

# Chronic Obstructive Pulmonary Disease (COPD)

## Diagnosis and Treatment Guideline

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**Guidelines** are systematically developed statements to assist patients and providers in choosing appropriate health care for specific clinical conditions. While guidelines are useful aids to assist providers in determining appropriate practices for many patients with specific clinical problems or prevention issues, guidelines are not meant to replace the clinical judgment of the individual provider or establish a standard of care. The recommendations contained in the guidelines may not be appropriate for use in all circumstances. The inclusion of a recommendation in a guideline does not imply coverage. A decision to adopt any particular recommendation must be made by the provider in light of the circumstances presented by the individual patient.

## Background

Chronic obstructive pulmonary disease (COPD), the fourth leading cause of death in the United States, is a major public health problem that is both preventable and treatable. COPD is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and lungs to noxious particles or gases. Exacerbations and comorbidities contribute to overall severity in individual patients.

Recommendations for the diagnosis and treatment of patients with **concurrent COPD and asthma** are excluded from this guideline because these patients should be managed in consultation with a pulmonologist.

## Risk Factors

- Cigarette smoking is the cause of 80% of COPD cases.
- Passive exposure to cigarette smoke
- Indoor air pollution, especially from burning biomass fuels in confined spaces
- Occupational dusts and chemicals
- Genetic factors, including deficiency of the antiprotease enzyme alpha<sub>1</sub>-antitrypsin

## Prevention

Smoking cessation is the most effective way to reduce the risk of developing COPD or to slow its progression. See the KPWA Nicotine Cessation Guideline for recommendations on helping patients quit smoking.

## Screening

Screening for COPD is not recommended in asymptomatic adults.

## Diagnosis and Assessment

COPD should be considered in any patient who has persistent dyspnea that worsens with exercise, chronic cough, wheezes, or sputum production, and/or a history of exposure to risk factors for the disease such as smoking and occupational or environmental exposures.

### Diagnosis of COPD using spirometry

Spirometry with post-bronchodilator testing is required in order to confirm a clinical suspicion of COPD and to rule out asthma, as well as to assess COPD severity. (See [Spirometry Practice Resources](#) on the KPWA Clinical Library.)

Table 1. Diagnosing COPD and determining COPD severity based on post-bronchodilator spirometry		
Interpretation Stage	Results Post-bronchodilator FEV <sub>1</sub> /FVC ratio	Results FEV <sub>1</sub> % of predicted
Normal or at-risk <sup>1</sup>	Higher than 0.70	80% or higher
GOLD stage 1 = mild	0.70 or lower	80% or higher
GOLD stage 2 = moderate	0.70 or lower	50–79.9%
GOLD stage 3 = severe	0.70 or lower	30–49.9%
GOLD stage 4 = very severe	0.70 or lower	Lower than 30%

<sup>1</sup> Patients who may be at risk of developing COPD include those who smoke or are exposed to pollutants; have cough, sputum, or dyspnea; and/or have a family history of respiratory disease.

## Methods for assessing symptoms

### COPD Assessment Test (CAT)

The CAT is a validated tool for assessing the impact on COPD on wellbeing and daily life. There are eight questions on a 1- to 5-point scale, which focus on cough, sputum, breathlessness, chest tightness, confidence, activity, sleep, and energy levels. Scores of 10 or higher indicate that COPD symptoms are not well controlled. See Appendix 1, p. 19.

### Modified Medical Research Council (mMRC) dyspnea scale

Use of the MRC dyspnea scale is recommended to assess the severity of dyspnea related to activity level. Scores of 2 or higher indicate poor control of COPD symptoms. See Appendix 2, p. 20.

## Additional tests

Table 2. Additional tests to consider		
Test	Population	Reason
EKG	All patients	Assess for heart disease
CBC	All patients	Assess for anemia or polycythemia
Oximetry, at rest and after exercise	Patients with severe or very severe COPD (FEV <sub>1</sub> lower than 50% of predicted)	Determine the degree of hypoxemia and the potential need for long-term oxygen therapy
Arterial blood gases	Patients with: <ul style="list-style-type: none"><li>Very severe COPD (FEV<sub>1</sub> lower than 30% of predicted)</li><li>Signs of heart failure</li><li>Signs of polycythemia (Hct &gt; 55%)</li></ul>	Assess for hypercapnia (respiratory failure)
Cardiopulmonary exercise testing	Patients with disproportionate degree of dyspnea for FEV <sub>1</sub>	Quantify impairment and/or disability and help select patients able to safely undergo lung volume reduction surgery
Alpha <sub>1</sub> -antitrypsin	Patients with: <ul style="list-style-type: none"><li>Early onset COPD</li><li>Little or no history of smoking</li><li>Family history of COPD</li><li>Predominance of basilar emphysema</li></ul>	Assess for alpha <sub>1</sub> -antitrypsin deficiency
Pulmonary function tests	Patients with suspected emphysema	Assess for emphysema by monitoring for reduced carbon monoxide diffusion capacity
Echocardiogram	Patients with dyspnea	Assess for cardiac dysfunction or disease, or pulmonary hypertension
Chest X-ray	Patients with dyspnea	Rule out other diagnoses (e.g., TB, lung cancer, congestive heart failure)
Sputum culture and TB smear and culture	Patients with persistently purulent sputum or during recurrent infectious exacerbations	Rule out TB or other infections

## Treatment Goals

The goals of managing COPD are to prevent disease progression, reduce the frequency and severity of exacerbations, and improve health status, exercise tolerance, daily activities, and quality of life.

