

# **Pulmonary Rehabilitation**

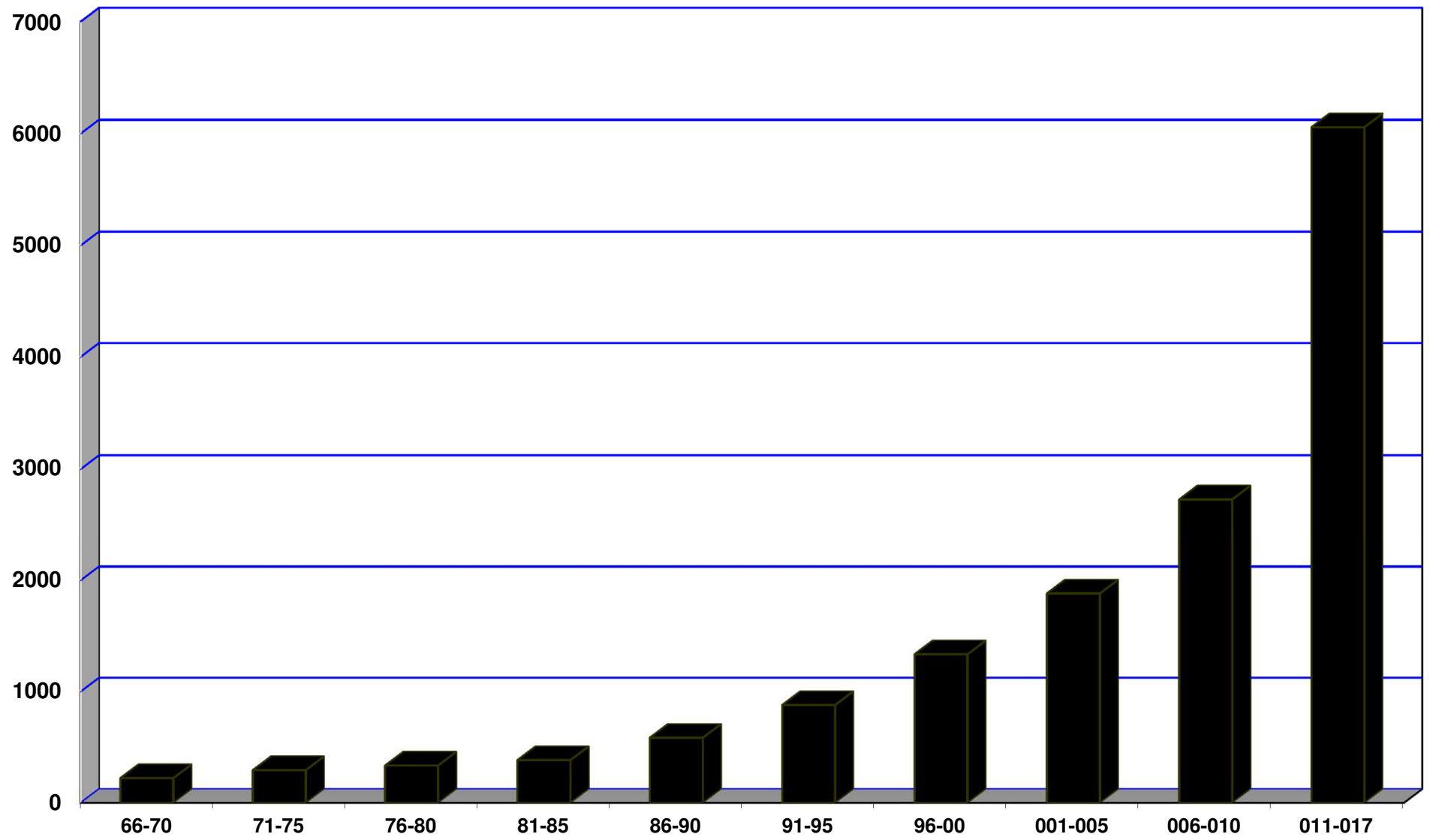
**Nicolino Ambrosino FERS**

**ERS Programme Director**

**[nico.ambrosino@gmail.com](mailto:nico.ambrosino@gmail.com)**

# Conflict of interest disclosure

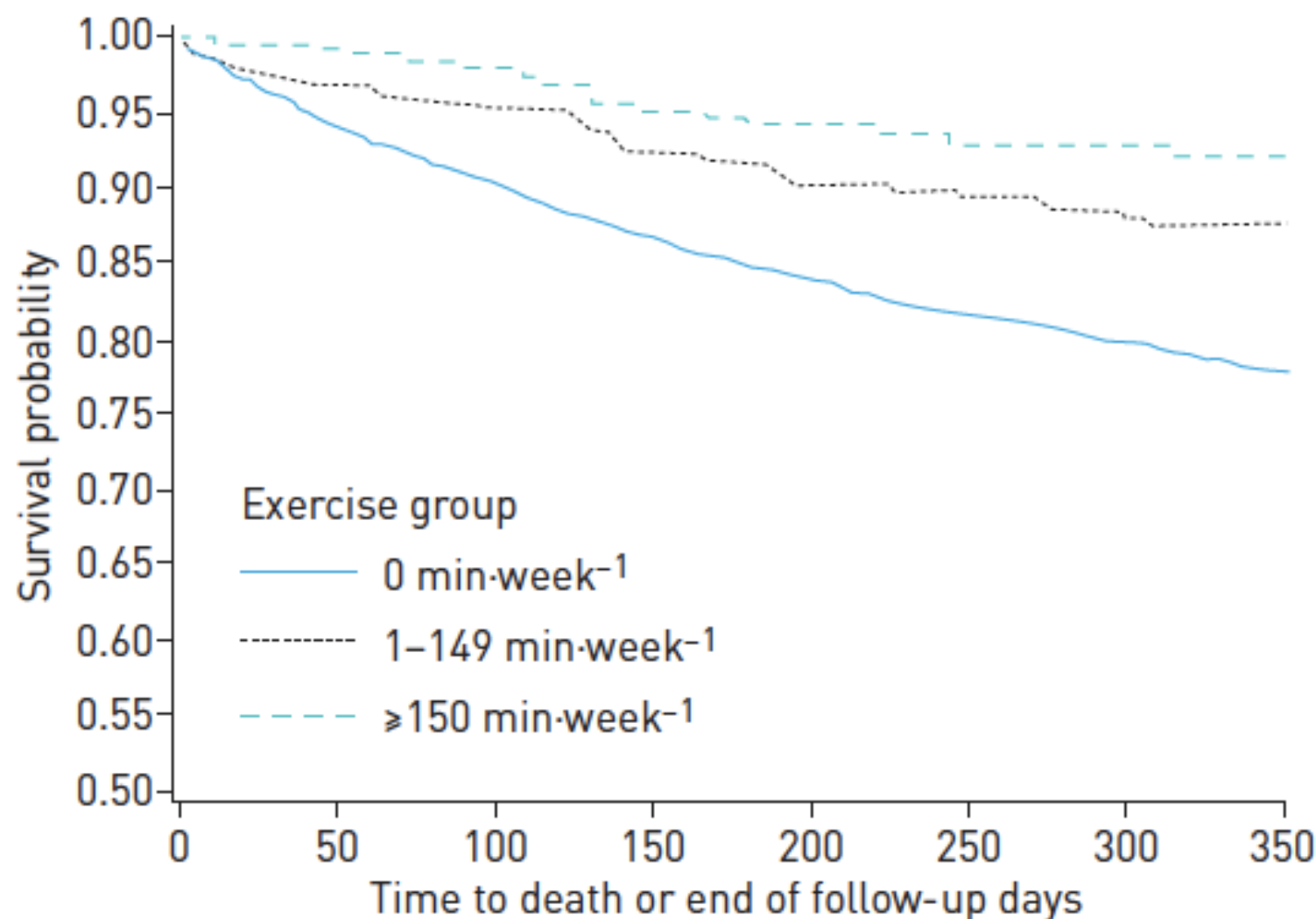
- ☒ I have no, real or perceived, direct or indirect conflicts of interest that relate to this presentation.



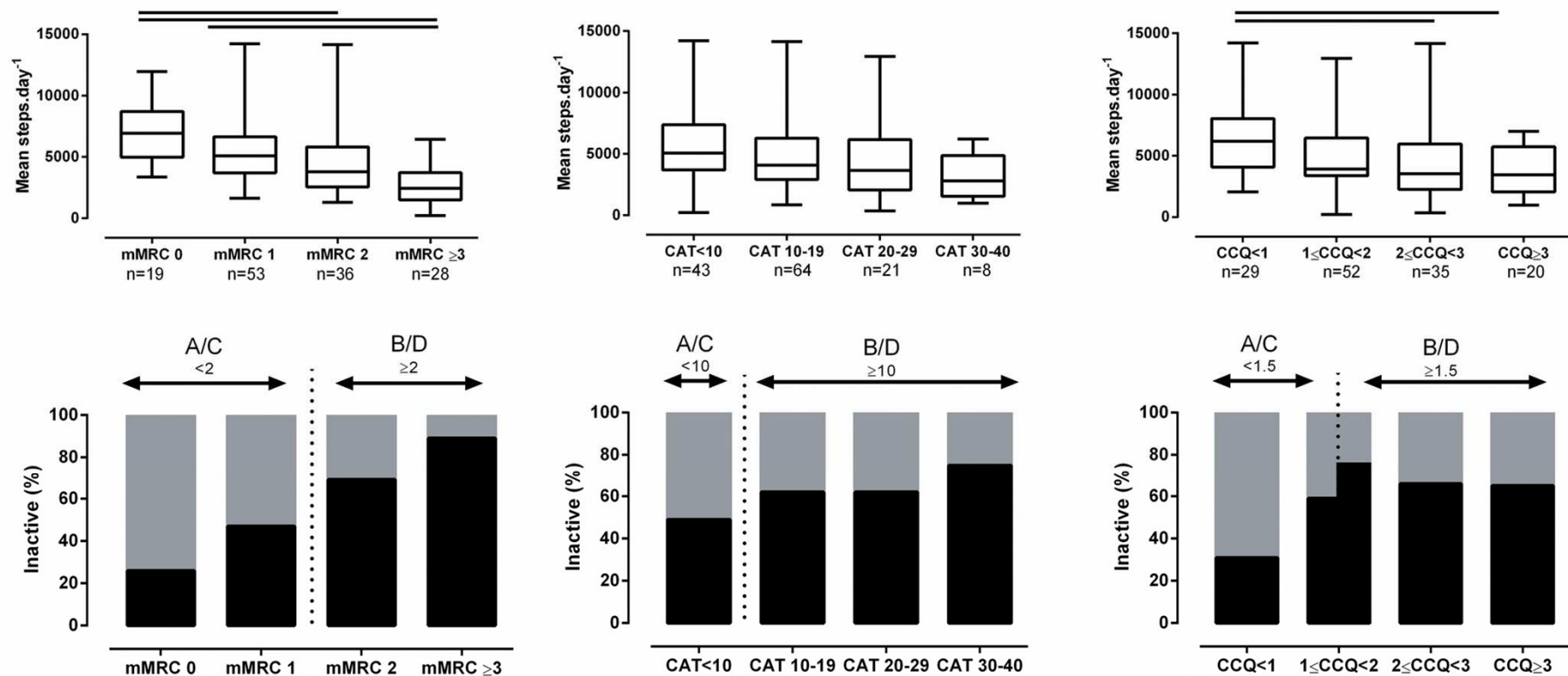
# Physical activity assessed in routine care predicts mortality after a COPD hospitalisation

ERJ Open Res 2016; 2: 00062-2015

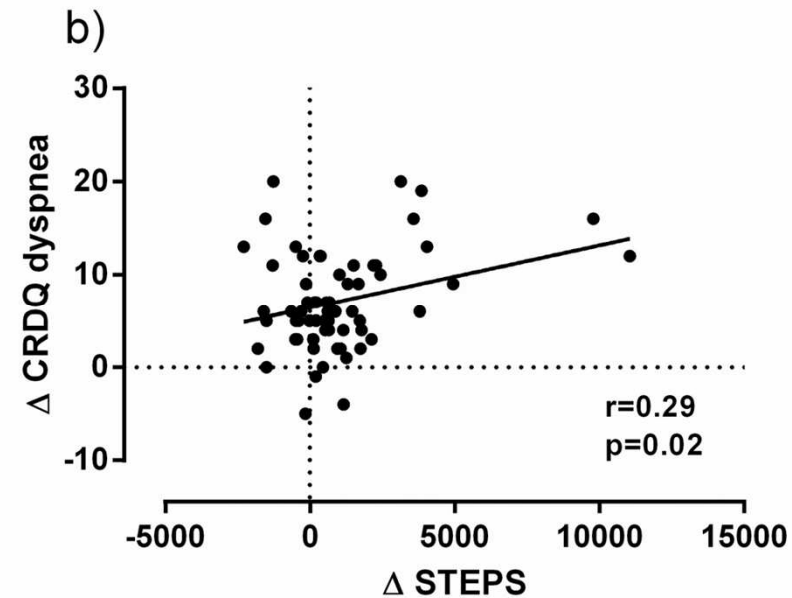
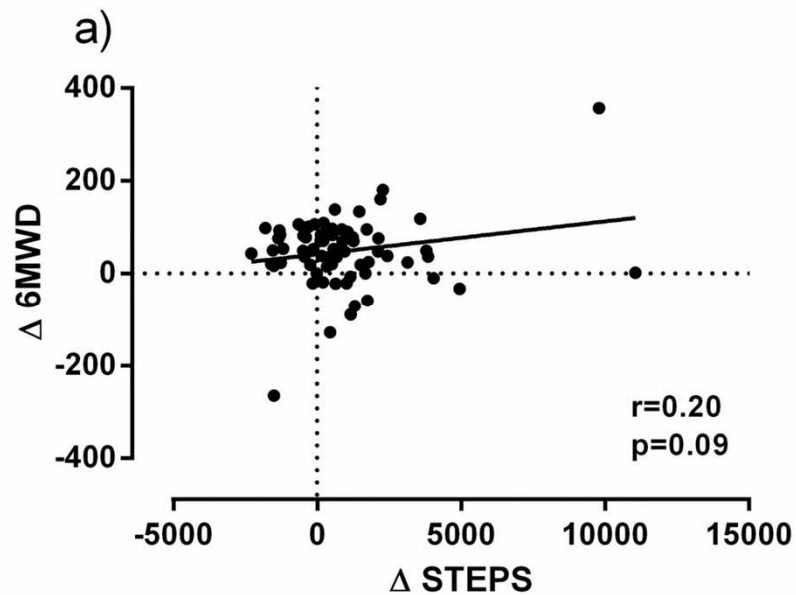
Marilyn L. Moy<sup>1</sup>, Michael K. Gould<sup>2</sup>, In-Lu Amy Liu<sup>2</sup>, Janet S. Lee<sup>2</sup> and  
Huong Q. Nguyen<sup>2</sup>



