

Supplementary Online Content

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eAppendix. PPI Co-therapy and Anticoagulant-Related UGI Bleeds

This supplementary material has been provided by the authors to give readers additional information about their work.

Appendix: PPI Co-therapy and Anticoagulant-Related UGI Bleeds

Table 1A Exclusions: end-stage renal disease

Diagnosis or procedure code for dialysis or end-stage renal disease outside of the hospital	
28521	– anemia in ckd
5855	– Stage V , ckd
5856	– end stage renal disease
V451	– Renal dialysis status
V560	– Extracorporeal dialysis
V561	– fitting & adjustment of extracorporeal dialysis catheter
99673	– complications due to renal dialysis
CPT-4 Procedure Codes	
36825	arteriovenous fistula autogenous gr
36830	creation of arteriovenous fistula;
36831	thrombectomy, arteriovenous fistula without revision, autogenous or
36832	revision of an arteriovenous fistula, with or without thrombectomy,
36833	revision, arteriovenous fistula; with thrombectomy, autogenous or nonaut
36834	plastic repair of arteriovenous aneurysm (separate procedure)
36835	insertion of thomas shunt
36838	distal revascularization & interval ligation, upper extremity
36840	insertion mandril
36845	anastomosis mandril
36860	cannula declotting;
36861	cannula declotting;
36870	thrombectomy, percutaneous, arteriovenous fistula, autogenous or nonauto
90918	end stage renal disease (esrd) related services per full month;
90919	end stage renal disease (esrd) related services per full month;
90920	end stage renal disease (esrd) related services per full month;
90921	end stage renal disease (esrd) related services per full month;
90922	end stage renal disease (esrd) related services (less than
90923	end stage renal disease (esrd) related services (less than full month),
90924	end stage renal disease (esrd) related services (less than full month),
90925	end stage renal disease (esrd) related services (less than full month),
90930	physician maintenance fee for dialysis patients
90935	hemodialysis procedure with single physical evaluation
90937	hemodialysis procedure requiring repeated evaluation(s)w/wo sub of
90939	hemodialysis access flow study to determine blood flow in grafts and
90940	hemodialysis access flow study to determine blood flow in grafts and
90941	hemodialysis initial or acute patient over 40 kg
90942	hemodialysis initial or acute patient 21-40 kg
90943	hemodialysis initial or acute 11-20 kg
90944	hemodialysis initial or acute patient under 10 kg
90945	dialysis procedure other than hemodialysis w/single physician evaluation
90947	dialysis procedure other than hemodialysis requiring repeated elav,w/wo
90951	hemodialysis for chronic irrevers renal insuff pat over 40 kg
90952	hemodialysis for chronic irrevers renal insuff patient 21-40kg
90953	hemodialysis for chronic irrevers renal insuff patient 11-20kg
90954	hemodialsis for chronic irrevers renal insuff pat under 10 kg
90955	hemodialysis, for end-stage renal disease (esrd), maintenance
90956	hemodialysis, for end-stage renal disease (esrd), maintenance
90957	hemodialysis, for end-stage renal disease (esrd), maintenance

90958	hemodialysis, for end-stage renal disease (esrd), maintenance
90966	peritoneal dialysis for acute renal failure and /or intoxication
90967	peritoneal dialysis for renal failure patient 21-40kg
90968	peritoneal dialysis for renal failure patient 11-20 kg
90969	peritoneal dialysis for acute renal failure patient under 10 kg
90976	peritoneal dialysis for chronic renal failure patient over 40 kg
90977	peritoneal dialysis for chronic renal failure patient 21-40 kg
90978	peritoneal dialysis for chronic renal failure patient 11-20 kg
90979	peritoneal dialysis for chronic renal failure patient 10kg
90982	peritoneal dialysis for end-stage renal disease (esrd),
90983	peritoneal dialysis for end-stage renal disease (esrd),
90984	peritoneal dialysis for end-stage renal disease (esrd),
90985	peritoneal dialysis for end-stage renal disease (esrd),
90988	supervision of hemodialysis in hospital or other facility
90989	dialysis training,complete course
90990	hemodialysis training and/or counseling
90991	home hemodialysis care, outpatient, for those services
90992	peritoneal dialysis training and/or counseling
90993	dialysis training, per training session
90994	supervision of chronic ambulatory peritoneal dialysis
90995	end stage renal disease (esrd) related services, per full month
90996	continuous arteriovenous hemofiltration (per day)
90997	hemoperfusion (eg with activated charcoal or resin)
90998	end stage renal disease (esrd) related services (less than full
90999	unlisted dialysis procedure
ICD-9 Procedure Codes:	
3927	dialysis arteriovenostom
3942	revis ren dialysis shunt
3943	remov ren dialysis shunt
3995	hemodialysis
5498	peritoneal dialysis

Table 1B Gastrointestinal exclusion diseases.

