

Pulmonary Rehabilitation

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Educational Objectives:

1. Understand the physiology behind pulmonary rehabilitation.
2. Discuss the indications for pulmonary rehabilitation.
3. Identify and prepare patients for pulmonary rehabilitation
4. Understand what components constitute a traditional pulmonary rehabilitation program and what complementary exercise programs might benefit patients.
5. Understand the outcomes and benefits of pulmonary rehabilitation.

Scenario:

Mr. Jones is a 65-year-old man with a history of COPD (FEV₁ 50% predicted), obesity, and diabetes presenting to your office for ongoing management of his COPD and chronic dyspnea. He is on inhaled budesonide/formoterol BID and tiotropium daily. He uses his albuterol inhaler 3-4 times a day. He often runs out of his albuterol inhaler and is not sure if it helps him. He has not had any exacerbations, ER visits or hospitalizations for his COPD since he quit smoking 7 years ago. He notes progressive exercise limitation. He has a small dog he walks but now has to stop every ½ a block to catch his breath, whereas 2 years ago he could make it around a whole block without stopping. He spends much of his time on the couch watching the news. Though he would like to be more active, he found this to be too difficult. His weight is stable, and although he would like to lose weight, he has struggled to do so.

Question 1: You think Mr. Jones might be a candidate for pulmonary rehabilitation. What is the physiology behind the benefits of exercise training?

- Chronic lung disease has systemic effects and exercise training targets these effects. Patients with lung disease not only have muscle atrophy but also alterations in muscle fiber type distribution and decreased metabolic capacity. Ventilatory or gas-exchange limitations are common in more advanced lung disease and can certainly limit exercise. However, these patients also often have decreased exercise capacity due to peripheral muscle and cardiovascular deconditioning. As a result, they experience early onset anaerobic metabolism and lactic acid production during exercise. Peripheral muscle deconditioning does respond to exercise training.

- Upper extremity muscle weakness can also contribute to dyspnea especially in advanced lung disease when they are used as accessory muscles of respiration. Training of the upper extremity muscles is another important component of pulmonary rehab programs and has been shown to be effective in randomized clinical trials.
- Patients with obstructive lung disease have dynamic hyperinflation, which leads to decreased effectiveness and fatigue of respiratory muscles. As exercise training improves muscular strength and efficiency, ventilatory requirement decreases during exertion. Patients are able to breath at lower respiratory rates and reduce dynamic hyperinflation.
- Exercise has been shown to improve mood and can reduce symptoms of anxiety and depression that increase morbidity in chronic lung disease.

Question 2: What are the indications for pulmonary rehabilitation?

- Patients with COPD who are GOLD stages B, C, or D qualify for pulmonary rehabilitation.
- Patients with other chronic respiratory diseases - such as asthma, interstitial lung disease, bronchiectasis including from cystic fibrosis, and pulmonary arterial hypertension – also benefit.
- The indications for pulmonary rehabilitation include:
 - Severe dyspnea and fatigue
 - Decreased exercise ability
 - Inability to perform ADLs
 - Decreased occupational performance
 - Nutritional depletion
 - Increased medical resource utilization
- Most centers require patients to be able to walk a minimum distance and if not, to start physical therapy prior to pulmonary rehabilitation.
- Patients with high risk of untreated cardiovascular disease may require additional screening or testing.
- Transplant centers are typically able to accommodate patients who require high FiO₂ during exercise.

Hospitalizations/exacerbations:

- Pulmonary rehabilitation initiated shortly after a hospitalization for a COPD exacerbation is clinically effective, safe, and associated with a reduction in subsequent hospital admissions.
- Exercise rehabilitation commenced during acute or critical illness reduces the extent of functional decline and hastens recovery.

Question 3: What should be considered prior to referral to pulmonary rehabilitation?

- Patients should be medically optimized as best as possible prior to referral to pulmonary rehab. This includes appropriate bronchodilators and oxygen if indicated. Patients with optimized lung function can exercise at higher intensities, with greater improvements in their overall exercise capacity. Mr. Jones appears to be optimized, although proper inhaler technique should also be confirmed.
- For patients with significant cardiac comorbidities, consider whether a cardiac rehabilitation referral may be more appropriate.

