

**Role of the National Cancer Institute
in
Addressing Cancer Clusters**

**Statement
of
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I am Dr. Robert Hoover, Director of the Epidemiology and Biostatistics Program at the National Cancer Institute (NCI). Dr. Susan Devesa, Chief of the Descriptive Studies Section, accompanies me today. Thank you, Members of the Coalition, for inviting me to speak with you about the concerns about cancer shared by many of our communities. I appear before you today as a scientist and representative of the NCI, and as a concerned citizen. Each of my colleagues on this panel and all the people from their respective organizations are concerned citizens - members of our Nation's communities who have lost friends and loved ones to cancer and who have struggled to understand why this happens. Indeed, we share the concerns of the community at a very personal level and have made it our professional challenge to address those concerns. Each of us here has an important role in meeting that challenge.

What are cancer clusters?

A disease cluster is the occurrence of a greater than expected number of cases of a particular disease within a group of people, a geographic area, or a period of time. Cancer clusters may be suspected when people report that several family members, friends, neighbors, or co-workers have been diagnosed with cancer. Additionally, many

investigators have observed variations in cancer rates across geographic areas, with some areas exhibiting higher incidences or death rates than others.

Not unreasonably, communities frequently suspect that exposure to something people have encountered in their immediate environment is the cause. It is important to note that the term "environment" refers not only to air, water, and soil, but also to substances and conditions in the home and workplace. It includes diet; the use of tobacco, alcohol, or drugs; and exposure to chemicals, and sunlight and other forms of radiation. Lifestyle, economic, and behavioral factors all contribute to cancer risk, and these elements are not distributed uniformly across our population. When we observe geographic variation in cancer burden we must include all of these elements in our analysis. Cancer resulting from an environmental exposure may take many years to appear, and today's communities are very dynamic, with community membership constantly changing. Many clusters are simply statistical fluctuations, and others, disappointingly, yield little or no insight about unique causative factors. The difficulties associated with investigating a small cluster make for a formidable task that usually does not culminate in a satisfactory explanation, despite the resources and energy expended.

So, what can be gained from studying cancer clusters? Historically, investigations of cancer clusters have led to some important discoveries and certainly may contribute leads for further study. In the 1960s, one of the best known cancer clusters emerged, involving many cases of mesothelioma, a rare cancer of the lining of the chest and abdomen. Researchers traced the development of mesothelioma to exposure to a fibrous mineral called asbestos. Exposure to asbestos, which was used heavily in ship building during World War II and has also been used in manufacturing many industrial and consumer products, is the only established risk factor for mesothelioma.

What can our government do about cancer clusters?

State health departments are on the front lines in responding to reports of cancer clusters. They often receive assistance from a number of federal agencies, including the Centers for Disease Control and Prevention (CDC), the Agency for Toxic Substances and Disease Registry (ATSDR), and the Environmental Protection Agency (EPA), who provide additional technical expertise and infrastructure. Representatives of some of these organizations are here today to describe their activities and we commend their work and contributions to the total cooperative effort to respond to the concerns of our communities.

The NCI, as our Nation's premier agency for cancer research, lends valuable expertise to this important work and has a long history of active participation in these endeavors. One of our most important contributions is our guidance about state-of-the-art interventions for physicians and other health professionals as they seek to provide the highest quality of care to the community. In addition, NCI is uniquely equipped to provide the most current and accurate information on the natural course of the disease. We continuously introduce new tools to aid investigators in studying geographic variations of cancer incidence and impact, as well as the relationships of environmental factors with cancer development,

and we consult closely with scientists from state and other federal agencies and academia to ensure that our resources are used to their maximum potential.

The first requirement for understanding an unusual circumstance is having a good grasp of what is usual. This concept is embedded in NCI's mission. Just as it is imperative to understand the differences between a normal cell and its cancerous counterpart, we must know something about the normal patterns of cancer incidence and impact before we can be alert to aberrations.

