ORIGINAL

Characteristics of rehabilitation services in high-FIM efficiency hospitals after hip fracture

Daichi Asanuma[a], and Ryo Momosaki[b]

[a]Department of Rehabilitation, Teikyo University School of Medicine University Hospital, Mizonokuchi, Kanagawa, Japan, [b]Department of Rehabilitation Medicine, Teikyo University School of Medicine University Hospital, Mizonokuchi, Kanagawa, Japan

Abstract : Characteristics of rehabilitation services probably explain a large proportion of the variation in clinical outcomes following hip fracture. The aim of this study was to clarify rehabilitation characteristics of high-performance hospitals after hip fracture. This is a retrospective observational study using the Japan Rehabilitation Database for the period 2005–2015. We divided facilities into high-FIM efficiency and low-FIM efficiency hospitals by using the mean of Functional Independence Measure efficiency for each hospital. We compared rehabilitation characteristics between high- and low-FIM efficiency hospitals. We identified 1247 patients with hip fracture from 12 hospitals who were eligible for analysis after applying exclusion criteria. Using one-to-one random matching on admission Functional Independence Measure, 880 pairs of patients were included for final analysis. More patients were discharged home in the high-FIM efficiency hospitals compared with low-FIM efficiency hospitals. High-FIM efficiency hospitals had significantly shorter length of stay. Patients in high-FIM efficiency hospitals received higher amounts of daily rehabilitation, early rehabilitation, and preoperative rehabilitation. Patients in high-FIM efficiency hospitals engaged in more weekend exercise and self-exercise. Our data suggested that the amount, timing, and type of rehabilitation are essential indicators of performance in acute hip fracture. J. Med. Invest. 66 : 324-327, August, 2019

***Keywords* :** *activities of daily living, aged, hip fracture, pay-for-performance, quality indicator*

INTRODUCTION

Hip fracture is the most common fracture among the older individuals and its incidence is rising in developed countries alongside population aging (1). Rehabilitation plays an important role in mitigating the diminished ability to perform activities of daily living among these patients (2).

Facility characteristics explain a large proportion of the variation in clinical outcomes following hip fracture. A previous cohort study using Medicare data showed facility size, ownership by a facility organization, hospital market concentration, percent of patients who have multiple problems, and occupancy rate were significant facility characteristics affecting outcomes after hip fracture (3). We focused on variation of rehabilitation services as a facility characteristic ; for instance, type and amount of rehabilitation. We could change characteristics of rehabilitation services easier than other facility characteristics. Another cohort study using the Uniform Data System for Medical Rehabilitation Database did not show any significant correlation of rehabilitation characteristics with gains in motor and cognitive function (4). In addition, if significant characteristics of rehabilitation services are clarified, we could use these characteristics as quality indicators of rehabilitation in each hospital.

This retrospective observational study aimed to clarify characteristics of rehabilitation services in high-performance hospitals after acute hip fracture.

Received for publication February 26, 2019 ; accepted August 1, 2019.

Address correspondence and reprint requests to Ryo Momosaki, Department of Rehabilitation Medicine, Teikyo University School of Medicine University Hospital, Mizonokuchi, 5-1-1 Futako, Takatsu, Kawasaki, Kanagawa 213-8507, Japan and Fax : +81-44-844-3201.

PATIENTS AND METHODS

This study was approved by the Institutional Review Board of the Japanese Association of Rehabilitation Medicine. The requirement of informed patient consent was waived because anonymized data from the association's database were used for analysis.

The Japan Rehabilitation Database was established with financial support from the Ministry of Health, Labour and Welfare of Japan. Comprehensive clinical data was accumulated for rehabilitation in continuous patients discharged from participating hospitals from 2005. The database comprises solely voluntary hospital samples, not random hospital with unique identifiers for the specific patient data. Baseline data were collected at admission ; time-dependent variables and outcome data were collected at discharge. The data were then submitted to the Japan Association of Rehabilitation Database. All personal data were coded and deidentified by deleting all personal identifying information.

In this study, we included patients with hip fracture admitted to acute care hospital from the database. We excluded patients admitted to hospitals that registered less than 10 patients, those not admitted within the day after onset, and patients with missing Functional Independence Measure (FIM) data.

