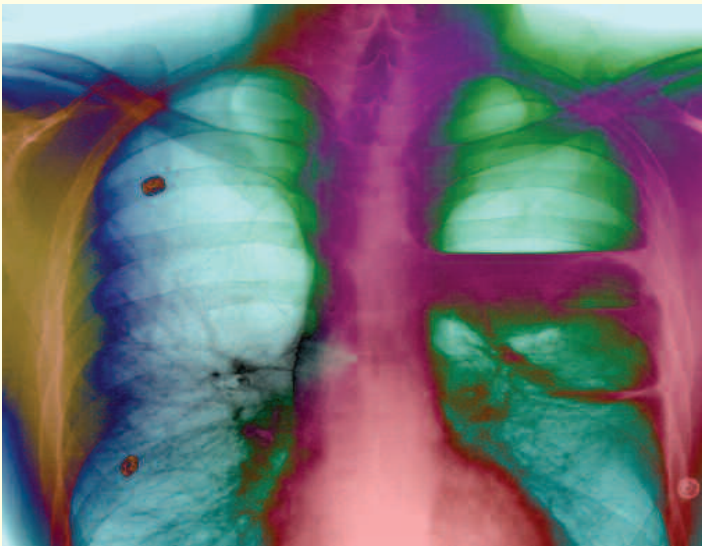
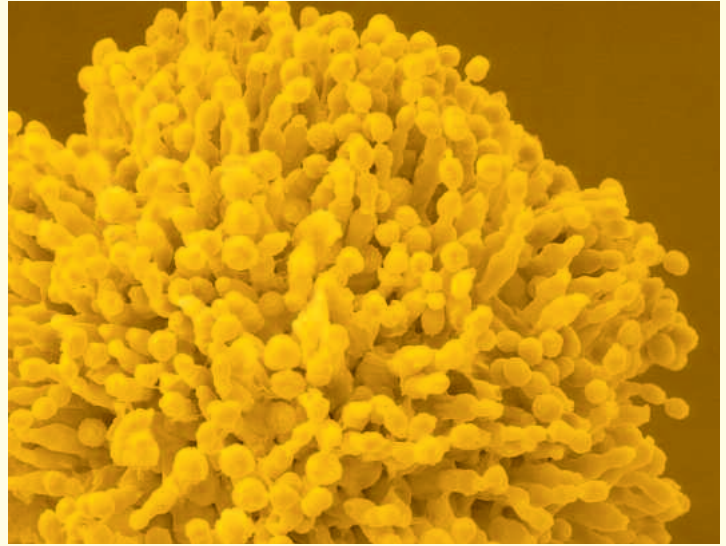


# COPD

## Strategies for Diagnosis and Effective Management



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### LEARNING OBJECTIVES

After completing this activity, participants should be better able to:

- Cite the prevalence of COPD and burden of disease
- Identify the symptoms of COPD
- Describe available diagnostic tests
- Explain nonpharmacologic management and techniques for patient education about COPD
- Describe the available pharmacologic treatments for COPD

### NEEDS ASSESSMENT

Chronic obstructive pulmonary disease (COPD), a progressive lung disease characterized by airflow limitation that is not fully reversible,<sup>1</sup> is the fourth leading cause of death in the United States.<sup>2</sup> Primarily caused by cigarette smoking, COPD affects nearly 10 million Americans,<sup>3</sup> although it largely remains under-recognized and undiagnosed. Because the effects of COPD are more easily treated in the earlier stages of disease progression, primary care clinicians can play a crucial role in patient care by recognizing and diagnosing COPD, educating and counseling patients, and prescribing optimal pharmacologic and nonpharmacologic therapies.

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**Dennis E. Niewoehner, MD**, serves as a consultant, receives grant support, and is on the speakers' bureau for Boehringer Ingelheim; is on the Speaker's Bureau for Pfizer Inc.; and serves as a consultant for Adams Respiratory Therapeutics, Forest Laboratories, and GlaxoSmithKline.