Esophageal varices	CPT codes
ICD9CM	43842 vertical banded gastroplasty
Esophageal varices with bleeding (456.0)	43843 Gastric restrictive procedure other than vertical-banded gastroplasty
Esophageal varices without mention of bleeding (456.1)	43845 partial gastrectomy, pylorus preserving duodenoileostomy and ileoileostomy to limit absorption.
Esophageal varices in diseases classified elsewhere (456.2)	43846 Roux-en-Y gastroenterostomy.
Esophageal varices in diseases classified elsewhere with bleeding (456.20)	43847 with small intestine reconstruction to limit absorption
Esophageal varices in diseases classified elsewhere without mention of bleeding (456.21)	43848 Revision of gastric restrictive procedure for morbid obesity
Endoscopic excision or destruction of lesion or tissue of esophagus (42.33)	43644 gastric bypass and Roux-en-Y gastroenterostomy (roux limb 150 cm or less)
CPT codes	43860 Revision of gastrojejunal anastomosis
43204 Endoscopy w inject sclerosis esophageal varices	43865 with vagotomy
43205 Endoscopy w band ligation esophageal varices	Gastrointestinal Cancer
	ICD9CM: 150-154, 197.4, 197.5, 230
	Others
	ICD9CM
43243 Endoscopy, injection sclerosis esophageal and/or gastric varices	Perforation of the esophagus (530.4)
43244 Endoscopy with band ligation of esophageal and/or gastric varices	Inflammatory bowel disease Crohn's disease (555.x) Ulcerative colitis (556.x)
43460 Esophagogastric tamponade, with balloon (Sengstaken type)	Coagulopathies Congenital factor VIII disorder (286.0) Congenital factor IX disorder (286.1) Von Willebrand's disease (286.4) Defibrination syndrome (286.6)
75885 Percutaneous transhepatic portography	
75887 Percutaneous transhepatic portography	
75889 Hepatic venography, wedged or free	
75891 Hepatic venography, wedged or free,	
Bariatric and other surgeries	
ICD9CM	
Partial gastrectomy with anastomosis to jejunum Billroth II operation (43.7)	

Table 2 Trauma exclusions: For ICD9-CM codes, if only 3 digits are given, all 4th digits are accepted; if 4 digits given, all 5th digits accepted. GI = gastrointestinal, GU=genitourinary, CNS=cerebral. Procedures indicated with *.

Code	Diagnosis/Procedure	GI	GU	CNS	Other
62000*	Elevation of depressed skull, simple #;			y	
62005*	Elevation of depressed skull, compound;			y	
62010*	Elevation of depressed skull, with repair of dura/debridement			y	
800-804	Fracture skull;			y	
800-829	Fracture, except 814-817 [metacarpal] and 825-826 [metatarsal]				y
806.0/2	Fracture vertebrae w SC injury;			y	a
806.x	Fracture vertebrae w SC injury;		y		a
807.4	Flail chest;		y	y	a
808	Fracture of pelvis	y	y	y	a
812	Fracture humerus		y	y	a
820	Fracture proximal femur		y	y	a
821	Fracture shaft femur;		y	y	a
828	Multiple fractures, different sites	y	y	y	a
860	Traumatic pneumothorax	y	y	y	y
862.0/862.1	Diaphragm injury closed/open;	y	y	y	y
862.8/9	Crushed chest closed/open;	y	y	y	y
863.0/1	Injury stomach w/out open wound;	y			y
863.2/3x	Injury SI w/out open wound;	y			y
863.4/5	Injury LI w/out open wound;	y			y
863.8/9	Injury GI NOS w/out open wound;	y			y
864.1	Injury Liver w open wound;	y			y
865.1	Splenic Rupture;	y	y	y	y
866	Injury to kidney;	y	y		y
867	Injury to pelvic organs		y		
873.0/1	open wound of scalp			y	
875.0/1	open wound of chest wall				y
902.4	injury to renal vessels;		y		
902.55/56	injury to uterine vessels;		y		
902.81/82	injury to ovarian vessels		y		
925-929	crushing injury				y
925	crushing injury face/scalp/neck			y	b
926	crushing injury ext genitalia;		y		b
926.8	crushing of multiple sites trunk;	y	y		b
928	crushing of hip/thigh;		y		b
929	crushing of multiple sites NOS	y	y	y	b
958.4	Traumatic shock;	y	y	y	y
958.5	Traumatic anuria;	y	y	y	y
958.7	Traumatic subcutaneous emphysema	y	y	y	y
996.7	Includes hemorrhage due to devices	y	y	y	y
998.11,	postoperative bleeding	y	y	y	y
998.12	postoperative hematoma	y	y	y	y
998.2	accidental puncture or laceration during procedure	y	y	y	y
E805	hit by rolling stock	y	y	y	y
E870	Accidental cut, puncture, perforation, or hemorrhage during medical care	y	y	y	y
E881	Fall ladder/scaffolding;	y	y	y	y
E882	Fall from building;	y	y	y	y
E883	Fall into hole	y	y	y	y

E922/923	accident with firearm/explosive	y	y	y	y
E955	Suicide/injury by firearm/explosive	y	y	y	y
E960	Fight/rape;	y	y	y	y
E965	Assault by firearm/explosive	y	y	y	y
E970	Legal intervention by firearm	y	y	y	y
E985	Injury by firearm/explosive, accidentally or purposely	y	y	y	y
	^a Included in 800-829 fracture, except 814-817 [metacarpal] and 825-826 [metatarsal]				
	^b Included in 925-929 crushing injury				

Table 3: Additional exclusion/covariates

	International Classification of Diseases 9 th Revision (ICD9) and CPT codes
Mitral stenosis	391.1, 392.0, 394.0, 394.1, 394.2, 396.0, 396.1, 424.0, 093.21, 746.5, 799.89
Other valve disease	394.x-396.x, 424.x, 746.x (except for above)
Heart valve surgery (excluding bioprosthesis)	35 (excluding 35.21, 35.23, 35.25, 35.27) V43.5 CPT codes: 33361-33369, 33400-33417, 33418-33430), 33460-33468, 33470-33478, 33496, 33600, 33602, 33860, 33863, 33864
Heart valve surgery, bioprosthesis	35.21, 35.23, 35.25, 35.27
Antiphospholipid antibody syndrome	289.81
Organ Transplant (Includes kidney, heart, lung, liver, bone marrow, and pancreas)	996.8x, V42.0x, V42.1x, V42.6x, V42.7x, V42.81, V42.83 CPT: 32851, 32852, 32853, 32854, 33935, 33945, 38240, 38241, 47135, 47136, 48554, 48556, 50340, 50341, 50360, 50365, 50370, 50380 ICD-9 procedure: 33.5x, 33.6x, 37.5x, 50.5x, 52.8x, 55.6, 410x