## Non-Pharmacologic Treatment Options

### Lifestyle modifications

Counsel all patients with COPD to quit smoking and to avoid secondhand smoke. Smoking cessation is the most important factor in slowing the progression of the disease.

Patients should also be encouraged to reduce exposure to dusts, fumes, gases, and to indoor and outdoor air pollutants.

In patients with weight loss or malnutrition, consider dietary supplementation with exercise and nutritional consultation.

## Pulmonary rehabilitation

Many patients with COPD may benefit from pulmonary rehabilitation. Pulmonary rehabilitation (PR) is a multidisciplinary program designed to improve both the physical and psychological impacts of chronic respiratory disease. Studies show that PR helps to improve dyspnea, health status and exercise tolerance—especially in patients with moderate to severe COPD—and reduces the risk of re-hospitalization after an exacerbation. Program components include exercise training, disease education, nutritional support, and behavior change strategies that promote long-term adherence to healthy habits. The optimal benefits are obtained from programs lasting for 6-8 weeks with supervised exercise training at least twice per week.

Consider PR for:

- Symptomatic patients with FEV1 < 50% predicted
- Patients recently hospitalized for an acute exacerbation
- Patients with more than one exacerbation per year

Note: PR is not suitable for patients who are unable to walk, have unstable angina, or have recently had an MI.

Referral for PR:

Currently, PR is not offered at KPWA, but patients can be referred to community-based programs using the “miscellaneous external referral” and writing “Pulmonary Rehab” in the notes.

## Self-management/Living Well workshops

### Self-management

Self-management interventions are strategies that allow patients to become active participants in their own care. The process involves working collaboratively with patients and family members to set personal goals and developing a series of steps that can help them achieve those goals. For example, patients may be offered a short course of oral corticosteroids and oral antibiotics to keep at home as part of the exacerbation plan if they had an exacerbation within the last year and are still at risk, and if they understand and are confident about how to use the medication. Studies have indicated that self-management interventions like these can improve patients' health status and decrease hospitalizations and emergency department visits for COPD exacerbations.

### Living Well

Encourage your patients to sign up for a Living Well in-person or Better Choices, Better Health online workshop. Both workshops are evidence-based options to help your patients build skills and confidence in managing their health conditions. These workshops improve outcomes of patients with ongoing health conditions, such as COPD as participants experience fewer symptoms, get more exercise, have better medication adherence, are more active partners in their health care, and spend less time in the hospital. In-person workshops sessions meet for 2½ hours, once a week for 6 weeks. at KPWA medical offices throughout the year. Better Choices, Better Health web-based workshops follow the same 6-week structure, but there's no set time to participate. Participants log on for workshop activities 2 to 3 times each week at a time that's most convenient for them. Both programs are offered to patients free of charge.

Use [.avslivingwellwithchronicconditions](#) to refer patients to the program.

## Pharmacologic Treatment Options

Pharmacologic management of COPD should be **individualized** according to presence of symptoms and exacerbation \* risk:

- **No symptoms:** mMRC  $\leq 1$  or CAT  $< 10$
- **Symptoms present:** mMRC  $> 2$  or CAT  $\geq 10$
- **Low exacerbation risk:** 0 or 1 moderate exacerbations (not leading to hospital admission) in the past year
- **High exacerbation risk:**  $\geq 2$  moderate exacerbations or  $\geq 1$  exacerbations leading to hospital admission in the past year

