

The impact of

cannabis

on your lungs

Contents

Executive summary and summary of recommendations	2
Part 1: Introduction	3
1.1 About the report	3
Part 2: Background	4
2.1 Who smokes cannabis?	4
2.2 Types and potency of cannabis used in the UK	4
2.3 Active constituents of cannabis	5
2.4 Components of cannabis smoke	5
2.5 Cannabis and tobacco cigarettes	5
Part 3: Health effects of cannabis	7
3.1 Chronic obstructive pulmonary disease (COPD) and lung function	7
3.2 Lung cancer	8
3.3 Collapsed lung (pneumothorax)	9
3.4 Respiratory infections and immune effects	10
3.5 Broader health effects, including mental health and cardiovascular disease	10
3.6 Medicinal use of cannabis	11
Part 4: Evidence gaps	12
Part 5: Conclusions and recommendations	13
References	14

Executive summary and summary of recommendations

In 2002, the British Lung Foundation published *A smoking gun?*, summarising the evidence around the impact of smoking cannabis on respiratory health.

Ten years on, this report updates *A smoking gun?*, detailing the evidence published over the past decade.

About a third of adults in the UK have tried cannabis¹. An estimated 2.2 million used cannabis in England and Wales during 2010 and 2011.

Current evidence shows that smoking cannabis is hazardous to our lungs. We know far less about the effects of cannabis smoke than the impact of tobacco smoke. However, there is evidence that cannabis smoking is linked to many adverse effects, including:

- chronic coughing;
- wheezing;
- sputum (phlegm) production;
- tuberculosis;
- legionnaires' disease;
- aspergillosis;
- acute bronchitis;
- airway obstruction;
- pneumothorax, and
- lung cancer.



Published research shows:

- a link between smoking cannabis and many respiratory problems, including **chronic coughing, sputum production and wheezing**;
- a connection between smoking cannabis and infective lung conditions such as **tuberculosis (TB)** and **legionnaires' disease**
- a link between smoking cannabis and **collapsed lung (pneumothorax)**;
- stronger evidence than ever before that smoking cannabis is linked to **lung cancer**;
- a lack of conclusive evidence on how smoking just cannabis (i.e., without tobacco) affects lung function and the development of **chronic obstructive pulmonary disease (COPD)**, and
- smoking both tobacco and cannabis appears to lead to a greater risk of COPD and pneumothorax than smoking a similar amount of tobacco alone.

We believe more investment is urgently needed to find out the true effects of smoking cannabis on respiratory health. We especially need to know more about the impact smoking cannabis has on lung function and COPD risk.

We need to dedicate more resources to raising awareness of the impacts of cannabis smoking on respiratory health (and its impact on other aspects of people's health), and to supporting people who want to stop smoking cannabis.

PART 1: Introduction

1.1 About the report

In 2002, the British Lung Foundation published its *A smoking gun?* report summarising the impact of smoking cannabis on respiratory health. The report reviewed the evidence available at the time, which suggested that:

- Cannabis smokers are more likely to suffer chronic and acute respiratory problems compared with non-smokers.
- Smoking cannabis damages the immune system.
- The cannabis smoked today is stronger than it was in the 1960s.

However, the report also emphasised the lack of research in this field and stressed the need for more research to increase our understanding of this complex public health concern.

In the decade since the publication of the original *A Smoking Gun?*, further research has started to reveal important new information about the effects of smoking cannabis on lung health. This report gives an overview of the current evidence.



PART 2: Background

Who smokes cannabis in the UK?

Around a third of adults in the UK have tried cannabis. Latest available figures, taken from the 2010/2011 *British Crime Survey of England and Wales*, suggest that 30.7 per cent of 16- to 59-year-olds have used cannabis in their lifetime. That figure rises to 34.5 per cent for 16- to 24-year-olds¹.

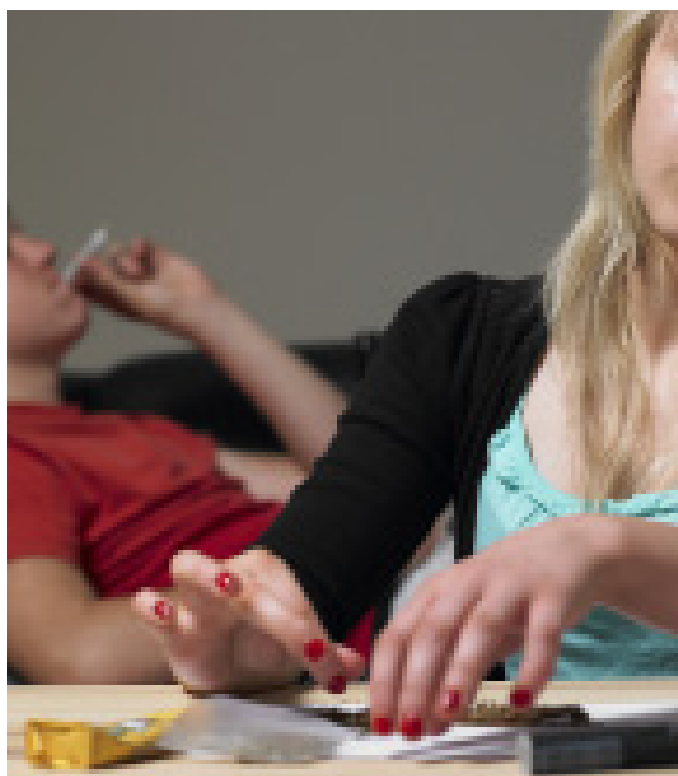
Cannabis was the most commonly used illegal drug among 16- to 59-year-olds in 2010-2011; one in 15 people said they had used it in the last year¹. That's around 2.2 million people in England and Wales.

