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IS EARLY HOSPITAL DISCHARGE AFTER STROKE COMBINED WITH ASSESSMENT IN THE NURSING HOME SAFE AND ACCEPTABLE?

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Abstract: *Background:* A new stroke care model has been developed aiming at the early hospital discharge of stroke patients to a nursing home for systematic assessment with subsequent planning for rehabilitation. Our hypothesis was that this new model for stroke care improves the delivery of care without affecting quality of life, functional outcomes and satisfaction with care. *Design:* A non-randomised comparative trial. *Setting:* Two Dutch stroke services in the regions of Maastricht and Eindhoven. *Participants:* Acute stroke patients, over 18 years of age. *Intervention:* Hospital discharge of stroke patient within 5 days to a nursing home, followed by a systematic multidisciplinary assessment in a specialised nursing home assessment unit to determine the optimal rehabilitation track. Usual care consists of an average of 10 days of hospital care, followed by less extensive assessment. *Measurements:* The primary outcome measures were quality of life and activities of daily living. The primary and secondary outcomes - impairment, cognitive functioning, instrumental activities of daily life, mood, satisfaction with care, caregivers' strain, length of stay, and medical complications - were assessed using validated instruments. *Results:* 239 acute stroke patients participated in this study: 122 in the intervention and 117 in the control group. We did not succeed in implementing early discharge from hospital, although the systematic assessment in the nursing home was accomplished. No clinically relevant differences were found between the groups for functional outcomes, quality of life or satisfaction with care. In comparison with the control group, a trend towards reduction in length of nursing home stay was found in the intervention group. *Conclusion:* Although the new care model failed to implement early discharge, more stroke patients in the intervention group were assessed by a multidisciplinary team in a nursing home in comparison with the usual care group, where more patients were discharged home after their initial hospital stay.

Key words: Stroke, nursing home, functional outcomes.

Introduction

Strokes have a profound effect on a person's life and also present a large economic burden to society (1). Changes in the delivery of health care, driven by the need to optimise the delivery of care and reduce costs, have resulted in shorter hospital stays and a decrease in the number of acute care beds in hospitals (1). It is estimated that in the Netherlands the prevalence of strokes will rise until 2025 (2). Accordingly, managing the growing number of strokes demands creative solutions that will not have a negative impact on stroke outcomes.

Hospitalisation often leads to worsening of overall health condition by iatrogenic induced disability, therefore early hospital discharge is important, especially for the elderly (3). Early discharge from a hospital followed by assessment of stroke-induced disabilities and rehabilitation planning in a nursing home setting might be a solution for the Netherlands, where a considerable part of stroke rehabilitation for older stroke patients already takes place in nursing homes (4). Therefore the stroke service Maastricht Heuvelland introduced an innovative care model aimed at reducing hospital stays for stroke patients to 5 days, followed by assessment in a nursing home. A hospital stay of 5 days can be achieved, as shown earlier by Vos et al (5). The development and implementation of this care model are described elsewhere (6).

The positive effects of stroke unit care on the reduction of mortality, length of hospital stay and the number of long-term care admissions have been well-documented (7). Earlier studies on early supported discharge, with rehabilitation beginning in the acute phase continued with home-based rehabilitation, showed a decrease in the length of hospital stay and a reduction of institutional care, with no effect on outcomes such as activities of daily living, instrumental activities of daily life or cognitive functioning (8).

Results of other forms of stroke care organisation, including various types of home-based rehabilitation, have been inconclusive. A recent review showed little evidence of the effectiveness of these interventions on functional outcomes such as activities of daily living and quality of life in stroke (8).

In accordance with these findings, our hypothesis was that the new care model, consisting of early hospital discharge

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in combination with assessment and rehabilitation planning in a nursing home, may optimise care delivery and decrease the length of hospital stay even further, without negatively affecting functioning, quality of life or satisfaction with care.

We performed a non-randomised comparative study, consisting of an effect evaluation, an economic evaluation and a process evaluation. The innovative care model provided by the stroke service Maastricht Heuvelland, the intervention region, was compared to "care as usual" provided by the stroke service in the Eindhoven area. This paper describes the effect evaluation of the new care model on quality of life, functional outcomes, and satisfaction with care. To our knowledge, no study has addressed the effects of early discharge from hospital with subsequent assessment and rehabilitation planning in a nursing home on functional outcomes in stroke patients.

