Pneumo Update Europe 2017

9-10 June, Vienna

Rehabilitation

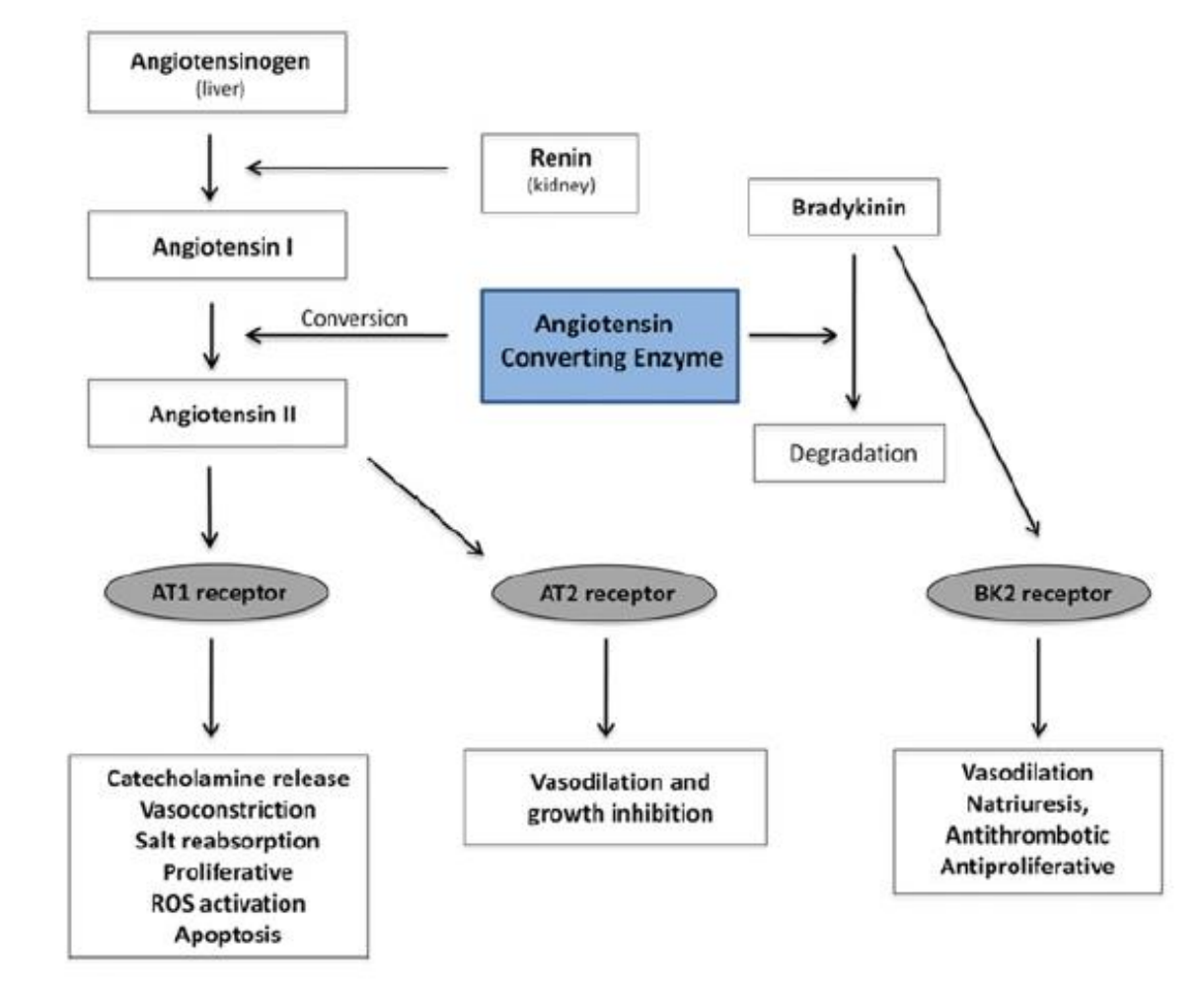
Emiel Wouters, Netherlands

Outline of presentation

- **Pulmonary rehabilitation in COPD**
  - **ACE inhibition**
  - **subgroups**
  - **outcomes**
  - **comorbidities**
  - **cognitive impairment and behavioural therapy**
  - **frailty and pulmonary rehabilitation**
  - **miscellaneous**
- **Pulmonary rehabilitation and ILD**
- **mHealth and home training**

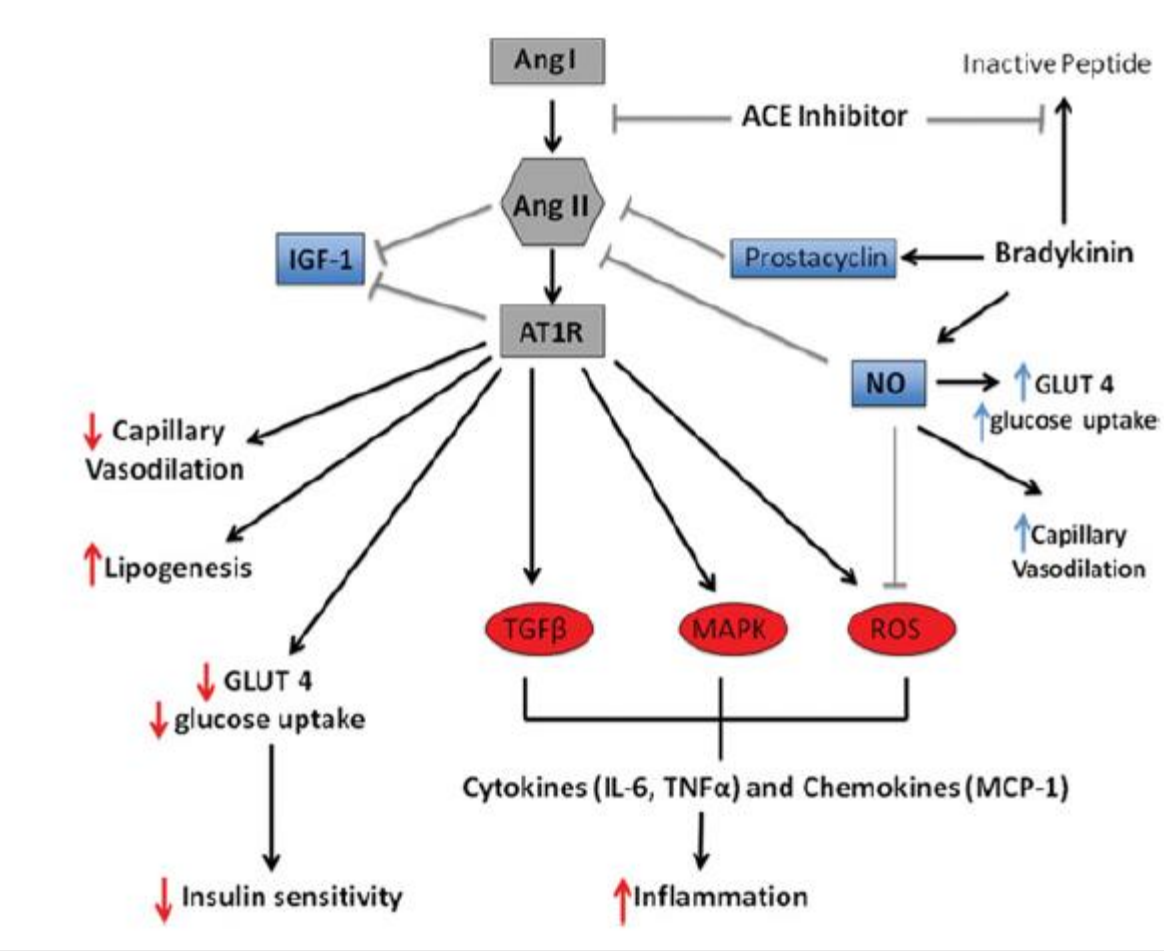
- **PERSONAL SELECTION OF ARTICLES**

RAS system



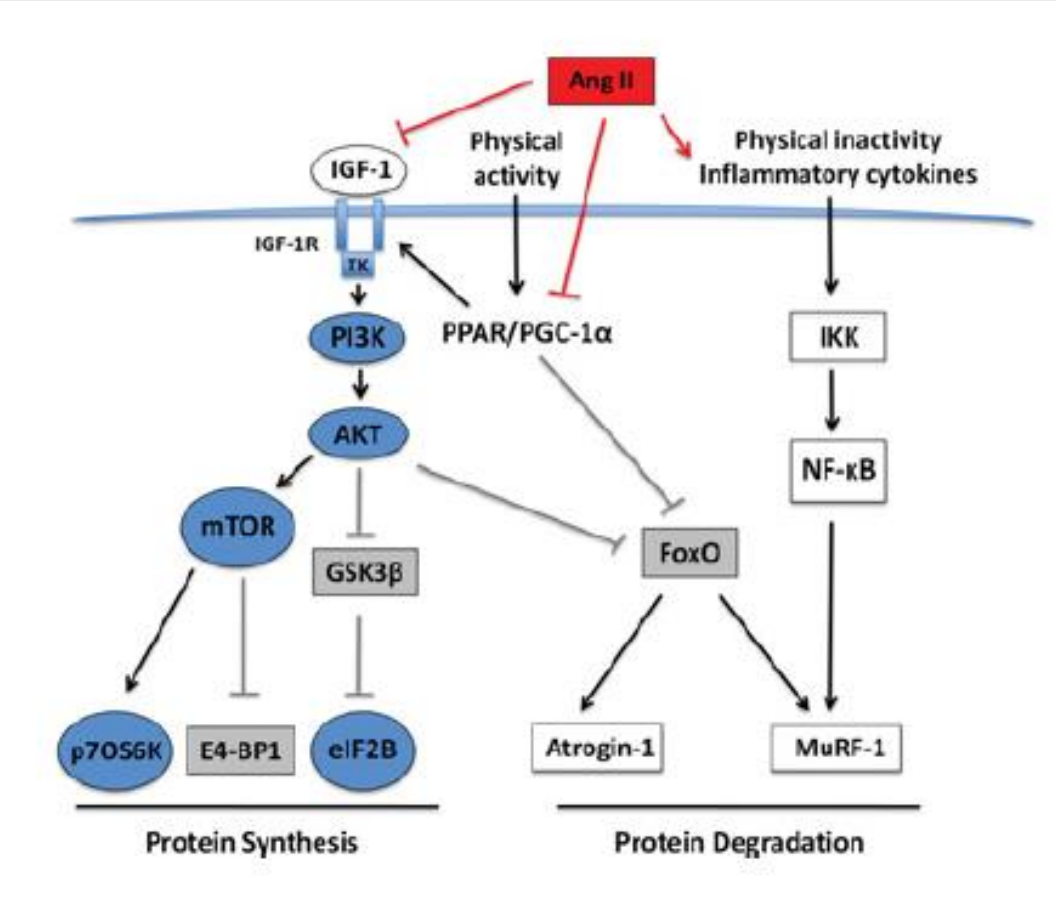
ACE activity: DD > ID > II: 287 base pair intron 16 chr.17

Actions of RAS in COPD



Shrikrishna et al Clin Sci 2012; 123(8):487-98

Ang II and muscle signalling



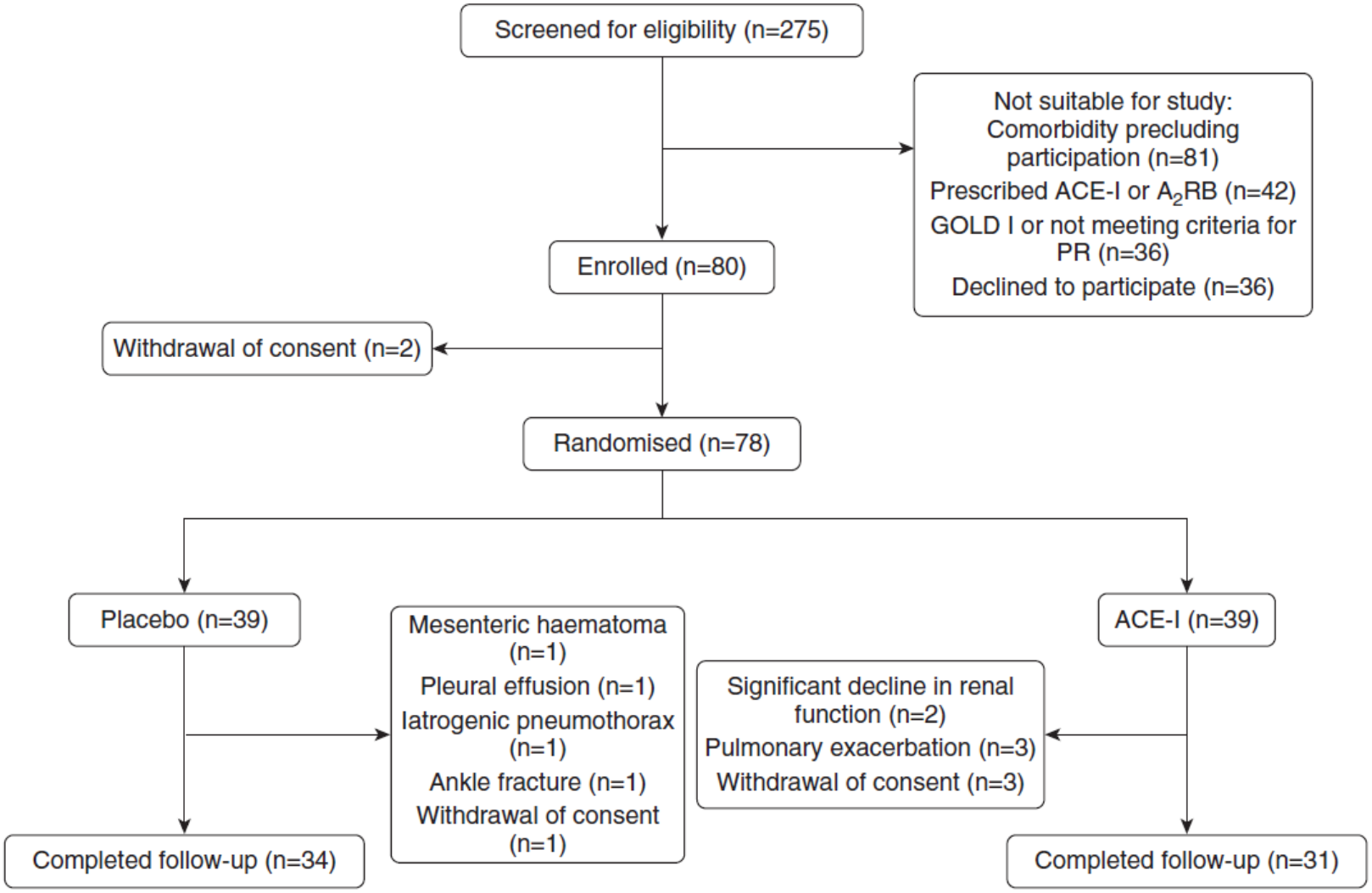
ORIGINAL ARTICLE

Angiotensin-Converting Enzyme Inhibition as an Adjunct to Pulmonary Rehabilitation in Chronic Obstructive Pulmonary Disease

Katrina J. Curtis[1], Victoria M. Meyrick[1,2], Bhavin Mehta[1], Gulam S. Haji[1], Kawah Li[3], Hugh Montgomery[3], William D.-C. Man[1,4], Michael I. Polkey[1], and Nicholas S. Hopkinson[1]

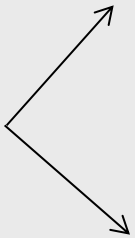
[1]National Institute for Health Research Respiratory Biomedical Research Unit, Royal Brompton & Harefield NHS Trust and Imperial College, London, United Kingdom; [2]Department of Respiratory Medicine, King's College London NHS Foundation Trust, London, United Kingdom; [3]Institute for Sport, Exercise and Health, University College London, London, United Kingdom; and [4]Harefield Pulmonary Rehabilitation Unit, Harefield Hospital, London, United Kingdom

ACE inhibition and pulmonary rehabilitation in COPD



Curtis et al, Am J Respir Crit Care Med 2016

ACE inhibition and pulmonary rehabilitation in COPD



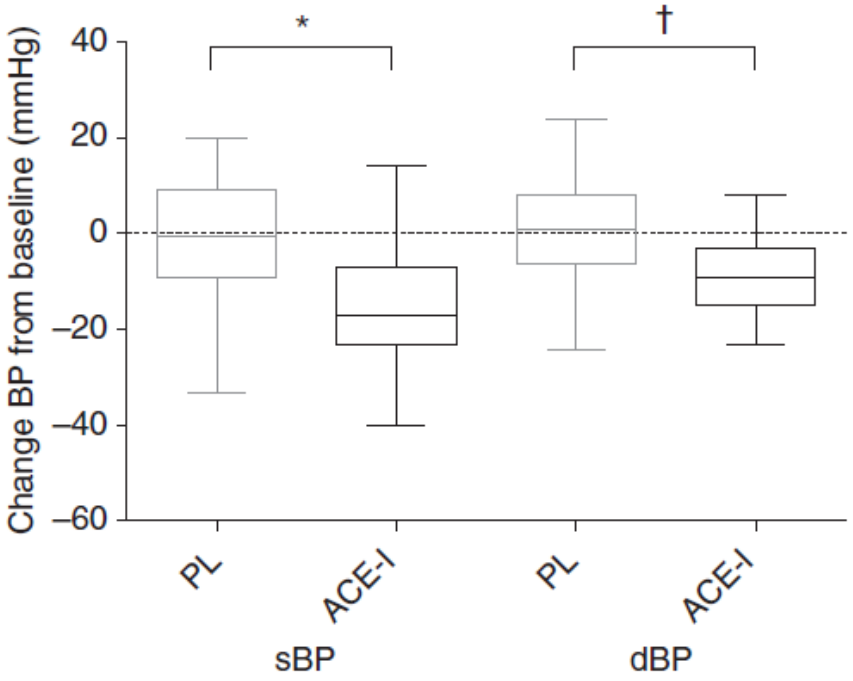
ACE-I: 10 mg enalapril once daily for 10 weeks

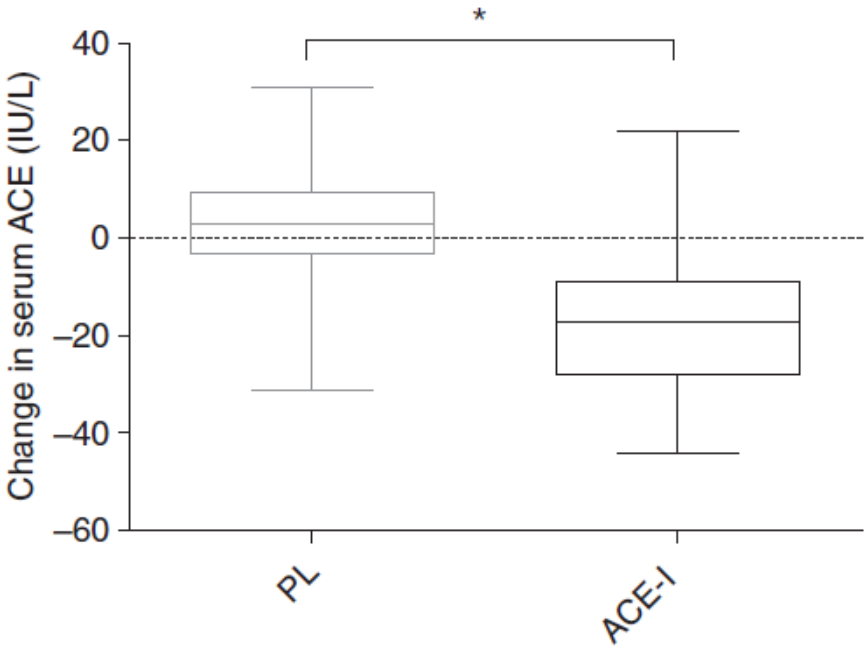
placebo

- **Randomisation based on peak power (50 W as cut-off) and ACE genotype**
- **Pulmonary rehabilitation: 8 weeks outpatient program, 3 sessions/week, 1 hour supervised exercise**

Curtis et al, Am J Respir Crit Care Med 2016

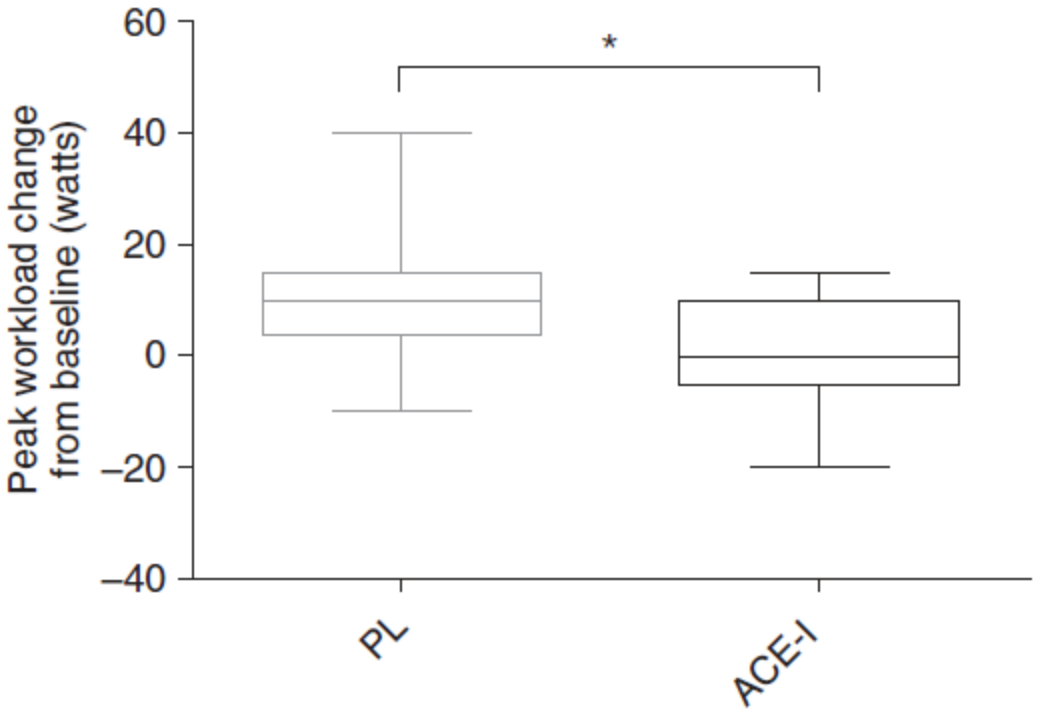
ACE inhibition and pulmonary rehabilitation in COPD





