Post-stroke disposition from a geriatric-rehabilitative stroke care area: an Italian experience

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ABSTRACT

A large number of stroke patients cannot be discharged at home. Studies on post stroke disposition have low validity outside the country in which they are carried out because healthcare systems offer different rehabilitative and long-term facilities. Moreover absolute selection criteria for admission to rehabilitation are not available yet. Few studies on post-stroke disposition from Italian stroke units are available. Authors evaluated data of a 18-month period from a geriatric managed stroke care area where comprehensive multi-professional assessment and discharge planning are routinely carried out. Only patients discharged with diagnosis related to acute stroke were considered. Baseline characteristics, clinical, neurological and functional conditions according to the structured multidimensional assessment were prospectively collected in the stroke unit registry. Univariate and multinomial logistic regression were performed to identify independent variables associated with three discharge settings: home, rehabilitation and skilled long-term ward. Out of 188 patients evaluated, 56.4% were discharged home, 18.6% to rehabilitation and 25.0% to long-term ward. Data showed an efficient disposition to intermediate settings with a shorter length of stay compared to other international studies. Factors associated with post-stroke disposition were age, dysphagia, neurological impairment on admission (NIH-SS≥6), after stroke functional status (mRankin≥3), poor pre-stroke functional level (mRankin≥3) and hemorrhagic stroke. Dysphagia, severe neurological impairment and post-stroke disability were associated with discharge to rehabilitation and long term ward. These two settings differed in age and pre-stroke functional condition. Patients discharged to long-term wards were about 10 years older than those admitted to rehabilitative ward. Only 5% of patients discharged to rehabilitation had a pre-stroke mRankin score ≥3. Disposition to a skilled long-term ward of older patients with pre-stroke disability seemed positive on an economic ground but further studies are mandatory to understand the consequences in terms of functional recovery and social costs.

Introduction

Stroke is a main challenge for health care systems because its prevalence increases in older people.[1] Aiming at reducing mortality and disability many countries have developed a network system of stroke units dedicated to the acute management of stroke patients.[2,3] In stroke unit a specialized multi-professional team focuses on direct stroke treatment (systemic fibrinolysis, endovascular revascularization, vascular surgery) and ensures quick team activation, specialized nursing care, effective management of dysphagia, prevention of complications, and early rehabilitation.[2]

Nevertheless patients develop functional deficits and dependence in a percentage ranging from 15 to 30% and cannot return home because they need individual rehabilitative treatment and/or management of disability.[1] Post-stroke disposition affects the length of stay (LOS) and the appropriate allocation of resources.

International literature reports several studies on predictive criteria of post-stroke disposition. In the USA, Israel and Scandinavia three main discharge settings (home, rehabilitation department and nursing home) are considered.[4-9] In France authors differentiate among four settings: home, rehabilitation, convalescent (temporary) home and long-term nursing home.[10] Main factors associated with post-stroke disposition are the severity of neurological deficit at the entrance,[4,7,8] age, LOS in stroke units, functional impairment of the upper arm and/or aphasia,[9] the level of disability at discharge,[11] incontinence, the need of feeding probe and cognitive impairment.[12] In a recent systematic review Hakkennes highlighted the most important indicators of disposition from a stroke unit [age, cognitive status, National Institute of Health Stroke Scale (NIH-SS) score, after stroke functional status and comorbidity] and the indicators of admission to rehabilitation (after stroke impairment, pre-stroke functional level and cognitive status).[13] Nevertheless absolute selection criteria for rehabilitation admission remain not available.[14]

In 2010, according to the Emilia Romagna regional stroke care program, a new stroke area opened in the Bentivoglio Hospital, which offers in-patient cares to the 150,000 inhabitants in the northern suburban province of Bologna. The stroke area was implemented inside the acute geriatric ward, which insisted in a geriatric-rehabilitative area that encompassed also two post-acute long-term wards and a rehabilitation ward. In our region, post-acute long-term wards are in-hospital settings that offer temporary skilled nursing care and low intensive physiotherapy to patients with disability not eligible to individual rehabilitative treatment. In post-acute wards a discharge planning is carried out in order to foster the patient's return home. The geriatric ward of the Bentivoglio Hospital has a undisputed competence in multi-professional team working and in multidimensional assessment.[15] Geriatricians and geriatric nurse staff grant comprehensive care and direct management through the multidisciplinary approach of comprehensive geriatrics assessment. Since the opening of the stroke care area, a clinical governance program has been implemented and an audit continuously monitors patients' care, treatments and disposition.[15]

Few studies on post-stroke disposition are available from Italian stroke units.[16] The most recent ones only evaluated predictors to clinical outcomes or to disposition to rehabilitative treatment excluding the discharge to long-term ward.[17,18] In the present study the authors evaluated a stroke unit in which comprehensive geriatric and multi-professional assessment and discharge planning are carried out. Baseline, clinical and post-stroke factors and length of stay were analyzed in order to provide a complete representation of how they correlated to the discharge settings.

