

Australian Orthopaedic Association National Joint Replacement Registry

2023 SUPPLEMENTARY REPORT

Revision of Hip and Knee Arthroplasty



AOA
AUSTRALIAN
ORTHOPAEDIC
ASSOCIATION

Australian
Orthopaedic
Association
National
Joint
Replacement
Registry

Australian Orthopaedic Association National Joint Replacement Registry

Revision of Hip and Knee Arthroplasty

2023 Supplementary Report

Clinical Director: Professor Paul Smith
E: admin@aoanjrr.org.au

Executive Manager: Ms Kathy Hill
E: khill@aoanjrr.org.au

AOANJRR
SAHMRI Building
North Terrace
ADELAIDE SA 5000
T: +61 8 8128 4280

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

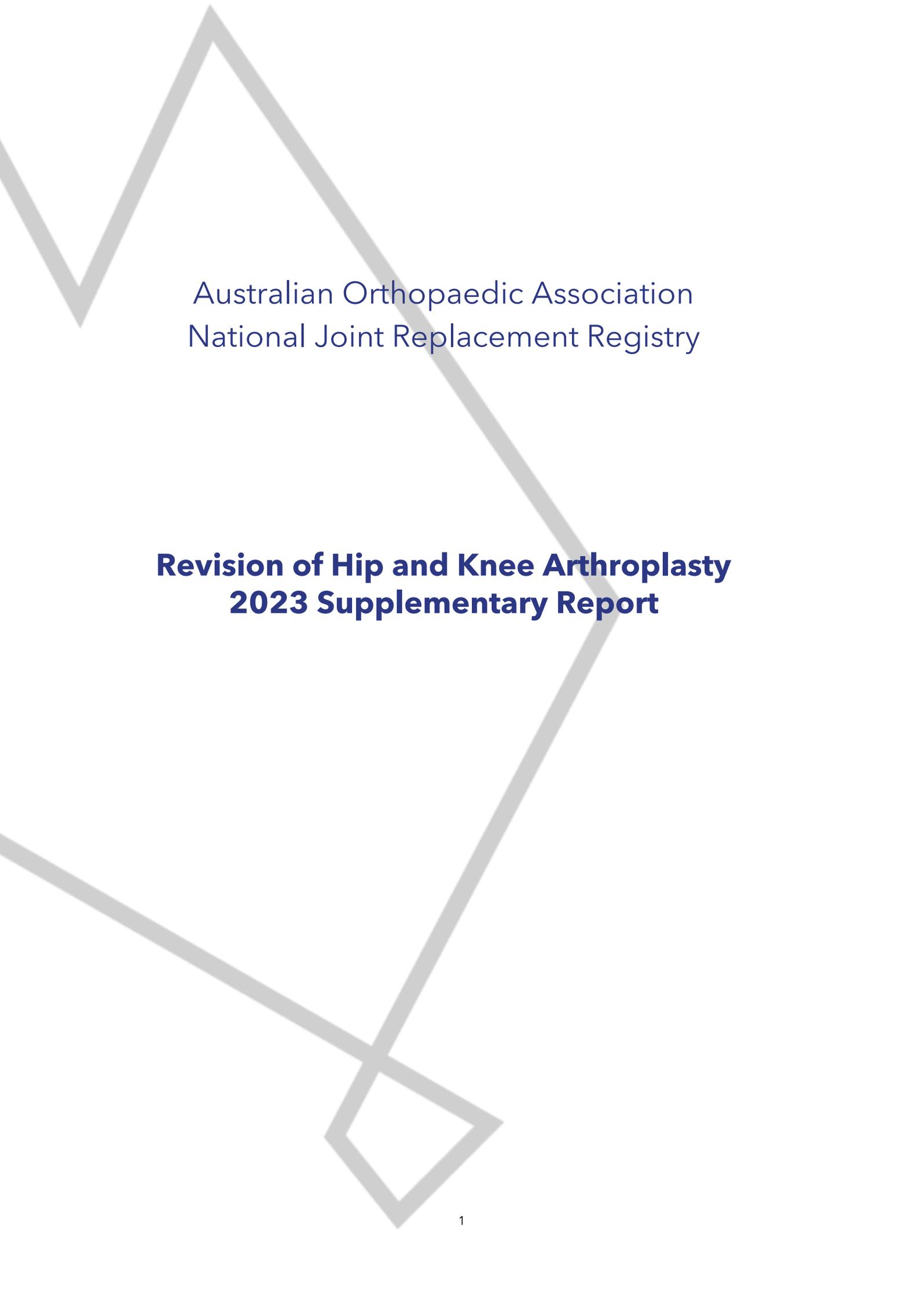
Cite this report

Smith PN, Gill DR, McAuliffe MJ, McDougall C, Stoney JD, Vertullo CJ, Wall CJ, Corfield S, Cashman K, Cuthbert AR, Du P, Harries D, Holder C, Lorimer MF, Lewis PL. Revision of Hip and Knee Arthroplasty Supplementary Report in Hip, Knee & Shoulder Arthroplasty: 2023 Annual Report, Australian Orthopaedic Association National Joint Replacement Registry, AOA, Adelaide; 2023.
<https://doi.org/10.25310/JDJG4638>

The use and/or reproduction of AOANJRR data provided in this report requires adherence to the AOANJRR Publications and Authorship Policy available at: <https://aoanjrr.sahmri.com/aoanjrr-data-publication-and-authorship>

www.aoa.org.au

© Australian Orthopaedic Association National Joint Replacement Registry 2023



Australian Orthopaedic Association
National Joint Replacement Registry

**Revision of Hip and Knee Arthroplasty
2023 Supplementary Report**

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.

AOANJRR Clinical Director

Professor Paul Smith

AOANJRR Deputy Clinical Directors

Associate Professor Peter Lewis

Professor Chris Vertullo

Adjunct Professor Michael McAuliffe

AOANJRR Assistant Deputy Clinical Directors

Associate Professor Catherine McDougall

Dr James D Stoney

Associate Professor Chris Wall

Dr David Gill

AOA Registry Committee Membership

Neil Bergman

Chris Morrey

Paul Smith

Richard Page

Peter Stavrou

Michael Schuetz

Bill Walter

Joshua Petterwood

David Wysocki

Peter McEwen

Rob Kuru

Committee Chair

AOA President

Registry Clinical Director

Shoulder & Elbow Society

Foot & Ankle Society Representative

AOA Research Committee Chair

Arthroplasty Society President

TAS representative

WA representative

Knee Society Representative

Spine Society Representative

Clinical Advisors

Professor Richard Page

Dr Peter Stavrou

PROMs Advisor

Professor Ilana Ackerman

Data Linkage

Dr Katherine Duszynski (UniSA)

AUSTRALIAN ORTHOPAEDIC ASSOCIATION NATIONAL JOINT REPLACEMENT REGISTRY

Registry Executive Manager

Kathy Hill

Registry Nested Clinical Studies (RNCS) Manager

Durga Bastiras

PROMS & Core Manager

Bec Harvey

Ad Hoc Requests & Publications Manager

Sophie Corfield

Registry Executive Assistant

Jade Caboche

RNCS Team

Tania Alland

Libby Poole

Khashayar Ghadirinejad

Dianne Buranyi-Trevarton

William Du Moulin

Laura Busk

PROMs Team

Nea Ryan

David Metherell

Pablo Flores Figuera

Publications Team

Sarah Jameel

Administration Officer

Elise Tapper

SOUTH AUSTRALIAN HEALTH AND MEDICAL RESEARCH INSTITUTE (SAHMRI)

