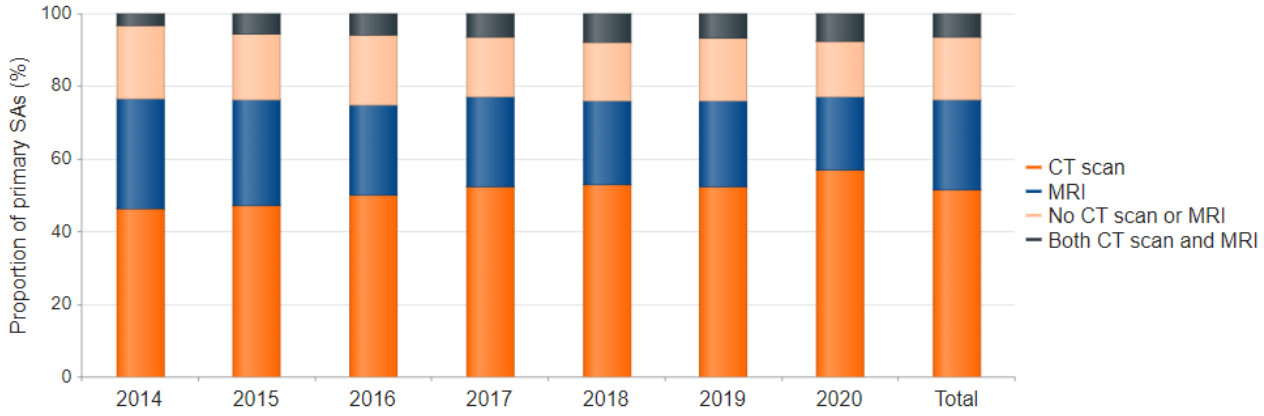
	Reverse (n=2,112) Proportion[1] (%)	Total anatomical (n=458) Proportion[1] (%)	Hemi (n=175) Proportion[1] (%)
Previous surgery to the relevant shoulder (total)	16.2	15.1	12.6
Rotator cuff repair	7.5	1.3	0.6
Osteosynthesis	4.7	3.5	4.6
Acromioplasty	4.7	3.5	1.1
Distal clavicle resection	2.0	2.2	2.9
Stabilisation procedure	1.1	3.7	1.7
Other	3.9	4.8	2.9

[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 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

Additional imaging

FIGURE Trend (proportion [%] per year) in use of additional imaging in primary shoulder arthroplasties in the Netherlands in 2014-2020

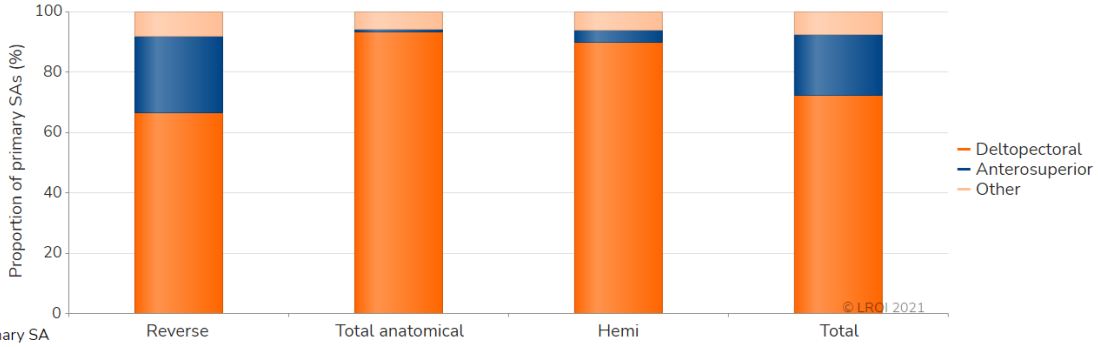


Year	2014	2015	2016	2017	2018	2019	2020	Total
Additional imaging (%)								
CT scan	46.43	47.33	50.02	52.24	52.82	52.41	57.08	**51.62**
MRI	30.24	29.05	24.78	24.85	23.11	23.49	20.18	**24.65**
No CT scan or MRI	20.08	17.97	19.39	16.40	16.22	17.42	15.24	**17.33**
Both CT scan and MRI	3.25	5.65	5.80	6.51	7.85	6.68	7.49	**6.39**
Total (n):	**1,693**	**2,248**	**2,429**	**2,720**	**2,929**	**3,112**	**2,696**	**17,827**

SA: shoulder arthroplasty; CT: computed tomography; MRI: magnetic resonance imaging.

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 2020

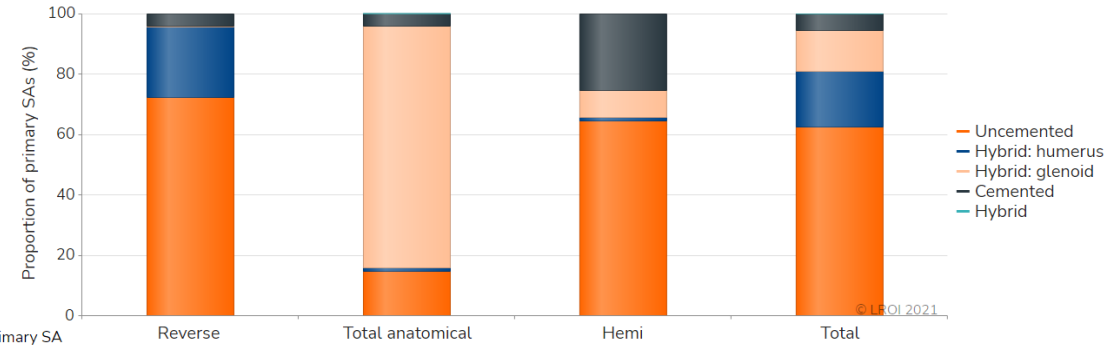


Type of primary SA	Reverse	Total anatomical	Hemi	Total
Surgical approach (%)				
Deltopectoral	66.41	93.19	89.71	**72.33**
Anterosuperior	25.41	0.88	4.00	**19.99**
Other	8.17	5.93	6.29	**7.68**
Total (n):	**2,117**	**455**	**175**	**2,747**

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 2020



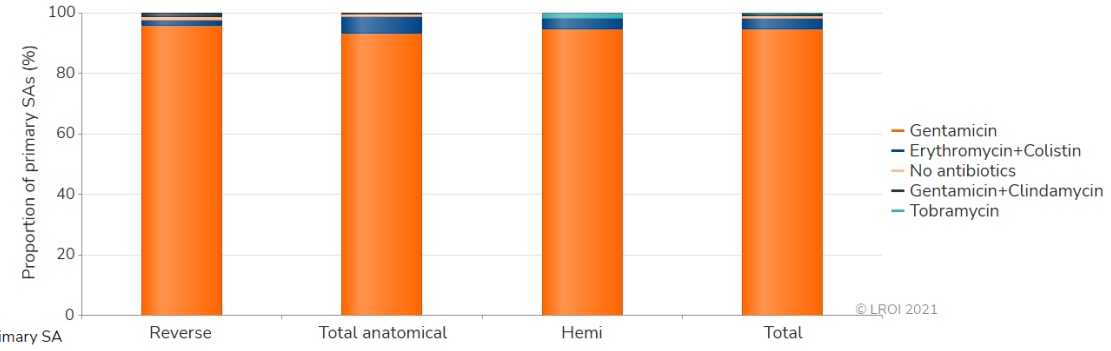
Type of primary SA	Reverse	Total anatomical	Hemi	Total
Fixation (%)				
Uncemented	72.32	14.68	64.53	**62.52**
Hybrid: humerus	23.28	1.15	1.16	**18.30**
Hybrid: glenoid	0.29	80.05	8.72	**13.70**
Cemented	4.11	3.90	25.58	**5.44**
Hybrid	0.00	0.23	0.00	**0.04**
Total (n):	**2,092**	**436**	**172**	**2,700**

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 2020

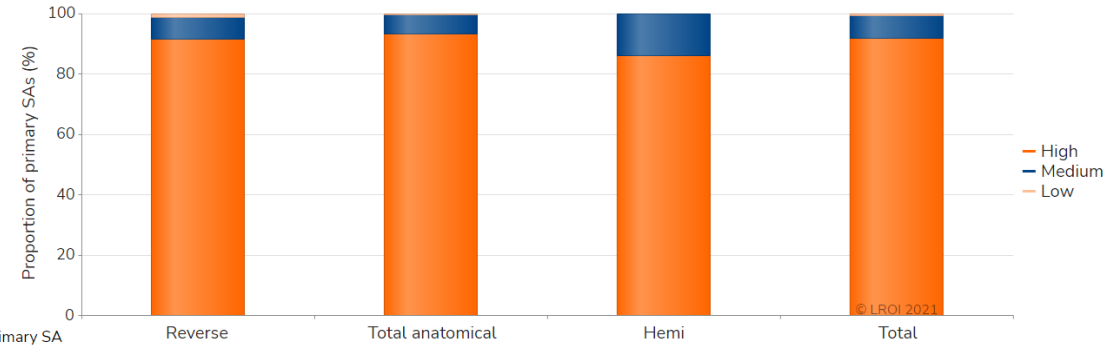


Type of primary SA	Reverse	Total anatomical	Hemi	Total
Bone cement antibiotics (%)				
Gentamicin	95.74	93.20	94.74	**94.79**
Erythromycin+Colistin	1.93	5.50	3.51	**3.28**
No antibiotics	0.97	0.97	0.00	**0.91**
Gentamicin+Clindamycin	1.35	0.32	0.00	**0.91**
Tobramycin	0.00	0.00	1.75	**0.11**
Total (n):	**517**	**309**	**57**	**883**

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 2020

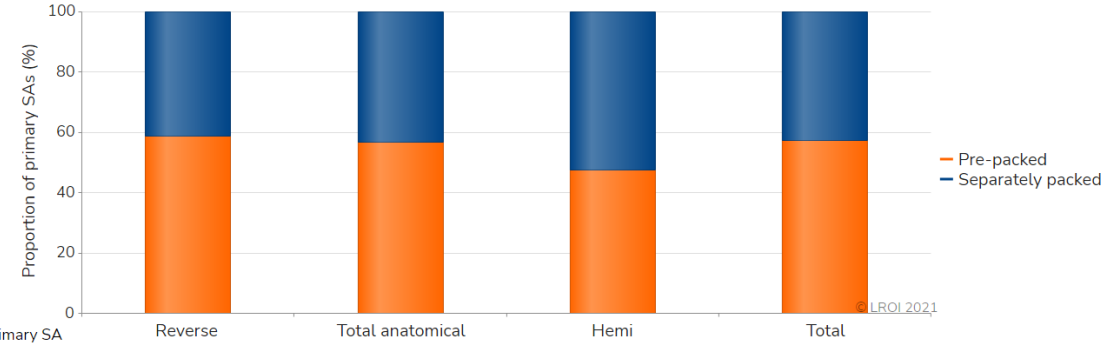


Bone cement viscosity (%)				
High	91.49	93.20	85.96	**91.73**
Medium	7.35	6.47	14.04	**7.47**
Low	1.16	0.32	0.00	**0.79**
Total (n):	**517**	**309**	**57**	**883**

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 2020



Vacuum mixing system (%)				
Pre-packed	58.61	56.63	47.37	**57.19**
Separately packed	41.39	43.37	52.63	**42.81**
Total (n):	**517**	**309**	**57**	**883**

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 2020

Humeral stem (n=1,886)

Name	Proportion (%)
Delta X-tend	31.0
Aequalis Ascend Flex	14.4
Comprehensive	12.5
Aequalis Reversed Fracture	7.2
Aequalis Reversed	7.0

Humeral liner (n=1,841)

Name	Proportion (%)
Delta X-tend	34.8
Aequalis Ascend Flex	14.9
Comprehensive	13.6
Aequalis Reversed	7.7
Aequalis Reversed Fracture	6.6

Glenosphere (n=1,767)

Name	Proportion (%)
Delta X-tend	29.2
Aequalis Reversed	26.4
Comprehensive	14.0
TM Reverse Glenoid Heads	8.7
Aequalis Perform Reversed	5.3

Metaphysis (n=1,439)

Name	Proportion (%)
Delta X-tend	29.5
Aequalis Ascend Flex	18.7
Comprehensive	16.8
Aequalis Reversed	9.1
Equinoxe	7.1

Glenoid baseplate (n=1,829)

Name	Proportion (%)
Delta X-tend	34.6
Aequalis Reversed	25.5
Comprehensive	13.2
Trabecular Metal Baseplate	8.3
Aequalis Perform Reversed	4.8

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 2020

Humeral stem (n=362)

Name	Proportion (%)
Aequalis Acsend Flex	33.7
Global Unite	11.6
Comprehensive	11.3
Affinis Short	9.1
Global Icon	7.5

Humeral head (n=373)

Name	Proportion (%)
Aequalis Acsend Flex	33.2
Global Unite/ Global AP	16.4
Comprehensive	11.0
Affinis Short	8.3
SMR head	8.0

Glenoid (n=359)

Name	Proportion (%)
Aequalis Perform glenoid	37.9
Global APG+	25.1
Comprehensive	12.3
Affinis	6.4
Anatomical Shoulder Glenoids	5.6

Shoulder hemiarthroplasty

TABLE The most frequently registered humeral stems and humeral heads in primary shoulder hemiarthroplasties in the Netherlands in 2020

Humeral stem (n=135)		Humeral head (n=138)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Aequalis Acsend Flex	25.2	Aequalis Pyrocarbon	16.7
Aequalis Fracture hemi	14.1	Aequalis humeral head	13.8
Comprehensive	14.1	Comprehensive	11.6
SMR stem	7.4	SMR head	10.9
Eclipse	4.4	Copeland	10.1
SMR stemless	4.4		
Sidus Baseplate	4.4		

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 2020

Separately packed bone cement (n=214)		Bone cement pre-packed in a vacuum mixing system (n=292)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	59.3	Palacos R+G	57.4
Refobacin Bone Cement R	14.5	Refobacin Bone Cement R	32.3
Palacos MV+G	7.9	Refobacin Plus Bone Cement	10.2
Subiton G	5.1		
Simplex ABC EC	4.7		

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 2020

Separately packed bone cement (n=134)		Bone cement pre-packed in a vacuum mixing system (n=175)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	61.9	Palacos R+G	54.9
Refobacin Bone Cement R	19.4	Refobacin Bone Cement R	37.7
Simplex ABC EC	12.7	Refobacin Plus Bone Cement	7.4
Biomet Plus Bone Cement	2.2		
Subiton G	2.2		

Shoulder hemiarthroplasty

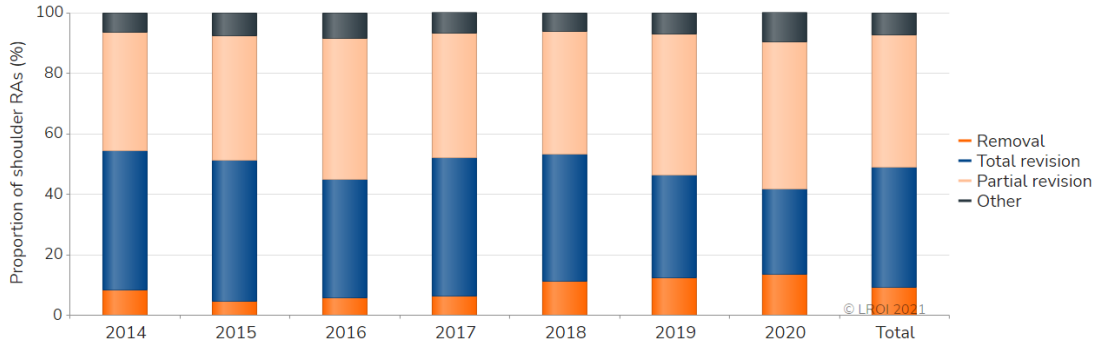
TABLE The most frequently registered types of bone cement by type of mixing system used during primary shoulder hemiarthroplasties in the Netherlands in 2020

Separately packed bone cement (n=30)		Bone cement pre-packed in a vacuum mixing system (n=27)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	66.7	Refobacin Plus Bone Cement	40.7
Palacos MV+G	13.3	Refobacin Bone Cement R	33.3
Refobacin Bone Cement R	6.7	Palacos R+G	25.9
Simplex ABC EC	6.7		
Simplex P	3.3		
Subiton G	3.3		

Shoulder revision arthroplasty

Type of revision

FIGURE Trend (proportion [%] per year) in type of revision in shoulder revision arthroplasties in the Netherlands in 2014-2020



Type of shoulder revision (%)								
Removal	8.33	4.62	5.70	6.33	11.21	12.36	13.58	**9.11**
Total revision	46.08	46.54	39.16	45.78	42.06	33.91	28.15	**39.80**
Partial revision	39.22	41.15	46.77	41.27	40.50	46.55	48.68	**43.65**
Other	6.37	7.69	8.37	6.63	6.23	7.18	9.60	**7.44**
Total (n):	**204**	**260**	**263**	**332**	**321**	**348**	**302**	2,030

RA: revision arthroplasty.

