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GUIDELINES  
FOR PATIENTS®

2024

# Metastatic Non-Small Cell Lung Cancer



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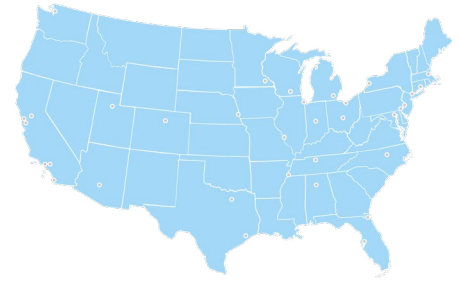
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Did you know that top cancer centers across the United States work together to improve cancer care? This alliance of leading cancer centers is called the National Comprehensive Cancer Network® (NCCN®).



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 Non-Small Cell Lung Cancer, Version 7.2024 — June 26, 2024.**

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# 1

## Lung cancer basics

- 5 What is NSCLC?
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**If you're reading this, you or someone you care about might have non-small cell lung cancer (NSCLC). It's the most common type of lung cancer. In this chapter, you'll learn what this type of cancer is and what it means if it's metastatic.**

Lung cancer cells grow out of control. They don't die when they should and make many new cancer cells, which become tumors.

Lung cancer cells also don't stay in place. They can break away from a tumor, spread outside the lung, and form more tumors.

### **NSCLC is a type of lung carcinoma**

Almost all lung cancers are carcinomas (kar-sin-OH-mas). Lung carcinomas form from cells that line the airways of the lungs. The airways of the lungs are the bronchi, bronchioli, and alveoli.

NSCLC is the most common lung carcinoma. Other lung carcinomas are neuroendocrine tumors. Information on lung neuroendocrine tumors can be found at

## What is NSCLC?

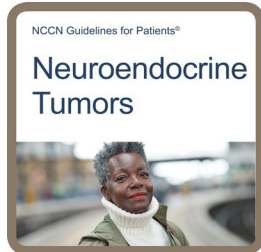
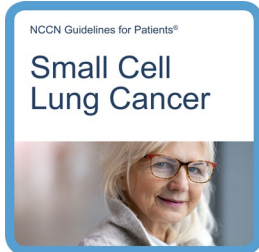
Non-small cell lung cancer (NSCLC) is a type of lung cancer. Another type of lung cancer is small cell lung cancer, but it is a different cancer covered in another book.

### **Airways of the lungs**

**The air you breathe moves through a series of airways. It travels down your throat and through your windpipe (trachea). The windpipe splits into two airways called bronchi. Inside the lung, each bronchus divides into smaller airways called the bronchioli. At the end of the bronchioli are sacs called alveoli. Oxygen is transferred from air into the blood in the alveoli.**



[NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.



**Cancers that have spread to the lungs are not lung cancers. For example, stomach cancer that has spread to the lungs is still stomach cancer.**

## There are several types of NSCLC

Each type of NSCLC forms from a particular kind of cell. Below are common types of NSCLC:

- **Adenocarcinoma** (A-deh-noh-KAR-sih-NOH-muh) often forms from cells that line the alveoli and make mucus. This is the most common type of NSCLC.
- **Large cell carcinoma** forms from any of the large cells that are found throughout the airways.
- **Squamous cell carcinoma** (squay-mous) forms from cells that line the bronchi.

## What's metastatic NSCLC?

Metastatic NSCLC is lung cancer that has spread to other organs. NSCLC can spread the brain, liver, bone, and adrenal glands and from one lung to the other lung. Metastatic NSCLC also includes lung cancer that has spread to the lining of the lungs.

## Cancer stages and metastasis

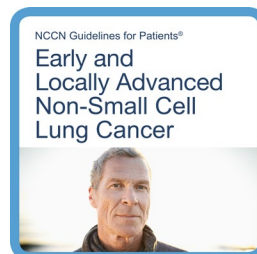
A cancer stage describes the extent of lung cancer in the body. The main stages of

lung cancer are often written with Roman numerals—stages I (1), II (2), III (3), and IV (4). We will be listing stages as 1, 2, 3, and 4 to make the stages easier to read.

Stage 4 lung cancer is metastatic cancer at diagnosis, but some earlier stages can become metastatic cancer as well.

Cancer in stages 1, 2, and 3 has grown from the airway into lung tissue. Some of these early and locally advanced cancers spread far after diagnosis. If this happens, the cancer's stage doesn't change. Instead, these cancers are referred to as metastatic lung cancer.

This book focuses on metastatic NSCLC. Information on early and locally advanced NSCLC can be found at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.





## What's the best treatment?

There's no single treatment for NSCLC that's best for everyone. The best treatment is the treatment that's right for you. The following chapters explain expert recommendations that are based on the latest research and current practices at leading cancer centers.

### **Systemic therapy is the most common treatment**

Systemic therapy is drug treatment for lung cancer anywhere in the body. Medical oncologists prescribe systemic therapy.

Most people with metastatic lung cancer will be on systemic therapy for the rest of their lives. The type of systemic therapy you will receive is partly based on features of the cancer. More information is in Chapters 3, 4, and 5.

### **Local treatment is helpful at times**

Local treatment may be used for a specific area of metastatic cancer. It includes surgery, radiation therapy, and chemoradiation.

Local treatment is commonly used to reduce symptoms caused by metastasis. Less often, it is used to try to cure limited metastases. An example is cancer that has spread to only the brain or an adrenal gland.

### **Supportive care addresses the challenges of cancer**

Supportive care has been shown to extend and enhance life for people with lung cancer. Tell your care team about your symptoms and other needs to get the best supportive care for

you. More information on supportive care is in Chapter 2 and other chapters.

### **Clinical trials offer hope to all people with lung cancer**

Clinical trials are a type of health research that tests new ways of fighting cancer. Ask your care team if there is a clinical trial that is a good fit for you. Learn more about clinical trials in Chapter 5.

### **Advocate for yourself**

You are an important member of your cancer care team. Discuss the recommendations in this book with your team. Together, you can make a care plan that's best for you.

There is a list of suggested questions in Chapter 6 to ask your team. You're more likely to get the care you want by asking questions and making decisions with your team.

## Key points

- Non-small cell lung cancer (NSCLC) is a cancer of lung cells. Cancers that spread to the lungs are not lung cancer.
- Metastatic NSCLC is cancer that has spread far from the lung in which it started.
- Treatment for metastatic lung cancer varies among people based on what is best for them. It often involves a whole-body drug treatment called systemic therapy.

# 2

## Tests for metastatic NSCLC

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**Your care team will make a treatment plan just for you. To make the plan, they'll need to learn about your cancer and your general health. This chapter describes the tests and other care needed to make your treatment plan.**

## Goals of testing

Not all non-small cell lung cancers (NSCLCs) are alike. Before you can be treated, you'll need to undergo several tests to learn about the cancer and you. These tests are needed to:

- Assess your general health and well-being
- Stage the cancer by testing areas where it may have spread, which may be done at the same time as diagnosis
- Profile the cancer by testing for defining features called biomarkers

Tests for metastatic NSCLC are listed in **Guide 1**.

### Guide 1

#### Initial tests and services for metastatic NSCLC

<b>Health history and exam</b>	<ul style="list-style-type: none"> <li>• Medical history including weight loss and smoking history</li> <li>• Physical exam and performance status</li> </ul>
<b>Blood tests</b>	<ul style="list-style-type: none"> <li>• Complete blood count (CBC)</li> <li>• Chemistry profile</li> </ul>
<b>Imaging</b>	<ul style="list-style-type: none"> <li>• Diagnostic CT scan of the chest and upper abdomen with contrast</li> <li>• FDG-PET/CT scan</li> <li>• Brain MRI</li> </ul>
<b>Cancer cell tests</b>	<ul style="list-style-type: none"> <li>• Biopsy of metastasis</li> <li>• Molecular tests for driver mutations</li> <li>• PD-L1 test</li> </ul>
<b>Lung tests</b>	<ul style="list-style-type: none"> <li>• Pulmonary function tests</li> </ul>
<b>Initial services</b>	<ul style="list-style-type: none"> <li>• Supportive care</li> <li>• Treatment to quit smoking</li> </ul>

## Care team

It takes a team to plan treatment of NSCLC. Your team will use your test results to plan treatment. You are an important part of the team. Tell your team about your wishes for treatment and any challenges you are facing. Your input is just as important as tests for treatment planning.

Your team may consist of many members:

- A pulmonologist, thoracic radiologist, interventional radiologist, thoracic surgeon, and pathologist to diagnose and stage the cancer
- A medical oncologist, radiation oncologist, and thoracic surgical oncologist to treat NSCLC
- A palliative care provider, social worker, mental health provider, and registered dietitian to provide supportive services

Many of these experts are supported by nurses, technicians, or assistants who are often on the frontline of cancer care.

**Bring a list of your medications, including herbals and supplements, to appointments.**

## Health history

Expect your care team to review your health in detail. This is known as taking a medical history. Your team will want to know everything possible about your past and current health.

You will likely be asked about:

- Illnesses and injuries
- Symptoms like unexplained weight loss, trouble breathing, chest pain, and cough
- Prescribed and over-the-counter medicines and supplements
- Previous surgeries
- Lifestyle choices, including your diet, how active you are, and whether you smoke or drink alcohol

Some cancers and other diseases run in families. Be prepared to discuss the health problems of your close blood relatives. Such family members include siblings, parents, and grandparents related to you by birth and not by adoption.

## Physical exam

A team member will also perform a thorough physical exam of your body. This exam may include:

- Checking your vital signs—blood pressure, heart rate, breathing rate, and body temperature—and assessing your overall appearance
- Feeling and listening to organs, including your spleen and liver

- Feeling for enlarged lymph nodes, which are small disease-fighting structures throughout your body
- Assessing your level of pain, if any, when you are touched

Based on your health history and exam, your care team will rate your performance status. Performance status is your ability to do day-to-day activities. It is one of the most important factors that your team will use to plan treatment.

## Blood test

Blood tests are commonly used to screen for disease. They are also used to assess if cancer is affecting organs.

Samples of your blood will be removed with a needle inserted into one of your veins. This is called a blood draw.

### Complete blood count

A complete blood count (CBC) measures parts of the blood including counts of white blood cells, red blood cells, and platelets.

### Chemistry profile

A chemistry profile assesses natural salts in your body and how well your liver and kidneys are working.

