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ORIGINAL RESEARCH

Development of an integrated chronic obstructive pulmonary disease service model in an inner-city region in the UK: initial findings and 12-month results

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Abstract

Aims: To improve the management of chronic obstructive pulmonary disease (COPD) in Salford, UK, and to evaluate the impact of an integrated service model after one year.

Methods: A health needs analysis and benchmarking exercise was undertaken in 2007. These activities were used to develop an integrated service model in order to improve the diagnosis and management of COPD and reduce unscheduled hospital admissions and length of stay.

Results: Following implementation of the model, 811 further patients were diagnosed. Unscheduled hospital admissions for COPD fell from 935 to 840, length of stay was reduced from 8.3 to 7.7 days, and associated costs fell from £1,772, 865 to £1,528,080. The number of patients who completed pulmonary rehabilitation increased from 84 to 143.

Conclusions: An integrated COPD service model was successful in increasing diagnosis, reducing hospital admissions and reducing length of hospital stay – in line with the proposed National Strategy for COPD Services in England. It also promoted management according to National Institute of Health and Clinical Excellence (NICE) guidelines.

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See linked editorial by Kearney *et al*. on pg 304

Introduction

Chronic obstructive pulmonary disease (COPD) is a common condition that imposes substantial demands on patients, their carers, and health care resources.[1] Much of this burden derives from unscheduled hospital admissions for COPD exacerbations.[2] Improvements in the diagnosis and management of COPD could therefore offer the twin benefits of decreasing the burden of morbidity and mortality associated with the disease, and lowering health care costs by reducing the number of unscheduled hospital admissions.

The economic downturn in recent years has highlighted the importance of improving quality and productivity across the UK National Health Service (NHS),[3] and this has been emphasised in the recent consultation document on a Strategy for Services for COPD in England.[4] The strategy aims to promote safe, effective and responsive care via streamlined services delivered closer to home. As yet there are limited data to demonstrate that such an approach will realise quality and productivity benefits.

Since 2006, a project has been under way in Salford, a city in the north-west of England, aimed at improving the management of COPD by better integration of healthcare services, streamlining patient care pathways, and facilitating access to services close to patients' homes.[5] The inner city population of Salford is an appropriate target for such a programme because it includes areas of significant

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deprivation; the inner city area lies in the lowest quintile of socioeconomic deprivation in England as measured by the Index of Multiple Deprivation (IMD),[6] although Salford is unusual in that it has one of the widest variations in deprivation levels across its population in the UK.[7] Cigarette smoking rates are significantly higher than the English national average (31.4% versus 24.1%, respectively).[8] The estimated prevalence of COPD exceeds 2%, as compared with a national prevalence of 1.4% in England,[9] and the hospital admission rate for COPD is also higher than the national average (23.7 versus 23.1 per 10,000).[10] As a result, the burden of COPD in this area is higher than the English national average – as might be expected given the known association between COPD and socioeconomic deprivation[11-13] and the high prevalence of smoking, the most important risk factor for COPD.[14] There is thus a need to decrease the burden of morbidity and mortality, and the consequent health care costs, associated with COPD in this area.

Prior to 2006, there was little integration of specialist COPD services (such as pulmonary rehabilitation and early supported discharge), although importantly, relations between primary and secondary care providers were generally good. Hence, an action plan was developed and implemented, aimed at redesigning COPD services to meet the needs of the local population, reducing health inequalities, improving morbidity and mortality rates, and reducing unscheduled admissions for COPD. A concomitant health needs analysis was undertaken to determine the prevalence of COPD in Salford at practice level, identify current diagnostic and therapeutic practice, and document the number of hospitalisations for COPD. After one year, the impact of the service redesign on markers of improved care (according to the National Institute for Health and Clinical Excellence [NICE])[1] was evaluated. In this paper we describe how we developed the integrated service model, and we present the first year results.

Methods

Redesign of COPD services

The redesign of COPD services was led by specially appointed medical and nursing consultants whose remit extended across both primary and secondary care. The first stage, which took place during the winter of 2006-2007, was the implementation of an action plan that included improved diagnosis, stratification of general practice COPD registers (which are a requirement of the Quality Outcomes Framework [QOF][15]) by disease severity (mild, moderate or severe), implementation of self-management plans, and monitoring of hospital referrals and admissions. Data from a proprietary general practice data audit tool (POINTS: GlaxoSmithKline, Uxbridge, UK, described below), were used to help general practitioners (GPs) manage their COPD patients appropriately using local COPD treatment and management guidelines (NICE) and to implement the use of self-management plans. The practices themselves monitored hospitalisations and referrals for COPD. These activities were accompanied by general educational initiatives about COPD, the provision of clinical support to practices, and launch events to raise awareness of the programme.