Table 4 ICD9-CM diagnoses indicating bleeding of the type, according to site

Code	Diagnosis	Code	Diagnosis
<i>Gastroduodenal Site</i>		<i>Lower Gastrointestinal Site</i>	
		455.2	Internal hemorrhoids with other complication
531.0x	Acute gastric ulcer with hemorrhage	455.5	External hemorrhoids with other complication
531.2x	Acute gastric ulcer with hemorrhage and perforation	455.8	Unspecified hemorrhoids with other complication
531.4x	Chronic or unspecified gastric ulcer with hemorrhage	562.02	Diverticulosis of small intestine with hemorrhage
531.6x	Chronic or unspecified gastric ulcer with hemorrhage and perforation	562.03	Diverticulitis of small intestine with hemorrhage
532.0x	Acute duodenal ulcer with hemorrhage	562.12	Diverticulosis of colon with hemorrhage
532.2x	Acute duodenal ulcer with hemorrhage and perforation	562.13	Diverticulitis of colon with hemorrhage
532.4x	Chronic or unspecified duodenal ulcer with hemorrhage	568.81	Hemoperitoneum
532.6x	Chronic or unspecified duodenal ulcer with hemorrhage and perforation	569.3	Hemorrhage of rectum and anus
533.0x	Acute peptic ulcer, site unspecified, with hemorrhage	569.85	Angiodysplasia of intestine with hemorrhage
533.2x	Acute peptic ulcer, site unspecified, with hemorrhage and perforation	<i>Unspecified Gastrointestinal Site</i>	
533.4x	Chronic peptic ulcer, site unspecified, with hemorrhage	578.1	Blood in stool
533.6x	Chronic peptic ulcer, site unspecified, with hemorrhage and perforation	578.9	Hemorrhage of gastrointestinal tract, unspecified
534.0x	Acute gastrojejunal ulcer with hemorrhage		
534.2x	Acute gastrojejunal ulcer w hemorrhage/perforation		
534.4x	Chronic gastrojejunal ulcer with hemorrhage	<i>Genitourinary Site</i>	
534.6x	Chronic gastrojejunal ulcer with hemorrhage and perforation	593.81	Vascular disorders of kidney
535.01	Acute gastritis with hemorrhage	599.7	Hematuria
535.11	Atrophic gastritis with hemorrhage	623.8	Other specified noninflammatory disorders of vagina
535.21	Gastric mucosal hypertrophy with hemorrhage	626.2	Excessive/frequent menstruation, with secondary diagnosis indicating acute bleeding: anemia (280.0,285.1,285.9), orthostasis (458.0),syncope (780.2)
535.31	Alcoholic gastritis with hemorrhage		
535.41	Other specified gastritis with hemorrhage	626.6	Metrorrhagia
535.51	Unspecified gastritis and gastroduodenitis with hemorrhage	<i>Cerebral Site</i>	
535.61	Duodenitis with hemorrhage	430	Subarachnoid hemorrhage
537.83	Angiodysplasia of stomach and duodenum with hemorrhage	431	Intracerebral hemorrhage
		432.0	Nontraumatic extradural hemorrhage
<i>Esophageal Site</i>		432.1	Subdural hemorrhage
456.0	Esophageal varices with bleeding	432.9	Unspecified intracranial hemorrhage
456.20	Esophageal varices in diseases classified elsewhere with bleed		

530.7	Mallory-Weiss tear (gastroesophageal laceration-hemorrhage syndrome)	<i>Other Site</i>	
530.82	Esophageal hemorrhage	423.0	Hemopericardium
		459.0	Hemorrhage, unspecified
		568.81	Hemoperitoneum (nontraumatic)
<i>Upper Gastrointestinal, Unspecified</i>		719.1x	Hemarthrosis
578.0	Hematemesis	784.7	Epistaxis
		784.8	Hemorrhage from throat
		786.3	Hemoptysis

¹Source: Arnason *et al*, Accuracy of coding for possible warfarin complications in hospital discharge abstracts. *Thrombosis Research* 2006; 118:253-262. 'x' denotes that any subsequent digit is allowed. Minor changes from cited

Table 5 Diagnosis codes indicating bleeding, when confirmed by a secondary discharge diagnosis in Table 1 or a code indicating transfusion*. Note the sites for primary and secondary diagnoses do not need to match.

Code	Diagnosis	Code	Diagnosis
<i>Gastroduodenal Site</i>		<i>Lower Gastrointestinal Site</i>	
531.1	Gastric ulcer acute with perforation	455.x	Hemorrhoids, not incl 455.2,455.5, 455.8
531.3	Acute gastric ulcer without mention of hemorrhage or perforation	562.00	Diverticula of small intestine without mention of hemorrhage
531.5	Chronic or unspecified ulcer with perforation	562.01	Diverticulitis of small intestine without mention of hemorrhage
531.7	Chronic gastric ulcer without mention of hemorrhage or perforation	562.10	Diverticula of colon without mention of hemorrhage
531.9	Gastric ulcer, unspecified, without mention of hemorrhage or perforation	562.11	Diverticulitis of colon without mention of hemorrhage
532.1	Duodenal ulcer acute with perforation		
532.3	Acute duodenal ulcer without mention of hemorrhage or perforation	<i>Esophageal Site</i>	
532.5	Duodenal ulcer chronic/unspecified w perforation	530.1	Esophagitis
532.7	Duodenal ulcer chronic without mention of hemorrhage or perforation		
532.9	Unspecified as acute or chronic duodenal ulcer without mention of hemorrhage or perforation	<i>Unspecified Site</i>	
533.1	Peptic ulcer acute with perforation	280.0	Anemia due to loss of blood**
533.3	Peptic ulcer, acute, no mention of hemorrhage	285.1	Acute posthemorrhagic anemia
533.5	Peptic ulcer chronic/unspecified w perforation	285.9	Anemia, unspecified**
533.7	Peptic ulcer, chronic, without mention of hemorrhage or perforation	790.92	Abnormal coagulation profile**
533.9	Peptic ulcer, unspecified as acute or chronic without mention of hemorrhage or perforation		
534.1	Gastrojejunal ulcer acute with perforation		
534.3	Gastrojejunal ulcer acute without mention of hemorrhage or perforation		
534.5	Gastrojejunal ulcer chronic/unspecified w perforation		
534.7	Chronic gastrojejunal ulcer without mention of hemorrhage or perforation		
534.9	Gastrojejunal ulcer, unspecified acute: chronic, without mention of hemorrhage or perforation		
535.00	Acute gastritis without mention of hemorrhage		
535.10	Atrophic gastritis, no mention of hemorrhage		
535.20	Gastric mucosal hypertrophy without mention of hemorrhage		
535.30	Alcoholic gastritis, no mention of hemorrhage		
535.40	Other specified gastritis, no mention of hemorrhage		

