Chronic Obstructive Pulmonary Disease

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Case #1

- 1. A 62-year-old man is evaluated for chronic cough productive of thin clear sputum and dyspnea on exertion that has worsened over the last 2 years. He has a 54-pack-year smoking history. Medical history is otherwise unremarkable, and he takes no medications.
- On physical examination, vital signs are normal. The patient coughs during the examination, and mild expiratory wheezing is heard over the posterior lung fields. Cardiac examination is normal.
- Chest radiograph shows hyperinflated lungs with a flattened diaphragm without infiltrates.
- Spirometry shows an FEV1/FVC ratio of 0.65 and an FEV1 of 52% of predicted without a significant bronchodilator response.
- Which of the following is the most likely diagnosis?
- A Asthma
- B Bronchiectasis
- C COPD
- D Desquamative interstitial pneumonia

Case #2

- A 62-year-old man is evaluated during a follow-up visit for COPD. He continues to smoke one pack daily and has a 40-pack-year history. He can walk rapidly on a level surface but has breathlessness walking up a slight hill. He has not been hospitalized or seen urgently for an exacerbation. Medications are salmeterol and tiotropium.
- On physical examination, vital signs are normal. Oxygen saturation is 92% with the patient breathing ambient air. Faint expiratory wheezing is present.
- Spirometry shows an FEV1/FVC ratio of 0.58, and FEV1 is 62% of predicted.
- Which of the following is the most appropriate additional therapy?
- A Chronic azithromycin therapy
- B Prednisone
- C Pulmonary rehabilitation
- D Smoking cessation

Case#3

- A 59-year-old man is seen in a follow-up visit for a 6-month history of progressively worsening chronic cough productive of small amounts of thin clear sputum and dyspnea on exertion. He has shortness of breath when he walks quickly and when he walks uphill. He has a 45-pack-year smoking history but quit 2 years ago. He has been using albuterol as needed since his diagnosis of COPD 3 months ago, but he remains symptomatic.
- On physical examination, oxygen saturation is 95% with the patient breathing ambient air. Scattered expiratory wheezing is heard. Cardiac examination is normal.
- Chest radiograph from 3 months ago shows flattened diaphragm but no infiltrate.
- Spirometry at the time of diagnosis showed reduced postbronchodilator FEV1/FVC ratio and FEV1 of 69% of predicted.
- Which of the following is the most appropriate pharmacologic treatment?
- A Inhaled fluticasone propionate–salmeterol
- B Inhaled tiotropium bromide
- C Prednisone
- D Roflumilast

Objectives

- Define COPD based on pathophysiology and spirometry.
- Describe the different stages of COPD severity by Gold criteria, including mMRC and how COPD assessment test is utilized.
- Know the recommended treatment for each stage of COPD severity.
- Describe the diagnosis and management strategy of COPD exacerbation.

GLOBAL INITIATIVE FOR CHRONIC OBSTRUCTIVE LUNG DISEASE (GOLD):

TEACHING SLIDE SET 2022

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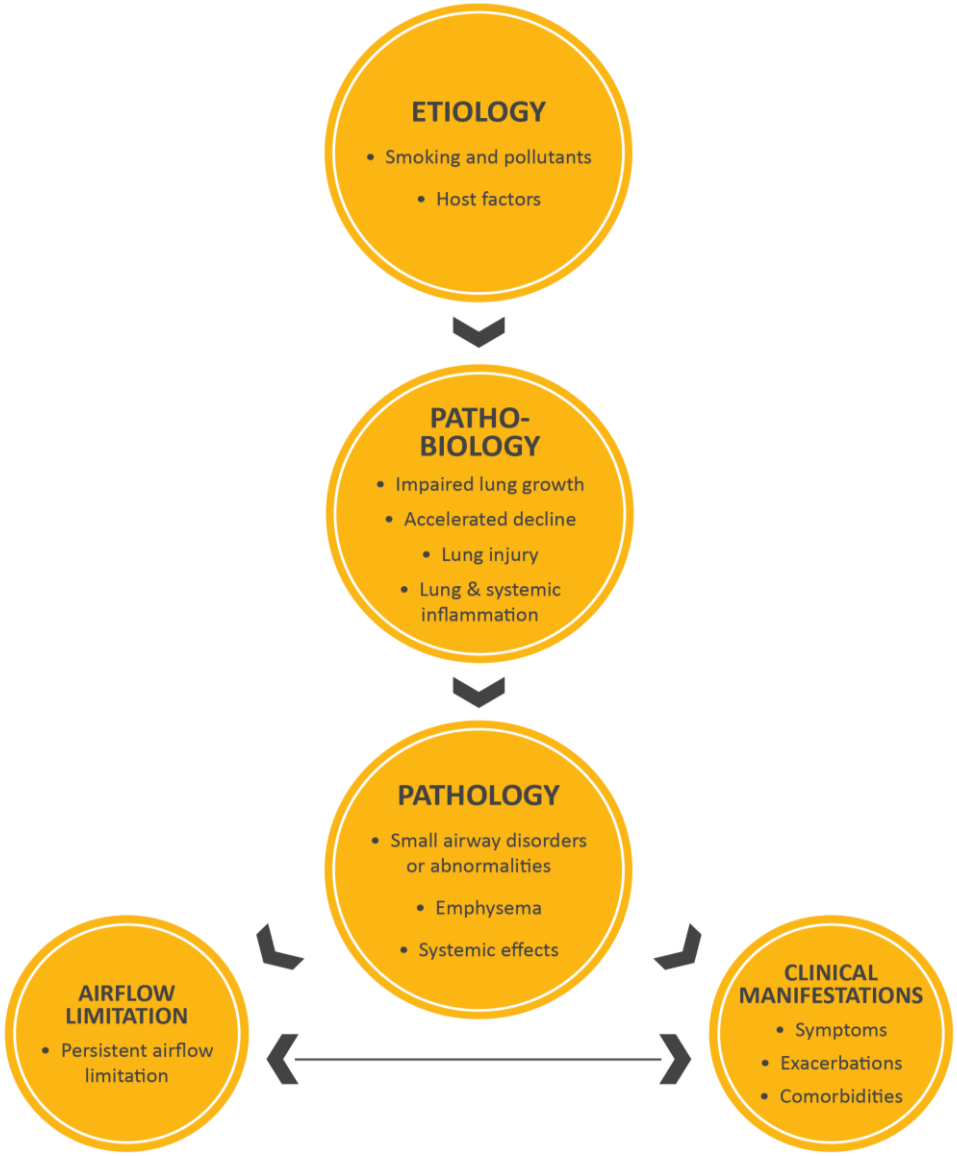
COPD

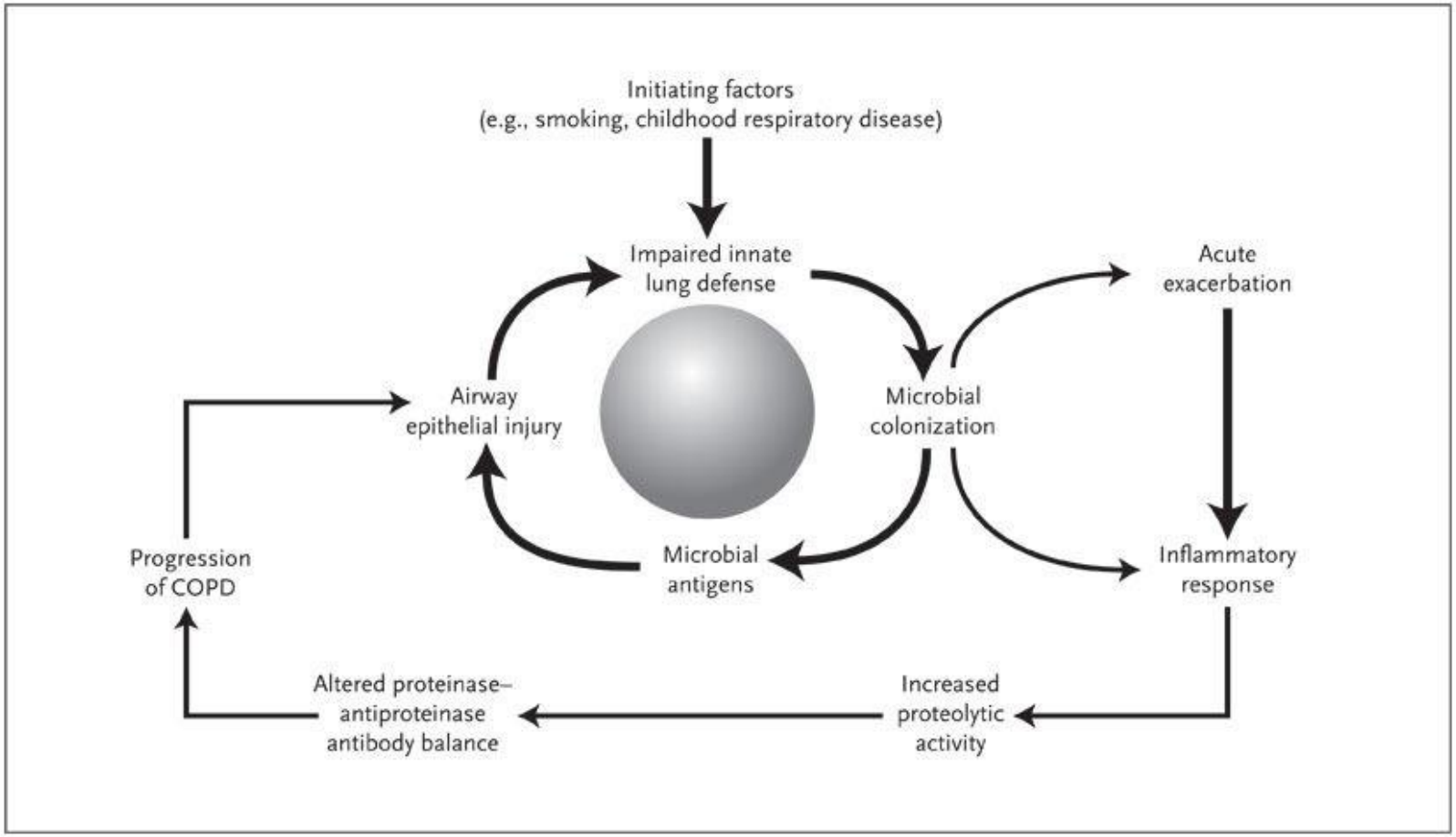
- Third leading cause of death in the United States
- Affects 13 million Americans
- Annually ± 800,000 patients are hospitalized with COPD
- One in five patients are readmitted after discharge from index COPD admission.
- Readmissions after discharge from a COPD hospitalization cost ~$13 billion and are associated with poor outcomes

Puebla Neira DA, Hsu ES, Kuo YF, Ottenbacher KJ, Sharma G. Readmissions Reduction Program: Mortality and Readmissions for Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med. 2021 Feb 15;203(4):437-446. doi: 10.1164/rccm.202002-0310OC. PMID: 32871097; PMCID: PMC7885833.

ETIOLOGY, PATHOBIOLOGY AND PATHOLOGY OF COPD LEADING TO AIRFLOW LIMITATION AND CLINICAL MANIFESTATIONS

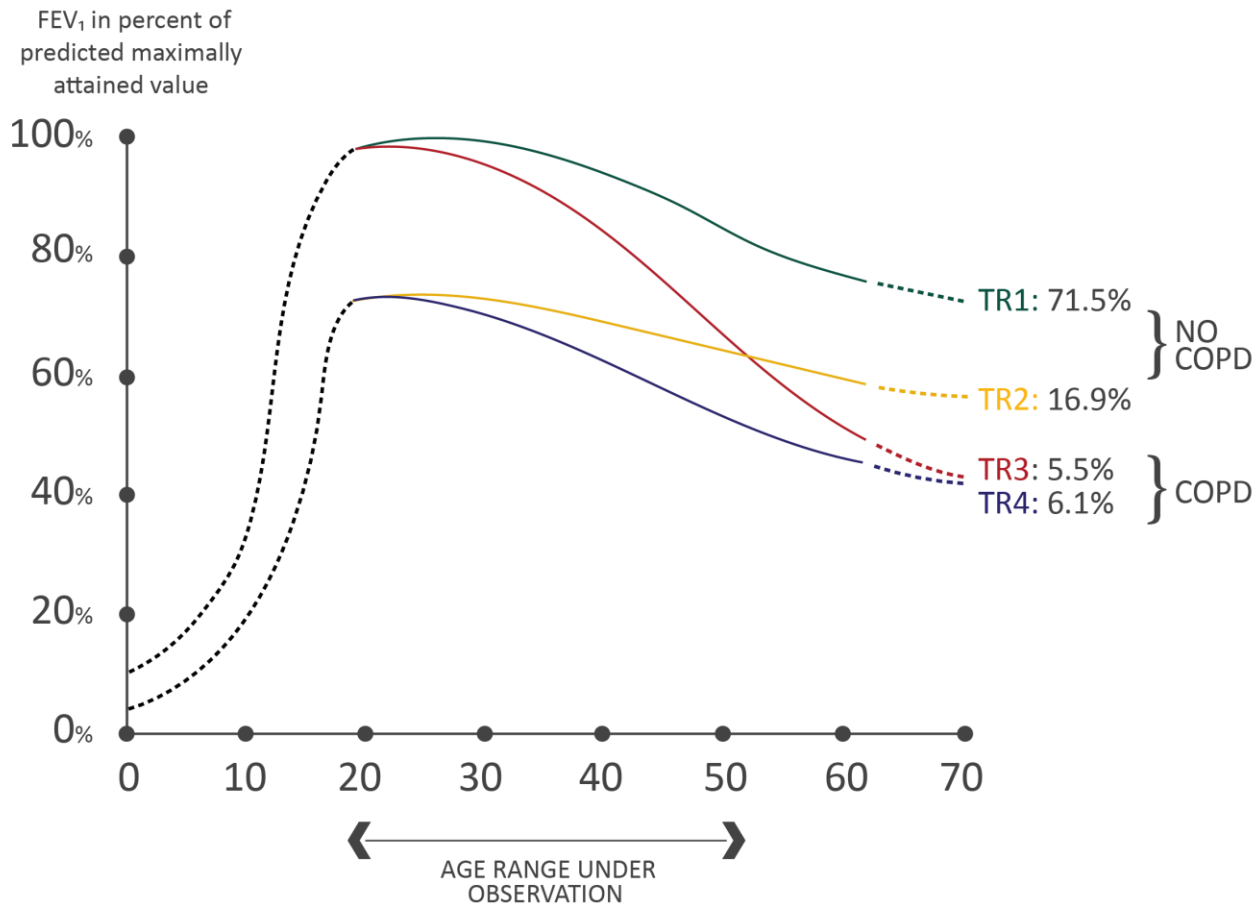


The Vicious-Circle Hypothesis of Infection and Inflammation in COPD.



