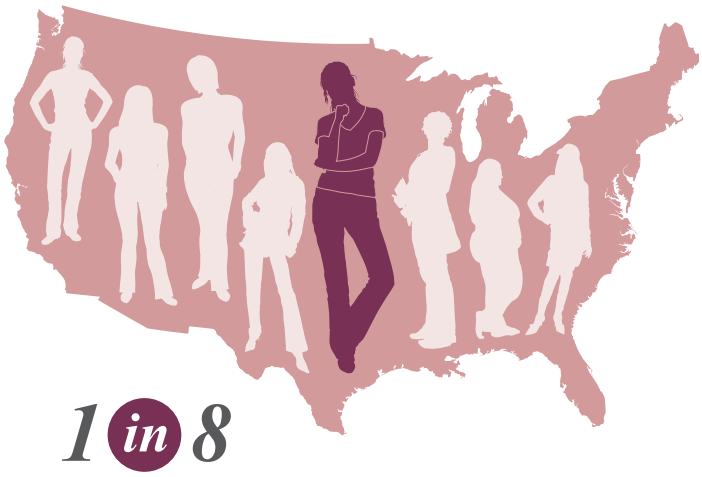
National Institute of Environmental Health Sciences
Your Environment. Your Health.

Breast Cancer: Why the Environment Matters

A woman has a 1 in 8 chance of developing breast cancer in her lifetime, according to the American Cancer Society. It is the second most common cancer among women in the United States, next to skin cancer. Breast cancer occurs mostly in women who are 50 years old or older.



Prevention is Key

Supported by NIEHS and the National Cancer Institute, the Interagency Breast Cancer and Environmental Research Coordinating Committee concluded, in a 2013 landmark report[1], that prevention is key to reducing the emotional, physical, and financial burden of breast cancer.

Research shows, in general, maintaining a healthy weight, staying physically active, and consuming a nutritious diet can reduce the chance of developing cancer over your lifetime.

What Causes Breast Cancer?

Most women who develop breast cancer have no family history of the disease, suggesting an environmental link. In a study, inherited factors, such as the BRCA1 or BRCA2 genes, accounted for only 27% of breast cancer risk.[2]

Although we know of many risk factors that increase women's chances of developing breast cancer, scientists do not completely understand what causes normal cells to become cancerous. But most experts agree that a combination of genetic, hormonal, and environmental factors leads to breast cancer.

What Does NIEHS Research Tell Us About Breast Cancer?

NIEHS plays a leadership role in funding and conducting studies on the ways in which genetic and environmental factors may affect breast cancer risk. For example, NIEHS scientists discovered women living in areas with higher levels of air pollution may have a higher risk of breast cancer.[3] Research that helps us figure out how to reduce contact with environmental factors linked to breast cancer presents tremendous opportunity for disease prevention.

The Sister Study

The NIEHS Sister Study includes more than 50,000 sisters of women with breast cancer from the U.S. and Puerto Rico. The study looks at lifestyle and environmental exposures, as well as genetic and biological factors that may affect a woman's chance of developing breast cancer. Genetic profiles and environmental exposures of women who developed breast cancer are compared with their sisters who have not. These scientific comparisons help uncover how the disease develops. Important study findings follow.

- Women who exercised or played sports more than seven hours a week during ages 5-19 had a lower risk of breast cancer as adults.[4]
- Women who regularly took vitamin D supplements had lower rates of postmenopausal breast cancer.[5]
- Women who developed diabetes during two or more pregnancies had a higher incidence of breast cancer.[6]

PO Box 12233 • Research Triangle Park, NC 27709
Phone: 919-541-3345 • **www.niehs.nih.gov**

National Institutes of Health
U.S. Department of Health and Human Services

September 2021

♻ Printed on recycled paper

- Age is a leading risk factor. NIEHS scientists found biological aging, a measure of DNA changes, may be tied to environmental exposures and the likelihood of developing breast cancer.[7]
- Trouble sleeping four or more nights per week is associated with increased breast cancer risk.[8]
- Women who live in areas of air pollution with higher levels of lead, mercury, and cadmium have a greater chance of developing postmenopausal breast cancer.[9]
- Women who regularly used hair dye were 9% more likely than women who did not to develop breast cancer. Among Black women, using permanent dyes every five to eight weeks or more was associated with a 60% increased chance of developing breast cancer as compared with an 8% increased risk for white women.[10]

Two Sister Study

A related NIEHS study focuses on women under 50 with young-onset breast cancer. This study found certain factors may reduce the risk of young-onset breast cancer, such as older age at menarche, younger age at menopause, premenopausal hysterectomy, and early age at first-term pregnancy.[11]

Breast Cancer and the Environment Research Program (BCERP)

NIEHS, with the National Cancer Institute, studied developmental periods in women's lifespans, such as puberty, pregnancy, and menopause, to identify factors related to breast cancer. As a result, future prevention efforts may be targeted and more effective.

