Expected Outcomes of Pulmonary rehabilitation

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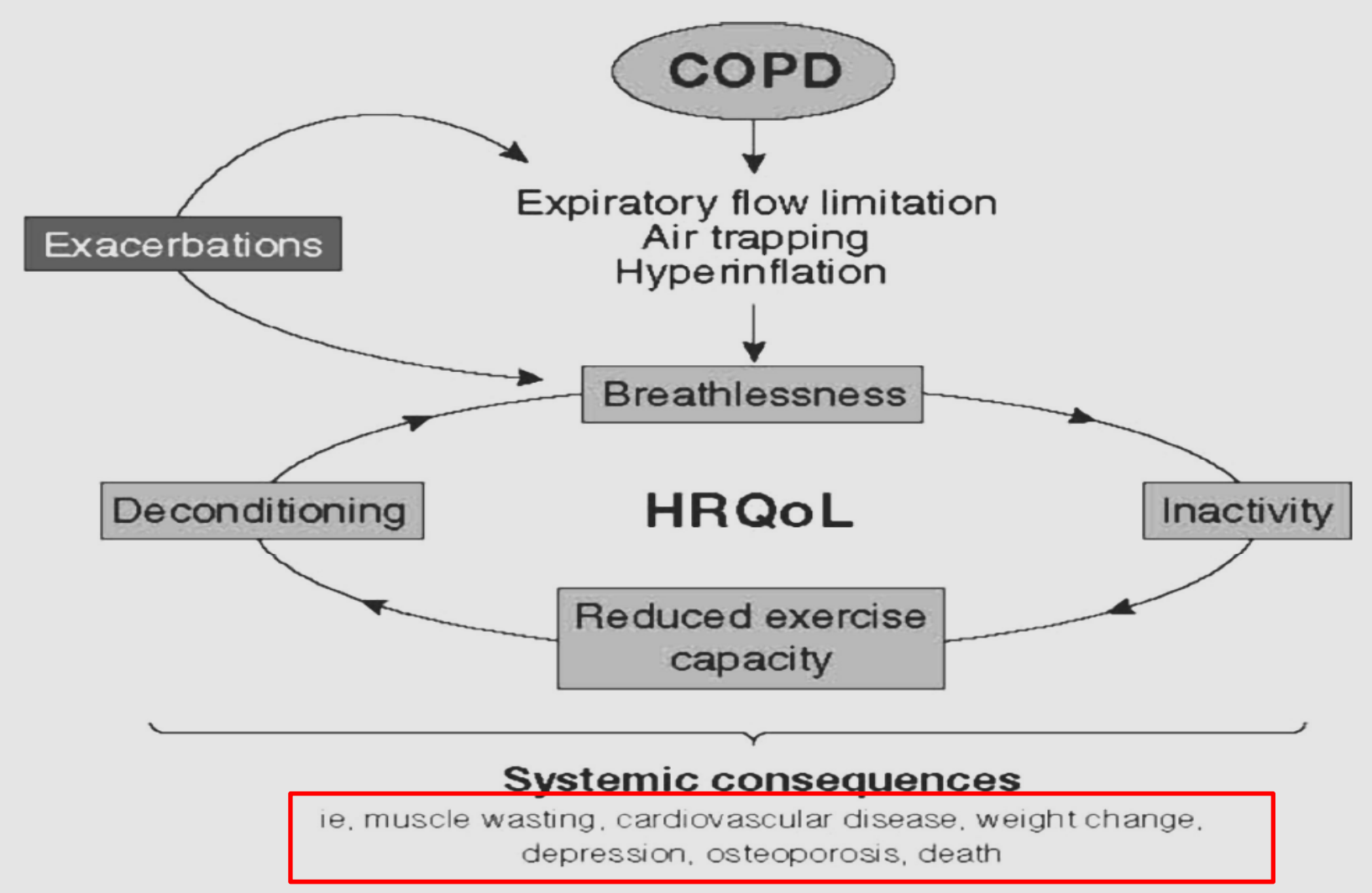
Chronic respiratory diseases

- Increasingly important causes of morbidity and mortality in the modern world

- COPD
  most common chronic lung diseases
  major cause of lung-related death and disability

