Gerard J. Criner, MD, is Professor and Founding Chair, Department of Thoracic Medicine and Surgery at the Lewis Katz School of Medicine at Temple University in Philadelphia, PA, where he also obtained his medical degree in 1979. Dr. Criner completed his internship, residency and chief residency in internal medicine at Temple University Hospital, and his Fellowship in pulmonary and critical care medicine at Boston University School of Medicine in Boston, MA. Dr. Criner serves on the board of directors for the Global Initiative for Chronic Obstructive Lung Disease (GOLD) and acts as Chairman for the ACCP guidelines on the prevention of acute exacerbations in chronic obstructive pulmonary disease (COPD). He is a member of the board of directors for the Global Initiative for Chronic Obstructive Lung Disease. In 2013, Dr. Criner was the recipient of the Paul W. Eberman Faculty Research Award from Temple University, the Honored Professor Award from Temple University in 2015 and the Distinguished Medical Research Award from Philadelphia Business Journal in 2016. As a principal investigator, Dr. Criner has received extensive research funding and has conducted several clinical trials in pulmonary disease. His primary research focuses on advanced lung conditions, including COPD, emphysema, pulmonary fibrosis, and respiratory failure. Dr. Criner has published over 360 scientific papers, reviews, and book chapters, with numerous research articles in peer-reviewed journals including New England Journal of Medicine, American Journal of Respiratory and Critical Care Medicine (AJRCCM), Chest and Lancet Respiratory Medicine. He serves as Associate Editor for AJRCCM and Thorax. Dr. Criner has lectured nationally and internationally at numerous scientific meetings and congresses.

OBJECTIVES:
Participants should be better able to:

1. Increase awareness of COPD among health professionals, health authorities, and the general public;
2. Improve diagnosis, management and prevention;
3. Decrease morbidity and mortality;
4. Stimulate research.
GOLD COPD 2018 Report Update

Gerard J. Criner, M.D.
Professor and Chair, Department of Thoracic Medicine and Surgery
Temple University
Philadelphia, PA

PRESENTER DISCLOSURES

Gerard J. Criner, M.D.

(1) The following relationships with commercial interests related to this presentation existed during the past 60 months:

Honoraria: None

Grants received: NIH-NHLBI, PA-DOH, GSK, Boehringer-Ingelheim, Novartis, Astra Zeneca, Respironics, Pearl, Philips, PalmTrx, ResMed, Mereo, Probioterix, Broncus, Spiration

Grants pending: NIH-NHLBI, Fisher Paykel,

Consultation: Amirall, Holaira, Boehringer –Ingelheim, Astra Zeneca, Respironics, Mereo, Patara

Equity Interest: HGE Health Care Solutions, Inc.

Member of GOLD
• Vice Chair GOLD Board of Directors
• Science committee member
Global Initiative for Chronic Obstructive Lung Disease (GOLD) Objectives

- Increase awareness of COPD among health professionals, health authorities, and the general public
- Improve diagnosis, management and prevention
- Decrease morbidity and mortality
- Stimulate research

© 2017 Global Initiative for Chronic Obstructive Lung Disease

GOLD 2017

- Not a guideline!
- Recommendations for clinical care using best available EBM by leading international experts in COPD care and research
- Continuing update on ongoing basis as new evidence becomes available
- Its international and should reflect that in its scope and recommendations
- Attempts to be impartial and free of industrial influence
GOLD 2017: Most Significant Changes

- Assessment of COPD has been refined to separate the spirometric assessment from symptom evaluation.
- ABCD groups are now proposed to be derived exclusively from patient symptoms and their history of exacerbations.
- For each group A to D, escalation strategies for pharmacological treatments are proposed.
- The concept of de-escalation of therapy is introduced in the treatment assessment scheme.
- Non-pharmacologic therapies are comprehensively presented.
- The importance of comorbid conditions in managing COPD is reviewed.

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that 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.

GOLD COPD Definition – Old vs. New

GOLD 2011

Chronic Obstructive Pulmonary Disease (COPD) is 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.

