

# Smoking and Respiratory Disease

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## Introduction

Respiratory diseases are conditions which affect the airways and other structures of the lungs. They include lung cancer, asthma, tuberculosis (TB), chronic obstructive pulmonary disease (COPD) and pneumonia, which are some of the leading causes of mortality and morbidity globally.<sup>1,2</sup>

Respiratory disease is the third-leading cause of death in England, affecting one-in-five people over the course of their lives, and placing a substantial burden on the health care system.<sup>3,4</sup> Smoking or exposure to secondhand smoke is a leading cause of most respiratory diseases, with current smokers 11 times more likely to develop lung cancer compared to non-smokers.<sup>2,3,4</sup>

It is estimated that smoking causes more than 77,000 premature deaths annually in England,<sup>5</sup> and is responsible for 15.1% of attributable cancer cases in the United Kingdom (UK).<sup>6</sup> In 2017, 37% of all deaths from respiratory diseases in England were estimated to be attributable to smoking.<sup>5</sup> Around quarter of the excess mortality among smokers is accounted for by lung cancer and COPD.<sup>7</sup>

Smoking cessation is one of the most effective ways to prevent respiratory diseases and also one of the most effective treatments for people who have them.<sup>4</sup> This factsheet provides an overview of the harm caused by smoking and the different types of respiratory diseases.

## Smoking, respiratory disease and COVID-19

COVID-19 is a respiratory viral infection that affects the lungs and airways, and can cause life threatening systemic inflammation and pulmonary and cardiovascular complications.<sup>8</sup> It is caused by a novel coronavirus called SARS-CoV-2.<sup>9</sup> People infected by the virus may be asymptomatic, or have mild to moderate symptoms (in particular dry cough, breathlessness, fever and anosmia) while others develop a severe form of pneumonia that can require admission to an intensive care unit or be fatal.<sup>10</sup>

There is strong evidence that smoking tobacco is generally associated with an increased risk of developing respiratory viral infections including pneumonia.<sup>4,11</sup> There is also some evidence that current smoking compared with never smoking is associated with greater disease severity in those hospitalised for COVID-19.<sup>12</sup>

Evidence suggests that people with significant comorbidities such as COPD are at increased risk of more severe symptoms from COVID-19,<sup>13,14,15,16</sup> with one meta-analysis finding that COPD patients with COVID-19 had almost double the risk of more severe complications compared to patients without COPD.<sup>17</sup>

Data from a primary care population of over 17 million people in the OPENSsafELY study found that, adjusted for age and sex, current smokers were 1.14 times more likely to die from COVID-19 than never smokers. The Zoe symptom study of 2.4 million people found that smokers using the app were 1.14 times more likely to report “classic” COVID-19 symptoms of cough, breathlessness and fever.<sup>18</sup>

## Lung cancer

Lung cancer is one of the most common and severe types of cancer and it remains the leading cause of cancer death worldwide.<sup>19</sup> Every year about 47,000 people are diagnosed with lung cancer in the UK.<sup>20</sup> In 2017 alone 24,300 men and 23,100 women were diagnosed with lung cancer, about 35,300 of whom died as a result.<sup>21</sup> Lung cancer has one of the lowest survival rates (after diagnosis) of any cancer<sup>22</sup> with only 7.6% of men and 11.3% of women surviving 10 years beyond diagnosis.<sup>23</sup>

Tobacco is the biggest cause of lung cancer in the United Kingdom with over 72% of cases of lung cancer resulting from tobacco smoking.<sup>6</sup> People who smoke were first shown to be more likely to develop lung cancer relative to non-smokers in the 1950s. A major study in the UK found that people who smoked around 20 cigarettes a day had 26 times the lung cancer risk of non-smokers, and those who smoked three cigarettes a day had 6 times greater risk.<sup>24</sup> Similarly, a 2016 meta-analysis estimated that lung cancer is 11 times more likely to develop in current smokers than in non-smokers.<sup>25</sup>

