Papers

Training care givers of stroke patients: economic evaluation

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Abstract

Background Training care givers reduces their burden and improves psychosocial outcomes in care givers and patients at one year. However, the cost effectiveness of this approach has not been investigated.
Objective To evaluate the cost effectiveness of caregiver training by examining health and social care costs, informal care costs, and quality adjusted life years in care givers.
Design A single, blind, randomised controlled trial.
Setting Stroke rehabilitation unit.
Subjects 300 stroke patients and their care givers.
Interventions Caregiver training in basic nursing and facilitation of personal care techniques compared with no care giver training.
Main outcome measures Health and social care costs, informal care costs, and quality adjusted life years in care givers over one year after stroke.
Results Total health and social care costs over one year for patients whose care givers received training were significantly lower (mean difference −£4043 ($7249; €6072), 95% confidence interval −£6544 to −£1595). Inclusion of informal care costs, which were similar between the two groups, did not alter this conclusion. The cost difference was largely due to differences in length of hospital stay. The EQ-5D did not detect changes in quality adjusted life years in care givers.
Conclusion Compared with no training, caregiver training during rehabilitation of patients reduced costs of care while improving overall quality of life in care givers at one year.

Introduction

Informal care givers make an important contribution to supporting disabled stroke survivors at home, often at a great personal cost.[1–5] The United Kingdom health and community care reforms of the 1990s seem to have done little to provide support for care givers[6] but may have increased the burden of care.[7] Studies on caregiver interventions show limited benefits; their cost effectiveness has not been evaluated.[8] This study reports an economic evaluation of an intervention that entailed training care givers, carried out within a randomised controlled trial.[9]

Methods

Full details of the study design, subjects, ethical approval, randomisation, intervention, outcome assessment, and data analysis have been given previously.[9] To summarise, 300 patients and their care givers were randomised to receive caregiver training and not to receive training, in addition to conventional care on a stroke rehabilitation unit. This training consisted of instruction in basic skills of moving and handling, facilitation of activities of daily living, and simple nursing tasks; care givers received training over three to five sessions, lasting for 30-45 minutes each, and a follow up session at home.

Assessment of care givers' quality of life

We used the EuroQol five-dimensional questionnaire (EQ-5D)[10] at baseline, and at 4, 12, 26, and 52 weeks after stroke to carry out assessments. We imputed missing values for eight care givers with partially missing EQ-5D data by carrying forward the last value. We did not impute missing data if caregiver data were missing at all assessment points, if no caregiver data were available from week 4 assessment onwards (to avoid an upwards bias due to carrying forward baseline pre-stroke values), and if a patient died before the care giver's missing assessment. We applied utility weights from a UK general population survey[11] to EQ-5D health states to calculate quality adjusted life years (QALYs). We assumed measures of health state at each assessment point to represent the time since the last assessment. We therefore multiplied QALYs for each assessment point by the relevant proportion of a year and summed these proportional tariffs to represent a complete year after onset of stroke. We examined QUALY outcomes in terms of change between baseline and week 52. As we anticipated decreases in quality of life between baseline and follow up, we made comparisons between groups based on minimising losses in QUALYs.

Use of resources

We adopted a societal perspective, including health services, other formal care agencies, and informal carers for the economic evaluation. We collected data on use of health and social care services over one year after onset of stroke and on use of hospital resources for a three month period before stroke. Therapists providing treatment recorded data on hospital use and therapy input after stroke. We used a specially adapted version of the client service receipt inventory to collect data on use of services after discharge from hospital retrospectively, at 12, 26, and 52 weeks during patients' assessment interviews.[12] We verified the completeness and accuracy of data on use of resources of hospital and social services against records of service providers. "Initial admission" includes the admission to the stroke unit and therapy inputs received while on the unit. "12 month follow up" covers any subsequent hospital use, social services, and input of informal care during the 12 month follow up period.