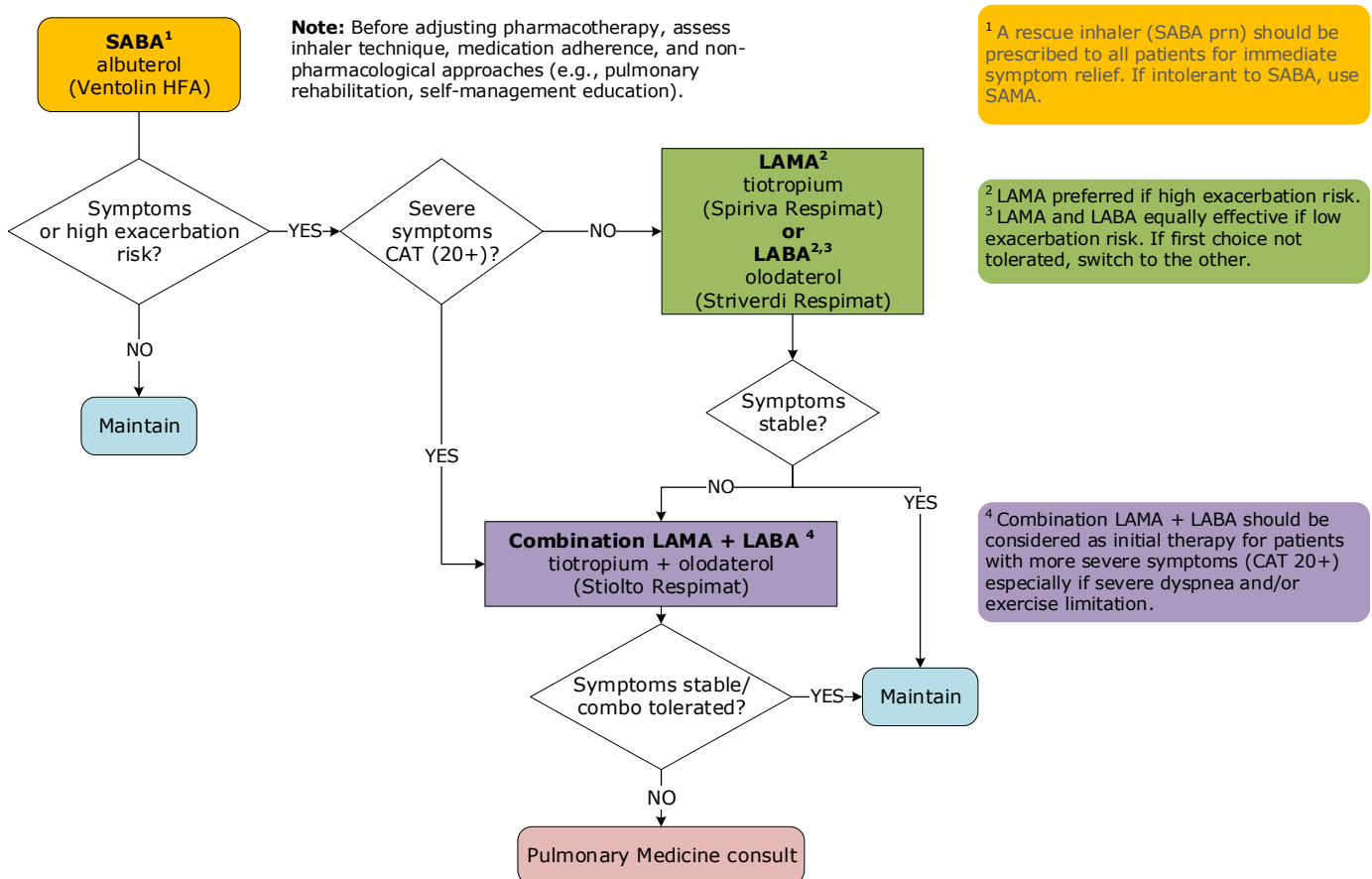
\* See COPD Exacerbations, p. 9.

### Bronchodilator therapy for patients with confirmed, stable COPD

Regular treatment with inhaled corticosteroids (ICS) increases the risk of pneumonia, especially in those with severe disease (*high-quality evidence*).

**Note:** For patients who are currently on ICS therapy:

- If patient also has asthma, do not discontinue ICS therapy and consider referral to Pulmonology.
- Otherwise, consider de-escalation of ICS or switch therapy (to LAMA, LABA, or LAMA/LABA) if presented with any of the following conditions:
  - Recent pneumonia or history of pneumonia while on ICS therapy
  - Adverse effects (oral candidiasis, hoarse voice, or skin bruising)
  - Lack of response to ICS treatment
  - Original indication for ICS was inappropriate (ICS initially used to treat symptoms in the absence of a history of exacerbations)



**Note:** Before adjusting pharmacotherapy, assess inhaler technique, medication adherence, and non-pharmacological approaches (e.g., pulmonary rehabilitation, self-management education).

<sup>1</sup> A rescue inhaler (SABA prn) should be prescribed to all patients for immediate symptom relief. If intolerant to SABA, use SAMA.

<sup>2</sup> LAMA preferred if high exacerbation risk.  
<sup>3</sup> LAMA and LABA equally effective if low exacerbation risk. If first choice not tolerated, switch to the other.

<sup>4</sup> Combination LAMA + LABA should be considered as initial therapy for patients with more severe symptoms (CAT 20+) especially if severe dyspnea and/or exercise limitation.

Table 3: Medication guide			
Category	Medications Unshaded = preferred	COPD dosing	Inhaler technique video links (YouTube)
<b>SABA</b>	<b>Ventolin HFA</b> <i>albuterol</i>	2 puffs every 4–6 hours as needed	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
	<b>albuterol HFA (ProAir)</b> <i>albuterol</i>	2 puffs every 4–6 hours as needed	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
	<b>levalbuterol HFA (Xopenex)</b> <i>levalbuterol</i>	2 puffs every 4–6 hours as needed	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
If patient is intolerant to SABA, use:			
<b>SAMA</b>	<b>Atrovent HFA</b> <i>ipratropium</i>	2 puffs 4 times daily	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
<b>LAMA</b>	<b>Spiriva Respimat 2.5 mcg</b> <i>tiotropium</i>	2 puffs (5 mcg) once daily	<a href="#">Respimat</a>
	<b>Spiriva Handihaler</b> <i>tiotropium</i>	Inhale contents of 1 capsule once daily	<a href="#">Handihaler</a>
	<b>Incruse Ellipta</b> <i>umeclidinium</i>	1 puff once daily	<a href="#">Ellipta</a>
<b>LABA</b>	<b>Striverdi Respimat</b> <i>olodaterol</i>	2 puffs once daily	<a href="#">Respimat</a>
	<b>Serevent Diskus</b> <i>salmeterol</i>	1 puff BID	<a href="#">Diskus</a>
<b>LAMA/LABA</b>	<b>Stiolto Respimat</b> <i>tiotropium/olodaterol</i>	2 puffs once daily	<a href="#">Respimat</a>
	<b>Anoro Ellipta</b> <i>Umeclidinium/vilanterol</i>	1 puff once daily	<a href="#">Ellipta</a>
<b>ICS/LABA</b> (with Pulmonary consult)	<b>Advair Diskus 250/50 mcg</b> <i>fluticasone/salmeterol</i>	1 puff BID	<a href="#">Diskus</a>
	<b>Advair HFA 230/21 mcg</b> <i>fluticasone/salmeterol</i>	1 puff BID	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
	<b>Dulera 200/5 mcg</b> <i>mometasone/formoterol</i>	1 puff BID	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
	<b>Symbicort 160/4.5 mcg</b> <i>budesonide/formoterol</i>	2 puffs BID	<a href="#">MDI with spacer</a> <a href="#">MDI without spacer</a>
<b>SABA:</b> Short-acting beta-2 agonist; <b>SAMA:</b> short-acting muscarinic antagonist; <b>LAMA:</b> long-acting muscarinic antagonist; <b>LABA:</b> long-acting beta-2 agonist; <b>ICS:</b> inhaled corticosteroid			