Table 1. Stakeholders involved in the service redesign.

- Health care professionals
  - GPs
  - practice nurses and community matrons
  - hospital physicians and specialist nurses
  - pharmacists
  - allied healthcare professionals, e.g. physiotherapists
  - out-of hours service providers
  - palliative care team
  - mental health care team
- Health care commissioners
- Patient/carer representatives
- Social services
- Pharmaceutical industry representatives

A health needs analysis was undertaken in parallel with this action plan in order to document the prevalence and management of COPD in Salford. As part of this analysis, process mapping and gap analysis[16] were performed to characterise the current management of COPD and identify any unmet needs. In addition, stakeholders such as healthcare professionals and patient groups (Table 1) were consulted and involved in this process. These analyses and discussions were used to develop an integrated strategy for the management of COPD (Figure 1), with an emphasis on improved management in primary care and access to specialist services where appropriate. There were two main aspects to this strategy: the first was a focus on smoking cessation, early and accurate diagnosis, appropriate management according to evidence-based guidelines, self-care, pulmonary rehabilitation and end-of-life care; the second was increased provision of specialist community services, such as consultant-led clinics, case note reviews and virtual multidisciplinary team (MDT) meetings for complex or severe cases. These measures were aimed at reducing unscheduled hospitalisations, while allowing for planned hospital admissions where necessary. The impact of this service redesign was evaluated in a further analysis one year later.

Health needs analysis

Data were obtained retrospectively from COPD patients in 59 general practices in Salford, which were grouped into eight geographical clusters (Table 2). Cluster 1 had the highest levels of socioeconomic deprivation as measured by the IMD scores for the areas where the patients lived (identified by post code), and Cluster 8 had the lowest. Clusters 7 and 8

Figure 1. The integrated COPD management pathway and strategy developed as a result of the Service redesign process. The triangle represents the COPD patient population in primary care. The strategy is based on the Wagner Chronic Care Model,[17] which emphasizes the interactions between primary and secondary care, and between patients who take an active role in their care and their health care providers.

