Early supported discharge services for stroke patients: a meta-analysis of individual patients' data

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Summary

Background **Stroke patients conventionally undergo a substantial part of their rehabilitation in hospital. Services have been developed that offer patients early discharge from hospital with rehabilitation at home (early supported discharge [ESD]). We have assessed the effects and costs of such services.**

Methods **We did a meta-analysis of data from individual patients who took part in randomised trials that recruited patients with stroke in hospital to receive either conventional care or any ESD service intervention that provided rehabilitation and support in a community setting with the aim of shortening the duration of hospital care. The primary outcome was death or dependency at the end of scheduled follow-up.**

Findings **Outcome data were available for 11 trials (1597 patients). ESD services were mostly provided by specialist multidisciplinary teams to a selected group (median 41%) of stroke patients admitted to hospital. There was a reduced risk of death or dependency equivalent to six (95% CI one to ten) fewer adverse outcomes for every 100 patients receiving an ESD service ($p=0\cdot02$). The hospital stay was 8 days shorter for patients assigned ESD services than for those assigned conventional care ($p<0\cdot0001$). There were also significant improvements in scores on the extended activities of daily living scale and in the odds of living at home and reporting satisfaction with services. The greatest benefits were seen in the trials evaluating a coordinated multidisciplinary ESD team and in stroke patients with mild to moderate disability.**

Interpretation **Appropriately resourced ESD services provided for a selected group of stroke patients can reduce long-term dependency and admission to institutional care as well as shortening hospital stays.**

Introduction

Stroke is one of the major causes of death and disability in more developed countries and consumes about 5% of health-service resources.[1] Much of the cost is attributable to the care of disabled patients in hospital. Organised inpatient (stroke-unit) care is effective in reducing rates of death and disability in these patients,[2] but many questions remain about provision of stroke services. In particular, are there effective options other than inpatient care, and how can care best be provided after discharge from hospital?

Systems of care that offer stroke patients avoidance of hospital admission ("hospital at home") appear to have poorer outcomes than stroke-unit care.[3,4] Another approach has been to develop services that aim to accelerate the discharge home of patients already admitted to hospital (early supported discharge [ESD]). We have assessed whether such services can: accelerate the return home of people with stroke who are admitted to hospital; produce equivalent or better outcomes for patients and carers than conventional care; and provide a cost-effective alternative to conventional services.

Methods

This analysis used Cochrane Review methods[5] and will appear in an expanded version in *The Cochrane Library*.[6] We used the Cochrane Stroke Group search strategy,[7] supplemented by discussions with trialists. The last search of their Specialised Register of Controlled Trials was in August, 2004. We sought to avoid publication bias through comprehensive searching and inclusion of published and unpublished data.

Our primary outcome for patients was the combination of death or dependency (defined[2] as a Barthel index of <19/20 or a Rankin score of >2) recorded at the end of scheduled follow-up. Secondary outcomes were death, place of residence, activities of daily living (ADL) score, extended ADL score, subjective health status, mood or depression score, outcomes for carers (mood and subjective health), and satisfaction of patients and carers. The primary resource outcome was the duration of the index hospital admission. Other resource outcomes included the number of readmissions and the total cost of service interventions.

Trial selection

Trials were scrutinised by two independent reviewers who decided on eligibility and assessed the method of concealment of treatment allocation and the presence of masking of outcome assessment. We included all relevant randomised trials that recruited patients in hospital with a clinical diagnosis of stroke to receive either conventional care or an ESD intervention. The latter was defined as aiming to accelerate discharge from hospital with the provision of rehabilitation and support (regular assistance) in a community setting. We excluded

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trials that recruited a mixed group of patients. The specific type of intervention was recorded but not used as an exclusion criterion. Prespecified service subgroup comparisons included whether care was planned and provided by a specialist multidisciplinary team whose work was coordinated through regular meetings.

