

Supplementary Online Content

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

eTable 1. Low-Value Service Definitions

Low Value Health Service	Eligible Cohort	Sensitive Criteria (base definition)	Specific Criteria (additional restrictions)
Imaging			
Back imaging for patients with nonspecific low back pain	Patients with a back pain diagnosis	Back imaging with a low back pain diagnosis coded within six weeks prior to imaging	No red flag diagnoses coded within 30 days of imaging and imaging occurred within six weeks of the first diagnosis of back pain.
Screening for carotid artery disease in asymptomatic adults	All patients	Carotid imaging for patients without a history of stroke or TIA within one year of imaging and without a diagnosis of focal neurological symptoms within 30 days prior to imaging	Test did not occur during an inpatient stay or within 14 days of an ER visit
Imaging for plantar fasciitis	Patients with a plantar fasciitis diagnosis	Radiographic imaging or MRI with a diagnosis of plantar fasciitis within one year	Imaging was within 14 days of the first appearance of a relevant foot pain diagnosis
Head imaging for uncomplicated headache	Patients with a headache diagnosis	Brain CT/MRI with non-post-traumatic, non-thunderclap headache diagnosis within 30 days prior to imaging	No red-flag diagnosis warranting imaging within 30 days of the imaging test
EEG for headaches	Patients with a headache diagnosis	EEG with headache diagnosis within 30 days prior to imaging	No epilepsy or convulsions noted within one year prior to imaging
Head imaging in the evaluation of syncope	Patients with syncope diagnosis	CT or MRI of the head with a diagnosis of syncope within 30 days prior to imaging	No current diagnosis of epilepsy, stroke/TIA, head trauma, convulsions, altered mental status, nervous system symptoms, speech problems within 30 days prior to imaging. No history of stroke within one year prior to imaging
Screening for carotid artery disease in the evaluation of syncope	Patients with syncope diagnosis	Carotid imaging with syncope diagnosis 30 days prior to imaging	No acute stroke/TIA or focal neurological symptoms noted within 30 days prior to imaging. No history of stroke/TIA within one year prior to imaging

CT of the sinuses for uncomplicated acute rhinosinusitis	Patients with sinusitis diagnosis	Maxillofacial CT study with a diagnosis of sinusitis within 30 days prior to imaging	No current complications of sinusitis, immune conditions, nasal polyps, or head/face trauma noted within 30 days prior to imaging. No chronic sinusitis patients, defined by presence of sinusitis diagnosis between 30 and 365 days prior to imaging
Cancer Screening			
PSA testing for men aged ≥ 75 y	Men aged 75 and older	PSA test	No history of prostate cancer within one year prior to PSA test
Cervical cancer screening for women aged ≥ 65 y	Women aged 65 and older	Screening Papanicolaou test	No personal history of cervical cancer, dysplasia, other female genital cancers, abnormal Papanicolaou findings, or human papillomavirus positivity within one year prior to screening
Colorectal cancer screening for adults aged ≥ 75 y	Patients aged 75 and older	Colorectal cancer screening (i.e., colonoscopy, sigmoidoscopy, barium enema, or fecal occult blood testing)	No history of colon cancer
Cancer screening for patients with CKD receiving dialysis	Patients with ESRD (i.e., receiving dialysis)	Screening for cancer of the breast, cervix, colon, or prostate for patients with chronic kidney disease receiving dialysis services within one year prior	Only patients aged 75 and older
Preoperative Testing			
Preoperative chest radiography	Patients undergoing selected low or intermediate risk non-cardiothoracic surgical procedure	Chest x-ray specified as part of a preoperative assessment (pre-operative assessment coded at or 30 days prior) or occurring within 30 days prior to low or intermediate risk surgery	No chest x-rays related to inpatient or emergency care. Only chest x-rays that preceded a low or intermediate risk non-cardiothoracic surgical procedure
Preoperative echocardiography	Patients undergoing selected low or intermediate risk non-cardiothoracic surgical procedure	Echocardiogram specified as part of a preoperative assessment (pre-operative assessment coded at or 30 days prior) or occurring within 30 days prior to a low or intermediate risk non-cardiothoracic surgical procedure	No echocardiograms related to inpatient or emergency care. Only echocardiograms that preceded a low or intermediate risk non-cardiothoracic surgical procedure

Preoperative PFT	Patients undergoing selected low or intermediate risk non-cardiothoracic surgical procedure	PFTs specified as part of a preoperative assessment (pre-operative assessment coded at or 30 days prior) or occurring within 30 days prior to a low or intermediate risk non-cardiothoracic surgical procedure, or other one of the following procedures: CABG, aneurysm repair, thromboendarterectomy, PTCA, pacemaker insertion	No PFTs related to inpatient or emergency care. Only PFTs that preceded a low or intermediate risk surgical procedure
Preoperative stress testing	Patients undergoing selected low or intermediate risk non-cardiothoracic surgical procedure	Stress electrocardiogram, echocardiogram, nuclear medicine imaging, cardiac MRI or CT angiography specified as part of a preoperative assessment (pre-operative assessment coded at or 30 days prior) or occurring within 30 days prior to a low or intermediate risk non-cardiothoracic surgical procedure	No testing related to inpatient or emergency care. Only testing that preceded a low or intermediate risk non-cardiothoracic surgical procedure
Diagnostic and Preventive Testing			
Bone mineral density testing at frequent intervals	Sensitive criteria: all patients Specific criteria: patients with osteoporosis	Bone mineral density testing less than two years after a prior bone mineral density test	Only patients with osteoporosis prior to the initial bone mineral density test
Homocysteine testing for cardiovascular disease	All patients	Any homocysteine testing	No diagnosis of folate or B12 deficiencies and no folate or B12 testing within 30 days prior to homocysteine testing
Hypercoagulability testing for patients with deep vein thrombosis	Patients with deep vein thrombosis	Lab tests for a hypercoagulable state within 30 days following diagnosis of lower extremity deep vein thrombosis or pulmonary embolism	No evidence of recurrent thrombosis (i.e., diagnosis of deep vein thrombosis or pulmonary embolism) more than 90 days prior to claim
PTH measurement for patients with stage 1-3 CKD	Patients with CKD not receiving dialysis	PTH measurement in patients with CKD and no dialysis services prior to PTH testing or within 30 days following testing	No hypercalcemia diagnosis
Total or free T3 level testing for patients with hypothyroidism	Patients with hypothyroidism	Total or free T3 measurement in the same year as hypothyroidism diagnosis	
1,25-dihydroxyvitamin D testing in the absence of hypercalcemia or decreased kidney function	All patients	Calcitriol testing for patients without hypercalcemia or secondary hyperthyroidism of renal origin noted within 30 days prior to testing and without a history of CKD	No diagnoses indicating non-PTH mediated hypercalcemia, (i.e., sarcoidosis, TB, selected neoplasms) within one year prior to testing
Cardiovascular Testing and Procedures			