Citation: Demeyer H, Gimeno-Santos E, Rabinovich RA, Hornikx M, Louvaris Z, de Boer WJ, et al. (2016) Physical Activity Characteristics across GOLD Quadrants Depend on the Questionnaire Used. PLoS ONE 11(3): e0151255. doi:10.1371/journal.pone.0151255



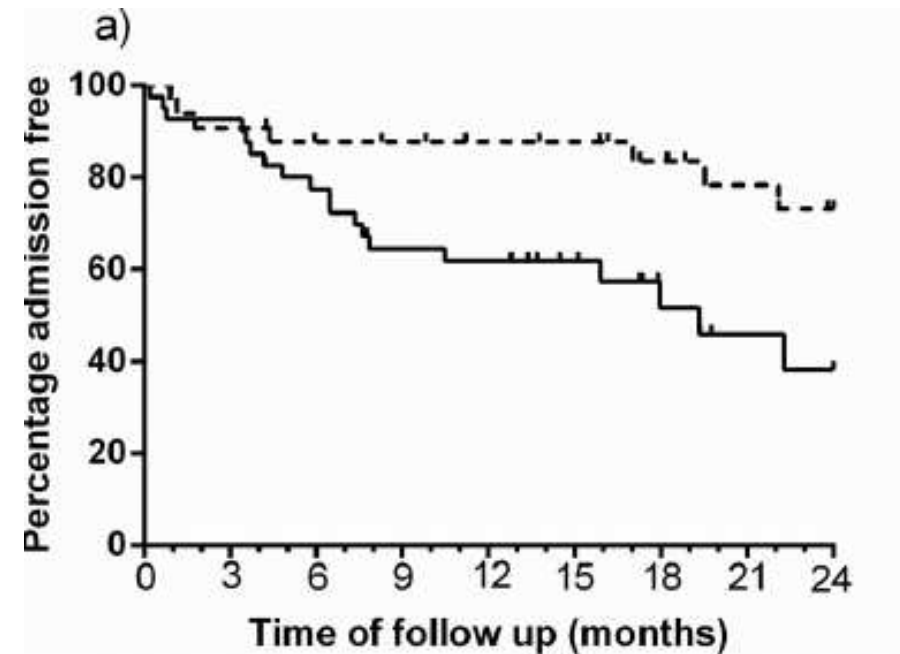
The MID after pulmonary rehabilitation lies between 600 and 1100 steps.day<sup>-1</sup>.



### The Minimal Important Difference in Physical Activity in Patients with COPD

Heleen Demeyer<sup>1,2,3</sup>, Chris Burtin<sup>1,4</sup>, Miek Hornikx<sup>1,5</sup>, Carlos Augusto Camillo<sup>1,2</sup>, Hans Van Remoortel<sup>1,2,6</sup>, Daniel Langer<sup>1,2</sup>, Wim Janssens<sup>2</sup>, Thierry Troosters<sup>1,2\*</sup>

PLoS One. 2016 Apr 28;11(4):e0154587



# American Thoracic Society Documents

An Official American Thoracic Society/ European Respiratory Society Statement: Key Concepts and Advances in Pulmonary Rehabilitation

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Am J Respir Crit Care Med Vol 188, Iss. 8, pp e13–e64, Oct 15, 2013

Based on our current insights, the ATS and the ERS have adopted the following new

definition of pulmonary rehabilitation: *“Pulmonary rehabilitation is a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies, which include, but are not limited to, exercise training, education and behavior change, designed to improve the physical and emotional condition of people with chronic respiratory disease and to promote the long-term adherence of health-enhancing behaviors.”*

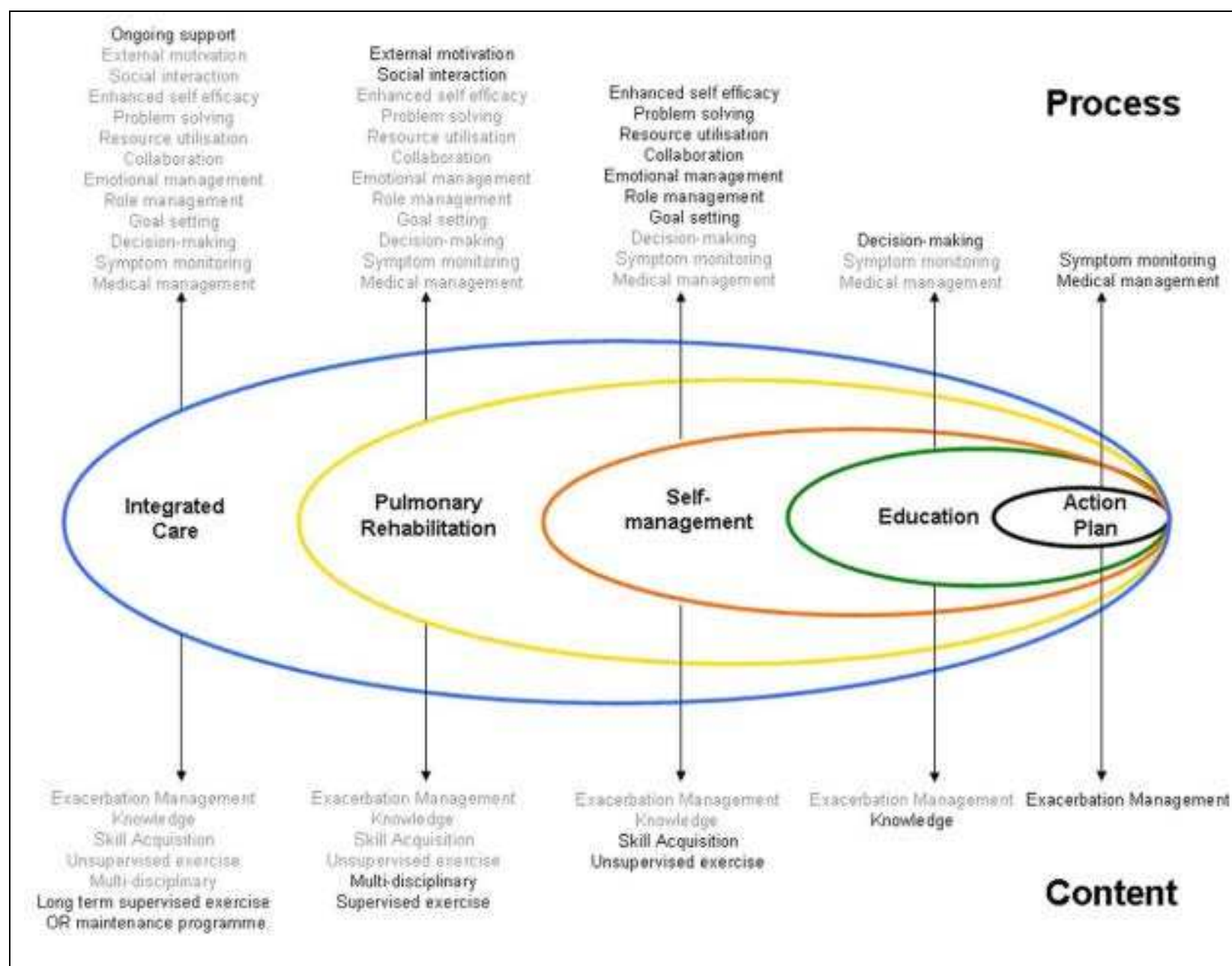
**Citation:** McCarthy B, Casey D, Devane D, Murphy K, Murphy E, Lacasse Y. Pulmonary rehabilitation for chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews* 2015, Issue 2. Art. No.: CD003793. DOI: 10.1002/14651858.CD003793.pub3.

### **Authors' conclusions**

Pulmonary rehabilitation relieves dyspnoea and fatigue, improves emotional function and enhances the sense of control that individuals have over their condition. These improvements are moderately large and clinically significant. Rehabilitation serves as an important component of the management of COPD and is beneficial in improving health-related quality of life and exercise capacity. It is our opinion that additional RCTs comparing pulmonary rehabilitation and conventional care in COPD are not warranted. Future research studies should focus on identifying which components of pulmonary rehabilitation are essential, its ideal length and location, the degree of supervision and intensity of training required and how long treatment effects persist. This endeavour is important in the light of the new subgroup analysis, which showed a difference in treatment effect on the CRQ between hospital-based and community-based programmes but no difference between exercise only and more complex pulmonary rehabilitation programmes.



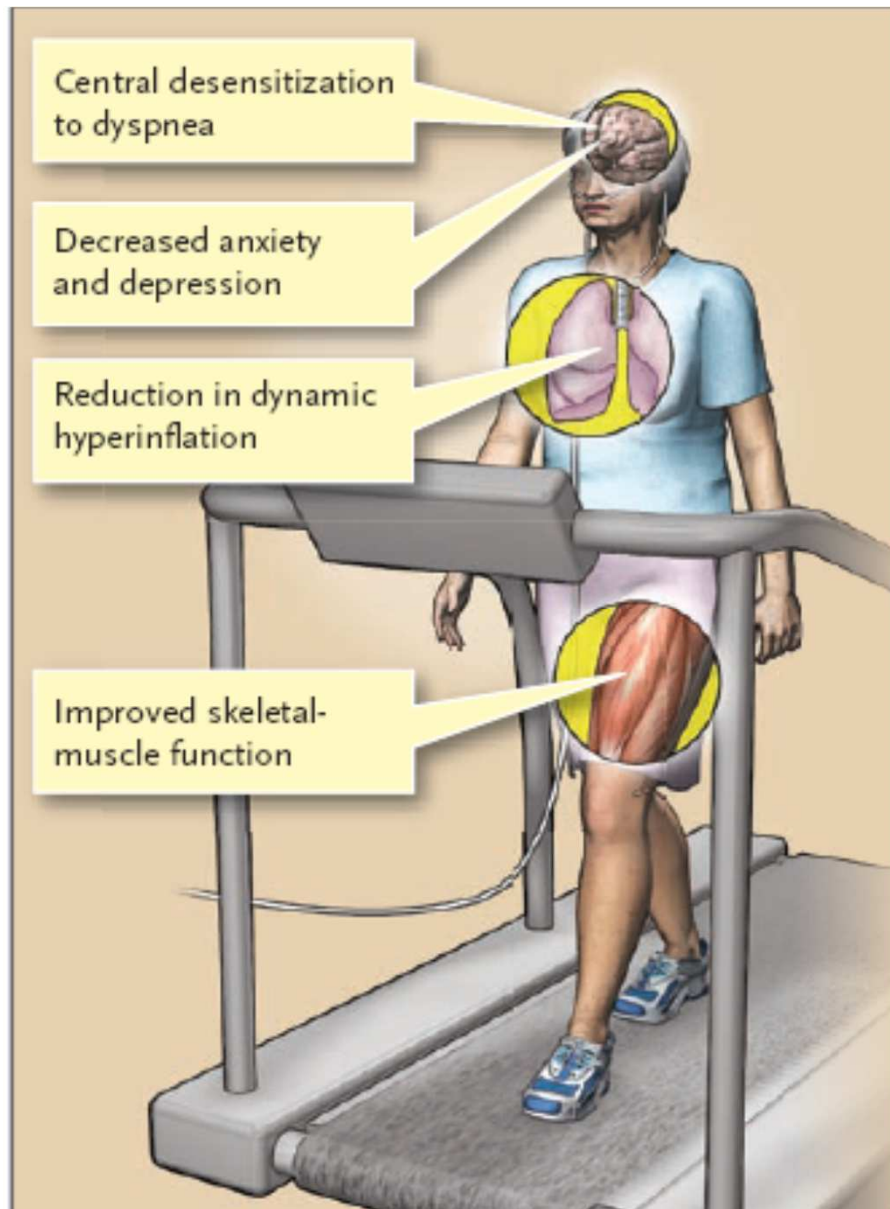
**Figure. A spectrum of support for chronic obstructive pulmonary disease**