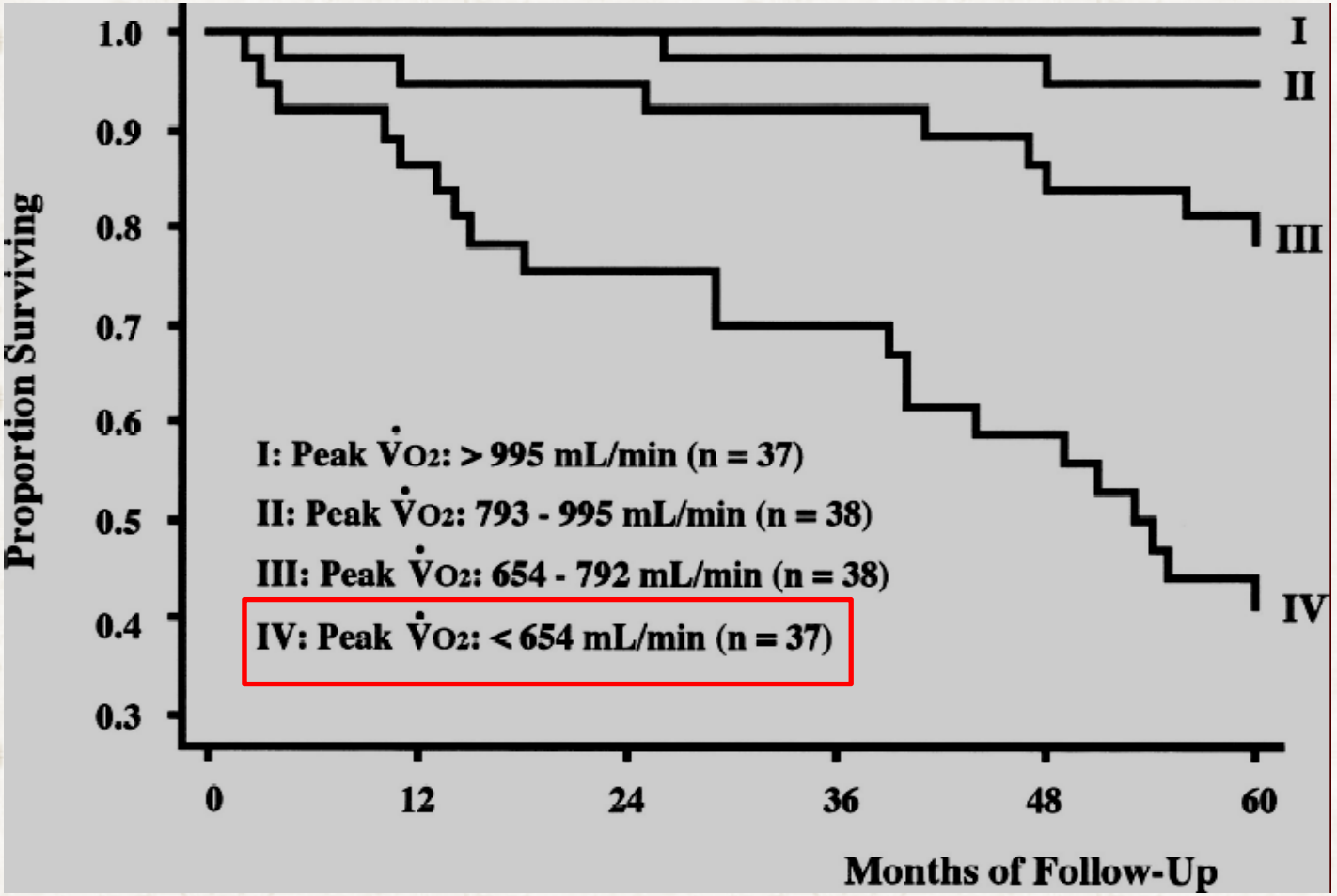
- Pulmonary rehabilitation (PR)
  recommended standard of care for patients with chronic lung disease



The clinical course of COPD, showing the vicious cycle that ensues and some of the association with systemic consequences and co-morbidities

Effects of Exercise impairment in COPD

Survival in COPD



Midthigh muscle cross-sectional area is a better predictor of mortality than BMI in patients with COPD

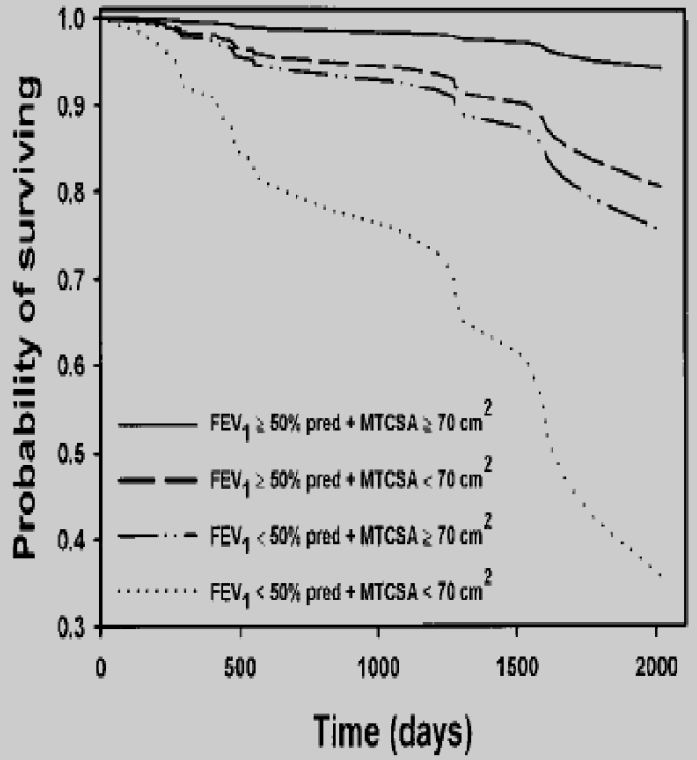
TABLE 3. PREDICTORS OF MORTALITY: MULTIVARIATE ANALYSIS

	Hazard Ratio	95% CI	p Value
$MTCSA_{CT} < 70\ cm^2$	3.68	1.52–8.09	0.0038
$FEV_1 < 50\%$ predicted	4.78	1.12–20.34	0.0342

Definition of abbreviations: CI = confidence interval; $MTCSA_{CT}$ = midthigh muscle cross-sectional area obtained by CT scan.

