

Busting Cancer Clusters: Realities Often Differ From Perceptions

By Steven Benowitz

Cancer clusters often have all the necessary ingredients for great detective stories and human drama, and that fact has not been lost on either Hollywood or the news media.

Woburn, Mass., Hinkley, Calif., and Toms River, N.J., are all examples of small towns thrust into the public spotlight because of a reported cluster of cancer cases (and potentially related environmental conditions) that drew both local and national headlines. The Woburn story spawned a bestselling novel and a movie, *A Civil Action*. The movie *Erin Brockovich* tackled the story of a cluster of childhood cancers in a small desert town in California.

Cancer clusters come in two basic types: occupational and environmental, with variations on both themes. Occupational clusters are easier to spot because they are confined to one population with similar exposures to potential contaminants. Examples include asbestos and mesothelioma, vinyl chloride monomer and liver cancer. Community—and potentially environmentally caused—clusters are harder to unravel because of the difficulty in determining and measuring the myriad variables involved, such as age, potential exposure, and length of time living in an area. They are incredibly difficult to prove and even harder to trace to specific causes.

Epidemiologists like to distinguish between perceived and observed clusters.

It is one thing for some residents to think that their community has had an abnormally high number of cancers over a given period and another to actually meet the Centers for Disease Control and Prevention's (CDC) definition of "a greater than expected number of cancer cases that occurs within a group of people, in a geographic area or over a period of time."

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But clusters mean different things to different people. When residents begin to see several cancers in a small community, or even in their families, they tend to want to find a common cause. Sometimes they forget how common cancer can be. Or they fail to take into account that cancer is a hundred different diseases with different causes. And of course, few think about random chance.

According to veteran "cluster buster" Tim Aldrich, Ph.D., associate professor of epidemiology at East Tennessee State University in Johnson City, the cancers that are involved in a cluster have to be rare diseases to be detected. "Common cancers such as breast, lung, colon, and prostate have too much background noise to tell if an environmental exposure is the culprit," he said. "If, as some say, 3%–5% of cancers are environmental, and 1%–2% of perceived clusters really are clusters, then you're dealing with a very uncommon event. You have to have a rarefied distribution to see these things jump up."

"There have only been a few reported cancer clusters that have proven to be real clusters," said Melissa Bondy, Ph.D., professor of epidemiology at the University of Texas M. D. Anderson Cancer Center in Houston. "People get alarmed when they hear about cancers at various sites in an area. There have been some that epidemiologists have been able to untangle, but most cancer clusters have not been well documented. They usually don't pan out to be anything."

When To Investigate

Hundreds of cancer cluster reports are filed by the public each year with local or state health departments. Only a few are routed to the federal government for further investigation. A more likely scenario might involve an expert consultant who is brought in, noted Aldrich.



Melissa Bondy, Ph.D.

Cluster investigations are resource exhausting in time, effort, and money. "Investigations are overwhelming, and that's why formal ones are rarely done," said Habibul Ahsan, M.D., professor of health studies, human genetics, and medicine at the University of Chicago.

Because state health departments have cluster response protocols, they have "first pass" to say if a supposed cluster meets a certain threshold that warrants more information. According to the CDC Web site, most investigations begin with the local or state health department gathering information that includes the expected cancer rate; the number and types of cancers; and the age, sex, race, age at diagnosis, and address of individuals with cancer. Patients and families may be contacted. All this information is compared to state registry data to

see whether there is a higher than expected number of cases.

“The health departments have to track down every single case that may be going on in an area and compare that to what the rates would be in those areas,” Bondy said. “They have the data that they can access to see if there are really increases compared with state population data.”

But such thresholds can be subjective, and cancer cluster investigations are complicated. Generally, Aldrich said, investigators look for several signs, such as a short time in which the cancers were diagnosed, a credible possibility of an environmental cause, and a severalfold risk increase. Sometimes suspected clusters don’t have enough cases to make a statistically sound argument. There must be a good comparison population, and investigators need to decide how to handle residents moving in and out of an area, as well as prior exposures to the potentially cancer-causing agent.

Making a compelling argument for a broader research effort is not easy. In Woburn, Mass., 21 cases of childhood leukemia were diagnosed from 1969 to 1986, including eight deaths. There was also an elevated rate of birth defects, as well as other health problems. Yet not until Harvard School of Public Health biostatistician Marvin Zelen, Ph.D., and a colleague looked more closely at the drinking water wells contaminated with industrial pollutants was real progress made in the cluster investigation. They scrutinized records of which families received drinking water from the wells and when, and they compared that information with records of cancers and birth defects. Eventually they made the case that those children who drank from the contaminated wells had a higher risk of developing leukemia and various types of birth defects, including Down syndrome. The study wasn’t funded and relied on hundreds of volunteers from Woburn. Initially, however, some experts challenged Zelen’s research methods and dismissed the findings.

