

# La riabilitazione: efficace a qualunque età ?



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Pulmonary rehabilitation is defined as  
“**a multidisciplinary programme** of care  
for patients with chronic respiratory  
impairment that is **individually tailored**  
and designed to optimise physical and  
social performance and **autonomy**”

# **Pulmonary Rehabilitation**

**Rationale**

**Efficacy in COPD + CRF (Chronic Respiratory Failure)**

**Efficacy in COPD + Comorbidity**

**Efficacy in old patients**

**Conclusions**

# **Pulmonary Rehabilitation**

## **Rationale**

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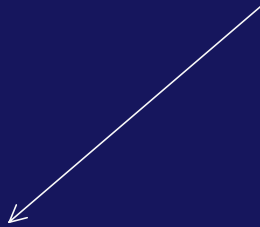
**Treatment**



**Symptoms**



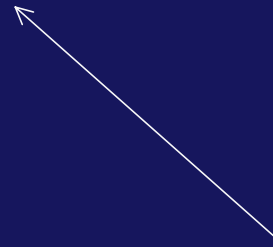
**Partial Success**



**Pulmonary  
Rehabilitation**



**Symptoms**



**Pulmonary rehabilitation results in improvements in multiple outcome areas of considerable importance to the patient, including**

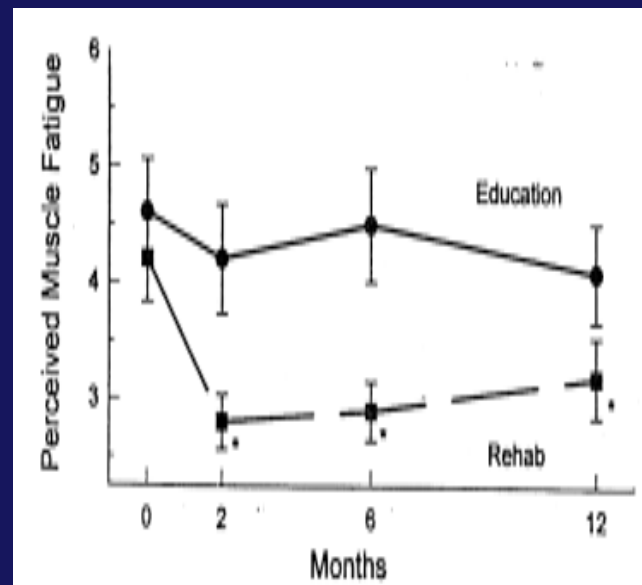
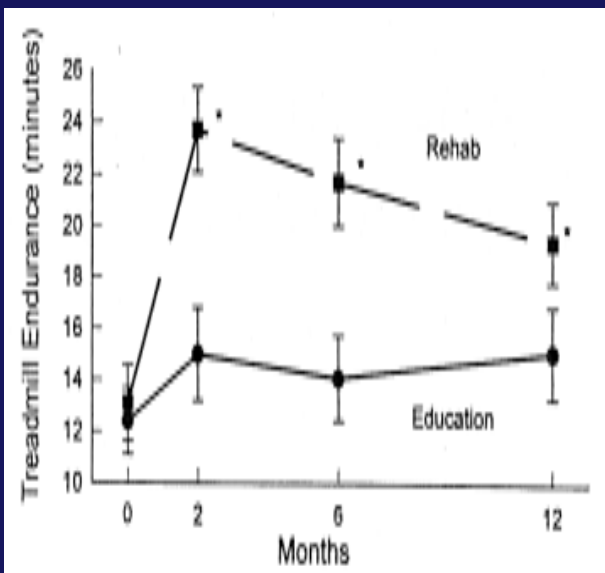
**Dyspnea**

**Exercise tolerance**

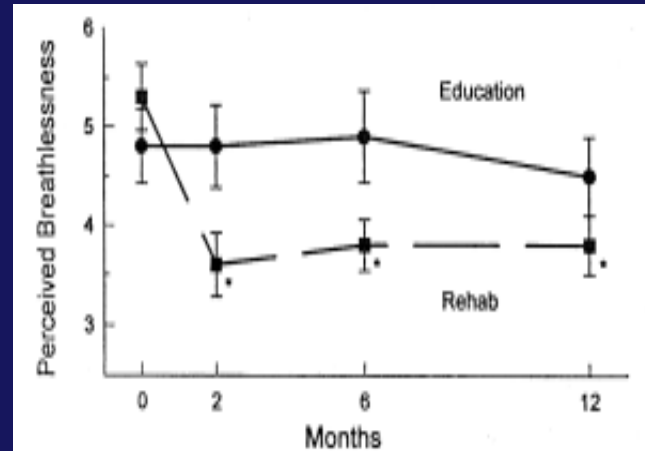
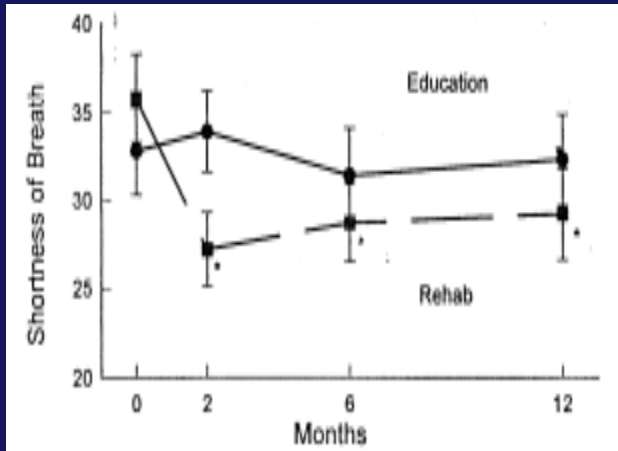
**Health care utilisation**

**Health status**

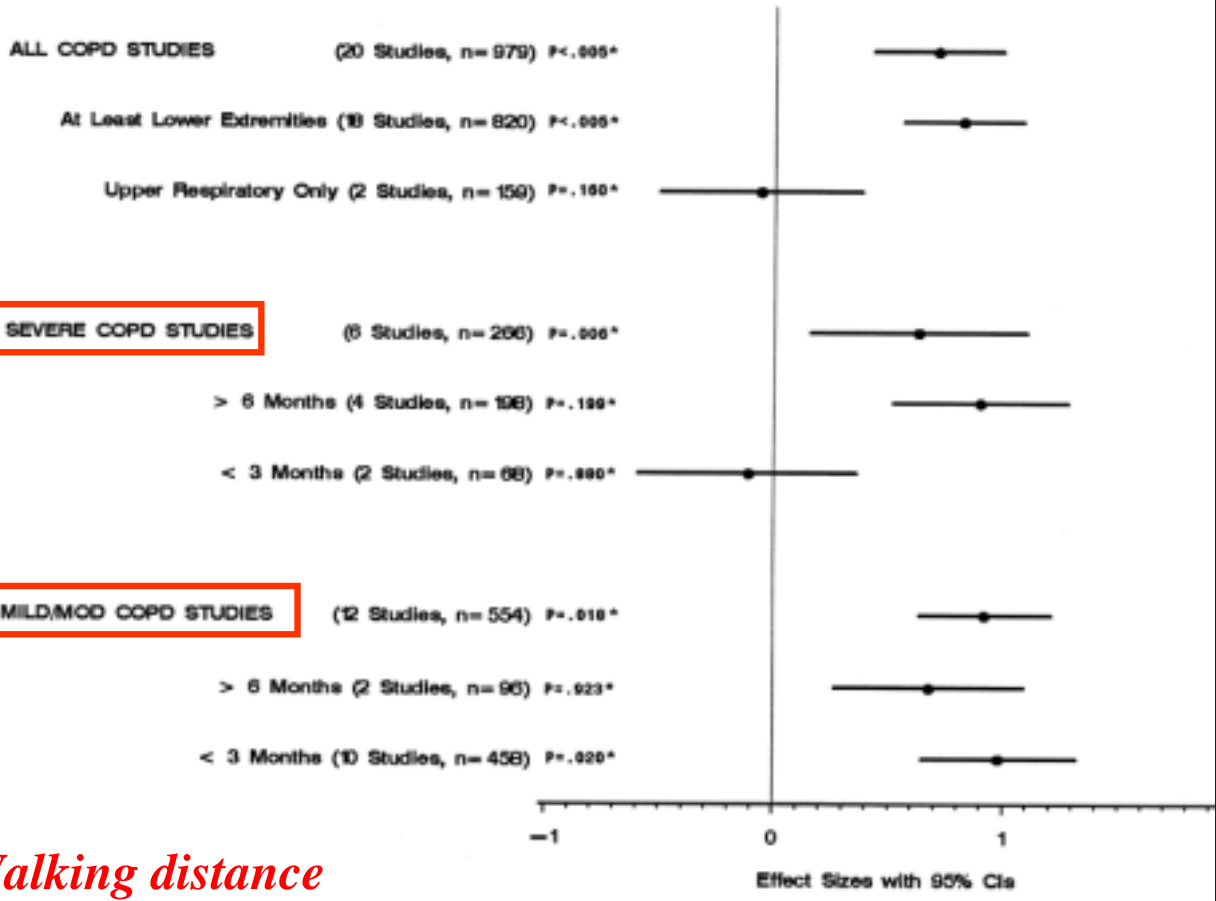
**Survival**



*Ries AL et al Ann Intern Med 1995;122:823-832*



*Ries AL et al Ann Intern Med 1995;122:823-832*



*Walking distance*

ALL COPD STUDIES (12 Studies, n=809)  $P < .005^*$

At Least Lower Extremities (11 Studies, n=727)  $P = .063^*$

Upper Respiratory Only (1 Study, n=82)

