Diagnosis of airway obstruction in primary care in the UK: the CADRE (COPD and Asthma Diagnostic/management REassessment) programme 1997–2001

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Objective: Asthma and COPD require different management strategies, but differentiation in primary care is difficult. This primary care support initiative observed the impact of spirometry and clinical assessment on the diagnosis of airway disease.
Materials and methods: Of 61 191 patients aged ≥40 years being treated for respiratory conditions within 1003 UK primary care practices, 43 203 underwent a diagnostic review including standardized spirometric assessment. The proportion of patients in whom the diagnosis was changed by the additional information was determined. The relationship of various patient characteristics was compared with the baseline and review diagnoses and with any change in diagnosis.
Results: Asthma was initially diagnosed in 43% of patients, COPD in 35%, mixed disease in 9%, and other respiratory condition in 13%. Patients initially diagnosed with asthma, mixed disease, or another condition were more likely to have their diagnosis changed at review (54%, 46%, and 63%, respectively) than those initially diagnosed with COPD (14%). A change from asthma to COPD was associated with male gender, smoking, older age, and reduced lung function, the opposite being associated with a change from COPD to asthma.
Conclusion: In this study, a clinical review supplemented by additional information including spirometry highlights apparent mislabeling of significant numbers of patients with chronic obstructive disease in general practice with significant implications for individual treatment and healthcare provision. This study shows that the addition of more clinical information can have a major effect on diagnostic tendency in patients with airway disease. An initial diagnosis of COPD seems less likely to change following review than an asthma diagnosis. While it is likely that greater information leads to a more accurate diagnosis, the differential effect of new information on diagnostic labeling highlights the insecurity of the diagnostic process in primary care in the UK.

Keywords: COPD, spirometry, guidelines, primary care, diagnosis, asthma

INTRODUCTION

Chronic respiratory diseases are common and account for a large proportion of patients seen in general practice (Pearson et al 1996). Both asthma and COPD result in significant morbidity, impaired quality of life, and mortality (Petty 2000; Jacobs et al 2001; Pauwels et al 2001). In addition, both conditions pose a considerable economic burden for the health system (NIH 1997; Rutten van-Molken and Feenstra 2001). Airflow limitation is common to both asthma and COPD, but the mechanisms involved, prognosis, and management strategies differ (ATS 1995; Siafakas 1995; NIH 1997; The COPD Guidelines Group of the Standards of Care Committee of the BTS 1997; Pauwels et al 2001; British Guideline on the Management of Asthma 2003). When properly treated, symptomatic asthma will be well controlled in most

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patients, whereas the symptoms of COPD will be, at best, minimized (McIvor and Chapman 1996).

A crucial precondition for the optimal management of airways disease is to make a reliable diagnosis (Martinez 1998). The diagnosis of COPD is dependent on objective demonstration of airflow limitation (forced expiratory volume [FEV_1], FEV_1/forced vital capacity [FVC] ratio) using spirometry. By definition, COPD differs from asthma as it lacks full reversibility of airflow limitation (Martinez 1998; Pauwels et al 2001); however, even in well-equipped secondary care clinics, it is often difficult to distinguish between the two conditions in smokers over the age of 40 (Jans et al 1998), and their differentiation is more challenging in primary care, where access to or training in the use of spirometry is often limited. In primary care, diagnosis was traditionally based on history and physical examination alone although this is currently changing. This is a particular problem with older patients in whom clinical findings may be equivocal, due to multiple pathology, under-reporting of symptoms, and reduced perception of dyspnea (Tregonning and Langley 1999). In some cases, the diagnosis of asthma or COPD can be completely missed (Renwick and Connolly 1996; McIvor and Tashkin 2001).

Little is known about factors influencing the general practitioner's (GP)'s decision in the diagnosis and treatment of chronic respiratory patients in the absence of spirometry. It is likely that clinical features specific to COPD, as well as smoking history, are considered in making a diagnosis (Griffiths et al 1999), but their validity may have some limitations (Price and van der Molen 2001). While it is likely that adding relevant information will improve diagnostic accuracy, it is equally possible that simply being presented with extra information encourages change.

