

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-2022>.

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 2021 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	527	2988	33425	1.58 (1.44, 1.72)
Other Total Conventional Hip	15859	453455	2721137	0.58 (0.57, 0.59)
TOTAL	16386	456443	2754562	0.59 (0.59, 0.60)

Note: Prostheses no longer used in 2021 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
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)
Other Total Conventional Hip	1.7 (1.7, 1.8)	2.2 (2.2, 2.2)	2.5 (2.5, 2.6)	2.8 (2.8, 2.9)	3.1 (3.0, 3.2)	3.4 (3.3, 3.5)	3.7 (3.6, 3.7)

CPR	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs
BHR	10.9 (9.8, 12.2)	12.4 (11.3, 13.7)	14.3 (13.0, 15.7)	16.2 (14.8, 17.6)	17.6 (16.2, 19.1)	19.0 (17.6, 20.6)	20.3 (18.7, 22.0)
Other Total Conventional Hip	4.0 (3.9, 4.0)	4.3 (4.2, 4.4)	4.6 (4.6, 4.7)	5.0 (4.9, 5.1)	5.4 (5.3, 5.5)	5.8 (5.7, 5.9)	6.3 (6.1, 6.4)

CPR	15 Yrs	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs
BHR	21.1 (19.4, 22.8)	22.9 (20.9, 25.1)	24.6 (22.1, 27.4)				
Other Total Conventional Hip	6.7 (6.5, 6.8)	7.1 (6.9, 7.3)	7.5 (7.3, 7.7)	7.9 (7.6, 8.1)	8.6 (8.3, 8.9)	8.9 (8.5, 9.3)	9.8 (9.0, 10.8)

Note: Prostheses no longer used in 2021 are excluded from the comparator. Procedures using metal/metal prostheses with head size larger than 32mm are excluded from the comparator.

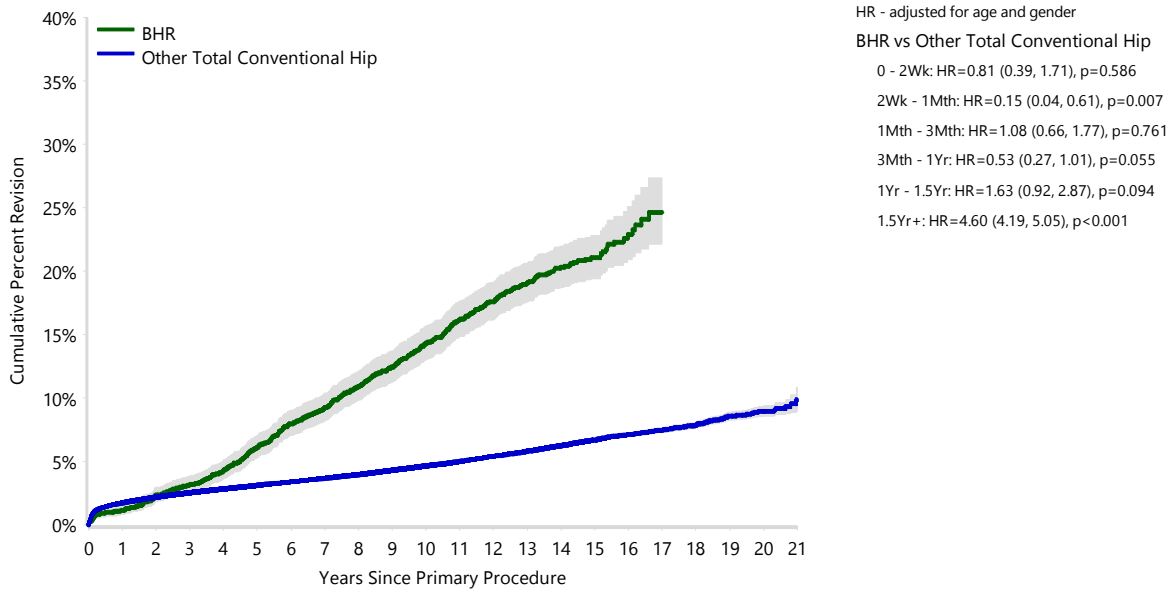
FIGURE 1

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



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
BHR	2988	2917	2850	2791	2712	2619	2523	2430	2305	2201	2061
Other Total Conventional Hip	453455	398683	354053	309177	267205	228060	191587	158583	131210	108026	88155

