A pilot study of identification and case management of high-risk COPD patients in a general practice

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Background. A variety of individual therapeutic interventions have been shown to reduce hospital admissions and improve quality of life in patients with chronic obstructive pulmonary disease (COPD). However, there is a paucity of data of looking at the effect of case management in primary care (i.e. using an integrated care approach) of people at higher risk of mortality from COPD.

Objective. To examine the effect of case management in primary care of patients with COPD at high risk of hospital admission, identified using a novel multidimensional index of disease severity (DOSE index).

Methods. Observational pilot study in a single general practice. High-risk patients were identified using the DOSE index and case managed using an IT system according to British National Guidelines over a 6-month period.

Results. Eleven patients entered and completed the study. There was no improvement in health status, but there was a non-significant reduction in total hospital admissions (three versus zero) and total bed days (16 versus 0) compared to the same reference period in the previous year. There was an increase in self-management knowledge.

Conclusions. Case management of high-risk patients in primary care may reduce hospital admissions. This needs to be tested in a randomized controlled trial.

Keywords. Case management, COPD, DOSE index, primary care.

Background

Chronic obstructive pulmonary disease (COPD) is a growing burden to patients and to the National Health Service (NHS) in the UK. The annual costs are estimated at £1639.08 per patient, of which 54% are for unscheduled care relating to exacerbations.\textsuperscript{1} COPD is the second largest cause of emergency admissions in the UK (130 000 admissions per year). The inpatient care for COPD accounts for almost half of the NHS expenditure on the disease and it remains one of the most costly inpatient conditions.\textsuperscript{2} It is therefore important to identify patients who might be at high risk of hospital admission and actively manage them to prevent admission.

The DOSE index is a recently developed index of COPD disease severity.\textsuperscript{3} It is a weighted multi-component index of severity, which includes the Medical Research Council (MRC) dyspnoea score (D), grade of airflow obstruction (O), current smoking status (S) and number of exacerbations per year (E). This categorizes patients on a scale of 0–8, the higher the score the more severe. The DOSE index correlates well with quality of life and health care consumption. Using a cut-off of three, the DOSE index predicts mortality (hazard ratio 3) and therefore has the potential to identify high-risk patients.

There is abundant evidence in clinical trials that individual treatment interventions can prevent hospital admissions in patient with severe disease (for example, the use of inhaled corticosteroid/long-acting beta-2 agonist combinations) and this evidence has formed the basis of national\textsuperscript{4} and international treatment guidelines.\textsuperscript{5} However, there is a paucity of evidence that putting these guidelines into everyday clinical practice can improve patient outcomes. This pilot study looks at the feasibility of identifying patients with COPD at higher risk of hospital admission and the effects of case managing them within a primary care setting.
Aims

To examine the effect of case management, using a guideline-based computer software package, of patients with COPD at high risk of hospital admission, identified by the DOSE index.

Objectives

1. To identify patients with more severe disease, at high risk of hospitalization from exacerbations, using the DOSE index.

2. To identify if structured case management of these patients reduces frequency of exacerbations, improves health status and reduces health care consumption.

3. To inform the feasibility and power calculations for a randomized controlled trial of case management of high-risk COPD patients using the DOSE index and case management.

Methods

Subjects and recruitment

This was a 6-month observational study carried out between October 2007 and April 2008 in a single general practice in the south west of England. Patients with COPD were identified from the practice list and the diagnosis checked by the research nurse in line with National Institute for Health and Clinical Excellence (NICE) guidelines diagnostic criteria.

‘High risk’ patients were identified by one or more of:

- A DOSE score of \( \geq 3 \). The DOSE score was calculated from 12-month retrospective recordings of the key elements of the DOSE index. (MRC dyspnoea score, forced expiratory volume in 1 second (FEV-1), smoking status and number of exacerbations in the last year.)
- Evidence of a COPD exacerbation in the previous year.
- Recorded FEV-1 of \(<50\%\) predicted.

Eligible patients were approached by a telephone call from the research nurse. Interested patients were invited to the surgery where written informed consent was obtained by the GP principal investigator. If the DOSE score was unavailable, then the DOSE score was recalculated by recording of the MRC dyspnoea score, smoking status and FEV-1 as per centage predicted at the baseline visit. Patients were included in the study if they had a current DOSE score \( \geq 3 \). Patients were excluded if they had suffered an acute exacerbation of COPD in the previous 4 weeks.

The intervention

Patients were assessed by the practice nurse using a computer-based system (see below) at baseline and 1 month to optimize care and then at 6 months post baseline. Patients were actively case managed by the practice COPD team, which consisted of a respiratory-interested GP and practice nurse who were trained to administer the intervention. Housebound patients were visited at home by the practice nurse. All patients were issued with a COPD action plan, involving use of standby antibiotics and/or oral steroids at the earliest signs of an exacerbation.

