

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1: Characteristics of Patients Undergoing Hip Replacement and of Patients Readmitted Within 30 Days of Discharge (All-cause, Surgical, RTT)

	Number of patients	% of total index ops	All-cause readmissions		Surgical readmissions		RTT readmissions	
			Number	%	Number	%	Number	%
Age 0-39	10902	2.1	525	4.8	335	3.1	76	0.7
Age 40-49	25664	5.0	1169	4.6	729	2.8	160	0.6
Age 50-59	72574	14.1	3290	4.5	2048	2.8	483	0.7
Age 60-69	152004	29.5	7675	5.0	4547	3.0	1210	0.8
Age 70-79	175694	34.2	11143	6.3	5922	3.4	1570	0.9
Age 80+	77617	15.1	6687	8.6	2918	3.8	787	1.0
Females	307227	59.7	17037	5.5	9156	3.0	2300	0.7
Males	207228	40.3	13452	6.5	7343	3.5	1986	1.0
Resurfacing	16297	3.2	787	4.8	505	3.1	79	0.5
Hybrid	76267	14.8	4270	5.6	2254	3.0	638	0.8
Not cemented	203440	39.5	11250	5.5	6348	3.1	1611	0.8
Cemented	218451	42.5	14182	6.5	7392	3.4	1958	0.9
RTT during index	3089	0.6	467	15.1	297	9.6	166	5.4
Diabetes Mellitus	49378	9.6	3702	7.5	1835	3.7	536	1.1
Hypertension	231060	44.9	15553	6.7	8045	3.5	2237	1.0
Arrhythmias	44857	8.7	3952	8.8	1733	3.9	499	1.1
Valvular disease	12751	2.5	1130	8.9	492	3.9	130	1.0
Congestive Heart Failure	8269	1.6	881	10.7	326	3.9	81	1.0
Peripheral Vascular Disease	7522	1.5	769	10.2	334	4.4	85	1.1
Chronic lung disease	68816	13.4	5493	8.0	2835	4.1	688	1.0
Lung circulation disorders	2339	0.5	243	10.4	98	4.2	33	1.4
Cancer without metastasis	9381	1.8	763	8.1	327	3.5	91	1.0
Cancer with metastasis	1875	0.4	189	10.1	47	2.5	15	0.8
Renal disease	20296	3.9	1762	8.7	674	3.3	194	1.0
Dementia	1858	0.4	218	11.7	85	4.6	34	1.8
Psychoses	960	0.2	107	11.1	62	6.5	20	2.1
Alcohol abuse	7639	1.5	622	8.1	352	4.6	104	1.4
Drug abuse	732	0.1	58	7.9	39	5.3	17	2.3
Depression	16164	3.1	1216	7.5	654	4.0	213	1.3
Other mental health dx	5329	1.0	371	7.0	187	3.5	58	1.1
Any mental health dx	30427	5.9	2282	7.5	1224	4.0	380	1.2
Living alone	7543	1.5	629	8.3	309	4.1	80	1.1
Liver disease	3096	0.6	297	9.6	160	5.2	54	1.7
Peptic ulcer	2083	0.4	197	9.5	100	4.8	27	1.3

Paraplegia	1395	0.3	150	10.8	75	5.4	22	1.6
Blood loss anaemia	366	0.1	24	6.6	11	3.0	3	0.8
Deficiency anaemia	7400	1.4	658	8.9	288	3.9	63	0.9
Coagulopathy	2382	0.5	259	10.9	141	5.9	29	1.2
Weight loss	1640	0.3	157	9.6	67	4.1	13	0.8
Fluid and electrolyte disorders	8952	1.7	943	10.5	356	4.0	106	1.2
Hypothyroidism	34413	6.7	2246	6.5	1155	3.4	286	0.8
Obesity	37885	7.4	2339	6.2	1380	3.6	446	1.2
Other neuro diseases	9587	1.9	879	9.2	423	4.4	140	1.5
Rheumatic disorders	23832	4.6	1731	7.3	899	3.8	250	1.0
Previous pneumonia	2219	0.4	269	12.1	106	4.8	35	1.6
Previous stroke	855	0.2	78	9.1	27	3.2	6	0.7
Previous AMI	750	0.1	77	10.3	38	5.1	6	0.8
Frailty indicator	47040	9.1	3932	8.4	1901	4.0	614	1.3

eTable 2: Results of Multiple Logistic Regression Analysis for Patient-Related Predictors of 30-day Readmission (All-cause, Surgical and RTT)
Green= significant reduction in risk, Red= significant increase in risk

