



# National Institutes of Health

## Cancer

### YESTERDAY

In 1975, the incidence rate for all cancers combined in the United States was 400 new cases for every 100,000 people in the population; the mortality rate was 199 deaths for every 100,000 persons.

Among adults diagnosed with cancer during the period from 1974 through 1976, the 5-year relative survival rate for all cancers combined was 50%. Among whites, it was 51%; among blacks, it was approximately 40%. During the same period, the 5-year relative survival rate for all childhood cancers combined was about 62%. (Note: Relative survival compares the survival of a cancer patient to that of an average person of the same age and sex.)

For the five most common cancers diagnosed in adults, the 5-year survival rates were: breast, 75%; prostate, 69%; lung, 13%; colorectal, 51%; and bladder, 74%.

In the mid-1970s, approximately 37% of U.S. adults were current smokers. In 1975, the lung cancer mortality rate among men was about 76 deaths per 100,000 persons; among women, it was about 18 deaths per 100,000 persons.

In the mid-1960s, clinical investigation of combination chemotherapy, using multiple drugs with different mechanisms of action, in the treatment of cancer was just beginning. Clinical studies of anticancer vaccines (treatment or prevention) had not yet begun.

### TODAY

In 2007, the latest year for which we have updated statistics, the U.S. incidence rate for all cancers combined was 461 new cases diagnosed for every 100,000 people in the population; the mortality rate was 178 deaths for every 100,000 persons. Although the incidence rate in 2007 was higher than that in 1975, the increase is largely attributed to earlier diagnosis and aging of the population. This rate has been declining since 1992, when cancer incidence peaked at 510 new cases for every 100,000 people. Similarly, cancer death rates have been declining since 1991, when they peaked at 215 deaths for every 100,000 people.

Among adults, the 5-year relative survival rate for all cancers combined is now approximately 68%; among whites, it's about 69%; among blacks, it's about 59%. The improvements in survival seen since the mid-1970s reflect progress in diagnosing certain cancers, such as prostate cancer, at earlier stages and improvements in treatment.

The 5-year relative survival rate for all childhood cancers combined is now approximately 81%.

As of 2006, the 5-year relative survival rates for the five most common cancers were: breast, 90%; prostate, 100%; lung, 16%; colorectal, 67%; and bladder, 81%. The dramatic increase in 5-year relative survival for prostate cancer seen since the mid-1970s is due, in part, to the fact that most men diagnosed with this disease today are diagnosed through screening (e.g., prostate-specific antigen [PSA] testing), and, overall, screened men tend to be healthier (and live longer) than average men—a phenomenon known as the “healthy screenee” effect. In addition, PSA testing detects many slow-growing, non-life-threatening cancers.

In 2007, approximately 20% of U.S. adults were current smokers. The decrease in the prevalence of current smoking seen since the 1970s has been a major factor in the decline of the U.S. cancer death rate overall—and especially the lung cancer death rate among men. In 2007, the lung cancer death rate among men was 65 per 100,000 individuals; among women, it was 40 deaths per 100,000 individuals. The current higher lung cancer death rate among women reflects the later uptake of cigarette smoking compared with men; lung cancer death rates among women have been declining since about 2002.

Combination chemotherapy is now standard in the treatment of many cancers and has contributed to increasing

survival and cure rates. For example, the introduction of combination chemotherapy that contained the drug cisplatin led to cure rates for testicular cancer of approximately 95 percent. Treatment for this disease has become so effective that 80 percent of patients with metastatic testicular cancer can now be cured. Thirty-five years ago, 95 percent of these patients died, usually within 1 year of diagnosis.

Thus far, three cancer prevention vaccines have been approved by the U.S. Food and Drug Administration (FDA). One of these vaccines, the hepatitis B virus vaccine, has the potential to prevent some forms of liver cancer. The remaining two vaccines are directed against human papillomavirus (HPV) types 16 and 18 and have the potential to prevent approximately 70% of cervical cancers and some other HPV-associated cancers.

In 2010, the FDA approved the first cancer treatment vaccine, sipuleucel-T (<http://www.cancer.gov/cancertopics/druginfo/sipuleucel-T>). This vaccine can be used to treat advanced prostate cancer. Several other cancer treatment vaccines are currently being tested in large-scale clinical trials, including vaccines for the treatment of non-small cell lung cancer, pancreatic cancer, ovarian cancer, melanoma, and multiple myeloma.

Therapies that target the specific molecular changes that cause cells to become cancerous and processes that are required for continuous cancer cell growth and survival are now part of our therapeutic arsenal. To date, the FDA has approved approximately 30 molecularly targeted agents for cancer-related indications, including trastuzumab and three different aromatase inhibitors for breast cancer; imatinib mesylate for chronic myelogenous leukemia and gastrointestinal stromal cell tumors (GIST); sunitinib for advanced kidney cancer and imatinib-resistant GIST; bevacizumab for advanced colorectal, non-small cell lung, and kidney cancers; and bortezomib for multiple myeloma and a type of non-Hodgkin lymphoma.

Refined radiation therapy techniques, such as three-dimensional conformal radiation therapy, stereotactic radiosurgery, and brachytherapy (radioactive seeds), which are designed to deliver high doses of radiation to tumors while minimizing the doses delivered to nearby healthy tissue, are now widely used. These advances result in greater tissue, organ, and limb preservation.

Effective therapies to control the side effects of cancer and its treatment, including pain, mouth sores, nausea, and vomiting, are currently available.

## **TOMORROW**

We will continue our overall efforts to control cancer by lowering the risk of developing cancer, increasing the cure rate of cancer, and converting to the status of a chronic disease those cancers that are not cured.

To increase our opportunities for cancer control, we will develop methods to specifically express genes that can antagonize cancer development, in addition to inhibiting genes whose expression drives the cancer process.

Through The Cancer Genome Atlas (TCGA) (<http://tcga.cancer.gov/>), a joint effort of the National Cancer Institute and the National Human Genome Research Institute, we will greatly expand our understanding of the genetic basis of more than 20 cancers that affect adults and identify specific molecular changes that can be targeted for the development of new treatments or exploited to detect cancer earlier or prevent its occurrence. Another project, called Therapeutically Applicable Research to Generate Effective Treatments (TARGET) (<http://www.cancer.gov/recoveryfunding/page8>), will use a similar approach to identify molecular changes that lead to a variety of cancers affecting children.

We will continue to explore the use of advanced technologies and new fields of study to find new ways to prevent, diagnose, treat, and screen for cancer.

We will optimize our use of information technology to facilitate cancer research and accelerate our efforts to control cancer.

We will continue to support cancer research in other countries and expand our efforts to improve global health.

We will continue our efforts to increase awareness of and access to state-of-the-art cancer control methods, to eliminate cancer-related health disparities, to widely offer palliative care, and to ensure the best possible outcomes for all cancer patients.