Original Article

Factors Associated with Delayed Discharges after Inpatient Stroke Rehabilitation in Singapore

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Abstract

Introduction: This study determines the extent of, and factors associated with, delayed discharges for stroke patients from inpatient rehabilitation. Materials and Methods: A retrospective cohort study utilising medical notes review was conducted at an inpatient rehabilitation centre in Singapore. Acute stroke patients (n = 487) admitted between March 2005 and December 2006 were studied. The primary measure was delayed discharge defined as an extension in inpatient stay beyond the planned duration. Factors associated with delays in discharge were categorised as individual, caregiver, medical and organisational. Results: There were a total of 172 delayed discharges (35.6%). The mean [standard deviation (SD)] length of stay was 40.5 days (SD, 19.5 days) and 25.8 days (SD, 11.4 days) for patients with delayed and prompt discharges, respectively. Mean extension of stay was 9.7 days (SD, 13.8 days). Caregiver-related reasons were cited for 79.7% of the delays whereas organisational factors (awaiting nursing home placement, investigations or specialist appointments) accounted for 17.4%. Four factors were found to be independently associated with delayed discharge: discharge to the care of foreign domestic helper, nursing home placement, lower admission Functional Independence Measure (FIM) motor score and discharge planning process. Conclusions: Our study suggests that caregiver and organisational factors were main contributors of delayed discharge. Targeted caregiver training and the provision of post-discharge support may improve the confidence of caregivers of patients with greater motor disability. The use of structured discharge planning programmes may improve the efficiency of the rehabilitation service. To reduce delays, problems with the supply of formal and informal post-discharge care must also be addressed.

Ann Acad Med Singapore 2009;39:435-41

Key words: Caregiver, Discharge planning, Length of stay, Nursing home

Introduction

Persisting disabilities from stroke lead to partial or total dependence for up to two-thirds of survivors.[1] To improve mobility and to enable the recommencement of self-care activities, rehabilitation is essential. Patients are often entered into inpatient-based rehabilitation programmes and while one of the main aims of rehabilitation is community reintegration, stroke patients are on the whole at a higher risk of extended inpatient stays.[2-4] This not only increases the likelihood of deconditioning[5] for the patient but also prevents rehabilitation beds from being used appropriately and efficiently. In order to devise strategies to minimise delays in discharge, underlying aetiologies need to be clarified.

Individual, medical and organisational factors often interact to put patients at risk of delayed discharge.[6] Age, gender and caregiver-related factors such as living alone[7] and reliance on foreign domestic helpers as informal caregivers,[8] have been found to contribute to an increased likelihood of unnecessary hospital bed-days. Functional dependency[9,10] and occurrence of medical complications[10,11] may also extend the length of stay whereas protective factors include caregiver availability.[8] Due to the complex nature of stroke rehabilitation, organisational elements such as nature of the team in charge of discharge assessment[2] have also been found to influence the length of stay (LOS) while discharge planning programmes have assisted in reducing LOS and unplanned readmission.[12]

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The transition between alternative levels of care has been found to be problematic because of poor linkages between the acute and long-term care sectors and a general shortage of nursing home beds even in developed healthcare systems.[13,14] In Singapore, the prevailing government policy of promoting self-reliance and placement in nursing homes as a last resort, regulated not only usage but also supply. Currently, every 1000 persons aged 65 years and above is served by 29 nursing home beds, which is relatively low compared with the Organisation for Economic Co-operation and Development (OECD) average of 40 beds per 1000 older persons.[15]

A number of studies[5,14,16,17] have reported on the factors that influence delays in the discharge of stroke patients from acute hospitals and found 27% to 43% of inpatient days to be medically inappropriate. Besides medical management, physical rehabilitation is also an important part of stroke treatment. However, less is known about the characteristics of patients or the reasons underlying delayed discharges for stroke rehabilitation. Although previous Singaporean studies[18,19] have examined the determinants of rehabilitation LOS for stroke patients, they did not differentiate between appropriate and inappropriate LOS. In this study, we aimed to identify the extent of and factors associated with delayed discharge for patients with acute stroke in an inpatient rehabilitation setting.

