

Smoking and Cancer

Introduction

This fact sheet reviews the risks of developing various types of cancer from smoking, other tobacco use and exposure to other people's tobacco smoke. It is estimated that 1 in 2 people born after 1960 in the UK will be diagnosed with some form of cancer during their lifetime and that more than one in four will die from the disease.¹ Up to two in three long-term smokers are expected to die from a smoking-related disease.² Smoking is the single biggest avoidable risk factor for cancer. Tobacco smoke is estimated to be responsible for nearly one fifth (64,500) of all new cancer cases a year and causes 27% of all cancer deaths in the UK.^{3,4} The most recent statistics for the UK show that 19% of all cancers are linked to exposure to tobacco smoke.^{3,4}

Worldwide, one in five cancer deaths (22%) is caused by tobacco.⁵ Over the years the tobacco epidemic has grown in Low and Middle Income Countries (LMICs), although they are still at an earlier stage of the epidemic than high income countries.⁶ LMICs currently account for about 57% of all cases and 65% of cancer deaths worldwide, with lung cancer now being the leading cause of cancer morbidity and mortality among men in these nations.⁷ However, it is estimated that, as the tobacco epidemic matures, the future burden of tobacco-related cancers on less economically developed countries is expected to lead to a 70% increase in tobacco-related cancer cases.⁶

In October 2009, under the auspices of the International Agency for Research on Cancer (IARC) scientists from 10 countries met to reassess the carcinogenicity of several compounds, including tobacco. Some more recent studies and the IARC review, published by The Lancet Oncology, conclude that there is sufficient evidence to confirm that smoking is a cause of at least 16 types of cancer, namely, from the head down: paranasal sinuses and nasal cavity (nose); oral cavity (mouth, including lips and tongue); larynx (voice box); pharynx (throat); oesophagus (gullet); lung; liver; pancreas; kidney; stomach; myeloid leukaemia (a type of bone marrow cancer); colorectum (bowel); bladder; ureter; ovary; and cervix.^{4, 8} Cancer of the ureter has been added to this list since IARC's 2009 review.⁹

Research also shows that there is some evidence to suggest that smoking is a cause of breast cancer. The findings have been published as Part E of Volume 100 of the IARC Monographs,⁹ as well as in several more recent research papers.

Emerging evidence also links cancer to Hodgkin lymphoma, prostate cancer, endometrial cancer, and cancer of the vagina and vulva.

Some people are unable to quit smoking after a cancer diagnosis.¹⁰ Continued smoking can limit the effectiveness of cancer treatments; increase the risk of complications and of developing additional primary and secondary cancers; increase pain; and reduce quality of life and survival.

The risk of cancer may also be increased when smoking is combined with other unhealthy risk factors. For example, research suggests current and ex-smokers who drink 15+ units per week may be positively associated with smoking-related cancer deaths.¹² There is also evidence that alcohol can make it easier for the cancer-causing tobacco chemicals found in cigarettes to get into tissue and cells.¹³

Recent research is in the early stages of discovering the process of how smoking causes cancer and damages DNA, i.e., through cell mutations. Most of the mutations affect the tissues with direct exposure to smoke, such as those in the lungs. Until recently, epidemiological research could only link smoking and cancer, but now the molecular changes caused by cigarette smoking can actually be quantified.¹⁴ Additional research is needed to unlock the complexities of cancer development caused by smoking.

Paranasal sinuses and nasal cavity

While occupational exposure to wood dust is the most common cause of cancer in the nose and sinus, smoking has been found to increase the risk of cancer particularly for squamous cell carcinoma and adenocarcinoma.^{11 15 16 17} Even though nasal cancer is rare, smoking significantly increases the risk of developing the disease.¹⁸

A case-control study carried out in the United States found that heavy smokers had a two- to three-fold increased risk of nasal cancer and that there was also an increased risk associated with snuff use.¹⁹