Costs

To obtain a cost per patient we multiplied resource volumes by unit costs. Local services provided unit costs, to approximate

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actual intervention costs. Some local unit costs were based on charges rather than costs. We used national statistics when local costs were not available.[13] We used the opportunity cost method (the value of the opportunities forgone by care givers as a result of time spent on care giving) to estimate the cost of informal care. We used the United Kingdom minimum wage (£4.10 per hour[14]) as a proxy valuation of their time. We used the NHS Executive's hospital and community health services inflation index or personal social services inflation index,[13] as relevant, to standardise all costs to 2001-2 prices. Table 1 shows unit costs.

Data analysis and statistical methods

The primary outcome measure for the study was health and social care costs during the first year after onset of stroke. We analysed the data on an intention to treat basis. Data were incomplete for those patients who died before the end of the study and their care givers, and for some survivors and their care givers. We included all available data in the analyses. All costs are reported as mean values with standard deviations. We used Student's *t* test to compare differences between groups and non-parametric bootstrap methods, with 5000 repetitions, to obtain 95% confidence intervals.

Results

We found no significant difference between the training and the no training groups for the number of patients who died, or the number of days that they were alive (P = 0.88). It was therefore not necessary to adjust cost data for differential survival time.

Quality adjusted life years

Mean QALY values for trained and untrained care givers were comparable at baseline (0.94 (SD 0.10) *v* 0.94 (SD 0.14)) and at one year (0.91 (SD 0.11) *v* 0.90 (SD 0.14)). We found no significant difference between groups in QALY losses between baseline and one year. Given that the visual analogue scale detected changes over time and a difference between the groups (accompanying paper), it is likely that the EQ-5D was insensitive to change in care givers' health related quality of life, rather than that there were no effects on QALYs.

Resource use and costs

The two groups used resources to a similar extent at baseline (table 2). Patients in the training group stayed in hospital less long (mean difference −12.4 days, 95% confidence interval −19.5 to −5.6) and had less physiotherapy (−30.2 units, −51.8 to −8.9) and occupational therapy (−3.2 units, −4.8 to −1.6) than patients in the no training group. Use of speech and language therapy was similar between the two groups. The differences in use of therapy are likely to be due to the longer stay in hospital in the no training group. About a third of patients in both groups received help from social services with personal care, and 14-17% received domestic help. Although a trend towards lesser use of personal and domestic care services

Table 1 Summary of unit costs and sources of information

Item	Unit cost in £, at 2001-2 prices	Source
Initial admission for stroke		
Stroke unit per day	233.34	Business Centre, Finance and Contracting, Bromley Hospitals NHS Trust, 1998
Physiotherapist per personal interaction unit	9.68	Business Centre, Finance and Contracting, Bromley Hospitals NHS Trust, 1998
Occupational therapist per personal interaction unit	9.68	Business Centre, Finance and Contracting, Bromley Hospitals NHS Trust, 1998
Hospital speech and language therapist per minute of patient contact	0.70	Netten and Curtis, 2002[13]
Other secondary care services		
General medical ward per day	297.63	Business Centre, Finance and Contracting, Bromley Hospitals NHS Trust, 1998
Outpatient visit	82.00	Netten and Curtis, 2002[13]
Accident and emergency per visit	75.00	Netten and Curtis, 2002[13]
Day hospital per visit	57.00	Netten and Curtis, 2002[13]
Social services		
Personal care per hour	13.72	Bromley Social Services, unpublished data, 1997
Domestic assistance per 1 hour contact	12.85	Bromley Social Services, unpublished data, 1997
Laundry assistance per 1 hour contact	12.85	In the absence of a specific unit cost for this service, domestic assistance unit cost used as a proxy
Shopping assistance per 1 hour contact	12.85	In the absence of a specific unit cost for this service, domestic assistance unit cost used as a proxy
Meals on wheels per meal	2.35	Bromley Social Services, unpublished data, 1997
Carelink per 15 minute contact	3.43	In the absence of a specific unit cost for this service, an estimate was based on the following assumptions: the service is usually provided by a social services personal care professional, contacts are usually made over the telephone, and that such contacts are approximately 15 minutes in duration. Therefore, unit cost is 25% of a personal care contact
Social services day care centre per session	33.09	Netten and Curtis, 2002[13]
Community based care		
General practitioner per surgery visit	16.00	Netten and Curtis, 2002[13]
General practitioner per home visit	49.00	Netten and Curtis, 2002[13]
District nurse per minute of home visit	0.89+1.13 travel	Netten and Curtis, 2002[13]
Dentist per 20 minute visit	19.05	Health and Personal Social Services Statistics, 1996
Optician per visit	15.91	Doctors and Dentists Remuneration. *Twenty-fifth report.* London: Stationery Office, 1996
Chiropody per clinic visit	10.19	Netten and Curtis, 2002[13]
Chiropody per home visit	19.30+1.13 travel	Netten and Curtis, 2002[13]
Respite care per week	537.74	Netten and Curtis, 2002[13]
Informal care		
Domestic assistance per 1 hour contact	12.85	Bromley Social Services, unpublished data, 1997
United Kingdom national minimum wage per hour	4.10	Department of Trade and Industry. *A detailed guide to the national minimum wage, October 2001.* www.dti.gov.uk/er/nmw/gtmw.pdf (accessed 19 Sep 2003).[14]