Senior Manager, Registry Science

Emma Heath

Biostatisticians

Michelle Lorimer

Alana Cuthbert

Carl Holder

Dylan Harries

Kara Cashman

Peiyao Du

Data Assistants

Georgina Daynes

Kirsty Modystach

Anh Pham

Jacinta Greer

Anna Fergusson

Vivien Do

Michael Crame

Andrew Ioakim

Anita Wright

Jeremy Durward

ICT

Andrew Brock

Nazia Dilnaz

Daina Ross

Vincent Talladira

Christian Boyd

Jen Coleman

Data Managers

Janey Barrow

Robert Armitage

Primali De Silva

Courtney Cullen

Contents

SUMMARY	4
REVISION HIP AND KNEE REPLACEMENT	5
Classes of Revision Procedures.....	5
Approach to Analysis	5
Revision Hip	6
Demographics of All Revisions.....	6
Demographics of 1 st Revisions of Known Primary Procedures.....	7
Outcome of 1 st Revision of Known Primary Total Conventional Hip Replacement	10
Outcome of 1 st Revision of Known Primary Total Resurfacing Hip Replacement.....	12
Revision Knee	13
Demographics of All Revisions.....	13
Demographics of 1 st Revisions of Known Primary Procedures.....	14
Outcome of 1 st Revision of Known Primary Unicompartmental Knee Replacement (UKR)	17
Outcome of 1 st Revision of known Primary Total Knee Replacement.....	20
LIST OF TABLES	23
LIST OF FIGURES	23

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 (33.7%), followed by infection, prosthesis dislocation and fracture. For knee replacement, the most common reason for revision is loosening (28.2%), 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 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

DEMOGRAPHICS OF ALL REVISIONS

This report analyses 87,193 revisions of hip replacements with a procedure date up to and including 31 December 2022. This is an additional 3,987 procedures compared to the previous report.

Type of Revision

The majority of revisions recorded by the Registry are major revisions (80.9%) (Table R1). The most common types of major revision are acetabular component only (28.7%), total hip replacement (femoral/acetabular) (26.8%), and femoral component only (19.8%) (Table R1).

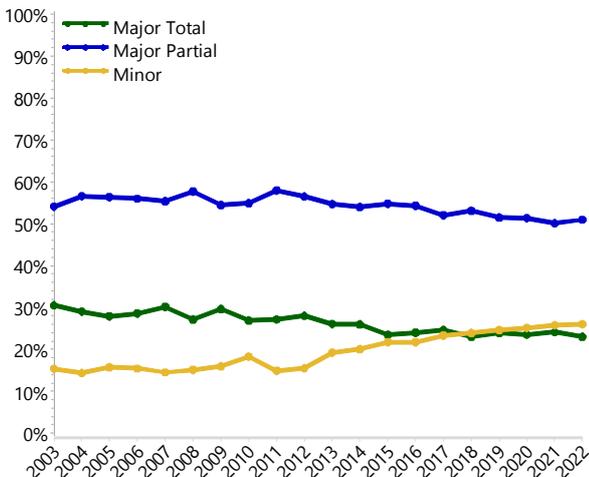
Minor revisions account for 19.1% of all hip replacement revision procedures. The most common type of minor revision is head and insert exchange, accounting for 13.7% of all revisions (Table R1).

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 23.0% in 2022) and an increase in minor revisions (15.4% in 2003 to 26.0% in 2022) (Figure R1).

Reason for Revision

The most common reasons for revision are loosening (33.7%), infection (18.7%), prosthesis dislocation (14.6%), and fracture (12.9%) (Table R2).

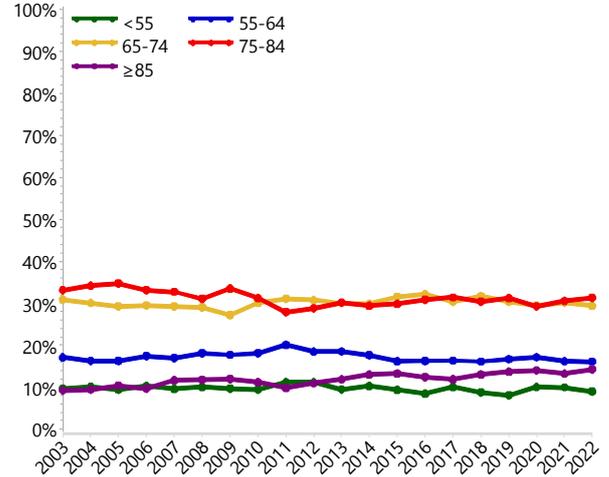
Figure R1 Revision Hip Replacement by Class



Age and Gender

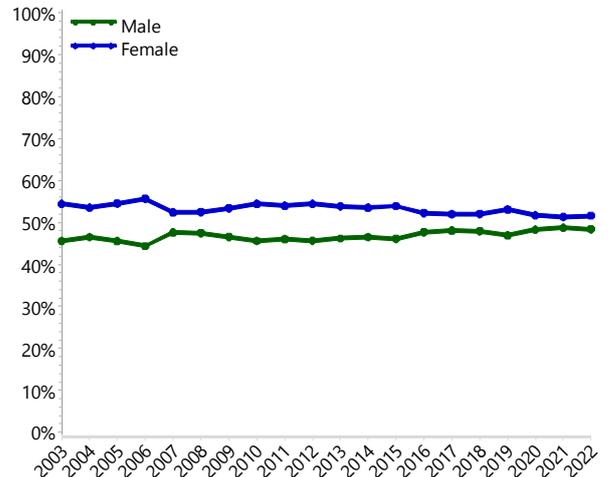
Age distribution of revision procedures has remained stable since 2003 (Figure R2).

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).

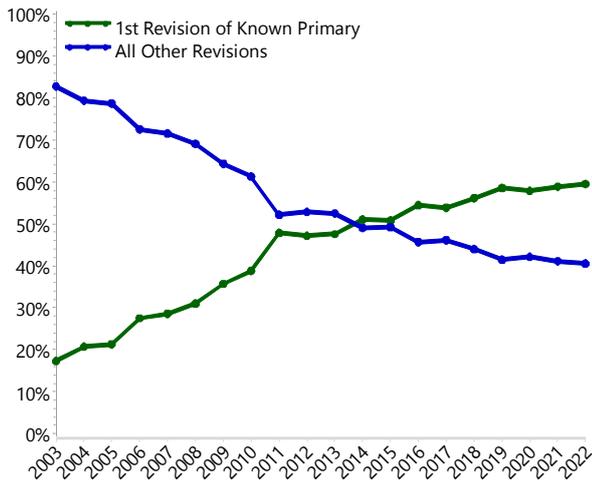
Figure R3 Revision Hip Replacement by Gender



DEMOGRAPHICS OF 1ST REVISIONS OF KNOWN PRIMARY PROCEDURES

There have been 36,397 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 2,415 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 (76.0%) compared to the all revisions group (80.9%). There are less acetabular only and total hip replacement (acetabular /femoral) revisions, but more femoral only revisions (Table R1).