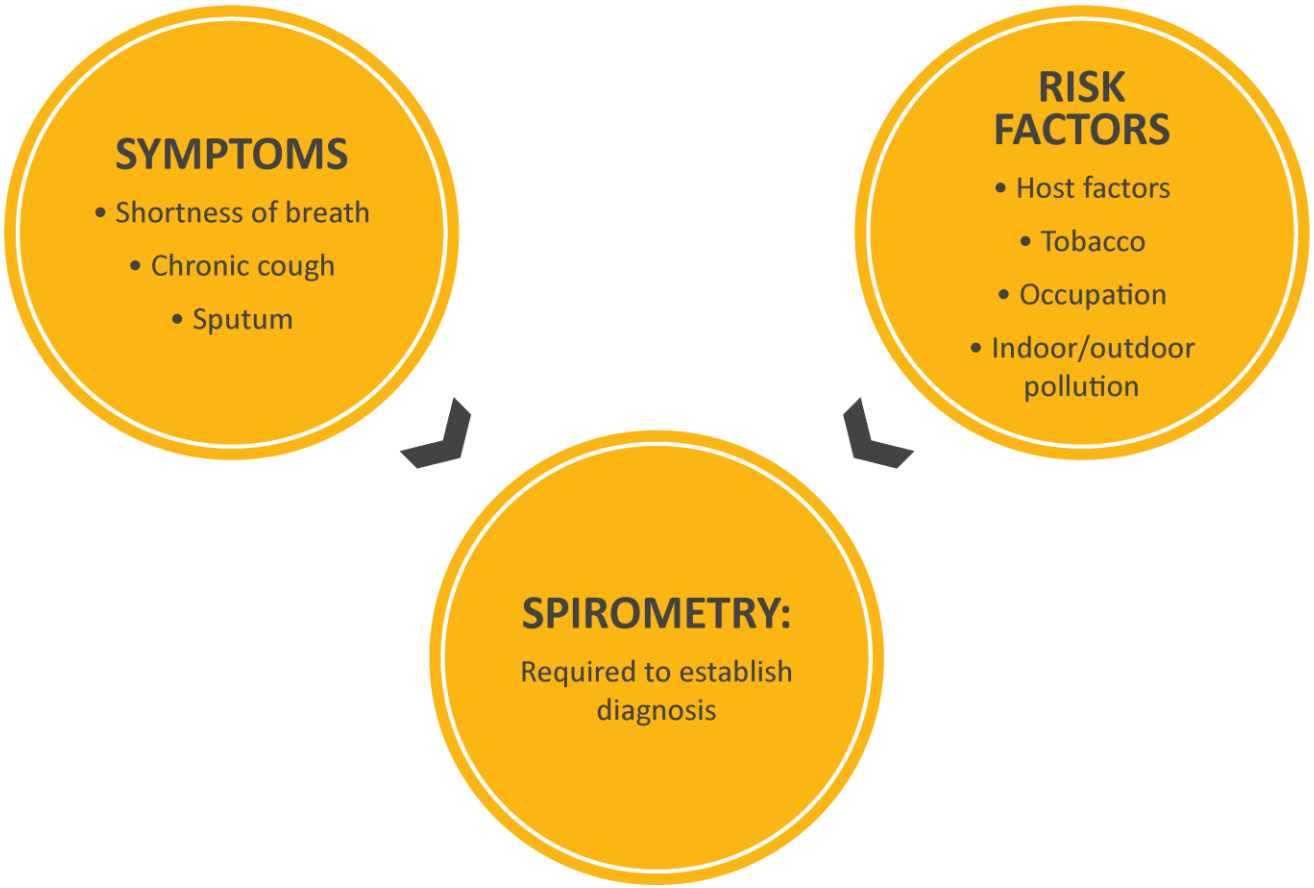
Sethi S, Murphy TF. N Engl J Med 2008;359:2355-2365.

FEV_1 PROGRESSION OVER TIME



Note: This is a simplified diagram of FEV_1 progression over time. In reality, there is tremendous heterogeneity in the rate of decline in FEV_1 owing to the complex interactions of genes with environmental exposures and risk factors over an individual's lifetime [adapted from Lange et al. NEJM 2015;373:111-22].

PATHWAYS TO THE DIAGNOSIS OF COPD



KEY INDICATORS FOR CONSIDERING A DIAGNOSIS OF COPD

Consider COPD, and perform spirometry, if any of these indicators are present in an individual over age 40. These indicators are not diagnostic themselves, but the presence of multiple key indicators increases the probability of a diagnosis of COPD. Spirometry is required to establish a diagnosis of COPD.

Dyspnea that is:	Progressive over time. Characteristically worse with exercise. Persistent.
Chronic Cough:	May be intermittent and may be unproductive. Recurrent wheeze.
Chronic Sputum Production:	Any pattern of chronic sputum production may indicate COPD.
Recurrent Lower Respiratory Tract Infections	
History of Risk Factors:	Host factors (such as genetic factors, congenital/developmental abnormalities etc.). Tobacco smoke (including popular local preparations). Smoke from home cooking and heating fuels. Occupational dusts, vapors, fumes, gases and other chemicals.
Family History of COPD and/or Childhood Factors:	For example low birthweight, childhood respiratory infections etc.

OTHER CAUSES OF CHRONIC COUGH

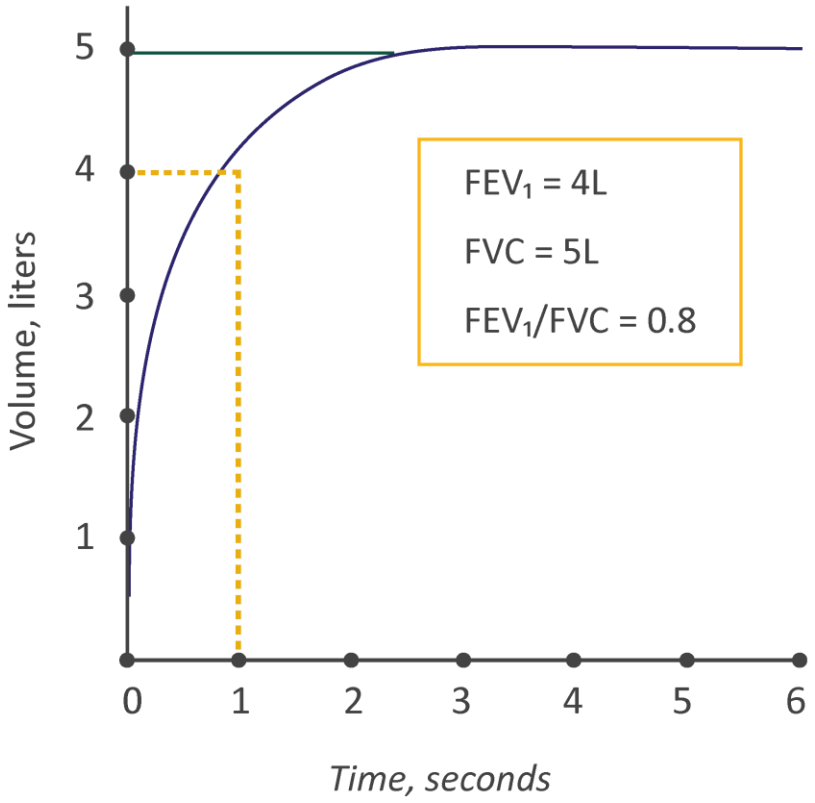
INTRATHORACIC

- Asthma
- Lung Cancer
- Tuberculosis
- Bronchiectasis
- Left Heart Failure
- Interstitial Lung Disease
- Cystic Fibrosis
- Idiopathic Cough

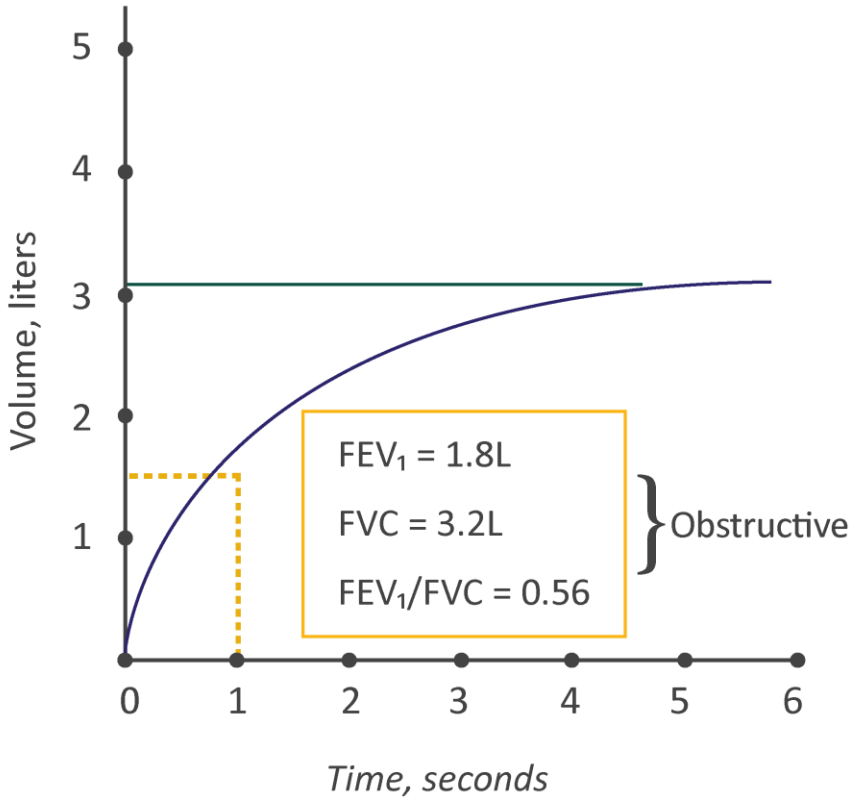
EXTRATHORACIC

- Chronic Allergic Rhinitis
- Post Nasal Drip Syndrome (PNDS)
- Upper Airway Cough Syndrome (UACS)
- Gastroesophageal Reflux
- Medication (e.g. ACE Inhibitors)

SPIROMETRY - NORMAL TRACE



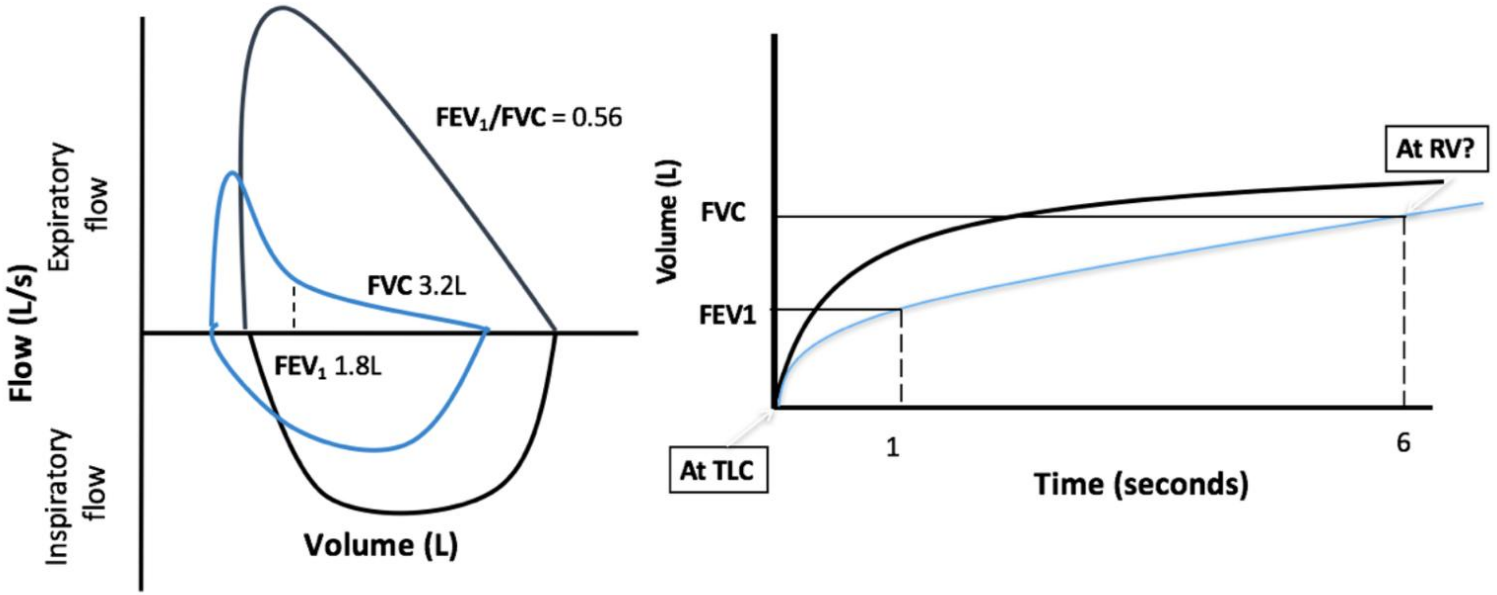
SPIROMETRY - OBSTRUCTIVE DISEASE



FVC =

FEV_1 =

Obstructive Lung Disease



https://www.grepmed.com/images/1749/flowvolumeloops-obstructive-diagnosis-copd-pfts

CLASSIFICATION OF AIRFLOW LIMITATION SEVERITY IN COPD (BASED ON POST-BRONCHODILATOR FEV_1)

In patients with FEV1/FVC < 0.70:

GOLD 1:	Mild	$FEV_1 \geq 80\%$ predicted
GOLD 2:	Moderate	$50\% \leq FEV_1 < 80\%$ predicted
GOLD 3:	Severe	$30\% \leq FEV_1 < 50\%$ predicted
GOLD 4:	Very Severe	$FEV_1 < 30\%$ predicted

MODIFIED MRC DYSPNEA SCALE[a]

PLEASE TICK IN THE BOX THAT APPLIES TO YOU | ONE BOX ONLY | Grades 0 - 4

mMRC Grade 0.	I only get breathless with strenuous exercise.	☐
mMRC Grade 1.	I get short of breath when hurrying on the level or walking up a slight hill.	☐
mMRC Grade 2.	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.	☐
mMRC Grade 3.	I stop for breath after walking about 100 meters or after a few minutes on the level.	☐
mMRC Grade 4.	I am too breathless to leave the house or I am breathless when dressing or undressing.	☐

[a] Fletcher CM. BMJ 1960; 2: 1662.