Data extracted from the database and forwarded to us for analysis are listed below : Number of patients in each hospital, FIM scores (from 18 [totally dependent] to 126 [totally independent]) (5) on admission and discharge, length of stay, days from onset, amount of daily rehabilitation, rehabilitation onset day from admission, preoperative rehabilitation, self-exercise without medical staff, weekend exercise, fracture type, pre-injury bedridden degree, whether the patient underwent surgery.

The 18-item FIM scale assesses independence in common activities of daily living, and FIM scores are familiar to most rehabilitation staff in Japan. Each item is assessed on a 7-point ordinal scale, with higher scores reflecting greater independence. The FIM is grouped into a 13-item motor subscale (eating, grooming, bathing, upper-body dressing, lower-body dressing, personal hygiene, bladder management, bowel management, bed-to-chair transfer, toilet transfer, shower transfer, walk or wheel-chair and stairs) and a 5-item cognitive subscale (com-prehension, expression, social interaction, problem solving and memory). The motor subscale score ranges from 13 to 91 (motor FIM). Therapists evaluated FIM on the ward using ADL performance. Even if patients could not walk, they could perform several ADLs in a subcategory of FIM, such as eating, grooming, upper-body dressing, and personal hygiene. FIM gain was calculated as : (FIM score on discharge – FIM score on admission). FIM efficiency was calculated as (FIM score on discharge – FIM score on admission) /length of stay in days (6).

All patients with hip fracture participated in rehabilitation programs that focused on gait- and exercise-related to activities of daily living, typically involving 40–60 min of rehabilitation per weekday. Weekend exercise is rehabilitation therapy provided by therapists on Saturdays and Sundays. Weekend rehabilitation is usually provided at the discretion of the attending physician based on their prescription of rehabilitation therapy and the setup of rehabilitation therapy services (7). Self-exercise was performed with the instructions of a therapist, nurse, or physician. Self-exercise supplemented formal therapy by repeating the activity or motion. Self-exercise varied in terms of content and load, and although the details were not clear for every acute hospital, a survey of some of the facilities indicated that self-exercise was planned under the guidance of a therapist and that the primary focus was on standing training, transfer training, and gait training (8).

Bedridden degree, which is used to judge the level of long-term care. This indicates the level of independence of elderly patients in ADL, ranging from fully independent to completely bedridden as follows : independent (fully independent), J1 and J2 (independent with some disability), A1 and A2 (moving around indoors independently, but requiring some assistance when they go out), B1 and B2 (mostly bedridden), or C1 and C2 (completely bedridden). In the present study, we divided this range of independence into four variables : independent (independent, J1 or J2), homebound (A1 or A2), mostly bedridden (B1 or B2), or completely bedridden (C1 or C2).

We used FIM efficiency as a performance index of in-hospital rehabilitation services. We divided facilities into high-FIM efficiency and low-FIM efficiency hospitals by using the median of FIM efficiency. Before and after one-to-one random matching on admission FIM, rehabilitation characteristics were compared between high-FIM efficiency and low-FIM efficiency hospitals using the chi-square test for categorical variables and the unpaired t-test for continuous variables. We used SPSS 19.0 software (IBM SPSS Inc., Armonk, NY) for all analyses, with statistical significance set at $p < 0.05$.

RESULTS

A total of 3088 patients with hip fracture were identified in 32 acute hospitals for the study period. Of these, we excluded 841 patients who were admitted to hospitals that registered less than 10 patients ; 621 were not admitted within the day after onset and 379 had missing data on FIM. This left 1247 patients from 12 acute hospitals eligible for analysis (Figure 1). FIM efficiency for each hospital are shown in Table 1. Median of FIM efficiency in all patients was 0.5. We defined high-FIM efficiency hospitals as facilities with median of FIM efficiency over 0.5 and identified 6 high-FIM efficiency hospitals (50%) with 589 patients (47.2%).

