FEATURE

Effects of a 6-Month Nurse-Led Self-Management Program on Comprehensive Pulmonary Rehabilitation for Patients with COPD Receiving Home Oxygen Therapy

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ADL; COPD; home oxygen therapy; QOL; self-management.

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Abstract

Purpose: This study was to examine the effectiveness of a nurse-led 6-month comprehensive pulmonary rehabilitation program for stage IV chronic obstructive pulmonary disease patients receiving home oxygen therapy.
Design: A controlled clinical study was performed.
Methods: Face-to-face and telephone interviews were conducted with the intervention group, whereas conventional education was given to the control group.
Findings: Fifteen participants were analyzed in each group. There were no improvements in physiological outcomes; however, the severity of dyspnea, social activity, and walking distance significantly improved in the intervention group, and consequently quality of life was improved. Three patients in the intervention group received treatment for cold-like-symptoms but did not require hospitalization. However, five patients in the control group received treatment for cold-like-symptoms and two required hospitalization.
Conclusions: The findings demonstrate that our program contributes to patients' learning of self-management skills and significantly improves dyspnea, social activity level, walking distance, and overall quality of life.

Introduction

A comprehensive pulmonary rehabilitation program is required to manage chronic obstructive pulmonary disease (COPD) so as to relieve symptoms, prevent disease progression, improve exercise tolerance and health status, prevent and treat complications and exacerbations and reduce mortality (Global Initiative for Chronic Obstructive Lung Disease, 2010). Nurses play central roles in promoting and implementing pulmonary rehabilitation program in the community (Akinci & Olgun, 2011; Sridhar, Taylar, Dawson, Roberts, & Partridge, 2008; Zakrisson et al., 2011). It has been suggested that a successful pulmonary rehabilitation program should aim to provide a patient education which promotes self-management (Carriei-Kohlman et al., 2005; Chavannes et al., 2009; Tiep & Barnett, 2008); and subsequently prevent complications and exacerbations.

Review of the literature

It is important to note that the results of self-management education differ from study to study, and the efficacy of such education has not been well established. For instance, there are several reports on self-management programs that have resulted in reduced exacerbations and hospitalizations of patients (Bourbeau et al., 2003; Gadoury et al., 2005), improvement in patients' quality of life (Bourbeau et al., 2003; Koff, Jones, Cashman, Voelkel, & Vandivier, 2009) and potential economic

benefits (Bourbeau et al., 2006). Arguably, these studies have produced mixed results for pulmonary function outcomes, long-term physiological effects, and mortality. Indeed, systematic evaluation reviews have shown that self-management education can potentially modify lifestyle, reduce symptoms, and improve healthcare utilization among COPD patients with no improvement in pulmonary function and varied effects on quality of life and hospitalization (Blackstock & Webster, 2007; Taylor et al., 2005). A previous study using proactive integrated care (PIC) and St George's Respiratory Questionnaire (SGRQ) has demonstrated that the self-management educational intervention can improve early detection and treatment of exacerbations in COPD patients (Koff et al., 2009). Additionally, a recent UK study which assessed the effectiveness measured by quality of life (QOL) and cost effectiveness of a layperson-led theoretically driven COPD self-management support program reported the program's potential to meet the UK health criteria for cost effectiveness (Taylor et al., 2012). Thus, it is important in different populations to provide self-management education for COPD patients using the SGRQ that is becoming a reliable tool for measuring patient's QOL (Al-Shair et al., 2012).

Therefore, this study aimed to improve overall QOL of the patients by reducing exacerbations and hospitalization and improve pulmonary function and dyspnea using a carefully designed nurse-led educational program developed and implemented for stage IV severe COPD patients on home oxygen therapy (HOT).

Development of self-management education program for COPD patients

Self-management education is operationally defined in this study, based on the works of Funnell et al. (2007) and Moriyama et al. (2009), as an approach for supporting a process involving a patient's understanding of his/her disease through the establishment of a partnership between the patient and healthcare professionals. Self-management education also includes provision of support by healthcare professionals and the patients' families, provision of relevant information to the patients, patients understanding of the basics of decision making and the treatment regimen, appropriate management of a patient's lifestyle and emotions, and the patients' sustenance of health management activities. This study, which is based on the review of literature and operational definition, aimed to improve overall QOL and strengthen the weak points of self-management, through reducing exacerbations and hospitalizations and improving pulmonary function and dyspnea using a carefully designed nurse-led educational program developed and implemented for stage IV, severe COPD patients on HOT.

The study was based on the ethnographical research method to identify when and how patients fail to acquire self-management skills and lose adherence before the program development. Through this research, we found that patients practiced incorrect breathing methods during their activities of daily life (ADL). We learned that patients' fear, shame, and hesitation in the use of oxygen during activities such as bathing, sleeping, and activities outside the home was due to a lack of knowledge, causing a vicious cycle of inactivity resulting in social isolation, altered mood status, muscle weakness, weight loss due to lack of appetite, and decreased pulmonary function. Moreover, patients with stable condition visited non-specialist clinics, where no pulmonary rehabilitation/exercise education was provided; therefore, patients did not practice at home.

In this study, other issues are addressed. In Japan, although a Lung Information Needs Questionnaire program, a self-complete questionnaire that measures the information needs of patients with COPD, has been reported (Watanabe et al., 2011), there is no report of a comprehensive COPD patient education program. Obstacles to the establishment of a COPD educational program include the following: (1) lack of an established structure and process of patient education to enhance self-management; therefore, there are no nurses with adequate and appropriate training; and (2) an ineffective and fractured healthcare delivery system. Because many patients visit non-specialists, there is little recognition for the importance of patient education. Moreover, patient education on COPD self-management is not included in national health insurance reimbursement program warranting that some physicians are reluctant to provide education.

