Randomised controlled trial of effectiveness of Leicester hospital at home scheme compared with hospital care

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Abstract

Objective To compare effectiveness of patient care in hospital at home scheme with hospital care.
Design Pragmatic randomised controlled trial.
Setting Leicester hospital at home scheme and the city's three acute hospitals.
Participants 199 consecutive patients referred to hospital at home by their general practitioner and assessed as being suitable for admission. Six of 102 patients randomised to hospital at home refused admission, as did 23 of 97 allocated to hospital.
Intervention Hospital at home or hospital inpatient care.
Main outcome measures Mortality and change in health status (Barthel index, sickness impact profile 68, EuroQol, Philadelphia geriatric morale scale) assessed at 2 weeks and 3 months after randomisation. The main process measures were service inputs, discharge destination, readmission rates, length of initial stay, and total days of care.
Results Hospital at home group and hospital group showed no significant differences in health status (median scores on sickness impact profile 68 were 29 and 30 respectively at 2 weeks, and 24 and 26 at 3 months) or in dependency (Barthel scores 15 and 14 at 2 weeks and 16 for both groups at 3 months). At 3 months' follow up, 26 (25%) of hospital at home group had died compared with 30 (31%) of hospital group (relative risk 0.82 (95% confidence interval 0.52 to 1.28)). Hospital at home group required fewer days of treatment than hospital group, both in terms of initial stay (median 8 days *v* 14.5 days, P = 0.026) and total days of care at 3 months (median 9 days *v* 16 days, P = 0.031).
Conclusions Hospital at home scheme delivered care as effectively as hospital, with no clinically important differences in health status. Hospital at home resulted in significantly shorter lengths of stay, which did not lead to a higher rate of subsequent admission.

Introduction

Hospital at home schemes "provide treatment that otherwise would require in-patient care, in the patient's home, always for a limited period."[1] Schemes have been developed to prevent the need for hospital admission and to enable early discharge. As a response to the increasing demand for inpatient care, they have the potential to improve health outcomes, increase patient and carer satisfaction, and reduce costs.

The evidence base for such schemes remains scant. A systematic review published in 1997 found only five trials and noted that all were small and lacked power.[1] All these trials were of schemes for early discharge from hospital. Later studies of early discharge hospital at home schemes have added new impetus to the debate about their effectiveness,[2 3] suggesting that their future may be promising.[4]

To date, evaluations of schemes to avoid admission to hospital have been unable to use a randomised trial design because of resistance from established users or of the service requirements of the scheme.[5] This randomised controlled trial of the Leicester admission avoidance hospital at home scheme is the first to be completed in the United Kingdom. (Details of the scheme are given in the appendix.) The aim of this study was to compare the effectiveness of care in a hospital at home scheme with hospital care. An economic evaluation and findings on patient satisfaction will be published separately.

Participants and methods

Participants

In the 8 months between November 1995 and May 1997 all patients referred to the hospital at home scheme with an acute condition were eligible for inclusion in our trial. They had to fulfil the admission requirements of hospital at home and hospital and agree to receiving hospital at home. General practitioners referred patients to hospital at home by contacting Bed Bureau, the agency that in Leicester allocates all acute medical admissions. Bed Bureau then contacted the hospital at home team, who assessed the patient in the usual way. If the patient was suitable the hospital at home team contacted Bed Bureau staff, who randomised patients to hospital at home or hospital care using consecutively numbered sealed opaque envelopes prepared from a block randomisation with block size 10. The trial was approved by Leicestershire Health's research ethics committee.

Assessment

The initial assessment was performed by hospital at home staff before randomisation. We conducted research interviews with patients at three days, two

weeks, and three months after admission, regardless of where patients were receiving care, and we included those patients who declined their allocated place of care.

Cognitive function was assessed at initial assessment with the information and orientation sub-test of the Clifton assessment procedure for the elderly (CAPE).[6] In our interviews we assessed health status using the sickness impact profile 68[7 8] (a shortened, anglicised version of the sickness impact profile[9]), in which higher scores indicate greater limitation; the Barthel index to measure dependence[10]; and the anglicised version of the Philadelphia geriatric morale scale[11] and EuroQol[12] to assess quality of life. We identified deaths within three months of entry to the study from Office of National Statistics data.

