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[Leukemia - Acute Myeloid - AML - Childhood - Treatment Options](#) [1]

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ON THIS PAGE: You will learn about the different ways doctors use to treat children with this type of cancer. To see other pages, use the menu on the side of your screen.

Treatment overview

In general, cancer in children is uncommon, so it can be hard for doctors to plan treatments unless they know what has been most effective in other children. That's why more than 60% of children with cancer are treated as part of a clinical trial. [Clinical trials](#) [3] are research studies that compare standard treatments (the best known treatments available) with newer approaches to treatments that may be more effective.

Clinical trials may test such approaches as a new drug, a new combination of standard treatments, or new doses of current therapies. Studying new treatments involves careful monitoring using scientific methods, and all participants are followed closely to track their health and progress.

To take advantage of these newer treatments, children with cancer should be treated at a specialized cancer center. Doctors at these centers have extensive experience in treating children with cancer and have access to the latest research. A doctor who specializes in treating children with cancer is called a pediatric oncologist. If a pediatric cancer center is not nearby, general cancer centers sometimes have pediatric specialists who are able to be part of your child's care.

In many cases, a team of doctors works with a child and the family to provide care; this is called a [multidisciplinary team](#) [4]. Pediatric cancer centers often have extra support services for children and their families, such as child life specialists, dietitians, physical and occupational therapists, social workers, and counselors. Special activities and programs to help your child and family cope may also be available.

An increasing number of pediatric cancer centers also have services for [teenagers](#) [5] and [young adults](#) [6]. Sometimes, adult cancer centers also offer clinical trials for teens and young adults with cancer.

Descriptions of each treatment option for AML are listed below. Two types of treatment commonly used to treat AML in children are chemotherapy and stem cell/bone marrow transplantation. Radiation therapy is used occasionally in specific situations. Sometimes, more than one treatment is used.

Treatment options and recommendations depend on several factors, including the subtype of AML, possible side effects, the patient's preferences, and the patient's overall health. Your child's care plan may also include treatment for symptoms and side effects, an important part of cancer care. Take time to learn about all of the treatment options and be sure to ask questions about things that are unclear. Also, talk about the goals of each treatment with your child's doctor and what you and your child can expect while receiving the treatment. Learn more about [making treatment decisions](#) [7].

Chemotherapy

Chemotherapy is the most common treatment for AML. It is the use of drugs to destroy cancer cells, usually by stopping the cancer cells' ability to grow and divide. It is given by a pediatric hematologist-oncologist, a doctor who specializes in treating cancer in children with medication.

Systemic chemotherapy gets into the bloodstream to reach cancer cells throughout the body. Common ways to give chemotherapy include an intravenous (IV) tube placed into a vein using a needle or in a pill or capsule that is swallowed.

A chemotherapy regimen (schedule) usually consists of a specific number of cycles given over a set period of time. A patient may receive one drug at a time or combinations of different drugs at the same time.

Several treatment regimens have been developed that involve intensive use of several drugs. Following these regimens, about 85% of children will have an initial remission, and about 50% to 70% will be cured, meaning that the cancer never returns. See below for detailed descriptions about the levels of remission used to describe the state of disease. During treatment, children with AML need to be watched very carefully and often spend many weeks in the hospital because very low blood cell counts increase the risk of [developing infections](#) [8].

The choice of drugs depends on whether the child has previously been treated for AML, as well

as other factors. Chemotherapy for AML is usually divided into two phases of treatment: induction and intensification.

- **Induction chemotherapy** uses chemotherapy to destroy as many of the cancer cells as possible to make the AML to go into remission.
- **Intensification chemotherapy** is used to destroy any cancer cells that may be hiding after induction chemotherapy has led to remission. This means that there are too few to detect by modern tests. Stem cell transplantation also can be used for intensification therapy (see below).

The side effects of chemotherapy depend on the individual and the dose used, but they can include fatigue, low blood cell counts, risk of infection, hair loss, nausea and vomiting, loss of appetite, or diarrhea.

