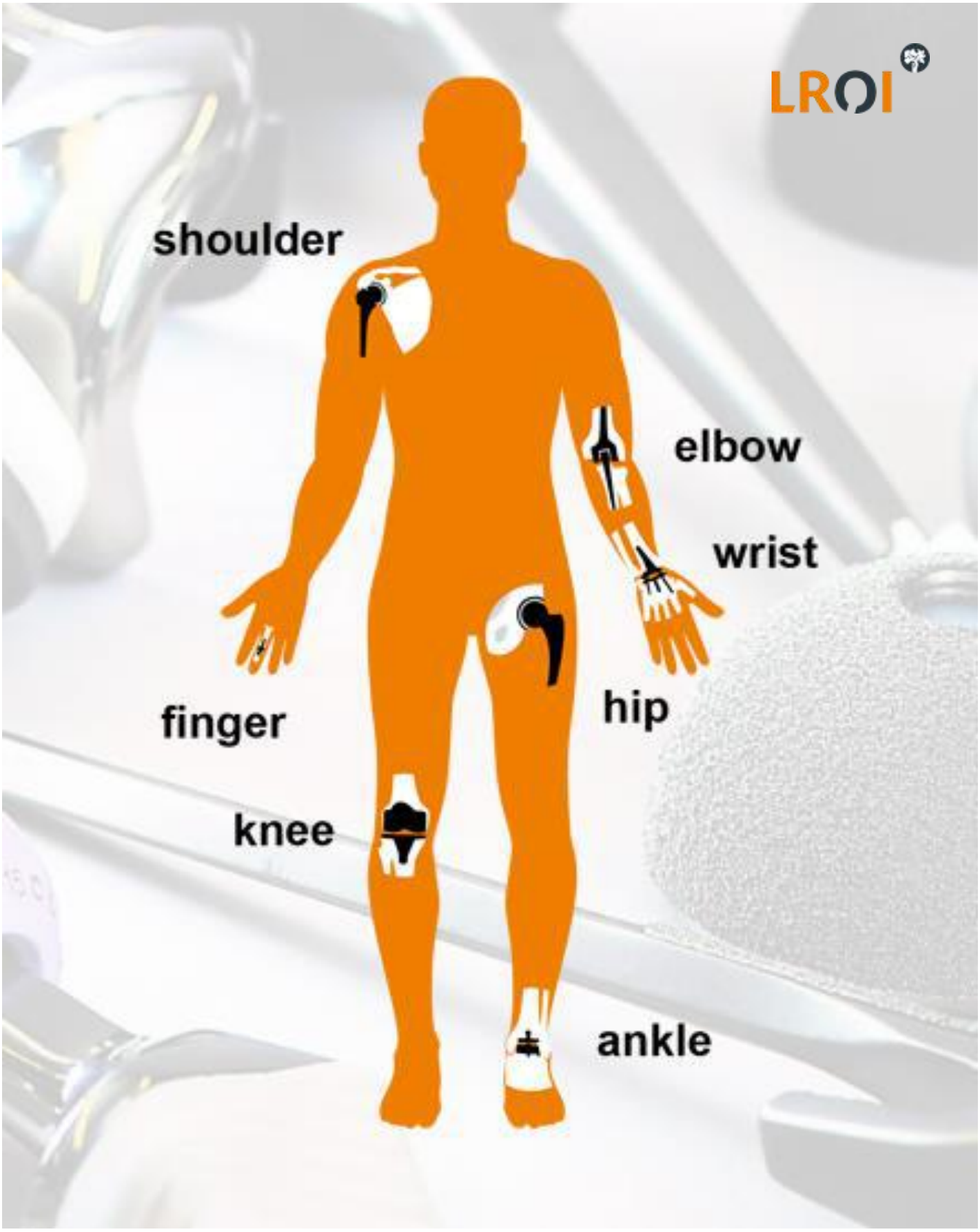

Online LROI annual report 2019 - PDF

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Introduction

This online annual report 2019 of the Dutch Arthroplasty Register (LROI) contains information on orthopaedic prosthesis procedures in the Netherlands in 2018. This concerns primary hip, knee, ankle, shoulder, elbow, wrist and finger arthroplasties and revision procedures, performed by orthopaedic surgeons, trauma surgeons and plastic surgeons. In this annual report, the focus is on trends of prosthesis characteristics, surgical techniques and patient characteristics of patients who underwent an arthroplasty procedure. Furthermore, 10 year survival of hip and knee arthroplasties in the Netherlands is shown for the first time.

You will find data on:
- Prosthesis characteristics
- Surgical techniques
- Survival of prostheses
- Patient characteristics of patients who underwent an arthroplasty procedure
- Patients' experiences in the form of PROMs (Patient Reported Outcome Measures)
- Information on the data quality, like completeness and validity of the register

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Contents

Hip arthroplasty

Numbers

Registered procedures 2007-2018

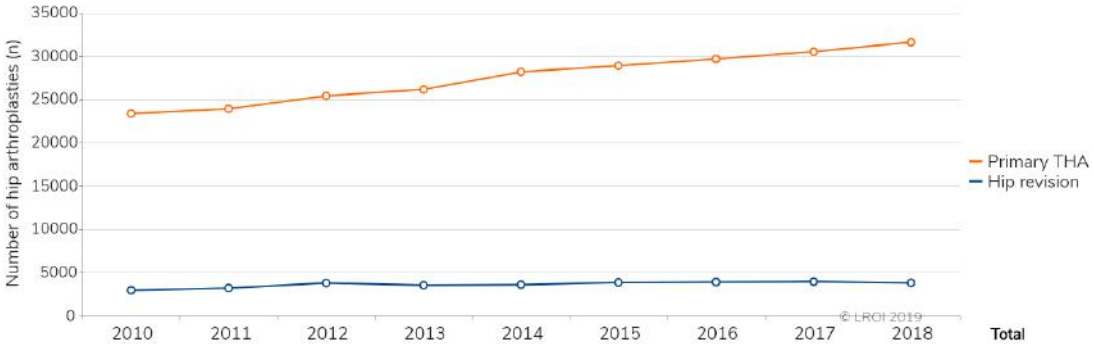
TABLE NUMBER OF REGISTERED HIP ARTHROPLASTIES PER YEAR OF SURGERY (2007-2018) IN THE LROI IN APRIL 2019.

Year of surgery	Type of hip arthroplasty						Total (n)
	Total arthroplasty (n)	Hemi-arthroplasty (n)	Resurfacing arthroplasty (n)	Other (n)	Unknown/ missing (n)	Revision arthroplasty (n)	
2007	8,667	938	451	379	910	1,269	12,614
2008	15,152	1,365	734	410	442	1,857	19,960
2009	21,505	2,047	865	629	372	2,681	28,099
2010	23,340	2,344	609	644	302	2,951	30,190
2011	23,902	2,395	227	665	268	3,199	30,656
2012	25,405	2,791	10	606	254	3,770	32,836
2013	26,129	3,018	1	166	289	3,516	33,119
2014	28,182	3,735	0	29	164	3,581	35,691
2015	28,889	4,920	15	21	77	3,833	37,755
2016	29,672	5,324	16	28	105	3,883	39,028
2017	30,515	5,707	3	29	52	3,919	40,225
2018	31,599	5,398	1	26	36	3,788	40,848
Total	292,957	39,982	2,932	3,632	3,271	38,247	381,021

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

Type of procedures 2010-2018

FIGURE NUMBER OF PRIMARY TOTAL HIP ARTHROPLASTIES AND HIP REVISION ARTHROPLASTIES REGISTERED IN THE LROI IN THE NETHERLANDS IN 2010-2018.



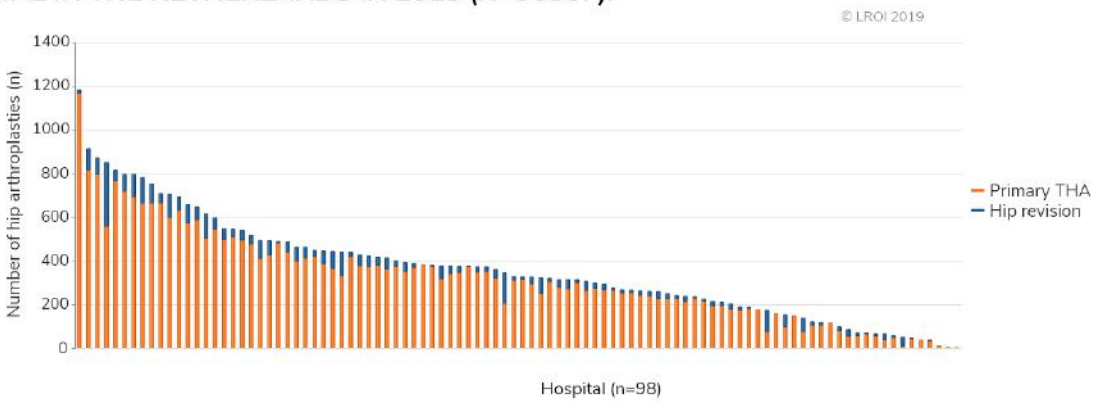
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Type of procedure (n)										
Primary THA	23,340	23,902	25,405	26,129	28,182	28,889	29,672	30,515	31,599	**247,633**
Hip revision	2,951	3,199	3,770	3,516	3,581	3,833	3,883	3,919	3,788	**32,440**
Total:	**26,291**	**27,101**	**29,175**	**29,645**	**31,763**	**32,722**	**33,555**	**34,434**	**35,387**	280,073

THA: total hip arthroplasty.

Out of 31,599 primary total hip arthroplasties that were performed in 2018, 3.0% (n=938) was performed bilaterally.

Type of procedure per hospital

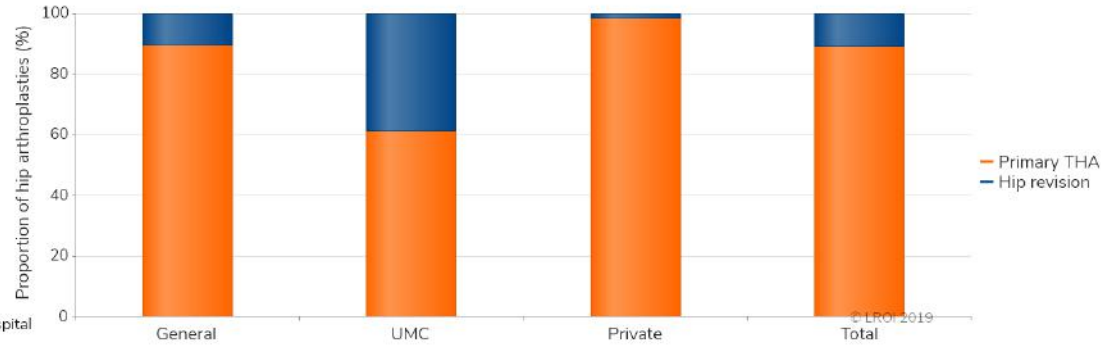
FIGURE NUMBER OF PRIMARY TOTAL HIP ARTHROPLASTIES AND HIP REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=35387).



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 2018.



Type of procedure (%)	General	UMC	Private	Total
Primary THA	89.61	61.25	98.30	**89.34**
Hip revision	10.39	38.75	1.70	**10.66**
Total (n):	**30,193**	**1,342**	**3,293**	**34,828**

Please note: In 2018, 75 general hospitals, 9 UMCs and 14 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 2018.

N	Osteoarthritis 27,573 (87.3%)	Fracture 1,471 (4.7%)	Osteonecrosis 840 (2.7%)	Late post-traumatic 675 (2.1%)	Dysplasia 490 (1.6%)	Reumatoid arthritis 172 (0.5%)	Post-Perthes' disease 90 (0.3%)	Tumour 75 (0.2%)	Total 31,599
Completeness (%)									99
Mean age (years) (SD)	69.8 (9.9)	69.9 (87.8)	62.5 (15.1)	67.3 (12.8)	54.1 (13.6)	64.7 (12.1)	47.4 (15.4)	61.9 (14.3)	69.1 (10.6)
Age (years) (%)									
<50	3	2	19	9	36	11	51	10	5
50-59	12	10	20	14	29	17	23	27	12
60-69	30	34	25	32	20	35	19	31	30
70-79	39	42	23	28	12	32	6	23	38
≥80	16	12	13	17	3	5	1	9	15
Gender (%)									
Men	35	31	49	40	26	29	63	43	35
Women	65	69	51	60	74	71	37	57	65
ASA score (%)									
I	16	11	12	16	34	2	27	5	16
II	64	59	52	55	56	71	52	31	63
III-IV	20	30	36	29	10	27	11	64	21
Type of hospital (%)									
General	87	75	86	89	75	91	76	79	87
UMC	2	10	8	9	10	6	14	21	3
Private	11	15	6	2	15	3	10	0	10
Charnley-score (%)									
A One hip joint affected	42	66	63	75	48	35	73	76	44
B1 Both hip joints affected	31	12	16	11	30	28	12	8	30
B2 Contralateral hip joint with a total hip prosthesis	24	17	17	10	19	17	14	0	23
C Multiple joints affected or chronic disease that affects quality of life	3	5	4	4	3	20	1	16	3
Body Mass Index (kg/m²) (%)									
Underweight (≤18,5)	1	4	2	5	3	2	1	7	1
Normal weight (>18,5-25)	32	54	40	45	44	38	36	42	34
Overweight (>25-30)	42	32	37	39	32	40	30	38	42
Obesity (>30-40)	24	9	20	11	21	18	32	11	22
Morbid obesity (>40)	1	1	1	0	0	2	1	2	1
Smoking (%)									
No	91	86	76	84	85	87	82	84	90
Yes	9	14	24	16	15	13	18	16	10

Please note: In 2018, 188 (0.6%) patients received a primary THA after a diagnosis that is not listed in the table. Of 25 (0.1%) primary THAs the diagnosis was not registered.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary THAs are included.
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation; THA: total hip arthroplasty.

Age category 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN AGE CATEGORY IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Age category (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
<50	4.49	4.49	4.62	4.69	4.76	4.73	4.46	4.48	4.35	**4.56**
50-59	11.99	12.49	12.29	12.77	12.34	12.40	12.59	11.99	12.14	**12.33**
60-69	31.16	31.90	32.15	32.28	32.35	32.76	32.81	31.18	30.25	**31.86**
70-79	37.17	36.22	35.72	35.10	35.63	35.05	35.40	37.49	37.99	**36.22**
>80	15.19	14.90	15.21	15.16	14.91	15.06	14.74	14.85	15.27	**15.03**
Total (n):	**23,299**	**23,851**	**25,344**	**26,079**	**28,150**	**28,872**	**29,651**	**30,509**	**31,594**	**247,349**

THA: total hip arthroplasty.

Previous surgery 2014-2018

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 2014-2018.

Year	**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
Primary THA (n)	27,117	27,997	29,578	30,169	31,154	146,015
Previous surgery to the relevant hip (total) Proportion[1] (%)	5.0	5.0	4.9	4.8	4.5	4.8
Osteosynthesis	3.6	3.8	3.6	3.5	3.3	3.6
Osteotomy	0.9	0.9	0.9	0.9	0.9	0.9
Girdlestone situation	0.1	0.1	0.1	0.1	0.1	0.1
Arthrodesis	0.1	0.1	0.1	0.0	0.1	0.1
Other	1.3	1.3	1.2	1.1	1.0	1.2

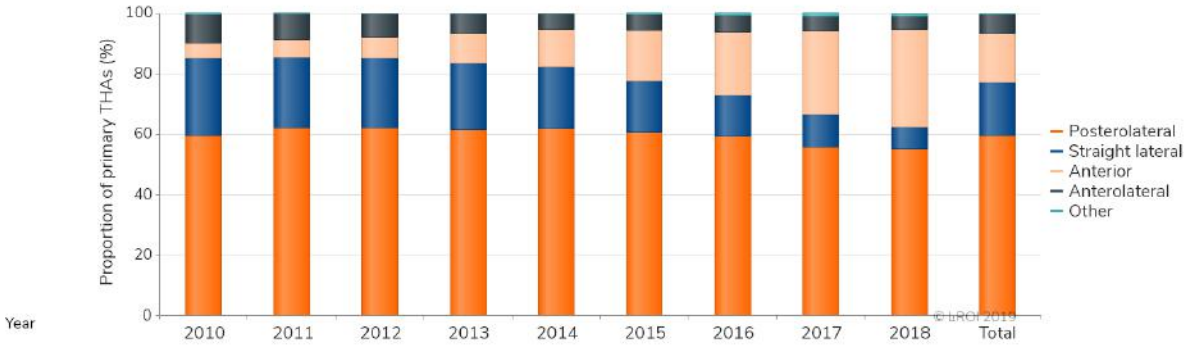
[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patients with one or more previous surgeries to the same joint.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on previous surgeries in case of a bilateral arthroplasty were excluded. As of this annual report, all primary THAs are included.
THA: total hip arthroplasty.

Surgery and prosthesis

Surgical techniques

Surgical approach 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY TOTAL HIP ARTHROPLASTY IN THE NETHERLANDS IN 2010-2018.



Surgical approach (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Posterolateral	59.60	62.24	62.09	61.64	62.00	60.66	59.27	55.72	55.12	**59.63**
Straight lateral	25.66	23.30	23.08	21.77	20.19	17.03	13.55	10.63	7.45	**17.48**
Anterior	4.67	5.64	6.80	9.93	12.35	16.76	20.88	27.68	31.98	**16.11**
Anterolateral	9.64	8.63	7.86	6.57	5.35	5.12	5.50	4.95	4.47	**6.28**
Other	0.44	0.20	0.16	0.09	0.10	0.43	0.81	1.02	0.98	**0.50**
Total (n):	**23,145**	**23,682**	**25,189**	**25,960**	**28,018**	**28,810**	**29,656**	**30,493**	**31,584**	**246,537**

THA: total hip arthroplasty.

Fixation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

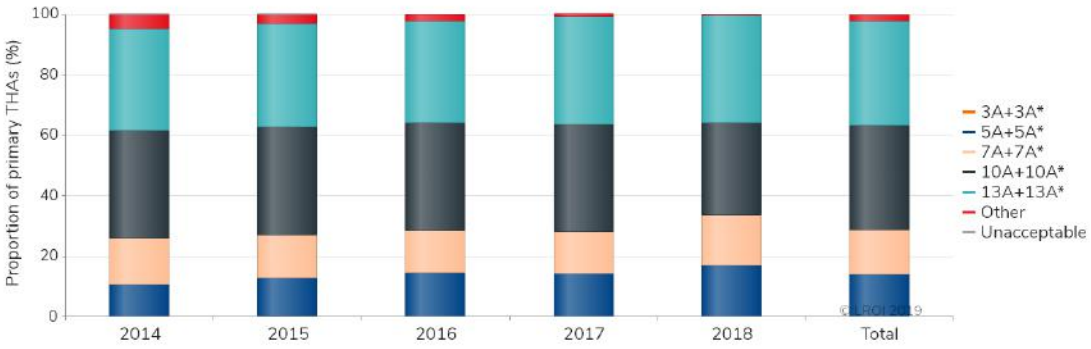
Fixation (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Uncemented	62.32	62.91	62.51	62.68	61.54	63.57	63.89	65.37	66.51	**63.59**
Cemented	29.34	29.15	28.92	27.96	27.95	26.12	26.16	25.44	24.09	**27.07**
Hybrid	4.79	4.04	4.08	4.62	4.77	4.91	4.89	5.28	6.30	**4.90**
Reversed hybrid	3.55	3.90	4.49	4.74	5.74	5.40	5.06	3.91	3.10	**4.44**
Total (n):	**23,153**	**23,722**	**25,206**	**25,980**	**28,016**	**28,761**	**29,519**	**30,077**	**31,410**	**245,844**

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 2014-2018.

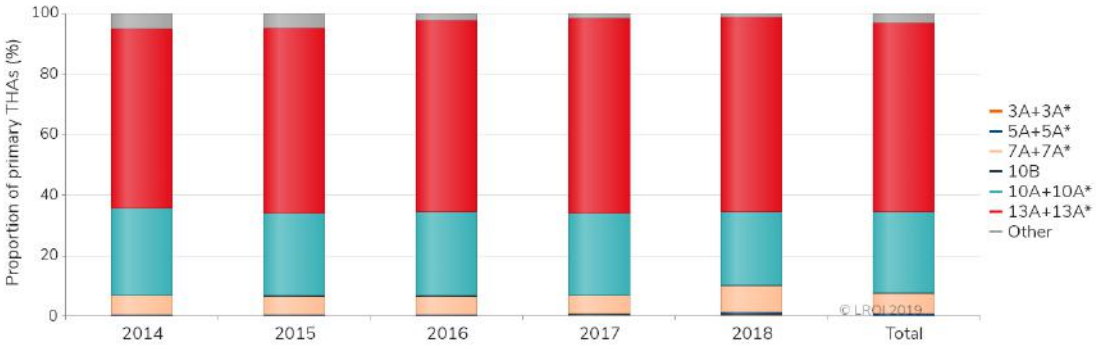


Year	2014	2015	2016	2017	2018	Total
ODEP rating (%)						
3A+3A*	0.14	0.17	0.02	0.02	0.05	**0.08**
5A+5A*	10.60	12.74	14.68	14.44	17.01	**13.96**
7A+7A*	15.09	14.24	13.70	13.72	16.70	**14.71**
10A+10A*	35.80	35.51	35.74	35.54	30.27	**34.51**
13A+13A*	33.60	34.34	33.56	35.47	35.45	**34.50**
Other	4.59	2.98	2.29	0.82	0.52	**2.20**
Unacceptable	0.19	0.03	0.00	0.00	0.00	**0.04**
Total (n):	**27,794**	**28,435**	**28,452**	**29,060**	**30,584**	**144,325**

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 2014-2018.

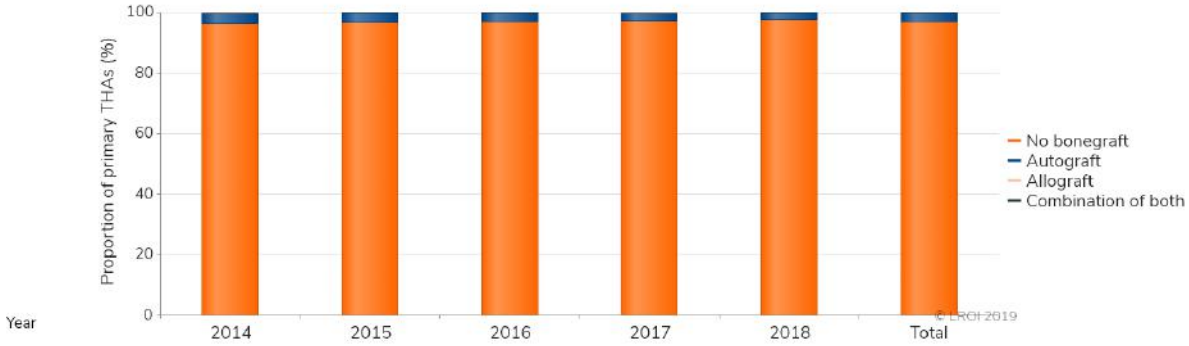


Year	2014	2015	2016	2017	2018	Total
ODEP rating (%)						
3A+3A*	0.17	0.31	0.33	0.54	0.45	**0.36**
5A+5A*	0.40	0.22	0.12	0.22	1.01	**0.40**
7A+7A*	6.38	6.21	6.08	6.08	8.58	**6.69**
10B	0.02	0.06	0.39	0.09	0.44	**0.20**
10A+10A*	28.80	27.11	27.67	27.15	24.12	**26.92**
13A+13A*	59.28	61.24	63.17	64.37	64.21	**62.51**
Other	4.95	4.85	2.23	1.55	1.19	**2.91**
Total (n):	**27,718**	**28,370**	**28,730**	**29,072**	**30,566**	**144,456**

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

Type of bonegraft 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF BONEGRAFT IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Type of bonegraft (%)	2014	2015	2016	2017	2018	Total
No bonegraft	96.35	96.61	96.91	97.14	97.65	**96.95**
Autograft	3.36	3.15	2.85	2.57	2.16	**2.80**
Allograft	0.18	0.14	0.14	0.16	0.12	**0.15**
Combination of both	0.11	0.10	0.10	0.13	0.06	**0.10**
Total (n):	**27,267**	**28,536**	**29,575**	**30,396**	**31,504**	**147,278**

THA: total hip arthroplasty

Type of acetabular component 2010-2018

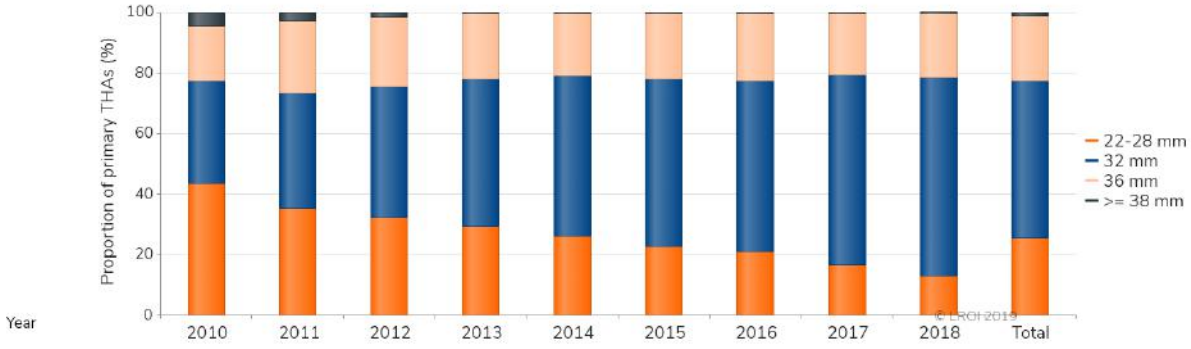
FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF ACETABULAR COMPONENT IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Type of acetabular component (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Press-fit	59.49	60.16	60.66	63.20	64.37	67.13	67.62	70.53	73.03	**65.56**
Cemented	32.59	32.80	33.17	32.34	33.41	31.03	31.03	28.54	26.50	**31.10**
Screw cup	7.93	7.03	6.17	4.46	2.22	1.84	1.35	0.92	0.46	**3.34**
Total (n):	**22,743**	**23,302**	**24,839**	**25,739**	**27,795**	**28,435**	**28,459**	**29,639**	**30,590**	**241,541**

THA: total hip arthroplasty

Femoral head diameter 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN FEMORAL HEAD COMPONENT DIAMETER IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



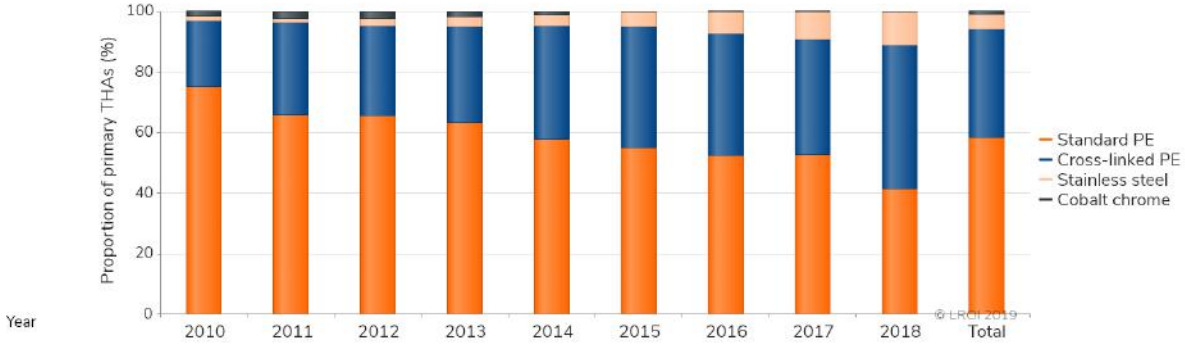
Femoral head size (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
22-28 mm	43.57	35.37	32.32	29.38	26.05	22.61	21.03	16.74	13.09	**25.67**
32 mm	33.76	37.94	42.98	48.52	52.98	55.43	56.49	62.57	65.43	**51.83**
36 mm	18.33	23.98	23.15	21.61	20.42	21.51	22.02	20.28	20.93	**21.34**
>= 38 mm	4.34	2.71	1.54	0.48	0.55	0.45	0.46	0.40	0.56	**1.16**
Total (n):	**21,467**	**22,302**	**23,948**	**24,472**	**26,599**	**27,557**	**27,970**	**29,249**	**30,660**	**234,224**

THA: total hip arthroplasty.

Materials

Cemented acetabular component 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN CEMENTED ACETABULUM MATERIAL IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

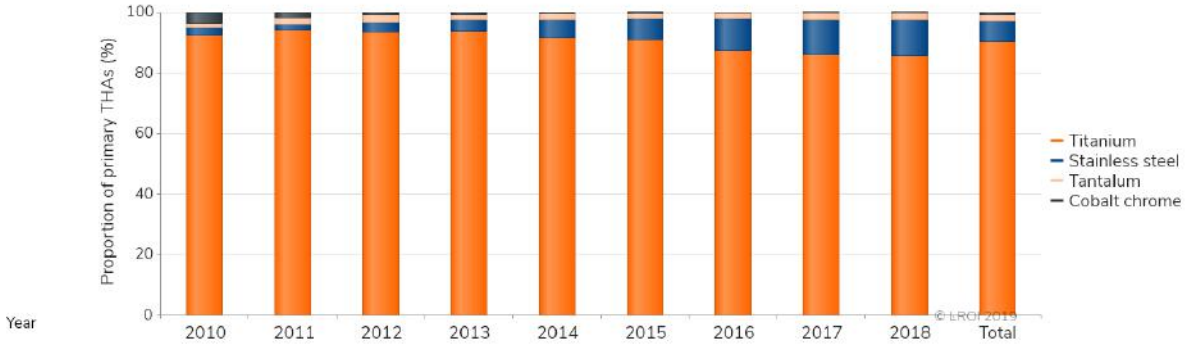


Cemented acetabulum material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Standard PE	74.98	65.96	65.57	63.26	57.96	55.10	52.47	52.67	41.48	**58.52**
Cross-linked PE	22.09	30.37	29.71	31.65	37.18	39.99	40.30	37.96	47.48	**35.46**
Stainless steel	1.34	1.35	2.22	3.22	3.59	4.70	7.01	9.14	10.82	**4.89**
Cobalt chrome	1.59	2.32	2.50	1.87	1.27	0.20	0.23	0.24	0.22	**1.13**
Total (n):	**7,410**	**7,642**	**8,239**	**8,323**	**9,285**	**8,822**	**8,832**	**8,460**	**8,107**	**75,120**

Please note: Titanium was used in 7 (0.01%) primary THAs in 2010-2015.
THA: total hip arthroplasty; PE: polyethylene.

Uncemented acetabular component 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN UNCEMENTED ACETABULUM MATERIAL IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

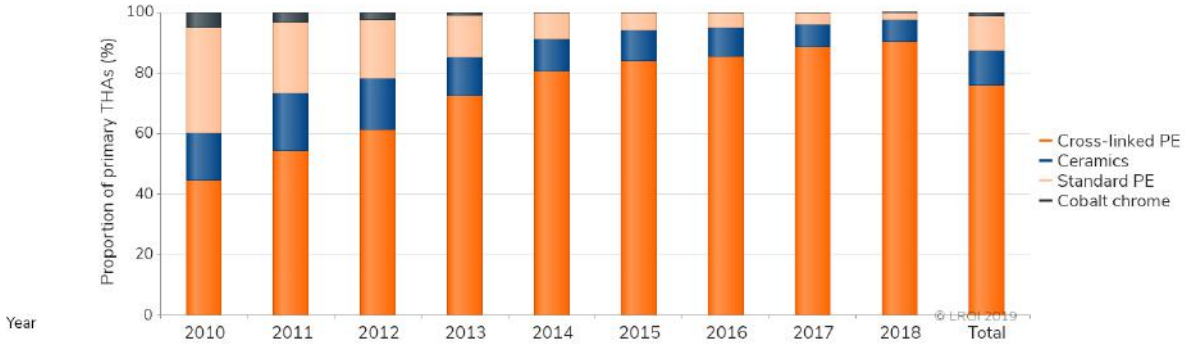


Uncemented acetabulum material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Titanium	92.48	93.97	93.59	93.83	91.44	91.04	87.54	85.96	85.89	**90.28**
Stainless steel	2.49	2.20	3.16	3.60	6.20	6.73	10.24	11.57	11.68	**6.87**
Tantalum	1.34	1.97	2.58	1.85	1.87	1.75	2.02	2.23	2.26	**2.00**
Cobalt chrome	3.69	1.86	0.66	0.72	0.49	0.48	0.20	0.25	0.17	**0.85**
Total (n):	**15,332**	**15,658**	**16,599**	**17,415**	**18,509**	**19,612**	**19,627**	**21,179**	**22,483**	**166,414**

THA: total hip arthroplasty.

Inlay 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN INLAY MATERIAL IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Inlay material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Cross-linked PE	44.65	54.48	61.24	72.43	80.47	84.03	85.61	88.69	90.23	**75.83**
Ceramics	15.51	18.98	17.13	12.88	10.71	10.17	9.25	7.33	7.26	**11.57**
Standard PE	34.75	23.36	19.27	13.70	8.56	5.53	5.08	3.86	2.40	**11.44**
Cobalt chrome	5.08	3.18	2.36	0.98	0.26	0.27	0.06	0.12	0.11	**1.15**
Total (n):	**12,846**	**14,361**	**15,421**	**15,967**	**16,839**	**17,968**	**18,932**	**20,436**	**21,766**	**154,536**

THA: total hip arthroplasty; PE: polyethylene.

Femur component 2010-2018

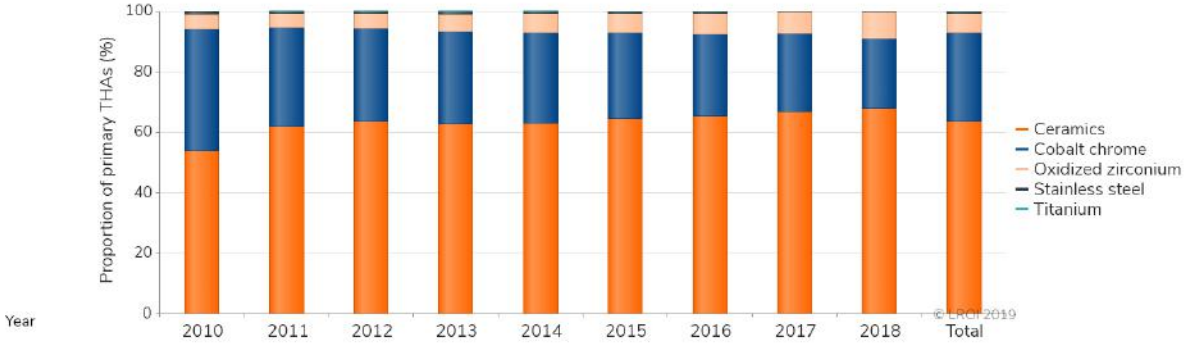
FIGURE TREND (PROPORTION [%] PER YEAR) IN FEMUR COMPONENT MATERIAL IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Femur material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Titanium	58.04	60.58	61.44	63.04	63.07	65.36	66.79	67.46	69.20	**64.20**
Cobalt chrome	34.55	32.64	31.57	30.02	29.55	27.58	26.08	25.72	25.11	**28.91**
Stainless steel	7.41	6.78	6.99	6.94	7.37	7.06	7.13	6.82	5.69	**6.89**
Total (n):	**22,765**	**23,469**	**25,042**	**25,852**	**27,718**	**28,368**	**28,736**	**29,615**	**30,569**	**242,134**

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

Femoral head component 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN FEMORAL HEAD MATERIAL IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

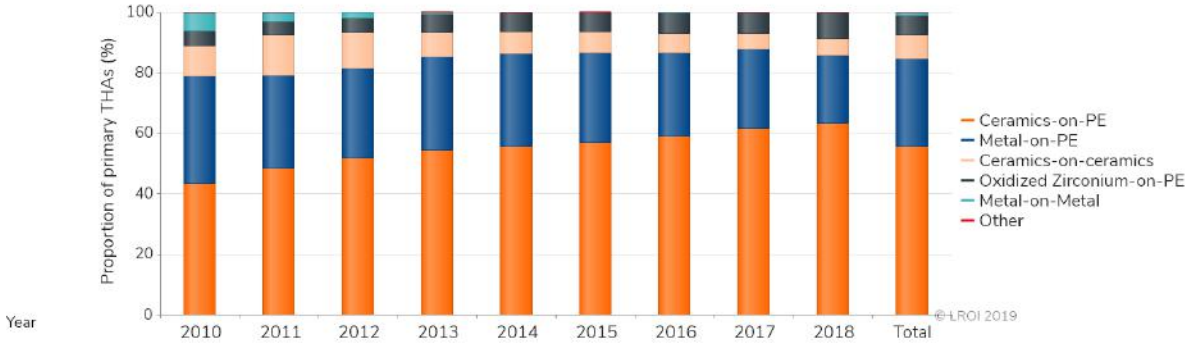


Femoral head material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Ceramics	53.68	61.78	63.63	62.82	63.08	64.36	65.30	66.66	67.78	**63.60**
Cobalt chrome	40.29	32.76	30.75	30.28	29.87	28.65	27.01	26.12	23.22	**29.41**
Oxidized zirconium	4.91	4.79	4.82	6.02	6.29	6.24	6.97	6.94	8.89	**6.34**
Stainless steel	1.11	0.65	0.76	0.88	0.73	0.73	0.71	0.27	0.10	**0.63**
Titanium	0.00	0.02	0.04	0.01	0.03	0.02	0.01	0.00	0.00	**0.02**
Total (n):	**21,466**	**22,301**	**23,945**	**24,471**	**26,598**	**27,557**	**27,970**	**29,247**	**30,658**	**234,213**

Please note: A cross-linked PE femoral head was used in 3 (<0.01%) primary THAs in 2010-2018. A standard PE femoral head was used in 2 (<0.01%) primary THAs in 2010-2018.
THA: total hip arthroplasty; PE: polyethylene.

Articulation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN ARTICULATION IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

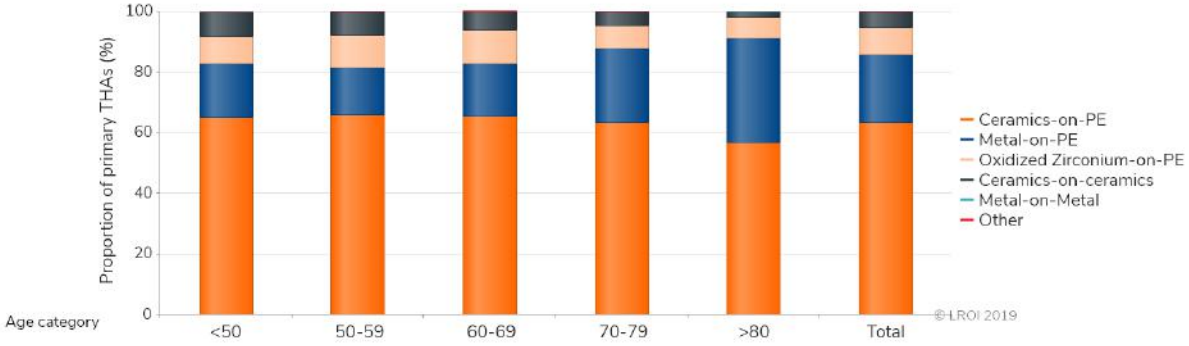


Articulation (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Ceramics-on-PE	43.38	48.26	51.76	54.52	55.47	57.11	58.94	61.60	63.36	**55.61**
Metal-on-PE	35.37	30.93	29.74	30.62	30.91	29.51	27.62	26.19	22.50	**28.92**
Ceramics-on-ceramics	10.31	13.09	11.85	8.11	7.02	6.82	6.36	5.20	5.27	**7.95**
Oxidized Zirconium-on-PE	4.80	4.84	4.89	6.09	6.43	6.38	7.04	6.92	8.79	**6.37**
Metal-on-Metal	6.09	2.67	1.76	0.65	0.14	0.16	0.03	0.08	0.06	**1.11**
Other	0.05	0.20	0.00	0.01	0.03	0.03	0.00	0.01	0.02	**0.04**
Total (n):	**20,690**	**21,718**	**23,302**	**23,915**	**25,682**	**26,668**	**27,378**	**28,564**	**29,730**	**227,647**

THA: total hip arthroplasty; PE: polyethylene.

Articulation by age category

FIGURE ARTICULATION (PROPORTION [%] PER CATEGORY) IN PRIMARY TOTAL HIP ARTHROPLASTIES BY AGE CATEGORY IN THE NETHERLANDS IN 2018.



Articulation (%)	<50	50-59	60-69	70-79	>80	Total
Ceramics-on-PE	65.15	65.91	65.34	63.43	56.63	**63.35**
Metal-on-PE	17.70	15.55	17.67	24.25	34.65	**22.50**
Oxidized Zirconium-on-PE	8.85	10.66	10.66	7.50	6.81	**8.79**
Ceramics-on-ceramics	7.91	7.68	6.26	4.81	1.82	**5.27**
Metal-on-Metal	0.23	0.17	0.07	0.00	0.09	**0.06**
Other	0.16	0.03	0.01	0.01	0.00	**0.02**
Total (n):	**1,277**	**3,582**	**8,989**	**11,382**	**4,496**	**29,726**

THA: total hip arthroplasty; PE: polyethylene.

Bone cement

Antibiotics 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Bone cement antibiotics (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Gentamicin	87.82	90.85	91.99	92.17	92.77	93.95	95.05	96.18	96.59	**93.20**
Tobramycin	7.63	4.96	4.53	4.08	2.97	2.29	1.77	0.94	0.33	**3.14**
Erythromycin + Colistin	0.92	2.60	2.86	3.08	3.75	3.31	2.84	2.62	2.77	**2.79**
No antibiotics	3.37	1.42	0.40	0.32	0.22	0.07	0.01	0.02	0.01	**0.58**
Gentamicin + Clindamycin	0.25	0.17	0.22	0.31	0.28	0.37	0.30	0.22	0.25	**0.26**
Gentamicin + Vancomycin	0.00	0.00	0.00	0.03	0.01	0.01	0.03	0.02	0.05	**0.02**
Total (n):	**7,925**	**8,448**	**9,087**	**9,329**	**9,998**	**9,573**	**9,809**	**9,973**	**9,582**	**83,724**

THA: total hip arthroplasty.

Viscosity 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN BONE CEMENT VISCOSITY IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

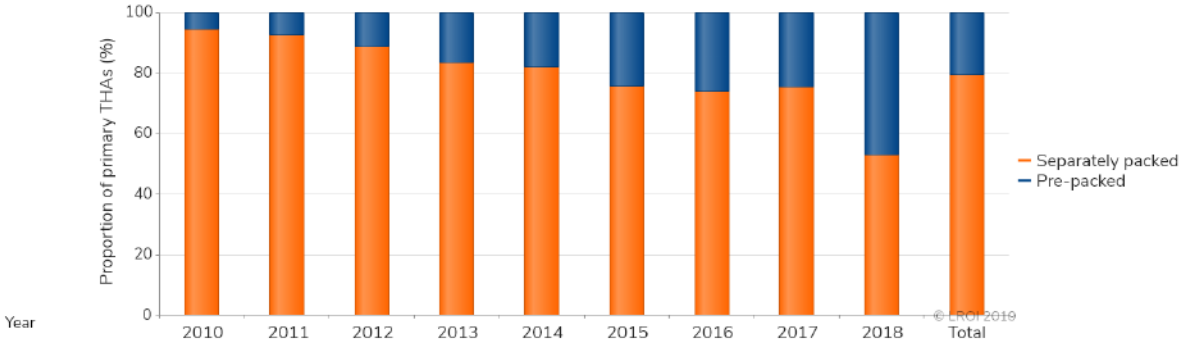
Bone cement viscosity (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
High	85.95	87.71	88.48	87.44	88.09	90.44	92.15	93.90	94.40	**89.98**
Medium	14.05	12.29	11.52	12.56	11.91	9.56	7.85	6.10	5.60	**10.02**
Total (n):	**7,923**	**8,447**	**9,086**	**9,328**	**9,997**	**9,573**	**9,809**	**9,972**	**9,582**	**83,717**

Please note: Low viscosity in bone cement was used in 7 (<0.01%) primary THAs in 2010-2018.
THA: total hip arthroplasty.

Vacuum mixing system 2010-2018

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 2010-2018.



Vacuum mixing system (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Separately packed	94.44	92.57	88.57	83.51	82.07	75.67	74.09	75.49	53.08	**79.40**
Pre-packed	5.56	7.43	11.43	16.49	17.93	24.33	25.91	24.51	46.92	**20.60**
Total (n):	**7,925**	**8,448**	**9,087**	**9,329**	**9,998**	**9,573**	**9,809**	**9,973**	**9,582**	**83,724**

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 2018.

Acetabulum

Cemented (n=8,172)		**Uncemented (n=22,234)**	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
IP Cup	17.2	Allofit	32.4
Muller low profile Durasul	16.5	Pinnacle	21.7
FAL Cup	9.7	R3	11.1
Avantage Cemented	9.4	Trident	6.6
Muller low profile	9.4	Exceed ABT	6.4
Exeter Rimfit X3	8.5	Mallory Head	3.1
Exceed ABT Cemented	7.8	Trident Tritanium	3.0
Reflection All Poly XLPE	4.3	RM Pressfit Vitamys cup	2.9
CCB cup Low Profile	3.2	RM Pressfit cup	2.7
Exeter Contemporary Hooded	2.9	Continuum	2.2

Femur

Cemented (n=9,104)		**Uncemented (n=21,282)**	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Lubinus SPII	36.9	Taperloc Complete	29.0
Original ME Muller	25.9	Corail	22.2
Exeter	13.0	Polarstem	10.0
Stanmore	8.8	Accolade	9.6
Spectron EF	5.5	Alloclassic Zweymuller SL	4.5
C-Stem AMT	2.8	Twinsys stem Cementless	4.4
CCA stem	2.2	CLS Spotorno	4.1
Taperloc Hip Cemented CoCr	1.4	M/L Taper	2.4
Taperloc Complete	0.7	Mallory Head Stems	1.7
Twinsys stem Cemented	0.6	Taperloc Hip System	1.3

Types of bone cement

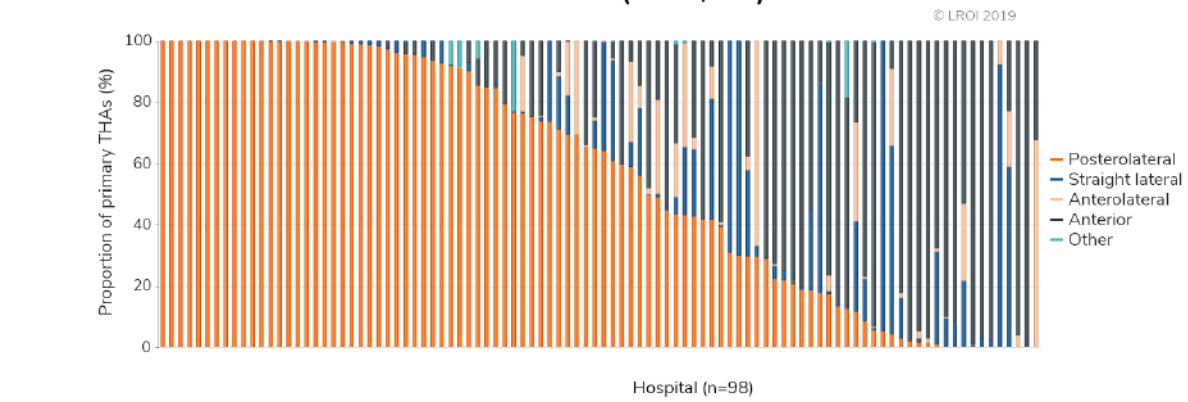
TABLE THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT BY TYPE OF MIXING SYSTEM USED DURING PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Separately packed bone cement components (n=5,085)		Bone cement pre-packed in a vacuum mixing system (n=4,493)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	84.1	Refobacin Bone Cement R	50.7
Simplex ABC EC	5.2	Palacos R+G	44.5
Palacos MV+G	4.7	Refobacin Plus Bone Cement	4.7
Refobacin Bone Cement R	2.3	Refobacin Revision	0.1
Synicem1G	1.7		

Practice variation

Surgical approach

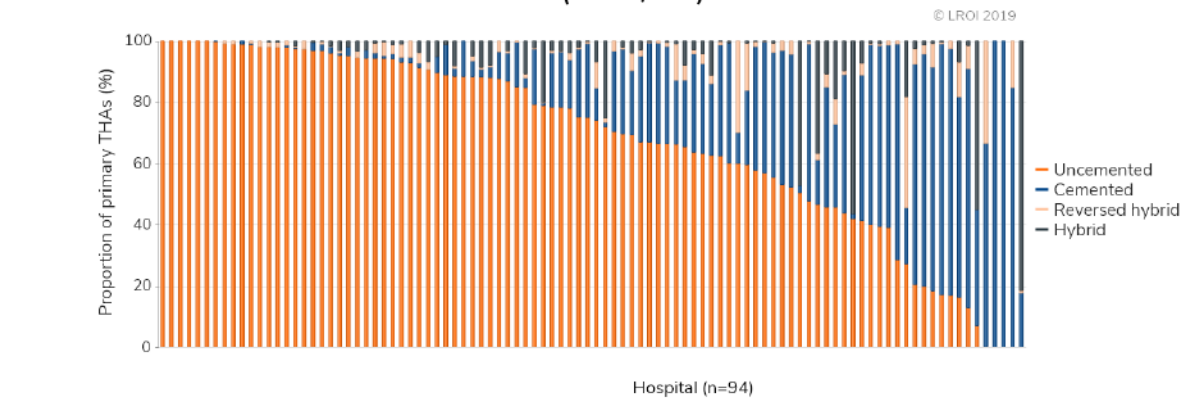
FIGURE DISTRIBUTION OF SURGICAL APPROACH USED DURING PRIMARY TOTAL HIP ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=31,584).