GOLD 2017

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases.
COPD Etiology, Pathobiology & Pathology

**Etiology**
- Smoking and pollutants
- Host factors

**Pathobiology**
- Impaired lung growth
- Accelerated decline
- Lung injury
- Lung & systemic inflammation

**Pathology**
- Small airway disorders
- Emphysema
- Systemic effects

**Airflow limitation**
- Persistent airflow limitation

**Clinical manifestations**
- Symptoms & Exacerbations
- Comorbidities

Trajectory of Airflow Obstruction in COPD

Lung Function Trajectories Leading to COPD

Patterns of Growth and Decline in Lung Function in Persistent Childhood Asthma

Lange, NEJM, 2015

McGeachie, NEJM, 2016
Management of COPD should be individualized to reduce *both* current symptoms and future risk of exacerbations.

**Individual presentation and underlying mechanisms**
- Mortality
- Disease progression
- Lung function
- Symptoms: cough, sputum production, and dyspnea
- Exercise tolerance
- Exacerbations
- Disability
- Health status and quality of life

**Individual risk factors and comorbidities**
- Pneumonia
- Tuberculosis
- Skin bruising
- Osteoporosis or fractures
- Muscle dysfunction
- Nutritional impairment
- Cataract
- Diabetes
- Tremor
- Cardiovascular events
- Neuropsychological events
- Gastrointestinal symptoms

**Expected Benefits**
- Individualization of treatment choices in COPD

**Expected Risks**
- LABA; LAMA; LABA + LAMA; LABA + ICS; LABA + LAMA + ICS; LABA + roflumilast; LAMA + roflumilast
- Non-Pharm therapies

**Keys to Assessing Treatment in COPD**

- **Severity of airflow obstruction**
- **Assessment of Respiratory Symptoms**
- **Assessment of Exacerbation Risk**

- **Spirometry**
- **Clinical History**
Spirometry: Real Life Practice

Done infrequently!

Results frequently unusable!

Arne, Resp Med, 2010
Miravitlles, Resp Med, 2007

Should Spirometry be Used to Screen for COPD?

Routine Screening

- USPSTF recommends against screening for COPD with spirometry in asymptomatic adults
  - Screening has no outcome benefits
  - Associated with large costs
- ACP/ATS/ERS and NICE have same conclusion

Active Case Finding

- Questionnaire
  - Risk Factors
  - Smoking Hx
  - Demographics
  - Respiratory Symptoms

Moderate–High Burden

FEV/FVC < 0.70

Treatment considerations

Hill, 2010; Dirven, 2013;
Classification of Airflow Limitation Severity in COPD

<table>
<thead>
<tr>
<th>GOLD Class</th>
<th>Severity</th>
<th>( \text{FEV}_1 % \text{ predicted} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Mild</td>
<td>( \text{FEV}_1 \geq 80% )</td>
</tr>
<tr>
<td>II</td>
<td>Moderate</td>
<td>( 50% \leq \text{FEV}_1 &lt; 80% )</td>
</tr>
<tr>
<td>III</td>
<td>Severe</td>
<td>( 30% \leq \text{FEV}_1 &lt; 50% )</td>
</tr>
<tr>
<td>IV</td>
<td>Very Severe</td>
<td>( \text{FEV}_1 &lt; 30% )</td>
</tr>
</tbody>
</table>

Classifying Symptoms: MRC or CAT

**Modified MRC Dyspnea Scale**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I only get breathless with strenuous exercise</td>
</tr>
<tr>
<td>1</td>
<td>I get short of breath when hurrying on the level or walking up a slight hill</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>
</tr>
<tr>
<td>3</td>
<td>I stop for breath after walking about 100 meters or after a few minutes on the level</td>
</tr>
<tr>
<td>4</td>
<td>I am too breathless to leave the house or I am breathless when dressing or undressing</td>
</tr>
</tbody>
</table>

**COPD Assessment Test (CAT)**

For each item below, place a mark (0 to 6) in the box that best describes you currently. Be sure to only select one response for each question.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I am very breathless</td>
</tr>
<tr>
<td>1</td>
<td>I am a little breathless</td>
</tr>
<tr>
<td>2</td>
<td>I am breathless most of the time</td>
</tr>
<tr>
<td>3</td>
<td>I am breathless all the time</td>
</tr>
</tbody>
</table>

