

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. ICD-10-PCS Codes for Definition of Surgical Admissions

Coronary Artery Bypass Grafting

0210083	0213083	02100J3	02100ZF	02110J9	021209F	02120KW	02130J8
0210088	0213088	02100J3	02104A3	02110JC	021209W	02120Z3	02130J9
0210089	0213089	02100J8	02104J3	02110JF	02120A3	02120Z8	02130JC
0210093	0213093	02100J9	02104K3	02110JW	02120A8	02120Z9	02130JF
0210098	0213098	02100JC	02104Z3	02110K3	02120A9	02120ZC	02130JW
0210099	0213099	02100JF	021108C	02110K8	02120AC	02120ZF	02130K3
0210493	021008C	02100JW	021108F	02110K9	02120AF	021308C	02130K8
0211083	021008F	02100K3	021108W	02110KC	02120AW	021308F	02130K9
0211088	021008W	02100K3	021109C	02110KF	02120J3	021308W	02130KC
0211089	021009C	02100K8	021109F	02110KW	02120J8	021309C	02130KF
0211093	021009F	02100K9	021109W	02110Z3	02120J9	021309F	02130KW
211098	021009W	02100KC	02110A3	02110Z8	02120JC	021309W	02130Z3
0211099	02100A3	02100KF	02110A8	02110Z9	02120JF	02130A3	02130Z8
0212083	02100A3	02100KW	02110A9	02110ZC	02120JW	02130A8	02130Z9
0212088	02100A8	02100Z3	02110AC	02110ZF	02120K3	02130A9	02130ZC
0212089	02100A9	02100Z3	02110AF	021208C	02120K8	02130AC	02130ZF
0212093	02100AC	02100Z8	02110AW	021208F	02120K9	02130AF	
0212098	02100AF	02100Z9	02110J3	021208W	02120KC	02130AW	
0212099	02100AW	02100ZC	0110J8	021209C	02120KF	02130J3	

Open Abdominal Aortic Aneurysm Repair

04B00ZZ	041009Q	04100J8	04100KD	04100ZJ	041C0ZK	041E09K	041F0AK
04R007Z	041009R	04100J9	04100KF	04100ZK	041D09H	041E0AH	041F0JH
04R00JZ	04100A6	04100JB	04100KG	04100ZQ	041D09J	041E0AJ	041F0JJ
04R00KZ	04100A7	04100JC	04100KH	04100ZR	041D09K	041E0AK	041F0JK
04500ZZ	04100A8	04100JD	04100KJ	041C09H	041D0AH	041E0JH	041F0KH
04B00ZZ	04100A9	04100JF	04100KK	041C09J	041D0AJ	041E0JJ	041F0KJ
0410096	04100AB	04100JG	04100KQ	041C09K	041D0AK	041E0JK	041F0KK
0410097	04100AC	04100JH	04100KR	041C0AH	041D0JH	041E0KH	041F0ZH
0410098	04100AD	04100JJ	04100Z6	041C0AJ	041D0JJ	041E0KJ	041F0ZJ
0410099	04100AF	04100JK	04100Z7	041C0AK	041D0JK	041E0KK	041F0ZK
041009B	04100AG	04100JQ	04100Z8	041C0JH	041D0KH	041E0ZH	041H09H
041009C	04100AH	04100JR	04100Z9	041C0JJ	041D0KJ	041E0ZJ	041H09J
041009D	04100AJ	04100K6	04100ZB	041C0JK	041D0KK	041E0ZK	041H09K
041009F	04100AK	04100K7	04100ZC	041C0KH	041D0ZH	041F09H	041H0AH
041009G	04100AQ	04100K8	04100ZD	041C0KJ	041D0ZJ	041F09J	041H0AJ
041009H	04100AR	04100K9	04100ZF	041C0KK	041D0ZK	041F09K	041H0AK
041009J	04100J6	04100KB	04100ZG	041C0ZH	041E09H	041F0AH	041H0JH
041009K	04100J7	04100KC	04100ZH	041C0ZJ	041E09J	041F0AJ	041H0JJ

041H0JK	041H0KK	041H0ZK	041J09K	041J0AK	041J0JK	041J0KK	041J0ZJ
041H0KH	041H0ZH	041J09H	041J0AH	041J0JH	041J0KH	041J0ZH	041J0ZK
041H0KJ	041H0ZJ	041J09J	041J0AJ	041J0JJ	041J0KJ		