TABLE 4. INTERACTION BETWEEN FEV_1 AND $MTCSA_{CT}$

	No Deaths/ N of Patients	Hazard Ratio	95% CI
$FEV_1 \geq 50\%$ and $MTCSA_{CT} \geq 70\ cm^2$	1/29	1 (referent)	—
$FEV_1 \geq 50\%$ and $MTCSA_{CT} < 70\ cm^2$	1/16	2.14	0.13–34.4
$FEV_1 < 50\%$ and $MTCSA_{CT} \geq 70\ cm^2$	6/51	3.37	0.41–28.00
$FEV_1 < 50\%$ and $MTCSA_{CT} < 70\ cm^2$	17/46	13.16	1.74–99.20



Marquis K, AJRCCM 2002;166:809-813

Multivariate adjusted risk factors of readmission to hospital for an exacerbation in a cohort of 312 patients with COPD

	Adjusted HR (95% CI)	p value
⩾3 COPD admissions in the year before recruitment*	1.66 (1.16 to 2.39)	0.006
% predicted FEV_1	0.97 (0.96 to 0.99)	0.001
Po_2 (kPa)	0.88 (0.79 to 0.98)	0.024
Controlled by a:		
General practitioner	1.00	
Pulmonologist	1.66 (0.98 to 2.80)	0.058
Anticholinergics	1.81 (1.11 to 2.94)	0.017
Usual physical activity (in tertiles):		
<79 kcal/day	1.00	
79–232 kcal/day	0.87 (0.60 to 1.27)	0.469
>232 kcal/day	0.54 (0.34 to 0.86)	0.010

Garcia-Aymerich J. Thorax. 2003;58:100-105

Our Most Successful Interventions for Improving Exercise Tolerance in COPD

- Pulmonary rehabilitation

  Improves peripheral muscle function

- Bronchodilator

  Improves lung function

Definition of pulmonary rehabilitation

- From the ATS in 2006
- Evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory disease 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

Pulmonary rehabilitation (PR)

- Patient assessment
- Exercise and physical training
- Education
- Nutritional intervention
- Psychological support

Patient selection

- Functional status
  COPD patients at all stage of disease
- Severity of dyspnea
  MRC grade 5 ; not benefit
- Motivation
  highly motivated patients
  ; especially important in the case of outpatient
- Smoking status
  No evidence; smokers will benefit less than nonsmokers
  continuing smokers ; less likely to complete
  rehabilitation than nonsmokers (evidence B)

Contraindication to exercise testing

- A recent significant change in the resting EKG suggesting significant ischemia, recent MI (within 2 days), or other acute cardiac event
- Unstable angina
- Uncontrolled cardiac arrhythmia
- Severe symptomatic aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolius or pulmonary infartion
- Acute myocarditis or pericarditis
- Suspected or known dissecting aneurysm
- Acute infection

