

Pulmonary Rehabilitation

Where We've Succeeded and Where We've Failed

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Disclosures: Consultant, Grants, Speakers Bureau
for Boehringer-Ingelheim, Novartis, Astra Zeneca,
GSK, Astellas

Pulmonary Rehabilitation

- outline -

- Where we've succeeded
 - Establishing a firm scientific basis of patient-relevant benefits
- Where we've failed
 - Poor availability for patients who would benefit
- ...And a path forward

The Accumulated Evidence

Pulmonary rehabilitation:

- improves exercise tolerance
- improves the symptom of dyspnea
- improves health-related quality of life

These benefits are generally of greater magnitude than for any other COPD therapy

Documentation of Scientific Advances

High profile publications
document the effectiveness
of pulmonary rehabilitation

Documentation of Scientific Advances

State of the Art

Pulmonary Rehabilitation in Chronic Obstructive Pulmonary Disease

Thierry Troosters, Richard Casaburi, Rik Gosselink, and Marc Decramer

Respiratory Rehabilitation and Respiratory Division, University Hospital; Department of Rehabilitation Sciences, Faculty of Physical Education and Physiotherapy, Katholieke Universiteit Leuven; and Respiratory Rehabilitation, Universitaire Ziekenhuizen Gasthuisberg, Leuven, Belgium; and Rehabilitation Clinical Trials Center, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California

AJRCCM 172:19–38, 2005

Documentation of Scientific Advances



CHEST

Supplement

PULMONARY REHABILITATION: JOINT ACCP/AACVPR EVIDENCE-BASED CLINICAL PRACTICE GUIDELINES

Pulmonary Rehabilitation*

Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines

*Andrew L. Ries, MD, MPH, FCCP (Chair);
Gerene S. Bauldoff, RN, PhD, FCCP; Brian W. Carlin, MD, FCCP;
Richard Casaburi, PhD, MD, FCCP; Charles F. Emery, PhD;
Donald A. Mahler, MD, FCCP; Barry Make, MD, FCCP;
Carolyn L. Rochester, MD; Richard ZuWallack, MD, FCCP; and
Carla Herrerias, MPH*

Chest 2007,131:4S-42S

Documentation of Scientific Advances

The NEW ENGLAND JOURNAL of MEDICINE

CLINICAL THERAPEUTICS

Pulmonary Rehabilitation for Management of Chronic Obstructive Pulmonary Disease

Richard Casaburi, Ph.D., M.D., and Richard ZuWallack, M.D.

N ENGL J MED 360;13 NEJM.ORG MARCH 26, 2009

Documentation of Scientific Advances

American Thoracic Society Documents

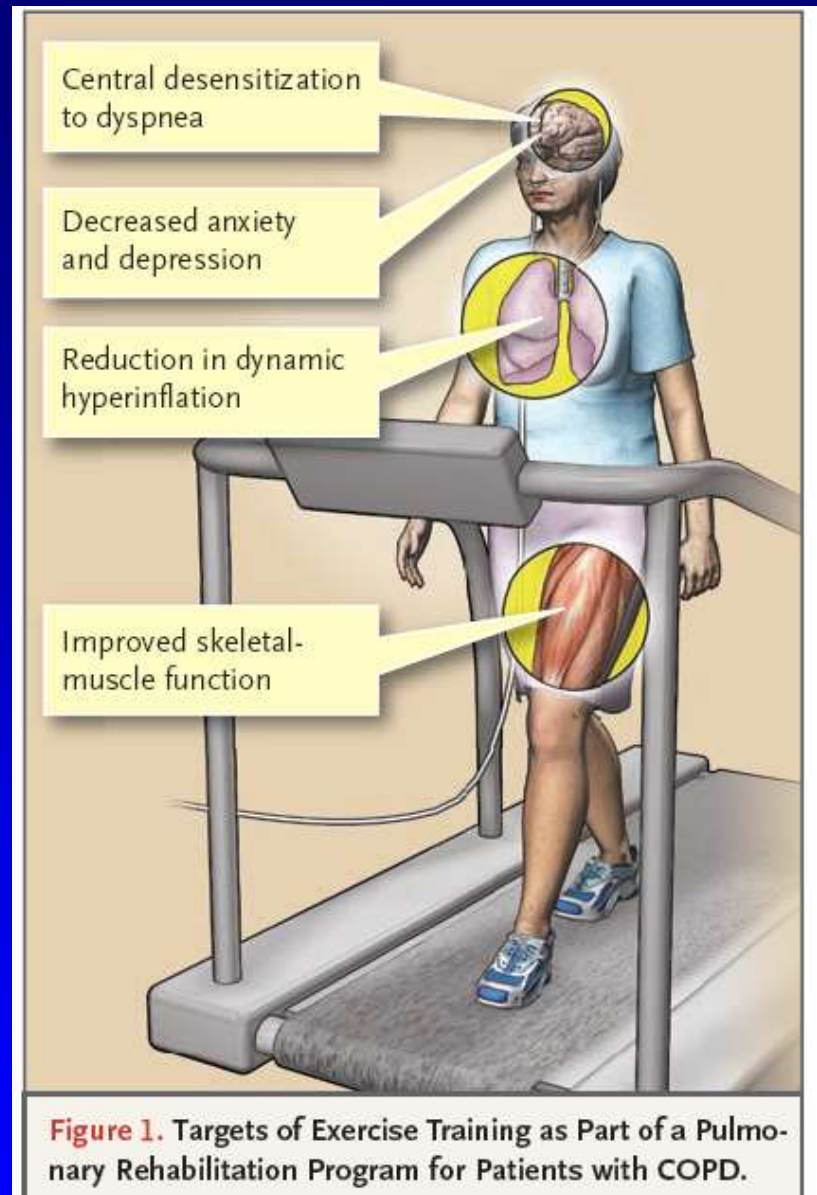
An Official American Thoracic Society/European Respiratory Society Statement: Key Concepts and Advances in Pulmonary Rehabilitation

