

Appendix

TABLE E-1 Codes Used in the Study*

Condition	Code
Knee-related diagnosis	
ICD-9 diagnoses	71516, 71526, 71536, 71596, 71616, 71656, 71666, 71686, 71696, 7170, 7171, 7172, 7173, 7174, 71740, 71741, 71742, 71743, 71749, 7175, 7176, 7177, 7178, 71781, 71782, 71783, 71784, 71785, 71789, 7179, 71846, 71886, 71906, 71916, 71926, 71936, 71946, 71956, 71966, 71986, 71996, 7266, 72669, 72931, 7366, 8360, 8361, 8362, 8441, 8442, 8443, 8448, 8449
ICD-10 diagnoses	M02061, M02062, M02161, M02162, M02169, M02261, M02262, M02361, M02362, M02369, M02861, M02862, M02869, M05061, M05062, M05161, M05162, M05169, M05261, M05262, M05269, M05361, M05362, M05369, M05461, M05462, M05469, M05561, M05562, M05569, M05661, M05662, M05669, M05761, M05762, M05769, M05861, M05862, M05869, M06061, M06062, M06069, M06261, M06262, M06269, M06361, M06362, M06369, M06861, M06862, M06869, M07661, M07662, M07669, M08061, M08062, M08069, M08261, M08262, M08461, M08462, M08861, M08862, M08869, M08961, M08962, M08969, M10061, M10062, M10069, M10161, M10162, M10169, M10261, M10262, M10269, M10361, M10362, M10369, M10461, M10462, M10469, M11061, M11062, M11161, M11162, M11169, M11261, M11262, M11269, M11861, M11862, M11869, M12061, M12062, M12069, M12161, M12162, M12169, M12261, M12262, M12269, M12361, M12362, M12369, M12461, M12462, M12469, M12561, M12562, M12569, M12861, M12862, M12869, M13161, M13162, M13169, M13861, M13862, M13869, M14661, M14662, M14669, M14861, M14862, M14869, M170, M1710, M1711, M1712, M172, M1730, M1731, M1732, M174, M175, M179, M1A0610, M1A0611, M1A0620, M1A0621, M1A0690, M1A0691, M1A1610, M1A1611, M1A1620, M1A1690, M1A2610, M1A2611, M1A2620, M1A2621, M1A2690, M1A3610, M1A3611, M1A3620, M1A3621, M1A3690, M1A3691, M1A4610, M1A4611, M1A4620, M1A4621, M1A4690, M21061, M21062, M21069, M21161, M21162, M21169, M21261, M21262, M21269, M2200, M2201, M2202, M2210, M2211, M2212, M222X1, M222X2, M222X9, M223X1, M223X2, M223X9, M2240, M2241, M2242, M228X1, M228X2, M228X9, M2290, M2291, M2292, M23000, M23001, M23002, M23003, M23004, M23005, M23006, M23007, M23009, M23011, M23012, M23019, M23021, M23022, M23029, M23031, M23032, M23039, M23041, M23042, M23049, M23051, M23052, M23059, M23061, M23062, M23069, M23200, M23201, M23202, M23203, M23204, M23205, M23206, M23207, M23209, M23211, M23212, M23219, M23221, M23222, M23229, M23231, M23232, M23239, M23241, M23242, M23249, M23251, M23252, M23259, M23261, M23262, M23269, M23300, M23301, M23302, M23303, M23304, M23305, M23306, M23307, M23309, M23311, M23312, M23319, M23321, M23322, M23329, M23331, M23332, M23339, M23341, M23342, M23349, M23351, M23352, M23359, M23361, M23362, M23369, M2340, M2341, M2342, M2350, M2351, M2352, M23601, M23602, M23611, M23612, M23619, M23621, M23622, M23629, M23631, M23632, M23639, M23641, M23642, M23671, M23672, M238X1, M238X2, M238X9, M2390, M2391, M2392, M24361, M24362, M24461, M24462, M24469, M24561, M24562, M24569, M24661, M24662, M24669, M25061, M25062, M25069, M25161, M25162, M25169, M25261, M25262, M25269, M25361, M25362, M25369, M25461, M25462, M25469, M25561, M25562, M25569, M25661, M25662, M25669, M25761, M25762, M25769, M25861, M25862, M25869, M67361, M67362, M67369, M67461, M67462, M67469, M6750, M6751, M6752, M67861, M67862, M67863, M67864, M67869, M7040, M7041, M7042, M7050, M7051, M7052, M7120, M7121, M7122, M71461, M71462, M71469, M71561, M71562, M71569, M71861, M71862, M7650, M7651, M7652, M9240, M9241, M9242, M93261, M93262, M93269, M94261, M94262, M94269, Q682, Q741, S83101A, S83101D, S83101S, S83102A, S83102D, S83102S, S83103A, S83103D, S83104A, S83104D, S83104S, S83105A, S83105D, S83105S, S83106A, S83106D, S83106S, S83111A, S83111D, S83112A, S83112D, S83114A, S83114D, S83115A, S83115D, S83115S, S83116S, S83121A, S83121D, S83122A, S83122D, S83124A, S83124S, S83125A, S83126A, S83126D, S83131A, S83132A, S83132D, S83134A, S83135A, S83135D, S83141A, S83141D, S83141S, S83142A, S83142D, S83143A, S83144A, S83145A, S83145D, S83146A, S83191A, S83191D, S83191S, S83192A, S83192D, S83192S, S83193A, S83194A, S83194D, S83194S, S83195A, S83195D, S83195S, S83196A, S83196S, S83200A, S83200D, S83200S, S83201A, S83201D, S83201S, S83202A, S83202D, S83202S, S83203A, S83203D, S83203S, S83204A, S83204D, S83204S, S83205A, S83205D, S83205S, S83206A, S83206D, S83206S, S83207A, S83207D, S83207S, S83209A, S83209D, S83209S, S83211A, S83211D, S83211S, S83212A, S83212D, S83212S, S83219A, S83219D, S83219S, S83221A, S83221D, S83221S, S83222A, S83222D, S83222S, S83229A, S83229D, S83229S, S83231A, S83231D,

