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Stroke rehabilitation after hospital discharge: a randomized trial comparing domiciliary and day-hospital care

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Abstract

Objectives: to compare the effectiveness and costs of a new domiciliary rehabilitation service for elderly stroke patients with geriatric day-hospital care.
Design: randomized controlled trial.
Participants: stroke patients aged 55+ who required further rehabilitation after hospital discharge or after referral to geriatricians from the community.
Setting: Poole area, East Dorset, a mixed urban/rural area on the south coast of England.
Main outcomes: primary—changes between hospital discharge and 6-month follow-up in physical function as measured by Barthel index. Secondary—changes over this period in Rivermead Mobility Index and mental state (Philadelphia Geriatric Centre Morale Scale) and differences in social activity (Frenchay Activities Index) and generic health status (SF-36). Health service and social service cost per patient were compared for the two groups.
Results: 180 patients were eligible and 140 (78%) were randomized. The groups were well balanced for age, sex, social class and initial Barthel index. We achieved follow-up in 88% of subjects who were alive at 6 months. We detected no significant differences in patient outcomes, although there was a non-significant improvement in measures of physical function and social activity in the domiciliary group. Domiciliary patients had more physiotherapy time per session and more district nurse time, and made greater use of social service day centres and home helps. Total cost per patient did not differ significantly between the two groups, with reduced health service costs in the domiciliary arm offset by higher social service costs.
Conclusion: no significant differences were detected in the effectiveness of the two services. Neither service influenced patients' mental state, and their social activity remained low. Total costs were similar. A mixed model of day-hospital and domiciliary care may be most cost-effective for community stroke rehabilitation, but this requires further evaluation.

Keywords: *day hospital, domiciliary care, randomized trial, stroke rehabilitation*

Introduction

Stroke is a major public health problem, with an estimated 5% of National Health Service resources devoted to stroke care [1]. Most stroke victims are old, and half the survivors have residual disability [1]. Co-ordinated inpatient rehabilitation improves functional ability after stroke [2]. The most cost-effective type of outpatient rehabilitation for patients after discharge has not been established. Current practice at

the time of this study was to continue rehabilitation in a geriatric day-hospital—despite conflicting evidence on its effectiveness compared with alternatives [3, 4]. Stroke patients are the largest single group attending day hospitals.

One alternative is domiciliary rehabilitation, with the potential advantages of greater involvement of the informal caregiver, rehabilitation in the place that the patient spends most time, and avoidance of patient travel. However, rehabilitation may be easier to co-ordinate from day hospitals, which provide the opportunity for regular medical monitoring, social contact and group activity.

The day-hospital and domiciliary models for rehabilitation have been compared in two UK randomized trials [5–7]. A combined analysis found a small beneficial effect of domiciliary care at a lower cost per patient, and suggested that further studies were needed to evaluate the effectiveness and costs of domiciliary care in other parts of the UK, particularly non-urban areas [8].

Here, we present a comparison of the cost-effectiveness of a new domiciliary rehabilitation service for stroke patients with rehabilitation in geriatric day hospitals.

Methods

Patient recruitment

We studied patients with a newly identified stroke admitted to Poole Hospital National Health Service Trust or one of its associated community hospitals and those with recent strokes directly referred from the community for day-hospital rehabilitation.

Patients were deemed eligible if they: (i) had a confirmed diagnosis of stroke; (ii) were aged 55 or over; (iii) were residents of East Dorset; (iv) needed further rehabilitation for the disability caused by stroke; (v) were physically able to attend day hospital; (vi) had any previous disability which was not too severe to prevent further rehabilitation; and (vii) had no signs of advanced dementia. We excluded those with terminal illness and needing day hospital for social or medical reasons.

We recorded prospectively all acute stroke admissions by contact each week with all acute geriatric admission and rehabilitation wards. We ascertained community referrals by regular contact with geriatricians. Consultant geriatricians assessed each patient's eligibility. Before hospital discharge, we obtained informed consent and derived the Barthel index. We randomized subjects before discharge by calling a central office where closed lists of computer-generated randomization schedules were kept. Randomization was stratified by sex, age, disability level (Barthel index <10, 10–14 or $\geqslant 15$) and day hospital catchment.

