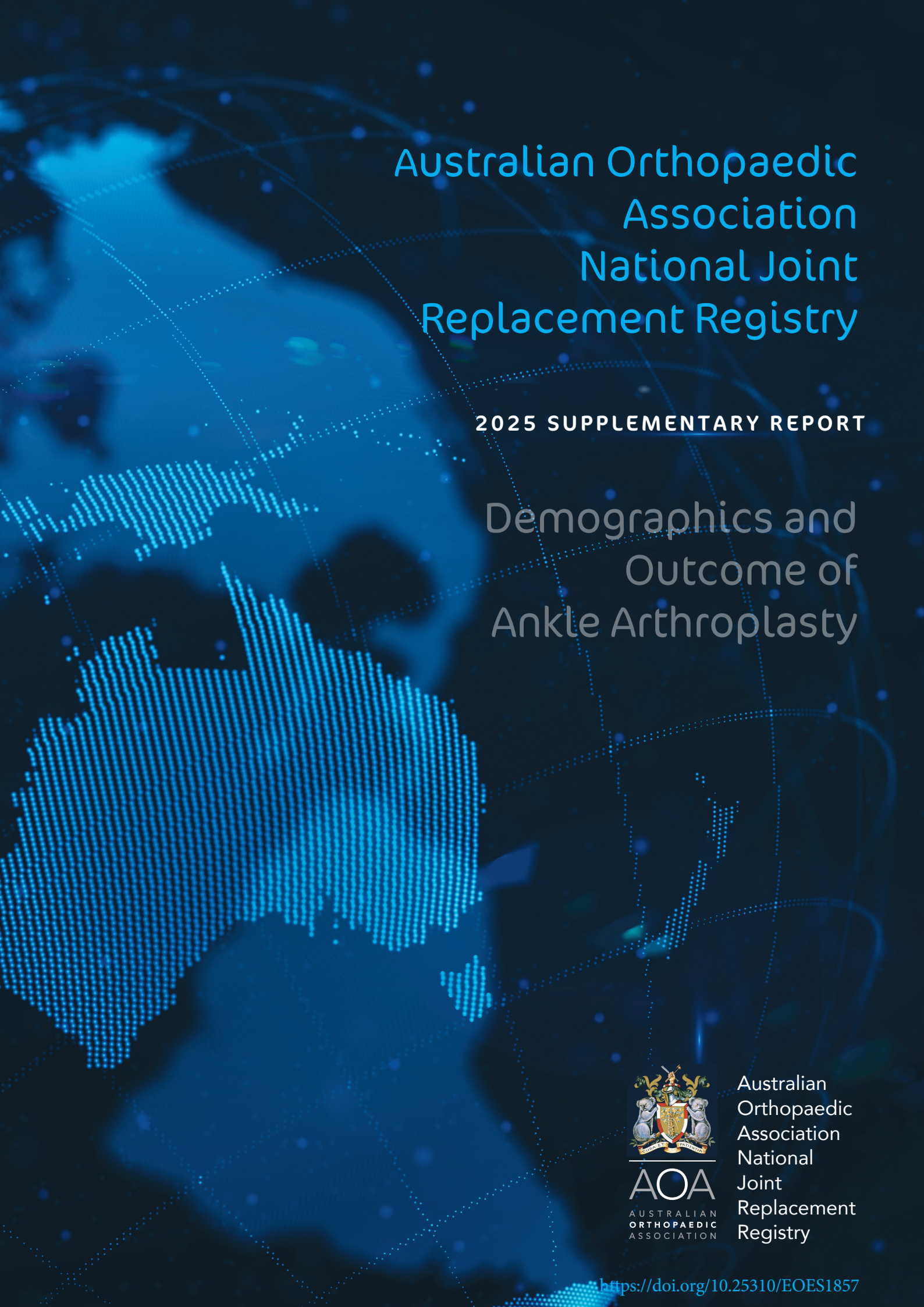
Australian Orthopaedic Association National Joint Replacement Registry

2025 SUPPLEMENTARY REPORT

Demographics and Outcome of Ankle Arthroplasty



Australian Orthopaedic Association National Joint Replacement Registry

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Australia Orthopaedic Association National Joint Replacement Registry

Demographics and Outcome of Ankle Arthroplasty

2025 Supplementary Report

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Introduction

This Ankle Arthroplasty Supplementary Report is based on the analysis of 6,198 ankle procedures with a procedure date from 2006 up to and including 31 December 2024.

This Report is one of 14 supplementary reports to complete the AOANJRR Annual Report for 2025.

Information on the background, purpose, aims, benefits and governance of the Registry can be found in the Introductory chapter of the 2025 Hip, Knee and Shoulder Arthroplasty Annual Report.

The Registry data quality processes including data collection, validation and outcomes assessment, are provided in detail in the Data Quality section of the introductory chapter of the 2025 Hip, Knee and Shoulder Arthroplasty Annual Report: https://aoanjrr.sahmri.com/annual-reports-2025.

Ankle Replacement

CATEGORIES OF ANKLE REPLACEMENT

Ankle replacements are grouped into two broad categories: primary total and revision ankle replacement.

A primary total ankle replacement is the initial procedure involving replacing both the tibial and talar articular surfaces of the ankle joint with tibial and talar prostheses and an intervening insert, which may or may not be attached to the tibial component.

Revision procedures are subsequent operations of previous ankle replacements where one or more of the prosthetic components are replaced, removed, or another component is added. Revisions include subsequent operations of primary total or previous revision procedures.

Ankle revisions are subcategorised into three classes: major total, major partial and minor revisions. Major total involves replacing both the tibial and talar components. Major partial involves revising either the tibial or talar component, and a minor revision procedure retains the original tibial and talar components and most often involves a revision of the insert only.

There is a third category of ankle replacement procedure data that the AOANJRR collects. This is information on re-operation after ankle replacement, but without revision of any of the components. Surgeons have reported a small number of these procedures, and the future aim of the AOANJRR is to increase reporting of these operations.

DEMOGRAPHICS OF ANKLE REPLACEMENT

This report is an analysis of 6,198 ankle replacement procedures (5,379 primaries (86.8%) and 819 revisions (13.2%). This excludes 2 primary partial resurfacing ankle replacements from 2008.

Ankle replacement is more frequently undertaken in males (62.1%). The overall mean age is 69.9 years, and the most common age group for both male and female patients is 65-74 years (Table A1 to Table A3 and Figure A1).

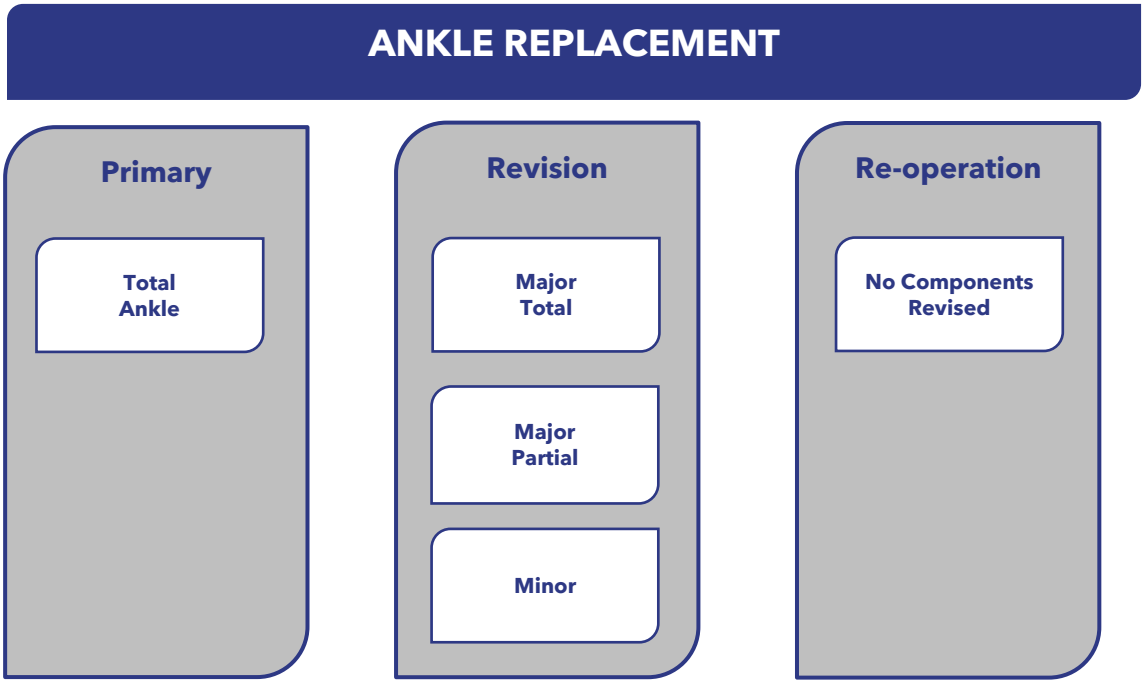


Table A1 Number of Ankle Replacements by Gender

Ankle Replacement	Male		Female		TOTAL	
	N	Row%	N	Row%	N	Row%
Primary Total	3338	62.1	2041	37.9	5379	100.0
Revision	514	62.8	305	37.2	819	100.0
TOTAL	**3852**	**62.1**	**2346**	**37.9**	**6198**	**100.0**

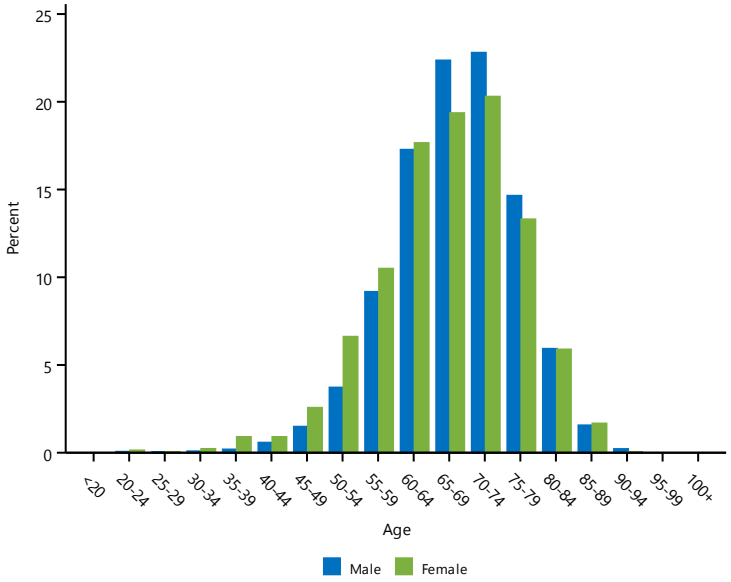
Table A2 Number of Ankle Replacements by Age

Ankle Replacement	<55		55-64		65-74		75-84		≥85		TOTAL	
	N	Row%	N	Row%	N	Row%	N	Row%	N	Row%	N	Row%
Primary Total	427	7.9	1504	28.0	2295	42.7	1062	19.7	91	1.7	5379	100.0
Revision	74	9.0	174	21.2	374	45.7	180	22.0	17	2.1	819	100.0
TOTAL	**501**	**8.1**	**1678**	**27.1**	**2669**	**43.1**	**1242**	**20.0**	**108**	**1.7**	**6198**	**100.0**

Table A3 Age and Gender of Primary and Revision Ankle Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	3852	62.1%	23	94	68	68.0	8.6
Female	2346	37.9%	20	90	67	66.5	9.8
TOTAL	**6198**	**100.0%**	**20**	**94**	**68**	**67.4**	**9.1**

Figure A1 Ankle Replacement by Age and Gender



DEMOGRAPHICS

There have been 5,379 primary total ankle replacements reported to the Registry. This is an additional 766 procedures since the last report.

