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## Abstract

Chronic obstructive lung diseases (COLD), also referred to as chronic obstructive pulmonary disease (COPD), are a group of diseases characterised by persistent and progressive cough and airflow limitation. As the third leading cause of mortality globally causing 3.2 million deaths annually, these constitute a substantial socio-economic burden. The prevalence is significantly higher among men aged  $\geq 40$  years and in tobacco smokers. Exposure to ambient and indoor air pollution, and occupational exposures

are other important risk factors. The key strategies to prevent COLD include smoking cessation and avoiding exposure to air pollutants, adopting gas for cooking, and switching to motor vehicles run on compressed natural gas or to electric cars. In addition, early diagnosis, access to high quality healthcare, life-saving medications including oxygen, and influenza and pneumococcal vaccinations are an integral part of national programmes. High priority must be accorded to strengthening capacity in low-income and middle-income countries to enable collectively achieve the related Sustainable Development Goal 3.4 by 2030.

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## Keywords

Chronic obstructive lung diseases (COLD) · Chronic obstructive pulmonary disease (COPD) · Tobacco smoking · Air pollution exposure · Occupational exposure

## 25.1 Introduction

Chronic obstructive lung diseases (COLD), also referred to as chronic obstructive pulmonary disease (COPD), are a group of pulmonary diseases including chronic bronchitis and emphysema that are characterised by persistent and progressive cough leading to airflow limitation. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) [1] defines COLD as “a common, pre-

ventable, and treatable disease 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”. Cough with mucus production, shortness of breath, wheezing and airflow limitations are cardinal features of GOLD [2].

## 25.2 Epidemiology and Disease Burden

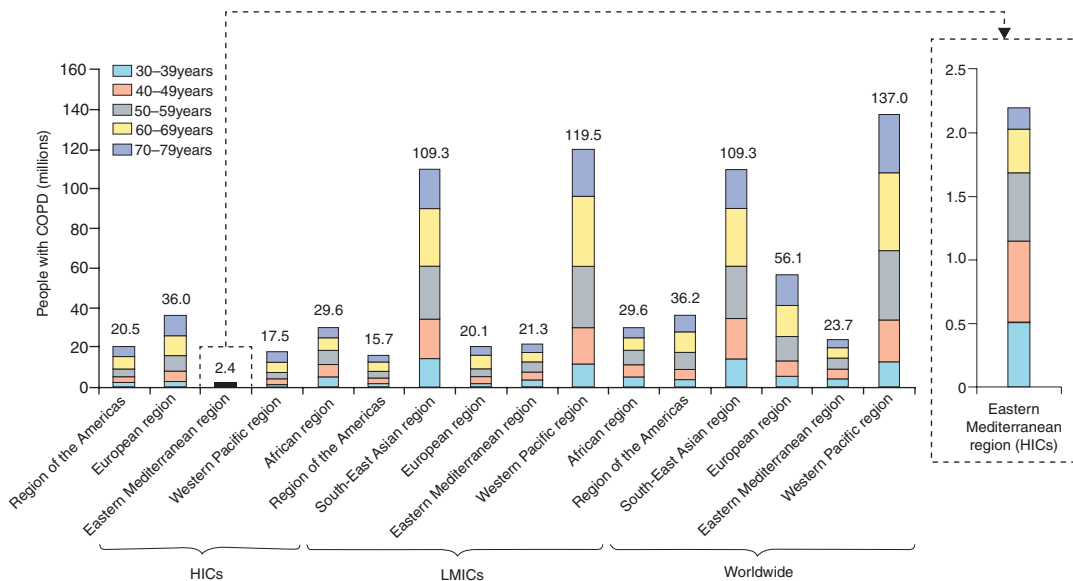
According to the World Health Organization (WHO), GOLD is the third leading cause of death worldwide, causing 3.2 million deaths annually; most of these deaths occur in those <70 years living in low-and middle-income countries (LMICs) where prevention and control measures are either not implemented or are not accessible [1, 3–6].