Data collection

The trialists were asked to give a description of their intervention and control services and to provide basic individual patients' data. When these were not available (two trials) we sought standardised tabular outcome data. Descriptive information about service characteristics was collected by use of a standard questionnaire before the identification and analysis of outcome data.

Prespecified subgroup analyses were planned on patients' age, sex, presence of a carer, and initial stroke severity. Severity was based on the Barthel index during the first week after stroke, which was provided from most trials as Barthel index at randomisation. For three trials, severity had to be inferred from Barthel index data collected after the first week[8,9] or from initial neurological impairment.[10] Stroke severity and age were initially analysed in three categories each but subsequently collapsed into two groups for simplicity and consistency with previous reviews.[2]

Statistical methods and data analysis

Standardised staffing levels of ESD teams (estimated as whole-time equivalents required to manage a notional 100 new patients per year) were estimated from recorded staff contact times or a typical team case load. We assumed staff would work a 35 h week with 20 h of direct contact with patients and 10 h of indirect contact time.

All individual patients' data were checked for consistency internally and with published reports. Binary outcome data were analysed with the odds ratio and 95% CI by Revman software (version 4.1).[5] Patients with missing data were assumed to be alive, living at home, and independent. Most secondary outcomes were expressed as continuous outcome scores, which were analysed by use of the weighted mean difference for identical outcome measures or the standardised mean difference when different measures were used. If only median results were available, these were assumed to approximate to the mean. If only IQR was reported, the SD was inferred from the expected distribution. Several outcome scores had to be reversed to ensure that all scores were operating in the same direction. Heterogeneity was tested by use of the χ^2 test.[5]

Role of the funding source

No funding source had any role in study design; collection, analysis, or interpretation of data; or the writing of the report. The corresponding author had full access to all the data in the study and took full responsibility for the decision to submit the paper for publication.

Results

The search strategy identified 28 potentially eligible trials of which four were unpublished. Two trials (from New Zealand and the UK) were identified in the early stages of planning but never started. The remaining 26 were suitable for consideration by two independent assessors. There was agreement on the exclusion of 14 trials (eight recruited mixed groups of patients, four were services to prevent hospital admission, and two were late interventions) and on the inclusion of ten trials; there was disagreement on two.[11,12] After we had obtained more information, both these trials were judged eligible. No further outcome information has yet been obtained for the New York trial,[12] so 11 trials were left in the analysis.

The 11 trials (1597 patients) came from six countries (Australia, Canada, Norway, Sweden, Thailand, UK). Most were established in city hospitals servicing largely urban populations. Nine trials[8–10,13–17] (and Dey P, Woodman M, FASTAR trial group; unpublished) used a clearly concealed randomisation procedure, and ten[8,9,11,13–17] (and FASTAR, unpublished) used a clearly independent (masked) assessment of outcomes at a fixed time after randomisation.

The services under comparison are outlined in table 1. Services were divided into three subgroups to reflect the prespecified view that effectiveness of ESD services would be greater if care was provided by a coordinated multidisciplinary team with some specialist interest in stroke. The first subgroup was ESD team coordination and delivery: in seven trials,[8,9,13–15,17] (and FASTAR, unpublished) a multidisciplinary team coordinated discharge from hospital and postdischarge care and provided rehabilitation at home. The second subgroup was ESD team coordination: in two trials,[10,16] discharge home and the immediate postdischarge care were planned and supervised by a coordinated multidisciplinary team. However, care was subsequently handed over to a range of existing community-based agencies. The third subgroup had no ESD team: in two trials,[11,18] patients received multidisciplinary-team care in hospital but postdischarge care was provided either by a range of uncoordinated community services[11] or by health-care volunteers.[18]

Standardised ESD team staffing levels (table 1) were estimated from recorded staff contact times[8,9,14,15,17] or a typical team case load.[10,13] By these estimates, to manage 100 new patients per year, a "typical" ESD team had a median of 3·07 whole-time equivalent staff (range 2·30–4·60) as follows: medical 0·10, nursing 0 (range 0–1·20), physiotherapy 1·00, occupational therapy 1·00, speech and language therapy 0·40, and assistant staff 0·25. Varied levels of social-work and secretarial support were also available.

