Understanding Radiation Therapy: A Guide for Patients and Families

You've been told you have cancer. You've looked at your treatment options, and you and your doctor have agreed that radiation therapy (**ray**-dee-**A**-shun **ther**-uh-pee) is your best choice – either alone or along with another treatment. Now you may have questions about radiation treatment.

The American Cancer Society knows you may have concerns about radiation therapy, and we have answers to some of your questions. Remember that, along with reading about your treatment, you can also count on your doctor and nurse to answer your questions.

At the end of this document, you will find a glossary that defines words and terms used by your health care team. The words that are in italics the first time they are used are also in the glossary. You can use the glossary to help you better understand the talks you have with your health care team. Open and honest talks with your cancer care team are the best way to understand what is going on with you, your body, and the cancer.

What is radiation therapy? When is it used?

Radiation therapy uses high-energy particles or waves, such as *x-rays*, *gamma rays*, *electron beams*, or protons, to destroy or damage *cancer* cells. Other names for radiation therapy are radiotherapy, irradiation, or x-ray therapy.

Radiation therapy is one of the most common treatments for cancer. It's often part of the treatment for certain types of cancer, such as cancers of the head and neck, bladder, lung, and Hodgkin disease. Many other cancers are also treated with radiation therapy.

Radiation can be given alone or used with other treatments, such as surgery or *chemotherapy*. In fact, certain drugs are known to be radiosensitizers (**ray**-dee-oh-**SENS**-it-tie-zers). This means they can actually make the cancer cells more sensitive to radiation, which helps the radiation to better kill cancer cells.

There are also different ways to give radiation. Sometimes a patient gets more than one type of radiation treatment for the same cancer.

How does radiation therapy work?

Radiation therapy uses special equipment to send high doses of radiation to the cancer cells.

Most cells in the body grow and divide to form new cells. But cancer cells grow and divide faster than many of the normal cells around them. Radiation works by making small breaks in the DNA inside cells. These breaks keep cancer cells from growing and dividing, and often cause them to die. Nearby normal cells can also be affected by radiation, but most recover and go back to working the way they should.

Unlike chemotherapy, which exposes the whole body to cancer-fighting drugs, radiation therapy is usually a local treatment. It's aimed at and affects only the part of the body being treated. The goal of radiation treatment is to damage cancer cells, with as little harm as possible to nearby healthy tissue.

Some treatments use radioactive substances that are given in a vein or by mouth. In this case, the radiation does travel throughout the body. But for the most part, the radioactive substance collects in the area of the *tumor*, so there's little effect on the rest of the body.

Do the benefits of radiation therapy outweigh the risks and side effects?

Radiation therapy may be more helpful in some cases than in others. For example, some types of cancer are more sensitive to radiation than others. And some cancers are in areas that are easier to treat with radiation without causing major side effects.

There are lifetime dose limits of radiation. Doctors know the amount of radiation that normal parts of the body can safely get without causing damage that can't be reversed. They use this information to help decide how much radiation to give and where to aim radiation during treatment. If a part of your body has been treated with radiation before, you may not be able to get radiation to that area a second time – it depends on how much radiation you got the first time. If one part of your body has already gotten the maximum safe lifetime dose of radiation, you might still be able to get radiation treatment to another area if the distance between the two areas is large enough.

If your doctor or cancer team recommends radiation treatment, it's because they believe that the benefits you'll get from it will outweigh the possible side effects. Still, this is something you must be comfortable with. Knowing as much as you can about the possible benefits and risks can help you be sure that radiation therapy is best for you. Questions to ask your doctor might include:

- What is the purpose of radiation treatment for my type of cancer? To destroy or shrink the tumor? To prevent or stop cancer spread? To lessen the chance the cancer may come back?
- If radiation is to be done after surgery, what are the chances it will kill any cancer cells that were left behind? Could radiation be used instead of surgery?
- What's the chance that the cancer will spread or come back if I do – or do not – have radiation therapy?
- Are there other treatment options?
- What can I do to be ready for treatment?
- What will radiation treatment be like? How often is it given? How long will it take?
- How will the radiation affect the area around the cancer?
- What side effects am I likely to have?
- Will any of these side effects affect how I do things, such as eat or drink, exercise, work, etc.?
- Will side effects change how I look?
- How long will the side effects last?
- Will I be at higher risk for any other health problems in the future?

Radiation and pregnancy

Women: It's important not to become pregnant while getting radiation therapy – radiation can harm the growing baby. If there's a chance you might become pregnant, be sure to talk to you doctor about birth control options.

If you are or might be pregnant, let your doctor know before starting treatment.

Men: Little is known about radiation's effect on the children conceived by men who are getting radiation therapy. Because of the uncertain risk, doctors often advise men to avoid getting a woman pregnant during and for some weeks after treatment.

How much does radiation treatment cost?

Treating cancer with radiation can cost a lot. Radiation treatment requires complex equipment and the services of many health care professionals. The exact cost of your radiation therapy will depend on the type and number of treatments you need.

Most health insurance plans, including Medicare Part B, cover radiation therapy, but you might still have to pay for some part of the treatment. Talk with your doctor's office staff or the hospital business office about your health plan and how your treatment bills will be paid.

In some states, Medicaid (which makes health care services available to people with financial need) may help pay for treatments. Call your city or county social services office to find out if you qualify for Medicaid and if it covers radiation therapy.

If you need financial help, contact your hospital's social service office or the American Cancer Society at 1-800-227-2345 to learn where you might get more help.

Who gives radiation treatments?

During your radiation therapy, you will have a team of medical professionals caring for you. Your team may include these people:

- **Radiation oncologist:** A doctor specially trained to treat cancer patients with radiation. This person is in charge of your radiation treatment plan.
- **Radiation physicist:** This is the person who makes sure the radiation equipment is working as it should and that it gives you the dose prescribed by your radiation oncologist.
- **Dosimetrist:** Supervised by the radiation physicist, this person helps the radiation oncologist plan the treatment.
- ***Radiation therapist*** or **radiation therapy technologist:** This is the person who operates the radiation equipment and positions you for treatment.
- ***Radiation therapy nurse*****:** This nurse has special training in cancer treatment and can give you information about radiation treatment and managing side effects.

You may also need the services of a *dietitian*, *physical therapist*, *medical or clinical social worker*, dentist or dental oncologist, or other health care professionals.

Informed consent for radiation therapy

Before treatment, you will be asked to sign a consent form. This form gives the doctor permission to treat you with radiation and do the tests that are needed to plan your treatment. The details of the consent form can vary, but it usually says that your doctor has explained to you how radiation therapy may benefit you, the possible risks, the type of radiation to be used, and your other treatment options. By signing the form, you are saying that you have gotten this information, you understand it, and you are willing to be

treated with radiation. It also means that you understand there is no guarantee that the treatment will work.

Before signing the consent form, be sure that you understand these things:

- Your diagnosis
- The type of radiation treatment the doctor plans to use
- Other treatment options available for you
- How the treatment will be given, including how long it will last
- Whether you will need tattoos or permanent markings for treatment
- The goal and potential benefits of the treatment
- The possible side effects, including when they usually show up and how long they last
- When to call your doctor
- The possible outcomes if you refuse treatment

How is radiation therapy given?

Radiation therapy can be given in 3 ways:

- *External radiation*
- *Internal radiation*
- *Systemic radiation*

In some cases more than one type is used.

Deciding which type of radiation to use depends on the kind of cancer you have and where it is in your body.

The different types of radiation therapy are described in more detail in the next sections.

External radiation therapy

External radiation (or external beam radiation) uses a machine that directs high-energy rays from outside the body into the tumor and some normal nearby tissue. Most people get external radiation therapy over many weeks. It’s done during outpatient visits to a hospital or treatment center.

How does your doctor plan your treatment?

After a physical exam and a review of your medical history and test results, the doctor will pinpoint the area to be treated. This is done a few days before starting radiation therapy in a process called *simulation*. You will be asked to lie still on a table while the radiation therapist uses a special x-ray machine (a CT scan or MRI) to define your *treatment field* (also called the treatment *port*). These are the exact places on your body where the radiation beams will be aimed.

Radiation beams are aimed very precisely. A special mold, mask, or cast of a body part may be made to help you stay still during treatment. These will also help get you in the same position for each treatment. The radiation therapist may mark the treatment field with freckle-sized dots of semi-permanent ink. The marks will likely fade away over time, but they are needed until your treatment is finished. Don't use soap on or scrub these marks. Sometimes the area may be marked with permanent dots like a tattoo. (These can later be removed with a laser if you like.)

Based on the simulation, other tests, and your medical diagnosis, the doctor will decide how much radiation is needed, how it will be given, and how many treatments you should have.