Martijn A. Spruit, Sally J. Singh, Chris Garvey, Richard ZuWallack, Linda Nici, Carolyn Rochester, Kylie Hill, Anne E. Holland, Suzanne C. Lareau, William D.-C. Man, Fabio Pitta, Louise Sewell, Jonathan Raskin, Jean Bourbeau, Rebecca Crouch, Frits M. E. Franssen, Richard Casaburi, Jan H. Vercoolen, Ioannis Vogiatzis, Rik Gosselink, Enrico M. Clini, Tanja W. Effing, François Maltais, Job van der Palen, Thierry Troosters, Daisy J. A. Janssen, Eileen Collins, Judith Garcia-Aymerich, Dina Brooks, Bonnie F. Fahy, Milo A. Puhan, Martine Hoogendoorn, Rachel Garrod, Annemie M. W. J. Schols, Brian Carlin, Roberto Benzo, Paula Meek, Mike Morgan, Maureen P. M. H. Rutten-van Mölken, Andrew L. Ries, Barry Make, Roger S. Goldstein, Claire A. Dowson, Jan L. Brozek, Claudio F. Donner, and Emiel F. M. Wouters; on behalf of the ATS/ERS Task Force on Pulmonary Rehabilitation

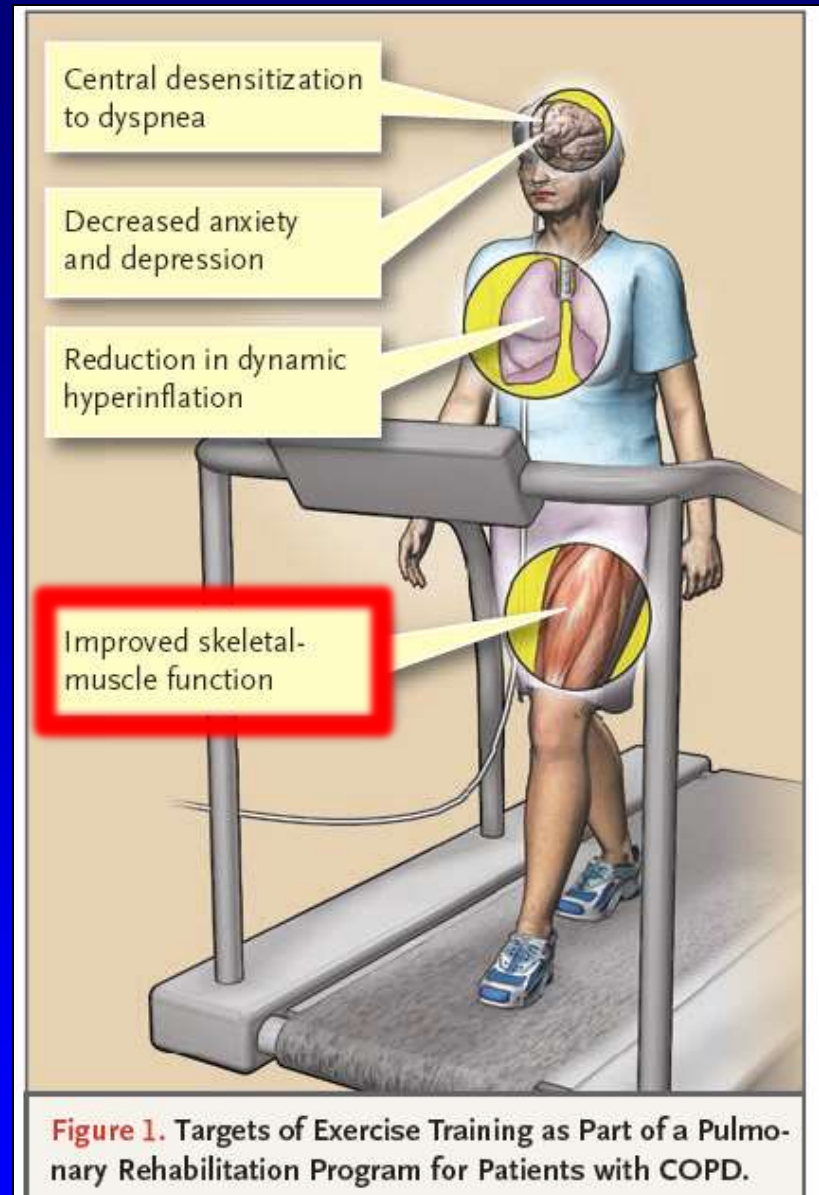
THIS OFFICIAL STATEMENT OF THE AMERICAN THORACIC SOCIETY (ATS) AND THE EUROPEAN RESPIRATORY SOCIETY (ERS) WAS APPROVED BY THE ATS BOARD OF DIRECTORS, JUNE 2013, AND BY THE ERS SCIENTIFIC AND EXECUTIVE COMMITTEES IN JANUARY 2013 AND FEBRUARY 2013, RESPECTIVELY

