

Supplementary data

Table 1. Descriptive statistics according to femoral head size and approach for primary non-MoM THAs for osteoarthritis in the Netherlands between 2007 and 2015. Numbers may not add up to total, due to missing data

	22–28 mm n (%)	32 mm n (%)	36 mm n (%)	Total n (%)
A. Straight lateral approach				
Number of cases ^a	13,504	16,158	5,343	35,830
Age, years				
< 60	1,468 (10.9)	2,083 (12.9)	871 (16.3) ^b	4,482 (12.8)
60–74	6,591 (49.0)	8,242 (51.1)	2,752 (51.6)	17,666 (50.4)
≥ 75	5,394 (40.1)	5,803 (36.0)	1,709 (32.1)	12,933 (36.9)
Sex				
Male	3,707 (27.5)	4,980 (30.9)	2,391 (44.9) ^b	11,165 (31.8)
Female	9,756 (72.5)	11,134 (69.1)	2,940 (55.1)	23,911 (68.2)
ASA score				
I	2,884 (22.2)	3,418 (21.6)	1,324 (25.6) ^b	7,693 (22.5)
II	8,254 (63.7)	10,493 (66.3)	3,355 (64.8)	22,191 (65.0)
III–IV	1,824 (14.1)	1,921 (12.1)	495 (9.6)	4,252 (12.5)
Period				
2007–2009	5,176 (38.3)	2,617 (16.2)	605 (11.3) ^b	8,415 (23.9)
2010–2012	5,414 (40.1)	5,589 (34.6)	2,527 (47.3)	13,633 (38.8)
2013–2015	2,914 (21.6)	7,952 (49.2)	2,211 (41.4)	13,125 (37.3)
Articulation ^c				
MoP	6,200 (45.9)	4,659 (28.8)	957 (17.9) ^b	11,877 (33.8)
CoP	6,935 (51.4)	10,515 (65.1)	2,060 (38.6)	19,510 (55.5)
CoC	175 (1.3)	265 (1.6)	1,298 (24.3)	1,823 (5.2)
Other	194 (1.4)	719 (4.4)	1,028 (19.2)	1,963 (5.6)
Fixation				
Uncemented	6,861 (51.1)	10,598 (65.9)	4,643 (87.2) ^b	22,256 (63.6)
Cemented	5,607 (41.8)	3,701 (23.0)	461 (8.7)	9,779 (28.0)
Hybrid	431 (3.2)	588 (3.7)	174 (3.3)	1,195 (3.4)
