

# Cost comparison of hospital- and home-based treatment models for acute chronic obstructive pulmonary disease

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## Abstract

*This trial compared the cost of an integrated home-based care model with traditional inpatient care for acute chronic obstructive pulmonary disease (COPD). 25 patients with acute COPD were randomised to either home or hospital management following request for hospital admission. The acute care at home group costs per separation (\$745, CI95% \$595- \$895, n=13) were significantly lower ( $p<0.01$ ) than the hospital group (\$2543, CI95% \$1766-\$3321, n=12). There was an improvement in lung function in the hospital-managed group at the Outpatient Department review, decreased anxiety in the Emergency Department in the home-managed group and equal patient satisfaction with care delivery.*

*Acute care at home schemes can substitute for usual hospital care for some patients without adverse effects, and potentially release resources. A funding model that allows adequate resource delivery to the community will be needed if there is a move to devolve acute care to community providers.*

## Introduction

There is a growing body of research seeking to evaluate the performance of innovative healthcare delivery systems regarding their efficiency, quality of care and provider and patient satisfaction (Hillman 1999a). Our analysis compares the cost of home-based care for acute patients with conventional hospital based care for the same condition.

Hospitals have to review the efficiency of their care system due to the current pressures (largely financial constraints) to reduce hospital bed numbers, cut hospital admissions and reduce length of stay. Not only may it be cheaper but better for some patients to be treated outside the hospital environment. This has led to the development of imaginative alternatives to hospital-based care (Caplan et al. 1999; Hillman 1999b). General Practitioners (GPs) and other community-based healthcare providers are having more acute healthcare devolved

to them as acute hospitals attempt to decrease admission rates, reduce length of stay and facilitate early discharge (Hillman 1999b). However, whilst the community providers are willing to take a role, little or no preparation or resource allocation is accompanying these initiatives.

Managing the demand for hospital services by shifting activity requires alternatives that can be justified on clinical and economic grounds (Jones et al. 1999). One such alternative, with a contested evidence base, is hospital in the home (HITH) care. The critical element of HITH is that it is substitutable hospital care at home (Board et al. 2000) – ie, without the HITH care the patient would require care in hospital (Montalto & Grayson 1998). HITH should not establish intermediate care programs or duplicate current community service (Montalto 1999). Hospital at home in acute care provides an alternative to in-hospital care either by early discharge or avoidance of hospital admission (Jones et al. 1999). Recognising the limited potential of early discharge of patients from HITH programs, the recent focus has been on providing hospital-at-home services that avert acute admission (Illife 1997).

Evidence on the costs of hospital at home compared with standard hospital care is mixed. Some hospital at home studies found that

- HITH provided care at a lower cost than hospital inpatient care (Caplan et al. 1998; Coast et al. 1998)
- HITH did not reduce overall healthcare costs for COPD patients with some evidence of cost shift with GPs (Shepperd et al. 1998).

While HITH programs may appear to have a lower cost per day, some schemes may increase the length of the episode of care (Hensher et al. 1996). The belief that some HITH patients sometimes have more days of care is still open to interpretation. It may be that HITH teams have more difficulty discharging patients. Alternatively, discharge of hospital patients may be premature and, although home care is longer, it may be more appropriate (Illife 1998).

It is generally accepted that well planned hospital at home programs are effective, accepted by patients and safe (Montalto 1999). This paper discusses a trial that offered substitutable care in the community for a proportion of patients presenting to hospital with an acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD). Existing community healthcare providers delivered care with expert support from the hospital respiratory team, rather than using a hospital outreach model. This allowed the utilisation of a pre-existing extensive community infrastructure, the opportunity for more efficient broad-based delivery and the opportunity to provide a 'seamless' progression to non-acute management following cessation of acute care.

The objective of this economic evaluation was to compare the resource use and cost of acute care at home with inpatient care costs for acute COPD patients.

## Method

Patients with acute COPD identified as requiring admission from ED were recruited at the Mater Adult Hospital (MAH) and Princess Alexandra Hospital (PAH), Brisbane from October 1999 to October 2000. Patients were selected on the basis of the criteria shown in table 1. In total, 25 patients were suitable from 168 candidates, which represented 15 percent of hospital admissions.

