

ORIGINAL ARTICLE

## Factors related to quality of life in elderly users of day care rehabilitation services: An investigation using health-related quality of life and subjective well-being

Yamato Niioka<sup>1,2)</sup>, Eiki Tsushima<sup>1)</sup>, Hirofumi Ogihara<sup>1)</sup>, Takaaki Sato<sup>1)</sup>,  
Kazuya Hirayama<sup>3)</sup>, and Takayuki Taguchi<sup>4)</sup>

### Abstract

**Aim:** We aimed to clarify the physical, mental and social factors related to the quality of life of the elderly adults who require long-term care.

**Methods:** The physical functions of 123 users of day care rehabilitation services were measured. Survey and measurement items were the physical and mental component summaries of the 8-item Short-Form Health Survey, Life Satisfaction Index K, 30-Second Chair-Stand Test, 5-meter walking time maximum, pain, Geriatric Depression Scale-15, K-I Scale, Japanese version of the abbreviated Lubben Social Network Scale, age, gender, nursing care level, living arrangements, residence history, educational level, and hobbies. Canonical correlation analysis was used to clarify factors related to quality of life.

**Results:** The Geriatric Depression Scale-15 was found to be related to the Life Satisfaction Index K and mental component summary. The 30-Second Chair-Stand and pain were found to be related to the physical component summary.

**Conclusions:** Depression, pain, and leg muscle strength are related to quality of life in elderly users of day care rehabilitation services when evaluating quality of life using health-related quality of life and subjective well-being as a single construct.

Hirosaki Med. J. 70 : 130–138, 2020

**Key words:** depression; elderly; health-related quality of life; Long-term care; subjective well-being.

### Introduction

Elderly adults who require long-term care have difficulty maintaining good quality of life (QOL). These adults require care for their activities of daily living, and have reduced physical, mental, and social function compared with the general elderly adult population. Day care rehabilitation services can support elderly adults who live in the community and require nursing care, and one of the functions of this service is improving QOL. There are various factors related to QOL, including physical function, mental state, and

social environment. Therefore, it is difficult to support QOL in elderly users of day care rehabilitation services, for whom the above factors have deteriorated.

Previous research on quality of life has primarily been in the medical field and in the field of gerontology and social psychology. Quality of life in the medical field focuses on physical function, and is handled as health-related quality of life (HRQOL). There are disease-specific scales that are used to determine the therapeutic effect of treatment for conditions such as cancer<sup>1)</sup>, cerebrovascular disease<sup>2)</sup>, and osteoarthritis.

<sup>1)</sup> Graduate School of Health Sciences, Hirosaki University School of Medicine Health Sciences, Hirosaki, Japan

<sup>2)</sup> Department of Physical Therapy, Faculty of Health Sciences, Aomori University of Health and Welfare, Aomori, Japan

<sup>3)</sup> Department of Rehabilitation, Faculty of Medical Science and Welfare, Tohoku Bunka Gakuen University, Sendai, Japan

<sup>4)</sup> Department of Physical Therapy, School of Health and Social Services, Saitama Prefectural University, Saitama, Japan

Correspondence: Y. Niioka

Received for publication, November 11, 2019

Accepted for publication, December 10, 2019

tis<sup>3)</sup>, and global scales<sup>4)</sup>, that measure factors related to health common to both patients and healthy individuals. These kinds of patient-based assessments are indispensable in today's medicine.

Quality of life in gerontology and social psychology focuses on mental state and the social environment, and is handled as subjective well-being (SWB). Subjective well-being is defined as the extent to which a person believes and feels that their own life is progressing well<sup>5)</sup>. It is an extremely broad concept, for which a large number of scales have been developed<sup>5)</sup>. Systematic reviews<sup>5-7)</sup> on SWB have reported on a large number of factors, ranging from external factors such as relationships with family and friends, income, and education to internal factors such as physical function, mental status, and the presence or absence of disease. The relationship between lifespan and incidence of health impairment has also been reported;<sup>6)</sup> thus, it is also regarded as an important aid for social policy planning<sup>8)</sup>.