535.50	Unspecified gastritis and gastroduodenitis without mention of hemorrhage		
535.60	Duodenitis without mention of hemorrhage		

Table 6 Procedure codes consistent with upper and lower gastrointestinal sites.

Code	Diagnosis	Code	Diagnosis
<i>Upper GI Site ICD9</i>		<i>Lower GI Site ICD9</i>	
42.2	Diagnostic Procedures on Esophagus	45.2	Diagnostic procedures on large intestine
42.33	Control of esophageal bleeding by endoscopic approach	45.7	Open and other partial excision of large intestine
42.4	Excision of esophagus	45.9	Intestinal anastomosis
42.82	Suture of laceration of esophagus	46.1	Colostomy
42.9	Other operations on esophagus	46.2	Ileostomy
44.1	Diagnostic procedures on stomach	46.3	Other enterostomy
44.4	Control of hemorrhage and suture of ulcer of stomach or duodenum	46.75	Suture of laceration of the large intestine
44.61	Suture of laceration of stomach	48.23	Rigid proctosigmoidoscopy
44.91	Ligation of gastric varices	48.3	Local excision or destruction of lesion or tissue of rectum
45.1	Diagnostic procedures on small intestine	48.71	Suture of laceration of rectum
46.71	Suture of laceration of duodenum	49.4	Procedures on hemorrhoids
46.73	Suture of laceration of SI, not duodenum	Lower GI CPT4	
Upper GI CPT4		44140	Colectomy, partial; with anastomosis
43200-43259	Endoscopy upper (all except ERCP)	44202-8	Colectomy
43460	Esophogastric tamponade with balloon	44391	Colonoscopy through stoma; with control of bleeding, any method
43501	Gastrostomy; with suture repair of bleeding ulcer	44604-5	Suture of large intestine (colorrhaphy) for perforated ulcer, diverticulum, wound, injury or rupture (single or multiple perforations); without colostomy / with colostomy
43502	Gastrostomy; with suture repair of pre-existing esophagogastric laceration (eg, Mallory-Weiss)	45300-45392	Endoscopy lower GI
43840	Gastrorrhaphy, suture of perforated duodenal or gastric ulcer, wound, or injury	46083	Incision of thrombosed hemorrhoid, external
44360-44394	Small intestinal endoscopy	46221/46230/46250/46255/46257/46258/46260/46261/46262	Hemorrhoidectomies
44602-3	Suture of small intestine (enterorrhaphy) for perforated ulcer, diverticulum, wound, injury or rupture; single perforation/multiple perforations	46600-46615	Anoscopy
		46934-6	Destruction of hemorrhoids

Table 7 Diagnoses* and procedures associated with use of anticoagulants

Indication	Definition
Atrial fibrillation/atrial flutter	ICD9CM 427.31, 427.32 CPT 33254-9, 93656, 93657
DVT/PE	ICD9CM: 451.x-453.9, 415.1, 416.2 CPT 34401-34490, 33910-33916
AMI/revascularization/thrombolysis	ICD9CM: 410.x, 412, 429.7, V.45.81, 36.01-36.19 CPT: 33510-33516, 33517-33530, 33533-33536, 92980-92982, 92984, 92920-92973, 92975-92977, 92995-92996
Other cardiovascular, including cerebrovascular with no atrial fibrillation	394.0-397.x, 424.x: valve disorder 414: Other forms of chronic ischemic heart disease 416: primary pulmonary hypertension 425: cardiomyopathy 426: conduction disorders 427: cardiac dysrhythmias (except for 427.31) 428: heart failure 429.0: myocarditis 429.2: cardiovascular disease, unspecified 429.82: hyperkinetic heart disease 429.89: carditis CPT4 35301: carotid thromboendarterectomy, 37215,37216 with stent ICD9 38.1: endarterectomy Occlusion of cerebral arteries (433-434 and 436), TIA (435), cerebral atherosclerosis (437.0), other generalized ischemic cerebrovascular disease (437.1), late effects of cerebrovascular disease (438)
Orthopedic (hip fracture/replacement, knee replacement)	ICD9CM: 733.14, 820.x, 81.50-81.55, V43.64, V43.65 CPT: 27120, 27122, 27125, 27130, 27132, 27134, 27137, 27138, 27220-27248, 27284, 27437-27447, 27486-27487
Thrombectomy	CPT4: 34001-34490, 35875, 35876, 36870
Device/Graft/Implant complications	ICD9CM: 996.73-996.74 CPT4: 36831-36870
Other thromboembolic disease	ICD9CM: 444.x, 445.x, 38.0, 38.1
Hypercoagulable states, chronic	ICD9CM: 289.81

*Diagnoses from inpatient, ED, physician encounters, all diagnoses in these encounters in the previous 30 days are considered.

*Diagnoses from inpatient, ED, physician encounters, all diagnoses in these encounters are considered.

