

## 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-2024>.

Note: Procedures using prostheses with no recorded use in 2023 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	67	227	3.52 (1.52, 6.93)
Other Unipolar Modular Hip	1612	49798	164579	0.98 (0.93, 1.03)
<b>TOTAL</b>	<b>1620</b>	<b>49865</b>	<b>164807</b>	<b>0.98 (0.94, 1.03)</b>

Note: Prostheses no longer used in 2023 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 of Primary Unipolar Modular Hip Replacement

CPR	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs
Avenir	7.7 (3.3, 17.6)	10.0 (4.6, 21.2)	10.0 (4.6, 21.2)	13.2 (6.2, 26.8)	13.2 (6.2, 26.8)	17.3 (8.4, 33.8)		
Other Unipolar Modular Hip	2.0 (1.9, 2.1)	2.7 (2.5, 2.8)	3.2 (3.0, 3.4)	3.8 (3.6, 4.0)	4.3 (4.1, 4.6)	4.8 (4.6, 5.1)	5.4 (5.1, 5.7)	6.0 (5.6, 6.3)

CPR	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs
Avenir								
Other Unipolar Modular Hip	6.5 (6.1, 6.9)	7.0 (6.6, 7.5)	7.5 (7.0, 8.0)	7.8 (7.2, 8.4)	8.2 (7.6, 8.9)	9.1 (8.3, 10.0)	9.2 (8.4, 10.2)	10.1 (8.9, 11.5)

CPR	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs	23 Yrs
Avenir							
Other Unipolar Modular Hip	10.1 (8.9, 11.5)	11.3 (9.4, 13.5)	11.3 (9.4, 13.5)	12.5 (9.8, 16.0)			

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

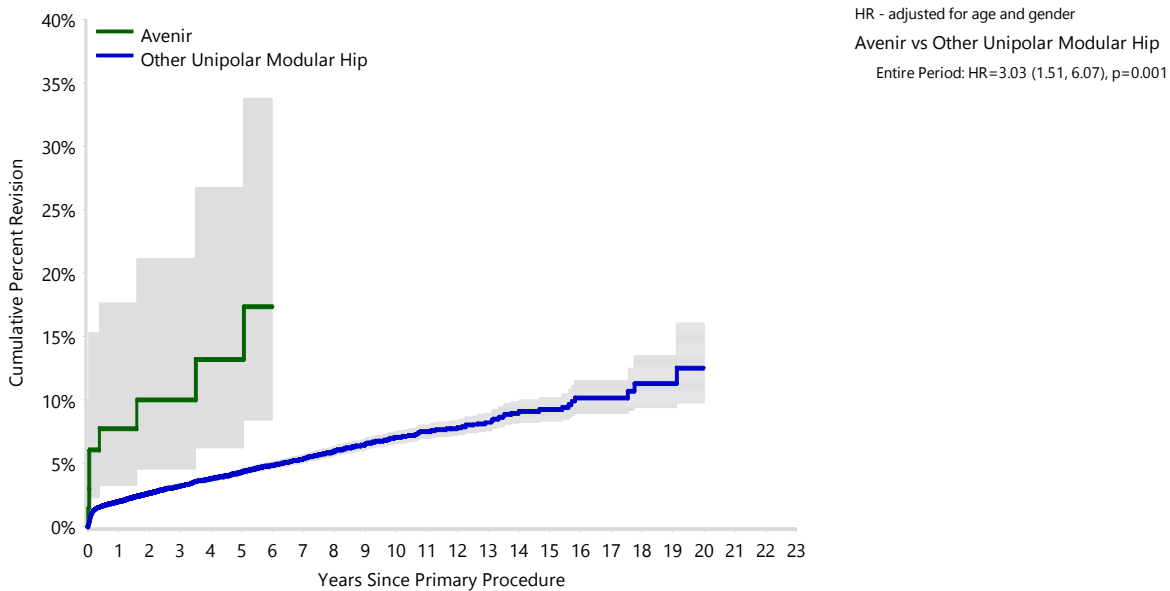
FIGURE 1

**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	67	52	38	31	24	21	12	7	7	5	2	2
Other Unipolar Modular Hip	49798	33348	26229	20518	15844	12182	9238	6980	5208	3920	2910	2172

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	0	0	0	0	0	0	0	0	0	0	0
Other Unipolar Modular Hip	1585	1123	780	520	340	207	133	80	40	15	4	1

Note: Prostheses no longer used in 2023 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**

Primary Diagnosis	Avenir		Other Unipolar Modular Hip	
	Number	Percent	Number	Percent
Fractured Neck Of Femur	8	100.0	1524	94.5
Osteoarthritis			47	2.9
Failed Internal Fixation			25	1.6
Osteonecrosis			8	0.5
Tumour			7	0.4
Rheumatoid Arthritis			1	0.1
<b>TOTAL</b>	<b>8</b>	<b>100.0</b>	<b>1612</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 Unipolar Modular Hip Replacement - Reason for Revision (Follow-up Limited to 12.5 Years)

Revision Diagnosis	Number	Avenir		Other Unipolar Modular Hip		
		% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Infection	1	1.5	12.5	401	0.8	25.2
Prosthesis Dislocation/Instability	1	1.5	12.5	342	0.7	21.5
Fracture	3	4.5	37.5	250	0.5	15.7
Chondrolysis/Acetab. Erosion	1	1.5	12.5	249	0.5	15.6
Pain	1	1.5	12.5	163	0.3	10.2
Loosening				127	0.3	8.0
Lysis				17	0.0	1.1
Progression Of Disease				8	0.0	0.5
Leg Length Discrepancy				7	0.0	0.4
Incorrect Sizing	1	1.5	12.5	5	0.0	0.3
Malposition				4	0.0	0.3
Metal Related Pathology				4	0.0	0.3
Tumour				4	0.0	0.3
Implant Breakage Stem				3	0.0	0.2
Osteonecrosis				1	0.0	0.1
Other				7	0.0	0.4
<b>N Revision</b>	<b>8</b>	<b>11.9</b>	<b>100.0</b>	<b>1592</b>	<b>3.2</b>	<b>100.0</b>
<b>N Primary</b>	<b>67</b>			<b>49798</b>		

