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Length of Stay and Functional Outcomes Among Patients with Stroke Discharged from an Inpatient Rehabilitation Facility in Saudi Arabia

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEFG 1 Saad M. Bindawas
ACDE 1 Vishal Vennu
ABE 2 Hussam Mawajdeh
BCDE 2 Hisham M. Alhaidary
CDEF 1,3 Emad Moftah

1 Department of Rehabilitation Sciences, King Saud University, Riyadh, Saudi Arabia
2 Rehabilitation Hospital, King Fahad Medical City, Riyadh, Saudi Arabia
3 Department of Rehabilitation, King Abdulaziz Medical City, Riyadh, Saudi Arabia

Corresponding Author: Saad M. Bindawas, e-mail: sbindawas@ksu.edu.sa
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Background: In many countries, the length of stay (LOS) for inpatient rehabilitation following stroke has gradually decreased. It is unclear whether this trend is associated with differences in functional outcomes, especially in developing countries. This study aimed to examine associations between LOS and functional outcomes among patients with stroke discharged from an inpatient rehabilitation facility in Saudi Arabia.

Material/Methods: This retrospective study included all patients (N=409) aged ≥18 years who were admitted to an inpatient rehabilitation for stroke during 2008–2014. There were no deaths in the cohort during the study period. Patients were divided into 4 groups according to days of rehabilitation: ≤30 days (n=114), 31–60 days (n=199), 61–90 days (n=72), and >90 days (n=24). Multivariate regression analyses were used to evaluate functional outcomes using the functional independence measure (FIM).

Results: The fully adjusted model showed that higher total and subscale FIM scores were significantly associated with a LOS ≤30 days (total β: 18.2, standard error [SE]=4.43, $P \leq 0.0001$; motor-FIM: β=13.9, SE=3.70, $P=0.0002$; cognitive-FIM: β=4.3, SE=1.29, $P=0.001$), and 31–60 days (total β: 11.3, SE=4.07, $P=0.005$; motor-FIM: β=8.8, SE=3.40, $P=0.009$; cognitive-FIM: β=2.4, SE=1.19, $P=0.038$) compared with >90 days.

Conclusions: A short or intermediate LOS is not necessarily associated with worse outcomes, assuming adequate care is provided.

MeSH Keywords: Length of Stay • Rehabilitation • Stroke

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Background

Length of stay (LOS) refers to the duration of a single episode of hospitalization [1]. A trend toward gradually decreased LOS in inpatient rehabilitation facilities (IRF) following stroke has been associated with differences in functional outcomes [2,3]. For example, the average LOS in the United States was 20 days until 2000 but decreased to 16.5 days from 2007. A previous observational study demonstrated that hospital readmission within 30 days for diagnoses such as heart failure, chronic obstructive pulmonary disease, acute myocardial infarction, community-acquired pneumonia, and gastrointestinal bleed decreased in conjunction with decreased LOS (from 5.44 to 3.98 days) [4]. Another study found that longer LOS for chronic conditions (e.g., coronary artery disease, congestive heart failure, and chronic kidney disease) was associated with marginally increased risk for rehospitalization (1.03, 95% confidence interval 1.02–1.04) [5]. These findings are important because hospital readmission is used as a quality indicator.

Typical post-stroke LOS in an IRF differs across countries [6]. For example, the average LOS for patients with stroke in the United States is 16.5 days [2], whereas the reported average is 23–49 days in Canada, 28 days in Australia, and 30 days in New Zealand [7]. From 2005–2008, the average LOS in Saudi Arabia (SA) was 45 days [8,9]. A synthesis report indicated that LOS variation across settings and countries is based on insurance or type of healthcare coverage, and number and quality of IRFs [10]. Regardless of LOS, patients with less severe stroke may be expected to have better functional outcomes at discharge than those with more severe stroke [11]. Previous studies suggested that average LOS may be related to multiple factors including age, family structure, stroke severity, and complications [12–15]. A retrospective study found that the LOS for inpatient rehabilitation for people with stroke varied across 10 geographic regions in the United States, even after adjusting for demographic and clinical characteristics [16]. Another study using Medicare fee-for-service beneficiaries' data with stroke who received inpatient rehabilitation were conducted to examine the functional status variations by geographic locations [17]. That study suggested the level of the IRF effect accounted for more variation in functional status than the geographic region. This may be explained by different settings having different governing rules and regulations, admission policies, staffing ratios, and service delivery patterns [17].

