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Original Article

Factors related to physical and mental components of quality of life in the community-dwelling frail older persons

Naoki Maki, PhD, RPT[1)a], Harumi Sakamoto, PhD, OTR[2)a], Yu Takata, PhD, RPT[2)], Yuki Mutsukura, OTR[2)], Wijesinghe Ashoka, MBBS[1)], Takahiro Yanagihara, MD[1)], Yusuke Saeki, MD[1)], Shinsuke Kitazawa, PhD, MD[1)], Naohiro Kobayashi, PhD, MD[1)], Shinji Kikuchi, PhD, MD[1)], Yukinobu Goto, PhD, MD[1)], Hideo Ichimura, PhD, MD[1)], Yukio Sato, PhD, MD[1)], Hisako Yanagi, PhD, MD[3)*]

[1)] *Department of Thoracic Surgery, Faculty of Medicine, University of Tsukuba, Japan*
[2)] *AHR Medical and Welfare College School, Japan*
[3)] *Department of Medical Science and Welfare, Faculty of Medicine, University of Tsukuba: 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8577, Japan*

Abstract. [Purpose] The aim of this study was to investigate factors associated with changes in both the physical and mental components of quality of life (QOL) in of community-dwelling frail older persons in long-term care and to clarify which aspects are important to maintaining physical and mental components of QOL. [Participants and Methods] In this 1 year follow-up cohort study, participants were older persons from a single day care rehabilitation center in Japan. The Medical Outcome Study 8-Item Short-Form Health Survey (MOS-SF8), which gives both physical component summary (PCS) and mental component summary (MCS) scores, was used as the main QOL assessment. Participants were divided according to their level of QOL maintenance according to changes in PCS and MCS scores over the study period, and the variables were compared between the groups. [Results] PCS domain was significantly associated with forced vital capacity and the MCS domain was significantly associated with the Geriatric Depression Scale and Dysphagia Risk Assessment for the Community-Dwelling Elderly Test. [Conclusion] Depression, reduced pulmonary function, and reduced deglutition ability were independently related to low QOL. Assessment of these factors could be beneficial for maintaining the physical and mental components of QOL in community-dwelling frail older persons in long-term care.

Key words: Pulmonary function, Quality of life, Community-dwelling frail older persons

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INTRODUCTION

Japan has a rapidly aging population and, by 2030, 31.2% of the population is expected to exceed 65 years of age, with which comes an ever-increasing demand for long-term care services[1)]. In Japan, stroke, cardiorespiratory disease, and musculoskeletal disease are the major risk factors associated with the need for long-term care[2)]. Activities of daily living (ADL), quality of life (QOL), and bodily and psychological functions can be adversely affected by these diseases. Previous studies reported that QOL tends to decrease in frail older persons who have experienced stroke, COPD, and musculoskeletal disease[3)].

[a]These authors contributed equally as co-first authors. *Corresponding author. Hisao Yanagi (E-mail: hyanagi@md.tsukuba.ac.jp)

Multiple studies have reported the factors associated with decrease of QOL in frail older persons, and QOL is reported to be affected by ADL, depression, deglutition, nutrition, and economic status[4, 5]. According to Xie and colleagues, impaired pulmonary function has a significant negative impact on QOL in middle-age populations[6]. While some reports have examined the relationship between QOL and its associated factors among community-dwelling older persons in long-term care, few have done so by separately investigated the physical and mental domains of QOL. To the best of our knowledge, the factors related to the physical and mental components of QOL in the community-dwelling frail older persons have not been established. Therefore, the purpose of this study was to investigate the factors associated with physical and mental components of QOL in community-dwelling frail older persons in long-term care and measure changes in their QOL after a 1 year period, with the aim of identifying which aspects are important for maintaining the physical and mental QOL.