**SEVERE COPD STUDIES** (3 Studies, n=100)  $P = .155^*$

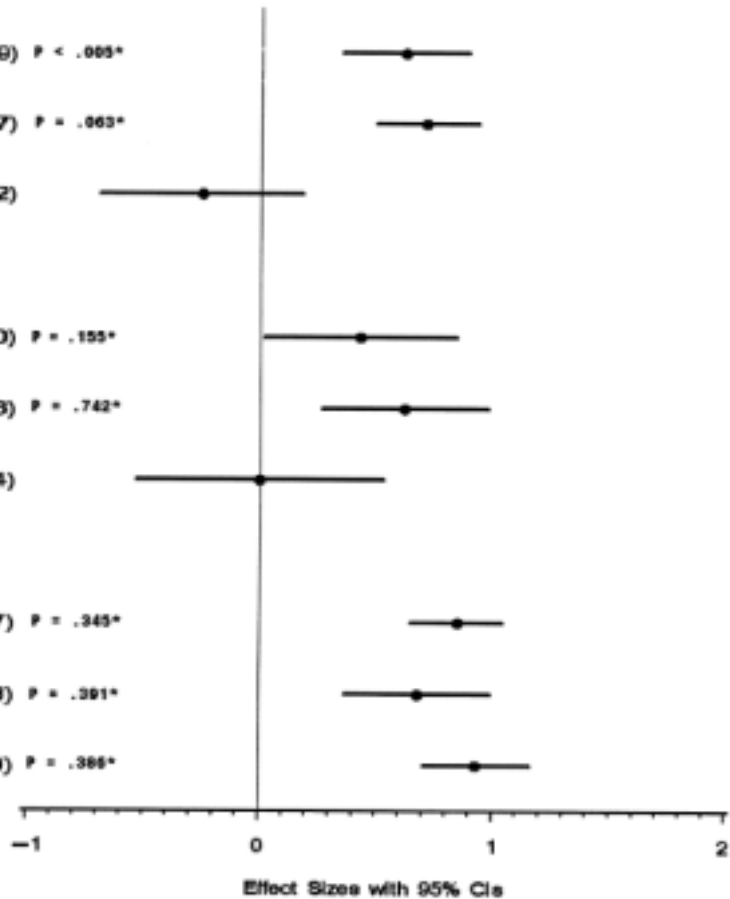
> 6 Months (2 Studies, n=126)  $P = .742^*$

< 3 Months (1 Study, n=54)

**MILD/MOD COPD STUDIES** (8 Studies, n=547)  $P = .345^*$

> 6 Months (2 Studies, n=188)  $P = .391^*$

< 3 Months (6 Studies, n=379)  $P = .385^*$



*Dyspnea*

**Pulmonary rehabilitation results in improvements in multiple outcome areas of considerable importance to the patient, including**

**Dyspnea**

**Exercise tolerance**

**Health care utilisation**

**Health status**

**Survival**

## Community pulmonary rehabilitation after hospitalisation for acute exacerbations of chronic obstructive pulmonary disease: randomised controlled study

William D-C Man, Michael I Polkey, Nora Donaldson, Barry J Gray, John Moxham



### What this study adds

*BMJ 2004; 329:1209-1213*

Early pulmonary rehabilitation, in the recovery period after hospital discharge after an admission for an acute exacerbation of COPD, leads to significant improvements in functional capacity and quality of life at three months compared with usual care

	<b>Control group</b>	<b>Rehabilitation group</b>	<b>p*</b>
<b>All patients admitted</b>			
Total	41	40	0.98†
Hospital admissions			
Respiratory illness	1.9 (1.4)	1.4 (1.3)	0.044
All causes	2.2 (1.5)	1.7 (1.1)	0.048
Days spent in hospital			
Respiratory illness	18.1 (19.3)	9.4 (10.2)	0.021
All causes	21.0 (20.7)	10.4 (9.7)	0.022
Per admission	9.0 (7.6)	6.0 (3.4)	0.100

**Pulmonary rehabilitation results in improvements in multiple outcome areas of considerable importance to the patient, including**

