

Appendix

Table S1. The candidate features.

Feature category	Features	Notes
Patient demographics	Age [30,50,59]; gender; marital status (married, single, partnered, divorced, widowed, or separated); race; ethnicity (Hispanic or non-Hispanic); and language.	Acceptable range: Age: 40-122 years [102]. Number of features: 6.
Laboratory test	Minimum Alpha-1 antitrypsin (A1AT) level; maximum A1AT level; whether the minimum A1AT level is abnormally low; minimum arterial oxygen saturation (SaO ₂) level [69]; maximum arterial partial pressure of carbon dioxide (PaCO ₂) level; minimum PaCO ₂ level; maximum arterial partial pressure of oxygen (PaO ₂) level; minimum PaO ₂ level; maximum blood eosinophil count; maximum percentage of blood eosinophils; maximum blood neutrophil count [65,66]; maximum percentage of blood neutrophils; maximum C-reactive protein (CRP) level [64]; whether the maximum CRP level is abnormally high; maximum hematocrit (Hct) level; minimum Hct level [67]; whether the maximum Hct level is abnormally high; whether the minimum Hct level is abnormally low; maximum hemoglobin A1c (HbA1c) level; maximum hemoglobin (Hgb) level [68]; minimum Hgb level; whether the maximum Hgb level is abnormally high; whether the minimum Hgb level is abnormally low; whether an immunoglobulin E (IgE) test was performed; maximum total serum IgE level; whether the maximum total serum IgE level is abnormally high; maximum red blood cell count [63]; maximum white blood cell count [18,60]; no. of laboratory tests; no. of days from the last laboratory test; and no. of laboratory tests having abnormal results.	Number of features: 31.
Vital sign	Maximum body mass index (BMI) [70]; the relative change of BMI = (the last logged BMI / the first logged BMI - 1) × 100%; maximum diastolic blood pressure; average diastolic blood pressure; maximum heart rate [71]; average heart rate; maximum height; minimum peak expiratory flow [61]; average peak expiratory flow; minimum peripheral capillary oxygen saturation (SpO ₂) [28]; average SpO ₂ ; maximum respiratory rate; average respiratory rate; maximum systolic blood pressure; average systolic blood pressure; maximum temperature; average temperature; and the relative change of weight = (the last logged weight / the first logged weight - 1) × 100%.	Acceptable ranges: Weight: 0.26-635 kilograms [103,104]; height: 0.24-2.72 meters [105,106]; BMI: 7.5-204.0 [107,108]; systolic and diastolic blood pressure: 0-300 mm Hg; heart rate: 30-300 beats/minute; respiratory rate: 0-120; temperature: 80-110 °F; SpO ₂ : 0-100; and peak expiratory flow: 0-700 liters/minute. Number of features: 18.
Spirometry	Whether a spirometry was performed; average forced expiratory volume in 1 second (FEV ₁) [61]; minimum FEV ₁ ; average FEV ₁ percent predicted; minimum FEV ₁ percent predicted; average forced vital capacity (FVC); minimum FVC; average FEV ₁ /FVC ratio; minimum FEV ₁ /FVC ratio; whether any FEV ₁ percent predicted is <80% with a normal FEV ₁ /FVC ratio (preserved ratio impaired spirometry, PRISm); and the highest GOLD stage of COPD [3,18,30,50,60].	FEV ₁ percent predicted was computed using the Hankinson's prediction equation [109-111]. Number of features: 11.
Diagnosis	Computed based on International Classification of Diseases, Ninth Revision (ICD-9) and International Classification of Diseases, Tenth Revision (ICD-10) diagnosis codes: No. of ICD-9 and ICD-10 diagnosis codes; no. of chronic obstructive pulmonary disease (COPD) diagnoses; no. of primary or principal COPD diagnoses; no. of diagnoses of acute COPD exacerbation; no. of years from the first encounter related to COPD [50]; whether the last COPD diagnosis is a primary or principal diagnosis; no. of days from the last COPD diagnosis; no. of days from the last diagnosis of acute COPD exacerbation; no. of diagnoses of	Number of features: 62.

