

SPECIAL ARTICLE

# Pulmonary Rehabilitation and Respiratory Physiotherapy: Time to Push Ahead

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## Introduction

Given that the concepts of pulmonary rehabilitation and respiratory physiotherapy are commonly confused in the health care sector, we need to clarify the meaning of each from the outset. In 1974 the Committee on Pulmonary Rehabilitation of the American College of Chest Physicians defined pulmonary rehabilitation as “an art.”<sup>1</sup> Nearly 20 years later another group of experts described it as “a service.”<sup>2</sup> However, the definition contained in the recently published joint statement of the American Thoracic Society and the European Respiratory Society (ATS/ERS) probably represents the broadest and most suitable definition for our times. “Pulmonary rehabilitation is an evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities. Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health care costs through stabilizing or reversing systemic manifestations of the disease.”<sup>3</sup> The ATS/ERS statement further indicated as follows: “Pulmonary rehabilitation programs involve patient assessment, exercise training, education, nutritional intervention, and psychosocial support.” In regard to the education aspect, we would add that this includes physiotherapy (Table 1) Respiratory physiotherapy, therefore, is just one component of a pulmonary rehabilitation program, which typically includes techniques whose general aim is to improve regional ventilation, gas exchange, respiratory muscle function, dyspnea, exercise tolerance, and health-related quality of life (HRQL).<sup>4</sup> Respiratory physiotherapy—which consists of 3 kinds of techniques aimed at improving airway patency, relaxing the patient, and providing breathing training—focuses in a general sense, on improving mucociliary clearance and optimizing respiratory function by enhancing respiratory muscle efficiency and improving chest wall compliance<sup>4</sup> (Table 2).

Until recently, Spanish legislation did not explicitly refer to pulmonary rehabilitation as a care option offered by the national health system. Moreover, although the Royal Decree enacted in September 2006<sup>5</sup>—establishing a portfolio of common services to be provided by the national health system—included respiratory physiotherapy as a primary care service, no mention was made of pulmonary rehabilitation. The aim of this study is to draw attention to the demonstrated usefulness of pulmonary rehabilitation and to the possibilities offered by the new legislation with regard to pulmonary rehabilitation and, more specifically, respiratory physiotherapy.

## Demonstrated Benefits of Pulmonary Rehabilitation

It can now be safely asserted that rehabilitation programs that include muscle training improve dyspnea, exercise tolerance, and HRQL in patients with chronic obstructive pulmonary disease (COPD)<sup>6-9</sup> as well as other respiratory diseases.<sup>10</sup> That said, not all pulmonary rehabilitation components produce the same benefits<sup>6-9</sup> (Tables 3 and 4).

Educating patients about key aspects of their disease has been shown to be of little benefit to participants in a pulmonary rehabilitation program (level of evidence, C<sup>7</sup>)—possibly due to the fact that there are few well-designed studies available on this point. While education by itself has been demonstrated to have a beneficial effect on HRQL and exercise tolerance for asthmatic patients,<sup>11</sup> this does not appear to be the case for COPD patients.<sup>12-16</sup> Education combined with exercise training, on the other hand, can lead to significant improvements in both exercise tolerance and HRQL.<sup>17</sup> The ATS/ERS statement recommends emphasizing self-management skills in the educational

TABLE 1  
Components of a Respiratory Rehabilitation Program

Education
Respiratory physiotherapy
Muscle training
Lower extremity muscles
Upper extremity muscles
Respiratory muscles
Psychosocial support
Nutritional support
Occupational therapy

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GÜELL ROUS MR ET AL. PULMONARY REHABILITATION AND RESPIRATORY PHYSIOTHERAPY: TIME TO PUSH AHEAD

TABLE 2  
Respiratory Physiotherapy Techniques

Airway Clearance	Relaxation	Respiratory Re-Education
Positioning to utilize the effect of gravity	Jacobson technique	Slow controlled breathing
Postural drainage	Shultz's autogenic training	Pursed-lips breathing
Controlled inspiratory flow	Caycedo dynamic relaxation	Directed breathing
Shock wave therapy	Gerda Alexander eutony movements	Thoracic mobilization
Percussion (chest clapping)	Oriental therapies (yoga, zen meditation)	Controlled breathing during activities of daily living
Vibration/shaking		
Flutter device		
Compression techniques		
Directed cough		
Manual chest compression		
Active cycle of breathing		
Forced expiration (huff)		
Expiratory flow increase		
Slow expiration with the glottis open in lateral position		
Autogenic drainage		
Positive pressure		
Positive expiratory pressure		
Continuous positive airway pressure		
Bilevel positive airway pressure		

From Güell and de Lucas,<sup>4</sup> chapter 18.