The ESD teams could have either a community or hospital base and specialised in stroke or neurological rehabilitation[8–10,13–15,17] (and FASTAR, unpublished) or

Ref	Control		ESD				ESD staffing (whole-time equivalents for a case load of 100 patients per year)								ESD service procedures		
	Service base	n	Service base	Team expertise	Service coordination	n	Medical	Nursing	PT	OT	SALT	Assistant	Other	Total	Discharge assessment	Postdischarge input	Termination of input
8	Rehabilitation unit (stroke and neurological)	44	Mixed hospital and community	Neurological rehabilitation	Weekly MDT meeting	42	0·06	0·06	0·7	1·6	0·25	0·4	Social work	3·07	PDHV (including carers)	Begin on day of discharge; continue for up to 5 days/ week; PHMR	Reduced as goals achieved
13	Mixture (medical, geriatric, stroke unit)	54	Community	Stroke rehabilitation	Weekly MDT meeting	59	0·1	0	1·5	1·0	0·5	1·5	Secretary, social work	4·6	PDHV often	Begin within 2 days of discharge; continue for several days/week; PHMR	Within 3 months
9	Mixture (medical, stroke unit)	164	Community	Neurological and stroke rehabilitation	Weekly MDT meeting	167	0·1	0	1	1	0·5	0·5	..	3·1	PDHV often	Begin on day of discharge; continue with daily input	Planned within 3 months
U*	Mixture (medical, stroke team or unit)	11	Community	Stroke rehabilitation	Weekly MDT meeting	12	ND	ND	ND	ND	ND	ND	..	ND	PDHV	Begin on day of discharge; continue daily if required	Within 3 months
14	Mixture (medical, neurology)	56	Community	Stroke rehabilitation	Regular MDT meeting	58	0	0·4	1·0	0·7	0·4	..	Dietitian	2·5		Begin early; continue <5 sessions/ week	Within 4 weeks
15	Mixture (medical, geriatric)	46	Community	Stroke rehabilitation	Weekly MDT meeting	46	0	0	0·8	1·0	0·3	0·2	Secretary, social work, carers	2·3	Environmental visit	Begin on day of discharge; continue with daily input if required; PHMR	When goals achieved; average 9 weeks (1–44 weeks)
17	Stroke unit	41	Hospital (stroke unit)	Neurological rehabilitation	Twice-weekly MDT meeting	42	0·03	0	1·0	1·0	0·5	..	..	2·6	Case manager coordinated PDHV	Begin early; continue with <daily input; patient diary	Within 3–4 months
16	Stroke unit	40	Community	Stroke rehabilitation	Weekly MDT meeting	42	ND	ND	ND	ND	ND	ND	..	ND	Environmental visit	Begin on day of discharge; continue with daily input if required	At 4 weeks then review clinic
10	Stroke unit	160	Hospital (stroke unit)	Stroke rehabilitation	Weekly MDT meeting	160	0·12	1·2	1·2	1·2	0	..	..	3·7	PDHV often	Begin early	Within 1 month with later review
11	Stroke unit	127	Community (PNH, PT, SALT)	General rehabilitation	None	124	ND	ND	ND	ND	ND	ND	..	ND	Variable	Variable input from a range of community services (30% got none)	Variable
18	Neurology	50	Community	Red Cross volunteers	Report to nurses	52	ND	ND	ND	ND	ND	ND	..	ND	No	Begin within 2 days; continue with 3 visits/ week reducing to 1 visit per 2 months	At 6 months

PT=physiotherapy; OT=occupational therapy; SALT=speech and language therapy; MDT meeting=multidisciplinary team meeting; PDHV=predischarge home visit; PHMR=patient-held medical record; ND=no comparable data; PNH=private nursing home. U*=FASTAR, unpublished.