Stress testing for stable coronary disease	Patients with ischemic heart disease or angina	Stress electrocardiogram, echocardiogram, nuclear medicine imaging, cardiac MRI, or CT angiography with a diagnosis of ischemic heart disease or angina at least six months prior to the stress test	Patient with a diagnosis of myocardial infarction within one year prior to testing
Percutaneous coronary intervention with balloon angioplasty or stent placement for stable coronary disease	Patients with ischemic heart disease or angina	Coronary stent placement or balloon angioplasty for patients with a diagnosis of ischemic heart disease or angina at least six months prior to PCI	Patients with a diagnosis of myocardial infarction within one year prior to testing
Renal artery angioplasty or stenting	Patients with hypertension	Renal/visceral angioplasty or stent placement	Diagnosis of renal atherosclerosis or renovascular hypertension and no diagnosis of fibromuscular dysplasia of renal artery within 30 days prior to angioplasty or stenting
Carotid endarterectomy in asymptomatic patients	All patients	Carotid endarterectomy for patients without a history of stroke/TIA within one year prior to operation, and without stroke, TIA, or focal neurological symptoms within 30 days prior to operation. Operation not associated with an ER visit.	Only female patients
IVC filters to prevent pulmonary embolism	All patients	Any IVC filter placement	Any IVC filter placement
Other Procedures			
Arthroscopic surgery for knee osteoarthritis	Patients with osteoarthritis	Arthroscopic debridement/chondroplasty of the knee with diagnosis of osteoarthritis or chondromalacia within 30 days prior to surgery	No meniscal tear within 30 days prior to surgery
Spinal injection for low-back pain	Patients with low back pain	Epidural facet or trigger point injections for low back pain within 30 days prior to injection and not associated with an inpatient stay	No diagnoses indicating radiculopathy within 30 days prior to injection

Abbreviations: TIA, transient ischemic attack; ER, emergency room; MRI, magnetic resonance imaging; CT, computed tomography; EEG, electroencephalography; HIV, human immunodeficiency virus; PSA, prostate-specific antigen; CKD, chronic kidney disease; PFT, pulmonary function test; CABG, coronary artery bypass graft; PTCA, percutaneous transluminal coronary angioplasty; PTH, parathyroid hormone; TB, tuberculosis; IVC, inferior vena cava

eTable 2. Administrative Codes used to Identify Relevant Medical History, Exclusion Criteria, and Low-Value Service Use

Low Value Health Service	CPT Codes used to identify health service use	ICD-10 Codes used to identify Veterans with a medical condition qualifying them to receive each service	ICD-10 and other codes used to exclude Veterans when applying the specific criteria	Additional Ancillary Service Codes used for Pricing
Imaging				
Back imaging for patients with nonspecific low back pain	X-ray, CT, and MRI imaging of spine: 72010 72020 72052 72100 72110 72114 72120 72200 72202 72220 72131-72133 72141 72142 72146-72149 72156 72157 72158	Back pain, various cause: M47.20 M47.26 M47.27 M47.28 M47.816 M47.817 M47.818 M47.819 M47.896 M47.897 M47.898 M47.899 M47.9 M48.06 M48.07 M48.08 M51.16 M51.17 M51.26 M51.27 M51.36 M51.37 M51.86 M51.87 M51.9 M53.2X6 M53.2X7 M53.2X8 M53.3 M53.86 M53.87 M53.88 M54.16 M54.17 M54.18 M54.30 M54.31 M54.32 M54.40 M54.41 M54.42 M54.5 M54.89 M54.9 M99.03 M99.04 M99.23 M99.33 M99.43 M99.53 M99.63 M99.73 M99.83 M99.84 S33.5 S33.6 S33.8 S33.9 S39.002 S39.012 S39.092 S39.82 S39.92	<p>Cancer: C D0 D37-D44 D46 D47 D48 D49 Z85</p> <p>Trauma: S0 S10 S11 S12 S13.0 S13.1 S13.2 S14.0 S14.11 S14.12 S14.13 S14.14 S14.15 S21 S22 S23.0 S23.1 S23.2 S24.0 S24.1 S26 S27 S28 S31.0 S32 S33.0 S33.1 S33.2 S33.3 S33.4 S34.0 S34.11 S34.12 S34.13 S36 S37 S38 S42 S43.0 S43.1 S43.2 S43.3 S49.0 S49.1 S52 S53.0 S53.1 S53.2 S53.3 S57 S58 S59.0 S59.1 S59.2 S62 S63.0 S63.1 S63.2 S63.3 S63.4 S72 S73.0 S77 S78 S79.0 S79.1 S82 S83.0 S83.1 S87 S88 S89.0 S89.1 S89.2 S89.3 S92 S93.0 S93.1 S97 S98 S99.0 S99.1 S99.2 T79</p> <p>Tuberculosis: A15 A17 A18 A19</p> <p>IV drug use: F11 F13 F14 F15</p> <p>Spinal infection: M46.2 M46.3 M46.4 M46.5 G06.1</p> <p>Cauda Equina: G83.4</p> <p>Endocarditis: I33 I38 I39</p> <p>Sepsis: A40 A41</p> <p>Other signs or symptoms: R50 R68.83 R63.0 R63.4 R63.6 R53.8 R61 D64.9</p>	