**Table 1: Inclusion-exclusion trial criteria**

Inclusion criteria	Exclusion criteria
Age > 45 years	Unstable co-morbid conditions needing acute medical management
Documented diagnosis of COPD	
Current or ex-smoker	Pneumonia on chest x-ray
FEV1 < 60% predicted	Hypoxia indicated by a SaO <sub>2</sub> of < 90% or a PaO <sub>2</sub> <60 mmHg on room air or usual flow rate of O <sub>2</sub> if on home oxygen therapy
Admission requested by general practice or considered necessary by outpatient clinic staff or ED staff	
Willing and able to give informed consent	
Telephone at home	

The trial used a brokerage model for community nursing and community allied health services. The home managed group received care from hospital medical staff in ED and Outpatients Department (OPD), the patient's own GP, community nursing from one of the three non-government organisation (NGO) nursing groups in Brisbane and community allied health from the Domiciliary Allied Health Acute Care and Rehabilitation Team (DAART). With this model all direct care, including that from community providers, was funded by the National Demonstration Hospitals Program Phase 3 (NDHP3) and is included in the costing. This avoided the possibility of cost shift that has been a criticism of some HITH care trials (Montalto 1998). The hospital specialist under whom the patient was admitted was responsible for the clinical supervision in the intervention group as patients retained an in-patient status whilst on the acute care at home program. The hospital retained clinical, fiscal and legal responsibility for home-based patients by providing telephone daily contact between the respiratory team and GP and community nurses. Hospital medical staff provided 24-hour telephone support and a "hot rescue referral" for trial patients who required re-admission.

Cost comparisons are meaningful where clinical and satisfaction outcomes are comparable (Board et al. 2000). This clinical trial demonstrated an improvement in lung function in the hospital-managed patients at the OPD review whilst patients in the home managed group were significantly less anxious in the ED, although the sample size was small (Bowler et al. nd).

### Costing: hospital managed patients

Medical records coded by the medical records department grouped patients using Australian Refined Diagnosis Related Groups Version 4.1 (AR-DRG V4.1) (Queensland Health 1999). The Casemix Unit at the MAH performed retrospective hospital-wide cost modelling for the financial year 1999-2000. The costs included nursing (from Trendcare); allied health (from the Allied Health Integrated Information System); pathology, radiology, pharmacy, medical, administration, catering, CSSD, linen and consumables.

Cost per day was identified for control patients using AR-DRGs E65B (Chronic Obstructive Airways Disease without catastrophic and/or severe complication or comorbidity) and E69B (Bronchitis & Asthma age > 49 without complication or comorbidity). Data was collected from the Transition II database, a Queensland Health initiative. The limitations of using average DRG costs have been noted by other authors (Grayson 1998) and are acknowledged. This includes the lack of patient-specific financial information.

AR-DRG cost per day was multiplied by length of stay for the control patients to give an average cost per hospital episode.

Additional costs included ED costs (medical, nursing, case manager), collected for individual patients; and OPD clinic visits (included medical, nursing, administration and clinical co-ordinator) as a modelled cost (Queensland Health 1999). Average cost per episode and the additional costs were summed to give total cost per episode.

## Costing: home managed patients

The acute care at home encounters were costed individually and included direct and non-direct costs.

Domiciliary allied health and nursing costs were based on the figure modelled by these organisations. DAART, through the *Ambulatory Care Reform Program 1995-1997* funded by the Commonwealth Department of Health and Aged Care, had previously undertaken costing studies on the provision of domiciliary allied health services to post acute patients with a range of AN-DRGs. This cost includes all direct and indirect costs as listed below.

Direct costs included labour. This comprised client-related time (time directed to a specific patient such as face-to-face contact, telephone, case conference and non-contact documentation). This included staff on-costs of annual leave and leave loading, sick leave, long service leave, workers compensation insurance and superannuation.

Clinical service management (ie, time not related to a specific patient) includes client management/ scheduling, in-service/ team meetings, resource preparation and service liaison.

Administrative time (non-clinical but service related) included average travel time of service providers. Hotel costs included catering and linen.

Indirect costs included non-labour costs (eg, fuel, vehicle repairs, consumables, telephone calls and servicing); recurring cost not related to direct services provision (ie, advertising, professional development, insurance, legal expenses and cleaning) and fixed costs (eg, labour costs of administration support and data management), and non-labour costs of service delivery such as office consumables and vehicle leasing.

### General Practitioner

GP costs for home visits and/or surgery visits were met via program funding and calculated using divisional hourly rates of \$91.00 per hour. Costs allocated for the completion of evaluation material for the trial were not included in the clinical costing data.

### Emergency Department

Staff input data was collected for individual patients to give ED costs per patient. This was a direct labour cost for staff involved in the patient's care.

### Overnight stay

Some of the intervention group were randomised out of hours and had an overnight stay in hospital. This modelled casemix cost was included in the home cost where applicable.

### Respiratory Unit

The GP and community nurses were required to contact the Respiratory Registrar after each visit. This telephone support significantly supported patient care and enhanced information sharing between hospital and community clinicians.

### Outpatient Department clinic

The development of weighted costs for Australian ambulatory healthcare is an accepted approach (Cleary et al. 1998) and has been used to provide the modelled cost of the outpatient clinic visit (Queensland Health 1999).

