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Follow-up services for stroke survivors after hospital discharge – a randomized control study

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Objective: To evaluate whether follow-up services for stroke survivors could improve functional outcome and reduce readmission rate. In this paper results of functional outcome are reported.
Design: Randomized controlled trial allocating patients to one of three different types of aftercare: (1) follow-up home visits by a physician, (2) physiotherapist instruction in the patient's home, or (3) standard aftercare.
Subjects: Stroke patients with persisting impairment and disability who, after completing inpatient rehabilitation, were discharged to their homes.
Outcome measures: Six months after discharge, functional outcome was assessed with Functional Quality of Movement, Barthel Index, Frenchay Activity Index and Index of Extended Activites of Daily Living.
Results: One-hundred and fifty-five stroke patients were included in the study. Fifty-four received follow-up home visits by a physician, 53 were given instructions by a physiotherapist in their home and 48 received standard aftercare only.

No statistically significant differences in functional outcome six months after discharge were demonstrated between the three groups. However, all measurements showed a tendency towards higher scores indicating better function in both interventions groups compared with the control group.
Conclusion: Follow-up services after stroke may be a way of improving functional outcome. The results of the present study should be evaluated in future trials. More research in this field is needed, especially studies of how to support stroke survivors to resume social and leisure activities.

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Introduction

Despite modern treatment and multidisciplinary rehabilitation in stroke units, about half of the stroke survivors are discharged with disabling sequelae often lasting for the rest of their lives. Clinical studies in the aftermath of stroke have described an array of persisting stroke consequences: impaired extremity function, speech problems, cognitive dysfunction, need of assistance with basic activities of daily living, and mobility problems such as difficulties in walking outside, climbing and descending stairs.[1,2] Furthermore, depression, social inactivity and isolation are often reported.[3–5] Several authors have emphasized the need for postdischarge support and counselling for these patients.[6–8] However, knowledge about how such services should be organized is sparse. We conducted a randomized trial to evaluate two new models of follow-up services for stroke survivors. Our hypothesis was that follow-up services could prevent functional decline and reduce readmission and institutionalization among community-dwelling disabled stroke survivors. We have previously published our results on readmission, showing that follow-up intervention seems to be a way of preventing readmission, especially for patients with long inpatient rehabilitation.[9] This article reports results of functional outcome six months after discharge.

Methods

Patients

Patients were recruited from rehabilitation wards (neurological, rheumatological and geriatric) at three hospitals within the Copenhagen Hospital Corporation from 1 February 1996 to 15 June 1998. All wards had well-coordinated and integrated multidisciplinary rehabilitation teams. Stroke patients were consecutively screened for eligibility at the end of inpatient rehabilitation. Patients were eligible if they had a diagnosis of acute stroke, defined by the WHO criteria,[10] and were to be discharged to their own home with impaired motor capacity (for details, see Table 1).

Baseline assessment

Baseline data, including demographics, data on stroke type and initial stroke severity were obtained from medical records. CT scans performed during admission were described by a specialist in neuroradiology. Functional state at discharge was assessed during the last two weeks of hospitalization. Neurological impairments at discharge (measured by the Scandinavian Stroke Scale,[11] the British Medical Research Council Muscle Strength Assessment,[12] and visual field) were assessed by the project physician. Mobility was tested by the project physiotherapists using a new measurement instrument: the Functional Quality of Movement Scale (FQM) developed for this study. Validation of FQM has confirmed that the instrument is valid, reliable and sensitive (unpublished data, paper in preparation). FQM contains two subscales: FQM-motor performance and FQM-quality of movement. FQM-motor performance measures the patient's ability to perform a given activity. FQM-quality of movement measures qualitative aspects of movement including unwanted motor reactions, degree of integration of the affected parts of the body, and control of the activity. Assessments of cognitive functions were carried out by research neuropsychologists testing nine cognitive domains (anosognosia, general cognitive function, memory, language function, visual and visuoconstructive function, neglect, executive function, speed, apraxia) using a detailed test battery.[13–15] Functional limitations were measured by the Barthel index.[16]

Table 1 Entry criteria for the patients to the study

Inclusion criteria		
	I.1	Admitted with acute stroke[a]
	I.2	Discharge planned to own home
	I.3	Impaired motor capacity[b]
Exclusion criteria		
	E.1	Communication not possible
	E.2	Other disease likely to shorten life dramatically
	E.3	Previously included in this study
	E.4	Participation in other clinical studies
	E.5	Lack of consent to participate in study

[a]Defined by the WHO criteria; patients with subarachnoid haemorrhage were not included.
[b]Scandinavian Stroke Scale score at discharge <58, subscore for arm, hand, leg ≤5 or subscore for gait ≤9; or British Medical Research Council Muscle Strength Assessment score ≤4+.