**Table E7. Indications for individuals with chronic respiratory disease which commonly lead to referral to pulmonary rehabilitation**

- Dyspnea/fatigue and chronic respiratory symptoms
- Impaired health-related quality of life
- Decreased functional status
- Decreased occupational performance
- Difficulty performing activities of daily living
- Difficulty with the medical regimen
- Psychosocial problems attendant to the underlying respiratory illness
- Nutritional depletion
- Increased use of medical resources (e.g. frequent exacerbations, hospitalizations, emergency room visits, MD visits)
- Gas exchange abnormalities including hypoxemia

# Effects of exercise training in COPD



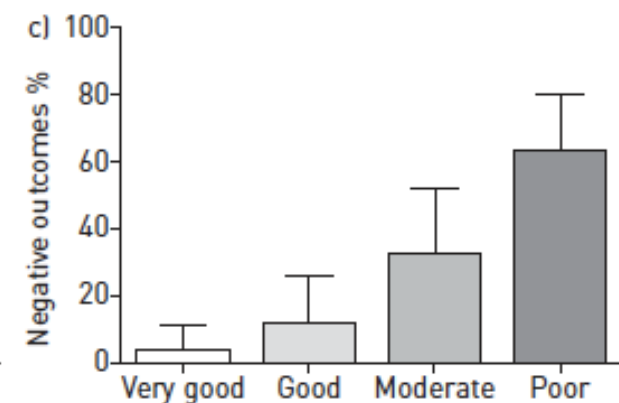
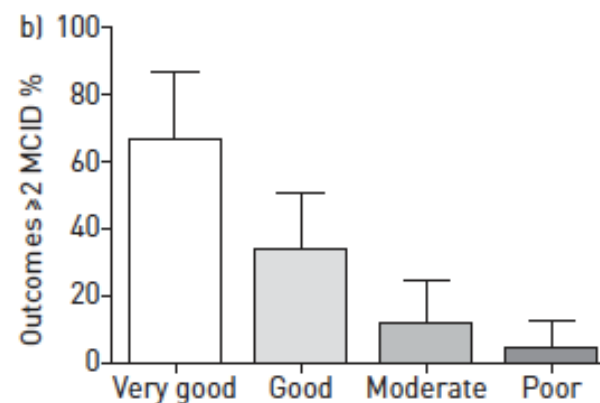
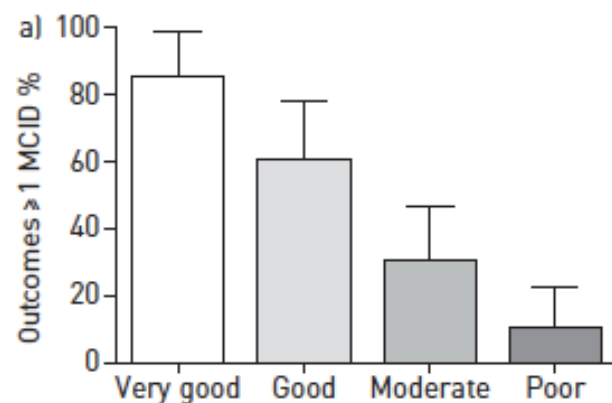
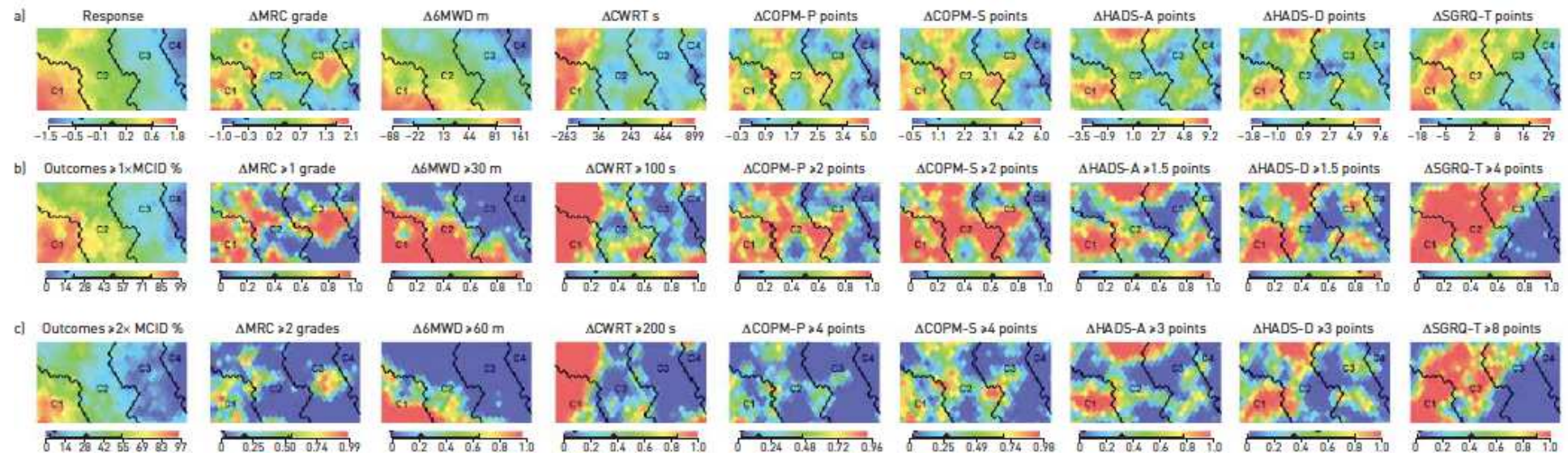
- ***Endurance***
- ***Strength***  
*(active or even passive i.e. NEMS)*

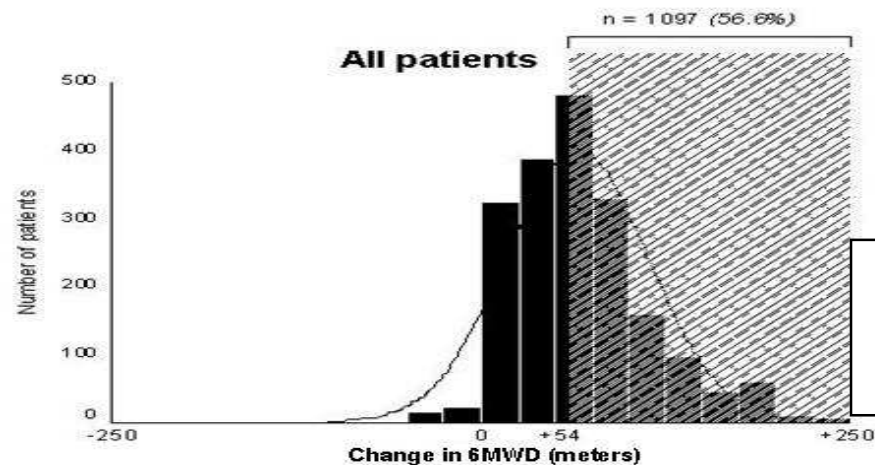




# Differential response to pulmonary rehabilitation in COPD: multidimensional profiling

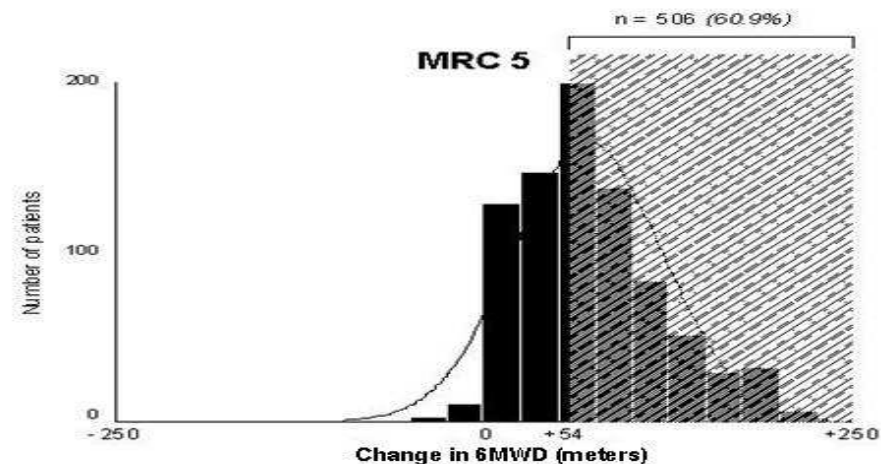
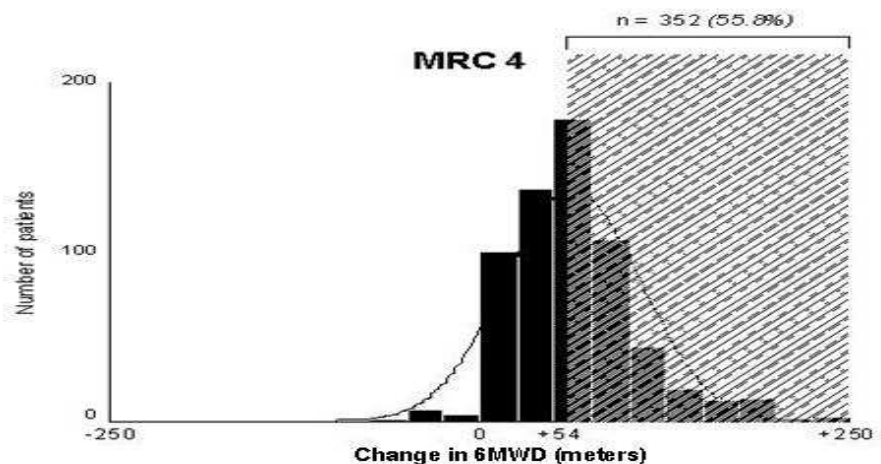
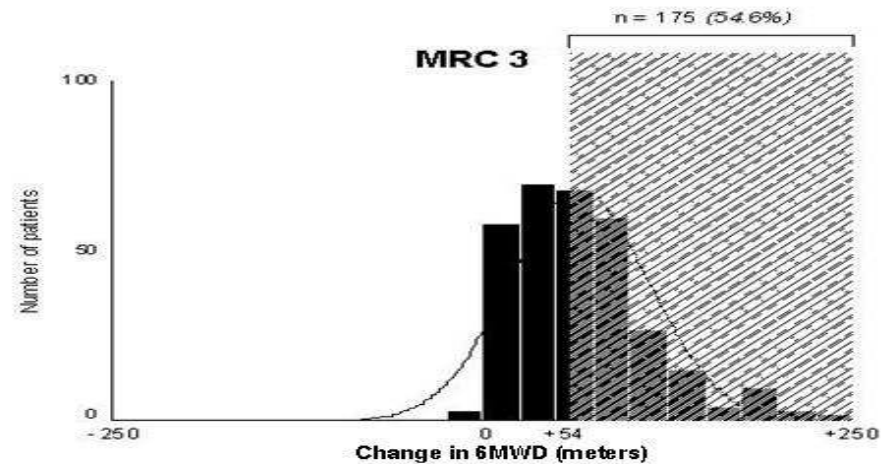
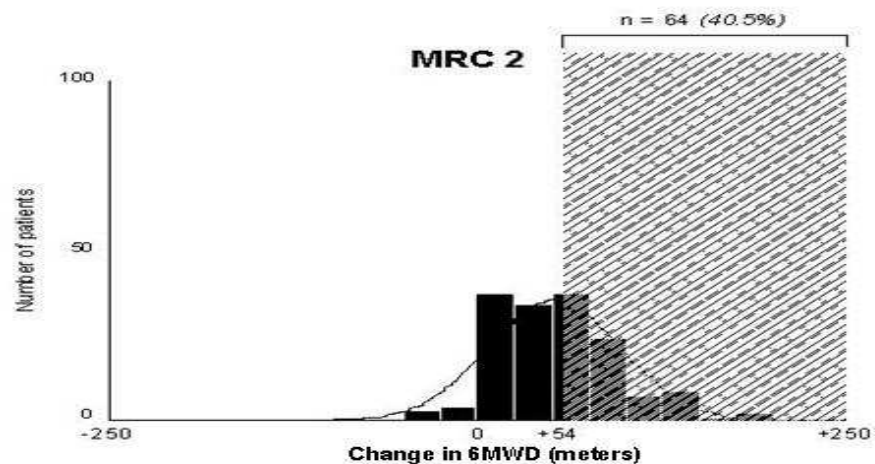
Eur Respir J 2015; 46: 1625–1635





**1938 AECOPD patients**

**Clini et al Respi Med 2009 103, 1526-1531**



# A Prospective Multicentric Study of Pulmonary Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease and Different Clinical Phenotypes

Respiration 2015;89:141–147

Nicolino Ambrosino<sup>a</sup> Elena Venturelli<sup>b</sup> Francesco de Blasio<sup>c</sup>

Pierluigi Paggiaro<sup>d</sup> Franco Pasqua<sup>e</sup> Michele Vitacca<sup>f</sup> Guido Vaghegginia<sup>a</sup>

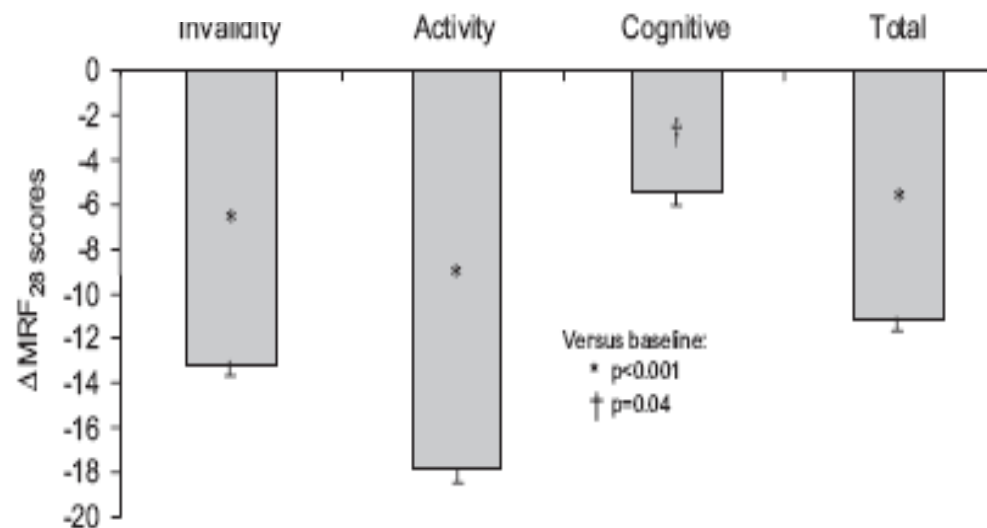
Enrico M. Clini<sup>b</sup>

**Results:** PRP resulted in significant improvements in all outcome measures without any significant differences between groups. **Conclusions:** Our study confirms that COPD patients may benefit from pulmonary rehabilitation independent of their clinical phenotype.

