A nurse led intermediate care package in patients who have been hospitalised with an acute exacerbation of chronic obstructive pulmonary disease

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ABSTRACT

Objectives: To determine the effects of a nurse led intermediate care programme in patients who have been hospitalised with an acute exacerbation of chronic obstructive pulmonary disease (AECOPD).

Design: Randomised controlled trial.

Setting: Community and hospital care in west London.

Participants: 122 patients with COPD.

Intervention: A care package incorporating initial pulmonary rehabilitation and self-management education, provision of a written, personalised COPD action plan, monthly telephone calls and 3 monthly home visits by a specialist nurse for a period of 2 years.

Main outcome measure: Hospital readmission rate.

Secondary outcomes: Unscheduled primary care consultations and quality of life.

Results: There were no differences in hospital admission rates or in exacerbation rates between the two groups. Self-management of exacerbations was significantly different and the intervention group were more likely to be treated with oral steroids alone or oral steroids and antibiotics, and the initiators of treatment for exacerbations were statistically more likely to be the patients themselves. 12 patients in the control group died during the 2 year period, eight as a result of COPD, compared with six patients in the intervention group, of whom one died from COPD. This is a significant difference. When the numbers were adjusted to reflect the numbers still alive at 2 years, in the intervention group patients reported a total of 171 unscheduled contacts with their general practitioner (GP) and in the control group, 280 contacts. The number needed to treat was 0.558—i.e., for every one COPD patient receiving the intervention and self-management advice, there were 1.79 fewer unscheduled contacts with the GP.

Conclusions: An intermediate care package incorporating pulmonary rehabilitation, self-management education and the receipt of a written COPD action plan, together with regular nurse contact, is associated with a reduced need for unscheduled primary care consultations and a reduction in deaths due to COPD but did not affect the hospital readmission rate.

Chronic obstructive pulmonary disease (COPD) represents a global health burden and will move from 12th place to be the fifth largest cause of disability adjusted life years lost by 2020.¹ In the UK, 30 000 deaths per year are attributed to COPD, over 5% of all deaths,² and up to one in eight emergency hospital admissions may be due to COPD.³ Much of the morbidity and mortality related to the condition results from exacerbations of the disease, and frequent exacerbations are associated with more rapid decline in lung function.⁴ These exacerbations are much feared by patients who dislike their impact on everyday life and fear of being housebound, bedridden or hospitalised.⁵ ⁶ Previous research has focused on optimal therapeutic strategies for both the prevention⁷–¹⁰ and treatment of acute exacerbations¹¹ and also on the effectiveness of care interventions such as “hospital at home” and early discharge schemes for those having acute exacerbations of COPD.¹² ¹³ A systematic review of the effectiveness of innovations in nurse led management has concluded that there is little evidence to date to support such interventions, but the authors conclude that the data are too sparse to be certain, and none of the studies extended beyond a duration of 12 months.¹⁴ There is a similar lack of evidence to show whether self management education alters outcomes in COPD.¹⁵

We have undertaken a randomised controlled trial to determine the effects of a nurse led intermediate care programme in the management of patients who have been hospitalised with an acute exacerbation of COPD. The care package incorporated initial pulmonary rehabilitation followed by an emphasis on self-management education and nurse follow-up for 2 years.

METHODS

A list of patients who had been admitted to Charing Cross and Hammersmith Hospitals, London, UK, between 1 January 2000 and 31 August 2004 with the main reason for admission being coded on discharge as having been due to an acute exacerbation of COPD was obtained from the hospital database. The clinical notes of these patients were reviewed by the investigators using a proforma. If thought to represent a suitable patient, the case notes were discussed and, where necessary, further information obtained. Exclusion criteria included significant comorbidity such as severe heart disease or cancer, or any condition that would preclude participation in the physical therapy component of a pulmonary rehabilitation programme. None of the patients had previously undertaken a pulmonary rehabilitation programme. Those patients thought to be suitable were sent a letter inviting them to participate in the study and those who responded were invited for initial assessment and, if still suitable and
agreeable, randomised to the intervention or usual care groups.