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Procedure	
Injection	CPT 20610
Total knee replacement	CPT 27447
Injection type (HCPCS codes)	
Corticosteroid	J0702, J1020, J1030, J1040, J1094, J1100, J1700, J1710, J1720, J2920, J2930, J3300, J3301, J3302, J3303
Hyaluronic acid	J7317, J7319, J7320, J7321, J7322, J7323, J7324, J7325, J7326, J7327, J7328, Q4083, Q4084, Q4085, Q4086
Periprosthetic joint infection	
CPT	27301, 27303, 27310, 27331, 27372, 27488, 29870, 29871
ICD-9 diagnosis	99667, 99851, 99859
ICD-9 procedure	0080, 0084, 8006
ICD-10 diagnosis	T8453XS, T8454XS
ICD-10 procedure	0SPC09Z, 0SPC0JZ, 0SPC3JZ, 0SPC4JZ, 0SPD09Z, 0SPD0JZ, 0SPD3JZ, 0SPD4JZ

*These are a listing of the codes used to identify total knee arthroplasty, injections, knee-related diagnoses, medication type, and periprosthetic joint infection. ICD-9 = International Classification of Diseases, Ninth Revision, ICD-10 = International Classification of Diseases, Tenth Revision, HCPCS = Healthcare Common Procedure Coding System, and CPT = Current Procedural Terminology.

