Clinical Rehabilitation 2004; **18:** 238–248

Evaluation of an extended stroke unit service with early supported discharge for patients living in a rural community. A randomized controlled trial

T Askim Department of Public Health and General Practice and Department of Neuroscience, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, **G Rohweder** The Stroke Unit, Department of Medicine, University Hospital of Trondheim, **S Lydersen** Unit for Applied Clinical Research, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim and **B Indredavik** Department of Neuroscience, Faculty of Medicine, Norwegian University of Science and Technology and The Stroke Unit, Department of Medicine, University Hospital of Trondheim, Trondheim, Norway

Received 24th July 2003; returned for revisions 11th September 2003; revised manuscript accepted 8th November 2003.

Objective: To evaluate the effect of an extended stroke unit service (extended service), with early supported discharge and co-ordination of further rehabilitation in co-operation with the primary health care system in three rural municipalities.
Design: A randomized controlled trial comparing extended service with ordinary stroke unit service (ordinary service).
Subjects: Sixty-two eligible patients with acute stroke living in the rural municipalities of Malvik, Melhus and Klæbu.
Main measures: The primary outcome was the proportion of patients who were independent according to Modified Rankin Scale (mRS) (independence = mRS ≤ 2) 52 weeks after onset of stroke. Secondary outcomes were mRS at 6 and 26 weeks and Barthel Index (BI), Nottingham Health Profile (NHP) and Caregiver Strain Index (CSI) at 6, 26 and 52 weeks. Mortality and length of stay were registered during the 52 weeks.
Results: Twelve patients (39%) in the extended service group versus 16 patients (52%) in the ordinary service group were independent according to mRS at 52 weeks ($p = 0.444$). The odds ratio for independence (extended service versus ordinary service) was 0.33 (95% confidence interval (CI) 0.088–1.234). According to outcome by secondary measures there were no significant differences except less social isolation on NHP in the extended service group at 26 weeks ($p = 0.046$). There were no significant differences in length of stay.
Conclusion: An extended stroke unit service with early supported discharge seems to have no positive effect on functional outcome for patients living in rural communities, but might give a trend toward better quality of life. There were no significant differences in length of stay.

Address for correspondence: Torunn Askim, Department of Public Health and General Practice, Medisinsk teknisk forskningssenter, N-7489 Trondheim, Norway. e-mail: torunn.askim@medisin.ntnu.no

10.1191/0269215504cr752oa

Introduction

Several trials have shown that stroke unit care provided by a co-ordinated multidisciplinary team in a dedicated stroke ward improves outcome for stroke patients.[1] Limited information exists about the organization and efficiency of follow-up care after the initial treatment in stroke unit.

Seven randomized controlled trials evaluating an early supported discharge service for stroke patients organized by a multidisciplinary team have been conducted.[2–8] They indicated that early supported discharge service was equal to[2–6] or better than[7,8] a conventional rehabilitation service with regard to functional outcome.

A preliminary meta-analysis showed a significant reduction in initial length of stay in hospital and a trend in favour of early supported discharge, co-ordinated by a multidisciplinary team, regarding death and dependency.[9] However, owing to the small number of participating studies, which were almost exclusively carried out in an urban setting, the results are not conclusive. There is an obvious need for further research to clarify the benefits of early supported discharge following acute stroke in various settings.

A systematic review including economic analysis of published randomized clinical trials shows early supported discharge to be a cost saving alternative to conventional care in urban centres.[10] One of the studies in this review, which has shown a beneficial effect of the early supported discharge in an urban centre, was conducted for patients living in the city of Trondheim, admitted to the stroke unit at the University Hospital of Trondheim, Norway.[8] In the present study we wanted to test the early supported discharge strategy and to evaluate its effect in a more rural area.

The aim of this study was to evaluate the effect of an extended stroke unit service (extended service), with early supported discharge and coordination of the further rehabilitation in co-operation with the primary health care system in three surrounding rural municipalities to the city of Trondheim, Norway. More emphasis on rehabilitation at home was an essential element of the extended service.

Method

Subjects

Patients from the municipality of Malvik, Melhus and Klæbu, who were admitted to the stroke unit at the University Hospital of Trondheim, and who lived within 30–90 minutes driving distance from the hospital were screened for inclusion into the trial. The primary health care system in the three communities all provided home-based rehabilitation, however there were differences in inpatient rehabilitation. Inclusion criteria were as follows: diagnosis of an acute stroke according to the World Health Organization definition of stroke[11]; Scandinavian Stroke Scale (SSS)[12] score greater than 2 points and less than 58 points; living at home before the stroke; inclusion within 72 hours after admission to the stroke unit and within seven days after the onset of symptoms; able and willing to provide informed consent.

