2013 Measure Updates and Specifications Report:
Hospital-level 30-day Readmission Following Admission for an Acute Exacerbation of Chronic Obstructive Pulmonary Disease (Version 2.0)

Submitted By:
Yale New Haven Health Services Corporation /Center for Outcomes Research and Evaluation
(YNHHSC/CORE)

Prepared For:
Centers for Medicare & Medicaid Services (CMS)

March 2013

Table of Contents

YNHHSC/CORE Project Team

Elizabeth E. Drye, MD, SM
Peter Lindenauer*, MD, MSc
Changqin Wang, MD, MS
Michael Araas, MPH
Siphannay Nhean, MPH
Megan Keenan, MPH
Kanchana Bhat, MPH
Leora I. Horwitz, MD, MHS
Jacqueline Grady, MS
Zhenqiu Liu, PhD
Harlan M. Krumholz, MD, SM
Susannah M. Bernheim, MD, MHS

*Baystate Medical Center

INTRODUCTION

The Centers for Medicare & Medicaid Services (CMS) contracted with Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (YNHHSC/CORE) to develop a hospital-level 30-day measure of readmission after an acute exacerbation of chronic obstructive pulmonary disease (COPD). The YNHHSC/CORE team developed the measure using Medicare claims and enrollment data and in 2011 prepared a methodology report, *Hospital-level 30-day Readmission Following an Acute Exacerbation of Chronic Obstructive Pulmonary Disease*. YNHHSC/CORE subsequently revised the measure based on stakeholder input to identify and not count planned readmissions in the outcome.

This report is an update to the 2011 methodology report. It describes the approach used to identify planned readmissions and the impact of this change on the measure results. For convenience, the report also presents the current measure specifications.

2013 MEASURE UPDATE

1. Planned Readmission Algorithm

(This is an update to Section 2.3.2 in the 2011 methodology report.)

Background

> Readmission measures are intended to capture unplanned readmissions that arise from acute clinical events requiring urgent rehospitalization within 30 days of discharge. Generally, planned readmissions are not a signal of quality of care. Therefore, CMS has worked with experts in the medical community, as well as with other stakeholders, to identify planned readmissions for procedures and treatments and not count them in readmission measures.

> Specifically, CMS contracted with YNHHSC/CORE to develop a "planned readmission algorithm" that can be used to identify planned readmissions across its readmission measures. The algorithm is a set of criteria for classifying readmissions as planned using Medicare claims. It identifies admissions that are typically planned and that may occur within 30 days of discharge from the hospital. CMS has applied the algorithm to each of its measures, including this COPD measure.

> We based the planned readmission algorithm on three principles:

> 1. A few specific, limited types of care are always considered planned (obstetrical delivery, transplant surgery, maintenance chemotherapy/radiotherapy/immunotherapy, rehabilitation);

> 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and

> 3. Admissions for acute illness or for complications of care are never planned.

YNHHSC/CORE worked with CMS to develop the algorithm based on a hospital-wide, but not condition-specific, cohort of patients. We began the development by using the Agency for Healthcare Research and Quality's (AHRQ's) Clinical Classification Software (CCS) codes to group thousands of individual procedure and diagnosis International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes into clinically coherent, mutually exclusive procedure CCS categories and mutually exclusive diagnosis CCS categories, respectively. Clinicians then reviewed the procedure categories and identified those that are commonly planned and require inpatient admission. Clinicians also reviewed the diagnosis categories and identified those that are acute diagnoses unlikely to accompany elective procedures.

In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the tables to better reflect the likely clinical experience of each measure's patient cohort. For the COPD readmission measure, CMS used the *Planned Readmission Algorithm Version 2.1 - General Population* without making any changes. The algorithm worked well without revision for patients admitted with COPD.

Description of Algorithm Flowchart and Tables

The planned readmission algorithm uses a flow chart (Figure PR1) and four tables (Tables PR1-PR4) of specific procedure categories and discharge diagnosis categories to classify readmissions as planned. The details of the *index* admission (diagnosis or procedures) are not considered when determining whether a readmission is planned. As illustrated in the flow chart, readmissions that include certain procedures (Table PR1) or are for certain diagnoses (Table PR2) are always considered planned.

