

Intermediate care—Hospital-at-Home in chronic obstructive pulmonary disease: British Thoracic Society guideline

British Thoracic Society Guideline Development Group*

Intermediate care is a treatment model which bridges the interface between hospital and community care. It often involves cooperation between hospital doctors, general practitioners, nurses, physiotherapists and other healthcare professionals. A specific subtype of intermediate care is Hospital-at-Home (HaH), where active treatment is provided by healthcare professionals in the patient's home for a condition that otherwise would require hospital care, always for a limited period.

In 2003 a Cochrane systematic review concluded that HaH was a safe and effective treatment approach for selected patients with exacerbations of chronic obstructive pulmonary disease (COPD), and suggested that one in four patients presenting to hospital as an emergency would be suitable for home treatment with nursing support,¹ although some felt that this was an underestimate of eligibility for HaH (Stevenson, 2005).

In 2004 the National Institute for Clinical Excellence (NICE) COPD guidelines² included appraisal of HaH in exacerbations of COPD. A distinction was made between HaH (where hospital admission was avoided) and assisted or early discharge schemes (where a short initial admission was followed by home care). We suggest that it is illogical to exclude cases of early or assisted discharge from HaH and, in this guideline, we will consider HaH as a treatment modality which encompasses both admission avoidance and early supported discharge.

The NICE guideline identified four randomised controlled trials (RCTs) and one service evaluation which were applicable to admission avoidance for patients with exacerbations of COPD, and one RCT related to early supported discharge.

The evidence statements can be summarised as follows:

- There were no significant differences in forced expiratory volume in 1 second (FEV₁),³⁻⁵ re-admission rates,³⁻⁶ mortality⁴⁻⁶ or number of days in care⁵ between HaH and hospital care.
- Two studies showed no difference between the groups for health status,³⁻⁴ but a Spanish study showed improvement in St George's Respiratory Questionnaire (SGRQ) in the HaH group.⁶ One study showed no difference between the groups for symptom scores⁵ and, in the same study, there was no difference in satisfaction scores for either patients or carers.
- One study found that reducing inpatient stay from 6.1 to 3.2 days by using supported discharge was not associated with any increase in readmission rate or mortality.⁷

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- There was no convincing evidence that HaH was either more or less expensive than conventional care.

Recommendations from NICE guidelines

The recommendations from the NICE guidelines are shown in table 1, but leave many unanswered questions:

- How, where and by whom should patients be assessed for suitability for HaH?
- Should HaH aim to avoid admission or to implement early supported discharge?
- Should the service be limited to 9:00 to 17:00 hours Monday to Friday or should its hours of operation be more extended?
- What proportion of patients with exacerbations of COPD will be suitable for HaH?
- Should the HaH team be composed of specialist practitioners or could it be generic?
- Does HaH require modification of treatment policy?
- What competencies are necessary to deliver HaH?
- What should comprise home care?
- How many visits will be necessary and for how long?
- Would stable COPD patients benefit from intermediate care?

This guideline will attempt to answer the above questions so that both existing services may be modified and also that new services may be set up in the light of the present evidence base.

METHODS

The methodology recommended by NICE Guideline Development Methods was used to develop these guidelines (<http://www.nice.org.uk/page.aspx?o=guidelinstechnicalmanual>). A systematic literature review was performed for relevant studies between 1966 and April 2005 searching the following databases: MEDLINE, CINAHL, EMBASE, Cochrane, ACP Journal Club, DARE and CCTR. Additional contemporary articles including those published since April 2005 were identified by the Guideline Development Group on an ad hoc basis. The levels of evidence and recommendations are described using the system used in the NICE COPD guidelines,² since the HaH

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Table 1 Recommendations from the NICE guidelines

Hospital-at-Home and assisted discharge schemes are safe and effective and should be used as an alternative way of managing patients with exacerbations of COPD who would otherwise need to be admitted or stay in hospital.	Grade A
The multi-professional team required to operate these schemes should include allied health professionals with experience in managing patients with COPD, and may include nurses, physiotherapists, occupational therapists and generic health workers.	Grade D
There are currently insufficient data to make firm recommendations about which patients with an exacerbation are most suitable for Hospital-at-Home or early discharge. Patient selection should depend on the resources available and absence of factors associated with a worse prognosis, eg acidosis.	Grade D
Patients' preferences about treatment at home or in hospital should be considered.	Grade D

guideline is an amplification of one aspect of the main guideline, and are defined in table 2.

GLOSSARY OF TERMS

ATS, American Thoracic Society
 BTS, British Thoracic Society
 COPD, chronic obstructive pulmonary disease
 ESD, early supported discharge
 ERS, European Respiratory Society
 FEV₁, forced expiratory volume in 1 second
 Fio₂, fractional inspired oxygen concentration
 HaH, Hospital-at-Home
 HRQoL, health related quality of life
 ICP, integrated care pathway
 RCT, randomised controlled trial
 Spo₂, oxygen saturation
 SGRQ, St George's Respiratory Questionnaire

SUMMARY OF KEY PRIORITIES FOR IMPLEMENTATION

The Guideline Development Group felt that the first priority was to resolve the uncertainties experienced by hospitals intending to set up HaH for exacerbations of COPD. Secondly,

the Group hoped to provide advice to hospitals where HaH had been established but were encountering difficulties. Thirdly, it was considered important to define the role of intermediate care in stable COPD.

