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Original Article

Seasonal changes in activity levels among nursing care insurance service users in areas with different climates

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Abstract. [Purpose] To clarify seasonal changes in activity levels among nursing care insurance service users in areas with different climates using the Life Space Assessment. [Subjects] A total of 72 nursing care insurance service users aged ≥65 years, who were from areas along the Sea of Japan or those around the Inland Sea. [Methods] The subjects were divided into 2 groups according to their home prefecture, and each survey was conducted over two successive seasons (Survey I: fall and winter, n=48, Survey II: winter and spring, n=24). We investigated the subjects' basic information, and determined their FIM, the Life Space Assessment, and Modified Falls Efficacy Scale scores. These scores were subjected to between-group and -season comparisons. [Results] In Survey I, there were no significant differences in any investigation item between the 2 groups, but the Japan Sea group showed decreases in the Life Space Assessment, Independent Life space, and Minimal Life space scores in winter. In Survey II, we did not note any between-group or -season differences. [Conclusion] Our findings suggest that the Life Space Assessment, whose scores are influenced by outdoor environments, may be used as a tool to clarify seasonal changes in activity levels of nursing care insurance service users.
Key words: Life Space Assessment, Seasonal changes, Outdoor environments

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INTRODUCTION

In October 2013, elderly Japanese people numbered 39.1 million, comprising 25.1% of the total population, and this percentage is the highest in the world[1)]. The number of elderly people living at home is also increasing, and individuals who receive at-home nursing care using the nursing care insurance system now number approximately 4 million[2)]. As many disabled elderly people also live at home, it is necessary to prevent reductions in their motor function and activity levels in order to maintain their QOL at a favorable level. An age-related reduction in physical function causes a decrease in activities of daily living, and it is necessary to clarify the frequency of activities and degree of independence in order to assess activity levels[3)]. Therefore, it is important for rehabilitation specialists who are involved with community-dwelling elderly people to monitor decreases in their physical performance and activity levels during their at-home lives.

Recent studies using the Life Space Assessment (LSA) as proposed by Baker et al.[4)] have reported activity levels among community-dwelling elderly people, and the scale's reliability and validity have been verified[3, 4)]. The LSA is a useful scale for quantitatively assessing the level, frequency, and range of elderly people's activities, as well as their degree of dependence. Previous studies have reported that LSA scores correlate with physical function, ADL, IADL[3–6)], balance skills, and fear of falling[7)]. According to some researchers, LSA scores are not affected by target individuals' residential areas (e.g., urban or rural)[3)]. Some studies have reported decreases in the number of steps and activity levels due to outdoor environmental changes occurring in winter[8–11)]; however, researchers have yet to investigate whether LSA-based assessments are influenced by the season. In Japan, the climate, temperature, and precipitation vary according to the season, and, hence, the outdoor environments of different areas may differently affect elderly people's activities.

Against this background, we used the LSA to investigate nursing care insurance service users who were from areas with different climates (areas along the Sea of Japan, and those around the Inland Sea), in order to clarify the seasonal changes in their activity levels.

SUBJECTS AND METHODS

The study subjects comprised 72 nursing care insurance service users aged 65 years or older. They lived in either the Ishikawa (along the Sea of Japan) or Osaka/Hyogo (around

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the Inland Sea) Prefectures, and comprised 30 men and 42 women, with a mean age of 78.2±8.0 years. We explained the study to the managers of nursing care insurance facilities, and recruited the subjects from 9 facilities (7 from areas around the Inland Sea, and 2 from areas along the Sea of Japan) whose managers consented to participation in this study. We explained the study objectives and other details to the subjects, and obtained their consent in written form. This study was designed following the ethical principles of the Declaration of Helsinki, and we received approval from the Medical and Ethical Committee of Kanazawa University (Approval number: 449).

