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| Supplemental Digital Content Table 1: ICD-9/10-CM codes used to search for patients undergoing common intra-abdominal procedures. | |
| Procedure | **ICD-9/10-CM Codes** |
| Large bowel resection | 4571, 4572, 4573, 4574, 4575, 4576, 4579, 4581, 4582, 4583, 1731, 1732, 1733, 1734, 1735, 1736, 1739, 0DTE, 0DTF, 0DTG, 0DTH, 0DTK, 0DTL, 0DTM, 0DTN |
| Small bowel resection | 4561, 4562, 4563, 0DT8, 0DT9, 0DTA, 0DTB, 0DTC |
| Gastric resection | 435, 436, 437, 4381, 4382, 4389, 4391, 4399, 0DT6, 0DT7 |
| Pancreatic resection | 526, 527, 0FTG |
| Nephrectomy | 554, 555, 5551, 5552, 5554, 0TT0, 0TT1, 0TT2 |
| Cystectomy | 576, 577, 5771, 5779, 0TTB |

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| Supplemental Digital Content Table 2: CPT codes used to identify echocardiography and other cardiac testing claims. | |
| Procedure | **CPT Codes** |
| Transthoracic echocardiography (TTE) | 93306, 93307, 93308 |
| Stress echocardiography | 93350, 93351, 93352, C8928, C8930 |
| Stress test (exercise or pharmacological) | 93015, 93016, 93017, 93018 |
| Myocardial nuclear imaging | 78451, 78452, 78453, 78454, 78460, 78461, 78464, 78465, 78472, 78473, 78481, 78483, 78491, 78492 |
| Stress MRI | 75559, 75560, 75563, 75564 |
| Transesophageal echocardiography (TEE) | 93312, 93312, 93314 |

**Supplemental Digital Content Table 3: Principal and Secondary Diagnoses used to identify appropriateness of preoperative echocardiography according to the appropriate use criteria.**