The World Health Organization reported that both HRQOL and SWB should be incorporated into the results of health services<sup>9)</sup>. This is because despite QOL being affected by factors such as physical function, mental state, and the social environment, the scope that affects HRQOL is limited to physical function and the respective therapeutic effect<sup>10)</sup>, and it is difficult to reflect factors related to lifestyle, such as the social environment<sup>11)</sup>. Furthermore, SWB is only weakly correlated with physical function, so it is unsuitable as a QOL index for people with reduced physical function<sup>12)</sup>. When either HRQOL or SWB alone is used to measure QOL, the results may only represent one aspect of QOL. Thus, in this study, we captured HRQOL and SWB as a single QOL construct to obtain basic knowledge on factors related to QOL in elderly users of day care rehabilitation services with the aim of clarifying related factors.

## Methods

### Participants

The study was conducted in the day care rehabilitation units of six geriatric health service facilities in Saitama. Inclusion criteria were people who had used day care rehabilitation services between March and October 2014 and agreed to the study aims, resulting in 152 subjects. Exclusion criteria were people aged younger than 65 years, a Mini-Mental State Examination (MMSE) score of less than 21, and the inability to understand the survey and measurement methods. This resulted in 123 subjects ( $78.46 \pm 7.53$  years, men  $n=39$ , women  $n=84$ ). The study was conducted in accordance with the Declaration of Helsinki and its subsequent revisions and amendments. The aims and methods were explained to the subjects in writing and verbally, and the study was implemented after consent was obtained from the subjects. Ethical approval was obtained from the institutional review boards of Saitama Prefectural University (25527) and the Graduate School of Health Sciences, Hirosaki University School of Medicine Health Sciences (2018-055).

### Measures

A physical therapist (PT) or occupational therapist (OT) in each of the facilities administered the survey and took the measurements. The survey and measurements were either implemented in a single session or across multiple sessions, depending on the tiredness of the subject.

### Measurement variable

#### *Main Outcome*

Health-related quality of life

The standard version of the 8-Item Short-Form Health Survey (SF-8)<sup>13)</sup> was used to measure HRQOL. The SF-8 consists of a total of eight questions covering eight different health

domains. Questions are based on either a 5-point scale or a 6-point scale. Scoring is based on national standard values, enabling calculation of the physical component summary (PCS), which shows a person's sense of physical health, and the mental component summary (MCS), which shows a person's sense of mental health. The higher the score, the higher the HRQOL<sup>13)</sup>.

#### Subjective well-being

The Life Satisfaction Index K (LSIK)<sup>14)</sup> was used to measure SWB. The LSIK contains three subscales: satisfaction with entire life, psychological stability, and evaluation of old age. There are a total of nine items, with either a 2-point scale or a 3-point scale for each item. If a positive option is selected, 1 point is allocated, if another option is selected, 0 points are allocated. A respondent may receive a score between 0-9 points in total. A higher score indicates a higher level of life satisfaction<sup>14)</sup>.

#### *Sub-outcomes*

##### Basic information

Data on age, gender, and care level were collected from the subjects' medical records. Care level is evaluated by the seven grades in the long-term care insurance system in Japan. Subjects with support level 1 require the least amount of care, while those with care level 5 need the greatest amount of care. We also investigated MMSE score, living arrangements, residence history, academic background, and whether the person had hobbies.

##### Physical function

The 30-second Chair-Stand Test (CS-30)<sup>15)</sup> was used to measure lower limb strength, and the 5-meter Walking Time Maximum (5MWT)<sup>16)</sup> was used to measure movement ability. A numerical rating scale (NRS)<sup>17)</sup> was used to measure the condition of pain currently experienced by the subject. The NRS assesses the extent of pain cur-

rently experienced by the subject on an 11-point scale from 0 "No pain" to 10 "Worst pain possible"<sup>17)</sup>. The highest NRS score of the pain experienced by the subject was adopted. Functional Independence Measure-motor score (FIM-m) was obtained from the medical records as an indicator of complex motor functional ability.

