

ICD-10 CODES

SUPPLEMENTARY MATERIAL

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STATISTICS:

- The positive predictive value (PPV) for being a case was determined as number of cases identified by the phenotyping algorithm and confirmed by review divided by the total number of cases identified by the algorithm.
- The negative predictive value (NPV) for being a control was defined as number of true negatives in the numerator with total number of controls classified by the algorithm in the denominator.
- Gold standard: manual chart review by an expert cardiologist-lipidologist initially blinded to a case-control status.

Table 2B. ICD codes to ascertain pregnancy.

Phenotype	ICD-9 code number	ICD-9 code description	ICD-10 code number	ICD-10 code description
PREGNANCY	V22.x	Normal pregnancy	Z34.xx	Encounter for supervision of normal pregnancy
			Z33.x	Pregnant state
	V23.xx	Supervision of high-risk pregnancy	O09.xxx	Supervision of high risk pregnancy
	645.xx	Late pregnancy	O48.x	Late pregnancy
	651.xx	Multiple gestation	O30.xxx	Multiple gestation
			O31.xxx	Complications specific to multiple gestation
	652.xx	Malposition and malpresentation of fetus	O32.xxxx	Maternal care for malpresentation of fetus
			Z3A.2x	Pregnancy (single) (uterine) Weeks of gestation of pregnancy, weeks 20-29
			Z3A.3x	Weeks of gestation of pregnancy, weeks 30-39
			Z3A.4x	Weeks of gestation of pregnancy, weeks 40 or greater
	V27.xx	Outcome of delivery	Z37.xx	Outcome of delivery
	V28.xx	Encounter for antenatal screening of mother	Z36	Encounter for antenatal screening of mother

Footnote: unfilled areas marked in gray denote absence of the corresponding code; cells with the text marked in grey denote codes that were not tested.

Diagnostic accuracy (ICD-10 codes)

Condition	Sensitivity	Specificity	PPV	NPV
Pregnancy	100% (69.2-100.0)	100% (69.2-100.0)	100%	100%

Each condition was checked using 10 randomly selected cases (patients identified with the condition based on the code algorithm), and 10 randomly selected controls (patients with no indication of the condition based on the code algorithm). For pregnancy, the patients selected were restricted to females aged ≤ 45 years.

Table 3B. CPT codes of procedures and ICD procedure codes for commonly used extracorporeal lipid-lowering treatment procedures.

Description	ICD-9/CPT-4	ICD-10/CPT-4
Extracorporeal immunoabsorption and plasma reinfusion	36515 99.76	36515
Extracorporeal selective adsorption or selective filtration and plasma reinfusion	36516	36516
Low density lipoprotein (LDL) apheresis using heparin-induced extracorporeal LDL1 precipitation		HCPCS: S2120
Pheresis of Plasma		6A550Z3 6A551Z3

HCPCS = Healthcare Common Procedure Coding System

NOTE: Codes 6A550Z3 and 6A551Z3 are not specific to such indication lipid abnormalities. If used, each case requires manual validation. The number of cases is expected to be small.

Footnote: unfilled areas marked in gray denote absence of the corresponding code.

CONDITION: ≥ 2 codes separated by at least 5 days, before the age-specific cut-off.

NOTES:

- The code logic does not distinguish between the atherosclerotic and non-atherosclerotic (e.g., paradoxical embolism) origins of the acute coronary syndromes.
- The code logic does not account for “mis-coding” applied to each individual case (i.e., wrong application of the code). By calling codes on two separate encounters separated in time we increase the precision but do not fully eliminate the false assignment.
- Codes for angina pectoris with documented spasm (ICD-10 code I20.1) and for unspecified angina pectoris (ICD-10 code I20.9) were removed due to unspecificity and lack of clinical impact in defining CHD status in the FH scoring algorithm.
- There is no specific ICD-10 code for pontine infarction (or brainstem infarction).
- Codes pertinent to “abdominal aortic aneurysm” were not tested in this version.
- The revised algorithm defines premature ASCVD as having two or more corresponding codes found during the same time frame and before the gender-specific age cut-offs, with at least 5 or more days separating the two codes.
- Code for the “bypass, cardiopulmonary (ICD-10-PCS)”. i.e., 5A1221Z, excluded due to non-specificity.