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
BHR	1857	1584	1246	901	555	244	92	36	13	0	0
Other Total Conventional Hip	70603	55343	42208	31909	24032	17719	12212	7611	4006	1573	276

Note: Prostheses no longer used in 2021 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	445	84.4	13112	82.7
Fractured Neck Of Femur	14	2.7	1164	7.3
Osteonecrosis	34	6.5	718	4.5
Developmental Dysplasia	16	3.0	247	1.6
Rheumatoid Arthritis	7	1.3	173	1.1
Failed Internal Fixation	1	0.2	140	0.9
Tumour			137	0.9
Other Inflammatory Arthritis	8	1.5	91	0.6
Fracture/Dislocation			47	0.3
Arthrodesis Takedown	2	0.4	16	0.1
Other			14	0.1
TOTAL	527	100.0	15859	100.0

Note: Prostheses no longer used in 2021 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 19.8 Years)

Revision Diagnosis	Number	BHR		Other Total Conventional Hip		
		% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Prosthesis Dislocation/Instability	19	0.6	3.6	3717	0.8	23.4
Infection	75	2.5	14.2	3552	0.8	22.4
Fracture	35	1.2	6.6	3438	0.8	21.7
Loosening	77	2.6	14.6	3228	0.7	20.4
Pain	18	0.6	3.4	286	0.1	1.8
Leg Length Discrepancy	5	0.2	0.9	260	0.1	1.6
Metal Related Pathology	233	7.8	44.2	69	0.0	0.4
Malposition	2	0.1	0.4	225	0.0	1.4
Lysis	48	1.6	9.1	183	0.0	1.2
Implant Breakage Stem	6	0.2	1.1	151	0.0	1.0
Implant Breakage Acetabular Insert				114	0.0	0.7
Incorrect Sizing	2	0.1	0.4	95	0.0	0.6
Wear Acetabular Insert	1	0.0	0.2	91	0.0	0.6
Implant Breakage Acetabular	1	0.0	0.2	67	0.0	0.4
Wear Head				45	0.0	0.3
Tumour	3	0.1	0.6	37	0.0	0.2
Implant Breakage Head				30	0.0	0.2
Heterotopic Bone				23	0.0	0.1
Wear Acetabulum	1	0.0	0.2	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	228	0.1	1.4
N Revision	527	17.6	100.0	15852	3.5	100.0
N Primary	2988			453455		

Note: This table is restricted to revisions within 19.8 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2021 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

