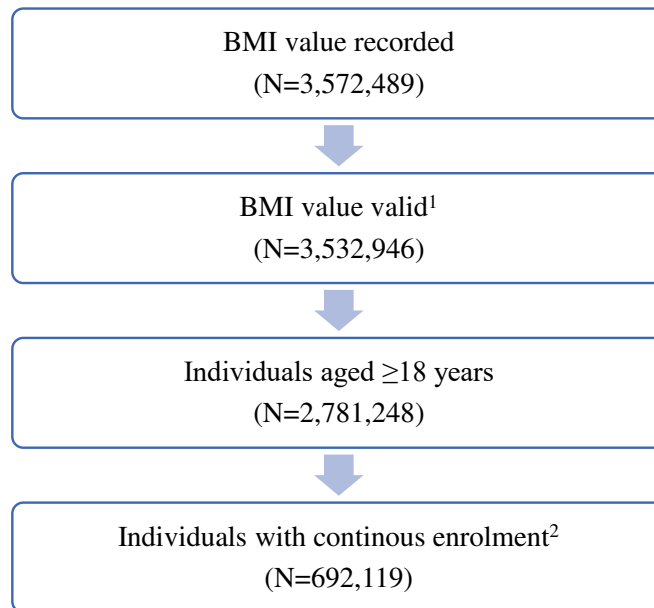


**Supplemental data**

<b>Title</b>	Applying Machine Learning Approaches to Predict Obesity Risk using US Health Administrative Claims Database
<b>Authors</b>	Casey Kar-Chan Choong <sup>1</sup> , Alan Brnabic <sup>1</sup> , Chanadda Chinthammit <sup>1</sup> , Meena Ravuri <sup>1</sup> , Kendra Terrell <sup>1</sup> , Hong Kan <sup>1</sup>
<b>Affiliation</b>	1. Eli Lilly and Company, 893 S Delaware St., Indianapolis, IN 46225, USA
<b>Corresponding author</b>	Casey Kar-Chan Choong

**Supplemental Figure 1: Cohort Attrition**

BMI: Body mass index; N, number of patients

<sup>1</sup> BMI value valid refers to values between 15 and 99 kg/m<sup>2</sup>

<sup>2</sup> Individuals who were commercially insured or covered under a Medicare Supplemental plan with continuous enrolment during the baseline period (i.e., 12 months prior to, or on the index date).

**Supplemental Table 1: Hyperparameters of the machine learning models.**

<b>Models</b>	<b>Hyperparameters</b>
XGBoost Model	Learning Rate: 0.05, Max Depth: 10, Number of Estimators: 500, Min Child Weight: 1, Gamma: 5, Column Subsample Ratio by Tree: 0.5, No. of Features: 479
Logistic Regression Model	Alpha: 0.01, Lambda: 0.0091, No. of Features: 458
Random Forest Model	Number of Estimators: 1000, Max Depth: 10, Min Samples Leaf: 5, No. of Features: 478
LASSO Model	Lambda: 0.0076, No. of Features: 58

LASSO: Least Absolute Shrinkage and Selection Operator; XGBoost: Extreme Gradient Boosting

**Supplemental Table 2: Coding of obesity-related diagnoses in the claims data by measured BMI as recorded in the EMR from 2013-2019.**

		Obesity Based on BMI in EMR		
		Yes	No	Total
Obesity Based on Claim Diagnosis	Yes	84,967 (TP)	11,460 (FP)	96,427
	No	191,679 (FN)	404,013 (TN)	595,692
	Total	276,646	415,473	692,119

