

# Bone & Joint Open

## Supplementary Material

**Table i.** Diagnosis and procedure codes used to exclude secondary and non-elective joint arthroplasty procedures.

Conditions excluded	ICD-10-AM orACHI codes
Fracture of femur	S72
Fracture of lumbar spine and pelvis	S32
Nonunion of fracture	M84.1
Malunion of fracture	M84.0
Pathological fracture	M80.0, M80.1, M80.2, M80.3, M80.4, M80.5, M80.8, M80.9, M84.4
Stress fracture	M84.3
Mechanical complications of prosthesis	T84.0 – T84.4
Resurfacing of knee	49534-00, 49534-01, 90562-00
Revision arthroplasty of knee	49530-00, 49530-01, 49533-00, 49554-00, 49545-00, 49548-00, 49551-00, 49527-00
Hemiarthroscopy of knee	49517-00
Removal of knee prosthesis	49515-00
Excision arthroplasty of hip	49312-00
Partial arthroplasty of hip	49315-00
Resurfacing of hip (unilateral)	90607-00
Revision arthroplasty of hip	49346-00, 49324-00, 49327-00, 49330-00, 49333-00, 49339-00, 49342-00, 49345-00, 49525-00, 49525-01
Malignant neoplasm of: Pelvis, sacrum, coccyx	C41.4
Long bones of lower limbs	C40.2
Bone	C41.9
Pelvis	C76.3
Lower limb	C76.5
Secondary malignant neoplasm of bone/bone marrow	C79.5
Disseminated malignant neoplasm	C80.0

**Table ii.** List of International Classification of Diseases 10th Revision codes (ICD-10) to identify comorbidities.

<b>Comorbidity</b>	<b>ICD-10-AM codes</b>
Diabetes	E10.x- E14.x
Hypertension	I10.x -I13.x, I15.x, U82.3
Acute myocardial infarction	I21.x
Stroke	G45.x, G46.x, H34.0, I60.x-I69.x
Peripheral vascular disease	I70.x, I71.x, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, Z95.8, Z95.9
Pulmonary circulation disease	I26.x, I27.x, I28.0, I28.8, I28.9
Rheumatoid arthritis	L94.0, L94.1, L94.3, M05.x, M06.x, M08.x, M12.0, M12.3, M30.x, M31.0-M31.3, M32.x -M35.x, M45.x, M46.1, M46.8, M46.9, U86.2 – U86.4
Valvular disease	A52.0, I05.x -I08.x, I09.1, I09.8, I34.x - I39.x, Q23.0-Q23.3, Z95.2-Z95.4
Cancers	C00.x -C26.x, C30.x -C34.x, C37.x -C41.x, C43.x, C45.x -C58.x, C60.x -C76.x, C77.x - C80.x, C81.x-C85.x, C88.x, C96.x, C90.0, C90.2, C97.x
Cardiac arrhythmias	I44.1-I44.3, I45.6, I45.9, I47.x-I49.x, R00.0, R00.1, R00.8, T82.1, Z45.0, Z95.0
Chronic kidney disease	N00.x–N08.x, N11.x, N12.x, N14.x–N16.x, N18.x, N19.x, N25.x–N28.x, N39.1, N39.2, Q60.x–Q63.x, T82.4, T86.1, V56.0, V56.8, V42.0, V45.1, Z49.x, Z94.0, Z99.2, U87.1
Chronic pulmonary disease	I27.8, I27.9, J40.x -J44.x, J60.x -J67.x, J68.4, J70.1, J70.3, U83.2 – U83.5
Congestive heart failure	I09.9, I11.0, I13.0, I13.2, I42.0, I42.5-I42.9, I43.x, I50.x, P29.0, U82.2
Liver disease	B18.x, I85.x, I86.4, I98.2, K70.x, K71.1, K71.3-K71.5, K71.7, K72.x -K74.x, K76.0, K76.2-K76.9, Z94.4