TABLE 3  
Respiratory Rehabilitation Efficacy: Evidence Levels According to the American Thoracic Society<sup>7</sup>

Component	Level of Evidence <sup>a</sup>
Lower extremity training	A
Upper extremity training	A
Respiratory muscle training	B
Education and physiotherapy	B
Psychosocial support	C
<b>Benefits</b>	
Dyspnea	A
Health-related quality of life	A
Reduced cost	B
Survival	C

<sup>a</sup>A: High level of evidence; B: Moderate level of evidence; C: Low level of evidence.

TABLE 4  
Respiratory Rehabilitation Efficacy: Evidence Levels According to the British Thoracic Society<sup>8</sup>

Benefits	Level of Evidence <sup>a</sup>
Functional capacity	A
Health-related quality of life	A
Dyspnea	A
Reduced cost	A

<sup>a</sup>A: High level of evidence.

component of rehabilitation, particularly in managing exacerbations in terms of both detection and treatment.<sup>3</sup>

The level of evidence supporting respiratory physiotherapy is quite weak (level C<sup>7</sup>), as a consequence of a paucity of studies and contradictory results from the few that have been published.<sup>18</sup> Few studies have demonstrated benefits in terms of HRQL or exercise tolerance when physiotherapy is combined with exercise training<sup>19</sup> or given in isolation.<sup>20</sup> The ATS/ERS statement

however, supports the use of physiotherapy techniques for selected patients.<sup>3</sup>

The role of psychosocial support in rehabilitation programs is debated (level of evidence, C<sup>7</sup>), despite the high incidence of depression and anxiety in patients with COPD.<sup>21</sup> Several studies have demonstrated the benefits of relaxation techniques for patients with dyspnea and anxiety,<sup>22,23</sup> but others conclude that psychosocial support programs do not positively affect exercise tolerance, anxiety, depression, or HRQL.<sup>24-26</sup> Few studies have analyzed the impact of pulmonary rehabilitation on emotional disorders when no specific intervention has been undertaken. Some have concluded that rehabilitation reduces depression and anxiety,<sup>3,27-29</sup> whereas others have found no improvement.<sup>12</sup> The ATS/ERS statement<sup>3</sup> recommends, nonetheless, that anxiety and depression be assessed in participants in a pulmonary rehabilitation program and that suitable support be provided to these patients.

Muscle training of the lower extremities is the main factor determining the success of rehabilitation programs (level of evidence, A). Recent studies have demonstrated that lower extremity training improves dyspnea, exercise tolerance, and HRQL,<sup>3,7-9</sup> and also leads to structural and functional changes in muscles.<sup>30</sup> Improvement is possible with both high<sup>31</sup> and low intensity training programs.<sup>32,33</sup> What remains unclear is the benefit of training other muscle groups. Upper extremity activity clearly has a significant metabolic and ventilatory impact, but there are few studies that have analyzed the specific benefits of arm exercises. Although some studies have demonstrated a significant improvement in the strength and resistance of muscle groups,<sup>3,8,9,34</sup> none were able to lay claim to more general benefits—in terms of improved functional capacity or HRQL, for example. The ATS/ERS statement recommends training both the upper and lower extremities—combining strength and endurance training and preferably using the interval training method.<sup>3</sup> The efficacy of specific training of respiratory muscles continues to be debated (level of

GÜELL ROUS MR ET AL. PULMONARY REHABILITATION AND RESPIRATORY PHYSIOTHERAPY:  
TIME TO PUSH AHEAD

evidence, B). Nonetheless, the findings of 3 meta-analyses<sup>35-37</sup> and of recent randomized controlled trials<sup>38,39</sup> indicate that training can improve strength and respiratory muscle resistance when mouth pressure is sufficient. Furthermore, some studies have demonstrated an improvement in HRQL and in exercise tolerance when specific respiratory muscle training is combined with general training.<sup>40</sup> The ATS/ERS statement indicates that specific respiratory muscle training should be included as part of general training for patients presenting with weak respiratory muscles.<sup>3</sup>

