

## BHR Total Conventional Hip Investigation

Note: This analysis compares the BHR acetabular prosthesis with all other total conventional 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-2023>.

Note: Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator. Procedures using prostheses with no recorded use in 2022 are excluded from the comparator.

### TABLE 1

#### Revision Rate of Primary Total Conventional Hip Replacement

The revision rate of the BHR total conventional hip prosthesis is compared to all other total conventional hip prostheses.

**Table 1: Revision Rates of Primary Total Conventional Hip Replacement**

Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
BHR	551	2988	35033	1.57 (1.44, 1.71)
Other Total Conventional Hip	17452	494145	3081462	0.57 (0.56, 0.57)
<b>TOTAL</b>	<b>18003</b>	<b>497133</b>	<b>3116495</b>	<b>0.58 (0.57, 0.59)</b>

Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

TABLE 2

**Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement**

The yearly cumulative percent revision of the BHR total conventional hip prosthesis is compared to all other total conventional hip prostheses.

**Table 2: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement**

CPR	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs
BHR	1.1 (0.8, 1.6)	2.3 (1.9, 2.9)	3.2 (2.6, 3.9)	4.3 (3.6, 5.1)	6.1 (5.3, 7.0)	8.0 (7.0, 9.0)	9.2 (8.2, 10.4)	10.9 (9.8, 12.2)
Other Total Conventional Hip	1.7 (1.7, 1.8)	2.2 (2.1, 2.2)	2.5 (2.5, 2.6)	2.8 (2.7, 2.8)	3.1 (3.0, 3.1)	3.4 (3.3, 3.4)	3.6 (3.6, 3.7)	3.9 (3.9, 4.0)

CPR	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	15 Yrs
BHR	12.4 (11.2, 13.7)	14.3 (13.0, 15.6)	16.1 (14.7, 17.5)	17.5 (16.1, 19.0)	18.9 (17.5, 20.5)	20.0 (18.5, 21.6)	21.0 (19.4, 22.7)
Other Total Conventional Hip	4.3 (4.2, 4.3)	4.6 (4.5, 4.7)	4.9 (4.8, 5.0)	5.3 (5.2, 5.4)	5.7 (5.6, 5.8)	6.1 (6.0, 6.2)	6.5 (6.4, 6.6)

CPR	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs
BHR	22.7 (20.9, 24.6)	24.1 (22.0, 26.2)	24.7 (22.4, 27.3)				
Other Total Conventional Hip	6.9 (6.8, 7.1)	7.3 (7.1, 7.4)	7.6 (7.4, 7.8)	8.2 (8.0, 8.5)	8.5 (8.2, 8.8)	8.9 (8.5, 9.3)	9.3 (8.8, 9.8)

Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

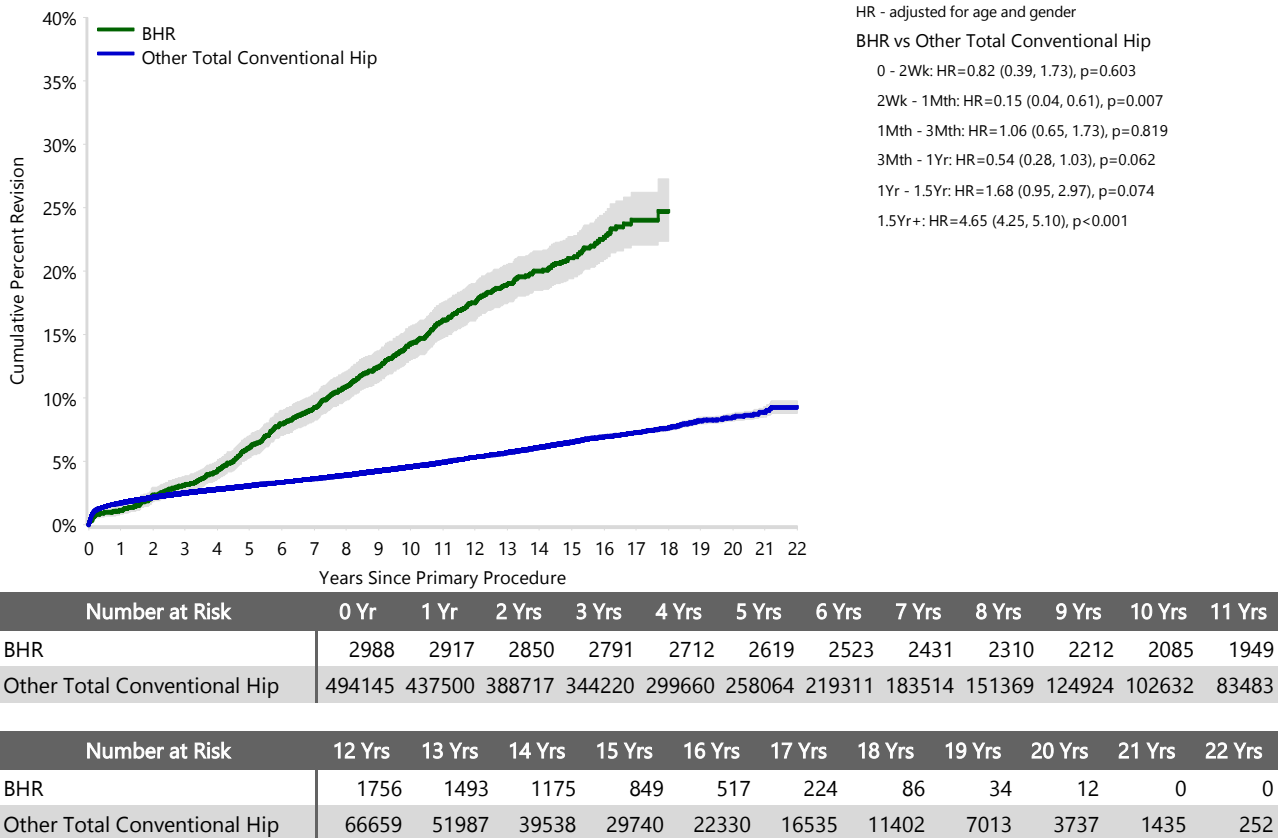
FIGURE 1

**Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement**

The yearly cumulative percent revision of the BHR total conventional hip prosthesis is compared to all other total conventional 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 Total Conventional Hip Replacement**



Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

**TABLE 3****Primary Diagnosis for Revised Primary Total Conventional 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 total conventional hip prostheses.

**Table 3: Primary Diagnosis for Revised Primary Total Conventional Hip Replacement**

Primary Diagnosis	BHR		Other Total Conventional Hip	
	Number	Percent	Number	Percent
Osteoarthritis	466	84.6	14432	82.7
Fractured Neck Of Femur	15	2.7	1291	7.4
Osteonecrosis	35	6.4	797	4.6
Developmental Dysplasia	16	2.9	279	1.6
Rheumatoid Arthritis	8	1.5	186	1.1
Failed Internal Fixation	1	0.2	147	0.8
Tumour			145	0.8
Other Inflammatory Arthritis	8	1.5	99	0.6
Fracture/Dislocation			46	0.3
Arthrodesis Takedown	2	0.4	16	0.1
Other			14	0.1
<b>TOTAL</b>	<b>551</b>	<b>100.0</b>	<b>17452</b>	<b>100.0</b>

Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm 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 Conventional Hip Replacement - Reason for Revision (Follow-up Limited to 20.8 Years)