VO2 max

Exercise programs

- Maximal cardiopulmonary exercise test

  → assess the safety of exercise

  the factors contributing to exercise limitation

  the exercise prescription

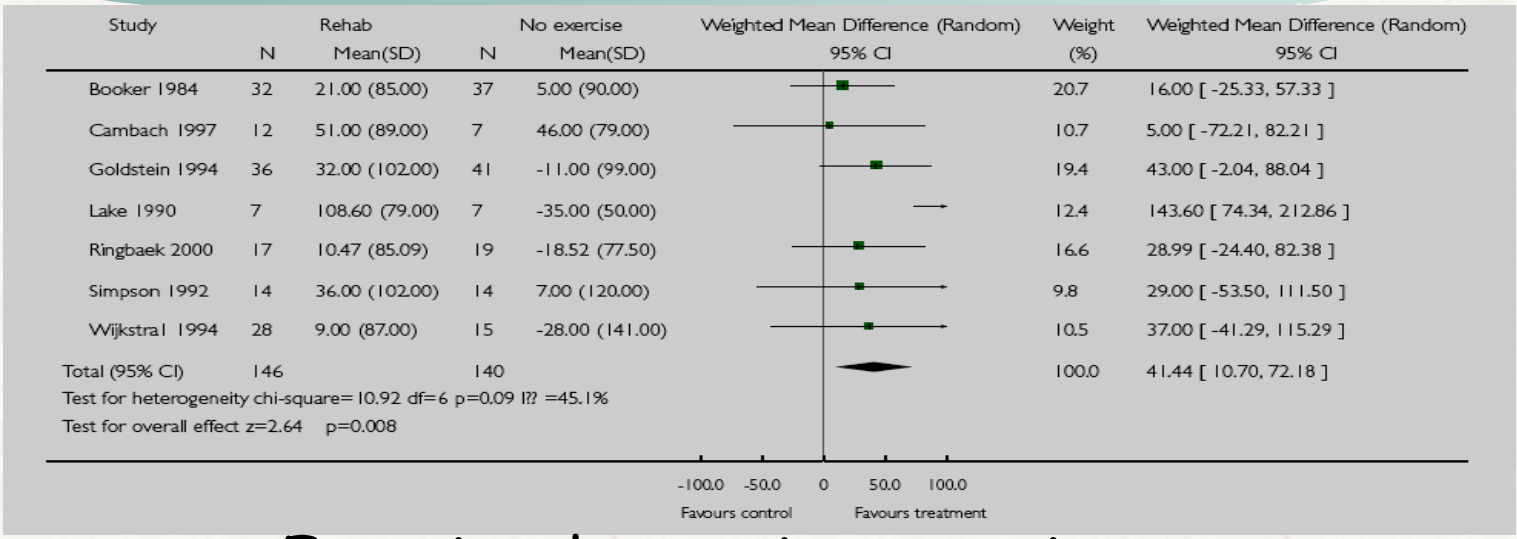
- Program duration and frequency

  At least 3 times for week

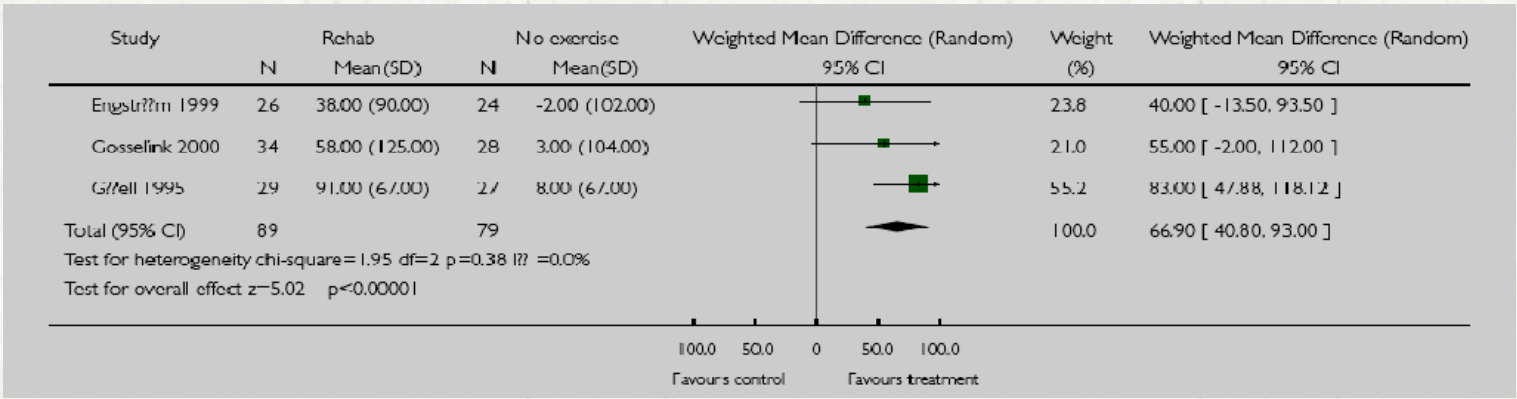
  minimum length of an effective program ; 6 weeks

  longer programs yield larger more training effects

Functional exercise capacity -program duration < 6 months



Functional exercise capacity -program duration => 6 months



Cochrane database 2001, CD003793

Exercise programs

Intensity of Exercise

- **High** vs Low intensity
- **> 60%** of the **peak exercise capacity**

  some physiologic training effects
- Symptom scores (dyspnea or fatigue)

  → Borg score : 4 to 6

Exercise programs

Endurance and strength training

- Endurance training (cycling or walking)

  Intensity (60% maximal work rate).

  > 30 minutes

  Interval training

- Strength or resistance training

  two to four sets of 6 to 12 repetitions
  (50 to 85% of one repetition maximum)

Practice guidelines

1. A minimum of 20 sessions, three times per week
2. High-intensity exercise produces greater physiologic benefit

   however, low-intensity training is also effective
3. Both upper and lower extremity training should be utilized.
4. The combination of endurance and strength training generally has multiple beneficial effects
5. Interval training may be useful in more symptomatic patients

Nutrition counseling

Nutritional counseling

- 25% of patients with COPD (stage II-IV)
  : reduction in body mass index and fat free mass
- Reduction of BMI
  : independent risk factor for mortality in COPD
- Breathless while eating
  : take small, frequent meals
- Poor dentition should be corrected and comorbidities should be managed appropriately.

Nutritional counseling

- Improving the nutritional state of COPD who are losing weight can be improved respiratory muscle strength.
- Controversy remains to whether this additional effort is cost effective.
- Nutritional supplementation alone may not be a sufficient strategy.
- Anabolic steroids in COPD with weight loss

  : increase body weight and lean body mass but have little or no effect on exercise capacity

