

UCSF BENIOFF CHILDREN'S HOSPITALS

Pediatric Cancer Program



Taking care of children with cancer requires a multidisciplinary team. At UCSF Benioff Children's Hospitals, our patients have access to highly skilled oncologists, surgeons, nurses and other specialists to care for the child and their entire family.



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Overview

UCSF Benioff Children's Hospitals have been on the forefront of research and treatment for childhood cancer for decades, at both our San Francisco and Oakland campus. Our robust clinical and research programs have had an impact on pediatric cancer care worldwide. Our programs are designed specifically for accurate diagnosis and treatment of children. Because of the level of expertise we provide, the future is brighter for many of the patients who come to us for care.

Cure rates for childhood cancers have risen dramatically over the past 40 years, thanks to remarkable advances in the treatment of leukemia and other cancers. Today, the overall 5-year survival rate for childhood cancer is nearly 85 percent. In the 1970s, it was 10 percent.



Research has shown that teenagers and young adults with childhood cancer have vastly improved outcomes and survival rates when treated at a pediatric hospital with a specialized oncology center that offers participation in clinical trials. We use treatment protocols that are more aggressive than those used at adult hospitals, and we have the expertise to handle the side effects such treatment can cause.

Despite these improvements, the effects of childhood cancer can be long lasting. The disease may affect cognition, education, socialization and development. It may also increase the risk of other major medical conditions including heart disease and subsequent cancers. At UCSF Benioff Children's Hospitals our survivorship program helps patients monitor their progress once they have recovered and resumed their lives post-treatment.

Clinical care

Taking care of children who have cancer requires expertise not just in pediatric oncology but in numerous other subspecialties. At UCSF Benioff Children's Hospitals, patients have access to some of the best clinicians in the world. Many of our physicians are leaders in national groups focused on pediatric cancer research into leukemia, neuroblastoma, liver tumors, brain tumors and other cancers.

Pediatric oncology care is complex and requires numerous pediatric subspecialists working together to provide coordinated care. Our team-based care includes pediatric experts in:

- Endocrinology
- Gastroenterology
- Infectious disease
- Intensive care
- Neurology and neurosurgery
- Ophthalmology
- Pain, palliative and integrative medicine
- Pathology
- Radiation oncology
- Radiology
- Rehabilitation medicine
- Surgery

As an academic medical center, our faculty offers a depth of expertise in these and many other subspecialties, all in one place and accessible whenever needed.



“We are committed to providing cutting-edge care informed by the latest research to our diverse population of patients across the Bay Area.”

Alejandro Sweet-Cordero, MD



Family support

We create a healing environment for the entire family with special programs for teens, music and art therapy, service dogs, games and an in-hospital school.

Pediatric social workers help patients and their families cope with a broad range of psychological stressors related to illness and the experience of the medical environment. They can assist families to:

- Manage the emotional affect of cancer on parents, siblings and other family members.
- Connect with resources that can help them cope with the financial burden of cancer treatment can create.
- Access transportation, lodging and other community resources, especially if a family is coming for treatment from another city.

Both our Oakland and San Francisco hospitals have facilities nearby that offer free or low-cost housing to eligible families during their child's treatment at UCSF Benioff Children's Hospitals. And our Family House, adjacent to our San Francisco hospital, provides a home away from home for qualifying families who live 70 or more miles from the hospital.

Family members may visit either of our family resource centers (in both our Oakland and San Francisco locations), where they can access a library of information about health,

illness and coping with hospitalization. These resource rooms feature fax machines, computers with internet access, phone jacks for laptops, phones, copiers and other services.

Research

Clinicians and scientists at UCSF Benioff Children's Hospitals make significant contributions that benefit all children with cancer. Our research commitment includes both bench science and clinical trials of new drugs and therapies. Our patients can enroll in many clinical trials through our global partnerships with numerous cooperative groups, and through our participation in local and multi-institutional studies investigating epidemiology, prevention, tumor biology and novel diagnostics.

Our portfolio of research studies includes:

- Leukemia and lymphoma
- Solid cancers (including neuroblastoma, osteosarcoma, Ewing sarcoma and rhabdomyosarcoma)
- Brain tumors
- Stem cell transplantation and immunotherapy.

In addition to participating in national clinical research studies of the most innovative treatments for pediatric and adolescent cancers, UCSF investigators conduct cutting-edge research to understand the molecular abnormalities that cause cancer and drive abnormal cell growth. The UCSF Helen Diller Family Comprehensive Cancer Center (HDFCCC), which is supported by a large grant from the National Cancer Institute (NCI), brings pediatric cancer clinicians together with researchers from many UCSF departments to undertake collaborative research studies spanning subject areas from epidemiology and population sciences to biochemistry and chemical biology. The HDFCCC Pediatric Malignancies Program plays a key role in these efforts.

UCSF Benioff Children's Hospital Oakland is the pediatric component of the Bay Area Tumor Institute's (BATI) NCI Community Oncology Research Program (NCORP), a national network that brings cancer clinical trials and cancer care delivery to people in their own communities. This program gives clinical trial access to the diverse socioeconomic and ethnic populations we serve.

Two exemplary examples of "team science" related to pediatric and adolescent cancer are NCI-funded Specialized Programs of Research Excellence (SPOREs), which focus on brain tumors and on cancers that develop in patients with neurofibromatosis type 1 (NF1) and other RASopathy disorders.

- **The UCSF Brain Tumor SPORE** seeks to identify factors that contribute to the likelihood of surviving brain cancer, to identify noninvasive imaging that can help predict therapeutic responses in patients with glioma, and to develop better mechanism-based therapies for treating brain cancer. The research proposed in this Brain Tumor SPORE application has a high likelihood of changing the way we detect, diagnose and treat brain cancer.
- **The Developmental and HyperActive Ras Tumor (DHART) SPORE** is a collaborative effort led by researchers at the Indiana University Melvin and Bren Simon Comprehensive Cancer Center and the UCSF HDFCCC. Its goal is to conduct cutting-edge research that will lead to better treatments for patients with NF1 and other RASopathy disorders who develop different tumors and cancers, many of which occur early in life.

National leadership

UCSF Benioff Children's Hospitals actively participate in the Children's Oncology Group (COG) consortium. Its San Francisco campus offers Phase 1 clinical trials supported by the COG's Pediatric Early Phase-Clinical Trial Network (PEP-CTN) in Northern California (there are only 23 nationwide).

COG is a consortium of institutions in the United States, Canada, New Zealand and Australia. Its member hospitals and research centers are dedicated to pooling data from clinical trials at each of these organizations. By standardizing practices across 215 member institutions worldwide, more powerful data are assembled than could be done by an individual institution. The result is an ability to conduct robust clinical trials that demonstrate the efficacy of various interventions.

Faculty members from UCSF Benioff Children's Hospitals hold active leadership roles in four COG committees:

- Cancer control (supportive care)
- Diversity and health disparities
- Neurology
- Non-Hodgkin's lymphoma

Most of our faculty also contribute as active members of other COG committees.



We are also active participants in:

- Beat Childhood Cancer Research Consortium
- Cancer Center Support Grant (CCSG)
- Center for Cancer Genomics (CCG)
- Childhood Hepatic Tumors International Collaborative (CHIC)
- COG Pediatric Early Phase Clinical Trials Network (PEP-CTN)
- Histiocyte Society
- New Approaches to Neuroblastoma Therapy (NANT) consortium, founded by faculty member Katherine Matthay, MD
- North American Consortium for Histiocytosis (NACHO)
- Pacific Pediatric Neuro-Oncology Consortium (PNOC)
- Therapeutic Advances in Childhood Leukemia & Lymphoma (TACL) consortium.