For further information on the **closure of the database,** please see the **Glossary** of the **Hip, Knee & Shoulder Arthroplasty Annual Report**.

The use of total ankle replacement was lowest in 2014 and is currently at its highest recorded usage of 729 procedures in 2024. There has been a 370.3% increase in the use of ankle replacement since 2014. In 2024, there was a 9.6% increase in the number of total ankle replacements compared to 2023 (Figure A2). The principal primary diagnosis is osteoarthritis (94.4%) (Table A4).

Figure A2 Numbers of Ankle Replacement

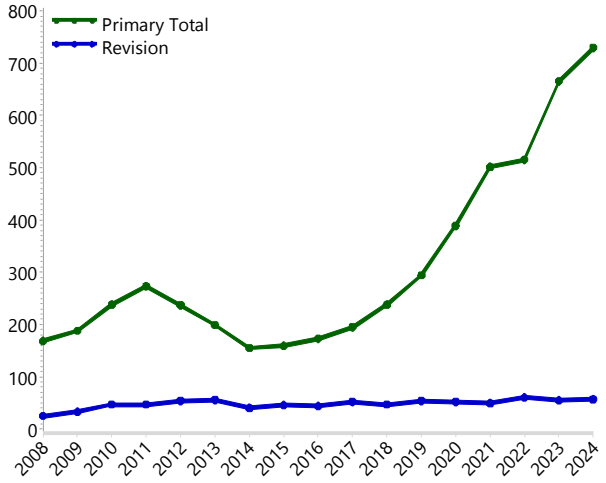
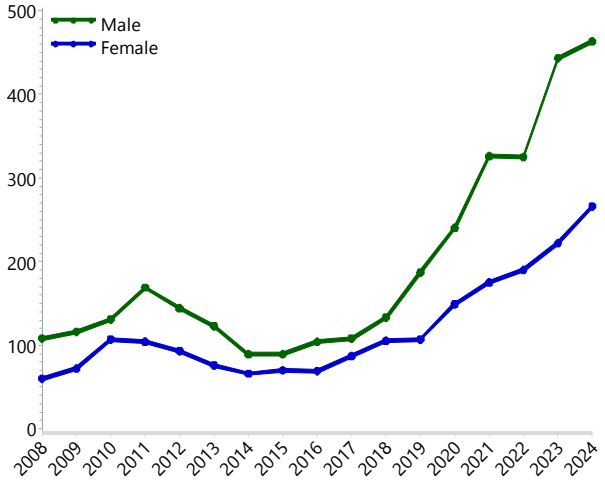


Table A4 Primary Total Ankle Replacement by Primary Diagnosis

Primary Diagnosis	Number	Percent
Osteoarthritis	5079	94.4
Rheumatoid Arthritis	191	3.6
Other Inflammatory Arthritis	34	0.6
Instability	32	0.6
Fracture/Dislocation	15	0.3
Osteonecrosis	12	0.2
Tumour	2	0.0
Other	14	0.3
TOTAL	**5379**	**100.0**

Overall, 62.1% of primary ankle procedures are performed on males. The use of primary ankle replacement in males has increased in recent years (Table A5 and Figure A3).

Figure A3 Number of Primary Total Ankle Replacement by Gender



The median age is 68 years with males and females having a similar median age. The most common age group is 65-74 years. All age groups have larger numbers in 2024 compared to both 2022 and 2023 (Figure A4).

Figure A4 Number of Primary Total Ankle Replacement by Age

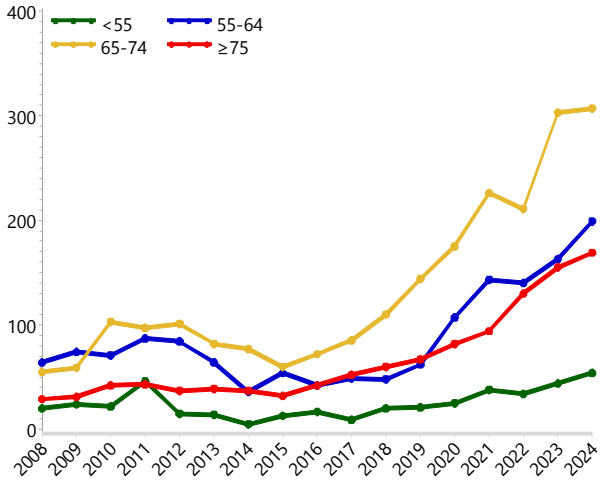


Table A5 Age and Gender of Primary Total Ankle Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	3338	62.1%	23	94	68	67.8	8.6
Female	2041	37.9%	20	90	67	66.5	9.7
TOTAL	**5379**	**100.0%**	**20**	**94**	**68**	**67.3**	**9.0**

ASA AND BMI

ASA scores are an indication of comorbidity and have been collected since 2012. The Registry has ASA data on 4,095 primary total ankle replacement procedures. Total ankle replacement is most commonly performed in patients with an ASA score 2 (Table A6).

BMI data have been collected since 2015. There are BMI data on 3,673 primary total ankle replacement procedures. Total ankle replacement is more common in patients who are pre-obese or obese class 1 (Table A7).

BILATERAL PROCEDURES

The Registry has recorded 367 bilateral ankle replacements, 15.3% of which were performed within 6 months of the initial procedure (Table A8).

PROSTHESIS USE

Information on the changing use of tibial and talar prostheses in recent years compared to 2008 is provided in Table A9 and Table A10.

Table A6 ASA Score for Primary Total Ankle Replacement

ASA Score	Number	Percent
ASA 1	358	8.7
ASA 2	2271	55.5
ASA 3	1429	34.9
ASA 4	37	0.9
TOTAL	**4095**	**100.0**

Table A7 BMI Category for Primary Total Ankle Replacement

BMI Category	Number	Percent
Underweight (<18.50)	12	0.3
Normal (18.50-24.99)	554	15.1
Pre Obese (25.00-29.99)	1470	40.0
Obese Class 1 (30.00-34.99)	1134	30.9
Obese Class 2 (35.00-39.99)	341	9.3
Obese Class 3 (≥40.00)	162	4.4
TOTAL	**3673**	**100.0**

Note: BMI has not been presented for patients aged ≤19 years

Table A8 Time between Procedures for Bilateral Primary Ankle Replacement

Bilateral Procedures	Same Day		1day-6months		≥6months		TOTAL	
	N	Total%	N	Total%	N	Total%	N	Total%
Both - Total Ankle	5	1.4	51	13.9	311	84.7	367	100.0
TOTAL	**5**	**1.4**	**51**	**13.9**	**311**	**84.7**	**367**	**100.0**

Table A9 Most Used Tibial Prostheses in Primary Total Ankle Replacement

2008		2020		2021		2022		2023		2024	
N	Model	N	Model	N	Model	N	Model	N	Model	N	Model
98	Mobility	200	Infinity	268	Infinity	313	Infinity	414	Infinity	458	Infinity
34	Hintermann Series H3	81	Trabecular Metal	90	Trabecular Metal	75	Trabecular Metal	82	Inbone	122	Inbone
18	Buechel-Pappas	40	Inbone	47	Salto Talaris	63	Inbone	81	Trabecular Metal	79	Trabecular Metal
11	Salto	32	Salto Talaris	42	Inbone	27	Salto Talaris	67	Vantage	55	Vantage
6	BOX	20	Hintermann Series H3	24	Hintermann Series H3	21	Hintermann Series H3	20	Hintermann Series H3	15	Hintermann Series H3
1	Ankle Joint (Eska)	15	Vantage	23	Vantage	16	Vantage	1	Salto Talaris		
		1	Salto	4	Zenith						
				2	Invision						
				1	Salto						
Most Used											
168	(6) 100.0%	389	(7) 100.0%	501	(9) 100.0%	515	(6) 100.0%	665	(6) 100.0%	729	(5) 100.0%

Table A10 Most Used Talar Prostheses in Primary Total Ankle Replacement

2008		2020		2021		2022		2023		2024	
N	Model	N	Model	N	Model	N	Model	N	Model	N	Model
98	Mobility	129	Infinity	201	Infinity	259	Infinity	356	Infinity	391	Infinity
34	Hintermann Series H3	108	Inbone	109	Inbone	113	Inbone	137	Inbone	187	Inbone
18	Buechel-Pappas	81	Trabecular Metal	90	Trabecular Metal	75	Trabecular Metal	81	Trabecular Metal	79	Trabecular Metal
11	Salto	32	Salto Talaris	47	Salto Talaris	27	Salto Talaris	67	Vantage	55	Vantage
6	BOX	20	Hintermann Series H3	24	Hintermann Series H3	21	Hintermann Series H3	20	Hintermann Series H3	15	Hintermann Series H3
1	Ankle Joint (Eska)	15	Vantage	23	Vantage	16	Vantage	2	Invision	2	Invision
		3	Invision	4	Zenith	4	Invision	1	Custom Made (OsseoInt)		
		1	Salto	2	Invision			1	Salto Talaris		
				1	Salto						
Most Used											
168	(6) 100.0%	389	(8) 100.0%	501	(9) 100.0%	515	(7) 100.0%	665	(8) 100.0%	729	(6) 100.0%

OUTCOME FOR ALL DIAGNOSES

PRIMARY DIAGNOSIS

The cumulative percent revision for osteoarthritis at 10 years is 13.5%. There has only been a small number of procedures for rheumatoid arthritis, and when adjusted for age and gender, there is no difference in the revision rate when compared to osteoarthritis (Table A11 and Figure A5).

REASON FOR REVISION

Loosening is the most common reason for revision of primary total ankle replacement. This accounts for 33% of all revisions, followed by infection, lysis, implant breakage and instability (Table A12). The cumulative incidence of the five most common reasons for revision is presented in Figure A6.