Education

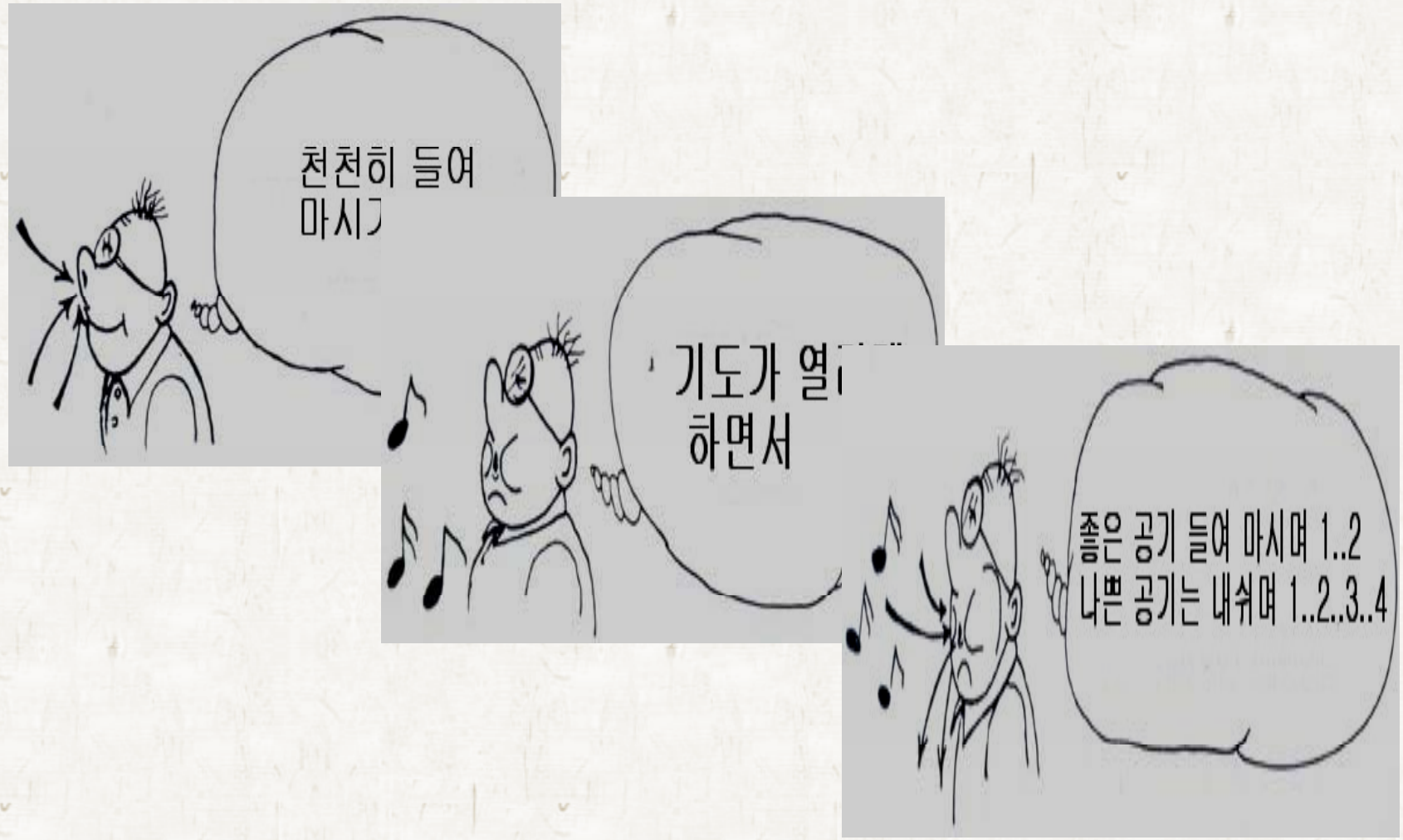
Patient Education

- Smoking cessation and reducing risk factors
- Learning about the causes and clinical outlook of COPD
- Inhalers and medications
- Exacerbation
- Strategies to minimize dyspnea
- Complication ; cor pulmonale and cachexia
- Oxygen therapy
- End of life