1. HaH should be offered to patients with exacerbations of COPD unless there is impairment of consciousness, confusion, acidosis, serious co-morbidity or inadequate social support.
2. After suitability for HaH is confirmed by assessment in hospital, a treatment package is prescribed which includes antibiotics, steroids, nebulised bronchodilators and oxygen if necessary.
3. Home care should be delivered by specialist respiratory nurses/physiotherapists or in generic teams by district nurses.
4. For most hospitals the preferred model of HaH should be early supported discharge (ESD) rather than admission avoidance.
5. The role of intermediate care in stable COPD is not yet clearly defined and initiatives in this area should be conducted as experimental and controlled interventions.

ASSESSMENT

There are several objectives of the assessment process when referred a patient for home management of exacerbation of COPD:

1. Confirm the patient has COPD.
2. Confirm the patient has an exacerbation.
3. Determine that it is safe to manage the patient at home.
4. Tailor the treatment to the patient and the exacerbation.

Assessment proformas/protocols/integrated care pathways

Several studies have shown that integrated care pathways (ICPs) can improve the delivery of care. This has been demonstrated by RCTs in the areas of inpatient asthma management, pneumonia, stroke rehabilitation, heart failure and orthopaedic surgery.⁸⁻¹³ Given the stereotyped nature of assessment and treatment in exacerbations of COPD, it is a potential area in which to use an ICP, but there have been no trials of this. Most ESD services use assessment proformas,

Table 2 Levels of evidence and recommendations²

Hierarchy of evidence		Grading of recommendations	
Level	Type of evidence	Level	Type of evidence
Ia	Evidence from systematic reviews or meta-analysis of randomised controlled trials	A	Based on hierarchy I evidence
Ib	Evidence from at least one randomised controlled trial		
IIa	Evidence from at least one controlled study without randomisation	B	Based on hierarchy II evidence or extrapolated from hierarchy I evidence
IIb	Evidence from at least one other type of quasi-experimental study		
III	Evidence from non-experimental descriptive studies such as comparative studies, correlation studies and case-control studies	C	Based on hierarchy III evidence or extrapolated from hierarchy I or II evidence
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities	D	Directly based on hierarchy IV evidence or extrapolated from hierarchy I, II or III evidence
NICE	Evidence from NICE guidelines or Health Technology Appraisal programme	NICE	Evidence from NICE guidelines or Health Technology Appraisal programme
HSC	Evidence from health service circulars	HSC	Evidence from health service circulars

although some have more detailed protocols (Angus, 2005). Examples of such documents can be viewed on the BTS website (<http://www.brit-thoracic.org.uk/>). [Level of evidence IV]

Recommendation

- (R1) A hospital should use an assessment proforma, protocol or ICP if setting up an integrated care service in order to deliver uniform care and facilitate audit. [Grade D]

The decision to treat at home

In making this decision, several questions need to be asked:

- During the period of the exacerbation, patients are likely to need increased social or nursing input to enable them to manage their essential activities of daily living. Can this be provided by relatives, social services and respiratory liaison nurses? Can the patients rapidly and easily obtain help should they deteriorate?
- Can additional pharmacological treatment be delivered in the home environment? The major issues are compliance, ability to operate a nebuliser or oxygen cylinder unsupervised and current smoking status if oxygen is required.
- Is it possible to identify patients at high risk of rapid decline or failure to cope such that they should not be offered home treatment?

On the last question, many studies have demonstrated factors which identify group characteristics of patients at an increased risk of relapsing or requiring admission to hospital during an exacerbation of COPD.^{14–25}

Such factors include:

- increasing age;
- longer duration of COPD;
- severity of impairment of FEV₁;
- frequency of exacerbations;
- chronic mucus hypersecretion;
- co-morbidity (especially heart disease);
- use of home oxygen or maintenance steroids;
- failure of first-line treatment;
- previous history of relapses;
- generalised debility or malnutrition.

However, the models developed from these risk factors to predict relapse show only moderate sensitivity and specificity^{14–26} and are of marginal usefulness when faced with individuals. In a descriptive study of intermediate care for COPD,²⁷ the initial severity of the exacerbation was similar among those treated at home and those who later required admission.

The RCTs looking at HaH for exacerbations of COPD have taken a pragmatic approach in deciding which patients can be managed at home. Since they have repeatedly shown no increase in admission/readmission rates, it is likely that their criteria for managing at home are safe.

The least restrictive set of absolute criteria for admission which were used in three studies^{3–7} were impaired level of consciousness, acute confusion, pH <7.35, acute changes on the chest radiograph, a concomitant medical problem requiring inpatient stay, insufficient social support, no telephone and residence geographically removed from hospital.

Some of the studies were slightly more prescriptive and required an ECG to be performed,⁴ or excluded subjects with any respiratory failure²⁸ or those with newly diagnosed type 2 respiratory failure.⁵ [Level of evidence III]

Recommendations

HaH should not be offered to patients with:

- (R2) Impaired level of consciousness. [Grade C]
- (R3) Acute confusion. [Grade C]
- (R4) pH <7.35, if arterial blood gases have been measured. [Grade C]
- (R5) Acute changes on chest radiograph. [Grade C]
- (R6) Concomitant medical problem requiring inpatient stay. [Grade C]
- (R7) Insufficient social support, no telephone, residence geographically removed from hospital. [Grade C]
- (R8) New hypoxaemia (SpO₂ ≤90%)—a contraindication if oxygen cannot be provided at home. [Grade D]

Venous blood tests

Venous blood tests may help in some cases to clarify the cause or contributory factors of an exacerbation or help in guiding treatment. The frequency with which such tests affect management in exacerbations of COPD has not been the subject of a study and therefore they are not routinely recommended. [Level of evidence IV]

Recommendation

- (R9) Blood tests need not be routinely performed when considering patients for home management of their exacerbation but should be available if they are indicated after assessment. [Grade D]

Sputum analysis

The use of sputum microbiology to guide treatment of an exacerbation of COPD has not been the subject of a study. It is known that the airways of a proportion of patients with stable COPD are chronically colonised with bacteria and consequently an organism cultured during an exacerbation may not be causal.^{29–30} Similarly, the spectrum of antibiotic-responsive organisms commonly causing exacerbations is well known without the need for culture.¹⁸ Consequently, the NICE guideline² recommends routine sputum culture only for patients admitted to hospital and when the sputum is purulent.