Oral cavity

Ninety-five per cent (95%) of all malignant tumours of the oral cavity (mouth) are oral squamous cell carcinoma.²⁰ Cigarette, pipe and cigar smoking are all major risk factors for cancers associated with the oral cavity.^{21 22} The risk for these cancers increases with the number of cigarettes smoked.²³ People who smoke pipes or cigars experience a risk similar to that of cigarette smokers.²³ People who combine cannabis, alcohol and tobacco use have a much higher risk of oral cancers than those using each of these substances individually.^{24 25 26 27} It has been estimated that smoking is a cause of 65% of cancers of the oral cavity (including the lip, tongue and mouth) and pharynx (throat) in the UK.²⁶ Ninety-one per cent (91%) of all oral cavity and pharynx cancers are preventable.²⁸ In total, 7,688 new cases of oral cavity and pharynx cancer were recorded in the UK in 2014.²⁹ Oral cavity and pharynx cancer incidence rates have increased by 68% in males and females combined in the UK since the mid 1990s³⁰ and oral cavity and pharynx cancer incidence rates are expected to continue to increase by a further 33% from 2014 to 2035.³¹

Also see: ASH Research Report Tobacco and Oral Health.

Larynx

IARC and the US Surgeon General have both found that there is a causal relationship between smoking and cancer of the larynx (voice box).^{32 33 34} Cigarette, pipe and cigar smoking are all major risk factors for cancers associated with the larynx.^{23 24} Overall, people who have ever smoked cigarettes have laryngeal cancer risks 8.3 times greater than never-smokers and smoking is linked to an estimated 79% of laryngeal cancer cases in the UK.³⁵ It has also been shown that the more one smokes and the longer one smokes, the greater the risk of laryngeal cancer.⁴

Pharynx

Smoking has been found to cause cancer of the pharynx (throat).³⁴ It has been estimated that smoking is a cause of 65% of cancers of the pharynx and oral cavity in the UK.²⁶ People who combine alcohol and tobacco use have a much higher risk of pharyngeal cancer than those using tobacco or alcohol individually.^{27 28 29 36} The risk of pharyngeal cancer decreases rapidly for the first ten years after smoking cessation.⁴

Oesophagus

Tobacco smoking is a cause of cancer of the oesophagus (gullet).^{34 37 38} Tobacco and alcohol, acting independently and together, are the main risk factors for squamous cell carcinoma of the oesophagus in Western countries.³⁹ The risk increases with the number of cigarettes smoked and duration of smoking, and remains elevated many years after smoking cessation.³⁹ ⁴⁰ According to Cancer Research UK, smoking is linked to an estimated 66% of oesophageal cancer cases in the UK.⁴¹ There is a particularly poor prognosis for all-cause oesophageal cancer; only 15% of patients are predicted to survive their disease for 5 years or more. ⁴¹

Lungs

Lung cancer has been estimated to be the most common cancer in the world for a number of decades.⁴² In 2012, there were an estimated 1.83 million new cases of lung cancer worldwide,⁴³ accounting for about 13% of the total new cancer diagnoses,^{36 44} and an estimated 1.59 million deaths.⁴⁵ In the UK, where lung cancer is the third most common cancer,⁴ 46,403 people were diagnosed with lung cancer in 2014 (nearly 130 cases diagnosed every day) and 35,895 died of the disease in the same year.⁴⁶

Lung cancer has the largest proportion of cases caused by smoking. According to a recent estimate, in the UK about 87% of lung cancer cases in men are attributable to tobacco and about 84% of cases in women.⁴⁷

Smokers who start when they are young are at a particularly increased risk of developing lung cancer. A study by Professor Richard Peto and colleagues found that taking up smoking before the age of 15 doubles the risk of lung cancer compared to starting at the age of 20 or later, after taking into account the amount smoked.⁴⁸

Because of its poor prognosis, lung cancer is still the most common cause of cancer death in both men and women, responsible for the deaths of about three people per minute worldwide⁴⁹ and more than 1 in 5 (22%) of all cancer deaths in the UK.⁵⁰ Only 5% of people with lung cancer in England and Wales will survive at least ten years beyond diagnosis.⁴⁹ In fact, since lung cancer is usually diagnosed at a very late stage, only around a third (32%) of people diagnosed with lung cancer in England and Wales survive their disease for one year or more.