Table 2 Use of resources in the first year after onset of stroke

	Training			No training		
	No of patients	No (%) of patients using service or resource	Mean*	No of patients	No (%) of patients using service or resource	Mean*
Initial admission for stroke						
Stroke unit in days	151	151 (100.0)	30.8	149	149 (100.0)	43.2
Physiotherapy in personal interaction units†	151	151 (100.0)	115.1	149	149 (100.0)	145.3
Occupational therapy in personal interaction units†	151	150 (99.3)	9.3	149	149 (100.0)	12.4
Speech and language therapy in hours	151	87 (57.6)	6.7	149	82 (55.0)	5.3
12 months afterwards						
Secondary care:						
Admissions in days	134	11 (8.2)	10.9	126	10 (7.9)	12.8
Outpatients in visits	134	57 (42.5)	2.2	126	53 (42.1)	2.3
No of visits to accident and emergency	134	1 (0.7)	3.0	126	3 (2.4)	1.0
Day hospital in visits	134	38 (28.4)	5.6	126	24 (19.0)	7.2
Social services:						
Personal care in contacts	151	56 (37.1)	247.4	149	50 (33.6)	317.7
Domestic assistance in contacts	151	22 (14.6)	29.2	149	26 (17.4)	32.0
Carelink in contacts	151	10 (6.6)	248.5	149	15 (10.1)	246.8
Laundry assistance in contacts	151	6 (4.0)	30.8	149	9 (6.0)	42.3
Shopping assistance in contacts	151	19 (12.6)	26.8	149	17 (11.4)	32.0
Meals on wheels in meals	151	16 (10.6)	202.5	149	24 (16.1)	170.0
Day care in visits	151	14 (9.3)	18.6	149	26 (17.4)	25.8
Other community based care (visits):						
General practitioner in surgery	134	84 (62.7)	2.9	125	68 (54.4)	3.2
General practitioner at patient's home	134	47 (35.1)	3.0	125	54 (43.2)	2.7
District nurse at patient's home	134	41 (30.6)	7.4	127	31 (24.4)	6.4
Dentist	134	30 (22.4)	1.6	125	31 (24.8)	1.5
Optician	134	35 (26.1)	1.1	125	35 (28.0)	1.3
Chiropody in clinic	134	21 (15.7)	1.3	125	16 (12.8)	1.6
Chiropody at home	134	7 (5.2)	1.7	125	8 (6.4)	1.9
Respite care in weeks	151	7 (4.6)	3.7	149	12 (8.1)	3.0

*Mean for users only.
† One personal interaction unit is equivalent to approximately 30 minutes.

became obvious in the training group, the difference was significant only for use of day care (− 2.8 visits, − 5.1 to − 0.5).