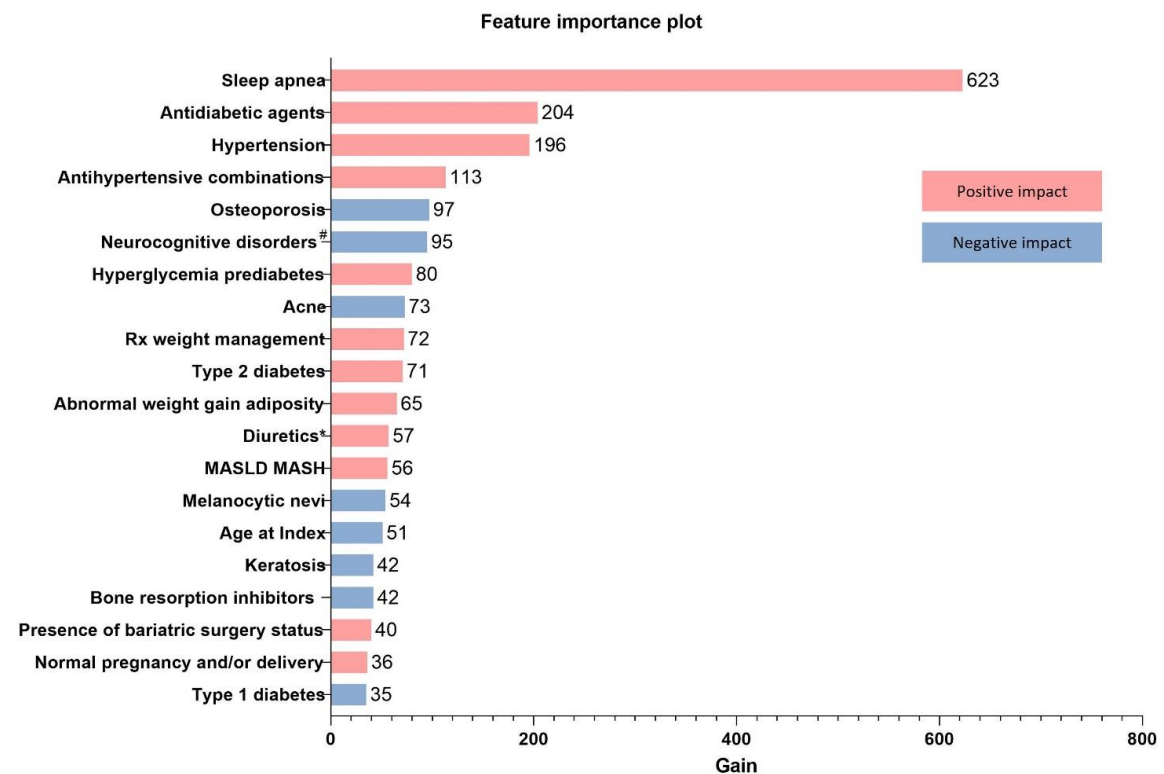
BMI: Body Mass Index; EMR: Electronic Medical Record; FN: False Negatives; FP: False Positives; TN: True Negatives; TP: True Positives; PPV: positive predictive value; NPV: negative predictive value;

- Sensitivity =  $TP/(TP+FN) = 0.31$
- Specificity =  $TN/(TN+FP) = 0.97$
- PPV =  $TP/(TP+FP) = 0.88$
- NPV =  $TN/(TN+FN) = 0.68$

**Supplemental Table 3: Model performance on binary target of 30 kg/m<sup>2</sup> in test set**

<b>Model Type</b>	<b>No. of Features</b>	<b>AUC (%)</b>	<b>Average Precision (%)</b>	<b>Brier Score</b>	<b>PPV(%)</b>	<b>Sensitivity (%)</b>	<b>Precision (%)</b>	<b>Youden Index (%)</b>	<b>F1 Score</b>	<b>NPV (%)</b>	<b>Specificity (%)</b>
<b>XGBoost Model</b>	479	79.3	75.3	0.174	73.5	61.5	68.7	43.0	0.649	76.2	81.5
<b>Reg Logistic Model</b>	458	76.4	71.4	0.187	71.5	59.9	65.5	39.0	0.626	74.9	79.2
<b>Logistic Model</b>	481	76.3	71.3	0.187	71.4	60.0	65.4	39.0	0.626	74.9	79.0
<b>Random Forest Model</b>	478	76.1	72.0	0.198	71.9	57.4	67.3	38.9	0.619	74.3	81.5
<b>LASSO Model</b>	58	75.3	70.7	0.194	72.1	53.7	69.3	37.7	0.605	73.3	84.3

AUC: area under curve; LASSO: least absolute shrinkage and selection operator; PPV: positive predictive value; NPV: negative predictive value; XGBoost: extreme gradient boosting

**Supplemental Figure 2: Top 20 features identified from retraining XGBoost without a baseline obesity diagnosis**

Gain is the relative contribution of the corresponding feature to the model. All features were captured at baseline, except when indicated as index.

