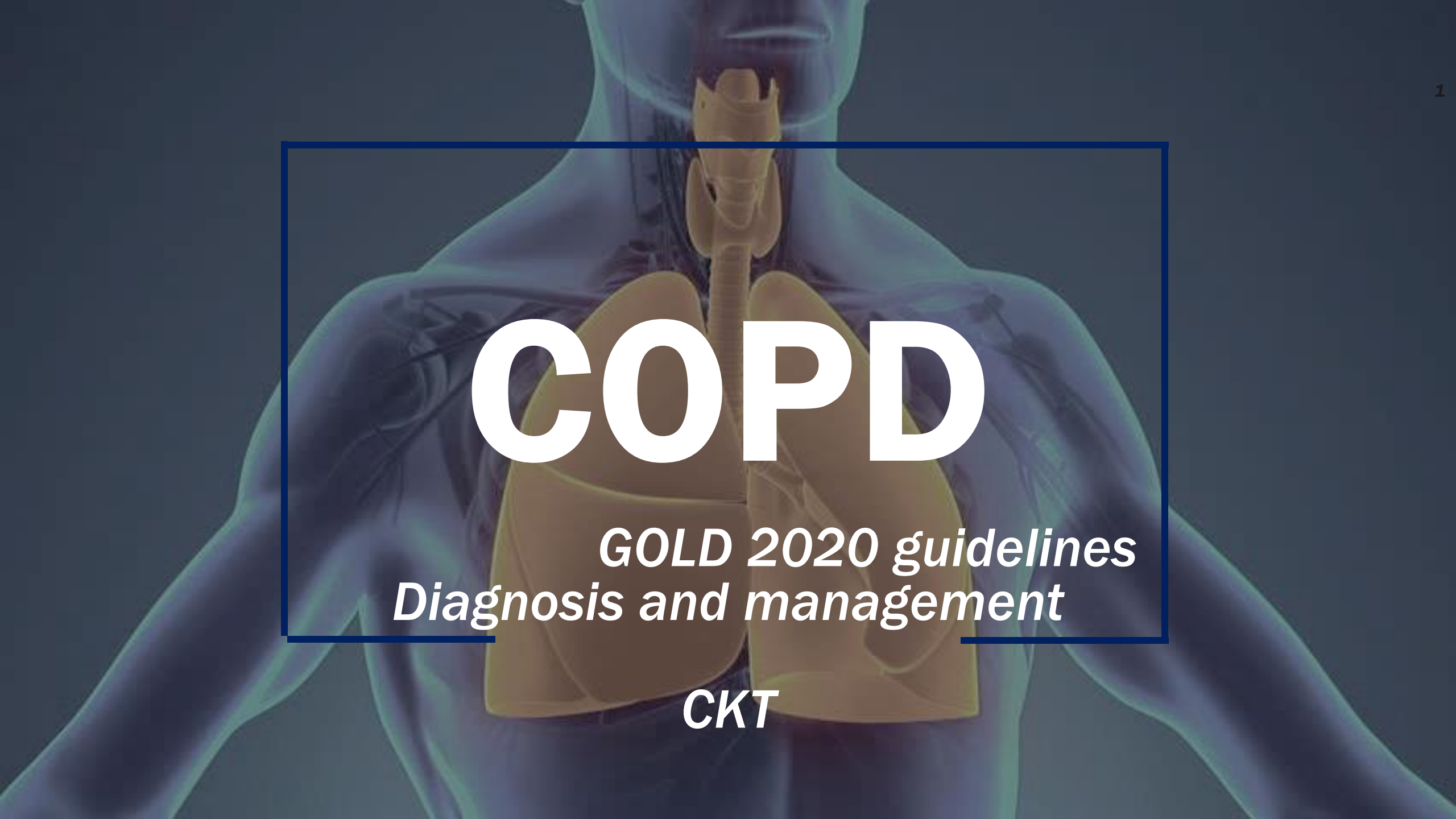


COPD

GOLD 2020 guidelines
Diagnosis and management

CKT

COPD definition “The Global Initiative for Chronic Obstructive Lung Disease (GOLD)”

- (COPD) is a heterogeneous disease/syndrome 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 and influenced by host factors including abnormal lung development.**

- Significant comorbidities may have an impact on morbidity and mortality.

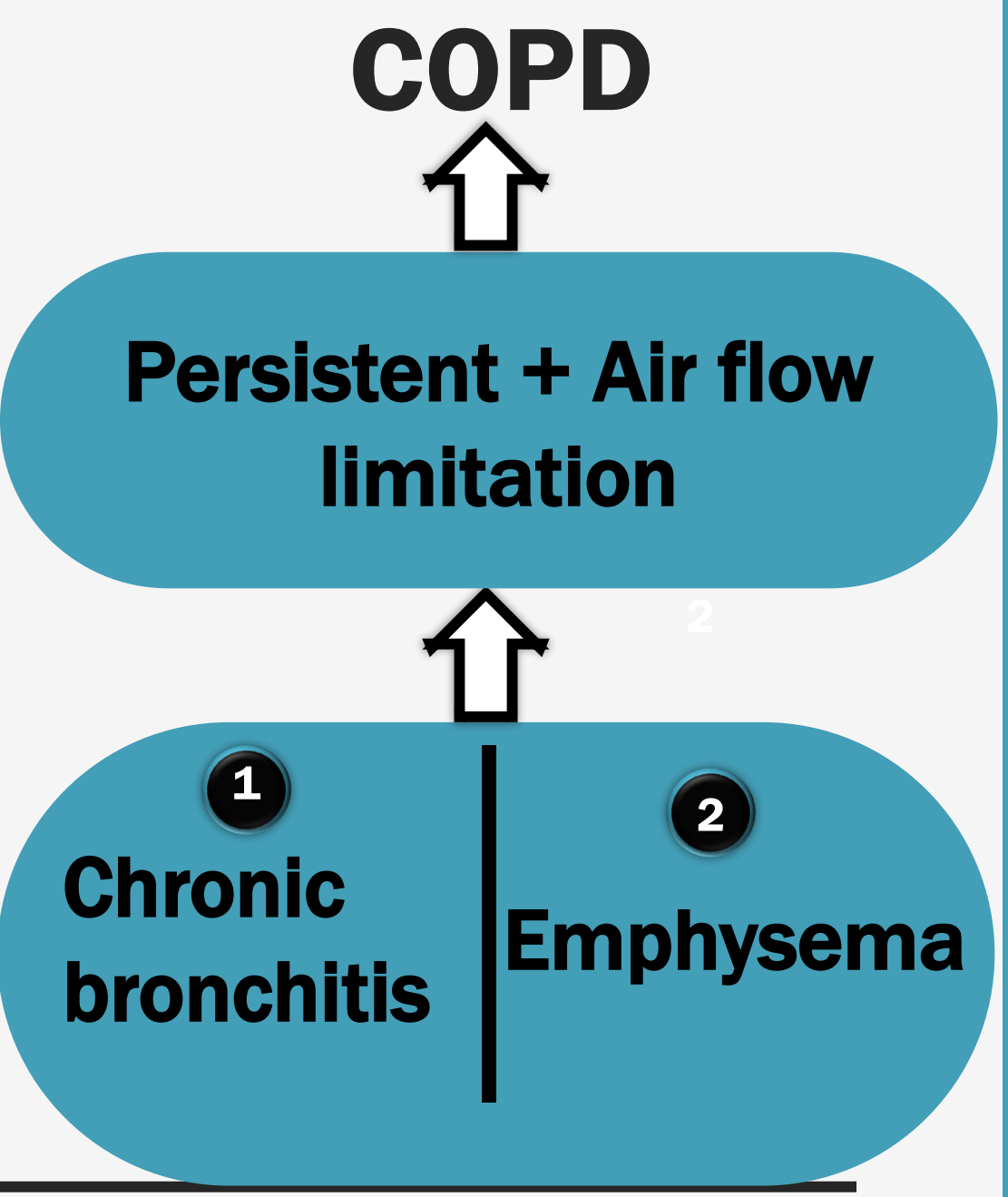
Pathology of COPD

- The chronic airflow limitation that characterizes COPD is caused by a mixture of small airways disease (e.g., obstructive bronchiolitis) and parenchymal destruction (emphysema), the relative contributions of which vary from person to person.

- There may be significant lung pathology (e.g., emphysema) in the absence of airflow limitation that needs further evaluation.

❑ Chronic inflammation causes structural changes, small airways narrowing, and destruction of lung parenchyma.

❑ A loss of small airways may contribute to airflow limitation and muco-ciliary dysfunction, a characteristic feature of the disease."



1. Chronic bronchitis is defined as a chronic productive cough for three months in each of two successive years in a patient in whom other causes of chronic cough (e.g., bronchiectasis) have been excluded.

2. Emphysema is a pathological term that describes some of the structural changes sometimes associated with COPD which include permanent enlargement of the airspaces distal to the terminal bronchioles that is accompanied by destruction of the airspace walls, without obvious fibrosis.

