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Effects of a Home-Visit Short-Term Intensive Service on the Exercise Habits of Older Adults Living in Mountainous Areas

Takaaki Nishimura[1,2]*, Ryo Miyachi[3], Masayasu Tanaka[4], Maki Ishisaki[4], Yuichi Kitamura[4], Tomoko Washio[4], Kinso Horio[4], Aika Saito[4], Saori Niwa[4], Naoko Hashiba[4], Tamaki Yoshizawa[4]

[1]Department of Community-based-Rehabilitation, Nanto Municipal Hospital, Toyama, Japan.
[2]Department of Physical Therapy, Graduate Course of Rehabilitation Science, Division of Health Sciences, Graduate School of Medical Sciences, Kanazawa University, Ishikawa, Japan.
[3]Faculty of Health and Medical Sciences, Hokuriku University, Ishikawa, Japan.
[4]Nanto City Home-visit Nursing Station, Toyama, Japan.

***Corresponding Author:** *Takaaki Nishimura, Department of Community-based-Rehabilitation, Nanto Municipal Hospital, Toyama, Japan.*

Abstract

This study aimed to examine whether a home-visit short-term intensive service (HSIS) is effective in forming exercise habits, improving exercise function, and expanding life space for older adults living in mountainous areas. The study included nine older adults (four males and five females, aged 85.0±7.1 years) living in a mountainous area in Japan. As an HSIS intervention, the interventionists instructed the participants to perform self-training (at least 30 minutes/day, 2 days/week) at the first visit. The interventionists visited the participants once a week for 12 weeks. During the visits, they grasped the participants' exercise implementation status and checked and modified their exercise methods. The assessment tools used were the Short Physical Performance Battery (SPPB), Life-Space Assessment (LSA), Functional Independence Measure (FIM), and weekly exercise time and frequency were also assessed. The interventionists assessed SPPB, LSA, and FIM at the first and last visit and compared pre-and post-intervention for each measurement. As a result, SPPB scores, total LSA scores, FIM motor item scores, and weekly exercise time and frequency increased significantly pre-intervention compared to post-intervention. Thus, HSIS can be effective in forming exercise habits, improving motor functions, and expanding life space for older adults living in mountainous areas.

Keywords: *Community-dwelling older adults; Exercise habits; Home-visit short-term intensive service.*

Introduction

As prevention for the need for long-term care of older adults in Japan, efforts are being made to promote self-management through the formation of exercise habits [1]; however, the low self-management ability of older adults living in mountainous areas poses a problem [2, 3]. In general, older adults have a low rate of regular exercise at home [4], and the resulting decrease in activity and narrowing of life space can lead to disuse syndrome [2, 5]. In particular, it has been reported that older adults living in mountainous areas have low awareness of proactive exercise [3], and are at a high risk of developing disuse syndrome. Therefore, to prevent disuse syndrome in older adults living in mountainous areas, it is necessary for older adults to recognize and change behaviors to form exercise habits and maintain motor functions by themselves.

Home-visit short-term intensive service (HSIS), a unique prevention plan for long-term care in Japan aiming to promote independent activities of older adults, has been attracting attention regarding behavioral change in this population [6]. In Japan, the long-term care insurance system was established in 2000 for holistic support of older adults[7]; the degree of need for daily care is divided into seven levels, and social welfare services necessary for living at home are provided according to their care need level. Further, the comprehensive business for the prevention of long-term care and daily life support has been newly established in the care insurance system [6]. The comprehensive business is implemented for those who fall into the category of "support required" with a mild need for care (the lower two levels of the seven levels of care required) and those with reduced motor function (scoring 3 or more points in the motor function items of the basic checklist for identifying priority targets for prevention of long-term care specified by the Ministry of Health, Labor, and Welfare) [8]. HSIS is a social welfare service, that aims to improve the motor function, expand the life space, and improve the Activities of Daily Living (ADL) by improving the independence of older adults through advice-oriented interventions by medical professionals [6]. Reportedly, advice-oriented interventions, a feature of HSIS, can cause behavioral changes (forming exercise habits) in older adults [6]. In addition, Nomoto et al. [9] reported that the HSIS intervention improved ADL ability and health-related quality of life. Therefore, forming exercise habits through HSIS is expected to be effective in improving motor functions and expanding the life space of older adults living in mountainous areas; however, these effects have not been fully investigated.

