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# Lung Cancer Causes, Risk Factors, and Prevention

Learn about the risk factors for lung cancer and what you might be able to do to help lower your risk.

## Risk Factors

A risk factor is anything that affects your chance of getting a disease such as cancer. Learn more about the risk factors for lung cancer.

- [Lung Cancer Risk Factors](#)
- [What Causes Lung Cancer?](#)

## Prevention

There is no way to completely prevent cancer. But there are things you can do that might lower your risk. Learn more.

- [Can Lung Cancer Be Prevented?](#)

## [Know Your Cancer Risk](#)

Take the ACS CancerRisk360™ assessment to learn more about what you can change to improve your health. By taking 5 minutes to answer a few questions, we will give you a personalized roadmap of actions with helpful resources you can use to lower your risk of cancer.

# Lung Cancer Risk Factors

A risk factor is anything that increases a person's chance of getting a disease such as cancer.

- [Factors that may affect lung cancer risk](#)
- [Risk factors you can change](#)
- [Risk factors you cannot change](#)
- [Factors with uncertain or unproven effects on lung cancer risk](#)

## Factors that may affect lung cancer risk

Different cancers have different risk factors. Some risk factors, like smoking, can be changed. Others, like a person's age or family history, can't be changed.

But having a risk factor, or even several, does not mean that you will get the disease. And some people who get the disease may have few or no known risk factors.

Several risk factors can make you more likely to develop lung cancer. These factors are related to the risk of lung cancer in general.

## Risk factors you can change

### Tobacco smoke

[Smoking](#)<sup>1</sup> is by far the leading risk factor for lung cancer. About 80% of lung cancer deaths are thought to result from smoking, and this number is probably even higher for small cell lung cancer (SCLC). It's rare for someone who has never smoked to have SCLC.

The risk of lung cancer for people who smoke is many times higher than for people who don't smoke. The longer you smoke and the more packs a day you smoke, the greater your risk.

[Cigar smoking](#)<sup>2</sup>, pipe smoking, and menthol cigarette smoking are almost as likely to cause lung cancer as cigarette smoking. Smoking low-tar or "light" cigarettes increases lung cancer risk as much as regular cigarettes.

### Secondhand smoke

If you don't smoke, breathing in the smoke of others (called [secondhand smoke](#)<sup>3</sup> or environmental tobacco smoke) can increase your risk of developing lung cancer. Secondhand smoke is the third most common cause of lung cancer in the United States.

If you or someone you care about needs help quitting, see [How to Quit Using Tobacco](#)<sup>4</sup> or call the American Cancer Society at 1-800-227-2345

## **Exposure to radon**

Radon is a naturally occurring radioactive gas that results from the breakdown of uranium in soil and rocks. You can't see, taste, or smell it. According to the US Environmental Protection Agency (EPA), radon is the second-leading cause of lung cancer in the United States, and it's the leading cause among people who don't smoke.

Outdoors, there is so little radon that it is not likely to be dangerous. But indoors, radon can be more concentrated. Breathing it in exposes your lungs to small amounts of radon. This may increase a person's risk of lung cancer.

Homes and other buildings in nearly any part of the country can have high indoor radon levels (especially in basements).

For more information, see [Radon and Cancer](#)<sup>5</sup>.

## **Exposure to asbestos**

People who work with asbestos (such as in mines, mills, textile plants, places where insulation is used, and shipyards) are several times more likely to die of lung cancer. Lung cancer risk is much greater in workers exposed to asbestos who also smoke. It's not clear how much low-level or short-term exposure to asbestos might raise lung cancer risk.

People exposed to large amounts of asbestos also have a greater risk of developing mesothelioma, a type of cancer that starts in the pleura (the lining surrounding the lungs). For more on this type of cancer, see [Mesothelioma](#)<sup>6</sup>.

In recent years, government regulations have greatly reduced the use of asbestos in commercial and industrial products. It's still present in many homes and other older buildings, but it's not usually considered harmful as long as it's not released into the air by deterioration, demolition, or renovation. For more information, see [Asbestos and Cancer Risk](#)<sup>7</sup>.

## Exposure to other cancer-causing agents in the workplace

Other carcinogens (cancer-causing agents) found in some workplaces that can increase lung cancer risk include:

- Radioactive ores, such as uranium
- Inhaled chemicals, such as arsenic, beryllium, cadmium, silica, vinyl chloride, nickel compounds, chromium compounds, coal products, mustard gas, and chloromethyl ethers
- [Diesel exhaust](#)<sup>8</sup>

The government and industry have taken steps in recent years to help protect workers from many of these exposures. But the dangers are still there, so if you work around these agents, be careful to limit your exposure whenever possible.