Among young people, cannabis is still the most commonly used illicit drug. The same survey estimates that around one in six (17.1 per cent of) 16- to 24-year-olds used cannabis during 2010-2011¹. This is around 1.1 million young people in England and Wales.

The *Scottish Schools Adolescent Lifestyle and Substance Use Survey 2010*² asked 37,307 Scottish 13- and 15-year-olds about their cannabis use. It found that cannabis was by far the most common drug they used. Overall, 10 per cent of 15-year-olds and 2 per cent of 13-year-olds said they had used cannabis in the last month. By gender, 13 per cent of 15-year-old boys, 8 per cent of 15-year-old girls, 2 per cent of 13-year-old boys, and 1 per cent of 13-year-old girls had used cannabis in the last month.

The *Drug Use in Ireland and Northern Ireland Survey (Drug Prevalence Survey)*³ asked 2,535 15- to 64-year-olds about their use of illicit substances during late 2010 and early 2011. It found that cannabis was the most commonly used illegal drug; 24 per cent said they had used it. One in 20 respondents said they had used cannabis in the last year and 3 per cent said they had used it in the last month.

Despite the drug's widespread use, public awareness of the health consequences of smoking cannabis remains low. Research conducted by TNS on behalf of the British Lung Foundation in May 2012 showed that almost a third (32 per cent) of the British population don't think smoking cannabis is harmful to your health. The figure rises to almost 40 per cent among those aged under 35. This contrasts with public perception of other well-known health risks. Almost 90 per cent of the 1,045 people surveyed recognise the negative health impact of smoking tobacco, and nearly 80 per cent recognise the health consequences of eating fatty foods – both areas that have been the subject of major public health campaigns in recent years.



The research also revealed that 88 per cent of people think a typical tobacco cigarette puts you at greater risk of developing lung cancer than a typical cannabis cigarette. This stands in stark contrast to evidence, discussed later in this report, showing that a typical cannabis cigarette increases the smoker's risk of developing lung cancer by 20 times the amount of one tobacco cigarette.

2.2 Types and potency of cannabis used in the UK

There are three main species of cannabis; *cannabis sativa*, *cannabis indica* and *cannabis ruderalis*. The plant is also known as hemp and it has historically been used in making rope and other fabrics.

As an illicit drug, you can get cannabis in several forms:

- As **marijuana**, also known as herbal cannabis. Marijuana is made up of the plant's dried leaves and female flower heads. 'Sinsemilla' (literally 'without seeds') is a highly potent, intensively cultivated version of domestically grown marijuana.
- As **hashish**, also known as cannabis resin. Hashish is made up of the resin the leaves and flower heads secrete, and often compressed into blocks. Cannabis resin can be mixed with other substances to increase its weight, thereby increasing profits.

For many years, herbal cannabis was imported into the UK from the Caribbean, west and north Africa and Asia. UK production of herbal cannabis started around 1990. This sinsemilla is grown indoors from seeds or by propagating female plant cuttings, using artificial light, heat and control of day-length. It consists mostly of the flowering tops of female plants and is easy to distinguish from imported cannabis.

The potency of cannabis is measured according to its concentration of tetrahydrocannabinol (THC). THC is the main component responsible for the psychoactive properties of the plant, including its mood-altering effects or 'high'. There is THC in different concentrations in the stalks, leaves, flowers and seeds of the plant as well as in the resin secreted by the female plant.

Sophisticated cultivation of sinsemilla has made cannabis stronger over the last 30 years. The average cannabis cigarette in the 1960s and 1970s had about 10mg of THC. Today, it could have up to 150mg, or 300mg if it's laced with hashish oil⁴. That means today's cannabis smoker is likely to be exposed to greater doses of THC than in the 1960s and 1970s^{5,6} so the conclusions of many previous studies investigating the long-term effects of smoking cannabis may not be applicable to current cannabis smokers.

Data suggests the percentage of THC in sinsemilla increased from 5.8 per cent in 1995 to 10.4 per cent in 2007⁷. However, the same data suggests that the strength of traditional imported herbal cannabis and cannabis resin has varied over this time, and there appears to be no significant trend in potency – as might be expected, since the substance is often adulterated. Additionally, data from 2008 suggests the average potency of sinsemilla was 16.2 per cent⁸.