AJRCCM 188:1011-1027,2013

Targets for Improving Exercise Tolerance



Targets for Improving Exercise Tolerance



Physiologic Benefits of Exercise Training in Rehabilitation of Patients with Severe Chronic Obstructive Pulmonary Disease

**RICHARD CASABURI, JANOS PORZASZ, MARY R. BURNS, EVE R. CARITHERS,
ROBERT S. Y. CHANG, and CHRISTOPHER B. COOPER**

Division of Respiratory and Critical Care Physiology and Medicine, Harbor-UCLA Medical Center; Pulmonary Rehabilitation Program, Little Company of Mary Hospital, Torrance, California

1997 Am J Respir Crit Care Med

486 Citations!

American Thoracic Society/European Respiratory Society

Skeletal Muscle Dysfunction in Chronic Obstructive Pulmonary Disease

A Statement of the American Thoracic Society and European Respiratory Society

1999

AMERICAN THORACIC SOCIETY DOCUMENTS

An Official American Thoracic Society/European Respiratory Society Statement: Update on Limb Muscle Dysfunction in Chronic Obstructive Pulmonary Disease

François Maltais, Marc Decramer, Richard Casaburi, Esther Barreiro, Yan Burelle, Richard Debigaré, P. N. Richard Dekhuijzen, Frits Franssen, Ghislaine Gayan-Ramirez, Joaquim Gea, Harry R. Gosker, Rik Gosselink, Maurice Hayot, Sabah N. A. Hussain, Wim Janssens, Micheal I. Polkey, Josep Roca, Didier Saey, Annemie M. W. J. Schols, Martijn A. Spruit, Michael Steiner, Tanja Taivassalo, Thierry Troosters, Ioannis Vogiatzis, and Peter D. Wagner; on behalf of the ATS/ERS Ad Hoc Committee on Limb Muscle Dysfunction in COPD

THIS OFFICIAL STATEMENT OF THE AMERICAN THORACIC SOCIETY (ATS) AND THE EUROPEAN RESPIRATORY SOCIETY (ERS) WAS APPROVED BY THE A DIRECTORS, NOVEMBER 2013, AND BY THE ERS EXECUTIVE COMMITTEE, SEPTEMBER 2013

2014

Five Most Effective Interventions to Improve COPD Limb Muscle Function

1. Exercise training
2. Exercise training
3. Exercise training
4. Exercise training
5. Exercise training

Strategies to Improve the Effectiveness of Pulmonary Rehabilitative Programs in COPD

- Bronchodilators
- Anabolic drugs
- Oxygen breathing
- Heliox breathing
- Pressure support ventilation
- Interval training
- Electrical muscle stimulation

Global Initiative for Chronic Obstructive Lung Disease

“The benefits to COPD patients from pulmonary rehabilitation are considerable and rehabilitation has been shown to be the most effective therapeutic strategy to improve shortness of breath, health status and exercise tolerance. Pulmonary rehabilitation is appropriate for most patients with COPD; improved functional exercise capacity and health related quality of life have been demonstrated across all grades of COPD severity”

2018 Update

**GLOBAL STRATEGY FOR THE DIAGNOSIS,
MANAGEMENT, AND PREVENTION OF
CHRONIC OBSTRUCTIVE PULMONARY DISEASE**

Pulmonary Rehabilitation

-outline -

- Where we've succeeded
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- **Where we've failed**
 - **Poor availability for patients who would benefit**
- ...And a path forward

Three Major COPD Therapies

- Bronchodilators
- Supplemental Oxygen
- Pulmonary Rehabilitation

Comparison of Benefits

	Bronchodilator	Oxygen	Rehabilitation
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Comparison of Benefits

