Role of PT in COPD: what we should know and how we could do

Chronic Obstructive Pulmonary Disease (COPD)

Benjamas Chuaychoo, MD, Ph.D.
Division of Respiratory Diseases and Tuberculosis
Department of Medicine
Faculty of Medicine Siriraj Hospital
Mahidol University

24 June 2015
Outline

• Definition
• Risk factors
• Pathogenesis, pathophysiology
• Diagnosis, differential diagnosis
• Co morbidity
• Assessment
• Management
• ACOS (Asthma COPD overlap syndrome)
• COPD sleep overlap syndrome
• Pulmonary hypertension in COPD
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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.

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Risk Factors for COPD

- Genes
- Exposure to particles
  - Tobacco smoke
  - Occupational dusts, organic and inorganic
  - Indoor air pollution from heating and cooking with biomass in poorly ventilated dwellings
  - Outdoor air pollution
- Lung growth and development
- Gender
- Age
- Respiratory infections
- Socioeconomic status
- Asthma/Bronchial hyperreactivity
- Chronic Bronchitis

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Risk Factors for COPD

- Cigarette smoke
- Occupational dust and chemicals
- Environmental tobacco smoke (ETS)
- Indoor and outdoor air pollution
- Genes
- Infections
- Socio-economic status
- Aging Populations

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Human Airways

### Anatomical Features of lower airways

```
<table>
<thead>
<tr>
<th>Structure</th>
<th>Inner diameter (mm)</th>
<th>Cilia</th>
<th>Goblet cells</th>
<th>Cartilage</th>
<th>Smooth muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larynx</td>
<td>35–45</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>0</td>
</tr>
<tr>
<td>Trachea</td>
<td>20–25</td>
<td>+++</td>
<td>+++</td>
<td>+++ (C-shaped)</td>
<td>+</td>
</tr>
<tr>
<td>Primary bronchi</td>
<td>12–16</td>
<td>+++</td>
<td>++</td>
<td>+++ (rings)</td>
<td>++</td>
</tr>
<tr>
<td>Secondary bronchi</td>
<td>10–12</td>
<td>+++</td>
<td>++</td>
<td>+++ (plates)</td>
<td>++</td>
</tr>
<tr>
<td>Tertiary bronchi</td>
<td>8–10</td>
<td>+++</td>
<td>++</td>
<td>++ (plates)</td>
<td>++</td>
</tr>
<tr>
<td>Smaller bronchi</td>
<td>1–8</td>
<td>+++</td>
<td>+</td>
<td>+ (plates)</td>
<td>++</td>
</tr>
<tr>
<td>Bronchioles</td>
<td>0.5–1</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+++</td>
</tr>
<tr>
<td>Termini bronchioles</td>
<td>&lt; 0.5</td>
<td>++</td>
<td>0</td>
<td>0</td>
<td>+++</td>
</tr>
<tr>
<td>Respiratory bronchioles</td>
<td>&lt; 0.5</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Alveolar sacs</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>
```

- **Small airway**: ≤ 2 mm
- **Emphysema**
Figure 4.1. **Mechanisms of airway obstruction.** (A) The lumen is partly blocked, for example, by excessive secretions. (B) The airway wall is thickened, for example, by edema or muscle hypertrophy. (C) The abnormality is outside the airway; in the example shown, the lung parenchyma is partly destroyed and the airway has narrowed because of loss of radial traction.
Airway obstruction in COPD

- Decreased airway diameter → Bronchiolitis
- Decreased elastic recoil → Emphysema

(permanent damage of the airspaces distal to the terminal bronchiole)

West JB. Pulmonary pathophysiology, the essentials, 7th ed, 2008
Small airway obstruction

(A) Normal  (B) Normal small airway with bland mucous plug  
(C) Airway with inflammation, thickened wall with inflammatory exudate  
(D) Airway narrowed by the deposition in the peribronchiolar space  

Hogg JC. Lancet 2004; 364: 709–21
Emphysema

Normal

Emphysema
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
Lung volumes during exercise: dynamic hyperinflation in COPD

Normal

COPD

Pre-bronchodilator

Post-bronchodilator

EELV = end-expiratory lung volume
IRV = inspiratory reserve volume
TLC = total lung capacity; $V_T$ = tidal volume

Lung hyperinflation (LH)

- Defined by increased functional residual capacity (FRC)*
- Conventionally, LH is defined as an increase in TLC regardless of underlying mechanisms

\[
\text{FRC} = \text{IC}
\]

* at end of tidal expiration

TLC = Total lung capacity

Lung hyperinflation (LH)