The computer-based assessment and management system

Designed to facilitate a structured consultation between a nurse trained in COPD care and a patient with COPD, the system has been described in more detail elsewhere. After consent was obtained, data were entered on a laptop or PC during the consultation; the data were then encrypted and stored on a secure server. The following information was collected:

1. Demographic and morbidity data
   - Age,
   - Gender,
   - Spirometry,
   - Current drug therapy including immunization,
   - Exacerbations and health care consumption including hospital admissions, emergency department attendances and unscheduled primary care consultations,
   - Smoking status and smoking cessation needs,
   - Pulse oximetry measurements,
   - Services already attended, e.g. oxygen assessments or pulmonary rehabilitation.

2. Patient-entered data
   - A set of self-completed questionnaires were completed via the computer,
   - MRC dyspnoea scale (version recorded in NICE COPD guidelines),
   - Clinical COPD questionnaire (CCQ),
   - Lung Information Needs Questionnaire (LINQ).

In addition, patients completed two depression screening questions as recommended by NICE:

(a) During the last month have you often been bothered by feeling down, depressed or hopeless?

(b) During the last month, have you been bothered by having little interest or pleasure in doing things?

Patients who have a positive answer to either question were assessed by the Patient Health Questionnaire-9 (PHQ-9) and if scoring \( \geq 10 \) were referred to the GP for consideration of antidepressant treatment.
Data review and reports
Following collection of patients’ data, the system automatically produced recommendations according to NICE guidelines. The practice nurse then reviewed all the findings and recommendations amended them as appropriate for the individual patient. Summary reports were issued for both the patient and the GP.

The recommendations included:
Drug treatment,
Non-drug management (e.g. dietary advice and immunizations),
Referrals (smoking cessation, pulmonary rehabilitation),

Suggested follow-up by GP/practice nurse,
Referral for oxygen therapy.

Education
Patients who had educational needs identified by the LINQ were given oral education and appropriate information leaflets produced by the British Lung Foundation. They were also given contact details of the local patient (‘Breathe Easy’) support group.

Physical activity
All participants were interviewed about their exercise levels and given information on how they can improve their levels of physical activity. The nurse used simple motivational interview techniques to encourage physical activity and offered a range of options, including leaflets, a DVD demonstrating a programme of exercises for patients with COPD (‘Move on up’ video via Respiratory Marketing Department, Boehringer Ingelheim, UK, tel. +44 1344 424600) and referral to a non-clinical exercise regime or pulmonary rehabilitation.

Social intervention
Patients and carers (if present) were asked about their care needs and if appropriate referred to the practice social worker for assessment. Carers were provided with an information pack.

Data analysis
Descriptive statistics were used and comparison analysis pre and post visits was made using Wilcoxon signed-rank tests due to the non-parametric distribution of the data.

Health care costs
Costs of health care interventions by the hospital, for example, bed days or outpatient appointments and primary care such as GP/practice nurse appointments, were estimated using the Unit Costs of Health and Social Care 2007 produced by Personal Social Services Research Unit at the University of Kent (http://www.pssru.ac.uk/uc/uc2007contents.htm). Drugs costs were estimated using prices in the British National Formulary (September 2008).

TABLE 1 Baseline demographic details (n = 11)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>70.6 (±8.1)</td>
</tr>
<tr>
<td>Gender</td>
<td>8 females and 3 males</td>
</tr>
<tr>
<td>Pack years smoking</td>
<td>30 (±20.8)</td>
</tr>
<tr>
<td>FEV-1% predicted</td>
<td>37.4%(±14.3)</td>
</tr>
<tr>
<td>Body mass index</td>
<td>22.8 ± 6.17</td>
</tr>
</tbody>
</table>

TABLE 2 Comparing exacerbations of COPD, hospital admissions during October 2007 to March 2009 compared to October 2006 to October 2007

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre intervention, n = 11</th>
<th>Post intervention, n =11</th>
<th>P (Wilcoxon signed-rank test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sum</td>
<td>Median</td>
<td>IQRs</td>
</tr>
<tr>
<td>Number of hospital admissions</td>
<td>3</td>
<td>0</td>
<td>0–1</td>
</tr>
<tr>
<td>Number of bed days</td>
<td>16</td>
<td>0</td>
<td>0–3</td>
</tr>
<tr>
<td>Number of exacerbations</td>
<td>18</td>
<td>2</td>
<td>0–3</td>
</tr>
<tr>
<td>Number of out of hours visits</td>
<td>4</td>
<td>0</td>
<td>0–1</td>
</tr>
</tbody>
</table>

ns, non-significant; IQR, interquartile range.
Results

The practice has 6400 patients of whom 109 were on the COPD register (prevalence 1.7%). Figure 1 shows the patient flow chart.