##### Mental function

The Geriatric Depression Scale-15 (GDS-15)<sup>18)</sup> was used to measure depression status, and the K-I Scale<sup>19)</sup> was used to measure sense of purpose. The GDS-15 is a screening test for depression, with a 2-point scale of yes or no answers to 15 questions. The responses are allocated 0 points or 1 point. Scores of 5 points or more show a depressive tendency, and the higher the total score, the stronger the depressive tendency<sup>18)</sup>. The K-I Scale is used to measure the extent of an elderly person's sense that life is worth living, and consist of a total of 12 items. There are four subscales: self-fulfillment and motivation, sense of fulfillment, zest for living, and presence. The questions are based on a 3-point scale, and there are three response options ("Yes," "Cannot say either way," and "No"), which are scored as 2, 1, or 0. The higher the total score, the higher the sense of purpose<sup>19)</sup>.

##### Social function

The Japanese version of the abbreviated Lubben Social Network Scale (LSNS-6)<sup>20)</sup> was used to measure a person's social network. The LSNS-6 is used as a screening tool for social isolation, and it evaluates the network size and contact frequency of an individual's interpersonal exchanges, the presence of emotional and instrumental support, and whether personal interactions are with family or non-family members. The scale consists of a total of six items: three items on the person's family network and three items on the person's non-family network. The higher the respondent's score, the

**Table 1.** Results of survey and measurement of analysis set

Measurements		Outcomes ( <i>n</i> =123)
Age (years)		78.46 (7.53)
Gender, <i>n</i>	Men	39 (31.7)
	Women	84 (68.3)
Care level, <i>n</i>	Support level 1	15 (12.2)
	Support level 2	24 (19.5)
	Care level 1	40 (32.5)
	Care level 2	25 (20.3)
	Care level 3	17 (13.8)
	Care level 4	2 (1.6)
MMSE		27.11 (1.47)
Residence history, <i>n</i>	Within 5 years	16 (13.0)
	6 to 20 years	24 (19.5)
	Over 21 years	83 (67.5)
Living arrangement, <i>n</i>	Living alone	20 (16.3)
	Living with others	103 (83.7)
Educational level, <i>n</i>	Primary school	7 (5.7)
	Junior high school	35 (28.5)
	High school	50 (40.7)
	Vocational school	18 (14.6)
	University	13 (10.6)
Hobbies, <i>n</i>	Yes	98 (79.7)
	No	25 (20.3)
PCS		40.56 (8.44)
MCS		48.72 (7.88)
LSIK		4.28 (2.01)
CS-30 (times)		11.41 (5.68)
Pain		3.47 (3.08)
5MWT max (sec)		7.70 (5.22)
FIM-m		84.37 (9.37)
GDS-15		5.42 (3.58)
K-I Scale		21.82 (6.27)
LSNS-6		21.79 (5.11)

Data are presented as the number of participants (percentage) or mean (standard deviation). MMSE, Mini-Mental State Examination; PCS, physical component summary of the 8-item Short-Form Health Survey; MCS, mental component summary of the 8-item Short-Form Health Survey; LSIK, Life Satisfaction Index K; CS-30, 30-Second Chair Stand Test; 5MWT max, 5-Meter Walking Test Maximum; FIM-m, Functional Independence Measure motor score; GDS-15, 15-item Geriatric Depression Scale; K-I Scale; LSNS-6, six-item Lubben Social Network Scale.

more abundant their social network<sup>21)</sup>.

### Statistical analysis

Of the surveyed items, the items represented by a nominal scale were set as dummy variables of type 0-1. Then, PCS, MCS, and LSIK were set as dependent variables and other variables were set as independent variables to investigate the relationship between PCS, MCS and LSIK, which represent QOL. The results were analyzed using Canonical correlation analysis (CCA). Prior to conducting CCA, single correlation coefficients were confirmed between all the variables to confirm multicollinearity in advance. The statistical

analysis software programs R2.8.1 (CRAN, free-ware) and SPSS Statistics version 22 (IBM Corp., Armonk, NY) were used, and level of significance was set as 5%.