- Plays central role in pathophysiology of dyspnea and poor exercise tolerance in COPD
- Static LH:
  - Caused by destruction of pulmonary parenchyma and loss of elastic recoil
- Dynamic LH:
  - develops when COPD patients breathe in before achieving a full exhalation and, as a consequence, air is trapped within the lungs with each further breath
  - Dynamic LH may also occur at rest but it becomes clinically relevant during exercise and exacerbation

Lung hyperinflation (LH)

- increased ventilatory workload
- decreased inspiratory muscle pressure generating capacity
- adverse effects on cardiovascular function
- assessment of the presence and severity of LH is useful clinical approach to assess impact of therapeutic interventions on symptoms, exercise tolerance and health-related quality of life

Airflow limitation leads to dyspnea and exercise intolerance

Peripheral airways obstruction → FEV₁ and progressive air trapping during expiration → Hyperinflation at rest and during exercise → Dyspnea, Inspiratory capacity, Exercise capacity

Emphysema - defined pathologically as an abnormal permanent enlargement of air spaces distal to the terminal bronchioles, accompanied by the destruction of alveolar walls and without obvious fibrosis.

Decreased DLCO

no gas exchange

gas exchange

Effect of Emphysema on Compliance and Diffusing Capacity (DLco)

http://www.netterimages.com/image/1000.htm
**Definition**

- **Chronic bronchitis**
  - is a *clinical diagnosis*
  - “Presence of cough and sputum production for at least 3 months in each of two consecutive years”

- **Emphysema**, or destruction of the gas exchanging surfaces of the lung (alveoli)
  - is a *pathological diagnosis*
  - “Abnormal, permanent enlargement of the airspaces distal to the terminal bronchiole, accompanied by destruction of their walls”

**Cough**

**Emphysema**

**Dyspnea**
Outline

- Definition
- Risk factors
- Pathogenesis, pathophysiology
- Diagnosis, differential diagnosis
- Co morbidity
- Assessment
- Management
- ACOS (Asthma COPD overlap syndrome)
- COPD sleep overlap syndrome
- Pulmonary hypertension in COPD
Who is/are COPD patient(s)?
Diagnosis and Assessment: Key Points

- A clinical diagnosis of COPD should be considered in any patient who has dyspnea, chronic cough or sputum production, and a history of exposure to risk factors for the disease.

- Spirometry is required to make the diagnosis; the presence of a post-bronchodilator FEV$_1$/FVC < 0.70 confirms the presence of persistent airflow limitation and thus of COPD.
Diagnosis

• Symptoms:
  – Dyspnea, chronic cough or sputum production

• Exposure to risk factors:
  – Tobacco, occupation, indoor/outdoor pollution

• Post-bronchodilator $\text{FEV}_1/\text{FVC} < 0.7$ (spirometry)
ท่านมีความเสี่ยงต่อการเกิดโรคปอดอุดกั้นเรื้อรังหรือไม่

<table>
<thead>
<tr>
<th>ไอบ่อย ๆ</th>
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<th>□ ไม่ใช่</th>
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ท่านสูบบุหรี่หรือเคยสูบบุหรี่

```
pack-yeak (ซอง-ปี) = จำนวนบุหรี่คิดเป็นชองต่อวัน ∙ จำนวนปีที่สูบ

ตัวอย่าง สูบบุหรี่ 1 ชองต่อวัน นาน 20 ปี = 20 ชอง-ปี
สูบบุหรี่ 2 ชองต่อวัน นาน 10 ปี = 20 ชอง-ปี
```
Spirometry: Normal Trace Showing FEV₁ and FVC

FEV₁ = 4L
FVC = 5L
FEV₁/FVC = 0.8
Spirometry: Obstructive Disease

- FEV₁ = 1.8L
- FVC = 3.2L
- FEV₁/FVC = 0.56

Obstructive

FEV₁/FVC < 0.7

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Sue I have inserted a bracket and shifted the obstructive label. The FVC in this slide is about 3.4 by eyeball - should be moved down to 3.2 or the numbers should be changed.

Christine Jenkins, 4/14/2008
Post bronchodilator FEV1/FVC < 0.7
spirometry

ชายไทย อายุ 70 ปี เหนื่อยมา 3 ปี สูบบุหรี่ 20 ซอง-ปี

<table>
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<th></th>
<th>Pre-Rx</th>
<th>Pred</th>
<th>% pred</th>
<th>Post-Rx</th>
<th>% pred</th>
<th>% change</th>
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<td>FVC</td>
<td>2.04</td>
<td>2.55</td>
<td>80.0</td>
<td>2.05</td>
<td>80.4</td>
<td>5</td>
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<tr>
<td>FEV1</td>
<td>0.78</td>
<td>2.17</td>
<td>36</td>
<td>0.85</td>
<td>39.2</td>
<td>9</td>
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<tr>
<td>FEV1/FVC</td>
<td>38</td>
<td>85</td>
<td>45</td>
<td>41</td>
<td></td>
<td>48</td>
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<tr>
<td>FEF25-75%</td>
<td>0.31</td>
<td>3.37</td>
<td>9</td>
<td>0.31</td>
<td>9</td>
<td>9</td>
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<tr>
<td>PEF</td>
<td>177</td>
<td>388</td>
<td>46</td>
<td>219</td>
<td></td>
<td>56</td>
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</tbody>
</table>