Lower Extremity Bypass

041K09H	041K0JK	041K0ZM	041L0AP	041L0KS	041M0JL	041N0AL
041K09J	041K0JL	041K0ZN	041L0AQ	041L0ZH	041M0JM	041N0AM
041K09K	041K0JM	041K0ZP	041L0AS	041L0ZJ	041M0JP	041N0AP
041K09L	041K0JN	041K0ZQ	041L0JH	041L0ZK	041M0JQ	041N0AQ
041K09M	041K0JP	041K0ZS	041L0JJ	041L0ZL	041M0JS	041N0AS
041K09N	041K0JQ	041L09H	041L0JK	041L0ZM	041M0KL	041N0JL
041K09P	041K0JS	041L09J	041L0JL	041L0ZN	041M0KM	041N0JM
041K09Q	041K0KH	041L09K	041L0JM	041L0ZP	041M0KP	041N0JP
041K09S	041K0KJ	041L09L	041L0JN	041L0ZQ	041M0KQ	041N0JQ
041K0AH	041K0KK	041L09M	041L0JP	041L0ZS	041M0KS	041N0JS
041K0AJ	041K0KL	041L09N	041L0JQ	041M09L	041M0ZL	041N0KL
041K0AK	041K0KM	041L09P	041L0JS	041M09M	041M0ZM	041N0KM
041K0AL	041K0KN	041L09Q	041L0KH	041M09P	041M0ZP	041N0KP
041K0AM	041K0KP	041L09S	041L0KJ	041M09Q	041M0ZQ	041N0KQ
041K0AN	041K0KQ	041L0AH	041L0KK	041M09S	041M0ZS	041N0KS
041K0AP	041K0KS	041L0AJ	041L0KL	041M0AL	041N09L	041N0ZL
041K0AQ	041K0ZH	041L0AK	041L0KM	041M0AM	041N09M	041N0ZM
041K0AS	041K0ZJ	041L0AL	041L0KN	041M0AP	041N09P	041N0ZP
041K0JH	041K0ZK	041L0AM	041L0KP	041M0AQ	041N09Q	041N0ZQ
041K0JJ	041K0ZL	041L0AN	041L0KQ	041M0AS	041N09S	041N0ZS

Laparoscopic Colon Resection

0DTH4ZZ	0DTL4ZZ	0DTN4ZZ	0DBF4ZZ	0DBH4ZZ	0DBL4ZZ	0DBN4ZZ	0DTM4ZZ
0DTF4ZZ	0DTG4ZZ	0DBE4ZZ	0DBG4ZZ	0DBK4ZZ	0DBM4ZZ	0DTK4ZZ	0DTE4ZZ

Open Colon Resection

0DBE0ZZ	0DTK0ZZ	0DTN0ZZ	0DBG0ZZ	0DBL0ZZ	0DTK0ZZ
0DTH0ZZ	0DTL0ZZ	0DBE0ZZ	0DBH0ZZ	0DBM0ZZ	0DTM0ZZ
0DTF0ZZ	0DTG0ZZ	0DBF0ZZ	0DBK0ZZ	0DBN0ZZ	0DTE0ZZ

Thoracoscopic Pulmonary Lobectomy

0BBC4ZZ
0BBD4ZZ

OBBF4ZZ
OBBG4ZZ
OBBJ4ZZ

Open Pulmonary Lobectomy

OB5C0ZZ	OB5D7ZZ	OB5G3ZZ	OBBC0ZZ	OBBD7ZZ	OBBG3ZZ	OBTC4ZZ	OBTC0ZZ
OB5C3ZZ	OB5F0ZZ	OB5G7ZZ	OBBC3ZZ	OBBF0ZZ	OBBG7ZZ	OBTD4ZZ	OBTD0ZZ
OB5C7ZZ	OB5F3ZZ	OB5J0ZZ	OBBC7ZZ	OBBF3ZZ	OBBJ0ZZ	OBTF4ZZ	OBTF0ZZ
OB5D0ZZ	OB5F7ZZ	OB5J3ZZ	OBBD0ZZ	OBBF7ZZ	OBBJ3ZZ	OBTG4ZZ	OBTG0ZZ
OB5D3ZZ	OB5G0ZZ	OB5J7ZZ	OBBD3ZZ	OBBG0ZZ	OBBJ7ZZ	OBTJ4ZZ	OBTJ0ZZ