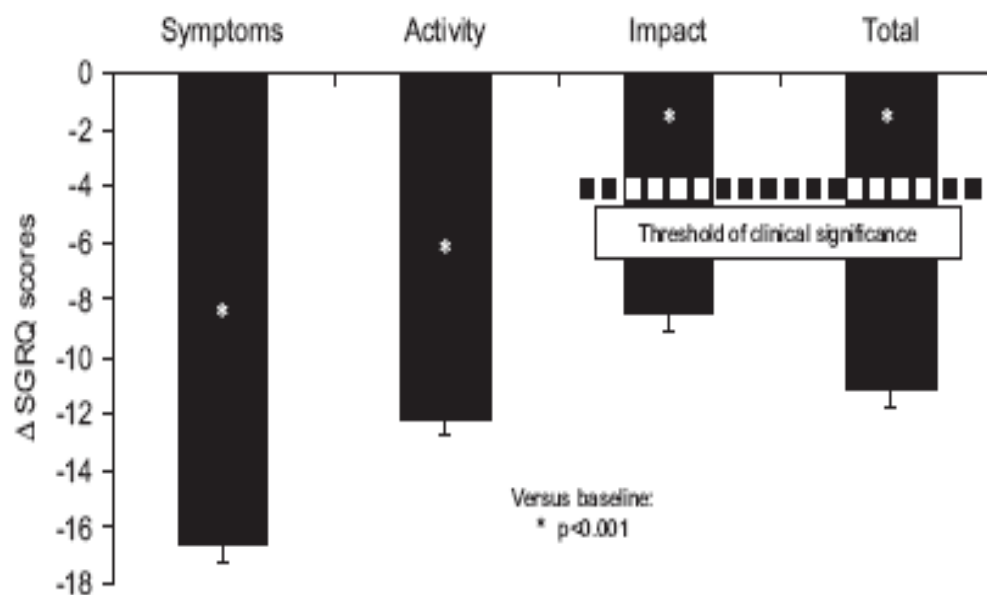


# Efficacy of pulmonary rehabilitation in chronic respiratory failure (CRF) due to chronic obstructive pulmonary disease (COPD): The Maugeri Study

M. Carone<sup>a,\*</sup>, A. Patessio<sup>a</sup>, N. Ambrosino<sup>b</sup>, P. Baiardi<sup>c</sup>, B. Balbi<sup>a</sup>,  
G. Balzano<sup>d</sup>, V. Cuomo<sup>e</sup>, C.F. Donner<sup>f</sup>, C. Fracchia<sup>g</sup>, S. Nava<sup>c</sup>,  
M. Neri<sup>h</sup>, E. Pozzi<sup>i</sup>, M. Vitacca<sup>j</sup>, A. Spanevello<sup>e</sup>



1 Improvement in MRF<sub>28</sub> scores (patients with CRF) (mean value ± SE) after PR programme.



Improvement in SGRQ scores (patients without CRF) (mean value ± SE) after PR programme.

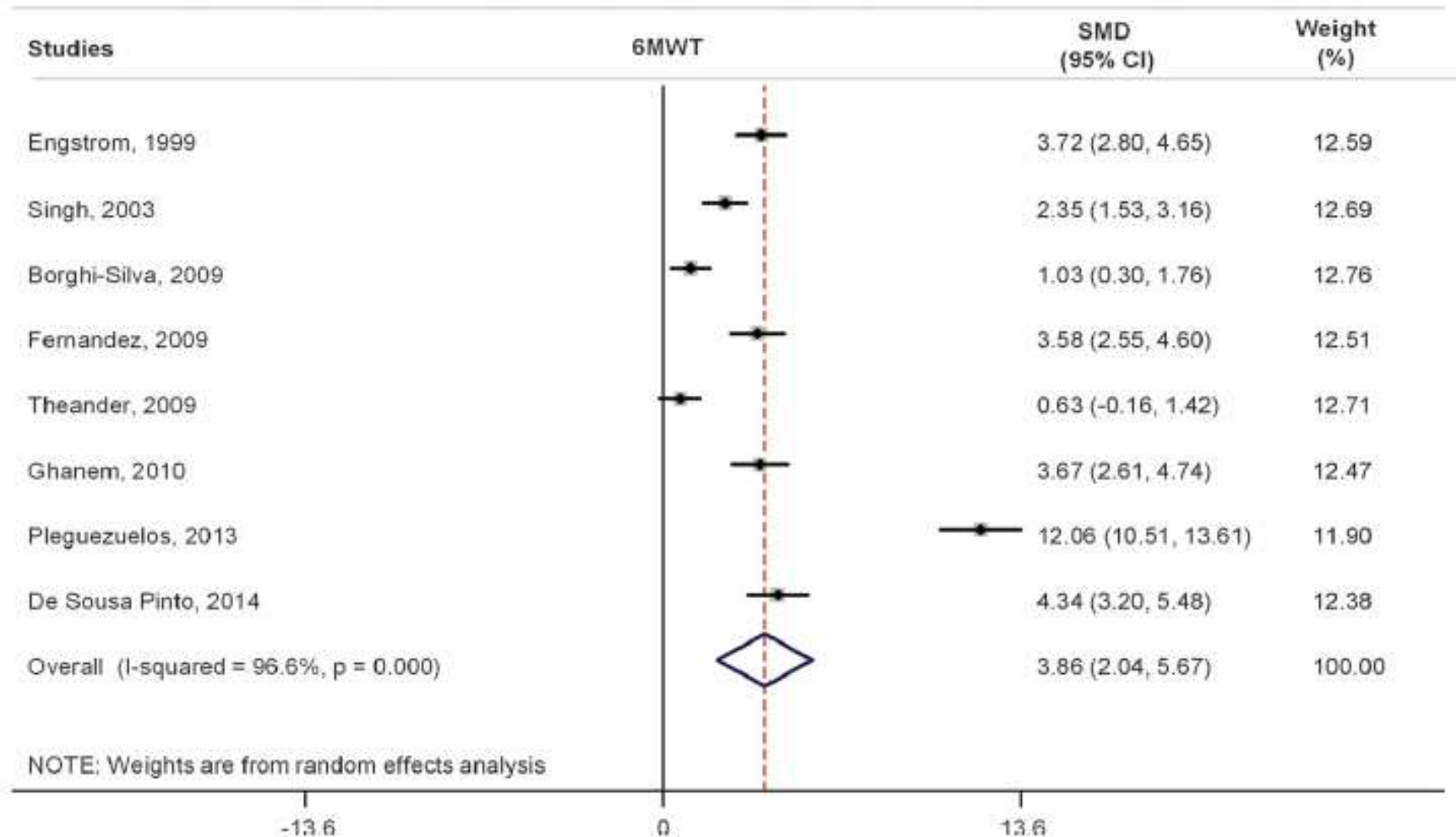


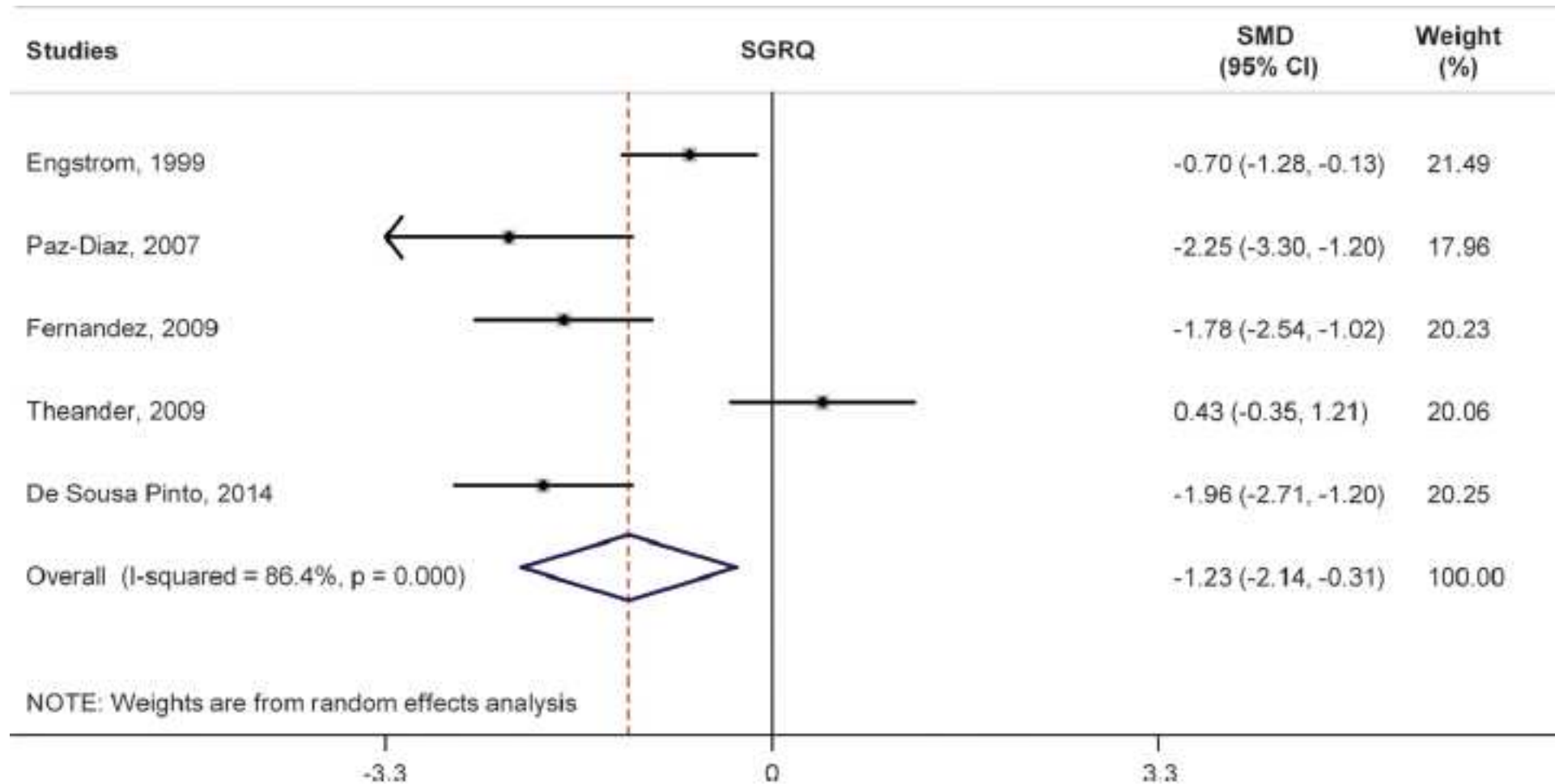
# Aerobic Exercise Training in Very Severe Chronic Obstructive Pulmonary Disease

Am J Phys Med Rehabil. 2017 Jan 17

## A Systematic Review and Meta-Analysis

Mara Paneroni, PT, MSc, Carla Simonelli, PT, Michele Vitacca, MD, FERS, and Nicolino Ambrosino, MD, FERS



