



Original Article

## Effects of assigning physical therapists exclusively to the acute-phase stroke patient ward

YUICHI NISHIKAWA, RPT, PhD<sup>1)\*</sup>, KAZUHIKO HIRATA, RPT, MSc<sup>2)</sup>, YOSHIHIRO ITO, RPT, MSc<sup>2)</sup>, KAZUYUKI UEDA, RPT, BSc<sup>2)</sup>, HIROAKI KIMURA, MD, PhD<sup>3)</sup>

<sup>1)</sup> Faculty of Frontier Engineering, Institute of Science & Engineering, Kanazawa University: Kakuma-machi, Kanazawa, Ishikawa 920-1192, Japan

<sup>2)</sup> Division of Rehabilitation, Department of Clinical Practice and Support, Hiroshima University Hospital, Japan

<sup>3)</sup> Department of Rehabilitation Medicine, Hiroshima University Hospital, Japan

**Abstract.** [Purpose] In April 2014, an additional health insurance system aiming to maintain or improve activities of daily living levels was newly established by the Japanese government. The purpose of this study was to determine the influence of this new medical system for rehabilitation on patient management (e.g., activities of daily living level and length of hospital stay) in an acute-phase stroke patient ward. [Participants and Methods] All patients were admitted to the stroke patient ward in our hospital and were registered between January 2012 and December 2019. We assessed the differences in the time to initiation of rehabilitation, length of hospitalization, implementation rate of rehabilitation, and Barthel Index between the period before the start of the new medical system (Prior period) and after this system was started (Post period). [Results] Significant improvements were observed in the initiation of rehabilitation and the difference in the Barthel Index scores after the start of the new medical system. Although the length of hospitalization and implementation rate of rehabilitation did not differ significantly, both indicators gradually improved after the start of the new system. [Conclusion] Our results suggest that the new medical system for rehabilitation is beneficial for patient management in the acute-phase stroke patient ward.

**Key words:** Acute-phase, Stroke, Rehabilitation

(This article was submitted Nov. 12, 2021, and was accepted Dec. 20, 2021)

### INTRODUCTION

In acute care hospitals such as university hospitals, it is necessary to start rehabilitation as soon as possible to prevent a decline in an individual's ability to perform activities of daily living (ADL). In particular, early initiation of rehabilitation is useful for improving ADL levels in patients with certain diseases (e.g., stroke and brain tumors<sup>1-3)</sup>, pulmonary disease<sup>4)</sup>, and cardiovascular disease<sup>5)</sup>). However, in the Japanese medical system, rehabilitation is initiated only after it is indicated by a physician, and it is difficult to initiate rehabilitation immediately after admission.

In April 2014, an additional health insurance system aiming to maintain or improve ADL levels was newly established by the Japanese government<sup>6)</sup>. The main purpose of this new medical system was to promote early mobilization among patients immediately after admission to acute-phase wards by assigning physical therapists (PTs) exclusively to the wards, to prevent functional declines because of inactivity and to promote early discharge<sup>6)</sup>. The fundamental aims of the additional medical system are as follows: (1) to prevent a decline in ADL levels during hospitalization and to facilitate early discharge and (2) to promote interdisciplinary safety management, prevent disuse syndrome and pressure sores, and share information with patients and their families<sup>7)</sup>. This system is gradually becoming more common in hospitals nationwide, and it has been

\*Corresponding author. Yuichi Nishikawa (E-mail: [yuichi@se.kanazawa-u.ac.jp](mailto:yuichi@se.kanazawa-u.ac.jp))

©2022 The Society of Physical Therapy Science. Published by IPEC Inc.



This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License. (CC-BY-NC-ND 4.0: <https://creativecommons.org/licenses/by-nc-nd/4.0/>)

reported to contribute to the early initiation of rehabilitation and a shortened hospitalization period in cardiovascular internal medicine wards<sup>7</sup>). This system has been introduced in various departments, but there have been no reports of its introduction in stroke patients ward, where early initiation of rehabilitation is necessary<sup>1-3</sup>).