## Imaging

Imaging takes pictures of the inside of your body. It is used to help stage the cancer by showing cancer in lung tissue and if the cancer has spread from the lung.

A radiologist is a doctor who's an expert in reading images like CT, MRI, or PET scans, or x-rays. This doctor will convey the test results to your care team.

Scans that were done more than 60 days ago should not be used to decide your treatment.

### Diagnostic CT scan

A CT scan is a more detailed kind of x-ray. It takes many pictures from different angles. A computer combines the images to make 3D pictures.

A diagnostic CT shows body tissue more clearly. It is often the first scan done to stage lung cancer. Images of your chest and upper abdomen including the adrenal glands are needed.

A higher dose of radiation is used for diagnostic CT compared to regular CT. You'll receive an injection of contrast if it's safe for you. Contrast is a substance that makes images clearer. Contrast travels through your bloodstream, and you pee it out.

### FDG-PET/CT scan

PET/CT is necessary if you haven't had this scan already. It may detect cancer that was not found by CT alone.

Your whole body will be scanned, or the scan will extend from your neck to the middle of your thighs.

The PET scan highlights tissue in your body that may be cancerous. Before the scan, you will be injected with a sugar radiotracer called fluorodeoxyglucose (FDG). The tracer will pass out of your body in pee in about 2 days.

Cancer cells take in more of the tracer than normal cells and show up as bright (or hot) spots on the scan.

Multiple health problems can cause hot spots, so the cause of hot spots often needs to be confirmed by other testing.

### Brain MRI

Lung cancer tends to spread to the brain. MRI may show small brain tumors that aren't causing symptoms. If you have or may have metastatic lung cancer, a brain MRI is very important.

MRI uses a safe magnetic field and radio waves to make pictures, so you don't need to worry about radiation. Contrast will also be used unless it would not be safe for you. If you can't have an MRI, you may get a CT scan of your head with contrast.

## Biopsy of metastasis

A biopsy is a procedure that removes body tissue or fluid for cancer testing. Often, tissue from the organ with the metastasis is taken rather than from the lungs. Your care team will use imaging to select the biopsy site, which is often the adrenal gland, liver, or bone.

The type of biopsy that will be done depends on the body part and the experience of your care team. Common types of biopsies for metastatic lung cancer are:

- An external **needle biopsy** involves guiding a thin needle through your skin and into a tumor. These biopsies include transthoracic needle aspiration (TTNA), core needle biopsies, pericardiocentesis, and thoracentesis.
- **Down-the-throat biopsies** involve guiding a thin tube down your throat into your airways (bronchus) or food pipe (esophagus). These procedures include many types of bronchoscopy.
- **Keyhole surgeries** involve making small openings in your chest. Small tools are inserted through the holes to remove tissue. Compared to open surgery, this method is minimally invasive. These surgeries include laparoscopy and thoracoscopy. Thoracoscopy is also called video-assisted thoracoscopic surgery (VATS).

### The removed tissue must be large enough for testing

A doctor called a pathologist will assess the tissue. Pathologists are experts in tissue and cells and diagnosing cancer.

The tissue must be large enough to run several special lab tests. At some cancer centers, the pathologist checks the tissue size right after removal. This method is called rapid on-site evaluation (ROSE). It helps to prevent having the same procedure a second time.

### A pathologist assesses for cancer

The pathologist will prepare the biopsy tissue. This may take a couple of days. Then, the pathologist will look at the tissue with a microscope and classify the disease. This is called histologic typing. If NSCLC is found, the pathologist will identify the type, which is

very important for the treatment of metastatic cancer:

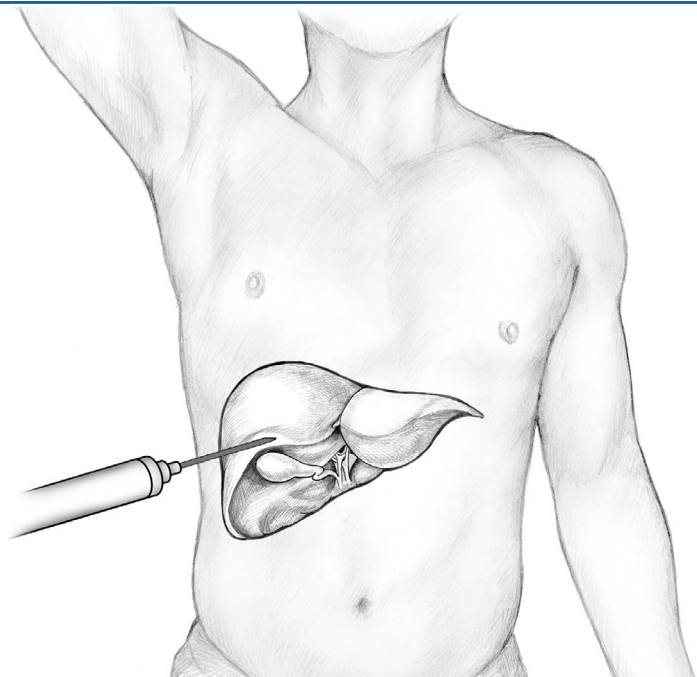
- Adenocarcinoma
- Large cell lung carcinoma
- Squamous cell carcinoma
- Mixed and rare types

The results of lab tests used for diagnosis are recorded in a pathology report. Ask your care team for a copy of the pathology report and to review the results with you. Always try to take notes and ask questions.

### Biopsy of metastasis

If your care team suspects metastatic lung cancer, you may have a biopsy of the metastasis instead of the lung tumor. A biopsy of the metastasis can diagnose and stage the cancer at the same time. A needle biopsy through the skin may reach some metastases, such as in the liver (shown). Imaging is often used to help guide the needle to the correct spot.

Credit: [https://commons.wikimedia.org/wiki/File:Human\\_liver\\_biopsy.jpg](https://commons.wikimedia.org/wiki/File:Human_liver_biopsy.jpg)





### Biomarker tests

Biomarker tests look for biological clues, or markers, of cancer that differ between people. Because of biomarkers, a treatment that helps one person might not help you.

Biomarker tests are performed on tumor tissue removed with biopsy or during surgery, but a blood sample may be tested as well. See **Guide 2** for a list of biomarkers and which cancers should be tested for them.

**Driver mutations** cause normal cells to become cancer cells and support cancer growth. A driver mutation is found in at least 1 in 3 people with metastatic adenocarcinoma but is much less common in squamous cell lung cancer. It is very rare for cancers to have more than one driver mutation.

Molecular tests assess for mutations. Since very few squamous cell carcinomas have a driver mutation, molecular testing is decided on a person-by-person basis.

NCCN experts strongly advise broad molecular profiling of all mutations listed in Guide 2. There are other known mutations linked with lung cancer that may be tested, too. This testing will help many people get the best treatment for their cancer. Since many genes are tested, it can take up to 3 weeks to get the results.

**PD-L1** is a protein on the surface of cells. PD-L1 on cancer cells stops white blood cells called T cells from killing them. The cancer cells then survive and make more cancer cells.

All lung cancers should be tested for PD-L1. A lab method called immunohistochemistry (IHC) detects PD-L1.

#### What if there's not enough tissue for biomarker testing?

If there's not enough tissue, a second biopsy may need to be scheduled. Sometimes a blood sample can be drawn and the plasma in the blood sample is tested for biomarkers.

#### What if the cancer has no biomarkers?

Some lung cancers do not have a known biomarker for which there is treatment. Treatment options for these cancers are based on the lung cell type, as discussed in Chapter 5.



**DO NOT be afraid to ask your medical team ANY questions at any time!!! Your questions will help you and them. No question is stupid.”**



## Guide 2

## Biomarker tests for metastatic NSCLC

	Adenocarcinoma, large cell carcinoma, and rare cell types	Squamous cell lung cancer
<b>Driver mutation</b>		
<i>EGFR</i> exon 19 deletion or L858R mutation	●	●
<i>EGFR</i> S768I, L861Q, or G719X mutation	●	●
<i>EGFR</i> exon 20 insertion	●	●
<i>ALK</i> rearrangement	●	●
<i>ROS1</i> rearrangement	●	●
<i>BRAF</i> V600E mutation	●	●
<i>NTRK</i> gene fusion	●	●
<i>MET</i> exon 14 skipping	●	●
<i>RET</i> rearrangement	●	●
<i>KRAS</i> G12C mutation	●	●
<i>ERBB2</i> ( <i>HER2</i> ) mutation	●	●
<b>Cell protein</b>		
PD-L1	●	●

● Testing is recommended for everyone

● Testing is a person-by-person decision

## Pulmonary function tests

For some people, treatment of metastatic NSCLC includes radiation therapy or surgery. Treatment is based on how well the lungs work.

Pulmonary function tests assess how well you breathe:

- Spirometry involves blowing into a tube to measure how much air and how fast you breathe.
- A gas diffusion test involves breathing in a special, harmless gas and measuring how much you breathe out. It tells how much oxygen travels from your lungs into your blood.
- Body plethysmography involves sitting in a small room and breathing into a tube. This test measures how much air your lungs can hold and how much air is left in your lungs after you breathe out.

## Supportive care

Supportive care is cancer care that improves your quality of life. It is not just for people at the end of life who need hospice. It has been shown to extend and enhance life for people with lung cancer.

### Start supportive care early

Supportive care is sometimes called palliative care since symptom relief is a main goal. You may undergo procedures that help you breathe and eat better and reduce coughing up blood.

Supportive care addresses many needs other than symptom relief. You can get help with making treatment decisions and coordination of care between health providers. You can get emotional or spiritual support, financial aid, or family counseling.

A palliative care specialist may be a member of your cancer care team. This specialist has received specific training to provide additional support to you. Some cancer centers have palliative care programs.

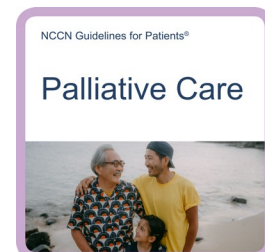
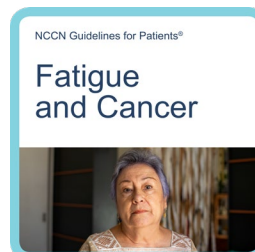
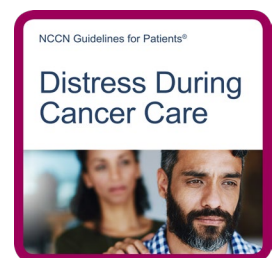
Other specialists who may be involved in your care include:

- Respiratory therapists
- Rehabilitation specialists
- Registered dietitians
- Social workers

The library of NCCN Guidelines for Patients has books on supportive care. These books focus on common physical and emotional effects of many cancers and their treatment.