External radiation therapy is usually given with a machine called a *linear accelerator* (often called a "linac" for short), which is described below.

How long does the treatment take?

In most cases the total dose of radiation needed to kill a tumor can't be given all at once. This is because it's very hard to give radiation therapy without harming normal cells nearby. A dose of radiation given all at once can cause more damage to normal tissues. This can cause more side effects than giving the same dose over many treatments.

Because of this, the total dose of external radiation therapy is usually divided into smaller doses called *fractions*. The most common way to give it is daily, 5 days a week (Monday through Friday) for 5 to 8 weeks. Weekend rest breaks allow time for normal cells to recover. The total dose of radiation and the number of treatments can vary, based on:

- The size and location of your cancer
- The type of cancer
- The reason for the treatment
- Your general health
- Any other treatments you are getting

Other radiation schedules may be used in certain cases. For example, radiation therapy may last only a few weeks (or less) when it's being given to relieve symptoms, because the overall dose of radiation is lower. In some cases, radiation might be given as 2 or more treatments each day (called *hyperfractionated radiation*). Or it might be given as split-course therapy, which allows for several weeks off in the middle of treatments to give the body time to recover while the cancer shrinks.

What happens during each treatment visit?

External radiation is a lot like having a regular x-ray. The treatment itself is painless and takes only a few minutes. But each session can last 15 to 30 minutes because of the time it takes to set up the equipment and put you in position.

Depending on the area being treated, you may need to undress, so wear clothes that are easy to take off and put on. You'll be asked to lie on a treatment table next to the radiation machine (the linear accelerator or linac). The machine has a wide arm that extends over the table. The radiation comes out of this arm. The machine can move around the table to change the angle of the radiation, if needed.

The radiation therapist may put special heavy shields between the machine and parts of your body that are not being treated to help protect normal tissues and organs.

Once you are in the correct position, the radiation therapist will go into a nearby room to operate the machine and watch you on a TV screen. The room is shielded, or protected from the radiation so that the therapist is not exposed to it. You will be able to talk with the therapist over an intercom. You'll be asked to lie still during the treatment. You do not have to hold your breath – just breathe normally.

The radiation therapy machine will make clicking and whirring noises and may sometimes sound like a vacuum cleaner as it moves to aim the radiation beam from different angles. The radiation therapist controls the movement and checks to be sure it's working properly. If you are concerned about anything that happens in the treatment room, ask the therapist to explain. If you feel ill or uncomfortable during the treatment, tell the therapist right away. The machine can be stopped at any time.

Will I be radioactive during or after external radiation treatment?

External radiation therapy affects cells in your body only for a moment. Because there's no radiation source in your body, you are not radioactive at any time during or after treatment.

Newer forms of external radiation therapy

Newer, more precise ways of giving external radiation therapy can help doctors better focus the radiation on the tumors and do less damage to normal tissues. This allows doctors to use higher doses of radiation. Because these methods are newer, their long-term effects are still being studied.

Three-dimensional *conformal radiation therapy* (3D-CRT) delivers shaped radiation beams at the cancer from different directions. Patients are fitted with a mold or cast to keep the body part still so the radiation can be aimed more accurately. By aiming the radiation more precisely, it may be possible to reduce radiation damage to normal tissues and better kill the cancer by increasing the radiation dose to the tumor.

Intensity modulated radiation therapy (IMRT) conforms to the tumor shape like 3D-CRT, but also changes the strength of the beams in some areas to give stronger doses to certain areas of the tumor and lessen damage to normal body tissues. IMRT gives even more control in reducing the radiation that reaches normal tissue and allows a higher dose to the tumor.

A form of IMRT called *helical tomotherapy* uses a linear accelerator inside a large "donut." For this treatment, you lie on a table that slowly slides through the donut as the machine spirals around you. It delivers many small beams of radiation at the tumor from different angles around the body. This may allow for even more precisely focused radiation.

Conformal proton beam radiation therapy is much like conformal therapy, but it uses proton beams instead of x-rays. Protons are parts of atoms that cause little damage to tissues they pass through but are very good at killing cells at the end of their path. This means that proton beam radiation may be able to deliver more radiation to the tumor while reducing side effects on normal tissues. Protons can only be put out by a special machine called a cyclotron or synchrotron. This machine costs millions of dollars and requires expert staff. This is why *proton beam therapy* costs a lot and is only in a small number of radiation treatment centers. More studies are needed to find out if proton radiation gives better results in certain cancers than other types of radiation treatment.

Intraoperative radiation therapy (IORT) is external radiation given directly to the tumor or tumors during surgery. It may be used if the tumors can't be removed completely or if there's a high risk the cancer will come back in the same area. The surgeon finds the cancer while the patient is under *anesthesia* ([**an**-es-**THEE**-zhuh] drugs are used to make the patient sleep and not feel pain). Normal tissues are moved out of the way and protected with special shields, so IORT lets the doctor give one large dose of radiation to the cancer and limit the effects on nearby tissues. IORT is usually given in a special operating room that has radiation-shielding walls.

Stereotactic radiosurgery (**steer**-e-o-**TACK**-tick **ray**-dee-o-**SUR**-jer-ee) is not really surgery, but a type of radiation treatment that gives a large dose of radiation to a small

tumor area, usually in one session. It's mostly used for brain tumors and other tumors inside the head. In some cases, a head frame or shell may be used to help keep the patient's head still. Once the exact location of the tumor is known from CT or MRI scans, radiation is sent to the area from a machine. The radiation is very precisely aimed to affect nearby tissues as little as possible.

There are 3 different ways stereotactic radiosurgery can be given:

- The most common type uses a movable linear accelerator that's controlled by a computer. The machine moves around to target the tumor from many different angles. Several machines do stereotactic radiosurgery in this way, with names such as X-Knife™, CyberKnife®, and Clinac®.
- The Gamma Knife® uses about 200 small beams aimed at the tumor from different angles for a short period of time to deliver a large dose of radiation. It's usually given in one treatment session. Again, it does not use a knife and there's no cutting.
- A third type uses heavy charged particle beams (like protons or helium ion beams) to deliver radiation to the tumor. Also aimed at the tumor from different angles, the particles allow most of the radiation's energy to be delivered to more precise depths, at the end of their paths. This limits damage to nearby healthy tissues or organs.

Most of the time, stereotactic radiosurgery uses one session to give the whole radiation dose, but it may be repeated if needed. Sometimes doctors give the radiation in many smaller treatments to deliver the same or slightly higher dose. (This is called *fractionation* [**frack**-shun-**A**-shun].) This may be called *fractionated radiosurgery* or fractionated stereotactic radiotherapy.

Internal radiation therapy (brachytherapy)

Internal radiation is also called *brachytherapy* (**brake**-ee-**THER**-uh-pee). It uses a radioactive source, called an *implant*, that's put inside the body in or near the tumor. The radiation from the implant travels only a short distance, so it has very little effect on normal body tissues.

What is internal radiation therapy?

Internal radiation therapy uses a radiation source that's usually sealed in a small holder (called an implant). The implant is placed very close to or inside the tumor. It's placed so that it harms as few normal cells as possible. Internal radiation therapy lets the doctor give a higher dose of radiation to a smaller area than might be possible with external radiation treatment.

The main types of brachytherapy are *intracavitary radiation* and *interstitial radiation*. Both of these methods use radioactive implants such as pellets, seeds, ribbons, wires, needles, capsules, balloons, or tubes.

- During intracavitary (**in**-truh-**KAV**-uh-tair-ee) radiation, the radioactive source is placed in a cavity (space) in the body, such as the rectum or uterus.
- With interstitial (**in**-ter-**STIH**-shul) radiation, the implants are placed in or near the cancer, but not in a body cavity.

How are implants placed in the body?

Before being put in the body, the implants are kept and carried in special containers that hold the radiation inside so it can't affect others. You will likely be treated in a special shielded room that also contains the radiation. The health professionals handling the implants may wear special gear that protects them from exposure once the implants are taken out of the container.

Sealed radioactive substances are put into body cavities or body tissue with *applicators* (**AP**-lick-**ate**-ur), which are often metal tubes or plastic tubes called *catheters* (**cath**-it-urs). These are typically put in place in a hospital operating room. You will get anesthesia (**an**-es-**THEE**-zhuh), which may be either general (where drugs are used to put you into a deep sleep so that you don't feel pain) or local (where part of your body is numbed). The doctor usually puts the applicators in using an imaging test (such as an x-ray or MRI) to find the exact place they need to go.

The radioactive implants are put into the body through the applicator(s). Some implants are permanent. They are put in through the applicator and then the applicator is removed. Other implants are left in only for a certain amount of time. If the implants will be removed but then put in again later, the applicator is often left in until the treatment is finished (stitches may be used to keep it in place). The applicator is then removed when the implants are taken out for the last time.

