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Validation of chronic obstructive pulmonary disease recording in the Clinical Practice Research Datalink (CPRD-GOLD)

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ABSTRACT

Objectives: The optimal method of identifying people with chronic obstructive pulmonary disease (COPD) from electronic primary care records is not known. We assessed the accuracy of different approaches using the Clinical Practice Research Datalink, a UK electronic health record database.

Setting: 951 participants registered with a CPRD practice in the UK between 1 January 2004 and 31 December 2012. Individuals were selected for ≥1 of 8 algorithms to identify people with COPD. General practitioners were sent a brief questionnaire and additional evidence to support a COPD diagnosis was requested. All information received was reviewed independently by two respiratory physicians whose opinion was taken as the gold standard.

Primary outcome measure: The primary measure of accuracy was the positive predictive value (PPV), the proportion of people identified by each algorithm for whom COPD was confirmed.

Results: 951 questionnaires were sent and 738 (78%) returned. After quality control, 696 (73.2%) patients were included in the final analysis. All four algorithms including a specific COPD diagnostic code performed well. Using a diagnostic code alone, the PPV was 86.5% (77.5–92.3%) while requiring a diagnosis plus spirometry plus specific medication; the PPV was slightly higher at 89.4% (80.7–94.5%) but reduced case numbers by 10%. Algorithms without specific diagnostic codes had low PPVs (range 12.2–44.4%).

Conclusions: Patients with COPD can be accurately identified from UK primary care records using specific diagnostic codes. Requiring spirometry or COPD medications only marginally improved accuracy. The high accuracy applies since the introduction of an incentivised disease register for COPD as part of Quality and Outcomes Framework in 2004.

Strengths and limitations of this study

- We have shown that the presence of a specific chronic obstructive pulmonary disease (COPD) Read code alone is sufficient to identify patients with COPD from electronic health records. Minimal precision lost by not including spirometry and medications in the algorithm allows an increase in the number of individuals who can potentially be included in a study by up to 10%.
- We were able to investigate the accuracy of algorithms when identifying patients with COPD within the CPRD, and the accuracy of the actual general practitioner diagnosis of COPD.
- The amount of missing data among the responding questionnaires was low, suggesting reasonable data quality.
- Although the overall response rate for this study was acceptable (77.6%), the proportion of questionnaires accompanied by additional evidence allowing for adjudication was lower.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) represents an enormous health burden worldwide. Currently, COPD is the fourth leading cause of death and is predicted to become the third by 2020.[1] There are approximately 835 000 people diagnosed with COPD in the UK and an estimated 2 200 000 people remain undiagnosed.[2 3]

Electronic health records in the UK provide an excellent resource in which to study COPD as they offer a large cohort size, the presence of disease severity indicators and long-term follow-up information on a patient's integrated medical history. Although multiple studies have been undertaken to investigate various aspects of COPD over the past 10 years in several electronic health record databases, there is no standard definition used to identify COPD in large databases and codelists used to identify patients with COPD vary by author. Over 10 years ago, the diagnosis of COPD was validated in the Clinical Practice Research Datalink-Global initiative for Chronic

Obstructive Lung Disease (CPRD-GOLD, formerly GPRD) using OXMIS codes.[4] This coding system is now obsolete in CPRD and Read codes are used as the standard.

There is no single diagnostic test for COPD. The diagnosis of COPD relies on clinical judgement based on a combination of history, physical examination and confirmation of the presence of airflow obstruction using spirometry.[5] When retrospectively evaluating the accuracy of a COPD diagnosis, commonly used COPD definitions may misclassify patients as having COPD. Using multiple diagnostic codes in combination with pharmacy may improve the accuracy of identification of patients with COPD.[6] Further, over the past 10 years, the definition of COPD in clinical practice has evolved, leading to changes in how COPD is diagnosed and the diagnosis recorded. With the introduction of the Quality and Outcomes Framework (QOF) codes for COPD in 2004 in England and Wales, there are more codes available to identify COPD then there were previously. QOF is a voluntary incentive scheme for primary care physicians (general practitioners, GPs) in the UK which contains indicators against which GP practices can score points and hence be rewarded for how well they care for patients.[7] Evaluation of airflow limitation using spirometry is used as the standard to confirm COPD diagnosis and severity of COPD is part of the patient with annual COPD review.[3 8] However, even spirometry, if incorrectly performed or interpreted, can lead to misdiagnosis (both overdiagnosis and underdiagnosis of COPD) in approximately 20% of cases. It is also recognised that some subgroups of individuals (eg, women and individuals under 50 and over 80) are less likely to have spirometry measured.[8]

This study aimed to improve our ability to identify patients with COPD within electronic health records. We used the CPRD, a widely used collection of computerised medical records, which is commonly used for clinical and research purposes. CPRD is comparable to other electronic health record databases used in the UK. Our objective was to test the accuracy of different definitions of COPD in the CPRD using the positive predictive value (PPV), by comparing the database records with additional information provided by GPs. This work is important for epidemiological research in COPD and diseases where COPD is an important comorbidity as well as for clinical practice.

METHODS

Data set

CPRD is the world's largest validated computerised database of anonymised longitudinal medical records for primary care.[9 10] Data comprise approximately 14 million patients with around 5.4 million of these being currently alive and registered from 660 primary care practices spread throughout the UK. Records are derived from a widely used GP software system and contain complete prescribing and coded diagnostic and clinical information as well as information on tests requested, laboratory results and referrals made at or following on from each consultation.[11]

Codelists and algorithms

Lists of medical codes (Read codes) specific and non-specific for COPD were created prior to the study initiation. Read codes are a hierarchical clinical coding system of over 80 000 terms that are used in general practice in the UK and are entered by the GP into Vision Software.[12] These data are then uploaded by CPRD after they have been processed, quality checked and added to the CPRD database for research use. Specific COPD codes consisted of codes listing either COPD or COPD-specific entities of emphysema (see online supplementary material for specific codes included). Non-specific codes consisted of a variety of lung diseases that could potentially be COPD, for example, chronic bronchitis. Combinations of codelists and additional material in the form of the presence of spirometry or COPD medications (see online supplementary material) were used to make up the eight algorithms. The first four definitions required a specific COPD diagnosis code, with the first three requiring additional documentation (eg, medication and/or spirometry). The other four definitions required non-specific bronchitis or respiratory symptom codes, with the least specific definition requiring only respiratory symptom codes. Details regarding each algorithm can be found in the online supplementary material. Briefly, the eight algorithms were defined as follows, from the expected most specific to most sensitive construct:

1. Specific COPD code and more than one prescription of a COPD medication and presence of spirometry (*COPD Code+spirometry+COPD medication*);
2. Specific COPD code and presence of spirometry (*COPD Code+spirometry*);
3. Specific COPD code and more than one prescription of a COPD medication (*COPD Code+COPD medication*)
4. Specific COPD code only (*COPD Code only*);
5. Non-specific bronchitis code and more than one prescription of a COPD medication (*Bronchitis+COPD medication*);
6. Non-specific bronchitis code only (*Bronchitis only*);
7. Respiratory symptoms and presence of spirometry. Respiratory symptoms consisted of persistent cough, sputum production or dyspnoea (*Symptoms +spirometry*);
8. Respiratory symptom definition only (*Symptoms only*).

The presence of spirometry for inclusion in the algorithm was based on the existence of a record of a specific value or a Read code for spirometry rather than an examination of the actual value. We were able to assess the interpretation of spirometry in the subset of patients who had flow volume loops or clinic letters attached and where the actual forced expiratory volume in 1 s and forced vital capacity values were available in CPRD.

Study population

The study population consisted of a random sample of individuals selected from all participants registered in CPRD with the cohort entry being on or after 1 January 2004. At cohort entry, people included had to be: over 35 years old, with at least 1 year historical data, and a possible diagnosis of COPD defined as evidence of having ever smoked and a record of at least one specific or possible COPD code or respiratory symptoms suggestive of COPD. The presence of the algorithms was ascertained during a period between patient cohort entry and 31 December 2012. Patients had to be alive within 4 months of the last collection date of CPRD data for the January 2013 data build for inclusion in the analysis so that CPRD could access their medical records and additional information. For the main analysis, a patient could contribute to one algorithm only. It was possible for an individual to be eligible for more than one algorithm depending on the codes used in their medical record over the study period. Individuals were randomly selected from the algorithm with the fewest number of participants first and then removed from the cohort so that they could not be selected for another algorithm.

CPRD mailed a short, structured questionnaire to GPs in charge of randomly selected patients requesting confirmation of COPD status as well as any available specific information from the individual's medical record including spirometry printouts and hospital respiratory outpatient letters (see online supplementary material). Data were 'twice encrypted' within CPRD to ensure anonymity, first between practices and CPRD and second from CPRD to researchers. In the questionnaire, the GP was asked whether or not the patient had a diagnosis of COPD, what that diagnosis was based on, whether or not the patient had seen a respiratory physician and if they had, whether there were any other respiratory diagnoses. A pilot set of 20 questionnaires were sent to GPs to assess the quality of the questionnaire. In total, 951 questionnaires were sent out, assuming an 80% response rate.

Primary outcome

The primary outcome was identification of a diagnosis of COPD according to the predefined eight algorithms. The gold standard for the diagnosis of COPD was the decision made after respiratory physicians independently reviewed the evidence from the GP (questionnaire response with or without additional evidence). Where they did not agree, a third independent physician decided. Additionally, GP diagnosis of COPD was validated in a subset of patients where the GP provided supportive information including spirometry printouts and hospital letters. This also allowed a review of spirometry interpretation in some cases. Although we used two respiratory physicians independently as the gold standard for diagnosing COPD, this was done by reviewing the questionnaire sent to the GP (see appendix) as well as any additional information the GP sent which supported that diagnosis. This supporting information ranged from free text in the GP database to spirometry printouts done in the GP surgery to letters from secondary care. Therefore, we were not solely relying on information from secondary care to make the diagnosis unless the GP decided to share that information. In this way, we were able to include and validate the diagnosis of COPD in people who were not seen in secondary care.

Analysis

The primary analysis focused on the accuracy of identification of a COPD diagnosis in each of the predefined algorithms as defined by the PPV, that is, the proportion of 'true positives' (individuals with COPD) in each algorithm as determined by the gold standard. In addition, within each algorithm, where additional information was provided (lung function, hospital clinic letters), we calculated the accuracy of the GP diagnosis of COPD relative to the gold standard. This allowed a review of spirometry interpretation in some cases.

We assessed the impact of commonly occurring comorbidities on the accuracy of the prespecified algorithms stratifying for cardiovascular comorbidity, previous asthma diagnosis, smoking status and, where possible, GOLD staging of airflow limitation severity.[13] Cardiovascular comorbidity included angina, history of myocardial infarction, previous coronary artery bypass graft/percutaneous coronary intervention or heart failure, but not hypertension due to its lack of overlap of symptoms that could mimic COPD. All covariates for stratification analysis were derived from information available up to cohort entry.

As a post hoc analysis, individuals were eligible to be placed into multiple algorithms where possible, and the PPV was calculated for all individuals who had a specific COPD code compared with those with a specific COPD code and additional information (either spirometry or a COPD medication).

Assessment of possible trends in COPD diagnosis recording were also evaluated, including temporal trends in codes used and diagnostic specificity from 2004 to 2011. In addition, we compared our specific COPD codes with those recommended for use by QOF (see online supplementary material)[14 15]: H31% (excluding H3101 (smoker's cough), H31y0 (chronic tracheitis) and H3122 (acute exacerbation of COPD)) and H32% H36-H3z (excluding H3y0 and H3y1).

Sample size calculation

Our sample size for each algorithm was chosen to achieve accuracy of the true positives or the PPV ±0.08 based on the reviewing physician's judgement as the gold standard. Assuming an estimated PPV of 0.85 for any one algorithm, we required a sample of at least 77 individuals in each algorithm to achieve the desired accuracy (95% CI ±0.08). All analyses were performed using STATA V.13.

RESULTS

Nine hundred and fifty-one questionnaires were sent to GPs (see figure 1 for patient selection). Of those, 738 (77.6%) were returned, 704 (74.0%) met quality control standards and were not duplicates and 696 (73.2%) could be included in the final analysis (8 had 'uncertain' COPD diagnosis and no supporting documentation and were therefore excluded).