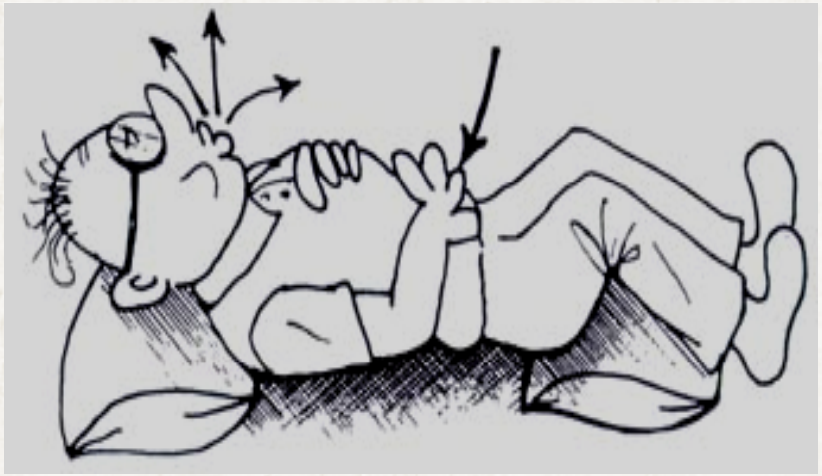
Breathing Strategies

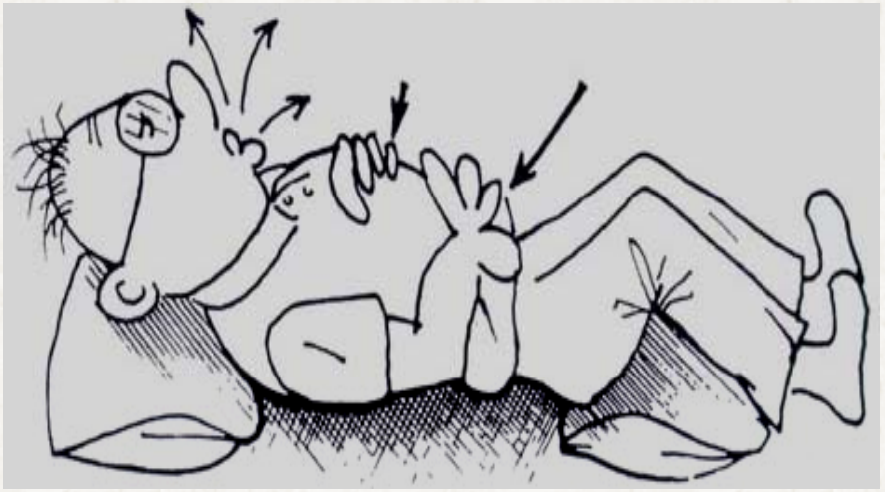
- Pursed-lip breathing
- Active expiration
- Diaphragmatic breathing
- Specific body positions
- Coordinating paced breathing with activities.

Pursed-lip breathing
(휘파람 호흡법)



Diaphragmatic breathing
(복식호흡)





Body positions to reduce shortness of breath

Sitting positions

Standing positions

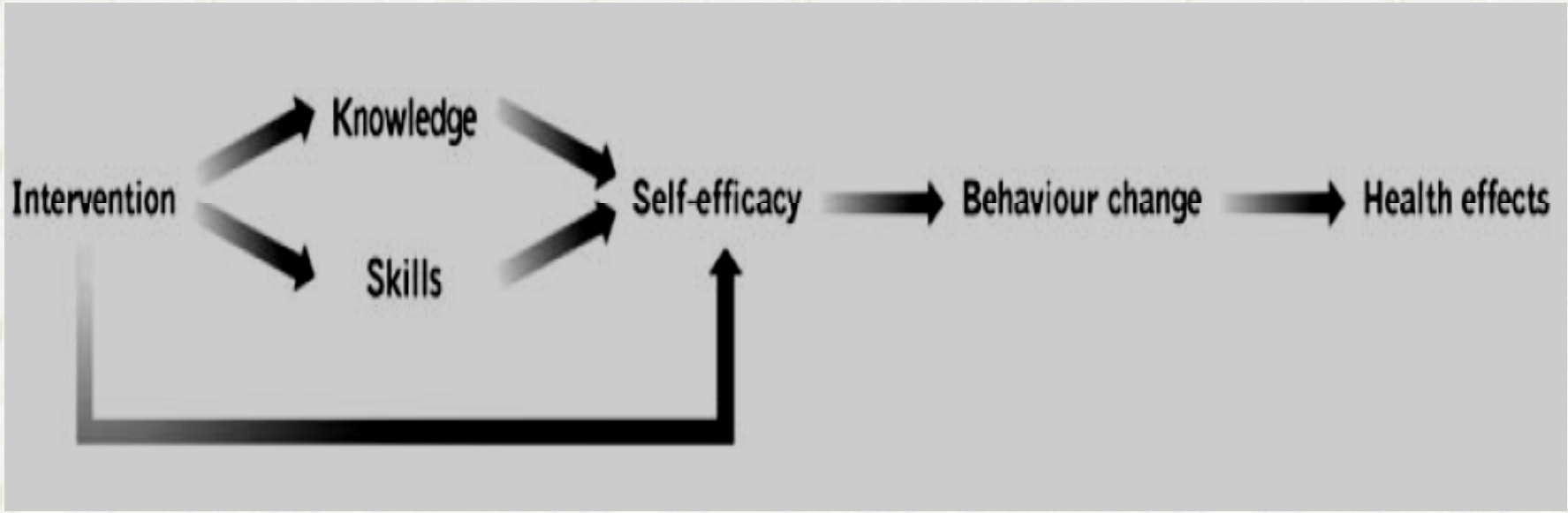
Lean your chest forward slightly. This will lessen pressure against your diaphragm allowing it to relax more.

Six principles of energy conservation

- Prioritize your activities
- Plan your schedule within your limits
- Pace yourself
- Positioning
- Pursed-lip breathing
- Positive attitude

Self-Management Education

- Core component of comprehensive PR



Assessment and follow-up

- Detailed history and physical examination
- Spirometry (PFT with BDR)
  → establishing entry suitability and baseline status but not used in outcome assessment
- Assessment of exercise capacity
- Measurement of health status and impact of breathlessness
- Assessment of inspiratory and expiratory muscle strength and lower limb strength in patients who suffer from muscle wasting

Benefits of pulmonary rehabilitation in COPD

Evidence A

Improves exercise capacity

Reduces the perceived intensity of breathlessness

Improve health-related quality of life

Reduces the number of hospitalizations and days in the hospital

Reduces anxiety and depression associated with COPD

Benefits of pulmonary rehabilitation in COPD

Evidence B

Strength and endurance training of the upper limbs improves arm function

Benefits extend well beyond the immediate period of training

Improves survival

Benefits of pulmonary rehabilitation in COPD

Evidence C

Respiratory muscle training is beneficial, especially when combined with general exercise training.

Psychosocial intervention is helpful.