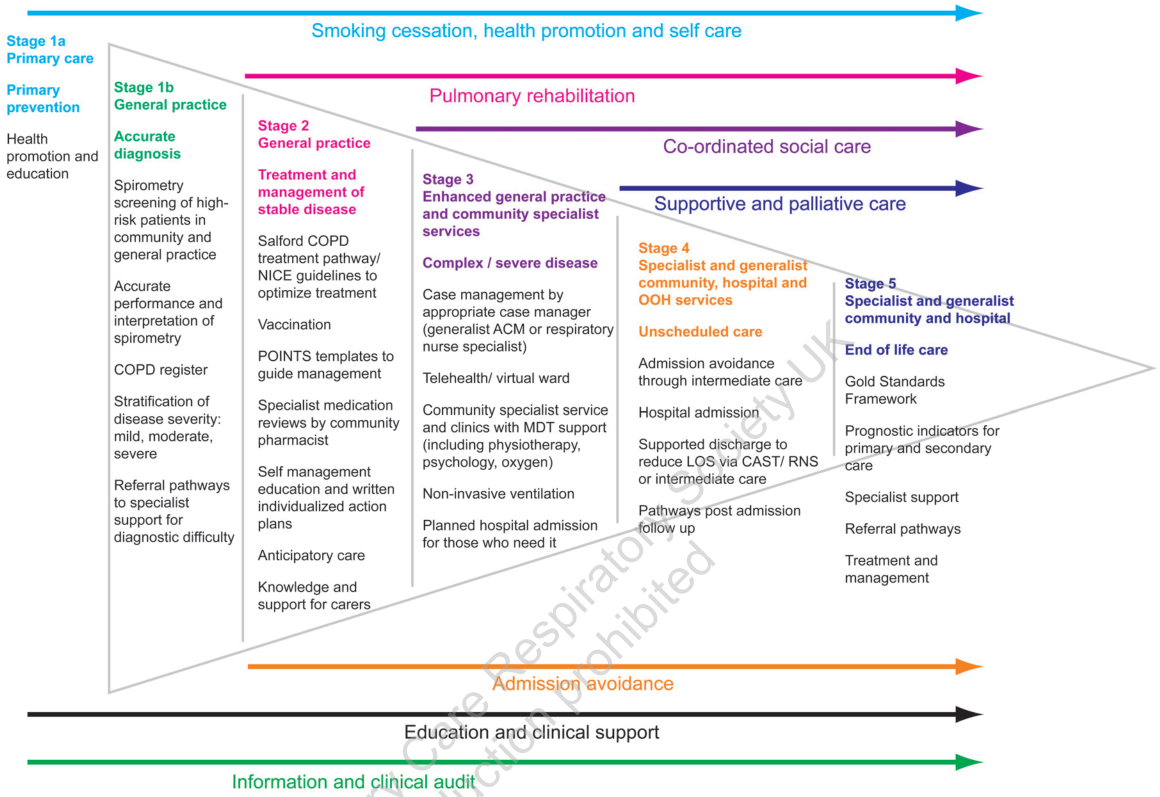


Table 2. Characteristics of practice clusters used in the health needs analysis. Clusters are ranked according to their Index of Multiple Deprivation (IMD).

		Cluster 1 (N=9)	Cluster 2 (N=7)	Cluster 3 (N=7)	Cluster 4 (N=5)	Cluster 5 (N=10)	Cluster 6 (N=6)	Cluster 7 (N=5)	Cluster 8 (N=6)	All Practices (N=55)	p-value
IMD of cluster population	Mean (SD) No. Practices	55.9 (1.8) 9	48.4 (7.4) 7	44.4 (4.9) 7	43.7 (8.9) 5	39.6 (4.4) 10	30.2 (6.3) 6	26.8 (0.9) 5	26.8 (6.4) 6	40.7 (11.2) 55	<0.0001
Mean age of cluster population	Mean (SD) No. Practices	37.1 (2.6) 9	36.1 (3.4) 7	36.1 (3.6) 7	39.7 (2.8) 5	38.2 (2.7) 10	39.9 (1.7) 6	37.8 (3.1) 5	39.3 (3.0) 6	37.9 (3.0) 55	0.12
Current Smokers (in cluster population (%)	Mean (SD) No. Practices	32.4 (3.3) 9	30.6 (6.4) 7	32.5 (5.8) 7	28.5 (9.5) 5	30.7 (6.4) 10	22.2 (6.4) 6	28.4 (9.5) 5	19.0 (5.4) 6	29.1 (7.9) 55	<0.0001
Gender of COPD population (%)	Females N patients	55.2 610	52.1 751	50.2 317	50.2 604	50.5 867	54.6 524	53.2 218	54.1 547	52.4 4438	0.45
Age of COPD population	Mean (SD) N patients	67.4 (11.0) 608	67.3 (10.6) 747	68.6 (12.1) 316	69.5 (9.9) 601	67.4 (11.6) 866	70.6 (11.0) 524	67.5 (10.4) 218	69.8 (10.9) 547	68.4 (11.0) 4427	<0.0001
Smoking status (of COPD population)	Current smoker Ex-smoker Non-smoker N patients	47.7% 41.0% 11.3% 585	46.8% 44.1% 9.1% 728	36.7% 44.1% 19.3% 311	38,2% 46.4% 15.4% 573	44.7% 44.5% 10.8% 831	34.2% 53.1% 12.7% 512	44.9% 46.3% 8.9% 214	34.0% 46.4% 19.5% 527	41.4% 45.6% 13.0% 4281	<0.0001
FEV_1 of COPD population (% predicted)	Mean (SD) N patients	55.9 (22.1) 312	55.0 (18.4) 503	55.0 (19.9) 174	55.4 (18.9) 328	57.7 (19.2) 602	54.0 (19.5) 351	56.7 (20.4) 72	60.5 (21.1) 374	56.4 (19.9) 2716	0.0002

had equal mean IMD scores, but Cluster 8 includes some of the least deprived areas in both Salford and England and was therefore considered to be the less deprived. The study population consisted of all patients registered with a general practice within one of these clusters who had a READ code[18] diagnosis of COPD (H36.00-H38.00). READ codes are broadly similar to the International Classification of Disease [ICD]-10.

Data were derived from a number of sources. Data on COPD prevalence and smoking status of the general practice population were obtained from the Quality Management and Analysis System (QMAS), which provides data on QOF measures from each practice. QMAS data for 2006-2007 were obtained at practice level in July 2007, and combined for each cluster.