There are a higher proportion of minor revisions in the 1st revisions of known primary procedures group (24.0%) compared to the all revisions group (19.1%) (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 (21.8% compared to 33.7%). 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	9866	27.1	17288	19.8
Acetabular Component	8990	24.7	25066	28.7
THR (Femoral/Acetabular)	6804	18.7	23391	26.8
Cement Spacer	1277	3.5	3266	3.7
Bipolar Head and Femoral	379	1.0	661	0.8
Removal of Prostheses	310	0.9	826	0.9
Reinsertion of Components	45	0.1	67	0.1
Saddle	2	0.0	5	0.0
Thrust Plate	1	0.0	2	0.0
N Major	27674	76.0	70572	80.9
Head/Insert	5905	16.2	11938	13.7
Head Only	1571	4.3	2325	2.7
Minor Components	567	1.6	1078	1.2
Insert Only	248	0.7	714	0.8
Bipolar Only	238	0.7	309	0.4
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	8723	24.0	16621	19.1
TOTAL	36397	100.0	87193	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	7948	21.8	29397	33.7
Fracture	6999	19.2	11269	12.9
Infection	6499	17.9	16265	18.7
Prosthesis Dislocation	6235	17.1	12756	14.6
Metal Related Pathology	2844	7.8	3338	3.8
Lysis	1097	3.0	4812	5.5
Pain	1085	3.0	1664	1.9
Chondrolysis/Acetab. Erosion	453	1.2	576	0.7
Malposition	408	1.1	536	0.6
Leg Length Discrepancy	407	1.1	496	0.6
Instability	395	1.1	690	0.8
Implant Breakage Stem	384	1.1	915	1.0
Wear Acetabular Insert	228	0.6	1329	1.5
Implant Breakage Acetabular Insert	212	0.6	479	0.5
Implant Breakage Acetabular	186	0.5	697	0.8
Incorrect Sizing	172	0.5	206	0.2
Wear Head	92	0.3	109	0.1
Tumour	88	0.2	164	0.2
Implant Breakage Head	69	0.2	122	0.1
Osteonecrosis	55	0.2	131	0.2
Heterotopic Bone	44	0.1	85	0.1
Wear Acetabulum	41	0.1	341	0.4
Progression Of Disease	16	0.0	34	0.0
Synovitis	10	0.0	16	0.0
Other	430	1.2	766	0.9
TOTAL	36397	100.0	87193	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 20,747 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).

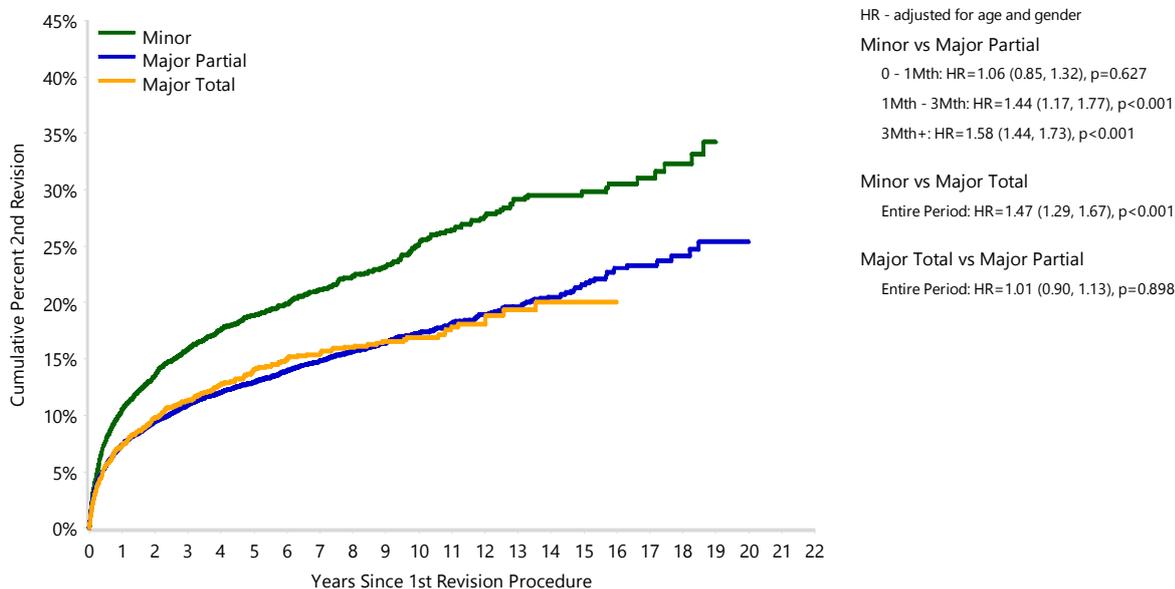
The outcome for the five most common types of 1st revision is detailed in Table R4 and Figure R6.

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	918	4635	10.5 (9.7, 11.5)	15.9 (14.8, 17.0)	18.9 (17.7, 20.1)	25.1 (23.5, 26.8)	29.8 (27.7, 32.1)	
Major Partial	1883	13735	7.4 (6.9, 7.8)	10.9 (10.4, 11.5)	12.9 (12.3, 13.5)	17.3 (16.5, 18.1)	21.6 (20.3, 23.0)	25.4 (22.8, 28.2)
Major Total	328	2377	7.3 (6.3, 8.5)	11.3 (10.1, 12.7)	14.1 (12.6, 15.7)	16.9 (15.2, 18.8)	20.0 (17.4, 23.0)	
TOTAL	3129	20747						

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

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)



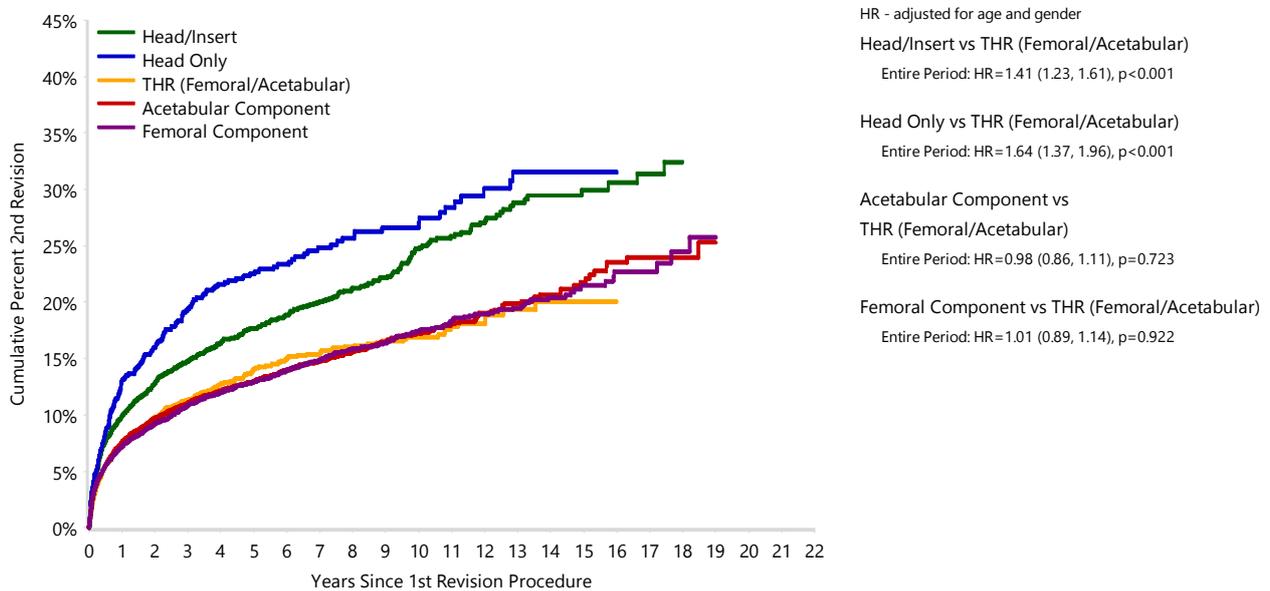
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	4635	3779	2900	2128	787	229	27
Major Partial	13735	11463	9030	6817	2751	511	43
Major Total	2377	2001	1552	1155	447	63	3