Revision Diagnosis	Number	BHR		Other Total Conventional Hip		
		% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Prosthesis Dislocation/Instability	19	0.6	3.4	4021	0.8	23.0
Infection	79	2.6	14.3	4008	0.8	23.0
Fracture	37	1.2	6.7	3811	0.8	21.8
Loosening	81	2.7	14.7	3531	0.7	20.2
Pain	18	0.6	3.3	310	0.1	1.8
Leg Length Discrepancy	5	0.2	0.9	270	0.1	1.5
Malposition	2	0.1	0.4	244	0.0	1.4
Metal Related Pathology	244	8.2	44.3	78	0.0	0.4
Lysis	49	1.6	8.9	196	0.0	1.1
Implant Breakage Stem	6	0.2	1.1	168	0.0	1.0
Implant Breakage Acetabular Insert				120	0.0	0.7
Incorrect Sizing	2	0.1	0.4	102	0.0	0.6
Wear Acetabular Insert	1	0.0	0.2	102	0.0	0.6
Implant Breakage Acetabular	1	0.0	0.2	70	0.0	0.4
Wear Head				45	0.0	0.3
Tumour	3	0.1	0.5	41	0.0	0.2
Implant Breakage Head	1	0.0	0.2	32	0.0	0.2
Heterotopic Bone				26	0.0	0.1
Wear Acetabulum	2	0.1	0.4	9	0.0	0.1
Progression Of Disease				2	0.0	0.0
Osteonecrosis				1	0.0	0.0
Synovitis				1	0.0	0.0
Other	1	0.0	0.2	257	0.1	1.5
<b>N Revision</b>	<b>551</b>	<b>18.4</b>	<b>100.0</b>	<b>17445</b>	<b>3.5</b>	<b>100.0</b>
<b>N Primary</b>	<b>2988</b>			<b>494145</b>		

Note: This table is restricted to revisions within 20.8 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

**FIGURE 2**

**Cumulative Incidence Revision Diagnosis of Primary Total Conventional 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 BHR total conventional hip prosthesis. A comparative graph is provided of the cumulative incidence for the same reasons for revisions for all other total conventional hip prostheses.