The **C**OPD and **A**sthma **D**iagnostic/management **RE**assessment (CADRE) programme considered baseline information of a primary care audit support initiative commenced in 1997, at around the time of the first British Thoracic Society (BTS) COPD guidelines in response to the low availability of spirometry in primary care. The initiative offered the chance to observe the impact of adding further specific clinical assessment and spirometric data to the pattern of diagnostic labeling by GPs of patients with obstructive airway diseases throughout the UK. Results in terms of disease labeling before and after spirometric assessment from 1997 to 2001 are reported in this paper together with factors associated with making a change in diagnostic labeling.

Patients and methods

Study design

The CADRE programme collected data regarding respiratory patients being managed in primary care practices across the UK between 1997 and 2001. Practices were selected if they met the following criteria: a computerized respiratory register; an asthma-trained practice nurse; GP commitment to the project; and more than 300 identifiable respiratory patients over the age of 40 years.

Methods

Data were collected by a team of 40 diploma-qualified respiratory nurses (National Respiratory Training Centre, Warwick, UK) employed by an independent contract company, who were formally seconded and clinically responsible to each general practice for the purposes of this programme. The nurses were authorized by each practice to analyze practice notes and review patients. All therapeutic decisions remained the responsibility of the prescribing GP and no patient-identifiable information was removed from the practice.

The respiratory nurses identified all patients likely to have obstructive lung disease from practice records based on the following predefined screening criteria: ≥40 years old, with more than one prescription for bronchodilators in the past 12 months; at least one persistent respiratory symptom; recurrent "chest infections"; or lung function outside the normal range (as measured by peak expiratory flow [PEF] or FEV_1).

Identified patients were then invited to a review clinic and, subject to their written informed consent, offered an additional respiratory assessment by the nurse. Consenting patients were reassessed by both clinical assessment and spirometry. In each case, the best of three repeatable spirometric measurements was used. The clinical assessment included a specific smoking history, night-time and day-time symptoms, prior respiratory and allergy history, medication details, and family history.

The additional clinical and lung-function data were shared with the GP, who reviewed each patient's diagnosis and classified it as one of the following: asthma, COPD, mixed disease (asthma and COPD), or another respiratory condition ("other"). The revised diagnosis was recorded in the database. The GP also adjusted disease management based on clinical need and the review data as necessary. Any changes in treatment were recorded in the database, and these will be reported elsewhere.

In order to analyze the social status of the sample, the postcodes of the participating practices were collected and compared with both the index of multiple social deprivation, and the associated ranks of the indices. These data were obtained from publicly available sources and were only available for English wards.

Ethical and consent approach

This programme began as an audit support initiative within individual GP practices. The additional assessments offered were those recommended in guidelines but often not available in primary care. This was an observational study with no therapeutic intervention.

While individual data were available to the staff at the practice for both audit and patient management, only data that were not patient-identifiable were recorded on the database for central analysis. The 43 803 patients who accepted the assessment gave written consent for their data to be evaluated. The basic demographic data of the 17 388 patients who did not attend assessment were used to confirm that the population studied was representative of the wider general practice population. This use of anonymized data are in line with current guidelines (The Confidentiality and Security Advisory Group for Scotland 2002).

Data evaluation

The level of baseline medication was used as a crude disease severity stratification as follows:

- If the initial diagnosis was asthma or mixed disease, patients were matched to the closest corresponding treatment step of the BTS asthma guidelines 1993, as utilized previously (Guidelines on the Management of Asthma 1993).
- If the initial diagnosis was COPD, patients were matched to the following medication use scheme, adapted by the authors from the BTS COPD guidelines (9): Level 1 = single inhaled bronchodilator; Level 2 = multiple short-acting bronchodilators (inhaled/oral); Level 3 = level 2 plus long-acting β_2-agonist (LABA); Level 4 – addition of nebulized bronchodilator(s); and level 5 = regular oral steroids.

Analysis of patient factors associated with a change in diagnosis

A multiple logistic regression analysis was performed for each of the baseline and review diagnoses to assess the effect of various patient characteristics (gender, age, smoking habits, FEV_1, and FEV_1/FVC ratio) on a change in diagnosis. The Hosmer-Lemeshow goodness-of-fit test was used to test the fit of each model. Variance in the dependent variable of each model was also assessed. The software used was SAS® Version 8.2.