Therefore, to implement this research study, we set up a disease management center for nurses to provide patient education outside hospitals settings. A nurse-led self-management program involving the application of comprehensive pulmonary rehabilitation by the participants themselves was used, and goals for physiological outcomes were set. This article examined the effectiveness of the nurse-led program in terms of the acquisition of self-management skills, physiological outcomes, and overall QOL.

Methods

Framework of the self-management educational program for COPD patients

An outline of the educational program, the outcome indicators, and nurses' collaboration with patients are shown in Figure 1. The focus of this program was the acquisition of self-management skills for the period of 6 months using a predesigned interactive workbook, learning materials, and a daily journal for self-monitoring. Each patient worked with a nurse and used the workbook to analyze his/her own physiological data to understand his/her own condition and to set long-term (purpose of life) and short-term (lifestyle and behavior change) goals. The patient also learned the basics in the management of signs and symptoms such as dyspnea, color of sputum, and edema and self-management of skills and behavior as listed in Figure 1. Subsequently, the patient practiced pulmonary rehabilitation, gargling and hand washing, effective coughing (sputum elimination techniques), and exercise training on a daily basis and recorded them in the daily journal. Self-monitoring was performed for pulse rate, SpO_2 (resting and during exercise), body weight, symptoms of common cold, shortness of breath, color of sputum, cigarette smoking, amount of exercise, number of steps taken/day, duration of oxygen use (in hour), and amount of social activity. These data were also recorded in the daily journal. The patients set behavioral step-by-step goals, such as "a walk to the mailbox at home everyday" for the first month, then "a walk around his/her house everyday" for the second month. For pulmonary rehabilitation activities such as diet, effective coughing, and smoking cessation were reported to the nurse on a monthly basis. The physician and nurse checked the journal monthly and provided positive reinforcement and education as necessary.

Two nurses who participated in this program were trained on self-management education and motivational interviewing techniques for 2 weeks. All processes of the program were led by the nurses, who taught basic knowledge and skills to patients, set monthly goals, evaluated the results with patients, and provided feedback to patients.

The primary endpoint of the study was an improvement in overall QOL. The program began with the patient learning self-management skills. Thereafter, the patient would execute the required treatment regimen every day and record his or her activities, and we hypothesized that this action would result in an increase in practical adherence behavior, improve in dyspnea and physiological outcomes, and then improve ADL

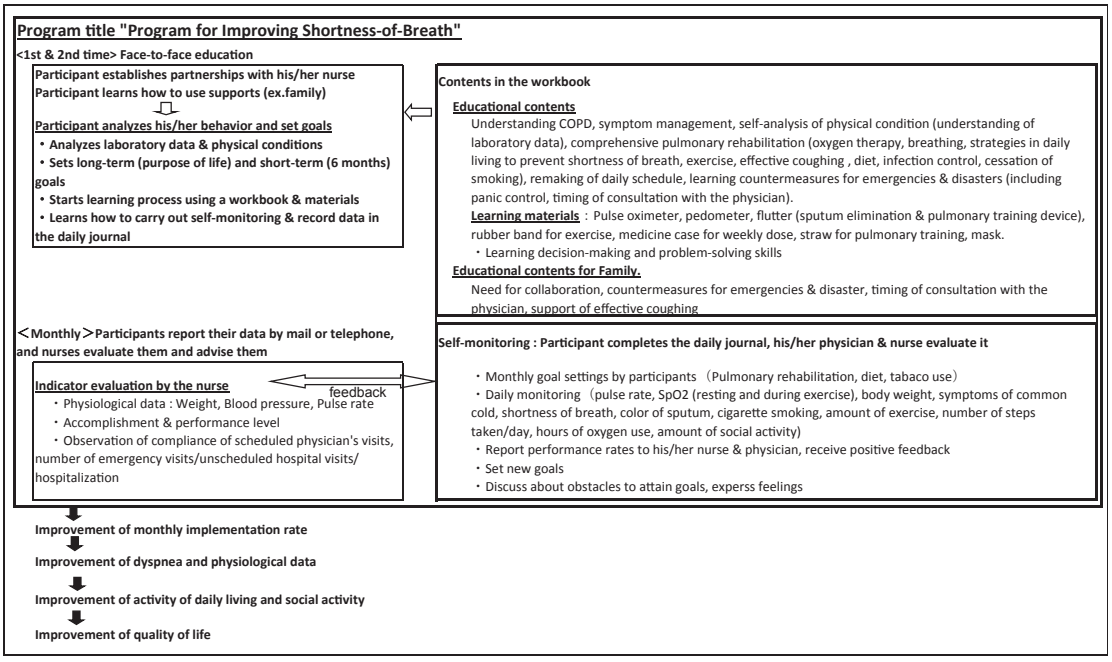

Figure 1 Conceptual framework of this study: an outline of the program and the outcome indicators.

and social activities with a resultant enhancement of QOL.

Study period

The participants were enrolled from May to December 2008, and the program was implemented from May 2008 to June 2009.

Participants

The participants were stage IV COPD outpatients undergoing HOT, who had no physical or cognitive impairment that would interfere with their participation in the program. All participants provided informed consent. Participants were eligible for the study regardless of age, sex or treatment other than HOT, although those with congestive heart failure (CHF) with New York Heart Association functional classification Class II to IV were excluded as exercise for those patients often was not appropriate and it is difficult to distinguish whether symptoms were produced by CHF or COPD.

