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Original Article

Relationships between life-space mobility, physical function, and empowerment in patients with chronic obstructive pulmonary disease

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Abstract. [Purpose] This study aimed to elucidate the relationship between the Life-Space Assessment measure, which conceptualizes physical activity in terms of life-space, and indicators of empowerment, and physical function, in stable patients with chronic obstructive pulmonary disease. [Participants and Methods] This was a cross-sectional study. The participants were 25 stable outpatients with chronic obstructive pulmonary disease (22 males, mean age 75.6 ± 6.1 years). Measurements included the Life-Space Assessment; the Empowerment Scale for the Elderly; respiratory function; grip strength; weight-adjusted knee extension strength; and a six-minute walk test. Pearson's correlation coefficient and a multivariate analysis were used to examine the relationship between the Life-Space Assessment and each indicator, with the significance level set at 5%. [Results] The Life-Space Assessment score (83.4 ± 23.7 points) correlated with the percentage forced vital capacity and the six-minute walk distance. However, the Life-Space Assessment demonstrated no association with the Empowerment Scale for the Elderly (38.3 ± 7.0 points). [Conclusion]The results of this study suggest that physical function correlates with scores on the Life-Space Assessment in patients with stable chronic obstructive pulmonary disease.

Key words: Chronic obstructive pulmonary disease (COPD), Life-space assessment test, Empowerment

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive chronic respiratory disease characterized by dyspnea and is the seventh leading cause of disability-adjusted life years lost[1)]. The mortality rate associated with COPD is high globally. In our country, the prevalence of COPD among those aged 40 and over has been reported to be 12.0%[2, 3)]. Clinical issues in patients with COPD include comorbidities, such as heart failure and sarcopenia[4, 5)], which can lead to decreased endurance capacity[6)] and poor health-related quality of life (HRQOL)[7)]. As a result, physical activity in patients with COPD tends to decrease compared to that in healthy older individuals[8)], and decreased physical activity is associated with life prognosis[9–11)].

Baker et al.[12)] reported that the life space assessment (LSA), which conceptualizes physical activity in terms of life space, is associated with the level of physical activity. The LSA has been widely validated in community-dwelling older adults.

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Additionally, the clinical validity of LSA is supported[13]. LSA is associated with significant events including mortality[14, 15], hospitalization, emergency department visits[16], frailty[17], decreased quality of life (QOL)[18], and falls[19]. Patients with COPD are also affected by aging; therefore, similar associations were expected. Iyer et al.[20] reported in a prospective cohort study that a reduction in life space in patients with COPD predicted severe exacerbation, which led to decreased endurance capacity, worsened dyspnea, and decreased HRQOL. The LSA is an index that evaluates movement in the spatial expansion of an individual's life, ranging from moving only within the bedroom to going outside the town. Empowerment is also considered a factor in the physical activity of older individuals[21, 22]. Empowerment is a central concept in promoting social participation among older adults[23]. Empowerment is of importance for older adult to make independent decisions about their own life space mobility and ways of living[24]. In recent years, several studies have investigated empowerment among older individuals and those with chronic diseases[24–27]. Empowerment in patients with COPD is reported to enhance self-management and serve as a basis for improving QOL[28], with the potential to reduce disability and healthcare costs[29]. However, it is not clear whether empowerment is involved in LSA in patients with COPD.

Therefore, this study aimed to clarify the relationship among LSA, which conceptualizes physical activity in terms of life space, empowerment, and physical function. It was hypothesised that living space mobility and empowerment would be related in COPD patients as well as in older adults.

PARTICIPANTS AND METHODS

The study design was a cross-sectional study. This study recruited participants from stable outpatients with COPD who visited Choseido Watanabe Clinic between November 1, 2022, and January 31, 2023. The study objectives and overview were explained to all participants, both in writing and orally, and their consent to participate in the study was obtained. This study was approved by the Nara Gakuen University Research Ethics Committee (approval number: 4-H004).

The selection criteria for participants were as follows: (i) At least 60 years of age, (ii) A Mini-Mental State Examination (MMSE) score <24, with no apparent warning signs of cognitive impairment, (iii) No spirometry performed after registration.