Patient factor		All-cause readmissions		Surgical readmissions		RTT readmissions			
		OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value		
Age group	Age 0-39	0.93 (0.85 to 1.03)	0.1682	0.98 (0.86 to 1.10)	0.7158	0.86 (0.67 to 1.10)	0.2259		
	Age 40-44	0.97 (0.88 to 1.08)	0.5673	1.00 (0.88 to 1.14)	0.949	0.82 (0.63 to 1.08)	0.1609		
	Age 45-49	0.91 (0.84 to 0.99)	0.029	0.89 (0.80 to 0.99)	0.0275	0.80 (0.64 to 1.00)	0.045		
	Age 50-54	0.94 (0.88 to 1.01)	0.0823	0.94 (0.86 to 1.02)	0.138	0.84 (0.70 to 0.99)	0.0414		
	Age 55-59	0.94 (0.88 to 0.99)	0.0256	0.93 (0.87 to 1.00)	0.0533	0.88 (0.76 to 1.01)	0.0777		
	Age 60-64	1		1		1			
	Age 65-69	1.08 (1.03 to 1.13)	0.0023	1.01 (0.95 to 1.08)	0.6797	1.00 (0.89 to 1.12)	0.9494		
	Age 70-74	1.17 (1.12 to 1.22)	<.0001	1.09 (1.03 to 1.16)	0.0033	1.04 (0.93 to 1.17)	0.4875		
	Age 75-79	1.31 (1.25 to 1.37)	<.0001	1.17 (1.10 to 1.24)	<.0001	1.07 (0.95 to 1.20)	0.2618		
	Age 80-84	1.50 (1.42 to 1.58)	<.0001	1.24 (1.15 to 1.32)	<.0001	1.09 (0.95 to 1.24)	0.218		
Gender	Age 85-89	1.65 (1.55 to 1.76)	<.0001	1.40 (1.28 to 1.52)	<.0001	1.24 (1.05 to 1.46)	0.01		
	Age 90+	1.83 (1.64 to 2.04)	<.0001	1.33 (1.12 to 1.57)	0.0013	1.04 (0.75 to 1.45)	0.7991		
	Male	1.29 (1.26 to 1.32)	<.0001	1.26 (1.22 to 1.30)	<.0001	1.38 (1.29 to 1.47)	<.0001		
	Op group	Resurfacing	1.03 (0.95 to 1.12)	0.4289	1.05 (0.95 to 1.17)	0.3131	0.69 (0.54 to 0.88)	0.0024	
		Hybrid	0.97 (0.94 to 1.01)	0.1918	0.99 (0.94 to 1.05)	0.8141	1.05 (0.95 to 1.16)	0.3826	
		Not cemented	1.02 (0.99 to 1.05)	0.2146	1.03 (0.98 to 1.07)	0.2187	0.99 (0.91 to 1.07)	0.7902	
		Cemented	1		1		1		
		SES quintile	1 (least deprived)	1		1		1	
			2	0.99 (0.95 to 1.02)	0.4819	1.01 (0.96 to 1.05)	0.8082	0.98 (0.89 to 1.07)	0.6485
	3		1.07 (1.03 to 1.11)	0.0002	1.07 (1.02 to 1.12)	0.0065	0.99 (0.90 to 1.09)	0.8011	
4	1.09 (1.05 to 1.13)		<.0001	1.12 (1.06 to 1.18)	<.0001	1.12 (1.01 to 1.23)	0.0246		
5 (most deprived)	1.17 (1.12 to 1.22)		<.0001	1.21 (1.14 to 1.28)	<.0001	1.16 (1.04 to 1.29)	0.0093		
Number of prior emergency admissions	0	1		1		1			
	1	1.26 (1.21 to 1.31)	<.0001	1.23 (1.16 to 1.30)	<.0001	1.17 (1.06 to 1.30)	0.0027		
	2	1.42 (1.31 to 1.53)	<.0001	1.32 (1.18 to 1.47)	<.0001	1.20 (0.97 to 1.47)	0.0951		
	3+	2.33 (2.11 to 2.57)	<.0001	1.78 (1.54 to 2.06)	<.0001	1.45 (1.09 to 1.91)	0.0104		
	White ethnicity	1		1		1			
Mixed ethnicity	0.82 (0.60 to 1.12)	0.2089	0.83 (0.56 to 1.24)	0.3618	0.42 (0.14 to 1.27)	0.1226			
Asian / Asian British	1.00 (0.85 to 1.18)	0.9647	0.89 (0.71 to 1.12)	0.3286	0.91 (0.59 to 1.40)	0.6739			
Black / Black British	1.13 (0.99 to 1.30)	0.0667	1.06 (0.88 to 1.26)	0.5613	0.96 (0.66 to 1.39)	0.8177			
Other ethnic group	0.87 (0.72 to 1.06)	0.1601	0.89 (0.69 to 1.14)	0.3518	0.89 (0.54 to 1.46)	0.6356			

