



Lung Cancer (Non-Small Cell) Overview

The information that follows is an overview of this type of cancer. It is based on the more detailed information in our document *Lung Cancer (Non-Small Cell)*. This document and other information can be obtained by calling 1-800-227-2345 or visiting our website www.cancer.org.

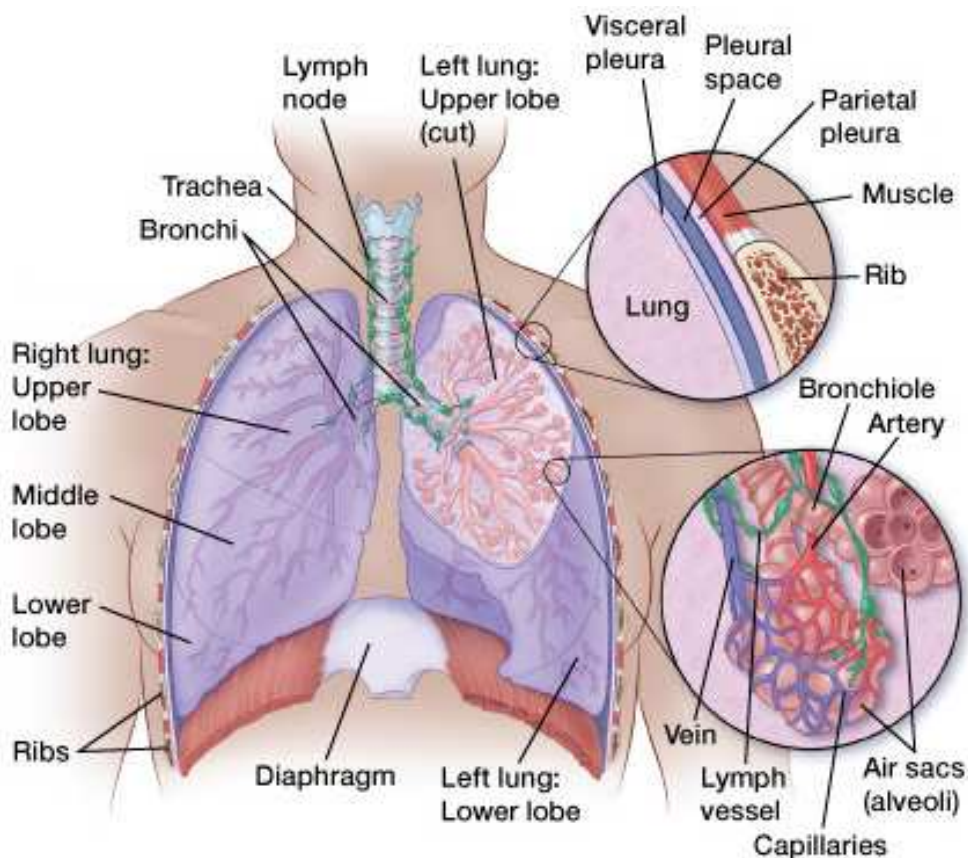
What is non-small cell lung cancer?

Note: *This document covers only the non-small cell type of lung cancer. The treatment for the 2 main types of lung cancer (small cell and non-small cell) is very different. Some of the information for one type will not apply to the other type. If you are not sure which type of lung cancer you have, it is very important to ask your doctor so you can be sure you get the right information.*

Lung cancer is a cancer that starts in the lungs. In order to understand lung cancer, it helps to know something about the structure of the lungs and how they work.

The lungs

The lungs are 2 sponge-like organs found in the chest. Each lung is divided into sections called *lobes*. The right lung has 3 lobes, while the left lung has 2 lobes. The left lung is smaller because the heart takes up more room on that side of the body.



When you breathe in, air enters through your mouth and nose and goes into your lungs through the windpipe (*trachea*). The trachea divides into tubes called the *bronchi*, which enter the lungs and divide into smaller branches. These divide into even smaller branches called *bronchioles*. At the end of the bronchioles are tiny air sacs known as *alveoli*. Many tiny blood vessels run through the alveoli. They absorb oxygen from the air you breathe in and pass carbon dioxide from the body into the alveoli to be breathed out when you exhale. Taking in oxygen and getting rid of carbon dioxide are your lungs' main functions.

The thin lining around the lungs, called the *pleura*, helps to protect the lungs and allows them to move during breathing.

Below the lungs, a thin muscle called the *diaphragm* separates the chest from the belly (abdomen). When you breathe, the diaphragm moves up and down, forcing air in and out of the lungs.

Start and spread of lung cancer

Lung cancers are thought to start as areas of pre-cancerous changes in the lung. These changes are not a mass or tumor. They can't be seen on an x-ray and they don't cause symptoms.

Over time, pre-cancers may go on to become true cancer. The cells divide to make new cells and a tumor may form. In time, the tumor becomes large enough to show up on an x-ray.

At some point, cancer cells can break away and spread to other parts of the body in a process called *metastasis*. Lung cancer can be a life-threatening disease because it often spreads in this way before it is found.

The lymph system

One of the ways lung cancer can spread is through the lymph system. Lymph vessels are like veins, but they carry lymph instead of blood. Lymph is a clear fluid that contains tissue waste products and cells that fight infection.

Lung cancer cells can enter lymph vessels and begin to grow in lymph nodes (small collections of immune cells) around the bronchi and in the area between the lungs. Once lung cancer cells have reached the lymph nodes, they are more likely to have spread to other organs of the body. The stage (extent) of the cancer and decisions about treatment are based in part on whether or not the cancer has spread to the nearby lymph nodes. This is covered in "Staging for non-small cell lung cancer."

Types of lung cancer

There are 2 main types of lung cancer and they are treated differently.

- Small cell lung cancer (SCLC)
- Non-small cell lung cancer (NSCLC)

(If the cancer has features of both types, it is called *mixed small cell/non-small cell cancer*. This is not common.)

The information here only covers non-small cell lung cancer. Small cell lung cancer is covered in *Lung Cancer (Small Cell) Overview*.

Non-small cell lung cancer (NSCLC)

About 9 out of 10 cases of all lung cancers are the non-small cell type. Based on how the cells look under the microscope, NSCLC is usually one of 3 sub-types:

- Squamous cell carcinoma
- Adenocarcinoma
- Large cell (undifferentiated) carcinoma

Other types of lung cancer

Along with the 2 main types of lung cancer, other cancers can be found in the lungs, too. Cancers that start in other places can spread to the lungs. Sometimes tumors that aren't cancer are found in the lungs, as well.

Keep in mind that cancer that starts in other organs (such as the breast, pancreas, kidney, or skin) can sometimes spread (metastasize) to the lungs, but these are **not** lung cancers. For example, cancer that starts in the kidney and spreads to the lungs is still kidney cancer, not lung cancer. Treatment for these cancers that have spread to the lungs depends on where the cancer started.

What are the risk factors for non-small cell lung cancer?