International outreach

The UCSF Global Cancer Program performs innovative research that addresses the disparate burden of cancer in low- and middle-income countries, where cancer survival is approximately 20 percent as compared to 80 percent in higher-income countries.

Michelle Hermiston, MD, PhD, is associate director of the UCSF Global Cancer Program. In collaboration with Anurag Agrawal, MD, and other national and international colleagues, they began work in Vietnam in 2016 to improve outcomes for children with cancer. In 2019, they developed a pediatric hematology/oncology two-year master's training program to build local expertise in cancer and blood disorders.

With additional funding to support local data managers at most children's hospitals in Vietnam, they will be able to better track cancer cases and outcomes. They are also working on the development of unified national treatment protocols parallel to what is done in the United States.

The pediatric cancer program is also collaborating with scientists in Mexico to help bring advanced genome sequencing approaches developed at UCSF to help diagnose cancer patients in Mexico who currently do not have access to these technologies. Working with Mexican scientists and colleagues at the UCSF Clinical Cancer Genomics Laboratory, Alejandro Sweet-Cordero, MD, and his group hope to contribute to the development of a robust genomics program in Mexico to benefit pediatric cancer patients.



UCSF Milestones in Pediatric Cancer Research

- First to develop and offer metaiodobenzylguanidine (MIBG) therapy for neuroblastoma.
- First to discover that NF1 is a tumor-suppressor gene in pediatric leukemia (1994) and first to develop the robust models for testing new treatments (2004).
- First to describe that CBL is a tumor-suppressing gene, and to show that inherited mutations cause a familial cancer predisposition syndrome. This furthered research and discovery of RASopathies – germline conditions that predispose a person to cancer.
- First to discover all the mutations that occur in juvenile myelomonocytic leukemia, and to develop a diagnostic sequencing test for use at UCSF Benioff Children's Hospitals.
- First to identify a new familial cancer syndrome called myelodysplasia and leukemia syndrome associated with monosomy 7 (1987), and, in recent work with Jeffery Kico, MD, PhD, of St. Jude Children's Research Hospital, to show that it is caused by inherited mutations in the SAMD9 or SAMD9L genes (2018). This work has informed the diagnosis and management of affected families, including deciding which children should undergo bone marrow transplantation.
- First to perform Convection Enhanced Delivery (CED) into primary brain tumors, which delivers medication directly to the brain over a period of hours.

Precision Cancer Medicine



The science of genomics reveals the genes that are altered in a specific disease. This information can guide crucial decisions about diagnosing and caring for a child with cancer.

The UCSF Clinical Cancer Genomics Laboratory

The UCSF Clinical Cancer Genomics Laboratory (CCGL) is the only resource in Northern California to offer the UC500 panel, a unique gene sequencing tool designed by oncology and genomics experts that can identify mutations and other alterations in more than 500 genes involved in childhood cancer. The CLIA-approved CCGL laboratory has sequenced more than 10,000 samples, including 1,000 samples from children and young adults. Results of the UC500 panel are discussed by UCSF experts in oncology, pharmacology and genetics. The UC500 is an example of how UCSF Benioff Children's Hospitals provide access to cutting-edge precision-medicine care for all children with cancer.

The UC500 test can assist patients and clinicians in three ways:

- 1. To clarify a diagnosis, especially in the case of a rare tumor.** Traditional histopathology review may in some cases not be specific enough to identify very rare cancers. The UC500 can provide a rapid and specific diagnosis, avoiding time wasted pursuing a treatment path that is not focused enough for a specific patient.
- 2. To determine if a child has a genetic predisposition to a cancer.** An estimated 15 percent of children with cancer have a familial or genetic predisposition to cancer. Identifying these predispositions is critical not only for treatment of the current diagnosis but to prevent other cancers later in life. It is increasingly clear that modern prevention strategies such as serial imaging is critical for these patients so they can be followed over time to prevent that secondary cancer from developing. This is also important for siblings or other family members who may carry the same predisposition in their DNA.
- 3. To identify potential new therapies.** Though many cancers have a standard treatment method that may include chemotherapy, radiation and/or surgery, some cancers do not respond to these traditional approaches. The CCGL's vast database of patients sequenced using the UC500 is accessible to physicians to see drugs or treatments were used for similar cases and how patients responded to them. This can be lifesaving in some situations.

Precision cancer medicine at UCSF is an integrated effort across both our adult and pediatric hospitals. This is important since most drugs are initially tested in adults, not children. By understanding adult treatment outcomes and toxicities with specific drugs, we are better able to create clinical trials adapted to the needs of children with cancer.

UCSF Benioff Children's Hospitals' clinicians recommend that providers submit tissue samples for sequencing for all children with a high-risk cancer diagnosis.



Alejandro Sweet-Cordero, MD, leads the Precision Medicine program at UCSF for both adults and children. He also leads a separate research program dedicated to performing more in-depth sequencing for advanced pediatric cancer patients, especially those who have not responded to standard therapies offered elsewhere.

Genomics research

In addition to the CCGL, UCSF has a research-focused genomics laboratory that explores genes and genetic pathways relevant to tumor development and therapeutic responses.

Overall, precision medicine is focused on identifying specific mutations in the cancer cells that respond to drugs, such as:

- The ALK mutation in neuroblastoma
- Mutations of BRAF in brain tumors
- NTRK fusions across a variety of rare cancers
- Ph-like ALL

"It's one thing to do a test, but it's another to interpret the results. The UC500 panel gives us an excellent assessment tool to help us find the right diagnosis."

Sabine Mueller, MD, PhD, MAS



One of the challenges is that there are many different mutations possible even in a single gene, and they may each require a new drug. UCSF investigators are actively working to link the genetic profile of each cancer to a personalized treatment.

Early Phase Clinical Trials Program

The treatment of newly diagnosed pediatric cancers is often standard across medical centers, and may include chemotherapy, radiation and/or surgery. However, when the standard therapy is not effective and the cancer progresses or recurs, new options for therapy are needed. In this situation, patients are often referred for enrollment in a clinical trial of novel agents.

UCSF Benioff Children's Hospitals have a broad portfolio of clinical trials that cover most forms of childhood cancers. Every year, we enroll about 80 children in early-phase clinical trials. These are also referred to as Phase 1 or Phase 2 trials and are carried out to evaluate the safety and efficacy of such therapies. UCSF Benioff Children's Hospitals faculty members are involved in both developing and leading these trials at both campuses.

Our Early Phase Clinical Trials Program is designed to carry out studies involving novel approaches to refractory or relapsed pediatric and young adult cancers. Because of our in-depth experience in coordinating these trials, we are often invited to participate in these studies by pharmaceutical companies or other organizations that conduct trials worldwide, including:

- Children's Oncology Group Pediatric Early Phase Clinical Trials Network (COG PEP-CTN)
- Consortium for Pediatric Cellular Immunotherapy (CPCI)
- North American Consortium for Histiocytosis (NACHO)
- New Approaches to Neuroblastoma Therapy (NANT)
- Pacific Pediatric Neuro-Oncology Consortium (PNOC)
- Therapeutic Advances in Childhood Leukemia & Lymphoma (TACL)

Most clinical trials are carried out at academic medical centers, for several reasons:

- **Infrastructure.** It takes a well-developed infrastructure to run multiple clinical trials that rigorously protect the interests of the patients who have agreed to participate. At UCSF Benioff Children's Hospitals, we have a dedicated team of clinical research nurses and coordinators who oversee the trials. This ensures that the quality of data collected is robust and reliable.
- **Physicians.** Clinicians and researchers have the expertise required to determine which trial is likely to offer the most potential benefit for each patient.
- **Patient volume.** Pediatric cancers are rare, but UCSF Benioff Children's Hospitals attract many such patients because of the sophisticated level of clinical care we provide. This ensures that there are enough eligible patients to enroll in clinical trials to generate strong data.