	<p>noncompliance with medication regimen; acquired immunodeficiency syndrome; allergic rhinitis; Alzheimer’s or Parkinson’s disease; anaphylaxis; anxiety or depression [72]; asthma; breathing abnormality like dyspnea; bronchopulmonary dysplasia; cirrhosis; cerebrovascular disease; congestive heart failure [30]; cystic fibrosis; decreased tone; dementia; diabetes without chronic complication [30]; diabetes with chronic complication; eczema; esophagitis; folate deficiency; gastroesophageal reflux [18]; gastrointestinal bleeding; gastrointestinal obstruction; gastrostomy tube; hypertension; immunoglobulin A (IgA) deficiency; increased tone; inflammatory bowel disease; ischemic heart disease [30]; lung cancer; malignancy; mental disorder; metastatic solid tumor; mild liver disease; moderate or severe liver disease; myocardial infarction; obesity; paraplegia or hemiplegia; peptic ulcer disease; peripheral vascular disease [50]; pneumonia; pregnancy; psoriasis; renal disease [30]; rheumatic disease; sleep apnea; substance use; upper respiratory tract infection; vasculitis; vitamin D deficiency; and vocal cord dysfunction.</p> <p>Computed based on ICD-9 and ICD-10 procedure and diagnosis codes: Tracheostomy.</p> <p>Computed based on Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) procedure codes: Cataract; and sinusitis.</p>	
Problem list	<p>No. of active problems; no. of active problems of COPD; no. of active problems of COPD exacerbation; no. of active problems of anxiety or depression; no. of active problems of asthma; no. of active problems of asthma with (acute) exacerbations; no. of active problems of gastroesophageal reflux disease; no. of active problems of congestive heart failure; no. of active problems of diabetes; no. of active problems of dyspnea; no. of active problems of hypertension; no. of active problems of obesity; no. of active problems of rhinitis; no. of active problems of sleep apnea; no. of active problems about smoking; no. of active problems of wheezing; and the priority of the last active problem of COPD.</p>	<p>Number of features: 17.</p>
Medication	<p>Total no. of COPD medications ordered; no. of COPD medication orders; total no. of distinct COPD medications ordered; total no. of COPD medication refills allowed; total no. of units of COPD medications ordered; no. of COPD reliever orders; total no. of medications in COPD reliever orders; total no. of distinct medications in COPD reliever orders; total no. of refills allowed for COPD relievers; total no. of units of COPD relievers ordered; no. of COPD controller orders; total no. of medications in COPD controller orders; total no. of distinct medications in COPD controller orders; total no. of refills allowed for COPD controllers; total no. of units of COPD controllers ordered; whether a nebulizer was used; no. of nebulizer medication orders; total no. of medications in nebulizer medication orders; total no. of distinct medications in nebulizer medication orders; total no. of refills allowed for nebulizer medications; total no. of units of nebulizer medications ordered; whether a spacer was used; no. of medication orders; total no. of medications ordered; total no. of distinct medications ordered; total no. of units of medications ordered; total no. of medication refills allowed; total no. of short-acting muscarinic antagonists (SAMA) ordered; total no. of refills allowed for SAMA; total no. of units of SAMA ordered; total no. of inhaled corticosteroids (ICS) ordered; total no. of refills allowed for ICS; total no. of units of ICS ordered; total no. of short-acting beta-2 agonists (SABA) ordered; total no. of refills allowed for SABA; total no. of units of SABA ordered; total no. of</p>	<p>COPD medication categories [3,112]:</p> <ul style="list-style-type: none"> • Short-term relievers: systemic corticosteroid [50]; short-acting muscarinic antagonist (SAMA) [50]; short-acting beta-2 agonist (SABA); SABA and SAMA combination; and mucolytic agent. • Long-term controllers: inhaled corticosteroid (ICS); long-acting muscarinic antagonist (LAMA); long-acting beta-2 agonist (LABA); LABA and LAMA combination; ICS and LABA combination; ICS, LABA, and LAMA combination; methylxanthine; anti-interleukin-5; anti-interleukin-5 receptor; and phosphodiesterase-4 inhibitor (PDE-4). <p>Number of features: 52.</p>