Recommendation

- (R10) Routine sputum culture before referral to HaH is not necessary. [Grade D]

ECG

The usefulness of an ECG has not been the specific subject of a study in exacerbations of COPD. In the absence of specific symptoms or signs such as chest pain or arrhythmia, it is unlikely that this test would alter management. [Level of evidence IV]

Recommendation

- (R11) An ECG need not be routinely performed when considering patients for home management of their exacerbation but is indicated if the resting heart rate is <60/min or >110/min. [Grade D]

Arterial blood gases and pulse oximetry

According to the NICE guidelines²:

- supplemental oxygen therapy should be given in exacerbations of COPD to maintain SpO₂ >90% and <94%; and

- patients with hypercapnic respiratory failure with an arterial blood pH <7.35 should be considered for ventilatory support.

Since oxygen therapy can cause decompensation of respiratory failure in COPD, arterial blood gas measurements should be performed before and after 1 hour on the flow rate of oxygen on which it is intended to send the patient home. [Level of evidence NICE]

Recommendation

- **(R12) Pulse oximetry should be performed on all subjects being considered for home management. Arterial blood gas measurements should be performed if SpO₂ is ≤90%. These should be repeated after 1 hour on the intended therapeutic flow rate of oxygen aiming for 90% <SpO₂ <94% and an arterial blood pH >7.35. [Grade NICE]**

Chest radiography

In patients presenting to hospital with an exacerbation of COPD, performance of chest radiography leads to a change in management in 7–21% of patients.^{31–33} In the population of patients considered for HaH, this figure is likely to be lower as these patients are less acutely unwell. However, as the principal differential diagnoses are detectable on a chest radiograph (pneumonia, pneumothorax, pulmonary oedema),³⁴ this test remains important. [Level of evidence IV]

Recommendation

- **(R13) A chest radiograph should be performed on all subjects being considered for home management. [Grade D]**

Spirometry

Spirometry is important in confirming the diagnosis of COPD and, unless confused or comatose, even the sickest of patients can attempt an FEV₁ manoeuvre. [Level of evidence IV]

Recommendation

- **(R14) Baseline spirometry should be carried out to confirm the diagnosis in cases where this is the patient's first presentation with presumed COPD. [Grade D]**

DETAILS OF SERVICE

The RCTs which have shown that HaH for COPD exacerbations is a safe and effective alternative to conventional inpatient treatment have used different methodologies, and no studies have compared the relative effectiveness of the various HaH models. Here we describe the different types of service provision and identify which models may be the most suitable in particular hospital settings.

Types of service

1. Admission avoidance following A&E attendance

This model is described in RCTs from Edinburgh³ and Liverpool.⁴ Patients were assessed in the A&E department by standby specialist respiratory staff, including both nurses and doctors. If admission was not considered mandatory, they were allowed home with a treatment package and follow-up on subsequent days by nurses was arranged.

In Edinburgh, eligibility for HaH was 29%. Hospital admission was necessary for 7% of patients randomised to the HaH scheme before they had been discharged from HaH. In Liverpool, eligibility for HaH was 33% and admission was

necessary for 9% of the HaH patients within 2 weeks of randomisation to the HaH scheme. The readmission rate at 8 weeks in the Edinburgh study was 25% for HaH patients and 34% for controls, and in the Liverpool study at 3 months was 31% for HaH patients and 32% for controls.

This type of scheme requires high staffing levels and is most suited to busy inner city hospitals. [Level of evidence 1b]

2. Admission avoidance following direct GP referral

This model was described in an observational study from Glasgow.²⁷ Local GPs referred patients directly to the respiratory department of the hospital where they were assessed on the same day by a respiratory nurse and a respiratory trainee doctor. Eligibility for HaH was 80% and 15% were admitted from HaH.

One study based on direct GP referral carried out assessment in the patient's home by a nurse or physiotherapist and did not include plain chest radiography. Eligibility for HaH was very high (only 1.5% of patients were not considered suitable) and 6% were admitted later from HaH.³⁵

These schemes suffer from significant numbers of inappropriate referrals although some early exacerbations may be aborted. [Level of evidence III]

3. Early supported discharge (ESD)

This model was described in studies from Glasgow⁷ and Hull.⁵ Patients admitted with exacerbations of COPD were assessed on the morning after admission by the respiratory team, which therefore did not need to be available to see patients throughout the day. The readmission rate at 60 days in the Glasgow study was 29% for HaH patients and 30% for controls, and in the Hull study at 3 months the readmission rate was 33% for HaH patients and 44% for controls.

