

Supplementary Materials for

Can we trust administrative data in joint arthroplasty? A validation study against the Italian Arthroplasty Registry data as a gold standard

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This PDF file includes:

Table A1. Mapping of ICD9-CM and MDS codes to categories and sub-categories

Table A2. Mapping of ICD9-CM and MDS codes to diagnoses

Table B1. Range of prediction metrics of investigated procedures in leave-one-out validation

Table B2. Range of prediction metrics of investigated diagnoses in leave-one-out validation

Table A1
Mapping of ICD9-CM and MDS codes to categories and sub-categories

Joint	Category	Sub-category	ICD-9-CM	MDS
Hip	Primary	Total primary	81.51, 00.85	A1, A3
		Partial primary	81.52	A2
	Revision	Total revision	81.53, 00.70	C, E
		Partial revision	00.71, 00.72, 00.73	B
		Removal	80.05	D, D1
Knee	Primary	Total primary	81.54	A1, A2, A3, A4, A5, A6, A7, A8, A9
	Revision	Total revision	81.55, 00.80	D
		Partial revision	00.81, 00.82, 00.83, 00.84	C
		Removal	00.86	E, E1

Table A2
Mapping of ICD9-CM and MDS codes to diagnoses

Joint	Intervention	Diagnosis	ICD-9-CM	MDS
Hip	Primary	Osteoarthritis	714.4, 715.0, 715.00, 715.09, 715.1, 715.10, 715.15, 715.18, 715.2, 715.20, 715.25, 715.28, 715.3, 715.30, 715.35, 715.38, 715.8, 715.80, 715.89, 715.9, 715.90, 715.95, 715.98, 716.1, 716.10, 716.15, 716.19	CAU1 = A, B
		Rheumatoid arthritis	712.10, 712.15, 712.19, 712.25, 714.0, 714.3, 714.30, 714.31, 714.32, 714.33, 716.5, 716.50, 716.55, 716.59, 716.6, 716.60, 716.65, 716.68, 716.9, 716.90, 716.95, 716.98, 716.99, 719.3, 719.30, 719.35, 719.38, 719.39	CAU1 = C
		Neoplasm	170.6, 170.7, 170.8, 170.9, 171.3, 195.5, 198.5, 213.7, 213.8, 213.9, 215.3, 238.0, 719.2, 719.20, 719.25, 719.28, 719.29	CAU1 = D
		Necrosis	733.4, 733.40, 733.42, 733.43, 733.49, 945.4, 945.40, 945.44, 945.46, 945.49, 945.5, 945.50, 945.54, 945.56, 945.59	CAU1 = E
		Deformity	718.5, 718.50, 718.55, 718.58, 718.59, 718.7, 718.70, 718.75, 718.78, 718.79, 732.1, 732.2, 732.6, 732.9, 736.3, 736.30, 736.31, 736.32, 736.39, 738.6, 754.3, 754.30, 754.31, 754.32, 754.33, 754.35, 755.6, 755.60, 755.61, 755.62, 755.63	CAU1 = F, G
		Fracture	733.14, 733.15, 733.95, 808, 808.0, 808.2, 808.42, 808.43, 808.49, 808.8, 820, 820.00, 820.01, 820.02, 820.03, 820.09, 820.10, 820.11, 820.12, 820.13, 820.19, 820.20, 820.21, 820.22, 820.30, 820.31, 820.8, 820.9, 821, 821.00, 821.01, 821.10, 821.20, 821.21, 821.22, 821.23, 821.29, 821.33, 828.0	CAU1 = H
		Sepsis	711.00, 711.05, 711.09, 711.90, 711.95, 711.99, 730.9, 730.90, 730.95, 730.98, 730.99	CAU1 = I
		Pseudo-arthritis	7338, 73381, 73382, 9053, 9054	CAU1 = L
	Revision	Loosening	996.4, 996.40, 996.41, 996.47, 996.49, 996.52, 996.59	CAUR = J, K, L
		Peri-prosthetic fracture	996.44	CAUR = F
		Dislocation	996.42	CAUR = E
		Infection	996.60, 996.66, 996.67, 996.69, 998.51, 998.59	CAUR = G
		Metallosis	985, 985.01, 985.02, 985.03, 985.04, 985.05, 985.06, 985.07, 985.08, 985.09	CAUR = P
		Wear	996.46	CAUR = C
		Pain	338.18, 338.28, 355.71, 996.70, 996.74, 996.78, 996.79	CAUR = A
		Prosthetic fracture	996.43	CAUR = D1, D2, D3, D4
Knee	Primary	Osteoarthritis	715.0, 715.00, 715.09, 715.1, 715.16, 715.18, 715.2, 715.20, 715.26, 715.28, 715.3, 715.30, 715.36, 715.38, 715.8, 715.80, 715.89, 715.9, 715.90, 715.96, 715.98, 716.1, 716.0, 716.16, 716.19, 716.5, 716.50, 716.56, 716.58, 716.59, 716.6, 716.60, 716.66, 716.68	CAU1 = A, B
		Rheumatoid arthritis	711.06, 711.08, 711.09, 711.96, 711.98, 711.99, 714.0, 714.3, 714.30, 714.31, 714.32, 714.33, 714.9, 714.8, 716.9, 716.90, 716.96, 716.98, 716.99	CAU1 = C
		Neoplasm	170.7, 170.8, 170.9, 195.5, 198.5, 198.8, 198.89, 199.0, 199.1, 213.7, 213.8, 213.9, 215.3, 215.8, 215.9, 234.8, 234.9, 238.0, 238.9, 239.2, 239.8, 239.9	CAU1 = D
		Necrosis	733.4, 733.40, 733.43, 733.49	CAU1 = E
	Revision	Loosening	996.4, 996.40, 996.45, 996.47, 996.49	CAUR = A, B, C, C1
		Peri-prosthetic fracture	996.44	CAUR = G
		Dislocation	996.41	CAUR = E
		Infection	996.6, 996.60, 996.66, 996.67, 998.5, 998.51, 998.59	CAUR = I
		Wear	996.46	CAUR = D
		Pain	338.18, 338.28, 355.7, 355.71, 719.4, 719.40, 719.46, 719.48, 719.49, 996.7, 996.70, 996.77, 996.78, 996.79	CAUR = N
		Prosthetic fracture	996.43	CAUR = H
		Instability	996.42	CAUR = F
		Stiffness	718.4, 718.40, 718.46, 718.48, 718.49, 719.5, 719.50, 719.56, 719.58, 719.59	CAUR = L

