

# Evaluation of a Pulmonary Rehabilitation Program in Hong Kong

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**Abstract** Pulmonary rehabilitation (PR) is a multi-disciplinary approach to management of patients with chronic obstructive pulmonary disease. After the program, patients gain the ability to adapt to their chronic lung disease, independence, life satisfaction and self-esteem is promoted. Starting in 1998, PR programs were implemented in some hospitals in Hong Kong. The aim of this study was to evaluate a multi-disciplinary pulmonary rehabilitation program. Retrospective case review was conducted with 53 patients with disabling chronic lung disease who had participated in a 4 weeks multidisciplinary pulmonary rehabilitation program. Findings showed that the PR program encompassing education, breathing retraining, chest physiotherapy, followed by exercise training leads to improvement in functional exercise capacity, knowledge related to chronic obstructive pulmonary disease (COPD) care, and health related quality of life (HRQL) which included dyspnea, fatigue, emotion and mastery. The study did not show significant reduction in the rate of Accident and Emergency visits and length of stay for hospitalization one year prior to and following the program.

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the common chronic illnesses in Hong Kong. It affects about 9% of Hong Kong residents aged 70 and above. In 1999, the morbidity rate of COPD in Hong Kong was 0.65/1000 population (Hospital Authority, 2001). The Hospital Authority classified COPD as one of the six prioritized diseases to be managed in the 1997-1998 annual plan.

COPD gradually impairs a patient's overall physical ability and reduces health-related quality of life (HRQL). Its prevalence is high, and its economic impact is great. Pulmonary rehabilitation (PR) has proved to be effective in improving exercise capacity and HRQL in COPD patients (Fernandez et al., 1999; Ries et al., 1995; Troosters et al., 2000).

It is commonly agreed that PR improves exercise performance, decreases dyspnea, improves quality of life and patients'

knowledge (Chan, 1999; Parker & Walker, 1998; Ries et al., 1995). Several studies have compared health-care utilization in the years following pulmonary rehabilitation and the year prior to the program, the results have demonstrated a consistent reduction in hospital days over the succeeding years (Carter et al., 1993; Cox et al., 1993).

However, there are contrary findings, which showed no significant reduction in hospitalizations (Guell et al. 2000). Starting in 1998, a "Four weeks comprehensive inpatient pulmonary rehabilitation program" for chronic lung disease patients was implemented in a rehabilitation hospital in Hong Kong. Evaluation of these programs is needed. For this reason, the aim of this study was to examine the short and long-term effects on exercise capacity, knowledge related to COPD, HRQL, accident and emergency visits and length of hospital stay in COPD patients participating in the in-patient rehabilitation program.

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## OBJECTIVES

1. To examine the effectiveness of the rehabilitation program in terms of exercise tolerance and knowledge related to COPD.
2. To evaluate change in quality of life by means of the instrument Chronic Respiratory Questionnaire (CRQ).
3. To examine the long-term benefits of a pulmonary rehabilitation program by measuring the incidence of Accident and Emergency visits and length of stay during hospitalization.

## METHOD

### Sample

All the subjects who completed the Pulmonary Rehabilitation Program (PRP) during 1999 were included in the study. In total there were 62 patients who met the criteria. The exclusion criteria were subjects who had recently had (within three months) an attack of myocardial infarction, uncontrolled arrhythmias or personality disorders. There were 9 cases (14.5%) with incomplete records and they were excluded. Therefore, 53 medical records were reviewed in the study, which represented 86% of all Pulmonary Rehabilitation Program graduates in 1999. All case records from January – December 1999 were also reviewed for frequency of emergency visits and hospitalization days one year prior to and after the program.

### Pulmonary rehabilitation program

Pulmonary rehabilitation is a multidisciplinary approach to disease management. It integrates expertise from various health-care disciplines into a comprehensive, cohesive program. The team members included a physician, nurses, an occupational therapist, a physiotherapist, a dietician and a social worker. The team shared the common goal of restoring or maintaining function and self-control in patients with pulmonary disabilities. Each member brought a special skill to patients and participated in decision making with the patients and the functioning of the team (Spenceley, 1995). The "Four weeks comprehensive inpatient pulmonary rehabilitation program" included:

1. Comprehensive assessment of physical symptoms, nutritional state and exercise tolerance.
2. A series of talks were given by experienced pulmonary rehabilitation nursing staff and guest speakers, such as a physiotherapist; occupational therapist, dietitian; clinical psychologist, medical social worker and pharmacist on the following topics:

Anatomy and pathophysiology of the lung;  
What is chronic obstructive pulmonary disease?