The study intervention involved all patients initially participat-
ing in a hospital based pulmonary rehabilitation programme
consisting of two attendances per week for 4 weeks. During this
visit, the patients received general education about their disease
and its treatment (1 h per session) and underwent an
individualised physical training programme (1 h per session).
Following completion of the pulmonary rehabilitation pro-
gramme, the patients received a baseline home visit by a
specialist respiratory nurse, and during this first visit, the
patients were given a personalised written COPD action plan (a
copy of which is shown in appendix A online). This contained
both lifestyle advice and advice about their usual medication,
and gave specific advice about when the patient should start a
course of antibiotics and when they should start a course of
steroid tablets. The general practitioners of these patients were
requested to provide for the patient reserve supplies of these
medications.

Subsequently, those in the intervention group had monthly
telephone calls from the respiratory nurses and a home visit
every 3 months. During each interview and visit, the nurses
undertook a structured approach to history taking and during home
visits measured pulse and respiratory rate, oxygen saturation and end-tidal carbon monoxide. Spirometry was
performed at baseline and after 12 and 24 months. During both
telephone and home visits, they reinforced advice regarding
treatments, smoking cessation if relevant, the need to continue
their exercise therapy and discussed and reinforced the self-
management education which had been given and offered
encouragement for successful self-treatment. The patients were
also given written advice about the treatment of COPD which
they were asked to show to their doctor if they underwent any
unscheduled healthcare.

Patients in the control group received usual care from their
primary care physician, or secondary care and/or the respiratory
nursing service as appropriate. No attempt was made to
influence this care. Patients in both the control and intervention
groups had their use of healthcare monitored by monthly
telephone self-report verified by confirmation of the general
practice and hospital records. General practice records alone
were not used because they do not always contain a record of
hospital admissions and it is not always possible to tell which
consultation within primary care was scheduled and which was
unscheduled. Corroboration of patient self-reported general
practitioner (GP) consultations was undertaken by the GPs
themselves from their records. Corroboration of patient self-
reported hospital admissions was undertaken by the respiratory
research nurses against local hospital records. A copy of the
death certificate was requested for all patients who died.

Quality of life was assessed using the Chronic Respiratory
Questionnaire at baseline and three further times during the
subsequent 2 years.

The study was approved by the Riverside Research Ethics
Committee.

Statistical analysis

The primary end point for our trial was to be hospital
readmission rate with secondary outcomes being unscheduled
consultations with GP and quality of life. Retrospective review
of previous local hospital admission rates suggested that over a
2 year period, 579 patients might accrue a total of 1180
admissions (mean 2.04 admissions per patient). We calculated
that we would need a study of 88 patients to have an 80% chance of detecting a difference (95% readmission in usual care
versus 75% in the intervention group), using a two sided
alpha = 0.05. All statistical analysis was carried out using the
software program SPSS (V.12.0). For all analyses, chi² tests,
the Mann–Whitney test, independent or paired t tests were used.

RESULTS

There were 2305 admissions to Hammersmith Hospitals NHS
Trust between 1 January 2000 and 31 August 2004. Many of
these were multiple admissions and the total number of
patients admitted with an acute exacerbation of COPD in that
period was 1247. A total of 507 of these patients had died at the
time we began recruiting to this study and of the 740 who were
alive, 166 lived outside our area and were not therefore able to
attend the pulmonary rehabilitation programme if randomised
to intervention. This left 574 patients who were assessed. Two
hundred and seventy-seven of these were thought to be
unsuitable for the reasons shown in table 1.

Of the 297 patients who were suitable for inclusion in the trial,
120 (40.4%) responded that they did not wish to take part
in the trial, 55 (18.5%) did not reply and 122 (41%) patients
were suitable, and were recruited and randomised by the use of
random numbers to the intervention or control group. These
data are summarised in the consort diagram in fig 1.