Suggested score of 7-10 indicates moderate airflow limitation.
Assessment of Exacerbation Risk

- Defined as acute worsening of respiratory symptoms that results in additional therapy
- Severity of events are characterized as
  - Mild: treated with SABDs only
  - Moderate: treated with steroids + antibiotics
  - Severe—ER or hospitalized
- Higher prevalence of Exacerbations
  - Greater airflow limitation
  - Hospitalization
  - Prior exacerbations

<table>
<thead>
<tr>
<th>Number of Exacerbations</th>
<th>Factor</th>
<th>Odds Ratio</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AECOPD prior yr.</td>
<td>5.72</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>GERD</td>
<td>2.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>FEV1</td>
<td>1.11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>WBC</td>
<td>1.08</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>SGRQ</td>
<td>1.07</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Hurst, NEJM, 2010

Assessment of Comorbidities

- COPD frequently hallmarked by concomitant diseases, particularly in elderly with common risk factors
  - Smoking, alcohol, obesity, inactivity
- COPD itself has extra-pulmonary effects
  - Weight loss, weakness, fatigue, cognitive decline
- Comorbid conditions may significantly impact the treatment and outcome of patients with COPD

Divo, AJRCCM, 2012
GOLD Recommendations To Manage Stable COPD:
Pharmacologic Therapy RECOMMENDED FIRST CHOICE

GOLD 4
GOLD 3
GOLD 2
GOLD 1

CAT < 10
mMRC 0-1

CAT > 10
mMRC ≥ 2

ICS + LABA
or
LAMA

ICS + LABA
and/or
LAMA

SAMA prn
or
SABA prn

LABA
or
LAMA

2 or more
or
≥ 1 leading
to hospital
admission

1 (not leading
to hospital
admission)

ABCD Classification

Pluses
- “ABCD” assessment tool of the 2011 GOLD update was a major advancement from the simple spirometric grading system of earlier GOLD versions
- Incorporated patient-reported symptoms
- Highlighted the importance of exacerbation prevention in the management of COPD

Minuses
- Performed no better than spirometric grades for mortality prediction or other important health outcomes
- Unable to assess the individual contributions of severity of airflow limitation from exacerbation frequency or severity
- Hindered initial ABCD assessment in subjects without spirometry (ER, hospitalized patient, initial outpatient assessment)
The GOLD Refined ABCD Assessment Tool

**Diagnosis** = Assessment of airflow limitation + Assessment of symptoms/risk of exacerbations

<table>
<thead>
<tr>
<th>Grade</th>
<th>FEV₁ (%) pred.</th>
<th>Exacerbation History</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≥80</td>
<td>≥2 or ≥1 leading to hospitalization</td>
</tr>
<tr>
<td>2</td>
<td>50-79</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>30-49</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&lt;30</td>
<td></td>
</tr>
</tbody>
</table>

**FEV1/FVC<0.7**

<table>
<thead>
<tr>
<th>Grade</th>
<th>FEV₁ (%) pred.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≥80</td>
</tr>
<tr>
<td>2</td>
<td>50-79</td>
</tr>
<tr>
<td>3</td>
<td>30-49</td>
</tr>
<tr>
<td>4</td>
<td>&lt;30</td>
</tr>
</tbody>
</table>

**Example: Consider Two Patients**

Both with FEV₁ < 30% and CAT scores of 18

- **No AECOPDs**
- **3 AECOPDs**

Both labelled GOLD D in prior classification scheme

- **No AECOPDs**
- **3 AECOPDs**

Both labelled GOLD D, Category D

- **3 AECOPDs** - GOLD 4, Category D
- **No AECOPDs** - GOLD 4, Category B
Examples of Initiating Therapy in STABLE COPD

Two 60 year old Patients with progressive breathlessness. FEV₁/FVC 34%, FEV₁ 30% predicted

One Pt is symptomatic (CAT 20) and has experienced two exacerbations in last year – follow pharmacotherapy recommendations

Other Pt has severe, symptoms but no exacerbations COPD – consider interventional options

