



## Review on Chronic Obstructive Pulmonary Disease

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### ABSTRACT :

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory complaint characterized by persistent airflow limitation, primarily caused by long-term exposure to dangerous particles or gases, such as cigarette smoke. The complaint encompasses habitual bronchitis and emphysema, leading to symptoms like dyspnea, habitual cough, and foam product. COPD is a major global health burden, contributing to significant morbidity and mortality, with smoking being the leading threat factor. Other contributors include environmental adulterants and inheritable tendencies, similar as nascence- 1 antitrypsin insufficiency. opinion relies on spirometry (post-bronchodilator FEV1/ FVC rate<0.70), clinical assessment, and imaging. Management involves smoking cessation, bronchodilators, corticosteroids, pulmonary rehabilitation, and, in severe cases, oxygen therapy or surgical intervention. Despite advances in treatment, COPD remains incurable, emphasizing the need for early detection and preventive strategies to improve patient outcomes and quality of life.

**Keywords:** COPD, airflow obstruction, smoking, spirometry, bronchodilators, pulmonary rehabilitation.

### 1. Introduction

Chronic obstructive pulmonary disease (COPD) represents a significant yet avoidable respiratory condition marked by persistent airflow obstruction that typically worsens over time. This progressive disorder stems from chronic inflammatory processes affecting both the airways and lung tissue (GOLD, 2023). The disease primarily manifests through two distinct but often overlapping pathological presentations: chronic bronchitis, involving prolonged inflammation of the bronchial tubes, and emphysema, characterized by irreversible damage to the alveoli (Vogelmeier et al., 2020). These pathological changes disrupt normal respiratory function, resulting in characteristic symptoms including breathlessness, persistent coughing, and excessive mucus production. COPD is a leading cause of morbidity and mortality worldwide, ranking as the third leading cause of death globally, with an estimated 3.23 million deaths annually (World Health Organization [WHO], 2023). The primary risk factor is tobacco smoking, accounting for approximately 80-90% of cases, but other contributors include environmental pollutants (e.g., biomass fuel exposure, occupational dust), genetic predisposition (e.g., alpha-1 antitrypsin deficiency), and recurrent respiratory infections (Barnes, 2017).

Diagnosis relies on spirometry, where a post-bronchodilator FEV1/FVC ratio <0.70 confirms persistent airflow obstruction (GOLD, 2023). While COPD has no cure, early diagnosis and evidence-based management—including smoking cessation, bronchodilators, pulmonary rehabilitation, and oxygen therapy—can significantly improve quality of life and slow disease progression (Decramer et al., 2012). This paper explores the pathophysiology, risk factors, clinical manifestations, and current management strategies for COPD, emphasizing the need for early intervention and preventive measures to reduce its global burden.

### Epidemiology of COPD.

#### \*Global Burden

**Prevalence:** Affects approximately 391 million people worldwide, with the highest burden in low- and middle-income countries (LMICs) (Adeloye et al., 2022).

**Mortality:** Third leading cause of death globally, responsible for 3.23 million deaths annually (WHO, 2023).

Projected to become the #1 cause of death by 2030 due to aging populations and continued risk factor exposure (Lancet Respiratory Medicine, 2023).

**Disability:** Ranked 7th in global disability-adjusted life years (DALYs), with severe impacts on quality of life (GBD Collaborators, 2020).

#### \* Key Risk Factors

- Smoking: Accounts for 70–80% of COPD cases; risk correlates with pack-years smoked.
- Secondhand smoke increases risk by 40% (GBD Collaborators, 2020).
- Environmental Exposures: Household air pollution (e.g., biomass fuels) linked to 25% of COPD cases in LMICs (WHO, 2023). Occupational dust/chemicals (e.g., coal, silica) contribute to 15–20% of cases (Blanc et al., 2019).

- Genetic & Comorbidities: Alpha-1 antitrypsin deficiency (1–2% of cases in high-income countries). Strong associations with cardiovascular disease, diabetes, and depression (Mannino et al., 2022).