Total Hip Arthroplasty

OSR9019	OSR904Z	OSRB02Z	OSRB0KZ	OSRA0J9	OSRE03A	OSRR03A	OSRS03A
OSR901A	OSR907Z	OSRB039	OSRA009	OSRA0JA	OSRE03Z	OSRR03Z	OSRS03Z
OSR901Z	OSR90J9	OSRB03A	OSRA00A	OSRA0JZ	OSRE07Z	OSRR07Z	OSRS07Z
OSR9029	OSR90JA	OSRB03Z	OSRA00Z	OSRA0KZ	OSRE0J9	OSRR0J9	OSRS0J9
OSR902A	OSR90JZ	OSRB049	OSRA019	OSRE009	OSRE0JA	OSRR0JA	OSRS0JA
OSR902Z	OSR90KZ	OSRB04A	OSRA01A	OSRE00A	OSRE0JZ	OSRR0JZ	OSRS0JZ
OSR9039	OSRB019	OSRB04Z	OSRA01Z	OSRE00Z	OSRE0KZ	OSRR0KZ	OSRS0KZ
OSR903A	OSRB01A	OSRB07Z	OSRA039	OSRE019	OSRR019	OSRS019	
OSR903Z	OSRB01Z	OSRB0J9	OSRA03A	OSRE01A	OSRR01A	OSRS01A	
OSR9049	OSRB029	OSRB0JA	OSRA03Z	OSRE01Z	OSRR01Z	OSRS01Z	
OSR904A	OSRB02A	OSRB0JZ	OSRA07Z	OSRE039	OSRR039	OSRS039	

Total Knee Arthroplasty

OSRC07Z	OSRD0LZ	OSRV0KZ
OSRC0J9	OSRT07Z	OSRW07Z
OSRC0JA	OSRT0J9	OSRW0J9
OSRC0JZ	OSRT0JA	OSRW0JA
OSRC0KZ	OSRT0JZ	OSRW0JZ
OSRC0L9	OSRT0KZ	OSRW0KZ
OSRC0LA	OSRU07Z	
OSRC0LZ	OSRU0J9	
OSRD07Z	OSRU0JA	
OSRD0J9	OSRU0JZ	
OSRD0JA	OSRU0KZ	
OSRD0JZ	OSRV07Z	
OSRD0KZ	OSRV0J9	
OSRD0L9	OSRV0JA	
OSRD0LA	OSRV0JZ	

eTable 2. Top 15 Diagnosis Codes for 90-Day Readmissions	
Primary Diagnosis for Readmission	Readmissions (n=164,755), n(%)
Infection following a procedure, initial encounter	7097 (6.6)
Sepsis, unspecified organism	6420 (6.0)
Acute Kidney Failure, unspecified	3224 (3.0)
Hypertensive Heart Disease with Heart Failure	2437 (2.3)
Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease	2099 (2.0)
Other pulmonary embolism without acute cor pulmonale	2032 (1.9)
Encounter for attention to ileostomy	1961 (1.8)
Pneumonia, unspecified organism	1572 (1.5)
Urinary tract infection, site not specified	1309 (1.2)
Disruption of external operation (surgical) wound, not elsewhere classified, initial encounter	1292 (1.2)
Non-ST elevation (NSTEMI) myocardial infarction	1204 (1.1)
Pleural effusion, not elsewhere classified	1110 (1.0)
Paroxysmal atrial fibrillation	939 (0.9)
Unspecified intestinal obstruction	899 (0.8)
Gastrointestinal hemorrhage, unspecified	894 (0.8)
*Bolded entries represent codes defined as Ambulatory Care Sensitive Conditions (ACSCs)	

