

Chemicals, Cancer, and You

There are many risk factors for cancer: age, family history, viruses and bacteria, lifestyle (behaviors), and contact with (touching, eating, drinking, or breathing) harmful substances. More than 100,000 chemicals are used by Americans, and about 1,000 new chemicals are introduced each year. These chemicals are found in everyday items, such as foods, personal products, packaging, prescription drugs, and household and lawn care products. While some chemicals can be harmful, not all contact with chemicals is dangerous to your health.

This booklet will discuss the link between contact with harmful chemicals, cancer, and you. It will explain risk factors (things that make you likelier to get cancer), how cancer develops, and how contact with (exposure to) chemicals affects your body. We hope this booklet will help you understand the relationship between chemicals, cancer, and you.



Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation



Chemicals, Cancer, and You

Some factors that increase your risk of developing cancer include behaviors such as smoking, heavy alcohol consumption, on-the-job exposure to chemicals, radiation and sun exposure, and some viruses and bacteria. When all these risks are considered together, the role of chemical exposures in causing cancer is small and, as of now, not very clear. Scientists know very little about how contact with most chemicals causes cancer.

Substances known to cause cancer are called carcinogens. Coming into contact with a carcinogen does not mean you will get cancer. It depends on what you were exposed to, how often you were exposed, and how much you were exposed to, among other things.

An early link between cancer and a chemical was found in the late 1700s. An English physician noted that a large number of chimney sweeps had cancer of the scrotum due to exposure to soot, which contains chemicals known as polycyclic aromatic hydrocarbons. Since then, many more chemicals have been identified as known or suspected causes of cancer. Today, much of what we know about chemicals causing cancer in humans we have learned from workers exposed at their jobs.

Examples of Known Human Carcinogens

- *Asbestos*
- *Arsenic*
- *Benzene*
- *Beryllium*
- *Vinyl chloride*

Examples of Possible Human Carcinogens

- *Chloroform*
- *DDT*



What Is Cancer?

The cell is the basic building block of all living things. All cells normally grow and divide (multiply) to replace old cells to keep the body healthy. A cell becomes cancerous when it grows quickly and uncontrollably. In most cancers, this process leads to the growth of tumors. A tumor is an abnormal growth of tissue resulting from uncontrolled cell growth.

Tumors are either benign or malignant. Benign tumors are not cancer. Cells from benign tumors do not spread to other parts of the body. Benign tumors are not usually life threatening.

Malignant tumors are cancer. Cancer cells can spread to other tissues and organs near the tumor. They can also spread to other sites in the body through the bloodstream or lymphatic system. This spreading is called metastasis.

People of all ages get cancer, but it is most common in people older than 55. One of every three people will get cancer at some point in his/her life.

Though we know more about some cancers than others, in most cases we don't know why or how a normal cell changes into a cancer cell. We do know that changes occur in a series of steps, which usually takes a long time. The time from the first cell change to the time the cancer is detected is called the latency period.



Understanding which chemicals cause which cancers is one of our greatest scientific challenges. People are exposed to trace amounts of many chemicals every day. These everyday exposures are usually too small to cause health problems.

Exposure to chemicals in the outdoors, at home, and at work may add to your chances of getting cancer. Certain chemicals, including benzene, beryllium, asbestos, vinyl chloride, and arsenic are known human carcinogens, meaning they have been found to cause cancer in humans. A person's risk of developing cancer depends on how much, how long, how often, and when they are exposed to these chemicals. When you are exposed is important because a small exposure in the womb, for example, may be more serious than a small exposure as an adult. The genes that you inherit from your parents also play a role.

Some chemicals are known to cause cancer in animals, but they have not been proven to cause cancer in humans. These chemicals are reasonably anticipated to cause cancer in humans and are sometimes called possible human carcinogens. Chloroform, DDT, formaldehyde, and polychlorinated biphenyls (PCBs) are examples of possible human carcinogens.

Getting cancer from a chemical depends on the following:

- the kind of chemical you were exposed to,
- how much of the chemical you were in contact with,
- how long the contact lasted,
- how often you were exposed,
- when you were exposed,
- how you were exposed, and
- your general health.

Exposure at Work



Though everyday exposures to chemicals are usually too low to cause harmful health problems, exposure in the workplace can be more serious. Chemical exposures in the workplace can happen at high levels and over long periods of time. That is why some jobs require that employees wear protective clothing and equipment and/or respirators. Companies are supposed to notify their employees of a potential danger to their health. Remember, exposure to harmful substances in the workplace can be very different from exposure in other settings.