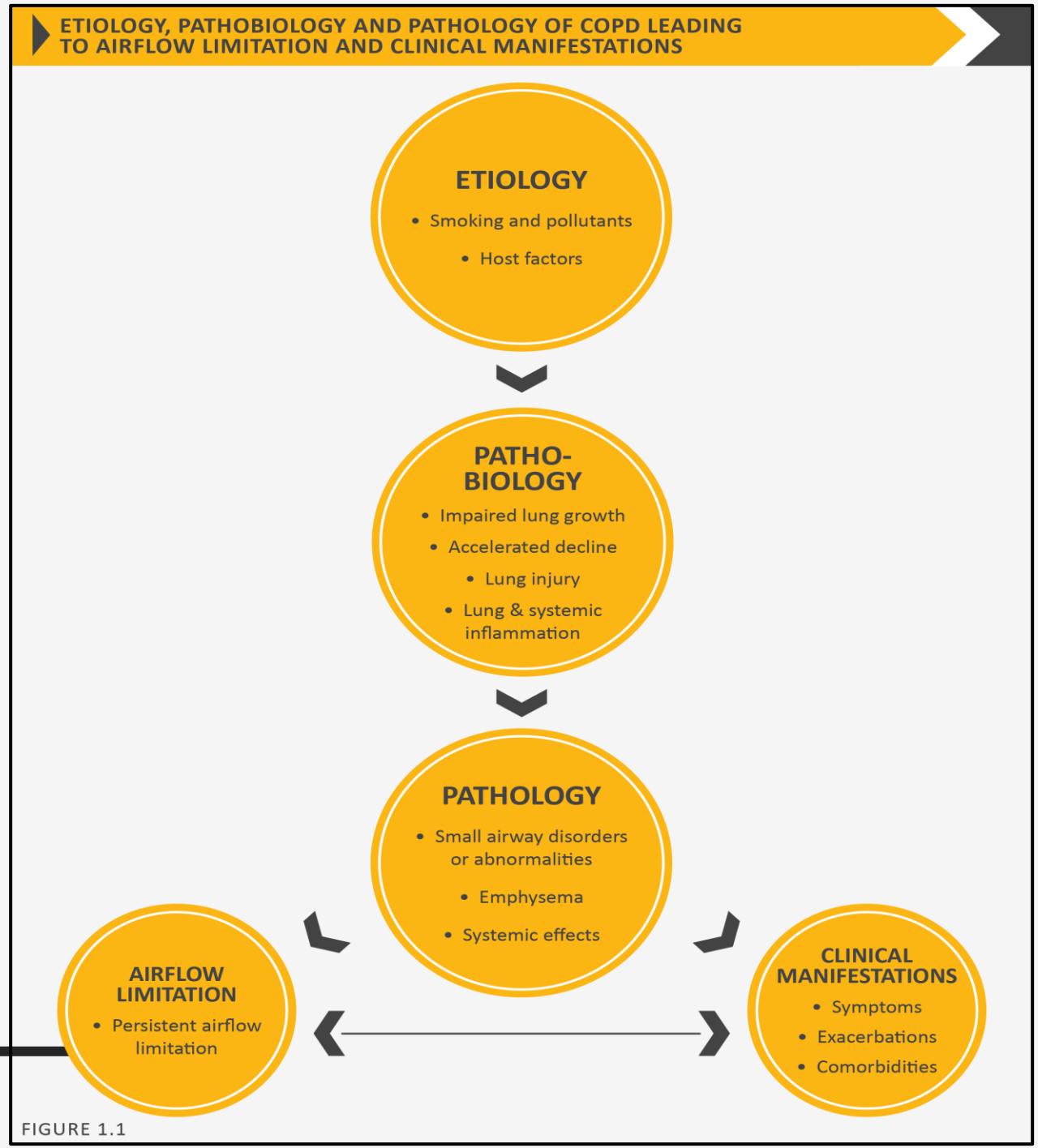

ETIOLOGY, PATHOBIOLOGY AND PATHOLOGY OF COPD LEADING TO AIRFLOW LIMITATION AND CLINICAL MANIFESTATIONS
ETIOLOGY
• Smoking and pollutants
• Host factors
PATHO-BIOLOGY
• Impaired lung growth
• Accelerated decline
• Lung injury
• Lung & systemic inflammation
PATHOLOGY
• Small airway disorders or abnormalities
• Emphysema
• Systemic effects
AIRFLOW LIMITATION
• Persistent airflow limitation
CLINICAL MANIFESTATIONS
• Symptoms
• Exacerbations
• Comorbidities

FIGURE 1.1

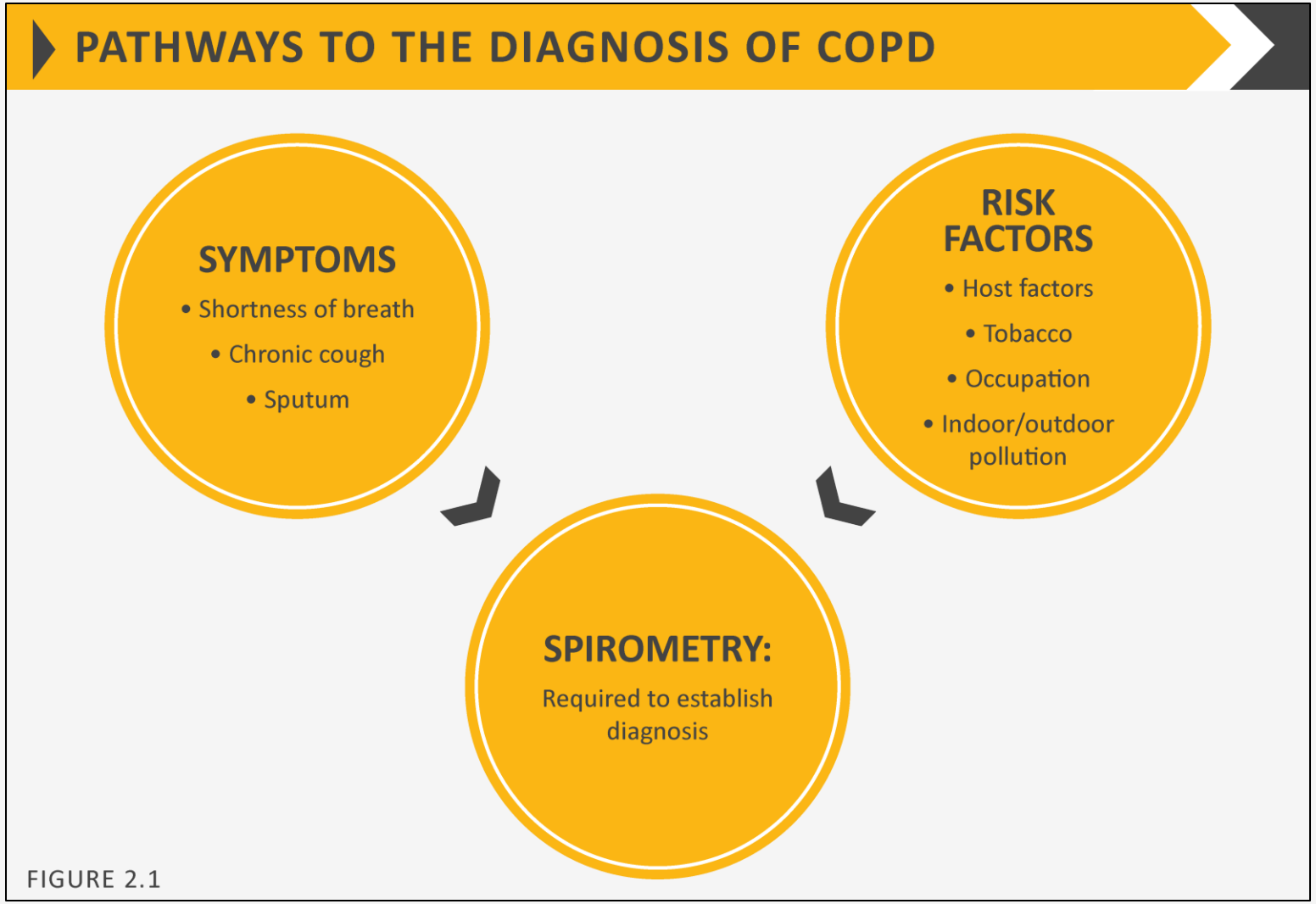

PATHWAYS TO THE DIAGNOSIS OF COPD
SYMPTOMS
• Shortness of breath
• Chronic cough
• Sputum
RISK FACTORS
• Host factors
• Tobacco
• Occupation
• Indoor/outdoor pollution
SPIROMETRY:
Required to establish diagnosis

FIGURE 2.1

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.

TABLE 2.1

Key indicators for considering a diagnosis of COPD

Symptoms
Dyspnea
Cough
Sputum
Risk factors
Smoking
Biomass fuel exposure
Asthma
Childhood infections
Prematurity
Family history
Comorbidities
Heart disease
Metabolic syndrome
Osteoporosis
Sleep apnea
Depression
Lung cancer
Skin wrinkling

Consider the diagnosis of COPD and perform spirometry if any of these indicators are present. These indicators are not diagnostic by themselves, but the presence of multiple key indicators increases the probability of a diagnosis of COPD. Spirometry is needed to establish a diagnosis of COPD.

Diagnosis of chronic obstructive pulmonary disease: Clinical features

History
Risk factors
▪ Family history
▪ Smoking history
• Age at initiation
• Average amount smoked per day since initiation
• Date when stopped smoking or a current smoker
▪ Environmental history
• The chronologically taken environmental history may disclose important risk factors for COPD
▪ Asthma

Symptoms

- Dyspnea
  - Ask about the amount of effort required to induce uncomfortable breathing. Many individuals will deny symptoms of dyspnea, but will have reduced their activity levels substantially.
- Cough
  - Cough with or without sputum production should be an indication for spirometric testing. The presence of chronic cough and sputum has been used to define chronic bronchitis.
- Wheezing
  - Wheezing or squeaky noises occurring during breathing indicate the presence of airflow obstruction
- Acute chest illnesses
  - Inquire about occurrence and frequency of episodes of increased cough and sputum with wheezing, dyspnea, or fever

Physical examination

All physical findings are generally present only with severe disease

Chest

- The presence of emphysema (only when severe) is indicated by: overdistention of the lungs in the stable state (chest held near full inspiratory position at end of normal expiration, low diaphragmatic position), decreased intensity of breath and heart sounds, and prolonged expiratory phase
- Evidence of airflow obstruction: wheezes during auscultation on slow or forced breathing and prolongation of forced expiratory time
- Frequently observed with severe disease (characteristic, but not diagnostic): pursed-lip breathing, use of accessory respiratory muscles, retraction of lower interspaces

Other

- Unusual positions to relieve dyspnea at rest
- Digital clubbing is NOT typical in COPD (even with associated hypoxemia) and suggests other diagnoses (eg, lung cancer, bronchiectasis, pulmonary fibrosis)
- Mild dependent edema may be seen in the absence of right heart failure

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.

TABLE 2.6

SPIROMETRY - NORMAL TRACE

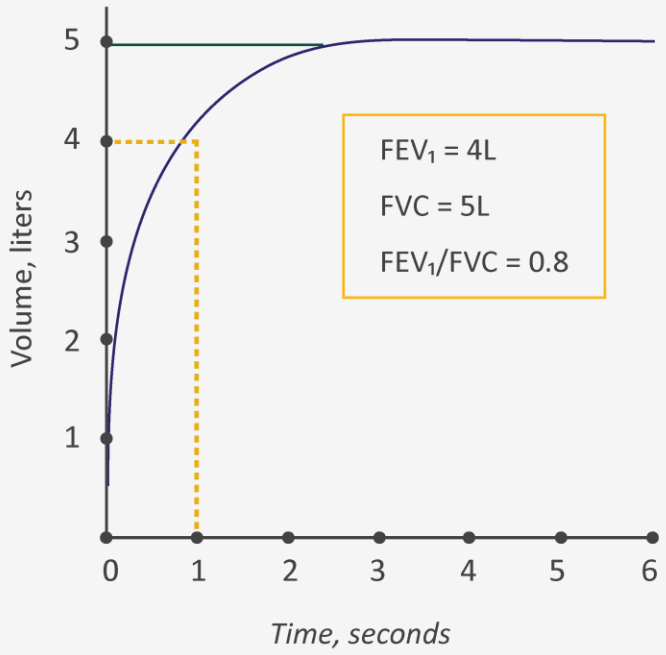


FIGURE 2.2A

SPIROMETRY - OBSTRUCTIVE DISEASE

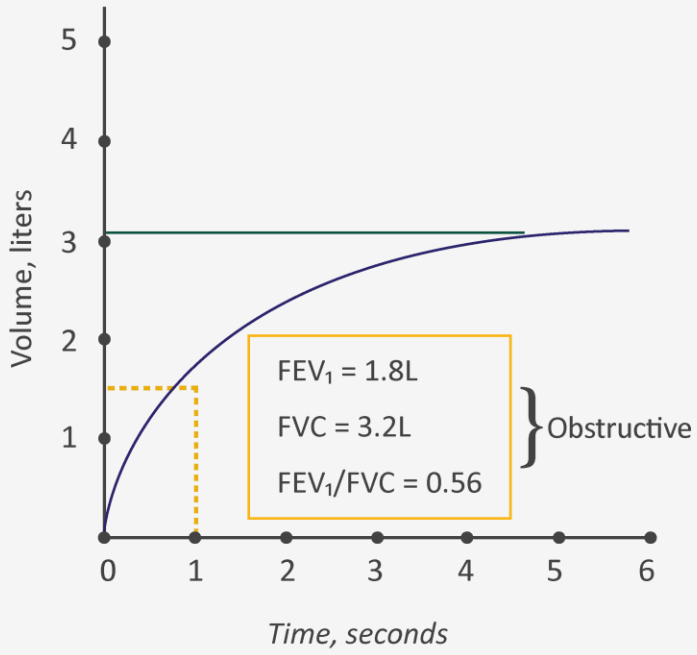


FIGURE 2.2B

FVC =

FEV_1 =

CAPTURE questionnaire for identifying patients with undiagnosed COPD

Instructions: For each question, place an X in the box with the answer that is best for you. There are no right or wrong answers, only answers which are right for you.

