Papers

Effectiveness of innovations in nurse led chronic disease management for patients with chronic obstructive pulmonary disease: systematic review of evidence

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Abstract

Objective To determine the effectiveness of innovations in management of chronic disease involving nurses for patients with chronic obstructive pulmonary disease (COPD).

Design Systematic review of randomised controlled trials.

Data sources 24 electronic databases searched for English or Dutch language studies published between January 1980 and January 2005.

Review methods Included studies described inpatient, outpatient, and community based interventions for chronic disease management that were led, coordinated, or delivered by nurses. Hospital at home and early discharge schemes for acute exacerbations of COPD were excluded.

Results We identified nine relevant randomised controlled trials, most of which had some potential methodological flaws. All the interventions seemed to be variations on a case management model. The interventions described could be divided into brief (one month) and longer term (around a year) or more intensive interventions. Only two studies examined the effect of brief interventions, these found little evidence of any benefit. Meta-analysis of the long term interventions failed to detect any influence on mortality at 9–12 months' follow-up (Peto odds ratio 0.85, 95% confidence interval 0.58 to 1.26).

Conclusion There is little evidence to date to support the widespread implementation of nurse led management interventions for COPD, but the data are too sparse to exclude any clinically relevant benefit or harm arising from such interventions.

Introduction

Chronic obstructive pulmonary disease (COPD) affects an estimated 600 million people worldwide1 and in Europe it is the fifth leading cause of death.2-4 Each year the NHS spends more than £800m ($1415m, €1161m) on the disease,5 and exacerbations of COPD are a principal cause of the pressure on acute hospital beds in winter.6 Recognition of the public health burden of COPD has provided the impetus to develop new models of care. In the United Kingdom innovations in clinical service for COPD are being driven by a host of initiatives to redesign roles and processes in primary care and at the primary and secondary care interface, including changes to community and primary care nursing7 and general practitioners' contracts8 and schemes to support self management, such as the expert patient programme,9 together with the national service frameworks.10

The literature around these service innovations describes two types of interventions: hospital at home or early discharge schemes for acute exacerbations and interventions aimed at improving the management of COPD as a chronic disease. Such interventions may be multidisciplinary but commonly they are led, coordinated, and delivered (at least in part) by nurses. Ram and colleagues recently reviewed the role of early discharge schemes and hospital at home schemes for acute exacerbations of COPD11 and suggested that they are safe and should be adopted. But what is the evidence to support schemes to improve the chronic disease management of COPD?

As part of a larger project10 that attempted to synthesise all the available evidence (including qualitative, quantitative, economic, and “grey” literature) on the effectiveness of all the different clinical service innovations for COPD provided or led by nurses, we conducted a systematic review of randomised controlled trials of chronic disease management interventions for COPD.

Methods

Types of trials

To be considered for inclusion, studies had to evaluate clinical service interventions or packages of care aimed at improving the management of patients with COPD in the community. Eligible studies included inpatient, outpatient, or community based interventions that were either nurse led, nurse coordinated, or largely delivered by nurses. (Whenever necessary we contacted authors to establish the nature of the intervention.) We excluded drug trials, hospital at home or early discharge schemes for patients with acute exacerbations, educational interventions directed...
solely at other healthcare providers, and studies in which a substantial proportion of patients did not have COPD.

**Types of outcomes**
Principal outcomes of interest included survival, use of healthcare resources, activities of daily life, patients’ health related quality of life (HRQOL), and carers’ quality of life. We also examined all other reported outcomes.

**Identification and selection of trials**
We performed a systematic literature review of English and Dutch language papers using a predefined protocol. (We included Dutch papers because of the tradition of research on community nursing in the Netherlands.) We searched 16 electronic English language databases for the period January 1980 to January 2005 and eight Dutch citation databases and hand searched the conference proceedings of seven respiratory associations (see bmj.com, appendix 1). We also wrote to researchers and practitioners to identify unpublished trials.

Two reviewers working independently screened every citation retrieved in the searches and obtained the full text of all potentially eligible studies. BC undertook data extraction, using forms developed for the study, and quality assessment, which was checked by ST. HV extracted data from the Dutch language papers. Disagreements were resolved by discussion among the steering group.

