

Maxim (cementless)/Vanguard (cemented) Total Knee Investigation

Note: This analysis compares the Maxim (class)/Vanguard (ctd) 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 Maxim (class)/Vanguard (ctd) 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)
Maxim (class)/Vanguard (ctd)	69	413	5330	1.29 (1.01, 1.64)
Other Total Knee	26061	727695	4729125	0.55 (0.54, 0.56)
TOTAL	26130	728108	4734455	0.55 (0.55, 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 Maxim (class)/Vanguard (ctd) 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
Maxim (class)/Vanguard (ctd)	1.2 (0.5, 2.9)	2.9 (1.7, 5.1)	3.7 (2.2, 6.0)	4.7 (3.0, 7.2)	6.0 (4.0, 8.8)	6.2 (4.2, 9.1)	7.3 (5.1, 10.3)
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
Maxim (class)/Vanguard (ctd)	7.6 (5.4, 10.7)	8.2 (5.8, 11.4)	9.4 (6.9, 12.8)	10.4 (7.7, 14.0)	12.4 (9.4, 16.3)	13.8 (10.6, 17.9)	14.9 (11.5, 19.2)
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, 5.2)	5.4 (5.3, 5.5)	5.7 (5.7, 5.8)	6.1 (6.0, 6.1)

CPR	15 Yrs	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs
Maxim (class)/Vanguard (ctd)	16.5 (12.9, 21.1)	18.8 (14.8, 23.7)	21.5 (17.1, 26.8)	22.9 (18.2, 28.5)			
Other Total Knee	6.4 (6.3, 6.6)	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 (8.0, 8.5)

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

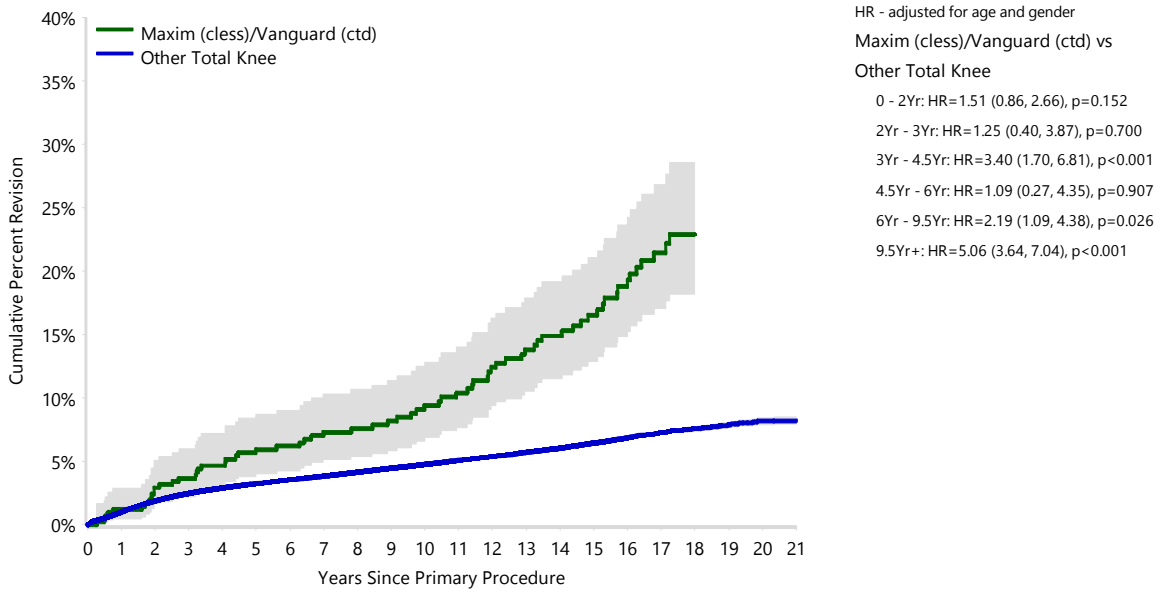
FIGURE 1

Yearly Cumulative Percent Revision of Primary Total Knee Replacement

The yearly cumulative percent revision of the Maxim (cless)/Vanguard (ctd) 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
Maxim (cless)/Vanguard (ctd)	413	406	395	388	375	365	351	339	324	301	287
Other Total Knee	727695	657528	592760	527219	464041	403691	347132	293768	245752	202649	163502

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
Maxim (cless)/Vanguard (ctd)	271	258	242	218	192	166	116	70	34	16	1
Other Total Knee	128843	99109	75527	56481	41660	29601	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	Maxim (class)/Vanguard (ctd)		Other Total Knee	
	Number	Percent	Number	Percent
Osteoarthritis	67	97.1	25251	96.9
Rheumatoid Arthritis	1	1.4	331	1.3
Other Inflammatory Arthritis	1	1.4	161	0.6
Tumour			151	0.6
Osteonecrosis			98	0.4
Fracture			49	0.2
Other			19	0.1
Chondrocalcinosis			1	0.0
TOTAL	69	100.0	26061	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

