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GUIDELINES  
FOR PATIENTS®

2023

# Lung Cancer Screening



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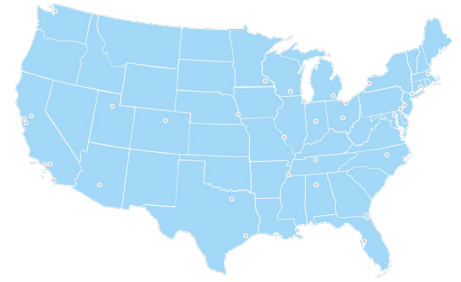


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Cancer care is always changing. NCCN develops evidence-based cancer care recommendations used by health care providers worldwide. These frequently updated recommendations are the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®). The NCCN Guidelines for Patients plainly explain these expert recommendations for people with cancer and caregivers.

**These NCCN Guidelines for Patients are based on the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Lung Cancer Screening Version 2.2023 – May 17, 2023.**

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# 1

## Lung cancer screening basics

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- 6 Lung cancer
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**Lung cancer starts in the cells of the lungs. For those at risk of developing lung cancer, regular screening can help find lung cancer at its earliest, most treatable stages.**

## The lungs

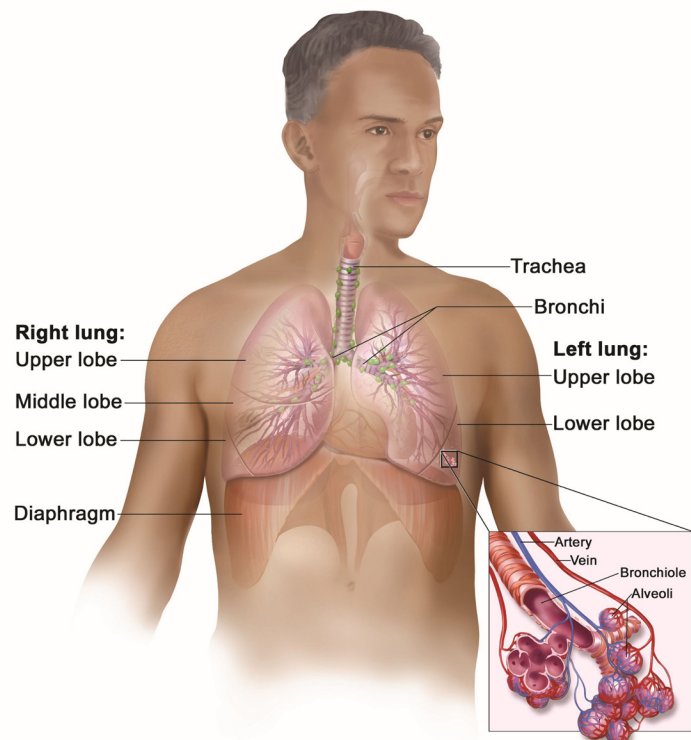
The lungs are a pair of organs located in the chest. The lungs move important gases in and out of the blood. You breathe in oxygen and exhale carbon dioxide (a gas made by cells) from the body.

The lungs have sections called lobes. The left lung has 2 lobes and the right lung has 3 lobes. A thin layer of tissue surrounds the lungs called the pleural membrane. This membrane protects the lungs.

Two large breathing tubes, called bronchi, connect the windpipe (trachea) to the lungs. There is one tube, called a bronchus, for each lung. Inside the lungs are small tubes (bronchioles) and small air sacs (alveoli).

## The respiratory system

The air you breathe moves through a series of airways. It travels down your throat and through your windpipe (trachea). The windpipe splits into 2 airways called bronchi. Inside the lung, each bronchus branches off into the parts of the lung called lobes. The right lung has 3 lobes and the left lung has 2 lobes. The bronchi divide into smaller airways called the bronchioles. At the end of the bronchioli are sacs called alveoli. From here, oxygen is transferred into your blood.



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## Lung cancer

Almost all lung cancers are a subtype called carcinomas. Lung carcinomas start in the cells that line the airways of the lungs. The airways of the lungs include the bronchus, bronchioles, and alveoli.

There are different types of lung carcinoma. The main types are non-small cell lung cancer and small cell lung cancer. Other types of cancer can spread to the lungs, such as breast cancer. Breast cancer that has spread to the lungs is still called breast cancer.

### Non-small cell lung cancer

Non-small cell lung cancer (NSCLC) is a group of cancers that are the most common type of lung cancer.

NSCLC can be broken down into subtypes by looking at the cancer cells under a microscope. This is called histology.

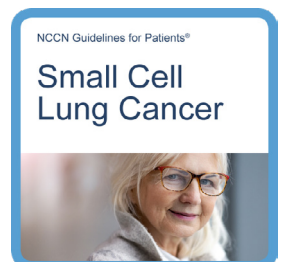
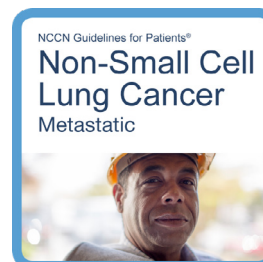
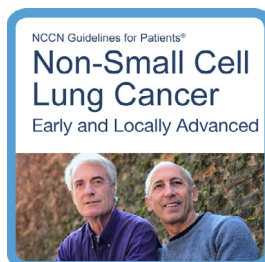
- **Adenocarcinoma** starts in the mucus-making cells that line the alveoli (small air sacs). This is the most common subtype. About 4 out of 10 lung cancers are adenocarcinomas. This is the most common type of lung cancer seen in those who don't smoke or who don't have a history of smoking.

- **Squamous cell (epidermoid) carcinoma** starts in the flat cells that line the inside of the airways (bronchi) in the lungs. About 3 out of 10 lung cancers are squamous cell carcinomas.
- **Large cell (undifferentiated) carcinoma** starts in large cells that can grow anywhere in the lungs. This accounts for 1.5 out of 10 NSCLCs.

### Small cell lung cancer

Small cell lung cancer (SCLC) is a fast-dividing cancer of the neuroendocrine cells. Under a microscope, the cancer cells look small and oval- or oat-shaped. It is the second most common type of lung cancer. About 1 out of every 10 lung cancers (10%) are SCLC.

**More information on NSCLC and SCLC is available at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.**





## Early detection

The goal of lung cancer screening is to find lung cancer at an early stage, even before there are any symptoms. This is when treatment will be most successful. Early detection of lung cancer helps prevent death. Together, you and your health care provider should discuss if screening is right for you.

## Key points

- The lungs are a pair of organs that move important gases in and out of the blood.
- Lung cancer starts in the cells that line the lungs.
- Most lung cancers are a subtype called carcinomas. Lung carcinomas start in the cells that line the airways of the lungs. The airways of the lungs include the bronchus, bronchioles, and alveoli.
- Lung cancer screening aims to find cancer early and before symptoms start. Lung cancer found earlier is more likely to be treated successfully.

