Pulmonary Rehabilitation
COPD
COPD, a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases.

Exacerbations and comorbidities contribute to the overall severity in individual patients.
COPD

Emphysema

* Permanent enlargement of airspaces distal to the terminal bronchioles
* Loss of alveolar walls results in decrease in elastic recoil
* Loss of the alveolar supporting structure leads to airway narrowing, which further limits airflow

Chronic bronchitis

* Chronic productive cough for 3 months
* Mucous gland hyperplasia
* Damage to the endothelium impairs the mucociliary response
* Narrowing of airway caliber and increase in airway resistance
* Undamaged pulmonary capillary bed
COPD

Emphysema

- Mucus in bronchiole
- Enlarged alveoli
- Fewer capillaries

Chronic bronchitis

- Normal bronchial tube
- Inflamed bronchial tube
COPD

Emphysema

Chronic bronchitis
Mechanisms Underlying Airflow Limitation in COPD

- **Small Airways Disease**
  - Airway inflammation
  - Airway fibrosis, luminal plugs
  - Increased airway resistance

- **Parenchymal Destruction**
  - Loss of alveolar attachments
  - Decrease of elastic recoil

**AIRFLOW LIMITATION**

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### Table 1-1 Classification of COPD Severity

<table>
<thead>
<tr>
<th>COPD stage</th>
<th>Severity</th>
<th>Post-bronchodilator spirometric values</th>
<th>Symptoms that may be present</th>
</tr>
</thead>
</table>
| I          | Mild     | $\text{FEV}_1 / \text{FVC} < 0.70$  
$\text{FEV}_1 \geq 80\%$ predicted | Chronic cough and sputum 
production may be present. 
At this stage, the individual is 
usually unaware that his or her lung 
function is abnormal. |
| II         | Moderate | $\text{FEV}_1 / \text{FVC} < 0.70$  
$50\% \leq \text{FEV}_1 < 80\%$ predicted | Dyspnoea typically on exertion, 
cough and sputum production 
sometimes also present. 
This is the stage at which patients 
usually seek medical attention 
because of chronic respiratory 
symptoms or an exacerbation of 
COPD. |
| III        | Severe   | $\text{FEV}_1 / \text{FVC} < 0.70$  
$30\% \leq \text{FEV}_1 < 50\%$ predicted | Greater dyspnoea, reduced exercise 
capacity, fatigue, and repeated 
exacerbations that almost always 
have an impact on the patient’s 
quality of life. |
| IV         | Very severe | $\text{FEV}_1 / \text{FVC} < 0.70$  
$\text{FEV}_1 < 30\%$ predicted  
or  
$\text{FEV}_1 < 50\%$ predicted plus 
chronic respiratory failure | Respiratory failure may lead to 
cor pulmonale with signs which 
include elevation of the jugular 
venous pressure and pitting ankle 
oedema. At this stage, quality 
of life is markedly impaired 
and exacerbations may be life-
threatening. |

$\text{FEV}_1$: forced expiratory volume in one second; $\text{FVC}$: forced vital capacity; respiratory failure: arterial partial 
pressure of oxygen ($\text{PaO}_2$) less than 8.0 kPa (60 mmHg) with or without arterial partial pressure of $\text{CO}_2$ ($\text{PaCO}_2$) 
greater than 6.7 kPa (50 mmHg) while breathing air at sea level.
Risk Factors for COPD

- Genes
- Infections
- Socio-economic status
- Aging Populations

- Cigarette smoke
- Occupational dust and chemicals
- Environmental tobacco smoke (ETS)
- Indoor and outdoor air pollution
Consequences of respiratory disease