	Bronchodilator	Oxygen	Rehabilitation
Exercise Tolerance	↑	↑↑	↑↑↑

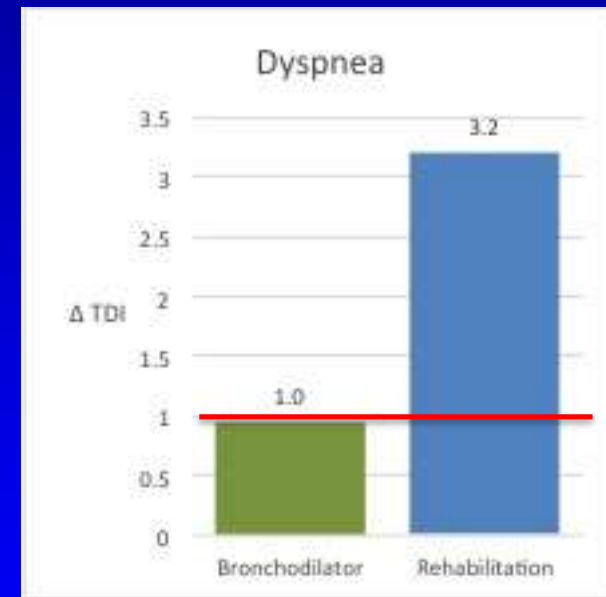
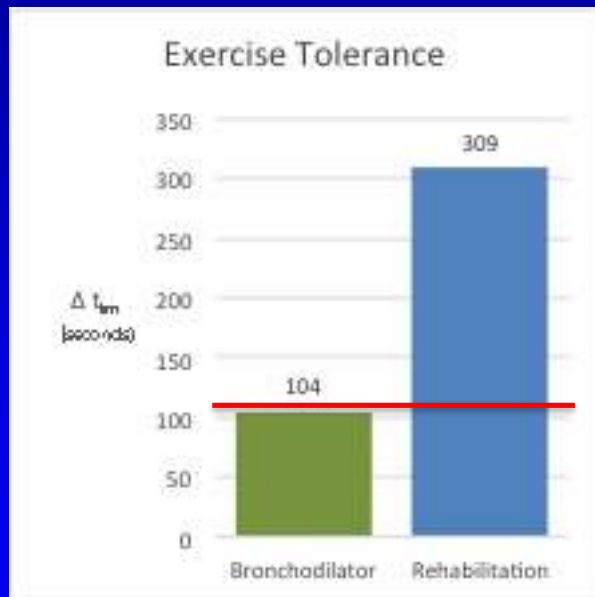
Comparison of Benefits

	Bronchodilator	Oxygen	Rehabilitation
Exercise Tolerance	↑	↑↑	↑↑↑
Dyspnea	↑	↑↑	↑↑↑

Comparison of Benefits

	Bronchodilator	Oxygen	Rehabilitation
Exercise Tolerance	↑	↑↑	↑↑↑
Dyspnea	↑	↑↑	↑↑↑
Quality of Life	↑	↑↑	↑↑↑

Magnitude of Benefit Bronchodilator vs. Rehabilitation



Data from literature meta-analyses
Red line = MCID
Bronchodilator = LABA or LAMA

Comparison of Benefits

	Bronchodilator	Oxygen	Rehabilitation
Exercise Tolerance	↑	↑↑	↑↑↑
Dyspnea	↑	↑↑	↑↑↑
Quality of Life	↑	↑↑	↑↑↑
Duration of Benefit after Withdrawal	Hours-Days	Minutes	Months-Years

Three Major COPD Therapies

-Comparing Availability-

- Bronchodilators
- Supplemental Oxygen
- Pulmonary Rehabilitation

Three Major COPD Therapies

-Comparing Availability-

- Bronchodilators
 - Near universal use in diagnosed disease

Three Major COPD Therapies

-Comparing Availability-

- Supplemental Oxygen
 - Near universal availability to qualifying patients
 - Over ~\$3 billion spent annually for ~1 million patients

Three Major COPD Therapies

-Comparing Availability-

- Pulmonary Rehabilitation
 - Available to roughly 1.2% of COPD patients who would benefit

ORIGINAL RESEARCH

An International Comparison of Pulmonary Rehabilitation: A Systematic Review

Laura Desveaux,^{1,2} Tania Janaudis-Ferreira,^{2,3} Roger Goldstein,^{1,2,4,5} and Dina Brooks^{1,2,4,5}

J COPD, 2014

“The annual national capacity for pulmonary rehabilitation...consistently translated to $\leq 1.2\%$ of the estimated COPD population for each respective country.”

No US data available for inclusion.



Pulmonary Rehabilitation Utilization in Older Adults With Chronic Obstructive Pulmonary Disease, 2003 to 2012

J Cardiopulm Rehabil, 2016

Shawn P. E. Nishi, MD; Wei Zhang, MS; Yong-Fang Kuo, PhD; Gulshan Sharma, MD

- The only published US based utilization data
- Only relates to Medicare-eligible patients
- Medicare claims data reviewed based on a 5% sampling of beneficiaries
- Spans period before and after pulmonary rehabilitation becoming a Medicare benefit (circa 2010)
- Found pulmonary rehabilitation participation rate increased from 2.6% in 2003 to 3.7% in 2012
- May well be an overestimate of general COPD population

AMERICAN THORACIC SOCIETY DOCUMENTS

An Official American Thoracic Society/European Respiratory Society Policy Statement: Enhancing Implementation, Use, and Delivery of Pulmonary Rehabilitation

Carolyn L. Rochester, Ioannis Vogiatzis, Anne E. Holland, Suzanne C. Lareau, Darcy D. Marciniuk, Milo A. Puhan, Martijn A. Spruit, Sarah Masefield, Richard Casaburi, Enrico M. Clini, Rebecca Crouch, Judith Garcia-Aymerich, Chris Garvey, Roger S. Goldstein, Kylie Hill, Michael Morgan, Linda Nici, Fabio Pitta, Andrew L. Ries, Sally J. Singh, Thierry Troosters, Peter J. Wijkstra, Barbara P. Yawn, and Richard L. ZuWallack; on behalf of the ATS/ERS Task Force on Policy in Pulmonary Rehabilitation

THIS OFFICIAL POLICY STATEMENT OF THE AMERICAN THORACIC SOCIETY (ATS) AND THE EUROPEAN RESPIRATORY SOCIETY (ERS) WAS APPROVED BY THE ATS BOARD OF DIRECTORS, OCTOBER 2015, AND BY THE ERS SCIENCE COUNCIL, SEPTEMBER 2015

AJRCCM, 2015

Conclusions: “The ATS and ERS commit to undertake actions that will improve access to and delivery of PR services for suitable patients. They call on their members and other health professional societies, payers, patients, and patient advocacy groups to join in this commitment.”