### 3. Causative agents of COPD

COPD is a multifactorial disease caused by prolonged exposure to noxious particles and gases that trigger chronic inflammation and irreversible airway damage. The primary causative agents include:

#### 1. Tobacco Smoke

- Primary cause (accounts for 70-80% of COPD cases)
- Both active smoking and secondhand smoke exposure
- Risk correlates with pack-years (number of cigarettes/days × years smoked)
- Causes:
  - Chronic bronchitis (airway inflammation)
  - Emphysema (alveolar destruction)
  - Impaired ciliary function

#### 2. Environmental & Occupational Exposures

- Indoor air pollution (major cause in developing countries):
  - Biomass fuel combustion (wood, dung, crop residues)
  - Coal burning for cooking/heating
  - Accounts for ~25% of global COPD cases
- Outdoor air pollution:
  - Particulate matter (PM2.5, PM10)
  - Nitrogen dioxide (NO<sub>2</sub>)
  - Sulfur dioxide (SO<sub>2</sub>)

#### 3. Occupational hazards:

- Dusts (coal, silica, grain)
- Chemical fumes (cadmium, isocyanates)
- Textile fibers (cotton, hemp)
- Contributes to 15-20% of COPD cases

{COPD is *non-communicable*—it cannot spread between people. “Transmission” of COPD risk occurs only through *shared environmental or genetic factors*. *Primary prevention* (e.g., quitting smoking) is the most effective way to reduce global COPD burden.}

### 4. Diagnosis of COPD

#### 4.1 Clinical Suspicion

COPD should be considered in patients with:

- Symptoms:
  - Chronic cough (with/without sputum)
  - Progressive dyspnea (worsening with exertion)
  - Recurrent wheezing
  - Frequent respiratory infections
- Risk factors:
  - Smoking history (current or past)
  - Long-term exposure to biomass fuels, air pollution, or occupational dusts/chemicals
  - Family history of COPD or alpha-1 antitrypsin deficiency

#### 4.2 Diagnostic Tests

##### A. Spirometry (Gold Standard)

- **Post-bronchodilator FEV<sub>1</sub>/FVC ratio < 0.70** confirms persistent airflow limitation
- Severity staging by FEV<sub>1</sub>% predicted:
  - GOLD 1 (Mild): ≥80%
  - GOLD 2 (Moderate): 50-79%
  - GOLD 3 (Severe): 30-49%
  - GOLD 4 (Very Severe): <30%

**B. Additional Tests**

- **Chest X-ray:**
  - Rules out other conditions (e.g., heart failure, pneumothorax)
  - May show hyperinflation, flattened diaphragms (emphysema)
- **CT scan** (not routine):
  - Identifies emphysema pattern, bullae
  - Helps plan surgical interventions (e.g., lung volume reduction)
- **Alpha-1 antitrypsin (AAT) testing:**
  - Recommended for all COPD patients, especially if:
    - Early-onset COPD (<45 years)
    - Family history of COPD/AAT deficiency
    - Basal emphysema on imaging
    -
- **Arterial blood gas (ABG):**
  - Assesses oxygenation and hypercapnia in advanced disease
- **6-minute walk test:**
  - Evaluates functional capacity and oxygen desaturation

**4.3 Differential Diagnosis****Conditions to rule out:**

- Asthma (reversible airflow limitation)
- Heart failure
- Bronchiectasis
- Tuberculosis
- Interstitial lung diseases

**4.4 Assessment of Severity and Impact**

- **GOLD ABCD Assessment Tool:**
  - Combines spirometry results with:
    - Symptom burden (e.g., COPD Assessment Test [CAT], mMRC dyspnea scale)
    - History of exacerbations
- **Comorbidity evaluation:**
  - Cardiovascular disease
  - Osteoporosis
  - Depression/anxiety

**4.5 Early Detection Challenges**

- Underdiagnosis is common (up to 50% of cases)
- Reasons:
  - Attributing symptoms to "normal aging"
  - Limited access to spirometry in primary care
  - Asymptomatic early-stage disease

**4.6 Emerging Diagnostic Tools**

- **Impulse oscillometry** (for patients unable to perform spirometry)

- **Exhaled nitric oxide (FeNO)** (to identify asthma-COPD overlap)
  - **Biomarkers** (e.g., fibrinogen, CRP - research ongoing).
  - **Pharmacological parameters for Diagnosis.**
1. **Spirometry is essential** for diagnosis - clinical suspicion alone is insufficient
  2. **Early diagnosis** prevents accelerated lung function decline
  3. **Comprehensive assessment** should guide personalized management
  4. **Screen for AAT deficiency** in appropriate patients

## Treatment & Management of COPD

### 5.1 Non-Pharmacological Management

#### A. Smoking Cessation (Most Critical Intervention)

- First-line: Nicotine replacement therapy (patches, gum)
- Pharmacotherapy: Varenicline, bupropion
- Behavioral support: Counseling programs

#### B. Pulmonary Rehabilitation

- Exercise training (aerobic + resistance)
- Breathing techniques (pursed-lip breathing)
- Nutritional counseling
- Psychosocial support