Among those included in the final analysis, additional evidence for the diagnosis of COPD was available for 272 patients. This represented 39.1% of the total study population, or 67.7% of the 402 patients with a confirmed COPD diagnosis in the study.

Overall, irrespective of the qualifying algorithm, 402 patients (57.8%) were considered to have a diagnosis of COPD based on the reviewing physician judgement. Table 1 shows the characteristics of the 696 patients included in the final analysis who were considered to possibly have COPD based on the inclusion criteria. On average, patients were in their mid-60s to early 70s across all algorithms. Approximately two-thirds of them were current smokers and one-quarter had a history of asthma. Generally, there were fewer patients with supporting information and cardiovascular comorbidity in the less specific algorithms (4–8).

The number of patients diagnosed with COPD confirmed by the gold standard and the PPV for each algorithm is given in table 2. The PPV was greatest for algorithms 1–4. Further data are available in the online supplementary material regarding the effect of comorbidities (see online supplementary table S1), smoking status (see online supplementary table S2) and GOLD staging (see online supplementary table S3) on the performance of each algorithm.

In a subset of 272 patients where additional evidence was available (in the form of spirometry printouts or hospital outpatient letters), we assessed accuracy of GP diagnosis of COPD. Overall, the PPV in this group was 95% (91.1–97.2). This is broken down by the algorithm in table 3. While the presence of supporting evidence improved the PPV in each group, algorithms 1–4 were still most accurate.

Post hoc analysis

We repeated the analysis allowing individuals to be put into more than one algorithm and tested the PPV of

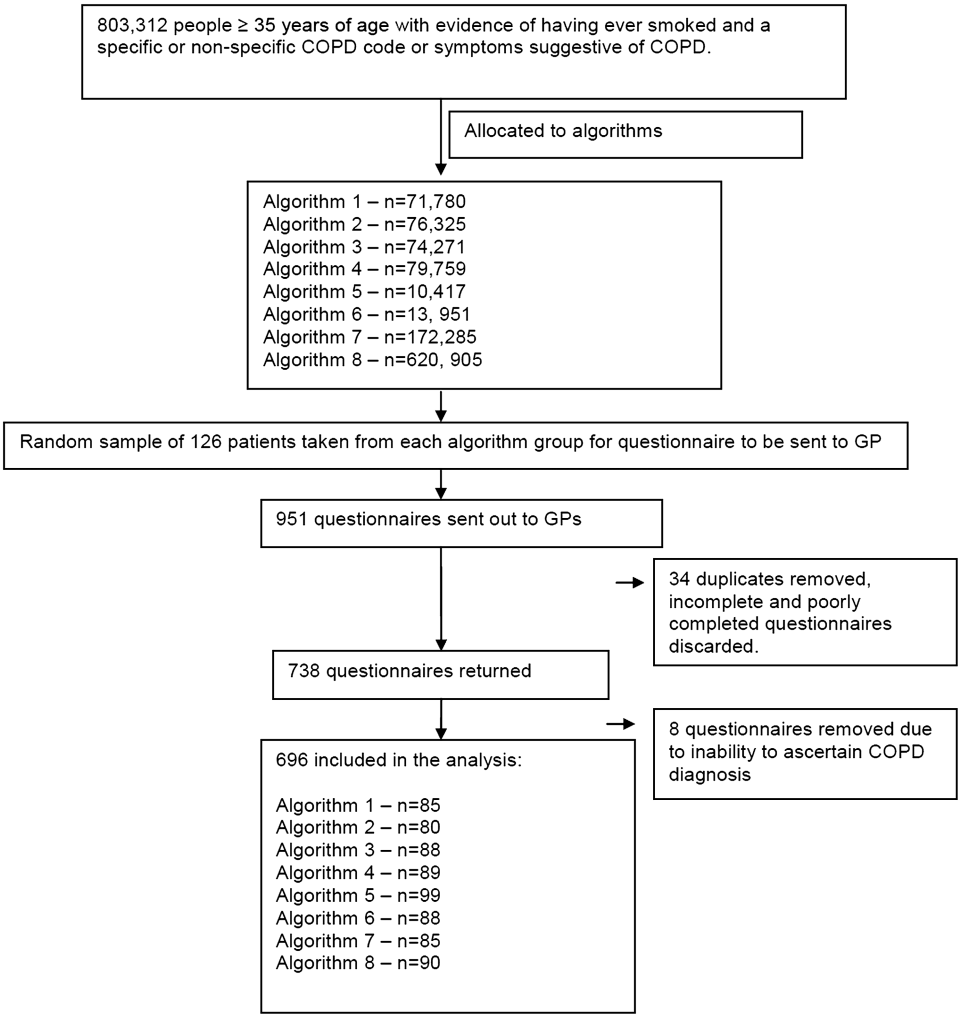

Figure 1 Study population (COPD, chronic obstructive pulmonary disease; GP, general practitioner).

Table 1 Characteristics of the 696 patients included in the final study analysis

Algorithm	COPD Code +spirometry+COPD medication	COPD Code +spirometry	COPD Code +COPD medication	COPD Code only	Bronchitis +COPD medication	Bronchitis only	Symptoms +spirometry	Symptoms only
Number of individuals (%)	85 (100)	79 (100)	88 (100)	89 (100)	98 (100)	84 (100)	83 (100)	90 (100)
Number (%) with supporting info	46 (54.1)	44 (55.7)	48 (54.5)	40 (44.9)	32 (32.7)	18 (21.4)	30 (36.1)	14 (15.6)
Mean age (SD)	68.7 (11.3)	68.3 (11.7)	71.8 (10.5)	71.1 (10.4)	68.5 (13.1)	67.8 (13.4)	65.9 (11.9)	63.4 (14.1)
Male (%)	45 (52.9)	41 (51.9)	40 (45.5)	44 (49.4)	31 (31.6)	29 (34.5)	43 (51.8)	47 (52.2)
Current smoker (%)	49 (57.7)	50 (63.3)	55 (62.5)	47 (52.8)	66 (67.4)	61 (72.6)	48 (57.8)	58 (64.4)
GOLD stage (n=465)*								
1	13 (16.3)	14 (18.0)	13 (15.9)	16 (20.5)	17 (28.8)	13 (35.1)	8 (20.0)	4 (36.4)
2	43 (53.8)	48 (61.5)	41 (50.0)	46 (59.0)	31(52.5)	13 (35.1)	22 (55.0)	5 (45.5)
3	18 (22.5)	13 (16.7)	22 (26.8)	12 (15.4)	9 (15.3)	8 (21.6)	8 (20.0)	2 (18.2)
4	6 (7.5)	3 (3.9)	6 (7.3)	4 (5.1)	2 (3.4)	3 (8.1)	2 (5.0)	0 (0.0)
History of cardiovascular disease	20 (23.5)	22 (27.8)	17 (19.3)	18 (20.2)	20 (20.4)	17 (20.2)	14 (16.9)	9 (10.0)
History of asthma	18 (21.2)	20 (25.3)	16 (18.2)	15 (16.9)	27 (27.6)	23 (27.4)	19 (22.9)	23 (25.6)
Mean BMI (SD) (n=575)	N=83 27.5 (5.4)	N=78 26.7 (5.8)	N=86 26.4 (4.7)	N=87 27.8 (5.4)	N=98 27.4 (5.1)	N=85 28.1 (5.0)	N=41 27.1 (4.5)	N=17 27.6 (4.7)

*GOLD staging was ascertained from CPRD records or from supplementary information provided by GPs.
BMI, body mass index; COPD, chronic obstructive pulmonary disease; CPRD, Clinical Practice Research Datalink; GOLD, Global initiative for Chronic Obstructive Lung Disease; GP, general practitioner.

Table 2 The positive predictive value (PPV) and proportion of patients diagnosed with chronic obstructive pulmonary disease (COPD) within each algorithm

Algorithm	Number of questionnaires sent out (n=951)	Number evaluable returned (n=696) (%)	Number with confirmed COPD	PPV and 95% CI
COPD Code+spirometry +COPD medication	119	85 (71.4)	76	89.4, 80.7 to 94.5
COPD Code+spirometry	119	79 (66.4)	67	83.8, 73.7 to 90.4
COPD Code+COPD medication	119	88 (73.9)	77	87.5, 78.6 to 93.0
COPD Code only	119	89 (74.8)	77	86.5, 77.5 to 92.3
Bronchitis+COPD medication	119	98 (82.4)	44	44.4, 34.8 to 54.5
Bronchitis only	119	84 (70.6)	26	29.5, 20.8 to 40.1
Symptoms+spirometry	119	83 (69.7)	37	43.5, 33.2 to 54.4
Symptoms only	118	90 (75.6)	11	12.2, 6.8 to 20.9

COPD by the algorithm relative to the gold standard where individuals were identified using only the presence of a specific COPD code (n=457) the PPV was identical to if they had a COPD code and evidence either in the form of spirometry or COPD medication prescription (n=454); PPV 83% (79–86) for both. In the majority of cases, where a specific COPD code had been assigned, there was additional evidence. Only three individuals had a specific COPD code with no additional evidence.

DISCUSSION

We tested the accuracy of eight different algorithms for identifying COPD within the CPRD among patients with suspected COPD (eg, >35 years of age, smoking history and recording of respiratory symptoms or COPD codes). The physician reviewer's consensus was the gold standard. The best performing algorithm allowed an accurate ascertainment of 90% of patients as diagnosed with COPD. This consisted of a combination of a specific COPD code, more than one prescription of a COPD medication and spirometry (PPV 89.4, 95% CI 80.7 to 94.5). The worst performing algorithm was represented by the presence of respiratory symptoms only (PPV 12.2, 95%CI 6.8 to 20.9). We found that any algorithm containing a specific COPD code performed better than those without (algorithms 1–4). In a post hoc analysis, where we allowed individuals to populate more than one algorithm, we established that the use of additional information such as spirometry or medications in an algorithm to a specific COPD Read code alone did not increase the PPV. This suggests that the presence of a specific COPD Read code alone is sufficient to accurately identify patients with COPD from the database. Some study protocols require the presence of obstructive spirometry for identification of patients with COPD; however, this study demonstrates that it may be unnecessary. This is particularly important as certain groups of individuals are less likely to have spirometry, namely

Table 3 Positive predictive value (PPV) by algorithm where evidence was available to assess GP compared with physician diagnosis of chronic obstructive pulmonary disease (COPD)

Algorithm	Total number with evidence (N=272)	Number of patients with COPD confirmed by gold standard (N=220)	Number with COPD according to GP	PPV and 95% CI
COPD Code +spirometry+COPD medication	46	46	46	100
COPD Code +spirometry	44	35	33	94.3, 82.4 to 98.9
COPD Code+COPD medication	48	43	41	95.3, 82.4 to 98.9
COPD Code only	40	34	33	97.1, 80.2 to 99.6
Bronchitis+COPD medication	32	21	19	90.5, 66.0 to 97.9
Bronchitis only	18	12	11	91.7, 49.9 to 99.2
Symptoms+spirometry	30	21	20	95.2, 69.1 to 99.4
Symptoms only	14	8	6	75.0, 27.6 to 95.9

women and patients <50 and >80 years of age.[8] This is also important as the minimal precision lost by not including spirometry and medications in the algorithm allows an increase in the number of individuals who can potentially be included in a study. Using the whole of CPRD, we identified individuals with COPD using a specific COPD code only compared with a specific code plus medication and spirometry and found an increase in the potential sample size for a study of 10% using a specific COPD code only.

One of the advantages of this study was our ability to investigate the accuracy of algorithms when identifying patients with COPD within the CPRD, and the accuracy of the actual GP diagnosis of COPD. When validating the GP diagnosis of COPD with a respiratory physician's diagnosis as the gold standard based on extra evidence provided by the GP, there was improved accuracy (PPV) across all algorithms, with algorithms 1–4 again performing best. This suggests that additional evidence is collected when the GP is reasonably certain that the patient has COPD. There was good concordance between the GP's and the respiratory physician's diagnosis, suggesting that respiratory consultant validation is not always needed. Where there was disagreement, this was usually because lung function did not meet the criteria for COPD.