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| --- | --- |
| **Appropriate** | |
| 785.2 | Undiagnosed cardiac murmurs |
| 785.3 | Other abnormal heart sounds |
| R01.1 | Cardiac murmur, unspecified |
| R01.2 | Other cardiac sounds |
| 786.50 | Chest pain, unspecified |
| 786.51 | Precordial pain |
| 413.9 | Other and unspecified angina pectoris |
| 413.0 | Angina decubitus |
| 413.1 | Prinzmetal angina |
| R07.2 | Precordial pain |
| R07.82 | Intercostal pain |
| R07.89 | Other chest pain |
| R07.9 | Chest pain, unspecified |
| I20.1 | Angina pectoris with documented spasm |
| I20.8 | Other forms of angina pectoris |
| I20.9 | Angina pectoris, unspecified |
| 786.05 | Shortness of breath |
| 786.09 | Dyspnea - other |
| R06.0 | Dyspnea |
| R06.00 | Dyspnea, unspecified |
| R06.02 | Shortness of breath |
| R06.03 | Acute respiratory distress |
| R06.09 | Other forms of dyspnea |
| 785.1 | Palpitations |
| R00.2 | Palpitations |
| 346.60 | Persistent migraine aura with cerebral infarction, without mention of intractable migraine without mention of status migrainosus |
| 346.61 | Persistent migraine aura with cerebral infarction, with intractable migraine, so stated, without mention of status migrainosus |
| 346.62 | Persistent migraine aura with cerebral infarction, without mention of intractable migraine with status migrainosus |
| 346.63 | Persistent migraine aura with cerebral infarction, with intractable migraine, so stated, with status migrainosus |
| 430 | Subarachnoid hemorrhage |
| 431 | Intracerebral hemorrhage |
| 432.0 | Nontraumatic extradural hemorrhage |
| 432.1 | Subdural hemorrhage |
| 432.9 | Unspecified intracranial hemorrhage |
| 433.01 | Occlusion and stenosis of basilar artery with cerebral infarction |
| 433.11 | Occlusion and stenosis of carotid artery with cerebral infarction |
| 433.21 | Occlusion and stenosis of vertebral artery with cerebral infarction |
| 433.31 | Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction |
| 433.81 | Occlusion and stenosis of other specified precerebral artery with cerebral infarction |
| 433.91 | Occlusion and stenosis of unspecified precerebral artery with cerebral infarction |
| 434.0 | Cerebral thrombosis |
| 434.00 | Cerebral thrombosis without mention of cerebral infarction |
| 434.01 | Cerebral thrombosis with cerebral infarction |
| 434.1 | Cerebral embolism |
| 434.10 | Cerebral embolism without mention of cerebral infarction |
| 434.11 | Cerebral embolism with cerebral infarction |
| 434.9 | Cerebral artery occlusion, unspecified |
| 434.90 | Unspecified cerebral artery occlusion without mention of cerebral infarction |
| 434.91 | Unspecified cerebral artery occlusion with cerebral infarction |
| 436 | Acute, but ill-defined, cerebrovascular disease |
| G43.601 | Persistent migraine aura with cerebral infarction, not intractable, with status migrainosus |
| G43.609 | Persistent migraine aura with cerebral infarction, not intractable, without status migrainosus |
| G43.611 | Persistent migraine aura with cerebral infarction, intractable, with status migrainosus |
| G43.619 | Persistent migraine aura with cerebral infarction, intractable, without status migrainosus |
| I60.00 | Nontraumatic subarachnoid hemorrhage from unspecified carotid siphon and bifurcation |
| I60.01 | Nontraumatic subarachnoid hemorrhage from right carotid siphon and bifurcation |
| I60.02 | Nontraumatic subarachnoid hemorrhage from left carotid siphon and bifurcation |
| I60.10 | Nontraumatic subarachnoid hemorrhage from unspecified middle cerebral artery |
| I60.11 | Nontraumatic subarachnoid hemorrhage from right middle cerebral artery |
| I60.12 | Nontraumatic subarachnoid hemorrhage from left middle cerebral artery |
| I60.20 | Nontraumatic subarachnoid hemorrhage from unspecified anterior communicating artery |
| I60.21 | Nontraumatic subarachnoid hemorrhage from right anterior communicating artery |
| I60.22 | Nontraumatic subarachnoid hemorrhage from left anterior communicating artery |
| I60.30 | Nontraumatic subarachnoid hemorrhage from unspecified posterior communicating artery |
| I60.31 | Nontraumatic subarachnoid hemorrhage from right posterior communicating artery |
| I60.32 | Nontraumatic subarachnoid hemorrhage from left posterior communicating artery |
| I60.4 | Nontraumatic subarachnoid hemorrhage from basilar artery |
| I60.50 | Nontraumatic subarachnoid hemorrhage from unspecified vertebral artery |
| I60.51 | Nontraumatic subarachnoid hemorrhage from right vertebral artery |
| I60.52 | Nontraumatic subarachnoid hemorrhage from left vertebral artery |
| I60.6 | Nontraumatic subarachnoid hemorrhage from other intracranial arteries |
| I60.7 | Nontraumatic subarachnoid hemorrhage from unspecified intracranial artery |
| I60.8 | Other nontraumatic subarachnoid hemorrhage |
| I60.9 | Nontraumatic subarachnoid hemorrhage, unspecified |
| I61.0 | Nontraumatic intracerebral hemorrhage in hemisphere, subcortical |
| I61.1 | Nontraumatic intracerebral hemorrhage in hemisphere, cortical |
| I61.2 | Nontraumatic intracerebral hemorrhage in hemisphere, unspecified |
| I61.3 | Nontraumatic intracerebral hemorrhage in brain stem |
| I61.4 | Nontraumatic intracerebral hemorrhage in cerebellum |
| I61.5 | Nontraumatic intracerebral hemorrhage, intraventricular |
| I61.6 | Nontraumatic intracerebral hemorrhage, multiple localized |
| I61.8 | Other nontraumatic intracerebral hemorrhage |
| I61.9 | Nontraumatic intracerebral hemorrhage, unspecified |
| I62.00 | Nontraumatic subdural hemorrhage, unspecified |
| I62.01 | Nontraumatic acute subdural hemorrhage |
| I62.02 | Nontraumatic subacute subdural hemorrhage |
| I62.03 | Nontraumatic chronic subdural hemorrhage |
| I62.1 | Nontraumatic extradural hemorrhage |
| I62.9 | Nontraumatic intracranial hemorrhage, unspecified |
| I63.00 | Cerebral infarction due to thrombosis of unspecified precerebral artery |
| I63.011 | Cerebral infarction due to thrombosis of right vertebral artery |
| I63.012 | Cerebral infarction due to thrombosis of left vertebral artery |
| I63.013 | Cerebral infarction due to thrombosis of bilateral vertebral arteries |
| I63.019 | Cerebral infarction due to thrombosis of unspecified vertebral artery |
| I63.02 | Cerebral infarction due to thrombosis of basilar artery |
| I63.031 | Cerebral infarction due to thrombosis of right carotid artery |
| I63.032 | Cerebral infarction due to thrombosis of left carotid artery |
| I63.033 | Cerebral infarction due to thrombosis of bilateral carotid arteries |
| I63.039 | Cerebral infarction due to thrombosis of unspecified carotid artery |
| I63.09 | Cerebral infarction due to thrombosis of other precerebral artery |
| I63.10 | Cerebral infarction due to embolism of unspecified precerebral artery |
| I63.111 | Cerebral infarction due to embolism of right vertebral artery |
| I63.112 | Cerebral infarction due to embolism of left vertebral artery |
| I63.119 | Cerebral infarction due to embolism of unspecified vertebral artery |
| I63.12 | Cerebral infarction due to embolism of basilar artery |
| I63.131 | Cerebral infarction due to embolism of right carotid artery |
| I63.132 | Cerebral infarction due to embolism of left carotid artery |
| I63.139 | Cerebral infarction due to embolism of unspecified carotid artery |
| I63.19 | Cerebral infarction due to embolism of other precerebral artery |
| I63.20 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified precerebral arteries |
| I63.211 | Cerebral infarction due to unspecified occlusion or stenosis of right vertebral artery |
| I63.212 | Cerebral infarction due to unspecified occlusion or stenosis of left vertebral artery |
| I63.219 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified vertebral artery |
| I63.22 | Cerebral infarction due to unspecified occlusion or stenosis of basilar artery |
| I63.231 | Cerebral infarction due to unspecified occlusion or stenosis of right carotid arteries |
| I63.232 | Cerebral infarction due to unspecified occlusion or stenosis of left carotid arteries |
| I63.239 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified carotid artery |
| I63.29 | Cerebral infarction due to unspecified occlusion or stenosis of other precerebral arteries |
| I63.30 | Cerebral infarction due to thrombosis of unspecified cerebral artery |
| I63.311 | Cerebral infarction due to thrombosis of right middle cerebral artery |
| I63.312 | Cerebral infarction due to thrombosis of left middle cerebral artery |
| I63.319 | Cerebral infarction due to thrombosis of unspecified middle cerebral artery |
| I63.321 | Cerebral infarction due to thrombosis of right anterior cerebral artery |
| I63.322 | Cerebral infarction due to thrombosis of left anterior cerebral artery |
| I63.329 | Cerebral infarction due to thrombosis of unspecified anterior cerebral artery |
| I63.331 | Cerebral infarction due to thrombosis of right posterior cerebral artery |
| I63.332 | Cerebral infarction due to thrombosis of left posterior cerebral artery |
| I63.339 | Cerebral infarction due to thrombosis of unspecified posterior cerebral artery |
| I63.341 | Cerebral infarction due to thrombosis of right cerebellar artery |
| I63.342 | Cerebral infarction due to thrombosis of left cerebellar artery |
| I63.349 | Cerebral infarction due to thrombosis of unspecified cerebellar artery |