A risk factor is anything that affects a person's chance of getting a disease such as cancer. Different cancers have different risk factors. Some risk factors, like smoking, can be changed. Others, like a person's age or family history, can't be changed.

But having a risk factor, or even many risk factors, does not mean that you will get the disease. And some people who get the disease may have few or no known risk factors. Even if a person with lung cancer has a risk factor, it is often very hard to know how much it may have contributed to the cancer.

Several risk factors can make you more likely to develop lung cancer:

- Smoking tobacco – including cigarettes, cigars, and pipes
- Secondhand smoke (breathing in the smoke of others)
- Radon
- Asbestos
- Air pollution
- Radiation therapy to treat cancers in the chest
- Arsenic in drinking water

- Certain workplace exposures
- Having had lung cancer before
- Having a family member with lung cancer

For more information about these factors and how they increase the risk of lung cancer, see the section about risk factors in *Lung Cancer (Non Small Cell)*.

Can non-small cell lung cancer be prevented?

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

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

If you smoke, stopping can help lower your risk of getting lung cancer. If you stop smoking before a cancer starts, your damaged lungs gradually repair themselves. No matter what your age or how long you've smoked, quitting may lower your risk of lung cancer and help you live longer. If you would like help quitting smoking, see our *Guide to Quitting Smoking* or call us at 1-800-227-2345.

Radon is also a cause of lung cancer. You can lower your exposure by having your home tested and treated, if needed. To learn more, see *Radon*.

Protecting yourself from cancer-causing chemicals at work and elsewhere can also be helpful. When people work where these chemicals are common, exposure should be kept as low as possible.

A good diet with lots of fruits and vegetables may also help reduce your risk of lung cancer.

Can non-small cell lung cancer be found early?

It is often hard to find lung cancer early. Most people with early lung cancer do not have any symptoms, so only a small number of lung cancers are found at an early stage. When lung cancer is found early, it is often because of tests that were being done for something else.

Screening for lung cancer

Screening is the use of tests or exams to find a disease like cancer in people who don't have any symptoms of that disease. Doctors have looked for many years for a test that could find lung cancer early and help patients live longer.

In recent years, a large clinical trial, known as the National Lung Screening Trial (NLST), found that in some people at high risk of lung cancer (due to their history of smoking), a screening test known as a low-dose CT (LDCT) scan could lower the chance of dying from lung cancer.

Still, screening with LDCT scans also has some downsides. One drawback is that this test also finds a lot of things that turn out not to be cancer but that still need to be tested to be sure. LDCTs also expose people to a small amount of radiation with each test. These factors, and others, need to be taken into account by people and their doctors who are thinking about whether screening with LDCT scans is right for them.

Based on the results of the NLST, the American Cancer Society has developing screening guidelines for lung cancer. People who are at higher risk for lung cancer, such as current or former smokers, might want to discuss these guidelines with their doctor to see if screening might be right for them. For more details about the American Cancer Society's lung cancer screening guidelines, see *Lung Cancer Prevention and Early Detection*.

Signs and symptoms of lung cancer

Most lung cancers do not cause symptoms until they have spread, but you should report any of the following problems to a doctor right away. Often these problems are caused by something other than cancer, but if lung cancer is found, getting treatment right away might mean treatment would work better. The most common symptoms of lung cancer are:

- A cough that does not go away or gets worse
- Chest pain, often made worse by deep breathing, coughing, or laughing
- Hoarseness
- Weight loss and loss of appetite
- Coughing up blood or rust-colored sputum (spit or phlegm)
- Shortness of breath
- Feeling tired or weak
- Infections such as bronchitis and pneumonia that don't go away or keep coming back

- New onset of wheezing

When lung cancer spreads to other parts of the body, it may cause:

- Bone pain (like pain in the back or the hips)
- Weakness or numbness of the arms or legs
- Headache, dizziness, balance problems, or seizures
- Jaundice (yellow coloring of the skin and eyes)
- Lumps near the surface of the body, caused by cancer spreading to the skin or to lymph nodes in the neck or above the collarbone

Some lung cancers can cause a group of very specific symptoms. These are often described as *syndromes*.

Horner syndrome

Cancers of the top part of the lungs (sometimes called *Pancoast tumors*) can damage a nerve that passes from the upper chest into your neck. This can cause severe shoulder pain. Sometimes these tumors also cause a group of symptoms called *Horner syndrome*:

- Drooping or weakness of one eyelid
- Having a smaller pupil (dark part in the center of the eye) in the same eye
- Reduced or absent sweating on the same side of the face

Conditions other than lung cancer can also cause Horner syndrome.

Superior vena cava syndrome

The superior vena cava (SVC) is a large vein that carries blood from the head and arms back to the heart. It passes next to the upper part of the right lung and the lymph nodes inside the chest. Tumors in this area may press on the SVC, which can cause swelling in the face, neck, arms, and upper chest. It can also cause headaches, dizziness, and a change in consciousness if it affects the brain. While SVC syndrome can develop slowly over time, in some cases it can become life-threatening, and needs to be treated right away.

Paraneoplastic syndromes

Some lung cancers can make hormone-like substances that enter the bloodstream and cause problems with other tissues and organs, even though the cancer has not spread to

those tissues or organs. These problems are called *paraneoplastic syndromes*. Sometimes these syndromes can be the first symptoms of lung cancer. Because the symptoms affect other organs, patients and their doctors at first may suspect that something other than lung cancer is causing them.

The most common paraneoplastic syndromes caused by non-small cell lung cancer are:

- High blood calcium levels, which can cause frequent urination, thirst, constipation, nausea, vomiting, belly pain, weakness, fatigue, dizziness, confusion, and other nervous system problems
- Too much growth of certain bones, like those in the finger tips, which is often painful
- Blood clots
- Breast growth in men

Most of the symptoms listed here are more likely to be caused by something other than lung cancer. Still, if you have any of these problems, you should see a doctor right away.

How is non-small cell lung cancer diagnosed?

If you have symptoms of lung cancer, you should go to your doctor. After asking questions about your health and doing a physical exam, your doctor might want to do some tests if he or she thinks you might have lung cancer:

Imaging tests

There are a number of different tests that can make pictures of the inside of your body. These can be used to find lung cancer, to see if it has spread, to find out whether treatment is working, or to spot a cancer that has come back after treatment.

Chest x-ray

A plain x-ray of your chest is often the first test your doctor will do to look for any spots on the lungs. If the x-ray is normal, you most likely do not have lung cancer. If anything does not look normal the doctor may order more tests.

CT scan (computed tomography)

A CT (or CAT) scan is a special kind of x-ray test that can show a detailed picture of a slice of your body.

A CT scan is more likely to show a lung tumor than a routine chest x-ray. It can also give the doctor precise information about the size, shape, and place of a tumor, or help find enlarged lymph nodes that might contain cancer. CT scans are used to find tumors in the adrenal glands, liver, brain, and other organs, too.