Revision Diagnosis	Maxim (class)/Vanguard (ctd)			Other Total Knee		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Infection	13	3.1	18.8	6981	1.0	26.8
Loosening	24	5.8	34.8	5841	0.8	22.4
Instability	4	1.0	5.8	2490	0.3	9.6
Pain	4	1.0	5.8	2064	0.3	7.9
Patellofemoral Pain	3	0.7	4.3	2048	0.3	7.9
Patella Erosion	1	0.2	1.4	1693	0.2	6.5
Arthrofibrosis				997	0.1	3.8
Fracture	1	0.2	1.4	944	0.1	3.6
Malalignment				603	0.1	2.3
Wear Tibial Insert	3	0.7	4.3	364	0.1	1.4
Lysis	7	1.7	10.1	345	0.0	1.3
Incorrect Sizing				259	0.0	1.0
Patella Maltracking				181	0.0	0.7
Bearing Dislocation	1	0.2	1.4	153	0.0	0.6
Implant Breakage Tibial Insert				150	0.0	0.6
Implant Breakage Patella	1	0.2	1.4	134	0.0	0.5
Metal Related Pathology	6	1.5	8.7	117	0.0	0.4
Prosthesis Dislocation				80	0.0	0.3
Synovitis				78	0.0	0.3
Osteonecrosis				58	0.0	0.2
Implant Breakage Tibial	1	0.2	1.4	42	0.0	0.2
Implant Breakage Femoral				38	0.0	0.1
Wear Patella				33	0.0	0.1
Tumour				28	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				302	0.0	1.2
N Revision	69	16.7	100.0	26061	3.6	100.0
N Primary	413			727695		

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 Maxim (class)/Vanguard (ctd) 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

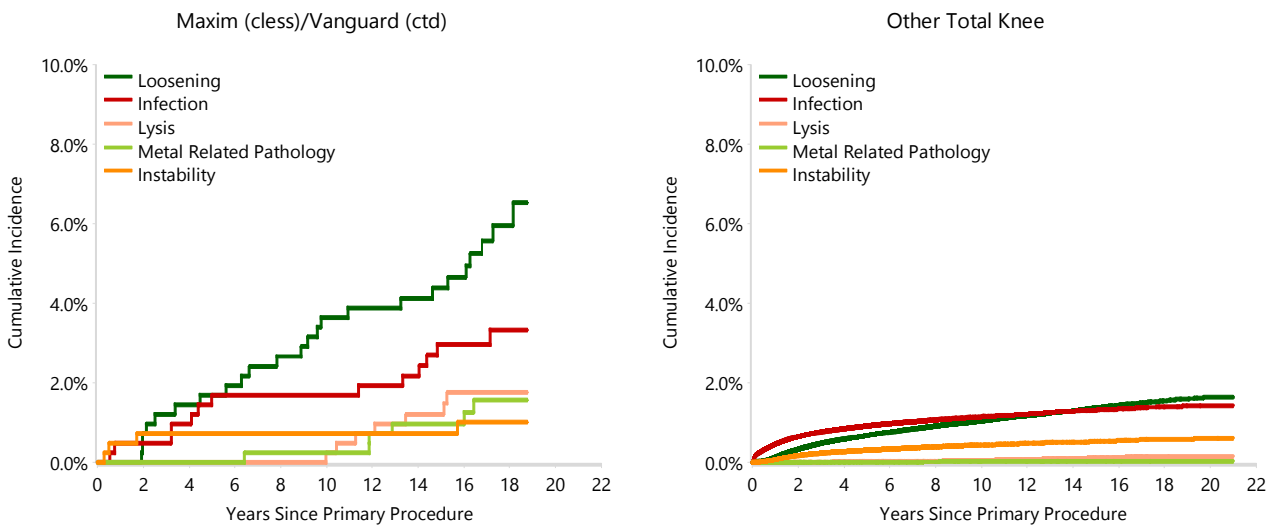


TABLE 5

Type of Revision Performed for Primary Total Knee Replacement

This analysis identifies the components used in the revision of the Maxim (cless)/Vanguard (ctd) 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 Maxim (cless)/Vanguard (ctd) total knee combination compared to all other total knee prostheses.

