

Late Effects of Childhood Cancer [1]

This section has been reviewed and approved by the [Cancer.Net Editorial Board](#) [2], 07/2013

 *Watch the [Cancer.Net Video: Late Effects of Childhood Cancer Treatment, with Lisa Diller, MD](#) [3], adapted from this content*

There are about 12 million cancer survivors in the United States, many who were diagnosed when they were under the age of 21. During the last 30 years, improved treatments and better supportive care have resulted in more kids surviving and recovering from cancer.

However, they are at risk for developing long-term side effects, also called late effects, from cancer treatment. Late effects can occur months or years after cancer treatment ends. With more than 80% of children treated for cancer surviving for five years or more after treatment, preventing and recognizing physical and emotional late effects is an important part of cancer care.

Causes of late effects

Any cancer treatment may cause late effects, including chemotherapy, radiation therapy, surgery, and bone marrow/stem cell transplantation. A child's risk of developing late effects depends on many factors:

- Type and location of cancer
- Area of the body treated
- Type and dose of treatment
- Child's age when treated
- Genetics and family history
- Other health problems that existed before the cancer diagnosis

Types of late effects

Late effects can be physical or emotional. Below is a listing of specific late effects of childhood cancer. Not all survivors will develop all of these long-term side effects; it depends on the type of treatment a child had and their age when treated.

If you are worried about any of the late effects mentioned in this article, talk with a doctor, nurse, social worker, or other member of the health care team to understand what the risks are and ways to manage them. (If you or your child is no longer in treatment, you may want to consult

with a [survivorship center of excellence](#) [4] located at many National Cancer Institute Comprehensive Cancer Centers or the follow-up care clinics listed at the [Pediatric Oncology Resource Center](#) [5] and the [National Children's Cancer Society](#) [6] websites.) The research community continues to make progress in preventing, managing, and treating late effects from childhood cancer, and more information to help children and their families is available all of the time. Many of the recommendations listed here are based on [clinical guidelines from the Children's Oncology Group](#) [7].

Emotional difficulties. No matter what age a child is during treatment, potentially long-lasting emotional effects, such as anxiety, depression, and fear of recurrence, may occur. Often, many survivors of childhood cancer avoid doctors and health-care settings, which can be harmful to their health as an adult.

Second cancers. Survivors of childhood cancer have a slightly increased risk of developing a second cancer, which is a different type of cancer that appears after the original cancer diagnosis. Sometimes this is called a secondary cancer. For example, children and adolescents treated for Hodgkin lymphoma have a higher risk for second cancers, including breast and thyroid cancers.

Causes often include radiation therapy and chemotherapy, especially the drugs cyclophosphamide (Neosar), ifosfamide (Ifex), etoposide (Toposar, VePesid), daunorubicin (Cerubidine, and doxorubicin (Adriamycin).

Reproductive and sexual development problems. Boys and girls are both at risk for these problems.

- In boys, radiation therapy to the brain, testicles, or abdomen may cause infertility (the inability to father a child), as can chemotherapy with alkylating agents, such as cyclophosphamide and ifosfamide. These treatments may also change levels of testosterone (a male hormone), which can affect puberty and sexual functioning.
- In girls, particularly those who have begun menstruation, chemotherapy and radiation therapy to the abdomen, pelvis, lower spine, or head can affect the ovaries, causing infertility (inability to conceive a child or maintain a pregnancy), irregular menstruation, and premature menopause. Learn more about [fertility and cancer treatment](#) [8].
- For both boys and girls, radiation therapy to the head can affect various glands that regulate the male and female hormone levels, which could affect fertility.

Growth, development, and hormone problems. Cancer treatments may affect the endocrine system, a group of hormone-producing glands that controls body functions, such as growth, energy, and puberty.

- Radiation therapy near the brain, eyes, or ears can affect the pituitary gland, which helps control growth. Children treated with radiation to these areas who have not reached adult height are at increased risk for growth problems. Pituitary gland radiation has also been linked to a higher risk of being obese and overweight. An endocrinologist (a doctor who specializes in endocrine glands and hormones) can test for problems and provide hormone treatments.
- Radiation therapy given to bone can lead to reduced or uneven growth and conditions such

as scoliosis (a sideways curving of the spine).

- Glucocorticoids (steroid drugs such as prednisone and dexamethasone [multiple brand names for both drugs]) and methotrexate (multiple brand names) have direct effects on bone formation (mineralization), which can lead to low bone mineral density, and, when severe, osteoporosis (a disease that causes weak bones and increases risk of bone fractures). However, most children regain their bone strength (density) after stopping these medications.