Nutritional support and occupational therapy are 2 key components that need to be included in any pulmonary rehabilitation program. In patients with COPD, malnutrition is accompanied by relatively greater pulmonary impairment and diminished physical capacity. Of patients with moderate-to-severe COPD, malnutrition affects a third of outpatients, and 32% to 63% of patients with COPD participating in rehabilitation programs. Excess weight and malnutrition are both problems for the patient with COPD. Although nutritional recommendations are based only on expert opinion, it should be remembered that a reduction in the body mass index of COPD patients is an independent mortality risk factor (level of evidence, A).<sup>7</sup>

A key to the success of pulmonary rehabilitation is the transformation of physiological improvements into benefits that are important to patients—a transformation facilitated by occupational therapy. In order to reduce the dyspnea caused by activities of daily living, the occupational therapist teaches the patient how to simplify routine activities to ensure greater efficiency and lower calorie expenditure. Although little research has been conducted in this area to date, some recent recommendations on the elements to include in patient education programs include energy conservation and work simplification techniques.<sup>4</sup>

A reiterated criticism of pulmonary rehabilitation is that any benefits gained are gradually lost once the patient terminates treatment. The severity of bronchial obstruction<sup>13,20,41-43</sup> and program intensity, duration or location<sup>12,20,41-53</sup> do not seem to have a bearing on the durability of a program's benefits (Tables 5 and 6); the course of the disease, the presence of comorbidities,<sup>44</sup> and, above all, the use or otherwise of maintenance techniques, however, do play a part. Several studies have demonstrated that implementing a simple maintenance program on terminating treatment<sup>41,42,46,54</sup> maintains exercise tolerance and HRQL (although not much beyond 1 or 2 years). What is clear, nonetheless, is that effectiveness is dependent on the intensity of the maintenance strategy. Recently, Foglio et al<sup>45</sup> demonstrated that regular repetition of the program merely reduces exacerbations.

#### *Hospital-Based or Community-Based Pulmonary Rehabilitation?*

Pulmonary rehabilitation programs are typically designed for hospital settings, irrespective of whether the patient has been admitted or is being treated as an outpatient. Programs for hospitalized patients, however, are rare, and typically have been designed in the USA and in Canada.

TABLE 5  
Studies Relating Degree of Bronchial Obstruction  
With Long-Term Maintenance  
of Benefits<sup>a</sup>

Authors, y	FEV <sub>1</sub>	Maintenance, m
Ries et al, <sup>13</sup> 1995	1.21 (0.55)	12
Grosbois et al, <sup>42</sup> 1999	1.33 (0.7)	18
Güell et al, <sup>20</sup> 2000	1.20 (0.5)	24
Troosters et al, <sup>41</sup> 2000	1.20 (0.5)	18
Finnerty et al, <sup>43</sup> 2001	0.99 (0.36)	6

Abbreviation: FEV<sub>1</sub>, forced expiratory volume in 1 second.

<sup>a</sup>Data are expressed as mean (SD).

TABLE 6  
Studies Relating Training Program Duration  
and Frequency With Long-Term Maintenance  
of Benefits

Authors, y	Frequency, Times/wk	Duration, wk	Maintenance, mo
Ries et al, <sup>13</sup> 1995	2	8	12
Singh et al, <sup>46</sup> 1998	2	7	10
Troosters et al, <sup>41</sup> 2000	2-3	24	18
Grosbois et al, <sup>42</sup> 1999	2	7	18
Güell et al, <sup>20</sup> 2000	3	24	24
Finnerty et al, <sup>43</sup> 2001	2	7	6
Foglio et al, <sup>45</sup> 2001	3	8	6

The benefits provided by these programs are undisputed,<sup>3,7-9</sup> but several randomized controlled trials have recently demonstrated that a home-based pulmonary rehabilitation program produces a significant improvement in HRQL and exercise tolerance.<sup>47-53</sup> It would even seem that the benefits of home-based programs last longer. Some home-based programs include intensive training with ergometers under supervision<sup>47-49</sup>; similar benefits have been obtained, however, for simpler programs operated without equipment or direct supervision.<sup>50-54</sup>

#### *The Current Situation*

Despite the benefits of pulmonary rehabilitation, as described above, only a few countries expressly fund this care option through their public health systems. Furthermore, there are significant geographical variations even within countries that do offer such coverage; consequently, only a small proportion of patients who could benefit from pulmonary rehabilitation actually have access. In the UK, for example, only around 50% of patients have their treatment paid for from public funds.<sup>55,56</sup> It is not known to what extent pulmonary rehabilitation programs are offered at the primary care level, as primary care rehabilitation is not centrally planned but is managed by the Primary Care Trusts.<sup>57</sup> A recent study estimated that only 1.5% of patients diagnosed with COPD have access to pulmonary rehabilitation programs in the UK.<sup>56</sup> These results are similar to those obtained for Canada, where around 40% of hospitals offer such programs, some regions have none at all, and only about 1.2% of all patients with COPD receive the treatment.<sup>58</sup> In the USA, and despite