Evidence A ; Randomized controlled trials, rich body of data

Evidence B ; Randomized controlled trials, limited body of data

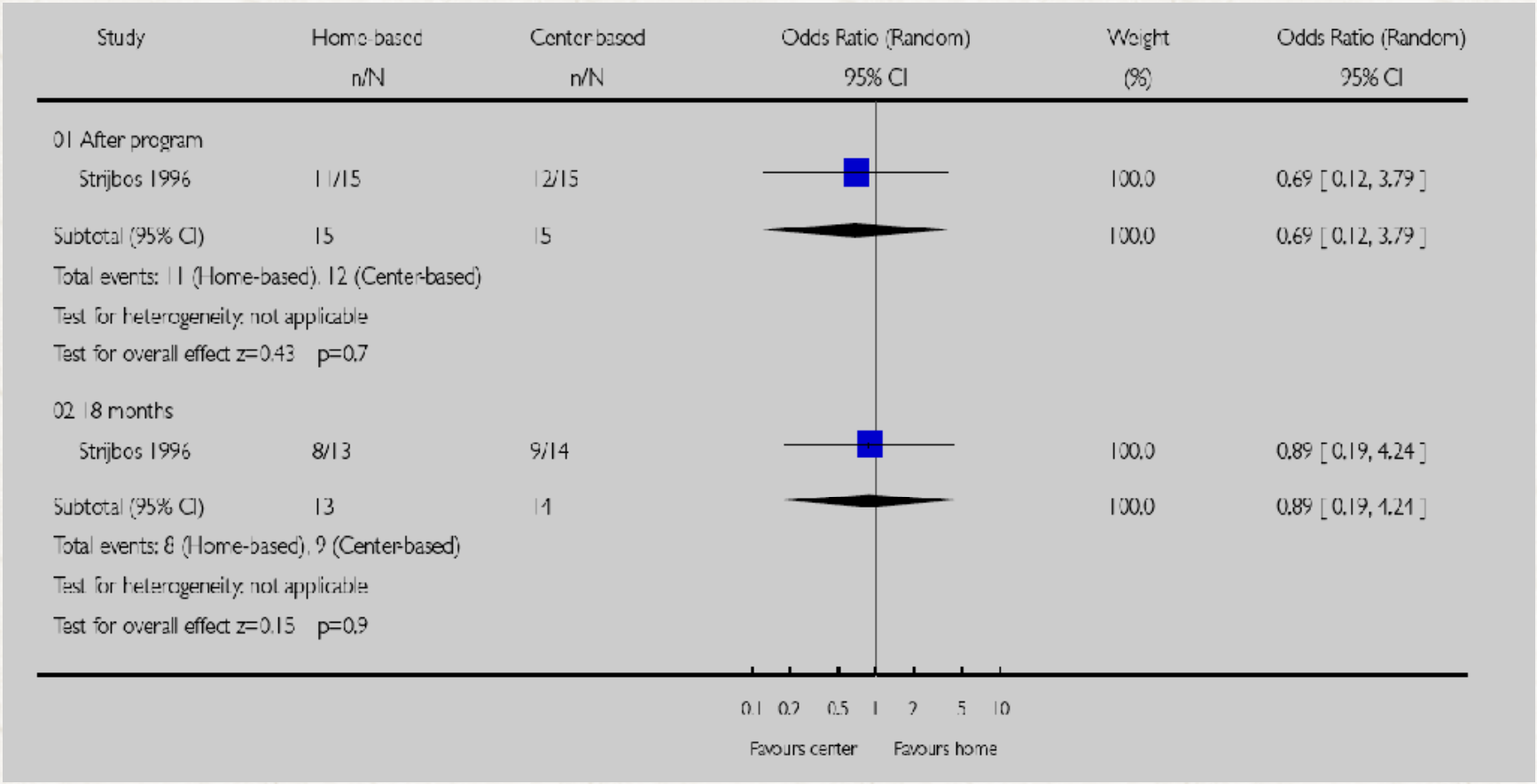
Evidence C ; Nonrandomized trials, observational studies

Location of Pulmonary Rehabilitation

1) Inpatient PR
2) Out-patient based PR
3) **Home-based PR**

Home vs center based physical activity programs in older adults

Quality of life



Cochrane database 2005, CD004017

A simple and easy home-based pulmonary rehabilitation programme for patients with chronic lung diseases

Na JO et al Monaldi Arch Chest Dis 2005;63:30-36

Table 3. - Changes in the Exercise Endurance, 6 Minute Walking

Variables	Rehabilitation Group		
	Baseline	12 weeks	*p* value
Lower extremity			
Duration (min)	8.2 ± 3.5	14.0 ± 4.5	0.001
Work (Watts)	41.5 ± 17.5	46.5 ± 19.0	0.005
Upper extremity			
Duration (min)	5.9 ± 3.2	6.8 ± 3.4	0.001
Work (Watts)	16.2 ± 8.0	19.7 ± 8.5	0.001
6 min walk(m)	470.7 ± 63.2	508.4 ± 61.1	0.001
Mean SaO_2*	89.9 ± 5.50	88.5 ± 5.94	NS
Min SaO_2**	86.1 ± 7.12	83.8 ± 7.66	NS
MIP (cm H_2O)	80.0 ± 29.5	103.5 ± 35.2	0.001