**Dyspnea**

**Exercise tolerance and ability**

**Health care utilisation**

**Health status**

**Survival**

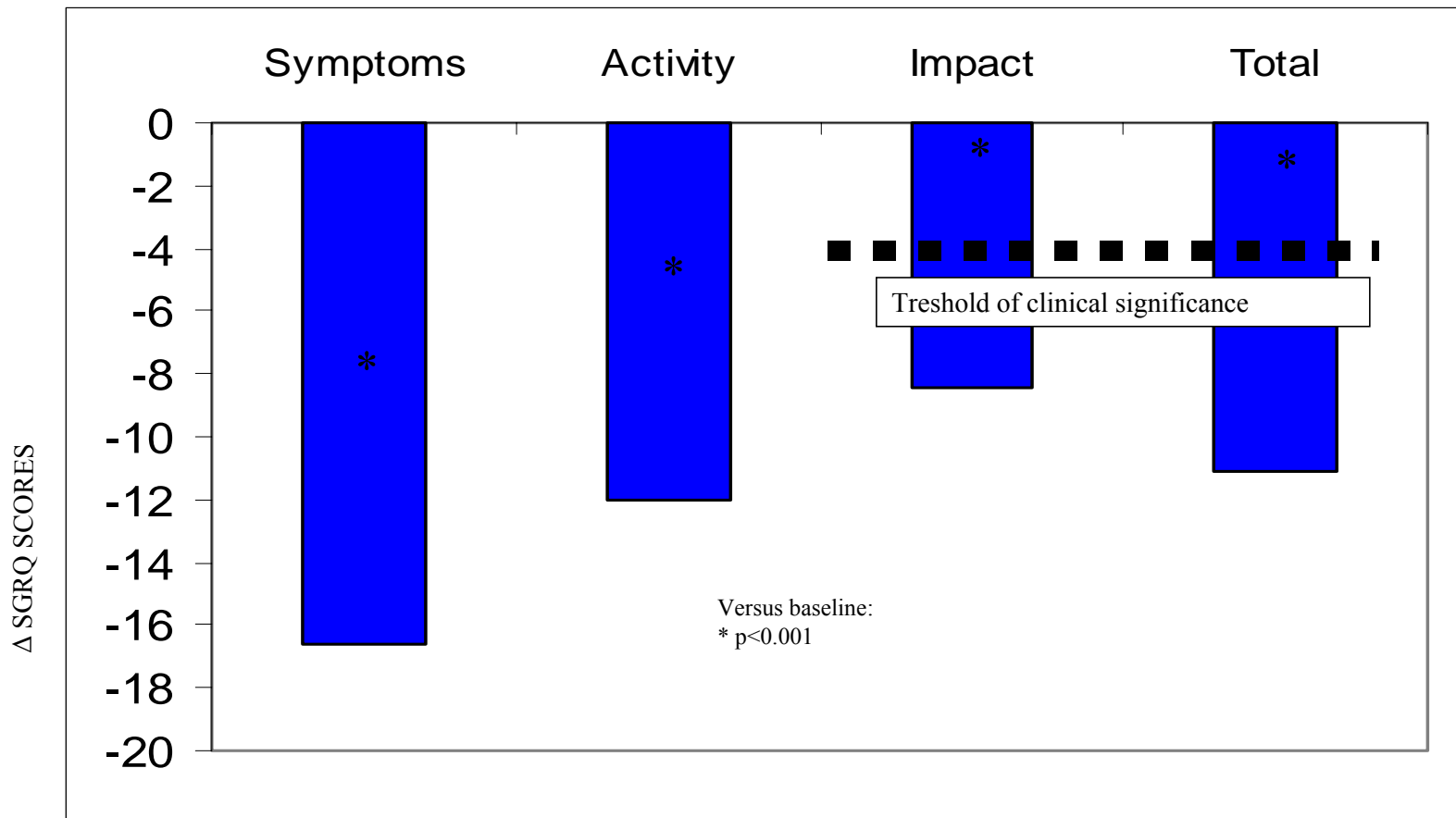


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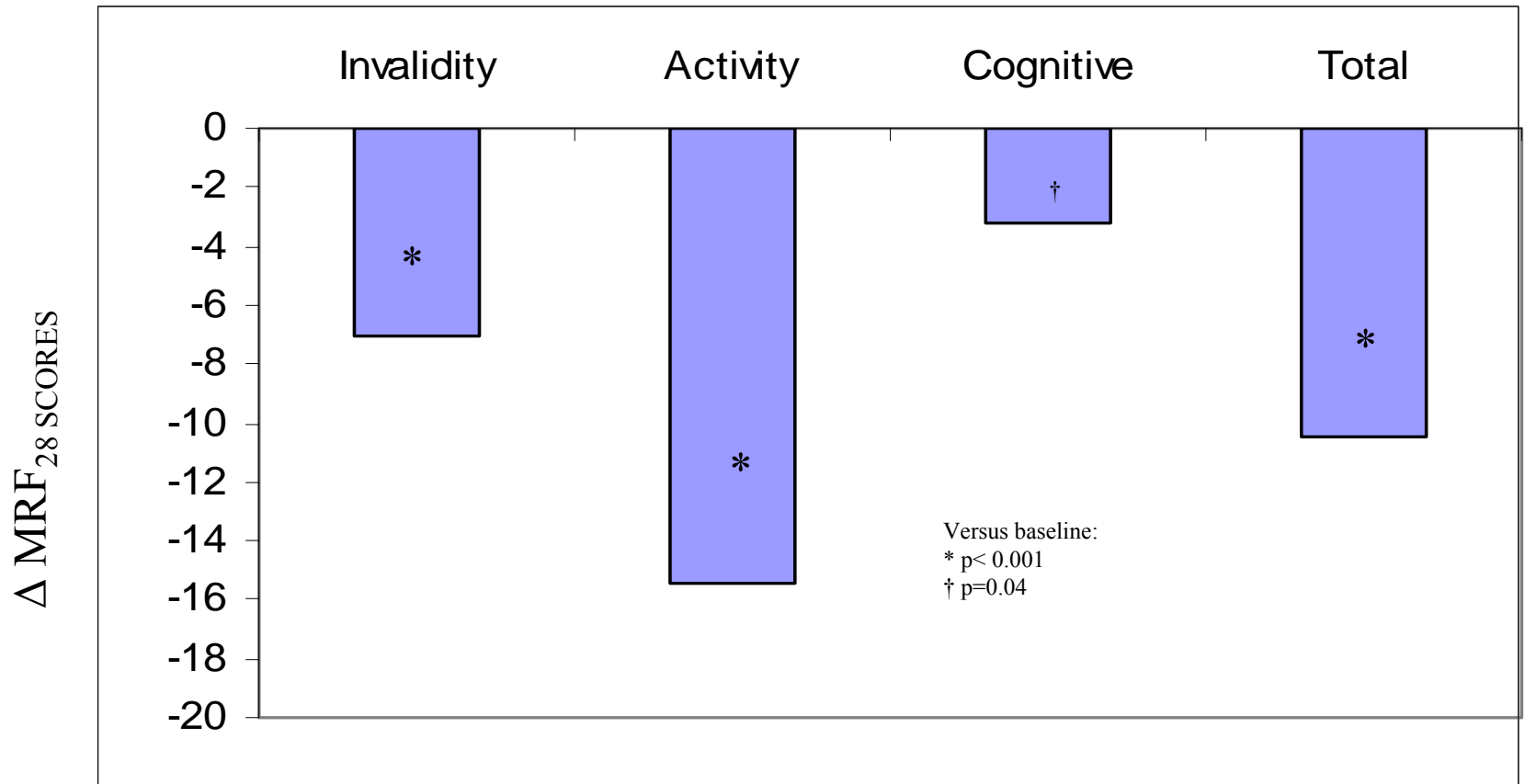
respiratoryMEDICINE

## 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>



**Improvement in SGRQ scores (patients without CRF) (mean value  $\pm$  SE) after PR programme**



Improvement in  $\Delta \text{MRF}_{28}$  scores (patients with CRF) (mean value  $\pm$  SE) after PR programme.

**Pulmonary rehabilitation results in improvements in multiple outcome areas of considerable importance to the patient, including**