We obtained ethical approval from East Dorset research ethics committee before starting the study.

Interventions

Five day hospitals were involved. Care was co-ordinated by multi-disciplinary teams, who gave therapy in both individual and group sessions. The domiciliary stroke team was a new service, comprising one whole-time-equivalent senior (grade 1) physiotherapist and 0.5 whole-time-equivalent senior (grade 1) occupational therapist, who met daily to plan activity and fortnightly with a consultant geriatrician (R.D.) to review patients, using a goal-setting approach.

In both situations, therapy was provided until maximum potential for recovery was reached. Patients were then placed on review and, if no further therapy input was needed, were discharged. Outpatient speech and language therapy was provided for the domiciliary group.

Main outcomes and data collection

The primary outcome was functional status as measured by the change in the Barthel index; secondary outcomes were mobility, mental state, social activity and generic quality of life.

We collected sociodemographic and clinical information at study entry and recorded Barthel index [9], Rivermead Mobility Index [10] and Philadelphia Geriatric Center Morale Scale [11] at entry and at 6-month follow-up, and Frenchay Activities Index [12] and perceived quality of life (SF-36) [13] at 6-month follow-up. We assessed cognitive status by the Abbreviated Mental Test [11]. A nurse researcher completed the 6-month assessments in the patient's home, blinded to the patient's allocation.

Economic evaluation

The economic analysis included health service and local authority social service costs [14]. We included transport costs borne by the public sector (ambulance and therapists' travel). Although some of the services provided by the local authority bear small charges, which are payable by the patient and capped, the full cost of these services was used. As most patients and their carers were elderly, employment issues were not considered.

We collated service use data using patient-specific records in each service (day hospital, domiciliary service, Poole hospitals' information system, district nursing Comcare system, local authority social services, ambulance and general practitioner records). In the domiciliary rehabilitation service, all therapists recorded their activities on specially designed forms in 15 min periods for six 2-week periods during the trial, using a classification scheme to describe the main activities undertaken [15].

Costing

National Health Service trust costs (day hospital attendances, outpatient and inpatient stays) were based on the financial returns for the appropriate acute and community trusts, supplemented by national unit cost estimates [16] for other services. We obtained the unit costs of each of the several day hospitals within the community trust from the trust and averaged with weighting by activity.

In the domiciliary arm, unit costs were based on the total salary costs (including National Insurance, superannuation and locum cover). Therapists' car mileage was costed at health service rates and ambulance costs were obtained from the local ambulance trust. We made an allocation to cover patient case management by a consultant geriatrician and physiotherapy supervision. A notional overhead charge was included (to cover office, stationery, telephone and heating). Costs were based on 1996/7 prices.

We performed sensitivity analysis to take account of uncertainty in estimates of therapist workload, domiciliary staffing costs, therapists' travel, domiciliary overheads and day-hospital and ambulance cost. We also used this to explore how much service use would need to change to affect the results.

Full details of costs used and sensitivity analysis are available from the authors.

Data analysis

All data were double entered and analysed using SPSS for Windows (SPSS, Chicago, IL, USA) and Minitab (version 12). We combined the SF-36 domain scores using a weighted scoring system to give physical and mental state scores [17]. Analyses followed the intention-to-treat principle. We used paired *t*-tests to estimate significance and to provide confidence limits to compare changes over 6 months between groups, as these followed a normal distribution. For comparisons of cross-sectional outcome data at 6 months and cost data, we used the Mann–Whitney *U*-test (non-parametric) as data were skewed.

The estimated study size was 128 (64 in each group). This would have been sufficient to demonstrate a two-point difference in activities of daily living (which is thought to be clinically meaningful) at 5% significance and 80% power, given the distribution of Barthel score (mean 16, SD 1.9) in a prior sample of 27 stroke patients discharged from the Poole day hospital.

