Clinical implications of pulmonary rehabilitation

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The burden of chronic obstructive pulmonary disease (COPD) has grown in recent years, making it the fourth most important cause of morbidity and mortality in Canada. The dramatic rise in COPD prevalence among women reflects increased smoking rates for women over the past 20 years. Many professional societies recommend rehabilitation, as part of COPD management, to increase health-related quality of life and improve functional exercise capacity. Rehabilitation is associated with a reduction in health resource utilization. Unfortunately, its benefits diminish with time. Current challenges include identifying the most effective approaches to rehabilitation in terms of location, essential components and ways to maintain the initial program benefits.

COPD – A MAJOR PROBLEM
COPD is a global health care challenge, predicted to move from the 12th to the fifth most important cause of mortality by 2020 (Figure 1). Data from the United States (1965 to 1998) reflect the increase in COPD concomitant with the gradual reduction in coronary artery disease, stroke and other cardiovascular conditions (Figure 2). In Canada, data concerning physician-diagnosed COPD from 1998 to 1999 showed that in the age group from 55 to 74 years, more women than men were diagnosed with COPD (Figure 3). Post-2002, the number of women dying from COPD is predicted to greatly exceed the number of men (Figure 4).

MANAGEMENT OF COPD
The clinical goals of COPD management include preventing further reduction in airflow, improving dyspnea and functional exercise capacity, and minimizing the impact of exacerbations. Clinically, this means secondary prevention (cessation...
of smoking, appropriate immunization), optimization of lung function (bronchodilators) and minimization of sequelae (oxygen, nutrition, rehabilitation and surgery). The primary respiratory impairment results in dyspnea from moderate exertion, abstention from exercise, deconditioning and, therefore, dyspnea during mild exertion. With further deconditioning and a sedentary lifestyle, activities of daily living may be markedly compromised.

THE ROLE OF REHABILITATION

Although primary lung impairments associated with chronic respiratory conditions are unlikely to change with rehabilitation, improvements in secondary impairments (respiratory muscle, peripheral muscle, cardiac, nutritional and psychosocial) have an important influence on the way that patients function.

The following points have emerged:

- Respiratory rehabilitation improves health-related quality of life and functional exercise capacity.
- These improvements have been associated with a reduction in health resource utilization.
- The benefits of rehabilitation diminish with time.

IMPROVEMENTS IN HEALTH-RELATED QUALITY OF LIFE AND FUNCTIONAL EXERCISE CAPACITY

Over the past 10 years, prospective, randomized, controlled trials employing valid reproducible and interpretable outcome measures have demonstrated the effectiveness of respiratory rehabilitation on exercise and health-related quality of life (Figure 5) (4-6). Rehabilitation programs are not site-specific and can be delivered as inpatient (4), outpatient (6) or community-based programs (5). Meta-analyses of respiratory rehabilitation in COPD (7,8) have confirmed that most clinical trials of rehabilitation show small but consistent benefits that exceed the minimal clinically important differences, especially in the domains of dyspnea, fatigue and mastery (Table 1).
When the components of respiratory rehabilitation have been evaluated (Table 2) (9), reports have concluded that lower extremity training is essential (Grade 1A evidence) to achieve improvements in exercise tolerance and health-related quality of life. Although upper extremity training is also valuable, there are, as of yet, too few prospective, randomized, controlled trials of upper extremity training for a definitive assessment of evidence. Although numerous trials of ventilatory muscle training (VMT) have been published, the evidence in support of its effectiveness, when VMT plus exercise training is compared with exercise training alone, is equivocal. The American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation Guidelines rated this evidence as weakly favourable for VMT, but the Lacasse review was clear that the available trials demonstrated an absence of effect for VMT (9,10). Unfortunately, there are too few studies to conclude that there is supporting evidence for psychosocial, behavioural or educational components of rehabilitation, although most rehabilitation programs include them. It appears that psychosocial support, in combination with exercise, reduces anxiety, promotes self-efficacy and improves exercise compliance.

HEALTH RESOURCE UTILIZATION
In a recent study, Griffiths et al (11) randomly assigned 200 patients with COPD to six weeks of outpatient rehabilitation versus a control group. After one year of follow-up, it was noted that although the total number of patients admitted to hospital with respiratory exacerbations did not differ between the study groups (41 patients – control group; 40 patients – rehabilitation group), those who completed rehabilitation spent fewer days in hospital (18.1 days – control group; 9.4 days – rehabilitation group) (P<0.05). Patients completing rehabilitation also required fewer primary care home visits (2.8 days – control group; 1.5 days – rehabilitation group) (P<0.05). A subsequent detailed economic analysis (12) established that the cost savings among the group that completed respiratory rehabilitation markedly exceeded the costs of the program itself.

DIMINUITION OF BENEFITS WITH TIME
Unfortunately, one year after outpatient rehabilitation, quality of life questionnaires often return to baseline values (Figure 6). This diminution of benefit has been reported in several programs (4-6,11). Longer programs may well extend the duration of improvement (13-15). Troosters et al (16) reported on 100 patients randomly assigned to a six-month program of rehabilitation. Differences in 6 min walk (52 m [95% CI 15 to 89 m]) and health-related quality of life (chronic respiratory questionnaire – 14 points [95% CI 6 to 21 points]) were both in excess of the minimal clinically important difference at 18 months (Figure 7).

HOW BEST TO MAINTAIN IMPROVEMENTS FOLLOWING INTENSIVE REHABILITATION
In a retrospective study, Vale et al (17) reviewed 51 patients 12 months after they had completed rehabilitation. Nineteen
patients had participated in a weekly exercise maintenance program and 32 patients had not. Walking ability and quality of life were both reduced, with no between-group differences attributable to the maintenance program (Figure 8). In a recent prospective study, Brooks et al (18) reported the results of an enhanced post-rehabilitation follow-up program. Patients with severe, stable COPD (forced expiratory volume in 1 s less than 40%, forced expiratory volume in 1 s/forced vital capacity less than 0.7) who completed rehabilitation were randomly assigned to receive enhanced follow-up or regular care. The enhanced follow-up group attended monthly supervised rehabilitation and were also called every four weeks (offset by two weeks from the group sessions). Control subjects received usual care. Both groups deteriorated with time (Figure 9). Although at six months the study group had better 6 min walk test results, by 12 months, there were no between-group differences in exercise capacity or quality of life. Adherence differed among exercises, and was greatest for breathing exercises and least for interval training (Figures 10 and 11). A high percentage of patients identified a respiratory exacerbation as the key contributor to noncompliance with rehabilitation (60% and 43% at three months, and 78% and 80% at nine months for control and enhanced subjects, respectively).

CONCLUSIONS
Rehabilitation is beneficial for patients with chronic respiratory conditions. There is good evidence that it improves health-related quality of life and functional exercise capacity. Programs are not site-specific but can be administered in the community or at an institution. There is an important reduction in health resource utilization associated with outpatient rehabilitation. Benefits of rehabilitation diminish with time and are not influenced by regular maintenance visits to the rehabilitation centre. Compliance with rehabilitation depends on the type of exercise in question; it is higher for breathing exercises and lower for interval training. The current challenge is to identify approaches that will help to improve compliance and maintain the benefits of the acute rehabilitation program. It may well be that patients require the most attention immediately following an acute exacerbation.

REFERENCES