How long do implants stay in place?

The type of implant you receive and your treatment schedule will depend on the kind of cancer, where it is in your body, your general health, and other treatments you have had. Some implants are taken out after several minutes, while others are left in place for a day or more, or might even be permanent.

High-dose rate brachytherapy

High-dose-rate (HDR) brachytherapy allows a person to be treated for only a few minutes at a time with a powerful radioactive source that's put in the applicator. The

source is removed after several minutes. This may be repeated over the course of a few days to weeks. The radioactive material is not left in your body. The applicator might be left in place between treatments, or it might be put in before each treatment.

Low-dose-rate brachytherapy

In this approach, the implant gives off lower doses of radiation over a longer period of time.

Some temporary implants are left in place from 1 to a few days. You will probably have to stay in the hospital, sometimes in a special room, during treatment. For larger implants, you might have to stay in bed and lie fairly still to keep it from moving.

Some smaller implants (such as the seeds or pellets) are left in place – they are never taken out. Over the course of several weeks they stop giving off radiation. The seeds are about the size of rice grains and rarely cause problems. If your implants are to be left in, you may be able to go home the same day they are put in. But you will need to stay in the treatment center until the anesthesia wears off.

How will I feel during implant therapy?

You are not likely to have a lot of pain or feel sick while implants are being put in. The drugs (anesthesia) used while they are being placed might make you feel drowsy, weak, or sick to your stomach, but these side effects do not last long. If your implant is held in place by an applicator, you may have some discomfort in that area. Ask for medicine to help you relax or to relieve pain if needed. Be sure to tell the nurse if you have any burning, sweating, or other symptoms.

What happens after a temporary implant is removed?

In most cases, anesthesia is not needed when the applicator and/or implant is removed. It’s usually done right in your hospital room. The treated area may be sore or tender for some time after treatment, but most people can return to normal activities quickly. Keep in mind that your body is recovering from radiation treatments, and you may need extra sleep or rest breaks over the next few days.

What happens to permanent implants?

Radioactive materials stop giving off radiation over time. This may take weeks or months. Talk to the doctor or nurse about how long it will take in your case. Once the radiation is gone, the implant(s) are no longer active. They usually stay in place and cause no harm, so there’s no need to take them out.

Will I be radioactive during or after internal radiation treatment?

With internal radiation therapy, your body may give off a small amount of radiation for a short time.

If the radiation is contained in a temporary implant, you will be asked to stay in the hospital and may have to limit visitors during treatment. You also may be asked to stay a certain distance away from them. Pregnant women and children may not be allowed to visit you. Your body fluids are not radioactive. Once the implant is removed, your body will no longer give off radiation.

Permanent implants give off small doses of radiation over a few weeks to months as they slowly stop giving off radiation. The radiation usually doesn't travel much farther than the area being treated, so the chances that others could be exposed to radiation is very small. Still, your health care team may ask you to take certain precautions such as staying away from small children and pregnant women, especially right after you get the implants. Again, body fluids and the things you use will not be radioactive.

Systemic radiation therapy

Systemic (sis-**tem**-ick) radiation uses radioactive drugs to treat certain types of cancer. These drugs can be given by mouth or put into a vein; they then travel throughout the body.

What is systemic radiation therapy?

Radioactive drugs called radiopharmaceuticals (**ray**-dee-o-**farm**-uh-**SUIT**-uh-kulls) are used to give systemic radiation. These *unsealed radiation* sources are in the form of a liquid made up of a radioactive substance, which is sometimes bound to a special antibody (called a *monoclonal antibody* [**ma**-nuh-**KLO**-nuhl **AN**-tih-**bah**-dee]) that attaches to the cancer cells. Radioactive iodine, strontium, and samarium are some other types of systemic radiation used to treat certain types of cancers, such as thyroid, bone, and prostate cancers.

The radiopharmaceuticals may be given in a vein (IV) or taken by mouth. They travel in the blood throughout the body. They collect where the cancer is to give off their radiation and kill the cancer cells.

The radiopharmaceuticals are kept in special containers that hold the radiation inside so it can't affect others. You will likely be treated in a shielded room that also contains the radiation. The health professionals handling the drugs may wear safety gear that protects them from exposure while they are giving you the radioactive drug.

Will I be radioactive during or after systemic radiation treatment?

Because systemic radiation uses an unsealed radioactive substance that goes through your whole body, some radiation will be in your body for a few days until your body has had a chance to get rid of it. You may need to stay in the hospital for 1 or 2 days. Your health care team will tell you what precautions to take until your body no longer contains radiation that might affect others. These precautions vary depending on the substance used.

Patient and family safety

Sometimes doctors recommend certain safety measures to protect the people around you from the systemic radiation in your body. This is because the radioactive materials can leave your body through saliva, sweat, blood, and urine, making these fluids radioactive.

In most cases, the safety precautions must be followed only the first few days after treatment. Over time, the radiation becomes weaker and your body gets rid of it. Talk to the doctor or nurse about how long this may take in your case, and if there are special precautions you will need to take.

You might be told to follow these precautions for a certain amount of time:

- Flush the toilet twice after each use, and wash your hands well after using the toilet.
- Use separate utensils and towels (laundry may need to be washed separately).
- Drink extra fluids to flush the radioactive material out of your body.
- No kissing or sexual contact (often for at least a week).
- Keep a distance of one arm’s length between yourself and any others who spend more than 2 hours next to you in any 24-hour period. (You may need to sleep alone for a week or so.)
- Limit your contact with infants, children, and women who are pregnant.
- Limit your contact with pets.

Ask your health care team about the precautions you need to take. Be sure you understand what you need to do to protect the people around you.

Preventing and managing side effects of radiation therapy

When the radiation damages nearby healthy tissue, it can cause side effects. Many people worry about this part of their cancer treatment. Before treatment, talk with your doctor or nurse about what you might expect.

Taking care of yourself during treatment

You need to take special care of yourself to protect your health during radiation treatment. Your doctor or nurse will give you advice based on your treatment plan and the side effects you might have.

Here are some general tips:

- **Be sure to get plenty of rest.** You may feel more tired than normal. Try to get good, restful sleep at night. Severe tiredness, called fatigue (fuh-**teeg**), may last for several weeks after your treatment ends. See “Fatigue” in the “Common side effects of radiation therapy” section for more information.
- **Eat a balanced, healthy diet.** Depending on the area of your body getting radiation, your doctor or nurse may suggest changes in your diet. You can get more information in our booklet called *Nutrition for the Person With Cancer During Treatment: A Guide for Patients and Families*.
- **Tell your doctor about all medicines you are taking.** Give your doctor a full list of everything you take and how often you take it, even things like aspirin, vitamins, or herbs. Don’t forget those you take only when you need them, such as sleep aids, antacids, headache remedies, and antihistamines.
- **Take care of the skin in the treatment area.** If you get external radiation therapy, the skin in the treatment area may become more sensitive or look and feel sunburned. Ask your doctor or nurse before using any soaps, lotions, deodorants, medicines, perfumes, cosmetics, powder, or anything else on the treated area. Some of these products may irritate sensitive skin. See “Skin problems” in the “Common side effects of radiation therapy” section for more on this.

Side effects can vary.

Your doctor and nurse are the best people to talk to about your treatment, side effects, things you need to do to take care of yourself, and any other medical concerns you have. Tell them about any changes in the way you feel and about any side effects you have, including skin changes, tiredness, diarrhea, or trouble eating. Be sure that you understand any home care instructions and know whom to call if you have more questions. Also be

sure you know what to do if you need help after office hours, just in case you have problems at night or on the weekend.

Side effects vary from person to person and depend on the radiation dose and the part of the body being treated. Some people have no side effects at all, while others have quite a few. There's no way to know who might have side effects.

How long do side effects last?

Radiation therapy can cause early and late side effects. Early side effects are those that happen during or shortly after treatment. They usually are gone within a few weeks after treatment ends. Late side effects are those that take months or even years to develop. They are often permanent.

The most common early side effects are fatigue (feeling tired) and skin changes. Other early side effects usually are related to the area being treated, such as hair loss and mouth problems when radiation treatment is given to the head.

Most side effects go away in time. In the meantime, there are ways to reduce the discomfort they may cause. If you have bad side effects, the doctor may stop your treatments for a while, change the schedule, or change the type of treatment you are getting. Tell your doctor, nurse, or radiation therapist about any side effects you notice so they can help you with them. The information here can serve as a guide to handling some side effects, but it can't replace talking with your doctor or nurse about what's happening to you.

People often become discouraged about how long their treatment lasts or the side effects they have. If you feel this way, talk to your doctor. If needed, your doctor should be able to suggest ways to help you feel better.