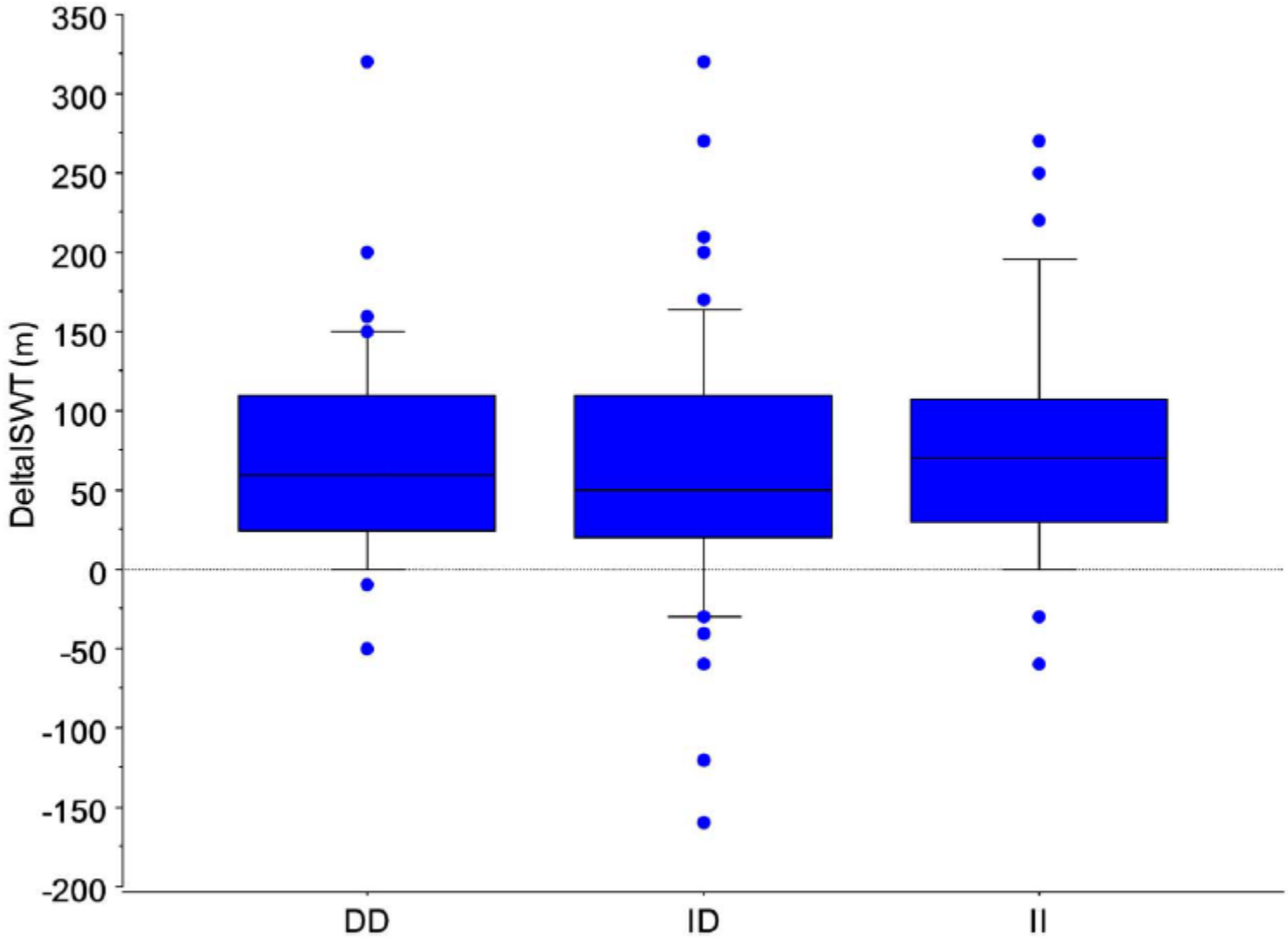
Curtis et al, Am J Respir Crit Care Med 2016

ACE inhibition and pulmonary rehabilitation in COPD



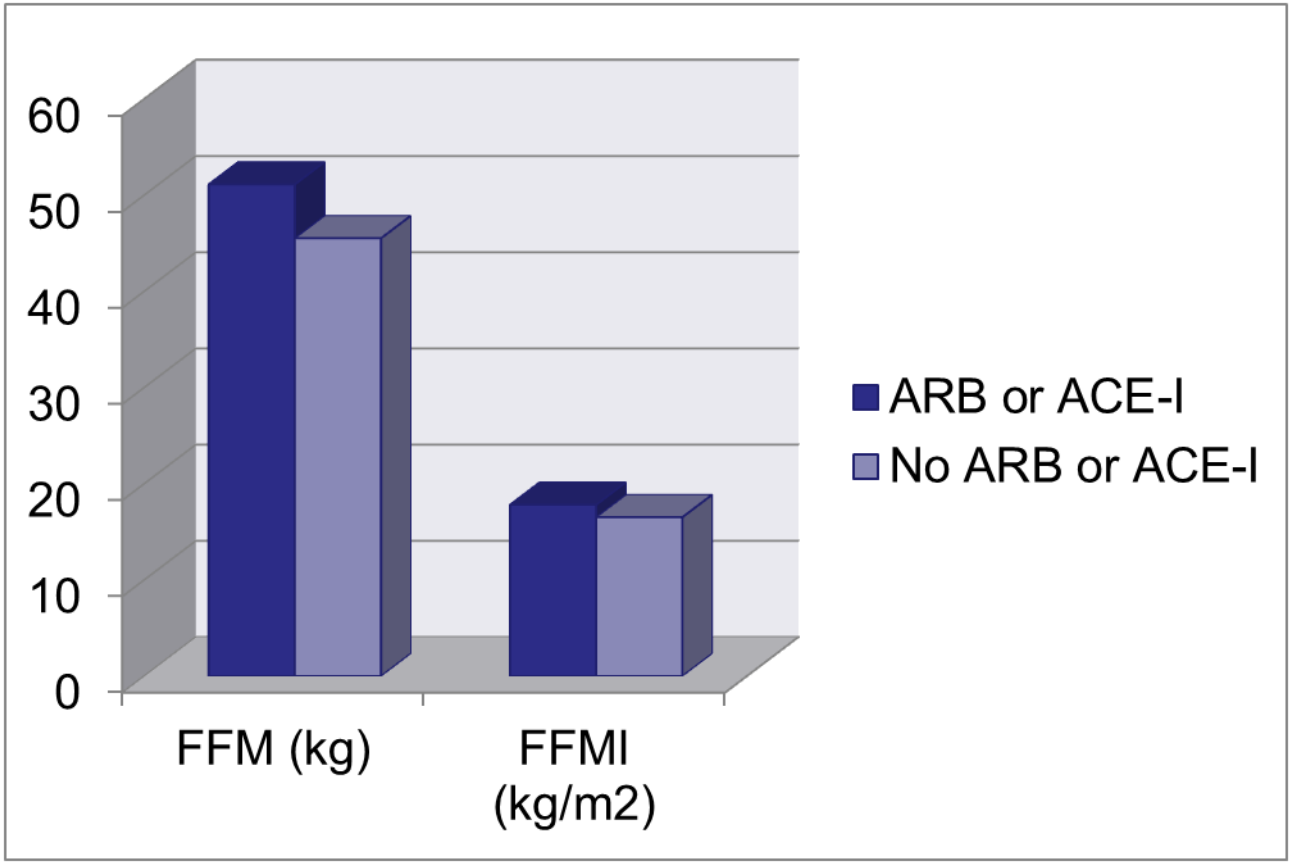
Curtis et al, Am J Respir Crit Care Med 2016

ACE inhibition and pulmonary rehabilitation in COPD



Kon et al, BMJ Open 2017

ACE inhibition and pulmonary rehabilitation in COPD



Kon et al, BMJ Open 2017

ACE inhibition and pulmonary rehabilitation in COPD

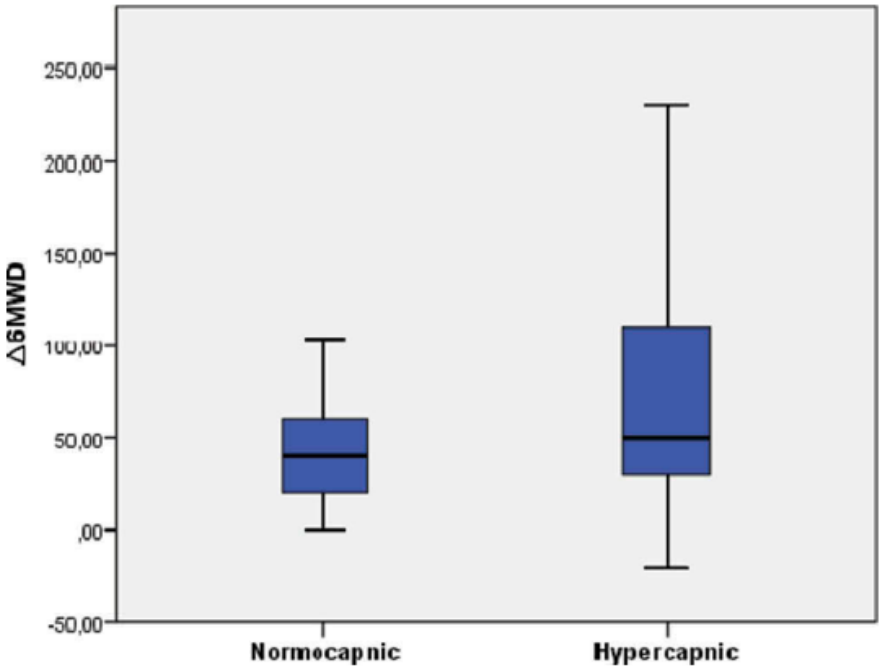
“When you have eleminated the impossible, whatever remains, must be the truth”

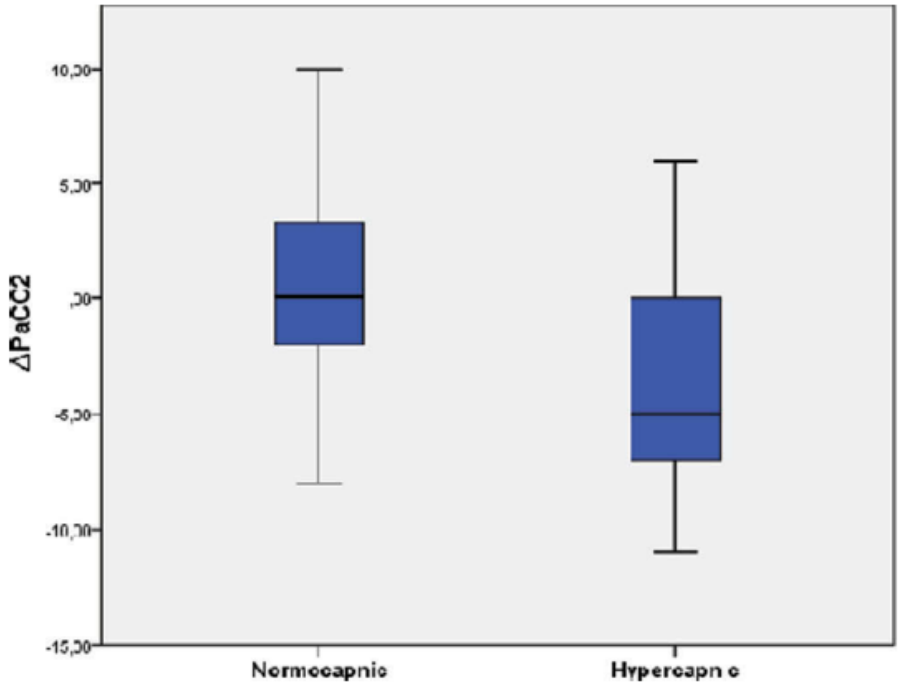
Sherlock Holmes

→ **Enalapril does not enhance to exercise training**

Ballman, Am J Respir Crit Care Med 2016

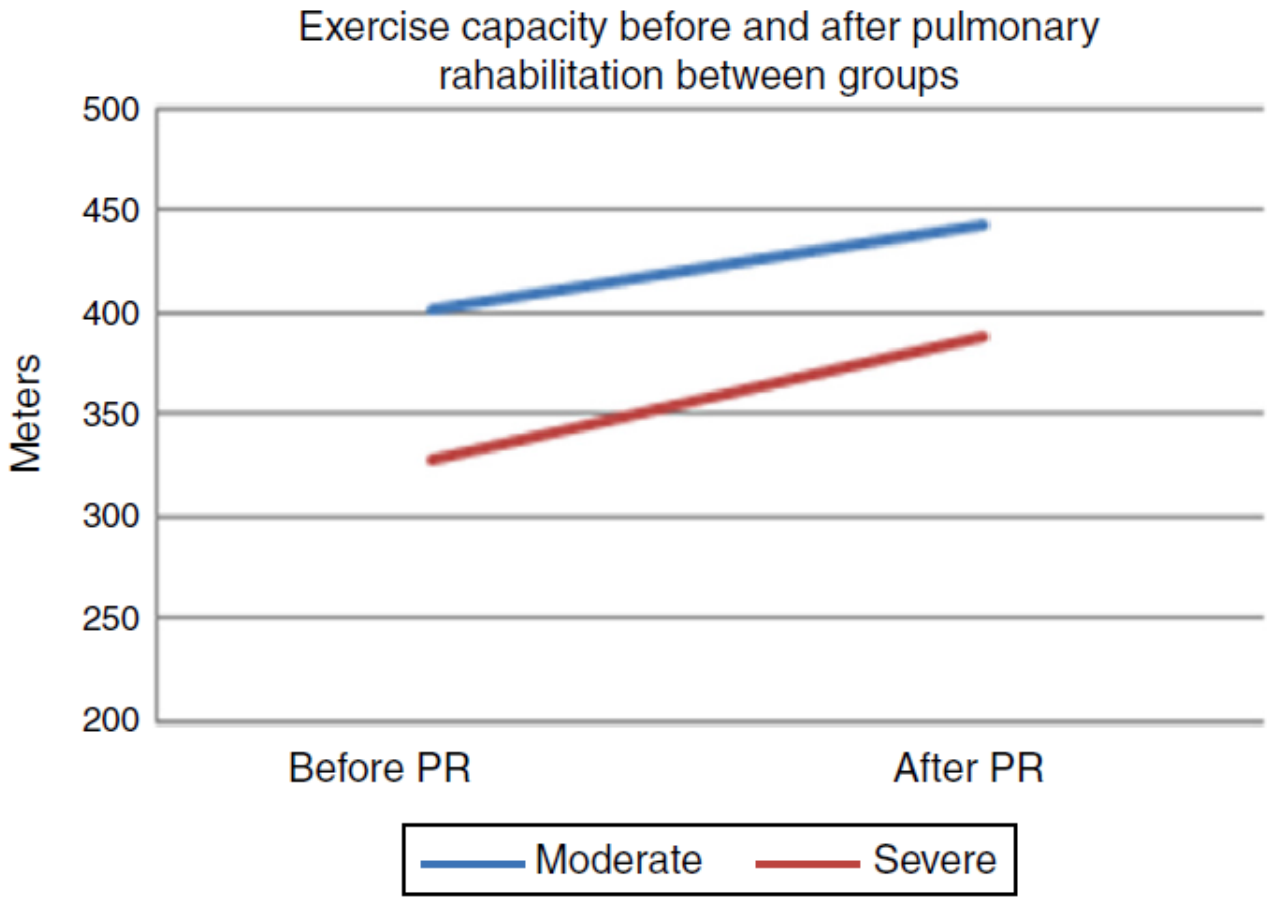
Pulmonary rehabilitation and chronic hypercapnic failure





Sahin et al, Exp Rev Respir Med 2016

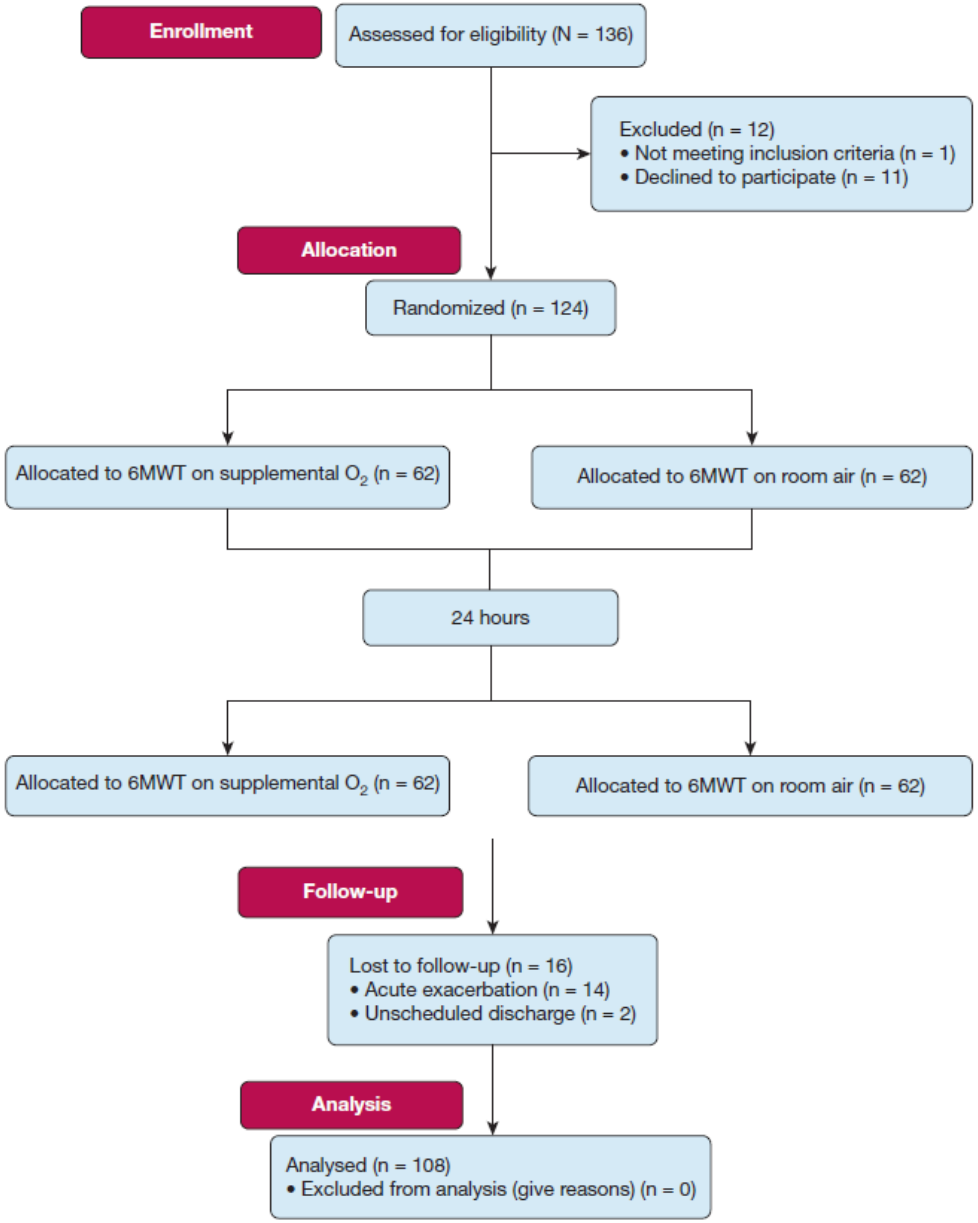
Impaired DLCO and outcome of pulmonary rehabilitation