Statistical analysis

The start of the trial coincided with the rights of admitting patients to the hospital at home scheme being extended to all general practices in Leicester and being removed from community nurses. If use of the scheme had continued at its previous level we would have expected to recruit about 400 patients in the 18 months, but shortly after the trial started it became clear that we could not expect more than about 200 referrals. Interim analysis of the first six months' data provided estimated standard deviations of six points for the Barthel score and 11 points for the sickness impact profile 68, giving 80% power with 200 patients to demonstrate equivalence to within three points on the Barthel score and five points on the sickness impact profile 68 at a one sided significance level of 5%. Allowance was made for 30% of the potential data being missing.

We compared the patients in the two arms of the trial on an intention to treat basis, using the Student's *t* test, Mann-Whitney U test, and χ^2 test for normally distributed, ordinal, and categorical data respectively. For risk analysis of time to death, we used Cox's proportional hazards regression model with adjustment for baseline covariates.

Results

Comparison of groups

A total of 199 patients were randomised—102 to hospital at home and 97 to hospital. The figure shows the flow of patients through the trial. Six patients randomised to hospital at home refused the service, and 23 randomised to hospital were not admitted because of refusal by the patient, carer, or general practitioner. Of the 199 patients entering the trial, 141 were women. Ages ranged from 33 to 102 years (median 84, interquartile range 77-89). Two patients were aged under 40, and the rest were 55 or over. As the former were considered a distinct group, they have been excluded from subsequent analyses. The Bed Bureau recorded the "reason for admission" of patients stated by their general practitioner at referral. The largest diagnostic groups were "cardiovascular" (18 in each arm) and "respiratory" (17 in the hospital at home arm, 24 in the hospital arm).

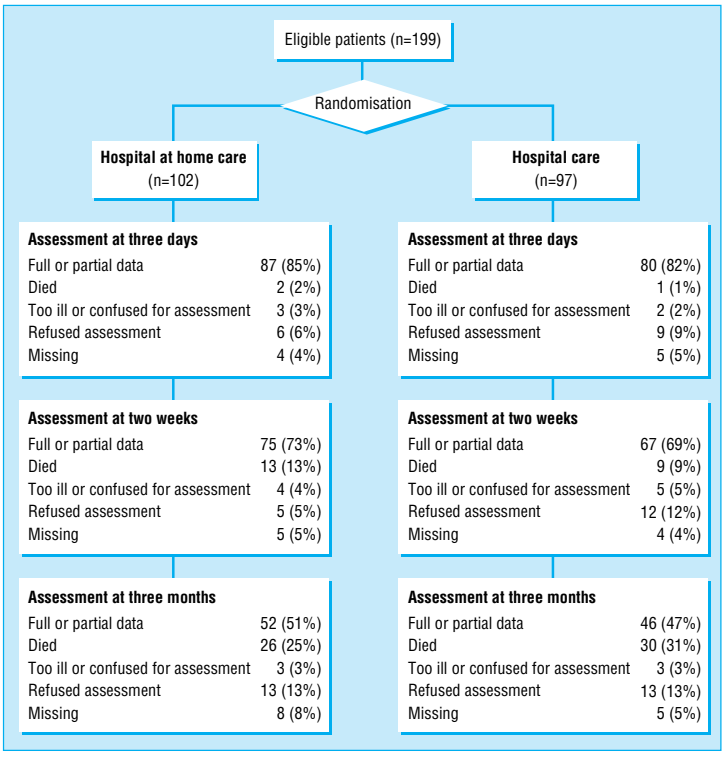
Both groups had similar baseline characteristics at initial assessment and at three days (table 1). In each treatment arm, we compared those who refused their place of care with those who accepted: there were no significant differences in sex ratio, age, or baseline Barthel index.

Process measures

Table 2 shows the location of patients at each assessment. By the assessment at three days, four of the six patients who refused hospital at home care had been admitted to hospital. On an intention to treat analysis, survivors in the hospital at home group were more likely than survivors in the hospital group to be discharged from care and at home by two weeks (60/88 (68%) *v* 39/87 (45%), relative risk 1.54 (95% confidence interval 1.2 to 2.1)), but, by the three month assessment, similar proportions of survivors in both groups were at home (53/73 (73%) *v* 48/64 (75%)). Nineteen patients admitted to hospital at home were transferred to hospital.

Analyses by intention to treat showed significantly shorter median stays in care for the hospital at home group than for the hospital group (median initial stay, 8 days *v* 14.5 days (P = 0.026); median total days of care in 3 months, 9 days *v* 16 days (P = 0.031)). When the analysis was restricted to the 96 hospital at home patients who received care there and the 74 patients who were randomised to and accepted hospital care, the differences were greater (median initial stay, 8 days *v* 21 days (P < 0.0001); median total days of care in 3 months, 9 days *v* 21 days (P < 0.0001)). All patients who remained in hospital at home care were discharged by 14 days.

