International Journal of Physical Medicine & Rehabilitation

Yang et al., Int J Phys Med Rehabil 2015, 3:4
DOI: 10.4172/2329-9096.1000281

Research article open access

Psychosocial Determinants of Longer Length of Stay on a Canadian Stroke Inpatient Rehabilitation Unit

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Receiving date: April 28, 2015; **Accepted date:** May 27, 2015; **Published date:** May 29, 2015

Abstract

Objective: The relationship between availability of psychosocial resources and inpatient stroke rehabilitation length of stay (LOS) has been inadequately studied. The purpose of this prospective observational study was to identify psychosocial determinants that prolong LOS of patients in a stroke rehabilitation program.

Methods: Patients admitted to a multidisciplinary inpatient stroke rehabilitation program in southern Ontario, Canada, were consecutively recruited from October 2008 to August 2010. Patients diagnosed as having had a cerebrovascular event resulting in neurological impairments that required intensive rehabilitation were eligible for the study. Independent variables included psychosocial (awaiting long-term care placement, poststroke depression, inadequate family support, limited access to community home care services), medical (comorbidity, medical complications), neurological (type and location of stroke, neurological deficits), and functional (Functional Independence Measure [FIM] score on admission and discharge, Modified Rankin Disability Scale score) factors. The main outcome measure was length of hospital stay (days).

Results: A total of 117 patients were recruited. The mean and median LOS were 49.8 and 45 days respectively. Most patients (92.3%) were discharged home. On multivariate linear regression analysis, the significant determinants associated with longer LOS were awaiting long-term care placement (P<0.001), low admission FIM score (P=0.001), post-stroke depression (P=0.007), difficulties arising from inadequate family support (P=0.033), limited access to community home care services (P=0.035), and presence of medical complication(s) (P=0.039). These 6 factors, 4 of which were psychosocial, accounted for 48.8% of the total variance in LOS.

Conclusion: Psychosocial factors were key determinants of longer LOS in addition to medical/neurological factors such as severity of stroke and medical complications. Health care systems must incorporate psychosocial information to a greater extent and recognize its fundamental role in rehabilitation outcomes.

Key words:

Discharge planning; Length of stay; Psychological variables; Rehabilitation; Social variables; Stroke

Introduction

Stroke is a leading cause of disability in Canada [1]. Given the aging population, there is rising demand for acute or sub-acute post-stroke rehabilitation services, and optimal utilization and allocation of limited resources are becoming even more challenging. Length of hospital stay has been shown to be significantly correlated with cost of hospital stay in stroke rehabilitation settings [2,3]. Reducing length of stay (LOS) can lead to significant cost savings [4,5]: in one study a 2-day reduction in stroke unit LOS per patient translated into savings of more than $2.1 million/1,000 patients [6]. In a Canadian study LOS was significantly shorter and case fatality lower for stroke patients managed on a stroke unit than for those managed on general neurology/medical wards [7].

Many factors have been shown to influence acute or rehabilitation stroke LOS, including admission Functional Independence Measure (FIM) score [8-11], stroke severity [12,13], Barthel Index score [14], ability to perform activities of daily living [15], high therapy intensity [16], and comorbid medical conditions and complications [17]. Psychosocial factors such as pre- or post-stroke depression [18], socioeconomic status [9], presence and/or type of health insurance [19,20], access to home-based community services [21] or long-term care placement [22], family support [9], and presence of a spouse or caregiver [23] have also been shown to influence LOS. Few studies, however, address the relationship between availability of psychosocial resources and inpatient stroke rehabilitation LOS. Waiting for outpatient services, home modification, or long-term care placement may account for 35% of the average post-stroke hospital stay [24,25].

The purpose of this study was to investigate how psychosocial variables directly affect LOS in a subacute stroke rehabilitation inpatient setting. We hypothesized that, in addition to medical factors, unique psychosocial variables related to discharge planning—lack of availability of outpatient therapy services, inadequate family support, limited access to community home care services, awaiting long-term care placement, and depression—contribute substantively to longer LOS.