Subsequent Therapy: Escalation or De-escalation

Or a patient has no AECOPD in prior 2 yrs. and moves from D to B

Patient is hospitalized for AECOPD; therapy is escalated for Increased Exacerbations from B to D
GOLD 2017 Compared to Prior Classification

Recommended Pharmacological Pathway Treatment Algorithms by GOLD Grade

**Special Emphasis on:**
- LAMA vs LABA
- Use of ICS
- De-escalation Rationale
- Macrolide vs Roflumilast
Rationale for GOLD Pharmacological Recommendations

- Increase QoL: LAMA = LABA
  - LAMA > LABA AECOPD Reduction
  - LABA/ICS Decreases AECOPD vs UC

- ICS CAN BE WITHDRAWN
LABA/LAMA vs ICS/LABA for Exacerbations

Headline results from IMPACT study showing single inhaler triple therapy Trelegy Ellipta reduced COPD exacerbations

- **Primary** 15% reduction for FF/UMEC/VI vs. Relvar/Breo Ellipta (FF/VI, 100/25 mcg)
- 25% reduction for FF/UMEC/VI vs. Anoro Ellipta (UMEC/VI, 62.5/25 mcg)

**Secondary**

- Change from baseline trough FEV1 at week 52 for FF/UMEC/VI vs. FF/VI was 97 mL; p<0.001 and for FF/UMEC/VI vs. UMEC/VI was 54 mL; p<0.001
- Change from baseline St George’s Respiratory Questionnaire at week 52 for FF/UMEC/VI vs. FF/VI was -1.8 units; p<0.001 and for FF/UMEC/VI vs. UMEC/VI was -1.8 units; p<0.001
- Analysis of time to first on-treatment moderate/severe COPD exacerbation demonstrated a 14.8% reduction in risk for FF/UMEC/VI vs. FF/VI; p<0.001, and a 16.0% reduction in risk for FF/UMEC/VI vs. UMEC/VI; p<0.001

Macrolide and Roflumilast for Exacerbation Prevention

- In patients with exacerbations despite LABA/ICS or LABA/LAMA/ICS, chronic bronchitis and severe to very severe airflow obstruction, the addition of a PDE4 inhibitor be considered (B)
- In former smokers with exacerbation despite appropriate therapy, macrolides can be considered (B)
Non-Pharmacologic Treatment

- Education and self-management
- Physical activity
- Pulmonary rehabilitation programs
- Exercise training
- Self-management education
- Nutritional support
- Vaccination
- Oxygen therapy
- Interventional procedures
- Comorbidities
- End of life and palliative care

LOTT Primary Outcome: Death or 1st Hospitalization

- In patients with stable COPD and resting or exercise-induced moderate desaturation, O₂ did not affect:
  - time to first COPD exacerbation
  - time to first COPD hospitalization
  - rate of all hospitalizations or rate of all COPD exacerbations
  - change in measures of quality of life, depression, anxiety, or functional status
- No effect when patients were segregated by desaturation type, prescription type or adherence.
Stable COPD: Treating Chronic Hypercapnia with NPPV

PRCT Show Conflicting Results

NPPV may improve Hospitalization –free survival in selected patients after recent hospitalization, particularly those with pronounced daytime persistent hypercapnia (PaCO₂ > 52 mmHg) (B)

Surgical and Interventional Therapies in Advanced COPD

- emphysema predominant phenotype with hyperinflation
  - large bulla
    - bullectomy
  - no large bulla
    - heterogeneous emphysema
      - + collateral ventilation
        - LVR (EBV, LVRC)
      - - collateral ventilation
        - LVR (EBV, LVRC)
    - homogeneous emphysema
      - + collateral ventilation
        - BLVR (EBV, LVRC)
      - - collateral ventilation
        - LVRS

not candidate for bullectomy, BLVR or LVRS

- lung transplant
Other Evolving Factors in the Diagnosis and Assessment of COPD Treatment

- Role of the eosinophil
- Sputum and peripheral blood
- Chest CT parameters
- Symptoms without airflow obstruction
- Bronchiectasis
- Chronic Bronchitis
- Pulmonary hypertension
- Respiratory Failure
- Comorbidities
- Functional Limitations

