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Original Article

One-year changes in activities of daily living and social life in elderly patients undergoing home-based rehabilitation within 1 year of stroke onset

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Abstract. [Purpose] In this study, we investigated changes in activities of daily living and social participation over 1 year in elderly patients with stroke, who underwent home-based rehabilitation. [Participants and Methods] This 1 year, multicenter cohort study included patients aged ≥65 years with diagnosis of the first onset of stroke within 1 year. Variables recorded included the functional independence measure and performance qualifiers for "d6 domestic life" and "d9 community, social, and civic life" (social life) based on the International Classification of Functioning, Disability and Health framework. [Results] Of the 44 partients recruited at baseline, 19 completed the study over 1 year. We observed significant improvements in the functional independence measure-motor, functional independence measure-cognitive, and functional independence measure-total and in the performance qualifiers ("domestic life" and "social life") of the International Classification of Functioning, Disability and Health tool. We also observed that the functional independence measure-total scores improved over 3 months and "domestic life" and "social life" scores gradually improved over 1 year. [Conclusion] Our results showed that activities of daily living improved earlier than other variables, including social participation, which gradually improved over 1 year and that home-based rehabilitation may effectively improve activities of daily living and social participation.
Key words: Home-based rehabilitation, Functional Independence Measure, Social participation

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INTRODUCTION

Home-based rehabilitation (HR) aims to support the elderly and individuals with disabilities living in local communities to maximize their abilities and help them lead independent lives, the challenge of which is how to provide evidence-based care. HR is a service in which a physical therapist, occupational therapist, or speech therapist visits the elderly or individuals with disabilities who have difficulty visiting hospitals, and then provides services necessary from the viewpoint of rehabilitation.

Elderly patients with stroke using HR require assistance with activities of daily living (ADL) and therefore face difficulty in going out and participating in social activities. Needless to say, ADL is an essential part of a person's life. It has been reported that social participation determines the quality of life among community-dwelling older adults[1)] and that it has an

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impact on the maintenance of cognitive function[2, 3]. It has been shown that life-space mobility, which represents the range of movement in daily activities[4, 5], is related to capacity for physical activity[4, 6]. Thus, for HR users, not only achieving independent ADL but also improving life-space mobility and realizing social participation as they desire are important HR issues for ensuring their quality of life.

Some studies performed outside of Japan have reported that HR is effective for stroke survivors within 1 year of the onset in improving ADL[7–9], reducing the length of hospital stay[10, 11], and improving their quality of life with disabilities[12]. On the other hand, some other studies have reported no differences between HR and control groups in ADL and instrumental ADL outcomes[13, 14]. Thus, there is still insufficient evidence of the value of HR for stroke survivors' ADL and social participation, warranting further accumulation of relevant data.

HR provides services in users' homes. Houses in Japan have a particular design, with most having a step up from the entranceway to the main floor of the house. In Japan, people also take off their shoes when they enter a house. Therefore, examinations in Japan are required. As a relevant study published in Japan, Makizako et al.[15] conducted a cluster randomized control trial (cluster RCT) in elderly participants requiring long-term care, in which it was shown that HR had a positive effect on time out of bed but no effect on ADL. An RCT study by Ito et al.[16] reported that HR intervention based on the Management Tool for Daily Life Performance was effective in improving ADL and social participation. Moreover, a prospective cohort study by Kamioka et al.[17] reported that HR users within 1 year of the onset of stroke or other conditions showed an improvement in ADL over 3 months, especially in walking, toileting, and bathing activities, as well as improvements in social participation and life-space mobility over 6 months. However, these studies targeted elderly participants requiring long-term care due to various diseases, while not specifically targeting stroke survivors. In addition, in all of these studies, the study period was set to 3 or 6 months, preventing the findings from revealing the impact of HR over longer periods. For these reasons, there is a need to obtain new findings on characteristic changes in elderly stroke survivors using HR for periods longer than 6 months in order to help provide evidence-based care. Against this background, the purpose of this study was to clarify characteristic changes over a 1 year period in ADL, social participation, and life-space mobility in elderly stroke survivors using HR within 1 year of the onset.