Reversed hybrid	503 (3.7)	1,175 (7.3)	40 (0.8)	1,718 (4.9)
Unknown	13 (0.1)	11 (0.1)	8 (0.2)	33 (0.1)
B. Posterolateral approach				
Number of cases ^d	34,317	44,932	18,525	100,823
Age, years				
< 60	3,879 (11.3)	6,508 (14.5)	3,293 (17.8) ^b	13,918 (14.1)
60–74	16,867 (49.3)	23,481 (52.4)	10,425 (56.4)	51,319 (52.1)
≥ 75	13,462 (39.4)	14,858 (33.1)	4,753 (25.7)	33,309 (33.8)
Sex				
Male	8,551 (25.0)	14,646 (32.9)	8,054 (43.6) ^b	31,749 (32.3)
Female	25,603 (75.0)	29,871 (67.1)	10,410 (56.4)	66,407 (67.7)
ASA score				
I	7,617 (23.4)	10,352 (23.6)	4,778 (26.2) ^b	23,070 (24.1)
II	20,410 (62.8)	28,435 (64.9)	11,156 (61.1)	60,608 (63.4)
III–IV	4,498 (13.8)	5,037 (11.5)	2,330 (12.8)	11,953 (12.5)
Period				
2007–2009	10,623 (31.0)	7,203 (16.0)	1,355 (7.3) ^b	19,277 (19.5)
2010–2012	12,721 (37.0)	15,021 (33.4)	8,052 (43.5)	36,578 (37.0)
2013–2015	10,973 (32.0)	22,708 (50.5)	9,118 (49.2)	42,943 (43.5)
Articulation				
MoP	16,425 (47.9)	12,338 (27.5)	4,463 (24.1) ^b	33,400 (33.8)
CoP	16,569 (48.3)	25,890 (57.6)	7,191 (38.8)	49,652 (50.3)
CoC	506 (1.5)	1,118 (2.5)	4,580 (24.7)	6,985 (7.1)
Other	817 (2.4)	5,586 (12.4)	2,291 (12.4)	8,761 (8.9)
Fixation				
Uncemented	13,427 (39.4)	27,923 (62.5)	15,426 (83.6)	57,657 (58.7)
Cemented	16,637 (48.9)	13,092 (29.3)	1,429 (7.7)	31,181 (31.7)
Hybrid	1,766 (5.2)	2,421 (5.4)	1,371 (7.4)	5,675 (5.8)
Reversed hybrid	2,172 (6.4)	1,242 (2.8)	235 (1.3)	3,649 (3.7)
Unknown	35 (0.1)	27 (0.1)	11 (0.1)	73 (0.1)