The POINTS audit tool was used to extract data from the COPD registry at participating practices. This tool uses a standard template that is incorporated into the practice's existing computer system and automatically collects routinely recorded data by READ code. Disease-specific READ code data from the patient record are anonymised, extracted to a practice spreadsheet, and sent automatically to a secure central database managed by Innovex (UK) Ltd. Individual patient data are tracked using a unique identifier that cannot be used to identify patients outside of the practice, therefore ensuring patient anonymity. The database is analysed automatically to produce baseline and quarterly reports that form the basis for a patient action plan. For this study, the POINTS template was modified for use in Salford. The extracted data included age, gender, COPD severity, and the use of investigations and treatments included in the NICE guidelines for COPD. COPD severity was defined according to the forced expiratory volume in one second (FEV_1), as described in the NICE guidelines.[1] All practices were asked to consent to their POINTS data being used in the study.

Data on the number of hospital admissions for COPD in 2006-2007, and the length of stay, were obtained from practice records by means of the NHS Tactical Information Systems (TIS) database which records all admissions for patients registered with an individual GP, thereby allowing the number of admissions to be recorded for each GP, practice and cluster. COPD admissions were identified by the ICD-10 codes J41-44. Since most admissions for COPD are unscheduled, the total number of admissions was used as a surrogate for unscheduled admissions. Costs were derived from the associated Health Resource Group (HRG) code for the admission (D39, D40 and D99).

Education programme

A programme of education was developed to underpin the launch and implementation of the integrated COPD strategy. A joint working group was formed that included representatives of the Primary Care Trust (PCT) and several pharmaceutical companies. The programme included monthly workshops, study days, a PCT-hosted website providing access to educational materials, guidelines and other resources such as self management plans, and the establishment of consultant-led clinical support via a virtual MDT. In addition, the PCT funded two COPD diploma-level courses for Practice Nurses and Community Matrons. GlaxoSmithKline (GSK) provided IT support to load POINTS software onto GP computer systems and organised training on the use of this software. GSK also funded a PCT-employed specialist respiratory nurse for one year who worked alongside practice nurses to improve knowledge and skills and embed NICE guidelines into practice.

Statistical analysis

Characteristics of practices with and without POINTS data were compared by t-tests for normally distributed data, and by Wilcoxon rank sum tests for non-normally distributed data. Differences between clusters were analysed by one-way analysis of variance (ANOVA) for normally distributed variables and by β_2-test for categorical variables. Logistic regression was used to compare drug usage and other nominal variables by FEV_1 severity. Relationships between IMD and QOF prevalence, unscheduled admissions and length of stay were assessed by Pearson's correlation coefficient at both practice and cluster level. All analyses were performed using SAS (Version 9.1) software (SAS Institute, Cary, North Carolina, USA) in Windows NT environment.

Results

Details of the practices in each cluster are shown in Table 3. Of the 59 practices, 4 were excluded because they were small practices serving atypical communities with very low smoking rates or no recorded QOF data. Thus, data on COPD prevalence according to QOF criteria, hospital admission rates and length of stay were available from 55 practices, with a total of 5491

Table 3. Details of practices included in each cluster.

Cluster No.	Total No. Practices	Practices included in the analysis	Practices With POINTS Data	COPD Patients with POINTS data
1	11	9	8	610 (87.0%)
2	8	7	5	751 (85.4%)
3	7	7	6	317 (85.9%)
4	6	5	4	604 (86.0%)
5	10	10	10	867 (91.2%)
6	6	6	4	524 (68.5%)
7	5	5	3	218 (49.0%)
8	6	6	5	547 (80.3%)
Total	59	55	45	**4438 (80.8%)**

Table 4. Comparison of background characteristics (Mean ± SD) for practices with and without POINTS Data.

Characteristic	Practices with Data Included in the Analysis (N=55)	Practices With POINTs Data (N=45)	Practices Without POINTS Data (N=10)	Comparison between groups P-value#
Practice Size Median (IQR)	3609 (3178)	3669 (3259)	3145 (2648)	0.66
Females (%) Mean (SD)	49.4 (2.6)	49.3 (2.8)	49.6 (1.9)	0.72
Age (Yrs) Mean (SD)	37.8 (3.1)	37.7 (3.1)	38.2 (3.2)	0.69
Elderly (≥60yrs)(%) Mean (SD)	19.3 (4.8)	19.2 (4.6)	20.1 (5.4)	0.56
Smoking Prevalence (%) Mean (SD)	28.3 (7.6)	29.0 (7.9)	25.6 (6.4)	0.21
IMD 2004 Mean (SD)	40.7 (11.2)	41.7 (11.2)	36.4 (10.9)	0.18