GÜELL ROUS MR ET AL. PULMONARY REHABILITATION AND RESPIRATORY PHYSIOTHERAPY:  
TIME TO PUSH AHEAD

the efforts of scientific and professional associations, there is no explicit cover for pulmonary rehabilitation in any publicly funded health programs. Currently underway, however, is a legislative proposal supporting such cover for pulmonary rehabilitation.<sup>59,60</sup> The situation is better in France, where the social security system does provide coverage,<sup>61</sup> and programs are implemented in certain hospitals (for fully or partially hospitalized patients), for outpatients, and more infrequently, for home-based patients. Nonetheless, the French Minister of Health and Solidarity—in referring to a program of actions aimed at COPD patients for the period 2005-2010—has acknowledged that pulmonary rehabilitation is not sufficiently widely available.<sup>62</sup> In Italy, this modality is offered as an outpatient service<sup>63</sup> that is provided in both hospital settings and in community settings. However, there are considerable differences in availability of this treatment from one geographic area to another.<sup>64</sup>

As far as we are aware, Andalusia is the only region in Spain that offers pulmonary rehabilitation to clinic outpatients and home-based patients as part of its portfolio of primary care services. It does so in accordance with Decree 137/2002 governing the provision of support to Andalusian families.<sup>65,66</sup> In 2000, INSALUD (the Spanish National Health Institute) established a Framework Agreement for Rehabilitation (the Carrasco 2000 Reference Framework Contract), on the basis of which other autonomous regions of Spain have entered into agreements to provide rehabilitation services—including pulmonary rehabilitation—for both outpatients and home-based patients.

In Catalonia, rehabilitation in hospital and community settings is performed by multidisciplinary teams coordinated by a rehabilitation physician. These teams depend on hospitals in the network of hospitals subsidized for public use, hospitals and rehabilitation facilities providing primary care support services to the Catalan Health Institute, public companies, mixed public and private consortia, and contracted providers of rehabilitation services. Some of these centers offer pulmonary rehabilitation programs, including, in some cases, home-based programs. A Rehabilitation Plan placed before the Parliament of Catalonia in June 2005 specifically included pulmonary rehabilitation in the portfolio of services offered by the Catalan Health Service to patients with chronic respiratory diseases,<sup>67</sup> and pulmonary rehabilitation has recently been put out to tender (as has happened with other physical rehabilitation programs). The Rehabilitation Plan distinguishes between respiratory physiotherapy and muscle training, describing specific indications and referral procedures for each. Referrals for pulmonary rehabilitation for both outpatients and home-based patients may come from the primary care level for the more frequent indications (COPD and bronchiectasis). Other conditions, such as cystic fibrosis and neuromuscular diseases, require referral from a specialist. Given the complexity of the initial assessment of patients who might need oxygen therapy or who may be receiving home mechanical ventilation, the referral for muscle training for both outpatients and home-based patients who fall into this category must come from certain designated hospitals.

## Remarks

Pulmonary rehabilitation reduces dyspnea, improves exercise tolerance, and certainly improves HRQL in patients with COPD and other respiratory diseases. These benefits are obtained irrespective of whether the rehabilitation program is conducted in a hospital setting (the most typical location) or in the patient's home. The evidence available in regard to the efficacy and benefits of pulmonary rehabilitation has inspired scientific and professional associations to recommend this treatment—particularly for patients with COPD.<sup>3,68-70</sup> The recent ATS/ERS consensus in fact recommends its prescription for all patients who need it.<sup>3</sup>

That said, however, studies conducted in a number of countries indicate that pulmonary rehabilitation is not being offered in all hospitals that have the capacity to develop such programs. Furthermore, the extent to which pulmonary rehabilitation is implemented in community environments is unknown, given the few studies available in this regard. The care deficit means that most patients who could benefit from pulmonary rehabilitation are unable to obtain access and that access is also marked by a geographic imbalance. In some advanced countries, such as the USA and the UK, public funding of pulmonary rehabilitation is still precarious. The reasons are probably to be found in the fact that the benefits of pulmonary rehabilitation are not well known—by either the health care professionals treating respiratory diseases or by governmental agencies. This lack of knowledge is a consequence of the fact that the evidence available to support the use of pulmonary rehabilitation is as yet fairly recent.