Materials and Methods

Authors evaluated the activity of the stroke care area of the Bentivoglio Hospital, Italy from January 1, 2011 to June 30, 2012. All patients admitted to the stroke unit with documented brain injury from ischemic stroke or intracerebral hemorrhage and discharged with diagnosis related to acute cerebrovascular accident were considered. Patients with transient ischemic attack, subarachnoid hemorrhage and cerebral venous sinus thrombosis were excluded.

Subjects were excluded if they deceased in hospital, and if they were hosted in nursing home or were totally dependent (modified Rankin score=5) before the index event. Patients were also excluded if previously admitted to other stroke units or whether disposing data were missing. Due to their small number, patients that received thrombolytic therapy were excluded too.

All patients underwent a structured multidimensional assessment. Characteristics of patients and indicators of comprehensive assessment were prospectively collected in a registry. A systematic internal audit continuously monitored indicators of quality. The results largely fulfilled the National Institute of Clinical Excellence (NICE) Quality Standard bundles for stroke and were reported in a previous study.[15] A team with a geriatrician, a nurse, a physiatrist and a physiotherapist visits stroke patients within 36 h from admission and patients start rehabilitation as soon as clinical conditions allow it. The multi-professional approach continues also in post-acute long-term ward where both nursing care and a low intensive physiotherapy are granted to patients with disabilities that cannot sustain more intensive rehabilitative programs.

Identification of patients and collection of data and indicators were based on the ward registry. For missing data, medical records of patients were reviewed. Patients' discharge pathway was assessed by the hospital log. Three settings of discharge were considered: home, rehabilitative ward and post-acute long-term ward. The study was approved by the Local Ethical Committee.

Statistical analysis

Univariate analyses were performed to test the relationship among variables and each setting of discharge. Continuous variables have been tested using

the analysis of variance (ANOVA) and those categorical using the χ^2 test or the Fischer test when indicated. All tests were two-tailed. Variables significant at univariate analysis (P<0.05) were considered for the multivariate analysis. Multinomial analyses were performed to identify independent variables associated with each setting of discharge for comparison to the discharge at home. All analyses were performed using STATA version 12.

Results

During the 18-month period, 260 patients were admitted to the stroke area. Among them 9 had stroke mimic, 31 had transient ischemic attack, 1 had subarachnoid hemorrhage, 2 lived in nursing home before stroke, 2 received intravenous thrombolysis, 20 expired in stroke care area and 7 were urgently referred to vascular surgeon or cardiologist.

Of the 188 remaining patients, 106 (56.4%) were discharged home, 35 (18.6%) to rehabilitation ward and 47 (25.0 %) to long-term wards. Their characteristics are described in Table 1.

The mean age was 77.9±10.9; male were 101 (53.7%). Social condition before stroke: 51.6% lived alone; 28.2% lived with spouse and 20.2% lived with relatives or had in-home care. The average NIH-SS score on admission was 6.78±6.93 (range min 0 - max 42).

Patients referred to post-acute long-term ward were significantly older (84.8±5.9) than those discharged home (75.9±11.4) or to rehabilitation ward (74.7±10.6). Patients were significantly discharged to long-term wards if they were female (P=0.02), had a pre-stroke diagnosis of dementia (P<0.001) or a worse pre-stroke disability condition as assessed by anamnestic modified Rankin score ≥3 (P<0.001). Living with relatives and having in-home care before stroke showed no significance to post-stroke disposition (P=0.06). Anamnestic prior strokes (P=0.68) and Charlston comorbidity index with a categorization of 0-1 and ≥2 showed no significant correlation.

