

Columbus/Columbus Total Knee Investigation

Note: This analysis compares the Columbus/Columbus femoral/tibial combination with all other total knee prostheses.

This combination has been identified as having a significantly higher rate of revision. For a detailed explanation of the process used by the Registry that results in identification of prostheses that have a higher than anticipated rate of revision please refer to the Prostheses with Higher than Anticipated Rates of Revision chapter of the most recent AOANJRR Annual Report, <https://aoanjrr.sahmri.com/annual-reports-2022>.

Note: Procedures using prostheses with no recorded use in 2021 are excluded from the comparator.

TABLE 1

Revision Rate of Primary Total Knee Replacement

The revision rate of the Columbus/Columbus total knee combination is compared to all other total knee prostheses.

Table 1: Revision Rates of Primary Total Knee Replacement

Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Columbus/Columbus	168	5251	18863	0.89 (0.76, 1.04)
Other Total Knee	25893	722444	4710261	0.55 (0.54, 0.56)
TOTAL	26061	727695	4729125	0.55 (0.54, 0.56)

Note: Prostheses no longer used in 2021 are excluded from the comparator.

TABLE 2

Yearly Cumulative Percent Revision of Primary Total Knee Replacement

The yearly cumulative percent revision of the Columbus/Columbus total knee combination is compared to all other total knee prostheses.

Table 2: Yearly Cumulative Percent Revision of Primary Total Knee Replacement

CPR	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs
Columbus/Columbus	1.2 (0.9, 1.5)	2.2 (1.8, 2.7)	3.3 (2.8, 4.0)	3.8 (3.2, 4.6)	4.4 (3.7, 5.3)	5.2 (4.3, 6.3)	5.8 (4.8, 7.0)
Other Total Knee	1.0 (1.0, 1.0)	1.9 (1.9, 1.9)	2.5 (2.4, 2.5)	2.9 (2.9, 2.9)	3.2 (3.2, 3.3)	3.6 (3.5, 3.6)	3.9 (3.8, 3.9)

CPR	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs
Columbus/Columbus	6.3 (5.2, 7.6)	6.7 (5.5, 8.1)	7.3 (6.0, 8.8)	7.5 (6.2, 9.1)	7.7 (6.4, 9.4)	8.2 (6.6, 10.0)	9.5 (7.3, 12.3)
Other Total Knee	4.2 (4.1, 4.2)	4.5 (4.4, 4.5)	4.8 (4.7, 4.8)	5.1 (5.0, 5.1)	5.4 (5.3, 5.5)	5.7 (5.6, 5.8)	6.0 (5.9, 6.1)

CPR	15 Yrs	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs
Columbus/Columbus	9.5 (7.3, 12.3)						
Other Total Knee	6.4 (6.3, 6.5)	6.9 (6.7, 7.0)	7.3 (7.1, 7.4)	7.6 (7.4, 7.8)	7.9 (7.7, 8.1)	8.2 (7.9, 8.4)	8.2 (7.9, 8.5)

Note: Prostheses no longer used in 2021 are excluded from the comparator.