Criteria to exclude participants were as follows: (i) Unable to understand the instructions for physical or cognitive tests, (ii) Unable to complete all tests.

The measurements included basic information and a survey of the social background obtained from medical records. Life-space reduction was measured using LSA[12], and empowerment assessment was assessed using the Elderly Empowerment Scale (ESE)[30]. Respiratory function was measured using the percentage of forced vital capacity (%FVC), percentage of forced expiratory volume (FEV)1.0, and FEV1.0%. Physical function was assessed using grip strength, weight-adjusted knee extension strength, and the 6-minute walk test[31]. The LSA was developed by Baker et al[12]. The parameter calculates scores for reduction in life space based on activity frequency and independence, with a maximum score of 120. A high score indicated a wide life space. Furthermore, based on the findings reported by Hamakawa et al.[32], this study defined decreased physical activity as a score of less than 60. Empowerment was assessed using the ESE developed by Momose[30]. The ESE consists of 12 items across three factors. The total score of the 12 items was the total ESE score (range: 12–60 points), and the total score of each subscale was the subscale ESE score. ESE-F1 (6 items, range: 6–30 points) represents "the perception of self-potential competence", ESE-F2 (three items, range: 3–15 points) represents "the recognized issues with interaction", and ESE-F3 (three items, range: 3–15 points) represents "an intention for positive action". The reliability and validity of the empowerment assessment for older individuals were confirmed. Grip strength was measured using a digital grip strength meter (Takei Kiki Kogyo), and knee extension strength was evaluated using a handheld muscle strength measurement device (Anima). Two measurements were obtained for each side, and the maximum value was recorded. Knee extension strength was calculated as the ratio adjusted for body weight (weight-adjusted knee extension strength). The 6-minute walk test was conducted according to the American Thoracic Society Statement[31], and the 6-minute walk distance (6 MWD) was measured.

The relationship between the LSA and each measurement item was analyzed using Pearson's correlation coefficient. Subsequently, multivariate analysis was performed with LSA as the dependent variable and age, respiratory function, 6 MWD, and ESE-total score as independent variables using the stepwise method. The significance level was set at 5%. IBM SPSS version 25 was used for statistical analyses.

RESULTS

This study targeted 25 stable outpatients with COPD, of whom 22 were male with a mean age of 75.6 ± 6.1 years. One patient using home oxygen therapy participated in the study. The mean value of LSA was 83.4 ± 23.7 points. Four individuals (16.0%) had an LSA score of less than 60, indicating low activity levels. The total ESE was 38.7 ± 7.0 points. The results of the other measurement indicators are listed in Table 1. No significant correlation was observed between the total LSA and ESE scores, as demonstrated in Table 2 (r=0.161, p=0.441). No significant correlation was identified between the LSA and ESE subscales. The indicators that exhibited significant correlations with LSA were %FVC (r=0.402, p=0.046) and 6 MWD (r=0.531, p=0.006) (Table 2). In the multivariate analysis, the 6 MWD was selected (Table 3).

Table 1. Characteristics of participants

	Mean ± SD
Age (years)	75.6 ± 6.1
Education history (years)	10.5 ± 2.5
Smoking history (years)	32.7 ± 17.4
BMI (kg/m^2)	24.0 ± 4.4
%FVC (%predicted)	75.2 ± 20.2
%FEV1.0 (%predicted)	61.9 ± 23.1
FEV1.0% (%)	64.2 ± 14.6
Grip strength (kg)	31.5 ± 7.1
knee extension strength (%)	55.8 ± 15.3
6MWD (m)	383.8 ± 75.3
ESE-Total (points)	38.3 ± 7.0
ESE-F1 (points)	19.2 ± 3.8
ESE-F2 (points)	9.8 ± 2.5
ESE-F3 (points)	9.3 ± 2.4
LSA (points)	83.4 ± 23.7

SD: standard deviation; BMI: body mass index; FVC: forced vital capacity; FEV1.0: forced expiratory volume in 1 s; 6 MWD: 6-minute walk distance; ESE: empowerment scale for the elderly; LSA: life-space assessment test.