**Table iii.** Top 15 reasons for readmission according to readmission category.

<b>Readmission reason category</b>	<b>Frequency</b>
<b>Orthopedic complications</b>	
Infection and inflammatory reaction due to internal joint prosthesis T84.5	1,390
Other complications of internal orthopaedic prosthetic devices, implants and grafts T84.8	1,193
Infection following a procedure, not elsewhere classified T81.4	1,157
Stiffness of joint, not elsewhere classified M25.6	1,127
Mechanical complication of internal joint prosthesis T84.0	1,062
Other primary gonarthrosis M17.1	809
Other specified surgical follow-up care Z48.8	615
Pain in joint M25.5	600
Infection following a procedure, not elsewhere classified T81.4	564
Other primary coxarthrosis M16.1	498
Orthopaedic follow-up care, unspecified Z47.9	466
Attention to surgical dressings and sutures Z48.0	375
Disruption of operation wound, not elsewhere classified T81.3	360
Other complications of internal orthopaedic prosthetic devices, implants and grafts T84.8	335
Pain in joint M25.5	302
<b>Non-orthopaedic complications</b>	
Pulmonary embolism without mention of acute cor pulmonale I26.9	493
Chest pain, unspecified R07.4	407
Other postprocedural disorders of circulatory system, not elsewhere classified I97.8	389
Cellulitis of other parts of limb L03.1	370
Cellulitis of other parts of limb L03.1	356
Gastrointestinal haemorrhage, unspecified K92.2	305
Urinary tract infection, site not specified N39.0	297
Syncope and collapse R55	280
Constipation K59.0	271
Congestive heart failure I50.0	265
Atrial fibrillation and atrial flutter, unspecified I48.9	249
Pneumonia, unspecified J18.9	244
Phlebitis and thrombophlebitis of other deep vessels of lower extremities I80.2	241
Atrial fibrillation and flutter I48	216
Follow-up examination after surgery for malignant neoplasm Z08.0	214

**Table iv.** Trends in length of stay during the index hospitalization and 90-day readmission rate following total hip and knee replacement surgery (2003 to 2022).

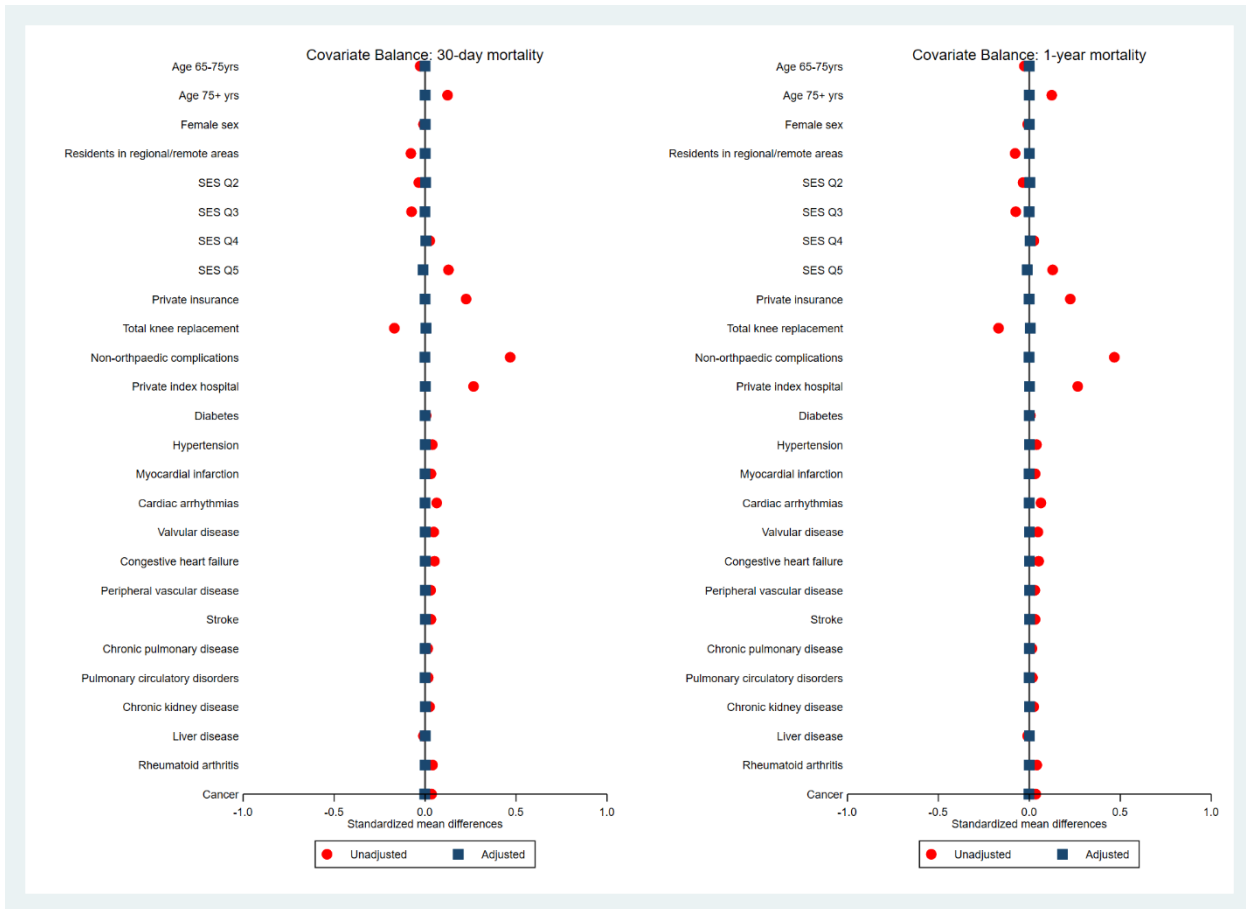
Year	Length of stay in days to median (IQR)	90-day readmission rate,
2003	8 (6 to 14)	10.1
2004	8 (6 to 14)	9.9
2005	8 (6 to 14)	9.9
2006	8 (6 to 14)	9.9
2007	8 (6 to 15)	9.3
2008	8 (6 to 15)	9.2
2009	8 (5 to 15)	9.0
2010	8 (5 to 16)	8.8
2011	8 (5 to 16)	9.1
2012	8 (5 to 16)	9.0
2013	7 (5 to 15)	9.3
2014	7 (5 to 15)	9.4
2015	7 (5 to 15)	9.4
2016	7 (4 to 15)	10.0
2017	7 (4 to 14)	9.9
2018	6 (4 to 14)	9.9
2019	6 (4 to 13)	9.6
2020	5 (4 to 12)	9.6
2021	5 (3 to 10)	9.8
2022	4 (3 to 6)	10.0