Methods

The study was conducted in a 30-bed stroke inpatient rehabilitation unit in southern Ontario, Canada. It is a regional stroke rehabilitation centre providing tertiary care. Consecutive patients admitted to the unit were recruited. Patients diagnosed as having had a cerebrovascular event resulting in neurological impairments that required intensive rehabilitation were eligible for the study. Patients were followed prospectively during their rehabilitation stay. The study was approved by our institutional research ethics board, and written informed consent was obtained from all participants.

Patient characteristics

The patients' demographic and clinical characteristics were collected on admission to the stroke rehabilitation program.

Neurological variables

Time between onset of stroke and admission to rehabilitation was calculated. Stroke subtype and location were confirmed by computed tomography or magnetic resonance imaging. Stroke-related neurological impairments, such as hemiplegia, hemiparesis, aphasia, dysphagia, dysarthria, apraxia, neglect, and ataxia, were documented within 1 week of admission.

Medical complications

A medical complication was defined as a medical or psychiatric illness that occurred after the initial assessment on admission and that required physician evaluation, laboratory or radiographic studies, change in medication, restriction in mobility, or interruption of therapies. The number of complications and days of service interruption were noted.

Measurement of function

Function was assessed prospectively during the stroke rehabilitation stay. Severity of stroke as measured by FIM scores and the Modified Rankin Disability Scale was recorded within 1 week after admission and discharge. FIM efficiency was calculated as FIM gain divided by LOS. Cognition was screened using the Montreal Cognitive Assessment, a standard tool in stroke rehabilitation. The Geriatric Depression Scale-15 (GDS) was administered on admission.

Psychosocial variables

The following psychosocial variables related to discharge planning were recorded: inadequate family support (financial difficulties, no spouse or caregiver, unwilling to accept patient's return home, home modification incomplete), limited access to community home care services (home visit by occupational therapist, swallowing reassessment by speech–language pathologist [SLP], personal care worker to assist with activities of daily living, equipment needs), awaiting long-term care placement, and availability of outpatient services (e.g., physical therapy, occupational therapy, SLP therapy, social work, and neuropsychology).

Outcome measures

LOS was the primary outcome measure. It was calculated from the date of admission to the stroke rehabilitation program to the date of discharge to home or a long-term care facility.

Data analysis

A sample size of 100 was estimated based on an empirical model of multivariate regression analysis that would confer high validity. Data were collected with the Case Report Form (Appendix 1) and entered twice into a database using EpiData version 3.0 (Epidata Association, Odense, Denmark). Data analysis was conducted using SPSS version 17.0 (SPSS Inc., Chicago, IL). Continuous variables were reported as mean ± standard deviation (SD), and discrete variables, as percentage. All the variables of interest were first examined using univariate analysis (t-test for 2 independent samples or 1-way analysis of variance) to assess the contribution of each factor to LOS. We used multiple linear regression analysis to identify potential determinants with independent influence on LOS. Variables significant at the $P< 0.05$ level in the univariate analysis were entered into a logistic regression analysis model. A variable was considered to exhibit multicolinearity with other variables if its variance inflation factor was greater than 10. Variables with more than 3 times the SD of residuals were considered outliers. Significance was set at a P value of 0.05.

Results

A total of 125 patients were recruited. Of the 125, 8 were excluded: 4 had a diagnosis of hemiparesis as a result of a brain tumour, for 2 there were insufficient data, and 2 were discharged within 7 days of admission (1 to acute care and 1 to home at the family's request). The LOS for the 117 remaining patients ranged from 18 to 128 days (mean 49.8 ± 22.1, median 45). Most patients (108 [92.3%]) were able to return home; 9 (7.7%) were discharged to long-term care facilities.