Radioprotective drugs

Doctors look for ways to reduce side effects caused by radiation therapy while still using the doses needed to kill cancer cells. One way to reduce side effects is by using radioprotective (**ray**-dee-o pro-**TEK**-tiv) drugs. These are drugs that are given before radiation treatment to protect certain normal tissues in the treatment area. The one most commonly used today is amifostine. This radioprotective drug may be used in people with head and neck cancer to reduce the mouth problems caused by radiation therapy.

Radioprotective drugs are an active area of research, and at this time not all doctors agree how these drugs should be used in radiation therapy. These drugs have their own side effects, too, so be sure you understand what to look for.

Common side effects of radiation therapy

Fatigue

Fatigue (fuh-**teeg**) is feeling tired physically, mentally, and emotionally. It's very common with cancer and its treatment, and often happens with radiation therapy. Managing fatigue is an important part of care.

Fatigue means having less energy to do the things you normally do or want to do. It can last a long time and can get in the way of your usual activities. It's different from the fatigue of everyday life, and it may not get better with rest. Cancer-related fatigue is worse, and it's more distressing. Cancer-related fatigue can:

- Differ from one day to the next in how bad it is and how much it bothers you
- Be overwhelming and make it hard for you to feel good
- Make it hard to be with your friends and family
- Make you less able to keep up your normal activities, including things like taking care of your home and going to work
- Make it hard to follow your cancer treatment plan
- Last different lengths of time, which makes it hard to guess how long you will have it

Only you know if you have fatigue and how bad it is. No lab tests or x-rays can diagnose or describe your level of fatigue. The best measure of fatigue comes from your own report to your doctor or nurse. You can describe your level of fatigue as none, mild, moderate, or severe. Or you can use a scale of 0 to 10, where a 0 means no fatigue, and a 10 is the worst fatigue you could imagine. Either way you choose, it's important to describe your fatigue to your cancer team.

Most people begin to feel tired after a few weeks of radiation therapy. Fatigue usually gets worse as treatment goes on. Stress due to your illness and daily trips for treatment may make fatigue worse.

The cause of cancer-related fatigue is not always clear. But if the cause is known, your doctor often can treat it. For example, if anemia ([uh-**nee**-me-uh] low red blood cell counts) is thought to be causing fatigue, the anemia can be treated. In some patients, treatment may include correcting fluid and mineral imbalances in the blood. Increasing physical activity, treating sleep problems, and eating well might all improve fatigue, too. Education and counseling are often part of the treatment; they can help you learn how to save energy, reduce stress, and use distraction to focus on things other than the fatigue.

By understanding fatigue, you can cope with it better and reduce your distress. Often, a family member can help you talk to your health care team about your fatigue and how it affects you.

Fatigue will usually go away over time after treatment ends. Until then, here are some things that you can do to help you deal with it:

- Make a list of the things you need to do in order of how important they are to you. Try to do the important ones first, when you have the most energy.
- Ask for help from loved ones and friends.
- Place things that you use often within easy reach.
- Try to reduce stress. Things like deep breathing, visual imagery, meditation, prayer, talking with others, reading, listening to music, painting, or any other activity that gives you pleasure may help you feel less stressed out.
- Keep a journal of how you feel each day. Take it with you when you see your doctor.
- Balance rest and activities. Try not to spend too much time in bed, which can make you feel weak. Schedule activities so that you have time for plenty of rest. Most people find that a few short rest periods are better than one long one.
- Talk to your doctor about whether you should exercise, and what types of physical activities may be best for you.
- Unless you are given other instructions, eat a healthy diet that includes protein (meat, milk, eggs, and beans), and drink plenty of water each day.

Let your doctor or nurse know about your fatigue, and be sure to talk with them if:

- Your fatigue does not get better, keeps coming back, or gets worse.
- You are more tired than usual during or after an activity.
- You are feeling tired, and it’s not related to something you’ve done.
- You become confused or can’t focus your thoughts.
- You can’t get out of bed for more than 24 hours.
- Your fatigue disrupts your social life or daily routine.

If you need to take time off from work, talk to your employer. You may also have some rights that will help you keep your job. Visit our website to get more information on fatigue, or call us for a free copy of *Fatigue in People With Cancer*. We also have the *Americans With Disabilities Act: Information for People Facing Cancer* and the *Family and Medical Leave Act (FMLA).* Some of these laws can help people with cancer.

Skin problems

Your skin in the treatment area may look red, irritated, swollen, blistered, sunburned, or tanned. After a few weeks, your skin may become dry, flaky, itchy, or it may peel. It's important to let your doctor or nurse know about any skin changes. They can suggest ways to ease the discomfort, maybe lessen further irritation, and try to prevent infection.

Most skin reactions slowly go away after treatment ends. In some cases, though, the treated skin will stay darker and might be more sensitive than it was before. You need to be gentle with your skin. Here are some ways to do this:

- **Do not wear tight, rough-textured, or stiff clothes over the treatment area**. This includes anything tight or elastic that squeezes the area. Instead, wear loose clothing made from soft, smooth fabrics. Do not starch your clothes.
- **Do not rub, scrub, scratch, or use adhesive tape on treated skin.** If your skin must be covered or bandaged, use paper tape or other tape for sensitive skin. Try to put the tape outside the treatment area, and do not put the tape in the same place each time.
- **Do not put heat or cold (such as a heating pad, heat lamp, or ice pack) on the treatment area.** Talk with your doctor first. Even hot water may hurt your skin, so use only lukewarm water for washing the treated area.
- **Protect the treated area from the sun**. Your skin may be extra sensitive to sunlight. If possible, cover the treated skin with dark-colored or UV-protective clothing before going outside. Ask your doctor if you should use sunscreen. If so, use one with a sun protection factor (SPF) of at least 30. Reapply the sunscreen often. Continue to give your skin extra protection from sunlight, even after radiation therapy ends.
- **Use only lukewarm water and mild soap.** Just let water run over the treated area. Do not rub. Also be careful not to rub away the ink marks needed for your radiation therapy until it's done.
- **Do not use a pre-shave or after-shave lotion or hair-removal products.** Use an electric shaver if you must shave the area, but first check with your doctor or nurse.
- **Ask your doctor or nurse before using anything on the skin in the treatment area.** This includes powders, creams, perfumes, deodorants, body oils, ointments, lotions, or home remedies while you are being treated and for several weeks afterward. Many skin products can leave a coating on the skin that can cause irritation, and may even change the dose of radiation that enters the body.

Hair loss

Radiation therapy can cause hair loss (the medical word for this is *alopecia* [**al**-o-**PEE**-shuh]). But hair is only lost in the area being treated. For instance, radiation to your head

may cause you to lose some or all of the hair on your head (even eyebrows and lashes), but if you get treatment to your hip, you will not lose the hair on your head.

Most people find that their hair grows back after treatment ends, but it can be hard to deal with hair loss. When it does grow back, your hair may be thinner or a different texture than it was before. Ask your doctor or nurse if you have questions or concerns about hair loss.

If you do lose your hair, your scalp may be tender and you may want to cover your head. Wear a hat or scarf to protect your head when you are in the sun. If you prefer to wear a hairpiece or wig, be sure the lining does not irritate your scalp. Your local American Cancer Society office may be able to help you get wigs or hats. You may also want to check to see if head coverings are tax deductible or if they are covered by your health insurance.

Blood count changes

Radiation therapy can cause low *white blood cell* counts or low levels of *platelets*, but this is rare. These blood cells help your body fight infection and prevent bleeding. If your blood tests show changes in your counts, treatment might be delayed for a week or so to allow your blood counts to return to normal. This side effect is more likely if you are also getting chemotherapy.

See our document called *Understanding Your Lab Test Results* to learn more about blood cells and what changes in the numbers of these cells means.

Eating problems

Radiation to the head and neck or parts of the digestive system (like the stomach or intestines) might cause eating and digestion problems. You may lose interest in food during treatment. But even if you’re not hungry, try to eat protein and some high-calorie foods. Doctors have found that patients who eat well can better handle their cancer treatments and side effects.

Coping with short-term diet problems may be easier than you expect. There are a number of guides and recipe booklets for people who need help with eating problems. See our document called *Nutrition for the Person With Cancer During Treatment: A Guide for Patients and Families* for advice on managing eating problems and some easy recipes to try.

The list below suggests things you can do when you don’t feel like eating, and how to make the most of it when you do feel like eating.

- Eat when you’re hungry, even if it’s not mealtime.
- Eat 5 or 6 small meals during the day rather than 2 or 3 large ones.