SA is a welfare state, and the government aims to implement total quality management in free healthcare to citizens through public and private services [18]. In this context, our previous retrospective observational study reported that decreasing the LOS is necessary to improve the efficiency of IRFs in SA [19]. In addition, it is essential to standardize IRFs to support identification of the predictors of LOS for patients with stroke. This will also be useful to help caregivers set a target date for discharge from the IRF and allow timely access to rehabilitation programs for other patients. Gaining appropriate access to rehabilitation services is a crucial challenge for people with stroke [20]. Such access is limited in SA, as reported in our previous call-for-action review about stroke rehabilitation in SA [21].

To the best of our knowledge, few studies in SA have examined the association between LOS in an IRF as a continuous variable and functional outcomes, independent of prognostic variables among patients with a stroke [8,21]. It remains unclear whether decreasing LOS is associated with differences in functional outcomes [22,23]. Therefore, this study aimed to investigate the associations between LOS and functional outcomes among patients with stroke discharged from an IRF in SA, independent of age, sex, stroke type, body involvement, and discharge disposition. Conceptually, variation in rehabilitation is linked with demographics (age and sex) [24], clinical characteristics (stroke type and body involvement) [25], and factors such as the functional independence measure (FIM) score, FIM efficiency, and discharge disposition, which influence care decisions and resource use [26]. We hypothesized that a shorter LOS would be associated with better functional outcomes.

Material and Methods

Study design

Two of the present investigators conducted a review of the computerized medical records database at the King Fahad Medical City-Rehabilitation Hospital (KFMC-RH) by stroke from 2008–2014. The time frame was determined based on the availability of medical records by stroke diagnosed according to International Classification of Diseases (Ninth Revision) codes 348–438 and 799.3. Differences in opinion regarding medical records and stroke classification were resolved by discussion between the investigators until consensus was reached.

Setting

The KFMC-RH is the largest Ministry of Health tertiary IRF and provides free rehabilitation services to referred patients in Riyadh, SA. The KFMC-RH database includes demographic variables (age and sex), diagnosis (stroke), stroke type, body involvement, and discharge disposition.

Participants

All patients (N=409) aged 18 years or older who were admitted to the IRF from 2008 to 2014 because of stroke were considered for inclusion in this study. Patients were classified

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into 4 groups by LOS in the IRF: ≤30 days; 31–60 days; 61–90 days; and >90 days. Based on the average LOS in SA, discharge from the IRF ≤30 days was defined as a short LOS, discharge at 31–60 days as an intermediate LOS, and discharge at 61–90 days as long LOS. Prolonged LOS (>90 days) was used as the reference group. This study was approved by the Committee on Human Research and the Institutional Review Board for KFMC-RH (approval number: 14-273). The need to obtain informed consent from patients was waived.

Data collection

Data extracted from the review of patients' medical records included age, sex, stroke type, body involvement, and discharge disposition (e.g., community-dwelling, assisted living, long-term hospital). The number of days each patient spent in the IRF, including admission and discharge days, was considered the LOS for that patient. Functional outcomes were evaluated with the FIM, which is administered in a standardized way for all admissions and discharges. The FIM is administered under the Uniform Data System for Medical Rehabilitation (UDSMR) protocol [27] and provides indices for the level of assistance a patient requires to accomplish activities of daily living [28].

The FIM comprises 18 items: 13 motor items (motor-FIM subscale) and 5 cognitive items (cognitive-FIM subscale). Each item is given an ordinal score from 1–7, with the minimum score (1) representing complete dependence on others for that task and the maximum score (7) representing full independence. The total-, motor-, and cognitive-FIM score ranges are 18–126, 13–91, and 5–35, respectively. Higher scores reflect greater independence. FIM scores were measured sequentially at admission and discharge to determine the effects of therapy. The FIM has been shown to be reliable and valid in patients with stroke [29–31].