Survey I, which compared activity levels between fall and winter, involved 48 subjects (mean age: 78.9±8.1 years; 20 men and 28 women), and Survey II, which compared activity levels between winter and spring, involved 24 subjects (mean age: 76.8±7.7 years; 10 men and 14 women). The following individuals were excluded from the study: persons younger than 65 years old, those who had not been certified as requiring support or care, those who were dependent for indoor movements, those with progressive diseases, and those who had been given a diagnosis of dementia by their attending physicians.

Based on the specified definitions of the seasons[12], Survey I was conducted during fall (between October 1st and 31st, 2013) and winter (between February 1st and 28th, 2014), and Survey II was conducted during winter (between February 1st and 28th, 2014) and spring (between April 1st and 30th, 2014). The study consisted of interviews using a questionnaire and motor function tests, which were conducted by physical and occupational therapists employed by each study center who received instructions in the study methods in advance.

The questionnaire inquired about the subjects' basic information (sex, age, level of care need, main diseases, family structure, and presence/absence of daytime caregivers) as well as a history of falls over the previous month. In addition, to evaluate the balance function, skill-based physical activities, life space, and self-efficacy regarding falls, we used the one-leg standing time with the eyes open, Functional Independence Measure (FIM), LSA, and the Modified Falls Efficacy Scale (MFES), respectively. After initially practicing several times, the one-leg standing time with the eyes open was measured for both the left and right legs using a stopwatch. The higher value was adopted, with a maximum recorded time of 30 seconds. Using the Japanese version of the LSA developed by Shimada et al.[5], we asked the subjects about their daily lives over the previous month, and calculated scores for their range and frequency of activities, as well as for their degree of independence. The range of activities was assessed on a 5-point scale: 1 (within the residence), 2 (around the residence), 3 (neighborhood), 4 (within town [area within a 16-km radius from the residence]), and 5 (outside town [area outside a 16-km radius from the residence]) points. The frequency of activities was evaluated for each activity range using a 4-point scale: 1 (less than once a week), 2 (once to 3 times a week), 3 (4 to 6 times a week), and 4 (every day) points. We also calculated points for the degree of independence for each activity range in terms of the use/non-use of assistance: 2 (independent), 1.5 (using assistive devices), and 1 (receiving assistance from other persons) points. For each of the 5 activity ranges, the frequency score was multiplied by the score for the degree of independence, and these 5 scores were added as the total score. The maximum total score is 120 points, and a higher score indicates a larger life space. The LSA includes three subscales (score: 0 to 5 points) of Independent Life space (LS-I), Life space using Equipment (LS-E), and Minimal Life space (LS-M). These subscales are used to determine the highest levels of activities performed independently, using walking aids, and using both assistive devices and assistance from other persons, respectively. A higher score indicates a larger life space. The MFES, a 10-grade scale comprising 14 items (score: 0 to 140 points), is a modified version (Hill et al.)[13] of the Falls Efficacy Scale, which was developed by Tinetti et al. This scale is used to determine the level of confidence in performing specified movements and actions without falling, with higher scores indicating higher levels of self-efficacy in fall prevention and less fear of falls. The subjects' basic information was investigated only during the initial season of each survey, as was the measurement of one-leg standing time with the eyes open. The other target items were investigated twice (once in each season studied).

The subjects from areas along the Sea of Japan (Survey I: n=32, Survey II: n=13) and those from areas around the Inland Sea (Survey I: n=16, Survey II: n=11) were classified into Japan Sea and Inland Sea groups, respectively. χ^2 tests or Fisher's exact test was used to compare the sex, main diseases, level of care need, family structure, as well as presence/absence of daytime caregivers and a history of falls over the previous month between the 2 groups. The t-test was used to compare the age and time standing on one leg, and Mann-Whitney's U test was used to compare the FIM, LSA, and MFES scores. We employed the Wilcoxon signed-rank test to investigate the seasonal differences in the FIM, LSA, and MFES scores. R2.8.1 was used for all analyses, and the level of significance was chosen as 0.05.

RESULTS

In Survey I, the two groups studied in the fall showed no significant differences in sex, age, main diseases, level of care need, family structure, one-leg standing time, or presence/absence of daytime caregivers, or history of falls over the previous month (Table 1). In addition, there were no significant differences in the scores of the FIM, MFES, LSA, or its subscales (LS-I, LS-E, and LS-M) between the groups (Table 2).