Please answer each question	No	Yes
1. Have you ever lived or worked in a place with dirty or polluted air, smoke, second-hand smoke, or dust?	☐	☐
2. Does your breathing change with seasons, weather, or air quality?	☐	☐
3. Does your breathing make it difficult to do things such as carry heavy loads, shovel dirt or snow, jog, play tennis, or swim?	☐	☐
4. Compared to others your age, do you tire easily?	☐	☐

Please answer the question	0	1	2 or more
5. In the past 12 months, how many times did you miss work, school, or other activities due to a cold, bronchitis, or pneumonia?	☐	☐	☐

The final score is a summation of patient responses to each of the five items, yielding a questionnaire score ranging from 0 ("no" to all 5 questions) to 6 ("yes" to all questions and at least two respiratory events during the past year).

CAPTURE: **C**hronic obstructive pulmonary disease **A**ssessment in **P**rimary care **T**o identify **U**ndiagnosed **R**espiratory disease and **E**xacerbation risk; COPD: chronic obstructive pulmonary disease.

- There is no evidence to support the benefit of population-based screening of asymptomatic adults for COPD, but (GOLD) does advocate active case finding among at risk individuals.

- The CAPTURE questionnaire can help identify patients who would likely benefit from therapy for COPD and would be candidates for diagnostic evaluation

Diagnosis of chronic obstructive pulmonary disease: PFTs

Spirometry

Spirometry is the essential test to confirm the diagnosis and establish the staging of COPD. If values are abnormal, a post-bronchodilator test may be indicated. Airflow limitation that is irreversible or only partially reversible with bronchodilator is suggestive of COPD rather than asthma. A postbronchodilator ratio of FEV1/FVC <0.7 or <LLN of FEV1/FVC is used to establish the presence of airflow limitation.

In the presence of a low FEV1/FVC, the percent of predicted FEV1 is used to determine the severity of airflow limitation.

- GOLD 1: Mild (FEV1 ≥80% predicted)
- GOLD 2: Moderate (50% predicted ≤FEV1 <80% predicted)
- GOLD 3: Severe (30% predicted ≤FEV1 <50% predicted)
- GOLD 4: Very severe (FEV1 <30% predicted)

Lung volumes

Body plethysmography to assess lung volumes is not necessary except in patients with a low FVC on spirometry (<80% predicted) or when concomitant interstitial lung disease is suspected.

Diffusing capacity for carbon monoxide

Measurement of DLCO can help establish the presence of emphysema, but is not necessary for the routine diagnosis of COPD.

Chest radiography

Only diagnostic of severe emphysema, but is frequently obtained to exclude other lung diseases.

Arterial blood gases (ABGs)

Mild and moderate airflow obstruction - ABG usually not needed.

Moderately severe airflow obstruction - ABG is optional, but oximetry should be done. ABGs are obtained if oxygen saturation is <92%.

Severe and very severe airflow obstruction - ABGs are essential to assess for hypercapnia.

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)

TABLE 2.2

Conditions associated with central airway obstruction

Malignant	Nonmalignant
Primary endoluminal malignancy	**Benign airway tumors**
Bronchogenic	Squamous cell papilloma
Adenoid cystic	Hamartoma
Mucoepidermoid	**Lymphadenopathy**
Carcinoid	Sarcoidosis
Plasmacytoma	Infectious (ie, tuberculosis)
Metastatic carcinoma to the airway	**Vascular**
Bronchogenic	Vascular ring
Renal cell	Vascular aneurysm
Breast	**Cartilage**
Thyroid	Relapsing polychondritis
Colon	**Granulation tissue**
Sarcoma	Endotracheal tubes
Melanoma	Tracheostomy tubes
Laryngeal and nasopharyngeal carcinoma	Airway stents
Esophageal carcinoma	Foreign bodies
Mediastinal tumors	Surgical anastomosis (eg, post resection or transplant)
Thymic carcinoma	Granulomatosis with polyangiitis (Wegener's)
Thyroid carcinoma	Rhinoscleroma (klebsiella infection)
Germ cell tumors (eg, teratoma)	**Pseudotumor**
Lymphadenopathy	Endobronchial pseudotumor
Associated with any of the above malignancies	**Hyperdynamic**
Lymphoma	Tracheomalacia
	Bronchomalacia
	Webs
	Idiopathic progressive subglottic stenosis
	Tuberculosis
	Sarcoidosis
	Other
	Goiter
	Mucus plug
	Vocal cord paralysis
	Airway hematoma
	Burn/smoke injury
	Epiglottitis
	Blood clot
	Amyloid

Differential diagnosis of COPD

Diagnosis	Suggestive features*
COPD	Onset in mid-life; onset in early adulthood should prompt suspicion for alpha-1 antitrypsin deficiency
	Symptoms slowly progressive
	Long smoking history, although can occur in nonsmokers
	Dyspnea during exercise
	Largely irreversible airflow limitation
Asthma	Onset early in life (often childhood)
	Symptoms vary from day to day
	Symptoms at night/early morning
	Allergy, rhinitis, and/or eczema also present
	Family history of asthma
	Largely reversible airflow limitation
Central airway obstruction (eg, bronchogenic or metastatic cancer, lymphadenopathy, scarring from endotracheal tube)	Monophonic wheeze or stridor
	Variable inspiratory or fixed slowing on flow volume loop
	Chest radiograph often normal
	Airway narrowing on three dimensional reconstruction of HRCT scan
Heart failure	Fine basilar crackles on auscultation
	Chest radiograph shows dilated heart, pulmonary edema
	Pulmonary function tests typically indicate volume restriction, but airflow limitation can sometimes be seen

Bronchiectasis	Large volumes of purulent sputum
	Commonly associated with recurrent or persistent bacterial infection
	Coarse crackles on auscultation, clubbing of digits
	Chest radiograph/HRCT shows bronchial dilation, bronchial wall thickening
Tuberculosis	Onset all ages
	Chest radiograph shows upper lung zone scarring and/or calcified granulomata
	Positive PPD or IGRA
	High local prevalence of tuberculosis
Obliterative bronchiolitis	Onset in younger age, nonsmokers
	May have history of rheumatoid arthritis or fume exposure
	HRCT on expiration shows hypodense areas, mosaic pattern
Diffuse panbronchiolitis	Most patients are male and nonsmokers
	Highest prevalence in East Asia
	Almost all have chronic sinusitis
	Chest radiograph and HRCT show diffuse small centrilobular nodular opacities and hyperinflation

HRCT: high resolution computed tomography; PPD: purified protein derivative; IGRA: interferon gamma release assay.
* These features tend to be characteristic of the respective diseases, but do not occur in every case. 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 elderly patients.

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.	☐

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	1	**X**	3	4	5	**I am very sad**	**SCORE**
I never cough	1	2	3	4	5	I cough all the time	
I have no phlegm (mucus) in my chest at all	1	2	3	4	5	My chest is completely full of phlegm (mucus)	
My chest does not feel tight at all	1	2	3	4	5	My chest feels very tight	
When I walk up a hill or one flight of stairs I am not breathless	1	2	3	4	5	When I walk up a hill or one flight of stairs I am very breathless	
I am not limited doing any activities at home	1	2	3	4	5	I am very limited doing activities at home	
I am confident leaving my home despite my lung condition	1	2	3	4	5	I am not at all confident leaving my home because of my lung condition	
I sleep soundly	1	2	3	4	5	I don‘t sleep soundly because of my lung condition	
I have lots of energy	1	2	3	4	5	I have no energy at all	

TOTAL SCORE: 40

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

FIGURE 2.3

THE REFINED ABCD ASSESSMENT TOOL

Spirometrically Confirmed Diagnosis

Post-bronchodilator $FEV_1/FVC < 0.7$

Assessment of airflow limitation

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

Assessment of symptoms/risk of exacerbations

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

FIGURE 2.4

Multidimensional assessment of COPD

GOLD "ABCD" grading: Assessment of symptoms and risk of exacerbations for initiation of COPD therapy

Assess exacerbation risk: Exacerbations/Hospitalizations	Assess symptoms	
	mMRC* 0 to 1; CAT <10¶	mMRC ≥2; CAT ≥10
0 or 1 exacerbations without hospitalization	A	B
≥2 exacerbations or ≥1 hospitalization	C	D

GOLD: Severity of airflow limitation (based on postbronchodilator FEV_1)

Stage	Severity	FEV_1 (percent predicted)
In patients with FEV_1/FVC <0.7:Δ		
GOLD 1	Mild	≥80
GOLD 2	Moderate	50 to 79
GOLD 3	Severe	30 to 49
GOLD 4	Very severe	<30

COPD: chronic obstructive pulmonary disease; GOLD: Global Initiative for Chronic Obstructive Lung Disease; mMRC: modified Medical Research Council dyspnea scale; CAT: COPD Assessment Test; FEV_1: forced expiratory volume in one second; FVC: forced vital capacity.

* mMRC dyspnea scale: Refer to UpToDate graphic.

¶ http://www.catestonline.org.

Δ The GOLD guidelines (www.goldcopd.org) prefer the threshold of <0.7 to the alternative of the fifth percentile lower limit of normal (LLN) for FEV_1/FVC.

Prevention, maintenance therapy.

In patients with severe resting chronic hypoxemia, long-term oxygen therapy improves survival.

In patients with severe chronic hypercapnia and a history of hospitalization for acute respiratory failure, long-term non-invasive ventilation may decrease mortality and prevent re-hospitalization.

Pulmonary Rehabilitation.

1. Smoking cessation
2. Inhaler technique
3. Influenza vaccine
4. Pneumococcal vaccine>=65 years.

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.*

TABLE 3.1

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.

TABLE 4.2

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)**.