Table 4. ICD codes and CPT4 codes for events/procedures defining ASCVD cases.

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
CORONARY HEART DISEASE				
Angina	413.0	Angina decubitus	I20.8	Other forms of angina pectoris
	413.1	Prinzmetal angina		
	413.9	Other and unspecified angina pectoris		
	411.1	Intermediate coronary syndrome	I20.0	Unstable angina
Myocardial infarction	410.00	Acute myocardial infarction of anterolateral wall episode of care unspecified	I21.01	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
	410.01	Acute myocardial infarction of anterolateral wall initial episode of care		
	410.02	Acute myocardial infarction of anterolateral wall subsequent episode of care	I21.02	
	410.10	Acute myocardial infarction of other anterior wall episode of care unspecified	I21.09	
	410.11	Acute myocardial infarction of other anterior wall initial episode of care		
	410.12	Acute myocardial infarction of other anterior wall subsequent episode of care		
	410.20	Acute myocardial infarction of inferolateral wall episode of care unspecified	I21.19	ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
	410.21	Acute myocardial infarction of inferolateral wall initial episode of care		
	410.22	Acute myocardial infarction of inferolateral wall subsequent episode of care		
	410.40	Acute myocardial infarction of other inferior wall episode of care unspecified		
	410.41	Acute myocardial infarction of other inferior wall initial episode of care		
	410.42	Acute myocardial infarction of other inferior wall subsequent episode of care		

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description	
Myocardial infarction	410.30	Acute myocardial infarction of inferoposterior wall episode of care unspecified	I21.11	ST elevation (STEMI) myocardial infarction involving right coronary artery	
	410.31	Acute myocardial infarction of inferoposterior wall initial episode of care			
	410.32	Acute myocardial infarction of inferoposterior wall subsequent episode of care			
	410.50	Acute myocardial infarction of other lateral wall episode of care unspecified	I21.21	ST elevation (STEMI) myocardial infarction involving other sites	
	410.51	Acute myocardial infarction of other lateral wall initial episode of care			
	410.52	Acute myocardial infarction of other lateral wall subsequent episode of care			
	410.60	True posterior wall infarction episode of care unspecified	I21.29		
	410.61	True posterior wall infarction initial episode of care			
	410.62	True posterior wall infarction subsequent episode of care			
	410.80	Acute myocardial infarction of other specified sites episode of care unspecified			
	410.81	Acute myocardial infarction of other specified sites initial episode of care			
	410.82	Acute myocardial infarction of other specified sites subsequent episode of care			
	410.70	Subendocardial infarction episode of care unspecified	I21.4		Non-ST elevation (NSTEMI) myocardial infarction
	410.71	Subendocardial infarction initial episode of care			
	410.72	Subendocardial infarction subsequent episode of care			
410.90	Acute myocardial infarction of unspecified site episode of care unspecified	I21.3	ST elevation (STEMI) myocardial infarction of unspecified site		
410.91	Acute myocardial infarction of unspecified site initial episode of care				

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Myocardial infarction	410.92	Acute myocardial infarction of unspecified site subsequent episode of care	I21.3	ST elevation (STEMI) myocardial infarction of unspecified site
			I22.xx	Subsequent ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction
	412	Old myocardial infarction	I25.2	Old myocardial infarction
	429.71	Certain sequelae of myocardial infarction not elsewhere classified acquired cardiac septal defect	I23.1	Atrial septal defect as current complication following acute myocardial infarction
			I23.2	Ventricular septal defect as current complication following acute myocardial infarction
	429.79	Certain sequelae of myocardial infarction not elsewhere classified other	I23.0	Hemopericardium as current complication following acute myocardial infarction
			I23.3	Rupture of cardiac wall without hemopericardium as current complication following acute myocardial infarction
			I23.4	Rupture of chordae tendinae without hemopericardium as current complication following acute myocardial infarction
			I23.5	Rupture of papillary muscle without hemopericardium as current complication following acute myocardial infarction
			I23.6	Thrombosis of atrium, auricular appendage, and ventricle as current complications following acute myocardial infarction.
			I23.7	Postinfarction angina
			I23.8	Other current complications following acute myocardial infarction
			I24.1	Dressler's syndrome (postmyocardial infarction syndrome)