Study design

The study was a nonrandomized controlled trial. As randomization was not considered an appropriate approach, participants in the control group were recruited from different medical facilities than those in the intervention group.

Procedure

After a voluntary consent was obtained, evaluation questionnaires were administered and physiological data were collected from the participants. Data for assessment were subsequently collected at the scheduled times.

Intervention Group
The nurse made a home visit twice in the enrolled month for a face-to-face individualized educational demonstration using our research devices tailored for comprehensive pulmonary rehabilitation activity practices. The daily journal is received monthly by mail from the second month. The nurse evaluated the data and made a telephone call once every month to provide advice for better practice. The participant was allowed to call the nurse if they have any questions, concerns or challenges.

Control Group
The participants were asked to visit physician's clinics monthly as required for consultation. Self-reported data were collected on the enrollment day (baseline) and at 3 and 6 months consultation days after starting the study. Physiological data were obtained from the patients' medical records. All participants in this group had received education on pulmonary rehabilitation once by medical staff at the clinics when they started HOT; however, no further education was received after that.

Evaluation indicators and points

Indicators for QOL (St. George's Respiratory Questionnaire; SGRQ) (Jones, Quirk, Baveystock, & Littlejohns, 1992), ADL (Nagasaki University Respiratory ADL Questionnaire; NRADL) (Matsumoto, Tanaka, Matsuki, Kitagawa, & Senjyu, 2006; Matsumoto et al., 2008), and severity of breathlessness (British Medical Research Council; MRC) (Bestall et al., 1999; Global Initiative for Chronic Obstructive Lung Disease, 2010) were evaluated. NRADL is the activities of daily living evaluation scale developed specifically for chronic respiratory disease patients with 10 enlisted activities such as eating, toileting, grooming, bathing, dressing, movement in a room/floor/house/stairs, and going out/shopping. These are evaluated from 0 to 3 points from three aspects of speed of movement, shortness of breath, and oxygen flow rate; and cumulative walking distance from 0 to 10 points are added. The score ranged from 0 to 100 in ascending order of improvement.

Social activity was evaluated in terms of range (how far they go out) and frequency (times of going out from home per week). Goal attainment rate was measured both subjectively by the participant and objectively from the daily journal data. Physiological data were obtained for body weight, blood pressure (systolic and diastolic), pulse rate, SpO_2 level and 24-h SpO_2 (under oxygen therapy), respiratory function (forced expiratory volume in 1 s [FEV_1]), FEV_1 percent (FEV_1%), and blood gas analysis (PaO_2 and $PaCO_2$ under oxygen therapy). The 6-min walk test (6MWT) could not be practiced because of a lack of space at clinics and hospitals. For all these items, data were collected at baseline and at 3 and 6 months of the intervention. Health economic data regarding the number of times each participant made an emergency/unscheduled hospital visit and the number of hospitalizations were also collected.

Statistical analysis

Baseline data for the intervention and control groups were compared by χ^2 test, *t*-test, or Mann–Whitney *U*-test after normality was verified. For evaluation of the indicators, two-way repeated-measures ANOVA was used for the physiological data and the respective scales for chronological comparison after verification of data normality. One-way repeated-measures ANOVA was conducted for chronological comparison of data in the intervention group. Friedman's test was also performed for the chronological comparison of each group for data that was not normally distributed. Two-tailed *p* values were used and the significance level was set at < 5%.

Ethical considerations

The study was approved by the Ethical Committee of the University. The intent of the study was explained in detail to each participant and informed voluntary consent was obtained.

Results

Participation and baseline characteristics and the comparison between the two groups

Three of 18 participants in the intervention group and two of 17 participants in the control group withdrew from the study. In the intervention group, one participant had difficulty completing the journal, one died of an aortic aneurysm rupture, and one was admitted to hospital for treatment of drug-induced acute heart failure. In the control group, two withdrew due to failure to complete the journal. Therefore, 15 patients in each group were included in the analysis. The program completion rate was 83.0% in the intervention group.

There were no significant differences in the baseline characteristics of the intervention and control groups (Table 1). SGRQ scores showed no significant difference between the groups (Table 2). NRADL scores indicated a significant difference only in shortness of breath at baseline ($p = .01$), with milder symptoms in the control group than in the intervention group (Table 3 a and b). The range and frequency of social activities did not differ between the groups. For physiological data, the 24-h SpO_2 value ($p = .05$) and $FEV_1\%$ ($p = .05$) were lower in the intervention group than in the control group, but there were no other significant differences (Table 4).

Table 1 Baseline characteristics of the participants and a comparison between the two groups

	Intervention Group ($n = 15$)	Control Group ($n = 15$)	*p-value*
Age (years) Mean ± *SD*	74.7 ± 9.8	72.0 ± 8.3	0.42[a]
Sex (Male /Female)	12/3	12/3	1.00[b]
Emergency /unscheduled hospital visit (times)	0.3 ± 0.60	0	0.10[a]
Hospitalization (None/Yes)	14/1	15/0	1.00[b]
Smoking (Yes/No)	3/12	5/10	0.68[b]

[a]*t*-test.
[b]Fisher's exact test.