Therefore, this study aimed to examine the effectiveness of HSIS in forming exercise habits, improving motor functions, and expanding life space for older adults living in mountainous areas.

Materials and Methods

Study Design and Participants

This study employed a pre-post design. The participants were nine older adults who requested HSIS by Nanto City community general support center between April 2019 and July 2021 (four males and five females, aged 85.0±7.1 years; height: 151.0±10.0 cm; weight: 51.9±12.1 kg). The criteria for HSIS in this study were those in the category of "support required" in the care insurance system or having reduced motor function (scoring 3 or more points in the motor function items of the basic checklist for identifying priority targets for preventing of long-term care specified by the Ministry of Health, Labor, and Welfare) [8] and without regular exercise habits (30 min/day or more, 2 days/week or more) [10]. Patients with significant dementia were excluded. This study was conducted after providing participants with sufficient explanation regarding the study and obtaining their written consent. This study was approval by the ethics committee of Nanto Visiting Nurse Station (approval number: 2020. NHS. 01).

Intervention

As an intervention method for HSIS, the interventionists instructed the participants at the first visit about voluntary exercise that can be performed at home. The participants were instructed to exercise for at least 30 minutes a day, at least two days a week. At that time, the participants were presented with an exercise record sheet and instructed to record the exercise time and the day of exercise. After the first visit, the interventionists visited the participants once a week to monitor the implementation of voluntary exercise and check and modify the exercise method. This exercise intervention continued for 12 weeks. To motivate the participants to exercise, the interventionists shared individually set intervention goals with the participants to ensure that they could proactively engage in exercise to achieve the goals. The content of the exercises was participant specific, did not require any special training equipment, focused on exercises that can be performed easily in daily life, and were in accordance with the set goals, such as standing and walking exercises.

Measurement

The assessment tools used were the Short Physical Performance Battery (SPPB) [11, 12] as an index of motor function, Life-Space Assessment (LSA) [13] as an index of life space, Functional Independence Measure (FIM) [14] as an index of ADL ability. Weekly exercise time and frequency were also recorded. Each measurement item was evaluated at the first and the last visit.

The SPPB is an evaluation battery consisting of three items: normal walking speed as an index of walking ability, the time to hold different standing postures as an index of standing balance ability, and the five-repetition sit-to-stand test as an index of lower extremities muscle strength. It is used to indicate the lower extremities motor function of older adults [11]. Each of these three evaluation items was graded on a scale of 0–4, with a higher total score indicating superior lower extremities motor function [11]. The SPPB measurement method was performed according to Makizako et al. [12]. For the measurement of normal walking speed, a walking path was set up with a measurement section of 2.4 m (8 ft) and a 2 m reserve path at both ends of the measurement section. The participants were instructed to walk on the walking path at their normal walking speed; the measurements were taken twice.

For the evaluation of standing balance ability, the holding time of tandem standing or close standing was measured after the holding time of semi-tandem standing was measured. Semi-tandem standing was defined as standing with the medial side of the hallux (first distal phalanx to proximal phalanx region) in contact with the medial side of the heel on the contralateral side; tandem standing was defined as standing with the heel on any side in contact with the contralateral distal foot; close standing was defined as standing with the medial sides of both feet in contact [12]. The order of measurement was as follows: first, the semi-tandem standing was measured, and if the semi-tandem standing was longer than 10 seconds, the tandem standing was measured afterward. If the semi-tandem standing was less than 10 seconds, the close standing was measured after the semi-tandem standing measurement. Each task was practiced once before the actual measurement. This test was conducted only once.

