Avenir Unipolar Modular Hip Investigation

Note: This analysis compares the Avenir femoral stem prosthesis with all other unipolar modular hip prostheses.

This prosthesis 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-2025.

Note: Procedures using prostheses with no recorded use in 2024 are excluded from the comparator.

TABLE 1

Revision Rate of Primary Unipolar Modular Hip Replacement

The revision rate of the Avenir unipolar modular hip prosthesis is compared to all other unipolar modular hip prostheses.

Table 1: Revision Rates of Primary Unipolar Modular Hip Replacement

Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Avenir	8	69	246	3.25 (1.40, 6.41)
Other Unipolar Modular Hip	1615	50827	169906	0.95 (0.90, 1.00)
TOTAL	**1623**	**50896**	**170152**	**0.95 (0.91, 1.00)**

Note: Prostheses no longer used in 2024 are excluded from the comparator.

TABLE 2

Yearly Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement

The yearly cumulative percent revision of the Avenir unipolar modular hip prosthesis is compared to all other unipolar modular hip prostheses.

Table 2: Yearly Cumulative Percent Revision (95% CI) of Primary Unipolar Modular Hip Replacement

CPR	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs
Avenir	7.6 (3.2, 17.3)	9.8 (4.5, 20.7)	9.8 (4.5, 20.7)	13.0 (6.1, 26.4)	13.0 (6.1, 26.4)	17.1 (8.3, 33.5)	17.1 (8.3, 33.5)	
Other Unipolar Modular Hip	2.0 (1.9, 2.1)	2.6 (2.5, 2.8)	3.1 (3.0, 3.3)	3.7 (3.5, 3.9)	4.2 (4.0, 4.5)	4.7 (4.4, 5.0)	5.2 (4.9, 5.5)	5.8 (5.4, 6.1)

CPR	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs
Avenir								
Other Unipolar Modular Hip	6.3 (5.9, 6.7)	6.8 (6.3, 7.3)	7.2 (6.7, 7.8)	7.6 (7.0, 8.2)	8.0 (7.4, 8.7)	8.7 (7.9, 9.5)	8.9 (8.1, 9.8)	9.6 (8.6, 10.8)

CPR	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs	23 Yrs
Avenir							
Other Unipolar Modular Hip	9.6 (8.6, 10.8)	10.5 (9.0, 12.3)	10.5 (9.0, 12.3)	11.4 (9.2, 14.0)			

Note: Prostheses no longer used in 2024 are excluded from the comparator.