If the readmission does not include a procedure or diagnosis in Table PR1 or Table PR2 that is always considered planned, the algorithm checks if the readmission has at least one procedure that is considered potentially planned (Table PR3). If the readmission has no procedures from Table PR3, the readmission is considered unplanned. Table PR3 includes 57 AHRQ procedure CCS categories from among 231 AHRQ procedure CCS categories, in addition to 11 individual ICD-9-CM procedure codes. Two examples of potentially planned procedures are total hip replacement (Procedure CCS 153) and hernia repair (Procedure CCS 85).

If the readmission does have at least one potentially planned procedure from Table PR3, the algorithm checks for a primary discharge diagnosis that is considered acute (Table PR4). If the readmission has an acute primary discharge diagnosis from Table PR4, the readmission is considered unplanned. Otherwise, it is considered planned. The list of acute primary discharge diagnoses includes 100 diagnosis groups from among 285 AHRQ condition categories, plus 4 groupings of individual ICD-9-CM diagnosis codes that represent cardiac diagnoses that would not be associated with a planned readmission. Two examples of acute primary discharge diagnoses that identify readmissions with potentially planned procedures as unplanned are sepsis (Diagnosis CCS 2) and pneumonia (Diagnosis CCS 122).

Table 1 shows the ten most common procedures the algorithm identifies as planned readmissions among Medicare fee-for-service (FFS) patients following an index admission for an acute exacerbation of COPD. We applied the *Planned Readmission Algorithm Version 2.1 – General Population* to the 352,631 Medicare FFS admissions for patients aged 65 and older who

were eligible for CMS's COPD readmission measure in 2008. From these 352,631 admissions, there were 2,542 planned readmissions. Some planned readmissions had multiple planned procedures that qualified the readmission as planned. Thus, for these 2,542 planned readmissions there were 3,405 procedure or diagnosis CCSs that qualified the readmissions as planned.

Table 1: Top 10 Planned Procedure Groups for COPD Readmissions

Procedure CCS	Description	N
47	Diagnostic cardiac catheterization; coronary arteriography	708
45	Percutaneous transluminal coronary angioplasty (PTCA)	282
48	Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator	238
84	Cholecystectomy and common duct exploration	165
78	Colorectal resection	130
49	Other OR heart procedures	124
159	Other diagnostic procedures on musculoskeletal system	101
224	Cancer chemotherapy	93
44	Coronary artery bypass graft (CABG)	85
211	Therapeutic radiology for cancer treatment	82