Smoking cessation techniques

Breathing and coughing techniques

Social Welfare

Medications

Nutrition

Coping with stress

Energy-saving techniques

3. Exercise tolerance training

Upper and lower extremities training and breathing and coughing exercise training were conducted for two hours every day from Monday to Saturday. The aim of the training was to exercise those muscles involved in daily activities. Upper extremity training improved performance for task-specific arm activities such as bathing, grooming, lifting and included hang weights, wall pulleys and posture-specific exercises. Lower extremity training involved the large muscle groups and included walking, stationary bike, bicycling. Respiratory muscle training increased the strength of respiratory muscles and endurance.

4. Energy conservation & Stress management training

This tailor-made training topic was prepared for individuals in order to teach the patients how to save energy during daily activities, for example: bathing, shopping, cooking, etc. The methods included environment modification, providing special equipment and practice. Stress management included a practical

model for stress and its effects on mind and body. Patients are trained to recognize their own early warning signs and symptoms of stress (e.g. anxiety, dyspnea, muscle tension) and be capable of performing a variety of stress management techniques and relaxation exercise practiced in class training.

### Outcome measures

The 'six minute walking test' is a simple and low-cost test that requires submaximal levels of physical exertion and reflects the ability to perform walking under conditions similar to those experienced in daily life (Jones, 1997). It is used to monitor exercise endurance by a timed distance walking test, which was developed by McGavin, Gupta and McHardy in 1976. The distance (in meters) covered during the test was found to be significantly related to the patient's forced vital capacity, symptom-limited maximum ventilation. It is relatively easy to carry out, especially for elderly patients. The result is relevant to activities of daily living, and requires limited equipment and space. It is commonly used to measure disability and to assess improvements in functional ability after a pulmonary rehabilitation program (Benzo et al., 2000; Brown et al., 2000).

The test was performed by observing the walking distance covered in a six-minute period. The distance walked was recorded as well as the number of times the patient stopped to rest. During the test, oxygenation (SpO<sub>2</sub>), pulse rate, respiratory rate and breathlessness were scored by using the Borg scale.

Curtis et al. (1994) suggested that dyspnea level is a better predictor of exercise tolerance and health-related quality of life than oxygenation. The Borg Scale (1982) for Rating of Perceived Dyspnea (RPD) indicates severity of dyspnea and patients rated their dyspnea by recording their perception of dyspnea from "nothing at all" to "maximal" after completing the six-minute walking test.

The Chronic Respiratory Disease Questionnaire (CRDQ) was developed by Guyatt and colleagues (1987) through in-depth, unstructured interviews with 100 patients

having COPD. It aims to measure the HRQL of COPD patients and has acceptable test-retest reliability ( $r = 0.73$ ). The CRDQ has been shown to be reproducible and valid as a primary outcome measure for subjects with COPD (Guyatt et al. 1987). However, this test requires a structured 15-minute interview with a trained interviewer (Wijkstra et al. 1994). The CRDQ was translated and validated for use in Chinese and consists of four domains, mainly measuring dyspnea, fatigue, emotional function and mastery during self-selected day-to-day activities. Each domain has between four to seven items scored on a scale of 1-7. A change in score of 0.5 per item was associated with a minimally important difference in health-related quality of life, a change of 1 was moderate, and a change of more than 1 was a large difference.

A questionnaire, based on educational materials presented during the program, was developed by the team nurse. It aims to examine participants' understanding of COPD and its management. Totally, there were 15 questions in the questionnaire with 1 point for each correct answer. The questions included topics on the pathophysiology of lung diseases, airway & symptom management, energy conservation techniques, nutrition and social support.

After development of the instrument, its validity was assessed. Content validity of the instrument was examined by a panel of experts including one chief of service (COS), one senior medical officer and two nurses who had at least five years of experience in related areas. The Content Validity Index (CVI), used to evaluate the extent of agreement, was 0.88, which was considered valid (Waltz, Strickland & Lenz, 1991). Minor revisions were made based on the expert's recommendations.