Table 8 Gastrointestinal disorders. There are three variables for each entry corresponding to inpatient, emergency department, and outpatient encounters. The analysis file codes indicate recency: 0='None', 1='Days 91-364', 2='Days 31-90', and 3='Past 30 days'.

<i>Esophageal</i>	
Benign neoplasm	ICD9CM: 211.0
Other	530 except 530.81 750.3: tracheoesophageal fistula
<i>Gastroduodenal</i>	
Benign neoplasm	ICD9CM: 211.1, 211.2
Peptic ulcer disease	ICD9 CM codes: 531, 532, 533, 534, 535.01, 535.41, 535.51, 578 CPT 43234-43236, 43239, 43255, 43259, 43640 and ICD: 44.0, 44.4
Gastritis/duodenitis	ICD9 CM codes: 535.0, 535.1, 535.2, 535.4, 535.5, 535.6, "535"
Other	ICD9 CM codes: 535.7, 537, 538, 539, 536 except 536.8 and 536.9
<i>Lower Gastrointestinal</i>	
Benign neoplasm	ICD9CM: 211.3, 211.4, 239.0
Diverticulitis/diverticulosis	562
Hemorrhoids	455.0-455.8
Other	555, 556, 557, 558, 560, 564, 565, 569
<i>Unspecified Gastrointestinal</i>	
Blood in stool/GI bleeding	578.1, 578.9
<i>Gastrointestinal Symptoms</i>	
Gastroesophageal reflux	530.81
Dyspepsia	787.1: heartburn, 536.8 Dyspepsia, 536.9 Unspecified functional disorder of stomach
Abdominal pain	789.0: abdominal/epigastric pain
Other upper GI	787.0: nausea and vomiting, 787.2: dysphagia, 787.3: flatulence, eructation, and gas pain. "787" Symptoms involving digestive system
Other lower GI	787.5 Abnormal bowel sounds, 787.7 abnormal feces, 787.9 (diarrhea, tenesmus)

Table 9 Other diseases that affect bleeding risk (times relative to t_0). Unless otherwise indicated, defined from inpatient, ED, or other outpatient medical care encounters.

Disease	Definition
<i>Past 30 days, i.e., [t₀-30, t₀-1]</i>	
Peptic ulcer	ICD9 CM codes: 531, 532, 533, 535.01, 535.41, 535.51, 578, 534 CPT 43234-43236, 43239, 43255, 43259, 43640 and ICD: 44.0, 44.4
GI, non-malignant (including bariatric surgery)	ICD9CM: 520-579 (except for those listed under peptic ulcer, GI cancer, and liver disease) CPT: 40702-49999
GI cancers	Esophagus: ICD9CM: 150.x, 230.1 Stomach: ICD9CM: 151.x, 230.2 Small intestine: ICD9CM: 152.x, 230.7 Colorectal: ICD9CM: 153.x, 154.x, 230.3, 230.4, 230.5, 230.6 Liver/gallbladder: ICD9CM: 155.x, 156.x, 230.8 Pancreas: ICD9CM: 157.x, 230.9
Other cancers (excluding non-malignant skin cancer)	Diagnosis (ICD9-CM codes 140-208, except for those listed under GI cancer and 173 [non-melanomous skin cancers]) or antineoplastic agents (Level 3 = 53 (alkylating agents: busulfan, chlorambucil, cyclophosphamide, mechlorethamine hydrochloride, mitomycin, cisplatin, carmustine, dacarbazine, uracil mustard, pipobroman, ifosfamide, temozolomide, streptozocin), 54 (antimetabolites: mercaptopurine, cytarabine, melphalan hydrochloride, thioguanine, fluorouracil, floxuridine, etoposide, fludarabine phosphate, capecitabine, gemcitabine), 55 (antibiotics: bleomycin sulfate, doxorubicin hydrochloride, daunorubicin hydrochloride, idarubicin hydrochloride, mithramycin, actinomycin, mitoxantrone hydrochloride), 56 (plant alkaloids: vincristine sulfate, vinblastine sulfate, paclitaxel, vinorelbine, vinorelbine, docetaxel), 57 (interferon alpha, asparaginase, hydroxyurea, procarbazine hydrochloride, lomustine, mitotane, testolactone, aminoglutethimide, calusterone, leuprolide acetate, flutamide, nilutamide, carboplatin, goserelin acetate, levamisole, estramustine phosphate sodium, altretamine, pipobroman, pentostatin, aldesleukin, teniposide, cladribine, bicalutamide, anastrozole, trimetrexate, letrozole, alitretinoin, irinotecan,hcl, bexarotene, tretinoin, imatinib, topotecan, pegaspargase, porfimer, arsenic trioxide, fulvestrant, gefitinib, rituximab, oxaliplatin, alemtuzumab, altretamine,porfimer), level2=212 (antiestrogen: toremifene citrate, tamoxifene citrate)
Liver disease	ICD9CM: 570-573
Renal impairment: without dialysis	ICD9CM 593.9, 997.5 (exclude if patient is on dialysis)
Anemia	ICD9CM 280-285
Iron prescription	Iron
Alcohol abuse	ICD9CM 291.x, 303.x, 305.0
Stroke/TIA	Occlusion of cerebral arteries (430-434 and 436), TIA (435), cerebral atherosclerosis (437.0), other generalized ischemic cerebrovascular disease (437.1), late effects of cerebrovascular disease (438)
Bleeding disorder	Coagulation defects, thrombocytopenia (287.3-287.5)
Anticoagulation defect	286, 287.1, 287.8, 287.9
Adverse anticoagulant effect	964.2: poisoning by anticoagulants 964.5: poisoning by anticoagulants antagonists and other coagulants E934.2
Other Susceptibility	E934.9