Interestingly, the type of cannabis people in the UK use appears to be changing. Herbal cannabis use has increased markedly in recent years. In 2002, it was estimated that around 30 per cent of the cannabis seized by police was herbal cannabis. But by 2008, 80.8 per cent of cannabis seized was herbal cannabis and 15.3 per cent was cannabis resin⁸. The remaining 3.9 per cent either couldn't be identified or wasn't cannabis. Of the herbal cannabis, microscopic examination of around two-thirds of samples showed that more than 97 per cent had been grown using intensive methods (sinsemilla)⁸. This shows that highly potent forms of cannabis are becoming more prevalent in the UK.

2.3 Active constituents of cannabis

All forms of cannabis contain more than 400 chemicals, including 60 different 'cannabinoids' – plant derivatives that are unique to cannabis. The most common is

THC. THC is highly soluble in fats and rapidly absorbed by the lungs and gut tract lining, where it enters the bloodstream. From there, it travels to the heart and brain.

Other cannabinoids include cannabidiol (CBD) and cannabinol. The amounts and proportions of the cannabinoids in each plant vary from strain to strain, and can be adjusted by breeding.

The intensity of cannabis's intoxicating effects depends on the way it's taken. Cannabis can be smoked, for example in a cannabis cigarette ('joint'), pipe or using a vapouriser. There are many more complex methods of smoking cannabis too. Cannabis can also be swallowed as a food or drink.

The concentration of THC in the blood of someone who has smoked cannabis is about 70-75 per cent higher than that of someone who has swallowed it⁴. A smoker will inhale about half the THC in the 'mainstream' smoke of a herbal cannabis cigarette (from the mouth end, rather than 'sidestream' smoke from the burning end). It will quickly enter the bloodstream and reach the brain in minutes.

2.4 Components of cannabis smoke

Cannabis smoke contains various chemicals, including THC, carbon monoxide and carcinogens (substances that cause cancer)⁹.

Previous studies have shown that with each puff, the components of cannabis smoke become more concentrated, meaning the joint gets stronger and stronger towards the end¹⁰. So, smoking fewer cannabis cigarettes down to a shorter butt length could mean taking in a greater number of smoke components than smoking the same amount of cannabis in more cigarettes smoked to a longer butt length¹⁰.

2.5 Cannabis and tobacco cigarettes

Evidence firmly shows that smoking tobacco causes lung cancer and chronic obstructive pulmonary disease (COPD). People often mix cannabis with tobacco, particularly resin as it needs tobacco for the desired 'slow burn'. This makes it difficult to isolate which health problems cannabis causes and which problems are caused by tobacco.

The active ingredients of cannabis plants and tobacco plants differ. Only cannabis has THC and only tobacco has nicotine. Otherwise, cannabis and tobacco smoke contain largely the same substances¹¹⁻¹³, including carbon monoxide, tar and carcinogens.

Cannabis smoke has the same carcinogens as tobacco smoke, including 'benzanthracenes' and 'benzpyrenes'. But cannabis smoke may contain up to 50 per cent higher concentrations than tobacco smoke^{4, 11, 12, 14}.

People generally smoke cannabis cigarettes less often than tobacco cigarettes. However, the way they inhale is very different. When smoking cannabis, people take in a puff volume (the amount taken into the mouth) two-thirds larger than if they were smoking tobacco. The inhaled volume (the amount that reaches the lungs) is larger too. Cannabis smokers also hold the smoke in their mouths four times longer, and end up with five times the amount of carboxyhaemoglobin in their blood per cigarette smoked¹⁵.

This means it's likely that the body retains much more of the products of cannabis smoke, leading to a greater respiratory burden of carbon monoxide and smoke particles than when smoking a similar quantity of tobacco. It's estimated that someone smoking a cannabis cigarette inhales four times more tar compared with smoking a tobacco cigarette. They also retain one-third more tar in the respiratory tract¹⁶. It's believed that this is because of the longer breath-holding time associated with cannabis, and differences in the filtering characteristics between the two types of cigarette.

NHS Quit Smoking teams that use carbon monoxide monitoring recognise that the high levels of exhaled carbon monoxide from inhaling cannabis are a useful indicator of cannabis smoking (personal communication, Whittington Health Quit Smoking Team, London).



PART 3: Health effects – current evidence

3.1 Chronic obstructive pulmonary disease (COPD) and lung function

The constituents of cannabis smoke are similar to those of tobacco smoke. The exception is that THC is found only in cannabis, and nicotine only in tobacco. Given these similarities, there is concern that regularly smoking cannabis could have similar health risks as regular tobacco smoking.

One of the biggest risks of long-term tobacco smoking is developing chronic obstructive pulmonary disease (COPD), a term describing a number of conditions including emphysema and chronic bronchitis. COPD leads to damaged airways in the lungs, causing them to narrow and making it harder for air to get in and out of the lungs.