One of the NCCN books is about distress.

Everyone with cancer feels distressed at some point. It is normal to feel worried, sad, helpless, or angry. Distress can become severe and affect the way you live.



The library of NCCN Guidelines for Patients is available at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.

### **It's never too late to quit smoking**

If you smoke, it is important to quit. Smoking can limit how well cancer treatment works.

Nicotine addiction is one of the hardest addictions to stop. The stress of having cancer may make it harder to quit.

There is help. Ask your care team about counseling and drugs to help you quit.

If you tried to quit before, try again. Most people slip or relapse before quitting for good.



**A common myth is that palliative care is only for terminally ill patients. It is so much more! It is worth reaching out to palliative care in your hospital or clinic. They treat the whole patient, not just cancer.”**

## Key points

- Your care team will make a treatment plan based on test results and your wishes.
- A member of your team will ask about your health, examine your body, and test blood samples.
- A diagnostic CT scan can help show where the cancer has spread. PET/CT may detect cancer that CT did not. You may get a brain MRI.
- To help stage the cancer, a body part that appears to have cancer and is far from the lung tumor will likely be tested.
- Biomarker tests look for small yet important features of cancer that differ between people. There are treatments for some markers.
- Supportive care aims to improve your quality of life. It is important for everyone, not just people at the end of life.
- Ask your care team for help to quit smoking. Quitting may improve treatment results.

# 3

## Treatment of driver mutations

- 19 What are driver mutations?
- 20 Targeted therapy
- 21 *EGFR* mutations
- 24 *KRAS* G12C mutation
- 24 *ALK* rearrangement
- 26 *ROS1* rearrangement
- 26 *BRAF* V600E mutation
- 27 *NTRK* gene fusion
- 27 *MET* exon 14 skipping
- 28 *RET* rearrangement
- 28 *ERBB2* (*HER2*) mutation
- 28 Key points

**For some, driver mutations promote the growth of cancer. Medicine that is targeted to those mutations can help slow the growth of cancer. Read this chapter to learn more.**

### **Treating mutations is more precise**

Mutations aren't just science fiction. All cancer cells have mutations, but not all mutations promote cancer. Mutations that support cancer growth are called driver mutations.

At this time, we know of several driver mutations in lung cancer. They can be detected with molecular testing. Researchers are looking for more driver mutations.

Chemotherapy destroys fast-growing cells even if they're not cancer cells. It was once the only treatment for metastatic lung cancer.

Today, newer treatments target the effects of driver mutations and harm fewer normal cells.

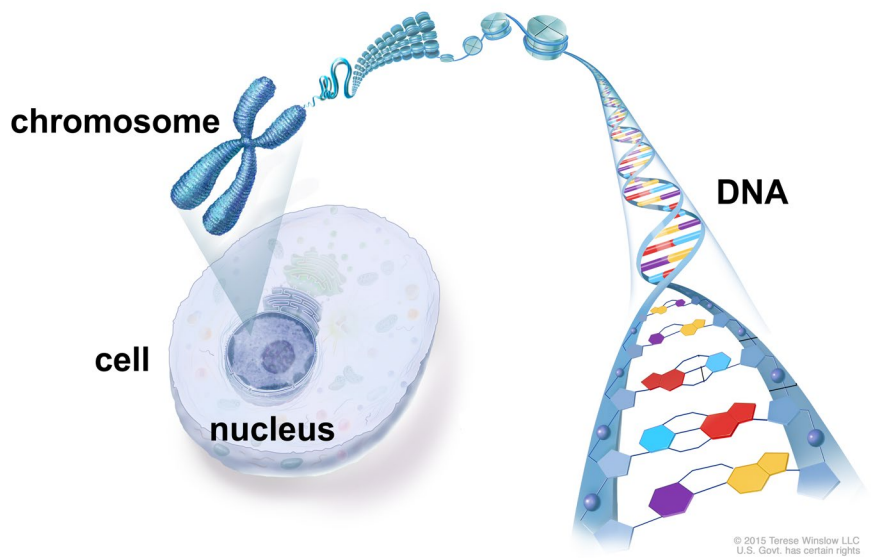
## What are driver mutations?

A driver mutation is an abnormal gene that supports the growth of cancer cells. It enables cancer cells to quickly duplicate, survive, and spread in the body.

### **Driver mutation**

**The nucleus is the control center or “brain” of cells. Within the nucleus is genetic information that tells the cells what to do. The information is stored in DNA, which looks like a twisted ladder.**

**Genes are parts of DNA that contain instructions for the cell. Cancer cells often have abnormal genes. A driver mutation is an abnormal gene that supports the growth of cancer cells.**



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## Targeted therapy

Driver mutations create cell proteins that help cancer cells grow. Targeted therapy works by stopping these proteins.

### Kinase inhibitors

Kinases are a type of cell protein. They are part of many chemical pathways, and some of them start cell growth. Kinase inhibitors stop the activity of kinases and, in turn, lower the number of new cancer cells being made. They are pills that can be taken at home.

### Antibody therapy

Cells have receptors on their surface. Cell receptors receive and send signals like antennas. Antibodies can attach to receptors.

Some types of antibody therapy target receptors on cancer cells, such as EGFR and MET. The antibodies stop signals that tell the cancer cells to grow.

VEGF antibodies stop the growth of blood vessels on tumors. Without blood, cancer cells die.

You will need to go to a health care center to receive antibody therapy through a slow drip (infusion) from a needle into a vein.

### Antibody-drug conjugate

An antibody-drug conjugate combines two drugs in one medicine. One drug finds and binds to certain cancer cells, and then the other drug attacks the cancer. Antibody-drug conjugates are given by infusion.

## What if I already started a treatment other than targeted therapy?

Some cancers with known driver mutations should first be treated with other medicines that are described in Chapter 5.

When targeted therapy is recommended as the first treatment, your options are:

- You may stop your current treatment early and start targeted therapy.
- You may finish your current treatment (including the last phase called maintenance therapy) and then start targeted therapy.

## New targeted therapy for lung cancer

Other types of targeted therapy are being studied in clinical trials. Clinical trials are a type of medical research. Ask your treatment team if there is an open clinical trial that's a good fit for you. More information on clinical trials is in *Chapter 5: Treatment by cell type*.

## Side effects

Side effects are unwanted health problems caused by treatment. All cancer treatments cause side effects. Side effects vary between

people based on the type and length of treatment as well as differences among people.

Ask your treatment team for a complete list of side effects of your treatments. Also, tell your treatment team about any new or worse symptoms you get. There may be ways to help you feel better. There are also ways to prevent some side effects.

## *EGFR* mutations

Some lung cancers have certain mutations in the gene that makes *EGFR*. These mutations cause the receptor to be overactive. *EGFR* overactivity makes the cancer cells grow quickly.

### Starting *EGFR*-targeted therapy

Targeted therapy of *EGFR*-mutated NSCLC is based on the type of mutation. **See Guide 3** for treatment options.

Some regimens in Guide 3 are marked as preferred. Preferred regimens work better, are

### Guide 3

#### Options when starting *EGFR*-targeted therapy for metastatic NSCLC

<p><b><i>EGFR</i> exon 19 deletion or <i>EGFR</i> exon 21 L858R mutation</b></p>	<ul style="list-style-type: none"> <li>• Osimertinib (preferred)</li> <li>• Osimertinib and pemetrexed (with cisplatin or carboplatin) for lung adenocarcinoma, large cell carcinoma, and rare cell types</li> <li>• Erlotinib</li> <li>• Afatinib</li> <li>• Gefitinib</li> <li>• Dacomitinib</li> <li>• Erlotinib and ramucirumab</li> <li>• Erlotinib and bevacizumab</li> </ul>
<p><b><i>EGFR</i> S768I, L861Q, or G719X mutation</b></p>	<ul style="list-style-type: none"> <li>• Afatinib (preferred)</li> <li>• Osimertinib (preferred)</li> <li>• Erlotinib</li> <li>• Gefitinib</li> <li>• Dacomitinib</li> </ul>
<p><b><i>EGFR</i> exon 20 insertion</b></p>	<ul style="list-style-type: none"> <li>• Amivantamab-vmjw, carboplatin, and pemetrexed for lung adenocarcinoma, large cell carcinoma, and rare cell types (preferred)</li> <li>• Amivantamab-vmjw is an option for all cell types that grow after treatment described in Chapter 5</li> </ul>



safer, or cost less than other options or there are better data supporting their use.

Targeted therapy is recommended as the first treatment of NSCLC with **EGFR deletions and mutations**. EGFR kinase inhibitors are:

- Osimertinib (Tagrisso)
- Erlotinib (Tarceva)
- Gefitinib (Iressa)
- Afatinib (Gilotrif)
- Dacomitinib (Vizimpro)

If your first treatment was immunotherapy, a short delay in starting osimertinib may be needed to prevent health problems.

Some regimens for *EGFR* exon 19 deletion and exon 21 L858R mutation combine kinase inhibitors and other medicines. Osimertinib with chemotherapy is an option for lung adenocarcinoma, large cell carcinoma, and rare cell types. Erlotinib and a VEGF antibody (bevacizumab [Avastin] or ramucirumab [Cyramza]) are options. It is not safe to receive bevacizumab if you are coughing up blood (hemoptysis).

Treatment of lung cancers with **EGFR exon 20 insertion** is based on the cell type. The preferred regimen for lung adenocarcinoma, large cell carcinoma, and rare cell types is chemotherapy with an EGFR-MET antibody called amivantamab-vmjw (Rybrevant). Otherwise, lung cancers with EGFR exon 20 insertion are first treated as explained in Chapter 5, and if the cancer grows, targeted therapy with amivantamab-vmjw is started.

#### Options when cancer grows again

Within a few years of starting targeted therapy, lung cancer starts to grow again in most people. The next treatment options are listed in **Guide 4** based on the type of EGFR mutation.