<p>Screening for carotid artery disease in asymptomatic adults</p>	<p>Carotid imaging: 36222-36224 70498 70547-70549 93880 93882 3100F</p>	<p>Stroke/TIA: I60 I61 I63.0 I63.1 I63.2 I63.3 I63.4 I63.5 I63.8 I63.9 I66 I67.81 I67.82 I67.83 I67.84 G45.0 G45.3 G45.4 G45.8 G45.9 G46 I97.81 I97.82 Z86.73</p> <p>Retinal vascular occlusion/ischemia: H34 H35.82</p> <p>Nervous and musculoskeletal symptoms: I69 R20 R25-27 R29.0 R29.1 R29.2 R29.701-R29.74 R29.81 R29.90 R40 R41 R43 R47 R55</p>	<p>N/A</p>	
<p>Imaging for diagnosis of plantar fasciitis</p>	<p>Foot radiograph: 73620 73630 73650</p> <p>Foot MRI: 73718 73719 73720</p> <p>Extremity ultrasound: 76880 76881 76882</p>	<p>Plantar fascial fibromatosis: M72.2</p>	<p>Foot pain: M25.57 M25.67 M25.87 M79.67</p>	
<p>Head imaging for uncomplicated headache</p>	<p>Head imaging: 70450 70460 70470 70551-70553</p>	<p>Headache: R51</p> <p>Other headache syndromes: G44 (exclude G44.3 and G44.53)</p> <p>Migraine: G43 (exclude G43.4 and G43.6)</p>	<p>Post-traumatic or thunderclap headache: G44.3 G44.53</p> <p>Hemiplegic migraine, migraine with cerebral infarction: G43.4 G43.6</p> <p>Cancer: Z85</p> <p>Giant cell arteritis: M31.5 M31.6</p> <p>Epilepsy or convulsions: G40 R56</p> <p>Cerebrovascular diseases, including stroke/TIA and subarachnoid hemorrhage: I6 G45 G46</p> <p>Head or face trauma: S0 S1</p> <p>Altered mental status, nervous and musculoskeletal system symptoms, including gait abnormality, meningismus, disturbed skin sensation, speech deficits: R20 R25 R26 R27 R29.0 R29.1 R29.2 R29.701-R29.74 R29.81 R29.90 R40 R41 R43 R47</p> <p>Personal history of stroke/TIA: R93.0 Z86.73</p>	

EEG for headaches	EEG: 95812 95813 95816 95819 95822 95827	Headache: R51 Other headache syndromes: G44 Migraine: G43	Epilepsy or convulsions: G40 R56 R25	
Head imaging in the evaluation of syncope	Head imaging: 70450 70460 70470 70551-70553	Syncope: R55 T67.1	Stroke/TIA: I60 I61 I63.0 I63.1 I63.2 I63.3 I63.4 I63.5 I63.8 I63.9 I66 I67.81 I67.82 I67.83 I67.84 G45.0 G45.3 G45.4 G45.8 G45.9 G46 I97.81 I97.82 R93.0 Z86.73 Epilepsy or convulsions: G40 R56 Head or face trauma: S0 S1 Altered mental status, nervous and musculoskeletal system symptoms, including gait abnormality, meningismus, disturbed skin sensation, speech deficits: R20 R25 R26 R27 R29.0 R29.1 R29.2 R29.701-R29.74 R29.81 R29.90 R40 R41 R43 R47	
Screening for carotid artery disease for syncope	Carotid imaging: 36222-36224 70498 70547-70549 93880 93882 3100F	Syncope: R55 T67.1	Stroke/TIA: I60 I61 I63.0 I63.1 I63.2 I63.3 I63.4 I63.5 I63.8 I63.9 I66 I67.81 I67.82 I67.83 I67.84 G45.0 G45.3 G45.4 G45.8 G45.9 G46 I97.81 I97.82 R93.0 Z86.73 Retinal vascular occlusion/ischemia: H34 H35.82 Nervous and musculoskeletal symptoms: I69 R20 R25 R26 R27 R29.0 R29.1 R29.2 R29.701-R29.74 R29.81 R29.90 R40 R41 R43 R47	
CT of the sinuses for uncomplicated acute rhinosinusitis	CT of maxillofacial area: 70486-70488	Sinusitis: J01 J32	Immune disorders: E84 B20 B97.35 D80 D81 D82 D83 D84 D89 Nasal polyp: J33 Eyelid/orbit inflammation: H00 H01 H05 Head or face trauma: S0 S1	
Cancer Screening				

PSA testing for men aged ≥ 75 y	PSA test: CPT: 84152-84154 HCPCS: G0102 G0103	N/A	Prostate cancer: C61 D07.5 Z85.46	CPT: 36415 (Venipuncture)
Cervical cancer screening for women aged ≥ 65 y	Screening Pap: CPT: 88141-881143 88147 88148 88155 88164 88165 88174 88175 HCPCS: G0123 G0124 G0141 G0143 G0144 G0145 G0147 G0148 P3000 P3001 Q0091	N/A	Cervical and other relevant cancers, dysplasias: C51-C53 D26.0 D06 D07.0 D07.1 D07.2 D07.3 N87 Abnormal Papanicolaou finding, human papillomavirus positivity: R87.61 R87.62 R87.81 Personal history of genital malignancy: Z85.40 Z85.41 Z85.44	CPT: 87620-87622 (average cost of these tests)
Colorectal cancer screening for adults aged ≥ 75 y	Sigmoidoscopy, colonoscopy, barium enema or blood occult test for colon cancer screening: CPT: 45330-45350 45378- 45393 45398 HCPCS: G0104-G0106 G0120- G0122 G0328 82270	N/A	Colon cancer: C18.0 C18.1 C18.2 C18.3 C18.4 C18.5 C18.6 C18.7 C18.8 C18.9 C19 C20 D01.0 D01.1 D01.2 Z85.038 Z85.040 Z85.048	CPT: 00810 (sedation), apply to all CPT/HCPCS codes except 82270, G0106, G0120, G0122, G0328
Cancer screening for patients with CKD receiving dialysis	Breast screening: 77057 77063 77067 G0202 Colorectal screening: 45330- 45350 45378-45393 45398 G0104-G0106 G0120 -G0122 G0328 82270 Prostate screening: G0102 G0103 84152-84154 Cervical screening: G0101 G0123 G0124 G0141 G0143 G0144 G0145 G0147 G0148 P3000 P3001 Q0091	Dialysis: P9A P9B	N/A	CPT: 36415 (Venipuncture) for prostate cancer screening CPT: 87620-87622 (average cost of these tests) for cervical cancer screening CPT: 00810 (sedation), apply to all CPT/HCPCS codes except 82270, G0106, G0120, G0122, G0328 for colorectal cancer screening
Preoperative Testing				