Methods

Patients

The patient population consisted of consecutive stroke patients admitted to hospital in both research regions during a period of 18 months. The diagnosis of stroke was made by a neurologist, and was based on the patient's history, physical examination and neuro-imaging. Patients were eligible to participate if they met the following inclusion criteria: over 18 years of age and fluent in Dutch. Exclusion criteria were: a life expectancy of less than a few days, a previous diagnosis of dementia, hospital discharge to home within a few days and occurrence of complications requiring prolonged hospital care. Each patient with a recurrent stroke during the study period, could be included only once: i.e. these patients were not asked to participate a second time. Detailed information about the research protocol is published elsewhere (9).

Intervention

The intervention involved a critical care pathway for stroke patients admitted to the academic hospital in Maastricht. In this care pathway, every stroke patient is admitted directly to the hospital stroke unit. In the emergency ward, acute diagnostic tests are performed. In case of a confirmed stroke, the patient will be admitted to the stroke unit of the hospital, where further diagnosis and treatment, including thrombolysis if indicated, are performed.

Subsequently, the care model consists of a strict discharge regime from the neurology ward of the academic hospital. All necessary tests and treatment in the hospital are planned to occur within 5 days after admission. Thereafter, in principle, all stroke patients, regardless of age, will be discharged to the stroke ward in the nursing home, where a comprehensive assessment takes place. Only patients who can be discharged home within 5 days after admission and those who are medically unstable will not be transferred from the hospital to the nursing home within 5 days. A skilled elderly care physician examines each patient immediately on arrival in the nursing home and initiates the assessment program. In this program, a multidisciplinary team consisting of a physiotherapist, occupational therapist, psychologist, speech therapist and trained nurses examines the patient, performing a structured assessment protocol. Following this assessment, the team meets within five days of the patient's admission to make recommendations for a rehabilitation program specifically tailored to the patient. After this multidisciplinary meeting, the patient and his family will be informed about the proposed rehabilitation track; if they approve, this track will be started.

There are three options for rehabilitation after the assessment in the nursing home.

1. Rehabilitation at home with home care and outpatient treatment provided by therapists from primary healthcare or day care rehabilitation in a hospital or nursing home
2. Inpatient rehabilitation in a specific nursing home rehabilitation ward
3. Inpatient rehabilitation in a specialised rehabilitation centre

Usual Care Group

In the Stroke Service Eindhoven, stroke patients are admitted to the stroke unit of the Catharina Hospital in Eindhoven, where diagnostic tests, treatment and observation take place. During the hospital stay a less extensive assessment is performed in order to determine the best suitable rehabilitation facility for the stable patient. A physiotherapist, an occupational therapist and trained nurses carry out the assessment; if necessary they are supported by a psychologist or a speech therapist.

On the basis of admission and discharge criteria formulated by various care providers, the patient can be discharged home, to a rehabilitation centre or to one of four nursing homes participating in the stroke service. The mean duration of the hospital stay in Eindhoven is 10 days (10). Consequently, the main differences in care arrangements between the experimental and the control region are the early hospital discharge and the structured multidisciplinary assessment in the nursing home in the intervention region.

Outcome Measures

The primary outcome measures were quality of life and activities of daily life (ADL). Quality of life was measured by means of the standard Dutch version of the European Quality of Life instrument (EQ-5D) (11), a validated general quality of life instrument frequently used, and ADL by means of the Barthel index (BI) (12), the most frequently used and validated instrument for measuring ADL in stroke research.