No differences in terms of 6MW changes

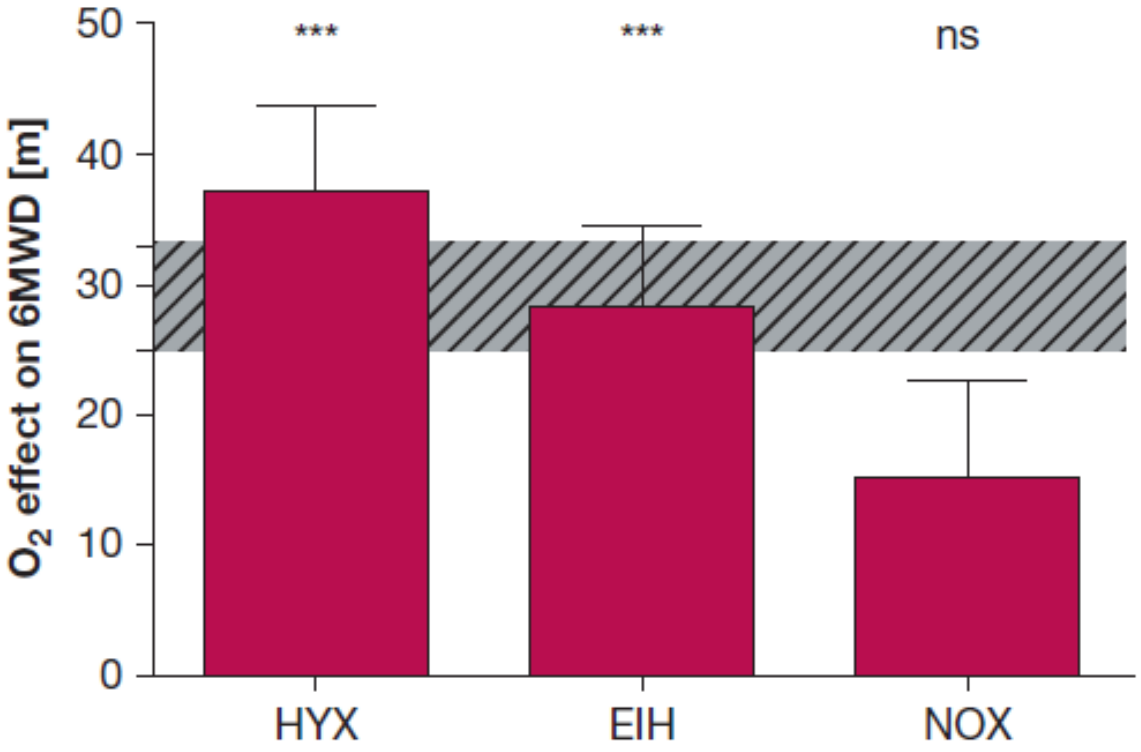
Sahin et al, Rev Port Pneumol 2016

Short-term effects of oxygen on 6MW



Jarosch et al, Chest 2017

Short-term effects of oxygen on 6MW



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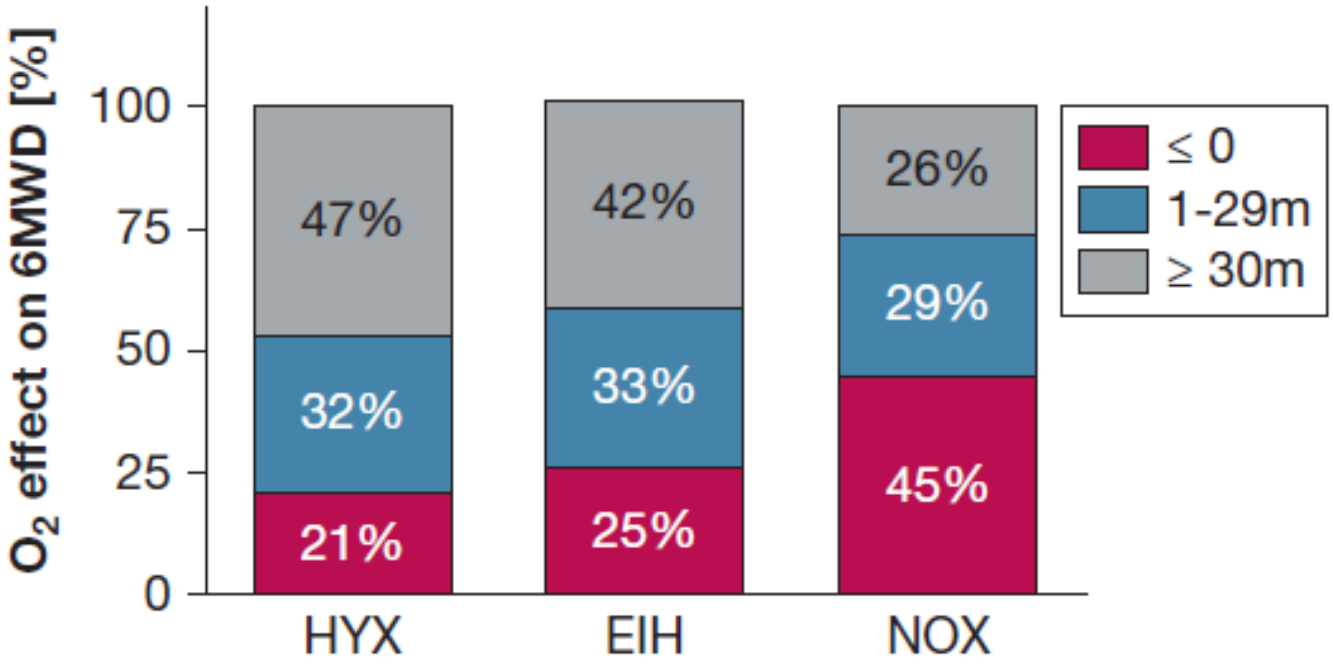
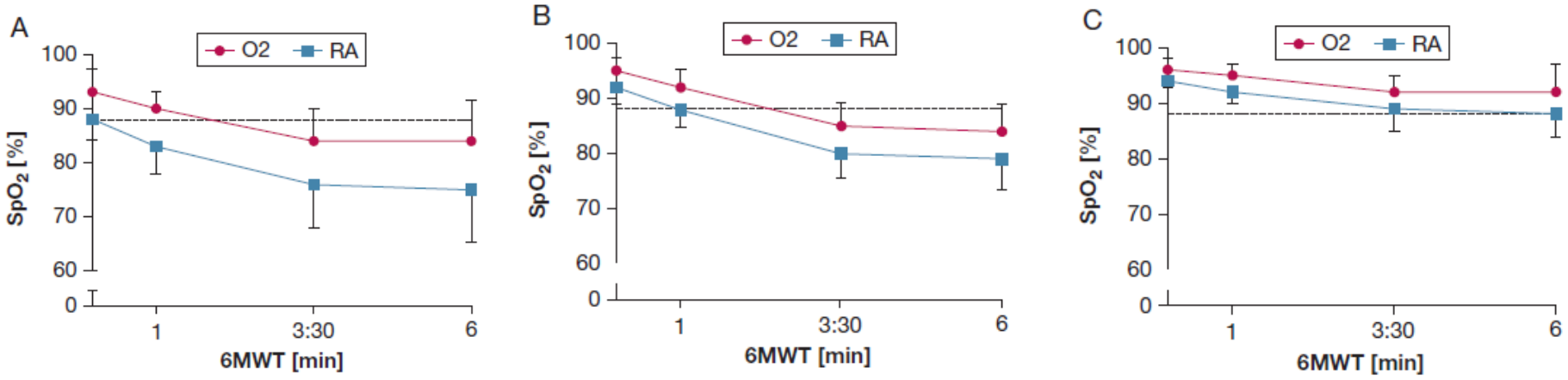


Jarosch et al, Chest 2017

Short-term effects of oxygen on 6MW



A: patients with HYK
B: patients with EIH
C: patients with NOX

Patients with HYX and EID benefit from supplemental oxygen by increasing exercise capacity.

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Maintaining the benefits of pulmonary rehabilitation: THE HOLY GRAIL

Benefits of Long-Term Pulmonary Rehabilitation Maintenance Program in Patients with Severe Chronic Obstructive Pulmonary Disease

Three-Year Follow-Up

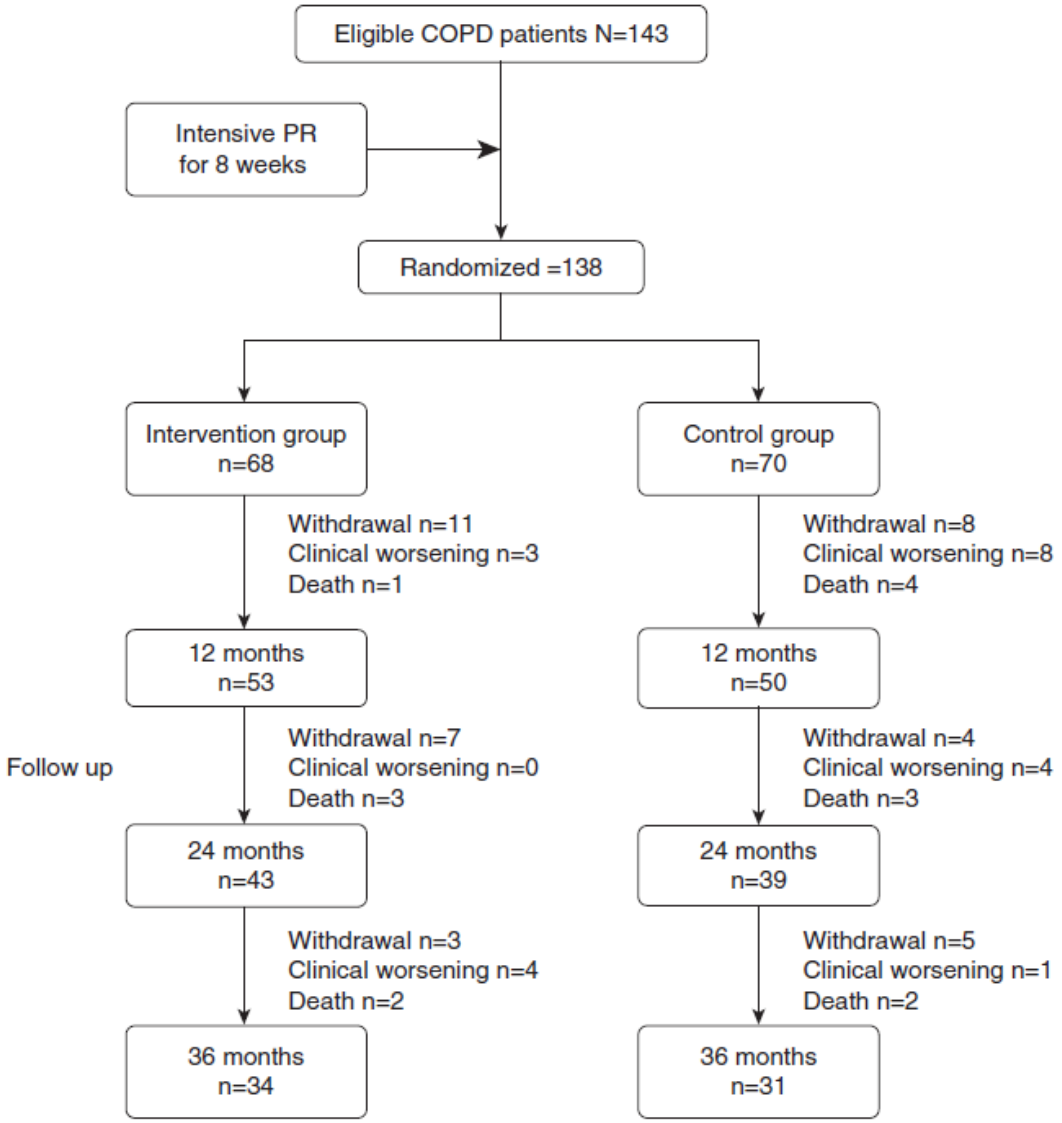
Maria-Rosa Güell[1], Pilar Cejudo[2,3], Francisco Ortega[2,3], M. Carmen Puy[1], Gema Rodríguez-Trigo[4], José Ignacio Pijoan[5,6,7], Lorea Martinez-Indart[5], Amaia Gorostiza[5], Khaled Bdeir[8], Bartolome Celli[9], and Juan B. Galdiz[5,10]

[1]Hospital de la Santa Creu I Sant Pau, Barcelona, Spain; [2]Hospital Virgen Rocío, Sevilla, Spain; [3]Instituto de Biomedicina de Sevilla, Sevilla, Spain; [4]Hospital Clínico San Carlos, Madrid, Spain; [5]Hospital Universitario Cruces, Barakaldo-Biocruces Health Research Institute, Barakaldo, Spain; [6]CIBER de Epidemiología y Salud Pública, Madrid, Spain; [7]Spanish Clinical Research Network, Madrid, Spain; [8]Hospital La Madalena, Castellón, Spain; [9]Pulmonary and Critical Care Medicine, Brigham and Women's Hospital, Boston, Massachusetts; and [10]CibeRes, Madrid, Spain

Benefits of long-term pulmonary rehabilitation maintenance program in patients with severe COPD

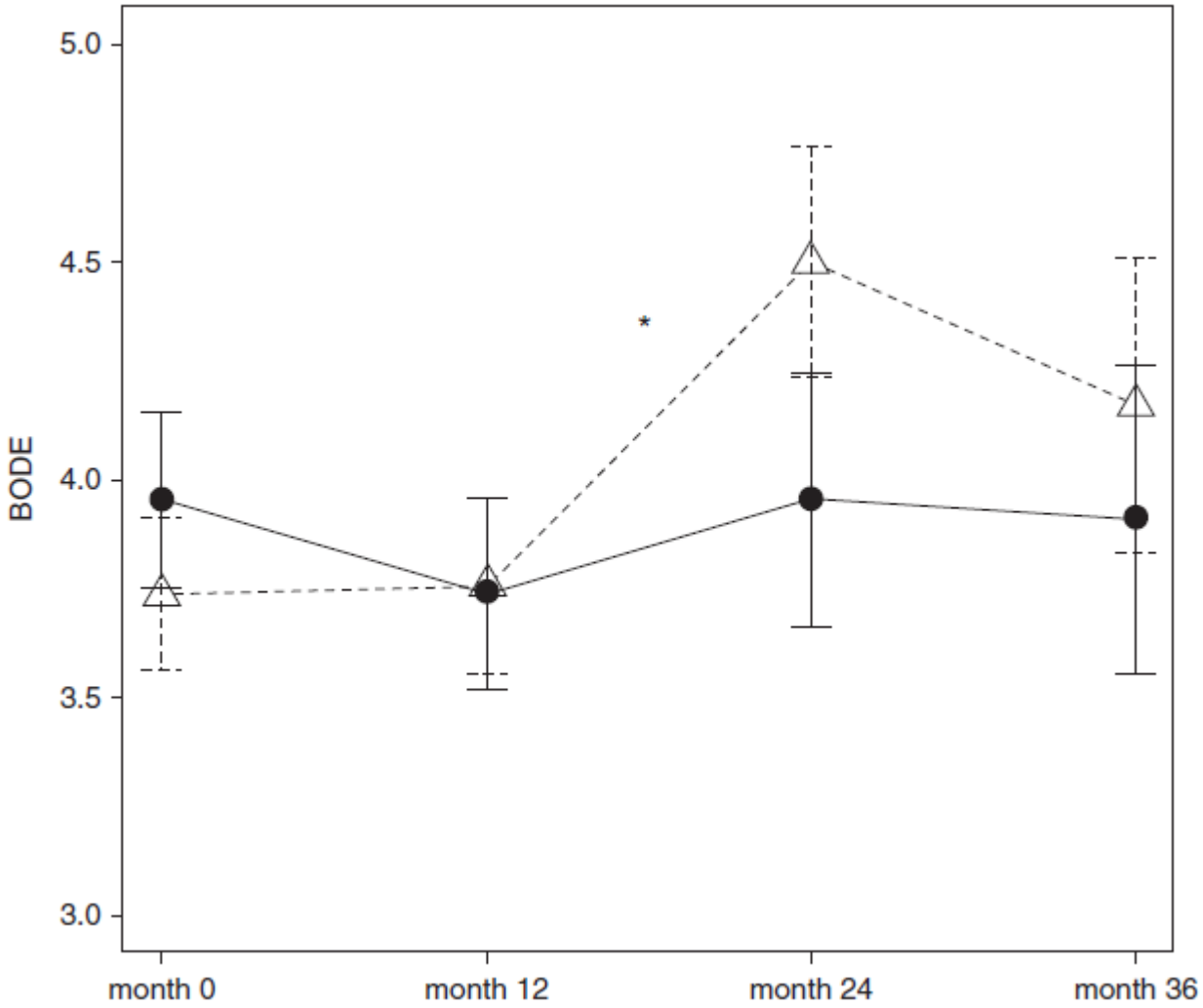
Intervention group:

- Phone call physiotherapist every 15 days during 3 years
- Alternate week: supervised training in the hospital
- Provision of cycle ergometer at home



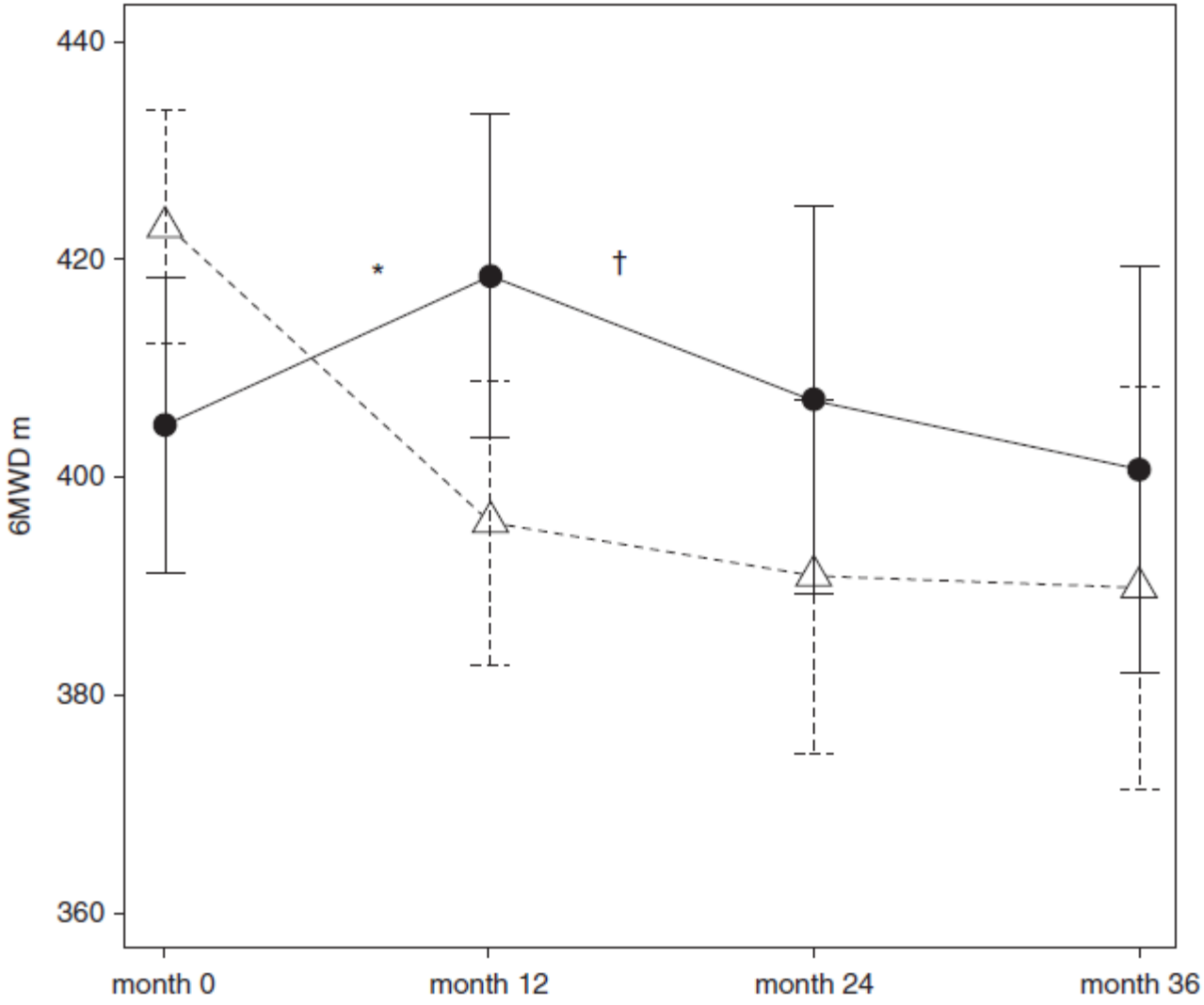
Güell et al, Am J Respir Crit Care Med 2017

Benefits of long-term pulmonary rehabilitation maintenance program in patients with severe COPD



Güell et al, Am J Respir Crit Care Med 2017

Benefits of long-term pulmonary rehabilitation maintenance program in patients with severe COPD

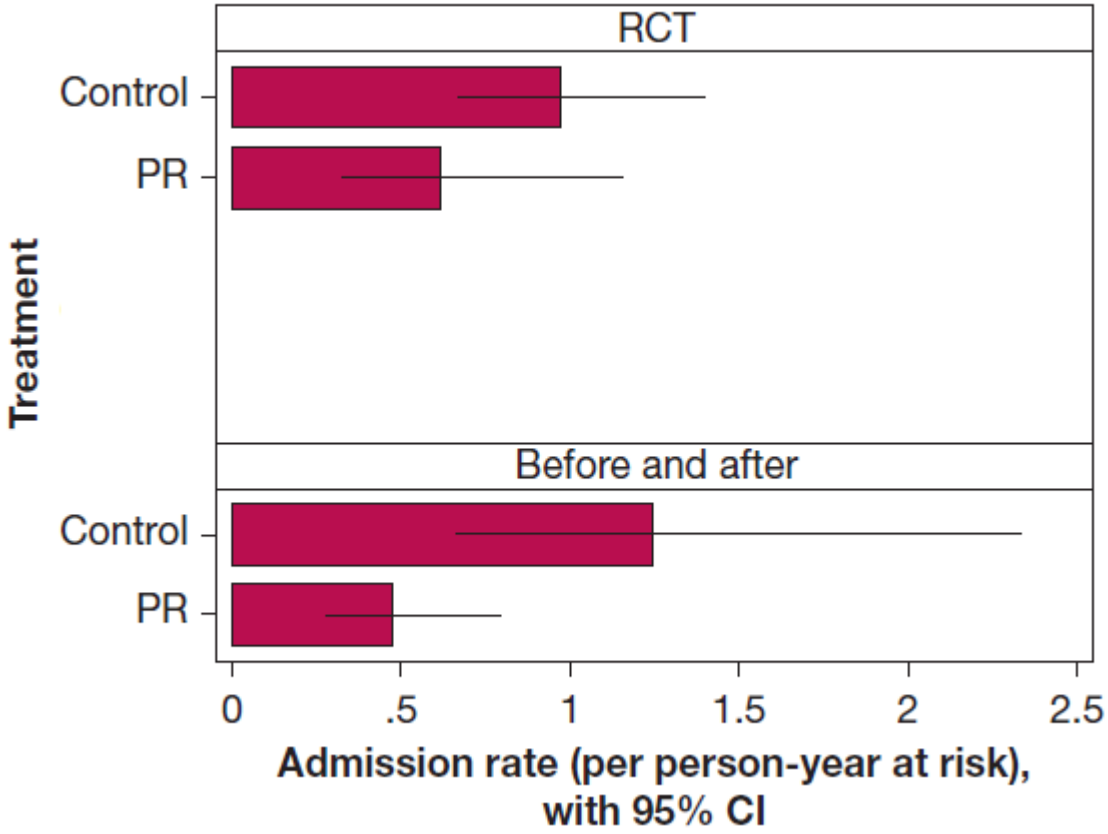


Güell et al, Am J Respir Crit Care Med 2017

Maintaining the benefits of pulmonary rehabilitation: THE HOLY GRAIL

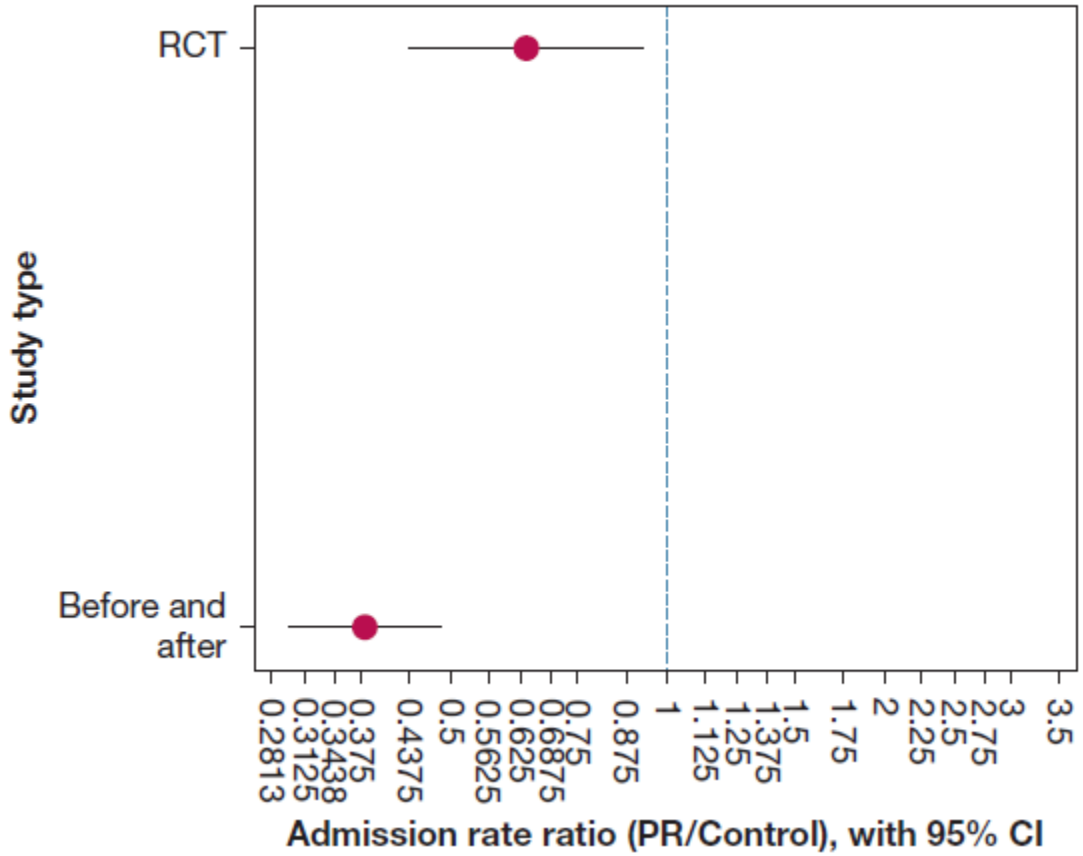
- **“One size does not fit all”**
- **Maintenance therapy: targeting specific needs over time**