From table 2 it can be seen that at baseline, the control and
intervention groups were well matched for age, gender, severity
of disease, previous hospitalisation rate, breathlessness scores,
weight, smoking habits and use of home oxygen. Both groups
had similar numbers of initial and persisting smokers and
breathlessness scores worsened during the course of the study in
both groups. Lung function appeared to decline to a greater
degree in the control group than in the intervention group, but
this difference was not statistically significant. At baseline,
similar proportions of patients were receiving long acting beta
agonist bronchodilators and anticholinergic agents, and the
majority of patients in both the intervention group and in the
control group were taking inhaled steroids at entry to the trial.
At the end of the trial, patients in the intervention group were
statistically more likely to be on a long acting inhaled beta
agonist or a short or long acting anticholinergic agent in the
intervention group, compared with the control group.

At the beginning of the trial, 5% of the intervention group
and 11.5% of the control group had a reserve supply of
antibiotics; corresponding values for steroid tablets were 5%
and 11.5% of the control group had a reserve supply of
these tablets. The general practitioners of these patients were
requested to provide for the patient reserve supplies of these
medications.

Table 1
Reasons for patients being regarded as unsuitable to be
included in the trial (n = 277)

- Alternative diagnosis, no evidence of COPD: 122 (44.1%)
  These were mainly because of perusal of the notes gave clear evidence of another
  major pulmonary condition, such as asthma, diffuse parenchymal lung disease or
  bronchiectasis
- Psychosocial problems and significant cognitive impairment: 68 (28.5%)
  (eg, dementia, blindness, alcohol abuse, psychiatric illness, homelessness or in
  prison)
- Severe limiting comorbidity involving other major organ systems: 50 (18.1%)
  (mainly cardiac but also cancer and alcohol related liver disease, etc)
- Factors limiting mobility and locomotion: 37 (13.3%)
  (housebound, wheelchair bound, previous cerebrovascular accident, severe arthritis)
group had a reserve supply of steroid tablets at the end of 2 years. There were no differences in exacerbation rates between the two groups (an exacerbation being defined as an unscheduled need for healthcare, or need for steroid tablets, or antibiotics for worsening of their COPD), nor was there a difference in the total number of exacerbations per group over the 2 year period. There was also no difference in the total number of hospital admissions or in the number of patients having an admission to hospital during the 2 year period. Because this could have been influenced by differences in death rates, this was also analysed as days alive and out of hospital in the two groups, but there was no statistically significant difference. Self-management of exacerbations was however significantly different and patients in the intervention group were more likely to have exacerbations treated with oral steroids alone or oral steroids and antibiotics than the control group, who were more likely to be treated with antibiotics alone. The initiator of treatment for exacerbations was statistically more likely to be the patient themselves in the intervention group and the GP in the control group.

Twelve patients in the control group died during the 2 year period, eight as a result of COPD, compared with six patients dying in the intervention group, of which one died from COPD. The number dying from COPD in the control group was significantly higher both as a proportion of the total deaths and as a proportion of hospital admissions or in the number of patients in the trial compared with those in the intervention group. The non-COPD deaths included four deaths due to pneumonia (three in the control group and one in the intervention group), one due to metastatic lung cancer, one due to cerebral haemorrhage, two due to coronary artery disease and one due to septic shock. All but two patients died in hospital. The stated cause of death was confirmed by acquisition of copies of the death certificates in all but one case. One patient died on a cruise ship off the coast of West Africa and death was reported by relatives to have been due to worsening of their lung condition over several days following exposure to adverse environmental conditions. When the numbers in the intervention and control groups were adjusted to reflect the numbers still alive, it can be seen that at 2 years, 55 of 61 patients in the intervention group were still alive, and these patients had reported a total of 171 unscheduled contacts with their GP. In the control group, 49 of the 61 patients were still alive, and they had had 280 contacts with their GP. The number needed to treat, therefore, was 0.558—that is, for every one COPD patient receiving self-management education, there was 1.79 less unscheduled contacts with the GP. The health economic costs of the pulmonary rehabilitation programme are shown in table 3, and suggest that the costs of the intervention were only very slightly greater per patient than the savings on unscheduled primary healthcare (£153 compared with £142).