Materials and Methods

Study Design

A retrospective review of case notes of patients admitted consecutively to an inpatient rehabilitation centre in Singapore between March 2005 and December 2006 was conducted. We also referred to records of discharged rehabilitation patients obtained from an in-house electronic database. The case notes were screened for the diagnosis of acute stroke. Patients with traumatic brain injuries or spontaneous subarachnoid haemorrhages were excluded. The National Healthcare Group Institutional Review Board approved the study.

Setting

Patients admitted were entered into a comprehensive rehabilitation programme provided by 2 multi-disciplinary teams. The teams were led by specialist rehabilitation physicians, and comprised physiotherapists, occupational therapists, speech therapists, nurse clinicians, medical social workers and psychologists. Both teams adopted a disability-focused and an impairment-reduction driven approach aimed at returning patients to normal life and home. The main difference between the 2 stroke rehabilitation teams was the structure and process of discharge planning. Team A had a structured approach with clearly defined team

roles, tasks and fixed timelines whereas Team B performed similar activities with greater variability in the processes (Table 1). Within team A, a designated liaison person from the rehabilitation team was assigned to each patient to facilitate communication with caregivers and to smoothen the discharge processes.

Definition of "Delayed Discharge" and "Prompt Discharge"

Readiness for discharge was based on the completion of planned rehabilitation goals, the patient's medical fitness and adequacy of a discharge plan and competency of the caregiver. An estimated discharge date was set for each patient within 2 weeks of rehabilitation admission based on the multi-disciplinary team's assessment of the patients' rehabilitation potential and targeted functional level. A delay in discharge was assessed to have occurred when the LOS exceeds the planned LOS whereas prompt discharge occurs when patients are discharged before or on the day of their planned discharge date.

Data Collection and Study Parameters

Data were extracted from case notes by 3 trained abstractors. Two of the authors (WST, WFC) who were not involved in the care of the patients abstracted the data. The third abstractor was a nurse who functioned as the rehabilitation centre's care coordinator and cared for patients who did not require intensive medical social worker intervention. However, she was not aware of the possibility of use of the data for this study.

The variables include demographic characteristics (age, gender and ethnicity), stroke type, comorbid conditions,

Table 1. Structure and Process of Discharge Planning in Teams A and B

	Team A	Team B
Structure		
Multi-disciplinary rehabilitation input	Yes	Yes
Assigned discharge liaison person within team	Yes	No
Process		
Caregiver or decision maker identification and short term goals	by end of 1st week	unstandardised
Rehabilitation goal setting (long term)	by end of 2nd week	unstandardised
Referral of high-risk patients to social worker	by end of 1st week	by end of 1st week
Assessment of caregiver fitness or willingness to care	by end of 2nd week	unstandardised
Team decision on estimated length of stay and estimated discharge date	by end 2nd week	unstandardised

discharge location and caregiver arrangement, rehabilitation length of stay, functional status and the structure and process of discharge planning under each of the 2 teams.

Information related to patients' functional status at admission measured using the Functional Independence Measure (FIM)[20] were extracted from electronic documents. It is a widely used functional assessment measure, which contains 13 items related to self-care, bowel and bladder continence, mobility and ambulation, and 5 items related to communication, social functioning and cognition. Rating is conducted on a 7-level ordinal scale, ranging between 1 (totally dependent) and 7 (totally independent). This resulted in a motor FIM score range of 13 to 91 and a cognitive FIM score range of 5 to 35.

Reasons causing delays in discharge were documented in the case notes routinely by the rehabilitation team members. We extracted the documented factors and classified them according to the following categories:[8,13]

- Individual factors (age, gender, ethnicity);
- Caregiver factors (presence of caregiver, domestic helper as caregiver);
- Medical factors (motor and cognitive function at admission, disease burden, medical complications); and
- Organisational factors (discharge planning process, nursing home placement).

Statistical Analysis

We first carried out univariate analyses to examine the relationship between delayed discharge and each of the variables. For categorical independent variables, the chi-square test or the Kruskal-Wallis test was used to assess the differences between patients with delayed and prompt discharges. For continuous independent variables, Analysis of Variance (ANOVA) was used.

The second phase of the analysis applied a multivariate model using logistic regression analysis. To avoid over-fitting the model, only variables with a probability (*P*) value of less than 0.1 in the univariate analysis were used as independent variables in the stepwise logistic regression analysis. Variables were retained or removed from the model, using a forward selection procedure based on the likelihood ratio test using *P* <0.05 as entry criterion and a *P* >0.1 as exit criterion. The Hosmer-Lemeshow goodness-of-fit statistic was used to assess model fit. *P* <0.05 was considered statistically significant.