We found that the diagnostic accuracy of COPD decreased across all algorithms when patients also had a diagnosis of cardiovascular disease or asthma (see online supplementary table S1). When patients had a concomitant diagnosis of asthma, the presence of spirometry was particularly important to improve accuracy of COPD diagnosis. This was predominantly due to the fact that spirometry had been misinterpreted. However, stratification led to smaller sample sizes, which could have impacted the precision of estimates. Unsurprisingly, the addition of the use of any inhaled COPD medication to the algorithm did not improve precision, most likely due to the overlap in medications used to treat asthma and COPD (see online supplementary material). The algorithm accuracy was not affected by smoking status (current vs ex-smoker; see online supplementary table S2). We only included current or former smokers in our analysis, and cannot be sure of the validity of the results in a patient who has never smoked. Certainly in the UK, the majority of COPD is related to tobacco smoking and we hypothesised that fixed airflow obstruction in a non-smoker would most likely be due to chronic asthma.

When considering the severity of COPD by GOLD classification, algorithms 2 and 3, that is, a specific COPD code and spirometry or COPD medications, had the greatest accuracy for patients with mild disease (GOLD stage 1; see online supplementary table S3). The PPV increased with increasing disease severity. It increases with disease prevalence, and the prevalence of COPD increased by moving from algorithm 8 to algorithm 1.

We considered the timing of diagnosis in view of an increased uptake of spirometry in primary care in more recent years and changes in QOF requirements over time during our study period (see online supplementary table S4). We found that algorithms 1–4 still had the greatest accuracy, but the PPV estimates were better for the post 2008 period than the pre 2008 period (see online supplementary material). Non-specific bronchitis codes and symptom codes were more likely to be used before 2008 rather than after 2008. This may require consideration when developing retrospective cohorts for analysis and otherwise suggests that QOF has had a positive effect on the consistency of codes used for COPD diagnoses. However, our codes were more specific than QOF codes and some of the codes included in QOF were not included in our specific COPD codelist, but were included in the non-specific bronchitis codes. While we cannot comment on the accuracy of QOF codes, it is important to highlight that some QOF codes are not disease specific and may not be a good way of identifying patients with COPD from electronic health records as inevitably people without COPD will be included. It is also important to highlight that Read codes change over time with new codes being added and some removed, and this needs consideration when identifying people with COPD.

There are limited COPD validation studies in electronic health records published in the literature with which we can compare our study. Soriano *et al*[4] validated COPD in the GPRD in 2001, when OXMIS codes were still in use. A Swedish study using a Swedish inpatient registry used International Classification of Diseases (ICD)-9 and ICD-10 codes and identified patients with COPD with similar accuracy.[16] A Canadian study in the Canadian primary care sentinel surveillance network used algorithms to identify several long-term conditions and also had a PPV similar to ours for COPD.[17] However, all of these studies used different codes, algorithms and databases.

Our analysis has several limitations. We appreciate that using the gold standard of a GP questionnaire and respiratory physician review is not perfect as when asked about whether or not a specific patient has a certain diagnosis, the GP is most likely to simply look in the electronic health record and see if that diagnosis has been recorded. However, there is no alternative. The overall response rate for this study was acceptable (77.6%), while the proportion of questionnaires accompanied by additional evidence allowing for adjudication was rather low. We used PPV in this study as the measure of accuracy to allow us to determine the probability that a patient had COPD from their electronic health record. The PPV is correlated with disease prevalence, and although it is strongly related to specificity, the actual estimates of specificity, sensitivity and negative predictive value cannot be determined from our data. Further, GP practices are self-selecting with respect to their contribution to CPRD; however, those practices appear to be representative of the UK population. Very few patients within contributing practices refuse to participate at an

individual level and this is not thought to bias the results. While CPRD is representative of the general population, as with all validation studies that require a response, we cannot be sure that our sample is representative of GPs who have not responded, although there is unlikely to be any difference. The amount of missing data among the responding questionnaires was low, suggesting reasonable data quality. One of the other limitations of this study is that patients had to be alive to be included; however, it is unlikely that coding would be different for individuals who are no longer alive.

The algorithm that consisted of a specific COPD code, COPD medication and spirometry had the highest PPV; however, the PPV was almost as high when a specific COPD code alone was used. The poorest performing algorithms were those that involved bronchitis codes or respiratory symptoms; we would not recommend using these algorithms to identify patients with COPD. In conclusion, we have shown that the presence of a specific COPD Read code alone is sufficient to identify patients with COPD from electronic health records such as CPRD. Minimal precision lost by not including spirometry and medications in the algorithm allows an increase in the number of individuals who can potentially be included in a study by up to 10%. However, by not including spirometry in the definition, the ability to stage COPD according to GOLD stages may not be possible for all patients with COPD included in a study.

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Supplementary information

Algorithms

1. Specific COPD code and more than one prescription of a COPD medication and presence of spirometry. The first COPD medication had to be prescribed within 4 weeks of the COPD diagnostic code.
2. Specific COPD code and presence of spirometry
3. Specific COPD code and more than one prescription of a COPD medication. The first COPD medication had to be prescribed within 4 weeks of the COPD diagnostic code.
4. Specific COPD code only
5. Non-specific bronchitis codes and more than one prescription of a COPD medication. The first COPD medication had to be prescribed within 4 weeks of the COPD diagnostic code.
6. Non-specific bronchitis codes only
7. Respiratory symptoms and presence of spirometry. Respiratory symptoms consisted of persistent cough, sputum production, or dyspnoea
8. Respiratory symptom definition only

Specific COPD codes

medcode	term
18476	COPD follow-up
45771	Chronic obstructive pulmonary disease does not disturb sleep
4084	Airways obstructn irreversible
794	Emphysema
998	Chronic obstructive airways disease
1001	Chronic obstructive pulmonary disease
5710	Chronic obstructive airways disease NOS
9520	Chronic obstructive pulmonary disease monitoring
9876	Severe chronic obstructive pulmonary disease
10802	Moderate chronic obstructive pulmonary disease
10863	Mild chronic obstructive pulmonary disease
10980	Centrilobular emphysema
11287	Chronic obstructive pulmonary disease annual review
14798	Emphysematous bronchitis
18621	Chronic obstructive pulmonary disease follow-up
18792	Chronic obstructive pulmonary disease monitoring admin
23492	Chronic bullous emphysema NOS
26018	Chronic obstructive pulmonary disease monitoring by nurse
26306	Chronic bullous emphysema
28755	Chronic obstructive pulmonary disease monitoring 1st letter
33450	Emphysema NOS
34202	Chronic obstructive pulmonary disease monitoring 2nd letter
34215	Chronic obstructive pulmonary disease monitoring 3rd letter
37247	Chronic obstructive pulmonary disease NOS
37371	Chronic obstructive pulmonary disease monitoring due
44525	Obstructive chronic bronchitis NOS
45998	Chronic obstructive pulmonary disease monitoring by doctor
93568	Very severe chronic obstructive pulmonary disease
12166	Other specified chronic obstructive airways disease

38074 Chronic obstructive pulmonary disease monitor phone invite
42258 Chronic obstructive pulmonary disease monitoring verb invite
42313 Health education - chronic obstructive pulmonary disease
45770 Chronic obstructive pulmonary disease disturbs sleep
45777 Chronic obstructive pulmonary disease clini management plan

COPD medication codes

prodcode productname
8 salbutamol 100micrograms/dose inhaler
17 salbutamol 100micrograms/dose inhaler cfc free
31 ventolin 100microgram/inhalation inhalation powder (glaxo wellcome uk ltd)
38 beclometasone 100micrograms/dose inhaler
99 becotide 100 inhaler (glaxosmithkline uk ltd)
218 aminophylline 100 mg cap
235 bricanyl 250micrograms/dose inhaler (astrazeneca uk ltd)
273 theophylline 200 mg cap
282 salbutamol 2mg/5ml oral solution sugar free
454 pulmicort 200microgram inhaler (astrazeneca uk ltd)
465 salmeterol 25micrograms/dose inhaler
510 ventolin 5mg/ml respirator solution (glaxosmithkline uk ltd)
549 serevent 25micrograms/dose inhaler (glaxosmithkline uk ltd)
555 aminophylline 225mg modified-release tablets
590 phyllocontin continus 225mg tablets (napp pharmaceuticals ltd)
638 seretide 250 accuhaler (glaxosmithkline uk ltd)
665 seretide 100 accuhaler (glaxosmithkline uk ltd)
674 ventolin 2.5mg nebules (glaxosmithkline uk ltd)
696 salbutamol 8mg modified-release capsules
719 salmeterol 50micrograms/dose dry powder inhaler
746 tiotropium 18 microgram capsule
752 carbocisteine 375mg capsules
856 ventolin 2mg/5ml syrup (glaxosmithkline uk ltd)
860 salbutamol 4mg tablets
862 salbulin inhalation powder (3m health care ltd)
863 slo-phyllin 125mg capsule (lipha pharmaceuticals ltd)
879 theophylline 125mg modified-release capsules
880 theophylline 60mg modified-release capsules
881 salbutamol 2mg tablets
882 salbutamol 200microgram inhalation powder capsules
883 becodisks 200microgram disc (allen & hanburys ltd)
895 beclazone 100 easi-breathe inhaler (teva uk ltd)
896 becotide easi-breathe 100microgram/actuation pressurised inhalation (allen & hanburys ltd)
898 ventolin evohaler 100 100microgram/inhalation pressurised inhalation (glaxo wellcome uk ltd)
907 bricanyl turbohaler 500 500microgram turbohaler (astrazeneca uk ltd)
908 pulmicort 400 turbohaler (astrazeneca uk ltd)
909 budesonide 200micrograms/dose inhaler
910 serevent diskhaler 50microgram inhalation powder (glaxo wellcome uk ltd)
911 flixotide accuhaler 250 250microgram/inhalation inhalation powder (allen & hanburys ltd)
947 budesonide 50micrograms/actuation refill canister
956 pulmicort 200 turbohaler (astrazeneca uk ltd)

957 salamol easi-breathe 100microgram/actuation pressurised inhalation (ivax pharmaceuticals uk ltd)
958 ventolin easi-breathe 100microgram/actuation pressurised inhalation (allen & hanburys ltd)
959 budesonide 50micrograms/dose inhaler
960 pulmicort 100 turbohaler (astrazeneca uk ltd)
987 ventolin 4mg tablet (allen & hanburys ltd)
1093 salamol 100microgram/actuation inhalation powder (ivax pharmaceuticals uk ltd)
1097 slo-phyllin 60mg capsule (lipha pharmaceuticals ltd)
1100 beclazone 100 inhaler (teva uk ltd)
1236 becloforte 250micrograms/dose inhaler (glaxosmithkline uk ltd)
1242 beclometasone 250micrograms/dose inhaler
1243 beclazone 250 easi-breathe inhaler (teva uk ltd)
1258 becotide 200 inhaler (glaxosmithkline uk ltd)
1259 beclometasone 200micrograms/dose inhaler
1269 becotide 50microgram/ml nebuliser liquid (allen & hanburys ltd)
1346 salbutamol 0.05mg/ml injection
1406 becotide 50 inhaler (glaxosmithkline uk ltd)
1409 ipratropium bromide 20micrograms/dose inhaler
1410 ipratropium bromide 0.25mg/ml
1411 ipratropium bromide 250micrograms/ml
1412 flixotide 250microgram/actuation inhalation powder (allen & hanburys ltd)
1414 salamol 5mg/2.5ml nebuliser liquid steri-neb unit dose vials (teva uk ltd)
1415 steri-neb ipratropium 250microgram/ml nebuliser liquid (ivax pharmaceuticals uk ltd)
1423 uniphyllin continus 200mg tablets (napp pharmaceuticals ltd)
1424 flixotide 250microgram disc (allen & hanburys ltd)
1426 flixotide 500microgram disc (allen & hanburys ltd)
1518 flixotide 50microgram/actuation inhalation powder (allen & hanburys ltd)
1537 becotide 200microgram rotacaps (glaxosmithkline uk ltd)
1551 beclazone 250 inhaler (teva uk ltd)
1552 becloforte easi-breathe 250microgram/actuation pressurised inhalation (allen & hanburys ltd)
1619 terbutaline 500micrograms/dose dry powder inhaler
1620 terbutaline 250micrograms/dose inhaler
1628 terbutaline 250micrograms/actuation refill canister
1630 salbutamol 2.5mg/2.5ml nebuliser liquid unit dose vials
1635 salbuvent 2mg/5ml oral solution (pharmacia ltd)
1642 budesonide 400micrograms/dose dry powder inhaler
1676 flixotide 125microgram/actuation inhalation powder (allen & hanburys ltd)
1680 pulmicort ls 50micrograms/dose inhaler (astrazeneca uk ltd)
1698 salbutamol 100micrograms/dose breath actuated inhaler
1711 salbutamol 5mg/2.5ml nebuliser liquid unit dose vials
1725 beclazone 50 easi-breathe inhaler (teva uk ltd)
1727 becotide easi-breathe 50microgram/actuation pressurised inhalation (allen & hanburys ltd)
1734 beclometasone 100micrograms/dose breath actuated inhaler
1741 salbutamol 100micrograms/dose breath actuated inhaler cfc free
1833 theophylline 200mg modified-release tablets
1834 theophylline 400mg modified-release tablets
1861 aerobec 100 autohaler (meda pharmaceuticals ltd)
1882 ventodisks 200microgram/blister disc (allen & hanburys ltd)
1885 beclazone 200 inhaler (teva uk ltd)
1950 ventodisks 400microgram/blister disc (allen & hanburys ltd)
1951 becodisks 400microgram disc (allen & hanburys ltd)
1952 ventolin 400microgram rotacaps (glaxosmithkline uk ltd)

