Australian Orthopaedic Association National Joint Replacement Registry

2024 SUPPLEMENTARY REPORT

Revision of Hip and Knee Arthroplasty

AOA
AUSTRALIAN ORTHOPAEDIC ASSOCIATION

Australian Orthopaedic Association National Joint Replacement Registry

https://doi.org/10.25310/IEJC8370

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Revision of Hip and Knee Arthroplasty

2024 Supplementary Report

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The AOANJRR is funded by the Australian Government Department of Health and Aged Care

Cite this report

Lewis PL, Gill DR, McAuliffe MJ, McDougall C, Stoney JD, Vertullo CJ, Wall CJ, Corfield S, Du P, Holder C, Harries D, Edwards S, Xu Q, Lorimer MF, Cashman K, Smith PN. Revision of Hip and Knee Arthroplasty Supplementary Report in Hip, Knee & Shoulder Arthroplasty: 2024 Annual Report, Australian Orthopaedic Association National Joint Replacement Registry, AOA, Adelaide; 2024.
https://doi.org/10.25310/IEJC8370

Australian Orthopaedic Association
National Joint Replacement Registry

Revision of Hip and Knee Arthroplasty
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Acknowledgements

The Registry continues to receive support and invaluable assistance from the Australian Government, state and territory health departments and orthopaedic companies.

The Registry acknowledges the cooperation and support provided by those undertaking the surgery and completing the data forms, in particular, all orthopaedic surgeons, registrars and nursing staff.

The Registry acknowledges the ongoing support of all hospitals, both public and private, that undertake arthroplasty surgery nationally. The support provided by each hospital through their nominated coordinator(s) is appreciated. A complete list of participating hospitals and coordinators is presented at the end of the Hip, Knee and Shoulder Arthroplasty Annual Report.

The Registry greatly appreciates the participation of all joint replacement patients throughout Australia. Their contribution allows ongoing improvements in arthroplasty outcomes to be achieved.

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Contents

Summary

This supplementary report provides demographic information and outcomes for revision hip and knee procedures.

There are separate sections for hip and knee replacement. Each section provides overall demographic and summary data. More detailed information, including types of revision, reasons for revision and outcomes are provided for the 1st revision where the primary procedure was captured by the Registry. These analyses are restricted to cases with a primary diagnosis of osteoarthritis and excluding those revised for infection.

For hip replacement overall, the most common reason for revision is loosening (32.9%), followed by infection, prosthesis dislocation and fracture. For knee replacement, the most common reason for revision is loosening (27.8%), followed by infection and progression of disease.

Revision Hip and Knee Replacement

Classes of Revision Procedures

The Registry defines revision of a joint replacement as any re-operation of any previous replacement procedure where one or more of the prosthetic components are replaced, removed, or one or more components are added.

Revisions are subcategorised into three classes: major total, major partial and minor.

Major total revision involves the insertion, removal and/or replacement of all major components.

Major partial revision involves the insertion, removal and/or replacement of one major component.

Minor revision involves the insertion, removal and/or replacement of any other component or implant including patella prostheses in knee replacement.

Major components are those that are fixed to bone. They involve the femoral prosthesis and the acetabular shell or cup in hip replacement and the femoral and tibial prostheses in either partial or total knee replacement. Although a patella prosthesis is fixed to bone, it is not considered a major component.

Different types of major partial and minor revisions are identified based on the specific prostheses or implants used in the revision. These are listed in Table R1 and Table R6.

If there is more than one revision, then subsequent revisions are identified in sequential order (i.e. 2nd, 3rd, 4th etc). The exception to this is a planned two-stage revision for infection, which is regarded as a single revision.

Approach to Analysis

The purpose of this analysis is to report the outcome of the 1st revision. To achieve this, it is necessary to have information on the primary procedure.

As the Registry has been collecting complete national data since 2003, the full history is not available for many of the revisions reported to the Registry. If the Registry does not have information on preceding procedures it is unable to establish if a reported revision is the first for that joint, or a revision of a previous revision. It is also unable to determine the type of primary procedure that subsequently required revision.

To assist in the analysis, revision procedures are grouped into 'all revisions' and 'revisions of known primary procedures'.

The all revisions group includes all revision procedures regardless of whether the Registry has a full chronological history, including the primary procedure. Analysis of this group provides information on the entire revision burden as well as demographic data, the reasons for revision and the types of revision undertaken.

The second group, referred to as revisions of known primary procedures, is a subset of the all revisions group. This group includes only the 1st revision of a primary procedure recorded in the Registry and is used to determine the outcome of the 1st revision. The number and proportion of revision procedures of known primary procedures continues to increase and will eventually approach 100%.

There are important differences between the two groups. The all revisions group covers the full spectrum of revisions including revisions of previous revisions and revisions of procedures undertaken prior to the implementation of the Registry.

As the revisions of known primary procedures group are revisions of primary procedures recorded by the Registry, the primary procedure must have been undertaken since the Registry began collecting data.

First revisions for infection have been excluded from the analysis of the revisions of known primary procedures group. Determining the outcome of these revisions is more complex than revisions undertaken for other reasons. There are many additional factors to consider, for instance: antibiotic treatment, adequacy of debridement, infective organism(s) and revision strategy, such as planned multi-staged procedures. The Registry does not have information on some of these factors and therefore meaningful interpretation of any analysis related to infection is difficult.

Revision Hip Replacement

DEMOGRAPHICS OF ALL REVISIONS

This report analyses 91,456 revisions of hip replacements with a procedure date up to and including 31 December 2023. This is an additional 4,263 procedures compared to the previous report.

Type of Revision

The majority of revisions recorded by the Registry are major revisions (80.5%) (Table R1). The most common types of major revision are acetabular component only (28.2%), total hip replacement (femoral/acetabular) (26.6%), and femoral component only (20.2%) (Table R1).

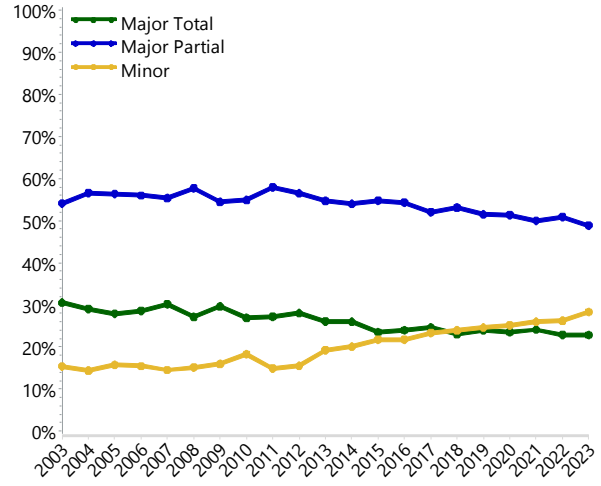
Minor revisions account for 19.5% of all hip replacement revision procedures. The most common type of minor revision is head and insert exchange, accounting for 14.1% of all revisions (Table R1).

Since 2003, the proportion of major partial revisions has remained unchanged. However, there has been a decrease in major total revisions (30.5% in 2003 to 22.8% in 2023) and an increase in minor revisions (15.4% in 2003 to 28.3% in 2023) (Figure R1).

Reason for Revision

The most common reasons for revision are loosening (32.9%), infection (19.2%), prosthesis dislocation (14.7%), and fracture (13.3%) (Table R2).