PARTICIPANTS AND METHODS

The participants of this prospective cohort study were selected from a day care rehabilitation center in Ishioka City, Ibaraki, Japan, from May, 2014 to August, 2017. The inclusion criteria were participants with history of stroke, musculoskeletal disorders, or cardiorespiratory disorders who were more than 65 years of age and for whom it had been 6 months since acute disease onset. The exclusion criteria were patients who have been hospitalized during the observation period and/or who could not use an auto spirometer.

The participants, who were undergoing a standard rehabilitation program, were observed over a 1 year period. Participants' demographics, including age, gender, and body mass index (BMI), were collected. QOL was evaluated using the Medical Outcome Study 8-Item Short-Form Health Survey (MOS-SF8)[7], which indicates both a physical component summary (PCS) score and a mental component summary (MCS) score. Pulmonary function testing was done using an auto spirometer (Vitalopower KH-801; Philips Company, Tokyo, Japan) and the forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1) and cough peak flow (CPF) were measured as respiratory capacity[8]. %FVC predictive and %FEV1 predictive values were calculated according to age, weight, height, and gender for each participant. Hand dynamometer and the Manual Muscle Test was used to measure grip and abdominal muscle strength. A goniometer, which measures thorax flexibility, was used to assess the range of motion (ROM) of the thoracolumbar spine. The 6-minute walk test (6MWT) was used measure exercise tolerance while, concurrently, percutaneous oxygen saturation (SpO_2) and Borg Scale were assessed[9]. The Mini Nutritional Assessment (MNA) was used to evaluate malnutrition. The Mini-Mental State Examination (MMSE) was used to assess cognitive function and the presence and level of depression were evaluated using the Geriatric Depression Scale (GDS)[10]. Deglutition ability was measured using the Dysphagia Risk Assessment for the Community-Dwelling Elderly (DRACE) Test[11]. The Functional Independence Measure (FIM) scale was used to evaluate ADL[12]. Measurements were carried out twice: at the start of the study (baseline) and 1 year later at the end of the study period (follow-up).

The participants were classified according to the extent of maintenance of their QOL as indicated by changes in PCS and MCS scores over the 1 year observation period. There were 2 groups for both PCS and MCS, respectively, indicating those who could maintain physical QOL and mental QOL over the 1 year period (maintain group) and those who could not (deterioration group). The amount of change in PCS/MCS score was calculated as: total PCS/MCS score at baseline minus the total PCS/MCS score at follow-up. The 50th percentile values were used as the cut-off point to classify the groups: the maintain group and deterioration group were defined as those in whom the amount of change PCS/MCS score higher or less than median, respectively. Changes in each variable were also calculated according to differences over a 1 year period observed in baseline and follow-up values.

SPSS version 25.0 (IBM Corporation, NY, USA) was used for statistical analyses. Baseline values of the groups were tested with χ^2 test for gender, main disease, and comorbidity. Mann-Whitney U test was used for comparisons of other baseline values and differences between the groups. Wilcoxon signed rank tests were used to compare the outcomes in each group. The data were analyzed using logistic regression analyses to detect factors associated with the PCS and MCS domains. Mean ± SD, and $p<0.05$ were set as significant. All participants provided informed consent. This study was carried out with the approval of the ethics committee of the University of Tsukuba (approval No. 725).

RESULTS

A total of 68 volunteers were evaluated for eligibility and 8 who could not use an auto spirometer were excluded. The remaining 60 participants were categorized into maintain groups (n=30) and deterioration groups (n=30) for both PCS and MCS. The cut-off point values used for the classification of the two groups were 3.97 points (PCS) and 3.20 points (MCS), respectively.