Within the Chronic Respiratory Questionnaire there was a statistical and clinically significant worsening in the mean dyspnoea score in both the intervention and control groups from baseline to end of year 2, and the mean mastery score improved in the intervention group but this change was not clinically significant.

To ensure that any differences did not reflect differences in routine healthcare received, data in table 4 show that equal numbers of patients received primary care alone in both the intervention and control groups from baseline to end of year 2, and the mean mastery score improved in the intervention group but this change was not clinically significant.

**DISCUSSION**

The proportion of patients who had been admitted to hospital with an exacerbation of COPD who were eligible for and consented to take part in this trial was lower than anticipated. This was because of both polymorbidity and non-consent, and...
<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatment (n = 61)</th>
<th>Control (n = 61)</th>
<th>Percentage difference</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males (%)</td>
<td>49.2 (30/61)</td>
<td>49.2 (30/61)</td>
<td>0</td>
<td>NS</td>
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<tr>
<td>Age (y) (mean (SD))</td>
<td>69.9 (9.6)</td>
<td>69.68 (10.4)</td>
<td>0.22</td>
<td>0.474†</td>
</tr>
<tr>
<td>BMI (median (range))</td>
<td>25.0 (14–38)</td>
<td>24 (16–40)</td>
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<tr>
<td>Smoking status</td>
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<td></td>
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<tr>
<td>Current smoker</td>
<td>29.5 (18/61)</td>
<td>29.1 (16/55)</td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>MRC dyspnoea score (median (range))</td>
<td>3 (1–5)</td>
<td>4 (1–5)</td>
<td></td>
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</tr>
<tr>
<td>Home O₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (%)</td>
<td>19.7 (12/61)</td>
<td>25.4 (18/61)</td>
<td>0.22</td>
<td>0.474†</td>
</tr>
<tr>
<td>Cylinder</td>
<td>33.3 (4/12)</td>
<td>28.6 (4/14)</td>
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<tr>
<td>Concentrator</td>
<td>66.6 (8/12)</td>
<td>71.4 (10/14)</td>
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<tr>
<td>FEV₁ (mean (SD))</td>
<td>1.04 (0.44)</td>
<td>0.95 (0.42)</td>
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<tr>
<td>FEV₁% pred (mean (SD))</td>
<td>42.9 (15.5)</td>
<td>41.1 (17.1)</td>
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<tr>
<td>Change in FEV₁ ml (mean (SD))</td>
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<td></td>
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<td>Prior hospital admissions (before randomisation)</td>
<td></td>
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<tr>
<td>Total No of admissions</td>
<td>73</td>
<td>64</td>
<td>9</td>
<td>0.186*</td>
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<tr>
<td>Admission in the 2 y prior to recruitment (%)</td>
<td>80.3 (49/61)</td>
<td>68.8 (42/61)</td>
<td>11.5</td>
<td>0.145</td>
</tr>
<tr>
<td>LABA prescription</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (%)</td>
<td>67.2 (41/61)</td>
<td>92.7 (51/55)</td>
<td>23.3</td>
<td>0.004</td>
</tr>
<tr>
<td>LABA inhaler alone</td>
<td>29.3 (12/41)</td>
<td>33.3 (13/39)</td>
<td></td>
<td></td>
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<tr>
<td>LABA and ICS combination inhaler</td>
<td>70.7 (29/41)</td>
<td>66.7 (26/39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICS prescription</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (%)</td>
<td>88.5 (54/61)</td>
<td>94.5 (52/55)</td>
<td>5.5</td>
<td>0.097</td>
</tr>
<tr>
<td>Inhaled ICS alone</td>
<td>46.3 (25/54)</td>
<td>46.9 (23/49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICS and LABA combination inhaler</td>
<td>53.7 (29/54)</td>
<td>50.0 (25/51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticholinergic prescription</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (%)</td>
<td>73.7 (45/61)</td>
<td>89.1 (49/55)</td>
<td>13.4</td>
<td>0.004</td>
</tr>
<tr>
<td>Short acting</td>
<td>53.3 (24/45)</td>
<td>58.9 (23/39)</td>
<td></td>
<td></td>
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<tr>
<td>Long acting</td>
<td>46.6 (21/45)</td>
<td>41.0 (16/39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths in 2 y study period</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (%)</td>