As COPD is a risk in long-term tobacco smokers, it's possible that cannabis smokers are also at risk of developing the condition. Previous studies have shown that cannabis smoking leads to a range of general respiratory problems that are consistent with a variety of lung conditions, including COPD. These include chronic cough, sputum production, wheezing and acute bronchitis¹⁷⁻¹⁹.

Lung function

Lung function tests check different variables that can tell doctors more about how well a person's lungs are working.

They measure:

- how much air you can take into your lungs. This is compared with other people your age, height and sex, allowing your doctor to see if you're in the normal range. This is known as your 'vital capacity' (VC). To measure it, you fill your lungs as much as you can (total lung capacity) and exhale forcefully and fully. The volume change is known as your 'forced vital capacity' (FVC);
- how much air you can blow out of your lungs and how fast you can do it. This is known as your FEV1 (forced expiratory volume in 1 second);
- how well your lungs deliver oxygen to your blood; and
- the strength of your breathing muscles.

To confirm a diagnosis of COPD it is crucial to take physiological measurements of lung function using a test known as 'spirometry'. Reporting lung function data recorded by spirometry can give us important insights into the impact of cannabis smoking on lung disease, including COPD.

A study by Aldington et al. in 2007 looked at tobacco and cannabis smoking among 339 people in New Zealand²⁰. Results suggested that the main effects of cannabis on respiratory health are wheezing, cough, chest tightness and sputum production. Researchers also found evidence linking cannabis to large airways obstruction, but not emphysema. The most important finding was that one joint of cannabis caused the same level of airflow obstruction as 2.5 to five tobacco cigarettes. The authors say this is of major public health significance²⁰.

In addition, preliminary data presented by Reid et al.²¹ at the 2011 British Thoracic Society Winter Meeting shows that cannabis smokers in a north Edinburgh population have more respiratory problems than those who smoke tobacco only, despite being younger and smoking less tobacco. They showed an equal prevalence of airflow limitation.

In 2007, Tetrault et al. carried out a systematic review of 34 separate published studies²² from between 1 January 1966 and 28 October 2005, which evaluated the effect of smoking cannabis on lung function and respiratory complications. The review concluded that long-term cannabis smoking is associated with respiratory symptoms including cough, phlegm production and wheezing. These symptoms suggest obstructive lung disease, but lung function measurements showed no significant association with airway obstruction. The review also suggested that short-term exposure to cannabis is associated with bronchodilation (opening of the airways).

A study by Taylor et al.²³ looked at cannabis and tobacco smoking in more than 900 young adults born in Dunedin, New Zealand, in 1972-1973. Researchers studied the subjects at age 18, 21 and 26. They found an association between cumulative cannabis smoking and a decreasing ratio of FEV₁/VC, which suggests development of airflow obstruction. The mean FEV₁/VC among subjects who used cannabis on 900 occasions or more was 7.2 per cent lower than non-users at age 18, 2.6 per cent less at 21 and 5 per cent less at 26.

The authors make clear that their results show only a marginally significant association, but explain that this may be due to the relatively short amount of time they

monitored participants (eight years). Monitoring longer-term cannabis smoking might reveal a greater effect. Meanwhile, a paper published by Hancox²⁴ drew similar conclusions, suggesting that smoking cannabis had a borderline effect on airflow obstruction.

A new study from Pletcher and colleagues²⁵, published in January 2012, looked at the effects of tobacco and cannabis smoking on lung function in 5,115 people in the US over a 20-year period. As expected, this study showed that both FEV₁ and FVC decreased relative to increasing tobacco exposure.

However, the relationship between cumulative cannabis exposure and lung function didn't follow a clear pattern. In people whose cannabis smoking was classed as moderate, the authors found very small increases in FEV₁ and FVC (FEV₁ increased by 13 mL/joint-year (95 per cent CI, 6.4 to 20; $P < .001$) and FVC by 20 mL/joint-year (95 per cent CI, 12 to 27; $P < .001$)).

What is 'moderate' cannabis use?

'Moderate' cannabis use is defined as up to seven joint-years of lifetime exposure, where smoking one cannabis cigarette a day for one year is one joint-year.

So, seven joint-years would be, for example, one joint a day for seven years or one joint a week for 49 years.

Some research studies have found more concrete links between smoking cannabis and the development of COPD. Work from Beshay et al. in 2007 linked cannabis to emphysema in young smokers (17 people aged between 19 and 43)²⁶. The study found cannabis had an effect even when tobacco use was taken into account - indicating that the emphysema was unlikely to be down to tobacco smoking.

This builds on earlier studies that showed evidence of obstructive lung disease in cannabis smokers¹⁷, including a 1987 study which showed symptoms like wheezing and sputum production increased in cannabis users¹⁸. The latter study suggested that male cannabis smokers suffered more detrimental effects on their lung function than male tobacco smokers (FEV₁: FVC 90.0 and 95.2 respectively)¹⁸.