Preoperative chest radiography	<p>Chest x-ray: 71010 71015 71020-71023 71030 71034 71035 71045 71046 71047 71048</p> <p>Sensitive criteria: Encounter for preprocedural examinations: Z01.810- Z01.812 Z01.818</p>	<p>Selected surgeries: P1x P3D P4A P4B P4C P5C P5D P8A P8G</p> <p>Relevant surgeries: 19120 19125 47562 47563 49560 58558</p>	N/A	
Preoperative echocardiography	<p>Echocardiogram: 93303 93304 93306-93308 93312 93315 93318</p> <p>Extra cost component: Echocardiography: 93303- 93352</p> <p>Sensitive criteria: Encounter for preprocedural examinations: Z01.810- Z01.812 Z01.818</p>	<p>Selected surgeries: P1x P3D P4A P4B P4C P5C P5D P8A P8G</p> <p>Relevant surgeries: 19120 19125 47562 47563 49560 58558</p>	N/A	
Preoperative PFT	<p>Spirometry: 94010</p> <p>Extra cost component: Pulmonary non-ventilatory services: 94010-94799 Plethysmography: 93720-93722</p> <p>Sensitive criteria: Encounter for preprocedural examinations: Z01.810- Z01.812 Z01.818</p>	<p>Selected surgeries: P1x P3D P4A P4B P4C P5C P5D P8A P8G</p> <p>Relevant surgeries: 19120 19125 47562 47563 49560 58558</p>	N/A	
Preoperative stress testing	<p>Stress testing, cardiac MRI, CT angiography: 75552-75564 75574 78451-78454 78460 78461 78464 78465 78472 78473 78481 78483 78491 78492 93015-93018 93350 93351 0146T 0147T 0148T 0149T</p> <p>Extra cost component: ECG: 93000-93042</p> <p>Echocardiography: 93303- 93352</p>	<p>Selected surgeries: P1x P3D P4A P4B P4C P5C P5D P8A P8G</p> <p>Relevant surgeries: 19120 19125 47562 47563 49560 58558</p>	N/A	

	<p>Cardiovascular nuclear diagnostic services: 78414-78499</p> <p>Cardiac MRI: 75552-75564</p> <p>Cardiac CT: 75571-75574</p> <p>Contrast: A9500-A9700</p> <p>Pharmacologic stress test injection: J0150 J0152 J0280 J1245 J1250 J2785</p> <p>Sensitive criteria: Encounter for preprocedural examinations: Z01.810-Z01.812 Z01.818</p>			
Diagnostic and Preventive Testing				
Bone mineral density testing at frequent intervals	<p>Bone density testing: 6070 76071 76075 76076 76078 76977 77078-77081 77083 77085 78350 78351</p>	N/A	<p>Osteoporosis: ICD9: 733.00 733.01 733.02 733.03 733.09 ICD10: M81.0 M81.6 M81.8</p>	
Homocysteine testing for cardiovascular disease	<p>Homocysteine chemistry: 83090</p>	N/A	<p>Folate or B12 disorders: E53.8 E72.1 D51.0 D51.1 D51.3 D51.8 D51.9 D52 D64.9</p>	CPT: 36415 (Venipuncture)
Hypercoagulability testing for patients with deep vein thrombosis	<p>Hypercoagulability chemistries: 81240 81241 83090 85300 85303 85306 85613 86147</p>	<p>Phlebitis, thrombophlebitis, pulmonary embolism, deep vein thrombosis: I26 I80.0 I80.1 I80.2 I80.3 I80.9 I82.4 I82.5</p>	<p>Phlebitis, thrombophlebitis, pulmonary embolism, deep vein thrombosis: I26 I80.0 I80.1 I80.2 I80.3 I80.9 I82.4 I82.5</p> <p>History of venous thrombosis and embolism, pulmonary embolism: Z86.711 Z86.718</p>	CPT: 36415 (Venipuncture)

<p>PTH measurement for patients with stage 1-3 CKD</p>	<p>Parathyroid hormone chemistry: 83970</p>	<p>CKD: A18.11 A52.75 B52.0 C64.1 C64.2 C64.9 C68.9 D30.00 D30.01 D30.02 D41.00 D41.01 D41.02 D41.10 D41.11 D41.12 D41.20 D41.21 D41.22 D59.3 E08.21 E08.22 E08.29 E08.65 E09.21 E09.22 E09.29 E10.21 E10.22 E10.29 E10.65 E11.21 E11.22 E11.29 E11.65 E13.21 E13.22 E13.29 E74.8 I12.0 I12.9 I13.0 I13.10 I13.11 I13.2 I70.1 I72.2 K76.7 M10.30 M10.311 M10.312 M10.319 M10.321 M10.322 M10.329 M10.331 M10.332 M10.339 M10.341 M10.342 M10.349 M10.351 M10.352 M10.359 M10.361 M10.362 M10.369 M10.371 M10.372 M10.379 M10.38 M10.39 M32.14 M32.15 M35.04 N00.0 N00.1 N00.2 N00.3 N00.4 N00.5 N00.6 N00.7 N00.8 N00.9 N01.0 N01.1 N01.2 N01.3 N01.4 N01.5 N01.6 N01.7 N01.8 N01.9 N02.0 N02.1 N02.2 N02.3 N02.4 N02.5 N02.6 N02.7 N02.8 N02.9 N03.0 N03.1 N03.2 N03.3 N03.4 N03.5 N03.6 N03.7 N03.8 N03.9 N04.0 N04.1 N04.2 N04.3 N04.4 N04.5 N04.6 N04.7 N04.8 N04.9 N05.0 N05.1 N05.2 N05.3 N05.4 N05.5 N05.6 N05.7 N05.8 N05.9 N06.0 N06.1 N06.2 N06.3 N06.4 N06.5 N06.6 N06.7 N06.8 N06.9 N07.0 N07.1 N07.2 N07.3 N07.4 N07.5 N07.6 N07.7 N07.8 N07.9 N08 N13.1 N13.2 N13.30 N13.39 N14.0 N14.1 N14.2 N14.3 N14.4 N15.0 N15.8 N15.9 N16 N17.0 N17.1 N17.2 N17.8 N17.9 N18.1 N18.2 N18.3 N18.4 N18.5 N18.6 N18.9 N19 N25.0 N25.1 N25.81 N25.89 N25.9 N26.1 N26.9 Q61.02 Q61.11 Q61.19 Q61.2 Q61.3 Q61.4 Q61.5 Q61.8 Q62.0 Q62.2 Q62.10 Q62.11 Q62.12 Q62.31 Q62.32 Q62.39 R94.4</p> <p>Exclude: Dialysis: P9A P9B</p>	<p>Hypercalcemia: E83.52</p> <p>Secondary hyperparathyroidism of renal origin: N25.81</p>	<p>CPT: 36415 (Venipuncture)</p>
<p>Total or free T3 level testing for patients with hypothyroidism</p>	<p>Total or free T3: 84480, 84481</p>	<p>Hypothyroidism: E01.8 E02 E03.2 E03.3 E03.8 E03.9 E89.0</p>	<p>N/A</p>	<p>CPT: 36415 (Venipuncture)</p>