Table 1 shows the participants' demographic characteristics at baseline. No significant differences between the variables of both groups (PCA and MCA domains) are present at baseline. Table 2 shows the changes in the participants' scores for the various measures used in this study over the 1 year study period. We found significant reduction in %FVC, 6MWT, DRACE, PCS, and MCS score at follow-up. Tables 3 and 4 show a comparison of changes across the study measures over the study period between the maintain and deterioration groups for the PCS and MCS domains, respectively. Regarding the PCS domain, %FVC in the deterioration group was significantly decreased compared to the maintain group (Table 3). As

Table 1. Demographic characteristics of the participants at baseline

		PCS domain (N=60)		MCS domain (N=60)	
	Total participants (N=60)	Maintain group (N=30)	Deteriorate group (N=30)	Maintain group (N=30)	Deteriorate group (N=30)
Age (years)	81.5 ± 5.2	80.1 ± 6.3	83.1 ± 4.9	79.8 ± 7.3	83.0 ± 6.1
Gender, Female	40	22	18	19	21
BMI (kg/m²)	23.9 ± 6.5	23.8 ± 6.1	24.0 ± 5.8	24.6 ± 6.5	23.2 ± 6.0
Certified care-need level	2.4 ± 0.6	2.3 ± 0.8	2.5 ± 1.0	2.3 ± 0.7	2.5 ± 1.0
Main diseases					
Stroke	17	10	7	9	8
Fracture	22	12	10	13	9
Osteoarthritis	16	7	9	7	9
Cardiorespiratory	3	1	2	1	2
Others	4	2	2	2	2
Comorbidity					
Hypertension	30	14	16	13	17
Diabetes mellitus	12	7	5	6	6

Values are expressed as mean ± SD.
χ^2 test.
Mann-Whitney U test.
PCS: Physical component summary; MCS: Mental component summary.
No significant differences between the variables of both groups (PCA and MCA domains).

Table 2. Change in scores for study measures over a 1 year period

	Total (N=60)	
Measures	Baseline (N=60)	Follow-up (N=60)
%FVC	87.3 ± 9.2	81.1 ± 7.5**
%FEV1	88.0 ± 9.0	85.3 ± 8.8
CPF (L/min)	235.6 ± 28.2	196.9 ± 32.3
Muscle strength		
Grip strength (kg)	15.2 ± 5.1	14.8 ± 4.9
Th spine ROM (°)		
Rotation	22.9 ± 7.5	18.5 ± 8.5*
6MWT (m)	102.6 ± 25.8	71.8 ± 30.2*
Swallowing function		
DRACE	3.7 ± 2.9	5.8 ± 2.7*
Depression		
GDS	5.4 ± 2.0	6.0 ± 3.2
Activities of daily living		
FIM	114.1 ± 7.3	109.3 ± 8.1
Quality of life		
SF8 (PCS)	48.4 ± 7.9	45.5 ± 7.9*
SF8 (MCS)	46.5 ± 7.9	43.5 ± 7.9*

*p<0.05, **p<0.01.
Values are expressed as mean ± SD.
Wilcoxon signed-rank test.
FVC: Forced vital capacity; FEV1: Forced expiratory volume in 1 second; CPF: Cough peak expiratory flow; Th spine ROM: Thoracolumbar spine range-of-motion; 6MWT: 6-minute walk test; DRACE: Dysphagia risk assessment for community-dwelling elderly; GDS: Geriatric Depression Scale; FIM: Functional Independence Measure; SF8PCS: Physical component summary; SF8MCS: Mental component summary.
Significant reduction in %FVC, 6MWT, DRACE, PCS, and MCS score at follow-up.

Table 3. Changes across the study measures between the maintain and deterioration groups for the PCS domain

