LAY ABSTRACT

TITLE: Environmental Exposures During Windows of Susceptibility for Breast Cancer: A Framework for Prevention Research

JOURNAL: Breast Cancer Research (2019) 21:96. Published August 20, 2019. Available at https://rdcu.be/bPbmT

AUTHORS: Mary Beth Terry, Karin B. Michels, Julia Green Brody, Celia Byrne, Shiuan Chen, D. Joseph Jerry, Kristen M.C. Malecki, Mary Beth Martin, Rachel L. Miller, Susan L. Neuhausen, Kami Silk, and Amy Trentham-Dietz on behalf of the Breast Cancer and the Environment Research Program (BCERP)

Corresponding author: Amy Trentham-Dietz, trentham@wisc.edu

Lay Abstract

Background: Scientists believe breast cancer starts to develop many years before the cancer is detected. Sometimes a cancer takes up to 30 years to develop after an exposure. This makes breast cancer research and risk reduction programs difficult. Breast cancer is not just one disease but many. There are also certain time periods when exposure to environmental chemicals may increase a woman's risk of breast cancer in the future. These are called "windows of susceptibility". "Windows" are often times when breasts are changing. They include when a baby is growing in a mother's womb, puberty, pregnancy, and menopause. Breast cancer is also associated with many factors including the environment.

Main text: This article provides a summary of what scientists have learned from breast cancer studies that look at environmental chemicals during important "windows". It also looks at how scientists who work in laboratories and scientists who study populations are working together. Studies that are part of the National Institutes of Health Breast Cancer and the Environment Research Program (BCERP) are looking at endocrine disrupting chemicals—chemicals that affect the body's natural hormone systems—during windows of susceptibility. Chemicals include polycyclic aromatic hydrocarbons (from smog and other sources), perflourinated compounds (nonstick and waterproof chemicals), polybrominated diphenyl ethers (flame retardants), and phenols (such as BPA in plastic)—and metals such as cadmium. BCERP scientists work closely with community groups to identify topics that are important to the public. BCERP also includes communication scientists to study how to translate research findings to the public and law makers.

Conclusions: Studies of breast cancer during "windows of susceptibility" are important to identify factors that increase risk of cancer and during what time of life. Studies that ignore these "windows" may miss important environmental factors that contribute to breast cancer. This work will inform both scientists and the public about what can be done to reduce risks of breast cancer.

Scientific Abstract

Background: The long time from exposure to potentially harmful chemicals until breast cancer occurrence poses challenges for designing etiologic studies and for implementing successful prevention programs. Growing evidence from animal and human studies indicates that distinct time periods of heightened susceptibility to endocrine disruptors exist throughout the life-course. The influence of environmental chemicals on breast cancer risk may be greater during several windows of susceptibility (WOS) in a woman's life, including prenatal development, puberty, pregnancy, and the menopausal transition. These time windows are considered as specific periods of susceptibility for breast cancer because significant structural and functional changes occur in the mammary gland, as well as alterations in the mammary micro-environment and hormone signaling that may influence risk. Breast cancer research focused on these breast cancer WOS will accelerate understanding of disease etiology and prevention.

Main text: Despite the plausible heightened mechanistic influences of environmental chemicals on breast cancer risk during time periods of change in the mammary gland's structure and function, most human studies of environmental chemicals are not focused on specific WOS. This article reviews studies conducted over the past few decades that have specifically addressed the effect of environmental chemicals and metals on breast cancer risk during at least one of these WOS. In addition to summarizing the broader evidence-base specific to WOS, we include discussion of the NIH-funded Breast Cancer and the Environment Research Program (BCERP) which included population-based and basic science research focused on specific WOS to evaluate associations between breast cancer risk and particular classes of endocrine disrupting chemicals—including polycyclic aromatic hydrocarbons, perfluorinated compounds, polybrominated diphenyl ethers, and phenols—and metals. We outline ways in which ongoing transdisciplinary BCERP projects incorporate animal research and human epidemiologic studies in close partnership with community organizations and communication scientists to identify research priorities and effectively translate evidence-based findings to the public and policy makers.

Conclusions: An integrative model of breast cancer research is needed to determine the impact and mechanisms of action of endocrine disruptors at different WOS. By focusing on environmental chemical exposure during specific WOS, scientists and their community partners may identify when prevention efforts are likely to be most effective.