

Supplementary materials

Table S1. Read codes to define COPD

Read code	Medical code	Clinical event	Read term
66YM.00	11287	382901	Chronic obstructive pulmonary disease annual review
H3...00	1001	338812	Chronic obstructive pulmonary disease
H3...11	998	205995	Chronic obstructive airways disease
66YB.00	9520	161278	Chronic obstructive pulmonary disease monitoring
H312200	1446	153677	Acute exacerbation of chronic obstructive airways disease
66Yf.00	28743	81666	Number of COPD exacerbations in past year
H36..00	10863	52387	Mild chronic obstructive pulmonary disease
H3z..00	5710	50568	Chronic obstructive airways disease NOS
H3y1.00	7884	48220	Chron obstruct pulmonary dis wth acute exacerbation, unspec
H37..00	10802	46111	Moderate chronic obstructive pulmonary disease
66YL.00	18621	45740	Chronic obstructive pulmonary disease follow-up
H32..00	794	44748	Emphysema
66YL.11	18476	30033	COPD follow-up
H31..00	3243	24068	Chronic bronchitis
H38..00	9876	21178	Severe chronic obstructive pulmonary disease
8H2R.00	11019	11033	Admit COPD emergency
66Yd.00	19106	5350	COPD accident and emergency attendance since last visit
66Ye.00	19003	4720	Emergency COPD admission since last appointment
H31z.00	15157	3461	Chronic bronchitis NOS

66YB000	102685	1499	Chronic obstructive pulmonary disease 3 monthly review
66YB100	103007	1470	Chronic obstructive pulmonary disease 6 monthly review
140X.00	96931	1448	At risk of chronic obstructive pulmonary disease exacerbation
H39..00	93568	1355	Very severe chronic obstructive pulmonary disease
H312100	14798	1157	Emphysematous bronchitis
H3y..00	12166	1113	Other specified chronic obstructive airways disease
H312.00	27819	1014	Obstructive chronic bronchitis
H32z.00	33450	862	Emphysema NOS
H3z..11	37247	794	Chronic obstructive pulmonary disease NOS
H310.00	25603	560	Simple chronic bronchitis
H320.00	26306	410	Chronic bullous emphysema
66Yi.00	46036	390	Multiple COPD emergency hospital admissions
14B3.12	103494	363	History of chronic obstructive pulmonary disease
H311.00	11150	309	Mucopurulent chronic bronchitis
8BP8.00	100123	152	Antibiotic therapy for acute pulmonary exacerbation
H320z00	23492	77	Chronic bullous emphysema NOS
H312z00	44525	64	Obstructive chronic bronchitis NOS
H32yz00	16410	54	Other emphysema NOS
H32y.00	40788	47	Other emphysema
Hyu3100	65733	47	[X]Other specified chronic obstructive pulmonary disease
H311000	40159	45	Purulent chronic bronchitis
H310z00	61118	33	Simple chronic bronchitis NOS

H311z00	61513	25	Mucopurulent chronic bronchitis
H313.00	24248	24	Mixed simple and mucopurulent chronic bronchitis
H3A..00	104608	22	End stage chronic obstructive airways disease
H31y.00	66043	18	Other chronic bronchitis
H31yz00	68066	15	Other chronic bronchitis NOS
H320200	60188	14	Giant bullous emphysema
H320000	56860	10	Segmental bullous emphysema
H320100	68662	10	Zonal bullous emphysema
H3y..11	67040	7	Other specified chronic obstructive pulmonary disease