Prior fall or fall-related injury	- Any fracture (unless E code) by procedure (21300-21470, 21493-21497, 21800-21825, 23500-23515, 23570-23630, 23665-23680, 24500-24587, 24620-24685, 25500-25652, 25680-25685, 26600-26615, 26645-26665, 26720-26765, 27193-27248, 27500-27514, 27520-27540, 27828, 28400-28525) or diagnostic code -(801xx – 829xx) exclude 805, 806 (vertebral) except 8056,8057,8066,8067(sacrum,coccyx).
Diabetes	Insulin, oral hypoglycemic agents, oral hypoglycemic combinations, injectable non-insulin hypoglycemic agents.
Hypertension	Defined by medications OR diagnosis Beta-adrenergic blocking agents, calcium channel antagonists, direct acting vasodilators, sympatholytic, combination sympatholytic-diuretic, combination direct acting diuretic, combination diuretic with potassium sparing agent, combination beta blocker-diuretic, ACE inhibitor, combination ACE inhibitor-diuretic, combination ACE inhibitor-CCB, angiotensin receptor antagonists, alpha adrenergic blockers, combination ARBs-diuretics ICD9CM: 401, 402, 403, 404, 405

Note medication use date defined as date of filling of prescription.

Table 10 Other drugs potentially affecting bleeding risk, prescription fill date in 365 days prior to to

Drug	Definition
<i>Peptic Ulcer Disease/Dyspepsia Treatment</i>	
H2RA	Cimetidine, famotidine, nizatidine, ranitidine
Antiacids	Aluminum hydroxide, magnesium hydroxide
Sucralfate	Sucralfate
Misoprostol	Misoprostol
Iron prescription	Iron

Table 11 Medications increasing the risk for gastrointestinal bleeding. The covariate is drug use on t_i with 3=current, 2=indeterminate, 1=former, 0=nonuse. See Table 3.2 for drug use definitions

Non-steroidal anti-inflammatory drugs	
Aspirin	Aspirin
NSAID	aceclofenac, choline/Mg salicylate combinations, diclofenac, diflunisal, etodolac, fenoprofen, flurbiprofen, ibuprofen, indomethacin, ketoprofen, ketorolac, meclofenamate, mefenamic acid, meloxicam, nabumetone, naproxen, oxaprozin, phenylbutazone/oxyphenbutazone, piroxicam, salsalate, salicylamide combinations, sulindac, tolmetin, tiaprofenic acid
COXIBs	celecoxib, etoricoxib, lumiracoxib, parecoxib, rofecoxib, valdecoxib
Other anti-platelet drugs	
PGY12 drugs	clopidogrel, ticlopidine, prasugrel, ticagrelor
Other	Dipyridamole, cilastazole
Other anticoagulants	
Heparin	heparin
Enoxaparin, others	enoxaparin, dalteparin, daneparoid, tinzaparin, fondaparinux
Other anticoagulants	acenocoumarol, phenprocoumon, atromentin, phenindionem, hirudin, lepurudin, bivalirudin
Other drugs	
Systemic corticosteroids	prednisone, prednisolone, triamcinolone, dexamethasone, methylprednisolone, hydrocortisone, cortisone, bethametasone, adrenocorticotropin hormone, fludrocortisone, budesonide.
Antineoplastic drugs, except methotrexate	(Level 3 = 53 (alkylating agents: busulfan, chlorambucil, cyclophosphamide, mechlorethamine hydrochloride, mitomycin, cisplatin, carmustine, dacarbazine, uracil mustard, pipobroman, ifosfamide, temozolomide, streptozocin), 54 (antimetabolites: mercaptopurine, cytarabine, melphalan hydrochloride, thioguanine, fluorouracil, floxuridine, etoposide, fludarabine phosphate, capecitabine, gemcitabine), 55 (antibiotics: bleomycin sulfate, doxorubicin hydrochloride, daunorubicin hydrochloride, idarubicin hydrochloride, mithramycin, actinomycin, mitoxantrone hydrochloride), 56 (plant alkaloids: vincristine sulfate, vinblastine sulfate, paclitaxel, vinorelbine, vinorelbine, docetaxel), 57 (interferon alpha, asparaginase, hydroxyurea, procarbazine hydrochloride, lomustine, mitotane, testolactone, aminoglutethimide, calusterone, leuprolide acetate, flutamide, nilutamide, carboplatin, goserelin acetate, levamisole, estramustine phosphate sodium, altretamine, pipobroman, pentostatin, aldesleukin, teniposide, cladribine, bicalutamide, anastrozole, trimetrexate, letrozole, alitretinoin, irinotecan,hcl, bexarotene, tretinoin, imatinib, topotecan, pegaspargase, porfimer, arsenic trioxide, fulvestrant, gefitinib, rituximab, oxaliplatin, alemtuzumab, altretamine,porfimer), level2=212 (antiestrogen: toremifene citrate, tamoxifene citrate)
Methotrexate	methotrexate

DMARDs for rheumatoid arthritis	sulfasalazine, hydroxychloroquine, chloroquine, gold (oral or by injection), D-penicillamine, cyclosporine, cyclophosphamide, azathioprine, leflunomide, minocycline, infliximab, etanercept, adalimumab, golimumab, certolizumab, rituximab, anakinra, abatacept, tocilizumab, tofacitinib
SSRI antidepressants	fluoxetine, sertraline, paroxetine, venlafaxine, fluvoxamine, citalopram, escitalopram

*From the FDA website:

<http://www.fda.gov/Drugs/DevelopmentApprovalProcess/DevelopmentResources/DrugInteractionsLabeling/ucm093664.htm>