Sixty per cent of total annual costs in each group were accounted for by bed days during the initial admission, which rose to 80% after including therapy costs (table 3). These costs were significantly lower in the training group ($P < 0.0001$) and were due to the shorter initial stay in hospital rather than reduced costs in the 12 months after stroke.

The number of care givers providing assistance to patients in various informal care activities increased in both groups compared with baseline (table 4 and table 5). We found no significant differences in the average number of care hours provided per day, the number of days that such care was provided, or the total average annual number of care hours. Informal care, costed at minimum wage, amounted to an average of £884 ($1585; €1328) (SD £1482) in the training and £933 (SD £1283) in the no training group. The addition of these to total annual costs did not alter the finding that the training group had lower total costs.

Table 3 Mean costs in £, at 2001-2 prices, in the first year after onset of stroke

	Training (n=151)		No training (n=149)		Training *v* no training	
	No of patients using service or resource	Mean (SD)	No of patients using service or resource	Mean (SD)	Mean difference (BS, 95% CI)	P value
Initial admission for stroke						
Stroke unit	151	7 189 (6177)	149	10 079 (7 851)	–2890 (–4515 to –1301)	<0.001
Therapy	151	1 365 (1087)	149	1 650 (1 043)	–285 (–525 to –37)	0.021
Total	151	8 554 (6939)	149	11 729 (8 506)	–3176 (–4980 to –1409)	<0.001
12 month follow up period						
Secondary care	134	434 (1399)	125	555 (2 317)	–120 (–633 to 303)	0.611
Social services	151	1 235 (2708)	149	1 471 (2 898)	–236 (–881 to 402)	0.466
Other community based care	134	221 (501)	125	258 (491)	–38 (–159 to 86)	0.544
Informal care	134	884 (1482)	125	933 (1 283)	–49 (–392 to 303)	0.777
Total excluding informal care	134	1 953 (3400)	125	2 494 (4 060)	–541 (–1479 to 353)	0.244
Total including informal care	134	2 837 (4182)	125	3 427 (4 409)	–590 (–1634 to 469)	0.270
Total annual costs						
Total excluding informal care	134	10 544 (9278)	125	14 587 (10 844)	–4043 (–6544 to –1595)	0.001
Total including informal care	134	11 429 (9825)	125	15 520 (11 106)	–4091 (–6675 to –1578)	0.002

SD=standard deviation, BS=bootstrap, CI=confidence interval

Table 4 Informal care inputs. Values are numbers (percentages) of patients using a service or resource

	Training		No training	
Service or resource	**Baseline (n=134)**	**After stroke (n=133)**	**Baseline (n=124)**	**After stroke (n=124)**
Personal care	8 (6.0)	50 (37.6)	6 (4.8)	43 (34.7)
Mobility	5 (3.7)	42 (31.6)	7 (5.6)	29 (23.4)
Meal preparation	10 (7.5)	49 (36.8)	12 (9.7)	38 (30.6)
Housework	11 (8.2)	52 (39.1)	18 (14.5)	46 (37.1)
Shopping	16 (11.9)	59 (44.4)	24 (19.3)	59 (47.6)
Outings	17 (12.7)	64 (48.1)	22 (17.9)	59 (47.6)

Sensitivity analyses

We carried out sensitivity analyses on two aspects of the evaluation to assess the robustness of the findings. As methods of costing informal care inputs remain controversial,[15] we used the replacement cost method (the cost of replacing inputs of informal care givers with professional care) to estimate the costs of informal care. Applying the cost of a home care worker from social services (£12.85 per hour[13]) increased the average cost of informal care in each group but did not affect comparisons of total costs (table 6). Further, as differences in cost were attributable mainly to differences in the duration of initial hospitalisation between the two groups, we examined the effect of increasing the length of stay of patients in the training group by 10%, 15%, and 20%. Differences between the groups in hospitalisation costs remained, with an up to 15% increase in the training group's length of stay and in total annual costs for health and social care with up an to 20% increase in length of stay.