Variables

Based on the available literature, we examined 3 common stroke rehabilitation outcomes: demographic and clinical factors, and discharge disposition [24,32,33]. Consistent with our conceptual model and available data, we entered demographic characteristics (age and sex), clinical factors (stroke type and body involvement), and other factors such as discharge disposition.

Statistical analysis

Descriptive statistics are presented as percentages for categorical measures and means with standard deviations for continuous measures. For group comparisons, chi-square tests were used to analyze frequencies and analyses of variance. Fisher's post hoc tests were conducted for continuous variables. We computed 3 individual multiple linear regression analyses for LOS with the total-, motor-, and cognitive-FIM score datasets. Each analysis comprised 3 models: unadjusted (Model 1); adjusted for age and sex (Model 2); and adjusted for age, sex, stroke type, body involvement, and discharge disposition (Model 3). The short, intermediate, and long LOS groups versus the prolonged LOS group (reference) were compared in all models. The analyses were performed with SAS version 9.2 (SAS Institute, Inc., Cary, NC). Mean regression output beta values are reported with standard errors.

Results

Descriptive statistics for the 4 patient groups stratified by LOS in the IRF are summarized in Table 1. Compared with the reference group (>90 days), patients in the short (≤30 day) and intermediate (31–60 day) groups were significantly older by an average of 8 and 6 years, respectively. The mean LOS was 19 days for the short group, 45.5 days for the intermediate group, and 71 days for the long group, compared with 131 days for the reference group. The majority of patients in the intermediate group were men (n=101) and had experienced a hemorrhagic stroke (40% of the entire sample). Most patients in this group had suffered a stroke that affected the left side of their body (22% of the entire sample) and were discharged to home (48% of the entire sample). Patients in the short, intermediate, and long groups showed significant functional improvement between admission and discharge. Significant ($P<0.05$) differences were found between the short, intermediate, and long groups compared with the reference group, but not between the long LOS and reference groups (Table 1).

Figure 1 presents the means for the 4 groups' FIM scores. The mean total-, motor-, and cognitive-FIM scores were significantly higher in the short and intermediate groups. As LOS in the IRF increased, the total-, motor-, and cognitive-FIM gradually decreased.

Model 1 showed the total-FIM score was significantly improved by 14.5 points ($P=0.002$) in the short group and 9 points ($P=0.038$) in the intermediate group compared with the reference group. Model 2 (adjusted for age and sex) showed the total-FIM score was significantly improved by 18 points ($P<0.0001$) in the short group and 11.3 points ($P=0.005$) in the intermediate group. Finally, Model 3 (adjusted for age, sex, stroke type, body involvement, and discharge disposition) showed the total-FIM score was significantly improved by 18.2 points ($P<0.0001$) in the short group and 11.3 points ($P=0.005$) in the intermediate group (Table 2). Motor-FIM scores in the short group were significantly improved by 10.8 points ($P=0.006$), 13.7 points ($P=0.002$), and 13.9 points ($P=0.002$) in Models 1, 2, and 3, respectively. In the intermediate group, motor-FIM

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Table 1. Descriptive characteristics of study participants, stratified by length of stay (N=409).

Characteristic	LOS ≤30 days N=114 (28%)	LOS, 31–60 days N=199 (49%)	LOS, 61–90 days N=72 (17%)	LOS >90 days N=24 (6%)	P*
LOS, mean ±SD	19.3±7.4	45.5±8.0	71.0±7.0	131.0±54.0	<.0001
Age in years, n (%)	60.0±14.6	57.0± 16.4	59.0±14.1	51.6±19.3	.080
Gender, n (%)					.130
Men	73 (18)	101 (25)	41 (10)	15 (4)	
Women	41 (10)	98 (24)	31 (7)	9 (2)	
Stroke type, n (%)					.522
Hemorrhagic	99 (24)	162 (40)	62 (15)	19 (5)	
Other stroke	15 (4)	37 (9)	10 (2)	5 (1)	
Body involvement, n (%)					.770
Left	60 (15)	91 (22)	33 (8)	14 (3)	
Right	35 9)	79 (20)	28 (7)	7 (2)	
Bilateral	19 (4)	29 (7)	11 (2)	3 (1)	
Discharge disposition, n (%)					.721
Home	110 (27)	195 (48)	70 (16)	24 (6)	
Not to home	4 (1)	4 (1)	2 (1)	0 (0.0)	
Total-FIM, mean ±SD					
Admission	72.7±25.5	59.3±20.6	49.8±17.6	52.9±27.6	<.0001
Discharge	93.0±29.7	88.8±25.1	79.0±26.3	77.2±28.7	.001
Differences	20.3±14.4	29.4±16.2	29.1±16.5	24.3±15.8	<.0001
Motor-FIM, mean ±SD					
Admission	44.0±19.8	33.3±16.6	25.6±11.2	31.1±23.1	<.0001
Discharge	62.9±24.7	59.9±21.6	51.7±20.4	51.5±23.8	.003
Differences	18.9±13.9	26.0±15.4	26.0±15.1	20.4±14.5	<.0001
Cognitive-FIM, mean ±SD					
Admission	28.6±8.1	26.0±8.4	24.2±10.4	21.7±11.4	.0005
Discharge	30.0±7.2	28.8±6.6	27.3±9.0	25.6±10.0	.020
Differences	1.3±2.6	2.8±3.8	3.1±4.5	3.8±4.9	.0001