According to literature,[4-7,9-13,19] the NIH-SS score on admission highly correlated to hospital disposition (P<0.0001). Among patients discharged home 76% had a NIH-SS score ≤5, 22% had NIH-SS score ≥6-13 and only 2% had a score >13. Among patients admitted to rehabilitation 46% had NIH-SS score ≤5, 34% had a NIH-SS score ≥6-13 and 20% had a NIH-SS >13. Of those discharged to long-term ward 26% had NIH-SS score ≤5, 46% had a NIH-SS score ≥6-13 and 28% had a NIH-SS >13. Dysphagia (P<0.0001) but not aphasia was associated with discharge to intermediate care settings.[20]

Cardioembolic stroke patients were significantly discharged to long-term ward (P=0.02), lacunar stroke were significantly disposed home (P=0.03); patients with total anterior circulation infarct were significantly discharged to intermediate care settings (P<0.001). In-hospital complications were significantly more frequent in patients who were not discharged home (P<0.001).

LOS in stroke unit was shorter in patients discharged home (8.6±3.1 days) than in patients sent to rehabilitation (12.4±6.5 days) or to long-term wards (10.4±4.6 days). Univariate analysis showed significant difference only between home and rehabilitation (P<0.001).

Functional status at discharge from stroke unit according to mRankin score was significantly better in patients who went home (P<0.001). More than 75% of those admitted to rehabilitation had disability in activity of daily living or were unable to walk alone (mRankin score ≥3). The percentage raised to 93% in those discharged to long-term ward. Bars in Figures 1 and 2 show the distributions of mRankin score on admission and at discharge.

The overall length of stay in hospital ranged from 9.1±3.6 for those discharged home, to 30.5±17.9 for those discharged to post-acute long-term ward, and to 43.5±22.9 for those admitted to rehabilitation (P<0.0001).
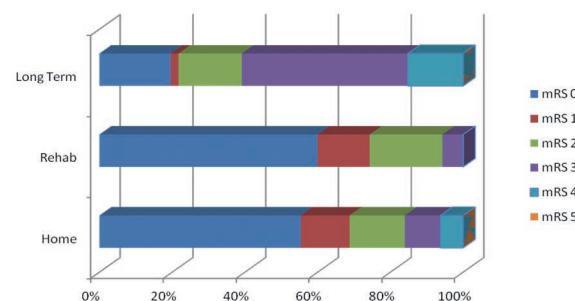

Figure 1. Distribution of pre-stroke mRankin score (mRS) (patients with pre-stroke mRS=5 not admitted to stroke unit).
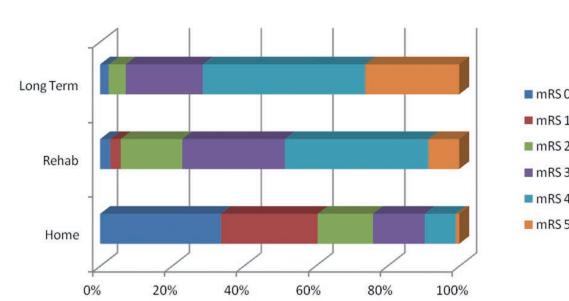

Figure 2. Distribution of post-stroke mRankin score (mRS).

Table 1. Characteristic of patients according to disposition from stroke unit (univariate analysis).

Baseline characteristics	Home	Rehabilitation	Long-term ward	P
N. of patients: total 188 (%)	106 (56.4%)	35 (18.6%)	47 (25.0%)	
Age (y)	75.9±11.4	74.7±10.6		0.82
Age (y)	75.9±11.4		84.8±5.9	<0.001
Age (y)		74.7±10.6	84.8±5.9	<0.001
Female sex	37.7	51.4	61.7	0.02
Social status				0.06
Living alone	17.9	22.9	23.4	
With spouse	63.9	54.3	34.0	
Other relatives/home care	23.6	22.9	42.6	
Dementia before stroke	7.6	2.9	33.3	<0.001
Comorbidity				0.745
CCI=0	66.0	77.1	63.8	
CCI=1	10.4	5.7	10.6	
CCI ≥2	23.6	17.1	25.5	
Prior stroke	13.7	8.8	15.2	0.688
Disability prior to stroke				<0.001
mRankin score before stroke 0-2	84.9	97.1	46.8	
mRankin score before stroke 3-5	15.1	2.9	53.2	
Admission stroke factors				
Acute neurological evaluation (NIH-SS score)				<0.001
NIH-SS ≤5	76.4	45.7	26.1	
NIH-SS 6-13	21.7	34.3	45.6	
NIH-SS >13	1.9	20.0	28.3	
Neurologic symptoms				
Aphasia	19.0	25.7	34.8	0.112
Dysphagia	13.2	45.7	47.8	<0.001
Type of stroke (TOAST)				0.055
Intracerebral hemorrhage	4.7	8.6	10.6	0.376
Cardioembolism	19.8	22.8	40.4	0.024
Lacunar	18.9	8.6	4.3	0.032
Large-artery atherosclerosis	14.1	5.7	14.9	0.380
Indeterminate	36.8	48.6	29.8	0.218
Other	5.7	5.7	0.0	0.248
OCSP classification				
Total anterior cerebral infarction	1.9	20.0	21.3	<0.001
In-hospital complications	19.8	35.3	53.2	<0.001
Length of stay in stroke unit (days)				
Length of stay in stroke unit	8.6±3.1	12.4±6.5		<0.001
Length of stay in stroke unit	8.6±3.1		10.4±4.6	0.07
Length of stay in stroke unit		12.4±6.5	10.4±4.6	0.10
Post-stroke factors				
mRankin score at disposition				<0.001
mRankin score 0-2	79.1	28.6	7.0	
mRankin score 3-5	20.9	71.4	93.0	
Overall in-hospital length of stay				
Mean±SD	9.1±3.6	43.5±22.9		<0.001
	9.1±3.6		30.5±17.9	<0.001
		43.5±22.9	30.5±17.9	<0.001