RESULTS

A total of 61 191 patients from 1003 general practices throughout the UK met the screening criteria; of these, 60 008 (98%) had a baseline diagnosis recorded, and 43 803 (72%) also had a diagnostic review. The number of patients with both a baseline and review diagnosis was 43 203 (71%), as 600 patients had a review but no baseline diagnosis.

Of the 1003 practices, 768 (82%) were located in England and entered the analysis of social deprivation. The participating practices were located in socially more deprived wards than the average in England, with 50% of the participating practices ranking within the lowest 30 percentiles compared with 18% within the highest 30 percentiles. The average index of social deprivation score of the participating practices (21.7±15.4) was significantly lower than in all English wards (29.7±18.1; $p<0.0001$) (Office for National Statistics 1998).

Baseline characteristics and diagnoses

The 43 203 patients that attended the diagnosis review had similar baseline characteristics to those initially screened and included 18 931 (44%) who were labeled as asthma; 14 572 (34%) as COPD; 3979 (9%) as mixed disease; and 5721 (13%) as "other" (Table 1).

The category of "other" included prior labels of bronchitis, breathlessness, bronchiectasis, cough, chest infections, shortness of breath, cardiogenic symptoms, and upper respiratory tract infection. An asthma label was associated with being female (14 476 patients; 56%), better lung function (mean FEV_1: 1.63 L), younger age (mean 64 years), and non-smokers (3308 [18%] patients). In contrast, those labeled COPD had a male preponderance (12058 [57%] patients), worse lung function (mean FEV_1: 1.26 L), older age (mean 70 years), and included fewer non-smokers (9% vs 54% for ex-smokers and 37% for current-smokers). The mixed disease group was intermediate for each (Table 2).

There was a trend for a worse FEV_1 with increasing treatment intensity, but no correlation with either smoking status or whether or not the diagnosis was later revised (Table 3).

Table 1 Patient demographics at baseline and at review visit

	Baseline (n=61191)	Review[a] (n=43203)
Gender[b]; n (%)		
Male	30955 (50.6)	22128 (51.3)
Female	30203 (49.4)	21045 (48.7)
Age (years); mean (±SD)	66.7 (±11.1)	66.7 (±10.7)
Smoking status[c]; n (%)		
Never smoked	5853 (14.0)	5805 (14.1)
Ex-smoker	21364 (51.1)	21033 (51.0)
Current smoker	14590 (34.9)	14373 (34.9)
FEV_1 (L)[d]; mean (±SD)	1.49 (±0.68)	1.49 (±0.68)
Baseline diagnosis[e]; n (%)		
Asthma	25959 (43.3)	18931 (43.8)
COPD	21012 (35.0)	14572 (33.7)
Mixed disease	5501 (9.2)	3979 (9.2)
Other condition	7536 (12.6)	5721 (13.2)

[a]Patients with diagnosis at both baseline and review visit.
[b]Missing for 33 patients at baseline and 30 at review.
[c]Missing for 19384 patients at baseline and 1992 at review.
[d]Missing for 24322 patients at baseline and 6809 at review.
[e]Missing for 1183 patients at baseline.

Change in diagnosis

We analyzed only patients with both a baseline and review diagnosis (n=43203). Patients with an initial diagnostic label of asthma, mixed disease, or other condition were more likely to have their diagnosis changed at review (10228 [54%], 1811 [46%], and 3616 [63%], respectively), than those initially diagnosed with COPD (2028 [14%]) (Table 4).

Gender, age, smoking status, and lung function were all statistically significant predictors of a change in diagnosis for patients originally diagnosed with asthma and COPD (Tables 4 and 5). For patients originally diagnosed with asthma, male gender, smoking status (smokers and ex-smokers), older age, lower FEV_1, and a lower FEV_1/FVC were more likely to be associated with a subsequent change in diagnosis. Conversely, for patients originally diagnosed with COPD, female gender, a non-smoking status, younger age, higher FEV_1, and a higher FEV_1/FVC ratio were more likely to produce a subsequent change in diagnosis. None of the potential predictors were statistically significant in the analysis of a change in diagnosis for the mixed-disease group.