<td>9.8 (6/61)</td>
<td>19.7 (12/61)</td>
<td>13.1</td>
<td>0.126</td>
</tr>
<tr>
<td>COPD</td>
<td>16.7 (1/6)</td>
<td>66.6 (8/12)</td>
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<td>0.015</td>
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<tr>
<td>Non-COPD</td>
<td>83.3 (5/6)</td>
<td>33.3 (4/12)</td>
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<td>0.417</td>
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<tr>
<td>Hospital admissions</td>
<td></td>
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<tr>
<td>Total No of admissions in study period</td>
<td>70</td>
<td>52</td>
<td>3.8</td>
<td>0.421*</td>
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<tr>
<td>Admission in study period (%) (n)</td>
<td>52.7 (29/55)</td>
<td>48.9 (24/49)</td>
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<td>0.361</td>
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<tr>
<td>No of admissions per patient (median (range))</td>
<td>0 (0–13)</td>
<td>0 (0–5)</td>
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<tr>
<td>Days alive and out of hospital/2 y</td>
<td>41400/44530</td>
<td>39 578/44 530</td>
<td>70.5*</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>(93.0%)</td>
<td>(88.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (range)</td>
<td>724 (244–730)</td>
<td>730 (19–730)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-management of COPD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserve oral antibiotics prescribed</td>
<td>4.9 (3/61)</td>
<td>92.7 (51/55)</td>
<td>88.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Reserve oral steroids prescribed</td>
<td>4.9 (3/61)</td>
<td>92.7 (51/55)</td>
<td>76.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No of patients who reported an exacerbation</td>
<td>86.9 (53/61)</td>
<td>86.9 (53/61)</td>
<td>0</td>
<td></td>
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<tr>
<td>Treated with oral antibiotics only</td>
<td>36.2 (161/445)</td>
<td>63.8 (233/384)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Treated with oral steroids only</td>
<td>19.8 (88/445)</td>
<td>7.7 (28/364)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Treated with oral antibiotics and steroids</td>
<td>44.0 (196/445)</td>
<td>28.3 (103/384)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Who initiated treatment for exacerbation?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self</td>
<td>43.1 (192/445)</td>
<td>10.4 (38/364)</td>
<td>32.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Research nurse</td>
<td>6.3 (28/445)</td>
<td>0 (0/364)</td>
<td>6.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>GP</td>
<td>31.5 (140/445)</td>
<td>68.7 (250/384)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>A&amp;E doctor</td>
<td>0.9 (4/445)</td>
<td>2.5 (9/364)</td>
<td></td>
<td>0.077</td>
</tr>
<tr>
<td>Outpatients clinic doctor</td>
<td>2.9 (13/445)</td>
<td>5.2 (18/364)</td>
<td></td>
<td>0.095</td>
</tr>
<tr>
<td>Inpatient hospital doctor</td>
<td>15.3 (68/445)</td>
<td>13.5 (48/364)</td>
<td></td>
<td>0.464</td>
</tr>
<tr>
<td>Total No of unscheduled GP visits/contact</td>
<td>171</td>
<td>260</td>
<td>109</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>Telephonic consultation</td>
<td>9.9 (17/171)</td>
<td>3.5 (10/280)</td>
<td>6.4</td>
<td>0.006</td>
</tr>
<tr>
<td>Practice attendance</td>
<td>67.8 (116/171)</td>
<td>88.2 (247/280)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Home visit</td>
<td>22.3 (38/171)</td>
<td>8.2 (23/280)</td>
<td>14.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Disease Specific QoL Questionnaire: CRQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continued</td>
<td></td>
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</tbody>
</table>
the latter was due more to the intervention, including pulmonary rehabilitation, than to it being a research trial. As a result, recruitment was lower than expected but neither the total number of readmissions nor the number of patients having an admission during the 2 year follow-up period differed between the intervention and control groups. This result is thus consistent with a previous review but extends our knowledge to show that the same applies if the intervention continues for 2 years. The secondary outcome of rate of unscheduled GP consultations was significantly less in the intervention group.