eTable 3. 90-Day Readmissions

Diagnosis	90 Day Readmissions									
	All Surgery	CABG	AAA	LE Bypass	Lap Colon	Open Colon	VATS Lobectomy	Open Lobectomy	THA	TKA
Any Diagnosis	8.5%	15.0%	16.6%	24.6%	11.6%	17.8%	10.0%	13.1%	6.7%	4.3%
All Potentially Preventable Reasons	1.5%	4.1%	2.9%	5.3%	1.3%	2.5%	1.7%	2.4%	1.3%	0.5%
Short Term Diabetes Complications	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Long Term Diabetes Complications	0.1%	0.2%	0.2%	2.6%	0%	0.1%	0%	0%	0%	0%
Chronic Obstructive Pulmonary Disease	0.2%	0.3%	0.5%	0.4%	0.1%	0.2%	0.6%	0.7%	0.2%	0.1%
Hypertension	0%	0.1%	0.1%	0.1%	0%	0%	0%	0.1%	0%	0%
Hypertension-Related Chronic Kidney Disease	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Congestive Heart Failure	0.5%	2.6%	0.8%	1.4%	0.2%	0.4%	0.3%	0.4%	0.4%	0.1%
Community Acquired Pneumonia	0.2%	0.4%	0.2%	0.3%	0.1%	0.2%	0.5%	0.7%	0.2%	0.1%
Sickle Cell Disease	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Urinary Tract Infection	0.2%	0.2%	0.3%	0.2%	0.2%	0.4%	0.1%	0.2%	0.2%	0.1%
Uncontrolled Diabetes	0%	0.1%	0.1%	0.1%	0%	0.1%	0%	0%	0%	0%
Failure to Thrive	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dental Conditions	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Vaccine Preventable Diseases	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nutritional Deficiencies	0%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%
Convulsions	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Dehydration	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hypoglycemia	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pelvic Inflammatory Disease	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ear-Nose-Throat Infections	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Angina	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Grand Mal Seizures	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Superficial Surgical Site Infection	0%	0%	0.1%	0%	0%	0%	0%	0%	0%	0%
Acute Kidney Injury/Acute Renal Failure	0.3%	0.5%	0.7%	0.6%	0.6%	1.2%	0.1%	0.3%	0.2%	0.1%
Aspiration Pneumonitis	0.1%	0.1%	0.1%	0.1%	0%	0.1%	0.1%	0.1%	0.1%	0%

eTable 4. Sensitivity Analysis—Multivariable Model—ACSC Only

Characteristic	aOR	95% CI	P value
Age, per additional decade	1.19	1.17-1.22	<0.001
Female	1.14	1.09-1.19	<0.001
Surgical Procedure			
Coronary Artery Bypass Grafting	REF	REF	
Open Abdominal Aortic Aneurysm Repair	1.05	0.83-1.31	0.697
Lower Extremity Bypass	1.66	1.49-1.86	<0.001
Laparoscopic Colon Resection	0.53	0.47-0.61	<0.001
Open Colon Resection	0.49	0.45-0.55	<0.001
Video Assisted Thoracoscopic Pulmonary Lobectomy	1.03	0.87-1.22	0.745
Open Pulmonary Lobectomy	1.63	1.41-1.87	<0.001
Total Hip Arthroplasty	0.46	0.42-0.50	<0.001
Total Knee Arthroplasty	0.48	0.43-0.53	<0.001
Insurance Status			
For age <65 years			
Private Insurance	REF	REF	
Medicare/Medicaid	2.21	2.03-2.42	<0.001
Uninsured	1.17	0.92-1.48	0.197
Other	1.28	1.04-1.57	0.017
For age ≥ 65 years			
Private Insurance	REF	REF	
Medicare/Medicaid	1.20	1.07-1.34	0.001
Uninsured	0.68	0.40-1.13	0.135
Other	0.83	0.65-1.06	0.129
Hospital Metropolitan-Teaching Status			
Metropolitan Non-teaching	REF	REF	
Metropolitan Teaching	0.89	0.82-0.96	0.003
Non-metropolitan	1.09	0.97-1.23	0.149
Hospital Size			
Small	REF	REF	
Medium	0.95	0.85-1.05	0.288
Large	0.88	0.80-0.97	0.007
Median Household Income Quartile of Patient Zip Code			
<25%	REF	REF	
25-50%	0.95	0.89-1.00	0.061
50-75%	0.92	0.86-0.98	0.021
>75%	0.83	0.77-0.90	<0.001
Emergent Surgery	7.81	7.18-8.48	<0.001
Comorbidities			

Acute Myocardial Infarction	0.59	0.55-0.64	<0.001
Congestive Heart Failure	3.68	3.49-3.88	<0.001
Peripheral Vascular Disease	0.94	0.88-1.00	0.039
Cerebrovascular Disease	0.84	0.77-0.91	<0.001
Dementia	1.09	1.00-1.19	0.045
Chronic Obstructive Pulmonary Disease	1.62	1.45-1.70	<0.001
Rheumatoid Disease	1.22	1.10-1.36	<0.001
Peptic Ulcer Disease	0.91	0.74-1.12	0.356
Mild Liver Disease	0.97	0.85-1.12	0.693
Diabetes	1.49	1.41-1.58	<0.001
Diabetes with Complications	1.88	1.77-2.00	<0.001
Hemiplegia or Paraplegia	0.94	0.72-1.23	0.654
Chronic Kidney Disease	1.51	1.43-1.60	<0.001
Cancer	1.04	0.94-1.14	0.484
Moderate to Severe Liver Disease	0.91	0.67-1.22	0.508
Metastatic Cancer	1.06	0.93-1.22	0.394
Acquired Immunodeficiency Syndrome	2.10	1.34-3.28	0.001