Randomization

Patients fulfilling the inclusion criteria were included and block randomized in blocks of four, six or eight patients to either an ordinary stroke unit service (ordinary service) or the newly constructed extended service. The order of the blocks was randomly chosen. Sealed opaque envelopes were used for randomization and the procedure was carried out by an external office.

An independent and blinded assessor specially trained in the use of all the outcome measures performed the assessments in the patient's home.

Intervention

The ordinary service was developed during a previous trial. It consists of treatment in a combined acute and rehabilitation stroke unit and further follow-up organized by rehabilitation clinics and/or the primary health care system. In a randomized controlled trial, the ordinary service has shown to be more beneficial than treatment in general wards.[13–15] Hence, the ordinary service may be defined as the stroke unit treatment of choice according to evidence-based recommendations. It is combined with further inpatient rehabilitation when more long-term rehabilitation is necessary or a follow-up programme organized by the primary health care system.

The extended service was also developed during a previous trial for patients living in the city of Trondheim. It consists of stroke unit treatment combined with a home-based programme of follow-up care co-ordinated by a mobile stroke team that offers early supported discharge and works in close co-operation with the primary health care system during the first four weeks after discharge.[8] The mobile team was based within the stroke unit and consisted of a nurse, a physiotherapist, an occupational therapist and the consulting service of a physician. In principle, the same primary health care system was available to both the ordinary service and the extended service patients, but the co-operating mobile team was only available to the extended service patients.

Due to the distance between the hospital and the three co-operating municipalities, some changes in the main features of the already existing extended service had to be made. As soon as a patient was randomized to the extended service, the team was contacted and one of the three team members started collecting basic information. At the same time the primary health care system was informed about the patient. For those patients living within 30–45 minutes radius from the hospital where direct discharge to home was likely to occur, a visit at home was usually performed as soon as the medical condition of the patient allowed. The aim of the visit was to assess the home environment, to define the goals of further rehabilitation and to make a plan for follow-up together with the family and the primary health care providers. For those patients living more than 45 minutes from the hospital we asked the primary health care providers to make this visit.

The need for further rehabilitation was subsequently defined in a telephone conversation. The mobile team then established a service and support system for the patient allowing him or her to return home as soon as possible and to continue the necessary training and rehabilitation at home, in a day clinic or both. On the day of discharge, a meeting was organized with the patient and their family, the physician and the mobile stroke team member. The aim of the meeting was to jointly define the plans for further follow-up care. The definite day of discharge was decided in collaboration with the mobile team, the patient and their family.

For patients with extensive deficits after a stroke who needed help and support 24 hours a day, plans for further inpatient rehabilitation in a rehabilitation clinic were made following the protocol of the already existing extended service.[8]

During the first four weeks after discharge the mobile team acted as a safety net for the patient, and kept in contact both by telephone and by at least one other home visit to ensure the functioning of follow-up care. This period of close follow-up by the mobile team terminated with an outpatient consultation for those patients living 30–45 minutes radius from the hospital. A consultation was conducted in the patient's home for those patients living further from the hospital. The physician responsible for the patient's treatment during the acute hospital stay, the mobile team member, the patient and, if possible, the family participated in this visit.

When a group of patients was identified within the same community, the mobile team invited them and their families to a local meeting. The aim of this meeting was to give general information about acute and chronic issues of stroke care, as well as to give the patients an opportunity to share their experiences.

The main points in the extended stroke unit service are summarized in Figure 1. The Regional Committee on Medical Research Ethics evaluated the study protocol and approved the trial.

Evaluation

All patients were followed up at 6, 26 and 52 weeks after onset of stroke. A range of standardized outcome measures were used to assess disability and handicap. Modified Rankin Scale (mRS) was used to measure disability. Patients with an mRS score ≤ 2 were classified as independent in activities of daily living (ADL).[16,17] The Barthel Index (BI), maximum score of 100, was also used to measure disability. According to the Barthel Index the patients were categorized as independent (BI ≥ 95) versus dependent (BI < 95) or death.[17–19] Nottingham Health Profile (NHP) was used to assess subjective health status across six domains: energy, pain, emotion, sleep, social isolation, and physical mobility. The maximum score within each domain is 100 with a high score indicating poor health status. In addition we calculated the global score where higher