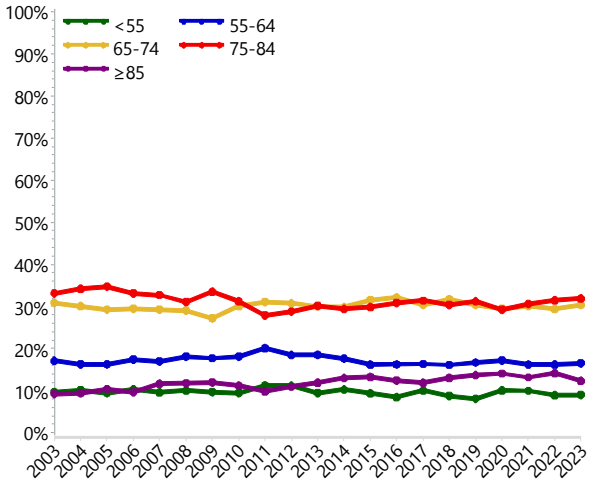
Figure R1 Revision Hip Replacement by Class



Age and Gender

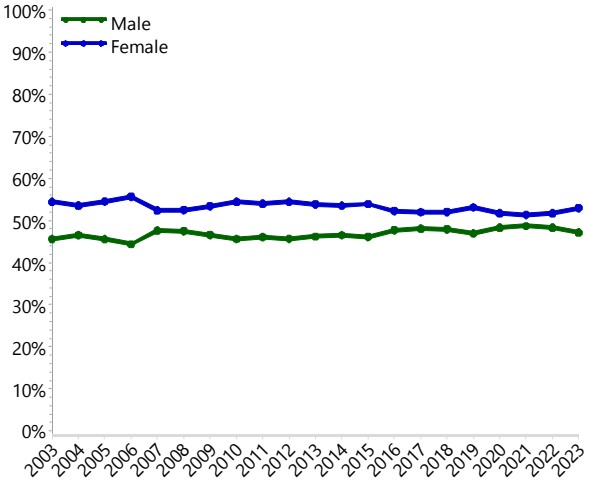
Age distribution of revision procedures has remained stable since 2003 (Figure R2).

Figure R2 Revision Hip Replacement by Age



Revision hip replacement is more common in females (53.3%). There has been little change in the proportion of females undergoing revisions since 2003 (Figure R3).

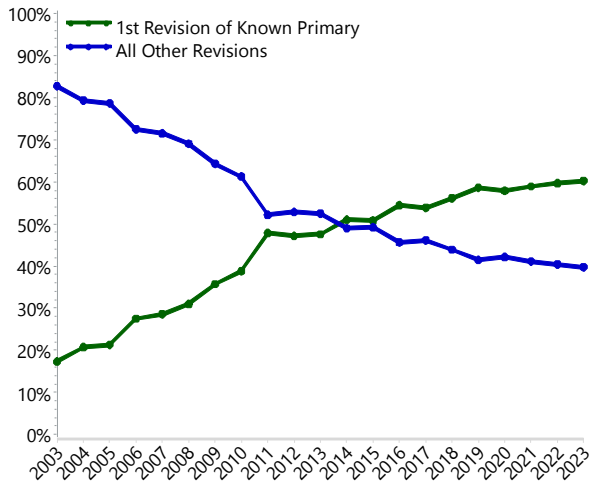
Figure R3 Revision Hip Replacement by Gender



DEMOGRAPHICS OF 1ST REVISIONS OF KNOWN PRIMARY PROCEDURES

There have been 38,980 1st revision procedures where the primary procedure has been recorded by the Registry. This includes revisions of all primary partial, total conventional and total resurfacing hip replacements. This is an additional 2,583 procedures compared to the previous report (Figure R4).

Figure R4 Revision Hip Replacement by Revision



Type of Revision

The 1st revisions of known primary procedures group and the all revisions group differ in the types of revisions recorded.

The 1st revisions of known primary procedures group has a smaller proportion of major revisions (75.4%) compared to the all revisions group (80.5%). There are less acetabular only and total hip replacement (acetabular /femoral) revisions, but more femoral only revisions (Table R1).

There is a higher proportion of minor revisions in the 1st revisions of known primary procedures group (24.6%) compared to the all revisions group (19.5%) (Table R1).

Reason for Revision

There are differences in the reasons for revision between the 1st revisions of known primary procedures group and the all revisions group. Loosening is the most common reason for revision in both groups, but the proportion is lower in the 1st revisions of known primary procedures group (21.5% compared to 32.9%). Other diagnoses such as prosthesis dislocation, fracture, metal related pathology and pain are more common in the 1st revisions of known primary procedures group (Table R2).

Table R1 Revision Hip Replacement by Type of Revision

Type of Revision	1st Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Femoral Component	10734	27.5	18451	20.2
Acetabular Component	9416	24.2	25823	28.2
THR (Femoral/Acetabular)	7176	18.4	24357	26.6
Cement Spacer	1307	3.4	3355	3.7
Bipolar Head and Femoral	412	1.1	717	0.8
Removal of Prostheses	314	0.8	840	0.9
Reinsertion of Components	47	0.1	69	0.1
Saddle	2	0.0	5	0.0
Thrust Plate	1	0.0	2	0.0
N Major	**29409**	**75.4**	**73619**	**80.5**
Head/Insert	6558	16.8	12886	14.1
Head Only	1689	4.3	2479	2.7
Minor Components	595	1.5	1117	1.2
Bipolar Only	276	0.7	360	0.4
Insert Only	259	0.7	738	0.8
Head/Neck/Insert	121	0.3	152	0.2
Head/Neck	63	0.2	90	0.1
Neck Only	7	0.0	9	0.0
Cement Only	1	0.0	4	0.0
Incomplete	1	0.0	1	0.0
Neck/Insert	1	0.0	1	0.0
N Minor	**9571**	**24.6**	**17837**	**19.5**
TOTAL	**38980**	**100.0**	**91456**	**100.0**

Table R2 Revision Hip Replacement by Reason for Revision

Reason for Revision	1st Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Loosening	8366	21.5	30101	32.9
Fracture	7628	19.6	12122	13.3
Infection	7156	18.4	17576	19.2
Prosthesis Dislocation	6663	17.1	13445	14.7
Metal Related Pathology	2911	7.5	3432	3.8
Lysis	1160	3.0	4928	5.4
Pain	1126	2.9	1716	1.9
Chondrolysis/Acetab. Erosion	467	1.2	595	0.7
Instability	444	1.1	770	0.8
Malposition	442	1.1	579	0.6
Leg Length Discrepancy	431	1.1	522	0.6
Implant Breakage Stem	421	1.1	974	1.1
Wear Acetabular Insert	244	0.6	1368	1.5
Implant Breakage Acetabular Insert	224	0.6	506	0.6
Implant Breakage Acetabular	194	0.5	718	0.8
Incorrect Sizing	177	0.5	214	0.2
Tumour	99	0.3	183	0.2
Wear Head	99	0.3	118	0.1
Implant Breakage Head	71	0.2	124	0.1
Osteonecrosis	58	0.1	139	0.2
Heterotopic Bone	47	0.1	90	0.1
Wear Acetabulum	43	0.1	347	0.4
Progression Of Disease	19	0.0	41	0.0
Synovitis	10	0.0	16	0.0
Other	480	1.2	832	0.9
TOTAL	**38980**	**100.0**	**91456**	**100.0**

OUTCOME OF 1ST REVISION OF KNOWN PRIMARY TOTAL CONVENTIONAL HIP REPLACEMENT

This analysis reports the outcome of the 1st revisions of known primary total conventional hip replacements.