No studies have been conducted in Spain on the characteristics or regional availability of pulmonary rehabilitation programs or on the percentage of patients who receive this treatment.<sup>71</sup> We can suppose, however, that the situation in Spain is not likely to be very different from that in countries where such data is available. On this basis it can be assumed that there are significant differences—both between and within regions of Spain—in the provision of pulmonary rehabilitation, and that most potential candidates do not have access. In this regard, the recent Royal Decree establishing the services to be provided by the national health system and dictating the inclusion of respiratory physiotherapy in the primary care portfolio represents an important advance. Nonetheless, there remains some uncertainty as to the real scope of the service, given that respiratory physiotherapy is just one component. Furthermore, there is concern that respiratory physiotherapy will replace, or be performed instead of, genuine pulmonary rehabilitation, thereby limiting the potential benefits.

Consequently, in the interest of ensuring quality care while avoiding severe inequalities in terms of access to pulmonary rehabilitation, the systematic and beneficial development of pulmonary rehabilitation programs will require joint action by public bodies and scientific associations and the fostering of greater awareness among health professionals. It would be useful, for example, to raise awareness of pulmonary rehabilitation in pre- and

GÜELL ROUS MR ET AL. PULMONARY REHABILITATION AND RESPIRATORY PHYSIOTHERAPY:  
TIME TO PUSH AHEAD

post-graduate training programs for key groups of professionals (pulmonologists, rehabilitators, physiotherapists, family physicians, nurses, etc). It would be equally useful to map out the availability of pulmonary rehabilitation programs in Spain. Finally, the inclusion of pulmonary rehabilitation in health care planning and in specific autonomous community programs aimed at providing comprehensive treatment to patients with COPD and other respiratory diseases would also contribute to promoting the use of pulmonary rehabilitation. Along with measures to encourage people to quit smoking and to educate people in the proper use of medications, pulmonary rehabilitation is probably one of the interventions that would most contribute to improving the HRQL of patients with respiratory diseases. Given the substantial evidence already available in support of the usefulness of pulmonary rehabilitation, the way ahead is clear: for the good of patients with respiratory diseases and society in general, it is clearly time to push ahead with this promising addition to specialized respiratory care.