Eligibility for HaH was slightly higher than in admission avoidance schemes: 38% in Glasgow and 36% in Hull. Early inpatient assessment after a period of hospital care may therefore increase eligibility for HaH. Furthermore, recruitment for early supported discharge after admission allows the HaH team to plan its activity economically. [Level of evidence 1b]

4. Combination of admission avoidance and ESD

This model was described in an RCT from Barcelona.⁶ Patients were assessed in the emergency room by a specialised respiratory team. Admission was avoided in 68% of the HaH patients and, in those admitted, the length of stay was reduced to 1.7 days compared with 4.2 days in the control group. Eligibility for HaH was 39% and 10% were readmitted from the emergency room. [Level of evidence 1b]

A similar combined approach was used in an observational study from Southend in England where a generic rather than a specialised respiratory team carried out HaH.³⁶ Eligibility for HaH was not shown, but the outcome measures were otherwise similar to those with specialised teams. [Level of evidence III]

Second UK COPD audit (2003)³⁷

In this audit 44% of hospitals had access to ESD and, in these, eligibility for ESD was 31%. The types of service in the hospitals with ESD were:

- Admission avoidance from A&E: 5%
- Early supported discharge (<48 hours): 26%
- Supported discharge (>48 hours): 23%
- Combination of above: 12%
- Unknown: 34%

Recommendations

- (R15) In busy inner city hospitals, if staffing levels permit, the combined approach of admission avoidance and early supported discharge is practicable but might be expensive. Eligibility for HaH varies from 30% to 35% with readmission from home care of 10%. [Grade A]
- (R16) In hospitals with fewer admissions for COPD or limited respiratory staffing levels, early inpatient assessment for supported discharge is the favoured model for HaH. Eligibility for HaH varies from 35% to 40%. [Grade A]
- (R17) Recruitment for HaH following direct GP referral is not recommended because of large numbers of inappropriate referrals. [Grade C]

Hours of operation

1. Admission avoidance schemes

The models designed to recruit patients from A&E had variable hours of operation. In Edinburgh the team worked from 09:00 hours to 17:00 hours, Mondays to Fridays.³ In Liverpool the service operated from 08:00 hours to 18:00 hours 7 days a week,⁴ and in Barcelona the hours of service were 09:00 hours to 16:00 hours on weekdays only.⁶ In the 2nd UK COPD audit,³⁷ 64% of units ran a 5 day service and 27% had a 7 day scheme.

Unless a 24 hour service or next day review approach is adopted, a proportion of the patients will be missed by the HaH programme. The Edinburgh authors predicted that a full service available at all times would be able to support 150 out of 700 patients per year compared with 115 out of 500 presenting on weekdays only.³ In many hospitals the majority of COPD admissions occur in the early evening, and services based on the normal working day will therefore fail to recruit many patients for whom admission avoidance may be possible. [Level of evidence IV]

2. Early supported discharge schemes

Services designed to deliver early supported discharge can function on a 09:00 to 17:00 hour basis, but there will be a delay in assessment at weekends unless a 7 day service is used. [Level of evidence III]

Recommendations

- (R18) For inner city hospitals with high COPD admission rates, a 24 h/7 day service should be set up in order to maximise admission avoidance. [Grade C]
- (R19) For hospitals with fewer COPD admissions, hours of operation should correspond to the peak times of COPD referrals and a Monday to Friday service may be most cost effective. [Grade C]

A summary of HaH approaches in COPD is shown in table 3.

Overall responsibility

In general, out-of-hours cover and responsibility for the patient has remained with the hospital-based HaH service although, in one study, patients were advised to contact their GP if problems arose out-of-hours.⁷ The authors did not report how this arrangement impacted on primary care services. All schemes have included assessment by a respiratory physician before recruitment to HaH. Patients are usually discharged from the service by the respiratory practitioner who has been supervising the home care. At that stage clinical responsibility is formally transferred back to primary care either by fax or email. [Level of evidence III]

Recommendations

- (R20) After recruitment to HaH, clinical responsibility and out-of-hours cover should be undertaken by the acute trust. [Grade C]
- (R21) When the patient is discharged from HaH, clinical responsibility should be formally transferred

Table 3 Summary of HaH approaches in COPD

	Admission avoidance		
	Direct GP referral to respiratory unit for assessment	Hospital referral for admission	Early supported discharge
Setting	Outpatient clinic	A&E admissions unit	Review of COPD inpatients
Scope	Standby service operating at least during normal working hours		Normal minimum includes review on the weekday following admission
Expected workload	High, difficult to predict, inappropriate referrals likely	Between one fifth and one sixth of all COPD admissions depending on the hours of operation of the service	Over one third of admissions for COPD
Proportion suitable for HaH	Approximately two thirds	One third	Over one third
Advantages	Popular with patients and GPs	Reduces hospital bed-days	Allows planned assessments and uses HaH resources economically Allows period of clinical stability which increases eligibility for HaH
Disadvantages	May generate unnecessary work Not examined in randomised controlled trials	Recruitment limited by hours of operation Requires large throughput of patients to be time efficient	Does not reduce admission rates

back to primary care either by fax or by email. [Grade C]

Team composition

The medical lead in all teams which have published their results has come from a consultant respiratory physician, backed up by junior respiratory trainees. Respiratory nurse specialists have been members of the HaH team in all published randomised trials. Respiratory physiotherapists also participate in several UK schemes.³⁸

Generic HaH models have been described in which home care is provided by non-specialist district nurses.^{28 36 39} Two of these were small RCTs^{28 39} and the other an observational study.³⁶ In the latter, the initial assessment was carried out by specialised respiratory staff and the results were broadly similar to the findings in the RCTs where HaH was delivered by specialist respiratory practitioners.³⁻⁷