\*Diuretics include bumetanide, mannitol, furosemide, torsemide

<sup>#</sup>Neurocognitive disorders include delirium, dementia, amnesic, and other cognitive disorders

MASLD, metabolic dysfunction-associated steatotic liver disease; MASH, metabolic dysfunction-associated steatohepatitis

**Supplemental Table 4: Features importance**

<b>Feature</b>	<b>Rank</b>	<b>Gain</b>
Number of obesity diagnoses	1	692
Obesity diagnosis from inpatient settings	2	384
Sleep apnea	3	331
Overweight	4	141
Hypertension	5	130
Antidiabetic agents	6	126
Antihypertensive combinations	7	113
Underweight	8	82
Obesity ER visit	9	68
Type 2 Diabetes	10	67
Osteoporosis	11	53
Acne	12	46
Melanocytic Nevi	13	39
Diuretics	14	39
Examinations encounter	15	37
Age at Index	16	37
Neurocognitive disorders	17	32
Hyperglycemia prediabetes	18	31
Bone resorption inhibitors	19	29
MASLD MASH	20	28
Abnormal weight gain adiposity	21	27
Type 1 Diabetes	22	24
Normal pregnancy and/or delivery	23	23
Fluid and electrolyte disorders	24	23
Transportation - patient, provider, equipment	25	22
Keratosi	26	22
Pathology	27	22
Smoking	28	21
Sex hormones	29	21
Forceps, vacuum, and breech delivery	30	20
Angiotensin converting enzyme inhibitors	31	18
Antigout agents	32	18
Upper respiratory combinations	33	18
Rx Weight Management	34	17
Bariatric surgery status	35	17
Pleurisy; pneumothorax; pulmonary collapse	36	17
Constipation	37	17

Feature	Rank	Gain
Alcohol-related disorders	38	16
Antiviral agents	39	16
Analgesics	40	16
Eye disorders	41	16
Needles & Syringes	42	15
Diseases of arteries; arterioles; and capillaries	43	15
Bronchodilators	44	15
Antihyperlipidemic agents	45	15
Fetal monitoring	46	14
Cerebrovascular disease	47	14
Angiotensin II inhibitors	48	14
Antihyperuricemic agents	49	14
Complications during labor	50	14
Number of Unique Diagnosis	51	14
Diseases of the heart	52	13
Antitussives	53	13
Aldosterone receptor antagonists	54	13
Anesthesia	55	13
CNS stimulants	56	13
Arthrocentesis	57	13
Number of Inpatient visits	58	13
Gender: FEMALE	59	13
Adrenal cortical steroids	60	13
Other gastrointestinal disorders	61	12
Anxiolytics, sedatives, and hypnotics	62	12
Respiratory infections	63	12
Viscosupplementation agents	64	12
Non-traumatic joint disorders	65	12
Skin and subcutaneous tissue infections	66	12
Other diagnostic procedures (interview, evaluation, consultation)	67	12
Proton pump inhibitors	68	12
Excision of semilunar cartilage of knee	69	12
Gout and other crystal arthropathies	70	12
Other endocrine disorders	71	12
Beta-adrenergic blocking agents	72	11
Vaginal preparations	73	11
Asthma	74	11
Charlson comorbidity index	75	11
Dyslipidemia	76	11
Thyroid hormones	77	11



Feature	Rank	Gain
Calcium channel blocking agents	78	11
General anesthetics	79	11
Gender: MALE	80	11
Other bone disease and musculoskeletal deformities	81	11
Weight Gain Antidepressant	82	10
Other gastrointestinal cancer	83	10
Diagnostic Tests	84	10
5-alpha-reductase inhibitors	85	10
Anemia	86	10
Other procedures to assist delivery	87	10
Ophthalmologic and otologic diagnosis and treatment	88	10
Mammography	89	10
Cancer of skin	90	10
Maintenance chemotherapy; radiotherapy	91	10
Muscle relaxants	92	10
Fractures	93	10
Mouth and throat products	94	9
Arthroplasty knee	95	9
Other vascular catheterization, not heart	96	9
Weight Management Procedure	97	9
Complications mainly related to pregnancy	98	9
Inotropic agents	99	9
Diagnostic ultrasound of heart (echocardiogram)	100	9
Vitamins medications	101	9
Urinary anti-infectives	102	9
DME and supplies	103	9
Anxiety disorders	104	9
Other complications of birth; puerperium affecting management of mother	105	9
Depression	106	9
Diseases of veins and lymphatics	107	9
Otic preparations	108	9
Immunostimulants	109	9
Radiologic adjuncts	110	9
CT scan chest	111	9
Diseases of female genital organs	112	8
Substance-related disorders	113	8
Electrocardiogram	114	8
Physical therapy exercises, manipulation, and other procedures	115	8
Antineoplastic hormones	116	8
Other respiratory therapy	117	8