These side effects usually go away once treatment is finished. The severity of side effects may also be affected by other factors, including genetic differences in the way the drugs are used by the body and the child's overall health and well-being.

Doctors understand that everyone is different. Most children are initially treated similarly to other children with the same cancer. However, based on the side effects, doses or schedules may be changed. This is a constant balance between the effort to destroy all the cancer cells and the need to avoid severe side effects. Your child's doctor will discuss changes to the treatment plan with you as they are needed, and not all children will need to have their chemotherapy changed.

There are two very unique subtypes of childhood AML that are treated differently from the rest:

- **Children with Down syndrome who develop AML under 4 years of age.** The AML that develops in this case is more sensitive to chemotherapy, and less intense chemotherapy may be used with very good cure rates of nearly 90% survival at 5 years.
- **Acute Promyelocytic Leukemia (APL) with t(15;17)(q22;q12).** This leukemia results from two genes, *PML* and *RARA*, which due to chromosome abnormalities are brought next to each other. Two drugs, all-trans retinoic acid (ATRA) and arsenic trioxide, are unique agents and unlike traditional chemotherapy. This treatment approach, when combined with chemotherapy, has achieved excellent response rates above 90%. Other studies have shown a similar benefit when both drugs are used without chemotherapy.

Learn more about the basics of [chemotherapy](#) [9] and [preparing for treatment](#) [10]. The

medications used to treat cancer are continually being evaluated. Talking with your child's doctor is often the best way to learn about the medications prescribed for your child, their purpose, and their potential side effects or interactions with other medications. Learn more about prescriptions by using [searchable drug databases](#) [11].

Stem cell transplantation/bone marrow transplantation

Children with AML have different risks of recurrence depending on the [subtype](#) [12]. Recurrence is when the leukemia returns following treatment. For children with a higher risk of recurrence, it is more likely that the doctor will recommend stem cell transplantation to help prevent a recurrence.

A stem cell transplant is a medical procedure in which bone marrow that contains cancer is replaced by highly specialized cells called hematopoietic stem cells that develop into healthy bone marrow. Hematopoietic stem cells are blood-forming cells found both in the bloodstream and in the bone marrow. Today, this procedure is more commonly called a stem cell transplant rather than bone marrow transplant. That's because it is the stem cells in the blood that are typically being transplanted, not the actual bone marrow tissue.

Before recommending stem cell transplantation, doctors will talk with the patient about the risks of this treatment. Doctors will also consider several other factors, such as the type of leukemia, results of any previous treatment, and patient's age and general health.

Not all children with AML need stem cell transplantation. For instance, children with Down syndrome and the subtype called APL with t(15;17) do not need stem cell transplantation unless the AML recurs. AML with certain genetic changes (for example, chromosome abnormalities known as inv 16 and t[8;21], or molecular changes known as NPM1 or CEBP α) is not treated with stem cell transplantation unless the leukemia has recurred. Children with subtypes of AML that have lower risks of recurrence and therefore higher chances of cure can usually receive chemotherapy alone.

Doctors sometimes look at how well induction chemotherapy worked to decide whether stem cell transplantation will be used. Children without high risk factors for recurrence, such as FLT3-ITD, monosomy 7, monosomy 5 or deletion of the q arm of chromosome 5 (5q deletion), who have no MRD in their bone marrow after induction, also may be treated without use of a stem cell transplant in the first remission.

There are two types of stem cell transplantation depending on the source of the replacement blood stem cells:

- **Allogeneic (ALLO).** ALLO transplantation is the type most often used for AML. An ALLO transplantation uses donated stem cells, from a related or unrelated donor.

- **Autologous (AUTO).** AUTO transplantation uses the patient's own stem cells.

For children with a higher risk for recurrence, when a related donor is available, stem cell transplantation is the preferred treatment after a child has a first remission. For children with the highest risk of recurrence and the poorest chance of recovery, stem cell transplantation with either a related or unrelated donor is often used in addition to chemotherapy after the child has a first remission.