Table 1: **Characteristics of early supported discharge (ESD) services in the randomised trials**

general rehabilitation,[16] and they coordinated their work through a weekly multidisciplinary-team meeting (table 1). A typical approach would involve the early identification of the patient in hospital and a visit from the key worker (case manager) from the ESD team. Discharge was planned with the patient and carer and in many cases involved a predischarge home visit (attended by the patient) or environmental visit (not attended by the patient). Team input typically began on the day of discharge, could be provided for at least 4 days per week, and was recorded on a patient-held medical record. Recovery goals would be agreed with the patient, and the termination of services negotiated within 3 months.

For control services, all[8,10,11,16,17] or most[13] patients were recruited from a multidisciplinary stroke unit in six trials, and five trials[9,14,15,18] (and FASTAR, unpublished) recruited only a minority of patients from a stroke-unit setting.

Patients tended to be elderly (mean or median age in trials 68–78 years) with a clinical diagnosis of stroke. Selection of patients was in most trials based on need (persisting disability), practicability (living within the local area), and stability of medical condition. The median proportion of patients eligible for the ESD services was 41% (range 13–68). The typical population had a Barthel index at randomisation of 14/20 (IQR 10–18/20). The typical Barthel index at discharge (where it was recorded within the week before discharge) was 15/20 (IQR 12–17/20).

Our main outcomes of death, dependency in ADL, and place of residence were available at the end of scheduled follow-up (median 6 months; range 3–12). Death or dependency data (figure 1) were available for all 11 trials (1597 patients). Data were missing for 17 intervention patients and 18 controls. There was a significant reduction in the odds of death or dependency among

patients assigned ESD (odds ratio 0·79 [95% CI 0·64 to 0·97], p=0·02) with no substantial heterogeneity. This reduction equates to an extra six (95% CI one to ten) patients regaining independence for every 100 receiving ESD services. Similar results were obtained if analyses were restricted to the trials that reported concealed randomisation and masked follow-up (0·69 [0·55 to 0·88], p=0·002).

There was no significant difference between ESD and control populations in case-fatality (0·90 [0·64 to 1·27]) but the odds of death or requiring long-term institutional care were reduced with ESD (0·74 [0·56 to 0·96], p=0·02) with no significant heterogeneity. This reduction equates to an extra five (one to nine) patients living at home for every 100 treated.

The other outcomes for patients were available (in various formats) for between five and ten trials (513–1154 patients; table 2). Extended ADL scores were higher among survivors receiving ESD services than among those assigned control services. Measures of subjective health status, mood, and ADL score showed no significant differences between groups. ESD patients were significantly more likely to report satisfaction with outpatient services or services in general than were controls. There was no significant difference between groups in the subjective health status, mood scores, or service satisfaction of carers (table 2).

Data on length of initial hospital stay (acute care and rehabilitation for index admission) were available for nine trials (1015 patients). Across all trials, there was a significant reduction with ESD in the length of hospital stay of 7·7 days (95% CI 4·2 to 10·7; p<0·0001). Hospital readmission rates during scheduled follow-up were very similar between the ESD service and conventional care groups (27% *vs* 25%).

Costing data estimated total costs up to 3 months,[19,20] 6 months,[21] or 12 months[22,23] after randomisation. We were not able to combine data, but in each instance estimated costs were lower in the ESD group (median cost reduction 20%; range 4–30) and were reported to be stable in sensitivity analyses.

Subgroup data (figure 2) were available for at least nine trials (1175 patients). There was no significant interaction of ESD service effect with patient's age, sex, or the presence of a carer. Subgroup analysis by initial stroke severity indicated an interaction (p=0·04) with a reduced odds of death or dependency (odds ratio 0·73 [0·57 to 0·93], p=0·01) in patients with moderate stroke severity (initial Barthel index >9) but not in the severe subgroup (1·41 [0·83 to 2·41], p=0·20). Similar patterns