Feature	Rank	Gain
Diagnostic physical therapy	118	8
Other non-OR therapeutic procedures on musculoskeletal system	119	8
Complications	120	8
Routine chest X-ray	121	8
Viral infection	122	8
Anticoagulants	123	8
Urinary antispasmodics	124	8
Diseases of male genital organs	125	8
Other fracture and dislocation procedure	126	8
Laboratory - Chemistry and Hematology	127	8
Pancreatic disorders (not diabetes)	128	8
CT scan head	129	8
Antiplatelet agents	130	8
Heart Failure	131	8
Symptoms; signs; and ill-defined conditions	132	8
Immunizations and screening for infectious disease	133	8
Hereditary and degenerative nervous system conditions	134	8
Other Laboratory	135	8
Diseases of white blood cells	136	8
Secondary malignancies	137	8
Cancer of bronchus; lung	138	8
Other connective tissue disease	139	8
Nutritional deficiencies	140	8
Respiratory failure; insufficiency; arrest (adult)	141	8
Non-OR therapeutic procedures on skin and breast	142	8
Diabetes complications	143	8
Headache; including migraine	144	8
Other OR therapeutic procedures on respiratory system	145	8
Cholinesterase inhibitors	146	8
Miscellaneous mental disorders	147	7
Systemic lupus erythematosus and connective tissue disorders	148	7
Cardiac and circulatory congenital anomalies	149	7
Decongestants	150	7
Psychological and psychiatric evaluation and therapy	151	7
Proctoscopy and anorectal biopsy	152	7
Chronic obstructive pulmonary disease and bronchiectasis	153	7
Number of outpatient visits	154	7
Adjustment disorders	155	7
Suture of skin and subcutaneous tissue	156	7
Other diagnostic ultrasound	157	7

Feature	Rank	Gain
Neoplasms of unspecified nature or uncertain behavior	158	7
Abdominal hernia	159	7
Number of ER visit	160	7
Penicillin	161	7
Vasopressors	162	7
Attention deficit conduct and disruptive behavior disorders	163	7
Tracheoscopy and laryngoscopy with biopsy	164	7
Heart valve procedures	165	7
Weight Gain Antiepileptics	166	7
No of Unique MULTUM level 2	167	7
Diagnostic bronchoscopy and biopsy of bronchus	168	7
Ear conditions	169	7
Epilepsy; convulsions	170	7
Biliary tract disease	171	7
Ophthalmic preparations	172	7
Antihistamines	173	7
Microscopic examination (bacterial smear, culture, toxicology)	174	7
Home Health Services	175	7
Mycoses	176	7
Anticonvulsants	177	7
Diagnostic cardiac catheterization; coronary arteriography	178	7
Laxatives	179	7
Excision of skin lesion	180	7
Other procedures to assist delivery	181	7
Electrographic cardiac monitoring	182	7
Immunity disorders	183	7
Diseases of the urinary system	184	7
Other lower respiratory disease	185	7
Antidepressants	186	7
Cholecystectomy and common duct exploration	187	7
Minerals and electrolytes medication	188	7
Glucose Monitoring Test Supplies	189	7
Weight Gain Antipsychotic	190	7
Functional bowel disorder agents	191	7
Other gastrointestinal diagnostic procedures	192	7
Other OR gastrointestinal therapeutic procedures	193	7
Magnetic resonance imaging	194	7
Chronic ulcer of skin	195	7
Indications for care in pregnancy; labor; and delivery	196	7
Factors influencing health care	197	7

