

Childhood Cancer: Looking for the Environmental Link

Cancer is a painful, often deadly, disease, and when its victim is a child, it can seem especially cruel. Nor is childhood cancer as rare as one might think: a pediatric monograph by the National Cancer Institute (NCI) said that in 1998, 12,400 children and adolescents 20 or younger were diagnosed with cancer and that 2,500 died, making it the leading cause of disease-related mortality in that age group. Measured in other ways, 46 children are diagnosed with cancer daily in the U.S., and 1 in every 330 Americans develops cancer before the age of 20.

Advances in modern medicine have greatly improved the survival rates of children who do get cancer. The principal reason for the survival gains, the NCI report said, is "more efficacious chemotherapy agents" used in the treatment of leukemia, especially acute lymphoblastic leukemia, which accounts for about a third of all pediatric cases.

Still, scientists know little about the causes of the disease. As with adults, "childhood cancer is not one disease—it is many, many kinds of diseases," said Beverly Kingsley, an epidemiologist with the Centers for Disease Control and Prevention's (CDC) National Center for Environmental Health, and "we don't understand it anywhere near as well as we would like to." If there were more scientific research into the issue, Kingsley continued, steps toward prevention might be more of a possibility.

Despite the dearth of studies, preliminary evidence indicates that the environment may be an important factor in the development of certain types of cancer. But while environmental causes have long been suspected, they're difficult to pinpoint a) because the cancers usually arise long after the

exposure occurs and b) because it's difficult to identify when the exposure occurred—during the fetal stages, during infancy or during childhood or adolescence.

CANCERS AND CAUSES

Children generally have different cancers (leukemia and brain) than those experienced by adults (lung, prostate and breast). And while medical treatments overall have improved, the rates for some cancers that occur in childhood are rising. According to NCI, for example, the incidence of leukemia has increased by about 1 percent a year since 1977, even though it can now be cured more than 80 percent of the time, and brain and testicular cancer are also on the rise. Some scientists maintain that the higher rates merely reflect use of better diagnostic tools that help identify cases earlier on, while others connect the increased incidence to factors such as changes in the environment.

Indeed, some of the more-established causes of childhood cancer—genetic abnormalities and exposure to X-ray radiation—explain only a small percentage of cases. "The biological plausibility that childhood exposures to things we believe cause cancer in adults, such as radiation, is certainly there," said Kingsley. Other environmental factors with a proven link to cancer and to which kids are exposed are air pollutants, including tobacco smoke, and some toxic chemicals, including benzene and other solvents. "There is some evidence that exposure to tobacco smoke *in utero* may cause leukemia," she added, and also a suggestion that excessive alcohol use during pregnancy causes "some types of cancer." Pesticides may be a culprit, too. Studies show that kids who

live in a home where pesticides are used or whose parents are exposed at work are more likely to develop various cancers.

A child's formative years may also be important in determining future cancer risk. "Certain behaviors that can contribute to the development of cancer are learned behaviors," said Carol Friedman, M.D., a medical epidemiologist at CDC. "For instance, we know that prolonged exposure to the sun can lead to skin cancer" and in some extreme cases, to its deadliest form: melanoma.

Currently, 1.3 million Americans a year develop skin cancer, resulting in nearly 10,000 deaths, and the rate has more than doubled since 1973. So even though youngsters who have multiple sunburns may not get skin cancer for 20 to 30 years after the exposure, "we need to impress upon [them] the importance of prevention activities"—protective clothing and sunscreen—"before the behaviors become ingrained," she said. To that end, the U.S. Health and Human Services Department in April 2002 released guidelines schools can use to encourage students to protect themselves from the sun, in order to avoid skin cancer later in life.

CHILDHOOD SUSCEPTIBILITY

Just how susceptible are children to cancer-causing agents in the environment? For starters, they breathe, drink and eat several times as much as an adult for every pound of body weight, which means they take in more of any chemicals that may be present in the air, water or food. In addition, kids tend to immerse themselves in the environment by playing close to the ground and touching, tasting and feeling the things around them. And because they are still growing, they likely process the chemicals differently than adults. As **Indiana Sen. Beverly Gard** put it, "Children react much differently than adults to environmental toxins or pollutants."

Cognizant of the danger, the Environmental Protection Agency (EPA) in April proposed stricter guidelines for reducing cancer risks for the very young, noting that for certain chemical exposures, children under age two are at a tenfold greater risk of developing future cancer than are adults. According to EPA, the vulnerability to carcinogens may stem from several things, including the fact that the rapid growth and developmental stages that occur both before and after birth

[Cancer, p. 6]

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may create a window of vulnerability, or a time when chemical exposures can cause their most damage.