	systemic corticosteroid ordered; total no. of refills allowed for systemic corticosteroids; total no. of units of systemic corticosteroids ordered; total no. of long-acting beta-2 agonists (LABA) ordered; total no. of refills allowed for LABA; total no. of units of LABA ordered; total no. of long-acting muscarinic antagonists (LAMA) ordered; total no. of refills allowed for LAMA; total no. of units of LAMA ordered; total no. of phosphodiesterase-4 inhibitors (PDE-4) ordered; total no. of refills allowed for PDE-4; total no. of units of PDE-4 ordered; total no. of ICS and LABA combinations ordered; total no. of ICS, LABA, and LAMA combinations ordered; total no. of LABA and LAMA combinations ordered; and total no. of SABA and SAMA combinations ordered.	
Insurance	Computed based on the end of the index year: whether the patient had any private insurance; whether the patient had any public insurance; and whether the patient was paid by oneself or a charity.	Number of features: 3.
Encounter	No. of all types of encounters; no. of major encounters for COPD [28,50]; no. of outpatient visits; no. of outpatient visits with a primary diagnosis of COPD; no. of emergency department (ED) visits; average length of stay of an ED visit; no. of ED visits related to COPD [28]; no. of inpatient stays; total length of inpatient stays; average length of an inpatient stay; no. of inpatient stays related to acute COPD exacerbation or respiratory failure; no. of encounters related to acute COPD exacerbation or respiratory failure [18,60]; no. of outpatient visits to the patient's primary care provider (PCP); no. of admissions to the intensive care unit; admission type of the most emergent encounter (elective, urgent, emergency, or trauma); admission type of the last encounter (elective, urgent, emergency, or trauma); type of the last encounter (ED visit, outpatient visit, or inpatient stay); type of the first encounter (ED visit, outpatient visit, or inpatient stay) related to COPD in the data set; length of stay of the last ED visit; no. of ED visits in the past 6 months; no. of inpatient stays in the past 6 months; and no. of major encounters for COPD in the past 6 months.	A major encounter for COPD was defined as an ED visit having a COPD diagnosis code, an inpatient stay having a COPD diagnosis code, or an outpatient visit having a primary diagnosis of COPD. All else being equal and compared with a patient with only outpatient visits with COPD as a secondary diagnosis, a patient with ≥ 1 major encounter for COPD is more likely to have severe COPD exacerbations in the future. Number of features: 22.
Visit status and appointment scheduling	The day of the week when the last ED visit started; the last encounter's discharge disposition location (home, left against medical advice, or other non-home location); no. of times of leaving against medical advice; no. of no shows; no. of cancelled appointments; no. of days since the last inpatient stay; no. of days since the last outpatient visit; no. of days since the last outpatient visit on COPD; no. of days since the last ED visit; no. of days since the last ED visit on COPD [62]; the shortest time between making the request and the actual visit among all occurred encounters; no. of days between making the request and the actual visit of the last encounter; no. of visits having same day appointments; and whether the last inpatient stay came from the ED.	Number of features: 14.
Patient's care continuity degree	No. of distinct medication prescribers; no. of distinct COPD medication prescribers; no. of distinct providers seen in outpatient visits; no. of distinct PCPs of the patient; and no. of distinct ED locations the patient went to (including inpatient stays admitted from the ED).	Number of features: 5.
Procedure	No. of CPT and HCPCS procedure codes; no. of ICD-10 and ICD-9 procedure codes; no. of CPT procedure codes of the fractional exhaled nitric oxide test; no. of CPT procedure codes of spirometry; no. of HCPCS procedure codes of home oxygen therapy; no. of CPT and HCPCS procedure codes of influenza vaccination; and whether mechanical ventilation was recorded using ICD-10 and ICD-9 procedure codes.	Number of features: 7.
Allergy	No. of the patient's allergies; indicator of food allergy; indicator of drug or material allergy; indicator of environmental allergy; the greatest severity of the patient's food allergies; the greatest severity of the	Number of features: 7.