Post-bronchodilator FEV$_1$/ FVC < 0.70
### Differential diagnosis asthma and COPD

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>Asthma</th>
<th>COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of onset</td>
<td>Usually early childhood, but may any age</td>
<td>Mid-late adult life (&gt;40 yrs)</td>
</tr>
<tr>
<td>Smoking history</td>
<td>May be non-, ex-, or current smoker</td>
<td>Usually smoker or ex-smoker ( &gt; 10 pack-yr)</td>
</tr>
<tr>
<td>Atopy</td>
<td>common</td>
<td>Not a prominent feature</td>
</tr>
<tr>
<td>Family history of atopy or asthma</td>
<td>common</td>
<td>Not usually a feature</td>
</tr>
<tr>
<td>Lung function</td>
<td>Normal or obstruction</td>
<td>Airflow obstruction (hallmark of COPD)</td>
</tr>
<tr>
<td>Reversibility of airflow obstruction</td>
<td>Mostly reversible (Characteristic of asthma)</td>
<td>Mostly irreversible</td>
</tr>
<tr>
<td>Peak flow variability</td>
<td>Characteristic of asthma, usually &gt; 20%</td>
<td>Not vary</td>
</tr>
<tr>
<td>Diffuse capacity</td>
<td>Usually normal</td>
<td>Decrease in emphysema</td>
</tr>
<tr>
<td>inflammation</td>
<td>Eosinophilic, CD4</td>
<td>Neutrophilic, CD8</td>
</tr>
<tr>
<td>Corticosteroids</td>
<td>Steroid responsive</td>
<td>Steroid resistance</td>
</tr>
</tbody>
</table>

Asthma and COPD, Basic mechanisms and clinical management. edited by Peter Barnes, et al. 2002
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Exacerbations and comorbidities contribute to the overall severity in individual patients.
Systemic effects and comorbidities of COPD

Lung cancer

Peripheral lung inflammation

"Spill-over"

Systemic inflammation
IL-6, IL-1β, TNF-α

Acute phase proteins
CRP
Serum amyloid A
Surfactant protein D

Skeletal muscle weakness
Cachexia

Ischaemic heart disease
Cardiac failure

Osteoporosis
Diabetes metabolic syndrome
Normocytic anaemia
Depression
Figure 1. Hazard ratio (95% confidence interval) of death within 5-year follow-up (Cox proportional hazard model adjusted for age, sex, race, smoking status, education level, and body mass index) by severity of airflow limitation and presence of 0, 1, 2, or 3 comorbid diseases (diabetes, hypertension, or cardiovascular disease [CVD]). Reproduced with permission from reference (9). GOLD = stages of airflow limitation according to the Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease (40); GOLD 0 = presence of respiratory symptoms with normal spirometry; Normal = subjects with normal lung function for each comorbid disease; R = restricted, FEV\textsubscript{1}/FVC ≥ 0.70 and FVC < 80% reference value.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total n= 150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (mean ± SD, range)</td>
<td>72± 8</td>
</tr>
<tr>
<td>Male sex, no (%)</td>
<td>137 (91.3)</td>
</tr>
<tr>
<td>BMI (kg/m²), no. (%)</td>
<td></td>
</tr>
<tr>
<td>&lt; 18.5 (underweight)</td>
<td>31 (20.7)</td>
</tr>
<tr>
<td>18.5-24.9 (normal)</td>
<td>92 (61.3)</td>
</tr>
<tr>
<td>25-29.9 (overweight)</td>
<td>23 (15.3)</td>
</tr>
<tr>
<td>≥ 30 (obese)</td>
<td>4 (2.7)</td>
</tr>
<tr>
<td>Co-morbidity, no.(%)</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>20 (13.3)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>89 (59.3)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>67 (44.7)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>23 (30.6)</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>10 (6.7)</td>
</tr>
</tbody>
</table>
Prevalence of osteoporosis and osteopenia in Thai COPD patients. Rittayamai N, Chuaychoo B, Sriwijitkamol A.