CAT™ ASSESSMENT

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	0 **X** 2 3 4 5	**I am very sad**	**SCORE**
bronchitis: I never cough	0 1 2 3 4 5	I cough all the time	
bronchitis: I have no phlegm (mucus) in my chest at all	0 1 2 3 4 5	My chest is completely full of phlegm (mucus)	
dyspnea: My chest does not feel tight at all	0 1 2 3 4 5	My chest feels very tight	
dyspnea: 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	
dyspnea: 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	
Comorbid conditions: I sleep soundly	0 1 2 3 4 5	I don't sleep soundly because of my lung condition	
Comorbid conditions: I have lots of energy	0 1 2 3 4 5	I have no energy at all	

Reference: Jones et al. ERJ 2009; 34 (3); 648-54.

TOTAL SCORE: ◯

THE REFINED ABCD ASSESSMENT TOOL

Spirometrically Confirmed Diagnosis › Assessment of airflow limitation › Assessment of symptoms/risk of exacerbations

Post-bronchodilator $FEV_1/FVC < 0.7$

Grade	FEV_1 (% predicted)
GOLD 1	≥ 80
GOLD 2	50-79
GOLD 3	30-49
GOLD 4	< 30

Moderate or Severe Exacerbation History

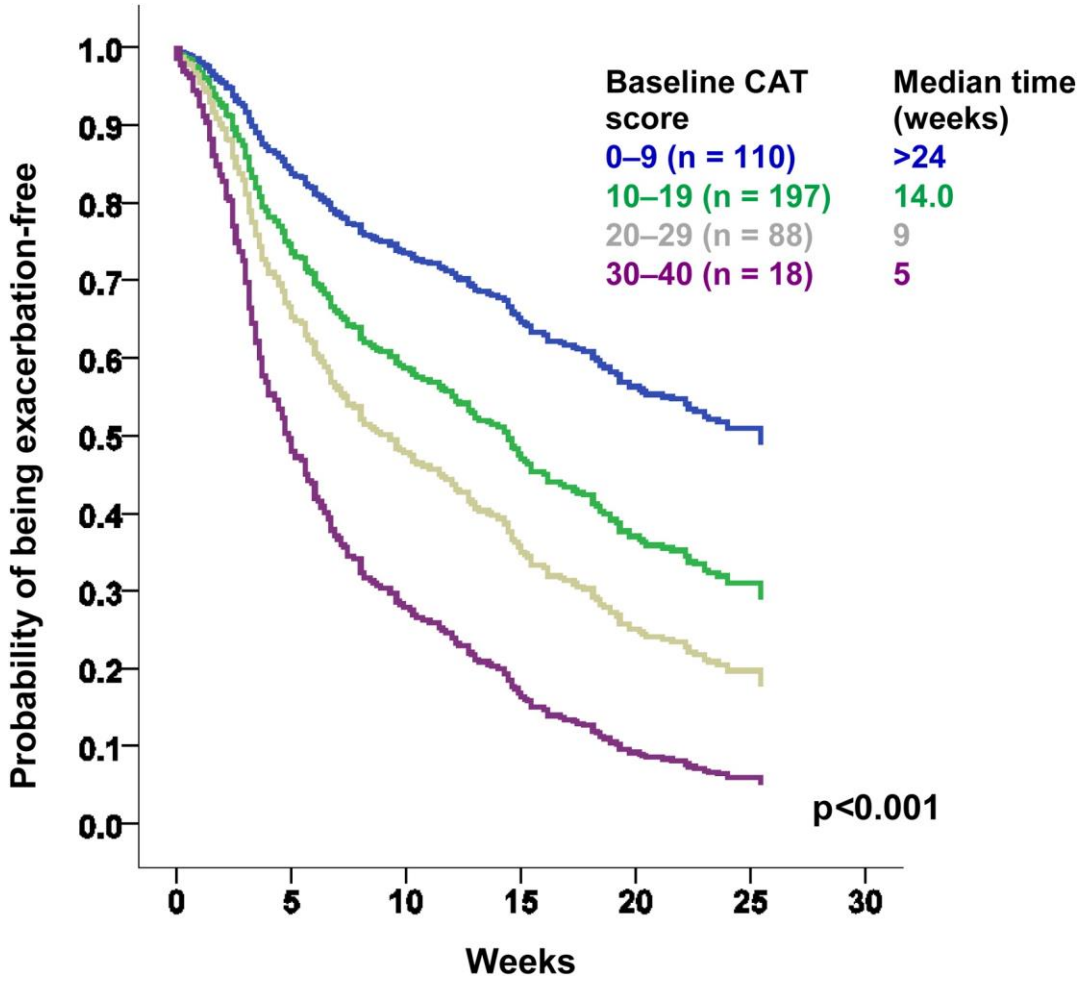
- ≥2 or ≥ 1 leading to hospital admission
- 0 or 1 (not leading to hospital admission)

C	D
A	B

mMRC 0-1 CAT < 10	mMRC ≥ 2 CAT ≥ 10

Symptoms

CAT score



Sang-Do Lee, et al. The COPD assessment test (CAT) assists prediction of COPD exacerbations in high-risk patients, Respiratory Medicine, Volume 108, Issue 4, 2014, Pages 600-608, ISSN 0954-6111, https://doi.org/10.1016/j.rmed.2013.12.014.

DIFFERENTIAL DIAGNOSIS OF COPD

DIAGNOSIS	SUGGESTIVE FEATURES
COPD	Onset in mid-life. Symptoms slowly progressive. History of tobacco smoking or exposure to other types of smoke.
Asthma	Onset early in life (often childhood). Symptoms vary widely from day to day. Symptoms worse at night/early morning. Allergy, rhinitis, and/or eczema also present. Family history of asthma. Obesity coexistence.
Congestive Heart Failure	Chest X-ray shows dilated heart, pulmonary edema. Pulmonary function tests indicate volume restriction, not airflow limitation.
Bronchiectasis	Large volumes of purulent sputum. Commonly associated with bacterial infection. Chest X-ray/CT shows bronchial dilation, bronchial wall thickening.
Tuberculosis	Onset all ages. Chest X-ray shows lung infiltrate. Microbiological confirmation. High local prevalence of tuberculosis.
Obliterative Bronchiolitis	Onset at younger age, nonsmokers. May have history of rheumatoid arthritis or acute fume exposure. Seen after lung or bone marrow transplantation. CT on expiration shows hypodense areas.
Diffuse Panbronchiolitis	Predominantly seen in patients of Asian descent. Most patients are male and nonsmokers. Almost all have chronic sinusitis. Chest X-ray & HRCT show diffuse small centrilobular nodular opacities & hyperinflation.

These features tend to be characteristic of the respective diseases, but are not mandatory. For example, a person who has never smoked may develop COPD (especially in the developing world where other risk factors may be more important than cigarette smoking); asthma may develop in adult and even in elderly patients.

GOALS FOR TREATMENT OF STABLE COPD

- Relieve Symptoms
- Improve Exercise Tolerance
- Improve Health Status

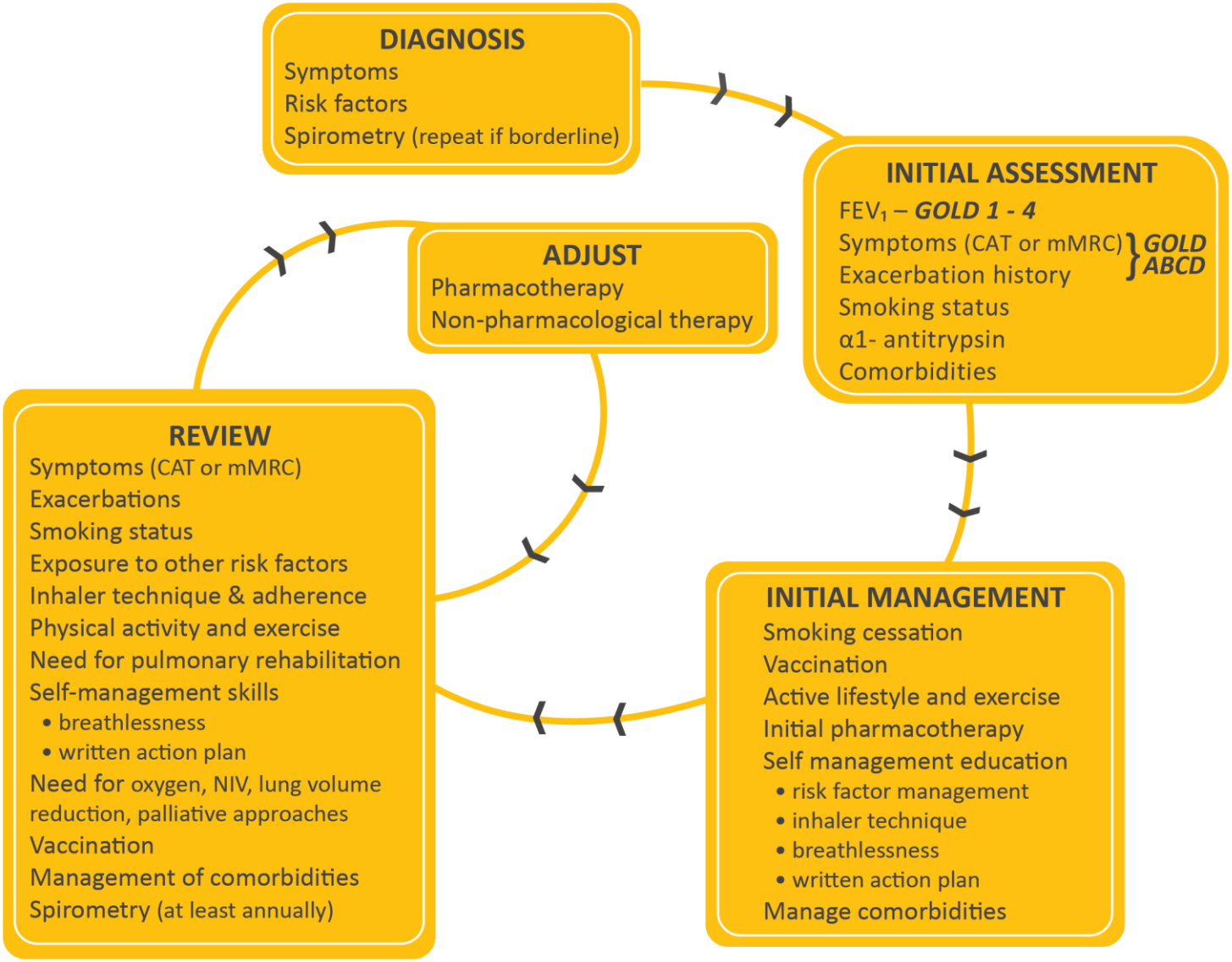
→ REDUCE SYMPTOMS

and

- Prevent Disease Progression
- Prevent and Treat Exacerbations
- Reduce Mortality

→ REDUCE RISK

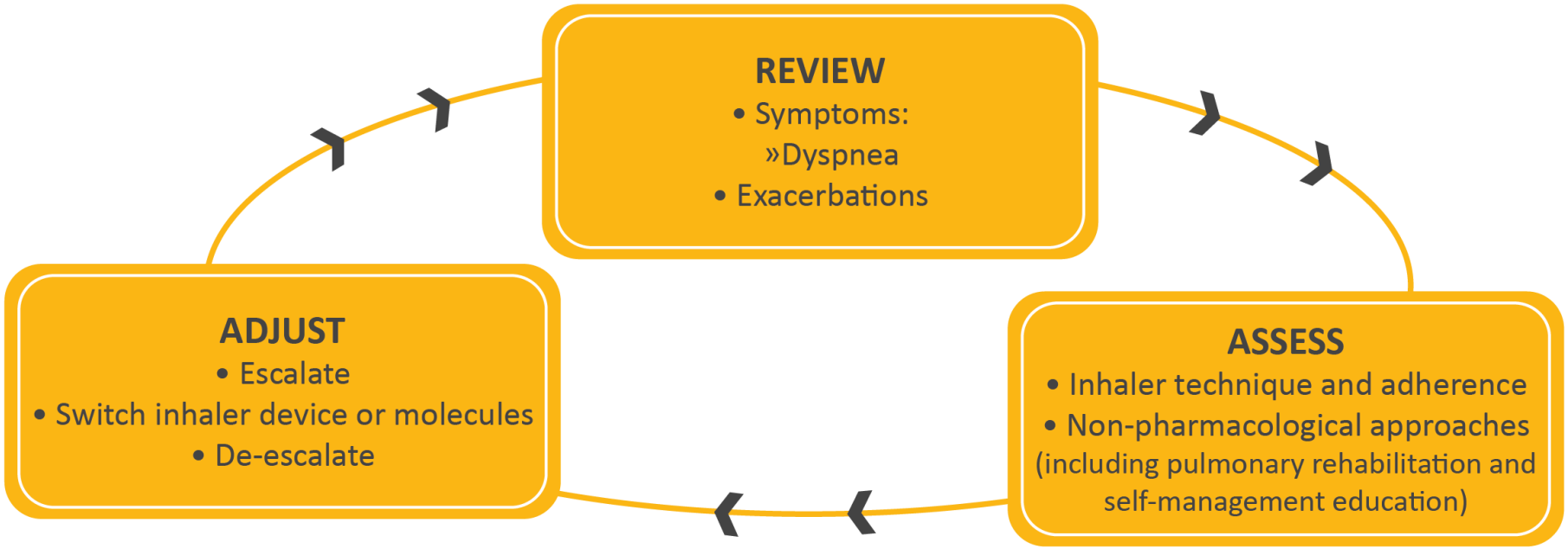
MANAGEMENT OF COPD



INITIAL PHARMACOLOGICAL TREATMENT

≥ 2 moderate exacerbations or ≥ 1 leading to hospitalization	**Group C** LAMA	**Group D** LAMA or LAMA + LABA* or ICS + LABA** *Consider if highly symptomatic (e.g. CAT > 20) **Consider if eos ≥ 300
0 or 1 moderate exacerbations (not leading to hospital admission)	**Group A** A Bronchodilator	**Group B** A Long Acting Bronchodilator (LABA or LAMA)
	mMRC 0-1, CAT < 10	mMRC ≥ 2, CAT ≥ 10