## Oxygen therapy

Oxygen therapy is considered a pharmacologic treatment with risks and benefits.

Use of supplemental oxygen therapy for a minimum of 15 hours per day increases survival and improves the quality of life of patients with COPD who are severely hypoxic at rest. However, oxygen does not provide any benefit for patients with stable COPD and mild or no hypoxemia at rest. Due to the risk of potentially life-threatening facial and upper airway burns, patients who continue to smoke should not be prescribed oxygen.

Severe hypoxia is defined as:

- SaO<sub>2</sub> 88% or lower and/or PaO<sub>2</sub> 55 mm Hg or lower while patient is *clinically stable*.
- SaO<sub>2</sub> 89% or lower and/or PaO<sub>2</sub> 56–59 mm Hg and signs of tissue hypoxia (hematocrit higher than 55%, pulmonary hypertension, or cor pulmonale), angina or dependent edema suggestive of heart failure.
- SaO<sub>2</sub> 88% or lower or PaO<sub>2</sub> 55 mg Hg *upon exertion*.

Before prescribing supplemental oxygen therapy, the following items must be documented:

- An oxygen assessment was done within 30 days prior to initial home oxygen order.
- COPD symptoms have progressed over time and persist despite maximum medication therapy.
- O<sub>2</sub> saturation must improve while the patient is on oxygen—at rest and/or upon exertion.

Use the **Home Oxygen SmartSet** to ensure that all [coverage criteria](#) have been met, and to specify O<sub>2</sub> delivery method (cannula, mask, portable O<sub>2</sub>) and flow rate during exertion, at rest, and during sleep. Use of the Home Oxygen SmartSet also ensures that oxygen is added to the medication list. Patient information can be added to the After Visit Summary using **.avsoxygentherapy**.

Follow-up visits are needed:

- Within 30 days of oxygen initiation in order to assess the continued need for home oxygen and adjust O<sub>2</sub> flow as needed.
- 3 months after oxygen initiation.
- Annually thereafter.

### Pharmacologic treatments that are *not* recommended

Table 4. Pharmacologic options that are <i>not</i> recommended for COPD	
Medication class	Examples
ICS (as monotherapy)	Ciclesonide
Opioids as cough suppressant	Codeine
Antitussives	Guaifenesin, benzonatate
Endothelin-receptor antagonists	Ambrisentan
Leukotriene-receptor antagonists	Montelukast
Methylxanthines	Theophylline
Phosphodiesterase-4 inhibitors	Roflumilast
Phosphodiesterase-5 inhibitors	Sildenafil



## COPD Exacerbations

### COPD exacerbation

A sustained acute-onset worsening of the person's symptoms from their usual stable state, which goes beyond their normal day-to-day variations, and leads to a change in medication. Diagnosis relies exclusively on clinical presentation of **three cardinal symptoms**:

- Increased dyspnea
- Increased sputum volume
- Increased sputum purulence

Note: If increased purulence of sputum is one of the symptoms, then only one other cardinal symptom (increased dyspnea or increased sputum volume) is required for an exacerbation diagnosis.

A chest X-ray is recommended for all patients with a suspected COPD exacerbation.

### Severity of exacerbation

- Mild exacerbation: the person has an increased need for short acting bronchodilators, which they can manage in their own normal environment.
- Moderate exacerbation: the person has a sustained worsening of respiratory status that requires treatment with systemic corticosteroids and/or antibiotics.
- Severe exacerbation: the person experiences a rapid deterioration in respiratory status that requires hospitalization.

If hypoxia is a new symptom for your patient, consider the exacerbation as severe and triage as above.

## Treatment of COPD exacerbations

### All COPD exacerbations: bronchodilator therapy and oral corticosteroids

Goals are to minimize the impact of the exacerbation and prevent subsequent exacerbations.

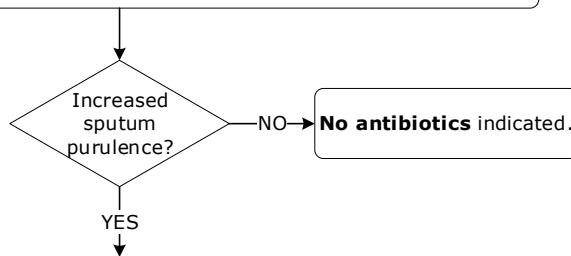
### Bronchodilators

- Increase dose and/or frequency of SABA (albuterol) with or without SAMA (ipratropium).
- Consider adding spacer if patient not already using.
- Review inhaler technique.