Secondary outcome measures were: instrumental activities of daily life (measured by means of the Frenchay Activity Index FAI) (13), handicap (Modified Rankin Scale MRS) (14), cognitive functioning (Mini Mental State Examination MMSE, Apraxia Test AT and Star Cancellation Test SCT) (15,16,17), anxiety and depression (Hospital Anxiety and Depression Scale HADS) (18), sickness specific quality of life (Stroke Adapted

Table 1
Overview of used measures in this study

Data	Time	Subject of assessment
Characteristics		
Age, gender, soci-economic status, risk factors, co-morbidity, stroke classification, stroke location	T0	Comparison at baseline
Length of stay		
Hospital	T0-T3	
Nursing home	T0-T3	
Primary outcome		
EuroQol	T2,T3	Health-related quality of life
Barthel Index	T0,T1,T2,T3	Activities of daily life
Secondary outcome		
SASIP-30	T2,T3	Stroke specific quality of life
FAI	T0,T3	Instrumental activities of daily life
MRS	T0,T1,T2,T3	Level of handicap
MMSE	T0,T3	Screening for cognitive dysfunction
AT	T0,T3	Measuring the degree of apraxia
SCT	T0,T3	Testing for neglect
HADS	T1,T3	Identifies anxiety and depression
CSI	T3	Caregivers strain
SASC-19	After every discharge	Satisfaction with care
Medical complications	T0-T2	

T0= within 1 week after stroke,T1= 1 month after stroke, T2= 3 months after stroke, T3= 6 months after stroke

Sickness Impact Profile 30 SA-SIP30) (19), satisfaction with care (Satisfaction with stroke care Questionnaire SASC-19) (20) and strain on caregivers (Caregivers' Strain Index CSI) (21). All these secondary measures are reliable and validated for use in stroke research. Other secondary outcome measures were length of hospital stay (LOS H), length of nursing home stay (LOS NH) and medical complications occurring within 3 months after stroke. The following diagnoses were regarded as medical complications: a new stroke, pneumonia, urinary tract infections, epileptic seizures, fractures, myocardial infarct, atrial fibrillation and heart failure. The data on medical complications were collected from patients' files.

In addition to the primary and secondary outcome measures, we assessed relevant background variables. The following personal characteristics were assessed: age, gender, socio-economic status, co-morbidity, risk factors, stroke location, stroke classification and stroke severity, as measured by the National Institute of Health Stroke Scale (NIHSS) (22). All background variables were measured within a week after the stroke (baseline).

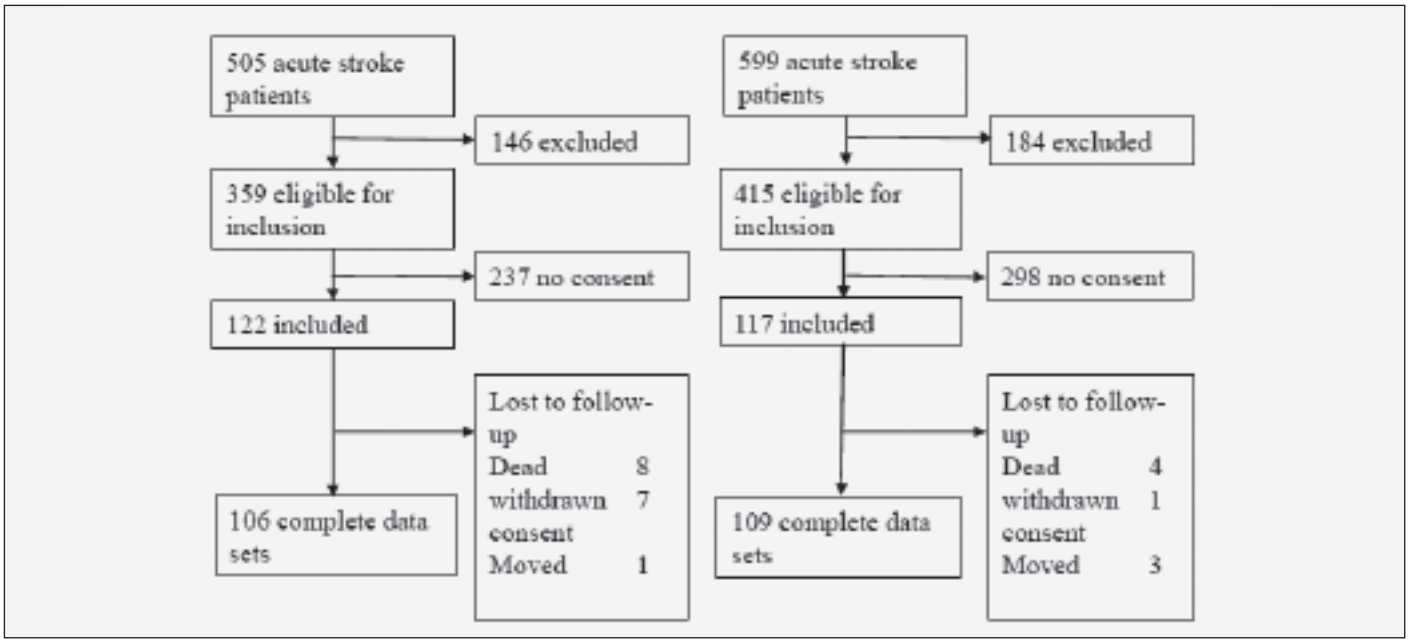
Patients were assessed by the researchers at baseline, 1 month, 3 months and 6 months after their stroke. Due to the non-randomised design of the study, the researchers weren't blinded to group assignment. An overview of the measures used and moments of assessment is shown in Table I.