MANAGEMENT CYCLE



FACTORS TO CONSIDER WHEN INITIATING ICS TREATMENT

Factors to consider when initiating ICS treatment in combination with one or two long-acting bronchodilators (note the scenario is different when considering ICS withdrawal):

· STRONG SUPPORT ·	· CONSIDER USE ·	· AGAINST USE ·
• History of hospitalization(s) for exacerbations of COPD#	• 1 moderate exacerbation of COPD per year#	• Repeated pneumonia events
• ≥ 2 moderate exacerbations of COPD per year#	• Blood eosinophils ≥ 100 to < 300 cells/µL	• Blood eosinophils <100 cells/µL
• Blood eosinophils ≥ 300 cells/µL		• History of mycobacterial infection
• History of, or concomitant, asthma		

#despite appropriate long-acting bronchodilator maintenance therapy (see Table 3.4 and Figure 4.3 for recommendations);

*note that blood eosinophils should be seen as a continuum; quoted values represent approximate cut-points; eosinophil counts are likely to fluctuate.

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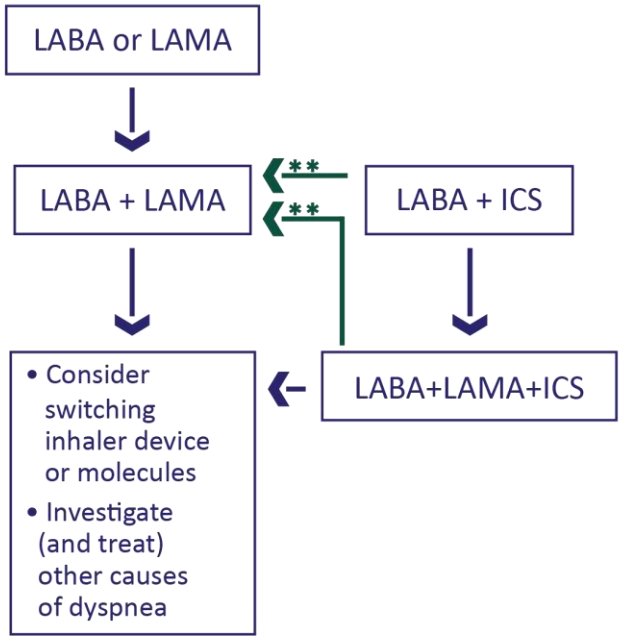
FIGURE 3.1

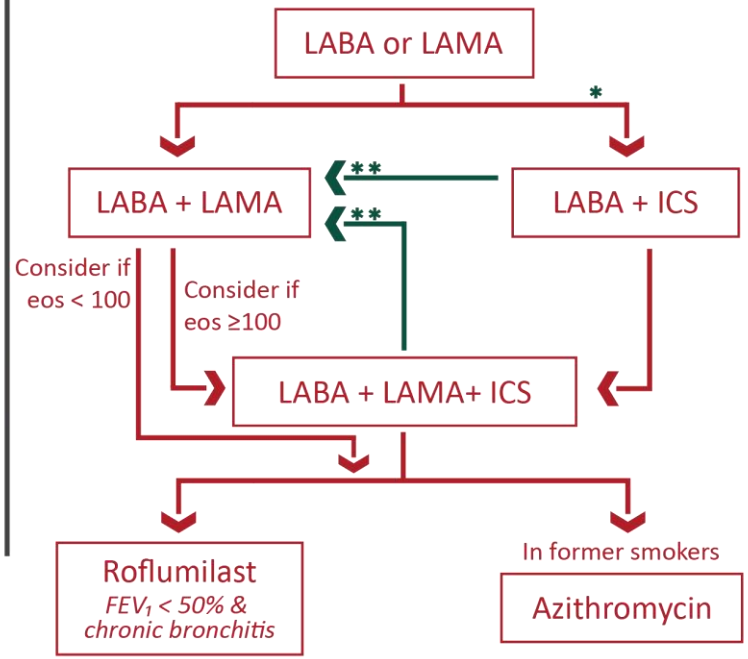
FOLLOW-UP PHARMACOLOGICAL TREATMENT

1. **IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT.**
2. **IF NOT:**
   - ✓ Consider the predominant treatable trait to target (dyspnea or exacerbations)
     - Use exacerbation pathway if both exacerbations and dyspnea need to be targeted
   - ✓ Place patient in box corresponding to current treatment & follow indications
   - ✓ Assess response, adjust and review
   - ✓ These recommendations do not depend on the ABCD assessment at diagnosis

• DYSPNEA •



• EXACERBATIONS •



eos = blood eosinophil count (cells/µL)

** Consider if eos ≥ 300 or eos ≥ 100 AND ≥2 moderate exacerbations / 1 hospitalization*

*** Consider de-escalation of ICS or switch if pneumonia, inappropriate original indication or lack of response to ICS*

VACCINATION FOR STABLE COPD

- Influenza vaccination reduces serious illness and death in COPD patients **(Evidence B)**.
- The WHO and CDC recommend SARS-Cov-2 (COVID-19) vaccination for people with COPD **(Evidence B)**.
- The 23-valent pneumococcal polysaccharide vaccine (PPSV23) has been shown to reduce the incidence of community-acquired pneumonia in COPD patients aged < 65 years with an FEV_1 < 40% predicted and in those with comorbidities **(Evidence B)**.
- In the general population of adults ≥ 65 years the 13-valent conjugated pneumococcal vaccine (PCV13) has demonstrated significant efficacy in reducing bacteremia & serious invasive pneumococcal disease **(Evidence B)**.
- The CDC recommends Tdap (dTaP/dTPa) vaccination to protect against pertussis (whooping cough) for adults with COPD who were not vaccinated in adolescence **(Evidence B)** and Zoster vaccine to protect against shingles for adults with COPD aged ≥ 50 years **(Evidence B)**.

TABLE 3.2

BRONCHODILATORS IN STABLE COPD

- Inhaled bronchodilators in COPD are central to symptom management and commonly given on a regular basis to prevent or reduce symptoms **(Evidence A)**.
- Regular and as-needed use of SABA or SAMA improves FEV_1 and symptoms **(Evidence A)**.
- Combinations of SABA and SAMA are superior compared to either medication alone in improving FEV_1 and symptoms **(Evidence A)**.
- LABAs and LAMAs significantly improve lung function, dyspnea, health status, and reduce exacerbation rates **(Evidence A)**.
- LAMAs have a greater effect on exacerbation reduction compared with LABAs **(Evidence A)** and decrease hospitalizations **(Evidence B)**.
- Combination treatment with a LABA and LAMA increases FEV_1 and reduces symptoms compared to monotherapy **(Evidence A)**.
- Combination treatment with a LABA/LAMA reduces exacerbations compared to monotherapy **(Evidence B)**.
- Tiotropium improves the effectiveness of pulmonary rehabilitation in increasing exercise performance **(Evidence B)**.
- Theophylline exerts a small bronchodilator effect in stable COPD **(Evidence A)** and that is associated with modest symptomatic benefits **(Evidence B)**.

THE INHALED ROUTE

- When a treatment is given by the inhaled route, the importance of education and training in inhaler device technique cannot be over-emphasized.
- The choice of inhaler device has to be individually tailored and will depend on access, cost, prescriber, and most importantly, patient's ability and preference.
- It is essential to provide instructions and to demonstrate the proper inhalation technique when prescribing a device, to ensure that inhaler technique is adequate and re-check at each visit that patients continue to use their inhaler correctly.
- Inhaler technique (and adherence to therapy) should be assessed before concluding that the current therapy is insufficient.

IDENTIFY & REDUCE RISK FACTOR EXPOSURE

- Smoking cessation interventions should be actively pursued in all COPD patients **(Evidence A)**.
- Efficient ventilation, non-polluting cooking stoves and similar interventions should be recommended **(Evidence B)**.
- Clinicians should advise patients to avoid continued exposures to potential irritants, if possible **(Evidence D)**.

NON-PHARMACOLOGIC MANAGEMENT OF COPD*

PATIENT GROUP	ESSENTIAL	RECOMMENDED	DEPENDING ON LOCAL GUIDELINES
A	Smoking Cessation (can include pharmacologic treatment)	Physical Activity	Flu Vaccination Pneumococcal Vaccination Pertussis Vaccination Covid-19 Vaccination
B, C and D	Smoking Cessation (can include pharmacologic treatment) Pulmonary Rehabilitation	Physical Activity	Flu Vaccination Pneumococcal Vaccination Pertussis Vaccination Covid-19 Vaccination

*Can include pharmacologic treatment.

TABLE 4.8

FOLLOW-UP OF NON-PHARMACOLOGICAL TREATMENT

1. IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT AND OFFER:

- Flu vaccination every year and other recommended vaccinations according to guidelines
- Self-management education
- Assessment of behavioral risk factors such as smoking cessation (if applicable) and environmental exposures

Ensure

- Maintenance of exercise program and physical activity
- Adequate sleep and a healthy diet

2. IF NOT, CONSIDER THE PREDOMINANT TREATABLE TRAIT TO TARGET

• DYSPNEA •

Self-management education (written action plan) with integrated self-management regarding:

- Pulmonary rehabilitation (PR) program and/or maintenance exercise program post PR
- Breathlessness and energy conservation techniques, and stress management strategies

• EXACERBATIONS •

Self-management education (written action plan) that is personalized with respect to:

- Avoidance of aggravating factors
- How to monitor/manage worsening of symptoms
- Contact information in the event of an exacerbation

All patients with advanced COPD should be considered for end of life and palliative care support to optimize symptom control and allow patients and their families to make informed choices about future management

PRESCRIPTION OF SUPPLEMENTAL OXYGEN TO COPD PATIENTS

Arterial hypoxemia defined as:
PaO_2 < 55 mmHg (7.3 kPa) or SaO_2 < 88%

or

PaO_2 > 55 but < 60 mmHg (> 7.3 kPa but < 8 kPa)
with right heart failure or erythrocytosis

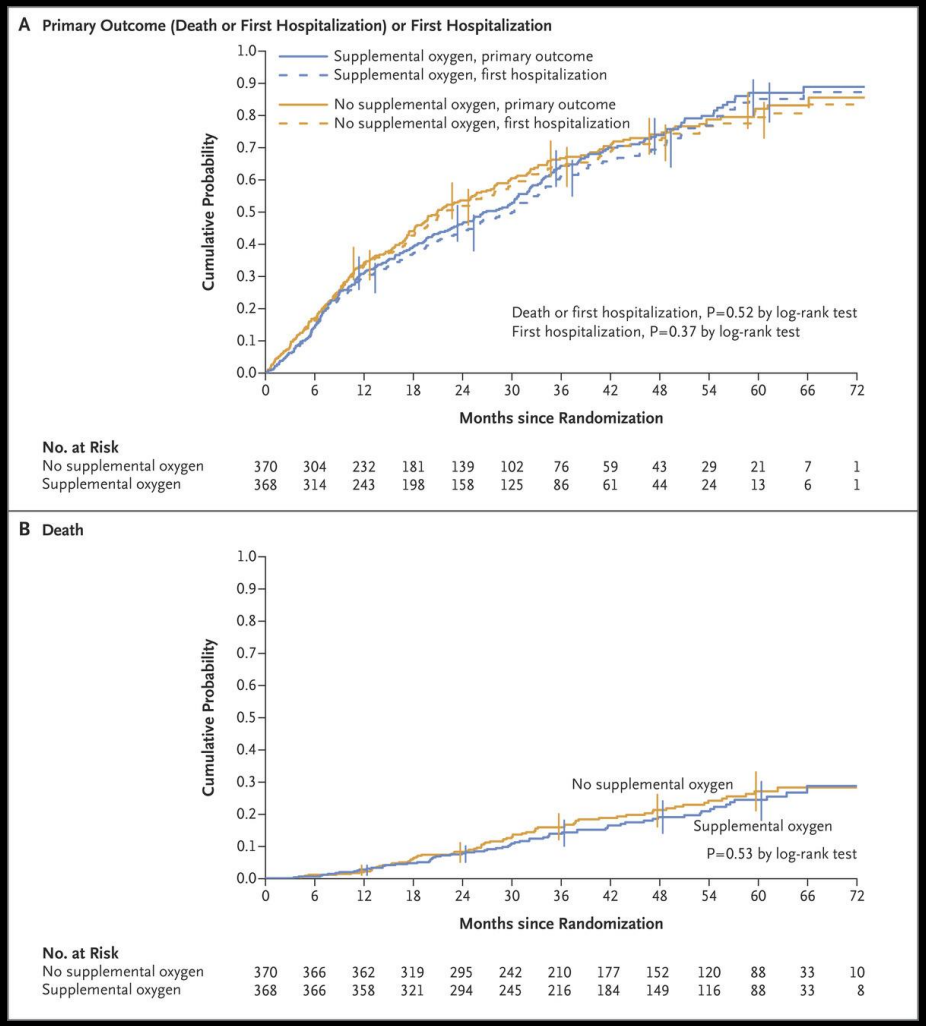
Prescribe supplemental oxygen and
titrate to keep SaO_2 ≥ 90%

Recheck in 60 to 90 days to assess:

» If supplemental oxygen is still indicated

» If prescribed supplemental oxygen is effective

Kaplan–Meier Analyses of the Primary Outcome of Death or First Hospitalization for Any Cause and for the Component Events in the Intention-to-Treat Population.