Immediately before discharge patients were randomized to receive one of three different types of aftercare: (1) follow-up home visits by a physician (INT1-HVP), (2) physiotherapist instruction in the patient's home (INT2-PI), or (3) standard aftercare (control). The local ethical committee approved the study.

Randomization

Before initiation of the study, each participant number was assigned to one of the three care groups: follow-up home visits by a physician (INT1-HVP), physiotherapist instruction in the patient's home (INT2-PI), or standard aftercare (control). Two secretaries, not involved in recruitment or patient selection, made the assignments by randomly drawing lots. The assignments were then stored in a central secretariat, and were not accessible to anyone on the research team until after the last six-month assessment was done. After informed consent was given, participants were registered in the secretariat and given consecutive participant numbers according to time of inclusion. At discharge allocation group assignment was derived from the central secretary. Once randomized, the patients were followed for the six-month period. The research team had no authority to withdraw patients from the study after randomization.

Interventions

Three types of aftercare were tested: two new types of organized aftercare (INT1-HVP and INT1-PI) and standard aftercare (control). The two new follow-up services (INT1-HVP and INT2-PI) were provided as a supplement to standard aftercare.

Intervention 1: Follow-up home visits by a physician (INT1-HVP)

The physician intervention consisted of three 1-hour home visits (at 2, 6 and 12 weeks after discharge). These visits focused on early detection and treatment of complications, maintenance of functional ability and psychological and social adjustment to a new life with stroke related disability. Each visit consisted of a discussion concerning actual health conditions, stroke-related symptoms, functional capacity including social activity and family function, and use of social services. A medical examination was performed if needed. On this basis, problems were identified, and the physician intervened to solve the problems. Intervention included medication, reference to other services, liaison between the patient and stroke services, and counselling. In addition patients and care-givers were provided with information on stroke, stroke rehabilitation, social services, benefits and stroke clubs. Patients were allowed the opportunity to contact the project physician by phone whenever they wished. The project physician was trained in geriatric rehabilitation including stroke rehabilitation.

Intervention 2: Physiotherapist instruction in the patient's home (INT2-PI)

Patients in this group received instruction and re-education by the hospital physiotherapist during a six-week period immediately after discharge. The visits took place in the patient's home; frequency was determined by the physiotherapist and was adjusted to the patient's needs. Each visit lasted approximately 1 hour. The average number of visits per patient was 2.9 (range 1–8). The physiotherapist evaluated a range of functions related to indoor and outdoor mobility and some basic activities of daily living. Problems were identified and the patient and the physiotherapist tested different strategies to solve the problems. Relatives and professional care-givers were instructed how to assist the patient in a way that allowed the patient to use his or her functional skills as best as possible. Instruction and education, not training, characterized the intervention.

Control group

The patients in the control group received standard aftercare including outpatient rehabilitation on ordination by a hospital physician or the general practitioner, and home care to compensate for disability. Standard aftercare did not include follow-up home visits.

Outcome assessment

Six months after discharge, patients reported to the outpatient clinic, where we assessed functional ability in terms of functional limitation and disability. Mobility was measured with the Functional Quality of Movement Scale, administered

by the project physiotherapists. Disability was measured with the Barthel Index, score from 0 to 100, the higher the score the more independent the patient; and the Frenchay Activity Index, score from 0 to 45, high score indicating high level of social activity.[17] These instruments were administered by the project physician and based on patient and care-giver interviews.

In addition, we used an instrument developed especially for this study: the Index of Extended Activities of Daily Living, which included a wide range of activities of daily living. The interview was administered by the research neuropsychologist who had no information about group allocation. On the basis of a Rasch Analysis addressing specifically the internal validity of the Index of Extended Activities of Daily Living (by addressing the homogeneity of items under different conditions) we identified four dimensions of functional ability.[18] The answers of the different ADL questions could be added up in four sumscales: mobility, personal daily care activities, domestic activities and leisure/social activities. The four sumscales are presented in the Appendix.