| I63.40 | Cerebral infarction due to embolism of unspecified cerebral artery |
| I63.411 | Cerebral infarction due to embolism of right middle cerebral artery |
| I63.412 | Cerebral infarction due to embolism of left middle cerebral artery |
| I63.419 | Cerebral infarction due to embolism of unspecified middle cerebral artery |
| I63.421 | Cerebral infarction due to embolism of right anterior cerebral artery |
| I63.422 | Cerebral infarction due to embolism of left anterior cerebral artery |
| I63.429 | Cerebral infarction due to embolism of unspecified anterior cerebral artery |
| I63.431 | Cerebral infarction due to embolism of right posterior cerebral artery |
| I63.432 | Cerebral infarction due to embolism of left posterior cerebral artery |
| I63.439 | Cerebral infarction due to embolism of unspecified posterior cerebral artery |
| I63.441 | Cerebral infarction due to embolism of right cerebellar artery |
| I63.442 | Cerebral infarction due to embolism of left cerebellar artery |
| I63.449 | Cerebral infarction due to embolism of unspecified cerebellar artery |
| I63.49 | Cerebral infarction due to embolism of other cerebral artery |
| I63.50 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebral artery |
| I63.511 | Cerebral infarction due to unspecified occlusion or stenosis of right middle cerebral artery |
| I63.512 | Cerebral infarction due to unspecified occlusion or stenosis of left middle cerebral artery |
| I63.519 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified middle cerebral artery |
| I63.521 | Cerebral infarction due to unspecified occlusion or stenosis of right anterior cerebral artery |
| I63.522 | Cerebral infarction due to unspecified occlusion or stenosis of left anterior cerebral artery |
| I63.529 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified anterior cerebral artery |
| I63.531 | Cerebral infarction due to unspecified occlusion or stenosis of right posterior cerebral artery |
| I63.532 | Cerebral infarction due to unspecified occlusion or stenosis of left posterior cerebral artery |
| I63.539 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified posterior cerebral artery |
| I63.541 | Cerebral infarction due to unspecified occlusion or stenosis of right cerebellar artery |
| I63.542 | Cerebral infarction due to unspecified occlusion or stenosis of left cerebellar artery |
| I63.549 | Cerebral infarction due to unspecified occlusion or stenosis of unspecified cerebellar artery |
| I63.59 | Cerebral infarction due to unspecified occlusion or stenosis of other cerebral artery |
| I63.6 | Cerebral infarction due to cerebral venous thrombosis, nonpyogenic |
| I63.8 | Other cerebral infarction |
| I63.9 | Cerebral infarction, unspecified |
| I66.01 | Occlusion and stenosis of right middle cerebral artery |
| I66.02 | Occlusion and stenosis of left middle cerebral artery |
| I66.03 | Occlusion and stenosis of bilateral middle cerebral arteries |
| I66.09 | Occlusion and stenosis of unspecified middle cerebral artery |
| I66.11 | Occlusion and stenosis of right anterior cerebral artery |
| I66.12 | Occlusion and stenosis of left anterior cerebral artery |
| I66.13 | Occlusion and stenosis of bilateral anterior cerebral arteries |
| I66.19 | Occlusion and stenosis of unspecified anterior cerebral artery |
| I66.21 | Occlusion and stenosis of right posterior cerebral artery |
| I66.22 | Occlusion and stenosis of left posterior cerebral artery |
| I66.23 | Occlusion and stenosis of bilateral posterior cerebral arteries |
| I66.29 | Occlusion and stenosis of unspecified posterior cerebral artery |
| I66.3 | Occlusion and stenosis of cerebellar arteries |
| I66.8 | Occlusion and stenosis of other cerebral arteries |
| I66.9 | Occlusion and stenosis of unspecified cerebral artery |
| 433.0 | Occlusion and stenosis of precerebral arteries – basilar artery |
| 433.00 | Occlusion and stenosis of basilar artery without mention of cerebral infarction |
| 433.1 | Occlusion and stenosis of precerebral arteries – carotid artery |
| 433.10 | Occlusion and stenosis of carotid artery without mention of cerebral infarction |
| 433.2 | Occlusion and stenosis of precerebral arteries – vertebral artery |
| 433.20 | Occlusion and stenosis of vertebral artery without mention of cerebral infarction |
| 433.3 | Occlusion and stenosis of precerebral arteries – multiple and bilateral |
| 433.30 | Occlusion and stenosis of multiple and bilateral precerebral arteries without mention of cerebral infarction |
| 433.8 | Occlusion and stenosis of precerebral arteries – other specified precerebral arteries |
| 433.80 | Occlusion and stenosis of other specified precerebral artery without mention of cerebral infarction |
| 433.9 | Occlusion and stenosis of precerebral arteries – unspecified precerebral artery |
| 433.90 | Occlusion and stenosis of unspecified precerebral artery without mention of cerebral infarction |
| I65.01 | Occlusion and stenosis of right vertebral artery |
| I65.02 | Occlusion and stenosis of left vertebral artery |
| I65.03 | Occlusion and stenosis of bilateral vertebral arteries |
| I65.09 | Occlusion and stenosis of unspecified vertebral artery |
| I65.1 | Occlusion and stenosis of basilar artery |
| I65.21 | Occlusion and stenosis of right carotid artery |
| I65.22 | Occlusion and stenosis of left carotid artery |
| I65.23 | Occlusion and stenosis of bilateral carotid arteries |
| I65.29 | Occlusion and stenosis of unspecified carotid artery |
| I65.8 | Occlusion and stenosis of other precerebral arteries |
| I65.9 | Occlusion and stenosis of other precerebral arteries |
| 437.0 | Cerebral atherosclerosis |
| 437.1 | Other generalized ischemic cerebrovascular disease |
| 437.3 | Cerebral aneurysm, nonruptured |
| 437.4 | Cerebral arteritis |
| 437.5 | Moyamoya disease |
| 437.6 | Nonpyogenic thrombosis of intracranial venous sinus |
| 437.7 | Transient global amnesia |
| 437.8 | Other and ill-defined cerebrovascular disease, other |
| 437.9 | Other and ill-defined cerebrovascular disease, unspecified |
| G46.0 | Middle cerebral artery syndrome |
| G46.1 | Anterior cerebral artery syndrome |
| G46.2 | Posterior cerebral artery syndrome |
| G46.3 | Brain stem stroke syndrome |
| G46.4 | Cerebellar stroke syndrome |
| G46.5 | Pure motor lacunar syndrome |
| G46.6 | Pure sensory lacunar syndrome |
| G46.7 | Other lacunar syndromes |
| G46.8 | Other vascular syndromes of brain in cerebrovascular diseases |
| I67.1 | Cerebral aneurysm, nonruptured |
| I67.2 | Cerebral atherosclerosis |
| I67.5 | Moyamoya disease |
| I67.6 | Nonpyogenic thrombosis of intracranial venous system |
| I67.7 | Cerebral arteritis, not elsewhere classified |
| I67.81 | Acute cerebrovascular insufficiency |
| I67.82 | Cerebral ischemia |
| I67.83 | Posterior reversible encephalopathy syndrome |
| I67.841 | Reversible cerebrovascular vasoconstriction syndrome |
| I67.848 | Other cerebrovascular vasospasm and vasoconstriction |
| I67.89 | Other cerebrovascular disease |
| I67.9 | Cerebrovascular disease, unspecified |
| I68.0 | Cerebral amyloid angiopathy |
| I68.2 | Cerebral arteritis in other diseases classified elsewhere |
| I68.8 | Other cerebrovascular disorders in diseases classified elsewhere |
| 435.0 | Basilar artery syndrome |
| 435.1 | Vertebral artery syndrome |
| 435.2 | Subclavian steal syndrome |
| 435.3 | Vertebrobasilar artery syndrome |
| 435.8 | Other specified transient cerebral ischemias |
| 435.9 | Unspecified transient cerebral ischemia |
| G45.0 | Vertebro-basilar artery syndrome |
| G45.1 | Carotid artery syndrome (hemispheric) |
| G45.2 | Multiple and bilateral precerebral artery syndromes |
| G45.3 | Amaurosis fugax |
| G45.4 | Transient global amnesia |
| G45.8 | Other transient cerebral ischemic attacks and related syndromes |
| G45.9 | Transient cerebral ischemic attack, unspecified |
| 438.0 | Late effects of cerebrovascular disease, cognitive deficits |
| 438.10 | Speech and language deficit, unspecified |
| 438.12 | Dysphasia |
| 438.13 | Dysarthria |
| 438.14 | Fluency disorder |
| 438.19 | Other speech and language deficits |
| 438.20 | Hemiplegia affecting unspecified side |
| 438.21 | Hemiplegia affecting dominant side |
| 438.22 | Hemiplegia affecting nondominant side |
| 438.30 | Monoplegia of upper limb affecting unspecified side |
| 438.31 | Monoplegia of upper limb affecting dominant side |
| 438.32 | Monoplegia of upper limb affecting nondominant side |
| 438.40 | Monoplegia of lower limb affecting unspecified side |
| 438.41 | Monoplegia of lower limb affecting dominant side |
| 438.42 | Monoplegia of lower limb affecting nondominant side |
| 438.50 | Other paralytic syndrome affecting unspecified side |
| 438.51 | Other paralytic syndrome affecting dominant side |
| 438.52 | Other paralytic syndrome affecting nondominant side |
| 438.53 | Other paralytic syndrome, bilateral |
| 438.6 | Alterations of sensations |
| 438.7 | Disturbances of vision |
| 438.81 | Apraxia |
| 438.82 | Dysphagia |
| 438.83 | Facial weakness |
| 438.84 | Ataxia |
| 438.85 | Vertigo |
| 438.89 | Other late effects of cerebrovascular disease |
| 438.9 | Unspecified late effects of cerebrovascular disease |
| 444.0 | Arterial embolism and thrombosis of abdominal aorta |
| 444.01 | Saddle embolus of abdominal aorta |