PARTICIPANTS AND METHODS

From the long-term care service information disclosure system of the Ministry of Health, Labour and Welfare, we selected a total of 1,046 facilities across Japan that provided home-based rehabilitation, and then sent a letter asking for cooperation with the study to the director of each facility. After obtaining consent from 62 facilities, we screened candidates from each facility and eventually recruited participants from 34 facilities. The period of participant recruitment was 1 month.

The participants were the elderly aged ≥65 years who had experienced their first onset of cerebrovascular disease within 1 year, those who had used HR. Exclusion criteria included patients with progressive disease (e.g., cancer, progressive neurologic disease, dementia due to degenerative CNS disorders such as Alzheimer's disease and dementia with Lewy bodies), those with concomitant psychiatric or congenital pediatric disease, those with cognitive decline that makes it difficult for them to give consent to participate in the survey, and users of daycare rehabilitation services.

We conducted a 1 year cohort study. The survey time points were baseline, 3 months, 6 months, and 12 months. The survey period was from June 2019 to June 2020. The survey endpoints were ADL, social participation, and life-space mobility. The questionnaires were completed by physical therapists or occupational therapists at the facilities that cooperated with the survey.

Basic information included males/females, age, diagnosis, presence/absence of dementia, presence/absence of higher brain dysfunction, date of onset, date of starting HR, long-term insurance need certification level, service currently used, and HR service provision status.

ADL was measured using the functional independence measure (FIM)[18]. The FIM consists of 18 items, each of which is rated on a 7-point scale from 1 to 7, depending on the amount of assistance required. The total score ranges from 18 to 126 points; the higher the score, the less assistance required (i.e., a higher degree of independence). The score consists of 13 FIM motor items (13 to 91 points) and 5 FIM cognitive items (5 to 35 points).

The survey endpoints for social participation were determined as the categories up to the second level of "d6 domestic life" and "d9 community, social and civic life" (hereafter referred to as "social life") in the activities and participation components of the International Classification of Functioning, Disability and Health (ICF)[19]. Domestic life involved six endpoints: acquiring a place to live, acquisition of goods and services, preparing meals, doing housework, caring for household objects, assisting others. Social life involved five endpoints: community life, recreation and leisure, religion and spirituality, human rights, political life and citizenship. Each item was graded using the ICF's performance qualifiers and scored as follows: "No difficulty: 4 points" (always or often achieves full participation, with or without human assistance), "Mild difficulty: 3 points" (achieves occasional or partial participation, without human assistance), "Moderate difficulty: 2 points" (achieves occasional or partial participation, with human assistance including monitoring or encouraging), "Severe difficulty: 1 point" (achieves occasional or partial participation, with full human assistance), and "Complete difficulty: 0 points" (no participation, including when prohibited). The total score ranges from 0 to 24 points for domestic life and 0 to 20 points for social life; the higher the score, the more active participation achieved.

Life-space mobility was measured using the Life-Space Assessment (LSA)[4, 5]. The LSA was developed to measure the life-space mobility of community-dwelling elderly people[4, 5] and has high levels of reliability and validity[20, 21]. In recent years, it has also been applied to frail elderly people with mobility-related disabilities[20], stroke sequelae[22], and HR users[17]. The LSA scores the extent of going out behavior over the last 4 weeks by adding up the maximum reach to 5 life-space levels (Level 1: Home, Level 2: Outside house, Level 3: Neighborhood, Level 4: Town, and Level 5: Outside town), the frequency of travel, use of aids, and independence status. The score ranges from 0 to 120 points; the higher the score, the greater the range of behavior.

The participants to be analyzed were those who had completed the 1 year survey. First, the change over 1 year in each variable was analyzed. After checking for normality, one-way repeated-measures ANOVA was performed for statistical processing. Multiple comparisons were made using the Bonferroni method. SPSS Statistics 28.0.1 (IBM, Tokyo, Japan) was used for statistical analysis, with a significance level of 5%.