On the other hand, a study from 2009 presents rather different evidence. It looked at nearly 900 people aged over 40 in Vancouver. Fifty-three per cent of them had smoked tobacco and 46 per cent had smoked cannabis. The study suggested that, while smoking tobacco mixed with marijuana increased the risk of COPD, there was no conclusive evidence that smoking only marijuana led to increased risk of respiratory problems or COPD²⁷.

However, smoking a mixture of marijuana and tobacco was associated with a greater risk of COPD than smoking only tobacco (COPD odds ratio 2.74, 95 per cent CI 1.66–4.52 in tobacco-only smokers vs. odds ratio 2.90, 95 per cent CI 1.53–5.51 in smokers of tobacco-cannabis mix). This suggests that, when mixed together, cannabis and tobacco have a detrimental effect on lung health. Risk of COPD increases after 50 joints mixed with tobacco. The authors suggest that anti-smoking campaigns should aim to reduce cannabis use as well as tobacco use, and try especially hard to reach people who regularly use both marijuana and tobacco.

An earlier study from 1980 found no evidence of COPD or abnormalities in the smaller airways in cannabis smokers²⁸. However, this study found a mild yet significant narrowing of larger airways in cannabis smokers, which they did not detect in tobacco smokers of a similar age.

Clearly, there is conflicting evidence about the effect smoking cannabis on its own has on lung function and the risk of developing COPD.

However, there is evidence that the risk of airway obstruction increases with the number of joint-years of cannabis smoking, and of an increased risk of COPD from smoking cannabis with tobacco regularly.

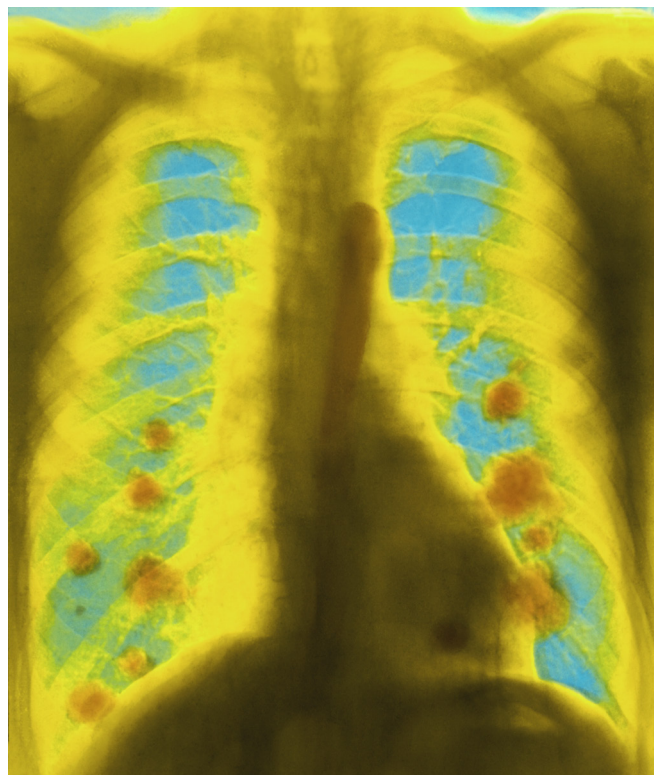
3.2 Lung cancer

Lung cancer develops when cells in the lungs become abnormal and grow out of control. Over time they form a clump, known as a tumour. Since lung cancer is largely caused by smoking tobacco, and cannabis smoke contains many of the same cancer-causing agents, investigating the relationship between lung cancer and smoking cannabis is vital. Indeed, previous laboratory studies have demonstrated the cancer-causing effects of cannabis smoke²⁹. However, studies in human populations have yielded conflicting evidence on the subject: some suggest there is a link between smoking cannabis and lung cancer³⁰⁻³² while others don't³³. It's worth noting that these studies are of limited value as they looked at relatively small numbers of people and didn't take into consideration the quantity of cannabis smoked or the effects of smoking a mixture of tobacco

and cannabis. In addition, some previous evidence suggests that THC may have anti-carcinogenic effects³⁴⁻³⁶.

Cannabis smoke has up to twice the concentration of cancer-causing polyaromatic hydrocarbons as tobacco smoke¹¹. In addition, people tend to inhale higher concentrations of cancer-causing components when smoking cannabis because they tend to smoke the cigarettes without filters³⁷ and to a smaller butt size than tobacco cigarettes³⁸. Cannabis smokers also inhale more deeply and hold their breath for longer¹⁵, so carcinogenic products deposit in the lower respiratory tract. Taken together, this evidence forms a legitimate rationale that smoking cannabis may have greater potential to cause lung cancer than smoking tobacco.