### Cost to carer and patient

The scope of analysis during the trial was limited to measuring carer strain. Some concern had been expressed that such programs are made to appear cheaper than hospital care by shifting costs to patients and carers (Jones et al. 1999). Individual costs borne by carers and patients were not collected, as trial patients were not required to purchase equipment, undertake additional dressings or travel. Previous work has demonstrated that significant decreases in length of stay (LOS) do not place an increased burden on patients or carers after discharge when it is part of a co-ordinated system of care for elective surgical patients (Caplan et al. 1998) or medical patients (Shepperd et al. 1998).

## Data Analysis

Data was analysed using the t-test for independent variables to test for differences between intervention and control groups in total costs of treatment. The postulated hypothesis is that there is no difference between the cost of traditional in-patient hospital care and a home management model for acute COPD patients.

## Results

### Intervention and control groups compared

The acute care at home group costs per separation were significantly lower ( $p < 0.01$ ) than the control hospital group (Table 1). There was no significant difference in clinical outcomes at 10-14 days OPD visit, and there was equal patient satisfaction.

**Table 1: Average cost per episode**

	Control group (\$ per episode)	Intervention group (\$ per episode)
Mean	2543	745
N	12	13
CI95%	1766	595
to	3321	895
Significance		$p < 0.01$

Average cost per home-managed patient episode was 29% of the average hospital-managed patient episode, giving a cost-effectiveness ratio of 3:1.

### Intervention group

Providing care at home in the acute period for COPD patients using this model incurred a significant hospital cost. Of the acute care at home group costs, 59% were community provider costs and 41% hospital costs (Table 2). This hospital cost included an overnight stay for some patients, ED, OPD and Clinical Co-ordinator costs. In previous hospital at home studies, hospital costs were 26% of total hospital at home costs (Jones et al. 1999).

**Table 2: Hospital and community costs of patients randomised to home**

	Hospital costs (%)	Community costs (%)
General practice		10
Domiciliary Allied Health		21
Community nursing		28
<b>Total</b>	<b>41</b>	<b>59</b>

In the breakdown of community provider costs for the intervention group, 10% were attributable to GPs, 21% to domiciliary allied health and 28% to community nursing (Table 2).

## Discussion

The economic analysis suggests that appropriate home care for a proportion of this diagnostic group can be provided at a substantially lower cost than a comparable hospital admission. Actual cost saving is, however, reliant on sufficient patient numbers to impact on bed-day costs per patient. Most bed-day costs are fixed. Actual savings with smaller patient numbers would only be in direct costs such as hotel services. Thus, an appropriate 'critical mass' for home-managed patients is essential for the efficiencies projected in the analysis.

This trial addresses the challenge identified by some authors (Illife 1998; Montalto & Grayson 1998) of providing substitutable care in the home for an acute condition. It evaluated a diagnostic group that could be safely, effectively, and acceptably managed at home with the collective expertise of a multidisciplinary hospital and community team which delivered the same clinical outcomes, and has demonstrated the potential for releasing resources.

Despite participation in this trial of two teaching hospitals, the numbers of patients randomised was small. Significant co-morbidities were a limiting factor in the attainment of enrolment criteria. For this reason hospital-based acute medical assessment units may be an important way of avoiding inappropriate admissions, or facilitating early discharge within 24-48 hours for admitted patients in the acute period. Such units, together with further integration with community and home care services, may allow patients to be discharged from them without an inpatient admission (Hensher et al. 1999).

Involvement of community healthcare providers in the development of acute care at home programs as a model had a number of benefits. It was possible to use established providers already in the community, and patients were cared for by providers known to them. It was patient focused, was cheaper for the patient's whose carer had to attend the hospital, was safe, satisfied patient need and was able to avoid duplication. It is believed that continued development of hospital at home care models is not only worth pursuing but is likely to become a necessary component of future health care (Grayson 1998). Such models will need to satisfy consumer demand as well as meeting their expectations of care.

For such home-based programs to be successful there are a number of issues which need to be considered. From the hospital perspective, there is still a significant cost in providing care and support for patients and community carers. This requires health care providers to change their practice, which involves education. Strong commitment from clinical and management staff is essential to embed such programs into mainstream services. A full time co-ordinator is necessary to facilitate many aspects of these programs (Palmer 1996). To establish and sustain such changes in practice requires funding. Although it cannot be costed, goodwill and enthusiasm are essential to establish services that improve patient and health provider satisfaction.

With the development of hospital at home models using existing community services, the issue of how this will be funded needs consideration. Whether adequate funding to the community will follow the move to devolve acute care to community providers is yet to be seen (Hillman 1999b). The next challenge is to identify future sustainable flexible funding models that promote this type of care.

We have demonstrated that for this group of patients, providing acute care at home using existing services involves significantly lower cost. There is a need for more studies of patients with severe illness treated at home to further test these and the findings of others in this area.

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