Cancers Associated with Various Occupations or Occupational Exposure

Cancer	Substances or Processes
Lung	Arsenic, asbestos, cadmium, coke oven fumes, chromium compounds, coal gasification, nickel refining, foundry substances, radon, soot, tars, oils, silica
Bladder	Aluminum production, rubber industry, leather industry, 4-aminobiphenyl, benzidine
Nasal cavity and sinuses	Formaldehyde, isopropyl alcohol manufacture, mustard gas, nickel refining, leather dust, wood dust
Larynx	Asbestos, isopropyl alcohol, mustard gas
Pharynx	Formaldehyde, mustard gas
Mesothelioma	Asbestos
Lymphatic and hematopoietic	Benzene, ethylene oxide, herbicides, x-radiation system
Skin	Arsenic, coal tars, mineral oils, sunlight
Soft-tissue sarcoma	Chlorophenols, chlorophenoxy herbicides
Liver	Arsenic, vinyl chloride
Lip	Sunlight

Sources: American Cancer Society Fact Sheet "Occupation and Cancer"; International Agency for Research on Cancer.

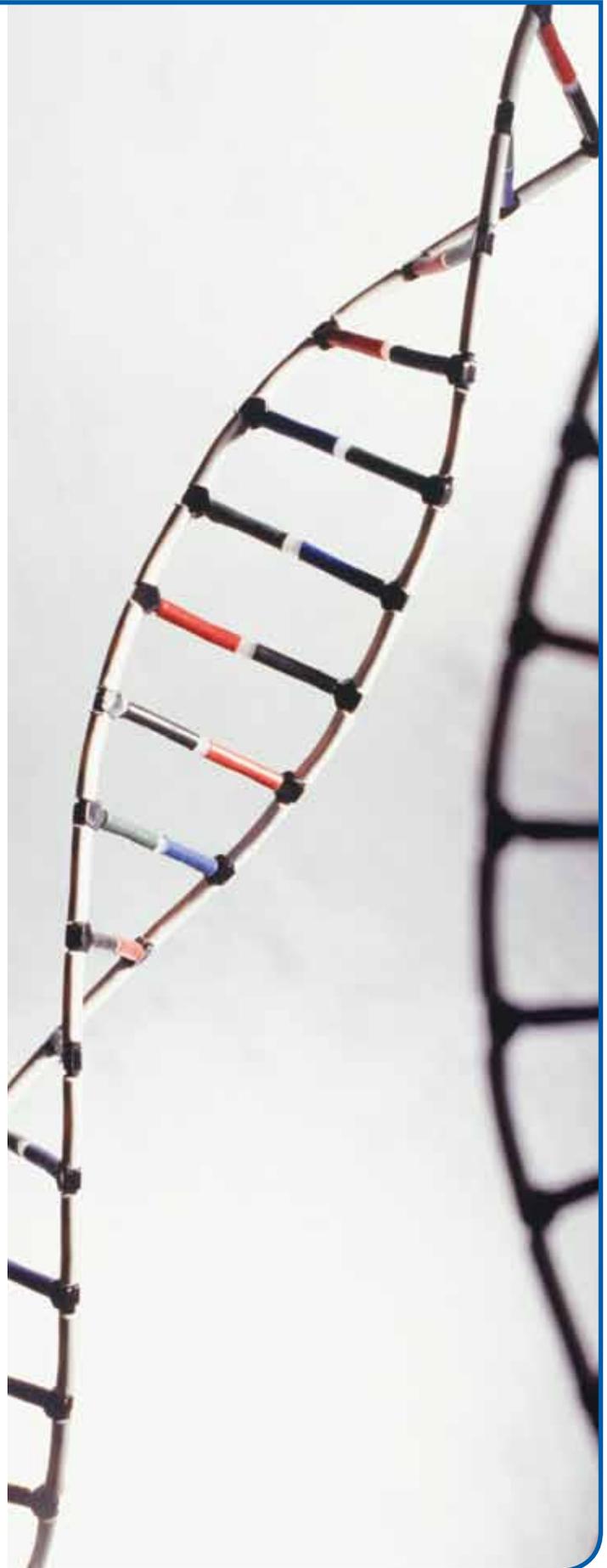
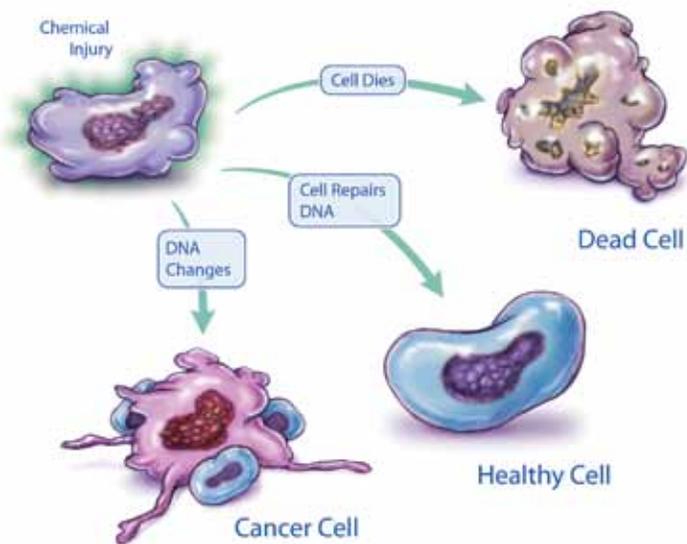
How Chemical Exposure Affects the Body

