

## 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-2024>.

Note: Procedures using prostheses with no recorded use in 2023 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	231	7427	30220	0.76 (0.67, 0.87)
Other Total Knee	24700	728656	4657842	0.53 (0.52, 0.54)
<b>TOTAL</b>	<b>24931</b>	<b>736083</b>	<b>4688062</b>	<b>0.53 (0.53, 0.54)</b>

Note: Prostheses no longer used in 2023 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	8 Yrs
Columbus/Columbus	1.1 (0.9, 1.4)	1.9 (1.6, 2.3)	2.7 (2.4, 3.2)	3.2 (2.8, 3.8)	3.8 (3.3, 4.4)	4.3 (3.7, 5.1)	5.0 (4.2, 5.9)	5.4 (4.6, 6.4)
Other Total Knee	1.0 (0.9, 1.0)	1.8 (1.8, 1.8)	2.4 (2.3, 2.4)	2.8 (2.7, 2.8)	3.1 (3.1, 3.1)	3.4 (3.4, 3.5)	3.7 (3.7, 3.8)	4.0 (4.0, 4.1)

CPR	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs
Columbus/Columbus	5.8 (4.9, 6.9)	6.3 (5.3, 7.5)	6.5 (5.4, 7.7)	6.6 (5.5, 7.9)	7.3 (6.0, 8.9)	8.4 (6.7, 10.4)	8.8 (7.0, 11.0)	9.3 (7.3, 11.9)
Other Total Knee	4.3 (4.3, 4.4)	4.6 (4.6, 4.7)	4.9 (4.8, 5.0)	5.2 (5.1, 5.3)	5.5 (5.5, 5.6)	5.8 (5.7, 5.9)	6.2 (6.1, 6.3)	6.6 (6.5, 6.7)

CPR	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs	23 Yrs
Columbus/Columbus	9.3 (7.3, 11.9)						
Other Total Knee	7.0 (6.8, 7.1)	7.3 (7.1, 7.4)	7.5 (7.3, 7.7)	7.7 (7.5, 7.9)	8.0 (7.7, 8.3)	8.2 (7.9, 8.6)	8.2 (7.9, 8.6)

Note: Prostheses no longer used in 2023 are excluded from the comparator.

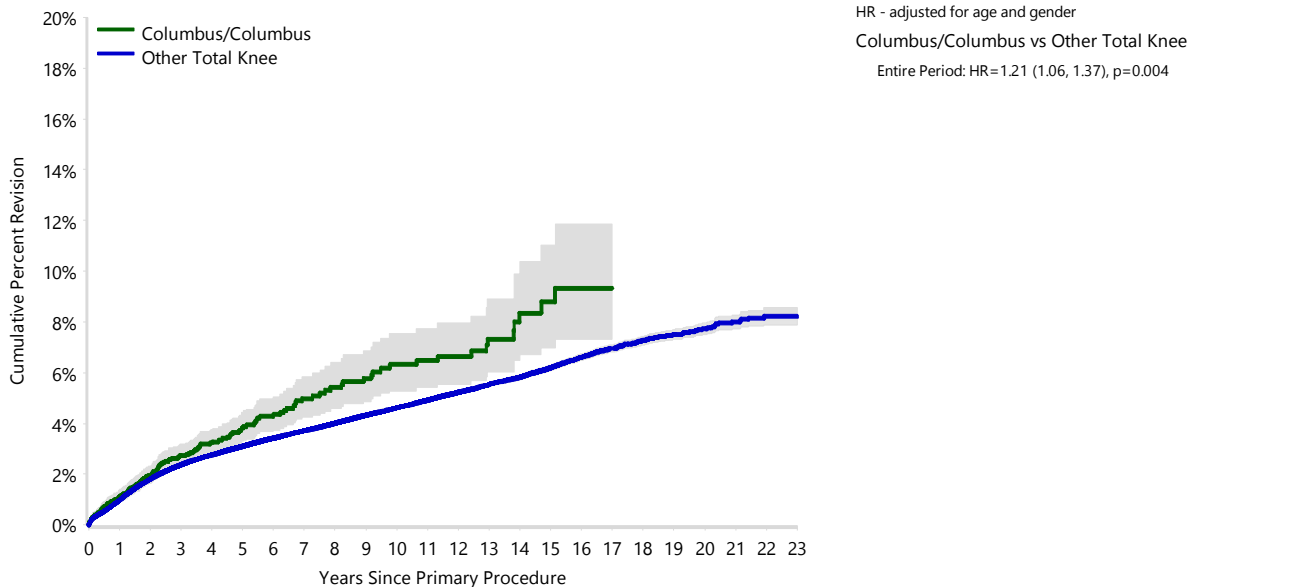
FIGURE 1

**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	11 Yrs
Columbus/Columbus	7427	6250	5117	3955	2824	1998	1321	961	820	737	665	579
Other Total Knee	728656	650222	584593	518813	460226	400402	343377	289586	240778	196070	157762	124865