Effect on Cohort

Using the original 2011 COPD readmission measure, the unadjusted 30-day unplanned readmission rate was 21.9%. The updated measure decreased the number of readmissions counted in the outcome by identifying additional readmissions as planned. For the updated 2013 COPD readmission measure, the unadjusted 30-day unplanned readmission rate was 21.2%. The rate of planned readmissions was approximately 0.7%.
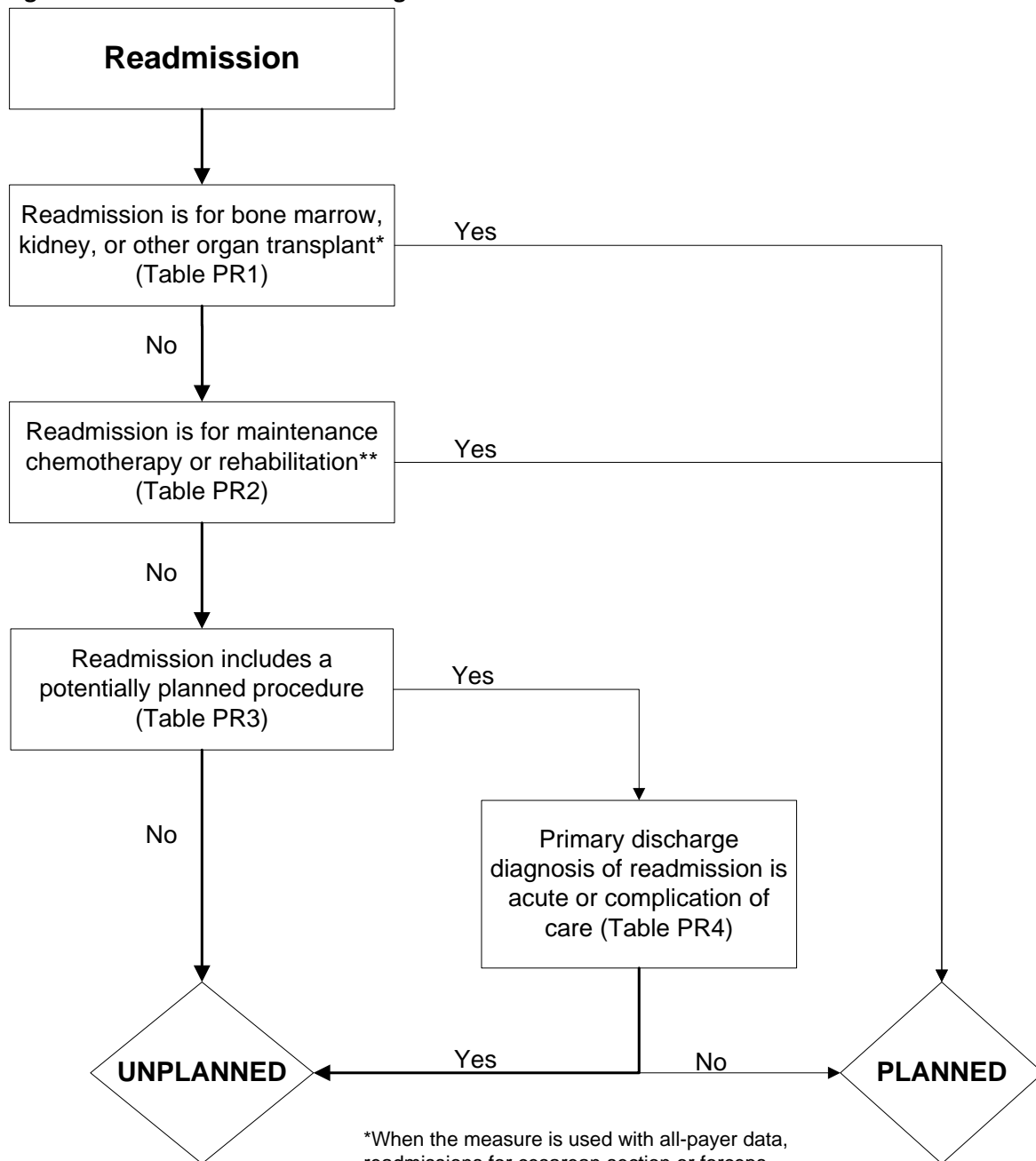
CURRENT MEASURE SPECIFICATIONS

An overview of key measure specifications and methodology is shown in below. For complete details of the cohort, outcome, and statistical methodology, please see the original *Hospital-level 30-day Readmission Following an Acute Exacerbation of Chronic Obstructive Pulmonary Disease* methodology report.

- **Measure Cohort:** Hospitalizations for patients admitted for an acute exacerbation of COPD.
- **Timeframe**: The measure uses a 30-day outcome timeframe. The timeframe is within a 30-day period from the date of discharge from an index admission.
- **Measure Outcome:** The outcome is all-cause unplanned readmission. The measure counts all unplanned readmissions. It captures readmissions that arise from acute clinical events requiring urgent rehospitalization within 30 days of discharge. The measure does not count planned readmissions as part of the outcome; it identifies planned readmissions using CMS's *Planned Readmission Algorithm Version 2.1 - General Population*.
- **Inclusion Criteria**:
  - Patient is aged 65 years or older
  - Patient continuously enrolled in Medicare FFS for the 12 months prior to the index admission
- **Exclusion Criteria**:
  - Admissions for patients without at least 30 days of post-discharge enrollment in Medicare FFS
  - Admissions for patients with in-hospital deaths
  - Admissions for patients discharged against medical advice
  - Admissions for patients who were transferred to another acute care facility
  - Admissions for COPD within 30 days of discharge from an index COPD admission; these are considered as potential readmissions but not as potential index admissions
- **Risk Adjustment**: The COPD readmission measure adjusts for case mix differences (age and clinical status of the patient, accounted for by adjusting for comorbidities) as described in detail in the measure methodology report. Consistent with National Quality Forum guidelines, the model does not adjust for socioeconomic status or race.
- **Statistical Modeling**: The measure uses hierarchical logistic regression to adjust for differences in hospital case mix and to account for the clustering of patients within a hospital.
- **Measure Score Calculation**: The measure calculates a risk-standardized ratio of the number of predicted readmissions to the number of expected readmissions. This ratio is multiplied by the national observed readmission rate to get the risk-standardized readmission rate (RSRR).