TABLE E-2 Comorbidities*

Comorbidity	No Injection (N = 38,432)	Hyaluronic Acid ≤3 Months (N = 646)	P Value	Corticosteroid ≤3 Months (N = 6,653)	P Value
Congestive heart failure	4.79%	5.73%	0.271	4.22%	0.043†
Cardiac arrhythmias	13.38%	13.78%	0.767	13.68%	0.506
Heart valvular disease	4.83%	4.49%	0.687	5.01%	0.544
Pulmonary circulation disorders	1.39%	<1.7%	0.019†	1.22%	0.257
Peripheral vascular disorders	4.20%	2.63%	0.048†	3.79%	0.122
Hypertension	62.93%	66.25%	0.082	64.68%	0.006†
Paralysis	0.28%	<1.7%	0.546	0.24%	0.560
Other neurologic disorders	1.97%	2.32%	0.530	2.47%	0.009†
Chronic pulmonary disease	17.05%	16.41%	0.668	17.48%	0.387
Diabetes	27.73%	26.32%	0.425	25.57%	<0.001†
Hypothyroidism	17.51%	18.27%	0.617	17.68%	0.744
Renal failure	5.10%	3.25%	0.034†	4.21%	0.002†
Liver disease	1.05%	<1.7%	0.771	0.96%	0.532
Peptic ulcer disease	1.09%	<1.7%	0.265	1.29%	0.142
HIV/AIDS‡	0.03%	<1.7%	0.653	<0.17%	0.960
Lymphoma	0.36%	<1.7%	0.383	0.36%	0.991
Metastatic cancer	0.11%	<1.7%	0.010†	<0.17%	0.880
Solid tumors without metastasis	7.59%	7.28%	0.765	7.73%	0.700
Rheumatoid arthritis or collagen vascular diseases	5.16%	5.57%	0.640	5.10%	0.820
Coagulopathy	3.57%	3.56%	0.992	2.84%	0.003†
Obesity	20.71%	13.62%	0.000†	19.24%	0.006†
Weight loss	0.41%	<1.7%	0.825	0.39%	0.834
Fluid and electrolyte disorders	10.64%	12.38%	0.154	11.02%	0.357
Blood loss anemia	1.76%	2.17%	0.438	1.92%	0.356
Deficiency anemias	16.32%	15.48%	0.568	16.64%	0.512
Alcohol abuse	0.64%	<1.7%	0.673	0.59%	0.609
Drug abuse	0.70%	<1.7%	0.097	0.53%	0.110
Psychoses	2.61%	3.25%	0.312	2.83%	0.310
Depression	13.02%	14.24%	0.361	13.33%	0.486
Smoking	6.20%	5.88%	0.743	6.06%	0.666

*A comparison of the comorbidities for patients who received no injection and those who received corticosteroid or hyaluronic acid within 3 months of total knee arthroplasty. †Significant. ‡HIV/AIDS = human immunodeficiency virus or acquired immunodeficiency syndrome.

TABLE E-3 Effect of Comorbidities in Modeling of Periprosthetic Infection Risk by Injection Timing*

	OR†	P Value
Congestive heart failure	1.56 (1.29 to 1.88)	<0.001‡
Cardiac arrhythmias	1.33 (1.16 to 1.52)	<0.001‡
Heart valvular disease	0.96 (0.76 to 1.20)	0.752
Pulmonary circulation disorders	1.10 (0.74 to 1.59)	0.613
Peripheral vascular disorders	1.41 (1.14 to 1.73)	0.001‡
Hypertension	1.43 (1.28 to 1.60)	<0.001‡
Paralysis	1.05 (0.41 to 2.20)	0.906
Other neurologic disorders	1.45 (1.08 to 1.90)	0.010‡
Chronic pulmonary disease	1.27 (1.12 to 1.43)	<0.001‡
Diabetes	1.02 (0.91 to 1.14)	0.694
Hypothyroidism	1.13 (0.99 to 1.28)	0.072
Renal failure	0.70 (0.53 to 0.91)	0.009‡
Liver disease	1.31 (0.85 to 1.93)	0.196
Peptic ulcer disease	1.09 (0.67 to 1.67)	0.697
HIV/AIDS§	8.33 (2.32 to 23.90)	<0.001‡
Lymphoma	1.87 (1.05 to 3.29)	0.047‡
Metastatic cancer	0.56 (0.03 to 2.56)	0.562
Solid tumors without metastasis	1.00 (0.82 to 1.21)	0.993
Rheumatoid arthritis or collagen vascular diseases	1.20 (0.97 to 1.46)	0.081
Coagulopathy	1.09 (0.84 to 1.39)	0.487
Obesity	1.26 (1.12 to 1.42)	<0.001‡
Weight loss	1.40 (0.71 to 2.47)	0.283
Fluid and electrolyte disorders	1.30 (1.12 to 1.50)	<0.001‡
Blood loss anemia	1.52 (1.12 to 2.03)	0.005‡
Deficiency anemias	1.29 (1.14 to 1.46)	<0.001‡
Alcohol abuse	0.95 (0.52 to 1.60)	0.866
Drug abuse	0.95 (0.51 to 1.59)	0.846
Psychoses	1.47 (1.15 to 1.86)	0.002‡
Depression	1.30 (1.13 to 1.48)	<0.001‡
Smoking	1.33 (1.11 to 1.60)	0.002‡