Table S2. Read codes to define pneumonia

Read code	Medical code	Clinical event	Read term
H25..11	16287	1.368	chest infection - unspecified bronchopneumonia
H26..11	19400	517	chest infection - pneumonia due to unspecified organism
H22..11	22795	452	chest infection - other bacterial pneumonia
H20..11	9389	304	chest infection - viral pneumonia
H270.11	29457	131	chest infection - influenza with pneumonia
H21..11	29166	71	chest infection - pneumococcal pneumonia
H23..11	30653	62	chest infection - pneumonia organism OS
H2B..00	104121	1.358	community acquired pneumonia
H26..00	572	152.581	pneumonia due to unspecified organism
H23..00	25694	1.404	pneumonia due to other specified organisms
H231.00	1576	3.638	pneumonia due to mycoplasma pneumoniae
H223.00	12423	781	pneumonia due to streptococcus
H224.00	5612	416	pneumonia due to staphylococcus
H22y200	12061	568	pneumonia - legionella
H23z.00	34251	320	pneumonia due to specified organism NOS
H201.00	31269	240	pneumonia due to respiratory syncytial virus
H220.00	23546	202	pneumonia due to klebsiella pneumoniae
H221.00	30591	170	pneumonia due to pseudomonas
H222.00	37881	97	pneumonia due to haemophilus influenzae
H202.00	36675	36	pneumonia due to parainfluenza virus
H22y.00	50867	79	pneumonia due to other specified bacteria
H200.00	67836	30	pneumonia due to adenovirus
H223000	63858	22	pneumonia due to streptococcus, group B
H222.11	48804	19	pneumonia due to haemophilus influenzae

H22y100	45425	2	pneumonia due to proteus
H22y000	65419	12	pneumonia due to escherichia coli
Hyu0B00	98381	13	{X} pneumonia due to other specified infectious organisms
H22y011	60299	6	e. coli pneumonia
H233.00	17025	107	chlamydial pneumonia
A022200	58896	16	salmonella pneumonia
A54x400	47973	12	herpes cimplex pneumonia
H25..00	886	81.043	bronchopneumonia due to unspecified organism
H21..00	1849	33.743	lobar (pneumococcal) pneumonia
H260.00	9639	9.071	lobar pneumonia due to unspecified organism
H261.00	3683	8.061	basal pneumonia due to unspecified organism
H232.00	73735	3	pneumonia due to pleuropneumonia like organisms
H2z..00	6094	25.862	pneumonia or influenza NOS
H2...00	10086	11.512	pneumonia and influenza
H270.00	15912	369	influenza with pneumonia
H270z00	35745	55	influenza with pneumonia NOS
H270100	62632	7	influenza with pneumonia, influenza virus identified
H2y..00	11849	4.971	other specified pneumonia or influenza
H28..00	5324	6.049	atypical pneumonia
H20..00	5202	4.455	viral pneumonia
H20z.00	14976	2.153	viral pneumonia NOS
H20y.00	33478	154	viral pneumonia NEC
Hyu0800	52520	12	{X} other viral pneumonia
H22z.00	23095	2.636	bacterial pneumonia NOS
H22yz00	43884	233	pneumonia due to bacteria NOS
H22..00	28634	1.402	other bacterial pneumonia
Hyu0A00	63763	17	{X} other bacterial pneumonia

A3By.00	41721	14	other specified bacterial infection
H56y100	4910	998	interstitial pneumonia
H24y200	27519	137	pneumonia with pneumocystis carinii
H24y700	23726	107	pneumonia with varicella
H243.00	30437	107	pneumonia with whooping cough
H24..00	40498	105	pneumonia with infectious diseases EC
H24y.00	69782	11	pneumonia with other infectious diseases EC
H24yz00	70559	4	pneumonia with other infectious diseases EC NOS
H24z.00	66362	7	pneumonia with infectious diseases EC NOS
H243.11	35082	86	pneumonia with pertussis
H246.00	34274	45	pneumonia with aspergillosis
H24y000	61623	40	pneumonia with actinomycosis
H26000	8318	3.513	Lung consolidation
H263.00	38065	893	Pneumonitis, unspecified
A521.00	25462	417	Varicella pneumonitis
H240.00	41034	135	pneumonia with measles
A551.00	32172	94	postmeasles pneumonia
H530300	35189	67	abscess of lung with pneumonia
H22yx00	52384	3	pneumonia due to other aerobic gram-negative bacteria