In the 2nd UK COPD audit,³⁷ 81% of the schemes were run primarily by respiratory nurses, 11% by general nurses, 2% by physiotherapists and 2% by both physiotherapists and nurses. [Level of evidence III]

Recommendations

- (R22) The lead clinician should be a consultant respiratory physician, supported by trainee junior medical staff. [Grade C]
- (R23) The home care team should be lead by a specialist respiratory nurse, physiotherapist or appropriately qualified health professional. [Grade C]
- (R24) Inner city hospitals should aim for specialist teams, but district general hospitals in provincial or rural areas should consider generic teams which may deal with several HaH services. [Grade C]

Home care team competencies

None of the published studies has dealt with the skills which are necessary for the home care nurses and physiotherapists. The following recommendations are based on the consensus view of the Guideline Development Group. [Level of evidence IV]

Recommendations

- (R25) Key skills for members of the HaH teams include:
 - ability to take a comprehensive clinical history;
 - proficiency in assessing clinical condition;
 - familiarity with pharmacological and non-pharmacological approaches;
 - knowledge of current guidelines in COPD management;
 - excellent communication skills;
 - excellent team working skills. [Grade D]
- (R26) Useful but non-essential team member skills include:
 - ability to perform chest auscultation;
 - venous and arterial blood sampling;
 - performance of and basic interpretation of an ECG;
 - interpretation of a chest radiograph;
 - performance of spirometry;
 - understanding of airway clearance techniques. [Grade D]

Assessment at home after recruitment into HaH scheme

None of the published studies has critically evaluated the various aspects of assessment at home during HaH. However, there is general agreement that the first visit should be on the day after recruitment to HaH and subsequent visits arranged as considered necessary by the respiratory practitioner. In one study, visits were carried out twice daily for the first 3 days.⁴ In most studies, dyspnoea, cough, sputum colour/volume and vital signs were recorded. Oxygen saturation was measured by oximetry.

The studies on the role of oral steroids in exacerbations have used changes in FEV₁ as an outcome measure and have shown that this measurement can detect recovery from an exacerbation.⁴⁰ Furthermore, a low FEV₁ value at admission associated with failure to improve over the first few days of an exacerbation in hospital was highly predictive of a poor clinical outcome.⁴¹ In some HaH studies spirometry was carried out using portable electronic spirometers,^{7 27} but was not always considered essential.³⁶ It is, however, recommended before discharge.²

Telephone contact via the respiratory practitioner's mobile phone was encouraged^{6 42} and a copy of the clinical notes left with the patient to assist the general practitioner if called in an emergency.²⁷ In two studies there were weekly team meetings with the hospital respiratory physician.^{3 6} In an inner city scheme, each nurse visited 5–6 patients daily usually in the mornings with an average of 2–3 assessments carried out in the hospital in the afternoons (Stevenson, 2005). [Level of evidence IV]

Recommendations

- (R27) The first visit should be carried out on the day after recruitment to HaH. [Grade D]
- (R28) Details of level of dyspnoea, cough and sputum volume/colour should be recorded. [Grade D]
- (R29) Vital signs including pulse, BP, respiratory rate and temperature should be measured. [Grade D]
- (R30) Oxygen saturation should be measured by oximetry and the SpO₂ documented alongside the FIO₂. [Grade D]
- (R31) A copy of the clinical notes and observations should be left in the patient's home. [Grade D]
- (R32) Serial spirometry may be useful as objective confirmation of improvement or worsening during an exacerbation and should always be measured before discharge. [Grade D]
- (R33) Treatment compliance and nebuliser/oxygen usage should be assessed. [Grade D]
- (R34) Telephone contact with respiratory practitioner should be encouraged. [Grade D]
- (R35) Weekly team meetings should be held. [Grade D]

Duration of hospital/home care and number of visits

The duration of home care has varied considerably in the published studies, from 3.56 days⁶ to 24 days,⁷ with a mean value of 11 days. The number of visits varied from 3.8³ to 11.^{4 7} In one study the intervention was considered to have failed if more than five visits were required.⁶ These parameters are obviously influenced by the experience and confidence of the practitioners. There is no evidence that the outcomes were affected by the duration of care or by the number of visits.

In the 2nd UK COPD audit³⁷ the median length of stay in hospitals with access to ESD was 4 days compared with 7 days where there was no ESD. The median length of stay in the ESD

scheme was 11 days (hospital time + ESD time). [Level of evidence III]

Recommendations

- (R36) Home care should be completed in fewer than 14 days and with fewer than 10 visits. [Grade C]
- (R37) Failure to comply with the above recommendation requires team discussion. [Grade C]

Understanding ESD

Three important points arose from a recent qualitative study which was aimed at evaluating a COPD supported discharge scheme (Clarke *et al*, unpublished, 2005):

- (1) Hospital managers and staff should agree precise aims and objectives of the service.
- (2) Patients should understand why the service was set up, the meaning of supported discharge and the necessity of home visits by respiratory practitioners.
- (3) The discharge process was often similar to that for ordinary discharges and included long waits for transport and delays in getting drugs from pharmacy, despite HaH patients technically still being within a period of secondary care. [Level of evidence IV]

Recommendations

- (R38) There should be written agreement between management and medical/nursing staff defining the scope and objectives of an ESD service. [Grade D]
- (R39) Patients should be given an information leaflet about the service, as shown in Appendix 2. [Grade D]
- (R40) The process of discharge should be streamlined. [Grade D]