Figure PR1: Planned Readmission Algorithm Version 2.1 Flowchart

```
                    ┌─────────────────────┐
                    │     Readmission     │
                    └──────────┬──────────┘
                               │
                               ▼
         ┌──────────────────────────────┐
         │ Readmission is for bone marrow,│   Yes
         │ kidney, or other organ transplant* ──────────────────────────┐
         │        (Table PR1)           │                              │
         └──────────────┬───────────────┘                              │
                        │ No                                           │
                        ▼                                              │
         ┌──────────────────────────────┐                             │
         │ Readmission is for maintenance │  Yes                       │
         │ chemotherapy or rehabilitation** ───────────────────        │
         │        (Table PR2)           │                     │        │
         └──────────────┬───────────────┘                     │        │
                        │ No                                   │        │
                        ▼                                      │        │
         ┌──────────────────────────────┐                     │        │
         │   Readmission includes a     │  Yes                │        │
         │ potentially planned procedure ───────┐             │        │
         │        (Table PR3)           │       │             │        │
         └──────────────┬───────────────┘       │             │        │
                        │ No                     ▼             │        │
                        │         ┌──────────────────────┐    │        │
                        │         │  Primary discharge   │    │        │
                        │         │ diagnosis of readmission is │       │
                        │         │  acute or complication of │        │
                        │         │   care (Table PR4)   │    │        │
                        │         └──────────┬───────────┘    │        │
                        ▼                    │                ▼        ▼
                  ◇──────────◇       Yes     │        No   ◇──────────◇
                  │ UNPLANNED │◄──────────────┴────────────►│ PLANNED  │
                  ◇──────────◇                              ◇──────────◇
```

*When the measure is used with all-payer data, readmissions for cesarean section or forceps, vacuum, or breech delivery are considered planned

**When the measure is used with all-payer data, readmissions for forceps or normal delivery are considered planned

Table PR1: Procedure Categories that are Always Planned (Version 2.1 – General Population)

Procedure CCS	Description
64	Bone marrow transplant
105	Kidney transplant
134	Cesarean section[1]
135	Forceps; vacuum; and breech delivery[1]
176	Other organ transplantation

Table PR2: Diagnosis Categories that are Always Planned (Version 2.1 – General Population)

Diagnosis CCS	Description
45	Maintenance chemotherapy
194	Forceps delivery[1]
196	Normal pregnancy and/or delivery[1]
254	Rehabilitation

---

[1] CCS to be included only in all-payer settings, not intended for inclusion in CMS' claims-based readmission measures for Medicare fee-for-service beneficiaries aged 65+ years

Table PR3: Potentially Planned Procedure Categories (Version 2.1 – General Population)

Procedure CCS	Description
3	Laminectomy; excision intervertebral disc
5	Insertion of catheter or spinal stimulator and injection into spinal
9	Other OR therapeutic nervous system procedures
10	Thyroidectomy; partial or complete
12	Other therapeutic endocrine procedures
33	Other OR therapeutic procedures on nose; mouth and pharynx
36	Lobectomy or pneumonectomy
38	Other diagnostic procedures on lung and bronchus
40	Other diagnostic procedures of respiratory tract and mediastinum
43	Heart valve procedures
44	Coronary artery bypass graft (CABG)
45	Percutaneous transluminal coronary angioplasty (PTCA)
47	Diagnostic cardiac catheterization; coronary arteriography
48	Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator
49	Other OR heart procedures
51	Endarterectomy; vessel of head and neck
52	Aortic resection; replacement or anastomosis
53	Varicose vein stripping; lower limb
55	Peripheral vascular bypass
56	Other vascular bypass and shunt; not heart
59	Other OR procedures on vessels of head and neck
62	Other diagnostic cardiovascular procedures
66	Procedures on spleen
67	Other therapeutic procedures; hemic and lymphatic system
74	Gastrectomy; partial and total
78	Colorectal resection
79	Local excision of large intestine lesion (not endoscopic)
84	Cholecystectomy and common duct exploration
85	Inguinal and femoral hernia repair
86	Other hernia repair
99	Other OR gastrointestinal therapeutic procedures
104	Nephrectomy; partial or complete
106	Genitourinary incontinence procedures
107	Extracorporeal lithotripsy; urinary
109	Procedures on the urethra
112	Other OR therapeutic procedures of urinary tract
113	Transurethral resection of prostate (TURP)
114	Open prostatectomy
119	Oophorectomy; unilateral and bilateral
120	Other operations on ovary
124	Hysterectomy; abdominal and vaginal