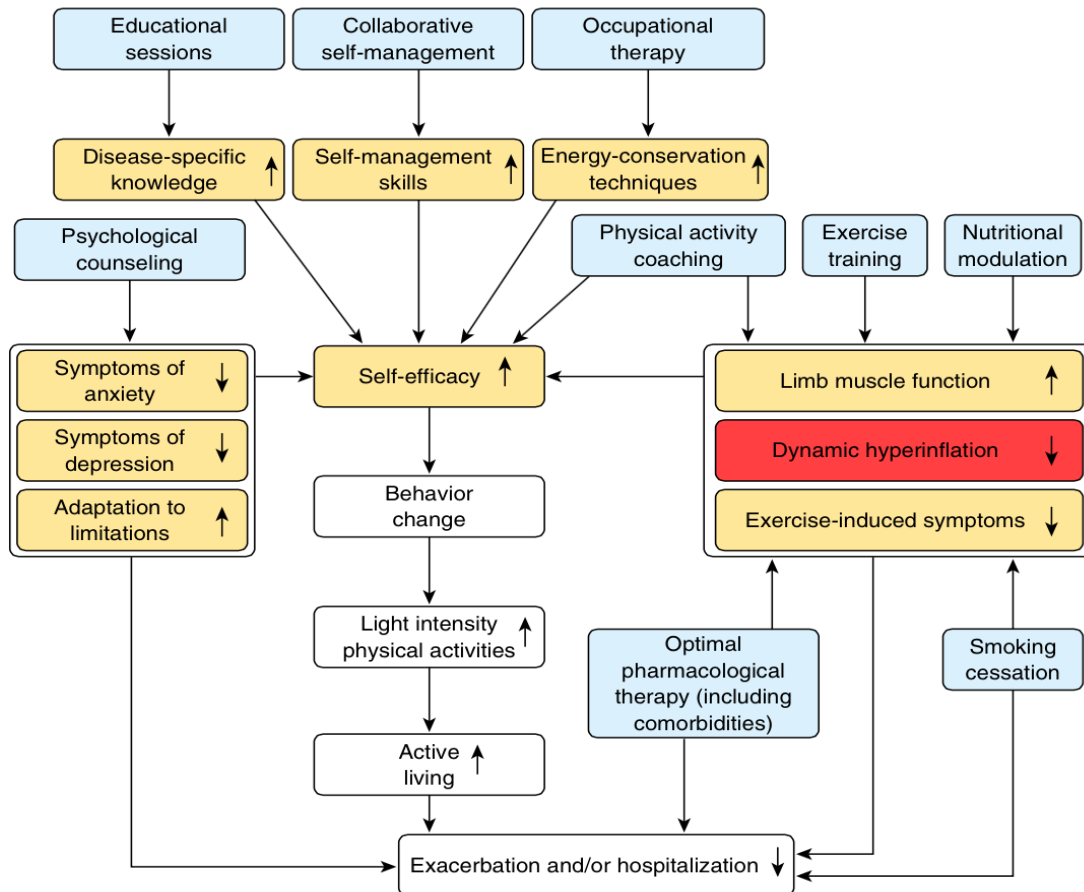
Question 4: What are the benefits of pulmonary rehabilitation?

- Pulmonary rehabilitation has not been shown to directly improve lung function in patients with chronic lung disease. However, a significant amount of disability associated with lung disease results from the systemic effects of the disease which do respond to treatment.
- Pulmonary rehabilitation (PR) has been widely studied in patients with COPD.
 - Traditionally patients with moderately-severe to severe COPD were felt to be appropriate for pulmonary rehabilitation, however decreased activity likely starts early in COPD and is under-recognized
 - Studies have shown that pulmonary rehabilitation improves symptoms and quality of life:
 - Improved 6WMT
 - Improved dyspnea scores
 - Improved QOL on St. George Respiratory Questionnaire or Chronic Respiratory Questionnaire
- There is conflicting data about whether pulmonary rehab reduces healthcare utilization in patients with chronic respiratory disease.
- Pulmonary rehabilitation has not been shown to consistently and clearly reduce mortality in two conflicting large observational studies; one meta-analysis suggested mortality benefit after COPD exacerbation.

Question 5: Mr. Jones asks, “what does pulmonary rehab consist of?”