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Coronary atherosclerosis/ chronic ischemic heart disease	414.00	Coronary atherosclerosis of unspecified type of vessel native or graft	I25.10	Atherosclerotic heart disease of native coronary artery without angina pectoris
	414.01	Coronary atherosclerosis of native coronary artery		
	414.02	Coronary atherosclerosis of autologous vein bypass graft	I25.810	Atherosclerosis of coronary artery bypass graft(s) without angina pectoris
	414.03	Coronary atherosclerosis of nonautologous biological bypass graft		
	414.04	Coronary atherosclerosis of artery bypass graft		
	414.05	Coronary atherosclerosis of unspecified bypass graft		
	414.06	Coronary atherosclerosis of native coronary artery of transplanted heart	I25.811	Atherosclerosis of native coronary artery of transplanted heart without angina pectoris
	414.07	Coronary atherosclerosis of bypass graft (artery) (vein) of transplanted heart	I25.812	Atherosclerosis of bypass graft of coronary artery of transplanted heart without angina pectoris
			I25.110 I25.111 I25.118 I25.119 I25.700 I25.701 I25.708 I25.709 I25.710 I25.711 I25.718 I25.719 I25.720 I25.721 I25.728 I25.729 I25.730 I25.731	Atherosclerotic heart disease of coronary arteries or bypass graft with unspecified or other unstable angina pectoris

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Coronary atherosclerosis/ chronic ischemic heart disease			I25.738 I25.739 I25.750 I25.751 I25.758 I25.759 I25.760 I25.761 I25.768 I25.769 I25.790 I25.791 I25.798 I25.799	Atherosclerotic heart disease of coronary arteries or bypass graft with unspecified or other unstable angina pectoris
	414.2	Chronic total occlusion of coronary artery	I25.82	Chronic total occlusion of coronary artery
	414.3	Coronary atherosclerosis due to lipid rich plaque	I25.83	Coronary atherosclerosis due to lipid rich plaque
	414.4	Coronary atherosclerosis due to calcified coronary lesion	I25.84	Coronary atherosclerosis due to calcified coronary lesion
	414.8	Other specified forms of chronic ischemic heart disease	I25.5	Ischemic cardiomyopathy
			I25.89	Other forms of chronic ischemic heart disease
414.9	Chronic ischemic heart disease, unspecified	I25.9	Chronic ischemic heart disease, unspecified	
Percutaneous coronary revascularization CPT Procedure Codes:	92920-92921; 92924-92925; 92928-92929; 92933-92934; 92937-92938; 92941; 92943-92944; 92980-82, 92984, 92995-6, 92973-92974			
Percutaneous coronary revascularization ICD Procedure	36.01-36.07, 36.09 00.66		Z98.61	Coronary angioplasty status
			Z95.5	Presence of coronary angioplasty implant and graft
			0270xxx	Dilation of Coronary Artery, One Artery