#### REFERENCES

- Intersociety Commission on Heart Disease. Pulmonary rehabilitation Study Group. Community resources for rehabilitation of patients with chronic obstructive pulmonary disease and cor pulmonale. *Circulation*. 1974;49 Suppl 1:A1-A20.
- Fishman AP. Pulmonary rehabilitation research. NIH workshop summary. *Am J Respir Crit Care Med*. 1994;149:825-33.
- Nice L, Donner CI, Wouters E, Zuwallack R, et al. American Thoracic Society/European Respiratory Society statement on pulmonary rehabilitation. *Am J Respir Crit Care Med*. 2006;173:1390-413.
- Güell R, de Lucas, P, editors. *Tratado de rehabilitación respiratoria*. Barcelona: Grupo Ars XXI; 2005.
- Real Decreto 1030/2006, de 15 de septiembre, por el que se establece la cartera de servicios comunes del Sistema Nacional de Salud y el procedimiento para su actualización. BOE n.º 222, de 16 de septiembre de 2006.
- Lacasse Y, Wong E, Guyatt GH, et al. Meta-analysis of respiratory rehabilitation in chronic obstructive pulmonary disease. *Lancet*. 1996;348:1115-9.
- ACCP/AACVPR Pulmonary Rehabilitation Guidelines Panel. Pulmonary rehabilitation. Joint ACCP/AACVPR Evidence-Based Guidelines. *Chest*. 2007;131:4S-51S.
- British Thoracic Society, Standards of Care Subcommittee on Pulmonary Rehabilitation. Pulmonary rehabilitation. *Thorax*. 2001;56:827-34.
- Lacasse Y, Brosseau L, Milne S, Martin S, Wong E, Guyatt GH, et al. *Cochrane Database of Systematic Reviews*. 2002;(3): CD003793.
- Foster S, Thomas HM III. Pulmonary rehabilitation in lung disease other than chronic obstructive pulmonary disease. *Am Rev Respir Dis*. 1990;141:601-4.
- Gallefoss F, Sigvald Bakke P, Kiaersgarard P. Quality of life assessment after patient education in a randomized controlled study on asthma and chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 1999;159:812-7.
- Toshima MC, Kaplan RM, Ries AL, et al. Experimental evaluation of rehabilitation in chronic obstructive pulmonary disease: short-term effects on exercise endurance and health status. *Health Psychol*. 1990;9:237-52.
- Ries AL, Kaplan RM, Limberg TM, et al. Effects of pulmonary rehabilitation on physiologic and psychosocial outcomes in patients with chronic obstructive pulmonary disease. *Ann Intern Med*. 1995;122:823-32.
- Mazucca SA. Does patient education in chronic disease have therapeutic value? *J Chron Dis*. 1982;35:521-9.
- Lacasse Y, Guyatt GH, Goldstein RS. The components of a respiratory rehabilitation program. A systematic overview. *Chest*. 1997;111:1077-88.
- Monninkhof E, van de Valk P, van der Palen J, van Herwaarden C, Partridge MR, Zielhuis G. Self-management education for patients with chronic obstructive pulmonary disease: a systematic review. *Thorax*. 2003;58:394-8.
- Atkins CJ, Timms RM, Reinsch S, et al. Behavioral exercise programs in the management of chronic obstructive pulmonary disease. *J Consult Clin Psychol*. 1984;52:591-603.
- Gosselink R. Controlled breathing and dyspnea in patients with chronic obstructive pulmonary disease (COPD). *J Rehabil Res Dev*. 2003;40:25-34.
- Casciari R, Fairshter RD, Harrison A, et al. Effects of breathing retraining in patients with chronic obstructive pulmonary disease. *Chest*. 1981;79:393-8.
- Guell R, Casan P, Belda J, et al. Long term effects of outpatient rehabilitation of COPD: a randomized trial. *Chest*. 2000;117:976-83.
- Light RW, Merrill EJ, Despars JA, et al. Prevalence of depression and anxiety in patients with COPD. Relationship to functional capacity. *Chest*. 1985;87:35-8.
- Renfroe KL. Effect of progressive relaxation on dyspnea and state anxiety in patients with chronic obstructive pulmonary disease. *Heart Lung*. 1988;17:408-13.
- Gift AG, Moore T, Soeken K. Relaxation to reduce dyspnea and anxiety in COPD patients. *Nurs Res*. 1992;41:242-6.
- Sassi-Dambrom DE, Eakin EG, Ries AL, et al. Treatment of dyspnea in COPD – a controlled clinical trial of dyspnea management strategies. *Chest*. 1995;107:724-59.
- Blake RB, Vandiver TA, Braum S, et al. A randomized controlled evaluation of psychosocial intervention in adults with chronic lung disease. *Fam Med*. 1990;22:365-70.
- Gornley JM, Carrieri-Kohlman V, Douglas MK, et al. Treadmill self-efficacy and walking performance in patients with COPD. *J Cardiopulm Rehabil*. 1993;13:424-31.
- Dekhuijzen PRN, Beek MML, Folgering HTM, et al. Psychological changes during pulmonary rehabilitation and target-flow inspiratory muscle training in COPD patients with a ventilatory limitation during exercise. *Int J Rehabil Res*. 1990;13:109-17.
- Garuti G, Cilione C, Dell'Orso D, et al. Impact of comprehensive pulmonary rehabilitation on anxiety and depression in hospitalized COPD patients. *Monaldi Arch Chest Dis*. 2003;59:56-61.
- Güell R, Resqueti V, Sengenis M, Morante F, Martorell B, Casan P, et al. Impact of pulmonary rehabilitation on psychosocial morbidity in patients with severe COPD. *Chest*. 2006;129:899-904.
- Maltais F, Leblanc P, Simard CI, et al. Skeletal muscle adaptation to endurance training in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 1996;154:442-7.
- Casaburi R, Patessio A, Ioli F, et al. Reductions in exercise lactic acidosis and ventilation as a result of exercise training in patients with obstructive lung disease. *Am Rev Respir Dis*. 1991;143:9-18.
- Maltais F, Leblanc P, Jobin J, et al. Intensity of training and physiologic adaptation in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 1997;155:555-61.
- Normandin EA, McCusker C, Connors M, Vale F, Gerardi D, ZuWallack R. An evaluation of two approaches to exercise conditioning in pulmonary rehabilitation. *Chest*. 2002;121:1085-91.
- Martínez FJ, Vogel PD, Dupont DN, Stanopoulos I, Gray A, Beamis JF. Supported arm exercise vs unsupported arm exercise in the rehabilitation of patients with severe chronic airflow obstruction. *Chest*. 1993;103:1397-402.
- Smith K, Cook D, Guyatt GH. Respiratory muscle training in chronic airflow limitation: a meta-analysis. *Am Rev Respir Dis*. 1992;145:533-9.
- Lötters F, van Tol B, Kwakkel G, Gosselink R. Effects of controlled inspiratory muscle training in patients with COPD: a metaanalysis. *Eur Respir J*. 2002;20:570-6.
- Geddes EL, Reid WD, Crowe J, et al. Inspiratory muscle training in adults with chronic obstructive pulmonary disease. A systematic review. *Respir Med*. 2005;99:1440-58.
- Weiner P, Magadle R, Beckerman M, Weiner M, Berar-Yanay N. Comparison of specific expiratory, inspiratory and combined muscle training programs in COPD. *Chest*. 2003;124:1357-64.
- Ramírez-Sarmiento A, Orozco-Levi M, Güell R, Barreiro E, Hernández N, Mota S, et al. Inspiratory muscle training in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 2002;166:1491-7.