- Peripheral muscle dysfunction
- Respiratory muscle dysfunction
- Nutritional abnormalities
- Cardiac impairment
- Psychosocial dysfunction
- Skeletal disease
Pulmonary Rehabilitation
* Pulmonary rehabilitation is an evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities.
<table>
<thead>
<tr>
<th>Evidence Category</th>
<th>Sources of Evidence</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Randomized controlled trials (RCTs). Rich body of data.</td>
<td>Evidence is from endpoints of well-designed RCTs that provide a consistent pattern of findings in the population for which the recommendation is made. Category A requires substantial numbers of studies involving substantial numbers of participants.</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Randomized controlled trials. Limited body of data.</td>
<td>Evidence is from endpoints of intervention studies that include only a limited number of patients, posthoc or subgroup analysis of RCTs, or meta-analysis of RCTs. In general, Category B pertains when few randomized trials exist, they are small in size, they were undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Nonrandomized trials. Observational studies.</td>
<td>Evidence is from outcomes of uncontrolled or nonrandomized trials or from observational studies.</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Panel consensus judgment</td>
<td>This category is used only in cases where the provision of some guidance was deemed valuable but the clinical literature addressing the subject was deemed insufficient to justify placement in one of the other categories. The Panel Consensus is based on clinical experience or knowledge that does not meet the above-listed criteria.</td>
</tr>
</tbody>
</table>
Benefits of Pulmonary Rehabilitation

* Improves exercise capacity (Evidence A)
* Reduces the perceived intensity of breathlessness (Evidence A)
* Improves health-related quality of life (Evidence A)
* Reduces the number of hospitalizations and days in the hospital (Evidence A)
* Reduces anxiety and depression associated with COPD (Evidence A)
* Improves recovery after hospitalization for an exacerbation (Evidence A)
Benefits of Pulmonary Rehabilitation

- Strength and endurance training of the upper limbs improves arm function (Evidence B)
- Benefits extend well beyond the immediate period of training (Evidence B)
- Improves survival (Evidence B)
- Enhances the effect of long-acting bronchodilators (Evidence B)
- Respiratory muscle training can be beneficial, especially when combined with general exercise training (Evidence C)
Multidisciplinary Team

- Pul. Rehab. team medical director
- Respiratory care practitioner
- Nurse
- Physical therapist
- Occupational therapist
- Exercise physiologist
- Psychologist
- Vocational counselor
- Recreational therapist
- Social worker
- Nutritionist
Comprehensive Pulmonary Rehabilitation

* Exercise training
* Chest physical therapy and breathing techniques
* Education
* Nutritional counseling
* Psychosocial/behavioral intervention
* Outcome assessment
Exercise training
Mechanisms for morbidities

- Deconditioning
- Malnutrition
- Effects of hypoxemia
- Steroid myopathy or critically-ill neuropathy
- Diaphragmatic fatigue
- Frequent hospitalizations
- Effects of various medications
- Psychosocial dysfunction resulting from anxiety, depression, guilt, dependency and sleep disturbance.
Evidence of Skeletal Muscle Dysfunction in COPD

- Lactic acidosis threshold is low.
- Intramuscular fall in pH with exercise is accentuated.
- Muscle aerobic enzymes are low.
- Oxygen uptake kinetics are slow.
- Muscle mass is low.
Effects on Skeletal Muscle

* Systemic inflammatory mediators accelerate muscle protein turnover
* Malnutrition reduced protein intake leads to muscle breakdown (type II fibers)
* Malnutrition also contributes to reduced muscle enzyme capacity
* Hypoxemia reduces oxygen delivery to all the organs of the body
* The respiratory muscles “steal” blood away from skeletal muscles, which further compromises systemic muscle function.
Effects on Skeletal Muscle

* Impair mitochondrial oxygen utilization, which produces muscle-cell hypoxia and thus a conversion to anaerobic metabolism at low levels of exercise
* This leads to lactate accumulation and earlier fatigability of the muscles.
* In limb muscles, especially lower-extremity limb muscles, muscle weakness and respiratory insufficiency lead to inactivity and chronic underloading of the muscles.

* In limb muscles, underloading leads to less muscle mass, especially decreases in the type I fibers. This reduces the oxidative capacity of the muscles and makes them more prone to fatigue.
In contrast, respiratory muscles have to deal with an increased work to breathe and are thus chronically overloaded.

Structurally, diaphragmatic sarcomeres become shorter to adapt to the new shorter resting length.