A 50-year longitudinal study of smoking among British doctors found substantial long-term health risks associated with smoking, including increased rates of lung cancer and COPD.<sup>7</sup> The study also found that smokers who quit smoking at age 30, 40, 50 or 60 years gained respectively, 10, 9, 6 and 3 years of life relative to those who continued to smoke. Another study which modelled absolute risk of lung cancer mortality following smoking cessation at different ages, found that the risk of lung cancer mortality remains elevated after quitting, relative to non-smokers, but that those who quit at younger ages had a lower risk than those who quit later in life.<sup>26</sup>

Although minor benefits may also be obtained through attempts to reduce cigarette intake, these are likely to only emerge if smokers reduce their cigarette consumption by a significant amount (i.e. 75-80%).<sup>27</sup> This is because smokers tend to compensate by smoking each remaining cigarette harder, a process referred to as self-titration.

Quitting smoking is also the most effective way for smokers who have been diagnosed with early stage lung cancer to improve their outcomes.<sup>28</sup> Smoking cessation after diagnosis is associated with prolonged survival after treatment for patients with small-cell lung cancer (18.0 vs. 13.6 months), and better general health for patients with non-small cell lung cancer.<sup>29</sup> However, relapse to smoking remains a significant problem for lung cancer patients with recent smoking histories, with one study finding that nearly half of non-small-cell lung cancer patients return to smoking after surgery.<sup>30 31</sup>

Evidence shows that:

- The more a person smokes, the more likely they are to get lung cancer. However, the length of time spent smoking is the most important predictor.<sup>32</sup> Smoking one pack of cigarettes a day for 40 years is more hazardous than smoking two packs a day for 20 years.<sup>33</sup>
- Those who start smoking at younger ages have higher cancer risk and mortality.<sup>34</sup> In a study conducted in the UK, males who began smoking in their teens (16–19) had high levels of lung-cancer-related mortality.<sup>34</sup> Similar trends have also been found among women: those who had started smoking

around 15 years of age were at greater risk of smoking related mortality than those who had started only 4 years later.<sup>35</sup>

- Data pooled across a number of studies show that smoking is more strongly linked with risk of small cell lung cancer and squamous cell carcinoma than other types of lung cancer.<sup>33 36</sup>
- Exposure to secondhand smoke significantly increases the risk of lung cancer in adult non-smokers.<sup>26</sup> A case control study in Japan revealed a 50% increased risk of lung cancer among non-smoking women whose husbands smoked. The risk tended to increase among women who worked outside their homes and whose husbands were heavy smokers.<sup>37</sup> A more recent study found an estimated 15% of lung cancer cases in never smokers were due to environmental tobacco smoke.<sup>38</sup>

Besides lung cancer, tobacco use also increases the risk for cancers of the mouth, lips, nose and sinuses, larynx (voice box), pharynx (throat), oesophagus (gullet), stomach, pancreas, liver, kidney, bladder, uterus, cervix, colon/rectum, ovary, and acute myeloid leukaemia.<sup>39</sup>

For more information see [ASH Fact Sheet: Smoking and Cancer](#)

## Chronic Obstructive Pulmonary Disease (COPD)

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines COPD as a progressively disabling disease characterised by airflow obstruction that interferes with normal breathing.<sup>40</sup> Typical symptoms include increased breathlessness, a persistent phlegm-based cough and frequent chest infections.<sup>41</sup> Unlike many other common chronic diseases, the prevalence of COPD has not declined in recent years. The latest statistics show that 65 million people suffer from moderate to severe COPD worldwide, from which about 3 million die each year, making COPD the world's third-highest cause of death.<sup>42</sup> COPD was previously thought to be a disease which primarily affected older men, but recent evidence shows that it affects both men and women equally<sup>43</sup> and is associated with factors linked to socioeconomic deprivation, early life disadvantage and smoking. Individuals of low socioeconomic status are more likely to be diagnosed and to die from COPD than those of higher socioeconomic status.<sup>44</sup>

The UK has the 12th highest number of recorded deaths from COPD in the world, with around 1.2 million people are currently living with diagnosed COPD.<sup>45</sup> However, most people with COPD are not diagnosed until they are in their fifties or older and many more people may remain undiagnosed.<sup>46</sup> This is partially due to individuals dismissing the symptoms as a common cough.<sup>42</sup> There is no single diagnostic test for COPD. Making a diagnosis relies on clinical judgement based on a combination of history, physical examination and confirmation of the presence of airflow obstruction using spirometry – a breath test measuring pulmonary function.<sup>42 46</sup>