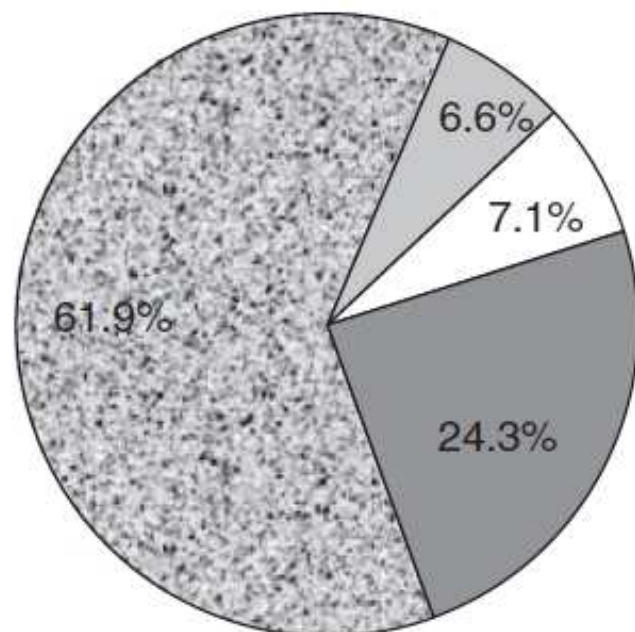


# Frequent coexistence of chronic heart failure and chronic obstructive pulmonary disease in respiratory and cardiac outpatients: Evidence from SUSPIRIUM, a multicentre Italian survey

Raffaele Griffo<sup>1</sup>, Antonio Spanevello<sup>2</sup>, Pier Luigi Temporelli<sup>3</sup>, Pompilio Faggiano<sup>4</sup>, Mauro Carone<sup>5</sup>, Giovanna Magni<sup>6</sup>, Nicolino Ambrosino<sup>7</sup> and Luigi Tavazzi<sup>8</sup>; on behalf of the SUSPIRIUM Investigators

Eur J Prev Cardiol. 2017 Apr;24(6):567-576

(a) Entry diagnosis

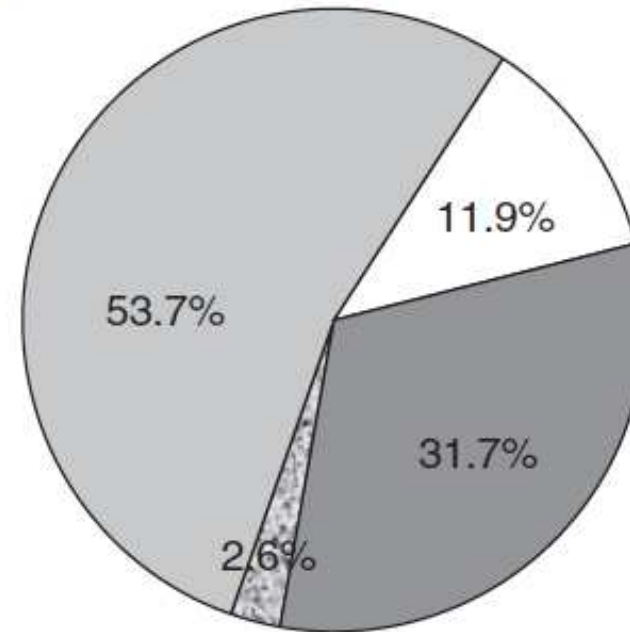


- CHF never investigated diagnostically
- CHF reported by patient but never diagnosed
- CHF previously confirmed by diagnosis
- CHF previously excluded by diagnosis

2017 Jan 1



(b) Final diagnosis



- CHF uncertain
- CHF excluded by clinical judgment
- CHF diagnosed
- CHF excluded by diagnosis

# A Prospective Multicentric Study of Pulmonary Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease and Different Clinical Phenotypes

Respiration 2015;89:141–147

Nicolino Ambrosino<sup>a</sup> Elena Venturelli<sup>b</sup> Francesco de Blasio<sup>c</sup>

Pierluigi Paggiaro<sup>d</sup> Franco Pasqua<sup>e</sup> Michele Vitacca<sup>f</sup> Guido Vaghegginia<sup>a</sup>

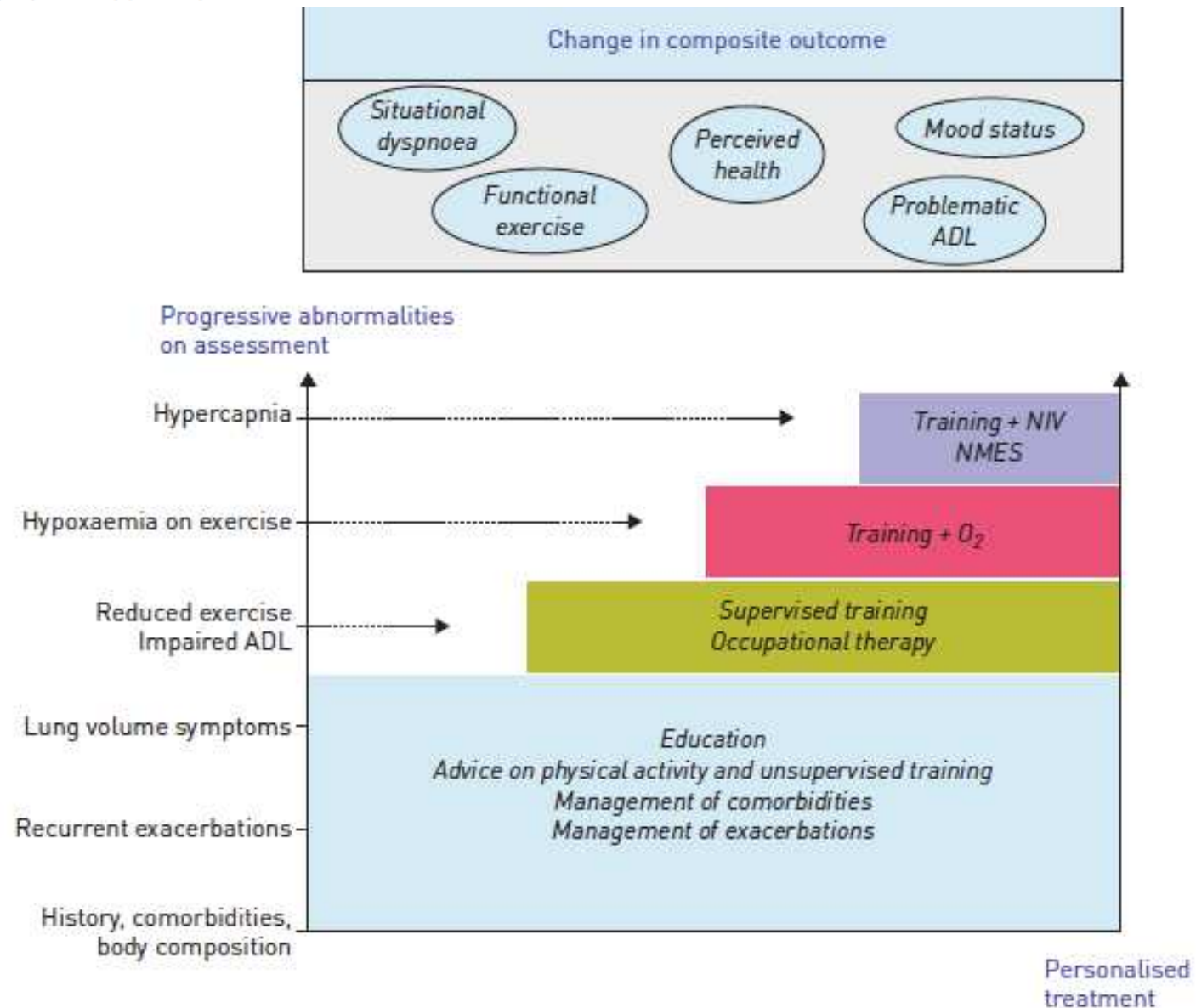
Enrico M. Clini<sup>b</sup>

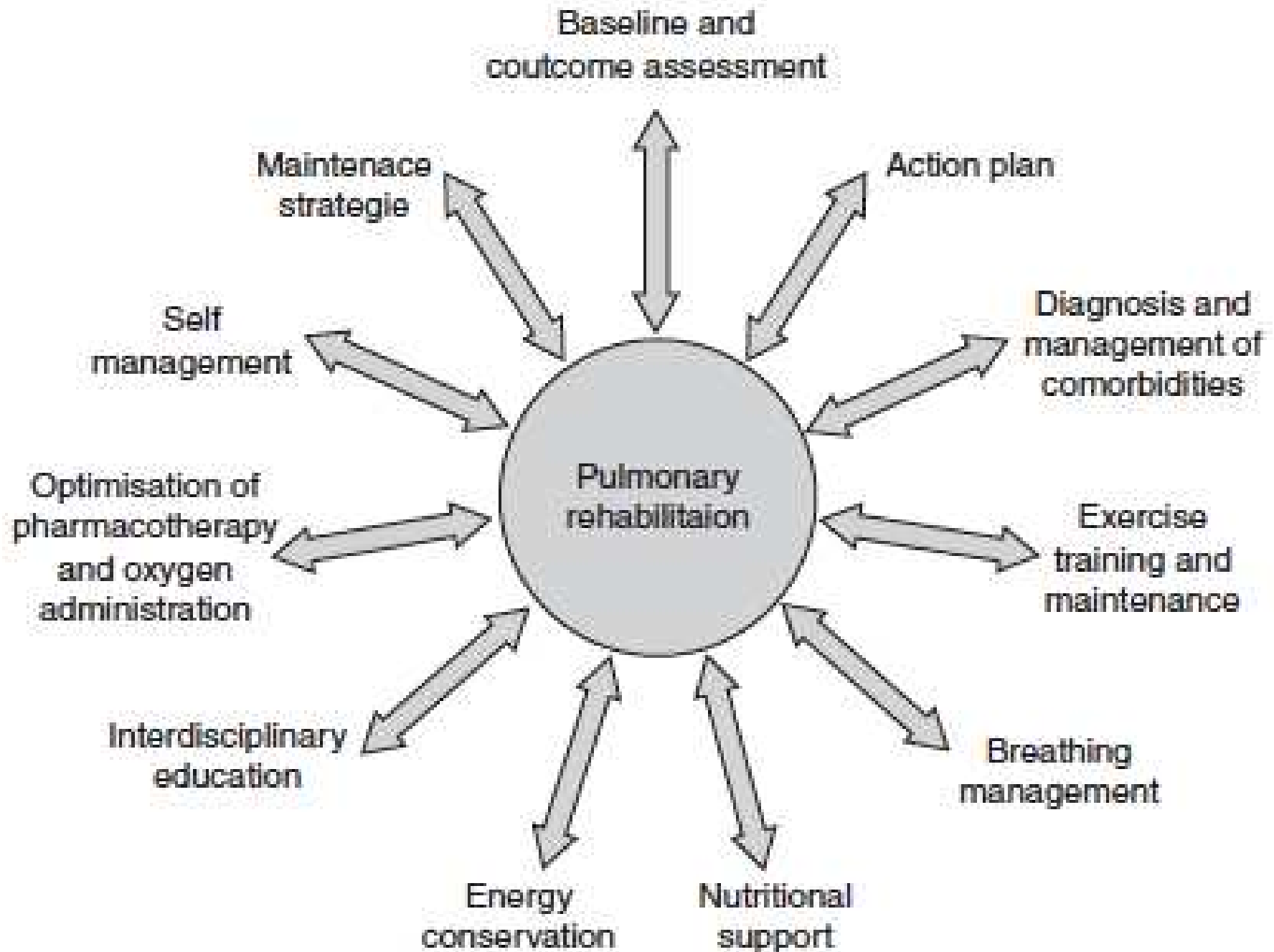
**Results:** PRP resulted in significant improvements in all outcome measures without any significant differences between groups. **Conclusions:** Our study confirms that COPD patients may benefit from pulmonary rehabilitation independent of their clinical phenotype.