1956 pulmicort 1mg respules (astrazeneca uk ltd)
1957 ventolin 5mg nebules (glaxosmithkline uk ltd)
1959 pulmicort 0.5mg respules (astrazeneca uk ltd)
1972 oxygen bp size af lightweight gas 1360 litres
1974 oxis 12 turbohaler (astrazeneca uk ltd)
1975 oxis 6 turbohaler (astrazeneca uk ltd)
2044 prednisone 2.5 mg tab
2092 budesonide 200micrograms/dose dry powder inhaler
2124 pulmicort refil 200 mcg inh
2125 pulmicort 200microgram refill canister (astrazeneca uk ltd)
2147 theophylline 250mg modified-release capsules
2148 beclometasone 400microgram disc
2149 steri-neb salamol 2.5 mg inh
2152 ipratropium bromide with salbutamol 20mcg + 100mcg
2159 aerobec 50 autohaler (meda pharmaceuticals ltd)
2160 beclometasone 50micrograms/dose breath actuated inhaler
2224 serevent 50micrograms/dose accuhaler (glaxosmithkline uk ltd)
2229 becodisks 100microgram disc (allen & hanburys ltd)
2282 fluticasone 500micrograms/dose dry powder inhaler
2335 qvar 100 inhaler (teva uk ltd)
2368 prednisolone 2.5mg tablet
2390 prednisolone e/c 1 mg tab
2395 salbutamol 2 mg/5ml syr
2437 oxitropium bromide 100micrograms/dose inhaler
2440 flixotide accuhaler 500 500microgram/inhalation inhalation powder (allen & hanburys ltd)
2510 oxygen bp gas 1280 litres
2600 beclometasone 250micrograms/dose breath actuated inhaler
2655 airomir 100micrograms/dose inhaler (teva uk ltd)
2723 fluticasone 25micrograms/dose inhaler
2757 slo-phyllin 250mg capsule (lipha pharmaceuticals ltd)
2758 bricanyl refill canister (astrazeneca uk ltd)
2799 prednisolone 10 mg tab
2850 salbutamol 400microgram inhalation powder capsules
2851 ventolin 200microgram rotacaps (glaxosmithkline uk ltd)
2869 salbutamol 8mg modified-release tablets
2892 becloforte 400microgram disks (glaxosmithkline uk ltd)
2893 beclometasone 200micrograms disc
2949 prednisone 5mg tablets
2951 fluticasone 250microgram/actuation pressurised inhalation
2978 salbutamol 200micrograms/dose dry powder inhaler
2992 beclazone 50 inhaler (teva uk ltd)
2995 nuelin sa 175mg tablets (meda pharmaceuticals ltd)
3018 beclometasone 50micrograms/dose inhaler
3059 prednisolone 50 mg tab
3065 bextasol inhalation powder (allen & hanburys ltd)
3075 becotide 400microgram rotacaps (glaxosmithkline uk ltd)
3119 becloforte integra 250microgram/actuation inhaler with compact spacer (glaxo laboratories ltd)
3150 beclometasone 100micrograms/actuation extrafine particle cfc free inhaler
3163 salbutamol 200micrograms disc
3188 pulmicort complete 50 mcg inh
3189 salbuvent inh inh
3220 qvar 50 autohaler (teva uk ltd)
3254 salbulin 4mg tablet (3m health care ltd)

3289 flixotide 25micrograms/dose inhaler (glaxosmithkline uk ltd)
3297 salmeterol 50micrograms disc
3322 aerolin inh 400 100 mcg aer
3345 sintisone tablet (pharmacia ltd)
3347 oxygen bp size f gas 1360 litres
3363 becloforte 400microgram disks with diskhaler (glaxosmithkline uk ltd)
3388 theophylline 175mg modified-release tablets
3442 pulmicort complete 200 mcg inh
3443 salbutamol 100microgram/inhalation spacehaler (celltech pharma europe ltd)
3534 bricanyl 5mg tablets (astrazeneca uk ltd)
3546 qvar 50 inhaler (teva uk ltd)
3556 beclometasone 50micrograms with salbutamol 100micrograms/inhalation inhaler
3557 prednisone 1mg tablets
3570 budesonide 200micrograms/actuation refill canister
3584 bricanyl 1.5mg/5ml syrup (astrazeneca uk ltd)
3666 seretide 500 accuhaler (glaxosmithkline uk ltd)
3743 filair 50 inhaler (meda pharmaceuticals ltd)
3753 flixotide diskhaler-community pack 250 mcg
3758 pulmadil inhalation powder (3m health care ltd)
3763 terbutaline respules inh
3764 bricanyl respules (5mg/2ml) 2.5 mg/ml inh
3786 fenoterol 100micrograms/dose / ipratropium 40micrograms/dose inhaler
3838 salbutamol 400mcg/beclometh.100mcg r/cap inh
3927 filair 100 inhaler (meda pharmaceuticals ltd)
3947 becotide 100microgram rotacaps (glaxosmithkline uk ltd)
3988 flixotide diskhaler-community pack 100 mcg
3989 flixotide 100microgram disc (allen & hanburys ltd)
3993 filair forte 250micrograms/dose inhaler (meda pharmaceuticals ltd)
3994 salbutamol 4mg modified-release tablets
4055 salbulin 2mg/5ml oral solution (3m health care ltd)
4131 fluticasone 100microgram disc
4132 fluticasone 125microgram/actuation pressurised inhalation
4165 zithromax 250mg capsules (pfizer ltd)
4171 ventolin 2mg tablet (allen & hanburys ltd)
4222 bricanyl 10mg/ml respirator solution (astrazeneca uk ltd)
4268 ipratropium bromide 40micrograms/dose inhaler
4365 beclometasone 100micrograms disc
4412 oxygen bp size g gas 3400 litres
4413 qvar 100 autohaler (teva uk ltd)
4497 ventolin accuhaler 200 200microgram/actuation inhalation powder (glaxo wellcome uk ltd)
4499 aerobec 250microgram/actuation pressurised inhalation (meda pharmaceuticals ltd)
4514 aminophylline 350mg modified-release tablets
4538 oxygen bp size pd gas 300 litres
4541 bricanyl sa 7.5mg tablets (astrazeneca uk ltd)
4545 pulmicort ls 50microgram refill canister (astrazeneca uk ltd)
4593 theophylline 125mg tablets
4601 asmabec 100 clickhaler (focus pharmaceuticals ltd)
4634 salamol 2.5mg/2.5ml nebuliser liquid steri-neb unit dose vials (teva uk ltd)
4640 bricanyl 5mg/2ml nebuliser liquid (astrazeneca uk ltd)
4665 salbulin 100micrograms/dose inhaler (3m health care ltd)
4688 fluticasone 50microgram/actuation pressurised inhalation
4759 beclometasone 100microgram inhalation powder capsules
4791 oxygen bp size c gas 170 litres
4801 budesonide 500micrograms/2ml nebuliser liquid unit dose vials

4803 beclazone 250microgram/actuation inhalation powder (actavis uk ltd)
4842 fenoterol 100microgram/actuation inhaler
4908 ventolin rotahaler (glaxosmithkline uk ltd)
4926 flixotide accuhaler 100 100microgram/inhalation inhalation powder (allen & hanburys ltd)
4942 budesonide 1mg/2ml nebuliser liquid unit dose vials
5057 azithromycin 200mg/5ml oral suspension
5116 azithromycin 250mg capsules
5143 seretide 50 evohaler (glaxosmithkline uk ltd)
5161 seretide 125 evohaler (glaxosmithkline uk ltd)
5170 salamol 100micrograms/dose inhaler cfc free (teva uk ltd)
5172 seretide 250 evohaler (glaxosmithkline uk ltd)
5185 fenoterol 200micrograms/dose inhaler
5223 fluticasone 50micrograms/dose inhaler cfc free
5261 nuelin sa 250 tablets (meda pharmaceuticals ltd)
5308 terbutaline 5mg/2ml nebuliser liquid unit dose vials
5309 flixotide 50micrograms/dose evohaler (glaxosmithkline uk ltd)
5335 zithromax 500mg tablets (pfizer ltd)
5453 uniphyllin continus 400mg tablets (napp pharmaceuticals ltd)
5516 salamol 100micrograms/dose easi-breathe inhaler (teva uk ltd)
5521 beclometasone 200micrograms/dose dry powder inhaler
5522 beclometasone 100micrograms/dose dry powder inhaler
5551 flixotide 0.5mg/2ml nebules (glaxosmithkline uk ltd)
5558 salmeterol 50micrograms with fluticasone 500micrograms cfc free inhaler
5580 flixotide accuhaler 50 50microgram/inhalation inhalation powder (allen & hanburys ltd)
5584 oxygen cylinders size pd (boc ltd)
5683 flixotide 250micrograms/dose evohaler (glaxosmithkline uk ltd)
5718 flixotide 125micrograms/dose evohaler (glaxosmithkline uk ltd)
5740 airomir 100micrograms/dose autohaler (teva uk ltd)
5753 salbutamol 400micrograms disc
5773 oxygen bp size dd gas 460 litres
5780 oxygen cylinders size af (boc ltd)
5804 beclometasone 250micrograms/dose dry powder inhaler
5822 fluticasone 250micrograms/dose inhaler cfc free
5837 salamol steri-neb 5mg/2.5ml nebuliser liquid (numark management ltd)
5864 salmeterol 25micrograms with fluticasone 250micrograms cfc free inhaler
5885 fluticasone 100micrograms/dose dry powder inhaler
5889 salamol 100microgram/inhalation inhalation powder (kent pharmaceuticals ltd)
5898 salamol steri-neb 2.5mg/2.5ml nebuliser liquid (numark management ltd)
5941 uniphyllin continus 300mg tablets (napp pharmaceuticals ltd)
5942 salmeterol 50micrograms with fluticasone 250micrograms cfc free inhaler
5975 fluticasone 125micrograms/dose inhaler cfc free
5976 oxygen bp size dd 460 litre inhalation gas (boc ltd)
5992 beclometasone 50micrograms/dose dry powder inhaler
6081 ipratropium bromide 20micrograms/dose breath actuated inhaler
6276 carbocisteine 250mg/5ml oral solution
6315 slo-phyllin 250mg capsules (merck serono ltd)
6325 symbicort 200/6 turbohaler (astrazeneca uk ltd)
6419 oxygen cylinders size f (boc ltd)
6420 oxygen bp size d gas 340 litres
6423 oxygen bp with integral headset 1360 litre inhalation gas (boc ltd)
6462 salbutamol 95micrograms/dose dry powder inhaler
6522 ipratropium bromide 20micrograms/dose inhaler cfc free
6526 formoterol 12microgram inhalation powder capsules with device