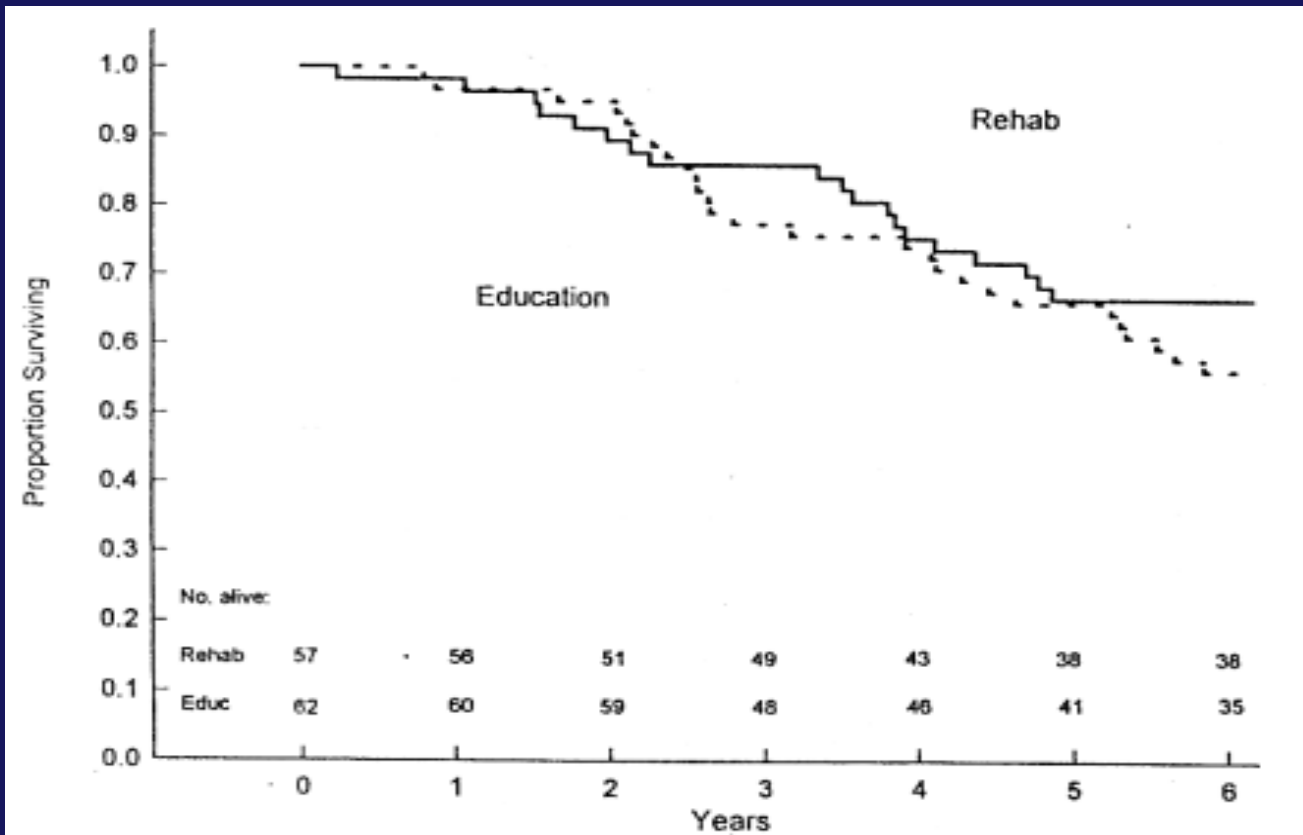
**Dyspnea**

**Exercise tolerance and ability**

**Health care utilisation**

**Health status**

**Survival**



*Ries AL et al Ann Intern Med 1995;122:823-832*

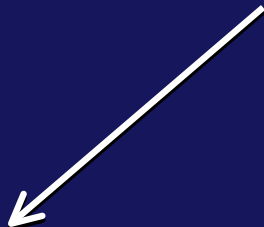
**Treatment**



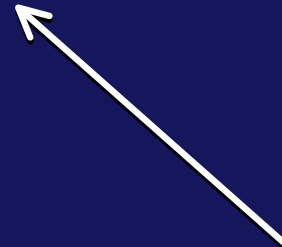
**Symptoms**



**Partial Success**



**Pulmonary  
Rehabilitation**

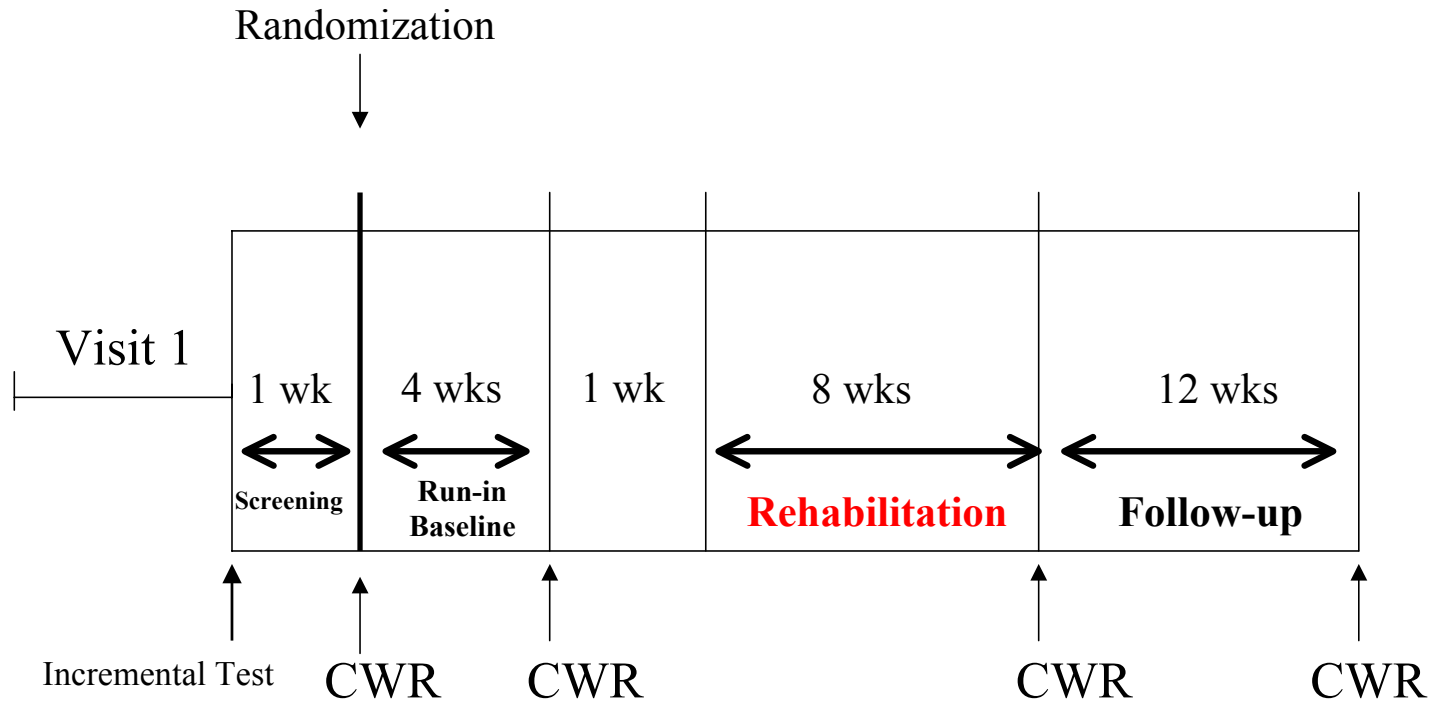


**Symptoms**

**Improvement in Exercise Endurance  
with the Combination of Tiotropium  
and Rehabilitative Exercise Training  
in COPD Patients**

Casaburi et al. Chest 2005;127:809-17

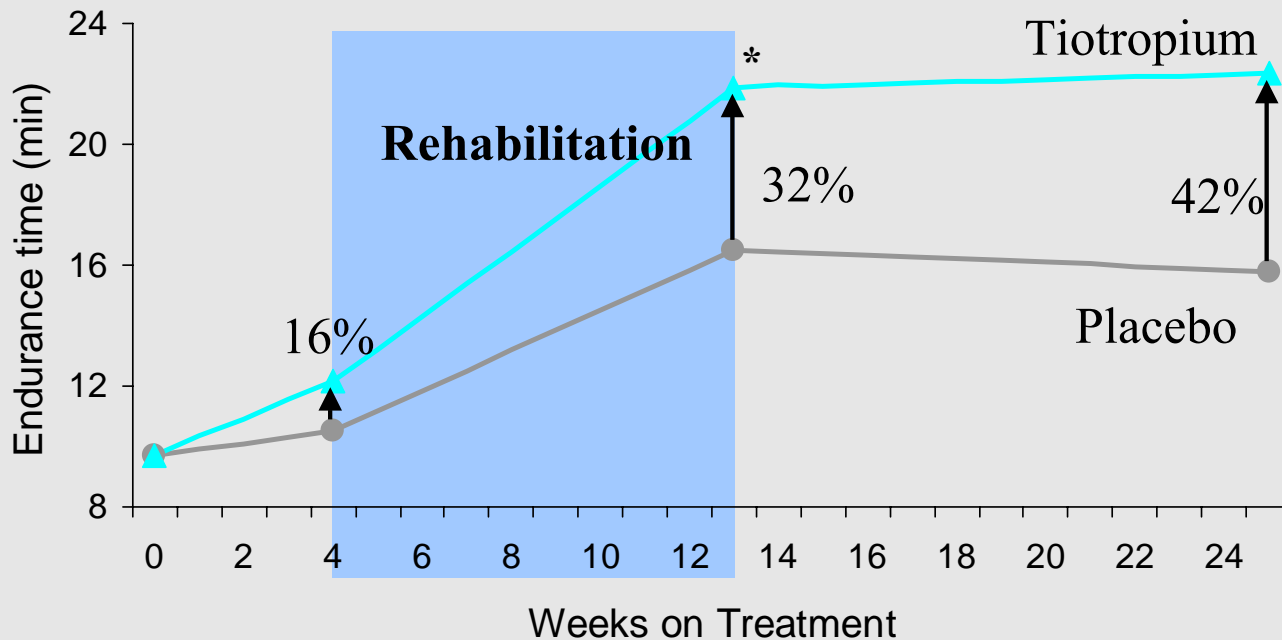
# Study design



## Demographics and initial exercise responses

	Tiotropium	Placebo	Total
Total treated (n)	55	53	108
Male (%)	55	59	57
Age (yrs)	65.9	67.3	66.6
Duration of COPD (yrs)	9.7	8.9	9.3
BMI (kg/cm <sup>2</sup> )	25.0	26.8	25.9
FEV <sub>1</sub> (L)	0.82	0.94	0.88
FEV <sub>1</sub> (% predicted)	32.6	36.2	34.4
FEV <sub>1</sub> /FVC (%)	41.5	44.6	43.0
FVC (L)	2.01	2.14	2.08
Incremental treadmill test:			
Maximum speed (mph)	2.98	2.81	2.90

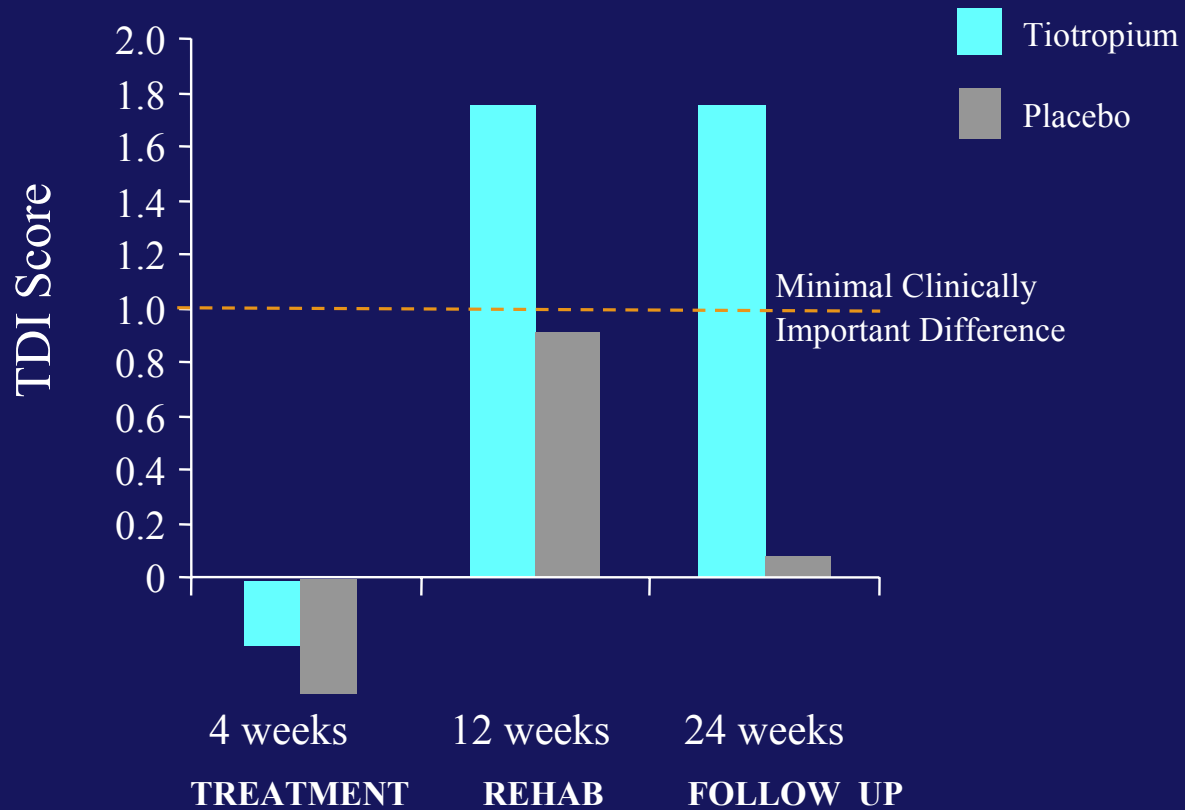
# Effect of tiotropium on the improvement in exercise tolerance resulting from rehabilitation



