

*Original Article***Mean length of stay and rate of discharge to home adjusted for severity in rehabilitation hospitals participating in Kumamoto Stroke Liaison Critical Pathway**

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ABSTRACT

Tokunaga M, Watanabe S, Nakanishi R, Yamanaga H, Kawasaki M, Hirata Y, Yamaga M, Terasaki T, Hashimoto Y, Sonoda S. Mean length of stay and rate of discharge to home adjusted for severity in rehabilitation hospitals participating in Kumamoto Stroke Liaison Critical Pathway. *Jpn J Compr Rehabil Sci* 2012; 3: 26–31.

Objective: To clarify the mean length of stay (LOS) and rate of discharge to home adjusted for severity [total Nichijo-seikatsu-hyokahyo (NSKH; English translation: Functional Assessment of Daily Living Table) score] in rehabilitation hospitals participating in Kumamoto Stroke Liaison Critical Pathway.

Methods: A total of 762 stroke patients were studied. The overall severity distribution in all the hospitals was used as the standard severity distribution. The severity distribution in each rehabilitation hospital was adjusted to match the standard severity distribution.

Under this condition, the mean LOS and rate of discharge to home in each hospital were calculated.

Results: The adjusted rate of discharge to home tended to increase in a nearly linear manner with prolongation of the adjusted mean LOS. However, even in hospitals with adjusted mean LOS longer than 90 days, the adjusted rate of discharge to home remained around 0.7.

Conclusion: No rehabilitation hospitals in Kumamoto Prefecture achieved a short LOS and high rate of discharge to home. To avoid reduction of the rate of discharge to home, an adjusted mean LOS longer than 90 days is probably necessary.

Key words: length of stay, discharge to home, community liaison critical pathway, severity, stroke

Introduction

Many researchers predicted the hospitalization period, outcome and prognosis based on the data of activities of daily living (ADL), age and comorbidities [1–3]. Such prediction, however, is not accurate enough to be used for predicting individual outcome in the future [4]. Since 2001, the Kaifukuki Rehabilitation Ward Association has conducted annual nationwide surveys focusing on the actual mean length of stay (LOS) and outcome. According to the results obtained, the LOS of stroke patients in convalescent rehabilitation wards (CRW) was 89.3 days on the average in 2008, which was shorter than the mean LOS of 92.8 days in 2001. These numerical data, however, suggests that further decrease in mean LOS could not be expected [5]. The Japanese healthcare system allows insurance coverage for up to 150-day stay in CRW for stroke (180 days for serious stroke accompanying higher brain dysfunction). The relatively mildly impaired

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patients, however, leave CRW after a short stay. Thus, the mean LOS in CRW seems to be about 89 days. Sonoda [6] defined the appropriate LOS in CRW as the period in which a patient should receive training under the supervision of a coach almost every day, and proposed that completion of convalescent rehabilitation and completion of rehabilitation are two different concepts [6]. All the hospitals, however, do not necessarily make the same judgment of completion of kaifukuki rehabilitation and completion of rehabilitation. The rate of discharge to home from CRW was 65.6% in 2008 [5]. However, special attention should be directed to the fact that the mean LOS in CRW and the rate of discharge to home from CRW depend largely on the severity distribution of the stroke patients [7, 8].

In a preceding study using the Nichijo-seikatsukino-hyokahyo (NSKH; English translation: Functional Assessment of Daily Living Table) (Table 1) [9], which is the designated method for rating severity for health insurance treatment by the stroke liaison critical pathway (liaison path), the authors stratified stroke patients and calculated the “adjusted mean gain of NSKH” under the condition that the severity distribution in a hospital with a CRW (rehabilitation hospital) was the same as the severity distribution in all the local rehabilitation hospitals [10]. Using the same method in the present study, the authors aimed to clarify the mean LOS and the rate of discharge to home adjusted for severity in the rehabilitation hospitals

participating in the stroke liaison path in Kumamoto Prefecture.