Home-based PR in Korea

Variables	Rehabilitation group			Control group		
	Baseline	12 weeks	*p* value	Baseline	12 weeks	*p* value
WR max (watts)	53.3±11.7	58.4±11.9	NS	58.2±24.4	60.1±23.5	NS
VO_2 max (L/min)	0.75±0.20	0.80±0.22	NS	0.85±0.31	0.84±0.29	NS
AT (L/min)	0.64±0.18	0.64±0.26	NS	0.84±0.21	0.77±0.22	NS
O_2 pulse (ml/beat)	7.02±1.35	6.68±1.58	NS	8.2±5.1	6.9±2.2	NS
HR max (beats/min)	126.0±19.1	132.4±17.9	NS	134.1±28.1	133.7±23.1	NS
V_E max (L/min)	34.1±9.6	36.0±10.1	NS	32.4±11.5	31.8±9.1	NS
Lower extremity Duration (sec)	6.89±3.6	14.8±3.7	0.002	9.1±2.8	10.4±3.0	NS
Work (Joule)	37.2±7.5	41.1±8.6	0.01	37.8±16.4	41.7±17.3	0.043
Upper extremity Duration (sec)	5.3±1.6	6.2±2.2	0.02	6.3±4.4	5.7±3.9	NS
Work (Joule)	15.6±4.6	19.4±5.3	0.001	18.3±11.5	17.8±9.7	NS

Yoon SH et al. Tuber Resp Dis 2002;52:597-607

Home-based PR in Korea

Variables	Rehabilitation group			Control group		
	Baseline	12 weeks	*p* value	Baseline	12 weeks	*p* value
6 min walk (m)	464.9±59.8	508.4±37.2	0.003	490.8±66.3	513.4±56.6	NS
MIP (cmH_2O)	72.8±27.2	93.7±36.6	0.012	91.4±30.9	100.2±32.9	NS
Score	Baseline	12 weeks	*p* value	Baseline	12 weeks	*p* value
Symptom	47.9±20.6	45.4±21.1	NS	50.0±19.3	48.9±23.0	NS
Activity	68.5±19.2	55.0±14.9	0.008	62.5±14.6	64.5±19.6	NS
Impact	39.4±18.7	21.8±12.3	0.001	38.6±13.5	33.3±13.2	0.02
Total	49.6±16.7	35.7±12.0	0.001	47.7±11.7	45.3±14.5	NS

Yoon SH et al. Tuber Resp Dis 2002;52:597-607

Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease (Review)

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2009, Issue 1

Figure 2. Forest plot of comparison: 1 Rehabilitation versus control, outcome: 1.1 Hospital admission (to end of follow-up).

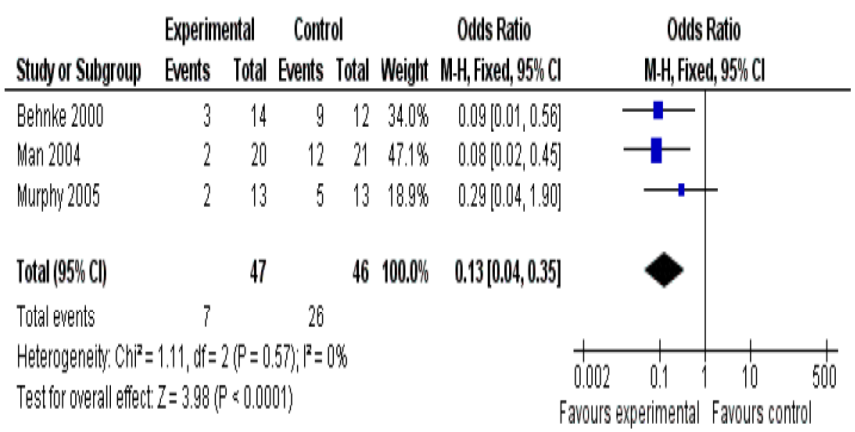
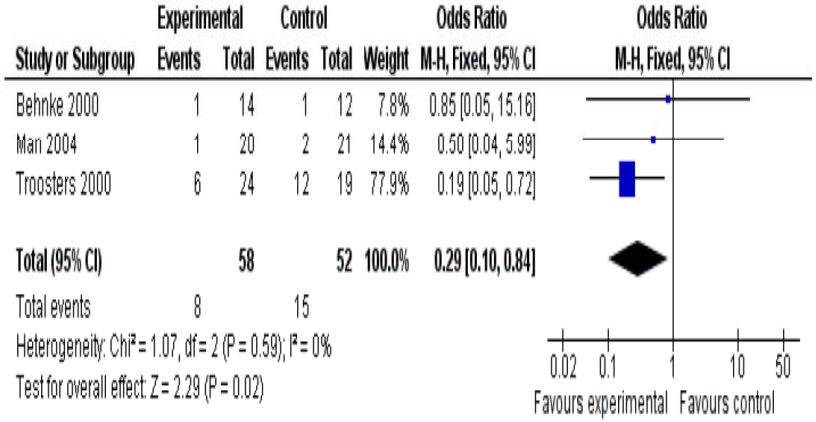


Figure 4. Forest plot of comparison: 1 Rehabilitation versus control, outcome: 1.2 Mortality.



Evidence from small studies of moderate methodological quality suggests that pulmonary rehabilitation is a highly effective and safe intervention to reduce hospital admissions and mortality and to improve health-related quality of life in COPD patients after suffering an exacerbation.

Thank you for your attention !!!!