The five-repetition sit-to-stand test was conducted by repeating five consecutive sit-to-stand movements from the chair sitting position as fast as possible, and measuring the time required from the start of the movement to the full standing position at the end. The starting posture was a sitting posture with both upper extremities folded in front of the chest in a 45-cm chair with a backrest. This test was conducted once. If the knee joint was not fully extended while standing or not flexed at a 90-degree angle when sitting, the measurement was repeated. All measurements were performed without the use of a walking aid, such as a cane or walker. The fastest value of the two measurements of normal walking speed in SPPB was used as the representative value of the participants. In accordance with previous studies, the scores of the three evaluation items, normal walking speed, standing balance ability, and the five-repetition sit-to-stand test, were totaled and calculated on a 12-point scale.

The LSA was calculated by collecting information verbally from the participants, and the total score was calculated. The LSA scores represent the degree of going-out (0–120 points) by accumulating the frequency and degree of independence for each activity range in the past month. The LSA is closely related to changes in motor function and is considered an excellent scale that sensitively captures changes in the life space of older adults [13]. For the FIM, information was collected verbally from each participant; the scores of three items— motor item, cognitive item, and total score—were calculated respectively.

The exercise time and frequency pre-intervention were defined as the values in the week pre-intervention, whereas the exercise time and frequency post-intervention were defined as the values in the 11th week of the intervention. The exercise time and frequency pre-and post-intervention were calculated. The exercise time during the HSIS visit was not included in the exercise time by the participants themselves.

Statistical Analysis

Statistical analysis was performed using EZR (Easy R, Saitama Medical Center, Jichi Medical University, Saitama, Japan) [15]. Paired t-test was used for comparison of each measurement pre-and post-intervention. The significance level was set at 5%.

Results

The basic attributes of the participants in this study are shown in Table 1. Table 2 shows the comparison of each measurement and total score in the SPPB, motor item scores, cognitive item scores and total score in the FIM, the total score in the LSA, and weekly exercise time and frequency pre-and post-intervention. In terms of motor function, the scores of normal walking speed, standing balance ability, the five-repetition sit-to-stand test, and total score in the SPPB were significantly improved by 25.0%, 25.0%, 33.3%, and 27.8%, respectively, compared with pre-intervention. Regarding life space, the LSA total score significantly improved by 10.7% compared to pre-intervention. In terms of ADL ability, FIM motor item scores were significantly improved by 1.5% compared with pre-intervention. There was no significant difference in the cognitive item scores and total score in the FIM pre-and post-intervention. The exercise time and frequency at post-intervention were significantly higher than that in pre-intervention.

Table 1. *The basic attributes of the participants in this study*

Gender n (%)	Males 4 (44%), Females 5 (56%)	
Care level, n	Support Required 1	5
	Support Required 2	3
Basic disease, n	Fracture of the distal end of ulna	1
	Bilateral knee osteoarthritis	3
	High-blood pressure	3
	Angina	1
	Hyperlipidemia	2
	Multiple cerebral infarct	3
	Chronic subdural hematoma	1
	Lumbar compression fracture	2
	Alcoholism	1

Support Required 1: The level with the least need for care among the seven levels of care that express the need for care.

Support Required 2: Of the seven levels of care that indicate the need for care, the level of need for care is the second-lowest after support required.

Basic diseases may overlap among the participants.