The Medical Ethical Committee of the University of Maastricht approved the study. All patients gave their informed consent to take part in the study. The study was registered as: Current Controlled Trials ISRCTN58135104. Detailed information on the measurement instruments used is published elsewhere (9).

Sample Size

The total sample size planned was 139 participants per group (9). This included a 25% dropout rate, which means a remaining sample of 104 patients per group. Based on this number of participants and an independent samples t-test, a standardized effect size (Cohen's d) of 0.4 can be detected with 80% power and a significance level of 0.05. This effect size is classified as small (d = 0.2) to medium (d = 0.5) by Cohen (23) and corresponds to a mean difference of 0.1 on the EQ-5D with a within-group SD of 0.25, which was also found by others (24).

Figure 1
Trial Flow Chart



Statistical Analysis

Numerical and categorical variables were presented by mean (SD) and number (%), respectively. Baseline differences between the experimental and control region were examined using an independent samples t-test for numerical variables and a chi-square test for categorical variables. The longitudinal effects of the regions on primary and secondary outcomes were assessed using linear mixed models with an unstructured covariance structure for repeated measures. Region (intervention vs. control), time (time-points at which the outcome is measured, see Table I), time*region and variables related to the outcome (see Table II) were included as fixed factors. The restricted maximum likelihood estimation method was used. For CSI, SASC-19 and the number of medical complications, which were measured only once, linear regression analysis was used to test the region effect, where the abovementioned variables related to outcome were included as covariates. A p-value ≤ 0.05 was considered statistically significant. All analyses were performed with IBM SPSS for Windows (version 20.0 Armonk. NY:IBM Corp.).

Results

The trial flow chart (Figure 1) shows the flow of patients during the trial. Between May 2009, and July, 2011, 1104 stroke patients were identified who were admitted to one of the two hospitals participating in the trial. 146 patients (13%) were excluded from the intervention and 184 (17%) from the usual care group because they were not able to give their consent, did not speak Dutch fluently, had a recurrent stroke or were not living in the stroke care region. Of the remaining 774 patients, 122 (16%) in the intervention and 178 (23%) in the usual care group were not able to give consent within a week and 115 (15%) in the intervention and 120 (16%) in the usual care group refused to give their consent. Of the 239 patients participating, 1 (0.4%) in the intervention and 3 (1.3%) in the usual care group moved out of the stroke service area and 7 (3%) patients withdrew their consent in the intervention versus 1 (0.4%) in the usual care group. During the study 8 (3%) patients in the intervention group died in comparison with 4 (2%) in the usual care group.

Baseline characteristics

Table II summarizes the baseline characteristics, looking at the demographic and clinical features of both groups. Participants in the intervention group were significantly older (p= .049) more often had a lower education (p= 0.02), a lower BI (p= .020), or a higher SCT (p= .039).

The NIHSS was not systematically registered in the participating hospitals, resulting in insufficient NIHSS data for analysis.