A rigorous case-control study by Aldington and colleagues³⁹ in 2008 made significant progress in showing that the link exists. The authors analysed the smoking habits of people diagnosed with lung cancer and a control group without lung cancer. Their major finding was that smoking cannabis increases the risk of developing lung cancer in young adults. The study also suggests that smoking one cannabis cigarette a day for one year increases the risk of lung cancer by 8 per cent. Importantly, researchers took variables including tobacco smoking into account when calculating this figure.



False-colour chest X-ray (front view) showing evidence of cancer in both lungs. Cancerous masses appear as distinct orange shadows over both blue lung fields

By way of comparison, the same study suggests that smoking one pack of tobacco cigarettes (20 cigarettes) a day for one year increased the risk of lung cancer by 7 per cent. This suggests that smoking just one cannabis cigarette increases the risk of developing lung cancer by a similar amount as smoking 20 tobacco cigarettes. The study also concluded that 5 per cent of lung cancers in those aged 55 or under may be caused by smoking cannabis.

A study by Berthiller and colleagues looking at cannabis smoking in North African men showed a 2.4-fold increase in the risk of lung cancer among men who had smoked cannabis compared with those who had never smoked it. This was after adjustment for age, tobacco smoking, occupational exposures and country⁴⁰.

Further research is needed to confirm these findings and to explain why smoking a cannabis cigarette might pose a greater risk than smoking a tobacco cigarette. Identifying the mechanisms by which the components of cannabis smoke may cause lung cancer is also crucial.

3.3 Collapsed lung (pneumothorax)

Collapsed lung (pneumothorax) happens when there is a tear or breach in the lung, allowing air into the lung cavity. This makes the lungs deflate, compress and partially 'collapse'. An injury from broken ribs or even from some medical procedures can cause this, while a 'spontaneous' pneumothorax can happen without any warning. This leads to sudden unexpected breathlessness and/or chest pain, which is worse when you breathe.

Selected case reports and series have suggested that smoking cannabis may be associated with an increased risk of pneumothorax. Some evidence suggests a link between cannabis smoking and spontaneous pneumothorax^{26, 41-44}. Some of these studies only have evidence from a few cases⁴¹⁻⁴⁴. However, one study²⁶ found 17 young Swiss patients (16 men with an average age of 27) who were regular cannabis smokers and had suffered spontaneous pneumothorax. These patients didn't have any symptoms but CT scans showed damage to their lungs, including multiple bullae or emphysema at the lung apices. The report suggests that pneumothorax in cannabis smokers is possibly caused by coughing while holding their breath as they smoke a cannabis cigarette⁴⁴.

In addition, the risk of pneumothorax appears to increase in tobacco smokers⁴⁵ and people who smoke both tobacco and cannabis may face a greater risk than those who only smoke tobacco^{42, 43}.

3.4 Respiratory infections and immune effects

There is now lots of research showing that THC stops the human immune system working as well as it should. Studies suggest that THC suppresses several cells in the immune system, including macrophages, natural killer cells and T cells⁴⁶⁻⁴⁹. Researchers are starting to understand more about how the components of cannabis smoke affect the immune system⁵⁰.

Current evidence shows that cannabis smokers are more at risk of developing a range of infective lung conditions. One study⁵¹ shows that cannabis smokers are at increased risk of developing legionnaires' disease. Several studies report cannabis smokers developing tuberculosis⁵²⁻⁵⁵. One of these⁵² shows how a cluster of cannabis smokers in Seattle, USA developed tuberculosis.

In another study, a 34-year-old man developed pulmonary aspergillosis 75 days after a marrow transplant for chronic myelogenous leukaemia. He had been smoking marijuana heavily for several weeks before admission to hospital. Cultures grown from his marijuana revealed the mould *aspergillus fumigates*. This was identical to the mould grown from an open lung biopsy specimen, providing evidence that the marijuana smoked was the source of the aspergillosis infection⁵⁶.

Lower immune function may explain why there appears to be a link between cannabis use and opportunistic bacterial and fungal pneumonias in people with cancer⁵⁷, transplant patients^{56,58} and people with human immunodeficiency virus (HIV) infection⁵⁹.

3.5 Broader health effects, including mental health and cardiovascular disease

The wider impacts of smoking cannabis are well documented and include dependence on the drug, increased risk of motor vehicle accidents, cardiovascular disease and mental health problems⁶⁰.

Cannabis has some of the features of addictive drugs, including tolerance (having to take more and more to get the same effect) and withdrawal symptoms, including craving, decreased appetite, difficulty sleeping, weight loss, aggression, anger, irritability and restlessness. These cause about the same level of discomfort as withdrawing from tobacco. In Australia, Canada and the US, cannabis dependence is the most common type of drug dependence after alcohol and tobacco⁶¹. It is estimated that 9 per cent of cannabis users will become dependent over their lifetime⁶². This rises to one in six for people who start using cannabis in adolescence⁶². The equivalent risks are 32 per cent for nicotine, 23 per cent for heroin, 17 per

cent for cocaine, 15 per cent for alcohol and 11 per cent for stimulants⁶³.