A CT scan can also be used to guide a biopsy needle (see below) right into a place that might have cancer. To have this done, you stay on the CT scanning table while the doctor moves a biopsy needle through the skin and into the mass. A biopsy sample is then removed and looked at under a microscope.

MRI scan (magnetic resonance imaging)

Like CT scans, MRI scans give detailed pictures of soft tissues in the body. But MRI scans use radio waves and strong magnets instead of x-rays. MRI scans are useful in looking for the spread of lung cancer to the brain or spinal cord.

MRI scans take longer than x-rays – often up to an hour. Also, you have to be placed inside a tube-like machine, which upsets some people. Special “open” MRI machines can sometimes help with this if needed.

PET scan (positron emission tomography)

For a PET scan, a form of radioactive sugar is injected into the blood. Cancer cells in the body absorb large amounts of the sugar. A special camera can then spot the radioactivity.

If you appear to have early stage lung cancer, this test can help show if the cancer has spread to nearby lymph nodes or other areas, which can help determine if surgery may be an option for you. This test can also help tell whether an abnormal area on a chest x-ray or CT scan might be cancer.

Special machines combine a CT and a PET scan to even better pinpoint tumors. This is called a PET/CT and is the most common form of PET used for patients with lung cancer.

Bone scan

A bone scan can help show if a cancer has spread to the bones. For this test, a small amount of radioactive substance is put into your vein. The amount used is very low. This substance builds up in areas of bone that may not be normal because of cancer. These will show up on the scan as “hot spots.” While these areas may suggest the spread of cancer, other problems can also cause hot spots.

PET scans, which are often done in people with non-small cell lung cancer, can usually show the spread of cancer to bones, so bone scans aren’t needed very often. Bone scans are done mainly when other test results aren’t clear.

Tests to diagnose lung cancer

The actual diagnosis of non-small cell lung cancer is made by looking at lung cells under a microscope. The cells can be taken from lung secretions (sputum or phlegm), removed from the lung (known as a *biopsy*), or found in fluid removed from the area around the lung. The choice of which tests to use depends on the situation.

Sputum cytology

In this test, a sample of mucus you cough up from the lungs (called *sputum* or *phlegm*) is looked at under a microscope to see if cancer cells are present. This test is more likely to help find cancers that start in the big airways of the lung.

Needle biopsy

For this test, a long, hollow needle is used to remove a sample of cells from the area that may be cancer. If the area is in the outer part of the lungs, the biopsy needle can be inserted through the skin on the chest wall. An imaging test (like a CT scan) is used to guide the needle to the right spot. The sample is looked at in the lab to see if there are cancer cells in it.

A needle biopsy may also be done during a bronchoscopy (see below) to take samples of lymph nodes between the lungs.

Thoracentesis

If fluid has built up around the lungs, this test can be done to check whether it is caused by cancer or by some other medical problem, such as heart failure or an infection. First, the skin is numbed and then a hollow needle is placed between the ribs to drain the fluid. The fluid is checked for cancer cells.

Samples from biopsies or other tests are sent to a lab. There, a doctor looks at the samples under a microscope to find out if they contain cancer and if so, what type of cancer it is. Special tests may be needed to help classify the cancer. Cancers from other organs can spread to the lungs. It's very important to find out where the cancer started, because treatment is different for different types of cancer.

The results of these tests are described in a pathology report, which is usually available within about a week. If you have any questions about your pathology results or any tests, talk to your doctor. For more information on understanding your pathology report, see the Lung Pathology section of our website.

Tests to look for cancer spread in the chest

Bronchoscopy

A lighted, flexible tube (called a bronchoscope) is passed through the mouth or nose and into the larger airways of the lungs. The mouth and throat are sprayed first with a numbing medicine. You may also be given medicine through an intravenous (IV) line to make you feel relaxed. This test can help the doctor see tumors, or it can be used to take samples of tissue or fluids to see if cancer cells are present.

Endobronchial ultrasound

Ultrasound is a test that uses sound waves to make pictures of the inside of your body. For endobronchial ultrasound, a bronchoscope is fitted with an ultrasound device at its tip and is passed down into the windpipe to look at nearby lymph nodes and other structures in the chest. If enlarged lymph nodes are seen on the ultrasound, a hollow needle can be passed through the bronchoscope and guided into the area to take biopsy samples. The samples are then looked at under a microscope to see if cancer cells are present.

Endoscopic esophageal ultrasound

This test is much like an endobronchial ultrasound, except that an endoscope (a lighted, flexible tube) is passed down the throat and into the esophagus (the swallowing tube that connects the mouth to the stomach). This test is done with numbing medicine and drugs to make you sleepy (light sedation).

The esophagus lies just behind the windpipe. Ultrasound images taken from inside the esophagus can help find large lymph nodes inside the chest that might contain lung cancer. If enlarged lymph nodes are seen on the ultrasound, a hollow needle can be passed through the endoscope to get biopsy samples of them. The samples are then looked at under a microscope to see if they contain cancer cells.

Mediastinoscopy and mediastinotomy

Both of these tests let the doctor look at and take samples of the structures in the area between the lungs (called the *mediastinum*). These tests are done in an operating room while you are in a deep sleep (under general anesthesia). The main difference between them is that a mediastinotomy involves a slightly larger cut (incision), a little lower down on the chest.

Thoracoscopy

This test can be done to find out if cancer has spread to the spaces between the lungs and the chest wall, or to the linings of these spaces. It can also be used to sample tumors on

the outer parts of the lungs. It is done in an operating room while you are in a deep sleep (under general anesthesia). The doctor makes a small cut in the skin on the side of the chest and uses a thin, lighted tube connected to a video camera and screen to look at the space between the lungs and the chest wall. Samples of tumor or lymph nodes can be removed and sent to the lab to look for cancer.

Thoracoscopy can also be used as part of the treatment to remove part of a lung in some early-stage lung cancers. This type of operation, known as video-assisted thoracic surgery (VATS), is described in more detail in “Surgery for non-small cell lung cancer.”

Other tests

Blood tests

Blood tests are not used to find lung cancer, but they are done to get a sense of a person’s overall health. A complete blood count (CBC) shows whether your blood has normal numbers of different blood cell types. This test will be done often if you are treated with chemo because these drugs can affect the blood-forming cells of the bone marrow. Other blood tests can spot problems in different organs such as the kidneys, liver, and bones.

Pulmonary function tests

Pulmonary function tests (PFTs) show how well your lungs are working. This is especially important if surgery might be an option in treating the cancer. These tests can give the surgeon an idea if all or part of one of your lungs can be removed or if you are healthy enough for surgery in the first place. For these tests, you breathe in and out through a tube that is connected a machine that measures airflow.

Staging for non-small cell lung cancer

The stage of a cancer describes how far it has spread. This is very important because your treatment and the outlook for your recovery depend largely on the stage of your cancer.

The exams and tests described in “How is non-small cell lung cancer found?” are also used to stage lung cancer.

There are really 2 types of staging.