Using one-to-one matching on admission FIM, 880 pairs of patients were included for final analysis. Table 2 shows the comparison between the high-FIM efficiency and low-FIM efficiency hospitals. High-FIM efficiency hospitals had significantly higher FIM efficiency and FIM gain scores than the control group, and a significantly shorter length of stay in both matched and unmatched groups. More patients engaged in early rehabilitation, high amounts of rehabilitation, preoperative rehabilitation, self-exercise, and weekend rehabilitation in the high-FIM efficiency hospitals compared with low-FIM efficiency hospitals before and after matching.

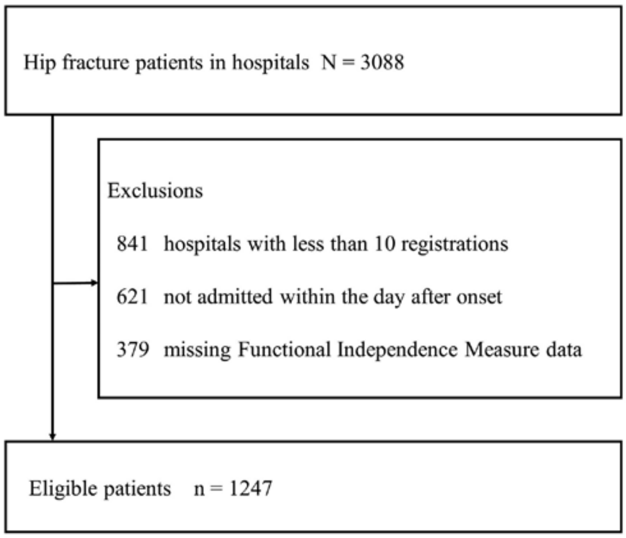

Figure 1. Flow chart of patient selection

Table 1. Number of patients and FIM efficiency for each hospital

Hospital	FIM efficiency	
	Mean ± standard deviation	Median [Interquartile range]
A	0.44 ± 0.25	0.40 [0.24, 0.62]
B	1.26 ± 0.85	1.10 [0.69, 1.74]
C	0.64 ± 0.47	0.57 [0.20, 1.04]
D	0.59 ± 0.55	0.49 [0.24, 0.79]
E	0.62 ± 0.59	0.51 [0.23, 0.74]
F	0.94 ± 0.67	0.82 [0.41, 1.35]
G	1.17 ± 0.69	1.12 [0.59, 1.79]
H	0.61 ± 0.56	0.44 [0.15, 1.05]
I	0.35 ± 0.25	0.28 [0.17, 0.51]
J	0.52 ± 0.39	0.42 [0.25, 0.69]
K	0.37 ± 0.33	0.28 [0.09, 0.54]
L	0.99 ± 1.90	0.58 [0.26, 1.00]

FIM, Functional Independence Measure.

Table 2. Differences between patients in high-FIM efficiency and low-FIM efficiency hospitals