Children should receive regular check-ups to monitor their growth and development throughout puberty. Doctors often measure bone mineral density with x-rays. These tests help the doctor learn whether a child needs dietary supplements or specialized foods and/or physical activity to help improve bone density.

Learning and memory problems. Any child treated for cancer is at a higher risk for learning difficulties (especially if they missed school), learning disabilities, and memory problems. Survivors of childhood cancer may need to be evaluated after treatment if they are having problems in school or at work.

Heart problems. Drugs called anthracyclines, including doxorubicin, daunorubicin, and idarubicin (Idamycin), may cause heart problems, such as abnormal heart beat, disease of the heart muscle, and congestive heart failure. In addition, radiation therapy to the chest, spine, or upper abdomen and bone marrow/stem cell transplantation may increase the risk of heart late effects.

Women and younger children are at increased risk of heart-related late effects. Survivors of childhood cancer should visit their doctor yearly for follow-up care because heart conditions often have no symptoms. An electrocardiogram (ECG or EKG) and an echocardiogram [9] or multigated acquisition (MUGA) scan [10], noninvasive tests that check how the heart is functioning, should be done approximately two years after treatment is finished. The Children's Oncology Group provides clinical guidelines [7] on how frequently a patient should continue to have these tests.

Lung and breathing problems. Certain types of chemotherapy, including bleomycin (Blenoxane), carmustine (BiCNU), and lomustine (CeeNU), may cause lung damage. Chest radiation and surgery to the chest or lungs may also cause lung problems. Children who were at a younger age at the time of treatment have a greater risk of lung and breathing problems. Childhood cancer survivors should have lung function tests done at least two years after treatment ends. Talk with your doctor about how often these tests need to be repeated.

Dental problems. Radiation therapy to the mouth, head, or neck may cause problems such as xerostomia (dry mouth) and cavities. Chemotherapy, especially when given to a child whose adult teeth have not formed, may cause tooth development problems. Childhood cancer survivors should visit their dentist every six months for check-ups and tell the dentist about the cancer treatment they received. Talk with your child's dentist before and after treatment for guidance on reducing these potential late effects.

Digestive system. The gastrointestinal system, which helps digest and absorb food, can be affected by abdominal or pelvic surgery and radiation therapy to the neck, chest, abdomen, or pelvis. Survivors of childhood cancer should talk with their doctor if they experience abdominal

pain or chronic (long-term) constipation, diarrhea, heartburn, or nausea and vomiting.

Hearing problems. Radiation therapy to the head or brain may cause hearing loss. Some chemotherapy, such as cisplatin (Platinol) or carboplatin (Paraplatin), may also affect hearing. Younger children are at greater risk for these problems. All survivors of childhood cancer should have their hearing tested at least once by an audiologist (a medical professional who identifies, treats, and manages hearing problems) after completing treatment. If there is hearing loss, a survivor should be tested every year or as recommended by your doctor.

Vision and eye problems. High doses of radiation to the eye, eye socket, or brain may cause eye problems such as cataracts (a clouding of the eye lens). Radioiodine treatment for thyroid cancer may result in increased tearing, and bone marrow/stem cell transplants increase risk for dry eyes. An ophthalmologist (a doctor who specializes in diseases of the eye) should evaluate childhood cancer survivors.

More Information

[Managing Late Effects of Childhood Cancer \[11\]](#)

[Coping \[12\] \[13\]](#)

[Managing Side Effects \[14\]](#)

[Guide to Childhood Cancer \[15\]](#)

Additional Resource

[National Cancer Institute: Late Effects of Treatment for Childhood Cancer \[16\]](#)

Links:

[1] <http://www.cancer.net/navigating-cancer-care/children/late-effects-childhood-cancer>

[2] <http://www.cancer.net/about-us>

[3] <http://www.cancer.net/node/27136>

[4] <http://www.livestrong.org/What-We-Do/Our-Actions/Programs-Partnerships/LIVESTRONG-Survivorship-Centers-of-Excellence>

[5] <http://www.acor.org/ped-onc/treatment/surclinics.html>

[6] <http://www.beyondthecure.org/page.aspx?pid=783>

[7] <http://www.survivorshipguidelines.org/>

[8] <http://www.cancer.net/node/25268>

[9] <http://www.cancer.net/node/24509>

[10] <http://www.cancer.net/node/24599>

[11] <http://www.cancer.net/node/24587>

[12] <http://www.cancer.net/node/21>

[13] <http://www.cancer.net/sideeffects>

[14] <http://www.cancer.net/node/25238>

[15] <http://www.cancer.net/node/18689>

[16] <http://www.cancer.gov/cancertopics/pdq/treatment/lateeffects/Patient/page1>