*Effect of primary payer stratified by age < or ≥ 65 years was estimated with a single model including an interaction term between the covariate for primary payer and a categorical variable for age ≥ 65 years. Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; ACSC, Ambulatory Care Sensitive Condition

eTable 5. Sensitivity Analysis—Multivariable Model—LOS ≤ 2 Days

Characteristic	aOR	95% CI	P value
Age, per additional decade	1.00	1.00-1.00	0.214
Female	0.91	0.89-0.93	<0.001
Surgical Procedure			
Coronary Artery Bypass Grafting	REF	REF	
Open Abdominal Aortic Aneurysm Repair	1.25	1.10-1.43	0.001
Lower Extremity Bypass	1.78	1.65-1.93	<0.001
Laparoscopic Colon Resection	1.58	1.46-1.72	<0.001
Open Colon Resection	1.14	1.06-1.23	<0.001
Video Assisted Thoracoscopic Pulmonary Lobectomy	1.00	0.89-1.12	0.961
Open Pulmonary Lobectomy	1.82	1.66-1.99	<0.001
Total Hip Arthroplasty	0.80	0.75-0.85	<0.001
Total Knee Arthroplasty	1.35	1.23-1.47	<0.001
Insurance Status			
For age <65 years			
Private Insurance	REF	REF	
Medicare/Medicaid	1.44	1.38-1.50	<0.001
Uninsured	0.75	0.67-0.83	<0.001
Other	0.93	0.85-1.02	0.105
For age ≥ 65 years			
Private Insurance	REF	REF	
Medicare/Medicaid	1.09	1.02-1.15	0.007
Uninsured	0.65	0.47-0.90	0.009
Other	0.91	0.80-1.03	0.144
Hospital Metropolitan-Teaching Status			
Metropolitan Non-teaching	REF	REF	
Metropolitan Teaching	1.04	0.97-1.11	0.282
Non-metropolitan	0.94	0.85-1.04	0.231
Hospital Size			
Small	REF	REF	
Medium	0.97	0.88-1.08	0.611
Large	0.99	0.91-1.09	0.900
Median Household Income Quartile of Patient Zip Code			
<25%	REF	REF	
25-50%	1.03	0.99-1.07	0.178
50-75%	1.06	1.01-1.11	0.009
>75%	1.02	0.97-1.08	0.467
Emergent Surgery	9.93	9.20-10.71	<0.001
Comorbidities			

Acute Myocardial Infarction	0.75	0.72-0.78	<0.001
Congestive Heart Failure	1.27	1.23-1.32	<0.001
Peripheral Vascular Disease	1.03	0.99-1.07	0.105
Cerebrovascular Disease	1.37	1.30-1.43	<0.001
Dementia	0.78	0.73-0.83	<0.001
Chronic Obstructive Pulmonary Disease	1.18	1.14-1.21	<0.001
Rheumatoid Disease	1.16	1.10-1.23	<0.001
Peptic Ulcer Disease	1.48	1.34-1.63	<0.001
Mild Liver Disease	1.07	1.00-1.14	0.065
Diabetes	1.18	1.15-1.21	<0.001
Diabetes with Complications	1.17	1.12-1.22	<0.001
Hemiplegia or Paraplegia	0.95	0.85-1.07	0.396
Chronic Kidney Disease	1.24	1.20-1.29	<0.001
Cancer	1.20	1.14-1.26	<0.001
Moderate to Severe Liver Disease	1.56	1.33-1.82	<0.001
Metastatic Cancer	1.53	1.43-1.64	<0.001
Acquired Immunodeficiency Syndrome	1.22	0.98-1.52	0.077

*Effect of primary payer stratified by age < or ≥ 65 years was estimated with a single model including an interaction term between the covariate for primary payer and a categorical variable for age ≥ 65 years
Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; LOS, length of stay