- Prevalence of osteoporosis 31.4%
- Prevalence of osteopenia 32.4%
- Prevalence of osteoporosis in COPD patients was higher than that in age-matched Thai males from historical data (31.4% vs. 12.6%, respectively).
- The predictive value of BMI < 20.5 kg/m2 and hs-CRP > 2.3 mg/L demonstrated risk of osteoporosis in COPD patients (adjusted Odds ratio 7.2 and 4.1, respectively).
ภาวะซึมเศร้าในผู้ป่วยโรคปอดอุดกั้นเรื้อรังจากแบบสอบถาม T-HADS

<table>
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<th>T-HADS</th>
<th>จำนวนผู้ป่วย</th>
<th>ร้อยละ</th>
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<tr>
<td>&lt; 11</td>
<td>93</td>
<td>87.7</td>
</tr>
<tr>
<td>≥ 11</td>
<td>13</td>
<td>12.3</td>
</tr>
</tbody>
</table>

N =106
Prevalence of MCI in COPD (total n = 122) (mild cognitive impairment)

- Prevalence of MCI in COPD was 38.5 %
- The main contributing factor in COPD patients were age, education years, and frequent exacerbation.

Pimpawee Kirdsup, et al.
Physiology of exacerbations in a hypothetical regular smoker with COPD by stage of severity

Frequent exacerbators represent stable COPD phenotype - independent of severity

- Proportion of subjects experiencing ≥2 exacerbations/year increases year-on-year
- Stable population provides potential to understand the cause(s) of the phenotype

ECLIPSE 3 year data
The ‘frequent exacerbator phenotype’: Frequency/severity by GOLD Category (1)

% of patients

<table>
<thead>
<tr>
<th>Category</th>
<th>Hospitalised for exacerbation in yr 1</th>
<th>Frequent exacerbations (2 or more)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOLD II (N=945)</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>GOLD III (N=900)</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td>GOLD IV (N=293)</td>
<td>33</td>
<td>47</td>
</tr>
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</table>

p<0.01

ECLIPSE 1 year data

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Global Strategy for Diagnosis, Management and Prevention of COPD

Manage Stable COPD: Goals of Therapy

- Relieve symptoms
- Improve exercise tolerance
- Improve health status
- Prevent disease progression
- Prevent and treat exacerbations
- Reduce mortality

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Manage Stable COPD: Goals of Therapy

- Relieve symptoms
- Improve exercise tolerance
- Improve health status
- Prevent disease progression
- Prevent and treat exacerbations
- Reduce mortality

Reduce symptoms
Reduce risk

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Global Strategy for Diagnosis, Management and Prevention of COPD

Assessment of COPD

- Assess symptoms
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations
- Assess comorbidities

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Global Strategy for Diagnosis, Management and Prevention of COPD
Assessment of COPD

- Assess symptoms
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations
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Assessment of COPD

- Assess symptoms

COPD Assessment Test (CAT)

or

Clinical COPD Questionnaire (CCQ)

or

mMRC Breathlessness scale

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ผลของท่านเป็นอย่างไรบ้าง? ได้รับการประเมินผลเกี่ยวกับโรคคุมหลังฟอง (COPD Assessment Test™, CAT)

แบบสอบถามจะช่วยให้ทราบและแหล่งของท่านสามารถทำการประเมินผลการของโรคคุมหลังฟองได้โดยสะดวก และการทำการประมวลผลของงาน ท่านและแพทย์ท่านสามารถใช้ข้อมูลแสดงผลและแบบทดสอบของท่านเพื่อช่วยในการปรับปรุงการจัดการโรคของผู้ป่วย หรือปัจจัยที่จะเป็นประโยชน์ต่อสุขภาพของผู้ป่วย

โปรดชิ้นเขียนหมายเลข (X) ลงในช่องใจกลางที่เกี่ยวข้องกับอาการปัจจุบันของท่านได้ดังที่กล่าว

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<tr>
<td>ข้อ 3</td>
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http://www.catestonline.org/english/index_Thai.htm
เกณฑ์การให้คะแนนภาวะหายใจลำบาก
(Modified Medical Research Council Dyspnea Scale; mMRC)

<table>
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<td></td>
<td>(1)</td>
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<td>เดินบนพื้นร้านได้ข้าวาว คนอื่นที่อยู่ในวัยเดียวกัน</td>
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<td>เพราะหายใจเหนื่อย หรือต้องหยุดเพื่อหายใจ เมื่อเดิน</td>
<td></td>
<td></td>
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<tr>
<td>ตามปกติบนพื้นร้าน</td>
<td></td>
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<tr>
<td>ต้องหยุดเพื่อหายใจ หลังจากเดินได้ประมาณ 100</td>
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<td>(3)</td>
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<td>เมตร หรือหลังจากเดินได้สักพัก บนพื้นร้าน</td>
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<td>หายใจเหนื่อยมากเกินกว่าที่จะออกจากบ้าน หรือหาย</td>
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<tr>
<td>มากขณะเดินต่อว้า หรือเปลี่ยนเครื่องยนต์ตัวอื่น</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assessment of COPD