More oxidative or type I sarcomeres also develop, and these increase endurance capabilities.
<table>
<thead>
<tr>
<th>Muscle-Fiber Type</th>
<th>Description</th>
<th>Metabolism</th>
<th>Myoglobin/mitochondria</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Slow, fatigue-resistant</td>
<td>Oxidative</td>
<td>Rich, “red”</td>
<td>Standing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Quiet breathing</td>
</tr>
<tr>
<td>IIa*</td>
<td>Fast, fatigue-resistant</td>
<td>Oxidative/glycolytic</td>
<td>Mixed</td>
<td>Walking</td>
</tr>
<tr>
<td>IIb*</td>
<td>Fast, fatigable</td>
<td>Glycolytic</td>
<td>Low, “white”</td>
<td>Hyperventilating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Jumping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Coughing</td>
</tr>
</tbody>
</table>

*An intermediate Type IIx fiber with fast twitch features and intermediate fatigability has also been described.*
Exercise Limitation

* Gas exchange abnormalities
* Dynamic lung hyperinflation
* Insufficient energy supply to the peripheral and respiratory muscles
* Morphological alterations in leg and diaphragm
* Chest 2005; 128: 651-656
Implementing an Exercise Training Program

* Endurance training
* Strength training
* Inspiratory muscle training
* Electrical muscle stimulation
Endurance Training

- Most common
- Improve aerobic exercise
- Improve quality of life
- Change of muscle fiber morphology and typology
- High-intensity endurance training induces greater physiological benefits than lower intensity exercise
- Continuous versus interval training
## Endurance Training

**TABLE 2** Practical recommendations for the implementation of continuous and interval endurance training programmes

<table>
<thead>
<tr>
<th>Continuous endurance training</th>
<th>Interval endurance training</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>3-4 days-week⁻¹</td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td>Continuous</td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td>3-4 days-week⁻¹</td>
</tr>
<tr>
<td>Initially 60–70% of PWR</td>
<td>Interval modes:</td>
</tr>
<tr>
<td>Increase work load by 5–10% as tolerated</td>
<td>30 s of exercise, 30 s of rest or</td>
</tr>
<tr>
<td>Progressively try to reach ~80-90% of baseline PWR</td>
<td>20 s of exercise, 40 s of rest</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Initially 80–100% of PWR for the first three to four sessions</td>
</tr>
<tr>
<td>Initially 10–15 min for the first three to four sessions</td>
<td>Increase work load by 5–10% as tolerated</td>
</tr>
<tr>
<td>Progressively increase exercise duration to 30–40 min</td>
<td>Progressively try to reach ~150% of baseline PWR</td>
</tr>
<tr>
<td><strong>Perceived exertion</strong></td>
<td>Initially 15–20 min for the first three to four sessions</td>
</tr>
<tr>
<td>Try to aim for a perceived exertion on the 10-point Borg scale</td>
<td>Progressively increase exercise duration to 45–60 min (including resting time)</td>
</tr>
<tr>
<td>of 4 to 6</td>
<td>Try to aim for a perceived exertion on the 10-point Borg scale</td>
</tr>
<tr>
<td><strong>Breathing technique</strong></td>
<td>of 4 to 6</td>
</tr>
<tr>
<td>Suggest pursed-lip breathing or the use of PEP devices to prevent dynamic hyperinflation and to reduce breathing frequency</td>
<td>Suggest pursed-lip breathing or the use of PEP devices to prevent dynamic hyperinflation and to reduce breathing frequency</td>
</tr>
</tbody>
</table>

PWR: peak work rate; PEP: positive expiratory pressure. Adapted from [30].