Methods

Between January 1, 2009 and November 30, 2010, a total of 1,957 stroke patients were admitted to acute hospitals in Kumamoto Prefecture and registered in the electronic liaison critical pathway of Kumamoto Seamless Stroke Referral Associates for CVD Amelioration (K-STREAM) [11]. Of these, 1,637 stroke patients were transferred to rehabilitation hospitals. Registration forms with complete entries including total NSKH score, LOS in rehabilitation hospitals, and outcome at discharge could be obtained from 762 of 1,637 stroke patients. K-STREAM consists of the following medical institutions in Kumamoto Prefecture: 10 acute hospitals, 34 rehabilitation hospitals, 33 medical long-term care sanatoriums, 18 geriatric health service facilities, and 37 clinics. For patients who are eligible for treatment by the stroke liaison path, the patients and their families are notified and explained during admission to an acute hospital that their clinical data will be used in a clinical study, and written informed consent is obtained.

Assessment 1: LOS and percentage of patients discharge to home at each rehabilitation hospital

Rehabilitation hospitals were ranked in descending order according to the number of patients treated as

Table 1. Nichijo-seikatsu-kino-hyokahyo (NSKH)

	Patients' Conditions etc.	0 point	1 point	2 points
1	Instruction of bed rest	None	Present	
2	Either right hand or left hand can be raised up to the chest	Possible	Impossible	
3	Rolling over	Possible	Possible if there is something to hold on to	Impossible
4	Sitting up	Possible	Impossible	
5	Maintaining the sitting position	Possible	Possible if there is any supporting tool	Impossible
6	Transferring from the bed to the wheelchair	Possible	Watching/partial assistance needed	Impossible
7	Transferring method	Moving requiring no assistance	Moving requiring assistance	
8	Oral hygiene care	Possible	Impossible	
9	Having meals	No assistance	Partial assistance	Total assistance
10	Putting on/taking off the clothes	No assistance	Partial assistance	Total assistance
11	Communicating with others	Possible	Occasionally possible and occasionally impossible	Impossible
12	Understanding treatment/healthcare instructions	Yes	No	
13	Dangerous behavior	None	Present	

Table 2. Number of patients, length of stay (LOS) and rate of discharge to home stratified according to total NSKH score on admission

The adjusted LOS, adjusted rate of discharge to home and standard severity distribution are explained in the Methods section.

Number of patients

	0-1	2-5	6-9	10-13	14-19	Total
Hospital A	38	42	41	29	24	174
Hospital B	35	35	22	14	19	125
Hospital C	29	30	25	15	19	118
Hospital D	20	12	12	17	14	75
Remaining hospitals	53	46	62	37	72	270
All hospitals	175	165	162	112	148	762
Standard severity distribution	0.230	0.217	0.213	0.147	0.194	1

Length of stay (LOS)

	0-1	2-5	6-9	10-13	14-19	Mean LOS	Adjusted mean LOS
Hospital A	37.5	59.2	92.1	99.9	97.0	74.2	74.5
Hospital B	38.3	67.1	100.3	98.6	108.2	74.7	80.2
Hospital C	42.0	72.3	106.1	126.5	134.7	89.0	92.6
Hospital D	62.2	97.0	99.4	121.2	140.7	101.7	101.6
Remaining hospitals	43.3	73.5	101.2	126.9	108.4	90.5	87.1
All hospitals	43.0	70.0	99.4	115.5	112.9	85.1	85.1

Rate of discharge to home

	0-1	2-5	6-9	10-13	14-19	Rate	Adjusted rate
Hospital A	0.947	0.833	0.634	0.241	0.042	0.603	0.576
Hospital B	0.943	0.829	0.864	0.286	0.000	0.680	0.622
Hospital C	0.966	0.967	0.520	0.800	0.053	0.703	0.669
Hospital D	1.000	0.917	0.667	0.412	0.286	0.667	0.686
Remaining hospitals	0.981	0.848	0.726	0.541	0.236	0.641	0.689
All hospitals	0.966	0.867	0.685	0.446	0.155	0.651	0.651

follows: Hospital A (174 patients), Hospital B (125 patients), Hospital C (118 patients), Hospital D (75 patients) and a group of the remaining 20 hospitals with less than 35 patients per hospital (270 patients in total). The mean LOS and rate of discharge to home were obtained from all the hospitals, Hospital A, Hospital B, Hospital C, Hospital D and the remaining hospitals.