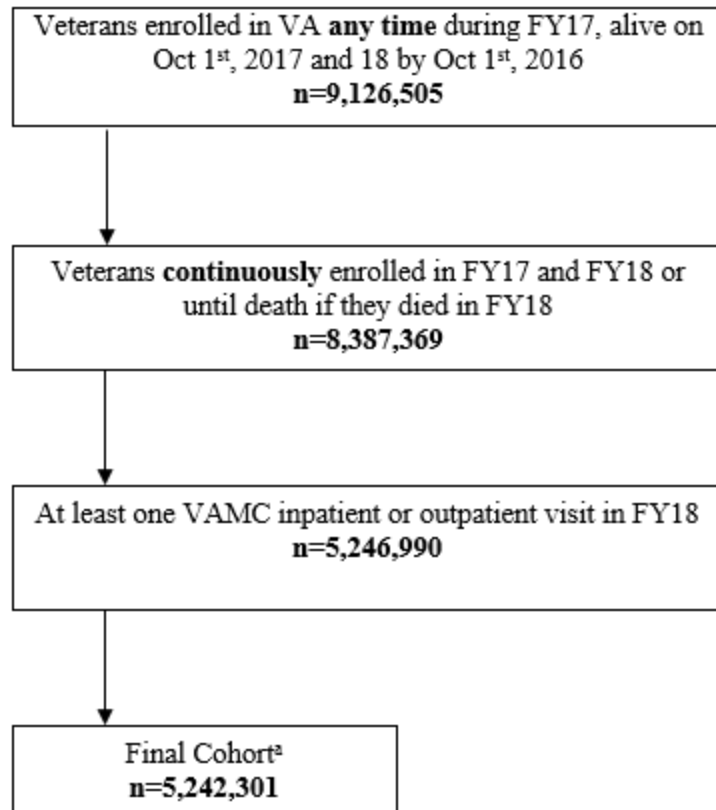
<p>1,25-dihydroxyvitamin D testing in the absence of hypercalcemia or decreased kidney function</p>	<p>1, 25 dihydrovitamin D3: 82652</p>	<p>N/A</p>	<p>Sensitivity exclusion criteria: Hypercalcemia: E83.52</p> <p>Secondary hyperparathyroidism of renal origin: N25.81</p> <p>CKD: A18.11 A52.75 B52.0 C64.1 C64.2 C64.9 C68.9 D30.00 D30.01 D30.02 D41.00 D41.01 D41.02 D41.10 D41.11 D41.12 D41.20 D41.21 D41.22 D59.3 E08.21 E08.22 E08.29 E08.65 E09.21 E09.22 E09.29 E10.21 E10.22 E10.29 E10.65 E11.21 E11.22 E11.29 E11.65 E13.21 E13.22 E13.29 E74.8 I12.0 I12.9 I13.0 I13.10 I13.11 I13.2 I70.1 I72.2 K76.7 M10.30 M10.311 M10.312 M10.319 M10.321 M10.322 M10.329 M10.331 M10.332 M10.339 M10.341 M10.342 M10.349 M10.351 M10.352 M10.359 M10.361 M10.362 M10.369 M10.371 M10.372 M10.379 M10.38 M10.39 M32.14 M32.15 M35.04 N00.0 N00.1 N00.2 N00.3 N00.4 N00.5 N00.6 N00.7 N00.8 N00.9 N01.0 N01.1 N01.2 N01.3 N01.4 N01.5 N01.6 N01.7 N01.8 N01.9 N02.0 N02.1 N02.2 N02.3 N02.4 N02.5 N02.6 N02.7 N02.8 N02.9 N03.0 N03.1 N03.2 N03.3 N03.4 N03.5 N03.6 N03.7 N03.8 N03.9 N04.0 N04.1 N04.2 N04.3 N04.4 N04.5 N04.6 N04.7 N04.8 N04.9 N05.0 N05.1 N05.2 N05.3 N05.4 N05.5 N05.6 N05.7 N05.8 N05.9 N06.0 N06.1 N06.2 N06.3 N06.4 N06.5 N06.6 N06.7 N06.8 N06.9 N07.0 N07.1 N07.2 N07.3 N07.4 N07.5 N07.6 N07.7 N07.8 N07.9 N08 N13.1 N13.2 N13.30 N13.39 N14.0 N14.1 N14.2 N14.3 N14.4 N15.0 N15.8 N15.9 N16 N17.0 N17.1 N17.2 N17.8 N17.9 N18.1 N18.2 N18.3 N18.4 N18.5 N18.6 N18.9 N19 N25.0 N25.1 N25.81 N25.89 N25.9 N26.1 N26.9 Q61.02 Q61.11 Q61.19 Q61.2 Q61.3 Q61.4 Q61.5 Q61.8 Q62.0 Q62.2 Q62.10 Q62.11 Q62.12 Q62.31 Q62.32 Q62.39 R94.4</p> <p>Specific exclusion criteria: Sarcoidosis, TB, select neoplasms, polycythemia: D86 A15 A17 A18 A19 C44 C50 C64 C65 C67 C56 C81-C96 D45</p>	<p>CPT: 36415 (Venipuncture)</p>
<p>Cardiovascular Testing and Procedures</p>				