Statistical analysis

Group differences at baseline and at six months after discharge were tested using χ^2 for categorical variables, and ANOVA and the F-test for continuous, normally distributed variables. The level of significance was set to 0.05 and we used a two-sided p-value. In the initial outcome analysis all tested patients were included. In a subsequent analysis we only included patients who had not had a recurrence of stroke within the six-month period after discharge. All analyses were performed based on the intention-to-treat principle.

Results

Patients

A total of 866 patients were screened for eligibility. Two hundred and one patients fulfilled the entry criteria. Of these, 46 were excluded because of lack of consent to participate. The remaining 155 patients were randomized: 54 to Intervention 1: Follow-up home visits by a physician (INT1-HVP), 53 to Intervention 2: Physiotherapist instruction in the patient's home (INT2-PI), and 48 to standard aftercare. A total of 138 patients (89%) completed assessment of functional outcome at six months (five of these patients completed only parts of the test programme). For details of recruitment, see Figure 1.

Baseline characteristics for the randomized patients are shown in Table 2. Mean age was higher in the physiotherapist intervention group (INT2-PI) than in the two other groups. No other significant differences in baseline characteristics were found between the groups.

Functional outcome

Table 3 shows the results of the functional outcome assessment for the three randomization groups at six months after discharge. No statistically significant differences were demonstrated. However all used measurements showed a tendency towards higher scores, indicating better function, in both intervention groups compared with the control group. This tendency was most notable for functional quality of movement measured by FQM-quality of movement ($p = 0.111$) and for basic activities of daily living measured by Barthel Index ($p = 0.165$).

The mean Frenchay Activity Index score was low in all randomization groups, as was the mean score for all sumscales of the Index of Extended Activities of Daily Living, which indicates that the level of IADL and social activities was low in this group of disabled patients. When the two intervention groups were combined into one and compared with the control group the same insignificant tendency of better function in the intervention group than in the control group was seen (data not shown).

Three patients died within the six-month period after discharge (one in INT1-HVP and two in INT2-PI). Six patients (two in INT1-HVP, one in INT2-PI and three in the control group) had a recurrent stroke within the six-month period. When functional outcome for patients without recurrence of stroke was analysed, the same results of functional outcome were found as for the total group of patients (data not shown).

For the patients without recurrence of stroke we performed an analysis of the distribution of