	patient's drug or material allergies; and the greatest severity of the patient's environmental allergies.	
Social behavior history	Whether the patient was last recorded as a current smoker; whether the patient was last recorded as a former smoker; the last recorded no. of packs of cigarettes the patient consumed per day; the average no. of packs of cigarettes the patient consumed per day across all of the records; no. of years the patient had smoked for based on the last record; whether the patient was ever documented of consuming alcohol; whether the patient consumed alcohol based on the last record; the last recorded no. of fluid ounces of alcohol the patient consumed per week; the average no. of fluid ounces of alcohol the patient consumed per week across all of the records; the last recorded no. of alcohol drinks the patient consumed per week; the average no. of alcohol drinks the patient consumed per week across all of the records; whether the patient took any illicit drug based on the last record; whether the patient was ever documented of taking any illicit drug; the last recorded no. of times the patient took illicit drugs per week; and the average no. of times the patient took illicit drugs per week across all of the records.	Number of features: 15.
Provider	The PCP's type (physician, nurse, physician assistant, or other); whether the PCP is a resident; the PCP's clinician title (Doctor of Medicine, registered nurse, physician assistant, or other); the PCP's age; whether the patient and the PCP are of the same gender; no. of years for which the PCP had practiced at the UWM; no. of patients with COPD of the PCP; and the percentage of the PCP's patients with COPD in the pre-index year having severe COPD exacerbations in the index year.	A patient's current PCP was defined as the patient's PCP known at the last outpatient visit. Number of features: 8.

Table S2. The features employed in the final model in the main analysis and their importance values.

Rank	Feature	Importance value in % based on the feature's apportioned contribution to the model
1	Number of days since the last diagnosis code of acute COPD exacerbation	8.384
2	Number of COPD diagnoses	5.287
3	Number of diagnoses of acute COPD exacerbation	5.107
4	Number of days since the last ED visit	4.851
5	Number of major encounters	4.583
6	Number of primary or principal COPD diagnoses	3.571
7	Number of days since the last COPD diagnosis code	2.249
8	Average SpO ₂	2.016
9	Maximum body mass index	2.003
10	Number of ED visits	1.947
11	Number of ED visits in the past 6 months	1.900
12	Number of years from the first encounter related to COPD	1.846
13	Whether the patient is married	1.659
14	Number of days since the last ED visit related to COPD	1.534
15	Average length of stay of an ED visit	1.521
16	Average respiratory rate	1.275
17	Number of CPT procedure codes	1.128
18	Average heart rate	1.056
19	Total number of distinct medications ordered	1.013
20	Number of no shows	0.994
21	Minimum SpO ₂	0.990
22	Average temperature	0.965
23	Whether the first COPD diagnosis was given at an outpatient visit	0.951
24	Number of encounters related to acute COPD exacerbation or respiratory failure	0.928