The Long-Term Oxygen Treatment Trial Research Group. N Engl J Med 2016;375:1617-1627.

The NEW ENGLAND JOURNAL of MEDICINE

PULMONARY REHABILITATION, SELF-MANAGEMENT AND INTEGRATIVE CARE IN COPD

PULMONARY REHABILITATION

- Pulmonary rehabilitation improves dyspnea, health status and exercise tolerance in stable patients **(Evidence A)**.
- Pulmonary rehabilitation reduces hospitalization among patients who have had a recent exacerbation (≤4 weeks from prior hospitalization) **(Evidence B)**.
- Pulmonary rehabilitation leads to a reduction in symptoms of anxiety and depression **(Evidence A)**.

EDUCATION AND SELF-MANAGEMENT

- Education alone has not been shown to be effective **(Evidence C)**.
- Self-management intervention with communication with a health care professional improves health status and decreases hospitalizations and emergency department visits **(Evidence B)**.

INTEGRATED CARE PROGRAMS

- Integrative care and telehealth have no demonstrated benefit at this time **(Evidence B)**.

PALLIATIVE CARE, END OF LIFE AND HOSPICE CARE IN COPD

- Opiates, neuromuscular electrical stimulation (NMES), oxygen and fans blowing air on to the face can relieve breathlessness **(Evidence C)**.
- In malnourished patients, nutritional supplementation may improve respiratory muscle strength and overall health status **(Evidence B)**.
- Fatigue can be improved by self-management education, pulmonary rehabilitation, nutritional support and mind-body interventions **(Evidence B)**.

OXYGEN THERAPY AND VENTILATORY SUPPORT IN STABLE COPD

OXYGEN THERAPY

- The long-term administration of oxygen increases survival in patients with severe chronic resting arterial hypoxemia **(Evidence A)**.

- In patients with stable COPD and moderate resting or exercise-induced arterial desaturation, prescription of long-term oxygen does not lengthen time to death or first hospitalization or provide sustained benefit in health status, lung function and 6-minute walk distance **(Evidence A)**.

- Resting oxygenation at sea level does not exclude the development of severe hypoxemia when traveling by air **(Evidence C)**.

VENTILATORY SUPPORT

- NPPV may improve hospitalization-free survival in selected patients after recent hospitalization, particularly in those with pronounced daytime persistent hypercapnia ($PaCO_2 \geq 52$ mmHg) **(Evidence B)**.

INTERVENTIONAL THERAPY IN STABLE COPD

LUNG VOLUME REDUCTION SURGERY

- Lung volume reduction surgery improves survival in severe emphysema patients with an upper–lobe emphysema and low post–rehabilitation exercise capacity **(Evidence A)**.

BULLECTOMY

- In selected patients, bullectomy is associated with decreased dyspnea, improved lung function and exercise tolerance **(Evidence C)**.

TRANSPLANTATION

- In appropriately selected patients with very severe COPD, lung transplantation has been shown to improve quality of life and functional capacity **(Evidence C)**.

BRONCHOSCOPIC INTERVENTIONS

- In select patients with advanced emphysema, bronchoscopic interventions reduce end-expiratory lung volume and improve exercise tolerance, health status and lung function at 6-12 months following treatment. Endobronchial valves **(Evidence A)**; Lung coils **(Evidence B)**; Vapor ablation **(Evidence B)**.

KEY POINTS FOR THE MANAGEMENT OF EXACERBATIONS

- Short-acting inhaled beta$_2$-agonists, with or without short-acting anticholinergics, are recommended as the initial bronchodilators to treat an acute exacerbation **(Evidence C)**.
- Systemic corticosteroids can improve lung function (FEV_1), oxygenation and shorten recovery time and hospitalization duration. Duration of therapy should not be more than 5-7 days **(Evidence A)**.
- Antibiotics, when indicated, can shorten recovery time, reduce the risk of early relapse, treatment failure, and hospitalization duration. Duration of therapy should be 5-7 days **(Evidence B)**.
- Methylxanthines are not recommended due to increased side effect profiles **(Evidence B)**.
- Non-invasive mechanical ventilation should be the first mode of ventilation used in COPD patients with acute respiratory failure who have no absolute contraindication because it improves gas exchange, reduces work of breathing and the need for intubation, decreases hospitalization duration and improves survival **(Evidence A)**.

POTENTIAL INDICATIONS FOR HOSPITALIZATION ASSESSMENT*

- Severe symptoms such as sudden worsening of resting dyspnea, high respiratory rate, decreased oxygen saturation, confusion, drowsiness.
- Acute respiratory failure.
- Onset of new physical signs (e.g., cyanosis, peripheral edema).
- Failure of an exacerbation to respond to initial medical management.
- Presence of serious comorbidities (e.g., heart failure, newly occurring arrhythmias, etc.).
- Insufficient home support.

*Local resources need to be considered.

DIFFERENTIAL DIAGNOSIS OF COPD EXACERBATION

WHEN THERE IS CLINICAL SUSPICION OF THE FOLLOWING ACUTE CONDITIONS, CONSIDER THE FOLLOWING INVESTIGATIONS:

PNEUMONIA

- Chest radiograph
- Assessment of C-reactive protein (CRP) and/or procalcitonin

PNEUMOTHORAX

- Chest radiograph or ultrasound

PLEURAL EFFUSION

- Chest radiograph or ultrasound

PULMONARY EMBOLISM

- D-dimer and/or Doppler sonogram of lower extremities
- Chest tomography – pulmonary embolism protocol

PULMONARY EDEMA DUE TO CARDIAC RELATED CONDITIONS

- Electrocardiogram and cardiac ultrasound
- Cardiac enzymes

CARDIAC ARRHYTHMIAS – ATRIAL FIBRILLATION/FLUTTER

- Electrocardiogram

MANAGEMENT OF SEVERE BUT NOT LIFE-THREATENING EXACERBATIONS*

- Assess severity of symptoms, blood gases, chest radiograph.
- Administer supplemental oxygen therapy, obtain serial arterial blood gas, venous blood gas and pulse oximetry measurements.
- Bronchodilators:
  - » Increase doses and/or frequency of short-acting bronchodilators.
  - » Combine short-acting beta 2-agonists and anticholinergics.
  - » Consider use of long-active bronchodilators when patient becomes stable.
  - » Use spacers or air-driven nebulizers when appropriate.
- Consider oral corticosteroids.
- Consider antibiotics (oral) when signs of bacterial infection are present.
- Consider noninvasive mechanical ventilation (NIV).
- At all times:
  - » Monitor fluid balance.
  - » Consider subcutaneous heparin or low molecular weight heparin for thromboembolism prophylaxis.
  - » Identify and treat associated conditions (e.g., heart failure, arrhythmias, pulmonary embolism etc.).

*Local resources need to be considered.

INDICATIONS FOR RESPIRATORY OR MEDICAL INTENSIVE CARE UNIT ADMISSION*

- Severe dyspnea that responds inadequately to initial emergency therapy.
- Changes in mental status (confusion, lethargy, coma).
- Persistent or worsening hypoxemia (PaO_2 < 5.3 kPa or 40mmHg) and/or severe/worsening respiratory acidosis (pH < 7.25) despite supplemental oxygen and noninvasive ventilation.
- Need for invasive mechanical ventilation.
- Hemodynamic instability - need for vasopressors.

*Local resources need to be considered.

INDICATIONS FOR NONINVASIVE MECHANICAL VENTILATION (NIV)

At least one of the following:

- Respiratory acidosis ($PaCO_2 \geq 6.0$ kPa or 45 mmHg and arterial pH ≤ 7.35).
- Severe dyspnea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing, or both, such as use of respiratory accessory muscles, paradoxical motion of the abdomen, or retraction of the intercostal spaces.
- Persistent hypoxemia despite supplemental oxygen therapy.

INDICATIONS FOR INVASIVE MECHANICAL VENTILATION

- Unable to tolerate NIV or NIV failure.
- Status post - respiratory or cardiac arrest.
- Diminished consciousness, psychomotor agitation inadequately controlled by sedation.
- Massive aspiration or persistent vomiting.
- Persistent inability to remove respiratory secretions.
- Severe hemodynamic instability without response to fluids and vasoactive drugs.
- Severe ventricular or supraventricular arrhythmias.
- Life-threatening hypoxemia in patients unable to tolerate NIV.

INTERVENTIONS THAT REDUCE THE FREQUENCY OF COPD EXACERBATIONS

INTERVENTION CLASS	INTERVENTION
Bronchodilators	LABAs LAMAs LABA + LAMA
Corticosteroid-containing regimens	LABA + ICS LABA + LAMA + ICS
Anti-inflammatory (non-steroid)	Roflumilast
Anti-infectives	Vaccines Long Term Macrolides
Mucoregulators	N-acetylcysteine Carbocysteine Erdosteine
Various others	Smoking Cessation Rehabilitation Lung Volume Reduction Vitamin D Shielding measures (e.g., mask wearing, minimizing social contact, frequent hand washing)

TABLE 5.9

COMMON RISK FACTORS FOR DEVELOPMENT OF LUNG CANCER

- Age > 55
- Smoking history > 30 pack years
- Presence of emphysema by CT scan
- Presence of airflow limitation $FEV_1/FVC < 0.7$
- BMI < 25 kg/m^2
- Family history of lung cancer

Outcomes of Patients with COPD Hospitalized for Coronavirus Disease 2019.

Background

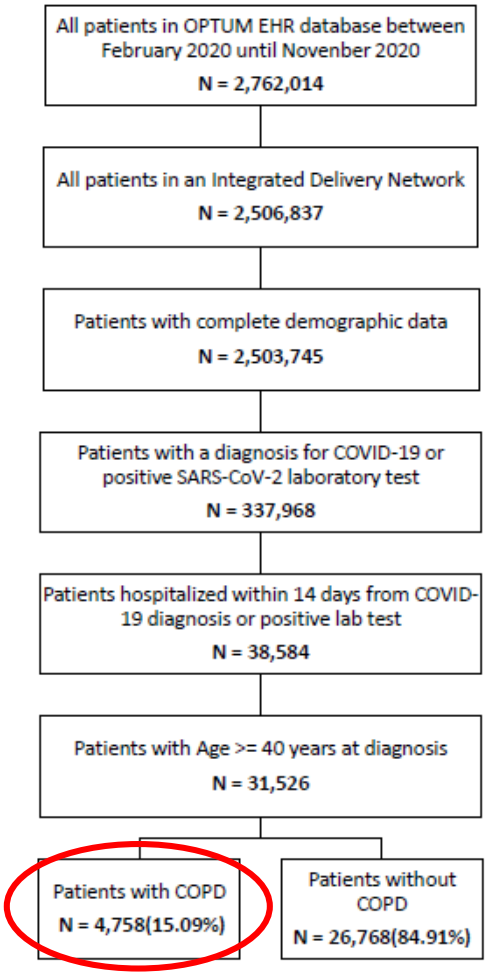
- **Controversy** exists concerning the association of **COPD** as a risk factor for mortality in patients **hospitalized with COVID-19**.
  - *Some studies have reported COPD to be a risk factor in COVID-19 for greater health care utilization, with increased risk of hospitalization, intensive care unit (ICU) admission, and death, while others have not shown this association.*

- **Prevalence** of COPD among patients with COVID-19 **varies** between

Puebla Neira DA, et al. Outcomes of Patients with COPD Hospitalized for Coronavirus Disease 2019. Chronic Obstr Pulm Dis. 2021 8(4): 517-527. doi: 10.15326/jcopdf.2021.0245. PMID: 34614553

Methods

- **Retrospective** cohort study.
- Included patients with COVID-19 **hospitalized** within 14 days of diagnosis.
- Feb-2020, and Nov-2020.
- EHR from U.S. facilities (**Optum** COVID-19 data).
- Excluded patients <40 years age.
- Primary outcome: **Inpatient mortality**
- Main independent Variable: **COPD**

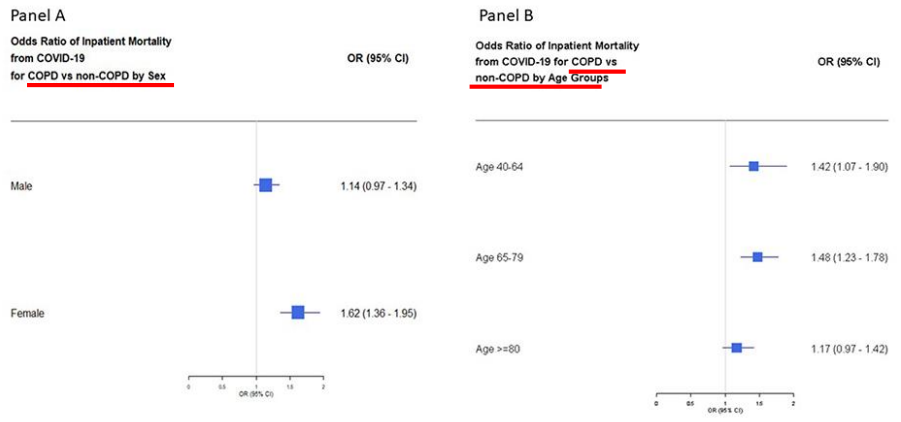


Puebla Neira DA, et al. Outcomes of Patients with COPD Hospitalized for Coronavirus Disease 2019. Chronic Obstr Pulm Dis. 2021 8(4): 517-527. doi: 10.15326/jcopdf.2021.0245. PMID: 34614553

Results

- Overall inpatient **mortality** in our cohort: 9.6% of 31,526 patients.
- Patients with COPD identified: 4,758.
- Mortality: COPD > no COPD(*14.02% and 8.8%, respectively*).
- **Mortality risk** due to COVID-19: **COPD >no COPD**.
- Increased mortality risk associated with COPD **worse in women**
- Increased mortality risk associated with COPD **worse in age group 40-79 y**

Figure 1. Interaction Effects Examined in the Multivariate Model Showing the Association Between COPD and Mortality by Sex[a] and Mortality by Age[b] and Adjusted for All Other Covariates in Patients Hospitalized with COVID-19[c]



[a]Panel A
[b]Panel B
[c]in the United States

The results of the interaction effects showed that the association between COPD and mortality varied significantly by sex (p<0.0001) and age (p=0.014), but not race (p=0.323) or ICS use (p=0.725) (data not shown).