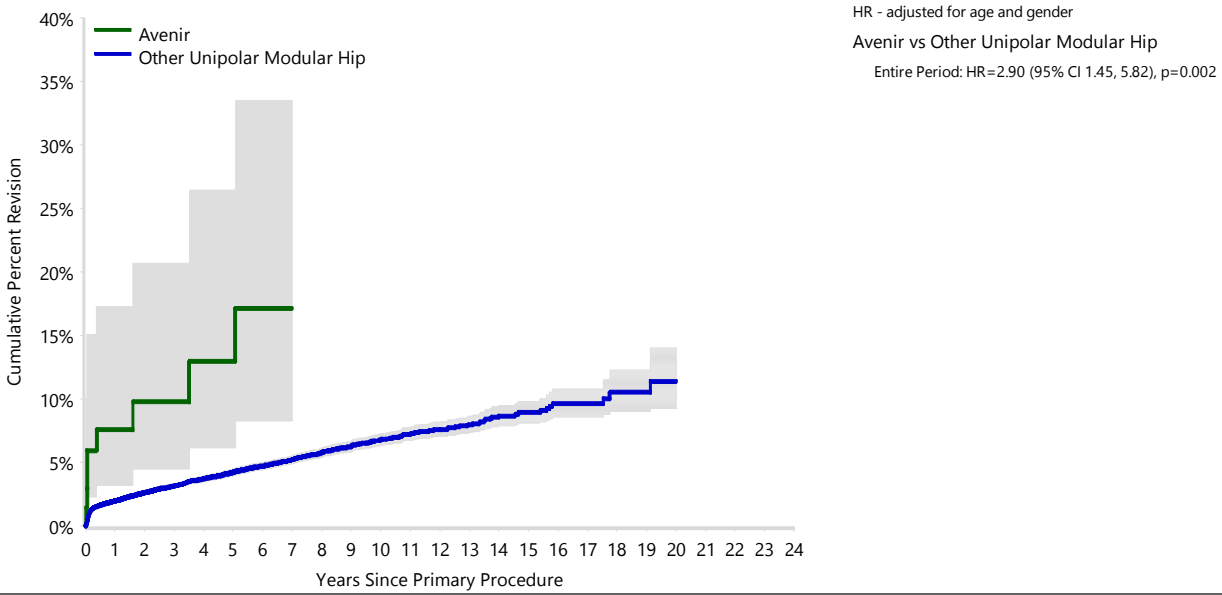
FIGURE 1

Yearly Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement

The yearly cumulative percent revision of the Avenir unipolar modular hip prosthesis is compared to all other unipolar modular hip 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 Unipolar Modular Hip 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
Avenir	69	54	39	32	24	21	18	12	7	6	3	2
Other Unipolar Modular Hip	50827	34073	26979	20971	16178	12494	9501	7251	5488	4142	3093	2366

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
Avenir	1	1	0	0	0	0	0	0	0	0	0	0
Other Unipolar Modular Hip	1771	1307	928	657	417	291	169	106	60	33	14	4

Note: Prostheses no longer used in 2024 are excluded from the comparator.

TABLE 3

Primary Diagnosis for Revised Primary Unipolar Modular Hip 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 unipolar modular hip prostheses.

Table 3: Primary Diagnosis for Revised Primary Unipolar Modular Hip Replacement

	Avenir		Other Unipolar Modular Hip	
Primary Diagnosis	Number	Percent	Number	Percent
Fractured Neck Of Femur	8	100.0	1525	94.4
Osteoarthritis			46	2.8
Failed Internal Fixation			24	1.5
Tumour			11	0.7
Osteonecrosis			8	0.5
Rheumatoid Arthritis			1	0.1
TOTAL	**8**	**100.0**	**1615**	**100.0**

Note: Prostheses no longer used in 2024 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 Unipolar Modular Hip Replacement - Reason for Revision (Follow-up Limited to 13.5 Years)

	Avenir			Other Unipolar Modular Hip		
Revision Diagnosis	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Infection	1	1.4	12.5	415	0.8	25.9
Prosthesis Dislocation/Instability	1	1.4	12.5	345	0.7	21.5
Chondrolysis/Acetab. Erosion	1	1.4	12.5	258	0.5	16.1
Fracture	3	4.3	37.5	244	0.5	15.2
Pain	1	1.4	12.5	160	0.3	10.0
Loosening				125	0.2	7.8
Lysis				20	0.0	1.2
Leg Length Discrepancy				6	0.0	0.4
Implant Breakage Stem				5	0.0	0.3
Tumour				5	0.0	0.3
Incorrect Sizing	1	1.4	12.5	4	0.0	0.2
Metal Related Pathology				4	0.0	0.2
Malposition				3	0.0	0.2
Osteonecrosis				1	0.0	0.1
Other				7	0.0	0.4
N Revision	**8**	**11.6**	**100.0**	**1602**	**3.2**	**100.0**
N Primary	**69**			**50827**		

Note: This table is restricted to revisions within 13.5 years for all groups to allow a time-matched comparison of revisions.
Note: Prostheses no longer used in 2024 are excluded from the comparator.

FIGURE 2

Cumulative Incidence Revision Diagnosis of Primary Unipolar Modular Hip 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 Avenir unipolar modular hip prosthesis. A comparative graph is provided of the cumulative incidence for the same reasons for revisions for all other unipolar modular hip prostheses.

Figure 2: Cumulative Incidence Revision Diagnosis for Primary Unipolar Modular Hip Replacement