### Results

Of the 152 subjects, 16 were aged less than 65 years, 9 scored less than 21 on the MMSE, and 4 had missing data. All of these subjects were excluded from the study, leaving 123 subjects in the analysis set. The survey and measurement results of the analysis set are shown in Table 1. Approximately 70% of the subjects were women,

**Table 2.** Association between LSIK, PCS, MCS and other variables

		<b>1st Canonical Variates</b>	<b>2nd Canonical Variates</b>	<b>3rd Canonical Variates</b>
Independent variables	Age	-0.091	-0.103	-0.128
	Gender	0.194	-0.202	-0.080
	Care level	-0.082	-0.329	-0.014
	MMSE	0.147	-0.235	0.146
	Living arrangement	0.083	0.178	-0.240
	Residence history	0.189	0.276	0.085
	Educational level	-0.003	-0.077	0.388
	Hobbies	-0.265	-0.104	-0.177
	CS-30	0.188	0.473	-0.068
	5-m Walking Time max	-0.008	-0.182	-0.424
	Pain	0.249	-0.681	0.112
	FIM-m	0.089	0.352	0.085
	GDS-15	0.884	-0.073	0.052
	K-I Scale	-0.192	0.151	0.123
	LSNS-6	-0.261	0.119	-0.211
	Dependent variables	PCS	0.032	0.979
MCS		-0.574	-0.255	-0.778
LSIK		-0.950	0.157	0.270
Canonical correlation coefficient		0.692	0.522	0.317
<i>p</i> value		0.010	0.062	0.753

5-m Walking Time max, 5-meter walking time maximum; CS-30, 30-Second Chair Stand Test; FIM-m, Functional Independence Measure motor score; GDS-15, Geriatric Depression Scale-15; LSIK, Life Satisfaction Index K; LSNS-6, Lubben Social Network Scale; MCS, mental component summary of the 8-item Short-Form Health Survey; MMSE, Mini-Mental State Examination; PCS, physical component summary of the 8-item Short-Form Health Survey.

Only 1st and 2nd canonical variates for which the canonical correlation coefficient was  $\geq 0.4$  were analyzed.

Items with a canonical loading of  $\geq 0.4$  and that were the highest of the 1st or 2nd canonical variates were extracted.

and approximately 80% of the subjects had long-term care level 2 or lower.

The CCA results for MCS, PCS, LSIK and the other variables are shown in Table 2. Items with a canonical correlation coefficient of  $\geq 0.4$  were first and second canonical variates. The first canonical variates showed that GDS-15 was related to LSIK and MCS. The second canonical variates showed that CS-30 and pain were related to PCS in that order. No correlation coefficient of  $\geq 0.9$  was found between any variables in the single correlation analysis conducted prior to CCA; thus, it was determined that there were no issues with regard to multicollinearity.

Table 3 shows a breakdown of the GDS-15 survey results of the subject. About 48% of the

**Table 3.** GDS-15 results

<b>GDS-15 Score (points)</b>	<b>Outcomes (<i>n</i>=123)</b>
0-5	64 (52.0)
6-10	48 (39.0)
11-15	11 (8.9)

Data are presented as the number of participants (percentage).

GDS-15, 15-item Geriatric Depression Scale.

subjects were in depression.

## Discussion

### *Basic attributes of the analysis set*

According to a report by the Japanese Ministry of Health, Labour and Welfare, the mean age of all users of day care rehabilitation

services (elderly-only in Japan) in 2016 was  $80.1 \pm 9.1$  years, 61.1% were women, and 78.5% ranged from support level 1 to long-term care level 2<sup>22)</sup>. The analysis set in this study had a larger percentage of women, and a large percentage of this group were within the range of support level 1 to long-term care level 2. The report indicated that the number of men who are users increases as the nursing care requirements increase<sup>22)</sup>. However, in this study dementia was an exclusion criteria, so overall there were a larger number of patients with lower nursing care requirements, which is also thought to have resulted in fewer men in the study. The lower nursing care requirements of the analysis set and dementia being an exclusion criterion may have resulted in a larger number of people with good physical and mental function in the analysis set in the results of this study. Therefore, the results of this study must be interpreted with these factors in mind.