TABLE 4.3

PRESCRIPTION OF SUPPLEMENTAL OXYGEN TO COPD PATIENTS

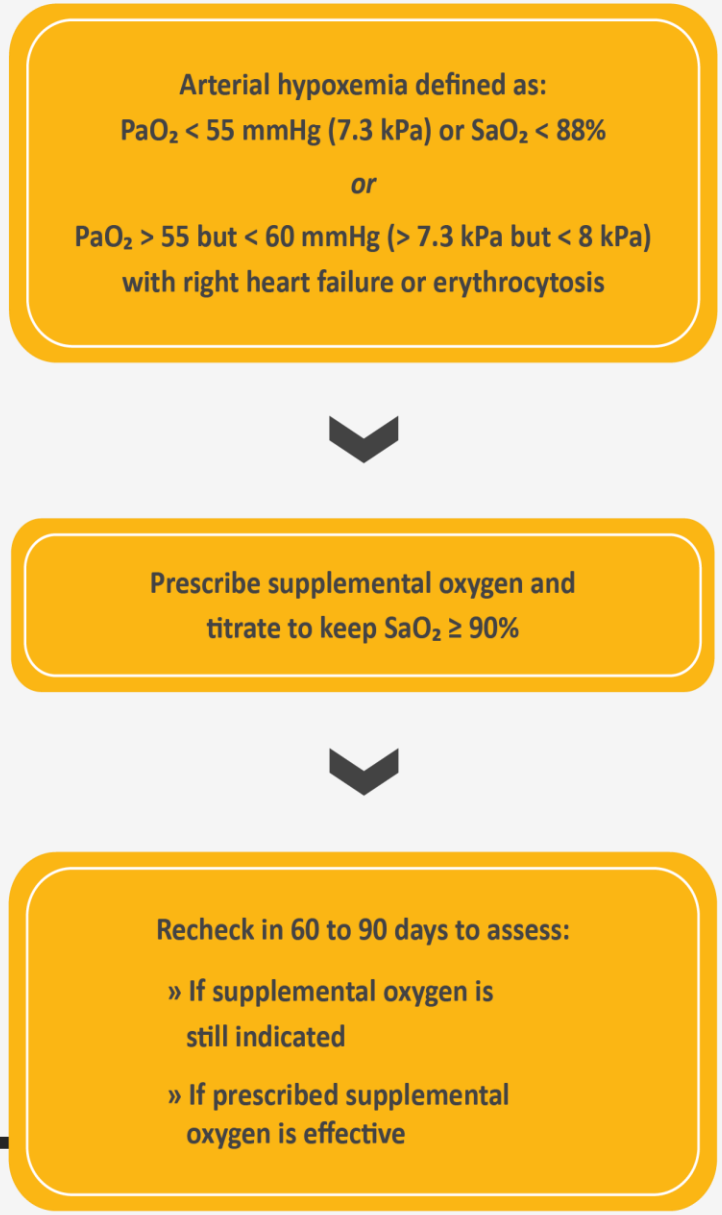
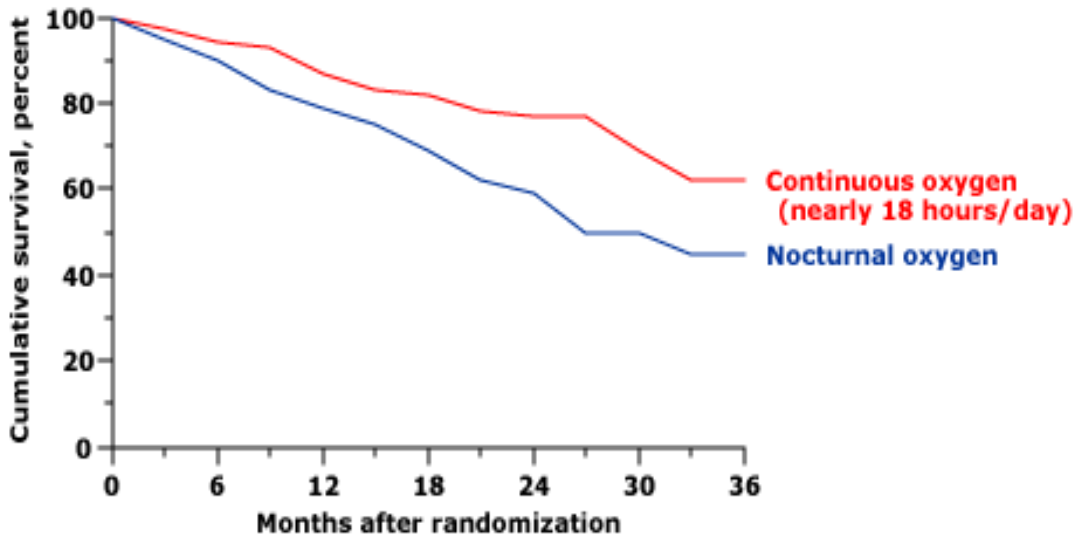
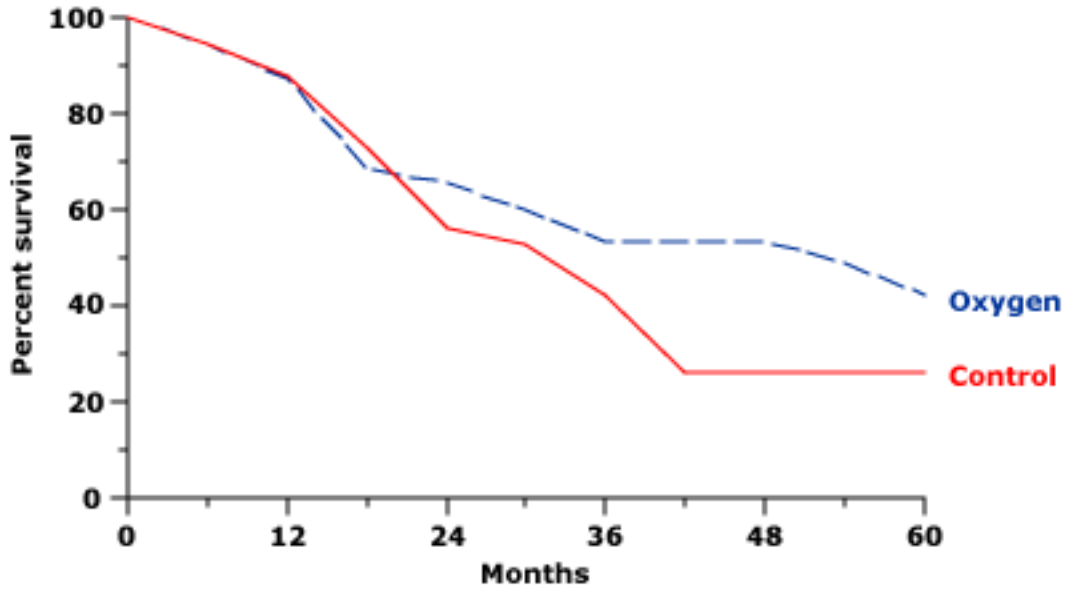


FIGURE 4.5

Survival benefit of continuous long-term oxygen therapy in COPD



Survival benefit of long-term oxygen therapy in COPD



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)**.

TABLE 3.10

VACCINATION FOR STABLE COPD

- Influenza vaccination reduces serious illness and death in COPD patients **(EvidenceB)**.
- 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)**.

TABLE 3.2

MANAGEMENT OF COPD

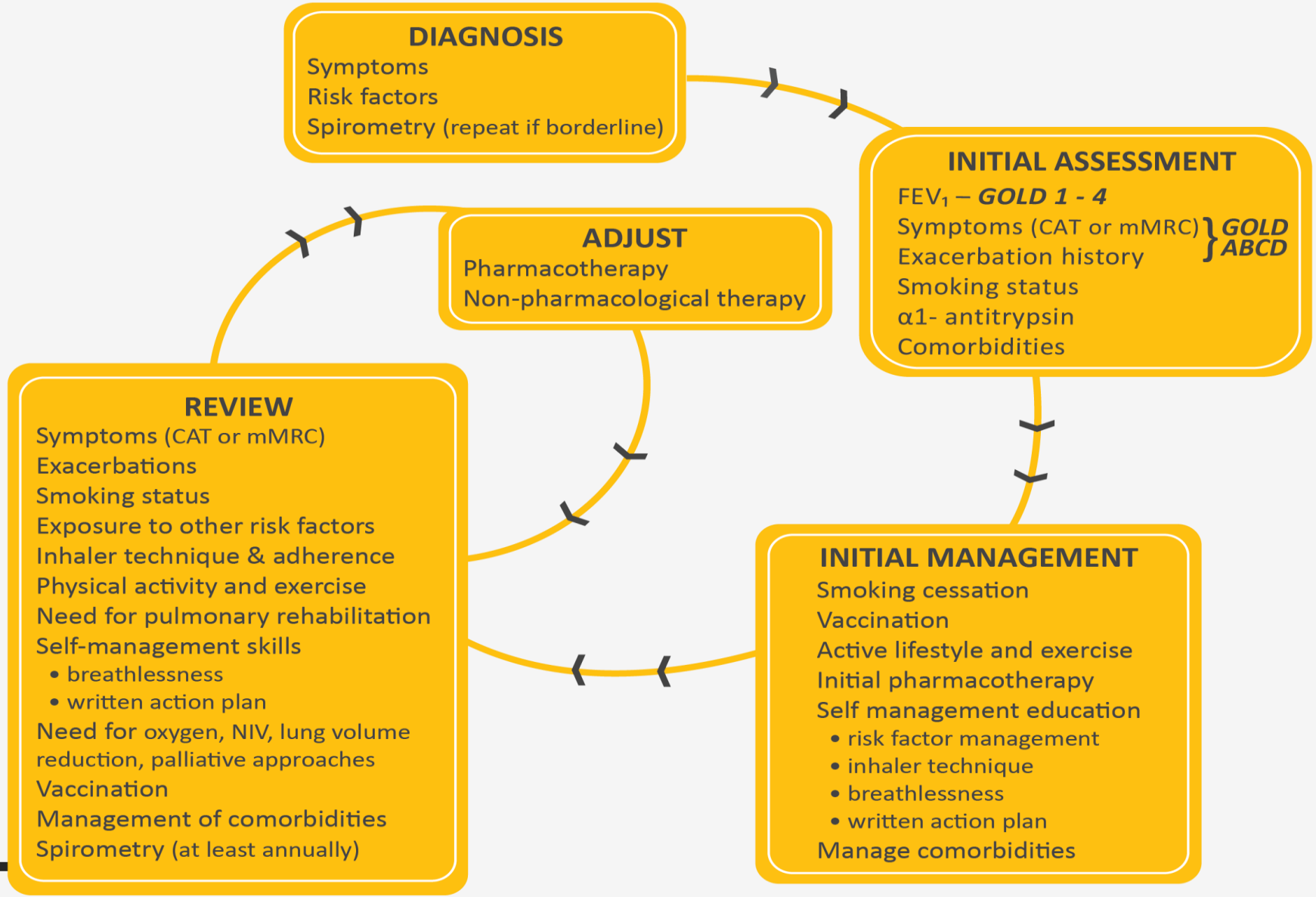


FIGURE 4.1

Management of stable COPD: Initiation of therapy based on the GOLD ABCD assessment of symptoms and risk of exacerbation*

Groups	Symptoms	Risk	Suggested treatment
All			▪ Avoidance of risk factor(s), such as smoking ▪ Annual influenza vaccination ▪ Pneumococcal vaccination ▪ Regular physical activity ▪ Regular review/correction of inhaler technique ▪ Long-term oxygen therapy if chronic hypoxemia ▪ Pulmonary rehabilitation
A	**Less symptomatic** Mild or infrequent symptoms (ie, breathless with strenuous exercise or when hurrying on level ground or walking up a slight hill)¶ or CAT <10Δ	**Low risk** 0 or 1 exacerbations in the past year without associated hospitalization	Short-acting bronchodilator (SABA, SAMA, or combination of SABA-SAMA), as needed.
B	**More symptomatic** Moderate to severe symptoms (ie, patient has to walk more slowly than others of same age due to breathlessness, has to stop to catch breath when walking on level ground at own pace, or has more severe breathlessness)¶ or CAT ≥10Δ	**Low risk** 0 or 1 exacerbations in the past year without associated hospitalization	Regular treatment with a long-acting bronchodilator, either LAMA or LABA, based on patient preference. Short-acting bronchodilator (usually SABA) for symptom relief as needed.
C	**Less symptomatic** Mild or infrequent symptoms (ie, breathless with strenuous exercise or when hurrying on level ground or walking up a slight hill)¶ or CAT <10Δ	**High risk** ≥2 exacerbations per year with one or more leading to hospitalization	Regular treatment with a LAMA; SABA available for symptom relief as needed.
D	**More symptomatic** Moderate to severe symptoms (ie, patient has to walk slower than others of same age due to breathlessness, has to stop to catch breath when walking on level ground at own pace, or has more severe breathlessness)¶ or CAT ≥10Δ	**High risk** ≥2 exacerbations per year with one or more leading to hospitalization	Regular treatment with LAMA **or**, if severe breathlessness (eg, CAT >20), combination LABA plus LAMA. Combination glucocorticoid-LABA inhaler may be preferred, if features of asthma/COPD overlap. SABA available for symptom relief as needed.