CCI, Charlson comorbidity index; mRankin score, modified Rankin score; NIH-SS, National Institute of Health Stroke score; TOAST, Trial of Org10172 in Acute Stroke Treatment; OSCP, Oxfordshire Community Stroke Project classification; SD, standard deviation. Values are percent or mean±SD.

Multivariate analysis

Two multivariate multinomial models analyzed factors associated with home disposition *versus* discharge to rehabilitative ward or to post-acute long-term ward.

The first model considered demographic variables (age, sex, social status), baseline and stroke related indicators on admission that were significant at univariate analysis: pre-stroke anamnestic mRankin, pre-stroke diagnosis of dementia, NIH-SS score on admission, stroke type, dysphagia (Table 2). Oxforshire Community Stroke Project classification (OCSP) types were excluded from analysis because the NIH-SS score has a strong concurrent validity with respect to infarct volume that might influence results.[21,22] Having home disposition as referent, factors associated with rehabilitation were dysphagia [odds ratio (OR) 4.5 (95% confidence interval, CI 1.68-12.13) P=0.003], NIH-SS score ≥6-13 [OR 2.91 (95% CI 1.05-8.04) P=0.04], NIH-SS score >13 [OR 23.5 (95% CI 4.11-134.83) P>0.001], pre-stroke mRanking score <3 [OR 0.10 (95% CI 0.01-0.80) P=0.03]. Factors associated with discharge to long-term ward were dysphagia [OR 4.31 (95% CI 1.35-13.72) P=0.013], NIH-SS score ≥6-13 [OR 3.47 (95% CI 1.16-10.41) P=0.03], intra cerebral hemorrhage [OR 4.14 (95% CI 1.10-15.64) P=0.04] and age [OR 1.09 (95% CI 1.00-1.19) P=0.04].

A second model added three stroke dependent co-variates represented by in-hospital complications, post-stroke disability and LOS in stroke unit (Table 3). In this model, factors associated with rehabilitation were post-stroke mRankin score ≥3 [OR 46.82 (95% CI 10.03-218.60) P<0.0001), dysphagia [OR 5.34 (95% CI 1.48-19.31) P<0.01), younger age [OR 0.93 (95% CI 0.89-0.98, P<0.009) and pre-stroke mRankin <3 [OR 0.03 (95% CI 0.00-0.28, P<0.002]. Factor associated with discharge in long-term ward were post-stroke mRankin score ≥3 [OR 68.61 (95% CI 13.01-361.75) P<0.0001] and dysphagia [OR 3.64 (95% CI 1.00-13.31) P<0.05].

The results of the two models were coherent: dysphagia, neurological impairment, poor post-stroke functional status were associated with disposition to intermediate care settings. Younger age and good pre-stroke functional status were related to rehabilitation. Older age and hemorrhagic stroke were associated with discharge to long-term wards.

Discussion

According to literature a proportion of patients ranging from 25% to 45% cannot be discharged home after an acute stroke and are admitted to rehabilitation or to temporary/long term facilities or nursing home.[5,8,10] The characteristics of post-stroke settings vary from country to country and sometimes within the same country accounting for the differences reported in epidemiological studies. Those differences may significantly affect the LOS.[4,5,10]

Table 2. Multinomial regression analysis of admission characteristics associated with post-stroke disposition (patients No. 179 - R²=0.2938).