In our hospital, this medical system was introduced in the stroke patients ward in 2015 to facilitate early initiation of rehabilitation, assessment of the ADL level and sharing of information with patients, their families, and medical staff (e.g., physicians, nurses, and medical social workers). The aim of this study was to determine the influence of a system aiming to maintain or improve the ADL level on patient management (ADL level and length of hospital stay) in an acute-phase stroke patients ward by comparing the pre- and postintervention periods.

## PARTICIPANTS AND METHODS

This single-center, case registry, retrospective study included patients who were admitted to the stroke patients ward in our hospital between January 2012 and December 2019. Thus, we defined the period before the new medical system of rehabilitation was implemented as the 'prior period', and the period after implementation of the new medical system of rehabilitation was defined as the 'post period'. Clinical parameters (age, gender, disease, and functional ability, including the Barthel Index (BI) were recorded for all patients during hospitalization. This study was approved by the Institutional Review Board of Hiroshima University Hospital (E-1171-1). All clinical investigations were conducted according to the principles of the Declaration of Helsinki. Because the data were anonymized, informed consent was not required.

For the group managed under the new medical system of rehabilitation, the information (environmental and individual factors) and disease and physical statuses of newly admitted patients were assessed by a PT. If necessary, a PT conducted rehabilitation consultations with a medical doctor to prevent disuse syndrome, minimize the period of bed rest after patients were admitted to the hospital and gradually initiate a rehabilitation intervention. If it was determined that rehabilitation was not necessary, exercise instruction was provided as needed, and changes in ADL levels during hospitalization were assessed periodically. Furthermore, a case conference was held for each clinical department (e.g., neurology and neurosurgery) every week to share information on all patients' ADL statuses and rehabilitation programs with physicians, nurses, and medical social workers. In the prior period, the rehabilitation intervention was initiated only after an attending physician prescribed a rehabilitation intervention; thus, the rehabilitation department did not directly manage patients until the prescription was issued. Furthermore, the ward case conferences were limited to cases of participating patients who were in a rehabilitation program.

In each group, the length of hospital stay, time to initiation of rehabilitation, implementation rate of rehabilitation, and  $\Delta$ BI score (absolute value at difference of admission and discharge) were determined based on the medical records.

Statistical analyses were performed using Stata ver. 17 (StataCorp LLC, College Station, TX, USA). Before statistical analysis, the Shapiro-Wilk test was performed to confirm a normal distribution of the data. The median (minimum–maximum) and 95% confidence interval (CI) values were calculated for each variable. Age and BI on admission to the hospital were compared between each group using the Kruskal-Wallis test. Statistical analyses of comparisons between groups were performed using the chi-square test for sex and disease type. The effect of introducing the new medical system for rehabilitation was analyzed using interrupted time-series analysis. Two-tailed *p*-values <0.05 were considered statistically significant.

## RESULTS

A total of 529 patients who were admitted to the stroke patients ward in our hospital during the study period were included in this study (prior period, *n*=184, post period, *n*=345).

Table 1 shows the baseline characteristics of the patients. The gender distribution significantly differed between groups (*p*<0.0001). However, age, disease type, and BI score at admission were not significantly different between groups (*p*>0.05).

After the introduction of the new rehabilitation medical system, the initiation of rehabilitation was accelerated (−0.0428 days, 95% CI=−0.0709 to −0.0147, *p*=0.0134, Fig. 1A), and  $\Delta$ BI was increased (+3.0 points, 95% CI=1.0764 to 4.9236, *p*=0.0123, Fig. 1B).