**Assessment of methodological quality of trials**
We used the Delphi list14 and the Jadad criteria15 to assess methodological quality. We used the results of our data extraction together with the outcomes of the quality assessment to allocate an evidence score to each individual study using the levels of evidence from the Oxford Centre for Evidence-based Medicine.17

**Synthesis**
We grouped the findings of each study by type or duration of intervention and synthesised each outcome variable separately with an overall score for level of evidence for each outcome. When feasible and appropriate we conducted meta-analyses and calculated Peto odds ratios or Cohen’s d standardised differences. When feasible and appropriate we conducted meta-analyses and calculated Peto odds ratios or Cohen’s d standardised differences using Comprehensive Meta Analysis software (Biostat, NJ, 1999).

**Results**

**Search for trials**
After screening of titles and abstracts we identified 175 potentially relevant articles, of which we included nine randomised controlled trials describing interventions for the management of chronic disease (fig 1).17–25 We also identified one systematic review26 that included four of the trials we identified. We identified five potentially relevant studies whose results were unavailable because the studies were ongoing or being written up (see bmj.com, appendix 2). We excluded two potential trials because one did not present any data comparing the intervention and control groups27 and in the other the results of the statistical analyses did not seem to be adjusted for the cluster randomised design.28

**Methodological quality**
Most of the trials had potential methodological limitations, and only two studies reported on both random sequence generation and allocation concealment (see bmj.com, appendix 3). Five trials either did not report a clear calculation of sample size or failed to achieve the intended sample size. We assessed the level of evidence for each of the individual trials to be either 2b (‘low quality randomised controlled trial’) or 1b– (individual randomised controlled trial with a wide confidence interval; we have also used this where no confidence interval was supplied).29

**Description of the studies**

Table 1 describes the characteristics of the included studies. Most studies included patients with moderate or severe COPD (British Thoracic Society definitions30); one study included only patients receiving long term oxygen therapy.31 The interventions could be divided into brief interventions after a hospital admission (two studies,32 33 both around one month in duration) and more intensive34 or long term studies (around a year duration35–37) with follow-up at one year. The interventions studied had many similarities and all seemed to be variations on a “case management” approach ( involving “the active management of high risk people with complex needs with case managers, usually nurses, taking responsibility for caseloads working in an integrated system”).38 All the interventions included home visits by a nurse, except for one that was clinic based and two studies that were unclear on this point.39 40 Three interventions included telephone follow-up,41 42 43 Promotion of self care or self management44 was a major component of most of the home visits. This typically involved educating patients about medication and
Table 1 Characteristics of trials included in the review