## Taking certain dietary supplements

Studies looking at the possible role of vitamin supplements in reducing lung cancer risk have had disappointing results. In fact, multiple studies found that people who smoked and took beta-carotene supplements actually had an increased risk of lung cancer. The results of these studies suggest that people should avoid taking beta-carotene supplements.

## Arsenic in drinking water

Studies of people in parts of Southeast Asia and South America with high levels of [arsenic](#)<sup>9</sup> in their drinking water have found a higher risk of lung cancer. In most of these studies, the levels of arsenic in the water were many times higher than those typically seen in the United States, even areas where arsenic levels are above normal. For most Americans who are on public water systems, drinking water is not a major source of arsenic.

## Risk factors you cannot change

### Previous radiation therapy to the lungs

People who have had [radiation therapy to the chest for other cancers](#)<sup>10</sup> are at higher risk for lung cancer, particularly if they smoke. Examples include people who have been treated for [Hodgkin lymphoma](#)<sup>11</sup> or women who were treated with chest radiation for [breast cancer](#)<sup>12</sup>.

## Air pollution

In cities, air pollution, such as from diesel exhaust, appears to raise the risk of lung cancer slightly. This risk is far less than the risk caused by smoking, but about 1% to 2% of all deaths from lung cancer in the United States are thought to be due to outdoor air pollution.

## Personal or family history of lung cancer

If you have had lung cancer, you have a higher risk of developing another lung cancer.

Brothers, sisters, and children of people who have had lung cancer may have a slightly higher risk of lung cancer themselves, especially if the relative was diagnosed at a younger age. It's not clear how much of this risk might be due to shared genes among family members and how much might be from shared household exposures (such as tobacco smoke or radon).

Researchers have found that genetics do play a role in some families with a strong history of lung cancer. (To learn more, see [What Causes Lung Cancer?](#))

## Factors with uncertain or unproven effects on lung cancer risk

### Smoking marijuana

There are reasons to think smoking marijuana might increase lung cancer risk.

- Marijuana smoke contains tar and many of the same cancer-causing substances that are in tobacco smoke. (Tar is the sticky, solid material that remains after burning, which is thought to contain most of the harmful substances in smoke.)
- Marijuana cigarettes (joints) are typically smoked all the way to the end, where tar content is the highest.
- Marijuana is inhaled very deeply, and the smoke is held in the lungs for a long time, which gives any cancer-causing substances more opportunity to deposit in the lungs.
- Because marijuana is still illegal in many places, it may not be possible to control what other substances it might contain.

It's been hard to study whether there is a link between marijuana and lung cancer because marijuana has been illegal in many places for so long, and it's not easy to

gather information about the use of illegal drugs. Also, in studies that have looked at past marijuana use in people who had lung cancer, most of the people who smoked marijuana also smoked cigarettes. This can make it hard to know how much any increased risk is from tobacco and how much might be from marijuana. We do know that smoking marijuana will irritate your lungs and possibly increase your risk of getting more lung infections. More research is needed to know the cancer risks from smoking marijuana.

## E-cigarettes

[E-cigarettes](#)<sup>13</sup> are a type of electronic nicotine delivery system. Most e-cigarettes contain nicotine, so the Food and Drug Administration (FDA) classifies them as “tobacco products.” The FDA states that e-cigarettes cause health risks, including lung damage. Furthermore, e-cigarettes have not been shown to improve your chances of quitting smoking. Whether e-cigarettes directly increase your risk of lung cancer is not yet known.