Self-management behavior of participants

The performance in self-management behavior defined in the program was calculated for the intervention group based on the daily journal using the formula: (number of days with good behavioral practice/number of days in the month) × 100. The number of cigarettes smoked per day was examined to obtain the monthly average. All behaviors except cigarette use significantly increased after the intervention. During the program, the average (±*SD*) rates of performance of behavior were 96.2 ± 8.7% for pulmonary exercise, 96.0 ± 14.9% for gargling and hand washing, 65.9 ± 41.6% for effective coughing, 64.8 ± 25.4% for exercise training, 99.6 ± 1.5% for weight measuring, and 99.4 ± 2.3% for medication intake. The rates for performance of each behavior at the end of the program (6 months from start) were 97.3 ± 6.9%, 99.8 ± 0.8%, 73.5 ± 40.4%, 68.7 ± 26.1%, 99.8 ± 0.8%, and 98.8 ± 4.7%, respectively.

Four participants did not perform effective coughing as they had no sputum, leading to a large deviation in the data. Variation in exercise training was observed depending on the severity of dyspnea and co-morbidities. Three participants in the intervention group and five in the control group used tobacco at baseline, and one in the intervention group and four in the control group stopped smoking after the start of the study. Only two participants in the intervention group and one in the

Table 2 Chronological changes in QOL (St. George's Respiratory Questionnaire: SGRQ) Scores between two groups

	Intervention Group (n = 15)			Control Group (n = 15)			Two-way repeated-measures ANOVA (upper: F-value; lower: p-value)		
SGRQ	Baseline	3 months	6 months	Baseline	3 months	6 months	Interaction	Between Groups	Within Groups
Total	54.2 (12.4)	44.9 (14.3)	50.9 (13.1)	56.3 (12.8)	55.7 (12.4)	55.3 (14.3)	2.095	1.929	2.533
							0.133	0.176	0.088
Symptoms	51.7 (21.4)	48.9 (19.9)	49.1 (21.6)	53.4 (15.5)	57.9 (21.6)	55.6 (20.3)	0.625	0.835	0.055
							0.539	0.369	0.947
Activity	76.8 (7.4)	73.8 (9.2)	73.3 (12.0)	75.3 (13.1)	75.5 (11.9)	78.1 (14.1)	1.187	0.227	0.271
							0.313	0.637	0.764
Impacts	43.5 (19.5)	36.0 (16.8)	38.9 (19.3)	46.3 (15.5)	43.7 (14.4)	42.2 (16.1)	0.765	0.643	3.103
							0.432	0.429	0.071

Values denote mean (*SD*).
Baseline comparison between two groups: total p = .66, symptoms p = .81, activity p = .72, impacts p = .68.
The lower the score, the higher the QOL.

Table 3(a) Chronological comparison of ADL (The Nagasaki University Respiratory ADL Questionnaire: NRADL) Scores between two groups

	Intervention Group (n = 15)			Control Group (n = 14)			Two-way repeated-measures ANOVA (upper: F-value; lower: p-value)		
ADL	Baseline	3 months	6 months	Baseline	3 months	6 months	Interaction	Between Groups	Within Groups
Total	51.7 (14.0)	54.1 (17.7)	56.2 (21.6)	56.2 (23.2)	59.6 (20.8)	60.7 (22.2)	0.033	0.466	2.294
							0.968	0.501	0.111
Speed of movement	17.3 (3.1)	17.4 (4.6)	19.0 (5.7)	18.9 (6.6)	20.4 (5.9)	20.2 (6.4)	0.657	1.154	1.597
							0.523	0.292	0.212
Oxygen flow	18.6 (10.0)	16.9 (11.5)	16.4 (12.2)	17.3 (11.5)	17.9 (12.2)	19.6 (11.8)	2.843	0.052	0.274
							0.089	0.821	0.675

Values denote mean (*SD*).
Baseline comparison: total p = .54, Speed of Movement p = .44, Oxygen Flow p = .74.
The higher the score, the higher the ADL.
The higher the score, the lower the oxygen flow.

control group continued smoking after the program. It would appear that some of the patients in the control group made extraordinary effort to stop smoking even when they had no intervention.

QOL and ADL

There were no significant changes in SGRQ scores over time or between the groups. The average total score and all subscales scores were reduced (improved QOL) in the intervention group. In contrast, there were no changes in these scores in the control group (Table 2). Similarly, there were no significant changes in total NRADL score and the score for speed of movement over time or between the groups (Table 3a). There was no significant difference in oxygen flow rate between the groups; however, the score decreased (increased flow rate) in the intervention group and increased (decreased flow rate) in the control group.

Table 3(b) Chronological changes in the ADL (NRADL)

	Intervention Group					Control Group				
	n	Baseline	3 months	6 months	*p*-value	*n*	Baseline	3 months	6 months	*p*-value
Shortness of breath	15	13.3(4.1)	16.1(4.4)	15.6(5.4)	0.230		19.5(5.8)	20.1(5.1)	19.4(5.8)	0.923
Cumulative walking distance	15	2.0(0.7)	2.7(1.0)	3.2(1.0)	<0.001	14	2.1(1.2)	1.9(0.8)	2.0(1.0)	0.861

Values denote mean (*SD*).
Shortness of breath: One-way repeated ANOVA, as baseline difference was significant $p = .01$, the higher the score, the lighter the shortness of breath.
Cumulative walking distance: Friedman's test. Baseline comparison $p = .65$.
Multiple comparison (Bonferroni correction): BL-3M ($p = .005$), BL-6M ($p = .002$), 3M-6M ($p = .052$).
Cumurative walking distance (curriculated by not score but by rank): 1 = within 50 m, 2 = 50–200 m, 3 = 200–500 m, 4 = 500 m–1 km, 5 = more than 1 km.

These results suggest that participants in the intervention group who did not follow the treatment regimen for oxygen use came to comply with it and that the nurses reported the status of the patients accurately to physicians, with a resultant increase in oxygen flow rate.