Not known or stated ethnic group		0.69 (0.66 to 0.72)	<.0001	0.67 (0.63 to 0.72)	<.0001	0.61 (0.54 to 0.70)	<.0001
RTT during index admission		1.80 (1.61 to 2.00)	<.0001	3.10 (2.71 to 3.54)	<.0001	5.35 (4.45 to 6.43)	<.0001
Diabetes Mellitus		1.09 (1.05 to 1.14)	<.0001	1.05 (1.00 to 1.11)	0.05	1.11 (1.01 to 1.22)	0.0311
Hypertension		1.06 (1.03 to 1.09)	<.0001	1.06 (1.02 to 1.10)	0.0008	1.17 (1.10 to 1.25)	<.0001
Arrhythmias		1.16 (1.12 to 1.21)	<.0001	1.07 (1.01 to 1.12)	0.0235	1.09 (0.99 to 1.21)	0.0885
Valvular heart disease		1.08 (1.01 to 1.16)	0.0165	1.05 (0.95 to 1.15)	0.3423	0.99 (0.82 to 1.18)	0.8755
Congestive Heart Failure		1.07 (0.99 to 1.15)	0.0999	0.93 (0.83 to 1.05)	0.2286	0.78 (0.62 to 0.98)	0.0366
Peripheral Vascular Disease		1.27 (1.18 to 1.38)	<.0001	1.16 (1.04 to 1.30)	0.01	1.05 (0.84 to 1.31)	0.6758
Chronic pulmonary disease		1.31 (1.27 to 1.35)	<.0001	1.28 (1.22 to 1.33)	<.0001	1.12 (1.03 to 1.22)	0.0084
Pulmonary Circulatory disease		1.14 (0.99 to 1.31)	0.0593	1.06 (0.86 to 1.31)	0.5691	1.23 (0.86 to 1.74)	0.2559
Metastases		1.47 (1.25 to 1.74)	<.0001	0.73 (0.53 to 0.98)	0.0388	0.83 (0.49 to 1.43)	0.5034
Renal disease		1.08 (1.02 to 1.14)	0.0061	0.89 (0.82 to 0.96)	0.0045	0.90 (0.78 to 1.05)	0.1804
Dementia		1.27 (1.10 to 1.47)	0.0013	1.18 (0.95 to 1.48)	0.142	1.57 (1.11 to 2.22)	0.0113
Psychoses		1.51 (1.23 to 1.86)	<.0001	1.73 (1.33 to 2.25)	<.0001	1.83 (1.16 to 2.87)	0.0091
Alcohol abuse		1.15 (1.05 to 1.26)	0.0019	1.21 (1.07 to 1.36)	0.0015	1.32 (1.07 to 1.63)	0.0105
Drug abuse		1.15 (0.87 to 1.52)	0.3246	1.33 (0.96 to 1.86)	0.0905	2.22 (1.34 to 3.67)	0.0019
Depression		1.24 (1.16 to 1.32)	<.0001	1.26 (1.16 to 1.37)	<.0001	1.52 (1.31 to 1.76)	<.0001
Other mental health disorder		1.27 (1.14 to 1.41)	<.0001	1.20 (1.04 to 1.39)	0.0154	1.38 (1.06 to 1.80)	0.0158
Living alone		0.99 (0.9 to 1.08)	0.7603	1.04 (0.92 to 1.17)	0.561	1.01 (0.80 to 1.26)	0.9648
Liver disease		1.24 (1.09 to 1.41)	0.001	1.27 (1.07 to 1.51)	0.0054	1.51 (1.13 to 2.02)	0.0051
Peptic ulcer disease		1.16 (1.00 to 1.35)	0.0547	1.22 (0.99 to 1.49)	0.0592	1.25 (0.85 to 1.83)	0.2596
Paraplegia		1.32 (1.10 to 1.57)	0.0021	1.45 (1.14 to 1.84)	0.0022	1.42 (0.92 to 2.19)	0.1109
Anaemia due to blood loss		0.77 (0.51 to 1.17)	0.2165	0.76 (0.42 to 1.39)	0.3731	0.78 (0.25 to 2.43)	0.6712
Iron deficiency anaemia		1.10 (1.01 to 1.19)	0.0342	1.01 (0.89 to 1.14)	0.91	0.81 (0.63 to 1.05)	0.1109
Coagulopathy		1.61 (1.41 to 1.84)	<.0001	1.73 (1.45 to 2.06)	<.0001	1.21 (0.83 to 1.75)	0.3225
Recent weight loss		1.04 (0.87 to 1.23)	0.6881	0.96 (0.75 to 1.23)	0.7478	0.71 (0.41 to 1.24)	0.2316
Fluid balance abnormality		1.18 (1.10 to 1.27)	<.0001	1.03 (0.92 to 1.15)	0.6481	1.03 (0.84 to 1.26)	0.7874
Hypothyroidism		1.04 (0.99 to 1.09)	0.0937	1.03 (0.97 to 1.10)	0.3125	0.96 (0.85 to 1.09)	0.5179
Obesity		1.14 (1.09 to 1.20)	<.0001	1.27 (1.19 to 1.35)	<.0001	1.46 (1.32 to 1.63)	<.0001
Other neurological disorder		1.29 (1.20 to 1.39)	<.0001	1.23 (1.11 to 1.36)	<.0001	1.45 (1.21 to 1.72)	<.0001
Rheumatological disorder		1.14 (1.08 to 1.20)	<.0001	1.14 (1.07 to 1.23)	0.0002	1.23 (1.08 to 1.40)	0.0021
Previous pneumonia		1.00 (0.87 to 1.14)	0.9777	0.94 (0.77 to 1.15)	0.5561	1.16 (0.82 to 1.65)	0.402
Previous stroke		0.82 (0.64 to 1.04)	0.0963	0.62 (0.42 to 0.91)	0.0156	0.49 (0.22 to 1.10)	0.0853
Previous AMI		0.89 (0.70 to 1.14)	0.3531	1.04 (0.74 to 1.45)	0.8261	0.61 (0.27 to 1.37)	0.234
Cancer diagnosis		1.00 (0.92 to 1.09)	0.9936	0.95 (0.85 to 1.07)	0.4233	0.96 (0.77 to 1.20)	0.7221
Index LOS in nights	0	1.50 (1.10 to 2.05)	0.0103	1.08 (0.69 to 1.71)	0.7318	1.30 (0.57 to 2.96)	0.5323
	1	1.06 (0.92 to 1.23)	0.4362	0.95 (0.78 to 1.15)	0.5898	0.94 (0.65 to 1.36)	0.7419
	2	1		1		1	
	3	1.09 (1.03 to 1.16)	0.0036	1.11 (1.03 to 1.20)	0.0073	1.05 (0.91 to 1.22)	0.5193
	4	1.21 (1.14 to 1.28)	<.0001	1.17 (1.09 to 1.27)	<.0001	1.09 (0.94 to 1.26)	0.2625
	5	1.28 (1.20 to 1.36)	<.0001	1.20 (1.11 to 1.30)	<.0001	1.12 (0.96 to 1.31)	0.1435