| 444.09 | Other arterial embolism and thrombosis of abdominal aorta |
| 444.1 | Arterial embolism and thrombosis of thoracic aorta |
| 444.21 | Arterial embolism and thrombosis of upper extremity |
| 444.81 | Arterial embolism and thrombosis of iliac artery |
| 444.89 | Arterial embolism and thrombosis of other artery |
| 444.9 | Arterial embolism and thrombosis of unspecified artery |
| 445.01 | Atheroembolism of upper extremity |
| 445.02 | Atheroembolism of lower extremity |
| 445.81 | Atheroembolism of kidney |
| 445.89 | Atheroembolism of other site |
| I74.2 | Embolism and thrombosis of arteries of the upper extremities |
| 451.0 | Phlebitis and thrombophlebitis of superficial vessels of lower extremities |
| 451.11 | Phlebitis and thrombophlebitis of femoral vein |
| 451.19 | Phlebitis and thrombophlebitis of other |
| 451.2 | Phlebitis and thrombophlebitis of lower extremities, unspecified |
| 451.81 | Phlebitis and thrombophlebitis of iliac vein |
| 451.82 | Phlebitis and thrombophlebitis of superficial veins of upper extremities |
| 451.83 | Phlebitis and thrombophlebitis of deep veins of upper extremities |
| 451.84 | Phlebitis and thrombophlebitis of upper extremities, unspecified |
| 451.89 | Phlebitis and thrombophlebitis of other |
| 451.9 | Phlebitis and thrombophlebitis of unspecified site |
| 452 | Portal vein thrombosis |
| 453.0 | Budd-Chiari syndrome |
| 453.1 | Thrombophlebitis migrans |
| 453.2 | Of inferior vena cava |
| 453.3 | Of renal vein |
| 453.40 | Acute venous embolism and thrombosis of unspecified deep vessels of lower extremity |
| 453.41 | Acute venous embolism and thrombosis of deep vessels of proximal lower extremity |
| 453.42 | Acute venous embolism and thrombosis of deep vessels of distal lower extremity |
| 453.50 | Chronic venous embolism and thrombosis of unspecified deep vessels of lower extremity |
| 453.51 | Chronic venous embolism and thrombosis of deep vessels of proximal lower extremity |
| 453.52 | Chronic venous embolism and thrombosis of deep vessels of distal lower extremity |
| 453.6 | Venous embolism and thrombosis of superficial vessels of lower extremity |
| 453.71 | Chronic venous embolism and thrombosis of superficial veins of upper extremity |
| 453.72 | Chronic venous embolism and thrombosis of deep veins of upper extremity |
| 453.73 | Chronic venous embolism and thrombosis of upper extremity, unspecified |
| 453.74 | Chronic venous embolism and thrombosis of axillary veins |
| 453.75 | Chronic venous embolism and thrombosis of subclavian veins |
| 453.76 | Chronic venous embolism and thrombosis of internal jugular veins |
| 453.77 | Chronic venous embolism and thrombosis of other thoracic veins |
| 453.79 | Chronic venous embolism and thrombosis of other specified veins |
| 453.8 | Acute venous embolism and thrombosis of other specified veins |
| 453.81 | Acute venous embolism and thrombosis of superficial veins of upper extremity |
| 453.82 | Acute venous embolism and thrombosis of deep veins of upper extremity |
| 453.83 | Acute venous embolism and thrombosis of upper extremity, unspecified |
| 453.84 | Acute venous embolism and thrombosis of axillary veins |
| 453.85 | Acute venous embolism and thrombosis of subclavian veins |
| 453.86 | Acute venous embolism and thrombosis of internal jugular veins |
| 453.89 | Acute venous embolism and thrombosis of other specified veins |
| 453.9 | Other venous embolism and thrombosis of unspecified site |
| V12.51 | Venous thrombosis and embolism |
| V12.52 | Thrombophlebitis |
| I82.40 | Acute embolism and thrombosis of unspecified deep veins of lower extremity |
| 427.69 | Other premature beats |
| 427.31 | Atrial fibrillation |
| 427.32 | Atrial flutter |
| 427.0 | Paroxysmal supraventricular tachycardia |
| 427.1 | Paroxysmal ventricular tachycardia |
| I49.3 | Ventricular premature depolarization |
| I48.0 | Paroxysmal atrial fibrillation |
| I48.1 | Persistent atrial fibrillation |
| I48.11 | Longstanding persistent atrial fibrillation |
| I48.19 | Other persistent atrial fibrillation |
| I48.20 | Chronic atrial fibrillation, unspecified |
| I48.21 | Permanent atrial fibrillation |
| I48.3 | Typical atrial flutter |
| I48.4 | Atypical atrial flutter |
| I48.91 | Unspecified atrial fibrillation |
| I48.92 | Unspecified atrial flutter |
| I47.1 | Supraventricular tachycardia |
| I47.2 | Ventricular tachycardia |
| 780.2 | Syncope and collapse |
| R55 | Syncope and collapse |
| 416.0 | Primary pulmonary hypertension |
| 416.9 | Chronic pulmonary heart disease, unspecified |
| 415.0 | Acute cor pulmonale |
| I27.0 | Primary pulmonary hypertension |
| I27.2 | Other secondary pulmonary hypertension |
| I27.20 | Pulmonary hypertension, unspecified |
| I27.21 | Secondary pulmonary arterial hypertension |
| I27.22 | Pulmonary hypertension due to left heart disease |
| I27.23 | Pulmonary hypertension due to lung diseases and hypoxia |
| I27.24 | Chronic thromboembolic pulmonary hypertension |
| I27.29 | Other secondary pulmonary hypertension |
| 394.0 | Mitral stenosis |
| 394.1 | Rheumatic mitral insufficiency |
| 394.2 | Mitral stenosis with insufficiency |
| 394.9 | Other and unspecified mitral valve diseases |
| 395.0 | Rheumatic aortic stenosis |
| 395.1 | Rheumatic aortic insufficiency |
| 395.2 | Rheumatic aortic stenosis with insufficiency |
| 395.9 | Other and unspecified rheumatic aortic diseases |
| 396.0 | Mitral valve stenosis and aortic valve stenosis |
| 396.1 | Mitral valve stenosis and aortic valve insufficiency |
| 396.2 | Mitral valve insufficiency and aortic valve stenosis |
| 396.3 | Mitral valve insufficiency and aortic valve insufficiency |
| 396.8 | Multiple involvement of mitral and aortic valves |
| 396.9 | Mitral and aortic valve diseases, unspecified |
| 397.0 | Diseases of tricuspid valve |
| 397.1 | Rheumatic diseases of pulmonary valve |
| 397.9 | Rheumatic diseases of endocardium, valve unspecified |
| 424.0 | Mitral valve disorders |
| 424.1 | Aortic valve disorders |
| 424.2 | Tricuspid valve disorders, specified as nonrheumatic |
| 424.3 | Pulmonary valve disorders |
| 746.3 | Congenital stenosis of aortic valve |
| 746.4 | Congenital insufficiency of aortic valve |
| 746.5 | Congenital mitral stenosis |
| 746.6 | Congenital mitral insufficiency |
| Q23 | Congenital malformations of aortic and mitral valves |
| Q23.0 | Congenital stenosis of aortic valve |
| Q23.1 | Congenital insufficiency of aortic valve |
| Q23.2 | Congenital mitral stenosis |
| Q23.3 | Congenital mitral insufficiency |
| Q23.8 | Other congenital malformations of aortic and mitral valves |
| Q23.9 | Congenital malformation of aortic and mitral valves, unspecified |
| I05.0 | Rheumatic mitral stenosis |
| I05.1 | Rheumatic mitral insufficiency |
| I05.8 | Other rheumatic mitral valve diseases |
| I05.9 | Rheumatic mitral valve disease, unspecified |
| I06.0 | Rheumatic aortic stenosis |
| I06.1 | Rheumatic aortic insufficiency |
| I06.2 | Rheumatic aortic stenosis with insufficiency |
| I06.8 | Other rheumatic aortic valve diseases |
| I06.9 | Rheumatic aortic valve disease, unspecified |
| I07.0 | Rheumatic tricuspid stenosis |
| I07.1 | Rheumatic tricuspid insufficiency |
| I07.2 | Rheumatic tricuspid stenosis and insufficiency |
| I07.8 | Other rheumatic tricuspid valve diseases |
| I07.9 | Rheumatic tricuspid valve disease, unspecified |
| I08.0 | Rheumatic disorders of both mitral and aortic valves |
| I08.1 | Rheumatic disorders of both mitral and tricuspid valves |
| I08.2 | Rheumatic disorders of both aortic and tricuspid valves |
| I08.3 | Combined rheumatic disorders of mitral, aortic and tricuspid valves |
| I08.8 | Other rheumatic multiple valve diseases |
| I08.9 | Rheumatic multiple valve disease, unspecified |
| I09.1 | Rheumatic diseases of endocardium, valve unspecified |
| I09.89 | Other specified rheumatic heart diseases |
| I34.0 | Nonrheumatic mitral (valve) insufficiency |
| I34.1 | Nonrheumatic mitral (valve) prolapse |
| I34.2 | Nonrheumatic mitral (valve) stenosis |
| I34.8 | Other nonrheumatic mitral valve disorders |
| I34.9 | Nonrheumatic mitral valve disorder, unspecified |
| I35.0 | Nonrheumatic aortic (valve) stenosis |
| I35.1 | Nonrheumatic aortic (valve) insufficiency |
| I35.2 | Nonrheumatic aortic (valve) stenosis with insufficiency |
| I35.8 | Other nonrheumatic aortic valve disorders |
| I35.9 | Nonrheumatic aortic valve disorder, unspecified |
| I36.0 | Nonrheumatic tricuspid (valve) stenosis |
| I36.1 | Nonrheumatic tricuspid (valve) insufficiency |
| I36.2 | Nonrheumatic tricuspid (valve) stenosis with insufficiency |
| I36.8 | Other nonrheumatic tricuspid valve disorders |
| I36.9 | Nonrheumatic tricuspid valve disorder, unspecified |
| I37.0 | Nonrheumatic pulmonary valve stenosis |
| I37.1 | Nonrheumatic pulmonary valve insufficiency |
| I37.2 | Nonrheumatic pulmonary valve stenosis with insufficiency |
| I37.8 | Other nonrheumatic pulmonary valve disorders |
| I37.9 | Nonrheumatic pulmonary valve disorder, unspecified |
| 996.02 | Mechanical complication of cardiac device, implant, and graft due to heart valve prosthesis |
| T82.0 | Mechanical complication of heart valve prosthesis |
| T82.01 | Breakdown (mechanical) of heart valve prosthesis |
| T82.01XA | Breakdown (mechanical) of heart valve prosthesis, initial encounter |