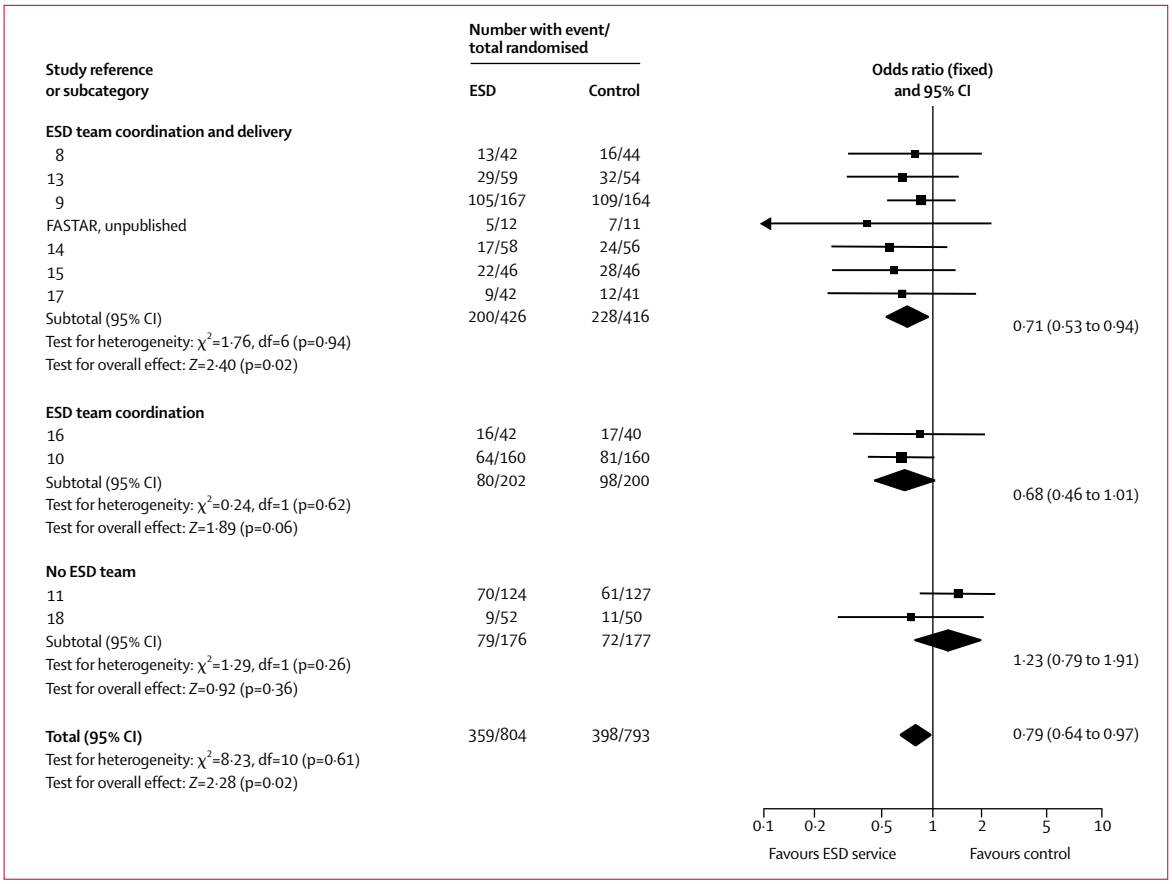

Figure 1: **Odds ratios for combined outcome of death or dependency in ADL at the end of scheduled follow-up for ESD services versus conventional care**

of results were seen for the outcome death or institutional care. The reduction in duration of hospital stay was much greater for the severe stroke subgroup (weighted mean difference 28 days [95% CI 15 to 41], p<0·0001) than the moderate group (4 days [2 to 6], p=0·0002).