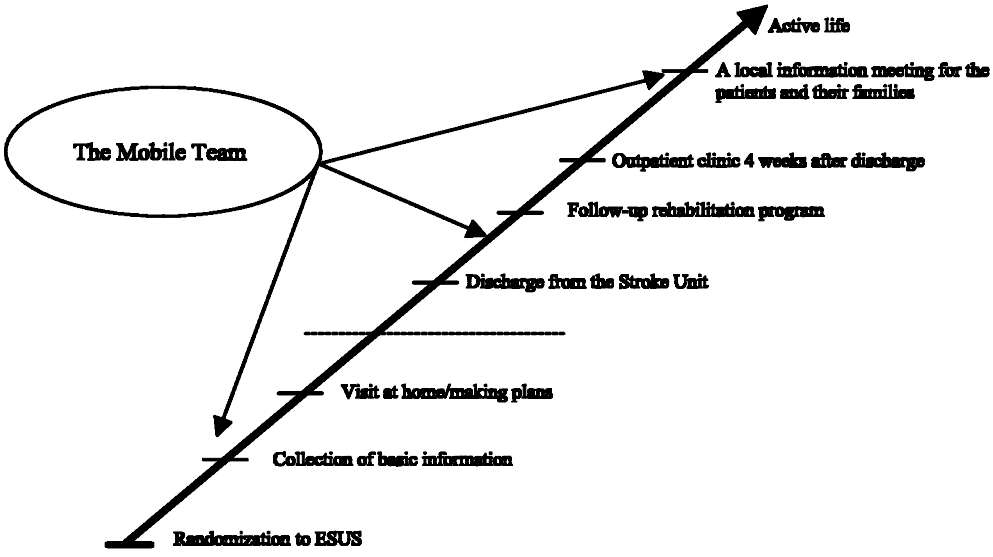

Figure 1 Main points in the extended stroke unit service from randomization until the patient returns to an active life.

score denotes higher health status.[20] Caregiver Strain Index (CSI) is a 13-item index developed to measure the burden of the patient's illness on the caregiver. The relative or person nearest to the patient was defined as the caregiver and asked to complete the form. The total score ranges from 13 to 26. High score indicates a low level of burden.[21] Mortality was registered and death reports were sent to us from the Registry Office. Initial length of stay in the hospital (stroke unit) and total length of stay in an institution (stroke unit plus rehabilitation clinics) including readmission to a rehabilitation clinic during the 52 weeks were registered.

The primary outcome was mRS scores 52 weeks after onset of stroke. Secondary outcomes were mRS scores at 6 and 26 weeks after onset of stroke as well as BI, NHP scores and CSI at 6, 26 and 52 weeks after onset of stroke.

Statistical analysis

At baseline, group homogeneity was analysed with the Fisher's exact test for sex, medical history, living conditions, diagnosis and home community. Age and severity of stroke according to Scandinavian Stroke Scale were analysed with the Mann–Whitney U-test. The difference in BI and mRS scores assessed within 24 hours after randomization was also analysed with the Mann–Whitney U-test.

In all analyses on the categorized mRS and BI, intention to treat analysis was applied and a p-value < 0.05 was considered significant. For those who withdrew from the study, the assessment of mRS and BI were performed using all available information. All patients participated in at least one assessment. Combining the results of this assessment with information from readmission to the hospital, it was possible to categorize the patients' functional level. Differences between the groups in the proportion of patients independent and deceased was compared by the Fisher's exact test. The confidence intervals have been computed by StatXact5,[22] using the exact method proposed by Chan and Zhang.[23]

On the NHP, CSI and average BI score all available cases were analysed.[24] There was no significant difference in missing documentation between the two groups. The NHP, CSI, average BI score and length of stay were compared by the Mann–Whitney U-test. The confidence intervals on average BI score have been computed using Student's t confidence interval for difference between the two groups while the confidence intervals on length of stay have been computed using Hodges–Lehman confidence interval for differences.

Multiple logistic regression was used to obtain a more precise estimate of the primary outcome

adjusting for potential confounders.[25] SSS, age and living conditions are known to be strong predictors for outcome after stroke.[26] We wanted to adjust for these variables in the model. Age was dichotomized at the median, SSS scores were put in the model as a continuous variable, and living condition was categorized as living alone or not.

Results

Table 1 shows the baseline characteristics of the two groups. There were no significant differences between the groups for any characteristics.

Figure 2 shows the flow of patients through the study and the reason for exclusion. In all, 89 patients with acute stroke from the three communities were admitted to the stroke unit at the University Hospital of Trondheim, between 1 June 1999 and 15 June 2001. Sixty-two subjects were included in the study and 31 patients were randomly allocated to the extended service group and 31 patients to the ordinary service group. At the six-week follow-up evaluation two patients had died in the extended service group. Causes of death were stroke progression ($n = 1$) and new stroke ($n = 1$). Two patients in the extended service group failed to report the NHP score because of illness at that time. One patient had died (for unknown reason) and one patient wanted to withdraw from the study in the ordinary service group at that time. At the 26-week follow-up evaluation six more patients had died in the extended service group. Causes of death were myocardial infarction ($n = 1$), cerebral haemorrhage ($n = 2$), hepatic failure ($n = 1$) and unknown reason ($n = 2$). One patient was not followed with the NHP score because of illness, and one caregiver was not followed with the CSI for unknown reason. In the ordinary service group another patient wanted to withdraw from the study at that time and five