Participating in a clinical trial can benefit the patient by providing:

- Access to drugs or treatments that may not be available elsewhere.
- Opportunities to contribute to scientific research that may benefit other patients in the future.
- Hope to families who may have tried other treatments before enrolling in a trial.



“What motivates me is the type of research we’re doing here, which enables us to bring all these new drugs to pediatric populations.”

Kieuhoa Vo, MD



Leukemia and Lymphoma

UCSF Benioff Children's Hospitals provide expert care in the treatment of infants, children and young adults with acute leukemias and Hodgkin's and non-Hodgkin's lymphoma in a collaborative patient- and family-centered environment. The cure rates for these diseases continue to improve for most children; however, certain children relapse with very high-risk forms of leukemia and lymphoma. UCSF Benioff Children's Hospitals offer state-of-the-art therapies designed for these most difficult cases, including immunotherapies and stem cell transplantation.

Cooperative trials at UCSF through the Children's Oncology Group (COG), Therapeutic Advances in Childhood Leukemia & Lymphoma (TACL) and other consortia, allow us to offer cutting-edge clinical trials that are designed to improve outcomes with new approaches. We hold leadership roles in COG, a national organization that leads ongoing efforts to improve outcomes for these patients while minimizing the toxicities of therapy. We also offer many trials that are not widely available.

Some leukemias and lymphomas may be hereditary or difficult to diagnose. The UC500 panel is a molecular test that analyzes the DNA of tumor cells and helps determine the type of cancer and potential molecular-targeted therapy. This panel is unique to UCSF Benioff Children's Hospitals and is used widely by clinicians throughout the Bay Area and around the country.

At weekly leukemia and lymphoma multidisciplinary tumor board meetings, UCSF oncologists and transplant specialists meet to review complex cases and to make recommendations for care. Referring physicians are welcome to participate.

UCSF Benioff Children's Hospitals are nationally recognized centers of excellence for treating juvenile myelomonocytic leukemia (JMML), an extremely rare form of cancer. We lead or participate in clinical trials for this disease and see more JMML patients than any other medical center in the country.

Immunotherapy

Effectively harnessing the patient's own immune system to fight cancer has been a recent groundbreaking therapy. Chimeric antigen receptor T-cell (CAR-T cell) therapy is one such revolutionary treatment for childhood and young-adult leukemia and non-Hodgkin's lymphoma. It offers new hope for children who have no other therapeutic options.

In 2018, UCSF Benioff Children's Hospitals were one of the first sites to offer Kymriah, an FDA-approved CAR-T cell therapy product produced by Novartis. UCSF continues to offer innovative CAR-T cell therapy trials to patients with leukemia, in addition to carrying out cutting-edge laboratory research on novel CAR-T cell therapy treatment approaches and disease targets.

UCSF Benioff Children's Hospitals are experienced and skilled in these multiple steps required to offer CAR-T cell therapy:

- **Apheresis:** The patient's mononuclear cells are removed from the patient and sent for re-engineering in a laboratory to specifically target the protein of interest (in this case, CD19).
- **CAR-T cell infusion:** The re-engineered cells are infused back into the patient who is closely monitored for acute side effects (such as cytokine release syndrome or neurotoxicity), as the CAR-T cells rapidly target and kill all the patient's CD19-positive cells.
- **Follow-up:** The patient is monitored for short- and long-term side effects of therapy. UCSF Benioff Children's Hospitals communicate with the referring center to ensure that all necessary monitoring is done and questions are answered.

Many other methods of harnessing the patient's own immune system are used and studied at UCSF Benioff Children's Hospitals, including medications such as monoclonal antibodies. Clinical trials for these approaches have the goal of providing more curative options while minimizing toxicity.

In 2021, UCSF established the Living Therapeutics Initiative (LTI) to bring together UCSF's vast scientific and clinical expertise to accelerate research and quickly advance



promising therapies to clinical trials for patients who have few, if any, good treatment options. Building on advances in CAR-T cell therapies, researchers across UCSF are creating the next generation of cellular therapies to harness the immune system to treat pediatric cancers. These therapies will be smarter, safer, and more effective than the current generation of CAR-T, thanks to recent breakthroughs in cell engineering and gene editing.

Transplant program

Leukemia often becomes resistant to chemotherapy because the cancer cells learn how to evade the drugs that are trying to destroy them. A stem cell transplant (also sometimes called a bone marrow transplant) provides a form of immunotherapy in which the donor cells recognize the cancer cells as foreign and therefore attack and kill them.

The challenge of stem cell transplants is enhancing the graft-versus-leukemia effect and avoiding the development of graft-versus-host disease. In our cellular therapy laboratory, we can modify the stem cell product and remove most of the cells that cause graft-versus-host disease before the donor cells are infused into the patient.

One type of allogeneic transplant UCSF Benioff Children's Hospitals routinely perform is haploidentical stem cells, rather than stem cells that are an exact match. The term "haplo" means "half"; this indicates that now a successful donor (often a parent) can be half matched to the patient,

resulting in a much larger pool of people who can serve as donors. These may be parents, siblings and other family members. UCSF Benioff Children's Hospitals have long been national leaders in utilizing transplants with haploidentical donors, as this approach offers the possibility of a strong graft-versus-leukemia effect.

Supportive Care program

Every drug we give our patients has the potential for side effects, including infections and other toxic reactions. The UCSF Benioff Children's Hospitals Supportive Care program works to find ways to diminish these adverse reactions to chemotherapy. Our goals are to:

- Improve the efficacy of chemotherapy, immunotherapy and transplants.
- Minimize the time it takes for the treatment to be effective.
- Decrease treatment side effects.

Patients undergoing chemotherapy, immunotherapy and stem cell transplant may be severely immunocompromised and need extremely close management after these therapies. Sometimes they become critically ill from the acute toxicities resulting from treatment. The pediatric intensive care units at UCSF Benioff Children's Hospitals are staffed with clinicians who are specially trained in this type of critical care. They are considered national experts in the critical-care management of patients with cancer and those undergoing transplantation.

Brain and Spinal Cord Tumors



Brain and spinal cord tumors are the most challenging forms of childhood cancers. But scientists have made great strides in diagnosing and treating these conditions.

One of the most difficult aspects of treating brain tumors is the existence of the blood brain barrier, which prevents medications from entering the brain where the tumor is located. The tumor location and the impact of therapy on the developing brain may also present obstacles to treatment. For these reasons, researchers seek alternative means of entry. UCSF Benioff Children's Hospitals' clinicians and scientists have made remarkable advances in this area.

The progression of care for brain tumors is similar to that of other conditions: diagnosis, treatment and follow-up. What distinguishes the approach at UCSF Benioff Children's Hospitals is the depth of experience and the breadth of expertise available to care for each individual patient at every stage of this process.