Results

Patient recruitment and characteristics

From October 1995 to June 1997, 397 patients with stroke were admitted to Poole NHS Trust, of whom 165 (42%) were eligible for the study. The main reasons for ineligibility were death or resolution of stroke (Table 1). One hundred and twenty-five (76%) consented and were randomized. In addition, 15 patients were recruited from community referrals.

The main reasons for refusal were patient preferences for therapy or unwillingness to take part in the trial. There were no differences in age and sex distribution between participants and patients who refused to participate.

One hundred and forty patients were randomized: 66 to domiciliary and 74 to day-hospital care (Table 2). The two groups were well-matched for age, sex, marital status, social class, baseline Barthel score and comorbidity, including previous stroke and type (Bamford classification [18]) and side of stroke. There were no significant differences in hospital post-stroke complications.

Outcomes at follow-up

We obtained 6-month outcome data for 54 (84%) of the domiciliary patients and 58 (78%) of those in the day-hospital group (Figure 1). There were a few cross-overs, largely from domiciliary to day hospital—three because of other medical problems, one out of patient choice and one because of temporary lack of a domiciliary physiotherapist. Most losses to follow-up (19 out of 26) were due to death, a recurrent stroke or the patient moving away. There was no difference in the age or baseline Barthel index between participants and those lost to follow-up for non-clinical reasons. As anticipated, those who died or who had another stroke were older and had a lower initial Barthel score (indicating a more severe stroke).

Barthel index and Rivermead Mobility Index improved in both groups, but there were non-significant differences in favour of the domiciliary group: subgroup

Table 1. Reasons for ineligible patients not participating in study

Reason for ineligibility	No. (and %)
Clinical	
Death	78 (34)
Virtual resolution of stroke	36 (16)
Disability too severe to benefit from rehabilitation	14 (6)
Severe dysphasia	13 (5.5)
Frailty	9 (4)
Advanced dementia	8 (3)
Too confused	2 (1)
Non-clinical	
Non-resident	22 (9)
Social referral to day hospital	5 (2)
Age < 55 years	3 (1)
Self-discharge	1 (0.5)
Other	4 (2)
Unknown	37 (16)
Total	232

Table 2. Comparison of patient baseline characteristics

	Treatment group	
	Domiciliary	Day hospital
No. of participants		
Randomized	66	74
Recruited from hospital	57	68
Recruited from community	9	6
Mean age, years (range)	78.3 (62–91)	79.6 (60–95)
No. (and %) female	33 (52)	42 (57)
Personal circumstances, no. (and %)		
Married	33 (52)	37 (50)
Widowed	24 (38)	32 (43)
Retired	60 (94)	71 (96)
Social class, no. (and %)		
Non-manual	37 (56)	41 (55)
Manual	24 (38)	32 (43)
Armed forces	2 (3)	1 (2)
Missing	1 (1.5)	0
Living arrangements, no. (and %)		
With spouse	31 (48)	38 (51)
Alone	27 (42)	26 (35)
Home owner	48 (75)	49 (66)
No. (and %) owning a car	29 (45)	27 (37)
No. (and %) with previous stroke	19 (31)	23 (32)
Median time in hospital, days (IQR)	50 (36.8, 85.3)	48 (30, 80)
No (and %) scoring $<7/10$ on AMT	10 (16)	14 (19)
Barthel score		
Mean (SD)	12.6 (4.4)	12.8 (5.0)
Median (IQR)	14.0 (9.0, 16.0)	14.0 (9.0, 17.0)

AMT, Abbreviated Mental Test; IQR, interquartile ratio; SD, standard deviation.