- Vary your diet, and try new recipes.
- If you enjoy company while eating, try to eat with family or friends, or turn on the radio or television.
- Keep healthy snacks close by for nibbling when you get the urge.
- If other people offer to cook for you, let them. Don't be shy about telling them what you would like to eat.
- If you live alone, you might want to arrange for a program like Meals on Wheels to bring food to you. Ask your doctor, nurse, or local American Cancer Society office about programs in your area.

If you're able to eat only small amounts of food, you can increase the calories per serving by trying the following:

- Add butter or olive oil.
- Mix canned cream soups with milk or half-and-half rather than water.
- Drink milk shakes, instant breakfast mixes, or liquid supplements (in cans or bottles) between meals.
- Add cream sauce or melted cheese to your favorite vegetables.

Some people find they can handle large amounts of liquids even when they don't feel like eating solid foods. If this is the case for you, try to get the most from each glassful by making drinks enriched with powdered milk, yogurt, juice, or liquid nutrition drinks.

Talk to your health care team if you have any eating problems. They can help you find ways to feel better and get the nutrients your body needs.

How will I feel emotionally?

Many patients feel tired during radiation therapy, and this can affect emotions. You also might feel depressed, afraid, angry, frustrated, alone, or helpless.

We have a lot of information that can help you understand and manage the emotional changes that often come with cancer and cancer treatment. *Coping With Cancer in Everyday Life*, *Distress in People With Cancer*, and *Anxiety, Fear, and Depression* are a few examples. These can be read online, or you can call us to have free copies sent to you.

Getting involved with a support group and meeting other people with cancer may help you. Ask your doctor or call the American Cancer Society for more information about ways to connect with others who share your problems and concerns.

Will side effects limit my activity?

Side effects might limit your ability to do some things. But what you can do will depend on how you feel. Talk to your doctor about this. Some patients are able to go to work or enjoy leisure activities while they get radiation therapy. Others find they need more rest than usual and can't do as much. Your doctor may suggest you limit activities that might irritate the area being treated.

Long-term side effects of radiation therapy

During and right after radiation therapy, it can be hard to think ahead to what might happen many years in the future. But depending on the type of treatment and the location of the cancer, there may be long-term side effects from your radiation treatment. (Some of these are described in more detail in the section below, called "Managing side effects of treatment to certain parts of the body.") Talk to your doctor about possible long-term problems from the treatment you're getting. Even though they are less common than short-term ones, these problems should still be taken into account when making decisions about radiation therapy.

Damage to your body

Radiation can damage normal cells, and sometimes this damage can have long-term effects. For instance, radiation to the chest area may damage the lungs or heart. In some people this might affect a person's ability to do things. Radiation to the abdomen (belly) or pelvis can lead to bladder, bowel, fertility, or sexual problems in some people. Radiation in certain areas can also lead to fluid build-up and swelling in parts of the body, a problem called lymphedema (**lim**-fuh-**DEE**-muh).

See the "To learn more" section to find out where you can get more detailed information on many of these long-term side effects.

Risk of another cancer

A long-term problem linked to radiation treatment is the possible increased risk of getting a second cancer some time in the future. A second cancer may develop many years later, and is caused by the radiation damage to healthy tissues. The risk of this happening is small but real.

The link between radiation and cancer was noted many years ago in studies of atomic bomb survivors, workers exposed to radiation on their jobs, and patients treated with radiation therapy. For instance, young women who had whole-body radiation for the treatment of Hodgkin disease were found to be at increased risk for breast cancer and other cancers later in life. (Whole-body radiation is seldom used for Hodgkin disease today.) Some cases of leukemia are also linked to past radiation exposure. The leukemia

usually develops within a few years of exposure – risk peaks about 5 to 9 years after the radiation exposure and then slowly declines. Other types of cancer after radiation exposure often take much longer to develop. Most do not happen until at least 10 years after exposure, and some are diagnosed 15 or more years later.

You can learn more about this in *Second Cancers Caused by Cancer Treatment*, which can be read online or sent to you.

What does this mean to me?

Radiation therapy has steadily improved over the past few decades. Treatments now target the cancers more precisely, and more is known about choosing the best radiation doses. More precise radiation means less damage to nearby healthy tissues. This often means fewer side effects. These advances may also reduce the number of second cancers that result from radiation treatment, but this is not yet known. Still, the overall risk of second cancers is low and must be weighed against the benefits of radiation treatments.

Talk to your doctor before you start radiation to make sure you are aware of the possible long-term effects. This can help you make an informed treatment decision and help you know what symptoms you may need to watch out for after treatment.

Managing side effects of radiation treatment to certain parts of the body

The next sections give you tips on how to manage side effects that may be caused by radiation to certain parts of the body. These are general side effects. Be sure to talk to your health care team about what you might expect and what you should look out for with your own treatment plan. Tell them about any changes you notice, so they can be managed before they worsen. Also make sure you know what problems need to be reported right away and where to get help after normal office hours and on weekends and holidays.

- Radiation therapy to the head and neck
- Radiation therapy to the brain
- Radiation therapy to the breast
- Radiation therapy to the chest
- Radiation therapy to the stomach and abdomen
- Radiation therapy to the pelvis

More details on treatment side effects and how to manage them can be found in our document called *Caring for the Patient With Cancer at Home: A Guide for Patients and Families*.

Radiation therapy to the head and neck

Some people who get radiation to the head and neck have redness and soreness in the mouth, dry mouth, mouth sores, trouble swallowing, changes in taste, or nausea. Other possible side effects include a loss of taste, earaches, tooth decay, and swelling. You may lose your hair, your skin texture might change, and your jaw may feel stiff.

If you get radiation therapy to the head or neck, you need to take good care of your teeth, gums, mouth, and throat. Here are a few tips that may help you manage mouth problems:

- Avoid strong spices and coarse foods, such as raw vegetables, dry crackers, and nuts.
- Do not eat or drink very hot or very cold foods or beverages.
- Do not smoke, chew tobacco, or drink alcohol – these can make mouth sores worse.
- Stay away from sugary snacks.
- Ask your doctor or nurse to recommend a good mouthwash. The alcohol in some mouthwashes can dry and irritate mouth tissues.
- Rinse your mouth with warm salt and soda water every 1 to 2 hours as needed. (Use 1 teaspoon of salt and 1 teaspoon of baking soda in 1 quart of water.)
- Sip cool drinks often throughout the day.
- Eat sugar-free candy or chew gum to help keep your mouth moist.
- Moisten food with gravies and sauces to make it easier to eat.
- Ask your doctor or nurse about medicines to help treat mouth sores and control pain while eating.

If these measures are not enough, ask your doctor or nurse for advice. Mouth dryness may be a problem even after treatment is over; if so, talk to your doctor or dentist about what you can do.

Dental care

Radiation treatment to your head and neck can increase your chances of getting cavities. Mouth care to prevent problems will be an important part of your treatment. Before starting radiation, talk to your doctor about whether you should get a complete check-up with your dentist. Ask your dentist to talk with your radiation doctor before you start

treatment. If you have one or more problem teeth, your dentist may suggest removing them before you start treatment. Radiation (and dry mouth) might damage them to the point where they will need to be removed anyway, and this can be harder to do after treatment starts.

If you wear dentures, they may no longer fit well because of swollen gums. If your dentures cause sores, you may need to stop wearing them until your radiation therapy is over to keep sores from getting infected.

Your dentist may want to see you during your radiation therapy to check your teeth, talk to you about caring for your mouth and teeth, and help you deal with any problems. Most likely, you will be told to:

- Clean your teeth and gums with a very soft brush after meals and at least one other time each day.
- Use fluoride toothpaste that contains no abrasives.
- If you normally floss, keep flossing at least once a day. Tell your doctor if this causes bleeding or other problems. If you do not usually floss, talk with your doctor before you start.
- Rinse your mouth well with cool water or a baking soda solution after you brush. (Use 1 teaspoon of baking soda in 1 quart of water.)

Radiation therapy to the brain

Stereotactic radiosurgery (**steer**-e-o-**TACK**-tick **ray**-dee-o-**SUR**-jer-ee) is often used when cancer is in only one or a few sites in the brain. Side effects vary depending on where the radiation is aimed, and usually become most serious 1 to 2 years after treatment. Talk with your radiation oncologist about what to watch for and when to call for help.

Sometimes the whole brain is treated with radiation when cancer is in many areas. This may also be done to keep cancer from spreading to the brain. Whole-brain radiation can cause these side effects:

- Headaches
- Hair loss
- Nausea
- Vomiting
- Extreme tiredness (fatigue)

- Hearing loss
- Skin and scalp changes
- Trouble with memory and speech
- Seizures

Some of these side effects can be caused by swelling of the brain from the radiation. Medicines are usually given to prevent brain swelling, but it's important to let your doctor know about headaches or any other symptoms. Delayed effects (usually 1 or 2 years later) of whole-brain radiation may be caused by death of brain tissue. These delayed effects can include serious problems such as memory loss, stroke-like symptoms, and poor brain function.