	Unmatched groups			Matched groups using admission FIM		
	Patients in high-FIM efficiency hospitals	Patients in low-FIM efficiency hospitals	*p*-value	Patients in high-FIM efficiency hospitals	Patients in low-FIM efficiency hospitals	*p*-value
Number of patients	589	658		440	440	
Female (%)	462 (78.4)	526 (79.9)	0.514	338 (76.8)	357 (81.1)	0.136
Age (%)						
< 64	52 (8.8)	45 (6.8)	0.014	31 (7.0)	32 (7.3)	0.466
65-74	78 (13.2)	55 (8.4)		50 (11.4)	36 (8.2)	
75-84	193 (32.8)	226 (34.3)		145 (33.0)	148 (33.6)	
90-	266 (45.2)	332 (50.5)		214 (48.6)	224 (50.9)	
Comorbidities (%)						
Cerebrovascular disease	72 (12.2)	59 (9.0)	0.065	62 (14.1)	43 (9.8)	0.061
Orthopedic disease	93 (15.8)	101 (15.3)	0.831	64 (14.5)	63 (14.3)	0.924
Dementia	211 (35.8)	258 (39.2)	0.220	180 (40.9)	153 (34.8)	0.071
Non-operative (%)	34 (5.8)	30 (4.6)	0.369	25 (5.7)	17 (3.9)	0.268
Fracture type (%)			0.001			0.001
Femoral neck	186 (31.6)	128 (19.5)		123 (28.0)	85 (19.3)	
Trochanteric	231 (39.2)	139 (21.1)		175 (39.8)	94 (21.4)	
Missing	172 (29.2)	391 (59.4)		142 (32.3)	261 (59.3)	
Pre-injury bedridden degree (%)			0.588			0.080
Independent	182 (30.9)	209 (31.8)		100 (22.7)	141 (32.0)	
Homebound	128 (21.7)	164 (24.9)		104 (23.6)	102 (23.2)	
Mostly bedridden	79 (13.4)	79 (12.0)		71 (15.9)	43 (9.8)	
Completely bedridden	23 (3.9)	27 (4.1)		19 (4.3)	17 (3.9)	
Missing	177 (30.1)	179 (27.2)		147 (33.4)	137 (31.1)	
FIM score on admission ± SD	53.1 ± 20.3	45.6 ± 19.6	< 0.001	48.2 ± 18.1	48.2 ± 18.1	1
Motor FIM score on admission ± SD	28.7 ± 13.9	24.4 ± 13.2	< 0.001	25.6 ± 11.9	25.3 ± 12.4	0.716
Cognitive FIM score on admission ± SD	24.3 ± 9.8	21.1 ± 9.2	< 0.001	22.6 ± 9.74	22.9 ± 9.0	0.635
FIM score on discharge ± SD	85.2 ± 29.4	72.0 ± 30.9	< 0.001	79.9 ± 28.9	75.9 ± 29.6	0.045
FIM gain ± SD	32.1 ± 19.2	26.3 ± 20.3	< 0.001	30.9 ± 19.7	27.4 ± 20.2	0.044
FIM efficiency ± SD	1.06 ± 0.93	0.56 ± 0.50	< 0.001	0.94 ± 0.72	0.62 ± 0.52	< 0.001
Home discharge (%)	303 (51.4)	189 (28.7)	< 0.001	204 (46.4)	130 (29.5)	< 0.001
Length of stay (days) ± SD	39.7 ± 24.9	54.1 ± 30.6	< 0.001	41.9 ± 25.4	54.2 ± 30.8	< 0.001
Rehabilitation starting day from admission ± SD	2.8 ± 22.1	5.3 ± 4.8	< 0.001	3.3 ± 21.8	5.5 ± 4.6	0.043
Amount of daily rehabilitation (min) ± SD	58.0 ± 22.7	43.3 ± 34.7	< 0.001	57.1 ± 23.5	43.8 ± 34.9	< 0.001
Preoperative rehabilitation (%)	244 (41.4)	140 (21.3)	< 0.001	176 (40.0)	91 (20.7)	< 0.001
Self-exercise (%)	172 (29.2)	35 (5.3)	< 0.001	103 (23.4)	18 (4.1)	< 0.001
Weekend rehabilitation (%)	311 (52.8)	10 (1.5)	< 0.001	217 (49.3)	6 (1.4)	< 0.001

FIM, Functional Independence Measure ; SD, standard deviation.

DISCUSSION

This study used a large rehabilitation inpatient database to clarify rehabilitation characteristics in high-FIM efficiency hospitals after hip fracture. Patients in the high-FIM efficiency hospitals received early rehabilitation and more amounts of rehabilitation. Also, high-FIM efficiency hospitals provided more preoperative rehabilitation, self-exercise, and weekend exercise.

A cohort study demonstrated that participation of rehabilitation specialists, conference execution rate, amount of exercise per day, self-exercise without therapists, and exercise in wards were significant characteristics in recovery among stroke patients (9). In the present study, timing, amount, and type of rehabilitation were associated with hospital performance ; we obtained similar results as in the previous study. In addition, a systematic review reported the effect of intensive and early rehabilitation for hip fracture (10). Self-exercise and weekend exercise may contribute to improving physical ability by increasing the amount of exercise and variety of rehabilitation after hip fracture (7, 8).

High-FIM efficiency hospitals had significantly shorter lengths of stay. However, high-FIM efficiency hospitals provided longer rehabilitation time for patients. The difference in length of stay was 12 days on average between the two groups. The additional provision of rehabilitation services totally costs on average about 14800 Japanese yen. We think this cost is reasonable.