Diagnosis: The first point of entry

The pathologic diagnosis of brain tumors is complex and evolving. We now have expanded capabilities including genomic studies to complement traditional histopathology in more precise diagnostics that include the ability to identify potential drugs to target tumor growth pathways.

1. Gene sequencing. Cancer genomics plays a major role in diagnosis. We tap into the UC500 panel for all our patients because it gives us the best means of determining the nature of the illness. This tool is an important distinguishing feature of care at UCSF Benioff Children's Hospitals, and sets us apart from other medical centers in terms of the resources that are available here for our patients.

The UC500 is a gene-sequencing panel that reveals the molecular underpinnings of a disease (see page 6). It adds significant value to traditional pathology tests, and can lead us to diagnoses that could have been missed had it not been for this resource.

2. Expert interpretation. In addition to genomic testing, our expert team includes specialists in molecular neuropathology, who interpret the findings from the UC500 sequencing, and in neuroradiology, to interpret images taken with the most advanced technology available.

3. Neurosurgery. The neurosurgical team at UCSF Benioff Children's Hospitals has collective expertise in highly advanced surgical approaches to taking biopsies of brain tissue. For example, a condition known as diffuse intrinsic pontine glioma (DIPG) occurs in the brain stem, an area that ordinarily is challenging to access surgically. Neurosurgeons at UCSF use a procedure known as stereotactic biopsy to retrieve brain tissue samples for diagnosing conditions such as DIPG, with minimal side effects. Rehabilitation services are available to complement postoperative care and recovery for these patients.



Care and treatment options

The type and location of a tumor determines the treatment chosen. The care of every patient is discussed at a multidisciplinary neuro-oncology tumor board, to which the referring physician is invited to attend. The team includes experts in:

- Molecular neuropathology
- Neuro-oncology
- Neuropsychology
- Neurosurgery
- Neuroradiology
- Radiation oncology.

Treatment usually begins with the clinical standard of care. If there is no standard treatment for the type of brain cancer identified, or if the tumor has resisted treatment, the patient has the opportunity to enroll in a clinical trial if clinically appropriate and if the trial is available locally. Patients may also be informed about possible trials at other institutions.

UCSF Benioff Children's Hospitals lead an international consortium of medical centers that are developing highly innovative treatment protocols for brain tumors. Called the Pacific Pediatric Neuro-Oncology Consortium (PNOC), this group offers participation in numerous early phase clinical trials with colleagues at 22 institutions in the United States, Australia, India, Israel, the Netherlands and Switzerland.

“Every kid should have access to the best care possible regardless of where they land in this world.”

Michelle Hermiston, MD, PhD



Innovative treatments

Our UCSF Benioff Children's Hospitals experts are passionate about finding new treatments for childhood brain cancer. For example:

- 1. Convection enhanced delivery (CED).** Because the blood brain barrier prevents medications from reaching the brain in concentrations needed to reduce tumors, an innovative treatment method was explored by the UCSF team. Catheters are introduced directly into the tumor and the chemotherapeutic agent is infused into the malignant tissue. This method is currently in trial so no outcomes can be reported at this time.
- 2. MEK inhibitors for Neurofibromatosis 1.** Neurofibromatosis type 1 (NF1) is the most common neurologic genetic disorder, affecting one in every 3,000 people worldwide. UCSF conducts a comprehensive multidisciplinary NF clinic for both pediatric and adult patients. Tumors of the central and peripheral nervous system are common in patients with NF1. Critical work to understand how these tumors grow has been performed at UCSF for more than three decades. The most common tumors in patients with NF1 are neurofibromas. Until recently, there were no effective treatments for these tumors, which grow along nerve roots, or under or on the skin. Investigators at UCSF are studying how MEK-inhibitors, which are showing great promise, target the growth of neurofibromas and affect patients. Our team provides state-of-the-art treatment for patients with NF1, and access to clinical trials that aim to improve the health and quality-of-life for these patients.
- 3. Immunotherapy for diffuse midline gliomas (DMGs).** Use of immunotherapy has resulted in remarkable improvement in the outcomes of adults and children with specific types of cancers such as melanoma and leukemia. Implementing such novel and promising approaches for DMGs is now underway. This therapy has the potential to significantly affect the treatment approach for a disease for which improved outcomes have been elusive.

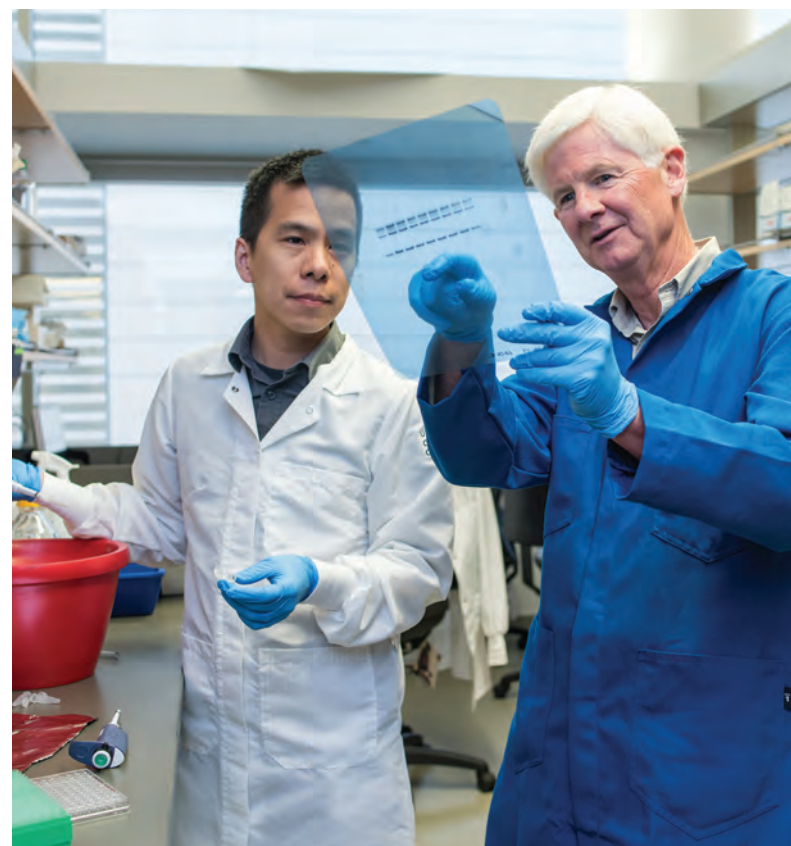
In laboratory research, UCSF Benioff Children's Hospitals scientists can now make T cells that specifically recognize DMG cells with the H3.3K27M mutation that is responsible for creating DMGs. These specific T cells can kill tumor cells in mice. Based on these exciting data, we are beginning to test this new therapy approach in the trial.

Long-term follow-up

Brain tumor treatment may have long-term side effects, even if the child recovers. Survival following surgery, radiation or chemotherapy may be accompanied by losses in physical and cognitive ability. Whatever the outcome, experts at UCSF Benioff Children's Hospitals are available to work with families to manage the functional or psychological issues they may face.

Our multidisciplinary clinic for follow-up care works to develop a personalized strategy for families and children, to help them achieve their maximum potential. Pediatric subspecialists in this clinic include:

- Endocrinologists
- Neuro-oncologists
- Neurologists
- Neuropsychiatrists
- Neurosurgeons
- Physiatrists
- Psychologists
- Social workers.