There are 22,237 1st revisions of primary total conventional hip replacements undertaken for osteoarthritis, excluding all procedures with a 1st revision for infection.

Minor 1st revisions have a higher rate of 2nd revision when compared to major partial 1st revisions after the first month. Minor 1st revisions also have a higher rate of 2nd revision compared to major total 1st revisions. There is no difference in the rate of 2nd revision between major partial and major total 1st revisions (Table R3 and Figure R5).

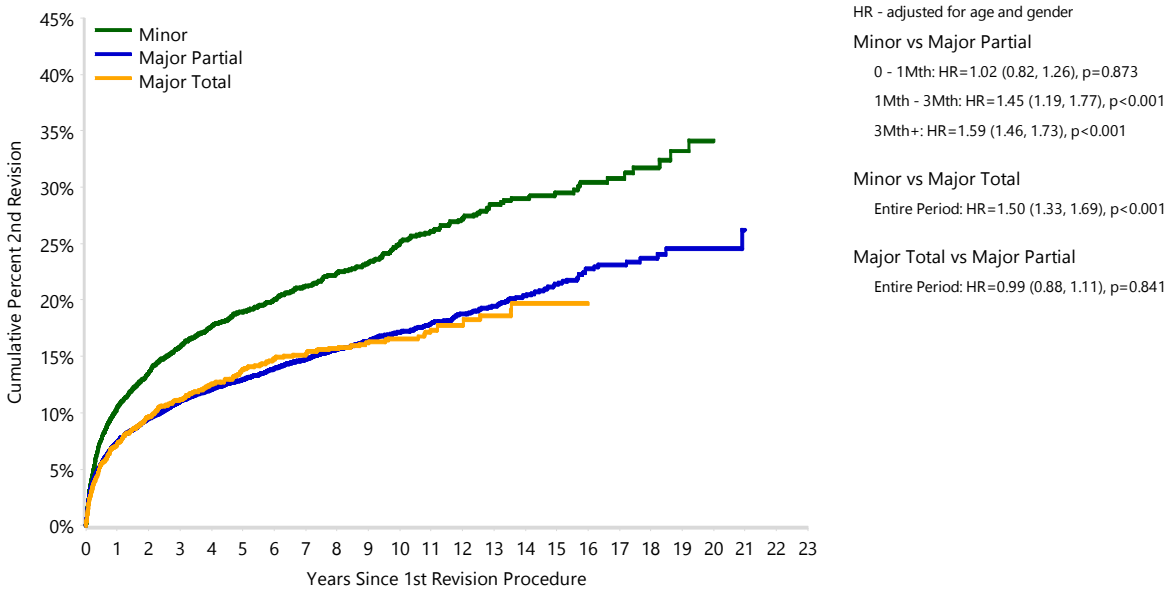
The outcome for the five most common types of 1st revision is detailed in Table R4 and Figure R6.

Table R3 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Class of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	995	4981	10.5 (9.6, 11.4)	15.9 (14.8, 17.0)	19.0 (17.8, 20.2)	24.9 (23.4, 26.5)	29.5 (27.4, 31.6)	34.1 (30.5, 38.0)
Major Partial	2037	14720	7.4 (7.0, 7.9)	11.0 (10.5, 11.5)	12.9 (12.4, 13.5)	17.1 (16.4, 17.9)	21.4 (20.2, 22.7)	24.5 (22.5, 26.7)
Major Total	349	2536	7.2 (6.3, 8.3)	11.2 (9.9, 12.5)	13.9 (12.5, 15.4)	16.6 (14.9, 18.4)	19.7 (17.2, 22.4)	
TOTAL	**3381**	**22237**						

Note: Excluding revisions where no minor or major femoral/acetabular components have been inserted
Procedures using large head metal/metal have been included

Figure R5 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	4981	4041	3140	2368	921	268	45
Major Partial	14720	12209	9690	7465	3211	664	78
Major Total	2536	2135	1671	1280	533	86	4

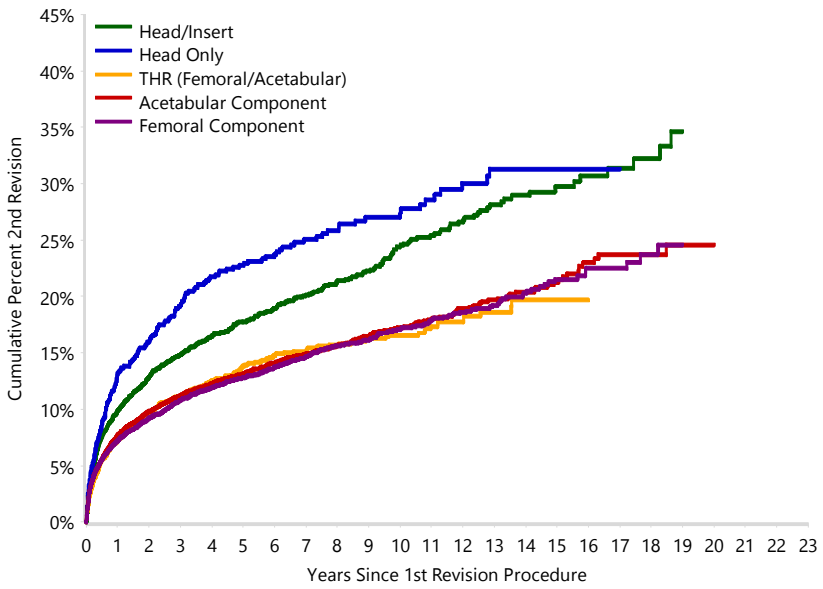
Note: Excluding revisions where no minor or major femoral/acetabular components have been inserted
Procedures using large head metal/metal have been included

Table R4 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Type of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Head/Insert	658	3456	9.8 (8.9, 10.9)	14.8 (13.6, 16.1)	17.8 (16.4, 19.2)	24.4 (22.6, 26.4)	29.7 (27.1, 32.6)	
Head Only	202	842	13.2 (11.0, 15.7)	19.3 (16.7, 22.2)	22.8 (19.9, 26.0)	27.0 (23.7, 30.7)	31.3 (27.3, 35.8)	
THR (Femoral/Acetabular)	349	2536	7.2 (6.3, 8.3)	11.2 (9.9, 12.5)	13.9 (12.5, 15.4)	16.6 (14.9, 18.4)	19.7 (17.2, 22.4)	
Acetabular Component	1017	6704	7.7 (7.1, 8.4)	11.2 (10.4, 12.0)	13.1 (12.3, 14.0)	17.2 (16.2, 18.3)	21.3 (19.7, 23.0)	24.6 (21.9, 27.5)
Femoral Component	1018	8001	7.2 (6.6, 7.8)	10.8 (10.1, 11.5)	12.8 (12.0, 13.6)	17.1 (16.0, 18.2)	21.5 (19.7, 23.4)	
TOTAL	**3244**	**21539**						

Note: Only the outcome of the five most common types of revision have been listed
Procedures using large head metal/metal have been included

Figure R6 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)



HR - adjusted for age and gender

Head/Insert vs THR (Femoral/Acetabular)
Entire Period: HR=1.44 (1.26, 1.64), p<0.001

Head Only vs THR (Femoral/Acetabular)
Entire Period: HR=1.69 (1.42, 2.00), p<0.001

Acetabular Component vs THR (Femoral/Acetabular)
Entire Period: HR=1.00 (0.89, 1.13), p=0.954

Femoral Component vs THR (Femoral/Acetabular)
Entire Period: HR=1.02 (0.90, 1.15), p=0.764

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Head/Insert	3456	2823	2186	1617	596	161	27
Head Only	842	674	538	428	197	73	10
THR (Femoral/Acetabular)	2536	2135	1671	1280	533	86	4
Acetabular Component	6704	5828	4897	3977	1971	327	40
Femoral Component	8001	6370	4784	3481	1238	335	37

Note: Only the outcome of the five most common types of revision have been listed
Procedures using large head metal/metal have been included

OUTCOME OF 1ST REVISION OF KNOWN PRIMARY TOTAL RESURFACING HIP REPLACEMENT

There are 1,877 1st revisions of primary total resurfacing hip replacement undertaken for osteoarthritis, excluding procedures with a 1st revision for infection.