GÜELL ROUS MR ET AL. PULMONARY REHABILITATION AND RESPIRATORY PHYSIOTHERAPY:  
TIME TO PUSH AHEAD

40. Weiner P, Azgad Y, Ganam R. Inspiratory muscle training combined with general exercise reconditioning in patients with COPD. *Chest*. 1992;102:1351-6.
41. Troosters T, Gosselink R, Decramer M. Short and long-term effects of outpatient rehabilitation in patients with chronic obstructive pulmonary disease: a randomized trial. *Am J Med*. 2000;109:207-12.
42. Grosbois JM, Lamblin C, Lemaire B, et al. Long-term benefits of exercise maintenance after outpatient rehabilitation program in patients with chronic obstructive pulmonary disease. *J Cardiopulm Rehabil*. 1999;19:216-25.
43. Finnerty JP, Keeping I, Bullough I, Jones J. The effectiveness of outpatient pulmonary rehabilitation in chronic lung disease. *Chest*. 2001;119:1705-10.
44. Mall RW, Medeiros M. Objective evaluation of results of a pulmonary rehabilitation program in a community hospital. *Chest*. 1988;94:1156-60.
45. Foglio K, Bianchi L, Ambrosino N. Is it really useful to repeat outpatient pulmonary rehabilitation programs in patients with chronic airway obstruction? A 2 year controlled study. *Chest*. 2001;119:1696-704.
46. Singh SJ, Smith DL, Hyland ME, et al. A short outpatient pulmonary rehabilitation programme: immediate and longer-term effects on exercise performance and quality of life. *Respir Med*. 1998; 92:1146-54.
47. Wijkstra PJ, Ten Vergert EM, van Altena R, et al. Long term benefits of rehabilitation at home on quality of life and exercise tolerance in patients with chronic obstructive pulmonary disease. *Thorax*. 1995;50:824-8.
48. Cambach W, Chadwick-Straver RVM, Wagenaar RC, et al. The effects of a community-based pulmonary rehabilitation programme on exercise tolerance and quality of life: a randomized controlled trial. *Eur Respir J*. 1997;10:104-13.
49. Strijbos JH, Postma DS, van Altena R, et al. A comparison between an outpatient hospital-based pulmonary rehabilitation program and a home-care pulmonary rehabilitation program in patients with COPD. A follow-up of 18 months. *Chest*. 1996;109:366-72.
50. Debigare R, Maltais F, Whittom F, et al. Feasibility and efficacy of home exercise training before lung volumen reduction. *J Cardiopulm Rehabil*. 1999;19:235-41.
51. Puente Maestu L, Sanz ML, Sanz P, et al. Comparison of effects of supervised versus self-monitored training programmes in patients with chronic obstructive pulmonary disease. *Eur Respir J*. 2000; 15:517-25.
52. Hernández MT, Rubio TM, Ruiz FO, et al. Results of a home-based training program for patients with COPD. *Chest*. 2000;118: 106-14.
53. Güell R, De Lucas P, Gladis JB, Montemayor T, Rodríguez González-Moro JM, Gorostiza A, et al. Home vs. hospital-based rehabilitation in COPD patients. A multicenter randomised trial.
54. Güell R, Casan P, Belda J, et al. Effects of maintenance techniques on the results of pulmonary rehabilitation programme for COPD patients. *Eur Respir J*. 1997;10:394S.
55. British Lung Foundation and British Thoracic Society. Pulmonary rehabilitation Survey. 2002. [Cited 11 Dec 2007]. Available from: [http://www.lunguk.org/NR/rdonlyres/0D6900FC-FA53-4594-8C51-8351DA04A1D1/0/BLF\\_pul\\_rehab\\_survey.pdf](http://www.lunguk.org/NR/rdonlyres/0D6900FC-FA53-4594-8C51-8351DA04A1D1/0/BLF_pul_rehab_survey.pdf).