Three Major COPD Therapies

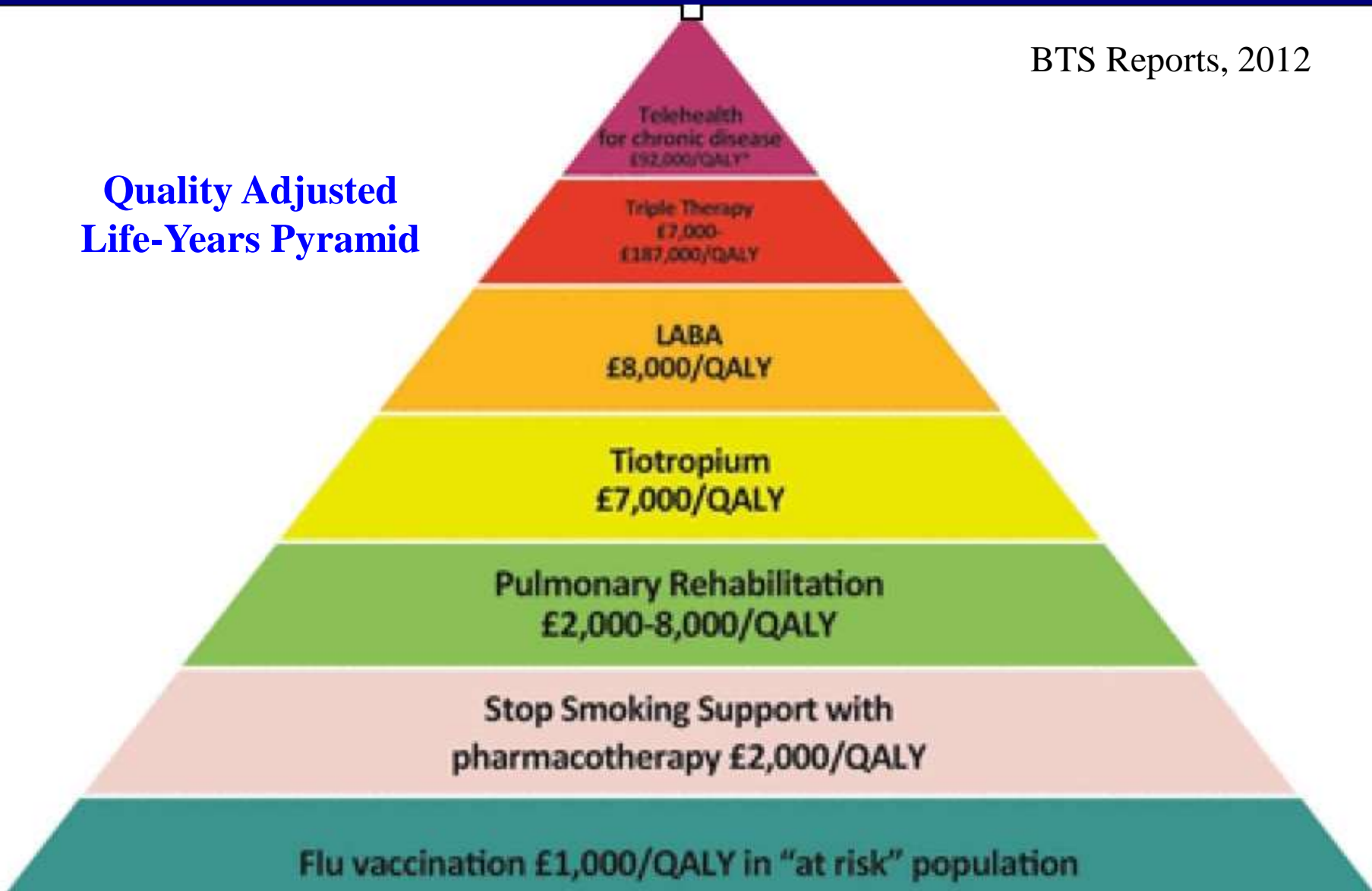
-Comparing Availability-

- Bronchodilators
- Supplemental Oxygen
- Pulmonary Rehabilitation

Similar Guidelines Approval

All Considered Standard of Care

Quality Adjusted Life-Years Pyramid



Policies Differ

What do bronchodilators and supplemental oxygen have that rehabilitation lacks?

- Bronchodilators have

What do bronchodilators and supplemental oxygen have that rehabilitation lacks?

- Bronchodilators have *marketing*

What do bronchodilators and supplemental oxygen have that rehabilitation lacks?

- Bronchodilators have *marketing*
- Supplemental oxygen

What do bronchodilators and supplemental oxygen have that rehabilitation lacks?