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description	
Codes: Percutaneous coronary revascularization ICD Procedure Codes	36.01-36.07, 36.09 00.66	Percutaneous transluminal coronary angioplasty status	0271xxx	Dilation of Coronary Artery, Two Arteries	
			0272xxx	Dilation of Coronary Artery, Three Arteries	
			0273xxx	Dilation of Coronary Artery, Four or More Arteries	
	02C0xxx		Extirpation of Matter from Coronary Artery		
	02C1xxx				
	02C2xxx				
	V45.82		Percutaneous transluminal coronary angioplasty status	02C3xxx	Dilation of coronary artery by percutaneous approach
				02703ZZ	
				02704ZZ	
				02713ZZ	
02714ZZ					
V45.82	Percutaneous transluminal coronary angioplasty status	02723ZZ	Dilation of coronary artery by percutaneous approach		
		02724ZZ			
		02733ZZ			
		02734ZZ			
V45.82	Percutaneous transluminal coronary angioplasty status	3E07017	Introduction of thrombolytic / platelet inhibitor into coronary artery, open or percutaneous		
		3E070PZ			
		3E07317			
		3E073PZ			
Coronary bypass surgery CPT Procedure Codes	33510-33514 33516-33519 33521-33523 33533-33536				
Coronary bypass surgery ICD Procedure Codes	36.10 - 36.19, 36.2		Z95.1	Presence of coronary artery bypass graft (ICD-10-CM)	
	V45.81	Aortocoronary bypass status	0210xxx – 0213xxx	Bypass, Sites	

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
CEREBROVASCULAR DISEASE				
ICD-9: Stroke	434	Occlusion of cerebral arteries	I66.01 I66.02 I66.03 I66.09	Occlusion and stenosis of unspecified middle cerebral artery
			I66.11 I66.12 I66.13 I66.19	Occlusion and stenosis of unspecified anterior cerebral artery
			I66.21 I66.22 I66.23 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
			434.00	Cerebral thrombosis without mention of cerebral infarction
	434.01	Cerebral thrombosis with cerebral infarction	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
			I63.313	Cerebral infarction due to thrombosis of bilateral middle cerebral arteries
			I63.319	Cerebral infarction due to thrombosis of unspecified middle cerebral artery
			I63.321	Cerebral infarction due to thrombosis of right anterior cerebral artery

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Stroke	434.01	Cerebral thrombosis with cerebral infarction	I63.322	Cerebral infarction due to thrombosis of left anterior cerebral artery
			I63.323	Cerebral infarction due to thrombosis of bilateral anterior cerebral arteries
			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
			I63.333	Cerebral infarction due to thrombosis of bilateral posterior cerebral arteries
			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
			I63.343	Cerebral infarction due to thrombosis of bilateral cerebellar arteries
			I63.349	Cerebral infarction due to thrombosis of unspecified cerebellar artery
			I63.39	Cerebral infarction due to thrombosis of unspecified other cerebral artery
			I63.6	Cerebral infarction due to cerebral venous thrombosis, non-pyogenic
	434.10	Cerebral embolism without mention of cerebral infarction	I66.9	Occlusion and stenosis of unspecified cerebral artery
434.90	Cerebral artery occlusion, unspecified without mention of cerebral infarction			
434.11	Cerebral embolism with cerebral infarction	I63.40	Cerebral infarction due to embolism of unspecified cerebral artery	

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
ICD-9: Stroke	434.11	Cerebral embolism with cerebral infarction	I63.411	Cerebral infarction due to embolism of right middle cerebral artery
			I63.412	Cerebral infarction due to embolism of left middle cerebral artery
			I63.413	Cerebral infarction due to embolism of bilateral middle cerebral arteries
			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
			I63.423	Cerebral infarction due to embolism of bilateral anterior cerebral arteries
			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
			I63.433	Cerebral infarction due to embolism of bilateral posterior cerebral arteries
			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
			I63.443	Cerebral infarction due to embolism of bilateral cerebellar arteries
I63.449	Cerebral infarction due to embolism of unspecified cerebellar artery			

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
ICD-9: Stroke	434.11	Cerebral embolism with cerebral infarction	I63.49	Cerebral infarction due to embolism of unspecified other cerebral artery
	434.91	Cerebral artery occlusion, unspecified with cerebral infarction	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
			I63.513	Cerebral infarction due to unspecified occlusion or stenosis of bilateral middle cerebral arteries
			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
			I63.523	Cerebral infarction due to unspecified occlusion or stenosis of bilateral anterior cerebral arteries
			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			