Eosinophilic Phenotype in COPD

Blood Eosinophilia and Response to COPD Treatment: FLAME

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>No. of patients (N/BRM)</th>
<th>Eosinophil count (BRM)</th>
<th>Role-LTR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;5%</td>
<td>622 / 969</td>
<td>0.88 ± 1.24</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;5%</td>
<td>1,800 / 999</td>
<td>0.86 ± 1.15</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;5%</td>
<td>7,911 / 1,001</td>
<td>0.89 ± 2.02</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;5%</td>
<td>800 / 919</td>
<td>0.86 ± 1.26</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;5%</td>
<td>1,667 / 1,006</td>
<td>0.88 ± 2.01</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;5%</td>
<td>200 / 208</td>
<td>1.01 ± 1.01</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;150 cells/μL</td>
<td>828 / 964</td>
<td>0.80 ± 2.06</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;100 cells/μL</td>
<td>150 / 200 cells</td>
<td>0.91 ± 1.17</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;100 cells/μL</td>
<td>300 cells</td>
<td>0.93 ± 1.17</td>
</tr>
<tr>
<td>Blood eosinophil count</td>
<td>&lt;100 cells/μL</td>
<td>Overall</td>
<td>1,801 / 1,003</td>
</tr>
</tbody>
</table>

Moderate/severe exacerbations by blood eosinophil categories for mepolizumab 100 mg SC versus placebo.

Roche, AJRCCM, 2017

Pavord, NEJM, 2017
Future Staging of COPD?

At Risk for COPD

**STAGE A**
At high risk for COPD but without structural signs of COPD or symptoms

Patients with:
- Active/passive smoke/inhalant exposure
- Prematurity
- Frequent chest infections
- Asthma
- Family hx Lung disease

**STAGE B**
Structural lung disease but no signs/symptoms COPD

Patients with:
- Emphysema
- Respiratory Bronchiolitis by X-ray or pathology
- Bronchiectasis

**STAGE C**
Structural lung disease & signs & Symptoms of COPD

**STAGE D**
Refractory COPD

Patients with COPD and Refractory disease:
- Recurrent exacerbations
- Recurrent hospitalizations

FEV₁/FVC
- ≥ 0.7 COPD PR
- < 0.7 COPD RR

Summary

- The diagnosis and treatments of COPD is changing
- New data suggests patients develop COPD along different paths
- Ultralong bronchodilators and ICS and their combinations may allow us to refine our current treatment paradigms
- Additional Tools (HRCT) now enable us to diagnose patients at an earlier stage
- New biological characterization schemes (EOS, PMNs) have promise to personalize treatment with novel therapies (IL-5 antagonists)
- GOLD continues to use new data to enhance our understanding of the management of patients with COPD
A 45 year old sedentary man presents to the office with a history of intermittent dyspnea precipitated by “colds”, worsened during the winter months and accompanied by noise in his chest when the episodes occur.

He works as a “dry goods” store manager, is married, has 3 children and smokes approximately 10 cigarettes a day since age 19. As a child he had a history of asthma and so does one of his children. His physical exam is unremarkable except for minimal bilateral rhonchi on forced exhalation.

Which of the following tests would help you confirm a diagnosis of Asthma-COPD-Overlap.

A. Complete blood count showing blood eosinophil level of >2%
B. Two peak flow rate values of < 280 /min measured in different days
C. An FEV1 increase of 400 ml after bronchodilators
D. A chest X-ray consistent with lung hyperinflation
E. Result of a serum IG-E of 385 mg/L
Question 1 (Criner) Which of the following tests would help you confirm a diagnosis of Asthma-COPD-Overlap.

A. Complete blood count showing blood eosinophil level of >2%
B. Two peak flow rate values of < 280 /min measured in different days
C. An FEV1 increase of 400 ml after bronchodilators
D. A chest X-ray consistent with lung hyperinflation
E. Result of a serum IG-E of 385 mg/L

GOLD COPD 2018 Report update

Question #1

Correct Answer
C. An FEV1 increase of 400 ml after bronchodilators
A 68 year old woman presents with complaints of cough, increasing shortness of breath while walking up a slight grade and sputum production—about a tablespoon of white mucous on most days for the past 2-3 years. She had two episodes in the past year when her primary doctor treated her with oral antibiotics and prednisone for about 5-7 days. She started smoking at the age of 15 and continues to smoke about ½ pack of cigarettes daily. She is retired but used to work as an accountant. Her physical exam is remarkable for scattered rhonchi, increased tympany to percussion and rare wheezes best heard in the posterior bases of both lungs.

