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TOBACCO AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

- *Smoking is the leading cause of chronic obstructive pulmonary disease (COPD) in high-income countries, contributing to approximately 70% of cases. Quitting tobacco is the first step toward better lung health.*
- *People with COPD face a significantly higher risk of lung cancer. Quitting smoking is a powerful measure to reduce this risk and protect lung health.*
- *Cardiovascular disease and type 2 diabetes are common complications in people with COPD. Quitting smoking not only improves COPD management, but also reduces the risk of developing these coexisting conditions.*
- *Tobacco smoke significantly impacts children's lung growth and development, increasing the risk of COPD later in life. Governments should implement effective tobacco control measures to protect vulnerable populations.*
- *The tobacco industry's aggressive strategies in the marketing of nicotine and tobacco products specifically target children, adolescents and young adults. Protecting our youth from these harmful tactics is a top priority.*

What is COPD?

Chronic obstructive pulmonary disease (COPD) is a progressive and irreversible lung condition that narrows the airways, thus reducing airflow that leads to poor lung health *(1, 2, 3)*. It involves structural changes or scarring of the airways with persistent inflammation *(4, 5)*. People with COPD are also at risk of developing both infections and lung cancer *(5, 6)*. Symptoms of COPD, such as shortness of breath, chronic cough and phlegm, negatively impact health and productivity. The 5-year mortality rate for COPD is about 25% *(7, 8)*.

Health impact of COPD

COPD is a major global health problem and the third leading cause of death worldwide. In 2019, there were 392 million cases of COPD globally *(9)*, associated with 3.23 million *(2)* deaths and 74.4 million disability adjusted life years *(10)*. Three quarters of people with COPD live in low- and middle-income countries *(2, 9, 10)*.

Smoking is a major risk factor for COPD and leads to airway inflammation and remodelling associated with lung destruction. Besides smoking, both indoor and outdoor air pollution can also contribute. Early childhood respiratory infections, preterm

Tobacco definitions

Smoked tobacco products: any product made or derived from tobacco which generates smoke. Examples include manufactured cigarettes, roll-your-own tobacco, cigars, shisha (also known as waterpipe), kreteks and bidis.

Second-hand smoke (SHS): the smoke emitted from the burning end of a cigarette or other tobacco products, usually in combination with the smoke exhaled by the smoker.

Smokeless tobacco: any product that consists of cut, ground, powdered or other tobacco that is intended to be placed in the oral or nasal cavity. Examples include snuff, chewing tobacco, gutka, mishri and snus.

Heated tobacco product (HTP): tobacco products that produce aerosols containing nicotine and toxic chemicals when tobacco is heated or when a device containing tobacco is activated. These aerosols are inhaled by users during a process of sucking or smoking involving a device. They contain the highly addictive substance nicotine, as well as non-tobacco additives, and are often flavoured.

Electronic nicotine delivery system (ENDS) (also known as e-cigarette): a device that heats a liquid to create an aerosol that is inhaled by the user, which typically contains nicotine and toxic substances that are harmful to both users and non-users who are exposed to the aerosols second-hand; the liquid is often flavoured.

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birth, low birth weight *(11)* and tuberculosis *(9)*, can also contribute to the development of COPD *(12, 13)*. Second-hand tobacco smoke exposure is an important risk factor for these childhood events. The Global Burden of Disease collaborators report that direct smoking exposure accounts for nearly 70% of COPD cases in high-income countries, while environmental exposures and other factors account for almost 60% of COPD cases in low- and middle-income countries *(14, 15)*.

How does tobacco smoke cause COPD?

Cigarette smoke contains harmful substances such as nicotine, tar and thousands of chemicals, including ones with toxic and carcinogenic effects *(16)*. Nicotine levels vary in different tobacco leaves *(17)*. Depending on the size of the inhaled complex smoke particles, they can be deposited throughout the airway. Larger particles favour the larger and more central airways, while smaller particles are deposited in the smaller outer airways and sacs, leading to chronic inflammation, infections, oxidative stress and damage to the airways and gas exchange areas of the lung *(18, 19)*. Additives, chemicals and flavourings are usually added to increase the palatability, attractiveness and addictiveness of tobacco products *(20, 21)*. Combined with other substances, such additives can become toxic during use of these products *(20, 22)*. Other forms of smoked tobacco products, for example, hookah or water-pipe, burn the tobacco leaves with other additives *(23, 24)*. These forms of smoking are at least as detrimental to lung health as smoking cigarettes and should not be considered as a safe alternative *(25)*. Moreover, nicotine, a highly addictive substance, is deposited in the lung and rapidly absorbed, stimulating the central nervous system to elevate the heart rate and blood pressure *(26, 27)*.