- Assess symptoms
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations
- Assess comorbidities
Global Strategy for Diagnosis, Management and Prevention of COPD

Classification of Severity of Airflow Limitation in COPD*

In patients with $\text{FEV}_1/\text{FVC} < 0.70$:

**GOLD 1: Mild** $\text{FEV}_1 \geq 80\%$ predicted

**GOLD 2: Moderate** $50\% \leq \text{FEV}_1 < 80\%$ predicted

**GOLD 3: Severe** $30\% \leq \text{FEV}_1 < 50\%$ predicted

**GOLD 4: Very Severe** $\text{FEV}_1 < 30\%$ predicted

*Based on Post-Bronchodilator $\text{FEV}_1$*
Assessment of COPD

- Assess symptoms
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations
- Assess comorbidities
High risk of exacerbation:

- $\geq 2$ exacerbations within the last year or
- $\text{FEV}_1 < 50\%$ of predicted value are indicators of high risk.
- $\geq 1$ hospitalizations for COPD exacerbation should be considered high risk.
Global Strategy for Diagnosis, Management and Prevention of COPD

Combined Assessment of COPD

- Assess symptoms
- Assess degree of airflow limitation using spirometry
- Assess risk of exacerbations

*Combine these assessments for the purpose of improving management of COPD*

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Combined Assessment of COPD

Risk (GOLD Classification of Airflow Limitation)

Symptoms

Breathlessness

mMRC 0–1

mMRC ≥ 2

CAT < 10

CAT ≥ 10

(A)

(B)

(C)

(D)

≥ 2

or

≥ 1 leading to hospital admission

1 (not leading to hospital admission)

0

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Combined Assessment of COPD

Assess symptoms first

- If CAT < 10 or mMRC 0-1: Less Symptoms/breathlessness (A or C)
- If CAT ≥ 10 or mMRC ≥ 2: More Symptoms/breathlessness (B or D)

Symptoms
- mMRC 0–1
- mMRC > 2

Breathlessness

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Combined Assessment of COPD

- **Symptoms**
  - CAT < 10
  - CAT ≥ 10

- **Breathlessness**
  - mMRC 0–1
  - mMRC ≥ 2

- **Risk**
  - GOLD Classification of Airflow Limitation
  - Exacerbation history

- **Combination Criteria**
  - (A) CAT < 10 and mMRC 0–1
  - (B) CAT ≥ 10 and mMRC 0–1
  - (C) CAT < 10 and mMRC ≥ 2
  - (D) CAT ≥ 10 and mMRC ≥ 2

- **Risk Levels**
  - 0 (not leading to hospital admission)
  - 1 (not leading to hospital admission)
  - ≥ 2 or ≥ 1 leading to hospital admission

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Combined Assessment of COPD

When assessing risk, choose the highest risk according to GOLD grade or exacerbation history. One or more hospitalizations for COPD exacerbations should be considered high risk.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Characteristic</th>
<th>Spirometric Classification</th>
<th>Exacerbations per year</th>
<th>CAT</th>
<th>mMRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Low Risk Less Symptoms</td>
<td>GOLD 1-2</td>
<td>≤ 1</td>
<td>&lt; 10</td>
<td>0-1</td>
</tr>
<tr>
<td>B</td>
<td>Low Risk More Symptoms</td>
<td>GOLD 1-2</td>
<td>≤ 1</td>
<td>&gt; 10</td>
<td>&gt; 2</td>
</tr>
<tr>
<td>C</td>
<td>High Risk Less Symptoms</td>
<td>GOLD 3-4</td>
<td>≥ 2</td>
<td>&lt; 10</td>
<td>0-1</td>
</tr>
<tr>
<td>D</td>
<td>High Risk More Symptoms</td>
<td>GOLD 3-4</td>
<td>≥ 2</td>
<td>&gt; 10</td>
<td>&gt; 2</td>
</tr>
</tbody>
</table>

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COPD patients are at increased risk for:

- Cardiovascular diseases
- Osteoporosis
- Respiratory infections
- Anxiety and Depression
- Diabetes
- Lung cancer
- Bronchiectasis

These comorbid conditions may influence mortality and hospitalizations and should be looked for routinely, and treated appropriately.
Manage Stable COPD: Goals of Therapy

- Relieve symptoms
- Improve exercise tolerance
- Improve health status
- Prevent disease progression
- Prevent and treat exacerbations
- Reduce mortality