Pay-for-performance initiatives provide financial benefits or consequences to individual health care providers, groups of providers, or institutions based on their performance in measures of quality (11). Pay-for-performance was found to improve quality and efficiency of cardiac rehabilitation (12). Also, a pay-for-performance model was associated with improved quality of care for older patients with hip fracture (13). Thus, rehabilitation characteristics of this study could be used as quality indicators and assessment criteria for pay-for-performance. Further research is required to clarify whether these indices could be used in pay-for-performance evaluation with a larger amount of data.

We recognize a certain limitation in this study. First, the Japan Rehabilitation Database solely contains data provided voluntarily, not random samples, from participating hospitals, and so generalization of our findings to all hospitals may be limited. Second, the low-FIM efficiency hospitals had more missing data compared with high-FIM efficiency hospitals. This suggests that low-FIM efficiency hospitals probably did not make concerted efforts in data collection.

In conclusion, we have clarified the characteristics of high-FIM efficiency hospitals in acute hip fracture rehabilitation. Our data suggested that amount, timing, and type of rehabilitation are essential indicators of performance in acute hip fracture rehabilitation.

CONFLICT OF INTERESTS

No conflict of interest to declare.

ACKNOWLEDGMENTS

This study gratefully acknowledges the Japan Association of Rehabilitation Database for providing the data analyzed in this study. Discussion of the results of this study represent the views of the authors and not the official views of the Japan Association of Rehabilitation Database.

REFERENCES

1. Johnell O, Kanis JA : An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporos Int 17 : 1726-1733, 2006
2. Radosavljevic N, Nikolic D, Lazovic M, Jeremic A : Hip fractures in a geriatric population – rehabilitation based on patient's needs. Aging Dis 5 : 177-182, 2014
3. Neuman MD, Silber JH, Passarella MR, Werner RM : Comparing the contributions of acute and postacute care facility characteristics to outcomes after hospitalization for hip fracture. Med Care 55 : 411-420, 2017
4. Johnston MV, Wood KD, Fiedler R : Characteristics of effective and efficient rehabilitation programs. Arch Phys Med Rehabil 84 : 410-418, 2003
5. Hetherington H, Earlam RJ : Measurement of disability after multiple injuries : the functional independence measure. Clinical review. Eur J Surg 161 : 549-555, 1995
6. Koh GC, Chen CH, Petrella R, Thind A : Rehabilitation impact indices and their independent predictors : a systematic review. BMJ Open 3 : e003483, 2013
7. Kinoshita S, Momosaki R, Kakuda W, Okamoto T, Abo M : Association between 7 days per week rehabilitation and functional recovery of patients with acute stroke : a retrospective cohort study based on the Japan Rehabilitation Database. Arch Phys Med Rehabil 98 : 701-706, 2017
8. Shiraishi N, Suzuki Y, Matsumoto D, Jeong S, Sugiyama M, Kondo K : Effects of a self-exercise program on activities of daily living in patients after acute stroke : a propensity score analysis based on the Japan Association of Rehabilitation Database. Arch Phys Med Rehabil 98 : 434-441, 2017
9. Jeong S, Kondo K, Shiraishi N, Inoue Y : An evaluation of the quality of post-stroke rehabilitation in Japan. Clinical Audit 2 : 59-66, 2010
10. Chudyk AM, Jutai JW, Petrella RJ, Speechley M : Systematic review of hip fracture rehabilitation practices in the elderly. Arch Phys Med Rehabil 90 : 246-262, 2009
11. Mendelson A, Kondo K, Damberg C, Low A, Motúapuaka M, Freeman M, Kansagara D : The effects of pay-for-performance programs on health, health care use, and processes of care : a systematic review. Ann Intern Med 166 : 341-353, 2017
12. Mead H, Grantham S, Siegel B : Improving cardiovascular care through outpatient cardiac rehabilitation : an analysis of payment models that would improve quality and promote use. J Cardiovasc Nurs 29 : 158-164, 2014
13. Colais P, Pinnarelli L, Fusco D, Davoli M, Braga M, Perucci CA : The impact of a pay-for-performance system on timing to hip fracture surgery : experience from the Lazio Region (Italy). BMC Health Serv Res 13 : 393, 2013