Cost effectiveness

It was not necessary to calculate incremental cost effectiveness ratios because the caregiver training was clearly the more desirable option, with both lower costs and better outcomes.

Discussion

Improving the skills of consenting informal care givers during the rehabilitation of inpatients reduces costs for stroke care and improves their quality of life without increasing the burden of care to families or transferring costs to the community. Previous evaluations of caregiver interventions lack reliable cost effectiveness analyses because of difficulties in deciding the domains and timeframes for such assessments.[16]

Training care givers did not substantially reduce use or costs of resources in the community after discharge from hospital. This may be because many stroke patients receive only little statutory support where further reductions were not possible or because decreased needs in some areas may have been balanced by increased needs in areas not identified previously. The possibility exists that the trends towards lower personal and domestic care costs may have reached significance in a larger sample.

Potential biases

Cost advantages seem to be a result of earlier discharge from hospital in the training group. This unexpected finding has several potential explanations. The most likely reason is that training and some input into care before discharge may have increased the confidence and competence of care givers, who were more capable of continuing rehabilitation practices at home. Interestingly, more patients in this group had achieved independence in their abilities for personal care at three months than in the no training group.[9] It is also possible that patients' and care givers' awareness that they were receiving extra interventions or these families being viewed as "special" by the multidisciplinary team may have expedited discharge, although there was no evidence to show that they received more therapy input, more benefits, or more community support after discharge. Finally, complete blinding to intervention is not possible in pragmatic therapy based trials, especially when care givers are involved in discharge planning process. The possibility of bias due to unblinding was considered to be small because length of hospital stay was not a predefined outcome measure, the team deciding discharge was different to the research team, and sensitivity analyses showed that findings remained valid even when the length of stay was increased by 20% in these patients.

Weaknesses of the study

Our assessment of costs did not include the initial investment into developing the training intervention. The ongoing costs of training care givers were also embedded within the activity returned by the therapists and difficult to dissect from overall costs of therapy. A cost of between £150 (three 30 minute sessions and one home visit) and £285 (five 45 minute sessions and one home visit) per trained care giver is suggested by the protocol, but this is likely to be an underestimation that does not reflect true service costs. The inclusion of these costs would equalise costs of therapy but not affect comparisons between groups.

The EQ-5D seemed insensitive to changes in care givers' QALYs. Although the EQ-5D has previously been used successfully with care givers,[17] others have shown it to be less sensitive in

Table 5 Informal care inputs received over and above baseline levels

	Full sample				Among those actually receiving informal care			
	Training (n=134)		No training (n=125)		Training (n=86)		No training (n=73)	
Informal care received over and above baseline values	**No of patients using service or resource**	**Mean (SD)**	**No of patients using service or resource**	**Mean (SD)**	**No of patients using service or resource**	**Mean (SD)**	**No of patients using service or resource**	**Mean (SD)**
Mean hours per day	134	0.8 (1.2)	125	0.8 (1.0)	86	1.3 (1.3)	72	1.4 (1.0)
Mean number of days care was received over the 12 month follow up period	134	175.1 (160.3)	125	156.4 (156.0)	86	272.8 (115.1)	72	271.5 (104.0)
Mean total hours over the 12 month follow up period	134	215.7 (361.4)	125	227.6 (313.0)	86	336.0 (404.3)	72	395.1 (322.5)

Table 6 Sensitivity analyses: effects of increased length of stroke admission in the training group and alternative method of informal care costing