IQR= Interquartile range

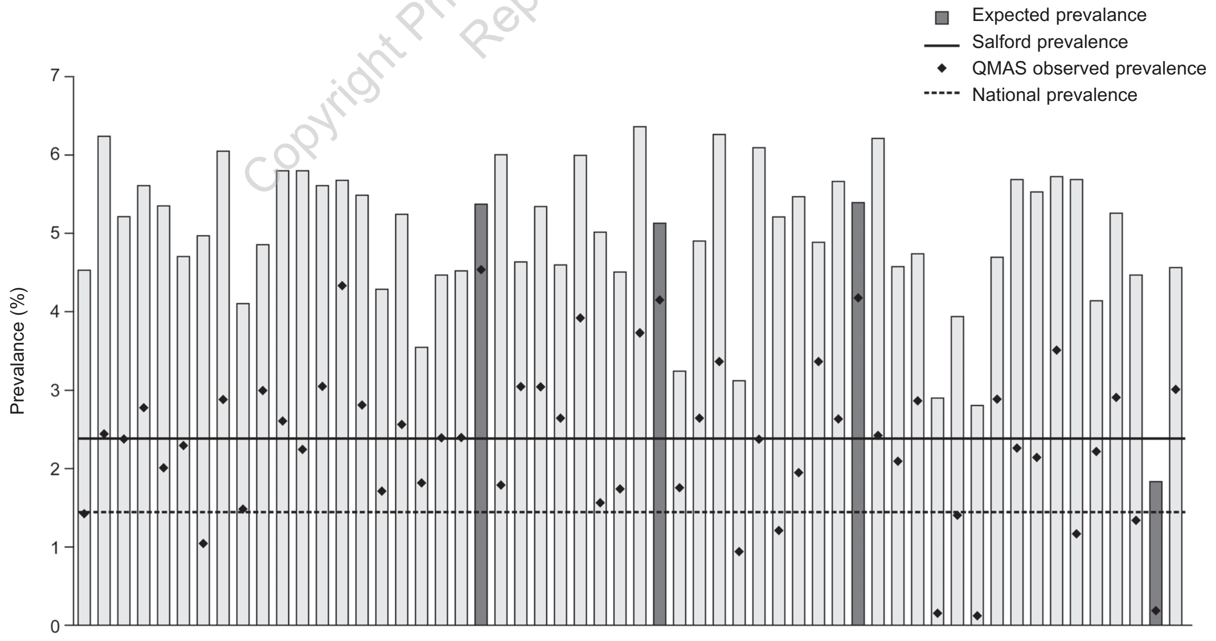
COPD patients (Table 2). A total of 45 practices had POINTS installed by 1 November 2007. Technical problems or refusal to participate were the reasons for non-installation. These practices included 4438 COPD patients (81% of the total COPD population). There were no significant differences between the characteristics of practices with and without POINTS data (Table 4).

Details of the patients included in the practices' COPD registers at baseline are summarised in Table 2.

Diagnosis and management of COPD

The total number of patients diagnosed with COPD (QOF criteria) at 12 months was 5850; thus, 811 additional patients were diagnosed during the study period. The overall prevalence of COPD, diagnosed according to QOF criteria, was 2.4%. 52% of COPD patients were female. However, there were marked variations in prevalence between practices (Figure 2). In most cases, the observed prevalence was markedly lower than that predicted according to the model of Nacul *et al.*[9] This would suggest that under-diagnosis of COPD is common in Salford. There was a positive correlation between the prevalence of COPD and levels of socioeconomic deprivation as measured by the IMD (r = 0.39, P=0.004); there was also a trend towards an association between deprivation and hospitalisations for COPD (r = 0.33, P=0.015). Current smoking rates among COPD patients (derived from QOF data) at baseline and 12 months were 41% and 40%, respectively,

Figure 2. Prevalence of COPD, as diagnosed by the Quality Outcomes Framework (QOF) criteria, in general practices in Salford in July 2007. Each bar shows the prevalence in an individual practice. The height of the bar indicates the prevalence predicted by the model of Nacul *et al.*[9] while the black diadmond shows the observed QOF prevalence. The four dark grey bars show the practices with the smallest differences between observed and predicted prevalence. The solid horizontal line shows the overall prevalence in Salford while the dotted line shows the English national prevalence.



QMAS: Quality Management and Analysis System, a computer system which provides data on QOF measures from individual general practices.

Table 5. Use of drugs for COPD according to severity of airflow obstruction (FEV_1 % predicted).