**TABLE 4**

Practical recommendations for the implementation of strength training

<table>
<thead>
<tr>
<th>Frequency</th>
<th>2–3 days·week⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Targeting for local muscular exhaustion within a given number of repetitions for major muscle groups of upper and lower extremities</td>
</tr>
<tr>
<td>Mode</td>
<td>Two to four sets of six to 12 repetitions</td>
</tr>
<tr>
<td>Intensity</td>
<td>50–85% of one repetitive maximum as a reference point</td>
</tr>
<tr>
<td></td>
<td>Increase work load by 2–10% if one to two repetitions over the desired number are possible on two consecutive training sessions</td>
</tr>
<tr>
<td>Speed</td>
<td>Moderate (1–2 s concentric and 1–2 s eccentric)</td>
</tr>
</tbody>
</table>

Data from [53].

Fig. 4. Changes in exercise-test results after exercise rehabilitation in patients with chronic obstructive pulmonary disease. The exercise tests were performed before and after the exercise rehabilitation, using the same exercise work load, so decreases represent improved function (less lactate development), lower ventilation requirement, lower oxygen need, lower carbon-dioxide production, and lower heart-rate requirement. Patients in the left panel underwent a high-intensity exercise program; patients in the right panel underwent a less intense exercise program. Though both the exercise programs improved function, the high-intensity program produced a greater effect. (From Reference 45, with permission.)
Chest Physical Therapy and Breathing Techniques
Pursed-lip breathing relieves dyspnea by increasing expiratory airway pressure, thereby inhibiting dynamic expiratory airway collapse.

Pursed-lip breathing shifts a major portion of the inspiratory work of breathing from the diaphragm to the ribcage muscles.
3 Major Breathing Techniques

* Pursed-lip breathing relieves dyspnea by increasing expiratory airway pressure, thereby inhibiting dynamic expiratory airway collapse.
* Pursed-lip breathing shifts a major portion of the inspiratory work of breathing from the diaphragm to the ribcage muscles.
* Posture techniques: leaning-forward
* Diaphragmatic breathing
Education
Smoking Cessation
Nutrition

* Weight loss is a poor prognostic indicator.
* A reduction in BMI is an independent risk factor for mortality in COPD patients.
Choose easy to chew foods

Eat 6 small meals instead of 3 regular ones.

If loss of appetite, eat high calorie foods first or try liquid supplements e.g. Ensure

Avoid or eat small portions of foods that cause gas.

Eat slowly

Clear the throat or cough gently every so often to clear your airway of saliva and food

Drink fluids carefully, avoid drinking a lot of fluids with your meal.

Use oxygen as prescribed.
Travel

* Plane: patients with COPD and LTOT can achieve to maintain an-in-flight PaO2 of at least 50 mmHg by supplementary oxygen at 3L/min by nasal cannula.
* Resting PaO2 at sea level >70 mmHg: likely to be safe to fly without supplementary oxygen.
OUTCOME
Outcome Measures

* Lung function
* Exercise capacity
* Dyspnea
* Health status
Lung Function : FEV1

* Indicate disease progression
* Do not always correlate with clinically relevant outcomes such as dyspnea, health status, and exercise capacity
Exercise capacity: 6MWT

**Strength**

* Simple to perform, well tolerated
* Reflects everyday life-like activity

**Limitations**

* Patient’s motivation
* Spatial requirements
* Personnel and time consuming
* Frequently change direction
* Learning effect
# Dyspnea

<table>
<thead>
<tr>
<th>Type of scale</th>
<th>Type of stimulus</th>
<th>Items</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI/TDI</td>
<td>multi-dimensional</td>
<td>8/9</td>
<td>interview</td>
</tr>
<tr>
<td>MRC-Scale</td>
<td>uni-dimensional</td>
<td>1</td>
<td>self-administered by patient</td>
</tr>
<tr>
<td>Borg-Scale</td>
<td>uni-dimensional</td>
<td>1</td>
<td>self-administered by patient</td>
</tr>
</tbody>
</table>