Table S3. Read codes to define smoking

Read code	Pegasus code	Clinical event	Read term
1371.00	33	6470929	Never smoked tobacco
137..00	54	2502551	Tobacco consumption
137L.00	60	2304618	Current non-smoker
137S.00	90	3052739	Ex smoker
137P.00	93	2676385	Cigarette smoker
137K.00	776	229539	Stopped smoking
1376.00	1822	21119	Very heavy smoker - 40+cigs/d
137P.11	1823	248966	Smoker
1374.00	1878	306129	Moderate smoker - 10-19 cigs/d
SM7z.11	2758	4192	Smoke inhalation
1375.00	3568	180120	Heavy smoker - 20-39 cigs/day
900..12	7130	31688	Stop smoking monitoring admin.
8CAL.00	7622	2065441	Smoking cessation advice
67A3.00	10184	1096	Pregnancy smoking advice
13p..00	10211	66778	Smoking cessation milestones
137R.00	10558	298165	Current smoker
8HTK.00	10742	28366	Referral to stop-smoking clinic
9N2k.00	11356	80957	Seen by smoking cessation advisor
9N4M.00	11527	12018	DNA - Did not attend smoking cessation clinic
1371.11	11788	486937	Non-smoker
137G.00	12240	122363	Trying to give up smoking
137T.00	12878	22138	Date ceased smoking
1372.11	12941	63145	Occasional smoker
137..11	12942	29304	Smoker - amount smoked

137J.00	12943	44369	Cigar smoker
1373.00	12944	192364	Light smoker - 1-9 cigs/day
137M.00	12945	44090	Rolls own cigarettes
137F.00	12946	184203	Ex-smoker - amount unknown
137H.00	12947	42546	Pipe smoker
137Q.11	12951	4825	Smoking restarted
137Q.00	12952	5262	Smoking started
9001.00	12953	34338	Attends stop smoking monitor.
ZV4K000	12954	77	[V]Tobacco use
1379.00	12955	102459	Ex-moderate smoker (10-19/day)
137A.00	12956	63329	Ex-heavy smoker (20-39/day)
1378.00	12957	67388	Ex-light smoker (1-9/day)
1372.00	12958	45508	Trivial smoker - < 1 cig/day
137B.00	12959	14127	Ex-very heavy smoker (40+/day)
137Z.00	12960	5648	Tobacco consumption NOS
1377.00	12961	17473	Ex-trivial smoker (<1/day)
137Y.00	12963	3136	Cigar consumption
137C.00	12964	6648	Keeps trying to stop smoking
137X.00	12965	2300	Cigarette consumption
137V.00	12966	2268	Smoking reduced
137a.00	12967	4160	Pipe tobacco consumption
8H7i.00	18573	52913	Referral to smoking cessation advisor
67H1.00	18926	2697	Lifestyle advice regarding smoking
900A.00	19485	8032	Stop smoking monitor.chck done
1370.00	19488	2476	Ex cigar smoker
900Z.00	21637	6887	Stop smoking monitor admin.NOS
137N.00	26470	4026	Ex pipe smoker
900..00	28834	15149	Anti-smoking monitoring admin.

137c.00	30423	2733	Thinking about stopping smoking
137d.00	30762	5336	Not interested in stopping smoking
137b.00	31114	4532	Ready to stop smoking
900..11	32083	1482	Stop smoking clinic admin.
E251.00	32687	2802	Tobacco dependence
137W.00	32973	117	Chews tobacco
13p0.00	34126	24577	Negotiated date for cessation of smoking
13p5.00	38112	6814	Smoking cessation programme start date
9003.00	40417	725	Stop smoking monitor default
9002.00	40418	2940	Refuses stop smoking monitor
8CAg.00	41042	333	Smoking cessation advice provided by community pharmacist
137e.00	41979	358	Smoking restarted
9004.00	42722	10208	Stop smoking monitor 1st lettr
137g.00	46300	2262	Cigarette pack-years
137f.00	46321	36	Reason for restarting smoking
13WK.00	52503	230	No smokers in the household
9007.00	53101	490	Stop smoking monitor verb.inv.
9008.00	58597	395	Stop smoking monitor phone inv
9005.00	60720	159	Stop smoking monitor 2nd lettr
137h.00	62686	1277	Minutes from waking to first tobacco consumption
9009.00	63901	15	Stop smoking monitoring delete
9006.00	66387	17	Stop smoking monitor 3rd lettr
E251z00	68658	242	Tobacco dependence NOS
E251100	70746	12	Tobacco dependence, continuous
E251300	72706	115	Tobacco dependence in remission
745H.00	74907	12882	Smoking cessation therapy
745H000	81440	1883	Nicotine replacement therapy using