Current smokers are 15 times more likely to die from lung cancer than life-long non-smokers.⁵¹ The risk of dying from lung cancer increases with the number of cigarettes smoked per day, although duration of smoking is the strongest determinant of lung cancer in smokers.⁵² Even for people who smoke 10 or fewer cigarettes a day lung cancer risk is up to 20 times higher than in never-smokers. People who smoke fewer than 4 cigarettes a day have up to a 5 times higher risk of lung cancer.⁵³

The study by Peto et al. also examined the effects of prolonged cigarette smoking and prolonged cessation on mortality from lung cancer.⁵¹ It found that when people who have been smoking for many years stop, even if they are well into middle age, they avoid most of their subsequent risk of lung cancer. Stopping smoking before middle age avoids more than 90% of the risk attributable to smoking. Two other major studies have shown similar results.^{54 55}

Despite the benefits of quitting, many smokers diagnosed with lung cancer continue to smoke even after treatment, with estimates ranging from 13% to 60%.⁵⁶ Of those who do quit, most only do so immediately after their diagnosis, which leaves them at high risk of relapse, especially during the early treatment period.^{57 58}

See also: ASH Fact Sheet on: Smoking and Respiratory Disease.

Liver

Large studies have demonstrated an association between smoking and risk of liver cancer.^{59 60} Since 2004, IARC has stated that there is sufficient evidence to judge the association between tobacco smoking and liver cancer as causal.⁶¹

In many studies, as with cancer of other organs, the risk increases with duration of smoking or number of cigarettes smoked daily.^{62 67} Similar to lung cancer, by the time any symptoms appear, liver cancer is typically at an advanced stage, leaving limited options for treatment.⁶³ In the UK, it is estimated that almost a quarter (23%) of liver cancers are linked to smoking, with a higher proportion in men (27%) than in women (15%).³³

People who have a Hepatitis B or C infection have around a 20 times higher risk of hepatocellular liver cancer,³³ which is increased even further if they smoke, with greater than 20-fold increases in risk shown for people who smoke and are also infected with hepatitis viruses.^{64 65}

Pancreas

Cancer of the pancreas is a rapidly fatal disease because it is often diagnosed very late in its trajectory.⁶⁶ 21% of people diagnosed with pancreatic cancer survive their disease for one year or more and 3% survive for five years or more. Smoking is the single most significant risk factor for pancreatic cancer⁶⁷ and is responsible for 11-32% of pancreatic cancer worldwide.^{68 69 70} Cigarette smoking is linked to 29% of cases of pancreatic cancer in the UK.⁷¹

Risk of the disease is related to amount and duration of smoking.⁶⁹ In general, smokers have more than double the risk of being diagnosed with pancreatic cancer than non-smokers.⁶⁸ ⁷² People smoking up to 25 cigarettes per day have about twice as high a risk for pancreatic cancer mortality as non-smokers, whereas people smoking more than 25 cigarettes per day have three times the risk. A 2012 study calculated a 27% increased risk of pancreatic cancer for every five cigarettes smoked per day.^{68 73}

The risk diminishes after cessation, although results of studies are inconsistent regarding how long it takes for the level of risk of an ex-smoker to fall to the level of someone who has never smoked.^{74 75} A recent review cited 10-20 years of being smoke-free to eliminate any additional risk caused by smoking.⁷⁶

With the reduction in smoking among men over the last several decades, a study in Australia showed that the rate of pancreatic cancer among men has also dropped. It is expected that this change will also occur in women in Australia and other economically developed countries as smoking rates are further reduced.⁷⁷

Kidney

Kidney cancer accounts for more than 4% of all cancers in men and 3% in women in the UK.⁷⁸ Although comparatively rare, kidney cancer has consistently been found to be more common in smokers than in non-smokers and there is sufficient evidence to show that smoking is a risk factor for the three principal types of kidney cancer: renal cell carcinoma, cancers of the renal pelvis and cancers of the ureter.^{10 79}