| T82.01XD | Breakdown (mechanical) of heart valve prosthesis, subsequent encounter |
| T82.01XS | Breakdown (mechanical) of heart valve prosthesis, sequela |
| T82.02 | Displacement of heart valve prosthesis |
| T82.02XA | Displacement of heart valve prosthesis, initial encounter |
| T82.02XD | Displacement of heart valve prosthesis, subsequent encounter |
| T82.02XS | Displacement of heart valve prosthesis, sequela |
| T82.03 | Leakage of heart valve prosthesis |
| T82.03XA | Leakage of heart valve prosthesis, initial encounter |
| T82.03XD | Leakage of heart valve prosthesis, subsequent encounter |
| T82.03XS | Leakage of heart valve prosthesis, sequela |
| T82.09 | Other mechanical complication of heart valve prosthesis |
| T82.09XA | Other mechanical complication of heart valve prosthesis, initial encounter |
| T82.09XD | Other mechanical complication of heart valve prosthesis, subsequent encounter |
| T82.09XS | Other mechanical complication of heart valve prosthesis, sequela |
| 421.0 | Acute and subacute bacterial endocarditis |
| 421.1 | Acute and subacute infective endocarditis in diseases classified elsewhere |
| 421.9 | Acute endocarditis, unspecified |
| 424.90 | Endocarditis, valve unspecified, unspecified cause |
| 424.91 | Endocarditis in diseases classified elsewhere |
| 424.99 | Endocarditis, valve unspecified, other |
| I33.0 | Acute and subacute infective endocarditis |
| I33.9 | Acute and subacute endocarditis, unspecified |
| I38 | Endocarditis, valve unspecified |
| 423.0 | Hemopericardium |
| 423.1 | Adhesive pericarditis |
| 423.2 | Constrictive pericarditis |
| 423.3 | Cardiac tamponade |
| 423.8 | Other specified diseases of pericardium |
| 423.9 | Unspecified disease of pericardium |
| 393 | Chronic rheumatic pericarditis |
| 420.0 | Acute pericarditis in diseases classified elsewhere |
| 420.90 | Acute pericarditis, unspecified |
| 420.91 | Acute idiopathic pericarditis |
| 420.99 | Other and unspecified acute pericarditis, other |
| I30.0 | Acute nonspecific idiopathic pericarditis |
| I30.1 | Infective pericarditis |
| I30.8 | Other forms of acute pericarditis |
| I30.9 | Acute pericarditis, unspecified |
| I31.0 | Chronic adhesive pericarditis |
| I31.1 | Chronic constrictive pericarditis |
| I31.2 | Hemopericardium, not elsewhere classified |
| I31.3 | Pericardial effusion (noninflammatory) |
| I31.8 | Other specified diseases of pericardium |
| I31.9 | Disease of pericardium, unspecified |
| I32 | Pericarditis in diseases classified elsewhere |
| 441.0 | Dissection of aorta |
| 441.00 | Dissection of aorta, unspecified site |
| 441.01 | Dissection of aorta, thoracic |
| 441.02 | Dissection of aorta, abdominal |
| 441.03 | Dissection of aorta, thoracoabdominal |
| 441.2 | Thoracic aneurysm without mention of rupture |
| 441.4 | Abdominal aneurysm without mention of rupture |
| 441.7 | Thoracoabdominal aneurysm, without mention of rupture |
| 441.9 | Aortic aneurysm of unspecified site without mention of rupture |
| 747.29 | Other anomalies of aorta, other |
| I71.0 | Dissection of aorta |
| I71.00 | Dissection of aorta, unspecified site |
| I71.01 | Dissection of aorta, thoracic |
| I71.02 | Dissection of aorta, abdominal |
| I71.03 | Dissection of aorta, thoracoabdominal |
| I71.2 | Thoracic aortic aneurysm, without rupture |
| I71.4 | Abdominal aortic aneurysm, without rupture |
| I71.6 | Thoracoabdominal aortic aneurysm, without rupture |
| I71.9 | Aortic aneurysm of unspecified site, without rupture |
| Q25.43 | Congenital aneurysm of aorta |
| Q25.44 | Congenital dilation of aorta |
| 402.0 | Hypertensive heart disease, malignant |
| 402.00 | Hypertensive heart disease, malignant, without heart failure |
| 402.01 | Hypertensive heart disease, malignant, with heart failure |
| 402.1 | Hypertensive heart disease, benign |
| 402.10 | Hypertensive heart disease, benign, without heart failure |
| 402.11 | Hypertensive heart disease, benign, with heart failure |
| 402.9 | Hypertensive heart disease, unspecified |
| 402.90 | Hypertensive heart disease, unspecified, without heart failure |
| 402.91 | Hypertensive heart disease, unspecified, with heart failure |
| 404.0 | Hypertensive heart and chronic kidney disease, malignant |
| 404.00 | Hypertensive heart and chronic kidney disease, malignant, without heart failure and with chronic kidney disease stage I through stage IV, or unspecified |
| 404.01 | Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified |
| 404.02 | Hypertensive heart and chronic kidney disease, malignant, without heart failure and with chronic kidney disease stage V or end stage renal disease |
| 404.03 | Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage V or end stage renal disease |
| 404.1 | Hypertensive heart and chronic kidney disease, benign |
| 404.10 | Hypertensive heart and chronic kidney disease, benign, without heart failure and with chronic kidney disease stage I through stage IV, or unspecified |
| 404.11 | Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified |
| 404.13 | Hypertensive heart and chronic kidney disease, benign, with heart failure and chronic kidney disease stage V or end stage renal disease |
| 404.9 | Hypertensive heart and chronic kidney disease, unspecified |
| 404.90 | Hypertensive heart and chronic kidney disease, unspecified, without heart failure and with chronic kidney disease stage I through stage IV, or unspecified |
| 404.91 | Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified |
| 404.92 | Hypertensive heart and chronic kidney disease, unspecified, without heart failure and with chronic kidney disease stage V or end stage renal disease |
| 404.93 | Hypertensive heart and chronic kidney disease, unspecified, with heart failure and chronic kidney disease stage V or end stage renal disease |
| I11.0 | Hypertensive heart disease with heart failure |
| I11.9 | Hypertensive heart disease without heart failure |
| I13.0 | 7Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease |
| I13.10 | Hypertensive heart and chronic kidney disease without heart failure, with stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease |
| I13.11 | Hypertensive heart and chronic kidney disease without heart failure, with stage 5 chronic kidney disease, or end stage renal disease |
| 782.3 | Edema |
| R60.0 | Localized edema |
| R60.1 | Generalized edema |
| R60.9 | Edema, unspecified |
| 428.0 | Congestive heart failure, unspecified |
| 428.1 | Left heart failure |
| 428.20 | Systolic heart failure, unspecified |
| 428.21 | Systolic heart failure, acute |
| 428.23 | Systolic heart failure, acute on chronic |
| 428.30 | Diastolic heart failure, unspecified |
| 428.31 | Diastolic heart failure, acute |
| 428.33 | Diastolic heart failure, acute on chronic |
| 428.40 | Combined systolic and diastolic heart failure, unspecified |
| 428.41 | Combined systolic and diastolic heart failure, acute |
| 428.43 | Combined systolic and diastolic heart failure, acute on chronic |
| 428.9 | Heart failure, unspecified |
| I50.1 | Left ventricular failure, unspecified |
| I50.20 | Unspecified systolic (congestive) heart failure |
| I50.21 | Acute systolic (congestive) heart failure |
| I50.23 | Acute on chronic systolic (congestive) heart failure |
| I50.30 | Unspecified diastolic (congestive) heart failure |
| I50.31 | Acute diastolic (congestive) heart failure |
| I50.33 | Acute on chronic diastolic (congestive) heart failure |
| I50.40 | Unspecified combined systolic (congestive) and diastolic (congestive) heart failure |
| I50.41 | Acute combined systolic (congestive) and diastolic (congestive) heart failure |
| I50.43 | Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure |
| 428.22 | Systolic heart failure, chronic |
| 428.32 | Diastolic heart failure, chronic |
| 428.42 | Combined systolic and diastolic heart failure, chronic |
| I50.22 | Chronic systolic (congestive) heart failure |
| I50.32 | Chronic diastolic (congestive) heart failure |
| I50.42 | Chronic combined systolic (congestive) and diastolic (congestive) heart failure |
| 425.0 | Endomyocardial fibrosis |
| 425.1 | Hypertrophic cardiomyopathy |
| 425.11 | Hypertrophic obstructive cardiomyopathy |
| 425.18 | Other hypertrophic cardiomyopathy |
| 425.2 | Obscure cardiomyopathy of Africa |
| 425.3 | Endocardial fibroelastosis |
| 425.4 | Other primary cardiomyopathies |
| 425.5 | Alcoholic cardiomyopathy |
| 425.7 | Nutritional and metabolic cardiomyopathy |
| 425.8 | Cardiomyopathy in other diseases classified elsewhere |
| 425.9 | Secondary cardiomyopathy, unspecified |
| I42.0 | Dilated cardiomyopathy |
| I42.1 | Obstructive hypertrophic cardiomyopathy |
| I42.2 | Other hypertrophic cardiomyopathy |
| I42.3 | Endomyocardial (eosinophilic) disease |
| I42.4 | Endocardial fibroelastosis |
| I42.5 | Other restrictive cardiomyopathy |
| I42.6 | Alcoholic cardiomyopathy |
| I42.7 | Cardiomyopathy due to drug and external agent |
| I42.8 | Other cardiomyopathies |
| I42.9 | Cardiomyopathy, unspecified |
| 745.0 | Common truncus |
| 745.1 | Transposition of great vessels |
| 745.10 | Complete transposition of great vessels |
| 745.11 | Double outlet right ventricle |
| 745.12 | Corrected transposition of great vessels |
| 745.19 | Transposition of great vessels, other |
| 745.2 | Tetralogy of Fallot |