**Figure 2: Cumulative Incidence Revision Diagnosis for Primary Total Conventional Hip Replacement**

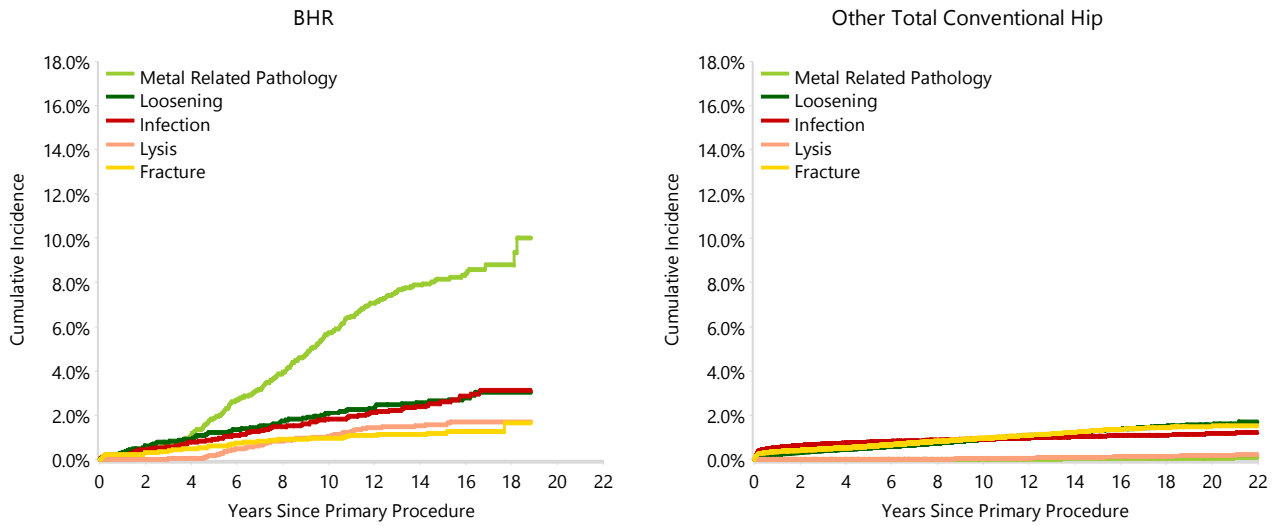


TABLE 5

### Type of Revision Performed for Primary Total Conventional Hip Replacement

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

**Table 5: Primary Total Conventional Hip Replacement - Type of Revision (Follow-up Limited to 20.8 Years)**

Type of Revision	BHR		Other Total Conventional Hip	
	Number	Percent	Number	Percent
Femoral Component	49	8.9	5699	32.7
Acetabular Component	264	47.9	3313	19.0
THR (Femoral/Acetabular)	114	20.7	2027	11.6
Cement Spacer	26	4.7	619	3.5
Removal of Prostheses	3	0.5	95	0.5
Reinsertion of Components			27	0.2
Total Femoral			8	0.0
Bipolar Head and Femoral	1	0.2	5	0.0
Saddle	1	0.2	1	0.0
<b>N Major</b>	<b>458</b>	<b>83.1</b>	<b>11794</b>	<b>67.6</b>
Head/Insert	70	12.7	4324	24.8
Head Only	20	3.6	844	4.8
Minor Components	2	0.4	298	1.7
Insert Only	1	0.2	181	1.0
Bipolar Only			2	0.0
Cement Only			1	0.0
Head/Neck			1	0.0
<b>N Minor</b>	<b>93</b>	<b>16.9</b>	<b>5651</b>	<b>32.4</b>
<b>TOTAL</b>	<b>551</b>	<b>100.0</b>	<b>17445</b>	<b>100.0</b>

Note: This table is restricted to revisions within 20.8 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

**TABLE 6****Revision Rates of BHR Primary Total Conventional 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 BHR Primary Total Conventional Hip Replacement by Fixation**

Fixation	N Revised	N Total
Cemented	2	7
Cementless	375	1995
Hybrid (Femur Cemented)	174	985
Reverse Hybrid (Femur Cementless)	0	1
<b>TOTAL</b>	<b>551</b>	<b>2988</b>

**TABLE 7****Revision Rates of BHR Primary Total Conventional Hip 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 prosthesis are listed.

**Table 7: Revised Number of BHR Primary Total Conventional Hip Replacement by Bearing Surface**

Bearing Surface	N Revised	N Total
Ceramic/Metal	0	2
Metal/Metal	550	2984
Unknown	1	2
<b>TOTAL</b>	<b>551</b>	<b>2988</b>

**TABLE 8****Revision Rates of BHR Primary Total Conventional Hip Replacement by Approach**

This analysis is provided as some prostheses are used with a variety of surgical approaches. All surgical approaches used with this prosthesis are listed.

**Table 8: Revised Number of BHR Primary Total Conventional Hip Replacement by Approach**

Approach	N Revised	N Total
Lateral	0	1
<b>TOTAL</b>	<b>0</b>	<b>1</b>

Note: Excludes 2987 procedures with no approach recorded

TABLE 9

**Revision Rates of Primary Total Conventional Hip Replacement by State**

This enables a state by state variation to be identified for the BHR total conventional hip prosthesis and provides the comparative data for each of the states for all other total conventional 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 9: Revised Number of Primary Total Conventional Hip Replacement by State**

Component	State	N Revised	N Total
BHR	NSW	200	1140
	VIC	52	316
	QLD	270	1442
	WA	2	3
	SA	6	38
	TAS	5	16
	ACT/NT	16	33
Other Total Conventional Hip	NSW	4728	144768
	VIC	4348	128324
	QLD	3451	86927
	WA	2389	58888
	SA	1621	45638
	TAS	405	16382
	ACT/NT	510	13218
<b>TOTAL</b>		<b>18003</b>	<b>497133</b>

Note: Prostheses no longer used in 2022 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

**TABLE 10****Number of Revisions of BHR Primary Total Conventional Hip Replacement by Year of Implant**

This analysis details the number of prostheses reported each year to the Registry for the BHR total conventional 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 2022 has a maximum of one year to be revised, whereas a primary procedure performed in 2020 has a maximum of three years to be revised.