Kidney cancer risk is 33% higher in current smokers compared with non-smokers.^{80 81} There is a dose-response relationship, with a higher risk the greater the number of cigarettes smoked per day.^{4 81} Smoking more than 20 cigarettes a day can double the risk in smokers of the most common type of kidney cancer (renal cell cancer) compared to never-smokers.⁴ Risk appears to drop after smoking cessation.^{82 83} Approximately 29% of kidney cancer cases in men and 15% in women in the UK can be attributed to smoking.⁸⁴

Stomach

Stomach cancer rates have been in decline in recent years but it remains the fourth most common cancer in the world and the second most common cause of cancer death.⁸⁵ Studies have long shown a consistent association between cigarette smoking and cancer of the stomach in both men and women.^{79 86 87 88} An estimated 22% of stomach cancers in the UK are linked to smoking.^{4 89}

Current smokers have almost double the risk of stomach cancer compared to non-smokers⁴ and risk remains higher for 10-20 years after quitting smoking.^{90 91} Risk increases with duration of smoking and number of cigarettes smoked,^{33 92 93} but decreases with smoking cessation.⁴

Myeloid leukaemia

Leukaemia is a cancer of the white blood cells and bone marrow. There are four main types of leukaemia: acute myeloid (AML), acute lymphoblastic (ALL), chronic myeloid (CML) and chronic lymphocytic (CLL). Smoking increases the risk of myeloid leukaemia,⁹⁴ and is linked to around 6% of all leukaemia cases in the UK.^{84 95} The risk increases with the number of cigarettes smoked and with the duration of smoking.⁴

Colon

The IARC update (2010) concludes that smoking is a cause of colorectal (bowel) cancer.¹⁰ ⁹⁶ These findings are echoed by the World Health Organization,⁹⁷ the US Surgeon General (2014)⁹⁸ and other studies.^{99 100}

According to Cancer Research UK, colorectal cancer risk is 17-21% higher in current cigarette smokers compared with never-smokers.¹⁰⁰ One meta-analysis found that smoking doubles the risk of colorectal adenomas and is linked to 12% of colorectal cancers.¹⁰¹ In the UK smoking is linked to an estimated 8% of bowel cancers.¹⁰²

Long-term smokers are more likely than never-smokers to have and die from colorectal cancer.⁴ Continued smoking after diagnosis increases the risk of death.¹⁰³

Ureter

Tobacco smoking has been shown to cause cancer of the ureter in both men and women.^{10 104 105 106 107 108} Smoking also worsens the prognosis.¹⁰⁸ Even though this is a relatively rare type of cancer, smoking is one of the few major risk factors.¹⁰⁹

Bladder

Tobacco contains cancer-causing chemicals that pass into a smoker's bloodstream and are filtered by the kidneys into the urine, thereby putting the bladder at risk.⁴ Both IARC and the US Surgeon General concluded that smoking causes bladder cancer.^{79 110} Tobacco smoking is the single largest preventable risk factor for bladder cancer in both men and women.^{111 112} Smoking is linked to an estimated 37% of bladder cancer cases in the UK.¹¹³

The risk of developing bladder cancer is two to four times higher in smokers than in people who have never smoked.¹¹³ The incidence of bladder cancer is three to four times higher among men than women¹¹⁴ and it is estimated that smoking causes about 31% of bladder cancer deaths among men and 14% of deaths among women worldwide.^{115 116}

As with lung cancer, the risk is associated with both the dose and duration of smoking.¹¹³ Cancer Research UK states that, "[b]ladder cancer risk is around 2-4 times higher in current smokers compared with never-smokers."¹¹³ People who stop smoking reduce their risk, although they remain at higher risk than never-smokers for over 25 years after they quit.^{113 117 118} Early smoking cessation is therefore highly recommended.⁸¹

Ovary

Ovarian cancer has been included in the IARC list of cancers caused by smoking.¹¹⁹ Ovarian cancer is the sixth most common cancer in women in the UK and the second most common gynaecological cancer (after uterus).¹²⁰ Only 3% of ovarian cancers in the UK are deemed to be caused by smoking.¹²¹ However, smoking increases by 31-49% a woman's risk of a particular sub-type of the disease: mucinous ovarian cancer.¹²² A 2015 Norwegian study found that, among middle-aged women, one in six mucinous tumors could have been prevented if the women had not smoked.¹²³