Reduce symptoms
Reduce risk

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Avoidance of risk factors

- smoking cessation
- reduction of indoor pollution
- reduction of occupational exposure

Influenza vaccination
### Manage Stable COPD: Non-pharmacologic

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>Essential</th>
<th>Recommended</th>
<th>Depending on local guidelines</th>
</tr>
</thead>
</table>
| A             | Smoking cessation (can include pharmacologic treatment) | Physical activity | Flu vaccination
|               |           |             | Pneumococcal vaccination    |
| B, C, D      | Smoking cessation (can include pharmacologic treatment) Pulmonary rehabilitation | Physical activity | Flu vaccination
|               |           |             | Pneumococcal vaccination    |
All COPD patients benefit from *exercise training programs* with improvements in exercise tolerance and symptoms of dyspnea and fatigue.

Although an effective pulmonary rehabilitation program is 6 weeks, the longer the program continues, the more effective the results.

If exercise training is maintained at home, the patient's health status remains above pre-rehabilitation levels.
Oxygen therapy

- Three ways of administration
  - Longterm continuous therapy
  - During exercise
  - Relieve acute dyspnea

- Primary goal
  - Increase PaO2 > 60 mmHg, SaO2 > 90%
ข้อบ่งชี้ในการให้ Long-term oxygen therapy (> 15 hrs/day)

- PaO2 < 55 mm Hg หรือ SaO2 < 88%
- 55 mmHg < PaO2 < 60 mm Hg หรือ SaO2 of 88% ที่มีภาวะที่บ่งชี้ว่ามี chronic hypoxemia ได้แก่
  - pulmonary hypertension
  - peripheral edema suggesting congestive cardiac failure
  - polycythemia (hematocrit > 55%)

LTOT จะให้ใน stable COPD ที่มี chronic hypoxemia ตามเกณฑ์ดังกล่าว ข้างต้น กรณีที่ผู้ป่วยมีอาการกำเริบเฉียบพลันและมี hypoxemia อาจให้ออกซิเจนเป็นการชั่วคราว ถ้าหากยังมีภาวะ hypoxemia หลังจาก 3 เดือน จึงมีข้อบังคับสำหรับ LTOT
Global Strategy for Diagnosis, Management and Prevention of COPD

Manage Stable COPD: Pharmacologic Therapy

**RECOMMENDED FIRST CHOICE**

- **GOLD 4**
  - ICS + LABA
  - or
  - LAMA

- **GOLD 3**
  - ICS + LABA
  - and/or
  - LAMA

- **GOLD 2**
  - SAMA prn
  - or
  - SABA prn

- **GOLD 1**
  - LABA
  - or
  - LAMA

**Exacerbations per year**

<table>
<thead>
<tr>
<th>CAT &lt; 10</th>
<th>CAT &gt; 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>mMRC 0-1</td>
<td>mMRC &gt; 2</td>
</tr>
</tbody>
</table>

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are central to symptomatic management of COPD

prescribed on an as-needed or on a regular basis to prevent or reduce symptoms

The principal bronchodilator treatments are

- beta$_2$-agonists
- Anticholinergics
- Theophylline

or combination therapy
An exacerbation of COPD is:

“an acute event characterized by a worsening of the patient’s respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication.”
Diagnosis COPD exacerbations

- Clinical diagnosis
- Acute worsening of symptoms (beyond normal day-to-day variations and leads to a change in medication)
  - Dyspnea
  - Cough and/or
  - Sputum production

Chest 2000;117;398S-401S

2014 Global Initiative for Chronic Obstructive Lung Disease
Consequences Of COPD Exacerbations

- Negative impact on quality of life
- Impact on symptoms and lung function
- Accelerated lung function decline
- Increased economic costs
- Increased Mortality

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Outline

- Definition
- Risk factors
- Pathogenesis, pathophysiology
- Diagnosis, differential diagnosis
- Co morbidity
- Assessment
- Management
- ACOS (Asthma COPD overlap syndrome)
- COPD sleep overlap syndrome
- Pulmonary hypertension in COPD
Definition

Asthma

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable expiratory airflow limitation. [GINA 2014]

COPD

COPD is a common preventable and treatable disease, characterized by persistent airflow limitation that is usually progressive and associated with enhanced chronic inflammatory responses in the airways and the lungs to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients. [GOLD 2015]

Asthma-COPD overlap syndrome (ACOS) [a description]

Asthma-COPD overlap syndrome (ACOS) is characterized by persistent airflow limitation with several features usually associated with asthma and several features usually associated with COPD. ACOS is therefore identified by the features that it shares with both asthma and COPD.
Why is asthma–COPD overlap important?