TYPE OF REVISION

The most common type of revision is an insert only revision (44.8%) (Table A13).

CHANGE IN OUTCOME OVER TIME

There has been an improvement in primary total ankle replacement outcomes over time.

Comparing procedures undertaken prior to 2015 to those undertaken since 2015, the 7 year cumulative percent revision has declined from 12.9% to 6.4% (Table A14 and Figure A7).

RE-OPERATION

There have been 49 procedures where a re-operation without component revision was performed on a primary total ankle replacement. These procedures are not included in the revision analysis.

PROSTHESIS TYPES

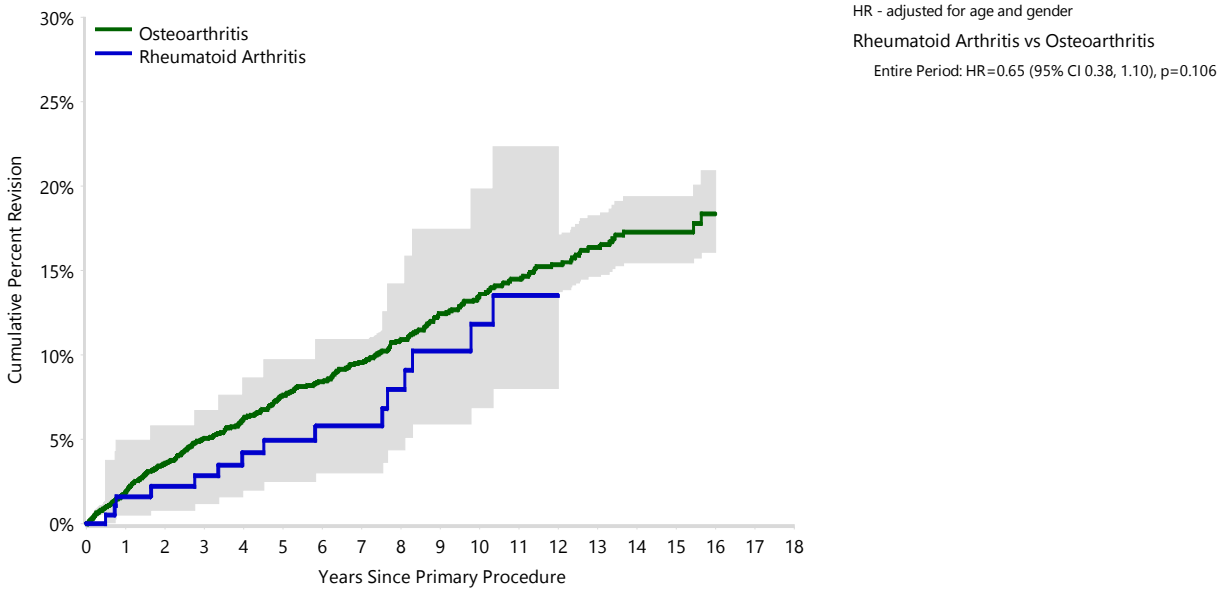
The outcomes of different prosthesis types are listed in Table A15.

Table A11 Cumulative Percent Revision of Primary Total Ankle Replacement by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	400	5079	1.9 (1.5, 2.3)	5.1 (4.4, 5.8)	7.6 (6.7, 8.5)	9.6 (8.5, 10.7)	13.5 (12.1, 15.1)	17.3 (15.4, 19.4)
Rheumatoid Arthritis	15	191	1.6 (0.5, 5.0)	2.8 (1.2, 6.7)	4.9 (2.5, 9.7)	5.8 (3.0, 10.9)	11.8 (6.9, 19.8)	
Other Inflammatory Arthritis	2	34	0.0 (0.0, 0.0)	7.3 (1.9, 26.3)	7.3 (1.9, 26.3)	7.3 (1.9, 26.3)	7.3 (1.9, 26.3)	
Instability	3	32	3.1 (0.4, 20.2)	3.1 (0.4, 20.2)	3.1 (0.4, 20.2)	17.0 (3.5, 62.4)		
Fracture/Dislocation	1	15	7.1 (1.0, 40.9)	7.1 (1.0, 40.9)	7.1 (1.0, 40.9)			
Other	1	14	0.0 (0.0, 0.0)	7.7 (1.1, 43.4)	7.7 (1.1, 43.4)	7.7 (1.1, 43.4)		
Osteonecrosis	2	12	11.1 (1.6, 56.7)	11.1 (1.6, 56.7)	11.1 (1.6, 56.7)	11.1 (1.6, 56.7)	11.1 (1.6, 56.7)	
Other (1)	0	2	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)		
TOTAL	**424**	**5379**						

Note: Only primary diagnoses with over 10 procedures have been listed

Figure A5 Cumulative Percent Revision of Primary Total Ankle Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	5079	4267	2995	2074	1535	977	199
Rheumatoid Arthritis	191	177	154	122	92	56	13

Note: Only primary diagnoses with over 50 procedures have been listed

Table A12 Reason for Revision of Primary Total Ankle Replacement

Revision Diagnosis	Number	Percent
Loosening	140	33.0
Infection	61	14.4
Lysis	40	9.4
Implant Breakage Ankle Insert	38	9.0
Instability	34	8.0
Pain	22	5.2
Impingement	21	5.0
Fracture	17	4.0
Prosthesis Dissociation	11	2.6
Arthrofibrosis	7	1.7
Malalignment	7	1.7
Wear Ankle Insert	6	1.4
Heterotopic Bone	5	1.2
Synovitis	3	0.7
Incorrect Sizing	2	0.5
Implant Breakage Tibial	2	0.5
Metal Related Pathology	1	0.2
Tumour	1	0.2
Osteonecrosis	1	0.2
Progression Of Disease	1	0.2
Other	4	0.9
TOTAL	**424**	**100.0**

Table A13 Type of Revision of Primary Total Ankle Replacement

Type of Revision	Number	Percent
Insert Only	190	44.8
Tibial/Talar	82	19.3
Arthrodesis	49	11.6
Tibial Only	39	9.2
Talar Only	30	7.1
Cement Spacer	20	4.7
Removal of Prostheses	7	1.7
Minor Components	7	1.7
TOTAL	**424**	**100.0**

Figure A6 Cumulative Incidence Revision Diagnosis of Primary Total Ankle Replacement

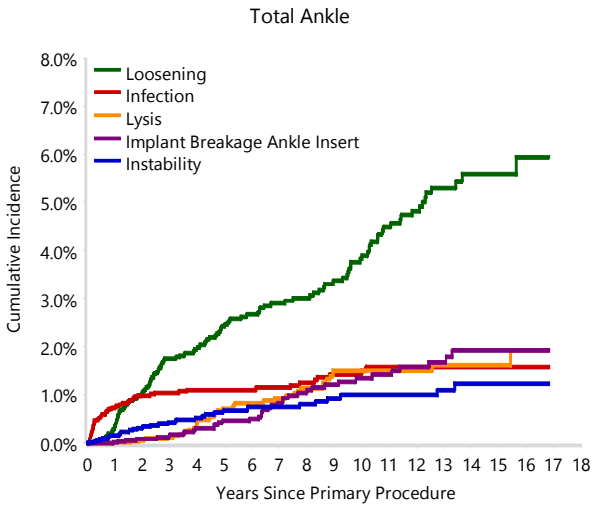
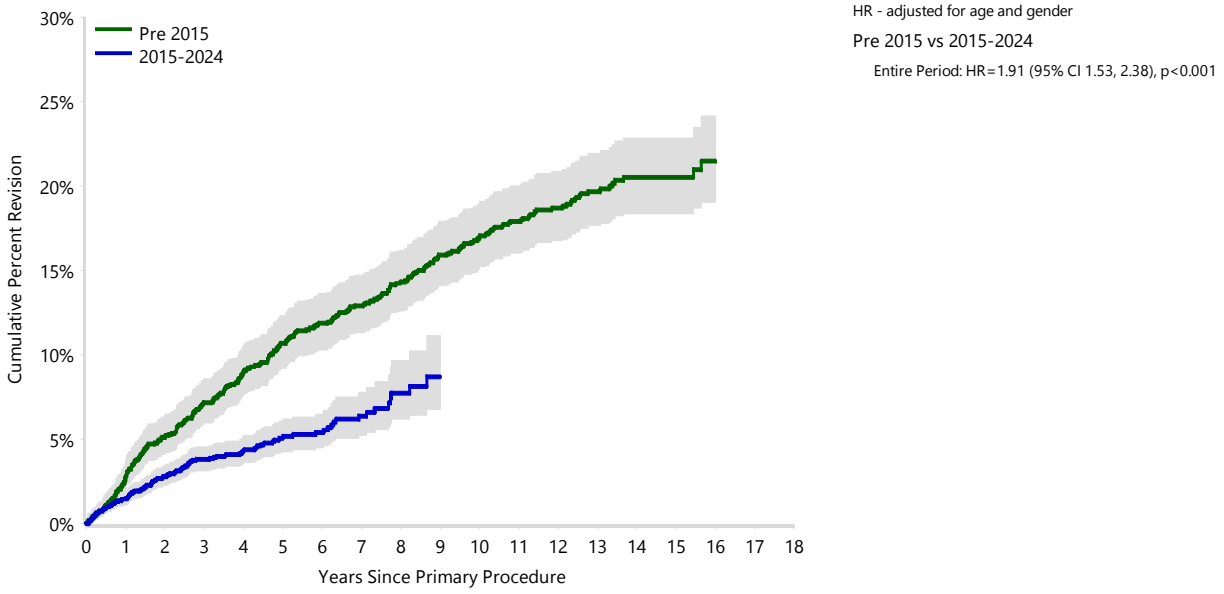


Table A14 Cumulative Percent Revision of Primary Total Ankle Replacement by Period

Period	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
2015-2024	144	3858	1.5 (1.1, 2.0)	3.8 (3.1, 4.6)	5.1 (4.2, 6.1)	6.4 (5.2, 7.8)		
Pre 2015	280	1521	2.8 (2.1, 3.7)	7.2 (6.0, 8.6)	10.7 (9.2, 12.4)	12.9 (11.3, 14.7)	17.0 (15.1, 19.0)	20.5 (18.4, 22.9)
TOTAL	**424**	**5379**						

Figure A7 Cumulative Percent Revision of Primary Total Ankle Replacement by Period



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Pre 2015	1521	1467	1376	1289	1208	1052	216
2015-2024	3858	3067	1826	948	449	0	0

Table A15 Cumulative Percent Revision of Primary Total Ankle Replacement by Prosthesis Combination