**Claire Murphy, RN, MSN, NP-C**, has nothing to disclose with regard to commercial support.

**Mary Ettari, MPH, PA-C**, has nothing to disclose with regard to commercial support.

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# COPD

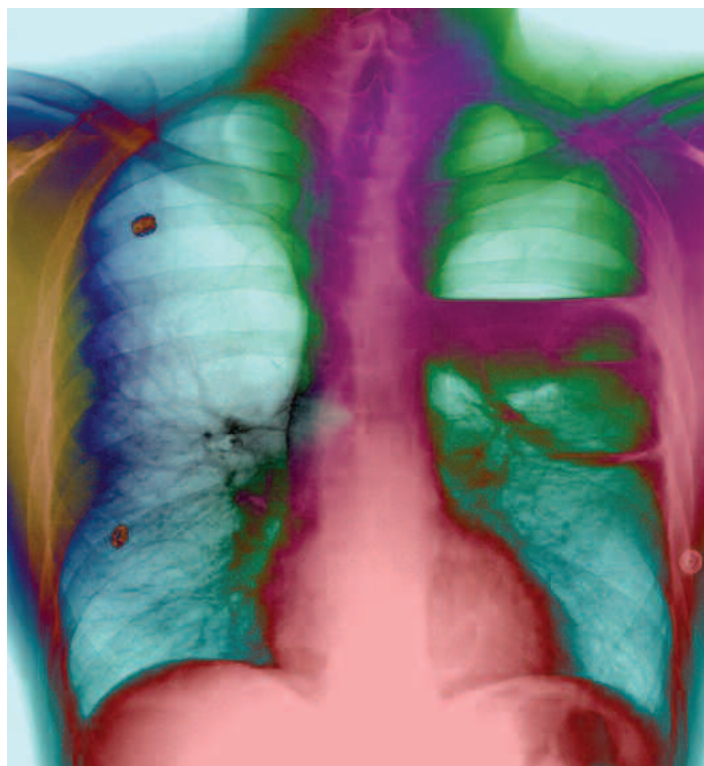
## Strategies for Diagnosis and Effective Management

Chronic obstructive pulmonary disease (COPD) is a slowly progressive airway disease characterized by a gradual loss of lung function that is not fully reversible.<sup>1</sup> COPD encompasses a number of diseases such as emphysema, chronic bronchitis, or some combination thereof, in which normal breathing function becomes increasingly difficult. Cigarette smoke is by far the key causative factor for COPD in the Western world,<sup>2</sup> although risk factors for COPD can also include exposure to a wide variety of gases and particles such as occupational pollutants or air pollution.

As the fourth leading cause of death in the United States, COPD kills more than 122,000 Americans each year.<sup>1</sup> Annually accounting for more than 1.5 million visits to emergency departments and 14 million office visits, COPD is associated with more than \$20 billion each year in direct medical costs alone. In addition, prolonged time to diagnosis and resultant disease progression further increase the overall cost of COPD treatment. Although 16 million people in the United States have already been diagnosed with COPD, an additional 14 million are estimated to have undiagnosed COPD, illustrating that this condition is both under-recognized and undertreated.<sup>3,4</sup>

The principal barrier to COPD diagnosis and treatment is a lack of awareness and education about COPD among both patients and clinicians. Typical symptoms of COPD such as dyspnea or persistent cough are often attributed to heart disease or asthma. Common misconceptions about COPD patients are also barriers to diagnosis. Patients with COPD are often assumed to be males or persons older than 65 years of age.<sup>3</sup> In actuality, more than half of COPD patients are under the age of 65, representing 67% of all COPD-related visits to a physician's office.<sup>5</sup> Males are no longer considered the more susceptible of the two genders. Recent studies have shown that both males and females are at equal risk for COPD, and since 2003, the number of women dying from COPD each year has surpassed the number of men.<sup>6</sup>

A serious and debilitating disease, COPD has high rates of both comorbidity and mortality. Comorbidities often associated with COPD include forms of cancer, as well as diseases of the cardiovascular and organ systems – all of which contribute to the high mortality rate of COPD patients. Among the causes of death in COPD patients, pulmonary disease accounted for 35% of all deaths, cardiovascular disease for 27%, and cancer for 21%.<sup>2</sup> COPD can also have a negative impact on other medical conditions, because inflammatory mediators in the lungs can affect the regulating mechanisms in the