We calculated rates of emergency admission after discharge from care for each group by dividing the total number of emergency admissions by the person days at risk of admission (that is, not in hospital or hospital at home). This analysis excludes the two patients aged under 40 (one in each group). Of the



Progress of patients through trial

Table 1 Baseline characteristics of patients randomised to hospital at home care or hospital care.* Values are numbers of patients unless stated otherwise

Characteristic	Hospital at home (n=101)		Hospital (n=96)	
	Value	No of missing data	Value	No of missing data
Sociodemographic data				
Median (interquartile range) age (years)	84 (77-89)	0	84 (77-89)	1
Female	73	0	67	1
White	93	7	91	4
Median (interquartile range) age when left school (years)	14 (14-15)	31	14 (14-16)	26
Living arrangements:		2		9
Alone	48		49	
With others	48		33	
Residential care	3		5	
Housing tenure:		29		40
Rented	34		23	
Owner occupier	37		33	
Other	1		0	
Median (interquartile range) No of people in household	1 (1-2)	28	1 (1-2)	27
Services required before enrolment:		22		22
Nursing	12		15	
Home care	25		33	
"Meals on wheels"	16		13	
Chiropody	9		8	
Physiotherapy	1		1	
Occupational therapy	1		2	
Initial assessment				
Clifton assessment procedure for the elderly (CAPE):		0		5
0-8	38		28	
9-12	63		63	
Barthel index, median (interquartile range) score	9 (5-12)	0	9 (6-13)	3
Assessment at three days				
Sickness impact profile 68, median (interquartile range) score	31 (25-37)	37	32 (25-35)	45
Philadelphia geriatric morale scale:		43		51
Low	31		19	
Medium	14		18	
High	13		8	

*Excludes two patients aged under 40, one from each treatment arm.

Table 2 Location of patients randomised to hospital at home care or hospital care* at each assessment according to whether they accepted or refused treatment allocated. Values are numbers of patients

	Hospital at home (n=101)			Hospital (n=96)		
	Accepters	Refusers	Total	Accepters	Refusers	Total
Initial assessment						
Home	95	6	101	0	23	23
Hospital	0	0	0	73	0	73
Assessment at three days						
Home	84	2	86	1	19	20
Hospital	9	4	13	72	3	75
Died	2	0	2	0	1	1
Assessment at two weeks						
Home	59	1	60	22	17	39
Hospital	17	4	21	46	2	48
Other institution	7	0	7	0	0	0
Died	12	1	13	5	4	9
Assessment at three months						
Home	53	0	53	35	13	48
Hospital	5	0	5	4	0	4
Other institution	11	4	15	12	0	12
Died	24	2	26	21	9	30
Missing	2	0	2	1	1	2

*Excludes two patients aged under 40, one from each treatment arm.

101 patients assigned to hospital at home, 21 had a total of 28 subsequent emergency admissions in 5895 person days at risk, whereas 16 of the 96 patients assigned to hospital care had 18 emergency admissions in 5027 person days at risk. Crude proportions of patients readmitted once or more were therefore 21/101 in the hospital at home arm and 16/96 in the hospital arm. The rate of subsequent emergency admission for the hospital at home group was 4.75 per 1000 person days compared with 3.58 for the hospital group (rate ratio for hospital at home to hospital 1.13 (95% confidence interval 0.63 to 2.04)).

Mortality and functional change

Of 101 patients randomised to hospital at home, 26 died before the three month follow up, compared with 30 of the 96 patients randomised to the hospital ward; the relative risk of death for hospital at home compared with hospital ward was 0.82 (near exact 95% confidence interval 0.52 to 1.28). Analysis of deaths with Cox's proportional hazards model revealed similar death rates during the study within the two groups, and this result was unaltered by adjustment for baseline values of age, sex, Barthel index, and Clifton assessment procedure for the elderly. The hazard ratio for death in hospital at home care compared with hospital care was 0.93 (approximate 95% confidence interval 0.58 to 1.49).

At two weeks and three months' follow up, the two groups had similar measures of health status (table 3). The number of cases where assessment was not possible was higher than expected, reflecting the frailty of this population. Refusal rates and missing values at the two week assessment were slightly higher in the hospital arm, reflecting the difficulty of conducting these assessments in hospital.