Cannabis and THC impair⁶⁴ people's reaction times, information processing, perceptual-motor coordination, motor performance and attention^{64,65}, according to laboratory tests. The more someone smokes, the worse these effects will be. If cannabis users drive while they're intoxicated⁶⁰, it can increase the risk of having an accident two- or three-fold⁶⁴. In comparison, alcohol makes you 6–15 times more likely to crash.

Research has also shown that cannabis has adverse effects on cardiovascular health. Cannabis use and isolated THC have been shown to increase heart rate. The more cannabis or THC a person takes, the more their heart rate increases⁶⁰. One study showed that cannabis use can increase the risk of myocardial infarction (heart attack) by 4.8 times in the hour after someone uses it⁶⁶. A related study reported that people who smoke cannabis less than once a week are more than twice as likely to die from a heart attack, compared with people who don't use cannabis. That rises to four times more likely in people who use cannabis more than once a week⁶⁷. Laboratory studies indicating that smoking cannabis causes angina in patients with heart disease⁶⁸ support these findings.

Researchers have found that smoking cannabis affects mental health. A study of 50,465 Swedish men found that those who had smoked cannabis by the time they were 18 were more than twice as likely to be diagnosed with schizophrenia as those who had not⁶⁹. Their schizophrenia risk increased the more they used cannabis. The study also showed that people who had used cannabis 10 times or more by the age of 18 were around twice as likely to be diagnosed with schizophrenia as those who had not.

A related study showed that the more cannabis 18-year-olds used, the higher their risk of schizophrenia⁷⁰. The researchers estimated that 13 per cent of schizophrenia cases could be prevented if people hadn't smoked cannabis. Studies in the Netherlands⁷¹, Germany⁷² and New Zealand^{73,74} have supported these findings.

Cannabis has other effects on mental function too, according to UK mental health charity Mind. Heavy users can experience lethargy, loss of communication skills and a general lack of ambition. Cannabis is thought to affect a person's ability to store new memories, but not memories that are already in place. In a study of adolescents in Australia, those who used more cannabis were more likely to develop depression and anxiety⁷⁵. Further research has shown cannabis causes panic attacks and anxiety, depression, tiredness and low motivation in a significant number of users⁷⁶.

3.6 Medicinal use of cannabis

Some research suggests that cannabis may have legitimate medical uses⁷⁷, including; to treat chronic pain, help AIDS patients with anorexia to eat more, prevent vomiting caused by cancer chemotherapy, relieve pain in rheumatoid arthritis and relieve pain and diarrhoea in Crohn's disease⁷⁷. The immunosuppressive effects of cannabis derivatives⁴⁹ may also help treat inflammatory disorders⁷⁸.

Evidence from the 1970s suggests that taking cannabis or THC orally can open up the airways in people who have asthma - as well as in people who don't have airways disease - for two to four hours⁷⁹⁻⁸¹. However, more recent research has suggested that this short-term 'bronchodilator' effect is modest and doesn't appear to be sustained with continued use over six to eight weeks⁸². There are other medicines that have a greater effect. For example, salbutamol (the established bronchodilator inhaler medication) has greater bronchodilator effects after five minutes than THC⁸². Also, we need to weigh the potential short-term therapeutic effects against increasing evidence of the adverse effects, including increased cough, sputum

production and wheeze, which have been associated with regular inhaled cannabis use⁸².

Our understanding of how cannabis derivatives affect the body has greatly improved in recent years with the description of two cannabinoid receptors and the cannabinoid system. Evidence suggests that the cannabinoid system is involved in many physiological and pathological processes and consequently, has therapeutic potential⁷⁷.

Despite this, using 'crude cannabis' as a medicine is still unsanctioned. Indeed, in 2005 the UK Court of Appeal rejected a bid to allow the use of cannabis to relieve chronic pain. The negative health effects of smoking cannabis have been well-documented (as summarised in this report) and cannabinoid treatment can have side-effects⁷⁷.

We need to do a great deal of further work to develop safe, effective medicines. The British Medical Association says that crude cannabis is unsuitable for medical use because it contains toxic components that are harmful to human health. However, it would like to see more research into the potential for cannabis-based medicines to relieve pain.



PART 4: Evidence gaps

Although cannabis is the world's most widely used illicit drug, there has been surprisingly little research into its effects on respiratory health. Part of the problem is the inherent difficulty of studying the long-term effects of an illegal habit.

Renewed efforts are needed to overcome these issues and to get conclusive answers. Further work is also needed to clarify the true effects of smoking cannabis on several key aspects of respiratory health, including lung function, COPD and lung cancer.