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
B, C and D	Smoking Cessation (can include pharmacologic treatment) Pulmonary Rehabilitation	Physical Activity	Flu Vaccination Pneumococcal Vaccination

*Can include pharmacologic treatment.

TABLE 4.8

KEY POINTS FOR THE USE OF NON-PHARMACOLOGICAL TREATMENTS

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)**.

NUTRITION

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

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)**.

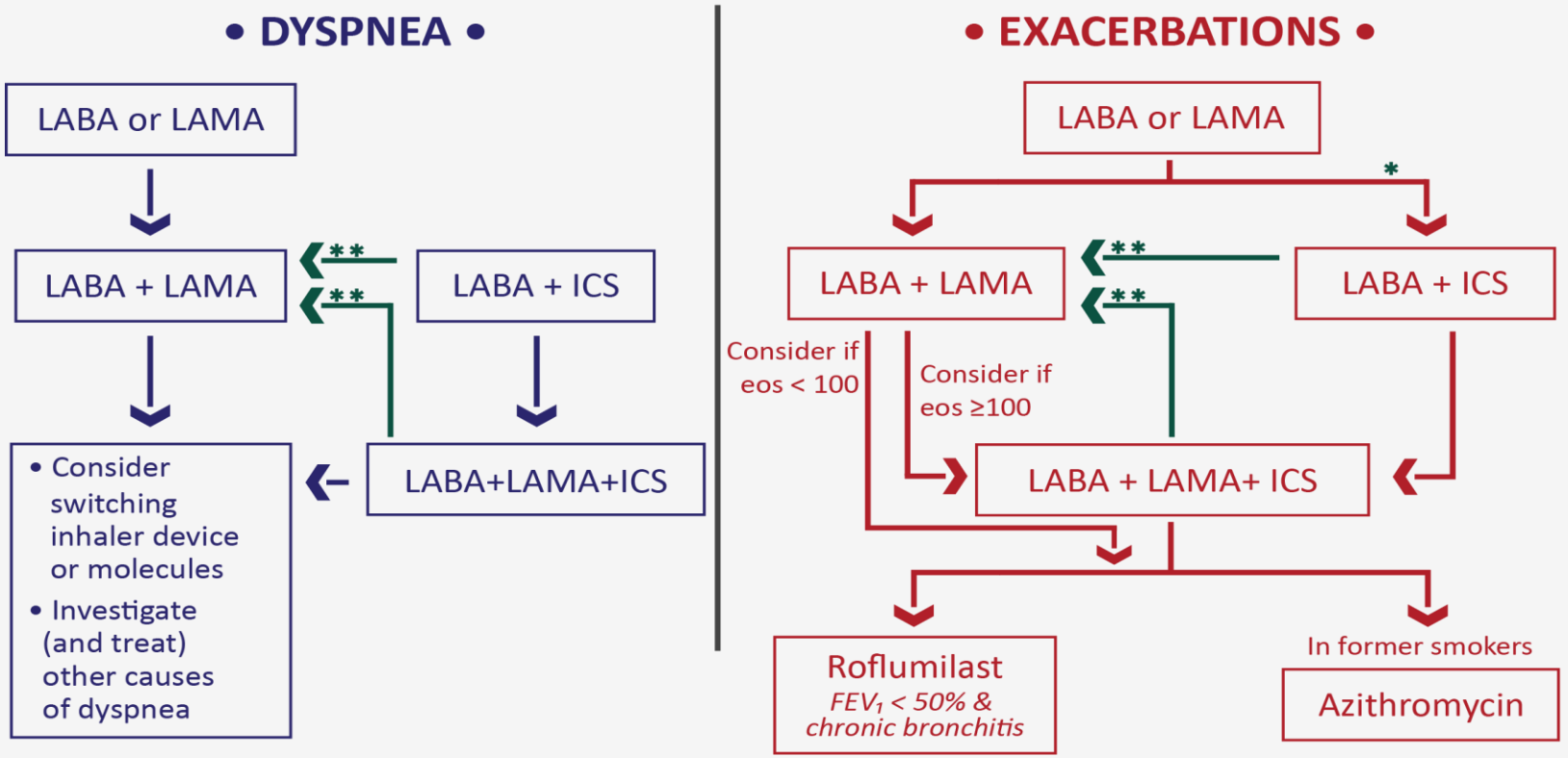
INTEGRATED CARE PROGRAMS

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

TABLE 3.8

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



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*

FIGURE 4.4

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

• 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

TABLE 4.9

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)**.

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)**.

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)**.

TABLE 3.9

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)**.

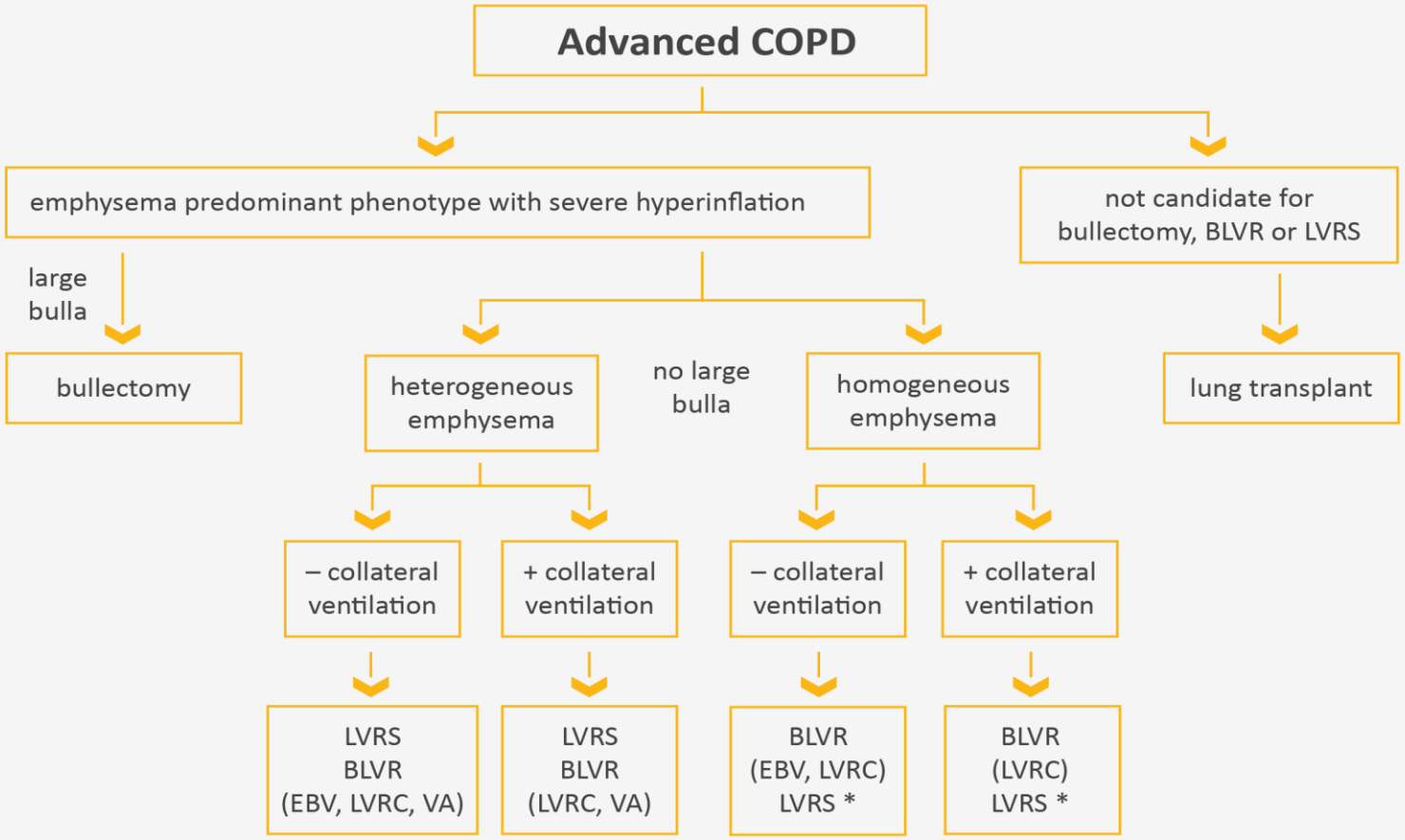
BRONCHOSCOPIC INTERVENTIONS

- 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)**.

TABLE 3.11

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

FIGURE 4.6

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 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	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
PHOSPHODIESTERASE-4 INHIBITORS					
Roflumilast			pill		24 hours
MUCOLYTIC AGENTS					
Erdosteine			pill		12 hours
Carbocysteine†			pill		
N-acetylcysteine†			pill		

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)**.

TABLE 3.4

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 ICS/LAMA/LABA improves lung function, symptoms and health status and reduces exacerbations compared to ICS/LABA, LABA/LAMA or LAMA monotherapy **(Evidence A)**.

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.

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)**.

TABLE 3.7

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 100-300 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.