I in the Japan Sea group, there was no significant difference in the FIM or MFES score between the seasons studied; however, the LSA, LS-E, and LS-M scores were significantly lower in winter than in fall ($p<0.01$, $p<0.01$, and $p<0.05$, respectively). In contrast, there was no significant difference in the LS-I score between the seasons. On the other hand, in the Inland Sea group, we found no significant differences in the scores of the LSA, its subscales, or MFES between the seasons.

As was the case in Survey I, Survey II revealed no significant differences in age, sex, main diseases, presence/absence of daytime caregivers, history of falls over the pre-

Table 1. Basic information

Items	Survey I		Survey II		
	Japan Sea group (n=32)	Inland Sea group (n=16)	Japan Sea group (n=13)	Inland Sea group (n=11)	
Age (mean±SD)	79.6 (±8.2)	78.6 (±7.9)	77.5 (±8.8)	76.0 (±6.1)	
Gender					
Male	14	6	8	3	
Female	18	10	5	8	
Level of care need					
Requiring support (level: 1–2)	13	6	7	3	
Requiring nursing care (level: 1–4)	19	10	6	8	
Main diseases					
Bone and joint diseases	12	5	5	3	
Cerebrovascular disease, visceral impairment, and others	20	11	8	8	
Family structure					
One-person household	10	7	4	3	
Other types of household	21	9	9	8	
Daytime caregivers					
Yes	15	5	8	2	*
No	17	11	5	9	
History of falls over the previous month					
Yes	3	4	2	4	
No	29	12	11	7	
One-leg standing time (mean±SD)	5.6 (±7.6)	6 (±7.1)	8.1 (±11.1)	6.6 (±8.2)	

*$p<0.05$

vious month, or one-leg standing time; however, the rate of requiring daytime caregivers was significantly higher among the Japan Sea group (Table 1). During winter, there were no significant differences in the scores of the FIM, MFES, LSA, or its subscales between the Japan Sea and Inland Sea groups.

In the Japan Sea group, no significant differences were noted in any investigation item between the seasons studied. On the other hand, the Inland Sea group showed a significantly higher LS-M score in spring than in winter ($p<0.05$) (Table 2).

DISCUSSION

In contrast to previous studies that reported average LSA scores of 62.9 to 92.7 points among subjects certified as requiring support or nursing care[3–6], in this study, the median value of LSA scores that were calculated during the earlier season of each survey was relatively low (35.5 points) among all subjects. A possible explanation for this finding in that our study did not involve participants in health checkup programs, and the subjects comprised nursing care insurance service users with relatively low physical functions, who had been certified as requiring support or nursing care.

In Survey I, the Inland Sea group did not show significant changes between the seasons studied, but the Japan Sea group showed significantly lower LSA scores in the winter than in the fall. These results suggest that individuals' life space is influenced by the season in some residential areas. Portegijs et al.[14] investigated the test-retest reliability of the LSA with a 2-week interval, and found the scale had poorer reproducibility in winter than in spring, suggesting that precipitation and other seasonal conditions specific to winter, except for temperature, markedly influence LSA scores. Some studies have also reported that outdoor conditions during winter, such as slippery streets, may influence elderly people's activities outside their homes[8]. According to meteorological data in Japan, the numbers of days with snowfall were 0 and 4 in January and February (2014) in areas around the Inland Sea, and 14 and 12 in January and February (same year) in areas along the Sea of Japan, respectively[15]. Thus, streets become icy and slippery more often in the Japan Sea areas than in the Inland Sea areas during winter, indicating that individuals' opportunities for activities (e.g., going out) are affected by outdoor environmental changes regardless of their degree of daily life independence and the presence/absence of a fear of falls.