6556 oxygen cylinders size c (boc ltd)
6569 salmeterol 25micrograms with fluticasone 125micrograms cfc free inhaler
6616 salmeterol 25micrograms with fluticasone 50micrograms cfc free inhaler
6619 oxygen bp size cd gas 460 litres
6719 ipratropium bromide 500micrograms/2ml nebuliser liquid unit dose vials
6746 budesonide 400micrograms/dose / formoterol 12micrograms/dose dry powder inhaler
6758 ipratropium 250micrograms/1ml nebuliser liquid steri-neb unit dose vials (teva uk ltd)
6768 oxygen bp size cd 460 litre inhalation gas (boc ltd)
6772 ipratropium bromide 250micrograms/1ml nebuliser liquid unit dose vials
6780 symbicort 400/12 turbohaler (astrazeneca uk ltd)
6796 budesonide 200micrograms/dose / formoterol 6micrograms/dose dry powder inhaler
6802 mucodyne 375mg capsules (sanofi)
6848 oxygen cylinders size dd with integral headset 2 and 4litres/minute flow rate (boc ltd)
6920 mecysteine 100mg gastro-resistant tablets
6938 salmeterol 50micrograms with fluticasone 100micrograms dry powder inhaler
6976 oxygen bp with integral headset gas 430 litres
6988 aminophylline hydrate 100mg modified-release tablets
7013 symbicort 100/6 turbohaler (astrazeneca uk ltd)
7017 salbutamol 100micrograms/dose dry powder inhaler
7031 oxygen bp size e gas 680 litres
7042 oxygen cylinders size e (boc ltd)
7133 formoterol 12micrograms/dose dry powder inhaler
7192 bambuterol 10mg tablets
7239 oxygen cylinders size b10s (air products plc)
7268 serevent 25micrograms/dose evohaler (glaxosmithkline uk ltd)
7270 salmeterol 25micrograms/dose inhaler cfc free
7452 ventolin .25 mg inj
7584 prednisolone 4 mg tab
7602 fluticasone 50microgram disc
7638 fluticasone 250microgram disc
7653 beclometasone 400microgram inhalation powder capsules
7710 prednisolone 15 mg tab
7711 terbutaline 250micrograms/dose inhaler with spacer
7724 betamethasone valerate 100micrograms/actuation inhaler
7730 theo-dur 300mg tablets (astrazeneca uk ltd)
7731 theo-dur 200mg tablets (astrazeneca uk ltd)
7732 theophylline 300mg modified-release tablets
7733 theophylline 250mg modified-release tablets
7788 budesonide 100micrograms/dose dry powder inhaler
7832 choline theophyllinate 200mg tablets
7841 nuelin 125mg tablets (3m health care ltd)
7891 fluticasone 500microgram disc
7934 prednisone 30 mg tab
7935 maxivent 100microgram/inhalation inhalation powder (ashbourne pharmaceuticals ltd)
7948 fluticasone 250micrograms/dose dry powder inhaler
7953 terbutaline 1.5mg/5ml oral solution sugar free
7954 bricanyl 250micrograms/dose spacer inhaler (astrazeneca uk ltd)
7964 beclometasone 50micrograms/ml nebuliser suspension
7965 salbutamol 5mg/ml nebuliser liquid
8012 exirel 15mg capsule (3m health care ltd)
8056 aminophylline 100mg tablets
8057 aminophylline 100mg modified-release tablets
8111 becloforte vm 250microgram/actuation vm pack (allen & hanburys ltd)
8183 oxygen bp gas 640 litres

8251 pulmicort refil 50 mg inh
8252 pirbuterol 15mg capsule
8267 sodium cromoglicate 1mg/dose / salbutamol 100micrograms/dose inhaler
8333 ipratropium bromide 40microgram inhalation powder capsules
8339 fenoterol hydrobromide complete unit inh
8429 ventolin i/v 5 mg inj
8433 budesonide 100micrograms/actuation inhaler
8450 flixotide diskhaler-community pack 50 mcg
8504 exirel 15 mg tab
8505 oxygen bp gas 6400 litres
8522 terbutaline 7.5mg modified-release tablets
8572 rimiterol inhaler
8635 flixotide 50microgram disc (allen & hanburys ltd)
8636 ventolin s/r 8 mg spa
8676 terbutaline 10mg/ml nebuliser liquid
8757 oxygen bp gas 3200 litres
8806 phyllocontin continus 350mg tablet (napp pharmaceuticals ltd)
8955 theophylline 100 mg tab
9018 mucodyne 375mg capsule (aventis pharma)
9092 theophylline 350mg modified release tablets
9164 fluticasone 50micrograms/dose dry powder inhaler
9233 beclometasone 200microgram inhalation powder capsules
9270 ipratropium bromide with fenoterol hydrobromide 500micrograms + 1.25mg/4ml
9384 salbutamol 4mg modified-release capsules
9477 asmabec 100microgram/actuation spacehaler (celltech pharma europe ltd)
9571 beclometasone 250micrograms/actuation vortex inhaler
9577 asmabec 50 clickhaler (focus pharmaceuticals ltd)
9599 beclazone 50microgram/actuation inhalation powder (actavis uk ltd)
9642 mucodyne 250mg/5ml oral solution (aventis pharma)
9651 asmasal 100microgram/inhalation spacehaler (celltech pharma europe ltd)
9658 oxitropium bromide 100micrograms/dose breath actuated inhaler
9711 formoterol 6micrograms/dose dry powder inhaler
9727 prednisolone 50mg tablets
9805 salbutamol 5mg/50ml solution for infusion vials
9889 oxygen cylinders size g (boc ltd)
9895 oxygen bp size df with integral headset gas 1360 litres
9906 mucodyne 250mg/5ml syrup (sanofi)
9921 beclometasone 100micrograms/dose breath actuated inhaler cfc free
9943 visclair 100mg gastro-resistant tablets (ranbaxy (uk) ltd)
10043 oxygen composite cylinders size b10c with integral headset (air products plc)
10053 oxygen connection cubing 1.8m
10090 beclometasone 50micrograms/actuation extrafine particle cfc free inhaler
10218 budesonide 100micrograms/dose / formoterol 6micrograms/dose dry powder inhaler
10321 budesonide 400microgram inhalation powder capsules
10331 nuelin 60mg/5ml liquid (3m health care ltd)
10353 salbuvent rondo
10360 aerocrom inhaler (castlemead healthcare ltd)
10407 phyllocontin paediatric continus 100mg tablets (napp pharmaceuticals ltd)
10433 theophylline 60mg/5ml oral solution
10458 ventolin cr 4mg tablet (allen & hanburys ltd)
10561 aminophylline 250mg/ml injection
10723 theophylline 125mg/5ml syrup
10744 theophylline 80 mg eli
10808 mucodyne paediatric 125mg/5ml syrup (sanofi)
10825 terbutaline 5mg tablets

10831 biophylline 125mg/5ml oral solution (lorex synthelabo ltd)
10858 pulmadil auto inhalation powder (3m health care ltd)
10958 salbutamol .25 mg inj
10968 foradil 12microgram inhalation powder capsules with device (novartis pharmaceuticals uk ltd)
11046 ipratropium bromide with salbutamol 500micrograms + 2.5mg/2.5ml
11149 betnelan 500microgram tablets (focus pharmaceuticals ltd)
11198 beclometasons 50 micrograms/actuation vortex inhaler
11307 salbutamol 100micrograms/dose / beclometasone 50micrograms/dose inhaler
11410 fluticasone 500micrograms/dose / salmeterol 50micrograms/dose dry powder inhaler
11478 fluticasone 2mg/2ml nebuliser liquid unit dose vials
11497 beclometasone 400micrograms/dose dry powder inhaler
11588 fluticasone 125micrograms/dose / salmeterol 25micrograms/dose inhaler cfc free
11618 fluticasone 250micrograms/dose / salmeterol 25micrograms/dose inhaler cfc free
11659 oxygen bp size dd with integral headset gas 460 litres
11719 slo-phyllin 60mg capsules (merck serono ltd)
11732 beclometasone 50micrograms/dose breath actuated inhaler cfc free
11779 ipratropium bromide 40microgram inhalation powder capsules with device
11993 pro-vent 300mg capsule (wellcome medical division)
12042 ventolin cr 8mg tablet (allen & hanburys ltd)
12144 bambuterol 20mg tablets
12240 theophylline 300mg modified release capsules
12463 pirbuterol 15 mg tab
12479 aerolin inh auto refil 100 mcg aer
12486 bronchodil 500microgram/dose inhalation powder (viatris pharmaceuticals ltd)
12529 fabrol 200mg granules (novartis consumer health uk ltd)
12563 exirel inhalation powder (3m health care ltd)
12699 pecram 225mg modified-release tablet (novartis consumer health uk ltd)
12808 fenoterol 100micrograms/dose / ipratropium bromide 40micrograms/dose breath actuated inhaler
12822 salbutamol 2.5mg with ipratropium bromide 500micrograms/2.5ml unit dose nebuilser solution
12909 salbutamol 100micrograms/dose / ipratropium 20micrograms/dose inhaler
12994 fluticasone 50micrograms/dose / salmeterol 25micrograms/dose inhaler cfc free
13037 pulvinal beclometasone dipropionate 200micrograms/dose dry powder inhaler (chiesi ltd)
13038 pulvinal salbutamol 200micrograms/dose dry powder inhaler (chiesi ltd)
13040 fluticasone 250micrograms/dose / salmeterol 50micrograms/dose dry powder inhaler
13181 easyhaler salbutamol sulphate 100micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
13206 oxygen bp with integral headset gas 300 litres
13273 fluticasone 100micrograms/dose / salmeterol 50micrograms/dose dry powder inhaler
13290 clenil modulite 100micrograms/dose inhaler (chiesi ltd)
13307 bricanyl 500microgram/ml injection (astrazeneca uk ltd)
13522 prednisolone 2 mg tab
13529 amnivent-225 sr tablets (ashbourne pharmaceuticals ltd)
13575 bambec 20mg tablets (astrazeneca uk ltd)
13615 prednisone 10 mg tab
13757 tropiovent steripoule 250microgram/ml nebuliser liquid (ashbourne pharmaceuticals ltd)
13815 beclazone 100microgram/actuation inhalation powder (actavis uk ltd)
13996 salamol 100microgram/inhalation inhalation powder (sandoz ltd)
14294 qvar 50micrograms/dose easi-breathe inhaler (teva uk ltd)
14306 formoterol 12micrograms/dose inhaler cfc free
14321 beclometasone 200micrograms/dose inhaler cfc free

14482 bricanyl 2.5 mg inj
14483 terbutaline 500micrograms/ml injection
14514 zithromax 200mg/5ml oral suspension (pfizer ltd)
14524 bdp 250microgram/actuation spacehaler (celltech pharma europe ltd)
14525 salbutamol 100micrograms/inhalation vortex inhaler
14527 bambec 10mg tablets (astrazeneca uk ltd)
14561 salbutamol 400microgram / beclometasone 200microgram inhalation powder capsules
14567 asmabec 250 clickhaler (focus pharmaceuticals ltd)
14590 asmabec 250microgram/actuation spacehaler (celltech pharma europe ltd)
14700 budesonide 400micrograms/actuation inhaler
14736 pulvinal beclometasone dipropionate 400micrograms/dose dry powder inhaler (chiesi ltd)
14739 norphyllin sr 225mg tablets (teva uk ltd)
14757 pulvinal beclometasone dipropionate 100micrograms/dose dry powder inhaler (chiesi ltd)
14991 aminophylline 250mg/10ml injection
15075 bronchodil 20mg tablet (viatris pharmaceuticals ltd)
15165 reproterol 500micrograms/dose inhaler
15214 oxygen bp size pd 300 litre inhalation gas (medigas ltd)
15281 oxygen cylinders size pa2 with integral headset (air products plc)
15284 slo-phyllin 125mg capsules (merck serono ltd)
15301 carbocisteine 125mg/5ml oral solution
15326 beclometasone 100micrograms/dose inhaler cfc free
15365 theophylline 10mg/5ml sf elixir
15409 theophylline 3 mg sol
15441 fenoterol hydrobromide .5 % sol
15613 salbutamol 500micrograms/1ml solution for injection ampoules
15706 beclometasone 100 micrograms/actuation vortex inhaler
15979 oxygen bp with integral headset 300 litre inhalation gas (boc ltd)
16054 budesonide 200micrograms/actuation breath actuated powder inhaler
16124 oxygen cylinders (medigas ltd)
16148 clenil modulite 250micrograms/dose inhaler (chiesi ltd)
16151 clenil modulite 200micrograms/dose inhaler (chiesi ltd)
16158 clenil modulite 50micrograms/dose inhaler (chiesi ltd)
16236 pirbuterol acetate inhaler
16305 flixotide 2mg/2ml nebules (glaxosmithkline uk ltd)
16523 oxygen cylinders size cd with integral headset 0-15litres/minute flow rate (boc ltd)
16577 easyhaler salbutamol sulphate 200micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
16584 beclometasone 50micrograms/dose inhaler cfc free
16625 ventide rotacaps (glaxosmithkline uk ltd)
16724 prednisone 50 mg tab
16994 aminophylline hydrate 350mg modified-release tablets
17002 aminophylline hydrate 225mg modified-release tablets
17005 oxygen bp size cd with integral headset gas 460 litres
17140 aminophylline 200mg tablets
17185 ventolin 500micrograms/1ml solution for injection ampoules (glaxosmithkline uk ltd)
17465 fluticasone 500micrograms/2ml nebuliser liquid unit dose vials
17644 oxygen bp with integral headset gas 2122 litres
17654 easyhaler beclometasone 200micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
17670 easyhaler budesonide 100micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
17696 ventmax sr 4mg capsules (chiesi ltd)