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Stroke	434.91	Cerebral artery occlusion, unspecified with cerebral infarction	I63.532	Cerebral infarction due to unspecified occlusion or stenosis of left posterior cerebral artery
			I63.533	Cerebral infarction due to unspecified occlusion or stenosis of bilateral posterior cerebral arteries
			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
			I63.543	Cerebral infarction due to unspecified occlusion or stenosis of bilateral cerebellar arteries
			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 unspecified other cerebral artery
			I63.8	Other cerebral infarction
			I63.9	Cerebral infarction, unspecified
			437.0	Cerebral atherosclerosis
437.1	Other generalized ischemic cerebrovascular disease	I67.82	Cerebral ischemia	
Transient Ischemic Attack	435.0	Basilar artery syndrome	G45.0	Vertebro-basilar artery syndrome
	435.1	Vertebral artery syndrome		
	435.2	Subclavian steal syndrome	G45.8	Other transient cerebral ischemic attacks and related syndromes
	435.3	Vertebrobasilar artery syndrome		

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Transient Ischemic Attack	435.8	Other specified transient cerebral ischemias	G45.1	Carotid artery syndrome (hemispheric)
			G45.2	Multiple and bilateral precerebral artery syndromes
	435.9	Unspecified transient cerebral ischemia	G45.9	Transient cerebral ischemic attack, unspecified
Carotid artery disease	433	Occlusion and stenosis of precerebral arteries		
	433.00	Occlusion and stenosis of basilar artery without mention of cerebral infarction	I65.1	Occlusion and stenosis of basilar artery
	433.01	Occlusion and stenosis of basilar artery with cerebral infarction	I63.22	Cerebral infarction due to unspecified occlusion or stenosis of basilar arteries
			I63.02	Cerebral infarction due to thrombosis of basilar artery
			I63.22	Cerebral infarction due to unspecified occlusion or stenosis of basilar artery
	433.10	Occlusion and stenosis of carotid artery without mention of cerebral infarction	I65.29	Occlusion and stenosis of unspecified carotid 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
	433.11	Occlusion and stenosis of carotid artery with cerebral infarction	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
			I63.131	Cerebral infarction due to embolism of right carotid artery

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Carotid artery disease	433.11	Occlusion and stenosis of carotid artery with cerebral infarction	I63.132	Cerebral infarction due to embolism of left carotid artery
			I63.133	Cerebral infarction due to embolism of bilateral carotid arteries
			I63.139	Cerebral infarction due to embolism of unspecified carotid artery
			I63.239	Cerebral infarction due to unspecified occlusion or stenosis of unspecified carotid arteries
	433.20	Occlusion and stenosis of vertebral artery without mention of cerebral infarction	I65.09	Occlusion and stenosis of unspecified vertebral artery
			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
	433.21	Occlusion and stenosis of vertebral artery with cerebral infarction	I63.219	Cerebral infarction due to unspecified occlusion or stenosis of unspecified vertebral 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
			I63.213	Cerebral infarction due to unspecified occlusion or stenosis of bilateral vertebral arteries
			I63.011	Cerebral infarction due to thrombosis of right vertebral artery
			I63.012	Cerebral infarction due to thrombosis of left vertebral artery