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	601	3189	9.9 (8.9, 11.0)	14.8 (13.5, 16.1)	17.7 (16.3, 19.2)	24.7 (22.7, 26.8)	30.0 (27.1, 33.0)	
Head Only	187	787	13.1 (10.9, 15.7)	19.4 (16.7, 22.5)	22.5 (19.6, 25.8)	26.6 (23.3, 30.4)	31.5 (27.2, 36.4)	
THR (Femoral/Acetabular)	328	2377	7.3 (6.3, 8.5)	11.3 (10.1, 12.7)	14.1 (12.6, 15.7)	16.9 (15.2, 18.8)	20.0 (17.4, 23.0)	
Acetabular Component	946	6391	7.6 (7.0, 8.3)	11.0 (10.3, 11.9)	13.0 (12.1, 13.9)	17.2 (16.2, 18.3)	21.8 (19.9, 23.8)	
Femoral Component	935	7330	7.2 (6.6, 7.8)	10.8 (10.1, 11.6)	12.9 (12.1, 13.8)	17.4 (16.2, 18.6)	21.5 (19.6, 23.5)	
TOTAL	2997	20074						

Note: Only the outcome of the five most common types of revision have been listed

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)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Head/Insert	3189	2626	1994	1435	508	138	12
Head Only	787	640	507	393	173	61	9
THR (Femoral/Acetabular)	2377	2001	1552	1155	447	63	3
Acetabular Component	6391	5571	4636	3693	1691	253	26
Femoral Component	7330	5882	4385	3118	1058	256	17

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

There are 1,819 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 (74.3%), followed by femoral only (23.5%) and acetabular only revisions (2.2%).

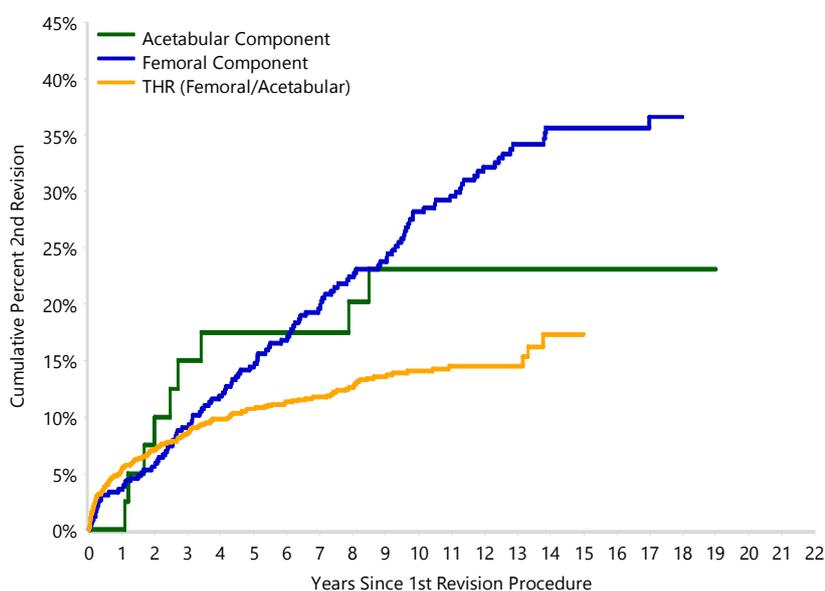
After 2 years, revising both the femoral and acetabular component has a lower rate of 2nd revision compared to revising only the femoral component. However, there is no difference when compared to revising the acetabular only (Table R5 and Figure R7).

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	9	40	0.0 (0.0, 0.0)	15.0 (7.0, 30.4)	17.5 (8.8, 33.2)	23.1 (12.7, 39.8)	23.1 (12.7, 39.8)	
Femoral Component	118	427	3.6 (2.2, 5.9)	9.1 (6.6, 12.3)	14.5 (11.3, 18.4)	28.2 (23.7, 33.3)	35.7 (30.6, 41.3)	
THR (Femoral/Acetabular)	167	1352	5.4 (4.3, 6.7)	8.5 (7.1, 10.2)	10.7 (9.1, 12.6)	14.1 (12.1, 16.3)	17.3 (13.9, 21.5)	
TOTAL	294	1819						

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 THR (Femoral/Acetabular)
Entire Period: HR=1.42 (0.72, 2.80), p=0.311

Acetabular Component vs Femoral Component
Entire Period: HR=0.63 (0.32, 1.25), p=0.185

Femoral Component vs THR (Femoral/Acetabular)

- 0 - 3Mth: HR=0.65 (0.30, 1.38), p=0.261
- 3Mth - 6Mth: HR=1.51 (0.53, 4.36), p=0.442
- 6Mth - 2Yr: HR=0.80 (0.41, 1.54), p=0.503
- 2Yr - 5Yr: HR=2.36 (1.49, 3.75), p<0.001
- 5Yr - 5.5Yr: HR=7.77 (2.01, 30.07), p=0.003
- 5.5Yr - 6.5Yr: HR=5.34 (1.74, 16.35), p=0.003
- 6.5Yr - 10Yr: HR=3.84 (2.17, 6.80), p<0.001
- 10Yr+: HR=5.31 (1.95, 14.44), p=0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Acetabular Component	40	40	34	33	27	17	2
Femoral Component	427	387	331	291	209	106	11
THR (Femoral/Acetabular)	1352	1234	1066	908	451	46	3

Revision Knee

DEMOGRAPHICS OF ALL REVISIONS

There have been 83,216 revisions of knee replacements with a procedure date up to and including 31 December 2022. This is an additional 4,843 procedures compared to the previous report.

Type of Revision

The majority of revision procedures are major revisions (63.8%). The most common major revisions are total knee replacement (TKR) (tibial and femoral) (47.2%) and tibial only (5.8%) (Table R6).

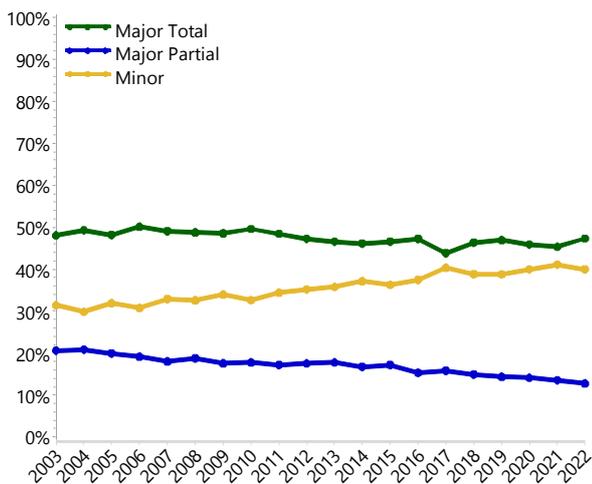
Minor revisions account for 36.2% of all revision knee procedures. The most common types of minor revision are insert only (17.3%), patella only (10.4%) and insert/patella (7.1%) (Table R6).