Stress testing for stable coronary disease	Stress testing, cardiac MRI, CT angiography: 75552-75564 75574 78451-78454 78460 78461 78464 78465 78472 78473 78481 78483 78491 78492 93015-93018 93350 93351 0146T 0147T 0148T 0149T	Ischemic heart disease or angina: I20.0 I20.1 I20.8 I20.9 I21.01 I21.02 I21.09 I21.11 I21.19 I21.21 I21.29 I21.3 I21.4 I21.A1 I21.A9 I22.0 I22.1 I22.2 I22.8 I22.9 I23.0 I23.1 I23.2 I23.3 I23.4 I23.5 I23.6 I23.7 I23.8 I24.0 I24.1 I24.8 I24.9 I25.10 I25.110 I25.111 I25.118 I25.119 I25.2 I25.3 I25.41 I25.42 I25.5 I25.6 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 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 I25.810 I25.811 I25.812 I25.82 I25.83 I25.84 I25.89 I25.9	Inpatient claim only: Myocardial infarction: I21.01 I21.02 I21.09 I21.11 I21.19 I21.21 I21.29 I21.3 I21.4 I21.9 I21.A1 I21.A9 I22.0 I22.1 I22.2 I22.8 I22.9	
Percutaneous coronary intervention with balloon angioplasty or stent placement for stable coronary disease	Coronary stent placement or balloon angiography: 92920 92924 92928 92933 92937 92943 92980 92982 G0290 C9600 C9602 C9604 C9607	Ischemic heart disease or angina: I20.0 I20.1 I20.8 I20.9 I21.01 I21.02 I21.09 I21.11 I21.19 I21.21 I21.29 I21.3 I21.4 I21.A1 I21.A9 I22.0 I22.1 I22.2 I22.8 I22.9 I23.0 I23.1 I23.2 I23.3 I23.4 I23.5 I23.6 I23.7 I23.8 I24.0 I24.1 I24.8 I24.9 I25.10 I25.110 I25.111 I25.118 I25.119 I25.2 I25.3 I25.41 I25.42 I25.5 I25.6 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 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 I25.810 I25.811 I25.812 I25.82 I25.83 I25.84 I25.89 I25.9	Inpatient claim only: Myocardial infarction: I21.01 I21.02 I21.09 I21.11 I21.19 I21.21 I21.29 I21.3 I21.4 I21.9 I21.A1 I21.A9 I22.0 I22.1 I22.2 I22.8 I22.9	
Renal artery angioplasty or stenting	Renal artery angioplasty or stenting: 35471 35450 37205 37207 37236 37246 75960 75966	Hypertension: H35.031 H35.032 H35.033 H35.039 I10 I11.0 I11.9 I12.0 I12.9 I13.0 I13.10 I13.11 I13.2 I15.0 I15.1 I15.2 I15.8 I15.9 I67.4 N26.2	Specific inclusion criteria: Atherosclerosis of renal artery, renovascular hypertension: I70.1 I15.0 Specific exclusion criteria: Arterial fibromuscular dysplasia: I77.3	

Carotid endarterectomy in asymptomatic patients	Carotid endarterectomy: 35301	N/A	Cerebrovascular diseases, including stroke/TIA and subarachnoid hemorrhage: I60 I61 I63.0 I63.1 I63.2 I63.3 I63.4 I63.5 I63.8 I63.9 I66 I67.81 I67.82 I67.83 I67.84 G45.0 G45.3 G45.4 G45.8 G45.9 G46 I97.81 I97.82 Z86.73 Retinal vascular occlusion/ischemia: H34 H35.82 Nervous and musculoskeletal symptoms: I69 R20 R25 R26 R27 R29.0 R29.1 R29.2 R29.701-R29.74 R29.81 R29.90 R40 R41 R43 R47	
IVC filters to prevent pulmonary embolism	IVC placement, repositioning: 37191 37192 Radiological supervision of inferior vena cava placement: 75940 Extra cost component: Catheter insertion, IVC interruption, venography, ultrasound guidance: 36010 37620 75825 76937	N/A	N/A	
Other Procedures				
Arthroscopic surgery for knee osteoarthritis	Knee arthroscopy with chondroplasty: 29877 29879 29880 29881 G0289	Chondromalacia, osteoarthritis: M22.4 M94.2 M15.0 M15.3 M15.4 M15.8 M15.9 M17 M19.9	Meniscus tear or osteophyte: S83.2 M23.2 M25.76	
Spinal injection for low-back pain	Epidural injections: 62311 62322 62323 64483 Trigger point injections: 20552 20553 Facet injections: 64493 64475 Etanercept: J1438	Back pain, various cause: M47.20 M47.26 M47.27 M47.28 M47.816 M47.817 M47.818 M47.819 M47.896 M47.897 M47.898 M47.899 M47.9 M48.06 M48.07 M48.08 M51.16 M51.17 M51.26 M51.27 M51.36 M51.37 M51.86 M51.87 M51.9 M53.2X6 M53.2X7 M53.2X8 M53.3 M53.86 M53.87 M53.88 M54.16 M54.17 M54.18 M54.30 M54.31 M54.32 M54.40 M54.41 M54.42 M54.5 M54.89 M54.9 M99.03 M99.04 M99.23 M99.33 M99.43 M99.53 M99.63 M99.73 M99.83 M99.84 S33.5 S33.6 S33.8 S33.9 S39.002 S39.012 S39.092 S39.82 S39.92	Back pain with radiculopathy: M47.20 M47.26 M47.27 M47.28 M51.16 M51.17 M54.16	

Abbreviations: CPT, Current Procedural Terminology; ICD, International Classification of Diseases; CT, computed tomography; MRI, magnetic resonance imaging; IV, intravenous; TIA, transient ischemic attack; EEG, electroencephalography; PSA, prostate-specific antigen; HCPCS, Healthcare Common Procedure Coding System; Pap, Papanicolaou; PFT, pulmonary function test; CKD, chronic kidney disease; TB, tuberculosis; IVC, inferior vena cava	
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eFigure 1: Construction of the Cohort



a. 4,689 Veterans whose primary facility utilized used was Manila were excluded from the Final Cohort

eTable 3. Overall Use and Cost of Low-Value Services Delivered by VA facilities and in VA Community Care in Fiscal Year 2018 Applying the Sensitive Criteria