# Response to pulmonary rehabilitation: toward personalised programmes?

Eur Respir J 2015; 46: 1538–1540

Nicolino Ambrosino<sup>1</sup> and Enrico M. Clini<sup>2</sup>

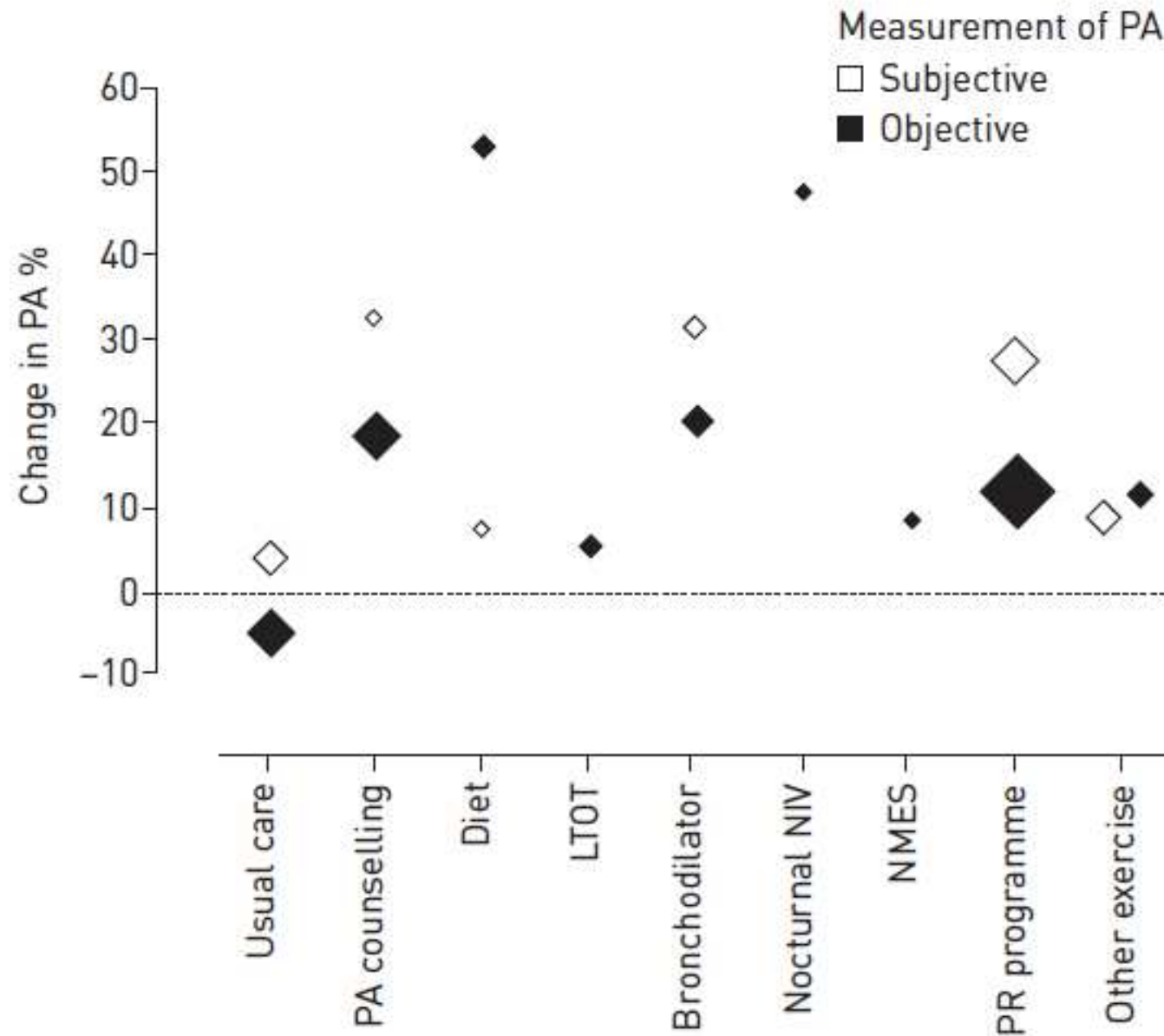






# Interventions to modify physical activity in patients with COPD: a systematic review

Eur Respir J 2016; 48: 69–81

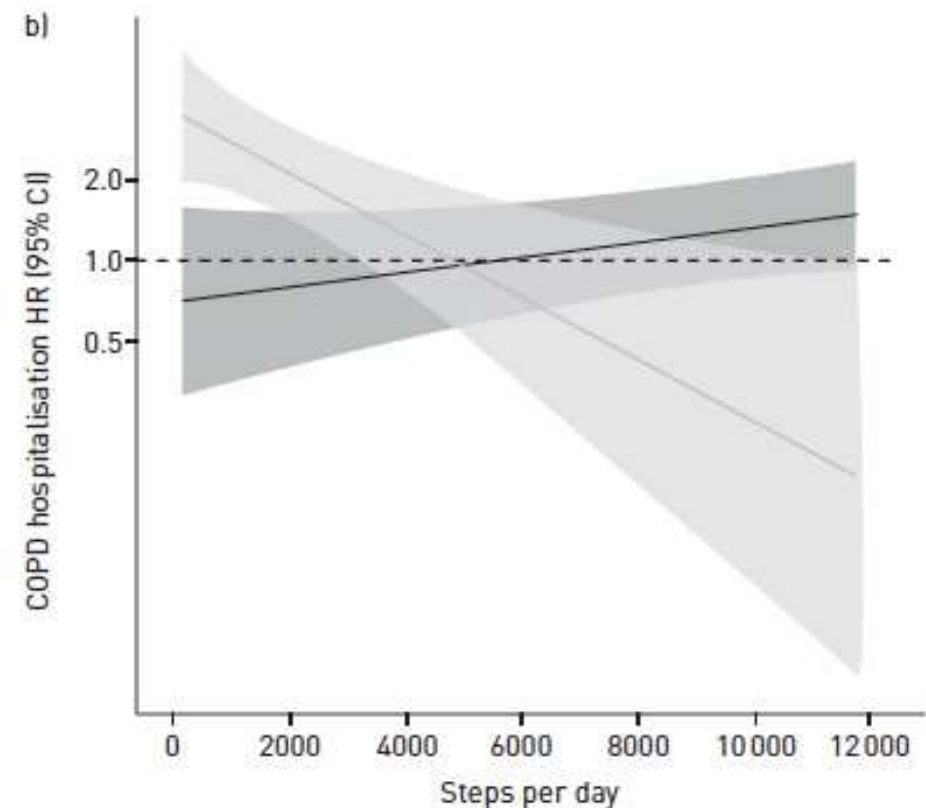
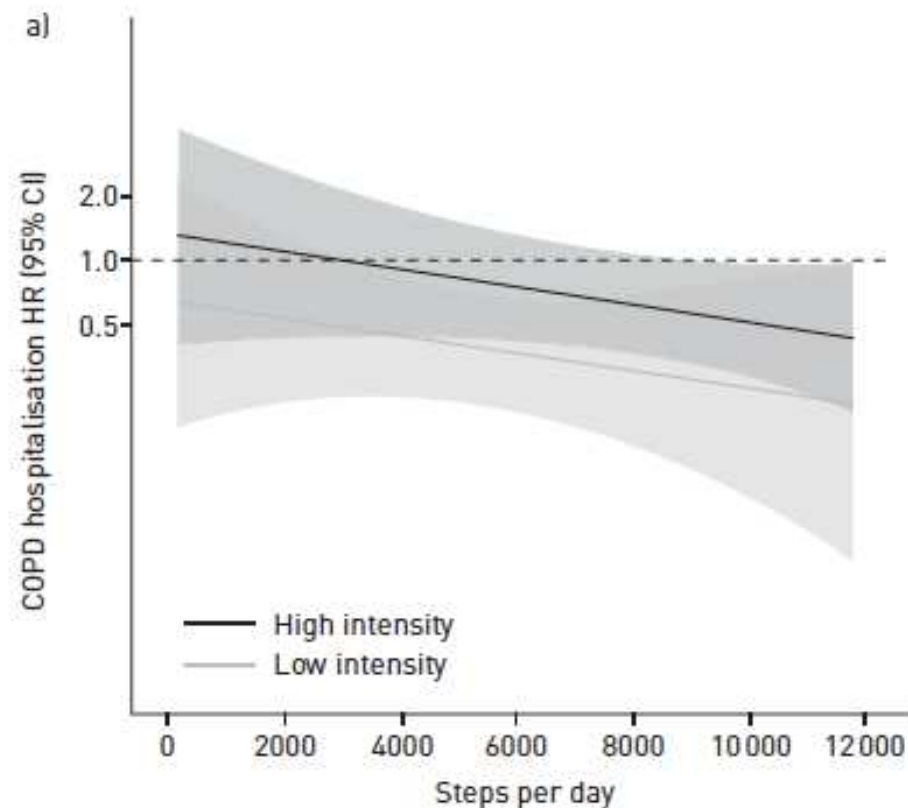


# Benefits of physical activity on COPD hospitalisation depend on intensity

David Donaire-Gonzalez

Eur Respir J 2015; 46: 1281-1289

The main finding of our study is that increased quantity of physical activity reduces the risk of future COPD hospitalisations when the average intensity of physical activity is low. The finding that high quantity of physical activity at high average intensity of physical activity may be unhelpful in COPD patients with





## Effects of Home-Based Pulmonary Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease

A Randomized Trial

*Ann Intern Med.* 2008;149:869-878.

### Context

Pulmonary rehabilitation programs improve outcomes, but access to outpatient, hospital-based programs is very limited.

### Contribution

In a 10-center, randomized, noninferiority trial in Canada, investigators randomly assigned 252 patients to home-based or outpatient, hospital-based exercise training for 8 weeks. At 1 year, the 2 interventions had reduced dyspnea by the same amount, as measured on the dyspnea subscale of the Chronic Respiratory Questionnaire. The difference between the programs in dyspnea at 1 year was statistically very unlikely to be clinically important.

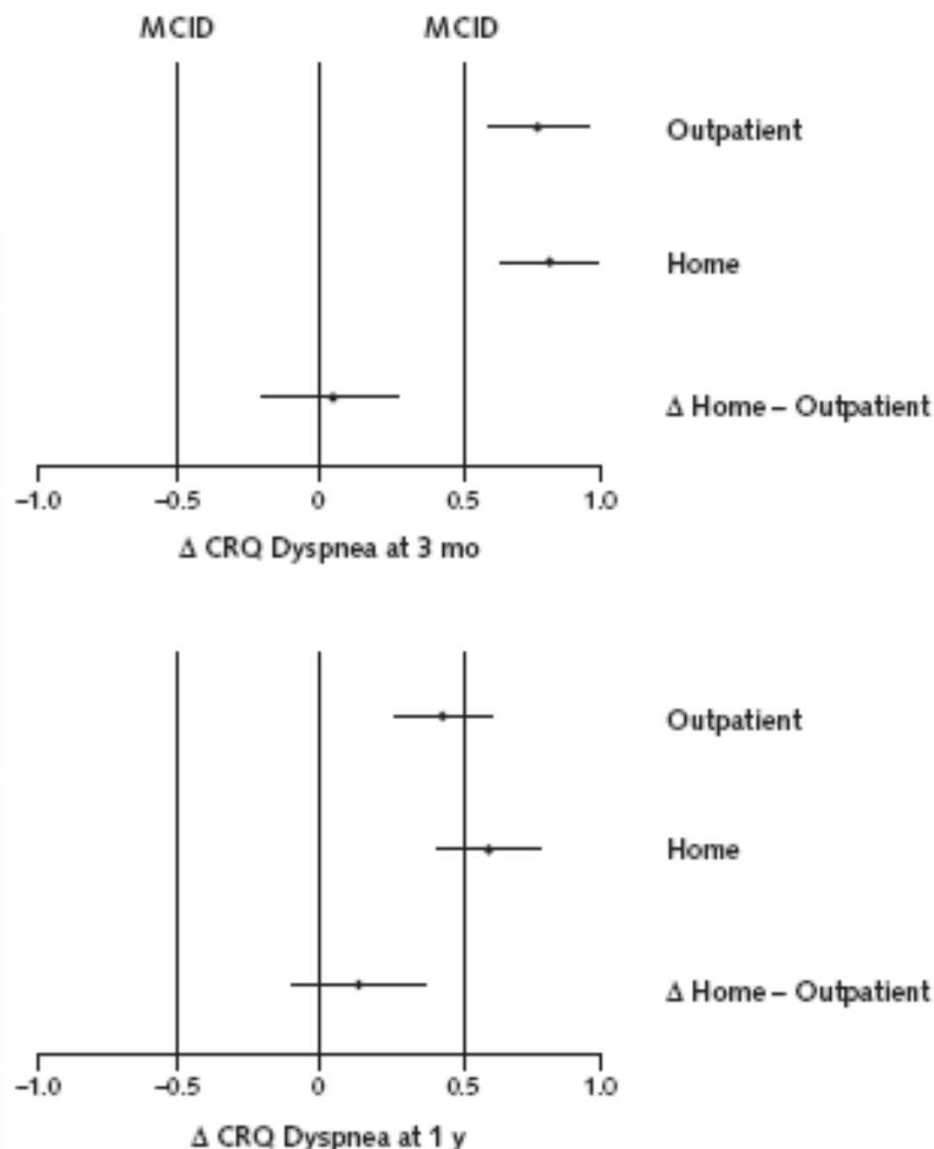
### Caution

The study was unblinded, and its primary outcome was self-reported.

### Implication

Home-based pulmonary rehabilitation is a reasonable alternative to hospital-based programs.

**Figure 2.** Changes in Chronic Respiratory Questionnaire (CRQ) dyspnea according to the study interventions at 3 months (*top*) and at 1 year (*bottom*).



# Home-based rehabilitation for COPD using minimal resources: a randomised, controlled equivalence trial

Anne E Holland,<sup>1,2,3</sup> Ajay Mahal,<sup>4</sup> Catherine J Hill,<sup>3,5</sup> Annemarie L Lee,<sup>1,2,3</sup>  
Angela T Burge,<sup>1,2,3</sup> Narelle S Cox,<sup>1,3</sup> Rosemary Moore,<sup>3</sup> Caroline Nicolson,<sup>1,2</sup>  
Paul O'Halloran,<sup>6</sup> Aroub Lahham,<sup>1,3</sup> Rebecca Gillies,<sup>1,5</sup> Christine F McDonald<sup>3,7,8</sup>

Thorax. 2017 Jan;72(1):57-65

## What is the bottom line?

- This home-based pulmonary rehabilitation model resulted in short-term improvements in functional exercise capacity and health-related quality of life (HRQoL) that were at least equivalent to conventional centre-based training, and HRQoL outcomes were equivalent at 12 months following programme completion.