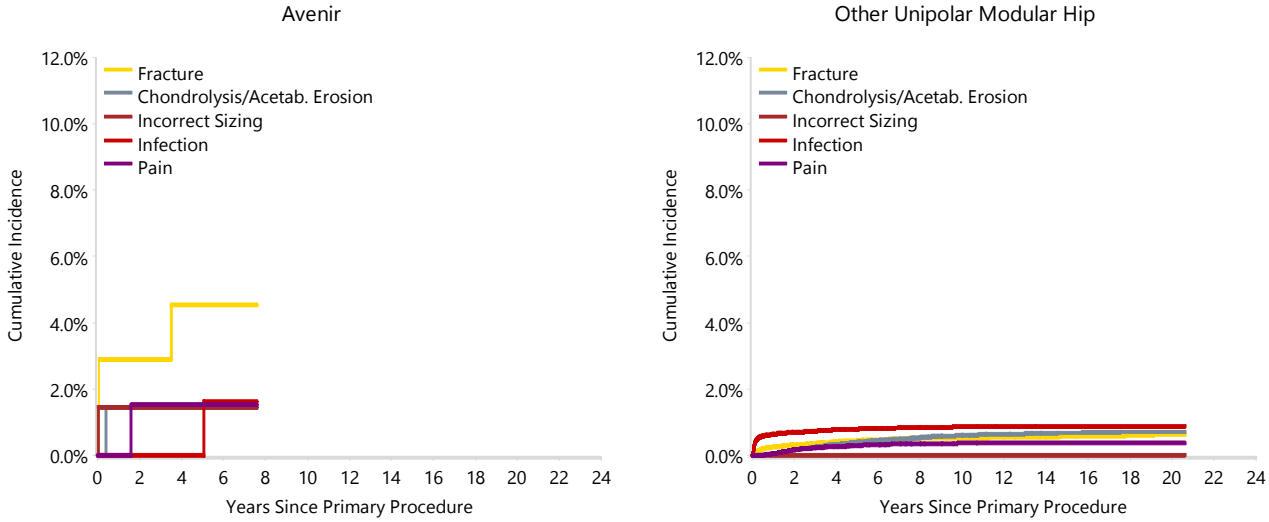


TABLE 5

Type of Revision Performed for Primary Unipolar Modular Hip Replacement

This analysis identifies the components used in the revision of the Avenir unipolar modular hip prosthesis and compares it to the components used in the revision of all other unipolar modular hip 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 unipolar modular hip prostheses i.e. is there a difference in the type of revision undertaken for the Avenir unipolar modular hip prosthesis compared to all other unipolar modular hip prostheses.

Table 5: Primary Unipolar Modular Hip Replacement - Type of Revision (Follow-up Limited to 13.5 Years)

	Avenir		Other Unipolar Modular Hip	
Type of Revision	Number	Percent	Number	Percent
Acetabular Component	3	37.5	638	39.8
THR (Femoral/Acetabular)			265	16.5
Femoral Component	2	25.0	161	10.0
Bipolar Head and Femoral	3	37.5	74	4.6
Cement Spacer			57	3.6
Removal of Prostheses			54	3.4
Reinsertion of Components			6	0.4
N Major	**8**	**100.0**	**1255**	**78.3**
Head Only			279	17.4
Minor Components			43	2.7
Bipolar Only			23	1.4
Head/Insert			2	0.1
N Minor			**347**	**21.7**
TOTAL	**8**	**100.0**	**1602**	**100.0**

Note: This table is restricted to revisions within 13.5 years for all groups to allow a time-matched comparison of revisions.
Note: Prostheses no longer used in 2024 are excluded from the comparator.

TABLE 6

Revision Rates of Avenir Primary Unipolar Modular Hip 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 Avenir Primary Unipolar Modular Hip Replacement by Fixation

Fixation	N Revised	N Total
Cementless	8	69
TOTAL	**8**	**69**

TABLE 7

Number of Revisions of Avenir Primary Unipolar Modular Hip Replacement by Year of Implant

This analysis details the number of prostheses reported each year to the Registry for the Avenir unipolar modular hip prosthesis. 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 2024 has a maximum of one year to be revised, whereas a primary procedure performed in 2022 has a maximum of three years to be revised.

Table 7: Number of Revisions of Avenir Primary Unipolar Modular Hip Replacement by Year of Implant

Year of Implant	Number Revised	Total Number
2011	1	8
2012	1	8
2013	0	5
2014	2	7
2015	1	3
2016	1	6
2017	0	8
2018	0	10
2020	0	1
2021	0	3
2022	0	3
2023	2	5
2024	0	2
TOTAL	**8**	**69**

TABLE 8

Revision Rates of Avenir Primary Unipolar Modular Hip Replacement by Component

A prosthesis may be combined with multiple components. This analysis has been undertaken to determine if the revision rate varies according to the component with which it is combined.

Table 10: Revised Number of Avenir Primary Unipolar Modular Hip Replacement by Head Component

Head Component	N Revised	N Total
Metasul	2	16
VerSys	6	53
TOTAL	**8**	**69**