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention group</th>
<th>Control group</th>
<th>Duration</th>
<th>Description of intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cockcroft 1987</td>
<td>22</td>
<td>Australia</td>
<td>9 months</td>
<td>Intervention: respiratory health worker visiting patients at home. Discharge planning component: not specified, not all patients recruited after acute admission. Home visits: patients visited once a month. Visits educative and supportive, tailored to individual needs. Procedure for clinical deterioration: not specified. Clinical support to nurses: from consultant chest specialist and consultant physiotherapist who were independent of study. Additional services and health carers involved in intervention: not specified.</td>
</tr>
<tr>
<td>Egan 2002</td>
<td>23</td>
<td>USA</td>
<td>12 months</td>
<td>Intervention: specialised respiratory home care programme delivered by trained respiratory nurses. Discharge planning component: not specified, not all patients recruited after acute admission. Home visits: home care nurse visited within 24 hours of study entry and then as often as nurse considered necessary but at least once a month during study year. Nurses provided acute and continuing care—no other details given. Out of hours cover: not specified. Procedure for clinical deterioration: not specified. Clinical support to nurses: nurses worked with primary physician, care and medications provided only with physician approval. Additional services and health carers involved in intervention: not specified.</td>
</tr>
<tr>
<td>Bermes 1989</td>
<td>19</td>
<td>UK</td>
<td>12 months</td>
<td>Intervention: respiratory health worker. Discharge planning component: not applicable. Home visits: not specified. Intervention: patients received normal care at chest clinic plus respiratory health worker who provided health education directed at the patient and primary care team; monitoring of treatment compliance and optimisation of treatment by ensuring correct inhalation techniques and supervision of domiciliary oxygen etc; monitoring of spirometry results and symptoms to enable acute exacerbations and worsening heart failure to be detected and treated early; liaison between hospital based services (including domiciliary physiotherapy and social services) and GP. Out of hours cover: not specified. Procedure for deterioration: not specified. Clinical support to nurses: not specified. Additional services and health carers involved in intervention: not specified.</td>
</tr>
<tr>
<td>Littlejohns 1999</td>
<td>17</td>
<td>Australia</td>
<td>12 months</td>
<td>Intervention: “respiratory home based nursing intervention” (HBNI). Discharge planning component: inpatients visited by HBNI nurse on ward, discharge planning with goals for discharge. Case conference with social worker, hospital medical officer, GP, and HBNI nurse if considered beneficial (outpatients and GP referrals evaluated at home, discussion with GP on patient’s needs, involvement of domiciliary services facilitated, appliances provided, and need for O2 therapy assessed at home). Home visits: inpatients seen by HBNI nurse within week of discharge. All referrals followed up by 2-4 weekly visits; spirometry and oximetry performed at each visit, and results communicated to GP. Ongoing education including use of inhaler medication, medication compliance, and fitness advice (as required fitness advice including: upper and lower limb training, “intimacy advice,” and coping strategies for dyspnoea). Education and counselling around smoking cessation, referral to GP for nicotine replacement. Nurse also aimed to identify exacerbations early. Out of hours cover: not specified. Procedure for clinical deterioration: not specified. Clinical support to nurses: not specified. Additional services and health carers involved in intervention: not specified.</td>
</tr>
<tr>
<td>Smith 1999</td>
<td>19</td>
<td>UK</td>
<td>12 months</td>
<td>Intervention: respiratory home based nursing intervention (HBNI). Discharge planning component: outpatients and GP referrals evaluated at home; discussion with GP on patient’s needs, involvement of domiciliary services facilitated, appliances provided, and need for O2 therapy assessed at home. Home visits: not specified. Intervention: patients received normal care at chest clinic plus respiratory health worker who provided health education directed at the patient and primary care team; monitoring of treatment compliance and optimisation of treatment by ensuring correct inhalation techniques and supervision of domiciliary oxygen etc; monitoring of spirometry results and symptoms to enable acute exacerbations and worsening heart failure to be detected and treated early; liaison between hospital based services (including domiciliary physiotherapy and social services) and GP. Out of hours cover: not specified. Procedure for deterioration: not specified. Clinical support to nurses: not specified. Additional services and health carers involved in intervention: not specified.</td>
</tr>
<tr>
<td>Égan 2002</td>
<td>19</td>
<td>Australia</td>
<td>12 months</td>
<td>Intervention: nursing based case management. Discharge planning component: case management (CM) conducted case conference and arranged discharge planning. After discharge CM conducted comprehensive nursing assessment to identify physical, psychological, and resource needs, during admission CM coordinated patient’s care using clinical path. CM provided education for patient and carer on managing disease, treatment, rehabilitation, and available community services, conducted case conference and arranged discharge planning. After discharge CM provided ongoing support and acted as referral point for community services for patient with follow-up care at 1 and 6 weeks after discharge. Home visits: not clear if CM visited patient at home. Phone calls: CM made phone calls to patient and carer on regular basis. Out of hours cover: not specified. Procedure for clinical deterioration: not specified. Clinical support to nurses: not specified. Additional services and health carers involved in intervention: not specified.</td>
</tr>
<tr>
<td>Hemmiz 2002</td>
<td>19</td>
<td>Australia</td>
<td>3 months</td>
<td>Intervention: home based care by community nurse. Discharge planning component: none. Home visits: visit by community nurse one week and one month after discharge. First visit included detailed assessment of patient’s health status and respiratory function; written and verbal education on disease and advice on smoking cessation; managing activities of daily living and energy conservation; exercise; understanding and use of drugs; health maintenance; and early recognition of signs that require medical intervention. Nurse also identified problems and, if indicated, referred patients to other services, such as home care. Care plan documenting problem areas, education provided, and referral to other services posted to patient’s GP, and GP contacted by phone, if necessary. Second visit included: progress and need for further follow-up reviewed. Patients encouraged to refer to education booklet for guidance and to keep in contact with GP. Out of hours cover: not applicable. Procedure for clinical deterioration: not applicable. Clinical support for nurses: not specified. Additional services and health carers involved in intervention: not specified.</td>
</tr>
</tbody>
</table>
The evidence around days spent in hospital and readmissions for acute exacerbations, 57% reduction in other admissions, confidence intervals not given, both P = 0.01.26 and Farrero et al (mean number of admissions per intervention patient 0.5 (SD 0.9) v 1.3 (SD 1.7) per control patient)27 reported a significant reduction in hospital admissions with their interventions, but three other studies reporting this outcome found no significant effect on hospital admissions.25 27 29 Only two studies reported on respiratory readmissions at 12 months, again the results differed.28 The evidence around days spent in hospital and visits to the general practitioner or family physician was also equivocal, but there was some evidence for fewer visits to an emergency department (table 2).