The human body has defenses to guard against all sorts of harms, including those that may lead to cancer. When something enters your body, it often goes through a process that allows the body to more easily use or get rid of it. This process is called metabolism. Depending on how a chemical is processed, or metabolized, in your body, three types of carcinogens exist:

1. chemicals that can cause cancer (direct acting carcinogens),
2. chemicals that do not cause cancer unless they are changed when they are metabolized (procarcinogens), and
3. chemicals that do not cause cancer by themselves but can act with another chemical to cause cancer (cocarcinogens).

Damage to DNA in cells can lead to cancer. However, cells can often repair DNA damage. If the damage is extreme, the cells may die. Unrepaired DNA damage can lead to mutations, or changes, in genes, and mutations in certain genes can cause cancer. You can also inherit mutations. Because cancer has a long latency period, determining which exposure, if any, may have led to a mutation is difficult. We, therefore, know very little about specific causes of cancers.

How Cells Respond to Chemical Injuries



Cancer Clusters

Because many cancers are common diseases, they occur quite often in communities. We expect to find several cases of cancer in any given neighborhood or workplace. Because most cancers are tracked in national databases, we have a good idea of how many cases to expect in a certain area over a certain amount of time. However, multiple cases of cancer in a neighborhood can cause a great deal of concern to residents. People may suspect there is a cancer cluster in their community if several people have cancer. They may also suspect something in the environment is the cause.

A cancer cluster is when more people have the same type of cancer or related cancers within a specific geographic area than would normally be expected over a certain time period. However, what appears to be a cluster may actually reflect the expected number of cancer cases within the group or area, or it may be due to chance alone. Clusters may be suspected if the cancer found is normally rare. For example, mesothelioma is found only in people who have been exposed to asbestos, therefore many cases of mesothelioma were found in communities with asbestos exposure.