- Bronchodilators have *marketing*
- Supplemental oxygen *improves survival*



Dr. Thomas L. Petty

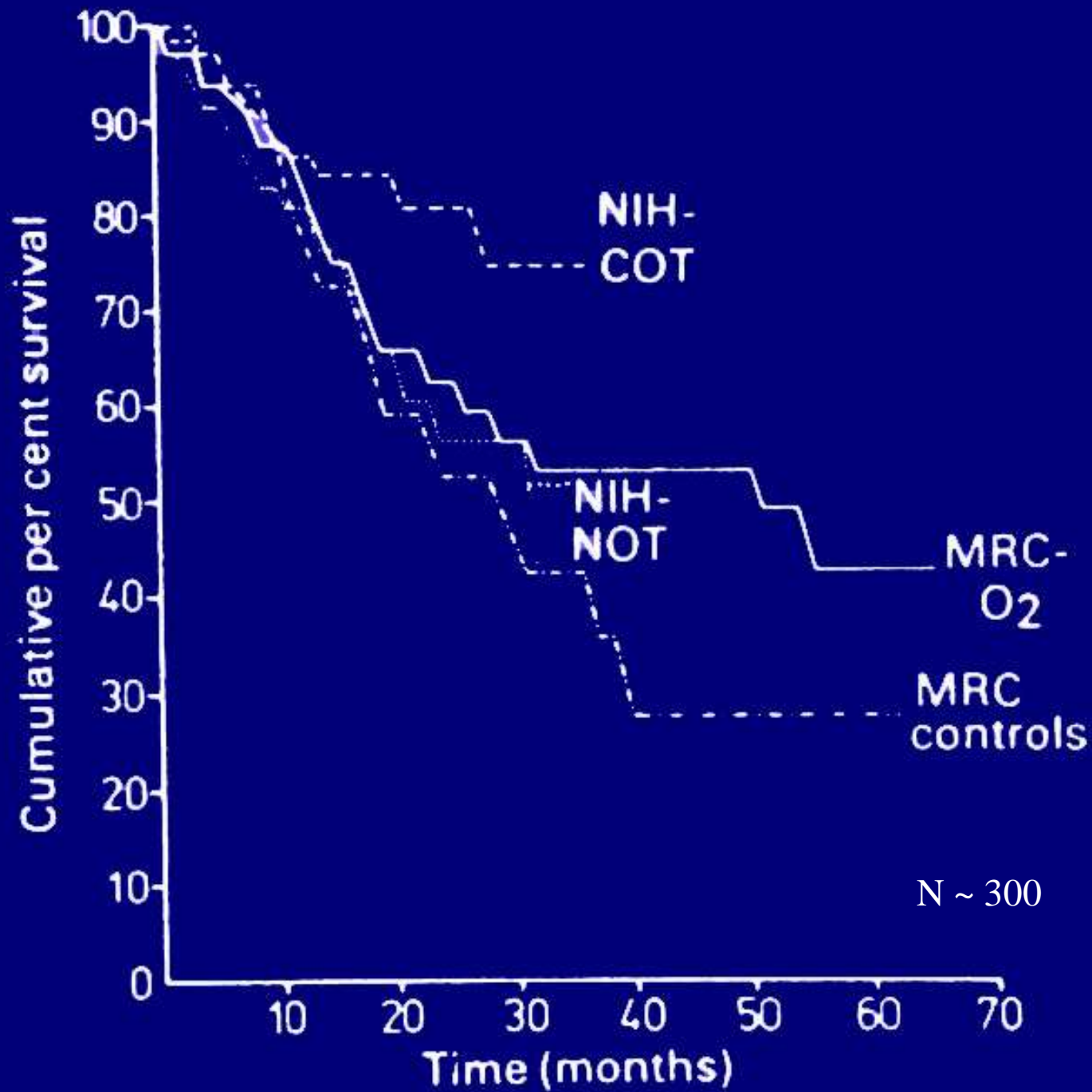
ANNALS 
of Internal Medicine

SEPTEMBER 1980 • VOLUME 93 • NUMBER 3

Published Monthly by the American College of Physicians

Continuous or Nocturnal Oxygen Therapy in Hypoxemic Chronic Obstructive Lung Disease

Dr. Thomas L. Petty



What do bronchodilators and supplemental oxygen have that rehabilitation lacks?

- Bronchodilators have *marketing*
- Supplemental oxygen *improves survival*

Therapies that improve survival have a high priority...for patients, their physicians and for health care systems



The Powerful Attraction of Life- Extending Therapies

What do bronchodilators and supplemental oxygen have that rehabilitation lacks?

- Bronchodilators have *marketing*
- Supplemental oxygen *improves survival*

Rehabilitation will never have marketing
Does it improve survival?