Albuterol HFA: One puff every hour x 2–3 doses, then every 2–4 hours based on patient's response.

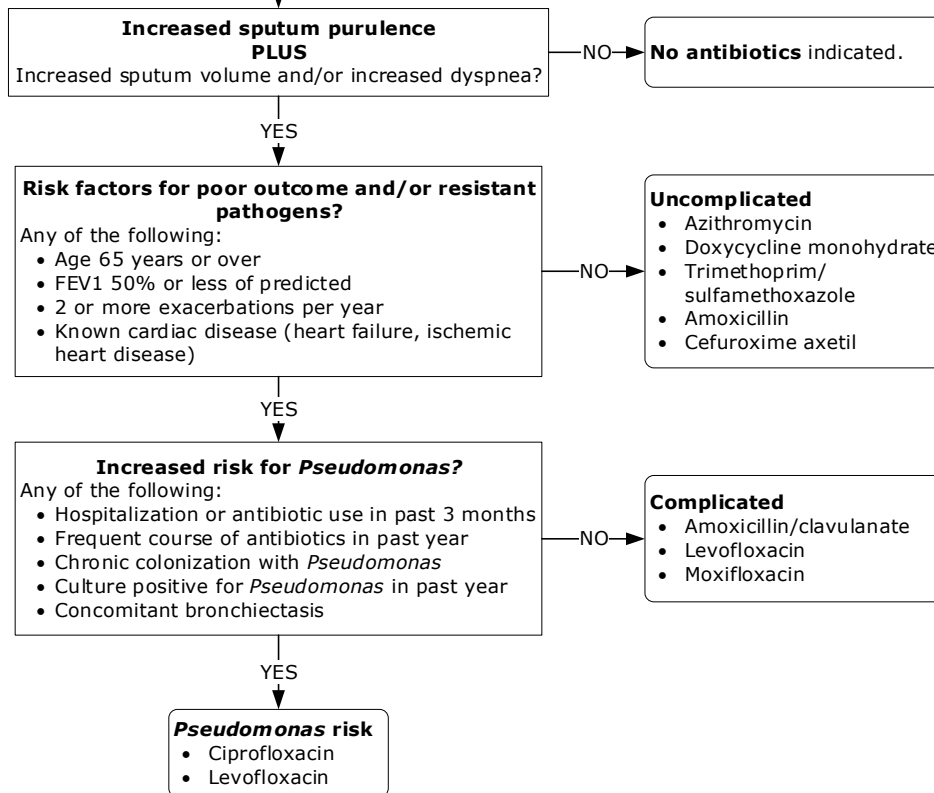
**Oral corticosteroids** can improve lung function (FEV1) and oxygenation, and shorten recovery time and duration of hospitalization.

Prednisone: 40 mg x 5 days.



### Antibiotic therapy if indicated

Antibiotic therapy can shorten recovery time, reduce the risk of early relapse and treatment failure, and shorten the duration of hospitalization. Antibiotic use should not exceed 7 days.



For antibiotic dosing, see Table 5 on the following page.

**Table 5. Antibiotic dosing for treatment of COPD exacerbations**

Antibiotic	Dosing	Duration	Risk Pathway
Amoxicillin	500 mg TID	5–7 days	Uncomplicated
Amoxicillin/clavulanate	875/125 mg BID	5–7 days	Complicated
Azithromycin	500 mg x 1 dose, then 250 mg daily x 4 days	5 days	Uncomplicated
Cefuroxime axetil	500 mg BID	5–7 days	Uncomplicated
Ciprofloxacin	500 mg BID	5–7 days	<i>Pseudomonas</i> risk
Doxycycline	100 mg BID	5–7 days	Uncomplicated
Levofloxacin	750 mg daily	5–7 days	Complicated <i>Pseudomonas</i> risk
Moxifloxacin	400 mg daily	5–7 days	Complicated
Trimethoprim/sulfamethoxazole (TMP/SMX)	800/160 mg BID	5–7 days	Uncomplicated

### Prophylactic antibiotics to prevent COPD exacerbations

Prophylactic antibiotic use should be considered for patients with COPD who meet the following criteria:

- Do not smoke, **and**
- Have optimized non-pharmacologic management and inhaled therapies, relevant vaccinations and (if appropriate) have been referred for pulmonary rehabilitation, **and**
- Continue to have 1 or more of the following, particularly if they have significant daily sputum production:
  - Frequent (typically 4 or more per year) exacerbations with sputum production
  - Prolonged exacerbations with sputum production
  - Exacerbations resulting in hospitalization

Before referral to or E-Consult with Pulmonology for prophylactic antibiotics, ensure the person has had:

- Sputum culture and sensitivity (including tuberculosis culture), to identify other possible causes of persistent or recurrent infection that may need specific treatment (for example, antibiotic-resistant organisms, atypical mycobacteria or *Pseudomonas aeruginosa*)
- Training in airway clearance techniques to optimize sputum clearance
- A CT scan of the thorax to rule out bronchiectasis and other lung pathologies

## Follow-up and Monitoring

To optimize treatment and prevent complications, periodic monitoring is advised.

For patients on medications, monitor symptoms at every visit. Repeat spirometry is recommended for those patients with a persistent change in symptoms or to assess response to a new treatment.