**Lung cancer screening is not recommended for everyone. Screening is for those at risk for developing lung cancer. Ask your health care provider if you qualify for lung cancer screening. Your wishes are always important. Talk to your health care provider and make your wishes known.**



# 2

## Risk assessment

- 9 Risk factors
- 12 Find out your level of risk
- 12 Care team
- 13 Start before you have symptoms
- 14 Key points

**Risk is your chance of developing lung cancer. Some people are more likely than others to develop lung cancer. Anything that increases your chances of developing lung cancer is called a risk factor. Lung cancer screening is based on your risk factors described in this chapter.**

## Risk factors

Risk is your chance of developing lung cancer. Everyone has some risk for developing lung cancer. However, some people are at increased risk. Risk factors can be activities that people do, things in the environment, or traits passed down from biological parents to children through genes. Genes are a set of instructions that tell new cells what to become (for example, lung, heart, and skin) and what to do (make hormones, absorb nutrients, and kill germs). Known risk factors for lung cancer are listed in **Guide 1**.

See your health care provider (HCP) regularly for checkups and cancer screenings, which may include screenings for skin, breast, prostate cancer, and other types of cancer. You might be asked to see your HCP more than every year based on your risk factors for developing lung cancer. As your family health history changes, it is important to keep your HCP updated.

### Guide 1 Risk factors for lung cancer

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Tobacco use

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Radon exposure

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Occupational (work-related) exposure to asbestos and cancer-causing agents

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Cancer history

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Family history of lung cancer in first-degree biological relatives (parents, children, siblings)

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History of chronic obstructive pulmonary disease (COPD) or pulmonary fibrosis

---

Second-hand smoke exposure

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## Tobacco smoke

Smoking tobacco is the biggest risk factor for developing lung cancer. It is a modifiable risk. This means you can take steps to change your risk level by quitting smoking. Smoking tobacco causes lung cancer and accounts for 8.5 out of 10 lung cancer deaths. Smoking also increases the risk for other cancers, such as:

- Head and neck
- Kidney
- Bladder
- Pancreatic
- Stomach
- Cervical
- Acute myeloid leukemia (AML)

Tobacco smoke has over 7,000 chemicals, and at least 70 of them cause cancer. The more you smoke, the higher your risk. If you quit smoking, your risk will decrease. Those who smoked in the past have a higher risk of developing lung cancer than people who never smoked. Current or past tobacco smoking is a risk factor for lung cancer. It is never too late to stop smoking.

## Radon

Radon is radioactive gas found in nature that can cause lung cancer. You cannot see or smell radon. Radon gas is given off by soil or rock and can enter buildings and homes. The risk for lung cancer may depend on how much radon is in the home and the number of years you have been exposed. For people who have been exposed to radon, the risk for lung cancer is higher for those who smoke than for those who don't smoke.

## If you smoke or vape, seek help to quit

A history of smoking or vaping nicotine increases your chances of developing lung and other cancers. Smoking and vaping can limit how well cancer treatment works and prevents wound healing. It also greatly increases your chances of having side effects during and after surgery. Marijuana use might also affect the amount of anesthesia used during surgery.

Nicotine is the chemical in tobacco that makes you want to keep smoking and vaping. Nicotine withdrawal is challenging for most people who smoke or vape. The stress of having cancer may make it even harder to quit. If you smoke or vape, ask your care team about counseling and medicines to help you quit.

For online support, try these websites:

- [SmokeFree.gov](https://SmokeFree.gov)
- [BeTobaccoFree.gov](https://BeTobaccoFree.gov)
- [CDC.gov/tobacco](https://CDC.gov/tobacco)

## Other cancer-causing agents

Besides radon, other cancer-causing agents that target the lungs include the following:

- Arsenic, beryllium, cadmium, chromium, and nickel
- Asbestos
- Coal smoke, soot, silica, and diesel fumes

If you have been exposed to these agents, the risk for lung cancer is higher if you smoke than if you have never smoked.

## History of cancer

If you've had other cancers, you might have an increased risk for lung cancer. The following increases your risk of developing new lung cancer:

- If you had lung cancer
- If you had lymphoma
- If you had a smoking-related cancer, like kidney, bladder, or head and neck cancer
- If you had chest radiation therapy or alkylating agent (type of chemotherapy) treatment

## Family history of lung cancer

You have an increased risk of lung cancer if a close family (biological) relative has had lung cancer. Your risk is greater if your relative was diagnosed at a young age or if more than one relative has had lung cancer.

## History of lung disease

A history of either chronic obstructive pulmonary disease (COPD) or pulmonary fibrosis increases your risk of lung cancer. In COPD the lung tissue is damaged causing a cough and too much mucus. Pulmonary fibrosis scars and thickens the tissue around and between the air sacs (alveoli) in your lungs making it hard to breathe. COPD includes emphysema and chronic bronchitis. COPD and pulmonary fibrosis are chronic lung diseases that cause damage and inflammation of the lungs. The chronic damage and inflammation increase the risk of lung cancer.

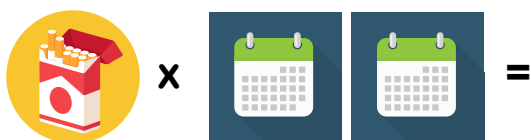
## Second-hand smoke

Second-hand smoke is smoke from burning tobacco products, such as cigarettes, cigars, or pipes. It is also smoke that has been exhaled, or breathed out, by a person smoking. Second-hand smoke by itself is not considered a risk factor for lung cancer. However, second-hand smoke combined with other risk factors increases the risk of lung cancer. Lung cancer screening is not recommended for people whose only risk factor is contact with second-hand smoke.

## Find out your level of risk

The decision to undergo lung cancer screening is based on a risk assessment that includes your lung cancer risk factors, your overall health, if you have or had lung cancer, or if you have other serious health issues. All of this information is considered when placing you into a risk group. In general, risk groups are divided by age and pack-years of smoking. A pack-year is the number of packs of cigarettes you smoked every day multiplied by the number of years you smoked.

- **High risk** – 50 years of age and over with a 20 pack-year or more history of smoking cigarettes. Lung cancer screening is recommended. People at high risk for lung cancer may benefit from low-dose computed tomography (LDCT) screening.
- **Low risk** – Under 50 years of age or less than a 20 pack-year history of smoking cigarettes. Lung cancer screening is not recommended.



Number of packs per day  
x years of smoking  
= Pack-years

*Example:*

1.5 packs a day x 30 years =  
45 pack-years

Lung cancer screening is not recommended for everyone. Ask your health care provider (HCP) to share information regarding potential benefits, risks, and limitations of lung cancer screening. Shared decision-making between you and your HCP is encouraged.

## Care team

Lung cancer screening should be part of a larger program of care and not done by itself. Doctors or medical staff from different areas of medicine should work together with you to decide on a lung screening plan.

For lung cancer screening, specialists from these areas might be included in your program of care:

- **Thoracic (chest) radiology** – a thoracic radiologist is an expert in reading test images for lung diseases.
- **Pulmonary (lung) medicine** – a pulmonologist is an expert in lung diseases.
- **Thoracic surgery** – a thoracic surgeon is an expert in operations within the chest.

A care team will:

- Assess your risk for developing lung cancer
- Review test results for signs of cancer

A care team might:

- Repeat tests to see if there are any changes
- Order new tests
- Remove tissue (biopsy) from your body only if signs of cancer are present

## Start before you have symptoms

Screening can help find disease early, even before symptoms occur. The earlier lung cancer is found, the more likely it is to be cured with treatment. The goal of lung cancer screening is to find lung cancer in those who are at a high risk for lung cancer. Most lung cancer is found when cancer is more advanced, often after symptoms appear. The later lung cancer is found, the more difficult it is to treat and less likely it is to be cured.