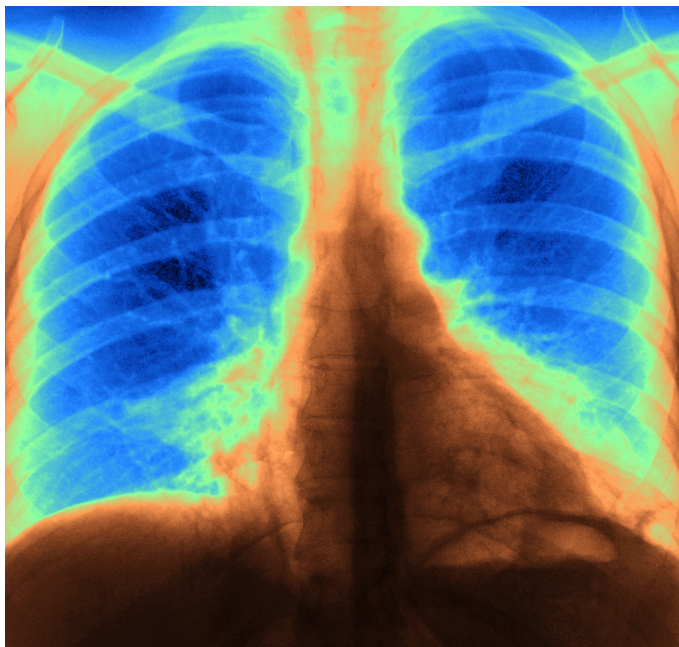
Given the addictive nature of cannabis, more research is needed into how best to support people to give it up.



PART 5: Conclusions and recommendations

Current evidence shows that cannabis smoking poses a substantial hazard to our lungs, although we know far less about the effects of cannabis smoke than the effects of tobacco smoke. There are established links between cannabis smoking and:

- chronic coughing;
- wheezing;
- sputum production;
- tuberculosis;
- legionnaires' disease;
- aspergillosis;
- airway obstruction;
- acute bronchitis;
- pneumothorax, and
- lung cancer.



Frontal chest X-ray of the lungs of a patient with legionnaires' disease

Current evidence is contradictory about the effect of smoking cannabis on lung function and COPD. However, it's important to note that research suggests that smoking a mixture of tobacco and cannabis is linked to a greater risk of COPD than smoking a similar amount of tobacco alone. Evidence suggests that this is true for pneumothorax too. New research provides stronger evidence than ever before to support a link between cannabis smoking and lung cancer.

We recommend that public health education programmes be implemented to dispel the myth that smoking cannabis is relatively safe, and to highlight the adverse respiratory effects of smoking cannabis mixed with tobacco. This position is supported by a statement published by the Thoracic Society of Australia and New Zealand in 2003. British Lung Foundation research has shown that almost a third (32 per cent) of people in Britain wrongly believe that smoking cannabis does not harm your health, with only 12 per cent realising that a typical cannabis cigarette increases the risk of lung cancer more than a typical tobacco cigarette. By comparison, eating fatty foods and smoking tobacco – two areas that have been the focus of public health education programmes in the UK – were recognised as harmful to health by nearly 80 per cent and 90 per cent of people respectively.

People aged under 35 are most likely to have used cannabis but least likely to be aware that it poses health risks. This suggests that public health campaigns should be particularly targeted towards younger people. To support this approach, investment in the design and delivery of effective cannabis smoking cessation services and public health education programmes is paramount, to maximise the success of such.

Finally, we recommend further investment in research targeted at providing more conclusive evidence on the effects of smoking cannabis on lung function, COPD and lung cancer. Despite being one of the most commonly used recreational drugs in the UK, there has been little investigation into the impact cannabis has on health. On the other hand, there has been extensive research into the risks associated with alcohol and tobacco. This has boosted our understanding of the dangers they pose to our health, informed Government policy and affected public attitudes. Similar research into cannabis is necessary if we are to minimise the impact it is having on people's health.

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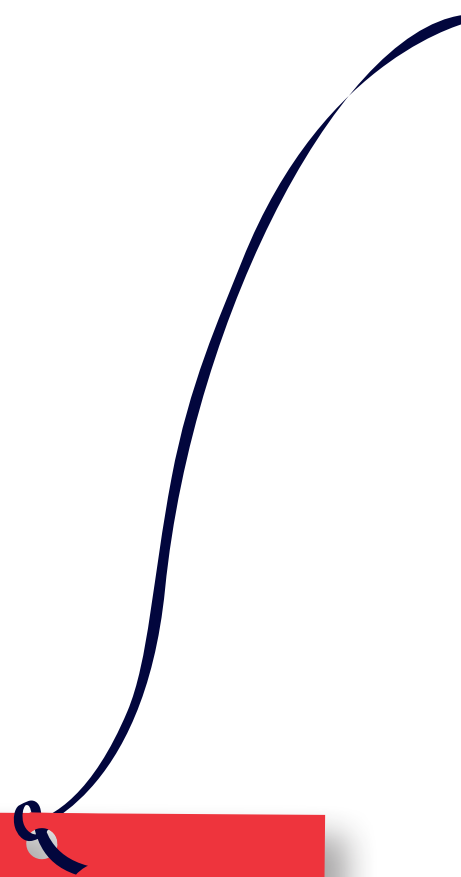
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