Pulmonary rehabilitation and reduction of hospitalisations in COPD



Moore et al, Chest 2016

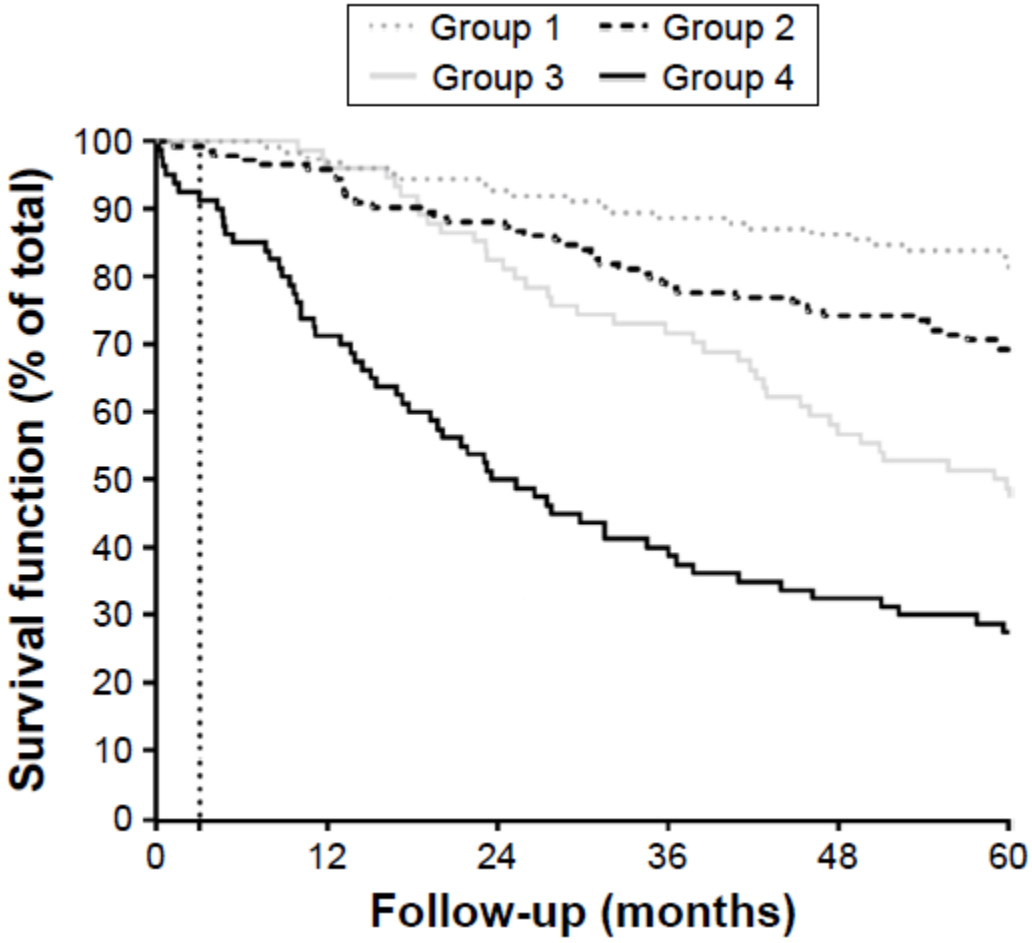
Pulmonary rehabilitation and reduction of hospitalisations in COPD



Evidence to suggest that providing rehabilitation is beneficial for reducing hospitalisations

Moore et al, Chest 2016

Survival after pulmonary rehabilitation in COPD



Camillo et al, Int J COPD 2016

Survival after pulmonary rehabilitation in COPD

Adjusted risk compared to G1	HR adjusted (95% CI)	*P*-value
G4: <350 m and delta <30 m	3.28 (2.02–5.33)	**<0.0001**
G3: <350 m and delta ≥30 m	1.90 (1.28–2.84)	**0.0016**
G2: ≥350 m and delta <30 m	1.36 (0.92–2.00)	0.1144

Camillo et al, Int J COPD 2016

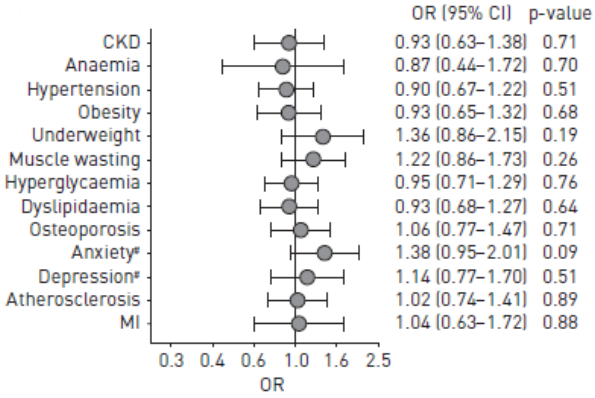
Comorbidities and Pulmonary Rehabilitation

Comorbidities and pulmonary rehabilitation

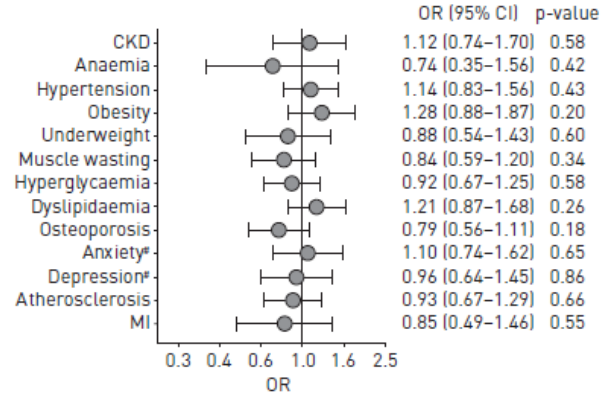
None of individual comorbidities, including previous cancer therapy, or indexes (Charlson, COTE and BODE) were correlated with the efficacy of pulmonary rehabilitation

Higashimoto et al, Geriatr Gerontol Int 2016

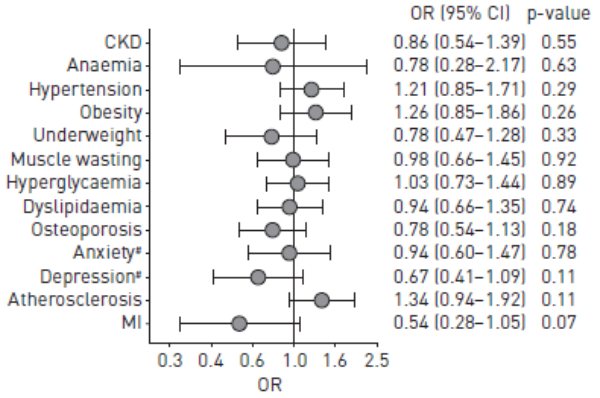
Predictive role of comorbidities on pulmonary rehabilitation outcomes



6MW



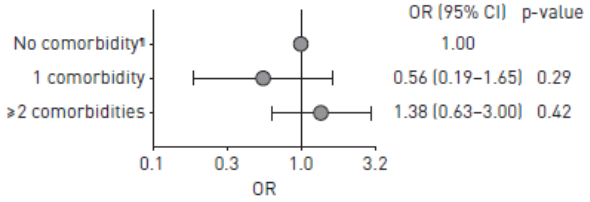
Constant work rate test



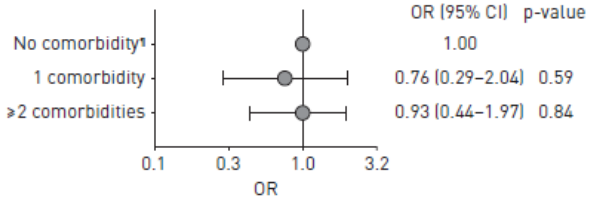
SGRQ

Mesquita et al, Eur Respir J 2015

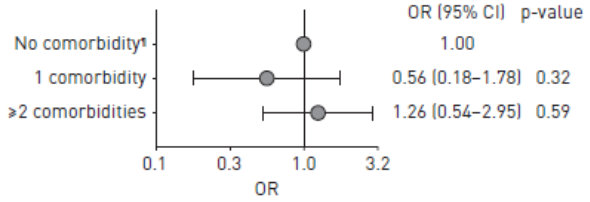
Predictive role of comorbidities on pulmonary rehabilitation outcomes



6MW



Constant work rate test



SGRQ

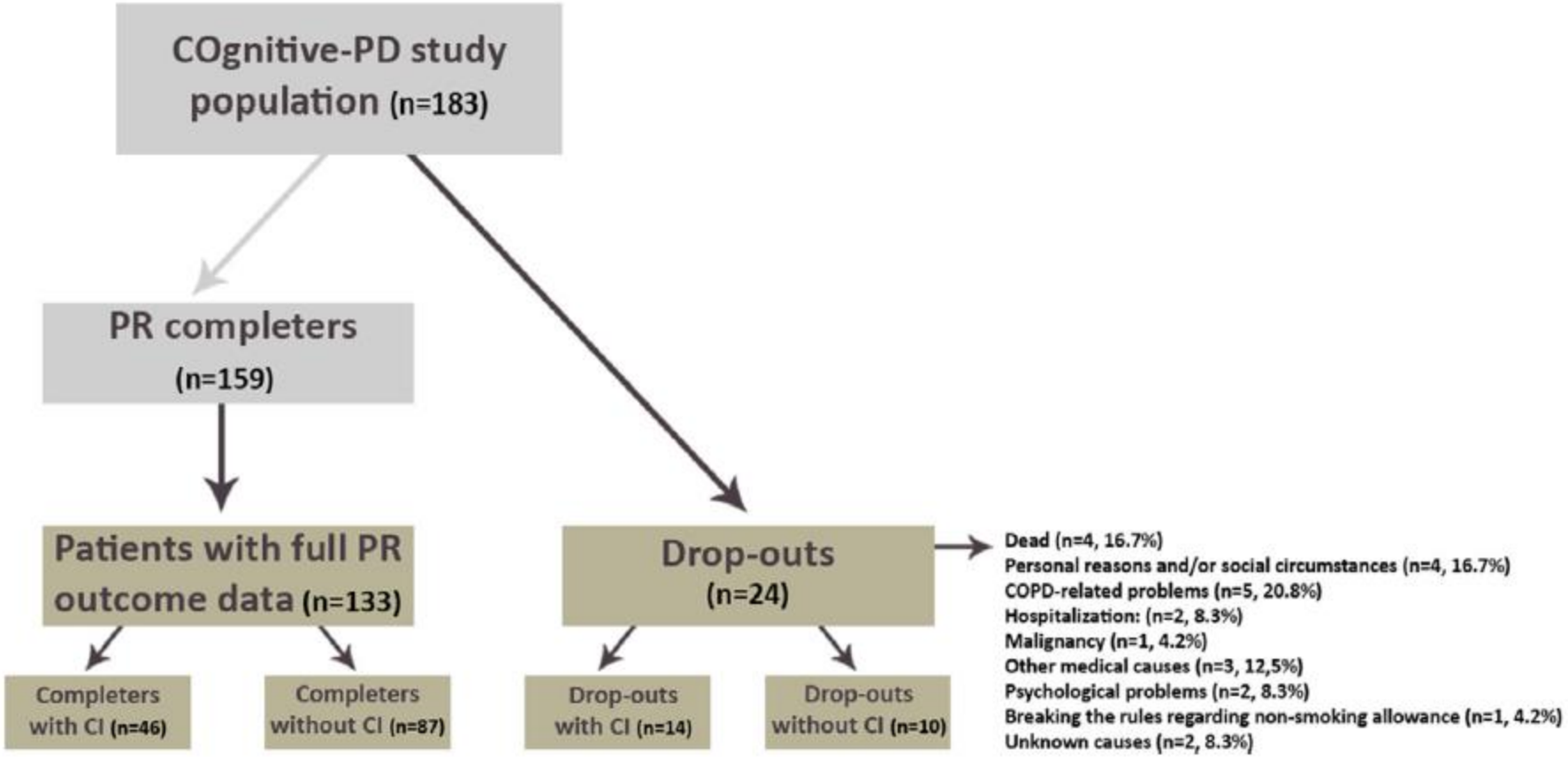
Mesquita et al, Eur Respir J 2015

Predictive role of comorbidities on pulmonary rehabilitation outcomes

	Mean change in raw parameters (SD) by age group				
	<70 years ($n = 202$)	n	>70 years ($n = 122$)	n	Mann-Whitney U test
FEV[1] (l/s)	− 0.003 (0.2)	123	0.003 (0.24)	82	$p =$ NS (non-significant)
ISWT (m)	39.7 (71.7)	127	32.8 (62.4)	89	$p =$ NS
ESWT (s)	78.4 (353)	123	68.4 (206.5)	87	$p =$ NS
SGRQ Total	− 2.5 (10.1)	97	− 2.8 (10.5)	61	$p =$ NS
HADS – A	− 0.8 (2.6)	126	− 0.5 (3.4)	89	$p =$ NS
HADS – D	− 0.6 (2.3)	126	− 0.3 (2.4)	88	$p =$ NS
Right Grip (kg)	1.6 (4)	129	1.2 (4.2)	86	$p =$ NS
Left Grip (kg)	1.4 (4.2)	128	1.1 (3.6)	87	$p =$ NS
mMRC	− 0.2 (1.1)	77	− 0.02 (1.4)	52	$p =$ NS
CAT	− 1.8 (6.0)	83	− 1.7 (6.6)	58	$p =$ NS

Bennett et al, COPD 2017

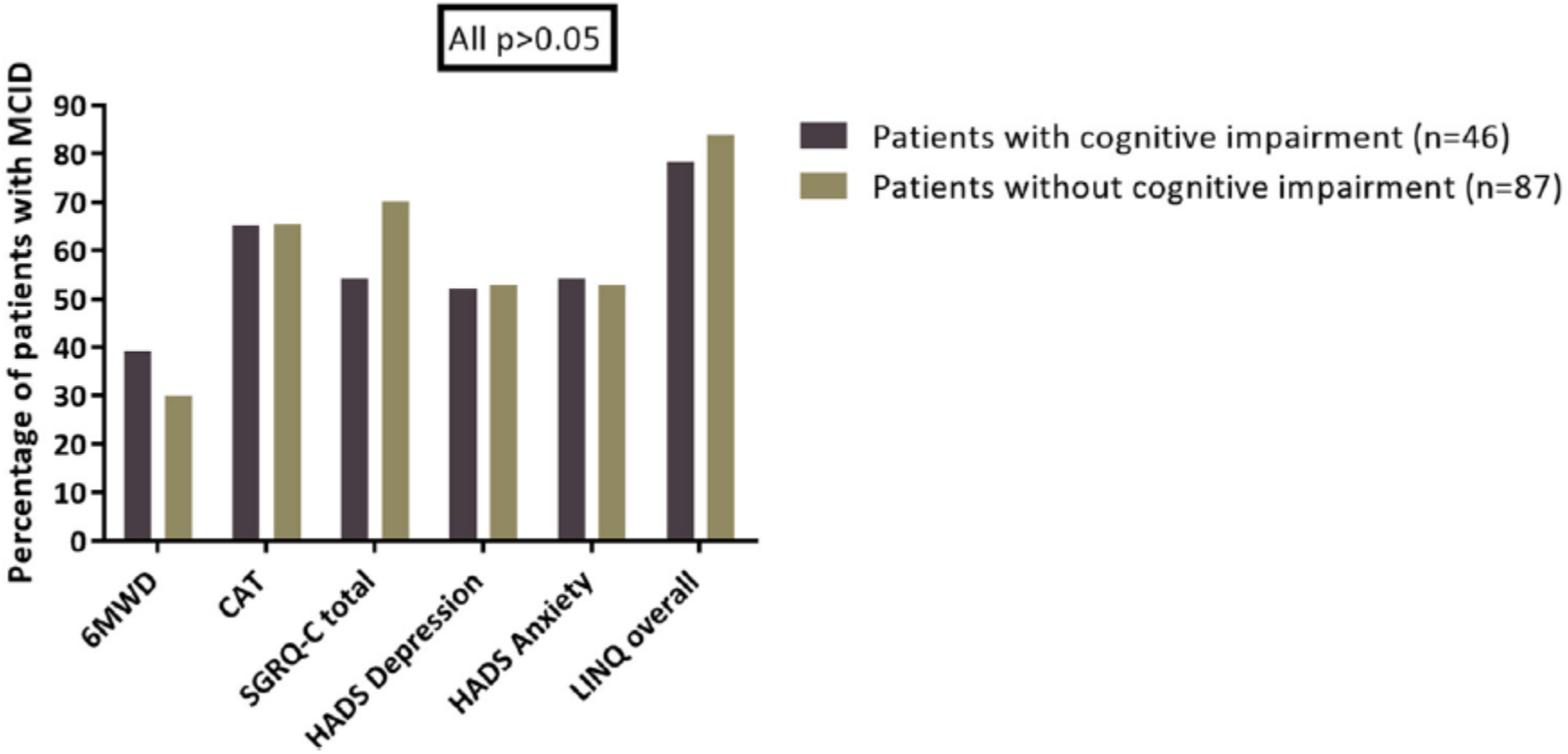
Cognitive impairment and efficacy of pulmonary rehabilitation in COPD



Patients with CI are at risk for dropout during pulmonary rehabilitation

Cleutjens et al, JAMDA 2017

Cognitive impairment and efficacy of pulmonary rehabilitation in COPD



Pulmonary rehabilitation is an effective treatment for patients with COPD and cognitive impairment

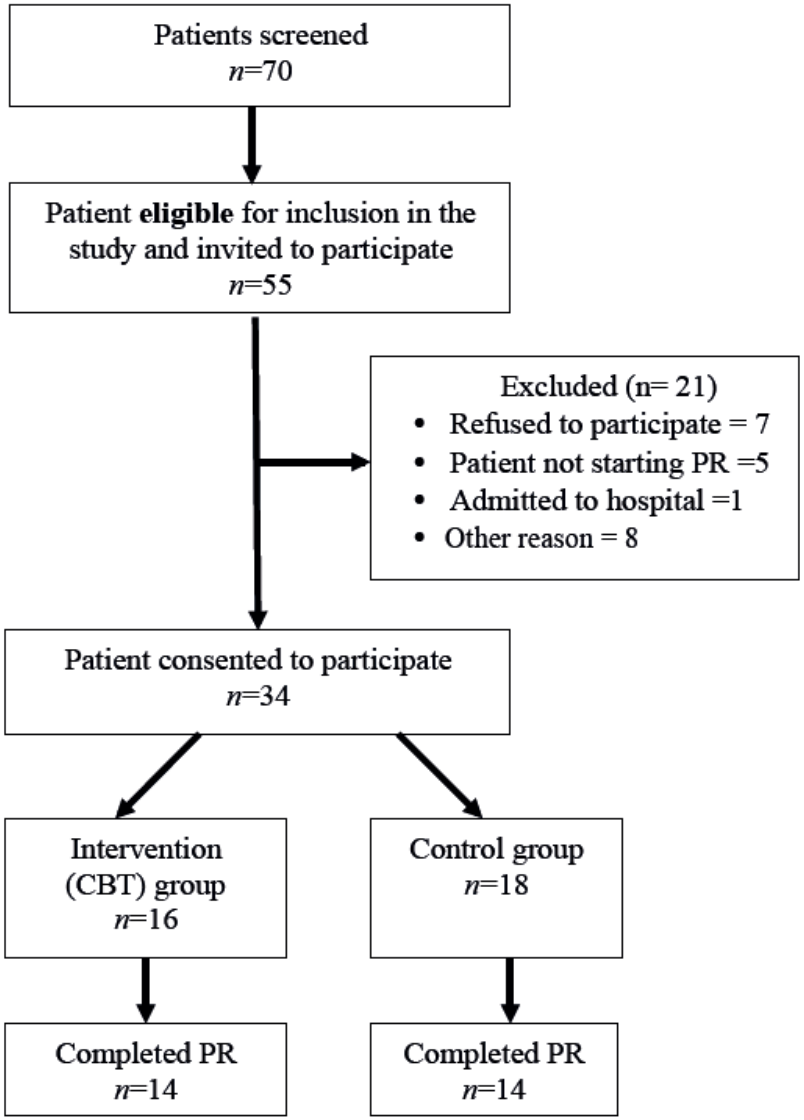
Cleutjens et al, JAMDA 2017

Cognitive behavioural therapy and pulmonary rehabilitation

- Breathing and relaxation
- Anxiety management
- Monitoring and responding to thoughts/self-talk
- Barriers to changing behaviour
- Goals, objectives and problem-solving
- Understanding and responding to the risk of depression

Luk et al, J Rehabil Med 2017

Cognitive behavioural therapy and pulmonary rehabilitation



Luk et al, J Rehabil Med 2017

Cognitive behavioural therapy and pulmonary rehabilitation

Significant differences in 6MWT, fatigue, depression and stress measures.