For ethical considerations, we gave the participants written and oral explanations on matters such as the purpose of the study, its methods, the voluntary nature of cooperation in the study, and the protection of personal information, thereby obtaining their informed consent in writing before starting the study. We gave written explanations to the managers, physical therapists, and occupational therapists at the facilities that cooperated with the study, thereby obtaining their consent. This study was conducted with the approval of the Research Ethics Committee of Ibaraki Prefectural University of Health Sciences (Approval No. 870).

RESULTS

A total of 44 participants started at baseline and 19 (43.2%) completed the study over 1 year. The reasons for dropouts were as follows: HR completed after achieving the goals (14 participants: 31.8%, mean period from HR start to completion: 7.6 ± 4.2 months), death (1), hospitalization (2), HR suspended with the spread of COVID-19 (1), relocation (1), admission to facilities for the elderly (2), and withdrawal (4) (Fig. 1).

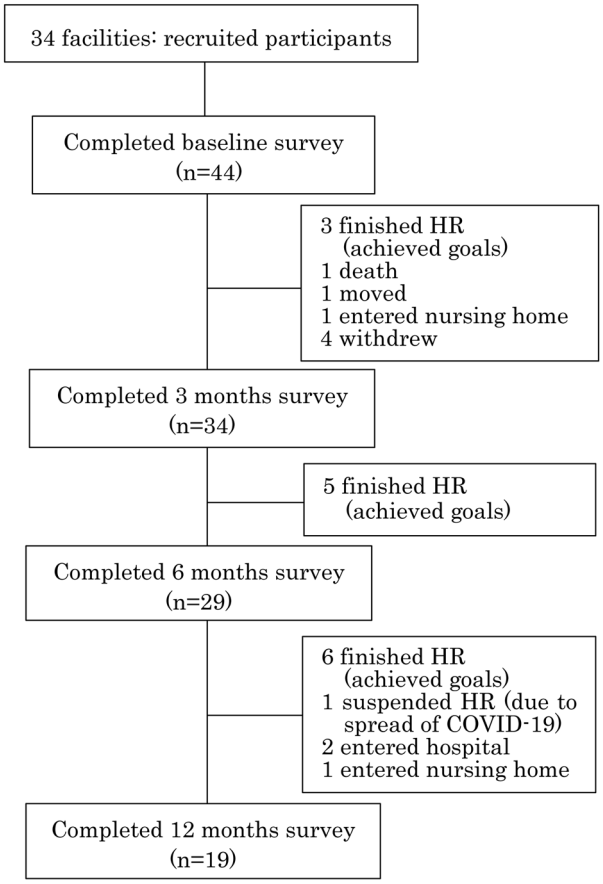

Fig. 1. Flow of participants through survey.
HR: home-based rehabilitation.

In terms of the demographics of the 19 participants, the mean age was 75.8 ± 7.3 years and 63.2% of the participants were females. The diagnosis was cerebral infarction in 57.9%. Those with dementia accounted for 15.8%, and those with higher brain dysfunction for 68.4%. The mean period from the onset to the start of HR was 4.3 ± 2.1 months, the mean period from the start of HR to the baseline survey was 2.9 ± 1.8 months. The most common long-term care need certification level was long-term care need level 3 at 26.3% (Table 1). Regarding the HR provision status, the most common provider/form was a physical therapist alone at 42.1%, and the highest frequency of HR was 4 to <8/month and 8 to <12/month, both at 47.4%. The most common duration of HR was 40 min at 57.7%. By session content, more than half of the participants performed the

Table 1. Characteristics of the participants (n=19)