See your health care provider (HCP) if you have any of the following symptoms:

- Cough that lasts
- Blood in mucus
- Shortness of breath
- Wheezing
- Pain in chest area
- Tiredness that lasts
- Pneumonia
- Pain when swallowing
- Weight loss

Most often, these symptoms are caused by health issues other than lung cancer. Your HCP can help you decide if a screening test is right for you or if you should consider other kinds of tests.

Lung cancer screening  
saves lives by  
detecting cancer  
earlier, when it can  
be treated more  
successfully.

Tell your HCP about:

- Any past or current health issues
- Your family health history of cancer and other diseases
- The types of jobs or places you have lived or worked that could have exposed you to radon or cancer-causing chemicals (agents)
- If you currently or ever smoked tobacco, how much and for how long, and, if you stopped smoking, how many years it has been since you quit

## Key points

- Anything that increases your chances of lung cancer is called a risk factor.
- Tobacco smoking is the biggest risk factor for lung cancer.
- If you smoke tobacco, ask your health care provider for support resources that can help you quit smoking.
- Screening can help find disease early, even before symptoms occur. When disease is found early, it is more likely to be cured with treatment.
- The goal of lung cancer screening is to find lung cancer early in those who are at a high risk for developing lung cancer.
- Most lung cancer is found only after symptoms appear and when the disease is more advanced and more difficult to cure.



### **We want your feedback!**

**Our goal is to provide helpful and easy-to-understand information on cancer.**

**Take our survey to let us know what we got right and what we could do better.**

**[NCCN.org/patients/feedback](https://www.nccn.org/patients/feedback)**



# 3

## Screening tests

- 16 Imaging tests
- 18 Types of lung nodules
- 19 Overview of screening tests
- 20 Screening plan
- 20 Key points

**This chapter provides an overview of imaging tests used in lung cancer screening and information on lung nodules. Ask questions and keep copies of your test results. Online patient portals are a great way to access your test results.**

## Imaging tests

Imaging tests take pictures of the inside of your body. A radiologist, an expert in interpreting imaging tests, will write a report and send this report to your health care provider (HCP). It is likely that the report will be sent directly to you through your patient portal or patient access system. You should discuss these results with your HCP.

### What is the difference between screening and diagnostic tests?

- Screening is done on a regular basis even when there are no signs or symptoms.
- Diagnostic tests are done when there are signs or symptoms.

The following imaging tests are not listed in order of importance. You will not have all of these tests.

### CT scan

A computed tomography (CT or CAT) scan uses x-rays and computer technology to take pictures of the inside of the body. It takes many x-rays of the same body part from different angles. All of the images are combined to make one detailed picture.

### Low-dose computed tomography

A low-dose computed tomography (LDCT) test is recommended as part of lung cancer screening. It uses small amounts of radiation and computer technology to take pictures of the inside of the body from different angles. The amount of radiation used is much lower than standard doses of a CT scan. Contrast material should not be used for screening LDCT. A chest x-ray is not recommended for lung cancer screening. Lung cancer screening should not be used in place of quitting smoking.

### Contrast material

Contrast material is used to improve the pictures of the inside of the body. Contrast materials are not dyes, but substances that help enhance and improve the images of several organs and structures in the body. It is used to make the pictures clearer. The contrast is not permanent and will leave the body in your urine immediately after the test. The types of contrast vary and are different for CT and magnetic resonance imaging (MRI). Contrast is not used in LDCT tests, but might be used in a chest CT.

## PET scan

A positron emission tomography (PET) scan uses a radioactive sugar molecule called a tracer. A tracer is a substance injected into a vein to see where cancer spots might be in the body and if they are using sugar produced by your body to grow. Cancer spots show up as bright areas on PET scans. However, not all tumors will appear on a PET scan and not all bright spots are cancer. It is normal for the brain, heart, kidneys, and bladder to be bright on the PET scan. Inflammation or infection can also show up as a bright spot. When a PET scan is combined with CT, it is called a PET-CT scan.

A PET scan may be used to see if a nodule found on a screening LDCT contains cancer cells. However, very small nodules are not easily seen on PET. These nodules could be the size of a large pea or smaller. Cancers of that size don't use enough sugar to be detected. However, PET-CT scans are not used as the first test to screen for lung cancer.

**Before starting a screening plan, talk with your health care provider about all of the possible benefits and risks of the plan.**

Benefits should include:

- ✓ Longer survival and better quality of life
- ✓ Less testing and treatment
- ✓ Support to quit smoking or vaping tobacco
- ✓ Possible discovery of other treatable health conditions
- ✓ Peace of mind

## CT machine

**A CT machine is large and has a tunnel in the middle. During the test, you will lie on the table that moves slowly through the tunnel.**



## Types of lung nodules

Screening with LDCT is used to find nodules in the lungs. Nodules are small, round areas of tissue and are quite common. They appear as round, white shadows on an LDCT test. Nodules can be caused by cancer, infection, scar tissue, or other conditions. Most nodules are not cancer (benign). People can have one or more lung nodules found during the LDCT test.

### Features of the nodule

Nodules caused by cancer have specific traits.

- They aren't likely to have calcium buildup.
- They often have rough edges (called spiculations) and odd shapes.
- They often grow faster, are more dense, and are larger in size than nodules that are not cancer.

If a lung nodule is new or has changed in size, shape, density, or appearance, your HCP may recommend further testing.

### Size

Many of the nodules found on screening are small, about the size of a pea, and most of these nodules are not cancer. Nodules are measured in mm (millimeters) and are rounded to the nearest whole number. A new crayon point is about 2 mm long, a pea is about 5 mm, and a marble is about 13 mm.

Nodules with cancer often grow faster and larger than those that are benign. There is an increased risk of cancer if a nodule is located in the upper lobes, especially the upper right lobe.

### Density

Radiologists or other experts will look at how dense or solid a nodule is. Density is how solid versus hazy a nodule looks on the LDCT pictures. A solid nodule has a higher density than a hazy one. Not all nodules are cancer. Nodules are divided into groups based on density.

There are 3 main types of lung (pulmonary) nodules.

- **Solid nodules** look about as solid as your muscle does on an LDCT picture. This means they have a high density. Solid nodules are the most common type of nodule.
- **Part-solid nodules or mixed solid nodules** have both solid and non-solid (called ground-glass) areas. This means they have both high- and low-density areas. Part-solid nodules are mainly adenocarcinomas. Part-solid nodules have the greatest chance of being lung cancer.
- **Non-solid nodules** look like a fuzzy or hazy cloud on an LDCT picture. These nodules are also called a ground-glass opacity (GGO) or a ground-glass nodule (GGN). Non-solid nodules are usually followed by more LDCT tests. Even if non-solid nodules are cancer, these are considered the kind of cancer that is unlikely to grow and spread.

Solid and part-solid nodules are more likely to be invasive and faster-growing cancers. All nodules will be closely monitored during lung cancer screening. You might have tests more often to track any changes in size, density, and appearance of nodules. If you have any questions about your nodules or the chance

that it might be cancer, talk to your health care provider (HCP).