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Carotid artery disease	433.21	Occlusion and stenosis of vertebral artery with cerebral infarction	I63.013	Cerebral infarction due to thrombosis of bilateral vertebral arteries
			I63.019	Cerebral infarction due to thrombosis of unspecified vertebral artery
			I63.111	Cerebral infarction due to embolism of right vertebral artery
			I63.112	Cerebral infarction due to embolism of left vertebral artery
			I63.113	Cerebral infarction due to embolism of bilateral vertebral arteries
			I63.119	Cerebral infarction due to embolism of unspecified vertebral artery
	433.30	Occlusion and stenosis of multiple and bilateral precerebral arteries without mention of cerebral infarction	I65.8	Occlusion and stenosis of other precerebral arteries
	433.80	Occlusion and stenosis of other specified precerebral artery without mention of cerebral infarction		
	433.31	Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction	I63.59	Cerebral infarction due to unspecified occlusion or stenosis of other cerebral artery
	433.81	Occlusion and stenosis of other specified precerebral artery with cerebral infarction	I63.09	Cerebral infarction due to thrombosis of other precerebral artery
			I63.19	Cerebral infarction due to embolism of other precerebral artery
			I63.29	Cerebral infarction due to unspecified occlusion or stenosis of other precerebral artery
	433.90	Occlusion and stenosis of unspecified precerebral artery without mention of cerebral infarction	I65.9	Occlusion and stenosis of unspecified precerebral artery
433.91	Occlusion and stenosis of unspecified precerebral artery with cerebral infarction	I63.20	Cerebral infarction due to unspecified occlusion or stenosis of unspecified precerebral arteries	

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
Carotid artery disease	433.91	Occlusion and stenosis of unspecified precerebral artery with cerebral infarction	I63.00	Cerebral infarction due to thrombosis of unspecified precerebral artery
			I63.10	Cerebral infarction due to embolism of unspecified precerebral artery
ICD Procedure Codes	38.12	Endarterectomy of other vessels of head / neck	03CLxxx	Extirpation left internal carotid artery
			03CHxxx	Extirpation of common carotid artery, right
			03CJxxx	Extirpation of common carotid artery, left
			03CKxxx	Extirpation of internal carotid artery, right
			03CMxxx	Extirpation of external carotid artery, right
			03CNxxx	Extirpation of external carotid artery, left
			03CPxxx	Extirpation of vertebral artery, right
			03CQxxx	Extirpation of vertebral artery, left
	00.61	Extracranial percutaneous angioplasty	03CGxxx	Extirpation of matter from intracranial artery
			037Hxxx	Dilation of common carotid artery, right
			037Jxxx	Dilation of common carotid artery, left
			037Kxxx	Dilation of internal carotid artery, right
			037Lxxx	Dilation of internal carotid artery, left
			037Mxxx	Dilation of external carotid artery, right
	39.28	Extracranial-intracranial vascular bypass	037Nxxx	Dilation of external carotid artery, left
	00.63	Carotid artery stent	037Hxxx	Dilation of Right Common Carotid Artery
			037Jxxx	Dilation of Left Common Carotid Artery
			037Kxxx	Dilation of Right Internal Carotid Artery
			037Lxxx	Dilation of Left Internal Carotid Artery
037Mxxx			Dilation of Right External Carotid Artery	
037Nxxx	Dilation of Left External Carotid Artery			
CPT Procedure codes	35301	Thromboendarterectomy of carotid, vertebral, subclavian		

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
CPT procedure codes:	37215	Transcatheter placement of intravascular stent(s), cervical carotid artery, open or percutaneous, including angioplasty, when performed, and radiological supervision and interpretation; with distal embolic protection		
	37216	Transcatheter placement of intravascular stent(s), cervical carotid artery, open or percutaneous, including angioplasty, when performed, and radiological supervision and interpretation; without distal embolic protection.		
PERIPHERAL ARTERIAL DISEASE				
PAD	440.20	Atherosclerosis of native arteries of the extremities unspecified	I70.209	Unspecified atherosclerosis of native arteries of extremities, unspecified extremity
			I70.201	Unspecified atherosclerosis of native arteries of extremities, right leg
			I70.202	Unspecified atherosclerosis of native arteries of extremities, left leg
			I70.203	Unspecified atherosclerosis of native arteries of extremities, bilateral legs
	440.21	Atherosclerosis of native arteries of the extremities with intermittent claudication	I70.219	Atherosclerosis of native arteries of extremities with intermittent claudication, unspecified extremity
			I70.211	Atherosclerosis of native arteries of extremities with intermittent claudication, right leg
			I70.212	Atherosclerosis of native arteries of extremities with intermittent claudication, left leg
			I70.213	Atherosclerosis of native arteries of extremities with intermittent claudication, bilateral legs