As most resurfacing prostheses are a combination of a solid metal acetabular component and a one-piece femoral component, the only possible revision is a major revision.

The most common type of major revision is femoral/acetabular (73.7%), followed by femoral only (24.1%) and acetabular only revisions (2.2%).

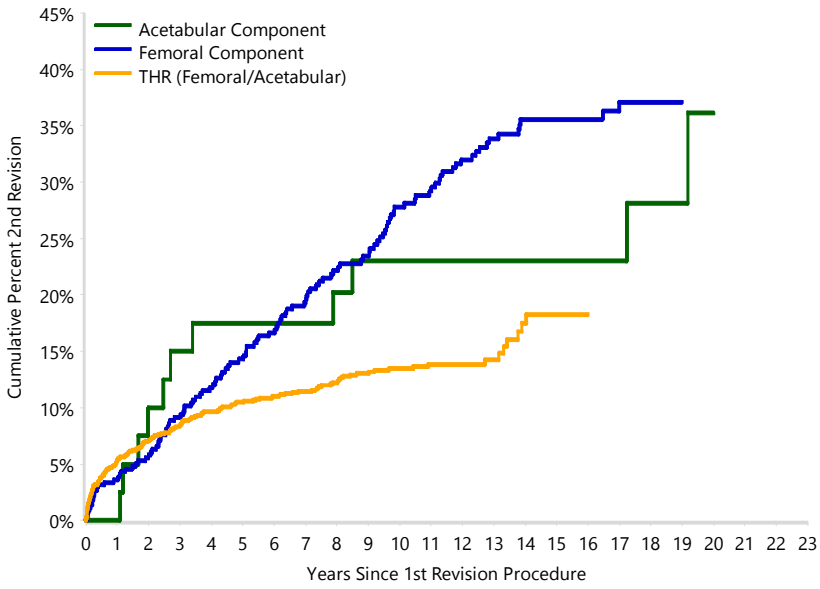
From 2 years to 13 years, revising both the femoral and acetabular component has a lower rate of 2nd revision compared to revising only the femoral component, with no difference outside this time period. There is no difference when compared to revising the acetabular only (Table R5 and Figure R7).

Table R5 Cumulative Percent 2nd Revision of Known Primary Total Resurfacing Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Type of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Acetabular Component	11	42	0.0 (0.0, 0.0)	15.0 (7.0, 30.4)	17.5 (8.8, 33.2)	23.0 (12.7, 39.6)	23.0 (12.7, 39.6)	36.1 (19.8, 59.8)
Femoral Component	123	452	3.6 (2.2, 5.8)	9.1 (6.7, 12.3)	14.3 (11.2, 18.2)	27.8 (23.4, 32.9)	35.6 (30.6, 41.1)	
THR (Femoral/Acetabular)	173	1383	5.3 (4.3, 6.7)	8.4 (7.0, 10.0)	10.5 (8.9, 12.3)	13.5 (11.6, 15.6)	18.3 (14.8, 22.4)	
TOTAL	307	1877						

Note: Excluding revisions where no major femoral/acetabular components have been inserted

Figure R7 Cumulative Percent 2nd Revision of Known Primary Total Resurfacing Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)



HR - adjusted for age and gender

Acetabular Component vs Femoral Component

Entire Period: HR=0.74 (0.40, 1.38), p=0.347

Acetabular Component vs THR (Femoral/Acetabular)

Entire Period: HR=1.49 (0.79, 2.80), p=0.215

Femoral Component vs THR (Femoral/Acetabular)

0 - 3Mth: HR=0.70 (0.34, 1.43), p=0.325

3Mth - 2Yr: HR=0.91 (0.52, 1.59), p=0.751

2Yr - 5.5Yr: HR=2.84 (1.85, 4.36), p<0.001

5.5Yr - 6.5Yr: HR=5.54 (1.81, 16.97), p=0.002

6.5Yr - 10Yr: HR=4.35 (2.46, 7.69), p<0.001

10Yr - 13Yr: HR=12.11 (3.52, 41.59), p<0.001

13Yr+: HR=0.69 (0.23, 2.06), p=0.509

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Acetabular Component	42	40	34	33	27	20	6
Femoral Component	452	410	347	299	213	123	26
THR (Femoral/Acetabular)	1383	1275	1126	954	537	67	3

Revision Knee Replacement

DEMOGRAPHICS OF ALL REVISIONS

There have been 88,657 revisions of knee replacements with a procedure date up to and including 31 December 2023. This is an additional 5,441 procedures compared to the previous report.

Type of Revision

The majority of revision procedures are major revisions (63.6%). The most common major revisions are total knee replacement (TKR) (tibial and femoral) (47.2%) and tibial only (5.6%) (Table R6).

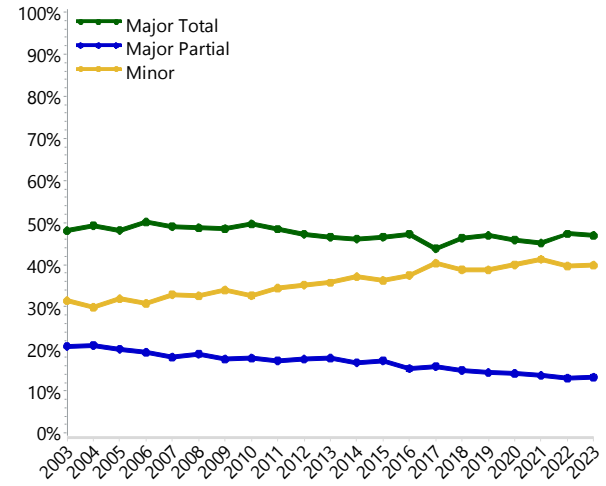
Minor revisions account for 36.4% of all revision knee procedures. The most common types of minor revision are insert only (17.7%), patella only (10.2%) and insert/patella (7.1%) (Table R6).

Since 2003, the proportion of major total revisions has remained unchanged. However, there has been a decrease in major partial revisions (20.6% in 2003 to 13.2% in 2023) and an increase in minor revisions (31.4% in 2003 to 39.8% in 2023) (Figure R8).

Reason for Revision

The most common reasons for revision are loosening (27.8%) and infection (25.9%) (Table R7).