Table 1 Baseline characteristics of patients allocated to ESUS and OSUS

	ESUS (n = 31)	OSUS (n = 31)
Age, mean/median	76.9/77.0	76.3/76.0
Sex, number (%) male	16 (51.6)	17 (54.8)
Living alone, number (%)	11 (35.5)	15 (48.4)
Diagnosis, number (%)		
Nonembolic infarction	18 (58.1)	20 (64.5)
Embolic infarction	5 (16.1)	8 (25.8)
Haemorrhage	7 (22.6)	3 (9.7)
Transient ischaemic attack	1 (3.2)	0 (0.0)
Medical history, number (%)		
Transient ischaemic attack	6 (19.4)	2 (6.5)
Stroke	2 (6.5)	1 (3.2)
Myocardial infarction	5 (16.1)	7 (22.6)
Atrial fibrillation	3 (9.7)	8 (25.8)
Hypertension	3 (9.7)	10 (32.3)
Diabetes	1 (3.2)	5 (16.1)
Functional states		
Scandinavian Stroke Scale, mean/median	45.4/46.0	41.5/46.0
Barthel Index, mean/median	57.7/55.0	54.0/55.0
Rankin Scale, mean/median	3.7/4.0	3.5/4.0
Allocated from, number (%)		
Malvik	12 (38.7)	10 (32.3)
Melhus	16 (51.6)	17 (54.8)
Klæbu	3 (9.7)	4 (12.9)

ESUS, extended stroke unit service; OSUS, ordinary stroke unit service.

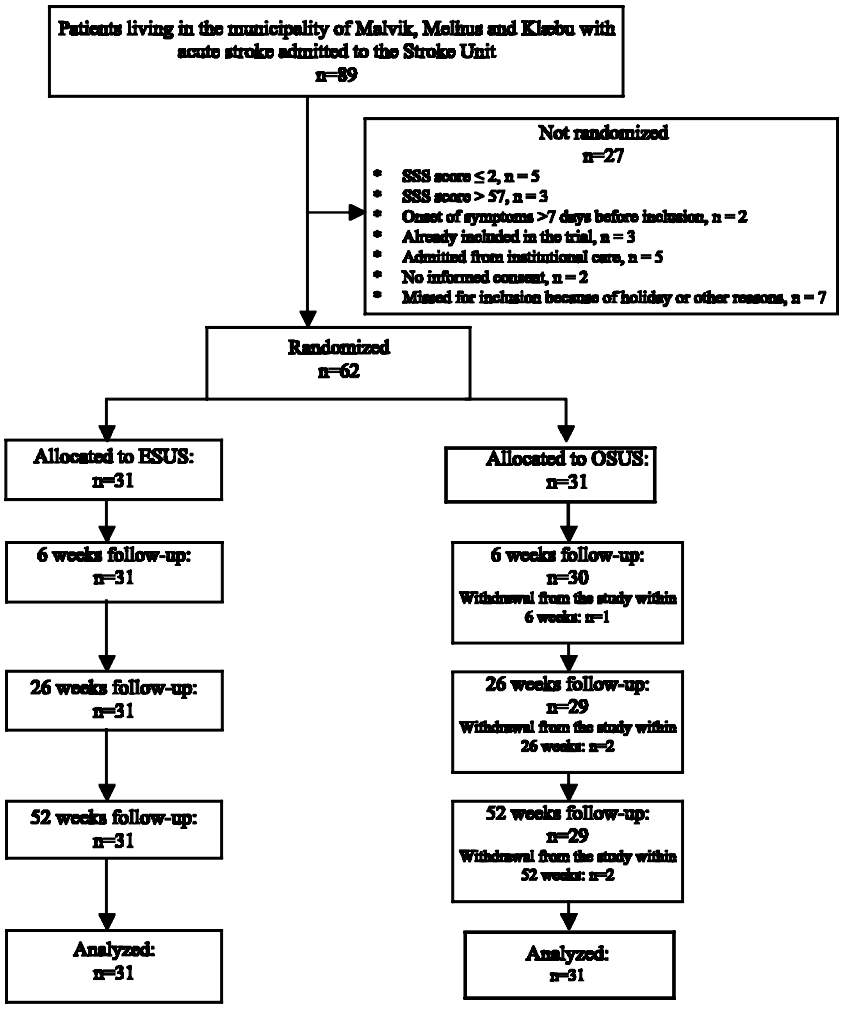

Figure 2 Flow chart of patient randomization and follow-up. ESUS, extended stroke unit service; OSUS, ordinary stroke unit service.

caregivers failed to report the CSI for unknown reasons. At the 52-week follow up evaluation, four more patients had died in the ordinary service group. Causes of death were cerebral haemorrhage ($n = 1$), sudden death during surgery ($n = 1$) and for unknown reasons in a nursing home ($n = 2$). Three caregivers were not followed with the CSI for unknown reasons in the ordinary service group at that time.