THA: total hip arthroplasty.

Fixation

FIGURE DISTRIBUTION OF TYPE OF FIXATION USED DURING PRIMARY TOTAL HIP ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=31,410).

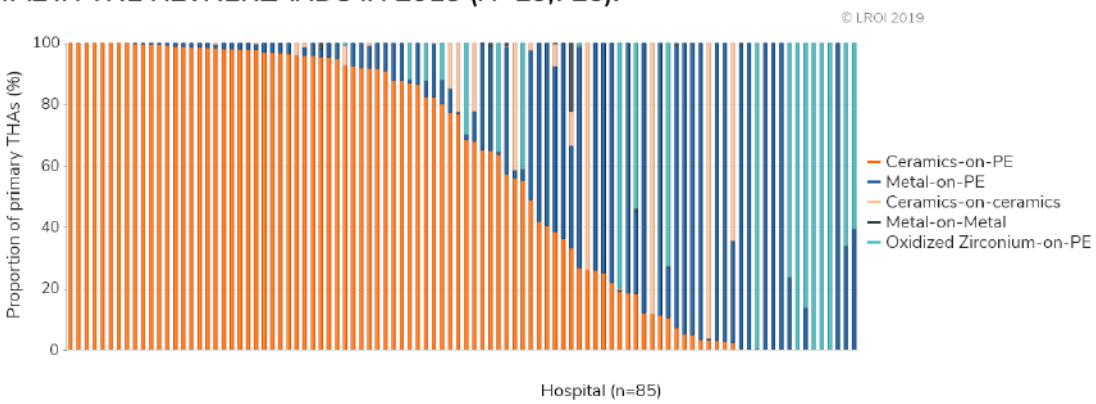


THA: total hip arthroplasty.

Femoral head diameter

Articulation

FIGURE DISTRIBUTION OF ARTICULATION USED DURING PRIMARY TOTAL HIP ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=29,725).



PE: polyethylene; THA: total hip arthroplasty.

Hip hemiarthroplasty

Demographics

TABLE PATIENT CHARACTERISTICS OF ALL PATIENTS WITH A PRIMARY HIP HEMIARTHROPLASTY BY SPECIALISM IN THE NETHERLANDS IN 2018.

	Orthopaedic surgeon	Trauma surgeon	Total
N	**3,942 (73.0%)**	**1,456 (27.0%)**	**5,398**
Completeness (%)	96	65	85
Mean age (years) (SD)	82.4 (8.6)	82.2 (8.5)	82.3 (8.5)
Age (years) (%)			
<50	1	0	1
50-59	1	1	1
60-69	5	5	5
70-79	24	27	25
≥80	69	66	68
Gender (%)			
Men	35	35	35
Women	65	65	65
ASA score (%)			
I	1	2	2
II	29	29	29
III-IV	70	69	69
Type of hospital (%)			
General	96	94	96
UMC	4	6	4
Diagnosis (%)			
Fracture (acute)	96	99	97
Osteoarthritis	2	1	1
Late post-traumatic	1	0	1
Tumour	1	0	1
Osteonecrosis	0	0	0
Dysplasia	0	0	0
Rheumatoid arthritis	0	0	0
Post-Perthes' disease	0	0	0
Inflammatory arthritis	0	0	0
Charnley-score (%)			
A One hip joint affected	63	52	62
B1 Both hip joints affected	12	19	13
B2 Contralateral hip joint with a total hip prosthesis	17	13	16
C Multiple joints affected or chronic disease that affects quality of life	8	16	9
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	5	6	5
Normal weight (>18,5-25)	56	56	56
Overweight (>25-30)	29	29	29
Obesity (>30-40)	9	9	9
Morbid obesity (>40)	1	0	1
Smoking (%)			
No	92	92	92
Yes	8	8	8

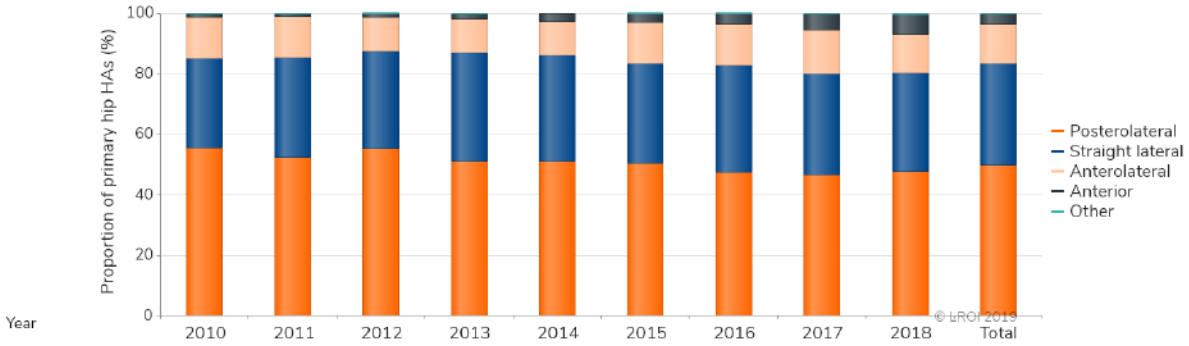
Please note: In 2018, 71 general hospitals and 7 UMCs performed primary hip hemiarthroplasties.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary hip hemiarthroplasties are included.
General: general hospital; UMC: university medical centre; SD: standard deviation.

Surgery and prosthesis

Surgical techniques

Surgical approach 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY HIP HEMIARTHROPLASTY IN THE NETHERLANDS IN 2010-2018.

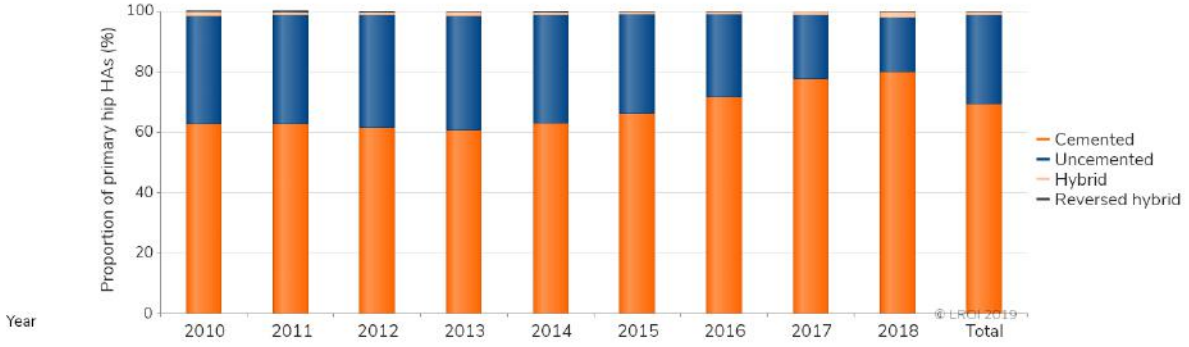


Surgical approach (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Posterolateral	55.48	52.25	55.36	51.02	50.93	50.28	47.39	46.69	47.77	**49.88**
Straight lateral	29.61	33.23	32.07	35.99	35.11	33.28	35.52	33.37	32.39	**33.58**
Anterolateral	13.67	13.50	11.41	11.10	11.10	13.45	13.45	14.30	12.92	**12.92**
Anterior	1.20	0.89	1.10	1.74	2.86	2.93	3.54	5.53	6.58	**3.50**
Other	0.04	0.13	0.07	0.13	0.00	0.06	0.11	0.11	0.33	**0.12**
Total (n):	**2,327**	**2,356**	**2,735**	**2,981**	**3,703**	**4,714**	**5,316**	**5,678**	**5,393**	**35,203**

HA: hemiarthroplasty.

Fixation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY HIP HEMIARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Fixation (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Cemented	62.86	62.63	61.71	60.58	63.10	66.27	71.77	77.60	80.13	**69.39**
Uncemented	35.59	36.07	37.09	37.72	35.58	32.71	27.23	21.01	17.83	**29.22**
Hybrid	1.29	1.01	0.87	1.47	1.02	0.91	0.94	1.39	2.02	**1.25**
Reversed hybrid	0.26	0.29	0.33	0.23	0.30	0.11	0.06	0.00	0.02	**0.14**
Total (n):	**2,318**	**2,376**	**2,766**	**3,001**	**3,718**	**4,708**	**5,300**	**5,687**	**5,384**	**35,258**

HA: hemiarthroplasty.

Most frequently registered

Components

TABLE THE MOST FREQUENTLY REGISTERED FEMUR AND FEMORAL HEAD COMPONENTS IN PRIMARY HIP HEMIARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Femur component (n=5,096)		Femoral head component (n=5,133)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Original ME Muller	26.9	Unipolar Head	31.2
Lubinus SPII	19.6	Link CoCr head	18.5
CCA stem	7.4	Modular Cathcard Unipolar head	10.9
Spectron EF	7.0	UHR Unitrax	9.8
Exeter	5.2	Stainless Steel head	8.5
C-Stem AMT	4.3	Uni-polar	7.6
Stanmore	3.8	Hemi Heads	4.8
Accolade	3.6	Smith&Nephew CoCr head	3.5
Alloclassic Zweymuller SL	2.9	COCR Modular Heads	2.0
Corail	2.7	Versys Endo	1.1

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 2018.

Separately packed bone cement components (n=1,714)		Bone cement pre-packed in a vacuum mixing system (n=1,996)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	78.3	Palacos R+G	48.5
Simplex ABC EC	4.4	Refobacin Bone Cement R	41.5
Refobacin Bone Cement R	3.8	Refobacin Plus Bone Cement	10.0
Copal G+V	3.0		
Palacos MV+G	3.0		

Hip revision arthroplasty

Type of revision 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF REVISION IN HIP REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Type of revision (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Girdlestone situation	2.93	2.62	2.39	3.51	5.76	6.76	6.69	6.63	5.91	**4.94**
Total revision	27.47	29.10	28.61	26.02	24.79	22.55	21.11	19.38	20.02	**24.06**
Major partial revision	55.89	54.84	56.94	57.11	54.00	51.93	51.12	48.71	50.95	**53.30**
Minor partial revision	10.33	10.46	9.43	11.42	12.59	15.97	17.51	18.53	18.01	**14.08**
Unknown partial revision	1.90	1.50	1.11	0.86	1.16	0.95	1.27	3.76	2.70	**1.71**
Other	1.48	1.47	1.53	1.09	1.70	1.84	2.31	2.99	2.41	**1.91**
Total (n):	**2,836**	**3,058**	**3,604**	**3,390**	**3,526**	**3,801**	**3,856**	**3,907**	**3,776**	**31,754**

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 986 (62.0%) major partial hip revision arthroplasties the acetabulum component was revised and in 604 (38.0%) major partial revision arthroplasties the femur component was revised in 2018.

Reasons for revision 2014-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN REASONS FOR REVISION OR RE-SURGERY IN PATIENTS WHO UNDERWENT A HIP REVISION ARTHROPLASTY IN THE NETHERLANDS in 2014-2018.

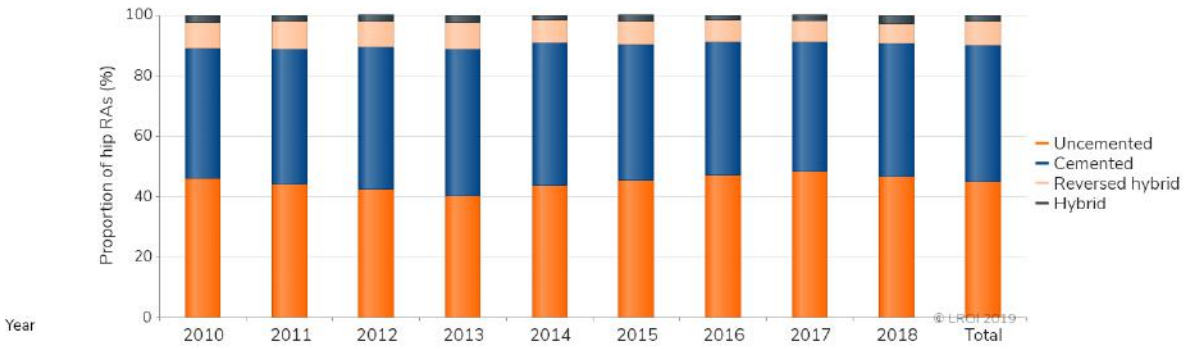
Year	2014	2015	2016	2017	2018	Total
Hip revision arthroplasty (n)	3,581	3,833	3,883	3,919	3,788	19,004
Reasons for revision; Proportion[1] (%)						
Loosening of acetabulum component	26.4	24.8	22.3	21.7	21.1	23.2
Loosening of femur component	20.9	19.5	18.8	18.0	19.3	19.3
Dislocation	19.1	19.9	19.4	17.9	18.9	19.0
Infection	12.3	17.9	19.4	21.2	20.6	18.4
Inlay wear	20.1	19.5	18.3	18.1	16.1	18.4
Peri-prosthetic fracture	11.7	11.4	12.5	14.6	14.3	12.9
Girdlestone situation	6.4	5.7	6.1	5.3	4.7	5.6
Symptomatic MoM bearing	5.8	4.6	3.9	2.7	2.7	3.9
Peri-articular ossification	2.6	2.0	2.3	1.5	1.3	1.9
Other	11.6	11.3	10.7	10.1	11.4	11.0

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

Surgery and prosthesis

Fixation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN HIP REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

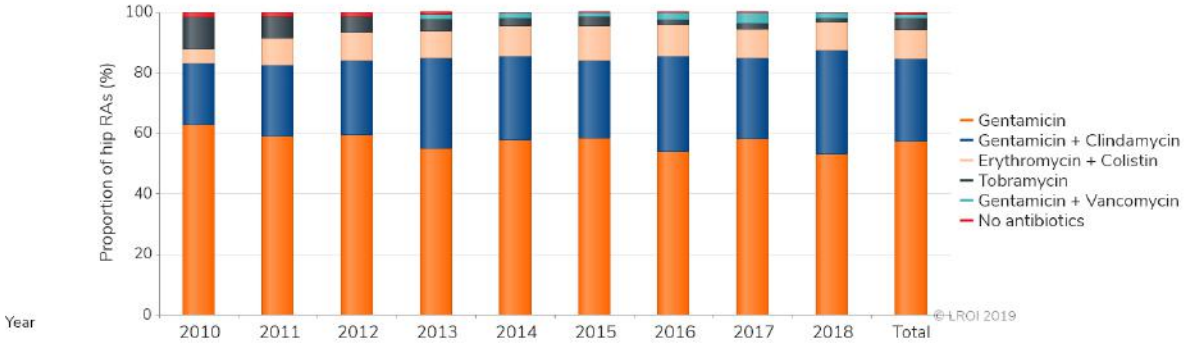


Fixation (%)										
Uncemented	46.14	44.04	42.47	40.42	43.72	45.38	47.13	48.39	46.59	**44.97**
Cemented	43.11	45.00	46.89	48.39	47.24	44.91	43.99	42.95	44.12	**45.18**
Reversed hybrid	8.31	8.86	8.58	8.68	7.50	7.51	7.32	6.70	6.59	**7.74**
Hybrid	2.43	2.10	2.07	2.51	1.53	2.20	1.55	1.96	2.70	**2.11**
Total (n):	**2,670**	**2,911**	**3,438**	**3,226**	**3,266**	**3,460**	**3,537**	**3,565**	**3,518**	**29,591**

RA: revision arthroplasty.

Bone cement antibiotics 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN HIP REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Bone cement antibiotics (%)

Gentamicin	62.60	58.96	59.61	54.93	57.80	58.32	54.17	58.21	53.13	**57.35**
Gentamicin + Clindamycin	20.46	23.65	24.52	30.07	27.81	25.59	31.20	26.80	34.29	**27.39**
Erythromycin + Colistin	4.58	8.86	9.24	8.75	9.87	11.68	10.50	9.39	9.39	**9.28**
Tobramycin	10.64	7.36	5.20	3.99	2.71	3.09	1.63	1.87	1.23	**3.97**
Gentamicin + Vancomycin	0.08	0.00	0.21	1.44	1.69	1.21	2.39	3.67	1.84	**1.43**
No antibiotics	1.64	1.16	1.22	0.83	0.12	0.12	0.12	0.06	0.12	**0.57**
Total (n):	**1,222**	**1,467**	**1,884**	**1,806**	**1,661**	**1,653**	**1,715**	**1,608**	**1,630**	**14,646**

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 2018.

Acetabulum

Cemented (n=1,371)		**Uncemented (n=529)**	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Avantage Cemented	54.3	Continuum	23.8
Polarcup	11.7	Delta-one TT	11.7
Exeter Rimfit X3	6.5	Trident	10.4
Saturne Dual Mobility Cemented	3.9	Allofit	8.7
FAL Cup	3.4	R3	7.6
Muller low profile Durasul	3.0	Avantage Reload	5.7
DS Evolution	2.8	Pinnacle	4.7
Reflection All Poly XLPE	2.8	Trident Tritanium	3.6
Marathon	1.8	Polarcup	3.4
Exeter Contemporary Hooded	1.6	Saturne Dual Mobility	3.0

Femur

Cemented (n=641)		**Uncemented (n=734)**	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Exeter	31.7	Restoration Modular	20.0
Lubinus SPII	25.9	MP Reconstruction Prosthesis	10.5
Spectron EF	9.8	Revitan	9.8
Original ME Muller	9.5	Arcos	7.1
Stanmore	6.2	Alloclassic SLL	6.1
C-Stem AMT	2.8	Corail Revision	4.8
MP Reconstruction Prosthesis	2.7	MRS stem	3.4
Twinsys stem Cemented	2.7	Redapt	3.4
CCA stem	1.6	Taperloc Complete	3.4
C-Stem AMT Long	1.2	Corail	3.3

Most frequently registered 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 2018.

Separately packed bone cement components (n=1,266)		Bone cement pre-packed in a vacuum mixing system (n=330)	
Name	Proportion (%)	Name	Proportion (%)
Palacos R+G	35.2	Refobacin Bone Cement R	62.4
Copal G+C	30.5	Palacos R+G	30.9
Simplex ABC EC	12.1	Refobacin Plus Bone Cement	6.1
Refobacin Revision	12.0	Refobacin Revision	0.6
Palacos MV+G	4.3		

Survival

Revision within 1 year

By type of revision

TABLE CUMULATIVE 1-YEAR REVISION PERCENTAGE OF PRIMARY TOTAL HIP ARTHROPLASTIES BY TYPE OF REVISION IN THE NETHERLANDS IN 2013-2017 (N=142,898).

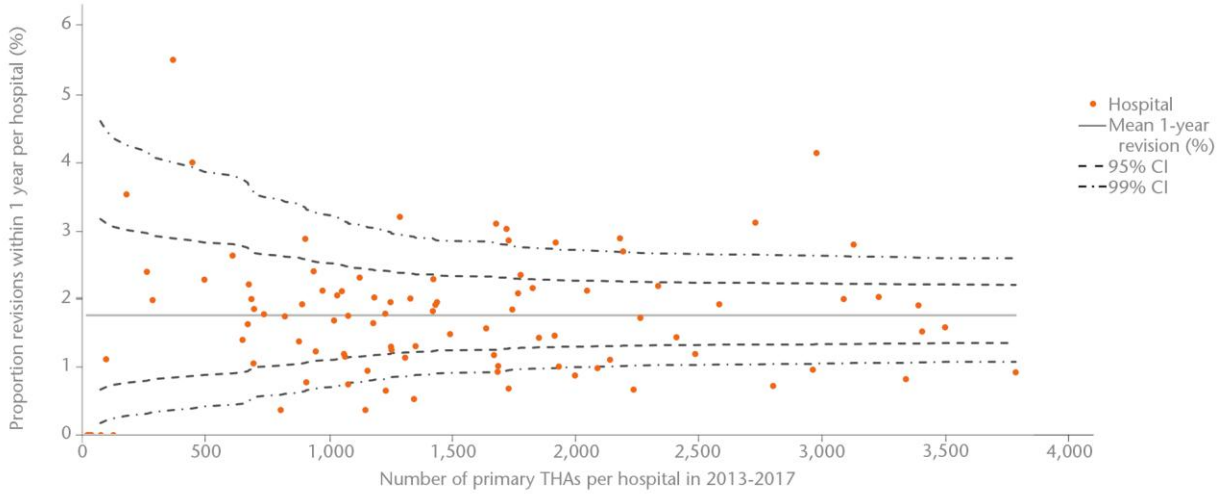
	Cumulative 1-year revision percentage	
	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Any type of revision[1]	1.7 (1.7-1.8)	1.8 (1.7-1.8)
Major revision[2]	1.1 (1.0-1.1)	1.1 (1.1-1.2)
Minor revision[3]	0.6 (0.6-0.7)	0.6 (0.6-0.7)

[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 2013-2017, 1,845 (1.3%) primary THAs were implanted in patients who died within one year after the primary procedure.

Overall revision per hospital

FIGURE FUNNEL PLOT OF PROPORTION OF HIP REVISION ARTHROPLASTIES WITHIN ONE YEAR AFTER A TOTAL HIP ARTHROPLASTY PER HOSPITAL IN THE NETHERLANDS IN 2013-2017 (N=142,898).

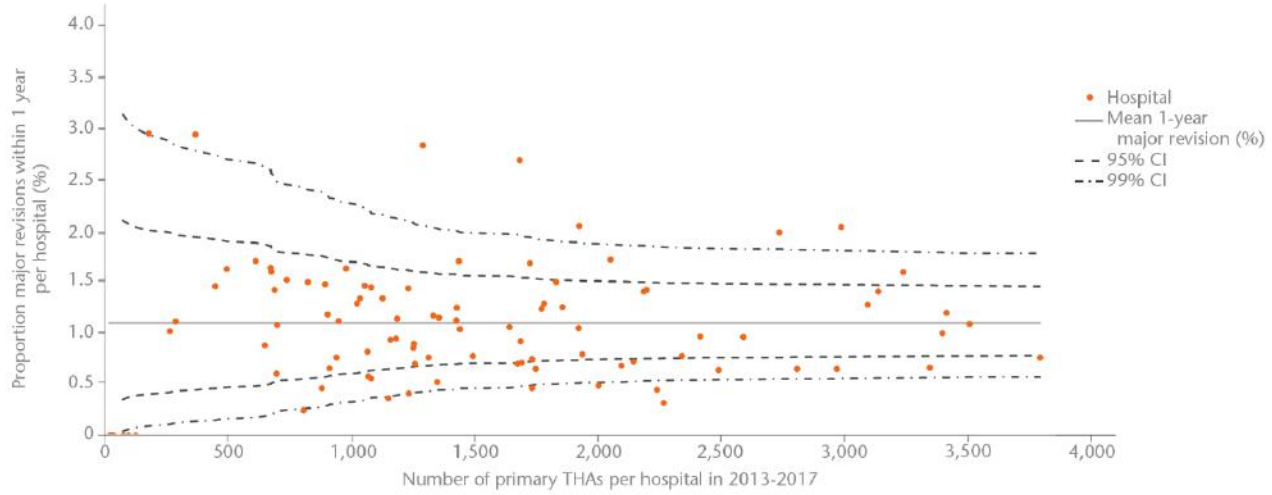


Please note: The proportions of revisions within 1 year per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).
THA: total hip arthroplasty; CI: confidence interval.

**The mean 1-year revision percentage is 1.8 (95% CI: 1.7-1.9) in the Netherlands in 2013-2017.
Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.**

Major revision per hospital

FIGURE FUNNEL PLOT OF PROPORTION OF HIP MAJOR REVISION ARTHROPLASTIES WITHIN ONE YEAR AFTER A TOTAL HIP ARTHROPLASTY PER HOSPITAL IN THE NETHERLANDS IN 2013-2017 (N=142,897).



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

The mean 1-year major revision percentage is 1.1 (95% CI: 1.2-1.2) in the Netherlands in 2013-2017. Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.

Reasons for revision by type of revision

TABLE REASONS FOR REVISION WITHIN ONE YEAR IN PATIENTS THAT UNDERWENT A HIP REVISION ARTHROPLASTY BY TYPE OF REVISION IN THE NETHERLANDS IN 2013-2017.

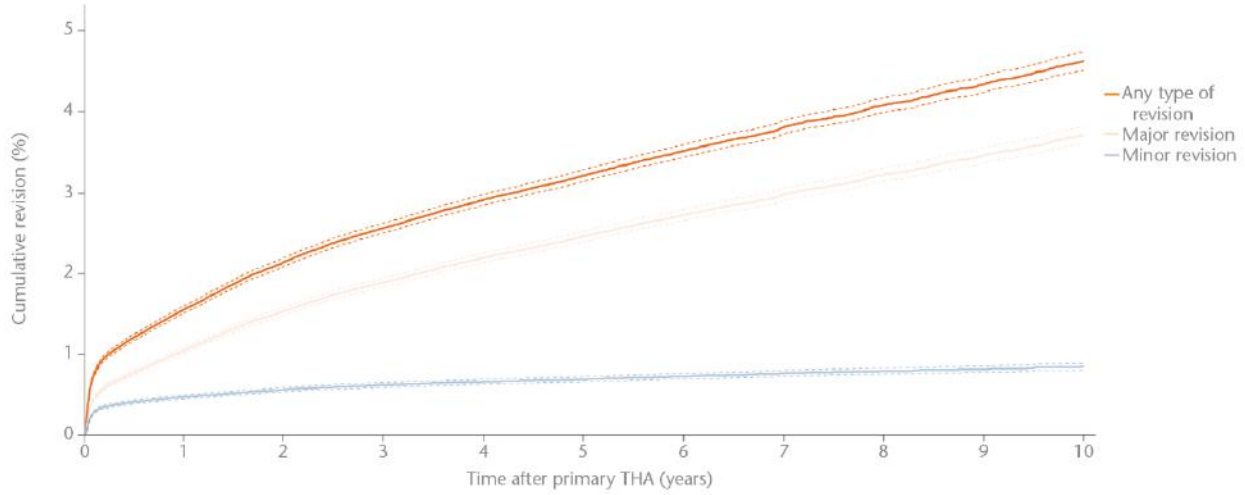
	Major revision[1] (n=1,576)	Minor revision[2] (n=883)	Any type of revision[3] (n=2,514)
Reasons for revision	**Proportion[4] (%)**	**Proportion[4] (%)**	**Proportion[4] (%)**
Infection	12.6	63.3	30.6
Dislocation	35.2	22.5	30.0
Peri-prosthetic fracture	28.9	1.7	18.9
Loosening of femur component	21.3	0.3	13.5
Loosening of acetabulum component	10.7	0.5	6.8
Girdlestone situation	2.8	0.2	1.9
Inlay wear	1.3	1.2	1.2
Peri-articular ossification	0.9	0.6	0.8
Symptomatic MoM bearing	0.1	0.0	0.1
Other	11.0	14.2	12.1

[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 or re-surgery. As such, the total proportion is over 100%.

Revision within 10 years

Overall

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL HIP ARTHROPLASTIES BY TYPE OF REVISION IN THE NETHERLANDS IN 2007-2018 (N=291,777).



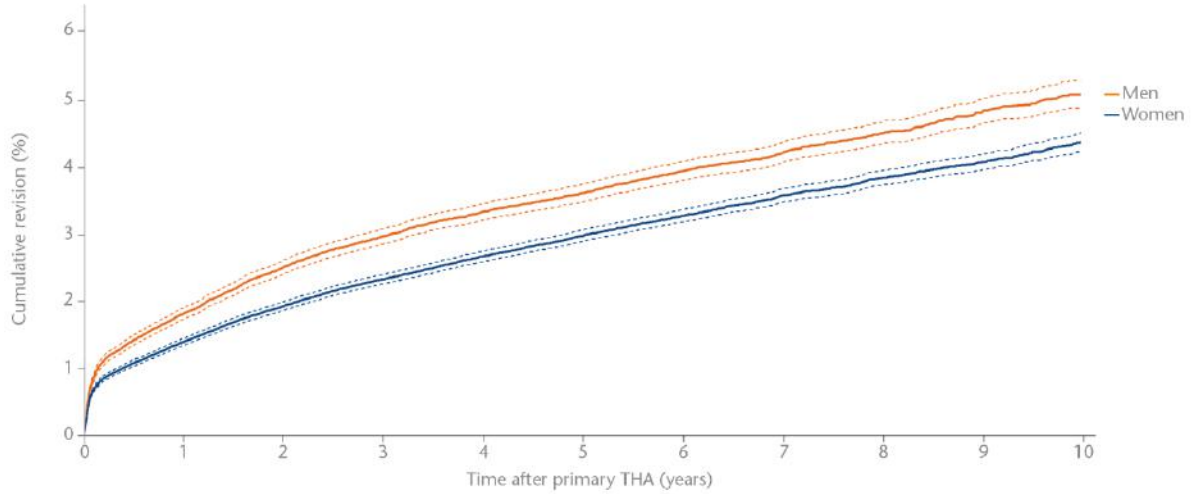
	Cumulative 10-year revision percentage	
	Competing risk[1] (95% CI)	Kaplan Meier (95% CI)
Any type of revision	4.6 (4.5-4.7)	5.0 (4.9-5.1)
Major revision[2]	3.7 (3.6-3.8)	4.1 (4.0-4.2)
Minor revision[3]	0.8 (0.8-0.9)	1.0 (0.9-1.0)

[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).
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
THA: total hip arthroplasty; CI: confidence interval.

In 2007-2018, 26,253 (9.1%) primary THAs were implanted in patients who died within ten years after the primary procedure.

By gender

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL HIP ARTHROPLASTIES BY GENDER IN THE NETHERLANDS IN 2007-2018 (N=291,209).

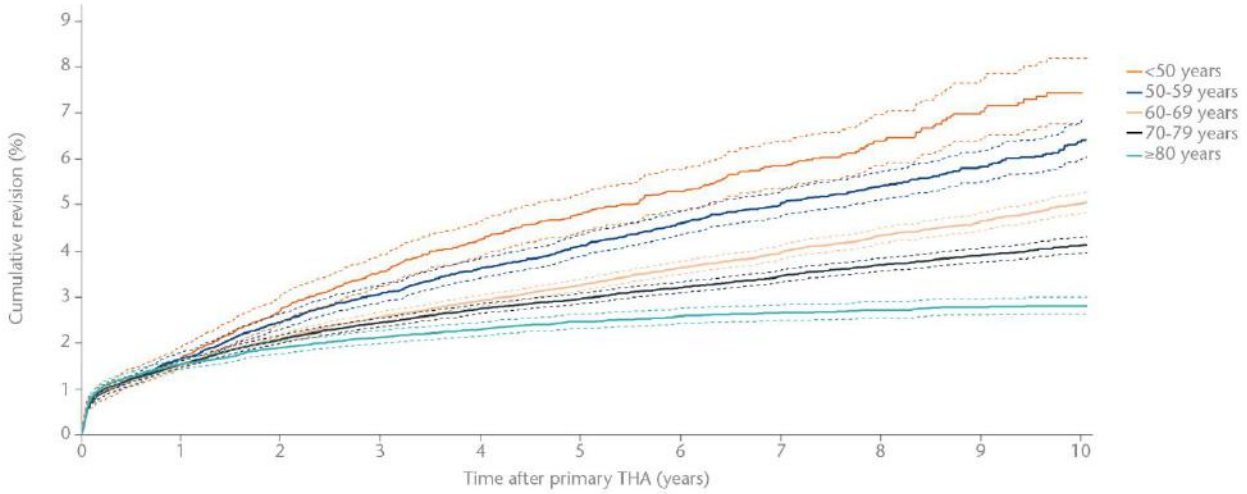


	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Gender			
Men	97,633	5.1 (4.9-5.3)	5.5 (5.3-5.8)
Women	193,576	4.4 (4.3-4.5)	4.7 (4.6-4.9)

[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 age category

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL HIP ARTHROPLASTIES BY AGE CATEGORY IN THE NETHERLANDS IN 2007-2018 (N=259,533).

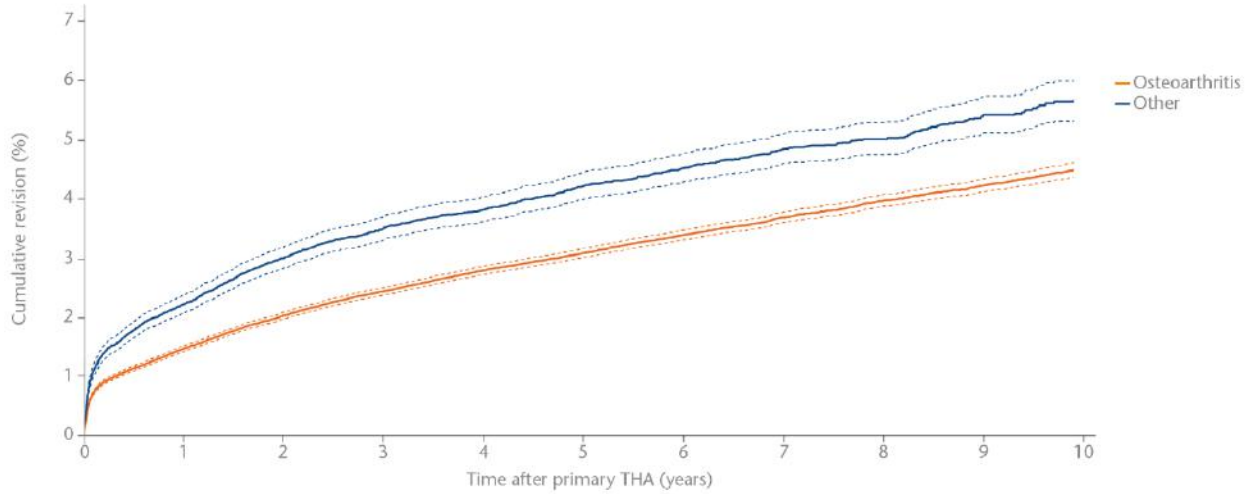


	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Age (years)			
<50	13,021	7.4 (6.8-8.2)	7.6 (6.9-8.3)
50-59	35,737	6.4 (6.0-6.9)	6.6 (6.2-7.1)
60-69	92,371	5.1 (4.8-5.3)	5.3 (5.1-5.5)
70-79	106,347	4.1 (4.0-4.3)	4.5 (4.3-4.6)
≥80	43,909	2.8 (2.6-3.0)	3.1 (2.9-3.4)

[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 diagnosis

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL HIP ARTHROPLASTIES BY DIAGNOSIS IN THE NETHERLANDS IN 2007-2018 (N=289,216).

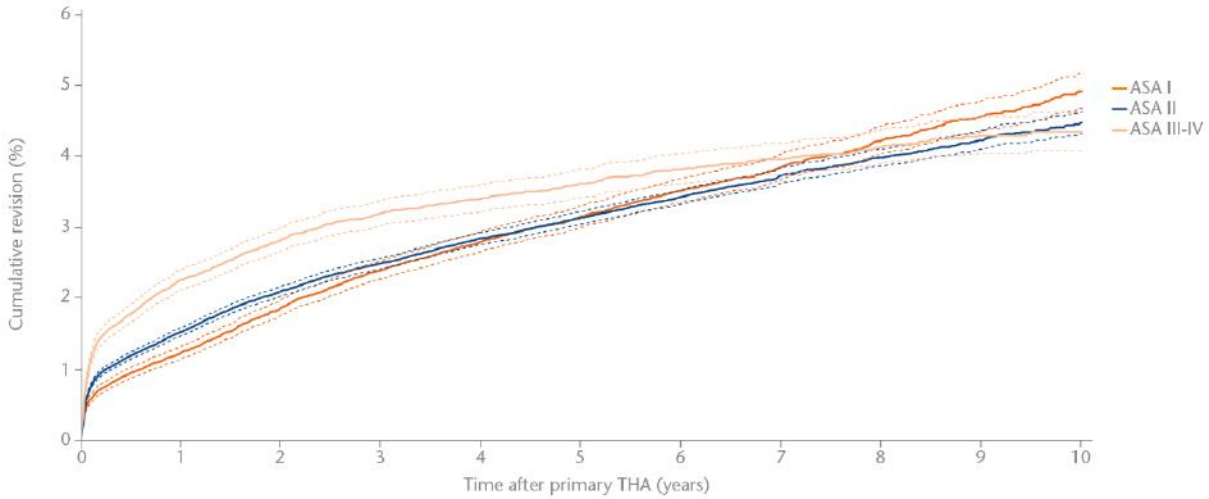


	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Diagnosis			
Osteoarthritis	251,860	4.5 (4.4-4.6)	4.8 (4.7-4.9)
Other	37,356	5.6 (5.3-6.0)	6.3 (5.8-6.7)

[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 ASA score

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL HIP ARTHROPLASTIES BY ASA SCORE IN THE NETHERLANDS IN 2007-2018 (N=281,893).



	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
ASA score			
I	61,249	4.9 (4.7-5.2)	5.1 (4.8-5.4)
II	177,848	4.5 (4.3-4.6)	4.8 (4.6-5.0)
III-IV	42,796	4.3 (4.1-4.6)	4.9 (4.6-5.3)

[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.

Revision per component

Cemented primary THA

TABLE CUMULATIVE REVISION PERCENTAGES OF CEMENTED PRIMARY TOTAL HIP ARTHROPLASTIES BY PROSTHESIS COMPONENT COMBINATION OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS IN THE NETHERLANDS IN 2007-2018 (N=67,717).

					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 revision	Only femur	Only acetabulum	Only femoral head/inlay	Missing/ unknown	1yr	3yr	5yr	7yr	10yr
All cemented THAs for osteoarthritis		**67,717**	**76 (71-80)**	**1,617**	**325**	**176**	**668**	**406**	**42**	**1.2 (1.1-1.3)**	**1.9 (1.8-2.0)**	**2.4 (2.3-2.6)**	**2.9 (2.8-3.1)**	**3.6 (3.4-3.9)**
Lubinus SPII	IP Cup	12,083	76 (71-80)	260	38	38	119	61	4	1.0 (0.8-1.2)	1.9 (1.6-2.1)	2.4 (2.1-2.7)	2.7 (2.3-3.0)	3.3 (2.6-3.9)
Original ME Muller	Muller low profile Durasul	5,868	74 (69-79)	131	19	1	18	91	2	1.5 (1.2-1.8)	2.0 (1.6-2.4)	2.6 (2.1-3.1)	2.9 (2.4-3.5)	3.4 (2.6-4.2)
Original ME Muller	Muller low profile	5,502	77 (73-81)	123	18	1	68	30	6	1.4 (1.1-1.7)	2.1 (1.7-2.5)	2.3 (1.9-2.7)	2.6 (2.1-3.1)	2.6 (2.1-3.1)
Spectron EF	Reflection All Poly XLPE	4,442	77 (73-81)	88	28	9	32	19	0	0.7 (0.5-1.0)	1.4 (1.1-1.8)	1.8 (1.4-2.2)	2.6 (2.0-3.1)	2.9 (2.3-3.6)
Lubinus SPII	FAL Cup	4,224	75 (70-80)	112	27	6	37	38	4	1.7 (1.3-2.1)	2.4 (1.9-2.9)	2.9 (2.3-3.3)	3.7 (2.9-4.5)	4.5 (3.3-5.6)
Exeter	Exeter Rimfit X3	3,428	75 (69-80)	68	14	17	15	22	0	1.4 (1.0-1.8)	2.0 (1.5-2.5)	2.5 (1.9-3.1)	2.5 (1.9-3.1)	n.a.
Stanmore	Stanmore	3,337	75 (70-80)	63	21	2	34	3	3	0.7 (0.4-1.0)	1.5 (1.1-2.0)	2.0 (1.5-2.5)	2.1 (1.6-2.7)	2.5 (1.8-3.2)
Exeter	Exeter Contemporary Hooded	2,738	76 (72-81)	72	15	15	27	12	3	1.2 (0.8-1.6)	1.7 (1.2-2.2)	2.2 (1.6-2.8)	2.9 (2.1-3.6)	4.0 (3.0-5.0)
Lubinus SPII	SHP	2,490*	75 (71-80)	40	9	3	27	1	0	0.4 (0.1-0.6)	0.7 (0.4-1.0)	1.0 (0.6-1.4)	1.6 (1.1-2.2)	2.2 (1.4-2.9)
Exeter	Exeter	2,429*	73 (68-79)	114	17	10	55	28	4	2.8 (2.1-3.5)	3.6 (2.9-4.4)	4.1 (3.3-4.9)	4.8 (3.9-5.7)	5.6 (4.5-6.8)
Exeter	Exeter Contemporary Flanged	2,372*	75 (67-80)	53	13	6	27	5	2	0.7 (0.4-1.1)	1.4 (0.9-1.9)	1.9 (1.3-2.5)	2.2 (1.5-2.8)	3.4 (2.3-4.5)
Stanmore	SHP	2,065	75 (71-80)	93	30	5	47	10	1	1.6 (1.0-2.1)	3.1 (2.3-3.9)	4.2 (3.2-5.1)	5.1 (4.0-6.2)	6.1 (4.8-7.5)
CCA stem	CCB cup Low Profile	1,428	77 (73-80)	37	4	2	10	20	1	2.1 (1.3-2.8)	2.3 (1.5-3.1)	2.7 (1.8-3.5)	2.9 (1.9-3.9)	3.6 (1.9-5.3)
Stanmore	All Poly Arcom Cup	1,048*	74 (69-79)	18	2	3	11	0	2	0.3 (0.0-0.6)	1.3 (0.6-2.0)	1.8 (1.0-2.7)	2.0 (1.1-3.0)	n.a.
Stanmore	Muller	877	76 (71-81)	12	3	2	6	1	0	0.7 (0.1-1.2)	1.3 (0.6-2.1)	1.3 (0.6-2.1)	1.3 (0.6-2.1)	2.9 (0.0-5.9)
Spectron EF	Mueller cup	825*	77 (72-81)	9	2	2	3	2	0	0.4 (0.0-0.8)	0.7 (0.1-1.3)	1.0 (0.3-1.7)	1.0 (0.3-1.7)	1.3 (0.4-2.2)
Stanmore	Exceed ABT Cemented	770	76 (71-81)	14	1	0	5	8	0	1.7 (0.7-2.7)	2.0 (0.8-3.1)	2.5 (0.9-4.0)	n.a.	n.a.
Spectron EF	Reflection All Poly	615*	77 (74-82)	33	8	0	22	3	0	0.8 (0.1-1.5)	1.8 (0.8-2.9)	2.7 (1.4-4.0)	3.5 (2.0-5.0)	6.4 (4.1-8.7)
Twinsys stem Cemented	CCB cup Low Profile	522	80 (76-83)	5	0	1	3	0	1	0.6 (0.0-1.2)	0.9 (0.0-1.8)	1.2 (0.1-2.3)	1.2 (0.1-2.3)	n.a.
M530	Muller low profile	496	78 (74-83)	15	0	8	6	1	0	0.8 (0.0-1.6)	1.7 (0.5-2.9)	2.7 (1.1-4.3)	3.2 (1.3-5.1)	5.1 (1.8-8.4)
Spectron EF	Muller low profile Durasul	457	78 (74-82)	9	3	0	1	5	0	0.9 (0.0-1.8)	2.4 (0.7-4.1)	n.a.	n.a.	n.a.
Stanmore	Apollo	372*	75 (70-80)	6	3	1	1	0	1	0.3 (0.0-0.8)	0.8 (0.0-1.8)	1.5 (0.0-5.5)	1.5 (0.0-5.5)	n.a.
Lubinus SPII	Avantage Cemented	369	78 (70-83)	8	3	0	1	4	0	1.7 (0.4-3.1)	1.7 (0.4-3.1)	3.2 (0.8-5.7)	n.a.	n.a.
Original ME Muller	Avantage Cemented	340	78 (73-83)	12	1	0	1	10	0	3.5 (1.5-5.6)	3.5 (1.5-5.6)	3.5 (1.5-5.6)	n.a.	n.a.
C-Stem AMT	Marathon	333	81 (79-84)	5	0	0	0	5	0	1.5 (0.2-2.8)	n.a.	n.a.	n.a.	n.a.
GHE-hulpstiel	Hulpfanne	271*	75 (71-80)	16	3	2	11	0	0	0.4 (0.0-1.1)	1.9 (0.2-3.6)	2.7 (0.7-4.7)	4.9 (2.2-7.7)	6.9 (3.4-10.4)
Stanmore	Avantage Cemented	257	79 (74-84)	3	0	1	0	2	0	0.8 (0.0-1.9)	1.4 (0.0-2.9)	n.a.	n.a.	n.a.
Charnley Modular	Marathon	255*	71 (65-79)	7	3	2	2	0	0	0.4 (0.0-1.2)	1.2 (0.0-2.6)	1.6 (0.0-3.2)	3.3 (0.8-5.7)	n.a.

* Denotes prosthesis combinations with no reported use in cemented primary THAs in 2018.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; RA: revision arthroplasty; CI: confidence interval; IQR: interquartile range.

Only combinations of cemented acetabulum and femur components with over 250 procedures have been listed. These combinations represented 88.9% of all registered cemented primary total hip arthroplasties.

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 REVISION PERCENTAGES OF UNCEMENTED PRIMARY TOTAL HIP ARTHROPLASTIES BY PROSTHESIS COMPONENT COMBINATION OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS IN THE NETHERLANDS IN 2007-2018 (N=160,066).