Neuroblastoma

Neuroblastoma is the second-most-frequent solid tumor diagnosed in children (brain tumors are the first). Even so, it is a rare disease, with about 700 cases annually in the United States.

Neuroblastoma is a tumor that forms in the tissues of the sympathetic nervous system. It has a heterogeneous presentation in patients. In 50 percent of cases, patients present with metastatic disease and have a poor prognosis, with only a 50 percent survival rate.

UCSF Benioff Children's Hospitals see many children with neuroblastoma who have relapsed or have not responded to treatment. Eligible patients come to enroll in a clinical trial or to try a novel therapy that is not available elsewhere. Their treatment relies on the multidisciplinary care available at UCSF Benioff Children's Hospitals.

Treatment

At UCSF Benioff Children's Hospitals, treatment for high-risk neuroblastoma is multimodal and intensive, often lasting more than a year. It involves chemotherapy, surgery, transplant, radiation and immunotherapy. The plan usually follows this sequence:

- 1. Induction.** The goal of induction is to attempt to reduce the size of the tumor to induce the patient into remission. This usually involves five cycles of high-dose chemotherapy, and surgery on the primary tumor.
- 2. Consolidation.** Following chemotherapy and surgery, a patient usually undergoes one or two autologous stem cell transplants. This is followed by radiation to the tumor bed to prevent tumor regrowth.
- 3. Post consolidation.** In this phase, the patient is treated with immunotherapy to maintain remission.



MIBG therapy

A hallmark of cancer care at UCSF Benioff Children's Hospitals is looking for investigating creative, new ways to treat the disease and improve survival.

In pioneering translational research that began more than 30 years ago, Katherine Matthay, MD, has developed and led multiple clinical trials using a unique targeted radiopharmaceutical, 131I-MIBG, to treat neuroblastoma. In this treatment, MIBG (metaiodobenzylguanidine) is specifically taken up by neuroblastoma cells. It is attached to a radioactive form of iodine and administered as an IV treatment.

The first Phase 3 clinical trial of MIBG with the Children's Oncology Group is currently underway at UCSF Benioff Children's Hospitals. In this trial, MIBG therapy is administered during the first phase of treatment (Induction), to see the response of the tumor can be improved early on and increase the chance of survival.

It takes a very specialized program to administer MIBG, including providing a lead-lined room for treatment to contain radioactivity, and a skilled and knowledgeable staff. UCSF Benioff Children's Hospitals are only one of two centers in California with these capabilities.

Clinical trials

Our Phase 1 clinical trials program (see page 8) includes many options for trying new agents for treating relapsed or refractory neuroblastoma. We work with biotech companies and several national and international groups that coordinate clinical trials in pediatric oncology, including the Children's Oncology Group (COG) and the New Approaches to Neuroblastoma Therapy (NANT) consortium.

Liver Tumors

Pediatric liver cancer is a rare disease, with an occurrence rate of about two per million children for hepatoblastoma (HB), the more prevalent type of pediatric liver cancer (the other is hepatocellular carcinoma, or HCC). However, over the past few years there has been an increase in the occurrence of HB. This increase may be related to epidemiological factors such as an increase in prematurity and low-birthweight infants in the United States, although the precise reasons remain unknown.

Hepatoblastoma occurs in approximately 150 children in the U.S. every year. It has been associated with certain genetic syndromes such as Beckwith-Wiedemann syndrome and cancer predisposition conditions such as Gardner syndrome. Children who are identified as carriers of such syndromes can be screened for liver cancers by ultrasounds and blood tests every three months during the first six years of their lives, before they develop signs or symptoms of such tumors.

Most treatments for pediatric liver cancer entail both chemotherapy and surgery, though some complex cases may be treated with more locoregional therapies such as chemoembolization or radioembolization. Some patients require liver transplantation if a tumor cannot be removed safely otherwise.

Since this disease is so rare, it's important to refer patients to an institution that shows a commitment to three factors: expertise, discovery and multidisciplinary communications. UCSF Benioff Children's Hospitals are dedicated to each of these components. Specifically:

- A rare disease such as liver cancer requires a range of expert practitioners available in one location. Subspecialists who participate in diagnosis and treatment include radiologists, interventional radiologists, pathologists, and pediatric and liver transplant surgeons.
- Our robust research program is in constant pursuit of new treatments, and makes available drugs and other novel therapies that may not be available elsewhere.
- Collaboration and communication are the hallmarks of our approach to care, with active participation in national and international research.

Expertise

Our providers have collective expertise in pediatric liver cancer. Our faculty holds leadership positions in national and international organizations including the Childhood Hepatic Tumors International Collaborative (CHIC), which manages the largest pediatric liver cancer database in the world.

Our UCSF International Multicenter Pediatric Liver Tumor Board meets every month to review challenging cases. Subspecialists from all disciplines participate, and physicians from around the country and the world are welcome to attend and present cases. Many patients whose cases are discussed are subsequently enrolled in a clinical trial at UCSF Benioff Children's Hospitals.

Our subspecialists have a wealth of expertise, such as in:

- Locoregional therapy for hepatic tumors
- Pediatric hepatobiliary transplantation
- Preoperative 3D modeling to determine the best surgical approach
- Pathology and advanced molecular diagnostics.



Research

UCSF Benioff Children's Hospitals faculty lead or participate in numerous clinical trials, often with medical centers from around the country. Some of these trials are based on drugs that were originally approved for adults but are adapted to determine their effectiveness in children. Examples include:

- How the use of sodium thiosulfate can help mitigate the hearing loss that is often associated with chemotherapy for HB patients
- Conducting a trial in patients with high risk hepatoblastoma that improved outcomes in patients with metastatic disease from 40 percent to above 90 percent by compressing the intervals between chemotherapy cycles.

Multiple laboratories at UCSF Benioff Children's Hospitals conduct basic research with the goal of improving diagnosis, care and treatment for pediatric liver cancer. Some of these projects include:

- Single-cell sequencing to focus on tumor heterogeneity, which can help explain why some tumors are more aggressive than others

- Mapping where tumor cells originate in the liver to analyze tumor behavior
- Understanding why some hepatoblastomas are beginning to appear with features that resemble hepatocellular carcinoma, a distinct type of liver cancer
- Using gene sequencing to identify mutations that have an affect on prognosis or choice of therapy
- Identifying biomarkers of tumor resistance to chemotherapy.

“We want to improve outcomes by promoting prevention, early detection and targeted treatments.”

Christopher Dvorak, MD



Pediatric Sarcomas

Pediatric sarcomas are rare and challenging to diagnose and treat. At UCSF Benioff Children's Hospitals, we have multiple subspecialists dedicated to pediatric cancer care who are available to support the treatment of children with sarcomas. Being part of UCSF Health, an adult treatment center, also offers opportunities to collaborate on adapting adult treatment modalities for use in children.

Sarcomas affect both adults and children, but in adults they comprise only 1 percent of all cancers; in children, they account for 15 percent. Survival rates for pediatric sarcomas range from 60-80 percent, though if the disease has metastasized the rate is much lower: 10-30 percent.

Diagnosis: The challenge and the key to treatment

The three most prevalent types of pediatric sarcomas are Ewing sarcoma, osteosarcoma and rhabdomyosarcoma. Because these conditions are rare, patients often suffer from delayed diagnosis since most medical providers are not experienced in treating them.