| 745.3 | Common ventricle |
| 745.4 | Ventricular septal defect |
| 745.5 | Ostium secundum type atrial septal defect |
| 745.6 | Endocardial cushion defects |
| 745.60 | Endocardial cushion defect, unspecified type |
| 745.61 | Ostium primum defect |
| 745.69 | Endocardial cushion defects, other |
| 745.7 | Cor biloculare |
| 745.8 | Bulbus cordis anomalies and anomalies of cardiac septal closure, other |
| 745.9 | Unspecified defect of septal closure |
| 746.00 | Pulmonary valve anomaly, unspecified |
| 746.01 | Anomalies of pulmonary valve, atresia, congenital |
| 746.02 | Anomalies of pulmonary valve, stenosis, congenital |
| 746.09 | Anomalies of pulmonary valve, other |
| 746.1 | Tricuspid atresia and stenosis, congenital |
| 746.2 | Ebstein's anomaly |
| 746.7 | Hypoplastic left heart syndrome |
| 746.8 | Other specified anomalies of heart |
| 746.81 | Subaortic stenosis |
| 746.82 | Cor triatriatum |
| 746.84 | Obstructive anomalies of heart, not elsewhere classified |
| 746.85 | Coronary artery anomaly |
| 746.86 | Congenital heart block |
| 746.87 | Malposition of heart and cardiac apex |
| 746.89 | Other specified anomalies of heart, other |
| 746.9 | Unspecified anomaly of heart |
| Q20 | Congenital malformations of cardiac chambers and connections |
| Q20.0 | Common arterial trunk |
| Q20.1 | Common arterial trunk |
| Q20.2 | Double outlet left ventricle |
| Q20.3 | Discordant ventriculoarterial connection |
| Q20.4 | Double inlet ventricle |
| Q20.5 | Discordant atrioventricular connection |
| Q20.6 | Isomerism of atrial appendages |
| Q20.8 | Other congenital malformations of cardiac chambers and connections |
| Q20.9 | Congenital malformation of cardiac chambers and connections, unspecified |
| Q24.0 | Dextrocardia |
| Q24.1 | Levocardia |
| Q24.2 | Cor triatriatum |
| Q24.3 | Cor triatriatum |
| Q24.4 | Congenital subaortic stenosis |
| Q24.5 | Malformation of coronary vessels |
| Q24.6 | Congenital heart block |
| Q24.8 | Other specified congenital malformations of heart |
| Q24.9 | Congenital malformation of heart, unspecified |
| V58.1 | Encounter for antineoplastic chemotherapy and immunotherapy |
| V58.11 | Encounter for antineoplastic chemotherapy |
| V58.12 | Encounter for antineoplastic immunotherapy |
| V58.69 | Long-term (current) use of other medications |
| Z51.1 | Encounter for antineoplastic chemotherapy and immunotherapy |
| Z51.11 | Encounter for antineoplastic chemotherapy |
| Z51.12 | Encounter for antineoplastic immunotherapy |
| Z79.899 | Other long term (current) drug therapy |
| 794.30 | Abnormal function study, unspecified |
| 794.31 | Abnormal electrocardiogram [ECG] [EKG] |
| 794.39 | Nonspecific abnormal results of function studies, cardiovascular, other |
| R94.30 | Nonspecific abnormal results of function studies |
| R94.31 | Abnormal electrocardiogram [ECG] [EKG] |
| **Rarely appropriate** | |
| V43.3 | Organ or tissue replaced by other means, heart valve |
| Z95.2 | Presence of prosthetic heart valve |
| Z95.3 | Presence of xenogenic heart valve |
| Z95.4 | Presence of other heart-valve replacement |
| 427.60 | Premature beats, unspecified |
| 427.61 | Supraventricular premature beats |
| 427.81 | Sinoatrial node dysfunction |
| 427.89 | Other specified cardiac dysrhythmias, other |
| I49.1 | Atrial premature depolarization |
| I49.40 | Unspecified premature depolarization |
| R00.1 | Bradycardia, unspecified |
| I49.5 | Sick sinus syndrome |
| 780.4 | Dizziness and giddiness |
| R42 | Dizziness and giddiness |
| 414.0 | Coronary atherosclerosis |
| 414.00 | Coronary atherosclerosis, of unspecified type of vessel, native or graft |
| 414.01 | Coronary atherosclerosis, of native coronary artery |
| 414.02 | Coronary atherosclerosis, of autologous vein bypass graft |
| 414.03 | Coronary atherosclerosis, of nonautologous biological bypass graft |
| 414.04 | Coronary atherosclerosis, of artery bypass graft |
| 414.05 | Coronary atherosclerosis, of unspecified type of bypass graft |
| 414.06 | Coronary atherosclerosis, of native coronary artery of transplanted heart |
| 414.07 | Coronary atherosclerosis, of bypass graft (artery) (vein) of transplanted heart |
| 414.2 | Chronic total occlusion of coronary artery |
| 414.3 | Coronary atherosclerosis due to lipid rich plaque |
| 414.4 | Coronary atherosclerosis due to lipid rich plaque |
| 414.8 | Other specified forms of chronic ischemic heart disease |
| 414.9 | Chronic ischemic heart disease, unspecified |
| 412 | Old myocardial infarction |
| I25.1 | Atherosclerotic heart disease of native coronary artery |
| I25.10 | Atherosclerotic heart disease of native coronary artery without angina pectoris |
| I25.2 | Old myocardial infarction |
| I25.810 | Atherosclerosis of coronary artery bypass graft(s) without angina pectoris |
| I25.811 | Atherosclerosis of native coronary artery of transplanted heart without angina pectoris |
| I25.812 | Atherosclerosis of bypass graft of coronary artery of transplanted heart without angina pectoris |
| I25.82 | Chronic total occlusion of coronary artery |
| I25.83 | Coronary atherosclerosis due to lipid rich plaque |
| I25.84 | Coronary atherosclerosis due to calcified coronary lesion |
| I25.89 | Other forms of chronic ischemic heart disease |
| I25.9 | Chronic ischemic heart disease, unspecified |
| V72.81 | Pre-operative cardiovascular examination |
| V72.83 | Other specified pre-operative examination |
| V72.84 | Pre-operative examination, unspecified |
| V72.85 | Other specified examination |
| V81.2 | Other and unspecified cardiovascular conditions |
| V70.9 | Unspecified general medical examination |
| Z01.818 | Encounter for other preprocedural examination |
| Z01.89 | Encounter for other specified special examinations |
| 401.0 | Essential hypertension, malignant |
| 401.1 | Essential hypertension, benign |
| 401.9 | Essential hypertension, unspecified |
| I10 | Essential (primary) hypertension |
| 250.00 | Diabetes mellitus without mention of complication, type II or unspecified type, not stated as uncontrolled |
| 272.4 | Other and unspecified hyperlipidemia |
| 272.0 | Pure hypercholesterolemia |
| 278.00 | Obesity, unspecified |
| 440.0 | Atherosclerosis of aorta |
| 593.9 | Unspecified disorder of kidney and ureter |
| 496 | Chronic airway obstruction, not elsewhere classified |
| 780.79 | Other malaise and fatigue |
| 786.00 | Respiratory abnormality, unspecified |
| 785.9 | Other symptoms involving cardiovascular system |
| **Unclassifiable** | |
| 429.9 | Heart disease, unspecified |
| 429.3 | Cardiomegaly |
| I51.7 | Cardiomegaly |
| I51.9 | Heart disease, unspecified |
| I51.89 | Other ill-defined heart diseases |
| I52 | Other heart disorders in diseases classified elsewhere |
| 411.1 | Intermediate coronary syndrome |
| 411.89 | Other acute and subacute forms of ischemic heart disease, other, other |
| 785.0 | Tachycardia, unspecified |
| R00.0 | Tachycardia, unspecified |
| 426.0 | Atrioventricular block, complete |
| 426.10 | Atrioventricular block, unspecified |
| 426.11 | First degree atrioventricular block |
| 426.12 | Mobitz (type) II atrioventricular block |
| 426.13 | Other second degree atrioventricular block |
| 426.2 | Left bundle branch hemiblock |
| 426.3 | Other left bundle branch block |
| 426.4 | Right bundle branch block |
| 426.5 | Bundle branch block, other and unspecified |
| 426.50 | Bundle branch block, unspecified |
| 426.51 | Right bundle branch block and left posterior fascicular block |
| 426.52 | Right bundle branch block and left anterior fascicular block |
| 426.53 | Other bilateral bundle branch block |
| 426.54 | Trifascicular block |
| 426.6 | Other heart block |
| 426.7 | Anomalous atrioventricular excitation |
| 426.8 | Other specified conduction disorders |
| 426.81 | Lown-Ganong-Levine syndrome |
| 426.82 | Long QT syndrome |
| 426.89 | Other specified conduction disorders, other |
| 426.9 | Conduction disorder, unspecified |
| I44 | Atrioventricular and left bundle-branch block |
| I44.0 | Atrioventricular block, first degree |
| I44.1 | Atrioventricular block, second degree |
| I44.2 | Atrioventricular block, complete |
| I44.3 | Other and unspecified atrioventricular block |
| I44.30 | Unspecified atrioventricular block |
| I44.39 | Other atrioventricular block |
| I44.4 | Left anterior fascicular block |
| I44.5 | Left posterior fascicular block |
| I44.6 | Other and unspecified fascicular block |
| I44.60 | Unspecified fascicular block |
| I44.69 | Other fascicular block |
| I44.7 | Left bundle-branch block, unspecified |
| 427.4 | Ventricular fibrillation and flutter |
| 427.41 | Ventricular fibrillation |
| 427.42 | Ventricular flutter |
| 427.8 | Other specified cardiac dysrhythmias |
| 427.89 | Other specified cardiac dysrhythmias, other |
| 427.9 | Cardiac dysrhythmia, unspecified |
| I49.0 | Ventricular fibrillation and flutter |
| I49.01 | Ventricular fibrillation |
| I49.02 | Ventricular flutter |
| I49.2 | Junctional premature depolarization |
| I49.4 | Other and unspecified premature depolarization |
| I49.40 | Unspecified premature depolarization |
| I49.49 | Other premature depolarization |
| I49.8 | Other specified cardiac arrhythmias |
| I49.9 | Cardiac arrhythmia, unspecified |
| I47.0 | Re-entry ventricular arrhythmia |
| I47.9 | Paroxysmal tachycardia, unspecified |