Lastly, a descriptive analysis was carried out to describe the characteristics of the patients and to examine the factors documented in the case notes as reasons to have caused the delays in discharge. All statistical tests were carried out using the Statistical Package for Social Sciences, version 15.0 (SPSS Inc., Chicago, IL, USA).

Results

A total of 525 case notes were retrieved. Of these, 3 patients diagnosed with traumatic intracerebral haemorrhage, 25 patients diagnosed with subarachnoid haemorrhage, 2 patients with missing data, and 8 patients not cared for by Team A and B were excluded.

Four hundred and eighty-seven patients were included

Table 2. Characteristics of Rehabilitation Inpatients

	Delayed (n = 172)	Prompt (n = 315)	P*
	No. (%) or Mean (SD)	No. (%) or Mean (SD)	
Individual factors			
Age, y	62.5 (13.9)	60.6 (13.0)	0.138
Gender, male	96 (55.8)	189 (60.0)	0.370
Ethnicity			0.337
Chinese	145 (84.3)	256 (81.3)	
Malay	9 (5.2)	37 (11.7)	
Indian	11 (6.4)	13 (4.1)	
Others	7 (4.1)	9 (2.9)	
Caregiver factors			
Family caregiver present	71 (41.3)	201 (63.8)	<0.001
Foreign domestic helper present	77 (44.8)	96 (30.5)	0.002
Alone	2 (1.2)	5 (1.6)	0.908
Medical factors			
Mean FIM motor score at admission	30.9 (14.1)	38.8 (16.3)	<0.001
Mean FIM cognitive score at admission	21.4 (10.5)	24.7 (9.9)	<0.001
Type of stroke			0.153
Ischaemic	127 (73.8)	213 (67.6)	
Haemorrhagic	45 (26.2)	102 (32.4)	
Comorbid conditions ≥4	22 (12.8)	36 (11.4)	0.657
Nosocomial medical complications			
Urinary tract infection	53 (30.8)	53 (16.8)	<0.001
Pneumonia	9 (5.2)	4 (1.3)	0.010
Organisational factors			
Discharge to nursing home	19 (11.0)	8 (2.5)	<0.001
Rehabilitation team			0.020
A	48 (27.9)	121 (38.4)	
B	124 (72.1)	194 (61.6)	
Mean rehabilitation LOS, days	40.5 (19.5)	25.8 (11.4)	<0.001

FIM: functional independence measure; LOS: length of stay; SD: standard deviation

* Chi-square test or Kruskal-Wallis test or ANOVA test was used to assess the differences between groups.

in the analysis, of which 172 patients (35.3%) recorded a delay in discharge. The mean age of patients was 61.3 years (SD, 13.3), and 285 (58.5%) were male. Four hundred and one (82.3%), 46 (9.4%) and 24 (4.9%) were of Chinese, Malay and Indian ethnicity, respectively. About 70% of the patients had ischaemic stroke and 11.9% had at least 4 comorbid conditions. Hypertension (79.1%), hyperlipidaemia (54.4%) and diabetes mellitus (35.7%) were the most prevalent comorbid conditions. Two hundred and seventy-two patients (55.9%) were discharged home to family who were caregivers and 173 (35.5%) to employed foreign domestic helpers as caregivers. Mean extension of stay was 9.7 days (SD, 13.8).

The univariate analyses showed that individual factors (age, gender and ethnicity) did not differ significantly between patients with delayed and prompt discharges. Relationship of the caregiver to patient was found to be statistically significant. A lower proportion of delays occurred amongst patients discharged to the care of family members whereas those discharged to be cared for by foreign domestic helpers experienced a higher incidence of delay. Baseline motor and cognitive FIM scores and nosocomial infection rates were also statistically different between the 2 patient groups. Organisational factors such as nursing home placement and the discharge planning structure and process were also associated with delayed discharge (Table 2).

In the multivariate analysis, the Hosmer-Lemeshow goodness-of-fit statistic ($P = 0.951$) was insignificant, indicating that model fit was good. Table 3 shows that the significant factors predicting delayed discharge were discharge to the care of a foreign domestic helper, nursing home placement, the extent of patients' dysfunction in physical activity at admission (FIM motor score) and the use of a structured discharge planning process.