For lung cancer with **EGFR exon 19 deletion or 21 L858R, S768I, L861Q, or G719X mutations**, you first may need to get a biopsy to check for:

- Mutations that stop targeted therapy from working—a *T790M* mutation is common after taking erlotinib with or without ramucirumab or bevacizumab, afatinib, gefitinib, or dacomitinib
- A change in the type of cancer from adenocarcinoma to small cell lung cancer

If the cancer did not spread to many more places, your oncologist may recommend local treatment and keeping you on targeted therapy. Local treatment is used to treat cancer in a specific area or organ:

- Radiation therapy uses very precise, high-dose x-ray beams to treat limited areas of metastatic lung cancer, such as stereotactic ablative radiotherapy (SABR).
- Surgery removes tumors or organs with cancer.
- Image-guided thermal ablation therapy uses extreme heat or cold to destroy cancer.

The cancer may be growing again, but targeted therapy could be slowing its growth. You'll likely stay on your current treatment if the cancer is growing again. Otherwise, the



cancer may grow faster if targeted therapy is stopped.

Switching to a different targeted therapy may help, especially if there are new mutations. Osimertinib after erlotinib, afatinib, gefitinib, or dacomitinib may be an option if there is a *T790M* mutation. Afatinib with an EGFR antibody called cetuximab (Erbix) may be another option. For widespread cancer after osimertinib, treatment may be switched to amivantamab-vmjw with chemotherapy.

If targeted therapy is not likely to help, your oncologist may recommend other treatment. See Chapter 5 for options.

For lung cancer with ***EGFR* exon 20 insertion**, switching from regimens containing amivantamab-vmjw to treatment for cell type is recommended. More information is in Chapter 5.

#### Guide 4

#### Options after metastatic NSCLC grows during EGFR-targeted therapy

**Lung cancer with *EGFR* exon 19 deletion or *L858R*, *S768I*, *L861Q*, or *G719X* mutations**

- Local treatment of limited tumors and targeted therapy
- Stay on the first targeted therapy if it has some benefit
  - Stay on osimertinib if the cancer didn't spread to many more places
  - Stay on erlotinib, afatinib, gefitinib, or dacomitinib regimens if there is no *T790M* mutation and no widespread cancer
- Switch to a different targeted therapy
  - Switch to osimertinib if there is a *T790M* mutation after taking erlotinib, afatinib, gefitinib, or dacomitinib
  - Switch to afatinib with cetuximab
  - Switch from osimertinib to the amivantamab-vmjw, carboplatin, and pemetrexed regimen for lung adenocarcinoma, large cell carcinoma, and rare cell types
- Start treatment for cell type as listed in Chapter 5

***EGFR* exon 20 insertion**

- Switch from regimens containing amivantamab-vmjw to treatment for cell type that is described in Chapter 5

## *KRAS* G12C mutation

A signaling protein inside of lung cells called *KRAS* can be overactive causing the cells to quickly grow. A mutation in the *KRAS* G12C gene causes this overactivity.

Lung cancers with *KRAS* G12C mutation are first treated based on PD-L1 level. For treatment of lung cancer with PD-L1, see *Chapter 4: Treatment based on low and high PD-L1*. For treatment of PD-L1–negative cancer, see *Chapter 5: Treatment by cell type*.

If the cancer grows, a *KRAS* inhibitor is recommended for the next treatment. Sotorasib (Lumakras) and adagrasib (Krazati) are options. If the cancer grows during targeted therapy, treatment options are based on cancer cell type.

## *ALK* rearrangement

For some lung cancers, the *ALK* surface receptor is overactive, causing tumor cells to grow quickly. The overactivity is caused when parts of two genes switch places, called a gene rearrangement. Targeted therapy is recommended for the first treatment.

### Starting *ALK*-targeted therapy

There are 5 *ALK* inhibitors used to treat lung cancer. Preferred regimens include alectinib (Alecensa), brigatinib (Alunbrig), and lorlatinib (Lorbrena). Preferred regimens work better, are safer, or cost less than other options or there are better data supporting their use. Other options are ceritinib (Zykadia) and crizotinib (Xalkori). All options are listed in **Guide 5**.

### Options when cancer grows again

Within a few years of starting targeted therapy, lung cancer starts to grow again in most people. You may need another biopsy to test for new mutations, which might change your treatment options. **See Guide 6** for the next treatment options.

#### Guide 5

#### Options when starting *ALK*-targeted therapy for metastatic NSCLC

- Alectinib (preferred)
- Brigatinib (preferred)
- Lorlatinib (preferred)
- Ceritinib
- Crizotinib

If the cancer did not spread to many more places, your doctor may recommend starting local treatment and staying on targeted therapy. Local treatment is used to treat cancer in a specific area or organ:

- Radiation therapy, such as SABR, uses very precise, high-dose x-ray beams to treat limited areas of metastatic lung cancer.
- Surgery removes tumors or organs with cancer.
- Image-guided thermal ablation therapy uses extreme heat or cold to destroy cancer.

The cancer may be growing again, but targeted therapy could be slowing down its growth. For this reason, you may stay on your current treatment. Otherwise, the cancer may grow faster if targeted therapy is stopped.

Switching to a different targeted therapy may help, especially if there are new mutations. Lorlatinib after alectinib, brigatinib, or ceritinib may be an option if there is a mutation, such as an *ALK* G1202R or L1196M mutation. After taking crizotinib, you may switch to alectinib, brigatinib, ceritinib, or lorlatinib.

If targeted therapy is not likely to help, your oncologist may recommend other treatments. See Chapter 5 for options.

#### Guide 6

#### Options after metastatic NSCLC grows during *ALK*-targeted therapy

Local treatment of limited tumors may be helpful for some people

Stay on first-line therapy if it has some benefit

- Stay on alectinib, brigatinib, ceritinib, or lorlatinib if the cancer didn't spread to many more places
- Stay on crizotinib if the cancer didn't spread to the brain or many more places

Switch to a newer *ALK* inhibitor

- Switch to lorlatinib if there's a mutation that stops alectinib, brigatinib, or ceritinib from working
- Switch to alectinib, brigatinib, ceritinib, or lorlatinib if on crizotinib

Start treatment for cell type as listed in Chapter 5

## *ROS1* rearrangement

A cell surface receptor called ROS can be overactive, causing lung cells to quickly grow. The overactivity is caused by parts of two genes switching places called a gene rearrangement.

Entrectinib (Rozlytrek), crizotinib (Xalkori), or repotrectinib (Augtyro) are preferred options. Entrectinib or repotrectinib may work better for treating and preventing the spread of lung cancer in the brain. The other option is ceritinib (Zykadia).

In time, the cancer will grow despite ongoing targeted therapy. If the cancer didn't spread to many more places, your oncologist may recommend local treatment, such as surgery or radiation therapy. You may also stay on your current treatment if there is some benefit.

A different targeted therapy may be used. If lung cancer spreads to the brain, you may

be switched from crizotinib to entrectinib, repotrectinib, or lorlatinib, for example. Lorlatinib or repotrectinib may also be used to treat more widespread lung cancer.

If targeted therapy is not likely to help, your oncologist may recommend other treatments. See Chapter 5 for options.

## *BRAF* V600E mutation

*BRAF*, a signaling protein, can be overactive, causing tumor cells to quickly grow. A *BRAF* V600E mutation causes its overactivity.

The preferred treatment is dabrafenib plus trametinib or encorafenib and binimetinib. Dabrafenib (Tafinlar) and encorafenib (Braftovi) stop growth signals from *BRAF*.

MEK is a protein within the same signaling pathway as *BRAF*. Trametinib (Mekinist) and

**"Ask about clinical trials available to you and the services your hospital and other facilities provide to cancer patients, such as counseling, physical therapy, palliative care, and integrative medicine. Don't be shy. Be your own advocate—or ask someone close to be one for you."**



binimetinib (Mektovi) stop growth signals from MEK.

If dabrafenib plus trametinib makes you too sick, you may receive dabrafenib alone or vemurafenib (Zelboraf). Vemurafenib also stops growth signals from BRAF.

Another option for initial treatment is systemic therapy based on cancer cell type (see Chapter 5).

In time, the cancer will worsen on targeted therapy. After targeted therapy, treatment based on cell type may be received. If not used before, dabrafenib and trametinib or encorafenib and binimetinib may be started if the cancer grows with another type of treatment.

## *NTRK* gene fusion

Lung cells have a family of 3 cell surface receptors called TRK. *NTRK* genes contain instructions for making TRK. Some lung cancers have too much TRK, which causes fast cell growth. The cause of excess TRK is a joining (fusion) of *NTRK* with another gene.

The preferred treatment is TRK inhibitors. These treatments include larotrectinib (Vitrakvi), entrectinib (Rozlytrek), and repotrectinib (Augtyro). Sometimes, treatment based on cancer cell type is useful as the first treatment (see Chapter 5).

In time, the cancer will worsen on targeted therapy. Your next treatment may be based on cell type. If not used before, a TRK inhibitor may be started if the cancer grows on another type of treatment.

## *MET* exon 14 skipping

Some lung cancers have too much of a cell surface receptor called MET. Too much MET causes fast cell growth. One of the causes of excess MET is a deleted (skipped) part of the *MET* gene called exon 14.

The preferred treatment is MET inhibitors. These treatments include capmatinib (Tabrecta) and tepotinib (Tepmetko). Crizotinib (Xalkori) is useful for some people. It inhibits MET and other kinases. Sometimes, treatment based on the cancer cell type is useful as the first treatment (see Chapter 5).

In time, the cancer will worsen after targeted therapy. Your next treatment may be based on cell type. If not used before, a MET inhibitor may be started if the cancer grows on other types of treatment.



**The good news is that today the medical industry has made great advances in treating cancer. They create a custom designed treatment specifically for you.”**

## *RET* rearrangement

A cell surface receptor kinase called RET can be overactive causing lung cells to multiply. The overactivity is caused by parts of genes switching places called a gene rearrangement.

The preferred treatment is RET inhibitors. These treatments include selpercatinib (Retevmo) and pralsetinib (Gavreto). Cabozantinib (Cometriq, Cabometyx) is useful for some people. It inhibits RET and other kinases but doesn't work as well as preferred treatments.

In time, the cancer will worsen on targeted therapy. After targeted therapy, treatment used for cell type may be an option. See Chapter 5. If not used before, a RET inhibitor may be started if the cancer grows on other types of treatment.

## *ERBB2 (HER2)* mutation

Lung cancer cells have a receptor on their surface called HER2. Certain mutations in the gene that makes HER2 cause the receptor to be overactive. HER2 overactivity makes the cancer cells grow quickly.