#### C. Oxygen Therapy

- Long-term oxygen (LTOT) for:
  - $\text{PaO}_2 \leq 55$  mmHg (or  $\leq 59$  mmHg with cor pulmonale)
  - $\geq 15$  hours/day use improves survival

#### D. Vaccinations

- Annual influenza vaccine
- Pneumococcal vaccines (PCV13 + PPSV23)
- COVID-19 vaccination

### 5.2 Pharmacological Therapy

(GOLD 2023 Guidelines-Based Approach)

#### A. Bronchodilators (Mainstay of Treatment)

Class	Examples	Key Features
<b>SABA</b>	Albuterol	Rescue medication
<b>LAMA</b>	Tiotropium, glycopyrrolate	Reduces exacerbations
<b>LABA</b>	Salmeterol, formoterol	Improves symptoms
<b>LABA/LAMA</b>	Umeclidinium/vilanterol	Dual therapy for persistent symptoms

#### ICSs:

- combination (laba/ics): fluticasone/salmeterol
  - triple therapy (laba/lama/ics): for frequent exacerbators
  - caution: increased risk of pneumonia other drugs.
  - phosphodiesterase-4 inhibitors (roflumilast): for severe copd with chronic bronchitis
  - mucolytics (carbocisteine): in chronic bronchitis
  - antibiotics (azithromycin): prophylaxis in frequent exacerbators
- 5.3 treatments of acute episodes.** Acute deterioration of respiratory signs necessitating supplementary treatment.  
Methodology:: 1. bronchodilators: enhanced saba occurrence. corticosteroids: prednisone 40mg/day  $\times$  5 days.
3. antibiotics (if purulent sputum): amoxicillin-clavulanate, doxycycline. mrsa risk: think about linezolid.
  4. oxygen titration (target  $\text{SO}_2$  88-92%). Non-invasive ventilation for acute respiratory failure.
- 5.4 innovative treatments to alleviate COPD.** A. Medical interventions.
- bullectomy (for giant bullae)

- lung volume reduction surgery (lvrs) (upper lobe emphysema)
  - lung transplantation (end-stage disease) O b. Medical procedures involving the use of a bronchoscope.
  - endobronchial valves (for emphysema)
  - coil implants • thermal vapor ablation 55:
  - cardiovascular disease: beta-blockers often underused
  - osteoporosis: calcium/vitamin d supplementation • depression/anxiety: ssris, counseling
5. 6 end-of-life care.

6. worldwide influence and difficulties. Chronic obstructive pulmonary disease (COPD) is a major global health concern, currently ranking as the third leading cause of death worldwide, resulting in over 3 million fatalities annually (who, 2023). Low- and middle-income countries (lmics) bear the greatest burden, accounting for approximately 90% of copd-related fatalities, primarily due to indoor air pollution from solid fuel use and workplace exposures (gbd collaborators, 2020). In contrast, affluent nations continue to experience high prevalence of COPD, primarily due to cigarette smoking, compounded by the aging population (Adeloye et al. , 2022). Despite efforts to bridge the gaps in diagnosis and treatment, challenges remain, particularly in the field of lung imaging and access to essential drugs, which are often scarce (gold, 2023). Key challenges include:

- unequal healthcare access: shortages of respiratory specialists and rehabilitation services in underserved areas (mannino et al
- financial consequences: annual global costs surpassing \$2
- ecological influences: increasing air pollution and climate variations worsening copd severity, especially in cities (who, 2023) The current interventions primarily concentrate on smoking cessation programs, enhancing air quality, and increasing the availability of diagnostic and therapeutic resources (gold, 2023). Despite the progress made in prevention strategies, screening initiatives, and international health policies, substantial investments are still necessary to effectively combat the increasing global impact of COPD.

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## Result

Chronic obstructive pulmonary disease (copd) remains a significant global health concern, with modifiable risk factors such as tobacco use, environmental pollutants, and workplace hazards playing a substantial role in its prevalence. The condition's high death rate and financial burden are worsened by ongoing issues with detection methods, available treatments, and prevention strategies, particularly in developing countries. Successful management of COPD necessitates comprehensive measures, including stricter anti-smoking regulations, the adoption of sustainable fuel alternatives, and equitable distribution of medical resources among different populations. By adopting prompt screening procedures, respiratory therapy programs, and comprehensive care for related conditions, patients worldwide could experience significant improvements in their health outcomes. To address the worsening impacts of COPD, global collaboration and increased financial assistance are crucial in reducing the disease's effects and enhancing patient health.

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