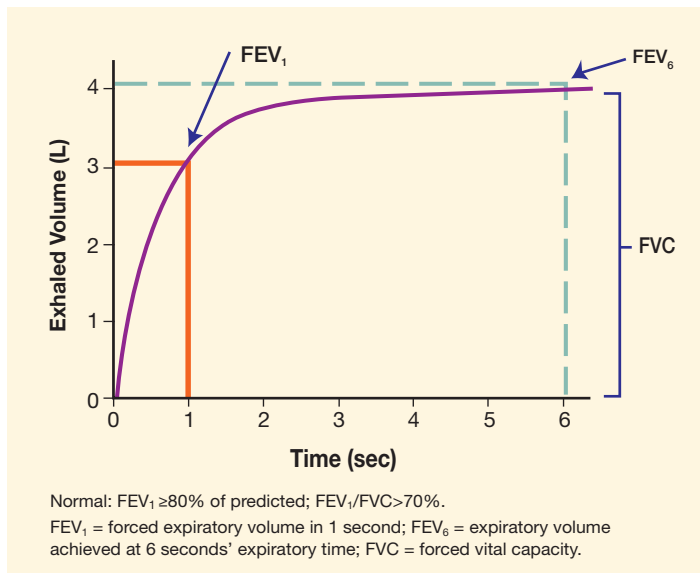


peripheral vasculature and arteries. Patients with COPD also have a higher incidence of bone fractures compared to those without COPD.<sup>7</sup>

Although numerous COPD therapies provide relief of symptoms or help to prevent disease progression, no known COPD treatment, apart from smoking cessation, has demonstrated long-term improvement for declining lung function.<sup>8</sup> Yet COPD is largely preventable. Therefore, it is essential for clinicians to become knowledgeable about recognizing and screening patients considered at risk, as well as actively treating patients already diagnosed with COPD, in order to improve outcomes and quality of life.

### ASSESSMENT AND DIAGNOSTIC STRATEGIES

The first step in optimal COPD management is a proper examination and diagnostic workup. Clinicians should check patients for any signs or symptoms of COPD and determine if any risk factors are present.



**FIGURE 1.** Spirometry values for interpretation

Questions clinicians should routinely ask when assessing a patient for COPD are:

- Are you a current or former smoker? Do you live with one?
- Do you experience difficulty breathing during mild exercise or at night?
- Have you had to restrict your physical activity?
- Do you often complain about exercise intolerance?
- Do you have a persistent cough in the morning, or a cough lasting more than 2 weeks?

The biggest risk factor for COPD is a history of cigarette smok-

ing, which is the cause of the vast majority of COPD cases; COPD may be associated much less frequently with exposure to occupational dusts and chemicals and indoor or outdoor pollution.<sup>3</sup> Clinicians should maintain a high index of suspicion of COPD when they see patients who have a significant smoking history, are aged  $\geq 45$  years, or have one or more major symptoms of COPD. The four main symptoms of COPD are chronic cough, excessive sputum production, wheezing, and dyspnea upon mild exertion that is disproportionate to the patient’s age.<sup>9</sup> A basic patient history, including questions regarding past or present smoking habits, changes in physical activity, and changes in activities of daily living, can help alert the clinician to the diagnosis of COPD. Since the effects of COPD are most treatable early on, utilizing early diagnostic testing, such as office spirometry or other pulmonary function tests (PFTs), can be invaluable when used in appropriate patients.