Radiation therapy to the breast

Radiation treatment to the breast area could affect the heart, causing things like hardening of the arteries (which can make you more likely to have a heart attack later on), heart valve damage, or irregular heartbeats. It might also cause swallowing problems, cough, or shortness of breath. Be sure you understand what to look for and tell your doctor or nurse if you notice any of these side effects.

If you get radiation therapy after surgery for breast cancer, try to go without wearing a bra whenever you can. If this is not possible, wear a soft cotton bra without underwires so that your skin is not irritated. If your shoulders feel stiff, ask your doctor or nurse about exercises to keep your arms moving freely.

Other side effects can include breast soreness, skin irritation and color changes, and swelling from fluid build-up in the treated area. These side effects most likely will go away a month or 2 after you finish radiation therapy. If fluid build-up (lymphedema [**lim**-fuh-**DEE**-muh]) continues to be a problem, ask your doctor what steps you can take. You can also call us or visit our website for more information on lymphedema.

Radiation therapy after breast surgery may cause other long-term changes in the breast. Your skin may be slightly darker, and pores may be larger and more noticeable. The skin may be more or less sensitive and feel thicker and firmer than it was before treatment. Sometimes the size of your breast changes – it may become larger because of fluid build-up or smaller because of scar tissue. Many women have little or no change in breast size. These side effects may last long after treatment.

If your treatment includes internal radiation implants, you might notice breast tenderness or tightness. After the implants are removed, you are likely to have some of the same side effects that happen with external radiation treatment. If so, follow the advice given above and let your doctor know about any problems you notice.

After about a year, you should not have any new changes. If you do see changes in breast size, shape, appearance, or texture after this time, tell your doctor about them right away.

Radiation pneumonitis (**new**-muh-**NI**-tis) is inflammation of the lungs that can be caused by radiation treatment to the breast. It may occur from about 6 weeks to up to 6 months after completing external radiation therapy. The risk of developing it depends on the radiation dose, the amount of lung that was affected by radiation, whether you had radiation in the past, and whether you are getting chemo at the same time. It's also more likely if you have other lung diseases, like COPD.

Common symptoms of radiation pneumonitis include:

- Shortness of breath that usually gets worse with exercise
- Chest pain, which is often worse when taking in a deep breath
- Cough
- Pink-tinged sputum
- Low-grade fever
- Weakness

In some cases, no symptoms are noticed, and radiation pneumonitis is found on a chest x-ray.

Radiation pneumonitis is treated by trying to decrease the inflammation. Steroids, like prednisone, are usually used. With treatment, most people recover without any lasting effects. But if it goes untreated or persists, it can lead to pulmonary fibrosis (stiffening or scarring of the lungs). When this happens, the lungs can no longer fully inflate and take in air. If a large area of the lungs is treated with radiation, these changes can cause shortness of breath, especially during physical activity.

Radiation therapy to the chest

Radiation treatment to the chest may affect the heart, causing things like hardening of the arteries (which can make you more likely to have a heart attack later on), heart valve damage, or irregular heartbeats. It can also cause swallowing problems, cough, or shortness of breath. Be sure you understand what to look for and tell your doctor or nurse if you notice any of these side effects.

Radiation pneumonitis (**new**-muh-**NI**-tis) is inflammation of the lungs caused by radiation treatment to the chest. It may occur from about 6 weeks to up to 6 months after completing external radiation therapy. The risk of developing it depends on the radiation dose, the amount of lung getting radiation, whether you had radiation in the past, and

whether you are getting chemo at the same time. It's also more likely if you have other lung diseases, like COPD.

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Radiation therapy to the stomach and abdomen

If you are getting radiation to your stomach or some part of the abdomen (belly), you may have vomiting, nausea, belly cramps, or diarrhea. Your doctor can give you medicines to help relieve these problems. Check with your doctor or nurse about any home remedies or over-the-counter drugs you are thinking about using.

Managing nausea

Some people say they feel queasy for a few hours right after radiation therapy. If you have this problem, try not eating for a couple of hours before and after your treatment. You may handle the treatment better on an empty stomach. If the problem persists, ask your doctor about medicines to prevent and treat nausea. Be sure to take the medicine as prescribed.

If you notice nausea before your treatment, try eating a bland snack, like toast or crackers, and try to relax as much as possible. Here are some tips to help an upset stomach:

- Stick to any special diet your doctor or dietitian gives you.

- Eat small meals.
- Eat often and try to eat and drink slowly.
- Avoid foods that are fried, spicy, sweet, or high in fat.
- Drink cool liquids between meals.
- Eat foods that don’t have strong smells and can be served cool or at room temperature.
- For a severe upset stomach, try a clear liquid diet (broth and juices) or bland foods that are easy to digest, such as dry toast and gelatin.
- Learn deep-breathing and relaxation techniques, and try them when you feel nauseated.

Please call us or visit our website for more detailed information on how to manage nausea and vomiting.

How to handle diarrhea

Diarrhea most often begins a few weeks after starting radiation therapy. Your doctor may prescribe medicine or give you special instructions to help with the problem. Diet changes may also be recommended, such as:

- Try a clear liquid diet (water, weak tea, apple juice, peach nectar, clear broth, popsicles, and plain gelatin) as soon as diarrhea starts or when you feel like it’s going to start.
- Don’t eat foods that are high in fiber or can cause gas or cramps, such as raw fruits and vegetables, beans, cabbage, whole-grain breads and cereals, sweets, and spicy foods.
- Eat frequent, small meals.
- Do not drink milk or eat milk products if they irritate your bowels.
- When the diarrhea starts to improve, try eating small amounts of low-fiber foods, such as rice, bananas, applesauce, yogurt, mashed potatoes, low-fat cottage cheese, and dry toast.
- Be sure you take in enough potassium (it can be found in bananas, potatoes, beans, peaches, and many other foods). This is an important mineral you may lose through diarrhea.

Diet planning is an important part of radiation treatment of the stomach and abdomen. Keep in mind these problems should get better when treatment is over. In the meantime,

try to pack the highest possible food value into even small meals so you get enough protein, calories, vitamins, and minerals.

Radiation therapy to the pelvis

If you get radiation therapy to any part of the pelvis, you might have one or more of the digestive problems already described. You may have some irritation of your bladder, as well as changes in your fertility (ability to have children) and your sex life.

Bladder problems

Pelvic radiation can affect the bladder, which can cause problems like pain, burning, trouble passing urine, blood in the urine, and an urge to urinate often. Most bladder problems get better over time, but if the radiation damages the lining of the bladder it can cause radiation cystitis (**ray**-dee-**A**-shun cis-**tie**-tis). This can be a long-term problem that causes blood in the urine or pain when passing urine.

In rare cases, radiation can cause abnormal connections (called fistulas [**fist**-chu-luhs]) to form between organs in the pelvis, such as the vagina and the bladder, or the bladder and the rectum. Surgery can be used to fix them.

Radiation treatments for certain cancers, such as prostate and bladder, may lead to urinary incontinence, which means you are not able to control your urine or have leakage or dribbling. There are different types and degrees of incontinence, but it can be treated. Even if incontinence cannot completely be corrected, it can still be helped. See our document called *Managing Incontinence for Men With Cancer* to learn more about this side effect and what can be done about it.

Fertility

Women: Talk to you doctor about how radiation may affect your fertility – it's best to do this **before** starting treatment. See our document called *Fertility and Women With Cancer* if you'd like to learn more about this.

Depending on the radiation dose, women having radiation therapy in the pelvic area may stop having their menstrual periods and have other symptoms of menopause. Treatment also can cause vaginal itching, burning, and dryness. Report these symptoms to your doctor so you can learn how to relieve these side effects.

Men: Radiation therapy to an area that includes the testicles can reduce both the number of sperm and their ability to function. If you want to father a child in the future and are concerned about reduced fertility, talk to your doctor **before** starting treatment. One option may be to bank your sperm ahead of time. Our document called *Fertility and Men With Cancer* has more information on this.

Other than studies that looked at survivors of atomic bomb blasts, there's little known about radiation's effect on the children conceived by men after getting radiation therapy. Because of the uncertain risk, doctors often advise men to avoid getting a woman for some weeks after treatment, especially if the radiation is given to or near the genital area.

Sex

With some types of radiation therapy involving the pelvis and/or sex organs, men and women may notice changes in their ability to enjoy sex or a decrease in their level of desire.

Women: During treatment to the pelvis, some women are told not to have sex. And some women may find sex painful. You most likely will be able to resume sex within a few weeks after treatment ends, but check with your doctor first. Some types of treatment can have long-term effects, such as scar tissue that could affect the ability of the vagina to stretch during penetration. Again, your doctor can offer ways to help if this happens to you. You can also get more information in our booklet called *Sexuality for the Woman With Cancer*.