Surveillance, Epidemiology, and End Results Program

The Surveillance, Epidemiology, and End Results (SEER) Program of the NCI is the most authoritative source of information on cancer incidence and survival in the United States. The SEER Program is considered as the standard for quality among population-based cancer registries around the world. The program continues to expand, and, on February 13, 2001, Dr. Richard Klausner, Director of the NCI, announced new awards to four additional states: Louisiana, Kentucky, New Jersey, and California (the remaining portions of the state not already under SEER coverage). The contracts were awarded through competitive selection and peer review, with emphasis on (1) coverage of populations for which limited data currently exist and (2) data quality that meets SEER standards and reporting requirements. Based on geographic location, expansion to the four new areas increases SEER coverage to 24 percent of African Americans, 44 percent of Hispanics (34 percent of non-Mexican Hispanics), 42 percent of American Indians and Alaska Natives, and 59 percent of Asian and Pacific Islanders. Overall, SEER coverage will increase from 14 to 26 percent of the U.S. population, from about 35 million to over 65 million.

The NCI has recognized the need to better explain the cancer burden in racial/ethnic minorities and medically underserved populations and is concerned with research on the full diversity of the U.S. population. In previous expansions since 1973, SEER increased the proportions of Hispanics, urban African Americans and Asian and Pacific Islanders in Southern California and the Greater Bay Area, rural African Americans in Georgia, northwestern populations in Seattle, Arizona Indians, and Alaska Natives. One of the recommendations of both the NCI Surveillance Implementation Group and the NCI Cancer Control Review Group was to further expand coverage to capture additional key populations, such as rural low-income whites, more diverse American Indian populations, rural African-Americans and other Hispanic groups. The addition of the four new SEER areas- the largest expansion to date-accomplishes this objective.

The NCI funds are coupled with funding from the Centers for Disease Control and Prevention (CDC) through the National Program of Cancer Registries (NPCR) as well as funding from the states. NCI's cost for the expansion is nearly \$4 million for the first year, totaling almost \$10 million for the first 29.5 months. A recent Memorandum of Understanding has secured cooperation in cancer surveillance between the NCI and CDC, with special emphasis on the registries of SEER and NPCR.

Beyond the expansion of SEER, NCI staff are working with the North American Association of Central Cancer Registries (NAACCR) to provide guidance for all state registries in order to achieve data content and compatibility acceptable for pooling data and improving national estimates. The SEER team is developing computer applications to unify cancer registration systems and to analyze and disseminate population-based data. Access to surveillance information also is being improved through expansion of web-based training, dissemination of analytic tools, and linkage to other national data sources.

We have expanded and will continue to expand what we call Rapid Response Studies that allow researchers and NCI staff to rapidly respond to urgent issues that are revealed by cancer surveillance. We have greatly expanded our capacity to monitor, report and evaluate geographic differences in cancer burden.

Atlas of Cancer Mortality

Geographic patterns of cancer may provide important clues to the causes of cancer. Because of this, the NCI has for over 30 years conducted a systematic program of studies of geographic patterns of cancer mortality across the United States. This program encompasses several components, including calculation of rates at the county level, mapping of these rates, correlations of these patterns with other data collected at the county level in order to generate hypotheses, and field studies in high-risk areas to test some of these hypotheses. Our most recent effort in this area is an updated atlas of cancer mortality. The new "Atlas of Cancer Mortality in the United States, 1950 - 1994," prepared and published by the NCI, is a book and website of maps, text, tables, and figures showing the geographic patterns of cancer death rates throughout the United States for more than 40 cancers, and features 254 color-coded maps that show the geographic variations during 1970-94 compared to those during 1950-69. The color maps make it easy to pinpoint geographic areas with average, below average, or elevated rates. The Atlas, and related information, can be explored at ["/atlasplus/](#). The website allows the user to tailor the data interactively, to produce maps by race, gender, time period, age group, state, state economic area, or county level; and to develop bar charts and trend line graphs. The site also provides links to related sites.