Diagnostic testing helps clinicians to evaluate patients at risk for COPD and to investigate any symptoms the patient may have. Spirometry, the most frequently used pulmonary function test, allows clinicians to gauge a patient’s lung function by measuring the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled. In addition to helping identify early signs of COPD, spirometry, considered to be the “gold standard” for diagnosing air-flow obstruction, can aid clinicians in making a differential diagnosis.<sup>10</sup> When assessing a patient with COPD, some clinicians may find it helpful to use additional diagnostic tests, such as chest X-rays, measurement of arterial blood gases, or screening for alpha-1 antitrypsin deficiency. Although these procedures cannot diagnose COPD, they can provide clinicians with valuable information about the patient’s condition and help direct the course of future treat-

	FEV <sub>1</sub> /FVC	FEV <sub>1</sub>	IMPACT
<b>Stage 1: MILD</b>	<70%	Normal ( $\geq 80\%$ )	Majority of patients; minimal impact on HR-QoL; modest expenditure
<b>Stage 2: MODERATE</b>	<70%	50%-80% predicted	Minority of patients; significant impact on HR-QoL; large expenditure
<b>Stage 3: SEVERE</b>	<70%	30%-49% predicted	Minority of patients; profound impact on HR-QoL; very large expenditure
<b>Stage 4: VERY SEVERE</b>	<70%	$\leq 29\%$ predicted	Minority of patients; profound impact on HR-QoL; VERY large expenditure

HR-QoL = health-related quality of life.

Executive Summary: Global Strategy for the Diagnosis, Management, and Prevention of COPD. Updated 2006. <http://www.goldcopd.org>.

**FIGURE 2.** Obstructive disease, World Health Organization classification

ments. Generally, chest X-rays are used to evaluate symptoms of shortness of breath or a chronic cough and can be useful in excluding alternative diagnoses such as pulmonary fibrosis and establishing the presence of significant comorbidities such as cardiac failure or lung cancer. The measurement of arterial blood gases or oxygen saturation is recommended for many patients with advanced COPD who might require oxygen therapy.<sup>8</sup>

Although largely underutilized in clinical practice, spirometry in appropriate patients offers an advantage to primary care clinicians, as it can be performed within an office setting. The patient blows into the spirometer, which measures the air flow and generates predicted values based on gender, height, weight, race, and age. To maintain consistency during the process, the patient should either sit or stand throughout the entire procedure. An adequate dosage of a short-acting inhaled bronchodilator can be administered prior to spirometry in order to minimize variability and help rule out asthma,<sup>11</sup> although this is not always used as part of standard testing.

Results from spirometry should yield a variety of respiratory measurements. The two most central values for interpretation are the forced expiratory volume (in liters) over 1 second ( $FEV_1$ ), and the forced vital capacity (FVC), or the total amount of air (in liters) the patient can forcibly exhale after full inspiration (*Figure 1*). Airway obstruction can be detected when the patient's values are represented as the ratio  $FEV_1/FVC$ . Generally, any  $FEV_1/FVC$  value  $<70\%$  is indicative of COPD.

After COPD is diagnosed, severity of the disease can be assessed by looking at the patient's  $FEV_1$  value. According to the World Health Organization (WHO), there are 4 stages of COPD, which

are classified by disease severity (*Figure 2*). The majority of COPD patients have stage 1, or mild COPD, which rarely has much impact on patients' quality of life. Stage 2, or moderate COPD, is more expensive to treat and likely to have a greater impact on patients' lives.<sup>12</sup> Stages 3, severe COPD, and 4, very severe COPD, both incur huge treatment expenditures and drastically alter patients' quality of life. COPD is a progressive disease and should be addressed before it worsens or complications develop.