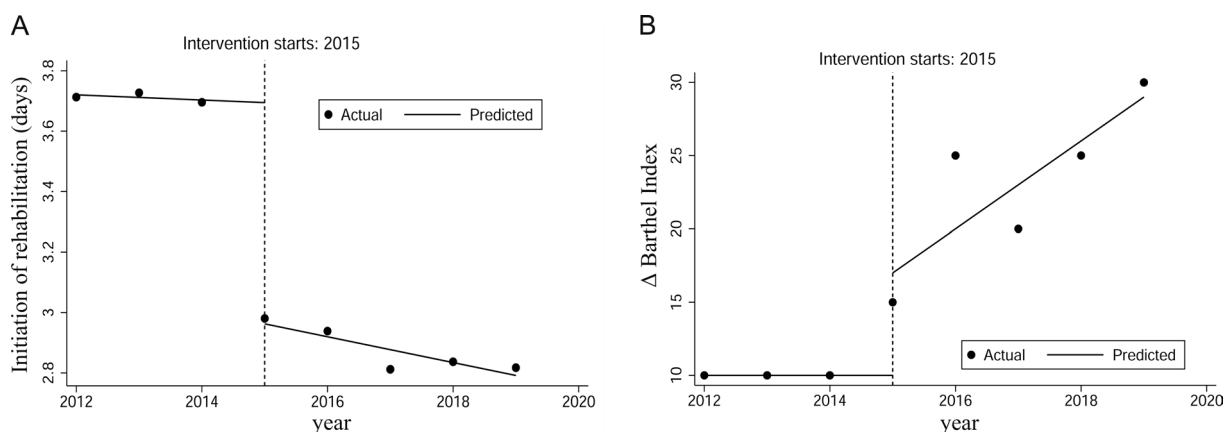
However, the hospital stay (−0.78 days, 95% CI=−1.7639 to 0.1994, *p*=0.0914, Fig. 2A), and implementation rate of rehabilitation (+1.5246%, 95% CI=−0.4351 to 3.4843, *p*=0.0969, Fig. 2B) did not show significant changes between the pre- and post-intervention period.

## DISCUSSION

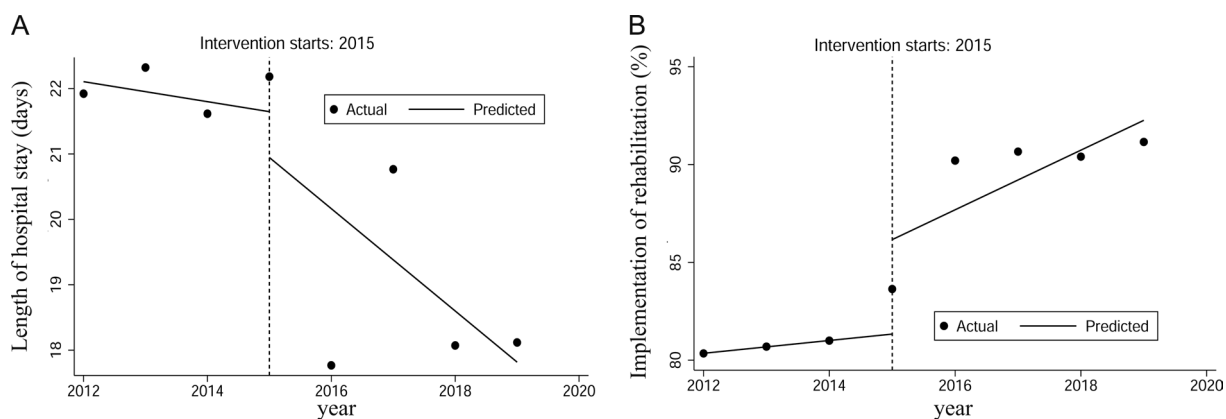
This study examined the effects of a new medical system for rehabilitation on patients in an acute-phase stroke patients ward. We found that the introduction of this medical system was effective in accelerating the initiation of rehabilitation and increasing ADL improvement. Although there were no significant differences in the hospital stay and implementation rate of rehabilitation, each showed a trend toward improvement. These findings suggest that this system may be beneficial for treatment in acute-phase stroke patients ward.

**Table 1.** Characteristics of participants

	Pre-period				Post-period			
	2012 n=60	2013 n=59	2014 n=65	2015 n=55	2016 n=69	2017 n=75	2018 n=70	2019 n=76
Age, years	70.1 ± 15.2	69.4 ± 15.3	69.2 ± 13.4	65.2 ± 11.7	69.0 ± 13.5	72.4 ± 12.9	70.0 ± 14.1	70.0 ± 12.8
Gender, female, %	49	47	51	35	26	45	37	34
Stroke subtype, %								
Cardioembolism	30	29	25	22	22	24	14	18
Large artery atherosclerosis	25	27	33	32	33	33	30	33
Small artery occlusion	8	8	12	5	10	8	17	20
Other mechanisms	17	15	18	12	17	17	17	17
Hemorrhage	20	20	18	23	30	37	37	32
Implementation rate of rehabilitation, %	80.3	80.7	80.0	84	94	91	87	88
Time to initiation of rehabilitation, days	3.7 ± 2.3	3.7 ± 2.6	3.6 ± 1.4	2.8 ± 1.9	2.9 ± 1.9	2.8 ± 2.2	2.8 ± 3.3	2.8 ± 2.0
Δ Barthel Index	10 (0–100)	10 (0–100)	10 (0–100)	15 (0–90)	25 (0–85)	20 (0–100)	25 (0–100)	10 (0–100)