The atlas does not provide information about why death rates may be higher in certain localities than in others, but it can generate leads for in-depth epidemiologic studies that may shed light on factors contributing to cancer risks. Possible risk factors include tobacco use, occupational exposures, dietary habits, ethnic background, and environmental exposures from the air or water. In addition, geographic differences in mortality rates may reflect differences in access to medical care, such as screening, diagnosis, or treatment facilities.

Earlier cancer atlases published by NCI led to focused studies that made it possible for researchers to identify factors that contributed to the high rates of certain cancers. For example, elevated death rates for lung cancer in coastal areas of Georgia, Virginia, northeastern Florida, and Louisiana were found to be linked to the exposures of shipyard workers to asbestos during World War II. Similarly, follow-up studies of elevated death

rates of bladder cancer showed that they were linked to a variety of occupations, including truck drivers and other workers exposed to motor exhausts. In addition, the use of smokeless tobacco was found to cause the elevated rates of oral cancer observed since the 1950s among women in the rural Southeast.

Since it is estimated that the vast majority of cancers are linked to lifestyle and other environmental factors, it is hoped that many of the leads provided by the new atlas will guide further epidemiologic and public health activities aimed at preventing cancer.

Geographic Information System

NCI has created a new tool to help overcome the frustrations associated with studying geographic variations of disease: a prototype computer system, called the Geographic Information System for Health (GIS-H), that allows examination and tracking over time and space of cancer rates with any geographically defined factor that might contribute to the cancer burden. It is the first system of its type developed for the study of breast cancer. The GIS-H is a new approach for researchers to use in investigating relationships between breast cancer and the environment, and to estimate exposures to environmental contamination. The GIS-H data layers will include geographic data for general mapping purposes and demographic data. Data on health care facilities, health care surveys, breast cancer, and the environment will also be included. The environmental data will include information on contaminated drinking water; sources of indoor and ambient air pollution, including emissions from aircraft; electromagnetic fields; pesticides and other toxic chemicals; hazardous and municipal waste; and radiation. The system will rely chiefly on existing databases obtained from federal, state, and local governments, and private sources - including historical information on environmental exposures from residents - with emphasis placed on high-quality data. More than 80 databases are slated to be included in the system.

The GIS-H provides the opportunity to apply a powerful emerging technology to the study of environmental causes of breast cancer and is anticipated to be ready for investigator-initiated pilot studies this year. The NCI is encouraging research proposals for new interdisciplinary studies that use the GIS-H and the Atlas of Cancer Mortality to explore geographic variations of cancer incidence and mortality and speed the process of scientific discovery and application, and about 30 applications have been received in response to this new initiative.

Genes and the Environment

People are exposed to a variety of environmental factors for varying lengths of time, and these factors interact in ways that are still not fully understood. Further, individuals have varying levels of susceptibility to these factors. During the last decade, the identification of human genes conferring susceptibility to complex diseases, and the application of increasingly sophisticated molecular technologies to the study of human genetics have provided new ways to analyze the human genome and to look at the relationship between disease development and individual genetic profile. Many types of cancer are complex

genetic diseases; that is, they result not from changes in a single gene, but from the combined, small effects of many genes and the interaction of these genes with environmental, hormonal, and other factors. Combining an epidemiologic approach with cutting-edge genetic and molecular technologies provides the multidisciplinary research approach required to understand the relationship between genes and the environment in the development of cancer.

Since 1993, the NCI has greatly expanded its efforts to identify the genetic and epidemiologic risk factors leading to cancer susceptibility in individuals, families, and populations; evaluate the etiologic interactions of these risk factors; assess the relevance of these risk factors to clinical practice and public health; and address the diverse and complex scientific, ethical, legal, and social issues associated with this research. The NCI has identified the study of genes and the environment as a high priority research area with great potential for discovery. As our knowledge base expands in this critical area we will be able to quantify the cancer risks associated with specific environmental and genetic factors and their interactions, and design new approaches to health and cancer care based on an understanding of how genes modify and interact with environmental exposures.