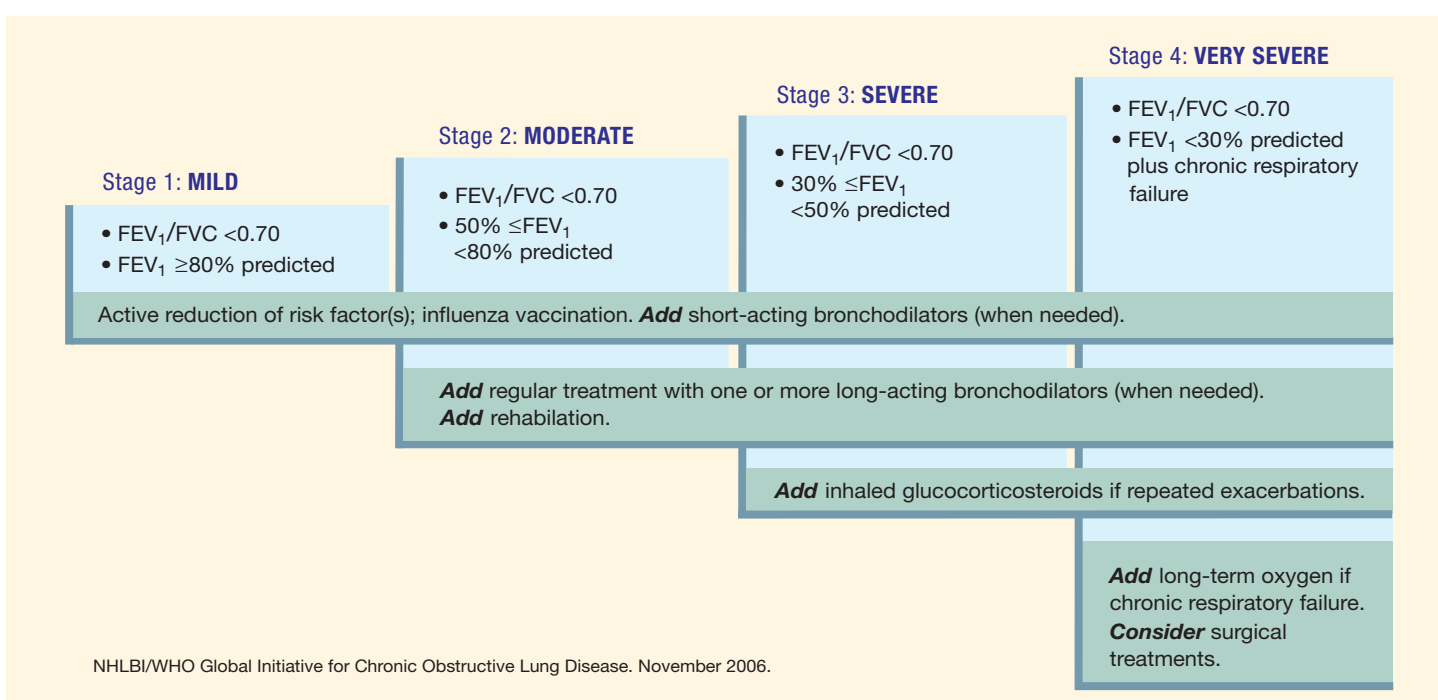
## EVALUATING TREATMENT OPTIONS IN PRIMARY CARE

According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD), COPD treatment is a 4-step process, consisting of:

- Diagnosing and monitoring the disease
- Reducing risk factors
- Managing stable COPD patients through education as well as pharmacologic and nonpharmacologic methods
- Managing exacerbations.

Although there is no cure for COPD, proper management of the disease can help relieve debilitating symptoms, slow the progression of disease, reduce exacerbations, and improve patients' quality of life considerably.<sup>8</sup>

The primary aim of COPD therapy is to stabilize the progression of the disease and control any exacerbations that occur. Clinicians should prescribe COPD therapies according to the individual patient's needs, such as the current level of disease progression and its effect on activities of daily living. A combination of nonpharmacologic and pharmacologic treatment may be ideal in some patients with COPD.



**FIGURE 3.** Treatment of COPD by stage

## CASE STUDY

### A 45-Year-Old Woman With Shortness of Breath

Mrs. F is a 45-year-old woman who complains of shortness of breath after performing routine chores such as walking the dog or climbing the stairs. Mrs. F reports that she often sleeps poorly and wakes up in the morning with a hacking cough that makes it difficult to catch her breath. She also admits feeling chronically run-down, juggling her hectic schedule as account executive, wife, and mother of 3 teenaged girls.