COPD=chronic obstructive pulmonary disease; COVID-19=coronavirus disease 2019; ICS= inhaled corticosteroid; OR=odds ratio; CI=confidence interval

Puebla Neira D A et al. Outcomes of Patients with COPD Hospitalized for Coronavirus Disease 2019. Chronic Obstr Pulm Dis. 2021 8(4): 517-527. doi: 10.15326/jcopdf.2021.0245. PMID: 34614553

Conclusions

- COPD is an **independent risk factor** for inpatient mortality in patients hospitalized with COVID-19.

- Patients with COVID-19 and COPD had **higher rates** of ICU admission, mechanical ventilation, and palliative care consultation than those without COPD.

Puebla Neira DA et al. Outcomes of Patients with COPD Hospitalized for Coronavirus Disease 2019. Chronic Obstr Pulm Dis. 2021 8(4): 517-527. doi: 10.15326/jcopdf.2021.0245. PMID: 34614553

KEY POINTS FOR THE MANAGEMENT OF STABLE COPD DURING COVID-19 PANDEMIC

PROTECTIVE STRATEGIES

- Follow basic infection control measures
- Wear a face covering
- Consider shielding/sheltering-in-place
- Have the COVID-19 vaccination in line with national recommendations

INVESTIGATIONS

- Only essential spirometry

PHARMACOTHERAPY

- Ensure adequate supplies of medications
- Continue unchanged including ICS

NON-PHARMACOLOGICAL THERAPY

- Ensure annual influenza vaccination
- Maintain physical activity

TABLE 7.1

KEY POINTS FOR THE MANAGEMENT OF PATIENTS WITH COPD AND SUSPECTED OR PROVEN COVID-19

SARS-CoV-2 TESTING

- Swab/Saliva PCR if new or worsening respiratory symptoms, fever, and/or any other symptoms that could be COVID related

OTHER INVESTIGATIONS

- Avoid spirometry unless essential
- Consider CT for COVID pneumonia and to exclude other diagnoses e.g. PE
- Avoid bronchoscopy unless essential
- Assess for co-infection

COPD PHARMACOTHERAPY

- Ensure adequate supplies of medication
- Continue maintenance therapy unchanged including ICS
- Use antibiotics and oral steroids in line with recommendations for exacerbations
- Avoid nebulization when possible

COPD NON-PHARMACOLOGICAL THERAPY

- Maintain physical activity as able

PROTECTIVE STRATEGIES

- Have the COVID-19 vaccination in line with national recommendations.
- Follow basic infection control measures
- Maintain physical distancing
- Wear a face covering

COVID-19 THERAPY

- Use systemic steroids and remdesivir as recommended for patients with COVID-19
- Use HFNT or NIV for respiratory failure if possible
- Use invasive mechanical ventilation if HFNT or NIV fails
- Post COVID-19 rehabilitation
- Ensure appropriate post COVID-19 follow-up

TABLE 7.2

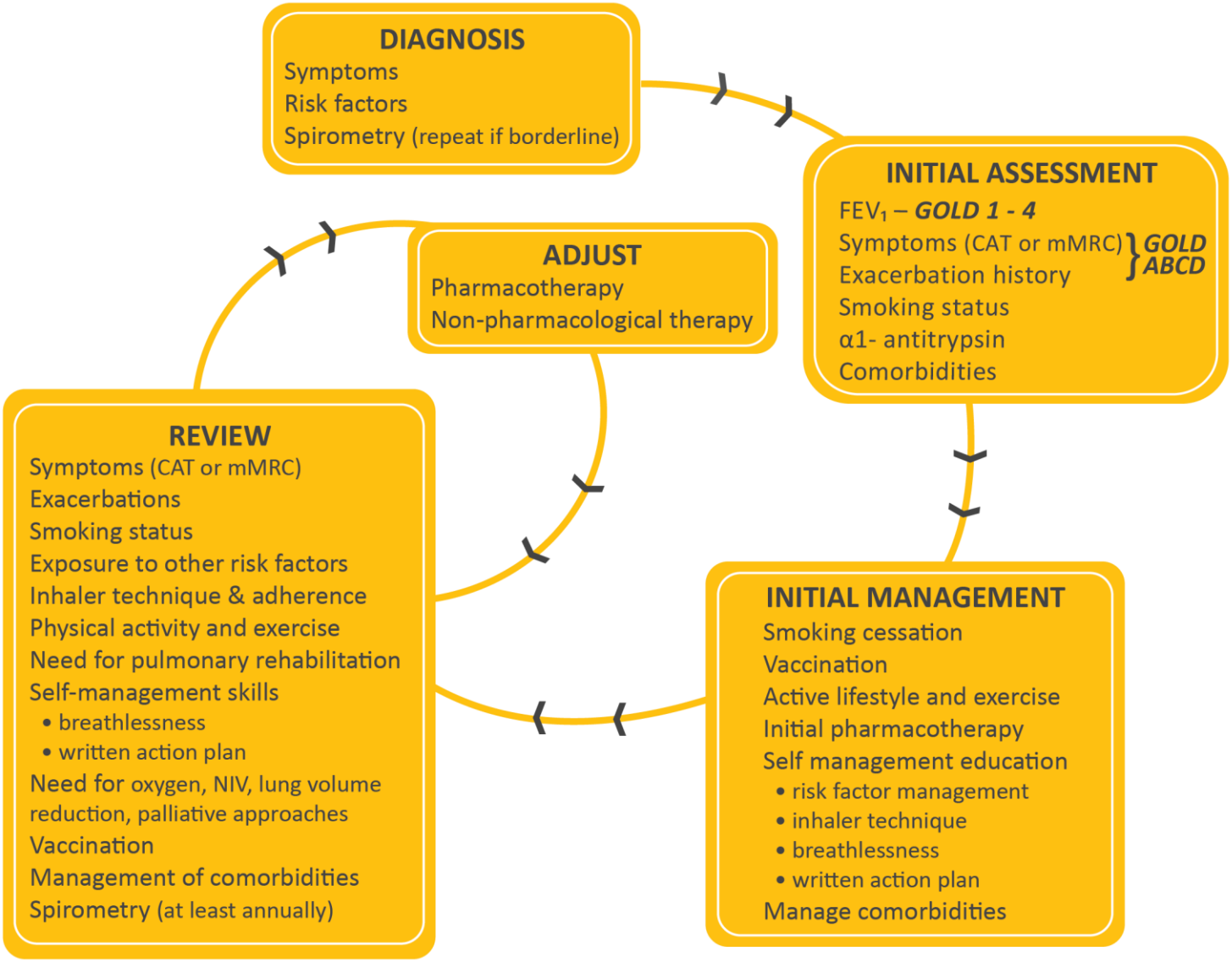
Case #1

- 1. A 62-year-old man is evaluated for chronic cough productive of thin clear sputum and dyspnea on exertion that has worsened over the last 2 years. He has a 54-pack-year smoking history. Medical history is otherwise unremarkable, and he takes no medications.
- On physical examination, vital signs are normal. The patient coughs during the examination, and mild expiratory wheezing is heard over the posterior lung fields. Cardiac examination is normal.
- Chest radiograph shows hyperinflated lungs with a flattened diaphragm without infiltrates.
- Spirometry shows an FEV1/FVC ratio of 0.65 and an FEV1 of 52% of predicted without a significant bronchodilator response.
- Which of the following is the most likely diagnosis?
- A Asthma
- B Bronchiectasis
- C COPD
- D Desquamative interstitial pneumonia

Case #2

- A 62-year-old man is evaluated during a follow-up visit for COPD. He continues to smoke one pack daily and has a 40-pack-year history. He can walk rapidly on a level surface but has breathlessness walking up a slight hill. He has not been hospitalized or seen urgently for an exacerbation. Medications are salmeterol and tiotropium.
- On physical examination, vital signs are normal. Oxygen saturation is 92% with the patient breathing ambient air. Faint expiratory wheezing is present.
- Spirometry shows an FEV1/FVC ratio of 0.58, and FEV1 is 62% of predicted.
- Which of the following is the most appropriate additional therapy?
- A Chronic azithromycin therapy
- B Prednisone
- C Pulmonary rehabilitation
- D Smoking cessation

MANAGEMENT OF COPD



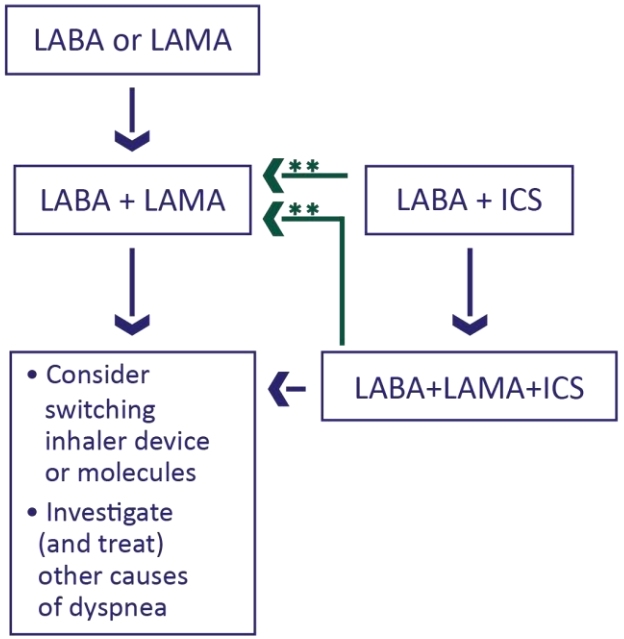
Case#3

- A 59-year-old man is seen in a follow-up visit for a 6-month history of progressively worsening chronic cough productive of small amounts of thin clear sputum and dyspnea on exertion. He has shortness of breath when he walks quickly and when he walks uphill. He has a 45-pack-year smoking history but quit 2 years ago. He has been using albuterol as needed since his diagnosis of COPD 3 months ago, but he remains symptomatic.
- On physical examination, oxygen saturation is 95% with the patient breathing ambient air. Scattered expiratory wheezing is heard. Cardiac examination is normal.
- Chest radiograph from 3 months ago shows flattened diaphragm but no infiltrate.
- Spirometry at the time of diagnosis showed reduced postbronchodilator FEV1/FVC ratio and FEV1 of 69% of predicted.
- Which of the following is the most appropriate pharmacologic treatment?
- A Inhaled fluticasone propionate–salmeterol
- B Inhaled tiotropium bromide
- C Prednisone
- D Roflumilast

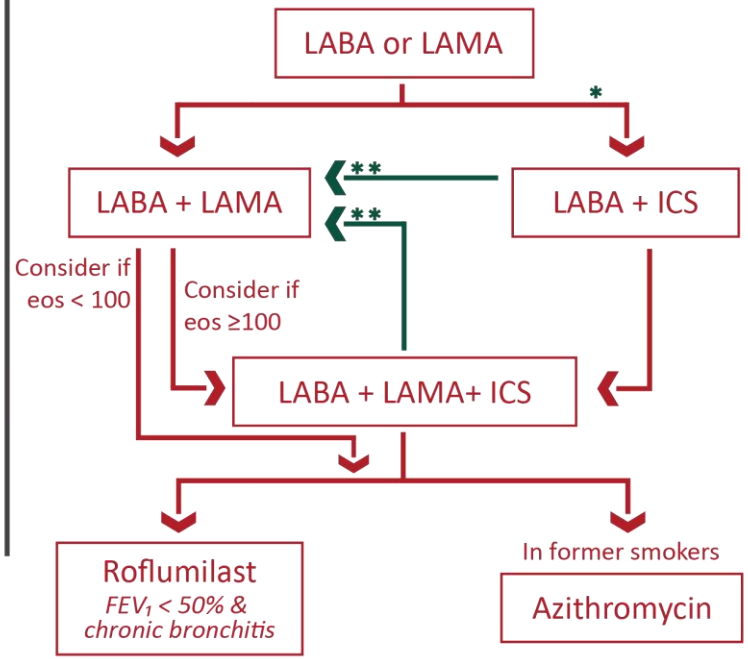
FOLLOW-UP PHARMACOLOGICAL TREATMENT

1. **IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT.**
2. **IF NOT:**
   - ✓ Consider the predominant treatable trait to target (dyspnea or exacerbations)
     - Use exacerbation pathway if both exacerbations and dyspnea need to be targeted
   - ✓ Place patient in box corresponding to current treatment & follow indications
   - ✓ Assess response, adjust and review
   - ✓ These recommendations do not depend on the ABCD assessment at diagnosis

• DYSPNEA •



• EXACERBATIONS •



eos = blood eosinophil count (cells/µL)

** Consider if eos ≥ 300 or eos ≥ 100 AND ≥2 moderate exacerbations / 1 hospitalization*

*** Consider de-escalation of ICS or switch if pneumonia, inappropriate original indication or lack of response to ICS*

Thank you

Questions?