Findings include:

- Exposures to common chemicals may change the timing of puberty. For example, girls exposed to high levels of triclosan, used in some antimicrobial soaps, had early breast development. Also, girls exposed to high levels of benzophenone-3, found in some sunscreens, had later breast development.[12]
- The chance of developing breast cancer increases with exposure to endocrine disrupting chemicals during these periods: her prenatal development, puberty, pregnancy, and menopausal transition.[13]
- About 300 chemicals used in personal care products, flame retardants, food processing, pesticides, and other purposes were tested and found to affect hormones known to increase breast cancer risk. Some chemicals tested may be in air and water pollution.[14]

National Toxicology Program (NTP)

An interagency program headquartered at NIEHS, NTP reported these six substances cause or may cause breast cancer: diethylstilbestrol (DES), a synthetic estrogen that was used to prevent miscarriages; steroidal estrogens used for menopausal therapy; X-ray and gamma radiation; alcoholic beverages; tobacco smoking; and ethylene oxide, a sterilizing agent.[15]

After conducting cancer assessments for working at night, NTP found that persistent night shift work that disrupts circadian rhythms can cause breast cancer in women. This type of work is considered frequent and long-term, especially beginning in early adulthood.[16]

For more information on the National Institute of Environmental Health Sciences, go to **https://niehs.nih.gov**.

[1] Interagency Breast Cancer and Environmental Research Coordinating Committee. 2013. Breast Cancer and the Environment: Prioritizing Prevention. Available: https://www.niehs.nih.gov/about/assets/docs/ibcercc_full_508.pdf

[2] Lichtenstein P, et al. 2000. Environmental and Heritable Factors in the Causation of Cancer: Analyses of Cohorts of Twins from Sweden, Denmark, and Finland. N Engl J Med 343(2):78-85.

[3] Niehoff NM, et al. 2020. Outdoor air pollution and terminal duct lobular involution of the normal breast. Breast Cancer Res. 24;22(1):100.

[4] Neihoff NM et al. 2017. Childhood and teenage physical activity and breast cancer risk. Breast Cancer Res Treat 164(3):697-705.

[5] O'Brien KM, et al. 2017. Serum Vitamin D and Risk of Breast Cancer Within Five Years. Environ Health Perspect 125(7):077004.

[6] Park YM, et al. 2017. Gestational diabetes mellitus may be associated with increased risk of breast cancer. Br J Cancer 116(7):960-963.

[7] Kresovich JK, Xu Z, O'Brien KM, Weinberg CR, Sandler DP, Taylor JA. 2019. Methylation-based biological age and breast cancer risk. J Natl Cancer Inst; doi:10.1093/jnci/djz020 [Online 22 February 2019].

[8] White AJ, et al. 2017. Sleep characteristics, light at night and breast cancer risk in a prospective cohort. Int J Cancer 141(11):2204-2214.

[9] White AJ, et al. 2018. Metallic Air Pollutants and Breast Cancer Risk in a Nationwide Cohort Study. Epidemiology; doi:10.1097/EDE.0000000000000917 [Online 06 September 2018].

[10] Eberle CE, et al. 2019. Hair dye and chemical straightener use and breast cancer risk in a large US population of black and white women. Int J Cancer 147(2):383-391.

[11] O'Brien KM, et al. 2015. Risk factors for young-onset invasive and in situ breast cancer. Cancer Causes Control. 26(12):1771-8.

[12] Wolff MS, et al. Breast Cancer and Environment Research Program. 2016. Environmental phenols and pubertal development in girls. Environ Int 84:174-180.

[13] Terry MB, et al. 2019. Environmental exposures during windows of susceptibility for breast cancer: a framework for prevention research. Breast Cancer Research; doi: 10.1186/s13058-019-1168-2

[14] Cardona B, Rudel RA. 2021. Application of an in Vitro Assay to Identify Chemicals That Increase Estradiol and Progesterone Synthesis and Are Potential Breast Cancer Risk Factors. Environ Health Perspect. 129(7):77003.

[15] U.S. Department of Health and Human Services. 2016. Report on Carcinogens, Fourteenth Edition. Available: https://ntp.niehs.nih.gov/go/roc14 [accessed 02 November 2018].

[16] National Toxicology Program. 2021. Cancer Hazard Assessment Report on Night Shift Work and Light at Night. Available: https://ntp.niehs.nih.gov/ntp/results/pubs/cancer_assessment/lanfinal20210400_508.pdf