Table 1 continued

	22–28 mm n (%)	32 mm n (%)	36 mm n (%)	Total n (%)
C. Anterolateral approach				
Number of cases ^e	5,783	5,179	1,467	12,744
Age, years				
< 60	527 (9.1)	694 (13.4)	363 (24.8) ^b	1,594 (12.8)
60–74	2,837 (52.3)	2,707 (52.3)	864 (59.0)	6,417 (51.6)
≥ 75	2,406 (41.7)	1,776 (34.4)	237 (16.2)	4,431 (35.6)
Sex				
Male	1,641 (28.4)	1,695 (32.9)	738 (50.4) ^b	4,085 (32.9)
Female	4,132 (71.6)	3,464 (67.1)	727 (49.6)	8,343 (67.1)
ASA score				
I	1,250 (22.6)	1,112 (22.1)	423 (30.5) ^b	2,794 (23.3)
II	3,457 (62.5)	3,294 (65.4)	826 (59.5)	7,597 (63.4)
III–IV	828 (15.0)	629 (12.5)	139 (10.0)	1,598 (13.3)
Period				
2007–2009	2,274 (39.3)	837 (16.2)	334 (22.8) ^b	3,450 (27.7)
2010–2012	2,197 (38.0)	2,130 (41.1)	708 (48.3)	5,060 (40.6)
2013–2015	1,312 (22.7)	2,212 (42.7)	425 (29.0)	3,950 (31.7)
Articulation				
MoP	2,743 (47.4)	886 (17.1)	471 (32.1) ^b	4,103 (32.9)
CoP	2,912 (50.4)	3,629 (70.1)	538 (36.7)	7,079 (56.8)
CoC	34 (0.6)	264 (5.1)	366 (24.9)	687 (5.5)
Other	94 (1.6)	400 (7.7)	92 (6.3)	591 (4.7)
Fixation				
Uncemented	2,817 (49.3)	4,045 (79.1)	1,345 (91.9)	8,235 (66.9)
Cemented	2,260 (39.6)	775 (15.2)	39 (2.7)	3,076 (25.0)
Hybrid	377 (6.6)	200 (3.9)	78 (5.3)	656 (5.3)
Reversed hybrid	249 (4.4)	93 (1.9)	1 (0.1)	343 (2.8)
D. Anterior approach				
Number of cases ^f	4,843	4,874	4,528	14,446
Age, years				
< 60	619 (12.8)	719 (14.8)	981 (21.7) ^b	2,328 (16.3)
60–74	2,505 (51.8)	2,697 (55.4)	2,760 (61.0)	7,981 (55.9)
≥ 75	1,712 (35.4)	1,452 (29.8)	782 (17.3)	3,960 (27.8)
Sex				
Male	1,197 (24.8)	1,036 (21.8)	2,290 (50.7) ^b	4,558 (32.2)
Female	3,639 (75.2)	3,726 (78.2)	2,225 (49.3)	9,597 (67.8)
ASA score				
I	1,177 (24.9)	1,174 (24.2)	1,353 (30.8) ^b	3,713 (26.5)
II	3,138 (66.4)	3,224 (66.4)	2,710 (61.7)	9,104 (64.9)
III–IV	416 (8.8)	455 (9.4)	330 (7.5)	1,202 (8.6)
Period				
2007–2009	349 (7.2)	160 (3.3)	206 (4.5) ^b	715 (5.0)
2010–2011	1,372 (28.3)	605 (12.4)	1,662 (36.7)	3,681 (25.8)
2013–2015	3,122 (64.5)	4,109 (84.3)	2,660 (58.7)	9,891 (69.2)
Articulation				
MoP	2,066 (42.7)	1,591 (32.6)	392 (8.7) ^b	4,049 (28.3)
CoP	2,470 (51.0)	2,500 (51.3)	1,246 (27.5)	6,216 (43.5)
CoC	239 (4.9)	660 (13.5)	2,860 (63.2)	3,800 (26.6)
Other	68 (1.4)	123 (2.5)	30 (0.7)	222 (1.6)
Fixation				
Uncemented	2,296 (47.7)	4,121 (84.8)	4,227 (93.7) ^b	10,686 (75.1)
Cemented	1,657 (34.5)	554 (11.4)	141 (3.1)	2,352 (16.5)
Hybrid	16 (0.3)	72 (1.5)	78 (1.7)	166 (1.2)
Reversed hybrid	839 (17.4)	115 (2.4)	64 (1.4)	1,018 (7.2)
^a Head diameter was ≥ 38 mm in 168 records and missing in 657 records.				
^b $p < 0.0001$.				
^c MoP: metal-on-polyethylene; CoP: ceramic-on-polyethylene; CoC: ceramic-on-ceramic.				
^d Head diameter was ≥ 38 mm in 1,024 records and missing in 2,025 records.				
^e Head diameter was ≥ 38 mm in 31 records and missing in 284 records.				
^f Head diameter was ≥ 38 mm in 42 records and missing in 159 records.				