Pulmonary Rehabilitation in Chronic Obstructive Pulmonary Disease

Thierry Troosters, Richard Casaburi, Rik Gosselink, and Marc Decramer

Respiratory Rehabilitation and Respiratory Division, University Hospital; Department of Rehabilitation Sciences, Faculty of Physical Education and Physiotherapy, Katholieke Universiteit Leuven; and Respiratory Rehabilitation, Universitaire Ziekenhuizen Gasthuisberg, Leuven, Belgium; and Rehabilitation Clinical Trials Center, Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, Torrance, California

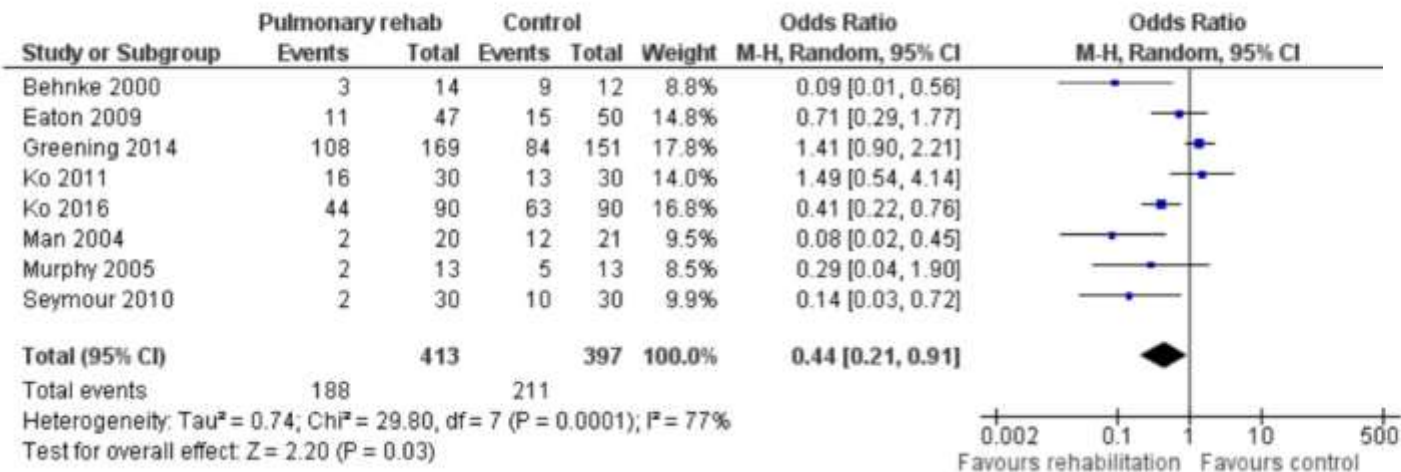
So far no study has convincingly shown evidence of improved survival after pulmonary rehabilitation...Because patients who enroll in pulmonary rehabilitation are generally in a relatively stable state, their likelihood of dying in the short term is rather low. Hence the absolute reduction in mortality is likely to be relatively modest. Studies investigating patients with higher mortality risk (e.g., after discharge from the hospital for an acute exacerbation) may be more successful in finding effects on survival.”



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

Puhan MA, Gimeno-Santos E, Cates CJ, Troosters T

Figure 3. Forest plot of comparison: I Rehabilitation versus control, outcome: I.I Hospital readmission (to end of follow-up).



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- Where we've succeeded
 - Establishing a firm scientific basis of patient-relevant benefits
- Where we've failed
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- ...**And a path forward**

The Dream

The image shows the front cover of The New England Journal of Medicine. The title is printed in red serif font within a black rectangular border. Below the title, the date, volume, and issue number are listed. The main article title and author group are centered below the journal information.

The NEW ENGLAND
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

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Pulmonary Rehabilitation Improves Survival in COPD

The Pulmonary Rehabilitation Investigator Group

Hypothesis: A convincing demonstration that pulmonary rehabilitation improves survival would yield a reformulation of health policy, resulting in improved access and uptake of this therapy.



The Long and Winding Road To a Rehabilitation Survival Trial

COPD Town Hall Meeting

Hosted by NHLBI

**Improving Access to Pulmonary
Rehabilitation Cited as a Major
Priority**

**NHLBI Approaches Rehabilitation
Community for Suggestions for
Research to Address this Priority**

Pulmonary Rehabilitation After Hospitalization for COPD: The **PROPEL** Study



28 Investigators
Recruited
9 Committees Formed



The PROPEL Study

-preliminary design features-

- Recruit ~2000 patients during a hospitalization for a COPD exacerbation
- Randomize within 2-4 weeks after discharge to rehabilitation vs. usual care at ~30 US sites
- Follow for ~2 years with re-hospitalization or mortality and primary outcome
- Assess other mediators and modulators of primary outcome prominently including physical activity in everyday life and frailty
- Determine cost-effectiveness

The PROPEL Study

-preliminary design features-

Components of the **Next-Generation** Pulmonary Rehabilitation

- Physiologically Based Exercise Training
- Activity Promotion
- Behavior Modification
- Maintenance Program