Low-Value Health Services by Domain	Overall Use (VA Facilities + VACC)		VA Facilities		VACC		Overall Cost (VA Facilities + VACC)	
	Total Count of Low-Value Health Services	Count per 100 Veterans ^a	Count of Low-Value Health Services	row %	Count of Low-Value Health Services	row %	Total cost (\$ mil)	Proportion of Overall Cost, %
Cancer Screening								
PSA testing for men aged ≥75 y	407,680	7.78	399,513	98.0	8,167	2.0	10.4	1.5
Colorectal cancer screening for adults aged ≥75 y	59,433	1.13	49,256	82.9	10,177	17.1	49.4	7.1
Cervical cancer screening for women aged ≥65 y	5,390	0.10	5,226	97.0	164	3.0	0.3	0.04
Cancer screening for patients with CKD receiving dialysis	15,764	0.30	14,512	92.1	1,252	7.9	4.1	0.6
<i>Total</i>	488,267	9.31	468,507	96.0	19,760	4.0	64.2	9.2
Imaging								
Back imaging for patients with nonspecific low back pain	555,515	10.60	432,051	77.8	123,464	22.2	118.6	17.0
Screening for carotid artery disease in asymptomatic adults	105,856	2.02	90,369	85.4	15,487	14.6	24.3	3.5
Head imaging for uncomplicated headache	89,890	1.71	62,466	69.5	27,424	30.5	22.1	3.2
Head imaging for syncope	38,734	0.74	23,070	59.6	15,664	40.4	8.2	1.2
CT of the sinuses for uncomplicated acute rhinosinusitis	17,861	0.34	14,265	79.9	3,596	20.1	3.0	0.4
Screening for carotid artery disease for syncope	12,715	0.24	7,877	62.0	4,838	38.0	3.0	0.4
Imaging for diagnosis of plantar fasciitis	29,948	0.57	23,651	79.0	6,297	21.0	2.8	0.4
EEG for headaches	5,207	0.10	3,402	65.3	1,805	34.7	1.6	0.2

<i>Total</i>	855,726	16.32	657,151	76.8	198,575	23.2	183.6	26.3
Pre-Operative Testing								
Preoperative chest radiography	378,075	7.21	250,439	66.2	127,636	33.8	27.6	4.0
Preoperative echocardiography	61,810	1.18	39,188	63.4	22,622	36.6	33.7	4.8
Preoperative stress testing	48,270	0.92	34,947	72.4	13,323	27.6	28.2	4.0
Preoperative PFT	12,912	0.25	10,835	83.9	2,077	16.1	1.9	0.3
<i>Total</i>	501,067	9.56	335,409	66.9	165,658	33.1	91.3	13.1
Diagnosis and Preventing Testing								
PTH measurement for patients with stage 1-3 CKD	114,935	2.19	110,003	95.7	4,932	4.3	6.2	0.9
1,25-dihydroxyvitamin D testing in the absence of hypercalcemia or decreased kidney function	28,295	0.54	27,863	98.5	432	1.5	1.4	0.2
Total or free T3 level testing for patients with hypothyroidism	24,205	0.46	22,263	92.0	1,942	8.0	0.5	0.1
Homocysteine testing for CVD disease	15,794	0.30	14,410	91.2	1,384	8.8	0.4	0.1
BMD testing at frequent intervals	16,705	0.32	16,148	96.7	557	3.3	2.0	0.3
Hypercoagulability testing for patients with deep vein thrombosis	6,101	0.12	4,913	80.5	1,188	19.5	0.2	<0.001
<i>Total</i>	206,035	3.93	195,600	94.9	10,435	5.1	10.7	1.5
Other Procedures								
Spinal injection for low-back pain	131,148	2.50	69,824	53.2	61,324	46.8	84.0	12.0
Arthroscopic surgery for knee osteoarthritis	7,137	0.14	3,139	44.0	3,998	56.0	21.2	3.0

<i>Total</i>	138,285	2.64	72,963	52.8	65,322	47.2	105.3	15.1
Cardiovascular Testing and Procedures								
Stress testing for stable coronary disease	142,122	2.71	107,291	75.5	34,831	24.5	84.9	12.1
PCI with balloon angioplasty or stent placement for stable coronary disease	13,557	0.26	7,563	55.8	5,994	44.2	142.9	20.4
IVC filters to prevent pulmonary embolism	1,423	0.03	643	45.2	780	54.8	6.4	0.9
Renal artery angioplasty or stenting	1,128	0.02	691	61.3	437	38.7	9.6	1.4
Carotid endarterectomy in asymptomatic patients	1,467	0.03	1,257	85.7	210	14.3	<0.001	<0.001
<i>Total</i>	159,697	3.05	117,445	73.5	42,252	26.5	243.7	34.9
Grand Total	2,349,077	44.81	1,847,075	78.6	502,002	21.4	698.9	100
<p><u>Abbreviations:</u> VACC, VA Community Care; EEG, electroencephalogram; CAD, coronary artery disease; CT, computerized tomography; CKD, chronic kidney disease; PFT, pulmonary function testing; BMD, bone mineral density; PCI, percutaneous coronary intervention; IVC, inferior vena cava</p> <p>a. Denominator is 5,242,301 for the full cohort</p>								

eTable 4. Overall use of Low-Value Services in FY2018 Among Veterans at Risk to Receive Each Service Applying the Specific and Sensitive Criteria