*The effect of comorbidities as part of a multivariate logistic regression comparing periprosthetic joint infection risk for patients stratified by the timing and medication used in their most recent injection. The no-injection cohort with female sex, age of <50 years, and no comorbidities was used as the baseline. †The values are given as the OR, with the 95% CI in parentheses.

‡Significant. §HIV/AIDS = human immunodeficiency virus or acquired immunodeficiency syndrome.

TABLE E-4 Effect of Comorbidities in Modeling of Periprosthetic Joint Infection Risk for Hyaluronic Acid Relative to Corticosteroid*

Comorbidity†	OR‡	P Value
Congestive heart failure	2.07 (1.28 to 3.22)	0.002§
Cardiac arrhythmias	1.41 (1.09 to 1.96)	0.047§
Heart valvular disease	0.89 (0.47 to 1.55)	0.703
Pulmonary circulation disorders	1.44 (0.49 to 3.40)	0.455
Peripheral vascular disorders	1.66 (0.94 to 2.76)	0.063
Hypertension	1.43 (1.06 to 1.93)	0.020§
Paralysis	1.71 (0.09 to 8.98)	0.613
Other neurologic disorders	1.27 (0.56 to 2.49)	0.521
Chronic pulmonary disease	1.06 (0.76 to 1.47)	0.710
Diabetes	1.06 (0.79 to 1.42)	0.681
Hypothyroidism	1.12 (0.78 to 1.58)	0.521
Renal failure	0.81 (0.38 to 1.55)	0.564
Liver disease	0.83 (0.13 to 2.77)	0.802
Peptic ulcer disease	0.60 (0.10 to 1.95)	0.485
Solid tumors without metastasis	0.61 (0.32 to 1.06)	0.105
Rheumatoid arthritis or collagen vascular diseases	1.36 (0.77 to 2.23)	0.257
Coagulopathy	1.09 (0.51 to 2.07)	0.800
Obesity	1.21 (0.87 to 1.66)	0.247
Weight loss	3.82 (1.08 to 10.40)	0.017§
Fluid and electrolyte disorders	1.33 (0.89 to 1.92)	0.144
Blood loss anemia	1.13 (0.44 to 2.43)	0.769
Deficiency anemias	1.44 (1.04 to 1.96)	0.026§
Alcohol abuse	0.42 (0.02 to 1.98)	0.394
Drug abuse	0.73 (0.04 to 3.48)	0.757
Psychoses	0.89 (0.37 to 1.81)	0.777
Depression	1.46 (1.01 to 2.08)	0.038§
Smoking	1.45 (0.88 to 2.28)	0.124

*The effect of comorbidities as part of a multivariate logistic regression comparing periprosthetic joint infection risk for patients receiving hyaluronic acid in their most recent injection relative to corticosteroid. The corticosteroid cohort with female sex, age of <50 years, and no comorbidities was used as the baseline. †The comorbidities of HIV/AIDS (human immunodeficiency virus or acquired immunodeficiency syndrome), lymphoma, and metastatic cancer appeared in so few patients in the study that a comparison was unable to be performed. ‡The values are given as the OR, with the 95% CI in parentheses. §Significant.