BDI: Baseline Dyspnoea Index; TDI: Transition Dyspnoea Index; MRC: Medical Research Council.
<p>| Grade 4 | <strong>No Impairment</strong> | Able to carry out usual activities and occupation without shortness of breath. |
| Grade 3 | <strong>Slight Impairment</strong> | Distinct impairment in at least one activity but <em>no activities completely abandoned</em>. Reduction, in activity at work or in usual activites, that seems slight or not clearly caused by shortness of breath. |
| Grade 2 | <strong>Moderate Impairment</strong> | Subject has changed jobs and/or has <em>abandoned at least one usual activity</em> due to shortness of breath. |
| Grade 1 | <strong>Severe Impairment</strong> | Subject <em>unable to work</em> or has given up most or all usual activities due to shortness of breath. |
| Grade 0 | <strong>Very Severe Impairment</strong> | Unable to work <em>and</em> has given up most or all usual activities due to shortness of breath. |
| W | <strong>Amount Uncertain</strong> | Subject is impaired due to shortness of breath, but amount cannot be specified. Details are not sufficient to allow impairment to be categorised. |
| X | <strong>Unknown</strong> | Information unavailable regarding impairment. |
| Y | <strong>Impaired for Reasons Other than Shortness of Breath</strong> | For example, musculoskeletal problem or chest pain. |</p>
<table>
<thead>
<tr>
<th>Grade</th>
<th>Magnitude of Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 4</td>
<td>Extraordinary</td>
<td>Becomes short of breath only with <em>extraordinary activity</em> such as carrying very heavy loads on the level, lighter loads uphill, or running. No shortness of breath with ordinary tasks.</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Major</td>
<td>Becomes short of breath only with such major activities as walking up a steep hill, climbing <strong>more than three flights of stairs</strong>, or carrying a moderate load on the level.</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Moderate</td>
<td>Becomes short of breath with moderate or average tasks such as walking up a gradual hill, climbing <strong>fewer than three flights of stairs</strong>, or carrying a light load on the level.</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Light</td>
<td>Becomes short of breath with light activities such as talking, <strong>on the level</strong>, washing, or standing.</td>
</tr>
<tr>
<td>Grade 0</td>
<td>No Task</td>
<td>Becomes short of breath at rest, while sitting, or lying down.</td>
</tr>
<tr>
<td>W</td>
<td>Amount Uncertain</td>
<td>Subject's ability to perform tasks is impaired due to shortness of breath, but amount cannot be specified. Details are not sufficient to allow impairment to be categorised.</td>
</tr>
<tr>
<td>X</td>
<td>Unknown</td>
<td>Information unavailable regarding limitation of magnitude of task.</td>
</tr>
<tr>
<td>Y</td>
<td>Impaired for Reasons Other than Shortness of Breath</td>
<td>For example, musculoskeletal problem or chest pain.</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Extraordinary</td>
<td>Becomes short of breath only with the greatest imaginable effort. No shortness of breath with ordinary effort.</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Major</td>
<td>Becomes short of breath with effort distinctly submaximal, but of major proportion. Tasks performed without pause unless the task requires extraordinary effort that may be performed with pauses.</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Moderate</td>
<td>Becomes short of breath with moderate effort. Tasks performed with occasional pauses and requiring longer to complete than the average person.</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Light</td>
<td>Becomes short of breath with little effort. Tasks performed with little effort or more difficult tasks performed with frequent pauses and requiring 50-100% longer to complete than the average person might require.</td>
</tr>
<tr>
<td>Grade 0</td>
<td>No Task</td>
<td>Becomes short of breath at rest, while sitting, or lying down.</td>
</tr>
<tr>
<td>W</td>
<td>Amount Uncertain</td>
<td>Subject’s exertional ability is impaired due to shortness of breath, but amount cannot be specified. Details are not sufficient to allow impairment to be categorised.</td>
</tr>
<tr>
<td>X</td>
<td>Unknown</td>
<td>Information unavailable regarding limitation of effort.</td>
</tr>
<tr>
<td>Y</td>
<td>Impaired for Reasons Other than Shortness of Breath</td>
<td>For example, musculoskeletal problems or chest pain.</td>
</tr>
</tbody>
</table>
# Modified MRC (mMRC) Questionnaire

**Table 1. Modified Medical Research Council (mMRC) Questionnaire for Assessing the Severity of Breathlessness**

<table>
<thead>
<tr>
<th>mMRC Grade</th>
<th>Description</th>
<th>Ticked</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I only get breathless with strenuous exercise.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>I get short of breath when hurrying on the level or walking up a slight hill.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking on my own pace on the level.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I stop for breath after walking about 100 meters or after a few minutes on the level.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I am too breathless to leave the house or I am breathless when dressing or undressing.</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Reprinted with permission from the *Global Strategy for Diagnosis, Management, and Prevention of COPD*, [www.goldcopd.org](http://www.goldcopd.org).