It thus looks as though the self-management education part of the intervention, given in group format during the pulmonary rehabilitation programme and individually by the nurse subsequently, led to intervention patients being more likely to have received supplies of antibiotics and steroids and more likely to start these themselves to treat an exacerbation than the control group.

Unexpectedly, we showed a significant reduction in deaths due to COPD in the intervention group. We acknowledge the difficulties around the accuracy of death certificates. However, this reduction in death rate could be explained by a reduction in the severity of exacerbations as a result of self-treatment with antibiotics and steroid tablets and it is probable that the ready availability of reserve medications leads to their prompter use, and earlier treatment of exacerbations has been shown to be associated with improved outcomes. A less likely explanation for a reduced death rate would be differences in routine inhaler therapy in the intervention group compared with the control group. While controversial, there have been suggestions that the use of inhaled steroids might be associated with a reduction.

### Table 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatment (n = 61) Baseline (% (n))</th>
<th>Control (n = 61) Baseline (% (n))</th>
<th>Year 2 (n = 55) (% (n))</th>
<th>Year 2 (n = 49) (% (n))</th>
<th>Percentage difference</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnoea</td>
<td>3.55 (1.12)</td>
<td>2.83 (1.21)*</td>
<td>3.49 (1.26)</td>
<td>2.65 (1.23)*</td>
<td>*p&lt;0.05</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>3.62 (1.26)</td>
<td>3.68 (1.35)</td>
<td>3.59 (1.51)</td>
<td>3.24 (1.11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical domain</td>
<td>4.58 (1.22)</td>
<td>4.74 (1.43)</td>
<td>4.39 (1.37)</td>
<td>4.03 (1.30)</td>
<td></td>
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<tr>
<td>Mastery</td>
<td>4.71 (1.26)</td>
<td>5.14 (1.33)*</td>
<td>4.71 (1.46)</td>
<td>4.44 (1.45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional domain</td>
<td>16.46 (4.05)</td>
<td>16.41 (3.94)</td>
<td>16.18 (4.56)</td>
<td>14.37 (3.97)*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Mann Whitney, †Student t test.
‡Percentage difference at 2 years between intervention and control (treatment – control).
§Control versus treatment end of year 2, all $\chi^2$ statistical analysis except where stated.

### Table 3

Health economic costs of the pulmonary rehabilitation programme

<table>
<thead>
<tr>
<th></th>
<th>Treatment (n = 61)</th>
<th>Control (n = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP unscheduled contacts</td>
<td>171</td>
<td>260</td>
</tr>
<tr>
<td>Cost (Curtis 2006)*</td>
<td>£6301</td>
<td>£8680</td>
</tr>
<tr>
<td>Somerset f self management education</td>
<td>81 nurse hours = £2511</td>
<td>No self management education/ home visits given</td>
</tr>
<tr>
<td>Travel costs for home visits (Netten 2006)</td>
<td>£37.21</td>
<td>£0</td>
</tr>
<tr>
<td>Routine follow-up calls for patients (by nurses)</td>
<td>547 calls, 48 hours (total length)</td>
<td>Cost £28.82</td>
</tr>
<tr>
<td>Nurse costs for telephone calls</td>
<td>£1488</td>
<td>£0</td>
</tr>
<tr>
<td>Total</td>
<td>£9329.62</td>
<td>£8680.00</td>
</tr>
</tbody>
</table>