#### ***Correlations between PCS, MCS, LSIK, and other variables***

We expected that HRQOL would be related to physical factors, and SWB would be related to mental and social factors. We also expected that when HRQOL and SWB were combined as a single QOL construct, each of the physical, mental, and social factors would also correlate. However, although there was correlation with physical and mental factors, there was no correlation with social factors.

Table 2 reveals that the first canonical variates showed that GDS-15 was related to LSIK and MCS. Both MCS and LSIK are scales that show the mental aspect of QOL, and GDS-15 is a scale that demonstrates the extent of depression, so the first canonical variates are thought to represent the mental aspect. This result indicates that a reduction in HRQOL sense of mental health and SWB is correlated with an increase in depressive tendency. In a study on elderly adults

in retirement homes, Andresen et al.<sup>23)</sup> reported that GDS and MCS were negatively correlated and depression reduces mental health status and the level of satisfaction in life as a whole. The average GDS-15 score of the analysis set from Table 1 was higher than the average score of community-dwelling elderly ( $2.7 \pm 2.5$  points)<sup>24)</sup>. The cutoff for depression in GDS-15 is  $\geq 6$ , but as shown in Table 3, almost half the analysis set had depressive tendencies. These results demonstrate that many elderly users of day care rehabilitation services have depressive tendencies, and the stronger the depression, the worse the mental aspect of QOL. Therefore, evaluation and intervention for depression is important for elderly users of day care rehabilitation services.

The second canonical variates showed that CS-30 and pain were related to PCS, in that order. The physical component summary is a scale that shows a person's sense of physical health in relation to HRQOL, and given that pain and CS-30 are also scales that reflect physical function, the second canonical variates is thought to represent the physical aspect. This result indicates that when pain is weak and lower limb strength is strong, a person's sense of physical health in relation to HRQOL increases. Fukuhara et al.<sup>13)</sup> reported that PCS is strongly correlated with subscale pain items in SF-8; therefore, the negative correlation between PCS and pain is a valid result. The canonical loading of pain in the second canonical variates was  $-0.681$ , which was particularly high compared with other factors, and demonstrates that the extent of pain is important in a person's sense of physical health in relation to HRQOL in elderly users of day care rehabilitation services. In this study, the CS-30 also was found to be positively correlated with PCS. Hart et al.<sup>25)</sup> conducted a systematic review on strength training and HRQOL in elderly adults, and reported that strength training was effective for improving HRQOL overall, including PCS<sup>25)</sup>. However, in a systematic review on the effect of

strength training in elderly adults, Liu *et al.*<sup>26)</sup> reported that although lower limb strength was related to walking ability and the ability to climb stairs, strength training was not related to ADL and HRQOL. In this study, there was no correlation between strength training and QOL, and we investigated whether having lower limb strength itself is related to QOL. Reports have shown that muscle strength is related to a variety of factors, including signs of frailty, fall rate, and mortality rate<sup>25)</sup>. Muscle strength is related to many factors, and it is also expected to affect QOL, so it is essential to carefully analyze the results of this study bearing these factors in mind.

In this study, social network, which was used to investigate social factors, was not found to be related to QOL. Many reports show a positive correlation between the scale of elderly adults' social network and QOL<sup>27,28)</sup>. However, Tornstam<sup>29)</sup> proposed the concept of gerotranscendence, and reported that, in terms of aging and social interactions, QOL is maintained if a person has close connections, even if the size of the social network is small. Tornstam suggested that critical life events, such as the person's own illness or disability, or separation from loved ones, promote gerotranscendence<sup>29)</sup>. It is highly likely that elderly users of day care rehabilitation services are facing these kinds of life events, and in those cases, there will not be a simple association between social networks and QOL. Based on the above findings, QOL in elderly users of day care rehabilitation services and social factors do not demonstrate a simple correlation. The findings suggest an interaction between factors such as a person's age, size of their social network, and quality of support. When providing support for elderly users of day care rehabilitation services, it is vital to investigate the circumstances of each individual in detail.