Lung cancers with *HER2* mutations are first treated by cancer cell type. See Chapter 5 for treatment options. If the cancer grows, you may receive an antibody-drug conjugate.

Fam-trastuzumab deruxtecan-nxki (Enhertu) is the preferred treatment. Another option is ado-trastuzumab emtansine (Kadcyla). Treatment options after a conjugate are again based on cancer cell type.

## Key points

- A driver mutation causes normal cells to become cancer cells. Biomarker tests detect driver mutations.
- Targeted therapy is used to treat driver mutations of lung cancer.
- For almost all known driver mutations, there is at least one preferred targeted therapy and often other regimens. When cancer grows during targeted therapy, treatment may be continued or switched to a different targeted therapy.
- When targeted therapy is not likely to help, you may receive treatment for cell type.
- Ask your care team for a complete list of side effects of your treatments. Also, tell your treatment team about any new or worse symptoms you get.

# 4

## Treatment based on PD-L1

- 30 Immune checkpoints
- 30 Immunotherapy
- 32 Treatment options
- 35 Key points



**There are some lung cancers that avoid death by stopping immune T cells. Immunotherapy restores the killing ability of those T cells. Read this chapter to learn more about this survival skill of cancer cells.**

## Immune checkpoints

The immune system is the body's natural defense against disease. White blood cells called T cells are a key part of this system. T cells that kill cancer cells are called cytotoxic, or killer, T cells.

The immune system has “brakes” that prevent or slow down an immune response. These brakes are called immune checkpoints. They protect the body's healthy cells. CTLA-4 and PD-1 are two types of brake pedals on T cells.

In people with lung cancer, the brake pedals on T cells may be overused. PD-1 is activated when attached to PD-L1 on lung cancer cells. CTLA-4 is activated when attached to B7 on immune cells called dendritic cells. With the brakes on, T cells are not able to kill cancer cells.

## Immunotherapy

Immunotherapy is a treatment that uses the immune system to kill cancer cells. Immune checkpoint inhibitors are a type of immunotherapy that releases the brake pedals on T cells.

There are 7 checkpoint inhibitors discussed in this chapter. These checkpoint inhibitors block proteins to keep the immune checkpoint turned off.

- Pembrolizumab (Keytruda), nivolumab (Opdivo), and cemiplimab-rwlc (Libtayo) are PD-1 inhibitors. They attach to PD-1 on T cells to block PD-L1 on cancer cells from attaching.
- Atezolizumab (Tecentriq) and durvalumab (Imfinzi) are PD-L1 inhibitors. They attach to PD-L1 on cancer cells so PD-L1 on T cells can't attach.
- Ipilimumab (Yervoy) and tremelimumab-actl (Imjudo) are CTLA-4 inhibitors. They attach to CTLA-4 on T cells and block attachment to B7.

Checkpoint inhibitors are slowly injected into a vein (infusion). It may take 30 or 60 minutes to get the full dose. Infusions are received every few weeks.

The number of weeks between treatments depends on the inhibitor used. Often, people get infusions for up to 2 years or until the treatments stop working.



### When not to take immunotherapy

Not all lung cancers should be treated with immunotherapy.

- Cancers with known driver mutations should first be treated as explained in Chapter 3.
- Immunotherapy may not be safe if you have an autoimmune disease or are taking medications that suppress your immune system.
- Immunotherapy may not be safe if you've had an organ transplant.
- Immunotherapy is typically not safe if your performance status is poor. High scores of 3 or 4 reflect poorer health.

### Side effects

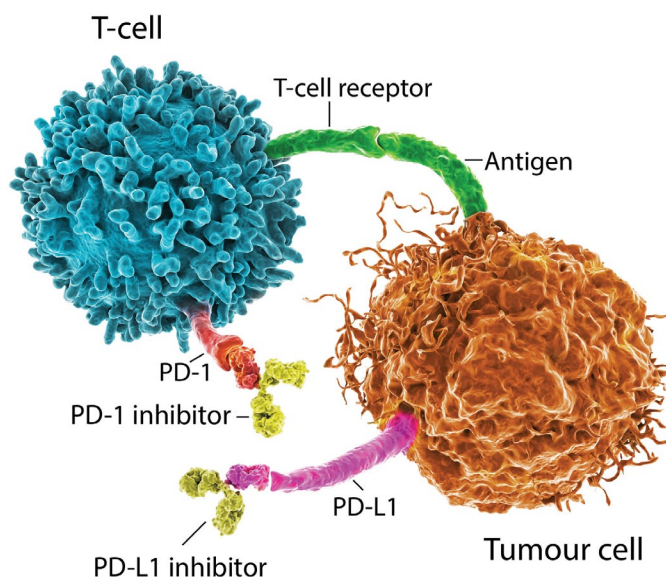
Immune checkpoint inhibitors may allow your immune cells to attack your healthy cells. Immune-related side effects can occur during or after treatment.

Read about immune-related side effects at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.



### PD-1 and PD-L1 inhibitors

Some lung cancer cells have PD-L1 on their surface. PD-L1 can attach to PD-1 on T cells and stop T cells from killing cancer cells. There are two types of immunotherapy used to stop PD-L1 on cancer cells. PD-L1 inhibitors attach to cancer cells, and PD-1 inhibitors attach to T cells. When either inhibitor is attached, T cells can attack cancer cells.



## Treatment options

Immunotherapy options are partly based on PD-L1. A pathologist will assess the percentage of cancer cells with PD-L1. A sample of a lung tumor is needed for testing.

- ▶ High PD-L1 means that at least half of the cancer cells have PD-L1 (50% or more).

- ▶ Low PD-L1 means that less than half of cancer cells have PD-L1 (1% to 49%).
- ▶ No PD-L1 means that fewer than 1 out of 100 cells have PD-L1 (less than 1%).

For lung cancer with PD-L1, see **Guide 7** for a list of treatment options for adenocarcinoma, large cell carcinoma, and rare cell types.

### Guide 7

#### Treatment of metastatic NSCLC with low or high PD-L1: Adenocarcinoma, large cell carcinoma, and rare cell types

Regimens	Low PD-L1	High PD-L1
Atezolizumab		●
Cemiplimab-rwlc		●
Pembrolizumab	●	●
Pembrolizumab, carboplatin, pemetrexed	●	●
Pembrolizumab, cisplatin, pemetrexed	●	●
Cemiplimab-rwlc, carboplatin, pemetrexed	●	●
Cemiplimab-rwlc, cisplatin, pemetrexed	●	●
Atezolizumab, carboplatin, paclitaxel, bevacizumab	●	●
Atezolizumab, carboplatin, albumin-bound paclitaxel	●	●
Nivolumab, ipilimumab, carboplatin, pemetrexed	●	●
Nivolumab, ipilimumab, cisplatin, pemetrexed	●	●
Cemiplimab-rwlc, carboplatin, paclitaxel	●	●
Cemiplimab-rwlc, cisplatin, paclitaxel	●	●
Tremelimumab-actl, durvalumab, carboplatin, albumin-bound paclitaxel	●	●
Tremelimumab-actl, durvalumab, carboplatin, pemetrexed	●	●
Tremelimumab-actl, durvalumab, cisplatin, pemetrexed	●	●
Nivolumab, ipilimumab	●	●

- Preferred regimen because it works better, is safer, or costs less than other options or there are better data supporting its use

Treatment options for squamous cell carcinoma are listed in **Guide 8**.

Treatment of lung cancer with no PD-L1 is discussed in *Chapter 5: Treatment by cell type*.

### First-line therapy

Some lung cancers with high PD-L1 are treated only with an immune checkpoint inhibitor. Combining checkpoint inhibitors with chemotherapy is also an option whether PD-L1 is high or low.

Platinum-doublet chemotherapy consists of cisplatin or carboplatin and another type of chemotherapy. It may be used with checkpoint inhibitors. Platinum-doublet chemotherapy can cause serious side effects, so you must be healthy enough to get this chemotherapy.

Bevacizumab is a part of one atezolizumab regimen. It is a targeted therapy called a VEGF antibody. It stops the growth of blood vessels on tumors. Without blood, cancer cells die.

#### Guide 8

#### Treatment of metastatic NSCLC with PD-L1: Squamous cell carcinoma

Regimens	Low PD-L1	High PD-L1
Atezolizumab		●
Cemiplimab-rwlc		●
Pembrolizumab	●	●
Pembrolizumab, carboplatin, paclitaxel	●	●
Pembrolizumab, carboplatin, albumin-bound paclitaxel	●	●
Cemiplimab-rwlc, carboplatin, paclitaxel	●	●
Cemiplimab-rwlc, cisplatin, paclitaxel	●	●
Nivolumab, ipilimumab, carboplatin, paclitaxel	●	●
Tremelimumab-actl, durvalumab, carboplatin, albumin-bound paclitaxel	●	●
Tremelimumab-actl, durvalumab, carboplatin, gemcitabine	●	●
Tremelimumab-actl, durvalumab, cisplatin, gemcitabine	●	●
Nivolumab, ipilimumab	●	●

● Preferred regimen because it works better, is safer, or costs less than other options or there are better data supporting its use

## Maintenance therapy

If treatment results are good, you may shift to maintenance therapy, which includes some of your first-line therapy. This is called continuation maintenance.

The goal of maintenance therapy is to prolong the time until the cancer worsens. Options for maintenance therapy are listed in **Guide 9**.

Within a few years on first-line therapy, lung cancer starts to grow again in most people. The next treatment is based on cell type as explained in Chapter 5.



**People will ask how they can help. Be specific. For example, you could say, ‘You can cook for me. Please pack meals in 4-ounce containers because that is all I can handle at any one time.’**

### Guide 9

#### Maintenance therapy for metastatic NSCLC with PD-L1

##### Adenocarcinoma, large cell carcinoma, and rare cell types

The maintenance regimen is based on your first-line therapy:

- Pembrolizumab
- Pembrolizumab, pemetrexed
- Atezolizumab, bevacizumab
- Atezolizumab
- Nivolumab, ipilimumab
- Cemiplimab-rwlc
- Cemiplimab-rwlc, pemetrexed
- Durvalumab
- Durvalumab, pemetrexed

##### Squamous cell lung cancer

The maintenance regimen is based on your first-line therapy:

- Pembrolizumab
- Atezolizumab for NSCLC with high PD-L1
- Nivolumab, ipilimumab
- Cemiplimab-rwlc
- Durvalumab

## Key points

- The body's defense against disease is called the immune system. T cells are part of this system. They kill cancer cells.
- Immune checkpoints keep immune responses in check. PD-1 and CTLA-4 are two types of immune checkpoints on T cells.
- In people with NSCLC, PD-1 and CTLA-4 are often activated and stop T cells from killing cancer cells.
- Immune checkpoint inhibitors are a type of immunotherapy that stops PD-1 and CTLA-4 from being activated.
- There are many checkpoint inhibitor regimens. The one chosen for treatment is based on the level of PD-L1 and the type of NSCLC.
- If cancer growth slows down, you may stay on some of them to increase the time until the cancer grows again. This is called maintenance therapy.