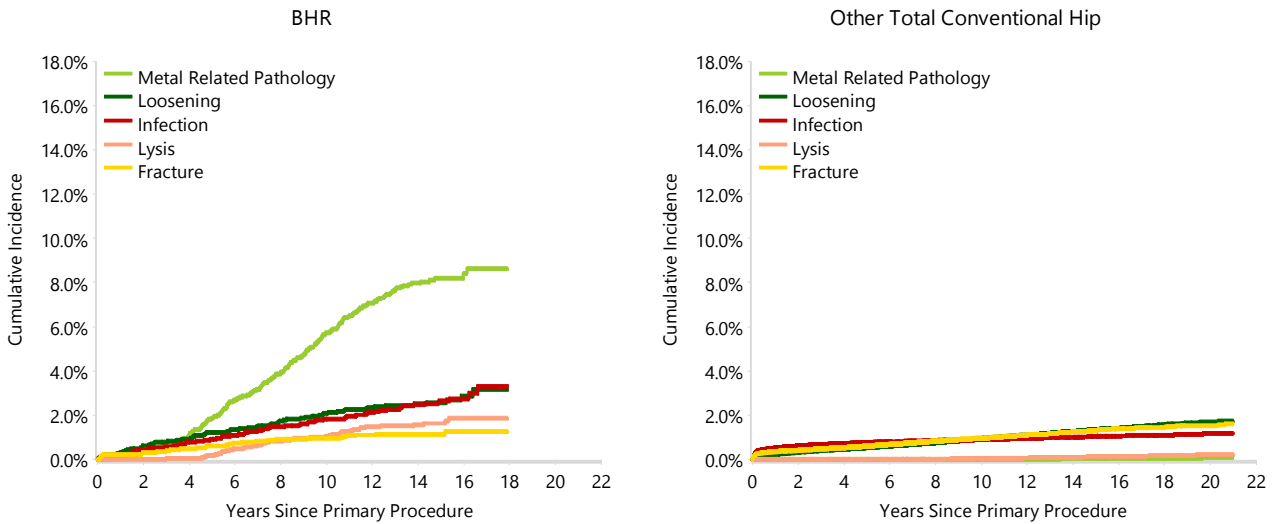


TABLE 5

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 19.8 Years)

Type of Revision	BHR		Other Total Conventional Hip	
	Number	Percent	Number	Percent
Femoral Component	44	8.3	5152	32.5
Acetabular Component	257	48.8	3057	19.3
THR (Femoral/Acetabular)	112	21.3	1813	11.4
Cement Spacer	25	4.7	594	3.7
Removal of Prostheses	3	0.6	97	0.6
Reinsertion of Components			25	0.2
Total Femoral			6	0.0
Bipolar Head and Femoral	1	0.2	4	0.0
Saddle	1	0.2	1	0.0
N Major	443	84.1	10749	67.8
Head/Insert	61	11.6	3875	24.4
Head Only	20	3.8	778	4.9
Minor Components	2	0.4	274	1.7
Insert Only	1	0.2	172	1.1
Bipolar Only			2	0.0
Cement Only			1	0.0
Head/Neck			1	0.0
N Minor	84	15.9	5103	32.2
TOTAL	527	100.0	15852	100.0

Note: This table is restricted to revisions within 19.8 years for all groups to allow a time-matched comparison of revisions.

Note: Prostheses no longer used in 2021 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	360	1995
Hybrid (Femur Cemented)	165	985
Reverse Hybrid (Femur Cementless)	0	1
TOTAL	527	2988

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	526	2984
Unknown	1	2
TOTAL	527	2988

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
TOTAL	0	1

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	190	1140
	VIC	50	316
	QLD	259	1442
	WA	2	3
	SA	5	38
	TAS	5	16
	ACT/NT	16	33
Other Total Conventional Hip	NSW	4298	132969
	VIC	3982	116998
	QLD	3146	80122
	WA	2184	53952
	SA	1415	41929
	TAS	372	15098
	ACT/NT	462	12387
TOTAL		16386	456443

Note: Prostheses no longer used in 2021 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 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 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	2	38
2003	9	66
2004	22	127
2005	50	288
2006	103	550
2007	107	581
2008	80	477
2009	83	404
2010	50	276
2011	17	134
2012	2	27
2013	2	13
2014	0	5
2015	0	1
TOTAL	527	2988

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
Acetabular						
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	41	204
120156-120166	31	227
120246-120254	10	35
120258-120266	4	15
74120144-74122154	206	1113
74120156-74122168	217	1274
74120246-74122252	12	88
74120258-74122264	6	31
CMD0171-CMD0171	0	1
TOTAL	527	2988

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	33	91
AcuMatch M-Series	1	1
Alloclassic	18	102
Anthology	71	387
BMHR	17	110
BMHR VST	35	256
Basis	0	1
Bi-Metric	8	61
C.F.P.	0	2
CLS	0	6
CORAIL	2	7
CPCS	58	289
Echelon	1	14
Emperion	8	30
Epoch	1	4
Exeter V40	6	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	17	82
Polarstem	7	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	93	537
Synergy	132	826
UniSyn	0	3
Wagner	1	1
ZMR	1	1
TOTAL	527	2988