EPA's proposal and its assertion that children may be more susceptible to carcinogens puts its recent assessment of air quality and children in a new light. In a report released in February, *America's Children and the Environment*, the agency said that every child in the U.S. is exposed to at least one toxic air pollutant at levels that are estimated to cause cancer in 1 of every 100,000 people and that 18 percent of children live in counties where toxic air pollutants create a 1 in 10,000 chance of developing cancer. Because some chemical exposures may be up to ten times more potent to kids than to adults and because the risk numbers are based on adults, the cancer risk for children may be much greater than one in 10,000. Much of the risk is posed by formaldehyde, a probable human carcinogen emitted by automobiles and trucks. (View the report at <http://www.epa.gov/envirohealth/children/>)

CANCER CLUSTERS: A MYSTERY

Since 1977, 16 children in the small agricultural town of Fallon, Nevada have been diagnosed with acute lymphocytic leukemia—a rate more than 30 times higher than expected for the region, causing residents to wonder what was making their children sick. The answer wasn't easily found. "The bane of a public health officer's existence is a birth defect or cancer cluster," observed Richard Jackson, M.D., former director of CDC's National Center for Environmental Health. "You can't deal with such events without good health and environmental data." Unfortunately, he noted, such data are often lacking, and as a result, most cluster investigations conducted by CDC over the past 30 years have failed to find a cause.

A major challenge confronting investigators is the tremendous number of variables, including long latency periods between exposure and the appearance of a disease, the high number of chemicals to which residents

are exposed and the tendency of people to move from place to place. The lack of reliable environmental and disease tracking data compounds their already-complex job, leaving residents of the community being investigated without many answers about the cause of the cluster, beyond "random chance."

In Fallon, where experts studying the leukemia cluster expect even more cases to surface in coming years, the suspects include a leak in the jet fuel pipeline at the nearby naval air base, radiation, viruses, pesticides, tungsten and arsenic in drinking water. In its report on the situation in February, for example, the federal government found that residents had high levels of tungsten and arsenic in their systems. The families of two of the children that died have since filed lawsuits against the owners of the pipeline, which runs through town, as well as the owners of a plant that manufactures tungsten carbide and the government of Fallon.

The Nevada legislature has also responded, enacting a law requiring the state health officer to analyze data from health facilities in order to determine whether there are trends in cancer incidence and to investigate when higher rates are detected. Nevada had a cancer registry, but "it was several years behind," said Assemblywoman Ellen Koivisto, sponsor of the measure (it was signed into law in May) "and we could not use the information quickly enough to track and identify clusters." For other states considering improvements in their registries, Koivisto recommends making sure that the data are maintained in a way that they are accessible and can help in spotting trends.

TRACKING: A VITAL ELEMENT

To CDC's Kingsley, the most important role for state legislators in childhood cancer is to support tracking and surveillance of the disease and linking cancer and exposure data—a direction in which some states are already moving. A 2001 Montana law, for instance, required a feasibility study of establishing a chronic disease registry. "The study

determined that we did need a registry," said Rep. Gail Gutsche, the bill's sponsor, and that "we did not need legislation to proceed." Accordingly, the state Department of Public Health and Human Services applied for and won a three-year CDC grant to establish a system to monitor links between chronic diseases and exposure to toxins like lead, arsenic, pesticides and mercury. At present, officials are conducting an assessment of all 56 Montana counties "to hear about pressing needs."

"You don't necessarily need legislation to have an impact on children's environmental health," Indiana's Gard agreed. Legislators can work with health departments on regulations or on improving the collection of data, she said, or they can partner with private sector groups, like "Improving Kids' Environment," a nonprofit advocacy coalition working to address issues such as elevated blood-lead levels of kids in some Indiana neighborhoods.

At the federal level, a consortium that includes CDC, EPA and the National Institute of Child Health and Human Development and the National Institute of Environmental Health Sciences at the National Institutes of Health is undertaking an ambitious research program that promises to yield a tremendous amount of information about the causes of children's diseases and add to the body of knowledge about potential causes of childhood cancer. Called the National Children's Study, it will follow more than 100,000 kids from birth to age 21, examining environmental influences on their health and development, including biological, genetic, social, cultural, physical and other factors that make up a child's environment. Though the study won't be completed until 2025, researchers will analyze information throughout it and release conclusions at regular intervals.