Editorial

# The Need to Change our View on Pulmonary Rehabilitation

Ambrosino N FERS<sup>1\*</sup>, Malkhabah DN<sup>2</sup> and Sutanto YS<sup>2</sup>

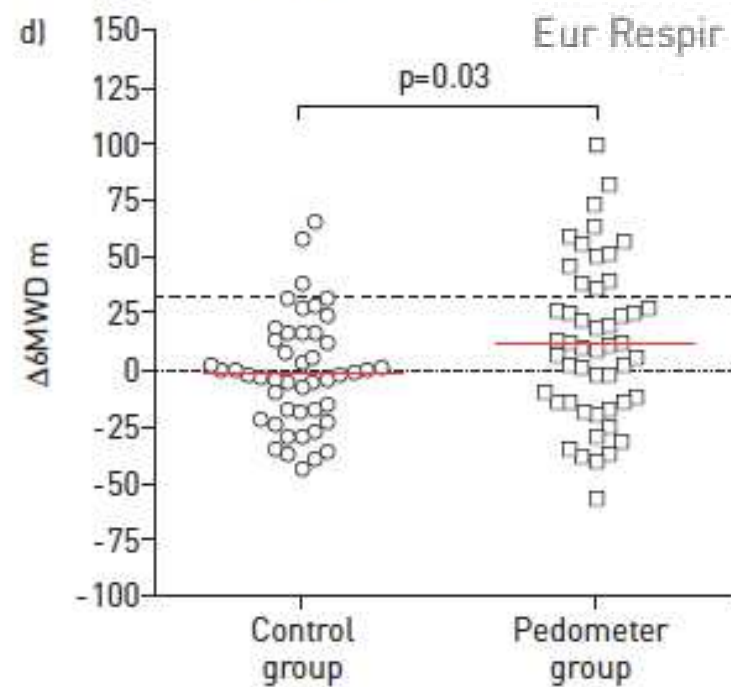
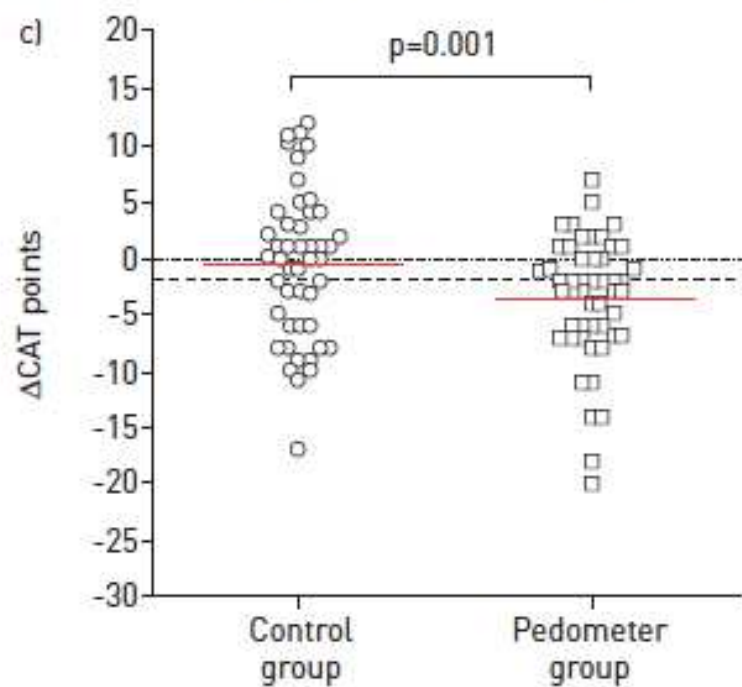
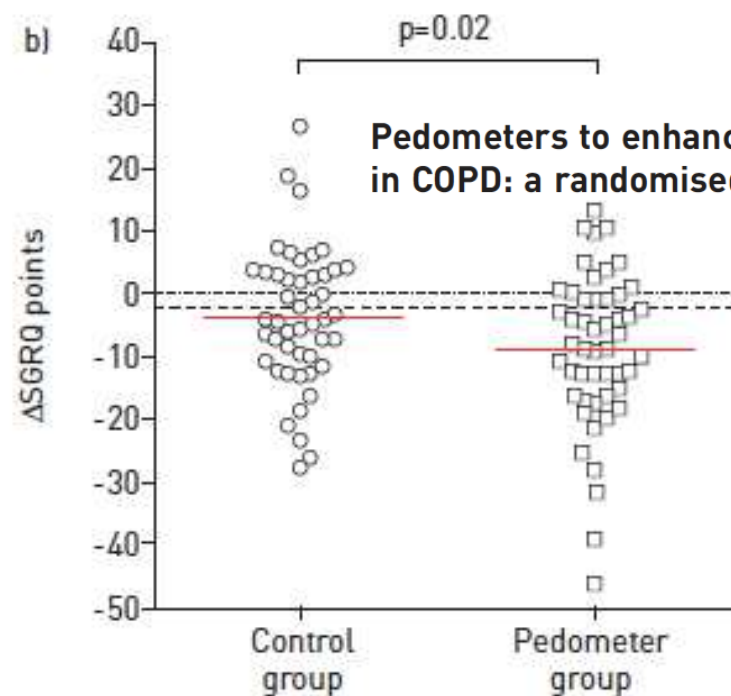
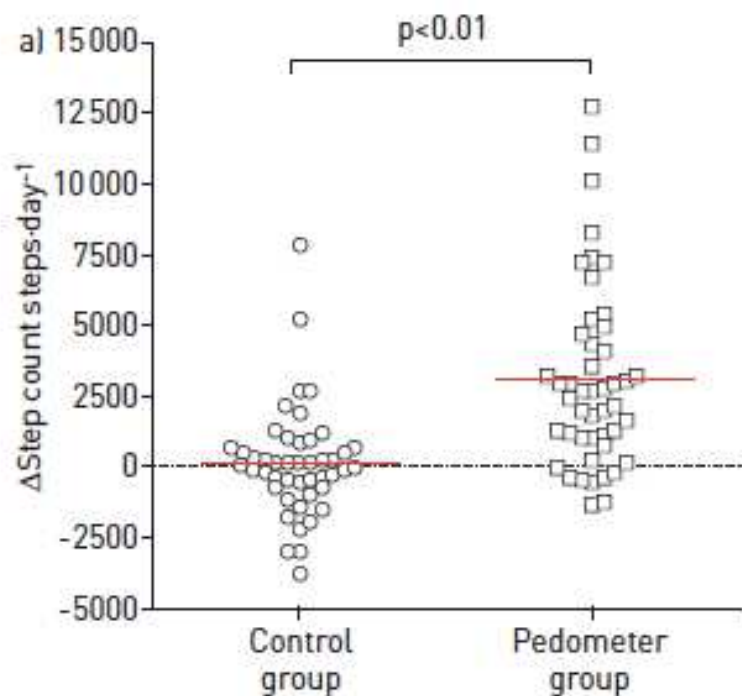
<sup>1</sup>Clinical and Research Departments, Auxilium Vitae, Volterra, Italy

<sup>2</sup>Pulmonary Department, Medical Faculty Sebelas Maret University, Solo, Indonesia

1. A more global approach to the patient, leaving the “disease-centered” toward a new “patient-centered paradigm of care” [5]. This task requires a cultural revolution and an effort to improve and increase personal knowledge. In other words we have to face a greater effort to keep into account the evolving pathologies which lead to a patient with multimorbidities requiring different

4. Use of technology. Recent development of tools, like non-invasive ventilation-aided exercise training and neuromuscular electrical stimulation, may allow sequential levels of intervention [9,10].

5. All these challenging task may find help by the use of new technologies and tele-rehabilitation programs [11]. Tele-



Eur Respir J 2015; 45: 347-354

# **Tele-monitoring of ventilator-dependent patients: a European Respiratory Society Statement**

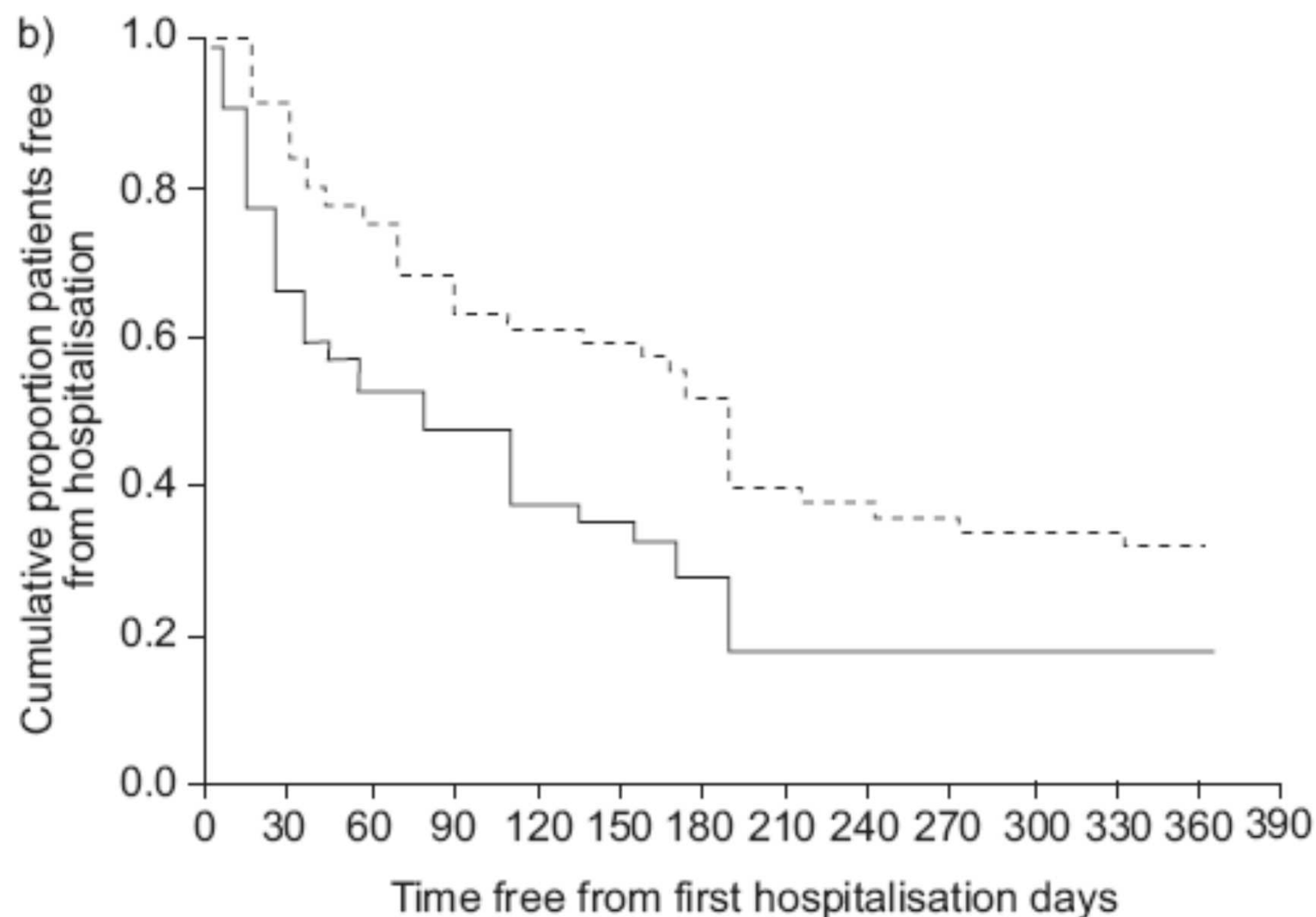
Nicolino Ambrosino<sup>1</sup>, Michele Vitacca<sup>2</sup>, Michael Dreher<sup>3</sup>, Valentina Isetta<sup>4,5</sup>, Josep M. Montserrat<sup>6,5</sup>, Thomy Tonia<sup>7</sup>, Giuseppe Turchetti<sup>8</sup>, Joao Carlos Winck<sup>9</sup>, Felip Burgos<sup>10</sup>, Michael Kampelmacher<sup>11</sup> and Guido Vagheggini<sup>1</sup> on behalf of the ERS Tele-Monitoring of Ventilator-Dependent Patients Task Force

