

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, adrenocorticotropic 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 |