There was a significant subgroup interaction (p=0·04) by ESD characteristics. The trials with a coordinated multidisciplinary ESD team showed an odds of death or dependency of 0·70 (0·56 to 0·88, p=0·002) compared with 1·23 (0·79 to 1·91, p=0·4) in those without an ESD team. There was no significant interaction with the background service (stroke unit or other ward) or the base for the ESD team (community inreach or hospital outreach). The reduction in length of hospital stay was more striking (subgroup interaction p=0·01) in the hospital outreach group (15 days [9 to 22], p<0·0001) than in the community inreach group (5 days [1 to 9], p=0·005).

Outcome	Trials	Patients randomised	Summary statistic	Summary result (95% CI)	p
Patients' outcomes					
Death or dependency	11	1597	OR	0·79 (0·64 to 0·97)	0·02
Death	11	1597	OR	0·90 (0·64 to 1·27)	0·56
Death or institution	9	1398	OR	0·74 (0·56 to 0·96)	0·02
ADL score	6	811	SMD	0·04 (−0·10 to 0·17)	0·60
Extended ADL score	9	1051	SMD	0·12 (0 to 0·25)	0·05
Subjective health status score	10	1154	SMD	−0·02 (−0·15 to 0·12)	0·87
Mood score	8	851	SMD	−0·06 (−0·19 to 0·07)	0·38
Satisfied with outpatient services	5	513	OR	1·60 (1·08 to 2·38)	0·02
Carers' outcomes					
Subjective health status score	6	613	SMD	0 (−0·25 to 0·24)	0·97
Mood score	2	58	SMD	−0·19 (−1·60 to 1·22)	0·79
Satisfied with outpatient services	4	279	OR	1·56 (0·87 to 2·81)	0·14
Resource outcomes					
Length of hospital stay	9	1015	WMD	−7·7 (−10·7 to −4·2)	<0·0001
Readmission to hospital	5	633	OR	1·14 (0·80 to 1·63)	0·48

OR=odds ratio; SMD=standardised mean difference; WMD=weighted mean difference. Results are presented as the pooled summary statistic for each outcome comparing ESD services with conventional care.

Table 2: **Summary of all outcomes for ESD services versus conventional care**

Discussion

The basic question addressed by this meta-analysis was whether a policy of early hospital discharge with support could be as effective and efficient as conventional predischarge care, discharge planning, and postdischarge care. Our inclusion criteria were, therefore, broad and focused on trials that compared two policies of care for stroke patients in hospital. We expected that a core group of trials would have tested a specialist multidisciplinary ESD team established specifically for this role. However, we wished to include other trials in which a policy of early discharge was tested in other ways. This broad approach has allowed us both to examine the effectiveness of a specific coordinated ESD team and to explore the service factors that influence outcomes for patients. These features should be borne in mind in interpretation of the results.

The individual patients' data analysis showed that patients receiving ESD services were more likely to be independent and living at home after the stroke than those who received conventional services. Our findings also confirm earlier reports[6] that ESD services can substantially shorten hospital stays. The observations that ESD patients scored higher on extended ADL scores and were more likely to report satisfaction with services appear to complement the primary outcome, but they are based on less complete data. Although information was limited, we have been unable to confirm earlier concerns[3] about the effect of ESD services on the mood and wellbeing of carers. Our conclusions appear to be robust. The results are strengthened if analyses focus on trials with clearly concealed randomisation and masked follow-up, or on the core group of trials testing a coordinated ESD team.

Economic analyses have been reported for five trials.[19–23] Although the underlying costs and assumptions were different for each analysis, all concluded that the savings from hospital bed-days released were greater than the cost of the ESD service. In practice, such cost savings can be difficult to realise, but ESD services appear to offer one way to manage the rising demand for a finite number of hospital beds.