Reasons for revision

TABLE Trend (proportion [%] per year) in reasons for revision in patients who underwent a shoulder revision arthroplasty by type of shoulder arthroplasty in the Netherlands in 2014-2020

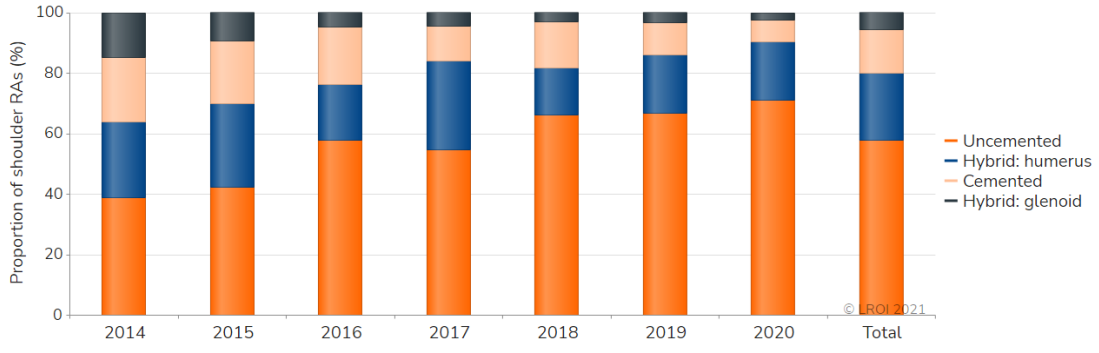
Year	2014	2015	2016	2017	2018	2019	2020	Total
Shoulder revision (n)	195	264	267	334	318	343	302	2,023
Reasons for revision; Proportion[1] (%)								
Infection	20.5	17.1	22.9	22.2	26.1	28.9	29.1	24.2
Instability	13.1	15.9	24.0	27.3	23.7	23.3	24.5	22.3
Progression of osteoarthritis	25.6	25.4	17.2	17.4	15.7	12.5	10.3	17.1
Cuff rupture	14.9	15.5	11.2	15.0	12.6	11.7	9.9	12.9
Loosening of glenoid component	13.2	13.6	10.9	13.5	11.6	11.7	10.6	12.1
Cuff arthropathy	13.2	13.6	13.9	12.3	10.1	12.0	9.6	12.0
Malalignment	12.8	13.3	8.6	8.7	6.3	6.4	9.3	9.0
Loosening of humeral component	8.2	7.6	11.2	4.8	7.6	5.5	8.9	7.6
Peri-prosthetic fracture	3.1	6.1	5.2	4.8	6.9	6.4	6.0	5.6
Other	11.3	12.1	12.4	9.6	13.2	12.2	17.2	12.6

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

Surgical techniques

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in shoulder revision arthroplasties in the Netherlands in 2014-2020

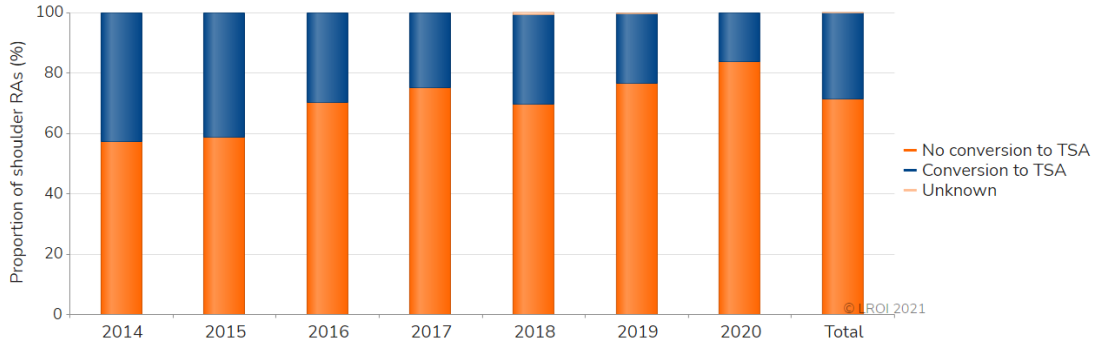


Fixation (%)	2014	2015	2016	2017	2018	2019	2020	Total
Uncemented	38.98	42.28	57.96	54.55	66.28	66.89	71.09	**57.94**
Hybrid: humerus	24.86	27.64	18.37	29.55	15.33	19.21	19.14	**22.01**
Cemented	21.47	20.73	18.78	11.36	15.33	10.60	7.42	**14.54**
Hybrid: glenoid	14.69	9.35	4.90	4.55	3.07	3.31	2.34	**5.52**
Total (n):	**177**	**246**	**245**	**308**	**261**	**302**	**256**	1,795

RA: revision arthroplasty.

Conversion to TSA

FIGURE Trend (proportion [%] per year) in conversion of a shoulder hemiprosthesis to a total (anatomical or reverse) shoulder arthroplasty in the Netherlands in 2014-2020

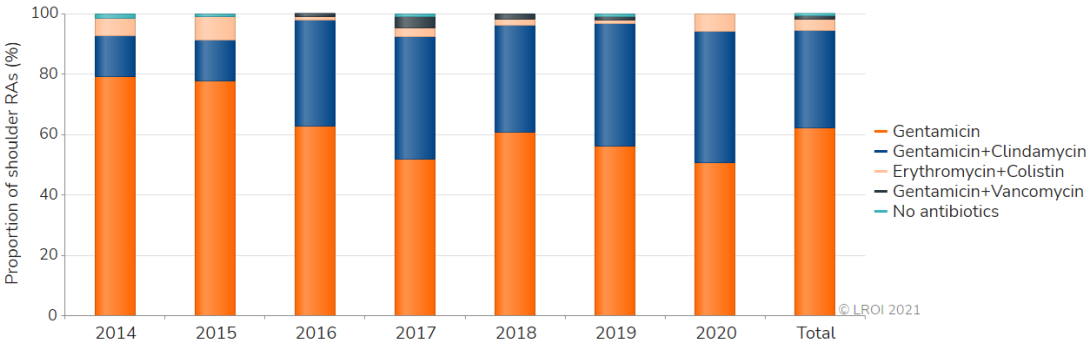


Conversion to TSA (%)	2014	2015	2016	2017	2018	2019	2020	Total
No conversion to TSA	57.14	58.68	70.24	75.23	69.67	76.44	83.73	**71.43**
Conversion to TSA	42.86	41.32	29.76	24.77	29.67	23.26	16.27	**28.42**
Unknown	0.00	0.00	0.00	0.00	0.67	0.30	0.00	**0.16**
Total (n):	**182**	**242**	**252**	**323**	**300**	**331**	**295**	1,925

RA: revision arthroplasty; TSA: total shoulder arthroplasty.

Bone cement antibiotics

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in shoulder revision arthroplasties in the Netherlands in 2014-2020



Bone cement antibiotics (%)	2014	2015	2016	2017	2018	2019	2020	Total
Gentamicin	79.10	77.78	62.63	51.92	60.58	56.18	50.75	**62.26**
Gentamicin+Clindamycin	13.43	13.33	35.35	40.38	35.58	40.45	43.28	**32.26**
Erythromycin+Colistin	5.97	7.78	1.01	2.88	1.92	1.12	5.97	**3.55**
Gentamicin+Vancomycin	0.00	0.00	1.01	3.85	1.92	1.12	0.00	**1.29**
No antibiotics	1.49	1.11	0.00	0.96	0.00	1.12	0.00	**0.65**
Total (n):	**67**	**90**	**99**	**104**	**104**	**89**	**67**	620

RA: revision arthroplasty.

Most frequently registered

Components

TABLE The most frequently registered humeral stems, humeral heads, humeral liners, glenoid baseplates, glenospheres and metaphyses in shoulder revision arthroplasties in the Netherlands in 2020

Humeral stem (n=50)		Humeral head (n=26)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Delta X-tend	60.0	Aequalis Ascend Flex	26.9
Equinoxe	8.0	Global AP	15.4
Aequalis Ascend Flex	6.0	Aequalis humerus kop	11.5
Aequalis Reversed Fractuur	6.0	Global Unite/ Global AP	7.7
Aequalis Flex Revive	4.0	Mutars	7.7

Humeral liner (n=179)		Glenoid baseplate (n=89)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Delta X-tend	39.7	Delta X-tend	44.9
Aequalis Ascend Flex	11.7	Aequalis Reversed	15.7
Comprehensive	11.2	Comprehensive	14.6
Aequalis Reversed	7.8	Affinis Inverse	6.7
Aequalis Reversed Fractuur	6.1	Trabecular Metal Baseplate	6.7

Glenosphere (n=134)		Metaphysis (n=93)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Delta X-tend	28.4	Comprehensive	19.4
Aequalis Reversed	16.4	Delta X-tend	18.3
SMR reversed head	11.9	Aequalis Ascend Flex	16.1
Comprehensive	11.2	Equinoxe	12.9
TM Reverse Glenoid Heads	8.2	Anatomical inverse Humeral Cups	9.7

Types of bone cement

TABLE The most frequently registered types of bone cement used during shoulder revision arthroplasties in the Netherlands in 2020 (n=60)

Name	Proportion (%)
Copal G+C	38.3
Palacos R+G	28.3
Refobacin Bone Cement R	11.7
Refobacin Revision	10.0
Simplex ABC EC	6.7

Survival

Revision within 1 year

By type of shoulder arthroplasty

TABLE Cumulative 1-year revision percentage of primary shoulder arthroplasties by type of shoulder arthroplasty in the Netherlands in 2015-2019

		Cumulative 1-year revision percentage	
Type of primary shoulder arthroplasty	Number (n)	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Reverse	9,625	2.4 (2.1-2.8)	2.5 (2.2-2.8)
Total anatomical	3,122	1.6 (1.2-2.1)	1.6 (1.1-2.0)
Hemi	1,484	3.1 (2.3-4.1)	3.1 (2.2-4.0)

Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.
CI: confidence interval

In 2015-2019, 235 (1.6%) primary shoulder arthroplasties were implanted in patients who died within one year after the primary procedure.

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 2015-2019

	Type of primary shoulder arthroplasty		
	Reverse (n=241)	Total anatomical (n=50)	Hemi (n=46)
Reason for revision	Proportion[1] (%)	Proportion[1] (%)	Proportion[1] (%)
Instability	44.0	34.0	21.7
Infection	27.4	4.0	10.9
Cuff rupture	n.a.	34.0	21.7
Malalignment	4.2	10.0	17.4
Cuff arthroplasty	n.a.	14.0	26.1
Loosening of glenoid component	7.5	6.0	0.0
Loosening of humeral component	2.9	4.0	8.7
Peri-prosthetic fracture	6.2	2.0	4.4
Progression of osteoarthritis	1.2	4.0	17.4
Other	8.3	10.0	17.4

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 6 years

By type of shoulder arthroplasty

FIGURE Cumulative revision percentage of primary shoulder arthroplasties by type of shoulder arthroplasty in the Netherlands in 2014-2020 (n=19,165)

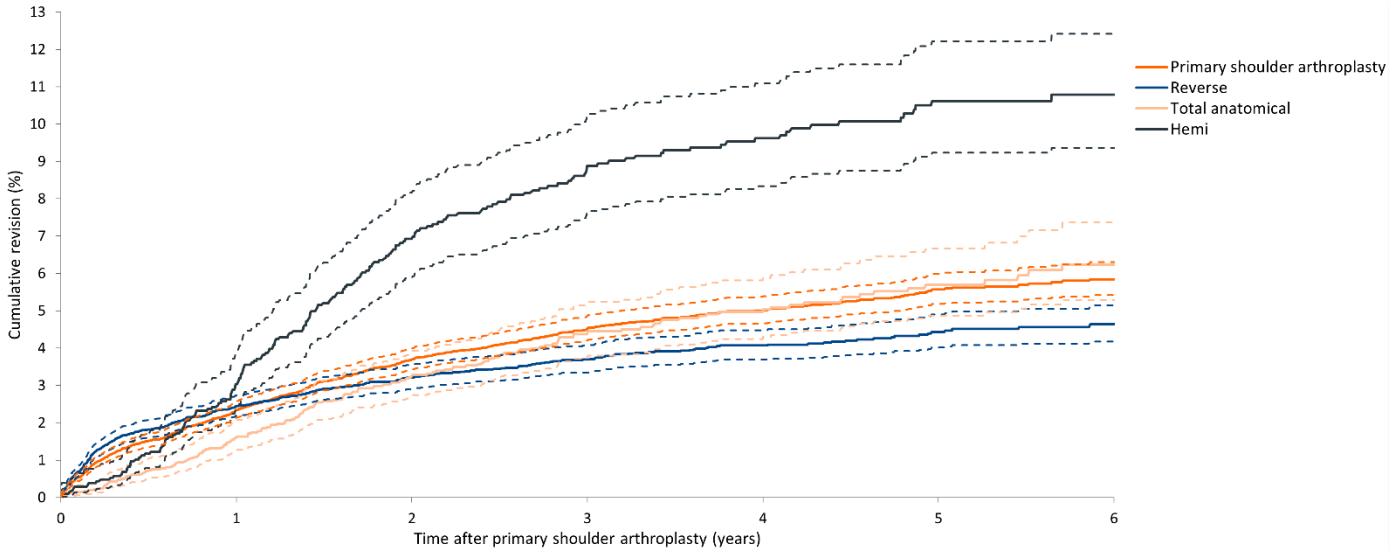


TABLE Cumulative revision percentages of primary shoulder arthroplasties

	Number (n)	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Primary shoulder arthroplasty	19,165			
1-year revision (%)		15,736	2.3 (2.1-2.6)	2.4 (2.2-2.6)
3-year revision (%)		8,990	4.5 (4.2-4.9)	4.7 (4.3-5.0)
5-year revision (%)		3,734	5.6 (5.2-6.0)	5.9 (5.4-6.3)
6-year revision (%)		1,629	5.8 (5.4-6.3)	6.2 (5.7-6.7)
By type of primary shoulder arthroplasty				
Reverse	12,891			
1-year revision (%)		10,310	2.4 (2.2-2.7)	2.5 (2.2-2.8)
3-year revision (%)		5,563	3.7 (3.3-4.1)	3.9 (3.5-4.2)
5-year revision (%)		2,124	4.4 (4.0-4.9)	4.7 (4.2-5.2)
6-year revision (%)		884	4.6 (4.2-5.1)	4.9 (4.4-5.5)
Total anatomical	4,093			
1-year revision (%)		3,514	1.6 (1.2-2.1)	1.6 (1.2-2.0)
3-year revision (%)		2,104	4.4 (3.7-5.1)	4.4 (3.7-5.1)
5-year revision (%)		922	5.7 (4.9-6.7)	5.8 (4.9-6.7)
6-year revision (%)		400	6.2 (5.3-7.4)	6.4 (5.3-7.5)
Hemi	2,086			
1-year revision (%)		1,838	3.0 (2.4-3.9)	2.9 (2.2-3.7)
3-year revision (%)		1,266	8.9 (7.7-10.3)	9.0 (7.6-10.3)
5-year revision (%)		667	10.6 (9.2-12.2)	11.1 (9.6-12.7)
6-year revision (%)		335	10.8 (9.4-12.4)	11.3 (9.7-12.9)

[1] The cumulative revision percentage using the competing risk method is shown in the figure.
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
Reverse: reverse total shoulder arthroplasty; Total anatomical: total anatomical shoulder arthroplasty; Hemi: shoulder hemiarthroplasty. CI: confidence interval

In 2014-2020, 1,456 (7.6%) primary shoulder arthroplasties were implanted in patients who died within six years after the primary procedure.