Feature	Rank	Gain
Radiocontrast agents	198	7
Mammogram	199	7
Cancer chemotherapy	200	7
Laminectomy, excision intervertebral disc	201	7
Upper gastrointestinal X-ray	202	7
Repair of current obstetric laceration	203	7
Disorders of teeth and jaw	204	7
Diagnostic procedures on nose, mouth and pharynx	205	7
Other hernia repair	206	7
Malignant neoplasm without specification of site	207	7
Aromatase inhibitors	208	7
Joint disorders and dislocations; trauma-related	209	7
Benign neoplasms	210	7
Antiemetic/antivertigo agents	211	7
Cancer of breast	212	7
Other diagnostic procedures on lung and bronchus	213	7
5-aminosalicylates	214	7
Diseases of mouth; excluding dental	215	7
Catecholamine vasopressors	216	7
Other non-OR therapeutic cardiovascular procedures	217	7
Dermatological agents	218	7
Other therapeutic ear procedures	219	7
Other OR procedures on vessels other than head and neck	220	7
Upper gastrointestinal endoscopy; biopsy	221	7
Disorders of lipid metabolism	222	7
Other therapeutic procedures	223	7
Antirheumatics	224	7
Other OR therapeutic nervous system procedures	225	7
Artificial rupture of membranes to assist delivery	226	7
Other OR lower GI therapeutic procedures	227	7
Cystic fibrosis	228	7
Upper gastrointestinal disorders	229	7
Traction, splints, and other wound care	230	7
Preprocedural exam	231	7
Other diagnostic cardiovascular procedures	232	7
Open wounds	233	7
Miscellaneous GI agents	234	7
Suicide and intentional self-inflicted injury	235	7
Cancer of uterus and cervix	236	7
Electroencephalogram	237	7

Feature	Rank	Gain
Partial excision bone	238	7
Paralysis	239	7
CT scan abdomen	240	7
Erectile dysfunction agents	241	7
Other OR procedures on vessels other than head and neck	242	7
Genitourinary congenital anomalies	243	7
Respiratory intubation and mechanical ventilation	244	7
Non-infectious gastroenteritis	245	7
Poisoning	246	7
Hysterectomy; abdominal and vaginal	247	7
Lincomycin derivatives	248	7
Liver disease	249	7
Antiparkinsonian agents	250	7
Arterio- or venogram (not heart and head)	251	7
Sprains and strains	252	7
Other bowel diagnostic procedures	253	7
Impulse control disorders not elsewhere classified	254	7
Antiseptic and germicides	255	7
Therapeutic radiology	256	6
Agents for pulmonary hypertension	257	6
Other OR therapeutic procedures on nose, mouth and pharynx	258	6
Complications	259	6
Other inflammatory condition of skin	260	6
Other upper respiratory disease	261	6
Other injuries and conditions due to external causes	262	6
Other OR gastrointestinal therapeutic procedures	263	6
Immunosuppressive agents	264	6
Extracorporeal circulation auxiliary to open heart procedures	265	6
Upper gastrointestinal endoscopy, biopsy	266	6
Crushing injury or internal injury	267	6
Miscellaneous genitourinary tract agents	268	6
Mood disorders	269	6
Contraceptive and procreative management	270	6
Antifungals	271	6
Disorders usually diagnosed in infancy childhood or adolescence	272	6
Coagulation and hemorrhagic disorders	273	6
Diagnostic ultrasound of abdomen or retroperitoneum	274	6
Antipsoriatics	275	6
Antimetabolites	276	6
Other nutritional; endocrine; and metabolic disorders	277	6

Feature	Rank	Gain
Other non-OR therapeutic procedures, female organs	278	6
Antiadrenergic agents, peripherally acting	279	6
Respiratory intubation and mechanical ventilation	280	6
Incision and drainage, skin and subcutaneous tissue	281	6
Long term insulin hypoglycemic drug	282	6
Other non-OR or closed therapeutic nervous system procedures	283	6
Other non-OR therapeutic cardiovascular procedures	284	6
Other diagnostic procedures, female organs	285	6
Antiarrhythmic agents	286	6
Excision; lysis peritoneal adhesions	287	6
Other hematologic conditions	288	6
Gastrointestinal hemorrhage	289	6
Ancillary Services	290	6
Nonoperative urinary system measurements	291	6
Colorectal cancer	292	6
Other non-OR therapeutic procedures on skin and breast	293	6
Tetracyclines	294	6
Arthroplasty	295	6
Other nervous system disorders	296	6
Percutaneous transluminal coronary angioplasty	297	6
Respiratory inhalant products	298	6
Antimalarial agents	299	6
Respiratory intubation and mechanical ventilation	300	6
Other OR therapeutic procedures on bone	301	6
Other therapeutic procedures	302	6
Other diagnostic radiology and related techniques	303	6
Other non-OR gastrointestinal therapeutic procedures	304	6
Colonoscopy and biopsy	305	6
Other non-OR lower GI therapeutic procedures	306	6
Cancer of male genital organs	307	6
Intracranial injury	308	6
Percutaneous transluminal coronary angioplasty	309	6
Macrolide derivatives	310	6
Diagnostic spinal tap	311	6
Upper gastrointestinal endoscopy; biopsy	312	6
GI stimulants	313	6
Other physical therapy and rehabilitation	314	6
Lower gastrointestinal disorders	315	6
Spondylosis; intervertebral disc disorders; other back problems	316	6
Acquired deformities	317	6