Severity of shortness of breath (Table 3b) was significantly higher in the intervention group at baseline ($p = .01$) which improved after our intervention. On the other hand no such changes were observed in the control group. Cumulative walking distance (Table 3b) significantly increased in the intervention group ($p < .001$). In contrast, no changes were observed in the control group. As significant difference was observed in intervention group, multiple comparison using Bonferroni correction was conducted between three points. The result showed that the average walking distance increased significantly from baseline to 3 months ($p = .005$) and to 6 months ($p = .002$) after the start of the program.

Social activities

The frequency and range of social activities were significantly extended only in the intervention group ($p = .011$ and $p = .041$, respectively; Figure 2a,b). A remarkable improvement was noticeable in the intervention group with an increase in the frequency and range of social activities in this group despite the greater severity of shortness of breath at baseline compared with the control group. Multiple comparison of time-course data for the frequency and range of social activities showed a significant increase only in the intervention group after the start of the program relative to baseline with a significant difference in frequency ($\chi^2 = 13.5 > 5.991$) and range ($\chi^2 = 9.6 > 5.991$) of social activities after 3 and 6 months, respectively.

Severity of shortness of breath

Changes in the self-reported severity of dyspnea (MRC) are shown in Figure 3. These data significantly improved over time in the intervention group ($p = .011$), whereas participants in the control group complained serious subjective symptoms of dyspnea throughout the study. Multiple comparison showed improved severity of dyspnea in the intervention group after 3 months ($\chi^2 = 7.756 > 5.991$) and 6 months ($\chi^2 = 17.566 > 5.991$) relative to baseline.

Physiological data

There was a trend toward decrease in systolic blood pressure in the intervention group, but not in the control group ($p = .061$, Table 4). There was no significant change in pulse rate, but a slight decrease in the intervention group and a slight increase in the control group were detected at the end of the study. The 24-h oxygen saturation measurement showed accelerated stabilization of pulse rate after exercise in the intervention group as compared with the control group. Vital capacity (FEV_1, $FEV_1\%$) were only measured in a few participants, as many participants in both groups were reluctant to undergo the pulmonary function test due to pain. For this reason, the number of participants in the control group was insufficient to compare PaO_2 and $PaCO_2$.

Consultation and prevention of exacerbations

Participants in both groups received regular consultation from a physician (hospital visits) throughout the study. Influenza vaccination was completed in 86.7% of the intervention group and 62.5% of the control group by

Table 4 Chronological changes in the physiological indicators between two groups

	Intervention Group				Control Group				Two-way repeated-measures ANOVA (upper: *F*-value; lower: *P*-value)		
	n	Baseline	3 months	6 months	*n*	Baseline	3 months	6 months	Interaction	Between Groups	Within Groups
Body weight (kg)	15	51.2 (12.0)	51.5 (12.1)	51.4 (11.7)	12	48.3 (9.4)	49.1 (10.3)	49.5 (10.4)	1.796 0.185	0.305 0.586	3.315 0.057
Systolic blood pressure (mmHg)	15	128.0 (17.7)	125.4 (19.3)	120.3 (21.1)	13	122.5 (14.7)	127.9 (18.3)	129.9 (12.4)	2.958 0.061	0.150 0.702	0.156 0.856
Diastolic blood pressure (mmHg)	15	68.6 (10.9)	70.6 (11.7)	70.1 (9.8)	13	71.1 (12.2)	71.4 (10.4)	73.2 (10.6)	0.146 0.865	0.441 0.513	0.327 0.723
Pulse rate (times/min)	15	90.9 (14.2)	85.6 (15.7)	86.7 (14.4)	14	86.9 (17.7)	87.3 (15.2)	87.2 (14.1)	0.824 0.444	0.015 0.903	0.591 0.557
SpO_2 (%)	15	94.7 (3.4)	96.3 (1.4)	95.9 (1.6)	15	96.5 (2.0)	96.2 (1.7)	95.3 (3.4)	2.067 0.154	0.518 0.478	0.683 0.455
24-h mean SpO_2	12	93.4 (3.6)	92.5 (3.9)	93.3 (3.0)	14	95.8 (2.0)	96.0 (1.8)	95.1 (3.6)	Intervention group(repeated ANOVA) $p = .404$ Control group(repeated ANOVA) $p = .536$		
Vital capacity (L)	15	2.16 (0.90)	-	2.16 (0.85)	6	1.78 (0.84)	-	1.87 (0.87)	0.234 0.634	0.672 0.423	0.190 0.668
FEV1	15	0.81 (0.36)	-	0.79 (0.38)	6	0.79 (0.31)	-	0.92 (0.62)	2.106 0.163	0.089 0.769	1.464 0.241
FEV1.0%	15	46.74 (10.74)	-	42.00 (12.53)	6	61.25 (20.51)	-	56.47 (10.91)	Intervention group (*t*-test) $p = .21$ Control group (*t*-test) $p = .44$		

Values denote mean (*SD*).
FEV1.0%: forced expiratory volume 1.0(s) %.
Data were taken by physicians on the visit day.
Baseline comparison: Body weight $p = .50$, Systolic blood pressure $p = .39$, Diastolic blood pressure $p = .58$, Pulse rate $p = .51$, SpO_2 $p = .09$, 24-h SpO_2 $p = .05$, Vital Capacity $p = .38$, FEV1 $p = .91$. FEV1.0% $p = .05$.
24-h SpO_2: significant difference was observed in baseline, One-way repeated ANOVA was calculated in each group.
FEV1.0%: significant difference was observed in baseline, *t*-test was calculated in each group
PaO_2 & $PaCO_2$ were taken only in two participants, therefore, it is not listed above.

