

# **2013 Measure Updates and Specifications Report: Hospital 30-day Readmission Following an Admission for an Acute Ischemic Stroke (Version 2.0)**

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## Table of Contents

YNHHSC/CORE Project Team .....	3
INTRODUCTION .....	4
2013 MEASURE UPDATES .....	4
1. Planned Readmission Algorithm .....	4
Background .....	4
Detailed Algorithm Flowchart and Tables .....	5
Table 1: Top 10 Planned Procedure Groups for Stroke Readmissions .....	6
Effect on Cohort.....	6
2. Removal of ICD-9-CM code 436 .....	7
Background and Rationale.....	7
Effect on Cohort.....	7
CURRENT MEASURE SPECIFICATIONS.....	8
FIGURES AND TABLES FOR PLANNED READMISSION ALGORITHM VERSION 2.1 .....	9
Figure PR1. Planned Readmission Algorithm Version 2.1 Flowchart.....	9
Table PR1: Procedure Categories that are Always Planned (Version 2.1 – Stroke Population) ....	10
Table PR2: Diagnosis Categories that are Always Planned (Version 2.1 – Stroke Population).....	10
Table PR3: Potentially Planned Procedure Categories (Version 2.1 – Stroke Population) .....	11
Table PR4: Acute Diagnosis Categories (Version 2.1 – Stroke Population) .....	13

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## 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 ischemic stroke admission. The YNHHSC/CORE team developed the measure using Medicare claims and enrollment data, and in 2010 prepared a methodology report, [Hospital 30-Day Readmission Following Acute Ischemic Stroke Hospitalization Measure](#). 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 2010 methodology report. It describes two measure revisions and their rationale. For convenience, the report also presents the current measure specifications.

In brief, CMS updated the model by:

- Adding CMS's Planned Readmission Algorithm Version 2.1 (adapted for Stroke) to expand the number and type of readmissions identified as planned and not counted in the measure outcome
- Removing International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code 436 from the list of codes defining the stroke measure cohort

## 2013 MEASURE UPDATES

### 1. Planned Readmission Algorithm

(This is an update to Section 2.2.1 in the 2010 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 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 may occur within 30 days of discharge from the hospital. CMS has applied the algorithm to each of its measures, including this stroke measure.

We based the planned readmission algorithm on three principles:

1. A few specific, limited types of care are always considered planned (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 (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 (ICD-9-CM) codes into clinically coherent, mutually exclusive procedure CCS categories and 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 were 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. The stroke readmission measure makes one modification to the [Planned Readmission Algorithm Version 2.1-General Population](#). It does not consider readmissions for patients who are readmitted for debridement of wound; infection or burn (Procedure CCS 169) planned because such treatments are commonly provided for decubitus ulcers that can be complications of care following admission for a stroke.

#### *Detailed Algorithm Flowchart and Tables*

The planned readmission algorithm uses a flowchart ([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 56 AHRQ procedure CCS categories from among 231 AHRQ procedure CCS categories, plus 11 individual ICD-9-CM procedure codes. Two examples of potentially planned procedures are endarterectomy of vessels on head or neck (Procedure CCS 51) and coronary artery bypass graft (CABG) (Procedure CCS 44).

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 cardiac arrest (Diagnosis CCS 107) and acute cerebrovascular disease (Diagnosis CCS 109).

[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 stroke. We applied the [Planned Readmission Algorithm Version 2.1 – General Population](#) to the 168,511 Medicare FFS admissions for patients aged 65 and older who were eligible for CMS’s stroke readmission measure in 2008. From these 168,511 admissions, there were 1,997 planned readmissions. Some planned readmissions had multiple planned procedures that qualified the readmission as planned. Thus, for these 1,977 planned readmissions there were 2,389 procedure or diagnosis CCSs that qualified the readmissions as planned.