→ **Non-exercise intervention improves the efficacy of PR.**

Luk et al, J Rehabil Med 2017

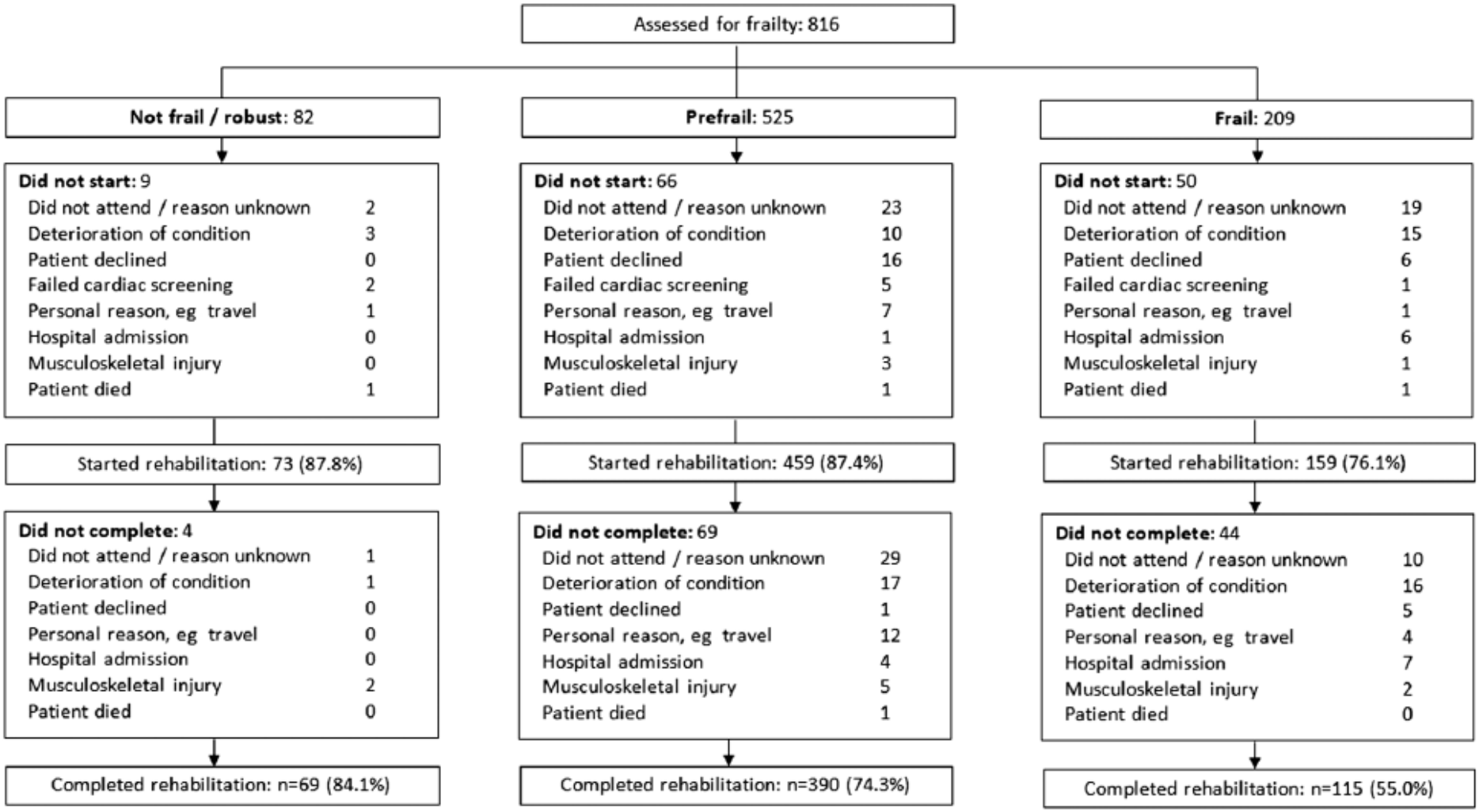
FRAILTY

Clinical syndrome characterised by multisystem decline that leads to reduced functional reserve and increased vulnerability to dependence or mortality following minor stressor events.

Frailty assessment: unintentional weight loss (shrinking), exhaustion, low physical activity, slowness and weakness.

Morley et al, JAMDA 2013

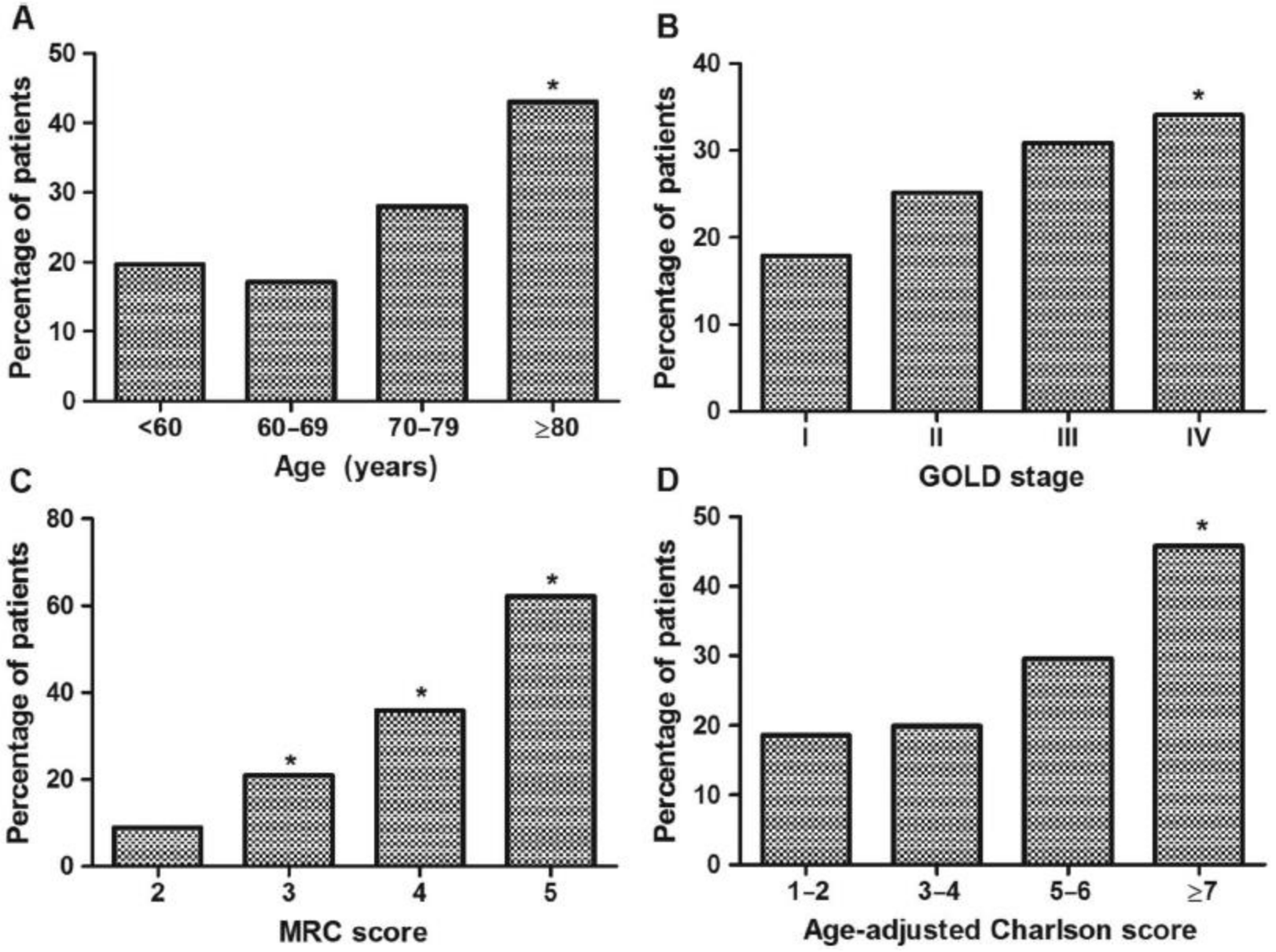
Physical frailty and pulmonary rehabilitation in COPD



Being frail is associated with over double adds of program non-completion

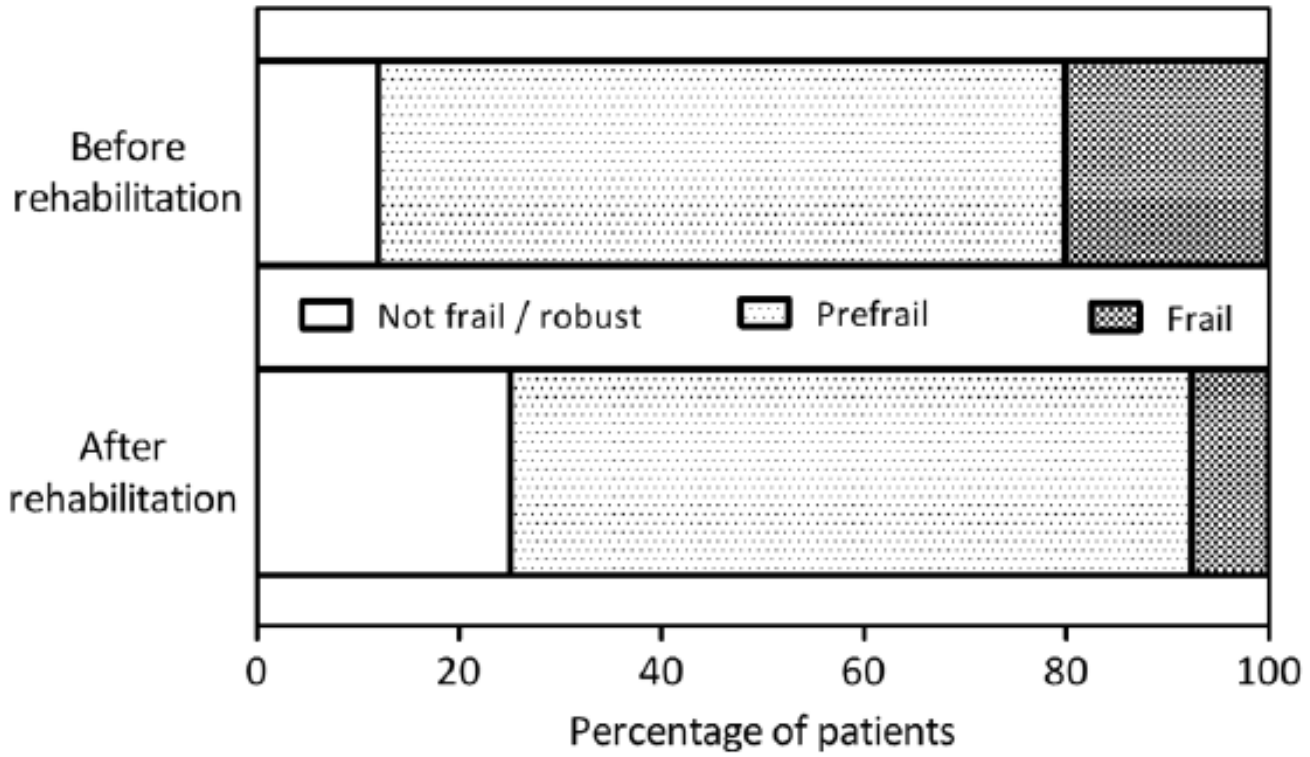
Maddocks et al, Thorax 2016

Physical frailty and pulmonary rehabilitation in COPD



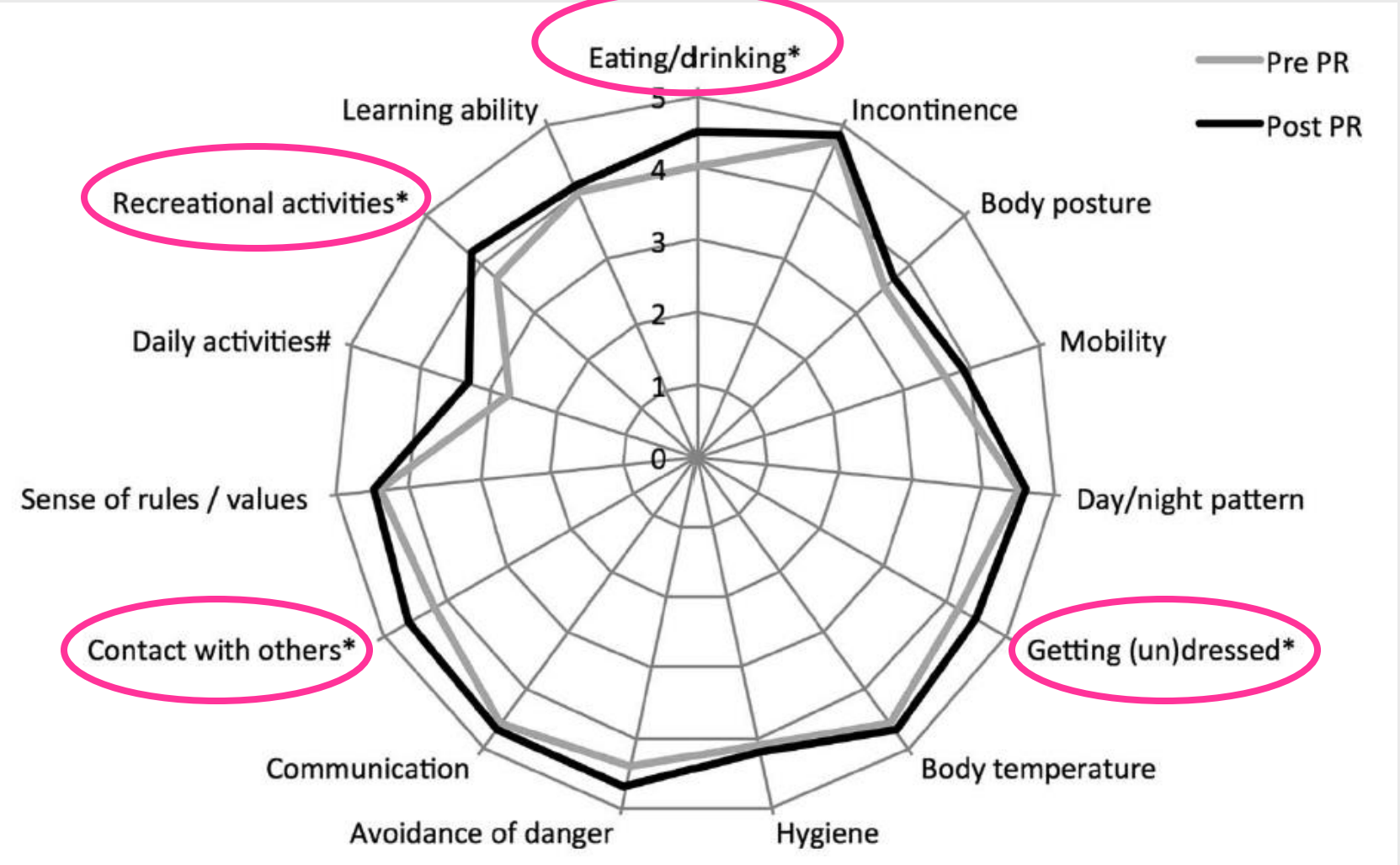
Maddocks et al, Thorax 2016

Physical frailty and pulmonary rehabilitation in COPD

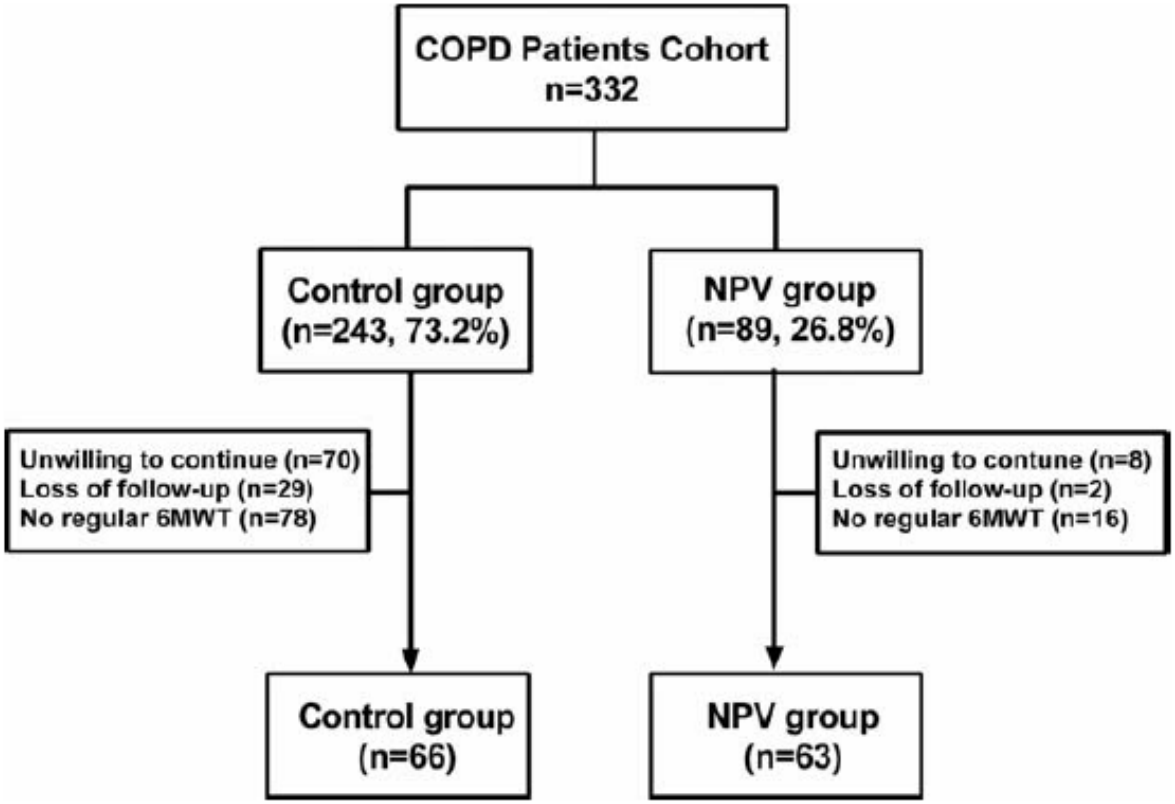


Maddocks et al, Thorax 2016

Relationship between pulmonary rehabilitation and care dependency in COPD



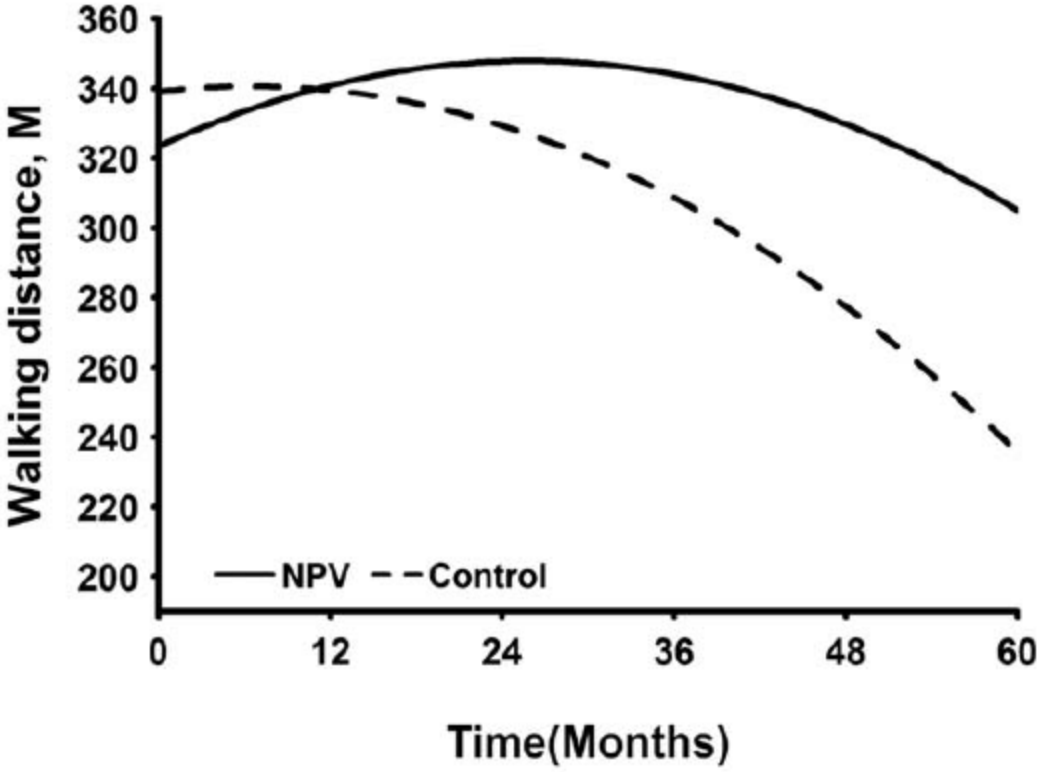
Pulmonary rehabilitation and NPV in COPD



NPV: cuirass ventilator for 60 minutes/daily

Huang et al, Medicine 2016

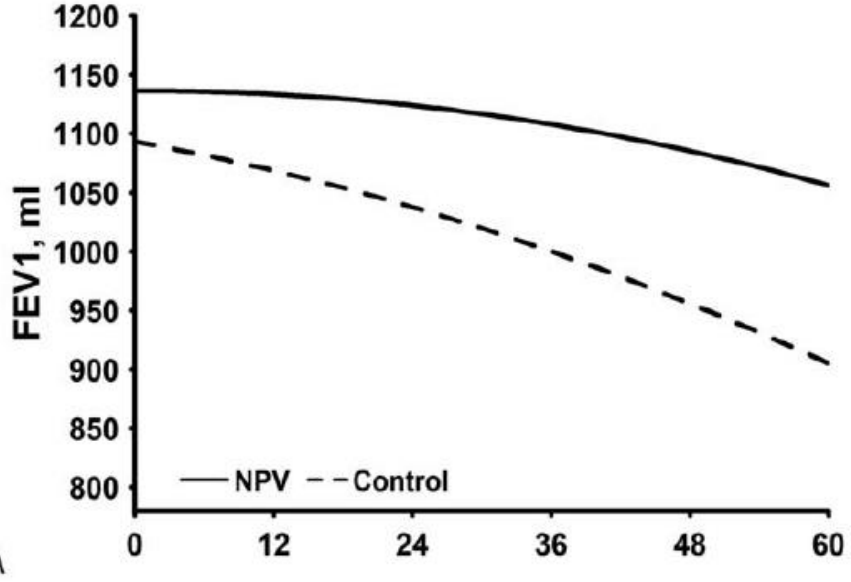
Pulmonary rehabilitation and NPV in COPD