COPD is an umbrella term which includes two main pathological processes - chronic bronchitis which affects the airways and emphysema where the lung tissue is damaged. People with chronic bronchitis have intermittent attacks of obstructed breathing during which their airways become inflamed, narrowed and clogged with mucus. Emphysema refers to the destruction of the alveoli (air sacs) in the lungs. Alveoli are essential for the exchange of oxygen in the blood: when they break down the lung loses its elasticity and there is less surface area of the lung to absorb oxygen. The onset of the disease is very gradual, and breathlessness only becomes troublesome when about half of the lung has been destroyed, which means that diagnosis is often late.<sup>42</sup>

Although COPD can be the result of exposure to occupational hazards and air pollution, it is predominantly caused by active or secondhand tobacco smoke exposure.<sup>4 42</sup> Cigarette smokers not only have a higher prevalence of respiratory symptoms and lung function abnormalities but also a higher mortality rate.<sup>4 26</sup> Other

forms of tobacco (e.g., cigars and water pipes) also increase the risk of COPD.<sup>46</sup> Smoking causes COPD through its irritant and inflammatory effects on the lungs. Subsequently, the inflammation causes the airways to thicken and narrow and larger amounts of mucus to be produced.<sup>47</sup>

#### Evidence shows that:

- Current smokers are four times more likely to develop COPD.<sup>26</sup>
- About half of cigarette smokers develop some sort of airflow obstruction and 10-20% develop clinically significant COPD.<sup>47</sup>
- The risk of developing COPD is increased if a person smokes from a young age.<sup>48</sup> The findings of a retrospective cohort study of adult smokers suggest that women are particularly at risk of COPD if they start to smoke before the age of 16.<sup>49</sup>
- 80% of COPD deaths are caused by smoking.<sup>50</sup>
- Secondhand smoking is also a major independent risk factor for COPD.<sup>51</sup> Evidence published in 2009 found an association between childhood exposure to secondhand smoke and the development of emphysema in adulthood. The findings suggest that the lungs may not recover completely from the effects of early-life exposure to second-hand smoke.<sup>52</sup>
- Data from the Health Survey for England show that smokers with COPD tend to be more addicted to cigarettes but show no greater desire to stop smoking than other smokers.<sup>53</sup>

Quitting smoking once COPD has developed cannot reverse the progress of disease but can help to decelerate its worsening.<sup>4 47 54</sup> Smoking cessation is more effective than all known pharmacological treatments for COPD and can also reduce the severity of COPD symptoms.<sup>4 55</sup> However, the best way to prevent COPD is to have never started smoking. The most effective way to quit smoking is by using a combination of behavioural therapy and pharmacotherapy.<sup>56</sup> A 2016 Cochrane review found that this combination is more effective in helping smokers with COPD to quit smoking than behavioural therapy alone.<sup>57</sup>

Although supporting smoking cessation is one of the highest value interventions for COPD,<sup>4</sup> both patient reports and audit data show that it is poorly provided.<sup>58 59</sup>

## Pneumonia

Pneumonia is a form of an acute respiratory infection that causes inflammation of the lung, making breathing painful and limiting oxygen intake.<sup>60</sup> It is caused by a number of infectious agents, including viruses, bacteria and fungi.<sup>61</sup> Globally, pneumonia kills millions of people annually and is the leading cause of death of children under 5.<sup>43</sup> The World Health Organization estimates that lower respiratory infections are the deadliest communicable disease, causing 3 million deaths worldwide.<sup>61</sup>

Pneumonia can be acquired in the community or acquired in the hospital/healthcare environment and can affect people of any age.<sup>62</sup> In the UK, pneumonia affects around 0.5 to 1% of adults each year. It is more widespread in autumn and winter.<sup>63</sup> This is because respiratory viral infections such as flu – which increase your risk of developing pneumonia – are more common in the winter and spread easily from person to person.<sup>64</sup>