25	Number of days between making the request and the actual visit of the last encounter	0.864
26	Whether the patient is Hispanic	0.834
27	Number of days since the last laboratory test	0.802
28	Whether the admission type of the most emergent encounter was elective	0.758
29	Number of medication orders	0.748
30	Total number of distinct medications in COPD reliever orders	0.708
31	Whether the admission type of the most emergent encounter was emergency	0.703
32	Relative change of body mass index	0.661
33	Number of ICD-9 and ICD-10 diagnosis codes	0.658
34	Number of days since the last outpatient visit	0.656
35	Maximum heart rate	0.649
36	Day of the week when the last ED visit started	0.631
37	Breathing abnormality like dyspnea	0.582
38	Relative change of weight	0.580
39	Total number of COPD medication refills allowed	0.557
40	Maximum red blood cell count	0.548
41	Maximum temperature	0.546
42	Maximum height	0.540
43	Maximum Hgb level	0.537
44	Maximum white blood cell count	0.534
45	Total number of units of long-acting muscarinic antagonists ordered	0.530
46	Average diastolic blood pressure	0.516
47	Total number of distinct medications in COPD medication orders	0.499
48	Average systolic blood pressure	0.493
49	Age	0.468
50	Maximum eosinophil count	0.467
51	Total number of units of medications ordered	0.466
52	Average length of an inpatient stay	0.463
53	Total number of medications ordered	0.460
54	The shortest time between making the request and the actual visit among all occurred encounters	0.457
55	Number of days since the last outpatient visit on COPD	0.454
56	Number of COPD medication orders	0.439
57	Number of nebulizer medication orders	0.434
58	Maximum neutrophil count	0.434
59	Whether the patient is a black or an African American	0.421
60	Maximum percentage of eosinophils	0.419
61	Number of major encounters in the past 6 months	0.414
62	Maximum systolic blood pressure	0.400
63	Number of years the patient had smoked for based on the last record	0.399
64	Number of laboratory tests	0.379
65	Maximum percentage of neutrophils	0.374
66	Average number of packs of cigarettes the patient smoked per day across all of the records	0.368
67	Number of ED visits related to COPD	0.364
68	Number of active problems	0.360
69	Length of stay of the last ED visit	0.354
70	Total number of medication refills allowed	0.354
71	Maximum respiratory rate	0.349
72	Maximum diastolic blood pressure	0.341
73	Total number of units of COPD controllers ordered	0.335
74	Minimum Hgb level	0.332
75	Total length of inpatient stays	0.322
76	Number of outpatient visits to the PCP	0.318
77	Maximum PaO ₂	0.312

78	Minimum Hct	0.301
79	Total number of refills allowed for COPD controllers	0.299
80	Total number of medications in nebulizer medication orders	0.298
81	Total number of short-acting beta-2 agonists ordered	0.296
82	Whether the first COPD diagnosis was given at an ED visit	0.295
83	Number of CPT and HCPCS procedure codes of influenza vaccination	0.291
84	Number of laboratory tests with abnormal results	0.288
85	The last recorded number of packs of cigarettes the patient consumed per day	0.288
86	Whether the patient was last recorded as a current smoker	0.283
87	Total number of long-acting muscarinic antagonists ordered	0.269
88	Number of distinct medication prescribers	0.268
89	Total number of long-acting beta-2 agonists ordered	0.260
90	Number of cancelled appointments	0.259
91	Whether the patient is a white	0.257
92	Maximum Hct	0.249
93	Total number of units of COPD medications ordered	0.223
94	Maximum HbA1c	0.223
95	Total number of refills allowed for long-acting muscarinic antagonists	0.223
96	Total number of COPD medications ordered	0.222
97	Total number of refills allowed for inhaled corticosteroids	0.219
98	Number of same day appointments	0.213
99	Priority of the last active problem of COPD	0.212
100	Number of all types of encounters	0.211
101	Total number of units of COPD relievers ordered	0.211
102	Total number of refills allowed for long-acting beta-2 agonists	0.209
103	Whether the patient's PCP is a Doctor of Medicine	0.208
104	Total number of inhaled corticosteroid and long-acting beta-2 agonist combinations ordered	0.206
105	Number of COPD controller orders	0.195
106	Number of COPD reliever orders	0.194
107	Total number of distinct medications in nebulizer medication orders	0.187
108	Number of distinct ED locations the patient went to (including inpatient stays admitted from the ED)	0.187
109	Maximum CRP	0.185
110	Whether the last encounter was an ED visit	0.185
111	Total number of inhaled corticosteroids ordered	0.184
112	Number of ICD-10 and ICD-9 procedure codes	0.172
113	Total number of units of short-acting muscarinic antagonists ordered	0.172
114	Total number of units of nebulizer medications ordered	0.172
115	Minimum PaCO ₂	0.172
116	Whether the last encounter's discharge disposition location was home	0.170
117	Total number of refills allowed for short-acting beta-2 agonists	0.169
118	Total number of short-acting muscarinic antagonists ordered	0.165
119	Number of active problems about smoking	0.163
120	Number of days since the last inpatient stay	0.162
121	Number of distinct COPD medication prescribers	0.161
122	Total number of distinct medications in COPD controller orders	0.148
123	The greatest severity of the patient's drug or material allergies	0.143
124	Total number of units of inhaled corticosteroids ordered	0.143
125	Number of active problems of COPD	0.140
126	Total number of short-acting beta-2 agonist and short-acting muscarinic antagonist combinations ordered	0.137
127	Total number of units of short-acting beta-2 agonists ordered	0.132
128	Total number of systemic corticosteroids ordered	0.128