Characteristic	Mean ± SD or number (and %) of patients	Median
Demographic		
Age (year)	69.06 ± 12.80	70
Sex		
Male	62 (53.0)	
Female	55 (47.0)	
Married	72 (61.5)	
Neurological		
Side of stroke		
Left	57 (48.7)	
Right	53 (45.3)	
Bilateral	7 (6.0)	
Location of stroke		
Cortical	48 (41.0)	
Subcortical	51 (43.6)	
Cerebellar	7 (6.0)	
Brain stem	20 (17.1)	
Type of stroke		
Ischemic	97 (82.9)	

Hemorrhagic	20 (17.1)	
Neurological deficits		
Hemiplegia	22 (18.8)	
Hemiparesis	74 (63.2)	
Aphasia	39 (33.3)	
Dysarthria	40 (34.2)	
Dysphagia	39 (33.3)	
Neglect	39 (33.3)	
Ataxia	16 (13.7)	
Apraxia	9 (7.7)	
Functional		
FIM score on admission	78.54 ± 21.84	76
FIM score at discharge	105.32 ± 16.35	110
FIM gain	26.74 ± 15.40	25
FIM efficiency	0.58 ± 0.33	0.55
Modified Rankin Disability Scale score	3.11 ± 0.86	3
Montreal Cognitive Assessment score	20.10 ± 6.34	21
Geriatric Depression Scale score	3.66 ± 2.63	3
Medical complication(s)	63 (53.8)	
Service interruption (d)	3.95 ± 2.08	2
Time between stroke onset and rehabilitation (d)	29.06 ± 22.38	23
Length of stay (d)	49.84 ± 22.11	45

Abbreviations:

SD: Standard deviation; FIM: Functional Independence Measure.

Table 1: Patient demographic, clinical, and functional characteristics (n=117)

The demographic and clinical characteristics of the 117 patients are summarized in Table 1. Most strokes (82.9%) were ischemic. The mean interval between stroke onset and admission to the rehabilitation unit was 29 days (SD 22.4, median 23). The mean FIM gain was 26.7 (SD 15.4) (paired t=18.837, P<0.001), indicating significant functional improvement. Sixty-three patients (53.8%) experienced 1 or more medical complications during the rehabilitation stay; the mean number of days of service interruption was 4.0 (SD 2.1, median 2.0). No patient died during the rehabilitation stay.

Psychosocial determinants are summarized in Table 2. More than one-third of patients (35.9%) experienced psychosocial difficulties arising from inadequate family support, and almost two-thirds (32.5%) had limited access to community home care services. More than half (52.1%) of patients who required outpatient services did not receive them as a result of lack of availability.

Characteristic	Number (and %) of patients
Difficulties arising from inadequate family support	42 (35.9)
Limited access to community home care services	38 (32.5)
Awaiting long-term care placement	9 (7.7)
Lack of availability of outpatient services*	61 (52.1)
Physical therapy	38 (32.5)
Occupational therapy	27 (23.1)
Speech–language pathology therapy	24 (20.5)
Neuropsychology	18 (15.4)

*The total number of patients exceeds 61 because some patients experienced a lack of 2 or more services.

Table 2: Psychosocial determinants

On univariate analysis, the variables significantly associated with longer LOS were presence of hemiplegia (P<0.001), lower admission FIM score (P<0.001), higher discharge FIM score (P=0.004), FIM gain (P<0.001), FIM efficiency (P=0.02), higher Modified Rankin Disability Scale score (P<0.001), presence of medical complication(s) (P=0.001), higher GDS score (P=0.001), difficulties arising from inadequate family support (P=0.01), limited access to community home care services (P=0.001), and awaiting long-term care placement (P=0.018) (Table 3). No statistically significant relationship was found between lack of ambulatory services and LOS (P=0.987).