- The *clinical stage* of the cancer is based on the results of the physical exam, biopsies, and tests like CT scans, chest x-rays, and PET scans.
- If you have surgery, your doctor can also assign a *pathologic stage*. It is based on the same factors as the clinical stage plus what is found as a result of the surgery.

In some cases, the clinical and pathologic stages may be different. For instance, during surgery the doctor may find cancer in a place that did not show up on the tests, which might give the cancer a more advanced pathologic stage.

Because most patients with lung cancer do not have surgery, the clinical stage is used most often.

The system used to stage non-small cell lung cancer is the AJCC (American Joint Committee on Cancer) system. It is based on 3 key pieces of information:

- The size of the main tumor and whether it has grown into nearby areas
- Whether the cancer has reached nearby lymph nodes
- Whether the cancer has spread to other parts of the body

Stages are described using Roman numerals from 0 to IV (0 to 4). Some stages are further divided into A and B. As a rule, the lower the number, the less the cancer has spread. A higher number, such as stage IV (4), means a more advanced cancer.

After looking at your test results, the doctor will tell you the stage of your cancer. Be sure to ask your doctor to explain your stage in a way you understand. This will help you both decide on the best treatment for you.

For more details the staging of lung cancer, see “How is non-small cell lung cancer staged?” in *Lung Cancer (Non-Small Cell)*.

Survival rates for non-small cell lung cancer

Some people with cancer may want to know the survival rates for their type of cancer. Others may not find the numbers helpful, or may even not want to know them. If you decide that you don't want to know them, stop reading here and skip to the next section.

Survival rates are a way for doctors and patients to get a general idea of the outlook for people with a certain type and stage of cancer. The 5-year survival rate refers to the percentage of patients who live *at least* 5 years after their cancer is found. Of course, some patients live much longer than 5 years.

To get 5-year survival rates, doctors look at people who were treated at least 5 years ago. Improvements in treatment since then may result in a better outlook for people now being diagnosed with non-small cell lung cancer.

Stage	5-year observed survival rate*
IA	49%
IB	45%
IIA	30%
IIB	31%
IIIA	14%
IIIB	5%
IV	1%

These numbers are based on data from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database, based on people who were diagnosed with non-small cell lung cancer between 1998 and 2000.

While these numbers provide an overall picture, keep in mind that every person's situation is unique and the statistics can't predict exactly what will happen in your case. Talk with your cancer care team if you have questions about your own chances of a cure, or how long you might survive your cancer. They know your situation best.

How is non-small cell lung cancer treated?

Choosing a treatment plan for non-small cell lung cancer

If you have lung cancer, your treatment choices may include:

- Surgery
- Radiofrequency ablation (RFA)
- Radiation therapy
- Chemotherapy
- Targeted therapy
- Immunotherapy

Palliative treatments are also sometimes helpful.

More than one kind of treatment may be used, depending on the stage of your cancer and other factors.

You may have different types of doctors on your treatment team, depending on the stage of your cancer and your treatment options. These doctors may include:

- A thoracic surgeon: a doctor who treats diseases of the lungs and chest with surgery.
- A radiation oncologist: a doctor who treats cancer with radiation therapy.
- A medical oncologist: a doctor who treats cancer with medicines such as chemotherapy.
- A pulmonologist: a doctor who treats diseases of the lungs.

Many other specialists may be involved in your care as well, including physician assistants, nurse practitioners, nurses, respiratory therapists, social workers, and other health professionals.

Be sure to discuss all of your treatment options as well as their possible side effects with your doctors so you can decide which option is best for you. (See “What are some questions I can ask my doctor about non-small cell lung cancer?”)

Important factors to think about include the stage of the cancer, your overall health, the likely side effects of the treatment, and the chance of curing the disease, extending life, or relieving symptoms. Be sure you understand the risks and side effects of the treatment options before making a decision.

If time allows, it is often a good idea to get a second opinion. This can give you more information and help you feel more confident about the treatment plan you choose.

Thinking about taking part in a clinical trial

Clinical trials are carefully controlled research studies that are done to get a closer look at promising new treatments or procedures. Clinical trials are one way to get state-of-the-art cancer treatment. In some cases they may be the only way to get access to newer treatments. They are also the best way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

If you would like to learn more about clinical trials that might be right for you, start by asking your doctor if your clinic or hospital conducts clinical trials. You can also call our clinical trials matching service at 1-800-303-5691 for a list of studies that meet your medical needs, or see the Clinical Trials section to learn more.

Considering complementary and alternative methods

You may hear about alternative or complementary methods that your doctor hasn't mentioned to treat your cancer or relieve symptoms. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

Complementary methods refer to treatments that are used along with your regular medical care. Alternative treatments are used instead of a doctor's medical treatment. Although some of these methods might be helpful in relieving symptoms or helping you feel better, many have not been proven to work. Some might even be dangerous.

Be sure to talk to your cancer care team about any method you are thinking about using. They can help you learn what is known (or not known) about the method, which can help you make an informed decision. See the Complementary and Alternative Medicine section to learn more.

Help getting through cancer treatment

Your cancer care team will be your first source of information and support, but there are other resources for help when you need it. Hospital- or clinic-based support services are an important part of your care. These might include nursing or social work services, financial aid, nutritional advice, rehab, or spiritual help.

The American Cancer Society also has programs and services – including rides to treatment, lodging, support groups, and more – to help you get through treatment. Call our National Cancer Information Center at 1-800-227-2345 and speak with one of our trained specialists on call 24 hours a day, every day.

The treatment information given here is not official policy of the American Cancer Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor. Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

Surgery for non-small cell lung cancer

Surgery to remove the cancer (often along with other treatments) may be an option for early stage non-small cell lung cancer (NSCLC). If surgery can be done, it offers the best chance of a cure.

Operations used to treat NSCLC involve removing a lung or part of a lung. If the entire lung is removed, it is called a pneumonectomy. Operations to remove part of a lung include lobectomy, segmentectomy, wedge resection, and sleeve resection.

Some doctors now treat some early stage lung cancers near the outside of the lung with a procedure called *video-assisted thoracic surgery* (VATS). Instead of making a big

incision, surgery is done through small holes (incisions) in the skin under the guidance of a tiny camera on the end of a tube that is placed into the chest through a small hole to let the surgeon see the tumor. The doctor who does this surgery should have experience because it takes a great deal of skill.

With any of these operations, nearby lymph nodes are also removed to look for possible spread of the cancer.

The type of operation your doctor suggests depends on the size and place of the tumor and on how well your lungs are working. People whose lungs are healthier can withstand having more of the lung removed. In some cases, if a person's lungs are healthy enough, doctors may want to do a bigger operation because it may offer a better chance to cure the cancer. Some people aren't healthy enough for surgery, and other treatments are used.

Surgery for lung cancer is a major operation, and recovering can take weeks to months. But people whose lungs are in good condition (other than the cancer) can often return to normal activities after some time if a lobe or even a whole lung is removed. If they also have problems such as emphysema or chronic bronchitis (common among heavy smokers), they may have long-term shortness of breath.