Telemetry

A home telecare system was found to be time consuming for staff as they had to familiarise themselves with the equipment and this was a barrier to its implementation. Procurement and user-friendliness of equipment were problematical.^{43–45} A review of cost effectiveness in telemedicine found that the literature was limited and the methodology seriously flawed.⁴⁶ This view was confirmed in a systematic review where only 4% of 600 studies met the criteria for inclusion in a formalised quality review.⁴⁷ [Level of evidence III]

Recommendation

- (R41) There is insufficient evidence to justify setting up telemetry in HaH at present. [Grade C]

Economics of service provision

The published HaH studies have largely been performed in inner city teaching hospitals. Two of the randomised trials of HaH have included economic evaluations of the intervention. In the Edinburgh study the estimated average cost to the health service of patients in the HaH group was £877 per exacerbation compared with £1753 in the control group.³ Similar findings were reported in the Barcelona study where the average health care cost of HaH patients was 62% less than that of the control patients.⁶ Difficulty in obtaining funding was the primary reason for inability to set up a HaH scheme for COPD among UK physicians.³⁸ Further more detailed health economic evaluations are required to inform healthcare providers of the cost implications of HaH for COPD exacerbations, but the evidence to date does suggest that a cost benefit is likely. A

sample business case is shown in Appendix 3. [Level of evidence III]

Recommendation

- (R42) Plans for new HaH services should include formal health economics evaluation. [Grade C]

TREATMENT

In determining the evidence base for recommending treatment strategies in the context of HaH, it is important to be aware of the following factors.

The available evidence base is derived from the study of treatments either performed in an outpatient or hospital setting, not HaH. Certain treatment modalities cannot be delivered in a HaH setting for practical or safety reasons. No reference is therefore made to the utility of some treatments (including intravenous therapies such as theophyllines, magnesium, antibiotics, doxapram or the application of assisted ventilation).

The NICE guidelines² have comprehensively reviewed the evidence base for treatments used in exacerbations of COPD. Here we aim to summarise the available guidance and highlight aspects relevant to HaH.

It is expected that all patients will be considered for potential treatment at home with the following modalities: bronchodilators (inhaler or nebulised), oral corticosteroids, oral antibiotics and oxygen. Some patients may have access to physiotherapy in the HaH setting.

When and how to give bronchodilators?

Short-acting bronchodilators (β agonists or anticholinergics) are effective in increasing FEV₁ and reducing breathlessness.² These can be given in combination and have effects that last between 4 and 6 hours and therefore need to be administered regularly at the time of exacerbation.

Bronchodilators can effectively be administered by nebulisers or hand-held inhalers.² Nebulised treatments are more convenient to administer as supervision of up to 20 inhalations of a hand-held inhaler would be necessary to produce a similar effect to one nebuliser.⁴⁸ Nebulised delivery of bronchodilator was the standard treatment for most patients enrolled in controlled trials of HaH.^{3–5 7 42} [Level of evidence NICE]

Recommendations

- (R43) Regular administration of short-acting bronchodilators (β agonist/anticholinergic or both) should be administered to all patients during HaH care. [Grade NICE]
- (R44) Nebulised delivery is the mode of choice in HaH. [Grade C]

Who should receive corticosteroids?

Well conducted trials have established a role for corticosteroid therapy in COPD exacerbations.^{49–51} Rates of treatment failure decrease and duration of hospital stay is reduced by approximately 2 days after corticosteroid administration.

In the randomised trials, a significant number of patients developed glycosuria or required treatment for hyperglycaemia. Employing HaH limits the approaches that can be taken to control hyperglycaemia induced by prednisolone. Particular attention should be paid to diabetics who are prescribed corticosteroids during home care.

The NICE guidelines have proposed the use of prednisolone at 30 mg for 7–14 days in all those hospitalised with an exacerbation and its consideration in outpatients with an exacerbation who can tolerate prednisolone.² Since HaH

patients would be hospitalised if the service did not exist, it is reasonable that they should all be prescribed corticosteroids. [Level of evidence NICE]

Recommendation

- (R45) Prednisolone 30 mg/daily should be given for 7–14 days to all patients unless there is a specific contraindication to steroid therapy. [Grade NICE]

Who should be given oxygen?

Oxygenation deteriorates unpredictably during an exacerbation.⁵² Oxygen administration improves arterial oxygenation and relieves symptoms including breathlessness.⁵³ It is considered that oxygen saturations greater than 90% and less than 94% are optimal and that this is usually achievable with 2 or 4 litres by nasal cannula, or by 24% or 28% by Venturi mask.⁵² The target oxygenation (90–93%), not mode of delivery, is prescribed in the NICE and joint ATS/ERS COPD guidelines.^{2 54}

Arterial blood gas measurement is necessary to assess the initial response to oxygen therapy and to monitor for worsening hypercapnia with repetition after 1 h.² Oxygen saturation monitors can be used to monitor the continuing need for oxygen at home. HaH services which were part of randomised trials have provided concentrator or cylinder oxygen to patients.^{3–5 7 42} It may not be possible to withdraw oxygen from all patients, hypoxic during exacerbation, when they have sufficiently recovered to be discharged from HaH back to primary care.⁵⁵ [Level of evidence III]

Recommendations

- (R46) Oxygen therapy is a cornerstone of treatment of an exacerbation of COPD and should be made available to patients if they are hypoxaemic. [Grade C]
- (R47) Supplementary oxygen should be administered in a controlled fashion aiming for 90% <SpO₂<94%. [Grade C]
- (R48) Patients who remain in respiratory failure should be referred for consideration of long term oxygen therapy. [Grade C]

Who should receive antibiotics?