## Overview of screening tests

Screening tests are repeated over time to see if a nodule may be cancer. The timing and type of screening test depend on whether there are changes in a nodule's size, density, or both. The type of lung screening test recommended is a low-dose computed tomography (LDCT). The first LDCT is called the baseline test. All future scheduled LDCT tests, called follow-ups, will be compared to this baseline test. Nodules over certain cutoff sizes on the baseline LDCT determine the risk a nodule is cancer and are used by your health care team to recommend the next steps. Follow-up LDCT scans are used to look for new nodules and changes in shape, size, or density of nodules seen on the

baseline LDCT scan. Such changes may be a sign of cancer.

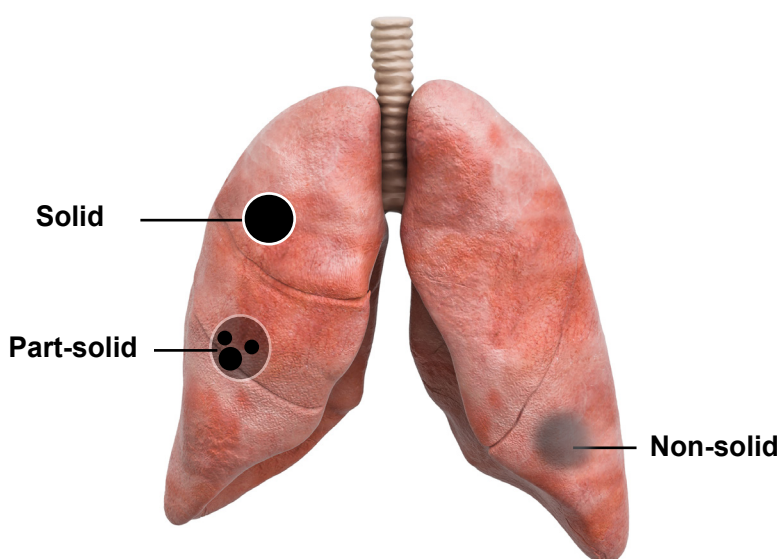
Often, an LDCT detects a nodule, but the results aren't clear if the nodule is cancer or benign (not cancer). Sometimes, a chest CT scan with contrast or PET scan might be ordered. A chest CT uses x-rays and computer technology to take images. The amount of radiation in a chest CT is higher than in an LDCT scan. A PET scan would check for disease throughout your body, and not just the chest area.

### Risks with testing

There are risks with any test. The LDCT might pick up unusual areas (abnormalities) that look like cancer but are not cancer. This error is called a false-positive result. With a false positive, you might have cancer-related tests, like a biopsy, only to find out you do not

### Nodule density

**Solid and part-solid nodules are more likely to be invasive and fast-growing cancers.**



have cancer. The risk is that you might have tests that cost money and that you do not need. Follow-up for a positive result is usually another LDCT test, not a biopsy. Given the number of false-positive results, you should discuss the risks and benefits of LDCT tests with your health care provider (HCP) before starting screening.

A false negative is when LDCT test results are clear, but you later find out that you have lung cancer. A false negative might give you a false sense of comfort. It might cause you to ignore symptoms that might have led to more tests.

Screening only those who are at high risk for developing lung cancer helps to prevent unneeded testing. Shared decision-making with your HCP is the best way to decide to start a lung cancer screening program. In shared decision-making, you and your HCP share information, weigh screening risks and benefits, and agree on a plan that works for you and your situation.

## Screening plan

A screening plan will include the timing of the LDCT tests. Keep the following in mind:

- You need a prescription or an order from a medical provider before scheduling a screening test.
- Find a screening site that provides LDCT tests.
- Decide on a screening plan that has many benefits and few risks.

## You need an order from a medical provider before a screening test

Most testing sites and insurance companies require a doctor's order or prescription before you have an LDCT test. Check with your insurance company to make sure you have met all the requirements before a lung cancer screening test. For example, the Centers for Medicare & Medicaid Services (CMS) requires not only that you meet certain risk factors, but that you receive counseling and participate in shared decision-making with your HCP. This must be done before lung cancer screening. If you have questions, ask your HCP.

## Key points

- Lung cancer screening should start before cancer symptoms appear.
- Only those at high risk for lung cancer should consider a screening program.
- An LDCT test is recommended as part of lung cancer screening.
- Many people have lung nodules. Nodules can be caused by cancer, infections, scar tissue, or other conditions.
- Often, screening tests are repeated over time to determine if a nodule may be cancer.
- The schedule and type of screening test depend on whether there are changes in a nodule's size, density, or both.

# 4

## LDCT tests and results

- 22 Baseline LDCT
- 22 Baseline LDCT test results
- 25 Follow-up LDCT
- 27 Biopsy
- 28 Key points



**A low-dose computed tomography (LDCT) test is recommended for lung cancer screening. The first LDCT is called the baseline test. All future LDCT tests, called follow-ups, will be compared to this baseline test.**

## Baseline LDCT

Your initial or very first LDCT test is called the **baseline LDCT**.

**A first follow-up LDCT** scan is done to compare to your baseline LDCT.

You will have other follow-up LDCT tests every year or more often. The timing of your follow-up LDCTs are based on your risk factors for developing lung cancer and results of your previous LDCTs.

## Baseline LDCT test results

For baseline LDCT test results for solid and part-solid lung nodules, **see Guide 2**.

### No lung nodules

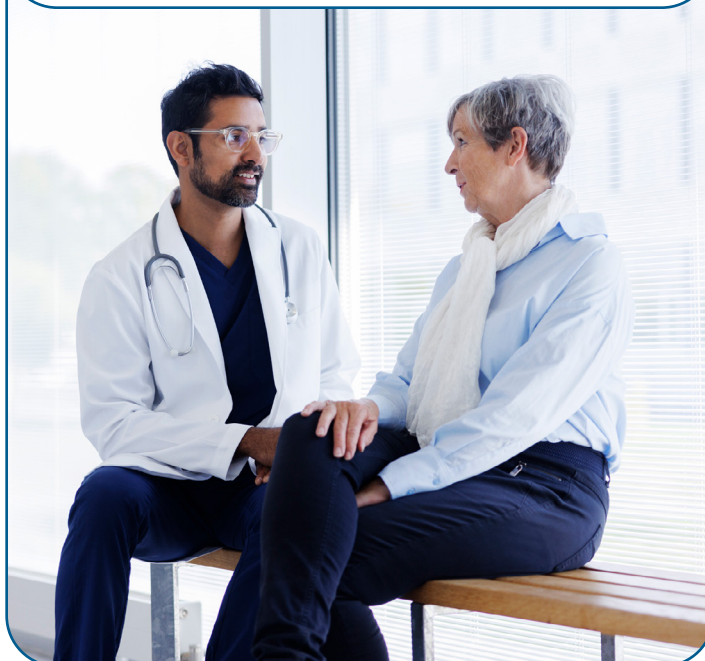
If no lung nodules are found on the baseline LDCT, then your next LDCT should be in 12 months. This would be your first follow-up LDCT. After that, you will continue to have LDCT tests every 12 months (annually).