Reverse total shoulder arthroplasty by demographics

TABLE Cumulative 5-year revision percentage of primary reverse total shoulder arthroplasties by demographics in the Netherlands in 2014-2020

			Cumulative 5-year revision percentage	
	Number (n)	Number at risk (n)	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Total	12,891	2,124	4.4 (4.0-4.9)	4.7 (4.2-5.2)
Gender				
Men	2,978	422	8.3 (7.2-9.6)	8.8 (7.6-10.0)
Women	9,902	1,696	3.3 (2.9-3.8)	3.5 (3.0-4.0)
Age (years)				
<50	98	15	n.a.	n.a.
50-59	467	53	8.7 (6.0-12.5)	8.9 (5.6-12.1)
60-69	2,785	440	7.0 (5.9-8.4)	7.3 (6.0-8.6)
70-79	6,519	1,118	4.0 (3.4-4.6)	4.2 (3.6-4.8)
≥80	3,010	493	2.2 (1.7-2.8)	2.4 (1.8-3.0)
Diagnosis				
Osteoarthritis	3,948	625	3.9 (3.2-4.8)	4.2 (3.3-5.1)
Other	8,912	729	4.8 (4.2-5.6)	4.9 (4.4-5.5)
ASA score				
I	699	138	7.8 (5.5-11.2)	8.0 (5.2-10.8)
II	7,530	1,278	3.7 (3.2-4.3)	4.0 (3.4-4.5)
III-IV	4,500	511	5.0 (4.2-5.9)	5.5 (4.6-6.4)
Walch score				
A1	5,797	1,152	4.5 (3.9-5.2)	4.8 (4.1-5.5)
A2	2,767	428	4.3 (3.5-5.4)	4.6 (3.5-5.6)
B1	1,117	230	3.9 (2.7-5.5)	4.3 (2.8-5.8)
B2	679	84	2.7 (1.5-4.8)	2.9 (1.2-4.5)
B3	231	33	n.a.	n.a.
C	147	5	n.a.	n.a.
Body Mass Index (kg/m²)				
Underweight (≤18,5)	125	23	n.a.	n.a.
Normal weight (>18,5-25)	3,608	578	4.1 (3.3-5.0)	4.4 (3.5-5.4)
Overweight (>25-30)	4,973	819	4.3 (3.6-5.0)	4.5 (3.8-5.3)
Obesity (>30-40)	3,584	579	4.7 (4.0-5.6)	4.9 (4.1-5.8)
Morbid obesity (>40)	357	50	6.1 (3.7-10.2)	6.3 (3.0-9.6)
Smoking				
No	11,380	1,784	4.3 (3.9-4.8)	4.6 (4.0-5.1)
Yes	1,230	212	5.8 (4.5-7.5)	6.0 (4.5-7.6)

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 2014-2020

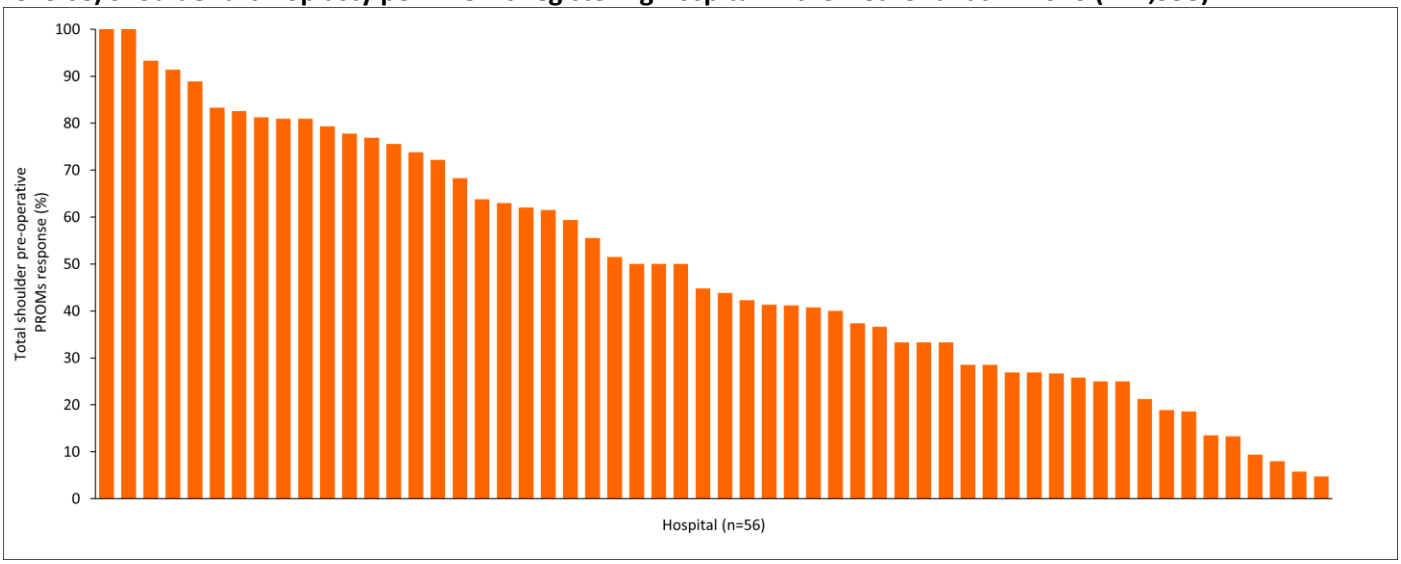
			Cumulative 5-year revision percentage	
	Number (n)	Number at risk (n)	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Total	4,093	922	5.7 (4.9-6.7)	5.8 (4.9-6.7)
Gender				
Men	1,209	261	6.4 (4.9-8.4)	6.5 (4.7-8.2)
Women	2,880	660	5.4 (4.5-6.6)	5.5 (4.4-6.6)
Age (years)				
<50	226	47	n.a.	n.a.
50-59	711	148	8.7 (6.4-11.9)	8.8 (6.1-11.6)
60-69	1,586	373	6.3 (5.0-8.0)	6.4 (4.8-7.9)
70-79	1,247	284	3.5 (2.4-5.1)	3.6 (2.2-5.0)
≥80	320	70	3.3 (1.6-6.7)	3.4 (0.9-5.9)
Diagnosis				
Osteoarthritis	3,422	723	5.1 (4.2-6.1)	5.1 (4.2-6.1)
Other	657	144	9.8 (7.2-13.3)	9.1 (6.4-11.7)
ASA score				
I	576	138	7.4 (5.1-10.7)	7.2 (4.5-9.8)
II	2,699	601	5.9 (4.8-7.2)	6.1 (4.9-7.2)
III-IV	667	140	4.0 (2.6-6.0)	3.9 (2.2-5.5)
Walch score				
A1	1,639	429	6.5 (5.2-8.1)	6.6 (5.1-8.1)
A2	1,158	251	5.4 (4.0-7.4)	5.5 (3.8-7.3)
B1	663	143	4.0 (2.5-6.2)	4.0 (2.2-5.8)
B2	283	46	n.a.	n.a.
B3	57	14	n.a.	n.a.
C	18	3	n.a.	n.a.
Body Mass Index (kg/m²)				
Underweight (≤18,5)	18	6	n.a.	n.a.
Normal weight (>18,5-25)	993	221	5.7 (4.1-7.9)	5.8 (3.9-7.7)
Overweight (>25-30)	1,584	362	5.1 (3.9-6.7)	5.2 (3.8-6.6)
Obesity (>30-40)	1,286	261	6.9 (5.3-8.9)	7.0 (5.2-8.8)
Morbid obesity (>40)	122	34	n.a.	n.a.
Smoking				
No	3,564	767	5.2 (4.3-6.2)	5.2 (4.3-6.2)
Yes	470	115	8.5 (5.8-12.4)	8.9 (5.5-12.3)

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

PROMs

Response

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 2020 (n=1,998)



"The mean pre-operative response rate in a PROMs registering hospital in 2020 was 44.3%.
Of the 1,249 patients who underwent a primary total shoulder arthroplasty between January and October 1st, the mean three months postoperative response rate was 37.6%.
In 2019, the mean twelve months postoperative response rate was 37.3% of the 2,019 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 ASA score in the Netherlands in 2016-2020

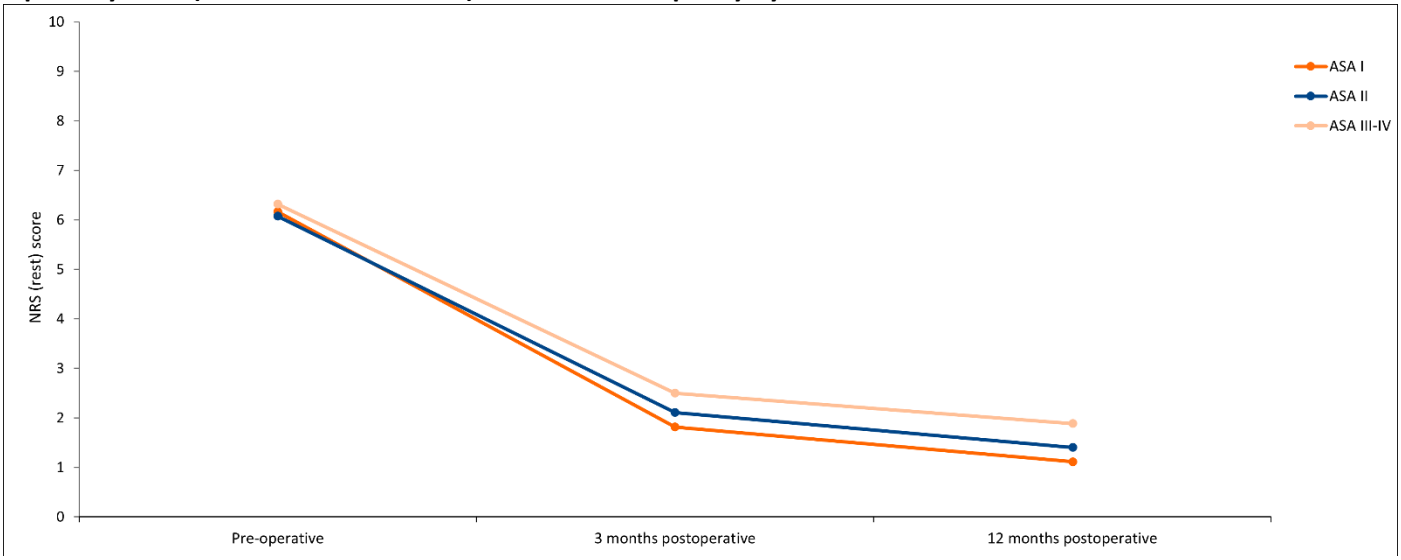


TABLE Mean NRS (rest) scores

NRS (rest) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	236	6.2 (5.9-6.5)	183	1.8 (1.5-2.1)	160	1.1 (0.8-1.4)
ASA II	1,774	6.1 (6.0-6.2)	1,218	2.1 (2.0-2.2)	1,083	1.4 (1.3-1.5)
ASA III-IV	1,031	6.3 (6.2-6.5)	638	2.5 (2.3-2.7)	517	1.9 (1.7-2.1)
Total	3,062	6.2 (6.1-6.3)	2,062	2.2 (2.1-2.3)	1,801	1.5 (1.4-1.6)

[1] The 12 months NRS (rest) score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2016-2020

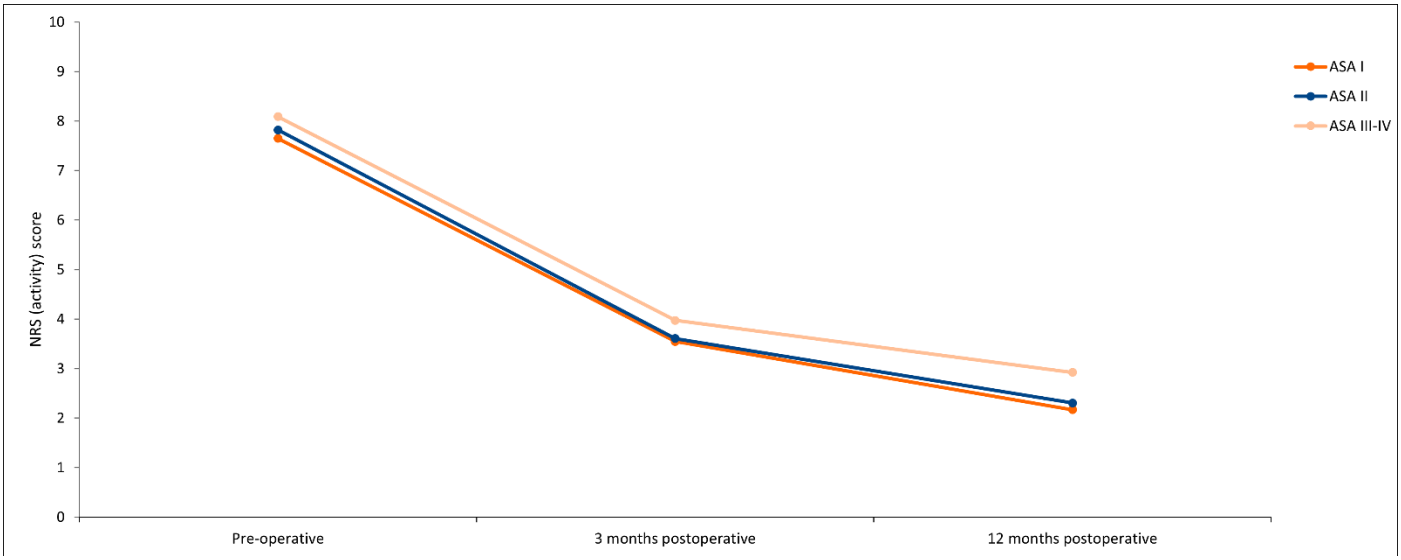


TABLE Mean NRS (activity) scores

NRS (activity) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	236	7.6 (7.4-7.9)	183	3.5 (3.2-3.9)	159	2.2 (1.8-2.6)
ASA II	1,775	7.8 (7.7-7.9)	1,216	3.6 (3.5-3.7)	1,079	2.3 (2.2-2.5)
ASA III-IV	1,031	8.1 (8.0-8.2)	636	4.0 (3.8-4.2)	515	2.9 (2.7-3.2)
Total	3,063	7.9 (7.8-8.0)	2,058	3.7 (3.6-3.8)	1,794	2.5 (2.4-2.6)

[1] The 12 months NRS (activity) score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2016-2020

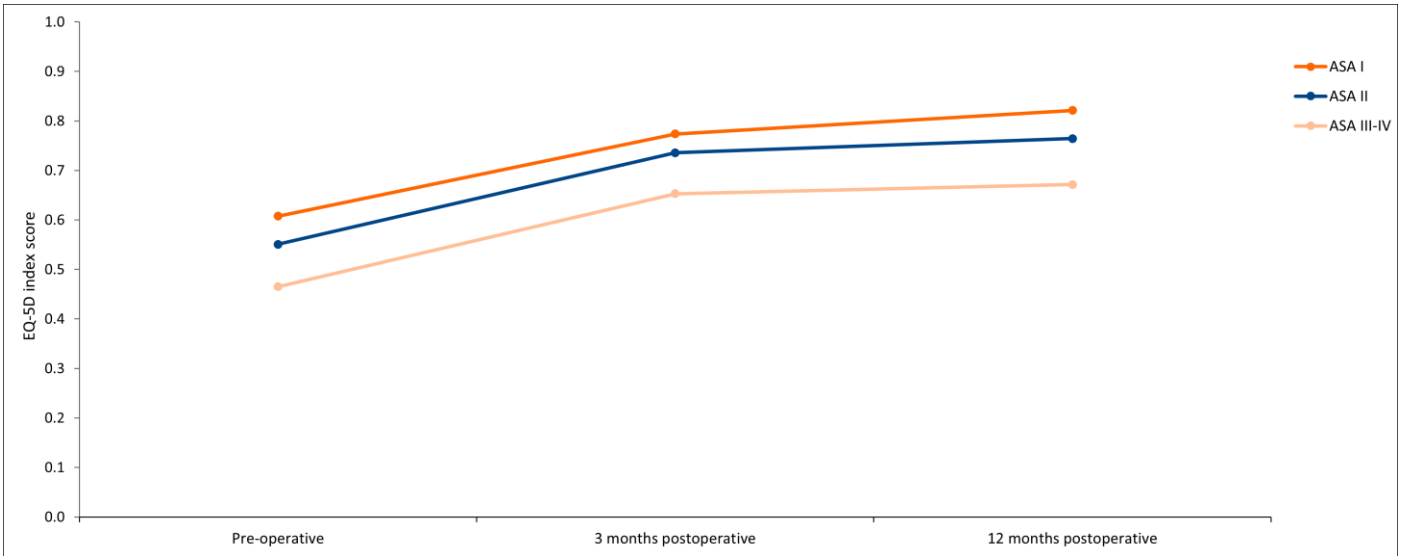


TABLE Mean EQ-5D Index scores

EQ-5D Index score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	234	0.61 (0.59-0.63)	204	0.77 (0.75-0.80)	169	0.82 (0.80-0.84)
ASA II	1,741	0.55 (0.54-0.56)	1,220	0.74 (0.73-0.75)	1,102	0.76 (0.75-0.77)
ASA III-IV	969	0.47 (0.45-0.48)	579	0.65 (0.64-0.67)	492	0.67 (0.65-0.69)
Total	2,996	0.53 (0.52-0.53)	2,038	0.71 (0.71-0.72)	1,775	0.74 (0.73-0.75)