Note: This table is restricted to revisions within 12.5 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 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**

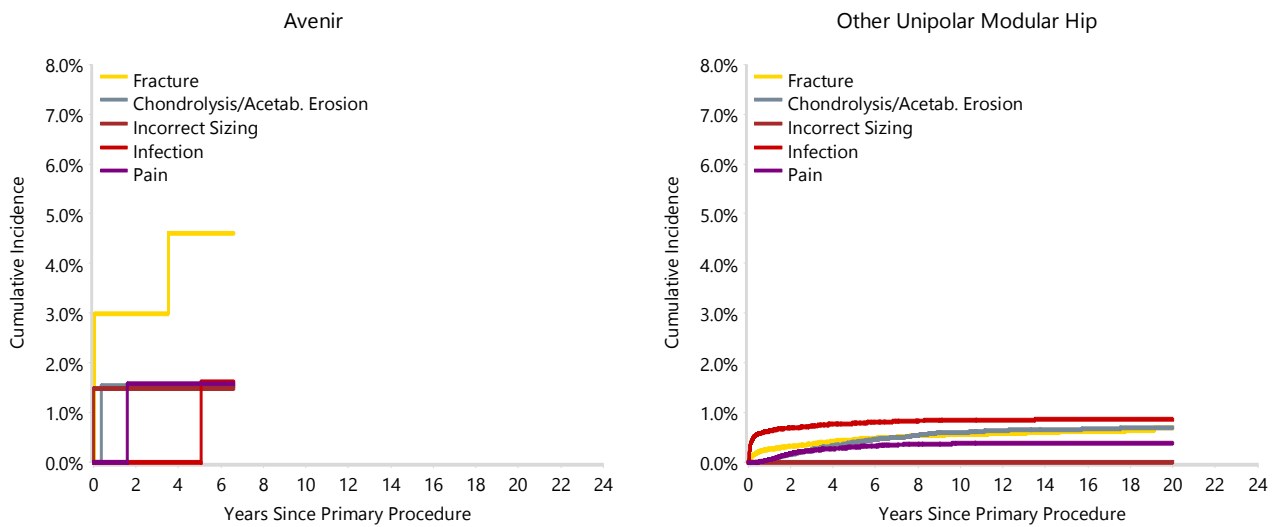


TABLE 5

**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 12.5 Years)**

Type of Revision	Avenir		Other Unipolar Modular Hip	
	Number	Percent	Number	Percent
Acetabular Component	3	37.5	646	40.6
THR (Femoral/Acetabular)			264	16.6
Femoral Component	2	25.0	160	10.1
Bipolar Head and Femoral	3	37.5	71	4.5
Cement Spacer			60	3.8
Removal of Prostheses			54	3.4
Reinsertion of Components			6	0.4
<b>N Major</b>	<b>8</b>	<b>100.0</b>	<b>1261</b>	<b>79.2</b>
Head Only			264	16.6
Minor Components			45	2.8
Bipolar Only			20	1.3
Head/Insert			2	0.1
<b>N Minor</b>			<b>331</b>	<b>20.8</b>
<b>TOTAL</b>	<b>8</b>	<b>100.0</b>	<b>1592</b>	<b>100.0</b>

Note: This table is restricted to revisions within 12.5 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 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	67
<b>TOTAL</b>	<b>8</b>	<b>67</b>



TABLE 7

**Revision Rates of Primary Unipolar Modular Hip Replacement by State**

This enables a state by state variation to be identified for the Avenir unipolar modular hip prosthesis and provides the comparative data for each of the states for all other unipolar modular hip 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 7: Revised Number of Primary Unipolar Modular Hip Replacement by State**

Component	State	N Revised	N Total
Avenir	NSW	7	56
	VIC	1	7
	QLD	0	3
	TAS	0	1
Other Unipolar Modular Hip	NSW	332	12010
	VIC	487	14833
	QLD	261	7865
	WA	236	7098
	SA	236	6347
	TAS	44	1309
	ACT/NT	16	336
<b>TOTAL</b>		<b>1620</b>	<b>49865</b>

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

**TABLE 8****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 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 8: 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
<b>TOTAL</b>	<b>8</b>	<b>67</b>

TABLE 9

**Revision Rates of Avenir Primary Unipolar Modular Hip 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 Avenir 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	Material	Coating
<b>Femoral Stem</b>					
Avenir	0106010001-0106010009	TITANIUM GRIT BLAST HA MULLER STANDARD STEM	NO	METAL	HA COATED
Avenir	0106010101-0106010109	TITANIUM GRIT BLAST HA MULLER LATERAL STEM	NO	METAL	HA COATED

**Table 9: Revised Number of Avenir Primary Unipolar Modular Hip Replacement by Catalogue Number Range**

Femoral Stem Range	N Revised	N Total
0106010001-0106010009	7	58
0106010101-0106010109	1	9
<b>TOTAL</b>	<b>8</b>	<b>67</b>

TABLE 10

**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	51
<b>TOTAL</b>	<b>8</b>	<b>67</b>