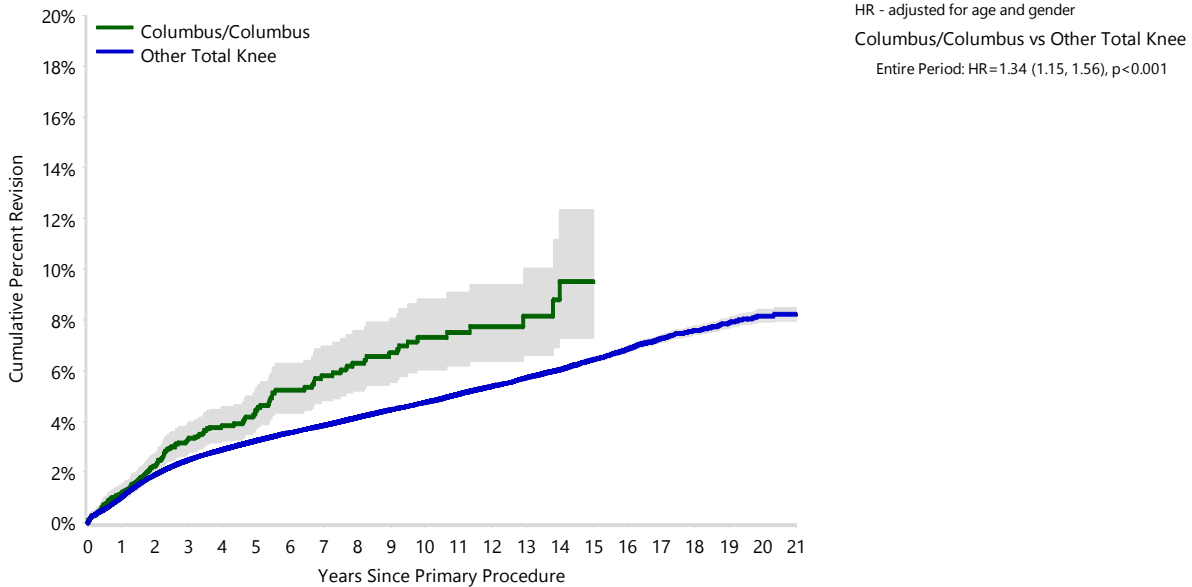
FIGURE 1

Yearly Cumulative Percent Revision of Primary Total Knee Replacement

The yearly cumulative percent revision of the Columbus/Columbus total knee combination is compared to all other total knee prostheses. In addition, hazard ratios are reported.

Hazard ratios are reported for specific time periods during which the hazard ratio is constant. This is done to enable more specific and valid comparisons of the risk of revision over time. The pattern of variation in risk has important implications with respect to the underlying reasons for any difference.

Figure 1: Cumulative Percent Revision of Primary Total Knee Replacement



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs
Columbus/Columbus	5251	4100	2951	2082	1397	1041	883	795	740	656	549
Other Total Knee	722444	653428	589809	525137	462644	402650	346249	292973	245012	201993	162953

Number at Risk	11 Yrs	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs
Columbus/Columbus	425	311	217	126	74	28	0	0	0	0	0
Other Total Knee	128418	98798	75310	56355	41586	29573	19593	11953	6490	2687	605

Note: Prostheses no longer used in 2021 are excluded from the comparator.

TABLE 3**Primary Diagnosis for Revised Primary Total Knee Replacement**

This table identifies the diagnosis of the primary procedure which was subsequently revised. This information is provided as there is a variation on outcome depending on the primary diagnosis. It is therefore important when considering the reasons for a higher than anticipated rate of revision that there is identification of the primary diagnosis. This information should be compared to the primary diagnosis for the revisions of all other total knee prostheses.

Table 3: Primary Diagnosis for Revised Primary Total Knee Replacement

Primary Diagnosis	Columbus/Columbus		Other Total Knee	
	Number	Percent	Number	Percent
Osteoarthritis	165	98.2	25086	96.9
Rheumatoid Arthritis			331	1.3
Other Inflammatory Arthritis	2	1.2	159	0.6
Tumour			151	0.6
Osteonecrosis	1	0.6	97	0.4
Fracture			49	0.2
Other			19	0.1
Chondrocalcinosis			1	0.0
TOTAL	168	100.0	25893	100.0

Note: Prostheses no longer used in 2021 are excluded from the comparator.

TABLE 4

Reasons for Revision

This is reported in two ways: a percentage of primary procedures revised and as a percentage of all revision procedures.

% Primaries Revised: This shows the proportional contribution of each revision diagnosis as a percentage of the total number of primary procedures. This percentage can be used to approximate the risk of being revised for that diagnosis. Differing percentages between groups, with the same distribution of follow up time, may identify problems of concern.

% Revisions: The number of revisions for each diagnosis is expressed as a percentage of the total number of revisions. This shows the distribution of reasons for revision within a group but cannot be used as a comparison between groups.

Table 4: Primary Total Knee Replacement - Reason for Revision (Follow-up Limited to 16.7 Years)