Variables	Notes	Home Reference	OR	Rehabilitation (95% CI)	P	OR	Long-term ward (95% CI)	P
Age		1	0.06	(0.93-1.00)	0.13	1.09	(1.00-1.19)	0.04**
Male	Female as reference	1	0.55	(0.22-1.41)	0.21	1.07	(0.30-3.84)	0.92
Spouse	Alone as reference	1	1.46	(0.39-5.47)	0.57	0.67	(0.19-2.40)	0.55
Relat/home care	Alone as reference	1	1.33	(0.42-4.21)	0.63	0.72	(0.17-3.04)	0.91
Pre-stroke dementia	No dementia as reference	1	0.44	(0.02-9.49)	0.60	2.00	(0.50-8.01)	0.33
Prior stroke	No prior stroke as reference	1	0.99	(0.22-4.49)	0.99	0.69	(0.16-3.04)	0.62
Pre-stroke mRankin 3-4	mRankin 0-2 referent	1	0.10	(0.01-0.80)	0.03*	2.93	(0.84-10.30)	0.09
ICH	ICH *vs* ischemic	1	2.42	(0.58-10.06)	0.22	4.14	(1.10-15.64)	0.04**
Cardioembolism	*vs* other TOAST types	1	1.14	(0.36-3.54)	0.82	2.56	(0.85-7.69)	0.09
NIH-SS score ≥6-13	NIH-SS ≤5 referent	1	2.91	(1.05-8.04)	0.04*	3.47	(1.16-10.41)	0.03**
NIH-SS score >13	NIH-SS ≤5 referent	1	23.5	(4.11-134.83)	<0.001*	8.16	(0.92-72.41)	0.06
Dysphagia	No dysphagia	1	4.51	(1.68-12.13)	0.003*	4.31	(1.35-13.72)	0.01**

OR, odds ratio; CI, confidence interval; mRankin, modified Rankin score; ICH, intracerebral hemorrhage; TOAST, Trial of Org10172 in Acute Stroke Treatment classification; NIH-SS, National Institute of Health Stroke score. *Significant to rehabilitation ward: pre-stroke mRankin 3-4, NIHSS score >5, dysphagia; **Significant to long-term ward: age, ICH, NIH-SS score ≥6-13, dysphagia.

Patients discharged to rehabilitation or nursing home usually stay in stroke unit longer than those disposed home.[5,10] In a recent population-based study in Dijon, France (152,000 inhabitants) a longer LOS was independently associated with discharge to rehabilitative ward and to convalescent home.[10] In the Israel National Survey the average LOS in primary hospital was of 8.7±13.5 days but it raised to 10 days in those admitted to rehabilitation and almost doubled in those discharged to nursing home.[5] The delays were attributed to clinical conditions (severity of neurological damage, longer time to medical stabilization) but also to the accessibility to beds in rehabilitation or nursing home.[5,10]

Our geriatric-rehabilitative area encompasses a stroke unit, 14 beds of rehabilitative ward and 40 beds in two long-term wards. After the acute stroke about 44% of patients were disposed other than home; 18.6% went to rehabilitation and 25.0% to long-term wards. Our organization seems to support an efficient disposition to intermediate settings. The LOS in our stroke unit was shorter and in multinomial analysis did not correlates to the discharge setting.

In our analysis the main factors associated with post-stroke disposition were age, dysphagia, severe neurological impairment on admission, severe after stroke functional status, poor pre-stroke functional level and hemorrhagic stroke. The association of dysphagia with a long in-hospital stay is consistent with literature, being dysphagia a dangerous condition that needs competent nursing (specific diets, tube feeding, etc.) and physiotherapeutic treatments to reduce complications and morbidity. Severe neurological status and poor post-stroke functional conditions are well established factors of disposition to intermediate care,