Table III shows the estimated means (SE) or numbers (%) for primary and secondary outcomes, measured at baseline, 1, 3 and 6 months after stroke. As expected there were no significant differences between the intervention and usual care group in EQ-5D, SA-SIP30, BI, MMSE, AT, HADS, SASC, and CSI scores. Furthermore, there were no significant differences in length of nursing home stay, medical complications, hospital re-admittance or deaths between both groups. Unexpectedly, we also found no significant differences in length of hospital stay between both groups and

Table 2
Baseline characteristics of patients

Characteristic	Intervention Group (N=122)	Control Group (N=117)	P Value
Age, mean (SD)	74.1(13.1)	70.8(12.8)	.049
Gender, number (%) male/female	66/56(54.1/45.9)	75/42(64.1/35.9)	.116
Education, (%)			
Low	57(47.5)	35(30.4)	.021
Middle	43 (35.8)	50(43.5)	
High	20 (16.7)	30(26.1)	
Living alone (%)			
Yes/No	41/76(35.0/65.0)	40/75(34.8/65.2)	.967
Stroke classification (%)			
LACI	43(35.8)	47(44.8)	.333
TACI	16(13.3)	8(7.6)	
PACI	29(24.2)	22(21.0)	
POCI	21(17.5)	14(13.3)	
Haemorrhage	11(9.2)	14(13.3)	
Stroke location (%)			
Left	52(42.6)	45(39.5)	.886
Right	63(51.6)	62(54.4)	
Other	7(5.7)	7(6.1)	
Risk factors (%)			
Yes/No	98/23(81.0/19.0)	104/13(88.9/11.1)	.089
Comorbidity (%)			
Yes/No	79/42(65.3/34.7)	64/53(54.7/45.3)	.095
Thrombolysis (%)			
Yes/No	16/106(13.1/86.9)	23/89(20.5/79.5)	.088
Barthel Index, mean (SD)	13.9(6.0)	15.7((5.7)	.020
Frenchay Activities Index, mean (SD)	21.5(9.1)	23.4(7.9)	.081
Modified Rankin Scale,mean (SD)	2.4(1.5)	2.7(1.3)	.074
Mini Mental State Examination, mean (SD)	24.1(5.9)	25.2(5.8)	.126
Apraxia Test, mean (SD)	84.7(15.5)	87.0(10.5)	.205
Star Cancellation Test, mean (SD)	49.1(9.2)	45.3(14.7)	.039

Stroke classification; LACI: Lacunar Circulation Syndrome, TACI: Total Anterior Circulation Syndrome, PACI: Partial Anterior Circulation Syndrome, POCI: Posterior Circulation Syndrome; Barthel Index (range 0-20), Frenchay Activities Index (range 0-45), Modified Rankin Scale (range 0-5), Mini Mental State Examination (range 0-30), Apraxia Test (range 0-90), Star Cancellation Test (range 0-54); For MRS the lower the score the better the performance; For BI, FAI, MMSE, AT, SCT the higher the score the better the performance

a significantly lower FAI score at 6 months in the intervention group (mean 18.1, SE 1.46) in comparison with the control group (mean 20.4, SE 1.32,p = .040).

As expected, significantly more stroke patients were assessed in a nursing home in the intervention group (66%) in comparison with the usual care group (25%). There were also significant differences in the number of patients who were discharged home, directly after their hospital stay, (23% in intervention group versus 68% in control group). Admission to a rehabilitation centre was not significantly different between both groups, (11% in intervention group versus 7% in the control group).

Table 3
Estimated means (SE) or number (%) of outcome at baseline, 1, 3 and 6 months adjusted for baseline characteristics