### Solid lung nodule

If a solid lung nodule is found during your baseline LDCT, what is done next depends on the size and traits of the nodule. Usually, small nodules less than 15 mm will have a follow-up LDCT scan done in 6 to 12 months to see if the nodule changes. For larger nodules, a chest CT and/or PET-CT scan and/or biopsy is recommended.

A nodule that is 15 mm or larger has the highest risk of cancer. Depending on the results of a chest CT and/or PET-CT, the next step might be to remove one or more samples of tissue (biopsy) or remove the entire nodule (surgical excision) to check for cancer. If no cancer is found, your next LDCT should be in 12 months. If cancer is confirmed, your health care team will work with you to develop a treatment plan.

**The timing of follow-up LDCTs is based on your risk factors for developing lung cancer and results of your previous LDCTs.**





## Solid endobronchial nodule

If a solid endobronchial (inside the windpipe) nodule is found, your health care provider (HCP) might recommend another LDCT in 1 month or less. This is so the radiologist can see if the nodule is just phlegm (thick mucus) or is an actual growth. Just before your LDCT, the technician will ask you to cough vigorously to help remove phlegm. If there is still an endobronchial nodule on the new LDCT, then a bronchoscopy should be done. A bronchoscopy is when a long, thin camera is guided into the airway to look at or remove tissue.

If there is a high concern for cancer, the next step would be to remove one or more samples of tissue (biopsy) or remove the entire nodule (surgical excision) to check for cancer. Once tissue or the nodule is removed, a pathologist will look at the cells under a microscope to see if cancer is present. If no cancer is found, your next LDCT should be in 12 months. If cancer is

## Order of screening tests

1. Baseline screening LDCT
2. First follow-up screening LDCT
3. Follow-up or yearly screening LDCT
4. If needed, chest CT or PET-CT

confirmed, your health care team will work with you to develop a treatment plan.

### Guide 2

#### Baseline LDCT results: Solid and part-solid lung nodules

<b>Solid nodule</b>	<ul style="list-style-type: none"> <li>• Smaller than 6 mm, next LDCT should be in 12 months</li> <li>• 6 to 7 mm, follow-up LDCT in 6 months</li> <li>• 8 to 15 mm, follow-up LDCT in 3 months or consider a PET-CT</li> <li>• 15 mm or larger, then a chest CT and/PET-CT scan and/or biopsy is recommended</li> </ul>
<b>Part-solid nodule</b>	<ul style="list-style-type: none"> <li>• Smaller than 6 mm, next LDCT should be in 12 months</li> <li>• 6 mm or larger with a solid part smaller than 6 mm, next LDCT should be in 6 months</li> <li>• 6 mm or larger with a solid part of between 6 and 8 mm, next LDCT should be in 3 months or a PET-CT is possible</li> <li>• Solid part of 8 mm or larger, then a chest CT and/or PET-CT</li> </ul>

## Part-solid lung nodule

A nodule may contain an area or areas that are more solid than the rest of the nodule. These are called part-solid nodules and both the whole nodule and the solid area are measured.

The timing of your next LDCT screening test is based on both the size of the whole nodule and size of the solid part. PET-CT scans have trouble measuring nodules that are 8 mm or less or are in certain locations of the lung. This is why your care team will consider other factors before ordering a PET-CT when the part-solid nodule is in this size range.

If there is high concern for cancer, the next step would be to remove one or more samples of tissue (biopsy) or remove the entire nodule (surgical excision) to check for cancer. Once tissue or the nodule is removed, a pathologist will look at the cells under a microscope to see if cancer is present. If no cancer is found, your next LDCT should be in 12 months. If cancer is confirmed, your health care team will work with you to develop a treatment plan.

## Non-solid lung nodule

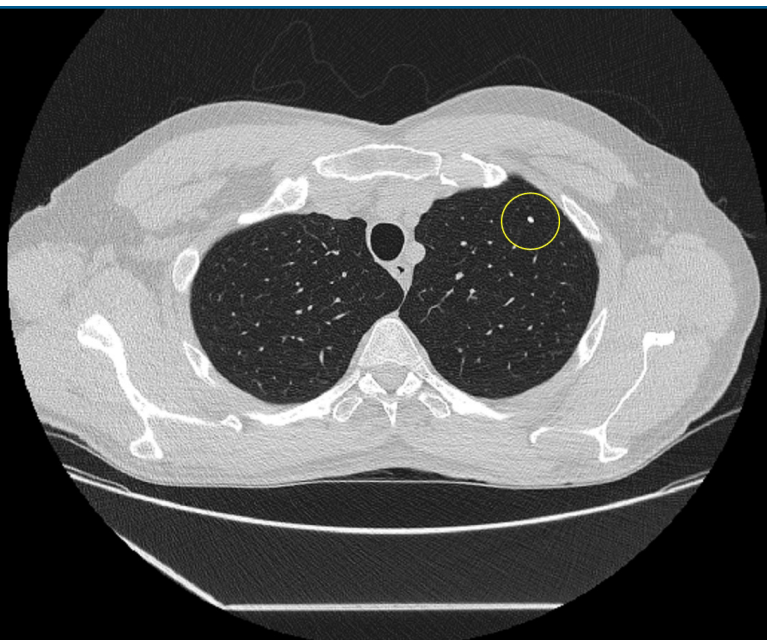
Many non-solid nodules can be followed-up with an LDCT every 12 months. You should have an LDCT in 6 months for a non-solid lung nodule that is 20 mm or larger. An olive or a cherry is about 20 mm.

Non-solid nodules may be cancer, but they may also be small areas of infection or inflammation. Large nodules are more likely to be cancer than small nodules. If a non-solid nodule develops a solid part on a future LDCT, this is a sign it could be cancer. The LDCT test will focus on taking pictures of the solid part of any part-solid nodule.

### Lung nodule

**A lung nodule is a small mass of tissue in the lung. Many people have lung nodules. Most are not cancer. When nodules are found by imaging, you may receive more scans to assess if the nodule is cancer.**

This work is licensed under a Creative Commons Attribution-ShareAlike 3.0 Unported License. <https://commons.wikimedia.org/wiki/File:CT-Low-Dose-1.25-Lung-Calcified-Nodule.jpg>



## Follow-up LDCT

If you have a new or growing nodule, it might be tested more often than every 12 months. The nodule size and density are also factors.

### New lung nodule on follow-up

Inflammation or infection might be the reason behind a new nodule found on a follow-up or yearly LDCT. If your health care provider (HCP) thinks this is the reason, then a follow-up LDCT will be in 1 to 3 months. During this time, your HCP may treat the infection or inflammation. Ongoing LDCT follow-up tests depend on if the infection or inflammation does or does not go away. If you have any questions, ask your HCP.

### Solid lung nodule on follow-up

The timing of the next LDCT test is based on the size of the solid nodule and whether the nodule is new or growing. Your HCP will compare the results from all of your tests to decide when you should have the next test. A new, smaller solid nodule might be tested sooner than a larger nodule that has not changed over time. Sometimes, additional tests such as a chest CT or PET-CT scan are recommended.