	Training (n=151)		No training (n=149)		Training *v* no training	
	No of patients using service or resource	Mean (SD)	No of patients using service or resource	Mean (SD)	Mean difference (BS 95% CI)	P value
Increased length of stay						
Effect on length of stay (days):						
Base scenario	151	30.8 (26.5)	149	43.2 (33.6)	−12.4 (−19 to −6)	0.000
Additional 10%	151	33.9 (29.1)	149	43.2 (33.6)	−9.3 (−17 to −2)	0.011
Additional 15%	151	35.4 (30.4)	149	43.2 (33.6)	−7.8 (−15 to −1)	0.037
Additional 20%	151	37.0 (32.8)	149	43.2 (33.6)	−6.2 (−14 to 1)	0.100
Effect on admission costs*:						
Base scenario	151	7 189 (6 177)	149	10 079 (7 851)	−2890 (−4515 to −1301)	0.000
Additional 10%	151	7 908 (6 794)	149	10 079 (7 851)	−2171 (−3876 to −523)	0.011
Additional 15%	151	8 267 (7 103)	149	10 079 (7 851)	−1812 (−3546 to −129)	0.037
Additional 20%	151	8 626 (7 412)	149	10 079 (7 851)	−1453 (−3226 to 263)	0.100
Effect on total costs of health and social care†:						
Base scenario	134	10 544 (9 278)	125	14 587 (10 844)	−4043 (−6544 to −1595)	0.001
Additional 10%	134	11 265 (9 884)	125	14 587 (10 844)	−3322 (−5908 to −822)	0.010
Additional 15%	134	11 625 (10 189)	125	14 587 (10 844)	−2962 (−5573 to −426)	0.024
Additional 20%	134	11 985 (10 496)	125	14 587 (10 844)	−2602 (−5237 to −27)	0.051
Alternative method of informal care costing						
Effect on informal care costs:						
Base scenario (opportunity cost method)	134	884 (1 482)	125	933 (1 283)	−49 (−392 to 303)	0.777
Replacement cost method	134	2 771 (4 644)	125	2 925 (4 022)	−153 (−1228 to 949)	0.777
Effect on follow up period costs:						
Base scenario (opportunity cost method)	134	2 837 (4 182)	125	3 427 (4 409)	−590 (−1634 to 469)	0.270
Replacement cost method	134	4 724 (6 696)	125	5 419 (6 063)	−695 (−2249 to 909)	0.383
Effect on total annual costs:						
Base scenario (opportunity cost method)	134	11 429 (9 825)	125	15 520 (11 106)	−4091 (−6675 to −1578)	0.002
Replacement cost method	134	13 316 (11 555)	125	17 512 (12 110)	−4196 (−7103 to −1332)	0.005

SD=standard deviation, BS=bootstrap, CI=confidence interval
*Excluding therapy costs.
†Excluding informal care costs.

detecting small changes towards the top end of the scale[18] and less sensitive than programme specific instruments.[19]

Strength of the study

We examined costs as well as changes in health outcomes. In addition, the study takes into consideration the possibility of shifting costs from statutory services to informal care and shows that caregiver training can reduce costs of formal care without shifting costs on to care givers, while improving clinical outcomes in care givers and patients.[9]

Conclusion

Despite care givers being recognised as one of the building blocks of community care,[20] and English national strategy ("Caring about Carers") prioritising information, support, and care for care givers,[21] little is known about how care givers can be assisted effectively. Improving the skills of consenting informal care givers during inpatient rehabilitation reduces stroke care costs and improves their quality of life without increasing the burden of care to families or transferring costs to the community.

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Contributors: AP was responsible for the analysis and interpretation of the data and drafting of the paper. MK was involved in the conception and design of the study, interpretation of data and writing of the paper. LK was responsible for the conception, design, initiation, and overall coordination of the study, interpretation of data and drafting of the paper. AE was responsible for collation of data and critical review of the paper. IP was involved in the design of the study, day to day administration of the study,

What is already known on this topic

In England care givers are increasingly being recognised as one of the building blocks of community care

Little is known, however, about the costs of assisting care givers effectively

What this study adds

Training care givers reduces health and social care costs in the first year after stroke compared with not training them

Costs of informal care are similar between trained and untrained care givers, and therefore no shift in the burden of care from statutory services towards carers is becoming apparent

Caregiver training is associated with smaller losses of quality of life among care givers; this effect is apparent soon after the patient's stroke

The EQ-5D questionnaire did not detect changes in care givers' quality adjusted life years

data collection, and data entry. LK will act as the guarantor of the paper on behalf of all investigators.

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