**Table v.** Selected characteristics of patients with total joint replacement (2003 to 2022), overall and by hospital type.

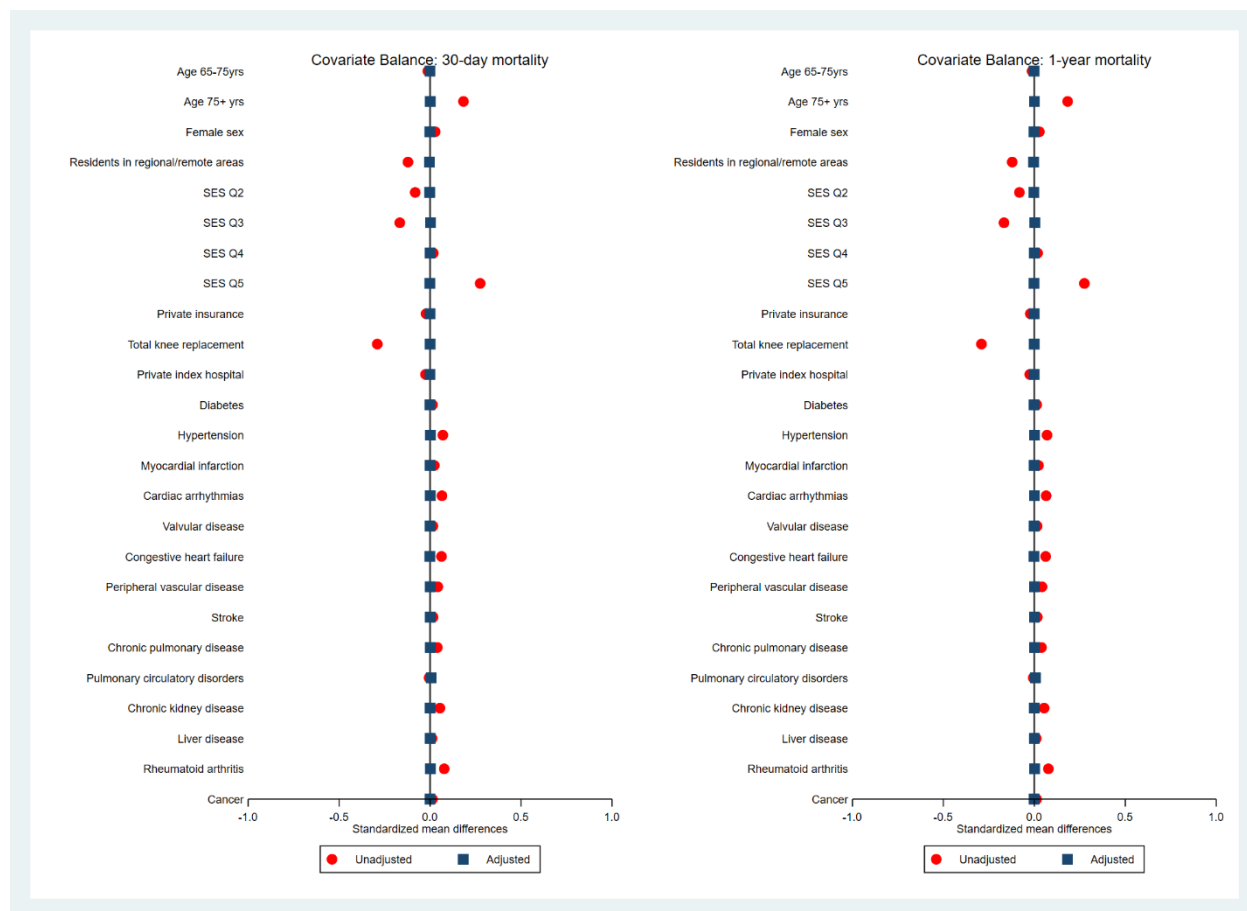
Variable	All patients	Public hospital patients	Private hospital patients	p-value*
Procedures, n (%)	394248 (100.0)	149771 (38.0)	244477 (62.0)	
<b>Procedure type, n (%)</b>				<0.001
Total hip arthroplasty	149456 (37.9)	55042 (36.8)	94414 (38.6)	
Total knee arthroplasty	244792 (62.1)	94729 (63.2)	150063 (61.4)	
Mean patient age, yrs (SD)	68.8 (10.1)	68.8 (10.3)	68.8 (10.0)	0.120
Female	218276 (55.4)	85911 (57.4)	132365 (54.1)	<0.001
<b>Socio-economic status, n (%)</b>				<0.001
Q1 - most disadvantaged	74925 (19.0)	39481 (26.4)	35444 (14.5)	
Q2	93917 (23.8)	41000 (27.4)	52917 (21.6)	
Q3	72466 (18.4)	28657 (19.1)	43809 (17.9)	
Q4	50406 (12.8)	15482 (10.3)	34924 (14.3)	
Q5 - least disadvantaged	75667 (19.2)	14156 (9.5)	61511 (25.2)	
<b>Remoteness of residence, n (%)</b>				<0.001
Major cities	263123 (66.7)	91620 (61.2)	171503 (70.2)	
Regional/remote areas	131125 (33.3)	58151 (38.8)	72974 (29.8)	
Private insurance	226668 (57.5)	8391 (5.6)	218277 (89.3)	<0.001
Pre-surgery transfer during index admission	2615 (0.7)	1133 (0.8)	1482 (0.6)	<0.001
Median length of stay, days (IQR)	7 (5 to 14)	5 (4 to 8)	9 (5 to 16)	<0.001
<b>Comorbidity profile, n (%)</b>				
Diabetes	60516 (15.3)	28166 (18.8)	32350 (13.2)	<0.001
Hypertension	160406 (40.7)	64913 (43.3)	95493 (39.1)	<0.001
Myocardial infarction	4619 (1.2)	2178 (1.5)	2441 (1.0)	<0.001
Cardiac arrhythmias	42685 (10.8)	15658 (10.5)	27027 (11.1)	<0.001
Valvular disease	5283 (1.3)	2073 (1.4)	3210 (1.3)	0.059
Congestive heart failure	9502 (2.4)	4411 (2.9)	5091 (2.1)	<0.001