**Fig. 1.** Comparison of the time to initiation of rehabilitation (A) and ΔBarthel Index (B) between the prior period and post period. The mean and median values were used for the time to initiation of rehabilitation and Δ Barthel Index, respectively.



**Fig. 2.** Comparison of the length of hospital stay (A), and implementation rate of rehabilitation (B) between the prior period and post period. The mean value was used for the length of hospital stay.

The results of the present study show that the period until initiation of rehabilitation was shortened, and patients' levels of physical function improved with the introduction of this medical system. Previous studies have shown that early rehabilitation induces improvements in physical function (e.g., gait, balance, and BI) in patients with stroke<sup>8, 9</sup>. The delay until initiation of rehabilitation is an important factor in the speed of physical function recovery<sup>1</sup>. In particular, early rehabilitation is very helpful for physical function recovery (e.g., gait and balance) in patients with stroke in terms of neuroplasticity<sup>3</sup>. These findings are consistent with the results of the study, which showed that the new medical system of rehabilitation resulted in earlier rehabilitation and improvement in ADL. In general, rehabilitation is initiated only after prescription by a physician in the Japanese medical system. However, with the new medical system of rehabilitation, PT can evaluate patients and intervene immediately after admission without a physician's order. This system is more advantageous for the early initiation of and effective rehabilitation than general medical care in stroke patients ward.

The new medical system of rehabilitation played an important role in maintaining good communication among the interdisciplinary medical staff (e.g., physicians, nurses, therapists, and medical social workers). In the prior period, the communication format was one-sided and consisted of the physician instructing the other medical staff how to proceed. Therefore, in many cases, information on the ADL and rehabilitation programs was shared inefficiently, resulting in excessive assistance and delays in rehabilitation. Under the new medical system of rehabilitation, therapists shared information on ADL status and communicated well with the interdisciplinary medical staff. Previous study reported that nurses became more aware of information sharing, ADL, and fall prevention after the introduction of this medical system<sup>10</sup>. We considered that these results are due to the fact that the PT work exclusively in the ward, which enables close communication and increase the attention of the hospitalized patients to their motor functions. Moreover, many previous studies have reported that interactive communication plays an important role in improving patient outcomes<sup>11–13</sup>. In particular, physicians and medical social workers need to communicate well to shorten patients' length of hospital stay (i.e., the period until they are discharged to their home or transferred to another hospital). Previous studies have reported that collaborations with interdisciplinary medical staff members are useful for improving the ADL level in patients<sup>13–15</sup>. Good communication and appropriate information sharing are important when multidisciplinary medical staff members are involved in patient care. Therefore, it is very important for a dedicated therapist to share information on a patient's ADL status and rehabilitation programs among these multidisciplinary teams. In our study, the percentage of patients who were discharged increased, and the length of hospital stay gradually decreased. This finding suggests that therapists need to be involved in not only rehabilitation interventions but also communications regarding patients' ADL levels and rehabilitation programs. Our results suggest that good communication and information sharing with a dedicated therapist gradually leads to efficient rehabilitation in neurology and neurosurgery wards.

The present study has several limitations. First, the influence of introducing the new medical system for rehabilitation was examined in a single-center study. Therefore, we cannot exclude the possibility of selection bias of the participants. Second, the present study recruited only patients in the stroke patients ward. Third, this study analyzed the data retrospectively, it was not possible to investigate how the attitudes of other medical staffs changed over time. Therefore, future studies (e.g., multicenter studies, studies including other wards (gastrointestinal medicine, digestive surgery, hematology), and questionnaire surveys of other medical staff) are needed to clearly understand the new medical system of rehabilitation in acute-phase hospital wards.