					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 revision	Only femur	Only acetabulum	Only femoral head/inlay	Missing/ unknown	1yr	3yr	5yr	7yr	10yr
All uncemented THAs for osteoarthritis		**160,066**	**68 (61-74)**	**5,197**	**838**	**1,839**	**1,343**	**1,068**	**109**	**1.6 (1.5-1.7)**	**2.7 (2.6-2.8)**	**3.4 (3.3-3.5)**	**4.2 (4.0-4.3)**	**5.2 (5.0-5.4)**
Corail	Pinnacle	26,604	69 (62-75)	609	106	195	116	185	7	1.4 (1.2-1.5)	2.2 (2.0-2.4)	2.7 (2.4-2.9)	3.2 (2.9-3.6)	4.5 (3.8-5.1)
Alloclassic Zweymuller SL	Allofit	13,329	70 (64-76)	377	60	144	91	77	5	1.2 (1.0-1.4)	2.0 (1.8-2.2)	2.6 (2.3-2.9)	3.3 (3.0-3.7)	4.0 (3.6-4.5)
CLS Spotorno	Allofit	9,207	65 (59-69)	340	39	141	78	67	15	2.5 (2.2-2.8)	3.5 (3.1-3.8)	3.9 (3.5-4.3)	4.4 (3.4-4.9)	5.2 (4.3-6.2)
Taperloc Complete	Allofit	7,014	68 (61-73)	103	6	45	12	37	3	1.6 (1.2-1.9)	1.9 (1.5-2.3)	n.a.	n.a.	n.a.
Taperloc Complete	Exceed ABT	6,828	69 (63-75)	125	18	48	21	33	5	1.4 (1.2-1.7)	2.0 (1.7-2.4)	2.1 (1.7-2.5)	2.3 (1.8-2.9)	n.a.
Accolade	Trident	6,647	69 (62-76)	220	29	121	27	41	2	1.5 (1.2-1.8)	3.1 (2.7-3.6)	4.2 (3.6-4.8)	4.9 (4.2-5.6)	5.7 (4.7-6.7)
Mallory Head Stems	Mallory Head	5,932	65 (60-69)	174	25	23	62	58	6	1.4 (1.1-1.7)	2.3 (1.9-2.7)	2.6 (2.2-3.1)	3.2 (2.7-3.7)	3.8 (3.2-4.5)
Taperloc Hip system	Exceed ABT	3,806	68 (62-74)	103	17	30	28	20	8	1.2 (0.8-1.5)	2.3 (1.8-2.8)	2.7 (2.2-3.2)	2.9 (2.3-3.4)	2.9 (2.3-3.4)
Taperloc Hip system	Mallory Head	3,651	67 (61-71)	111	20	33	37	19	2	1.5 (1.1-1.9)	2.5 (2.0-3.0)	2.8 (2.2-3.4)	3.7 (2.9-4.4)	4.2 (3.3-5.2)
Accolade	Trident Tritanium	3,59	68 (62-74)	70	5	28	13	24	0	1.0 (0.7-1.3)	1.9 (1.4-2.4)	2.8 (2.1-3.5)	n.a.	n.a.
SL Plus	Bicon Plus	3,583	70 (64-76)	184	28	91	48	15	2	1.7 (1.3-2.1)	3.9 (3.2-4.6)	4.9 (4.1-5.6)	5.7 (4.8-6.5)	7 .1 (5.8-8.4)
Taperloc Complete	Mallory Head	3,048	67 (61-73)	99	15	23	27	33	1	2.1 (1.6-2.6)	3.3 (2.6-3.9)	3.5 (2.8-4.2)	4.4 (3.0-5.8)	n.a.
Synergy	Reflection	2,911	66 (60-72)	111	10	56	21	23	1	2.2 (1.6-2.7)	2.7 (2.1-3.3)	3.2 (2.5-3.8)	3.7 (2.9-4.4)	4.6 (3.6-5.6)
Alloclassic Zweymuller SL	Alloclassic Zweymuller CSF	2,892	69 (63-75)	107	13	42	15	35	2	1.3 (0.9-1.7)	2.7 (2.1-3.3)	3.4 (2.7-4.1)	3.7 (2.9-4.4)	4.2 (3.3-5.0)
Twinsys stem Cementless	RM Pressfit Vitamys cup	2,751	66 (60-71)	50	9	21	10	9	1	1.1 (0.7-1.5)	1.9 (1.3-2.5)	2.4 (1.6-3.1)	2.4 (1.6-3.1)	n.a.
Twinsys stem Cementless	RM Pressfit cup	2,629	73 (67-79)	82	11	36	17	17	1	2.5 (1.9-3.1)	3.0 (2.3-3.7)	3.3 (2.6-4.1)	4.5 (3.2-5.8)	n.a.
Polarstem	R3	2,592	68 (62-74)	52	1	20	6	25	0	2.2 (1.6-2.7)	2.2 (1.6-2.7)	n.a.	n.a.	n.a.
Alloclassic offset	Allofit	2,321	71 (64-77)	57	11	21	11	11	3	1.2 (0.7-1.6)	1.9 (1.3-2.4)	2.6 (1.8-3.3)	3.0 (2.2-3.8)	3.4 (2.4-4.5)
Symax	Trident	2,067*	69 (63-75)	62	5	13	17	27	0	0.6 (0.3-0.9)	1.6 (1.1-2.2)	2.2 (1.6-2.9)	2.7 (2.0-3.4)	3.4 (2.5-4.3)
Synergy	R3	2,053	66 (59-72)	50	6	29	8	7	0	1.8 (1.2-2.4)	2.3 (1.6-2.9)	2.6 (1.9-3.4)	3.0 (2.0-4.0)	n.a.
Symax	Trident Tritanium	1,738*	67 (61-73)	72	8	34	19	10	1	2.3 (1.6-3.0)	3.6 (2.7-4.5)	4.1 (3.2-5.1)	4.5 (3.4-5.5)	n.a.
Mallory Head Stems	Exceed ABT	1,631	65 (59-71)	31	3	12	14	2	0	0.7 (0.3-1.2)	1.5 (0.9-2.1)	1.6 (1.0-2.2)	2.1 (1.3-2.8)	2.3 (1.4-3.2)
M/L Taper	Allofit IT	1,526	71 (64-76)	50	6	23	15	6	0	2.2 (1.4-2.9)	3.2 (2.2-4.1)	3.8 (2.7-4.9)	4.3 (3.0-5.6)	n.a.
Anthology	R3	1,498	65 (60-69)	43	6	18	6	13	0	2.4 (1.6-3.1)	2.7 (1.9-3.6)	3.6 (2.5-4.7)	3.6 (2.5-4.7)	3.6 (2.5-4.7)
Omnifit HA	Trident	1,495*	63 (57-67)	124	15	61	17	27	4	3.2 (2.3-4.1)	4.6 (3.6-5.7)	6.3 (5.0-7.5)	7.6 (6.3-9.0)	9.4 (7.7-11.1)
CLS Spotorno	RM Classic cup	1,168*	63 (58-68)	60	13	15	24	7	1	1.8 (1.0-2.6)	2.6 (1.7-3.5)	3.1 (2.1-4.1)	3.8 (2.7-4.8)	5.4 (4.0-6.9)
CLS Spotorno	Pinnacle	1,141	67 (62-72)	35	5	12	5	13	0	1.2 (0.6-1.8)	2.2 (1.3-3.0)	2.7 (1.7-3.8)	3.6 (2.2-4.9)	5.6 (3.1-8.0)
SL Plus Mia	R3	1,104	71 (65-77)	29	2	15	4	8	0	1.9 (1.1-2.7)	2.6 (1.6-3.6)	3.2 (1.9-4.5)	3.2 (1.9-4.5)	n.a.
Alloclassic Zweymuller SL	Continuum	1,061	70 (64-77)	19	4	10	1	3	1	0.9 (0.3-1.4)	1.6 (0.8-2.4)	2.1 (1.1-3.0)	2.1 (1.1-3.0)	n.a.
SL Plus	Reflection	1,02	67 (61-73)	35	4	10	13	8	0	1.9 (1.0-2.7)	3.3 (2.2-4.5)	3.7 (2.5-4.9)	3.7 (2.5-4.9)	n.a.
SL Plus	Hofer-Imhoff Lubrimet	968*	70 (64-76)	47	12	23	5	5	2	1.4 (0.6-2.1)	2.3 (1.4-3.2)	3.5 (2.3-4.7)	4.5 (3.2-5.8)	5.3 (3.8-6.8)
Polarstem	Reflection	862	70 (64-76)	15	3	4	2	6	0	2.2 (0.4-2.0)	2.4 (1.1-3.8)	3.4 (1.1-5.6)	n.a.	n.a.
Alloclassic Zweymuller SL	Trilogy	822*	70 (64-76)	30	7	9	7	7	0	1.3 (0.6-2.1)	2.1 (1.2-3.2)	2.7 (1.6-3.8)	3.1 (1.9-4.3)	4.3 (2.7-5.8)
SL Plus	EP-Fit Plus	781*	68 (63-75)	38	10	18	9	1	0	1.4 (0.6-2.3)	3.1 (1.9-4.4)	3.7 (2.3-5.0)	4.9 (3.3-6.5)	5.6 (3.7-7.5)
Alloclassic Zweymuller SL	Alloclassic Variall	766*	71 (64-77)	20	4	8	2	5	1	1.2 (0.4-1.9)	2.0 (1.0-3.0)	2.4 (1.3-3.5)	2.8 (1.6-4.0)	2.8 (1.6-4.0)
CLS Spotorno	Fitmore	754*	66 (61-71)	31	3	12	5	10	1	1.7 (0.8-2.7)	2.3 (1.2-3.3)	2.7 (1.5-3.8)	3.1 (1.9-4.3)	5.1 (3.1-7.0)
DB10	Spidercup	748*	71 (64-77)	29	3	13	6	6	1	1.8 (0.8-2.7)	2.2 91.1-3.2)	2.9 (1.7-4.1)	3.9 (2.4-5.4)	4.9 (2.8-7.0)
CLS Spotorno	Morscher	708	73 (68-78)	33	5	16	12	0	0	1.4 (0.5-2.3)	2.6 (1.4-3.8)	3.4 (2.0-4.8)	4.8 (3.0-6.6)	4.8 (3.0-6.6)
M/L Taper	Continuum	631	68 (63-73)	7	0	7	0	0	0	1.0 (0.2-1.8)	1.4 (0.3-2.6)	n.a.	n.a.	n.a.
CLS Spotorno	RM Pressfit cup	619	66 (60-71)	41	4	15	14	5	3	2.9 (1.6-4.3)	4.8 (3.0-6.5)	5.7 (3.8-7.6)	6.3 (4.3-8.3)	8.0 (5.5-10.5)
CBH stem	RM Pressfit Vitamys cup	589*	65 (60-70)	19	8	4	5	2	0	1.2 (0.3-2.1)	2.4 (1.2-3.6)	3.5 (1.9-5.0)	3.5 (1.9-5.0)	n.a.
Alloclassic Zweymuller SL	Trabecular Metal	548*	68 (62-75)	19	1	6	5	6	1	0.7 (0.0-1.4)	1.8 (0.7-3.0)	2.6 (1.3-3.9)	3.4 (1.8-4.9)	3.4 (1.8-4.9)
CBH stem	RM Pressfit cup	545	75 (69-79)	17	3	5	8	1	0	2.2 (1.0-3.5)	3.0 (1.6-4.5)	3.3 (1.7-4.9)	n.a.	n.a.

* Denotes prosthesis combinations with no reported use in uncemented primary THAs in 2018.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; RA: revision arthroplasty; CI: confidence interval; IQR: interquartile range.

Only combinations of uncemented acetabulum and femur components with over 500 procedures have been listed. These combinations represented 85.1% of all registered uncemented primary total hip arthroplasties.

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 2018, IN PRIMARY TOTAL HIP ARTHROPLASTIES IN THE NETHERLANDS IN 2007-2018.

		Cumulative revision percentage (95% CI)				
Bone cement	**n**	**1yr**	**3yr**	**5yr**	**7yr**	**10yr**
Separately packed bone cement components (n=77,785)						
Palacos R+G	58,586	1.5 (1.4-1.6)	2.4 (2.3-2.5)	2.9 (2.8-3.1)	3.4 (3.2-3.6)	4.0 (3.7-4.3)
Simplex ABC EC	2,587	2.5 (1.9-3.1)	3.7 (2.9-4.5)	4.8 (3.8-5.7)	5.8 (4.7-7.0)	8.1 (6.0-10.1)
Palacos MV+G	3,223	0.8 (0.5-1.1)	1.4 (0.9-1.8)	2.0 (1.4-2.5)	3.3 (2.3-4.2)	n.a.
Refobacin Bone Cement R	5,673	0.8 (0.6-1.1)	1.6 (1.2-2.0)	2.0 (1.6-2.4)	2.6 (2.1-3.0)	3.3 (2.6-3.9)
Synicem1G	188	0.7 (0.0-2.0)	n.a.	n.a.	n.a.	n.a.
Bone cement pre-packed in a vacuum mixing system (n=17,582)						
Refobacin Bone Cement R	9,442	1.8 (1.5-2.1)	2.7 (2.3-3.0)	3.4 (2.9-3.9)	4.0 (3.4-4.6)	n.a.
Palacos R+G	4,173	2.0 (1.5-2.4)	2.9 (2.1-3.8)	n.a.	n.a.	n.a.
Refobacin Plus Bone Cement	3,417	1.1 (0.7-1.4)	1.8 (1.4-2.3)	2.3 (1.7-2.8)	2.6 (2.0-3.3)	2.6 (2.0-3.3)
Refobacin Revision	72	8.5 (2.0-15.0)	n.a.	n.a.	n.a.	n.a.

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

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

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 2007-2018 (N=67,717).

					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**
All cemented THAs for osteoarthritis		**67,716**	**76 (71-80)**	**1,169**	**0.7 (0.6-0.7)**	**1.3 (1.2-1.4)**	**1.8 (1.7-1.9)**	**2.3 (2.1-2.4)**	**2.9 (2.7-3.1)**
Lubinus SPII	IP Cup	12,083	76 (71-80)	195	0.5 (0.4-0.7)	1.3 (1.1-1.6)	1.9 (1.6-2.2)	2.1 (1.8-2.5)	2.7 (2.1-3.3)
Original ME Muller	Muller low profile Durasul	5,868	74 (69-79)	38	0.2 (0.1-0.4)	0.5 (0.3-0.7)	1.0 (0.6-1.3)	1.1 (0.7-1.5)	1.3 (0.8-1.7)
Original ME Muller	Muller low profile	5,502	77 (73-81)	87	0.9 (0.7-1.2)	1.6 (1.2-1.9)	1.8 (1.4-2.2)	2.0 (1.5-2.4)	2.0 (1.5-2.4)
Spectron EF	Reflection All Poly XLPE	4,442	77 (73-81)	69	0.4 (0.2-0.6)	1.0 (0.7-1.3)	1.4 (1.0-1.8)	2.1 (1.6-2.6)	2.5 (1.8-3.1)
Lubinus SPII	FAL Cup	4,224	75 (70-80)	70	0.8 (0.5-1.1)	1.5 (1.1-1.9)	2.0 (1.5-2.5)	2.8 (2.1-3.6)	3.6 (2.4-4.7)
Exeter	Exeter Rimfit X3	3,428	75 (69-80)	46	0.9 (0.6-1.2)	1.3 (0.9-1.8)	1.8 (1.3-2.4)	1.8 (1.3-2.4)	n.a.
Stanmore	Stanmore	3,337	75 (70-80)	57	0.6 (0.4-0.9)	1.4 (1.0-1.9)	1.9 (1.4-2.4)	2.0 (1.5-2.6)	2.4 (1.7-3.1)
Exeter	Exeter Contemporary Hooded	2,738	76 (72-81)	57	0.9 (0.5-1.3)	1.3 (0.9-1.8)	1.7 (1.2-2.3)	2.3 (1.7-3.0)	3.5 (2.5-4.5)
Lubinus SPII	SHP	2,420*	75 (71-80)	39	0.3 (0.1-0.5)	0.7 (0.3-1.0)	1.0 (0.6-1.4)	1.6 (1.1-2.1)	2.1 (1.4-2.8)
Exeter	Exeter	2,429*	73 (68-79)	82	1.7 (1.2-2.2)	2.4 (1.8-3.1)	3.0 (2.3-3.7)	3.6 (2.8-4.4)	4.4 (3.4-5.5)

[1] Revision of at least the acetabulum or femur component.
* Denotes prosthesis combinations with no reported use in primary THAs in 2018.
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 2007-2018 (N=160,066).

					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
All uncemented THAs for osteoarthritis		**160,066**	**68 (61-74)**	**4,020**	**1.2 (1.1-1.2)**	**2.1 (2.0-2.1)**	**2.7 (2.6-2.8)**	**3.3 (3.2-3.4)**	**4.3 (4.1-4.4)**
Corail	Pinnacle	26,604	69 (62-75)	417	0.8 (0.7-1.0)	1.5 (1.3-1.6)	1.9 (1.7-2.1)	2.3 (2.1-2.6)	3.3 (2.7-3.8)
Alloclassic Zweymuller SL	Allofit	13,329	70 (64-76)	295	0.9 (0.7-1.1)	1.6 (1.4-1.8)	2.1 (1.9-2.4)	2.6 (2.3-2.9)	3.2 (2.8-3.6)
CLS Spotorno	Allofit	9,207	65 (59-69)	258	1.9 (1.6-2.1)	2.6 (2.3-2.9)	3.0 (2.6-3.4)	3.5 (3.0-3.9)	4.3 (3.3-5.3)
Taperloc Complete	Allofit	7,014	68 (61-73)	63	0.9 (0.7-1.2)	1.2 (0.8-1.5)	1.2 (0.8-1.5)	n.a.	n.a.
Taperloc Complete	Exceed ABT	6,828	69 (63-75)	87	1.1 (0.8-1.3)	1.5 (1.2-1.8)	1.5 (1.2-1.8)	1.7 (1.2-2.2)	n.a.
Accolade	Trident	6,647	69 (62-76)	177	1.1 (0.9-1.4)	2.5 (2.1-2.9)	3.5 (2.9-4.0)	3.9 (3.3-4.5)	4.7 (3.8-5.6)
Mallory Head Stems	Mallory Head	5,932	65 (60-69)	110	1.0 (0.7-1.2)	1.5 (1.2-1.8)	1.8 (1.4-2.1)	2.2 (1.7-2.6)	2.6 (2.1-3.1)
Taperloc Hip system	Exceed ABT	3,806	68 (62-74)	75	1.0 (0.7-1.4)	1.8 (1.4-2.2)	2.1 (1.6-2.6)	2.3 (1.8-2.7)	2.3 (1.8-2.7)
Taperloc Hip system	Mallory Head	3,651	67 (61-71)	90	1.1 (0.7-1.4)	2.0 (1.5-2.4)	2.3 (1.7-2.8)	3.1 (2.4-3.8)	3.6 (2.7-4.5)
Accolade	Trident Tritanium	3,590	68 (62-74)	46	0.5 (0.3-0.7)	1.2 (0.8-1.6)	2.0 (1.4-2.6)	2.0 (1.4-2.6)	n.a.

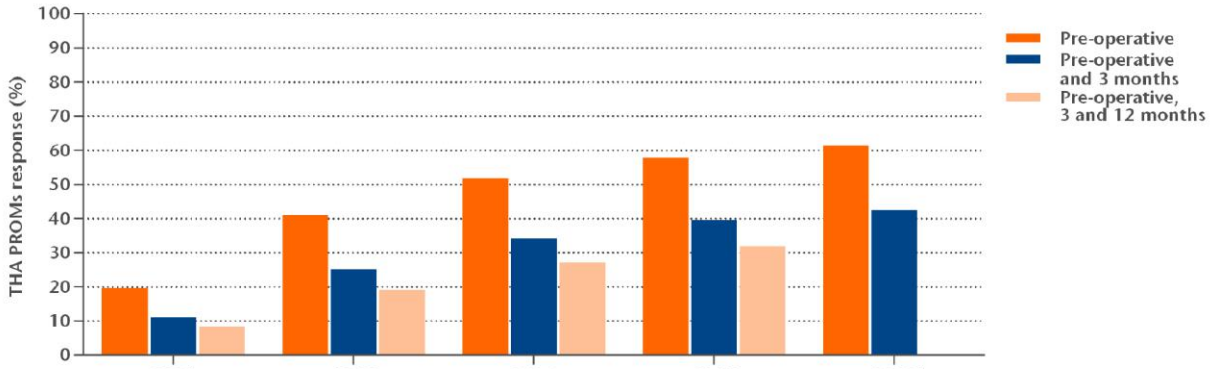
[1] Revision of at least the acetabulum or femur component.
Please note: n.a. if <50 cases were at risk; THA: total hip arthroplasty; CI: confidence interval; IQR: interquartile range.

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

PROMs

Response 2014-2018

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 2014-2018.



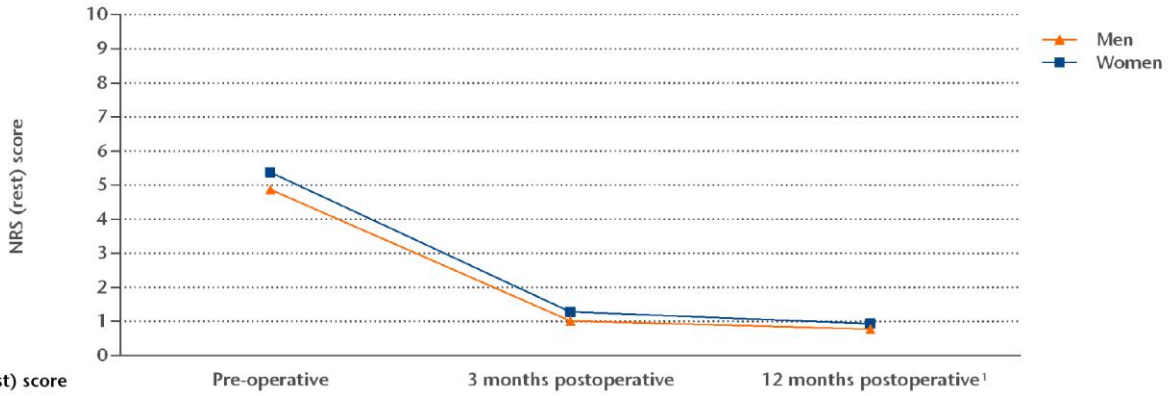
Year	2014	2015	2016	2017	2018[1]
THA for osteoarthritis (n)	22,782	23,456	24,034	25,214	26,623
THA PROMs response (%)					
Pre-operative	19.7	41.1	51.8	57.9	61.4
Pre-operative and 3 months postoperative	11.1	25.0	34.2	39.6	42.6
Pre-operative, 3 and 12 months postoperative	8.3	19.3	27.2	31.9	n.a.

[1] The 12 months postoperative PROMs response percentage is not (yet) available for 2018. The 3 months postoperative response percentage is not (yet) available after October 1st 2018. In total, 19,538 patients underwent a THA for osteoarthritis between January 1st and October 1st 2018.
THA: total hip arthroplasty; PROM: patient reported outcome measure.

Mean scores (preoperative, 3 months and 12 months)

NRS (rest)

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (REST) SCORES OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



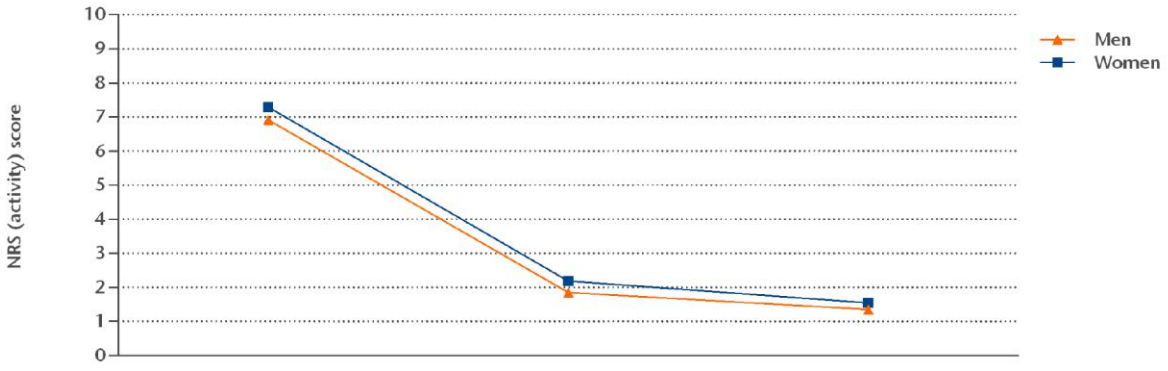
NRS (rest) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	19,624	4.9 (4.8-4.9)	14,527	1.0 (1.0-1.0)	10,505	0.8 (0.7-0.8)
Women	36,750	5.4 (5.3-5.4)	26,134	1.3 (1.3-1.3)	18,755	0.9 (0.9-1.0)
Total[2]	56,401	5.2 (5.2-5.2)	40,678	1.2 (1.2-1.2)	29,273	0.9 (0.9-0.9)

[1] The 12 months NRS (rest) score is not (yet) available for 2018.
[2] Also contains 57 (0.5%) NRS (rest) scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

NRS (activity)

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (ACTIVITY) SCORES OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



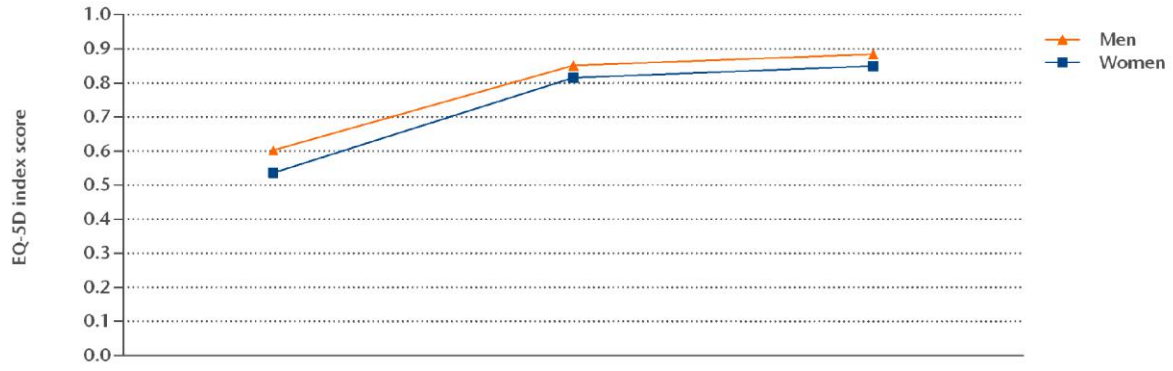
NRS (activity) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	19,699	6.9 (6.9-6.9)	14,548	1.8 (1.8-1.9)	10,562	1.4 (1.2-1.4)
Women	36,868	7.3 (7.3-7.3)	26,164	2.2 (2.2-2.2)	18,831	1.6 (1.5-1.6)
Total[2]	56,401	7.2 (7.1-7.2)	40,729	2.1 (2.0-2.1)	29,406	1.5 (1.5-1.5)

[1] The 12 months NRS (activity) score is not (yet) available for 2018.
[2] Also contains 57 (0.04%) NRS (activity) scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

EQ5D index score

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE EQ-5D INDEX SCORES OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



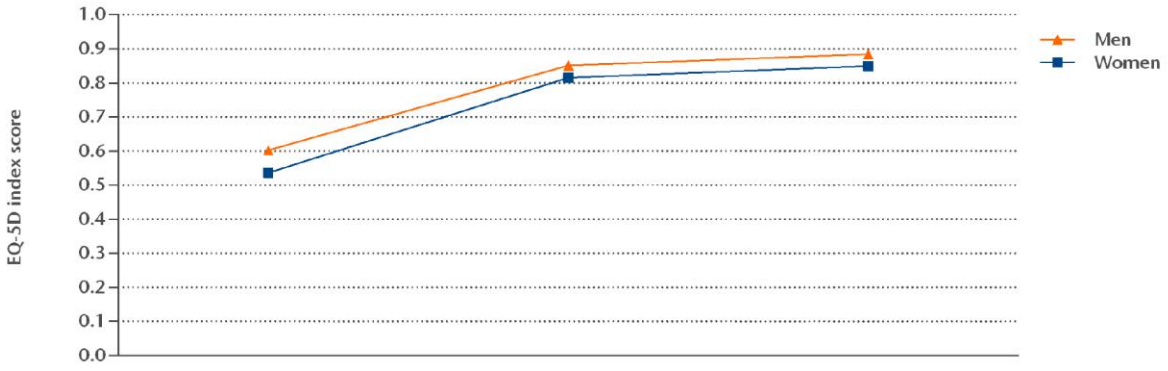
EQ-5D index score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	19,835	0.60 (0.60-0.61)	14,480	0.85 (0.85-0.85)	10,785	0.88 (0.88-0.89)
Women	37,077	0.54 (0.53-0.54)	25,870	0.81 (0.81-0.82)	19,104	0.85 (0.85-0.85)
Total[2]	56,940	0.56 (0.56-0.56)	40,367	0.83 (0.83-0.83)	29,902	0.86 (0.86-0.86)

[1] The 12 months EQ-5D index score is not (yet) available for 2018.
[2] Also contains 58 (0.05%) EQ-5D index scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

EQ5D thermometer

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE EQ-5D THERMOMETER SCORES OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



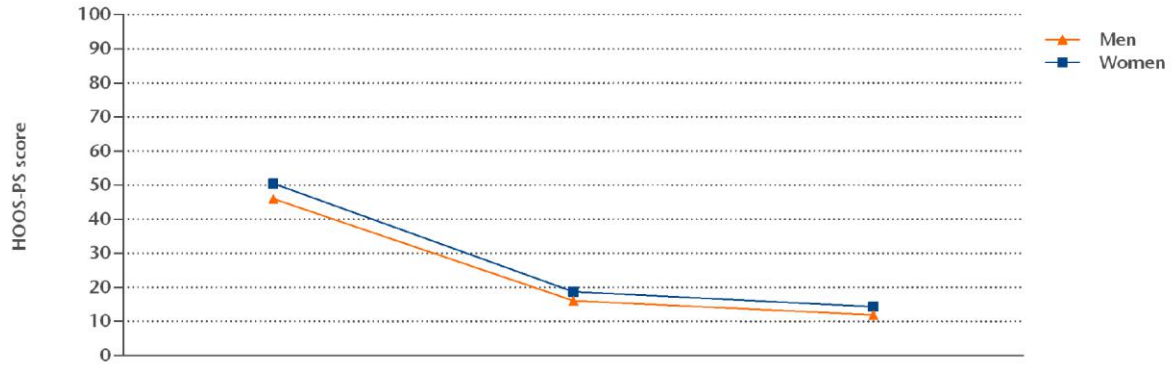
EQ-5D thermometer score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	19,830	67.5 (67.2-67.8)	14,561	77.9 (77.6-78.2)	10,918	78.3 (77.9-78.6)
Women	36,980	63.9 (63.8-64.2)	26,124	74.9 (74.7-75.2)	19,406	75.5 (75.2-75.8)
Total[2]	56,837	65.2 (65.1-65.4)	40,702	76.0 (75.8-76.2)	30,337	76.5 (76.3-76.7)

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2018.
[2] Also contains 57 (0.04%) EQ-5D thermometer scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

HOOS-PS score

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE HOOS-PS SCORES OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



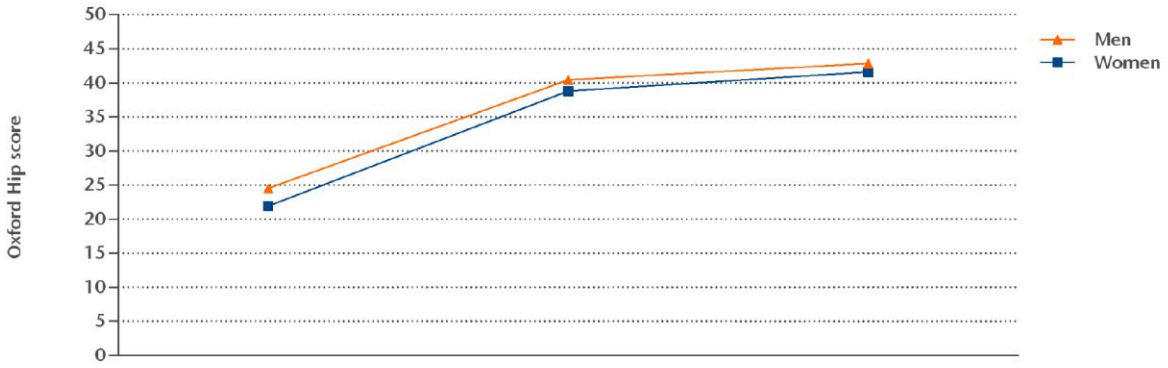
HOOS-PS score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	19,032	46.0 (45.8-46.3)	13,506	16.1 (15.9-16.3)	10,210	12.0 (11.7-12.2)
Women	34,646	50.5 (50.3-50.7)	23,258	18.7 (18.5-18.9)	17,372	14.3 (14.1-14.6)
Total[2]	53,706	48.9 (48.8-49.1)	36,781	17.8 (17.6-17.9)	27,595	13.5 (13.3-13.6)

[1] The 12 months HOOS-PS score is not (yet) available for 2018.
[2] Also contains 58 (0.05%) HOOS-PS scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

Oxford Hip score

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE OXFORD HIP SCORES OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



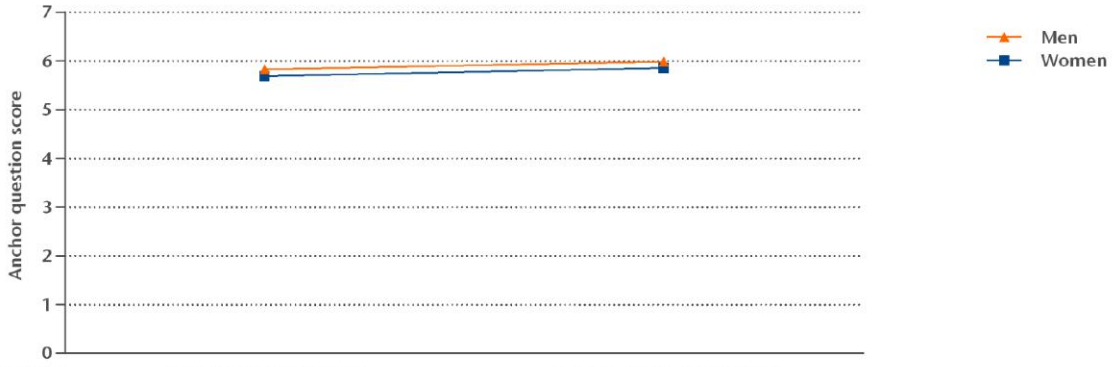
Oxford Hip score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	17,813	24.5 (24.4-24.6)	12,906	40.4 (40.3-40.5)	9,531	42.8 (42.6-42.9)
Women	33,191	21.9 (21.8-22.0)	22,786	38.8 (38.7-38.9)	16,806	41.6 (41.5-41.7)
Total[2]	51,029	22.8 (22.8-22.9)	35,708	39.4 (39.3-39.5)	26,348	42.0 (42.0-42.1)

[1] The 12 months Oxford Hip score is not (yet) available for 2018.
[2] Also contains 52 (0.05%) Oxford Hip scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

Anchor question: Daily functioning

FIGURE MEAN 3 MONTHS AND 12 MONTHS POSTOPERATIVE CHANGE IN DAILY FUNCTIONING OF PATIENTS WHO UNDERWENT A THA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



Anchor question score	3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	13,631	5.8 (5.8-5.9)	10,445	6.0 (6.0-6.0)
Women	24,460	5.7 (5.7-5.7)	18,626	5.9 (5.8-5.9)
Total[2]	38,108	5.7 (5.7-5.8)	29,084	5.9 (5.9-5.9)

[1] The 12 months anchor question score is not (yet) available for 2018.
[2] Also contains 30 (0.04%) anchor question scores of patients whose gender was registered as unknown.
THA: total hip arthroplasty; CI: confidence interval.

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

Knee arthroplasty

Numbers

Registered procedures 2007-2018

TABLE NUMBER OF REGISTERED KNEE ARTHROPLASTIES PER YEAR OF SURGERY (2007-2018) IN THE LROI IN APRIL 2019.

Year of surgery	Type of knee arthroplasty						Total (n)
	Total arthroplasty (n)	Unicondylar arthroplasty (n)	Patellofemoral arthroplasty (n)	Other (n)	Unknown/ missing (n)	Revision arthroplasty (n)	
2007	7,037	773	47	42	840	596	9,335
2008	11,749	1,211	92	61	356	908	14,377
2009	16,789	1,548	139	62	114	1,301	19,953
2010	18,500	1,717	144	78	166	1,625	22,230
2011	19,521	1,586	116	80	130	1,794	23,227
2012	21,719	1,578	172	91	175	2,118	25,853
2013	22,304	1,804	135	29	185	2,309	26,766
2014	24,242	2,364	116	27	94	2,559	29,402
2015	24,243	2,692	157	10	39	2,684	29,825
2016	24,882	2,948	144	5	94	2,925	30,998
2017	25,618	3,663	168	11	24	3,055	32,539
2018	25,569	4,011	181	10	19	2,901	32,691
Total	242,173	25,895	1,611	506	2,236	24,775	297,196

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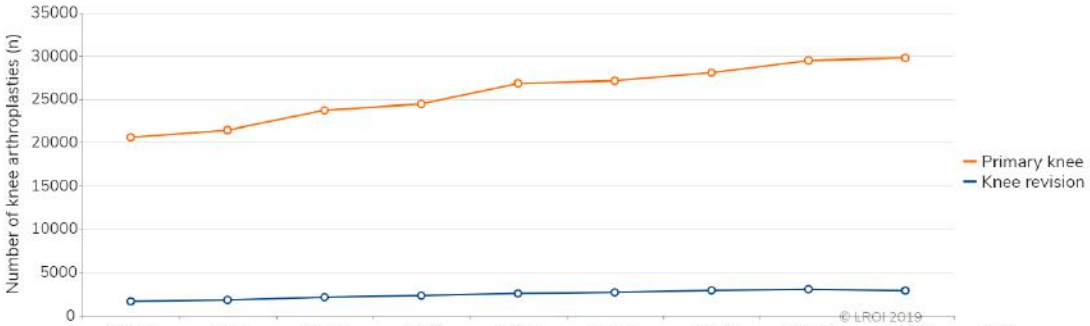
The LROI is nearly complete as of 2010. Therefore, a dotted line was inserted between 2009 and 2010.

Type of procedures 2010-2018

FIGURE NUMBER OF PRIMARY KNEE ARTHROPLASTIES AND KNEE REVISION ARTHROPLASTIES REGISTERED IN THE LROI IN THE NETHERLANDS IN 2010-2018.

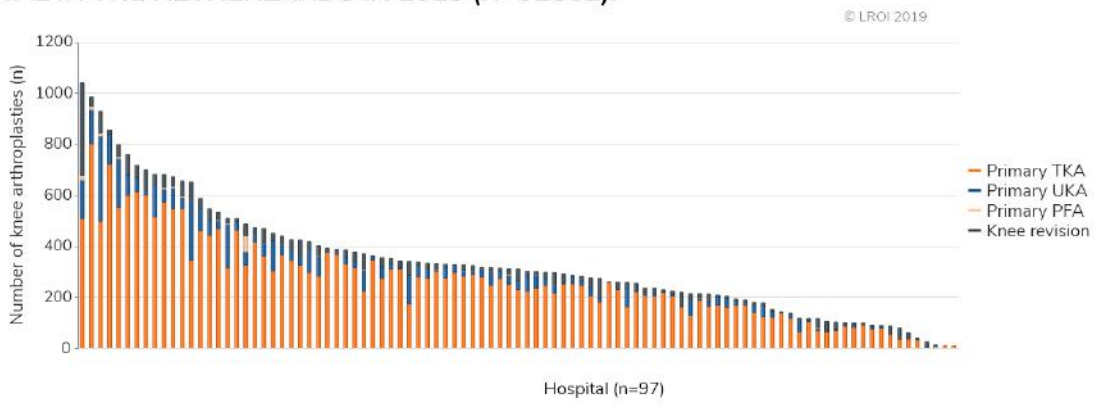


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Type of procedure (n)										
Primary knee	20,605	21,433	23,735	24,457	26,843	27,141	28,073	29,484	29,790	**231,561**
Knee revision	1,625	1,794	2,118	2,309	2,559	2,684	2,925	3,055	2,901	**21,970**
Total:	**22,230**	**23,227**	**25,853**	**26,766**	**29,402**	**29,825**	**30,998**	**32,539**	**32,691**	**253,531**

Out of 29,790 primary total knee arthroplasties that were performed in 2018, 3% (n=883) was performed bilaterally.

Type of procedure per hospital

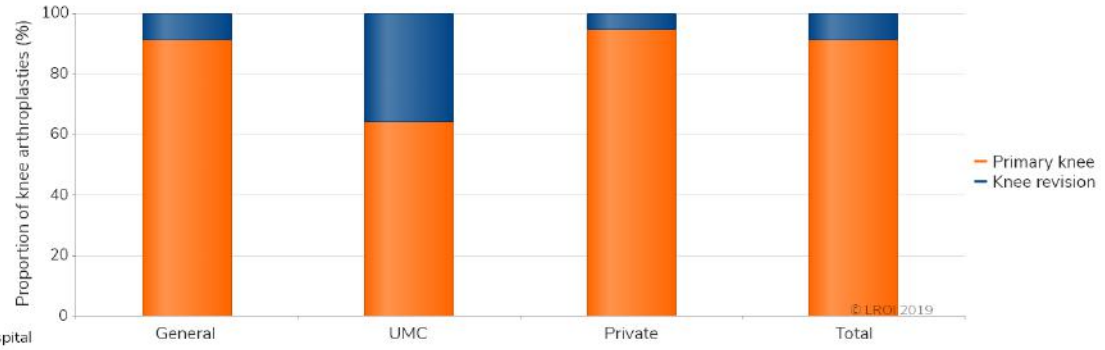
FIGURE NUMBER OF PRIMARY KNEE ARTHROPLASTIES AND KNEE REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=32662).



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 2018.

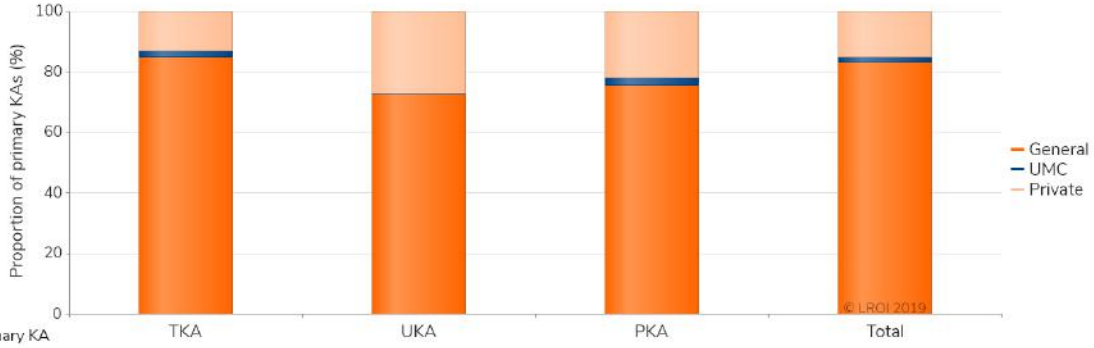


Type of hospital	General	UMC	Private	Total
Type of procedure (%)				
Primary knee	91.30	64.31	94.63	**91.13**
Knee revision	8.70	35.69	5.37	**8.87**
Total (n):	**27,149**	**793**	**4,749**	**32,691**

Please note: In 2018, 74 general hospitals, 8 UMCs and 15 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 2018.

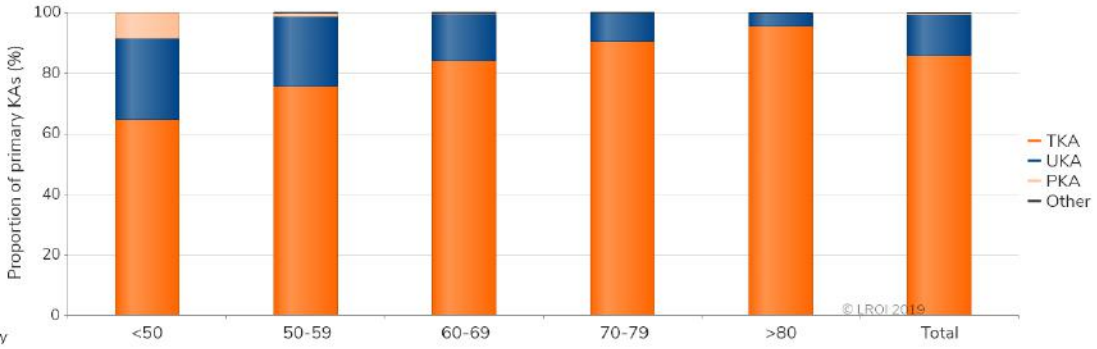


Type of primary KA	TKA	UKA	PKA	Total
Type of hospital (%)				
General	84.94	72.58	75.69	**83.22**
UMC	1.93	0.32	2.21	**1.71**
Private	13.13	27.10	22.10	**15.07**
Total (n):	**25,569**	**4,011**	**181**	**29,761**

Please note: In 2018, 10 (0.03%) primary knee arthroplasties were registered in the LROI as other type of primary knee arthroplasty. Of 19 (0.06%) primary knee arthroplasties, the type of prosthesis was not registered.
KA: knee arthroplasty; TKA: total knee arthroplasty; UKA: unicondylar knee arthroplasty; PKA: patellofemoral knee arthroplasty.
General: general hospital; UMC: university medical centre; Private: private hospital.

Type of primary knee prosthesis by age category

FIGURE TYPE OF PRIMARY KNEE ARTHROPLASTY (PROPORTION [%] PER CATEGORY) OF PATIENTS WHO UNDERWENT A PRIMARY KNEE ARTHROPLASTY BY AGE CATEGORY IN THE NETHERLANDS IN 2018.



Age category	<50	50-59	60-69	70-79	>80	Total
Type of primary knee arthroplasty (%)						
TKA	64.63	75.76	84.13	90.55	95.67	**85.88**
UKA	26.99	22.83	15.46	9.28	4.23	**13.47**
PKA	8.38	1.37	0.37	0.16	0.06	**0.61**
Other	0.00	0.04	0.05	0.02	0.03	**0.03**
Total (n):	**704**	**4,735**	**10,383**	**10,802**	**3,144**	**29,768**

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

Primary knee arthroplasty

Demographics

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 2018.

N	TKA (n=25,569)	UKA (n=4,011)	PFA (n=181)	Total[1] (n=29,790)
Completeness (%)				99
Mean age (years) (SD)	68.9 (9.1)	64.0 (8.9)	55.2 (10.7)	68.1 (9.3)
Age (years) (%)				
<50	2	5	33	2
50-59	14	27	36	16
60-69	34	40	21	35
70-79	38	25	9	36
≥80	3	3	1	11
Gender (%)				
Men	37	46	23	38
Women	63	54	77	62
ASA score (%)				
I	12	20	29	13
II	66	67	61	66
III-IV	22	13	10	21
Type of hospital (%)				
General	85	73	76	83
UMC	2	0	2	2
Private	13	27	22	15
Diagnosis (%)				
Osteoarthritis	97	99	94	97
Post-traumatic	1	0	5	1
Rheumatoid arthritis	1	0	0	1
Osteonecrosis	1	1	0	1
Other	0	0	1	0
Charnley-score (%)				
A One knee joint affected	39	52	54	41
B1 Both knee joints affected	35	30	31	34
B2 Contralateral knee joint with a total knee prosthesis	22	17	14	22
C Multiple joints affected or chronic disease that affects quality of life	4	1	1	3
Body Mass Index (kg/m²) (%)				
Underweight (≤18,5)	0	0	1	0
Normal weight (>18,5-25)	17	17	27	17
Overweight (>25-30)	41	45	39	41
Obesity (>30-40)	38	36	32	38
Morbid obesity (>40)	4	2	1	4
Smoking (%)				
No	92	91	86	92
Yes	8	9	14	8

[1] Also contains 10 (0.03%) primary knee arthroplasties that were registered as other and 19 (0.06%) primary knee arthroplasties of which the type of prosthesis had not been registered.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary knee arthroplasties are included.
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 2018.

N	Osteoarthritis (n=28,872)	Post-traumatic (n=355)	Rheumatoid arthritis (n=289)	Osteonecrosis (n=130)	Total (n=29,790)
Completeness (%)					99
Mean age (years) (SD)	68.2 (9.2)	62.8 (10.9)	65.8 (10.4)	68.9 (12.1)	68.1 (9.3)
Age (years) (%)					
<50	2	11	7	8	2
50-59	16	25	19	11	16
60-69	35	36	34	24	35
70-79	36	23	31	39	36
≥80	11	5	9	18	11
Gender (%)					
Men	38	42	25	32	38
Women	62	58	75	68	62
ASA score (%)					
I	13	20	1	10	13
II	66	67	66	56	66
III-IV	21	13	33	34	21
Type of hospital (%)					
General	83	76	86	83	83
UMC	2	8	7	5	2
Private	15	16	7	12	15
Charnley-score (%)					
A One knee joint affected	41	80	17	75	41
B1 Both knee joints affected	34	15	39	8	34
B2 Contralateral knee joint with a total knee prosthesis	22	3	21	11	22
C Multiple joints affected or chronic disease that affects quality of life	3	2	23	6	3
Body Mass Index (kg/m²) (%)					
Underweight (≤18,5)	0	1	1	0	0
Normal weight (>18,5-25)	17	24	24	22	17
Overweight (>25-30)	41	46	39	42	41
Obesity (>30-40)	38	28	34	32	38
Morbid obesity (>40)	4	1	2	4	4
Smoking (%)					
No	92	86	91	85	92
Yes	8	14	9	15	8

Please note: In 2018, 120 (0.4%) patients had a primary knee arthroplasty after a diagnosis that is not listed in the table. Of 24 (0.08%) primary knee arthroplasties the diagnosis was not registered.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary knee arthroplasties are included; General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

Age category 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN AGE CATEGORY IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Age category (%)										
<50	2.63	2.90	2.79	2.64	2.38	2.41	2.02	2.28	1.78	**2.39**
50-59	14.92	14.82	15.57	15.06	14.75	14.88	14.39	14.33	14.03	**14.72**
60-69	34.50	34.62	35.87	36.68	37.10	36.07	36.51	35.05	34.17	**35.65**
70-79	34.32	34.52	33.65	33.99	34.14	35.06	35.85	36.71	38.26	**35.27**
>80	13.64	13.15	12.13	11.63	11.63	11.58	11.23	11.63	11.77	**11.97**
Total (n):	**18,470**	**19,479**	**21,669**	**22,260**	**24,212**	**24,233**	**24,859**	**25,614**	**25,566**	**206,362**

TKA: total knee arthroplasty.

Previous surgery 2014-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN PREVIOUS SURGERIES TO THE SAME JOINT IN PATIENTS WHO UNDERWENT A PRIMARY KNEE ARTHOPLASTY IN THE NETHERLANDS IN 2014-2018.

Year	**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
Primary knee arthroplasty (n)	26,021	26,473	27,802	29,354	28,125	137,775
Previous surgery to the relevant knee (total) Proportion[1] (%)	35.7	34.5	33.4	28.1	25.2	31.3
Meniscectomy	29.1	28.2	26.9	22.3	20.5	25.3
Arthroscopy	18.3	19.4	19.5	17.2	15.5	18.0
Osteotomy	3.1	3.1	2.8	2.9	2.8	2.9
Osteosynthesis	1.8	1.8	1.4	1.5	1.5	1.6
ACL reconstruction	1.4	1.5	1.5	1.5	1.4	1.4
Synovectomy	1.2	1.2	1.1	0.8	0.6	1.0
Other	3.4	3.1	3.1	3.0	3.0	3.1

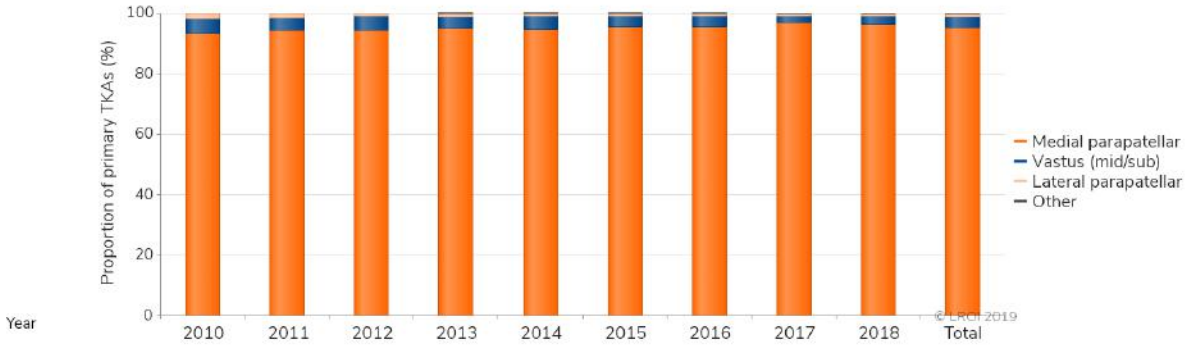
[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patiens with one or more previous surgeries to the same joint.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on previous surgeries in case of a bilateral arthroplasty were excluded. As of this annual report, all primary knee arthroplasties are included.