Procedure CCS	Description
129	Repair of cystocele and rectocele; obliteration of vaginal vault
132	Other OR therapeutic procedures; female organs
142	Partial excision bone
152	Arthroplasty knee
153	Hip replacement; total and partial
154	Arthroplasty other than hip or knee
157	Amputation of lower extremity
158	Spinal fusion
159	Other diagnostic procedures on musculoskeletal system
166	Lumpectomy; quadrantectomy of breast
167	Mastectomy
169	Debridement of wound; infection or burn
170	Excision of Skin Lesion
172	Skin graft
211	Therapeutic radiology for cancer treatment

ICD-9 Codes	Description
30.1, 30.29, 30.3, 30.4, 31.74, 34.6	Laryngectomy, revision of tracheostomy, scarification of pleura (from Proc CCS 42- Other OR Rx procedures on respiratory system and mediastinum)
38.18	Endarterectomy leg vessel (from Proc CCS 60- Embolectomy and endarterectomy of lower limbs)
55.03, 55.04	Percutaneous nephrostomy with and without fragmentation (from Proc CCS 103- Nephrotomy and nephrostomy)
94.26, 94.27	Electroshock therapy (from Proc CCS 218- Psychological and psychiatric evaluation and therapy)

Table PR4: Acute Diagnosis Categories (Version 2.1 – General Population)

Diagnosis CCS	Description
1	Tuberculosis
2	Septicemia (except in labor)
3	Bacterial infection; unspecified site
4	Mycoses
5	HIV infection
7	Viral infection
8	Other infections; including parasitic
9	Sexually transmitted infections (not HIV or hepatitis)
54	Gout and other crystal arthropathies
55	Fluid and electrolyte disorders
60	Acute posthemorrhagic anemia
61	Sickle cell anemia
63	Diseases of white blood cells
76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)
77	Encephalitis (except that caused by tuberculosis or sexually transmitted disease)
78	Other CNS infection and poliomyelitis
82	Paralysis
83	Epilepsy; convulsions
84	Headache; including migraine
85	Coma; stupor; and brain damage
87	Retinal detachments; defects; vascular occlusion; and retinopathy
89	Blindness and vision defects
90	Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease)
91	Other eye disorders
92	Otitis media and related conditions
93	Conditions associated with dizziness or vertigo
100	Acute myocardial infarction (with the exception of ICD-9 codes 410.x2)
102	Nonspecific chest pain
104	Other and ill-defined heart disease
107	Cardiac arrest and ventricular fibrillation
109	Acute cerebrovascular disease
112	Transient cerebral ischemia
116	Aortic and peripheral arterial embolism or thrombosis
118	Phlebitis; thrombophlebitis and thromboembolism
120	Hemorrhoids
122	Pneumonia (except that caused by TB or sexually transmitted disease)
123	Influenza
124	Acute and chronic tonsillitis
125	Acute bronchitis
126	Other upper respiratory infections

Diagnosis CCS	Description
127	Chronic obstructive pulmonary disease and bronchiectasis
128	Asthma
129	Aspiration pneumonitis; food/vomitus
130	Pleurisy; pneumothorax; pulmonary collapse
131	Respiratory failure; insufficiency; arrest (adult)
135	Intestinal infection
137	Diseases of mouth; excluding dental
139	Gastroduodenal ulcer (except hemorrhage)
140	Gastritis and duodenitis
142	Appendicitis and other appendiceal conditions
145	Intestinal obstruction without hernia
146	Diverticulosis and diverticulitis
148	Peritonitis and intestinal abscess
153	Gastrointestinal hemorrhage
154	Noninfectious gastroenteritis
157	Acute and unspecified renal failure
159	Urinary tract infections
165	Inflammatory conditions of male genital organs
168	Inflammatory diseases of female pelvic organs
172	Ovarian cyst
197	Skin and subcutaneous tissue infections
198	Other inflammatory condition of skin
225	Joint disorders and dislocations; trauma-related
226	Fracture of neck of femur (hip)
227	Spinal cord injury
228	Skull and face fractures
229	Fracture of upper limb
230	Fracture of lower limb
232	Sprains and strains
233	Intracranial injury
234	Crushing injury or internal injury
235	Open wounds of head; neck; and trunk
237	Complication of device; implant or graft
238	Complications of surgical procedures or medical care
239	Superficial injury; contusion
240	Burns
241	Poisoning by psychotropic agents
242	Poisoning by other medications and drugs
243	Poisoning by nonmedicinal substances
244	Other injuries and conditions due to external causes
245	Syncope