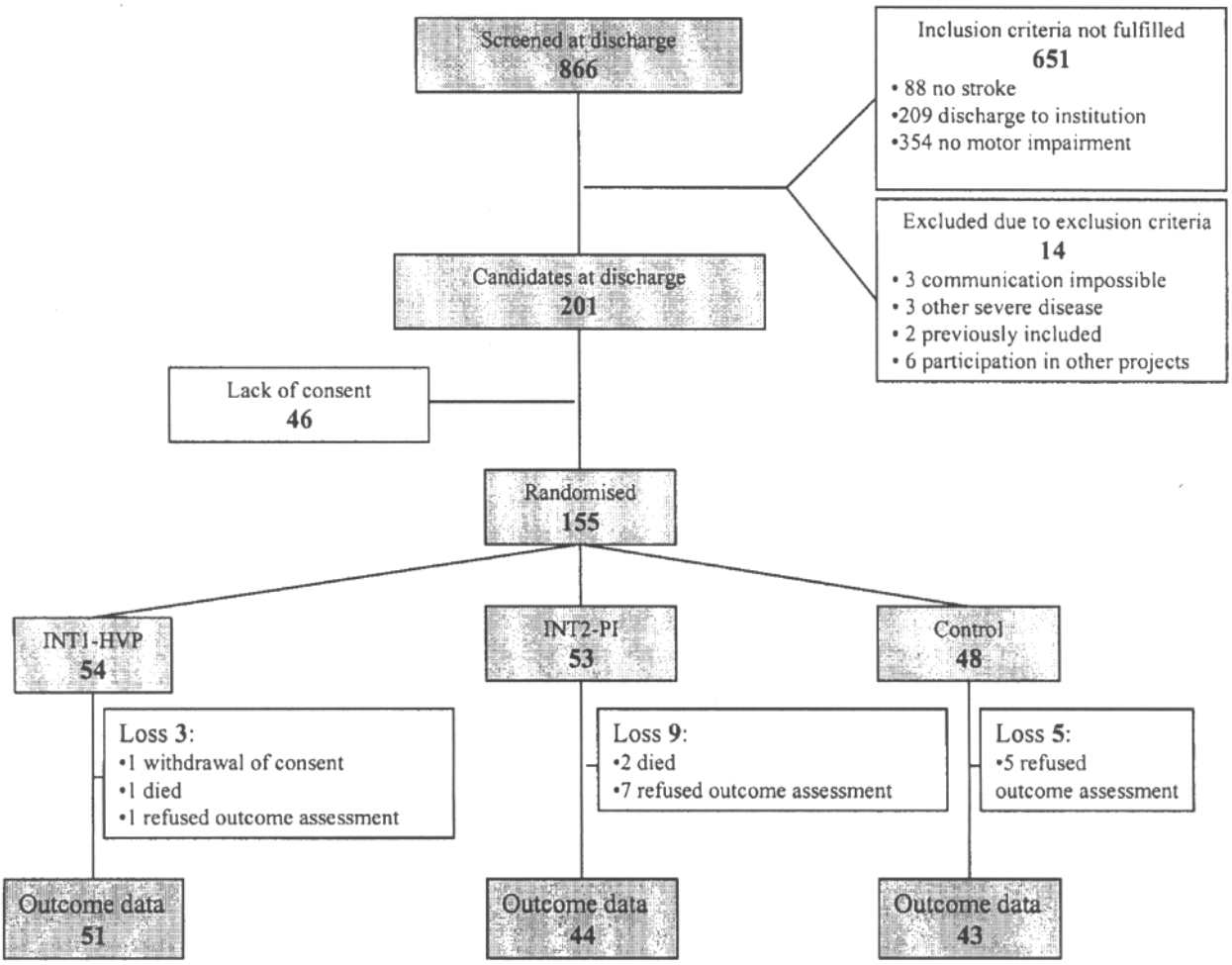

Figure 1 Flow chart for the study. INT1-HVP, Intervention 1 – Follow-up home visits by physician; INT2-PI, Intervention 2 – Physiotherapist instruction in the patient's home; Control, Standard aftercare.

patients who either improved, maintained or showed a decline in BI during the six-month period after discharge. A difference in BI greater than +5 was categorized as improvement, a difference at less than –5 as deterioration and a difference between –5 and +5 as unchanged function. The results are presented in Table 4. A total of 22 (17%) patients had a functional decline, whereas 109 (83%) maintained or improved in basic activities of daily living. No significant difference between the randomization groups was demonstrated ($p = 0.323$).

Discussion

In this randomized study we evaluated two different postdischarge follow-up services for stroke patients in comparison with a control group, who

Clinical messages

- Follow-up services for stroke survivors may be a way of improving functional outcome.
- Follow-up services for stroke survivors seem to prevent readmission.
- More research in follow-up services is needed.

Table 2 Baseline characteristics of patients in randomization groups

Characteristics		INT1-HVP (n = 54)	INT2-PI (n = 53)	Control (n = 48)
Gender, F/M		30/24	33/20	21/27
Age, years (mean ± SD)		69.8 ± 9.9	74.1 ± 11.4	68.3 ± 12.3*
Living alone		30	33	28
Medical history				
Previous stroke		11	8	9
Ischaemic heart disease		14	8	16*
Hypertension		13	22	14
Diabetes mellitus		11	6	9
Atrial fibrillation		7	4	8
Respiratory disorder		7	3	5
Rheumatic disorder		10	11	11
Alcohol abuse		6	4	10
Stroke severity				
Bamford classification[a]				
Total anterior circulation syndrome		11	7	6
Partial anterior circulation syndrome		19	24	18
Lacunar syndrome		21	18	20
Posterior circulation syndrome		2	4	3
CT scan[b]				
Lesion type	Haemorrhage	7	7	6
	Infarction	28	37	28
	No lesion	12	6	8
Lesion size[c]	<1.5 cm	10	18	9
	1.5–2 cm	9	8	6
	>2 cm	16	18	19
Localization[c]	Hemisphere left/right	19/14	15/24	15/17
	Cerebellum	1	0	1
	Brainstem	1	5	1
SSS at onset (mean ± SD)[a]		33.4 ± 11.7	35.6 ± 9.7	31.9 ± 13.3
BI at onset (mean ± SD)[a]		37.4 ± 26.6	36.7 ± 29.9	29.8 ± 22.8
Functional state at discharge				
SSS (mean ± SD)		47.7 ± 6.9	48.7 ± 6.1	46.9 ± 9.1
FQM–motor performance (mean ± SD)		21.7 ± 12.0	18.9 ± 12.2	18.0 ± 15.5
FQM–quality of movement (mean ± SD)		57.9 ± 31.6	57.4 ± 38.8	47.0 ± 39.3
BI (mean ± SD)		81.5 ± 19.0	80.6 ± 17.4	76.8 ± 23.7
Cognitive function				
Anosognosia		12	20	12
General reduction (dementia)		11	10	13
Impaired memory		25	21	18
Aphasia		12	12	10
Impaired visiospatial function		11	19	16
Neglect		3	9	4
Impaired executive function		20	18	14
Reduced speed		20	20	22
Apraxia		4	9	5
Hemianopia		9	7	8
Length of stay, days (mean/median)		87.6/76	83.0/74	98.3/88.5
Ongoing rehabilitation planned at discharge		42	31	32