	Severity of airflow obstruction				
	>80% predicted (n = 312)	Mild (n = 1349)	Moderate (n = 800)	Severe (n = 255)	P
Any long-acting muscarinic antagonists	17.3%	23.2%	39.0%	50.6%	<0.0001
Long-acting muscarinic antagonists alone	3.9%	5.0%	6.6%	5.5%	n.s.
Inhaled corticosteroids and long-acting β_2-agonists*	30.5%	38.8%	50.5%	63.1%	<0.0001
Long-acting β_2-agonists without inhaled corticosteroids	1.9%	2.3%	2.3%	3.1%	n.s.
Mucolytics	3.2%	4.8%	8.3%	10.6%	<0.0001

*Includes both fixed and free combinations

compared with a national average of 24%.[8] There was a significant positive correlation between baseline smoking rates and IMD (r = 0.6, P=0.0001).

At baseline, FEV_1 data were available in 2716 patients (49.5%). The proportion of these patients with mild, moderate or severe airflow obstruction was 49.7%, 29.5%, and 9.4%, respectively; 11.5% had an $FEV_1 > 80\%$. Forced vital capacity (FVC), and a record of COPD exacerbations, were seldom recorded. A total of 1042 patients (23%) had a Medical Research Council (MRC) breathlessness score recorded at baseline, as recommended by NICE.

Prescription rates for the principal drugs used in COPD (long-acting β_2-agonists [LABAs], inhaled corticosteroids [ICS], long-acting muscarinic antagonists [LAMA], and mucolytics) in patients with FEV_1 data are shown in Table 5. Of the patients with FEV_1 >80%, 3.9% were prescribed LAMAs alone, 1.9% were prescribed a LABA without ICS, and 30.5% received both ICS and LABA.

As a result of the education programme, the proportion of nurses in Salford who hold COPD diplomas is now above the national average (64% versus 48%).[19]

Early impact of the integrated management strategy

The introduction of the integrated management strategy was associated with a reduction in the number of unscheduled hospital admissions for COPD, from 935 in 2006-2007 to 840 in 2007-2008, and the mean length of stay decreased from 8.3 to 7.7 days. The costs of COPD admissions, based on HRG codes, therefore decreased from £1,772,865 in 2006-2007 to £1,528,080 in 2007-2008. The number of patients with moderate or severe COPD who completed pulmonary rehabilitation increased from 84 at baseline to 143 at 12 months.

Discussion

We have developed and implemented an integrated COPD service in Salford, an area with a high prevalence of COPD in England that is associated with significant deprivation and high smoking rates. This service included an emphasis on smoking cessation and self-management, strategies for improving early diagnosis and management, and improved access to specialist services such as pulmonary rehabilitation. The service was developed in the context of the NHS Quality, Innovation, Productivity and Prevention (QIPP) framework,[3] which aims to improve both the quality and efficiency of care, and promote patient education and empowerment. It is noteworthy that although the development process pre-empted the recent national consultation on the provision of COPD services,[4] many of the recommendations of this consultation are incorporated in our integrated model.

Our evaluation showed that implementation of the integrated model had an early impact on important outcomes. This is consistent with the previous finding that clinical guidelines have the greatest impact on practice when they are developed internally and accompanied by rigorous evaluation.[20] In addition, the study has provided valuable insights into a number of issues that could be used to inform service redesigns in other long-term conditions. An important lesson was that it is vital to liaise effectively with a wide range of stakeholders. Similarly, our collaborative approach with partners in the pharmaceutical industry provided a valuable resource. A ‘best practice’ approach was used, as recommended by the UK Department of Health,[21] to ensure that this collaboration was conducted in an ethical manner. An important aspect of this collaboration was the educational programme that was designed to underpin the launch and implementation of the new model. This programme was intended to facilitate COPD management according to NICE guidelines; it was run by the respiratory team, working within individual practices, with support from the working group. However, more work is needed. Although high numbers of nurses have attained accredited training, prescribing patterns suggest that GPs (the main prescribers in the PCT) require more education and support. For example, it is of concern that almost one third of patients with FEV_1 >80% predicted were receiving ICS and LABAs. Ongoing analysis will allow us to assess if COPD prescribing practice is changing in accordance with NICE guidelines.