Total knee arthroplasty

Surgical techniques

Surgical approach 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY TOTAL KNEE ARTHROPLASTY IN THE NETHERLANDS IN 2010-2018.



Surgical approach (%)										
Medial parapatellar	93.32	94.35	94.26	95.08	94.68	95.62	95.55	96.84	96.33	**95.22**
Vastus (mid/sub)	4.83	4.09	4.66	3.72	4.17	3.38	3.52	2.16	2.73	**3.62**
Lateral parapatellar	1.85	1.56	1.08	1.05	0.95	0.96	0.86	0.87	0.85	**1.08**
Other	0.00	0.00	0.00	0.16	0.20	0.05	0.08	0.12	0.09	**0.08**
Total (n):	**18,108**	**19,118**	**21,288**	**21,996**	**24,096**	**24,156**	**24,862**	**25,613**	**25,567**	**204,804**

TKA: total knee arthroplasty.

Fixation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

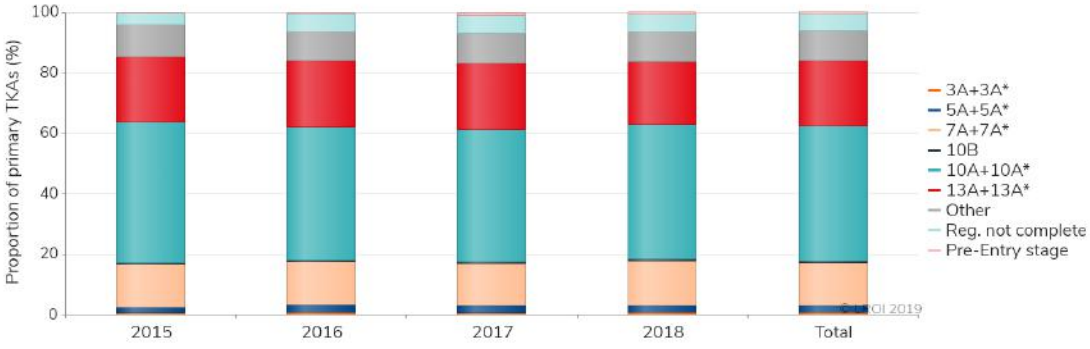
Fixation (%)										
Cemented	87.04	87.86	89.84	91.52	92.82	92.97	93.21	93.24	93.39	**91.58**
Uncemented	6.05	6.02	5.48	4.49	3.41	3.66	3.72	4.08	3.85	**4.42**
Hybrid: tibia	6.71	5.81	4.56	3.94	3.72	3.34	3.02	2.63	2.70	**3.90**
Hybrid: patella	0.16	0.23	0.07	0.02	0.00	0.00	0.02	0.01	0.02	**0.05**
Hybrid: femur	0.04	0.08	0.05	0.04	0.04	0.02	0.03	0.04	0.04	**0.04**
Total (n):	**18,035**	**19,096**	**21,315**	**22,031**	**24,011**	**24,072**	**24,769**	**25,504**	**25,443**	**204,276**

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 2015-2018.

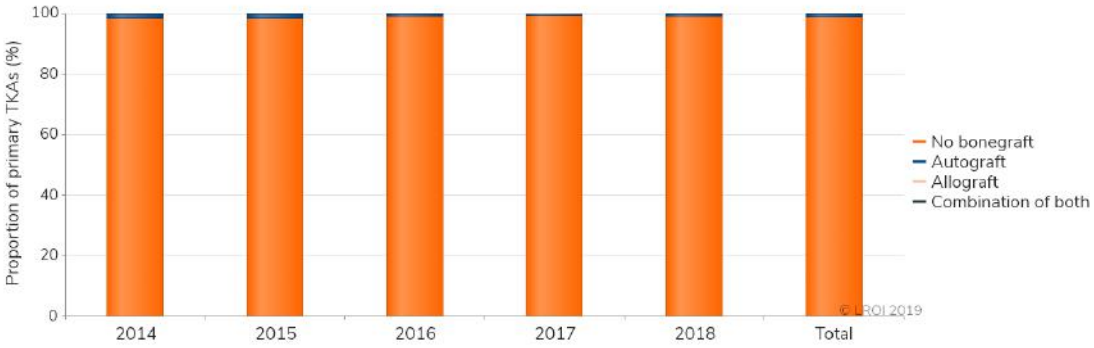


Year	2015	2016	2017	2018	Total
ODEP rating (%)					
3A+3A*	0.54	0.86	0.58	0.90	**0.72**
5A+5A*	2.00	2.50	2.69	2.18	**2.35**
7A+7A*	14.22	14.11	13.80	14.90	**14.26**
10B	0.47	0.58	0.61	0.36	**0.51**
10A+10A*	46.25	44.22	43.74	44.59	**44.68**
13A+13A*	21.67	21.69	21.73	20.75	**21.45**
Other	10.55	9.48	9.76	9.90	**9.92**
Reg. not complete	4.19	6.21	6.21	5.80	**5.62**
Pre-Entry stage	0.11	0.35	0.88	0.63	**0.50**
Total (n):	**24,243**	**24,882**	**25,618**	**25,569**	100,312

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

Type of bonegraft 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF BONEGRAFT IN PRIMARY TOTAL KNEE ARTHROPLASTY IN THE NETHERLANDS IN 2014-2018.

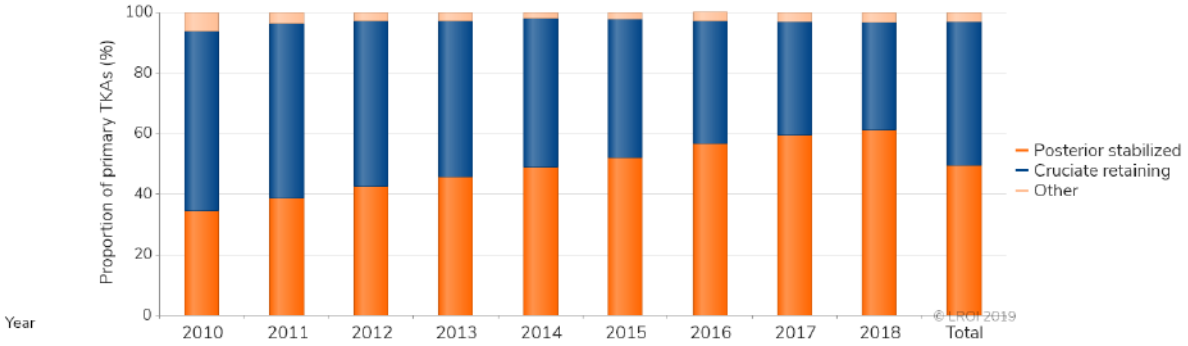


Year	2014	2015	2016	2017	2018	Total
Type of bonegraft (%)						
No bonegraft	98.55	98.39	98.94	99.22	99.02	**98.83**
Autograft	1.39	1.55	1.01	0.75	0.93	**1.12**
Allograft	0.03	0.02	0.03	0.02	0.03	**0.03**
Combination of both	0.03	0.03	0.02	0.00	0.02	**0.02**
Total (n):	**23,758**	**24,082**	**24,847**	**25,584**	**25,550**	123,821

TKA: total knee arthroplasty.

Type of femur component 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FEMUR COMPONENT IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

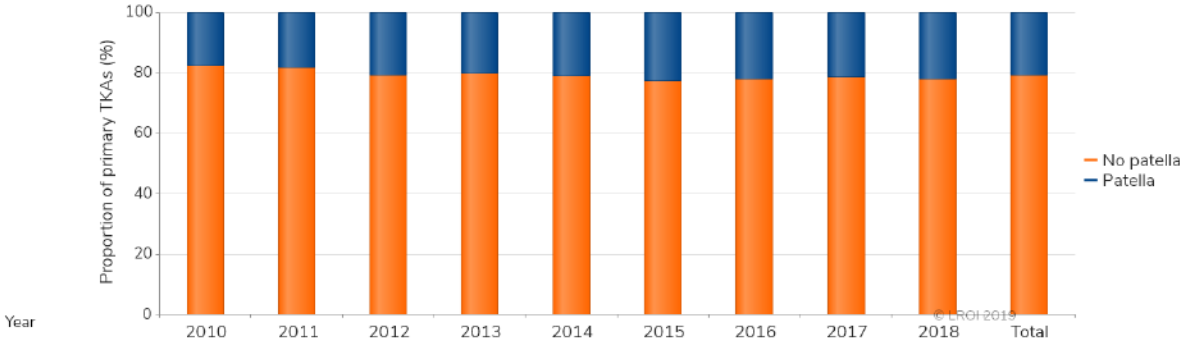


Type of femur component (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Posterior stabilized	34.41	38.54	42.61	45.77	48.83	52.04	56.56	59.50	61.33	**49.64**
Cruciate retaining	59.35	57.85	54.65	51.51	49.19	45.87	40.84	37.55	35.48	**47.33**
Other	6.23	3.61	2.74	2.71	1.97	2.09	2.61	2.95	3.19	**3.03**
Total (n):	**18,324**	**19,333**	**21,517**	**22,130**	**24,021**	**23,769**	**23,723**	**24,373**	**24,593**	**201,783**

TKA: total knee arthroplasty.

Implantation of patella 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN IMPLANTATION OF PATELLA IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Implantation of patella (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
No patella	82.21	81.60	79.01	79.64	78.75	77.48	77.98	78.58	77.90	**79.08**
Patella	17.79	18.40	20.99	20.36	21.25	22.52	22.02	21.42	22.10	**20.92**
Total (n):	**18,500**	**19,521**	**21,719**	**22,304**	**24,242**	**24,243**	**24,882**	**25,618**	**25,569**	**206,598**

TKA: total knee arthroplasty.

Materials

Femur component 2010-2018

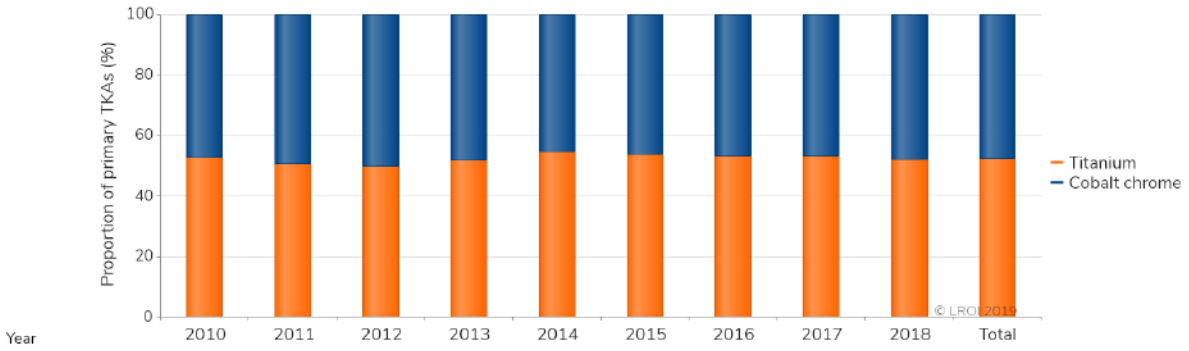
FIGURE TREND (PROPORTION [%] PER YEAR) IN FEMUR MATERIAL IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Femur material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Cobalt chrome	97.44	97.55	97.72	97.91	97.49	97.52	97.52	97.73	98.21	**97.69**
Oxidized zirconium	2.52	2.34	2.18	1.91	2.26	2.16	2.12	2.00	1.48	**2.09**
Titanium	0.04	0.11	0.10	0.15	0.20	0.24	0.31	0.23	0.27	**0.19**
Ceramics	0.00	0.00	0.00	0.03	0.05	0.08	0.05	0.04	0.03	**0.03**
Total (n):	**18,322**	**19,333**	**21,515**	**22,129**	**24,020**	**23,767**	**23,717**	**24,370**	**24,586**	**201,759**

TKA: total knee arthroplasty.

Tibia component 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TIBIA MATERIAL IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Tibia material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Titanium	52.61	50.67	49.85	51.80	54.68	53.75	53.28	53.19	52.09	**52.51**
Cobalt chrome	47.39	49.33	50.15	48.20	45.32	46.25	46.72	46.81	47.91	**47.49**
Total (n):	**18,271**	**19,275**	**21,444**	**22,085**	**24,010**	**23,797**	**24,011**	**24,611**	**24,638**	**202,142**

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

Insert 2010-2018

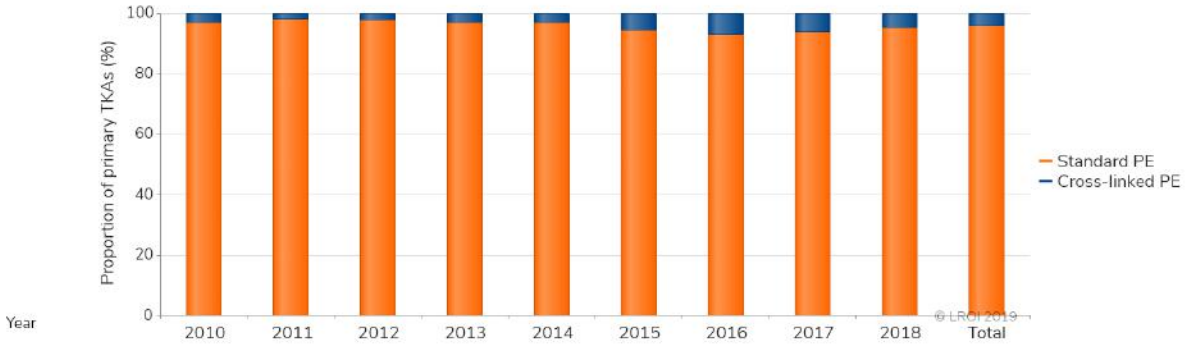
FIGURE TREND (PROPORTION [%] PER YEAR) IN INSERT MATERIAL IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Insert material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Standard PE	95.68	95.44	94.84	93.60	93.11	91.85	90.48	89.03	87.49	**92.11**
Cross-linked PE	4.32	4.56	5.16	6.40	6.89	8.15	9.52	10.97	12.51	**7.89**
Total (n):	**17,463**	**18,473**	**20,722**	**21,516**	**23,575**	**23,434**	**23,902**	**24,466**	**24,857**	**198,408**

TKA: total knee arthroplasty; PE: polyethylene.

Patella component 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN PATELLA MATERIAL IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Patella material (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Standard PE	96.94	98.02	97.82	97.04	96.84	94.47	93.05	93.83	95.11	**95.70**
Cross-linked PE	3.06	1.98	2.18	2.96	3.16	5.53	6.95	6.17	4.89	**4.30**
Total (n):	**3,201**	**3,530**	**4,489**	**4,464**	**5,057**	**5,228**	**5,264**	**5,267**	**5,455**	**41,955**

TKA: total knee arthroplasty; PE: polyethylene.

Bone cement

Antibiotics 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Bone cement antibiotics (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Gentamicin	87.66	87.56	89.74	89.81	91.46	93.03	96.29	98.13	98.53	**92.88**
Erythromycin + Colistin	3.90	4.47	4.24	4.47	4.01	2.57	0.69	0.47	0.32	**2.65**
Tobramycin	4.09	3.22	3.26	3.41	2.71	2.90	2.21	0.62	0.00	**2.38**
No antibiotics	4.26	4.64	2.56	2.17	1.71	1.39	0.67	0.69	1.01	**1.96**
Gentamicin + Clindamycin	0.09	0.11	0.20	0.15	0.11	0.11	0.15	0.09	0.15	**0.13**
Total (n):	**15,101**	**16,836**	**19,029**	**19,982**	**21,593**	**21,774**	**22,579**	**22,234**	**21,858**	**180,986**

Please note: Bone cement with gentamicin and vancomycin was used in 9 (<0.01%) primary TKAs in 2015-2018.
TKA: total knee arthroplasty.

Viscosity 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN BONE CEMENT VISCOSITY IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

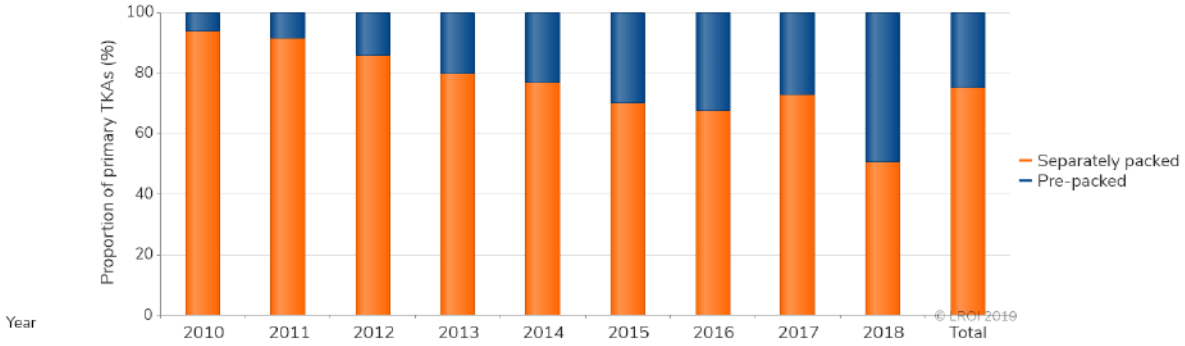
Bone cement viscosity (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
High	85.58	86.69	87.02	86.61	87.57	89.35	93.52	95.79	98.17	**90.40**
Medium	14.42	13.31	12.98	13.39	12.43	10.65	6.48	4.21	1.83	**9.60**
Total (n):	**15,092**	**16,835**	**19,024**	**19,981**	**21,593**	**21,776**	**22,580**	**22,234**	**21,864**	**180,979**

Please note: Low viscosity in bone cement was used in 16 (<0.01%) primary TKAs in 2010-2013.
TKA: total knee arthroplasty.

Vacuum mixing system 2010-2018

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 2010-2018.



Vacuum mixing system (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Separately packed	93.75	91.37	85.64	79.57	76.82	70.12	67.65	72.73	50.55	**75.19**
Pre-packed	6.25	8.63	14.36	20.43	23.18	29.88	32.35	27.27	49.45	**24.81**
Total (n):	**15,101**	**16,836**	**19,029**	**19,982**	**21,593**	**21,776**	**22,580**	**22,234**	**21,864**	**180,995**

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 2018 (N=24,591).

Name	Proportion (%)
Genesis II	24.9
NexGen	22.2
Vanguard Complete Knee	21.7
PFC / SIGMA	9.5
LCS	8.8

Types of bone cement

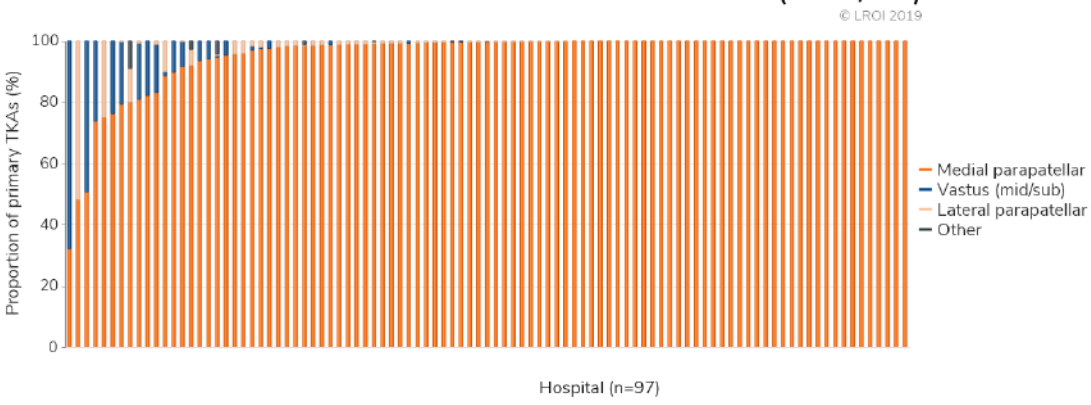
TABLE THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT BY TYPE OF MIXING SYSTEM USED DURING PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Separately packed bone cement components (n=11,045)		Bone cement pre-packed in a vacuum mixing system (n=10,804)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	90.0	Refobacin Bone Cement R	49.0
Palacos MV+G	3.0	Palacos R+G	40.9
Refobacin Bone Cement R	2.3	Refobacin Plus Bone Cement	10.1
Biomet Plus Bone Cement	1.5	Refobacin Revision	<0.01
Synicem1G	1.3		

Practice variation

Surgical approach

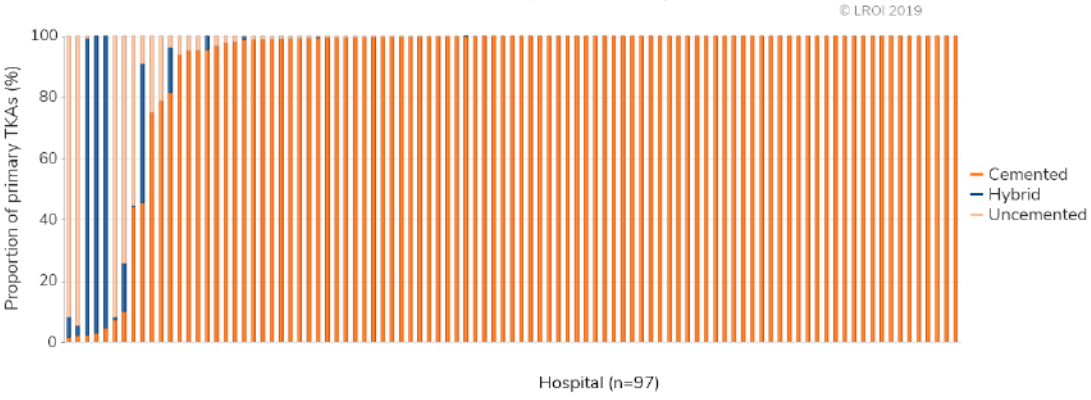
FIGURE DISTRIBUTION OF SURGICAL APPROACH USED DURING PRIMARY TOTAL KNEE ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=25,567).



TKA: total knee arthroplasty.

Fixation

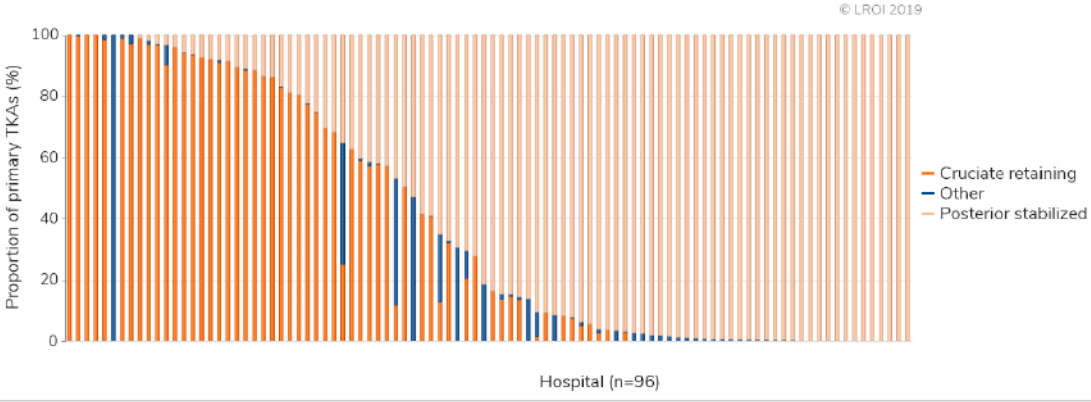
FIGURE DISTRIBUTION OF TYPE OF FIXATION USED DURING PRIMARY TOTAL KNEE ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=25,443).



TKA: total knee arthroplasty.

Type of femur component

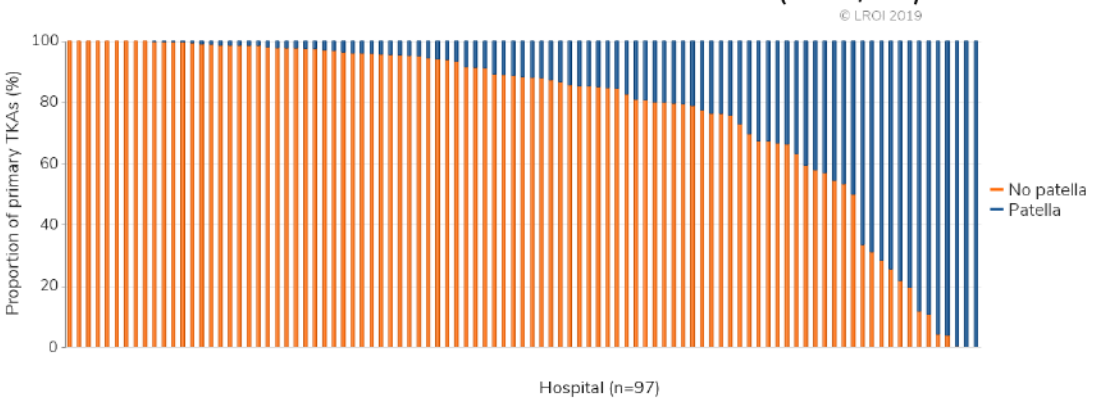
FIGURE DISTRIBUTION OF TYPE OF FEMUR COMPONENT USED DURING PRIMARY TOTAL KNEE ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=24,593).



TKA: total knee arthroplasty.

Implantation of patella

FIGURE DISTRIBUTION OF IMPLANTATION OF PATELLA DURING PRIMARY TOTAL KNEE ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=25,569).



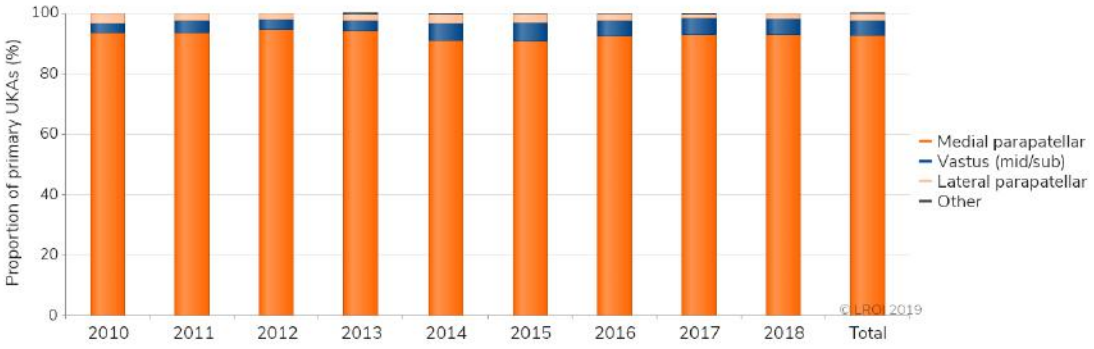
TKA: total knee arthroplasty.

Unicondylar knee arthroplasty

Surgical techniques

Surgical approach 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY UNICONDYLAR KNEE ARTHROPLASTY IN THE NETHERLANDS IN 2010-2018.

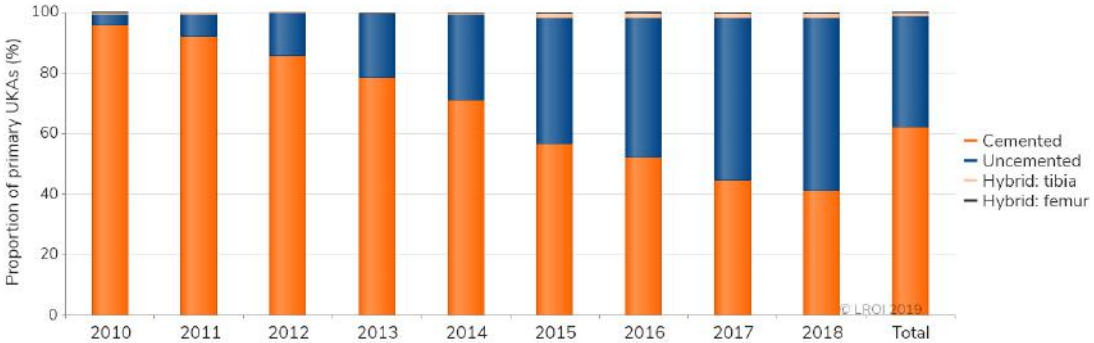


Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Surgical approach (%)										
Medial parapatellar	93.46	93.49	94.60	94.01	91.03	90.70	92.28	92.98	92.86	**92.65**
Vastus (mid/sub)	3.18	3.95	3.19	3.65	5.55	6.30	5.37	5.41	5.34	**4.95**
Lateral parapatellar	3.36	2.55	2.21	1.94	3.12	2.89	2.11	1.23	1.80	**2.23**
Other	0.00	0.00	0.00	0.40	0.30	0.11	0.24	0.38	0.00	**0.17**
Total (n):	**1,667**	**1,568**	**1,537**	**1,754**	**2,342**	**2,668**	**2,941**	**3,663**	**4,008**	**22,148**

UKA: unicondylar knee arthroplasty.

Fixation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY UNICONDYLAR KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Fixation (%)										
Cemented	95.89	92.12	85.82	78.47	71.20	56.58	52.02	44.53	41.14	**62.04**
Uncemented	3.28	7.24	13.93	20.97	27.95	41.48	46.08	53.72	56.96	**36.59**
Hybrid: tibia	0.78	0.64	0.26	0.39	0.64	1.64	1.50	1.39	1.40	**1.10**
Hybrid: femur	0.06	0.00	0.00	0.17	0.21	0.30	0.41	0.36	0.50	**0.28**
Total (n):	**1,677**	**1,561**	**1,558**	**1,793**	**2,347**	**2,676**	**2,943**	**3,658**	**4,003**	**22,216**

UKA: unicondylar knee arthroplasty.

Most frequently registered

Unicondylar knee prostheses

TABLE THE MOST FREQUENTLY REGISTERED PRIMARY UNICONDYLAR KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=3,583).

Name	Proportion (%)
Oxford PKR cementless	57.3
Oxford PKR cemented	27.9
Physica Zimmer Unicompartmental High Flex Knee	10.0
Journey Uni	1.8
Triathlon	0.8

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 2018.

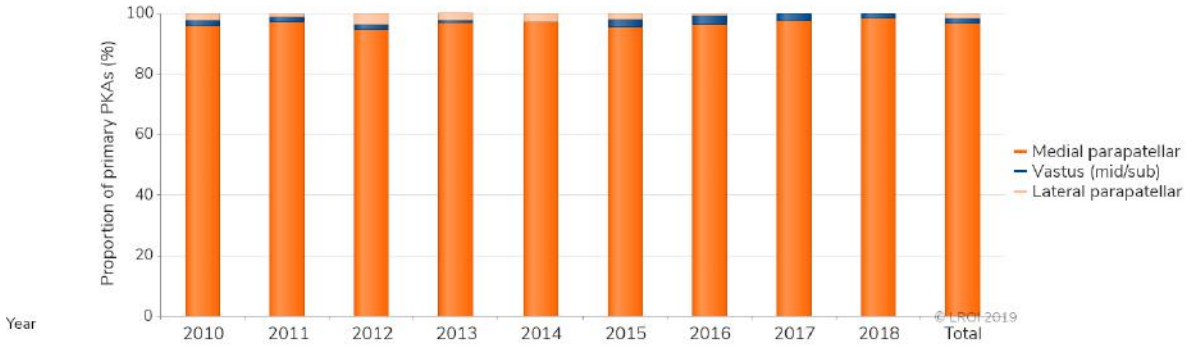
Separately packed bone cement components (n=896)		Bone cement pre-packed in a vacuum mixing system (n=682)	
Name	Proportion (%)	Name	Proportion (%)
Palacos R+G	84.5	Refobacin Bone Cement R	78.4
Palacos MV+G	9.8	Palacos R+G	18.0
Biomet Plus Bone Cement	3.7	Refobacin Plus Bone Cement	3.5
Refobacin Bone Cement R	0.6		
Simplex ABC EC	0.6		

Patellofemoral knee arthroplasty

Surgical techniques

Surgical approach 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY PATELLOFEMORAL KNEE ARTHROPLASTY IN THE NETHERLANDS IN 2010-2018.



Surgical approach (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Medial parapatellar	95.83	97.39	94.64	96.95	97.37	95.51	96.50	97.60	98.32	**96.66**
Vastus (mid/sub)	2.08	1.74	1.79	0.76	0.00	2.56	2.80	2.40	1.68	**1.82**
Lateral parapatellar	2.08	0.87	3.57	2.29	2.63	1.92	0.70	0.00	0.00	**1.52**
Total (n):	**144**	**115**	**168**	**131**	**114**	**156**	**143**	**167**	**179**	**1,317**

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

Fixation 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY PATELLOFEMORAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Fixation (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Cemented	93.71	92.11	96.49	96.24	97.39	99.36	98.61	95.83	98.33	**96.60**
Uncemented	5.59	5.26	1.75	2.26	0.87	0.64	1.39	4.17	1.67	**2.57**
Hybrid: patella	0.70	2.63	1.75	1.50	1.74	0.00	0.00	0.00	0.00	**0.83**
Total (n):	**143**	**114**	**171**	**133**	**115**	**156**	**144**	**168**	**180**	**1,324**

PKA: patellofemoral knee arthroplasty.

Most frequently registered

Patellofemoral knee prostheses

TABLE THE MOST FREQUENTLY REGISTERED PRIMARY PATELLOFEMORAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=147).

Name	Proportion (%)
Gender Solutions® Patello-Femoral Joint	60.5
Journey PFJ	19.7
Avon	15.0
IBalance PFJ	3.4
PFR implant	1.4

Types of bone cement

TABLE THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT USED DURING PRIMARY PATELLOFEMORAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=102).

Name	Proportion (%)
Palacos R+G	72.5
Refobacin Bone Cement R	16.7
Refobacin Plus Bone Cement	5.9
Simplex ABC EC	3.9
Palacos MV+G	1.0

Knee revision arthroplasty

Type of revision 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF REVISION IN KNEE REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Type of revision (%)										
Removal	2.15	2.39	3.13	4.52	5.41	6.24	6.68	5.74	6.12	**5.03**
Total revision	57.60	56.85	52.94	51.97	51.84	49.18	49.02	46.26	47.51	**50.72**
Major partial revision	12.68	11.71	12.73	11.21	10.82	9.79	8.85	7.74	7.65	**10.01**
Minor partial revision	25.55	27.29	29.65	31.46	31.11	33.11	34.01	38.69	37.37	**32.82**
Unknown partial revision	1.39	1.19	1.01	0.31	0.24	0.26	0.21	0.33	0.66	**0.55**
Other	0.63	0.57	0.53	0.53	0.59	1.42	1.24	1.25	0.69	**0.87**
Total (n):	**1,585**	**1,759**	**2,074**	**2,257**	**2,533**	**2,676**	**2,905**	**3,050**	**2,890**	**21,729**

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 2018, the femur component was revised in 92 (41.6%) major partial knee revision arthroplasties and the tibia component was revised in 111 (58.4%) major partial knee revision arthroplasties.

Reasons for revision 2014-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN REASONS FOR REVISION OR RE-SURGERY IN PATIENTS WHO UNDERWENT A KNEE REVISION ARTHROPALSTY IN THE NETHERLANDS in 2014-2018.

Year	2014	2015	2016	2017	2018	Total
Knee revision (n)	2,559	2,684	2,925	3,055	2,901	14,124
Reasons for revision; Proportion[1] (%)						
Instability	25.3	26.5	25.1	27.7	26.0	26.1
Patellar pain	22.9	23.0	21.5	19.8	19.0	21.1
Loosening of tibia component	22.4	20.6	21.8	20.8	19.5	21.0
Infection	14.7	16.4	19.6	20.3	20.4	18.4
Malalignment	15.7	14.7	13.8	11.3	10.8	13.2
Loosening of femur component	10.0	9.5	9.0	8.9	8.4	9.1
Progression of osteoarthritis	9.1	8.3	9.3	8.1	8.8	8.7
Insert wear	8.4	7.8	7.6	6.8	6.6	7.4
Revision after knee removal	6.9	5.7	6.3	5.7	4.9	5.9
Arthrofibrosis	4.7	5.1	4.3	4.8	4.6	4.7
Patellar dislocation	2.5	2.8	2.1	2.5	2.2	2.4
Periprosthetic fracture	2.2	2.3	1.7	1.8	1.6	1.9
Loosening of patella component	2.0	1.5	1.9	1.8	1.4	1.7
Other	8.1	8.6	8.3	8.2	7.8	8.2

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

Surgery and prosthesis

Fixation 2010-2018

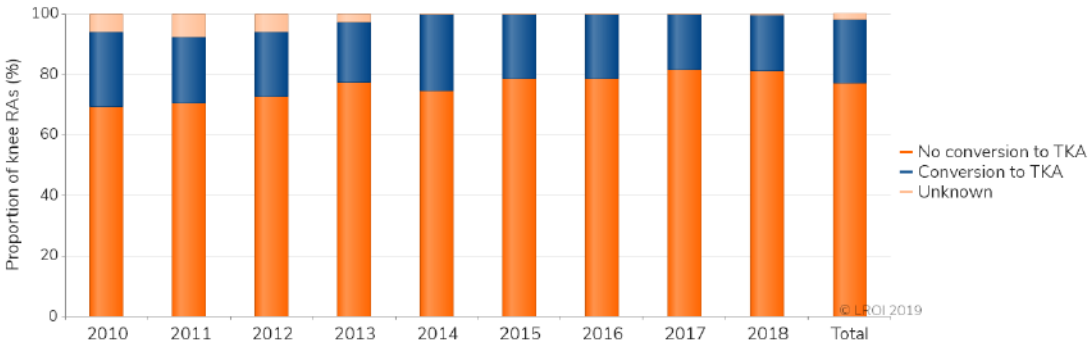
FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN KNEE REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Fixation (%)										
Cemented	87.04	87.70	88.06	85.25	86.47	84.67	83.03	80.86	78.87	**84.16**
Uncemented	10.46	10.04	9.77	13.13	12.36	14.09	15.65	17.91	19.55	**14.25**
Hybrid: tibia	1.89	1.84	1.74	1.22	0.95	0.99	1.01	1.05	1.25	**1.26**
Hybrid: patella	0.40	0.24	0.26	0.15	0.17	0.21	0.23	0.11	0.23	**0.21**
Hybrid: femur	0.20	0.18	0.16	0.24	0.04	0.04	0.08	0.07	0.11	**0.12**
Total (n):	**1,482**	**1,634**	**1,893**	**2,041**	**2,314**	**2,427**	**2,664**	**2,775**	**2,650**	**19,880**

RA: revision arthroplasty

Conversion to TKA 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN CONVERSION OF A UNICONDYLAR OR PATELLOFEMORAL KNEE ARTHROPLASTY TO A TOTAL KNEE ARTHROPLASTY IN THE NETHERLANDS IN 2010-2018.



Conversion to TKA (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
No conversion to TKA	69.21	70.55	72.65	77.28	74.56	78.55	78.59	81.46	81.06	**77.03**
Conversion to TKA	24.84	21.91	21.47	19.92	25.39	21.41	21.33	18.40	18.56	**21.12**
Unknown	5.95	7.54	5.88	2.80	0.05	0.04	0.08	0.14	0.38	**1.86**
Total (n):	**1,260**	**1,392**	**1,616**	**1,712**	**2,064**	**2,242**	**2,639**	**2,831**	**2,619**	18,375

RA: revision arthroplasty; TKA: total knee arthroplasty

Bone cement antibiotics 2010-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN KNEE REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2010-2018.

Bone cement antibiotics (%)	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Gentamicin	67.38	68.95	63.90	58.49	67.80	69.15	65.07	68.80	62.42	**65.67**
Gentamicin + Clindamycin	21.89	19.58	25.40	31.28	22.40	24.26	31.16	26.05	33.37	**26.64**
Erythromycin + Colistin	4.46	3.87	4.24	5.68	4.63	4.60	1.32	1.52	1.75	**3.42**
Tobramycin	4.29	4.39	3.48	2.33	2.37	0.74	0.34	0.05	0.05	**1.77**
Gentamicin + Vancomycin	0.00	0.00	0.13	1.02	1.83	0.91	1.67	3.05	1.86	**1.28**
No antibiotics	1.97	3.20	2.85	1.20	0.97	0.34	0.44	0.53	0.55	**1.22**
Total (n):	**1,165**	**1,343**	**1,579**	**1,672**	**1,643**	**1,760**	**2,041**	**1,904**	**1,828**	14,935

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 2018.

Femur (n=1,347)		Tibia (n=1,356)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Legion	26.7	Legion	27.4
NexGen	19.2	NexGen	18.0
Genesis II	7.8	S-Rom	10.8
Vanguard Complete Knee	7.1	Vanguard Complete Knee	6.3
PFC / SIGMA	6.6	Vanguard 360	6.0
LCS	6.2	Legion Hinged	5.8
Legion Hinged	5.6	Genesis II	5.3
Triathlon	5.1	Triathlon	5.0
Vanguard 360	4.2	PFC / SIGMA	3.7
Endo Rotation Knee	1.7	Rotation Hinged Knee	3.0

Insert (n=2,151		Patella (n=1,080)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Genesis II	26.5	Genesis II	44.8
NexGen	18.8	Vanguard	14.6
Vanguard Complete Knee	8.6	NexGen	14.0
LCS	7.7	PFC / SIGMA	9.0
PFC / SIGMA	7.2	LCS	4.2
Oxford PKR	4.6	Triathlon	4.0
Triathlon	4.1	Attune	2.4
Legion Hinged	3.8	Journey BCS	2.0
Vanguard SSK	3.5	ACS	1.2
Legion	2.9	Advance	0.6

Most frequently registered 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 2018.

Separately packed bone cement components (n=1,237)		Bone cement pre-packed in a vacuum mixing system (n=576)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	39.0	Refobacin Bone Cement R	49.1
Copal G+C	38.8	Palacos R+G	41.7
Refobacin Revision	9.7	Refobacin Plus Bone Cement	9.0
Refobacin Bone Cement R	3.0	Refobacin Revision	0.2
Simplex ABC EC	2.6		

Survival

Total knee arthroplasty

Revision within 1 year

By type of revision

TABLE CUMULATIVE 1-YEAR REVISION PERCENTAGE OF PRIMARY TOTAL KNEE ARTHROPLASTIES BY TYPE OF REVISION IN THE NETHERLANDS IN 2013-2017 (N=120,819).

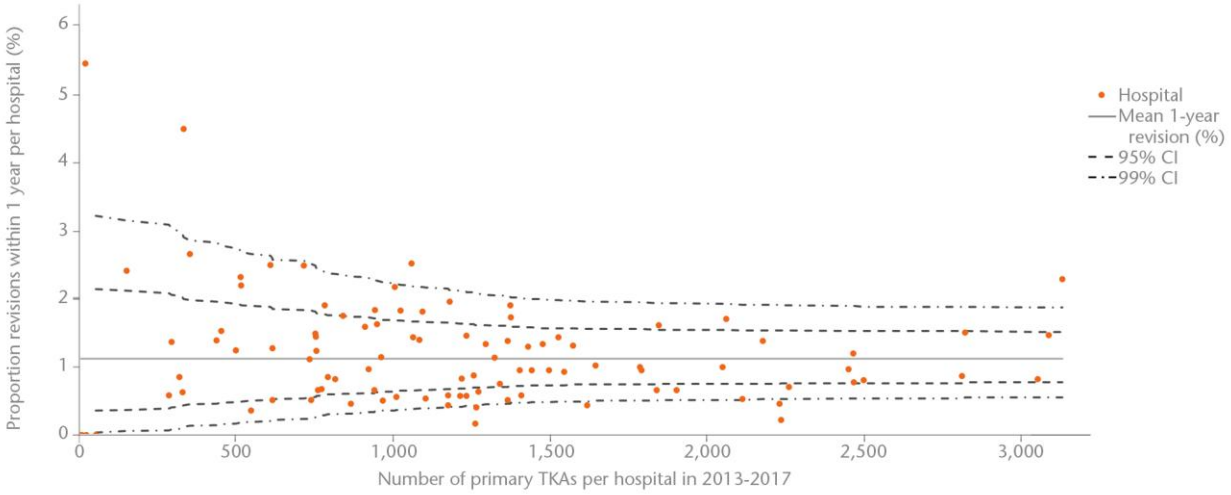
	Cumulative 1-year revision percentage	
	Competing Risk (95% CI)	**Kaplan Meier (95% CI)**
Any type of revision[1]	1.1 (1.0-1.2)	1.1 (1.1-1.2)
Major revision[2]	0.4 (0.4-0.5)	0.5 (0.4-0.5)
Minor revision[3]	0.6 (0.6-0.7)	0.7 (0.6-0.7)

[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 femur or tibia component.
[3] Only insert and/or patella exchange (including patella addition).
TKA: total knee arthroplasty; CI: confidence interval.

In 2013-2017, 885 (0.7%) primary TKAs were implanted in patients who died within one year after the primary procedure.

Overall revision per hospital

FIGURE FUNNEL PLOT OF PROPORTION OF KNEE REVISION ARTHROPLASTIES WITHIN ONE YEAR AFTER A TOTAL KNEE ARTHROPLASTY PER HOSPITAL IN THE NETHERLANDS IN 2013-2017 (N=120,819).

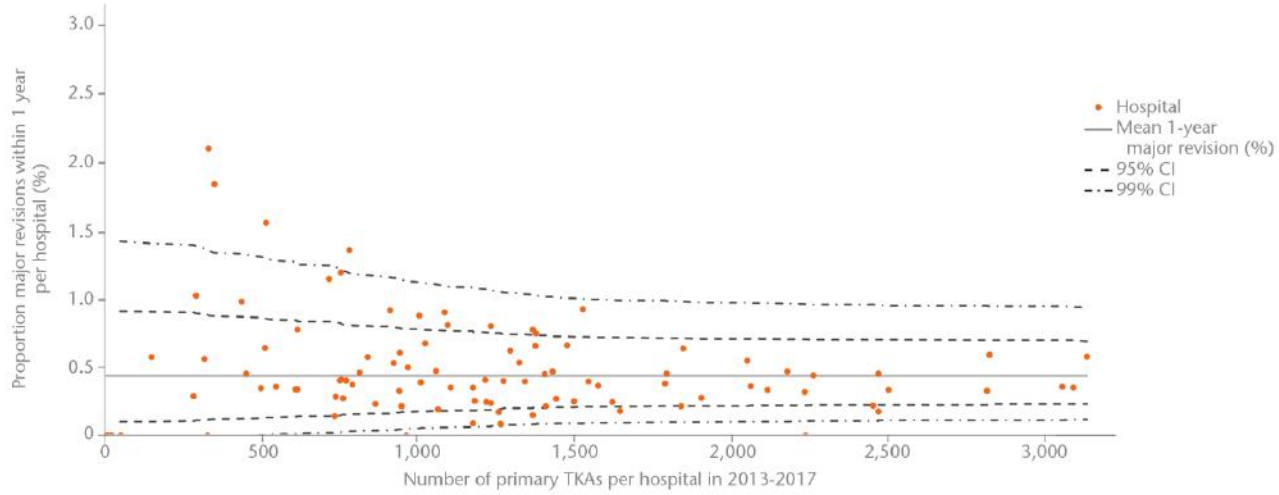


Please note: The proportions of revisions within 1 year per hospital were adjusted for casemix factors age, gender, ASA score and diagnosis (osteoarthritis versus other).
TKA: total knee arthroplasty; CI: confidence interval.

The mean 1-year revision percentage is 1.1 (95% CI: 1.1-1.2) in the Netherlands in 2013-2017. Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.

Major revision per hospital

FIGURE FUNNEL PLOT OF PROPORTION OF KNEE MAJOR REVISION ARTHROPLASTIES WITHIN ONE YEAR AFTER A TOTAL KNEE ARTHROPLASTY PER HOSPITAL IN THE NETHERLANDS IN 2013-2017 (N=120,819).



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

The mean 1-year major revision percentage is 0.47 (95% CI: 0.43-0.51) in the Netherlands in 2013-2017. Confidence intervals indicate the plausible range of outcome if all hospitals perform equally well.

Reasons for revision by type of revision

TABLE REASONS FOR REVISION WITHIN ONE YEAR IN PATIENTS THAT UNDERWENT A KNEE REVISION ARTHROPLASTY BY TYPE OF REVISION IN THE NETHERLANDS IN 2013-2017.

