

# Tobacco Smoking and Environmental Risk Factors for Chronic Obstructive Pulmonary Disease

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## KEYWORDS

- Chronic obstructive pulmonary disease • Risk factors • Environmental • Tobacco smoking
- Biomass smoke

## KEY POINTS

- A better understanding of the risk factors associated with chronic obstructive pulmonary disease (COPD) is important to help prevent the development and progression of COPD.
- Tobacco smoking is an established risk factor for COPD. Tobacco can be smoked in different forms apart from cigarettes, many of which are more harmful. Exposure to second-hand smoke is also a risk factor for COPD.
- However, many other risk factors associated with COPD remain underappreciated or neglected. More than 50% of cases of COPD can be attributed to nonsmoking risk factors.
- Exposure to indoor air pollution resulting from the burning of biomass fuels is a major risk factor for COPD, especially in developing countries.
- Other indoor air pollutants and outdoor air pollutants also contribute to the risk of COPD.
- Occupational causes contribute to up to 30% of COPD cases, but very little is known about this risk factor. Farming is a neglected risk factor for COPD.

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic progressive disease of the airways and lung parenchyma that is associated with exposure to tobacco smoke and other environmental insults in genetically susceptible individuals. The damaged lungs in COPD are difficult to revert back to normal. Current management is therefore aimed at reducing the symptoms and rapid decline in lung function, and preventing acute exacerbations. The economic burden associated with COPD is huge. Preventing the development of COPD, therefore, seems to be the only cost-effective public health intervention strategy that can reduce the global burden. Understanding the risk factors associated with the development of COPD is important so

that primary, secondary, and even tertiary preventive strategies can be developed.

The development of COPD is multifactorial, and the risk factors include both genetic and environmental factors. The association between tobacco smoking and chronic bronchitis was first highlighted in 1955 by Oswald and Medvei.<sup>1</sup> However, the landmark study that established the association between tobacco smoking and COPD was the 8-year prospective study of 792 British men by Feltcher and Peto,<sup>2</sup> which observed that susceptible smokers showed a sharp and progressive decline in lung function that was the hallmark of this disease. The larger and longer Framingham study from the United States has confirmed these earlier reports.<sup>3</sup> For the last 5 decades, tobacco smoking has remained the most important risk

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factor associated with COPD across the world. In fact, the term COPD is used synonymously with smoking-induced lung disease.

As early as 1958, Fairbairn and Reid<sup>4</sup> reported that outdoor air pollution was an important risk factor for COPD, and in 1963 Phillips<sup>5</sup> reported that risk factors other than tobacco smoking were associated with COPD. However, the overwhelming interest in smoking as the main risk factor for COPD overshadowed these nonsmoking causes. In 2003, Lundbäck and colleagues<sup>6</sup> from Sweden and Mannino and colleagues<sup>7</sup> from the United States reported that the population-attributable risk of tobacco smoking for COPD was 45% and 44%, respectively, indicating that more than half of the cases of COPD were due to nonsmoking causes. In the same year, Ezatti and Lopez<sup>8</sup> published global mortality rates attributable to smoking from all causes in *The Lancet*, and reported that 47% of COPD deaths in men and 78% of COPD deaths in women were not attributable to tobacco smoking (Fig. 1). In 2009, Salvi and Barnes<sup>9</sup> reviewed the global literature on the prevalence of COPD among never-smokers, and reported that between 25% and 45% of patients with COPD across the globe had never smoked; highlighting the fact that COPD in never-smokers is much more common than was previously believed. A recent study on COPD prevalence from 14 countries, defined by postbronchodilator spirometry values, reported that 23.3% of the COPD subjects were never-smokers.<sup>10</sup>

This article describes the role of tobacco smoking and the various environmental risk factors associated with the development of COPD. Other risk factors for COPD such as poorly treated chronic severe asthma, status post pulmonary tuberculosis, poor socioeconomic status, and nutritional factors are not covered herein, and for

a discussion of these factors the reader is referred to the review by Salvi and Barnes.<sup>9</sup>

## TOBACCO SMOKING

The cigarette looks deceptively simple, but it is one of the most effectively engineered inhaler devices that delivers a steady dose of nicotine to the human body. Nicotine is present in the tobacco leaf, and its concentration varies depending on the variety of tobacco leaf. For example, the bright variety, which was originally grown in Virginia, United States, contains 2.5% to 3% nicotine, whereas the burley type of tobacco contains 3.5% to 4% nicotine and the oriental tobacco type contains less than 2% nicotine.

Nicotine is an alkaloid that is an extremely powerful drug. It stimulates the central nervous system and also increases the heart rate and blood pressure. Nicotine causes addiction similar to that of heroin and cocaine,<sup>11</sup> and is contained in the moisture of the tobacco leaf. When the cigarette is lit it evaporates, attaching itself to minute droplets in the tobacco smoke inhaled by the smoker. After being deposited in the lung, nicotine is absorbed very quickly and reaches the brain within 10 to 19 seconds. The damage that occurs in the lungs of tobacco smokers is mainly mediated by the tar present in the smoke, whereas the nicotine is relatively harmless.

Tar is the sticky brown substance that stains smokers' fingers and teeth yellow-brown. All cigarettes produce tar, but different brands produce different amounts. Earlier cigarettes (1950s) contained 30 mg tar per cigarette, but because of strict legislation modern cigarettes have tar levels lower than 11 mg per cigarette. According to the European Union directives, upper limits of tar, nicotine, and carbon monoxide have been set at

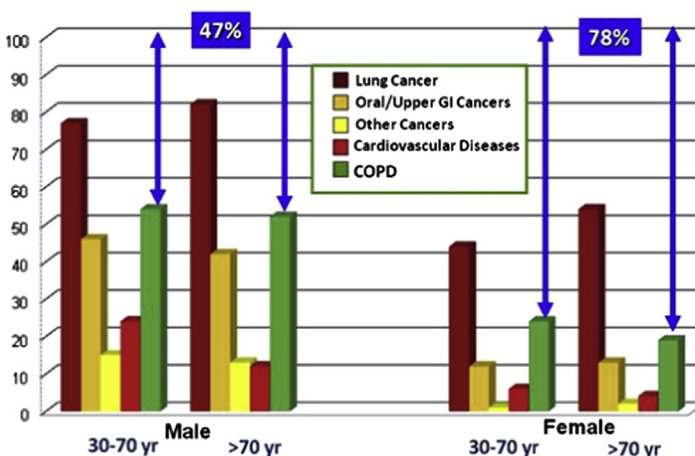


Fig. 1. Global mortality attributable to smoking: 47% of male COPD deaths and 78% of female COPD deaths are not attributable to tobacco smoking. (Data from Ezatti M, Lopez AD. Estimates of global mortality attributable to smoking in 2000. *Lancet* 2003;362(9387):847-52.)

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