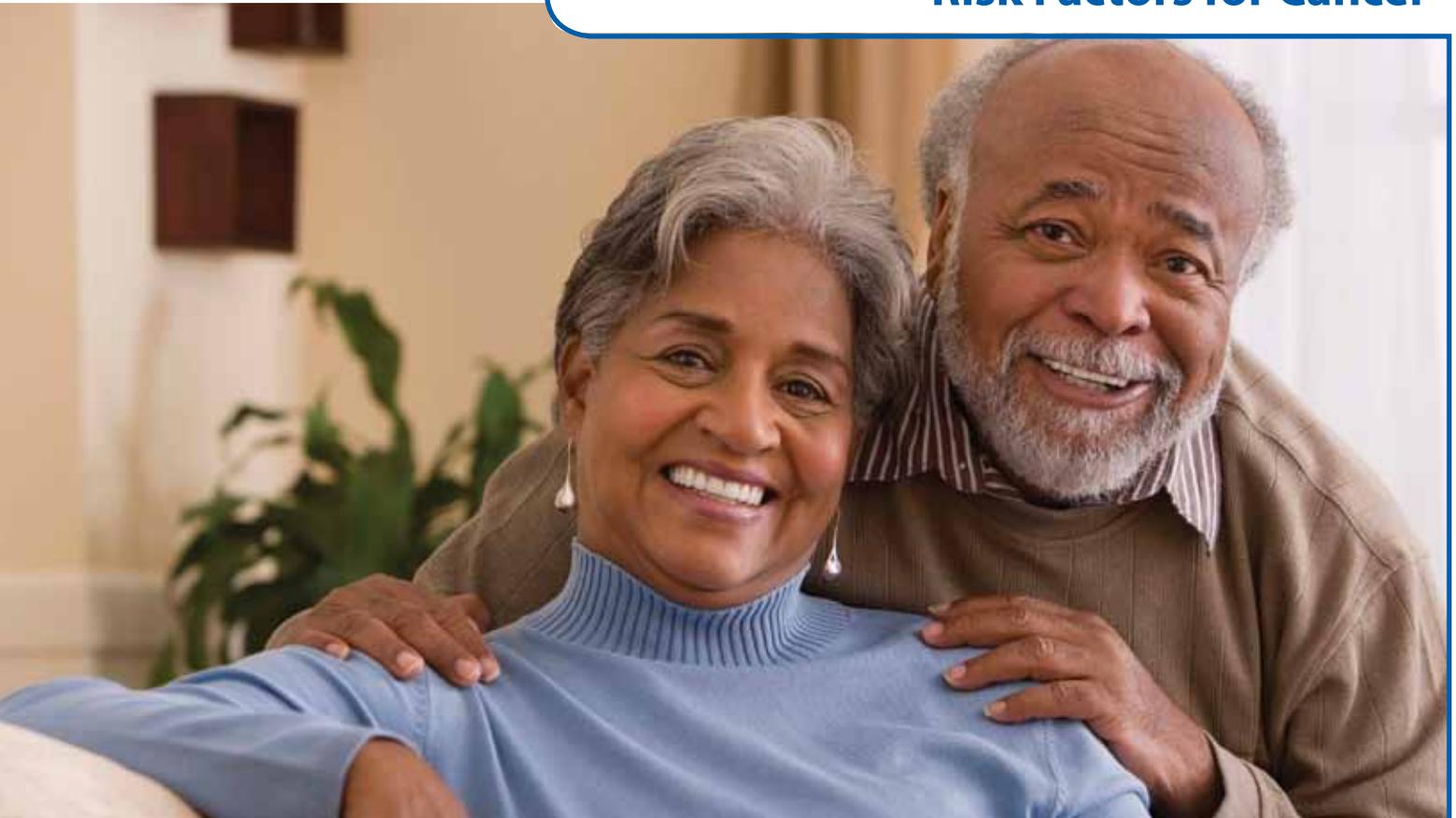
Cancer clusters are rare, especially those that are linked to an environmental exposure. When a group of cancers is linked to an environmental exposure, it is usually because of the following conditions:

- Many more cases than expected of one specific type of cancer or related cancers have been found.
- The cancer is found in an age group in which it is not usually found.
- The type of cancer is rare.
- Scientific evidence supports the link between the chemical in question and cancer.

Identifying just how much of a cancer-causing substance a community has been exposed to is challenging. For example, many hazardous waste sites contain more than one chemical, which makes relating health outcomes to a single chemical exposure difficult.

Remember that not all chemicals are harmful. Also, just because a chemical is in the environment near where you live or work does not mean that it has entered your body. To learn more about cancer clusters, environmental health concerns, and toxic chemicals where you live or work, go to <http://www.cancer.gov/cancertopics/factsheet/risk/clusters/>.





More than 200 types of cancer have been identified. Many risk factors—such as age, genetics, or lifestyle choices—can add to your chance of getting cancer. Cancer is usually not caused by only one risk factor but by several of them. The more risk factors you have, the higher your risk of getting cancer.

The most important risk factors are

- **age:** Although people of all ages can get cancer, older people are at greater risk.
- **genetics:** Your family history may put you at risk for cancer. If you or someone in your family had a certain type of cancer, you may be more at risk for that type of cancer. Genetics play a large role for many cancers, such as breast cancer and colon cancer.
- **behaviors:** Tobacco use and exposure to the sun or other sources of UV radiation are risk factors for cancer. Other lifestyle choices that might affect your chances of getting cancer include a poor diet, lack of exercise, or heavy drinking.
- **viruses or bacteria:** Some cancers are caused by a virus or bacteria. Some viruses linked to cancer are the human papillomavirus (HPV), which causes cervical cancer; hepatitis B and C viruses, which can cause liver cancer; and the Epstein-Barr virus, which may cause a type of lymphoma. Also, the *H. pylori* bacterium can cause gastric cancer.
- **exposure to chemicals:** As we have discussed, being exposed to chemicals may also be a risk factor.