As our knowledge of the genetic drivers of disease grows, we have become experts in tapping into the science of genomics to increase the precision of our diagnoses. Our in-house genetic sequencing program, the UCSF 500, enables us to increase the precision of our diagnoses with rapid turnaround and with the expertise to interpret results and develop a plan of care.

The treatment paradigms for each pediatric sarcoma are similar: chemotherapy, radiation and surgery, though outcomes vary depending on the disease type and the age of the patient. When those approaches are not effective, UCSF Benioff Children's Hospitals offer unique and novel treatments through its robust Phase 1 clinical trials program (see page 8). We work with families to determine which trial would be best for each patient, including what affect it would have on the child's lifestyle.

Innovative treatments

Our faculty is on the front lines of developing therapies for pediatric sarcomas, such as:

■ Intraoperative radiotherapy

UCSF orthopaedic oncologists were early adopters of intraoperative radiation therapy (IORT), using low-dose radiation directly on exposed tissue in the operating room. This is useful if a particular tumor may be difficult to remove, and also avoids the need for postoperative radiation therapy.

■ Stereotactic therapy

Some sarcomas don't respond to chemotherapy and radiation, and tumors may not be resectable. In these cases, stereotactic radiotherapy may be an appropriate treatment. Its advantage over more traditional radiation therapy is that a high dose of radiation can be delivered to a small area, so that treatment can be completed in a matter of days.

■ Minimally invasive procedures

For newly diagnosed and relapsed patients, minimally invasive procedures such as interventional radiology and fine-needle aspiration enables the care team to get the information needed to start treatment immediately.

■ 3D printed prostheses

Surgeons are now able to print a customized replacement hip socket, for use in treating complex hip tumors that require aggressive surgical resections.



Pediatric sarcoma tumor board

With all the innovations in pediatric sarcoma treatment, physicians want to make sure they are introducing each one in the best sequence to achieve the best possible outcome. At our monthly pediatric sarcoma tumor board, each case is discussed with a multidisciplinary team that includes orthopaedic oncologists, radiation oncologists, pathologists, and adult and pediatric medical oncologists. This team works together to create complex treatment plans and to exchange expertise with adult providers.

“What keeps me motivated is knowing there are kids who beat the odds. I try to make every single patient one of those success stories.”

Jennifer Michlitsch, MD



Pain Management, Palliative Care and Integrative Medicine

The advanced treatment of pain in children with cancer has undergone dramatic changes over the past 20 years. Today, it is considered inappropriate to perform elective painful procedures on children without evidence-based treatments that avoid or minimize pain.

UCSF Benioff Children's Hospitals support pediatric cancer patients with one of the most comprehensive pain management programs in the country. It is driven by two guiding principles:

- A child's pain is caused not only by the disease, but also by the interventions used to treat it.
- No avoidable suffering is acceptable, even for "minor" interventions.



Our goal is to relieve the pain, anxiety and distress that often accompany pediatric cancer treatment.

Our interdisciplinary pain program is devoted to preventing and treating acute, procedural, neuropathic, total, visceral and chronic pain for our pediatric patients, in close collaboration with all oncology clinicians and subspecialties. The palliative care team provides holistic care for pediatric patients with advanced cancer and adds an extra layer of support to the care of children with serious illness, and their families.

Integrative medicine provides and teaches safe, evidence-based therapies to provide care that promotes optimal health and supports the highest level of functioning in a child's activities. It may include massage, hypnosis, aromatherapy, acupressure and acupuncture.

UCSF Benioff Children's Hospital San Francisco is certified in pain relief by the prestigious ChildKind International. It is also certified in palliative care by The Joint Commission.

Multimodal approach

To successfully treat pain and other distressing symptoms, depending on the individual child, we combine up to eight approaches that have multimodal analgesia at their core. Together, these therapies are more effective, and have fewer side effects, than if we used only one. Those modalities may include:

1. **Basic analgesics:** Acetaminophen, NSAIDs, COX-2 inhibitors (if not contraindicated)
2. **Psychology:** Cognitive behavioral therapy (CBT), skill-based training
3. **Integrative therapies:** Mind-body techniques (such as hypnosis, biofeedback, abdominal breathing), acupressure, acupuncture, aromatherapy, massage
4. **Regional anesthesia:** Neuraxial infusion, peripheral/plexus nerve block, neurolytic block, intrathecal port/pump
5. **Adjuvant analgesia:** Such as alpha-agonist, gabapentinoids, TCAs, NMDA-antagonists, sodium-channel blockers
6. **Rehabilitation:** Exercise, physical therapy, occupational therapy
7. **Opioids:** Such as tramadol, morphine
8. **Plus:** Normalizing life (school attendance, sleep hygiene, social interaction, sports), spirituality, child life.



"We use advanced pain and symptom treatment to improve healing and enhance quality of life for children with cancer."

Stefan Friedrichsdorf, MD



Needle pain

Needle pain is reported by children to be their worst pain experience. In fact, needle phobia in adults is often associated with needle pain experienced as a child.

We employ four evidence-based therapies to minimize needle pain during a procedure:

1. **Topical analgesics**, such as 4 percent lidocaine cream, to numb the skin
2. **Comfort positioning**, with no child restraints
3. **Allow breastfeeding or sugar water for an infant younger than 12 months**, or a comforting position with skin contact with a parent or caregiver
4. **Age-appropriate distraction**, in cooperation with child life specialists.

End-of-life care

Though survival rates for childhood cancer continue to improve with cure rates at about 85 percent, some cancers unfortunately resist treatment despite our best efforts. For those children who face clinical uncertainty we offer a palliative care program that enables the child to live as long and as well as possible. Data show that palliative care specialists providing advanced pain and symptom management enable children to live longer with a better quality of life than those who do not receive such support.

The family in close collaboration with their oncologist determines if, when, where and how the child may receive end-of-life services. Some elect to remain home; others prefer a hospice setting. Our program helps families locate support agencies in their geographic area that can help them coordinate with their care team at UCSF Benioff Children's Hospitals.

Neurodevelopmental Issues in Pediatric Cancer

Many children who are treated for acute lymphoblastic leukemia (ALL) or pediatric brain tumors (BTs) are at risk for developing various physical and neurocognitive “late effects” that are associated with childhood cancer and its treatment. Late effects are defined as occurring after the successful completion of medical therapy, usually two or more years from the time of diagnosis. Depending on the age of the child and the exact nature of their disease, these issues may affect the child’s overall development for many years to come.