Values are numbers of patients, unless stated otherwise.
INT1-HVP: Intervention 1 – Follow-up home visits by physician.
INT2-PI: Intervention 2 – Physiotherapist instruction in the patient's home.
Control: Standard aftercare.

*p-value <0.1 (age p = 0.026, ischaemic heart disease p = 0.099).
[a]Bamford classification available for 153 out of 155 patients; SSS score on admission available for 71 out of 155 patients; BI on admission available for 81 out of 155 patients.
[b]CT scan data available for 139 out of 155 patients.
[c]For 113 patients cerebral lesions were detected and described.

Table 3 Functional outcome of 138 patients six months after discharge

Outcome	INT1-HVP (n = 51)	INT2-PI (n = 44)	Control (n = 43)	p-value
FQM				
Motor performance	23.9 ± 11.9	22.5 ± 12.1	19.1 ± 14.3	0.188
Quality of movement	65.2 ± 36.2	72.9 ± 33.2	56.5 ± 38.1	0.111
BI	84.6 ± 19.0	85.7 ± 20.1	77.5 ± 25.9	0.165
FAI	13.4 ± 8.4	12.0 ± 7.8	10.9 ± 8.9	0.355
IEADL				
MOB-extended	5.8 ± 3.2	5.7 ± 3.1	5.5 ± 3.1	0.861
PDC-extended	7.7 ± 3.3	7.8 ± 3.4	6.8 ± 3.4	0.330
IADL-dom	3.1 ± 2.7	3.9 ± 2.9	2.8 ± 2.9	0.200
IADL-leisure/social	7.1 ± 3.0	6.7 ± 3.5	6.4 ± 3.9	0.569

Functional state values are mean ± SD.
INT1-HVP: Intervention 1 – Follow-up home visits by physician.
INT2-PI: Intervention 2 – Physiotherapist instruction in the patient's home.
Control: Standard aftercare.
FQM, Functional Quality of Movement Scale; BI, Barthel Index; FAI, Frenchay Activity Index; IEADL, Index of Extended Activities of Daily Living; MOB-extended, mobility; PDC-extended, personal daily care; IADL-dom, instrumental activities of daily living-domestic activities; IADL-leisure/social, instrumental activities of daily living-leisure/social activities.

Table 4 Deterioration during the six-month period after discharge

	Total	INT1-HVP	INT2-PI	Control
BI[a]				
Decline	22 (17)	6 (12)	6 (14)	10 (26)
Improvement	44 (34)	14 (29)	16 (37)	14 (36)
Unchanged	65 (49)	29 (59)	21 (49)	15 (38)
Died	3	1	2	0
Recurrence of stroke	6	2	1	3

Values are number of patients (% of total number).
INT1-HVP: Intervention 1 – Follow-up home visits by physician.
INT2-PI: Intervention 2 – Physiotherapist instruction in the patient's home.
Control: Standard aftercare.
[a]Functional improvement/decline of 131 patients without recurrence of stroke.

received standard aftercare. The new services had different approaches to the stroke patient's life situation after discharge. The physician intervention was aimed at early detection and intervention in relation to the occurrence of new diseases and functional problems as well as support in resuming social activity. On this background we had expected that the physician intervention could prevent decline in basic activities of daily living and increase social and leisure activities. For the physiotherapist intervention, which was directly aimed at maintenance of functional ability, an effect on functional outcome, especially in relation to basic activities of daily living, motor performance and functional quality of movement, was expected.

No statistically significant differences in functional outcome six months after discharge were demonstrated between the three groups. However, all measurements showed a tendency towards higher scores indicating better function in both intervention groups compared with the control group. The effect was most notable in relation to mobility and basic activities of daily living, whereas instrumental activities of daily living, social and leisure activities were less affected. The same statistically insignificant tendency of better outcome in the intervention groups was

found in the analysis of deterioration. No differences between the two intervention groups could be demonstrated. We have previously published our results on readmission, showing statistically lower readmission rates in the intervention groups.[9] These results may be seen as a support for the hypothesis that the trend regarding better functional outcome in the intervention groups in this study is real.