17874 monovent 1.5mg/5ml oral solution (lagap)
17901 bricanyl nebule 2.5 ml
18140 respontin 500micrograms/2ml nebules (glaxosmithkline uk ltd)
18288 choline theophyllinate 100mg tablets
18299 fenoterol 1.25mg/4ml / ipratropium 500micrograms/4ml nebuliser liquid unit dose vials
18314 aerocrom syncroner with spacer (castlemead healthcare ltd)
18394 bdp 50microgram/actuation spacehaler (celltech pharma europe ltd)
18421 respontin nebules 250microgram/ml nebuliser liquid (glaxo wellcome uk ltd)
18456 salbutamol 200microgram / beclometasone 100microgram inhalation powder capsules
18484 ventide paediatric rotacaps (glaxosmithkline uk ltd)
18537 budesonide 200microgram inhalation powder capsules
18622 salbulin 2mg tablet (3m health care ltd)
18848 qvar 100micrograms/dose easi-breathe inhaler (teva uk ltd)
18937 sabidal sr 270 270 mg tab
18968 salbutamol 5mg/5ml solution for infusion ampoules
18988 choline theophyllinate 62.5mg/5ml oral solution
19031 bdp 100microgram/actuation spacehaler (celltech pharma europe ltd)
19121 beclometasone 100micrograms with salbutamol 200micrograms inhalation capsules
19376 beclometasone 200micrograms with salbutamol 400micrograms inhalation capsules
19389 asmabec 50microgram/actuation spacehaler (celltech pharma europe ltd)
19401 beclometasone 250micrograms/actuation inhaler and compact spacer
19563 becotide for nebuliser
19642 ventolin nebules
19649 ventolin rotahaler
19653 ventolin respirator
19726 ventolin s/r
19732 cobutolin inh
19735 uniphyllin continus
19736 becotide susp for nebulisation
19737 atrovent nebuliser solution (1ml vial)
19799 tulobuterol 2mg
19805 atrovent
20095 precortisyl forte 25mg tablet (aventis pharma)
20225 aminophylline 500 mg inj
20670 prednisolone e/c
20675 salbutamol rotahaler complete unit
20680 aerolin autohaler
20707 becotide 100
20720 atrovent forte
20763 becloforte
20781 salbutamol u.dose nebulising 2.5mg/2.5ml
20803 ipratropium bromide nebuliser solution
20812 pulmicort refill
20825 spacehaler bdp 250microgram/actuation spacehaler (celltech pharma europe ltd)
20838 salbuvent 2mg tablet (pharmacia ltd)
21005 beclometasone 250micrograms/dose inhaler cfc free
21102 salbutamol 2mg/5ml oral solution (lagap)
21330 oxygen composite cylinders size if2 with integral headset (medigas ltd)
21331 oxygen composite cylinders with integral headset (air products plc)
21402 oxygen cylinders size pd (air products plc)
21482 beclometasone 100micrograms/dose inhaler (generics (uk) ltd)
21769 lasma 300mg tablet (pharmax ltd)
21833 decortisyl 5mg tablet (roussel laboratories ltd)

21859 asmaven 100microgram inhalation powder (berk pharmaceuticals ltd)
22080 aminophylline 20 ml inj
22225 beclomethasone /salbutamol
22313 ventmax sr 8mg capsules (chiesi ltd)
22430 spacehaler salbutamol 100microgram/inhalation spacehaler (celltech pharma europe ltd)
22467 salbutamol respirator soln
22512 salbutamol inhaler
22550 duovent
22661 pirbuterol 10mg capsule
22663 respacal 2mg tablet (ucb pharma ltd)
22669 choline theophyllinate 270 mg tab
22790 reproterol 10mg/ml respirator solution
22828 carbocisteine 750mg/5ml forte oral solution
23269 maxivent 2.5mg/2.5ml nebuliser liquid unit dose steripoule vials (ashbourne pharmaceuticals ltd)
23337 oxygen cylinder f size 1280 litres
23512 precortisyl 5mg tablet (hoechst marion roussel)
23567 respontin 250micrograms/1ml nebules (glaxosmithkline uk ltd)
23572 aminophylline sr 225mg modified-release tablet (ivax pharmaceuticals uk ltd)
23675 pulmicort l.s. refil
23688 ventolin rotacaps
23709 ipratropium 500micrograms/2ml nebuliser liquid steri-neb unit dose vials (teva uk ltd)
23741 novolizer budesonide 200microgram/actuation pressurised inhalation (meda pharmaceuticals ltd)
23787 exirel 10mg capsule (3m health care ltd)
23905 oxygen cylinders size d (boc ltd)
23961 ipratropium bromide 250microgram/ml inhalation vapour (galen ltd)
24219 becotide rotacaps
24380 sodium cromoglicate 1mg/dose / salbutamol 100micrograms/dose inhaler with spacer
24418 biophylline 350mg tablet (lorex synthelabo ltd)
24456 carbocisteine 375mg tablets
24645 ventolin 5mg/5ml solution for infusion ampoules (glaxosmithkline uk ltd)
24660 betamethasone valerate
24674 biophylline 500mg tablet (lorex synthelabo ltd)
24716 prednisolone e/c
24898 spacehaler bdp 100microgram/actuation spacehaler (celltech pharma europe ltd)
25020 ipratropium bromide (forte)
25073 salbutamol
25093 theophylline s/r
25204 beclometasone 100micrograms/dose inhaler (a a h pharmaceuticals ltd)
25218 salbutamol cfc/free b/a
25272 precortisyl 1mg tablet (hoechst marion roussel)
25339 maxivent 5mg/2.5ml nebuliser liquid unit dose steripoule vials (ashbourne pharmaceuticals ltd)
25784 atimos modulite 12micrograms/dose inhaler (chiesi ltd)
25820 bronchodil 10mg/5ml oral solution (viatris pharmaceuticals ltd)
25821 exirel 7.5mg/5ml oral solution (3m health care ltd)
25829 pirbuterol 7.5mg/5ml oral solution
26063 beclometasone 100micrograms/dose inhaler (teva uk ltd)
26079 uniphyllin paediatric continus
26420 exirel 10 mg tab
26525 ventolin
26616 ipratropium bromide with fenoterol hydrobromide 0micrograms + 100micrograms/actuation

26665 pulmicort complete
26716 airomir autohaler cfc free b/a
26829 brelomax 2mg tablet (abbott laboratories ltd)
26873 cobutolin 2mg tablet (actavis uk ltd)
27040 phyllocontin continus
27188 easyhaler budesonide 200micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
27301 bromhexine hcl 8mg tablets
27340 salbuvent 0.5mg/ml injection (pharmacia ltd)
27505 ipratropium bromide with fenoterol hydrobromide 40micrograms + 100micrograms/actuation
27525 becotide 50
27558 choledyl
27573 ventolin
27583 pulmicort
27679 beclometasone 100microgram/actuation pressurised inhalation (approved prescription services ltd)
27842 aminophylline 2 ml inj
27889 prednisolone
27915 fluticasone prop disk refill
27959 prednisolone
27962 deltastab 1mg tablet (waymade healthcare plc)
28073 beclometasone 250microgram/actuation pressurised inhalation (approved prescription services ltd)
28241 aminophylline 250mg/10ml solution for injection minijet pre-filled syringes (ucb pharma ltd)
28376 prednisolone 2.5mg gastro-resistant tablet (biorex laboratories ltd)
28508 salbutamol 100microgram/inhalation inhalation powder (ivax pharmaceuticals uk ltd)
28577 ventolin 50microgram/ml injection (allen & hanburys ltd)
28640 beclometasone 100microgram/actuation inhalation powder (actavis uk ltd)
28761 spacehaler bdp 50microgram/actuation spacehaler (celltech pharma europe ltd)
28859 deltastab 5mg tablet (waymade healthcare plc)
28881 salbutamol 2mg/5ml oral solution sugar free (a a h pharmaceuticals ltd)
29267 salbuvent 4mg tablet (pharmacia ltd)
29273 aminophylline 225mg modified-release tablet (hillcross pharmaceuticals ltd)
29325 beclometasone 250micrograms/dose inhaler (generics (uk) ltd)
30118 salbutamol 100micrograms/dose inhaler cfc free (teva uk ltd)
30204 salbutamol 200micrograms inahalation capsules
30210 beclometasone 250micrograms/dose inhaler (teva uk ltd)
30212 salbutamol cyclohaler
30229 ipratropium bromide 250microgram/ml nebuliser liquid (galen ltd)
30230 salbutamol 100micrograms/actuation breath actuated inhaler
30238 beclometasone 50microgram/actuation pressurised inhalation (approved prescription services ltd)
30240 aerolin autohaler 100microgram/actuation pressurised inhalation (3m health care ltd)
30390 deltastab 2 mg tab
30596 aminophylline 225mg modified-release tablet (actavis uk ltd)
30649 easyhaler budesonide 400micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
30971 decortisyl 25 mg tab
31082 salbuvent 5mg/ml respirator solution (pharmacia ltd)
31290 salbulin cfc free
31327 prednisolone steaglate 6.65mg tablet
31758 uniphyllin continus
31774 beclometasone 50micrograms/dose inhaler (generics (uk) ltd)

31845 salapin 2mg/5ml syrup (pinewood healthcare)
31933 salbutamol 100micrograms/dose inhaler (a a h pharmaceuticals ltd)
32050 salbutamol 400 cyclocaps (teva uk ltd)
32102 salbutamol 4mg tablets (a a h pharmaceuticals ltd)
32461 choline theophyllinate 90 mg tab
32812 numotac 10mg tablet (3m health care ltd)
32874 beclometasone 50microgram/actuation inhalation powder (actavis uk ltd)
32893 theophylline 100mg/lysine 74mg mg tab
33089 salbutamol 100micrograms/dose inhaler (kent pharmaceuticals ltd)
33258 beclometasone 250micrograms/dose inhaler (a a h pharmaceuticals ltd)
33373 salbutamol 200 cyclocaps (teva uk ltd)
33588 salbutamol 100micrograms/dose inhaler (generics (uk) ltd)
33691 prednisolone 5mg gastro-resistant tablet (biorex laboratories ltd)
33817 salbutamol 100micrograms/dose inhaler cfc free (actavis uk ltd)
33849 beclometasone 100microgram/actuation inhalation powder (neo laboratories ltd)
33888 azithromycin 250mg tablets
33988 prednisolone 5mg tablet (co-pharma ltd)
33990 prednisolone 5mg tablet (ivax pharmaceuticals uk ltd)
34018 salbutamol 5mg/2.5ml nebuliser liquid (galen ltd)
34029 salbutamol 400micrograms inahalation capsules
34109 prednisolone 5 mg gastro-resistant tablet
34134 aerolin 400 100microgram/actuation inhalation powder (3m health care ltd)
34162 salbutamol 2.5mg/2.5ml nebuliser liquid (galen ltd)
34310 salbutamol 100micrograms/dose inhaler cfc free (a a h pharmaceuticals ltd)
34311 salbutamol 100microgram/inhalation inhalation powder (berk pharmaceuticals ltd)
34315 beclometasone 250microgram/actuation inhalation powder (actavis uk ltd)
34428 beclometasone 50microgram/actuation inhalation powder (neo laboratories ltd)
34618 salbutamol 2mg tablets (actavis uk ltd)
34619 salbutamol 100microgram/inhalation inhalation powder (kent pharmaceuticals ltd)
34631 prednisolone 1mg tablet (co-pharma ltd)
34702 salbutamol 100microgram/inhalation inhalation powder (c p pharmaceuticals ltd)
34739 beclometasone 50micrograms/dose inhaler (teva uk ltd)
34794 beclometasone 200micrograms/dose inhaler (a a h pharmaceuticals ltd)
34859 beclometasone 250microgram/actuation inhalation powder (neo laboratories ltd)
34914 prednisolone 1mg tablet (celltech pharma europe ltd)
34919 beclometasone 50micrograms/dose inhaler (a a h pharmaceuticals ltd)
34938 salbutamol 4mg tablets (actavis uk ltd)
35011 tiotropium bromide 18microgram inhalation powder capsules
35014 tiotropium bromide 18microgram inhalation powder capsules with device
35015 erdosteine 300mg capsules
35071 becodisks 200microgram (glaxosmithkline uk ltd)
35106 becodisks 100microgram with diskhaler (glaxosmithkline uk ltd)
35107 beclometasone 400microgram inhalation powder blisters with device
35113 beclometasone 200microgram inhalation powder blisters
35118 becodisks 400microgram with diskhaler (glaxosmithkline uk ltd)
35165 serevent 50microgram disks with diskhaler (glaxosmithkline uk ltd)
35178 erdotin 300mg capsules (galen ltd)
35225 flixotide 100microgram disks with diskhaler (glaxosmithkline uk ltd)
35288 beclometasone 400microgram inhalation powder blisters
35293 beclometasone 200microgram inhalation powder blisters with device
35299 becodisks 400microgram (glaxosmithkline uk ltd)
35374 flixotide 500microgram disks (glaxosmithkline uk ltd)
35392 flixotide 500microgram disks with diskhaler (glaxosmithkline uk ltd)
35408 becodisks 100microgram (glaxosmithkline uk ltd)
35430 becodisks 200microgram with diskhaler (glaxosmithkline uk ltd)