Those patients readmitted to the stroke unit were followed according to the protocol.

The primary outcome, mRS after 52 weeks, is presented in Table 2. Twelve patients (38.7%) treated in the extended service group and 16 patients (51.6%) treated in the ordinary service group were independent according to mRS at 52 weeks ($p = 0.444$). In the multiple logistic regression model, only age and SSS remained significant among the potential confounders. In this model, the odds ratio (95% confidence interval) for good outcome (extended service versus ordinary service) on mRS 52 weeks post stroke was 0.33 (0.088–

Table 2 Modified Rankin Scale and Barthel Index assessed at 6, 26 and 52 weeks after stroke

	ESUS	OSUS	*p-value*	95% CI for difference between two groups
Six weeks post stroke				
mRS ≤ 2, number (%)	(n = 31)	(n = 31)		
BI ≥ 95, number (%)	16 (51.6)	16 (51.6)	1.000	− 0.26 to 0.26
	13 (41.9)	14 (45.2)	1.000	− 0.28 to 0.22
BI, mean (SD)	(n = 29)	(n = 29)		
	75.2 (30.6)	74.0 (31.2)	0.769	− 15.1 to 17.5
26 weeks post stroke				
mRS ≤ 2, number (%)	(n = 31)	(n = 31)		
BI ≥ 95, number (%)	13 (41.9)	16 (51.6)	0.611	− 0.35 to 0.16
	11 (35.5)	14 (45.2)	0.605	− 0.34 to 0.15
BI, mean (SD)	(n = 23)	(n = 28)		
	75.0 (32.9)	77.7 (27.6)	0.914	− 20.0 to 14.7
52 weeks post stroke				
mRS ≤ 2, number (%)	(n = 31)	(n = 31)		
BI ≥ 95, number (%)	12 (38.7)	16 (51.6)	0.444	− 0.37 to 0.13
	11 (35.5)	15 (48.4)	0.440	− 0.37 to 0.12
BI, mean (SD)	(n = 23)	(n = 25)		
	71.7 (34.7)	79.0 (28.7)	0.450	− 25.9 to 11.4

ESUS, extended stroke unit service; OSUS, ordinary stroke unit service; CI, confidence interval; mRS, Modified Rankin Scale; BI, Barthel Index.

1.234), $p = 0.099$, indicating a trend towards better outcome in the ordinary service group. The number of patients independent in ADL, defined as BI score ≥ 95 after 52 weeks, were 11 (35.5%) in the extended service group versus 15 (48.4%) in the ordinary service group ($p = 0.440$). There were no significant differences in mean BI score at any time.

The quality of life and caregiver burden outcomes are presented in Table 3. There are no significant differences between the two groups for any of the six dimensions of the NHP at 6 or 52 week follow-up, but a significant difference in favour of the extended service group in the dimension social isolation ($p = 0.046$) at 26 weeks. Since tests on several secondary outcomes are performed, $p = 0.046$ on one of the tests is considered only as a trend. Apart from the dimension physical mobility at 26 weeks, the medians for the six dimensions in the extended service group are equal to or less than in the ordinary service group. CSI shows no difference between the two groups at any time during follow-up.

The mortality and length of stay is presented in Table 4. Eight patients died (25.8%) in the extended service group versus five patients (16.1%) in the ordinary service group ($p = 0.534$) within 52 weeks post stroke. The mean total length of stay in institution was 23.5 days in the extended service group versus 30.5 days in the ordinary service group. The median was 13 days in the extended service group versus 10 days in the ordinary service group ($p = 0.549$). There was no difference in mean initial length of stay in stroke unit between the two groups; 12.9 days in the extended service group versus 13.6 days in the ordinary service group ($p = 0.607$).

Discussion

To our knowledge this is the first early supported discharge trial conducted for patients living in a rural community in which both the intervention and the control arm received acute care in a stroke unit.

Independence according to mRS score showed no significant difference between the two groups 52 weeks after stroke, adjusting for age and SSS at inclusion, but there was a trend toward better

Table 3 Nottingham Health Profile and Caregiver Strain Index assessed at 6, 26 and 52 weeks after stroke