Discussion

This study suggests that hospital at home provided an effective alternative to hospital care, was able to maintain most patients at home, and resulted in fewer days of care both in the initial admission and during the three month follow up.

Methodological considerations

The number of patients who refused their allocated place of care after randomisation was higher than expected. An entry criterion was that the referring general practitioner thought that hospital admission would be necessary if hospital at home were not available. Gaining patient consent to hospital admission before randomisation would have reduced the number of refusers, but it might also have limited the number agreeing to enter the trial and reduced patient choice, as general practitioners might have consider hospital at home because patients did not want hospital care. It is possible that general practitioners might have been tempted to enter patients to the trial in the hope of getting hospital at home care without genuinely feeling that hospital admission was necessary. Our finding that hospital refusers were no different in their baseline Barthel index score and that their subsequent admission and death rates were high suggest that general practitioners were not abusing the system and

Table 3 Health status of patients randomised to hospital at home care or hospital care* at assessments at two weeks and three months

Outcome	Assessment at two weeks				Assessment at three months			
	Hospital at Home (n=101)	Hospital (n=96)	Difference (95% CI)	P value for difference	Hospital at Home (n=101)	Hospital (n=96)	Difference (95% CI)	P value for difference
No of patients who died before assessment	13	9			26	30		
No of survivors	88	87			75	65		
Barthel index								
Median (interquartile range)	15 (10-19)	14 (11-17)	1 (–1.0 to 2.0)	0.60†	16 (13-19)	16 (12-20)	0 (–1.1 to 2.1)	1.00†
No (%) with grouped score:								
0-14	30 (34)	31 (36)			18 (24)	17 (26)		
15-19	22 (25)	20 (23)			25 (33)	19 (29)		
20	9 (10)	8 (9)			10 (13)	12 (18)		
No (%) not assessed	27 (31)	28 (32)		0.98‡	21 (28)	18 (28)		0.85‡
Sickness impact profile 68								
Median (interquartile range)	29 (22-34)	30 (20-34)	–1 (–4.0 to 3.0)	0.82†	24 (20-31)	26 (20-31)	–2 (–4.1 to 4.0)	0.73†
No (%) not assessed	32 (36)	39 (45)		0.26‡	31 (41)	30 (46)		0.92‡
EuroQol								
Median (interquartile range)	0.59 (0.15-0.78)	0.56 (0.19-0.73)	0.03 (–0.11 to 0.11)	0.95†	0.64	0.63	0.01 (–0.12 to 0.09)	0.94†
No (%) Not assessed	25 (28)	34 (39)		0.14‡	28 (37)	28 (43)		0.81‡
Philadelphia geriatric morale score								
Median (interquartile range)	35 (29-42)	35 (30-41)	0 (–3.0 to 4.0)	0.88†	37 (30-42)	37 (31-43)	0 (–4.1 to 4.1)	0.94†
No (%) with grouped score:								
Low (⩽34)	24 (27)	19 (22)			17 (23)	13 (20)		
Medium (35-42)	16 (18)	14 (16)			12 (16)	10 (15)		
High (⩾43)	12 (14)	7 (8)			9 (12)	8 (12)		
No (%) not assessed	36 (41)	47 (54)		0.32‡	36 (48)	37 (57)		0.91‡

*Excludes two patients aged under 40, one from each treatment arm. †Calculated with Mann-Whitney U test. ‡Calculated with χ^2 test.

that these patients were ill enough to warrant hospital admission but were reluctant to agree to it.

The number of missing assessments was high, although consistent with similar studies,[13] showing the difficulty of undertaking evaluations in populations of elderly and frail patients. However, the proportion assessed in each arm was similar, reducing the risk of ascertainment bias. There is a need to develop simple and acceptable instruments to measure function in this group of patients.

Interpretation of findings

Mortality was similar in the two groups, but the trial was not powered to establish equivalence and the confidence interval leaves open the possibility of excess mortality with hospital at home care of up to 28%. Further trials will be necessary to rule this out, but the similarity of the groups on all measures of health status at each assessment is encouraging. The key outcome variable chosen to determine sample size was the sickness impact profile score at three months after entry. Sufficient patients in each arm were assessed for us to show that the median score at three months differed by only 2 points (95% confidence interval −4.1 to 4.0). There were also no statistically or clinically significant differences between the groups in their scores for the Barthel index, EuroQol, and Philadelphia geriatric morale scale. These results strongly suggest that the two groups fared almost identically in terms of health status, a finding consistent with trials of hospital at home schemes set up to enable early hospital discharge.[2,3]

We found that the hospital at home scheme resulted in fewer days of care than did hospital admission. This contrasts with several evaluations of hospital at home schemes for early discharge from hospital, which found longer stays in the hospital at home group.[14] Shorter length of stay than in hospital may be a feature of hospital at home schemes to avoid hospital admission, because of more aggressive rehabilitation from the start of care and through not having to reconstruct a disrupted home care package.