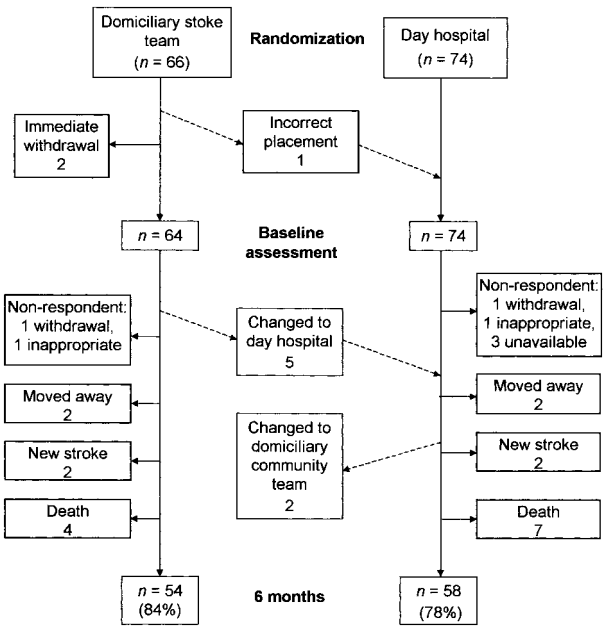

Figure 1. Patient follow-up from baseline to 6 months.

analysis showed that this was confined to those with less disability (Table 3). A Barthel index improvement of $\geqslant 2$ points was seen in 27 (50%) of those in the domiciliary arm and 23 (40%) of those in the day-hospital arm ($P=0.36$, difference in proportions 10%, 95% confidence interval -81% to $+29\%$).

Scores for the Frenchay Activities Index and SF-36 physical component were consistent with a tendency for greater physical function in the domiciliary group. However, the Frenchay Activities Index score was still low in both groups, indicating poor social function. The Philadelphia Geriatric Center Morale Scale fell in both groups, but less so in the domiciliary group. The groups showed no difference in SF-36 mental component score.

There was no significant difference in a composite poor outcome of death, recurrent stroke and a 6-month Barthel score of <14: this was found in 24 (36%) of those recruited to the domiciliary group and 31 (42%) of those recruited to the day-hospital group ($P=0.62$, difference in proportions -6%, 95% confidence interval -22% to $+11\%$).

Use of health and social services

The only quantitative difference between the rehabilitation service inputs were that the domiciliary physiotherapy sessions were longer (on average three 15-min blocks compared with two in the day-hospital group).

Other health service inputs showed little difference between the two arms, except for more district nurse visits (accounted for by two patients) in the domiciliary group and more inpatient days (accounted for by one patient) in the day-hospital group (Table 4). The domiciliary group made greater use of social service day centres and home helps. The greater home help time was largely due to five patients, all with Barthel scores of <10 at baseline.

Costs

The mean cost for rehabilitation per patient for the patients followed-up at 6 months was similar in the two groups (Table 5); although median costs were lower in the domiciliary group, this was not statistically significant. The average cost per visit was £48 for day hospital plus £16 for the ambulance, compared with £38 for domiciliary physiotherapy and £46 for domiciliary occupational therapy. Both groups had similar overall health service costs, with more district nurse visits in the domiciliary group being balanced by more hospital inpatient and outpatient attendances in the day-hospital group.

When costs incurred by social services are included, day-hospital rehabilitation had a non-significant cost advantage, due mostly to the greater home-care inputs in the domiciliary group. Sensitivity analysis of the rehabilitation inputs showed that the domiciliary arm would have the largest cost advantage if its therapy case load was increased by one-third from about three patient

Table 3. Scores for function, mobility, morale and health status at baseline and 6 months, and changes during this period for domiciliary and day-hospital groups

	Score, by treatment group				
	Domiciliary	Day hospital	Difference (and 95% CI)	*t*-value	*P*-value
Barthel index					
Median value (IQR)	(*n* = 54)	(*n* = 58)			
Baseline[a]	14.0 (9.3, 16.0)	13.0 (9.0, 17.0)			
6 months	17.0 (10.8, 19.0)	15.5 (9.0, 18.0)			
Mean change (SD)	1.8 (3.0)	0.7 (3.1)	1.1 (−0.1, 2.3)	1.97	0.05
Rivermead mobility index					
Median value (IQR)	(*n* = 52)	(*n* = 56)			
Baseline	6.0 (3.0, 8.0)	6.0 (2.0, 9.0)			
6 months	9.0 (6.0, 13.0)	8.0 (3.3, 11.0)			
Mean change (SD)	2.8 (2.8)	1.9 (3.0)	0.9 (−0.2, 2.0)	1.57	0.12
Philadelphia Geriatric Center morale scale					
Median value (IQR)	(*n* = 49)	(*n* = 51)			
Baseline	13.0 (9.0, 15.0)	12.0 (9.0, 15.0)			
6 months	11.0 (7.0, 14.0)	10.0 (6.0, 12.0)			
Mean change (SD)	−1.1 (3.7)	−2.2 (3.9)	1.1 (0.4, 2.6)	1.41	0.16
Median values at 6 months (IQR)					
SF-36	(*n* = 49)	(*n* = 50)			
Physical health	35.2 (26.5, 43.7)	32.7 (26.8, 39.2)	–	–	0.22[b]
Mental health	57.4 (49.9, 62.9)	57.1 (50.6, 63.0)	–	–	0.99[b]
Frenchay Activities Index	(*n* = 54)	(*n* = 56)			
	12.0 (3.0, 25.3)	7.5 (3.0, 16.5)	–	–	0.09[b]