More information about these surgeries can be found in the section about surgery in *Lung Cancer (Non-Small Cell)*.

Surgery for lung cancers with limited spread to other organs

If the lung cancer has spread to the brain or adrenal gland and there is only one tumor, you might have the metastasis removed. This surgery would be done only if the tumor in the lung can also be completely removed. Even then, not all lung cancer experts agree with this approach, especially if the tumor is in the adrenal gland.

For tumors in the brain, the surgery is done through a hole in the skull (called a *craniotomy*). It should only be done if the tumor can be removed without harming vital areas of the brain.

For more information about surgery, see *A Guide to Cancer Surgery*.

Radiofrequency ablation (RFA) to treat non-small cell lung cancer

This method might be an option for some small lung tumors that are near the outer edge of the lungs, especially in people who can't have or don't want surgery. RFA uses high-energy radio waves to heat the tumor. A thin, needle-like probe is placed through the skin and moved forward until the end is in the tumor. Once it is in place, an electric current is passed through the probe. It heats the tumor and destroys the cancer cells.

RFA is usually done as an outpatient basis, using numbing medicine (local anesthesia) where the probe is put in. You may also be given medicine to help you relax.

Problems after RFA are not common, but they can include bleeding in the lung or air leaking into the chest space outside of the lung.

Radiation treatment after non-small cell lung cancer

Radiation treatment is the use of high-energy rays (like x-rays) or particles to kill cancer cells or shrink tumors. It can be used as part of the main treatment for a lung cancer and to treat cancer spread.

The radiation may come from outside the body (external radiation) or from radioactive seeds placed into or next to the tumor (brachytherapy).

External beam radiation

In this method, radiation is focused from outside the body on the cancer. This is the type of radiation most often used to treat lung cancer or its spread to other organs.

Before your treatments start, careful measurements will be taken to find the best angles for aiming the radiation beams and the proper dose of radiation. Treatment is much like getting an x-ray, but the radiation dose is stronger. It does not hurt. Each treatment lasts only a few minutes, although the setup time – getting you into place for treatment – usually takes longer. Most often, radiation treatments are given 5 days a week for 5 to 7 weeks, but this depends on why the radiation is being given.

You may hear your doctor talk about newer methods of giving radiation, such as 3D-CRT, IMRT, or stereotactic body radiation therapy. Using these newer methods, doctors are now able to focus the radiation on the tumor much better than they could in the past. This may offer a better chance of success with fewer side effects.

Brachytherapy (internal radiation therapy)

Brachytherapy is sometimes used to shrink tumors to relieve symptoms caused by lung cancer that is blocking an airway. For this type of treatment, the doctor places a small source of radioactive material (often in the form of small pellets) right into the cancer or into the airway next to the cancer. This is usually done through a bronchoscope, although it may also be done during surgery. The pellets are usually removed after a short time. Less often, small radioactive “seeds” are left in place, and the radiation gets weaker over several weeks.

Possible side effects

Side effects of radiation depend on where the radiation is aimed. Some common side effects of radiation to treat lung cancer are:

- Skin problems where the radiation is aimed, such as redness, blistering, and peeling
- Feeling tired
- Nausea and vomiting
- Pain with swallowing and weight loss

These often go away after treatment.

Radiation to the chest can cause long-term damage to the lungs and cause a cough and trouble breathing.

For more information about radiation therapy for lung cancer, see *Lung Cancer (Non-Small Cell)*. More general information about radiation therapy can be found in the Radiation Therapy section of our website.

Chemotherapy for non-small cell lung cancer

Chemotherapy (chemo) is treatment with anti-cancer drugs that are put into a vein or taken by mouth. These drugs enter the bloodstream and go throughout the body, making this treatment useful for cancer anywhere in the body.

Doctors give chemo in cycles, with each round of treatment followed by a break to allow the body time to recover. Chemo cycles generally last about 3 to 4 weeks. (Some chemo drugs, though, are given every day.) Most often, chemo for non-small cell lung cancer uses 2 drugs.

When is chemo used?

- Chemo (sometimes along with radiation) may be used to try to shrink a tumor before surgery.
- Chemo (sometimes along with radiation) may be given after surgery to try to kill any cancer cells that may have been left behind.
- Chemo may be given as the main treatment (sometimes along with radiation) for more advanced cancers or for some people who aren't healthy enough for surgery.

Possible side effects of chemo

Chemo drugs kill cancer cells but they also damage some normal cells, causing side effects. These side effects depend on the type of drugs used, the amount given, and the length of treatment. Some common side effects include:

- Hair loss
- Mouth sores
- Loss of appetite
- Nausea and vomiting
- Diarrhea or constipation
- Increased chance of infections (from having too few white blood cells)
- Easy bruising or bleeding (from having too few blood platelets)
- Feeling tired all the time (from having too few low red blood cells)

Some chemo drugs can have other side effects. For instance, some drugs can damage nerves. This can cause numbness or tingling in the fingers and toes, and sometimes the arms and legs may feel weak. For more information, see *Peripheral Neuropathy Caused by Chemotherapy*.

Most of these side effects go away when treatment is over. If you have any problems with side effects, be sure to tell your doctor or nurse, as there are often ways to help.

For more information about the chemo used to treat lung cancer, see *Lung Cancer (Non-Small Cell)*. For more general information about chemo and dealing with its side effects, see the Chemotherapy section of our website.

Targeted drugs for non-small cell lung cancer

As researchers have learned more about the changes in lung cancer cells that help them grow, they have developed newer drugs that target these changes. These targeted drugs work differently from standard chemotherapy (chemo) drugs. They sometimes work when other cancer drugs don't, and they often have different (and less severe) side effects. At this time, they are most often used for advanced lung cancers, either along with chemo or by themselves. Three major types of targeted drugs are used to treat non-small cell lung cancer (NSCLC):

- **Angiogenesis inhibitors:** These drugs target tumor blood vessel growth. They include bevacizumab (Avastin[®]) and ramucirumab (Cyramza[®]). These drugs can

cause serious bleeding, so they can't be used in patients who are coughing up blood or are taking certain medicines.

- **EGFR inhibitors:** These drugs target a protein that some NSCLC cells have too much of called epidermal growth factor receptor (EGFR). The drugs erlotinib (Tarceva[®]), gefitinib (Iressa[®]) and afatinib (Gilotrif[®]) block EGFR from telling the cell to grow. The most bothersome side effect for many people from these drugs is an acne-like rash on the face and chest, which in some cases can lead to skin infections.
- **ALK inhibitors:** Drugs such as crizotinib (Xalkori[®]) and ceritinib (Zykadia[™]) target the protein made by an abnormal *ALK* gene. These drugs can only help the 5% of NSCLC patients whose cancers have an abnormal *ALK* gene.

For more information on the targeted drugs used to treat NSCLC, see “Targeted therapies for non-small cell lung cancer” in *Lung Cancer (Non-small Cell)*.

For more details about the skin problems that can result from anti-EGFR drugs, see *Targeted Therapy*.