Behavioral Risk Factors

The personal choices you make about the way you live can decrease your risk of getting cancer. These include avoiding tobacco use and exposure to secondhand smoke, limiting alcohol consumption, limiting your exposure to sunlight and tanning beds, protecting yourself from viruses spread through sexual contact, maintaining a healthy body weight, and exercising regularly.

Tobacco

Thirty percent of all cancers are caused by smoking or chewing tobacco. Cigarette, cigar, and pipe smoking can cause cancers of the lung, mouth, throat, larynx (voice box), esophagus, pancreas, kidney, bladder, stomach, and cervix, as well as acute myeloid leukemia. You should also avoid exposure to secondhand smoke, which causes lung cancer in nonsmoking adults and may increase the risk of other cancers in adults and children.

Diet & Exercise

Maintain a healthy body weight and live an active lifestyle. Obesity is associated with an increased risk of cancers of the breast, colon, kidney, and esophagus. Physical activity may also lower your risk for some cancers, including cancers of the colon and breast. See <http://www.cdc.gov/nccdphp/dnpao/index.html> to learn more about nutrition, physical activity, and obesity.

Sexual Behavior

Cervical, vaginal, and other genital cancers are caused by certain types of HPV. Genital HPV spreads through sexual contact, but condoms may reduce your risk of getting HPV. Vaccines can prevent infections with some but not all cancer-causing HPV types.

Alcohol

If you overuse alcohol, you may be putting yourself at risk for cancer. Long-term alcohol misuse is associated with cancers of the mouth, throat, esophagus, liver, colon, and breast.

Medical Tests and Treatments

Certain medical tests, such as certain types of imaging scans, can increase your risk of cancer. Hormones and hormone-related drugs, such as menopausal hormone therapy, may increase the risk of breast or uterine cancer in women. Even some treatments used to fight cancer, including drugs and radiation, have been shown to increase the patient's chance of a second occurrence of cancer. Talk to your doctor about the risks and benefits of medical tests and treatments.

Exposure at Work

Workers in current or former jobs at high risk for cancer include uranium miners, asbestos workers, shipbuilders, certain factory and chemical plant workers, and workers in nuclear industries. Workers can also bring home contamination on their clothing, shoes, or skin, which can potentially put others who share a home or car at risk. Visit <http://www.cdc.gov/niosh/> for more information on workplace safety.

Pollution & Exposure to Chemicals

Exposure to some chemicals and hazardous substances can increase the risk of cancer. A few well-known carcinogens are asbestos, nickel, cadmium, radon, vinyl chloride, benzidine, and benzene. These carcinogens may act alone or with another carcinogen to increase your risk. For example, asbestos workers who also smoke have a higher risk of lung cancer. Visit <http://www.atsdr.cdc.gov/> for more information on specific chemicals and your health.



Finding Cancer



More people are surviving cancer because of early detection and prompt and more effective treatment. Screening means checking your body for cancer before you have symptoms. Getting screening tests regularly may find some breast, cervical, and colorectal cancers early, when treatment may work best.

Tools for finding or diagnosing cancer include

- biopsy—a doctor removes tissue, which is looked at under a microscope;
- ultrasound—using reflected high-frequency sound waves to examine tissues of the body;
- X-ray—producing an image by passing x-rays through the body;
- computed tomography (CT)—using x-rays to produce a cross-sectional picture of body parts; and
- magnetic resonance imaging (MRI)—the use of magnetic fields and radio waves to show changes in soft tissues without the use of x-rays.

Ultrasound, X-ray, CT, and MRI are all painless and noninvasive; however, having too many CTs and/or x-rays can increase your risk of developing cancer because they expose you to radiation. In most cases the benefits outweigh the risks.

Mammograms are an example of how X-rays can be used to detect cancer. Other tools for finding and diagnosing cancer or abnormal cells that may become cancer include Pap tests, which look for abnormal cervical cells; HPV DNA tests, which look for DNA from cancer-causing HPV types in cervical cells; fecal occult blood tests (FOBT), which check for blood in the stool; sigmoidoscopy, which examines the lower colon; and colonoscopy, which examines the entire colon.

Some people choose to do self-exams, such as feeling around their breasts or testicles for new lumps or looking over their skin. Talk to your doctor if you notice anything unusual.