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 12.8% in 2022) and an increase in minor revisions (31.4% in 2003 to 39.9% in 2022) (Figure R8).

Reason for Revision

The most common reasons for revision are loosening (28.2%) and infection (25.5%) (Table R7).

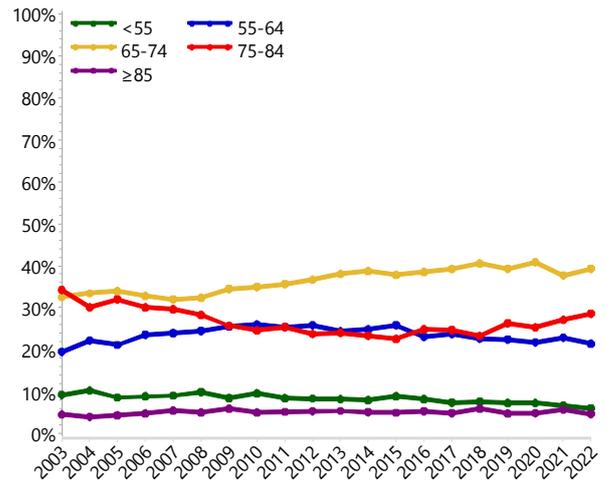
Figure R8 Revision Knee Replacement by Class



Age and Gender

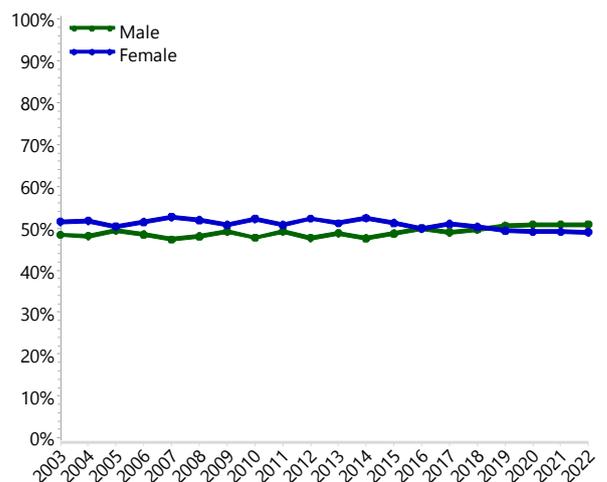
There has been an increase in the proportion of revisions undertaken in the 65-74 year age group from 32.5% in 2003 to 39.3% in 2022 and a decrease in the 75-84 year age group from 34.2% in 2003 to 28.6% in 2022 (Figure R9).

Figure R9 Revision Knee Replacement by Age



Revision knee replacement is slightly more common in females (50.9%). There has been little change in the gender proportion over the last 10 years (Figure R10).

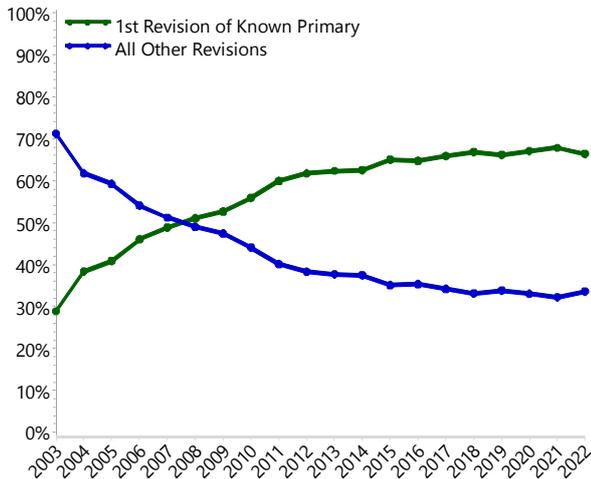
Figure R10 Revision Knee Replacement by Gender



DEMOGRAPHICS OF 1ST REVISIONS OF KNOWN PRIMARY PROCEDURES

There have been 47,394 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 3,227 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 (56.9%) compared to the all revisions group (63.8%), with less TKR (tibial/femoral)

revisions (41.5% compared to 47.2%) (Table R6). There is a higher proportion of minor revisions (43.1% compared to 36.2%) (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 (26.0% compared to 28.2%). 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 (9.1% compared to 6.5%) (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)	19678	41.5	39280	47.2
Tibial Component	2809	5.9	4816	5.8
Cement Spacer	1895	4.0	4379	5.3
Femoral Component	1827	3.9	3441	4.1
Uni Tibial Component	238	0.5	283	0.3
Removal of Prostheses	217	0.5	440	0.5
UKR (Uni Tibial/Uni Femoral)	145	0.3	200	0.2
Uni Femoral Component	86	0.2	112	0.1
Patella/Trochlear Resurfacing	57	0.1	94	0.1
Reinsertion of Components	25	0.1	39	0.0
N Major	26977	56.9	53084	63.8
Insert Only	9145	19.3	14393	17.3
Patella Only	6736	14.2	8615	10.4
Insert/Patella	3813	8.0	5921	7.1
Uni Insert Only	599	1.3	762	0.9
Minor Components	89	0.2	368	0.4
Cement Only	26	0.1	53	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	20417	43.1	30132	36.2
TOTAL	47394	100.0	83216	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	12341	26.0	23469	28.2
Infection	9383	19.8	21255	25.5
Progression Of Disease	4299	9.1	5418	6.5
Pain	3632	7.7	5035	6.1
Instability	3397	7.2	4929	5.9
Patellofemoral Pain	2896	6.1	3706	4.5
Patella Erosion	2356	5.0	2647	3.2
Fracture	1552	3.3	2299	2.8
Arthrofibrosis	1318	2.8	1766	2.1
Lysis	1032	2.2	2550	3.1
Wear Tibial Insert	919	1.9	2662	3.2
Malalignment	871	1.8	1234	1.5
Metal Related Pathology	445	0.9	676	0.8
Bearing Dislocation	406	0.9	617	0.7
Incorrect Sizing	385	0.8	501	0.6
Implant Breakage Tibial Insert	369	0.8	753	0.9
Patella Maltracking	272	0.6	409	0.5
Implant Breakage Patella	222	0.5	450	0.5
Implant Breakage Tibial	164	0.3	474	0.6
Prosthesis Dislocation	150	0.3	285	0.3
Synovitis	142	0.3	201	0.2
Osteonecrosis	109	0.2	133	0.2
Wear Patella	96	0.2	276	0.3
Implant Breakage Femoral	75	0.2	250	0.3
Wear Tibial	67	0.1	491	0.6
Tumour	38	0.1	75	0.1
Heterotopic Bone	18	0.0	43	0.1
Wear Femoral	9	0.0	21	0.0
Incorrect Side	3	0.0	3	0.0
Patella Dislocation	2	0.0	6	0.0
Other	426	0.9	582	0.7
TOTAL	47394	100.0	83216	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 9,247 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 16.5% 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).