LOS – length of stay; FIM – functional independent measure; SD – standard deviation. * Chi-square test for categorical variables and ANOVAs with Fisher's post hoc tests for continuous variables.

scores were significantly improved by 8.8 points (P=0.009) in Models 2 and 3 (Table 3). In the short group, cognitive-FIM score was significantly improved by 3.7 points (P = 0.004) in Model 1, and 4.3 points (P=0.001) in Models 2 and 3. In the intermediate group, the cognitive-FIM score was significantly improved by 2.5 points (P = 0.037) in Model 2, and 2.4 points (P=0.038) in Model 3 (Table 4). In these models, the explained variance increased from R^2=0.038 to R^2=0.16 for the total-FIM, R^2=0.034 to R^2=0.16 for motor-FIM, and R^2=0.023 to R^2=0.066 for cognitive-FIM.

The regression analysis indicated that age was significantly (P=0.001) associated with lower total- (–0.5 points), motor- (–0.4 points), and cognitive-FIM (–0.06 points) scores. Women had significantly lower scores for total- (–0.9 points, P=0.002) and motor-FIM (–0.8 points, P=0.0006) than men. Patients who were not discharged to home had significantly lower scores for total- (–3.5 points, P=0.001), motor- (–2.8 points, P=0.003), and cognitive-FIM (–0.7 points, P=0.005) scores compared with patients who were discharged to home.

Discussion

The present study revealed associations between LOS in an IRF and functional recovery, as evidenced by FIM scores. The

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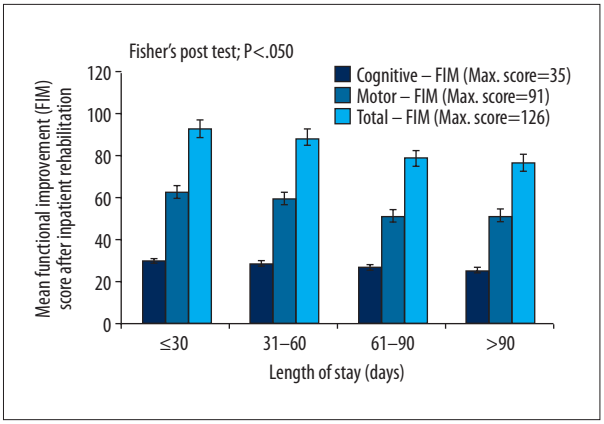

Figure 1. The mean of functional improvement scores in 4 length of stay groups after discharge from an inpatient rehabilitation facility.

short and intermediate LOS groups showed better functional gains in total-, motor-, and cognitive-FIM than the prolonged LOS group after adjustment for age, sex, stroke type, body involvement, and discharge disposition. The statistically and clinically significant improvement in cognitive-FIM score was an interesting finding from the present study. Age, sex, and discharge disposition were inversely associated with total- and motor-FIM. Being male was associated with a functional gain advantage for both total- and motor-FIM scores.