Measures	PCS domain (Total: N=60)			
	Maintain group		Deterioration group	
	Baseline (N=30)	Follow-up (N=30)	Baseline (N=30)	Follow-up (N=30)
%FVC	84.6 ± 5.1	80.4 ± 4.5	89.9 ± 4.9	81.8 ± 7.3*†‡
%FEV1	85.8 ± 9.2	80.1 ± 10.8	89.3 ± 9.2	83.3 ± 9.0
CPF (L/min)	231.2 ± 28.2	198.8 ± 32.3	239.6 ± 34.6	195.0 ± 46.8
Muscle strength				
Grip strength (kg)	15.9 ± 5.9	14.3 ± 4.7	15.7 ± 6.1	15.3 ± 5.2
Th spine ROM (°)				
Rotation	22.5 ± 8.9	19.0 ± 8.0	23.3 ± 10.5	18.1 ± 9.0
6MWT (m)	100.1 ± 29.4	68.1 ± 21.2*†	105.0 ± 30.7	69.5 ± 23.3*†
Swallowing function				
DRACE	3.8 ± 1.4	5.9 ± 2.1	3.6 ± 1.9	5.8 ± 2.6
Depression				
GDS	5.9 ± 3.4	6.5 ± 3.4	5.0 ± 3.4	5.4 ± 3.4
Activities of daily living				
FIM	110.5 ± 12.3	105.9 ± 8.6	117.8 ± 11.7	113.7 ± 9.0

*p<0.05.
Values are expressed as mean ± SD.
†Wilcoxon signed-rank test.
‡Mann-Whitney U test.
FVC: Forced vital capacity; FEV1: Forced expiratory volume in 1 second; CPF: Cough peak expiratory flow; Th spine ROM: Thoracolumbar spine range-of-motion; 6MWT: 6-minute walk test; DRACE: Dysphagia risk assessment for community-dwelling elderly; GDS: Geriatric Depression Scale; FIM: Functional Independence Measure; PCS: Physical component summary score.
%FVC in the deterioration group was significantly decreased compared to the maintain group.

Table 4. Changes across the study measures between the maintain and deterioration groups for the MCS domain

Measures	MCS domain (N=60)			
	Maintain group		Deterioration group	
	Baseline (N=30)	Follow-up (N=30)	Baseline (N=30)	Follow-up (N=30)
%FVC	86.5 ± 6.2	82.4 ± 7.5	88.9 ± 6.6	80.1 ± 7.0*†
%FEV1	87.2 ± 9.2	88.9 ± 10.8	84.5 ± 9.2	80.2 ± 9.0
CPF (L/min)	250.4 ± 39.4	213.8 ± 41.1	220.8 ± 42.5	180.0 ± 39.6
Muscle strength				
Grip strength (kg)	14.7 ± 6.0	14.5 ± 5.8	16.9 ± 6.1	15.1 ± 5.2
Th spine ROM (°)				
Rotation	23.5 ± 11.3	17.8 ± 7.8	22.3 ± 10.3	17.3 ± 9.9
6MWT (m)	114.2 ± 31.1	81.3 ± 21.1	90.9 ± 34.6	56.2 ± 19.7*†
Swallowing function				
DRACE	3.2 ± 1.5	4.2 ± 2.3	4.2 ± 1.4	7.4 ± 2.9*†‡
Depression				
GDS	6.3 ± 3.5	6.6 ± 3.6	4.6 ± 3.2	6.0 ± 3.4*†
Activities of daily living				
FIM	115.0 ± 10.2	111.3 ± 9.5	113.3 ± 10.7	108.2 ± 8.9

*p<0.05.
Values are expressed as mean ± SD.
†Wilcoxon signed-rank test.
‡Mann-Whitney U test.
FVC: Forced vital capacity; FEV1: Forced expiratory volume in 1 second; CPF: Cough peak expiratory flow; Th spine ROM: Thoracolumbar spine range-of-motion; 6MWT: 6-minute walk test; DRACE: Dysphagia risk assessment for community-dwelling elderly; GDS: Geriatric Depression Scale; FIM: Functional Independence Measure; MCS: Mental component summary.
GDS and DRACE in the deterioration group was significantly decreased compared to the maintain group.

for the MCS domain, GDS and DRACE in the deterioration group was significantly decreased compared to the maintain group (Table 4). Table 5 shows the results of our logistic regression analysis, which suggest that PCS score was significantly associated with %FVC, and MCS score was significantly associated with the GDS and DRACE (Table 6).