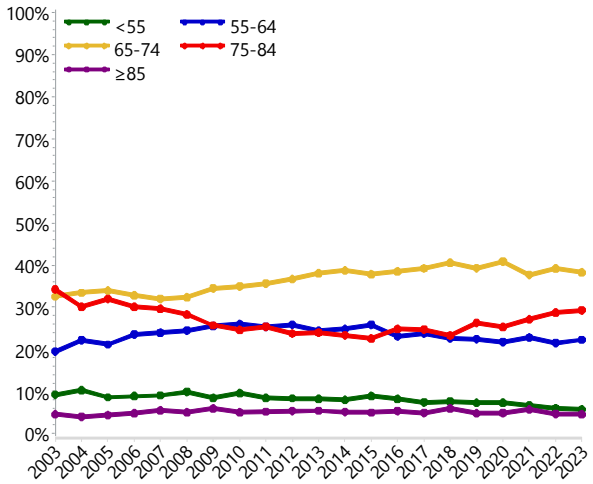
Figure R8 Revision Knee Replacement by Class



Age and Gender

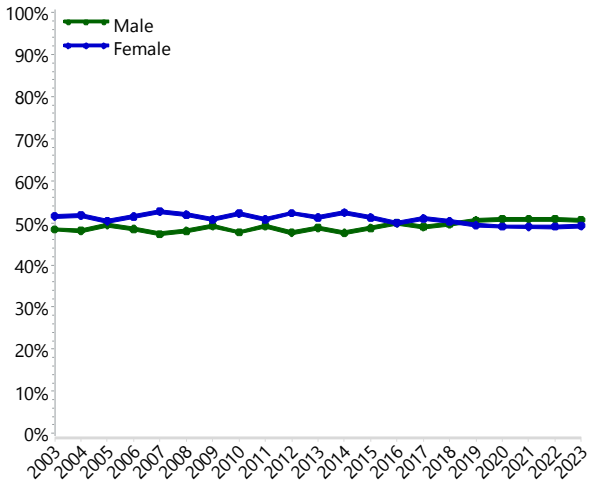
There has been an increase in the proportion of revisions undertaken in the 65-74 year age group from 32.5% in 2003 to 38.2% in 2023 and a decrease in the 75-84 year age group from 34.2% in 2003 to 29.2% in 2023 (Figure R9).

Figure R9 Revision Knee Replacement by Age



Revision knee replacement is slightly more common in males (50.7%). There has been little change in the gender proportions over the last 10 years (Figure R10).

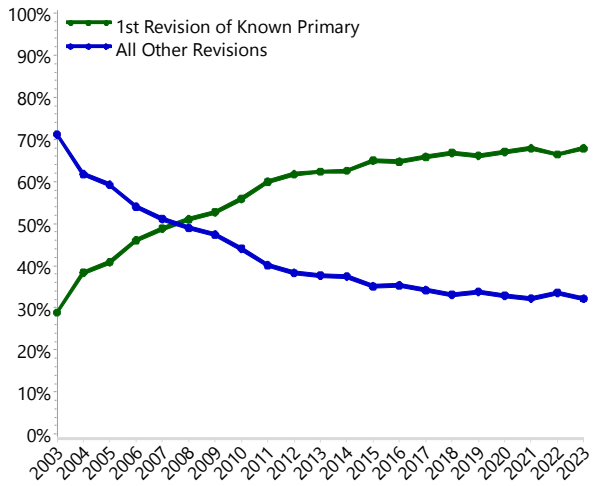
Figure R10 Revision Knee Replacement by Gender



DEMOGRAPHICS OF 1ST REVISIONS OF KNOWN PRIMARY PROCEDURES

There have been 51,093 1st revision procedures where the primary procedure has been recorded by the Registry. This includes revisions of primary partial and total knee replacement. This is an additional 3,699 procedures compared to the previous report (Figure R11).

Figure R11 Revision Knee Replacement by Revision



Type of Revision

Types of revision differ between the 1st revisions of known primary procedures group and the all revisions group.

The 1st revisions of known primary procedures group has a smaller proportion of major revisions (56.8%) compared to the all revisions group (63.6%), with less TKR (tibial/femoral) revisions (41.7% compared to 47.2%) (Table R6). There is a higher proportion of minor revisions (43.2% compared to 36.4%) (Table R6).

Reason for Revision

There are differences in the reasons for revision between the 1st revisions of known primary procedures group and the all revisions group. Loosening is the most common reason for revision, but the proportion is less in the 1st revisions of known primary procedures group (25.8% compared to 27.8%). Of the three most common reasons for revision, only progression of disease has a higher proportion in the 1st revisions of known primary procedures group (9.2% compared to 6.6%) (Table R7).

Table R6 Revision Knee Replacement by Type of Revision

Type of Revision	1st Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
TKR (Tibial/Femoral)	21285	41.7	41826	47.2
Tibial Component	2952	5.8	5008	5.6
Cement Spacer	1991	3.9	4584	5.2
Femoral Component	1989	3.9	3748	4.2
Uni Tibial Component	240	0.5	285	0.3
Removal of Prostheses	224	0.4	454	0.5
UKR (Uni Tibial/Uni Femoral)	149	0.3	206	0.2
Uni Femoral Component	87	0.2	113	0.1
Patella/Trochlear Resurfacing	61	0.1	102	0.1
Reinsertion of Components	25	0.0	41	0.0
N Major	**29003**	**56.8**	**56367**	**63.6**
Insert Only	10054	19.7	15648	17.7
Patella Only	7117	13.9	9059	10.2
Insert/Patella	4139	8.1	6293	7.1
Uni Insert Only	654	1.3	822	0.9
Minor Components	98	0.2	397	0.4
Cement Only	19	0.0	51	0.1
Partial Resurfacing	4	0.0	7	0.0
Unispacer	4	0.0	4	0.0
Uni Insert/Patella	1	0.0	1	0.0
Removal of Patella			8	0.0
N Minor	**22090**	**43.2**	**32290**	**36.4**
TOTAL	**51093**	**100.0**	**88657**	**100.0**

Table R7 Revision Knee Replacement by Reason for Revision

Reason for Revision	1st Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Loosening	13203	25.8	24661	27.8
Infection	10240	20.0	23000	25.9
Progression Of Disease	4688	9.2	5850	6.6
Pain	3795	7.4	5244	5.9
Instability	3714	7.3	5359	6.0
Patellofemoral Pain	2962	5.8	3780	4.3
Patella Erosion	2590	5.1	2916	3.3
Fracture	1717	3.4	2517	2.8
Arthrofibrosis	1418	2.8	1899	2.1
Lysis	1145	2.2	2699	3.0
Wear Tibial Insert	1048	2.1	2814	3.2
Malalignment	920	1.8	1312	1.5
Metal Related Pathology	466	0.9	711	0.8
Implant Breakage Tibial Insert	435	0.9	847	1.0
Bearing Dislocation	431	0.8	658	0.7
Incorrect Sizing	401	0.8	516	0.6
Patella Maltracking	292	0.6	433	0.5
Implant Breakage Patella	237	0.5	469	0.5
Implant Breakage Tibial	179	0.4	497	0.6
Prosthesis Dislocation	167	0.3	311	0.4
Synovitis	148	0.3	207	0.2
Osteonecrosis	113	0.2	137	0.2
Wear Patella	107	0.2	293	0.3
Implant Breakage Femoral	84	0.2	264	0.3
Wear Tibial	67	0.1	491	0.6
Tumour	42	0.1	81	0.1
Heterotopic Bone	21	0.0	48	0.1
Wear Femoral	10	0.0	22	0.0
Incorrect Side	3	0.0	3	0.0
Patella Dislocation	2	0.0	6	0.0
Other	448	0.9	612	0.7
TOTAL	**51093**	**100.0**	**88657**	**100.0**

OUTCOME OF 1ST REVISION OF KNOWN PRIMARY UNICOMPARTMENTAL KNEE REPLACEMENT

This analysis reports the outcome of the 1st revision of a known primary unicompartmental knee replacement (UKR).