### Medication monitoring

<b>Eligible population</b>	<b>Tests</b>
Patients being treated with SABA	<ul style="list-style-type: none"><li>• Blood pressure</li><li>• Heart rate</li><li>• Tremor</li></ul>
Patients being treated with LABA	<ul style="list-style-type: none"><li>• Blood pressure</li><li>• Heart rate</li><li>• Tremor</li></ul>
Patients being treated with SAMA	<ul style="list-style-type: none"><li>• Heart rate</li></ul>
Patients being treated with LAMA	<ul style="list-style-type: none"><li>• Heart rate</li></ul>
Patients being treated with long-term prednisone	<ul style="list-style-type: none"><li>• Assess lipids 1 month after initiation, then every 6–12 months</li><li>• Blood sugar every 3 to 6 months for first year, then annually after</li><li>• Eye exam annually (due to increased risk of cataracts and glaucoma)</li><li>• Assess bone density (due to risk of osteoporosis)</li></ul>

### Risk of osteoporosis is increased by long-term oral or inhaled steroid use

- Patients with COPD are at elevated risk for osteoporosis. Patients with COPD prescribed steroids are at even higher risk.
- Fracture risk is best estimated using the FRAX calculator because there is an increased risk of fracture even before bone mineral density decreases.
- COPD patients taking **oral** steroids at doses above 5 mg/day of prednisolone or equivalent for 3–6 months (or a lifetime cumulative oral steroid dose of 1,000 mg or more) have a greater risk of fracture than patients without COPD taking the same oral steroids. Patients on high-dose steroids should be screened for osteoporosis at least once (outside of standard screening recommendations) and given prophylactic calcium and vitamin D.
- **Intermittent use** of oral steroids is not associated with an increased risk of fractures.
- Patients continuously taking **inhaled** steroids for a duration of 3–4 years are at increased risk of bone demineralization and/or fracture and should be screened for osteoporosis at least once (outside of standard screening recommendations).

### Recommended immunizations

Ensure immunizations are current:

- Annual influenza vaccination.
- Pneumococcal vaccination (PPSV23). Patients who received a vaccination before age 65 need one revaccination after age 65, with at least 5 years between doses. As of February 2020, PCV13 is no longer routinely recommended for immunocompetent adults aged  $\geq 65$  years (defined as adults without an immunocompromising condition, cerebrospinal fluid leak or cochlear implants). COPD is not generally associated with great-than-average risk of exposure to PCV13 serotypes. See February 7, 2020 [Morbidity and Mortality Weekly Report](#).

## Referral

Consider a referral to **Pulmonology** for patients who:

- Are at COPD Stage 3 or 4
- Have hypoxic COPD
- Are being considered for prophylactic antibiotics
- Have pulmonary hypertension
- Have hypercapnic COPD (buildup of carbon dioxide in the bloodstream)
- Have two or more exacerbations per year
- May be appropriate for alpha<sub>1</sub>-antitrypsin augmentation

Consider a transfer to **Urgent Care** for patients with:

- Failure to respond to home care
- Worsening hypoxemia or hypercapnia
- Onset of cyanosis, altered mental status or other new signs
- History of frequent exacerbations or recent hospitalization
- Hypoxic COPD

In addition, consider a referral to **Palliative Care** in patients with severe disease or refractory symptoms to discuss advanced care planning and complete documentation of Health Care DPOA and POLST. See the [Palliative Care home page](#) on Connection for more information about the available options.

## Evidence Summary

The COPD Diagnosis and Treatment Guideline was developed using an evidence-based process, including systematic literature search, critical appraisal, and evidence synthesis.

As part of our improvement process, the Kaiser Permanente Washington guideline team is working towards developing new clinical guidelines and updating the current guidelines every 2–3 years. To achieve this goal, we are adapting evidence-based recommendations from high-quality national and international external guidelines, if available and appropriate. The external guidelines should meet several quality standards to be considered for adaptation. They must: be developed by a multidisciplinary team with no or minimal conflicts of interest; be evidence-based; address a population that is reasonably similar to our population; and be transparent about the frequency of updates and the date the current version was completed.

In addition to identifying the recently published guidelines that meet the above standards, a literature search was conducted to identify studies relevant to the key questions that are not addressed by the external guidelines.

### External guidelines eligible for adapting

- 2019 Update of 2017 Global Initiative for Chronic Obstructive Lung Disease (GOLD): Global strategy for the diagnosis, management and prevention of COPD
- 2018 KP National Clinical Practice Guideline: Chronic Obstructive Pulmonary Disease
- 2018 NICE Guideline: Chronic Obstructive Pulmonary Disease in Over 16; Diagnosis and Management
- 2017 European Respiratory Society/American Thoracic Society (ERS/ATS) guidelines on the prevention and management of COPD exacerbations

### Key questions addressed in the KPWA guideline

1. **At what dose, potency, and duration of inhaled or oral steroid use should patients with COPD be referred for bone mineral density (BMD) testing?**

#### *Oral steroids (OS)*

- Studies suggest that oral corticosteroid treatment using more than 5 mg/day of prednisolone or equivalent for 3–6 months leads to a reduction in bone mineral density and a rapid increase in the risk of fracture during the treatment period. The risk of fracture was found to increase rapidly after the start of oral corticosteroid therapy (within 3–6 months) and decrease after stopping therapy (Vestergaard 2008).
- A recent population-based study (Oshagbemi 2018) suggests that COPD patients with intermittent use of high average daily dose oral glucocorticoids did not have an increased risk of any osteoporotic, hip, or clinically symptomatic vertebral fracture compared to non-COPD patients.
- An earlier cross-sectional study (Dubois 2002) suggests that osteoporosis of the lumbar spine was most frequent in patients receiving multiple systemic prednisolone courses > 1,000 mg cumulatively for the treatment of exacerbations of COPD.