**Table 10: Number of Revisions of BHR Primary Total Conventional Hip Replacement by Year of Implant**

Year of Implant	Number Revised	Total Number
2001	0	1
2002	3	38
2003	9	66
2004	24	127
2005	52	288
2006	109	550
2007	110	581
2008	84	477
2009	86	404
2010	52	276
2011	18	134
2012	2	27
2013	2	13
2014	0	5
2015	0	1
<b>TOTAL</b>	<b>551</b>	<b>2988</b>

TABLE 11

## Revision Rates of BHR Primary Total Conventional 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 BHR 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	Fixation
<b>Acetabular</b>						
BHR	120144-120154	ACETABULAR CUP POROCAST HAP COATED <56MM	NO	METAL	HA COATED	POROUS
BHR	120156-120166	ACETABULAR CUP POROCAST HAP COATED	NO	METAL	HA COATED	POROUS
BHR	120246-120254	BIRMINGHAM DYSPLASIA CUP <56MM	NO	METAL	HA COATED	POROUS
BHR	120258-120266	BIRMINGHAM DYSPLASIA CUP	NO	METAL	HA COATED	POROUS
BHR	74120144-74122154	ACETABULAR CUP W/ IMPACTOR HAP COCR <56MM	NO	METAL	HA COATED	
BHR	74120156-74122168	ACETABULAR CUP W/ IMPACTOR HAP COCR	NO	METAL	HA COATED	
BHR	74120246-74122252	DYSPLASIA CUP W/ IMPACTOR HAP COCR <56MM	NO	METAL		
BHR	74120258-74122264	DYSPLASIA CUP W/ IMPACTOR HAP COCR	NO	METAL	HA COATED	
BHR	CMD0171-CMD0171	BHR DYSPLASIA CUP POROCAST HAP COCR	NO	METAL		

Table 11: Revised Number of BHR Primary Total Conventional Hip Replacement by Catalogue Number Range

Acetabular Range	N Revised	N Total
120144-120154	44	204
120156-120166	34	227
120246-120254	10	35
120258-120266	4	15
74120144-74122154	213	1113
74120156-74122168	228	1274
74120246-74122252	12	88
74120258-74122264	6	31
CMD0171-CMD0171	0	1
<b>TOTAL</b>	<b>551</b>	<b>2988</b>

TABLE 12

## Revision Rates of BHR Primary Total Conventional 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 12: Revised Number of BHR Primary Total Conventional Hip Replacement by Femoral Stem Component

Femoral Stem Component	N Revised	N Total
ABGII	1	6
Accolade I	35	91
AcuMatch M-Series	1	1
Alloclassic	18	102
Anthology	75	387
BMHR	17	110
BMHR VST	36	256
Basis	0	1
Bi-Metric	10	61
C.F.P.	0	2
CLS	0	6
CORAIL	2	7
CPCS	60	289
Echelon	1	14
Emperion	8	30
Epoch	1	4
Exeter V40	7	67
F2L	0	6
Generic Stem	1	1
Image	2	4
MS 30	2	10
MSA	0	1
MiniHip	0	1
Natural Hip	0	17
Omnifit	0	1
Platform	18	82
Polarstem	8	26
Reef	0	2
Restoration	1	3
SL-Plus	9	22
SLR-Plus	1	2
Secur-Fit	0	2
Secur-Fit Plus	0	5
Securus	0	1
Spectron EF	96	537
Synergy	139	826
UniSyn	0	3
Wagner	1	1
ZMR	1	1
<b>TOTAL</b>	<b>551</b>	<b>2988</b>