Immunotherapy for non-small cell lung cancer

Immunotherapy is the use of medicines to boost a person's own immune system to recognize and destroy cancer cells. It can be used to treat some forms of non-small cell lung cancer (NSCLC).

Nivolumab (Opdivo) and **pembrolizumab (Keytruda)** are drugs that basically take the brakes off the immune system, which can help boost the body's immune response against cancer cells. This can shrink some tumors or slow their growth.

These drugs can be used in people with certain types of NSCLC whose cancer starts growing again after chemotherapy or other drug treatments.

These drugs can sometimes cause the immune system to attack healthy cells in the body, which can lead to serious side effects. It's very important to tell your doctor or nurse right away about any new side effects you have. If serious side effects do happen, treatment might need to be stopped and you may get other medicines to suppress your immune system.

Palliative treatments for non-small cell lung cancer

Often, patients with lung cancer benefit from treatments that are aimed at relieving symptoms and that are not meant to cure the cancer. These are sometimes called palliative treatments.

Local treatments

At times, local treatments other than surgery or radiation may be used to destroy lung cancer cells that are only in a certain place. These can help very early lung cancers, but are more often used to help relieve symptoms from advanced lung cancers

Photodynamic therapy (PDT)

Photodynamic therapy is sometimes used to treat very early stage lung cancers in airway linings when other treatments aren't a good choice. It may also be used to help open up airways blocked by tumors so a person can breathe better.

To do PDT, a light-activated drug is put into a vein. Over the next couple of days, the drug collects in cancer cells. A bronchoscope (a thin, flexible, lighted tube) is passed down the throat and into the lung. A special laser light on the end of the bronchoscope is aimed at the tumor. The light turns on the drug which causes the cells to die. You may be put into a deep sleep (general anesthesia) for this treatment, or be given medicine to numb your throat (local anesthesia) and sedation. The dead cells are then taken out a few days later during a bronchoscopy. PDT can be repeated if needed.

PDT may cause swelling in the airway for a few days, which may lead to some shortness of breath, as well as coughing up blood or thick mucus. PDT can also make a person very sensitive to sunlight or strong indoor lights for several weeks. To learn more about this treatment, see *Photodynamic Therapy*.

Laser treatment

Lasers can sometimes be used to treat very small lung cancers in the linings of airways. They can also be used to help open up airways blocked by larger tumors to help people breathe better.

You are usually asleep (under general anesthesia) for this type of treatment. The laser is on the end of a bronchoscope, which is passed down the throat and next to the tumor. The doctor then aims the laser beam at the tumor to burn it away. This treatment can usually be done more than once, if needed.

Stent placement

Lung tumors that have grown into an airway can sometimes cause trouble breathing or other problems. To help keep the airway open (often after other treatments such as PDT or laser therapy), a hard plastic or metal tube called a *stent* may be placed in the airway using a bronchoscope.

Treatments to relieve fluid buildup

Sometimes fluid collects in the area between the lung and the ribs. This can press on the lung and make it hard to breathe. This fluid can be taken out through a small tube placed

in the chest. Then either talc or some type of drug can be placed into the chest to help seal the space and prevent future fluid build-up.

Fluid can also collect in the sac around the heart. The fluid can press on the heart so that it doesn't work well. The fluid can be removed with a needle. Then, to keep it from building up again, an operation can be done to put a hole in the sac around the heart that drains the fluid.

More information about these procedures can be found in *Lung Cancer (Non-small Cell)*.

Treating non-small cell lung cancer that keeps growing or comes back after treatment

If cancer keeps on growing during treatment or comes back, further treatment will depend on the extent of the cancer, what treatments have been used, and a person's health and desire for further treatment. You should know the goal of any further treatment – whether it is to try to cure the cancer, to slow its growth, or to help relieve symptoms – as well as the benefits and risks.

At some point, it may become clear that standard treatments are no longer working. If you want to keep on having treatment, you might think about taking part in a clinical trial of newer lung cancer treatments. While these are not always the best option for every person, they may help you as well as future patients.

Even if your lung cancer can't be cured, you should be as free of symptoms as possible. Treatment can often relieve symptoms and may even slow the spread of the disease. Symptoms caused by cancer in the lung airways, such as shortness of breath or coughing up blood, can often be treated with radiation therapy and palliative treatments. Radiation can also be used to help control cancer spread in the brain or relieve pain if cancer has spread.

Many people with lung cancer worry about pain. As the cancer grows near certain nerves it can sometimes cause pain, but this can almost always be treated with pain medicines. Sometimes radiation or other treatments will help, too. It is important that you talk to your doctor and use these treatments to ease any pain.

Deciding on the right time to stop treatment aimed at curing the cancer and focus on care that relieves symptoms is never easy. Good communication with doctors, nurses, family, friends, and clergy can often help people facing this situation.

What are some questions I can ask my doctor about non-small cell lung cancer?

As you cope with cancer and cancer treatment, we encourage you to have honest, open talks with your doctor. Feel free to ask any question that's on your mind, no matter how small it might seem. Here are some questions you might want to ask. Take them with you to your next visit to the doctor. Be sure to add your own questions as you think of them. Nurses, social workers, and other members of the treatment team may also be able to answer many of your questions.

- Would you please write down the exact type of lung cancer I have?
- May I have a copy of my pathology report?
- Where exactly is the cancer? Has it spread beyond the place where it started?
- What is the stage of my cancer? What does that mean in my case?
- Are there other tests that need to be done before we can decide on treatment?
- Are there other doctors I need to see?
- How much experience do you have treating this type of cancer?
- What treatment choices do I have?
- What do you suggest and why?
- What is the goal of this treatment?
- How long will treatment last? What will it involve? Where will it be done?
- How quickly do we need to decide on treatment?
- What are the chances my cancer can be cured with these options?
- What risks or side effects are there to the treatment you suggest? How long are they likely to last?
- What type of follow-up will I need after treatment?
- What are the chances of the cancer coming back after treatment? What would we do if that happens?
- What should I do to get ready for treatment?

Along with these sample questions, be sure to write down some of your own.

Moving on after treatment for non-small cell lung cancer

For some people with lung cancer, treatment may remove or destroy the cancer. It can feel good to be done with treatment, but it can also be stressful. You may find that you now worry about the cancer coming back. This is a very common concern among those who have had cancer. (When cancer comes back, it is called a *recurrence*.)

It may take a while before your recovery begins to feel real and your fears are somewhat relieved. You can learn more about what to look for and how to learn to live with the chance of cancer coming back in *Living With Uncertainty: The Fear of Cancer Recurrence*.

But for some people, the lung cancer may never go away completely. These people may get regular treatments with chemotherapy, radiation, or other types of treatments to help keep the cancer in check. Learning to live with cancer more like a chronic disease can be hard and stressful. It has its own type of uncertainty. See *When Cancer Doesn't Go Away* for more about this.