In patients labeled as having asthma at baseline who had a change in diagnosis, the change was mainly to COPD (6272 [61%]) or mixed disease (3474 [34%]). Of the small proportion of COPD patients in whom the diagnosis was changed, almost three-quarters were re-labeled as either mixed disease (847 [42%]) or asthma (648 [32%]). In the mixed population, the predominant change was to COPD (1386 [77%]) (Table 6). The diagnostic re-labeling was independent of the intensity of treatment (Table 3).

DISCUSSION

This study has shown that clinical review augmented by spirometry for respiratory patients in primary care leads to a change in diagnostic labeling in a significant proportion of such patients and that this is independent of current level of treatment. Before considering the implications of this, it is worth placing the study in context.

When the BTS COPD guidelines (ATS 1995) were conceived, it was apparent that access to spirometry in primary care was limited, and a survey by the BTS COPD consortium in 1999 confirmed that most had little awareness of FEV_1 as a diagnostic tool in COPD (Halpin and Rudolf 2002). Some in primary care were critical of the guidelines for relying on spirometry for diagnosis (Nolan and White 1999; White and Nolan 2000). The CADRE programme was

Table 2 Patient demographics at baseline by baseline diagnosis[a]

	Asthma (n=25959)	COPD (n=21012)	Mixed disease (n=5501)	Other (n=7536)
Gender[b], n (%)				
Male	11465 (44.2)	12058 (57.4)	2765 (50.3)	4030 (53.5)
Female	14476 (55.8)	8950 (42.6)	2732 (49.7)	3499 (46.5)
Age (years); mean (±SD)	63.5 (±11.5)	70.1 (±9.6)	67.5 (±10.4)	67.2 (±11.1)
Smoking status[c]; n (%)				
Never smoked	3308 (18.3)	1228 (8.9)	500 (13.3)	773 (13.9)
Ex-smoker	8698 (48.1)	7524 (54.4)	1998 (53.0)	2823 (50.9)
Current smoker	6065 (33.6)	5091 (36.8)	1270 (33.7)	1954 (35.2)
FEV_1 (L)[d]; mean (±SD)	1.63 (±0.70)	1.26 (±0.59)	1.37 (±0.61)	1.60 (±0.71)

[a]Patients with missing baseline diagnosis not included (1183).
[b]Missing for a further 33 patients at baseline.
[c]Missing for a further 18776 patients at baseline and 1992 at review.
[d]Missing for a further 23600 patients at baseline.

Table 3 Proportion of never-smokers (as compared to ex-smokers/smokers) at entry, summarized by baseline diagnosis and by medication level

Characteristic	Medication Level	Asthma (n=25959)	COPD (n=21012)	Mixed disease (n=5501)	Other (n=7536)
Proportion (%) of non-smokers	1	13.8	9.3	11.0	12.6
	2	18.3	7.8	15.3	13.2
	3	19.3	9.9	13.3	17.5
	4	20.7	7.0	11.3	14.4
	5	23.0	9.3	22.6	18.5
Mean FEV_1 (L)	1	1.66	1.35	1.40	1.61
	2	1.70	1.22	1.39	1.60
	3	1.65	1.24	1.43	1.49
	4	1.51	1.00	1.29	1.36
	5	1.41	1.09	1.26	1.22
Proportion (%) with change in diagnosis	1	56.7	16.7	53.5	60.8
	2	49.9	10.6	49.2	67.5
	3	51.4	15.2	44.7	69.1
	4	60.1	7.7	43.9	72.8
	5	63.4	13.8	41.8	64.6

established as a support service to over 1000 primary care practices offering spirometry and the services of a specialist nurse.

The primary care practices tended to be from the lower social-class areas of the UK (where respiratory diseases are more prevalent) (White and Nolan 2000), probably reflecting both the entry requirement for a large number of respiratory patients on the register and where existing COPD services are less established. This, along with the age-selection criterion, will have favored the inclusion of more COPD than asthma patients, so these data are only applicable to the age range studied. The high refusal rate could have biased the generalizability of the findings, but as those patients who did attend were of similar demographic characteristics, smoking habits, and diagnoses, this is probably not a factor. Although funded ultimately by a pharmaceutical company, the nurses who carried out the work were employed through a third party, and the clinical responsibility for responding to the additional information by deciding whether or not to alter the diagnostic label and/or treatment remained entirely with the GP. We cannot dissect out the relative importance of new clinical information and spirometry in persuading the GP to change diagnosis, which is a weakness of this study. Finally, no attempt was made to validate the accuracy of the review diagnosis. This limited the ability of the study to improve measurement of disease prevalence but did allow assessment of factors affecting diagnostic change.