but often authors complain that the most severe conditions are sent to convalescent home or nursing home and not to rehabilitation.[10] That was not the case. In our experience both conditions were strongly associated with discharge to rehabilitation (Tables 2 and 3). The main differences between rehabilitative wards and long-term wards were found in age, hemorrhagic stroke and pre-stroke functional condition. Patients disposed to long-term wards were about 10 years older than those admitted to rehabilitative ward. Only 5% of patients discharged to rehabilitation had a pre-stroke mRankin score ≥3. The role of age is frequently reported in literature[23-26] but it was quite unexpected in a geriatric managed stroke care area. A possible explanation may depend on organizational factors. Despite the multi-professional team, only the physiatrist can plan a rehabilitative program. The limited number of rehabilitative beds, the longer waiting time and the availability of a low intensive physiotherapy program in long-term wards might have lead physiatrists to select patients with better pre-stroke conditions and younger age in whom a valid functional recovery was more likely.[10,13] That choice had important economic effects. The overall in-hospital LOS was of 30.5±17.9 days for patients discharged to long-term ward and of 43.5±22.9 days for those admitted to rehabilitation ward. The daily reimbursement for in-hospital rehabilitation in Italy near doubles the reimbursement for long-term ward accounting for a difference of about € 10,000/patient. The effect of the disposition to a skilled long-term ward of older patients with pre-stroke disability seems positive on an economic ground but further studies are warranted to better understand the consequences in terms of functional recovery and social costs.

Table 3. Multinomial regression analysis of characteristics at discharge associated with post-stroke disposition (patients No. 176 - R^2=0.4295).

Variables	Notes	Home Reference	Rehabilitation OR	(95% CI)	P	Long-term ward OR	(95% CI)	P
Age			0.93	(0.89-0.98)	0.009*	1.03	(0.94-1.14)	0.50
Male	Female as reference	1	0.78	(0.22-2.78)	0.70	0.81	(0.22-2.93)	0.74
Spouse	Alone as reference	1	1.04	(0.19-5.61)	0.96	0.52	(0.13-2.05)	0.35
Relat/home care	Alone as reference	1	1.55	(0.31-7.87)	0.59	1.13	(0.24-5.25)	0.87
Dementia	No dementia as reference	1	0.31	(0.03-3.25)	0.33	2.04	(0.51-8.21)	0.31
Pre-stroke mRankin 3-4	mRankin 0-2 referent	1	0.03	(0.00-0.28)	0.002*	0.64	(0.17-2.46)	0.51
Complications	No complication	1	1.31	(0.39-4.43)	0.66	2.33	(0.75-7.27)	0.14
Dysphagia	No dysphagia	1	5.34	(1.48-19.31)	0.01*	3.64	(1.0-13.31)	0.05**
mRankin 3-4 discharge	mRankin 0-2 referent	1	46.82	(10.03-218.60)	<0.000*	68.61	(13.01-361.75)	<0.000**
LOS in Stroke Unit			1.07	(0.95-1.20)	0.22	0.95	(0.83-1.08)	0.40

OR, odds ratio; CI, confidence interval; mRankin, modified Rankin score; LOS, length of stay. *Significant to rehabilitation ward: age, pre-stroke mRankin 0-2, dysphagia, mRankin ≥3 at discharge; **Significant to long-term ward: dysphagia, mRankin ≥3 at discharge.

Study limitation

In our study, a single stroke unit located in a geriatric-rehabilitative area was considered, so results can be assumed as indicative of a regional condition and do not represent the whole Italian situation. Another limitation may depend on the quality of our long-term wards. The low intensive physiotherapy performed in our long-term ward may have influenced the choice of the physiatrist. A larger number of patients might have allowed a better understanding of the role of other factors like cognitive impairment in excluding patients from rehabilitation.

Conclusions

Stroke is a neurological condition that often produces disability and requires long hospitalization. Many authors stress the importance of both clinical and organizational conditions in establishing health care policies and in reducing costs. Healthcare systems offer different types of rehabilitative and long-term facilities and data from literature have low validity outside the country in which they were collected. However the organization of our geriatric-rehabilitative area and the multi-professional team implementing an early multi-dimensional assessment may explain the shorter LOS in stroke unit of our patients disposed to intermediate care when compared to other international experiences. Early and significant predictors supporting the choice among intermediate care settings remain uncertain. Until absolute selection criteria for admission to rehabilitation are available, each stroke unit should monitor the process of discharge. In our analysis dysphagia, severe neurological impairment and post-stroke disability were associated with discharge to intermediate care. Younger age and better pre-stroke functional status were associated with discharge to rehabilitation, and older age and hemorrhages to long-term wards. That does not contrast with literature but further studies are warranted to understand if a larger availability of rehabilitative beds may represent a better option for patients presently discharged to a skilled long-term ward and excluded from formal rehabilitation.

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