Cancer and Children

Why a child develops cancer is especially difficult to understand and accept. The most common cancers in children are leukemia, brain tumors, and lymphomas. Nearly 1 in every 450 children will be diagnosed with cancer before the age of 15 years.

The cause of most childhood cancers is unknown. Unlike cancers found in adults, childhood cancers are usually not related to lifestyle risk factors. Genetic predisposition (family history), radiation exposure, viruses and diseases, prenatal health problems, and chemical exposure are some of the factors linked to childhood cancers. Some scientists believe that mutated cells in a child's rapidly growing body divide before the cells can repair their DNA. This may contribute to the development of childhood cancer.

Finding Cancer in Children

Cancers in children are often hard to find. Parents should take their children to the doctor regularly and be alert to any changes in their health and energy levels, especially changes that last for a long time. Telling your doctor about any unusual signs or symptoms is important.

Some unusual signs or symptoms are

- new lumps or swelling;
- unexplained paleness;
- loss of energy;
- long-lasting pain or limping;
- long-lasting, unexplained fever or sickness;
- frequent headaches, often with vomiting;
- sudden eye or eyesight changes; and
- rapid extreme weight loss.



Recommendations



Though we do not fully understand why one person gets cancer and another doesn't, we do know that you can take steps to reduce your risk or find cancers early.

- Protect yourself from the sun's rays, especially if you burn easily. Use sunscreen and wear protective clothing.
- Maintain a healthy body weight and stay active.
- Don't use tobacco and avoid smoke from others.
- Go to a doctor or health professional regularly.
- Women should start having regular Pap tests beginning about 3 years after they begin to have sexual intercourse, but no later than age 21.
 - » Women should have mammograms every 1 to 2 years beginning at age 40. If you are at especially high risk of developing breast cancer, your doctor may suggest beginning screening earlier.
 - » People should start colorectal cancer screening at age 50, unless they are at high risk of this disease and their doctor suggests screening earlier. You should talk with your doctor about which tests to have.
 - » Adolescent girls should be vaccinated against infection with HPV.
 - » Everyone should be vaccinated against hepatitis B virus to prevent liver cancer.
- Be aware of the chemicals in the products you buy for your home—you can check for harmful ingredients at <http://householdproducts.nlm.nih.gov/>. You can wear a mask, gloves, or other protective clothing to reduce your exposure to household chemicals.
- Read product labels and follow the directions carefully.
- Store household chemicals, such as cleaners, paints/finishes, degreasers, and strippers, safely and prevent chemicals from spilling, leaking, and coming into contact with children and pets.
- Use chemicals in well-ventilated rooms or use them outside.
- Check your home for high levels of radon.
- Be aware of chemicals you are exposed to on the job. Wear personal protective equipment if asked to.

Summary



Cancer is a common disease. Many people worry that exposures in their environment may cause cancer. In the United States, millions of people live with cancer or will get cancer during their lifetimes.

Some environmental risk factors that cause cancer include pollution, tobacco smoke, exposure at work to chemicals, and radiation in our homes and workplace.

The risk of getting some types of cancer may be reduced by changes in a person's lifestyle. Some examples of cancer-preventing behaviors include not smoking, avoiding smoke from others, maintaining a healthy weight, exercising, and being careful about the chemicals you use in your home.

Screening is very important to early detection and treatment of certain cancers. In many cases, the sooner you find a cancer and start treating it, the better your chances for living a long and full life.

Sources:

National Cancer Institute (www.cancer.gov)

American Cancer Society (www.cancer.org)

Cancer Facts & Figures 2009, American Cancer Society, 2009

CDC's Division of Cancer Prevention and Control (www.cdc.gov/cancer)

U.S. Mortality Data 2006, National Center for Health Statistics, U.S. Centers for Disease Control and Prevention, 2009

For more information about cancer

Contact: Your Healthcare Provider

National Cancer Institute Cancer Information Specialists at
1-800-4-CANCER

Your Local American Cancer Society Chapter

Or visit these sites on the Internet:

<http://www.cdc.gov/cancer>

<http://www.cancer.gov>

<http://www.cancer.org>

<http://toxtown.nlm.nih.gov/>.

The Agency for Toxic Substances and Disease Registry (ATSDR), based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services. ATSDR partners with communities across the nation to increase knowledge about toxic substances, reduce the health effects of toxic exposures, and protect the public health.