Finally, CDC has been working with states to improve their disease tracking systems, laboratories for analyzing environmental hazards and data systems for implementation of statewide—and eventually, nationwide—environmental public health tracking systems. + GA/SW

STATE HEALTH NOTES

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A pediatric oncologist by training, Malcolm Smith, M.D., now oversees a clinical trials program devoted exclusively to research into childhood and adolescent cancer. Supported by the National Cancer Institute (NCI) in the National Institutes of Health, the program—the Children's Oncology Group, or COG, for short—is charged with developing and coordinating clinical trials at its 238 member institutions, including cancer centers at all major universities and teaching hospitals across the U.S. and Canada. In addition to his position as program director, Smith is NCI's liaison to childhood cancer investigators taking part in COG and heads the Pediatric Section of the Institute's Cancer Therapy Evaluation Program. In a recent interview, he talked about advances in the field and the challenges ahead. An edited transcript follows.

Q: How important is childhood cancer from a health perspective—that is, how many youngsters does it affect?

A: It is the leading cause of disease-related mortality among children beyond infancy, [defined as the first 12 months of life]. Each year in the U.S., about 12,500 cases of cancer are diagnosed among children and adolescents under the age of 20 and 2,000 to 2,500 die of the disease each year. Even though it is a relatively rare occurrence, a newborn still has a 1 in 300 chance of having a cancer diagnosed during childhood or adolescence. But the importance of the issue can't be told solely by statistics. A diagnosis of cancer profoundly changes the lives of affected children and their families. When you go to a children's hospital and talk to the individual kids and their families, you feel the urgency and the need for hope.

Q: What are the trends in treatment and prevention over the last few decades?

A: There have been remarkable advances in identifying curative treatments over the last four decades. In the 1960s, almost no children diagnosed with acute lymphoblastic leukemia—the most common cancer children get—were cured. By the mid-1970s, that had risen to 60 percent and today, more than 85 percent of children with acute lymphoblastic leukemia are alive five years from their diagnosis, and most are cured. Survival rates for all childhood cancers combined have risen from 55 percent in the mid 1970s to 77 percent in the 1990s. Still, more than 2,000 children die each year of their cancer, so much work remains.

HEALTH TALK

SMITH: THE CHALLENGE OF CHILDHOOD CANCER

Since the 1970s, the incidence of childhood cancer, or the annual rate that cancers develop, has increased at about 1 percent per year. But most of the increase occurred during the earlier part of that period; cancer incidence among children has been fairly stable throughout the 1990s.

Q: What do we know about the environment's role in childhood cancer?

A: The causes of most childhood cancers, be they environmental or genetic or some combination of the two, are unknown. There are clear examples of cancers that are related to genetic predisposition—for example, an eye cancer called retinoblastoma that occurs only in young children has a genetic component in about 40 percent of cases. For most cancers, however, there is no similar genetic explanation. There are many hypotheses about environmental factors that may be important, ranging from exposures to radiation and certain chemicals to some infectious agents or viruses. All of those are known to be able to cause cancer in special situations; what isn't known is what proportion of cancers in children actually result from one or more of those exposures.

Q: The community of Fallon, Nevada, has experienced a "cluster" of childhood leukemia cases. What's your view on cancer clusters and investigations of them?

A: It's important for public health agencies to have a systematic approach for addressing community concerns about possible cancer excess, or "clusters." Education and communication about risk are key. In some cases, a perceived cancer excess may be within the range of the expected number of cases in a community, so it's important to have standard methods for determining whether observed rates actually exceed expected rates. For some communities, cluster investigations may help reassure residents that remediable or "fixable" factors that might explain the excess will be sought and addressed, thereby reducing risk. But it is important to recognize and to communicate to the community that even with intensive investigations, the causes of cancer clusters have seldom been identified.

Q: Given its relative rarity, is childhood cancer given short shrift by the research community?

A: There is a "half-full, half-empty" response to that question. On the one hand, childhood cancer research is held up as a model for how physician-researchers can use evidence-based methods to discover more-effective treatments for people with life-threatening diseases. On the other hand, cancer in children represents only one percent of all cancers, and the market forces that drive pharmaceutical companies to develop new treatments for adults with breast, prostate or other common cancers are simply not applicable. That makes it essential to mobilize public policy, public resources and private philanthropy to support the research needed to identify better treatments for the thousands of children for whom current therapy is not adequate.