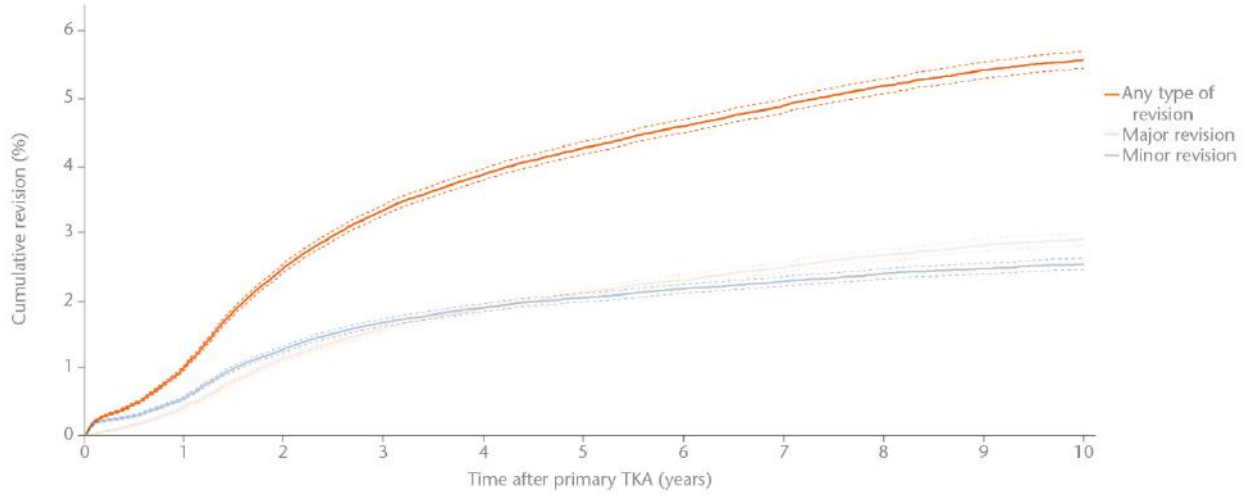
	Major revision[1] (n=529)	Minor revision[2] (n=787)	Any type of revision[3] (n=1,361)
Reasons for revision	**Proportion[4] (%)**	**Proportion[4] (%)**	**Proportion[4] (%)**
Infection	23.6	46.5	36.8
Instability	23.6	14.6	18.0
Patellar pain	6.6	19.7	14.4
Malalignment	25.3	0.6	10.3
Loosening of tibia component	25.1	0.3	9.9
Arthrofibrosis	7.6	7.2	7.3
Periprosthetic fracture	13.0	0.5	5.4
Patellar dislocation	2.6	3.6	3.3
Loosening of femur component	6.8	0.1	2.7
Revision after knee removal	5.3	0.1	2.1
Insert wear	0.8	1.9	1.4
Loosening of patella component	0.2	0.3	0.3
Progression of osteoarthritis	0.4	0.1	0.2
Other	9.5	14.5	12.3

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

Revision within 10 years

Overall

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL KNEE ARTHROPLASTIES BY TYPE OF REVISION IN THE NETHERLANDS IN 2007-2018 (N=241,326).



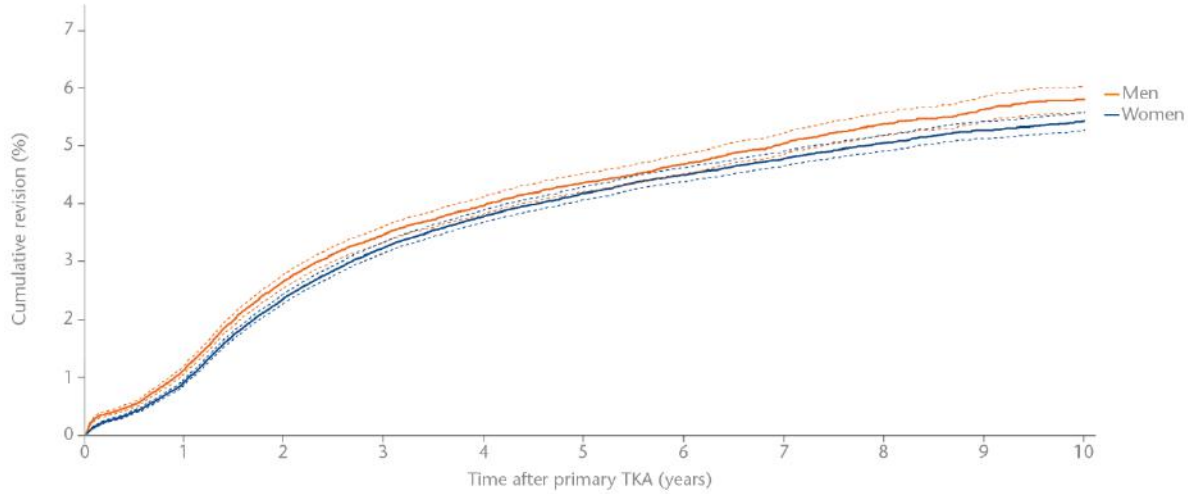
	Cumulative 10-year revision percentage	
	Competing risk[1] (95% CI)	Kaplan Meier (95% CI)
Any type of revision	5.6 (5.5-5.7)	5.9 (5.7-6.0)
Major revision[2]	2.9 (2.8-3.0)	3.2 (3.1-3.3)
Minor revision[3]	2.5 (2.5-2.6)	2.7 (2.6-2.8)

[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).
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
TKA: total knee arthroplasty; CI: confidence interval.

In 2007-2018, 18,014 (7.5%) primary TKAs were implanted in patients who died within ten years after the primary procedure.

By gender

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL KNEE ARTHROPLASTIES BY GENDER IN THE NETHERLANDS IN 2007-2018 (N=240,811).

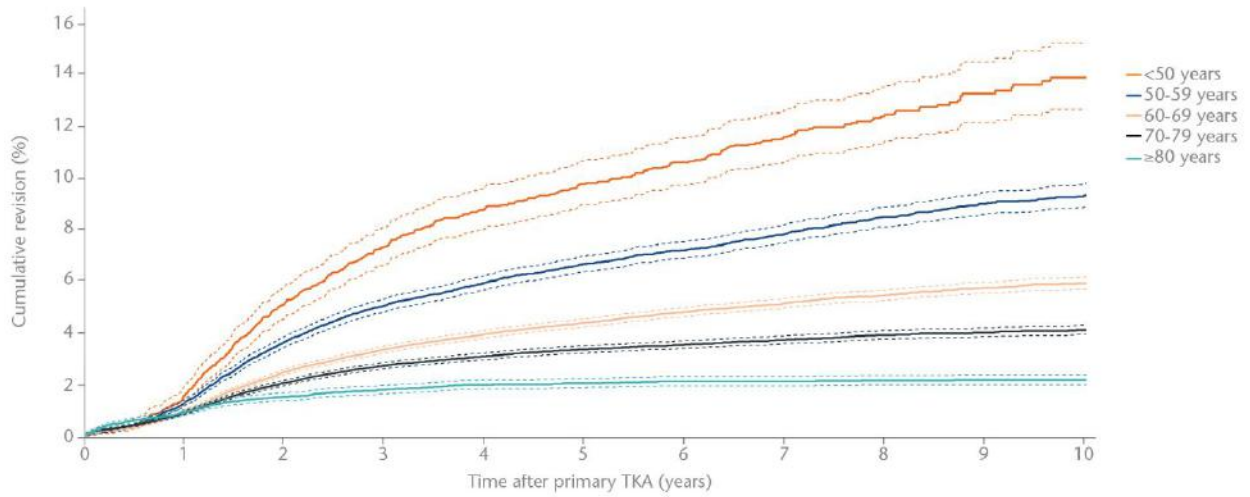


	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Gender			
Men	83,290	5.8 (5.6-6.1)	6.2 (5.9-6.4)
Women	157,521	5.5 (5.3-5.6)	5.7 (5.5-5.9)

[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.
TKA: total knee arthroplasty; CI: confidence interval.

By age category

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL KNEE ARTHROPLASTIES BY AGE CATEGORY IN THE NETHERLANDS IN 2007-2018 (N=241,019).

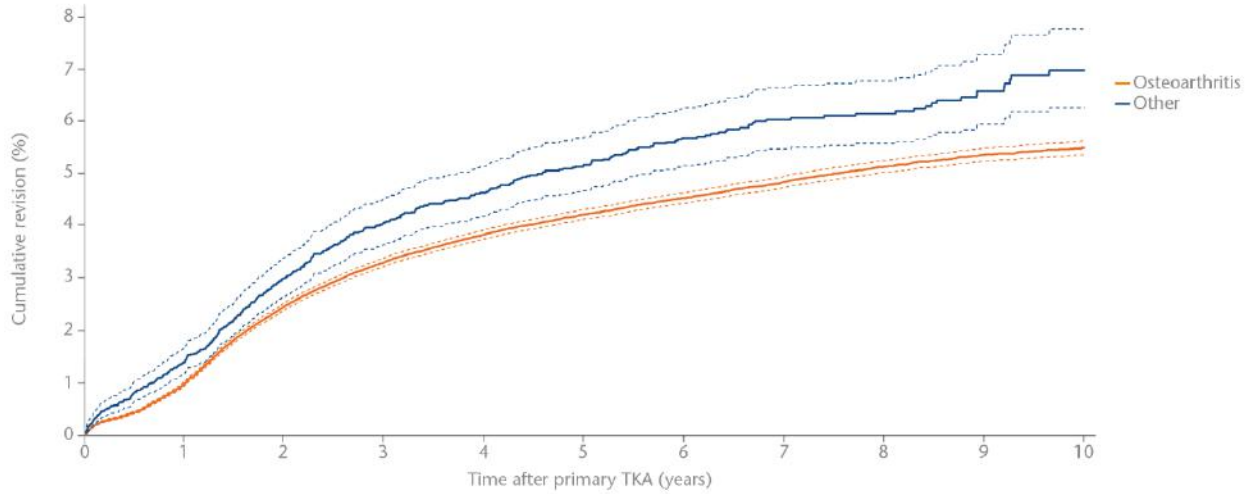


	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Age (years)			
<50	8,898	13.9 (12.7-15.3)	14.2 (12.8-15.5)
50-59	35,438	9.4 (8.9-9.8)	9.5 (9.1-10.0)
60-69	84,928	6.0 (5.8-6.2)	6.2 (5.9-6.4)
70-79	85,006	4.2 (4.0-4.4)	4.4 (4.2-2.6)
≥80	29,749	2.2 (2.1-2.4)	2.4 (2.2-2.6)

[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.
TKA: total knee arthroplasty; CI: confidence interval.

By diagnosis

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL KNEE ARTHROPLASTIES BY DIAGNOSIS IN THE NETHERLANDS IN 2007-2018 (N=238,889).

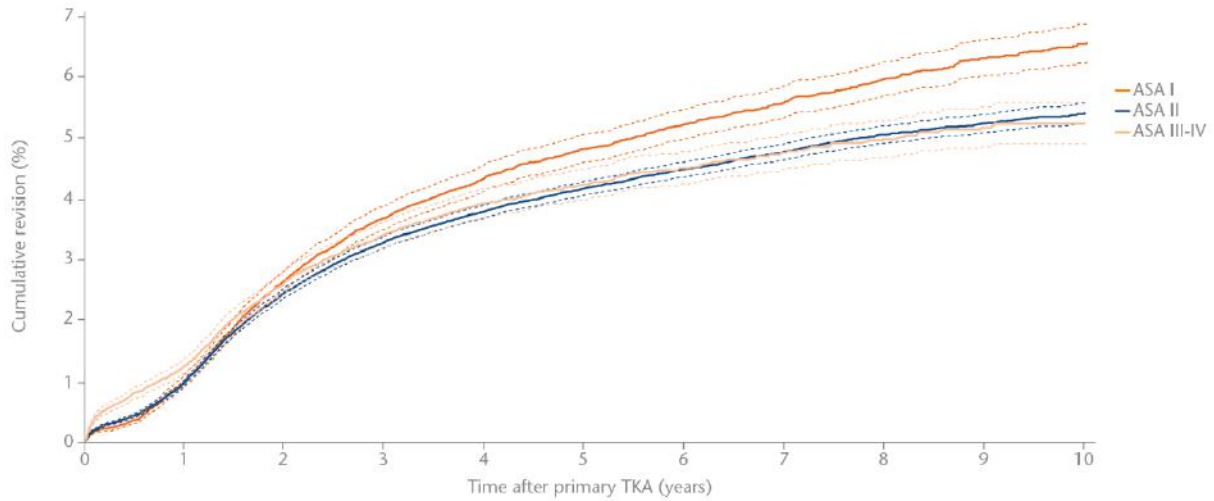


	Number (n)	Cumulative 10-year revision percentage: Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Diagnosis			
Osteoarthritis	229,752	5.5 (5.4-5.6)	5.8 (5.6-5.9)
Other	9,137	7.0 (6.3-7.8)	7.5 (6.6-8.3)

[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.
TKA: total knee arthroplasty; CI: confidence interval.

By ASA score

FIGURE CUMULATIVE REVISION PERCENTAGE OF TOTAL KNEE ARTHROPLASTIES BY ASA SCORE IN THE NETHERLANDS IN 2007-2018 (N=231,999).



	Number (n)	Cumulative 10-year revision percentage Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
ASA score			
I	40,565	6.5 (6.2-6.9)	6.7 (6.4-7.1)
II	155,432	5.4 (5.2-5.6)	5.7 (5.5-5.8)
III-IV	36,002	5.2 (4.9-5.6)	5.7 (5.3-6.1)

[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.
TKA: total knee arthroplasty; CI: confidence interval.

Revision per component

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 2007-2018 (N=204,702).

					Type of revision (n)						Cumulative revision percentage (95% CI)				
Femur component	Tibia component	Total primary TKAs (n)	Median (IQR) age (yr)	Total RAs (n)	Total revision	Patella addition	Only femur	Only Tibia	Only insert/ patella	Missing/ unknown	1yr	3yr	5yr	7yr	10yr
All cemented TKAs for osteoarthritis		**204,702**	**69 (62-75)**	**7,651**	**2,700**	**1,585**	**357**	**705**	**2,099**	**205**	**1.0 (0.9-1.0)**	**3.4 (3.3-3.5)**	**4.4 (4.3-4.5)**	**5.1 (4.9-5.2)**	**5.9 (5.7-6.0)**
Genesis II	Genesis II	45,521	69 (62-75)	1,870	502	424	173	119	599	53	1.2 (1.1-1.3)	4.1 (3.8-4.3)	5.1 (4.8-5.3)	5.6 (5.2-5.8)	6.3 (5.9-6.6)
NexGen	NexGen	43,788	69 (62-75)	1,563	626	177	46	192	467	55	1.0 (0.9-1.1)	3.0 (2.8-3.1)	4.1 (3.9-4.3)	5.1 (4.8-5.4)	6.1 (5.7-6.4)
Vanguard Complete Knee	Vanguard Complete Knee	33,637	69 (62-75)	1,075	364	226	32	103	321	29	1.0 (0.9-1.1)	3.1 (2.9-3.3)	3.9 (3.7-4.2)	4.6 (4.3-4.9)	5.2 (4.8-5.5)
PFC / Sigma	PFC / Sigma	25,060	70 (63-76)	856	255	224	22	63	272	20	1.0 (0.9-1.1)	3.2 (2.9-3.4)	3.9 (3.6-4.1)	4.3 (4.0-4.6)	4.8 (4.4-5.1)
LCS	LCS	14,353	70 (63-76)	538	278	50	27	107	70	6	0.8 (0.6-0.9)	3.4 (3.1-3.7)	4.5 (4.1-4.9)	5.1 (4.7-5.6)	5.7 (5.1-6.2)
Triathlon	Triathlon	4,675	70 (64-76)	130	42	29	9	7	40	3	1.0 (0.7-1.3)	3.4 (2.8-4.0)	4.0 (3.3-4.7)	4.7 (3.8-5.7)	n.a.
AGC V2	AGC V2	4,419*	71 (65-77)	131	73	43	1	2	9	3	0.4 (0.2-0.6)	2.1 (1.6-2.5)	2.5 (2.0-3.0)	3.1 (2.5-3.6)	3.5 (2.9-4.1)
Optetrak	Optetrak	3,059	70 (62-76)	267	122	84	3	33	20	5	1.3 (0.9-1.7)	5.4 (4.6-6.3)	7.2 (6.2-8.1)	8.0 (7.0-9.0)	11.5 (10.0-13.0)
TC Plus	TC Plus	2,827	70 (63-76)	73	39	14	2	5	10	3	0.7 (0.4-1.0)	2.2 (1.6-2.8)	3.0 (2.3-3.7)	3.2 (2.5-4.0)	3.5 (2.7-4.4)
ACS	ACS	2,645	67 (60-73)	121	27	17	8	12	50	7	0.8 (0.4-1.1)	4.0 (3.2-4.7)	4.8 (3.9-5.7)	5.1 (4.2-6.0)	n.a.
Scorpio NRG	Scorpio	2,631*	70 (63-76)	116	35	41	9	3	27	1	0.9 (0.6-1.3)	3.4 (2.6-4.1)	4.6 (3.7-5.4)	5.3 (4.3-6.3)	6.1 (4.8-7.4)
balanSys	balanSys	2,615	69 (62-75)	99	38	36	1	4	18	2	0.7 (0.4-1.1)	3.4 (2.6-4.2)	4.7 (3.7-5.7)	5.7 (4.4-6.9)	7.2 (5.3-9.0)
Scorpio	Scorpio	2,240*	71 (63-76)	100	53	19	3	6	16	3	0.4 (0.1-0.7)	2.4 (1.8-3.0)	3.2 (2.4-3.9)	3.7 (2.9-4.5)	4.8 (3.8-5.7)
PFC / SIGMA	LCS	1,206	66 (58-75)	50	26	11	3	1	9	0	0.3 (0.0-0.7)	2.3 (1.4-3.1)	3.3 (2.2-4.3)	4.3 (3.0-5.6)	5.4 (3.8-7.0)
NexGen CSF	NexGen	1,059	68 (61-74)	22	14	3	0	1	4	0	0.6 (0.1-1.0)	1.5 (0.7-2.2)	2.7 (1.5-3.8)	2.7 (1.5-3.8)	n.a.
Journey BCS	Journey BCS	1,058	67 (60-73)	91	14	47	1	3	25	1	1.4 (0.6-2.3)	6.7 (5.0-8.3)	8.2 (6.4-10.0)	9.9 (7.9-11.9)	12.1 (9.5-14.8)
Attune	Attune	964	67 (60-73)	13	2	4	1	1	5	0	0.6 (0.1-1.1)	1.8 (0.7-2.8)	n.a.	n.a.	n.a.
Journey II BCS	Journey BCS	919	67 (61-73)	41	6	22	0	0	11	2	0.4 (0.0-0.8)	5.3 (3.6-7.1)	6.6 (4.5-8.7)	n.a.	n.a.
Innex	Innex	904	70 (62-78)	34	10	10	0	4	10	0	1.2 (0.5-1.9)	2.5 (1.5-3.6)	3.4 (2.1-4.6)	4.2 (2.8-5.6)	4.2 (2.8-5.6)
Profix	Profix	771*	68 (61-76)	54	37	7	1	2	6	1	0.7 (0.1-1.2)	3.7 (2.3-5.0)	5.7 (4.1-7.4)	6.7 (4.9-8.5)	8.4 (5.6-11.2)
MRK	MRK	738	68 (62-75)	7	4	2	0	0	1	0	0.3 (0.0-0.7)	1.2 (0.2-2.1)	2.5 (0.0-5.2)	n.a.	n.a.
Genesis II	Profix/Genesis MB baseplate *	622	67 (60-75)	63	26	28	0	1	7	1	2.0 (0.9-3.0)	7.1 (5.1-9.1)	9.2 (6.8-11.5)	10.3 (7.8-12.7)	10.8 (8.3-13.3)
Evolution MP	Evolution MP	440	69 (64-74)	5	0	3	0	0	2	0	0.2 (0.0-0.7)	n.a.	n.a.	n.a.	n.a.
Rotaglide	Rotaglide	427*	71 (65-78)	30	22	1	2	0	5	0	1.2 (0.1-2.2)	4.7 (2.7-6.7)	6.2 (3.9-8.5)	7.2 (4.7-9.8)	7.9 (5.0-10.7)
Advance MP	Advance	312*	71 (65-78)	30	5	9	1	5	10	0	1.9 (0.4-3.5)	7.7 (4.8-10.7)	9.0 (5.8-12.2)	9.4 (6.1-12.6)	9.8 (6.4-13.1)
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)
Personaâ®	Personaâ®	271	67 (61-72)	11	4	1	0	0	6	0	0.8 (0.0-1.9)	4.8 (2.0-7.6)	n.a.	n.a.	n.a.

* Denotes prosthesis combinations with no reported use in cemented primary TKAs in 2018.
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 of cemented femur and tibia components with over 250 procedures have been listed.
These combinations represented 96.4% of all registered cemented primary total knee arthroplasties.

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 or patella resurfacing 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 2007-2018 (N=11,034).

					Type of revision (n)						Cumulative revision percentage (95% CI)				
Femur component	Tibia component	Total primary TKAs (n)	Median (IQR) age (yr)	Total RAs (n)	Total revision	Patella addition	Only femur	Only Tibia	Only insert/ patella	Missing/ unknown	1yr	3yr	5yr	7yr	10yr
All uncemented TKAs for osteoarthritis		**11,034**	**69 (62-76)**	**488**	**166**	**76**	**10**	**103**	**124**	**9**	**1.2 (1.0-1.4)**	**3.8 (3.5-4.2)**	**4.8 (4.3-5.2)**	**5.3 (4.8-5.8)**	**6.0 (5.5-6.6)**
LCS	LCS	7,263	69 (63-76)	295	77	40	7	81	86	4	1.0 (0.8-1.2)	3.6 (3.1-4.0)	4.2 (3.7-4.7)	4.6 (4.1-5.2)	5.3 (4.6-5.9)
Triathlon	Triathlon	914	70 (63-76)	20	5	4	0	2	9	0	0.7 (0.1-1.3)	1.7 (0.8-2.6)	3.0 (1.6-4.4)	3.3 (1.8-4.8)	n.a.
ACS	ACS	420	69 (61-76)	19	9	2	1	3	4	0	2.9 (1.3-4.5)	4.7 (2.6-6.7)	4.7 (2.6-6.7)	n.a.	n.a.
Duracon	Duracon	274*	69 (61-77)	7	3	1	0	0	3	0	0.4 (0.0-1.1)	0.7 (0.0-1.7)	1.5 (0.0-2.9)	1.5 (0.0-2.9)	2.8 (0.7-4.8)
Rotaglide	Rotaglide	265*	69 (61-76)	53	35	10	1	1	5	1	2.3 (0.5-4.1)	10.3 (6.6-14.0)	16.3 (11.8-20.8)	20.0 (15.0-24.9)	22.3 (16.4-28.1)
ACS LD	ACS LD	219	70 (61-76)	8	3	2	0	1	2	0	1.5 (0.0-3.2)	n.a.	n.a.	n.a.	n.a.
NexGen	NexGen	214	69 (63-77)	12	5	1	0	2	3	1	2.0 (0.1-4.0)	4.6 (1.5-7.8)	6.5 (2.5-10.5)	7.9 (3.1-12.8)	n.a.
Genesis II	Genesis II	213	68 (62-75)	10	4	4	0	1	0	1	1.0 (0.0-2.4)	5.8 (2.3-9.3)	5.8 (2.3-9.3)	n.a.	n.a.
Vanguard Complete Knee	Vanguard Complete Knee	170	68 (61-74)	8	4	0	0	4	0	0	2.5 (0.1-5.0)	6.9 (1.6-12.2)	6.9 (1.6-12.2)	n.a.	n.a.

* Denotes prosthesis combinations with no reported use in uncemented primary TKAs in 2018.
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 of uncemented femur and tibia components with over 100 procedures have been listed.
These combinations represented 90.2% of all registered uncemented primary total knee arthroplasties.

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 or patella resurfacing of the prosthesis may have influenced the cumulative revision percentages.

Bone cement

TABLE CUMULATIVE REVISION PERCENTAGES OF THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT BY TYPE OF MIXING SYSTEM IN 2018, IN PRIMARY TOTAL KNEE ARTHROPLASTIES IN THE NETHERLANDS IN 2007-2018.

		Cumulative revision percentage (95% CI)				
Bone cement	**n**	**1yr**	**3yr**	**5yr**	**7yr**	**10yr**
Separately packed bone cement components (n=154,818)						
Palacos R+G	114,517	1.0 (0.9-1.1)	3.4 (3.3-3.6)	4.4 (4.3-4.6)	5.1 (4.9-5.2)	6.0 (5.7-6.2)
Palacos MV+G	7,522	0.8 (0.6-1.0)	3.1 (2.7-3.5)	4.0 (3.5-4.5)	4.5 (3.9-5.1)	n.a.
Refobacin Bone Cement R	10,590	0.9 (0.7-1.0)	3.1 (2.8-3.5)	4.2 (3.7-4.6)	5.4 (4.9-5.9)	6.5 (5.8-7.2)
Biomet Plus Bone Cement	1,252	1.1 (0.5-1.6)	4.0 (2.8-5.2)	5.1 (3.6-6.6)	5.4 (3.8-6.9)	n.a.
Synicem1G	329	0.6 (0.0-1.6)	n.a.	n.a.	n.a.	n.a.
Bone cement pre-packed in a vacuum mixing system (n=45,777)						
Refobacin Bone Cement R	21,088	1.3 (1.1-1.4)	3.7 (3.4-4.0)	4.7 (4.3-5.0)	5.5 (5.0-6.1)	6.0 (5.1-7.0)
Palacos R+G	10,231	1.2 (0.9-1.4)	3.7 (3.1-4.3)	4.0 (3.3-4.7)	n.a.	n.a.
Refobacin Plus Bone Cement	12,794	0.8 (0.7-1.0)	3.4 (3.0-3.7)	4.2 (3.8-4.6)	4.9 (4.4-5.4)	5.3 (4.6-5.9)
Refobacin Revision	90	2.3 (0.0-5.3)	n.a.	n.a.	n.a.	n.a.

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.

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 2007-2018 (N=204,702).

					Cumulative revision percentage (95% CI)				
Femur component	**Tibia component**	**Total primary TKAs (n)**	**Median (IQR) age (yr)**	**Major revision[1] arthroplasties (n)**	**1yr**	**3yr**	**5yr**	**7yr**	**10yr**
All cemented TKAs for osteoarthritis		**204,702**	**69 (62-75)**	**3,762**	**0.4 (0.4-0.5)**	**1.6 (1.6-1.7)**	**2.2 (2.1-2.3)**	**2.6 (2.6-2.7)**	**3.2 (3.0-3.3)**
Genesis II	Genesis II	45,521	69 (62-75)	794	0.5 (0.4-0.6)	1.8 (1.6-1.9)	2.3 (2.1-2.4)	2.5 (2.3-2.7)	2.8 (2.5-3.0)
NexGen	NexGen	43,788	69 (62-75)	864	0.4 (0.4-0.5)	1.6 (1.4-1.7)	2.4 (2.2-2.5)	3.1 (2.9-3.3)	3.9 (3.6-4.2)
Vanguard Complete Knee	Vanguard Complete Knee	33,637	69 (62-75)	499	0.4 (0.3-0.5)	1.5 (1.3-1.6)	1.9 (1.8-2.1)	2.2 (2.0-2.4)	2.7 (2.3-3.0)
PFC / Sigma	PFC / Sigma	25,06	70 (63-76)	340	0.4 (0.3-0.5)	1.3 (1.1-1.4)	1.6 (1.4-1.8)	1.9 (1.7-2.1)	2.1 (1.8-2.3)
LCS	LCS	14,353	70 (63-76)	412	0.5 (0.4-0.6)	2.6 (2.3-2.8)	3.5 (3.1-3.9)	4.1 (3.7-4.5)	4.6 (4.1-5.0)
Triathlon	Triathlon	4,675	70 (64-76)	58	0.5 (0.3-0.7)	1.6 (1.2-2.0)	1.8 (1.3-2.3)	2.3 (1.6-3.0)	n.a.
AGC V2	AGC V2	4,419*	71 (65-77)	76	0.2 (0.1-0.3)	1.1 (0.8-1.4)	1.4 (1.2-1.8)	1.8 (1.4-2.2)	2.2 (1.7-2.7)
Optetrak	Optetrak	3,059	70 (62-76)	158	0.7 (0.4-1.0)	3.1 (2.5-3.7)	4.2 (3.5-4.9)	5.3 (4.5-6.2)	7.1 (5.9-8.4)
TC Plus	TC Plus	2,827	70 (63-76)	46	0.5 (0.2-0.8)	1.3 (0.9-1.8)	1.9 (1.4-2.5)	2.2 (1.5-2.8)	2.4 (1.6-3.1)
ACS	ACS	2,645	67 (60-73)	47	0.4 (0.1-0.6)	1.6 (1.1-2.1)	2.1 (1.5-2.7)	2.2 (1.6-2.8)	n.a.

[1] Revision of at least the femur or tibia component.
* Denotes prosthesis combinations with no reported use in primary TKAs in 2018.
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 2007-2018 (N=11,034).

					Cumulative revision percentage (95% CI)				
Femur component	Tibia component	Total primary TKAs (n)	Median (IQR) age (yr)	Major revision[1] arthroplasties (n)	1yr	3yr	5yr	7yr	10yr
All uncemented TKAs for osteoarthritis		**11,034**	**69 (62-76)**	**279**	**0.8 (0.6 -0.9)**	**2.3 (2.0-2.6)**	**2.8 (2.5-3.2)**	**3.1 (2.7-3.5)**	**3.4 (3.0-3.9)**
LCS	LCS	7,263	69 (63-76)	165	0.6 (0.4-0.8)	2.1 (1.8-2.5)	2.5 (2.1-2.9)	2.6 (2.2-3.0)	2.8 (2.4-3.3)
Triathlon	Triathlon	914	70 (63-76)	7	0.3 (0.0-0.7)	0.6 (0.1-1.2)	1.0 (0.3-1.8)	1.0 (0.3-1.8)	n.a.
ACS	ACS	420	69 (61-76)	13	2.2 (0.8-3.6)	3.2 (1.5-4.9)	3.2 (1.5-4.9)	n.a.	n.a.
Duracon	Duracon	274*	69 (61-77)	3	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.4 (0.0-1.1)	0.4 (0.0-1.1)	1.2 (0.0-2.5)
Rotaglide	Rotaglide	265*	69 (61-76)	37	1.5 (0.0-3.0)	6.9 (3.8-10.0)	11.3 (7.4-15.1)	14.0 (9.7-18.4)	n.a.
ACS LD	ACS LD	219	70 (61-76)	4	1.1 (0.0-2.5)	n.a.	n.a.	n.a.	n.a.
NexGen	NexGen	214	69 (63-77)	7	1.5 (0.0-3.2)	3.5 (0.7-6.3)	4.4 (1.1-7.6)	5.8 (1.5-10.1)	n.a.
Genesis II	Genesis II	213	68 (62-75)	5	0.5 (0.0-1.4)	3.6 (0.7-6.4)	3.6 (0.7-6.4)	3.6 (0.7-6.4)	n.a.
Vanguard Complete Knee	Vanguard Complete Knee	170	68 (61-74)	8	2.5 (0.1-5.0)	4.8 (1.3-8.2)	4.8 (1.3-8.2)	4.8 (1.3-8.2)	n.a.

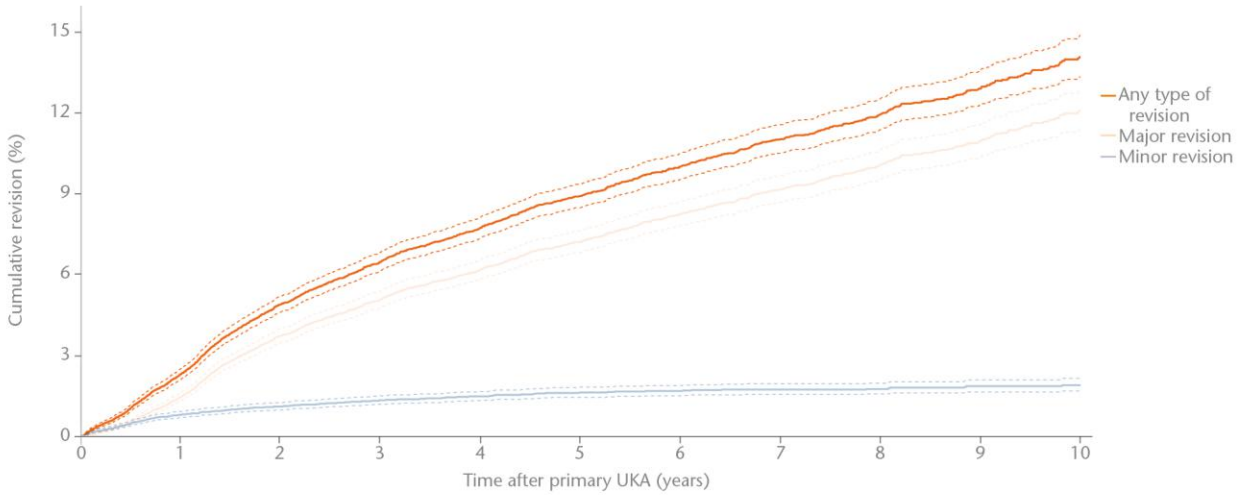
[1] Revision of at least the femur or tibia component.
* Denotes prosthesis combinations with no reported use in primary TKAs in 2018.
Please note: n.a. if <50 cases were at risk; TKA: total knee arthroplasty; CI: confidence interval; IQR: interquartile range.

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.

Unicondylar knee arthroplasty

Revision within 10 years

FIGURE CUMULATIVE REVISION PERCENTAGE OF UNICONDYLAR KNEE ARTHROPLASTIES BY TYPE OF REVISION IN THE NETHERLANDS IN 2007-2018 (N=25,217).



	Cumulative 10-year revision percentage	
	Competing risk[1] (95% CI)	Kaplan Meier (95% CI)
Any type of revision	14.1 (13.4-14.9)	14.6 (13.8-15.3)
Major revision[2]	12.1 (11.4-12.9)	12.6 (11.8-13.4)
Minor revision[3]	1.9 (1.7-2.2)	2.1 (1.8-2.3)

[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).
Please note: Dotted lines represent the upper and lower limits of the 95% confidence interval.
UKA: unicondylar knee arthroplasty; CI: confidence interval.

In 2007-2018, 719 (2.9%) primary UKAs were implanted in patients who died within ten years after the primary procedure.

Revision per component

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 2007-2018 (N=25,217).

					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
All UKAs for osteoarthritis		**25,217**	**63 (57-69)**	**1,927**	**1,487**	**8**	**15**	**57**	**338**	**22**	**2.3 (2.1-2.5)**	**6.6 (6.2-6.9)**	**9.1 (8.6-9.5)**	**11.3 (10.7-11.8)**	**14.6 (13.8-15.3)**
Oxford PKR cemented	Oxford PKR cemented	11,536	63 (57-69)	1,056	835	5	9	24	169	14	2.2 (1.9-2.5)	6.7 (6.1-7.0)	9.2 (8.6-9.8)	11.3 (10.6-12.0)	14.6 (13.6-15.6)
Oxford PKR cementless	Oxford PKR cementless	7,280	64 (58-70)	295	161	1	2	10	118	3	2.2 (1.8-2.5)	5.2 (4.6-5.8)	6.8 (5.9-7.8)	8.9 (7.1-10.6)	13.8 (8.2-19.4)
Physica Zimmer Unicompartmental High Flex Knee	Physica Zimmer Unicompartmental High Flex Knee	1,554	61 (56-66)	66	57	0	0	1	8	0	1.1 (0.6-1.7)	4.2 (3.0-5.4)	5.3 (3.8-6.7)	7.4 (5.4-9.5)	9.5 (6.8-12.2)
Genesis Uni	Genesis Uni	1,265	62 (57-69)	183	175	1	0	2	3	2	3.0 (2.0-3.9)	9.1 (7.5-10.7)	12.8 (10.9-14.8)	15.4 (13.2-17.6)	17.9 (15.3-20.5)
balanSys	balanSys	348	61 (55-68)	41	34	1	0	3	3	0	3.3 (1.4-5.1)	9.9 (6.6-13.1)	10.6 (7.2-14.0)	12.2 (8.4-16.0)	n.a.
Journey Uni	Journey Uni	265	62 (56-68)	12	9	0	2	1	0	0	2.7 (0.6-4.9)	7.3 (2.7-11.9)	n.a.	n.a.	n.a.
HLS Uni	HLS Uni	170	58 (54-62)	33	33	0	0	0	0	0	2.4 (0.1-4.6)	8.9 (4.5-13.1)	16.7 (10.9-22.2)	19.7 (13.7-25.8)	n.a.
Triathlon	Triathlon	133	58 (54-62)	9	9	0	0	0	0	0	0.0 (0.0-0.0)	5.3 (0.8-9.8)	7.8 (2.2-13.4)	n.a.	n.a.
Allegretto	Allegretto	103	57 (50-65)	14	11	0	0	3	0	0	6.4 (1.4-11.3)	13.4 (6.3-20.6)	n.a.	n.a.	n.a.

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

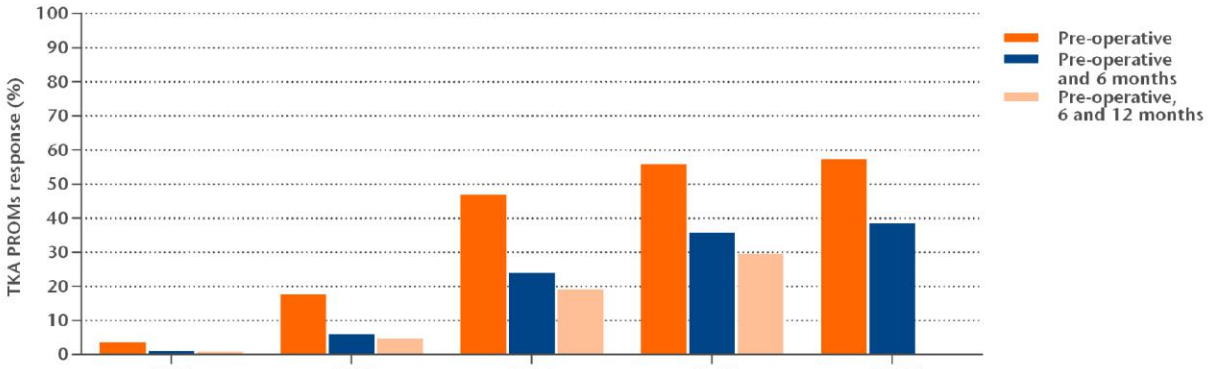
**Only combinations of femur and tibia components with over 100 procedures have been listed.
These combinations represented 89.8% of all registered primary unicondylar knee arthroplasties.**

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 or patella resurfacing of the prosthesis may have influenced the cumulative revision percentages.

PROMs

Response 2014-2018

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=91) IN THE NETHERLANDS IN 2014-2018.



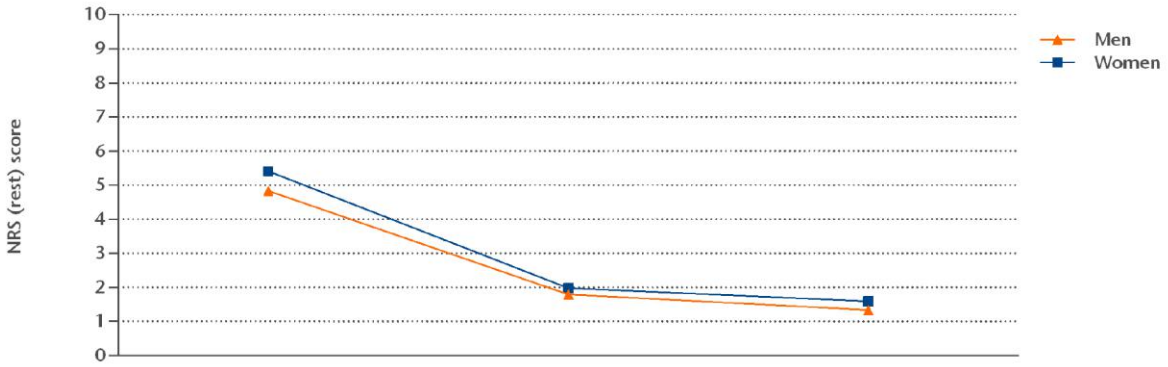
Year	2014	2015	2016	2017	2018[1]
TKA for osteoarthritis (n)	21,685	21,861	22,531	23,398	23,796
TKA PROMs response (%)					
Pre-operative	3.8	17.8	46.8	55.8	57.2
Pre-operative and 6 months postoperative	1.1	6.1	24.0	35.8	38.5
Pre-operative, 6 and 12 months postoperative	0.9	4.8	19.1	29.5	n.a.

[1] The 12 months PROMs response percentage is not (yet) available for 2018. The 6 months response percentage is not (yet) available after July 1st 2018. In total, 12,332 patients underwent a TKA for osteoarthritis between January 1st and July 1st 2018.
TKA: total knee arthroplasty; PROM: patient reported outcome measure.

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

NRS (rest)

FIGURE MEAN PRE-OPERATIVE, 6 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (REST) SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



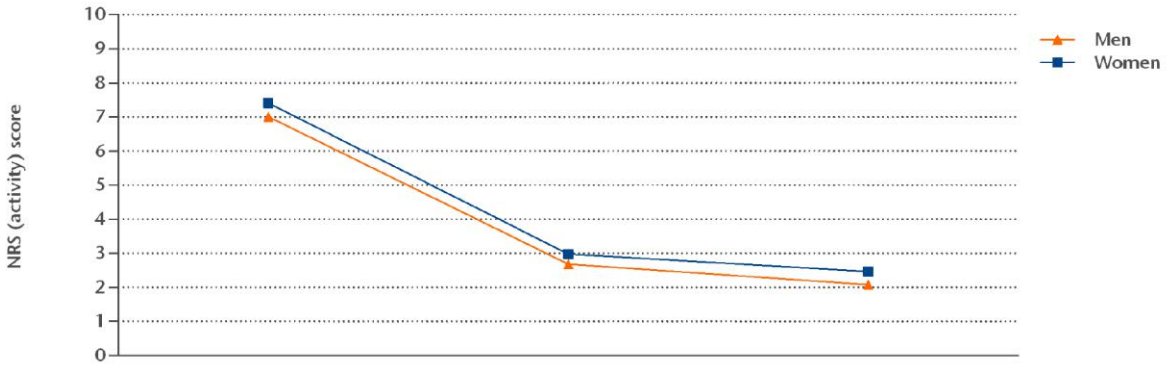
NRS (rest) score	Pre-operative		6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	14,351	4.8 (4.8-4.9)	8,748	1.8 (1.7-1.8)	7,393	1.3 (1.3-1.4)
Women	24,477	5.4 (5.4-5.4)	14,232	2.0 (1.9-2.0)	12,217	1.6 (1.6-1.6)
Total[2]	38,848	5.2 (5.2-5.2)	22,993	1.9 (1.9-1.9)	19,621	1.5 (1.5-1.5)

[1] The 12 months NRS (rest) score is not (yet) available for 2018.
[2] Also contains 44 (0.05%) NRS (rest) scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

NRS (activity)

FIGURE MEAN PRE-OPERATIVE, 6 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (ACTIVITY) SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



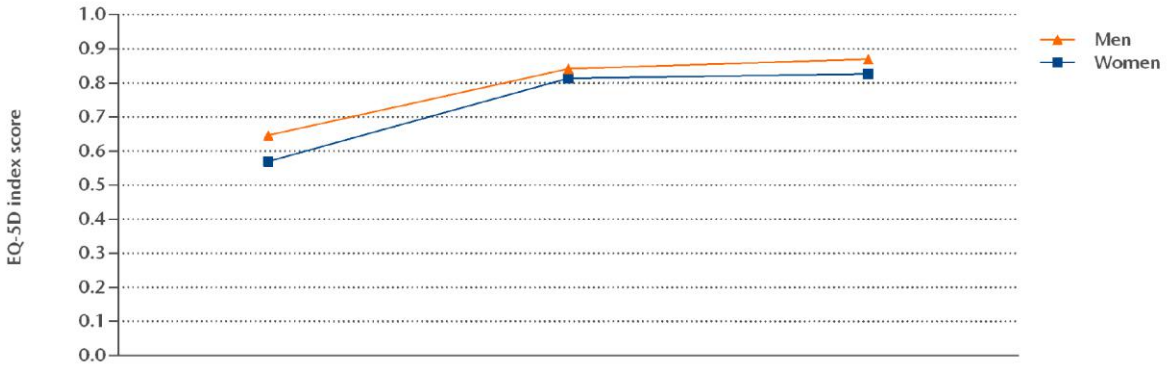
NRS (activity) score	Pre-operative		6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	14,345	7.0 (7.0-7.0)	8,752	2.7 (2.6-2.7)	7,405	2.1 (2.0-2.1)
Women	24,459	7.4 (7.4-7.4)	14,254	3.0 (2.9-3.0)	12,238	2.5 (2.4-2.5)
Total[2]	38,824	7.3 (7.2-7.3)	23,019	2.9 (2.8-2.9)	19,654	2.3 (2.3-2.4)

[1] The 12 months NRS (activity) score is not (yet) available for 2018.
[2] Also contains 44 (0.05%) NRS (activity) scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

EQ5D index score

FIGURE MEAN PRE-OPERATIVE, 6 MONTHS AND 12 MONTHS POSTOPERATIVE EQ-5D INDEX SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



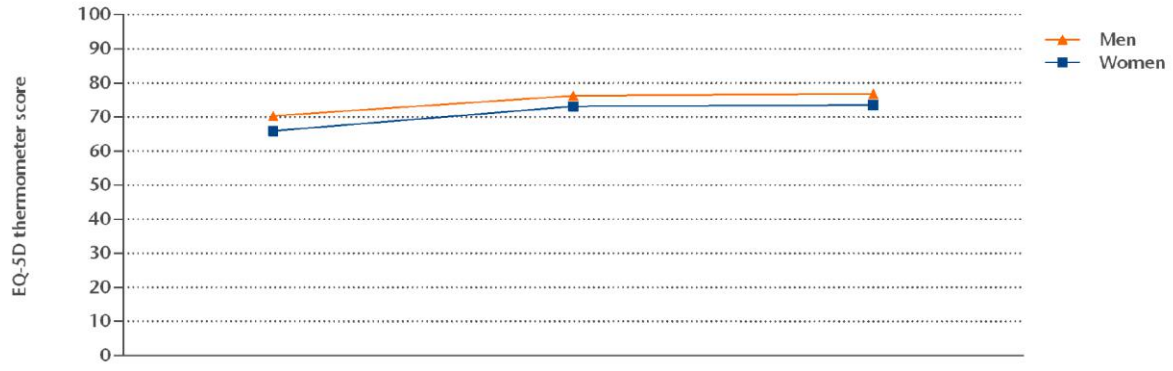
EQ-5D index score	Pre-operative		6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	15,256	0.65 (0.64-0.65)	9,362	0.84 (0.84-0.84)	8,111	0.87 (0.87-0.87)
Women	25,947	0.57 (0.57-0.57)	15,155	0.81 (0.81-0.82)	13,404	0.83 (0.82-0.83)
Total[2]	41,225	0.60 (0.60-0.60)	24,531	0.82 (0.82-0.83)	21,528	0.84 (0.84-0.85)

[1] The 12 months EQ-5D index score is not (yet) available for 2018.
[2] Also contains 49 (0.06%) EQ-5D index scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

EQ5D thermometer

FIGURE MEAN PRE-OPERATIVE, 6 MONTHS AND 12 MONTHS POSTOPERATIVE EQ-5D THERMOMETER SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



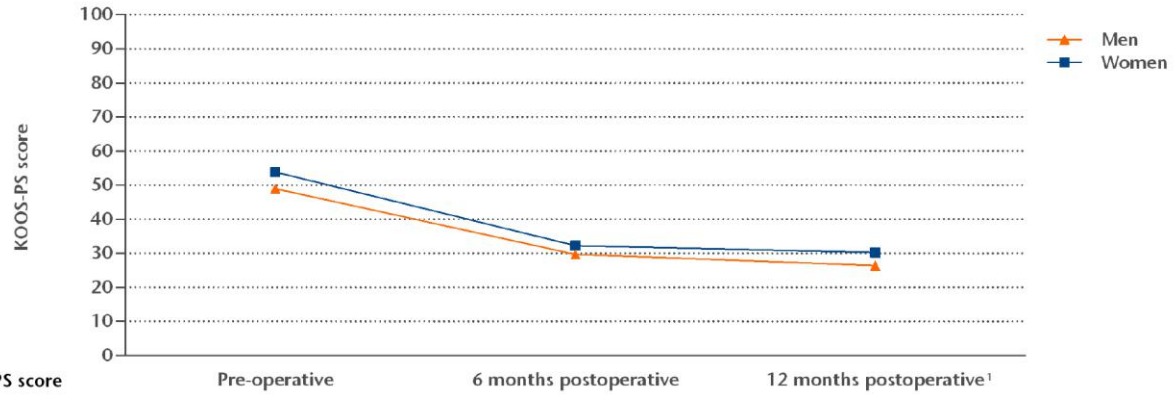
EQ-5D thermometer score	Pre-operative		6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	15,297	70.3 (70.0-70.6)	9,426	76.2 (75.8-76.6)	8,190	76.8 (76.4-77.2)
Women	25,940	65.9 (65.7-66.2)	15,296	73.1 (72.8-73.5)	13,576	73.5 (73.1-73.8)
Total[2]	41,260	67.5 (65.7-66.2)	24,735	74.3 (74.1-74.5)	21,779	74.7 (74.5-75.0)

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2018.
[2] Also contains 49 (0.06%) EQ-5D thermometer scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

KOOS-PS score

FIGURE MEAN PRE-OPERATIVE, 6 MONTHS AND 12 MONTHS POSTOPERATIVE KOOS-PS SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



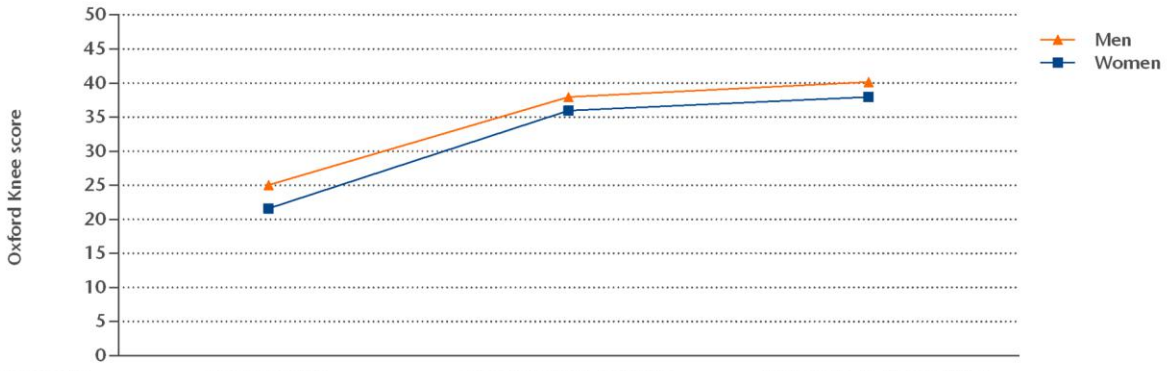
KOOS-PS score	Pre-operative		6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	15,134	48.9 (48.7-49.2)	9,234	29.7 (29.4-30.0)	7,961	26.4 (26.1-26.8)
Women	25,366	53.8 (53.6-54.0)	14,559	32.3 (32.0-32.5)	12,790	30.2 (30.0-30.5)
Total[2]	40,521	52.0 (51.8-52.1)	23,807	31.3 (31.1-31.4)	20,764	28.8 (28.6-30.0)

[1] The 12 months KOOS-PS score is not (yet) available for 2018.
[2] Also contains 48 (0.06%) KOOS-PS scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

Oxford Knee score

FIGURE MEAN PRE-OPERATIVE, 6 MONTHS AND 12 MONTHS POSTOPERATIVE OXFORD KNEE SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



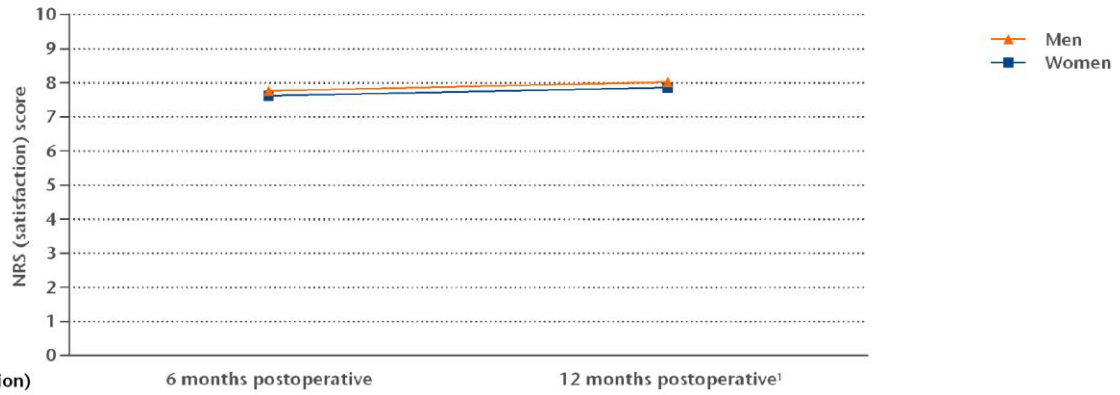
Oxford Knee score	Pre-operative		6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	13,200	25.0 (24.9-25.2)	8,488	38.0 (37.8-38.2)	7,194	40.2 (40.0-40.4)
Women	22,277	21.6 (21.5-21.7)	13,504	36.0 (35.8-36.1)	11,638	38.0 (37.8-38.1)
Total[2]	35,490	22.9 (22.8-23.0)	22,001	36.7 (36.7-36.9)	18,841	38.8 (38.7-38.9)

[1] The 12 months Oxford Knee score is not (yet) available for 2018.
[2] Also contains 31 (0.04%) Oxford Knee scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

NRS (satisfaction)

FIGURE MEAN 6 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (SATISFACTION) SCORES OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



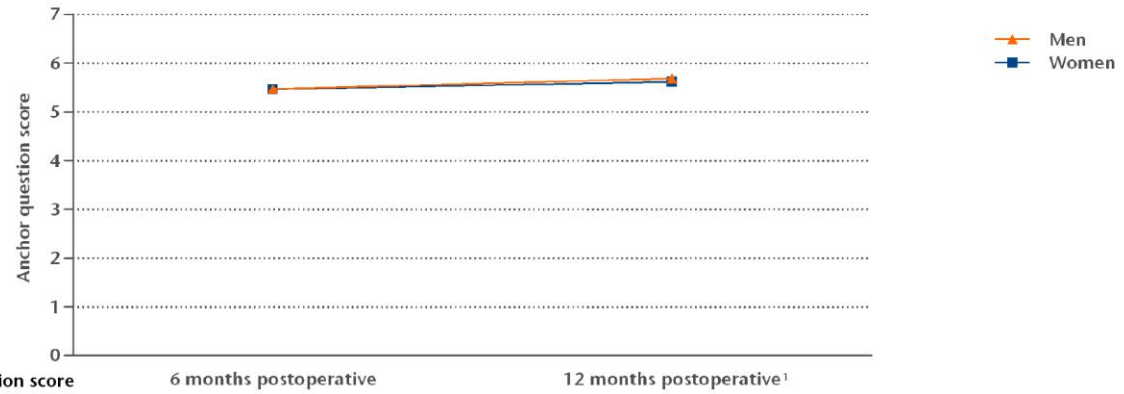
NRS (satisfaction)	6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	7,257	7.8 (7.7-7.8)	6,251	8.0 (8.0-8.1)
Women	11,977	7.6 (7.6-7.7)	10,658	7.9 (7.8-7.9)
Total[2]	19,246	7.7 (7.6-7.7)	16,918	7.9 (7.9-8.0)

[1] The 12 months NRS (satisfaction) score is not (yet) available for 2018.
[2] Also contains 21 (0.06%) NRS (satisfaction) scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

The NRS (satisfaction) score measures patients' satisfaction with the outcome of 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.