The global prevalence is ~12% with a considerable regional variation; Americas (14.5%) have the highest prevalence, South-East/Western Pacific regions have the lowest prevalence (Fig. 25.1) [4,

5]. Prevalence is substantially higher among men than women (15.7% vs. 9.1%) [7], among persons aged ≥40 years, among smokers and ex-smokers than non-smokers [1], and in rural areas [8]. As one of the prominent non-communicable diseases (NCDs), GOLD form part of the agenda for United Nations (UN) Sustainable Development Goals (SDGs), in particular target 3.4 which aims to reduce by one-third premature mortality from NCDs through prevention and treatment by 2030 [9].

## 25.3 Determinants and Risk Factors

Tobacco smoking remains the most important risk factor for development of GOLD globally. While an overall “dose-response curve” for tobacco smoking and lung function has been observed, severe disease may develop in some patients with fewer pack-years and others may not develop disease despite smoking. Other factors include ambient (outdoor) air pollution [especially, fine particulate matter <2.5 mm in



**Fig. 25.1** Number of people with GOLD-COPD by region and age groups in 2019. COPD = chronic obstructive pulmonary disease; GOLD = Global Initiative on Chronic Obstructive Lung Disease; HICs = high income countries; LMICs = low- and middle-income countries. GOLD-COPD is defined as forced expiratory volume in the first second (FEV<sub>1</sub>)/forced vital capacity (FVC) < 0.7.

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**Table 25.1** Determinants and risk factors for COLD development and progression

- Exposure to tobacco smoke from smoking or exposure to second-hand tobacco smoke
- Exposure to atmospheric particulate matter
  - Indoor and outdoor air pollution (e.g., from biomass fuel used for cooking and heating for, e.g. burning coal, wood, dried leaves, twigs, firewood, animal dung cakes, crop residues)
  - Occupational exposures (organic and inorganic dusts, chemicals, fumes, etc.)
- Genetic factors
  - Alpha-1 antitrypsin deficiency, suboptimal lung development during gestation or childhood, asthma, and airway hyperreactivity
- Demographic factors
  - Older age, male gender, low socio-economic status
- Infections
  - Severe childhood respiratory infections
  - Repeated viral, bacterial upper and lower respiratory tract infections
  - Tuberculosis
  - Human immunodeficiency virus infection

COLD = chronic obstructive lung diseases

aerodynamic diameter ( $PM_{2.5}$ ), household (indoor) air pollution (domestic and biomass fuel) and occupational exposures, which are important determinants especially in LMICs (Table 25.1). Given the higher exposure of these risk factors, the most disadvantaged groups of society such as the poor are more vulnerable to develop COLD. They, in addition, have limited access to information and healthcare services.

## 25.4 Approaches and Strategies for Prevention and Control

Various strategies include early diagnosis, effective management of stable disease and acute exacerbations, prevention of exposures and future exacerbations, as well as investigations to monitor complications (Box 25.1). At individual level, smokers must quit tobacco smoking and avoid exposure to other air pollutants, by refraining from burning firewood or trash in the vicinity, and by individuals planning various outdoor activities based on local air quality index. Households should resort to cooking gas and must refrain from using firewood or biomass for

cooking. Cooking gas should be made available at subsidised rates to the disadvantaged groups of the society by the national governments, as has been done in India [10]. Use of compressed natural gas (CNG) for motor vehicles, switching to electric cars and/or shifting industries away from urban areas can help reduce outdoor air pollution. Pulmonary rehabilitation should also be encouraged.

### Box 25.1 Key Strategies for Prevention and Control

- Tobacco smoking cessation counselling
- Avoiding exposure to various air pollutants
- Implementing various measures for ensuring good quality of air
- Ensuring availability of various medications, drug delivery devices (e.g., metered dose inhalers, dry powder inhalers, nebulisers, positive airway pressure devices, mechanical ventilation, heart-lung/lung transplantation)
- Facilitating access to quality health care (including, but not limited to oxygen therapy, emergency and intensive care for rational management and prevention of acute exacerbations of COLD) and health insurance coverage for COLD and its complications in national health schemes/programmes
- Carrying out investigations<sup>a</sup> periodically for early detection of complications (type I and type II respiratory failure, pulmonary artery hypertension and congestive cardiac failure, detection of co-existing coronary artery disease)
- Management of other comorbid conditions and correction of nutritional deficiencies
- Vaccination for SARS-CoV-2, seasonal influenza, pneumococcal infection, pertussis (for American adults who were not vaccinated during adolescence) and herpes zoster
- Education and training in various techniques of pulmonary rehabilitation