**Table 1: Top 10 Planned Procedure Groups for Stroke Readmissions**

Procedure CCS	Description	N
51	Endarterectomy; vessel of head and neck	900
47	Diagnostic cardiac catheterization; coronary arteriography	222
48	Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator	212
59	Other OR procedures on vessels of head and neck	141
49	Other OR heart procedures	76
45	Percutaneous transluminal coronary angioplasty (PTCA)	75
84	Cholecystectomy and common duct exploration	70
78	Colorectal resection	67
157	Amputation of lower extremity	49
44	Coronary artery bypass graft (CABG)	41

#### *Effect on Cohort*

The originally submitted ischemic stroke readmission measure identified readmissions as planned for procedures that are related to follow-up care after an ischemic stroke. These included the following procedures: carotid endarterectomy; carotid stenting; percutaneous carotid stenting; intracranial and intervertebral stenting; patent foramen ovale closure; ablation; aortic or mitral valve replacement; and cranioplasty. Readmissions for these procedures were considered planned unless the principal discharge diagnosis for the readmission indicated that the patient was admitted for one of the following acute clinical conditions: occlusion and stenosis of precerebral arteries; occlusion and stenosis of cerebral arteries; or acute, ill-defined, cerebrovascular disease. **All of those procedures considered planned in the original measure are included in the adapted planned readmission algorithm as potentially planned procedures. However, the algorithm has a more extensive list of acute diagnoses.**

After adapting the planned readmission algorithm for the ischemic stroke readmission measure by removing Procedure CCS 169 as a potentially planned procedure category, we updated the measure by replacing the definition of planned procedures in the originally submitted measure with the adapted planned readmission algorithm.

Using the original ischemic stroke readmission measure, the unadjusted 30-day unplanned readmission rate was 14.8% and the planned readmission rate was 0.6%. The updated measure decreased the number of readmissions counted in the outcome by identifying additional readmissions as planned. For the updated ischemic stroke readmission measure, the unadjusted 30-day unplanned readmission rate is 14.2%. The rate of planned readmissions was approximately 0.6%.

## 2. Removal of ICD-9-CM code 436

(This is an update to Section 2.3 in the 2010 methodology report.)

### *Background and Rationale*

During measure development YNHHS/CORE conducted a literature review and consulted with a technical expert panel to derive a list of ICD-9-CM codes that define an ischemic stroke admission in Medicare inpatient claims. YNHHS/CORE subsequently determined that ICD-9-CM code 436 is not commonly used to define acute ischemic stroke. The updated measure no longer includes ICD-9-CM code 436 (acute, but ill-defined, cerebrovascular disease) in the list of principal discharge diagnoses that define the measure cohort.

### *Effect on Cohort*

The removal of ICD-9-CM code 436 has no major impact on the measure cohort as only 1,332 patients (0.28% of total developmental cohort) are ICD-9-CM code 436.