Peripheral vascular disease	4503 (1.1)	1782 (1.2)	2721 (1.1)	0.028
Stroke	5789 (1.5)	2488 (1.7)	3301 (1.4)	<0.001
Chronic pulmonary disease	40109 (10.2)	18084 (12.1)	22025 (9.0)	<0.001
Pulmonary circulation disorders	5630 (1.4)	2200 (1.5)	3430 (1.4)	0.090
Chronic kidney disease	15610 (4.0)	7541 (5.0)	8069 (3.3)	<0.001
Liver disease	3422 (0.9)	1940 (1.3)	1482 (0.6)	<0.001
Rheumatoid arthritis and collagen vascular disease	46058 (11.7)	18562 (12.4)	27496 (11.2)	<0.001
Cancer	9339 (2.4)	3234 (2.2)	6105 (2.5)	<0.001
In-hospital mortality	425 (0.1)	186 (0.1)	239 (0.1)	0.014
90-day readmission	37431 (9.5)	18078 (12.1)	19353 (7.9)	<0.001

*Characteristics were present at the index hospitalisation with total hip or knee replacement surgery. \*Chi-squared test was conducted for categorical variables; t-test or Mann-Whitney test was used for continuous variables. IQR, interquartile range; SD, standard deviation.*

**Figure a.** Plot showing standardized differences in covariates between patients with index versus non-index readmission before and after inverse probability weighting in all patients undergoing joint replacement surgery.



**Figure b.** Plot showing standardized differences in covariates between patients with index versus non-index readmission for orthopaedic complications before and after inverse probability weighting in patients undergoing joint arthroplasty surgery.



**Figure c.** Plot showing standardised differences in covariates between patients with index versus non-index readmission for non-orthopaedic complications before and after inverse probability weighting in patients undergoing joint arthroplasty surgery.