Meta-analysis of the three studies24–26 reporting health related quality of life measured by the total St George's respiratory questionnaire score at between three and six months' follow-up found no detectable effect (Cohen's d standardised difference expressed in units of SD) 0.06, −0.14 to 0.26, fixed effects model, test for heterogeneity P = 0.61). Overall the evidence suggested that long term interventions do not improve patients' health related quality of life at 12 months' follow-up and may not improve patients' psychological wellbeing, impairment and disability, or pulmonary function. For many outcomes there was only reasonable quality evidence from a single trial, and the evidence was even weaker, or entirely absent, for several other outcomes (summarised in the box). In particular, there was an absence of evidence around the effect of these interventions on carers.

### Discussion

At present there is little evidence from randomised controlled trials to support the widespread adoption of chronic disease management by respiratory nurses, including case management,

### Table 1 continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention group</th>
<th>Control group</th>
<th>Duration</th>
<th>Description of intervention</th>
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<tbody>
<tr>
<td>Bourbeau 2003*</td>
<td>n=86 (52% men), mean (SD) age 69.4 (5.0) years, mean (SD) FEV1, 1 l (0.33), FEV,FVC 45%</td>
<td>n=95 (59% men), mean (SD) age 69.8 (7.4) years, mean (SD) FEV1, 0.98 l (0.31), FEV,FVC 45%</td>
<td>12 months</td>
<td>Intervention: “disease specific management programme” delivered by trained health professionals (most were nurses) acting as case managers. Discharge planning component: not applicable. Home visits: weekly for first 8 weeks, visits lasted one hour. Intervention included an educational programme covering: basic information about COPD, breathing and coughing techniques, energy conservation, relaxation exercises, inhaler technique, an individualised action plan for acute exacerbation, healthy lifestyles (smoking, nutrition, sexuality, sleep, and managing emotions), leisure activities and travelling, a simple home exercise programme, and education around long term oxygen therapy. If appropriate. After week 7 patients encouraged to follow (unsupervised) the home exercise programme at least 3 times a week for 30-45 mins. Phone calls: weekly for first 8 weeks then monthly, patients also able to phone case managers for advice and supervision of treatment. Out of hours cover: not specified. Procedure for clinical deterioration: patients had customised action plan for acute exacerbation, contact list; symptom monitoring list linked to appropriate therapeutic actions, and prescription for drugs. Clinical support for case managers: received supervision and collaboration from treating physician. Additional services and health carers involved in intervention: not specified</td>
</tr>
<tr>
<td>Monninkhof 2003‡</td>
<td>n=121 (85% men), mean (SD) age 65 (7) years, mean (SD) FEV1, 1.7 l (0.56)</td>
<td>n=121 (84% men), mean (SD) age 65 (7) years, mean (SD) FEV1, 1.76 l (0.54)</td>
<td>12 months</td>
<td>Intervention: comprehensive self management educational programme, delivered by respiratory nurse, and fitness course delivered by physiotherapists. Discharge planning component: not applicable. Intervention: five clinic based, 2 hour, group self management education sessions held 1, 2, 3, 4, and 12 weeks. Educational programme included: information about COPD; coping with breathlessness; plan for acute exacerbation; exercise; relaxation and energy conservation; nutrition; communication with their chest physician; and social relationships. Home visits: not specified. Phone calls: not specified. Out of hours cover: not specified. Procedure for clinical deterioration: patients had self treatment action plans for acute exacerbation based on symptom perception, including prescription for drugs or medication to keep at home. Clinical support to nurses: not specified. Additional services and health carers involved in intervention: one or two 1 hour small group fitness sessions a week led by physiotherapist for duration of follow-up. Beside physical goals fitness programme aimed at coping with COPD, social interactions, and behavioural change. Programme included strength training, breathing and cardiovascular exercises, individual goals and training log. Note: patient recruitment followed on from earlier RCT of fluticasone propionate (patients were re-randomised for this study)</td>
</tr>
</tbody>
</table>