Despite these caveats, this is one of the largest observational studies of UK practice for a specific condition and these limitations are unlikely to have influenced a GP's decision whether or not to change a diagnosis.

There are few data to show the relative prevalence of asthma and COPD in the UK population, and those published do not have any validation of the recorded diagnosis by means of a clinical assessment (Renwick and Connolly 1996; Soriano et al 2000, 2002). However, a common feature is the association of diagnostic inaccuracy in older people. This study shows a remarkable frequency of diagnosis change which could challenge the validity of pharmaco-epidemiological and other studies which have been based on an unchallenged primary care diagnosis (Soriano 2002).

Diagnosis was unchanged in 12 544 [86%] COPD patients. The features associated with a change of diagnosis from COPD (younger age, a non-smoking status, and better FEV_1) are those features that would, from the known epidemiology of COPD and asthma, be expected to be more typical of an asthma population. However, in those with the most severe disease (FEV_1 <1.0 L), 92% were confirmed as having COPD, suggesting that in the older smoker there may be some support for those who argue that it is possible to diagnose COPD without spirometry.

The diagnosis was changed in nearly half those patients with an initial diagnosis of mixed disease, and in over half those with an initial label of asthma. Together, these patients made up over half the cohort. The main shift in diagnosis was towards COPD, and the factors associated with a change (increased age, more smoking, lower lung function) are the opposite of those associated with the change in diagnosis

Table 4 Summary and analysis of change in diagnosis by individual predictor variables for asthma, COPD, mixed disease, and other disorders

Asthma (n=18931)	**No change in diagnosis (n [%]=8643 [45.7])**		**Change in diagnosis (n [%]=10288 [54.3])**		**Odds ratio calculation**	**Odds ratio (95% CI)**
	N	**%**	**n**	**%**		
Gender[a]						
Male	3421	40.7	4983	59.3	Females to males	0.70 (0.66, 0.74); p<0.001
Female	5211	49.6	5298	50.4		
Mean age, years (±SD)	62.0 (±11.4)		65.6 (±10.6)		Per 10 years	1.35 (1.31, 1.38); p<0.001
Smoking[2]						
Smokers	2396	39.5	3663	60.5		
Ex-smokers	3740	43.0	4952	57.0	Ex-smokers to smokers	0.87 (0.81, 0.93); p<0.001
Non-smokers	2018	61.1	1287	38.9	Non-smokers to smokers	0.42 (0.38, 0.46); p<0.001
FEV_1[b], mean (±SD)	1.92 (±0.73)		1.40 (±0.59)		Per litre	0.29 (0.28, 0.31); p<0.001
FEV_1/FVC[c], mean (±SD)	72.8 (±37.4)		60.4 (±14.7)		Per 10%	0.52 (0.50, 0.54); p<0.001

[1]Missing for 7 patients.
[2]Missing for 173 patients.
[3]Missing for 402 patients.
[4]Missing for 2783 patients.
Note: Odds ratios apply to the risk of that variable contributing to a change of diagnosis.

Table 4 (continued)

COPD (n=14572)	**No change in diagnosis (n [%]=12544 [86.1])**		**Change in diagnosis (n [%]=2028 [13.9])**		**Odds ratio calculation**	**Odds ratio (95% CI)**
	N	**%**	**n**	**%**		
Gender[a]						
Male	7575	88.5	982	11.5	Females to males	1.63 (1.48, 1.79); p<0.001
Female	4967	82.6	1046	17.4		
Mean age, years (±SD)	69.9 (±9.1)		68.4 (±10.0)		Per 10 years	0.84 (0.80, 0.89); p<0.001
Smoking[b]						
Smokers	4505	88.5	585	11.5		
Ex-smokers	6529	86.8	994	13.2	Ex-smokers to smokers	1.17 (1.05, 1.31); p<0.001
Non-smokers	861	70.2	366	29.8	Non-smokers to smokers	3.27 (2.82, 3.80); p<0.001
FEV_1[c], mean (±SD)	1.20 (±0.54)		1.61 (±0.69)		Per litre	2.89 (2.67, 3.14); p<0.001
FEV_1/FVC[d], mean (±SD)	55.9 (±17.6)		67.6 (±15.3)		Per 10%	1.54 (1.46, 1.62); p<0.001

[1]Missing for 2 patients.
[2]Missing for 732 patients.
[3]Missing for 2827 patients.
[4]Missing for 9703 patients.
Note: Odds ratios apply to the risk of that variable contributing to a change of diagnosis.