[a]In patients with data at both 0 and 6 months
[b]Mann–Whitney *U*-test
CI, confidence interval; IQR, interquartile ratio; SD, standard deviation.

visits to four per day (median cost £759 *versus* £1090 for day-hospital care; Mann–Whitney *U*-test, *P*=0.17). Even under scenarios most favourable to the day hospital (lower day-hospital costs, lower ambulance costs and higher domiciliary overheads), the median health service cost per patient in the 6-month period was still lower for the domiciliary group (£900 *versus* £913).

Discussion

We have demonstrated that a new domiciliary rehabilitation service was at least as effective as rehabilitation in a geriatric day hospital in terms of physical function, and was of similar cost to the health service. Although the sample size was too small to identify conclusively differences in rare adverse health events that might have been avoided by regular visits to a medically staffed day hospital, there was no evidence of such differences from inpatient or outpatient data or from mortality. However, social activity remained low in both groups and little effect was seen on patients' mental health in either group.

Patients in the domiciliary arm received on average more physiotherapy time per visit, but no more visits or any increase in overall duration of care. The nature of the therapy differed, with more carer involvement in the domiciliary group and more group therapy in the day hospital. Domiciliary costs of rehabilitation were equal to or lower than those for day-hospital care. However, the domiciliary group used more health and social service community resources, a difference that could be attributed to a small number of more disabled elderly patients. Overall costs therefore tended to be less in the day-hospital group once social service costs were taken into account, although this was not statistically significant.

As with other studies in this area, the study proved under-powered for the diversity of outcomes—especially after losses to follow-up. Multi-centre studies are more difficult to establish for such complex services, which depend on local enthusiasm and organizational factors.

The patient caseload may be lower initially for a new service than an existing one; sensitivity analysis showed that this was an important determinant of rehabilitation costs. Similarly, the level of staff experience may differ from that which might be routine, so cost-effectiveness is likely to vary between differing models of domiciliary care.

In this trial we could not address the marginal cost differences from switching from a day-hospital to domiciliary care model. The cost implications of diverting patients from day hospitals could depend on the extent to which the day hospital could reduce its capacity and costs, this in turn would depend on local circumstances [19].

Two recent UK studies of domiciliary care were carried out in Bradford and Nottingham [5, 6]. Our