Men: Radiation may affect the nerves that make a man able to have an erection. If erection problems do occur, they are usually gradual, over the course of many months or years. Talk with your doctor about treatment options if this is a concern for you. You can get more information in our booklet called *Sexuality for the Man With Cancer*.

If you get internal radiation therapy with seed implants, check with your doctor about safety precautions during sex.

Follow-up care after radiation therapy

What does "follow up" mean?

No matter what type of cancer you've had, you will need regular doctor visits to check your progress after radiation treatment ends. You may need help dealing with any problems that may come up, too. This phase of your treatment is called follow-up care.

Your follow-up care will include checking the results of your treatment, but it may also include more cancer treatment, rehabilitation, and counseling. It may include visits with your primary care doctor, surgeon, *medical oncologist* ([on-**kahl**-uh-jist] a doctor specially trained to treat patients with chemotherapy), and your radiation oncologist. Your follow-up care will depend on the type of cancer you have and other treatments you have had or will have.

Questions you may want to ask your doctor after radiation therapy:

- When can I go back to normal activities?

- How often will I need to see you?
- Which tests will be done and why?
- What symptoms or side effects should I look for and let you know about?
- When can I wear a *prosthesis* ([pros-**thee**-sis] an artificial replacement for a part of the body that has been removed due to cancer) or have reconstructive surgery?
- Do I need to follow a special diet?
- When can I go back to having sex or trying to have a baby?

Care after radiation therapy

For a short time after your treatment, you will need to continue some of the special care used during treatment. For instance, if you still have skin problems after your treatment ends, be gentle with the skin in the treatment area until all signs of irritation are gone. You also may need extra rest while your healthy tissues are rebuilding and healing. You may need to limit your activities to save energy and not try to go back to a full schedule right away.

Pain after therapy

A few patients need help managing pain that continues after radiation therapy. Unless directed by your doctor, do not use heat or cold to relieve pain in any area treated with radiation. Talk to your doctor or nurse and describe the location and type of pain in as much detail as possible. Keep working with your cancer team until you are able to get it under control.

You can learn more about pain and how to manage it in our booklet called *Guide to Controlling Cancer Pain.*

When should I call the doctor?

After treatment, you are likely to be very aware of your body and any slight changes in how you feel from day to day. If you have any of the problems listed below, tell your doctor right away:

- Pain that doesn’t go away, especially if it’s always in the same place
- New lumps, bumps, or swelling
- Nausea, vomiting, diarrhea, loss of appetite, or trouble swallowing
- Unexplained weight loss

- Fever or cough that doesn't go away
- Unusual rashes, bruises, or bleeding
- Any other signs or symptoms mentioned by your doctor or nurse

Do not hesitate to let your doctor know about any new problems or concerns you have. It's always best to find out the cause of a problem so it can be dealt with right away.

What about going back to work?

If you have stopped working, you can return to your job as soon as you and your doctor believe you are up to it. Some people are even able to work during their radiation therapy. If your job requires lifting or heavy physical activity, you may need to change your routine until you have regained your strength.

If you have any questions about you work, health insurance, or rights as an employee, call us. There are some documents listed in the "To learn more" section that may be helpful, too.

What records do I need to keep?

You will want to get copies of your treatment records to keep. It's important that you be able to give any new doctor you might see in the future the details of your diagnosis and treatment. Gathering these details soon after your treatment may be easier than trying to get them at some point in the future. Make sure you have this information for your own records:

- A copy of your pathology report from any *biopsy* (**by**-op-see) or surgery
- If you had surgery, a copy of your operative report
- A copy of your radiation therapy treatment summary
- If you stayed in the hospital, a copy of the discharge summary that doctors prepare when patients are sent home
- A list of the cancer treatment drugs you took, the drug doses, and when you took them

Any time you see a new doctor, be sure that you make copies of these records and keep your originals for yourself. After a certain period of time, doctors' offices and hospitals destroy this kind of information.

Radiation therapy glossary

These are words that you may hear your health care team use.

Accelerated radiation: a radiation schedule in which the total dose is given over a shorter period of time. Compare to *hyperfractionated radiation*.

Adjuvant therapy (**ad**-juh-vunt): a treatment used in addition to the main (primary) treatment. Radiation therapy often is used as an adjuvant to surgery.

Alopecia (al-o-**pee**-shuh): hair loss, including face and body hair

Anesthesia (**an**-es-**THEE**-zhuh): loss of feeling, sensation, or consciousness caused by certain drugs or gases. Also used to describe the drug or gas used to cause this.

Anti-emetic (**an**-tee-ih-**MEH**-tik or **an**-tie-ih-**MEH**-tik): a drug to prevent or treat nausea or vomiting

Applicator (**AP**-lick-**ate**-ur): a device used to put an implant or medicine into the body

Benign tumor (be-**nine too**-mer): a tumor (lump or mass) that is not cancer

Biologic therapy (**by**-o-**LA**-jick): treatment that uses the immune system to fight infection and disease. Also called immunotherapy or immune therapy.

Biopsy (**by**-op-see): the removal of a piece of tissue that is looked at under a microscope to see if it contains cancer or other abnormal cells

Brachytherapy (**brake**-ee-**THER**-uh-pee): internal radiation treatment done by putting radioactive material right into the tumor or close to it. Also called internal radiation therapy.

Cancer: a general term for more than 100 diseases that have uncontrolled, abnormal growth of cells that can spread into and destroy healthy tissues

Catheter (**cath**-ih-tur): a thin, flexible tube through which fluids or other materials can be put in or taken out of the body

Centigray (cGy) (**sent**-uh-gray): the preferred measurement of the amount of radiation dose absorbed by the body (1 cGy = 1 rad)

Chemotherapy (**key**-mo-**THER**-uh-pee): the use of certain types of drugs to treat cancer

Conformal radiation therapy (con-**for**-mul): a newer type of radiation treatment that uses a special computer to help shape the beams of radiation to match the shape of the tumor and delivers the beams from different directions rather than from one angle. This reduces the amount of radiation reaching nearby healthy tissues.

Dietitian or **registered dietitian** (**die**-uh-**TISH**-un): a health professional who plans well-balanced diet programs, including special diets to meet the needs of people with various medical conditions

Dosimetrist (doe-**sim**-uh-trist): a person who plans and calculates the proper radiation dose for each patient's cancer treatment

Electron beam (ee-**leck**-tron): a stream of high-energy particles called electrons used to treat some skin cancers

External radiation: radiation therapy that uses a machine located outside of the body to aim high-energy rays at cancer cells

Fractionated radiosurgery (**frack-**shun-ate-ed): see *stereotactic radiosurgery*

Fractionation (**frack-**shun-**A**-shun): dividing the total dose of radiation into smaller doses (usually given over weeks) in order to reduce damage to healthy tissues

Fractions: the smaller, divided doses of radiation that are given each day

Gamma rays: high-energy rays that come from a radioactive element such as cobalt-60 or radium

Helical tomotherapy (**he**-lick-ul **toe**-moh-**THER**-uh-pee): a newer form of intensity modulated radiation therapy (IMRT) in which the radiation is directed from a donut-shaped machine that spirals around the body

High-dose-rate (HDR) brachytherapy: a type of internal radiation in which the radioactive source is in place only for a short time and then removed. This may be repeated several times over a few days to weeks. See *brachytherapy*.

Hyperfractionated radiation (**hi**-per-**FRACK**-shun-ate-ed): a radiation schedule in which the radiation is given in smaller doses and more than once a day, but the overall length of treatment is the same. Compare to *accelerated radiation*.

Immune therapy: treatment that uses the immune system to fight infection and disease. Also called biologic therapy or immunotherapy.

Implant, radioactive: a small source or container of radioactive material placed in the body, either in or near a cancer. See *brachytherapy*.

Intensity modulated radiation therapy or **IMRT** (in-**ten**-si-tee **MOD-**you-**late**-ed): an advanced method of conformal radiation therapy in which the beams are aimed from many directions and the intensity (strength) of the beams is controlled by computers. This allows more radiation to treat the tumor while reducing the radiation to healthy tissues. See *conformal radiation therapy*.

Internal radiation: a type of therapy in which a radioactive substance is put into or close to the area needing treatment. Also called brachytherapy.

Interstitial radiation (**in**-ter-**STISH**-uhl): a type of internal radiation in which a radioactive source (implant) is put right into the tissue (not in a body cavity). Compare to *intracavitary radiation*.

Intracavitary radiation (**in**-truh-**KAV**-uh-tair-ee): a type of internal radiation in which a radioactive source (implant) is placed in a body cavity, such as the vagina or rectum, as opposed to right into a tumor. Compare to *interstitial radiation*.