#### *Inhaled corticosteroids (ICS)*

- The reported association between ICS and bone mineral density and fracture risk is inconsistent.
- The overall published literature suggests that long-term use of ICS may increase the risk of bone demineralization and/or fracture in a dose-response manner (Loke 2011).
- The results suggest that patients using medium to high doses of ICS for a duration of 3–4 years should be screened for the risk of fracture and be advised on protective measures for preventing falls to reduce the risk of fractures.

2. **Does the use of antibiotics in ambulatory adult patients with a COPD exacerbation improve outcomes and reduce risk of future exacerbations and/or rehospitalization compared to standard care?**

- Moderate-quality evidence from meta-analyses (Herath 2018, Wang 2018, and Cui 2018) shows that the continued or intermittent use of macrolides (azithromycin) reduces the frequency of exacerbations and the number of patients with one or more exacerbations, increases the time to the first exacerbation,

and improves the quality of life in older patients with moderate to severe COPD and a history of frequent exacerbations.

- The pooled analyses of published studies suggest that a duration of macrolide therapy less than 6 months may be insufficient to reduce the rate of COPD exacerbations.
- The benefits of continuous or intermittent use of antibiotics have to be weighed against their harms, including adverse events and antibiotic resistance, as well as the need for monitoring the patients for compliance and adverse events.

**3. Which COPD patients should be placed on long-term oxygen therapy?**

**4. How many hours a day should patients on long-term oxygen therapy be using it?**

**5. When, how, and how often should patients placed on long-term oxygen therapy be evaluated to determine whether they need to continue or discontinue the therapy?**

- The current recommendations for prescribing supplementary oxygen in patients with COPD are based on the NOTT and MRC trials published almost 40 years ago. The trials showed a survival benefit of continuous or at least 15 hours/day use of oxygen in patients with stable COPD and hypoxemia at rest.
- There is evidence from the landmark LOTT (Long-Term Oxygen Treatment Trial Research Group 2016) that long-term use of supplemental oxygen for patients with stable COPD and resting or exercise-induced moderate hypoxemia does not improve survival or first hospitalization, nor does it provide other benefits described in the trial. The results, however, may not be generalized to patients with resting hypoxemia not represented in the trial.
- Moderate-quality evidence from a Cochrane review (Edstrom 2017) pooling the results of 33 RCTs indicates that oxygen use during exercise can relieve breathlessness but does not improve the quality of life of mildly hypoxemic and non-hypoxemic COPD patients who do not qualify for home oxygen therapy.
- Low-quality evidence suggests that oxygen use during exercise may not have a survival benefit or significantly improve exercise capacity.
- There is insufficient published evidence on the effect of supplemental oxygen in improving outcomes in COPD patients with nocturnal oxygen desaturation.
- There is no published evidence that identifies predictors of response to long-term oxygen therapy in patients with moderate desaturation at rest or during exertion.
- Researchers recommend individualizing the use of ambulatory oxygen therapy for patients not meeting the criteria for long-term oxygen therapy. Engaging the patients in shared decision making and discussing the benefits, harms and uncertainties associated with the therapy is also recommended.
- Long-term supplemental oxygen therapy was prescribed 24 hours/day in the LOTT trial for patients with moderate saturation. It was prescribed continuously in the NOTT (Nocturnal Oxygen Therapy Trial Group 1980) intervention group and  $\geq 15$  hours/day in the MRC (Medical Research Council Working Party 1981) trial intervention group.
- Resting hypoxemia may be transient, as seen in NOTT. It may therefore be reasonable to recheck oxygen saturation in 2–3 weeks before prescribing long-term oxygen therapy for COPD patients with resting hypoxemia.

**6. Should pulmonary rehabilitation (PR) be offered to all patients with COPD?**

**7. What is the short- and long-term effectiveness of pulmonary rehabilitation in reducing the risk of COPD exacerbation and related hospitalization in adult patients with COPD, compared to routine care?**

**8. Are home-based, online, or tele-pulmonary rehabilitation as effective as conventional PR in improving physical performance and symptoms in patients with chronic COPD?**

- From GOLD guideline (2019):
  - o PR is indicated for all patients with relevant symptoms and/or high risk of exacerbations. Studies show that the benefits of PR in improving functional exercise capacity and quality of life were observed for all grades of severity of COPD, with the evidence being stronger for those with moderate to severe cases.
  - o Pulmonary rehabilitation improves dyspnea, health status, and exercise tolerance in stable patients.
  - o Pulmonary rehabilitation reduces hospitalization among patients who have had a recent exacerbation ( $\leq 4$  weeks from prior hospitalization).