Tobacco smoking and COPD-related complications

People with COPD also have a higher risk for other health problems *(1, 13)*. This can impact negatively on symptoms, quality of life, complication rates, disease management and life expectancy *(28)*. The most common other conditions include coronary artery disease, atrial fibrillation, congestive heart failure, skeletal muscle wasting, metabolic syndromes including diabetes mellitus, osteoporosis, depression, anxiety, and lung cancer *(13)*. Nearly half of all COPD patients have three or more other health conditions, underscoring the importance of a holistic person-centred approach to the overall management of COPD *(1)*.

Lung cancer

Individuals with COPD have a four-to-six-fold higher risk of developing lung cancer compared with the general population *(29)*. COPD and lung cancer share risk factors, such as exposure to tobacco smoke and indoor/outdoor air pollution, as well as common pathways for disease development *(30, 31, 32)*. COPD and lung cancer often have overlapping symptoms, such as chronic cough, shortness of breath and chest discomfort *(13, 33)*. This can make it challenging to differentiate between the two conditions based on symptoms alone.

Cardiovascular diseases

Individuals with COPD have more cardiovascular risk factors, such as smoking, obesity and hypertension *(34)*. Chronic inflammation in COPD can also contribute to the narrowing of blood vessels and increase the risk of blood clots *(1)*. Reduced lung function and impaired oxygen exchange can increase strain on the heart in people with COPD. Cardiovascular disease can have a negative impact on individuals with COPD, causing increased blood pressure in the lungs *(35)*. In addition, coronary artery disease or heart failure can compromise lung function by reducing oxygen supply to the lungs *(36)*. The coexistence of COPD and cardiovascular disease is associated with worse outcomes, increased hospitalization, higher death rates and reduced quality of life.

Second-hand smoke and COPD

Exposure to second-hand smoke is a significant risk factor for the onset and progression of COPD. Exposure to second-hand smoke in both childhood

and adulthood have been linked to an increased risk for COPD-related mortality *(37)*. Inhalation of second-hand smoke can adversely affect the respiratory system, particularly for individuals already affected by asthma, infections or allergies. Prolonged exposure to second-hand smoke can cause airway inflammation, constriction, airway obstruction and lung tissue damage, increase the likelihood of developing COPD, worsen existing COPD symptoms and accelerate the decline in lung function *(38, 39*). Second-hand smoke also increases the risk of developing lung cancer. In utero, smoke exposure may lead to preterm birth and increase the risk of respiratory diseases such as asthma and COPD in the offspring.

Smokeless tobacco and COPD

There is no direct evidence to date that smokeless tobacco (such as chewing tobacco or snuff) can lead to the development of COPD. Although smokeless tobacco does not involve inhaling smoke into the lungs, it still exposes users to high level of nicotine and harmful chemicals and toxins that can cause mouth and throat cancer, which could affect the lungs *(40)*. The use of smokeless tobacco can lead to chronic irritation and inflammation in the airways *(41)*, contributing to the development of respiratory conditions such as large airway inflammation or bronchitis.

New and emerging nicotine and tobacco products and COPD

Electronic nicotine delivery systems (ENDS)

Serious health concerns regarding the use of e-cigarettes have been raised, particularly related to their use by adolescents and young adults *(42, 43, 44)*. Early studies have shown a correlation between the use of e-cigarettes and lung injury *(12, 45)*, with e-cigarette users showing increased respiratory symptoms, an elevated risk of developing airway disease and a decline in lung function *(46)*. However, to date, there is no direct evidence that use of electronic smoking devices leads to the development of COPD. COPD develops over many years in response to smoking or environmental exposures. However, based on the literature review, it is postulated that continuous use of electronic smoking devices could lead to lung health issues and be a risk factor for development of COPD among those who have never smoked. Osei et al. reported that current e-cigarette users have a 75% higher risk of developing COPD compared with those who have never used e-cigarettes (47). Daily e-cigarette users and former tobacco cigarette smokers who currently use e-cigarettes are at a higher risk of developing COPD compared with individuals who have never smoked conventional cigarettes or used e-cigarettes *(48)*. In addition, individuals who both smoke conventional cigarettes and use e-cigarettes ("dual use") showed the highest likelihood of developing COPD compared with those who have never smoked conventional cigarettes or used e-cigarettes *(47, 49, 50)*. These findings suggest that the use of e-cigarettes may potentially promote pathophysiological processes similar to those seen in COPD. Hence e-cigarettes should not be promoted as an alternative to smoking cessation *(49, 50)*. Additional research is needed to examine the long-term risk of developing COPD among users of e-cigarette products, taking into account the evolving composition of e-cigarette products.