A central feature of this evaluation was the use of the POINTS clinical audit system to characterise the COPD patient population in primary care. Reliable data on current management practices are essential if changes are to be implemented; without such data, it is impossible to identify gaps in service provision and unmet patient needs. Although other audit tools are available, POINTS offers the advantage that data can be extracted to a central database for analysis, allowing ongoing evaluation of changes in practice and training aimed at remedying identified needs in diagnosis and treatment. This would not be feasible without such a database. Thus, the methods used in our evaluation of the impact of the integrated service allowed the COPD population to be well characterised at baseline. The analysis showed that while almost half of patients had their FEV_1 reported, MRC breathlessness scores were recorded in only 23%, and FVC and exacerbations were almost never documented. This might suggest that although the QOF facilitates recording of READ codes in the practice population, it provides no information about the issues that are most relevant to patients such as breathlessness or COPD exacerbations. Such information is essential if treatment is to be tailored to the needs of the individual patient.

Our initial evaluation suggests that our integrated model has resulted in a reduction in unscheduled admissions for COPD and length of stay, and hence in a decrease in admission-related costs reversing the trend for increasing admissions in previous years.[5] In addition to the financial impact, the reduction in hospitalisations would be expected to have an impact on patients, because it is well known that hospitalisation is the aspect of COPD that has the greatest effect on patients' quality of life.[22] Furthermore, the integrated service has resulted in improved access to pulmonary rehabilitation (PR) programmes; few patients were referred at baseline, whereas the number had increased significantly at 12 months. This may reflect increased recording of MRC breathlessness scores, because this is a prerequisite for referral. PR is an essential component of COPD management, improving health related quality of life and reducing exacerbation, yet PR is not available to all who need it. We estimate that we need to increase significantly our PR capacity to address local needs. Inequity of access to PR in other areas may influence replication of our results.

This evaluation was subject to certain limitations. Due to technical difficulties with computer systems used in some practices, it was not possible to obtain POINTS data from all participating practices. Moreover, because POINTS extracts data from existing COPD registers, which are being continuously updated, the baseline patient cohorts at any given level of severity will not be the same as the corresponding cohorts at 12 months. However, this approach does allow assessment of diagnostic and management practices at each level of severity. A further concern is that POINTS categorises the prevalence and severity of COPD based on spirometry results obtained within a 12-month time period. Thus, a patient who does not undergo spirometry within 12 months after a previous evaluation would be considered as uncategorised in terms of severity, and this would affect the reported prevalence at the relevant severity level within the POINTS system.

This audit was intended as a pragmatic evaluation of the impact of the integrated service. As such, alternative methodologies that would have been appropriate in a research setting, such as a randomised clinical trial, were not considered appropriate.

In conclusion, the implementation of an integrated COPD model has resulted in increased diagnosis and access to rehabilitation. However, more interventions are required to tackle other outstanding issues – particularly smoking rates, which remain high. It is therefore necessary to work with public health and smoking cessation services to address this issue, particularly in the most deprived regions where smoking rates are highest. Previous studies have shown that smoking cessation programmes tend to be less successful in people from more deprived backgrounds than in those in higher socio-economic groups.[23] A recent systematic review suggests that focusing efforts on providing information and facilitating goal-setting may be helpful in low income groups.[24]

A number of important questions arise from this study. For example, the marked variations in practice characteristics between and within clusters necessitates a more detailed look at practice-level, rather than cluster-level, data. We are also working to improve access to palliative care for those who need it. Finally, it is important to assess the extent to which the observed changes in COPD management have been maintained in routine practice. To address this, we have recently conducted a follow-up evaluation of the impact of the integrated service after two years. The results of this evaluation will be reported elsewhere.

Parts of this study have previously been presented at meetings of the British Thoracic Society:
Roberts J, Diar Bakerly N. Benchmarking COPD across an inner city PCT. *Thorax* 2007;**62**:A4 – A63.
Roberts J, Diar Bakerly N. Benchmarking COPD across an inner city PCT: One year on. *Thorax* 2008;**63**:A12-A15.

Conflict of interest declarations

June A Roberts and Nawar Diar Bakerly have received financial support from GSK for travel to educational meetings, lecturing and consultancy.
Toni K Maslin is an employee of GSK

References

1. National Collaborating Centre for Chronic Conditions. Chronic obstructive pulmonary disease. National clinical guideline on management of chronic

obstructive pulmonary disease in adults in primary and secondary care. *Thorax* 2004;**59**(Suppl 1):1-232.