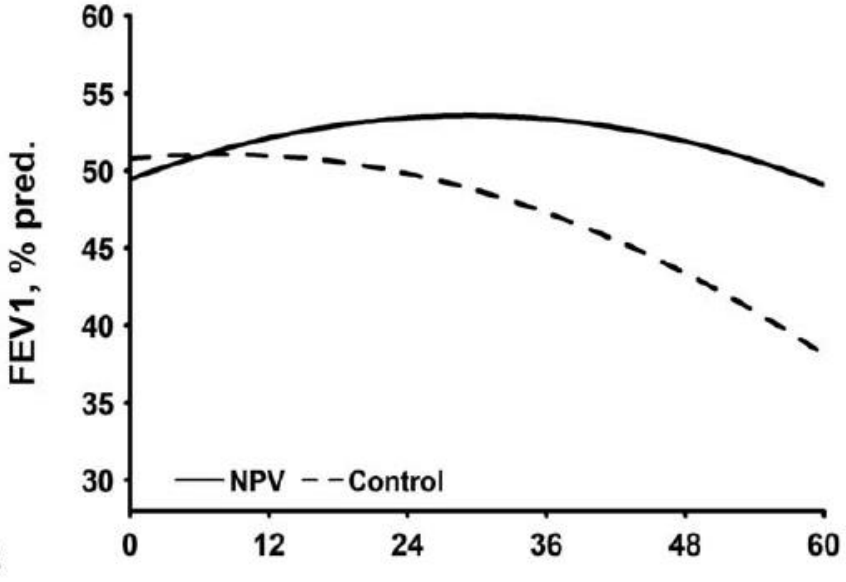
Years	0	1	2	3	4	5
NPV	323.4	340.9	347.7	344.1	329.8	305.1
Control	339.1	339.5	329.4	308.7	277.5	235.7

Huang et al, Medicine 2016

Pulmonary rehabilitation and NPV in COPD



A



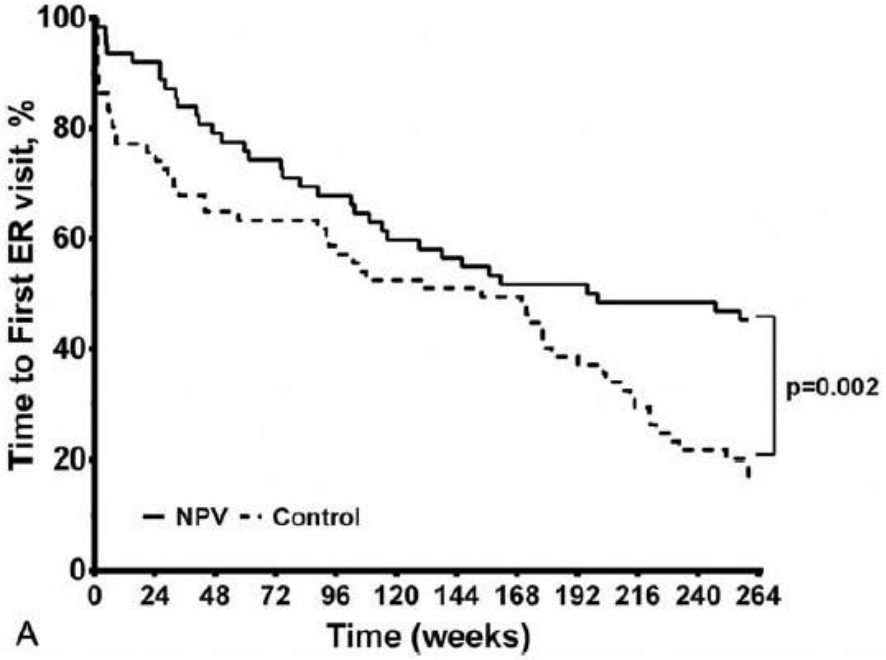
B

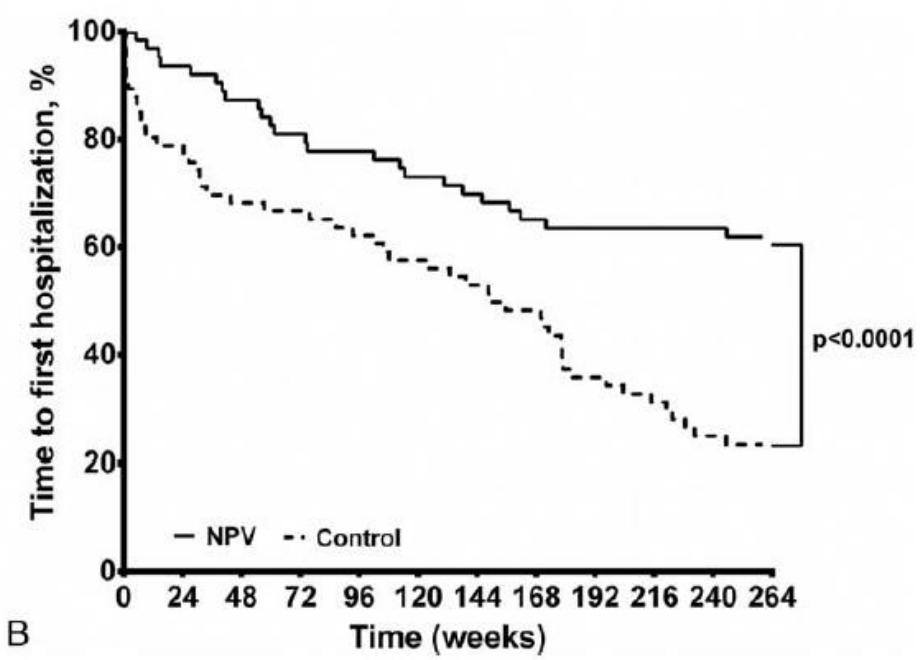
Years	0	1	2	3	4	5
NPV	1136	1134	1124	1108	1085	1056
Control	1093	1069	1038	1000	956	905

0	1	2	3	4	5
49.4	52.1	53.4	53.3	51.9	49.1
50.8	51.0	49.8	47.3	43.4	38.1

Huang et al, Medicine 2016

Pulmonary rehabilitation and NPV in COPD





Huang et al, Medicine 2016

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 psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors.

PULMONARY REHABILITATION= PERSONALISED MEDICINE

Take-Home Messages

- **ACE inhibition does not enhance response to PR**
- **Patients with HYX or EID benefit for supplemental oxygen**
- **Comorbidities, age, hypercapnia or impaired diffusing capacity or no contra-indications for PR**
- **Pulmonary rehabilitation has long-term benefits, including reduction in hospitalisations. Need for tailormade maintenance programmes.**
- **Physical frailty and care dependency in PR patients.**

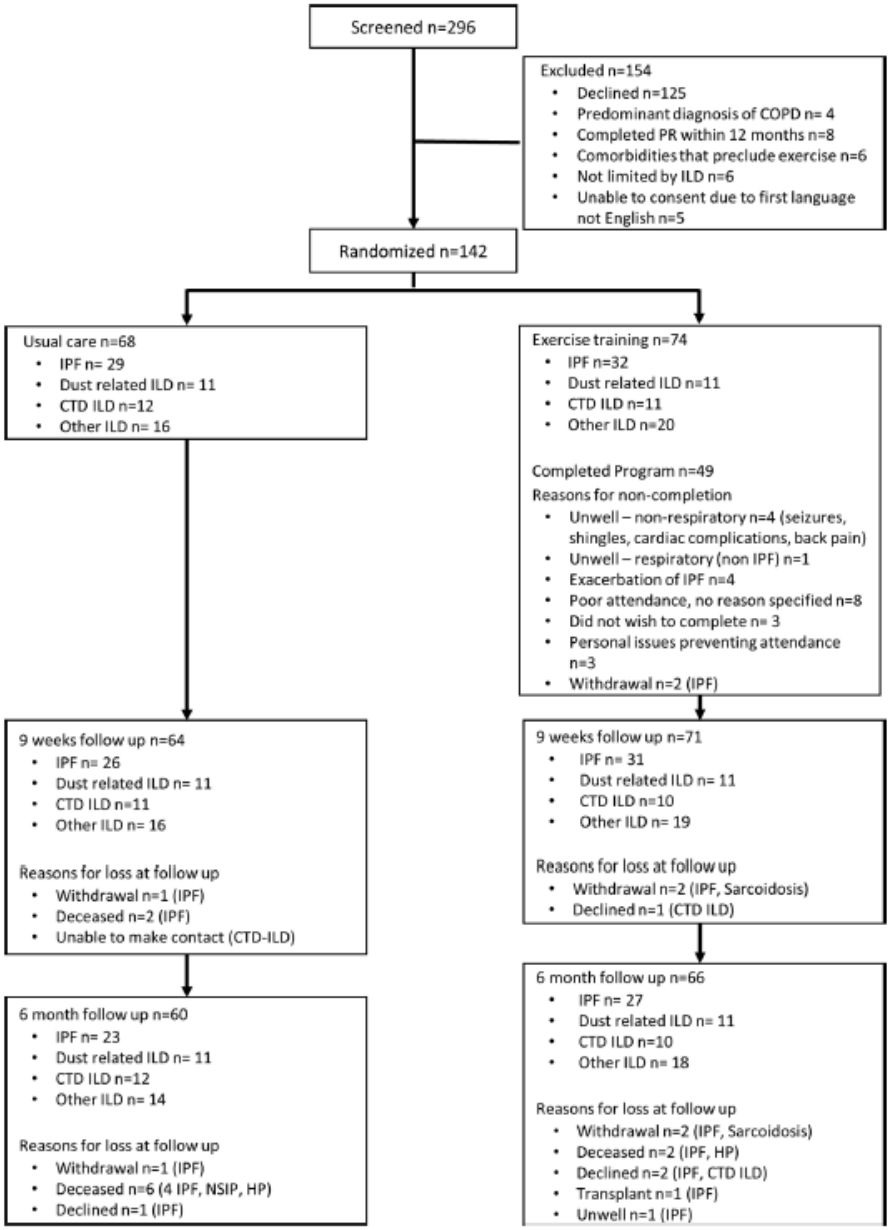
Rehabilitation and ILD

ORIGINAL ARTICLE

The evidence of benefits of exercise training in interstitial lung disease: a randomised controlled trial

Leona M Dowman,[1,2,3,4] Christine F McDonald,[3,4,5] Catherine J Hill,[2,4] Annemarie L Lee,[4,6] Kathryn Barker,[7] Claire Boote,[7] Ian Glaspole,[8,9] Nicole S L Goh,[3,4,8] Anne M Southcott,[10] Angela T Burge,[1,4,6] Rebecca Gillies,[1,4] Alicia Martin,[7] Anne E Holland[1,4,6]

Exercise training in ILD



Dowman et al, Thorax 2017

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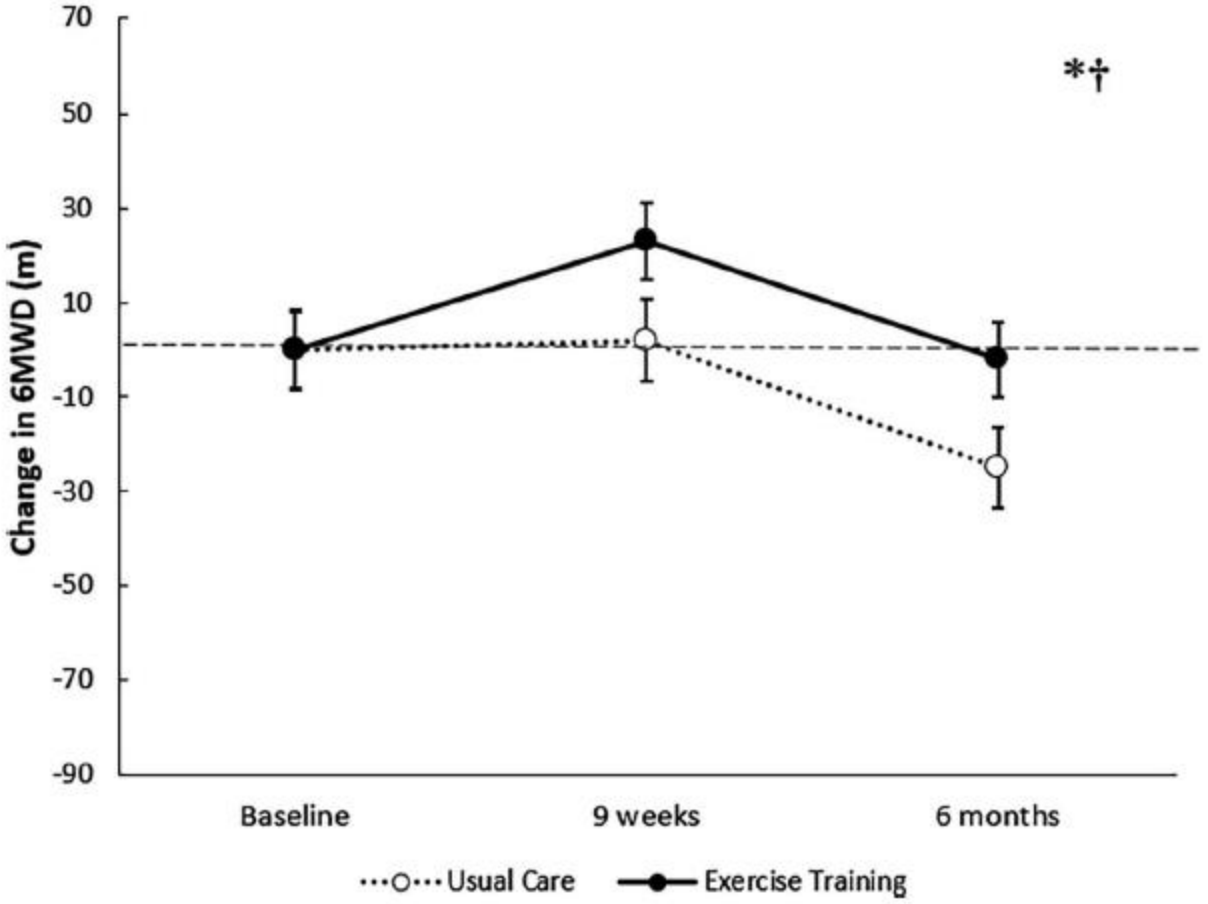
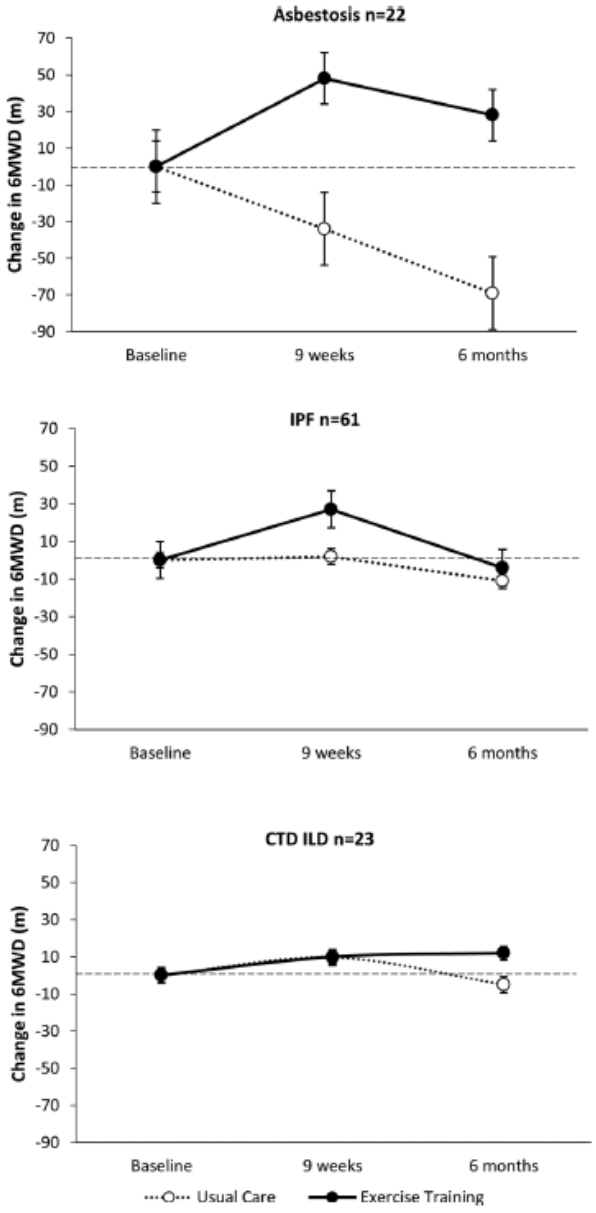


Dowman et al, Thorax 2017

Exercise training in ILD



Dowman et al, Thorax 2017

Exercise training in ILD

- **Exercise training results in clinically important improvements in 6MWD, symptoms and health status following exercise**
- **Exercise training must be considered as recommended treatment for all patients with ILD**
- **No basis for using pulmonary function markers of severity to predict response of exercise training**

Dowman et al, Thorax 2017

Unmet educational needs of ILD patients

- **Patient dissatisfaction with lack of available, decipherable information**
- **Lack of attention to emotional well-being**
- **Key topics for education**

  - pathophysiology of ILD

  - management symptoms

  - clinical tests: “*we live and die by lung capacity and DLCO*”

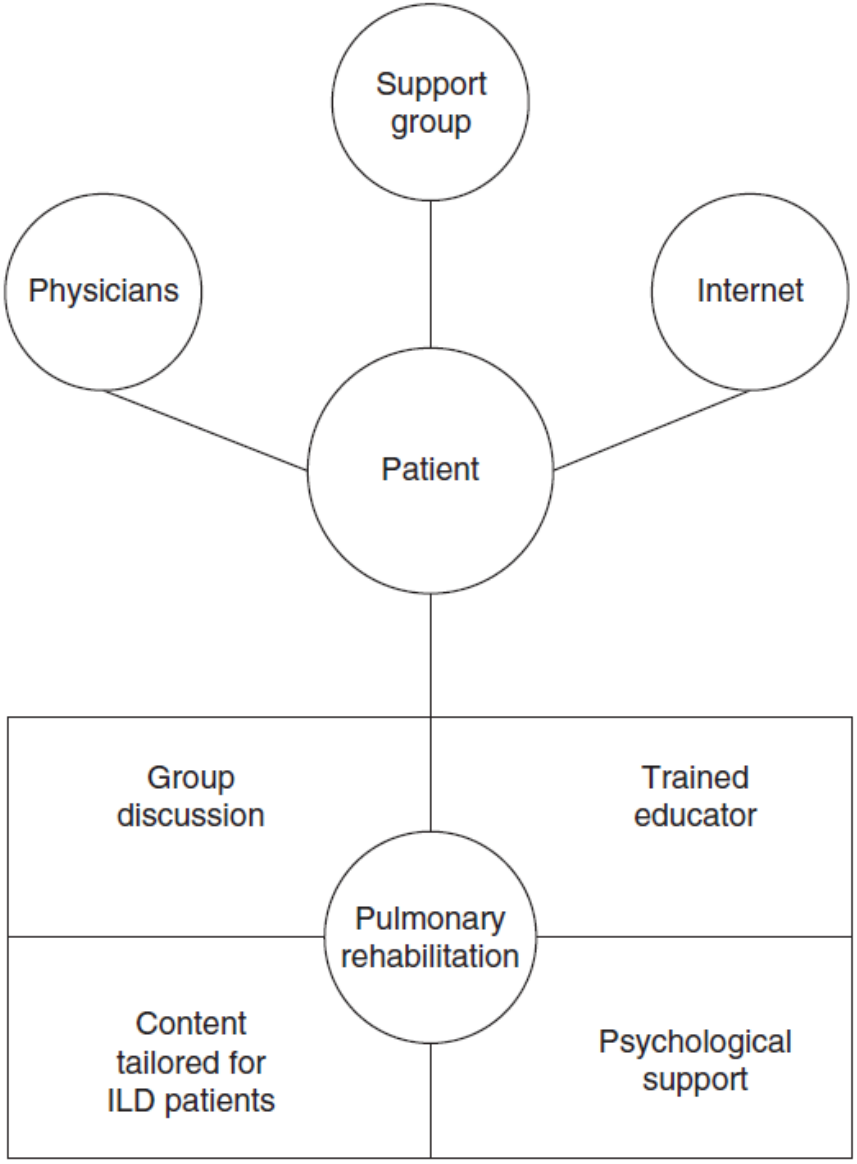
  - autonomy

  - oxygen use

  - end-of-life counseling: “*how does one die from ILD*”