DISCUSSION

In the present study, PCS and MCS scores were both significantly reduced over a 1 year period in community-dwelling, frail older persons who were receiving long-term care. In the logistic regression analysis, the factor associated with a decrease of PCS score was %FVC, while for the MCS, the factors were GDS and DRACE. At baseline, there was no significant difference in PCS scores regarding %FVC between the maintain and deterioration groups. However, %FVC of the deterioration group was significantly decreased compared to the maintain groups at follow-up. This data suggests that decline of PCS score is affected by decline in respiratory function, as indicated by the %FVC score. Rosińczuk[2] and colleagues reported that while QOL of patients with COPD is not affected by gender, decline in QOL level is associated with age and pulmonary function. In the present study, the participants did not include those with COPD; however, in our previous studies, we reported that pulmonary function decreased in community-dwelling frail older persons even without COPD and also showed an association between pulmonary function and ADL/QOL[13, 14].

Therefore, it is likely that the physical QOL of the participants in this study, as indicated by the PCS score, was negatively affected by reduced respiratory function. Regarding the MCS domain, no significant difference was observed in GDS and DRACE between the maintain and deterioration groups at baseline. However, GDS and DRACE scores of the deterioration group were significantly increased compared to the maintain groups at follow-up. This result showed that reduction of MCS score was affected by changes in depression (GDS) and deglutition ability (DRACE) at follow-up. Sivertsen and colleagues reported that older persons with depression had poorer global and generic health-related QOL than individuals without depression and that increase in depression severity was associated with a poorer global and generic health-related QOL[15]. With regards to deglutition, Miura and colleagues assert that healthy oral feeding is a pleasure in daily life, and a high percentage of people highly regard the enjoyment of eating and eating together with close friends as a purpose of life[16].

Thus, the eating and swallowing function of the elderly may be closely related to physical and mental health and also with social health, which indicates its important relationship with QOL. There are some limitations to this study that perhaps inhibit the generalization of the findings. These limitations include: the small sample size made up of participants from a single center and the limitation that data of economic status, family structure, and educational background, which may have

Table 5. Factors related to the decrease of quality of life in the PCS domain (N=60)

Independent variables	*B*	Odds Ratio	95%CI	
			LL	UL
Age	0.054	1.055	0.958	1.162
Gender	0.615	1.849	0.489	6.987
Desease	0.085	1.06	0.401	2.956
BMI (kg/m²)	0.058	1.088	0.920	1.221
%FVC**	0.13	1.138	1.033	1.254

**p<0.01.
CI: Confidence interval; BMI: Body mass index; FVC: Forced vital capacity.
PCS score was significantly associated with %FVC.

Table 6. Factors related to the decrease of quality of life in the MCS domain (N=60)

Independent variables	*B*	Odds Ratio	95%CI	
			LL	UL
Age	0.057	1.059	0.912	1.229
Gender	1.188	3.282	0.225	47.849
Desease	0.497	1.644	0.300	8.996
BMI (kg/m²)	−0.73	0.93	0.695	1.243
GDS*	1.04	2.829	1.092	7.327
DRACE**	2.96	19.29	2.649	140.454

*p<0.05, **p<0.01.
CI: Confidence interval; BMI: Body mass index; GDS: Geriatric Depression Scale; DRACE: Dysphagia risk assessment for community-dwelling elderly.
MCS score was significantly associated with the GDS and DRACE.

some bearing on these results, were not collected. While the findings of the current study lay some important groundwork, these limitations should be addressed in further research.

In conclusion, depression and reduced pulmonary and deglutition function were independently associated with deterioration of QOL, and thus, assessment of depression, pulmonary function, and deglutition could be beneficial to understanding and protecting both the physical and mental components of QOL in community-dwelling frail older persons in long-term care.

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Conflict of interest

The authors have no conflict of interest to declare.

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