

# SCIENTIFIC AMERICAN

## How Many Cancers Are Caused by the Environment?

Some experts say a decades-old estimate that six percent of cancers are due to environmental and occupational exposures is outdated and far too low

- By [Brett Israel](#), [Environmental Health News](#) on May 21, 2010

Traces of chemicals known to cause human cancer lurk everywhere. But after decades of research, figuring out how many people might contract cancer because of them remains an elusive goal.

More than 60 percent of U.S. cancer deaths are caused by [smoking](#) and diet. But what about the rest?

A report by the [President's Cancer Panel](#), released earlier this month, reignited a 30-year-old controversy among cancer experts and environmental epidemiologists about how large a role environmental factors play in the No. 2 killer of Americans.

Some experts, including the President's panel, say a decades-old estimate that six percent of cancer deaths are due to [environmental and occupational exposures](#) is outdated and far too low.

But scientists most likely will never be able to tease out the true role of [environmental contaminants](#) because environmental exposures, genetics and lifestyle seem to all intertwine.

"It's like looking at strands of a spider web and deciding which one is important," said Dr. Ted Schettler, director of the [Science and Environmental Health Network](#), a nonprofit group that advocates use of science in setting environmental policy.

From the womb to old age, people around the world are exposed to countless carcinogens in their food, air, water and consumer goods.

The [National Institutes of Health](#) has classified 54 compounds as known human carcinogens based on studies indicating they cause at least one type of cancer in people, according to the nation's 11<sup>th</sup> Report on Carcinogens. The highest exposures occur in an occupational setting, but there are environmental exposures as well.

For example, [benzene](#), a known cause of human leukemia, is a common pollutant in vehicle exhaust. Radon, a natural radioactive gas found in many homes, raises the risk of lung cancer. [Arsenic](#), linked to skin, liver, bladder and lung cancer, contaminates some drinking water supplies. Other known human carcinogens include asbestos, hexavalent chromium, aflatoxins and vinyl chloride.

Since 1981, agencies and institutes have cited the same estimate when regulating carcinogens in the workplace, air, water and consumer products. Roughly four percent of cancer deaths – or 20,000 deaths per year – may be attributable to occupational exposures, and two percent – or 10,000 deaths per year – to environmental exposures.

In its new report, the panel, appointed by former President Bush, called that estimate "woefully out of date," reporting that "the true burden of environmentally induced cancers has been grossly underestimated."

But the [American Cancer Society](#) took issue with that statement, saying there was no scientific consensus.

"On what grounds do you know it's being grossly underestimated? It's a possibility, but many hypotheses have been proposed, and unless you have real evidence, you can't say that it is," said [Dr. Michael Thun](#), vice president emeritus of epidemiology and surveillance research for the American Cancer Society.

Thun said the President's panel overstates the concern about environmental causes when the best way to prevent cancer is to combat the largest risks that people encounter: tobacco, diet and sun.

But many environmental epidemiologists say quibbling over the numbers becomes a diversionary tactic.

They say the American Cancer Society's statement sounds a bit like a principle espoused by industry groups – don't

act without absolute proof of harm. Many environmental epidemiologists are in favor of moving toward the precautionary principle – reducing people’s exposure to environmental pollutants even if there is uncertainty about the risks.

It’s an "erroneous exercise" to try to assign each chemical or exposure a specific fraction of cancer, said Richard Clapp of [Boston University's School of Public Health](#), who co-authored a 2005 review and 2007 update on environmental and occupational causes of cancer.

"It's estimating a fiction, because nobody knows and nobody can know," said Clapp. "Why do we keep beating this dead horse? If there are things we can move on, let's work on those."

Cancer is the second leading killer of Americans, and the leading cause of death worldwide. Every year, about 1.5 million new cases are diagnosed in the United States and more than half a million people die from the disease, according to the American Cancer Society.

Experts agree that most cancers are caused by lifestyle factors such as smoking, diet and alcohol. Smoking alone accounts for at least 30 percent of all U.S. cancer deaths, and another one-third is attributed to diet, obesity and physical inactivity, according to the American Cancer Society.

But it’s the remaining cancers – about one out of every three – that trigger debate.

A 1981 report by two scientists, Sir Richard Doll and Sir Richard Peto, published in the *Journal of the National Cancer Institute*, estimated that two percent of cancer deaths were attributable to exposures to pollutants in the environment and four percent to exposures in occupational settings. In 2009, those percentages amounted to about 30,000 U.S. deaths.

“If you looked at the number of deaths per day, if that were a plane crash it would be a national news story,” Clapp said.

The 1981 report only considered deaths, not cancer cases. (About half of those diagnosed with cancer die.) Also, the study only included Caucasians under the age of 65, although many cancers increase with age and many minority groups are more highly exposed to environmental contaminants.

The old two percent estimate for environmentally induced cancers is still commonly used – despite [advances in modern cancer biology](#).

New areas of cancer research are focusing on the potential for pollutants to interact with one another and with genetic factors. Carcinogens can act by damaging DNA, [disrupting hormones](#), inflaming tissues, or [switching genes on or off](#).

Also, exposure to hormonally active agents during critical periods of human development – particularly [in the womb or during childhood](#) – may trigger cancer later in life. For example, the risk of breast cancer could be influenced by exposures during puberty.

All these elements make it tricky to calculate the magnitude of environmentally induced cancers.

Scientists now know that getting cancer is like being attacked by a multi-headed monster: How can you really be sure which part did the most damage?