35461 flixotide 250microgram disks with diskhaler (glaxosmithkline uk ltd)
35503 salmeterol 50microgram inhalation powder blisters
35510 budesonide 200micrograms/dose dry powder inhalation cartridge with device
35522 bricanyl 500micrograms/1ml solution for injection ampoules (astrazeneca uk ltd)
35542 salmeterol 50microgram inhalation powder blisters with device
35557 ipramol nebuliser solution 2.5ml steri-neb unit dose vials (teva uk ltd)
35566 oxygen bp with set gas 1360 litres
35580 beclometasone 100microgram inhalation powder blisters with device
35602 budesonide 200micrograms/dose dry powder inhalation cartridge
35611 flixotide 250microgram disks (glaxosmithkline uk ltd)
35631 budelin novolizer 200micrograms/dose inhalation powder (meda pharmaceuticals ltd)
35638 fluticasone 100microgram inhalation powder blisters with device
35652 beclometasone 100microgram inhalation powder blisters
35700 fluticasone 500microgram inhalation powder blisters with device
35724 budelin novolizer 200micrograms/dose inhalation powder refill (meda pharmaceuticals ltd)
35725 formoterol easyhaler 12micrograms/dose dry powder inhaler (orion pharma (uk) ltd)
35744 bricanyl 2.5mg/5ml solution for injection ampoules (astrazeneca uk ltd)
35772 fluticasone 100microgram inhalation powder blisters
35825 serevent 50microgram disks (glaxosmithkline uk ltd)
35861 terbutaline 2.5mg/5ml solution for injection ampoules
35862 terbutaline 500micrograms/1ml solution for injection ampoules
35905 fluticasone 250microgram inhalation powder blisters
35986 flixotide 50microgram disks (glaxosmithkline uk ltd)
36021 fluticasone 50microgram inhalation powder blisters with device
36090 flixotide 100microgram disks (glaxosmithkline uk ltd)
36290 flixotide 50microgram disks with diskhaler (glaxosmithkline uk ltd)
36401 fluticasone 250microgram inhalation powder blisters with device
36462 fluticasone 500microgram inhalation powder blisters
36677 reproterol 10mg/5ml oral solution
36864 tiotropium bromide 2.5micrograms/dose solution for inhalation cartridge with device cfc free
37432 fostair 100micrograms/dose/6micrograms/dose inhaler (chiesi ltd)
37447 fluticasone 50microgram inhalation powder blisters
37470 beclometasone 100micrograms/dose / formoterol 6micrograms/dose inhaler cfc free
37612 terbutaline 5mg/2ml nebuliser liquid unit dose vials (galen ltd)
37791 ipratropium bromide 250microgram/ml
38079 salbutamol 100micrograms/dose dry powder inhalation cartridge with device
38097 salbutamol cyclocaps 200microgram inhalation powder (dupont pharmaceuticals ltd)
38120 theophylline 500mg modified release tablets
38136 salbulin novolizer 100micrograms/dose inhalation powder (meda pharmaceuticals ltd)
38214 salbutamol 100micrograms/dose dry powder inhalation cartridge
38226 salbulin novolizer 100micrograms/dose inhalation powder refill (meda pharmaceuticals ltd)
38407 prednisolone 20mg tablet
38416 salbutamol cyclocaps 400microgram inhalation powder (dupont pharmaceuticals ltd)
38419 terbutaline 1.5mg/5ml oral solution sugar free (a a h pharmaceuticals ltd)
39040 phyllocontin forte continus 350mg tablets (napp pharmaceuticals ltd)
39099 pulmicort 100micrograms/dose inhaler cfc free (astrazeneca uk ltd)
39102 budesonide 100micrograms/dose inhaler cfc free
39200 aerobec forte 250 autohaler (meda pharmaceuticals ltd)
39879 budesonide 200micrograms/dose inhaler cfc free
40057 pulmicort 200micrograms/dose inhaler cfc free (astrazeneca uk ltd)
40177 ipratropium bromide 250microgram/ml nebuliser liquid (hillcross pharmaceuticals ltd)
40218 azithromycin 500mg tablets (teva uk ltd)

40599 salbutamol 5mg/2.5ml nebuliser liquid unit dose steripoule vials (galen ltd)
40637 ipratropium 250micrograms/1ml nebuliser liquid unit dose steripoule vials (galen ltd)
40655 salbuvent 100microgram/actuation inhalation powder (pharmacia ltd)
40709 salbutamol 2.5mg/2.5ml nebuliser liquid unit dose vials (a a h pharmaceuticals ltd)
40832 ipratropium 500micrograms/2ml nebuliser liquid unit dose steripoule vials (galen ltd)
41269 beclometasone 400 cyclocaps (teva uk ltd)
41412 beclometasone 400micrograms/actuation inhaler
41548 salbutamol 2mg tablets (approved prescription services ltd)
41549 salbutamol 2mg tablet (c p pharmaceuticals ltd)
41691 salbutamol 2mg/5ml oral solution sugar free (sandoz ltd)
41832 monovent 1.5mg/5ml syrup (sandoz ltd)
42103 tulobuterol 1mg/5ml sugar free syrup
42279 salbutamol 2.5mg/2.5ml nebuliser liquid unit dose steripoule vials (galen ltd)
42497 salbutamol 8mg tablet
42511 aminophylline 25mg/ml injection (celltech pharma europe ltd)
42830 ventolin 100micrograms/dose evohaler (glaxosmithkline uk ltd)
42858 ventolin 200micrograms/dose accuhaler (glaxosmithkline uk ltd)
42867 terbutaline 1.5mg/5ml oral solution (sandoz ltd)
42886 bricanyl 500micrograms/dose turbohaler (astrazeneca uk ltd)
42910 aminophylline 250mg/10ml solution for injection ampoules (martindale pharmaceuticals ltd)
42928 flixotide 100micrograms/dose accuhaler (glaxosmithkline uk ltd)
42985 flixotide 50micrograms/dose accuhaler (glaxosmithkline uk ltd)
42994 flixotide 250micrograms/dose accuhaler (glaxosmithkline uk ltd)
43046 salipraneb 0.5mg/2.5mg nebuliser solution 2.5ml ampoules (arrow generics ltd)
43074 flixotide 500micrograms/dose accuhaler (glaxosmithkline uk ltd)
43085 bricanyl 5mg/2ml respules (astrazeneca uk ltd)
43400 clamelle 500mg tablets (actavis uk ltd)
43544 prednisone 5mg tablet (knoll ltd)
43738 indacaterol 150microgram inhalation powder capsules with device
43794 nebusal 7% inhalation solution 4ml ampoules (forest laboratories uk ltd)
43870 sodium chloride 7% inhalation solution 4ml ampoules
43893 onbrez breezhaler 150microgram inhalation powder capsules with device (novartis pharmaceuticals uk ltd)
44064 onbrez breezhaler 300microgram inhalation powder capsules with device (novartis pharmaceuticals uk ltd)
44173 roflumilast 500microgram tablets
44380 prednisone 1mg modified-release tablets
44431 daxas 500microgram tablets (takeda uk ltd)
44713 salbutamol 100microgram/inhalation inhalation powder (celltech pharma europe ltd)
45302 prednisolone 5mg tablet (biorex laboratories ltd)
45610 indacaterol 300microgram inhalation powder capsules with device
45863 salbutamol 5mg/2.5ml nebuliser liquid (generics (uk) ltd)
46157 beclometasone 200 cyclocaps (teva uk ltd)
46551 salbutamol 100microgram/inhalation inhalation powder (neo laboratories ltd)
46695 azithromycin 500mg tablet (hillcross pharmaceuticals ltd)
49016 sodium chloride 7% inhalation solution 4ml vials
49045 nebusal 7% inhalation solution 4ml vials (forest laboratories uk ltd)
49530 azithromycin 200mg/5ml oral suspension (sandoz ltd)
50508 mucodyne 250mg/5ml syrup (sigma pharmaceuticals plc)
52029 zithromax 250mg capsules (mawdsley-brooks & company ltd)
53303 carbocisteine 375mg capsules (arrow generics ltd)

Spirometry codes

medcode	readterm
6118	spirometry
10336	spirometry reversibility
10337	spirometry screening
10420	spirometry reversibility negative
10492	spirometry reversibility positive
13683	referral for spirometry
14453	forced expiratory volume - fev
19428	chronic obstructive pulmonary disease excluded by spirometry
26241	spirometry indicated
29015	spirometry
45993	incentive spirometry
102522	post bronchodilator spirometry
6091	Percent predicted FEV1
8512	FEV1/FVC percent
10320	Forced expired volume in 1 second
11078	FEV1/FVC > 70% of predicted
14455	FEV1/FVC ratio normal
14456	FEV1/FVC ratio
19830	FEV1 after bronchodilation
19832	FEV1/FVC ratio after bronchodilator
23237	FEV1 before bronchodilation
23285	FEV1/FVC ratio abnormal
25083	FEV1/FVC < 70% of predicted
27141	FEV1/FVC ratio before bronchodilator
43040	FEV1 pre steroids
43041	FEV1 post steroids
58632	FEV1/FVC ratio pre steroids
58633	FEV1/FVC ratio post steroids
99777	Forced expired volume in 1 second reversibility
100391	Forced expired volume in 1 second percentage change
101079	Percentage predicted FEV1 after bronchodilation

Non-specific bronchitis codes / Frequent winter bronchitis

medcode	readterm
148	bronchitis unspecified
152	wheezy bronchitis
3243	chronic bronchitis
3480	bronchitis nos
4519	h/o: bronchitis
5798	chronic asthmatic bronchitis
5909	chronic wheezy bronchitis
7092	recurrent wheezy bronchitis
11150	mucopurulent chronic bronchitis
13247	fh: bronchitis
13262	fh: bronchitis/coad
14798	emphysematous bronchitis
15157	chronic bronchitis nos
15626	chronic catarrhal bronchitis
17359	chest infection - unspecified bronchitis
24248	mixed simple and mucopurulent chronic bronchitis
25603	simple chronic bronchitis
27819	obstructive chronic bronchitis