	ESUS	OSUS	*p-value*
Six weeks post stroke			
Nottingham Health Profile; median (IQR)	(n = 27)	(n = 29)	
Energy	24.0 (0.0–60.8)	24.0 (0.0–63.2)	0.638
Pain	0.0 (0.0–9.0)	0.0 (0.0–12.9)	0.444
Emotion	7.0 (0.0–17.6)	7.1 (0.0–19.3)	0.580
Sleep	0.0 (0.0–35.9)	12.6 (0.0–35.9)	0.695
Social	0.0 (0.0–22.0)	0.0 (0.0–22.5)	0.143
Physical	34.7 (10.6–57.8)	47.1 (0.0–78.7)	0.667
Global score, median (IQR)	81.6 (71.1–92.1)	76.3 (59.2–92.1)	0.440
Global score, mean (SD)	80.0 (15.3)	75.9 (18.3)	
Caregiver Strain Index	(n = 29)	(n = 29)	
Median (IQR)	26.0 (23.5–26.0)	24.0 (23.0–26.0)	0.107
Mean (SD)	24.5 (2.3)	23.5 (2.4)	
26 weeks post stroke			
Nottingham Health Profile; median (IQR)	(n = 22)	(n = 28)	
Energy	24.0 (0.0–24.0)	24.0 (0.0–63.2)	0.399
Pain	0.0 (0.0–6.6)	0.0 (0.0–9.73)	0.486
Emotion	0.0 (0.0–9.3)	7.2 (0.0–22.7)	0.132
Sleep	0.0 (0.0–23.4)	4.3 (0.0–23.4)	0.643
Social	0.0 (0.0–19.4)	11.0 (0.0–41.4)	0.046*
Physical	39.2 (0.0–70.8)	26.5 (0.0–76.0)	0.782
Global score, median (IQR)	81.6 (67.8–95.4)	76.3 (55.9–96.7)	0.206
Global score, mean (SD)	82.5 (13.7)	75.8 (19.5)	
Caregiver Strain Index	(n = 22)	(n = 23)	
Median (IQR)	26.0 (21.8–26.0)	26.0 (24.0–26.0)	0.429
Mean (SD)	24.2 (2.5)	25.0 (1.6)	
52 weeks after stroke			
Nottingham Health Profile; median (IQR)	(n = 23)	(n = 25)	
Energy	24.0 (0.0–60.8)	24.0 (12.0–62.0)	0.235
Pain	0.0 (0.0–10.0)	0.0 (0.0–2.9)	0.702
Emotion	0.0 (0.0–10.5)	0.0 (0.0–15.3)	0.899
Sleep	0.0 (0.0–16.1)	0.0 (0.0–23.4)	0.945
Social	0.0 (0.0–20.1)	0.0 (0.0–22.0)	0.969
Physical	43.4 (0.0–100.0)	54.6 (0.0–83.0)	0.416
Global score, median (IQR)	79.0 (68.4–97.4)	81.6 (68.4–96.1)	0.918
Global score, mean (SD)	79.8 (16.8)	79.8 (17.7)	
Caregiver Strain Index	(n = 23)	(n = 22)	
Median (IQR)	26.0 (23.0–26.0)	26.0 (24.0–26.0)	0.832
Mean (SD)	24.3 (2.7)	24.8 (1.9)	

ESUS, extended stroke unit service; OSUS, ordinary stroke unit service; IQR, interquartile range, SD, standard deviation.
*$p < 0.05$.

outcome in the ordinary service group. Both mRS at 26-week and BI at 26- and 52-week follow-up confirm these results. At six-week follow-up the proportion of patients who were independent according to both mRS and BI was the same in both groups. The intervention by the stroke team lasted for four weeks after discharge and was for most of the patients concluded at the six-week follow-up evaluation. Another Norwegian early supported discharge trial conducted for patients living in 20 different municipalities, some in rural areas, showed worse function for those patients discharged directly to home compared with those receiving hospital rehabilitation. A multidisciplin-

Table 4 Length of stay and mortality

	ESUS (n = 31)	OSUS (n = 31)	p-value	95% CI for difference between groups
Inpatient care, number of days				
Stroke unit, mean (SD)	12.9 (10.3)	13.6 (15.0)		
Stroke unit, median (range)	12.0 (2.0–52.0)	10.0 (1.0–77.0)	0.607	−3.0 to 4.0
Stroke unit and rehabilitation clinics, mean (SD)[a]	23.5 (30.5)	30.5 (44.8)		
Stroke unit and rehabilitation clinics, median (range)[a]	13.0 (3.0–141.0)	10.0 (1.0–199.0)	0.549	−5.0 to 7.0
Mortality, number (%)				
52 weeks post stroke	8 (25.8)	5 (16.1)	0.534	−0.11 to 0.31

ESUS, extended stroke unit service; OSUS, ordinary stroke unit service; CI, confidence interval; SD, standard deviation.
[a]Within 52 weeks.

ary team did not support the early discharge.[27] This makes the results difficult to compare.

The most comparable study according to the follow-up care is the Trondheim study, which has demonstrated improved functional outcome at both 6 and 26 weeks after stroke.[8] There are several possible reasons why our study does not support these findings. The Trondheim study included 320 patients from an urban area with circa 150 000 inhabitants. The current study drew upon three communities with a total of 31 000 inhabitants. The limitations imposed by the relatively small number of patients and also the study period were clear to us from the outset. The lack of statistical power due to a small sample size would make it unlikely to show significant differences. However we hoped to identify trends.