The study failed to reach statistical significance, which may have several explanations. First the study may have been under-powered. Power calculations were not made beforehand, due to lack of data on readmission rates among stroke patients, and due to the use of newly developed measurement scales. On the background on other studies of follow-up services in the rehabilitation field we planned to include 300 patients, but this was not obtainable within the time frame of the study.

Another possibility is that the interventions may have affected dimensions of functional ability other than those measured in the study, such as speed of activity and the safety of performing the activity. Moreover quality of life, care-giver stress and emotional function could have been effected, but these dimensions of functional ability were not measured in this study.

Analysis of subgroups of patients (e.g. patients with severe cognitive impairment) could possibly have shown effect of the interventions, but the study size was too small for subgroup analyses.

In relation to the patients regaining their social and leisure activities the time span from the beginning of the intervention to the outcome assessment may have been too short to register any effect of the intervention. It can also be argued that more permanent interventions are needed to change habits and to make patients more active. Stroke clubs and leisure activities for disabled people could possibly provide better means in this aspect, and perhaps care systems should be more aware of involving the patient in activities of daily living. Another explanation may be that the interventions in this study were not aimed at training and therefore were not very intensive in terms of frequency and duration (three visits in the physician group, mean 2.9 visits in the physiotherapist group).

Finally standard care, which for many of the patients included outpatient rehabilitation, home care, home nursing and daycare, may in fact be as effective in relation to maintenance and improvement of functional capacity as standard care plus the new follow-up interventions.

We have no reason to believe that bias caused serious problems of internal validity for the following reasons. The study was a randomized clinical trial in which the three groups were comparable at baseline. Outcomes were assessed blindly with the Index of Extended Activities of Daily Living. When blinding was not used (the Barthel Index, the Functional Quality of Movement Scale, and the Frenchay Activity Index), it was ensured that the tester had no access to previous test results. Outcome assessments were performed with internationally acknowledged measurements with documented reliability and validity, and with newly developed measurement instruments, which in this study have been validated and found to be valid, reliable and with high correlation to known instruments. A dropout analysis showed no significant difference in group allocation between patients assessed at six months and those not assessed.[18] Because follow-up intervention was given in addition to standard care after discharge, we have studied carefully the standard care applied at discharge for the different groups. No differences were found among the groups (data shown in a previous article[9]).

Clinical trials on outpatient physio- and occupational therapy following primary rehabilitation in hospital indicate that continued rehabilitation after discharge can improve functional ability of disabled stroke survivors.[19–22] Other studies evaluating interventions focused on aids, identification and intervention in relation to mobility problems and social activity have also demonstrated effects on dimensions of functional ability.[23–25] Studies of supportive follow-up services providing information, counselling and other forms of psychosocial support suggest an effect of this kind of intervention on quality of life and psychological well-being, and in some studies also an effect in relation to social activities.[26–31] We have previously reported our results on readmission indicating that follow-up intervention can be a way to prevent readmission after stroke.[9] No other stroke studies have evaluated follow-up

interventions aimed at early detection of late complications including functional decline. Effect of supportive follow-up services for disabled elderly patients discharged to independent living in the community has been found by researchers in the geriatric and cardiology rehabilitation field in terms of reduced rate of readmission, and less institutionalization.[32–36] However, none of these studies evaluated functional outcome.

In conclusion, there is some evidence that supportive follow-up services can be effective means to alleviate the consequences of stroke for stroke survivors and their families. This study did not demonstrate a statistically significant better functional ability among patients in the intervention groups than in the control group. As our study is a small size study the risk of type 2 error is considerable, and therefore our results should not be used to dismiss supportive follow-up interventions as effective means of maintenance and improvement of various dimensions of functional ability.

Inherent in focusing on functional outcome at the time of discharge and follow-up intervention after discharge is the inevitable problem of different discharge policies in different settings, which may limit the generalizability of our results. During our study period stroke units in our system discharged patients when neurological remission was decreasing and only minor further neurological improvement was expected, usually after relative long inpatient rehabilitation. This discharge policy explains the long inpatient rehabilitation period (mean length of stay 90 days) in our study population, which consisted of patients with severe and disabling strokes. The general tendency in these years towards earlier discharge implies that patients with even more severe impairment and disability are sent back to their homes for further outpatient rehabilitation. There is no reason to believe that these more disabled patients would be in less need of follow-up services.