Tibia	Talar	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
BOX	BOX*	17	114	1.8 (0.4, 6.8)	5.4 (2.4, 11.6)	10.1 (5.7, 17.5)	10.1 (5.7, 17.5)	14.7 (9.1, 23.3)	
Buechel-Pappas	Buechel-Pappas*	11	63	1.6 (0.2, 10.7)	8.0 (3.4, 18.1)	9.6 (4.4, 20.1)	11.2 (5.5, 22.2)	16.6 (9.3, 28.8)	16.6 (9.3, 28.8)
Hintermann Series H3	Hintermann Series H3[1]	108	573	4.1 (2.7, 6.0)	8.4 (6.4, 11.1)	11.4 (8.9, 14.4)	15.7 (12.7, 19.2)	21.0 (17.5, 25.2)	25.7 (21.4, 30.8)
Inbone	Inbone	8	400	1.5 (0.6, 3.6)	2.8 (1.4, 5.5)	2.8 (1.4, 5.5)			
Infinity	Inbone	16	361	1.5 (0.6, 3.7)	4.4 (2.5, 7.6)	8.1 (4.5, 14.2)			
	Infinity	31	1515	1.1 (0.7, 1.9)	2.8 (1.9, 4.1)	3.7 (2.4, 5.7)			
Mobility	Mobility*	93	568	2.3 (1.3, 3.9)	7.1 (5.2, 9.5)	10.2 (7.9, 13.0)	11.1 (8.8, 14.0)	14.7 (11.9, 17.9)	17.9 (14.8, 21.6)
S.T.A.R	S.T.A.R*	14	49	4.1 (1.0, 15.5)	12.6 (5.8, 25.8)	14.7 (7.3, 28.4)	21.3 (12.0, 35.9)	29.9 (18.3, 46.3)	
Salto	Salto*	66	421	2.2 (1.1, 4.1)	5.5 (3.7, 8.2)	9.0 (6.6, 12.2)	11.8 (9.0, 15.4)	15.5 (12.3, 19.6)	
Salto Talaris	Salto Talaris*	26	507	1.2 (0.5, 2.6)	3.8 (2.5, 5.9)	4.6 (3.0, 6.9)	5.4 (3.7, 7.9)		
Trabecular Metal	Trabecular Metal	10	501	1.4 (0.7, 3.0)	2.0 (1.1, 3.9)	2.8 (1.4, 5.8)			
Vantage	Vantage	7	193	1.7 (0.6, 5.3)	7.7 (3.5, 16.7)				
Zenith	Zenith*	14	87	3.4 (1.1, 10.3)	6.9 (3.2, 14.8)	14.5 (8.5, 24.2)	14.5 (8.5, 24.2)	16.3 (9.8, 26.7)	
Other (9)		3	27	3.7 (0.5, 23.5)	12.0 (4.0, 32.8)	12.0 (4.0, 32.8)	12.0 (4.0, 32.8)	12.0 (4.0, 32.8)	
TOTAL		**424**	**5379**						

Note: Only prostheses with over 15 procedures have been listed

*denotes prosthesis combinations that have not had any reported use in primary total ankle procedures in 2024

[1] The Hinterman Series H3 combination has been identified as having a higher than anticipated rate of revision (HTARR) in the 2024 Annual Report:

See the Hinterman Series H3 combination in the HTARR Chapter

Corresponding prosthesis investigation of this combination is available here

HTARR methodology is available here

OUTCOME FOR OSTEOARTHRITIS

DEMOGRAPHICS

Age and Gender

Age is a risk factor for revision. Patients aged ≥75 years have a lower rate of revision compared to patients aged 65-74 years from 3 months, patients 55-64 years from 3-9 months and from 2.5 years, and when compared to patients aged <55 years for the entire period (Table A16 and Figure A8).

There is no difference in the rate of revision between males and females (Table A17 and Figure A9).

ASA and BMI

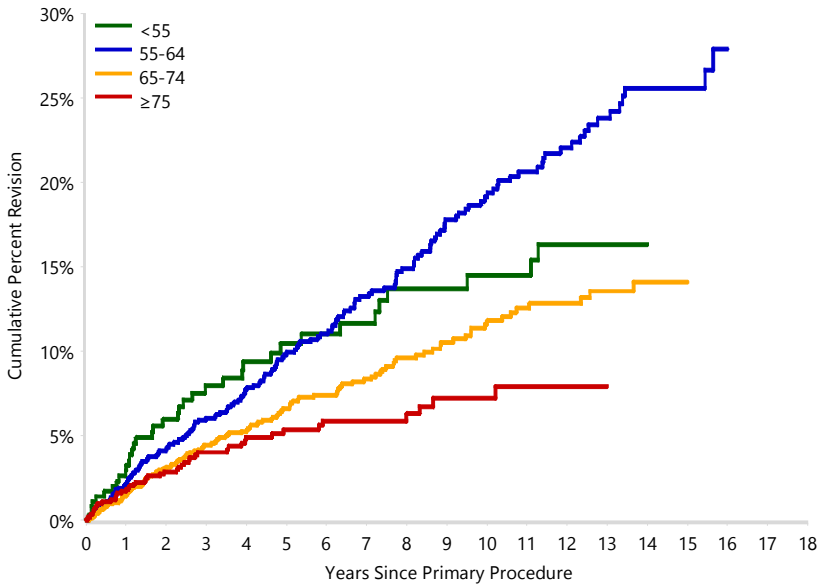
ASA is not a risk factor for revision (Table A18 and Figure A10).

As the number of procedures in each BMI category is relatively small, an analysis of combined BMI <30 kg/m^2 (underweight, normal and pre-obese) compared to BMI of ≥30 kg/m^2 (obese classes 1-3) was undertaken. BMI does affect revision rates, with obese patients at higher risk (Table A19 and Figure A11).

Table A16 Cumulative Percent Revision of Primary Total Ankle Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	37	366	3.3 (1.8, 5.8)	8.0 (5.4, 11.7)	10.5 (7.3, 14.8)	11.6 (8.2, 16.4)	14.5 (10.4, 20.0)	
55-64	171	1406	2.1 (1.5, 3.1)	6.0 (4.8, 7.6)	9.8 (8.1, 11.9)	13.2 (11.1, 15.8)	19.1 (16.3, 22.4)	25.6 (21.9, 29.8)
65-74	143	2185	1.5 (1.1, 2.2)	4.5 (3.6, 5.5)	6.6 (5.4, 8.0)	8.3 (6.9, 10.0)	11.8 (9.8, 14.1)	14.1 (11.6, 17.1)
≥75	49	1122	1.8 (1.2, 2.8)	4.0 (2.9, 5.6)	5.3 (3.9, 7.2)	5.9 (4.3, 7.9)	7.2 (5.2, 9.9)	
TOTAL	400	5079						

Figure A8 Cumulative Percent Revision of Primary Total Ankle Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

<55 vs ≥75

Entire Period: HR=2.00 (95% CI 1.30, 3.07), p=0.001

55-64 vs ≥75

0 - 3Mth: HR=0.74 (95% CI 0.31, 1.80), p=0.508

3Mth - 9Mth: HR=2.69 (95% CI 1.34, 5.38), p=0.005

9Mth - 2Yr: HR=1.70 (95% CI 1.01, 2.86), p=0.044

2Yr - 8.5Yr: HR=2.68 (95% CI 1.81, 3.97), p<0.001

8.5Yr+: HR=4.60 (95% CI 2.52, 8.39), p<0.001

65-74 vs ≥75

0 - 3Mth: HR=0.53 (95% CI 0.23, 1.26), p=0.150

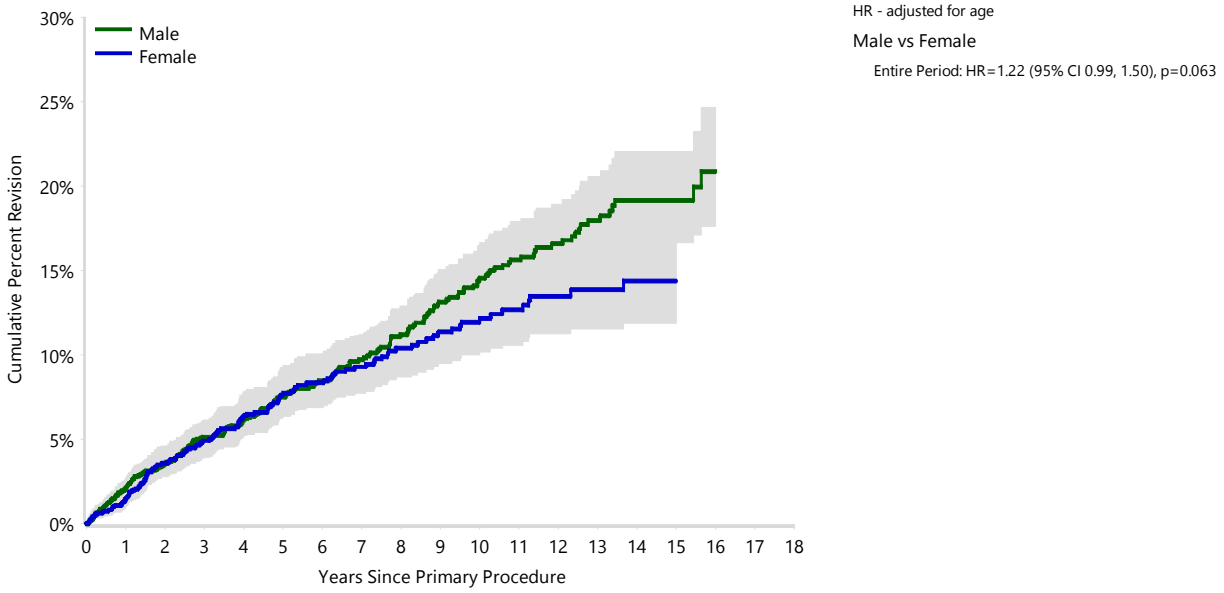
3Mth+: HR=1.54 (95% CI 1.10, 2.17), p=0.013

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	366	303	218	164	130	101	33
55-64	1406	1195	871	608	495	338	85
65-74	2185	1850	1290	882	629	395	64
≥75	1122	919	616	420	281	143	17

Table A17 Cumulative Percent Revision of Primary Total Ankle Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	263	3227	2.1 (1.6, 2.7)	5.1 (4.4, 6.1)	7.5 (6.5, 8.7)	9.7 (8.4, 11.2)	14.5 (12.7, 16.6)	19.2 (16.6, 22.0)
Female	137	1852	1.5 (1.0, 2.2)	4.9 (3.9, 6.2)	7.6 (6.3, 9.2)	9.3 (7.7, 11.2)	12.0 (10.0, 14.3)	14.4 (11.9, 17.3)
TOTAL	**400**	**5079**						

Figure A9 Cumulative Percent Revision of Primary Total Ankle Replacement by Gender (Primary Diagnosis OA)