External validity

Trials of health service provision usually raise questions about generalisability, and clearly our findings apply only to schemes offering the same care for the same mix of patients as in Leicester. However, our findings should persuade commissioners that a service similar to Leicester's could be introduced with safeguards for monitoring and audit of performance. During this phase, provision should be made for further trials to confirm our findings and perhaps explore the contribution of hospital at home care to the management of specific conditions.

The Leicester scheme is too small to have a measurable impact on numbers of hospital admissions. Further work is needed to assess the impact of hospital at home on the need for hospital beds. Our trial was preceded by an observational study,[15] and a further period of observation was started soon after its cessation in order to examine how far referral patterns, patient mix, and cost per case changed outside the trial setting.

This study would not have been possible without the cooperation of Fosse NHS Trust, Leicestershire Health Authority, participating general practitioners, the acute hospitals, Leicestershire Bed Bureau, and, most crucially, the hospital at home service.

Contributors: A Wilson was responsible for the design and completion of the study, was the principal writer of the paper, and is its guarantor. HP managed the trial, collected data, and assisted in analysis and interpretation. A Wynn contributed to data collection, entry, and analysis. CJ and NS provided statistical advice for the protocol and undertook data analyses. JJ was responsible for the design and collection of data on workload and health economics. GP contributed to the study design and interpretation of results.

Key messages

- The effectiveness of hospital at home schemes for avoiding hospital admission has not been tested in a trial
- In this study patients suitable for hospital at home care were randomised to hospital at home or hospital care and followed up for three months
- There were no clinically or statistically significant differences in outcome as measured by the sickness impact profile 68, Barthel index, Philadelphia geriatric morale scale, and EuroQol
- Length of stay in care and total days of care were about 45% less for patients randomised to hospital at home
- For patients who meet the admission criteria, hospital at home schemes can provide an effective and acceptable alternative to hospital admission

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Competing interests: None declared.

Appendix: Details of Leicester hospital at home scheme

The scheme began in 1994, provided by Fosse Community Health Trust. It accepts acute medical and terminally ill patients who would otherwise need hospital admission. It is a small, nurse led scheme able to admit a maximum of five patients at any one time.

Characteristics of service

- Referral by general practitioner, who maintains medical responsibility
- Maximum stay of 14 days
- Multidisciplinary care (team includes nurses, physiotherapist, occupational therapist, generic healthcare workers, and cultural link worker)
- Provides 4-24 hours' care a day
- Rapid access to equipment needed for home nursing, such as hospital beds, mattresses, commodes, etc
- Availability of a carer not essential (can be involved in care by negotiation if he or she wishes)

Admission criteria

- Lives in city of Leicester
- Condition does not require specialist diagnostic investigation
- Aged over 16 years
- Expected to be ready for discharge before 14 days
- General practitioner willing to accept medical responsibility
- Requires more than four hours' nursing care a day
- Would otherwise need hospital admission
- Conditions suitable for hospital at home
  - Chest infection
  - Immobility
  - Diarrhoea and vomiting
  - Cerebrovascular accident
  - Falls
  - Urinary tract infection
  - Acute exacerbation of chronic conditions such as Parkinson's disease, multiple sclerosis.

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Abandoning babies safely

I read with great interest the news article about how the provision of incubators in Hungarian hospital lobbies, after a rise in mothers killing or abandoning their babies, had led to lives being saved as mothers were able to abandon their babies safely and anonymously.[1]

While travelling in Perigord in southern France on holiday I visited the Ancien Hospice de Hautefort, which was founded in 1669 and is now a museum. This was a charitable institution dedicated to the welfare of the poor and infirm. In the outer wall of the hospice there is a "turn" or "tour." This is a cylindrical revolving cupboard which allowed impoverished parents to deposit their offspring anonymously to the care of the Sisters of Charity. The device was last used in 1847.

It is fascinating that a social welfare policy from two centuries ago has been adopted today as an effective means of dealing with this tragic human problem.

1 Kovac C. Incubators in Hungarian hospital lobbies allow babies to be abandoned more safely. *BMJ* 1999;319:214.

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We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changd my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.