Generally, it is assumed that late effects are chronic, if not progressive, in their course. Although there are medical and treatment differences between ALL and BTs, there are many similarities in their late-effect symptoms, particularly the neurocognitive deficits. A core set of cognitive processes seem to be particularly vulnerable, including:

- Attention/concentration
- Processing speed
- Various executive function processes
- Memory

At UCSF Benioff Children’s Hospitals, we monitor these patients once a child is medically stable. Our neuropsychological evaluations assess a child’s neurocognitive strengths and weaknesses across a variety of domains, such as:

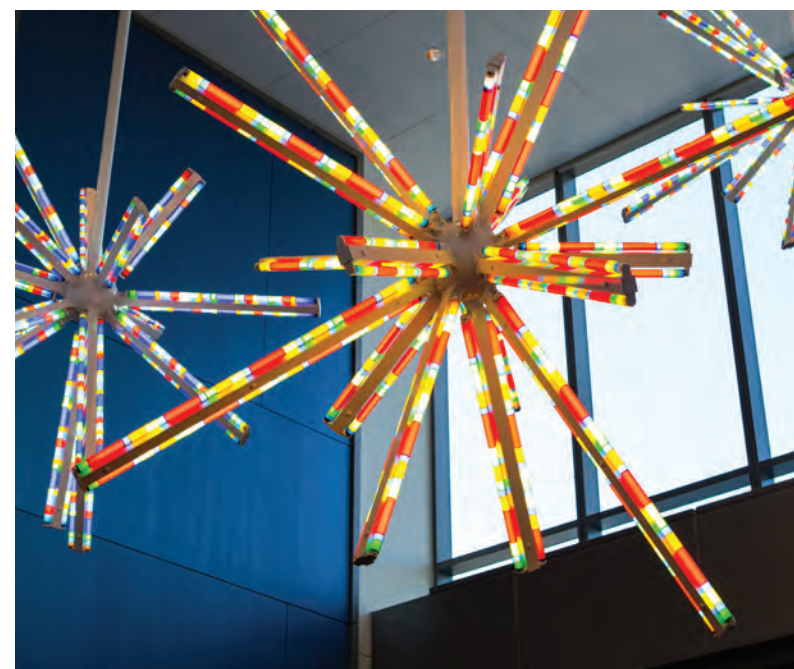
- Cognitive abilities
- Attention and impulse control
- Executive functioning and higher-order reasoning
- Learning and memory
- Fine motor and visual perception
- Social-emotional functioning

We help families better understand the affect cancer and medical therapy can have on daily functioning and ongoing development.

Following this evaluation, we create a plan to support the child through tailored recommendations for accommodations, services and interventions across home, school and community settings. We collaborate with the appropriate educational professionals at the child’s school to promote academic as well as social, emotional and behavioral success.

We also work with families to create a plan for coping with the social and emotional issues they and their child may face. It is common to experience anxiety, stress and adjustment issues related to all that a child and family have been through during cancer treatment. Many children have had long periods of hospitalization and recovery, and they may feel left out of many activities they once could do but no longer have the strength or coping skills to undertake. They may have missed out on important socialization learning opportunities with peers since they were in isolation for an extended time.

We recognize how challenging some of these issues may be, and work to provide short-term direct support to the family, and then help them seek out appropriate support and resources in their community.



Cancer Genetics and Prevention Program

The Pediatric Hereditary Cancer Clinic identifies and follows children who were born with a genetic mutation that places them at a high risk for developing cancer. Some of these children may already have recovered from cancer but are still at risk for recurrence because of the genetic mutation.

Though some children are never affected by these mutations, knowing about them offers the potential to prevent cancer from occurring or to detect it at an early, more treatable stage.

Some patients are tested because a physician suspects that the cancer they have may be hereditary. Others are seen in the clinic because a family member has learned through genetic testing that they have a mutation that may put other family members, including children, at risk for developing cancer. This process also allows families to avoid unnecessary long-term follow-up for their children who do not have gene mutations.

There are many types of hereditary cancer syndromes, most of which do not present an increased risk for cancer in children who have them. The UCSF Benioff Children’s Hospitals Pediatric Hereditary Cancer Clinic focuses on the conditions that specifically have an increased risk for cancer in childhood.

Patients who come to the clinic work with a multidisciplinary team that includes:

- Medical geneticists
- Pediatric oncologists
- Genetic counselors
- Nurse practitioners

Genetic testing

An estimated 10 percent of pediatric cancers are due to hereditary predisposition or susceptibility. Though the gene mutations seen in the Pediatric Hereditary Cancer Clinic are rare in the general population, they can predispose people who have such mutations to multiple types of cancers later in life. Discovering them early is an opportunity for early treatment, and for ongoing surveillance.

More than 40 different genetic syndromes may be revealed with genetic testing. The most common ones seen at the clinic are:

- Li-Fraumeni syndrome
- Retinoblastoma
- Von Hippel-Lindau syndrome
- PTEN hamartoma tumor syndrome
- Hereditary paraganglioma
- Constitutional mis-matched repair deficiency
- Hereditary rhabdoid tumor predisposition

Each syndrome has a specific set of surveillance guidelines that the clinic helps coordinate.

Genetic counseling

Our genetic counselors work closely with families to help them understand the implications of being told their child is at risk for developing cancer. Genetic counselors address the psychosocial and emotional impact of having a genetic mutation.

If a mutation is identified that indicates a child is at risk, a genetic counselor works with the child and the family to explain the ongoing surveillance they will go through together over the next months and years, depending on the age of the child.

Health Care Disparities in Pediatric Cancer

With the remarkable innovations in therapies to treat pediatric cancer, the social factors that determine health outcomes can sometimes be overlooked.

A growing body of research indicates that attention to a family's individual social situation is an essential aspect of personalizing medical care.

Part of the ethos of UCSF Benioff Children's Hospitals is a commitment to health equity, which is based on the premise that a deep understanding of social factors that can lead to poor health outcomes enables us to tailor interventions to improve disparities.

Though research in disparities in health outcomes in children with cancer is still a developing field, interest and attention has grown over the last several decades. Scientists and physicians at UCSF Benioff Children's Hospitals are among those leading the way in understanding the key factors that influence access to care and outcomes for pediatric cancer patients. They include:

- Access to transportation
- Education
- Ethnicity
- Food security
- Health insurance
- Housing conditions
- Income
- Language spoken
- Race

Finding the causes of health care disparities

Researchers at UCSF Benioff Children's Hospitals are now exploring the "diagnostic odyssey" for children with cancer: how to shorten the time between when a parent thinks the child is sick to the time of the actual cancer diagnosis. Now that we have data on these complex pathways, we are beginning to work on strengthening referrals to shorten this critical period of time.

The question researchers ask is, "Which patients have access to which services, and why?" across the entire spectrum of care, from diagnosis through cure or end of life. Some of the current areas of investigation include:

- Equitable access to enrollment in clinical trials, a mainstay of pediatric cancer treatment
- Access to advanced therapies such as CAR-T cell therapies or MIBG treatment
- Differential burden of chronic complications during survivorship
- Affect of governmental policy around health insurance type has on disparities
- Differences in intensity of end-of-life care.

Research confirms that stark disparities exist. Now, we are trying to find the mechanisms of action that cause these disparities, which will hopefully lead us to how to eliminate them.



Child Life and Creative Arts Programs



Children undergoing cancer treatment may need to be hospitalized for long periods of time, often for weeks or months. It is normal for children to regress during this time. Not only are they dealing with the potential loss of cognitive ability associated with long hospital stays, but they're also trying to cope with the stress and anxiety of cancer.

Child life specialists can help children understand the numerous steps and procedures involved in cancer treatment, from temperature or blood pressure checks to preparing for central line placement or chemotherapy. This understanding can help a child feel a greater sense of control, which enhances their ability to cope with treatment and hospitalization. Helping a child identify and give voice to their feelings allows them to gain needed emotional support in the hospital setting.

Many studies suggest that children who work with child life specialists require less pain medication and sedation, and experience faster healing from procedures and surgery.

Some of the many services offered through our Child Life and Creative Arts Programs include:

Diagnosis teaching

Child life specialists play a large role in educating children about cancer. Their approach varies with the age of the child. The specialist often includes caregivers and siblings in these teaching sessions so all family members can reinforce the learning with the child.

Canine visitors

Animals have a way of instantly breaking down communications barriers, especially with children. We work with local assisted-therapy programs, such as Canine Companions and the Society for the Prevention of Cruelty to Animals, to bring volunteer dogs into our hospitals for patients and families.