[1] The 12 months EQ-5D index score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2016-2020

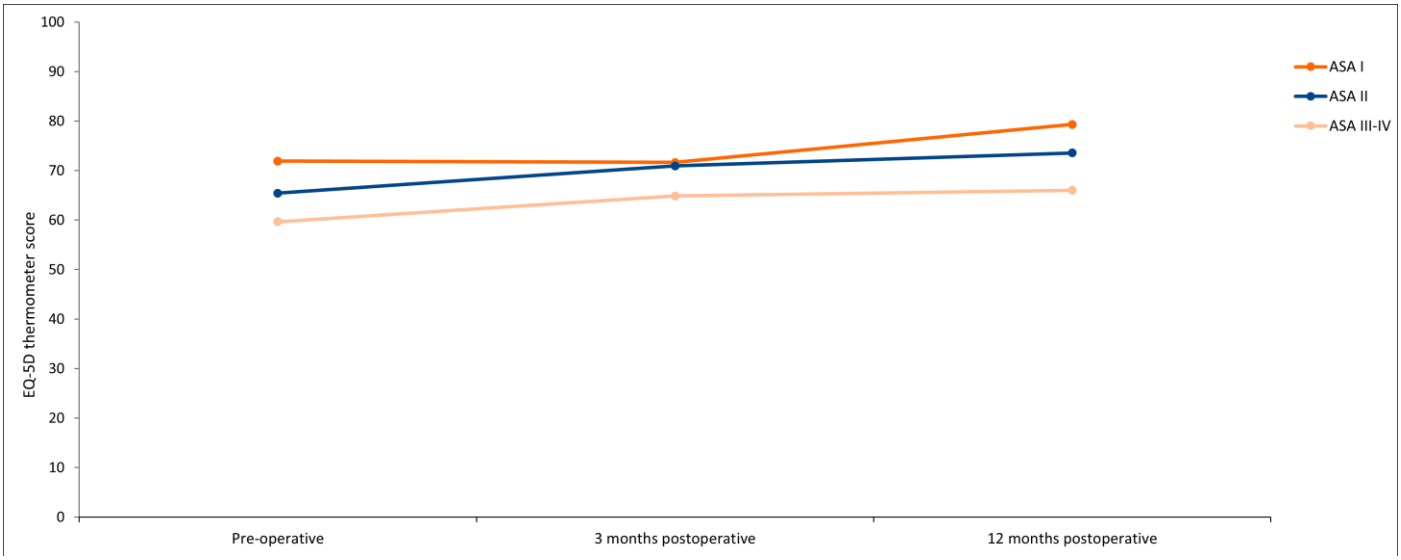


TABLE Mean EQ-5D thermometer scores

EQ-5D thermometer	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	238	71.9 (69.2-74.6)	211	71.6 (67.7-75.5)	172	79.3 (76.2-82.4)
ASA II	1,806	65.4 (64.4-66.4)	1.272	70.9 (69.7-72.2)	1,131	73.6 (72.4-74.8)
ASA III-IV	996	59.7 (58.3-61.0)	606	64.9 (63.1-66.7)	506	66.0 (64.2-67.8)
Total	3,092	64.0 (63.3-64.8)	2,214	69.3 (68.3-70.3)	1,821	72.0 (71.0-72.9)

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2016-2020

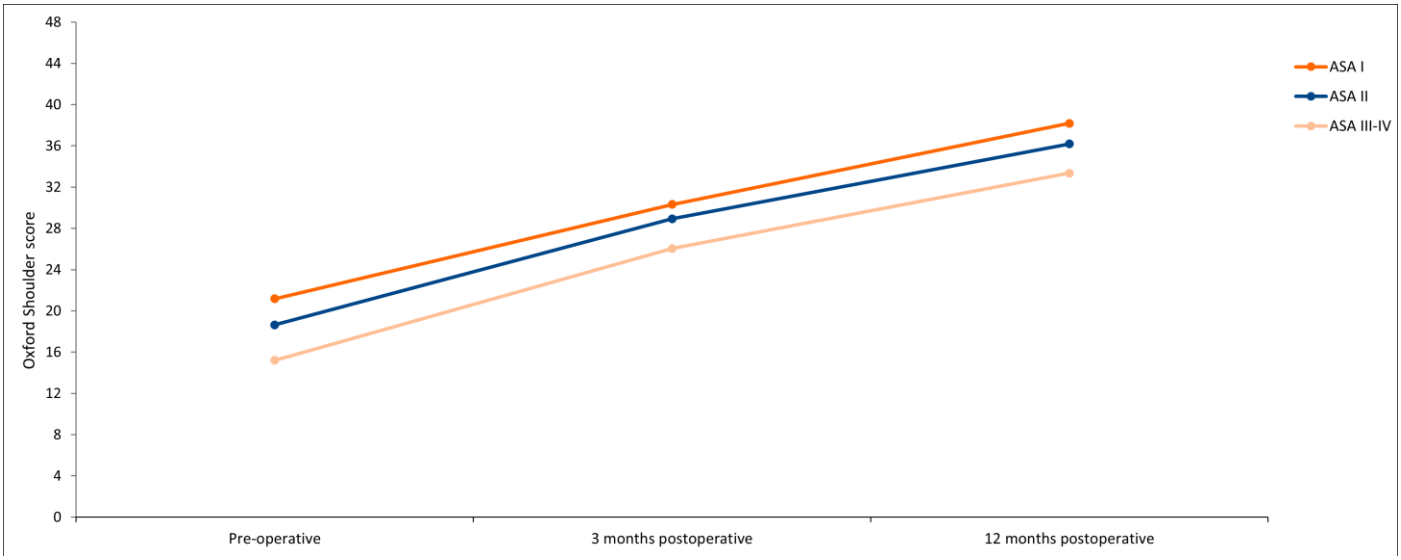


TABLE Mean Oxford Shoulder Scores (OSS)

Oxford Shoulder score	Pre-operative		3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	232	21.2 (20.2-22.1)	204	30.3 (28.9-31.7)	166	38.2 (36.6-39.7)
ASA II	1,736	18.6 (18.2-19.0)	1,225	28.9 (28.3-29.5)	1,053	36.2 (35.5-36.8)
ASA III-IV	964	15.2 (14.6-15.8)	584	26.0 (25.1-27.0)	469	33.3 (32.4-34.4)
Total	2,984	17.7 (17.4-18.0)	2,051	28.2 (27.7-28.7)	1,729	35.5 (35.0-36.0)

[1] The 12 months Oxford Shoulder score is not (yet) available for 2020.
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 ASA score in the Netherlands in 2016-2020

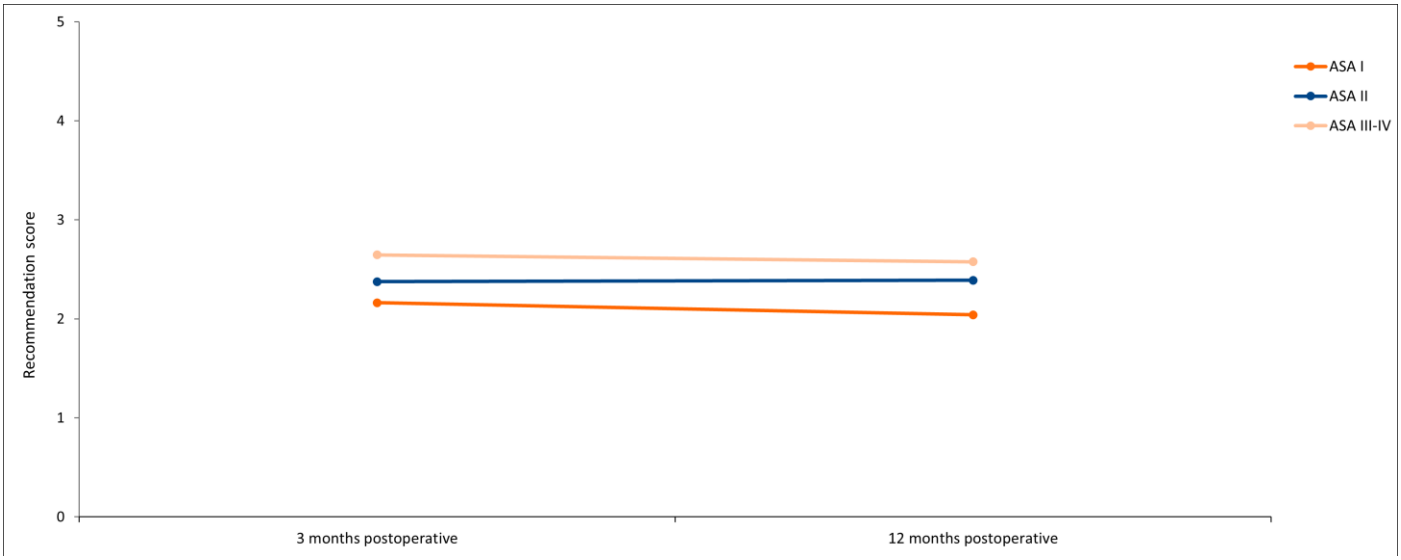


TABLE Mean recommendation

Recommendation score	3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	166	2.16 (1.94-2.38)	150	2.04 (1.81-2.27)
ASA II	1,119	2.38 (2.29-2.46)	999	2.39 (2.29-2.49)
ASA III-IV	583	2.65 (2.52-2.77)	480	2.58 (2.43-2.72)
Total	1,903	2.45 (2.38-2.52)	1,670	2.39 (2.32-2.45)

[1] The 12 months recommendation score is not (yet) available for 2020.
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 anchor scores: change in daily functioning of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by ASA score in the Netherlands in 2016-2020

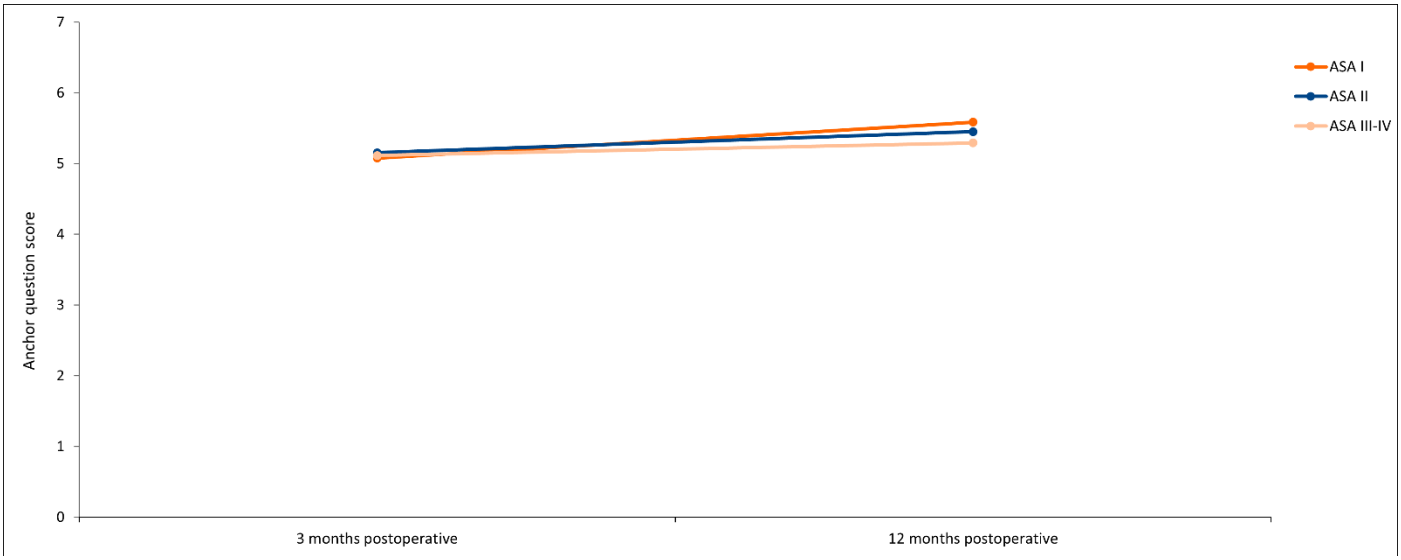


TABLE Mean anchor question: Daily functioning

Anchor question score	3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	198	5.1 (4.8-5.3)	159	5.6 (5.3-5.8)
ASA II	1,220	5.2 (5.1-5.2)	1,073	5.5 (5.4-5.5)
ASA III-IV	4,287	5.1 (5.0-5.2)	489	5.3 (5.1-5.4)
Total	2,049	5.1 (5.1-5.2)	1,762	5.4 (5.3-5.5)

[1] The 12 months anchor question score is not (yet) available for 2020.
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 anchor scores: change in pain of patients who underwent a primary total (anatomical or reverse) shoulder arthroplasty by ASA score in the Netherlands in 2016-2020

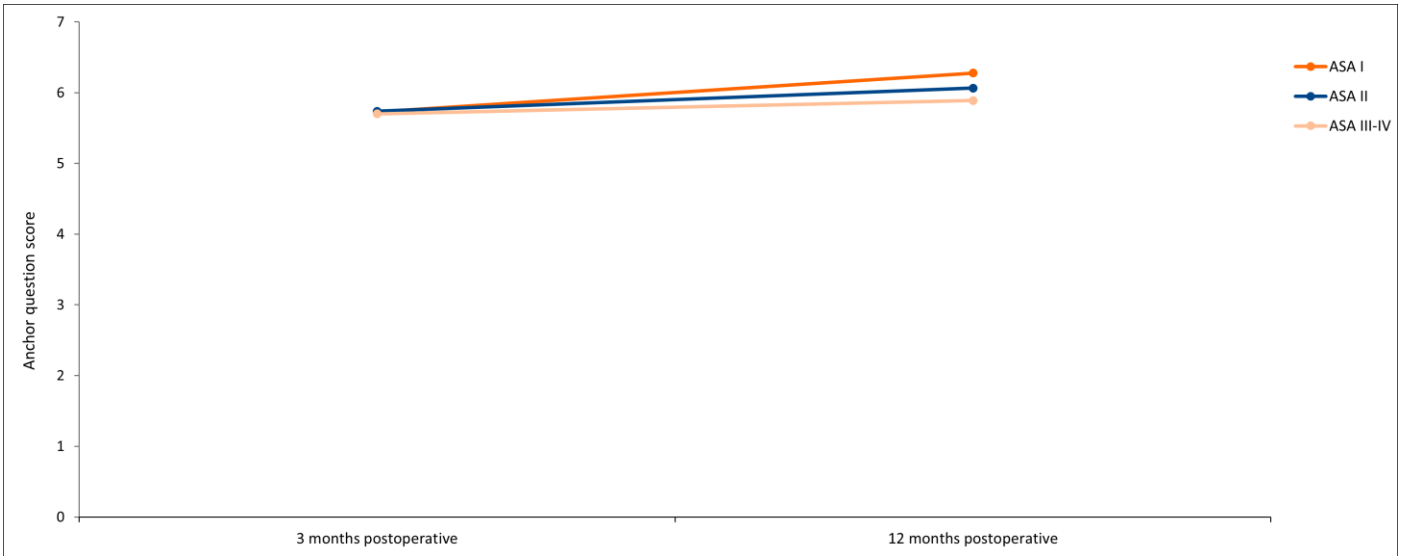


TABLE Mean anchor question: Pain

Anchor question score	3 months postoperative		12 months postoperative[1]	
ASA score	n	Mean (95% CI)	n	Mean (95% CI)
ASA I	187	5.7 (5.5-5.9)	159	6.3 (6.1-6.4)
ASA II	1,186	5.7 (5.7-5.8)	1,039	6.1 (6.0-6.1)
ASA III-IV	583	5.7 (5.6-5.8)	472	5.9 (5.8-6.0)
Total	1,992	5.7 (5.6-5.8)	1,711	6.0 (6.0-6.1)

[1] The 12 months anchor question score is not (yet) available for 2020.
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