COPD Follow-Up Checklist

In-person Follow-up □ **Phone Follow-up** □ **Virtual/online Follow-up** □

Date: YYYY / MM / DD	**Diagnosis:**

1. BASELINE SYMPTOMS – Breathlessness on a regular day: mMRC /4

Daily sputum production: □ no □ yes, color: Regular cough □ no □ yes

Recent change in symptoms □ no □ yes If yes, since when: □ Sputum color: □ Sputum volume ↑ = ↓ □ Dyspnea ↑ = ↓ □ Fatigue ↑ = ↓ □ Cough ↑ = ↓ □ Other □ Signs of hypercapnia **CAT: /40**	*Maintenance Medication and adherence:* □ SABA □ LABA/LAMA □ LABA □ LABA/ICS □ LAMA □ ICS/LABA/LAMA □Other: *Non pharmacological Rx:* O2: CPAP: BIPAP :

2. COVID-19 – If patient is feeling unwell, check other symptoms: □ Fever____ □ Sore throat □ Anosmia □ Others_____

Contact with someone COVID-19 positive? □ no □ yes Tested for COVID-19? □ no □ yes If yes □ positive □ negative

3. WRITTEN ACTION PLAN – no □ yes □

Instruction and any additional treatment: _____

Last time it has been used (date):

4. RECENT ADMISSIONS AND EMERGENCY VISITS

Hospital/ER	Where	Date	Length	Reason (Dx)

Comments:

5. COPD Self-management (healthy behaviors) – Integrated (patient has used it in his daily life)?

Smoke-free environment	yes	no	cannot tell
Medication adherence	yes	no	cannot tell
Prevention/management of exacerbations	yes	no	cannot tell
Breathing control	yes	no	cannot tell
Stress management	yes	no	cannot tell
Physical activity and exercise	yes	no	cannot tell
Other	yes	no	

Comments and what patient should prioritize based on his/her need:

6. MAIN ISSUES

1.	*2.*	*3.*

7. SUMMARY, INTERVENTIONS & PLAN

(healthcare professional name & signature)

DESCRIPTION OF LEVELS OF EVIDENCE

EVIDENCE CATEGORY	SOURCES OF EVIDENCE	DEFINITION
A	Randomized controlled trials (RCTs) Rich body of high quality evidence without any significant limitation or bias	Evidence is from endpoints of well-designed RCTs that provide consistent findings in the population for which the recommendation is made without any important limitations. Requires high quality evidence from ≥ 2 clinical trials involving a substantial number of subjects, or a single high quality RCT involving substantial numbers of patient without any bias.
B	Randomized controlled trials (RCTs) with important limitations Limited Body of Evidence	Evidence is from RCTs that include only a limited number of patients, post hoc or subgroup analyses of RCTs or meta analyses of RCTs. Also pertains when few RCTs exist, or important limitations are evident (methodologic flaws, small numbers, short duration, undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent).
C	Non-randomized trials Observational studies	Evidence is from outcomes of uncontrolled or non-randomized trials or from observational studies.
D	Panel consensus judgment	Provision of guidance is deemed valuable but clinical literature addressing the subject is insufficient. Panel consensus is based on clinical experience or knowledge that does not meet the above stated criteria.

CONSIDERATIONS IN PERFORMING SPIROMETRY

PREPARATION

- Spirometers need calibration on a regular basis.
- Spirometers should produce hard copy or have a digital display of the expiratory curve to permit detection of technical errors or have an automatic prompt to identify an unsatisfactory test and the reason for it.
- The supervisor of the test needs training in optimal technique and quality performance.
- Maximal patient effort in performing the test is required to avoid underestimation of values and hence errors in diagnosis and management.

BRONCHODILATION

- Possible dosage protocols are 400 mcg short-acting beta$_2$-agonist, 160 mcg short-acting anticholinergic, or the two combined.[a] FEV_1 should be measured 10-15 minutes after a short-acting beta$_2$-agonist is given, or 30-45 minutes after a short-acting anticholinergic or a combination of both classes of drugs.

PERFORMANCE

- Spirometry should be performed using techniques that meet published standards.[b]
- The expiratory volume/time traces should be smooth and free from irregularities. The pause between inspiration and expiration should be < 1 second.
- The recording should go on long enough for a volume plateau to be reached, which may take more than 15 seconds in severe disease.
- Both FVC and FEV_1 should be the largest value obtained from any of three technically satisfactory curves and the FVC and FEV_1 values in these three curves should vary by no more than 5% or 150 ml, whichever is greater.
- The FEV_1/FVC ratio should be taken from the technically acceptable curve with the largest sum of FVC and FEV_1.

EVALUATION

- Spirometry measurements are evaluated by comparison of the results with appropriate reference values based on age, height, sex, and race.
- The presence of a postbronchodilator $FEV_1/FVC < 0.70$ confirms the presence of airflow limitation.

a Pellegrino et al. Eur Respir J 2005; 26(5): 948-68;
b Miller et al. Eur Respir J 2005; 26(2): 319-38.

ROLE OF SPIROMETRY

- **Diagnosis**
- **Assessment of severity of airflow obstruction (for prognosis)**
- **Follow-up assessment**
  - » Therapeutic decisions.
    - – Pharmacological in selected circumstances (e.g., discrepancy between spirometry and level of symptoms).
    - – Consider alternative diagnoses when symptoms are disproportionate to degree of airflow obstruction.
    - – Non-pharmacological (e.g., interventional procedures).
  - » Identification of rapid decline.

BRIEF STRATEGIES TO HELP THE PATIENT WILLING TO QUIT

• **ASK:**	Systematically identify all tobacco users at every visit. *Implement an office-wide system that ensures that, for EVERY patient at EVERY clinic visit, tobacco-use status is queried and documented.*
• **ADVISE:**	Strongly urge all tobacco users to quit. *In a clear, strong, and personalized manner, urge every tobacco user to quit.*
• **ASSESS:**	Determine willingness and rationale of patient's desire to make a quit attempt. *Ask every tobacco user if he or she is willing to make a quit attempt at this time (e.g., within the next 30 days).*
• **ASSIST:**	Aid the patient in quitting. *Help the patient with a quit plan; provide practical counseling; provide intra-treatment social support; help the patient obtain extra-treatment social support; recommend use of approved pharmacotherapy except in special circumstances; provide supplementary materials.*
• **ARRANGE:**	Schedule follow-up contact. *Schedule follow-up contact, either in person or via telephone.*

ANTI-INFLAMMATORY THERAPY IN STABLE COPD

INHALED CORTICOSTEROIDS

- An ICS combined with a LABA is more effective than the individual components in improving lung function and health status and reducing exacerbations in patients with exacerbations and moderate to very severe COPD **(Evidence A)**.
- Regular treatment with ICS increases the risk of pneumonia especially in those with severe disease **(Evidence A)**.
- Triple inhaled therapy of LABA/LAMA/ICS improves lung function, symptoms and health status, and reduces exacerbations, compared to LABA/ICS, LABA/LAMA or LAMA monotherapy **(Evidence A)**. Recent data suggest a beneficial effect versus fixed-dose LABA/LAMA combinations on mortality in symptomatic COPD patients with a history of frequent and/or severe exacerbations.

ORAL GLUCOCORTICOIDS

- Long-term use of oral glucocorticoids has numerous side effects **(Evidence A)** with no evidence of benefits **(Evidence C)**.

PDE4 INHIBITORS

- In patients with chronic bronchitis, severe to very severe COPD and a history of exacerbations:
  - » A PDE4 inhibitor improves lung function and reduces moderate and severe exacerbations **(Evidence A)**.
  - » A PDE4 inhibitor improves lung function and decreases exacerbations in patients who are on fixed-dose LABA/ICS combinations **(Evidence A)**.

ANTIBIOTICS

- Long-term azithromycin and erythromycin therapy reduces exacerbations over one year **(Evidence A)**.
- Treatment with azithromycin is associated with an increased incidence of bacterial resistance **(Evidence A)** and hearing test impairments **(Evidence B)**.

MUCOREGULATORS AND ANTIOXIDANT AGENTS

- Regular treatment with mucolytics such as erdosteine, carbocysteine and NAC reduces the risk of exacerbations in select populations **(Evidence B)**.

OTHER ANTI-INFLAMMATORY AGENTS

- Simvastatin does not prevent exacerbations in COPD patients at increased risk of exacerbations and without indications for statin therapy **(Evidence A)**. However, observational studies suggest that statins may have positive effects on some outcomes in patients with COPD who receive them for cardiovascular and metabolic indications **(Evidence C)**.
- Leukotriene modifiers have not been tested adequately in COPD patients.

COMMONLY USED MAINTENANCE MEDICATIONS IN COPD*

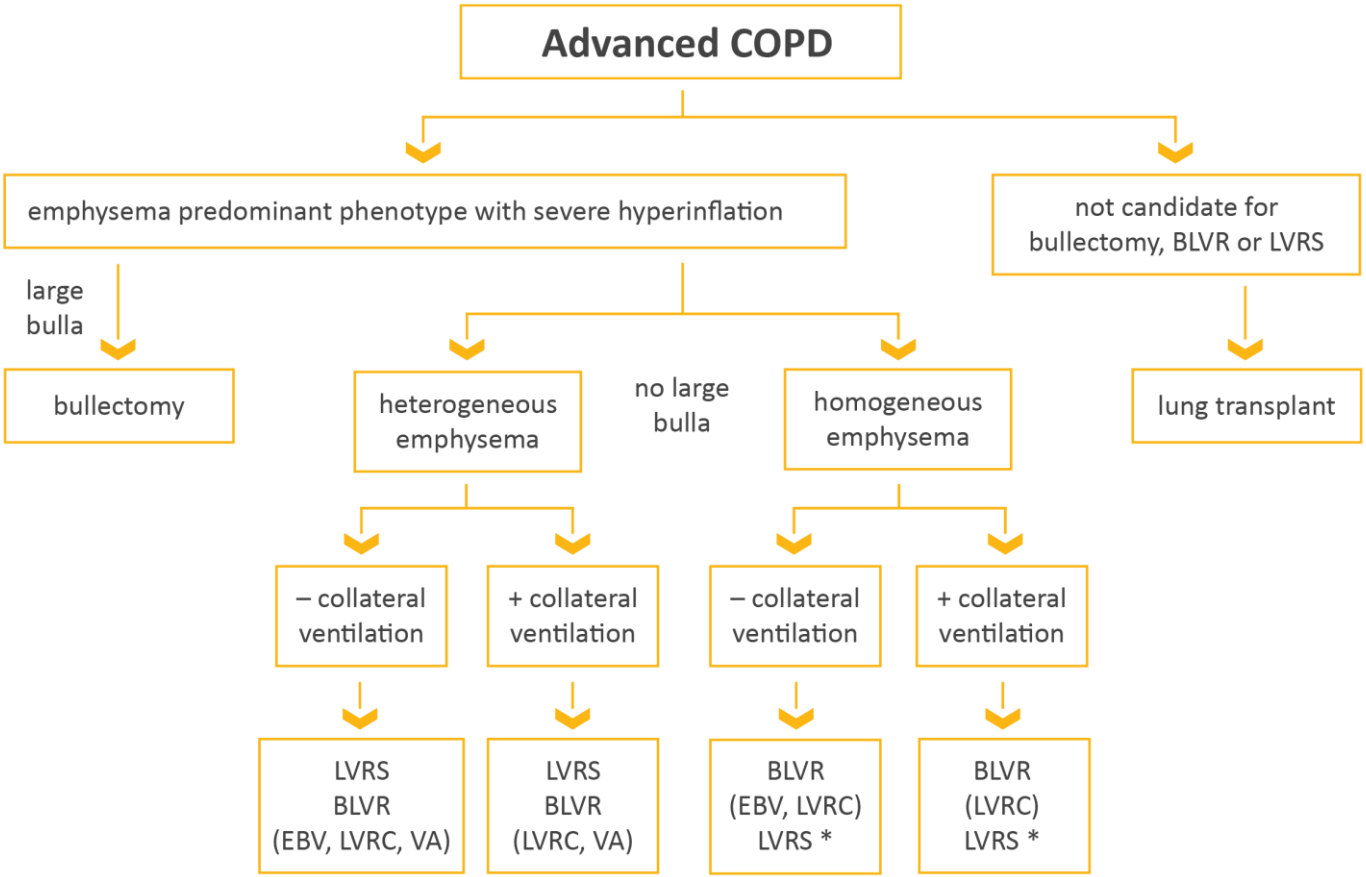
Generic Drug Name	Inhaler Type	DELIVERY OPTIONS: *Nebulizer*	*Oral*	*Injection*	Duration Of Action
BETA$_2$-AGONISTS					
SHORT-ACTING (SABA)					
Fenoterol	MDI	√	pill, syrup		4-6 hours
Levalbuterol	MDI	√			6-8 hours
Salbutamol (albuterol)	MDI & DPI	√	pill, syrup, extended release tablet	√	4-6 hours 12 hours (ext. release)
Terbutaline	DPI		pill	√	4-6 hours
LONG-ACTING (LABA)					
Arformoterol		√			12 hours
Formoterol	DPI	√			12 hours
Indacaterol	DPI				24 hours
Olodaterol	SMI				24 hours
Salmeterol	MDI & DPI				12 hours
ANTICHOLINERGICS					
SHORT-ACTING (SAMA)					
Ipratropium bromide	MDI	√			6-8 hours
Oxitropium bromide	MDI				7-9 hours
LONG-ACTING (LAMA)					
Aclidinium bromide	DPI, MDI				12 hours
Glycopyrronium bromide	DPI		solution	√	12-24 hours
Tiotropium	DPI, SMI, MDI				24 hours
Umeclidinium	DPI				24 hours
Glycopyrrolate		√			12 hours
Revefenacin		√			24 hours
COMBINATION SHORT-ACTING BETA$_2$-AGONIST PLUS ANTICHOLINERGIC IN ONE DEVICE (SABA/SAMA)					
Fenoterol/ipratropium	SMI	√			6-8 hours
Salbutamol/ipratropium	SMI, MDI	√			6-8 hours
COMBINATION LONG-ACTING BETA$_2$-AGONIST PLUS ANTICHOLINERGIC IN ONE DEVICE (LABA/LAMA)					
Formoterol/aclidinium	DPI				12 hours
Formoterol/glycopyrronium	MDI				12 hours
Indacaterol/glycopyrronium	DPI				12-24 hours
Vilanterol/umeclidinium	DPI				24 hours
Olodaterol/tiotropium	SMI				24 hours
METHYLXANTHINES					
Aminophylline			solution	√	Variable, up to 24 hours
Theophylline (SR)			pill	√	Variable, up to 24 hours
COMBINATION OF LONG-ACTING BETA$_2$-AGONIST PLUS CORTICOSTEROID IN ONE DEVICE (LABA/ICS)					
Formoterol/beclometasone	MDI, DPI				12 hours
Formoterol/budesonide	MDI, DPI				12 hours
Formoterol/mometasone	MDI				12 hours
Salmeterol/fluticasone propionate	MDI, DPI				12 hours
Vilanterol/fluticasone furoate	DPI				24 hours
TRIPLE COMBINATION IN ONE DEVICE (LABA/LAMA/ICS)					
Fluticasone/umeclidinium/vilanterol	DPI				24 hours
Beclometasone/formoterol/glycopyrronium	MDI				12 hours
Budesonide/formoterol/glycopyrrolate	MDI				12 hours
PHOSPHODIESTERASE-4 INHIBITORS					
Roflumilast			pill		24 hours
MUCOLYTIC AGENTS					
Erdosteine			pill		12 hours
Carbocysteine†			pill		
N-acetylcysteine†			pill		

TABLE 3.3

*Not all formulations are available in all countries. In some countries other formulations and dosages may be available. † Dosing regimens are under discussion. MDI = metered dose inhaler; DPI = dry powder inhaler; SMI = soft mist inhaler. Note that glycopyrrolate & glycopyrronium are the same compound.