Table B1
Range of prediction metrics of investigated procedures in leave-one-out validation

Hip	Prevalence (%)	Sensitivity (%)	Specificity (%)	Accuracy (%)	Kappa
Primary	94.04-94.46	99.04-99.68	92.96-96.91	98.68-99.49	0.89-0.95
<i>Total primary</i>	71.32-72.74	97.5-98.59	94.62-97.3	96.68-98.21	0.92-0.96
<i>Partial primary</i>	21.46-23.03	93.51-96.86	98.36-98.99	97.27-98.49	0.92-0.96
Revision	5.54-5.96	93.24-97.72	99.42-99.59	99.05-99.47	0.92-0.95
<i>Total revision</i>	1.5-1.62	78.73-96.09	97.37-98.14	97.07-98.07	0.45-0.6
<i>Partial revision</i>	3.3-4.11	45.95-71.13	99.51-99.61	97.31-98.58	0.57-0.77
<i>Removal</i>	0.24-0.75	20.29-49.03	99.88-99.9	99.29-99.78	0.3-0.51
Knee	Prevalence (%)	Sensitivity (%)	Specificity (%)	Accuracy (%)	Kappa
Primary	95.14-95.47	99.15-99.64	93.99-96.13	98.9-99.46	0.89-0.94
Revision	4.53-4.86	92.58-96.51	99.65-99.76	99.31-99.6	0.92-0.96
<i>Total revision</i>	3.39-3.51	90.44-93.87	98.95-99.42	98.65-99.21	0.82-0.89
<i>Partial revision</i>	1.02-1.08	42.01-68.11	99.86-99.89	99.28-99.52	0.55-0.75
<i>Removal</i>	0.08-0.31	28.1-38.46	99.61-99.85	99.53-99.63	0.12-0.32