Community acquired pneumonia (CAP) has been associated with excess mortality over subsequent years following survival.<sup>65</sup> Smoking and exposure to tobacco smoke are well known independent risk factors for CAP, likely due to the adverse impact smoking has on the clearance of bacteria from the respiratory tract.<sup>43</sup>

<sup>66 67 68</sup> Smokers account for approximately half of healthy adult patients with invasive pneumococcal disease

(causes pneumonia, bacteraemia, and meningitis).<sup>69</sup> Some studies have also demonstrated a higher risk of respiratory infections in children whose parents smoke and in adults exposed to second-hand smoke.<sup>70</sup>

#### Evidence shows that:

- Smokers are twice as likely to get pneumonia compared to non-smokers.<sup>26</sup>
- A dose-response relationship has been demonstrated between current number of cigarettes smoked per day and invasive pneumococcal disease.<sup>71</sup>
- Smokers have an increased risk of developing pneumonia after surgery as well as a greater chance of suffering a collapsed lung after undergoing anaesthesia and surgery.<sup>72</sup>
- Pneumonia is the leading cause of childhood death world-wide and parental smoking is a known risk factor for childhood pneumonia.<sup>71 73</sup>

Studies have shown that the risk of CAP is reduced by half, 5 years after stopping smoking.<sup>74</sup> The British Thoracic Society Guideline for the Management of Pneumonia also recommends that smoking cessation advice is offered to all CAP patients,<sup>75</sup> with evidence that this may decrease the chances of hospitalisation.<sup>76</sup>

## Tuberculosis

Tuberculosis (TB) is an infectious disease caused by the *Mycobacterium tuberculosis* bacteria.<sup>77</sup> In 2018, 10 million people contracted TB and 1.5 million died from the disease world-wide.<sup>78</sup> In the UK, a total of 4,655 cases of TB were recorded in 2018, an incidence of 8.3 per 100,000 residents.<sup>79</sup> TB is generally concentrated in lower socio-economic populations, with the most deprived 10% of the population featuring a TB rate of 16.6 per 100,000 compared to 3.0 per 100,000 in the least deprived 10%.<sup>80</sup>

The disease is spread through the inhalation of droplets coughed into the air by a patient with TB or through the inhalation of dust laden with the bacteria. Symptoms include a persistent cough, chest pain, weakness and fatigue, weight loss and other flu-like symptoms.<sup>79</sup>

In the past decade, a number of epidemiological studies and meta-analyses have implicated both active and passive smoking as a risk factor in the acquisition of TB infection, the development of active TB and death from TB.<sup>26 81</sup> Exposure to tobacco smoke is thought to contribute to TB infection, through its effects on the weakening of anti-TB immunity.<sup>82</sup>

- A study published in 2008 found that smoking was associated with relapse after successful treatment for TB.<sup>83</sup> A more recent study also established that smoking adversely affected baseline disease severity, bacteriological response, relapse and treatment outcome.<sup>84</sup>
- TB patients who smoke are more likely to transmit the infection to children in their household.<sup>85 86</sup>
- Most cases of TB occur in places where tobacco use is extremely common or rising rapidly. China and India alone which have high smoking rates, account for 40% of all cases of tuberculosis in the world.<sup>87</sup>
- Worldwide, an estimated 17.6% (95% CI): 8.4, 21.4) of TB cases and 15.2% (95% CI: 1.8, 31.9) of TB mortality were attributable to smoking.<sup>88</sup>

Although there have been only a handful of studies looking at smoking cessation in TB patients - for example, a large cohort study of nearly 500,000 adults in Taiwan, found that TB mortality rate decreased by 65% following abstinence from smoking.<sup>89</sup> The World Health Organization recommends that in addition to improving TB diagnostics, drugs and vaccinations, smoking cessation should be included in treatment regimes.<sup>90</sup>

# Asthma

Asthma is a chronic inflammatory disease that affects the airways and is characterised by respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that varies over time and in intensity, together with variable expiratory airflow limitation.<sup>91</sup> Asthma is the most common chronic disease of childhood and the leading cause of childhood morbidity from chronic disease as measured by school absences, emergency department visits and hospitalisation.<sup>92</sup>