Revision Diagnosis	Columbus/Columbus			Other Total Knee		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Infection	50	1.0	29.8	6912	1.0	26.8
Loosening	25	0.5	14.9	5772	0.8	22.4
Instability	20	0.4	11.9	2458	0.3	9.5
Pain	11	0.2	6.5	2048	0.3	7.9
Patellofemoral Pain	20	0.4	11.9	2026	0.3	7.9
Patella Erosion	12	0.2	7.1	1671	0.2	6.5
Arthrofibrosis	5	0.1	3.0	991	0.1	3.8
Fracture	5	0.1	3.0	928	0.1	3.6
Malalignment	8	0.2	4.8	593	0.1	2.3
Wear Tibial Insert	1	0.0	0.6	354	0.0	1.4
Lysis				338	0.0	1.3
Incorrect Sizing	2	0.0	1.2	256	0.0	1.0
Patella Maltracking				181	0.0	0.7
Bearing Dislocation	1	0.0	0.6	151	0.0	0.6
Implant Breakage Tibial Insert	1	0.0	0.6	147	0.0	0.6
Implant Breakage Patella	1	0.0	0.6	132	0.0	0.5
Metal Related Pathology	1	0.0	0.6	115	0.0	0.4
Prosthesis Dislocation				80	0.0	0.3
Synovitis	2	0.0	1.2	76	0.0	0.3
Osteonecrosis	1	0.0	0.6	57	0.0	0.2
Implant Breakage Tibial				42	0.0	0.2
Implant Breakage Femoral				38	0.0	0.1
Wear Patella				31	0.0	0.1
Tumour	1	0.0	0.6	26	0.0	0.1
Heterotopic Bone				15	0.0	0.1
Wear Tibial				12	0.0	0.0
Progression Of Disease				6	0.0	0.0
Patella Dislocation				2	0.0	0.0
Wear Femoral				2	0.0	0.0
Incorrect Side				1	0.0	0.0
Other	1	0.0	0.6	301	0.0	1.2
N Revision	168	3.2	100.0	25762	3.6	100.0
N Primary	5251			722444		

Note: This table is restricted to revisions within 16.7 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2021 are excluded from the comparator.

FIGURE 2

Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement

This figure details the cumulative incidence of the most common reasons for revision. The five most common reasons for revision are included as long as each of these reasons account for more than 10 procedures or at least 5% of all revisions for the Columbus/Columbus total knee combination. A comparative graph is provided of the cumulative incidence for the same reasons for revisions for all other total knee prostheses.

Figure 2: Cumulative Incidence Revision Diagnosis for Primary Total Knee Replacement

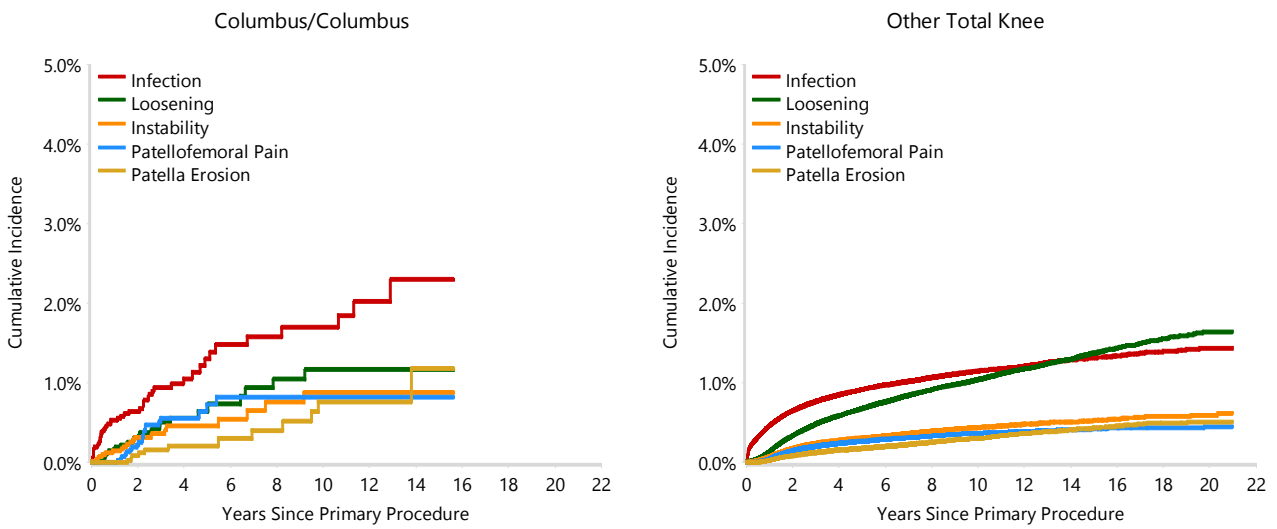


TABLE 5

Type of Revision Performed for Primary Total Knee Replacement

This analysis identifies the components used in the revision of the Columbus/Columbus total knee combination and compares it to the components used in the revision of all other total knee prostheses.