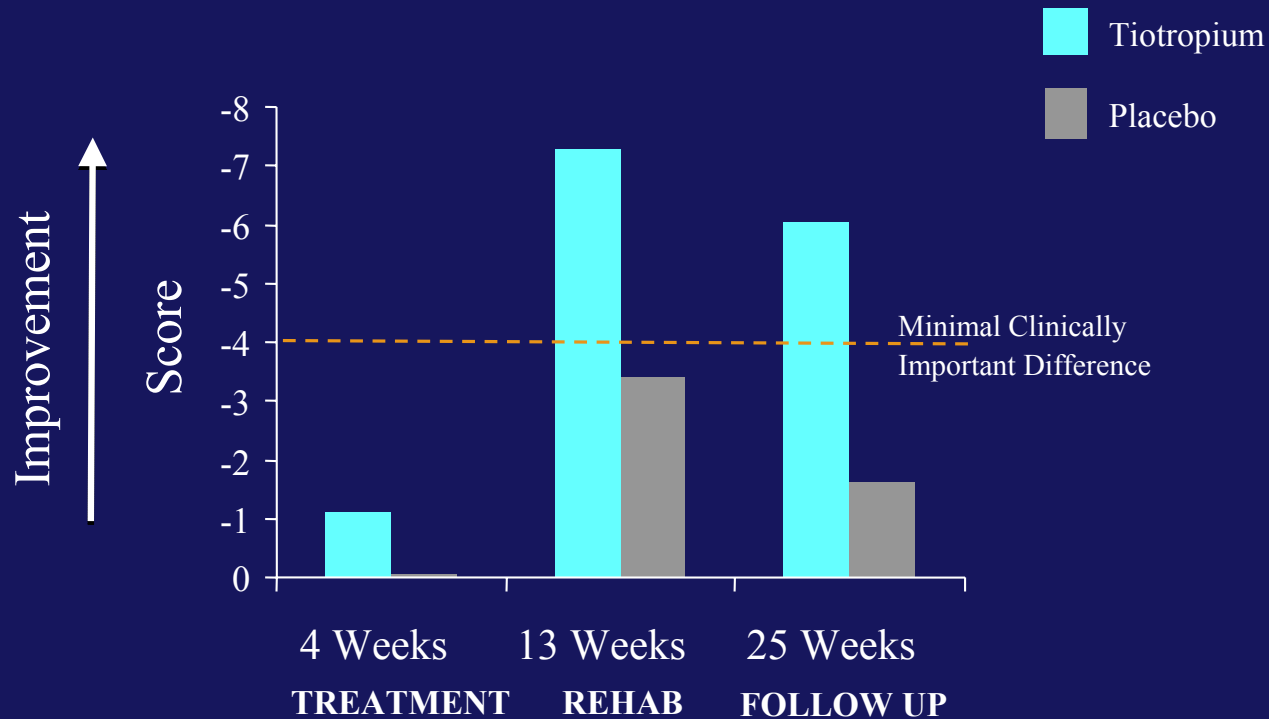
\* $P < 0.05$

Casaburi et al. Chest 2005;127:809-17

# Dyspnea – TDI results



# Health-related quality of life – SGRQ results



# **Pulmonary Rehabilitation**

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

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**Table 1** Baseline characteristics (mean value  $\pm$ SD) of the two groups of COPD patients.

Parameter	CRF	Non-CRF	p-Value
Number	327	720	
Males/females	251 /76	604/116	0.008
Age (years)	69.6 $\pm$ 7.9	68.9 $\pm$ 8.8	NS
BMI (kg/m <sup>2</sup> )	27.2 $\pm$ 5.7	26.6 $\pm$ 5.5	NS
FVC (% predicted)	61.7 $\pm$ 16.4	74.5 $\pm$ 16.3	0.001
FEV <sub>1</sub> (% predicted)	37.3 $\pm$ 14.3	48.6 $\pm$ 15.9	0.001
RV (% predicted)	154.1 $\pm$ 61.9	155.4 $\pm$ 53.8	NS
pH (units)	7.42 $\pm$ 0.04 <sup>‡</sup>	7.43 $\pm$ 0.03	0.01
PaO <sub>2</sub> (mmHg)	53.7 $\pm$ 6.1 <sup>‡</sup>	71.2 $\pm$ 7.9	0.001
PaCO <sub>2</sub> (mmHg)	46.9 $\pm$ 8.7 <sup>‡</sup>	38.8 $\pm$ 4.7	0.001
6MWT (m)	283.3 $\pm$ 106.2	360.2 $\pm$ 110.5	0.001
MRC <sup>*</sup>	3.75 $\pm$ 1.16	3.21 $\pm$ 1.17	0.001
BDI <sup>†</sup>	4.09 $\pm$ 2.06	5.2 $\pm$ 2.36	0.001
MRF <sub>28</sub> —Total score	53.7 $\pm$ 23.5	46.4 $\pm$ 23.7 <sup>§</sup>	0.01 <sup>§</sup>
MRF <sub>28</sub> —Activity	64.1 $\pm$ 27.5	56.8 $\pm$ 27.3 <sup>§</sup>	0.04 <sup>§</sup>
MRF <sub>28</sub> —Cognitive function	58.9 $\pm$ 26.9	57.4 $\pm$ 27.7 <sup>§</sup>	NS <sup>§</sup>
MRF <sub>28</sub> —Invalidity	66.9 $\pm$ 28.0	63.5 $\pm$ 27.4 <sup>§</sup>	0.02 <sup>§</sup>
SGRQ—Total score	38.8 $\pm$ 16.1 <sup>  </sup>	41.1 $\pm$ 16.9	NS <sup>  </sup>
SGRQ—Symptoms	53.0 $\pm$ 19.2 <sup>  </sup>	49.6 $\pm$ 21.7	NS <sup>  </sup>
SGRQ—Activity	52.6 $\pm$ 22.5 <sup>  </sup>	52.7 $\pm$ 20.7	NS <sup>  </sup>
SGRQ—Impact	27.2 $\pm$ 15.0 <sup>  </sup>	32.7 $\pm$ 18.2	0.004 <sup>  </sup>