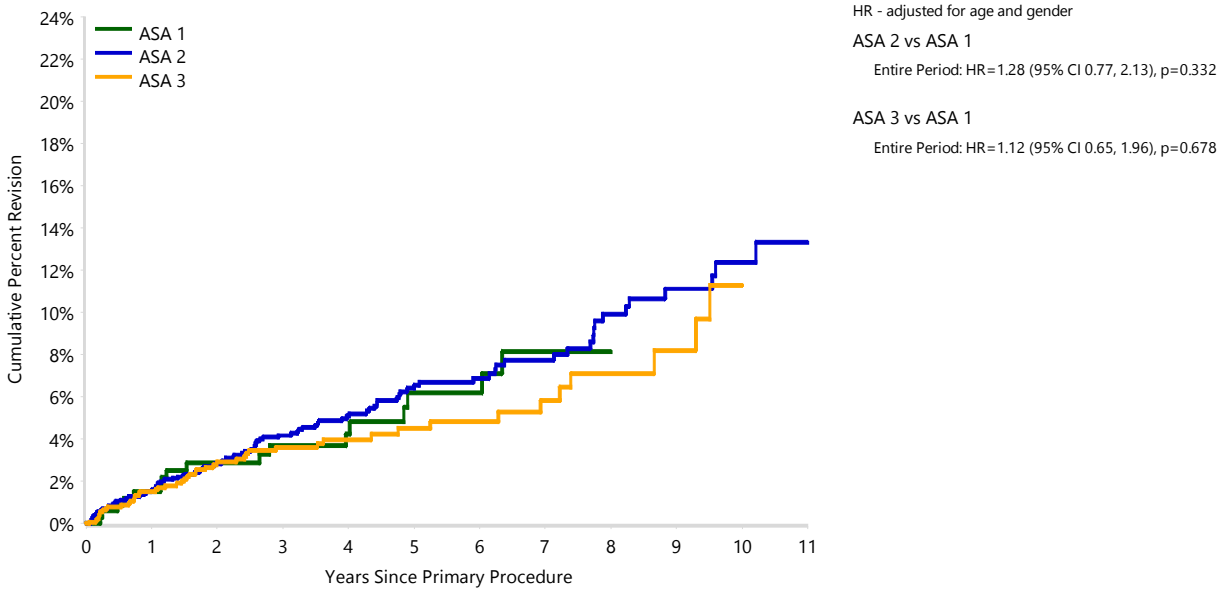


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	3227	2695	1867	1271	924	584	120
Female	1852	1572	1128	803	611	393	79

Table A18 Cumulative Percent Revision of Primary Total Ankle Replacement by ASA Score (Primary Diagnosis OA)

ASA Score	N Revised	N Total	1 Yr	2 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs
ASA 1	18	350	1.5 (0.6, 3.6)	2.9 (1.5, 5.4)	3.7 (2.1, 6.6)	6.2 (3.7, 10.4)	8.1 (4.9, 13.4)	
ASA 2	108	2186	1.6 (1.1, 2.2)	2.8 (2.1, 3.7)	4.2 (3.3, 5.3)	6.4 (5.1, 7.9)	7.7 (6.2, 9.6)	12.4 (9.6, 15.9)
ASA 3	49	1317	1.5 (0.9, 2.4)	2.9 (2.0, 4.1)	3.6 (2.6, 5.0)	4.5 (3.2, 6.2)	5.8 (4.1, 8.3)	11.3 (7.0, 18.0)
ASA 4	0	35	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	
TOTAL	**175**	**3888**						

Figure A10 Cumulative Percent Revision of Primary Total Ankle Replacement by ASA Score (Primary Diagnosis OA)



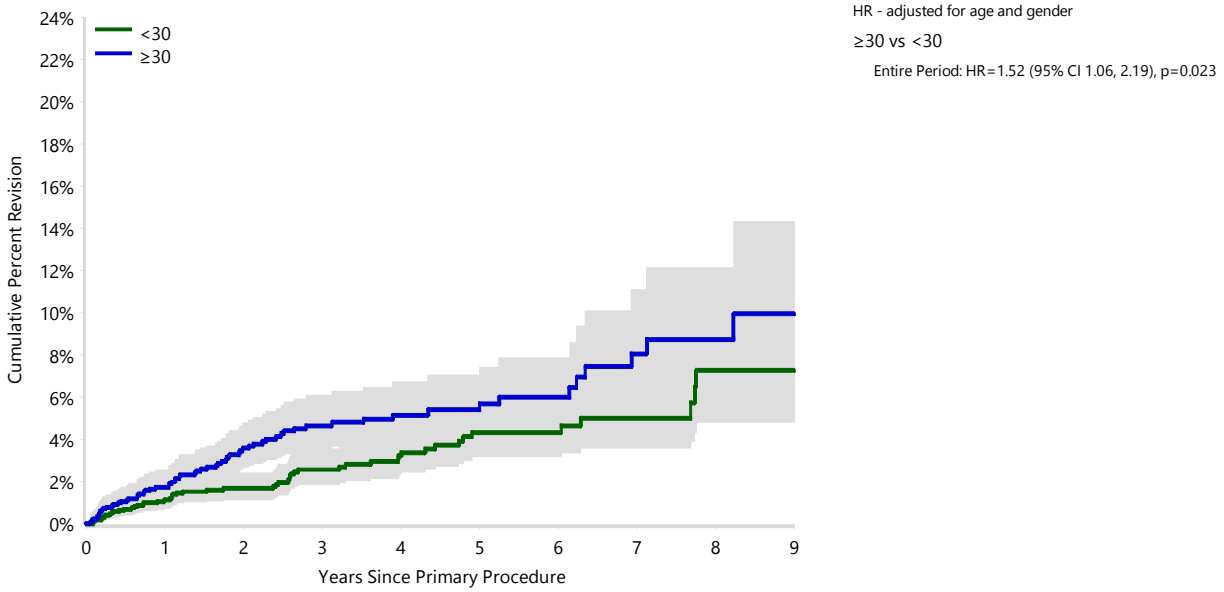
Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs
ASA 1	350	300	257	222	131	79	23
ASA 2	2186	1754	1364	1073	626	358	111
ASA 3	1317	1039	799	615	314	169	42

Table A19 Cumulative Percent Revision of Primary Total Ankle Replacement by BMI Category (Primary Diagnosis OA)

BMI Category	N Revised	N Total	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	7 Yrs
Underweight (<18.50)	0	8	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	
Normal (18.50-24.99)	14	509	1.1 (0.4, 2.6)	1.9 (0.9, 3.7)	3.0 (1.6, 5.5)	3.5 (1.9, 6.2)	4.0 (2.3, 7.1)	5.2 (2.8, 9.4)
Pre Obese (25.00-29.99)	39	1401	1.2 (0.7, 1.9)	1.6 (1.1, 2.5)	2.4 (1.6, 3.6)	3.2 (2.2, 4.6)	4.5 (3.1, 6.5)	5.0 (3.4, 7.3)
Obese Class 1 (30.00-34.99)	44	1091	1.8 (1.1, 2.8)	3.3 (2.3, 4.7)	4.5 (3.2, 6.2)	4.7 (3.4, 6.4)	4.7 (3.4, 6.4)	7.2 (4.8, 10.7)
Obese Class 2 (35.00-39.99)	15	332	1.0 (0.3, 3.2)	3.8 (2.0, 7.2)	4.9 (2.7, 8.8)	6.7 (3.8, 11.5)	6.7 (3.8, 11.5)	
Obese Class 3 (≥40.00)	7	147	3.2 (1.2, 8.3)	5.2 (2.4, 11.4)	5.2 (2.4, 11.4)			
TOTAL	**119**	**3488**						

Note: BMI has not been presented for patients aged ≤19 years

Figure A11 Cumulative Percent Revision of Primary Total Ankle Replacement by BMI Category (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	7 Yrs
<30	1918	1532	1166	896	644	441	191
≥30	1570	1207	909	684	477	332	145

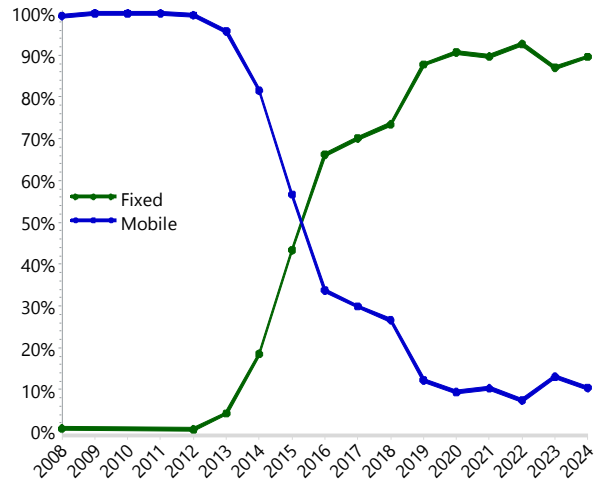
Note: BMI has not been presented for patients aged ≤19 years

PROSTHESIS CHARACTERISTICS

Insert Mobility

Inserts used in primary ankle replacement may be either fixed or mobile. There has been a major change in the type of insert chosen during the last decade. Fixed inserts are now more common for primary total ankle replacements (Figure A12).

Figure A12 Primary Total Ankle Replacement by Mobility (Primary Diagnosis OA)



Fixed inserts are used in the majority of primary total ankle replacements (61.7%). Total ankle replacements with fixed inserts have a lower rate of revision compared to mobile inserts (Table A20 and Figure A13).

Fixation

It is not possible to assess the comparative revision rate of cement and cementless fixation as almost all procedures (98%) use cementless fixation for both the tibial and talar components (Table A21).

Approximately 44% of cementless prostheses have an HA coating. Prostheses with an HA coating have a higher rate of revision compared to prostheses without HA (Table A22 and Table A14). However, there is no difference in revision rate for either fixed or mobile bearing prostheses when those with and without HA coating are compared (Table A23 and Figure A15).

Image Derived Instrumentation (IDI)

IDI has been used in 1,867 primary total ankle replacement procedures since 2015 (Figure A16). There is no difference in the rate of revision when primary total ankle replacement procedures using IDI are compared to procedures without IDI use (Table A24 and Figure A17). However, the results should be interpreted with caution as IDI is used with a limited number of primary total ankle prostheses.