	6	1.29 (1.21 to 1.38)	<.0001	1.18 (1.09 to 1.28)	0.0001	1.22 (1.04 to 1.43)	0.0159
	7	1.46 (1.37 to 1.56)	<.0001	1.25 (1.15 to 1.37)	<.0001	1.43 (1.21 to 1.69)	<.0001
	8	1.51 (1.41 to 1.63)	<.0001	1.32 (1.20 to 1.45)	<.0001	1.56 (1.30 to 1.86)	<.0001
	9	1.63 (1.50 to 1.76)	<.0001	1.36 (1.22 to 1.51)	<.0001	1.77 (1.45 to 2.15)	<.0001
	10	1.61 (1.47 to 1.76)	<.0001	1.32 (1.17 to 1.49)	<.0001	1.73 (1.39 to 2.15)	<.0001
	11	1.56 (1.42 to 1.73)	<.0001	1.21 (1.06 to 1.39)	0.0054	1.43 (1.11 to 1.85)	0.0053
	12	1.56 (1.40 to 1.73)	<.0001	1.16 (0.99 to 1.35)	0.0605	1.45 (1.10 to 1.91)	0.0082
	13	1.62 (1.45 to 1.81)	<.0001	1.22 (1.04 to 1.44)	0.0142	1.62 (1.22 to 2.14)	0.0009
	14	1.60 (1.43 to 1.80)	<.0001	1.07 (0.90 to 1.27)	0.4283	1.25 (0.91 to 1.71)	0.1695
	15	1.57 (1.37 to 1.79)	<.0001	1.00 (0.82 to 1.22)	0.9979	1.58 (1.14 to 2.19)	0.0065
	16	1.69 (1.46 to 1.96)	<.0001	1.03 (0.82 to 1.30)	0.8029	1.45 (0.98 to 2.16)	0.066
	17	1.67 (1.41 to 1.97)	<.0001	1.14 (0.89 to 1.46)	0.3026	1.61 (1.06 to 2.44)	0.0261
	18	1.80 (1.51 to 2.15)	<.0001	0.97 (0.73 to 1.30)	0.8573	1.24 (0.76 to 2.04)	0.3867
	19	1.62 (1.33 to 1.97)	<.0001	1.06 (0.78 to 1.43)	0.7135	1.79 (1.13 to 2.84)	0.0135
	20	1.43 (1.16 to 1.77)	0.001	0.50 (0.32 to 0.77)	0.0017	0.45 (0.18 to 1.10)	0.0807
	21+	1.90 (1.73 to 2.07)	<.0001	0.88 (0.77 to 1.02)	0.0837	1.14 (0.89 to 1.45)	0.3029