# **PULMONARY REHABILITATION**

## **Maugeri Study**

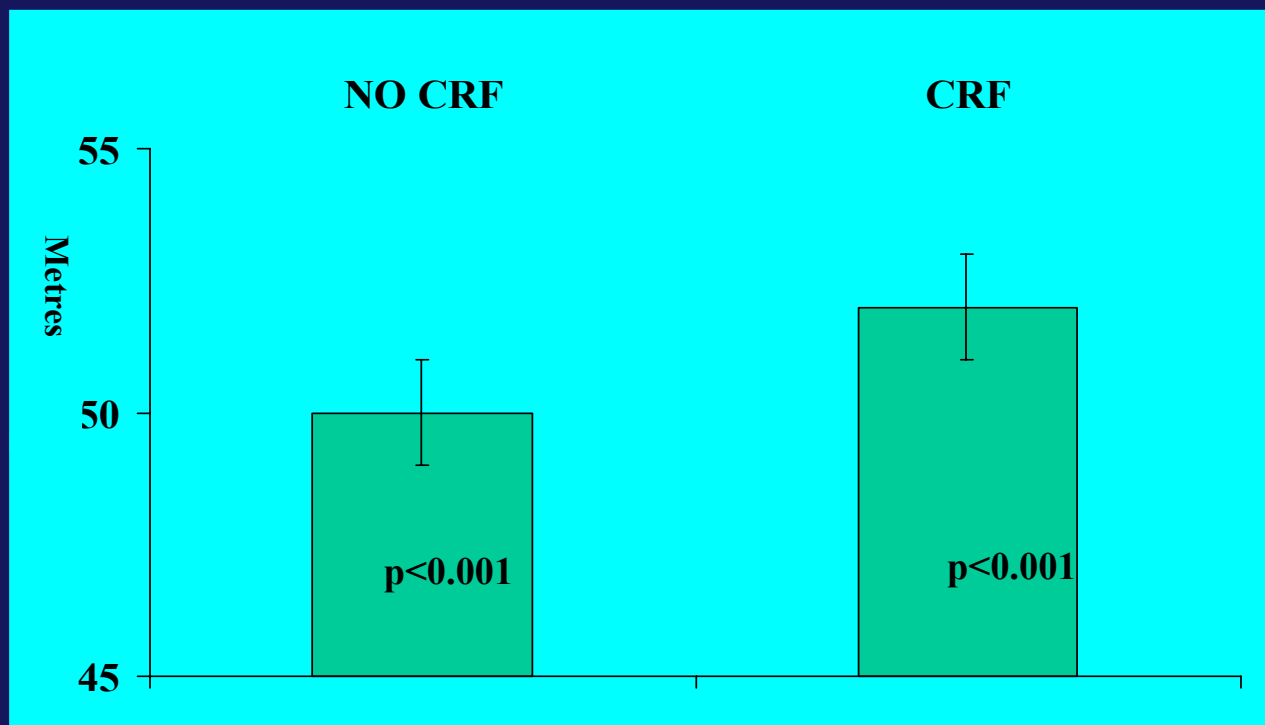
**Mean duration: 24 ± 4 days**

**Exercise training**

**Educational support**

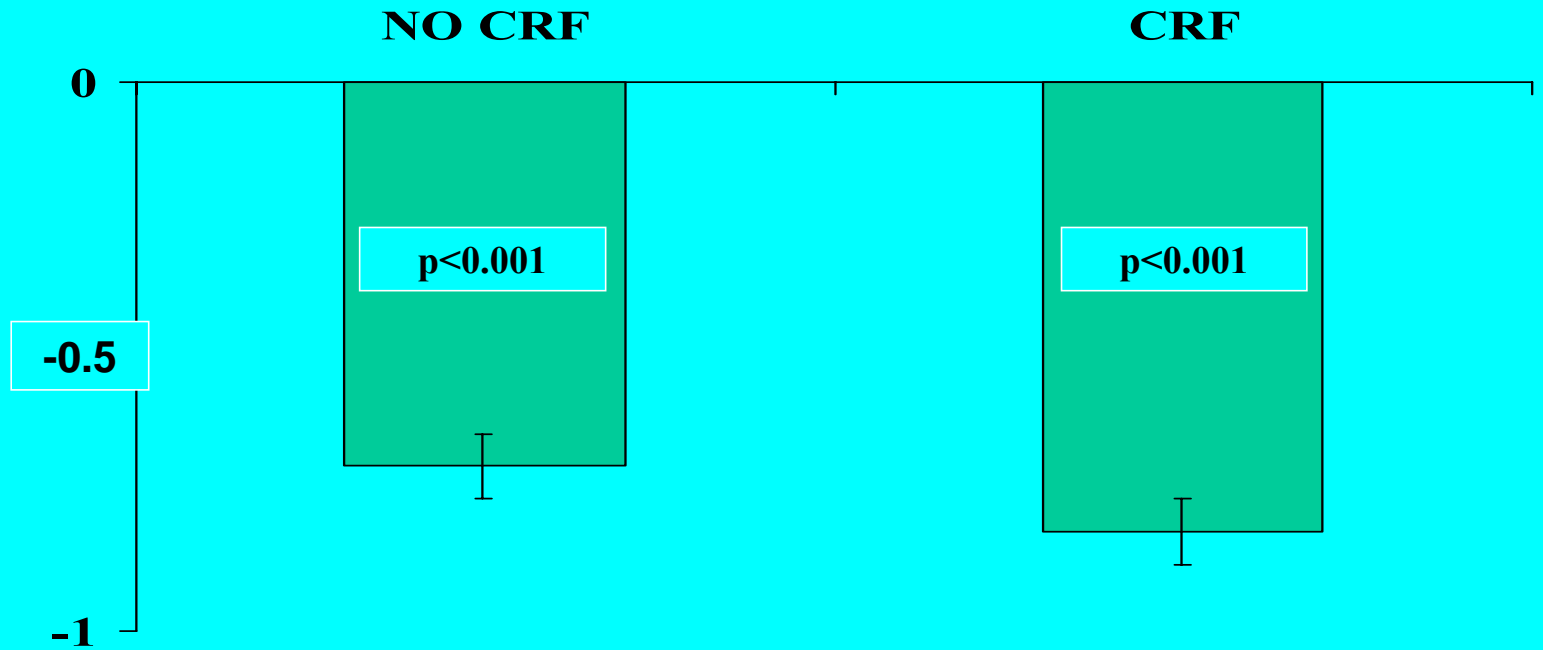
**Pharmacological therapy optimization**

## CHANGE IN WALKING DISTANCE (mean $\pm$ 95% CI)



# CHANGE IN MRC SCORE (mean $\pm$ 95% CI)

Punti



# Conclusions

**This study shows that PR is equally effective in the more severe COPD patients, i.e. those with CRF, and supports the prescription of PR also in these patients**

# **Pulmonary Rehabilitation**

**Rationale**

**Efficacy in COPD + CRF (Chronic Respiratory Failure)**

**Efficacy in COPD + Comorbiditis**

**Efficacy in old patients**

**Conclusions**

## The Body-Mass Index, Airflow Obstruction, Dyspnea, and Exercise Capacity Index in Chronic Obstructive Pulmonary Disease

Bartolome R. Celli, M.D., Claudia G. Cote, M.D., Jose M. Marin, M.D.,  
Ciro Casanova, M.D., Maria Montes de Oca, M.D., Reina A. Mendez, M.D.,  
Victor Pinto Plata, M.D., and Howard J. Cabral, Ph.D.



N Engl J Med 2004;350:1005-12.

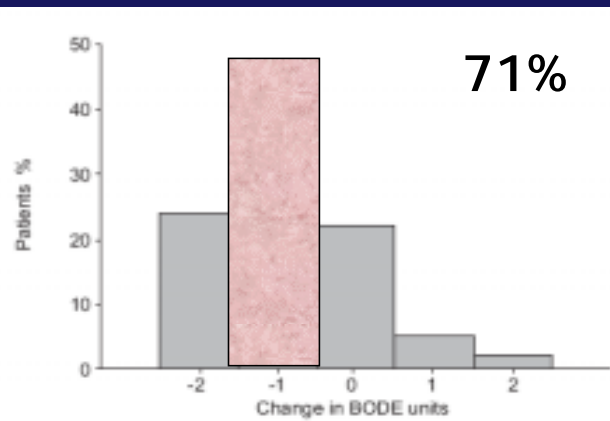
**Table 2. Variables and Point Values Used for the Computation of the Body-Mass Index, Degree of Airflow Obstruction and Dyspnea, and Exercise Capacity (BODE) Index.\***

Variable	Points on BODE Index			
	0	1	2	3
FEV <sub>1</sub> (% of predicted) <sup>†</sup>	≥65	50–64	36–49	≤35
Distance walked in 6 min (m)	≥350	250–349	150–249	≤149
MMRC dyspnea scale <sup>‡</sup>	0–1	2	3	4
Body-mass index <sup>§</sup>	>21	≤21		

# Pulmonary rehabilitation and the BODE index in COPD

C.G. Cote\* and B.R. Celli#

Eur Respir J 2005; 26: 630–636



**TABLE 2** Change in BODE following pulmonary rehabilitation (PR) in the patients enrolled in PR as well as the change in patients who did not enrol in rehabilitation (no PR)

Groups	Subjects n	Baseline	Post-PR (3 months)	1 yr	2 yrs
No PR	130	6.94 ± 1.97	6.81 ± 1.92	6.56 ± 2.1	7.22 ± 2 <sup>†</sup>
PR <sup>*</sup>	116	5.07 ± 1.5	4.16 ± 1.66 <sup>†</sup>	5.0 ± 2.1	5.11 ± 2.3 <sup>†</sup>

\*: p < 0.001 between no PR and PR at all time points; †: p < 0.001 by ANOVA compared with baseline.