In this light, future research should focus on follow-up services; what types are the most relevant and effective; how long they should continue; which strategies seem to stimulate patients to resume their social and leisure activities. These questions ought to be thoroughly investigated.

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References

1 Tennant A, Geddes JML, Fear J, Hillman M, Chamberlain MA. Outcome following stroke. *Disabil Rehabil* 1997; **19**: 278–84.
2 Kotila M, Waltimo O, Niemi M-L, Laaksonen R, Lempinen M. The profile of recovery from stroke and factors influencing outcome. *Stroke* 1984; **15**: 1039–44.
3 Kotila M, Numminen H, Waltimo O, Kaste M. Depression after stroke. *Stroke* 1998; **29**: 368–72.
4 King RB. Quality of life after stroke. *Stroke* 1996; **27**: 1467–72.
5 Åstrøm M, Adolfsson R, Asplund K. Major depression in stroke patients. A 3-year longitudinal study. *Stroke* 1993; **24**: 976–82.
6 Greveson G, James O. Improving long-term outcome after stroke – the views of patients and carers. *Health Trends* 1991; **23**: 161–62.
7 Wilkinson PR, Wolfe CD, Warburton FG *et al.* A long-term follow-up of stroke patients. *Stroke* 1997; **28**: 507–12.
8 Dijkerman HC, Wood VA, Hewer RL. Long-term outcome after discharge from a stroke rehabilitation unit. *J R Coll Physicians Lond* 1996; **30**: 538–46.
9 Andersen HE, Schultz-Larsen K, Kreiner S, Forchhammer HB, Eriksen K, Brown A. Can readmission after stroke be prevented? Results of a randomized clinical study: a postdischarge follow-up service for stroke survivors. *Stroke* 2000; **31**: 1038–45.