Anchor question: Daily functioning

FIGURE MEAN 6 MONTHS AND 12 MONTHS POSTOPERATIVE CHANGE IN DAILY FUNCTIONING OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



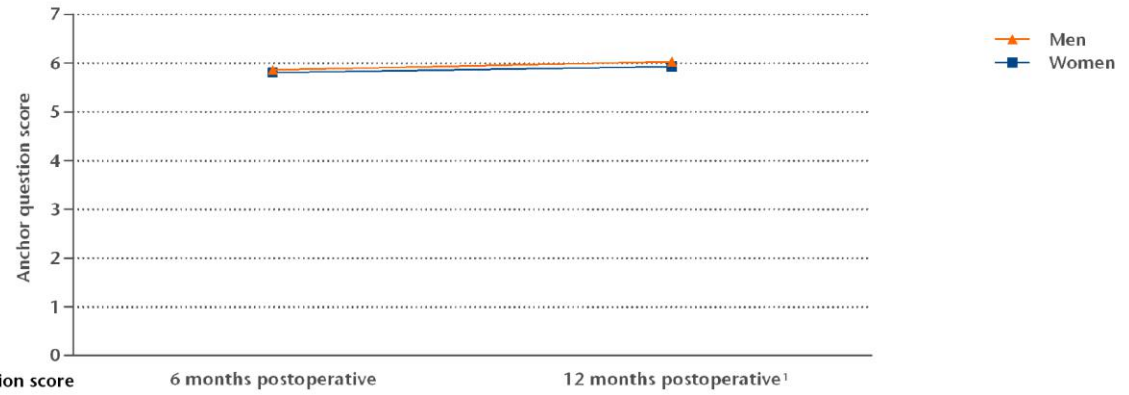
Anchor question score	6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	8,529	5.5 (5.4-5.5)	7,614	5.7 (5.7-5.7)
Women	13,895	5.5 (5.4-5.5)	12,616	5.6 (5.6-5.6)
Total[2]	22,438	5.5 (5.4-5.5)	20,242	5.6 (5.6-5.7)

[1] The 12 months anchor question score is not (yet) available for 2018.
[2] Also contains 26 (0.06%) anchor question scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

Anchor question: Pain

FIGURE MEAN 6 MONTHS AND 12 MONTHS POSTOPERATIVE CHANGE IN PAIN OF PATIENTS WHO UNDERWENT A TKA FOR OSTEOARTHRITIS BY GENDER IN THE NETHERLANDS IN 2014-2018.



Anchor question score	6 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	8,096	5.9 (5.8-5.9)	7,072	6.0 (6.0-6.1)
Women	13,015	5.8 (5.8-5.8)	11,550	5.9 (5.9-6.0)
Total[2]	21,124	5.8 (5.8-5.8)	18,663	6.0 (6.0-6.0)

[1] The 12 months anchor question score is not (yet) available for 2018.
[2] Also contains 24 (0.08%) anchor question scores of patients whose gender was registered as unknown.
TKA: total knee arthroplasty; CI: confidence interval.

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

Ankle arthroplasty

Numbers

Registered procedures 2014-2018

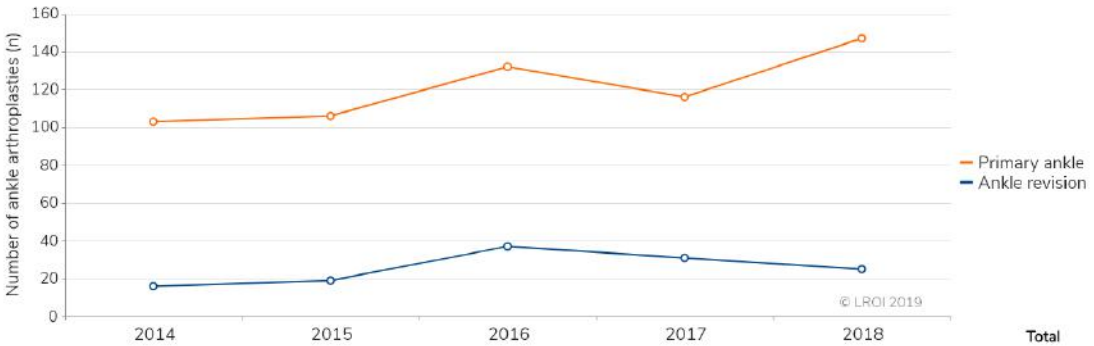
TABLE NUMBER OF REGISTERED ANKLE ARTHROPLASTIES PER YEAR OF SURGERY (2014-2018) IN THE LROI IN APRIL 2019.

Year of surgery	Type of ankle arthroplasty			
	Total arthroplasty (n)	Other (n)	Revision arthroplasty (n)	Total[1] (n)
2014	102	0	16	119
2015	106	0	19	125
2016	125	6	37	169
2017	112	3	31	147
2018	144	1	25	172
Total	589	10	128	732

[1] In 0.8% (n=5) primary ankle arthroplasties the type of primary ankle prosthesis has not been registered.

Type of procedures 2014-2018

FIGURE NUMBER OF PRIMARY ANKLE ARTHROPLASTIES AND ANKLE REVISION ARTHROPLASTIES REGISTERED IN THE LROI IN THE NETHERLANDS IN 2014-2018.

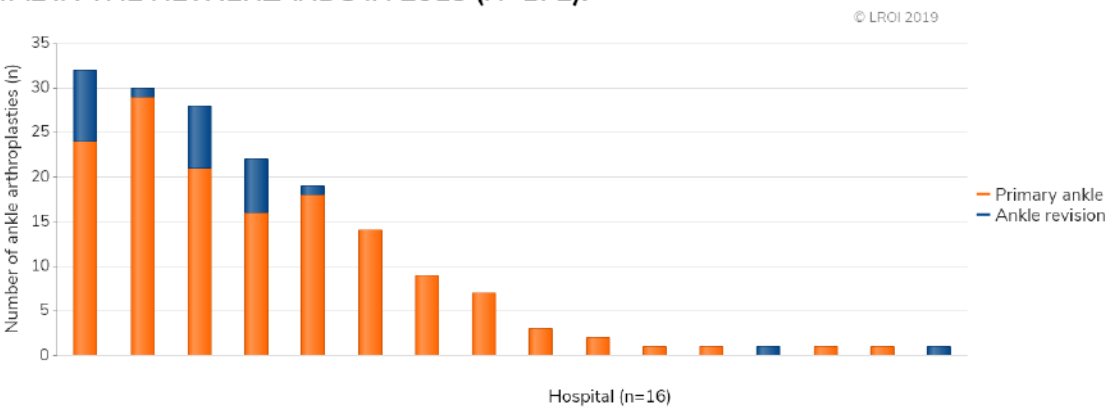


Year	2014	2015	2016	2017	2018	Total
Type of procedure (n)						
Primary ankle	103	106	132	116	147	**604**
Ankle revision	16	19	37	31	25	**128**
Total:	**119**	**125**	**169**	**147**	**172**	**732**

Three (2.0%) of the primary ankle arthroplasties that were performed in 2018 were performed bilaterally.

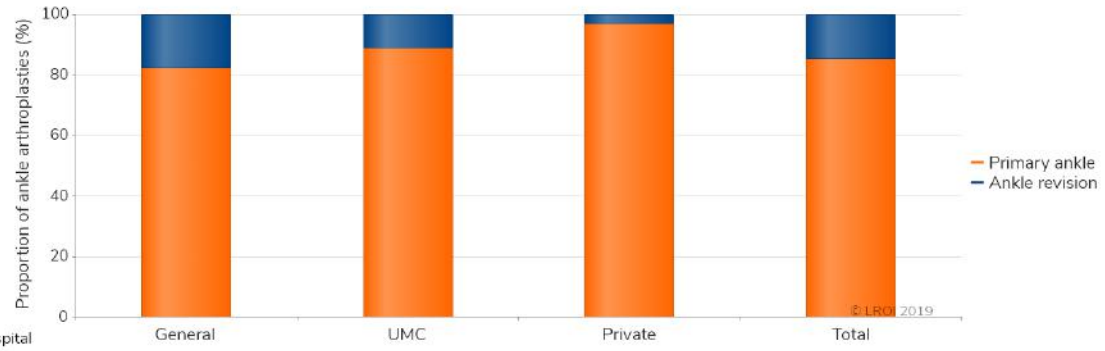
Type of procedure per hospital

FIGURE NUMBER OF PRIMARY ANKLE ARTHROPLASTIES AND ANKLE REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=172).



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 2018.



Type of hospital	General	UMC	Private	Total
Type of procedure (%)				
Primary ankle	82.31	88.89	96.97	**85.47**
Ankle revision	17.69	11.11	3.03	**14.53**
Total (n):	**130**	**9**	**33**	**172**

Please note: In 2018, 11 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

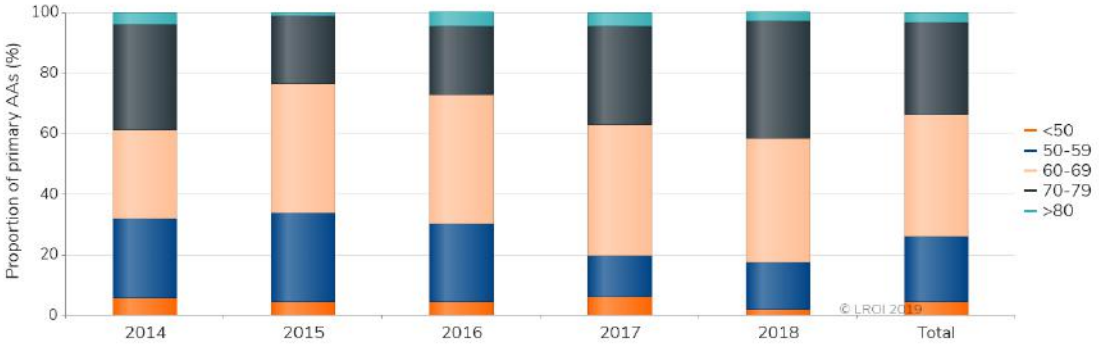
TABLE PATIENT CHARACTERISTICS OF ALL PATIENTS WITH A REGISTERED PRIMARY ANKLE ARTHROPLASTY BY DIAGNOSIS IN THE NETHERLANDS IN 2018.

	Osteoarthritis (n=114)	No osteoarthritis[1] (n=31)	Total[2] (n=147)
Completeness (%)			98
Mean age (years) (SD)	67.5 (8.0)	64.8 (8.2)	67.0 (8.3)
Age (years) (%)			
<50	2	3	2
50-59	13	23	15
60-69	39	48	41
70-79	43	26	39
≥80	3	0	3
Gender (%)			
Men	71	55	68
Women	29	45	32
ASA score (%)			
I	14	13	14
II	75	55	70
III-IV	11	32	16
Type of hospital (%)			
General	69	87	73
UMC	6	3	5
Private	10	10	22
Charnley-score (%)			
A One ankle joint affected	64	54	62
B1 Both ankle joints affected	15	17	16
B2 Contralateral ankle joint with a total ankle prosthesis	0	8	9
C Multiple joints affected or chronic disease that affects quality of life	12	21	13
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	0	3	1
Normal weight (>18,5-25)	20	32	23
Overweight (>25-30)	56	39	52
Obesity (>30-40)	23	26	23
Morbid obesity (>40)	1	0	1
Smoking (%)			
No	95	90	94
Yes	5	10	6

[1] Another diagnosis than osteoarthritis registered as primary diagnosis, specifically post-traumatic (10%), rheumatoid arthritis (7%), tumour (1%) or other primary diagnosis (3%).
[2] The primary diagnosis of 2 (1.4%) patients was not registered.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary ankle arthroplasties are included.
General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

Age category 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN AGE CATEGORY IN PRIMARY ANKLE ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Year	2014	2015	2016	2017	2018	Total
Age category (%)						
<50	5.83	4.72	4.55	6.03	2.04	**4.47**
50-59	26.21	29.25	25.76	13.79	15.65	**21.69**
60-69	29.13	42.45	42.42	43.10	40.82	**39.90**
70-79	34.95	22.64	22.73	32.76	38.78	**30.63**
>80	3.88	0.94	4.55	4.31	2.72	**3.31**
Total (n):	**103**	**106**	**132**	**116**	**147**	**604**

AA: ankle arthroplasty

Previous surgery 2016-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN PREVIOUS SURGERIES TO THE SAME JOINT IN PATIENTS WHO UNDERWENT A PRIMARY ANKLE ARTHOPLASTY IN THE NETHERLANDS IN 2016-2018.

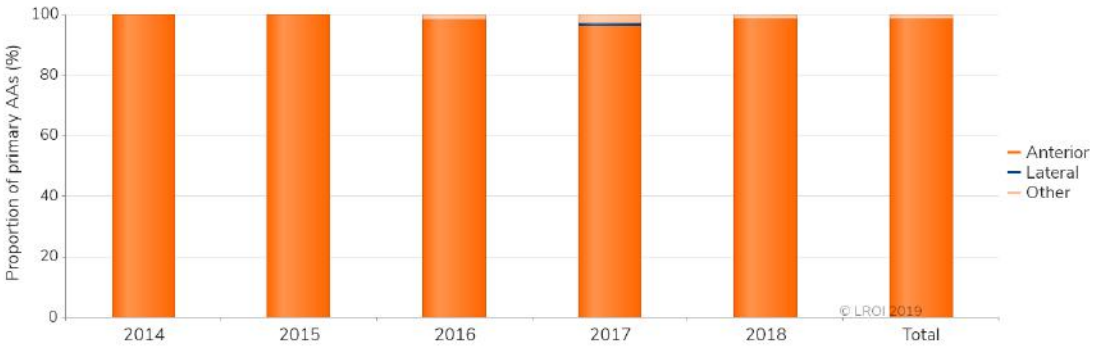
Year	**2016**	**2017**	**2018**	**Total**
Primary ankle arthroplasty (n)	125	114	145	384
Previous surgery to the relevant ankle (total); Proportion[1] (%)	31.2	28.9	29.7	29.9
Osteosynthesis	13.6	17.5	10.0	13.3
Arthroscopy	11.2	11.4	5.6	9.1
Hindfoot surgery	6.4	5.3	12.4	8.3
Arthrodesis	4.0	1.8	5.6	3.9
Treatment of osteochondral bone defect	1.6	2.6	1.4	1.8
Osteotomy	2.4	1.8	1.4	1.8
Synovectomy	1.6	2.6	0.7	1.6
Forefoot surgery	2.4	0.0	1.4	1.3
Ligament reconstruction	1.6	1.8	0.7	1.3
Other	4.8	2.6	3.4	3.6

[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.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on previous surgeries in case of a bilateral arthroplasty were excluded. As of this annual report, all primary ankle arthroplasties are included.

Surgery and prosthesis

Surgical approach 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY ANKLE ARTHROPLASTY IN THE NETHERLANDS IN 2014-2018.

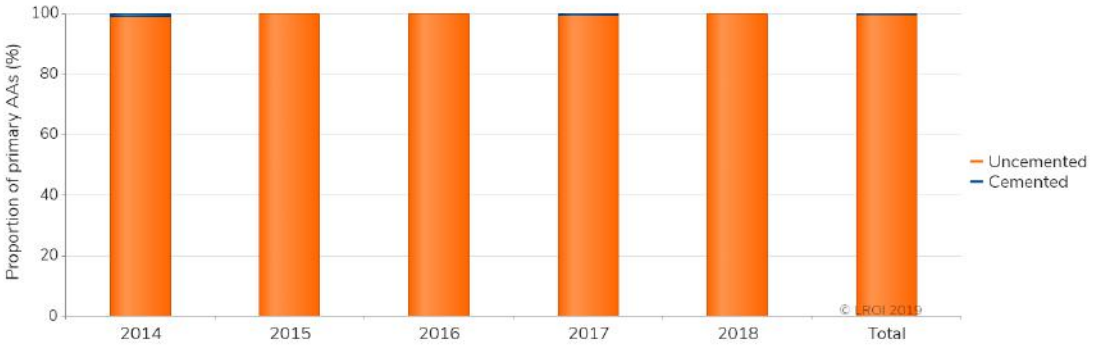


Surgical approach (%)	2014	2015	2016	2017	2018	Total
Anterior	100.00	100.00	98.46	96.46	98.61	**98.64**
Lateral	0.00	0.00	0.00	0.88	0.00	**0.17**
Other	0.00	0.00	1.54	2.65	1.39	**1.19**
Total (n):	**101**	**101**	**130**	**113**	**144**	**589**

AA: ankle arthroplasty

Fixation 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY ANKLE ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.

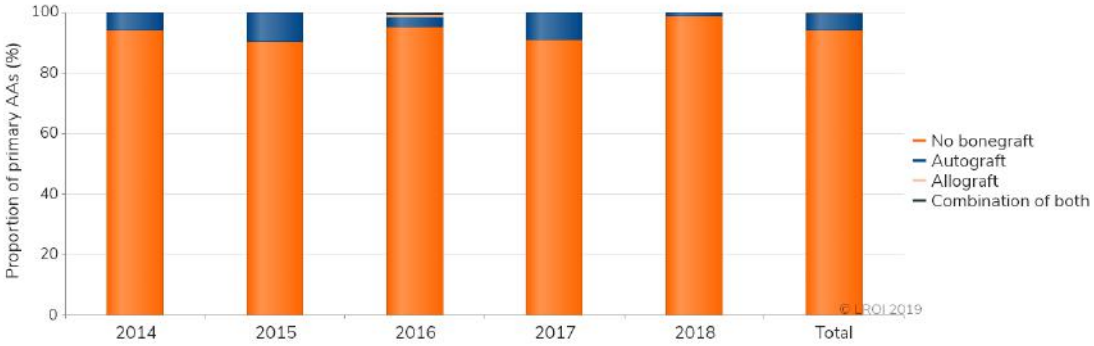


Fixation (%)	2014	2015	2016	2017	2018	Total
Uncemented	99.02	100.00	100.00	99.14	100.00	**99.67**
Cemented	0.98	0.00	0.00	0.86	0.00	**0.33**
Total (n):	**102**	**105**	**130**	**116**	**145**	**598**

AA: ankle arthroplasty

Type of bonegraft 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF BONEGRAFT IN PRIMARY ANKLE ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.

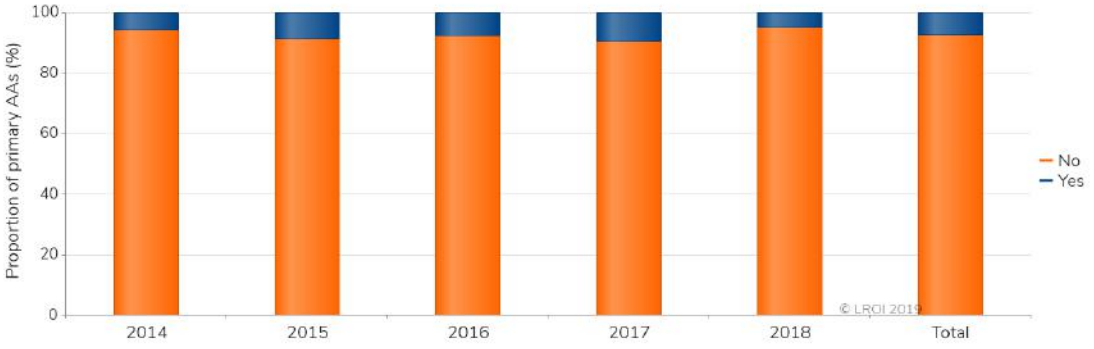


Type of bonegraft (%)						
No bonegraft	94.00	90.29	95.38	91.07	98.57	**94.19**
Autograft	6.00	9.71	3.08	8.93	1.43	**5.47**
Allograft	0.00	0.00	0.77	0.00	0.00	**0.17**
Combination of both	0.00	0.00	0.77	0.00	0.00	**0.17**
Total (n):	**100**	**103**	**130**	**112**	**140**	**585**

AA: ankle arthroplasty.

Medial malleolus osteotomy 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN MEDIAL MALLEOLUS OSTEOTOMY IN PRIMARY ANKLE ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.

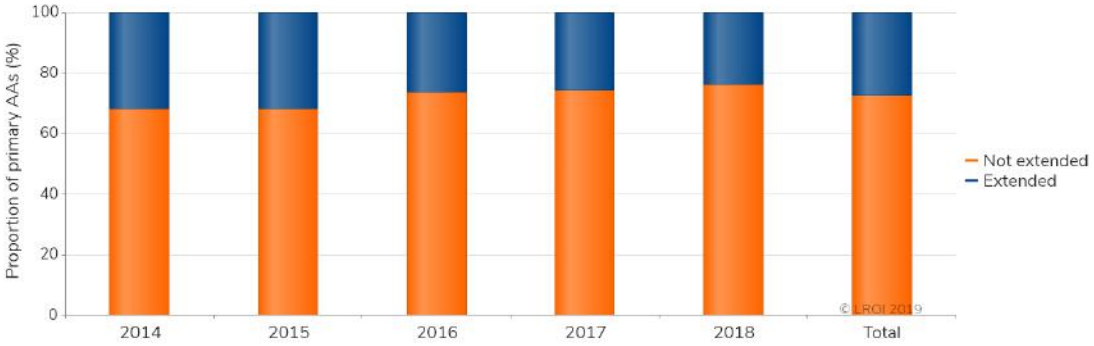


Medial malleolus osteotomy (%)						
No	94.12	91.35	92.31	90.27	95.10	**92.74**
Yes	5.88	8.65	7.69	9.73	4.90	**7.26**
Total (n):	**102**	**104**	**130**	**113**	**143**	**592**

AA: ankle arthroplasty.

Extension heel cord 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN HEEL CORD EXTENSION IN PRIMARY ANKLE ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Extension heel cord (%)	2014	2015	2016	2017	2018	Total
Not extended	68.32	68.27	73.64	74.34	76.22	**72.54**
Extended	31.68	31.73	26.36	25.66	23.78	**27.46**
Total (n):	**101**	**104**	**129**	**113**	**143**	**590**

AA: ankle arthroplasty.

Most frequently registered ankle prostheses

TABLE THE MOST FREQUENTLY REGISTERED PRIMARY ANKLE ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=129).

Name	Proportion (%)
Salto	52.7
Infinity	30.2
AAA OSG	12.4
Box	3.1
Cadence	1.6

Ankle revision arthroplasty

Type of revision 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF REVISION ARTHROPLASTY OF ANKLE REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.

Type of revision (%)	2014	2015	2016	2017	2018	Total
Removal	31.25	36.84	39.39	40.00	28.00	**35.59**
Total revision	18.75	15.79	9.09	20.00	20.00	**16.10**
Partial revision	37.50	42.11	45.45	32.00	20.00	**35.59**
Other	12.50	5.26	6.06	8.00	32.00	**12.71**
Total (n):	**16**	**19**	**33**	**25**	**25**	**118**

Please note: In 10 (7.8%) ankle revision arthroplasties, the type of revision was not registered.
RA: revision arthroplasty.

Reasons for revision 2016-2018

TABLE TREND (PROPORTION [%] PER YEAR) REASONS FOR REVISION OR RE-SURGERY IN PATIENTS WHO UNDERWENT AN ANKLE REVISION ARTHROPALSTY IN THE NETHERLANDS in 2016-2018.

Year	2016	2017	2018	Total
Ankle revision arthroplasty (n)	37	31	25	93
Reasons for revision; Proportion[1] (%)				
Inlay wear	35.1	45.2	32.0	37.6
Cyst formation	21.6	41.9	40.0	33.3
Loosening of talus component	29.7	38.7	32.0	33.3
Loosening of tibia component	18.9	22.6	32.0	23.7
Malalignment	8.1	29.0	24.0	19.4
Instability	8.1	25.8	20.0	17.2
Infection	13.5	3.2	24.0	12.9
Dislocation	5.4	9.7	8.0	7.5
Arthrofibrosis	5.4	9.7	4.0	6.5
Peri-prosthetic fracture	0.0	3.2	4.0	2.2
Other	5.4	0.0	12.0	5.4

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

Shoulder arthroplasty

Numbers

Registered procedures 2014-2018

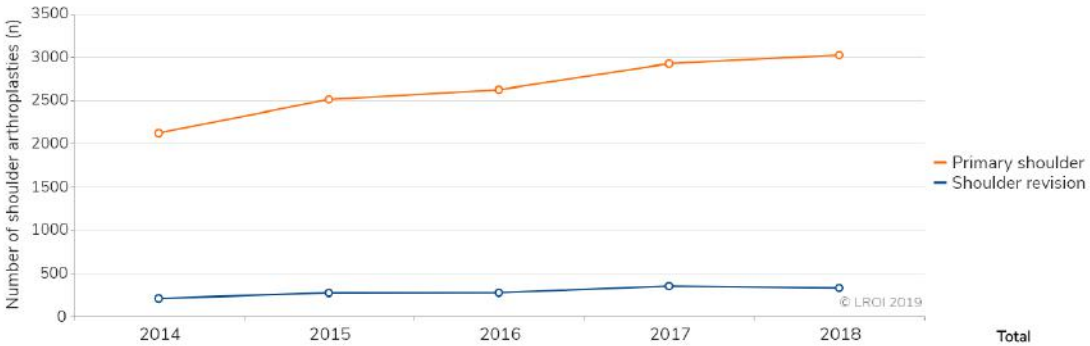
TABLE NUMBER OF REGISTERED SHOULDER ARTHROPLASTIES PER YEAR OF SURGERY (2014-2018) IN THE LROI IN APRIL 2019.

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

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

Procedures 2014-2018

FIGURE NUMBER OF PRIMARY SHOULDER ARTHROPLASTIES AND SHOULDER REVISION ARTHROPLASTIES REGISTERED IN THE LROI IN THE NETHERLANDS 2014-2018.

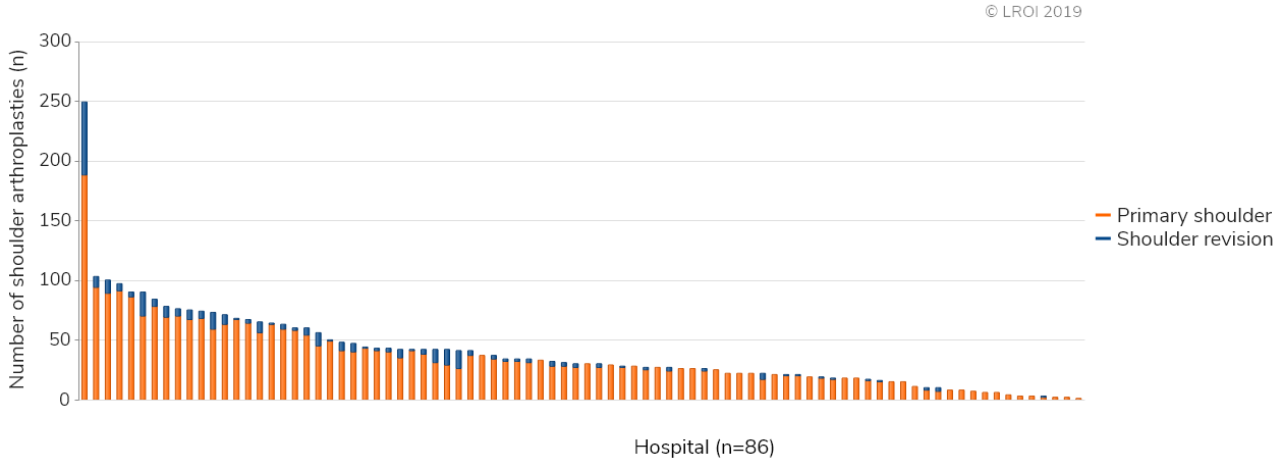


Year	2014	2015	2016	2017	2018	Total
Type of procedure (n)						
Primary shoulder	2,120	2,510	2,622	2,924	3,022	**13,198**
Shoulder revision	208	272	274	351	329	**1,434**
Total:	**2,328**	**2,782**	**2,896**	**3,275**	**3,351**	14,632

Out of 3,022 primary shoulder arthroplasties that were performed in 2018, 1% (n=31) was performed bilaterally.

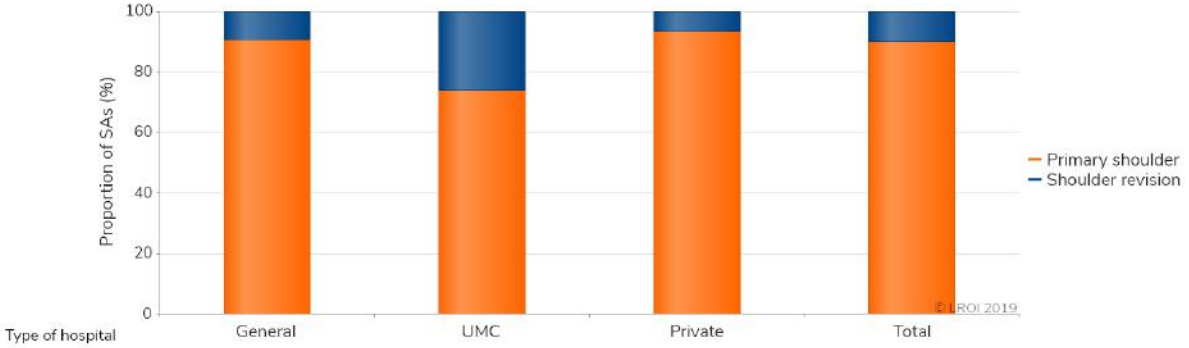
Type of procedure per hospital

FIGURE NUMBER OF PRIMARY SHOULDER ARTHROPLASTIES AND SHOULDER REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS 2018 (N=3351).



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 2018.

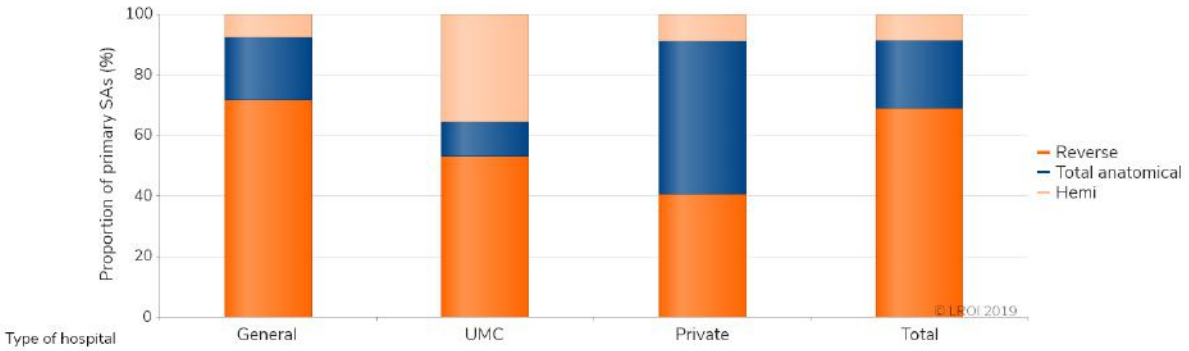


Type of procedure (%)	General	UMC	Private	Total
Primary shoulder	90.55	73.83	93.15	**90.18**
Shoulder revision	9.45	26.17	6.85	**9.82**
Total (n):	**3,025**	**107**	**219**	**3,351**

Please note: In 2018, 71 general hospitals, 6 UMCs and 9 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 2018.

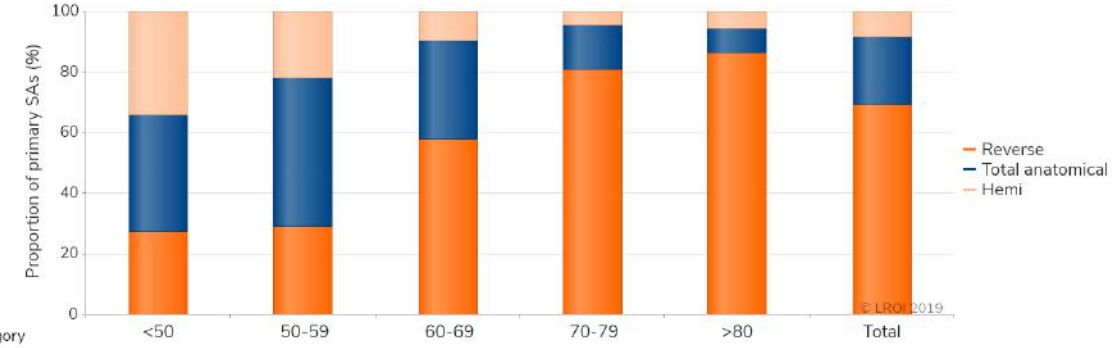


Type of primary shoulder arthroplasty (%)	General	UMC	Private	Total
Reverse	71.79	53.16	40.69	**69.20**
Total anatomical	20.49	11.39	50.49	**22.28**
Hemi	7.72	35.44	8.82	**8.52**
Total (n):	**2,733**	**79**	**204**	**3,016**

Please note: In 6 (0.2%) primary shoulder arthroplasties, the type of primary shoulder arthroplasty was not registered in 2018.
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 2018.



Type of primary shoulder arthroplasty (%)						
Reverse	27.27	28.93	57.88	80.80	86.47	**69.20**
Total anatomical	38.64	48.93	32.60	14.80	7.89	**22.28**
Hemi	34.09	22.14	9.52	4.39	5.64	**8.52**
Total (n):	**88**	**280**	**819**	**1,297**	**532**	**3,016**

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 2018.

N	Reverse (n=2,087)	Total anatomical (n=672)	Hemi (n=257)	Total[1] (n=3,022)
Completeness (%)				91
Mean age (years) (SD)	73.3 (8.3)	65.7 (9.3)	64.1 (12.8)	71.2 (9.8)
Age (years) (%)				
<50	1	5	12	3
50-59	4	20	24	9
60-69	23	40	30	27
70-79	50	29	22	43
≥80	22	6	12	18
Gender (%)				
Men	24	33	35	27
Women	76	67	65	73
ASA score (%)				
I	4	15	14	7
II	59	64	54	60
III-IV	37	21	32	33
Type of hospital (%)				
General	94	83	82	91
UMC	2	2	11	3
Private	4	15	7	6
Diagnosis (%)				
Osteoarthritis	32	86	44	45
Cuff arthropathy	30	1	1	21
Fracture	16	2	27	14
Post-traumatic	10	5	13	9
Cuff rupture	5	0	0	4
Rheumatoid arthritis	3	2	2	3
Osteonecrosis	1	3	7	2
Other	3	1	6	2
Walch score (%)				
A1 Humeral head centered, minor erosion glenoid	51	39	72	50
A2 Humeral head centered, major erosion glenoid	28	34	22	29
B1 Humeral head subluxed posteriorly, posterior joint space narrow, subchondrial sclerosis and osteophytes	10	17	2	11
B2 Humeral head subluxed posteriorly retroverted, glenoid with posterior rim erosion	7	9	2	7
B3 Humeral head subluxed posteriorly more than 70 percent and glenoid retroversion more than 10 degrees	2	1	1	2
C Glenoid retroversion more than 25 degrees regardless of erosion	2	0	1	1
Body Mass Index (kg/m²) (%)				
Underweight (≤18,5)	1	0	0	1
Normal weight (>18,5-25)	29	24	21	27
Overweight (>25-30)	37	40	41	38
Obesity (>30-40)	30	33	33	31
Morbid obesity (>40)	3	3	5	3
Smoking (%)				
No	91	89	87	90
Yes	9	11	13	10

[1] Also contains 6 (0.2%) primary shoulder arthroplasties of which the the type of prosthesis had not been registered.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary shoulder arthroplasties are included.
Reverse: reverse total shoulder arthroplasty; Total anatomical: anatomic total shoulder arthroplasty; Hemi: shoulder hemiarthroplasty; General: general hospital; UMC: university medical centre; Private: private hospital; SD: standard deviation.

The number of registered shoulder hemiarthroplaties in the LROI is not complete, since these procedures are also performed by trauma surgeons. For 2018, only shoulder hemiarthroplasties that were carried out by orthopaedic surgeons were registered in the LROI.

Age category 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN AGE CATEGORY IN PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.

Year	2014	2015	2016	2017	2018	Total
Age category (%)						
<50	2.28	1.64	2.23	2.36	2.10	**2.13**
50-59	5.73	6.52	6.82	7.01	7.90	**6.92**
60-69	24.60	25.56	26.44	25.38	26.86	**25.87**
70-79	44.45	45.85	45.50	45.68	44.94	**45.32**
>80	22.93	20.43	19.01	19.57	18.19	**19.76**
Total (n):	**1,622**	**2,070**	**2,288**	**2,581**	**2,759**	**11,320**

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 2018.

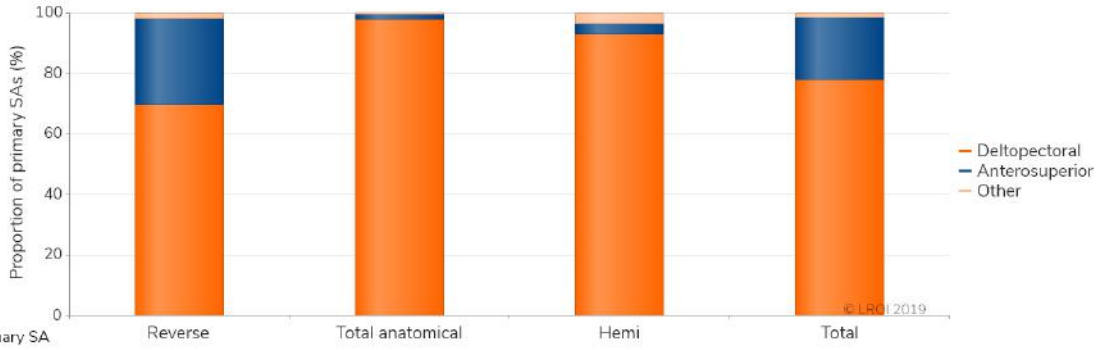
	Reverse (n=2,003) Proportion[1] (%)	Total anatomical (n=651) Proportion[1] (%)	Hemi (n=253) Proportion[1] (%)
Previous surgery to the relevant shoulder (total)	18.1	17.2	17.0
Acromioplasty	6.2	4.5	2.8
Rotator cuff repair	8.3	2.0	1.6
Osteosynthesis	5.0	3.2	5.9
Stabilisation procedure	1.3	3.2	3.2
Distal clavicle resection	2.6	3.4	2.4
Other	3.8	5.8	4.7

[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.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on previous surgeries in case of a bilateral arthroplasty were excluded. As of this annual report, all primary shoulder arthroplasties are included.
Reverse: reverse total shoulder arthroplasty; Total anatomical: anatomic total shoulder arthroplasty; Hemi: shoulder hemiarthroplasty.

Surgical techniques

Surgical approach by type of shoulder prosthesis

FIGURE SURGICAL APPROACH (PROPORTION [%] PER CATEGORY) BY TYPE OF PRIMARY SHOULDER ARTHROPLASTY IN PATIENTS WITH A PRIMARY SHOULDER ARTHROPLASTY IN THE NETHERLANDS IN 2018 (N=6430).

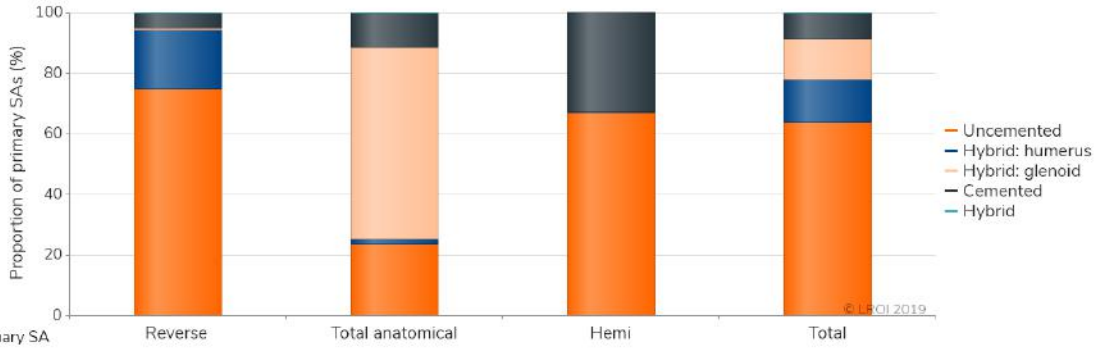


Type of primary SA	Reverse	Total anatomical	Hemi	Total
Surgical approach (%)				
Deltopectoral	69.75	97.77	93.00	**77.98**
Anterosuperior	28.52	1.79	3.50	**20.43**
Other	1.73	0.45	3.50	**1.59**
Total (n):	**2,086**	**672**	**257**	**3,015**

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 2018 (N=6098).



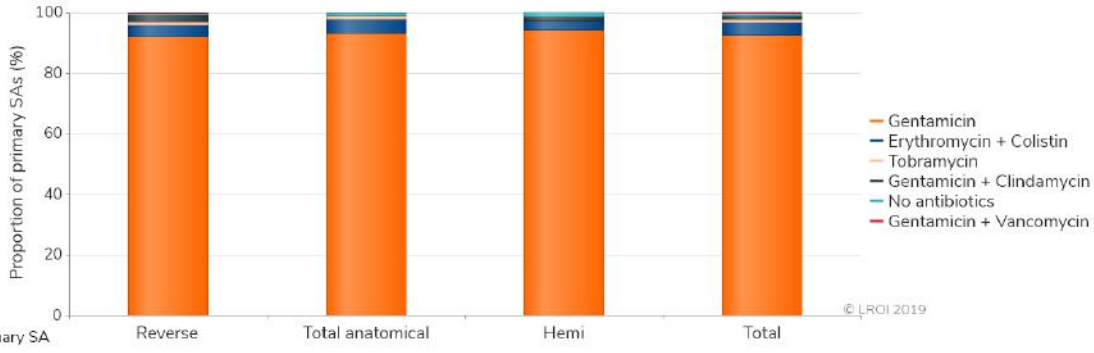
Type of primary SA	Reverse	Total anatomical	Hemi	Total
Fixation (%)				
Uncemented	74.86	23.48	66.93	**63.78**
Hybrid: humerus	19.53	1.74	0.39	**14.22**
Hybrid: glenoid	0.55	63.30	0.00	**13.16**
Cemented	4.91	11.30	32.68	**8.70**
Hybrid	0.15	0.17	0.00	**0.14**
Total (n):	**2,017**	**575**	**257**	**2,849**

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 ANTTIBIOTICS IN BONE CEMENT (PROPORTION [%] PER CATEGORY) BY TYPE OF PRIMARY SHOULDER ARTHROPLASTY IN PATIENTS WITH A PRIMARY SHOULDER ARTHROPLASTY IN THE NETHERLANDS IN 2018 (N=2424).

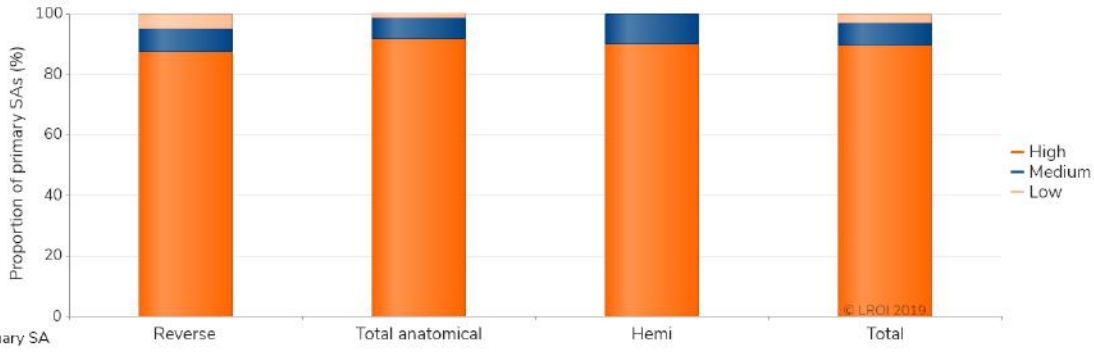


Type of primary SA	Reverse	Total anatomical	Hemi	Total
Bone cement antibiotics (%)				
Gentamicin	92.07	93.32	94.37	**92.79**
Erythromycin + Colistin	3.66	4.45	2.82	**3.95**
Tobramycin	1.22	1.34	0.00	**1.19**
Gentamicin + Clindamycin	2.24	0.00	1.41	**1.19**
No antibiotics	0.61	0.89	1.41	**0.79**
Gentamicin + Vancomycin	0.20	0.00	0.00	**0.10**
Total (n):	**492**	**449**	**71**	**1,012**

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 2018 (N=2424).