Key Practice Points

- Self-management education for COPD patients improves patients' perception of dyspnea, social functioning, and overall QOL.
- Self-management education for COPD patients prevents their hospitalization.
- It is important for rehabilitation nurses to acquire a self-management education skill.
- Self-management education should be included in the comprehensive pulmonary rehabilitation program.

the end of the program. Symptoms of common cold were observed in both groups with no significant differences in the rates of these symptoms between the groups. Three participants in the intervention group made eight unscheduled hospital visits for the treatment of common cold associated with COPD during the study period, but none were hospitalized. However, all five participants in the control group received treatment for pneumonia, dyspnea, and acute aggravation eight times during the study, and two required hospitalization for treatment of acutely exacerbated pneumonia.

Discussion

Effectiveness of the program

The objectives of our management program for COPD patients were to support comprehensive pulmonary rehabilitation at home, to encourage the acquisition of self-management skills and modification of lifestyle behavior, and to prevent deterioration of pulmonary function with the aim of improving the QOL. The results did not show significant improvement in physiological data, except systolic blood pressure, but it did show an improvement in the severity of dyspnea, a significant increase in the frequency and range of social activities, and a significant

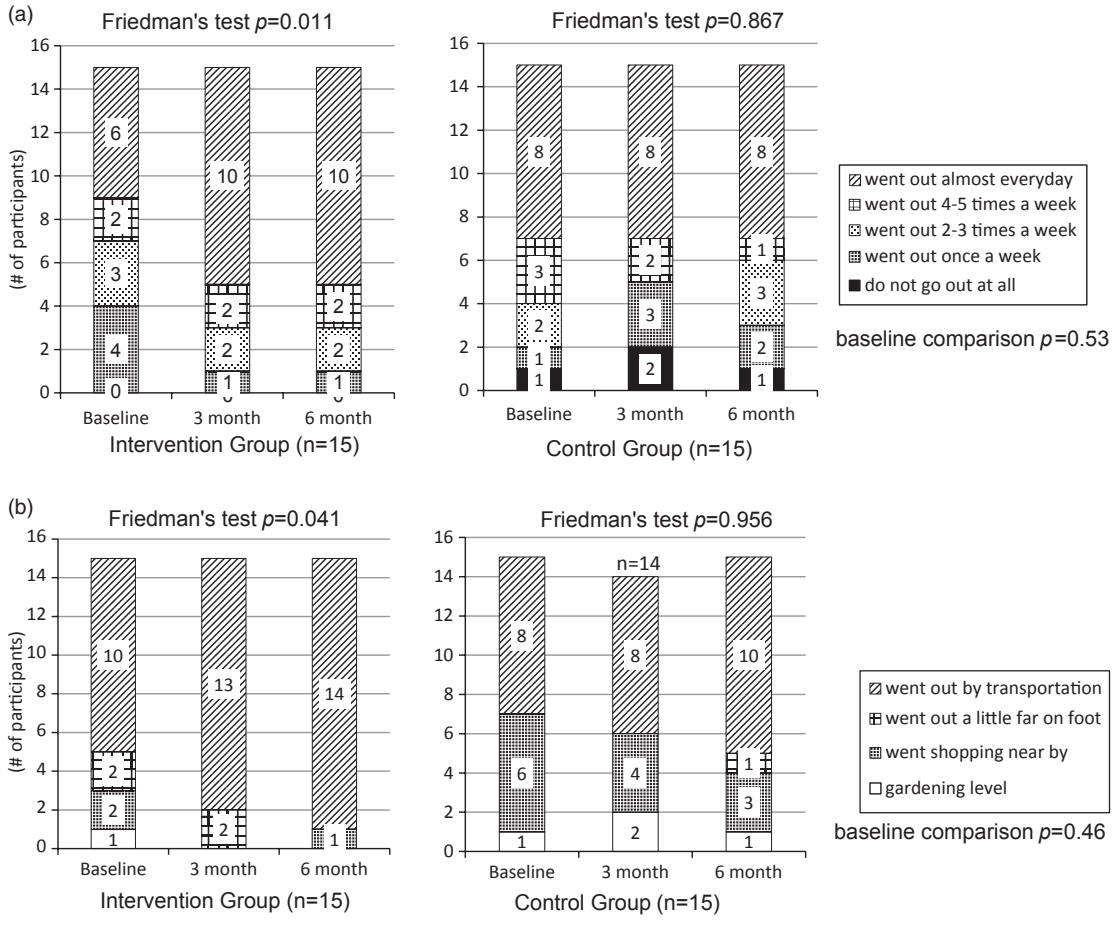

Figure 2 (a) Range of social activity: chronological change. (b) Frequency of social activity: chronological change.

