

State of the Evidence

What is the Connection Between the Environment and Breast Cancer?

Breast cancer now strikes more women in the world than any other type of cancer except skin cancer. During the past half-century, the lifetime risk of breast cancer more than tripled in the United States. In the 1940s, a woman's lifetime risk of breast cancer was one in 22. In 2004, it is one in seven. Breast cancer is the leading cause of death in American women ages 34 to 44.^{3,4} Although breast cancer in men accounts for less than 1 percent of the disease, in the United States, the incidence has increased by 25 percent in the past 25 years.⁵ An estimated 1,600 men are expected to be diagnosed with breast cancer this year.⁶

Once a disease almost exclusively of postmenopausal women, breast cancer now strikes women in their 20s and 30s. Of the estimated 211,000 women in the United States diagnosed with breast cancer in 2002, approximately 10,500 were women under 40.⁷

More American women have died of breast cancer in the last 20 years than the number of Americans killed in World War I, World War II, the Korean War and the Vietnam War combined.

Several factors associated with elevated risk of breast cancer exist. They include alcohol consumption,^{8,9} personal characteristics such as early puberty, late menopause and a woman's age at her first full-term pregnancy, and social factors such as higher income. Even when all known risk factors and characteristics including family history and genetics are aggregated, however, as many as 50 percent of breast cancer cases remain unexplained.^{10,11}

Purpose of This Report

The effort to understand and explain the major reasons for today's high incidence of breast cancer has produced an ongoing, unsettled debate with differing findings in existing epidemiological and biological research. A significant body of evidence indicates, however, that exposure to radiation and synthetic chemicals must be understood as contributing to the increased incidence of breast cancer.

This report summarizes that evidence—based on experimental, body burden and epidemiological studies—and recommends new directions for future research. It also outlines a six-part plan to act on the evidence and reduce the burden of synthetic chemicals in our environment and in our bodies, and reduce our exposure to radiation. This plan is based primarily on the

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precautionary principle,¹² which states that evidence of harm rather than proof of harm should be the trigger for action.

History of This Report

On February 20, 2002, Breast Cancer Fund and Breast Cancer Action introduced *State of the Evidence: What Is the Connection Between Chemicals and Breast Cancer?* at the first informational hearing on breast cancer and the environment of the California State Senate Health and Human Services Committee in Sacramento, Calif. The hearing was sponsored by Sen. Deborah Ortiz.

State of the Evidence also served as a core document for participants at the first International Summit on Breast Cancer and the Environment, convened in Santa Cruz, Calif., from May 22-25, 2002, sponsored by the U.S. Centers for Disease Control and Prevention and the University of California Berkeley School of Public Health. The primary policy recommendation from the Summit was to establish a national program of biomonitoring, using breast milk and other biospecimens as markers of community health. A report on the Summit was submitted to the CDC on January 23, 2003.¹³

On October 23, 2002, *State of the Evidence* was distributed at a joint informational hearing of the California State Senate Health and Human Services Committee and the State Assembly Health Committee, held in San Francisco. State Sen. Deborah Ortiz and Assemblymember Dario Frommer co-chaired the hearing. At this hearing, scientists, advocates and physicians presented testimony on breast cancer and the environment, including research and policy recommendations that emerged from the International Summit. The Healthy Californians Biomonitoring Program legislation was introduced in two successive sessions of the California state Legislature and progressed significantly in each effort. The legislation was reintroduced in the 2005 session amid growing support from the public, legislators, California Department of Health Services and non-governmental organizations across the state. A statewide public opinion poll conducted by Lake Snell Perry & Associates showed that nearly 80 percent of California voters voiced strong support for such legislation and 97 percent agreed that industrial pollutants can cause health problems and disease.