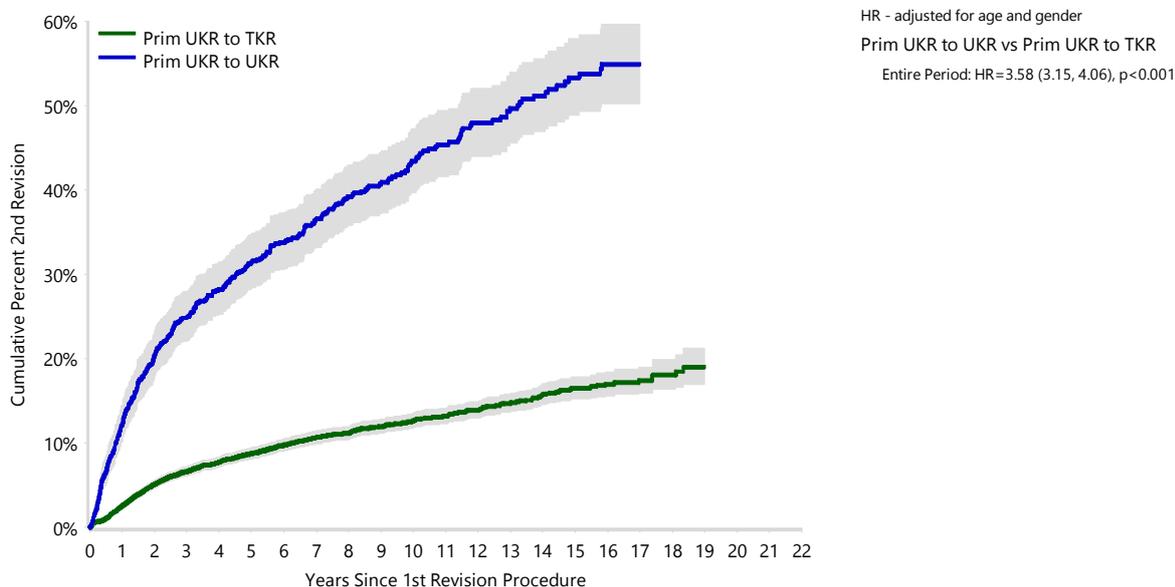
There is a difference in the outcome of revising a primary UKR to a TKR compared to revising a TKR to a TKR. The rate of 2nd revision of a UKR to TKR is lower than a TKR to TKR revision (Table R10 and Figure R14).

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	854	8366	2.5 (2.2, 2.9)	6.6 (6.0, 7.2)	8.8 (8.1, 9.4)	12.6 (11.8, 13.6)	16.5 (15.3, 17.9)	
Prim UKR to UKR	356	881	12.1 (10.1, 14.5)	24.8 (22.0, 27.9)	31.4 (28.3, 34.8)	43.4 (39.7, 47.3)	53.3 (48.9, 57.9)	
TOTAL	1210	9247						

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)



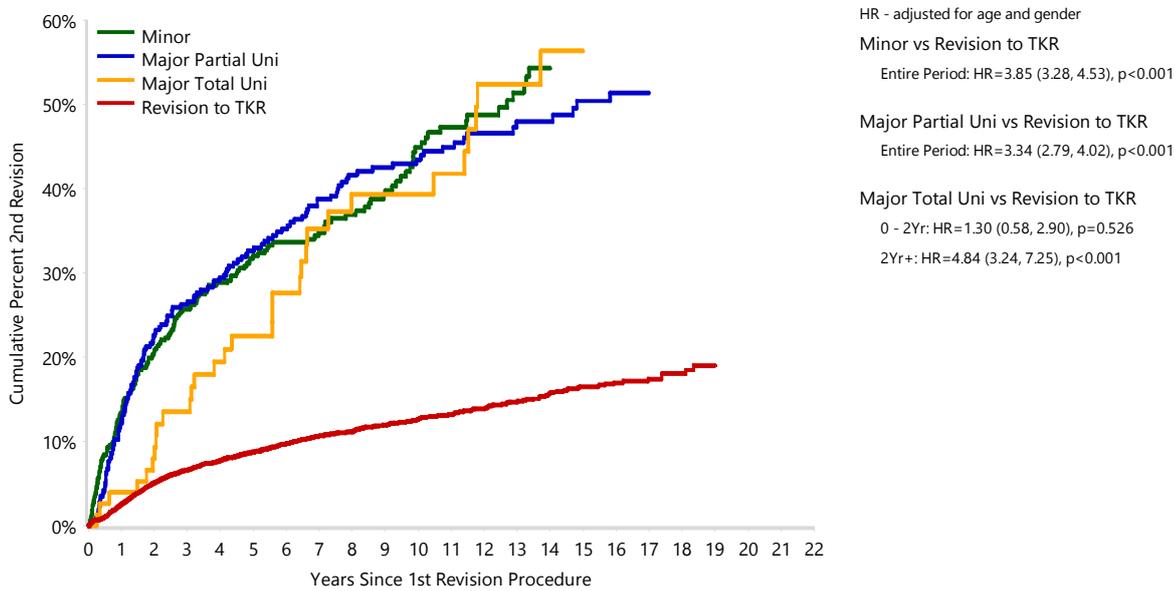
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Prim UKR to TKR	8366	7605	6144	4814	2230	673	39
Prim UKR to UKR	881	743	571	454	240	101	15

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	185	491	13.4 (10.7, 16.8)	25.7 (21.9, 30.0)	32.1 (27.8, 36.7)	44.9 (39.4, 50.8)		
Major Partial Uni	140	314	12.2 (9.0, 16.3)	26.3 (21.7, 31.6)	32.6 (27.7, 38.3)	43.5 (37.9, 49.5)	50.4 (44.1, 57.0)	
Major Total Uni	31	76	3.9 (1.3, 11.7)	13.5 (7.5, 23.7)	22.5 (14.4, 34.1)	39.3 (28.2, 52.9)	56.3 (42.2, 71.4)	
Revision to TKR	854	8366	2.5 (2.2, 2.9)	6.6 (6.0, 7.2)	8.8 (8.1, 9.4)	12.6 (11.8, 13.6)	16.5 (15.3, 17.9)	
TOTAL	1210	9247						

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)

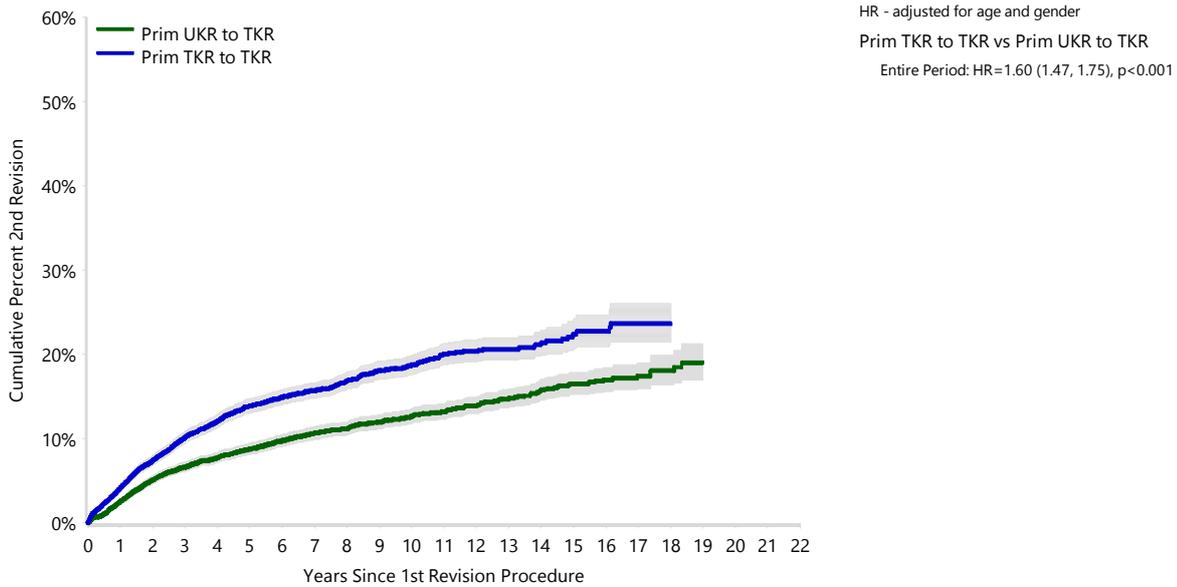


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	491	398	297	222	95	34	4
Major Partial Uni	314	272	215	185	118	58	9
Major Total Uni	76	73	59	47	27	9	2
Revision to TKR	8366	7605	6144	4814	2230	673	39