### Clinical Management System

Accident and Emergency (A&E) attendance and hospitalization stay records 1-year prior to and 1-year after the program were retrieved by the hospital clinical management system (CMS). The reasons for and frequencies of A & E attendance and hospitalization stays were reviewed and marked on the data collection sheet.

## Data collection

Subject's demographic characteristics such as gender, age, diagnosis, forced expiratory volume in one second (FEV<sub>1</sub>), smoking history and functional class were recorded. Subjects were classified on admission by the American Thoracic Society Functional Class, from Class A to Class E.

Functional Class A is full functional capacity, conditions include no dyspnea on level walking; dyspnea on climbing 2 flights of stairs; insignificant COPD symptoms and no restrictions imposed on the patient by his/her disease. Functional Class B means slightly diminished functional capacity, conditions include no dyspnea on level walking; dyspnea on climbing 1 flight of stairs; mild COPD symptoms and slight restrictions with respect to strenuous activities and stress. Functional Class C shows significantly diminished functional capacity, conditions include dyspnea on walking 1.5 level city blocks at own pace and some of the ADL; moderate COPD symptoms; considerable restrictions with respect to strenuous activities and stress; prolonged walking and standing are contraindicated as well as lifting objects greater than 5 lbs.

Functional Class D are persons with minimal remaining functional capacity, conditions include dyspnea on walking 0.5 level city block at own pace and on most minimal stair climbing & most of ADL. Functional Class E indicates there is no remaining functional capacity, conditions include dyspnea at rest; unable to carry out any of the ADL; severe COPD symptoms and maximal restrictions; patient is confined to wheelchair or bed; is completely dependent on others and can tolerate no environmental and emotional stress.

Other columns data collected included: duration of participation in the pulmonary rehabilitation program; knowledge score; the total distance (in meters) and rate of perceived dyspnea level after the six minute walking test and scores from the (CRDQ).

Data collected were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to describe the pre and post program sample characteristics. Differences in subject's

exercise tolerance parameters, knowledge scores, CRDQ score, A & E attendance and hospitalization days were assessed by using Paired - t test on pre- and post outcome measures. Statistical significance of this study was set at the 0.05 level. Ethics approval was obtained from the relevant University and Hospital Ethics committees.

## FINDINGS

### Patient Demographic and Pulmonary Function Characteristics

**Table 1 Demographic characteristics of subjects**

Characteristics	N	%
<b>Age (years)</b>		
55 - 64	4	7.5
65 - 74	24	45.3
75 - 84	22	41.5
85 - 88	3	5.7
<b>Sex</b>		
Male	42	79.2
Female	11	20.8
<b>Pulmonary Function Test - FEV<sub>1</sub></b>		
<60 % of normal FEV <sub>1</sub>	26	49.0
61 - 70 % of normal FEV <sub>1</sub>	10	18.9
71 - 80 % of normal FEV <sub>1</sub>	8	15.1
>80% of normal FEV <sub>1</sub>	9	17.0
<b>Functional Class</b>		
A - Full Functional Capacity	3	5.6
B - Slightly Diminished Functional Capacity	15	28.3
C - Significantly Diminished Functional Capacity	27	50.9
D - Minimal Remaining Functional Capacity	4	7.6
E - No Remaining Functional Capacity	4	7.6
<b>Smoking History</b>		
Non-smokers	16	30.2
Smokers	3	5.7
Ex-smokers	34	64.1
<b>Diagnosis group</b>		
Chronic Bronchitis	5	9.4
Emphysema	2	3.8
Asthma	5	9.4
Chronic Obstructive Pulmonary Disease without Asthma	29	54.7
Chronic Obstructive Pulmonary Disease with allied diseases (Pulmonary Tuberculosis, Cor-Pulmonale)	10	18.9
Chronic Obstructive Pulmonary Disease with other diseases	2	3.8

### Exercise tolerance and knowledge score

There was a significant improvement in exercise tolerance in the 50 meters six-minute walking test, a significant decrease in severity of dyspnea (RPD) and significant improvement in the knowledge score ( $p < 0.01$ ) (Table 2).

**Table 2 Parameters related to exercise tolerance and knowledge**

Group	Mean	SD	T value	P value
Pre-distance	229.45	83.93	-5.435	<0.01
Post-distance	279.06	97.23		
Pre-RPD	3.962	1.901	6.992	<0.01
Post-RPD	2.858	1.582		
Pre-knowledge Score	8.11	2.67	-7.311	<0.01
Post-knowledge Score	10.4	2.42		

### Quality of Life

Health related quality of life as measured demonstrated marked improvements ( $p < 0.01$ ) in the four domains: dyspnea, fatigue, emotion and mastery (Table 3).