56. Yohannes AM, Connolly MJ. Pulmonary rehabilitation programmes in the UK: a national representative survey. *Clin Rehabil*. 2004;18:444-9.
57. Luff. To ask the Secretary of State for Health which primary care trusts employ community pulmonary rehabilitation nurses. London (UK): House of Commons Hansard Written Answers for 8 April 2003. [Cited 11 Dec 2007]. Available from: <http://www.publications.parliament.uk/pa/cm200203/cmhansrd/vo030408/text/30408w30.htm>.
58. Brooks D, Sottana R, Bell B, Hanna M, Laframboise L, Selvanayarajah S, et al. Characterization of pulmonary rehabilitation programs in Canada in 2005. *Can Respir J*. 2007;14:87-92.
59. Ensure That Pulmonary Rehabilitation Will Be Provided to Medicare Beneficiaries. American Association for Respiratory Care [Internet]. Irving (TX) American Association for Respiratory Care; [2006]. [Cited 11 Dec 2007]. Available from: [http://www.aarc.org/advocacy/federal/pulmo\\_rehab\\_alert.asp](http://www.aarc.org/advocacy/federal/pulmo_rehab_alert.asp).
60. Pulmonary and Cardiac Rehabilitation Act of 2005 (S.329.IS). The Library of Congress [Cited 24 Oct 2006]. Available from: <http://thomas.loc.gov/cgi-bin/query/z?c109:S.1440.IS>
61. Classification commune des actes médicaux [Internet]. L'Assurance Maladie. [Cited 11 Dec 2007]. Available from: <http://www.ameli.fr/professionnels-de-sante/medecins/exercer-au-quotidien/codage/codage-actes-medicaux-c.c.a.m./consulter-la-c.c.a.m./c.c.a.m.-a-imprimer.php>.
62. Programme d'actions en faveur de la broncho-pneumopathie chronique obstructive (BPCO) 2005-2010. Ministère de la Santé et des Solidarités; Société de Pneumologie de Langue Française. [Cited 11 Dec 2007]. Available from: <http://www.splf.org/s/IMG/pdf/plan-BPCOfinalise2.pdf>.
63. Decreto del Ministero della Salute del 22 luglio 1996, che elenca le prestazioni di specialistica ambulatoriali erogabili, compresa la diagnostica strumentale e di laboratorio, con le relative tariffe in euro. Allegato 1.
64. Rapporto "Riabilitazione 2003". Dipartimento della Qualità. Direzione Generale del Sistema Informativo. Ministero della Salute. [Cited 11 Dec 2007]. Available from: [http://www.ministerosalute.it/imgs/C\\_17\\_pubblicazioni\\_456\\_allegato.pdf](http://www.ministerosalute.it/imgs/C_17_pubblicazioni_456_allegato.pdf).
65. Decreto 137/2002, de 30 de abril, de apoyo a las familias andaluzas. BOJA n.o 52, de 4 de mayo de 2002.
66. Rehabilitación y fisioterapia en Atención Primaria. Guía de procedimientos. Sevilla: Servicio Andaluz de Salud; 2003.
67. Pla de Rehabilitació a Catalunya. Diari de Sessions del Parlament de Catalunya, sèrie C, n.o 218, de 14 junio de 2005.
68. O'Donnell DE, Aaron S, Bourbeau J, Hernández P, Marciniuk D, Balter M, et al. Canadian Thoracic Society recommendations for the management of chronic obstructive pulmonary disease. *Can Respir J*. 2004;11:7B-59B.
69. American Thoracic Society. Pulmonary rehabilitation: 1999. *Am J Respir Crit Care Med*. 1999;159:1666-87.
70. Grupo de Trabajo de la Sociedad Española de Neumología y Cirugía Torácica. Guía clínica para el diagnóstico y el tratamiento de la enfermedad pulmonar obstructiva crónica. *Arch Bronconeumol*. 2001;37:297-316.
71. Sarmiento V, Tirado M, Villegas R, Márquez S, Briones E. Rehabilitación respiratoria: aproximación a la situación en España. *Rehabilitación (Madr)*. 2005;39:128-33.