New in This Edition

Previous editions have acknowledged ionizing radiation as a known cause of breast cancer. The continued aggressive promotion of mammography screening as “an important part of preventive care,”¹⁴ however, suggests the need for clarification and a more thorough examination of the role of radiation in

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carcinogenesis. The evidence that ionizing radiation causes breast cancer is indisputable.^{15,16} Decades of research that established ionizing radiation exposure is a major factor in the current epidemic of breast cancer. As science editor Peter Montague wrote, "Radiation is a known cause of breast cancer in women; it is not speculative or uncertain. It is widely accepted. It just is not widely discussed."¹⁷

In addition, there is evidence that non-ionizing radiation such as electromagnetic fields (EMFs) and radio-frequency radiation also increases the risk of breast cancer. Scientific research on this issue is incomplete but important to pursue, given that even a small increase in risk for such a common cancer will result in a significant increase in the number of cases.

Exposure to non-ionizing radiation is chronic, ubiquitous and increasing throughout the industrialized world. Health effects of EMF exposure are difficult to study because there is no unexposed population, i.e., no control group, and, unlike many chemicals, exposure to non-ionizing radiation cannot be traced through biomonitoring. Therefore, the differences in health effects between workers who have chronic occupational exposure to EMF and people without occupational exposure may be merely twofold. Nonetheless, numerous research studies have shown an association between EMF exposure and increased risk of breast cancer, other cancers and other chronic health conditions.

New Research Highlights

Since publication of the second edition of *State of the Evidence* in 2003, several pertinent research studies have furthered our understanding of the environmental links to breast cancer and the implications for research and public policy.

Germane research published since February 2003 includes the following studies:

- All types of **postmenopausal hormone replacement therapy (HRT)** were shown to **significantly increase the risk of breast cancer** in the Million Women Study in the United Kingdom. The risk was greatest among users of estrogen-progestin combination therapy.¹⁸ This study confirmed the findings relevant to HRT in the Women's Health Initiative Study reported in 2002. However, the findings about estrogen-only replacement therapy (ERT) differed in these two large studies. The Million Women Study found an increased risk of breast cancer among estrogen-only users whereas the Women's Health initiative study found no increase in risk with estrogen-only users.

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- In a Swedish trial, use of **HRT** after previously being diagnosed with breast cancer **tripled a woman's risk of recurrence** or development of a new breast tumor, causing researchers to halt what had been planned as a five-year study after only two years.¹⁹
- **Chlorinated chemicals were associated with elevated risk of breast cancer** in three new studies. Taiwanese electronics workers exposed to chlorinated solvents were found to have an increased risk of breast cancer.²⁰ Massachusetts women exposed to perchlorethylene-contaminated drinking water were found to have a small to moderate increased risk of breast cancer.²¹ A biomonitoring study in Belgium found higher levels of DDT and hexachlorobenzene (HCB) among breast cancer patients than in women without the disease.²²
- The solvent **ethylene glycol methyl ether (EGME)** and its metabolite, 2-methoxyacetic acid (MAA) were found to **sensitize breast tissue cells** to the effects of estrogens and progestins, thereby increasing the risk of breast cancer. EGME is used in the semiconductor industry and is also a component in varnishes, paints, dyes and fuel additives.^{23,24}
- **Polychlorinated biphenyls (PCBs)** were implicated in breast cancer recurrences in a study of 224 women on Long Island, N.Y.²⁵
- Several metals, including **cadmium, copper, cobalt, nickel, lead, mercury, tin and chromium demonstrated estrogen-like activity in MCF-7 breast cancer cells.**²⁶ An animal study by the same researchers found that in utero exposure to cadmium caused early puberty and altered mammary gland development in female offspring.²⁷ The presence of both cadmium and mercury in women's bodies has been confirmed through several breast milk monitoring studies.^{28,29,30,31}
- **Zeranol**, a hormone **used to help fatten beef cattle** more quickly, **caused breast cancer cells to proliferate** even when exposed to much lower levels of the hormone than the FDA has approved as safe.³²
- **Flight attendants** were found to have varying degrees of increased incidence of breast cancer in studies in Iceland, Sweden and California.^{33,34,35} These findings confirm earlier studies showing similar results.
- Two occupational health studies, one from Yale University, the other from Mt. Sinai School of Medicine, found **increased breast cancer risk among teachers and librarians.**^{36,37} The Mt. Sinai study, which looked only at women ages 20 to 44, also found elevated risk among computer

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equipment operators (which includes persons operating input/output devices such as tape drives, disk drives and printers).