Cervix

Smoking is known to increase the risk of cervical cancer,⁷⁹ especially squamous cell carcinoma.^{4 124} It is thought to be increased by the number of cigarettes smoked,^{125 126} although one review found inadequate data to report the effect of smoking duration.¹²⁷ Another meta-analysis showed that risk of squamous cell cervical cancer is increased by 50% in current smokers.¹²⁶ In the UK, it is estimated that around 7% of cervical cancer cases (around 220 cases) were linked to smoking.^{28 125}

A UK study of women aged 16 and over on cervical cancer awareness determined that few women know the risk factors for cervical cancer. Sixty-five percent (65%) of study participants could not recall any risk factors and 75% were unable to recall any symptoms.¹²⁸ This lack of knowledge may actually be deadly. A US study found that continued smoking among cancer survivors may increase their risk of subsequent tobacco-related malignancies and related

death. Despite the risks, almost 40% of women diagnosed with cervical cancer continue to smoke after diagnosis.¹²⁹ As with other cancers, stopping smoking can halt the growth of the cancer and reduce early cervical lesion size in women who give up smoking after diagnosis.¹³⁰
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Emerging evidence

There is overwhelming evidence for the impact of smoking on a range of cancers. In addition to those already discussed, there is emerging evidence for links to additional cancer sites.

Breast

Most older studies found no association between smoking and breast cancer but some studies published since 2000 suggest that there may be a link.^{132 133} An expert panel in Canada reviewed the results of nine cohort studies which showed that early age of smoking commencement, heavy smoking and long duration of smoking increased breast cancer risk by 15% to 40%.¹³⁴ Other studies suggest that the increase in breast cancer risk mostly affects premenopausal women,^{135 136 137} although a British study of middle-aged women found no evidence of an association with either active or passive smoking.¹³⁸

As of IARC's 2009 review, it considered the evidence for smoking as a causal factor for breast cancer to be limited.¹¹ The US Surgeon General's report of 2014 concluded that:

"1. The evidence is sufficient to identify mechanisms by which cigarette smoking may cause breast cancer. [...]"

"3. The evidence is suggestive but not sufficient to infer a causal relationship between active smoking and breast cancer. [...]"⁹⁸

A number of new studies have been completed showing causation that indicate it may be time to review the evidence.^{131 134 139 140 141 142}

Hodgkin lymphoma

Hodgkin lymphoma, a cancer that begins in white blood cells called lymphocytes, is a relatively rare type of cancer accounting for less than 1% of all cancer cases and cancer deaths in the UK in 2014.^{143 144}

Several major studies, including the European Prospective Investigation into Cancer and Nutrition (EPIC) and the UK Million Women Study, have shown an increased risk for Hodgkin lymphoma in smokers.^{145 146 147} Hodgkin lymphoma carries a 10-15% higher risk in ever-smokers than never-smokers.¹⁴⁸

Research from the Million Women Study has revealed that the risks of Hodgkin lymphoma and mature T-cell lymphomas were doubled in women who smoked around 15 or more cigarettes a day. The risks of other types of haematological (blood) cancer were also increased among smokers, but to a lesser extent.¹⁴⁹

Prostate

The 2004 US Surgeon General's Report states that "[t]he evidence is suggestive of no causal relationship between smoking and risk for prostate cancer." The latest IARC report from 2012 agrees that most studies have not shown a consistent correlation between smoking and prostate cancer. However, since these reports were issued, new research has found that smoking may increase the risk of prostate cancer^{133 150 151 152} and, in particular, heavy smokers have a 24-30% increased risk of death from prostate cancer,^{153 154} even though the increased risk of death is modest but statistically significant among regular smokers.^{150 155}

A recent literature review and a 2015 study found that smoking may also increase the risk of recurrence of prostate cancer.^{153 156} One study in which patients who had been smokers at the time of therapy found a recurrence rate 5.2 times greater than the rate of never-smokers, and in former smokers, the recurrence rate was 2.9 times greater.¹⁵⁷

Despite this emerging research, other recent studies maintain that, "*the relationship between tobacco smoking and prostate cancer remains inconclusive.*"¹⁵⁸ Additional research is needed before being able to determine definitively if smoking causes prostate cancer.