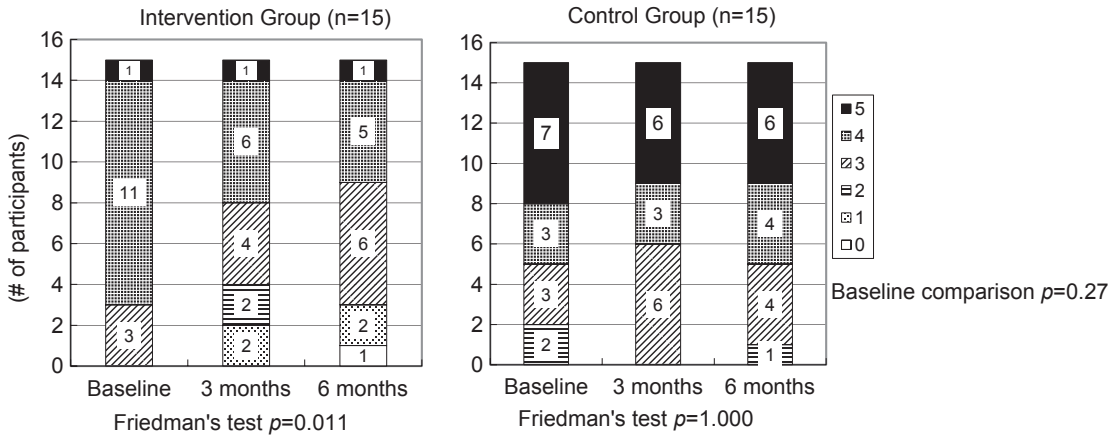

Figure 3 Severity of shortness of breath (MRC score): chronological change.

increase in total walking distance in ADL in those who participated in the program. These participants showed a high rate of adherence to the treatment regimen and learned breathing methods based on respiratory training. This led to an increase in SGRQ score and an improvement in QOL at the overall living level. One significant success of this program is that two participants in the control group were admitted to the hospital for treatment of pneumonia, whereas no participants in the intervention group were hospitalized during the winter season even though three had common colds. In addition to respiratory training, development of self-management behavior for prevention of infections, such as effective coughing, gargling and hand washing contributed to better outcomes.

Although a previous study suggested that a nurse-led educational intervention had less effect on pulmonary function as compared to physiotherapy and medication-based intervention (Taylor et al., 2005), the findings of our study showed that the program can assist in preventing patients from withdrawing from the society, improving subjective symptoms, and reduce patients hospitalization and exacerbations of symptoms in COPD patients at stage IV. The results of 24-h oxygen saturation measurements as an indicator of physiological improvement showed a trend toward restoration of the pulse rates of patients in the program after exercise regimen. This trend in pulse rate restoration is likely to be significant in a study with larger sample size.

Several participants provided positive comments during the study, including "I found that my life was worth living through this program," and "I was glad that the nurse checked and assessed my outcomes." These positive feelings may be due to increased self-confidence through the acquisition of knowledge, improved achievement and extension of social activities. Thus, the goals of our program were attained in terms of overall QOL. To observe physiological effects, more participants, a longer observation period and more pulmonary function test results are needed, but as discussed in the limitations, the medical care system in Japan is not sufficiently equipped for this purpose.

Significance of this program

For stage IV COPD patients, pulmonary function recovery is difficult and treatment goals shift over time to palliative care. In this situation, improvement and expansion of social activity, finding a meaning to life and a sense of self-worth are important. When the study began, the daily activities of many patients were limited to their homes. The program subsequently encouraged them to walk to their outside mailboxes to collect newspapers and letters, to walk in the garden and to walk around their houses. These specific activities gradually increased their overall activity levels. Consequently, some participants found greater meaning to their life, such as escorting schoolchildren for traffic safety. Additionally, using the study workbook, the importance of oxygen use especially during activity and sleeping were reinforced. Thus, the patients were relieved of their perceived social stigma and misconception regarding the use of oxygen. In our experience, the approach employed in the current program was effective for the participants given that social stigma is an important issue and a major challenge for patients with chronic illness (Saylor, Yoder, & Mann, 2002). Indeed, in this study, nurses' support to relief the patients of this perceived stigma helped them to make a tremendous progress.

Limitations and future suggestions: feasibility of program implementation

COPD patients often visit various medical facilities and the number of COPD patients per medical facility is often insufficient to conduct a study, which makes recruitment of participants difficult. Therefore, conducting a randomized trial was not feasible. In the future, a home-visiting nursing system may be available to provide this program with personnel from the HOT device companies. Given that in Japan there is the policy, in which the companies should inspect HOT devices periodically, our program will be of assistance in continuing the service within the range of available medical service fees.

Pulmonary function could not be assessed at many clinics because a spirometer or oxygen saturation instrument was not available, space was insufficient to conduct the 6MWT, and many patients with dyspnea refused the spirometry test. Thus, the use of alternative indicators including QOL assessment of social activities, 24-h oxygen saturation level in daily life, and the rate of development of complications was required. To conduct clinical trials in Japan, these obstacles have to be overcome.

Implications for rehabilitation nursing

Self-management education for COPD patients improves patients' perception of dyspnea, social functioning, overall QOL, and prevents hospitalization. Therefore, it is important for rehabilitation nurses to acquire this skill. Also, self-management education should be included in the comprehensive pulmonary rehabilitation program.

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References

Akinci, A.C., & Olgun, N. (2011). The effectiveness of nurse-led, home-based pulmonary rehabilitation in patients with COPD in Turkey. *Rehabilitation Nursing*, *36*, 159–165.

Al-Shair, K., Atherton, G.T., Kennedy, D., Powell, G., Denning, D.W., & Caress, A. (2012). Validity and reliability of the St. George's Respiratory Questionnaire in assessing health status in patients with chronic pulmonary aspergillosis. *Chest*, doi: 10.1378/chest.12-0014. [Epub ahead of print].

Bestall, J.C., Paul, E.A., Garrod, R., Garnham, R., Jones, P.W., & Wedzicha, J.A. (1999). Usefulness of the Medical Research Council (MRC) dyspnea scale as a measure of disability in patients with chronic obstructive pulmonary disease. *Thorax*, *54*, 5816.