FIGURE 3.1

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

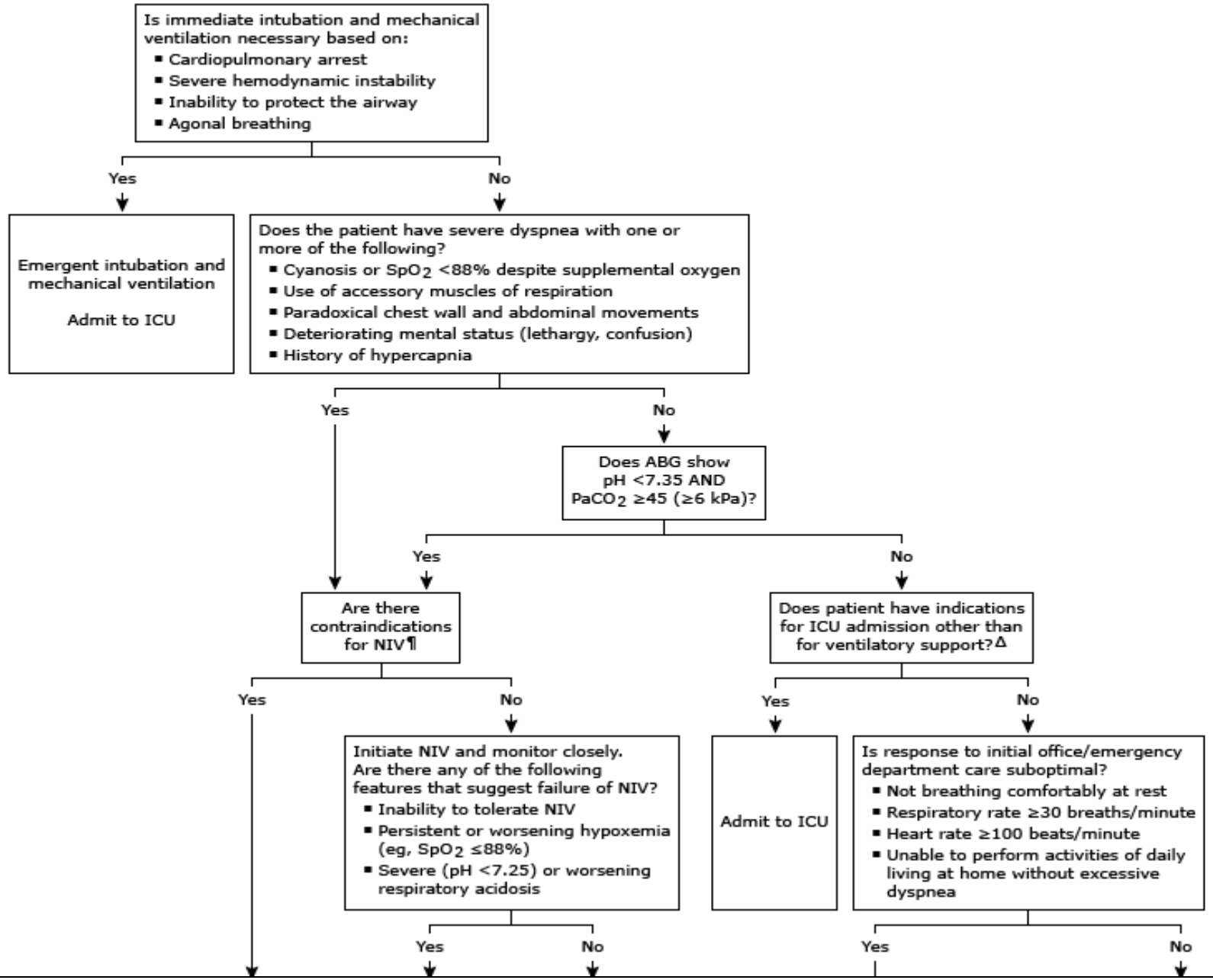
- Electrocardiogram and cardiac ultrasound
- Cardiac enzymes