	N (%)
Males	7 (36.8)
Females	12 (63.2)
Age (years)	75.8 ± 7.3
Diagnosis	
Cerebral infarction	11 (57.9)
Cerebral hemorrhage	7 (36.8)
Subarachnoid hemorrhage	1 (5.3)
With dementia	3 (15.8)
With higher brain dysfunction	10 (52.6)
Period from the onset to the start of HR (months)	4.3 ± 2.1
Period from the start of HR to the baseline survey (months)	2.9 ± 1.8
Period from the onset to the baseline survey (months)	7.2 ± 3.0
Location before starting HR	
General ward	4 (21.1)
Recovery phase rehabilitation ward	13 (68.4)
Home/Other	2 (10.5)
Current residence	
Home	17 (89.5)
Serviced elderly housing	2 (10.5)
Family composition	
One-person	4 (21.1)
Couple only	6 (31.6)
Couple with children	6 (31.6)
Others	3 (15.8)
Primary caregiver	
Spouse	11 (57.9)
Children/Child's spouse	7 (36.8)
Friends	1 (5.3)
Long-term care insurance need certification level	
Support need level 1	1 (5.3)
Support need level 2	3 (15.8)
Long-term care need level 1	3 (15.8)
Long-term care need level 2	1 (5.3)
Long-term care need level 3	5 (26.3)
Long-term care need level 4	4 (21.1)
Long-term care need level 5	2 (10.5)
Service use	
Daycare services for long-term care	9 (47.4)
Home-visit care	5 (26.3)
Home-visit nursing care	2 (10.5)
Short stay	1 (5.3)

Mean ± SD.
HR: home-based rehabilitation; SD: standard deviation.

following exercises: muscle-strengthening exercise (89.5%), range-of-motion exercise (73.7%), walking exercise (89.5%), sitting/transfer exercise (57.9%), and going out/out Door exercise (73.7%). Their caregivers were also given instructions on caregiving methods (63.2%) (Table 2).

Table 2. Description of home-based rehabilitation (n=19)

	N (%)
Therapist	
PT	8 (42.1)
PT, OT	5 (26.3)
ST	3 (15.8)
PT, ST	2 (10.5)
OT	1 (5.3)
Frequency (session/month)	
4 to <8	9 (47.4)
8 to <12	9 (47.4)
12	1 (5.3)
1 session time (all therapists) (min)	
40	15 (57.7)
45	1 (3.8)
50	1 (3.8)
60	9 (34.6)
Total time for one month (all therapists) (min)	
160–319	8 (42.1)
320–479	7 (36.8)
480–540	4 (21.1)
Mean ± SD	313.9 ± 125.1
Program (performed this past month)	
Assessment and explanation	14 (73.7)
Body functions and structures	
Muscle strengthening exercise	17 (89.5)
Range of motion exercise	14 (73.7)
Relaxation	13 (68.4)
Aphasia/dysarthria therapy	5 (26.3)
Dysphagia therapy	1 (5.3)
Respiratory therapy	0 (0.0)
Activities and participation	
Walking	17 (89.5)
Sitting and transfer	11 (57.9)
Communication	5 (26.3)
Toileting	3 (15.8)
Bathing	2 (10.5)
Eating	1 (5.3)
Dressing and grooming	1 (5.3)
Going out and outdoor exercise	14 (73.7)
Recreation and leisure	9 (47.4)
Household tasks	4 (21.1)
Others (get off the floor, stair climbing)	4 (21.1)
Environmental factors	
Instruction on how to assist	12 (63.2)
Orthosis and devices	7 (36.8)
Living environment adjustment	7 (36.8)

PT: physical therapist; OT: occupational therapist; ST: speech therapist; SD: standard deviation.

Regarding changes over 1 year, significant differences among the four time points were observed in one-way repeated-measures ANOVA for FIM motor (p=0.021), FIM cognition (p=0.034), and FIM total score (p=0.003). Multiple comparisons in FIM total showed significant differences between baseline and 3 months (p=0.02) and between baseline and 12 months (p=0.011).

Significant differences among the four time points were also observed in one-way repeated-measures ANOVA for "d6 domestic life" (p=0.041), "d9 social life" (p=0.023), and the total score for domestic life and social life (p=0.014). In domestic life and social life, multiple comparisons found no combinations with significant differences, but they gradually improved over 1 year. The LSA score tended to show little change from baseline to 6 months, and greater improvements from 6 to 12 months than from baseline to 6 months, but this difference was not significant (Table 3).

DISCUSSION

This study showed that ADL and social participation significantly improved over 1 year in elderly stroke survivors within 1 year of the onset who continued using HR for 1 year or longer. ADL improved early, and social participation improved gradually over the course of 1 year.

In the HR users, activities of daily living improved relatively early at 3 months, as in the previous study[17]. It was suggested that HR might be effective in encouraging independence in ADL in Japan, as in other countries[7–9]. As many of the participants performed walking and sitting/transfer exercises, and the caregivers also received instructions on caregiving methods (Table 2), it was thought that performing these exercises in the actual living environment would be effective in improving ADL.