The reason this analysis is undertaken is to identify whether there is one or more components which are being replaced that differ from the components replaced for revisions of all other total knee prostheses i.e. is there a difference in the type of revision undertaken for the Columbus/Columbus total knee combination compared to all other total knee prostheses.

Table 5: Primary Total Knee Replacement - Type of Revision (Follow-up Limited to 16.7 Years)

Type of Revision	Columbus/Columbus		Other Total Knee	
	Number	Percent	Number	Percent
TKR (Tibial/Femoral)	38	22.6	6325	24.6
Tibial Component	10	6.0	2085	8.1
Cement Spacer	8	4.8	1349	5.2
Femoral Component	8	4.8	1303	5.1
Removal of Prostheses			149	0.6
Total Femoral			20	0.1
Reinsertion of Components			11	0.0
N Major	64	38.1	11242	43.6
Insert Only	49	29.2	7049	27.4
Patella Only	40	23.8	4729	18.4
Insert/Patella	14	8.3	2670	10.4
Minor Components	1	0.6	58	0.2
Cement Only			14	0.1
N Minor	104	61.9	14520	56.4
TOTAL	168	100.0	25762	100.0

Note: This table is restricted to revisions within 16.7 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2021 are excluded from the comparator.

TABLE 6**Revision Rates of Columbus/Columbus Primary Total Knee Replacement by Fixation**

This analysis is provided as some prostheses have more than one fixation option. Additionally there are prostheses where an alternative to the recommended approach to fixation was used e.g. a cementless prosthesis that has been cemented or vice-versa.

Table 6: Revised Number of Columbus/Columbus Primary Total Knee Replacement by Fixation

Fixation	N Revised	N Total
Cemented	72	4460
Cementless	66	500
Hybrid (Tibial Cemented)	30	290
Hybrid (Tibial Cementless)	0	1
TOTAL	168	5251

TABLE 7**Revision Rates of Columbus/Columbus Primary Total Knee Replacement by Bearing Surface**

This analysis is provided as some prostheses are combined with a variety of bearing surfaces. All bearing surfaces used with this combination are listed.

Table 7: Revised Number of Columbus/Columbus Primary Total Knee Replacement by Bearing Surface

Bearing Surface	N Revised	N Total
Non XLPE	168	5251
TOTAL	168	5251

TABLE 8**Revision Rates of Columbus/Columbus Primary Total Knee Replacement by Bearing Mobility**

This analysis is provided as some prostheses are combined with a variety of bearing mobilities. All bearing mobilities used with this combination are listed.

Table 8: Revised Number of Columbus/Columbus Primary Total Knee Replacement by Bearing Mobility

Bearing Mobility	N Revised	N Total
Fixed	156	5187
Rotating	12	64
TOTAL	168	5251

TABLE 9**Revision Rates of Columbus/Columbus Primary Total Knee Replacement by Stability**

This analysis is provided as some prostheses are combined with a variety of stabilities. All stabilities used with this combination are listed.

Table 9: Revised Number of Columbus/Columbus Primary Total Knee Replacement by Stability

Stability	N Revised	N Total
Fully Stabilised	0	1
Minimally Stabilised	166	5200
Posterior Stabilised	2	50
TOTAL	168	5251

TABLE 10

Revision Rates of Primary Total Knee Replacement by State

This enables a state by state variation to be identified for the Columbus/Columbus total knee combination and provides the comparative data for each of the states for all other total knee prostheses.

The purpose of this analysis is to determine if the higher than anticipated rate of revision has widespread distribution between states. If there is widespread distribution then the reason for the higher than anticipated rate of revision is unlikely to be surgeon specific. If the prosthesis has been used in only a small number of states it is not possible to distinguish if the higher than anticipated rate of revision is related to the prosthesis, surgeon, technique or patient.

Table 10: Revised Number of Primary Total Knee Replacement by State

Component	State	N Revised	N Total
Columbus/Columbus	NSW	98	1752
	VIC	7	42
	WA	0	16
	SA	26	1819
	TAS	15	511
	ACT/NT	22	1111
	Other Total Knee	NSW	7624
	VIC	5546	144445
	QLD	5690	153171
	WA	3235	77889
	SA	2811	61621
	TAS	403	16374
	ACT/NT	584	17575
TOTAL		26061	727695

Note: Prostheses no longer used in 2021 are excluded from the comparator.