€Modified from Holbrook, AM et al. Arch Intern Med 2005; 165: 1095-1106

Table 12: Covariates related to cardiovascular disease

<i>Cardiac</i>	
Angina	ICD 9 CM codes: 411.1, 411.8, 413.x
Revascularization	Includes angioplasty, stents, and CABG Angioplasty/stents: ICD9 CM codes: 36.01, 36.02, 36.03, 36.05 - 36.09. V45.82, CPT codes: 92920-92973, (and old codes: 92980, 92981, 92982, 92984, 92995, 92996). HCPCS: C1874-C1877 CABG: ICD 9 CM: 36.10-36.39. V45.81. CPT: 33510-33530, 33533-33536. HCPCS: S2205-S2209
Myocardial infarction	410.x
Other coronary heart disease	411 (except 411.1), 412, 414
Cardiac valve disease	394, 396, 424.0, 395, 397, 424.1, 424.2, 424.3
Conduction disorder	426.x
Arrhythmia, except atrial fibrillation meeting definition for indication	427: cardiac dysrhythmias (except for 427.31)
Heart failure	402.01, 402.11, 402.91, 428.x
Aspirin-eligible	AMIs are identified from discharge inpatient diagnosis codes. The primary discharge diagnosis code (ICD-9-CM) must be 410.x. If there is a fifth digit, it cannot be '2', which indicates an old event. No minimum length of stay is required. Revascularization: angioplasty, stents, CABG (as above) Angina: ICD 9 CM codes: 411.1, 411.8, 413.x. Ischemic stroke: ICD9 CM codes: 433, 434, 436 TIA: ICD9 CM code: 435
Hypertension	401, 402, 403, 404, 405
<i>Cerebrovascular</i>	
Hemorrhagic stroke	430, 431, 432
Thrombotic stroke	433, 434, 436
Unspecified stroke	V12.54, 997.02
TIA	435
Other cerebrovascular	437 and 438
<i>Other</i>	
Diabetes, no complications	250.0x-250.3x
Diabetes, complications	250.4x-250.9x
Peripheral vascular disease	440.x, 441.x, 442.x, 443.14, 447.1, 785.4, 38.13-38.14, 38.16, 38.18, 38.33-38.34, 38.36, 38.38, 38.43-38.44, 38.46, 38.48, 39.22-39.26, 39.29
Renal failure/insufficiency	585-586, V42.0, V45.1, V56.x, 39.27, 39.42, 39.93-39.95, 54.98
Smoking/smoking-related disorders	305.1, 989.84, V1582
Hypovolemia	276.5
Other cardiovascular	390-459 (except for above)

Table 13 Cardiovascular medications

ACE inhibitors, alone or in combination	benazepril, captopril, enalapril, enalaprilat, fosinopril, lisinopril, moexipril, perindopril, quinapril, ramipril,trandolapril
Angiotensin receptor blocker	losartan, valsartan, irbesartan, telmisartan, candesartan, eprosartan, olmesartan
Antiarrhythmic agents	Class IA drugs (quinidine, procainamide, disopyramide), class IB drugs (mexiletine, tocainide), class IC (flecainide, propafenone, moricizine), class III drugs (amiodarone, bretilium, ibutilide, dofetilide, sotalol, azimilide)
Beta-blockers	acebutol, atenolol, betaxolol, bisoprolol, carteolol, carvedilol, esmolol, labetalol, metoprolol, nadolol, oxprenolol, penbutolol, pindolol, propranolol, sotalol, timolol
Calcium channel blockers	nifedipine, nicardipine, felodipine, isradipine, nisoldipine, amlodipine, lacidipine, nimodipine), bepridil, mibefradil, verapamil, diltiazem
Digoxin and other inotropic agents	digoxin, amrinone, milrinone, enoximone, vesnarinone, pimobendan levosimendan, dopamine, dobutamine, ibopamine, xamoterol, metaraminol bitartrate, digotoxin, digitalis NF, gitalin, lanatoside C, deslanoside, midodrine, inamrinone
Diuretics, loop	furosemide, bumetanide, torsemide, ethacrynic acid
Diuretics, thiazide or other	hydrochlorothiazide, chlorothiazide, chorthalidone, bendroflumethiazide, polythiazide, hydroflumethiazide, quinethazone, benzthiazide, metylchlothiazide, metolazone, indapamide, trichlormethiazide, cyclothiazide), potassium-sparing (amiloride, triamterene, spironolactone, eplerenone), acetazolamide, dichlorphenamide, mercaptomerin, mannitol, ethoxzolamide)
Hypoglycemics, insulin	lispro, aspart, glusine, regular, NPH or lente, ultralente, glargine, detemir
Hypoglycemics, oral	sulfonylureas (acetohexamide, tolazamide, chlorpropamide, tolbutamide, glipizide, glyburide, glimepride), biguanide (metformin, phenformin), alpha-glucosidase inhibitor (acarbose, miglitol), thiazolinedione (rosiglitazone, pioglitazone, troglitazone), other (rapiglinide, nateglinide, exenatide)
Other hypoglycemics, injected (pramlintide)	Pramlintide, exenatide, liraglutide, albiglutide
Lipid lowering drugs, statins	lovastatin, pravastatin, simvastatin, fluvastatin, atorvastatin, rosuvastatin, cerivastatin
Lipid lowering drugs, fibrate derivatives	clofibrate, gemfibrozil, fenofibrate
Nitrates, long and short acting	nitroglycerin, isosorbide, nitrates
Other antihypertensives	(alpha 1 blockers (prazosin, terazosin, doxazosin, phentolamine, phenoxybenzamine), reserpine, centrally acting sympatholytic agents (methyldopa, clonidine, guanabenz, guanfacine), sodium nitroprusside, fenoldopam, hydralazine hydrochloride, phentolamine, guanethidine, mebutamate, mecamlamine, ticrynafen, eplerenone, trimetaphan camsylate, rauwolfia serpentina, guanadrel, syrosingopine, deserpidine, alseroxyton, cryptenamine, rescinnamide, bethanidine, debrisoquine, metyrosine, minoxidil)
Other anti-anginals (ranolazine)	ranolazine
Other drugs to improve blood flow: pentoxifylline, peripheral vasodilators	pentoxifylline