- o The optimal benefits are obtained from programs lasting 6–8 weeks, and there are no additional benefits from extending the PR programs to 12 weeks.
  - o Community-based and home-based programs, including online supported PR, can be as effective as hospital based-programs as long as the frequency and intensity are equivalent.
  - o Conflicting results from published trials do not provide sufficient evidence to recommend the continuation of lower-intensity or lower-frequency exercise programs to maintain the benefits over long-term.
- Moderate-quality evidence from two meta-analyses of RCTs (Puhan 2016, Rysør 2018) indicates that pulmonary rehabilitation of COPD patients after hospital admission for an acute exacerbation improves their exercise capacity and HRQOL (that may be maintained for at least 12 months), and reduces hospital readmissions. There is insufficient evidence, however, to determine the long-term effect of PR on reducing mortality.
  - There is good-quality evidence that home-based PR improves dyspnea in COPD patients. Horton and colleagues' 2018 non-inferiority trial compared a home-based rehabilitation program with supervised PR and showed statistically significant improvements in the self-reported dyspnea in the two groups after 7 weeks. However, the evidence that home-based PR was non-inferior to hospital-based PR was inconclusive.
  - There is moderate-quality evidence showing that home-based PR significantly lowers the rate of acute exacerbation and related hospitalizations and ED visits among patients with moderate to severe COPD who are on optimal medical treatment and have a history of acute exacerbation 1 year prior to enrollment (Vasilpoulou 2017).
  - There is moderate-quality evidence from a non-inferiority single-blinded single-center RCT (Bourne 2017) suggesting that a 6-week program of online-supported PR was safe, well tolerated, and non-inferior to a conventional model delivered in face-to-face sessions in terms of effect on 6-minute walk test (6MWT) distance and symptom scores.

## 9. What interventions/strategies are effective and safe for the prevention of COPD exacerbations?

The guideline team adapted recommendations from the following externally developed guidelines:

- 2019 Update of 2017 Global Initiative for Chronic Obstructive Lung Disease (GOLD): Global strategy for the diagnosis, management and prevention of COPD
- 2018 KP National Clinical Practice Guideline: Chronic Obstructive Pulmonary Disease
- 2017 European Respiratory Society /American Thoracic Society (ERS/ATS) guidelines on the prevention and management of COPD exacerbations

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# Guideline Development Process and Team

## Development process

The COPD Guideline was developed using an evidence-based process, including systematic literature search, critical appraisal, and evidence synthesis. For details, see Evidence Summary and References.

This edition of the guideline was approved for publication by the Guideline Oversight Group in February 2020.

## Team

The COPD Guideline development team included representatives from the following specialties: family medicine, gerontology, nursing, residency, respiratory therapy, internal medicine, pharmacy, pulmonology, and urgent care.

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## Disclosure of conflict of interest

Kaiser Permanente requires that team members participating on a guideline team disclose and resolve all potential conflicts of interest that arise from financial relationships between a guideline team member or guideline team member's spouse or partner and any commercial interests or proprietary entity that provides or produces health care-related products and/or services relevant to the content of the guideline.

Team members listed above have disclosed that their participation on the COPD Diagnosis and Treatment Guideline team includes no promotion of any commercial products or services, and that they have no relationships with commercial entities to report.

## Appendix 1. COPD Assessment Test (CAT)

The CAT is a validated tool for assessing the impact on COPD on wellbeing and daily life. There are eight questions on a 1- to 5-point scale, which focus on cough, sputum, breathlessness, chest tightness, confidence, activity, sleep, and energy levels. Scores of 10 or higher indicate that COPD symptoms are not well controlled. [CAT online.](#)



Your name:

Today's date:

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

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

If you wish to complete the questionnaire by hand on paper, please [click here](#) and then print the questionnaire.

For each item below, place a mark (X) in the box that best describes your current situation. Please ensure that you only select one response for each question.

**Example:** I am very happy    0    1   2   3   4   5    I am very sad

Question	0	1	2	3	4	5	SCORE
I never cough    I cough all the time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
I have no phlegm (mucus) on my chest at all    My chest is full of phlegm (mucus)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
My chest does not feel tight at all    My chest feels very tight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
When I walk up a hill or a flight of stairs I am not out of breath    When I walk up a hill or a flight of stairs I am completely out of breath	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
I am not limited to doing any activities at home    I am completely limited to doing all activities at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
I am confident leaving my home despite my lung condition    I am not confident leaving my home at all because of my lung condition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
I sleep soundly    I do not sleep soundly because of my lung condition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
I have lots of energy    I have no energy at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="text"/>
<b>TOTAL SCORE</b>							<input type="text"/>

**Make sure you print your CAT before visiting your healthcare professional!**

A COPD assessment test was developed by an interdisciplinary group of international COPD experts with support from GSK. GSK's activities in connection with the COPD assessment test are monitored by a supervisory council that includes external, independent experts, one of which is chair of the council.

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## Appendix 2. Modified Medical Research Council (mMRC) dyspnea scale

Use of the mMRC dyspnea scale is recommended to assess the severity of dyspnea related to activity level. Scores of 2 or higher indicate poor control of COPD symptoms.

mMRC Dyspnea Scale <sup>a</sup>	
Grade of Dyspnea	Description
0	<b>No dyspnea.</b> No breathlessness except with strenuous exercise
1	<b>Mild dyspnea.</b> Shortness of breath when hurrying or walking up a slight hill
2	<b>Moderate dyspnea.</b> Walks more slowly than people of the same age due to breathlessness or has to stop for breath when walking at own pace on a level surface
3	<b>Severe dyspnea.</b> Stops for breath after walking approximately 100 meters or after a few minutes on a level surface
4	<b>Very severe dyspnea.</b> Too breathless to leave the house, or breathless when dressing or undressing.

<sup>a</sup> Mahler DA, Wells CK. Evaluation of clinical methods for rating dyspnea. Chest. 1988 Mar;93(3):580-6.