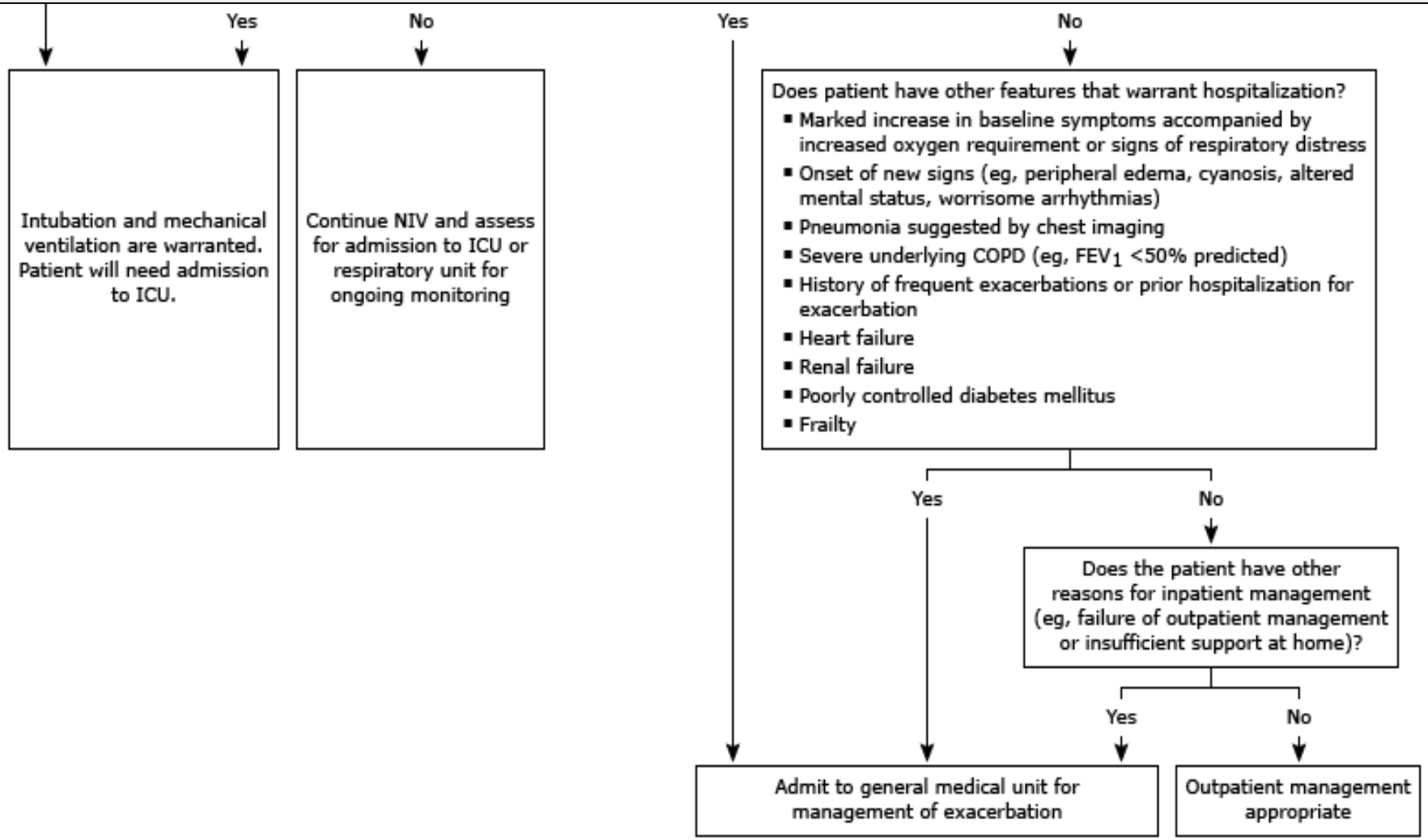
CARDIAC ARRHYTHMIAS – ATRIAL FIBRILLATION/FLUTTER

- Electrocardiogram

TABLE 5.1

Algorithm for triage of patients presenting with COPD exacerbation*

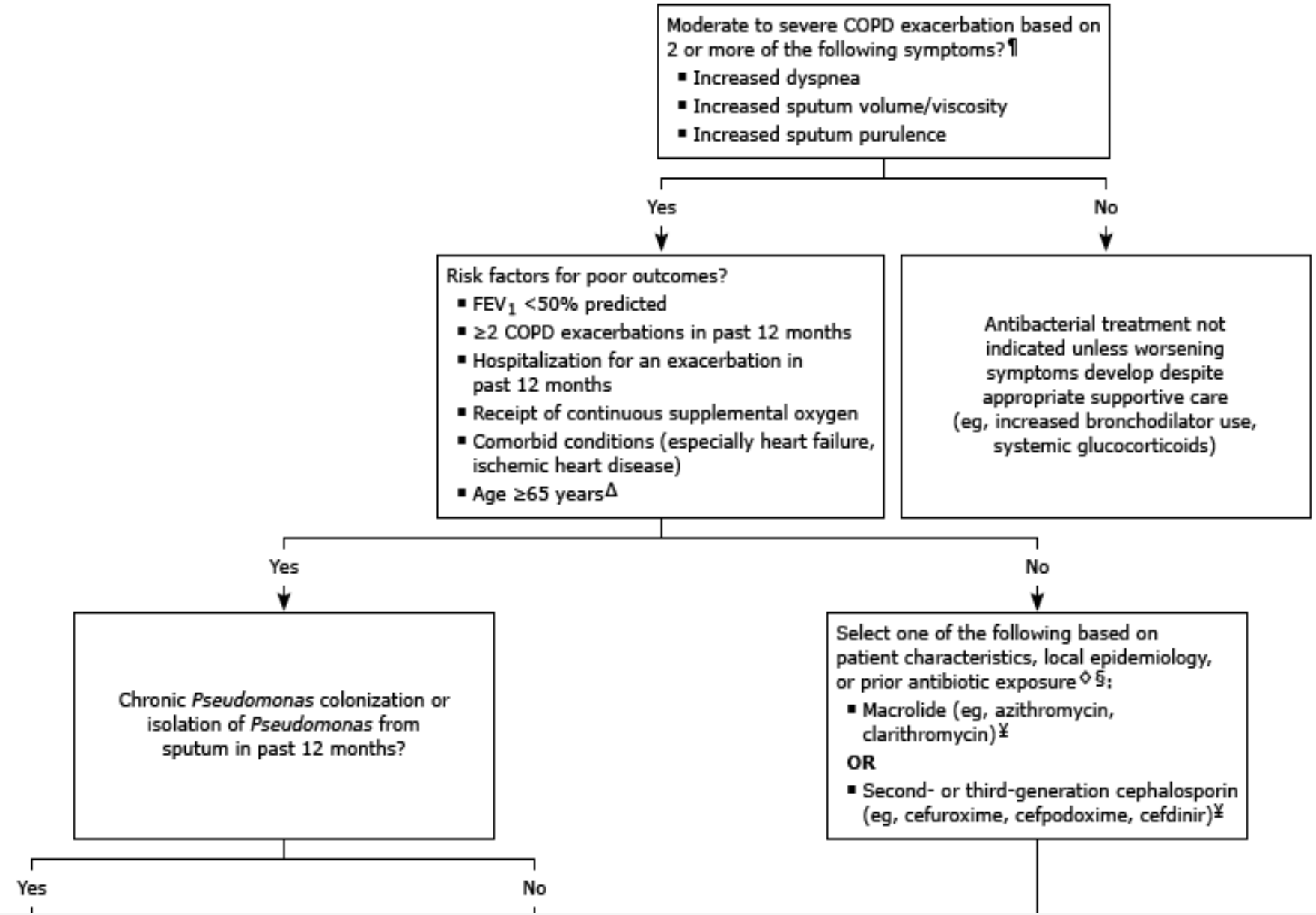


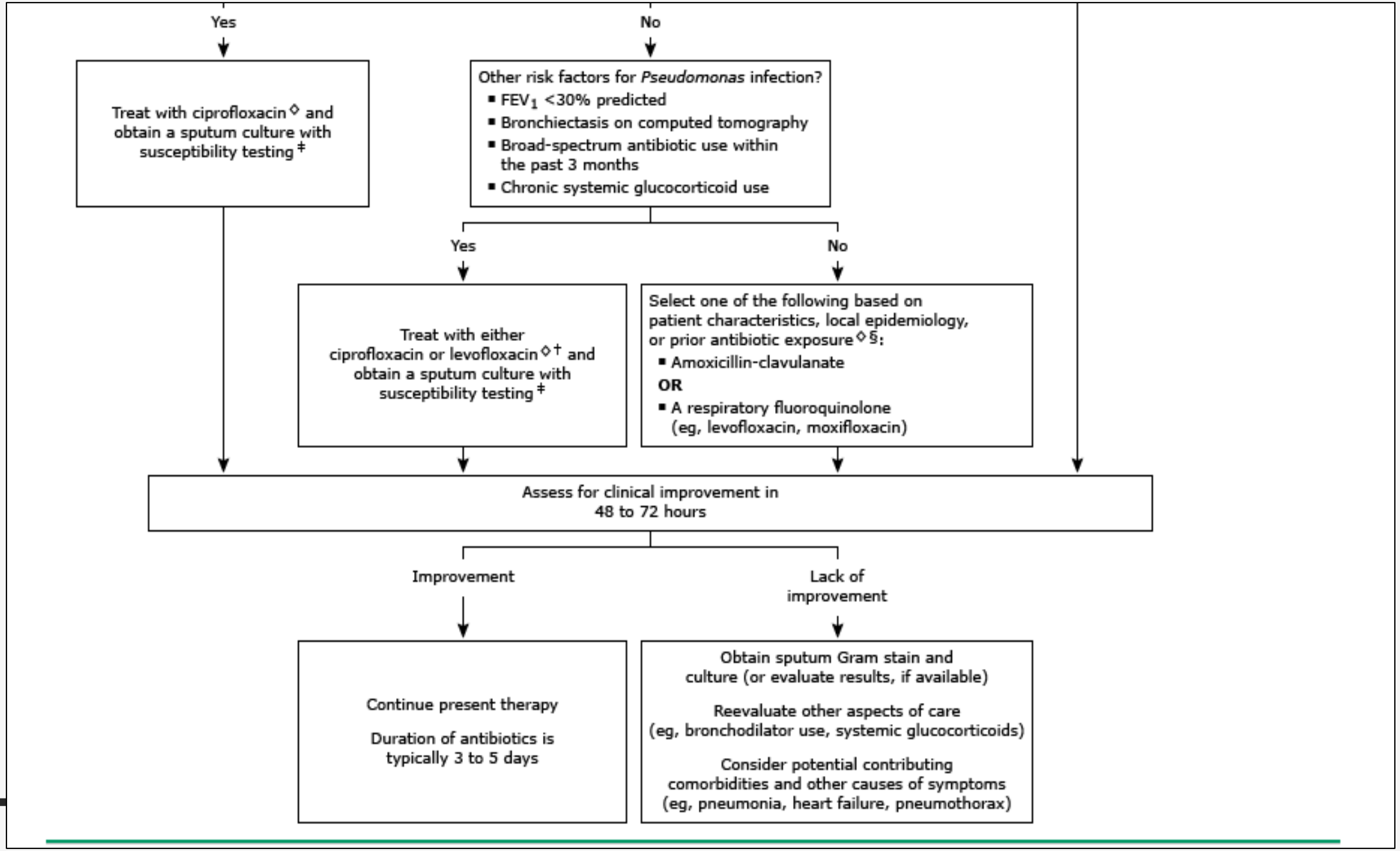


COPD: chronic obstructive pulmonary disease; ICU: intensive care unit; SpO_2: pulse oxygen saturation; NIV: noninvasive positive pressure ventilation via nasal mask, face mask, or nasal plugs; ABG: arterial blood gas; $PaCO_2$: arterial tension of carbon dioxide; FEV_1: forced expiratory volume in one second; PaO_2: arterial oxygen tension.

* This algorithm can be used to support decisions regarding hospitalization and ventilatory support, but clinical judgment should be employed in all cases. Prior goals of care and advance care planning discussions should be reviewed to ensure that decisions, particularly about invasive ventilation, are consistent with the patient's values and preferences.

Our approach to empiric antibacterial treatment of COPD exacerbations in outpatients*




Yes
No
Treat with ciprofloxacin ◇ and obtain a sputum culture with susceptibility testing ‡
Other risk factors for *Pseudomonas* infection?
▪ FEV_1 <30% predicted
▪ Bronchiectasis on computed tomography
▪ Broad-spectrum antibiotic use within the past 3 months
▪ Chronic systemic glucocorticoid use
Yes
No
Treat with either ciprofloxacin or levofloxacin ◇ † and obtain a sputum culture with susceptibility testing ‡
Select one of the following based on patient characteristics, local epidemiology, or prior antibiotic exposure ◇ §:
▪ Amoxicillin-clavulanate
OR
▪ A respiratory fluoroquinolone (eg, levofloxacin, moxifloxacin)
Assess for clinical improvement in 48 to 72 hours
Improvement
Lack of improvement
Continue present therapy
Duration of antibiotics is typically 3 to 5 days
Obtain sputum Gram stain and culture (or evaluate results, if available)
Reevaluate other aspects of care (eg, bronchodilator use, systemic glucocorticoids)
Consider potential contributing comorbidities and other causes of symptoms (eg, pneumonia, heart failure, pneumothorax)

Prompt and appropriate antibiotic use has been associated with improved clinical outcomes in patients with moderate to severe COPD exacerbations. Empiric regimens are designed to target the most likely pathogens (*Haemophilus influenzae*, *Moraxella catarrhalis*, and *Streptococcus pneumoniae*) and should be broadened to target drug-resistant pathogens and difficult-to-eradicate pathogens (eg, macrolide-resistant *S. pneumoniae*, nontypeable strains of *H. influenzae*) in those at risk for poor outcomes. Coverage for *Pseudomonas* is indicated in patients with risk factors for infection with this pathogen. All patients should be evaluated for clinical response in approximately 72 hours, and sputum Gram stain and culture should be considered for those who fail to response to empiric treatment. Modifications to this approach may be needed for patients with a history of colonization or infection with drug-resistant pathogens (including *Pseudomonas*) or when a specific pathogen is suspected.

COPD: chronic obstructive pulmonary disease; FEV_1: forced expiratory volume in 1 second.

* Antiviral therapy for influenza is also indicated for exacerbations triggered by influenza infection.

¶ Suspicion for other cardiopulmonary disorders (heart failure, pneumothorax) and more severe infections (eg, pneumonia) should be absent for the diagnosis of an acute COPD exacerbation.

Δ Age alone is not a strict risk factor but should be considered as additive to other risk factors.

◇ Selection among antibiotic choices is based on local microbial sensitivity patterns, patient comorbidities, prior infecting organisms, potential adverse events and drug interactions, and also provider and patient preferences. In particularly, modifications to this regimen may be needed for patients with a history of drug-resistant *Pseudomonas* based on severity of illness, degree of suspicion for *Pseudomonas*, and prior susceptibility profiles of pseudomonal isolates.

§ If recent antibiotic exposure (eg, within the past 3 months), select an antibiotic from a different class than the most recent agent used.

¥ Trimethoprim-sulfamethoxazole is a reasonable alternative when macrolides and cephalosporins cannot be used due to allergy, potential adverse effects, or availability.

‡ Because fluoroquinolone resistance is prevalent among *Pseudomonas aeruginosa* strains, we obtain a sputum Gram stain and culture with susceptibility testing for these patients to help guide subsequent management decisions. For most other outpatients, obtaining a sputum culture is not needed unless the patient fails to respond to empiric treatment.

† Levofloxacin has lesser activity against *Pseudomonas* than ciprofloxacin but has greater activity against *S. pneumoniae* and *M. catarrhalis* is thus a reasonable alternative to ciprofloxacin for patients who are at increased risk of *Pseudomonas* infection but lack microbiologic evidence of *Pseudomonas* infection or colonization.

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.

TABLE 5.2

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.

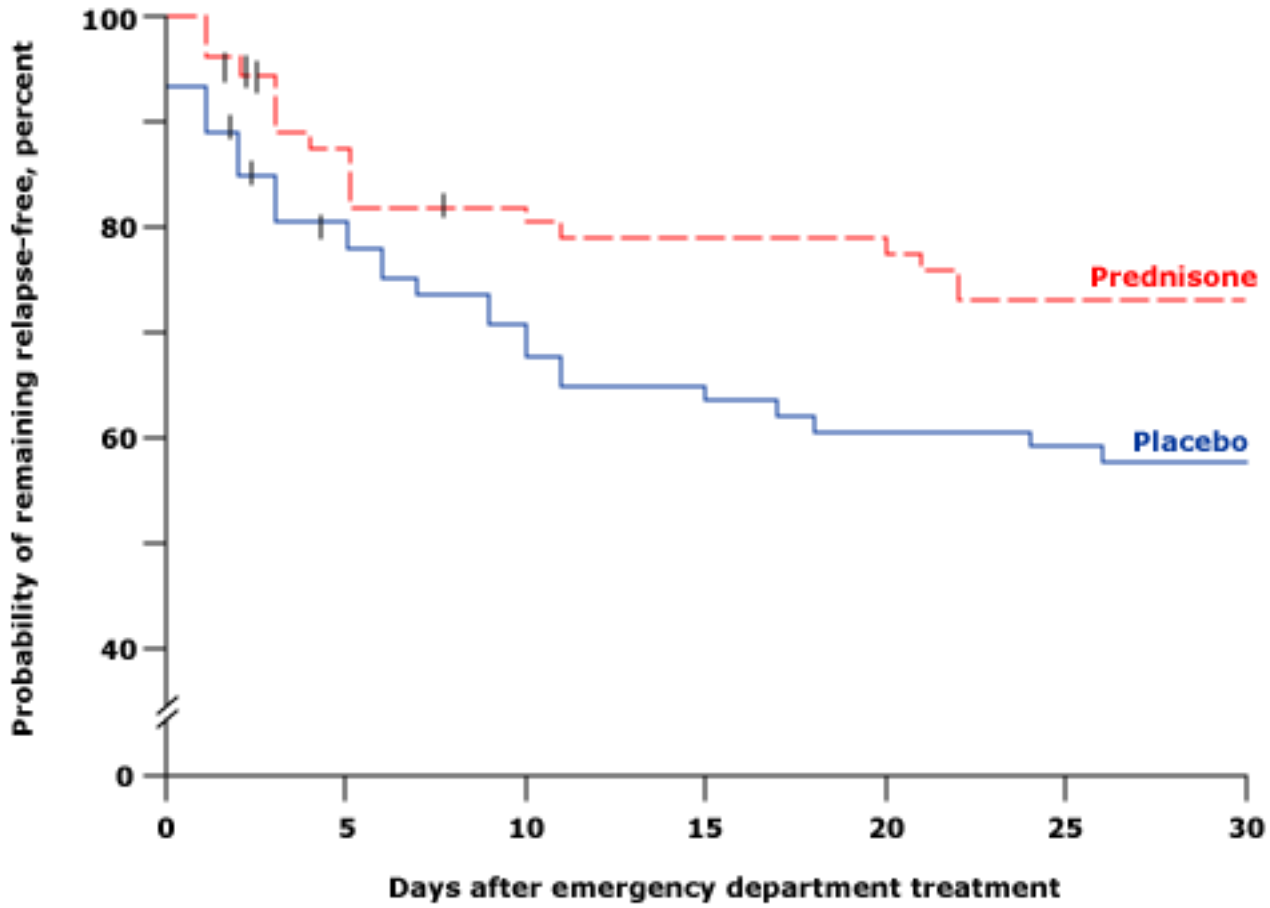
TABLE 5.3

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)**.

TABLE 5.4

Kaplan-Meier estimates of the probability of remaining relapse-free at 30 days for outpatients with acute exacerbations of COPD treated with prednisone or placebo



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.

TABLE 5.5

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.

TABLE 5.6

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.

TABLE 5.7

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 activities of daily living.
- 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.