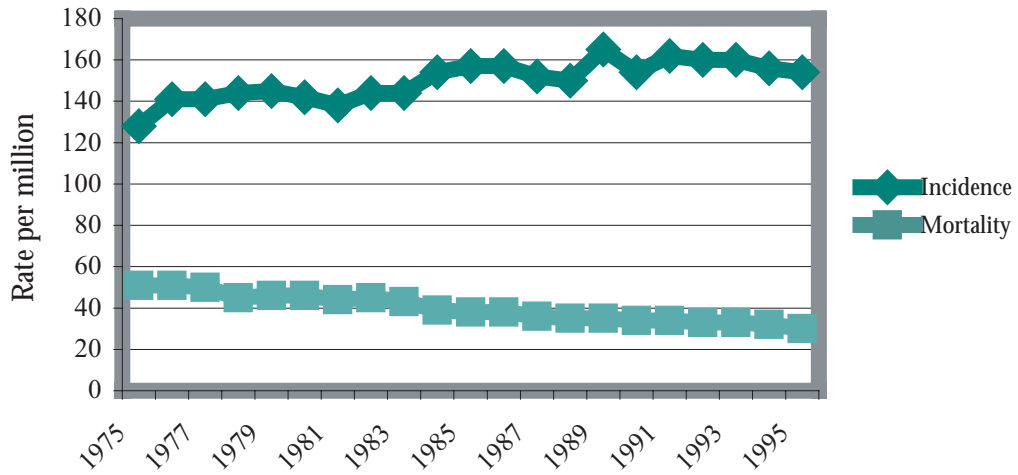
NCI's support of the Children's Oncology Group, Food and Drug Administration policies that encourage pharmaceutical companies to study their new drugs in children and millions of dollars in philanthropic support to support childhood cancer research are examples of the kinds of activities we need if we are to make further progress. That said, it is a constant battle to maintain the focus on the needs of children afflicted with cancer and to secure the resources required to address those needs by discovering more-effective treatment.

Q: What can state legislators do to help advance those goals?

A: Virtually all states are represented in the COG program, so one thing legislators can do is support the clinical cancer trials programs within their states, to assure that children are able to participate in the trials and benefit from treatments developed in them. It's also important that they support two other initiatives: state cancer registries, in order to gain a complete assessment of cancer rates within regions, and public health programs that can minimize the risk of cancer in childhood as well as health behaviors that can result in cancers in adulthood—programs like public education on the relationship between sun and ultraviolet exposure and skin cancer, for example, or between adolescent smoking and lung cancer in adults. Those kinds of programs have long-term benefits to state residents. †GA

Childhood Cancers

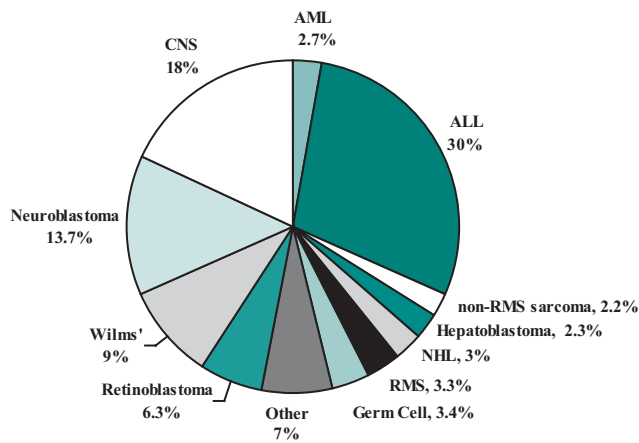
Cancer incidence and mortality for children under 20



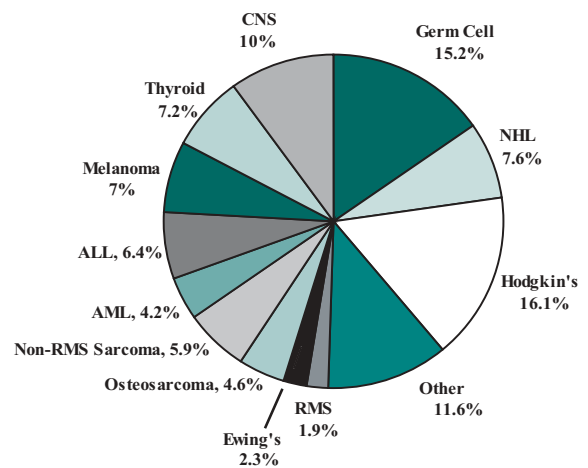
Distribution of Cancer Types

(Source: SEER, 1986-1995)

children <5



children 15-19



NHL: Non-Hodgkins Lymphoma

ALL: Acute Lymphoblastic Leukemia

AML: Acute Myeloid Leukemia

CNS: Central Nervous System

RMS: Rhabdomyosarcoma