Assessment 2: LOS and rates of discharge to home in 5 groups divided according to total NSKH score on admission

The patients were divided into the following 5 groups according to the total NSKH score on admission: 0-1 point, 2-5 points, 6-9 points, 10-13 points, and 14-19 points. The total NSKH score ranges from 0 to 19 points, and more critically ill patients have higher scores. Because most of the patients had scores ranging from zero to one point [12], the total NSKH score groups were divided as follows: the 0-1

point group with a 2-point interval, then the next three groups with 4-point intervals, and the 14-19 point group with a 6-point interval. The number of patients, LOS and rate of discharge to home in each group were obtained in all hospitals and in Hospital A, Hospital B, Hospital C, Hospital D and the remaining hospitals. The patients were divided into 5 groups according to severity and the number of patients in each group was obtained. The patient distribution obtained in this manner was regarded as severity distribution. The severity distribution reflecting the numbers of patients in the 5 groups in all the hospitals was used as the "standard severity distribution" (Table 2).

Assessment 3: Mean LOS and rate of discharge to home adjusted by standard severity distribution

Because different severity distributions were observed in Hospital A, Hospital B, Hospital C, Hospital D and the remaining hospitals, the "adjusted mean LOS" and the "adjusted rate of discharge to

home” were calculated in each hospital under the condition that the severity distribution in each rehabilitation hospital was the same as the standard severity distribution. For example, in the case of Hospital A, the mean LOS of the 0–1 point group (37.5 days) was multiplied by the standard severity distribution for the 0–1 point group (0.230, 175 of 762 patients), and the mean LOS of the 2–5 point group (59.2 days) was multiplied by the standard severity distribution for the 2–5 point group (0.217, 165 of 762 patients). Likewise, adjusted values were also obtained in the 6–9 point, 10–13 point and 14–19 point groups. Then, the adjusted mean LOS in Hospital A was calculated by summing the five values obtained (Table 2). Similarly, the adjusted mean LOS of Hospital B, Hospital C, Hospital D and the remaining hospitals were calculated. The adjusted rate of discharge to home was also obtained by multiplying the observed rate by the standard severity distribution in each group.

Results

The mean LOS was the longest in Hospital D followed by the remaining hospitals, Hospital C, Hospital B and Hospital A. The rate of discharge to home was the highest in Hospital C followed by Hospital B, Hospital D, the remaining hospitals and Hospital A (Figure 1). The overall mean LOS (85.1 days) and the overall rate of discharge to home (65.1%) were compared with the results of the survey conducted by the Kaifukuki Rehabilitation Ward Association (89.3 days, 65.6%) [5]. The overall mean LOS in the present study was shorter than the result of the survey by 4.2 days, while the overall rate of discharge to home in the present study was lower than that of the survey by 0.5%.

The patients were divided into five groups according to the total NSKH scores on admission, and the LOS and rate of discharge to home in each group are shown in the Table 2. The LOS distribution pattern was similar between Hospital C and the remaining hospitals.

The adjusted mean LOS was the longest in Hospital D followed by Hospital C, the remaining hospitals, Hospital B and Hospital A. The adjusted rate of discharge to home was the highest in the remaining hospitals followed by Hospital D, Hospital C, Hospital B and Hospital A (Figure 1). A greater influence of adjustment by standard severity distribution was observed in Hospital B and the remaining hospitals.

The adjusted rate of discharge to home tended to increase linearly with prolongation of the adjusted mean LOS. However, even in hospitals with adjusted mean LOS longer than 90 days, the adjusted rate of discharge to home remained around 0.7 (Figure 1).