It appears that the difference between the extended service and the ordinary service was not as significant in the rural communities as in the city of Trondheim. This may be due to different structure of the local services. Alternatively, the sample size in the present study was to small to show the results obtained in the previous larger Trondheim trial.[8]It is likely that the trend toward worse function in the extended service group is due to chance and the small number of patients. The possibility exists that the extended service encourages greater dependency, although that appears unlikely because the extended service was beneficial in the Trondheim study.[8] We judge that the true effect of the extended service in this study is no difference in functional outcome between the two groups. This lack of difference in functional outcome is supported by five other early supported discharge trials.[2–6]

The low statistical power is the most important weakness of the study. The small sample size increases the risk of uneven distribution of confounders. Although we have adjusted for stroke severity and age in the regression model, we cannot be sure that we have taken into account all possible confounders in this study. Another weakness is the fact that we cannot control for the differences in the primary health care system in the three involved municipalities.

The strength of the study is the randomized controlled design with a blinded assessor. Another strength is that all patients, in both the extended service group and the ordinary service group, received optimal treatment in a stroke unit in the acute phase.[13] It is also a strength that 70% of the patients admitted to the stroke unit met the criteria for inclusion in the trial.

Clinical messages

An extended stroke unit service with early supported discharge for stroke patients living in a rural community:

- Does not seem to have beneficial effect on functional outcome.
- Might gives a trend toward better quality of life.

After 52 weeks there was no significant difference in mortality between the two groups. Eight patients (25.8%) died in the extended service group versus five patients (16.1%) in the ordinary service group, which is equal to or lower than earlier documented post-stroke mortality at one year.[13,28] We assessed the deaths during the study and could not find any association between the intervention and the causes of death.

Regarding the quality of life measure there is a significant difference between the two groups for the domain social isolation at 26 weeks in favour of the extended service. The aim of the stroke team was to co-ordinate the primary health care system and to secure the needs of the patient and their family. This could have ensured less social isolation in the extended service group than in the ordinary service group. At 52 weeks the social isolation had decreased in the ordinary service group and there was no significant difference between the groups. Our study may indicate a temporary benefit of quality of life for the patients in the extended service group. This result is supported by another study which found improved patient well-being in the early supported discharge group compared with conventional rehabilitation service group three months post stroke, however not at six months post stroke.[5]

There are no differences in CSI at any time. More patients in the ordinary service group were lost to follow-up regarding CSI but this probably had no influence on the test result. These results confirm that the caregivers did not experience any extra burden because of the intervention and that the mobile stroke team served the needs of both the patient and family during the four weeks of intervention. These results are supported by another study, which found that caregivers in an early supported discharge group scored consistently lower on burden than caregivers in the control group at one month and three months after onset of stroke.[29]

The Trondheim study demonstrated an average reduction of 12 days in total length of stay compared with traditional stroke unit care.[8] In the present study the average total length of stay was reduced by seven days in the extended service group. In our view this is a clinically important difference as well. However the median was three days higher in the extended service group, and the results are far from significant, which makes it difficult to draw a safe conclusion. It is also difficult to compare the length of stay in institutional care between our study and other studies, because length of stay in an institution has been quite differently defined. Other early supported discharge studies have a mean initial length of stay ranging from 14 to 34 days for the intervention group and 22–43 days for the control group.[2–4] The initial length of stay (stroke unit) in our control group were 13.6 days (versus 12.9 days in the extended service group, $p = 0.607$). In our study both the extended service group and the ordinary service group received the well-documented benefits of treatment in a stroke unit where all the patients are early discharged. A reduction in institutional care therefore has to be due to reduction in stay in rehabilitation clinics.

In conclusion, an extended stroke unit service with early supported discharge seems to have no positive effect on functional outcome for patients living in a rural community, but might gives a trend towards better quality of life. There were no significant differences in total length of stay.

Acknowledgements

The authors wish to thank Heidi Hammer (occupational therapist) and Anita Elvenes (nurse) for their enthusiastic work as members of the mobile stroke team. We are also grateful to our secretary Margareth Ibenfeldt for help in preparing the data.

References

1 Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke (Cochrane Review). In: *The Cochrane Library*, Issue 1, 2003. Oxford: Update Software.

2 Rudd AG, Wolfe CDA, Tilling K, Beech R. Randomized controlled trial to evaluate early discharge scheme for patients with stroke. *BMJ* 1997; **315**: 1039–44.

3 Rodgers H, Soutter J, Kaiser W *et al*. Early supported hospital discharge following acute stroke: pilot study results. *Clin Rehabil* 1997; **11**: 280–87.