A chest CT or PET-CT scan might be ordered when there is concern for cancer. If there is a high concern for cancer, a biopsy or surgical excision (removal) of the solid lung nodule can confirm cancer. If cancer is confirmed, then treatment will start. If no cancer is found, then you will have LDCT tests every 12 months. For more information on the timing of your next LDCT for non-solid nodules, **see Guide 3.**

#### Guide 3

#### Solid nodule on follow-up or annual LDCT

##### No change on follow-up LDCT

- If smaller than 8 mm, then LDCT in 12 months.
- If 8 mm to less than 15 mm, then LDCT in 6 months.
- If 15 mm or larger, then LDCT in 6 months or PET-CT. Biopsy might follow.

##### No change on annual LDCT

- If no change on annual LDCT, then next LDCT in 12 months.

##### New nodule

- If smaller than 4 mm, then LDCT in 12 months.
- If 4 mm or less than 6 mm, then LDCT in 6 months.
- If 6 mm or less than 8 mm, then LDCT in 3 months.
- If 8 mm or larger, then chest CT with contrast and/or PET-CT. Biopsy might follow.

##### Nodule has grown more than 1.5 mm

- If smaller than 8 mm, then LDCT in 3 months.
- If 8 mm or larger, then chest CT with contrast and/or PET-CT. Biopsy might follow.

## Part-solid lung nodule on follow-up

In a part-solid nodule, both the whole nodule and the solid part are measured.

The timing of your next LDCT screening test is based on the following:

- Size of the whole nodule and size of the solid part
- If it is a new nodule
- If it is a growing nodule
- If there was no change from an earlier LDCT

If the part-solid lung nodule had no change on the LDCT done last year or a follow-up LDCT and is smaller than 6 mm, your next LDCT should be in 12 months. For those part-solid nodules that are new, or are growing, your next LDCT depends on the size of both the whole

nodule and the solid part. For more information on the timing of your next LDCT for part-solid nodules, **see Guide 4**.

You will have further testing based on the nodule size and concern for cancer. If there is a low concern for cancer, you will have an LDCT. If there is a high concern for cancer, you will have removal of part of all of the nodule for testing (biopsy or surgical excision). This is done instead of waiting to see if anything changes over time. A biopsy or surgical excision of the nodule can confirm if cancer is present.

### Guide 4

#### Part-solid nodule on follow-up or annual LDCT

<b>No change on follow-up LDCT</b>	<ul style="list-style-type: none"> <li>• If smaller than 6 mm, then LDCT in 12 months.</li> <li>• If 6 mm or larger with a solid part smaller than 6 mm, then LDCT in 12 months.</li> <li>• If 6 mm or larger with a solid part between 6 and 8 mm, then LDCT in 3 months or a PET-CT. Biopsy might follow.</li> </ul>
<b>No change on annual LDCT</b>	<ul style="list-style-type: none"> <li>• If no change on annual LDCT, then next LDCT in 12 months.</li> </ul>
<b>New nodule</b>	<ul style="list-style-type: none"> <li>• If smaller than 6 mm, then LDCT in 6 months.</li> </ul>
<b>If solid part has grown more than 1.5 mm</b>	<ul style="list-style-type: none"> <li>• If 6 mm or larger with a solid part smaller than 4 mm, then LDCT in 3 months.</li> <li>• If solid part is 4 mm or larger, then chest CT with contrast and/or PET-CT. Biopsy might follow.</li> </ul>

## Non-solid lung nodule on follow-up

If a non-solid nodule has disappeared or gotten smaller between tests, there is a chance it was a small infection and not cancer.

For new (4 mm or larger), stable, or growing non-solid nodules, see below:

- For a new or stable (not growing) non-solid nodule smaller than 20 mm, your next LDCT should be in 12 months.
- For a new 20 mm or larger non-solid nodule, your next LDCT should be in 6 months.
- For a stable 20 mm or larger non-solid nodule, your next LDCT should be in 12 months.
- If a nodule has grown more than 1.5 mm or become more solid since the last test, it may be cancer. Because of this concern, an LDCT should be in 6 months or your care team will consider a biopsy or removal of the nodule (surgical excision).
- If there are multiple non-solid nodules, then the next test will be based on the size of the largest nodule.

## Biopsy

A biopsy is a procedure that removes a sample of tissue or fluid. The sample is sent to a lab for testing. A pathologist will examine the sample under the microscope to determine if the tissue is not cancer (benign) or due to cancer (malignant). Biopsy results can be found in a pathology report. Ask questions about your biopsy results and what it means for next steps.

A biopsy removes a small sample of tissue from the lung nodule. A needle biopsy can be done either by a radiologist through the skin into the nodule or by a pulmonologist using a scope passed through the mouth while you are asleep into the windpipe to the nodule area. Surgery or surgical excision removes the entire nodule for testing. Since a biopsy only removes a very small piece of the nodule, the results could be incomplete. There may be cancer cells in another part of the nodule. If your risk for cancer is high, surgery might be recommended to remove the whole nodule. Your health care provider may suggest another biopsy, surgery, or more testing if the first biopsy shows no cancer, but cancer is suspected.

## Biopsy results

When no cancer is found in the biopsy or surgical tissue, yearly screening is suggested. Sometimes a sample of tissue from the biopsy does not have enough cells to check for cancer or may be abnormal but not cancer. Ask your health care provider (HCP) if you have any questions about your test results and when your next test might be.

If cancer cells are found in the biopsy sample, read the NCCN Patient Guidelines for treatment options recommended for every stage of lung cancer at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.

## Key points

- There are risks with any test.
- The LDCT might pick up unusual areas that look like cancer but are not cancer. This error is called a false-positive result.
- A false negative is when LDCT test results are clear, but you later find out you have lung cancer.
- Your initial or very first LDCT test is called the baseline LDCT.
- A first follow-up LDCT scan is done to compare to your baseline LDCT.
- If you have a new or growing nodule, it might be tested more often. The nodule size, shape, and density are also factors.
- Additional tests such as a chest CT or PET-CT scan might be recommended.
- A biopsy removes a small sample of tissue from the lung nodule for testing. A needle biopsy can be done through the skin or through the windpipe. Surgery or surgical excision removes the entire nodule for testing.
- Sometimes a sample of tissue from the biopsy does not have enough cells to check for cancer or may be abnormal but not cancer. Ask your health care provider (HCP) if you have any questions about your test results and when your next test might be.



### Create a medical binder

A medical binder or notebook is a great way to organize all of your records in one place.

- ✓ Make copies of blood tests, imaging results, and reports about your health.
- ✓ Choose a binder that meets your needs. Consider a zipper pocket to include a pen, small calendar, and insurance cards.
- ✓ Create folders for insurance forms, test types (such as blood, imaging, pathology, radiology, and genetics), treatments, and procedures. Organize items in the folder by date.
- ✓ Use online patient portals to view your test results and other records. Download or print the records to add to your binder.
- ✓ Add a section for questions and to take notes.

Bring your medical binder to appointments. You never know when you might need it!

# 5

## Questions to ask

30 Questions to ask

36 Resources



**In shared decision-making, you and your health care provider (HCP) discuss your risk for developing lung cancer and agree to a screening schedule. This chapter offers possible questions to ask your HCP.**

Family health information can change. Share with your health care provider any changes to your health or family history.

## Questions to ask

It is important to learn all you can about screening so you can be informed and engage in shared decision-making with your health care provider (HCP). Write down questions before each visit to ask your HCP, take notes, and repeat back what answers you hear. If possible, bring someone with you to appointments who can take notes and ask questions.