## CURRENT MEASURE SPECIFICATIONS

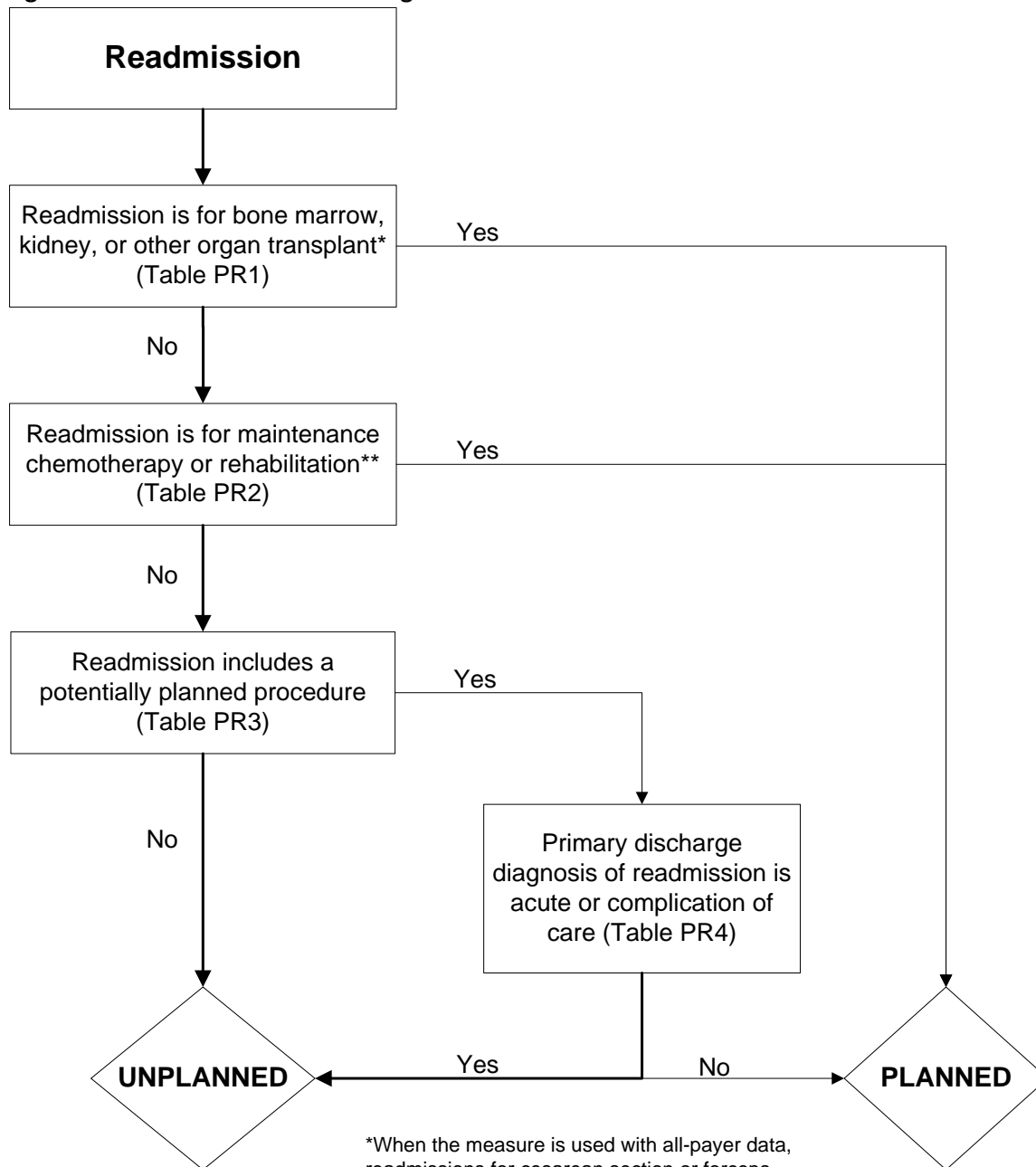
An overview of key measure specifications and methodology is shown below. For complete details of the cohort, outcome, and statistical methodology, please see the original 2010 [Hospital 30-Day Readmission Following Acute Ischemic Stroke Hospitalization Measure](#) methodology report.

- **Measure Cohort:** Hospitalizations for patients admitted for acute ischemic stroke
- **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 stroke within 30 days of discharge from an index stroke admission; these are considered as potential readmissions but not as potential index admissions
- **Risk Adjustment:** The stroke 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).



## FIGURES AND TABLES FOR PLANNED READMISSION ALGORITHM VERSION 2.1

Figure PR1. Planned Readmission Algorithm Version 2.1 Flowchart



\*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 – Stroke Population)**

<b>Procedure CCS</b>	<b>Description</b>
64	Bone marrow transplant
105	Kidney transplant
134	Cesarean section <sup>1</sup>
135	Forceps; vacuum; and breech delivery <sup>1</sup>
176	Other organ transplantation

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

<b>Diagnosis CCS</b>	<b>Description</b>
45	Maintenance chemotherapy
194	Forceps delivery <sup>1</sup>
196	Normal pregnancy and/or delivery <sup>1</sup>
254	Rehabilitation

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<sup>1</sup> 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 – Stroke Population)**

<b>Procedure CCS</b>	<b>Description</b>
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
170	Excision of skin lesion
172	Skin graft
211	Therapeutic radiology for cancer treatment
224	Cancer chemotherapy
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 – Stroke Population)**

<b>Diagnosis CCS</b>	<b>Description</b>
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
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**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

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

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

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**Acute ICD-9 codes within Dx CCS 106: Dysrhythmia**



Diagnosis CCS	Description
4272	Paroxysmal tachycardia nos
7850	Tachycardia nos
42789	Cardiac dysrhythmias nec
4279	Cardiac dysrhythmia nos
42769	Premature beats nec
<b>Acute ICD-9 codes within Dx CCS 108: Congestive heart failure; nonhypertensive</b>	
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