129	Number of outpatient visits	0.126
130	Whether the last COPD diagnosis was a primary or principal diagnosis	0.121
131	Number of patients with COPD of the PCP	0.120
132	Average number of fluid ounces of alcohol the patient consumed per week across all of the records	0.116
133	Number of allergies	0.116
134	Age of the PCP	0.113
135	Total number of medications in COPD controller orders	0.109
136	Total number of medications in COPD reliever orders	0.109
137	The last recorded number of alcohol drinks the patient consumed per week	0.108
138	Whether the patient was paid by oneself or a charity on the last day	0.107
139	The last recorded number of fluid ounces of alcohol the patient consumed per week	0.106
140	Whether the patient is divorced	0.095
141	Whether the patient was last recorded as a former smoker	0.093
142	Whether the patient is widowed	0.093
143	Average number of alcohol drinks the patient consumed per week across all of the records	0.092
144	Minimum SaO ₂	0.087
145	The percentage of the PCP's patients with COPD in the pre-index year having severe COPD exacerbations in the index year	0.087
146	Whether the patient's PCP is a physician	0.087
147	Whether the patient had any private insurance on the last day	0.085
148	Number of CPT procedure codes of spirometry	0.084
149	Total number of refills allowed for COPD relievers	0.082
150	Total number of units of long-acting beta-2 agonists ordered	0.080
151	Number of active problems of hypertension	0.079
152	Total number of refills allowed for short-acting muscarinic antagonists	0.078
153	Whether the patient took any illicit drug based on the last record	0.078
154	Number of inpatient stays related to acute COPD exacerbation or respiratory failure	0.076
155	Whether the patient is single	0.074
156	Minimum PaO ₂	0.074
157	Number of active problems of sleep apnea	0.073
158	Whether the patient had any public insurance on the last day	0.072
159	Peripheral vascular disease	0.071
160	Number of distinct providers seen in outpatient visits	0.070
161	Upper respiratory tract infection	0.068
162	Substance use	0.065
163	Whether a nebulizer was used	0.065
164	Whether the patient has any material or drug allergy	0.061
165	Whether the patient used a spacer	0.059
166	Number of distinct PCPs of the patient	0.058
167	Maximum PaCO ₂	0.057
168	Number of outpatient visits with a primary diagnosis of COPD	0.057
169	Total number of refills allowed for nebulizer medications	0.057
170	Number of inpatient stays	0.054
171	Congestive heart failure	0.054
172	Whether the patient consumed alcohol based on the last record	0.054
173	Dementia	0.051
174	Whether the patient is an Asian	0.049
175	Total number of units of systemic corticosteroids ordered	0.048
176	Mental disorder	0.046
177	Number of inpatient stays in the past 6 months	0.045
178	Whether the patient was ever documented of consuming alcohol	0.043
179	Cerebrovascular disease	0.041
180	Whether the patient was ever documented of taking any illicit drug	0.039