	Baseline		1 month		3 months		6 months		P Value
	I	C	I	C	I	C	I	C	
Euroqol index					0.75(0.04)	0.77(0.04)	0.80(0.04)	0.79(0.04)	.414
Euroqol vas					70.5(2.72)	74.6(2.66)	72.8(2.46)	76.7(2.42)	.938
BI	15.2(0.71)	16.2(0.68)	16.3(0.66)	17.7(0.63)	17.0(0.60)	18.4(0.58)	17.2(0.63)	18.6(0.60)	.737
MRS	1.7(0.13)	2.4(0.13)	1.4(0.15)	2.1(0.14)	1.3(0.14)	2.0(0.14)	1.3(0.16)	1.9(0.16)	.826
SA-SIP30					8.0(0.90)	7.3(0.82)	8.2(0.94)	6.9(0.86)	.479
FAI	25.6(1.34)	25.3(1.22)					18.1(1.47)	20.4(1.33)	.040
MMSE	25.4(0.73)	25.0(0.67)					26.0(0.77)	26.5(0.69)	.185
Apraxia Test	86.0(1.65)	87.6(1.54)					88.1(1.56)	88.7(1.43)	.416
SCT	50.4(1.48)	46.5(1.39)					51.9(1.20)	50.6(1.08)	.071
HADS A			4.8(0.86)	4.4(0.84)			4.2(0.84)	4.3(0.75)	.508
HADS D			6.5(0.78)	5.0(0.70)			6.4(0.78)	4.3(0.69)	.434
CSI							5.5(0.77)	4.5(0.69)	.192
LOS H (days)							9.5(1.06)	9.1(0.95)	.717
LOS NH (days)							64.8(16.0)	73.1(16.3)	.635
SASC-19									
Hospital							17.1(0.83)	17.6(0.76)	.531
NursingHome							15.4(0.77)	17.1(1.11)	.149
Rehab.Center							17.1(1.38)	17.2(1.38)	.921
Home							18.6(1.26)	17.2(1.09)	.210
Discharge home (%)	29(24)	80(68)							
Medical Complications <3 months (%)							24(20.2)	35(30.4)	.071
Hospital Readmittance<6months (%)							12/121(9.9)	10/115(8.7)	.747
Death < 6 months (%)							8(6.6)	4(3.5)	.287

I= intervention group C= usual care group; SASIP-30 (range 0-30), Barthel Index (range 0-20), Frenchay Activities Index (range 0-45), Modified Rankin Scale (range 0-5), Mini Mental State Examination (range 0-30), Apraxia Test (range 0-90), Star Cancellation Test (range 0-54), Hospital Anxiety and Depression Scale (range 0-21) Caregiver Strain Index (range 0-13); For SASIP,HADS,MRS,CSI the lower the score the better the performance; For BI, FAI, MMSE, AT, SCT the higher the score the better the performance

Discussion

This study, in accordance with earlier studies (8), showed no clinically relevant differences in functional outcomes, quality of life or satisfaction with stroke care between two types of care delivery for acute stroke patients. Neither the EQ-5D index nor the EQ-5D visual analogue scale showed significant differences between the two groups over time. It can be concluded that the generic quality of life experienced by both groups is similar. A more stroke-specific quality of life instrument, the SASIP-30 also failed to show significant differences between the two groups.

Furthermore, the aim of the intervention, namely early discharge of patients from hospital to a nursing home within five days after stroke, has not been achieved. We found that the mean duration of hospital stay was comparable in both groups and the length of stay in the nursing home in the intervention group was on average 8.3 days shorter. Although there were no differences in the length of hospital stay between both groups, in the intervention group significantly more patients were admitted to the nursing home than in the control group (66% in comparison with 25%), where significantly more stroke patients were discharged home after their initial hospital stay (68% compared to 24%).

Accordingly, one can conclude that the assessment in the nursing home was implemented considerably well, although with a delay of about 5 hospital days. A previous study on the effects of early hospital discharge combined with assessment and rehabilitation planning in a nursing home was done shortly after implementation of the current intervention in the

Maastricht Heuvelland stroke service (5). This study, in the same hospital and same stroke service demonstrated a decrease in hospital stay from 12 to 7.3 days. Why this initial decrease in hospital stay was not maintained is unclear, but we will reflect on some possible causes later in the discussion.

The small but significantly better FAI score at 6 months, in the usual care group, could be explained by the fact that in this group more patients were discharged home directly after their hospital stay. Being at home might affect the FAI in a positive way, as patients are forced to employ the skills measured by the FAI more often than are institutionalized patients. This effect has been described by other authors (25). It is also possible that this finding does not have clinical meaning, as a difference of less than 4 points on the FAI is regarded as clinically irrelevant (26), even though statistically significant.

Internationally, the mean duration of hospital stay after stroke (with early supported discharge) varies between 9.8 and 41.9 days (6). In 2008 in the Netherlands, the mean duration of hospital stay after stroke was 10.5 days (27). In this light, the intervention and usual care group perform somewhat better with 9.5 and 9.1 days of hospital stay respectively.