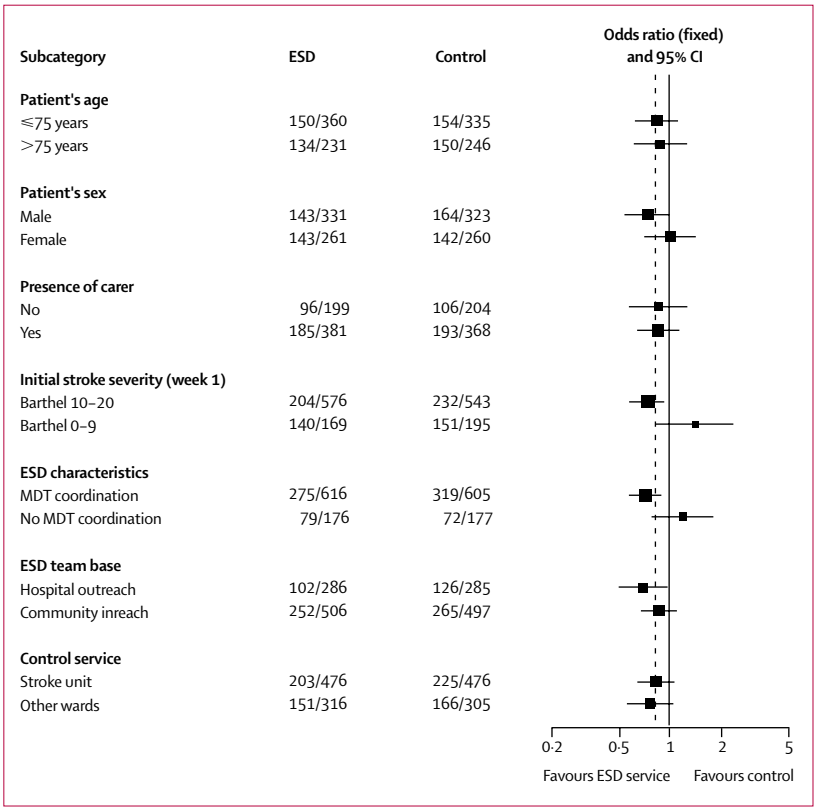

Figure 2: **Odds ratios for combined outcome of death or dependency in ADL at the end of scheduled follow-up for ESD services versus conventional care in various subgroups of patients and services**
The broken vertical line indicates the summary result for all ESD trials. MDT=multidisciplinary team.

We have tried to enrich the conclusions of this review by using detailed service descriptions and subgroup analyses. Although we recognise that such analyses carry a risk of error and bias, we believe that several conclusions can be drawn. First, most of the evidence of benefit of ESD services comes from trials of a specialist multidisciplinary ESD team (comprising physiotherapy, occupational therapy, and speech and language therapy staff with medical, nursing, and social-work support) whose work is coordinated through regular meetings. Second, ESD services appeared to be effective even in comparison with standard care based in a stroke unit. Third, the effectiveness of ESD services in more dispersed rural communities has not been adequately tested. Finally, most of the evidence of ESD benefit appears to be for patients with moderate disability (initial Barthel index of >9), although the balance of cost and benefit is not clear for this subgroup. For patients with more severe disability the substantial saving in bed-days might well be outweighed by a risk of poorer outcomes. We therefore cannot exclude the possibility that the clinical benefits gained by the subgroup with moderate disability required a net increase in rehabilitation input whereas the main cost savings (in terms of bed-days) came from the subgroup with severe disability.

In conclusion, appropriately resourced and coordinated ESD teams can offer a further effective service option for a selected group of stroke patients and should be considered, in addition to organised inpatient (stroke unit) care, as part of a comprehensive stroke service.

Contributors

Peter Langhorne initiated the study, drafted the protocol, coordinated the project, and drafted the report. Peter Langhorne, Martin Dennis, and Gillian Taylor formed the writing committee. The trialists provided original data and interpretation of data and redrafted the report. Gillian Taylor, Peter Langhorne, and Gordon Murray did the statistical analyses. Craig Anderson, Erik Bautz-Holter, Paola Dey, Bent Indredavik, Nancy Mayo, Michael Power, Helen Rodgers, Ole Morten Ronning, Sally Rubenach, Anthony Rudd, Nijasri Suwanwela, Lotta Widen-Holmqvist, and Charles Wolfe all contributed to study design, data collection and analysis, and revision of the report.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

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