Table 4. Resource use data at 6 months

	Domiciliary ($n=54$)	Day hospital ($n=58$)
Rehabilitation services		
Median no. of visits to day hospital	0	17
Median no. of domiciliary visits		
Total	17	–
Occupational therapy	8.5	–
Physiotherapy	8.5	–
No. (and %) attending for speech therapy	8 (15)	6 (10)
General practitioner visits		
No. (and %) attending	49 (91)	55 (95)
Median no. of visits (IQR)	6 (3, 10)	6 (3, 8)
Total no. of visits	339	358
District nurse visits		
No. (and %) attending	31 (57)	31 (53)
Median no. of visits (IQR)	3 (2, 7)	3 (2, 6)
Total no. of visits	456	231
Hospital readmission		
No. (and %) readmitted	12 (22)	13 (22)
Median no. of readmissions (IQR)	1.5 (1, 2)	2 (1, 2)
Total no. of readmissions	20	24
Median length of stay, days (IQR)	7 (2, 30)	11 (4, 26)
Total length of stay, days	203	296
Hospital outpatient visits		
No. (and %) attending	24 (44)	21 (36)
Median no. of visits (IQR)	1 (1, 3)	2 (1, 3)
Total no. of visits	45	58
Social services		
No. (and %) receiving occupational therapy	17 (31)	22 (38)
No. (and %) attending day centres	6 (11)	7 (12)
Median no. of visits (IQR)	28 (21, 46)	24 (13, 27)
Total no. of visits	178	134
No. (and %) receiving home care during daytime	23 (43)	18 (31)
Median no. of visits (IQR)	196 (89, 349)	84 (42, 166)
Total amount of day care, h	5961	1904
No. (and %) receiving home care at night	4 (7)	0
Total no. of nights	14	0
No. (and %) receiving meals on wheels	1 (2)	3 (5)
Total no. of meals	140	168

All differences non-significant at 5% level except number of hours of day-care ($P=0.009$)

Table 5. Costs per patient[a] of services used to 6 months

	Cost, £, by treatment group Domiciliary ($n=54$)	Day hospital ($n=58$)	95% CI for difference	P value[b]
Rehabilitation				
Mean (SD)	1170 (876)	1146 (802)		
Median (IQR)	933 (339 to 2010)	1090 (513 to 1475)	−298 to 306	0.93
Health service				
Mean (SD)	1965 (1818)	2057 (2357)		
Median (IQR)	1409 (649 to 2863)	1442 (961 to 2468)	−466 to 388	0.72
Health and social services				
Mean (SD)	3070 (3221)	2428 (2503)		
Median (IQR)	2208 (694 to 3849)	1568 (982 to 3130)	−429 to 975	0.71

[a]Patients surviving to 6 months and with outcome data.
[b]Mann–Whitney *U*.
CI, confidence interval; IQR, interquartile ratio; SD, standard deviation.

study group were older and more disabled than those in either of these studies: the Bradford service only provided physiotherapy, while the Nottingham study included younger patients from stroke units.

A combined analysis of the two previous studies showed a small advantage to the domiciliary arm in terms of outcome at 6 months (Barthel index) [8]. Baskett *et al.* similarly showed that combined domiciliary therapy was as effective over a 3-month period as rehabilitation on a day-hospital or outpatients basis, and it may be appropriate where patient access is a problem, as in rural areas [20]. A recent systematic review concluded that day-hospital care has no clear advantage over other forms of rehabilitation such as domiciliary care [21].

Despite differences in costing methods, both of the previous studies showed domiciliary rehabilitation to be cheaper. As indirect costs were not increased in Bradford or in Nottingham [22, 23] the conclusion was that domiciliary care was more cost-effective. Our results would generally support this, except that in our generally older, frail patient group we found some evidence of increased social service costs, which reduced the overall cost-effectiveness.

Conclusion

A mixed model of postdischarge rehabilitation for elderly stroke patients may be appropriate. Day hospitals provide a base for co-ordinated multidisciplinary care and for equipment. Some stroke patients appear to benefit from day-hospital care—for example, those with medical or nursing needs, those who prefer day-hospital care, those referred from the domiciliary arm and those with serious disability who may require considerable social service and district nurse inputs, and for whose carers day hospitals provide important respite care. Such models need to be evaluated.

The optimum duration of postdischarge rehabilitation and the relative contributions of different therapists remain research questions [24]. Effective interventions to improve the mental health and social activity of patients are still required.

Key points

- Stroke patients receiving rehabilitation are the largest patient group treated in geriatric day hospitals: domiciliary rehabilitation is an alternative with potential advantages.
- Domiciliary rehabilitation was as effective as day-hospital care, although social function and mental state remained low at 6-month follow-up.
- Domiciliary rehabilitation reduced health service costs, but increased social service costs. The average cost per patient was the same in each group.
- A mixed model of day-hospital and domiciliary therapy may be the most cost-effective policy for community rehabilitation of elderly stroke patients.

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