## Hyperlinks

1. [www.cancer.org/cancer/risk-prevention/tobacco.html](http://www.cancer.org/cancer/risk-prevention/tobacco.html)
2. [www.cancer.org/cancer/risk-prevention/tobacco/is-any-type-of-smoking-safe.html](http://www.cancer.org/cancer/risk-prevention/tobacco/is-any-type-of-smoking-safe.html)
3. [www.cancer.org/cancer/risk-prevention/tobacco/secondhand-smoke.html](http://www.cancer.org/cancer/risk-prevention/tobacco/secondhand-smoke.html)
4. [www.cancer.org/cancer/risk-prevention/tobacco/guide-quitting-smoking.html](http://www.cancer.org/cancer/risk-prevention/tobacco/guide-quitting-smoking.html)
5. [www.cancer.org/cancer/risk-prevention/radiation-exposure/radon.html](http://www.cancer.org/cancer/risk-prevention/radiation-exposure/radon.html)
6. [www.cancer.org/cancer/types/malignant-mesothelioma.html](http://www.cancer.org/cancer/types/malignant-mesothelioma.html)
7. [www.cancer.org/cancer/risk-prevention/chemicals/asbestos.html](http://www.cancer.org/cancer/risk-prevention/chemicals/asbestos.html)
8. [www.cancer.org/cancer/risk-prevention/chemicals/diesel-exhaust-and-cancer.html](http://www.cancer.org/cancer/risk-prevention/chemicals/diesel-exhaust-and-cancer.html)
9. [www.cancer.org/cancer/risk-prevention/chemicals/arsenic.html](http://www.cancer.org/cancer/risk-prevention/chemicals/arsenic.html)
10. [www.cancer.org/cancer/survivorship/long-term-health-concerns/second-cancers-in-adults.html](http://www.cancer.org/cancer/survivorship/long-term-health-concerns/second-cancers-in-adults.html)
11. [www.cancer.org/cancer/types/hodgkin-lymphoma.html](http://www.cancer.org/cancer/types/hodgkin-lymphoma.html)
12. [www.cancer.org/cancer/types/breast-cancer.html](http://www.cancer.org/cancer/types/breast-cancer.html)
13. [www.cancer.org/cancer/risk-prevention/tobacco/e-cigarettes-vaping.html](http://www.cancer.org/cancer/risk-prevention/tobacco/e-cigarettes-vaping.html)

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## What Causes Lung Cancer?

We don't know what causes each case of lung cancer. But we do know many of the risk factors for these cancers (see [Lung Cancer Risk Factors](#)) and how some of them cause normal cells to become cancer cells.

- [How smoking leads to lung cancer](#)
- [Causes in people who don't smoke](#)
- [Gene changes that may lead to lung cancer](#)
- [Inherited gene changes \(germline mutations\)](#)
- [Acquired gene changes \(somatic mutations or "driver mutations"\)](#)

### How smoking leads to lung cancer

[Smoking tobacco](#)<sup>1</sup> is by far the leading cause of lung cancer. About 80% of lung cancer deaths are caused by smoking, and many others are caused by exposure to secondhand smoke.

Smoking is clearly the strongest risk factor for lung cancer, but it often interacts with other factors. People who smoke and are exposed to other known risk factors, such as [radon](#)<sup>2</sup> and [asbestos](#)<sup>3</sup>, are at an even higher risk. Not everyone who smokes gets lung cancer, so other factors like genetics probably play a role as well (see below).

### Causes in people who don't smoke

Not all people who get lung cancer smoke. Many people with lung cancer formerly



smoked, but many others never smoked at all.

Lung cancer in people who don't smoke can be caused by exposure to radon, [secondhand smoke](#)<sup>4</sup>, air pollution, or other factors. Workplace exposures to asbestos, [diesel exhaust](#)<sup>5</sup>, or other chemicals can also cause lung cancers in some people who don't smoke.

Some people with no known risk factors may develop lung cancer. This may be due to random events that don't have an outside cause, but it also may be due to factors that we don't yet know about.

Lung cancers in people who don't smoke are often different from those that occur in people who do. They tend to develop in younger people and often have certain gene changes that are different from those in tumors found in people who smoke. In some cases, these gene changes can be used to guide treatment.

## Gene changes that may lead to lung cancer

DNA is the molecule in our cells that makes up our genes, which control how our cells function. DNA, which comes from both our parents, affects more than just how we look. It also can influence our risk for developing certain diseases, including some kinds of cancer.

Some genes help control when cells grow, divide to make new cells, and die:

- Genes that help cells grow, divide, or stay alive are called **oncogenes**.
- Genes that help control cell division or cause cells to die at the right time are called **tumor suppressor genes**.

Cancers can be caused by DNA changes that turn on oncogenes or turn off tumor suppressor genes. Changes in many different genes are usually needed to cause lung cancer. There are primarily two types of gene mutations (changes): germline mutations and somatic mutations.

## Inherited gene changes (germline mutations)

Inherited gene changes, or germline mutations, are gene changes that you inherit from your parents. These are the mutations in your DNA that you inherit from the egg and sperm cells when you are conceived. Some people inherit DNA mutations from their parents that may increase their risk for developing certain cancers. Historically,

germline mutations were not thought to cause very many lung cancers. However, recent studies have shown there may be a benefit to test all patients with lung cancer for germline mutations. If germline mutations are found, it would not only show that you were at an increased hereditary risk for developing lung cancer, but it could also help guide discussions about the best way to treat your lung cancer. If you have lung cancer and are also found to have a certain germline mutation, you may respond well to that mutation's targeted therapy.