Regarding the significant improvement in social participation, many of the participants went out and performed outdoor exercise, recreation, and leisure, and received instructions on adjustments of their living environment, such as the installation of handrails at entrances. In addition, if necessary, the caregiver received guidance on how to assist (Table 2). Therefore, it was considered that these were effective in improving the social participation of HR users. In terms of measurements of the social participation of HR users, we were able to measure changes in HR users over 1 year by using the performance qualifiers of the ICF. RCTs conducted outside of Japan comparing HR and daycare rehabilitation groups have reported that, when the Frenchay Activity Index (FAI) was used[23, 24], the two groups showed no difference at 6 months or even after a long-term follow-up of 5 years, but the Extended Katz Index was significantly higher in the HR group[25]. In this way, the results differ depending on the measurement parameters. It is therefore necessary to accumulate more research data in the future, including by examining measurement parameters to appropriately measure the social participation of HR users.

As we observed that ADL improved in 3 months and social participation improved gradually over 1 year, it was considered that ADL improved earlier than other parameters, including social participation, which improved slowly after that. Further research should be performed to confirm these findings.

It has been reported that life space is associated with mobility, instrumental ADL[21], and severe spatial neglect[22]. It was thought that the low level of life-space mobility in this study was due to the fact that the majority of participants had higher brain dysfunction, as well as low levels of ADL and social participation.

Limitations of this study include the small number of participants and dropout bias, which limit the generalizability of the obtained results. In addition, since it was an observational study, the effectiveness of HR as revealed here has not been verified. The large number of dropouts was due to the fact that as much as 31.8% of the participants completed HR after achieving their goals. Since this study had an observational design, the investigation was discontinued when HR was completed. Note that the timing of the 6-month survey conducted coincided with that of COVID-19 being discovered in China (December 2019), followed by the first confirmed case of infection in Japan (January 2020) and the curfew imposed due to the spread of infection. This situation may have had an inhibitory impact on the extent of social life and life-space mobility in this

Table 3. The change of measurements in 1 year (n=19)

	Baseline	3 months	6 months	12 months	p-value	Change score 0–12 months
FIM motor	68.3 ± 21.6	70.7 ± 21.5	71.9 ± 20.5	72.2 ± 20.9	0.021*	+3.9
FIM cognitive	26.3 ± 9.2	27.9 ± 8.2	28.0 ± 7.9	28.1 ± 8.2	0.034*	+1.8
FIM total	94.6 ± 25.6	98.7 ± 26.1*	99.9 ± 25.3	100.3 ± 25.1*	0.003**	+5.7
Domestic life	5.1 ± 4.9	6.3 ± 5.5	6.6 ± 5.8	7.5 ± 6.6	0.041*	+2.4
Social life	4.7 ± 4.0	5.9 ± 5.3	6.7 ± 5.2	7.8 ± 6.2	0.023*	+3.1
Total of domestic and social life	9.8 ± 8.1	12.2 ± 9.9	13.4 ± 10.4	15.3 ± 12.1	0.014*	+5.5
LSA	38.2 ± 22.4	36.6 ± 17.2	38.2 ± 19.8	41.9 ± 29.8	0.824	+3.7

Mean ± SD, p-value: one-way repeated measures ANOVA, *p<0.05, **p<0.01.
FIM: functional independence measure; Social life: community, social and civic life; LSA: Life-space assessment; ANOVA: analysis of variance.

study. However, this study, conducted with the cooperation of 34 facilities across Japan, is comparable to a previous study in Japan[17] in terms of the frequency, provider occupation, and session content of HR. The study was therefore considered to have successfully shown the average change over 1 year in HR users within 1 year from the onset of cerebrovascular disorders in Japan. In Japan, it is difficult to obtain data on a control group not undergoing HR. However, a control group needs to be established. It is also necessary to examine the effectiveness of HR in Japan through intervention research designs such as randomized controlled trials.

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Conflict of interest

There are no conflicts of interest in this study.

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