Number at Risk	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs	23 Yrs
Columbus/Columbus	488	376	260	179	112	66	26	0	0	0	0	0
Other Total Knee	96201	72465	53467	38536	26947	18742	12636	7866	4467	2602	1229	297

Note: Prostheses no longer used in 2023 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	225	97.4	23901	96.8
Rheumatoid Arthritis	1	0.4	312	1.3
Tumour			178	0.7
Other Inflammatory Arthritis	4	1.7	149	0.6
Osteonecrosis	1	0.4	88	0.4
Fracture			48	0.2
Other			23	0.1
Chondrocalcinosis			1	0.0
<b>TOTAL</b>	<b>231</b>	<b>100.0</b>	<b>24700</b>	<b>100.0</b>

Note: Prostheses no longer used in 2023 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 18.7 Years)

Revision Diagnosis	Columbus/Columbus			Other Total Knee		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Infection	80	1.1	34.6	6921	0.9	28.1
Loosening	40	0.5	17.3	5249	0.7	21.3
Instability	28	0.4	12.1	2531	0.3	10.3
Pain	12	0.2	5.2	1820	0.2	7.4
Patella Erosion	13	0.2	5.6	1776	0.2	7.2
Patellofemoral Pain	21	0.3	9.1	1610	0.2	6.5
Arthrofibrosis	6	0.1	2.6	1013	0.1	4.1
Fracture	6	0.1	2.6	983	0.1	4.0
Malalignment	8	0.1	3.5	517	0.1	2.1
Wear Tibial Insert	1	0.0	0.4	340	0.0	1.4
Lysis				281	0.0	1.1
Incorrect Sizing	4	0.1	1.7	225	0.0	0.9
Implant Breakage Tibial Insert	1	0.0	0.4	181	0.0	0.7
Patella Maltracking				180	0.0	0.7
Bearing Dislocation	1	0.0	0.4	139	0.0	0.6
Implant Breakage Patella	1	0.0	0.4	129	0.0	0.5
Metal Related Pathology	1	0.0	0.4	100	0.0	0.4
Prosthesis Dislocation				80	0.0	0.3
Synovitis	3	0.0	1.3	61	0.0	0.2
Osteonecrosis	1	0.0	0.4	49	0.0	0.2
Implant Breakage Femoral				44	0.0	0.2
Wear Patella				42	0.0	0.2
Implant Breakage Tibial				34	0.0	0.1
Tumour	1	0.0	0.4	30	0.0	0.1
Heterotopic Bone				14	0.0	0.1
Progression Of Disease				7	0.0	0.0
Wear Tibial				5	0.0	0.0
Patella Dislocation				2	0.0	0.0
Incorrect Side				1	0.0	0.0
Wear Femoral				1	0.0	0.0
Other	3	0.0	1.3	299	0.0	1.2
<b>N Revision</b>	<b>231</b>	<b>3.1</b>	<b>100.0</b>	<b>24664</b>	<b>3.4</b>	<b>100.0</b>
<b>N Primary</b>	<b>7427</b>			<b>728656</b>		

Note: This table is restricted to revisions within 18.7 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2023 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**