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### Table 3

**Modified Borg Scale**

<table>
<thead>
<tr>
<th>Score</th>
<th>Dyspnea</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>NONE</td>
</tr>
<tr>
<td>0.5</td>
<td>EXTREMELY MILD</td>
</tr>
<tr>
<td>1</td>
<td>VERY MILD</td>
</tr>
<tr>
<td>2</td>
<td>MILD</td>
</tr>
<tr>
<td>3</td>
<td>MODERATE</td>
</tr>
<tr>
<td>4</td>
<td>INTENSE</td>
</tr>
<tr>
<td>5</td>
<td>RATHER INTENSE</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>VERY INTENSE</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ALMOST UNBEARABLE</td>
</tr>
<tr>
<td>10</td>
<td>UNBEARABLE</td>
</tr>
</tbody>
</table>

From [37], mod.
COPD Assessment Test

How is your COPD? Take the COPD Assessment Test™ (CAT)

This questionnaire will help you and your healthcare professional measure the impact COPD (Chronic Obstructive Pulmonary Disease) is having on your wellbeing and daily life. Your answers and test score can be used by you and your healthcare professional to help improve the management of your COPD and get the greatest benefit from treatment.

For each item below, place a mark (X) in the box that best describes you currently. Be sure to only select one response for each question.

Example: I am very happy [X] 1 2 3 4 5 I am very sad

I never cough [ ] 0 1 2 3 4 5 I cough all the time [ ]

I have no phlegm (mucus) in my chest at all [ ] 0 1 2 3 4 5 My chest is completely full of phlegm (mucus) [ ]

My chest does not feel tight at all [ ] 0 1 2 3 4 5 My chest feels very tight [ ]

When I walk up a hill or one flight of stairs I am not breathless [ ] 0 1 2 3 4 5 When I walk up a hill or one flight of stairs I am very breathless [ ]

I am not limited doing any activities at home [ ] 0 1 2 3 4 5 I am very limited doing activities at home [ ]

I am confident leaving my home despite my lung condition [ ] 0 1 2 3 4 5 I am not at all confident leaving my home because of my lung condition [ ]

I sleep soundly [ ] 0 1 2 3 4 5 I don’t sleep soundly because of my lung condition [ ]

I have lots of energy [ ] 0 1 2 3 4 5 I have no energy at all [ ]

COPD Assessment Test and the CAT logo is a trade mark of the GlaxoSmithKline group of companies. © 2000 GlaxoSmithKline group of companies. All rights reserved. Last Updated: February 24, 2012
<table>
<thead>
<tr>
<th>Question</th>
<th>Response Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average, during the past week, how often did you feel:</td>
<td>never (0), hardly ever (1), a few times (2), several times (3), many times (4), a great many times (5), almost all the time (6)</td>
</tr>
<tr>
<td>1. Short of breath at rest?</td>
<td></td>
</tr>
<tr>
<td>2. Short of breath doing physical activities?</td>
<td></td>
</tr>
<tr>
<td>3. Concerned about getting a cold or your breathing getting worse?</td>
<td></td>
</tr>
<tr>
<td>4. Depressed (down) because of your breathing problems?</td>
<td></td>
</tr>
<tr>
<td>In general, during the past week, how much of the time:</td>
<td></td>
</tr>
<tr>
<td>5. Did you cough?</td>
<td></td>
</tr>
<tr>
<td>6. Did you produce phlegm?</td>
<td></td>
</tr>
<tr>
<td>On average, during the past week, how limited were you in these activities because of your breathing problems:</td>
<td>not limited at all (0), very slightly limited (1), slightly limited (2), moderately limited (3), very limited (4), extremely limited (5), totally limited or unable to do (6)</td>
</tr>
<tr>
<td>7. Strenuous physical activities (such as climbing stairs, hurrying, doing sports)?</td>
<td></td>
</tr>
<tr>
<td>8. Moderate physical activities (such as walking, housework, carrying things)?</td>
<td></td>
</tr>
<tr>
<td>9. Daily activities at home (such as dressing, washing yourself)?</td>
<td></td>
</tr>
<tr>
<td>10. Social activities (such as talking, being with children, visiting friends/relatives)?</td>
<td></td>
</tr>
</tbody>
</table>