eAppendix 1. OPCS Procedure Codes Used to Identify Primary Total Hip Arthroplasty

W371 (primary total prosthetic replacement of hip joint using cement), W381 (primary total prosthetic replacement of hip joint not using cement), W391 (primary total prosthetic replacement of hip joint not elsewhere coded (NEC)), W931 (primary hybrid prosthetic replacement of hip joint using cemented acetabular component), W941 (primary hybrid prosthetic replacement of hip joint using cemented femoral component), W951 (primary hybrid prosthetic replacement of hip joint using cement NEC) and W581 + Z843 (primary resurfacing of hip joint). Hip arthroplasty procedures were divided into the following subgroups: cemented, uncemented, hybrid and resurfacing.

eAppendix 2. Primary ICD-10 Diagnostic Codes Used to Define ‘Surgical’ Causes of Readmission

Relevant T (complication) codes e.g. T84.0= ‘mechanical complication of internal joint prosthesis’ which includes dislocation, T84.5= ‘infection and inflammatory reaction due to internal joint prosthesis’, T81.3= ‘disruption of operation wound, not elsewhere classified’, T85= ‘complications of other internal prosthetic devices, implants and grafts’, T81.0= ‘haemorrhage and haematoma complicating a procedure NEC’, T81.3= ‘disruption of operation wound, not elsewhere classified’, T81.4= ‘infection following a procedure, not elsewhere classified’, T81.8= ‘other complications of procedures, not elsewhere classified’, relevant M (diseases of the musculoskeletal system) codes e.g. M79.8= ‘other specified soft tissue disorders’ which includes limb swelling, M79.6= ‘pain in limb’, M96.6= ‘fracture of bone following insertion of orthopaedic implant, joint prosthesis or bone plate’ and relevant R (symptom) codes e.g. R22.4= ‘localised swelling, mass and lump, lower limb’. Of note, thromboembolic complications (I codes) were not included in this category. If a patient presented with limb swelling or pain and was subsequently diagnosed with a DVT, infection, haematoma or any other defined condition, they would be given a primary ICD-10 code for that condition and not included in the ‘other specified soft tissue disorders’ (M79.8) or ‘pain in limb’ (M79.6) groups.