Table 1 shows the patient demographic details. At baseline, all patients were receiving inhaled corticosteroid therapy, 10 patients (91%) had written action plans and 4 (36%) patients had received pulmonary rehabilitation.

Table 2 shows the comparison of exacerbations and hospital admissions during the 6-month study period compared to the corresponding period 12 months previously. This shows a non-significant increase in exacerbations and a non-significant fall in hospital admissions and bed days.

Table 3 shows data collected at baseline and at 6 months later (end of study). This shows no statistically change in the MRC dyspnoea score and no significant change in quality of life a measured by the CCQ. There was, however, a statistically significant improvement in the total LINQ score, which was largely contributed to by a significant improvement in the self-management domain ($P = 0.016$). Three patients screened positive for depression and two patients had a PHQ-9 score >10 (suggesting clinical depression) at baseline and at the end of the study.

Figure 2 shows the DOSE score distribution calculated retrospectively on 94 out of the 108 COPD patients in the practice (there was insufficient data for the remaining 14 patients) from the practice records. This shows that using a cut-off point of $\geq 3$ that one in six patients would fall into this high-risk category.

Discussion

This pilot study looks at the effect of case management in primary care of patients with COPD identified by the DOSE index at being at high dose of hospital admission due to an acute exacerbation of COPD.

Retrospective data were available in 94 patient notes enabling the DOSE score to be calculated. Future studies need to prospectively use DOSE rather than use retrospective data.

The number of hospital admissions and number of inpatient days fell from a total of three admissions to zero admissions and from 16 bed days to 0 bed days in the study period compared to the comparable 6-month period in the previous year. However, this did not reach statistical significance, probably due to the small numbers involved. The total number of exacerbations, defined by antibiotic or oral steroid use rose from 18 to 25 although this was not statistical

| Table 3 | Data at baseline and 6 months (end of study) |
|-------------------|-------------------|-------------------|
|                  | Baseline median (IQRs) | 6 month median (IQRs) | $P$ value (Wilcoxon signed-rank test) |
| FEV-1% predicted | 34% (30–48%) | 32% (27–46%) | ns |
| MRC score        | 4 (3–5) | 4 (2–5) | ns |
| CCQ total score  | 2.7 (2–4.1) | 3.1(2.4–3.5) | ns |
| LINQ total score | 6 (5–8) | 4 (3–6) | 0.006 |
ns, non-significant.
significant. This is not unexpected as there was probably a lower threshold to initiate antibiotic/oral steroid therapy after the trial intervention. This is borne out by a statistically significant rise ($P < 0.016$) in the LINQ self-management domain during the study.

There are major limitations in drawing conclusions by comparing the pre-study and final visit data. Even though the two periods are comparable in time of year (October to March), there are many confounding factors such as weather and respiratory infection prevalence, which makes it difficult to draw conclusions about intervention versus non-intervention in the absence of a randomized controlled trial. Nevertheless, the results of this pilot study do show a trend towards reduction in hospital admission and inpatient days.

Eighteen per cent (2 out of 11) of the patients were clinically depressed and this is slightly lower than the 25% previously reported in a cohort of patients with severe COPD.10 There was no improvement in health status, as measured by the CCQ during the study. Another limitation of the study is that it was carried out in a respiratory-interested practice where many of the NICE guideline recommendations were already being carried out and so there is less room for improvement with this formalized intervention. Nevertheless, there was a statistically significant improvement in the LINQ score.

The LINQ8 identifies patients’ educational needs in the domains of disease knowledge, medicines, diet, exercise, self-management and smoking. The improvement in the LINQ score was linked to a non-statistically significant trend in improvement in dietary, disease and exercise knowledge and a significant improvement in self-management knowledge. Since self-management programmes have been shown to reduce hospitalizations,11,12 the increase in self-management knowledge may be related to the reduction in hospitalizations noted in this study.

This pilot study in a respiratory-interested general practice suggests that case management, using computer-based system, of patients identified at being high risk of hospital admission by prospective use of the DOSE score can improve patient self-management knowledge and may reduce hospital admissions and inpatient days. This needs to be further tested in a randomized controlled trial.

**Declaration**

**Funding:** none.

**Ethical approval:** Wiltshire Research Ethics Committee (7/H0104/66).

**Conflict of interest:** none.

**References**