- **Prevalence:** ACOS ~ 20% of patients with obstructive airway disease (asthma or COPD) and 2% in general population
- **Increased illness burden:** ACOS leads to significant health status impairment, increased exacerbations and increased hospitalizations
- **Treatment implications:**
  - When asthma is not recognized, there is potential for increased adverse events and drug toxicity from LABA
  - Increased response to ICS and LABA in COPD patients with asthma
  - Limited evidence for treatment recommendations because ACOS patients are excluded from randomized controlled trials

LABA = long-acting B2 agonists, ICS = inhaled corticosteroids

<table>
<thead>
<tr>
<th>Feature</th>
<th>Asthma</th>
<th>COPD</th>
<th>ACOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of onset</td>
<td>Usually childhood but can commence at any age</td>
<td>Usually &gt;40 years</td>
<td>Usually ≥40 years, but may have had symptoms as child/early adult</td>
</tr>
<tr>
<td>Pattern of respiratory symptoms</td>
<td>Symptoms vary over time (day to day, or over longer period), often limiting activity. Often triggered by exercise, emotions including laughter, dust, or exposure to allergens</td>
<td>Chronic usually continuous symptoms, particularly during exercise, with ‘better’ and ‘worse’ days</td>
<td>Respiratory symptoms including exertional dyspnea are persistent, but variability may be prominent</td>
</tr>
<tr>
<td>Lung function</td>
<td>Current and/or historical variable airflow limitation, e.g. BD reversibility, AHR</td>
<td>FEV₁ may be improved by therapy, but post-BD FEV₁/FVC &lt;0.7 persists</td>
<td>Airflow limitation not fully reversible, but often with current or historical variability</td>
</tr>
<tr>
<td>Lung function between symptoms</td>
<td>May be normal</td>
<td>Persistent airflow limitation</td>
<td>Persistent airflow limitation</td>
</tr>
</tbody>
</table>

© Global Initiative for Asthma
## Usual features of asthma, COPD and ACOS (continued)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Asthma</th>
<th>COPD</th>
<th>ACOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past history or family history</td>
<td>Many patients have allergies and a personal history of asthma in childhood and/or family history of asthma</td>
<td>History of exposure to noxious particles or gases (mainly tobacco smoking or biomass fuels)</td>
<td>Frequently a history of doctor-diagnosed asthma (current or previous), allergies, family history of asthma, and/or a history of noxious exposures</td>
</tr>
<tr>
<td>Time course</td>
<td>Often improves spontaneously or with treatment but may result in fixed airflow limitation</td>
<td>Generally slowly progressive over years despite treatment</td>
<td>Symptoms are partly but significantly reduced by treatment. Progression is usual and treatment needs are high.</td>
</tr>
<tr>
<td>Chest X-ray</td>
<td>Usually normal</td>
<td>Severe hyperinflation and other changes of COPD</td>
<td>Similar to COPD</td>
</tr>
<tr>
<td>Exacerbations</td>
<td>Exacerbations occur, but risk can be substantially reduced by treatment</td>
<td>Exacerbations can be reduced by treatment. If present, comorbidities contribute to impairment</td>
<td>Exacerbations may be more common than in COPD but are reduced by treatment. Comorbidities can contribute to impairment.</td>
</tr>
</tbody>
</table>
### Features that (when present) favor asthma or COPD

<table>
<thead>
<tr>
<th>Feature</th>
<th>Favors asthma</th>
<th>Favors COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of onset</td>
<td>❑ Before age 20 years</td>
<td>❑ After age 40 years</td>
</tr>
<tr>
<td>Pattern of respiratory symptoms</td>
<td>❑ Symptoms vary over minutes, hours or days</td>
<td>❑ Symptoms persist despite treatment</td>
</tr>
<tr>
<td></td>
<td>❑ Worse during night or early morning</td>
<td>❑ Good and bad days, but always daily symptoms and exertional dyspnea</td>
</tr>
<tr>
<td></td>
<td>❑ Triggered by exercise, emotions including laughter, dust, or exposure to allergens</td>
<td></td>
</tr>
<tr>
<td>Lung function</td>
<td>❑ Normal between symptoms</td>
<td>❑ Record of persistent airflow limitation (post-BD FEV1/FVC &lt;0.7)</td>
</tr>
<tr>
<td></td>
<td>❑ Abnormal between symptoms</td>
<td></td>
</tr>
<tr>
<td>Past history or family history</td>
<td>❑ Previous doctor diagnosis of asthma</td>
<td>❑ Previous doctor diagnosis of COPD, chronic bronchitis or emphysema</td>
</tr>
<tr>
<td></td>
<td>❑ Family history of asthma, and other allergic conditions (allergic rhinitis or eczema)</td>
<td>❑ Heavy exposure to a risk factor: tobacco smoke biomass fuels</td>
</tr>
<tr>
<td>Time course</td>
<td>❑ No worsening of symptoms over time. Symptoms vary seasonally, or from year to year</td>
<td>❑ May improve spontaneously or respond immediately to BD or to ICS over weeks</td>
</tr>
<tr>
<td></td>
<td>❑ Symptoms slowly worsening over time (progressive course over years)</td>
<td>❑ Rapid-acting bronchodilator treatment provides only limited relief</td>
</tr>
</tbody>
</table>

Syndromic diagnosis of airways disease

The shaded columns list features that, when present, best distinguish between asthma and COPD.