A possible explanation for the increase in duration of hospital stay found in our study in comparison with the previous study by Vos is clinical variation in stroke severity. The severity of stroke, as scored by the mean BI in our study, has been found to be a predictor for length of hospital stay (28). In the earlier study stroke severity was not measured. It can well be that during the limited inclusion period of this study, only 4 months, patients with less severe strokes were included, resulting in shorter hospital stays. In our study we found that the BI of stroke patients admitted to the hospital in the intervention group was significantly worse than that of stroke patients admitted to the hospital in the usual care group. However, when corrected for baseline differences, no significant differences were found.

Another explanation for not maintaining early discharge in the intervention region could be changes in hospital personnel; this could have led to unfamiliarity with the early discharge procedures and subsequently longer hospital stays for stroke patients. During the research period the stroke care coordinator in the intervention region resigned. This could also have contributed to not maintaining the initial results in reducing length of hospital stay. Furthermore, the early enthusiasm of the team right after implementation of the new structure may have eroded during the following years.

After controlling for baseline scores, the length of nursing home stay in the intervention group was 64.8 days compared to 73.1 days in the control group. The average nursing home stay for stroke rehabilitation in the Netherlands is 69 days (29). So again, both groups perform more or less in conformity with the national level. Although there was no significant difference between both groups, on average stroke patients in the intervention group were discharged 8.3 days earlier from the nursing home than were patients in the usual care group and 4.2 days earlier than average stroke patients in the Netherlands.

Study strengths and limitations

A strength of this study is the uniqueness of the care model investigated, with assessment and rehabilitation planning within a nursing home. Another strength of this study is the systemic and holistic manner in which stroke outcomes were measured, with validated instruments.

A limitation of this study is the non-randomised design. The study was carried out after the new care model had already been implemented. It was not possible to organize a large RCT, with many participating regions that would consent to expose themselves, or not, to early discharge from hospital and nursing home assessment. Although both regions were selected because of their comparability, surprisingly we found several baseline differences between the research groups. This might have influenced the results in the intervention group in a negative way, because older age and greater disability both correlate with lesser functional outcomes. The differences between the regions are most likely caused by the more advanced age of the population in the Maastricht area (30).

Conclusion

As expected there were no clinically relevant differences found in quality of life, satisfaction with care and functional outcomes between the intervention and the control group. Although the new care model failed to implement early discharge, more stroke patients in the intervention group were assessed by a multidisciplinary team in a nursing home in comparison with the usual care group, where more patients were discharged home after their initial hospital stay. Which stroke care model is more cost efficient can be answered only by a cost-effectiveness analysis and cost utility analysis. Both are also part of this study and will be published separately.

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Conflict of interest: There are no conflicts of interest.

Ethical Standards: The study was approved by the Medical Ethical Committee of the University of Maastricht.

References

1. Roger VL, Go AS, Lloyd-Jones DM, et al. Heart disease and stroke statistics 2011 update: a report from the American Heart Association. Circulation 2011 Feb 1;123(4):e18-e209. Epub 2010 Dec 15.
2. Vaartjes I, Bots ML, Poos MJC. Is the number of stroke patients increasing or decreasing? In Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid. Bilthoven: RIVM; December 2013.
3. Sourdet S, Lafont C, Rolland Y, et al. Preventable Iatrogenic Disability in Elderly Patients During Hospitalization. J Am Med Dir Assoc. 2015 Apr 24 [Epub ahead of print].