Table 14 Indicators of frailty

Unintentional fall	
Wheelchair, walker, other mobility device. Note analysis file code is 0 (none), 1 (any 365 days)	E0100 Cane standard E0105 Cane, quad or three prong E0130 Walker, rigid (pickup) E0141 Walker wheeled E0143 Folding walker E0148 - E149 Walker, heavy duty E0154 Platform attachment, walker, E0155 Wheel attachment, rigid pick up walker E0176 Air pressure pad E0180 Pressure pad E0185 Decubitus care pad E0255, E0265, E0270 Hospital bed E0277 Powered pressure reducing air mattress E0630 Patient lift, hydraulic E0910 Trapeze bars, A/H/A patient helper E0964 3" cushion, for wheelchair E0971 Anti-tipping device wheelchair E1020 Economy wheelchair E1093 Wide heavy duty wheelchair E1130 Standard wheelchair, fixed full length E1220 Specially sized wheelchair E1230 Powered operated vehicle E1240 Lightweight wheelchair, det arms E1290 Heavy duty wheelchair, det arms K0001- K0004, K0006, K0007, K0014 Wheelchair K0107 Wheelchair tray K0458, K0459 Heavy duty walker
Incontinence, urinary	788.3x, 788.91
Incontinence, fecal	787.60
Urinary catheter, indwelling	51102, 51045, 51702-51703
Nutrition: malnutrition, cachexia, feeding problem, unexpected weight loss (783.2)	783.2 96.6, 99.15 CPT/HCPCS: 43750, 43760, 99560, 99561, 99562, B0777, B0779, B4034-B4036, B4081-B4086, B4099, B4150-B4199, B4216-B4224, B5000, B5100, B9000-B9006, B9998, Q0050-Q0056, Y0511, Y0512, Y3104, Y3163, Y3164
Decubitus ulcer (includes DME pressure mattress, etc)	707.0, 707.2
Muscle disuse atrophy (728.2)	728.2
Delirium or transient organic psychosis (293)	293.x

Variable	
Home oxygen	E0400-E0455, E1376-E1406, Y0260-Y0279, Y0505-Y0507, Y3133 E0601 CPAP K0187 Tubing used with CPAP K0188 Filter disposable, used with CPAP

Table 16 Other Comorbidity. Analysis file codes are 0 for any in past year or 1 for none in past year

Alcohol abuse and related illnesses	ICD9CM 291.x, 303.x, 305.0, V11.3 ICD9CM: 571.0, 571.2, 571.3, 571.5 (cirrhosis liver) Procedures for alcohol addiction (ICD9 CM procedure codes: 94.46, 94.53, 94.61, 94.62, 94.63)
Other substance abuse	Codes are 292.0 (drug withdrawal syndrome), 304.x (drug dependence), 305.2-305.9 (drug abuse, except alcohol/tobacco, 305.9 is abuse NOS, may be nonspecific, but better to exclude), 965.01 (accidental poisoning, heroin), 969.6 (poisoning, psychodysleptic [hallucinogens]), 970.81 (cocaine poisoning, added in 2010), E8500 (heroin poisoning), E8541 (psychodysleptic poisoning)
Liver disease	Viral hepatitis (070.x) Malignant/benign neoplasm (155.x, 197.7, 211.5, 230.8, 235.3) Acute and subacute necrosis of the liver (570), chronic liver disease not linked to alcohol (571.4,571.6,571.8,571.9), hepatic encephalopathy (572.2), portal hypertension (572.3), hepatorenal syndrome (572.4), other sequelae of chronic liver disease (572.8), other disorders (573.x, 997.4)
Pancreatic disease	Malignant/benign neoplasm (157.x, 211.6) Pancreatitis and other diseases pancreas (577.x)
Cancer, except for liver, pancreas and non-melanomous skin cancers	140.xx – 172.xx, 174.xx – 209.xx, 230.xx – 239.xx (except 237.7 [neurofibromatosis] and 233.1 [cervical cancer <i>in situ</i>]), 285.22 anemia in neoplastic diseases 786.6 chest mass (only used if another lung cancer code within the year) V10: history of malignant neoplasm (only of there is another cancer code from the same organ system within the 365 days before or after Encounter for chemotherapy and immunotherapy for neoplastic conditions: V58.1x

Table 17: Medical care utilization

Diagnosis	Codes
Gastrointestinal	ICD 520-579
Any other	All other codes

Table 18: Contraindications for NOAC therapy.

	International Classification of Diseases 9 th Revision (ICD9) and CPT codes
Mitral stenosis	391.1, 392.0, 394.0, 394.1, 394.2, 396.0, 396.1, 424.0, 093.21, 746.5, 799.89
Other valve disease	394.x-396.x, 424.x, 746.x (except for above)
Heart valve surgery (excluding bioprosthesis)	35 (excluding 35.21, 35.23, 35.25, 35.27) V43.5 CPT codes: 33361-33369, 33400-33417, 33418-33430), 33460-33468, 33470-33478, 33496, 33600, 33602, 33860, 33863, 33864
Heart valve surgery, bioprosthesis	35.21, 35.23, 35.25, 35.27
Antiphospholipid antibody syndrome	289.81
Organ Transplant (Includes kidney, heart, lung, liver, bone marrow, and pancreas)	996.8x, V42.0x, V42.1x, V42.6x, V42.7x, V42.81, V42.83 CPT: 32851, 32852, 32853, 32854, 33935, 33945, 38240, 38241, 47135, 47136, 48554, 48556, 50340, 50341, 50360, 50365, 50370, 50380 ICD-9 procedure: 33.5x, 33.6x, 37.5x, 50.5x, 52.8x, 55.6, 410x