Table 2. Correlation analysis between LSA and other measurements

	r
Age (years)	−0.087
Education history (years)	−0.052
Smoking history (years)	−0.079
BMI (kg/m^2)	−0.097
%FVC (%predicted)	0.402*
%FEV1.0 (%predicted)	0.204
FEV1.0% (%)	−0.137
Grip strength (kg)	0.130
knee extension strength (%)	−0.064
6MWD (m)	0.531**
ESE-Total (points)	0.161
ESE-F1 (points)	0.283
ESE-F2 (points)	0.055
ESE-F3 (points)	−0.034

*p<0.05, **p<0.01.
BMI: body mass index; FVC: forced vital capacity; FEV1.0: forced expiratory volume in 1 s; 6 MWD: 6-minute walk distance; ESE: empowerment scale for the elderly; LSA: life-space assessment test.

Table 3. Multiple regression analysis with LSA as dependent variable

	B	SE	β	95% Cl
(Constant)	−0.796	65.605		−137.646 to 136.054
Age	−0.004	0.736	−0.001	−1.540 to 1.533
%FVC	0.354	0.22	0.301	−0.105 to 0.813
6MWD*	0.145	0.063	0.46	0.013 to 0.277
ESE-Total	0.058	0.631	0.017	−1.259 to 1.375

*p<0.05.
FVC: forced vital capacity; 6 MWD: 6-minute walk distance; ESE: empowerment scale for the elderly; B: unstandardized coefficients; SE: standard error; β: standardized coefficients, 95% CI: 95% confidence interval for unstandardized coefficients.

DISCUSSION

This study aimed to elucidate the relationships among LSA, ESE, and physical function. Multivariate analysis with LSA as the dependent variable revealed that the 6 MWD was a significantly associated indicator. However, the results of correlation analysis revealed that ESE was not associated with LSA in patients with COPD. Empowerment is considered a factor in the physical activity of older individuals[21, 22]. Intriguingly, LSA, which conceptualizes physical activity in terms of life space, and ESE were not correlated in patients with COPD. One of the significant characteristics of patients with COPD is dyspnea. From a disease-specific perspective, it can be speculated that LSA and ESE are not related in patients with COPD. The average LSA score in this study was 83.4 points, with four individuals (16.0%) scoring below 60. Phillips et al.[33] reported LSA scores of around 80 points for older individuals aged 70 and above, which was similar to the findings of this study. Additionally, Hamakawa et al.[32] discovered that 20% of patients with COPD scored below 60 on the LSA. The 16% rate observed in this study is consistent with the results of previous research. Furthermore, Hamakawa et al.[32] revealed that increased airway obstruction and decreased muscle and subcutaneous fat tissue were independently associated with reduced physical activity in patients with symptomatic COPD. Even though this study did not identify a correlation between the degree of airway obstruction and the LSA, a significant correlation was observed with lung capacity. Symptomatic relief through bronchodilators and other interventions may not necessarily correlate with increased PA. Additionally, Iyer et al.[20] reported a positive correlation between LSA and 6 MWD, which is consistent with the finding of this study that 6 MWD was associated with LSA. Therefore, this study suggests that physical function may be more closely related to LSA than to empowerment in patients with COPD.

However, Ward et al.[34] excluded Japan from the analysis of empowerment research targeting Pacific Rim countries, because "the concept of empowerment still does not apply to the culture of older adults in Japan". Despite investigating empowerment in patients in this study, doubts remain regarding whether it was adequately validated within a cultural context. Tsubouchi et al.[24] proposed that reconstructing the concept of empowerment for older adults in contemporary cultural contexts to implement support for improving their health in Japan is essential. This remains a challenge for healthcare support in our country.

Intriguingly, this study revealed a correlation between physical function and LSA in patients with COPD, while negating the association with ESE. This suggests that disease-specific symptoms are closely associated with activity range. However, this study has several limitations. First, the cross-sectional design does not allow the verification of causality. Longitudinal studies are needed to examine whether LSA is influenced by other factors. Second, the small sample size may limit the interpretation of the results of the multivariate analysis. However, even with a large sample size, the likelihood of a correlation between LSA and ESE remained low in this study.

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Conflict of interest

The authors declare no conflicts of interest.

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