Blackstock, F., & Webster, K.E. (2007). Disease-specific health education for COPD: a systematic review of changes in health outcomes. *Health Education Research*, *22*, 703–717.

Bourbeau, J., Collet, J.P., Schwartzman, K., Ducruet, T., Nault, D., & Bradley, C. (2006). Economic benefits of self-management education in COPD. *Chest*, *130*, 1704–1711.

Bourbeau, J., Julien, M., Maltais, F., Rouleau, M., Beaupre, A., Begin, R., et al. (2003). Reduction of hospital utilization in patients with chronic obstructive pulmonary disease: a disease-specific self-management intervention. *Archives of Internal Medicine*, *163*, 585–591.

Carriei-Kohlman, V., Nguyen, H.Q., Donesky-Cuenco, D., Demir-Deviren, S., Neuhaus, J., & Stulbarg, M.S. (2005). Impact of brief or extended exercise training on the benefit of a dyspnea self-management program in COPD. *Journal of Cardiopulmonary Rehabilitation*, *25*, 286–287.

Chavannes, N.H., Grijsen, M., van den Akker, M., Schepers, H., Nijdam, M., Tiep, B., et al. (2009). Integrated disease management improves one-year quality of life in primary care COPD patients: a controlled clinical trial. *Primary Care Respiratory Journal*, *18*, 171–176.

Funnell, M.M., Brown, T.L., Childs, B.P., Haas, L.B., Hosey, G.M., Jensen, B., et al. (2007). National standards for diabetes self-management education. *The Diabetes Educator*, *33*, 599–614.

Gadoury, M.A., Schwartzman, K., Rouleau, M., Maltais, F., Julien, M., Beaupre, A., et al. (2005). Self-management reduces both short- and long-term hospitalization in COPD. *European Respiratory Journal*, *26*, 853–857.

Global Initiative for Chronic Obstructive Lung Disease. (2010). Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease. Retrieved April 15, 2011, from http://www.goldcopd.org/uploads/users/files/GOLDReport_April112011.pdf.

Jones, P.W., Quirk, F.H., Baveystock, C.M., & Littlejohns, P. (1992). A self-complete measure of health status for chronic airflow limitation: the St. George's Respiratory Questionnaire. *American Review of Respiratory Disease*, *145*, 1321–1327.

Koff, P.B., Jones, R.H., Cashman, J.M., Voelkel, N.F., & Vandivier, R.W. (2009). Proactive integrated care improves quality of life in patients with COPD. *European Respiratory Journal*, *33*, 1031–1038.

Matsumoto, T., Tanaka, T., Matsuki, Y., Kinoshita, M., Sumimoto, K., & Senjyu, H. (2008). The Nagasaki University Respiratory ADL questionnaire: NRADL no hannousei no kentou. [The Nagasaki University Respiratory ADL questionnaire: discussion on responsibility of NRADL.] *Journal of Japan Society for Respiratory Care*, *18*, 227–230.

Matsumoto, T., Tanaka, T., Matsuki, Y., Kitagawa, C., & Senjyu, H. (2006). Senjyura no ADL hyoukahyou ni taisuru shinraisei no kentou. [Discussion on reliability of Senjyu's Respiratory ADL questionnaire.] *Journal of Japan Society for Respiratory Care*, *15*, 612–616.

Moriyama, M., Nakano, M., Kuroe, Y., Nin, K., Niitani, M., & Nakaya, T. (2009). Efficacy of a self-management education program for people with type 2 diabetes: results of a 12 month trial. *Japan Journal of Nursing Science*, *6*, 51–63.

Saylor, C., Yoder, M., & Mann, R.J. (2002). Stigma. In I.M. Lubkin, & P.D. Larsen (Eds.), Chronic illness: impact and interventions 5th ed. (pp. 53–76). Boston: Jones and Bartlett.

Sridhar, M., Taylar, R., Dawson, S., Roberts, N.J., & Partridge, M.R. (2008). A nurse led intermediate care package in patients who have been hospitalized with an acute exacerbation of chronic obstructive pulmonary disease. *Thorax*, *63*, 194–200.

Taylor, S.J.C., Candy, B., Bryar, R.M., Ramsay, J., Vrijhoef, H.J., Esmond, G., et al. (2005). Effectiveness of innovations in nurse led chronic disease management for patients with chronic obstructive pulmonary disease: systematic review of evidence. *BMJ*, *331*, 485. doi:10.1136/bmj.38512.664167.8F.

Taylor, S.J., Sohanpal, R., Bremner, S.A., Devine, A., McDaid, D., Fernandez, J.L., et al. (2012). Self-management support for moderate-to-severe chronic obstructive pulmonary disease: a pilot randomised controlled trial. *British Journal of General Practice*. 2012;*62*(603):687–695. doi: 10.3399/bjgp12X656829.

Tiep, B.L., & Barnett, M.C. (2008). Disease management for chronic obstructive pulmonary disease: a clinical strategy. *Disease Management and Health Outcomes*, *16*, 305–313.

Watanabe, R., Motegi, T., Yamada, K., Yamada, K., Ishii, T., Jones, R.C.M., et al. (2011). Efficient integrated education for older patients with chronic obstructive pulmonary disease using the Lung Information Needs Questionnaire. *Geriatrics and Gerontology International*, *11*, 422–430.

Zakrisson, A.B., Engfeldt, P., Hagglund, D., Odencrants, S., Hasselgren, M., Arne, M., et al. (2011). Nurse-led multidisciplinary programme for patients with COPD in primary health care: a controlled trial. *Primary Care Respiratory Journal*, *20*, 427–433.