There are 9,863 1st revisions of primary UKR that were undertaken for osteoarthritis, excluding all procedures with a 1st revision for infection.

For primary UKR, the lowest rate of 2nd revision occurs when it is revised to a TKR. Revision to another UKR has a 15 year cumulative percent revision of 53.3% compared to 16.1% when revised to a TKR (Table R8 and Figure R12).

Most UKR to UKR revisions are minor revisions where the insert is exchanged or major partial revisions where either the tibial or the femoral prosthesis only is revised. Revision to a TKR has a lower rate of 2nd revision compared to minor, major partial UKR, and major total UKR revision after 2 years (Table R9 and Figure R13).

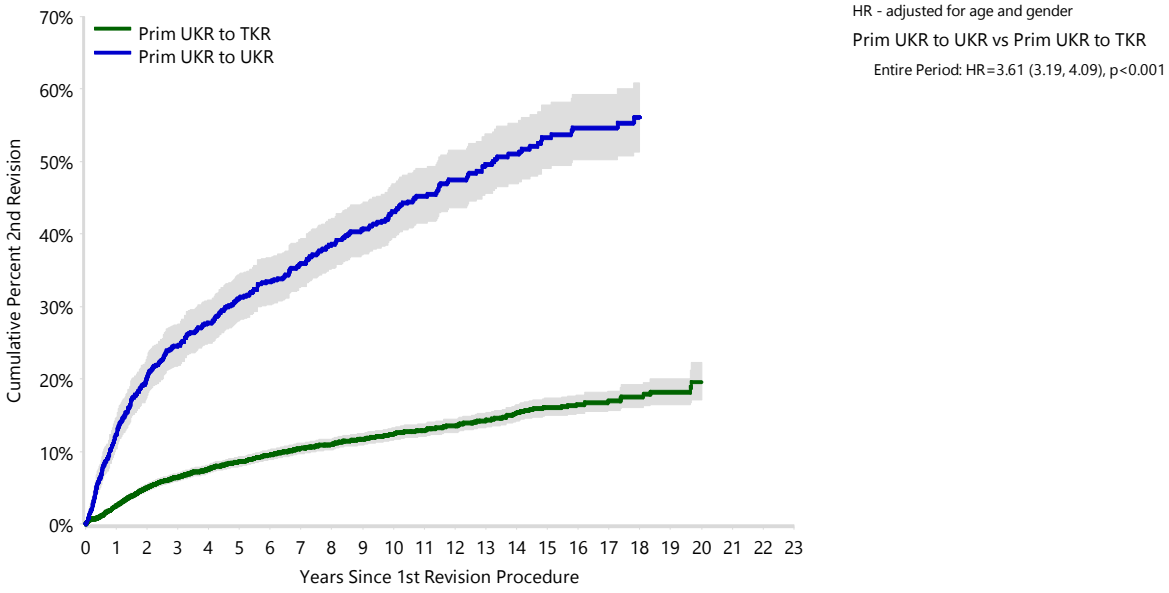
There is a difference in the outcome of revising a primary UKR to a TKR compared to revising a TKR to a TKR. The rate of 2nd revision of a UKR to TKR is lower than a TKR to TKR revision (Table R10 and Figure R14).

Table R8 Cumulative Percent 2nd Revision of Known Primary Unicompartmental Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Type of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Prim UKR to TKR	911	8942	2.5 (2.2, 2.9)	6.4 (5.9, 7.0)	8.6 (8.0, 9.2)	12.4 (11.6, 13.3)	16.1 (14.9, 17.4)	19.6 (17.1, 22.3)
Prim UKR to UKR	376	921	12.3 (10.3, 14.6)	24.5 (21.8, 27.5)	31.2 (28.2, 34.5)	43.1 (39.5, 46.9)	53.3 (49.0, 57.8)	
TOTAL	**1287**	**9863**						

Note: Excluding patella/trochlea resurfacing and revisions where no femoral and tibial components have been inserted

Figure R12 Cumulative Percent 2nd Revision of Known Primary Unicompartmental Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)



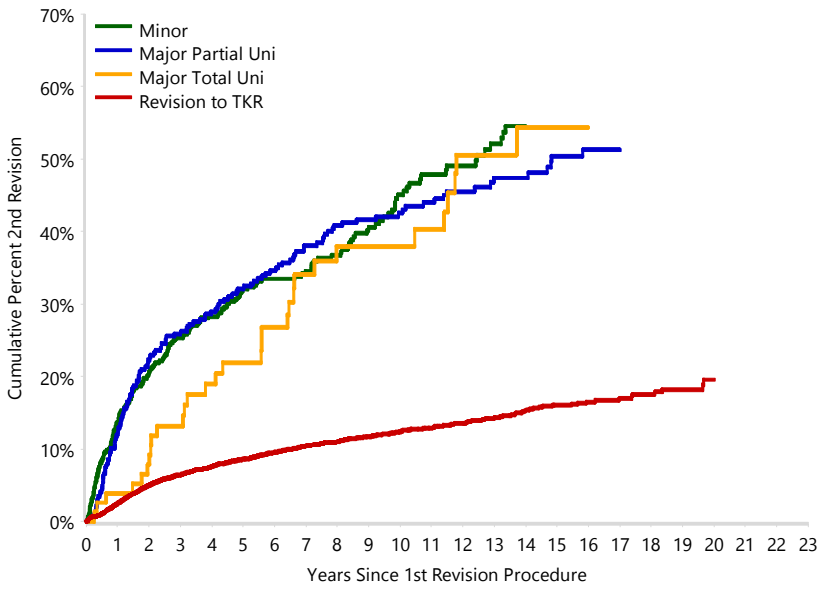
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Prim UKR to TKR	8942	8116	6615	5292	2552	857	89
Prim UKR to UKR	921	772	596	486	256	111	19

Table R9 Cumulative Percent 2nd Revision of Known Primary Unicompartmental Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Class of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	202	526	13.6 (11.0, 16.9)	25.4 (21.7, 29.5)	32.0 (28.0, 36.6)	45.0 (39.8, 50.6)		
Major Partial Uni	143	317	12.0 (8.9, 16.2)	25.9 (21.4, 31.1)	32.1 (27.2, 37.6)	42.6 (37.1, 48.5)	50.4 (44.2, 56.9)	
Major Total Uni	31	78	3.9 (1.3, 11.7)	13.2 (7.3, 23.1)	22.0 (14.0, 33.4)	38.0 (27.2, 51.2)	54.4 (40.6, 69.3)	
Revision to TKR	911	8942	2.5 (2.2, 2.9)	6.4 (5.9, 7.0)	8.6 (8.0, 9.2)	12.4 (11.6, 13.3)	16.1 (14.9, 17.4)	19.6 (17.1, 22.3)
TOTAL	**1287**	**9863**						

Note: Excluding patella/trochlea resurfacing and revisions where no femoral and tibial components have been inserted

Figure R13 Cumulative Percent 2nd Revision of Known Primary Unicompartmental Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)