Which of the following are necessary to diagnose or develop a general treatment plan for COPD?

A. Chest X-ray
B. Eosinophil level
C. Chest CT
D. History of exacerbations

GOLD COPD 2018 Report update

Question #2

Question 2 (Criner) Which of the following are necessary to diagnose or develop a general treatment plan for COPD?
COPD is a heterogeneous condition. In order to deliver personalized and precise treatment it is therefore imperative to stratify patients appropriately.

Which of the following stratifying characteristics is recommended by GOLD 2017 to guide pharmacological treatment?

A. Age
B. Severity of airflow limitation
C. Modified Medical Research Council (mMRC) dyspnea score
D. Chest CT
**Question 3 (Criner) Which of the following stratifying characteristics is recommended by GOLD 2017 to guide pharmacological treatment?**

A. Age

B. Severity of airflow limitation

C. Modified Medical Research Council (mMRC) dyspnea score

D. Chest CT

**Correct Answer**

C. Modified Medical Research Council (mMRC) dyspnea score
COPD is characterized by persistent airflow limitation. Which of the following mechanisms contribute to persistent airflow limitation in COPD?

A. Increased airway resistance
B. Increased elastic recoil
C. Normal lung development
D. Increased chest wall elastance
A 75 year old man complains of increasing dyspnea on exertion. He states that he can’t walk more than 30 yards on the level or 6 steps without stopping because of shortness of breath. He has no significant cough or mucus production. He’s had no exacerbations that have required treatment over the last year. He had lung function studies that showed an FEV1 35% of predicted and a residual volume 200% of predicted. Resting room air oxygen saturation is 94% and with ambulation during the 6-minute walk test oxygen saturation decreases to 88%. A recent CT scan of his chest shows more emphysematous destruction in both upper lobes compared to both lower lobes. The patient is on maximal medical treatment (e.g., LABA, LAMA, short acting SABA for rescue) and has completed a course of outpatient rehabilitation without significant improvement in his complaints. What therapies which you consider next to improve this patient’s clinical condition?
Which of the following treatments may improve this patient’s lung function, symptoms of dyspnea and quality of life?

A. Roflumilast
B. Supplemental oxygen
C. Theophylline
D. Lung volume reduction surgery
E. Lung transplantation
A 69 year old woman complains of increased shortness of breath, cough and sputum production. She has an FEV1 32% of predicted and gets short of breath walking up a slight grade. She is on multiple inhaled therapies for her diagnosis of COPD which includes long acting bronchodilators (LAMA/LABA), an inhaled corticosteroid, and supplemental oxygen. She underwent pulmonary rehabilitation in the past 6 months. She was recently discharged from the hospital for a COPD exacerbation 6 months ago. She does not use supplemental oxygen, her resting saturation is 92%. She has been treated for another exacerbation by her primary care doctor with a short course of oral glucocorticoids and an oral antibiotic about 2 months ago. She is asking you what else can be done to prevent future exacerbations.

Which of the following treatments may be considered to add to the patient’s therapy to decrease the frequency and severity of future acute exacerbations of COPD?

A. Rosuvastatin  
B. Supplemental oxygen  
C. Roflumilast  
D. Chronic prednisone therapy  
E. Daily guaifenesin
**Question 6 (Criner) Which of the following treatments may be considered to add to the patient's therapy to decrease the frequency and severity of future acute exacerbations of COPD?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Rosuvastatin</td>
<td></td>
</tr>
<tr>
<td>B. Supplemental oxygen</td>
<td></td>
</tr>
<tr>
<td>C. Roflumilast</td>
<td></td>
</tr>
<tr>
<td>D. Chronic prednisone therapy</td>
<td></td>
</tr>
<tr>
<td>E. Daily guaifenisin</td>
<td></td>
</tr>
</tbody>
</table>

**Correct Answer**
C. Roflumilast