Schettler said “we now know from cancer biology that multiple interacting factors” are involved so it’s impossible to assign percentages to certain causes.

“It’s really important that we understand the limits of this notion. We have to be humbled by this and know that our estimates may be way off,” he said.

Margaret Kripke, a professor at [University of Texas' M.D. Anderson Cancer Center](#) and co-author of the President’s Cancer Panel report, said the idea that cancer biologists can put a number on the environmental component of cancer is fraught with limitations.

She uses the example of a person who is genetically predisposed to lung cancer, but also smokes and lives in an area with high [air pollution](#). If this person develops cancer, it is almost always attributed to smoking because almost 90 percent of lung cancer deaths are caused by tobacco. But researchers can't simply dismiss the remaining 10 percent. The way these fractions are teased apart is crucial, and important contributors are easily overlooked by limitations in study design.

There is substantial evidence that synergism between two different exposures can cause some cancers. [Asbestos](#), for

example, enhances the carcinogenicity of tobacco smoke, so the rate of lung cancer was especially high among people who smoked and also were exposed to asbestos in their workplaces.

The major reason that it's so difficult to pin down how many cancers are due to environmental factors is that studies that allow epidemiologists to link human cancers to an environmental pollutant are rare opportunities.

Scientists need a setting where they can be absolutely certain about what and when people were exposed to something, and then be able to follow up with the patients many years later, since cancer takes decades to develop. Yet this is hardly ever possible, said [Dr. Richard Jackson](#), former director of the federal [Centers for Disease Control and Prevention's National Center for Environmental Health](#).

Humans aren't lab rats; they tend to move around, so they don't know what they were exposed to, said Jackson, who is now a UCLA professor. Also, tracking systems for environmental exposures and chemicals are inadequate.

Smoking is relatively easy to study – you can ask someone about their smoking habits – but if you ask someone if they were exposed to benzene, chlorinated solvents, or [pesticides](#), they probably won't have the slightest idea or they certainly won't know how much they were exposed to, Schettler said.

There are examples of natural experiments where communities have banned a suspected carcinogen such as a pesticide and then seen cancer rates drop, such as when Sweden banned phenoxy herbicides over a decade ago. While these natural experiments are useful to epidemiologists, they usually only confirm that a chemical is harmful and reveal little about its overall contribution to cancer death.

In most cases, environmental agencies estimate the number of cases attributable to a certain environmental chemical by extrapolating from studies of lab animals or occupational settings where cancer rates rise among workers, then estimating the public's exposures. But those risk assessments carry many uncertainties.

The two members of the President's Cancer Panel believe their claim about the "grossly underestimated" role of the environment is justified because technologies such as [CT scans](#), which expose people to large amounts of radiation, are in greater use today. Also, there are more known carcinogens today, and the original estimates didn't consider multiple exposures over a person's life.

"We think all of those things combine to make the current estimate higher. They certainly won't go down, but are probably much larger than estimated," said Kripke.

She said the panel's intent was to bring attention to human carcinogens in the environment that the public is unaware of, such as radon and [formaldehyde](#), she said.

The panel pointed out [bisphenol A](#), used in polycarbonate plastic and can linings, along with radon, formaldehyde and benzene, as carcinogens that need more regulation.

Clapp said instead of worrying about specific numbers, the focus should be on banning or restricting workplace carcinogens with strong evidence that they are harmful. One example is methylene chloride, used in semiconductor factories.

Reducing use of CT scans and cleaning up military bases are other ways to reduce exposures, according to the President's Cancer Panel report.

The American Cancer Society agreed with much of the panel's report, and in the past, it has expressed concern about environmental chemicals.

"Although the relatively small risks associated with low-level exposure to carcinogens in air, food, or water are difficult to detect in epidemiological studies, scientific and regulatory bodies throughout the world have accepted the principle that it is reasonable and prudent to reduce human exposure to substances shown to be carcinogenic at higher levels of exposure," the American Cancer Society said in a 2009 Cancer Facts and Figures report.

But the group worries that the President's Cancer Panel overstated the risks and [detracts from combating the bigger causes of cancer](#).

"There is no doubt that environmental pollution is an important issue to address to improve the lives of Americans. At the same time, it would be unfortunate if people came away with the message that the chemicals in the environment are the most important cause of cancer at the expense of those lifestyle factors, like tobacco, physical activity, nutrition, and obesity, that have by far the most potential in reducing cancer deaths," Thun said in a statement.

Thun added in an interview that "many of the carcinogens in smoking are the same ones that people worry about in the general environment," such as benzene. But in cigarettes, "they are much more concentrated and people are inhaling them deep into their lungs. The magnitude of exposure is just gigantically different."

But Kripke pointed out that there has been plenty of emphasis on smoking, diet and other causes of cancer over the past few years. Last year's 2009 President's Cancer Panel report focused on lifestyle-related cancers.

"To say that we have ignored those factors doesn't take into account that we have put a lot into work into it," Kripke said. "We're very cognizant that there are other, larger factors that contribute to cancer, but that doesn't mean we shouldn't look at the smaller ones."

The general public can understand that many factors can lead to disease and that all should be addressed, Schettler said.

"People can walk and chew gum at the same time. We can pay attention to many factors at the same time," he said.

*This article originally ran at [Environmental Health News](#), a news source published by Environmental Health Sciences, a nonprofit media company.*

DrFarrahCancerCenter.com