Table 4 (continued)

Mixed disease (n=3979)	**No change in diagnosis (n [%]=2168 [54.5])**		**Change in diagnosis (n [%]=1811 [45.4])**		**Odds ratio calculation**	**Odds ratio (95% CI)**
	N	**%**	**n**	**%**		
Gender[a]						
Males	1098	54.2	929	45.8	Females to males	0.97 (0.86, 1.10); p=0.66[b]
Females	1069	54.8	880	45.2		
Mean age, years (±SD)	67.2 (±10.2)		67.7 (±9.9)		Per 10 years	1.06 (1.00, 1.13); p=0.07
Smoking[c]						
Smokers	669	52.7	601	47.3		p=0.129
Ex-smokers	1084	54.3	913	45.7	Ex-smokers to smokers	
Non-smokers	290	58.0	210	42.0	Non-smokers to smokers	
FEV_1[d], mean (±SD)	1.39 (±0.59)		1.35 (±0.62)		Per litre	0.90 (0.80, 1.01); p=0.07
FEV_1/FVC[e], mean (±SD)	60.8 (±15.4)		60.3 (±15.1)		Per 10%	0.98 (0.91, 1.06); p=0.59

[1]Missing for 3 patients.
[2]Not significant.
[3]Missing for 212 patients.
[4]Missing for 879 patients.
Note: Odds ratios apply to the risk of that variable contributing to a change of diagnosis.

Table 4 (continued)

Other (n=3979)	No change in diagnosis (n [%]=2168 [54.5]) N	%	Change in diagnosis (n [%]=1811 [45.4]) n	%	Odds ratio calculation	Odds ratio (95% CI)
Gender[a]						
Male	1080	34.4	2060	65.6	Females to males	0.80 (0.71, 0.89); p<0.001
Female	1023	39.7	1551	60.3		
Mean age, years (±SD)	66.0 (±10.9)		68.1 (±10.4)		Per 10 years	1.21 (1.15, 1.27); p<0.001
Smoking[b]						
Smokers	626	32.0	1328	68.0		
Ex-smokers	986	35.0	1835	65.0	Ex-smokers to smokers	0.88 (0.78, 0.99); p<0.001
Non-smokers	404	52.3	369	47.7	Non-smokers to smokers	0.43 (0.36, 0.51); p<0.001
FEV_1[c], mean (±SD)	1.85 (±0.75)		1.46 (±0.64)		Per litre	0.45 (0.41, 0.49); p<0.0001
FEV_1/FVC[d], mean (±SD)	72.5 (±14.7)		61.8 (±14.4)		Per 10%	0.58 (0.54, 0.61); p<0.001

[1]Missing for 7 patients.
[2]Missing for 173 patients.
[3]Missing for 402 patients.
[4]Missing for 2783 patients.
Note: Odds ratios apply to the risk of that variable contributing to a change of diagnosis.

from COPD to asthma. Of some concern is the observation that a change in diagnosis is independent of the level of treatment. Those on high levels therapy who have symptoms to such an extent that these levels of treatment have been reached, appear to be just as likely to have their diagnosis changed. It might be assumed that high levels of treatment are associated with more robust diagnoses but this is not the case and, indeed, this pattern fits in with the author's own experience.

The diagnostic difficulties of respiratory conditions are not confined to asthma and COPD. While significant numbers of patients were switched to a diagnosis of COPD following clinical assessment and spirometry, there were significant numbers remaining in the "other" category, with a wide range of diagnoses suggesting that there is a substantive lack of precision in the diagnosing of the "chesty" patient in primary care.