### **Study limitations**

The limitations of this study include the small

study cohort and that PTs and OTs from the affiliated facilities recruited the subjects and conducted the survey and measurements. It is essential to interpret the results with due consideration for selection bias and information bias. Given the small number of variables related to QOL when using HRQOL and SWB as a single construct, other factors not surveyed or measured in this study may also be related to HRQOL and SWB. This study was exploratory research. In the future, it will be essential to increase the number of subjects and investigate factors not considered in this study.

### **Conclusion**

We investigated the QOL of elderly adults who require nursing care and use day care rehabilitation services, combining HRQOL and SWB as a single construct. A correlation was found between QOL and physical factors (pain, CS-30) and mental factors (GDS-15), but no correlation was found with social factors. This study clarified that low level of depression, low level of pain, and strong leg muscle strength correlates with high QOL in elderly users of day care rehabilitation services when evaluating QOL combining HRQOL and SWB as a single construct.

### **Disclosure statement**

The authors declare no conflict of interest.

### **Acknowledgments**

We would like to express our sincere gratitude to the staff and patients for their understanding and cooperation in this study.

### **References**

- 1) Aaronson NK, Ahmedzai S, Bergman B, Bullinger

- M, Cull A, Duez NJ, Filiberti A, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst.* 1993;85:365-76.
- 2) Williams LS, Weinberger M, Harris LE, Clark DO, Biller J. Development of a stroke-specific quality of life scale. *Stroke.* 1999;30:1362-9.
  - 3) Veenhof C, Bijlsma JW, van den Ende CH, van Dijk GM, Pisters MF, Dekker J. Psychometric evaluation of osteoarthritis questionnaires: a systematic review of the literature. *Arthritis Rheum.* 2006;55:480-92.
  - 4) Fukuhara S, Ware Jr JE, Kosinski M, Wada S, Gandek B. Psychometric and clinical tests of validity of the Japanese SF-36 Health Survey. *J Clin Epidemiol.* 1998;51:1045-53.
  - 5) Diener E, Lucas RE, Oishi S. Advances and open questions in the science of subjective well-being. *Collabra Psychol.* 2018;4.
  - 6) George LK. Still happy after all these years: research frontiers on subjective well-being in later life. *J Gerontol B Psychol Sci Soc Sci.* 2010; 65B:331-9.
  - 7) McNeil JK, Stones MJ, Kozma A. Subjective well-being in later life: Issues concerning measurement and prediction. *Soc Indic Res.* 1986;18:35-70.
  - 8) Stone AA, Mackie CE. *Subjective Well-Being: Measuring Happiness, Suffering, and other Dimensions of Experience*: Washington, DC: National Academies Press, 2013.
  - 9) World Health Organization. The European health report 2012-charting the way to well-being. 2013 [Cited 15 Sep 2019] Available from URL: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0004/197113/EHR2012-Eng.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0004/197113/EHR2012-Eng.pdf?ua=1)
  - 10) Kane RA. Definition, measurement, and correlates of quality of life in nursing homes: toward a reasonable practice, research, and policy agenda. *Gerontologist.* 2003;43 Spec No 2:28-36.
  - 11) McCabe C, Cronin P. Issues for researchers to consider when using health-related quality of life outcomes in cancer research. *Eur J Cancer Care (Engl).* 2011;20:563-9.
  - 12) Oberjé EJ, Dima AL, van Hulzen AG, Prins JM, de Bruin M. Looking beyond health-related quality of life: predictors of subjective well-being among people living with HIV in the Netherlands. *AIDS Behav.* 2015;19:1398-407.
  - 13) Fukuhara S, Suzukamo Y. *Manual of the SF-8 Japanese version*. Kyoto: Institute for Health Outcomes & Process Evaluation Research, 2004.
  - 14) Koyano W. Structure of a life satisfaction index : Invariability of factorial structure. *Japanese J Gerontol.*1990;12:102-16. (Japanese)
  - 15) Jones CJ, Rikli RE, Beam WC. A 30-s chair-stand test as a measure of lower body strength in community-residing older adults. *Res Q Exerc Sport.* 1999;70:113-9.
  - 16) Makizako H, Furuna T, Shimada H, Akanuma T, Yoshida H, Ihira H, Yokoyama K, et al. Relationship between 5-m walking time and the need for long-term care among community-dwelling adults aged above 75 years: a 39-month longitudinal study. *Physical Therapy Japan.* 2011;38:27-33. (Japanese)
  - 17) Rodriguez CS. Pain measurement in the elderly: a review. *Pain Manag Nurs.* 2001;2:38-46.
  - 18) Sheikh JI, Yesavage JA. Geriatric Depression Scale (GDS): recent evidence and development of a shorter version. *Clinical Gerontologist: Aging Ment Health.* 1986;5:165-73.
  - 19) Kondo T, Kamada J. Construction of 'the K-I Scale for the feeling that life is worth living among the aged' and the definition of this feeling. *Jpn J Soc Welf.* 2003;43:93-101. (Japanese)
  - 20) Kurimoto A, Awata S, Ohkubo T, Tsubota-Utsugi M, Asayama K, Takahashi K, Suenaga K, et al. Reliability and validity of the Japanese version of the abbreviated Lubben Social Network Scale. *Jpn J Geriatr.* 2011;48:149-57. (Japanese)
  - 21) Lubben JE. Assessing social networks among elderly populations. *Fam Community Health.* 1988; 11:42-52.
  - 22) Ministry of Health, & Labour and Welfare. *Rehabilitation to Kinoukunrenno Kinoubunkato Sonoarikatani Kansuru Tyosakenkyujigyo (Research business report on functional differentia-*