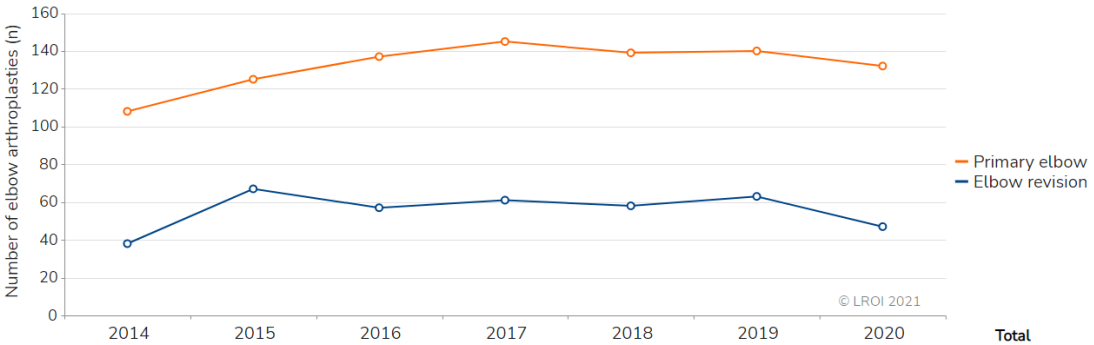
Registered procedures

TABLE Number of registered elbow arthroplasties per year of surgery (2014-2020) in the LROI in April 2021

	Type of elbow arthroplasty							
Year of surgery	Total arthroplasty (n)	Distal hemihumeral arthroplasty (n)	Radial head arthroplasty (n)	Radiocapitellar arthroplasty (n)	Other (n)	Unknown/ missing (n)	Revision arthroplasty (n)	Total (n)
2014	72	5	23	0	0	8	38	146
2015	78	4	41	1	0	1	67	192
2016	67	2	45	13	2	8	57	194
2017	67	1	41	13	0	23	61	206
2018	73	5	54	2	2	3	58	197
2019	79	2	57	0	0	2	63	203
2020	77	2	46	0	5	2	47	179
Total	513	21	307	29	9	47	391	1,317

Procedures

FIGURE Number of primary elbow arthroplasties and elbow revision arthroplasties registered in the LROI in the Netherlands in 2014-2020

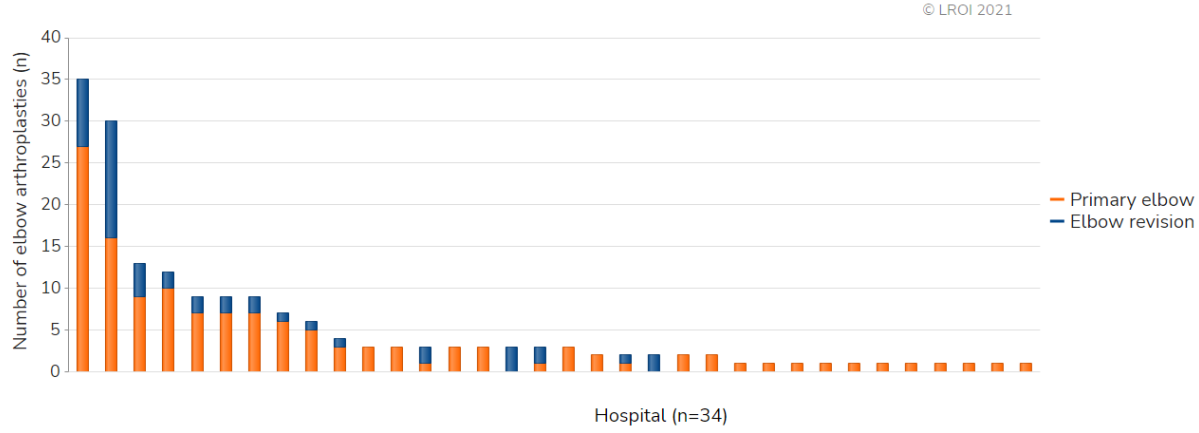


Year	2014	2015	2016	2017	2018	2019	2020	Total
Type of procedure (n)								
Primary elbow	108	125	137	145	139	140	132	**926**
Elbow revision	38	67	57	61	58	63	47	**391**
Total:	**146**	**192**	**194**	**206**	**197**	**203**	**179**	1,317

Out of 132 primary elbow arthroplasties that were performed in 2020, 2% (n=2) was performed bilaterally.

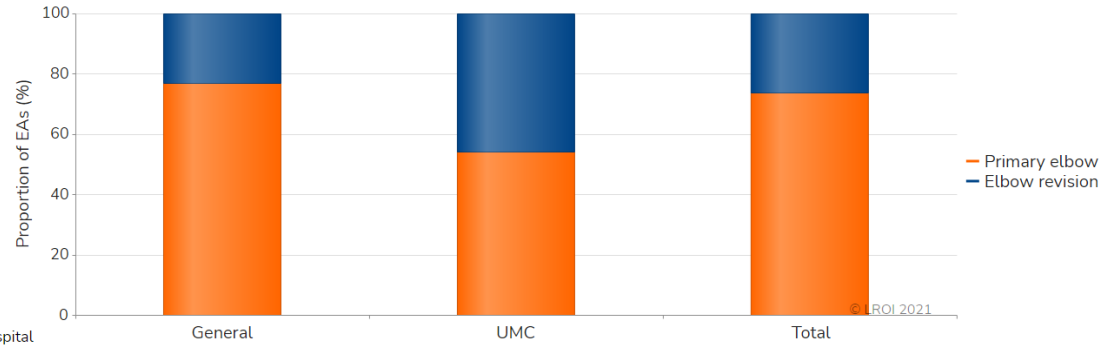
Type of procedure per hospital

FIGURE Number of primary elbow arthroplasties and elbow revision arthroplasties per hospital in the Netherlands in 2020 (n=179)



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 2020



Type of hospital	General	UMC	Total
Type of procedure (%)			
Primary elbow	76.77	54.17	**73.74**
Elbow revision	23.23	45.83	**26.26**
Total (n):	**155**	**24**	**179**

Please note: In 2020, 28 general hospitals and 6 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

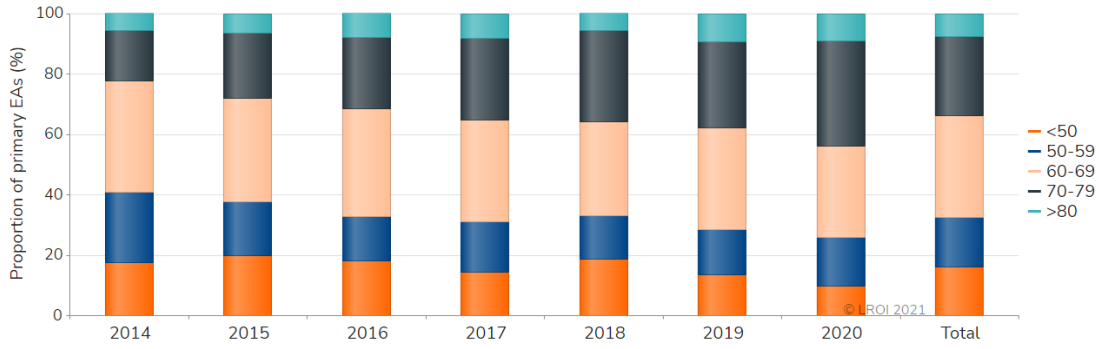
TABLE Patient characteristics of all patients with a registered primary elbow arthroplasty by type of elbow arthroplasty in the Netherlands in 2020

	Total arthroplasty[1] (n=79)	Radial head arthroplasty (n=46)	Total[2] (n=132)
Mean age (years) (SD)	69.1 (11.2)	59.9 (14.6)	65.6 (13.4)
Age (years) (%)			
<50	5	17	10
50-59	9	26	16
60-69	32	30	30
70-79	44	20	35
≥80	10	7	9
Gender (%)			
Men	18	41	27
Women	82	59	73
ASA score (%)			
I	9	28	16
II	48	50	49
III-IV	43	22	35
Type of hospital (%)			
General	89	91	90
UMC	11	9	10
Diagnosis (%)			
Acute fracture	9	70	32
Late post-traumatic	33	22	28
Osteoarthritis	28	4	19
Rheumatoid arthritis	22	0	13
Tumour	1	0	1
Osteonecrosis	0	0	0
Hemophilic arthropathy	0	0	0
Other	8	4	7
Mean Body Mass Index (kg/m²) (SD)	28.0 (5.6)	28.2 (4.8)	28.1 (5.3)
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	1	0	1
Normal weight (>18,5-25)	38	28	35
Overweight (>25-30)	29	42	34
Obesity (>30-40)	29	28	28
Morbid obesity (>40)	3	2	2
Smoking (%)			
No	92	95	93
Yes	8	5	7

[1] Including distal hemihumeral prostheses (n=2).
[2] Including pimary elbow arthroplasties that were registered in the LROI as other type of primary elbow arthroplasty (n=5).
General: general hospital; UMC: university medical centre; SD: standard deviation.

Age category

FIGURE Trend (proportion [%] per year) in age category in primary elbow arthroplasties in the Netherlands in 2014-2020



Age category (%)								
<50	17.59	20.00	18.25	14.48	18.71	13.57	9.85	**15.98**
50-59	23.15	17.60	14.60	16.55	14.39	15.00	15.91	**16.52**
60-69	37.04	34.40	35.77	33.79	30.94	33.57	30.30	**33.59**
70-79	16.67	21.60	23.36	26.90	30.22	28.57	34.85	**26.35**
>80	5.56	6.40	8.03	8.28	5.76	9.29	9.09	**7.56**
Total (n):	**108**	**125**	**137**	**145**	**139**	**140**	**132**	**926**

EA: elbow arthroplasty.

Previous surgery

TABLE Trend (proportion [%] per year) in previous surgeries to the same joint in patients who underwent a primary elbow arthoplasty in the Netherlands in 2016-2020

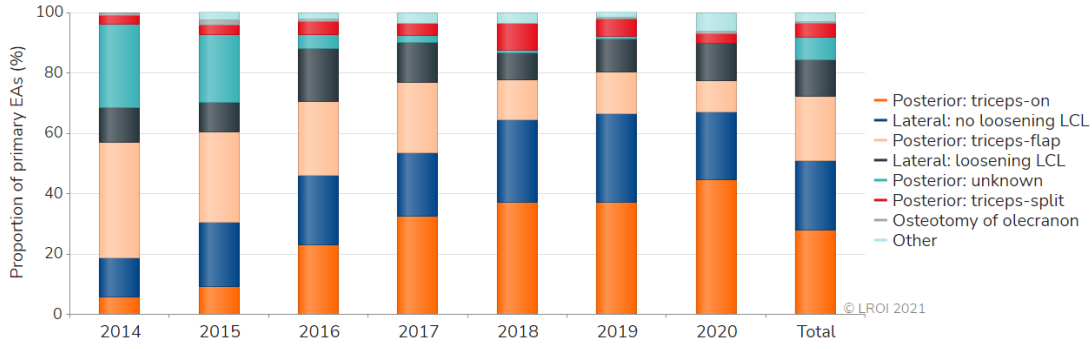
Year	2016	2017	2018	2019	2020	Total
Primary elbow arthroplasty (n)	134	143	134	138	128	677
Previous surgery to the relevant elbow (total); Proportion[1] (%)	39.6	32.9	29.1	32.6	35.2	33.8
Osteosynthesis	17.2	18.9	14.9	21.7	24.2	19.4
Lateral arthrotomy	22.4	19.6	8.2	16.7	10.2	15.5
Plate or screw removal	9.0	7.0	6.7	12.3	14.1	9.8
Posterior arthrotomy	7.5	8.4	8.2	7.3	7.0	7.7
Decompression ulnar nerve	3.7	4.9	3.7	2.9	7.0	4.4
Medial arthrotomy	4.5	3.5	3.0	3.6	2.3	3.4
Arthroscopy	6.0	1.4	2.2	2.2	0.8	2.5
Transposition ulnar nerve	0.0	1.4	1.5	2.2	3.1	1.6
Arthrodesis	0.0	0.0	1.5	0.0	0.0	0.3
Other	10.5	4.9	5.2	8.0	11.7	8.0

[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.

Surgical techniques

Surgical approach

FIGURE Trend (proportion [%] per year) in surgical approach for performing a primary elbow arthroplasty in the Netherlands in 2014-2020

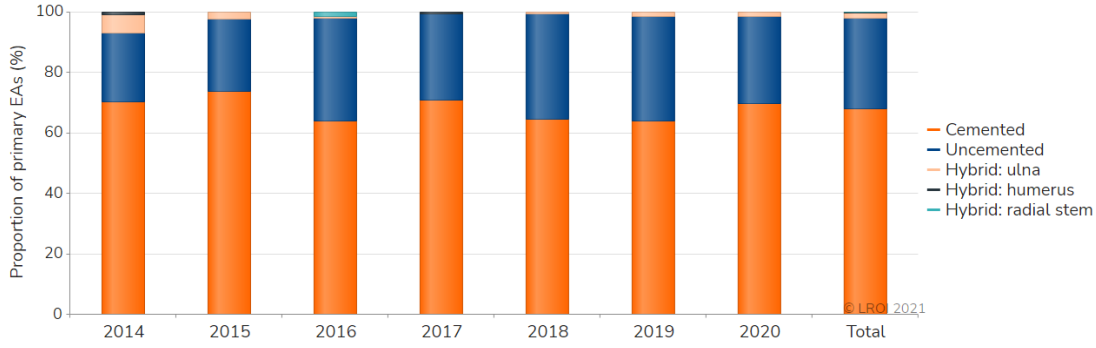


Surgical approach (%)	2014	2015	2016	2017	2018	2019	2020	Total
Posterior: triceps-on	5.88	9.09	22.96	32.39	37.04	37.23	44.53	**28.00**
Lateral: no loosening LCL	12.75	21.49	22.96	21.13	27.41	29.20	22.66	**22.89**
Posterior: triceps-flap	38.24	29.75	24.44	23.24	13.33	13.87	10.16	**21.22**
Lateral: loosening LCL	11.76	9.92	17.78	13.38	8.89	10.95	12.50	**12.22**
Posterior: unknown	27.45	22.31	4.44	2.11	0.74	0.73	0.00	**7.33**
Posterior: triceps-split	2.94	3.31	4.44	4.23	8.89	5.84	3.12	**4.78**
Osteotomy of olecranon	0.98	1.65	0.74	0.00	0.00	0.73	0.78	**0.67**
Other	0.00	2.48	2.22	3.52	3.70	1.46	6.25	**2.89**
Total (n):	**102**	**121**	**135**	**142**	**135**	**137**	**128**	**900**

EA: elbow arthroplasty.

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in primary elbow arthroplasties in the Netherlands in 2014-2020



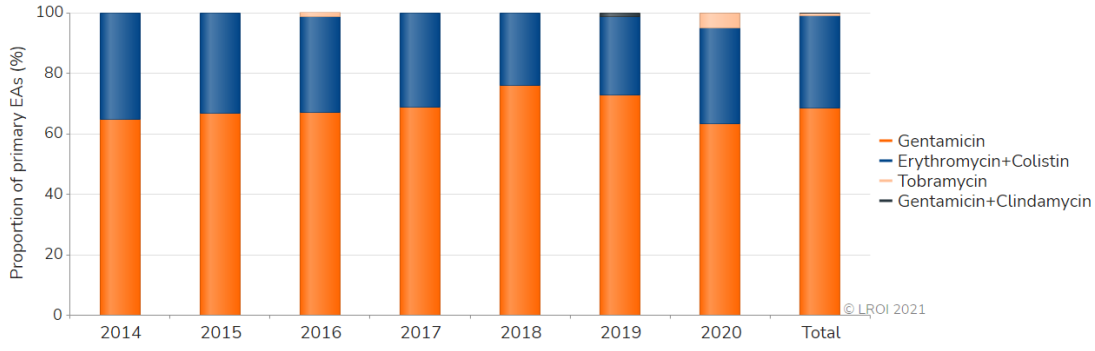
Fixation (%)	2014	2015	2016	2017	2018	2019	2020	Total
Cemented	70.30	73.77	63.91	70.92	64.44	63.77	69.77	**67.96**
Uncemented	22.77	23.77	33.83	28.37	34.81	34.78	28.68	**29.92**
Hybrid: ulna	5.94	2.46	0.75	0.00	0.74	1.45	1.55	**1.67**
Hybrid: humerus	0.99	0.00	0.00	0.71	0.00	0.00	0.00	**0.22**
Hybrid: radial stem	0.00	0.00	1.50	0.00	0.00	0.00	0.00	**0.22**
Total (n):	**101**	**122**	**133**	**141**	**135**	**138**	**129**	**899**

EA: elbow arthroplasty.