This study demonstrated that short and intermediate LOS had significant functional outcomes between admission and discharge. Moreover, a short LOS was associated with a statistically and clinically significant improvement in cognitive-FIM score. A retrospective cohort study conducted in the United States demonstrated that functional outcomes were improved among patients with stroke and they were clinically stable with a shorter LOS in an IRF, which is consistent with our findings [34]. Another study from the United States involving patients with stroke who completed inpatient rehabilitation between 2005 and 2007 [35] showed that cognitive-FIM score was improved by more than 3 points in patients with stroke [36], which represented meaningful clinical improvement [36]. Another interesting finding from the present study was that the long LOS group showed negative scores for total- and motor-FIM, although these differences were not significant. This is consistent with the results of a previous observational study that showed long LOS had a significantly increased risk of hospital readmission among patients with other chronic conditions [5].

As expected, differences in baseline FIM at admission may be attributed to LOS because FIM improvements between admission and discharge differed in each group. The short and intermediate LOS groups had significantly higher total and subscale FIM scores at admission than the other groups. The findings of the present study were similar to those of a retrospective cohort study involving patients with stroke admitted to an acute hospital rehabilitation center between March 2005 and December 2006 in Singapore [20]. These findings suggest that a higher motor-FIM score at admission is an important factor influencing LOS in an IRF.

Table 2. Regression analysis of the association between length of stay and total Functional Independence Measure score at discharge (N=409).

Characteristic	Model 1			Model 2			Model 3		
	beta	SE	*P**	*beta*	SE	*P**	*beta*	SE	*P**
Constant	82.1	2.84	<.0001	115.9	5.41	<.0001	114.9	5.79	<.0001
LOS >90 days (reference group)									
LOS ≤30 days (short LOS group)	14.5	4.68	.002	18.0	4.42	<.0001	18.2	4.43	<.0001
LOS 31–60 days (intermediate LOS group)	9.0	4.32	.038	11.3	4.07	.005	11.3	4.07	.005
LOS 61–90 days (long LOS group)	–4.1	5.12	.423	–0.8	4.82	.866	–0.6	4.83	.896
Age (continuous)				–0.5	0.08	<.0001	–0.5	0.08	<.0001
Gender (women *vs.* men)				–0.8	0.28	.003	–0.9	0.28	.002
Stroke type (hemorrhagic *vs.* other)							0.3	0.37	.341
Body involvement (left/right *vs.* bilateral)							0.04	0.67	.941
Discharge disposition (not to home *vs.* home)							–3.5	0.90	.0001
R^2	.038			.16			.16		

LOS – length of stay; SE – standard error. * Multiple linear regression tests.

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Table 3. Regression analysis of the association between length of stay and Functional Independence Measure motor subscale score at discharge (N=409).

Characteristic	Model 1			Model 2			Model 3		
	beta	SE	*P**	*beta*	SE	*P**	*beta*	SE	*P**
Constant	54.9	2.38	<.0001	84.1	4.51	<.0001	83.0	4.83	<.0001
LOS >90 days (reference group)									
LOS ≤30 days (short LOS group)	10.8	3.91	.006	13.7	3.69	.002	13.9	3.70	.0002
LOS 31–60 days (intermediate LOS group)	6.8	3.61	.062	8.8	3.39	.009	8.8	3.40	.009
LOS 61–90 days (long LOS group)	–4.3	4.29	.316	–1.5	4.02	.712	–1.3	4.03	.732
Age (continuous)				–0.4	0.06	<.0001	–0.4	0.07	<.0001
Gender (women *vs.* men)				–0.7	0.23	.001	–0.8	0.23	.0009
Stroke type (hemorrhagic *vs.* other)							0.2	0.31	.450
Body involvement (left/right *vs.* bilateral)							0.1	0.56	.744
Discharge disposition (not to home *vs.* home)							–2.8	0.75	.0003
R^2	.034			.16			.16		

LOS – length of stay; SE – standard error. * Multiple linear regression tests.

Table 4. Regression analysis of the association between length of stay and Functional Independence Measure cognitive subscale score at discharge (N=409).