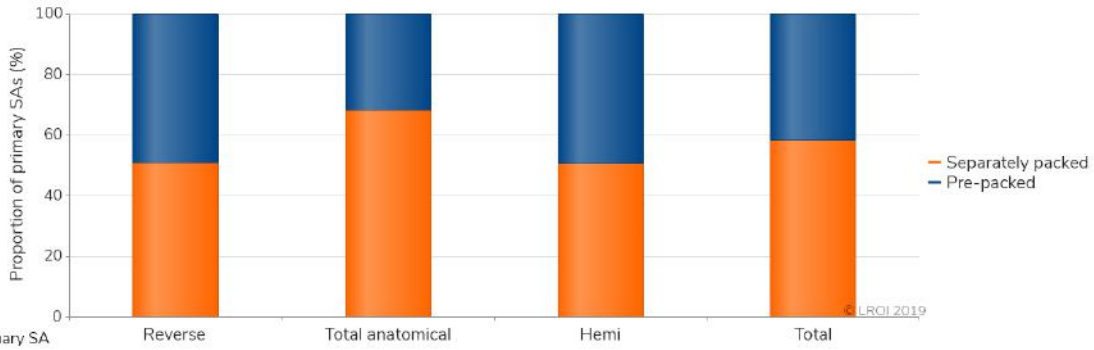


Type of primary SA	Reverse	Total anatomical	Hemi	Total
Bone cement viscosity (%)				
High	87.60	91.76	90.14	**89.62**
Medium	7.32	6.90	9.86	**7.31**
Low	5.08	1.34	0.00	**3.06**
Total (n):	**492**	**449**	**71**	**1,012**

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 2018 (N=2424).



Type of primary SA	Reverse	Total anatomical	Hemi	Total
Vacuum mixing system (%)				
Separately packed	50.81	68.15	50.70	**58.50**
Pre-packed	49.19	31.85	49.30	**41.50**
Total (n):	**492**	**449**	**71**	**1,012**

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 2018.

Humeral stem (n=1,908)

Name	Proportion (%)
Delta X-tend	34.1
Aequalis Ascend Flex	14.3
Comprehensive	11.8
Aequalis Reversed	10.3
Equinoxe	6.8

Humeral liner (n=1,749)

Name	Proportion (%)
Delta X-tend	33.9
Aequalis Ascend Flex	14.5
Comprehensive	11.7
Aequalis Reversed	10.7
Equinoxe	7.3

Glenosphere (n=1,834)

Name	Proportion (%)
Delta X-tend	35.3
Aequalis Reversed	25.0
Comprehensive	11.8
TM Reverse Glenoid Heads	7.1
Equinoxe	7.0

Metaphysis (n=1,439)

Name	Proportion (%)
Delta X-tend	34.2
Aequalis Ascend Flex	16.6
Comprehensive	14.5
Aequalis Reversed	13.1
Equinoxe	8.8

Glenoid baseplate (n=1,829)

Name	Proportion (%)
Delta X-tend	36.6
Aequalis Reversed	24.4
Comprehensive	12.2
Equinoxe	7.0
Trabecular Metal Baseplate	6.9

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 2018.

Humeral stem (n=550)		Humeral head (n=564)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Aequalis Acsend Flex	26.0	Aequalis Acsend Flex	25.9
Comprehensive	13.5	Global Unite/ Global AP	17.0
Global Unite	13.1	Comprehensive	13.5
Global AP	9.3	SMR head	8.2
SMR Stemless	5.3	Eclipse	7.3

Glenoid (n=579)	
Name	**Proportion (%)**
Global APG+	27.6
Aequalis Perform glenoid	23.8
Comprehensive	13.8
Aequalis Sferisch Glenoid	7.8
SMR uncemented glenoid	7.4

Shoulder hemiarthroplasty

TABLE THE MOST FREQUENTLY REGISTERED HUMERAL STEMS AND HUMERAL HEADS IN PRIMARY SHOULDER HEMIARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Humeral stem (n=194)		Humeral head (n=204)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Aequalis Fracture hemi	17.0	Aequalis humeral head	18.1
Comprehensive	16.5	Comprehensive	15.2
Aequalis Acsend Flex	13.4	Aequalis Acsend Flex	7.8
Copeland	7.7	Global Unite/ Global AP	7.8
Global Unite	7.7	Eclipse	7.4

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 2018.

Separately packed bone cement (n=242)		Bone cement pre-packed in a vacuum mixing system (n=249)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	64.7	Refobacin Bone Cement R	48.7
Palacos LV+G	10.0	Palacos R+G	45.9
Simplex ABC EC	7.2	Refobacin Plus Bone Cement	5.4
Palacos MV+G	4.8		
Copal G+C	4.0		

Total anatomical shoulder arthroplasty

TABLE THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT BY TYPE OF MIXING SYSTEM USED DURING PRIMARY TOTAL ANATOMICAL SHOULDER ARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Separately packed bone cement (n=353)		Bone cement pre-packed in a vacuum mixing system (n=124)	
Name	**Proportion (%)**	**Name**	**Proportion (%)**
Palacos R+G	62.6	Palacos R+G	48.4
Refobacin Bone Cement R	12.2	Refobacin Bone Cement R	43.5
Palacos LV+G	6.5	Refobacin Plus Bone Cement	7.3
Simplex ABC EC	5.9	Cemex Genta	0.8
Palacos MV+G	4.5		

Shoulder hemiarthroplasty

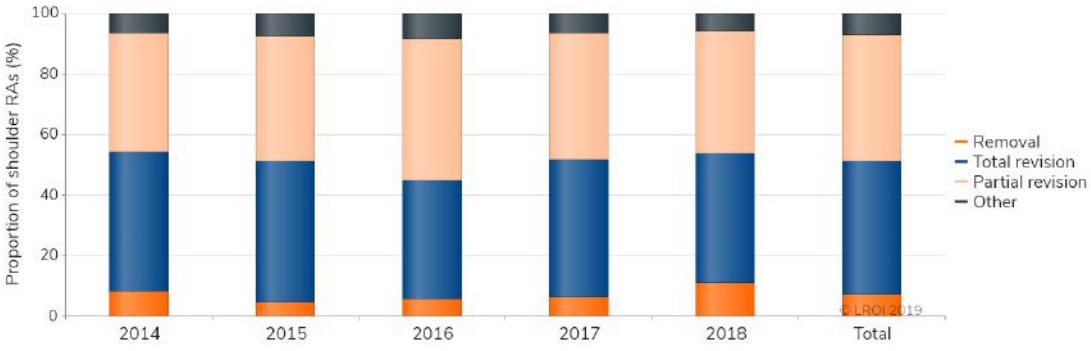
TABLE THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT BY TYPE OF MIXING SYSTEM USED DURING PRIMARY SHOULDER HEMIARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Name	Number (n)	Proportion (%)
Palacos R+G	32	45.1
Refobacin Bone Cement R	19	26.8
Refobacin Plus Bone Cement	11	15.5
Palacos MV+G	5	7.0
Simplex ABC EC	2	2.8

Shoulder revision arthroplasty

Type of revision 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF REVISION IN SHOULDER REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Type of shoulder revision (%)	2014	2015	2016	2017	2018	Total
Removal	8.33	4.62	5.70	6.23	11.36	**7.31**
Total revision	46.08	46.54	39.16	45.70	42.59	**43.95**
Partial revision	39.22	41.15	46.77	41.54	40.06	**41.78**
Other	6.37	7.69	8.37	6.53	5.99	**6.95**
Total (n):	**204**	**260**	**263**	**337**	**317**	**1,381**

RA: revision arthroplasty.

Reasons for revision 2014-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN REASONS FOR REVISION OR RE-SURGERY IN PATIENTS WHO UNDERWENT A SHOULDER REVISION ARTHROPLASTY BY TYPE OF SHOULDER ARTHROPLASTY IN THE NETHERLANDS IN 2014-2018.

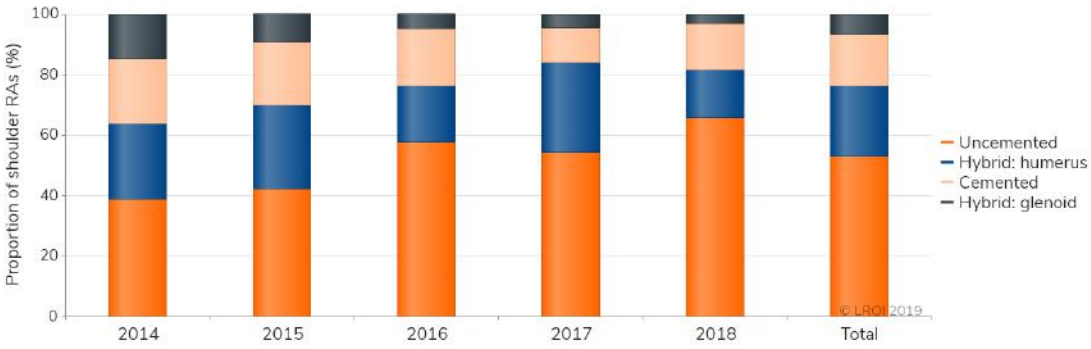
Year	2014	2015	2016	2017	2018	Total
Shoulder revision (n)	208	272	274	351	329	1,434
Reasons for revision; Proportion[1] (%)						
Infection	19.2	16.5	22.3	21.1	24.9	21.1
Instability	12.5	15.4	23.4	26.2	21.9	20.6
Progression of osteoarthritis	24.0	24.6	16.8	16.8	14.6	18.8
Cuff rupture	13.9	15.1	10.9	14.2	11.9	13.2
Loosening of glenoid component	12.5	13.2	10.6	12.8	10.9	12.0
Cuff arthropathy	12.5	13.2	13.5	11.7	9.1	11.9
Malalignment	12.0	12.9	8.4	8.3	5.8	9.1
Loosening of humeral component	7.7	7.7	10.9	4.6	7.0	7.4
Peri-prosthetic fracture	2.9	5.9	5.1	5.1	6.7	5.3
Other	10.6	11.8	12.0	12.5	12.5	12.0

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

Surgery and prosthesis

Fixation 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN SHOULDER REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Fixation (%)	2014	2015	2016	2017	2018	Total
Uncemented	38.98	42.28	57.96	54.31	66.02	**52.87**
Hybrid: humerus	24.86	27.64	18.37	29.71	15.62	**23.44**
Cemented	21.47	20.73	18.78	11.50	15.23	**16.98**
Hybrid: glenoid	14.69	9.35	4.90	4.47	3.12	**6.71**
Total (n):	**177**	**246**	**245**	**313**	**256**	**1,237**

RA: revision arthroplasty.

Conversion to TSA 2014-2018

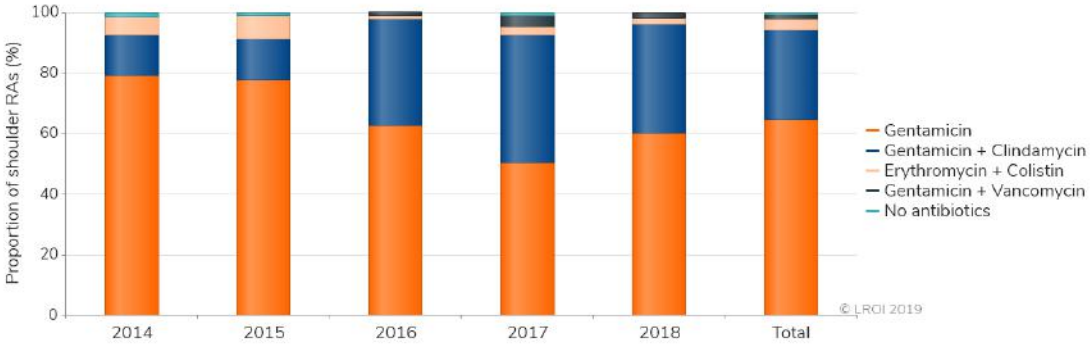
FIGURE TREND (PROPORTION [%] PER YEAR) IN CONVERSION OF A SHOULDER HEMIPROSTHESIS TO A TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY IN THE NETHERLANDS IN 2014-2018.

Conversion to TSA (%)	2014	2015	2016	2017	2018	Total
No conversion to TSA	57.14	58.51	70.24	75.30	68.81	**67.18**
Conversion to TSA	42.86	41.49	29.76	24.70	30.51	**32.67**
Unknown	0.00	0.00	0.00	0.00	0.68	**0.15**
Total (n):	**182**	**241**	**252**	**328**	**295**	**1,298**

RA: revision arthroplasty; TSA: total shoulder arthroplasty.

Bone cement antibiotics 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN SHOULDER REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Bone cement antibiotics (%)	2014	2015	2016	2017	2018	Total
Gentamicin	79.10	77.78	62.63	50.47	60.19	**64.59**
Gentamicin + Clindamycin	13.43	13.33	35.35	42.06	35.92	**29.61**
Erythromycin + Colistin	5.97	7.78	1.01	2.80	1.94	**3.65**
Gentamicin + Vancomycin	0.00	0.00	1.01	3.74	1.94	**1.50**
No antibiotics	1.49	1.11	0.00	0.93	0.00	**0.64**
Total (n):	**67**	**90**	**99**	**107**	**103**	466

RA: revision arthroplasty.

Most frequently registered components

TABLE THE MOST FREQUENTLY REGISTERED HUMERAL STEMS, HUMERAL HEADS, HUMERAL LINERS, GLENOID BASEPLATES, GLENOSPHERES, GLENOID COMPONENTS AND METAPHYSES IN SHOULDER REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Humeral stem (n=149)

Name	Proportion (%)
Delta X-tend	43.6
Comprehensive	9.4
Aequalis Reversed	6.7
SMR stem	6.7
Aequalis Ascend Flex	6.0

Humeral head (n=47)

Name	Proportion (%)
Global AP	23.4
Aequalis humerus kop	19.1
Aequalis Ascend Flex	10.6
SMR head	8.5
Global Unite/ Global AP	6.4

Humeral liner (n=179)

Name	Proportion (%)
Delta X-tend	46.9
Comprehensive	10.6
Aequalis Reversed	10.1
Aequalis Ascend Flex	8.4
Anatomical Inverse Humeral Poly Inlays	6.1

Glenoid baseplate (n=138)

Name	Proportion (%)
Delta X-tend	52.9
Aequalis Reversed	11.6
Comprehensive	9.4
Trabecular Metal Baseplate	6.5
Equinoxe	5.1

Glenosphere (n=191)

Name	Proportion (%)
Delta X-tend	46.1
Aequalis Reversed	14.7
Comprehensive	10.5
TM Reverse Glenoid Heads	5.2
Equinoxe	4.2

Glenoid component (n=4)

Name	Proportion (%)
SMR PE liner	50.0
Anatomical Shoulder Bipolar Inserts	25.0
SMR Liner Axioma	25.0

Metaphysis (n=104)

Name	Proportion (%)
Delta X-tend	26.0
Comprehensive	18.3
Aequalis Ascend Flex	14.4
Aequalis Reversed	10.6
Anatomical inverse Humeral Cups	9.6

Most frequently registered types of bone cement

TABLE THE MOST FREQUENTLY REGISTERED TYPES OF BONE CEMENT USED DURING SHOULDER REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=100).

Name	Proportion (%)
Palacos R+G	40.0
Copal G+C	29.0
Refobacin Bone Cement R	15.0
Refobacin Revision	6.0
Refobacin Plus Bone Cement	3.0

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 2014-2017.

		Cumulative 1-year revision percentage	
Type of primary shoulder arthroplasty	Number (n)	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Reverse	6,266	2.3 (2.0-2.7)	2.5 (2.1-2.9)
Total anatomical	2,260	1.6 (1.2-2.3)	1.4 (0.9-1.9)
Hemi	1,513	2.8 (2.1-3.8)	2.4 (1.6-3.2)

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

In 2014-2017, 174 (1.7%) 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 2014-2017.

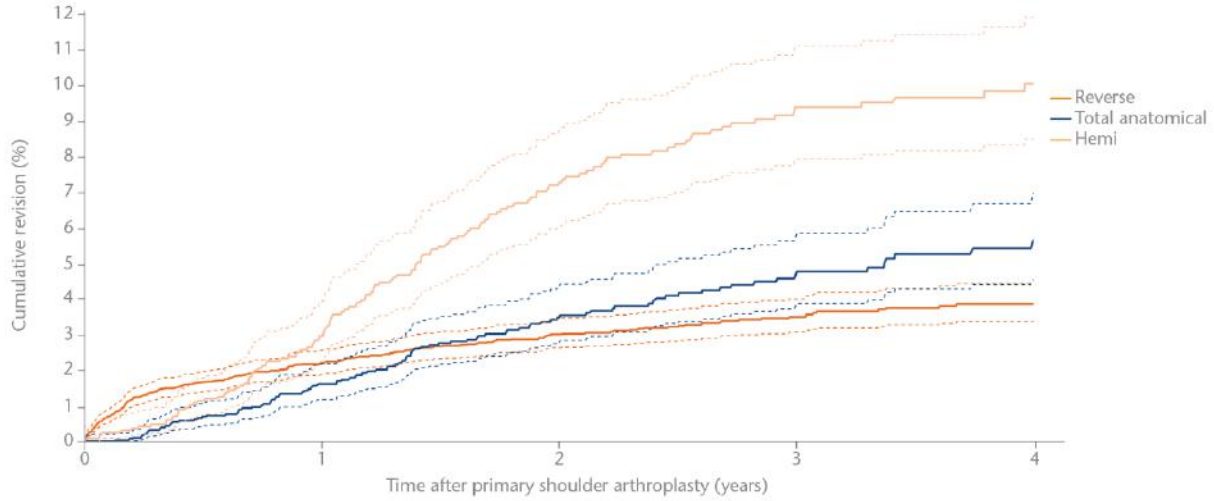
	Type of primary shoulder arthroplasty		
	Reverse (n=154)	Total anatomical (n=37)	Hemi (n=43)
Reason for revision	Proportion[1] (%)	Proportion[1] (%)	Proportion[1] (%)
Instability	40.3	37.8	20.9
Infection	30.5	8.1	7.0
Cuff rupture	n.a.	29.7	27.9
Malalignment	8.4	13.5	14.0
Cuff arthroplasty	n.a.	16.2	23.3
Loosening of glenoid component	9.1	8.1	2.3
Loosening of humeral component	2.6	2.7	14.0
Peri-prosthetic fracture	5.8	0.0	2.3
Progression of osteoarthritis	0.6	2.7	20.9
Other	9.7	10.8	16.3

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 4 years

By type of shoulder arthroplasty

FIGURE CUMULATIVE REVISION PERCENTAGE OF PRIMARY SHOULDER ARTHROPLASTIES BY TYPE OF SHOULDER ARTHROPLASTY IN THE NETHERLANDS IN 2014-2018 (N=13,041).



Type of primary shoulder arthroplasty	Number (n)	Cumulative 4-year revision percentage	
		Competing Risk[1] (95% CI)	Kaplan Meier (95% CI)
Reverse	8,346	3.9 (3.4-4.5)	4.1 (3.5-4.6)
Total anatomical	2,929	5.5 (4.4-6.7)	5.5 (4.4-6.7)
Hemi	1,766	10.1 (8.5-11.9)	10.5 (8.7-12.3)

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

In 2014-2018, 636 (5.6%) primary shoulder arthroplasties were implanted in patients who died within four years after the primary procedure.

Reverse total shoulder arthroplasty by demographics

TABLE CUMULATIVE 4-YEAR REVISION PERCENTAGE OF PRIMARY REVERSE TOTAL SHOULDER ARTHROPLASTIES BY DEMOGRAPHICS IN THE NETHERLANDS IN 2014-2018.

		Cumulative 4-year revision percentage	
	Number (n)	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Total	8346	3.9 (3.4-4.5)	4.1 (3.5-4.6)
Gender			
Men	1,875	7.8 (6.4-9.5)	8.0 (6.4-9.6)
Women	6,458	2.8 (2.3-3.4)	2.8 (2.3-3.2)
Age (years)			
<50	64	n.a.	n.a.
50-59	284	n.a.	n.a.
60-69	1,796	5.9 (4.6-7.5)	6.1 (4.6-7.6)
70-79	4,197	3.6 (2.9-4.4)	3.8 (3.0-4.6)
≥80	1,993	2.1 (1.5-2.9)	2.3 (1.6-3.0)
Diagnosis			
Osteoarthritis	2,467	3.2 (2.4-4.4)	3.3 (2.3-4.3)
Other	5,855	4.6 (3.8-5.6)	4.4 (3.7-5.1)
ASA score			
I	451	6.2 (3.6-10.7)	6.5 (3.1-9.8)
II	5,038	3.4 (2.9-4.1)	3.6 (3.0-4.2)
III-IV	2,76	4.3 (3.4-5.6)	4.6 (3.5-5.7)
Walch score			
A1	3,984	3.9 (3.2-4.7)	4.0 (3.3-4.8)
A2	1,75	4.0 (2.9-5.4)	4.0 (2.8-5.1)
B1	813	3.7 (2.4-5.8)	3.6 (2.1-5.0)
B2	419	2.5 (0.6-9.6)	2.7 (0.0-6.6)
B3	128	n.a.	n.a.
C	79	n.a.	n.a.

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

Total anatomical shoulder arthroplasty by demographics

TABLE CUMULATIVE 4-YEAR REVISION PERCENTAGE OF PRIMARY TOTAL ANATOMICAL SHOULDER ARTHROPLASTIES BY DEMOGRAPHICS IN THE NETHERLANDS IN 2014-2018.

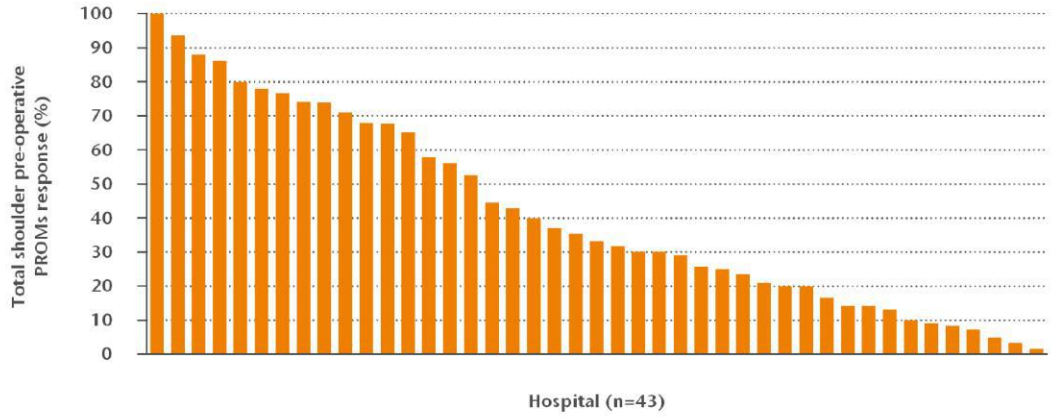
		Cumulative 4-year revision percentage	
	Number (n)	Competing Risk (95% CI)	Kaplan Meier (95% CI)
Total	2,932	5.5 (4.4-6.7)	5.5 (4.4-6.7)
Gender			
Men	858	6.1 (4.2-8.9)	6.2 (3.9-8.5)
Women	2,070	5.2 (4.1-6.7)	5.3 (4.0-6.6)
Age (years)			
<50	177	n.a.	n.a.
50-59	495	6.8 (4.5-10.3)	6.8 (4.0-9.6)
60-69	1,115	6.7 (4.9-9.2)	6.8 (4.7-8.9)
70-79	904	3.3 (2.0-5.3)	3.3 (1.7-4.9)
≥80	238	n.a.	n.a.
Diagnosis			
Osteoarthritis	2,407	4.7 (3.6-6.0)	4.7 (3.5-5.9)
Other	515	10.0 (6.9-14.5)	9.0 (5.8-12.2)
ASA score			
I	416	6.6 (3.9-11.1)	6.5 (3.2-9.9)
II	1,945	5.9 (4.6-7.6)	6.0 (4.5-7.4)
III-IV	539	2.9 (1.5-5.6)	2.8 (1.0-4.7)
Walch score			
A1	1,222	7.3 (5.5-9.6)	7.4 (5.3-9.4)
A2	832	4.3 (2.8-6.6)	4.3 (2.5-6.2)
B1	459	3.8 (2.1-6.8)	3.9 (1.6-6.1)
B2	182	n.a.	n.a.
B3	36	n.a.	n.a.
C	11	n.a.	n.a.

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

PROMs

Response 2018

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 2018 (N=1,514).



PROM: patient reported outcome measure.

Of all 1,514 patients who underwent a primary total shoulder arthroplasty in a PROMs registering hospital in 2018, the mean pre-operative response rate was 41.9% (n=635).

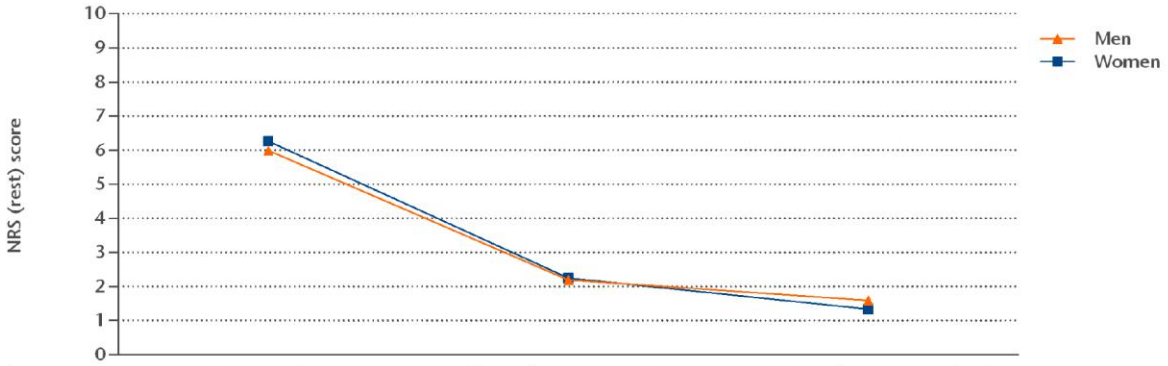
Of the 888 patients who underwent a primary total shoulder arthroplasty between January and October 1st, the mean three months postoperative response rate was 37.4% (n=332).

Of all 1,334 patients who underwent a primary total shoulder arthroplasty in a pre-operative PROMs registering hospital in 2017, the mean twelve months postoperative response rate was 25.9% (n=345).

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

NRS (rest)

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (REST) SCORES OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



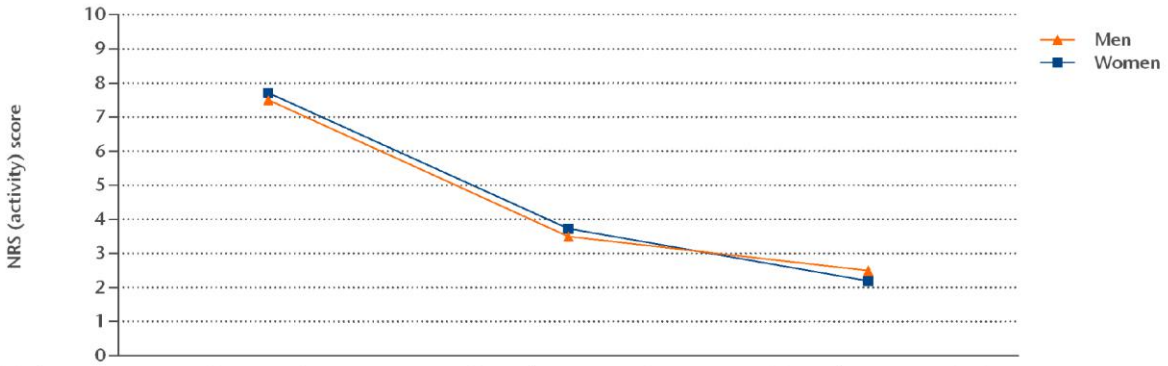
NRS (rest) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	n	mean (95% CI)	n	mean (95% CI)	n	mean (95% CI)
Men	309	6.0 (5.7-6.3)	232	2.2 (1.9-2.5)	148	1.6 (1.3-1.9)
Women	897	6.3 (6.1-6.4)	613	2.2 (2.1-2.4)	408	1.3 (1.1-1.5)
Total	1,206	6.2 (6.1-6.3)	845	2.2 (2.1-2.4)	556	1.4 (1.2-1.6)

[1] The 12 months NRS (rest) score is not (yet) available for 2018.

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

NRS (activity)

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE NRS (ACTIVITY) SCORES OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



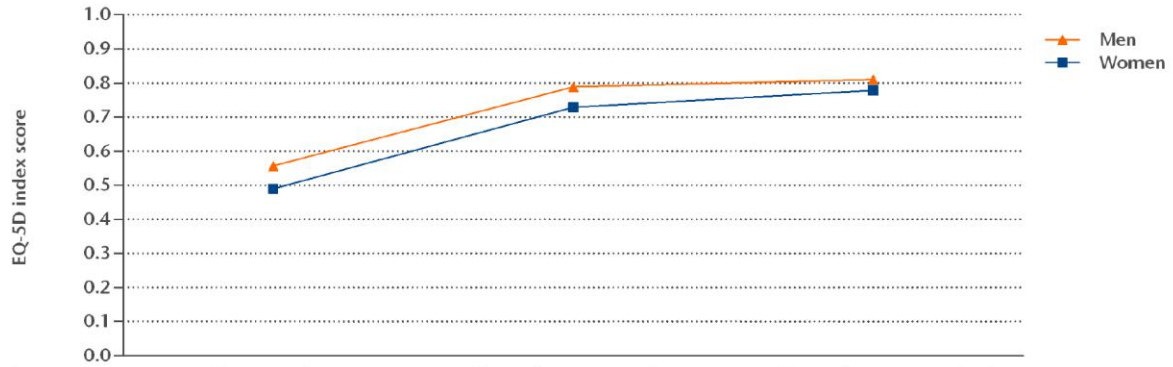
NRS (activity) score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	n	mean (95% CI)	n	mean (95% CI)	n	mean (95% CI)
Men	308	7.5 (7.2-7.8)	232	3.5 (3.2-3.8)	180	2.5 (2.1-2.9)
Women	898	7.7 (7.6-7.9)	612	3.7 (3.5-3.9)	478	2.2 (2.0-2.4)
Total	1,206	7.7 (7.5-7.8)	844	3.7 (3.5-3.8)	658	2.3 (2.1-2.5)

[1] The 12 months NRS (activity) score is not (yet) available for 2018.

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

EQ5D index score

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE EQ-5D INDEX SCORES OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



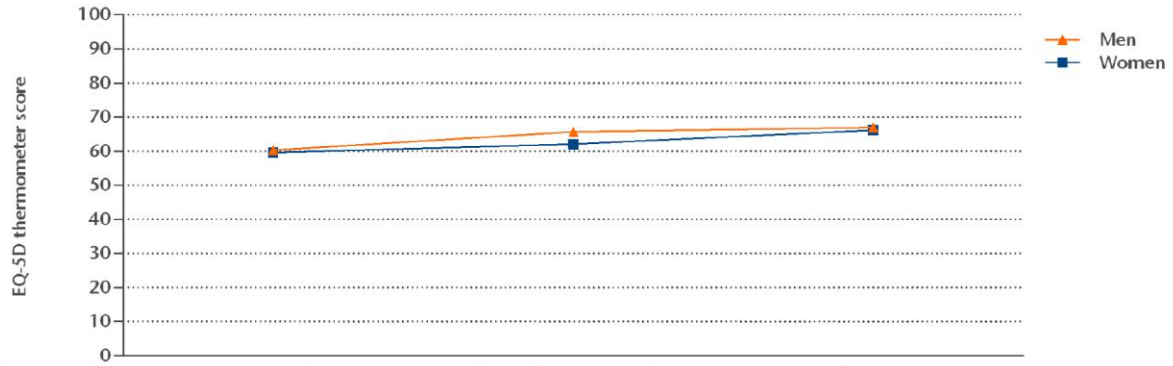
EQ-5D index score	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	n	mean (95% CI)	n	mean (95% CI)	n	mean (95% CI)
Men	296	0.56 (0.52-0.59)	218	0.79 (0.76-0.82)	146	0.81 (0.78-0.84)
Women	861	0.49 (0.47-0.51)	571	0.73 (0.71-0.75)	393	0.78 (0.76-0.80)
Total	1,157	0.51 (0.49-0.52)	789	0.75 (0.73-0.76)	539	0.79 (0.77-0.80)

[1] The 12 months EQ-5D index score is not (yet) available for 2018.

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

EQ5D thermometer

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE EQ-5D THERMOMETER SCORES OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



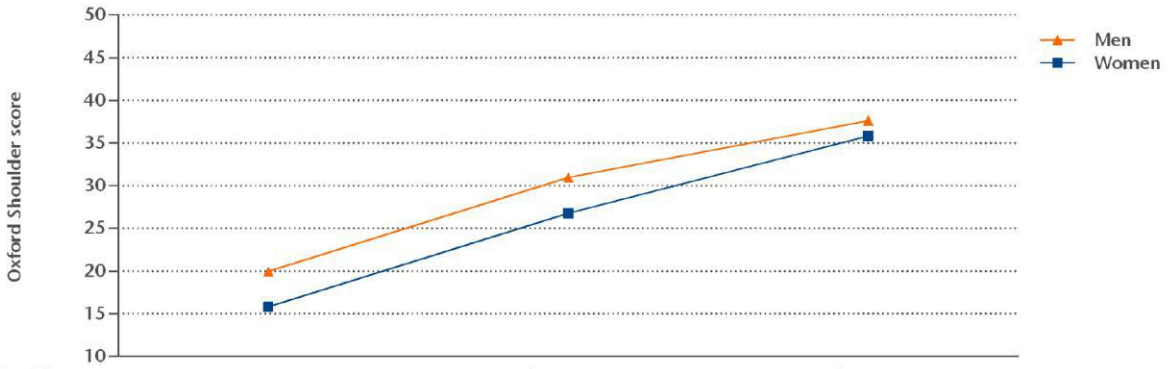
EQ-5D thermometer	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	n	mean (95% CI)	n	mean (95% CI)	n	mean (95% CI)
Men	311	60.3 (57.1-63.5)	231	65.7 (61.9-69.4)	150	66.9 (62.6-71.3)
Women	902	59.6 (57.9-61.2)	613	62.0 (59.8-64.3)	408	66.2 (63.8-68.6)
Total	1,213	59.8 (58.3-61.2)	844	63.0 (61.1-64.9)	558	66.4 (64.3-68.5)

[1] The 12 months EQ-5D thermometer score is not (yet) available for 2018.

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

Oxford Shoulder score

FIGURE MEAN PRE-OPERATIVE, 3 MONTHS AND 12 MONTHS POSTOPERATIVE OXFORD SHOULDER SCORES OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



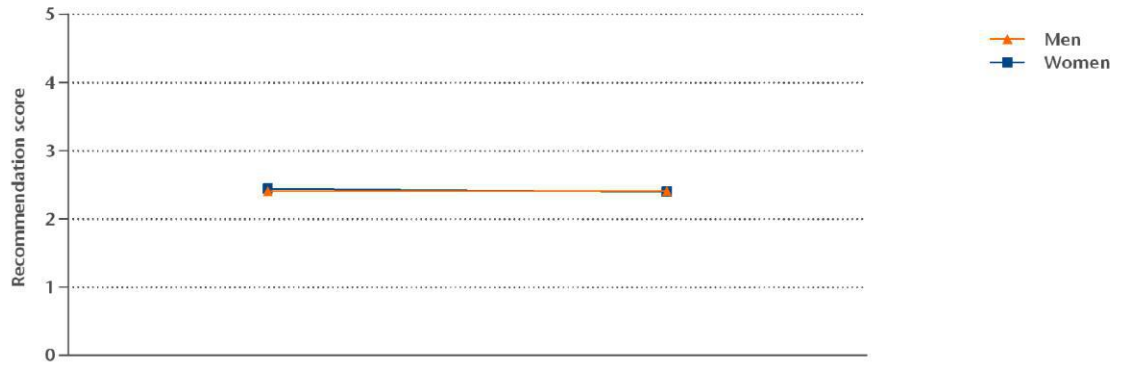
Oxford shoulder	Pre-operative		3 months postoperative		12 months postoperative[1]	
Gender	n	mean (95% CI)	n	mean (95% CI)	n	mean (95% CI)
Men	289	19.6 (19.0-20.9)	209	30.9 (29.5-32.4)	136	37.6 (36.0-39.2)
Women	830	15.8 (15.3-16.3)	549	26.8 (25.9-27.7)	374	35.8 (34.7-36.9)
Total	1,119	16.9 (16.4-17.3)	758	27.9 (27.2-28.7)	510	36.3 (35.4-37.2)

[1] The 12 months Oxford shoulder score is not (yet) available for 2018.

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 48.0 representing no functional disability and 48.0 the most possible functional disability.

Recommendation

FIGURE MEAN 3 MONTHS AND 12 MONTHS POSTOPERATIVE RECOMMENDATION SCORE OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



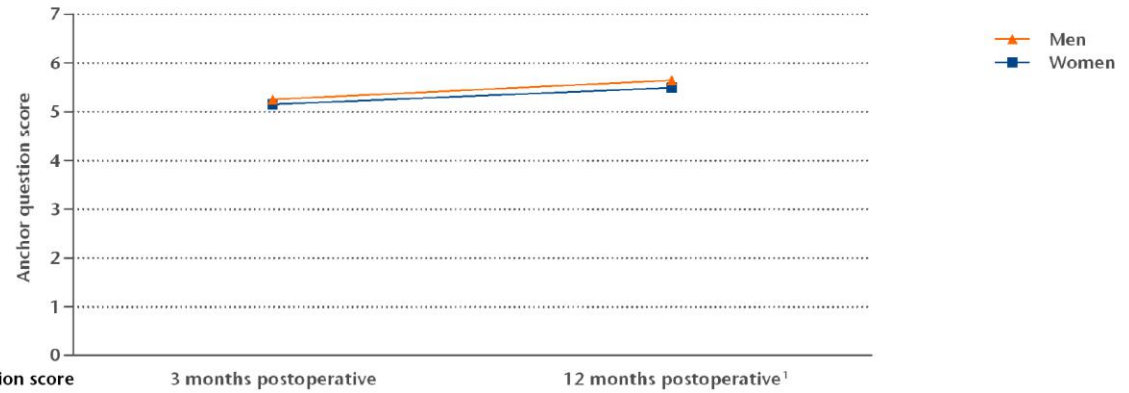
Recommendation score	3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	210	2.4 (2.2-2.6)	142	2.4 (2.1-2.7)
Women	567	2.4 (2.3-2.6)	386	2.4 (2.2-2.6)
Total	777	2.4 (2.3-2.5)	528	2.4 (2.3-2.5)

[1] The 12 months recommendation score is not (yet) available for 2018.
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 3 MONTHS AND 12 MONTHS POSTOPERATIVE CHANGE IN DAILY FUNCTIONING OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



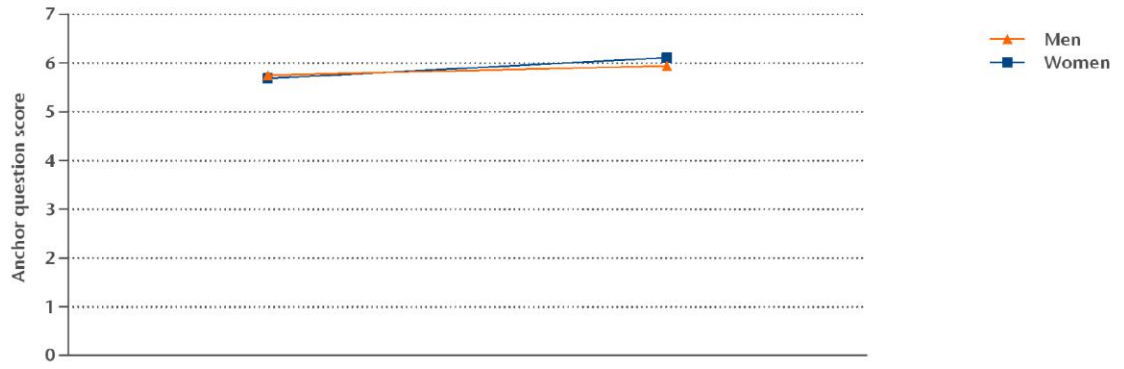
Anchor question score	3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	187	5.3 (5.0-5.5)	128	5.6 (5.4-5.9)
Women	524	5.2 (5.0-5.3)	360	5.5 (5.3-5.7)
Total	711	5.2 (5.1-5.3)	488	5.5 (5.4-5.7)

[1] The 12 months anchor question score is not (yet) available for 2018.
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 3 MONTHS AND 12 MONTHS POSTOPERATIVE CHANGE IN PAIN OF PATIENTS WHO UNDERWENT A PRIMARY TOTAL (ANATOMICAL OR REVERSE) SHOULDER ARTHROPLASTY BY GENDER IN THE NETHERLANDS IN 2016-2018.



Anchor question score	3 months postoperative		12 months postoperative[1]	
Gender	**n**	**mean (95% CI)**	**n**	**mean (95% CI)**
Men	187	5.8 (5.6-5.9)	128	5.9 (5.7-6.2)
Women	524	5.7 (5.6-5.8)	358	6.1 (6.0-6.2)
Total	711	5.7 (5.6-5.8)	486	6.1 (6.0-6.2)

[1] The 12 months anchor question score is not (yet) available for 2018.
CI: confidence interval.

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

Elbow arthroplasty

Numbers

Registered procedures 2014-2018

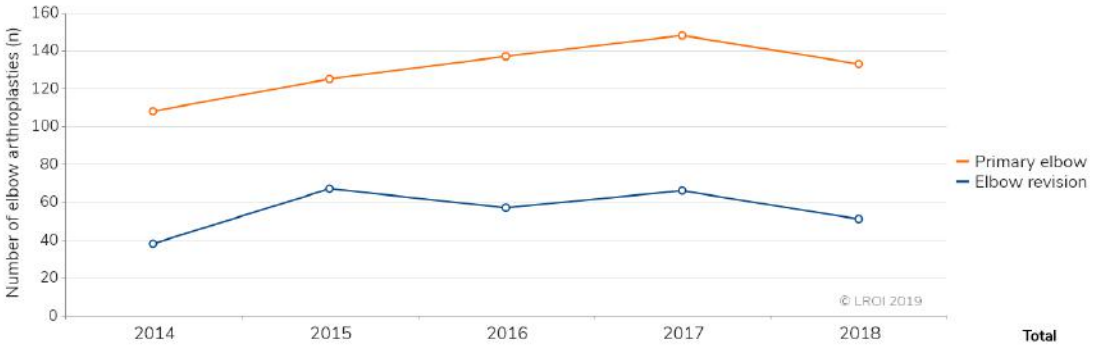
TABLE NUMBER OF REGISTERED ELBOW ARTHROPLASTIES PER YEAR OF SURGERY (2014-2018) IN THE LROI IN APRIL 2019.

	Type of elbow arthroplasty							
Year of surgery	Total arthroplasty (n)	Distal hemihumeral arthroplasty (n)	Radial head arthroplasty (n)	Radiocapitellar arthroplasty (n)	Lateral resurfacing arthroplasty (n)	Other (n)	Revision arthroplasty (n)	Total (n)
2014	72	5	23	0	0	0	38	146
2015	78	4	41	1	0	0	67	192
2016	67	2	45	13	0	2	57	194
2017	67	1	41	13	0	0	66	214
2018	73	5	49	2	0	1	51	184
Total	357	17	199	29	0	3	279	930

[1] In 7.1% (n=46) primary elbow arthroplasties the type of primary elbow prosthesis has not been registered.

Procedures 2014-2018

FIGURE NUMBER OF PRIMARY ELBOW ARTHROPLASTIES AND ELBOW REVISION ARTHROPLASTIES REGISTERED IN THE LROI IN THE NETHERLANDS IN 2014-2018.

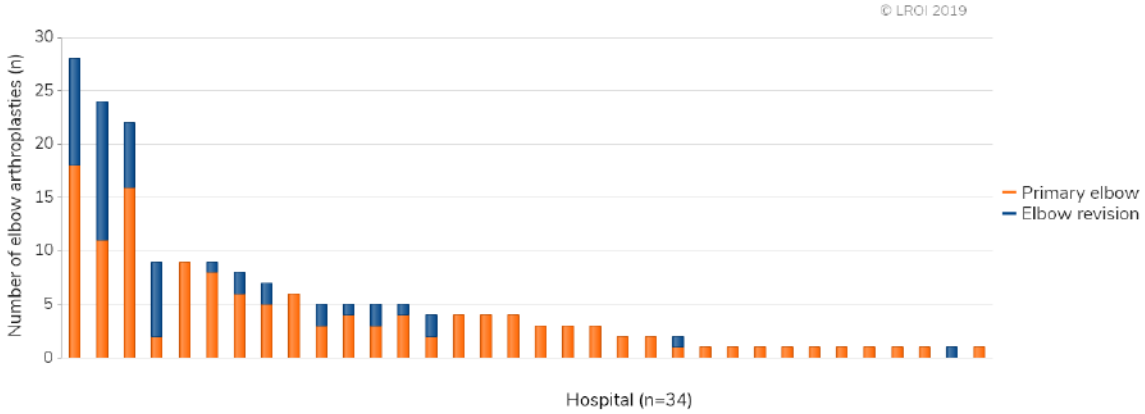


Year	2014	2015	2016	2017	2018	Total
Type of procedure (n)						
Primary elbow	108	125	137	148	133	651
Elbow revision	38	67	57	66	51	279
Total:	146	192	194	214	184	930

Out of 133 primary elbow arthroplasties that were performed in 2018, 2% (n=2) was performed bilaterally.

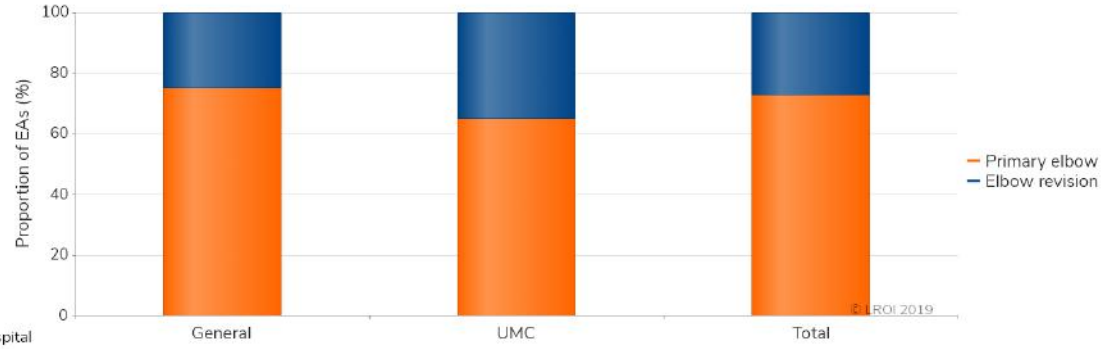
Type of procedure per hospital

FIGURE NUMBER OF PRIMARY ELBOW ARTHROPLASTIES AND ELBOW REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=184).



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 2018.



Type of hospital	General	UMC	Total
Type of procedure (%)			
Primary elbow	75.18	65.12	**72.78**
Elbow revision	24.82	34.88	**27.22**
Total (n):	**137**	**43**	**180**

Please note: In 2018, 29 general hospitals and 5 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

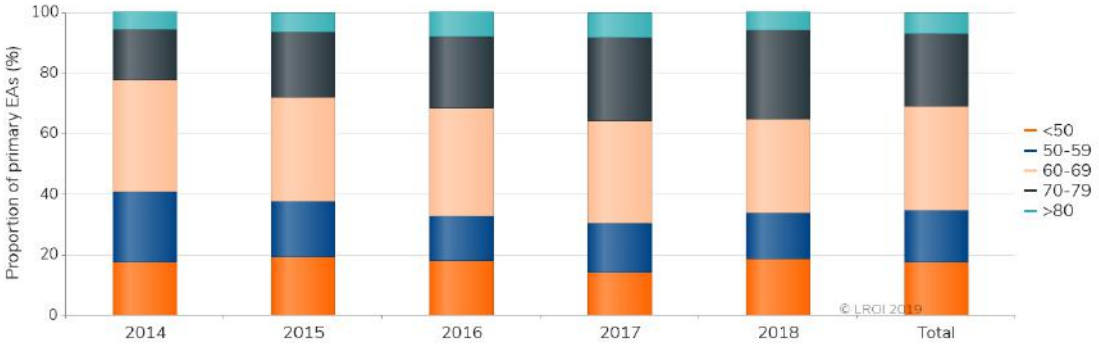
TABLE PATIENT CHARACTERISTICS OF ALL PATIENTS WITH A REGISTERED PRIMARY ELBOW ARTHROPLASTY BY TYPE OF ELBOW ARTHROPLASTY IN THE NETHERLANDS IN 2018.