Characteristic	LOS (d) (mean ± SD)	P value*
Hemiplegia		**<0.001**
Absent	46.26 ± 21.24	
Present	65.27 ± 19.34	
FIM on admission		**<0.001**
≤ 76	59.47 ± 23.80	
> 76	40.03 ± 14.99	
FIM at discharge		**0.004**
≤ 110	55.48 ± 22.16	
> 110	43.70 ± 20.54	
FIM gain		**<0.001**
≤ 25	42.38 ± 16.67	
> 25	57.96 ± 24.48	
FIM efficiency		**0.020**
≤ 0.55	54.47 ± 23.62	
> 0.55	44.96 ± 19.45	
Modified Rankin Disability Scale score		**0.001**

≤ 3	43.54 ± 21.31	
> 3	59.91 ± 19.69	
Medical complication(s)		
Absent	42.54 ± 17.96	
Present	56.10 ± 23.51	
Montreal Cognitive Assessment score		**0.068**
< 26	53.72 ± 22.86	
≥ 26	46.25 ± 20.57	
Geriatric Depression Scale score		**0.001**
< 5	42.91 ± 15.85	
≥ 5	59.62 ± 25.33	
Difficulties arising from inadequate family support		**0.010**
Absent	45.93 ± 20.40	
Present	56.81 ± 23.55	
Limited access to community home care services		**0.001**
Absent	46.09 ± 19.68	
Present	62.33 ± 25.39	
Awaiting long-term care placement		**0.018**
Absent	47.40 ± 19.39	
Present	79.11 ± 31.94	
Lack of availability of outpatient services		0.987
Absent	49.80 ± 2.03	
Present	49.87 ± 21.43	

*Two independent sample t-test or 1-way analysis of variance was used to analyse the differences between groups.

Abbreviations: LOS: Length Of Stay; SD: Standard Deviation; FIM: Functional Independence Measure.

Table 3: Univariate analysis of determinants associated with longer LOS

The results of multiple linear regression analysis are shown in Table 4. Neither multicolinearity among variables nor any outliers of cases were found. The following 7 variables were included in the model with the series of influence on LOS (in terms of standardized regression coefficients): admission FIM score, FIM gain, awaiting long-term care placement, GDS score, presence of medical complication(s), difficulties arising from inadequate family support, and limited access to community home care services. The regression model was statistically significant ($F=12.768$, $P<0.0001$). The R^2 was 0.488, indicating that 48.8% of the total variance in LOS could be explained by these variables. Six of the 7 variables, at the rank of standardized coefficients, were statistically significantly associated with longer LOS ($P<0.05$): awaiting long-term care placement, low admission FIM score, post-stroke depression, difficulties arising from inadequate family support, limited access to community home care services, and presence of medical complication(s).

Determinant	Unstandardized coefficient		Standardized coefficient	P value	Variance inflation factor
	β	SE			
(Constant)	-14.226	24.54	-	0.563	-
FIM score on admission	0.536	0.154	0.375	0.001	2.413
Awaiting long-term care placement	27.58	6.719	0.337	< 0.001	1.407
Geriatric Depression Scale score	1.925	0.697	0.23	0.007	1.455
FIM gain	0.214	0.166	0.213	0.198	5.636
Difficulties arising from inadequate family support	8.045	3.725	0.171	0.033	1.079
Limited access to community home care services	6.09	2.367	0.155	0.035	1.178
Medical complication(s)	3.613	1.724	0.104	0.039	1.393

*R^2=0.488, adjusted R^2 = 0.450. Abbreviations: SE: Standard Error.