Feature	Rank	Gain
Smoking cessation agents	318	6
Spinal fusion	319	6
Thyroid disorders	320	6
Other OR therapeutic procedures on bone	321	6
Other OR therapeutic procedures on joints	322	6
Other congenital anomalies	323	6
Diagnostic cardiac catheterization, coronary arteriography	324	6
Intravenous nutritional products	325	6
Nasal preparations	326	6
Diagnostic ultrasound	327	6
Diagnostic cardiac catheterization; coronary arteriography	328	6
Cancer; other primary	329	6
Cancer of urinary organs	330	6
Treatment of fracture or dislocation	331	6
Arterial blood gases	332	6
Leukotriene modifiers	333	6
Miscellaneous antibiotics	334	6
Local injectable anesthetics	335	6
Injections and aspirations of muscles, tendons, bursa, joints and soft tissue	336	6
Prophylactic vaccinations and inoculations	337	6
Other OR upper GI therapeutic procedures	338	6
Iron products	339	6
Cancer of ovary and other female genital organs	340	6
Abnormal CV Liver Blood Findings	341	6
Visual aids and other optical supplies	342	6
H2 antagonists	343	6
Other therapeutic procedures	344	6
Injections, infusions and other forms	345	6
Amebicides	346	6
Other infections; including parasitic	347	6
Skin graft	348	6
Gastrointestinal hemorrhage	349	6
Other diagnostic procedures on skin and subcutaneous tissue	350	6
Other skin disorders	351	6
Lung disease due to external agents	352	6
Superficial injury; contusion	353	6
Other CT scan	354	6
Extracorporeal shock wave, other than urinary	355	6
Presence long term medication use	356	6
Blood transfusion	357	6

Feature	Rank	Gain
Abortion-related disorders	358	6
Other diagnostic nervous system procedures	359	6
Radioisotope scan and function studies	360	6
Other vascular catheterization; not heart	361	6
Other diagnostic radiology and related techniques	362	6
Antianginal agents	363	6
Suture of skin and subcutaneous tissue	364	6
Cholinergic muscle stimulants	365	6
Diagnostic ultrasound of head and neck	366	6
Sulfonamides	367	6
Other OR procedures on vessels other than head and neck	368	6
Nutritional screen counselling	369	6
Other non-OR therapeutic cardiovascular procedures	370	6
Quinolones	371	6
Laminectomy; excision intervertebral disc	372	6
Cancer of lymphatic and hematopoietic tissue	373	6
Aspiration pneumonitis; food/vomitus	374	6
Endoscopy and endoscopic biopsy of the urinary tract	375	6
Insertion of catheter or spinal stimulator and injection into spinal canal	376	6
Breast biopsy and other diagnostic procedures on breast	377	6
Cardiac stress tests	378	6
Other OR therapeutic procedures on skin and breast	379	6
Abdominal swelling	380	6
Spinal fusion	381	6
Other therapeutic procedures on eyelids, conjunctiva, cornea	382	6
Other diagnostic cardiovascular procedures	383	6
Glycopeptide antibiotics	384	6
Debridement of wound, infection or burn	385	6
Physical therapy	386	6
Bacterial infection	387	6
Vitamin and mineral combinations	388	6
Other perinatal conditions	389	6
Other therapeutic procedures, hemic and lymphatic system	390	6
Other OR lower GI therapeutic procedures	391	6
Lens and cataract procedures	392	6
Liveborn	393	6
Coma; stupor; and brain damage	394	6
Other vascular catheterization; not heart	395	6
Miscellaneous mental health disorders	396	6
Cephalosporins	397	6