Intraoperative radiation (**in**-truh-**OP**-er-uh-tiv): a type of external radiation therapy used to deliver a large dose of radiation to the tumor during surgery

Linear accelerator (**lin**-ee-uhr ak-**SELL**-er-**a**-ter): a machine that creates high-energy radiation to treat cancers using electricity to form a beam of fast-moving subatomic particles called photons (**foe**-tahns). Also called a linac.

Malignant (muh-**lig**-nunt): cancerous; a malignant tumor or mass of cells is called cancer

Medical oncologist (**med**-ih-kull on-**kahl**-uh-jist): a doctor who is specially trained in the diagnosis and treatment of cancer and who specializes in the use of chemotherapy and other drugs to treat cancer

Medical social worker also called **clinical social worker**: a mental health professional with a master's degree in social work (MSW). A social worker can help people manage medical, psychological, social, and educational needs.

Metastasis (meh-**tas**-tuh-sis): the spread of cancer cells to distant areas of the body by way of the lymph system or bloodstream. Also used to describe the area to which cancer has spread. The plural is metastases (meh-**tas**-tuh-sees).

Monoclonal antibody (**ma**-nuh-**KLO**-nuhl **AN**-tih-**bah**-dee): man-made antibodies that are designed to lock onto certain antigens (substances that can be recognized by the immune system). Monoclonal antibodies can be attached to chemotherapy drugs or radioactive substances and deliver these treatments directly to the cancer cells, killing them with little risk of harming healthy tissue.

Oncologist (on-**kahl**-uh-jist): a doctor who specializes in caring for people with cancer

Oncology (on-**kahl**-uh-jee): the branch of medicine devoted to the diagnosis and treatment of cancer

Palliative care (**pal**-ee-uh-tiv): treatment intended to relieve symptoms caused by cancer, rather than cure cancer. Palliative care should be part of all phases of cancer treatment and can help people live more comfortably.

Physical therapist: a health professional who helps people use exercises and other methods to restore or maintain body strength, mobility, and function

Platelets (**plate**-lets): special blood cell fragments that help stop bleeding

Port (also **radiation port** or **treatment field**): the area of the body through which external beam radiation is directed to reach a tumor

Prosthesis (pros-**thee**-sis): an artificial replacement for a part of the body

Proton beam therapy (**pro-**tahn): a form of external radiation that uses proton beams to kill cancer cells. Protons are parts of atoms that cause little damage to tissues they pass through but are very good at killing cells at the end of their path.

Rad: short for "radiation absorbed dose;" an older term of measurement of the amount of radiation absorbed by the body (1 rad = 1 cGy). See *centigray*.

Radiation: in cancer treatment, energy carried by waves or a stream of particles. Types of radiation used to treat cancer include x-rays and gamma rays; electrons, protons, neutrons, and alpha and beta particles. Radioactive substances include forms of cobalt, radium, iridium, cesium, iodine, strontium, samarium, phosphorus, and palladium.

Radiation oncologist: a doctor who specializes in using radiation to treat cancer

Radiation physicist (fizz-**uh**-sist): a person trained to ensure that the radiation machine delivers the right amount of radiation to the treatment area. This person works with the radiation oncologist and dosimetrist to design, plan, and calculate the proper dose for radiation treatment. See *dosimetrist*.

Radiation therapist: a person with special training to use the equipment that delivers radiation

Radiation therapy or **radiation treatment**: the use of high-energy rays or subatomic particles that travel into the body to kill cancer cells

Radiation therapy nurse: a registered nurse who has special training in cancer and radiation therapy

Radiologist: a doctor with special training in reading and interpreting x-rays and scans and doing special x-ray procedures

Radiopharmaceuticals (**ray**-dee-o-**farm**-uh-**SUIT**-ih-kulls): radioactive medicines that are taken by mouth or injected into the body. They collect in the area of the tumor and help stop its growth.

Radio-resistance: the ability of cells to not be affected by radiation

Radiosensitivity (ray-dee-oh-**SENS**-ih-**tiv**-it-tee): how susceptible a cell is to radiation, or how easy it is for radiation to kill the cell. Cells that divide frequently are especially radiosensitive and are more affected by radiation.

Simulation: a process involving special imaging tests, which are used to plan radiation treatment so that the area to be treated is precisely located and marked

Stereotactic radiosurgery (**steer**-e-o-**TACK**-tick **ray**-dee-o-**SUR**-jer-ee): a type of treatment that uses thin beams of radiation given from many angles to give a large dose of radiation to a small tumor area, usually in one session. Though it's called surgery, no knife or scalpel is used. The treatment may be useful for tumors in places where surgery can't be done, for example, in parts of the brain or spinal cord, or when the patient's condition does not permit surgery.

Systemic radiation: the use of radioactive materials like iodine 131 or strontium 89 to kill cancer cells. The materials may be taken by mouth or injected into the body. See *radiopharmaceuticals*.

Teletherapy (**tell**-uh-**THER**-uh-pee): treatment in which the radiation source is at a distance from the body (external radiation)

Treatment field (or **port**): the area of the body through which external beam radiation is directed to reach a tumor

Tumor: an abnormal lump or mass of tissue. Tumors are either benign (not cancer) or malignant (cancer).

Unsealed radiation: internal radiation therapy that is swallowed or given by injecting a radioactive substance into the bloodstream or a body cavity. This substance is not sealed in a container or implant.

White blood cells: the blood cells that help defend the body against infection

X-ray: a form of radiation that can be used either at low levels to make a picture of the inside of the body or at high levels to kill cancer cells

To learn more

More information from your American Cancer Society

The following related information may also be helpful to you. These materials may be ordered from our toll-free number at 1-800-227-2345 or read on our website at www.cancer.org.

Talking about and coping with cancer

After Diagnosis: A Guide for Patients and Families (also in Spanish)

Helping Children When a Family Member Has Cancer: Dealing With Treatment (also in Spanish)

Talking With Your Doctor (also in Spanish)

Distress in People With Cancer

More on radiation treatment

Radiation Therapy Principles (also in Spanish)

More on radiation side effects

Radiation Therapy Side Effects Worksheet

Caring for the Patient With Cancer at Home: A Guide for Patients and Families (also in Spanish)

Fatigue in People With Cancer

Fertility and Women With Cancer (also in Spanish)

Fertility and Men With Cancer (also in Spanish)

Nausea and Vomiting

Guide to Controlling Cancer Pain (also in Spanish)

Sexuality for the Man With Cancer (also in Spanish)

Sexuality for the Woman With Cancer (also in Spanish)

Nutrition for the Person With Cancer: A Guide for Patients and Families (also in Spanish)

Nutrition for Children With Cancer (also in Spanish)

Understanding Your Lab Test Results

Understanding Lymphedema for Cancers Other than Breast Cancer

Lymphedema: What Every Woman With Breast Cancer Should Know (also in Spanish)

Other cancer treatments

Understanding Cancer Surgery: A Guide for Patients and Families (also in Spanish)

A Guide to Chemotherapy (also in Spanish)

Clinical Trials: What You Need to Know (also in Spanish)

Complementary and Alternative Methods and Cancer (also in Spanish)

Work and finance information

Health Insurance and Financial Assistance for the Cancer Patient (also in Spanish)

In Treatment: Financial Guidance for Cancer Survivors and Their Families (also in Spanish)

Children Diagnosed With Cancer: Financial and Insurance Issues

Americans With Disabilities Act: Information for People Facing Cancer (also in Spanish)

Family and Medical Leave Act (FMLA) (also in Spanish)

What Is COBRA? (also in Spanish)

Working During Cancer Treatment

Returning to Work After Cancer Treatment

Books

Your American Cancer Society also has books that you might find helpful. Call us at 1-800-227-2345 or visit our bookstore online at www.cancer.org/bookstore to find out about costs or to place an order.

National organizations and websites*

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

American College of Radiology (ACR)
Toll-free number: 1-800-227-5463
Website: www.acr.org

> The website has information on radiology procedures, radiation safety, FAQs, and a radiology glossary. It also offers a listing of accredited treatment facilities.

American Society for Radiation Oncology (ASTRO)
Toll-free number: 1-800-962-7876
Website: www.rtanswers.org

> Online brochures on radiation therapy are available, as is a locator to find registered radiation oncologists

National Cancer Institute (NCI)
Toll-free number: 1-800-422-6237 (1-800-4-CANCER)

TTY: 1-800-332-8615
Website: www.cancer.gov

> The website includes accurate, up-to-date information about cancer for patients, their families, and the general public that covers a variety of cancer-related topics. It also provides clinical trial information and a matching service for patients.

**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**. We want to help you get well.

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