4. Schols JMGA, Crebolder HFJM, Van Weel C. Nursing Home and Nursing Home Physician: The Dutch Experience. J Am Med Dir Assoc 2004; 5(3): 207-212.
5. Vos L, Van Oostenbrugge RJ, Limburg M, et al. How to implement process-oriented care; a case study on implementation of process-oriented in-hospital stroke care. Accres Qual Assur 2009; 14:5-13.
6. Heijnen R, Limburg M, Evers S, et al. Towards a better integrated stroke care: the development of integrated stroke care in the southern part of the Netherlands during the last 15 years (Special 10th Anniversary Edition paper). Int J Integr Care. 2012 Apr;12:e123. Epub 2012 May 25.
7. Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. Cochrane Database of systemic Reviews. 2013; Sep. 11: 9
8. Fens M, Vluggen TP, van Haastregt JC, et al. Multidisciplinary care for stroke patients living in a community: A systemic review. J Rehabil Med 2013; 45:321.
9. Heijnen R, Evers S, van der Weijden T, et al. The (cost)effectiveness of an early transition from hospital to nursing home for stroke patients: Design of a comparative study. BMC Public Health; published online 26 may 2010.
10. CVA-ketenzorg Eindhoven. Analyse database 2006-2007, Internal report; dienst Ketenzorg 2008
11. The EuroQol Group. EuroQol a new facility for the measurement of health-related quality of life. Health Policy 1990; 16(3):199-208.
12. de Haan RJ, Limburg M, Schuling J, et al. Klinimetrische evaluatie van de Barthel Index, een maat voor beperkingen in het dagelijkse functioneren. Ned Tijdschr Geneeskd 1993; 137(18):917-21.
13. Schuling J, de Haan RJ, Limburg L, et al. The Frenchay Activities Index Assessment of Functional Status in Stroke Patients. Stroke 1993; 24:1173-1177.
14. Van Swieten JC, Koudstaal PJ, Visser MC, et al.: Interobserver agreement for the assessment of handicap in stroke patients. Stroke 1988; 19: 604-607.
15. Folstein MF, Folstein SE, McHugh PR. Mini-mental state : a practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research 1975; 12: 189-198.
16. Heugten CM van, Dekker J, Deelman BG, Stehmann-Saris FC, Kinebanian A. A diagnostic test for apraxia in stroke patients: internal consistency and diagnostic value. Clin Neuropsychol. 1999; 13(2): 182-192.
17. Halligan PW, Wilson B, Cockburn J. A short screening test for visual neglect in stroke patients. Int disabil Stud. 1990; Jul-Sep; 12(3): 95-9.
18. Bjelland I, Dahl A, Haug T, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale. Journal of Psychosomatic Research 2002; 52: 69-77.
19. van Straten A, de Haan RJ, Limburg M, et al. A Stroke-Adapted 30 Item Version of the Sickness Impact Profile to Assess Quality of Life (SA-SIP30). Stroke 1997; 28: 2155-2161.
20. Boter H, de Haan RJ, Rinkel GJE. Clinimetric evaluation of a Satisfaction-with – Stroke-Care questionnaire. J Neurol 2003; 250: 534-541.
21. Marchi S, Murphy JF, Rousseau P. Caring for the caregivers. J Gerontol Nurs 1996; 22: 7-13.
22. Brott T, Adams HP, Olinger CP, et al. Measurements of acute cerebral infarction: a clinical examination scale. Stroke 1989; 20 864-870.
23. Cohen J. Statistical power analysis for the behavioural sciences, 2nd Ed., New York, Lawrence Earlbaum Associates, 1988.
24. Comans TA, Brauer S, Haines T. Domicilliary vs Centre-Based Rehabilitation of Older Community Dwellers: Randomised Trial with Economic Evaluation. The open Geriatric Medicine Journal 2008; 1 62-67.
25. French B, Thomas L, Leathley M, et al. Does repetitive task training improve functional activity after stroke? A Cochrane systemic review and meta-analysis. J Rehabil Med 2010; 42: 9-15.
26. Foster A, Young J, Green J, et al. Structured re-assessment system at 6 months after disabling stroke: a randomised controlled trail with resource use and cost study. Age and Ageing 2009; 38:576-583.
27. Hart- en vaatziekten in Nederland bij vrouwen en mannen. nederlandsche hartstichting 2008.
28. Chang KC, Tseng MC, Weng HH, et al. Prediction of length of Stay of First-Ever Ischemic Stroke. Stroke 2002; 33:2670-2674.
29. Behandelkaders geriatrische revalidatie. Verenso 2010.
30. Giesbers H, Verweij A, de Beer J. Ageing: Are there regional differences in the Netherlands? In: Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid. Bilthoven: RIVM; 21 maart 2013.