Endometrium

IARC states that there is no association between smoking and endometrial (womb) cancer.¹⁴⁹ In fact, a body of evidence shows that smoking can actually be protective against endometrial cancer, especially in post-menopausal women and long-term, heavy smokers.^{79 159 160} One meta-analysis found that smokers had a 29% reduced risk than never-smokers.¹⁶¹

However, given the causal link between smoking and other cancers, one study concluded that any reduced endometrial cancer risk among women smokers is not relevant to public health¹⁶² and smoking should still be strongly discouraged among all women.

Vulva and vagina

Although not included in the latest IARC review of cancers caused by smoking, new studies show that there appears to be an association between smoking and cancer of the vulva and vagina.^{163 164 165 166} One study reported at least double the risk for vulvar and vaginal squamous cell carcinoma in women who have high-risk human papilloma virus and smoke compared to lifelong non-smokers with the virus.¹⁶⁷ Smoking is among the most well established HPV cofactors in the etiology of vulvar cancer.^{168 169} Risk has been shown to increase with the number of cigarettes smoked and duration of smoking, and remains elevated more than five years after quitting.^{170 171} A recent study concluded that smoking is also a risk factor for recurrence of the cancer.¹⁶⁸

Secondhand smoke (Passive smoking)

Adults

Since 2004, IARC has stated that "*the evidence is sufficient to conclude that involuntary smoking is a cause of lung cancer in never smokers.*"¹⁷² This conclusion was echoed by the US Surgeon General's report in 2006.¹⁷³ According to IARC, there are over 55 epidemiological studies that show that secondhand smoke can cause lung cancer in never smokers.¹⁷⁴ Non-smokers are at risk of lung cancer from exposure to other people's smoke, particularly if they are genetically predisposed^{175 176 177} or if the exposure is long-term.^{178 179}

The UK's Scientific Committee on Tobacco and Health (SCOTH) reported an increased risk of lung cancer in non-smokers of between 20% and 30%.¹⁸⁰ A subsequent review of the evidence by SCOTH in 2004 confirmed that the increased risk was in the order of 24%.¹⁸¹ In cases of very high exposure, the risk of lung cancer can even double.^{182 183 184}

It is estimated that in the UK in 2010 there were around 1,000 cases of lung cancer in lifelong non-smokers caused by exposure to secondhand smoke.¹⁵⁹

A meta-analysis has also shown that the risk for cervical cancer is 73% higher in never-smokers exposed to secondhand smoke, compared to those who are not exposed.^{185 186}

The 2010 IARC update reports limited evidence showing an association between exposure to secondhand smoke and cancers of the larynx and pharynx.¹⁰

As for nose cancer, the 2006 US Surgeon General's report concluded that *"the evidence is suggestive but not sufficient to infer a causal relationship"* between secondhand smoke exposure and a risk of both nasal sinus cancer and nasopharyngeal carcinoma among non-smokers.¹⁷³

IARC also reported in 2010 and the US Surgeon General in 2014 that the evidence linking secondhand smoke to breast cancer is inconclusive.^{8 175} Some scientists are urging that a causal link between breast cancer and secondhand smoke be declared by authoritative organizations,¹⁸⁷ but some new studies show the link only in pre-menopausal women with certain genetic variants.^{188 189 190} Exposure to secondhand smoke in young women between menarche and their first full-term pregnancy seems to be particularly harmful.¹⁹¹

Recent studies have noted a possible link between secondhand smoke and bladder cancer in both mice and humans.^{81 192}

More research is needed in all of these areas except for lung cancer and cervical cancer to determine causality.

Thirdhand smoke

Thirdhand smoke is made up of the residual gases and particles that stick to surfaces and that are found in dust wherever people smoke indoors. Recent research indicates a possible link between thirdhand smoke and lung cancer.^{193 194} However, there is not yet a body of evidence large enough to infer causality.