### **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://www.nccn.org/patients/response)

# 5

## Treatment by cell type

- 37 Planning treatment
- 37 Types of systemic therapy
- 39 First-line therapy
- 42 Monitoring
- 43 Maintenance therapy
- 44 Second-line therapy
- 44 Clinical trials
- 47 Key points

**When it comes to lung cancer, no two people are alike. Lung cancer differs between people based on the type of cell affected. Read this chapter to learn the best treatment options based on cell type.**

## Planning treatment

Many non-small cell lung cancers (NSCLC) don't have a known biomarker that can be used for treatment. Cancer care is based on other factors when there's no such biomarker.

One deciding factor is your ability to do day-to-day activities. This ability is called performance status. Cancer and other diseases can limit what you can do. If your ability is limited, some cancer treatments may cause serious health problems.

The Eastern Cooperative Oncology Group (ECOG) Performance Status is a common scoring system. It consists of five scores ranging from 0 to 4. The lower the score, the better your ability to care for yourself.

**A performance status of 0, 1, or 2** means that you are fairly healthy. NCCN experts advise receiving systemic therapy. Systemic therapy treats cancer anywhere it is in the body. It can treat cancer in many places as well as hard-to-reach places.

**A performance score of 3 or 4** suggests that cancer treatment will be harmful. NCCN experts advise receiving supportive care.

Supportive care aims to improve your quality of life. It is sometimes called palliative care.

One of its goals is to treat the symptoms caused by the cancer. It also helps with mental, social, and spiritual issues. Discuss supportive care with your care team to get the best plan for you.

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



## Types of systemic therapy

Your oncologist will prescribe a regimen for you. A regimen consists of one or more drugs that are taken at a specific dose, schedule, and length of time.

### Chemotherapy

The classic treatment of widespread metastatic lung cancer is chemotherapy. It kills fast-growing cells, including cancer.

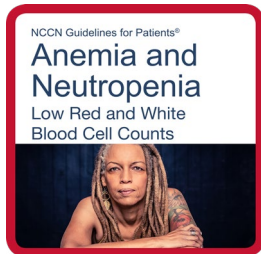
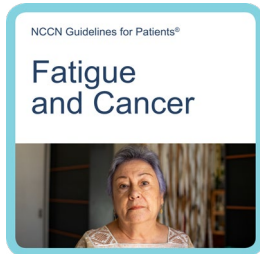
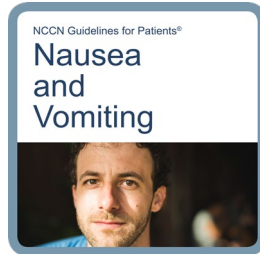
Chemotherapy for NSCLC is often a liquid that is injected into a vein. Some injections are done in the arm or hand, while others are done through an implanted device called a port. An infusion is a slow drip, controlled by a pump, that may take hours.

Chemotherapy causes side effects because it kills fast-growing normal cells as well as



cancer cells. Each chemotherapy has its own set of side effects, so ask your care team about what to expect.

Information on common side effects of chemotherapy can be found at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.



### Immunotherapy

Immunotherapy is a treatment that uses the immune system to kill cancer cells. Immune checkpoint inhibitors are a type of immunotherapy. They restore the ability of immune T cells to kill lung cancer cells.

Checkpoint inhibitors are given by infusion. It may take 30 or 60 minutes to get the full dose.

Immune checkpoint inhibitors may cause your immune cells to attack your healthy cells. Read about the management of immune-related side effects at [NCCN.org/patientguidelines](https://www.nccn.org/patientguidelines) and on the [NCCN Patient Guides for Cancer](#) app.



### Targeted therapy

Bevacizumab is a part of some regimens used to treat lung cancer. It is a targeted therapy called a VEGF antibody. It stops the growth of blood vessels on tumors. Without blood, cancer cells die.

Bevacizumab is given by infusion. The first dose takes about 90 minutes to receive. Later doses each take about 30 to 60 minutes.

Some of the common side effects of bevacizumab are high blood pressure, headache, changes in taste, dry or inflamed skin, watery eyes, and back pain.

Less common, but severe problems that may occur are tears in your digestive tract, wounds that don't heal, serious bleeding, and blood clots in deep veins.



## First-line therapy

The first treatment given to you is referred to as first-line therapy. Your oncologist will choose a regimen for you based on:

- Your health conditions and medications
- Your performance status (0, 1, or 2 is necessary for these treatments)
- The cell type—adenocarcinoma, large cell carcinoma, squamous cell carcinoma, or a rare type of NSCLC

Rare cell types of NSCLC are sometimes described as not otherwise specified (NOS).

### Regimens with immune checkpoint inhibitors

If your performance status is either 0 or 1, immune checkpoint inhibitors may be part of cancer treatment.

Immune checkpoint inhibitors treat lung cancer with PD-L1 as explained in Chapter 4. But they also extend life when lung cancer does not have PD-L1.

- Pembrolizumab (Keytruda), nivolumab (Opdivo), and cemiplimab-rwlc (Libtayo) are PD-1 inhibitors.
- Atezolizumab (Tecentriq) and durvalumab (Imfinzi) are PD-L1 inhibitors.
- Ipilimumab (Yervoy) and tremelimumab-actl (Imjudo) are CTLA-4 inhibitors.

Your oncologist will prescribe immune checkpoint inhibitors only if they are safe and work for you. They may not be safe if you had an organ transplant, have an autoimmune disease, or you are taking medications that suppress your immune system. They may not work well if the cancer has EGFR or ALK biomarkers.

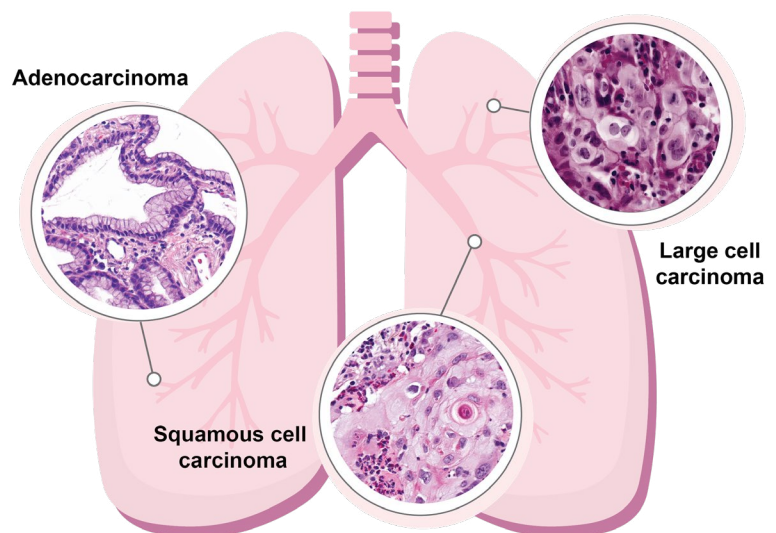
### Types of non-small cell lung cancer

There are 3 main types of non-small cell lung cancer. Adenocarcinoma is the most common type. It is a cancer of mucus-making cells. Large cell carcinoma starts in large cells of the lung. Squamous cell carcinoma starts in squamous cells.

Credit: [https://commons.wikimedia.org/wiki/File:Mucinous\\_lung\\_adenocarcinoma\\_-\\_high\\_mag.jpg](https://commons.wikimedia.org/wiki/File:Mucinous_lung_adenocarcinoma_-_high_mag.jpg)

[https://commons.wikimedia.org/wiki/File:Large\\_cell\\_carcinoma\\_of\\_the\\_lung\\_.jpg](https://commons.wikimedia.org/wiki/File:Large_cell_carcinoma_of_the_lung_.jpg)

[https://commons.wikimedia.org/wiki/File:Lung\\_squamous\\_carcinoma\\_-\\_high\\_mag.jpg](https://commons.wikimedia.org/wiki/File:Lung_squamous_carcinoma_-_high_mag.jpg)



Platinum-doublet chemotherapy is often used with immune checkpoint inhibitors. This combined treatment is called chemoimmunotherapy. See **Guide 10** and **Guide 11** for regimens.

Platinum-doublet chemotherapy consists of two types of chemotherapy. One is

either cisplatin or carboplatin. The second chemotherapy is either pemetrexed (Alimta, Pemfexy), paclitaxel, paclitaxel with human albumin (Abraxane), etoposide (Toposar, Etopophos), or gemcitabine (Gemzar, Infugem). Pemetrexed is not used for squamous cell carcinomas.

### Guide 10

#### First-line therapy of metastatic NSCLC by performance status (PS): Adenocarcinoma, large cell carcinoma, and rare cell types

Regimens with immune checkpoint inhibitors	PS 0 or 1	PS 2
Carboplatin or cisplatin, pemetrexed, pembrolizumab	●	
Carboplatin or cisplatin, pemetrexed, cemiplimab-rwlc	●	
Carboplatin, paclitaxel, bevacizumab, atezolizumab	●	
Carboplatin, albumin-bound paclitaxel, atezolizumab	●	
Nivolumab, ipilimumab	●	
Carboplatin or cisplatin, pemetrexed, nivolumab, ipilimumab	●	
Carboplatin or cisplatin, paclitaxel, cemiplimab-rwlc	●	
Carboplatin, albumin-bound paclitaxel, durvalumab, tremelimumab-actl	●	
Carboplatin or cisplatin, pemetrexed, durvalumab, tremelimumab-actl	●	
<b>Regimens without immune checkpoint inhibitors</b>		
Carboplatin, pemetrexed	●	●
Carboplatin, paclitaxel, bevacizumab	●	
Carboplatin or cisplatin, pemetrexed, bevacizumab	●	
Carboplatin and one other chemotherapy	●	●
Cisplatin and one other chemotherapy	●	
Gemcitabine and either docetaxel or vinorelbine	●	●
Single-agent chemotherapy		●

- Preferred regimen because it works better, is safer, or costs less than other options or there are better data supporting its use

In addition to chemoimmunotherapy, immunotherapy by itself may be another option for you. You may receive nivolumab and ipilimumab if your performance status is either 0 or 1.