Morisset et al, Ann Am Thorac Soc 2016

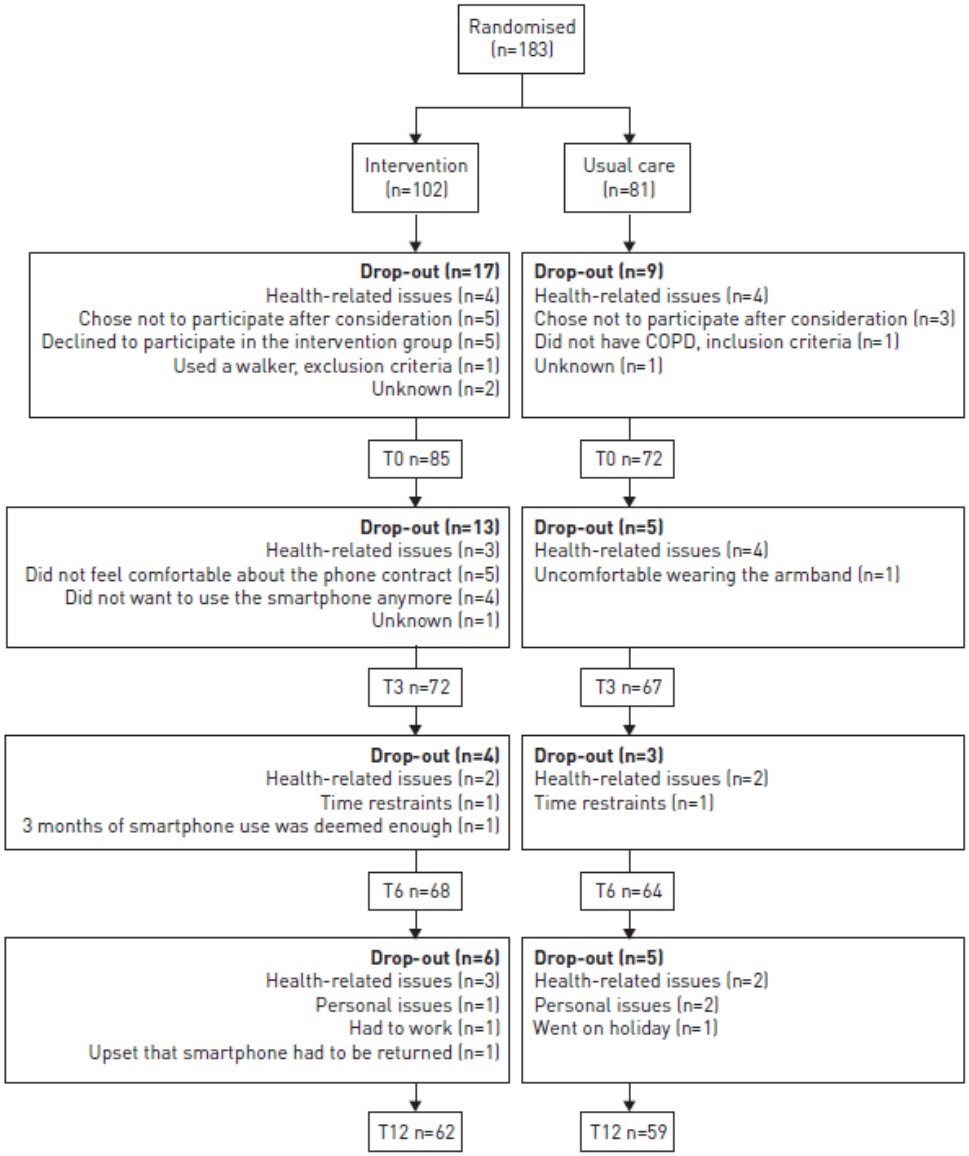
Unmet eductional needs of ILD patients



Morisset et al, Ann Am Thorac Soc 2016

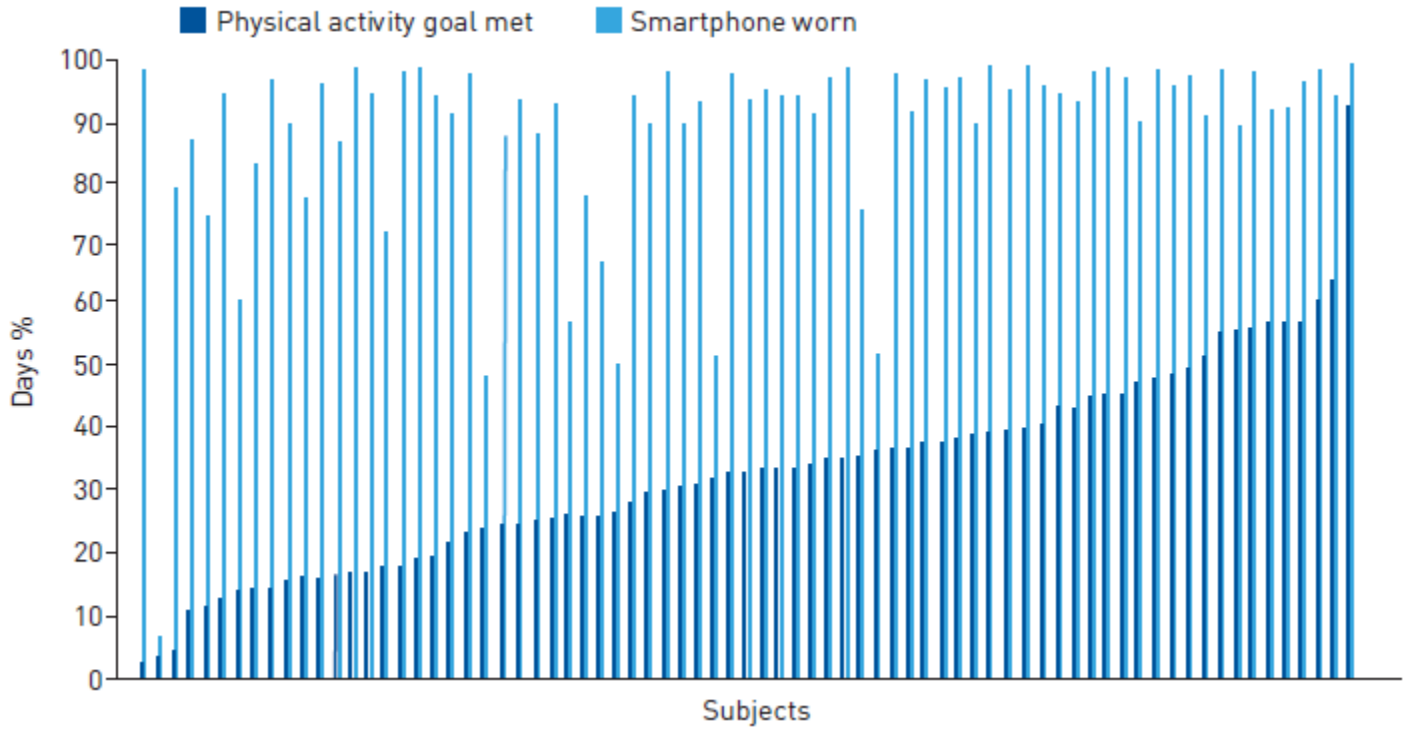
Rehabilitation or care management?

mHealth intervention after pulmonary rehabilitation



Vorrink et al, Eur Respir J 2016

mHealth intervention after pulmonary rehabilitation



Vorrink et al, Eur Respir J 2016

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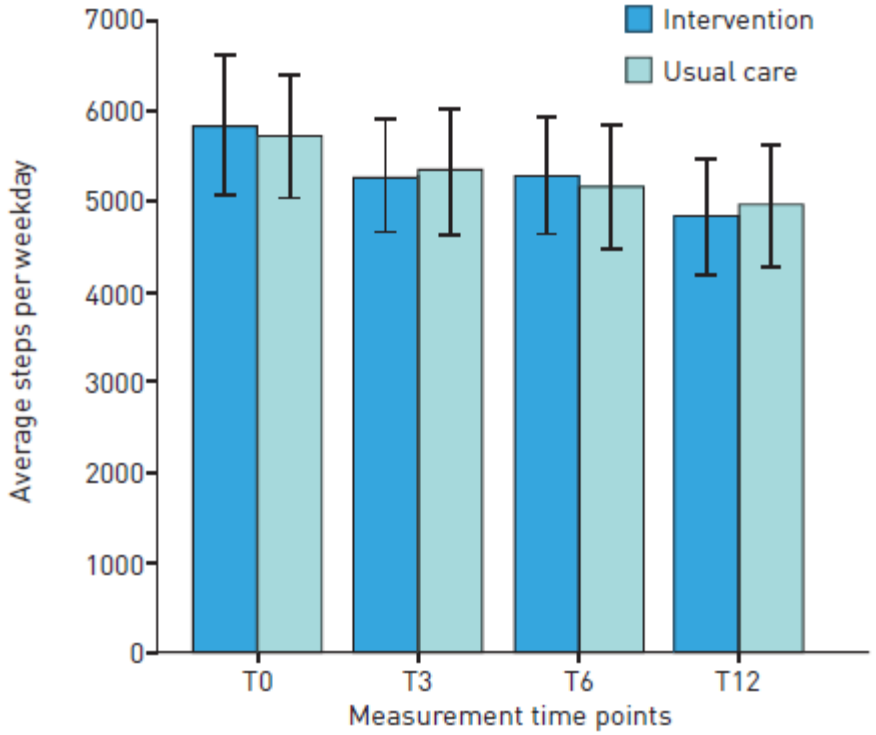
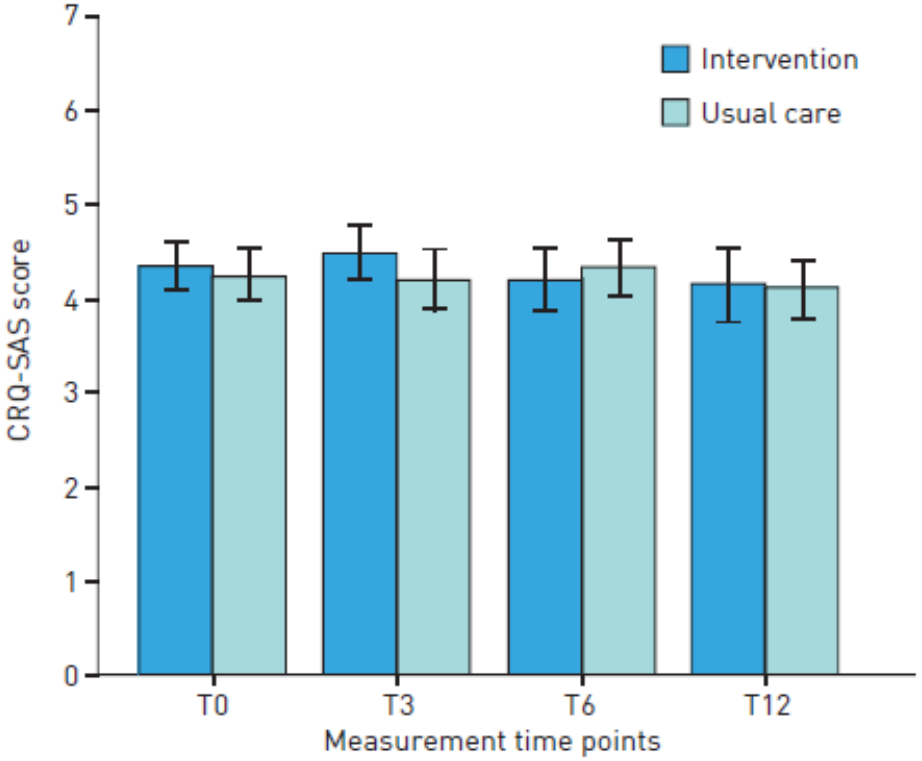




Vorrink et al, Eur Respir J 2016

mHealth intervention after pulmonary rehabilitation

MHealth intervention using a smartphone with support from a primary care physiotherapist did not improve or maintain physical activity in COPD patients following pulmonary rehabilitation.

Vorrink et al, Eur Respir J 2016

ORIGINAL ARTICLE

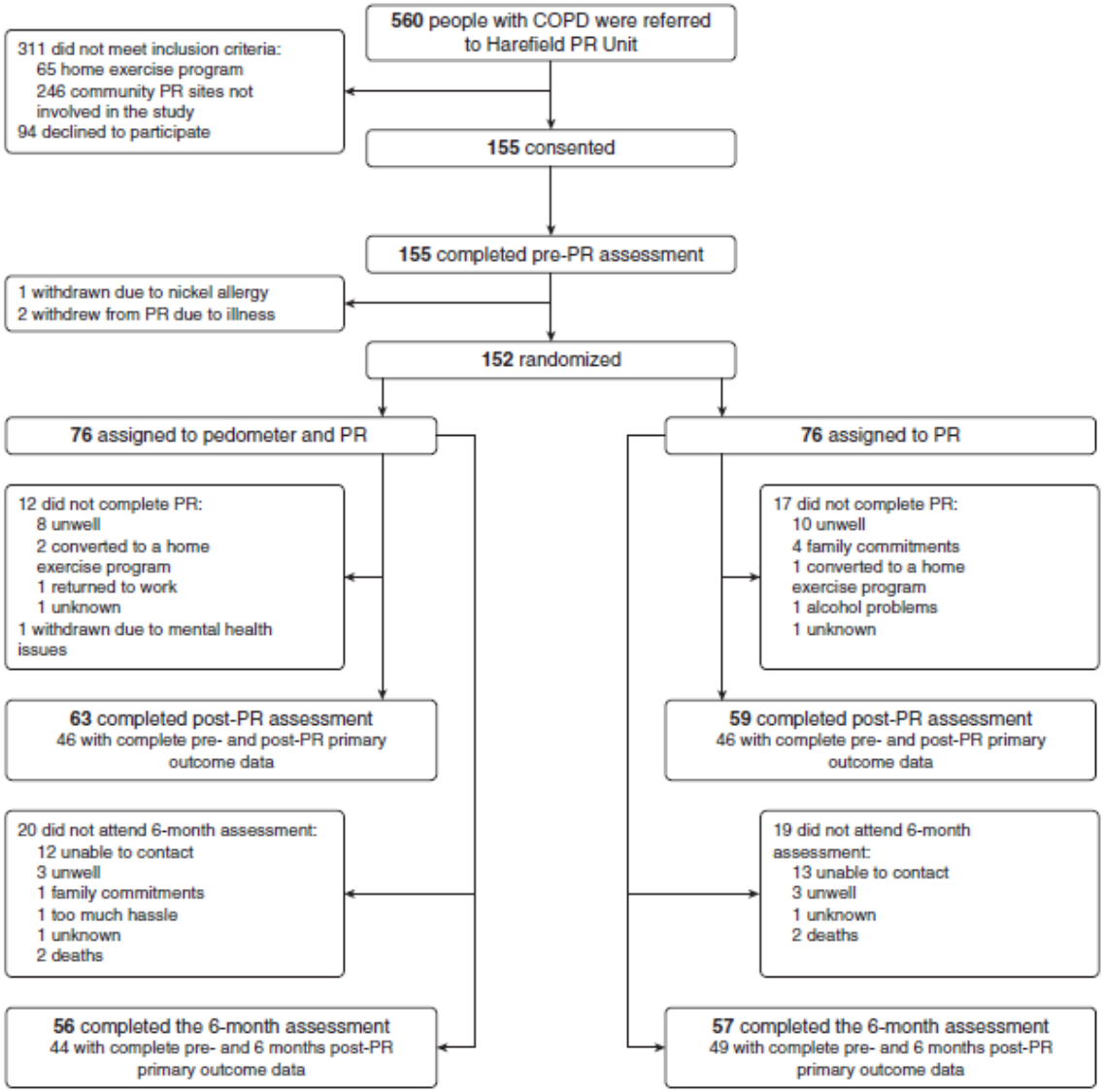
Pedometer Step Count Targets during Pulmonary Rehabilitation in Chronic Obstructive Pulmonary Disease

A Randomized Controlled Trial

Claire M. Nolan[1,2,3], Matthew Maddocks[4], Jane L. Canavan[1], Sarah E. Jones[1], Veronica Delogu[1], Djeya Kaliaraju[3], Winston Banya[1,5], Samantha S. C. Kon[1,6], Michael I. Polkey[1,2], and William D.-C. Man[1,2,3]

[1]National Institute for Health Research Respiratory Biomedical Research Unit, Royal Brompton & Harefield NHS Foundation Trust, Harefield, United Kingdom; [2]Imperial College London, London, United Kingdom; [3]Harefield Pulmonary Rehabilitation Unit, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, Harefield, United Kingdom; [4]Cicely Saunders Institute of Palliative Care, Policy & Rehabilitation, King's College London, London, United Kingdom; [5]Department of Medical Statistics, Research and Development, Royal Brompton & Harefield NHS Foundation Trust, London, United Kingdom; and [6]Department of Respiratory Medicine, The Hillingdon Hospital, London, United Kingdom

Pedometer step count targeting during pulmonary rehabilitation: consort study



Nolan et al, Eur Respir J 2016

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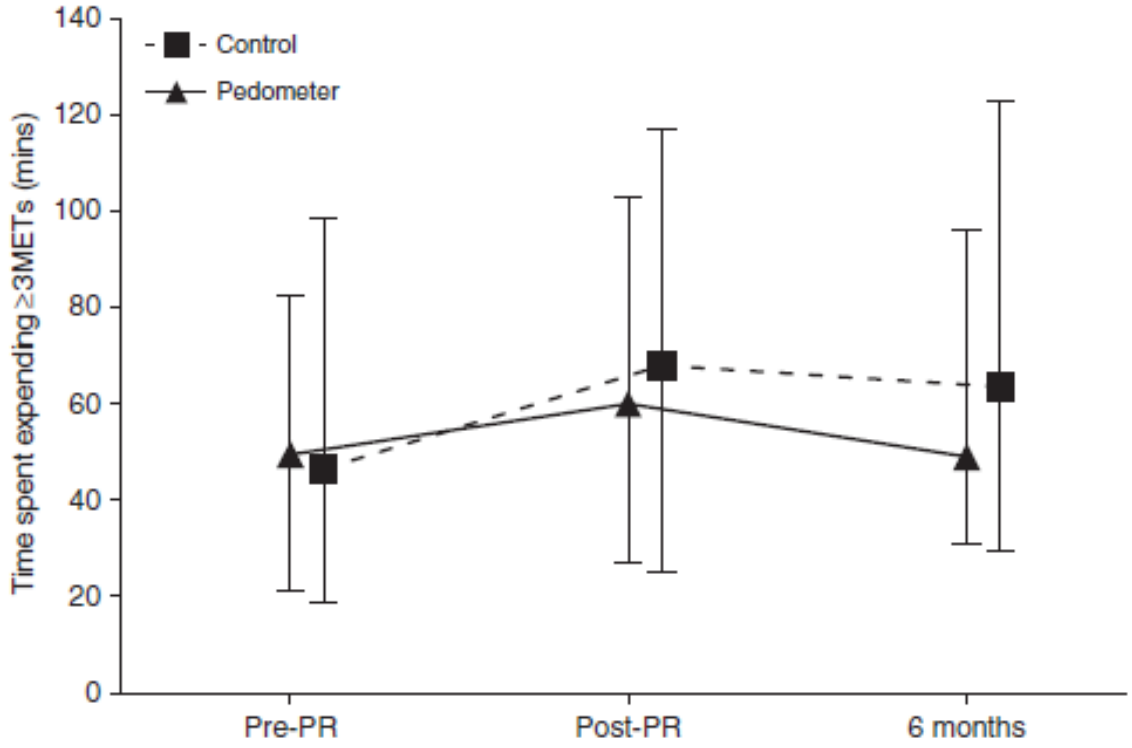
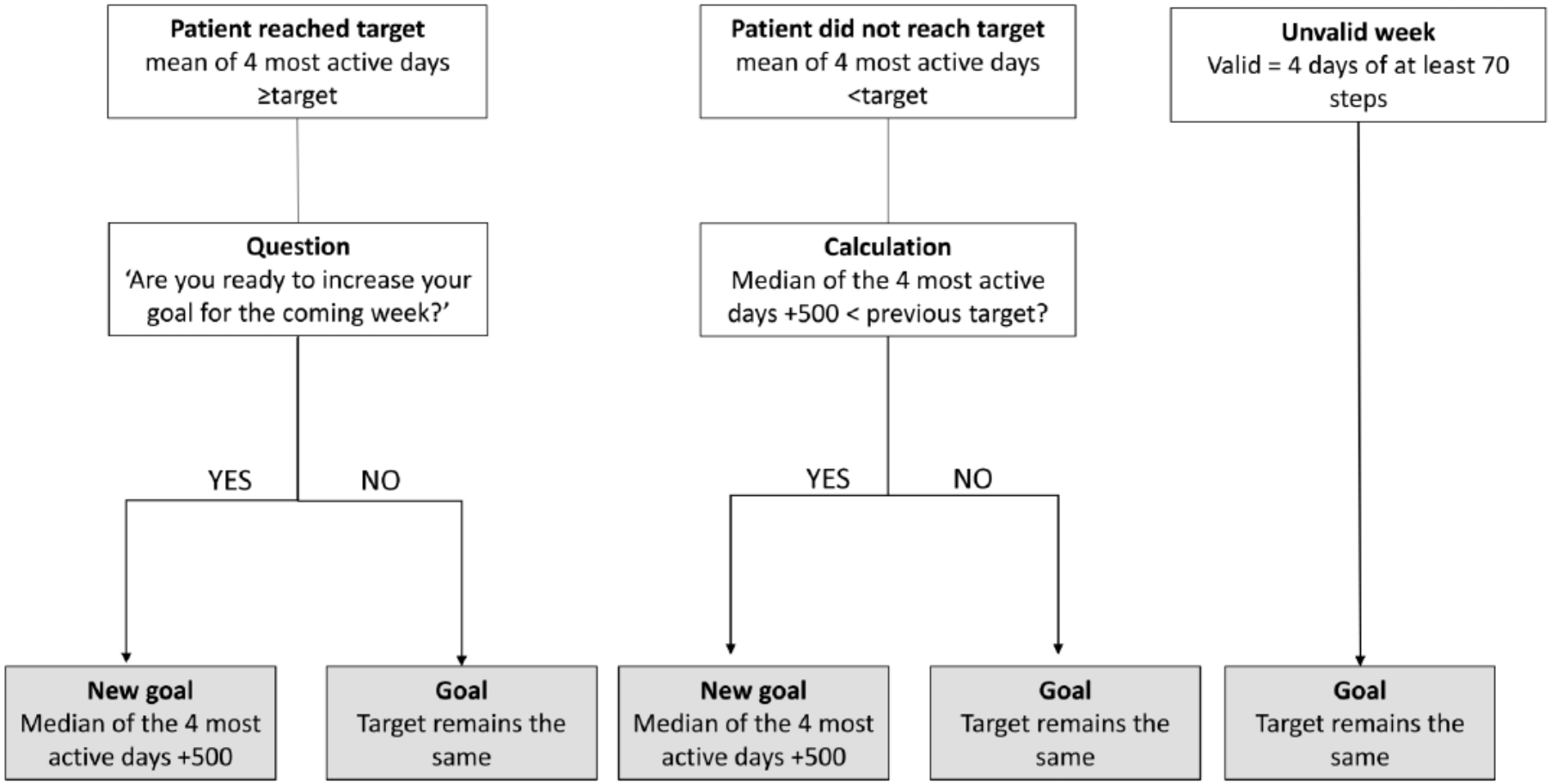