It has been shown that those with two or more symptoms of an exacerbation (purulent sputum, increased sputum and increased breathlessness) benefit from antibiotic therapy.^{56 57} The NICE guidelines recommend the use of antibiotics for those with a history of more purulent sputum, but do not stratify patients towards differing antibiotic therapy.² [Level of evidence NICE]

With severe disease, pathogens such as *Staphylococcus* and *Pseudomonas* become more likely and beta lactam resistant organisms are more prevalent in those with multiple antibiotic courses.^{57 58} Risk factors for treatment failure include increased exacerbation frequency, severe FEV₁ impairment, co-morbidity and increasing age.⁵⁸ It is therefore logical to avoid repeating similar antibiotics in those with recurrent requirements for treatment. [Level of evidence 1b]

Recommendations

- (R49) Antibiotic therapy should be offered to patients with two or more of breathlessness, increased sputum and increased sputum purulence. [Grade A]
- (R50) Patients with a high risk of treatment failure or unusual pathogens benefit from tailored antibiotic therapy. [Grade B]

What other treatments can be offered?

HaH interventions provide the opportunity to offer additional ancillary treatments to the patient. Although components of care such as smoking cessation and pulmonary rehabilitation were not offered as part of the studies forming the evidence base of HaH for COPD, these form part of basic COPD care delivery. Additional support for patients and carers may be provided by home help and occupational therapy services.

Positioning to improve the mechanics of breathing has been shown to improve breathlessness and respiratory muscle strength.⁵⁹ The use of positive expiratory pressure masks led to greater sputum clearance in a randomised trial.⁶⁰ Acute administration of nutritional support has been shown to be feasible during exacerbation, but with no clear benefit proven.⁶¹ Pulmonary rehabilitation begun in the aftermath of an exacerbation results in improvement in exercise capacity and quality of life evident 6 months after an initial hospital-based programme.⁶² [Level of evidence 1b]

Recommendations

- (R51) HaH should not prevent patients gaining access to broader COPD care such as pulmonary rehabilitation or smoking cessation programmes. [Grade D]
- (R52) Selected physiotherapeutic techniques and nutritional support may be beneficial. [Grade D]

INTERMEDIATE CARE IN STABLE COPD

Two systematic reviews have studied the efficacy of chronic disease management programmes for stable COPD.^{63 64} The individual RCTs included in these systematic reviews were performed in different countries and there were some differences between the subgroups of COPD patients.

In 2001 a Cochrane systematic review of home care for COPD concluded that it “is an expensive form of care that has not been shown to improve lung function. There may be some benefits for people with less severe disease, but more research is needed to demonstrate this”.⁶³ The most recent systematic review concluded that “there is little evidence 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”.⁶⁴ A recent ATS statement concurs: “Many home health interventions are based on empirical recommendations rather than research data”.⁶⁵

Components of the interventions

The components of home care/chronic disease management interventions for stable COPD patients may include:

- An education programme with information on the following topics:
 - the disease and its management;
 - control of symptoms;
 - encouragement and help to stop smoking;
 - plan of action for acute exacerbations;
 - adopting a healthy lifestyle;
 - leisure activities and travelling;
 - long term oxygen therapy if appropriate.
- An exercise programme.
- A contact list for advice on acute emergencies.
- Prescriptions at home to initiate when an exacerbation occurs.
- Follow-up visits at home or hospital or in the community.

- Psychological support.
- Support, advice and education for carers.

The relative importance of each component may vary according to the perspective of the patient, carer and health professional. We present the evidence relevant to the following questions, from the RCTs included in the two systematic reviews (together with RCTs published more recently):

- Do they improve quality of life?
- Do they improve objective measurements of pulmonary function or patient mortality?
- Do they alter the frequency of unscheduled visits to the GP or hospital A&E departments?
- Do they alter the frequency of hospital admissions?
- Do they depend on any particular type of intervention for their success?

Do the schemes improve the quality of life?

Several different types of health related quality of life (HRQoL) questionnaires have been used to measure this important outcome. The commonest measure has been the SGRQ. None of the RCTs of chronic disease management/home care schemes has demonstrated a significant improvement in total SGRQ with the intervention. Some statistically significant differences have been seen in individual components of the SGRQ, but their clinical significance is unclear.

There is currently no evidence to suggest that these interventions improve patients' HRQoL as measured by total SGRQ score. **[Level of evidence 1a]**

Recommendation

- **(R53) New and established schemes should include a validated tool to assess impact on patients' HRQoL. [Grade D]**

Do the schemes improve objective measurements of pulmonary function or patient mortality?

There is no evidence that the 6 minute walking test was improved in any of the three schemes where this parameter was measured.⁶⁵⁻⁶⁸ Patients not looked after by a respiratory health worker had a higher chance of dying (relative risk 2.9, confidence limits 0.8 to 10.2) in one study,⁶⁷ but the other studies have found no such effect and a meta-analysis of the effect on mortality found no significant improvement in the intervention patients.⁶⁴

There is no available evidence to suggest that such schemes alter pulmonary function or influence mortality rates. **[Level of evidence 1a]**

Do the schemes alter the frequency of hospital admissions or unscheduled visits to the GP or A&E departments?