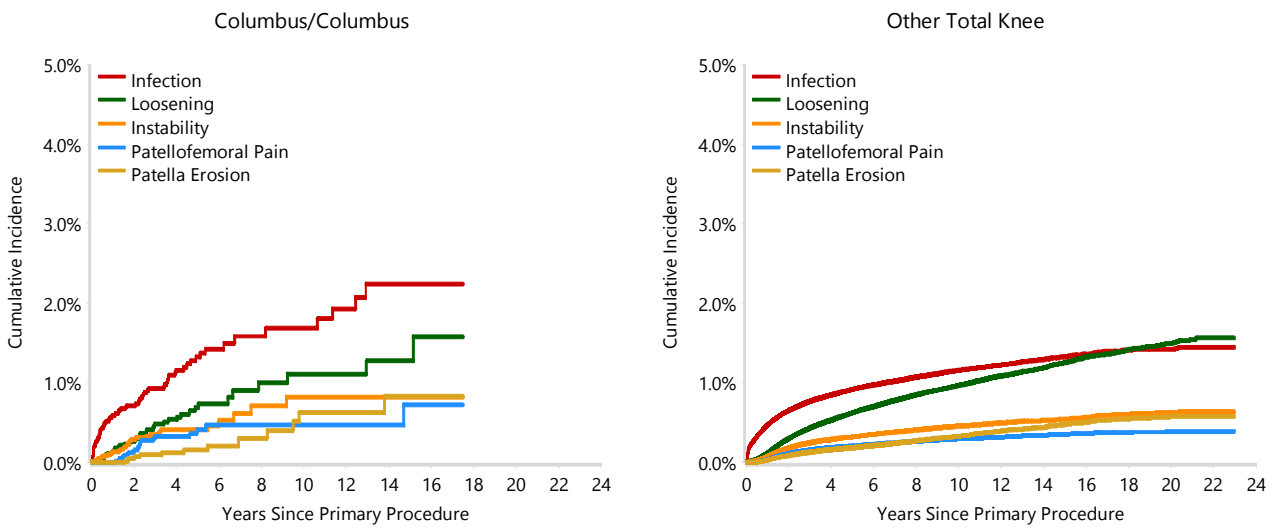


TABLE 5

**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 18.7 Years)**

Type of Revision	Columbus/Columbus		Other Total Knee	
	Number	Percent	Number	Percent
TKR (Tibial/Femoral)	60	26.0	5893	23.9
Tibial Component	11	4.8	1845	7.5
Femoral Component	9	3.9	1250	5.1
Cement Spacer	13	5.6	1160	4.7
Removal of Prostheses			130	0.5
Total Femoral			22	0.1
Reinsertion of Components			7	0.0
<b>N Major</b>	<b>93</b>	<b>40.3</b>	<b>10307</b>	<b>41.8</b>
Insert Only	79	34.2	7383	29.9
Patella Only	43	18.6	4280	17.4
Insert/Patella	15	6.5	2629	10.7
Minor Components	1	0.4	56	0.2
Cement Only			9	0.0
<b>N Minor</b>	<b>138</b>	<b>59.7</b>	<b>14357</b>	<b>58.2</b>
<b>TOTAL</b>	<b>231</b>	<b>100.0</b>	<b>24664</b>	<b>100.0</b>

Note: This table is restricted to revisions within 18.7 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2023 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	130	6636
Cementless	70	500
Hybrid (Tibial Cemented)	31	290
Hybrid (Tibial Cementless)	0	1
<b>TOTAL</b>	<b>231</b>	<b>7427</b>

**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	231	7424
Unknown	0	3
<b>TOTAL</b>	<b>231</b>	<b>7427</b>



**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	217	7360
Rotating	14	64
Unknown	0	3
<b>TOTAL</b>	<b>231</b>	<b>7427</b>

**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	2
Minimally Stabilised	229	7372
Posterior Stabilised	2	50
Unknown	0	3
<b>TOTAL</b>	<b>231</b>	<b>7427</b>

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	115	2120
	VIC	8	107
	QLD	0	1
	WA	0	126
	SA	54	3114
	TAS	16	595
	ACT/NT	38	1364
Other Total Knee	NSW	7211	249139
	VIC	5366	148559
	QLD	5361	153656
	WA	3064	79999
	SA	2702	60897
	TAS	442	18191
	ACT/NT	554	18215
<b>TOTAL</b>		<b>24931</b>	<b>736083</b>

Note: Prostheses no longer used in 2023 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 2023 has a maximum of one year to be revised, whereas a primary procedure performed in 2021 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	13	90
2008	19	148
2009	23	156
2010	12	135
2011	12	135
2012	11	108
2013	3	69
2014	0	36
2015	0	60
2016	5	118
2017	10	358
2018	17	670
2019	24	828
2020	23	1115
2021	24	1104
2022	12	1080
2023	6	1077
<b>TOTAL</b>	<b>231</b>	<b>7427</b>

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
<b>Femoral</b>			
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
<b>Tibial</b>			
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	1	28
	NN271K-NN279K	0	4
NN001Z-NN019Z	NN058Z-NN079Z	50	2355
	NN271Z-NN279Z	0	1
	NR068Z-NR079Z	0	1
NN021K-NN038K	NN058K-NN079K	27	245
	NN081K-NN089K	49	397
	NN271K-NN279K	1	9
	NN281K-NN289K	13	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	70	4045
NN820K-NN931K	NN058K-NN079K	3	36
	NN081K-NN089K	8	56
NN840K-NN951K	NN058K-NN079K	0	3
NR001Z-NR017Z	NN058Z-NN079Z	0	1
	NR068Z-NR079Z	0	2
<b>TOTAL</b>		<b>231</b>	<b>7427</b>