The PROPEL Study

-preliminary design features-

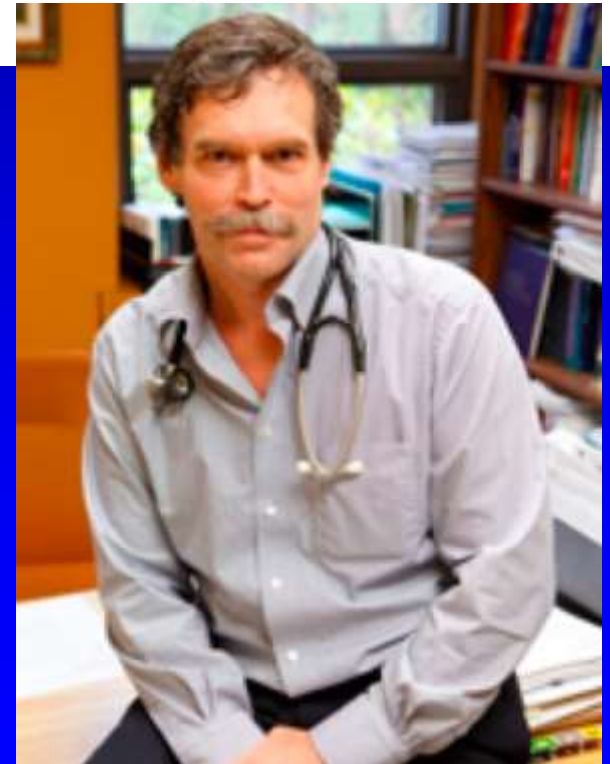
Components of the **Next-Generation** Pulmonary Rehabilitation

- Physiologically Based Exercise Training
- Activity Promotion
- Behavior Modification
- Maintenance Program

BMJ Open Behaviour-change intervention in a multicentre, randomised, placebo-controlled COPD study: methodological considerations and implementation

Jean Bourbeau,¹ Kim L Lavoie,^{2,3} Maria Sedeno,¹ Dorothy De Sousa,⁴ Damijan Erzen,⁵ Alan Hamilton,⁴ François Maltais,⁶ Thierry Troosters,⁷ Nancy Leidy⁸

Aim: Modify patient behaviors, enhance adherence to health-enhancing patient behaviors and increase activity level in everyday life



The PROPEL Study

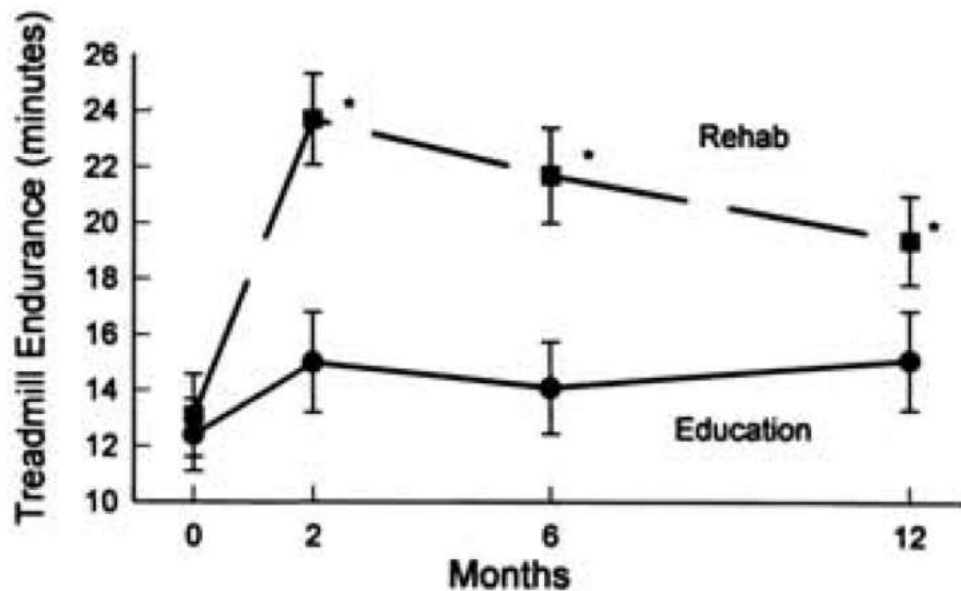
-preliminary design features-

Components of the **Next-Generation** Pulmonary Rehabilitation

- Physiologically Based Exercise Training
- Activity Promotion
- Behavior Modification
- **Maintenance Program**

Effects of Pulmonary Rehabilitation on Physiologic and Psychosocial Outcomes in Patients with Chronic Obstructive Pulmonary Disease

Andrew L. Ries, MD, MPH; Robert M. Kaplan, PhD; Trina M. Limberg, BS; and Lela M. Prewitt



Ann Int Med, 1995

Pulmonary Rehabilitation After Hospitalization for COPD: The PROPEL Study

Wish Us Luck!



28 Investigators
Recruited
9 Committees Formed



PROPEL **COPD**

The logo features the word "PROPEL" in a large, white, italicized, sans-serif font, with "COPD" in a smaller, white, bold, sans-serif font directly below it. To the right of the text are white silhouettes of a man and a woman walking towards the right. The background is a dark blue gradient with abstract, light blue, curved lines on the left side.

Barry Make, MD • National Jewish Health

Richard Casaburi, MD, PhD • Los Angeles Biomed Research Inst

Jerry Krishnan, MD, PhD • University of Illinois at Chicago

Stephen Wisniewski, PhD • DCC, University of Pittsburgh

Maria Brooks, PhD • DCC, University of Pittsburgh

Frank Scirba, MD • DCC, University of Pittsburgh

Third submission to NHLBI February, 2018

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Rehabilitation Clinical Trials Center