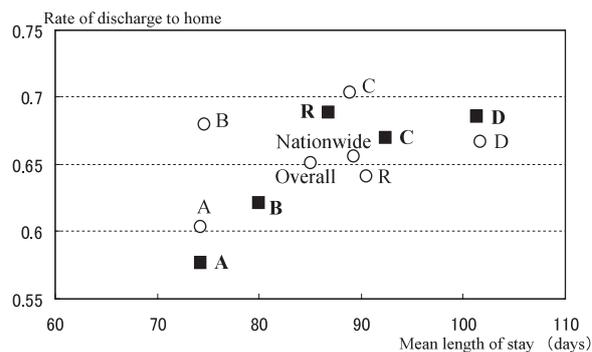


Figure 1. Mean length of stay (LOS) and rate of discharge to home.

○: Mean LOS and rate of discharge to home. ■: Adjusted mean LOS and adjusted rate of discharge to home corrected by standard severity distribution. Overall: Total data derived from Hospital A, Hospital B, Hospital C, Hospital D and the remaining hospitals. Nationwide: Results of the nationwide survey [5]. R: Remaining hospitals.

Discussion

Maejima et al. [13] followed stroke patients who were transferred from one acute hospital to 6 rehabilitation hospitals to investigate their mean LOS and Functional Independence Measures (FIMs). According to their report, there was no difference in FIM gain between hospitals, while there were differences in the mean LOS and FIM efficiency (FIM gain/LOS) between hospitals. Our search of literature found no report in which the mean LOS and rate of discharge to home are adjusted by standard severity distribution in all hospitals participating in the stroke liaison path.

Adjustment by standard severity distribution had a marked impact on Hospital B and the remaining hospitals. In Hospital B, adjustment for severity resulted in longer mean LOS and lower rate of discharge to home. These results suggest that Hospital B might have more mildly impaired patients. On the other hand, in the remaining hospitals, adjustment for severity resulted in shorter mean LOS and higher rate of discharge to home. These results indicate that the remaining hospitals might have more critically ill patients. In these hospitals in which the severity distribution differed from the standard severity distribution, the observed mean LOS and rate of discharge to home cannot be used directly, but the adjusted mean LOS and adjusted rate of discharge to home have to be used in comparisons.

An adjusted mean LOS longer than 90 days is probably needed to avoid a reduction in the adjusted rate of discharge to home. A hospital with adjusted mean LOS of 90 days seems to be positioned between Hospital C and the remaining hospitals. For an adjusted mean LOS of 90 days, the LOS distribution according

to total NSKH score reflecting severity can also be expressed as follows: 43 days in the 0–1 point group, 73 days in the 2–5 point group, 104 days in the 6–9 point group, 127 days in the 10–13 point group and 108–135 days in the 14–19 point group (Table 2). A rehabilitation hospital with sufficient rehabilitation capacity and home assistance capacity can achieve a higher rate of discharge to home with a shorter adjusted mean LOS. However, such a rehabilitation hospital cannot be found in Kumamoto Prefecture.

The present study has the following limitations. First, the data of more rehabilitation hospitals are needed to validate the relationship between the adjusted mean LOS and adjusted rate of discharge to home. Second, whether the results obtained in Kumamoto Prefecture can be generalized to different areas remains unknown. Third, we were not able to characterize the hospitals with longer mean LOS and lower rate of discharge to home, or to identify the cause of such phenomenon. Fourth, how discharge was determined at each hospital remains unknown. Whether patients were discharged predominantly after a period determined in advance, whether the adjusted mean LOS is longer in hospitals with more unused beds, whether the time of discharge was determined based on careful evaluation after a period of training supervised by a coach every day, and whether patients needed to wait for a long period before being transferred to different institutions also remain unknown. The mean LOS in each rehabilitation hospital and the rate of discharge to home from each rehabilitation hospital probably differ depending on the number of geriatric health service facilities and medical long-term care sanatoriums in the neighborhood. Fifth, the mean LOS in each rehabilitation hospital and the rate of discharge to home from each rehabilitation hospital may be affected not only by the number of hospitals/institutions for chronic phase rehabilitation but also by the LOS and rehabilitation capacity in the acute hospital. In some areas, stroke patients may be transferred to rehabilitation hospitals after a long stay in acute hospitals. In these areas, the LOS in rehabilitation hospitals is apparently shorter because of the longer stay in acute hospitals, under the condition that the total LOS (LOS in acute hospital plus LOS in rehabilitation hospital) is the same. On the other hand, the LOS in a rehabilitation hospital is likely to be prolonged if a stroke patient is affected seriously by disuse in the acute hospital. Sixth, further issues to be addressed include whether NSKH is an appropriate scale for rating the severity of stroke patients and whether dividing the patients into 5 groups according to their NSKH scores is reasonable. NSKH was developed for assessing the degree of nursing needs, and has not been established as a scale for rating severity of stroke patients [12]. Although researchers recommend stratifying stroke patients according to age, comorbidities, acute severity rated by scales