The following questions are suggestions to learn more about lung cancer screening risks and benefits. Feel free to use these questions or come up with your own questions for your HCP.



**share with us.**

**Take our survey,  
and help make the  
NCCN Guidelines for Patients  
better for everyone!**

**[NCCN.org/patients/comments](https://www.nccn.org/patients/comments)**



## Questions about risk

1. What is my risk for developing lung cancer?
2. Based on my risk factors, when should I start lung cancer screening and how long should it be continued?
3. Does risk increase with age?
4. If I currently smoke, how do you suggest I quit and what resources are available for counseling?
5. How can I reduce my risk of developing lung cancer?

## Questions about insurance

1. Will my insurance pay for each lung cancer screening test you recommend?
2. Is there a copay for screening tests? How much?
3. Do I have the insurance requirements to have lung cancer screening tests?
4. Do I need an order before each screening test?
5. Do I need to see a specialist to prescribe the screening test?
6. Is this doctor or testing center in my network?

## Questions about screening

1. Should I be screened for lung cancer?
2. What screening plan do you recommend for me? Why?
3. What are the benefits and risks of this screening plan?
4. Do you use LDCT for screening?
5. Where can I find a testing site?
6. Do you have a team of experts who are dedicated to lung cancer screening?
7. Does the team of experts include a pulmonologist, thoracic surgeon, and thoracic radiologist?
8. What do I have to do to prepare for this screening test?
9. How long will this screening test take?
10. How often will I have screening tests?

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## Questions about test results

1. When will I know the test results and who will explain them to me?
2. How can I get a copy of the pathology report and other test results?
3. What type of nodule(s) do I have? What does this mean?
4. Do I need more tests?
5. How long until my next test?

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

## Questions about biopsies

1. Do I need a biopsy? What type of biopsy will I have?
2. What are the risks with this type of biopsy?
3. Who will perform the biopsy?
4. What will you do to make me comfortable during the biopsy?
5. When and where will the biopsy be done?
6. How many of these types of biopsies are done at this hospital every year?
7. How will my biopsy be performed?
8. What else might be done during the biopsy?
9. How will I feel after the biopsy?
10. How do I find out the biopsy results and who will discuss them with me?

## Resources

### American Lung Association

[lung.org/lung-health-diseases/lung-disease-lookup/lung-cancer](https://lung.org/lung-health-diseases/lung-disease-lookup/lung-cancer)

### Cancer Hope Network

[cancerhopenetwork.org](https://cancerhopenetwork.org)

### Caring Ambassadors Program, Inc.

[LungCancerCAP.org](https://LungCancerCAP.org)

### Free Me from Lung Cancer

[freemefromlungcancer.org](https://freemefromlungcancer.org)

### Go2 Foundation for Lung Cancer

[go2foundation.org](https://go2foundation.org)

### LiveLung (Dusty Joy Foundation)

[dustyjoy.org](https://dustyjoy.org)

### Lung Cancer Action Network (LungCAN)

[lungcan.org](https://lungcan.org)

### Lung Cancer Research Foundation

[lcrf.org](https://lcrf.org)

### MedlinePlus

[medlineplus.gov/breastcancer.html](https://medlineplus.gov/breastcancer.html)

### National Cancer Institute (NCI)

[cancer.gov/types/lung](https://cancer.gov/types/lung)

### Triage Cancer

[triagecancer.org](https://triagecancer.org)



### Let us know what you think!

Please take a moment to complete an online survey about the NCCN Guidelines for Patients.

[NCCN.org/patients/response](https://NCCN.org/patients/response)



## Words to know

**adenocarcinoma**

A cancer that starts in the mucus-making cells of the body.

**alkylating agent**

A type of cancer-killing drug.

**arsenic**

A very toxic metallic chemical.

**asbestos**

A mineral fiber used in housing and commercial materials.

**baseline test**

A starting point to which future tests are compared.

**benign**

Tissue without cancer cells.

**beryllium**

A hard, gray metallic chemical.

**biopsy**

A procedure that removes fluid or tissue samples to be tested for a disease.

**board certified**

A status to identify doctors who finished training in a specialized field of medicine.

**bronchoscopy**

Use of a long, thin camera guided down the mouth into the lungs.

**cadmium**

A heavy metallic chemical.

**calcium**

A mineral found in body tissues.

**cancer screening**

The use of tests to find cancer before signs of cancer appear.

**carcinoma**

A cancer of cells that line the inner or outer surfaces of the body.

**chromium**

A hard, semi-gray metallic chemical.

**chronic obstructive pulmonary disease (COPD)**

Trouble with breathing due to lung damage or too much mucus.

**computed tomography (CT)**

A test that combines many x-rays to make pictures of the inside of the body.

**contrast**

A substance put into your body to make clearer pictures during imaging tests.

**diesel fumes**

Gases from fuel that is thick, heavy, and made from crude oil.

**early stage**

Cancer that has had little or no growth into nearby tissues.

**follow-up test**

A close watch by doctors of possible cancer using tests.

**gene**

Coded instructions in cells for making new cells and controlling how cells behave.

**genetic counseling**

Expert guidance on the chance for a disease that is passed down in families.



**ground-glass nodule (GGN)**

A small mass of non-solid lung cells with low density.

**ground-glass opacity (GGO)**

A small mass of non-solid lung cells with low density.

**histology**

The structure of cells, tissue, and organs as viewed under a microscope.

**imaging test**

A test that makes pictures (images) of the insides of the body.

**infection**

An illness caused by germs.

**inflammation**

Redness, heat, pain, and swelling from injury or infection.

**lobe**

A clearly seen division in the lungs.

**low-dose computed tomography (LDCT)**

A test that uses small amounts of radiation to make pictures of the inside of the body.

**lung**

An organ in the body made of airways and air sacs.

**lymph node**

A small group of disease-fighting cells.

**magnetic resonance imaging (MRI)**

A test that uses radio waves and powerful magnets to make pictures of the insides of the body.

**medical history**

A report of all your health events and medicines.

**millimeters (mm)**

A unit of length measuring one thousandth of a meter.

**mucus**

A sticky, thick liquid that moisturizes or lubricates.

**mutation**

An abnormal change.

**nickel**

A silvery-white metal.

**nodule**

A small mass of tissue.

**non-solid nodule**

A small mass of tissue of low density.

**non-small cell lung cancer (NSCLC)**

A cancer of lung cells that are not small.

**pack-years**

The number of cigarette packs smoked every day multiplied by the number of years of smoking.

**part-solid nodule**

A small mass of tissue with areas of low and high density.

**pathologist**

A doctor who's an expert in testing cells and tissue to find disease.

**positron emission tomography (PET)**

A test that uses radioactive material to see the shape and function of body parts.

**primary tumor**

The first mass of cancer cells.

**prognosis**

The likely course and outcome of a disease based on tests.

**pulmonary fibrosis**

Major scarring of lung tissue.

**pulmonologist**

A doctor who's an expert in lung diseases.

**radiologist**

A doctor who's an expert interpreting imaging tests.

**radon**

A gas without odor, taste, or color that is made from uranium as it decays.

**risk factor**

Something that increases the chance of getting a disease.