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
Various others	Smoking Cessation Rehabilitation Lung Volume Reduction Vitamin D

TABLE 5.9

Asthma versus COPD

- Asthma: never treat with bronchodilators alone (risk of death, hospitalization, severe exacerbations)
- COPD: start treatment with LABA and/or LAMA without ICS
- Patients with diagnoses of both asthma and COPD are more likely to die or be hospitalized if treated with LABA vs ICS-LABA
- High dose ICS may be needed for severe asthma, but should not be used in COPD (risk of pneumonia)

CLINICAL PHENOTYPE - ADULTS WITH CHRONIC RESPIRATORY SYMPTOMS (dyspnea, cough, chest tightness, wheeze)

HIGHLY LIKELY TO BE ASTHMA
if several of the following features
TREAT AS ASTHMA

HISTORY

- Symptoms vary over time and in intensity
  - Triggers may include laughter, exercise, allergens, seasonal
  - Onset before age 40 years
  - Symptoms improve spontaneously or with bronchodilators (minutes) or ICS (days to weeks)
- Current asthma diagnosis, or asthma diagnosis in childhood

LUNG FUNCTION

- Variable expiratory airflow limitation
- Persistent airflow limitation may be present

FEATURES OF BOTH ASTHMA + COPD
TREAT AS ASTHMA

HISTORY

- Symptoms intermittent or episodic
  - May have started before or after age 40
- May have a history of smoking and/or other toxic exposures, or history of low birth weight or respiratory illness such as tuberculosis
- Any of asthma features at left (e.g. common triggers; symptoms improve spontaneously or with bronchodilators or ICS; current asthma diagnosis or asthma diagnosis in childhood)

LUNG FUNCTION

- Persistent expiratory airflow limitation
- With or without bronchodilator reversibility

LIKELY TO BE COPD
if several of the following features
TREAT AS COPD

HISTORY

- Dyspnea persistent (most days)
  - Onset after age 40 years
  - Limitation of physical activity
  - May have been preceded by cough/sputum
  - Bronchodilator provides only limited relief
- History of smoking and/or other toxic exposure, or history of low birth weight or respiratory illness such as tuberculosis
- No past or current diagnosis of asthma

LUNG FUNCTION

- Persistent expiratory airflow limitation
- With or without bronchodilator reversibility

INITIAL PHARMACOLOGICAL TREATMENT (as well as treating comorbidities and risk factors. See Box 3-5A)

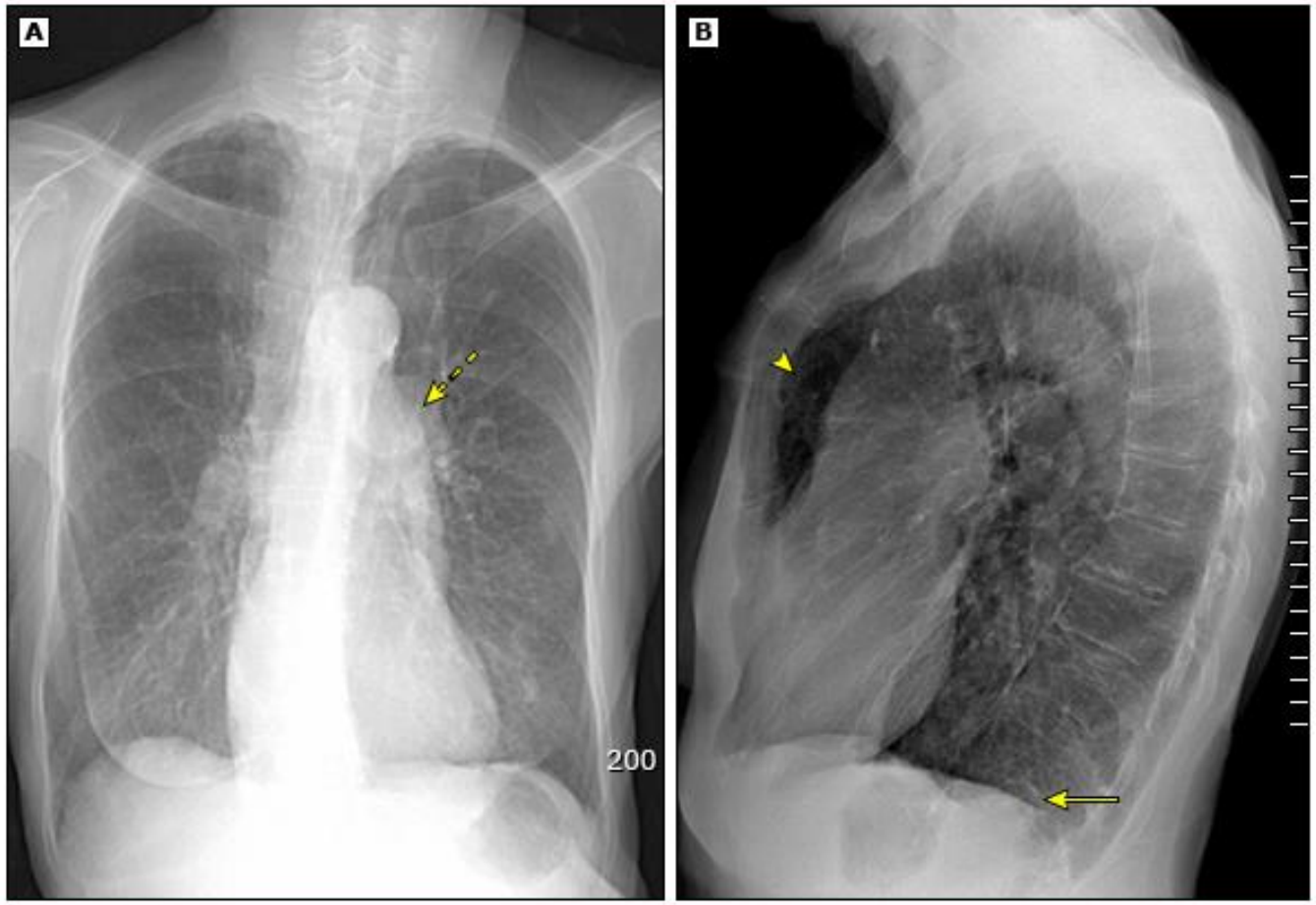
- **ICS-CONTAINING TREATMENT IS ESSENTIAL to reduce risk of severe exacerbations and death.** See Box 3-5A
  - As-needed low dose ICS-formoterol may be used as reliever. See Box 3-5A
- **DO NOT GIVE LABA and/or LAMA without ICS**
- Avoid maintenance OCS

- **ICS-CONTAINING TREATMENT IS ESSENTIAL to reduce risk of severe exacerbations and death.** See Box 3-5A
- Add-on LABA and/or LAMA usually also needed
- Additional COPD treatments as per GOLD
- **DO NOT GIVE LABA and/or LAMA without ICS**
- Avoid maintenance OCS

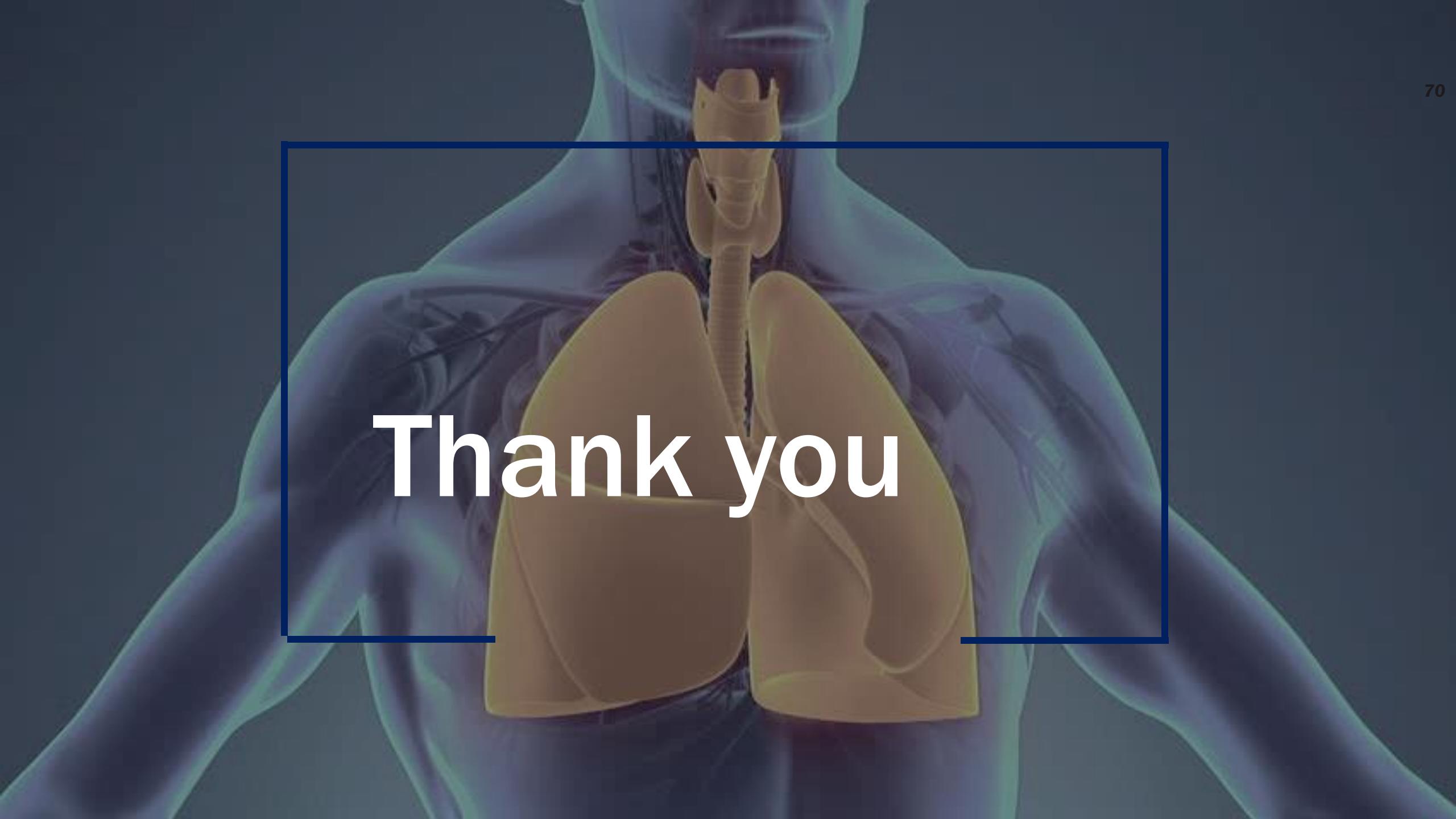
- **TREAT AS COPD (see GOLD report)**
  - Initially LAMA and/or LABA
  - Add ICS as per GOLD for patients with hospitalizations, ≥2 exacerbations/year requiring OCS, or blood eosinophils ≥300/µl
- Avoid high dose ICS, avoid maintenance OCS
- Reliever containing ICS is not recommended

REVIEW PATIENT AFTER 2-3 MONTHS. REFER FOR EXPERT ADVICE IF DIAGNOSTIC UNCERTAINTY OR INADEQUATE RESPONSE

Chest x-ray emphysema



The posteroanterior (A) and lateral (B) chest x-rays of a 71-year-old female with emphysema show increased lung volumes with flattened hemidiaphragms on the lateral examination (arrow) and increase in the retrosternal space (arrowhead). The normal retrosternal airspace is less than 2.5 cm. A prominent pulmonary artery on the posteroanterior view (dashed arrow) reflects secondary pulmonary hypertension.



Thank you