Mrs. F has a 22-year history of cigarette smoking, averaging 1 to 2 packs per day. She has tried to quit smoking several times and has cut down to half a pack per day. Mrs. F states that her father died of COPD in his late 60s and that she was hospitalized for pneumonia a year ago. Mrs. F has been in very good health throughout her life and has visited her physician infrequently over the past several years. Currently she takes hydrochlorothiazide for hypertension.

Her physical examination showed a slightly lengthened excursion with each breath, although there was no sign of cyanosis, clubbing, or edema. Standing 66 inches tall and weighing 135 lb, Mrs. F has a regular pulse rate and her blood pressure is 136/74 mm Hg. Her oxygen saturation is at 94%, and her respirations at rest are 22/min. Mrs. F does not use any accessory muscles for breathing and sits straight up in a chair. Her office spirometry showed her FEV<sub>1</sub>/FVC at 57%, with her FEV<sub>1</sub> at 50% of her predicted value



Mrs. F is diagnosed with moderate, or Stage 2, COPD. She is strongly encouraged to stop smoking cigarettes, as doing so can help slow progression of the disease. To manage her stable COPD, Mrs. F is prescribed a long-acting bronchodilator along with pulmonary rehabilitation. She also is scheduled to receive immunizations for both influenza and pneumonia to avoid any respiratory complications.

#### Nonpharmacologic Treatment

Once COPD is diagnosed and routinely monitored, clinicians should work with patients to reduce any relevant risk factors. Recently diagnosed COPD patients who smoke are strongly advised to begin smoking cessation because continuation of the habit accelerates disease progression and greatly increases the severity of other comorbidities.<sup>13</sup> Smoking cessation is the only known intervention that can modify the natural history of this disease over an extended period of time. COPD patients are also advised to avoid environmental tobacco smoke as well as other forms of indoor or outdoor pollution.

Pulmonary rehabilitation is often used for patients with moderate to very severe COPD. According to the American Thoracic Society, pulmonary rehabilitation is defined as “a multidisciplinary program of care for patients with chronic respiratory impairment that is individually tailored and designed to optimize physical and social performance and autonomy.”<sup>14</sup> Components of a pulmonary rehabilitation program include exercise training, nutrition counseling, and patient education. Exercise training should emphasize a regularly scheduled yet tolerable workout for the patient, while nutrition counseling may help the patient achieve an optimal target weight. Although patient education should begin upon diagnosis, further COPD education may clarify therapeutic strategies for the patient and help maintain a healthier lifestyle.

#### Pharmacologic Treatment

Bronchodilators and glucocorticosteroids, the two main pharmacologic treatments available for COPD, are generally effective in stabilizing COPD progression and managing exacerbations. In COPD management, bronchodilators are typically prescribed as first-line maintenance therapy, while glucocorticosteroids are recommended as second-line maintenance therapy (*Figure 3*).

Bronchodilators, which include  $\beta_2$ -agonists and anticholinergics, are used for a variety of respiratory diseases and are available in both short- and long-acting formulations.  $\beta_2$ -agonists, which can be inhaled or taken orally, work by increasing cyclic adenosine monophosphate (AMP) within cells and by promoting smooth muscle relaxation in the airway.<sup>14</sup> Anticholinergics are also useful for COPD therapy, as they block the effect of acetylcholine on M3 receptors and their effects typically last longer than their  $\beta_2$ -agonist counterparts. Unlike the longer-acting  $\beta_2$ -agonists, which may only last upwards of 12 hours, long-acting anticholinergic agents, such as tiotropium, can be effective for up to 24 hours after a single dosing. According to the 2006 GOLD recommendations, the choice between  $\beta_2$ -agonist, anticholinergic, theophylline, or combination therapy depends on availability and individual response in terms of symptom relief and side effects; however, long-acting inhaled bronchodilators are usually more effective and convenient.<sup>8</sup>

Glucocorticosteroids are useful for treating patients with advanced

**TABLE 1.** Patient Education: What to Provide at Each Stage

<b>Stage 0: At Risk for COPD</b>
- Information and advice about reducing risk factors
<b>Stages 1-3: Mild (1), Moderate (2), and Severe (3) COPD</b>
<i>Above topic, plus:</i>
- Information about the nature of COPD
- Instruction on how to use inhalers and other treatments
- Recognition and treatment of exacerbations
- Strategies for minimizing dyspnea
<b>Stage 4: Very Severe COPD</b>
<i>Above topic, plus:</i>
- Information about complications
- Information about oxygen treatment
- Advance directives and end-of-life decisions
Adapted from: GOLD Workshop Report Updated 2005. <a href="http://goldcopd.com/Guidelineitem.asp?1=2&amp;j2=1&amp;intId=989">http://goldcopd.com/Guidelineitem.asp?1=2&amp;j2=1&amp;intId=989</a> .