- **Exposure to ethylene oxide** was linked to **increased incidence of breast cancer** among female workers in commercial sterilization facilities, according to scientists at the National Institute for Occupational Safety and Health.³⁸
- **Radiation treatment for Hodgkin's disease greatly increased the risk of breast cancer** in four new studies.^{39,40,41,42}
- **Radiological technologists** were found to have an elevated risk of breast cancer, melanoma and thyroid cancer, based on a study by National Cancer Institute scientists.⁴³
- Both **residential and occupational EMF exposure was linked to increased risk of breast cancer** in Norwegian women. This population-based study used data from Statistics Norway and the Norwegian national cancer registry and found a higher incidence of estrogen-negative breast cancer in women of all ages.⁴⁴
- **EMF exposure from electrically heated bedding** (electric blankets, mattress pads and heated water beds) was associated with **increased risk of breast cancer among African-American women**.⁴⁵
- **EMF exposure was associated with increased breast cancer risk** in a study of **female radio and telegraph operators** by the Cancer Registry of Norway.⁴⁶

What Does Environment Mean?

Federal spending on breast cancer research increased dramatically in the past decade, totaling \$6.8 billion since 1991.⁴⁷ Only a small percentage has been directed toward studying environmental connections to breast cancer, however. In 2002 and 2003, for example, just one of every nine research dollars spent on breast cancer at the National Cancer Institute was to examine environmental links to the disease.⁴⁸ The relatively few environmental studies that have been undertaken often defined the environment to include nutrition, exercise and other lifestyle factors—i.e., broadly—and focused largely on voluntary exposures and individual behaviors. It is not surprising, therefore, that many questions about involuntary environmental links to breast cancer remain unanswered.

The environment includes the totality of living and working conditions as well as the physical, biological, social and cultural responses to these conditions.

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This report, however, is concerned primarily with people's exposures to environmental agents beyond their control, such as pesticides, dioxin, second-hand tobacco smoke and other chemicals. Some of these agents may be present in air, food, water, medications and soil.

Radiation (both ionizing and non-ionizing) is also discussed as an environmental exposure, even though some exposure to radiation is voluntary, as in the case of X-rays and other radiological procedures. Patients may choose whether to undergo these procedures; however, these are often uninformed choices because little or no specific information about radiation dose or potential risk usually is provided by health professionals. Exposure to non-ionizing radiation is largely involuntary and ubiquitous.

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Environmental Exposures

- Environmental exposures can occur daily at home, at school, in the workplace, in health care facilities and in other settings.
- Environmental exposures can also occur in the womb, when chemicals in the mother's body or diet cross the placenta to the fetus.
- Environmental exposures are often influenced by social, economic and cultural factors such as employment, income, housing, access to food and the way food is produced and processed.
- These exposures may be chronic (from occupation or residence, for example) or acute (from an industrial accident, such as a release of radioactive materials or other hazardous substances).

This article has been excerpted from the publication of the same name, "State of the Evidence: What is the Connection Between the Environment and Breast Cancer?," 3rd edition, 2004, that originated from an organization called the Breast Cancer Fund. Contact this organization at their e-mail address: info@breastcancerfund.org. For more information about the organization, go to <http://www.breastcancerfund.org>.

For a list of references, please contact the CSA office at (800) 345-3691.

We must work passionately and indefatigably to bridge the gulf between our scientific progress and our moral progress. One of the great problems of mankind is that we suffer from a poverty of the spirit which stands in glaring contrast to our scientific and technological abundance. The richer we have become materially, the poorer we have become morally and spiritually.

— Martin Luther King, Jr.