Bone cement

Antibiotics

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in primary elbow arthroplasties in the Netherlands in 2014-2020

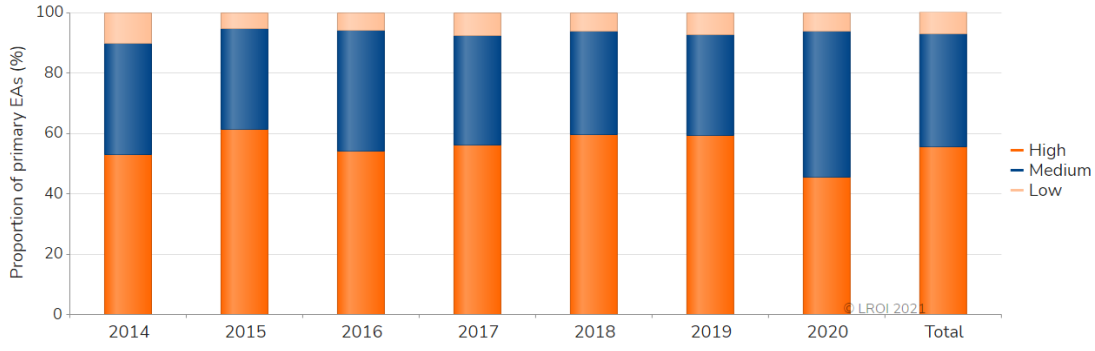


Bone cement antibiotics (%)	2014	2015	2016	2017	2018	2019	2020	Total
Gentamicin	64.71	66.67	67.06	68.75	75.95	72.84	63.29	**68.56**
Erythromycin+Colistin	35.29	33.33	31.76	31.25	24.05	25.93	31.65	**30.35**
Tobramycin	0.00	0.00	1.18	0.00	0.00	0.00	5.06	**0.91**
Gentamicin+Clindamycin	0.00	0.00	0.00	0.00	0.00	1.23	0.00	**0.18**
Total (n):	**68**	**75**	**85**	**80**	**79**	**81**	**79**	**547**

EA: elbow arthroplasty.

Viscosity

FIGURE Trend (proportion [%] per year) in bone cement viscosity in primary elbow arthroplasties in the Netherlands in 2014-2020

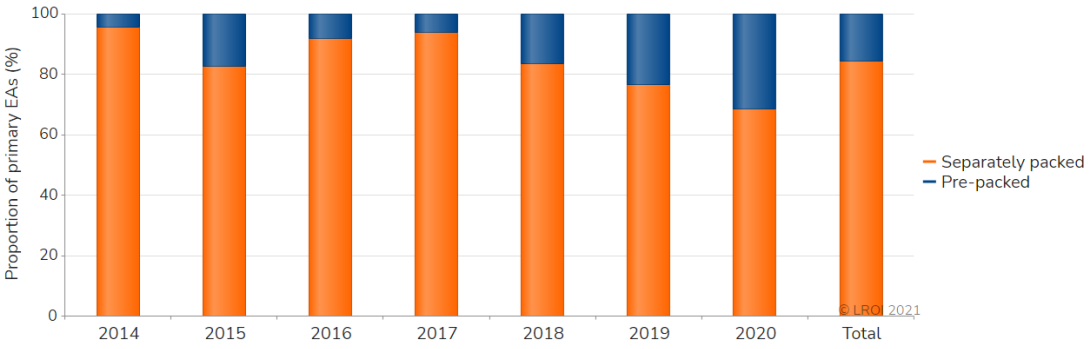


Bone cement viscosity (%)	2014	2015	2016	2017	2018	2019	2020	Total
High	52.94	61.33	54.12	56.25	59.49	59.26	45.57	**55.58**
Medium	36.76	33.33	40.00	36.25	34.18	33.33	48.10	**37.48**
Low	10.29	5.33	5.88	7.50	6.33	7.41	6.33	**6.95**
Total (n):	**68**	**75**	**85**	**80**	**79**	**81**	**79**	**547**

EA: elbow arthroplasty.

Vacuum mixing system

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 2014-2020



Vacuum mixing system (%)								
Separately packed	95.59	82.67	91.76	93.75	83.54	76.54	68.35	**84.46**
Pre-packed	4.41	17.33	8.24	6.25	16.46	23.46	31.65	**15.54**
Total (n):	**68**	**75**	**85**	**80**	**79**	**81**	**79**	**547**

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 2020

Total elbow arthroplasties[1] (n=58)			Radial head arthroplasties (n=36)		
Name	**Number (n)**	**Proportion (%)**	**Name**	**Number (n)**	**Proportion (%)**
Latitude EV	29	50.0	RHS	30	83.3
Coonrad/Morrey	12	20.7	Explor	2	5.6
Latitude	10	17.2	Anatomic Radial Head	1	2.8
Discovery	5	8.6	CRF	1	2.8
NES	2	3.5	Explor	1	2.8
			Evolve Radial Head	1	2.8

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

Types of bone cement

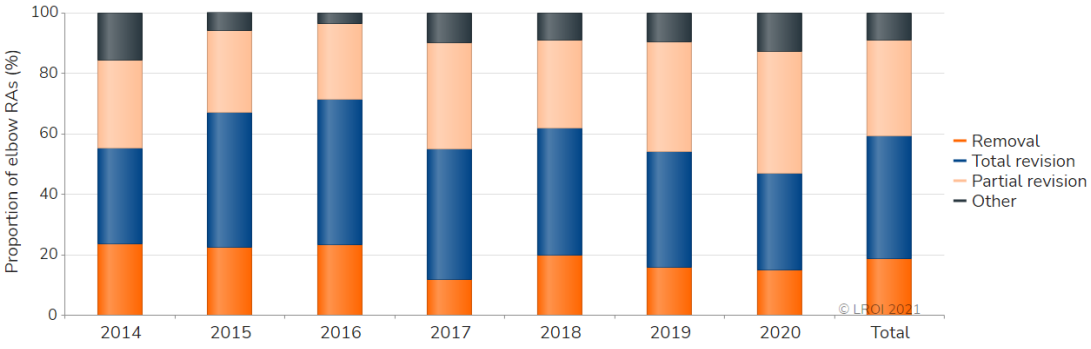
TABLE The registered types of bone cement used during primary elbow arthroplasties in the Netherlands in 2020 (n=80)

Name	Number (n)	Proportion (%)
Simplex ABC EC	25	31.3
Palacos R+G	18	22.5
Refobacin Bone Cement R	10	12.5
Palacos MV+G	9	11.3
Refobacin Plus Bone Cement	8	10.0

Elbow revision arthroplasty

Type of revision

FIGURE Trend (proportion [%] per year) in type of revision in elbow revision arthroplasties in the Netherlands in 2014-2020



Type of elbow revision (%)								
Removal	23.68	22.39	23.21	11.67	20.00	15.87	14.89	**18.65**
Total revision	31.58	44.78	48.21	43.33	41.82	38.10	31.91	**40.67**
Partial revision	28.95	26.87	25.00	35.00	29.09	36.51	40.43	**31.61**
Other	15.79	5.97	3.57	10.00	9.09	9.52	12.77	**9.07**
Total (n):	**38**	**67**	**56**	**60**	**55**	**63**	**47**	**386**

RA: revision arthroplasty.

Reasons for revision

TABLE Trend (proportion [%] per year) in reasons for revision in patients who underwent an elbow revision arthroplasty in the Netherlands in 2016-2020

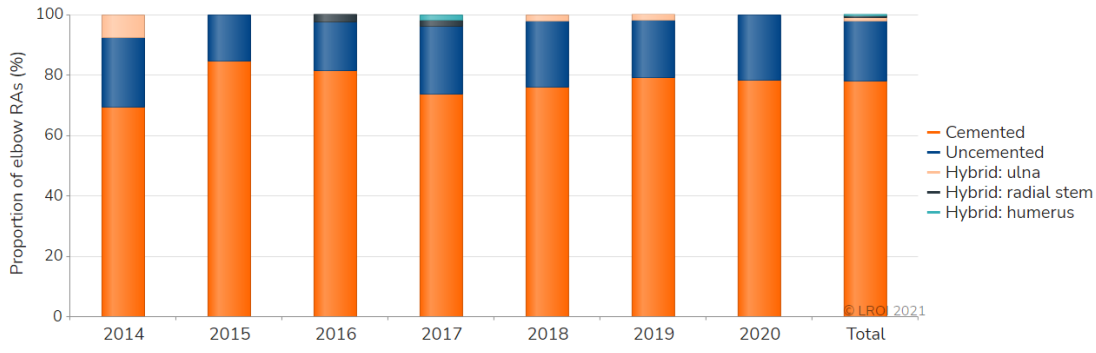
Year	2016	2017	2018	2019	2020	Total
Elbow revision arthroplasty (n)	56	60	55	61	44	276
Reasons for revision; Proportion[1] (%)						
Polyethylene wear	28.6	28.3	29.1	23.0	15.9	25.4
Instability	21.4	41.7	16.4	21.3	6.8	22.5
Metallosis	23.2	23.3	23.6	24.6	15.9	22.5
Loosening of ulnar component	16.1	18.3	18.2	18.0	27.3	19.2
Loosening of radial head component	21.4	18.3	21.8	16.4	15.9	18.8
Loosening of humeral component	16.1	15.0	16.4	13.1	34.1	18.1
Peri-prosthetic fracture	3.6	18.3	20.0	19.7	20.5	16.3
Infection	14.3	3.3	16.4	16.4	20.5	13.8
Other	12.5	25.0	10.9	14.8	13.6	15.6

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

Surgery and prosthesis

Fixation

FIGURE Trend (proportion [%] per year) in type of fixation in elbow revision arthroplasties in the Netherlands in 2014-2020

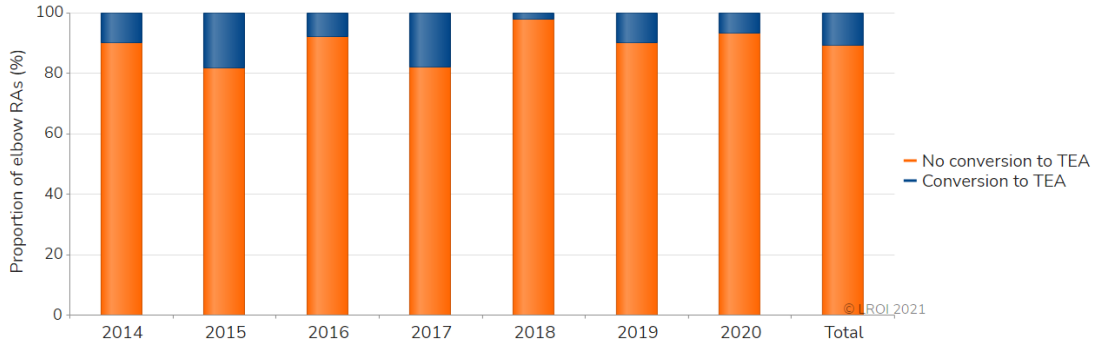


Fixation (%)	2014	2015	2016	2017	2018	2019	2020	Total
Cemented	69.23	84.62	81.40	73.58	76.09	79.25	78.38	**78.06**
Uncemented	23.08	15.38	16.28	22.64	21.74	18.87	21.62	**19.68**
Hybrid: ulna	7.69	0.00	0.00	0.00	2.17	1.89	0.00	**1.29**
Hybrid: radial stem	0.00	0.00	2.33	1.89	0.00	0.00	0.00	**0.65**
Hybrid: humerus	0.00	0.00	0.00	1.89	0.00	0.00	0.00	**0.32**
Total (n):	**26**	**52**	**43**	**53**	**46**	**53**	**37**	**310**

RA: revision arthroplasty.

Conversion to TEA

FIGURE Trend (proportion [%] per year) in conversion of a radial head arthroplasty to a total elbow arthroplasy in the Netherlands in 2014-2020

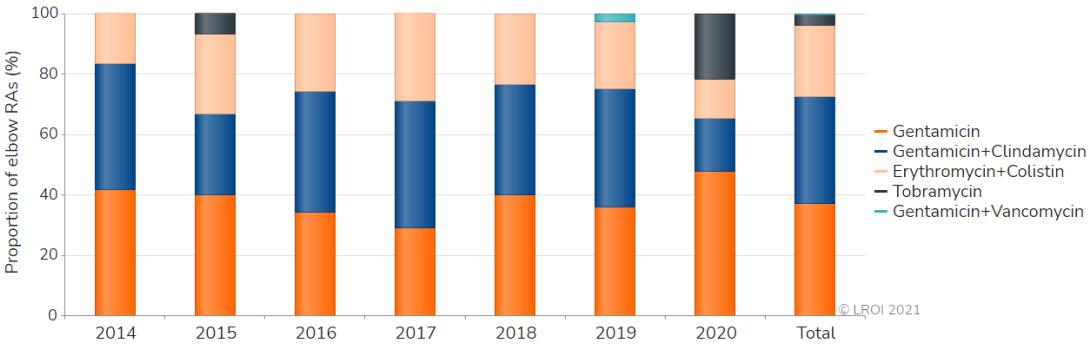


Conversion to TEA (%)	2014	2015	2016	2017	2018	2019	2020	Total
No conversion to TEA	90.00	81.82	92.00	82.14	97.96	90.00	93.18	**89.24**
Conversion to TEA	10.00	18.18	8.00	17.86	2.04	10.00	6.82	**10.76**
Total (n):	**30**	**55**	**50**	**56**	**49**	**60**	**44**	**344**

RA: revision arthroplasty; TEA: total elbow arthroplasty.

Bone cement antibiotics

FIGURE Trend (proportion [%] per year) in use of antibiotics in bone cement in elbow revision arthroplasties in the Netherlands in 2014-2020



Bone cement antibiotics (%)

Gentamicin	41.67	40.00	34.29	28.95	40.00	36.11	47.83	**37.25**
Gentamicin+Clindamycin	41.67	26.67	40.00	42.11	36.67	38.89	17.39	**35.29**
Erythromycin+Colistin	16.67	26.67	25.71	28.95	23.33	22.22	13.04	**23.53**
Tobramycin	0.00	6.67	0.00	0.00	0.00	0.00	21.74	**3.43**
Gentamicin+Vancomycin	0.00	0.00	0.00	0.00	0.00	2.78	0.00	**0.49**
Total (n):	**12**	**30**	**35**	**38**	**30**	**36**	**23**	**204**

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 2020

Humerus (n=15)	Number (n)	Proportion (%)
Latitude EV	8	53.3
Coonrad/Morrey	4	26.7
Discovery	2	13.3
Latitude	1	6.7

Ulna (n=18)	Number (n)	Proportion (%)
Latitude EV	13	72.2
Coonrad/Morrey	4	22.2
Discovery	1	5.6

Radial head (n=3)	Number (n)	Proportion (%)
RHS	3	100.0

Radial stem (n=1)	Number (n)	Proportion (%)
RHS	1	100.0

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 2020 (n=23)

Name	Number (n)	Proportion (%)
Palacos R+G	7	30.4
Simplex ABC Tobra	5	21.7
Refobacin Bone Cement R	3	13.0
Refobacin Revision	3	13.0
Simplex ABC EC	3	13.0
Copal G+C	1	4.4
Palacos MV+G	1	4.4

Survival

Revision within 5 years

By type of elbow arthroplasty

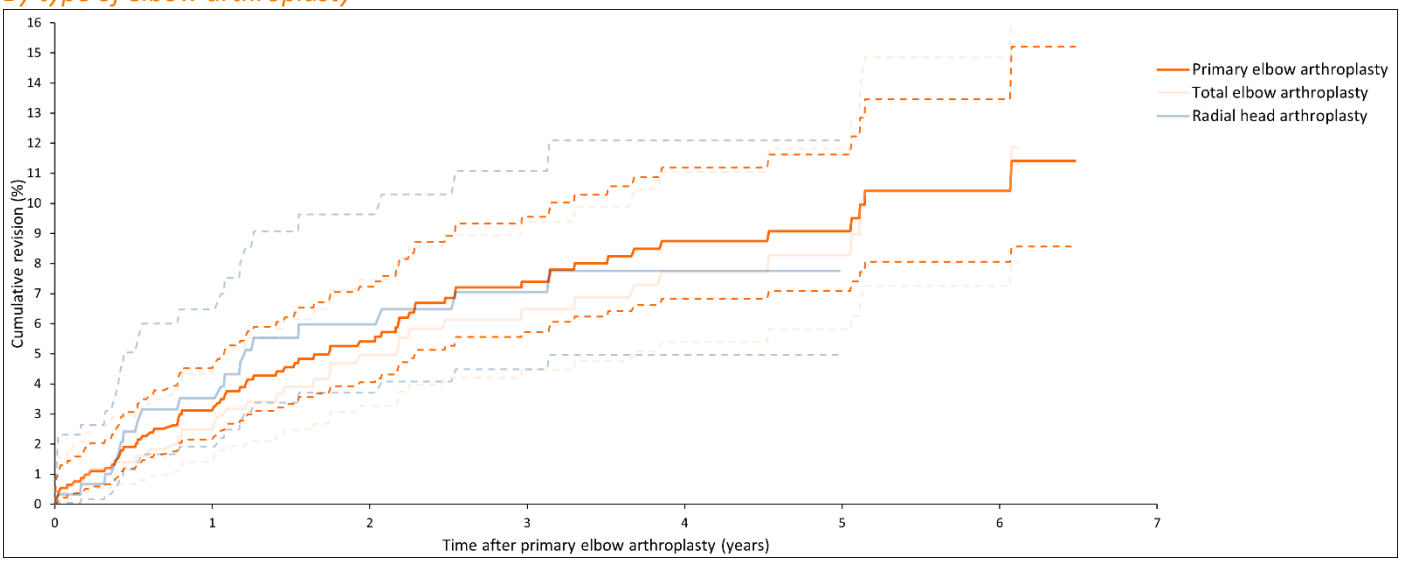


TABLE Cumulative revision percentages of primary elbow arthroplasties

	Number (n)	Number at risk (n)	Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Primary elbow arthroplasty	924			
1-year revision (%)		753	3.1 (2.1-4.5)	3.3 (2.1-4.4)
3-year revision (%)		450	7.4 (5.7-10.0)	7.6 (5.7-9.6)
5-year revision (%)		197	9.1 (7.1-11.6)	9.4 (7.1-11.8)
By type of elbow arthroplasty				
Total elbow arthroplasty	514			
1-year revision (%)		416	2.5 (1.4-4.3)	2.5 (1.1-3.9)
3-year revision (%)		251	6.5 (4.5-9.4)	6.7 (4.2-9.1)
5-year revision (%)		124	8.3 (5.8-11.8)	8.6 (5.5-11.7)
Radial head arthroplasty	308			
1-year revision (%)		249	3.5 (1.9-6.5)	3.8 (1.6-6.1)
3-year revision (%)		134	7.1 (4.5-11.1)	7.4 (4.2-10.6)
5-year revision (%)		58	7.8 (5.0-12.1)	8.1 (4.6-11.6)

[1] The cumulative revision percentage using the competing risk method is shown in the figure (>50 cases were at risk).
CI: confidence interval.