Examples of possible germline mutations for patients with lung cancer include: CHEK2, ATM, TP53, *BRCA1*, EGFR, APC, and PALB2. Studies are ongoing to better understand the role of germline mutations in lung cancer. Regardless of whether you carry a higher hereditary risk for lung cancer, doctors recommend that all people avoid tobacco smoke and other exposures that will increase cancer risk.

### **Acquired gene changes (somatic mutations or “driver mutations”)**

Acquired gene changes, or somatic mutations, may occur in any individual cell and cannot be inherited. Somatic mutations refer to DNA changes within cells that were not passed from your parents, but rather were acquired during your lifetime. Certain somatic mutations can affect the cell's ability to control its own growth, and will eventually transform a non-cancer cell to become a cancer cell. These somatic mutations are also known as “driver mutations.” If your tumor is found to have a driver mutation, you will likely respond well to targeted therapy.

For patients with advanced non-small cell lung cancer, it is recommended that the lung mass or a metastatic mass be tested for driver mutations. It is standard practice to test for the following driver mutations: EGFR, ALK, ROS1, MET, RET, BRAF, and NTRK. If any of these driver mutations are found, initial treatment with a targeted therapy (rather than chemotherapy) would be recommended. Although these mutations can be found in any patient with lung cancer, nonsmokers with lung cancer are more likely to have a driver mutation.

### **Hyperlinks**

1. [www.cancer.org/cancer/risk-prevention/tobacco.html](http://www.cancer.org/cancer/risk-prevention/tobacco.html)
2. [www.cancer.org/cancer/risk-prevention/radiation-exposure/radon.html](http://www.cancer.org/cancer/risk-prevention/radiation-exposure/radon.html)
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5. [www.cancer.org/cancer/risk-prevention/chemicals/diesel-exhaust-and-cancer.html](http://www.cancer.org/cancer/risk-prevention/chemicals/diesel-exhaust-and-cancer.html)

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# Can Lung Cancer Be Prevented?

Not all lung cancers can be prevented, but you may be able to lower your risk for lung cancer by changing the [risk factors](#) that you can control.

- [Stay away from tobacco](#)
- [Avoid radon exposure](#)
- [Avoid or limit exposure to cancer-causing agents](#)
- [Eat a healthy diet](#)

## Stay away from tobacco

The best way to reduce your risk of lung cancer is not to smoke and to avoid breathing in other people's smoke.

If you stop smoking before a cancer develops, your damaged lung tissue gradually starts to repair itself. No matter what your age or how long you've smoked, quitting will lower your risk of lung cancer and help you live longer. If you would like help quitting smoking, see [How to Quit Using Tobacco](#)<sup>1</sup> or call the American Cancer Society at 1-800-227-2345.

## Avoid radon exposure

Radon is an important cause of lung cancer. You can reduce your exposure to radon by having your home tested and treated, if needed. For more information, see [Radon and Cancer](#)<sup>2</sup>.

## Avoid or limit exposure to cancer-causing agents

Avoiding exposure to known cancer-causing agents, in the workplace and elsewhere, may also be helpful (see [Lung Cancer Risk Factors](#)). When people work where these exposures are common, they should be kept to a minimum.

## Eat a healthy diet

A [healthy diet](#)<sup>3</sup> with lots of fruits and vegetables may also help reduce your risk of lung cancer. Some evidence suggests that a diet high in fruits and vegetables may help protect people who smoke and those who don't against lung cancer. But any positive

effect of fruits and vegetables on lung cancer risk would be much less than the increased risk from smoking.

Trying to reduce the risk of lung cancer in people who currently smoke or those who formerly smoked by giving them high doses of vitamins or vitamin-like drugs has not been successful so far. In fact, some studies have found that supplements of beta-carotene, a nutrient related to vitamin A, appear to increase the rate of lung cancer in these people.

Some people who get lung cancer do not have any clear risk factors. Although we know how to prevent most lung cancers, at this time we don't know how to prevent all of them.

## Hyperlinks

1. [www.cancer.org/cancer/risk-prevention/tobacco/guide-quitting-smoking.html](http://www.cancer.org/cancer/risk-prevention/tobacco/guide-quitting-smoking.html)
2. [www.cancer.org/cancer/risk-prevention/radiation-exposure/radon.html](http://www.cancer.org/cancer/risk-prevention/radiation-exposure/radon.html)
3. [www.cancer.org/cancer/risk-prevention/diet-physical-activity/acs-guidelines-nutrition-physical-activity-cancer-prevention.html](http://www.cancer.org/cancer/risk-prevention/diet-physical-activity/acs-guidelines-nutrition-physical-activity-cancer-prevention.html)

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