**Table 3 Comparison of CRDQ scores**

Group	Mean	SD	T value	P value
Pre-Dyspnea	18.70	4.85	-8.842	<0.01
Post-Dyspnea	25.25	6.30		
Pre-Fatigue	17.09	3.75	-7.841	<0.01
Post-Fatigue	20.89	3.58		
Pre-Emotion	33.49	7.61	-6.463	<0.01
Post-Emotion	38.98	6.40		
Pre-Mastery	18.55	4.78	-7.792	<0.01
Post-Mastery	22.96	3.60		

### A&E attendance

There was increased A & E attendance for 32.1% of the subjects, while 17 subjects (32.1%) had reduced A & E attendance and 32.1% revealed no change. A paired-t test revealed there was no significant reduction in A & E service attendance (Table 4).

**Table 4 Comparison of the means of A & E attendance**

Group	Mean	SD	T value	P value
Pre-A & E visit	3.28	4.70	-0.520	0.605
Post-A&E visit	3.45	5.07		

### Hospitalization days

The length of stay in hospital decreased slightly from 25.79 (SD 31.03) to 24.68 (SD 24.85), but not significantly as shown in Table 5.

**Table 5 Comparison of length of stay (L.O.S.) in hospital**

Group	Mean	SD	No. of cases	T-value	P-value
Pre-L.O.S.	25.79	31.03	53	0.247	0.806
Post-L.O.S.	24.68	24.85			

### DISCUSSION

This study is consistent with previous reports (Elpern et al. 2000; Griffiths et al., 2000; Ries, et al., 1995 & Wedzicha et al., 1998) showing that a PR programme for COPD patients encompassing education, breathing retraining, chest physiotherapy, followed by exercise training leads to improvement in functional exercise capacity, knowledge related to COPD care, dyspnea and HRQL which included fatigue, emotion and mastery.

Findings from this study also showed there were no significant reductions in A&E visits and in length of hospital stay. This is not consistent with findings from other studies, which found significant reductions in A&E visits and in hospitalization (Bendstrup, et al., 1997 & Ries, et al., 1995). Our failure to demonstrate a significant reduction in A&E visits and hospitalization might have been caused by subjects becoming more alert to changes in their medical conditions after the pulmonary rehabilitation program, and being more prone to A & E visits than before. This suggests that subjects were not competent in handling the deterioration of their disease. Therefore, it is suggested that telephone follow-up or a telephone hotline should be offered to participants in order to support them after discharge. The mean length of stay in hospital after the rehabilitation program showed a reduction of 1.1 days, which is an improvement in absolute value.

### CONCLUSION

Results of the study indicate that a multi-disciplinary pulmonary rehabilitation program is effective for COPD patients resulting in better exercise tolerance, knowledge related to COPD and better HRQL. However, this study fails to demonstrate a significant reduction in Accident and Emergency visits and length of study one year following the program.

As the study only recruited patients from one hospital, it might not represent situations in other hospitals and the degree of generalization is low. Since the setting and facilities in other hospitals may be different from the study hospital, findings may also vary. A randomized controlled study with another group of COPD patients for direct comparison should be considered in a further study. A similar study could also be conducted to compare the outcomes of a 3 weeks in-patient program with an out-patient program.

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### 香港胸肺復康計劃評估

胸肺復康採取多專業取向，以達護理慢性阻塞肺病病人的目標。本計劃自一九九八年在香港多間醫院實行。參與計劃的病人學習到一些生活技能，以適應因慢性肺病帶來的生活不便，從而提高獨立能力，生活滿足感及自我形象。評估多專業取向胸肺復康計劃。以個案回顧方式訪問五十三位慢性阻塞肺病病人，他們均完成了四星期胸肺復康計劃。結果顯示本計劃包括教育、呼吸訓練、胸部物理治療、增強功能性運動能耐訓練、配合加強病人對慢性阻塞肺病的護理知識及與生活質量有關的健康知識，例如呼吸困難、疲倦、情緒及控制能力。病人參加本計劃前後一年，到急症室求診頻密率及住院日數比率並沒有顯著下降。

摘要