Wrist arthroplasty

Numbers

Registered procedures

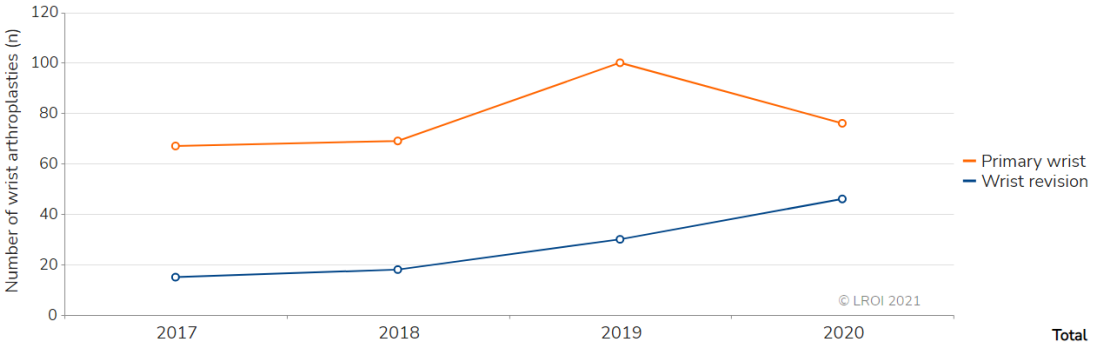
TABLE Number of registered wrist arthroplasties per year of surgery (2017-2020) in the LROI in April 2021

Year of surgery	Type of wrist arthroplasty: Total arthroplasty (n)	Ulnar head/ DRU arthroplasty (n)	Other (n)	Revision arthroplasty (n)	Total[1] (n)
2017	33	15	13	15	82
2018	36	22	7	18	87
2019	40	35	21	30	130
2020	31	29	13	46	122
Total	140	101	54	109	421

[1] In 5.4% (n=17) primary wrist arthroplasties the type of primary wrist prosthesis has not been registered.

Type of procedure

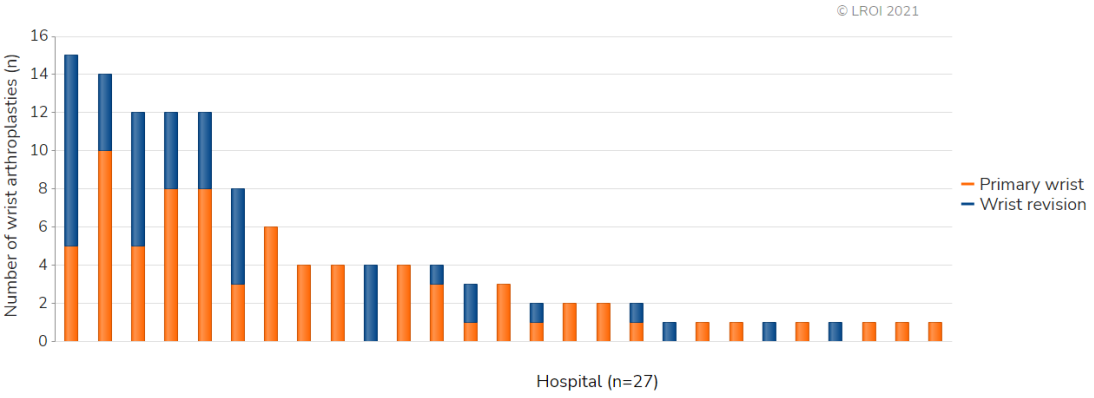
FIGURE Number of primary wrist arthroplasties and wrist revision arthroplasties registered in the LROI in the Netherlands in 2017-2020



Year	2017	2018	2019	2020	Total
Type of procedure (n)					
Primary wrist	67	69	100	76	**312**
Wrist revision	15	18	30	46	**109**
Total:	**82**	**87**	**130**	**122**	**421**

Type of procedure per hospital

FIGURE Number of primary wrist arthroplasties and wrist revision arthroplasties per hospital in the Netherlands in 2020 (n=122)



Please note: In 2020, 21 general hospitals, 3 UMCs and 2 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 2020

	Plastic surgeon (n=36)	Orthopaedic surgeon (n=40)	Total (n=76)
Mean age (years) (SD)	58.8 (14.2)	66.9 (12.0)	63.0 (13.7)
Age (years) (%)			
<50	22	5	13
50-59	22	18	20
60-69	31	35	33
70-79	22	30	26
≥80	33	12	8
Gender (%)			
Men	39	40	39
Women	61	60	61
ASA score (%)			
I	41	8	23
II	44	65	55
III-IV	15	27	22
Type of hospital (%)			
General	67	90	80
UMC	19	10	14
Private	14	0	7
Diagnosis (%)			
Osteoarthritis	71	50	60
Post-traumatic	18	18	18
Rheumatoid arthritis	3	15	9
Osteonecrosis	3	7	5
Inflammatory arthritis	0	5	3
Other	6	5	5
Mean Body Mass Index (kg/m²) (SD)	27.9 (5.7)	29.8 (6.6)	27.4 (4.5)
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	0	3	1
Normal weight (>18,5-25)	30	30	30
Overweight (>25-30)	49	47	48
Obesity (>30-40)	18	20	19
Morbid obesity (>40)	3	0	1
Smoking (%)			
No	91	88	89
Yes	9	12	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 2020 (n=69)

	Number[1] n (%)
Previous surgery to the relevant wrist (total)	23 (33.3)
ORIF of a distal radius fracture	4 (5.8)
Proximal row carpectomy	4 (5.8)
Intercarpal stabilisation/ligament reconstruction	3 (4.4)
Corrective osteotomy ulna	2 (2.9)
Partial arthrodesis	2 (2.9)
ORIF of a carpal fracture	2 (2.9)
Corrective osteotomy radius	1 (1.5)
Total arthrodesis	1 (1.5)
Sauvé-Kapandji procedure	0 (0)
Partial radial styloidectomy	0 (0)
Stabilisation of perilunate dislocation	0 (0)
Other	9 (13.0)

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, radial head and ulnar head components in primary wrist arthroplasties in the Netherlands in 2020

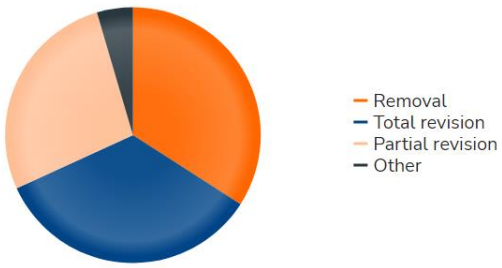
Carpal (n=20)		Radial stem (n=25)	
Name	**Number (n)**	**Name**	**Number (n)**
Freedom	11	Freedom	17
RCPI	4	Distal radioulnar joint	5
Remotion	3	Remotion	2
Amandys	1	Universal2	1
Motec	1		

Ulnar head (n=3)		Radial head (n=1)	
Name	**Number (n)**	**Name**	**Number (n)**
UHP prothese	2	Motec	1
Motec	1		

Wrist revision arthroplasty

Type of revision

FIGURE Type of revision arthroplasty of wrist revision arthroplasties in the Netherlands in 2020 (n=44)



Type of revision	Number (n)
Removal	15
Total revision	15
Partial revision	12
Other	2

Reasons for revision

TABLE Reasons for revision in patients who underwent a wrist revision arthroplasty in the Netherlands in 2020 (n=39)

Reasons for revision	Number[1] (n)
Lysis of components	10
Loosening of carpal component	9
Instability	9
Loosening of radial component	7
Dislocation	7
Infection	3
Implant fracture	3
Loosening of ulnar component	1
Peri-prosthetic fracture	0
Other	13

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

Finger arthroplasty

Numbers

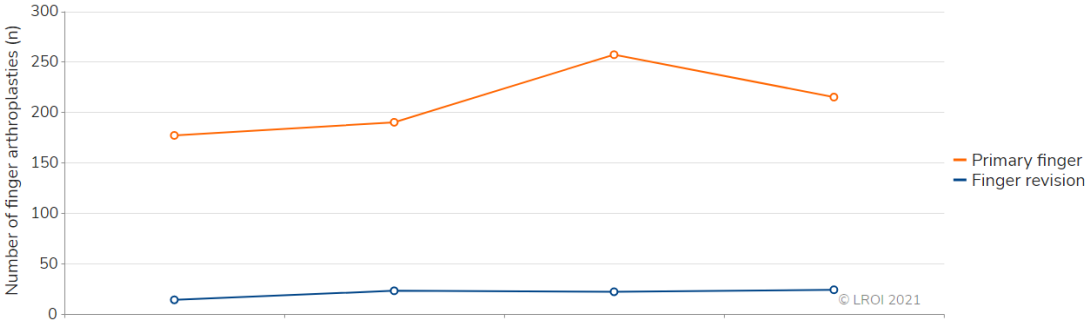
Registered procedures

TABLE Number of registered finger arthroplasties per year of surgery (2017-2020) in the LROI in April 2021

Year of surgery	Type of finger arthroplasty		Total (n)
	Total arthroplasty (n)	Revision arthroplasty (n)	
2017	177	14	191
2018	190	23	213
2019	257	22	279
2020	215	24	239
Total	839	83	922

Type of procedure

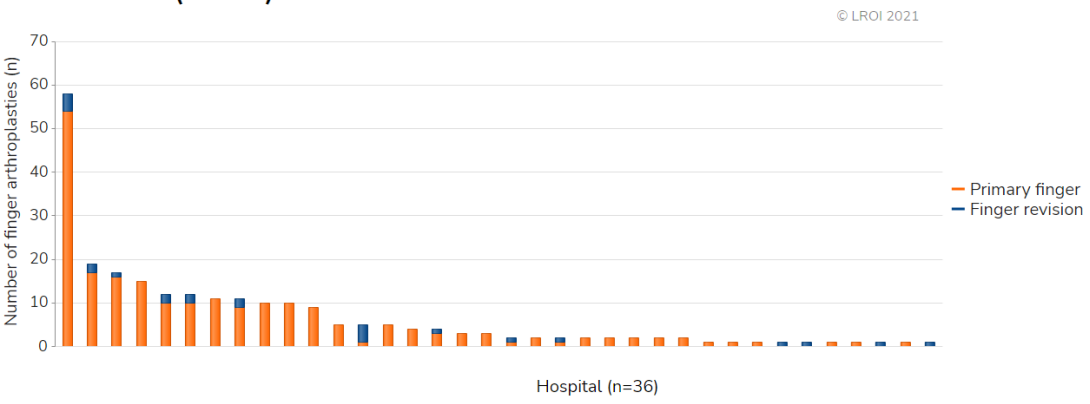
FIGURE Number of primary finger arthroplasties and finger revision arthroplasties registered in the LROI in the Netherlands in 2017-2020



Year	2017	2018	2019	2020	Total
Type of procedure (n)					
Primary finger	177	190	257	215	**839**
Finger revision	14	23	22	24	**83**
Total:	**191**	**213**	**279**	**239**	**922**

Type of procedure per hospital

FIGURE Number of primary finger arthroplasties and finger revision arthroplasties per hospital in the Netherlands in 2020 (n=239)



Please note: In 2020, 29 general hospitals, 3 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 2020 (n=215)

	Type of finger					
Finger joint	Thumb (n)	Index (n)	Middle (n)	Ring (n)	Small (n)	Total[1] (n)
CMC	57	n.a.	n.a.	n.a.	n.a.	57
MCP	2	11	19	6	4	5
PIP	n.a.	19	37	36	16	42
DIP	0	0	2	2	1	108
Total (n)	59	30	58	44	21	215

[1] In 3 (1.4%) 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 finger arthroplasty in the Netherlands in 2020

	Plastic surgeon (n=170)	Orthopaedic surgeon (n=45)	Total (n=215)
Mean age (years) (SD)	64.9 (8.8)	62.6 (8.9)	64.4 (8.9)
Age (years) (%)			
<50	4	4	4
50-59	11	33	25
60-69	48	38	46
70-79	22	25	21
≥80	5	0	4
Gender (%)			
Men	32	42	34
Women	68	58	66
ASA score (%)			
I	21	2	17
II	62	73	64
III-IV	17	25	19
Type of hospital (%)			
General	86	98	89
UMC	0	2	0
Private	14	0	11
Diagnosis (%)			
Osteoarthritis	87	69	83
Rheumatoid arthritis	7	20	10
Post-traumatic	5	2	5
Inflammatory arthritis	0	4	1
Osteonecrosis	0	0	0
Other	1	5	1
Mean Body Mass Index (kg/m²) (SD)	26.6 (4.3)	26.7 (4.4)	27.4 (5.1)
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	0	0	0
Normal weight (>18,5-25)	37	41	38
Overweight (>25-30)	40	32	39
Obesity (>30-40)	23	27	23
Morbid obesity (>40)	0	0	0
Smoking (%)			
No	87	91	88
Yes	13	9	12

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 finger arthroplasty in the Netherlands in 2020 (n=205)

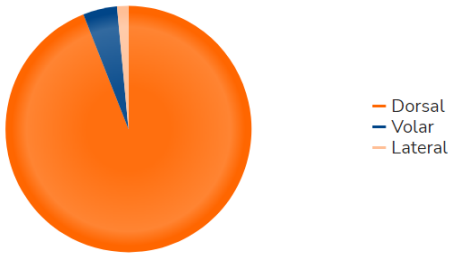
	Number[1] (n)
Previous surgery to the relevant finger (total)	9
Arthrodesis	2
Interposition arthroplasty	2
Interposition spacer	5
Ligament reconstruction	2
Correction osteotomy	0
Other	2

[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

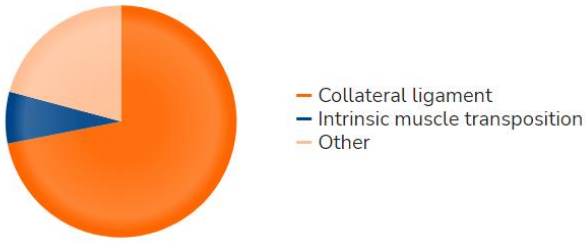
FIGURE Surgical approach for performing a primary finger arthroplasty in the Netherlands in 2020 (n=201)



Surgical approach	Number (n)	Proportion (%)
Dorsal	189	94.03%
Volar	9	4.48%
Lateral	3	1.49%

Soft tissue stabilisation

FIGURE Type of stabilisation in primary finger arthroplasty in the Netherlands in 2020 (n=139)

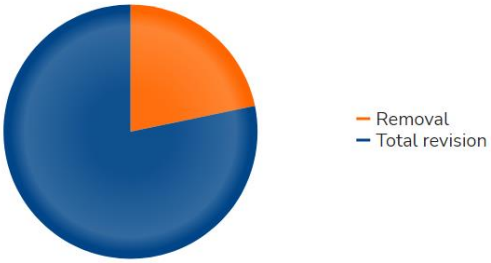


Stabilisation	Number (n)	Proportion (%)
Collateral ligament	100	71.94%
Intrinsic muscle transposition	10	7.19%
Other	29	20.86%

Finger revision arthroplasty

Type of revision

FIGURE Type of revision arthroplasty of finger revision arthroplasties in the Netherlands in 2020 (n=23)



Type of revision	Number (n)
Removal	5
Total revision	18

Reasons for revision

TABLE Reasons for revision in patients who underwent a finger revision arthroplasty in the Netherlands in 2020 (n=18)

Reasons for revision	Number[1] (n)
Implant fracture	7
Instability	5
Bone resorption of distal component	1
Bone resorption of proximal component	1
Loosening of distal component	1
Loosening of proximal component	1
Infection	1
Peri-prosthetic fracture	0
Other	5

[1] One patient may have more than one reason for revision.