Follow-up care

If you have finished treatment, it is very important to keep all follow-up appointments. During these visits, your doctors will ask about symptoms, do physical exams, and may order blood tests or imaging tests, such as CT scans or x-rays.

Follow-up is needed to check for signs that the cancer has come back or spread, as well as possible side effects of certain treatments. Almost any cancer treatment can have side effects. Some may last for a few weeks or months, but others can be permanent. Please tell your cancer care team about any symptoms or side effects that bother you so they can help you manage them. Use this time to ask your health care team questions and discuss any concerns you might have.

If your cancer comes back, treatment will depend on the location of the cancer and what treatments you've had before. Further treatment may involve surgery, radiation, chemo, targeted therapy, or some combination of these. Should your cancer come back, see *When Your Cancer Comes Back: Cancer Recurrence* for information on how to manage and cope with this phase of your treatment.

It is also important to keep health insurance. While you hope your cancer won't come back, it could happen. If it does, you don't want to have to worry about paying for treatment.

Seeing a new doctor

At some point after your cancer is found and treated, you may find yourself in the office of a new doctor. It is important that you be able to give your new doctor the exact details of your diagnosis and treatment. Gathering these details soon after treatment may be easier than trying to get them at some point in the future. Make sure you have this information handy and always keep copies for yourself:

- A copy of your pathology report from any biopsy or surgery
- If you had surgery, a copy of your operative report
- If you stayed in the hospital, a copy of the discharge summary that the doctor wrote when you were sent home
- If you had radiation treatment, a copy of the treatment summary
- If you had chemo or targeted therapies, a list of your drugs, drug doses, and when you took them
- Copies of your x-rays, CT scans, and other imaging tests (these can often be stored digitally on a DVD, etc.)

Lifestyle changes after treatment for non-small cell lung cancer

You can't change the fact that you have had cancer. What you can change is how you live the rest of your life – making choices to help you stay healthy and feel as well as you can. This can be a time to look at your life in new ways. Maybe you are thinking about how to improve your health over the long term. Some people even start during cancer treatment.

Make healthier choices

For many people, a diagnosis of cancer helps them focus on their health in ways they may not have thought much about in the past. Are there things you could do that might make you healthier? Maybe you could try to eat better or get more exercise. Maybe you could cut down on alcohol, or give up tobacco. Even things like keeping your stress level under control may help. Now is a good time to think about making changes that can have positive effects for the rest of your life. You will feel better and you will also be healthier.

You can start by working on those things that worry you most. Get help with those that are harder for you. If you smoke, one of the most important things you can do to improve your chances for treatment success is to quit. Studies have shown that patients who stop smoking after a diagnosis of lung cancer have better outcomes than those who don't. If

you are thinking about quitting smoking and need help, call the American Cancer Society at 1-800-227-2345.

Eating better

Eating right is hard for many people, but it can be even harder to do during and after cancer treatment. If treatment caused weight changes or eating or taste problems, do the best you can and keep in mind that these problems usually get better over time. You may find it helps to eat small portions every 2 to 3 hours until you feel better. You may also want to ask your cancer team about seeing a dietitian, an expert in nutrition who can give you ideas on how to deal with these treatment side effects.

One of the best things you can do after treatment is to put healthy eating habits into place. You may be surprised at the long-term benefits of some simple changes. Getting to and staying at a healthy weight, eating a healthy diet, and limiting your alcohol intake may lower your risk for a some other cancers, as well as having many other health benefits. Get more information in *Nutrition and Physical Activity During and After Cancer Treatment: Answers to Common Questions*.

Rest, fatigue, and exercise

Feeling tired (fatigue) is a very common problem during and after cancer treatment. This is not a normal type of tiredness but a bone-weary exhaustion that often doesn't get better with rest. For some people, fatigue lasts a long time after treatment and can keep them from staying active. But exercise can actually help reduce fatigue and the sense of depression that sometimes comes with feeling so tired.

If you are very tired, though, you will need to balance activity with rest. It is OK to rest when you need to. For more information on fatigue and other side effects, see the Physical Side Effects section of our website.)

If you were very ill or weren't able to do much during treatment, it is normal that your fitness, staying power, and muscle strength declined. You need to find an exercise plan that fits your own needs. Talk with your health care team before starting. Get their input on your exercise plans. Then try to get an exercise buddy so that you're not doing it alone.

Exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- It makes your muscles stronger.
- It reduces fatigue.
- It can help lower anxiety and depression.
- It can help you feel better about yourself.

Long term, we know that getting regular physical activity plays a role in helping to lower the risk of some cancers, as well as having other health benefits.

Can I lower my risk of the cancer growing or coming back?

Most people want to know if there are lifestyle changes they can make to reduce their risk of cancer growing or coming back. Unfortunately, for most cancers there is little solid evidence to guide people. This doesn't mean that nothing will help – it's just that for the most part this is an area that hasn't been well studied. Most studies have looked at lifestyle changes as ways of preventing cancer in the first place, not slowing it down or keeping it from coming back.

But there are some things people can do that might help them live longer or reduce the risk of lung cancer coming back.

Quitting smoking: If you smoke, quitting is important. Quitting has been shown to help people with lung cancer live longer, even when the cancer has spread. It also lowers the chance of getting another lung cancer, which is especially important for people with early stage lung cancer. Of course, quitting smoking may have other health benefits as well, such as lowering the risk of some other cancers. If you need help quitting, talk to your doctor or call the American Cancer Society at 1-800-227-2345.

Diet and nutrition: The possible link between diet and lung cancer growing or coming back is much less clear. Some studies suggest that people with early stage lung cancer who have higher vitamin D levels might have better outcomes, but so far no study has shown that taking extra vitamin D (as a supplement) helps. On the other hand, studies have found that beta carotene supplements may in fact *increase* the risk of lung cancer in smokers. Because of the lack of data in this area, it's important to talk with your health care team before making any major changes in your diet (including taking any supplements) to try to improve your outlook.

How might having non-small cell lung cancer affect your emotional health?

During and after treatment, you may find yourself overcome with many different emotions. This happens to a lot of people. You may find that you think about the effect of your cancer on your family, friends, and career. Money may be a concern as the medical bills pile up. Unexpected issues may also cause concern – for instance, as you get better and need fewer doctor visits, you will see your health care team less often. This can be hard for some people.

This is a good time to look for emotional and social support. You need people you can turn to. Support can come in many forms: family, friends, cancer support groups, church or spiritual groups, online support communities, or private counselors.

The cancer journey can feel very lonely. You don't need to go it alone. Your friends and family may feel shut out if you decide not to include them. Let them in – and let in anyone else who you feel may help. If you aren't sure who can help, call your American Cancer Society at 1-800-227-2345 and we can put you in touch with a group or resource that may work for you. You can also read *Distress in People with Cancer* or see the Emotional Side Effects section of our website for more information.

What happens if treatment for non-small cell lung cancer stops working

When a person has had many different treatments and the cancer has not been cured, over time the cancer tends to resist all treatment. At this time you may have to weigh the possible benefits of a new treatment against the downsides, like treatment side effects and clinic visits.