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
PAD	440.22	Atherosclerosis of native arteries of the extremities with rest pain	I70.229	Atherosclerosis of native arteries of extremities with rest pain, unspecified extremity
			I70.221	Atherosclerosis of native arteries of extremities with rest pain, right leg
			I70.222	Atherosclerosis of native arteries of extremities with rest pain, left leg
			I70.223	Atherosclerosis of native arteries of extremities with rest pain, bilateral legs
	440.23	Atherosclerosis of native arteries of the extremities with ulceration	I70.25	Atherosclerosis of native arteries of other extremities with ulceration
			I70.231	Atherosclerosis of native arteries of right leg with ulceration of thigh
			I70.232	Atherosclerosis of native arteries of right leg with ulceration of calf
			I70.233	Atherosclerosis of native arteries of right leg with ulceration of ankle
			I70.234	Atherosclerosis of native arteries of right leg with ulceration of heel and midfoot
			I70.235	Atherosclerosis of native arteries of right leg with ulceration of other part of foot
			I70.238	Atherosclerosis of native arteries of right leg with ulceration of other part of lower right leg
			I70.239	Atherosclerosis of native arteries of right leg with ulceration of unspecified site
	I70.241	Atherosclerosis of native arteries of left leg with ulceration of thigh		

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
PAD	440.23	Atherosclerosis of native arteries of the extremities with ulceration	I70.242	Atherosclerosis of native arteries of left leg with ulceration of calf
			I70.243	Atherosclerosis of native arteries of left leg with ulceration of ankle
			I70.244	Atherosclerosis of native arteries of left leg with ulceration of heel and midfoot
			I70.245	Atherosclerosis of native arteries of left leg with ulceration of other part of foot
			I70.248	Atherosclerosis of native arteries of left leg with ulceration of other part of lower left leg
			I70.249	Atherosclerosis of native arteries of left leg with ulceration of unspecified site
	440.24	Atherosclerosis of native arteries of the extremities with gangrene	I70.269	Atherosclerosis of native arteries of extremities with gangrene, unspecified extremity
			I70.261	Atherosclerosis of native arteries of extremities with gangrene, right leg
			I70.262	Atherosclerosis of native arteries of extremities with gangrene, left leg
			I70.263	Atherosclerosis of native arteries of extremities with gangrene, bilateral legs
	440.29	Other atherosclerosis of native arteries of the extremities	I70.299	Other atherosclerosis of native arteries of extremities, unspecified extremity
			I70.291	Other atherosclerosis of native arteries of extremities, right leg
			I70.292	Other atherosclerosis of native arteries of extremities, left leg

Phenotype	ICD-9 Code number	ICD-9 Code Description	ICD-10 Code number	ICD-10 Code Description
PAD	440.29	Other atherosclerosis of native arteries of the extremities	I70.293	Other atherosclerosis of native arteries of extremities, bilateral legs
Exclude if ICD-9 codes are with ≥ 2 occurrences of the following codes	237.70	Neurofibromatosis, unspecified	Q85.00	Neurofibromatosis, unspecified
	237.71	Neurofibromatosis, type 1	Q85.01	Neurofibromatosis, type 1
	237.72	Neurofibromatosis, type 2 (acoustic neurofibromatosis)	Q85.02	Neurofibromatosis, type 2
	237.73	Schwannomatosis	Q85.03	Schwannomatosis
	237.79	Other neurofibromatosis	Q85.09	Other neurofibromatosis
	443.1	Thromboangiitis obliterans (Buerger's disease)	I73.1	Thromboangiitis Obliterans [Buerger's Disease]
	446.0	Polyarteritis nodosa	M30.0	Polyarteritis nodosa
	446.4	Wegener's granulomatosis	M31.30	Wegener's granulomatosis without renal involvement
			M31.31	Wegener's granulomatosis with renal involvement
	446.5	Giant cell arteritis	M31.6	Other giant cell arteritis
			M31.5	Giant cell arteritis with polymyalgia rheumatica
	446.6	Thrombotic microangiopathy	M31.1	Thrombotic microangiopathy
	446.7	Takayasu's disease	M31.4	Aortic arch syndrome [Takayasu]
	710.1	Systemic sclerosis	M34.0	Progressive systemic sclerosis
			M34.1	CR(E)ST syndrome
	747.10	Coarctation of aorta (preductal, postductal)	Q25.1	Coarctation of aorta
	747.11	Interruption of aortic arch	Q25.21	Interruption of aortic arch
	747.22	Atresia and stenosis of aorta	Q25.3	Supravalvular aortic stenosis
			Q25.29	Other atresia of aorta
747.64	Lower limb vessel anomaly	Q27.32	Arteriovenous malformation of vessel of lower limb	