|  |
| --- |
| Supplemental Digital Content Table 4: ICD-9/10-CM codes used to classify myocardial infarction and cardiac arrest |
| Diagnosis | **ICD-9-CM** | **ICD-10-CM** |
| Myocardial Infarction | 410x | I21x |
| Cardiac Arrest | 427.5 | I46x |
| Heart Failure  (A complication of heart failure is only present if heart failure is coded for on the surgical inpatient admission and not present on any inpatient or outpatient coding prior to the surgical admission.  Or a diagnosis for acute heart failure is made during the surgical admission.) | 398.91, 402.01, 402.11. 402.91,  404.01, 404.03, 404.11, 404.13,  404.91, 404.93, 425.4 – 425.9, 428.x | I09.9, I11.0, I13.0, I13.2, I25.5, I42.0,  142.5 – I42.9, I43.x, I50.x, P29.0 |

# Supplemental Digital Content Table 5.

# ICD-9-CM, ICD-10-CM Codes for Patient Comorbidities (Elixhauser)

|  |  |  |  |
| --- | --- | --- | --- |
| **Patient** | **Elixhauser**  **Composite** |  | |
| **Characteristics** | **Pointsi** | **ICD-9-CMii** | **ICD-10-CMii** |
| Alcohol abuse | 0 | 265.2, 291.1 – 291.3, 291.5-291.9, | F10, E52, G62.1, I42.6, K29.2, K70.0, |
|  |  | 303.0, 303.9, 305.0, 357.5, 425.5, | K70.3, K70.9, T51.x, Z50.2, Z71.4, |
|  |  | 535.3, 571.0 – 571.3, 980.x, V11.3 | Z72.1 |
| AIDS/HIV | 0 | 042.x – 044.x | B20.x-B22.x, B24.x |
| Blood loss anemia | -2 | 280.0 | D50.0 |
| Cardiac arrhythmias | 5 | 426.0, 426.13, 426.7, 426.9, 426.10, | I44.1-I44.3, I45.6, I45.9, I47.x-I49.x, |
|  |  | 426.12, 427.0 – 427.4, 427.6-427.9, | ROO.O, ROO.1, ROO.8, T82.1, Z45.0, |
|  |  | 785.0, 996.01, 996.04, V45.0, V53.3 | Z95.0 |
| Chronic pulmonary | 3 | 416.8, 416.9, 490.x – 505.x, 506.4, | I27.8, 127.9, J40.x-J47.x, J60.x-J67.x, |
| disease |  | 508.1, 508.8 | J68.4, J70.1, J70.3 |
| Coagulopathy | 3 | 286.x, 287.1, 287.3-287.5 | D65 – D68.x, D69.1, |
|  |  |  | D69.3 – D69.6 |
| Congestive heart | 7 | 398.91, 402.01, 402.11. 402.91, | I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, |
| failure |  | 404.01, 404.03, 404.11, 404.13, | 142.5 – I42.9, I43.x, I50.x, P29.0 |
|  |  | 404.91, 404.93, 425.4 – 425.9, 428.x |  |
| Deficiency anemia | -2 | D50.8, D50.9, D51.x – D53.x | 280.1 – 280.9, 281.x |
| Depression | -3 | 296.2, 296.3, 296.5, 300.4, 309.x, 311 | F20.4, F31.3 – F31.5, F32.x, F33.x, |
|  |  |  | F34.1, F41.2, F43.2 |
| Diabetes, | 0 | 250.0 – 250.3 | E10.0, E10.1, E10.9, E11.0, E11.1, |
| uncomplicated |  |  | E11.9, E12.0, E12.1, E12.9, E13.0, |
|  |  |  | E13.1, E13.9, E14.0, E14.1, E14.9 |
| Diabetes, | 0 | 250.4 – 250.9 | E10.2 – E10.8, E11.2 – E11.8, E12.2 – |
| complicated |  |  | E12.8, E13.2 – E13.8, E14.2 – E14.8 |
| Drug abuse | -7 | 292.x, 304.x, 305.2 – 305.9, V65.42 | F11.x – F16.x, F18.x, F19.x, Z71.5. |
|  |  |  | Z72.2 |
| Fluid and electrolyte | 5 | 253.6, 276.x | E22.2, E86.x, E87.x |
| disorders |  |  |  |
| Hypertension, | 0 | 401.x | I10.x |
| uncomplicated |  |  |  |
| Hypertension, | 0 | 402.x – 405.x | I11.x – I13.x, I15.x |
| complicated |  |  |  |
| Hypothyroidism | 0 | 240.9, 243.x, 244.x, 246.1, 246.8 | E00.x – E03.x, E89.0 |
| Liver Disease | 11 | 070.22, 070.23, 070.32, 070.33, | B18.x, I85.x, I86.4, I98.2, K70.x, K71.1, |
|  |  | 070.44, 070.54, 070.6, 070.9, 456.0 – | K71.3 – K71.5, K71.7, K72.x – K74.x, |
|  |  | 456.2, 570.x, 571.x, 572.2 – 572.8, | K76.0, K76.2 – K76.9. Z94.4 |
|  |  | 573.3, 573.4, 573.8,573.9, V42.7 |  |
| Lymphoma | 9 | 200.x – 202.x, 203.0, 238.6 | C81.x – C85.x, C88.x, C96.x, |
|  |  |  | C90.0, C90.2 |
| Metastatic cancer | 12 | 196.x – 199.x | C77.x – C80.x |
| Obesity | -4 | 278.0 | E66.x |
| Other neuroligical | 6 | 331.9, 332.0, 332.1, 333.4, 333.5, | G10.x – G 13.x, G20.x – G22.x, G25.4, |
| disorders |  | 333.92, 334.x – 335.x, 336.2, 340.x, | G25.5, G31.2, G31.8, G31.9, G32.x, |
|  |  | 341.x, 345.x, 348.1, 348.3, 780.3, | G35.x – G37.x, G40.x, G41.x, G93.1, |
|  |  | 784.3 | G93.4, R47.0, R56.x |