It is intriguing that provision of new information resulted in such major changes in diagnostic labeling for initial diagnoses other than COPD. One issue that may have been related to a high diagnosis of asthma previously as well as lack of spirometry was the advent of asthma clinics in UK primary care in the late 1980s and early 1990s as opposed to obstructive lung disease clinics. This willingness to review diagnoses happened in the context of the first national COPD guidelines in the UK and a changing belief that COPD was no longer a nihilistic diagnosis and that treatment was indeed different to asthma. This trend in diagnostic review continues today and supports incentives in UK primary care for improving diagnostic accuracy in patients with likely obstructive lung disease.

Finally, the data show that the proportion of patients who had their diagnosis changed differed very little with regard to the intensity (high or low) of treatment, perhaps suggesting that many patients are receiving high-dose treatment without a firm diagnosis.

If it is accepted that the introduction of more information is more likely to lead to a more accurate diagnosis, then these data suggest that spirometry and more focused clinical information will improve the quality of clinical care in patients with airways disease.

Changing a diagnosis from asthma to COPD not only alters the aims of treatment for each patient, but also has

Table 5 Number and proportion (%) of patients whose diagnosis were changed, as listed by the following variables: FEV_1, age, smoking status, and gender

Variables	Baseline diagnosis		
	Asthma	COPD	Mixed disease
Gender			
Male	4983 (59.3)	982 (11.5)	929 (45.8)
Female	5298 (50.4)	1046 (17.4)	880 (55.2)
Age			
<60yrs	2948 (44.6)	390 (18.9)	369 (42.5)
≥60–≤70 yrs	3235 (56.0)	643 (14.1)	600 (45.5)
≥70 yrs	4105 (62.7)	995 (12.5)	842 (47.0)
Smoking status			
Non smoker	1287 (38.9)	366 (29.8)	210 (42.0)
Ex-smoker	4952 (57.0)	994 (13.2)	913 (45.7)
Smoker	3663 (60.5)	585 (11.5)	601 (47.3)
FEV_1			
<1 L	2430 (79.1)	383 (8.4)	511 (52.2)
≥1–≤2 L	5209 (60.2)	921 (15.9)	778 (47.3)
≥2 L	1397 (31.0)	499 (36.1)	227 (47.7)

Table 6 Baseline diagnosis by review diagnoses[a]

Baseline diagnosis	Review diagnosis n (%)			
	Asthma	COPD	Mixed disease	Other
Asthma (n=18931)	8643	6272 (61.0)	3474 (33.8)	542 (5.3)
COPD (n=14572)	648 (32.0)	12544	847 (41.8)	533 (26.3)
Mixed disease (n=3979)	347 (19.2)	1386 (76.5)	2168	78 (4.3)
Other (n=5721)	575 (15.9)	2652 (73.3)	389 (10.8)	2105

[a]Percentages presented and calculated only for those patients with a change in diagnosis.

implications about what the patient will be told, thus altering their expectations. Conversely, although the proportion of patients whose diagnosis changed from COPD to asthma was much smaller, the individual benefits for those with a new diagnosis of asthma will be greater and more realistic.

The overall use of respiratory treatments is well documented in most practices, and forms a major part of every GP budget. Prescription data are often associated with diagnostic Read codes that, presumably, would be based on the initial diagnosis we recorded. However, the diagnostic volatility that we have demonstrated implies that any study attempting to relate prescribing to the current GP diagnostic code is currently unreliable.

In summary, this study has shown that in older people with respiratory illnesses, there seems to be a high proportion of mislabeling. As these are observational data, it is not possible to determine whether the revised diagnosis was most influenced by the availability of spirometry, by the taking of a more structured history by the specialist nurse, or by the availability of a full smoking history. However, the diagnostic volatility implies that current patient management of obstructive airway conditions in primary care is less than optimal. The CADRE programme's provision of an additional expert resource – the respiratory nurse – along with time to undertake the extra work of reassessing the patients and perform spirometry seems to be of value. While such tasks can reasonably be expected of any respiratory nurse working in primary care, the resource may not be readily available from the NHS. However, if patients are to receive the best care, and the NHS is to make optimal use of its resources, establishing correct diagnoses using best procedures would seem to be a good place to begin and supports the recent advent of initiatives in UK primary care to support this process.

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