37959 fetid chronic bronchitis
40159 purulent chronic bronchitis
44525 obstructive chronic bronchitis nos
61118 simple chronic bronchitis nos
61513 mucopurulent chronic bronchitis nos
62913 [v]screening for chronic bronchitis or emphysema
66043 other chronic bronchitis
68066 other chronic bronchitis nos
202167 INFLUENZAL BRONCHITIS
207165 Acute streptococcal bronchitis
207166 Acute viral bronchitis unspecified
216109 Acute membranous bronchitis
216111 Acute bronchitis due to mycoplasma pneumoniae
216112 Acute bronchitis NOS
216141 Chest infection - unspecified bronchopneumonia
220234 BRONCHITIS FIBRINOUS ACUTE
225216 Acute pseudomembranous bronchitis
225241 Bronchitis NOS
234340 Acute bronchitis due to rhinovirus
239395 H/O: bronchitis
243349 Acute bronchitis and bronchiolitis
243350 Acute pneumococcal bronchitis
243351 Acute bronchitis due to echovirus
243389 Bronchitis unspecified
261710 Acute wheezy bronchitis
261711 Acute purulent bronchitis
261712 Acute croupous bronchitis
261713 Acute bronchitis due to respiratory syncytial virus
271007 Acute bronchitis due to coxsackievirus
280054 Acute fibrinous bronchitis
280055 Acute bronchitis due to parainfluenza virus
280082 Chest infection - unspecified bronchitis
289164 Acute bronchitis
289165 Acute neisseria catarrhalis bronchitis
289166 Subacute bronchitis unspecified
289233 [X]Acute bronchitis due to other specified organisms
293231 BRONCHITIS SUBACUTE
298435 Acute haemophilus influenzae bronchitis
298436 Acute bacterial bronchitis unspecified
298440 Acute bronchitis or bronchiolitis NOS
303952 BRONCHITIS ACUTE
303954 VIRAL BRONCHITIS
303963 BRONCHOPNEUMONIA
306525 BRONCHITIS PURULENT
306528 CATARRHAL BRONCHITIS
308788 Acute bronchitis

Respiratory symptom codes

Wheeze

medcode	readterm
152	wheezy bronchitis
173	wheezing
2210	[d]wheezing

2891 wheezing symptom
4836 nocturnal cough / wheeze
5861 o/e - expiratory wheeze
5909 chronic wheezy bronchitis
5978 acute wheezy bronchitis
7092 recurrent wheezy bronchitis
42317 increasing exercise wheeze
100954 [d]mild wheeze
101037 [d]moderate wheeze
101073 [d]severe wheeze
101421 [d]very severe wheeze
102480 on examination - inspiratory wheeze

Chronic cough

medcode	readterm
92	cough
292	chesty cough
1025	bronchial cough
1160	[d]cough
1234	productive cough nos
1273	c/o - cough
1612	chronic cough
3068	night cough present
3628	persistent cough
3645	coughing up phlegm
4070	morning cough
4836	nocturnal cough / wheeze
4931	dry cough
7706	productive cough -clear sputum
7707	cough symptom nos
7708	productive cough-yellow sputum
7773	productive cough -green sputum
16717	smokers' cough
22318	difficulty in coughing up sputum
29318	evening cough
43795	unexplained cough
60903	cough aggravates symptom
100333	cough on exercise

Exertional breathlessness

medcode	readterm
735	[d]breathlessness
1429	breathlessness
3092	[d]dyspnoea
5175	breathlessness symptom
5896	dyspnoea - symptom
6326	breathless - moderate exertion
7000	o/e - dyspnoea
7932	breathless - mild exertion
19426	mrc breathlessness scale: grade 3
19427	mrc breathlessness scale: grade 2
19429	mrc breathlessness scale: grade 5

19430 mrc breathlessness scale: grade 4
19432 mrc breathlessness scale: grade 1
21801 breathlessness nos
24889 breathless - strenuous exertion
31143 breathless - at rest
42287 borg breathlessness score: 6 severe (+)
53771 dyspnoea on exertion
57193 borg breathlessness score: 3 moderate
57759 borg breathlessness score: 2 slight
59860 borg breathlessness score: 4 somewhat severe
64049 borg breathlessness score: 5 severe
67566 borg breathlessness score: 9 very, very sev (almost maximal)
68707 borg breathlessness score: 1 very slight
70061 borg breathlessness score: 7 very severe
70818 borg breathlessness score: 0.5 very, very slight
72334 borg breathlessness score: 8 very severe (+)
101843 borg breathlessness score: 10 maximal
741 [D]Shortness of breath
2563 [D]Respiratory distress
2575 Short of breath on exertion
2931 Difficulty breathing
4822 Shortness of breath
5349 Shortness of breath symptom
9297 [D]Respiratory insufficiency
22094 Short of breath dressing/undressing
40813 Unable to complete a sentence in one breath

Sputum codes

medcode readterm
292 chesty cough
1025 bronchial cough
1234 productive cough nos
3645 coughing up phlegm
7706 productive cough -clear sputum
7708 productive cough-yellow sputum
7773 productive cough -green sputum
22318 difficulty in coughing up sputum
1251 [d]abnormal sputum
3727 sputum sent for c/s
8287 sputum sample obtained
8760 [d]positive culture findings in sputum
9807 sputum - symptom
14804 sputum appears infected
15430 [d]sputum abnormal - colour
16026 sputum examination: abnormal
18964 sputum clearance
20086 [d]sputum abnormal - amount
22318 difficulty in coughing up sputum
23582 [d]abnormal sputum nos
24181 sputum: mucopurulent
29294 sputum appears normal
30754 yellow sputum
30904 sputum sent for examination
31417 sputum - not infected
35577 sputum examination - general

36515 [d]abnormal sputum - tenacious
36880 green sputum
40201 sputum microscopy: nad
40202 mucoid sputum - o/e
42573 clear sputum
43270 sputum evidence of infection
43272 sputum examination nos
44214 [d]sputum abnormal - odour
49029 sputum gen. exam. nos
49694 sputum: organism on gram stain
52806 sputum: frothy/watery
54177 sputum: excessive - mucoid
61079 sputum inspection nos
91680 expectoration of induced sputum from respiratory tract
100484 volume of sputum
100524 moderate sputum
100629 white sputum
100647 copious sputum
100931 brown sputum
101782 profuse sputum
103209 grey sputum

QOF codes

H3... Chronic obstructive pulmonary disease
H31.. Chronic bronchitis
H310. Simple chronic bronchitis
H3100 Chronic catarrhal bronchitis
H310z Simple chronic bronchitis NOS
H311. Mucopurulent chronic bronchitis
H3110 Purulent chronic bronchitis
H3111 Fetid chronic bronchitis
H311z Mucopurulent chronic bronchitis NOS
H312. Obstructive chronic bronchitis
H3120 Chronic asthmatic bronchitis
H3121 Emphysematous bronchitis
H3123 Bronchiolitis obliterans
H312z Obstructive chronic bronchitis NOS
H313. Mixed simple and mucopurulent chronic bronchitis
H31y. Other chronic bronchitis
H31y1 Chronic tracheobronchitis
H31yz Other chronic bronchitis NOS
H31z. Chronic bronchitis NOS
H32.. Emphysema
H320. Chronic bullous emphysema
H3200 Segmental bullous emphysema
H3201 Zonal bullous emphysema
H3202 Giant bullous emphysema
H3203 Bullous emphysema with collapse
H320z Chronic bullous emphysema NOS
H321. Panlobular emphysema
H322. Centrilobular emphysema
H32y. Other emphysema
H32y0 Acute vesicular emphysema

H32y1 Atrophic (senile) emphysema
H32y2 MacLeod's unilateral emphysema
H32yz Other emphysema NOS
H32z. Emphysema NOS
H36.. Mild chronic obstructive pulmonary disease
H37.. Moderate chronic obstructive pulmonary disease
H38.. Severe chronic obstructive pulmonary disease
H39.. Very severe chronic obstructive pulmonary disease
H3A.. End stage chronic obstructive airways disease (v23)
H3y.. Other specified chronic obstructive airways disease
~~H3y0. Chronic obstructive pulmonary disease with acute lower respiratory infection~~ (v23)
~~H3y1. Chronic obstructive pulmonary disease with acute exacerbation, unspecified~~ (v23)
H3z.. Chronic obstructive airways disease NOS

GP Questionnaire

1. Do you think this patient has COPD? Yes / No / Uncertain
2. What was the diagnosis of COPD based on? (please circle all that apply)
   Smoking history symptoms spirometry other (please describe)
3. Has a respiratory physician seen the patient and confirmed a diagnosis of COPD?
4. Does the patient have any other respiratory condition?
   If yes, than what?

Table S1: The PPV and proportion of patients diagnosed with COPD who also had cardiovascular disease or asthma

Algorithm	Number with CVDx	Number confirmed COPD	PPV and 95% CI	Number with asthma	Number confirmed COPD	PPV and 95% CI
COPD Code + spirometry + COPD medication	20	17	85.0, 59.6-95.6	18	14	72.2, 45.3-89.1
COPD Code + spirometry	24	20	83.3, 61.1-94.1	20	14	70.0, 45.0-87.0
COPD Code + COPD medication	18	16	88.9, 61.1-97.6	16	9	56.3, 29.8-79.6
COPD Code only	18	16	88.9, 61.1-97.6	15	12	80.0, 48.8-94.4
Bronchitis + COPD medication	21	8	38.1, 19.1-61.7	27	4	14.8, 5.3-35.1
Bronchitis only	19	8	42.1, 21.1-66.5	23	6	26.1, 11.4-49.1
Symptoms + spirometry	15	9	60.0, 31.8-82.9	19	4	21.1, 7.3-47.3
Symptoms only	9	2	22.2, 3.9-67.0	23	2	8.7, 1.9-31.4

Table S2: The PPV and proportion of patients diagnosed with COPD who were current smokers

Algorithm	Number current smokers	Number confirmed COPD	PPV and 95% CI
COPD Code + spirometry + COPD medication	49	44	89.9, 77.1-95.8
COPD Code + spirometry	51	39	76.5, 62.5-86.4
COPD Code + COPD medication	55	46	83.6, 71.0-91.4
COPD Code only	47	41	87.2, 73.8-94.3
Bronchitis + COPD medication	67	34	50.7, 38.7-62.7
Bronchitis only	64	19	29.7, 19.6-42.3
Symptoms + spirometry	50	20	40.0, 27.1-54.5
Symptoms only	58	6	10.3, 4.6-21.7

Table S3: The PPV and proportion of patients diagnosed with COPD by COPD severity

Algorithm	GOLD 1 Number confirmed, (PPV and 95% CI)	GOLD 2 Number confirmed, (PPV and 95% CI)	GOLD 3 Number confirmed, (PPV and 95% CI)	GOLD 4 Number confirmed, (PPV and 95% CI)
COPD Code + spirometry + COPD medication	9, (69.2, 36.5-89.8)	34, (87.2, 71.8-94.8)	22, (100)	6, (100)
COPD Code + spirometry	8, (66.7, 32.9-89.1)	35, (83.3, 68.2-92.1)	20, (100)	3, (75, 4.1-99.5)
COPD Code + COPD medication	14, (82.4, 53.7-94.9)	32 (84.2, 68.1-93.0)	20, (95.2, 69.1-99.4)	6, (100)
COPD Code only	14, (82.4, 53.7-94.9)	37, (86.0, 71.5-93.8)	14, (93.3, 58.4-99.3)	3, (100)
Bronchitis + COPD medication	7, (36.8, 17.3-62.0)	20, (76.9, 55.6-89.9)	11, (91.7, 49.9-99.2)	2, (100)
Bronchitis only	3, (20.0, 5.6-51.2)	7, (63.6, 28.8-83.3)	10 (100)	1, (100)
Symptoms + spirometry	4, (57.1, 15.0-90.9)	19, (90.5, 66.0-97.9)	10 (90.9, 46.3-99.1)	1, (100)
Symptoms only	2, (40, 3.8-91.9)	6, (100)	0	0

Table S4: The PPV and proportion of patients diagnosed with COPD by timing of diagnosis

Algorithm	2004 to end 2008			Post 2008		
	Number in algorithm	**Number confirmed COPD**	**PPV and 95% CI**	**Number in algorithm**	**Number confirmed COPD**	**PPV and 95% CI**
COPD Code + spirometry + COPD medication	32	28	87.5, 69.8-95.5	53	48	90.6, 78.7-96.1
COPD Code + spirometry	14	11	78.6, 46.0-94.0	66	56	84.8, 73.7-91.8
COPD Code + COPD medication	27	23	85.2, 64.9-94.7	61	54	88.5, 77.4-94.5
COPD Code only	21	16	76.2, 51.7-90.5	68	61	89.7, 79.6-95.1
Bronchitis + COPD medication	94	42	44.7, 34.8-55.0	5	2	40.0, 3.8-91.9
Bronchitis only	83	22	26.5, 18.0-37.2	5	4	80.0, 11.1-99.2
Symptoms + spirometry	63	28	44.4, 32.4-57.1	22	9	40.9, 21.6-63.5
Symptoms only	64	10	15.6, 8.5-27.0	26	1	3.8, 0.47-25.4