FEV1=forced expiratory volume in one second, FVC=forced vital capacity, SaO2=arterial oxygen saturation, PaO2=partial pressure of oxygen in arterial blood, GP=general practitioner, ECG=electrocardiography, COPD=chronic obstructive pulmonary disease.

*Across study: mean age 65.1 years, mean FEV1 33.8% predicted.

‡No data provided on severity of COPD at baseline.

†All patients required and were receiving long term oxygen therapy.
Effects of nurse-led management interventions for COPD on mortality from trials of long-term or intensive interventions (Peto odds ratios)

<table>
<thead>
<tr>
<th>Study</th>
<th>Fixed weight (%)</th>
<th>Effect (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berger 1988(^{18})</td>
<td>25.0</td>
<td>1.02 (0.47 to 2.22)</td>
</tr>
<tr>
<td>Bourbeau 2003(^{25})</td>
<td>11.7</td>
<td>0.52 (0.17 to 1.61)</td>
</tr>
<tr>
<td>Cockroft 1987(^{17})</td>
<td>9.6</td>
<td>0.50 (0.14 to 1.78)</td>
</tr>
<tr>
<td>Farrero 2003(^{21})</td>
<td>27.4</td>
<td>1.21 (0.58 to 2.54)</td>
</tr>
<tr>
<td>Littlejohns 1991(^{19})</td>
<td>8.3</td>
<td>0.33 (0.09 to 1.28)</td>
</tr>
<tr>
<td>Monninkhof 2003(^{25})</td>
<td>8.7</td>
<td>0.95 (0.19 to 4.81)</td>
</tr>
<tr>
<td>Smith 1999(^{26})</td>
<td>12.3</td>
<td>1.17 (0.39 to 3.53)</td>
</tr>
<tr>
<td>Fixed combined (7)</td>
<td>8.5</td>
<td>0.85 (0.58 to 1.26)</td>
</tr>
</tbody>
</table>

Test for heterogeneity: Q value=4.79, df=6, P=0.57

Fig 2 Effects of nurse led management interventions for COPD on mortality from trials of long term or intensive interventions (Peto odds ratios)
Implications for policy makers and future research

Nurse led hospital at home or early discharge schemes for patients with COPD living in the community should be prioritised over the type of nurse led models of chronic disease management that have been studied to date. There is little evidence available at present to support most of these models that have been evaluated so far, although some studies are ongoing. Existing services providing this sort of care should be robustly evaluated against the aims of the particular service.

The evidence around long term or intensive case management and hospital readmission is currently equivocal and requires further study. The potential benefits, in terms of fewer hospital admissions and visits to emergency departments, with schemes for chronic disease management in patients with COPD receiving long term oxygen therapy should also be explored further. In addition, several potentially important outcomes have not been fully evaluated, including patients’ satisfaction, self management, patients’ coping and adherence, smoking cessation, and the effects on carers.

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Contributors: SJCT, CGJ, JAW, JR, and RMB initiated and designed the study. BC, SJCT, CGJ, JR, RMB, HJMV, and GE conducted the systematic review and interpreted the data. SJCT, BC, CGJ, JAW, GE, RMB, HJMV, and JR drafted the paper. SJCT is guarantor.

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Ethical approval: Not required.

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