4 Widén Holmquist L, von Koch L, Kostulas V *et al*. A randomized controlled trial of rehabilitation at

home after stroke in Southwest Stockholm. *Stroke* 1998; **29**: 591–97.
5 Bautz-Holter E, Sveen U, Rygh J, Rodgers H, Bruun Wyller T. Early supported discharge of patients with acute stroke: a randomized controlled trial. *Disabil Rehabil* 2002; **24**: 348–55.
6 Anderson C, Rubenach S, Ni Mhurchu C, Clark M, Spencer C, Winsor A. Home or hospital for stroke rehabilitation? Results of a randomized controlled trial. I: Health outcomes at 6 months. *Stroke* 2000; **31**: 1024–31.
7 Mayo NE, Wood-Dauphinee S, Côté R *et al*. There's no place like home. An evaluation of early supported discharge for stroke. *Stroke* 2000; **31**: 1016–23.
8 Indredavik B, Fjærtoft H, Ekeberg G, Løge A, Mørch B. Benefit of an extended stroke unit service with early supported discharge. A randomized, controlled trial. *Stroke* 2000; **31**: 2989–94.
9 Early Supported Discharge Trialists. Services for reducing duration of hospital care for acute stroke patients (Cochrane Review). In: *The Cochrane Library*, Issue 4, 2003. Chichester, John Wiley & Sons.
10 Anderson C, Ni Mhurchu C, Brown PM, Carter K. Stroke rehabilitation services to accelerate hospital discharge and provide home-based care. *Pharmacoeconomics* 2002; **20**: 537–52.
11 WHO MONICA Project. MONICA Manual, Part IV: Event Registration. Section 2: Stroke event registration data component (November 1990). Available from: http://www.ktl.fi/publications/monica/manual/part4/iv-2.htm, URN:NBN:fi-fe 19981155.
12 Lindstrøm E, Boysen G, Waage Christiansen L, Rogvittansen B, Würrtzen Nielsen P. Reliability of Scandinavian Neurological Stroke Scale. *Cerebrovasc Dis* 1991; **1**: 103–107.
13 Indredavik B, Bakke F, Solberg R, Rokseth R, Haaheim LL, Holme I. Benefit of a stroke unit: a randomized controlled trial. *Stroke* 1991; **22**: 1026–31.
14 Indredavik B, Slørdal SA, Bakke F, Rokseth R, Håheim LL. Stroke unit treatment. Long term effects. *Stroke* 1997; **28**: 1861–66.
15 Indredavik B, Bakke F, Slørdal SA, Rokseth R, Håheim LL. Stroke unit treatment. 10 year follow-up. *Stroke* 1999; **30**: 1524–27.
16 Rankin J. Cerebral vascular accidents in patients over the age of 60. 2. Prognosis. *Scot Med J* 1957; **2**: 118–23.
17 Sulter G, Steen C, De Keyser J. Use of the Barthel Index and Modified Rankin Scale in acute stroke trials. *Stroke* 1999; **30**: 1538–41.
18 Wolfe CD, Taub NA, Woodrow EJ, Burney PG. Assessment of scales of disability and handicap for stroke patients. *Stroke* 1991; **22**: 1242–44.
19 Rödén-Jülling Å, Britton M, Gustafson C, Fugl-Meyer A. Validation of four scales for the acute stage of stroke. *J Intern Med* 1994; **236**: 125–36.
20 O'Brien BJ, Buxton MJ, Ferguson BA. Measuring the effectiveness of heart transplant programmes: quality of life data and their relationship to survival analysis. *J Chronic Dis* 1987; **40**: 137S–153S.
21 Robinson BC. Validation of a Caregiver Strain Index. *J Gerontol* 1983; **38**: 344–48.
22 Mehta C, Patel N. *StatXact5*. CYTEL Software Corporation, 2001.
23 Chan ISF, Zhang Z. Test based exact confidence intervals for the difference of two binomial proportions. *Biometrics* 1999; **55**: 1201–209.
24 Fayers P, Machin D. *Quality of life: assessment, analysis and interpretation*. Chichester: John Wiley, 2001.
25 Kleinbaum DG, Klein M. *Logistic regression. A self-learning text*. New York: Springer-Verlag, 2002.
26 Jørgensen HS, Reith J, Nakayama H, Kammersgaard LP, Raaschou HO, Olsen TS. What determines good recovery in patients with the most severe strokes? The Copenhagen stroke study. *Stroke* 1999; **30**: 2008–12.
27 Rønning OM, Guldvog B. Outcome of subacute stroke rehabilitation. A randomized controlled trial. *Stroke* 1998; **29**: 779–84.
28 Rønning OM, Guldvog B. Stroke unit versus general medical wards, I: Twelve- and eighteen-month survival. A randomized, controlled trial. *Stroke* 1998; **29**: 58–62.
29 Teng J, Mayo NE, Latimer E *et al.* Costs and caregiver consequences of early supported discharge for stroke patients. *Stroke* 2003; **34**: 528–36.