### Regimens *without* immune checkpoint inhibitors

When immunotherapy is not an option, chemotherapy is used for treatment. Platinum-doublet chemotherapy is most often used. Bevacizumab is a part of some regimens.

#### Guide 11

#### First-line therapy of metastatic NSCLC by performance status (PS): Squamous cell carcinoma

Regimens with immunotherapy	PS 0 or 1	PS 2
Carboplatin, paclitaxel, pembrolizumab	●	
Carboplatin, albumin-bound paclitaxel, pembrolizumab	●	
Carboplatin or cisplatin, paclitaxel, cemiplimab-rwlc	●	
Nivolumab, ipilimumab	●	
Carboplatin, paclitaxel, nivolumab, ipilimumab	●	
Carboplatin, albumin-bound paclitaxel, durvalumab, tremelimumab-actl	●	
Carboplatin or cisplatin, gemcitabine, durvalumab, tremelimumab-actl	●	
<b>Regimens without immunotherapy</b>		
Carboplatin, albumin-bound paclitaxel	●	●
Carboplatin, gemcitabine	●	●
Carboplatin, paclitaxel	●	●
Carboplatin, docetaxel	●	●
Carboplatin, etoposide		●
Cisplatin and either docetaxel, etoposide, gemcitabine, or paclitaxel	●	
Gemcitabine and either docetaxel or vinorelbine	●	●
Single-agent chemotherapy		●

● Preferred regimen because it works better, is safer, or costs less than other options or there are better data supporting its use

Other options include gemcitabine with either docetaxel or vinorelbine. There are several options for single-agent chemotherapy, including:

- Albumin-bound paclitaxel
- Docetaxel
- Gemcitabine
- Paclitaxel
- Pemetrexed (only for non-squamous cell types)

## Monitoring

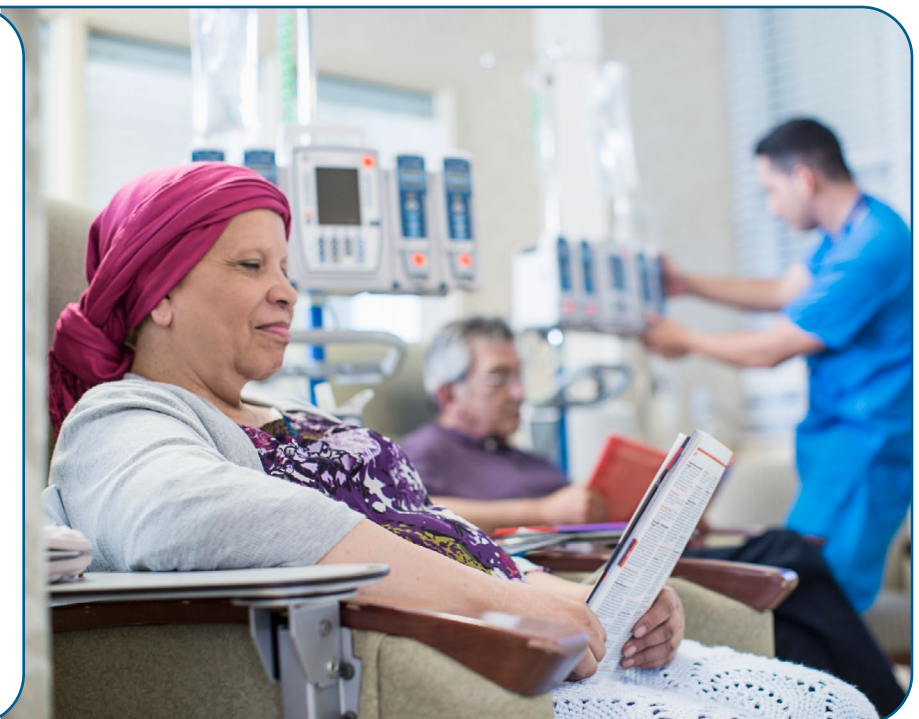
Systemic therapy is given in cycles of treatment days, followed by rest days. One cycle typically lasts for 3 to 4 weeks.

In general, systemic therapy is given for 4 cycles. If treatment isn't making you too sick, a total of 6 cycles may be completed.

After two cycles, your oncologist will assess the results. The extent of the cancer can be seen on CT scans. Contrast may be used. The CT scan will be repeated after another 2 to 4 cycles.

### Systemic therapy

**Systemic therapy for lung cancer is often a liquid that is injected into a vein. An infusion is a slow drip controlled by a pump that may take hours.**



## Maintenance therapy

If a line of treatment works, you may receive maintenance therapy after the regimen is finished. The goal of maintenance therapy is to increase the time until the cancer grows.

If results are good at the end of treatment, you may stay on at least one of the medicines. This is called continuation maintenance.

Another option is changing to a medicine that you didn't take as a first-line therapy. This is called switch maintenance. Options for maintenance therapy are listed in **Guide 12**.

You may stay on maintenance therapy for 2 years if your first-line therapy includes immunotherapy. If immunotherapy is part of second-line therapy, you'll stay on maintenance therapy until the cancer grows.

### Guide 12

#### Maintenance therapy for metastatic NSCLC by cell type

##### Adenocarcinoma, large cell carcinoma, and rare cell types

##### Continuation maintenance

- Bevacizumab
- Pemetrexed
- Bevacizumab, pemetrexed
- Pembrolizumab, pemetrexed
- Atezolizumab, bevacizumab
- Cemiplimab-rwlc with or without pemetrexed
- Atezolizumab
- Nivolumab, ipilimumab
- Durvalumab with or without pemetrexed
- Gemcitabine

##### Switch maintenance

- Pemetrexed

##### Squamous cell lung cancer

##### Continuation maintenance

- Cemiplimab-rwlc
- Durvalumab
- Pembrolizumab
- Nivolumab and ipilimumab
- Gemcitabine

## Second-line therapy

In time, lung cancer often starts to grow again after first-line therapy. Care options are based on performance status. This section describes treatment when performance status is 0, 1, or 2. NCCN experts recommend supportive care when performance status is either 3 or 4.

Second-line therapy is the second treatment used for cancer care. If more lines of therapy are needed, the options mentioned in this section may be received. Options for second-line therapy are listed in **Guide 13**.

- Immune checkpoint inhibitors are preferred if not received before. If the cancer grows while taking a checkpoint inhibitor, switching to another checkpoint inhibitor is not advised.
- Other options include docetaxel with ramucirumab. Ramucirumab is a VEGF antibody.

- Single-agent chemotherapy (where you would receive one chemotherapy drug) is an option.

Your oncologist will monitor treatment results. You will get a CT scan every 6 to 12 weeks. Contrast may be used.

## Clinical trials

Despite advances in treatment, more research is needed. Current treatment rarely cures metastatic lung cancer or gives people a long life. Improving treatment is made possible with clinical trials.

A clinical trial is a type of medical research study. After being developed and tested in a laboratory, potential new ways of fighting cancer need to be studied in people. If found to be safe and effective in a clinical trial, a

### Guide 13

#### Second-line therapy for metastatic NSCLC

##### Preferred options when you haven't had immunotherapy before

- Nivolumab
- Pembrolizumab
- Atezolizumab

##### Other options whether you've had immunotherapy or not

- Docetaxel
- Gemcitabine
- Ramucirumab, docetaxel
- Albumin-bound paclitaxel
- Pemetrexed for lung adenocarcinoma, large cell carcinoma, and rare cell types
- Fam-trastuzumab deruxtecan-nxki



drug, device, or treatment approach may be approved by the FDA.

Everyone with cancer should carefully consider all of the treatment options available for their cancer type, including standard treatments and clinical trials. Talk to your oncologist about whether a clinical trial may make sense for you.

### Phases

Most cancer clinical trials focus on treatment. Treatment trials are done in phases.

- Phase I trials study the dose, safety, and side effects of a drug or treatment approach. They also look for early signs that the drug or approach is helpful.
- Phase II trials study how well the drug or approach works against a type of cancer.
- Phase III trials test the drug or approach against a standard treatment. If the results are good, it may be approved by the FDA.
- Phase IV trials study the long-term safety and benefit of an FDA-approved treatment.

### Who can enroll?

Every clinical trial has rules for joining, called eligibility criteria. The rules may be about age, cancer type and stage, treatment history, or general health. These requirements ensure that participants are alike in specific ways and that the trial is as safe as possible for the participants.



## Finding a clinical trial

### In the United States

**NCCN Cancer Centers**

[NCCN.org/cancercenters](https://www.nccn.org/cancercenters)

**The National Cancer Institute (NCI)**

[cancer.gov/about-cancer/treatment/clinical-trials/search](https://www.cancer.gov/about-cancer/treatment/clinical-trials/search)

### Worldwide

**The U.S. National Library of Medicine (NLM)**

[clinicaltrials.gov](https://clinicaltrials.gov)

### Need help finding a clinical trial?

**NCI's Cancer Information Service (CIS)**

1.800.4.CANCER (1.800.422.6237)

[cancer.gov/contact](https://www.cancer.gov/contact)



### **Informed consent**

Clinical trials are managed by a group of experts called a research team. The research team will review the study with you in detail, including its purpose and the risks and benefits of joining. All of this information is also provided in an informed consent form. Read the form carefully and ask questions before signing it. Take time to discuss it with family, friends, or others whom you trust. Keep in mind that you can leave and seek treatment outside the clinical trial at any time.

### **Start the conversation**

Don't wait for your care team to bring up clinical trials. Start the conversation and learn about all of your treatment options. If you find a study that you may be eligible for, ask your treatment team if you meet the requirements. If you have already started standard treatment, you may not be eligible for certain clinical trials. Try not to be discouraged if you cannot join. New clinical trials are always becoming available.

### **Frequently asked questions**

There are many myths and misconceptions surrounding clinical trials. The possible benefits and risks are not well understood by many with cancer.

#### **Will I get a placebo?**

Placebos (inactive versions of real medicines) are almost never used alone in cancer clinical trials. It is common to receive either a placebo with a standard treatment or a new drug with a standard treatment. You will be informed, verbally and in writing, if a placebo is part of a clinical trial before you enroll.