			nicotine patches
745H200	85247	375	Nicotine replacement therapy using nicotine inhalator
745H100	85975	222	Nicotine replacement therapy using nicotine gum
745H300	89464	98	Nicotine replacement therapy using nicotine lozenges
745Hz00	90522	261	Smoking cessation therapy NOS
745Hy00	91708	38	Other specified smoking cessation therapy
745H400	94958	214	Smoking cessation drug therapy
E251000	95610	2	Tobacco dependence, unspecified

Table S4. Stratum-specific risk of CAP in patients with COPD compared to matched controls, stratified by age, gender and smoking status

	CAP	IR ^a		Age and gender adjusted HR (95% CI)	Fully adjusted HR (95% CI) ^b
	N = 7 730	COPD	non-COPD		
Non-COPD	3 911		6.75	reference	reference
COPD	3 819	32.00		4.67 (4.47-4.89)	4.51 (4.27-4.77)
By age (years) ^c					
40-59	817	28.03	5.40	5.39 (4.89-5.94)	4.97 (4.40-5.62)
60-79	2 234	30.06	6.29	4.67 (4.41-4.96)	4.48 (4.16-4.82)
80+	768	48.30	11.75	3.93 (3.56-4.33)	4.08 (3.61-4.60)
By gender ^d					
Males	1 939	29.50	6.18	4.49 (4.21-4.78) ^f	4.52 (4.19-4.89) ^g
Females	1 880	36.69	7.39	4.90 (4.60-5.22) ^f	4.61 (4.25-5.00) ^g
By smoking status ^e					
Never	509	39.51	6.40	5.47 (4.98-6.01)	5.25 (4.75-5.80) ^h
Current	1 758	34.03	7.82	4.86 (4.59-5.14)	4.94 (4.65-5.26) ^h
Former	1 552	28.31	6.78	4.28 (4.03-4.54)	4.26 (4.00-4.55) ^h

^aIR/1000 person-years. ^bAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery

disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease, chronic liver disease and smoking. ^cNon-COPD of the same age category as reference. ^dNon-COPD of the same gender as reference. ^eNon-COPD with the same smoking status as reference. ^fAdjusted for age. ^gAdjusted for age, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease, chronic liver disease and smoking. ^hAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease and chronic liver disease.

Abbreviations: CAP, community acquired pneumonia; COPD, chronic obstructive pulmonary disease; IR, incidence rate; HR, hazard ratio; ICS, inhaled corticosteroids.

Table S5. Risk of CAP in patients with COPD, stratified by age, gender, smoking status and the level of airflow obstruction

	CAP N = 3 819	IR^a	Age and gender adjusted HR (95% CI)	Fully adjusted HR (95% CI)^b
By age (years)				
40-59	817	28.03	reference	reference
60-79	2 234	30.06	2.16 (1.91-2.45)	2.26 (2.00-2.57)
80+	768	48.30	6.18 (4.99-7.66)	6.06 (4.86-7.55)
By gender				
Males	1 939	29.50	reference	reference
Females	1 880	36.69	1.31 (1.23-1.39) ^c	1.30 (1.22-1.39) ^d
By smoking status				
Never	509	39.51	reference	reference
Current	1 758	34.03	0.87 (0.78-0.96)	0.92 (0.82-1.02) ^e
Former	1 552	28.31	0.77 (0.70-0.86)	0.81 (0.73-0.90) ^e
By FEV₁				
≥80 %pred.	355	12.68	reference	reference
≥50 - <80 %pred.	627	12.72	0.93 (0.81-1.06)	0.93 (0.82-1.06)
≥30 - <50 %pred.	266	14.33	1.03 (0.87-1.20)	1.09 (0.93-1.29)
<30 %pred.	61	17.70	1.21 (0.92-1.59)	1.30 (0.98-1.73)