### Table 4

Care received by those in the intervention and control groups

<table>
<thead>
<tr>
<th></th>
<th>Intervention group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 care doctors only</td>
<td>31/61</td>
<td>36/61</td>
</tr>
<tr>
<td>1 care doctors and RNS</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Secondary care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 and 2 care doctors only</td>
<td>30/61</td>
<td>25/61</td>
</tr>
<tr>
<td>1 and 2 care doctors and RNS</td>
<td>30</td>
<td>16</td>
</tr>
</tbody>
</table>

RNS, Respiratory Nursing Service.
subsequent to that review, and subsequent to us starting this intervention in COPD, only two studies involved patients receiving a 
mortality without influencing the need or otherwise for admission to hospital, which is in any way likely to be influenced by social factors such as isolation, depression and available support in the home.

There are clearly still many unknowns with regard to what constitutes optimal care for those with COPD. We included pulmonary rehabilitation within our intermediate care package because it contains elements of exercise therapy, group support and group education, and has been shown to beneficially affect outcomes such as quality of life, exercise ability and breathlessness scores. It has not however been shown conclusively to affect hospitalisation rate, mortality or primary care consultation rates. The improvements in the latter two outcomes in our study are therefore unlikely to reflect incorporation of pulmonary rehabilitation within the intervention package. Regular follow-up by nurses in this study has again failed to demonstrate a benefit in terms of reduction in hospital admission rates and this result is almost identical to a shorter study from this hospital 20 years ago. However, we have demonstrated that an intervention which includes group advice regarding self-management education, followed by the issuing to each patient of a personalised action plan leads to an alteration in self-management behaviour and reduced need for unscheduled primary care. Previously, the case for self-management education in COPD was not proven. Studies reported subsequent to that review, and subsequent to us starting this study, have shown conflicting results. One group showed no differences in quality of life scores or walking distance and no reduction in exacerbation rate following self-management education, while another demonstrated a significant reduction in hospital admissions, emergency department visits and physicians visits. In the latter study, however, and indeed in our own, it is difficult to be certain which of several parts of a complex package achieved which benefit. The relationship between possession of antibiotics and oral steroids, their self-administration and the reduced need for unscheduled primary care in our study does appear to be causally related. One explanation for differences in previous studies may lie in the way in which the personalised self-management advice was given. In asthma, where there is overwhelming evidence in favour of self-management education, written action plans are a key component. In the systematic review of self-management in COPD, only two studies involved patients receiving a written action plan, and study of the action plans used in those two studies shows that one was a typical asthma action plan and did not, for example, include any advice to the patient about antibiotics. The other study did include an action plan which included advice as to when to start antibiotics and this did show an alteration in patient usage of antibiotics and steroids but the study was not powered to show a change in outcome.

A subsequent Cochrane review has suggested that use of action plans can alter self-management behaviour in those with COPD but did not lead to any hard outcomes. Our study does show that self-management education can be associated with change in patient behaviour and a reduction in the need for urgent primary care, and this plus follow-up by nurses and possibly optimisation of inhaled therapy can be associated with reduced mortality due to COPD.

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Competing interests: None.

Ethics approval: Yes.

Trial registration number: NCT0129779

REFERENCES


IP-10 as a biomarker for rhinoviral infections in asthma

Asthma exacerbations are most commonly triggered by viruses, particularly rhinovirus. There is currently no biomarker that can be used to predict that a virus has triggered an exacerbation.

This group studied bronchial epithelial cells (BECs) obtained by bronchoscopy from 10 healthy controls and 10 patients with asthma who had never received inhaled corticosteroids. The epithelial cells were cultured and exposed to rhinovirus 16. The supernatants were measured for various cytokines including interferon-γ-induced protein 10 (IP-10) by FACs analysis.

There was a significant increase in IP-10, RANTES, interleukin (IL)-6, IL-8 and tumour necrosis factor α from baseline, which peaked at 48 h after infection. There was no significant difference between patients with asthma and controls. Pretreatment of the BECs with dexamethasone did not significantly reduce the release of IP-10. Rhinovirus replication was significantly greater in BECs of subjects with asthma than controls, and there was a positive correlation between IP-10 release and viral concentrations.