INTERVENTIONAL BRONCHOSCOPIC AND SURGICAL TREATMENTS FOR COPD

Overview of various therapies used to treat patients with COPD and emphysema worldwide. Note that all therapies are not approved for clinical care in all countries. Additionally, the effects of BLVR on survival or other long term outcomes or comparison to LVRS are unknown.



Definition of Abbreviations: BLVR, Bronchoscopic Lung Volume Reduction, EBV, endobronchial Valve, LVRS, Lung volume reduction surgery, LVRC, Lung volume reduction coil, VA, Vapor ablation

*at some but not all centers

KEY POINTS FOR INHALATION OF DRUGS

- The choice of inhaler device has to be individually tailored and will depend on access, cost, prescriber, and most importantly, patient's ability and preference.

- It is essential to provide instructions and to demonstrate the proper inhalation technique when prescribing a device, to ensure that inhaler technique is adequate and re-check at each visit that patients continue to use their inhaler correctly.

- Inhaler technique (and adherence to therapy) should be assessed before concluding that the current therapy requires modification.

KEY POINTS FOR THE USE OF BRONCHODILATORS

- LABAs and LAMAs are preferred over short-acting agents except for patients with only occasional dyspnea **(Evidence A)**, and for immediate relief of symptoms in patients already on long-acting bronchodilators for maintenance therapy.

- Patients may be started on single long-acting bronchodilator therapy or dual long-acting bronchodilator therapy. In patients with persistent dyspnea on one bronchodilator treatment should be escalated to two **(Evidence A)**.

- Inhaled bronchodilators are recommended over oral bronchodilators **(Evidence A)**.

- Theophylline is not recommended unless other long-term treatment bronchodilators are unavailable or unaffordable **(Evidence B)**.

KEY POINTS FOR THE USE OF ANTI-INFLAMMATORY AGENTS

- Long-term monotherapy with ICS is not recommended **(Evidence A)**.
- Long-term treatment with ICS may be considered in association with LABAs for patients with a history of exacerbations despite appropriate treatment with long-acting bronchodilators **(Evidence A)**.
- Long-term therapy with oral corticosteroids is not recommended **(Evidence A)**.
- In patients with severe to very severe airflow limitation, chronic bronchitis and exacerbations the addition of a PDE4 inhibitor to a treatment with long acting bronchodilators with/without ICS can be considered **(Evidence B)**.
- Preferentially, but not only in former smokers with exacerbations despite appropriate therapy, macrolides, in particular azithromycin, can be considered **(Evidence B)**.
- Statin therapy is not recommended for prevention of exacerbations **(Evidence A)**.
- Antioxidant mucolytics are recommended only in selected patients **(Evidence A)**.

KEY POINTS FOR THE USE OF NON-PHARMACOLOGICAL TREATMENTS (Part I)

EDUCATION, SELF-MANAGEMENT AND PULMONARY REHABILITATION

- Education is needed to change patient's knowledge but there is no evidence that used alone it will change patient behavior .
- Education self-management with the support of a case manager with or without the use of a written action plan is recommended for the prevention of exacerbation complications such as hospital admissions **(Evidence B)**.
- Rehabilitation is indicated in all patients with relevant symptoms and/or a high risk for exacerbation **(Evidence A)**.
- Physical activity is a strong predictor of mortality **(Evidence A)**. Patients should be encouraged to increase the level of physical activity although we still don't know how to best insure the likelihood of success.

VACCINATION

- Influenza vaccination is recommended for all patients with COPD **(Evidence A)**.
- Pneumococcal vaccination: the PCV13 and PPSV23 are recommended for all patients> 65 years of age, and in younger patients with significant comorbid conditions including chronic heart or lung disease **(Evidence B)**.
- Covid-19 vaccination in line with national recommendations **(Evidence B)**.
- Tdap (dTaP/dTPa) vaccination for adults with COPD who were not vaccinated in adolescence to protect against pertussis (whooping cough) **(Evidence B)**.

NUTRITION

- Nutritional supplementation should be considered in malnourished patients with COPD **(Evidence B)**.

END OF LIFE AND PALLIATIVE CARE

- All clinicians managing patients with COPD should be aware of the effectiveness of palliative approaches to symptom control and use these in their practice **(Evidence D)**.
- End of life care should include discussions with patients and their families about their views on resuscitation, advance directives and place of death preferences **(Evidence D)**.

KEY POINTS FOR THE USE OF OTHER PHARMACOLOGICAL TREATMENTS

- Patients with severe hereditary alpha-1 antitrypsin deficiency and established emphysema may be candidates for alpha-1 antitrypsin augmentation therapy **(Evidence B)**.
- Antitussives cannot be recommended **(Evidence C)**.
- Drugs approved for primary pulmonary hypertension are not recommended for patients with a pulmonary hypertension secondary to COPD **(Evidence B)**.
- Low-dose long acting oral and parenteral opioids may be considered for treating dyspnea in COPD patients with severe disease **(Evidence B)**.

OTHER PHARMACOLOGICAL TREATMENTS

ALPHA-1 ANTITRYPSIN AUGMENTATION THERAPY

- Intravenous augmentation therapy may slow down the progression of emphysema **(Evidence B)**.

ANTITUSSIVES

- There is no conclusive evidence of a beneficial role of antitussives in patients with COPD **(Evidence C)**.

VASODILATORS

- Vasodilators do not improve outcomes and may worsen oxygenation **(Evidence B)**.

KEY POINTS FOR THE USE OF NON-PHARMACOLOGICAL TREATMENTS (Part II)

TREATMENT OF HYPOXEMIA

- In patients with severe resting hypoxemia long-term oxygen therapy is indicated **(Evidence A)**.
- In patients with stable COPD and resting or exercise-induced moderate desaturation, long term oxygen treatment should not be routinely prescribed. However, individual patient factors may be considered when evaluating the patient's needs for supplemental oxygen **(Evidence A)**.
- Resting oxygenation at sea level does not exclude the development of severe hypoxemia when travelling by air **(Evidence C)**.

TREATMENT OF HYPERCAPNIA

- In patients with severe chronic hypercapnia and a history of hospitalization for acute respiratory failure, long term noninvasive ventilation may be considered **(Evidence B)**.

INTERVENTION BRONCHOSCOPY AND SURGERY

- Lung volume reduction surgery should be considered in selected patients with upper-lobe emphysema **(Evidence A)**.
- In selected patients with a large bulla surgical bullectomy may be considered **(Evidence C)**.
- In select patients with advanced emphysema, bronchoscopic interventions reduce end-expiratory lung volume and improve exercise tolerance, quality of life and lung function at 6-12 months following treatment. Endobronchial valves **(Evidence A)**; Lung coils **(Evidence B)**; Vapor ablation **(Evidence B)**.
- In patients with very severe COPD (progressive disease, BODE score of 7 to 10, and not candidate for lung volume reduction) lung transplantation may be considered for referral with at least one of the following: (1) history of hospitalization for exacerbation associated with acute hypercapnia (Pco_2 >50 mm Hg); (2) pulmonary hypertension and/or cor pulmonale, despite oxyqen therapy; or (3) FEV_1 < 20% and either DLCO < 20% or homogenous distribution of emphysema **(Evidence C)**.

TABLE 4.10

DISCHARGE CRITERIA AND RECOMMENDATIONS FOR FOLLOW-UP

- Full review of all clinical and laboratory data.
- Check maintenance therapy and understanding.
- Reassess inhaler technique.
- Ensure understanding of withdrawal of acute medications (steroids and/or antibiotics).
- Assess need for continuing any oxygen therapy.
- Provide management plan for comorbidities and follow-up.
- Ensure follow-up arrangements: early follow-up < 4weeks, and late follow-up < 12weeks as indicated.
- All clinical or investigational abnormalities have been identified.

1 – 4 WEEKS FOLLOW-UP

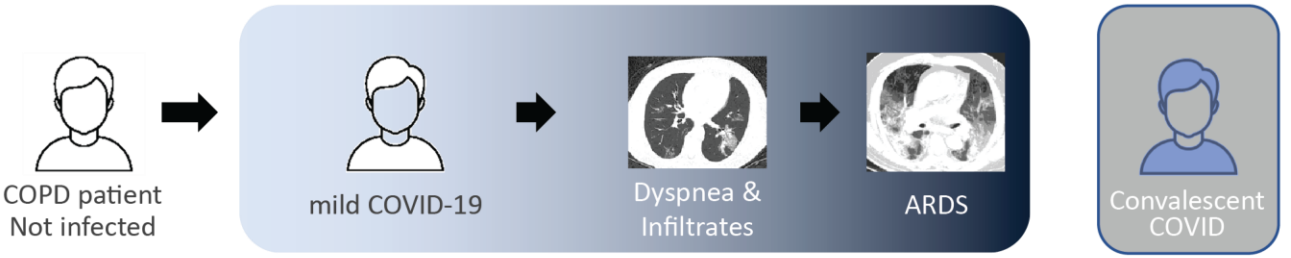
- Evaluate ability to cope in his/her usual environment.
- Review and understanding treatment regimen.
- Reassessment of inhaler techniques.
- Reassess need for long-term oxygen.
- Document the capacity to do physical activity and consider patient eligibility to be enrolled in pulmonary rehabilitation.
- Document symptoms: CAT or mMRC.
- Determine status of comorbidities.

12 – 16 WEEKS FOLLOW-UP

- Evaluate ability to cope in his/her usual environment.
- Review understanding treatment regimen.
- Reassessment of inhaler techniques.
- Reassess need for long-term oxygen.
- Document the capacity to do physical activity and activities of daily living.
- Measure spirometry: FEV_1.
- Document symptoms: CAT or mMRC.
- Determine status of comorbidities.

TABLE 5.8

COVID-19 & COPD



Clinical Features	**COPD:** Cough, SOB	Mild constitutional symptoms Fever > 37.5 °C, ↑ SOB Dry Cough, Fatigue, Diarrhea	↑↑ SOB ± hypoxia $PaO_2/FiO_2 \leq 300$ mmHg	ARDS SIRS/Shock Cardiac Failure VTE	Fatigue SOB Cough
Abnormal Investigations		SARS-CoV-2 PCR CXR/CT, SpO_2 Lymphopenia Thrombocytopenia CRP, D-dimer	CXR/CT, SpO_2 Lymphopenia Thrombocytopenia Transaminases D-dimer, PCT	SpO_2 CRP, LDH, IL-6 D-dimer, ferritin troponin, BNP	PFT CT Chest
	Continue Usual COPD Maintenance Therapy				
Possible Interventions	Home Exercise Protective Strategies	Protective Strategies, COPD Exacerbation Therapy Low intensity exercise *Therapeutic Trials*	Controlled Oxygen Systemic Steroids Remdesivir Anticoagulation *Therapeutic Trials*	NIV, HFNT IMV Prone positioning Anticoagulation *Therapeutic Trials*	Home exercise PR

(ARDS, Adult respiratory distress syndrome; BNP, brain natriuretic peptide; CRP, C reactive protein; CT, computed tomography; CXR, chest radiograph; HFNT, high flow nasal therapy; IL-6, interleukin 6; IMV, invasive mechanical ventilation; LDH, lactate dehydrogenase; NIV, non-invasive ventilation; PCT, procalcitonin; PFT, pulmonary function tests; PR, pulmonary rehabilitation; SOB, Shortness of breath; SpO_2 , peripheral oxygen saturation; VTE, venous thromboembolism)

Halpin et al. 2020. Global Initiative for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease: The 2020 GOLD Science Committee Report on COVID-19 & COPD. Published Ahead of Print: https://www.atsjournals.org/doi/abs/10.1164/rccm.202009-3533SO

The American Journal of Respiratory and Critical Care Medicine is an official journal of the American Thoracic Society

TREATING TOBACCO USE AND DEPENDENCE: A CLINICAL PRACTICE GUIDELINE — MAJOR FINDINGS & RECOMMENDATIONS

- Tobacco dependence is a chronic condition that warrants repeated treatment until long-term or permanent abstinence is achieved.
- Effective treatments for tobacco dependence exist and all tobacco users should be offered these treatments.
- Clinicians and health care delivery systems must operationalize the consistent identification, documentation, and treatment of every tobacco user at every visit.
- Brief smoking cessation counseling is effective and every tobacco user should be offered such advice at every contact with health care providers.
- There is a strong dose-response relation between the intensity of tobacco dependence counseling and its effectiveness.
- Three types of counseling have been found to be especially effective: practical counseling, social support of family and friends as part of treatment, and social support arranged outside of treatment.
- First-line pharmacotherapies for tobacco dependence — varenicline, bupropion sustained release, nicotine gum, nicotine inhaler, nicotine nasal spray, and nicotine patch—are effective and at least one of these medications should be prescribed in the absence of contraindications.
- Financial incentive programs for smoking cessation may facilitate smoking cessation.
- Tobacco dependence treatments are cost effective interventions.