<sup>a</sup>Arterial blood gas analysis, HRCT of the chest, 2-dimensional echocardiography and NT-Pro BNP, among others

COLD = chronic obstructive lung diseases; HRCT = high resolution computed tomography; NT-Pro BNP = N-terminal Pro B-type natriuretic peptide; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2

Disease awareness programmes on prevention and control should be held. There is a need for creating community awareness through information and communication campaigns, focussing on: (1) various risk factors associated with chronic respiratory diseases and avoiding exposure to these risk factors and (2) early detection of the disease. These strategies can help in prevention and management of various chronic respiratory diseases including COLD. Access to emergency and out-patient medical care for sick and disabled patients, oral, inhalational drugs, various devices (inhalers, nebulisers), supplemental oxygen and delivery devices should be facilitated by programmes and governments at district levels [11, 12]. Concurrent presence of comorbidities, multi-morbidity ( $\geq 2$  chronic conditions) should be identified for better management of COLD. The potential of artificial intelligence and machine learning should be explored in management and predicting exacerbations of COLD.

Vaccinations against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, seasonal influenza and pneumococcal infections for all COLD patients aged 65 years and in younger patients with significant comorbidities are recommended [1]. The US Centers for Disease Control (CDC) also recommends vaccination to protect against pertussis for American adults who were not vaccinated during adolescence and zoster vaccine for COLD patients >50 years [1].

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### 25.5 Cost-Effectiveness and Financial Considerations

Cost-effective strategies for disease prevention, e.g., tobacco smoking cessation, vaccination, and for early case detection and management are already available. These need to be implemented urgently and widely in order to reduce the disease burden and try to achieve the UN SDG target relating to NCDs. The socio-economic burden of COLD is enormous globally, especially in the developing world, although precise estimates are lacking. More research on the socio-economic burden of COLD in developing countries is

required. The disability-adjusted life years (DALYs) lost globally from COLD continues to increase, from being the 11th leading cause of total DALYs lost in 1990, to the fourth rank in 2019. It clearly is a major contributor to disability globally, and LMICs account for 62.6% of the global burden of COLD [6].

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### 25.6 Challenges Faced by National Programmes

Despite being the third most common cause of death and fourth in terms of DALYs lost, COLD is not given due priority by both policy makers and public health managers. The political will to combat this NCD is lacking and is often limited to token attention. Consequently, in most cases, no resources are available in government health-care facilities in LMICs for COLD. Serious efforts to systematically collect COLD surveillance data required for evidence-based public health policy and program planning are presently lacking. In most countries, no national guidelines on COLD exist [13, 14].

As COLD is not listed among the UN SDG indicators/targets, hence there is no mechanism in place to monitor or measure progress in mortality or morbidity reduction. Population groups too are unaware that COLD is a preventable and treatable disease and what they can do individually and collectively to ameliorate the problem. Healthcare technologies, including spirometry, drugs including antibiotics, corticosteroids, bronchodilators and delivery devices, supplemental oxygen and vaccines are generally not available at district level and below.

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### 25.7 National and International Efforts

There is an urgent need for implementing a national programme for surveillance and control of COLD globally with adequate financial and human resources to manage it. A compelling evidence exists that COLD is a cause of increased global morbidity and mortality, producing a

huge socio-economic impact and is a serious impediment to social and national development. To achieve the 2030 agenda for UN SDG 3.4 and reduction of one-third premature mortality from NCDs including COLD by 2030, we must ensure urgently a sustained scaling up of efforts towards prevention and healthcare interventions, universal health coverage for COLD, with technical and financial capacity building support to LMICs. There is also an urgent need to develop partnerships, multisectoral co-ordination, including with tuberculosis elimination and tobacco control programmes, both at national and international levels. To mobilise national and international efforts, a Global Alliance against Chronic Respiratory Diseases has been established as a voluntary alliance of national and international organizations which contributes to WHO's global work to prevent and control chronic respiratory diseases [15].

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