	Total arthroplasty[1] (n=78)	Radial head arthroplasty[2] (n=51)	Total[3] (n=133)
Completeness (%)			89
Mean age (years) (SD)	63.7 (12.9)	59.5 (14.3)	62.3 (13.5)
Age (years) (%)			
<50	17	23	19
50-59	15	16	15
60-69	31	33	31
70-79	31	22	29
≥80	6	6	6
Gender (%)			
Men	26	39	31
Women	74	61	69
ASA score (%)			
I	5	20	11
II	58	69	62
III-IV	37	12	27
Type of hospital (%)			
General	74	84	79
UMC	25	16	21
Diagnosis (%)			
Acute fracture	13	78	39
Rheumatoid arthritis	37	0	22
Late post-traumatic	21	20	20
Osteoarthritis	21	0	12
Inflammatory arthritis	3	0	2
Hemophilic arthropathy	1	0	1
Tumour	0	0	1
Other	4	2	3
Charnley-score (%)			
A One elbow joint affected	5	20	11
B1 Both elbow joints affected	58	69	62
B2 Contralateral elbow joint with a total elbow prosthesis	37	12	27
C Multiple joints affected or chronic disease that affects quality of life			
Body Mass Index (kg/m²) (%)			
Underweight (≤18,5)	3	0	2
Normal weight (>18,5-25)	28	30	29
Overweight (>25-30)	35	37	35
Obesity (>30-40)	33	31	32
Morbid obesity (>40)	1	2	2
Smoking (%)			
No	88	90	89
Yes	12	10	11

[1] Including distal hemihumeral prostheses (n=5).
[2] Including radiocapitellar prostheses (n=2).
[3] Also contains 1 primary elbow arthroplasty that was registered as other and 3 primary elbow arthroplasties of which the type of prosthesis had not been registered.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on patient characteristics in case of a bilateral arthroplasty were excluded. As of this annual report, all primary elbow arthroplasties are included.
General: general hospital; UMC: university medical centre; SD: standard deviation.

Age category 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN AGE CATEGORY IN PRIMARY ELBOW ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Age category (%)	2014	2015	2016	2017	2018	Total
<50	17.59	19.20	18.25	14.19	18.80	**17.51**
50-59	23.15	18.40	14.60	16.22	15.04	**17.20**
60-69	37.04	34.40	35.77	33.78	30.83	**34.25**
70-79	16.67	21.60	23.36	27.70	29.32	**24.12**
>80	5.56	6.40	8.03	8.11	6.02	**6.91**
Total (n):	**108**	**125**	**137**	**148**	**133**	**651**

EA: elbow arthroplasty.

Previous surgery 2016-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN PREVIOUS SURGERIES TO THE SAME JOINT IN PATIENTS WHO UNDERWENT A PRIMARY ELBOW ARTHOPLASTY IN THE NETHERLANDS IN 2016-2018.

Year	2016	2017	2018	Total
Primary elbow arthroplasty (n)	134	146	128	408
Previous surgery to the relevant elbow (total); Proportion[1] (%)	39.6	32.9	29.7	34.1
Osetosynthesis	17.2	18.5	15.6	17.2
Lateral arthrotomy	22.4	19.9	8.6	17.2
Posterior arthrotomy	8.2	8.2	8.6	8.3
Plate or screw removal	9.0	6.8	7.0	7.6
Decompression ulnar nerve	3.7	4.8	3.9	4.2
Medial arthrotomy	4.5	3.4	3.9	3.9
Arthroscopy	6.7	1.4	2.3	3.4
Transposition ulnar nerve	0.0	1.4	1.6	1.0
Arthrodesis	0.0	0.0	1.6	0.5
Other	10.4	4.8	4.7	6.6

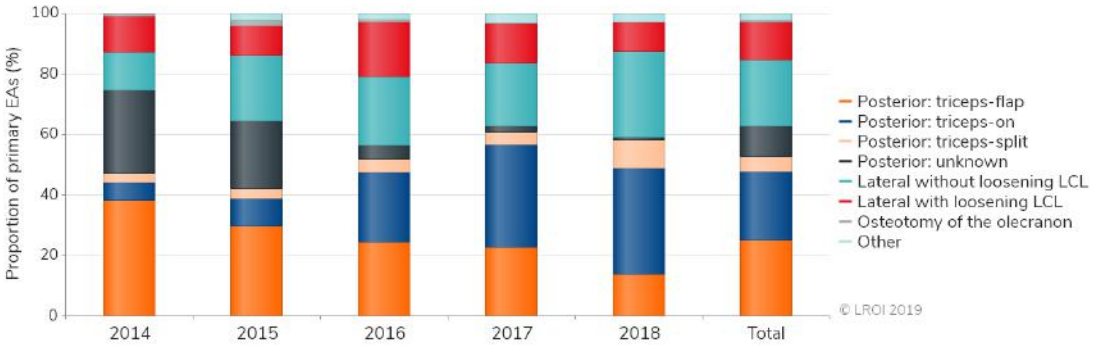
[1] A patient may have undergone multiple previous surgeries to the same joint. As such, the total proportion is more than the total proportion of patiens with one or more previous surgeries to the same joint.
Please note: In previous annual reports of the Dutch Arthroplasty Register (LROI), information on previous surgeries in case of a bilateral arthroplasty were excluded. As of this annual report, all primary elbow arthroplasties are included.

Surgery and prosthesis

Surgical techniques

Surgical approach 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN SURGICAL APPROACH FOR PERFORMING A PRIMARY ELBOW ARTHROPLASTY IN THE NETHERLANDS IN 2014-2018.

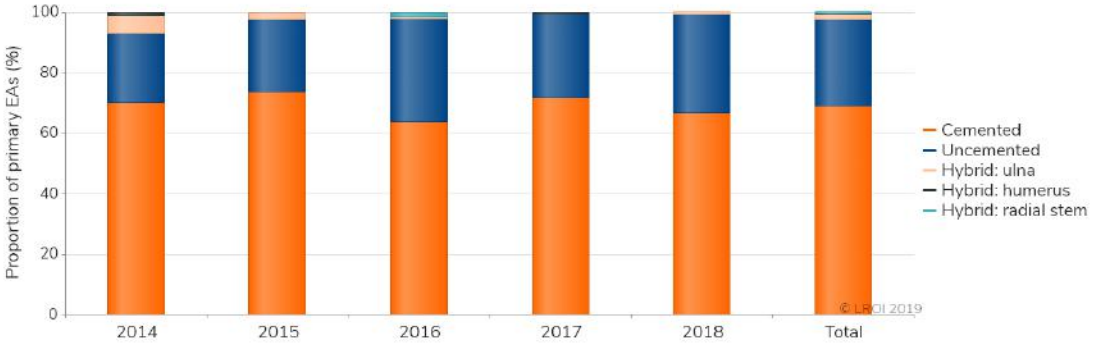


Surgical approach (%)	2014	2015	2016	2017	2018	Total
Posterior: triceps-flap	38.24	29.75	24.44	22.76	13.95	**25.16**
Posterior: triceps-on	5.88	9.09	22.96	33.79	34.88	**22.47**
Posterior: triceps-split	2.94	3.31	4.44	4.14	9.30	**4.91**
Posterior: unknown	27.45	22.31	4.44	2.07	0.78	**10.28**
Lateral without loosening LCL	12.75	21.49	22.96	20.69	28.68	**21.68**
Lateral with loosening LCL	11.76	9.92	17.78	13.10	9.30	**12.50**
Osteotomy of the olecranon	0.98	1.65	0.74	0.00	0.00	**0.63**
Other	0.00	2.48	2.22	3.45	3.10	**2.37**
Total (n):	**102**	**121**	**135**	**145**	**129**	**632**

EA: elbow arthroplasty.

Fixation 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN PRIMARY ELBOW ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



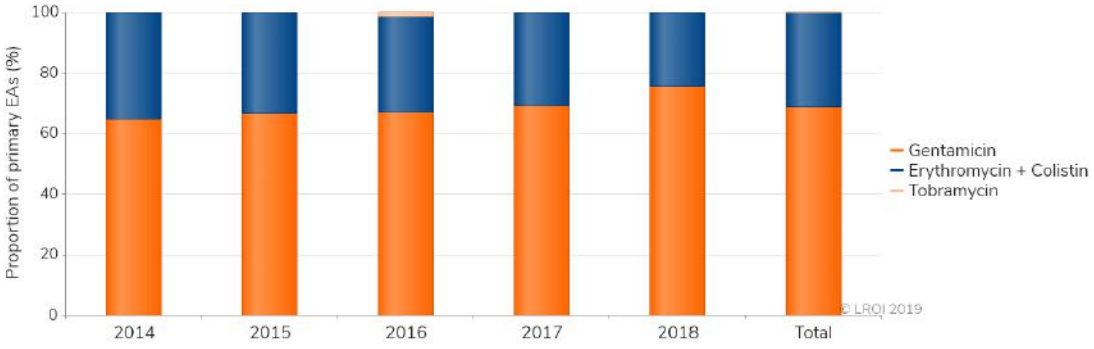
Fixation (%)	2014	2015	2016	2017	2018	Total
Cemented	70.30	73.77	63.91	71.53	66.67	**69.16**
Uncemented	22.77	23.77	33.83	27.78	32.56	**28.46**
Hybrid: ulna	5.94	2.46	0.75	0.00	0.78	**1.75**
Hybrid: humerus	0.99	0.00	0.00	0.69	0.00	**0.32**
Hybrid: radial stem	0.00	0.00	1.50	0.00	0.00	**0.32**
Total (n):	**101**	**122**	**133**	**144**	**129**	**629**

EA: elbow arthroplasty.

Bone cement

Antibiotics 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN PRIMARY ELBOW ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.

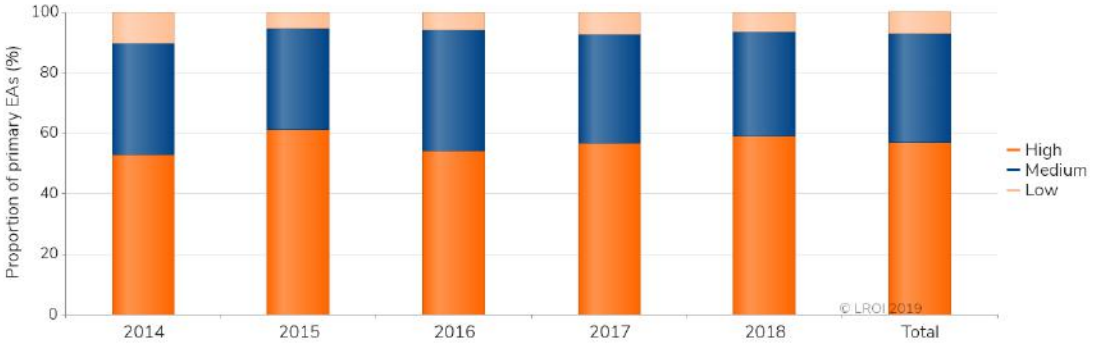


Bone cement antibiotics (%)	2014	2015	2016	2017	2018	Total
Gentamicin	64.71	66.67	67.06	69.14	75.64	**68.73**
Erythromycin + Colistin	35.29	33.33	31.76	30.86	24.36	**31.01**
Tobramycin	0.00	0.00	1.18	0.00	0.00	**0.26**
Total (n):	**68**	**75**	**85**	**81**	**78**	**387**

EA: elbow arthroplasty.

Viscosity 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN BONE CEMENT VISCOSITY IN PRIMARY ELBOW ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Bone cement viscosity (%)	2014	2015	2016	2017	2018	Total
High	52.94	61.33	54.12	56.79	58.97	**56.85**
Medium	36.76	33.33	40.00	35.80	34.62	**36.18**
Low	10.29	5.33	5.88	7.41	6.41	**6.98**
Total (n):	**68**	**75**	**85**	**81**	**78**	**387**

EA: elbow arthroplasty.

Vacuum mixing system 2014-2018

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 2014-2018.

Vacuum mixing system (%)						
Separately packed	95.59	82.67	91.76	93.83	84.62	**89.66**
Pre-packed	4.41	17.33	8.24	6.17	15.38	**10.34**
Total (n):	**68**	**75**	**85**	**81**	**78**	**387**

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 (INCLUDING DISTAL HEMIHUMERAL ARTHROPLASTIES) AND RADIAL HEAD ARTHROPLASTIES (INCLUDING RADIOCAPITELLAR ELBOW ARTHROPLASIES) IN PRIMARY ELBOW ARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Total elbow arthroplasties[1] (n=67)			Radial head arthroplasties[2] (n=42)		
Name	**Number (n)**	**Proportion (%)**	**Name**	**Number (n)**	**Proportion (%)**
Latitude EV	31	46.3	RHS	26	61.9
Coonrad/Morrey	23	34.3	Explor	13	31.0
Discovery	5	7.5	Anatomic Radial Head	2	4.8
NES	5	7.5	Evolve Radial Head	1	2.4
Latitude	2	3.0			
K Elbow	1	1.5			

[1] Including distal hemihumeral prostheses (n=5).
[2] Including radiocapitellar prostheses (n=2).

Types of bone cement

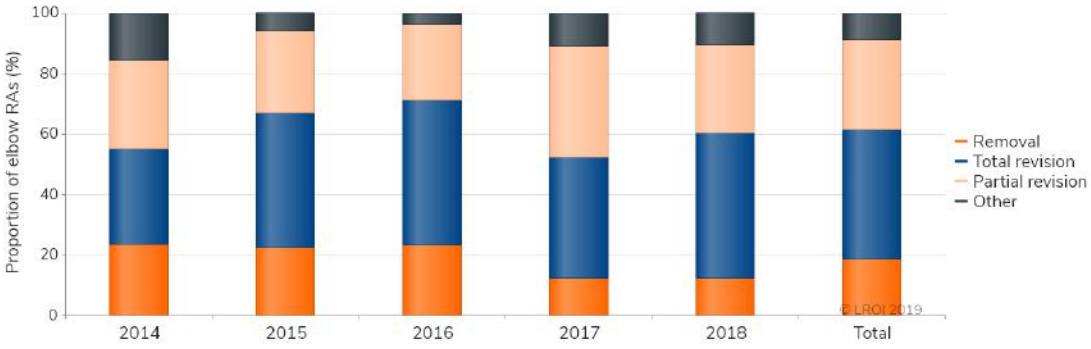
TABLE THE REGISTERED TYPES OF BONE CEMENT USED DURING PRIMARY ELBOW ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=78).

Name	Number (n)	Proportion (%)
Palacos R+G	27	34.6
Simplex ABC EC	19	24.4
Refobacin Plus Bone Cement	12	15.4
Palacos MV+G	8	10.3
Refobacin Bone Cement R	7	9.0
Palacos LV+G	5	6.4

Elbow revision arthroplasty

Type of revision 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF REVISION IN ELBOW REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Type of elbow revision (%)	2014	2015	2016	2017	2018	Total
Removal	23.68	22.39	23.21	12.31	12.50	**18.61**
Total revision	31.58	44.78	48.21	40.00	47.92	**43.07**
Partial revision	28.95	26.87	25.00	36.92	29.17	**29.56**
Other	15.79	5.97	3.57	10.77	10.42	**8.76**
Total (n):	**38**	**67**	**56**	**65**	**48**	**274**

RA: revision arthroplasty.

Reasons for revision 2016-2018

TABLE TREND (PROPORTION [%] PER YEAR) IN REASONS FOR REVISION OR RE-SURGERY IN PATIENTS WHO UNDERWENT AN ELBOW REVISION ARTHROPLASTY IN THE NETHERLANDS IN 2016-2018.

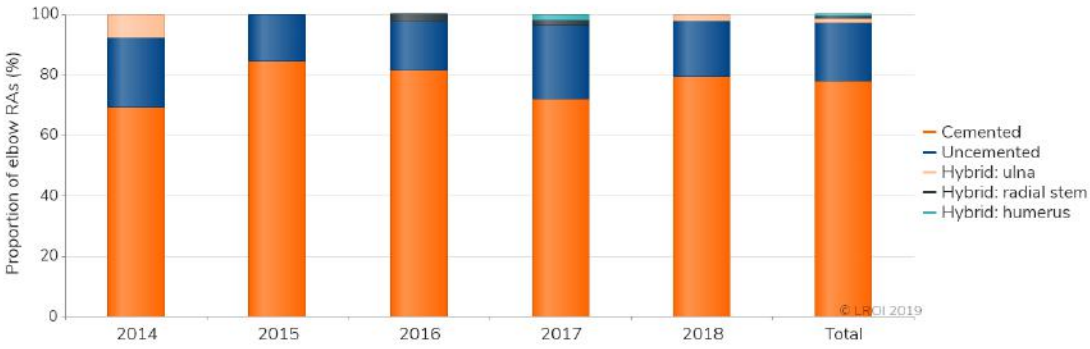
Year	2016	2017	2018	Total
Primary elbow arthroplasty (n)	134	146	128	408
Previous surgery to the relevant elbow (total); Proportion[1] (%)	39.6	32.9	29.7	34.1
Osetosynthesis	17.2	18.5	15.6	17.2
Lateral arthrotomy	22.4	19.9	8.6	17.2
Posterior arthrotomy	8.2	8.2	8.6	8.3
Plate or screw removal	9.0	6.8	7.0	7.6
Decompression ulnar nerve	3.7	4.8	3.9	4.2
Medial arthrotomy	4.5	3.4	3.9	3.9
Arthroscopy	6.7	1.4	2.3	3.4
Transposition ulnar nerve	0.0	1.4	1.6	1.0
Arthrodesis	0.0	0.0	1.6	0.5
Other	10.4	4.8	4.7	6.6

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

Surgery and prosthesis

Fixation 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN TYPE OF FIXATION IN ELBOW REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Fixation (%)						
Cemented	69.23	84.62	81.40	71.93	79.55	**77.93**
Uncemented	23.08	15.38	16.28	24.56	18.18	**19.37**
Hybrid: ulna	7.69	0.00	0.00	0.00	2.27	**1.35**
Hybrid: radial stem	0.00	0.00	2.33	1.75	0.00	**0.90**
Hybrid: humerus	0.00	0.00	0.00	1.75	0.00	**0.45**
Total (n):	**26**	**52**	**43**	**57**	**44**	222

RA: revision arthroplasty.

Conversion to TEA 2014-2018

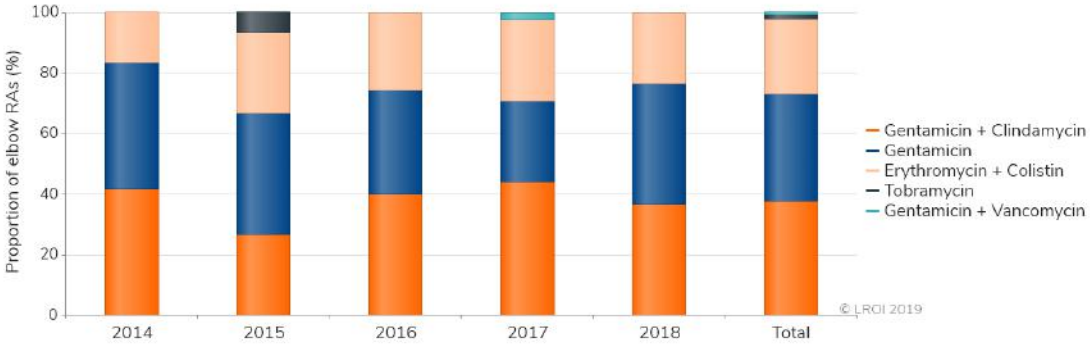
FIGURE TREND (PROPORTION [%] PER YEAR) IN CONVERSION OF A RADIAL HEAD ARTHROPLASTY TO A TOTAL ELBOW ARTHROPLASY IN THE NETHERLANDS IN 2014-2018.

Conversion to TEA (%)						
No conversion to TEA	90.00	81.82	92.00	81.97	97.73	**87.92**
Conversion to TEA	10.00	18.18	8.00	18.03	2.27	**12.08**
Total (n):	**30**	**55**	**50**	**61**	**44**	240

RA: revision arthroplasty; TEA: total elbow arthroplasty.

Bone cement antibiotics 2014-2018

FIGURE TREND (PROPORTION [%] PER YEAR) IN USE OF ANTIBIOTICS IN BONE CEMENT IN ELBOW REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2014-2018.



Bone cement antibiotics (%)						
Gentamicin + Clindamycin	41.67	26.67	40.00	43.90	36.67	**37.84**
Gentamicin	41.67	40.00	34.29	26.83	40.00	**35.14**
Erythromycin + Colistin	16.67	26.67	25.71	26.83	23.33	**25.00**
Tobramycin	0.00	6.67	0.00	0.00	0.00	**1.35**
Gentamicin + Vancomycin	0.00	0.00	0.00	2.44	0.00	**0.68**
Total (n):	**12**	**30**	**35**	**41**	**30**	**148**

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 2018.

Humerus (n=21)	Number (n)	Proportion (%)
Latitude EV	12	57.1
NES	4	19.0
Coonrad/Morrey	3	14.3
Discovery	2	9.5

Ulna (n=23)	Number (n)	Proportion (%)
Latitude EV	9	39.1
Latitude	6	26.1
Coonrad/Morrey	3	13.0
NES	3	13.0
Discovery	2	8.7

Radial head (n=4)	Number (n)	Proportion (%)
RHS	2	50.0
Anatomic Radial Head	1	25.0
Explor	1	25.0

Radial stem (n=3)	Number (n)	Proportion (%)
RHS	2	66.7
Explor	1	33.3

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 2018 (N=29).

Name	Number (n)	Proportion (%)
Palacos R+G	8	27.6
Copal G+C	7	24.1
Simplex ABC EC	7	24.1
Refobacin Revision	4	13.8
Palacos MV+G	2	6.9
Refobacin Bone Cement R	1	3.4

Wrist arthroplasty

Numbers

Registered procedures 2017-2018

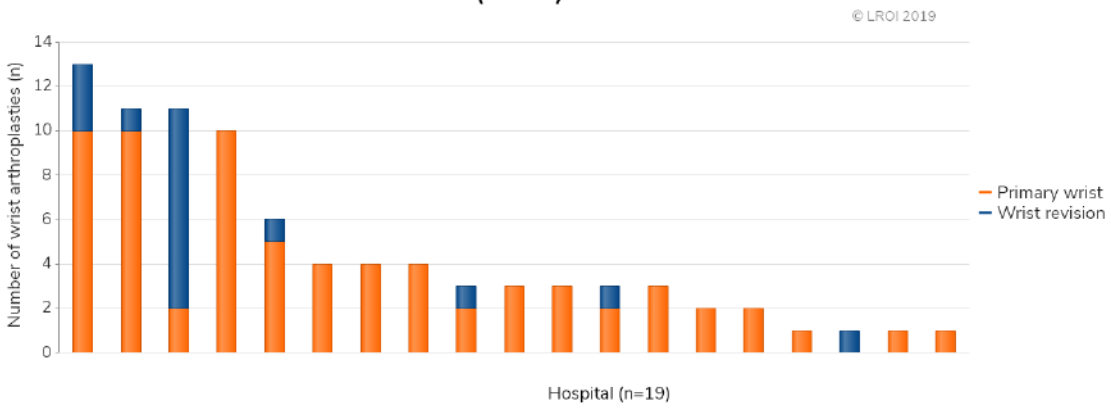
TABLE NUMBER OF REGISTERED WRIST ARTHROPLASTIES PER YEAR OF SURGERY (2017-2018) IN THE LROI IN APRIL 2019.

Year of surgery	Type of wrist arthroplasty				Total[1] (n)
	Total arthroplasty (n)	Ulnar head/ DRU arthroplasty (n)	Other (n)	Revision arthroplasty (n)	
2017	33	15	13	15	82
2018	36	24	6	17	86
Total	69	37	21	32	168

[1] In 6.6% (n=9) primary wrist arthroplasties the type of primary wrist prosthesis has not been registered.

Type of procedure per hospital

FIGURE NUMBER OF PRIMARY WRIST ARTHROPLASTIES AND WRIST REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=86).



Please note: In 2018, 15 general hospitals, 3 UMCs and 1 private hospitals performed wrist arthroplasties.
General: general hospital; UMC: university medical centre; Private: private hospital.

Primary wrist arthroplasty

Demographics

Patient characteristics

TABLE PATIENT CHARACTERISTICS OF ALL PATIENTS WITH A REGISTERED PRIMARY WRIST ARTHROPLASTY IN THE NETHERLANDS IN 2018.

	Primary wrist arthroplasty (n=69)
Completeness (%)	43
Mean age (years) (SD)	60.9 (12.3)
Age (years) (n)	
<50	14
50-59	13
60-69	19
70-79	21
≥80	2
Gender (n)	
Men	29
Women	40
ASA score (n)	
I	24
II	33
III-IV	10
Specialism (n)	
Plastic surgery	43
Orthopaedic surgery	21
Type of hospital (n)	
General	57
UMC	11
Private	1
Diagnosis (n)	
Osteoarthritis	37
Post-traumatic	13
Rheumatoid arthritis	8
Inflammatory arthritis	2
Other	7
Body Mass Index (kg/m²) (n)	
Underweight (≤18,5)	0
Normal weight (>18,5-25)	24
Overweight (>25-30)	30
Obesity (>30-40)	10
Morbid obesity (>40)	1
Smoking (n)	
No	55
Yes	10

Please note: Numbers may not add up to the total number of primary wrist arthroplasties due to missings.
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 2018 (N=69).

	Number[1] (n)
Previous surgery to the relevant wrist (total)	29
ORIF of a distal radius fracture	6
Intercarpal stabilisation/ligament reconstruction	5
Corrective osteotomy ulna	4
Partial arthrodesis	4
Proximal row carpectomy	4
Corrective osteotomy radius	1
ORIF of a carpal fracture	1
Sauvé-Kapandji procedure	1
Total arthrodesis	1
Partial radial styloidectomy	0
Stabilisation of perilunate dislocation	0
Other	11

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

Surgery and prosthesis

Most frequently registered components

TABLE THE MOST FREQUENTLY REGISTERED CARPAL, RADIAL STEM AND ULNAR HEAD COMPONENTS IN PRIMARY WRIST ARTHROPLASTIES IN THE NETHERLANDS IN 2018.

Carpal (n=25)

Name	Number (n)
Freedom	25
Universal 2	2
Amandys	1
Remotion	1

Radial stem (n=31)

Name	Number (n)
Freedom	26
Universal 2	3
Distal radioulnar joint	2

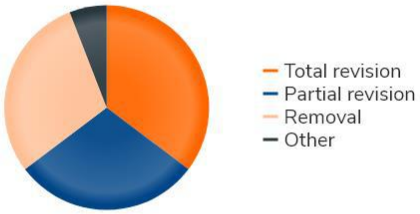
Ulnar head (n=5)

Name	Number (n)
DRUJ System	4
Eclypse	1

Wrist revision arthroplasty

Type of revision

FIGURE TYPE OF REVISION ARTHROPLASTY OF WRIST REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=17).



Type of revision	Number (n)
Total revision	6
Partial revision	5
Removal	5
Other	1

Reasons for revision

TABLE REASONS FOR REVISION IN PATIENTS WHO UNDERWENT A WRIST REVISION ARTHROPLASTY IN THE NETHERLANDS IN 2018 (N=17).

Reasons for revision	Number[1] (n)
Loosening of carpal component	5
Lysis of components	5
Instability	3
Dislocation	2
Infection	1
Loosening of radial component	1
Implant fracture	0
Loosening of ulnar component	0
Peri-prosthetic fracture	0
Other	5

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

Finger arthroplasty

Numbers

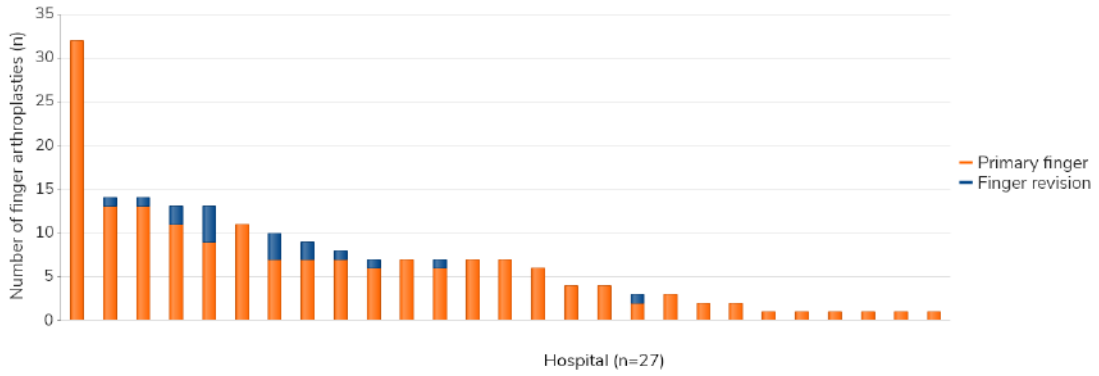
Registered procedures 2017-2018

TABLE NUMBER OF REGISTERED FINGER ARTHROPLASTIES PER YEAR OF SURGERY (2017-2018) IN THE LROI IN APRIL 2019.

	Type of finger arthroplasty		
Year of surgery	Total arthroplasty (n)	Revision arthroplasty (n)	Total (n)
2017	177	14	191
2018	172	17	189
Total	349	31	380

Type of procedure per hospital

FIGURE NUMBER OF PRIMARY FINGER ARTHROPLASTIES AND FINGER REVISION ARTHROPLASTIES PER HOSPITAL IN THE NETHERLANDS IN 2018 (N=189).



Please note: In 2018, 23 general hospitals, 1 UMCs and 3 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 2018 (N=165).

	Type of finger				
Finger joint	Thumb (n)	Index (n)	Middle (n)	Ring (n)	Small (n)
CMC	9	n.a.	n.a.	n.a.	n.a.
MCP	0	17	15	3	5
PIP	n.a.	25	37	34	16
DIP	1	2	0	0	1
Total (n)	10	44	52	37	22

Please note: In 7 (4.0%) 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 2018.

	Plastic surgeon (n=122)	Orthopaedic surgeon (n=57)	Total[1] (n=172)
Completeness (%)	83	64	75
Mean age (years) (SD)	63.0 (11.1)	63.4 (8.2)	63.1 (10.1)
Age (years) (n)			
<50	14	3	17
50-59	24	14	39
60-69	35	28	64
70-79	34	11	46
≥80	3	1	4
Gender (n)			
Men	28	21	50
Women	84	36	122
ASA score (n)			
I	33	8	41
II	51	40	92
III-IV	26	9	35
Type of hospital (n)			
General	91	52	145
UMC	2	4	6
Private	19	1	21
Diagnosis (n)			
Osteoarthritis	83	37	120
Rheumatoid arthritis	22	15	38
Post-traumatic	7	4	11
Other	0	1	1
Body Mass Index (kg/m²) (n)			
Underweight (≤18,5)	5	0	5
Normal weight (>18,5-25)	29	20	50
Overweight (>25-30)	28	25	53
Obesity (>30-40)	27	12	39
Morbid obesity (>40)	1	0	1
Smoking (n)			
No	79	52	132
Yes	20	4	24

[1]Also contains 3 (1.7%) primary finger arthroplasties of which specialism had not been registered.
Please note: Numbers may not add up to the total number of primary finger arthroplasties due to missings.
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 2018 (N=167).

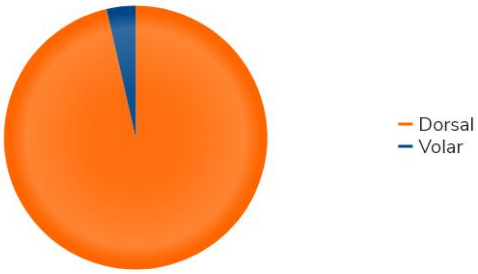
	Number[1] (n)
Previous surgery to the relevant finger (total)	15
Interposition arthroplasty	9
Arthrodesis	3
Ligament reconstruction	2
Interposition spacer	2
Correction osteotomy	0
Other	5

[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

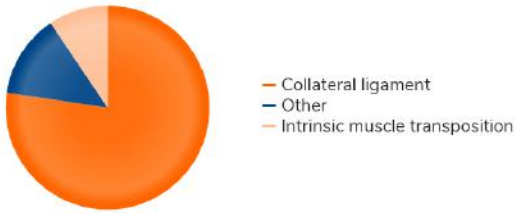
FIGURE SURGICAL APPROACH FOR PERFORMING A PRIMARY FINGER ARTHROPLASTY IN THE NETHERLANDS IN 2018 (N=169).



Surgical approach	Number (n)	Proportion (%)
Dorsal	163	96.45%
Volar	6	3.55%

Soft tissue stabilisation

FIGURE TYPE OF STABILISATION IN PRIMARY FINGER ARTHROPLASTY IN THE NETHERLANDS IN 2018 (N=106).

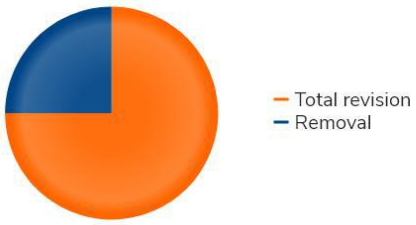


Stabilisation	Number (n)	Proportion (%)
Collateral ligament	82	77.36%
Other	14	13.21%
Intrinsic muscle transposition	10	9.43%

Finger revision arthroplasty

Type of revision

FIGURE TYPE OF REVISION ARTHROPLASTY OF FINGER REVISION ARTHROPLASTIES IN THE NETHERLANDS IN 2018 (N=16).



Type of revision	Number (n)
Total revision	12
Removal	4

Reasons for revision

TABLE REASONS FOR REVISION IN PATIENTS WHO UNDERWENT A FINGER REVISION ARTHROPLASTY IN THE NETHERLANDS IN 2018 (N=17).

Reasons for revision	Number[1] (n)
Instability	7
Implant fracture	6
Bone resorption of distal component	1
Bone resorption of proximal component	1
Infection	0
Loosening of distal component	0
Loosening of proximal component	0
Peri-prosthetic fracture	0
Other	3

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

Data quality

Coverage and completeness

TABLE COMPLETENESS OF REGISTERING HOSPITALS AND COMPLETENESS OF REGISTERED ARTHROPLASTIES IN THE LROI BASED ON THE HOSPITAL INFORMATION SYSTEM IN 2018.

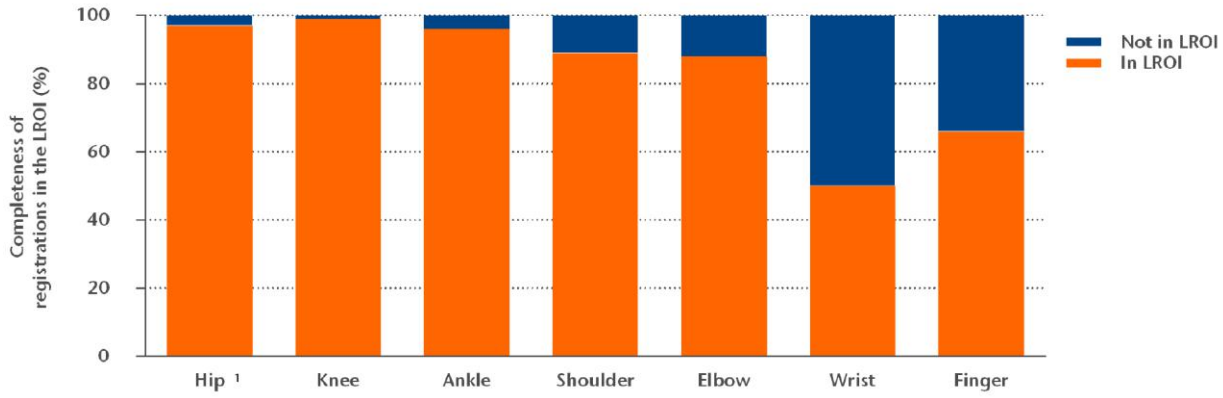
	Number of hospitals in LROI[1] (n)	Completeness of registering hospitals[2] (%)	Median [range] number of registrations	Completeness of registrations[3] (%)
Hip arthroplasties		100		
Primary total hip arthroplasties	98		307 [1-1,166]	99
Primary hip hemiarthroplasties (orthopaedic surgeon)	75		37 [1-197]	96
Primary hip hemiarthroplasties (trauma surgeon)	42		30 [1-145]	65
Hip revision arthroplasties	89		32 [1-290]	97
Knee arthroplasties		100		
Primary knee arthroplasties	97		285 [3-948]	99
Knee revision arthroplasties	93		23 [1-361]	97
Ankle arthroplasties				
Primary ankle arthroplasties	14	Unknown	8 [1-29]	98
Ankle revision arthroplasties	7		1 [1-8]	83
Shoulder arthroplasties		100		
Primary shoulder arthroplasties	86		28 [1-188]	91
Shoulder revision arthroplasties	56		3 [1-61]	78
Elbow arthroplasties		Unknown		
Primary elbow arthroplasties	22		3 [1-18]	89
Elbow revision arthroplasties	14		2 [1-13]	85
Wrist arthroplasties				
Primary wrist arthroplasties (orthopaedic surgeon)	14	Unknown	2 [1-11]	29
Primary wrist arthroplasties (plastic surgeon)	12		3 [1-10]	62
Wrist revision arthroplasties (orthopaedic surgeon)	9		2 [1-11]	83
Wrist revision arthroplasties (plastic surgeon)	3		1[1-1]	50
Finger arthroplasties				
Primary finger arthroplasties (orthopaedic surgeon)	18	Unknown	3 [1-11]	63
Primary finger arthroplasties (plastic surgeon)	16		5 [1-32]	68
Finger revision arthroplasties (orthopaedic surgeon)	9		2 [1-3]	100
Finger revision arthroplasties (plastic surgeon)	6		1 [1-4]	40

[1] Number of hospitals that performed arthroplasties in accordance with their hospital information system in 2018.
[2] Proportion of total number of hospitals that performed arthroplasties in 2018 (based on Vektis data).
[3] Completeness of number of registered arthroplasties in the LROI in October 2019, compared to the total number of arthroplasties performed (based on the hospital information system) in 2018. 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.

Completeness per arthroplasty

FIGURE COMPLETENESS (PROPORTION [%] PER JOINT) OF THE REGISTRATION OF PROCEDURES IN THE LROI IN 2018.



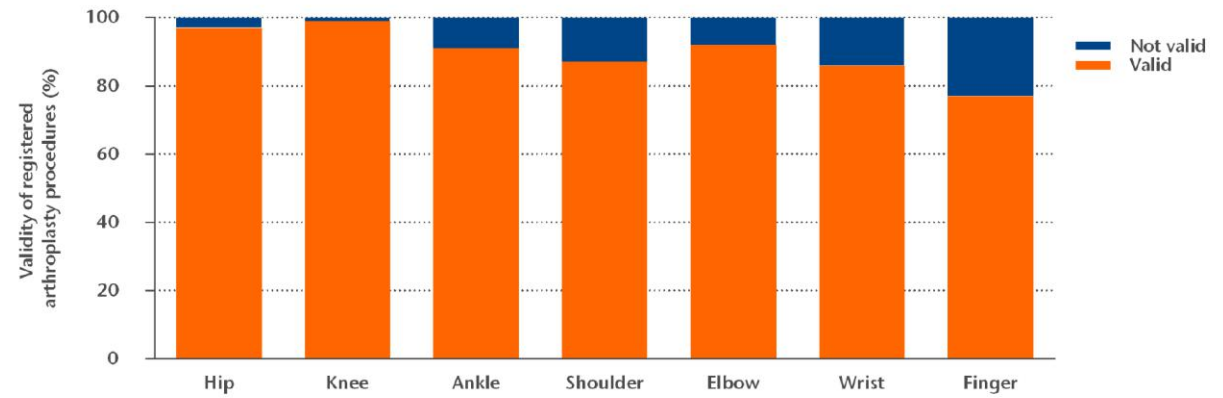
	Hip ¹	Knee	Ankle	Shoulder	Elbow	Wrist	Finger
Number of procedures in HIS (n)	39,729	31,247	154	3,198	200	94	157
Completeness of registrations in the LROI² (%)	96.9	99.0	96.1	88.6	88.0	50.0	65.6

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 2019, compared to the total number of arthroplasties performed (based on the hospital information system) in 2018. This pertains only to hospital that submitted data for comparison.

Validity

Overall validity

FIGURE VALIDITY (PROPORTION [%] PER JOINT) OF THE REGISTRATION OF PROCEDURES IN THE LROI IN 2018.



	Hip	Knee	Ankle	Shoulder	Elbow	Wrist	Finger
Number of procedures (n)	40,848	32,691	172	3,351	184	86	189
Validity registered procedures (%)	96.9	98.7	91.3	87.1	91.9	86.1	77.3

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 2018.

	Hip	Knee	Ankle	Shoulder	Elbow	Wrist	Finger
Number of arthroplasties (n)	**40,848**	**32,691**	**172**	**3,351**	**184**	**86**	**189**
Number of primary arthroplasties (n)	37,060	29,790	147	3,022	133	69	172
Number of revision arthroplasties (n)	3,788	2,901	25	329	51	17	17
General characteristics	%	%	%	%	%	%	%
Gender	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Encrypted citizen service number	99.4	99.8	100.0	99.8	98.9	98.8	98.9
HIS patient number	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Date of birth	100.0	100.0	100.0	100.0	100.0	100.0	98.9
Type of procedure	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Operating side	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Postal code	99.9	99.9	98.3	99.7	98.4	96.5	95.8
BMI	98.5	99.8	98.8	99.1	98.4	95.4	86.8
Smoking	99.5	99.7	95.4	99.2	96.7	95.4	91.5
ASA score	99.7	99.8	98.3	96.8	96.7	97.7	96.8
Fixation	99.8	99.9	97.1	99.7	97.8	94.2	97.4
Primary arthroplasty characteristics	%	%	%	%	%	%	%
Diagnosis	99.8	99.9	98.6	99.8	97.0	97.1	98.8
Charnley/Walch score	99.4	99.8	98.6	94.0	n.a.	n.a.	n.a.
Prosthesis	99.9	99.9	98.6	99.8	97.7	94.2	96.3
Surgical approach	99.9	99.9	98.0	99.8	97.0	97.1	98.8
Revision arthroplasty characteristics	%	%	%	%	%	%	%
Type of revision	99.7	97.7	100.0	96.4	94.1	100.0	94.1
Charnley score	97.7	98.5	n.a.	n.a.	n.a.	n.a.	n.a.
Reason for revision	99.2	97.0	100.0	95.1	94.1	94.1	82.4

Please note: Validity by variable as determined in April 2019.
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.

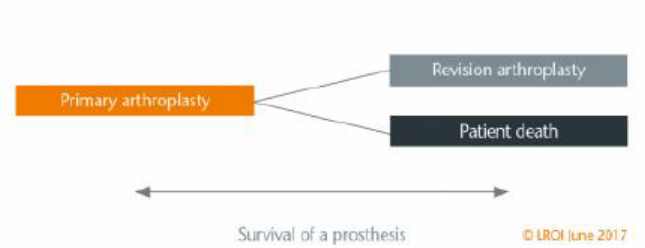
Kaplan Meier survival analysis

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 incl Victoria Kliniek H(O) K S
Albert Schweitzer Ziekenhuis H(O+T) K S W(P) F(P)
Alrijne Ziekenhuis H(O+T) K S
Amphia Ziekenhuis H(O) K S E W(O) (FO)
Antonius Ziekenhuis H(O) K A S
Bernhoven H(O) K S E F(P)
BovenIJ Ziekenhuis H(O+T) K
Bravis Ziekenhuis H(O+T) K A S E
Canisius-Wilhelmina Ziekenhuis H(O+T) K S
Catharina Ziekenhuis H(O) K S E
Centraal Militair Hospitaal H(O)
Deventer Ziekenhuizen H(O+T) K S F(P)
Diakonessenhuis Utrecht/ Zeist H(O) K S
Dijklander Ziekenhuis, Hoorn H(O) K S
Dijklander Ziekenhuis, Purmerend H(O) K S
Elisabeth-TweeSteden Ziekenhuis (Sint Elisabeth Ziekenhuis) H(O)
Elisabeth-TweeSteden Ziekenhuis (Twee Steden Ziekenhuis) H(O) K S E
Elkerliek Ziekenhuis H(O+T) K S F(P)
Flevoziekenhuis H(O+T) K S
Franciscus Gasthuis & Vlietland, location Sint Franciscus Gasthuis H(O) K S E W(O+P) F(O+P)
Franciscus Gasthuis & Vlietland, location Vlietland Ziekenhuis H(O+T) K S
GelreZiekenhuizen, location Apeldoorn H(O+T) K S W(O) F(O)
GelreZiekenhuizen, location Zutphen H(O) K S E
Groene Hart Ziekenhuis H(O) K S W(O) F(O)
Haaglanden Medisch Centrum H(O+T) K S W(P)
HagaZiekenhuis H(O+T) K A S E F(P)
Het Van Weel-Bethesda Ziekenhuis H(O+T) K S
IJsselland Ziekenhuis H(O) K S
Ikazia Ziekenhuis H(O) K S
Isala Klinieken H(O+T) K S E
Jeroen Bosch Ziekenhuis H(O+T) K S W(O+P) F(P)
LangeLand Ziekenhuis H(O+T) K S F(P)
Laurentius Ziekenhuis H(O) K S E F(O)
Maasstad Ziekenhuis H(O+T) K S E F(O)
Martini Ziekenhuis H(O) K A S E W(P) F(P)
Máxima Medisch Centrum H(O+T) K S E W(O)
MC Slotervaart H(O+T) K A S E
MC Zuiderzee H(O+T) K S
Meander Medisch Centrum H(O+T) K S W(P) F(P)
Medisch Centrum Leeuwarden incl. De Sionsberg H(O+T) K S W(P) F(O+P)
Medisch Spectrum Twente H(O) K S
Noordwest Ziekenhuisgroep, location Alkmaar H(O+T) K A S E W(O) F(O)
Noordwest Ziekenhuisgroep, location Den Helder H(O+T) K S E
OCON H(O) K S E F(O)
OLVG, locations Oost and West H(O+T) K A S E
Ommelander Ziekenhuisgroep Groningen H(O+T) K S
Reinier de Graaf Groep H(O+T) K S E
Rijnstate H(O+T) K S E W(P) F(P)
Rivas Zorggroep H(O) K S
Rode Kruis Ziekenhuis H(O+T) K A S
Röpcke Zweers Ziekenhuis H(O) K S
Sint Maartenskliniek, location Boxmeer H(O K

Sint Maartenskliniek, location Nijmegen H(O) K A S E W(O) F(O)
Slingeland Ziekenhuis H(O+T) K S
Spaarne Gasthuis H(O) K A S
Spijkenisse Medisch Centrum H(O) K S
St. Anna Ziekenhuis H(O+T) K A S
St. Antonius Ziekenhuis H(O+T) K S
St. Jans Gasthuis H(O+T) K S E
Streekziekenhuis Koningin Beatrix H(O+T) K S
Tergooi H(O+T) K S E
Treant Zorggroep, location Refaja Ziekenhuis H(O+T) K S
Treant Zorggroep, location Scheper Ziekenhuis H(O) K S
Treant Zorggroep, location Bethesda Ziekenhuis H(O) K
VieCuri MC H(O+T) K S E F(P)
Wilhelmina Ziekenhuis H(O) K S E
Zaans Medisch Centrum H(O) K S E F(O)
ZGT (Ziekenhuisgroep Twente) H(O+T)
Ziekenhuis Amstelland H(O) K S E
Ziekenhuis Gelderse Vallei H(O+T) K S
Ziekenhuis Nij Smellinghe H(O) K S
Ziekenhuis Rivierenland H(O+T) K S
Ziekenhuis St. Jansdal H(O) K S
Ziekenhuis Tjongerschans H(O) K S
ZorgSaam Zeeuws-Vlaanderen H(O) K S
Zuyderland, location Atrium MC H(O) K S E W(O) F(O)
Zuyderland, location Orbis Medisch Zorgconcern H(O) K S E

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

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

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

Private hospitals

Acibadem International Medical Center H(O+T) K A S
Annatommie MC H(O) K S
AVE Orthopedische Klinieken H(O) K S
Bergman Clinics H(O) K A S F(P)
CortoClinics H(O) K
Eisenhower Kliniek H(O) K S
Kliniek ViaSana H(O) K S
KneeClinic K
Medinovakliniek, location Breda H(O) K S
Medinovakliniek, location Klein Rosendael H(O) K S

Medinovakliniek, location Zestienhoven H(O) K
Orthoparc Kliniek H(O) K
Orthopedium H(O) K S
Park Medisch Centrum H(O) K
Reinaert Kliniek H(O) K
The Hand Clinic W(P) F(P)

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

Definitions and abbreviations

Definitions

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

Allograft
Transplant of bone tissue from a different body

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

Arthrodesis
A procedure in which a natural joint is fused together

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

Arthroscopy
Keyhole surgery to examine and treat joint disorders

Arthrotomy
Opening a joint during surgery

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

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

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

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

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

Bonegraft
Bone transplant

Bone resorption
Process by which osteoclasts break down bone tissue

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Inlay
Intermediate component (inner layer), made of polyethylene

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

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

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

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

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

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

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

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

Meniscectomy
Meniscus removal

Metallosis
Deposition of metal debris in soft tissues of the body

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

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

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

ODEP rating
Orthopaedic Data Evaluation Panel. ODEP provides ratings for hip femoral stems, hip acetabular cups and total knee replacement implants. An ODEP rating consists of a number and a letter (A or B), and a star (optional). The number

represents the number of years for which the product's performance had been evidenced. The letter represents the strength of evidence presented by the manufacturer (A represents strong evidence and B represents acceptable evidence). A Star (*) represents very strong evidence above A and B. Detailed information can be found at www.odep.org.uk

Olecranon
The most proximal part of the ulna

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
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
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