# **Pulmonary Rehabilitation**

**Rationale**

**Efficacy in COPD + CRF (Chronic Respiratory Failure)**

**Efficacy in COPD + Comorbidities**

**Efficacy in old patients**

**Conclusions**

# **EXERCISE TRAINING AND NUTRITIONAL SUPPLEMENTATION FOR PHYSICAL FRAILITY IN VERY ELDERLY PEOPLE**

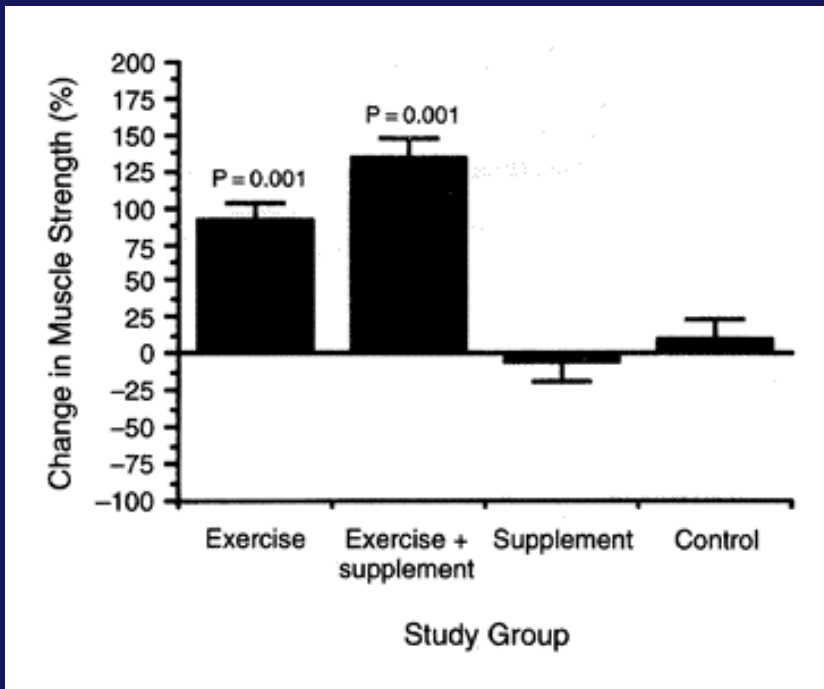
Fiatarone M. et al. NEJM 1994;330(25):1769-1775)

**A randomized, placebo-controlled trial comparing progressive exercise training, multivitamin supplementation, both interventions, and neither in 100 frail nursing home residents over a 10 week period**

# EXERCISE TRAINING AND NUTRITIONAL SUPPLEMENTATION FOR PHYSICAL FRAILITY IN VERY ELDERLY PEOPLE

Fiatarone M. et al. NEJM 1994;330(25):1769-1775)

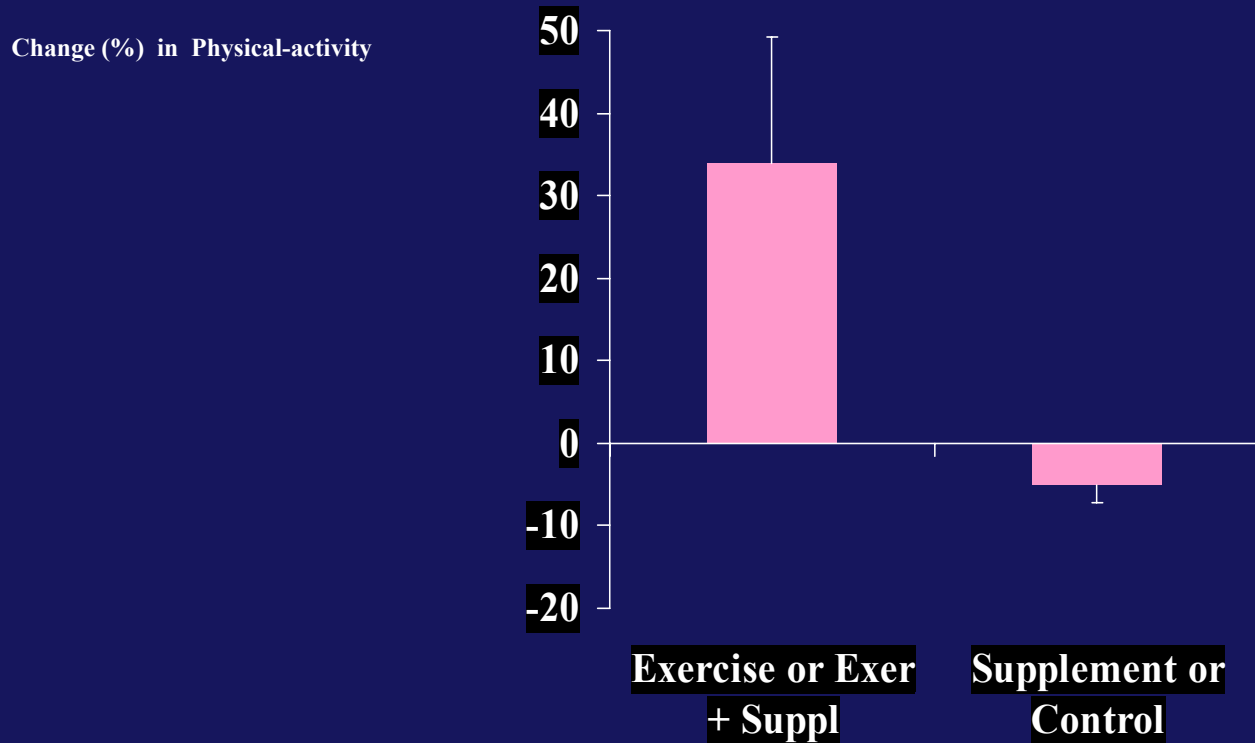
(n=100 age 87.1 ± 0.6 years)



Mean (±SE) Changes in Muscle Strength after Exercise, Nutritional Supplementation, Neither, or Both

# EXERCISE TRAINING AND NUTRITIONAL SUPPLEMENTATION FOR PHYSICAL FRAILITY IN VERY ELDERLY PEOPLE

Fiatarone M. et al. NEJM 1994;330(25):1769-1775



# **EXERCISE TRAINING AND NUTRITIONAL SUPPLEMENTATION FOR PHYSICAL FRAILTY IN VERY ELDERLY PEOPLE**

Fiatarone M. et al. NEJM 1994;330(25):1769-1775)

**High-intensity resistance exercise training is a feasible means of counteracting muscle weakness and physical frailty in very elderly people.**

**In contrast, multinutrient supplementation without concomitant exercise does not reduce muscle weakness or physical activity a 10 week period**

**Pulmonary Rehabilitation Improves  
Exercise Capacity in Older Elderly  
Patients with COPD\*** (Chest 1995; 107:730-34) |



*James I. Couser, Jr, MD, FCCP; Richard Guthmann, BA;  
M. Abdulgany Hamadeh, MD, FCCP; and Cynthia S. Kane, RN, MSN*

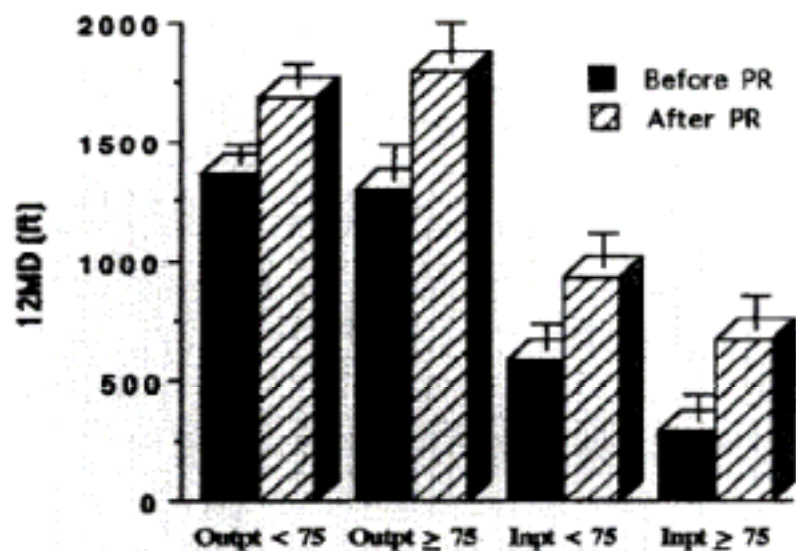
**Comparison between changes in 12-min walking distance (12MD) and self-assessment scores in 47 older elderly patients with moderate to severe COPD who completed inpatient or outpatient pulmonary rehabilitation with those achieved by 87 younger patients who participated in the same programs**

# Pulmonary Rehabilitation Improves Exercise Capacity in Older Elderly Patients with COPD\*

(Chest 1995; 107:730-34) |



James I. Couser, Jr, MD, FCCP; Richard Guthmann, BA;  
M. Abdulgany Hamadeh, MD, FCCP; and Cynthia S. Kane, RN, MSN



... comprehensive outpatient and inpatient pulmonary rehabilitation programs are as beneficial in older elderly patients with COPD as they are in younger patients with similar lung function abnormalities

# Pulmonary Rehabilitation Improves Exercise Capacity in Older Elderly Patients with COPD\*

(*Chest* 1995; 107:730-34) |



James I. Couser, Jr, MD, FCCP; Richard Guthmann, BA;  
M. Abdulgany Hamadeh, MD, FCCP; and Cynthia S. Kane, RN, MSN

**Table 2—Changes in 12MD and Self-Assessment Scores Before and After Outpatient PR**

	Young (Age <75 yr)	Old (Age ≥75 yr)
12MD, feet		
Before PR	1,361 ± 658	1,298 ± 791
After PR	1,683 ± 728*	1,800 ± 841*
Increase, feet	322 ± 554	502 ± 591
% increase	24	39
Education score, % correct		
Before PR	73 ± 14	72 ± 16
After PR	93 ± 8*	92 ± 7*

\*p<0.001 compared with values before PR.