181	Metastatic solid tumor	0.038
182	Whether the last inpatient stay came from the ED	0.038
183	Number of active problems of diabetes	0.036
184	Number of active problems of anxiety/depression	0.034
185	Hypertension	0.033
186	Renal disease	0.033
187	Number of active problems of acute COPD exacerbation	0.030
188	Obesity	0.029
189	Whether the maximum Hgb was abnormally high	0.027
190	Number of active problems of gastroesophageal reflux disease	0.027
191	Gastroesophageal reflux	0.027
192	Asthma	0.026
193	Whether the patient speaks English	0.025
194	Myocardial infarction	0.023
195	Total number of refills allowed for systemic corticosteroids	0.022
196	Whether the patient is a female	0.020
197	Whether the patient is separated from the spouse	0.020
198	Diabetes without chronic complication	0.020
199	Whether the last encounter was an inpatient stay	0.020
200	Whether the minimum Hct was abnormally low	0.019
201	Whether the admission type of the last encounter was elective	0.018
202	Whether the maximum Hct was abnormally high	0.017
203	Average peak expiratory flow rate	0.016
204	Whether the patient had undergone mechanical ventilation	0.016
205	Lung cancer	0.016
206	Whether the patient is a Native Hawaiian or an other Pacific Islander	0.015
207	Mild liver disease	0.014
208	Cirrhosis	0.014
209	Hemiplegia or paraplegia	0.014
210	Number of diagnoses of noncompliance with medication regimen	0.013
211	Pneumonia	0.013
212	Whether the patient's PCP's title is nurse	0.013
213	Ischemic heart disease	0.013
214	Acquired immunodeficiency syndrome	0.013
215	Whether the patient has any environmental allergy	0.011
216	Vitamin D deficiency	0.011
217	Number of active problems of congestive heart failure	0.010
218	The last recorded number of times the patient took illicit drugs per week	0.010
219	Malignancy	0.008
220	Number of active problems of dyspnea	0.008
221	Number of active problems of asthma	0.008
222	Gastrointestinal bleeding	0.008
223	Average number of times the patient took illicit drugs per week across all of the records	0.008
224	Cataract	0.007
225	Diabetes with chronic complication	0.006
226	Number of active problems of rhinitis	0.006
227	Whether the minimum Hgb was abnormally low	0.006
228	Number of active problems of obesity	0.005
229	Allergic rhinitis	0.004

We used the `xgb.save()` function in the `xgboost` package of R to save our final XGBoost model to a file in binary format. This file is available at http://faculty.washington.edu/luogang/COPD_care_model_UW.

Abbreviations:

A1AT: Alpha-1 antitrypsin
BMI: body mass index
COPD: chronic obstructive pulmonary disease
CPT: Current Procedural Terminology
CRP: C-reactive protein
ED: emergency department
FEV₁: forced expiratory volume in 1 second
FVC: forced vital capacity
HCPCS: Healthcare Common Procedure Coding System
Hct: hematocrit
HbA1c: hemoglobin A1c
Hgb: hemoglobin
ICD-10: International Classification of Diseases, Tenth Revision
ICD-9: International Classification of Diseases, Ninth Revision
ICS: inhaled corticosteroid
IgA: immunoglobulin A
IgE: immunoglobulin E
LABA: long-acting beta-2 agonist
LAMA: long-acting muscarinic antagonist
PaCO₂: arterial partial pressure of carbon dioxide
PaO₂: arterial partial pressure of oxygen
PCP: primary care provider
PDE-4: phosphodiesterase-4 inhibitor
SABA: short-acting beta-2 agonist
SAMA: short-acting muscarinic antagonist
SaO₂: arterial oxygen saturation
SpO₂: peripheral capillary oxygen saturation

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