10 Hatano S. Experience from a multicentre stroke register: a preliminary report. *Bull World Health Organ* 1976; **54**: 541–53.
11 Lindenstrøm E, Boysen G, Christiansen LW, Rogvi-Hansen B, Nielsen PW. Reliability of Scandinavian Neurological Stroke Scale. *Cerebrovasc Dis* 1991; **1**: 103–107.
12 Wade DT. *Measurement in neurological rehabilitation*. Oxford: Oxford Medical Publications, 1992.
13 Waldemar G, Bruhn P, Schmidt E, Kristensen M, Lassen NA, Paulson OB. Cognitive profiles and regional cerebral blood flow patterns in dementia of the Alzheimer type. *Eur J Neurol* 1994; **1**: 81–89.
14 Folstein MF, Folstein SE, McHugh PR. 'Mini-Mental State': a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; **12**: 189–98.
15 Anderson SW, Tranel D. Awareness of disease states following cerebral infarction, dementia, and head trauma: standardized assessment. *Clin Neuropsychologist* 1989; **3**: 327–39.
16 Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Md State Med J* 1965; **14**: 61–65.
17 Wade D, Legh-Smith J, Hewer RL. Social activities after stroke: measurement and natural history using the Frenchay Activities Index. *Int Rehabil Med* 1985; **7**: 176–81.
18 Andersen, H. E. [Opfølgende indsats til apopleksipatienter efter udskrivelsen fra hospital. Lægefaglig intervention efter udskrivelsen. Et randomiseret interventionsstudie]. Postdischarge follow-up services for stroke survivors. Home visits by physician. A randomized clinical study. PhD thesis, University of Copenhagen, 2001.
19 Smith DS, Goldenberg E, Ashburn A *et al.* Remedial therapy after stroke: a randomized controlled trial. *BMJ* 1981; **282**: 517–20.
20 Duncan P, Richards L, Wallace D *et al.* A randomized, controlled pilot study of a home-based exercise program for individuals with mild and moderate stroke. *Stroke* 1998; **29**: 2055–60.
21 Werner RA, Kessler S. Effectiveness of an intensive outpatient rehabilitation program for postacute stroke patients. *Am J Phys Med Rehabil* 1996; **75**: 114–20.
22 Walker MF, Drummond A, Lincoln NB. Evaluation of dressing practice for stroke patients after discharge from hospital: a cross-over design study. *Clin Rehabil* 1996; **10**: 23–32.
23 Logan PA, Ahern J, Gladman JR, Lincoln NB. A randomized controlled trial of enhanced Social Service occupational therapy for stroke patients. *Clin Rehabil* 1997; **11**: 107–13.
24 Wade DT, Collen FM, Robb GF, Warlow CP. Physiotherapy intervention late after stroke and mobility. *BMJ* 1992; **304**: 609–13.
25 Drummond A, Walker MF. A randomized controlled trial of leisure rehabilitation after stroke. *Clin Rehabil* 1995; **9**: 283–90.
26 Morrison VL, Johnston M, MacWalther PS, Pollard BS. Improving emotional outcomes following acute stroke: a preliminary evaluation of work-book based intervention. *Scot Med J* 1998; **43**: 52–53.
27 Mant J, Carter J, Wade DT, Winner S. The impact of an information pack on patients with stroke and their carers: a randomized controlled trial. *Clin Rehabil* 1998; **12**: 465–76.
28 Evans RL, Matlock AL, Bishop DS, Stranahan S, Pederson C. Family intervention after stroke: Does counselling or education help? *Stroke* 1988; **19**: 1243–49.
29 Dennis M, O'Rourke S, Slattery J, Staniforth T, Warlow C. Evaluation of a stroke family care worker: results of a randomised controlled trial. *BMJ* 1997; **314**: 1071–76.
30 Forster A, Young J. Specialist nurse support for patients with stroke in the community: a randomised controlled trial. *BMJ* 1996; **312**: 1642–46.
31 Geddes JML, Chamberlain MA. Improving social outcome after stroke: an evaluation of the volunteer stroke scheme. *Clin Rehabil* 1994; **8**: 116–26.
32 Townsend J, Piper M, Frank AO, Dyer S, North WR, Meade TW. Reduction in hospital readmission stay of elderly patients by a community based hospital discharge scheme: a randomised controlled trial. *BMJ* 1988; **297**: 544–47.
33 Martin F, Oyewole A, Moloney A. A randomized controlled trial of a high support hospital discharge team for elderly people. *Age Ageing* 1994; **23**: 228–34.
34 Hansen FR, Poulsen H, Sørensen KH. A model of regular geriatric follow-up by home visits to selected patients discharged from a geriatric ward: a randomized controlled trial. *Aging Clin Exp Res* 1995; **7**: 202–206.
35 Frasure-Smith N, Prince R. Long-term follow-up of the ischemic heart disease life stress monitoring program. *Psychosom Med* 1989; **51**: 485–513.
36 Stewart S, Vandenbroek AJ, Pearson S, Horowitz JD. Prolonged beneficial effects of a home-based intervention on unplanned readmissions and mortality among patients with congestive heart failure. *Arch Intern Med* 1999; **159**: 257–61.

Appendix – The four sumscales of functional ability within the extended ADL interview

MOB-extended

Mobility function
(score range 0–10)
Transfer (getting out of bed)
Walking indoors
Managing stairs
Walking outdoors in fine weather
Walking outdoors in poor weather
Doing shopping (light)
Doing all shopping
Walking outside, longer distances
Using public transportation
Bicycling

PDC-extended

Personal daily care activities
(score range 0–11)
Washing upper half of the body
Washing lower half of the body
Washing feet
Bathing
Going to the toilet
Cutting fingernails
Cutting toenails
Dressing upper half of the body
Dressing lower half of the body
Putting on stockings
Putting on shoes

IADL-dom

Instrumental activities of daily living-domestic
(score range 0–8)
Washing clothes (by hand)
Washing clothes (washing machine)
Ironing clothes
Watering flowers
Making the bed
Vacuum-cleaning
Washing floor
Cleaning the bathroom

IADL-leisure/social

Instrumental activities of daily living-leisure/social
(score range 0–14)
Cooking warm meal
Preparing lunch or breakfast
Cooking for guests
Washing dishes
Drying the dishes
Doing gymnastics in club
Reading books
Reading newspapers
Spending time on a hobby
Visiting family and friends
Inviting family and friends
Theatre or cinema visit
Been dancing
Been on trips/outings

The Index of Extended Activities of Daily Living measures functional ability including 43 different items of activities of daily living. It was administrated as an interview. For items in three of the four subscales (MOB-extended, PDC-extended and IADL-dom) we asked 'Did you within the last 14 days undertake this activity independently?' For items in subscale IADL-social/leisure we asked: 'Did you within the last month undertake this activity?' The statistical analysis was corrected for the fact that some items were not relevant for some of the patients. Each item was scored 1 for yes to undertaking the activity, and 0 for no. A detailed manual for scoring was made for each item.