^aIR/1000 person-years. ^bAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease, chronic liver disease and smoking. ^cAdjusted for age. ^dAdjusted for age, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease, chronic liver disease and smoking. ^eAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease and chronic liver disease. **Abbreviations:** CAP, community acquired pneumonia; COPD, chronic obstructive pulmonary disease; IR, incidence rate; HR, hazard ratio; FEV₁, forced expiratory volume in 1 second; %pred., percentage of predicted; ICS, inhaled corticosteroids.

Table S6. Risk of CAP in patients with COPD, stratified by the level of airflow obstruction within each smoking category

	CAP N = 3 819	IR^a	Age and gender adjusted HR (95% CI)	Fully adjusted HR (95% CI)^b
Never smoking	509			
≥80 %pred.	46	12.15	reference	reference
≥50 - <80 %pred.	73	15.86	1.22 (0.96-1.56)	1.17 (0.81-1.70)
≥30 - <50 %pred.	29	21.87	1.57 (1.08-2.27)	1.61 (1.01-2.56)
<30 %pred.	3	16.21	1.23 (0.40-3.84)	1.40 (0.44-4.51)
Current smoking	1 758			
≥80 %pred.	158	14.58	reference	reference
≥50 - <80 %pred.	267	12.65	0.86 (0.75-0.99)	0.81 (0.67-0.99)
≥30 - <50 %pred.	113	13.45	0.93 (0.77-1.13)	0.91 (0.71-1.16)
<30 %pred.	31	19.65	1.32 (0.92-1.89)	1.30 (0.88-1.93)
Former smoking	1 552			
≥80 %pred.	151	11.29	reference	reference
≥50 - <80 %pred.	287	12.17	0.95 (0.83-1.09)	0.99 (0.81-1.21)
≥30 - <50 %pred.	124	14.04	1.05 (0.87-1.28)	1.16 (0.91-1.48)
<30 %pred.	27	16.04	1.11 (0.76-1.64)	1.21 (0.79-1.85)

^aIR/1000 person-years. ^bAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease and chronic liver disease. **Abbreviations:** CAP, community acquired pneumonia; COPD, chronic obstructive pulmonary disease; IR, incidence rate; HR, hazard ratio; %pred., percentage of predicted; ICS, inhaled corticosteroids.

Table S7. Risk of CAP in matched control subjects, stratified by age, gender and smoking status

	CAP N = 3 911	IR ^a	Fully adjusted HR (95% CI) ^b
By age (years)			
40-59	819	5.40	reference
60-79	2221	6.29	2.54 (2.23-2.90)
80+	871	11.75	8.85 (7.10-11.00)
By gender			
Males	1890	6.18	reference
Females	2021	7.39	1.26 (1.18-1.35) ^c
By smoking status			
Never	2003	6.40	reference
Current	1130	7.82	1.07 (0.99-1.16) ^d
Former	778	6.78	1.23 (1.13-1.34) ^d

^aIR/1000 person-years. ^bAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease, chronic liver disease and smoking. ^cAdjusted for age, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease, chronic liver disease and smoking. ^dAdjusted for age, gender, BMI, antipsychotics, acid suppressants, immunosuppressants, influenza vaccination, pneumococcal vaccination, ICS, coronary artery disease, heart failure, diabetes mellitus, cerebrovascular disease, dementia, malignancy, chronic renal disease and chronic liver disease.

Abbreviations: CAP, community acquired pneumonia; COPD, chronic obstructive pulmonary disease; IR, incidence rate; HR, hazard ratio; ICS, inhaled corticosteroids.