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Follow-up

- History and physical examination
- Lung function: post-bronchodilator spirometry
- Assessment of exercise capacity
- Measurement of health status and impact of dyspnea e.g. MMRC, CAT, BDI
- Assessment of inspiratory and expiratory muscle strength and lower limb strength in patients who suffer from muscle wasting.
COPD/CVD Relationship

* COPD patients were nearly 5 times more likely to have CVD than those without COPD (Thorax 2010; 65:956)
* Every 10% decrease in FEV$_1$, cardiovascular mortality increases by 28% (Proc Am Thorac Soc 2005; 2:8)
* In patients with concomitant severe COPD and CAD: nonpharmacologic therapies eg. smoking cessation, pulmonary rehabilitation, vaccination against influenza and pneumococcus, supplemental oxygen are indicated to reduce symptoms, improve quality of life and prevent exacerbations.
Indications for LTOT (long term oxygen therapy)

* > 15 hours per day.
* LTOT improves survival 2-fold or more in hypoxemic patients with COPD.
* $\text{PaO}_2 \leq 55$ mmHg or $\text{SaO}_2 \leq 88\%$ during rest (Evidence B)
* $\text{PaO}_2$ 56-59 mmHg or $\text{SaO}_2$ >88% combined with evidence of pulmonary hypertension, cor pulmonale, right heart failure or polycythemia (Hct>55%) (Evidence D)
* $\text{PaO}_2$ >60 mmHg or $\text{SaO}_2$ >90% with significant coronary heart disease or active cardiac ischemia.
COPD who are not hypoxemic at rest, worsens during exertion.

During exercise, oxygen supplementation can:
- improve peripheral muscle oxygenation
- reduce dyspnea
- improve exercise tolerance
- prevent increases in pulmonary artery pressure
Prognosis: 4 Factors

* **BMI**: greater than 21 = 0 points; less than 21 = 1 point

* **FEV₁**: greater than 65% = 0 points
  
  - 50-64% = 1
  - 36-49% = 2
  - < 35% = 3

* **MMRC**

* **6MWT**: >350 meters = 0 points
  
  - 250-349 meters = 1
  - 150-249 meters = 2
  - < 149 meters = 3
**BODE Index for COPD**

The BODE Index is a composite marker of disease taking into consideration the systemic nature of COPD (Celli et al., 2004).

**Scoring the BODE Index**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV₁% pred</td>
<td>≥65</td>
<td>50-64</td>
<td>36-49</td>
<td>≤35</td>
</tr>
<tr>
<td>6MWD (m)</td>
<td>≥350</td>
<td>250-349</td>
<td>150-249</td>
<td>≤149</td>
</tr>
<tr>
<td>MMRC</td>
<td>0-1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>BMI (kg.m⁻²)</td>
<td>&gt;21</td>
<td>≤21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BODE Index score = 0 to 10 units

(FEV₁% pred = predicted amount as a percentage of the forced expiratory lung volume in one second; 6MWD = six minute walking distance; MMRC = modified medical research council dyspnea scale; BMI = body mass index)
Prognosis: 4-year survival

* 0-2 points = 80%
* 3-4 points = 67%
* 5-6 points = 57%
* 7-10 points = 18%
GLOBAL STRATEGY FOR THE DIAGNOSIS, MANAGEMENT, AND PREVENTION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE
Updated 2013