Children

Does secondhand smoke cause cancer in children? The evidence in this area is emerging and inconsistent.¹⁹⁵ In 2006, the US Surgeon General concluded that *"[t]he evidence is suggestive but not sufficient to infer a causal relationship between prenatal and postnatal exposure to secondhand smoke and childhood cancer."*¹⁷³ A meta-analysis of over 30 studies showed a 10% increase in risk of all childhood cancers when mothers-to-be smoked during pregnancy, but there was no evidence for an increased risk of any specific type of cancer.¹⁹⁶

However, exposure to parental smoking has been shown to be a cause of hepatoblastoma (a type of liver cancer) in offspring, and there is evidence that children of smokers have an increased risk of childhood leukaemia, according to IARC and others.^{10 197} Additional research suggests that heavier paternal smoking around the time of conception is a risk factor for childhood acute lymphoblastic leukaemia (ALL).^{198 199} ALL is the most common form of leukaemia in children.

Research has found that children who are exposed to tobacco smoke on a daily basis grow up with more than triple the risk of lung cancer later in life compared to those who grow up in smokefree environments.^{200 201 202} Furthermore, exposure to tobacco smoke during childhood may lead to head and neck squamous cell carcinoma later in life, although the research is limited on this topic.²⁰³ Emerging evidence also shows that adult and childhood secondhand smoke exposure may affect the risk of developing non-Hodgkin lymphoma.²⁰⁴

Further research is needed to support any emerging research, as well as to break new ground in linking tobacco smoke to other childhood cancers or cancers later in life for those who had long-term childhood exposure.

Smokeless tobacco

In 2007, IARC concluded that there is sufficient evidence in humans to state that smokeless tobacco causes cancer of the mouth, oesophagus and pancreas.^{205 206} This evidence was reconfirmed by IARC in 2012, but a 2014 review found insufficient evidence to declare smokeless tobacco a cause of pancreatic cancer.²⁰⁷

In 2012, IARC published an update, in which it concluded that *“switching from cigarette smoking to smokeless tobacco significantly increased the risk for lung cancer compared to never-tobacco users, and the risk was of greater magnitude than for quitting all together.”*²⁰⁸

More recent studies show that long-term use of smokeless tobacco increases the risk of head and neck squamous cell carcinoma, especially for snuff users.²⁰⁹

Animal studies point to the additional possibility of smokeless tobacco causing cancer of the forestomach, nasal cavity, skin and liver, but epidemiological studies are inconclusive at this stage.²⁴⁶

Ongoing research is needed by type of smokeless tobacco and among people who only use a specific product and those who use it in conjunction with other smokeless tobacco product(s) or cigarettes. Heavy drinking should also be controlled for because it, too, is a risk factor for many types of cancer.

Waterpipes

Waterpipes (also known as hookah, shisha or narghile) have recently increased in popularity, especially among youth and young adults who may consider them “healthier” than smoking cigarettes. Using a waterpipe is not safer than smoking. In fact, it contains 27 known or suspected carcinogens.²¹⁰

Although the cancer risks of waterpipe smoking have not been studied extensively, there is sufficient evidence to link waterpipe smoking to lung cancer, and some evidence linking shisha use to oral cancer, leukaemia, oesophageal squamous cell carcinoma, stomach and possibly other cancers.

Waterpipe smoking has been shown to more than double the risk of lung cancer, but these studies lacked methodological rigour.^{217 218 219} Additional research is required to definitively assess the relative risks. In the absence of conclusive research, shisha smokers should err on the side of caution and quit.²¹⁷

Cigars and pipes

Cigar smoking and cigarette smoking carry many of the same risks.²²⁰ People who smoke cigars only, with no history of smoking cigarettes or pipes, are at risk of several types of cancer.²²⁰ A 2015 systematic review and the IARC 2004 report both concluded that cigar and/or pipe smoking can cause cancers of the lung, oral cavity, pharynx, larynx, esophagus, pancreas, stomach and bladder.^{52 220}

Strong daily use and inhalation, which are relatively rare except among current or former cigarette smokers,⁹⁸ increase the risk for oral, esophageal, laryngeal, and lung cancers.⁷⁹ Even without inhalation, the relative mortality risk was still high for oral, esophageal, and laryngeal cancers.²²⁰

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