- tion and its way of rehabilitation and functional training). 2016. [Cited 15 Sep 2019.] Available from: [https://www.mhlw.go.jp/file/05-Shingikai-12601000-Seisakutoukatsukan-Sanjikanshitsu\\_Shakaihoshoutantou/0000126194.pdf](https://www.mhlw.go.jp/file/05-Shingikai-12601000-Seisakutoukatsukan-Sanjikanshitsu_Shakaihoshoutantou/0000126194.pdf)
- 23) Andresen EM, Gravitt GW, Aydelotte ME, Podgorski CA. Limitations of the SF-36 in a sample of nursing home residents. *Age Ageing*. 1999;28:562-6.
- 24) Makizako H, Shimada H, Tsutsumimoto K, Lee S, Doi T, Nakakubo S, Hotta R, et al. Social frailty in community-dwelling older adults as a risk factor for disability. *J Am Med Dir Assoc*. 2015;16:1003.e7-11.
- 25) Hart PD, Buck DJ. The effect of resistance training on health-related quality of life in older adults: systematic review and meta-analysis. *Health Promot Perspect*. 2019;9:1-12.
- 26) Liu CJ, Latham NK. Progressive resistance strength training for improving physical function in older adults. *Cochrane Database Syst Rev*. 2009;8:CD002759.
- 27) Hellstrom Y, Andersson M, Hallberg IR. Quality of life among older people in Sweden receiving help from informal and/or formal helpers at home or in special accommodation. *Health Soc Care Community*. 2004;12:504-16.
- 28) Huxhold O, Fiori KL, Windsor TD. The dynamic interplay of social network characteristics, subjective well-being, and health: the costs and benefits of socio-emotional selectivity. *Psychol Aging*. 2013;28:3-16.
- 29) Tornstam L. Gero-transcendence: a reformulation of the disengagement theory. *Aging (Milano)*. 1989;1:55-63.