Low-Value Health Services	At-risk for low value service (N)	Specific		Sensitive	
		count	rate/100 Veterans at risk for low value service	count	rate/100 Veterans at risk for low value service
Cancer Screening					
PSA testing for men aged ≥ 75 y	1,169,366	309,731	26.5	407,680	34.9
Colorectal cancer screening for adults aged ≥ 75 y	1,189,664	7,220	0.6	59,433	5.0
Cervical cancer screening for women aged ≥ 65 y	71,499	4,599	6.4	5,390	7.5
Cancer screening for patients with CKD receiving dialysis	26,906	2,082	7.7	15,764	58.6
Imaging					
Back imaging for patients with nonspecific low back pain	1,497,436	141,424	9.4	555,515	37.1
Screening for carotid artery disease in asymptomatic adults	5,242,301	90,080	1.7	105,856	2.0
Head imaging for uncomplicated headache	370,572	51,333	13.9	89,890	24.3
Head imaging for syncope	81,818	15,606	19.1	38,734	47.3
CT of the sinuses for uncomplicated acute rhinosinusitis	178,551	8,908	5.0	17,861	10.0
Screening for carotid artery disease for syncope	81,818	7,007	8.6	12,715	15.5
Imaging for diagnosis of plantar fasciitis	145,731	4,745	3.3	29,948	20.6
EEG for headaches	380,848	1,984	0.5	5,207	1.4
Pre-Operative Testing					
Preoperative chest radiography	721,522	117,777	16.3	378,075	52.4
Preoperative echocardiography	721,522	14,355	2.0	61,810	8.6
Preoperative stress testing	721,522	12,830	1.8	48,270	6.7
Preoperative PFT	779,784	7,044	0.9	12,912	1.7

Diagnosis and Preventing Testing					
PTH measurement for patients with stage 1-3 CKD	1,147,322	83,664	7.3	114,935	10.0
1,25-dihydroxyvitamin D testing in the absence of hypercalcemia or decreased kidney function	5,242,301	26,849	0.5	28,295	0.5
Total or free T3 level testing for patients with hypothyroidism	225,079	24,205	10.8	24,205	10.8
Homocysteine testing for CVD disease	5,242,301	4,878	0.1	15,794	0.3
BMD testing at frequent intervals	5,242,301	3,460	0.1	16,705	0.3
Hypercoagulability testing for patients with deep vein thrombosis	79,618	3,117	3.9	6,101	7.7
Other Procedures					
Spinal injection for low-back pain	1,478,140	72,659	4.9	131,148	8.9
Arthroscopic surgery for knee osteoarthritis	624,093	998	0.2	7,137	1.1
Cardio Testing					
Stress testing for stable coronary disease	1,019,358	6,914	0.7	142,122	13.9
PCI with balloon angioplasty or stent placement for stable coronary disease	1,019,358	3,471	0.3	13,557	1.3
IVC filters to prevent pulmonary embolism	5,242,301	1,423	0.03	1,423	0.03
Renal artery angioplasty or stenting	3,195,350	182	0.01	1,128	0.04
Carotid endarterectomy in asymptomatic patients	5,242,301	37	0.001	1,467	0.03
Abbreviations: VACC, VA Community Care; EEG, electroencephalogram; CAD, coronary artery disease; CT, computerized tomography; CKD, chronic kidney disease; PFT, pulmonary function testing; BMD, bone mineral density; PCI, percutaneous coronary intervention; IVC, inferior vena cava					

eTable 5. Changes in Detection of Low-Value Service Use Delivered by VA facilities when Integrating VA and Medicare Data to Identify Veterans Satisfying the Specific Criteria for each Low-Value Health Service

Low-Value Health Service	Count per 100 Veterans		Absolute Change in Low-Value Health Service Use
	(VA data alone) ^a	(VA + Medicare Data) ^b	
Cancer Screening			
PSA testing for men aged ≥75 y	5.8	5.4	-0.4
Colorectal cancer screening for adults aged ≥75 y	0.1	0.1	0.0
Cervical cancer screening for women aged ≥65	0.1	0.1	0.0
Cancer screening for patients with ESRD	0.04	0.05	0.01
<i>Total</i>	6.1	5.7	-0.4
Imaging			
Imaging for patients with nonspecific low back pain	2.3	2.3	0
Screening for carotid artery disease in asymptomatic adults	0.1	0.1	0
Head imaging for uncomplicated headache	0.8	0.8	0
Head imaging for syncope	0.2	0.2	0
CT of the sinuses for uncomplicated acute rhinosinusitis	0.1	0.1	0
Screening for carotid artery disease for syncope	1.5	1.5	0
Imaging for diagnosis of plantar fasciitis	0.1	0.1	0
EEG for headaches	0.02	0.03	0.01
<i>Total</i>	5.3	5.2	-0.1
Diagnostic and Preventive Testing			
PTH measurement for patients with stage 1-3 CKD	1.5	1.5	0
1,25-dihydroxyvitamin D testing in the absence of hypercalcemia or decreased kidney function	0.5	0.5	0
Total or free T3 level testing for patients with hypothyroidism	0.4	0.5	0.1
Homocysteine testing for CVD disease	0.1	0.1	0
BMD testing at frequent intervals	0.1	0.1	0
Hypercoagulability testing for patients with deep vein thrombosis	0.05	0.05	0
<i>Total</i>	2.7	2.8	0.1
Preoperative Testing			

Preoperative chest radiography	2.0	2.1	0.1
Preoperative echocardiography	0.2	0.3	0.1
Preoperative stress testing	0.2	0.2	0
Preoperative PFT	0.1	0.1	0
<i>Total</i>	2.5	2.6	0.1
Other Procedures			
Spinal injection for low-back pain	0.8	0.8	0
Arthroscopic surgery for knee osteoarthritis	0.01	0.01	0
<i>Total</i>	0.9	0.9	0
Cardiovascular Testing and Procedures			
Stress testing for stable coronary disease	0.1	0.1	0
PCI with balloon angioplasty or stent placement for stable coronary disease	0.03	0.03	0
IVC filters to prevent pulmonary embolism	0.01	0.01	0
Renal artery angioplasty or stenting	0.001	0.002	0.001
Carotid endarterectomy in asymptomatic patients	0.001	0.001	0
<i>Total</i>	0.1	0.1	0
Grand Total	17.5	17.3	-0.2
<p><u>Abbreviations:</u> EEG, electroencephalogram; CAD, coronary artery disease; CT, computerized tomography; CKD, chronic kidney disease; PFT, pulmonary function testing; BMD, bone mineral density; PCI, percutaneous coronary intervention; IVC, inferior vena cava</p> <p>a. VA data includes sociodemographic characteristics, medical comorbidities, as well as health service use data for services provided directly by VA facilities derived from the VA Corporate Data Warehouse (CDW). VA Program Integrity Tool (PIT) and fee basis file data was used to capture the use of health services delivered in VA Community Care (VACC) programs.</p> <p>b. Medicare Data includes diagnosis and procedure codes compiled from the Medicare Outpatient and Carriers files</p>			