Based on reasons documented in the case notes, we found requests for extension of stay by family members to account for 76 (44.2%) cases. This reflects caregiver-related issues as well as the philosophy and organisation of discharge planning since this reason was more common among Team B patients (18.2% vs 10.7%; $P = 0.018$). Placement in a nursing home was also cited to extend the discharge date for 11.6% of the patients. Forty-two patients (24.4%) with extended LOS were waiting for foreign domestic workers hired as caregivers to begin their employment term. Other reasons include individual patient requests, non-completion of caregiver training, lack of medical fitness and delays in the initiation of investigations and appointments (Table 4).

Discussion

The prevalence of delayed discharge among stroke rehabilitation patients was 35.6% in this study, which is

Table 3. Logistic Regression Analysis* Predicting Delayed Discharge (n = 487, Nagelkerkel R^2 = 0.141)

	Odds ratio	95% CI	P
Foreign domestic worker as caregiver			
Yes	1.65	1.08-2.54	0.022
[No]			
Discharge to nursing home			
Yes	4.60	1.89-11.25	0.001
[No]			
Rehabilitation team			
A	0.545	0.35-0.84	0.006
[B]			
FIM motor score at admission	0.971	0.96-0.99	<0.001

[.]: Reference group; 95% CI: 95% confidence interval
*Using forward selection (likelihood ratio) method

Table 4. Causes of Delayed Discharge (n = 172)

	Frequency	
	Number	(%)
Individual	**12**	**(7.0)**
Request for extension of stay by patient	12	(100.0)
Caregiver	**137**	**(79.7)**
Request for extension of stay by family	76	(55.5)
Have not completed caregiver training	19	(13.9)
Awaiting arrival of foreign domestic helper	42	(30.7)
Medical	**15**	**(8.7)**
Urinary tract infection	5	(33.3)
Others e.g. fever, prolonged International Normalised Ratio	10	(66.7)
Organisational	**30**	**(17.4)**
Awaiting nursing home	20	(66.7)
Awaiting investigation (e.g. colonoscopy, video fluoroscopy) or specialist appointment	8	(26.7)
Awaiting care equipment and home modification	2	(6.7)

comparable with the results from Canadian[5] and Dutch[17] studies conducted in the acute setting. There is, however, still considerable variability in the proportion of inappropriate stay reported in literature. In a Taiwanese study,[21] only 10.4% of the stroke patients had prolonged acute hospital stay whereas in a UK study, Hammond et al[22] found 69.7% of patients with a long-term neurological condition to have experienced an inappropriate LOS. These differences could be due to heterogeneity in study design, setting and definition of delayed discharge.

We found caregiver-related issues, which emerged as non-specific requests by families to be the biggest driver of delayed discharge. It is notable that the share of such patients was significantly higher for Team B. This underlined the importance of establishing a structured discharge planning process. The differences in the discharge process between the 2 teams include the timing of the decision-making process and the team philosophy adopted with regards to adherence to targeted discharge dates. The deployment of a dedicated liaison person by Team A as a strategy may have also helped improve the level of communication and coordination between the care team and patients' families. Other studies have similarly found organisational factors such as mechanisms to expedite discharge from stroke rehabilitation units[23] and the deployment of different professional staff to coordinate care assessments, to influence LOS.[13] Reinforcing the importance of the organisation of discharge planning, the multivariate regression analysis found Team A patients to experience lower odds of a prolonged stay. Consideration however must be given to the amount of additional resources required for more widespread implementation of intensive discharge planning.

Previous research[5,8,13] found access to nursing home beds to be a significant contributor of delayed discharge. Our study revealed similar results. When patients have to wait for a nursing home bed in the acute care setting, healthcare costs are raised unnecessarily. The shortage of step-down care facilities in Singapore has created systemic problems within the health sector. To address this problem, the Singapore government has committed to expanding the nursing home capacity from 9200 to 14,000 beds over the next decade,[24] which may help alleviate this problem in the future. Besides capacity constraints, process bottlenecks may also impede timely transfer of patients from acute hospitals to nursing homes. It is therefore essential to monitor the speed at which applications are processed and the length of time patients spent waiting for a nursing home bed, with the view of improving access and reducing inefficiencies during the transition. Such data are currently not publicly available in Singapore. On top of these factors, the decision to admit a family member to a nursing home is often difficult. Patients and their family typically require more time to explore various care options prior to deciding on nursing home placement. As such, further research on prolonged hospitalisation due to nursing placement is needed to clarify the contribution of the various factors.