Diagnosis CCS	Description
246	Fever of unknown origin
247	Lymphadenitis
249	Shock
250	Nausea and vomiting
251	Abdominal pain
252	Malaise and fatigue
253	Allergic reactions
259	Residual codes; unclassified
650	Adjustment disorders
651	Anxiety disorders
652	Attention-deficit, conduct, and disruptive behavior disorders
653	Delirium, dementia, and amnestic and other cognitive disorders
656	Impulse control disorders, NEC
658	Personality disorders
660	Alcohol-related disorders
661	Substance-related disorders
662	Suicide and intentional self-inflicted injury
663	Screening and history of mental health and substance abuse codes
670	Miscellaneous disorders

ICD-9 codes	Description
Acute ICD-9 codes within Dx CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy	
03282	Diphtheritic myocarditis
03640	Meningococcal carditis nos
03641	Meningococcal pericarditis
03642	Meningococcal endocarditis
03643	Meningococcal myocarditis
07420	Coxsackie carditis nos
07421	Coxsackie pericarditis
07422	Coxsackie endocarditis
07423	Coxsackie myocarditis
11281	Candidal endocarditis
11503	Histoplasma capsulatum pericarditis
11504	Histoplasma capsulatum endocarditis
11513	Histoplasma duboisii pericarditis
11514	Histoplasma duboisii endocarditis
11593	Histoplasmosis pericarditis
11594	Histoplasmosis endocarditis
1303	Toxoplasma myocarditis
3910	Acute rheumatic pericarditis
3911	Acute rheumatic endocarditis
3912	Acute rheumatic myocarditis
3918	Acute rheumatic heart disease nec

Diagnosis CCS	Description
3919	Acute rheumatic heart disease nos
3920	Rheumatic chorea w heart involvement
3980	Rheumatic myocarditis
39890	Rheumatic heart disease nos
39899	Rheumatic heart disease nec
4200	Acute pericarditis in other disease
42090	Acute pericarditis nos
42091	Acute idiopath pericarditis
42099	Acute pericarditis nec
4210	Acute/subacute bacterial endocarditis
4211	Acute endocarditis in other diseases
4219	Acute/subacute endocarditis nos
4220	Acute myocarditis in other diseases
42290	Acute myocarditis nos
42291	Idiopathic myocarditis
42292	Septic myocarditis
42293	Toxic myocarditis
42299	Acute myocarditis nec
4230	Hemopericardium
4231	Adhesive pericarditis
4232	Constrictive pericarditis
4233	Cardiac tamponade
4290	Myocarditis nos

Acute ICD-9 codes within Dx CCS 105: Conduction disorders

Diagnosis CCS	Description
4260	Atrioventricular block complete
42610	Atrioventricular block nos
42611	Atrioventricular block-1st degree
42612	Atrioventricular block-mobitz ii
42613	Atrioventricular block-2nd degree nec
4262	Left bundle branch hemiblock
4263	Left bundle branch block nec
4264	Right bundle branch block
42650	Bundle branch block nos
42651	Right bundle branch block/left posterior fascicular block
42652	Right bundle branch block/left ant fascicular block
42653	Bilateral bundle branch block nec
42654	Trifascicular block
4266	Other heart block
4267	Anomalous atrioventricular excitation
42681	Lown-ganong-levine syndrome
42682	Long qt syndrome
4269	Conduction disorder nos

Diagnosis CCS	Description
Acute ICD-9 codes within Dx CCS 106: Dysrhythmia	
4272	Paroxysmal tachycardia nos
7850	Tachycardia nos
42789	Cardiac dysrhythmias nec
4279	Cardiac dysrhythmia nos
42769	Premature beats nec
Acute ICD-9 codes within Dx CCS 108: Congestive heart failure; nonhypertensive	
39891	Rheumatic heart failure
4280	Congestive heart failure
4281	Left heart failure
42820	Unspecified systolic heart failure
42821	Acute systolic heart failure
42823	Acute on chronic systolic heart failure
42830	Unspecified diastolic heart failure
42831	Acute diastolic heart failure
42833	Acute on chronic diastolic heart failure
42840	Unspec combined syst & dias heart failure
42841	Acute combined systolic & diastolic heart failure
42843	Acute on chronic combined systolic & diastolic heart failure
4289	Heart failure nos