The authors went on to investigate whether acute virus-induced asthma could be differentiated form non-infective acute asthma. These patients were not steroid naïve. They found that patients with acute virus-induced asthma had significantly increased IP-10 levels compared with those with non-viral acute asthma. Viral infections were also found to be associated with lower forced expiratory volume in 1 s. Individuals with acute rhinoviral infection specifically had significantly increased IP-10 levels, and a level of 168–1916 pg/ml increased the likelihood of rhinoviral infection more than twofold.

It appears that rhinoviral infection initiates an inflammatory response with marked release of IP-10, and this correlates with rhinovirus replication. The authors conclude that IP-10 may therefore be a useful clinical marker to identify rhinovirus-induced asthma and may be a potential therapeutic target for the future.


Jennifer K Quint

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Appendix A

Oxygen
Use your oxygen as advised – either long-term or supplementary during exertion – know when to increase this and be aware of the importance of early morning confusion or headaches which might suggest that you are retaining your exhaust gas (carbon dioxide).

If you have been given a COPD Alert Card (because you have previously had Type II Respiratory failure) make sure that you show this to any doctor you see and to Ambulance Personnel.

Further Information
If you want further information about your condition do ask your doctor or nurse, or you can contact -
British Lung Foundation
73-75 Goswell Road
London EC1V 7ER
Tel: 020 7688 5555
www.lunguk.org

Department of Respiratory Medicine
Charing Cross Hospital

C.O.P.D. Self-management Card

Name: ......................................................
Hospital No.: ...........................................
Chest Consultant: ......................................
Respiratory Health Worker: ...........................
General Practitioner.................................

Self-management Plan
**Lifestyle changes**

1. Stop smoking (and avoid smoky environments).
2. Use nicotine replacement therapies as appropriate as advised.
3. Use effective breathing methods.
4. Use effective coughing methods.
5. Undertake your exercise programme as advised during your pulmonary rehabilitation course. Remember: Getting ‘puffed’ isn’t bad for you.
6. Eat a balanced diet: include plenty of fresh fruit and vegetables and drink plenty of fluids to help keep mucus thin. Avoid gas-forming foods such as broccoli, cabbage, onions, beans and sauerkraut. It is often best to eat little and often. If eating makes you breathless, use supplementary oxygen whilst chewing or liquidise solids. Try high energy foods if you are underweight.
7. Adjust daily activities of living. Sit down to do personal tasks such as washing or shaving or doing household tasks such as washing up or preparing meals.
8. Use a stool in the shower and use a hairdryer to dry feet or back.
9. Have flu vaccination every year and pneumovax every 5 to 10 years.

**Treatment changes**

1. Take your ………………. Inhaler (……..) in the dose of …… puffs, ………..times every day.
2. Take your ……………….. Inhaler (…….) in the dose of …… puffs, ……… times every day.
3. Take your ………………..Inhaler(……...) in the dose of ……  puffs, …………….. a day.
4. Take your………………... Inhaler (…….) in the dose of …… puffs ………………… times a day.
5. If you feel any more breathless, you may take your …BLUE…………… inhaler 2 puffs, every 3 to 4 hours to relieve symptoms.
6. If despite this you are becoming increasingly breathless and you are having to use your Blue inhaler very often you should start a course of steroid tablets by taking 6 tablets (5mg strength) immediately and repeat this dose every morning for 7 days before stopping the tablets (or reducing them according to individualised advice)
7. If you notice more than two of the following situations then you should start your reserve supply of antibiotics and complete the whole course –
   - Increasingly short of breath
   - Increasing quantities of phlegm/sputum
   - Phlegm or sputum has turned persistently green
8. If your ankles are more swollen than normal you should see your doctor.

If despite all of these measures you still feel your symptoms are worse then you should ring your doctor on

………………………………..

If you contact your Doctor because of worsening symptoms could you also inform the Respiratory Nurses (Renay Taylor and Simonne Dawson on: 020 8846 1356)