2. Donaldson GC, Wedzicha JA. COPD exacerbations. 1: Epidemiology. *Thorax* 2006;**61**(2):164-8. http://dx.doi.org/10.1136/thx.2005.041806
3. Department of Health. The NHS Quality, Innovation, Productivity and Prevention Challenge: an introduction for clinicians. London: Department of Health, 2010.
4. Department of Health. Consultation on a strategy for services for chronic obstructive pulmonary disease (COPD) in England. Available at: http://www.dh.gov.uk/en/Consultations/Liveconsultations/DH_112977 [Accessed 6 April,2010].
5. Salford COPD strategy 2008. Available from http://nww.salford-pct.nhs.uk/respiratorydisease/pages/COPDStrategy.asp?section=Respiratory+Commissioning+Strategy+Group&pagetitle=The+COPD+Strategy [Accessed 16th February 2010]
6. Communities and Local Government (2007). The English indices of deprivation 2007: summary. http://www.communities.gov.uk/communities/neibourhoodrenewal/deprivation/deprivation07 (accessed April 2010)
7. Association of Public Health Observatories. Health Profiles 2007 Available from http://www.communityhealthprofiles.info/ [Accessed 2 February, 2010].
8. Association of Public Health Observatories. Health Profiles 2009: Salford. Available from http://www.communityhealthprofiles.info/ [Accessed 2 February, 2010]
9. Nacul LC, Soljak M, Meade T. Model for estimating the population prevalence of chronic obstructive pulmonary disease: cross sectional data from the Health Survey for England. *Popul Health Metr* 2007;**5**:8. http://dx.doi.org/10.1186/1478-7954-5-8
10. http://www.laia.ac.uk/kf_copd_03.htm [Accessed 15 February 2010].
11. Prescott E, Lange P, Vestbo J, the Copenhagen City Heart Study Group. Socioeconomic status, lung function and admission to hospital for COPD: results from the Copenhagen City Heart Study. *Eur Respir J* 1999;**13**:1109-14 http://dx.doi.org/10.1034/j.1399-3003.1999.13e28.x.
12. Lopez AD, Shibuya K, Rao C, *et al*. Chronic obstructive pulmonary disease: current burden and future projections. *Eur Respir J* 2006;**27**(2):397-412. http://dx.doi.org/10.1183/09031936.06.00025805
13. Saxena S, George J, Barber J, Fitzpatrick J, Majeed A. Association of population and practice factors with potentially avoidable admission rates for chronic diseases in London: cross sectional analysis. *J R Soc Med* 2006;**99**(2):81-9. http://dx.doi.org/10.1258/jrsm.99.2.81
14. Chapman KR, Mannino DM, Soriano JB, *et al*. Epidemiology and costs of chronic obstructive pulmonary disease. *Eur Respir J* 2006;**27**(1):188-207. http://dx.doi.org/10.1183/09031936.06.00024505
15. Department of Health. Quality and Outcomes Framework. Guidance - updated August 2004. Available at: http://www.dh.gov.uk/en/Healthcare/Primarycare/Primarycarecontracting/QOF/DH_4125653. [Accessed 16 February 2010].
16. NHS Institute for Innovation and Improvement. Improvement Leaders Guides ILG 1.2 Process Mapping, Analysis and Redesign Available from http://www.institute.nhs.uk/index.php?option=com_joomcart&Itemid=194&main_page=document_product_info&cPath=65&products_id=295 [Accessed 6th February 2010]
17. Wagner EH. Chronic Disease Management: what will it take to improve care for chronic illness? *Eff Clin Pract* 1998;**1**(1):2-4.
18. http://www.connectingforhealth.nhs.uk/systemsandservices/data/readcodes [Accessed 16 February 2010].
19. Upton J, Madoc-Sutton H, Sheikh A, Frank TL, Walker S, Fletcher M. National survey on the roles and training of primary care respiratory nurses in the UK in 2006: are we making progress? *Prim Care Resp J* 2007;**16**:284-90. http://dx.doi.org/10.3132/pcrj.2007.00068
20. Grimshaw JM, Russell IT. Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *Lancet* 1993;**342**:1317-22. http://dx.doi.org/10.1016/0140-6736(93)92244-N
21. Department of Health. Best Practice Guidance for joint working between the NHS and the pharmaceutical industry. London: Department of Health, 2008.
22. Rodríguez Roisin R. Impacting patient–centred outcomes in COPD; exacerbations and hospitalizations. *Eur Respir Rev* 2006;**15**:47-50. http://dx.doi.org/10.1183/09059180.00009905
23. Bell K, McCullough L, Greaves L. The Effectiveness of National Health Service intensive treatments for smoking cessation in England: a systematic review. London: National Institute for Clinical Excellence, 2006.
24. Low-income groups and behaviour change interventions: a review of intervention, content and effectiveness. London: Kings Fund, 2008.