HR - adjusted for age and gender

Minor vs Revision to TKR

Entire Period: HR=3.93 (3.36, 4.58), p<0.001

Major Partial Uni vs Revision to TKR

Entire Period: HR=3.33 (2.78, 3.99), p<0.001

Major Total Uni vs Revision to TKR

0 - 2Yr: HR=1.31 (0.58, 2.92), p=0.516

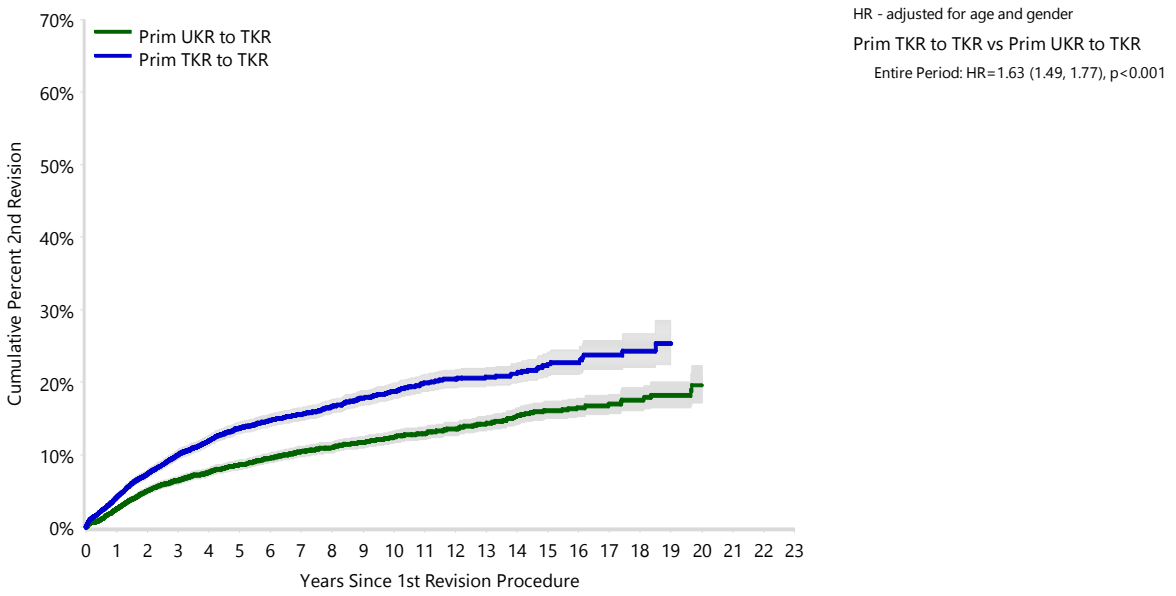
2Yr+: HR=4.60 (3.08, 6.88), p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	526	424	312	245	107	38	4
Major Partial Uni	317	275	224	190	122	63	13
Major Total Uni	78	73	60	51	27	10	2
Revision to TKR	8942	8116	6615	5292	2552	857	89

Table R10 Cumulative Percent 2nd Revision of Known Primary Knee Replacement by Type of Primary (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Type of Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Prim UKR to TKR	911	8942	2.5 (2.2, 2.9)	6.4 (5.9, 7.0)	8.6 (8.0, 9.2)	12.4 (11.6, 13.3)	16.1 (14.9, 17.4)	19.6 (17.1, 22.3)
Prim TKR to TKR	1249	9242	4.1 (3.7, 4.6)	10.0 (9.4, 10.7)	13.6 (12.9, 14.5)	18.8 (17.7, 19.9)	22.5 (20.9, 24.2)	
TOTAL	**2160**	**18184**						

Figure R14 Cumulative Percent 2nd Revision of Known Primary Knee Replacement by Type of Primary (Primary Diagnosis OA, Excluding 1st Revision for Infection)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Prim UKR to TKR	8942	8116	6615	5292	2552	857	89
Prim TKR to TKR	9242	7967	6071	4402	1655	352	24

OUTCOME OF 1ST REVISION OF KNOWN PRIMARY TOTAL KNEE REPLACEMENT

This analysis examines the outcome of the 1st revision of known primary TKR.

There are 28,361 1st revisions of known primary TKR undertaken for osteoarthritis, excluding all procedures where the 1st revision was for infection.

Major partial revisions have a higher rate of 2nd revision compared to minor revisions and major total revisions (up to 4 years) (Table R11 and Figure R15).

Comparing the three types of major revision, TKR (femoral/tibial) revision has a lower rate of 2nd revision than revision of the femoral component (from 1 month) and the tibial component (up to 1.5 years) (Table R12 and Figure R16).

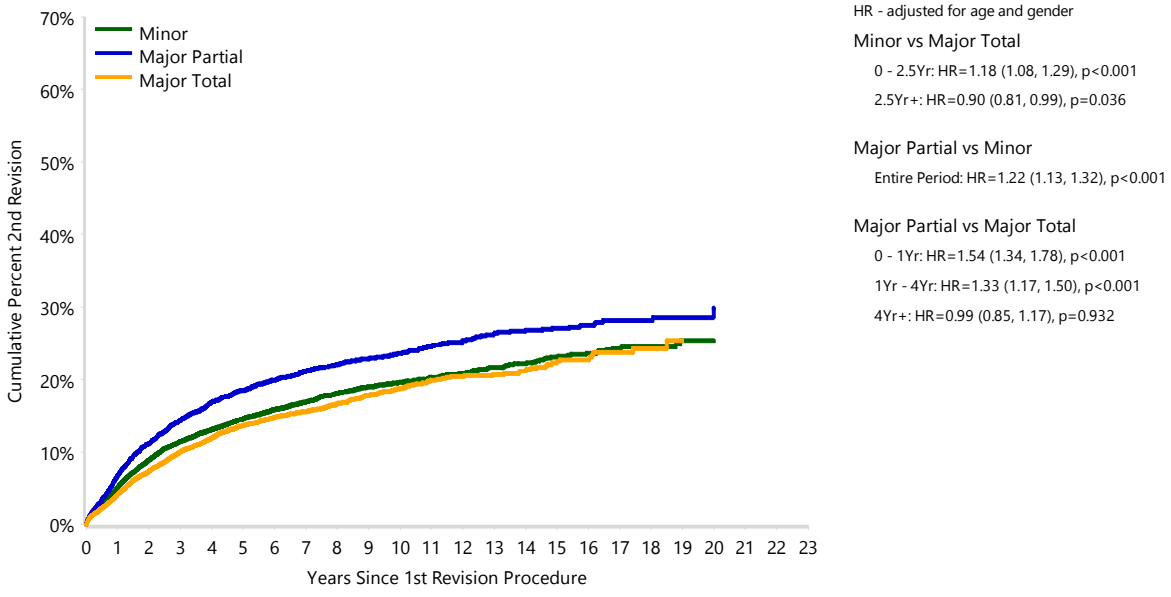
Revising the patella alone has the same rate of 2nd revision as revising the patella in combination with an insert exchange. At 15 years, the cumulative percent revision of the 1st revision of the patella only is 20.6% and 21.4% for a patella with an insert exchange. Revising the insert alone has the highest rate of 2nd revision of the three types of minor revision (Table R12 and Figure R17).