COPD stages and for managing acute exacerbations because they act at multiple points within the inflammatory cascade. Glucocorticosteroids can be inhaled or taken orally; however, inhaled steroids may be used chronically to prevent exacerbations and relieve symptoms, while oral glucocorticosteroids, used to treat acute exacerbations, may cause numerous adverse effects, including skeletal muscle myopathy and osteoporosis.<sup>14</sup> Often, clinicians may opt to combine inhaled glucocorticosteroids with bronchodilators or other non-pharmacologic treatments in order to achieve an optimal therapeutic response. Exacerbations may also be treated with systemic steroids and antibiotics.

### Immunization

Clinicians treating patients with COPD are strongly advised to administer immunizations to reduce the risk of serious respiratory illness. By vaccinating COPD patients against influenza, clinicians can reduce the risk of mortality by up to 50%.<sup>15,16</sup> Pneumococcal vaccinations, which should be given to patients aged  $\geq 65$  years or those who have severely impaired lung function ( $FEV_1 < 40\%$ ), have been shown to reduce the incidence of community-acquired pneumonia.<sup>17-19</sup>

### Other Therapies

Oxygen therapy is a long-term treatment strategy that helps improve physical and cognitive performance and increase overall survival rates in COPD patients.<sup>8</sup> It is often used in patients with very severe COPD (very low blood oxygen levels while resting). The primary goal of oxygen therapy is to achieve arterial oxygen saturation levels ( $SaO_2$ ) of at least 90%, which preserves vital organ function by ensuring adequate oxygen delivery.

Surgery is another option for the treatment of severe COPD that can reduce dyspnea and improve lung function when other therapies have failed. Surgeries that may be beneficial for advanced stages of COPD include bullectomy, lung volume reduction surgery

(LVRS), and lung transplantation. Patients who undergo lung surgery must be carefully screened beforehand, as such procedures can lead to postoperative pulmonary complications.<sup>8</sup> Surgical procedures used in COPD treatment typically involve partial removal of the lung or complete lung transplantation.

### PATIENT EDUCATION

Ideally, the role of patient education in treatment and management of COPD should highlight interventions supporting proper medication administration, comprehensible pathophysiology, and individualized action/management plans. Strategic keypoints of patient education should address individual current staging of COPD disease and concentrate on those teaching points applicable (*Table 1*).

Patient education sessions may be given individually or in a group session format. Provision of educational materials supplemented with didactic presentations can enhance effective delivery of instruction. Participation in hands-on demonstration of inhaler techniques can help patients understand the proper administration of medication.

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# Post-Test

## COPD: STRATEGIES FOR DIAGNOSIS AND EFFECTIVE MANAGEMENT

On the answer sheet on the next page, please darken the circle of the one answer to each question that is true. Complete answer sheets should be placed in a stamped envelope and returned to the address shown on the form or faxed to the number shown on the form. Credit is available through February 14, 2009.