Table 2. *Pre-and post-intervention changes in exercise time and frequency, SPPB, LSA, and FIM*

		pre	post	95%CI
Exercise days (day/week)		0.0	5.0±2.1*	-6.6 ~ -3.3
Exercise time (Minutes/day)		0.0	40.3±16.8*	-53.2 ~ -27.4
SPPB	Normal walking speed score (points)	1.6±0.5	2.6±0.7*	-1.3 ~ -0.6
	Standing balance ability score (points)	1.5±1.1	2.5±1.1*	-1.7 ~ -0.2
	Five-repetition sit-to-stand test scores (points)	1.1±0.9	2.4±1.6*	-2.4 ~ -0.1
	SPPB total score (points)	4.3±2.0	7.6±2.5*	-4.9 ~ -1.7
LSA	LSA total score (points)	22.7±8.7	35.5±7.2*	-21.8 ~ -3.8
FIM	FIM motor item score (points)	84.8±5.5	86.2±5.9*	-2.6 ~ -0.1
	FIM cognitive item score (points)	34.3±1.3	34.3±1.6	-1.7 ~ 1.7
	FIM total score (points)	118.6±6.8	120.5±7.4	-3.9 ~ 0.1

SPPB: Short Physical Performance Battery; LSA: Life-Space Assessment; FIM: Functional Independence Measure; CI: Confidence Interval

*: Significant difference pre-and post-intervention ($p<0.05$).

Discussion

This study examined the effectives of HSIS in forming exercise habits, improving motor function, and expanding life space for older adults living in mountainous areas.

In this study, the HSIS intervention resulted in participants engaging in an average of 40 minutes of exercise per day, 5 days per week, which was a significant increase over the pre-intervention. This result was higher than the minimum exercise time and frequency (30 min/day, 2 days/week or more) presented to the participants and exceeded the criteria considered as having an exercise habit by Nakano et al. [10]. Therefore, although the HSIS was limited to the intervention period, it can be interpreted that the HSIS enabled those who had no exercise habits to set aside a certain amount of time to exercise and form that habit. As factors related to exercise habits, Ishino et al. [16] reported goal setting and the presence of an exercise instructor as important for forming them. Furthermore, a strong psychological influence on exercise habits, especially related to self-efficacy, was reported [17, 18]. In this study, in addition to implementing individualized goal setting for the participants in the HSIS intervention and the sharing of goals and exercise selection with the interventionists, weekly checks and exercise modification were provided. As a result, the participants' self-efficacy is thought to have improved due to improvements in their own motivation for exercise and the sense of security in exercise, leading to forming exercise habits.

The results of this study also showed that the HSIS intervention significantly improved scores of all items and total scores in the SPPB, total scores in the LSA, and motor item scores in the FIM compared with the pre-intervention scores. In addition to improving motor function [10, 19], exercise habits have been reported to influence the expansion of life space [2, 10]. Therefore, forming exercise habits through HSIS and the resultant increase in the frequency of going out activity may have led to improving motor functions, such as walking ability and balance ability, and the expansion of life space. Therefore, HSIS as an intervention may be effective in preventing the need for long-term care plans by forming exercise habits among older adults living in mountainous areas with a low proactive exercise awareness. However, there was no significant difference in the cognitive item scores in the FIM pre-and post-intervention. Kato et al. [20] reported that regular exercise improved motor function but did not change cognitive function. In this study, all participants were independent in their ADL and did not use the care insurance service. Therefore, the cognitive item scores of the FIM were high for many of the participants from the pre-intervention stage, and the ceiling effect may have caused no significant differences pre-and post-intervention.

There are several limitations to this study. First, the number of participants in this study was only nine; therefore, it is necessary to increase the sample size in the future. Second, this study did not evaluate psychological effects, such as self-efficacy, of exercise. Since psychological influences are strongly related to the forming of exercise habits [17, 18], it is necessary to examine psychological changes in HSIS interventions in the future. Finally, this study did not investigate the status of the establishment of exercise habits after the end of the visit period at HSIS. Therefore, it is necessary to examine the long-term changes in exercise habits and motor functions post-intervention.

Conclusions

This study examined whether HSIS is effective in forming exercise habits, improving exercise function, and expanding life space for older adults living in mountainous areas. The results showed that HSIS achieved these changes when compared to pre-intervention. Therefore, HSIS may contribute to forming exercise habits, improving motor function, and expanding life space for older adults living in mountainous areas.

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