TABLE 11**Number of Revisions of Columbus/Columbus Primary Total Knee Replacement by Year of Implant**

This analysis details the number of prostheses reported each year to the Registry for the Columbus/Columbus total knee combination. It also provides the subsequent number of revisions of the primaries reported in that year.

Primary procedures performed in later years have had less follow up time therefore the number revised is expected to be less than the number revised in earlier years. For example, a primary procedure performed in 2021 has a maximum of one year to be revised, whereas a primary procedure performed in 2019 has a maximum of three years to be revised.

Table 11: Number of Revisions of Columbus/Columbus Primary Total Knee Replacement by Year of Implant

Year of Implant	Number Revised	Total Number
2005	4	49
2006	13	91
2007	12	90
2008	19	148
2009	20	156
2010	11	134
2011	12	136
2012	11	108
2013	3	69
2014	0	36
2015	0	60
2016	4	118
2017	8	358
2018	12	670
2019	13	828
2020	14	1111
2021	12	1089
TOTAL	168	5251

TABLE 12

Revision Rates of Columbus/Columbus Primary Total Knee Replacement by Catalogue Number Range

Many prostheses have a number of catalogue ranges. The catalogue range is specific to particular design features; more than one catalogue range usually indicates a minor difference in design in a particular Columbus/Columbus prosthesis.

This analysis has been undertaken to determine if the revision rate varies according to the catalogue number range.

Model	Catalogue Range	Catalogue Description	Cement
Femoral			
Columbus	NN001K-NN019K	CR CEMENTED FEMORAL COMPONENT	YES
Columbus	NN001Z-NN019Z	AS CR CEMENTED FEMORAL COMPONENT	YES
Columbus	NN021K-NN038K	CR CEMENTLESS FEMORAL COMPONENT	NO
Columbus	NN161K-NN178K	PS CEMENTED FEMORAL COMPONENT	YES
Columbus	NN161Z-NN177Z	AS PS CEMENTED FEMORAL COMPONENT	YES
Columbus	NN800K-NN911K	CR CEMENTED NARROW FEMORAL COMPONENT	YES
Columbus	NN800Z-NN911Z	AS CR CEMENTED NARROW FEMORAL COMPONENT	YES
Columbus	NN820K-NN931K	CR CEMENTLESS FEMORAL COMPONENT	NO
Columbus	NN840K-NN951K	PS CEMENTED NARROW FEMORAL COMPONENT	YES
Columbus	NR001Z-NR017Z	AS REV FEMORAL COMPONENT	YES
Tibial			
Columbus	NN058K-NN079K	CR/PS CEMENTED MODULAR TIBIAL PLATEAU	YES
Columbus	NN058Z-NN079Z	AS CR/PS CEMENTED MODULAR TIBIAL PLATEAU	YES
Columbus	NN081K-NN089K	CR/PS CEMENTLESS MODULAR TIBIAL PLATEAU	NO
Columbus	NN271K-NN279K	RP CEMENTED MODULAR TIBIAL PLATEAU	YES
Columbus	NN271Z-NN279Z	AS RP CEMENTED MODULAR TIBIAL PLATEAU	YES
Columbus	NN281K-NN289K	RP CEMENTLESS MODULAR TIBIAL PLATEAU	NO
Columbus	NR068Z-NR079Z	AS REV TIBIAL COMPONENT	YES

Table 12: Revised Number of Columbus/Columbus Primary Total Knee Replacement by Catalogue Number Range

Femoral Range	Tibial Range	N Revised	N Total
NN001K-NN019K	NN058K-NN079K	6	104
	NN058Z-NN079Z	0	17
	NN271K-NN279K	0	4
NN001Z-NN019Z	NN058Z-NN079Z	32	1699
	NN271Z-NN279Z	0	1
	NR068Z-NR079Z	0	1
NN021K-NN038K	NN058K-NN079K	26	245
	NN081K-NN089K	47	397
	NN271K-NN279K	1	9
	NN281K-NN289K	11	50
NN161K-NN178K	NN058K-NN079K	2	44
	NN058Z-NN079Z	0	1
NN161Z-NN177Z	NN058Z-NN079Z	0	3
NN800K-NN911K	NN058K-NN079K	1	42
NN800Z-NN911Z	NN058Z-NN079Z	31	2538
NN820K-NN931K	NN058K-NN079K	3	36
	NN081K-NN089K	8	56
NN840K-NN951K	NN058K-NN079K	0	3
NR001Z-NR017Z	NR068Z-NR079Z	0	1
TOTAL		168	5251