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	854	8366	2.5 (2.2, 2.9)	6.6 (6.0, 7.2)	8.8 (8.1, 9.4)	12.6 (11.8, 13.6)	16.5 (15.3, 17.9)	
Prim TKR to TKR	1131	8448	4.1 (3.7, 4.6)	10.1 (9.5, 10.9)	13.8 (13.0, 14.7)	18.8 (17.7, 19.9)	22.4 (20.7, 24.3)	
TOTAL	1985	16814						

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	8366	7605	6144	4814	2230	673	39
Prim TKR to TKR	8448	7353	5464	3869	1389	263	8

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 26,335 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 (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 and the tibial component (Table R12 and Figure R16).

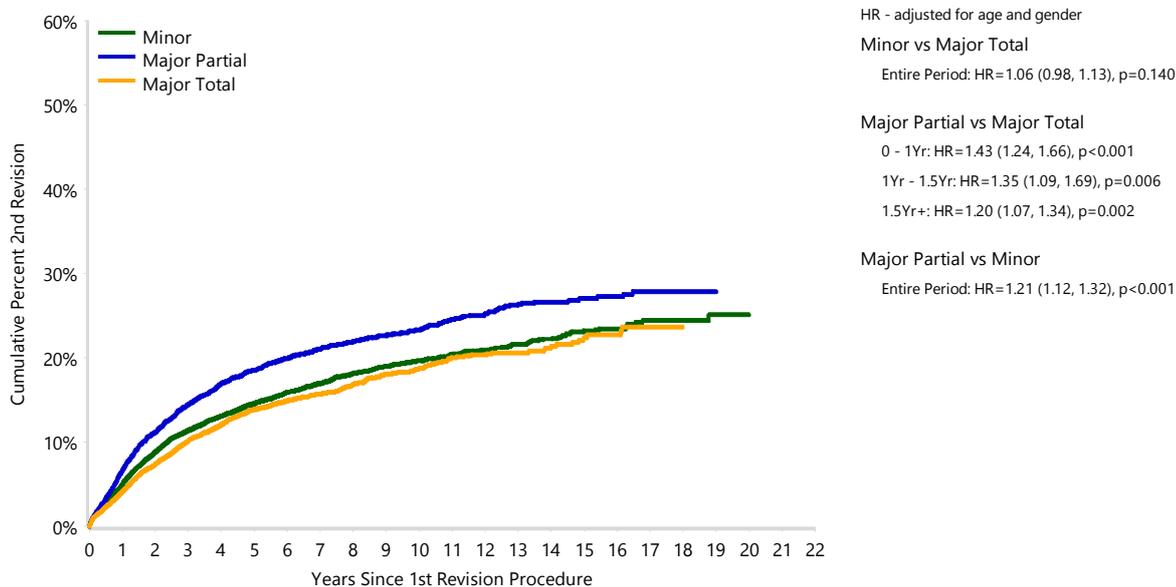
Revising the patella alone has the same rate of 2nd revision as revising the patella in combination with an insert exchange. At 15 years, the cumulative percent revision of the 1st revision of the patella only is 20.5% and 22.0% for a patella with an insert exchange. Revising the insert alone has the 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	2140	13928	4.9 (4.6, 5.3)	11.4 (10.8, 11.9)	14.6 (13.9, 15.2)	19.6 (18.8, 20.5)	23.2 (22.1, 24.4)	25.1 (23.2, 27.1)
Major Partial	815	3959	6.7 (5.9, 7.5)	14.4 (13.4, 15.6)	18.6 (17.3, 19.9)	23.3 (21.9, 24.9)	27.0 (25.2, 28.9)	
Major Total	1131	8448	4.1 (3.7, 4.6)	10.1 (9.5, 10.9)	13.8 (13.0, 14.7)	18.8 (17.7, 19.9)	22.4 (20.7, 24.3)	
TOTAL	4086	26335						

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)



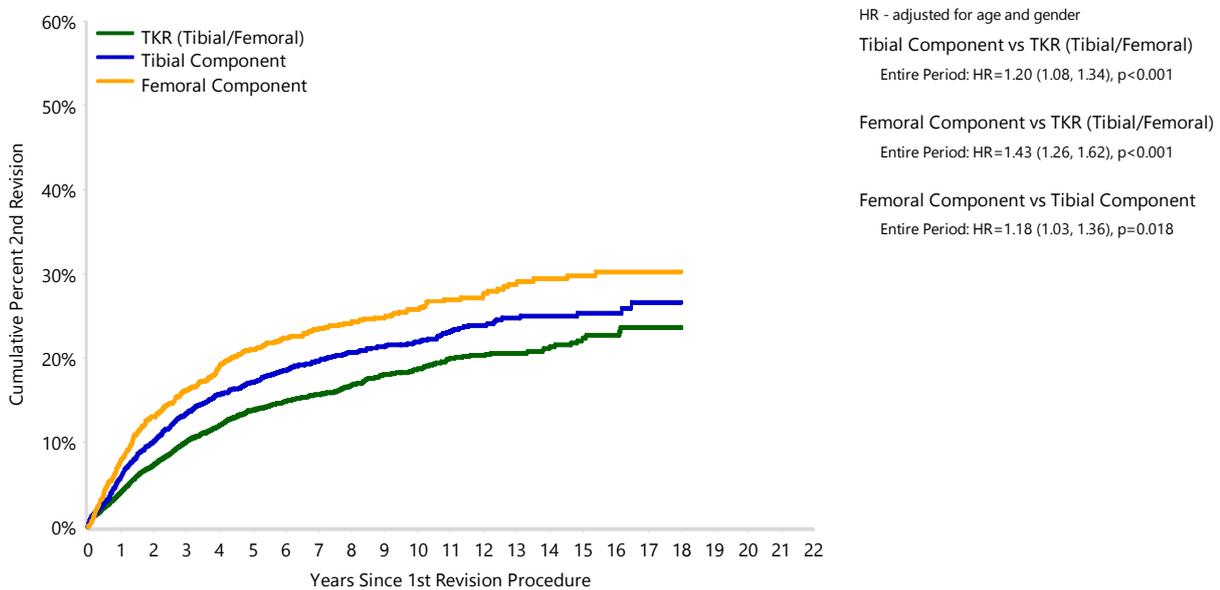
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Minor	13928	12307	9529	7223	2929	700	41
Major Partial	3959	3517	2870	2329	1131	360	28
Major Total	8448	7353	5464	3869	1389	263	8