In conclusion, our study demonstrates that the additional medical coverage system is beneficial for patient management (ADL level and discharge to home) in acute-phase stroke patients ward. Additional prospective studies are necessary to determine the effects of the additional medical coverage system in acute-phase hospital wards.

### *Conflict of interest*

The authors declare no conflict of interest.

## REFERENCES

- 1) van Wijk R, Cumming T, Churilov L, et al.: An early mobilization protocol successfully delivers more and earlier therapy to acute stroke patients: further results from phase II of AVERT. *Neurorehabil Neural Repair*, 2012, 26: 20–26. [[Medline](#)] [[CrossRef](#)]
- 2) Vargo M: Brain tumor rehabilitation. *Am J Phys Med Rehabil*, 2011, 90: S50–S62. [[Medline](#)] [[CrossRef](#)]
- 3) Dąbrowski J, Czajka A, Zielińska-Turek J, et al.: Brain functional reserve in the context of neuroplasticity after stroke. *Neural Plast*, 2019, 2019: 9708905. [[Medline](#)] [[CrossRef](#)]
- 4) Dong Z, Yu B, Zhang Q, et al.: Early rehabilitation therapy is beneficial for patients with prolonged mechanical ventilation after coronary artery bypass surgery. *Int Heart J*, 2016, 57: 241–246. [[Medline](#)] [[CrossRef](#)]
- 5) Suzuki S, Momosaki R, Watanabe T, et al.: Effectiveness of early rehabilitation for acute heart failure: a retrospective cohort study. *J Cardiopulm Rehabil Prev*, 2019, 39: E23–E25. [[Medline](#)] [[CrossRef](#)]
- 6) Aoyagi Y, Saitoh E, Kono Y, et al.: A health insurance system for maintaining of improving activities of daily living in acute wards in Japan. *Int J Neurorehabilitation*, 2018, 5: 4. [[CrossRef](#)]
- 7) Kono Y, Aoyagi Y, Kayukawa T, et al.: Efforts and effects of additional medical coverage to maintain or improve activities of daily living in an acute cardiovascular internal medicine ward. *Jpn J Compr Rehabil Sci*, 2017, 8: 104–108.
- 8) AVERT Trial Collaboration group: Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial. *Lancet*,

2015, 386: 46–55. [[Medline](#)] [[CrossRef](#)]

- 9) Cumming TB, Thrift AG, Collier JM, et al.: Very early mobilization after stroke fast-tracks return to walking: further results from the phase II AVERT randomized controlled trial. *Stroke*, 2011, 42: 153–158. [[Medline](#)] [[CrossRef](#)]
- 10) Sarada K, Hirata K, Nishikawa Y, et al.: Status and issues of implementation of additional system for maintenance and improvement of ADL at Hiroshima University Hospital. *J Natl Univ Rehabil*, 2016, 37: 130–133 (in Japanese).
- 11) Aoki S, Hosomi N, Hirayama J, et al. Hiroshima University Hospital Stroke Swallowing Team: The multidisciplinary swallowing team approach decreases pneumonia onset in acute stroke patients. *PLoS One*, 2016, 11: e0154608. [[Medline](#)] [[CrossRef](#)]
- 12) Nishikawa Y, Taito S, Sarada K, et al.: A multidisciplinary pain, agitation, and delirium management team can promote rehabilitation in the intensive care unit: a case report. *Prog Rehabil Med*, 2016, 1: 20160010. [[Medline](#)]
- 13) Suo DM, Liu LL, Jia K, et al.: Multidisciplinary rehabilitation for adults with neuromyelitis optica spectrum disorders: a pilot study. *J Rehabil Med*, 2019, 51: 692–697. [[Medline](#)] [[CrossRef](#)]
- 14) Langhorne P, Bernhardt J, Kwakkel G: Stroke rehabilitation. *Lancet*, 2011, 377: 1693–1702. [[Medline](#)] [[CrossRef](#)]
- 15) Majmudar S, Wu J, Paganoni S: Rehabilitation in amyotrophic lateral sclerosis: why it matters. *Muscle Nerve*, 2014, 50: 4–13. [[Medline](#)] [[CrossRef](#)]