Table 5: Primary Total Knee Replacement - Type of Revision

Type of Revision	Maxim (cless)/Vanguard (ctd)		Other Total Knee	
	Number	Percent	Number	Percent
TKR (Tibial/Femoral)	34	49.3	6419	24.6
Tibial Component	4	5.8	2100	8.1
Cement Spacer	4	5.8	1360	5.2
Femoral Component	3	4.3	1311	5.0
Removal of Prostheses			150	0.6
Total Femoral			21	0.1
Reinsertion of Components			11	0.0
N Major	45	65.2	11372	43.6
Insert Only	10	14.5	7123	27.3
Patella Only	4	5.8	4783	18.4
Insert/Patella	10	14.5	2710	10.4
Minor Components			59	0.2
Cement Only			14	0.1
N Minor	24	34.8	14689	56.4
TOTAL	69	100.0	26061	100.0

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

TABLE 6**Revision Rates of Maxim (class)/Vanguard (ctd) 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 Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Fixation

Fixation	N Revised	N Total
Cemented	10	72
Hybrid (Tibial Cemented)	59	340
Hybrid (Tibial Cementless)	0	1
TOTAL	69	413

TABLE 7**Revision Rates of Maxim (class)/Vanguard (ctd) 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 Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Bearing Surface

Bearing Surface	N Revised	N Total
Non XLPE	69	413
TOTAL	69	413

TABLE 8**Revision Rates of Maxim (cless)/Vanguard (ctd) 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 Maxim (cless)/Vanguard (ctd) Primary Total Knee Replacement by Bearing Mobility

Bearing Mobility	N Revised	N Total
Fixed	69	413
TOTAL	69	413

TABLE 9**Revision Rates of Maxim (cless)/Vanguard (ctd) 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 Maxim (cless)/Vanguard (ctd) Primary Total Knee Replacement by Stability

Stability	N Revised	N Total
Minimally Stabilised	57	318
Posterior Stabilised	12	95
TOTAL	69	413

TABLE 10**Revision Rates of Primary Total Knee Replacement by State**

This enables a state by state variation to be identified for the Maxim (cless)/Vanguard (ctd) 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
Maxim (cless)/Vanguard (ctd)	NSW	40	270
	VIC	11	40
	SA	18	103
Other Total Knee	NSW	7722	253121
	VIC	5553	144487
	QLD	5690	153171
	WA	3235	77905
	SA	2837	63440
	TAS	418	16885
	ACT/NT	606	18686
TOTAL		26130	728108

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

TABLE 11**Number of Revisions of Maxim (cless)/Vanguard (ctd) Primary Total Knee Replacement by Year of Implant**

This analysis details the number of prostheses reported each year to the Registry for the Maxim (cless)/Vanguard (ctd) 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 Maxim (cless)/Vanguard (ctd) Primary Total Knee Replacement by Year of Implant

Year of Implant	Number Revised	Total Number
2000	0	8
2001	6	34
2002	9	44
2003	22	94
2004	20	106
2005	4	64
2006	5	23
2007	2	30
2008	1	10
TOTAL	69	413

TABLE 12

Revision Rates of Maxim (class)/Vanguard (ctd) 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 Maxim (class)/Vanguard (ctd) 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	Fixation
Femoral				
Maxim	140050-140075	FEMORAL COMPONENT - ANATOMIC PRIMARY POROUS	NO	POROUS
Maxim	145110-145135	PS INTERLOK RAISED FLANGE COCR	EITHER	MATT
Maxim	145410-145435	PS POROUS FEMORAL COMPONENT	NO	POROUS
Tibial				
Vanguard	141210-141219	TITANIUM PRIMARY INTERLOK TIBIAL TRAY	YES	MATT
Vanguard	141221-141227	COCR I-BEAM MODULAR INTERLOK TIBIAL TRAY	YES	MATT
Vanguard	141230-141238	COCR FINNED MODULAR INTERLOK TIBIAL TRAY W/LOCKING BAR	YES	MATT
Vanguard	141241-141247	COCR I-BEAM MODULAR POLISHED INTERLOK TIBIAL TRAY	YES	POLISHED
Vanguard	141250-141258	COCR FINNED MODULAR POLISHED INTERLOK TIBIAL TRAY	YES	POLISHED
Vanguard	141480-141488	TITANIUM OFFSET INTERLOK TIBIAL TRAY	YES	
Vanguard	141510-141518	TITANIUM MODULAR STEMMED INTERLOK TIBIAL TRAY	YES	MATT

Table 12: Revised Number of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Catalogue Number Range

Femoral Range	Tibial Range	N Revised	N Total
140050-140075	141210-141219	52	233
	141221-141227	0	1
	141230-141238	4	62
	141250-141258	1	20
	141480-141488	0	2
145110-145135	141210-141219	11	80
	141230-141238	0	1
	141241-141247	0	2
	141480-141488	0	2
	141510-141518	0	3
145410-145435	141210-141219	1	5
	141230-141238	0	1
	141510-141518	0	1
TOTAL		69	413