This is likely to be the hardest time in your battle with cancer – when you have tried everything within reason and it's just not working anymore. Your doctor may offer you new treatment, but you will need to talk about whether the treatment is likely to improve your health or change your outlook for survival.

If you want to keep on getting treatment for as long as you can, you need to think about the odds of treatment having any benefit and how this compares to the possible risks and side effects. In many cases, your doctor can tell you how likely it is the cancer will respond to treatment you are thinking about. For instance, the doctor may say that more treatment might have about a 1 in 100 chance of working. Some people are still tempted to try this. But it is important to have realistic expectations if you do choose this plan.

No matter what you decide to do, it is important for you to feel as good as possible. Make sure you are asking for and getting treatment for pain, nausea, or any other problems you may have. This type of treatment is called *palliative* treatment. It helps relieve symptoms but is not meant to cure the cancer.

At some point you may want to think about hospice care. This is special care that treats the person rather than the disease; it focuses on quality rather than length of life. Most of the time it is given at home. You should know that having hospice care doesn't mean you can't have treatment for the problems caused by your cancer or other health issues. It just means that the purpose of your care is to help you live life as fully as possible and to feel as well as you can. You can learn more about this in *Hospice Care*.

Staying hopeful is important, too. Your hope for a cure may not be as bright, but there is still hope for good times with family and friends – times that are filled with joy and meaning. Pausing at this time in your cancer treatment gives you a chance to focus on the most important things in your life. Now is the time to do some things you've always wanted to do and to stop doing the things you no longer want to do. Though the cancer may be beyond your control, there are still choices you can make.

What's new in non-small cell lung cancer research?

Lung cancer research is going on now in many medical centers around the world.

Prevention

Prevention offers the greatest promise at this time for fighting lung cancer.

Tobacco: Smoking still accounts for almost 9 out of 10 lung cancer deaths. Studies are going on to look at how best to help people quit smoking through counseling, nicotine replacement, and other medicines. Other studies are looking at ways to convince young people not to start smoking. Still others are focused on gene changes that make some people much more likely to get lung cancer if they smoke or are exposed to someone else's smoke.

Environmental causes: Researchers also continue to look into some of the other causes of lung cancer, such as exposure to radon and diesel exhaust. Finding new ways to limit these exposures could potentially save many more lives.

Diet, nutrition, and medicines: Research continues to test ways to prevent lung cancer in people at high risk by using vitamins or medicines. So far, these have not proved to help. Many researchers think that simply following the American Cancer Society's advice about diet (staying at a healthy weight and eating a diet rich in fruits and vegetables) may be the best approach.

Finding lung cancer

As mentioned in the section "Can non-small cell lung cancer be found early?" a large study called the National Lung Screening Trial (NLST) found that low-dose CT scanning in people at high risk of lung cancer (due to smoking history) lowered the risk of death from lung cancer when compared to chest x-rays. This finding has led to the development of screening guidelines for lung cancer.

Another approach uses newer ways to look for cancer cells in sputum samples. Researchers have found many changes that often affect the DNA of lung cancer cells. New tests might be able to spot these changes and find lung cancer at an earlier stage.

Fluorescence bronchoscopy is a method that may help doctors find some lung cancers earlier, when they may be easier to treat. For this test, the doctor inserts a bronchoscope through the mouth or nose and into the lungs. The end of the bronchoscope has a special fluorescent light on it, instead of a normal (white) light. The light causes abnormal areas in the airways to show up in a different color than healthy parts of the airway. Some

cancer centers now use this technique to look for early lung cancers, especially if there are no obvious tumors seen with normal bronchoscopy.

An imaging test called *virtual bronchoscopy* uses CT scans to make detailed 3-D pictures of the airways in the lung. The pictures can be looked at as if the doctor were really using a bronchoscope. There are benefits and drawbacks to this approach. But it can be a useful tool in some cases, such as in people who might be too sick to get a standard bronchoscopy. This test will likely be used more as the technology improves.

Treatment

Surgery

Doctors now use video-assisted thoracic surgery (VATS) to treat some small lung tumors. It lets doctors remove parts of the lung through smaller cuts, which can lead to shorter hospital stays and less pain. Doctors are now studying whether it can be used for larger lung tumors.

In a newer approach, the doctor sits at a special control panel inside the operating room to move long surgical instruments using robotic arms. This approach, known as *robotic-assisted surgery*, is now being tested in some larger cancer centers.

Chemotherapy

Doctors are looking at newer ways of combining chemotherapy (chemo) drugs in the hope of causing fewer side effects. Studies are testing the best ways to combine chemo with radiation and other treatments.

Doctors know that chemo after surgery may be more helpful for some people with early cancers than for others, but figuring out which patients to give it to is not easy. In early studies, newer lab tests that look at patterns of certain genes in the cancer cells have shown promise in telling which people might be helped the most. Other lab tests may help predict whether a lung cancer will respond to certain chemo drugs. More studies of these tests are now being done.

Some recent studies have found that with cancers that have not progressed during chemo, continuing treatment beyond the usual 4 to 6 cycles with a single drug may help some people live longer. This is known as *maintenance therapy*. Some doctors now recommend maintenance therapy, while others wait for further research on this topic.

Targeted drugs

We are learning more about the inner workings of lung cancer cells that control how they grow and spread. This is being used to develop new targeted drugs. Some of these

treatments are already being used to treat non-small cell lung cancer. Others are being tested in clinical trials to see if they can help people with advanced lung cancer live longer or relieve their symptoms.

Researchers are also working on lab tests to help predict which patients will respond to which drugs. Studies have found that some patients do not benefit from certain targeted drugs, whereas others are more likely to have their tumors shrink quite a bit. Being able to tell who might respond could save some people from trying treatments that are unlikely to work for them and which could cause side effects.

Immune treatments

Researchers are studying drugs that can help the body's immune system fight the cancer.

More information about non-small cell lung cancer

We have a lot more information that you might find helpful. Explore www.cancer.org or call our National Cancer Information Center toll-free number, 1-800-227-2345. We're here to help you any time, day or night.

National organizations and websites*

Along with the American Cancer Society, other sources of information and support include:

American Lung Association

Toll-free number: 1-800-LUNGUSA (1-800-586-4872)

Website: www.lungusa.org

Lungcancer.org

Toll-free number: 1-800-813-HOPE (1-800-813-4673)

Website: www.lungcancer.org

Lung Cancer Alliance

Toll-free number: 1-800-298-2436

Website: www.lungcanceralliance.org

National Cancer Institute

Toll-free number: 1-800-4-CANCER (1-800-422-6237)

Website: www.cancer.gov

** Inclusion on this list does not imply endorsement by the American Cancer Society.*

No matter who you are, we can help. Contact us anytime, day or night, for cancer-related information and support. Call us at **1-800-227-2345** or visit www.cancer.org.

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For additional assistance please contact your American Cancer Society
1-800-227-2345 or www.cancer.org