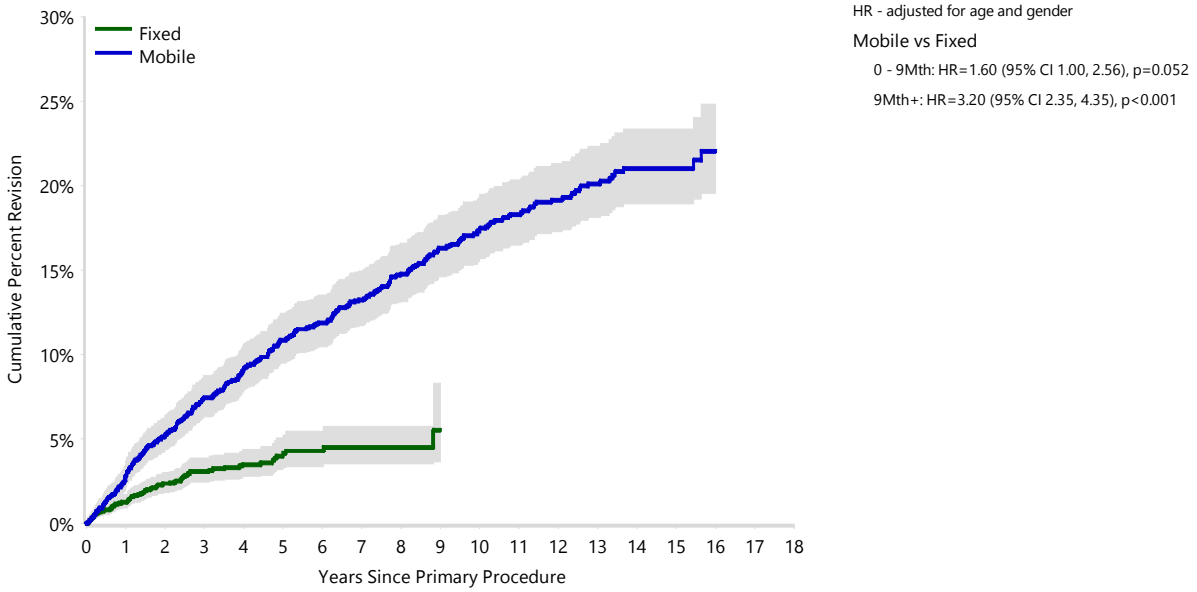
POLYETHYLENE TYPE

After 2022, there has been a precipitous reduction in the use of non-highly cross-linked polyethylene (non-XLPE) as a tibial insert surface compared to highly crosslinked polyethylene (XLPE) (Figure A18). In total, there are 2,301 primary total ankle replacements with non-XLPE and 1,511 with XLPE. There is an increased risk of revision of primary total ankle replacements utilising non-XLPE compared to implants with XLPE (Table A25 and Figure A19).

Table A20 Cumulative Percent Revision of Primary Total Ankle Replacement by Mobility (Primary Diagnosis OA)

Mobility	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	86	3106	1.3 (0.9, 1.7)	3.1 (2.4, 3.9)	4.0 (3.2, 5.1)	4.5 (3.5, 5.8)		
Mobile	314	1931	2.8 (2.1, 3.6)	7.4 (6.3, 8.7)	10.9 (9.5, 12.4)	13.3 (11.7, 15.0)	17.4 (15.6, 19.4)	21.0 (18.9, 23.4)
TOTAL	**400**	**5037**						

Figure A13 Cumulative Percent Revision of Primary Total Ankle Replacement by Mobility (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	3106	2463	1420	669	294	28	2
Mobile	1931	1801	1575	1405	1241	949	197

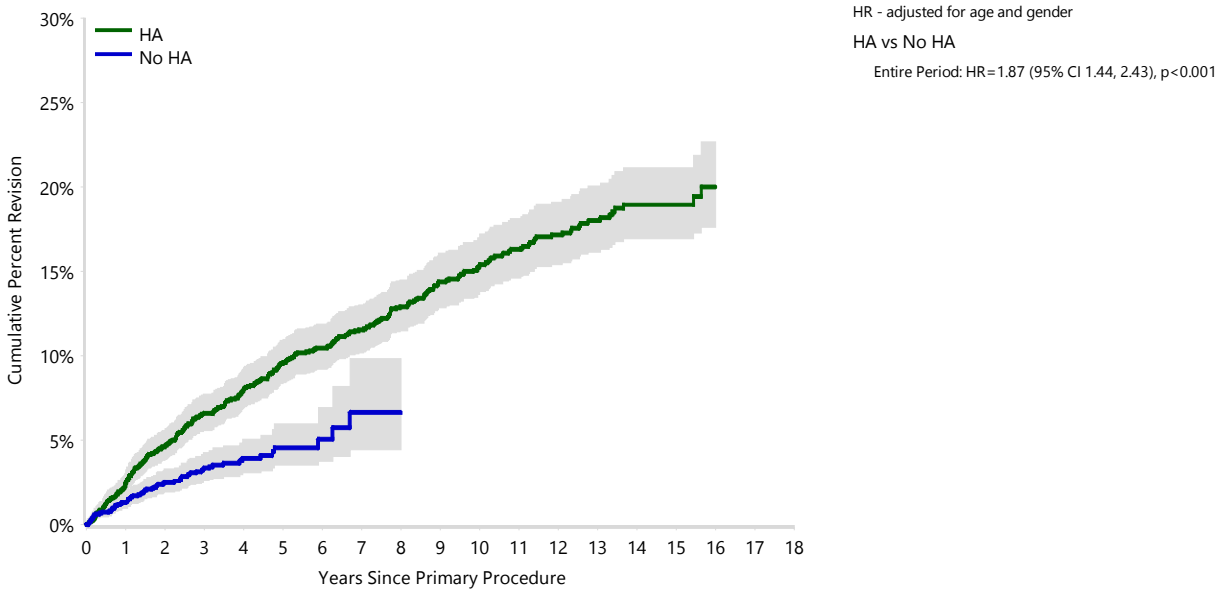
Table A21 Cumulative Percent Revision of Primary Total Ankle Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	1	35	2.9 (0.4, 19.1)	2.9 (0.4, 19.1)	2.9 (0.4, 19.1)	2.9 (0.4, 19.1)	2.9 (0.4, 19.1)	
Cementless	395	4985	1.9 (1.5, 2.3)	5.1 (4.4, 5.8)	7.6 (6.8, 8.6)	9.6 (8.6, 10.7)	13.6 (12.2, 15.1)	17.4 (15.5, 19.5)
Hybrid (Tibial Cemented)	1	27	4.2 (0.6, 26.1)	4.2 (0.6, 26.1)	4.2 (0.6, 26.1)			
Hybrid (Talus Cemented)	3	32	0.0 (0.0, 0.0)	6.9 (1.8, 25.0)	6.9 (1.8, 25.0)	17.3 (4.9, 51.1)		
TOTAL	**400**	**5079**						

Table A22 Cumulative Percent Revision of Cementless Primary Total Ankle Replacement by Surface Coating (Primary Diagnosis OA)

Coating	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
HA	314	2181	2.5 (1.9, 3.2)	6.6 (5.6, 7.7)	9.5 (8.3, 10.9)	11.5 (10.2, 13.0)	15.3 (13.7, 17.1)	19.0 (17.0, 21.2)
No HA	81	2803	1.3 (1.0, 1.9)	3.3 (2.6, 4.3)	4.6 (3.5, 6.0)	6.6 (4.4, 9.8)		
TOTAL	**395**	**4984**						

Figure A14 Cumulative Percent Revision of Cementless Primary Total Ankle Replacement by Surface Coating (Primary Diagnosis OA)

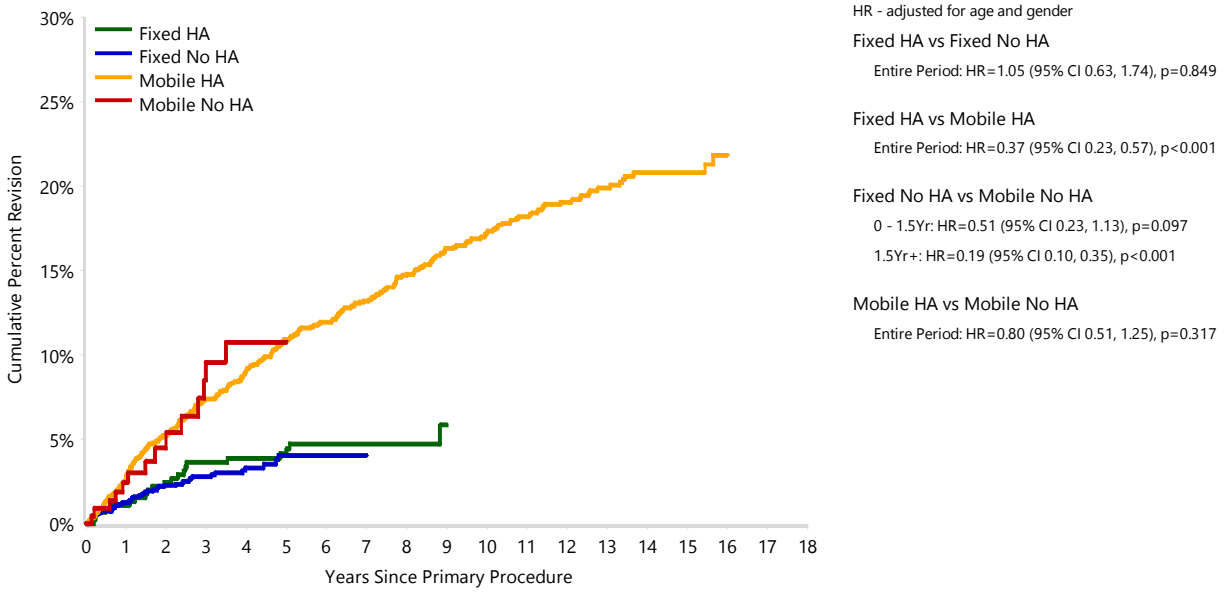


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
HA	2181	2061	1883	1680	1426	949	196
No HA	2803	2127	1049	364	90	19	0

Table A23 Cumulative Percent Revision of Cementless Primary Total Ankle Replacement by Mobility and Surface Coating (Primary Diagnosis OA)

Mobility	Coating	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	HA	21	450	1.1 (0.5, 2.7)	3.6 (2.2, 5.9)	4.2 (2.6, 6.6)	4.7 (3.1, 7.3)		
	No HA	60	2573	1.2 (0.9, 1.8)	2.8 (2.1, 3.7)	4.1 (3.0, 5.5)	4.1 (3.0, 5.5)		
Mobile	HA	293	1691	2.9 (2.2, 3.8)	7.4 (6.2, 8.8)	10.9 (9.5, 12.6)	13.2 (11.6, 15.0)	17.2 (15.4, 19.3)	20.8 (18.6, 23.2)
	No HA	21	230	2.4 (1.0, 5.8)	9.6 (5.5, 16.4)	10.8 (6.3, 18.1)			
TOTAL		**395**	**4944**						