School programs

We try as much as possible to maintain a normal life for our patients with cancer, and that includes going to school.



Survivorship Program

Though about 85 percent of children who have cancer survive, many of them remain at risk for other health issues over their lifetimes because of the disease or its treatment. Anyone who has survived childhood cancer or received a bone-marrow or other stem cell transplant as a child should be seen in a cancer survivors program.

- An estimated one in 500 adults is a survivor of childhood cancer, making it highly likely that primary care physicians will see some of these patients in their practices.
- The risk of death for cancer survivors 30 years after diagnosis is eight times higher than that of the general population.
- Cancer survivors need follow up, education and ongoing clinical surveillance.

Survivors may face both medical and psychosocial issues later in life. Being aware that these issues may arise is critical for patients, so they can take ownership of the risks as they grow into adulthood.

Services offered

The goals of the UCSF Benioff Children's Hospitals Pediatric Survivorship Program for Pediatric Hematology/Oncology/BMT* are to:

- Help childhood cancer survivors, their families and their primary care providers manage the late effects of survivorship
- Provide psychosocial support and assistance
- Serve as a link to other subspecialists and testing services as needed
- Contribute to survivorship research.

The program is dedicated to survivors of pediatric cancer and/or stem cell transplantation. At our survivorship clinic, we help patients understand the risks they may face in the future so they can take steps to prepare for or prevent them. Our multidisciplinary team includes nurses, nutritionists, oncologists, psychologists and social workers, with other practitioners available for consultation as needed.

“For many survivors of childhood cancer, being cured is not the end of the journey. Survival is insufficient.”

Robert Raphael, MD



The two-hour survivorship clinic visit includes:

- A thorough review of all prior treatments and therapies
- An examination with a physician who is a survivorship specialist, to review diagnosis, treatment and the affect of therapy on the survivor's present and future health
- Consultation with a social worker, psychologist and dietitian
- Referrals to subspecialty disciplines such as endocrinology, fertility, cardiology and gastroenterology as needed
- Scheduling of recommended tests such as blood work, heart function, hearing, pulmonary function and bone density.

All patients are referred back to their own physicians. Patients receive a survivorship care plan, which is summarized on a wallet-size card or other form of secure document for easy referral at future meetings with physicians and other care providers. Patients are welcome to return in five to 10 years for a follow-up evaluation, which may reflect new guidelines in treating and managing survivorship. There is no upper limit to the age of patients we see.

Adolescent and adult care

Research studies have shown that pediatric cancer survivors do better with treatment by a pediatrician through their adolescence and young adulthood. We are available to facilitate such care, and to help make the transition from pediatric to adult care at the appropriate time.

* The UCSF Benioff Children's Hospitals Survivorship Program is supported by Swim Across America.

We have fulltime credentialed teachers who work with children in our onsite classrooms. If children are too sick to come to the classroom, the teacher will work with them in their rooms.

Some children have been in treatment for a long time and may be worried about what returning to school will be like once they leave the hospital for home. They may be experiencing cognitive issues, fatigue, loss of fine motor skills and other issues that resulted from their cancer treatment.

Our teachers work with local schools to help create accommodations for children so they can be successful in the classroom. This may include meeting with the child's teacher, online training sessions with educators in the child's school, a school re-entry visit or working directly with the child's class to explain what to expect from their returning classmate.

If children aren't ready for in-school attendance, our teachers can work with the child's school district to arrange for a teacher who can make home or virtual visits.

Play areas for immunosuppressed children

Children undergoing stem cell transplant have suppressed immune systems. To prevent infection, they are kept under strict isolation for about three months. We have created special activity rooms for immunosuppressed children that are stocked with toys, games, puzzles and more. When appropriate, we offer programs including music therapy in these areas.

Music therapy

The Music Therapy Program offers a chance for children to experience the healing properties of music. Research shows that in a hospital setting, music therapy can be beneficial in managing pain, lowering rates of depression, increasing bodily movement, easing muscle tension and calming patients. Music therapists provide individual and family interventions at bedside as well as in group programs.

Refer a Patient

LOCATIONS

UCSF Benioff Children's Hospital Oakland

747 52nd St., Oakland, CA 94609

UCSF Benioff Children's Hospital San Francisco

1975 Fourth St., San Francisco, CA 94158

PHONE

The UCSF Benioff Children's Hospitals Pediatric Access Center can assist with referrals to any pediatric specialty at any location.

(877) 822-4453 (877-UC-CHILD)

FAX

Use the referral form on the inside back cover of this guide.

For Oakland referrals, fax all materials to (510) 985-2202.

For San Francisco referrals, fax all materials to (415) 353-4485.

If you are unsure whether to fax your materials to Oakland or San Francisco, fax them to either location, and our skilled staff will contact your patient family to determine the most appropriate location for their visit.

WEB

Visit: ucsfbenioffchildrens.org/refer-a-patient

For more information, visit: ucsfbenioffchildrens.org/cancer.

SCHEDULE AN APPOINTMENT

To schedule an appointment or check on the status of a referral, call (877) 822-4453 (877-UC-CHILD).

MD LINK

Website: ucsfhealth.org/mdlink

MD Link Support: (415) 514-8790

PHYSICIAN LIAISON SERVICES

Phone: (800) 444-2559

Email: liaisons@ucsf.edu

Referral Form

Fax Oakland referrals to (510) 985-2202

PREFERRED LOCATION:

- Brentwood Next available, any location
 Greenbrae Other _____
 Oakland URGENT
 San Ramon
 Walnut Creek

Fax San Francisco referrals to (415) 353-4485

PREFERRED LOCATION:

- Fremont San Mateo
 Greenbrae Santa Rosa
 Los Gatos Next available, any location
 Modesto Other _____
 San Francisco URGENT

From: _____

Date: _____ No. of pages: _____

Phone: _____

Fax: _____

Referred to Specialty Clinic: _____

Referred to Provider (optional): _____

PATIENT INFORMATION

Patient's First Name: _____ Last Name: _____

DOB: _____ Gender: _____

Home Phone: _____ Work Phone Cell Phone

Interpreter Needed: Yes No Language: _____

Parent/Guardian: _____ Relationship to Patient: _____

DOB: _____ Email: _____

Address: _____ City: _____ State: _____ Zip: _____

CONSULTATION REQUEST INFORMATION

Diagnosis: _____ ICD 10: _____

Reason for Referral: _____

Include brief pertinent medical records that support the consultation: Clinical Notes Growth Charts Imaging Labs

REFERRING PHYSICIAN INFORMATION

Referring MD: _____ Specialty: _____

Phone: _____ Fax: _____

Office Name: _____

Address: _____ City: _____ State: _____ Zip: _____

Signature: _____

PCP INFORMATION

PCP Name: _____ Phone: _____

INSURANCE INFORMATION

Include copy of insurance card (both sides)

Subscriber Name: _____ DOB: _____

Health Plan: _____ Member ID: _____

Group #: _____ Authorization #: _____

Secondary Insurance, if Any: _____

By providing the information requested and signing above, you agree that we may initiate treatment following consultation or perform medically necessary diagnostics in association with this consultation. We look forward to collaborating with you on your patient's treatment plan.

NOTICE OF CONFIDENTIALITY: This is a confidential fax and is intended solely for the person indicated above. If you are not the intended person, you are hereby notified of the confidential nature of this fax and you are not entitled to read, copy or otherwise disseminate any of the information contained herein.



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