Table 2. Reasons for revision in patients in the Netherlands who received a non-MoM THA for osteoarthritis in 2007–2015 and who underwent a revision

	22–28 mm n (%)	32 mm n (%)	36 mm n (%)	Total ^a n (%)	p-value for difference
A. Straight lateral approach (n = 788)					
Dislocation	89 (27.6)	61 (19.9)	18 (13.7)	168 (22.0)	0.009
Loosening femoral component	66 (20.4)	86 (28.0)	40 (30.5)	192 (25.1)	0.1
Periprosthetic fracture	42 (13.0)	60 (19.5)	24 (18.3)	126 (16.5)	0.4
Infection	47 (14.6)	50 (16.3)	18 (13.7)	116 (15.2)	0.9
Loosening acetabular component	46 (14.2)	62 (20.2)	12 (9.2)	120 (15.7)	0.07
Girdlestone	18 (5.6)	15 (4.9)	6 (4.6)	39 (5.1)	0.4
Cup/liner wear	20 (7.3)	3 (1.4)	1 (0.9)	24 (3.9)	0.002
Periarticular ossification	10 (3.1)	17 (5.5)	5 (3.8)	32 (4.2)	0.4
Other	72 (22.3)	47 (15.3)	30 (22.9)	151 (19.8)	0.02
B. Posterolateral approach (n = 2,359)					
Dislocation	398 (45.5)	319 (33.6)	89 (21.3)	812 (35.7)	< 0.001
Loosening femoral component	108 (12.3)	168 (17.7)	124 (29.7)	407 (17.9)	< 0.001
Periprosthetic fracture	85 (9.7)	123 (12.9)	81 (19.4)	294 (12.9)	< 0.001
Infection	107 (12.2)	181 (19.1)	70 (16.7)	358 (15.7)	< 0.001
Loosening acetabular component	116 (13.3)	90 (9.5)	49 (11.7)	256 (11.2)	0.2
Girdlestone	25 (2.9)	29 (3.1)	17 (4.1)	72 (3.2)	0.9
Cup/liner wear	23 (3.2)	36 (4.7)	9 (2.5)	71 (3.8)	0.02
Periarticular ossification	9 (1.0)	11 (1.2)	6 (1.4)	26 (1.1)	0.9
Other	136 (15.5)	167 (17.6)	72 (17.2)	383 (16.8)	0.8
C. Anterolateral approach (n = 326)					
Dislocation	41 (25.2)	15 (13.2)	2 (5.3)	58 (18.3)	0.003
Loosening femoral component	40 (24.5)	44 (38.6)	19 (50.0)	103 (32.5)	0.004
Periprosthetic fracture	22 (13.5)	18 (15.8)	3 (7.9)	43 (13.6)	0.8
Infection	26 (16.0)	7 (6.1)	7 (18.4)	40 (12.6)	0.1
Loosening acetabular component	26 (16.0)	23 (20.2)	6 (15.8)	55 (17.4)	0.8
Girdlestone	20 (12.3)	1 (0.9)	0 (0.0)	21 (6.6)	0.005
Cup/liner wear	9 (6.6)	2 (2.0)	1 (2.9)	13 (4.8)	0.008
Periarticular ossification	4 (2.5)	4 (3.5)	0 (0.0)	8 (2.5)	0.9
Other	28 (17.2)	19 (16.7)	8 (21.1)	56 (17.7)	0.6
D. Anterior approach (n = 281)					
Dislocation	34 (27.6)	13 (25.0)	10 (10.1)	57 (20.8)	0.004
Loosening femoral component	32 (26.0)	8 (15.4)	39 (39.4)	79 (28.8)	0.01
Periprosthetic fracture	15 (12.2)	11 (21.2)	13 (13.1)	39 (14.2)	0.3
Infection	11 (8.9)	4 (7.7)	13 (13.1)	28 (10.2)	0.7
Loosening acetabular component	14 (11.4)	8 (15.4)	7 (7.1)	29 (10.6)	0.3
Girdlestone	7 (5.7)	2 (3.8)	6 (6.1)	15 (5.5)	0.8
Cup/liner wear	2 (2.1)	4 (8.5)	6 (8.0)	12 (5.5)	0.1
Periarticular ossification	0 (0.0)	1 (1.9)	2 (2.0)	3 (1.1)	0.3
Other	24 (19.5)	13 (25.0)	19 (19.2)	56 (20.4)	0.7

^a This includes all femoral head sizes as well as THAs with unknown or missing femoral head size.

A patient could have more than one reason for revision, so the total number of reasons for revision is higher than the number of revisions.

Table 4A. Multivariable survival analysis of patients in the Netherlands with a non-MoM THA for the diagnosis osteoarthritis in the period 2007–2015, according to surgical approach (n = 166,231)