Figure A15 Cumulative Percent Revision of Cementless Primary Total Ankle Replacement by Mobility and Surface Coating (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	HA	450	440	401	337	225	26	1
	No HA	2573	1955	965	311	58	0	0
Mobile	HA	1691	1619	1482	1343	1201	923	195
	No HA	230	172	84	53	32	19	0

Figure A16 Primary Total Ankle Replacement by IDI Usage (Primary Diagnosis OA)

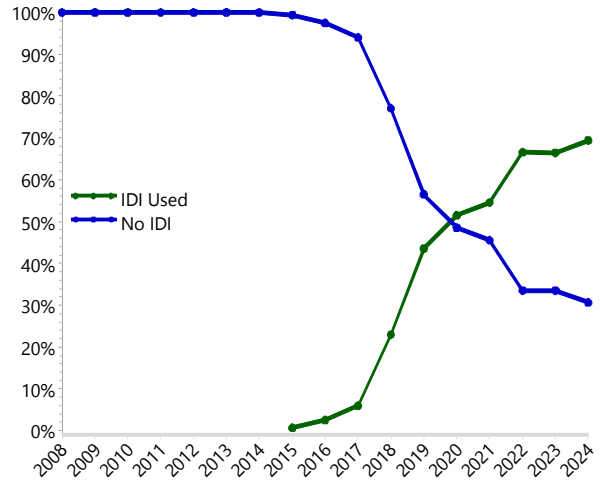
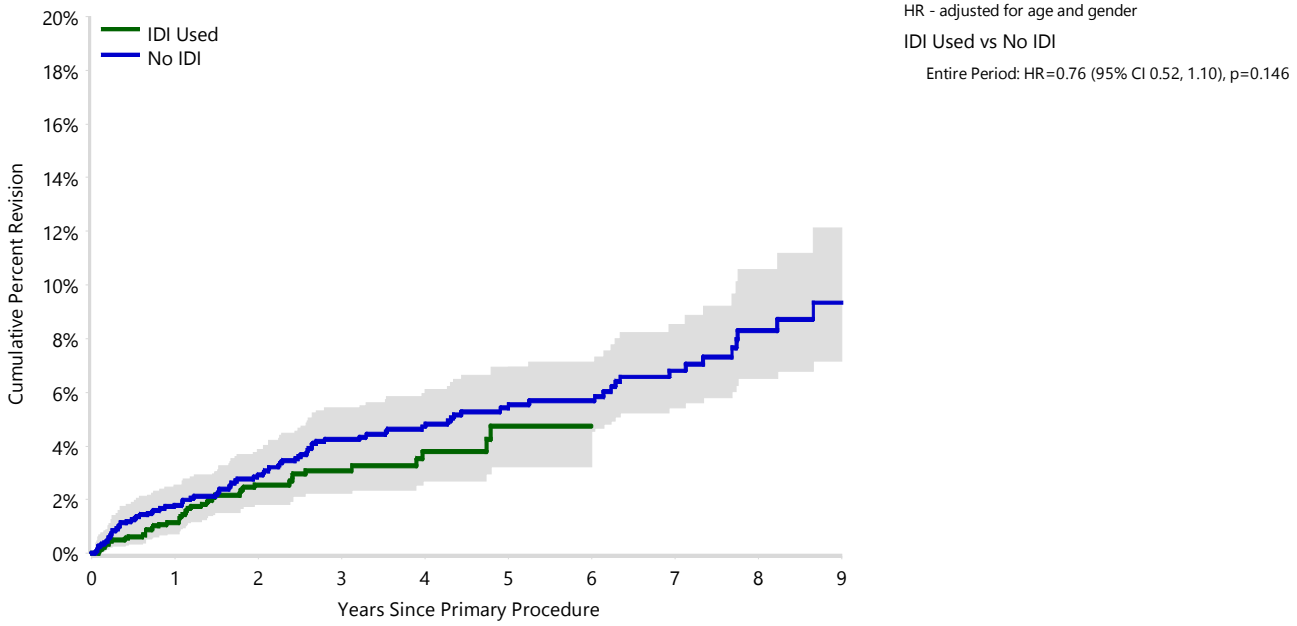


Table A24 Cumulative Percent Revision of Primary Total Ankle Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)

IDI Usage	N Revised	N Total	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	8 Yrs
IDI Used	45	1876	1.2 (0.7, 1.8)	2.6 (1.8, 3.6)	3.1 (2.2, 4.2)	3.8 (2.7, 5.3)	4.7 (3.2, 6.9)	
No IDI	90	1791	1.8 (1.3, 2.6)	2.9 (2.2, 3.9)	4.2 (3.3, 5.4)	4.7 (3.7, 6.0)	5.4 (4.3, 6.8)	8.3 (6.5, 10.6)
TOTAL	**135**	**3667**						

Figure A17 Cumulative Percent Revision of Primary Total Ankle Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	8 Yrs
IDI Used	1876	1361	921	598	348	165	4
No IDI	1791	1544	1307	1123	903	719	238

Figure A18 Primary Total Ankle Replacement by Polyethylene Type (Primary Diagnosis OA) by Polyethylene Type

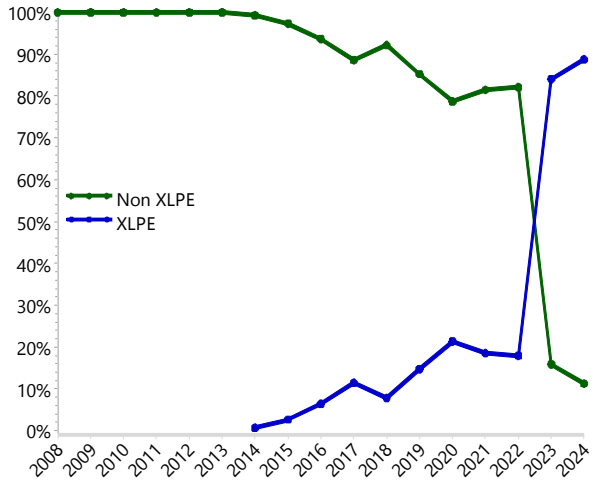
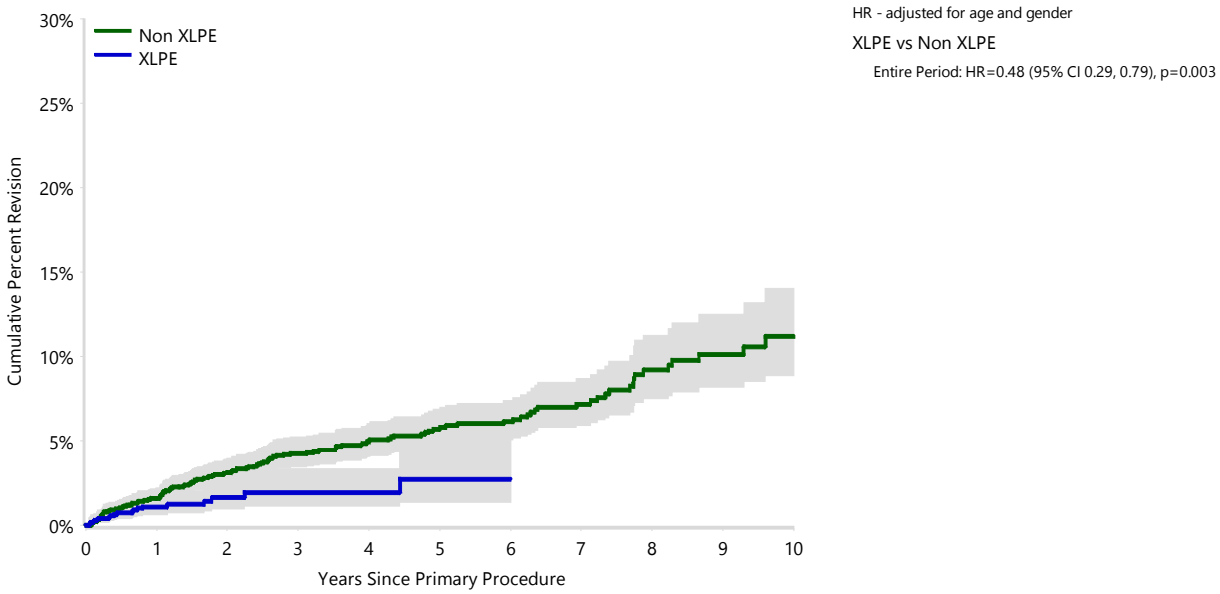


Table A25 Cumulative Percent Revision of Primary Total Ankle Replacement Since 2014 by Polyethylene Type (Primary Diagnosis OA)

Polyethylene Type	N Revised	N Total	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	8 Yrs
Non XLPE	134	2301	1.6 (1.2, 2.2)	3.2 (2.5, 4.0)	4.3 (3.5, 5.2)	5.0 (4.1, 6.0)	5.7 (4.7, 6.9)	9.2 (7.5, 11.3)
XLPE	19	1511	1.1 (0.7, 1.9)	1.6 (1.0, 2.8)	2.0 (1.1, 3.3)	2.0 (1.1, 3.3)	2.8 (1.4, 5.4)	
TOTAL	**153**	**3812**						

Figure A19 Cumulative Percent Revision of Primary Total Ankle Replacement Since 2014 by Polyethylene Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	8 Yrs
Non XLPE	2301	2174	2025	1606	1222	930	344
XLPE	1511	874	343	254	165	86	14

DEMOGRAPHICS OF ALL 1ST REVISIONS

This report analyses 819 revisions of ankle replacements with a procedure date up to and including 31 December 2024. This is an additional 71 procedures compared to the previous report.

TYPE OF REVISION

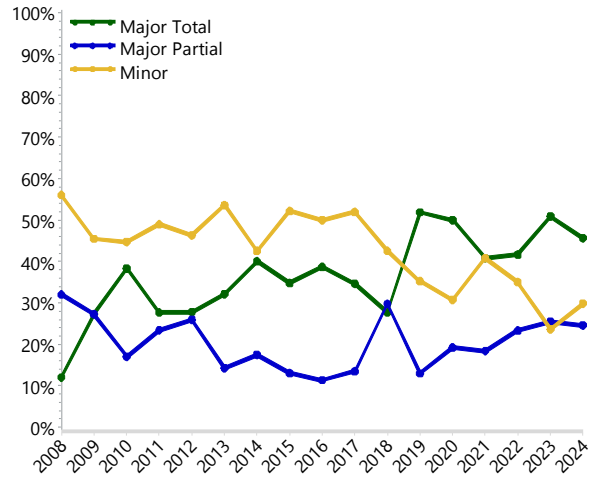
The majority of all revisions recorded by the Registry are major revisions (57.8%) (Table A26).