In the past, transplantations from unrelated donors were not done unless the AML had recurred. However, as the safety of using stem cells/bone marrow from unrelated donors has improved, these types of transplants are being used more often to prevent recurrence for children with high risk AML. Clinical trials are studying the use of unrelated donor transplants for patients with AML that has certain high-risk features. Examples include a chromosome abnormality called monosomy 7 or a child who doesn't experience a remission after their first induction chemotherapy.

The goal of stem cell transplantation is to destroy cancer cells in the marrow, blood, and other parts of the body and allow replacement blood stem cells to create healthy bone marrow.

Learn more about the basics of [stem cell and bone marrow transplantation](#) [13].

Radiation therapy

Radiation therapy is the use of high-energy x-rays or other particles to destroy cancer cells. A doctor who specializes in giving radiation therapy to treat cancer is called a radiation oncologist. The most common type of radiation treatment is called external-beam radiation therapy, which is radiation given from a machine outside the body. A radiation therapy regimen (schedule) usually consists of a specific number of treatments given over a set period of time.

Radiation therapy for AML is generally used only if the cancer has spread to the brain and does not respond to systemic chemotherapy and/or chemotherapy given into the spinal fluid. Radiation therapy may also be used to treat a chloroma when chemotherapy has not fully worked. As explained above, radiation therapy may also be used during a stem cell/bone marrow transplant.

Side effects from radiation therapy may include fatigue, mild skin reactions, upset stomach, or loose bowel movements. Most side effects go away soon after treatment is finished. Radiation therapy can sometimes interfere with the normal growth and development of the child's brain and body. Therefore, when possible, chemotherapy is used first to avoid radiation therapy. More information about long-term effects can be found in the Follow-up care section.

Learn more about the basics of [radiation therapy](#) [14].

Getting care for symptoms and side effects

Leukemia and its treatment often cause side effects. In addition to treatment to slow, stop, or eliminate the disease, an important part of care is relieving a child's symptoms and side effects. This approach is called palliative or supportive care, and it includes supporting the patient with his or her physical, emotional, and social needs.

Palliative care is any treatment that focuses on reducing symptoms, improving quality of life, and supporting patients and their families. Any person, regardless of age or type and stage of cancer, may receive palliative care. It works best when palliative care is started as early as needed in the cancer treatment process.

Children often receive treatment for the leukemia and treatment to ease side effects at the same time. In fact, patients who receive both often have less severe symptoms, better quality of life, and report they are more satisfied with treatment.

Palliative treatments vary widely and often include medication, nutritional changes, relaxation techniques, emotional support, and other therapies. Your child may also receive palliative treatments similar to those meant to eliminate the cancer, such as chemotherapy or radiation therapy. Talk with your child's doctor about the goals of each treatment in your child's treatment plan.

Before treatment begins, talk with your child's health care team about the possible side effects of the specific treatment plan and palliative care options. And during and after treatment, be sure to tell your child's doctor or another health care team member if your child is experiencing a problem so it can be addressed as quickly as possible. Learn more about [palliative care](#) [15].

Describing the State of Disease

The following terms are used to describe the state of disease for children with AML:

- **Untreated AML.** The child has not received any treatment except to relieve symptoms of the disease. The blood and/or bone marrow contains measurable amounts of leukemia cells, and the child may or may not have [symptoms and signs](#) [16] of the disease.
- **Complete Remission AML.** There are too few cancerous blast cells in the bone marrow to tell apart from healthy blasts under the microscope. Traditionally, this means there are fewer than 5% blasts in the bone marrow. New monitoring methods, called minimal residual disease (MRD; cancer cells not destroyed by treatment) methods, are better able to find fewer cancerous blasts, as well as tell the difference between cancerous blasts and healthy blasts. MRD methods are now being used more often to determine remission, and recent research has shown these methods are better able to predict the chance of curing the disease. The child usually does not have any signs or symptoms of the disease when in

complete remission.