Eur Respir J 2016; 48: 648–663

# Tele-assistance in chronic respiratory failure patients: a randomised clinical trial

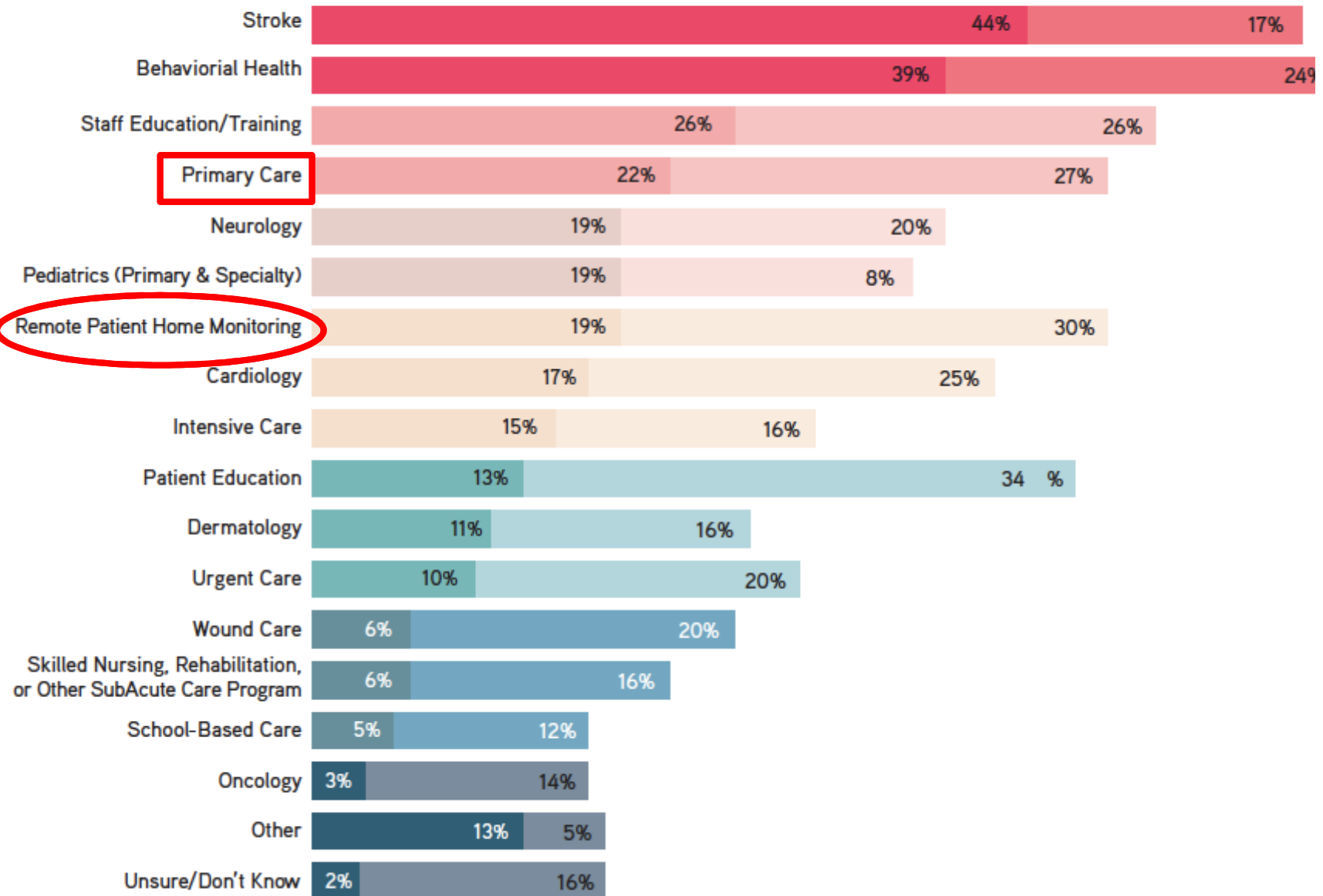
Eur Respir J 2009; 33: 411–418

M. Vitacca\*, L. Bianchi\*, A. Guerra\*, C. Fracchia#, A. Spanevello<sup>‡</sup>,  
B. Balbi\* and S. Scalvini<sup>§</sup>



# WHERE TELEHEALTH IS USED NOW – AND WHERE IT'S HEADED IN THE FUTURE: BY PRACTICE AREA

NOW VS. FUTURE



# Effect of “add-on” interventions on exercise training in individuals with COPD: a systematic review

ERJ Open Res 2016; 2: 00078-2015

Carlos A. Camillo<sup>1,2,8</sup>, Christian R. Osadnik<sup>1,3,4,5,8</sup>, Hans van Remoortel<sup>1,6</sup>,  
Chris Burtin<sup>1,7</sup>, Wim Janssens<sup>2</sup> and Thierry Troosters<sup>1,2</sup>



# The Use of Non-invasive Ventilation during Exercise Training in COPD Patients

Nicolino Ambrosino & Lixin Xie

COPD. 2017 Mar 24:1-5.



# Non invasive ventilation as an additional tool for exercise training

Ambrosino and Cigni *Multidisciplinary Respiratory Medicine* (2015) 10:14

**Table 1.** Potential mechanisms of NIV effect during exercise.

Setting	Mechanism
IPAP	WOB reduction; Respiratory muscle rest; Limb blood flow switch from respiratory to limb muscles; Anti-inflammatory action; Changes in vegetative status
PEEP or CPAP	Reduction in PEEPi

1. *The ideal candidate.* Differences in results of studies may be explained on the basis of different case mix. Further studies must identify the appropriate patient profile (e.g., level of obstruction; hypercapnic vs normocapnic; and naive vs acclimated to NIV and/or PRP).
2. *The most effective protocols.* (e.g., training alone, vs nocturnal NIV and vs NIV under exercise).
3. *The most appropriate outcome measures.* (e.g., tolerance to settings and equipment; incremental vs endurance test vs field tests; and HRQL vs dyspnoea vs daily life activities).

## The Use of Non-invasive Ventilation during Exercise Training in COPD Patients

Nicolino Ambrosino<sup>a</sup> and Lixin Xie<sup>b</sup>

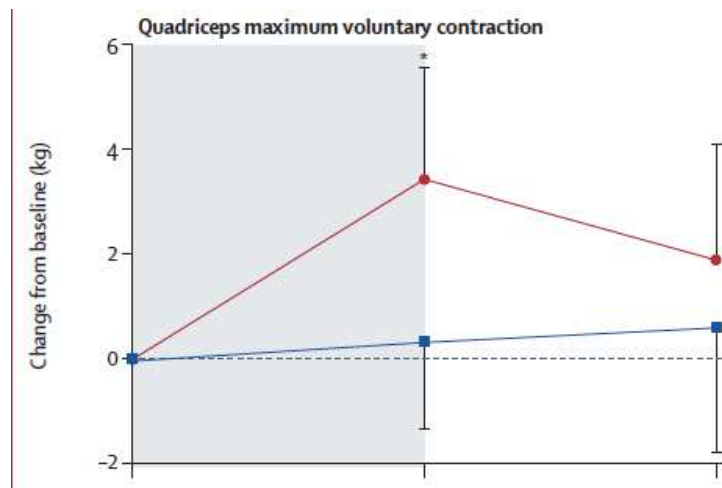
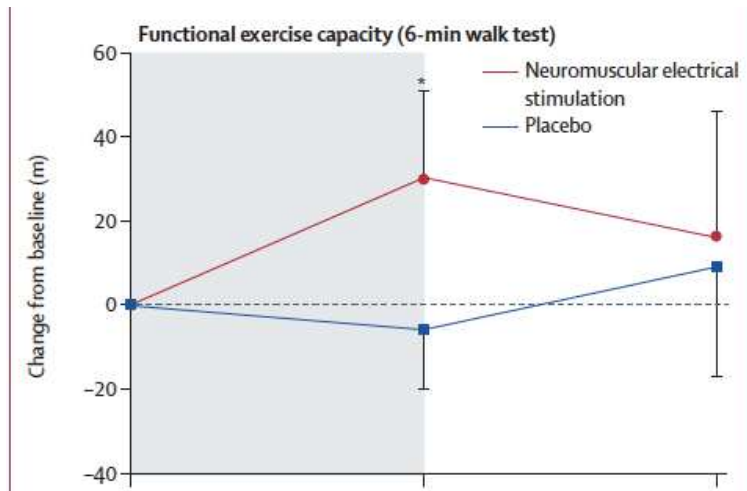
**Table 2.** Potential problems using NIV during exercise.

Source	Problem	Solution
Interfaces	Mouth breathing with nasal mask, increasing leaks	Full-face mask, mouthpiece
Comorbidities	Risk of exercising at loads higher than coronary ischaemic threshold	Careful pre-training clinical evaluation
Practicalities	Time required by physiotherapists; costs for professionals and equipment	Portable ventilators?

# Neuromuscular electrical stimulation to improve exercise capacity in patients with severe COPD: a randomised double-blind, placebo-controlled trial

Matthew Maddocks, Claire M Nolan, William D-C Man, Michael I Polkey, Nicholas Hart, Wei Gao, Gerrard F Rafferty, John Moxham, Irene J Higginson

**Lancet Respir Med 2016;  
4: 27-36**



## Added value of this study

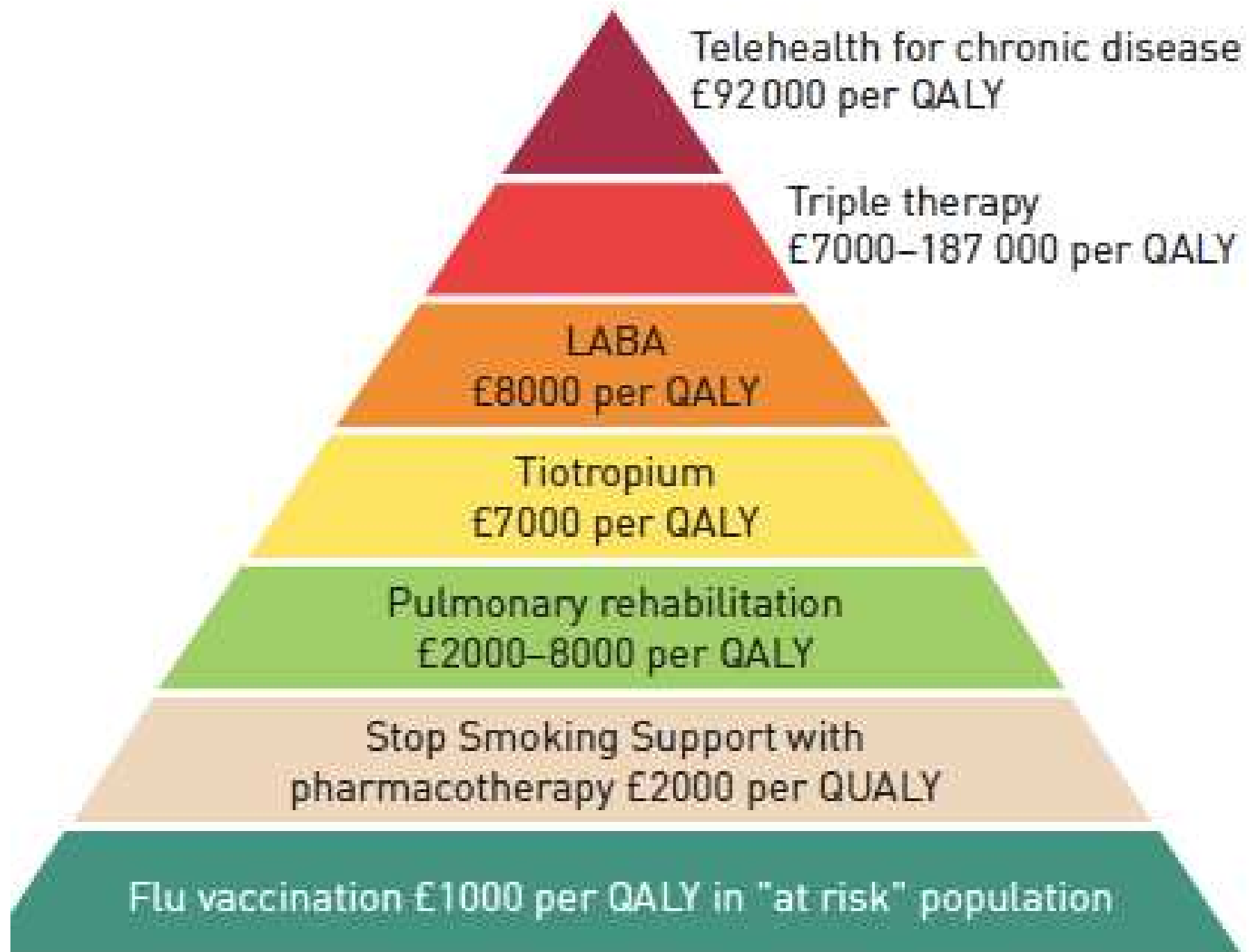
This trial provides high-quality evidence supporting the use of NMES to manage exercise intolerance among patients with severe COPD experiencing disability due to breathlessness. To our knowledge, our study is the first powered with exercise capacity as a primary endpoint, and to include follow-up data. NMES led to a clinically meaningful improvement in 6-min walk test distance at 6 weeks in this patient group compared with the placebo group. During interviews, participants also reported greater ease in undertaking activities of daily living following NMES. However, the effect waned after withdrawal of NMES (a further 6 weeks). This short duration of effect underscores the need to carefully time use within clinical practice, and to explore longer programmes, which are supported by the low risk profile observed here.

# Interactive videogame as rehabilitation tool of patients with chronic respiratory diseases: Preliminary results of a feasibility study

Respiratory Medicine (2014) 108, 1516-1524

Stefano Mazzoleni <sup>a,b,\*</sup>, Giulia Montagnani <sup>b,c</sup>,  
Guido Vaghegini <sup>b,c</sup>, Lorenzo Buono <sup>a,b</sup>, Francesca Moretti <sup>b,c</sup>,  
Paolo Dario <sup>a</sup>, Nicolino Ambrosino <sup>b,c</sup>







# Conclusion

- **Physical activity important for prognosis**
- **PR cornerstone of COPD management**
- **Physiological changes after PR, no changes in LF**
- **Additional tools effective**
- **Different locations and tele-rehab effective**