Table R11 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Revision of Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	2337	14928	5.0 (4.7, 5.4)	11.4 (10.9, 12.0)	14.6 (14.0, 15.2)	19.6 (18.8, 20.4)	23.1 (22.1, 24.2)	25.3 (23.6, 27.1)
Major Partial	870	4191	6.7 (6.0, 7.6)	14.4 (13.3, 15.5)	18.5 (17.3, 19.8)	23.6 (22.1, 25.1)	27.1 (25.3, 28.9)	29.8 (26.8, 33.1)
Major Total	1249	9242	4.1 (3.7, 4.6)	10.0 (9.4, 10.7)	13.6 (12.9, 14.5)	18.8 (17.7, 19.9)	22.5 (20.9, 24.2)	
TOTAL	**4456**	**28361**						

Note: Excluding revisions where no femoral or tibial components have been inserted

Figure R15 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)



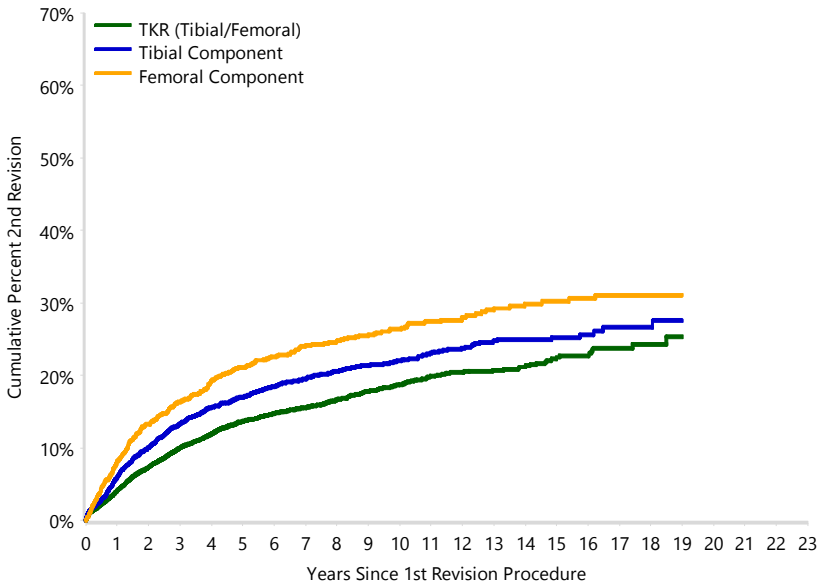
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	14928	13172	10313	7982	3402	936	85
Major Partial	4191	3671	2995	2491	1281	435	57
Major Total	9242	7967	6071	4402	1655	352	24

Table R12 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)

Type of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Insert/Patella	521	3895	3.7 (3.2, 4.4)	9.5 (8.6, 10.6)	12.5 (11.4, 13.7)	17.4 (15.9, 19.0)	21.4 (19.1, 24.0)	
Insert Only	838	4177	8.4 (7.6, 9.3)	15.6 (14.5, 16.8)	19.0 (17.7, 20.3)	25.3 (23.6, 27.0)	29.3 (27.2, 31.5)	
Patella Only	965	6811	3.6 (3.2, 4.1)	9.8 (9.1, 10.6)	13.0 (12.1, 13.8)	17.4 (16.4, 18.6)	20.6 (19.1, 22.1)	
TKR (Tibial/Femoral)	1249	9242	4.1 (3.7, 4.6)	10.0 (9.4, 10.7)	13.6 (12.9, 14.5)	18.8 (17.7, 19.9)	22.5 (20.9, 24.2)	
Tibial Component	525	2709	5.9 (5.1, 6.9)	13.3 (12.1, 14.7)	17.0 (15.6, 18.6)	22.0 (20.3, 23.9)	25.2 (23.2, 27.5)	
Femoral Component	343	1476	8.2 (6.9, 9.7)	16.3 (14.5, 18.4)	21.1 (19.0, 23.5)	26.4 (23.9, 29.0)	30.2 (27.3, 33.4)	
TOTAL	**4441**	**28310**						

Note: Only the outcomes of the six most common types of 1st revision have been listed

Figure R16 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, Major 1st Revisions, Excluding 1st Revision for Infection)



HR - adjusted for age and gender

Tibial Component vs TKR (Tibial/Femoral)

0 - 1.5Yr: HR=1.33 (1.14, 1.55), p<0.001

1.5Yr+: HR=1.11 (0.97, 1.27), p=0.118

Femoral Component vs TKR (Tibial/Femoral)

0 - 1Mth: HR=0.70 (0.34, 1.44), p=0.334

1Mth - 6Mth: HR=2.57 (1.90, 3.48), p<0.001

6Mth - 1Yr: HR=1.78 (1.31, 2.42), p<0.001

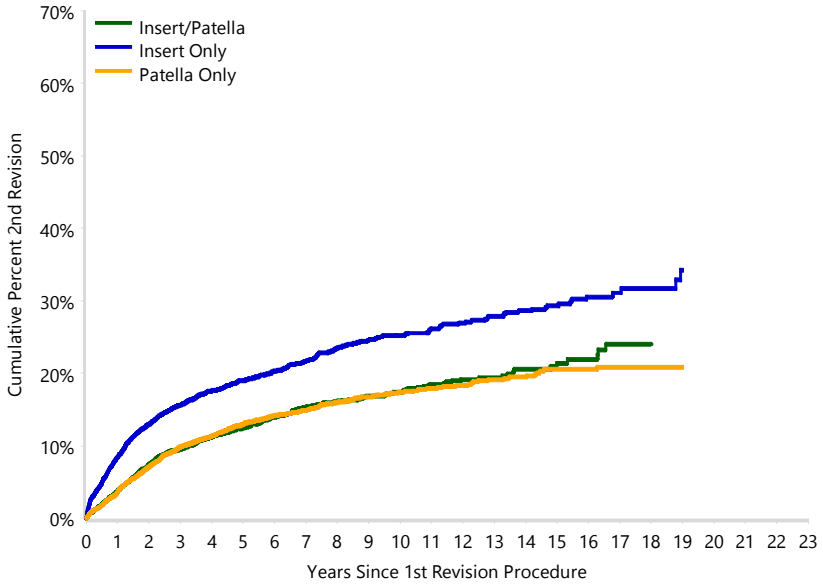
1Yr+: HR=1.30 (1.12, 1.50), p<0.001

Femoral Component vs Tibial Component

Entire Period: HR=1.21 (1.06, 1.39), p=0.005

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
TKR (Tibial/Femoral)	9242	7967	6071	4402	1655	352	24
Tibial Component	2709	2409	1976	1648	834	247	30
Femoral Component	1476	1257	1015	841	447	188	27

Figure R17 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, Minor 1st Revisions, Excluding 1st Revision for Infection)



HR - adjusted for age and gender

Insert Only vs Insert/Patella

0 - 2Wk: HR=6.90 (3.56, 13.37), p<0.001

2Wk - 3Mth: HR=2.37 (1.79, 3.15), p<0.001

3Mth - 1.5Yr: HR=1.80 (1.54, 2.11), p<0.001

1.5Yr - 2.5Yr: HR=1.03 (0.83, 1.29), p=0.773

2.5Yr+: HR=1.26 (1.07, 1.47), p=0.004

Insert Only vs Patella Only

0 - 2Wk: HR=6.81 (3.52, 13.16), p<0.001

2Wk - 6Mth: HR=2.26 (1.83, 2.80), p<0.001

6Mth - 1.5Yr: HR=1.69 (1.43, 2.00), p<0.001

1.5Yr - 3Yr: HR=1.02 (0.84, 1.24), p=0.813

3Yr+: HR=1.27 (1.09, 1.49), p=0.002

Patella Only vs Insert/Patella

Entire Period: HR=1.01 (0.91, 1.13), p=0.808

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Insert/Patella	3895	3447	2677	2040	754	169	19
Insert Only	4177	3511	2634	1949	829	259	27
Patella Only	6811	6182	4974	3971	1811	505	38

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Australian Orthopaedic Association National Joint Replacement Registry

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The AOANJRR is funded by the Australian Government Department of Health and Aged Care