Feature	Rank	Gain
Nervous system congenital anomalies	398	6
Other therapeutic procedures; hemic and lymphatic system	399	6
Other therapeutic procedures on muscles and tendons	400	6
Hemodialysis	401	6
Cancer of lymphatic and hematopoietic tissue	402	6
Other intraocular therapeutic procedures	403	6
Antiadrenergic agents, centrally acting	404	6
Antipsychotics	405	6
Conversion of cardiac rhythm	406	6
Schizophrenia and other psychotic disorders	407	6
Vasodilators	408	6
Cystoscopy and other transurethral procedures	409	6
Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator	410	6
Excision; lysis peritoneal adhesions	411	6
Digestive congenital anomalies	412	6
Intestinal infection	413	6
Extracorporeal circulation auxiliary to open heart procedures	414	6
Hearing devices and audiology supplies	415	6
Blood transfusion	416	6
Incision of pleura; thoracentesis; chest drainage	417	6
Cesarean section	418	6
Percutaneous transluminal coronary angioplasty	419	6
Other non-OR or closed therapeutic nervous system procedures	420	6
Diabetes mellitus with complications	421	6
Magnetic resonance imaging	422	6
Laminectomy; excision intervertebral disc	423	6
Cholecystectomy and common duct exploration	424	6
Indwelling catheter	425	6
Antidiarrheals	426	6
Colonoscopy and biopsy	427	6
Personality disorders	428	6
Diagnostic bronchoscopy and biopsy of bronchus	429	6
Other diagnostic radiology and related techniques	430	6
Abdominal paracentesis	431	6
Hemodialysis	432	6
Burns	433	6
Incision of pleura; thoracentesis; chest drainage	434	6
Other therapeutic procedures on muscles and tendons	435	6
Screening and history of mental health and substance abuse codes	436	6
Coronary artery bypass graft	437	6

Feature	Rank	Gain
Gastrectomy; partial and total	438	6
Spinal cord injury	439	6
Other OR therapeutic procedures on joints	440	6
Esophageal dilatation	441	6
Artificial rupture of membranes to assist delivery	442	6
Pathological fracture	443	6
Abdominal paracentesis	444	6
Other therapeutic procedures; hemic and lymphatic system	445	6
Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator	446	6
Partial excision bone	447	6
Mammography	448	6
Colorectal resection	449	5
Central nervous system infection	450	5
Schizophrenia and other psychotic disorders	451	5
Colonoscopy and biopsy	452	5
Inactivity	453	5
Radioisotope bone scan	454	5
Blood transfusion	455	5
Other OR therapeutic nervous system procedures	456	5
CT scan	457	5
Infective arthritis and osteomyelitis (except that caused by TB or STD)	458	5
Cesarean section	459	5
Immunity disorders	460	5
Other operations on fallopian tubes	461	5
Other diagnostic procedures on musculoskeletal system	462	5
Other OR heart procedures	463	5
Developmental disorders	464	5
Other OR therapeutic procedures of urinary tract	465	5
Hypertension	466	5
Colorectal resection	467	5
Other gastrointestinal diagnostic procedures	468	5
Other non-OR therapeutic procedures on skin and breast	469	5
Prophylactic vaccinations and inoculations	470	5
Fetal monitoring	471	5
Other diagnostic procedures (interview; evaluation; consultation)	472	5
Enteral and parenteral nutrition	473	5
Other OR heart procedures	474	5
Fetal monitoring	475	5
Other non-OR therapeutic procedures; female organs	476	5
Cholecystectomy and common duct exploration	477	4

<b>Feature</b>	<b>Rank</b>	<b>Gain</b>
Short gestation; low birth weight; and fetal growth retardation	478	4
Birth trauma	479	2

CNS=Central nervous system; CT=Computed tomography; DME=Durable medical equipment; ER=Emergency room; MASLD, metabolic dysfunction-associated steatotic liver disease; MASH, metabolic dysfunction-associated steatohepatitis; GI=Gastrointestinal;; STD=Sexually transmitted disease; TB= Tuberculous