Table B2
Range of prediction metrics of investigated diagnoses in leave-one-out validation

Hip	Prevalence (%)	Sensitivity (%)	Specificity (%)	Accuracy (%)	Kappa
Osteoarthritis	54.69-60.24	96.01-96.46	88.88-90.74	93.19-93.87	0.86-0.88
Reumatoid arthritis	0.24-0.29	23.57-31.36	99.62-99.8	99.44-99.61	0.16-0.3
Neoplasia	0.16-0.24	26.4-43.62	99.91-99.94	99.77-99.82	0.32-0.48
Necrosis	2.89-3.14	50.51-53.4	99.18-99.38	97.74-97.94	0.56-0.61
Malformation	1.91-2.34	14.47-19.97	99.72-99.82	97.79-98.29	0.22-0.3
Fracture	28.12-33.56	97.45-97.83	97.39-97.5	97.46-97.55	0.94-0.94
Sepsis	0.01-0.05	0-9.76	99.99-99.99	99.94-99.98	0-0.11
Pseudoarthrosis	0.06-0.28	53.26-70.95	99.3-99.41	99.2-99.38	0.09-0.3
Aseptic loosening	2.44-2.6	56.92-62.76	98.57-98.78	97.63-97.75	0.54-0.57
Periprosthetic fracture	0.67-0.93	47.16-57.12	99.77-99.87	99.29-99.57	0.55-0.63
Dislocation	0.82-1.04	43.82-46.71	99.5-99.58	98.95-99.14	0.45-0.47
Infection	0.44-0.58	71.75-77.08	99.4-99.56	99.27-99.44	0.52-0.55
Metallosis	0-0	0-0	100-100	100-100	0-0
Wear	0.33-0.54	26.23-33.33	99.91-99.93	99.52-99.69	0.37-0.42
Pain	0.27-0.39	1.03-1.72	99.83-99.85	99.46-99.57	0.01-0.02
Prosthesis fracture	0.07-0.28	12.5-24.89	99.69-99.81	99.47-99.76	0.06-0.18
Osteolysis	0.09-0.2	13.27-22.37	99.89-99.94	99.73-99.87	0.15-0.25
Knee	Prevalence (%)	Sensitivity (%)	Specificity (%)	Accuracy (%)	Kappa
Osteoarthritis	93.49-93.96	93.62-98.59	76.17-77.54	92.48-97.25	0.53-0.76
Reumatoid arthritis	0.62-0.66	18.05-30.88	99.64-99.8	99.13-99.36	0.2-0.37
Neoplasia	0.03-0.06	47.62-60.92	99.97-99.98	99.95-99.96	0.4-0.61
Necrosis	0.82-0.99	26.68-29	99.86-99.89	99.17-99.29	0.37-0.4
Aseptic loosening	1.93-2.28	25.57-29.69	99.06-99.32	97.66-97.75	0.29-0.33
Periprosthetic fracture	0.08-0.09	25-51.15	99.97-99.98	99.9-99.94	0.32-0.57
Dislocation	0.09-0.12	5.33-8.97	98.91-99.17	98.82-99.06	0.01-0.02
Infection	0.91-1.09	62.4-69.63	99.62-99.76	99.29-99.43	0.65-0.68
Wear	0.11-0.15	12.29-23.29	99.98-99.99	99.86-99.9	0.2-0.33
Pain	0.74-1.01	11.97-21.05	99.17-99.59	98.53-98.79	0.1-0.25
Prosthesis fracture	0.04-0.07	11.11-22.43	99.64-99.75	99.6-99.7	0.02-0.08
Instability	0.23-0.26	10.82-9.88	99.78-99.83	99.54-99.61	0.09-0.12
Rigidity	0.09-0.13	13.95-16.67	99.96-99.97	99.86-99.88	0.18-0.23