	Adjusted ^a hazard ratio for revision due to dislocation (95% CI)				Total (n = 166,231)
	Straight lateral (n = 35,824)	Posterolateral (n = 100,823)	Anterolateral (n = 12,737)	Anterior (n = 14,446)	
Head diameter					
22–28 mm	1.75 (1.25–2.45) ^b	1.53 (1.32–1.78) ^b	2.76 (1.50–5.10) ^b	2.39 (1.23–4.65) ^b	1.58 (1.39–1.80) ^b
32 mm	1.0	1.0	1.0	1.0	1.0
36 mm	0.80 (0.47–1.36)	0.62 (0.49–0.79) ^b	0.42 (0.09–1.81)	0.62 (0.27–1.44)	0.63 (0.52–0.78) ^b
Fixation					
Uncemented	1.0	1.0	1.0	1.0	1.0
Cemented	0.64 (0.44–0.95) ^b	0.78 (0.66–0.92) ^b	0.63 (0.32–1.24)	0.88 (0.44–1.76)	0.82 (0.71–0.94) ^b
Hybrid	1.08 (0.50–2.34)	1.00 (0.74–1.34)	1.15 (0.39–3.36)	1.98 (0.27–14.6)	1.11 (0.85–1.45)
Reversed hybrid	0.55 (0.22–1.34)	1.02 (0.73–1.42)	1.19 (0.36–3.94)	0.57 (0.20–1.66)	0.91 (0.68–1.22)
Age at surgery, years					
< 60	1.24 (0.80–1.92)	0.98 (0.79–1.21)	1.09 (0.50–2.42)	1.11 (0.50–2.46)	1.08 (0.90–1.28)
60–74	1.0	1.0	1.0	1.0	1.0
≥ 75	0.90 (0.63–1.28)	1.10 (0.94–1.29)	0.91 (0.50–1.65)	1.16 (0.64–2.11)	1.04 (0.91–1.19)
Sex					
Male	1.16 (0.85–1.60)	1.18 (1.02–1.36) ^b	1.28 (0.75–2.20)	1.65 (0.96–2.86)	1.21 (1.07–1.37) ^b
Female	1.0	1.0	1.0	1.0	1.0
ASA score					
I	1.0	1.0	1.0	1.0	1.0
II	1.44 (0.98–2.12)	1.14 (0.96–1.34)	1.10 (0.59–2.07)	1.38 (0.70–2.71)	1.20 (1.04–1.38) ^b
III–IV	1.41 (0.80–2.47)	1.37 (1.08–1.73) ^b	0.93 (0.37–2.36)	2.81 (1.17–6.76) ^b	1.40 (1.14–1.72) ^b
Period					
2007–2009	0.93 (0.63–1.37)	0.95 (0.79–1.34)	0.80 (0.42–1.52)	1.65 (0.67–4.04)	0.93 (0.80–1.09)
2010–2012	1.0	1.0	1.0	1.0	1.0
2013–2015	1.34 (0.92–1.95)	1.28 (1.08–1.51) ^b	1.23 (0.64–2.32)	0.88 (0.48–1.63)	1.26 (1.09–1.45) ^b

^a Adjusted for the variables listed in the table.

^b p < 0.05.

Table 4B. Multivariable survival analysis of patients in the Netherlands with a non-MoM THA for the diagnosis osteoarthritis in the period 2007–2015, according to femoral head size (n = 166,231)

Surgical approach	Adjusted ^a hazard ratio for revision due to dislocation (95% CI)			
	22–28 mm (n = 59,474)	32 mm (n = 58,080)	36 mm (n = 25,164)	Total (n = 166,231)
Direct lateral	0.55 (0.47–0.69) ^b	0.47 (0.35–0.64) ^b	0.65 (0.38–1.11)	0.56 (0.48–0.67) ^b
Posterolateral	1.0	1.0	1.0	1.0
Anterolateral	0.59 (0.43–0.82) ^b	0.36 (0.21–0.61) ^b	0.28 (0.07–1.14)	0.53 (0.41–0.69) ^b
Anterior	0.70 (0.49–1.00) ^b	0.29 (0.13–0.66) ^b	0.52 (0.26–1.04)	0.57 (0.44–0.75) ^b

^a Adjusted for age at surgery, gender, ASA score, fixation, and period of surgery.

^b p < 0.05.

Table 5A. Multivariable survival analysis of patients in the Netherlands with a non-MoM THA for the diagnosis osteoarthritis in the period 2007–2015, according to surgical approach (n = 166,231)