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	480	3593	3.6 (3.1, 4.3)	9.6 (8.6, 10.7)	12.6 (11.4, 13.8)	17.9 (16.3, 19.6)	22.0 (19.4, 24.8)	
Insert Only	752	3851	8.3 (7.5, 9.3)	15.5 (14.3, 16.7)	18.9 (17.6, 20.3)	25.0 (23.3, 26.8)	29.3 (27.0, 31.7)	
Patella Only	897	6442	3.5 (3.1, 4.0)	9.9 (9.1, 10.6)	13.1 (12.2, 14.0)	17.5 (16.4, 18.6)	20.5 (19.0, 22.2)	
TKR (Tibial/Femoral)	1131	8448	4.1 (3.7, 4.6)	10.1 (9.5, 10.9)	13.8 (13.0, 14.7)	18.8 (17.7, 19.9)	22.4 (20.7, 24.3)	
Tibial Component	496	2579	5.9 (5.1, 6.9)	13.5 (12.2, 14.9)	17.2 (15.7, 18.8)	22.0 (20.2, 23.9)	25.4 (23.2, 27.8)	
Femoral Component	317	1374	8.0 (6.7, 9.6)	16.2 (14.3, 18.3)	21.1 (18.9, 23.5)	25.8 (23.3, 28.6)	29.8 (26.8, 33.1)	
TOTAL	4073	26287						

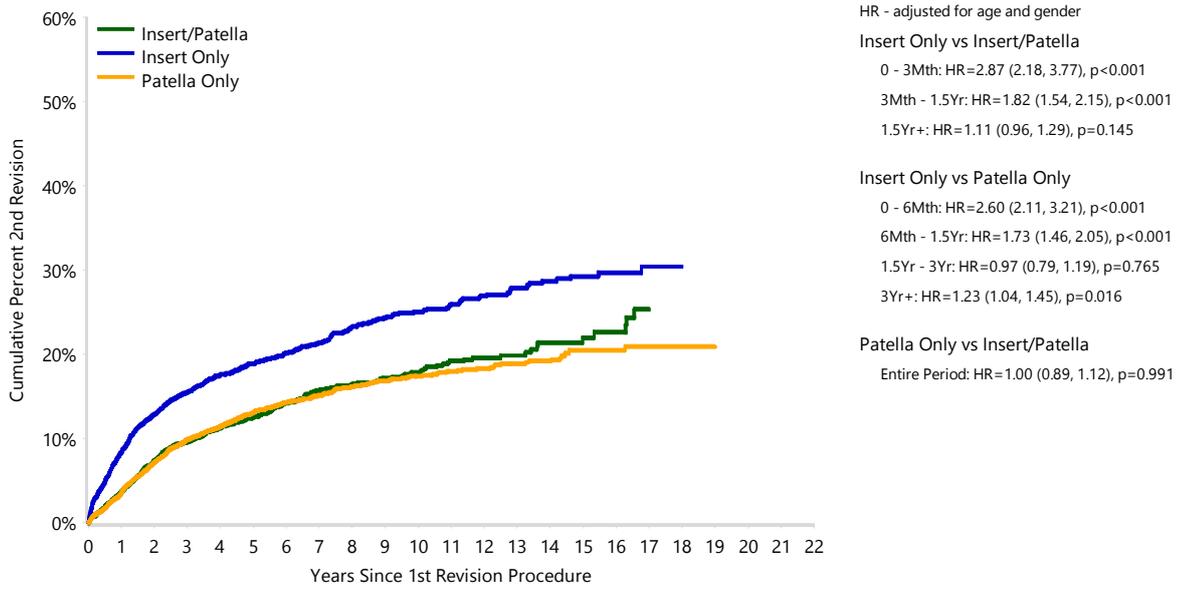
Note: Only the outcomes of the six most common types of 1st revision have been listed

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)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
TKR (Tibial/Femoral)	8448	7353	5464	3869	1389	263	8
Tibial Component	2579	2310	1894	1537	726	197	16
Femoral Component	1374	1202	973	791	405	163	12

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)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs	20 Yrs
Insert/Patella	3593	3208	2440	1803	623	136	9
Insert Only	3851	3246	2388	1766	733	189	12
Patella Only	6442	5823	4675	3636	1566	373	19

List of Tables

Revision Hip	6
Table R1 Revision Hip Replacement by Type of Revision	8
Table R2 Revision Hip Replacement by Reason for Revision	9
Table R3 CP2R of Known Primary THR by Class of 1st Revision (OA, Excluding 1st Revision for Infection).....	10
Table R4 CP2R of Known Primary THR by Type of 1st Revision (OA, Excluding 1st Revision for Infection)	11
Table R5 CP2R of Known Primary Total Resurf. HR by Type of 1st Revision (OA, Excl. 1st Revision for Infection).....	12
Revision Knee	13
Table R6 Revision Knee Replacement by Type of Revision	15
Table R7 Revision Knee Replacement by Reason for Revision.....	16
Table R8 CP2R of Known Primary UKR by Type of 1 st Revision (OA, Excluding 1 st Revision for Infection)	17
Table R9 CP2R of Known Primary UKR by Class of 1 st Revision (OA, Excluding 1 st Revision for Infection).....	18
Table R10 CP2R of Known Primary TKR by Type of Primary (OA, Excluding 1 st Revision for Infection)	19
Table R11 CP2R of Known Primary TKR by Class of 1st Revision (OA, Excluding 1st Revision for Infection)	20
Table R12 CP2R of Known Primary TKR by Type of 1st Revision (OA, Excluding 1st Revision for Infection).....	21

List of Figures

Revision Hip	8
Figure R1 Revision Hip Replacement by Class	6
Figure R2 Revision Hip Replacement by Age	6
Figure R3 Revision Hip Replacement by Gender.....	6
Figure R4 Revision Hip Replacement by Revision.....	7
Figure R5 CP2R of Known Primary THR by Class of 1st Revision (OA, Excluding 1st Revision for Infection).....	10
Figure R6 CP2R of Known Primary THR by Type of 1st Revision (OA, Excluding 1st Revision for Infection)	11
Figure R7 CP2R of Known Primary Total Resurf. HR by Type of 1st Revision (OA, Excl. 1st Revision for Infection).....	12
Revision Knee	13
Figure R8 Revision Knee Replacement by Class	13
Figure R9 Revision Knee Replacement by Age	13
Figure R10 Revision Knee Replacement by Gender.....	13
Figure R11 Revision Knee Replacement by Revision.....	14
Figure R12 CP2R of Known Primary UKR by Type of 1st Revision (OA, Excluding 1st Revision for Infection)	17
Figure R13 CP2R of Known Primary UKR by Class of 1st Revision (OA, Excluding 1st Revision for Infection).....	18
Figure R14 CP2R of Known Primary Knee Replacement by Type of Primary (OA, Excl. 1st Revision for Infection).....	19
Figure R15 CP2R of Known Primary TKR by Class of 1st Revision (OA, Excl. 1st Revision for Infection).....	20
Figure R16 CP2R of Known Primary TKR by Type of 1st Revision (OA, Major 1 st Revisions, Excl. 1st Revision for Infection)	21
Figure R17 CP2R of Known Primary TKR by Type of 1st Revision (OA, Minor 1st Revisions, Excl. 1st Revision for Infection).....	22



Australian
Orthopaedic
Association
National
Joint
Replacement
Registry

AOANJRR
SAHMRI Building
North Terrace, Adelaide SA 5000
T: +61 8 8128 4280
aoanjrr.sahmri.com
aoa.org.au

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