Heated tobacco products

Heated tobacco products (HTPs) emit toxic chemicals, including nicotine, when tobacco is heated or when a device containing tobacco is heated, and these are inhaled by the user. These products are marketed by the tobacco industry as a "less harmful alternative" to conventional cigarettes *(51, 52, 55)*. Currently, the existing evidence is insufficient to support the reduced exposure claims for HTPs, and existing evidence is also insufficient to support either the reduced risk or reduced harm claims for HTPs *(52, 53)*. HTPs have gained popularity in recent times and are available in about 70 countries *(54, 55)*. Research studies have shown that exposure to HTP emissions can be just as harmful to human lung cells as exposure to smoke from conventional cigarettes. It can cause a persistent allergic response, smoke- or environmental-triggered

inflammation that leads to airway scarring, which are the principal causes of airflow limitation in COPD *(54, 56)*. There is high prevalence of dual use of HTPs with conventional cigarettes among COPD patients (up to 33%), which does not reduce the harm for these patients *(57)* or the prevalence of smoking-related chronic disease *(58)*.

Impact of selected tobacco control interventions on COPD

Tobacco control plays an important role in public health and chronic disease management. There is no safe way to use tobacco. People should be supported to stop using tobacco in all forms, including e-cigarettes and HTPs.

Smoking cessation has a great impact on reducing the health risks associated with smoking. It is a crucial intervention for all people who smoke and have COPD, as it can slow the decline in lung function and the progression of COPD (13), improve respiratory symptoms and reduce mortality in patients with COPD compared with those who continue to smoke (59). Smoking cessation also benefits COPD patients who have nocturnal sleep disorders *(60)*. Health-care professionals and advice during routine medical visits should increase patients' awareness of the hazards of smoking and provide smoking cessation advice to enhance their self-efficacy in quitting *(61, 62)*. WHO urges governments to include smoking cessation and treatment services as part of tobacco control programmes *(63)*, which is also recommended in the United States Surgeon General's 2020 report on smoking cessation *(64)*.

Population-level interventions to address tobacco use

Population-level interventions to combat tobacco-linked COPD morbidity and mortality are essential. WHO has well-established tools for implementing tobacco control measures. To support countries in implementing the WHO Framework Convention on Tobacco Control (WHO FCTC), WHO introduced the MPOWER package in 2008 and reports on progress in a biennial report on the global tobacco epidemic *(61)*. MPOWER contains a set of six tobacco control and demand reduction measures that correspond to one or more articles in the WHO FCTC.

The WHO Package of Essential Noncommunicable (PEN) Disease Interventions for primary health care includes a module on the management of COPD. PEN emphasizes the need to inform people with COPD about the risks of smoking and indoor air pollution and the need to stop smoking *(62)*.

The updated "best buys" and other recommended interventions for the prevention and control of noncommunicable diseases were adopted by the 76th World Health Assembly in 2023. These include seven cost-effective interventions to reduce tobacco exposure and two on the management of COPD. WHO recommends the following population-level and pharmacological interventions to ensure access to comprehensive cessation support.

- **Brief advice:** advice on how to stop using tobacco, usually taking only a few minutes, and given to all tobacco users during the course of a routine consultation or interaction with a health professional.
- **Toll-free quit lines:** a telephone counselling service that provides proactive and reactive telephone counselling.
- **Pharmacological interventions:** nicotine replacement therapy, bupropion and varenicline should be provided for all tobacco users who want to quit.
- **mCessation and chatbots:** a two-way messaging system based on the mCessation content library, which guides tobacco users through a six-month text-message quit support programme. WHO has also developed chatbots in partnership with WhatsApp, WeChat and Viber to give tobacco users the best advice on how to quit tobacco smoking.
- **WHO Quit Tobacco mobile application:** the app targets all forms of tobacco including smokeless and other newer products and helps users to identify the triggers, set their targets, manage cravings and stay focused to quit tobacco.

Emerging concerns and future directions

The primary strategy to reduce the burden of COPD is to address all risk factors, especially all forms of exposure to tobacco smoke, to promote respiratory health and overall well-being. Lungs are not designed to inhale tobacco smoke. Bold action

is required by individuals, health practitioners and policy-makers to create a tobacco-free world.

The risk of developing COPD is present throughout life, and exposure to risk factors can be particularly harmful during lung growth and development (in utero, in childhood and in adolescence).

Tobacco use among children, adolescents and young people is therefore particularly concerning. These vulnerable groups are being actively targeted by the tobacco industry with campaigns promoting nicotine and tobacco products, including e-cigarettes and HTPs. The emergence of a tobacco epidemic among populations already vulnerable to COPD through adverse early life events and exposure to indoor and outdoor air pollution could be catastrophic for already overstretched health systems which are ill-equipped to manage chronic conditions.

Protecting these groups from the dangers of tobacco use through effective tobacco control legislation, including product regulation, is not just a matter of public health, but also an ethical obligation.

It is also crucial to expose the tobacco industry's tactics and equip the general public with knowledge and tools to combat the influence of the tobacco industry.

Moreover, it is imperative that all tobacco users, particularly those living in low-middle income countries, have access to comprehensive cessation support aligned with WHO recommendations. This support should encompass brief advice from health-care professionals, availability of toll-free quit lines, access to treatment for tobacco dependence and digital cessation tools.

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