- According to the ATS/ERS definition pulmonary rehabilitation is a “comprehensive intervention based on thorough patient assessment, followed by tailored therapies, that are included but 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 long-term adherence to health-enhancing behaviors.”
- It generally consists of a supervised exercise program 2-3 times per week for 8 weeks.
 - Most programs combine cardiovascular and resistance training. Traditionally programs focus on aerobic training and low-weight/high-rep resistance work. However, studies have shown non-inferiority of interval training.
 - Programs typically combine treadmill, bike, and arm cycle training. Treadmill may be most effective for improving walk distance.
- There is also an education component that is essential to promote health, behavioral change, and to improve chronic disease self-management. This generally occurs in a group setting. Educational topics often covered are shown below.

◆ Benefits of Exercise & Goal Setting	◆ Introduction to Breathing Retraining
◆ Anatomy and Physiology	◆ Medications
◆ Oxygen Therapy	◆ Home Program: Benefits of Exercise
◆ Energy Conservation	◆ Tobacco Cessation
◆ Advanced Directives	◆ Collaborative Self-Management
◆ Sexuality and Lung Disease	◆ Travel and Environmental Issues
◆ Mindfulness	◆ Stress Management
◆ Secretion Clearance	◆ Alternative tobacco products: cigars, e-cigarettes, marijuana
◆ Nutrition	



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Question 6: Mr. Jones loved the program that you referred him to and he is using his inhaler less (with improved technique!). But now his program is ending. What can he do now?

- Longer programs seem to provide more durable benefit. Exercise capacity has been shown to plateau in studies within 12 weeks.
- Positive effects on exercise capacity may dissipate over time, so empowering patients in long term adherence to exercise is exceedingly important. Rehab programs often provide exercise prescriptions for the maintenance phase of rehab.
- Most insurances will only cover a one-time pulmonary rehabilitation program. This makes it crucial to choose wisely regarding timing of pulmonary rehabilitation referral.
- Some programs have “maintenance therapy” where former patients can use the equipment for a small fee.
- The Veterans Affairs (VA) system does not have limitations on pulmonary rehabilitation referrals.
- YMCAs can offer “scholarships” for low/fixed income individuals and discounted programs for veterans.
- Appropriately resourced home-based exercise training has proven effective in reducing dyspnea and increasing exercise performance in individuals with COPD.

Question 7: Mr. Jones loved his pulmonary rehab program so much and was chatting with several of your patients about it in the waiting room. They are now *all* asking you about pulmonary rehabilitation and you are wondering whether patients with other respiratory diseases might also benefit from pulmonary rehabilitation?

YES! (Of course)

The following groups of patients have been shown in studies to benefit from pulmonary rehab:

- ◆ **ILD**
 - Short-term: improved QOL, exercise tolerance
- ◆ **Bronchiectasis**
 - Improved exercise performance
- ◆ **Cystic Fibrosis**
 - Improved quality of life
 - Slower decline of lung function
- ◆ **Asthma**
 - Improved Quality of Life
 - Decrease in asthma symptoms
- ◆ **Pulmonary Hypertension**
 - Improved exercise tolerance and quality of life
- ◆ **Lung Cancer**
 - Improved exercise tolerance
- ◆ **Transplant patients – pre- and post-**
 - Required part of post-transplant care

Question 8: Mrs. Lee is a 65-year-old patient of yours with COPD. She too would like to start an exercise program after hearing about Mr. Jones program in the waiting room. She wants to know if there are any alternative or complementary exercise programs that have been shown in studies to benefit patient with COPD?

Yes! Yoga and Tai Chi have been shown to be effective for decreasing respiratory symptoms compared to usual care. Mindfulness based interventions have also been shown to benefit patients with chronic lung disease. Small pilot studies of Mindfulness Based Interventions have been conducted in chronic lung diseases such as COPD, interstitial lung disease and asthma and have supported the feasibility and safety of such programs. Some of these interventions were performed in conjunction with usual pulmonary rehabilitation. There also were signals of improvement in mood, perception of stress and possible reductions in symptoms of depression.

Question 9: You are so inspired to get your patients exercising and are wondering what is next in pulmonary rehabilitation research?

- Newer studies aim to focus on improving activity overall – rather than focused on exercise activity. In “normal” individuals some studies suggest that increasing exercise may decrease overall activity.
- New activity monitors which measure full range of motion, tri-axial monitors versus “Fitbit style.”

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