Footnote: unfilled areas marked in gray denote absence of the corresponding code; cells with the text marked in grey denote codes that were not tested.

Diagnostic accuracy (ICD-10 codes)

Condition	Sensitivity	Specificity	PPV	NPV
CHD	85.7% (42.1-99.6)	92.3% (64.0-99.8)	85.7% (47.1-97.6)	92.3% (CI 66.0-98.7)
CVD	83.3% (35.9-99.6)	85.7% (57.2-98.2)	71.4% (39.8-90.5)	92.3% (CI 66.4-98.6)
PAD	100% (69.2-100.0)	100% (69.2-100.0)	100%	100%

Footnote: Each condition was checked using 10 randomly selected cases (patients identified with the condition based on the code algorithm), and 10 randomly selected controls (patients with no indication of the condition based on the code algorithm). For CHD and CVD, the cases were restricted to patients with premature disease (identified at age ≤ 55 years for males or at age ≤ 65 years for females). Data presented as the proportion and 95% confidence interval. CHD=coronary heart disease; CVD=cerebrovascular disease; PAD=peripheral arterial disease.

ADDITIONAL CODES

ICD-9 Diagnosis		ICD-10 Diagnosis	
272.0	Pure hypercholesterolemia	E78.01	Familial hypercholesterolemia
V17.3	Family history of ischemic heart disease	Z82.49	Family history of ischemic heart disease and other diseases of the circulatory system**

**Code Z82.49 is not specific to coronary heart disease and includes many non-atherosclerotic entities (listed below). Testing of this code in a random sample of 10 cases and 10 controls demonstrated the following performance: SN 70, SP 100, PPV 100, NPV 77 (all in %)

The following conditions are captured by this code:

- Family history of aneurysm of brain (situation)
- Family history of aneurysm of brain
- Family history of brain aneurysm (artery dilation)
- Family history of cardiovascular disease
- Family history of coronary arteriosclerosis
- Family history of coronary arteriosclerosis (situation)
- Family history of coronary artery disease at early age
- Family history of hypertensive disease or disorder
- Family history of ischemic heart disease
- Family history of ischemic heart disease (situation)
- Family history of myocardial infarction at a young age
- Family history of thromboembolic disease
- Family history of thromboembolic disorder
- Family history of thromboembolic disorder (situation)
- Family history: Cardiovascular disease (situation)
- Family history: Hypertension (situation)
- Family history: Myocardial infarction at less than 60 (situation)
- FHx: Cardiovascular disease
- FHx: Hypertension

- FHx: Myocardial infarction at less than 60
- FHx of brain aneurysm
- FHx of CAD
- FHx of cardiovascular disease
- FHx of early MI
- FHx of HTN
- FHx of ischemic heart disease
- FHx of thromboembolic disease

CMS. 2015 Official ICD-10-PCS Coding Guidelines.

<https://www.cms.gov/Medicare/Coding/ICD10/Downloads/2015-PCS-guidelines.pdf>

Code assignment: example

Section	Medical and surgical	0
Body System	Heart and great vessels	2
Operation	Dilation	7
Body Part	Coronary artery, two sites	1
Approach	Percutaneous	3
Device	Drug-eluting intraluminal device	4
Qualifier	No qualifier	Z