- **Partial Remission AML.** The number of cancerous blast cells in the bone marrow is reduced but still can be seen under the microscope or by MRD methods, if appropriate. The child usually does not have any signs or symptoms of the disease, which only matters during initial therapy called induction (see above).
- **Recurrent AML.** The disease has come back after the child had a period of remission (complete absence of symptoms; see above).
- **Refractory AML.** The leukemia did not go into complete remission after treatment.

Remission and the chance of recurrence

As described above, a complete remission is when leukemia cannot be detected in the body or at very low levels, and the patient usually doesn't experience any symptoms. This may also be called having "no evidence of disease" or NED.

A remission may be temporary or permanent. This uncertainty causes many people to worry that the cancer will come back. While many remissions are permanent, it's important to talk with your child's doctor about the possibility of the disease returning. Understanding the risk of recurrence and the treatment options may help patients and their families feel more prepared if the leukemia does return. Learn more about [coping with the fear of recurrence](#) [17].

If the cancer does return after the original treatment, it is called recurrent (or relapsed) cancer. Most often, AML comes back in the bone marrow, but sometimes it may come back in the brain or other parts of the body.

When this occurs, a cycle of testing will begin again to learn as much as possible about the recurrence. After testing is done, you and your child's doctor will talk about the treatment options. Treatment usually includes chemotherapy followed by stem cell transplantation. However, each child's treatment is planned based on his or her specific circumstances. Your child's doctor may also suggest clinical trials that are studying new ways to treat this type of recurrent cancer. For some children, recurrent AML can be cured.

Whichever treatment plan you choose, palliative care will be important for relieving symptoms and side effects.

When cancer recurs, patients and their families often experience emotions such as disbelief or fear. Families are encouraged to talk with their health care team about these feelings and ask about support services to help them cope.

Learn more about [dealing with cancer recurrence](#) [18].

If treatment fails

Although treatment is successful for the majority of children with cancer, sometimes it is not. If a child's cancer cannot be cured or controlled, this is called advanced or terminal cancer.

This diagnosis is stressful, and advanced cancer may be difficult to discuss. However, it is important to have open and honest conversations with your child's doctor and health care team to express your family's feelings, preferences, and concerns. The health care team is there to help, and many team members have special skills, experience, and knowledge to support patients and their families.

Parents or guardians are encouraged to think about where the child would be most comfortable: at home, in a home-like setting elsewhere, in the hospital, or in a hospice environment. Hospice care is a type of palliative care for people who are expected to live less than six months. It is designed to provide the best possible quality of life for people who are near the end of life.

Nursing care and special equipment can make staying at home a workable alternative for many families. Some children may be happier if they can arrange to attend school part-time or keep up other activities and social connections. The child's health care team can help parents or guardians decide on an appropriate level of activity.

Making sure a child is physically comfortable and free from pain is extremely important as part of end-of-life care. Learn more about [caring for a terminally ill child](#) [19] and [advanced cancer care planning](#) [20].

The death of a child is an enormous tragedy, and families may need support to help them cope with the loss. Pediatric cancer centers often have professional staff and support groups to help with the process of grieving. Learn more on [grieving the loss of a child](#) [21].

The [next section in this guide is About Clinical Trials](#) [3] and it offers more information about research studies that are focused on finding better ways to care for people with cancer. Or, use the menu on the side of your screen to choose another section to continue reading this guide.

Links

[1] <http://www.cancer.net/cancer-types/leukemia-acute-myeloid-aml-childhood/treatment-options>

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

[3] <http://www.cancer.net/node/19059>

[4] <http://www.cancer.net/node/25356>

[5] <http://www.cancer.net/node/25116>

[6] <http://www.cancer.net/node/25117>

[7] <http://www.cancer.net/node/24582>

[8] <http://www.cancer.net/node/25256>

- [9] <http://www.cancer.net/node/24723>
- [10] <http://www.cancer.net/node/24473>
- [11] <http://www.cancer.net/node/25369>
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- [21] <http://www.cancer.net/node/25288>