including the NIH stroke scale, impairment, and ADL [8], no concrete methods have been clearly mentioned. Stratification of stroke patients according to NSKH scores that have been incorporated in treatment under health insurance is simple and practical. A more appropriate stratification method, however, should be used if such a method is established in the future.

In the future, we expect that a nationwide survey will elucidate the adjusted mean LOS and adjusted rate of discharge to home of individual hospitals in Japan. In this process, if hospitals with shorter adjusted mean LOS and higher rate of discharge to home are identified, their rehabilitation capacity and home assistance capacity may serve as the goals to be achieved by other rehabilitation hospitals.

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References

1. Domen K: Prediction of stroke outcome. *J Clin Rehabil* 1998; 7: 347–56. Japanese.
2. Suzuki T, Sonoda S, Saitoh E: Prediction of outcome for stroke patients: function, ADL, discharge destination. *Sogo Rehabilitation* 2007; 35: 1023–9. Japanese.
3. Liu M, Domen K, Chino N. Comorbidity measures for stroke outcome research. *Arch Phys Med Rehabil* 1997; 75: 166–72.
4. The Joint Committee on Guidelines for the Management of Stroke. *Japanese Guidelines for the Management of Stroke* 2004. Tokyo: Kyowa Kikaku; 2004. p. 176–7. Japanese.
5. 2010 Annual Report from the Annual Survey Committee of Kaifukuki Rehabilitation Ward Association. February 2011. Japanese.
6. Sonoda S: How should the kaifukuki rehabilitation wards change to improve the quality. *Chiiki Rehabil* 2008; 3: 944–6. Japanese.
7. Tokunaga M, Tokisato K, Watanabe S, Nakanishi R, Yamanaga H, Nakashima H, et al. Correlation between independence, mobility capacity and FIM in patients with stroke in rehabilitation hospital. *J Clin Rehabil* 2008; 17: 1112–8. Japanese.
8. Japanese Association of Rehabilitation Medicine. Guidance about the stroke rehabilitation liaison critical pathway. *Jpn J Rehabil Med* 2010; 47: 420–2. Japanese.
9. Ministry of Health, Labour and Welfare. *Nichijo-seikatsu-kinou-hyokahyo*. Available from: http://www.mhlw.go.jp/topics/2008/03/dl/tp0305-1i_0012/pdf. Japanese.
10. Tokunaga M, Watanabe S, Nakanishi R, Yamanaga H, Sannomiya K, Hirata Y, et al. Comparison between convalescent rehabilitation hospitals participating in the stroke liaison critical pathway with respect to the gain of *Nichijo-seikatsu-kinou-hyokahyo* score. *Jpn J Compr*

- Rehabil Sci 2012; 3: 11-7.
11. Terasaki T, Hirata Y, Hashimoto Y, Yamaga M, Hirano T, Morioka M, et al. The development of digitalized version of stroke liaison critical pathway. *Jpn J Stroke* 2010; 32: 654-9. Japanese.
 12. Sonoda S, Miyai I, Nagai S, Yamamoto S, Takizawa Y, Ito I, et al. Relationship between Nichijo-seikatsu-kino-hyokahyo and the Functional Independence Measure in Kaifukuki rehabilitation ward. *Sogo Rehabil* 2009; 37: 453-60. Japanese.
 13. Maejima S, Osawa A, Ishihara S, Satoh A, Tanahashi N: Stroke liaison clinical pathway and convalescence rehabilitation ward from the acute phase hospital viewpoint. *Jpn J Stroke* 2010; 32: 357-64. Japanese.