In Fallon, Nev., 18 cases of childhood leukemia—including three deaths—over several years led to an expensive CDC investigation in 1997 into possible environmental causes. The agency tested the water,

air, and soil around homes in Fallon and even sampled urine and blood from residents. Yet, although new research grants were awarded last year to continue to study the suspected cluster, no single agent has been found responsible for the higher cancer incidence, even though there are substantial amounts of arsenic, tungsten, and jet fuel in the area.

Pediatric cancer specialist Leslie Robison, Ph.D., chair of epidemiology and cancer control at St. Jude Children’s Research Hospital in Memphis, Tenn., was on the advisory committee investigating the Fallon cancer cluster. Robison has been involved in many investigations of suspected clusters over the years. The Fallon situation, he said, “was so impressive in terms of time sequence and number of cases in a small population that I jumped at

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the chance to be involved. If I was ever going to understand the cause of a cancer cluster, the situation in Fallon was it.”

Randall Todd, Dr.P.H., the state epidemiologist at the time of the investigation, agreed. “Fallon unfolded so rapidly that it almost resembled a communicable disease outbreak,” said Todd, who is now director of epidemiology and public health preparedness for Washoe County, Nev. Still, it took a confluence of scientific, public, and political factors for the CDC to become involved, including the availability of new investigative technologies.

“The CDC investigation went far beyond what was justified from a scientific standpoint,” Robison said. “But it was important for the public to understand that, in fact, these studies covered every possible explanation. They did a remarkably good job balancing the scientific

rationale with the public concern. That’s not always easy to do when there are families with sick children.”

Public pressure cannot be overlooked. Concern over purportedly elevated rates of breast cancer in Long Island, N.Y., for example, led to the Long Island Breast Cancer Study Project, a National Cancer Institute–funded investigation. Scientists have yet to pinpoint a cause for the higher rates, and many factors present in the population, including genetic and socioeconomic reasons, may explain the possibly higher rates.

But not everyone agrees that such investigations are always worthwhile. “Despite the hundreds of millions of dollars this country has spent investigating real or perceived excesses of cancer clusters, little information has been learned that has allowed us to prevent any cancers,” said Alan Bender, D.V.M., Ph.D., section chief of chronic disease and environmental epidemiology at the Minnesota Department of Health. “Most of what we have learned from environmental carcinogenesis stems from the workplace. Investigating cancer clusters for an environmental cause is a next-to-impossible task.”

Cluster Studies Evolve

According to Aldrich, the so-called heyday of cancer clusters was in the late 1980s and early 1990s, when several high-profile cases occurred, including those in Woburn, the Seascale power plant in England, and Toms River. A federally sponsored study in the late 1970s estimated that 80% of cancers were attributable to the environment, including diet, lifestyle, and behavior. The public misunderstood what was meant by “environment.”

“It goes back to the idea that the lifestyle is responsible for most cancers, and the public doesn’t want to take responsibility for the fact that diet and lifestyle have such a strong effect,” Aldrich said. “It’s much easier to shift blame to the environment.”

But he pointed out that there’s been a dramatic change in how cluster reports are handled today with the establishment of cancer registries. Today, most states have

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standard protocols for investigating clusters, and most are organized through the registries. “The view on clusters today is much different from what it was in the strongly controversial days of the mid-1980s and 1990s,” when cancer cluster investigations seemed more sensationalized, Aldrich said.

“Public health departments have become much better at addressing people’s concerns yet having a balance in what determines the need for more extreme investigation,” said St. Jude’s Robison.

One reason is better communication with both the public and the news media. “Giving the public the right to know the cancer rates in their areas has gone a long way to lessen anxiety,” Aldrich said. “The biggest fuel behind the cancer cluster controversy was people being told ‘we don’t know and we can’t know and we’re not going to try to find out.’”

In 1988, Aldrich was asked to run the North Carolina state cancer registry and, in particular, to handle cancer cluster inquiries,

which were the responsibility of the epidemiology division. At that time, the division received about 30–40 reports of cluster activity a year but usually carried out only two or three investigations. At the end of Aldrich’s first year, the health department had performed 48 cluster investigations. “The reason is we had a protocol, had data, and didn’t say no. You can’t not tell people things—you have to take initiative to communicate.” Still, Aldrich said that of the nearly 500 cluster reports his team investigated, only five were actual clusters.

“From my perspective and my 35 years studying clusters, when I look at where we were in the 1970s and early 1980s, we are in a much better situation today,” he said. “I think that clusters keep coming because people don’t understand that in the progress against cancer, more people will be living with cancer and you’ll know more people with cancer. In the near future, I think that clusters will be rarer because people will understand them and cancer incidence better.”

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