For a patient, count the number of check boxes in each column.

- If 3 or more boxes are checked for either asthma or COPD, that diagnosis is suggested.
- If there are similar numbers of checked boxes in each column, the diagnosis of ACOS should be considered.
### Step 3 - Spirometry

<table>
<thead>
<tr>
<th>Spirometric variable</th>
<th>Asthma</th>
<th>COPD</th>
<th>ACOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal FEV₁/FVC pre- or post-BD</td>
<td>Compatible with asthma</td>
<td>Not compatible with diagnosis (GOLD)</td>
<td>Not compatible unless other evidence of chronic airflow limitation</td>
</tr>
<tr>
<td>Post-BD FEV₁/FVC &lt;0.7</td>
<td>Indicates airflow limitation; may improve</td>
<td>Required for diagnosis by GOLD criteria</td>
<td>Usual in ACOS</td>
</tr>
<tr>
<td>FEV₁ =80% predicted</td>
<td>Compatible with asthma (good control, or interval between symptoms)</td>
<td>Compatible with GOLD category A or B if post BD FEV₁/FVC &lt;0.7</td>
<td>Compatible with mild ACOS</td>
</tr>
<tr>
<td>FEV₁ &lt;80% predicted</td>
<td>Compatible with asthma. A risk factor for exacerbations</td>
<td>Indicates severity of airflow limitation and risk of exacerbations and mortality</td>
<td>Indicates severity of airflow limitation and risk of exacerbations and mortality</td>
</tr>
<tr>
<td>Post-BD increase in FEV₁ &gt;12% and 200mL from baseline (reversible airflow limitation)</td>
<td>Usual at some time in course of asthma; not always present</td>
<td>Common in COPD and more likely when FEV₁ is low, but consider ACOS</td>
<td>Common in ACOS, and more likely when FEV₁ is low</td>
</tr>
<tr>
<td>Post-BD increase in FEV₁ &gt;12% and 400mL from baseline</td>
<td>High probability of asthma</td>
<td>Unusual in COPD. Consider ACOS</td>
<td>Compatible with diagnosis of ACOS</td>
</tr>
</tbody>
</table>
Summary: Diagnosis of COPD

- **Symptoms:**
  - Dyspnea, chronic cough or sputum production

- **Exposure to risk factors:**
  - Tobacco, occupation, indoor/outdoor pollution

- **Required spirometry:** post-bronchodilator 
  FEV$_1$/FVC < 0.7
Management of COPD

COPD → Co-morbid diseases

Stable
- Pharmacologic treatment
  - Bronchodilator
  - Corticosteroid
  - Vaccination
- Non-pharmacologic treatment
  - Stop smoking
  - Pulmonary rehabilitation
  - Oxygen therapy
  - Surgical treatment

Exacerbation
- Home management
  - Bronchodilator
  - Systemic corticosteroid
  - Antibiotics
- Hospital management
  - Bronchodilator
  - Systemic corticosteroid
  - Oxygen
  - Antibiotics
  - Ventilatory support

Dyspnea
Cough
Sputum
Summary: Manage stable COPD

- **Goals of therapy:**
  - reduced symptoms, reduced risk of exacerbations

- **Assessment:**
  - Assess symptoms: CAT, CCQ, mMRC
  - Assess degree of airflow limitation: post bronchodilator FEV1% predicted (stage 1-4)
  - Assess risk of exacerbations: previous exacerbation (frequent exacerbations ≥ 2/year or 1 of hospitalization), severe COPD by FEV1% predicted
  - Assess comorbidities: e.g. cardiovascular disease, metabolic syndrome, anxiety/depression, osteoporosis
Summary: Manage stable COPD

- Combined assessment of symptoms and risk of exacerbations is the basis for non-pharmacologic and pharmacologic management of COPD
- Pharmacologic treatment
  - bronchodilator ± inhaled corticosteroid
- Non-pharmacologic treatment
  - smoking cessation
  - influenza vaccination ± pneumococcal vaccination
  - pulmonary rehabilitation
  - physical activity
Thank you for your attention