Characteristic	Model 1			Model 2			Model 3		
	beta	SE	*P**	*beta*	SE	*P**	*beta*	SE	*P**
Constant	27.2	0.79	<.0001	31.8	1.58	<.0001	31.9	1.69	<.0001
LOS >90 days (reference group)									
LOS ≤30 days (short LOS group)	3.7	1.30	.004	4.3	1.29	.001	4.3	1.29	.001
LOS 31–60 days (intermediate LOS group)	2.2	1.20	.067	2.5	1.19	.037	2.4	1.19	.038
LOS 61–90 days (long LOS group)	0.2	1.43	.889	0.6	1.41	.634	0.7	1.41	.598
Age (continuous)				–0.06	0.02	.006	–0.06	0.02	.005
Gender (women *vs.* men)				–0.06	0.08	.436	–0.07	0.08	.407
Stroke type (hemorrhagic *vs.* other)							0.1	0.11	.273
Body involvement (left/right *vs.* bilateral)							–0.1	0.19	.498
Discharge disposition (not to home *vs.* home)							–0.7	0.26	.005
R^2	.023			.062			.066		

LOS – length of stay; SE – standard error. * Multiple linear regression tests.

In our sample, the short group had an average LOS of 19 days and the intermediate group had an average LOS of 45 days, which is consistent with the LOS reported in South Korea [37], and SA [9]. Recent studies suggested that age, sex, and ethnic differences were determinants of LOS in IRFs among patients with stroke [8,9]. However, there are different standards of stroke severity for IRF admission, such as functional deficits secondary to stroke, ability to learn, and ability to physically participate [38].

Our findings about demographic factors (age and sex) and discharge disposition contradicted with previously reported results [21,39,40]. A previous literature review found that numerous variables were associated with outcomes after inpatient

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rehabilitation [39]. That review provided reliable evidence for many other factors that impact on prognosis, including age, sex, stroke type, admission FIM score, and discharge disposition. The present study also found that most included patients had hemorrhagic stroke, which a previous study reported is more prevalent in men [41]. According to that study, factors significantly associated with ischemic stroke as opposed to hemorrhagic stroke included older age and male sex. Other studies have demonstrated that demographic status, stroke type, and discharge disposition also influenced LOS in an IRF and functional outcomes [20,35].

We observed that the total LOS decreased from a median of 51 days in 2011–2012 to 41 days in 2014 (F=1.65, P=0.14). This is inconsistent with the results of Granger et al. [2], who provided benchmarking information for a large national sample of patients with stroke in 893 IRFs for 2000–2007 in the United States. Their secondary analysis of UDSMR data revealed that the average LOS decreased from 19.6 days to 16.5 days during the 8-year study period, and patients exhibited improved functional independence during their rehabilitation stay. Most patients in that study were discharged to home. Another retrospective United States cohort study found that LOS decreased substantially from 1994 to 2001 [34].

In SA, the Ministry of Health has established several rehabilitation facilities for persons with disabilities over the past 2 decades [42]. These facilities are an integral part of the nation's healthcare system. The Saudi Central Board for Accreditation of Healthcare Institutions has mandated that high-quality, standardized care including rehabilitation services to be provided to all citizens and residents in these facilities. The present findings suggest that to establish such high-quality care, rehab providers in SA should aim to standardize the average LOS in IRFs. Accomplishing this goal would require training of and collaboration among rehabilitation professionals, and along other recommendations, as reported in a review [21].

The present study has some limitations. First, it used a retrospective design, included a small sample, and examined only a limited number of factors. Second, the study was conducted at a single center and the findings may not be generalizable to other hospitals in SA or the Arabian Gulf region. Strengths of this study included the review of complete records for a well-defined cohort of stroke patients at KFMC-RH, a large tertiary care facility in Riyadh, SA. This hospital follows the UDSMR protocol for FIM administration, and is certified to use the FIM instrument. The FIM is a well-accepted measure of functional outcomes worldwide. Finally, this is the first study to examine the association between LOS and functional outcomes among patients with stroke discharged from an IRF in SA in recent years.

Conclusions

Our results demonstrated that a short or intermediate LOS in an IRF is not necessarily associated with worse outcomes, assuming adequate care is provided efficiently. Short and intermediate LOS were associated with functional outcomes independently of age, sex, and discharge disposition. A short LOS was associated with higher functional scores. Being male was associated with a functional gain. Future studies should be conducted on a national level including larger samples from multiple centers to confirm the present findings and inform provision of standardized rehabilitation services on a national level.

Conflicts of interest

None.

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