The proportion of revisions that are major total, major partial and minor revisions has changed since 2008. In 2008, 32.0% of ankle revisions performed were major partial revisions, and this has decreased to 24.6%. The proportion of minor revisions has also decreased over this time. The proportion of major total revisions has increased, from 12.0% of revisions performed in 2008 to 45.6% of revisions performed in 2024 (Figure A20).

REASON FOR REVISION

Overall, the most common reasons for revision are loosening (34.8%), infection (13.6%), implant breakage of the ankle insert (10.5%), and lysis (8.7%) (Table A27).

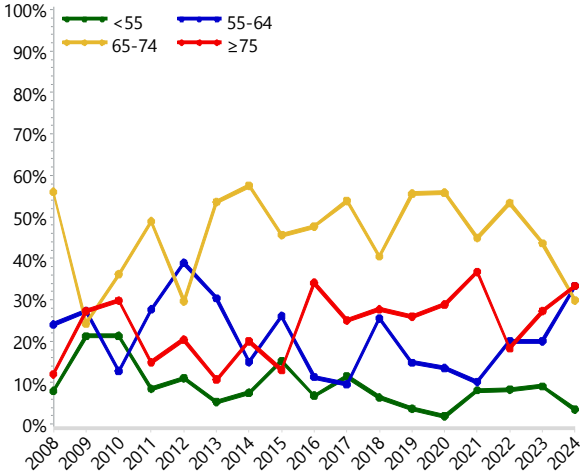
Figure A20 Revision Ankle Replacement by Class



AGE AND GENDER

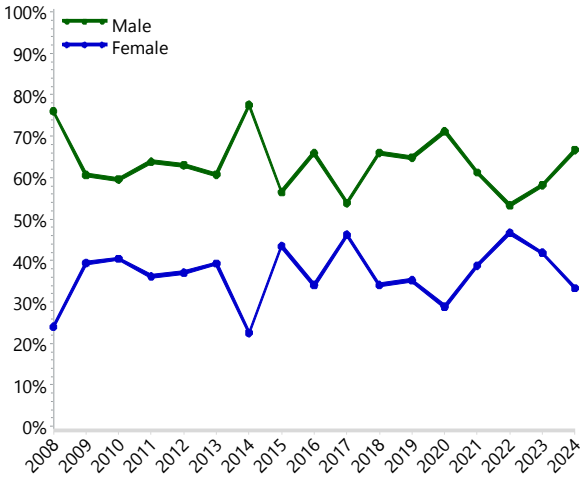
Compared to 2008, 2024 has seen an increase in the proportion of revision procedures in patients aged ≥75 years and a decrease in the proportion of procedures in patients aged 65-74 years (Figure A21).

Figure A21 Revision Ankle Replacement by Age



Revision ankle replacement is more common in males (62.8%). There has been a decrease in the proportion of males undergoing revisions since 2008 (Figure A22).

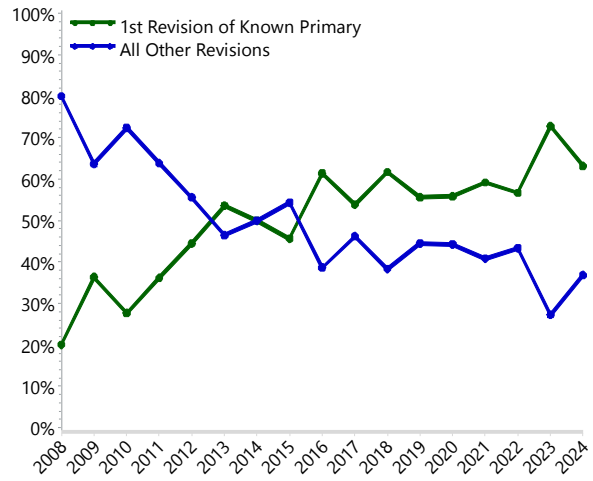
Figure A22 Revision Ankle Replacement by Gender



DEMOGRAPHICS OF 1ST REVISIONS OF KNOWN PRIMARY PROCEDURES

There have been 424 1st revision procedures where the primary procedure has been recorded by the Registry. This includes revisions of all known primary total ankle replacements (Figure A23).

Figure A23 Ankle 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 slightly smaller proportion of major revisions (53.5%) compared to the all revisions group (57.9%). There are less arthrodesis, tibial/talar and, but more tibial only and insert only revisions (Table A26).

There are a higher proportion of minor revisions in the 1st revisions of known primary procedures group (46.5%) compared to the all revisions group (42.1%) (Table A27).

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 (33.0% compared to 34.8%). There is a smaller proportion of implant breakage ankle insert in the 1st revisions group (9.0%) compared to the all revisions group (10.5%). Other diagnoses such as infection, lysis, instability and pain are slightly higher in the 1st revisions of known primary procedures group (Table A27).

Table A26 Revision Ankle Replacement by Type of Revision

Type of Revision	1st Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Tibial/Talar	82	19.3	175	21.4
Arthrodesis	49	11.6	134	16.4
N Major Total	**131**	**30.9**	**309**	**37.7**
Tibial Only	39	9.2	49	6.0
Talar Only	30	7.1	55	6.7
Cement Spacer	20	4.7	40	4.9
Removal of Prostheses	7	1.7	21	2.6
N Major Partial	**96**	**22.6**	**165**	**20.1**
Insert Only	190	44.8	333	40.7
Minor Components	7	1.7	12	1.5
N Minor	**197**	**46.5**	**345**	**42.1**
TOTAL	**424**	**100.0**	**819**	**100.0**

Table A27 Revision Ankle Replacement by Reason for Revision

Reason for Revision	1st Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Loosening	140	33.0	285	34.8
Infection	61	14.4	111	13.6
Lysis	40	9.4	71	8.7
Implant Breakage Ankle Insert	38	9.0	86	10.5
Instability	34	8.0	60	7.3
Pain	22	5.2	41	5.0
Impingement	21	5.0	45	5.5
Fracture	17	4.0	23	2.8
Prosthesis Dissociation	11	2.6	20	2.4
Arthrofibrosis	7	1.7	13	1.6
Malalignment	7	1.7	11	1.3
Wear Ankle Insert	6	1.4	11	1.3
Heterotopic Bone	5	1.2	7	0.9
Synovitis	3	0.7	3	0.4
Implant Breakage Tibial	2	0.5	2	0.2
Incorrect Sizing	2	0.5	2	0.2
Metal Related Pathology	1	0.2	1	0.1
Osteonecrosis	1	0.2	3	0.4
Progression Of Disease	1	0.2	1	0.1
Tumour	1	0.2	2	0.2
Avascular Talus			1	0.1
Cysts			1	0.1
Fusion/Arthrodesis			1	0.1
Malposition			1	0.1
Prosthesis Dislocation			1	0.1
Valgus Deformity			1	0.1
Other	4	0.9	15	1.8
TOTAL	**424**	**100.0**	**819**	**100.0**

OUTCOME OF 1ST REVISION OF KNOWN PRIMARY ANKLE REPLACEMENT

This analysis reports the outcome of the 1st revision of a known primary total ankle replacement.

There are 283 1st revisions of primary total ankle replacements undertaken for osteoarthritis, excluding all procedures with a 1st revision for infection or where no tibial or talar components have been inserted.

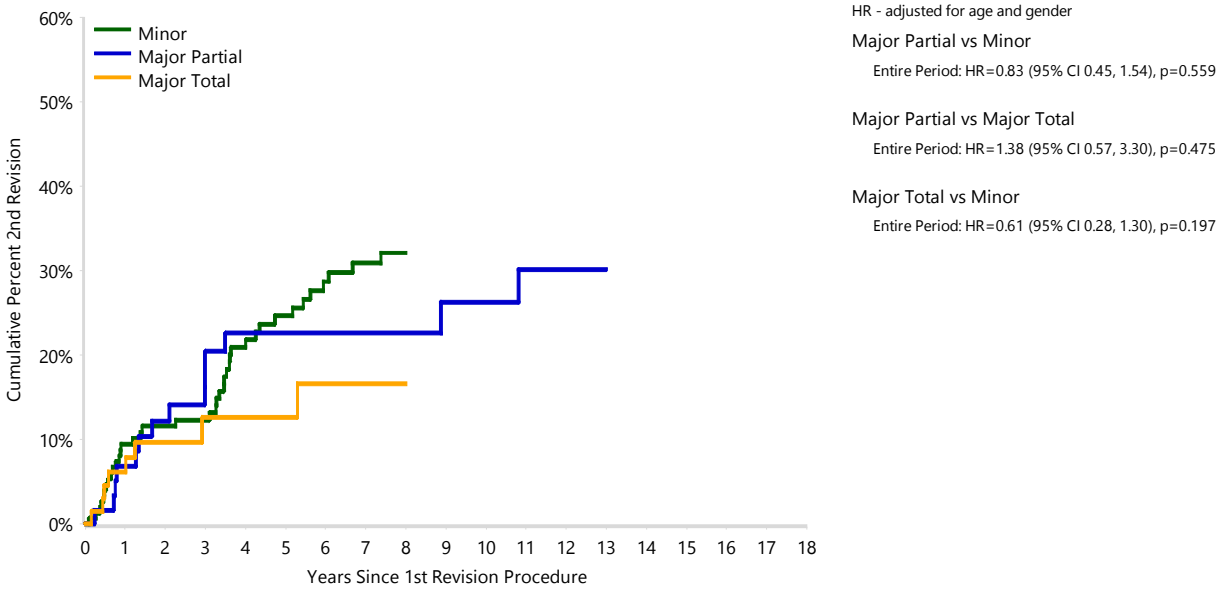
There is no difference in the rate of 2nd revision when the classes of 1st revision are compared (Table A28 and Figure A24).

Table A28 Cumulative Percent 2nd Revision of Known Primary Total Ankle 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	7 Yrs	10 Yrs	15 Yrs
Minor	39	152	9.5 (5.7, 15.4)	12.3 (8.0, 18.9)	24.6 (18.0, 33.2)	30.9 (23.3, 40.2)		
Major Partial	14	61	6.8 (2.6, 17.2)	20.4 (11.8, 34.0)	22.6 (13.4, 36.5)	22.6 (13.4, 36.5)	26.3 (15.8, 41.8)	
Major Total	8	70	6.2 (2.4, 15.6)	12.6 (6.0, 25.4)	12.6 (6.0, 25.4)	16.6 (8.1, 32.3)		
TOTAL	**61**	**283**						

Note: Excluding revisions where no minor or major tibial/talar components have been inserted

Figure A24 Cumulative Percent 2nd Revision of Known Primary Total Ankle 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	7 Yrs	10 Yrs	15 Yrs
Minor	152	131	105	76	59	25	2
Major Partial	61	52	38	33	25	20	2
Major Total	70	55	29	23	14	5	0