Establishing significant and valid evidence for gene-environment interactions requires studies of large populations over long periods of time. In cohort studies, information on exposures to factors that might affect cancer risk and biologic samples are collected from individuals in large population subgroups. By systematically following these people over time to determine who develops cancer and who remains cancer free, scientists can understand the risk of developing cancer for those with specified exposures and genetic profiles. In this way, early detection can be directed to those at greatest risk and diagnosis and treatment can be tailored to individual needs. NCI is establishing a Cohort Consortium of investigators from around the world to facilitate the pooling of data on very large numbers of people, foster collaborative links among resources, and organize collaborative studies.

Case-control studies retrospectively examine exposure histories and genetic profiles of people who already have cancer (cases) and compare them with those of people who have not developed cancer (controls). NCI is assembling a Case-Control Consortium to support large-scale studies of gene-environment interactions for less common cancers.

The NCI conducts studies throughout the United States and around the world to identify and evaluate environmental and workplace exposures associated with the risk of cancer. Because workers may have heavier and more prolonged exposures to hazardous chemicals that are widely distributed at lower levels in the general environment, positive findings from studies in the workplace provide important leads regarding causes of cancer in other settings. In fact, occupational studies have identified many chemical carcinogens and have provided direction for prevention activities to reduce or eliminate cancer-causing exposures in the workplace and elsewhere.

Communications and Outreach

Science and communications are always inextricably entwined. At no time in history has the pace of scientific discovery about cancer and its causes exceeded what we are experiencing today. Likewise, never has it been so easy for so many people to have access to such a vast wealth of information. Effective communication empowers people to make informed cancer-related decisions and to engage in behaviors that will improve their health. Few other initiatives have the potential to simultaneously improve health outcomes, decrease health care costs, and enhance community satisfaction.

Scientists and communications experts studying the process of effective communication and its impact on health for more than 25 years have produced increasingly refined theories of health communications, including those that focus on how people process health information and how they respond to cancer-related risks. These theories have been applied to interventions that have contributed to declining smoking rates among many groups in the United States, to the increasing proportions of Americans who are eating more fruits and vegetables each day, and to the larger numbers of people who are getting screened for breast, cervical, and colorectal cancers.

Substantial barriers still prevent major segments of the population from seeking and using cancer information. Some people continue to lack access to the array of communications media. Others are faced with content that is unintelligible to them (in the wrong language or language that is too complex), culturally inappropriate, or simply ineffective. NCI is creating Centers of Excellence in Cancer Communications Research to accelerate advances in cancer communications knowledge. Interdisciplinary teams of researchers will develop, implement, and evaluate strategies to improve both access to cancer information and its efficacy and dissemination. Our intent is to learn how to help people distinguish important from insignificant health risks and deal with contradictory or inaccurate health messages so they can make informed choices.

Conclusion

NCI has been entrusted with guiding our Nation's commitment to a complete understanding of cancer: from understanding how a normal cell becomes cancerous to understanding why some people get cancer and others do not; and across the continuum through detection, diagnosis, treatment, survivorship, and ultimately prevention. NCI's mission is broad and our approach is necessarily ambitious, because, while our primary role and our expertise is research, our interest is people: our families, friends, neighbors, and colleagues - and yours. Our goal is to eradicate cancer and save the lives of those who would otherwise be lost to us, and we have a long tradition of working with other like-minded agencies, organizations, and individuals to ensure that research progress is translated into action that has a meaningful impact for all. Dr. Devesa and I thank you for giving us the opportunity to put NCI's role in the study of cancer clusters and hot spots into perspective, and we would be pleased to answer any questions you may have.