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 2020

	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	94		252 [1-789]	99
Primary hip hemiarthroplasties (orthopaedic surgeon)	71		45 [1-274]	97
Primary hip hemiarthroplasties (trauma surgeon)	43		33 [1-190]	68
Hip revision arthroplasties	84		31 [1-281]	98
Knee arthroplasties		100		
Primary knee arthroplasties	94		244 [1-706]	99
Knee revision arthroplasties	88		20 [3-350]	98
Ankle arthroplasties				
Primary ankle arthroplasties	12	Unknown	6 [1-35]	95
Ankle revision arthroplasties	7		2 [1-7]	95
Shoulder arthroplasties		100		
Primary shoulder arthroplasties (orthopaedic surgeon)	84		28 [1-177]	96
Primary shoulder arthroplasties (trauma surgeon)	8		2 [1-9]	32
Shoulder revision arthroplasties	59		3 [1-77]	93
Elbow arthroplasties		Unknown		
Primary elbow arthroplasties	34		3 [1-28]	92
Elbow revision arthroplasties	16		2 [1-14]	91
Wrist arthroplasties		Unknown		
Primary wrist arthroplasties (orthopaedic surgeon)	12		3 [1-10]	70
Primary wrist arthroplasties (plastic surgeon)	13		2 [1-7]	56
Wrist revision arthroplasties (orthopaedic surgeon)	9		4 [1-10]	100
Wrist revision arthroplasties (plastic surgeon)	6		1 [1-4]	86
Finger arthroplasties		Unknown		
Primary finger arthroplasties (orthopaedic surgeon)	13		2 [1-10]	65
Primary finger arthroplasties (plastic surgeon)	25		4 [1-54]	82
Finger revision arthroplasties (orthopaedic surgeon)	8		1 [1-2]	41
Finger revision arthroplasties (plastic surgeon)	6		2 [1-4]	67

[1] Number of hospitals that performed arthroplasties in accordance with their hospital information system in 2020.
[2] Proportion of total number of hospitals that performed arthroplasties in 2020 (based on Vektis data).
[3] Completeness of number of registered arthroplasties in the LROI in October 2020, compared to the total number of arthroplasties performed (based on the hospital information system) in 2020. 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 2020

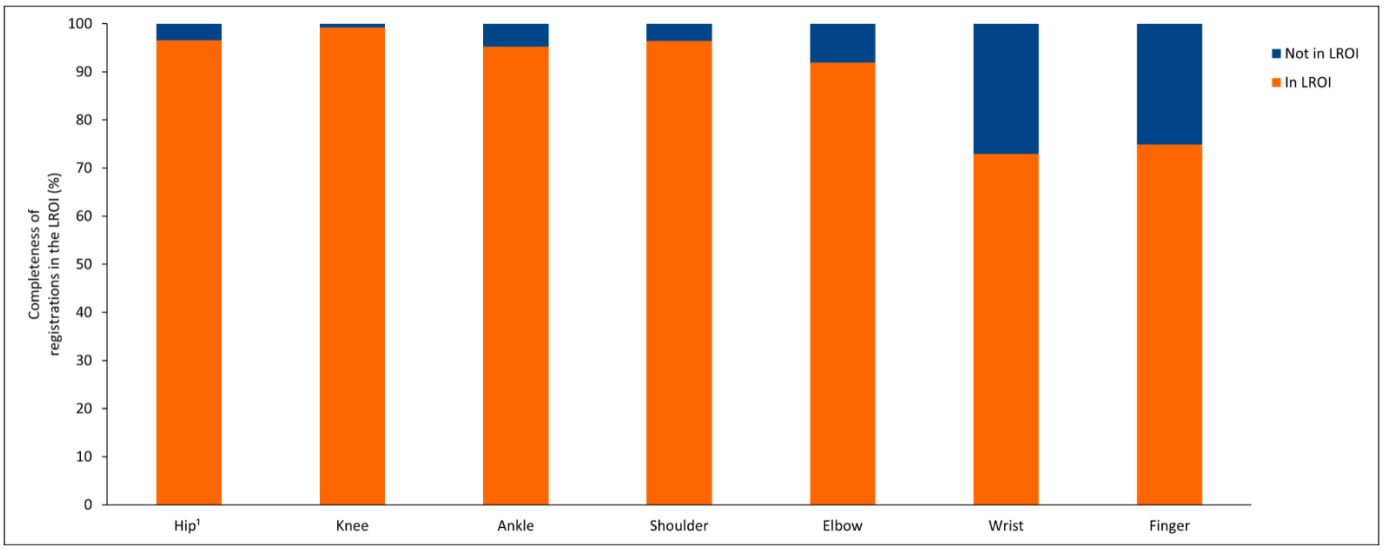


TABLE Completeness (proportion [%] per joint)

	Hip¹	Knee	Ankle	Shoulder	Elbow	Wrist	Finger
Number of procedures in HIS (n)	37,005	26,678	147	3,138	197	129	215
Completeness of registrations in the LROI² (%)	96.5	99.2	95.2	96.4	91.9	72.9	74.9

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 2020. This pertains only to hospital that submitted data for comparison.

Completeness per year

TABLE Completeness (proportion [%] per joint) of the registration of procedures in the LROI in 2013-2020

	2013	2014	2015	2016	2017	2018	2019	2020
Hip arthroplasties								
Primary total hip arthroplasties	97	96	98	99	99	99	99	99
Primary hip hemiarthroplasties (orthopaedic surgeon)	71	84	88	95	96	96	94	97
Primary hip hemiarthroplasties (trauma surgeon)	n.a.	n.a.	n.a.	50	64	65	63	68
Hip revision arthroplasties	88	93	97	97	98	97	97	98
Knee arthroplasties								
Primary knee arthroplasties	95	96	98	99	100	99	99	99
Knee revision arthroplasties	90	93	98	98	98	97	97	98
Ankle arthroplasties								
Primary ankle arthroplasties	n.a.	80	91	92	100	98	98	95
Ankle revision arthroplasties	n.a.	55	67	94	87	83	55	95
Shoulder arthroplasties								
Primary shoulder arthroplasties (orthopaedic surgeon)	n.a.	78	94	94	98	91	96	96
Primary shoulder arthroplasties (trauma surgeon)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	32
Shoulder revision arthroplasties	n.a.	74	90	92	90	78	91	93
Elbow arthroplasties								
Primary elbow arthroplasties	n.a.	70	85	88	91	89	85	92
Elbow revision arthroplasties	n.a.	55	86	93	87	85	83	91
Wrist arthroplasties								
Primary wrist arthroplasties (orthopaedic surgeon)	n.a.	n.a.	n.a.	n.a.	71	29	55	70
Primary wrist arthroplasties (plastic surgeon)	n.a.	n.a.	n.a.	n.a.	64	62	50	56
Wrist revision arthroplasties (orthopaedic surgeon)	n.a.	n.a.	n.a.	n.a.	18	83	77	100
Wrist revision arthroplasties (plastic surgeon)	n.a.	n.a.	n.a.	n.a.	25	50	50	86
Finger arthroplasties								
Primary finger arthroplasties (orthopaedic surgeon)	n.a.	n.a.	n.a.	n.a.	53	63	66	65
Primary finger arthroplasties (plastic surgeon)	n.a.	n.a.	n.a.	n.a.	67	68	60	82
Finger revision arthroplasties (orthopaedic surgeon)	n.a.	n.a.	n.a.	n.a.	17	100	90	41
Finger revision arthroplasties (plastic surgeon)	n.a.	n.a.	n.a.	n.a.	24	40	57	67

Completeness: Number of registered arthroplasies in the LROI compared to the total number of arthroplasties performed based on the hospital information system (HIS). This pertains only to hospitals that submitted data for comparison.
Please note: Ankle, shoulder and elbow arthroplasties were registered since 2014; wrist and finger arthroplasties were registered since 2016.

The completeness of number of registered arthroplasties in the LROI is determined every year in October. Improving data completeness and data quality by registering missing data is an ongoing process.

Validity

Overall validity

FIGURE Validity (proportion [%] per joint) of the registration of procedures in the LROI in 2020

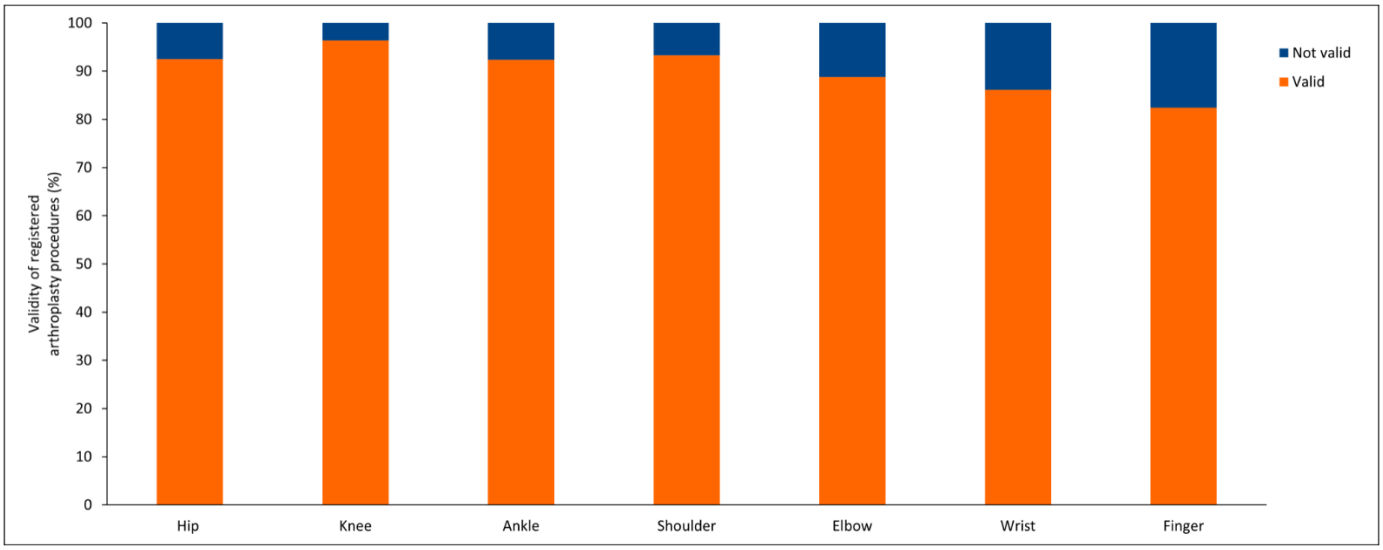


TABLE Validity (proportion [%] per joint)

	Hip	Knee	Ankle	Shoulder	Elbow	Wrist	Finger
Number of procedures (n)	36,817	26,811	145	3,089	179	122	239
Valid registered procedures (%)	92.5	96.4	92.4	93.3	88.8	86.1	82.4

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 2020

	Hip	Knee	Ankle	Shoulder	Elbow	Wrist	Finger
Number of arthroplasties (n)	**36,817**	**26,811**	**145**	**3,089**	**179**	**122**	**239**
Number of primary arthroplasties (n)	33,456	24,359	121	2,783	132	76	215
Number of revision arthroplasties (n)	3,361	2,452	24	306	47	46	24
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	99.9	99.4	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	99.3	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	99.8	99.8	100.0	99.8	98.9	98.4	94.6
BMI	95.4	98.2	97.2	96.3	97.8	95.9	89.1
Smoking	99.1	99.9	98.6	99.0	97.2	96.7	94.6
ASA score	99.8	99.9	100.0	99.6	98.9	96.7	96.7
Fixation	99.5	99.9	99.3	99.3	97.2	88.5	94.1
Primary arthroplasty characteristics	%	%	%	%	%	%	%
Diagnosis	99.1	99.7	99.2	99.6	97.7	97.4	97.2
Charnley/Walch score	97.4	99.2	98.4	98.2	n.a.	n.a.	n.a.
Prosthesis	99.9	100.0	99.2	99.6	98.5	96.1	98.7
Surgical approach	99.7	99.7	97.5	99.1	97.0	94.7	96.7
Revision arthroplasty characteristics	%	%	%	%	%	%	%
Type of revision	99.2	99.3	100.0	98.7	100.0	95.7	95.8
Charnley score	96.0	97.9	n.a.	n.a.	n.a.	n.a.	n.a.
Reason for revision	98.5	98.4	95.8	98.7	93.6	95.7	79.2

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.

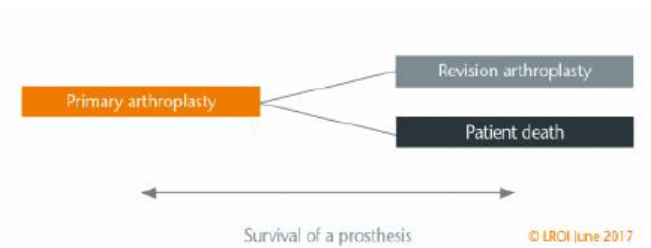
Kaplan Meier survival analysis

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 W(P) F(P)
Amphia Ziekenhuis H(O) K S E W(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
Centraal Militair Hospitaal H(O)
Deventer Ziekenhuizen H(O+T) K S E F
Diakonessenhuis H(O) K S
Dijklander Ziekenhuis H(O) K S E
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 E 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
HagaZiekenhuis H(O+T) K A S E W(P) 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 W(P) F(P)
Jeroen Bosch Ziekenhuis H(O+T) K S W(P) F(P)
LangeLand Ziekenhuis H(O+T) K S F(P)
Laurentius Ziekenhuis H(O) K S E W(O) F(O)
Maasstad Ziekenhuis H(O+T) K S E
Martini Ziekenhuis H(O) K A S E W(P) F(P)
Máxima Medisch Centrum H(O+T) K S W(O)
Meander Medisch Centrum H(O+T) K S W(P) F(P)
Medisch Centrum Leeuwarden H(O+T) K S F(P)
Medisch Spectrum Twente H(O) K S
Noordwest Ziekenhuisgroep H(O+T) K A S E W(O) F(O+P)
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 F(O)
Reinier de Graaf Gasthuis H(O+T) K S E F(O)
Reinier Haga Orthopedisch Centrum H(O) K A S W(O) F(O)
Rijnstate H(O+T) K S E W(O+P) F(P)
Rivas Zorggroep H(O) K
Rode Kruis Ziekenhuis H(O+T) K A S E
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 F(P)
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 E
Tergooi H(O+T) K S E W(O) F(O)
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
ZGT H(T)
Ziekenhuis Amstelland H(O) K S E
Ziekenhuis Gelderse Vallei H(O+T) K S
Ziekenhuis Nij Smellinghe H(O) K S W(P) F(P)
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 F(O)
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 F(O)
Leids Universitair Medisch Centrum H(O) K S E F(O)
Maastricht UMC+ H(O+T) K A S E W(O+P) F(O)
Radboudumc H(O+T) K S E
Universitair Medisch Centrum Groningen H(O) 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; F: finger.
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 W(P) F(P)
CortoClinics H(O) K
Eisenhower Kliniek H(O) K S
FlexClinics H(O) K
Kliniek ViaSana H(O) K S
KneeClinic K
Medische Kliniek Velsen H(O) K S
OrthoDirect K S
Orthoparc Kliniek H(O) K
Park Medisch Centrum H(O) K
The Hand Clinic W(P) F(P)
Xpert Clinics H(O) K A S F(O+P)

H: hip; K: knee; A: ankle; S: shoulder; W: wrist; 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