	Adjusted ^a hazard ratio for revision for any reason except dislocation (95% CI)				
	Straight lateral (n = 35,824)	Posterolateral (n = 100,823)	Anterolateral (n = 12,737)	Anterior (n = 14,446)	Total (n = 166,231)
Head diameter					
22–28 mm	1.00 (0.83–1.20)	0.93 (0.82–1.05)	0.93 (0.70–1.25)	1.49 (1.00–2.20) ^b	0.99 (0.90–1.08)
32 mm	1.0	1.0	1.0	1.0	1.0
36 mm	1.23 (0.98–1.55)	1.09 (0.95–1.25)	0.95 (0.64–1.40)	1.49 (1.02–2.19) ^b	1.16 (1.04–1.28) ^b
≥ 38 mm	0.95 (0.31–2.99)	1.41 (0.95–2.07)	2.17 (0.53–8.85)	0.00 (0–100)	1.35 (0.95–1.91)
Fixation					
Uncemented	1.0	1.0	1.0	1.0	1.0
Cemented	0.49 (0.39–0.62) ^b	0.61 (0.53–0.70) ^b	0.69 (0.47–1.00) ^b	0.84 (0.56–1.26)	0.59 (0.53–0.65) ^b
Hybrid	0.50 (0.29–0.87) ^b	0.84 (0.66–1.06)	0.63 (0.29–1.36)	0.84 (0.21–3.40)	0.72 (0.59–0.88) ^b
Reversed hybrid	1.44 (1.04–1.99) ^b	1.41 (1.13–1.77) ^b	2.10 (1.24–3.56) ^b	1.06 (0.64–1.76)	1.42 (1.21–1.67) ^b
Age at surgery, years					
< 60	1.27 (1.02–1.59) ^b	1.33 (1.16–1.52) ^b	1.83 (1.35–2.48) ^b	0.92 (0.63–1.34)	1.32 (1.19–1.46) ^b
60–74	1.0	1.0	1.0	1.0	1.0
≥ 75	0.87 (0.72–1.05)	0.91 (0.80–1.03)	0.73 (0.53–1.01)	1.17 (0.84–1.61)	0.91 (0.83–1.00) ^b
Sex					
Male	1.01 (0.85–1.20)	1.21 (1.09–1.35) ^b	1.09 (0.85–1.42)	1.13 (0.85–1.51)	1.15 (1.06–1.24) ^b
Female	1.0	1.0	1.0	1.0	1.0
ASA score					
I	1.0	1.0	1.0	1.0	1.0
II	1.25 (1.03–1.52) ^b	1.09 (0.97–1.23)	1.00 (0.76–1.32)	0.94 (0.70–1.27)	1.09 (1.00–1.20) ^b
III–IV	1.56 (1.17–2.07) ^b	1.41 (1.18–1.68) ^b	0.75 (0.46–1.24)	1.01 (0.59–1.74)	1.33 (1.16–1.52) ^b
Period					
2007–2009	1.20 (0.98–1.47)	0.93 (0.81–1.07)	1.22 (0.92–1.63)	1.72 (1.16–2.54) ^b	1.06 (0.96–1.17)
2010–2012	1.0	1.0	1.0	1.0	1.0
2013–2015	1.35 (1.09–1.66) ^b	1.31 (1.15–1.48) ^b	1.07 (0.75–1.54)	0.75 (0.54–1.03)	1.23 (1.12–1.35) [*]

^a Adjusted for the variables listed in the table.
^b p < 0.05.

Table 5B. Multivariable survival analysis of patients in the Netherlands with a non-MoM THA for the diagnosis osteoarthritis in the period 2007–2015, according to femoral head size (n = 166,231)

Surgical approach	Adjusted ^a hazard ratio for revision for any reason except dislocation (95% CI)			
	22–28 mm (n = 59,474)	32 mm (n = 58,081)	36 mm (n = 25,164)	Total (n = 166,231)
Direct lateral	1.15 (0.98–1.35)	1.09 (0.93–1.27)	1.15 (0.92–1.44)	1.06 (0.97–1.17)
Posterolateral	1.0	1.0	1.0	1.0
Anterolateral	1.37 (1.12–1.68) ^b	1.22 (0.98–1.53)	1.20 (0.84–1.71)	1.23 (1.08–1.40) ^b
Anterior	1.53 (1.21–1.94) ^b	0.77 (0.53–1.14)	1.24 (0.97–1.60)	1.17 (1.01–1.35) ^b

^a Adjusted for age at surgery, gender, ASA score, fixation, and period of surgery.
^b p < 0.05.