Table 4: Multiple linear regression analysis of determinants of longer LOS*

Discussion

We found that psychosocial factors played a key role in determining LOS on our inpatient stroke rehabilitation unit. Awaiting long-term care placement, post-stroke depression, difficulties arising from inadequate family support (financial difficulties, no spouse or caregiver, unwilling to accept patient's return home), and limited access to community home care services (home visit by occupational therapist, swallowing reassessment by SLP, personal care worker to assist with activities of daily living, and equipment needs) strongly influenced LOS in addition to severity of stroke and presence of medical complication(s). Similarly, Tan and colleagues [9] reported that socioeconomic status and family structure influenced LOS for stroke patients admitted to an acute hospital rehabilitation centre in Singapore, and in a British study stroke patients discharged to nursing homes had a significantly longer LOS than those who were discharged home, as a result of increased waiting time for placement [25]. Delays in discharge due to difficulties in arranging proper equipment and home modification are not uncommon, both internationally and in Canada [26,27]. These findings indicate that early liaison of the rehabilitation team with social services in order to ensure the timely provision of environmental aids and home adaptation or more rapid placement in a long-term care facility would reduce hospital LOS.

Our results corroborate the finding in other studies [18,28,29] that post-stroke depression is one of the factors associated with longer LOS.

Most of the patients in our study were able to return home. This is in accordance with results of a Canadian study showing that LOS was considerably longer in a Canadian facility (49.2 days) than in the United States [30]. In Canada, many patients stay in inpatient stroke rehabilitation to maximize functional outcome, which could otherwise have been achieved in an ambulatory care setting or via transfer to a sub-acute rehabilitation facility.

Few investigators have examined the influence of care and treatment resources on LOS [31]. In our study, although more than half the patients faced inadequate outpatient therapy services following discharge, none of the service characteristics, such as lack of ambulatory physical therapy, occupational therapy, or SLP services, seemed to prolong LOS. One explanation is that patients with more severe stroke (e.g., hemiplegia) are referred less often to outpatient services because of their lower functional status; thus, they remain in hospital longer. These patients may be passed over in favour of those who are making more FIM gains. Second, despite limited outpatient resources, patients with primarily cognitive/linguistic deficits are often designated a shorter LOS because of lack of physical impairments. As well, lack of neurocognitive and vocational resources after discharge has been reported to be one of the main reasons young stroke patients are kept in expensive inpatient beds for a shorter stay in the rehabilitation program [32]. These findings indicate the need for timely access to interdisciplinary ambulatory care services.

Our study has limitations. The median LOS in our stroke rehabilitation program, 45 days, is quite long, especially when compared to LOS in the United States. This is likely because there are no sub-acute rehabilitation (skilled nursing) facilities in Canada that can receive patients who do not require or cannot tolerate 3 hours of therapy daily. Thus, our findings may not be generalizable to rehabilitation facilities in countries where LOS is significantly shorter. Second, the study design was observational. Although we attempted to examine multiple comprehensive variables, all possible determinants of LOS may not have been prospectively captured. This model explained 48.8% of the total variance in LOS, which means that approximately half of the variation in LOS was influenced by other factors. Third, while the rehabilitation program is set and staffed according to national and provincial standards, local administrative factors such as bed availability, admission criteria, and increasing pressure to contain costs due to hospital budget cuts may have affected the results.

Conclusion

Stroke diagnosis, treatment, and care are complex, and psychosocial factors can influence their processes. Awaiting long-term care placement, post-stroke depression, difficulties arising from inadequate family support, and limited access to community home care services influenced LOS on our stroke rehabilitation unit. Health care systems must more comprehensively account for psychosocial factors and recognize the fundamental role they play in improving and adversely affecting rehabilitation outcomes. In addition, the impact of provision of ambulatory services on LOS requires further study.

Acknowledgements

Supported by Phase III Innovation Fund, Bruyère Academic Medical Organization, Bruyère Continuing Care, Ottawa, ON, Canada.

We thank Linda Greene-Finestone for critically reviewing the manuscript and Gloria Baker for editorial assistance. Presented in part at the Canadian Association of Physical Medicine and Rehabilitation meeting held June 8-11, 2011, Victoria, BC, Canada.

Author contributions:

Dr. Yang designed and conducted the study, Dr. Chen did the data analysis and interpretation, and Dr. Yang and Dr. Finestone contributed to manuscript preparation. All authors approved the final version of the manuscript.

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