During an asthma “attack”, the smooth muscle in the walls of the airways tightens and narrows “bronchospasm”, and the lining of the airways become inflamed and swollen “airway inflammation” which also narrows the airways.<sup>93</sup> Asthma affects all ages, races, ethnicities, and about 235 million people currently suffer from asthma around the world, with the disease being more common in low- and lower-middle-income countries.<sup>92</sup> In the UK, around 5.4 million people are currently receiving treatment for asthma; the equivalent of 1 in every 12 adults and 1 in every 11 children.<sup>94</sup>

The airways of individuals with asthma are sensitive to a variety of triggers, including tobacco smoke. Exposure to cigarette smoke (directly or second-hand) is known to trigger the development of asthma and exacerbate symptoms.<sup>26 95</sup> Studies report an accelerated decline in lung function and severe obstruction of airflow in asthmatic smokers.<sup>96</sup> Worsening asthma symptoms and lung function changes can be reversed with smoking cessation.<sup>97</sup> However, asthmatic patients who are more dependent, had late-childhood onset asthma but early smoking onset, find abstinence more difficult.<sup>98</sup>

- Adult smokers are at higher risk of developing asthma compared to adult non-smokers.<sup>26</sup>
- The severity of asthma appears to be dependent somewhat on the duration of smoking, with a greater severity among those with a history of 20 pack-years (smoking one 20-pack of cigarettes a day for 20 years).<sup>99</sup>
- Asthma patients who smoke have an impaired response to treatment, because smoking interferes with the action of inhaled corticosteroids.<sup>100 101</sup>
- Parental smoking is a cause of asthma in children and the prevalence of asthma increases with the number of smokers in the home.<sup>102 103</sup>
- Smoking during pregnancy has been associated with reduced lung function, increased risk of asthma and exercise-induced wheezing offspring.<sup>4 104 105</sup>
- Children who suffer from asthma, and whose parents smoke, are twice as likely to suffer asthma symptoms all year round compared to the children of non-smokers. Wheeze and physician-diagnosed asthma is more common in children who live with a smoker.<sup>104 106</sup>
- A review by the Royal College of Physicians notes that household smoking increases the risk of asthma in children by about 50%.<sup>107</sup>

For further information see ASH's [Research Report on Asthma and Smoking](#).

## Morbidity in the young

Second-hand smoke is responsible for a significant proportion of deaths from asthma, lower respiratory infections, lung cancer and ischemic heart disease. 30% of all deaths from second-hand smoke occur in children, with the largest disease burden from lower respiratory infections in those younger than 5 years of age.<sup>108</sup> Indeed, children of smoking parents have more respiratory illnesses than those of non-smokers.<sup>26 109</sup> For example, a review by the World Health Organization concluded that exposure to second-hand smoke is a major cause of bronchitis, pneumonia, coughing and wheezing and asthma attacks in children.<sup>110</sup>

As of 2018, 165 countries have now implemented smokefree laws banning smoking in enclosed public places.<sup>111</sup> However, such legislation does not cover smoking in private residences. Indeed, parental smoking is one of the major predictors of second-hand smoke exposure, in addition to low socio-economic status, being less educated and attitudes towards second-hand smoking.<sup>112</sup>

Survey data for England shows that in 2018, 13% of pupils reported being exposed to second-hand smoke in the home every day or most days.<sup>113</sup> Pupils were more likely to smoke themselves if they lived in a household with other smokers, with 9% of pupils who lived with three or more smokers being regular smokers themselves, compared to only 1% of those in households with no other smokers. The Millennium cohort study also found that smoking by early teens was more than twice as likely if the child's caregiver smoked.<sup>114</sup>

Children living in deprived communities with high rates of smoking are more likely to be exposed to secondhand smoke in the home. Children under 5 years of age living in social housing – where there is also a concentration of other indicators of disadvantage – are 4 times more likely to be exposed to tobacco smoke compared to children living in owner occupied homes.<sup>115 116</sup>

#### For further information, see:

- ASH Fact Sheet. [Young people and smoking](#)
- ASH Report. [Smoking in the home: New solutions for a Smokefree Generation](#)
- Royal College of Physicians. [Passive smoking and children](#)

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