**scar tissue**

Supportive fibers formed to heal a wound.

**second-hand smoke**

Inhaled smoke from a lit smoking product or that was exhaled by a person who smokes.

**silica**

A natural mineral mostly found in sand.

**small cell lung cancer (SCLC)**

A cancer of small, round lung cells.

**solid nodule**

A small mass of tissue of high density.

**surgical excision**

An entire nodule is removed during surgery.

**thoracic surgeon**

A doctor who's an expert in surgery within the chest.

**tumor**

An abnormal mass of cells.

**ultrasound**

A test that uses sound waves to take pictures of the inside of the body.

**wheezing**

A coarse, whistling sound while breathing.

# NCCN Contributors

This patient guide is based on the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Lung Cancer Screening Version 2.2023. It was adapted, reviewed, and published with help from the following people:

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# NCCN Cancer Centers

**Abramson Cancer Center**  
at the University of Pennsylvania  
Philadelphia, Pennsylvania  
800.789.7366 • [pennmedicine.org/cancer](http://pennmedicine.org/cancer)

**Case Comprehensive Cancer Center/**  
**University Hospitals Seidman Cancer Center and**  
**Cleveland Clinic Taussig Cancer Institute**  
Cleveland, Ohio  
UH Seidman Cancer Center  
800.641.2422 • [uhhospitals.org/services/cancer-services](http://uhhospitals.org/services/cancer-services)  
CC Taussig Cancer Institute  
866.223.8100 • [my.clevelandclinic.org/departments/cancer](http://my.clevelandclinic.org/departments/cancer)  
Case CCC  
216.844.8797 • [case.edu/cancer](http://case.edu/cancer)

**City of Hope National Medical Center**  
Duarte, California  
800.826.4673 • [cityofhope.org](http://cityofhope.org)

**Dana-Farber/Brigham and Women's Cancer Center |**  
**Massachusetts General Hospital Cancer Center**  
Boston, Massachusetts  
617.732.5500 • [youhaveus.org](http://youhaveus.org)  
617.726.5130 • [massgeneral.org/cancer-center](http://massgeneral.org/cancer-center)

**Duke Cancer Institute**  
Durham, North Carolina  
888.275.3853 • [dukecancerinstitute.org](http://dukecancerinstitute.org)

**Fox Chase Cancer Center**  
Philadelphia, Pennsylvania  
888.369.2427 • [foxchase.org](http://foxchase.org)

**Fred & Pamela Buffett Cancer Center**  
Omaha, Nebraska  
402.559.5600 • [unmc.edu/cancercenter](http://unmc.edu/cancercenter)

**Fred Hutchinson Cancer Center**  
Seattle, Washington  
206.667.5000 • [fredhutch.org](http://fredhutch.org)

**Huntsman Cancer Institute**  
at the University of Utah  
Salt Lake City, Utah  
800.824.2073 • [huntsmancancer.org](http://huntsmancancer.org)

**Indiana University Melvin and Bren Simon**  
**Comprehensive Cancer Center**  
Indianapolis, Indiana  
888.600.4822 • [www.cancer.iu.edu](http://www.cancer.iu.edu)

**Mayo Clinic Comprehensive Cancer Center**  
Phoenix/Scottsdale, Arizona  
Jacksonville, Florida  
Rochester, Minnesota  
480.301.8000 • Arizona  
904.953.0853 • Florida  
507.538.3270 • Minnesota  
[mayoclinic.org/cancercenter](http://mayoclinic.org/cancercenter)

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**Memorial Sloan Kettering Cancer Center**  
New York, New York  
800.525.2225 • [mskcc.org](http://mskcc.org)

**Moffitt Cancer Center**  
Tampa, Florida  
888.663.3488 • [moffitt.org](http://moffitt.org)

**O'Neal Comprehensive Cancer Center at UAB**  
Birmingham, Alabama  
800.822.0933 • [uab.edu/onealcancercenter](http://uab.edu/onealcancercenter)

**Robert H. Lurie Comprehensive Cancer Center**  
of Northwestern University  
Chicago, Illinois  
866.587.4322 • [cancer.northwestern.edu](http://cancer.northwestern.edu)

**Roswell Park Comprehensive Cancer Center**  
Buffalo, New York  
877.275.7724 • [roswellpark.org](http://roswellpark.org)

**Siteman Cancer Center at Barnes-Jewish Hospital**  
and Washington University School of Medicine  
St. Louis, Missouri  
800.600.3606 • [siteman.wustl.edu](http://siteman.wustl.edu)

**St. Jude Children's Research Hospital/**  
**The University of Tennessee Health Science Center**  
Memphis, Tennessee  
866.278.5833 • [stjude.org](http://stjude.org)  
901.448.5500 • [uthsc.edu](http://uthsc.edu)

**Stanford Cancer Institute**  
Stanford, California  
877.668.7535 • [cancer.stanford.edu](http://cancer.stanford.edu)

**The Ohio State University Comprehensive Cancer Center -**  
**James Cancer Hospital and Solove Research Institute**  
Columbus, Ohio  
800.293.5066 • [cancer.osu.edu](http://cancer.osu.edu)

**The Sidney Kimmel Comprehensive**  
**Cancer Center at Johns Hopkins**  
Baltimore, Maryland  
410.955.8964  
[www.hopkinskimmelfcancercenter.org](http://www.hopkinskimmelfcancercenter.org)

**The UChicago Medicine Comprehensive Cancer Center**  
Chicago, Illinois  
773.702.1000 • [uchicagomedicine.org/cancer](http://uchicagomedicine.org/cancer)

**The University of Texas MD Anderson Cancer Center**  
Houston, Texas  
844.269.5922 • [mdanderson.org](http://mdanderson.org)

**UC Davis Comprehensive Cancer Center**  
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[health.ucdavis.edu/cancer](http://health.ucdavis.edu/cancer)

### UC San Diego Moores Cancer Center

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858.822.6100 • [cancer.ucsd.edu](http://cancer.ucsd.edu)

### UCLA Jonsson Comprehensive Cancer Center

*Los Angeles, California*

310.825.5268 • [cancer.ucla.edu](http://cancer.ucla.edu)

### UCSF Helen Diller Family Comprehensive Cancer Center

*San Francisco, California*

800.689.8273 • [cancer.ucsf.edu](http://cancer.ucsf.edu)

### University of Colorado Cancer Center

*Aurora, Colorado*

720.848.0300 • [coloradocancercenter.org](http://coloradocancercenter.org)

### University of Michigan Rogel Cancer Center

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800.865.1125 • [rogelcancercenter.org](http://rogelcancercenter.org)

### University of Wisconsin Carbone Cancer Center

*Madison, Wisconsin*

608.265.1700 • [uwhealth.org/cancer](http://uwhealth.org/cancer)

### UT Southwestern Simmons Comprehensive Cancer Center

*Dallas, Texas*

214.648.3111 • [utsouthwestern.edu/simmons](http://utsouthwestern.edu/simmons)

### Vanderbilt-Ingram Cancer Center

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877.936.8422 • [vicc.org](http://vicc.org)

### Yale Cancer Center/Smilow Cancer Hospital

*New Haven, Connecticut*

855.4.SMILOW • [yalecancercenter.org](http://yalecancercenter.org)

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