**Table 4—Changes in 12MD and Self-Assessment Scores Before and After Inpatient PR**

	Young (Age <75 yr)	Old (Age ≥75 yr)
12MD, feet		
Before PR	581 ± 616	295 ± 465
After PR	931 ± 751*	669 ± 638*
Increase, feet	350 ± 365	374 ± 427
% increase	60	127
Education score, % correct		
Before PR	70 ± 13	63 ± 16
After PR	92 ± 8*	89 ± 10*

\*p<0.001 compared with values before PR.

**Pulmonary Rehabilitation Improves  
Exercise Capacity in Older Elderly  
Patients with COPD\*** (Chest 1995; 107:730-34) |



*James I. Couser, Jr, MD, FCCP; Richard Guthmann, BA;  
M. Abdulgany Hamadeh, MD, FCCP; and Cynthia S. Kane, RN, MSN*

**Comprehensive outpatient and inpatient  
pulmonary rehabilitation programs are as  
beneficial in older elderly patients with  
COPD as they are in younger patients with  
similar lung function abnormalities**

# **Pulmonary rehabilitation improves functional capacity in patients 80 years of age or older**

Marcel A Baltzan MD FRCPC, Hany Kamel MD, Arlene Alter PT, Michael Rotaple MD FRCPC,  
Noman Wolkove MD FRCPC FCCP

Can Respir J 2004;11(6):407-413.

**The objectives of the present study was to determine whether patients 80 years of age or older gain similar benefits from pulmonary rehabilitation as do younger patients.**

**Outcomes were compare in 230 consecutive inpatients with moderate to severe lung disease who partecipated in a comprehensive pulmonary rehabilitation program during one-year period.**

# Pulmonary rehabilitation improves functional capacity in patients 80 years of age or older

Marcel A Baltzan MD FRCPC, Hany Kamel MD, Arlene Alter PT, Michael Rotaple MD FRCPC,  
Noman Wolkove MD FRCPC FCCP

Can Respir J 2004;11(6):407-413.

**TABLE 2**  
**Six-minute walk distance after pulmonary rehabilitation**

	Age		P (YP vs OP)
	<80 years	80+ years	
<b>6 min walk (m)</b>			
Admission	144 (131 to 157)	133 (108 to 158)	0.48
Discharge	231 (231 to 244)	185 (159 to 211)	0.004
P (admission versus discharge)	<0.0001	<0.0001	
<b>Dyspnea at end of 6 min walk (Borg scale)</b>			
Admission	4.2 (3.9 to 4.5)	3.4 (2.8 to 4.1)	0.038
Discharge	3.5 (3.3 to 3.8)	3.1 (2.7 to 3.4)	0.033
P (admission versus discharge)	<0.0001	0.13	

## Pulmonary rehabilitation improves functional capacity in patients 80 years of age or older

Marcel A Baltzan MD FRCPC, Hany Kamel MD, Arlene Alter PT, Michael Rotaple MD FRCPC,  
Norman Wolkove MD FRCPC FCCP

Can Respir J 2004;11(6):407-413.

**TABLE 4**  
Global functional score before and after pulmonary rehabilitation

	Age		P YP vs OP
	<80 years	80+ years	
Global functional score (max 100)			
Admission	89 (87 to 90)	85 (81 to 89)	0.040
Discharge	94 (93 to 95)	91 (88 to 93)	0.002
P (admission versus discharge)	<0.0001	<0.0001	

**TABLE 5**  
Length of program and stay in hospital

	Age		P
	<80 years	80+ years	
Days in rehabilitation	23.1 (21.9 to 24.3)	23.1 (20.3 to 26.0)	0.98
Days in hospital	28.7 (28.0 to 31.3)	32.2 (27.1 to 37.3)	0.35

**A comprehensive inpatient pulmonary rehabilitation program is beneficial in selected patients 80 years of age or older**

# **Can individualized rehabilitation improve functional independence in elderly patients with COPD?**

**L. Sewell et al. Chest 2005; 128: 1194-1200**

**The aims of this prospective randomized , controlled trial were to establish whether pulmonary rehabilitation (PR) improves domestic function and daily activity levels in COPD and whether individually targeted exercise is more effective than general exercise.**

**Patients were randomized to a conventional 7-week general exercise program (GEP) or an individual targeted exercise program (ITEP).**

# Can individualized rehabilitation improve functional independence in elderly patients with COPD?

L. Sewell et al. Chest 2005; 128: 1194-1200

Domestic function was assessed by the Canadian Occupational Performance Measure (**COPM**).

Exercise performance was assessed by the incremental shuttle walk test (**ISWT**) and the endurance shuttle walk test (**ESWT**).

Health status was assessed by the chronic respiratory questionnaire – self reported (**CRQ-SR**)

# Can individualized rehabilitation improve functional independence in elderly patients with COPD?

L. Sewell et al. Chest 2005; 128: 1194-1200

Table 3—Prerhabilitation and Mean Change Results for Measures of Self-Reported Domestic Functions, Health Status, and Exercise Performance\*

Variables	GEP Group			ITEP Group		
	Pre-PR	Mean Change (95% CI)	p Value	Pre-PR	Mean Change (95% CI)	p Value
COPM performance	3.53 ± 1.17	1.71 (1.37–2.05)	0.0001†	3.96 ± 1.35	1.46 (1.05–1.87)	0.0001†
COPM satisfaction	2.91 ± 1.41	2.27 (1.74–2.81)	0.0001†	3.15 ± 1.69	2.04 (1.56–2.52)	0.0001†
ISWT, m	154.83 ± 92.01	81.72 (63.83–99.62)	0.0001‡	199.62 ± 119.48	85.52 (67.62–103.42)	0.0001‡
ESWT, s	238.16 ± 169.54	511.21 (417–604.58)	0.0001‡	262.42 ± 197.76	435.39 (344.60–526.17)	0.0001‡
CRQ-SR						
Dyspnea	2.45 ± 1.05	0.89 (0.55–1.23)	0.0001†	2.45 ± 0.94	0.62 (0.26–0.97)	0.001†
Fatigue	3.05 ± 1.06	0.83 (0.52–1.14)	0.0001†	3.45 ± 1.38	0.53 (0.18–0.88)	0.004†
Emotion	4.00 ± 1.39	0.60 (0.26–0.93)	0.001†	4.25 ± 1.36	0.62 (0.33–0.92)	0.0001†
Mastery	3.55 ± 1.31	0.79 (0.47–1.10)	0.0001†	4.24 ± 1.43	0.66 (0.28–1.04)	0.002†

\*Values given as mean ± SD or No., unless otherwise indicated. ESWT = endurance shuttle walking test; CRQ-SR = chronic respiratory questionnaire—self-reported.

†p Value on difference between week 1 and week 7 from Wilcoxon signed rank test.

‡p Value on difference between week 1 and week 7 from paired t test.

No statistically significant difference was found between the general exercise group and the individually targeted exercise group for any outcome measures

# Can individualized rehabilitation improve functional independence in elderly patients with COPD?

L. Sewell et al. Chest 2005; 128: 1194-1200

**Pulmonary rehabilitation improves domestic function and physical activity.**

**This study also demonstrated that general exercise training is as effective as individually targeted training**

# CONCLUSION

**Pulmonary Rehabilitation improvements  
Dyspnea, Exercise tolerance , Health care utilisation,  
Health status, Survival**

**Treatment + Pulmonary Rehabilitation  
further improvement**

# CONCLUSION

**Pulmonary Rehabilitation is equally effective in COPD patients with or without CRF**

**Pulmonary Rehabilitation results in improvements in secondary conditions (BODE index)**

**Pulmonary Rehabilitation is a feasible and effective intervention also in frail elderly**