Pedometer-directed targets do not enhance the effects of PR

Nolan et al, Am J Respit Crit Care Med 2017

Physical activity and telecoaching in COPD



Demeyer et al, Thorax 2017

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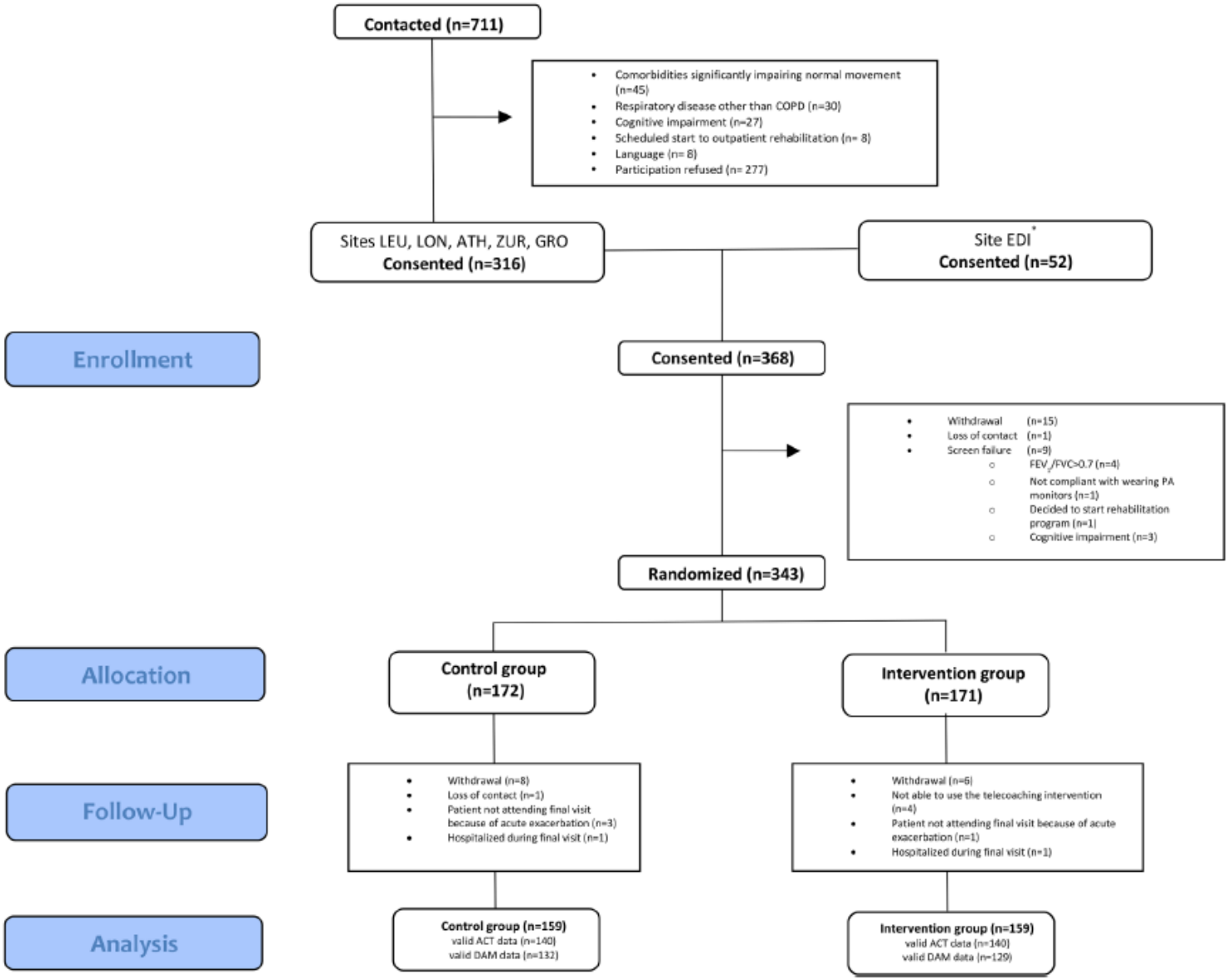

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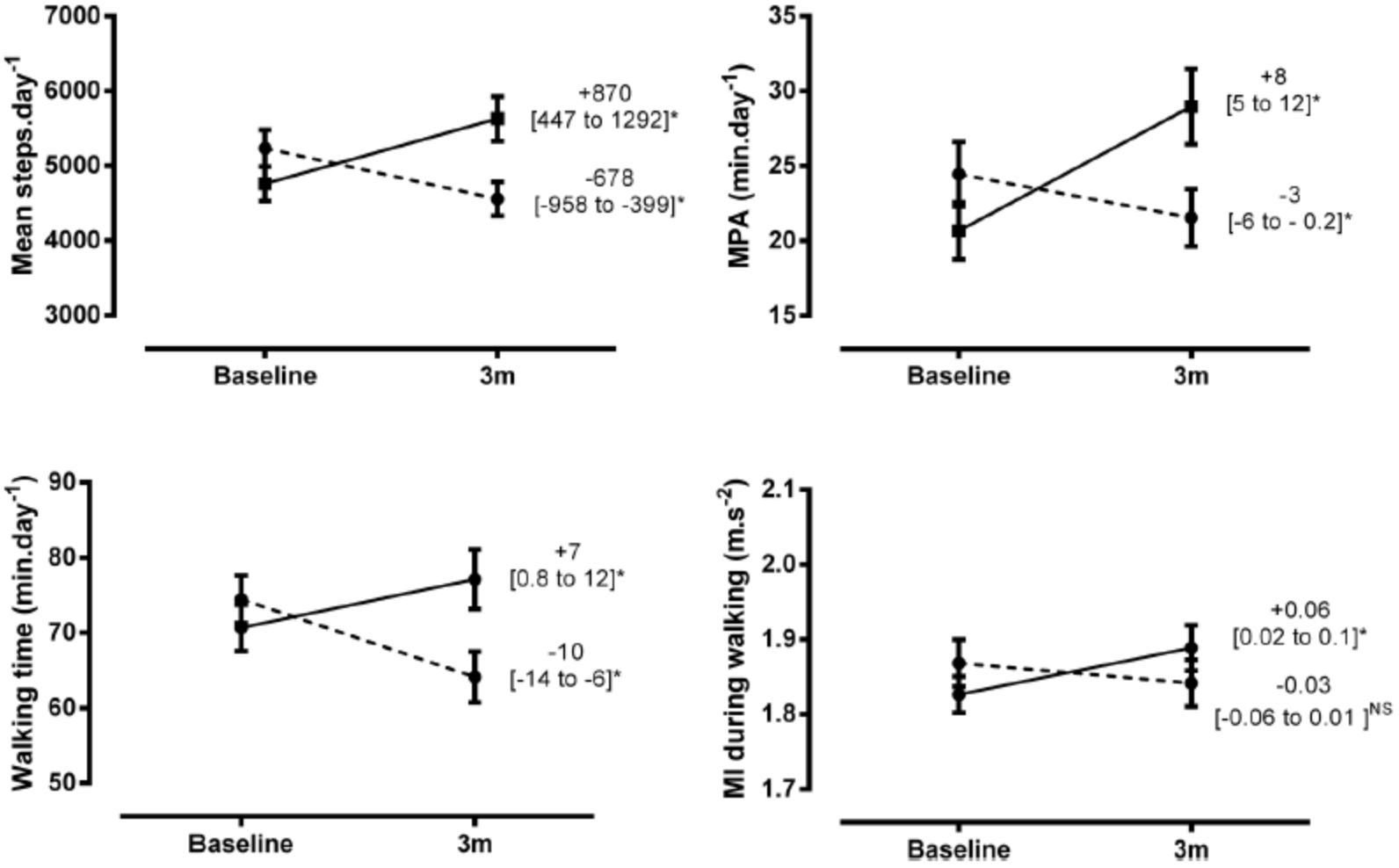
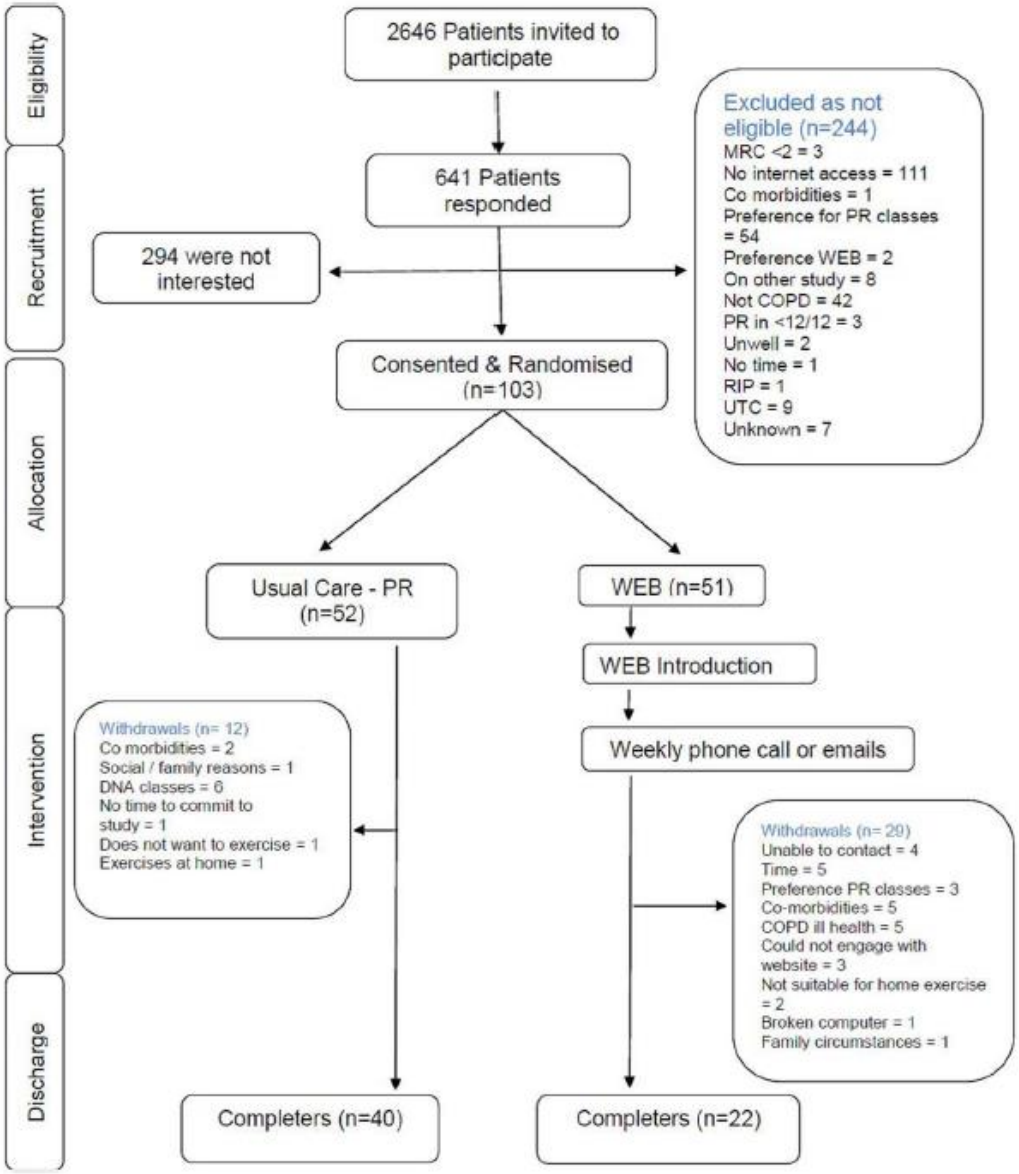
Physical activity and telecoaching in COPD



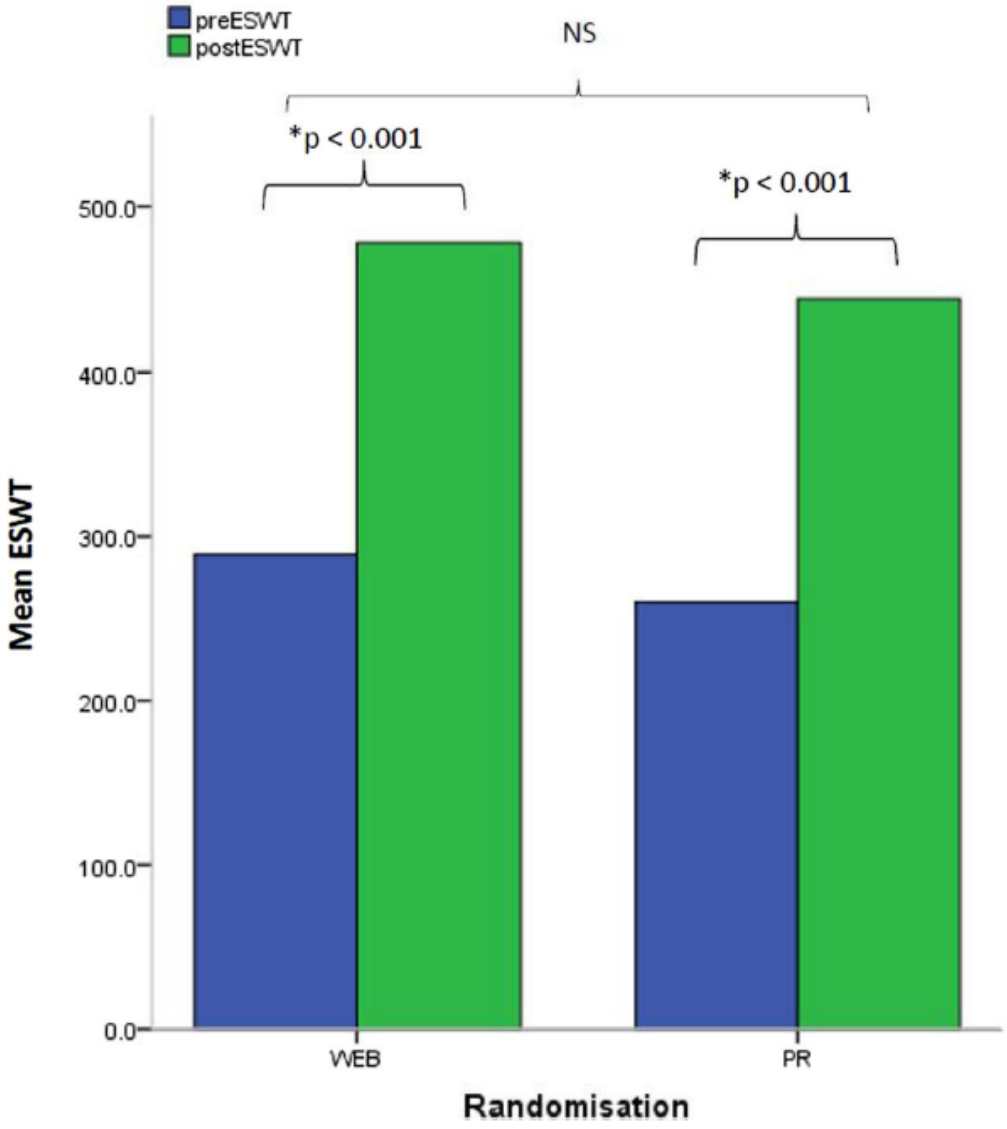
Demeyer et al, Thorax 2017

Web-based pulmonary rehabilitation



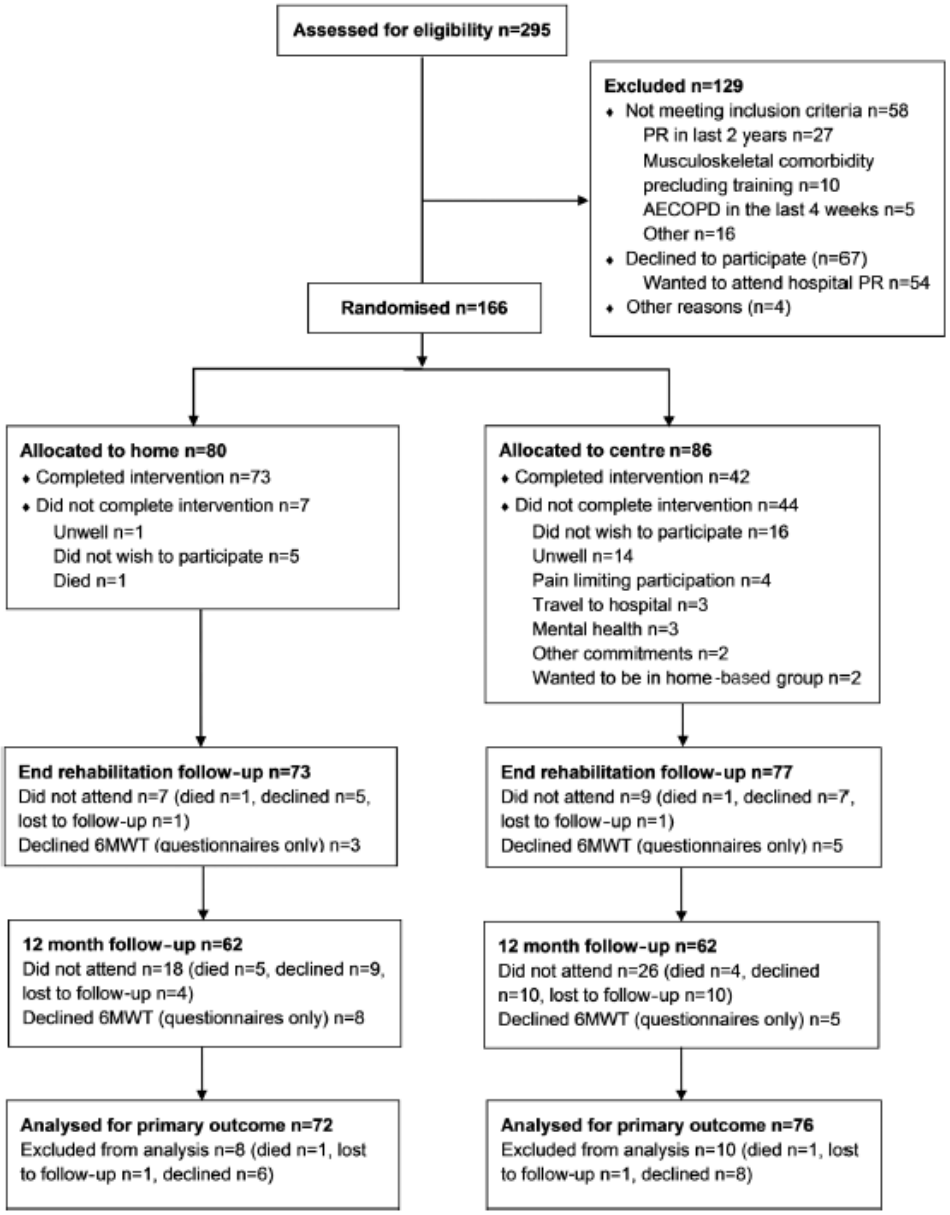
Chaplin et al, BMJ Open 2017

Web-based pulmonary rehabilitation



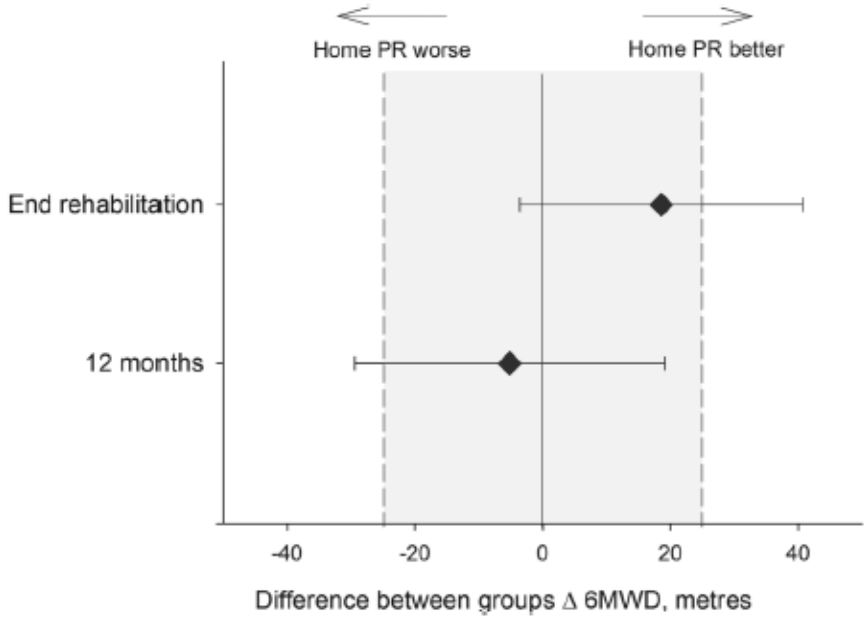
Chaplin et al, BMJ Open 2017

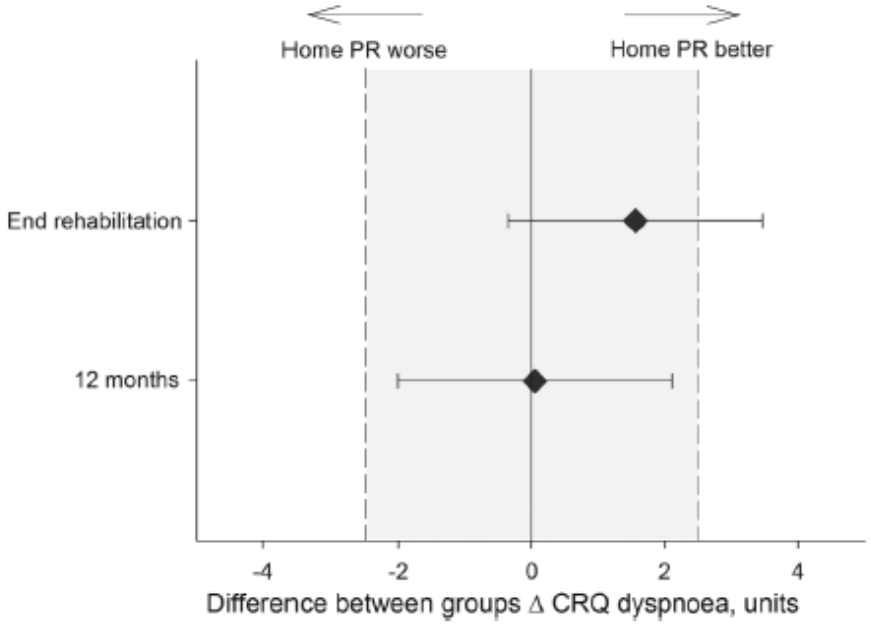
Home based rehabilitation in COPD



Holland et al, Thorax 2016

Home based rehabilitation in COPD





Non-inferiority of home based PR!
Centre-based intervention: improvement of 10.82 m after PR: failure of intervention?

Holland et al, Thorax 2016

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 psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors.

PULMONARY REHABILITATION= PERSONALISED MEDICINE

Spruit et al Am J Respir Crit Care Med. 2013;188(8):e13-64

Conclusions

- **Pulmonary rehabilitation: value based health intervention for patients with COPD**
- **Frailty: growing problem in COPD patients referred for pulmonary rehabilitation**
- **ACE inhibition: nor positive effects in COPD**
- **Exercise training: recommended treatment for all patients with COPD**
- **mHealth: changing life style ? No rehabiliation!**

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