1. **The primary cause of COPD is**
  - A. Occupational exposure
  - B.  $\alpha$ 1-antitrypsin deficiency
  - C. Cigarette smoke
  - D. Asthma
2. **What percentage of COPD patients is younger than age 65?**
  - A. 20%
  - B. 30%
  - C. 40%
  - D. More than 50%
3. **Which of the following is considered the “gold standard” for COPD diagnosis in appropriate patients?**
  - A. Lung biopsy
  - B. Spirometry
  - C. Chest X-rays
  - D. Arterial blood gas measurement
4. **Which of the following is the highest FEV<sub>1</sub>/FVC value that would permit a diagnosis of COPD?**
  - A. 88%
  - B. 80%
  - C. 69%
  - D. 90%
5. **What is the only known intervention that can slow the progression of COPD over an extended period of time?**
  - A. Oxygen therapy
  - B. Smoking cessation
  - C. Bronchodilators
  - D. Glucocorticosteroids
6. **The primary goal of COPD therapy is to**
  - A. Cure the disease
  - B. Effectively treat the disease until it goes into remission
  - C. Slow the progression of the disease
  - D. Prevent exacerbations
7. **Which of the following is typically prescribed as a first-line COPD maintenance therapy?**
  - A. Theophylline
  - B. Bronchodilators
  - C. Glucocorticosteroids
  - D. Oxygen therapy
8. **Which of the following bronchodilators is effective up to 24 hours after a single dosing?**
  - A. Tiotropium
  - B. Salmeterol
  - C. Albuterol
  - D. Ipratropium

# Answer Sheet

## COPD: STRATEGIES FOR DIAGNOSIS AND EFFECTIVE MANAGEMENT

Darken the circle with the correct answer(s) to each question in this activity.

1. (A) (B) (C) (D)      3. (A) (B) (C) (D)      5. (A) (B) (C) (D)      7. (A) (B) (C) (D)
2. (A) (B) (C) (D)      4. (A) (B) (C) (D)      6. (A) (B) (C) (D)      8. (A) (B) (C) (D)

In order to obtain credit, you must 1) Complete the post-test (a score of 70% or better must be achieved); 2) Complete the program evaluation form; 3) Mail or fax your completed post-test answers and Evaluation Form to: Code E.COPDHAY08, Boston University School of Medicine Continuing Medical Education, 715 Albany Street, A305, Boston, MA 02118; Fax: 617-638-4905. Credit is available through February 14, 2009. For questions, please contact BUSM CME at 617-638-4605. Please allow 4-6 weeks after receipt of post-test and evaluation to receive certificate.

Name \_\_\_\_\_ Degree \_\_\_\_\_

Specialty \_\_\_\_\_

Institution \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

Telephone \_\_\_\_\_ Fax \_\_\_\_\_

E-mail \_\_\_\_\_

(All information is confidential)

The amount of time I spent on this activity was \_\_\_\_\_ (max. 45 minutes).

### CME/CE EVALUATION FORM

Your evaluation will assist us in planning future CME/CE activities. Please complete the following questions.

1. **How would you rate this activity overall?** (5 = excellent, 1 = poor; please circle one)      5      4      3      2      1
2. **In your opinion, did you perceive any commercial bias?**  Yes  No If yes, please explain: \_\_\_\_\_
3. **Do you plan on making any changes in your practice as a result of this activity?**  
 Yes  No If yes, please explain: \_\_\_\_\_
- May we contact you in the future to determine if you made changes?**  Yes  No
4. **What barriers, if any, do you anticipate encountering as you make changes in your practice?** \_\_\_\_\_

5. **Do you feel each of the following objectives was met?**

Cite the prevalence of COPD and burden of disease	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> N/A
Identify the symptoms of COPD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> N/A
Describe available diagnostic tests	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> N/A
Explain nonpharmacologic management and techniques for patient education about COPD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> N/A
Describe the available pharmacologic treatments for COPD	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> N/A

6. **Do you feel that the information in this activity was based on the best evidence available?**  
 Yes  No If yes, please explain: \_\_\_\_\_
7. **Which of the following competency areas do you feel have been improved as a result of this activity?** (Mark all that apply)  
 Patient care       Professionalism       Practice based learning  
 Medical knowledge       System base practice       Communication skills
8. **Please suggest topics for future activities.** \_\_\_\_\_
9. **Please rate the content of this activity** (5 = excellent, 1 = poor; please circle one)  
9a. Timely, up to date?    5    4    3    2    1      9b. Relevant to your practice?    5    4    3    2    1
10. **General Comments:** \_\_\_\_\_