Interestingly, the Japan Sea group did not show lower LS-I scores in winter, suggesting no restrictions on activities that are performed independently. The median LS-I score was 1 point (within the residence) in both fall and winter. These findings indicate that many elderly people are independent regarding indoor activities, but require certain assistance for outdoor activities. Therefore, it is necessary to provide elderly people living in areas along the Sea of Japan with intervention programs, community healthcare, and nursing care services in a manner that maintains their outdoor life space during winter. Life space is correlated with physical performance[3], and assessment of life space helps to determine a subject's motor function and activity skills, because

Table 2. Between-group comparisons of each survey

Assessment			Japan Sea group			Inland Sea group		
			Fall	Winter		Fall	Winter	
Survey I	FIM	Total score	83.0 (77.0–88.0)	80.0 (77.0–83.0)		79.0 (72.5–84.0)	80.0 (76.5–85.5)	
	LSA	Total score	35.5 (21.9–48.2)	30.5 (16.4–36.0)	**	43.8 (28.0–54.8)	36.0 (30.0- 59.6)	
		LS-I	1.0 (0.0–2.0)	1.0 (0.0.-2.0)		0.5 (0.0–1.3)	1.0 (0.8–3.3)	
		LS-E	3.0 (1.0–5.0)	1.0 (0.0–3.0)	**	4.0 (2.0–5.0)	4.0 (2.0–4.2)	
		LS-M	5.0 (5.0–5.0)	4.5 (4.0–5.0)	*	5.0 (4.0–5.0)	5.0 (4.8–5.0)	
	MFES	Total score	89.0 (69.0–102.0)	84.0 (65.0–96.0)		85.0 (68.5–97.5)	84.0 (65.0–108.0)	
			Winter	Spring		Winter	Spring	
Survey II	FIM	Total score	81.0 (77.0–85.0)	80.0 (72.0–83.0)		85.0 (80.5–87.5)	87.0 (81.5–88.5)	
	LSA	Total score	30.0 (16.0–36.0)	31.0 (12.0–38.0)		40.0 (25.0–49.0)	35.0 (29.0–59.5)	
		LS-I	1.0 (0.0–2.0)	1.0 (0.0–2.0)		2.0 (1.0–2.0)	2.0 (0.0–3.0)	
		LS-E	2.0 (1.0–3.0)	2.0 (1.0–3.0)		3.0 (1.5–3.5)	3.0 (1.5–4.0)	
		LS-M	4.0 (4.0–5.0)	4.0 (4.0–5.0)		4.0 (4.0–5.0)	5.0 (5.0–5.0)	*
	MFES	Total score	84.0 (69.0–96.0)	102.0 (69.0–108.0)		102.0 (78.0–119.0)	120.0 (97.5–123.5)	

Median (25–75%). *p<0.05, **p<0.01

such skills influence the life space[16], and, hence, we suggest that its evaluation is meaningful.

In Survey II, the Inland Sea group showed significantly higher LS-M scores in spring than in winter, suggesting that this group had a larger life space along with higher levels of activities owing to assistance from other persons during spring. However, the reasons for this finding are unknown, as only 2 subjects had daytime caregivers among this group. I in a study conducted by Newman et al., who used a pedometer, elderly women showed the lowest activity levels during winter, and these levels increased in the following spring[17]. Another study also reported that activity levels of elderly people are strongly influenced by daylight hours and the average highest temperature[18]. However, unlike in these studies in which a pedometer or accelerometer was used to determine activity levels, in Survey II of our study, LSA scores in spring were not significantly higher than those in winter, possibly due to the fact that the subjects comprised users of nursing care insurance services, whose independent activities were limited. Also, because of the small number of subjects in Survey II, and the between-group difference in the daytime nursing care identified in winter, it will be necessary to repeat the study with a greater number of subjects to resolve this issue.

Our findings suggest that the LSA may be used as a tool to clarify the seasonal changes in the life space of nursing care insurance services users. It will be necessary to recruit individuals with decreased physical functions from various prefectures, and investigate environmental factors that influence their life space, in order to better understand measures that would maintain or increase community-dwelling elderly people's physical functions and activity levels, and contribute to the development of community-based rehabilitation of such individuals.

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