Researchers from Spain and Quebec have demonstrated reductions in the frequency of unscheduled visits to hospital A&E departments at 1 year⁶⁶⁻⁶⁹ and 2 years follow-up⁷⁰ with their chronic disease management schemes. In the Canadian study there was also a significant reduction in unscheduled visits to the family physician at 12 months in the intervention group.⁶⁶ The Spanish study only included patients receiving long term oxygen therapy,⁶⁹ whereas the other study involved patients with at least one hospital admission for an acute exacerbation of COPD in the 12 months before entry into the scheme.⁶⁶⁻⁷⁰

These two studies also demonstrated a significant reduction in hospital admissions from all causes in the intervention

groups. The Canadian study reported a 40% reduction in admissions for an acute exacerbation, a 57% reduction in admissions for other health problems at 12 months,⁶⁶ and a 27% reduction in all cause admissions at 2 years.⁷⁰

Patients in the Spanish study had a significant reduction in hospital stay (7.43 vs 18.2 days).⁶⁹ Similar findings were reported from the Quebec study (7.2 vs 12.5 days).⁶⁶ However, several other RCTs have failed to detect or report any benefit in terms of unscheduled visits to the GP,⁷¹ visits to A&E departments,⁷²⁻⁷³ hospital admissions,⁶⁷⁻⁷¹⁻⁷²⁻⁷⁴⁻⁷⁵ or length of hospital stay.⁷³ Overall, the trials defy meta-analysis due to their differing presentation of results.

The available evidence is conflicting and it is *not clear* whether these interventions reduce hospital admissions, unscheduled visits to the family physician/GP or attendance at A&E departments. **[Level of evidence 1a]**

Recommendations

- **(R54) Further robust studies are required to assess whether chronic disease management interventions improve patient outcomes in terms of hospital re-admission, A&E attendance or unscheduled GP/family physician attendance. [Grade D]**
- **(R55) The Spanish study of patients on long term oxygen therapy needs to be repeated as it may have identified a subgroup of patients who experience particular benefits from this kind of intervention. [Grade D]**

AUDIT

The outcome measures in HaH are well described in the various RCTs and show considerable concordance.³⁻⁷ It is therefore possible for all schemes to incorporate an audit tool to assess performance against an accepted standard.

Suggested audit criteria:

- Proportion of patients with exacerbations accepted for HaH.
- Proportion of patients accepted despite satisfying absolute criteria for exclusion from HaH.
- Proportion of patients readmitted/admitted to hospital from HaH.
- Reduction in duration of hospital stay.
- Mortality rate during HaH and within 3 months of HaH episode.
- Readmission rate within 3 months of HaH episode.
- Patient and carer satisfaction.

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APPENDIX 1 GUIDELINE DEVELOPMENT GROUP

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APPENDIX 2 HOSPITAL-AT-HOME PATIENT INFORMATION

You have a flare-up of your chest condition, chronic obstructive pulmonary disease (COPD). We have decided that you do not need to stay in hospital and that you can go home on the treatment which has been prescribed for you. This includes drugs you inhale with your nebuliser, steroid and antibiotic tablets and oxygen if your blood oxygen level is low. This treatment package will go home with you.

It is accepted that this treatment can be taken safely at home and the outcome is just as good, if not better, than if you had remained in hospital. You can expect to recover in a week or two and return to your normal state of health.

Your treatment will be supervised at home by one of our respiratory nurses or physiotherapists who will visit you on the day after you go home and will continue to visit you until you have almost fully recovered. At the visits your progress will be

monitored and your treatment will be adjusted if necessary. In the unlikely event that you do not improve as expected, you will be admitted to hospital for further tests and a change of treatment.

The nurse or physiotherapist will leave details in the house of your illness and the treatment which you are taking in case your GP comes to see you. She will also leave her mobile phone number and you can call her at any time for advice or reassurance.

If you have been lent a nebuliser, it will be taken back if you no longer need it. However, if it remains useful, you will be provided with one for long term use. Similarly, if you need oxygen and if your blood oxygen level remains low, we will arrange for you to have an oxygen concentrator again for long term use.

During your care at home, we will consider what can be done to improve your health so that further flare-ups will be less likely to happen. This might include advice on quitting smoking, exercises, dietary changes and information about COPD which will help you to cope better with your illness. Understanding COPD lets you recognise when things are going wrong and enables you to step up your treatment at an early stage to prevent further deterioration.

APPENDIX 3 BUSINESS CASE

Where are we now?	COPD predicted to rise from 12th to 5th most burdensome global disease from 1990 to 2020 Total UK COPD expenditure (1996/97) £817.5 million Inpatient cost of exacerbations £243.4 million Cost of one admission £3000
Relevance of HaH to national strategies	Chronic disease management Acute medical admissions (trolley waits) Community care
Stakeholders	COPD patients GPs Liaison nurses/physiotherapists A&E departments
Type of service	Admission avoidance (AA), high staffing levels, suitable for busy inner city hospital Early supported discharge (ESD), lower staffing level, suitable for moderate-sized DGH Combined AA and ESD best model but expensive Direct referral from primary care not recommended because of excess inappropriate referrals
Predicted activity (work load)	30–35% of COPD patients who present for hospital admission
Effect on bed days	Reduction in length of stay from 7 to 4 days (2nd UK COPD audit)
Team composition (5 day service): large DGH	Lead – consultant respiratory physician Trainee middle-grade doctors (rotating) Liaison nurses/physiotherapists 2.5 WTE (increasing to 3.5 WTE for 7 day service)
Start-up (non-recurring) costs (catchment area of 300 000)	Computers, printers, database software, office equipment: £5000 Portable oximeters: £2500 Electronic sphygmomanometers: £750 Electronic thermometers: £1000 Handheld spirometers: £1500
Recurring costs	Salaries Pharmacy Uniforms Travel expenses, petrol/car leasing Mobile phone line rental Audit Training courses Data collection