Our results showed that delays in the hiring process of foreign domestic helpers accounted for 24% of the cases with prolonged hospital stay. This factor remained significant for all patients in all ethnic groups. A similar result was reported in a Singaporean study that examined factors causing delays in the discharge for elderly inpatients.[8] This reflects the tendency for the Singaporean elderly to rely on receiving personal assistance from their children and spouse, and household maid.[25] As more women relinquish their traditional responsibility of caring for elderly family members,[26] the role of foreign domestic helpers has increased. Accurate prognostication of functional recovery and identification of care plans even prior to rehabilitation admission may be necessary to facilitate earlier initiation of the hiring process.

Nevertheless, reliance on an overseas supply of informal caregivers inevitably imply a waiting time of between 1 and 4 weeks or more, for the approval of the work permit application and for the foreign domestic helper to arrive in Singapore. Unless the hiring and immigration processes can be shortened, an extension of stay beyond the mean LOS of 25.8 days is expected for some patients. From a health system perspective, to minimise prolonged hospitalisation and associated costs, the development of a local industry to provide home care using domicile labour may fill the current service gap.

As in other studies,[27] motor FIM score at admission, which measures the extent of disability related to self-care, bowel and bladder continence, mobility and ambulation, was independently associated with delayed discharge. Caregivers of stroke patients face substantial stress[28,29] and their burden tend to increase when caring for patients with greater motor impairment.[30] While training caregivers in the skills of moving and handling the patient, and to perform simple nursing tasks have been found to reduce burden of care,[31,32] the rehabilitation centre is already providing this service. Perhaps greater customisation of caregiver training is needed. More sessions of post-discharge training or use of digital teaching aids may be required for caregivers of patients with greater physical disability. In addition, the early post-discharge period is a difficult time for both patients and caregivers as they adjust to the new situation. Development of services such as post-discharge helplines to support their needs would be important.

While other studies found cognitive dysfunction to prolong LOS,[33] we did not find cognitive status to be independently associated with delayed discharge. The strong correlation between motor and cognitive function ($P = 0.613, P < 0.001$) for patients with prolonged stay could indicate that the variable FIM motor score reflected the overall well-being of the patient.

Urinary tract infection is a common poststroke complication[34,35] and is associated with longer LOS.[8] Although it was not found to be a significant factor in the logistic analysis, its occurrence as a final event before discharge did prolong the stay for some patients. Thus, a pro-active approach is needed to prevent and treat any complications early throughout the stay to ensure timely

discharge.

On the whole, reasons underlying discharge delays are multi-factorial. Although we have tried to pre-specify a hypothesised set of individual, caregiver, medical and organisational factors, several aspects of human behaviour and caregiver-patient relationship may have been omitted because they are not easily quantifiable. While the absence of an available caregiver has been identified as an important determinant in other studies,[13] this was not found to be a risk factor in the current study. The sample size is too small for any meaningful inference since only 7 patients were discharged home without a caregiver. Nevertheless, subjective caregiver-related factors such as coping ability, personal commitment and social expectations are also more important in determining delayed discharge. In this study, the high number of caregivers not completing training on time and requesting for extension of stay, reflect these elements. Development of objective measures may be needed to help clinicians identify patients at risk of delayed discharge.

This study has some limitations. Due to the strong emphasis on prompt discharge at the centre, reasons extending LOS can be found in the medical notes. However, there were variations in the information documented. We have relied on documented reasons but there could be additional reasons behind patients' and their families' request for stay extension. In addition, there is no definitive way of assessing readiness for discharge. Hence, we have relied on the clinical judgement of the rehabilitation teams.

In conclusion, stroke rehabilitation will become more important as the population ages. Prolonged hospital stays create inefficiency in the system and diminish the gains from rehabilitation and is therefore an important issue to address. Our study highlighted the need to address the supply issues related to formal and informal caregivers. The use of structured discharge planning programmes, trained discharge liaison teams, additional manpower resources and the provision of customised caregiver training and post-discharge support for caregivers of patients with greater motor disability, might further improve the efficiency of the rehabilitation service and result in shorter rehabilitation length of stay.

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