**Supplemental Digital Content Table 5. ICD-9-CM, ICD-10-CM Codes for Patient Comorbidites (Elixhauser, continued)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Patient** | | **Elixhauser**  **Composite** | |  | |  | | |
| **Characteristics** | | **Pointsi** | | **ICD-9-CMii** | | **ICD-10-CMii** | | |
| Paralysis | | 7 | | 334.1, 342.x, 343.x, 344.0 – 344.6, | | G04.1, G11.4, G80.1, G80.2, G81.x, | | |
|  | |  | | 344.9 | | G82.x, G83.0 – G83.4, G83.9 | | |
| Peptic ulcer | | 0 | | 531.7, 531.9, 532.7, 532.9, 533.7, | | K25.7, K25.9, K26.7, K26.9, K27.7, | | |
| disease, no | |  | | 533.9, 534.7, 534.9 | | K27.9, K28.7, K28.9 | | |
| bleeding | |  | |  | |  | | |
| Peripheral vascular | | 2 | | 093.0, 437.3, 440.x, 441.x, 443.1 – | | I70.x, I71.x, I73.1, I73.8, I73.9, I77.1, | | |
| disorders | |  | | 443.9, 447.1, 557.1 557.9, V43.4 | | I79.0, I79.2, K55.1, K55.8, K55.9, | | |
|  | |  | |  | | Z95.8, Z95.9 | | |
| Psychoses | | 0 | | 293.8, 295.x, 296.04, 296.14, 296.44, | | F20.x, F22.x – F25.x, F28.x, F29.x, | | |
|  | |  | | 296.54, 297.x, 298.x | | F30.2, F31.2, F31.5 | | |
| Pulmonary | | 4 | | 415.0, 415.1, 416.x, 417.0, 417.8, | | G10.x – G 13.x, G20.x – G22.x, G25.4, | | |
| circulation disorders | |  | | 417.9 | | G25.5, G31.2, G31.8, G31.9, G32.x, | | |
|  | |  | |  | | G35.x – G37.x, G40.x, G41.x, G93.1, | | |
|  | |  | |  | | G93.4, R47.0, R56.x | | |
| Renal failure | | 5 | | 403.01, 403.11, 403.91, 404.02, | | I12.0, I13.1, N18.x, NI9.x, N25.0, Z49.0 | | |
|  | |  | | 404.03, 404.12, 404.13, 404.92, | | – Z49.2, Z94.0, Z99.2 | | |
|  | |  | | 404.93, 585.x, 586.x, 588.0, V42.0, | |  | | |
|  | |  | | V45.1, V56.x | |  | | |
| Rheumatoid | | 0 | | 446.x, 701.0, 710.0 – 710.4, 710.8, | | L94.0, L94.1, L94.3, M05.x, M06.x, | | |
| arthritis/collagen | |  | | 710.9, 711.2, 714.x, 719.3, 720.x, | | M08.x, M12.0, M12.3, M30.x, M31.0 – | | |
| vascular diseases | |  | | 725.x, 728.5, 728.89, 729.30 | | M31.3, M32.x – M35.x, M45.x, M46.1, | | |
|  | |  | |  | | M46.8, M46.9 | | |
| Solid tumor without | | 4 | | 140.x – 172.x, 174.x – 195.x | | C00.x – C26.x, C30.x – C34.x, C37.x – | | |
| metastasis | |  | |  | | C41.x, C43.x, C45.x – C58.x, C60.x – | | |
|  | |  | |  | | C76.x, C97.x | | |
| Valvular Disease | | -1 | | 093.2, 394.x – 397.x, 424.x, 746.3 – | | A52.0, I05.x – I08.x, I09.1, I09.8, I34.x | | |
|  | |  | | 746.6, V42.2, V43.3 | | – I39.x, Q23.O – Q23.3, Z95.2, Z95.4 | | |
| Weight loss | | 6 | | 260.x – 263.x, 783.2, 799.4 | | E40.x – E46.x, R63.4, R64 | | |
|  | |  | |  | | |
| **Patient Characteristics** | |  | | **ICD-9-CM** | | **ICD-10-CM** |
| Cerebrovascular disease | |  | | 430.x, 431.x, 433.x – 435.x, 438.x,  V12.54 | | I60.x, I61.x, I63.x, I66.x, I69.x,  G45.x, G46.x |
| Chronic kidney disease | |  | | 403.01, 403.11, 403.91, 404.02, | | I12.0, I13.11, I13.2, N18.3 – |
| stage III and greater | |  | | 404.03, 404.12, 404.13, 404.92, | | N18.6, N19.x, Z49.x, Z94.0, Z99.2 |
|  | |  | | 404.92, 404.93, 585.3 - 585.6,  586.x, V42.0, v45.1, v56.x | |  |
| Ischemic heart disease | |  | | 410.x, 412.x – 414.x | | I20.x – I22.x, I25.x |

An “x” at the end of the Internal Classification of Diseases, Ninth and Tenth Revisions, Clinical Modification (ICD-9-CM, ICD-10-CM) code signifies that multiple suffix codes were used to search for multiple sub-conditions sharing a common umbrella diagnosis. Preoperative treatment with insulin was determined using pharmaceutical claims data rather than diagnoses codes.

i: Elixhauser scores determined using van Walraven (2009)

ii: ICD-9-CM and ICD-10-CM codes for Elixhauser score determined using Quan (2005

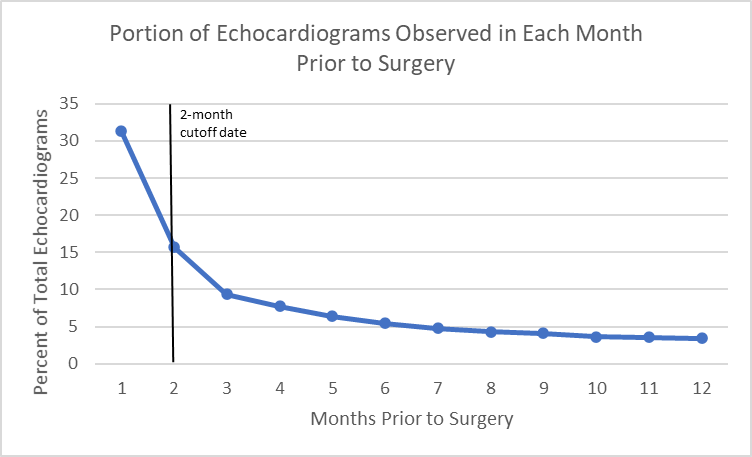
**Supplemental Digital Content Table 6**: Frequency of inappropriate echocardiograms by year 2005-2017. The number and frequency of appropriate and inappropriate echocardiograms that were classifiable by the Appropriate Use Criteria is presented below. The Cochrane Armitage test was used to identify a trend and no trend was identified (p=0.88)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
| Appropriate  n(%) | 612  (77.1) | 578  (74.2) | 568  (71.2) | 600  (73.2) | 695  (71.5) | 817  (74.4) | 1,114  (72.5) | 1,193  (72.0) | 1,151  (74.5) | 1,427  (74.6) | 866  (75.2) | 344  (75.3) | 292  (70.5) | 10,257  (73.6) |
| Inappropriate  n(%) | 182  (22.9) | 201  (25.8) | 230  (28.8) | 220  (26.8) | 277  (28.5) | 281  (25.6) | 423  (27.5) | 464  (28.0) | 394  (25.5) | 487  (25.4) | 285  (24.8) | 113  (24.7) | 122  (26.5) | 3,679  (26.4) |

**Supplemental Digital Content Table 7: Number of echocardiograms performed in each month prior to surgery**

|  |  |  |  |
| --- | --- | --- | --- |
|  | |  | |
| **Months prior**  **to surgery** | **Percent (%)** | | **Number of Echocardiograms** | |
| 1 | 31.3 | | 18,726 | |
| 2 | 15.7 | | 9,386 | |
| 3 | 9.4 | | 5,606 | |
| 4 | 7.8 | | 4,633 | |
| 5 | 6.4 | | 3,816 | |
| 6 | 5.5 | | 3,273 | |
| 7 | 4.8 | | 2,847 | |
| 8 | 4.3 | | 2,582 | |
| 9 | 4.1 | | 2,467 | |
| 10 | 3.7 | | 2,192 | |
| 11 | 3.6 | | 2,141 | |
| 12 | 3.5 | | 2,067 | |
| **Total** | **100** | | **59,778** | |

**Supplemental Digital Content Figure 1:** Frequency of echocardiograms in the year before surgery. The increase in frequency within the 2 months prior to surgery, accounting for roughly 50% of the echocardiograms within the cohort, is suggestive that the major abdominal surgical procedure is the reason for obtaining the study.

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