#### **Are clinical trials free?**

There is no fee to enroll in a clinical trial. The study sponsor pays for research-related costs, including the study drug. You may, however, have costs indirectly related to the trial, such as the cost of transportation or childcare due to extra appointments. During the trial, you will continue to receive standard cancer care. This care is billed to—and often covered by—insurance. You are responsible for copays and any costs for this care that are not covered by your insurance.

## Key points

- Treatment of lung cancer without treatable biomarkers is partly based on performance status. Performance status is your ability to do day-to-day activities.
- Whole-body treatment called systemic therapy is used to treat people with a performance status of 0, 1, or 2. Supportive care is generally recommended if performance status is 3 or 4.
- Chemotherapy with immunotherapy is recommended for fairly healthy people. Other options are chemotherapy by itself or chemotherapy with bevacizumab.
- Your oncologist will monitor the results of treatment. You may receive between 4 and 6 cycles of treatment.
- Maintenance therapy slows down the growth of cancer. It consists of one or more drugs from your first treatment.
- The next treatment options for lung cancer are immunotherapy if not received before, chemotherapy with ramucirumab, and single-agent chemotherapy.
- Clinical trials are a type of research. New ways of fighting cancer are studied among people in clinical trials. A clinical trial may be an option in addition to standard treatment.



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

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

# 6

## Making treatment decisions

- 49 It's your choice
- 49 Questions to ask
- 56 Resources

**It's important to be comfortable with the cancer treatment you choose. This choice starts with having an open and honest conversation with your care team.**

## It's your choice

In shared decision-making, you and your care team share information, discuss the options, and agree on a treatment plan. It starts with an open and honest conversation between you and your care team.

Treatment decisions are very personal. What is important to you may not be important to someone else. Some things that may play a role in your decision-making:

- What you want and how that might differ from what others want
- Your religious and spiritual beliefs
- Your feelings about certain treatments
- Your feelings about pain or side effects
- Cost of treatment, travel to treatment centers, and time away from school or work
- Quality of life and length of life
- How active you are and the activities that are important to you

Think about what you want from treatment. Discuss openly the risks and benefits of specific treatments and procedures. Weigh options and share concerns with your

care team. If you take the time to build a relationship with your care team, it will help you feel supported when considering options and making treatment decisions.

## Second opinion

It is normal to want to start treatment as soon as possible. While cancer can't be ignored, there is time to have another doctor review your test results and suggest a treatment plan. This is called getting a second opinion, and it's a normal part of cancer care. Even doctors get second opinions!

Things you can do to prepare:

- Check with your insurance company about its rules on second opinions. There may be out-of-pocket costs to see doctors who are not part of your insurance plan.
- Make plans to have copies of all your records sent to the doctor you will see for your second opinion.

## Support groups

Many people diagnosed with cancer find support groups to be helpful. Support groups often include people at different stages of treatment. Some people may be newly diagnosed, while others may be finished with treatment. If your hospital or community doesn't have support groups for people with cancer, check out the websites listed in this book.

## Questions to ask

Possible questions to ask your care team are listed on the following pages. Feel free to use these questions or come up with your own.















## 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)

### **Bag It Cancer**

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

### **CancerCare**

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

### **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)

### **Imerman Angels**

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

### **LiveLung (Dusty Joy Foundation)**

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

### **Lung Cancer Action Network (LungCAN)**

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

### **Lung Cancer Research Foundation**

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

### **LUNgevity**

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

### **National Coalition for Cancer Survivorship**

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

### **Triage Cancer**

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



## Words to know

### **adenocarcinoma**

A cancer of cells that line organs and make fluids or hormones.

### **adrenal gland**

A small organ on top of each kidney that makes hormones.

### **AJCC**

American Joint Committee on Cancer

### **alveoli**

The tiny sacs in the lungs where gases are transferred in and out of the blood.

### **biomarker**

Any molecule in your body that can be measured to assess your health.

### **biopsy**

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

### **body plethysmograph**

A test of how much air is in your lungs after inhaling or exhaling.

### **bronchioli**

Small airways within the lungs.

### **bronchus**

One of the two main airways that extends into the lungs.

### **cancer stage**

A rating of the outlook of a cancer based on its growth and spread.

### **carcinoma**

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

### **chemoradiation**

A cancer treatment with both cell-killing drugs and high-energy rays.

### **chemistry profile**

A lab test of the amount of 8 chemicals in a sample of blood. Also called metabolic panel.

### **chemotherapy**

Treatment with cancer drugs that kill fast-growing cells.

### **clinical trial**

A type of research that assesses how well health tests or treatments work in people.

### **complete blood count (CBC)**

A lab test that measures the parts of the blood.

### **computed tomography (CT)**

A test that uses x-rays from many angles to make a picture of the insides of the body.

### **continuation maintenance**

A treatment phase using one or more first-line drugs to prolong good treatment results.

### **contrast**

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

### **core needle biopsy**

A procedure that removes tissue samples with a hollow needle. Also called core biopsy.

### **diagnosis**

An identification of an illness based on tests.

### **DNA**

deoxyribonucleic acid

### **ECOG**

Eastern Cooperative Oncology Group

**FDG**

fluorodeoxyglucose

**gas diffusion**

A test that uses harmless gas to measure how much you can breathe out.

**gene**

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

**gene rearrangement**

A coded instruction within a cell that is made from parts of other coded instructions.

**immunohistochemistry (IHC)**

A special lab test done on a tissue sample.

**immunotherapy**

A treatment with drugs that help the body find and destroy cancer cells.

**large-cell lung carcinoma**

A cancer of lung cells that lack features to classify as another type of lung cancer.

**lymph node**

A small, bean-shaped, disease-fighting structure.

**magnetic resonance imaging (MRI)**

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

**maintenance therapy**

A treatment phase that is given to prolong good treatment results.

**medical history**

A report of all your health events and medications.

**metastasis**

The spread of cancer from the first tumor to a new site.

**mutation**

Abnormal changes in coded instructions within cells (genes).

**NCCN**

National Comprehensive Cancer Network

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

A cancer that starts in lung cells that are not small.

**NOS**

Not otherwise specified

**pathologist**

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

**performance status**

A rating of one's ability to do daily activities.

**pericardiocentesis**

A procedure that removes fluid from around the heart with a needle.

**physical exam**

A review of the body by a health expert for signs of disease.

**platinum-doublet chemotherapy**

A treatment with two cell-killing drugs, one of which contains the chemical platinum.

**positron emission tomography (PET)**

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

**positron emission tomography/computed tomography (PET/CT)**

A test that uses two picture-making methods to show the shape and function of tissue.

**prognosis**

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



**pulmonary function tests**

A set of breathing tests to test the strength of the lungs.

**radiation oncologist**

A doctor who's an expert in treating cancer with radiation.

**radiation therapy**

A treatment that uses intense energy to kill cancer cells.

**rapid on-site evaluation (ROSE)**

A size assessment of removed tissue during a medical procedure.

**respiratory system**

The group of organs that transfers gases in and out of the body.

**side effect**

An unhealthy or unpleasant physical or emotional response to treatment.

**small cell lung cancer (SCLC)**

A cancer of small, round lung cells.

**spirometry**

A test that uses a tube to measure how fast you breathe.

**squamous cell carcinoma**

A type of cancer of thin and flat cells that line the surface of organs.

**stereotactic ablative radiotherapy (SABR)**

Treatment with high-dose radiation within one or a few sessions. Also called stereotactic body radiation therapy (SBRT).

**supportive care**

Health care that includes symptom relief but not cancer treatment. Also sometimes called palliative care.

**surgery**

An operation to remove or repair a part of the body.

**switch maintenance**

A treatment phase with a new drug that is given to prolong good treatment results.

**targeted therapy**

A drug treatment that impedes the growth process specific to cancer cells.

**thoracic radiologist**

A doctor who's an expert in reading imaging tests of the chest.

**thoracoscopy**

A procedure to do work in the chest with a device passed through a small cut in the skin. Also called video-assisted thoracoscopic surgery (VATS).

**trachea**

The airway between the throat and airway into the lungs. Also called the windpipe.

**transthoracic needle aspiration (TTNA)**

A procedure that removes tissue samples with a thin needle guided through the ribs.

**ultrasound**

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

**VATS**

video-assisted thoracoscopic surgery

# NCCN Contributors

This patient guide is based on the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Non-Small Cell Lung Cancer, Version 7.2024. 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 • [penncancer.org/cancer](http://penncancer.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 |

Mass General Cancer Center  
Boston, Massachusetts  
877.442.3324 • [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 • [healthcare.utah.edu/huntsmancancerinstitute](http://healthcare.utah.edu/huntsmancancerinstitute)

## Indiana University Melvin and Bren Simon Comprehensive Cancer Center

Indianapolis, Indiana  
888.600.4822 • [www.cancer.iu.edu](http://www.cancer.iu.edu)

## Johns Hopkins Kimmel Cancer Center

Baltimore, Maryland  
410.955.8964  
[www.hopkinskimmelcancercenter.org](http://www.hopkinskimmelcancercenter.org)

## 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)

## 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 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

Sacramento, California  
916.734.5959 • 800.770.9261  
[health.ucdavis.edu/cancer](http://health.ucdavis.edu/cancer)

## UC San Diego Moores Cancer Center

La Jolla, California  
858.822.6100 • [cancer.ucsd.edu](http://cancer.ucsd.edu)

## UCLA Jonsson Comprehensive Cancer Center

Los Angeles, California  
310.825.5268 • [uclahealth.org/cancer](http://uclahealth.org/cancer)

## 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

Ann Arbor, Michigan  
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](https://utsouthwestern.edu/simmons)

Vanderbilt-Ingram Cancer Center  
Nashville, Tennessee  
877.936.8422 • [vicc.org](https://vicc.org)

Yale Cancer Center/Smilow Cancer Hospital  
New Haven, Connecticut  
855.4.SMLOW • [yalecancercenter.org](https://yalecancercenter.org)



## **We want your feedback!**

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

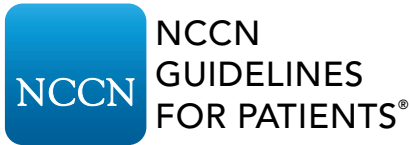
**Take our survey to let us know  
what we got right and what we  
could do better.**

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

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